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Cat.No.Z190-E1-02

Multi-Dimensional Sensor

Operation Manual

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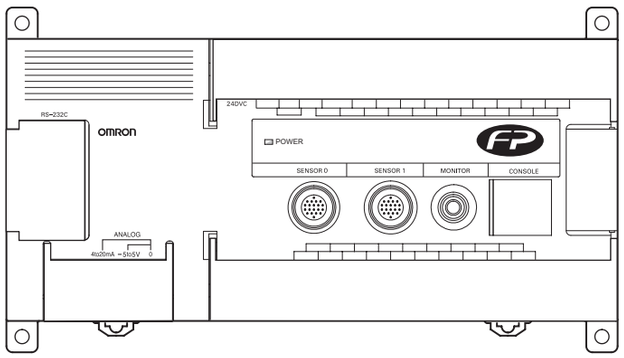
Multi-Dimensional Sensor

Z550

Operation Manual



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This manual explains menu operation method and communication method with external devices.

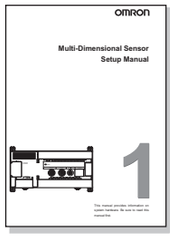
Cat.No. Z190-E1-02

INTRODUCTION

This operation manual describes the menu operations of the Controller. The Controller supports various methods of inspection by combining measurement methods and various settings.
Please read this manual and related manuals thoroughly before using the Controller in order to operate it properly.

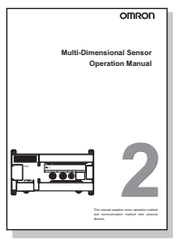
Operation Procedure and Reference Manual

The following shows main contents of operation steps and manuals. Select the manual suitable for your purpose and read it before starting operation



Setup Manual

Contains information on safe use of the unit, series of procedures starting from package content check, installation to cable connection, together with functions and specifications of the unit and its peripheral devices.



Operation Manual

Explains menu operation method and communication method with external devices.

Operation Manual

Multi-Dimensional Sensor Z550

Z550-MC10/-MC15

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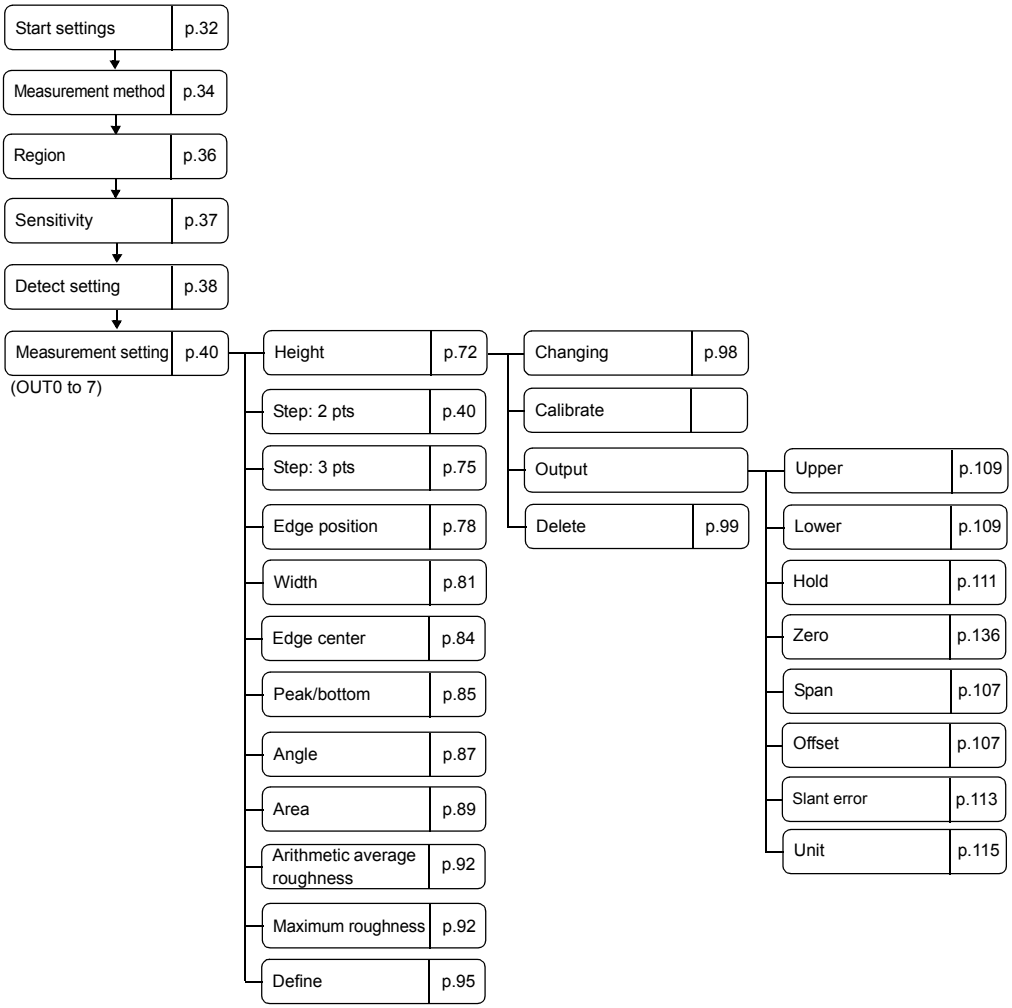
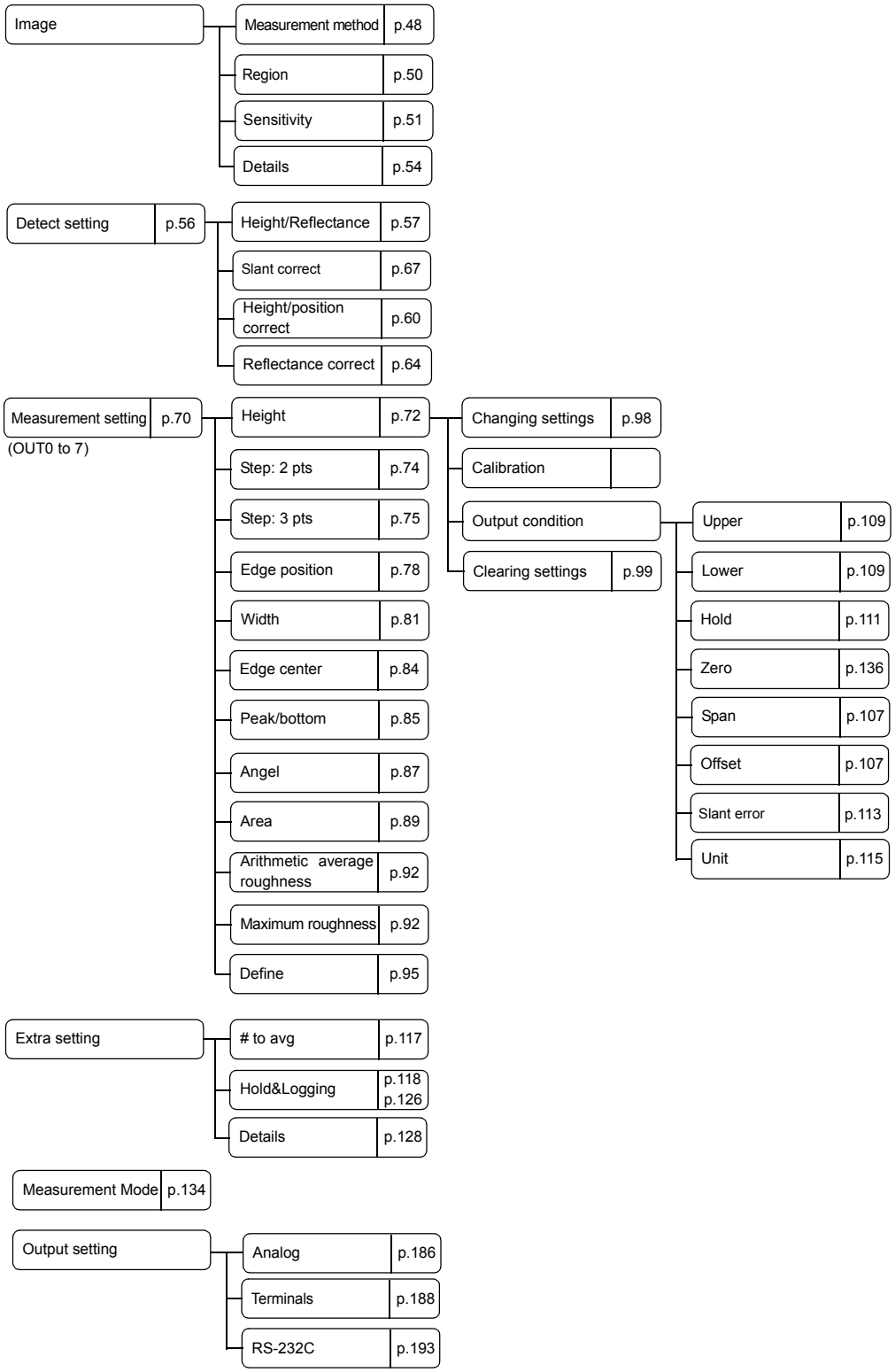


Expert Menu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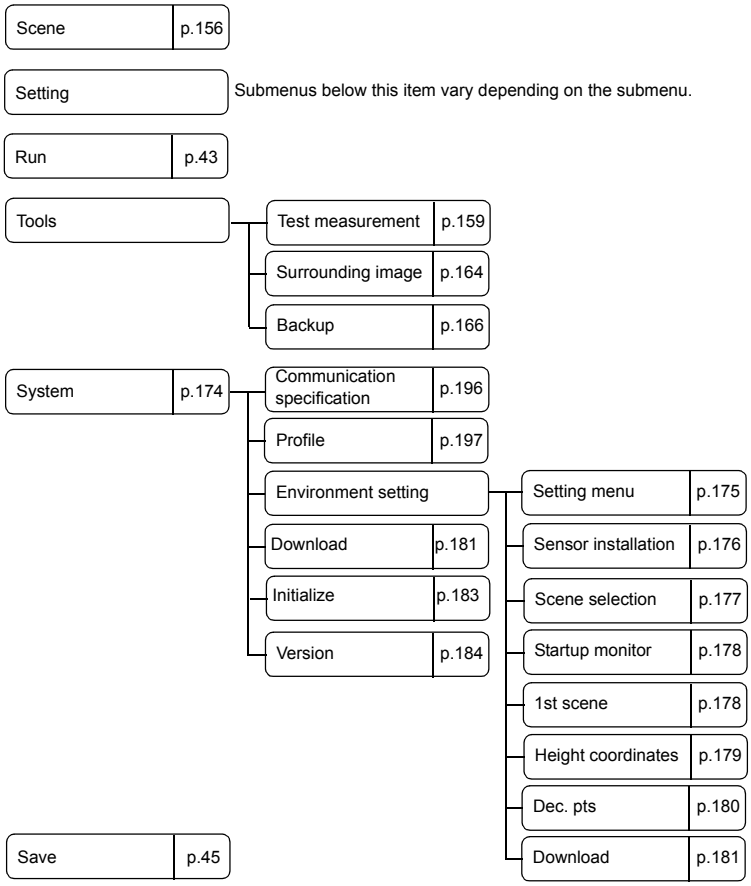
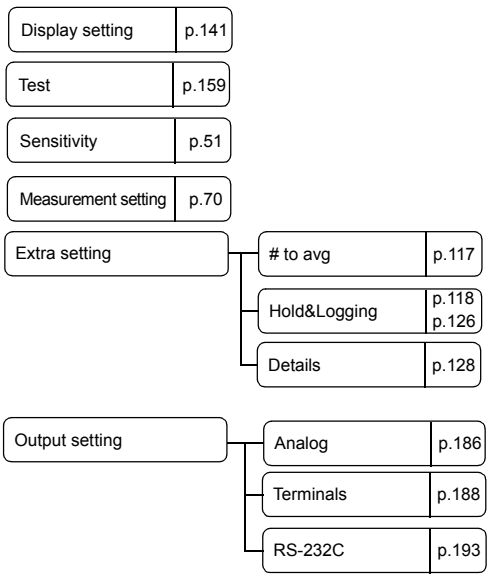
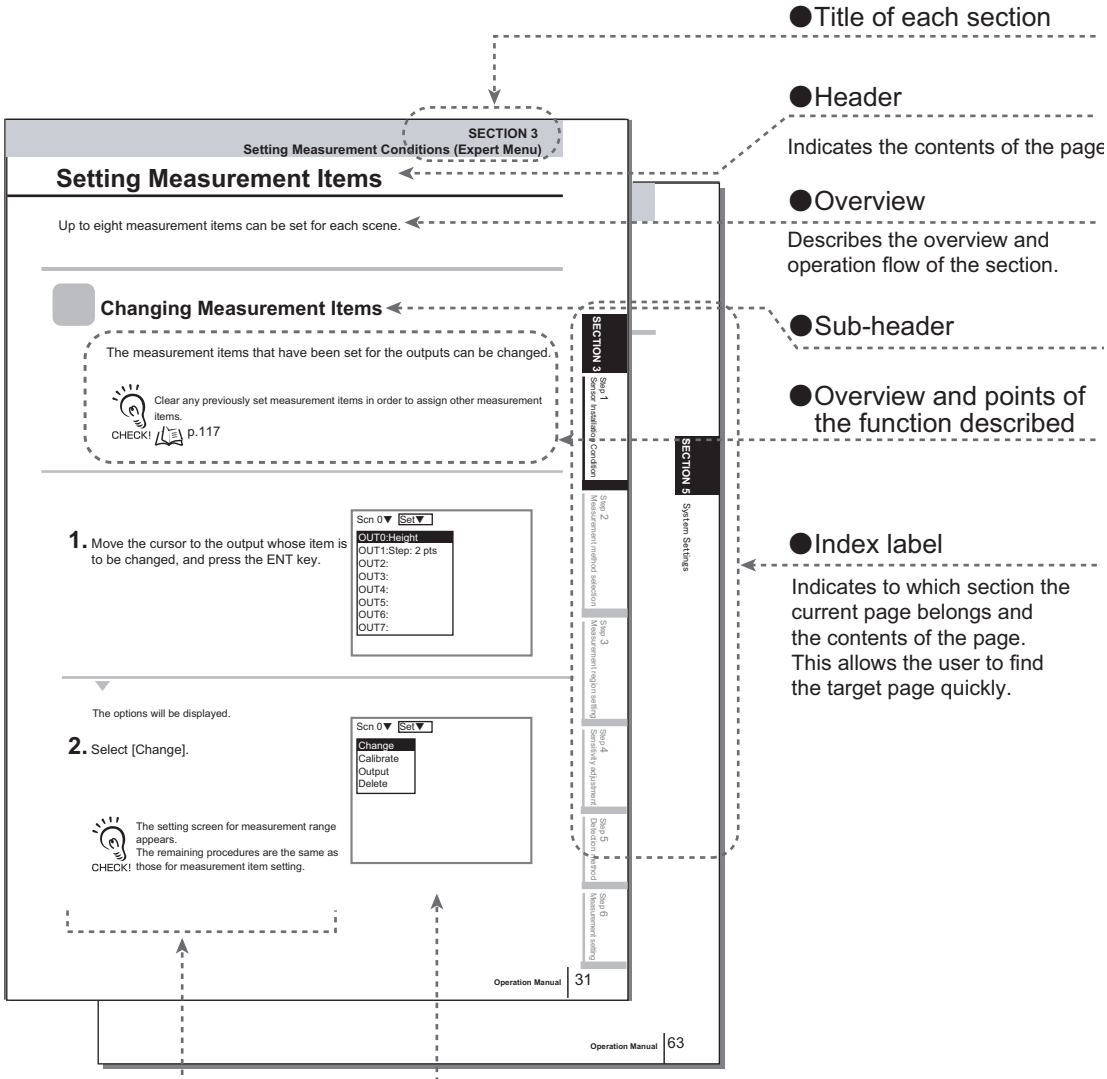


Adjustment menu (called from the measurement screen by pressing the SHIFT and ENT Keys.)



Editor's Note

Page Format



* This page does not exist.

Notational Conventions

Menu

In this manual, menu items displayed on the screen are enclosed with [ ]. Submenus are separated using "/."

Example: Move to [Tools/Backup].

This statement indicates to select the [Tools] menu followed by [Backup] to move to the Backup screen.

Key Operation on the Console

Example: Press the SHIFT and ESC Keys.

This statement indicates to press the ESC Key while pressing the SHIFT Key down on the console.

Example: Select [Setting].

This statement indicates to move the cursor to [Setting] and press the ENT Key.

Visual Aids

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

Indicates points that are important to achieve the full product performance, such as operational precautions and application procedures.

Indicates where to find related information.

Indicates information helpful in operation.

MEMO

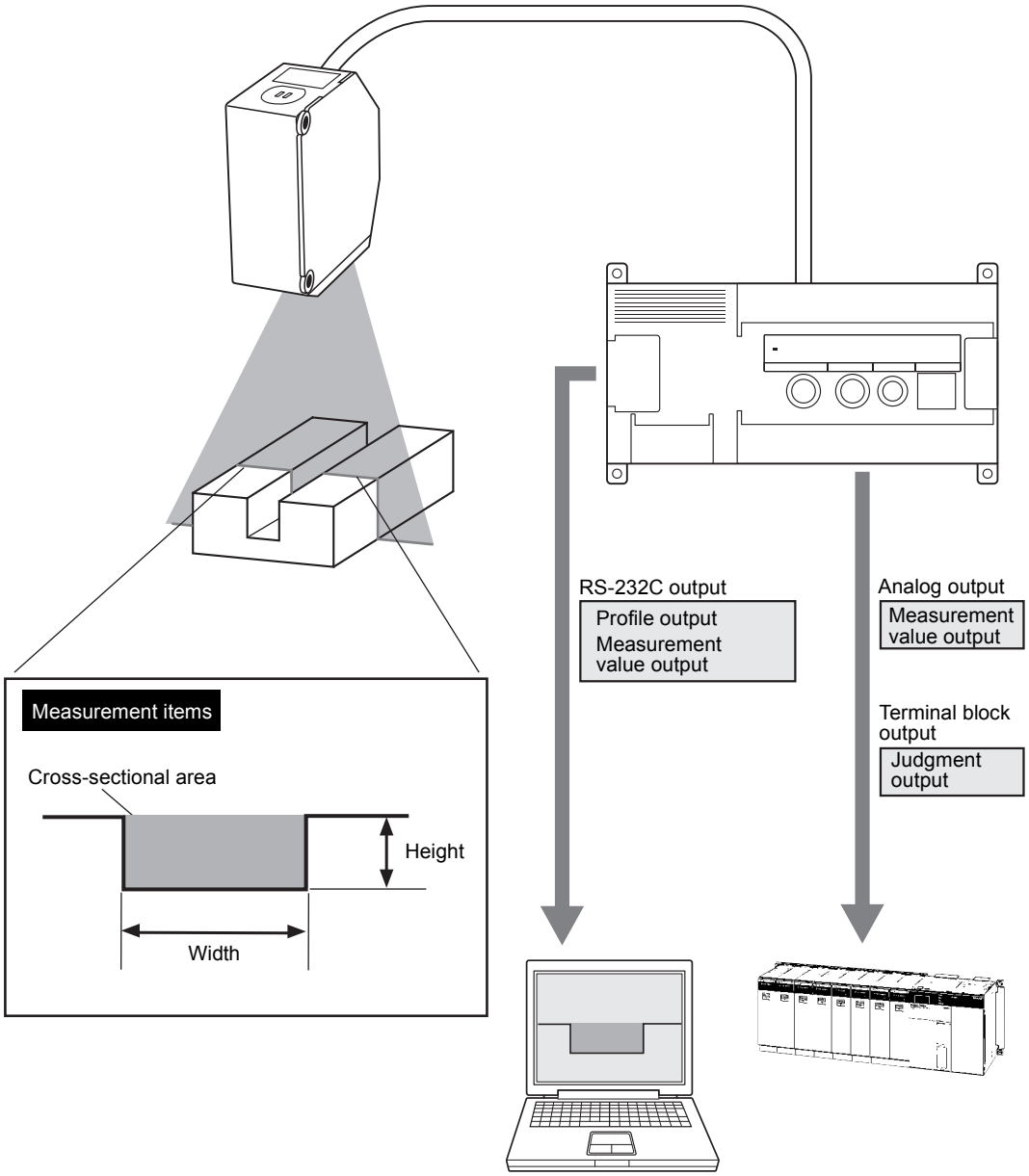
SECTION 1
Features

SECTION 1 explains the features of the Controller.

Features of the Controller

The Controller is a device used to measure the height, width, and area of a workpiece.
It makes these measurements by irradiating laser beams onto the workpiece and receiving the reflected light with the CCD inside the sensor.

Example: Inspection of LCD seal material application



Simple Setup Using Menus

The Controller is equipped with two types of menus.

If this is the first time you operate the Controller

Please use the **conversational menu**.
You can set up the measurement conditions with ease by simply entering the information according to the operation guidance that appears on the screen.

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If you want to set up the measurement conditions as you wish by utilizing various functions

Please use the **expert menu**.
It is possible to switch to the expert menus after setting up the conditions by using the conversational menu in order to make further adjustments.

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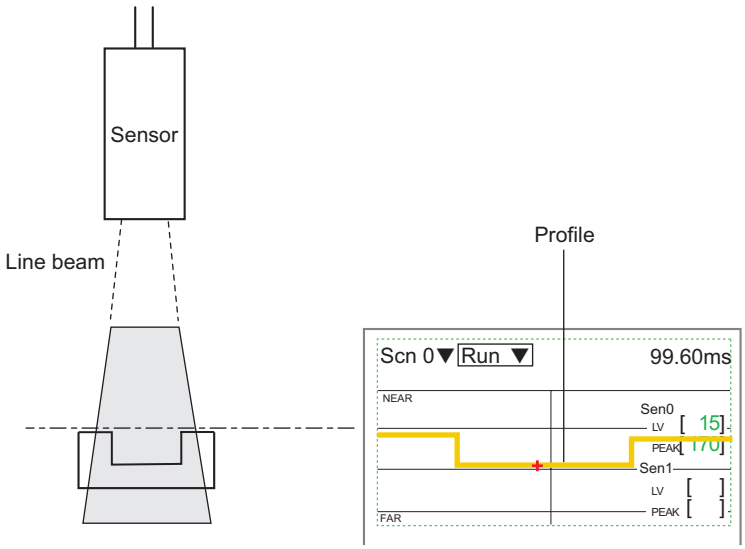
How to switch between the menus p.175

Monitoring While Viewing the Measurement Status

It is possible to visually keep track of how a workpiece is being detected on the monitor screen.
It is also possible to output the displayed profile (distribution of height measurement values) to a PC.



Twelve Types of Measurement Items

The Controller allows selection from 12 different measurement items, such as height, width, and cross-sectional area, according to the specific purpose.
Simultaneous measurement of up to 8 items can be performed.

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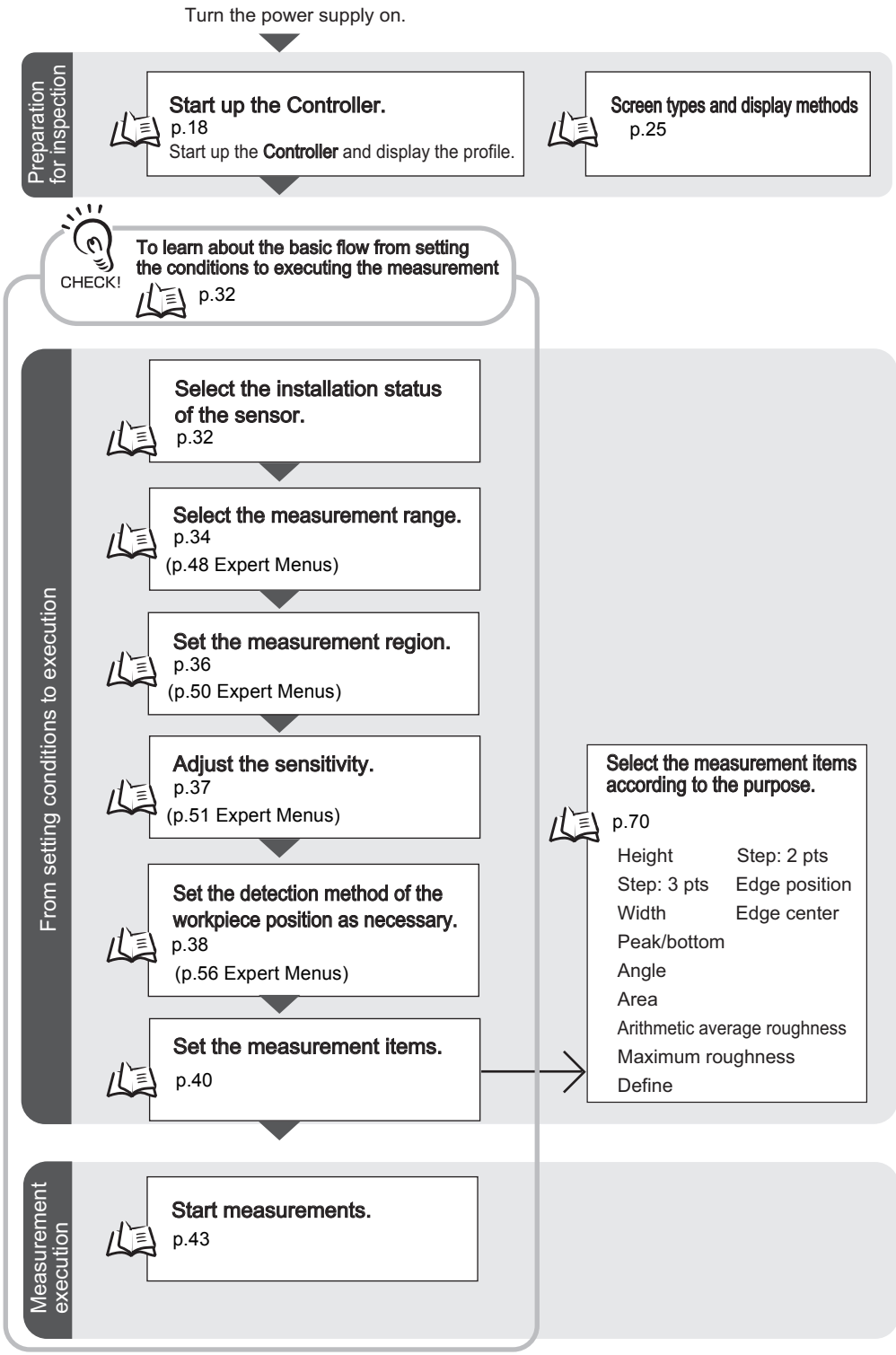
Operational Flow

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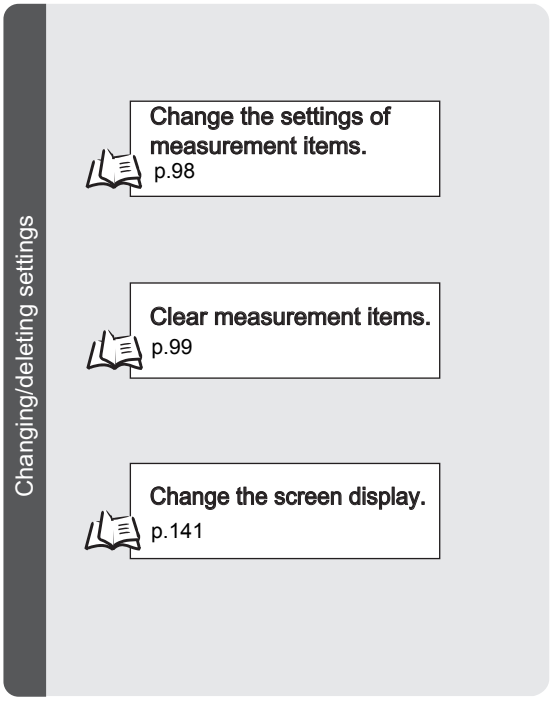
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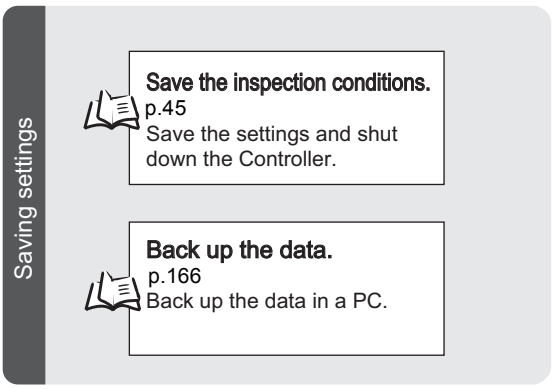
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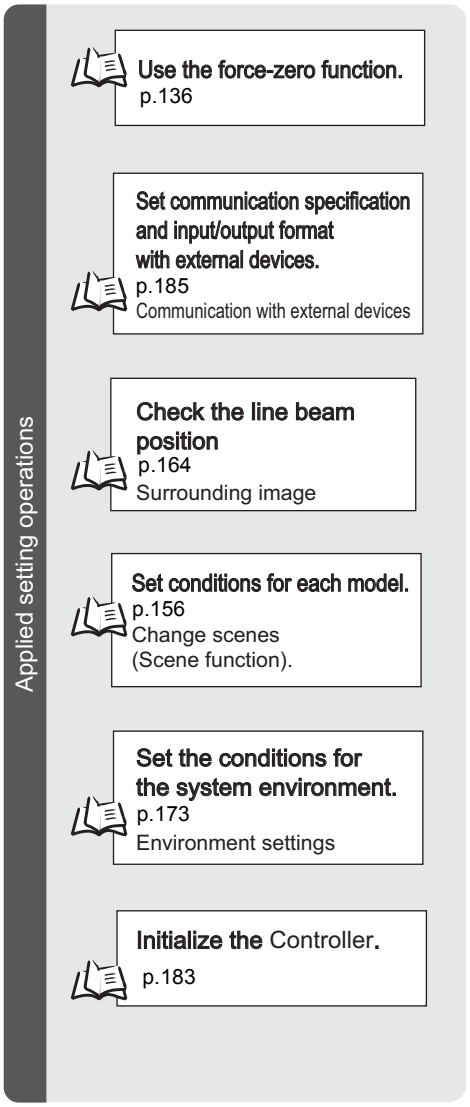
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MEMO

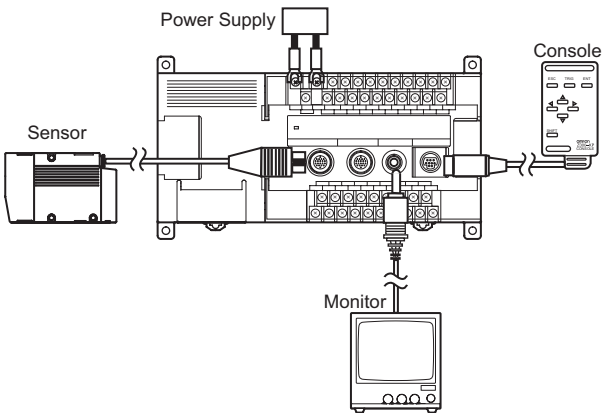
SECTION 2
Basic Operations

SECTION 2 shows the basic menu operations of the Controller.

Starting Controller and Displaying Profile

When the Controller is started up, the monitor displays the detection status.This is referred to as profile (plotted height information).
No profile is displayed if the workpiece is not placed within the measurement range of the sensor.
Place the workpiece and adjust the sensor position while monitoring the displayed image.

1. Check that the basic components have been connected correctly.



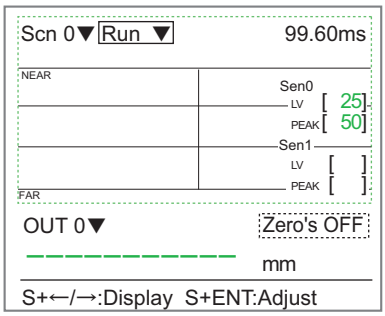
CHECK! Before connecting components or wiring power supply lines and grounding wires, be sure to refer to the relevant section in Setup Manual.

Page 15 in Setup Manual

2. Turn the power supply to the monitor on.

3. Turn the power supply to the Controller on.

The Image Monitor screen appears.



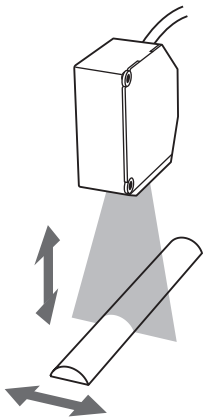
CHECK!

If the Image Monitor screen is not displayed, use the SHIFT Key and Right key or SHIFT Key and Left key on the console to switch between the monitor screens.

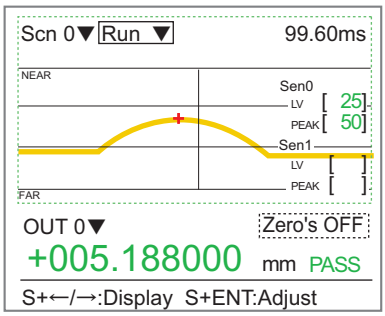
Screen types and display methods p.25

4. Position the workpiece.

Example:

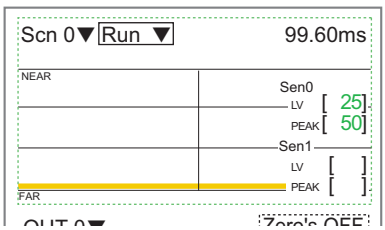


The profile (yellow line) indicating the height of the workpiece is displayed.



CHECK!

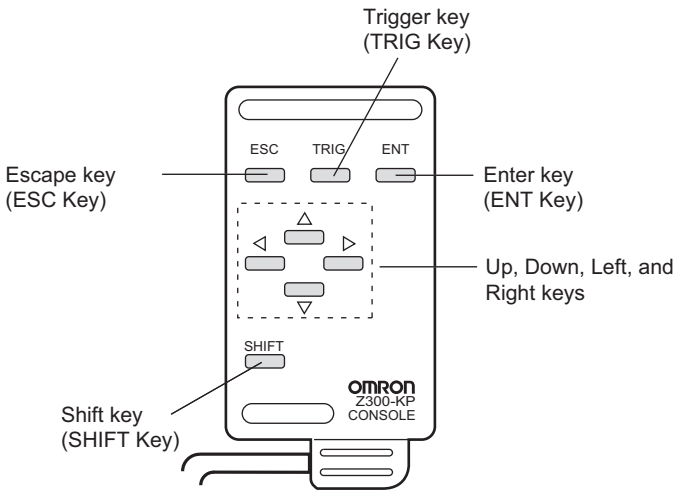
If the profile indicating the workpiece is not displayed, the workpiece is not positioned properly within the measurement range. Adjust the position of the workpiece relative to the sensor.



Menu Operations

Input Device

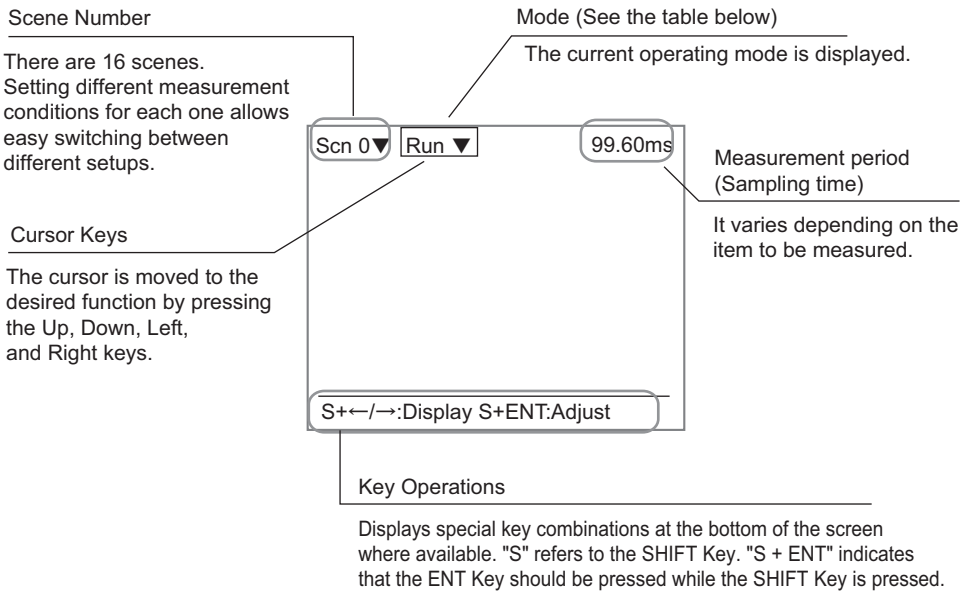
Menu operations are performed via the console.



Key	Function
Escape key (ESC Key)	Returns the cursor to the previous menu display or operation.
Trigger key (TRIG Key)	Used mainly when executing measurements.
Enter key (ENT Key)	Executes a function or sets a value.
Shift key (SHIFT Key)	Pressing this key alone does not have any effect. It must be pressed in combination with another key to have any effect.A function has been assigned to a key combination in each screen.
Up, Down, Left, and Right keys	The Up and Down keys are used to move the cursor up or down and also to set values. Use the Up key to increment a value by 1. Use the Down key to decrement a value by 1. Hold down the Up or Down key to increase or decrease a value rapidly. The Left and Right keys are used to move the cursor left or right.

Screen Structure

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



*Mode

Display	Description
Set	Select this to set the measurement conditions.
Run	This mode is used for performing the actual measurement. The measurement results are output to an external device via the terminal block or the RS-233C connection.
Tools	Select this to check the sensor installation status and save settings and images in a PC as backup.
System	This is used to set the system conditions of the Controller. Select this mode to set communication specifications with external devices.
Save	Select this to save data in the flash memory in the Controller. If new settings have been made, be sure to save the data before quitting.

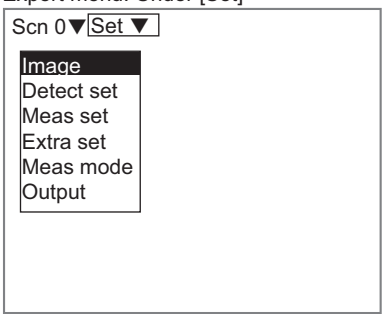
Menu Tree

The Controller menus are hierarchical. Move the cursor to the required functions to set measurement conditions.Use the following procedures to move around the menu tree.

1. Move the cursor to the item you want to select.
Up/Down key: Moves the cursor.

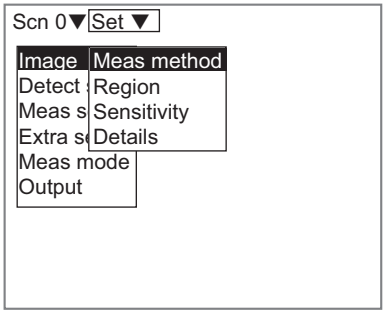
2. Press the ENT Key.

Expert menu: Under [Set]



In this example, the cursor will move to the submenu below [Image].

3. Repeat this operation to move the cursor to lower submenus.



Press the ESC Key once to move to the submenu immediately above.

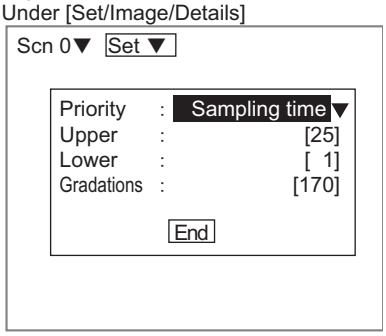
Triangle Mark

Items with a triangle mark displayed to the right have selections. Use the following procedure to make a selection from the selections.

1. Move the cursor to the item to be set.
In this example, move the cursor to [Sampling time].

2. Press the ENT Key.

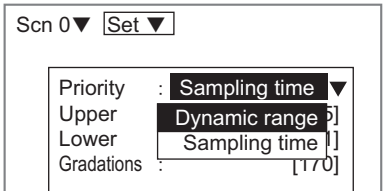
Expert menu:
Under [Set/Image/Details]



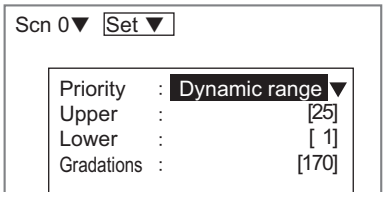
The selections appear.

3. Move the cursor using the Up/Down key.

4. Press the ENT Key.



The selection will be registered.



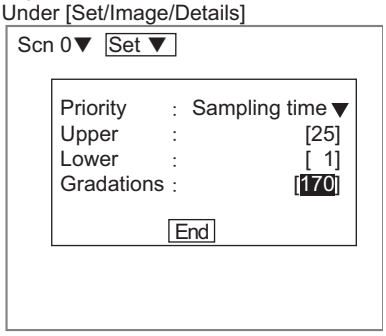
Inputting Values

This section explains how to input values required in order to set judgment conditions.

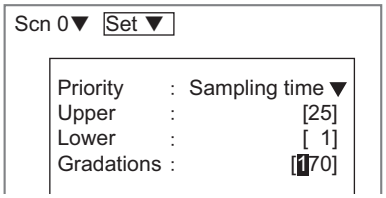
1. Move the cursor to the item for which a value is to be changed.

2. Press the ENT Key.

Expert menu:
Under [Set/Image/Details]

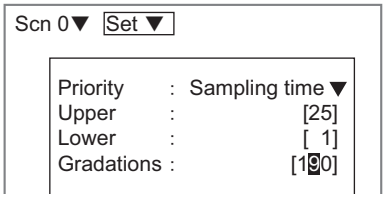


The cursor size will change to the size of a single digit.



3. Move the cursor to the digit to be changed.
Left/Right key: Moves the cursor to the left/right.

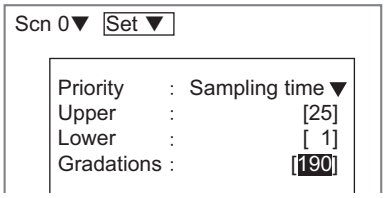
4. Change the value.
Up key: Increases the value.
Down key: Decreases the value.



5. Repeat this operation to change other digits.

6. Press the ENT Key.

The value will be set.

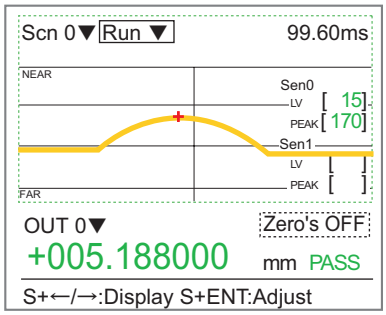


Screen Types and Display Methods

There are four monitor screens that can be used to display images on the Controller: Image Monitor, Digital Monitor, Trend Monitor, and Profile Monitor. These monitor screens are useful when it is required to check measurement information from various viewpoints.Switch between the monitor screens according to the purpose.
The first time the power supply is turned on after delivery, the Image Monitor screen is displayed.

Image Monitor

This monitor allows checking how the workpiece is detected by checking shape.
It is also possible to keep track of the height information visually.

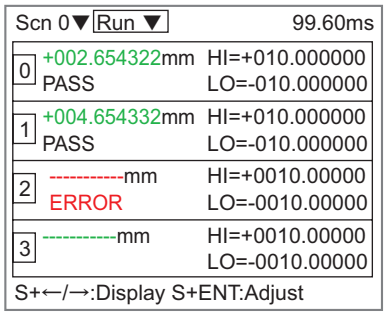


SHIFT Key + Right key

SHIFT Key + Left key

Digital Monitor

Two or more measurement results can be checked at the same time.
The Controller allows measuring up to eight items simultaneously. This monitor screen is convenient when multiple measurement items have been set.



SHIFT Key + Right key

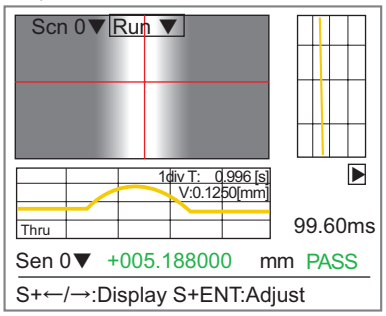
SHIFT Key + Left key

SHIFT Key + Left key

SHIFT Key + Right key

Profile Monitor

Chronological change of height distribution of 1024 points (profile) can be checked on a shaded 3-D image.
It is possible to check the height information of the specified point in the time-series by moving the workpiece.

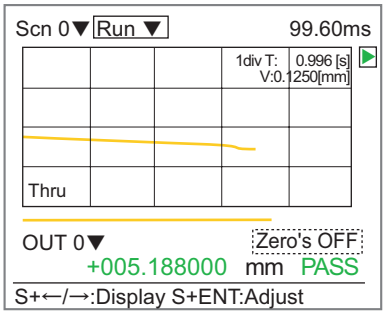


SHIFT Key + Left key

SHIFT Key + Right key

Trend Monitor

Chronological change of measured values can be checked.



CHECK! It is possible to select which monitor screen appears when the Controller is turned on.

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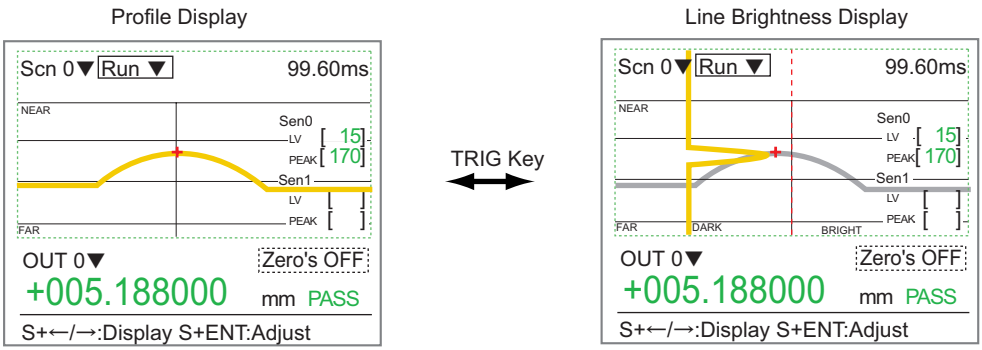
Image Monitor

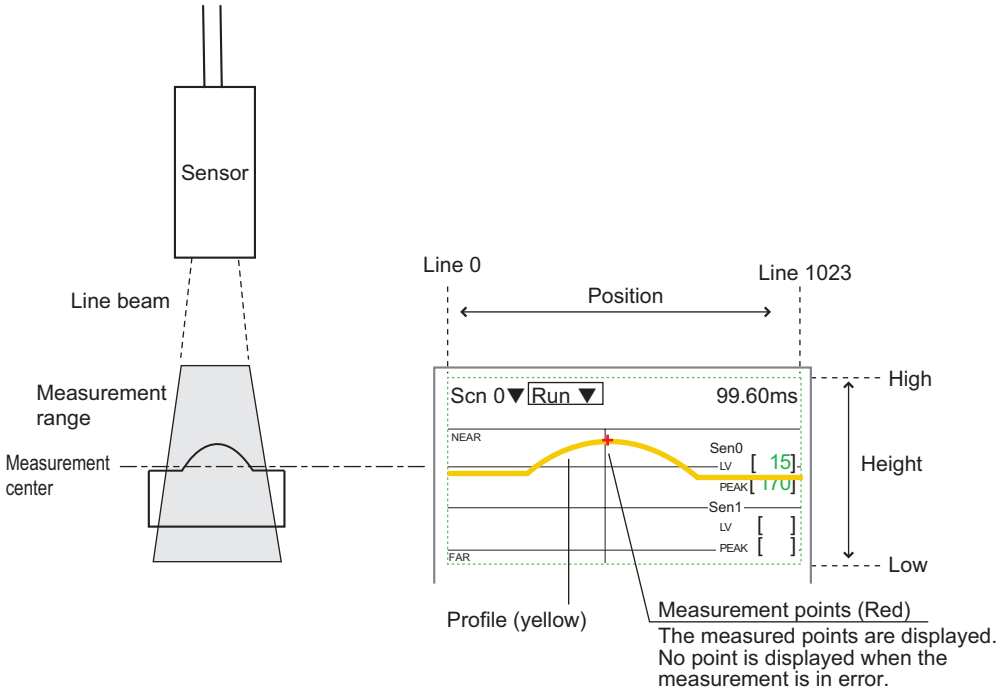
This is the main monitor screen of the Controller. The first time the power supply is turned on after delivery, this screen is displayed.The Image Monitor screen consists of two displays, the profile display and the line brightness display. Use the TRIG Key to switch between the displays.



Profile Display

The distribution of height measurements at 1024 points is displayed as a profile.This display allows keeping track of the height information visually; it is possible to check how the workpiece in the lines is detected by checking the shape.

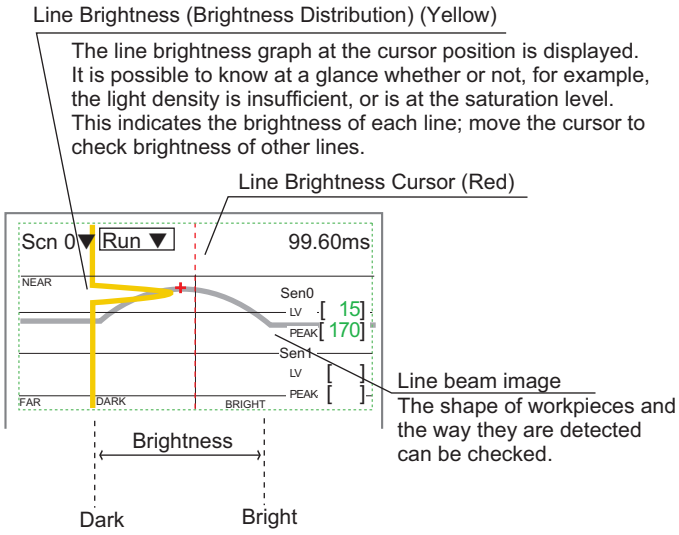
- At setting: It is possible to check whether the sensor is positioned within the measurement range.
- During measurement: It is possible to visually keep track of the detection status and the position of the workpiece .



Line Brightness Display

This display allows checking the line beam image and the brightness information for each line (line brightness).

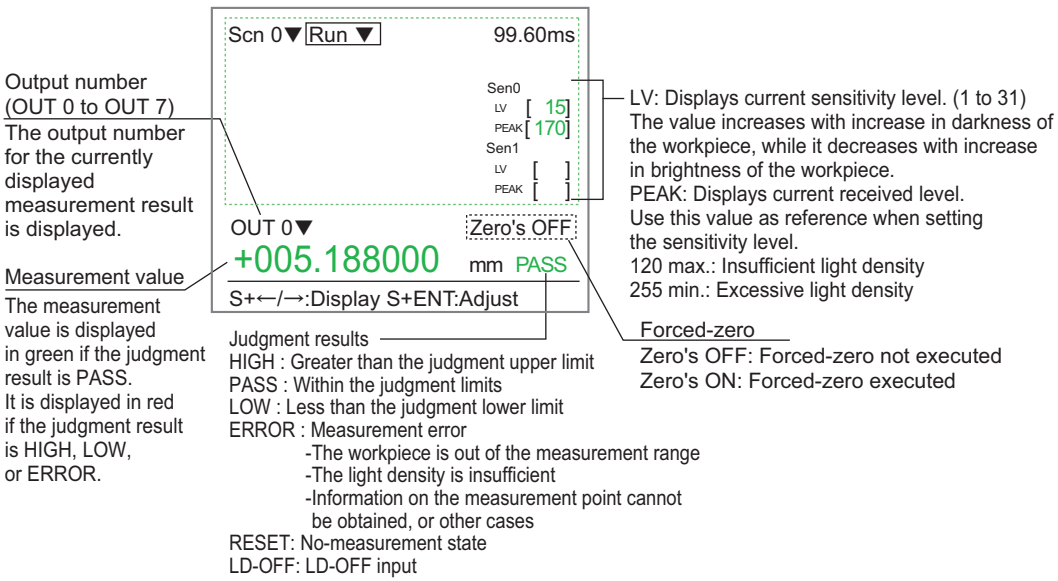
- At setting: It is possible to check whether sensitivity is appropriate.
- During measurement: It helps analyzing factors when an error occurs.



How to change the cursor position p.144

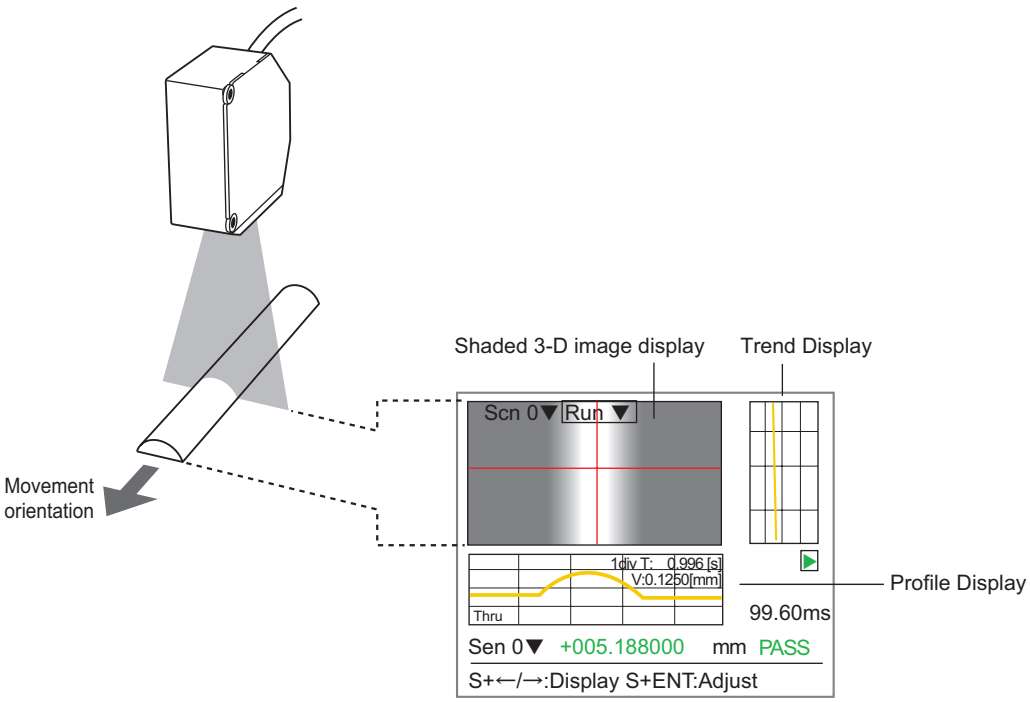
Common Display

Items commonly displayed in both the profile and line brightness displays are explained below.



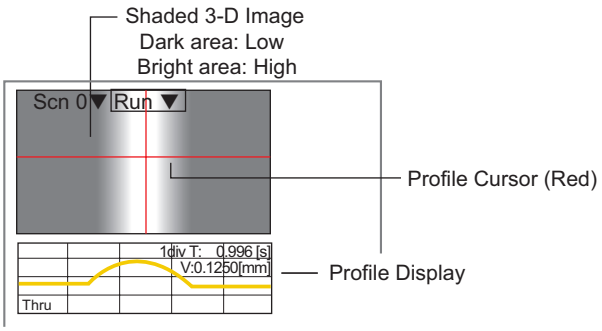
Profile Monitor

This monitor screen allows checking the profile using a shaded 3D image.
Move the workpiece in order to check the height information of one specified point in a time series.
This monitor screen is convenient when checking the installation conditions of the sensor.



Shaded 3D Image Display and Profile Display

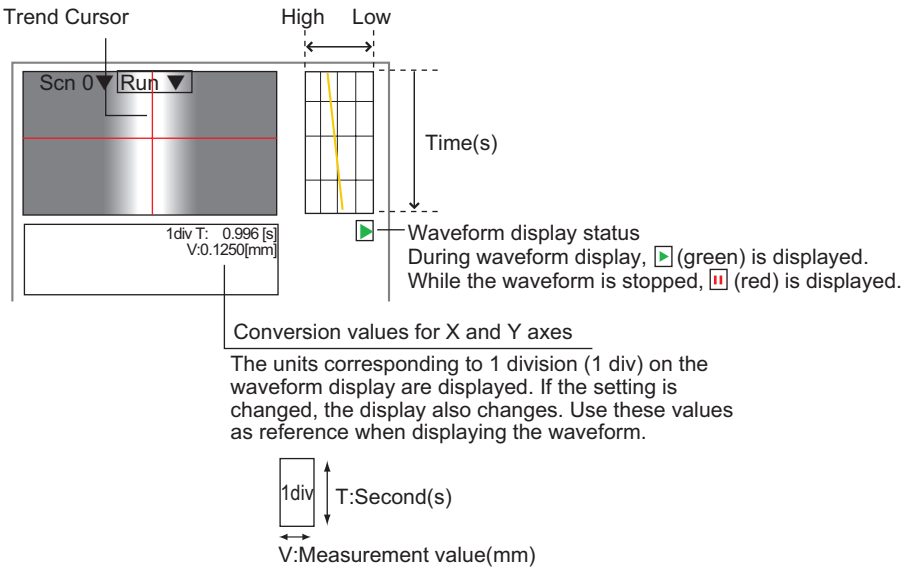
The profile or one horizontal line in the shaded 3D image is displayed at the lower part of the screen.



How to change the cursor position p.155

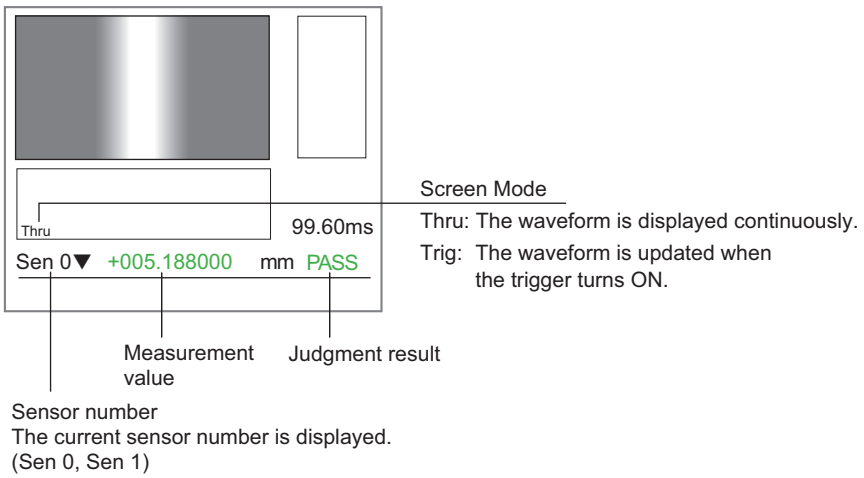
Trend Display

The measurement value at the trend cursor position is displayed in a time series.
Press the TRIG Key to switch between display update and stop.It is also possible to specify the timing via an external trigger.



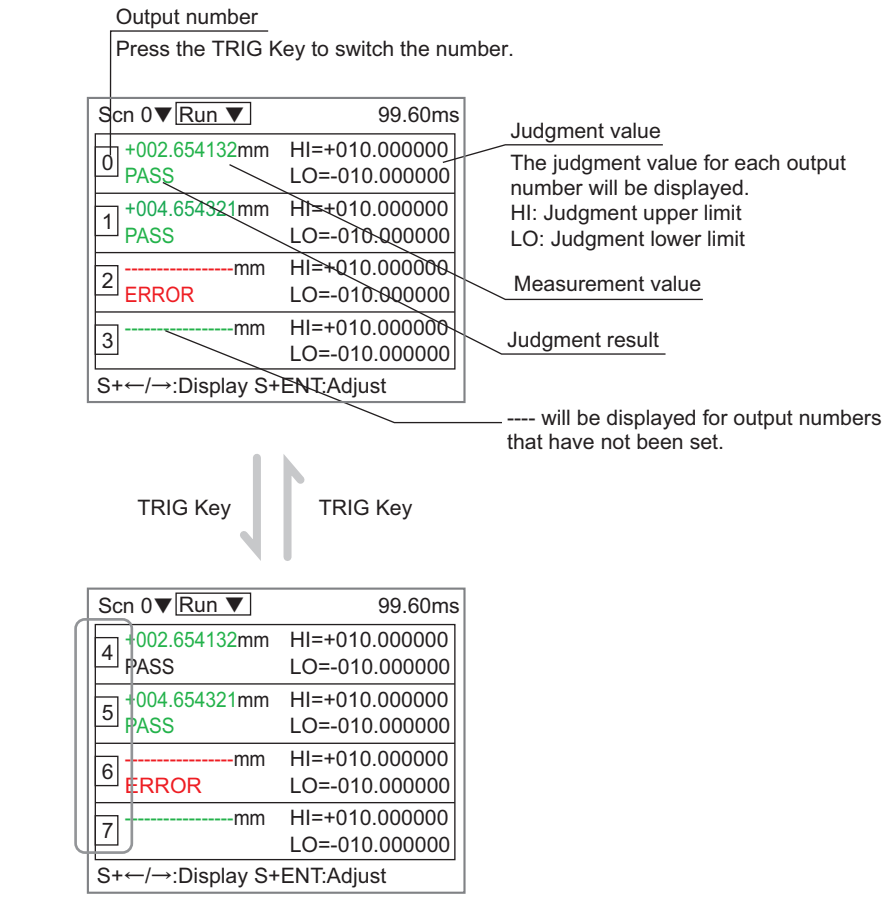
How to change the cursor position p.155

Other Display Items



Digital Monitor

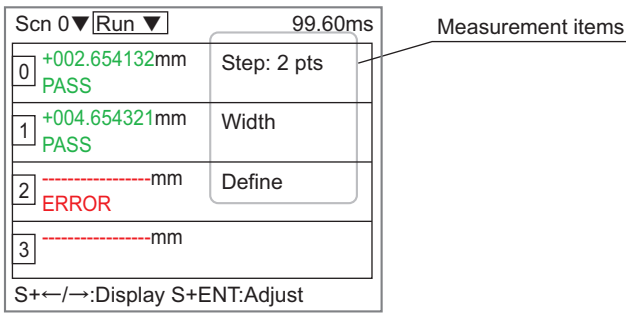
This monitor screen is mostly used during line operation.
Two or more measurement results that have been set for the output numbers of the displayed scenes appear.



CHECK!

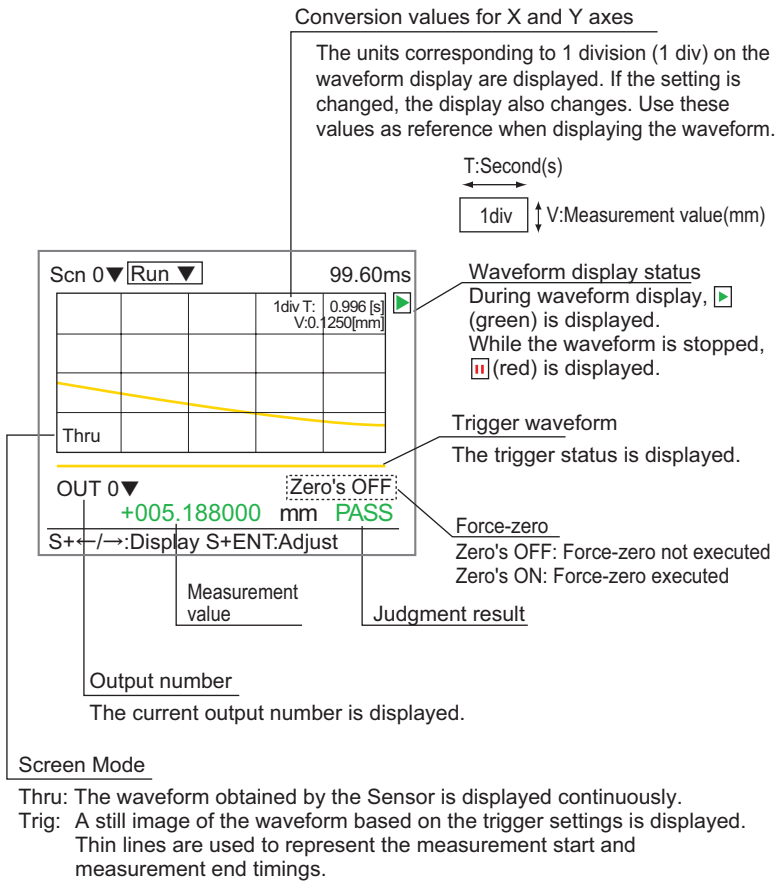
The measurement items can also be displayed instead of the judgment values.

p.145



Trend Monitor

It is possible to display a time series of measurement values (up to 30 seconds) as a waveform. When the measurement timing is entered using an external trigger, the measurement values are displayed as a time series from the time the trigger is turned on until it is turned off.
Press the TRIG Key to switch between display update and stop.It is also possible to specify the timing via an external trigger.

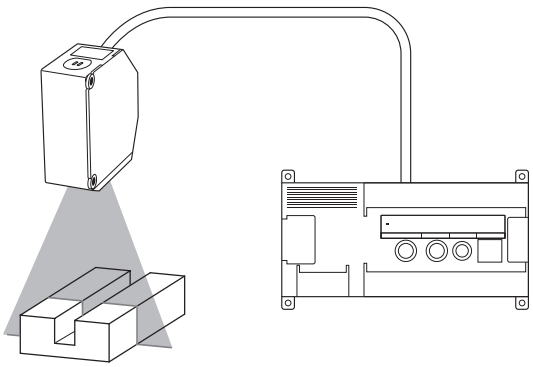


CHECK! If the hold function has been set to [Hold (External)] or [Hold (Self)], the waveform prior to when the measurement is held is displayed.
If the logging function has been specified, the waveform after the measurement is held is displayed.

Learning Basic Operations (Conversational Menu)

This section explains the flow of basic operations using the conversational menu. Here, the height of a seal material is measured as an example.
Switch to the conversational menu before starting the operation.

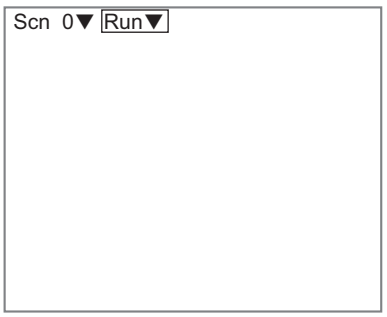
How to switch between the menus p.175



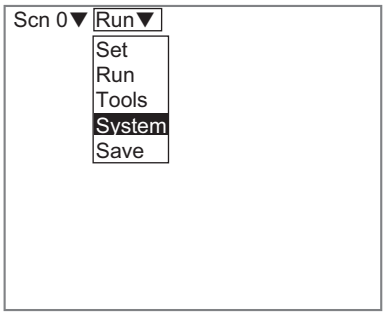
Step 1 Selecting the Sensor Installation Method

Set up the sensor so that it can project and receive laser beams properly so as to obtain correct measurement images. First, select whether the installation status of the connected sensor is "regular (mirror) reflection" or "diffuse reflection."

1. Move the cursor to [Run ▼] and press the ENT Key.

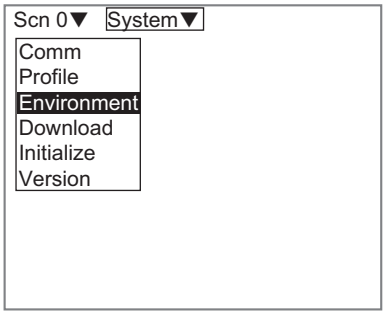


A list of modes appear.



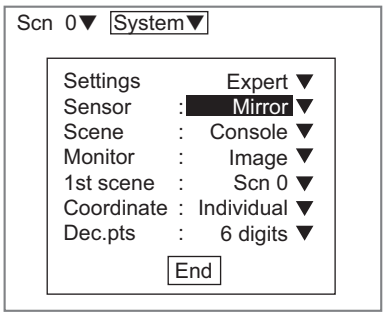
2. Select [System].

The selections of the System mode appear.



3. Select [Environment].

A setting screen appears.



4. Select [Sensor].

5. Select [End].

The setting will be registered and the screen display returns to **3**.

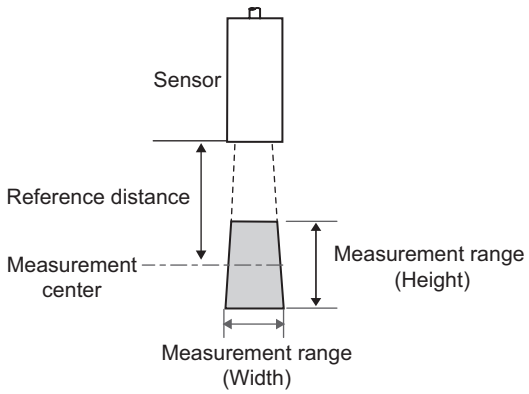
6. Press the ESC Key.

The screen display returns to **2**.
Proceed to **Step 2**.

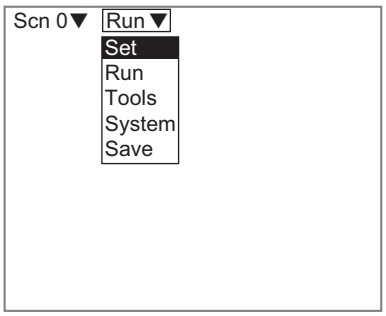
Step 2 Selecting the Measurement Method

It is possible to measure with higher accuracy by changing the measurement range in the height direction.

CHECK! Only the measurement range in the height direction is specified here. The measurement range in the width direction is automatically changed according to this setting. Please refer to Setup Manual for the measurement range of each sensor.

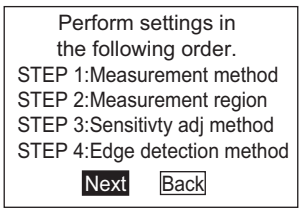


1. Select [Set].

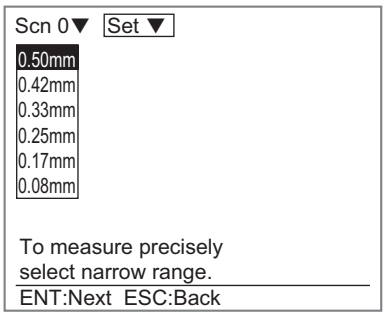


The initial screen of the conversational menu appears.

2. Select [Next].



A measurement range setting screen appears.



3. Select the measurement range while monitoring the image.

4. Select the setting by pressing the ENT Key.

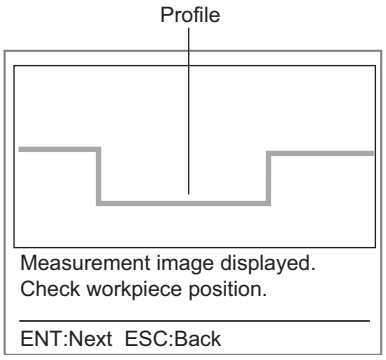
The setting is registered.
Proceed to **Step 3**.

Step 3 Setting the Measurement Region

The measurements obtained may not be stable due to influence from the background etc. with the default measurement region set at the shipment. In this case, set the measurement region so that only the measurement target is included.
If there is a possibility that the position of the workpiece may be shifted, determine the size of the region taking the possible range of movement into consideration as well.

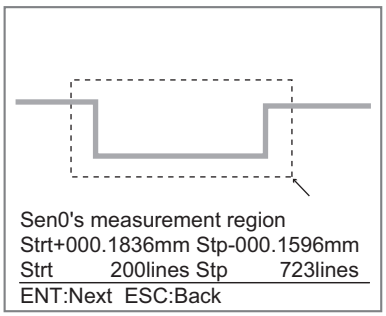
1. Position the workpiece.

2. Press the ENT Key.



The screen for specifying the region appears.

3. Adjust the region so to surround only the measurement target area.
Up/Down/Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.



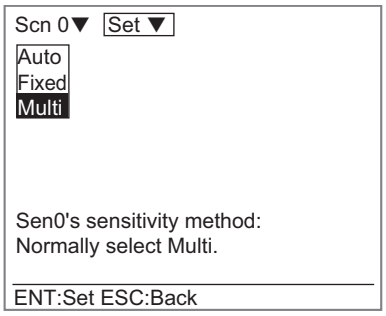
The measurement region is registered.
Proceed to **Step 4**.

Step 4 Adjusting the Sensitivity

Adjust the sensitivity so that the light density will not become excessive or insufficient.
The default sensitivity adjustment method set at the shipment is [Multi].Select [Multi] under normal circumstances.

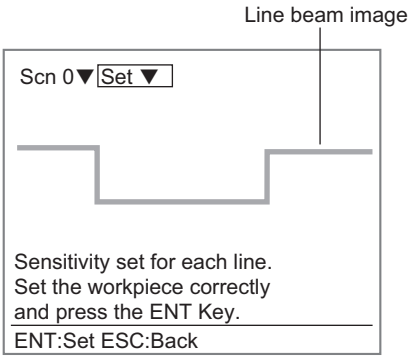
1. Select [Multi] as the sensitivity adjustment method.

Sensitivity adjustment method p.51



The multiple sensitivity setting screen appears.

2. Check that the workpiece is positioned within the measurement range and press the ENT Key.



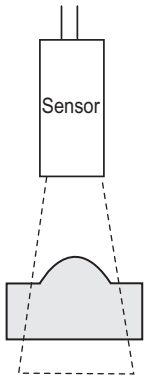
The sensitivity level is registered.
Proceed to Step 5.

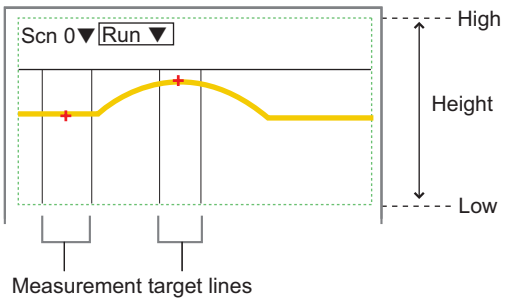
Step 5 Setting Workpiece Position Detection Method

Use the detection function if it is anticipated that the position of the workpiece may be shifted.
This function supports shifts in the position in the height and horizontal directions, and the inclination.

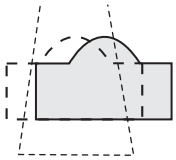
Example: Measuring the gap between two locations

No position shift
(the same position
as at the setting)

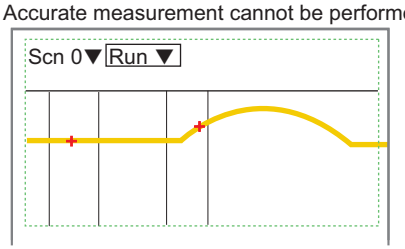




When the position shifts

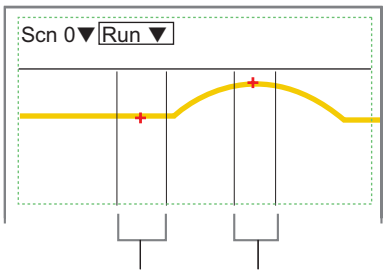


Accurate measurement cannot be performed.



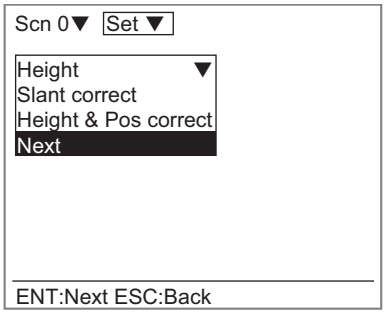
By setting position compensation...

The measurement target lines are automatically adjusted by
the amount of shift detected, and the measurement is performed.



Here, proceed to the next step without setting the detection method.
See SECTION 3 for the explanation about how to set thedetection method.
p.56

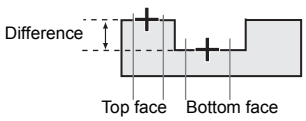
1. Select [Next].



Proceed to **Step 6**.

Step 6 Setting Measurement Items

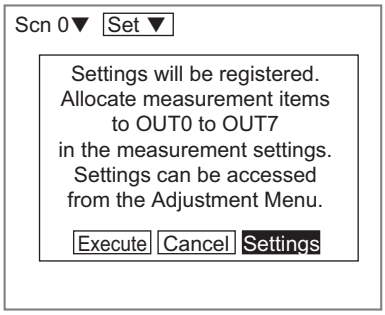
The Controller can measure up to eight items simultaneously.
Eight setting frames, OUT0 to 7, are provided for each scene; assign the measurement items for each scene.
In this example, [Step: 2 pts] is assigned to [OUT1].Specify two measurement target lines and calculate the difference between the two measurement points, i.e., the gap between them.



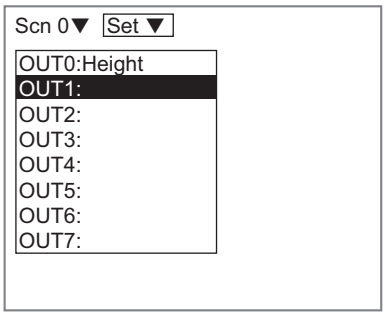
CHECK! [Height] is set in [OUT0] as the default setting.To set an item other than [Height] in [OUT0], delete the existing measurement item.
p.99

Other measurement items
p.70

1. Select [Settings].

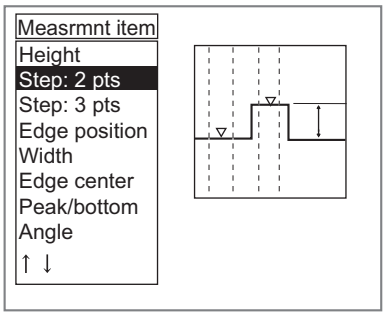


A list of outputs appear.



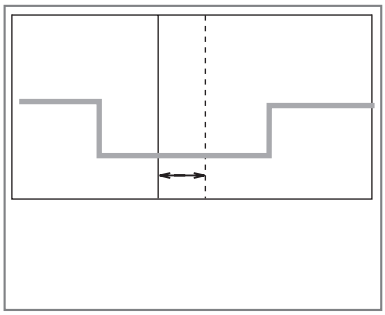
2. Select the output for which [Step: 2 pts] is to be set.
In this example, select [OUT1].

The selections for measurement item appear.



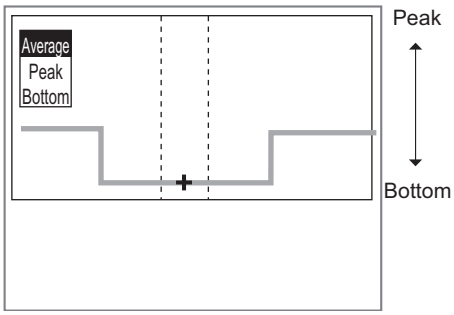
3. Select [Step: 2 pts].

The bottom face line setting screen appears.



4. Specify the start and end lines of the bottom face.
Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.
ESC Key: Cancels the setting.

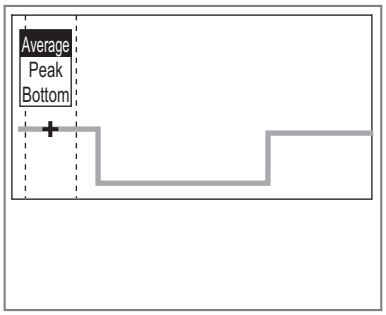
The characteristic quantity setting screen appears.



5. Select the measurement point for the bottom-face measurement.
Select which position (peak, bottom, or average) within the specified region will be the measurement point.
The cross cursor indicating the measurement point moves according to the selection; select the position while monitoring the image.

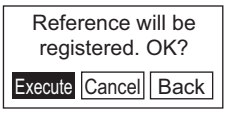
In this example, select [Average].

The top face line setting screen appears.



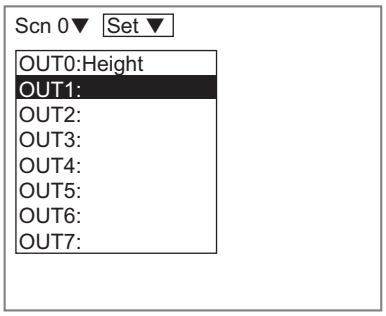
6. Repeat the operations in steps **4.** to **5.** to set the characteristic quantities of the measurement target line and the measurement point on the top face .

A confirmation message appears.



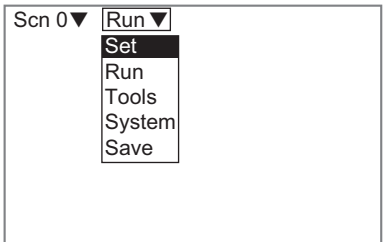
7. Select [Execute].

The setting will be registered and the screen display returns to **2**.



8. Press the ESC Key.

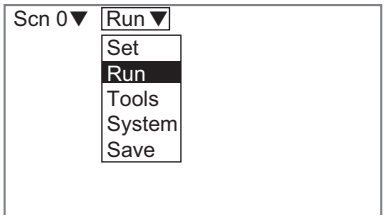
The mode selections appear.
Proceed to **Step 7**.



Step 7 Starting Measurements

Perform the measurement under the conditions that have been set previously.
The measurement is made under the conditions specified for the displayed scene and the measurement results are output to the external device connected.

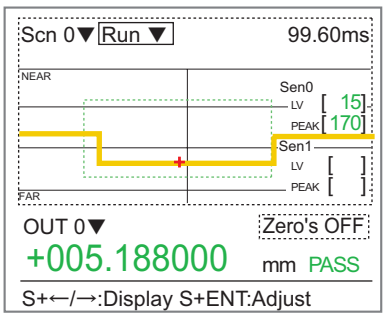
1. Select [Run].



The measurements are executed continuously, and the results are displayed.

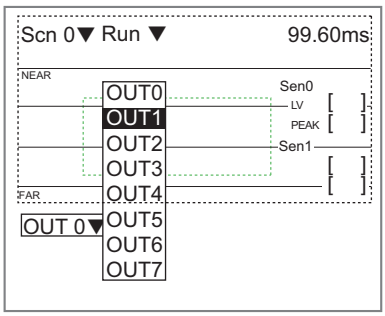
2. Move the cursor to [OUT 0 ▼].

3. Press the ENT Key.



The selections appear.

4. Select [OUT1] for which [Step: 2 pts] is set.



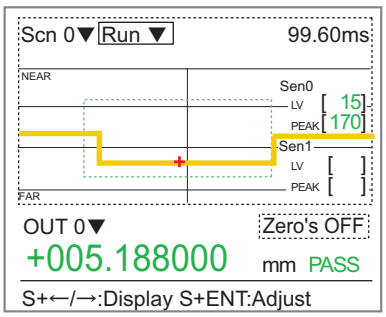
The measurement result of OUT1 is displayed.
Check that measurement is being performed correctly.

CHECK! To switch to the Profile Monitor, Trend Monitor, Digital Monitor or Image Monitor screen, press the SHIFT Key and Left/Right key.

Changing Measurement Conditions Using the Adjustment Menu

Press the SHIFT and ENT Keys at the same time to call up the adjustment menu. The main conditions can be called up using the adjustment menu; it is not necessary to return to the Set mode.

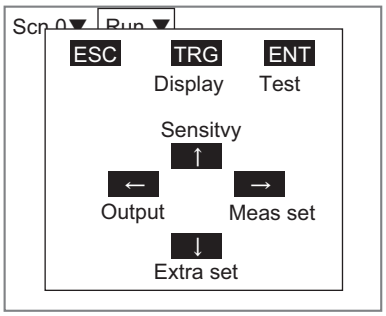
1. Press the SHIFT and ENT Keys in the Run screen.



The adjustment menu appears.

2. Press the key corresponding to the item you want to adjust.

Example: Press the Up key in order to adjust sensitivity.



The corresponding setting screen appears.

Key	Allocation	Reference
TRIG Key	Display setting	p.141
ENT Key	Test measurement	p.159
Up key	Sensitivity adjustment	p.51
Down key	Auxiliary setting	p.117 to p.128
Left key	Output setting	p.186 to p.193
Right key	Measurement setting	p.70
ESC Key	None	-

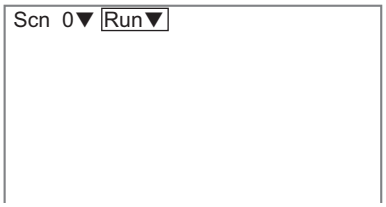
Saving Settings and Exiting Controller Operation

When any settings have been changed, be sure to save the new settings in the flash memory before turning the power supply off.

NOTICE The Controller loads the data in the flash memory every time it is started; therefore, changes made are deleted if the power is turned off before saving the changes in the flash memory.

1. Display the screen for the Run mode.

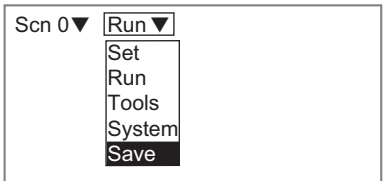
2. Move the cursor to [Run ▼] and press the ENT Key.



▼

A list of modes appears.

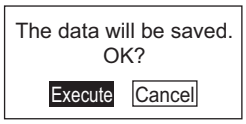
3. Select [Save].



▼

A confirmation message appears.

4. Select [Execute].



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

▼

When the saving has been completed, the screen display will return to **3**.

5. Turn the power supply off and exit the Controller operation.

MEMO

SECTION 3
Setting Measurement Conditions

(Expert Menu)

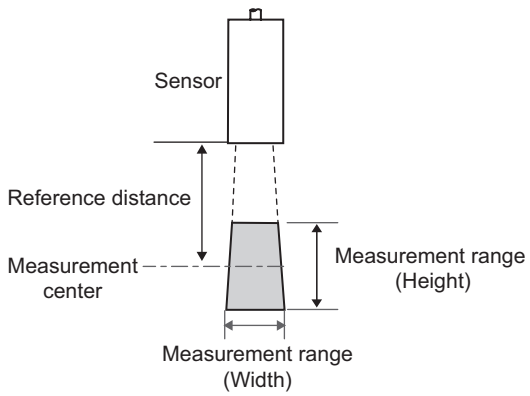
SECTION 3 explains how to set measurement conditions using the expert menu.

Selecting the Measurement Method

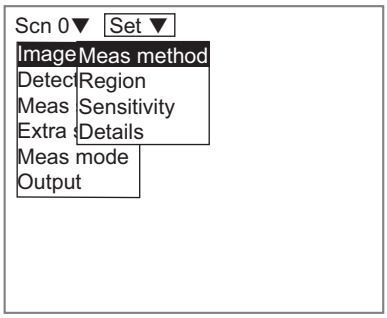
It is possible to measure with higher accuracy by changing the measurement range in the height direction.
The measurement range must be specified first. When the measurement range is changed, the data of the displayed scene is cleared.

CHECK!

Only the measurement range in the height direction is specified here. The measurement range in the width direction is automatically changed according to this setting.Please refer to Setup Manual for the measurement range of each sensor.



1. Select [Image/Meas method].



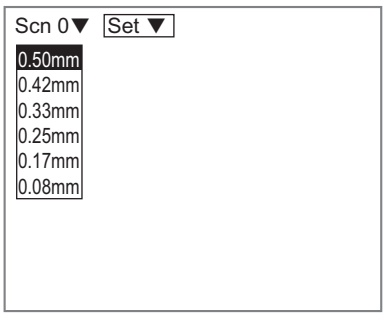
Sensor selections appear if two sensors are connected.
If only one sensor is connected, proceed to the operation in **3**.

2. Select which sensor to be used in the displayed scene.

CHECK!

The sensor to be used is selected for each scene; therefore, it is possible to prepare setup settings, including sensor installation status, for up to two sensors.

The selections for measurement range appear.



3. Select the measurement range while monitoring the image.

4. Select the setting by pressing the ENT Key.

The setting will be registered and the screen display returns to **1**.

CHECK!

Coordinates when converting the measurement range
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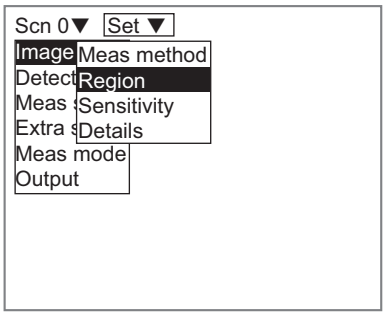
Setting the Measurement Region

If areas with various surface conditions and colors exist in the measurement region, the reflectance may fluctuate, causing the measurements to become unstable. The measurement region is set to cover the entire measurement range at shipment. Specify only the region to be measured in order to increase the accuracy.If there is a possibility that the position of the workpiece can be shifted, determine the size of the region taking the range of movement into consideration as well.

CHECK! The measurements may become inaccurate near the boundaries of the measurement region. Therefore, the measurement region should be specified with sufficient margin.

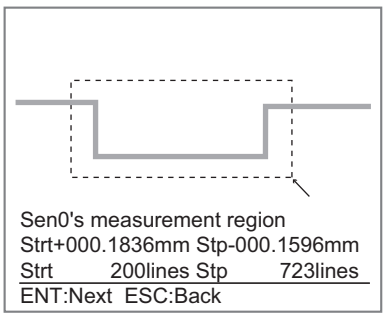
1. Select [Image/Region].



The screen for specifying the region appears.

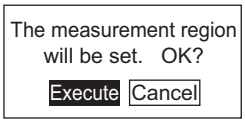
2. Specify the upper left and lower right corners of the region.

Up/Down/Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.



When the lower right corner setting is selected, a confirmation message appears.

3. Select [Execute].



The setting will be registered and the screen display returns to **1**.

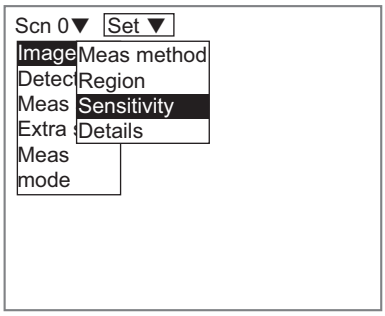
Changing the Sensitivity Adjustment Method

If the measurement results fluctuate, change the sensitivity adjustment method.
The default sensitivity adjustment method set at the time of shipment is [Multi].The [Multi] setting is sufficient under normal circumstances.

Option	Meaning	Minimum sampling time
Auto	Sensitivity is adjusted automatically based on the sensitivity within the measurement region, and then the measurement is made.This method is suitable when the brightness of the workpiece surface is constant.	119.52 ms
Fixed	The measurement is made with the fixed level of sensitivity specified.(Setting range: 0 to 31) This method is suitable when accurate measurements cannot be made with [Auto], for example for lines at which workpieces of various colors are fed alternately.	99.6 ms
Multi (Default setting)	Sensitivity is adjusted according to the sensitivity information of each line within the measurement region. This method is suitable when the brightness of the workpiece surface fluctuates to a large degree. Position a reference workpiece and select [Multi]. The Controller will automatically set the upper and lower limits of sensitivity on the basis of the brightness of the reflection from the reference workpiece.	99.6 ms

When Selecting [Auto]

1. Select [Image/Sensitivity].



▼

The selections for sensitivity adjustment appear.

2. Select [Auto].

▼

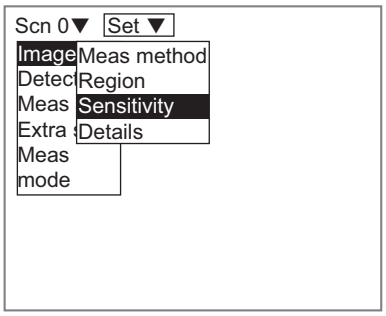
The setting will be registered and the screen display returns to **1**.

When Selecting [Fixed]

Position a reference workpiece and select an appropriate sensitivity level while checking the light reception level.

Setting range	Sensitivity	Color of workpiece
LV0 (laser turned off) LV1 · · · LV31	- Low High	- Bright Dark

1. Select [Image/Sensitivity].



The selections for sensitivity adjustment appear.

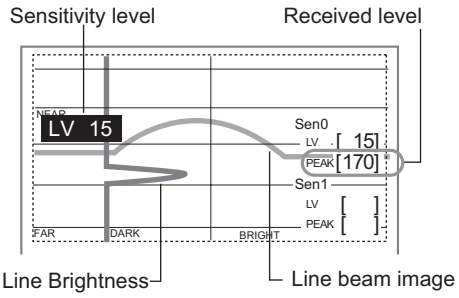
2. Select [Fixed].

The screen for setting the sensitivity level appears.

3. Select the sensitivity level using the Up/Down keys while monitoring the image on the monitor screen.

CHECK!

Select the level while checking the line brightness and light reception level.
- 120 or less: Insufficient light density
- 255 or more: Excessive light density



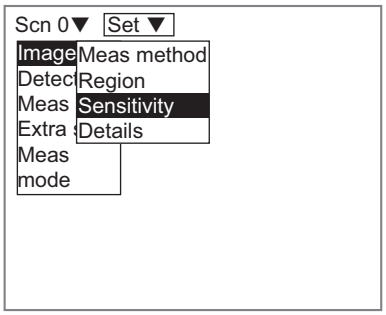
4. Select the setting by pressing the ENT Key.

The setting will be registered and the screen display returns to **1**.

When Selecting [Multi]

Position a reference workpiece and perform the following operations.
The sensitivity level is automatically set for each line based on the brightness of the reflection from the reference workpiece.

1. Select [Image/Sensitivity].

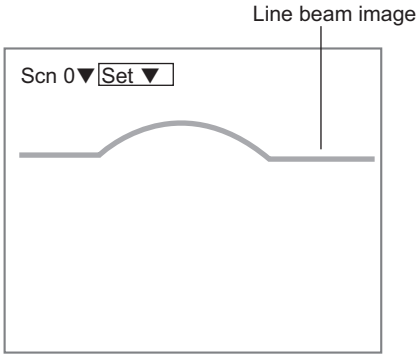


The selections for sensitivity adjustment appear.

2. Select [Multi].

The multiple sensitivity setting screen appears.

3. Check that the workpiece is positioned within the measurement range and press the ENT Key.



The sensitivity level will be registered and the screen display returns to **1**.

CHECK! After the settings have been completed, fine adjustment can be made under [Details].

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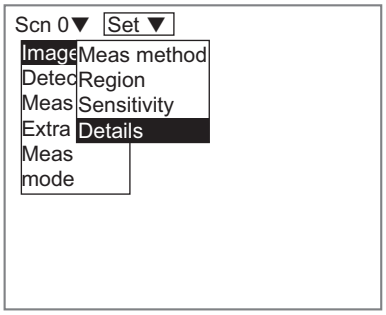
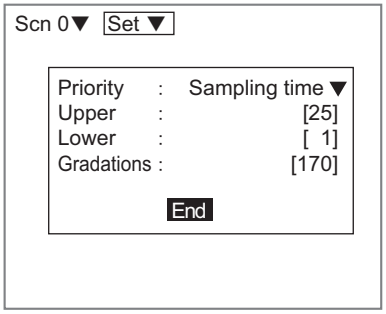
Setting Detailed Sensitivity Conditions

These detailed settings may be specified when either [Auto] or [Multi] has been selected as the sensitivity adjustment method. The default setting at the shipment is sufficient under normal circumstances. After changing the settings, perform a workpiece measurement to check that measurement can still be performed correctly.

1. Select [Image/Details].



The setting screen for sensitivity details appears.



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

3. Select [End].

The setting will be registered and the screen display returns to **1**.

Item	Option/Setting range	Meaning
Priority item (Only valid when [Multi] is selected)	Dynamic range	This refers to the priority order to be used when adjusting sensitivity. The default setting at shipment, [Sampling time] is sufficient under normal circumstances. Select [Dynamic range] if the measurement is unstable. The measurement time is shorter for [Sampling time].
	Sampling time (Default setting)	
Upper	0 to 31 (Set to 25 by default setting)	The appropriate sensitivity level is automatically selected from the range from the lower limit to the upper limit. Only a value in the range from 0 to 25 can be specified if [Sampling time] is set in [Priority] for [Multi].
Lower	0 to 31 (Set to 1 by default setting)	
Gradations	120 to 220 (Set to 170 by default setting)	Set the target light reception level. The sensitivity level where this light reception level can be achieved is selected.

Guideline for Sampling Time

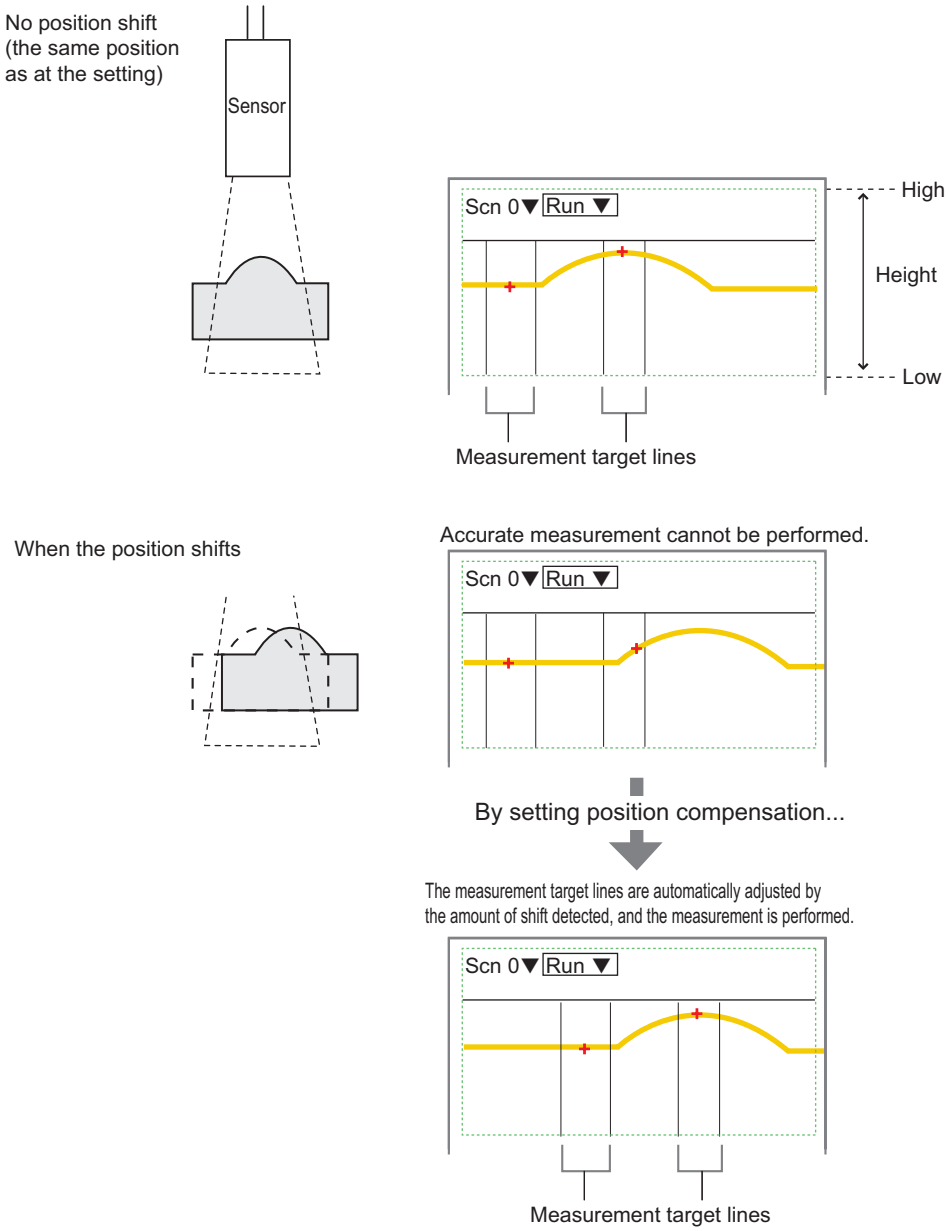
	Sampling time*	Sensitivity adjustment range
Dynamic range	100 to 640 mm (in 20 ms intervals)	0 to 31
Sampling time	100 to 260 mm (in 10 ms intervals)	0 to 25

* The sampling time becomes longer than the values given in this table if the number of measurement points is increased.

Setting the Workpiece Position Detection Method

As far as the position of a workpiece is fixed, it is possible to make the measurement with the measurement target lines and edge detection level specified initially. If, however, the workpiece moves, it is no longer possible to obtain accurate measurements.
The position compensation function is used when the position of the measurement workpiece is not consistent.

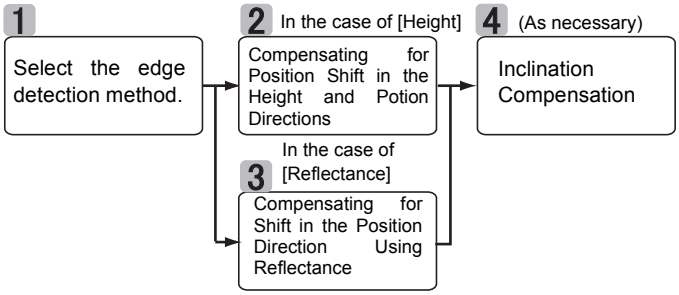
Example: Measuring the gap between two locations



CHECK!

Changing the [Detect set] setting may affect the specification of [Meas set].
Therefore, make sure to set [Detect set] first, and then [Meas set].

• Operational Flow



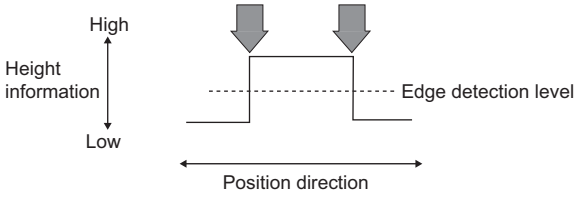
1 Select the edge detection method.

Select the edge detection method to be used for finding the position of the workpiece.
The default setting at shipment, [Height], is sufficient under normal circumstances. Try selecting [Reflectance] if edges cannot be detected properly with [Height].

Method	Meaning
Height (default setting)	Edges are detected based on the height information.
Reflectance	Edges are detected based on the reflectance information.

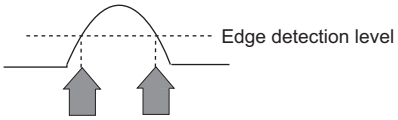
Example 1: Measuring the width of a convex object

Select [Height] to detect the edges with high reliability.

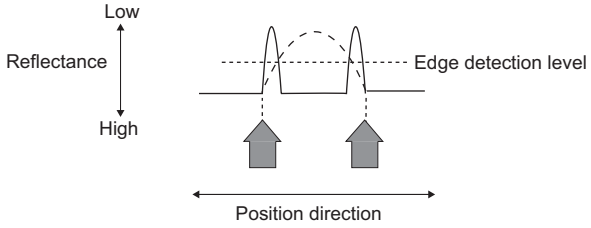


Example 2: Measuring the width of a mountain-shaped object

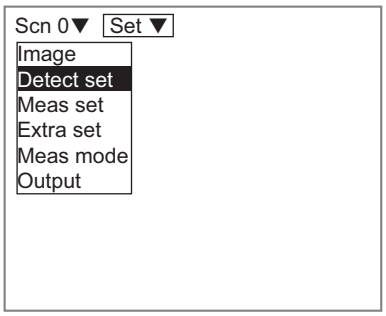
If [Height] is selected, the measurement result fluctuates depending on the inclination angle.



The edges may be detected with high reliability by selecting [Reflectance].

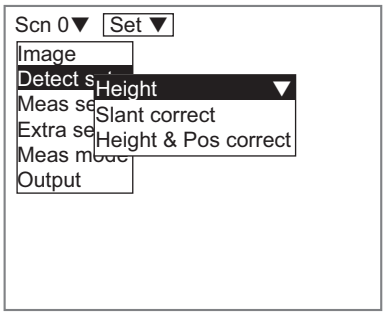


1. Select [Detect Set].



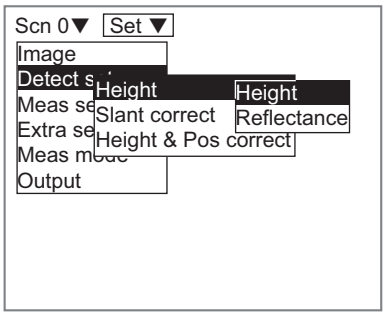
The selections for detection method appear.

2. Move the cursor to [Height] or [Reflectance] and press the ENT Key.

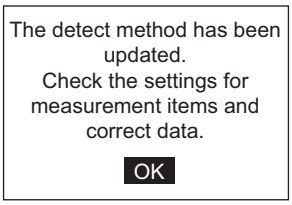


The selections for edge detection method appear.

3. Choose the detection method and select the choice by pressing the ENT Key.



A confirmation message appears if the settings of measurement items and the registration of reference (height position correction or reflectance correction) have already been performed.

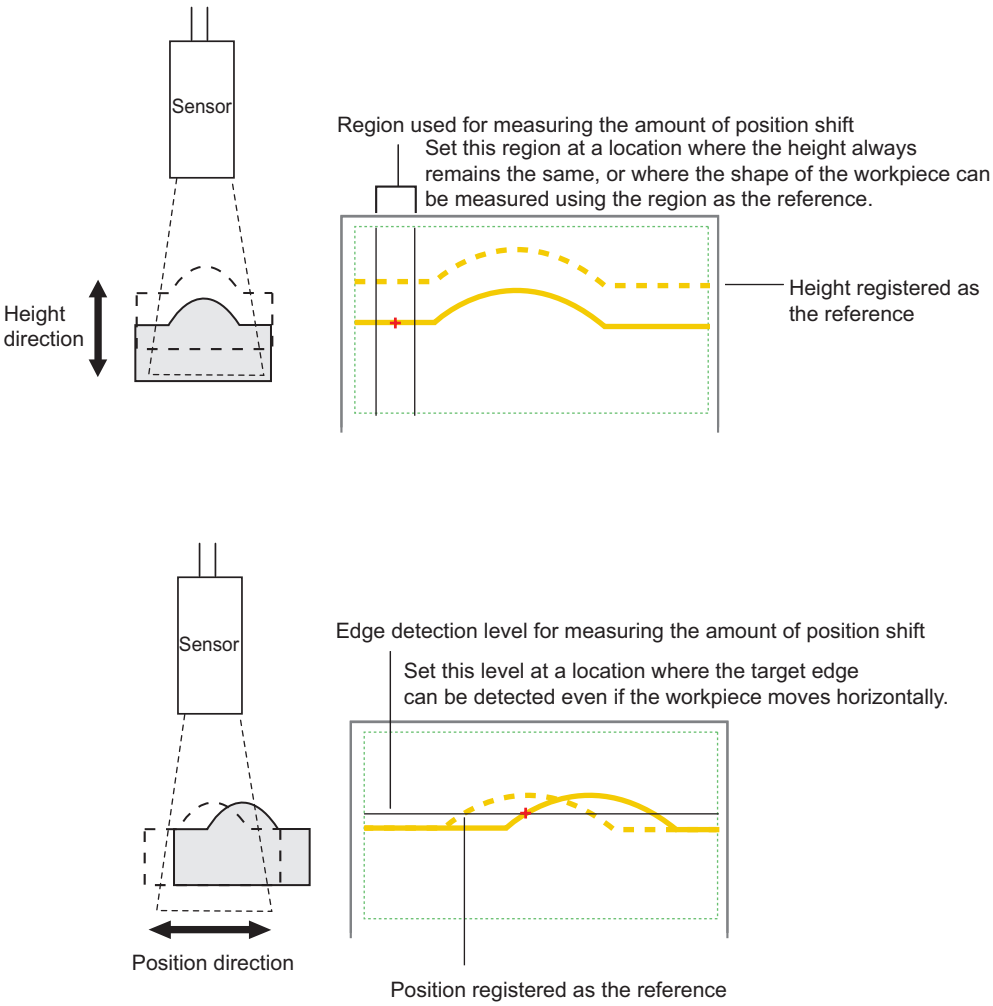


4. Press the ENT Key.

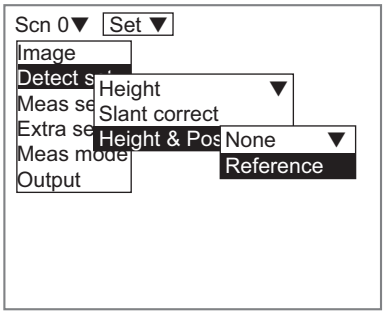
The setting will be registered and the screen display returns to **2**.

2 Compensating for Position Shift in the Height and Potion Directions

Set the area for measuring the amount of position shift. The measurement value at this point is registered as the reference position; place the workpiece at the correct position before starting the settings.
This function can only be used when [Height] is selected as the detection method.

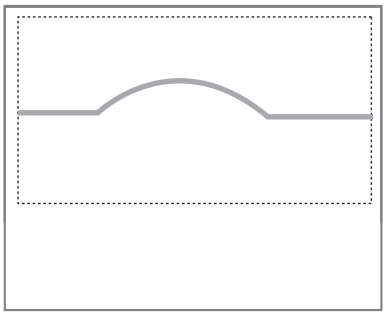


1. Select [Detect Set/Height&Pos correct/Reference].



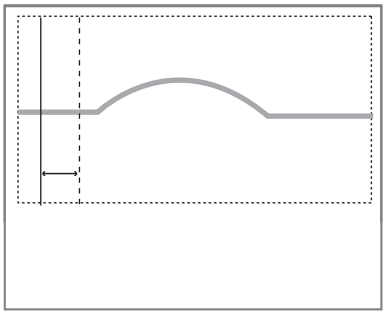
A profile graph appears.

2. Check that the workpiece is positioned correctly and press the ENT Key.



The screen for setting the area in the height direction appears.

CHECK! Keep the default setting (the entire screen) if compensation in the height direction is not necessary.



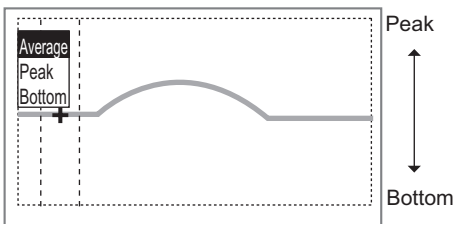
3. Specify the start and end lines.

Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.
ESC Key: Cancels the setting.

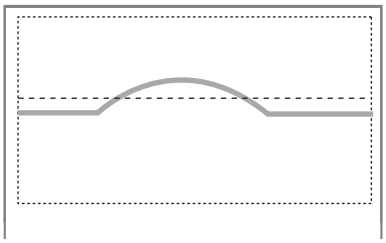
The characteristic quantity setting screen appears.

4. Select the characteristic quantity to be used as the reference point.

Select which position (peak, bottom, or average) within the specified area will be measured.
The cross cursor indicating the measurement point moves according to the selections.
Select the position while monitoring the image.



The screen for setting the edge detection level for compensating for shift in the position direction appears.



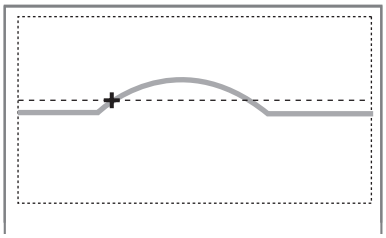
5. Align the dotted line with the edges to be detected.

Up/Down key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.

The selections appear.

6. Select the edge search direction.

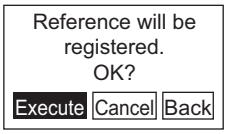
Points that can be detected at the specified edge level are displayed as measurement point candidates.



7. Repeat pressing the Left or Right key until the cross cursor appears at the point to be used as the reference position.

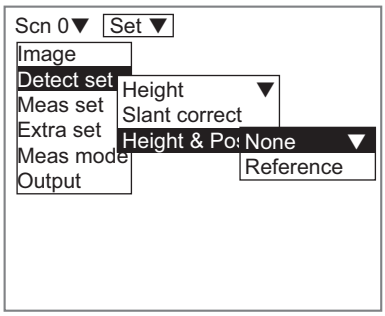
8. Select the setting by pressing the ENT Key.

A confirmation message appears.



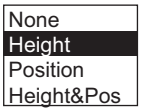
9. Select [Execute].

The reference registration will be selected and the screen display returns to **1**.



10. Move the cursor to [None] and press the ENT Key.

The selections appear.

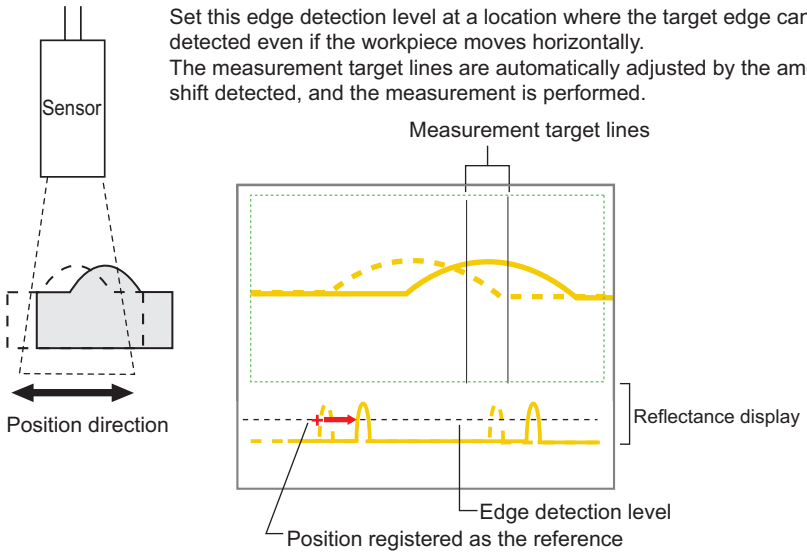


11. Select the compensation direction.

The setting will be registered and the screen display returns to **1**.

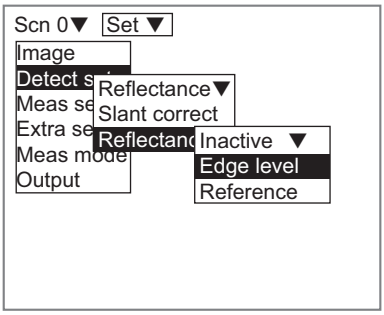
3 Compensating for Shift in the Position Direction Using Reflectance

Specify the edge detection level in order to compensate for position shift by detecting the reflection from the edge areas. The measurement value at this point is registered as the reference position; place the workpiece at the correct position before starting the settings.
This function can only be used when [Reflectance] is selected as the detection method.

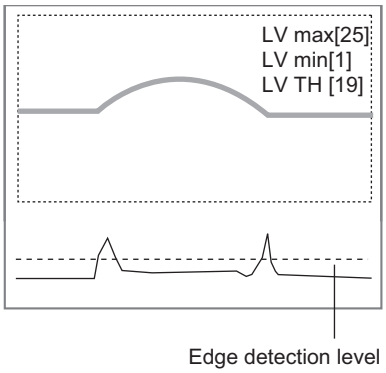


CHECK! The edge detection level specified here is also used for edge related measurement items (such as edge position and width).

1. Select [Detect set/Reflectance correct/Edge level].



The reflectance and edge detection level are displayed in the lower half of the screen.



2. Align the dotted line with the edges to be detected.
Up/Down key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)

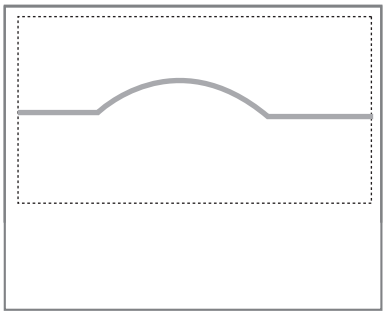
CHECK!
LV max: The maximum reflectance value
LV min: The minimum reflectance value
LV TH: The reflectance corresponding to the edge detection level

3. Press the ENT Key to select the setting.

The setting will be registered and the screen display returns to **1**.

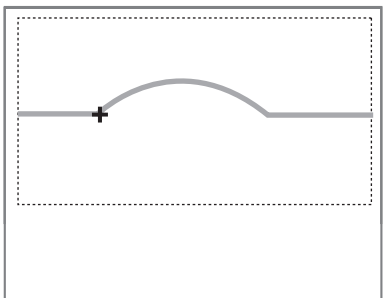
4. Select [Reference].

A profile graph appears.



5. Check that the workpiece is positioned correctly and press the ENT Key.

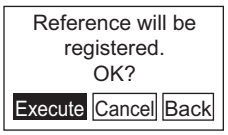
Points that can be detected at the edge level specified in **2.** are displayed as candidates.



6. Repeat pressing the Left or Right key until the cross cursor appears at the point to be used as the reference position.

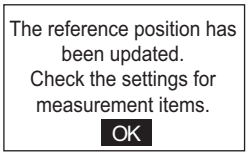
7. Select the setting by pressing the ENT Key.

A confirmation message appears.



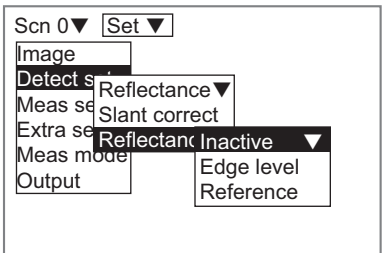
8. Select [Execute].

A confirmation message appears if the mesurement item has already been set.



9. Press the ENT Key.

The reference registration will be selected and the screen display returns to **1**.



10. Move the cursor to [Inactive] and press the ENT Key.

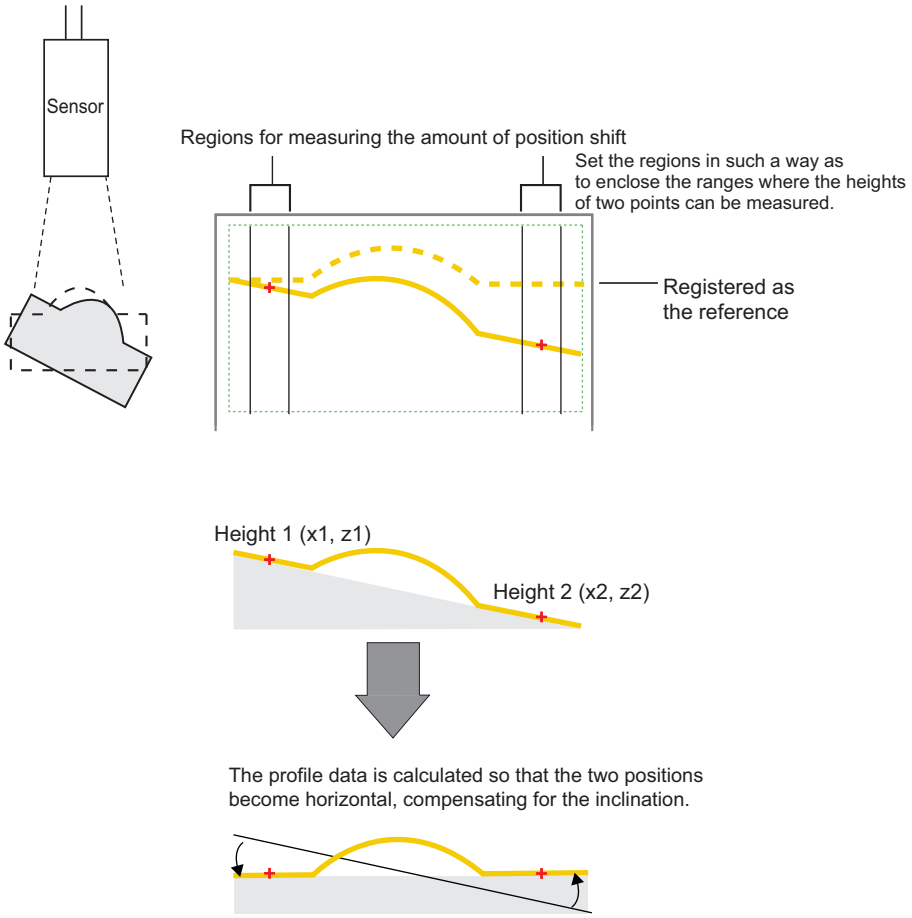
The selections appear.

11. Select [Active].

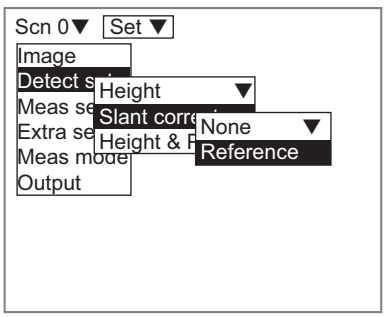
The setting will be registered and the screen display returns to **1**.

4 Inclination Compensation

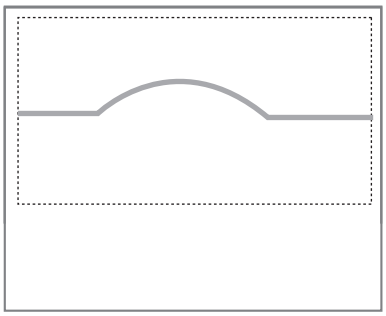
Set the area for measuring the inclination. The measurement value at this point is registered as the reference position; therefore, place the workpiece at the correct position before you start settings.



1. Select [Detect set/Slant correct/Reference].

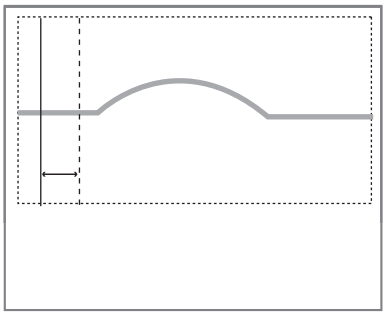


A profile graph appears.



2. Check that the workpiece is positioned correctly and press the ENT Key.

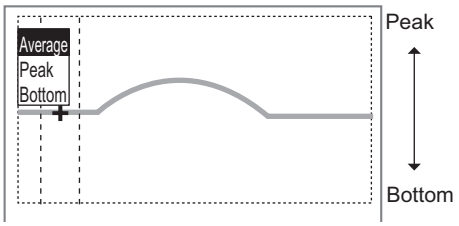
The screen for setting height 1 appears.



3. Specify the start and end lines.

Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.
ESC Key: Cancels the setting.

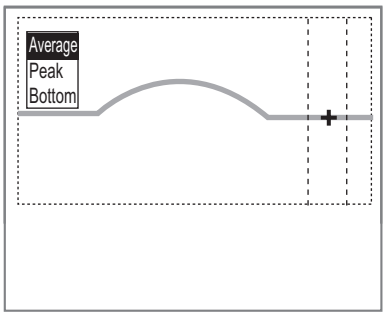
The characteristic quantity setting screen appear.



4. Select the characteristic quantity to be used as the reference point.

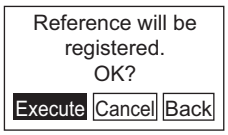
Select which position (peak, bottom, or average) within the specified area will be measured.
The cross cursor indicating the measurement point moves according to the selection; therefore, select the position while monitoring the image.

The screen for setting height 2 appears.



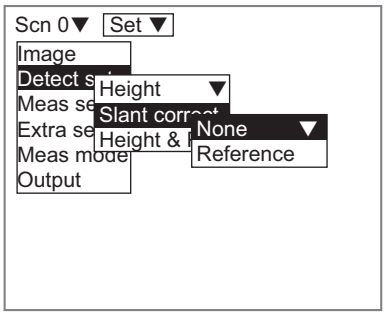
5. Specify the characteristic quantity for the measurement line and measurement point for the second point using the same procedure as in **3.** to **4**.

A confirmation message appears.



6. Select [Execute].

The reference registration will be selected and the screen display returns to **1**.



7. Move the cursor to [None] and press the ENT Key.

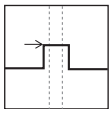
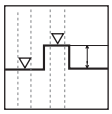
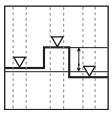
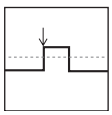
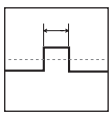
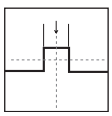
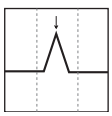
The selections appear.

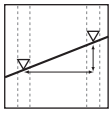
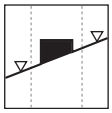
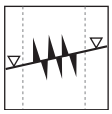
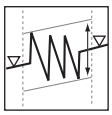
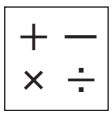
8. Select [Active].

The setting will be registered and the screen display returns to **1**.

Setting Measurement Items

Up to eight measurement items can be set for each scene.
The Controller provides 12 measurement items, each of which can be assigned to outputs OUT0 to OUT7.In other words, it is possible to perform up to eight measurements simultaneously.
[Height] is set in OUT0 as the default setting at shipment.

Measurement item	Meaning	Explanatory diagram	Reference
Height	The height is measured within the specified region.		p.72
Step: 2 pts	Two target measurement lines are specified. After taking the measurement point on the 1st line as the reference, the distance from the measurement point on the 2nd line is measured.		p.74
Step: 3 pts	Three target measurement lines are specified. After taking the average of the measurement points on two of the lines specified above, the difference from the measurement point on the 3rd line is measured.		p.75
Edge position	The specified edge position is measured.		p.78
Width	The difference between the specified two edge positions is measured.		p.81
Edge center	The center is measured based on the specified two edge positions.		p.84
Peak/bottom	The peak or bottom point of the height within the specified measurement target line is measured.		p.85

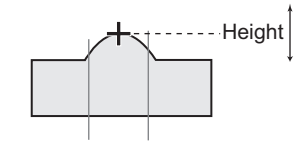
Measurement item	Meaning	Explanatory diagram	Reference
Angle	The inclination between the two specified points is measured.		p.87
Cross-sectional area	The cross-sectional area of the specified region is measured.		p.89
Arithmetic average roughness	The roughness of the specified region is measured.The average of absolute differences from the reference line is calculated.		p.92
Maximum roughness	The roughness of the specified region is measured.The difference between the maximum deviations in both directions from the reference line is calculated.		p.92
Define	The measurement items are set by a user-defined equation. The measurement result of an output can be assigned to the equation.		p.95


CHECK!

When using the position compensation function, set [Detect set] and [Meas set] in this order.

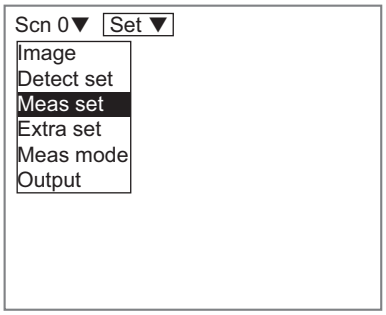
Height

Measure the height of the workpiece.
The following conditions will be used as an example for describing the setting procedures.



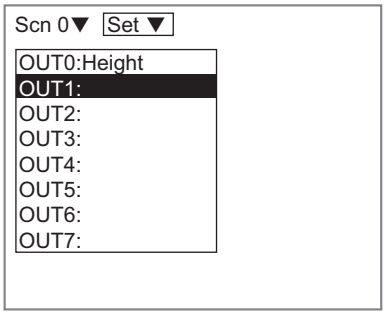
Measurement target lines

1. Select [Meas set].

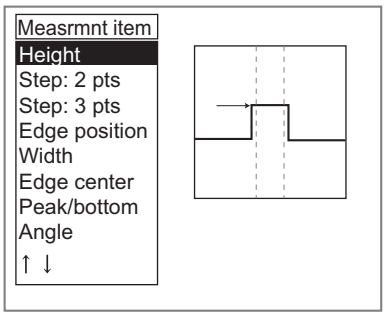


A list of outputs appears.

2. Select an output for which [Height] is set.
In this example, select [OUT1].

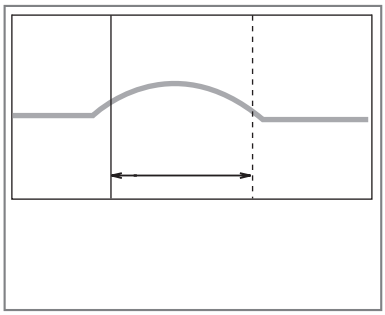


The selections for measurement item appear.



3. Select [Height].

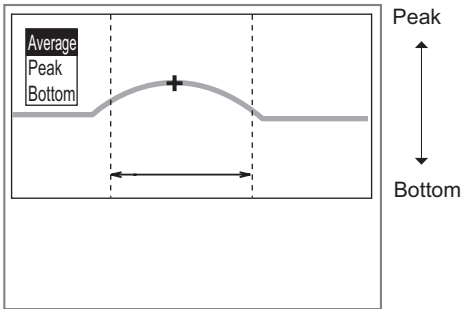
The measurement line setting screen appears.



4. Specify the start and end lines.

Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.
ESC Key: Cancels the setting.

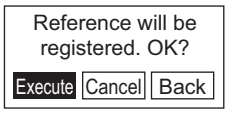
The characteristic quantity setting screen appears.



5. Select the measurement point.

Select which position (peak, bottom, or average) within the specified region will be measured.
The cross cursor indicating the measurement point moves according to the selection; therefore, select the position while monitoring the image.

A confirmation message appears.

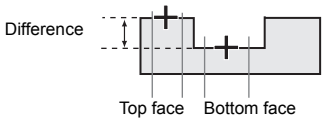


6. Select [Execute].

The setting will be registered and the screen display returns to **2**.

Step: 2 pts

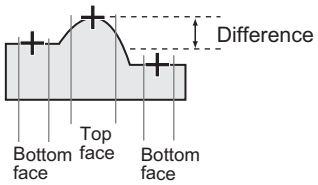
Level differences, grooves, and other items of workpieces can be measured.
Specify two measurement target regions. The difference between the measurement points in the regions, i.e., the gap between them, is calculated.



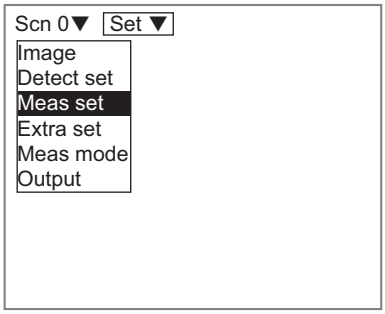
Refer to the next page for the operation method.
p.40

Step: 3 pts

Level differences, grooves, and other items of workpieces can be measured.
Specify two regions for the bottom face and one region for the top face. The difference, i.e., the gap between the average of the bottom face measurements and the top face measurement, is calculated.
The following conditions will be used as an example for describing the setting procedures.

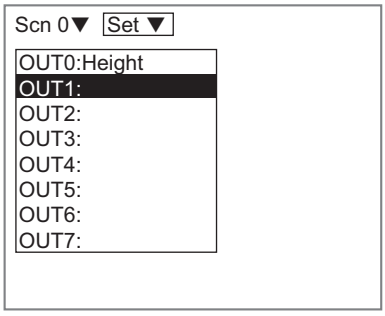


1. Select [Meas set].

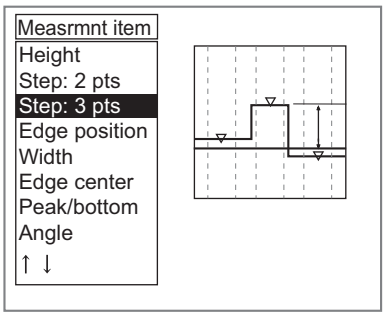


A list of outputs appears.

2. Select an output for which [Step: 3 pts] is set.
In this example, select [OUT1].

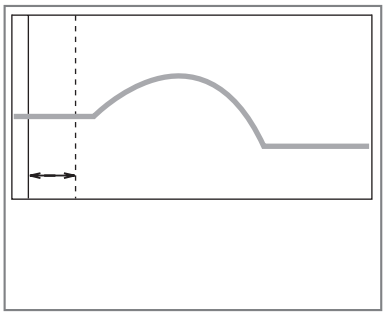


The selections for measurement item appear.



3. Select [Step: 3 pts].

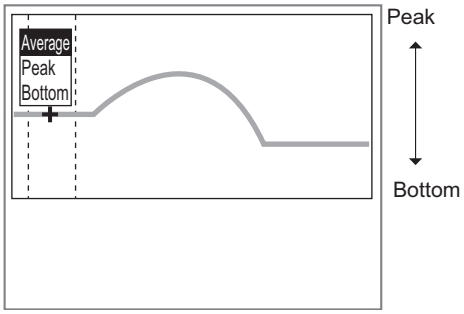
The measurement line setting screen for bottom face region 1 appears.



4. Specify the start and end lines of bottom face region 1.

Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.
ESC Key: Cancels the setting.

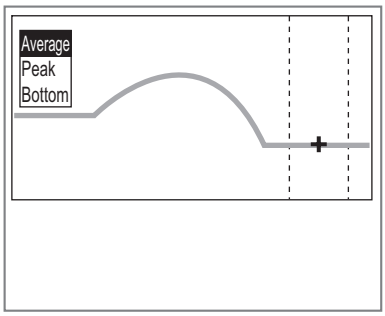
The characteristic quantity setting screen appears.



5. Select the measurement point for bottom face region 1.

Select which position (peak, bottom, or average) within the specified region will be measured.
The cross cursor indicating the measurement point moves according to the selection; therefore, select the position while monitoring the image.

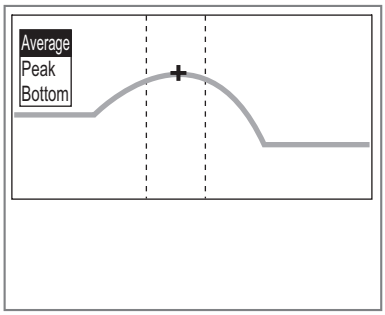
The measurement region setting screen for bottom face region 2 appears.



6. Repeat the operations in **4.** to **5.** to set the characteristic quantity for the measurement lines and measurement point for bottom face region 2.

▼

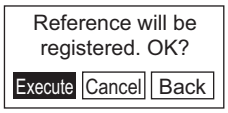
The measurement line setting screen for the top face region appears.



7. Repeat the operations in **4.** to **5.** to set the characteristic quantity for measurement lines and measurement point for the top face region.

▼

A confirmation message appears.



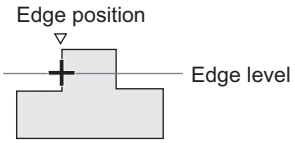
8. Select [Execute].

▼

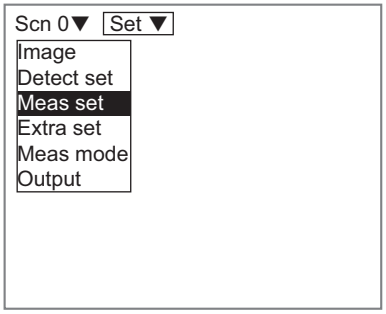
The setting will be registered and the screen display returns to **2**.

Edge Position

The edge position of the workpiece can be measured.
Specify the edge detection level. Edges corresponding to that level will be searched.
The following conditions will be used as an example for describing the setting procedures.



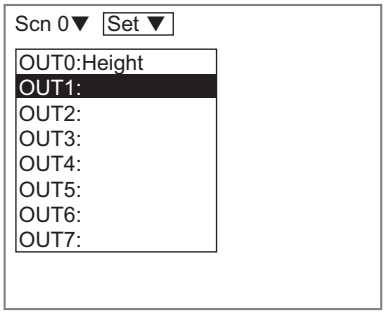
1. Select [Meas set].



A list of outputs appears.

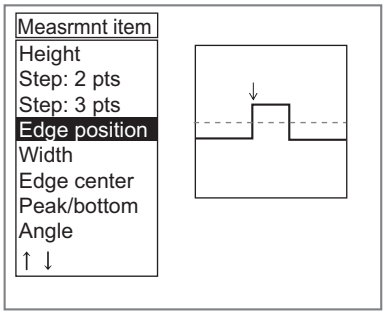
2. Select an output for which [Edge position] is set.

In this example, select [OUT1].

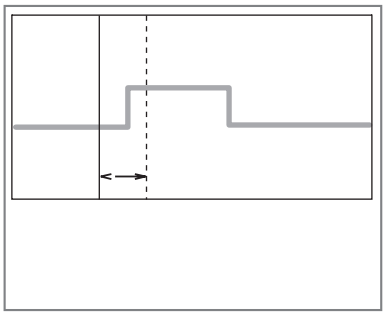


The selections for measurement item appear.

3. Select [Edge position].



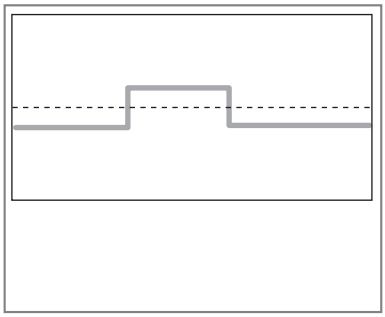
The measurement line setting screen appears.



CHECK! If [Reflectance] is specified as the detection method, the screens shown in **4.** to **9.** do not appear.The measurement is made at the edge level specified in [Reflectance correct/Edge level].
p.64

4. Specify the start and end lines.
Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.
ESC Key: Cancels the setting.

The edge level setting screen appears.



5. Align the dotted line with the edge to be detected.
Up/Down key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)

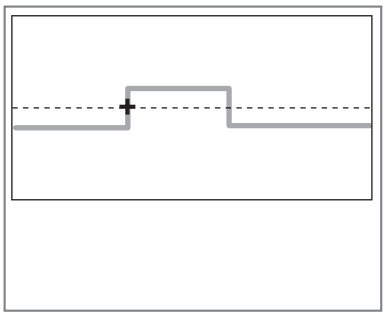
6. Press the ENT Key to select the setting.

The selections appear.

Left → Right
Right → Left

7. Select the edge search direction.

Points that can be detected at the specified edge level are displayed as measurement point candidates.



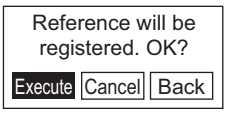
8. Repeat pressing the Left or Right key until the cross cursor appears at the edge to be detected.

CHECK!

In some cases, the cursor will not be displayed on the intersection point of the edge level and the edge position. However, selection of an arbitrary cursor will give the same measurement result (the intersection point becomes the measurement point), as long as the selected cursor exists near the intersection point.

9. Press the ENT Key to select the setting.

A confirmation message appears.

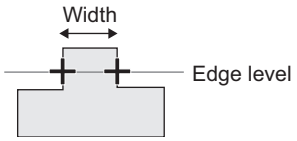


10. Select [Execute].

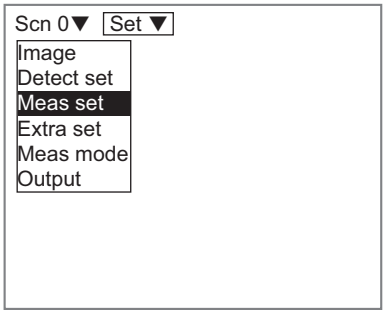
The setting will be registered and the screen display returns to **2**.

Width

The difference between two edges can be measured.
The following conditions will be used as an example for describing the setting procedures.



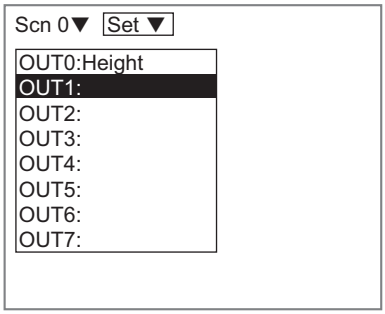
1. Select [Meas set].



A list of outputs appears.

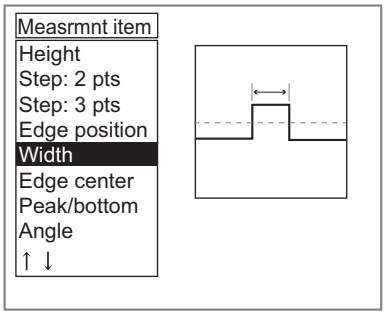
2. Select an output for which [Width] is set.

In this example, select [OUT1].

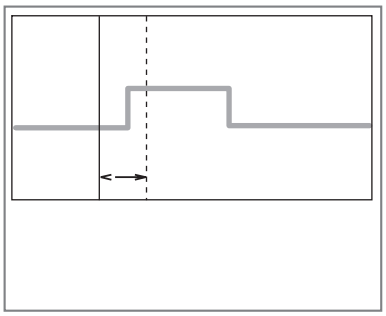


The selections for measurement item appear.

3. Select [Width].



The measurement line setting screen for the first point appears.



CHECK! If [Reflectance] is specified as the detection method, the screens shown in **4.** to **9.** do not appear.The measurement is made at the edge level specified in [Reflectance correct/Edge level].
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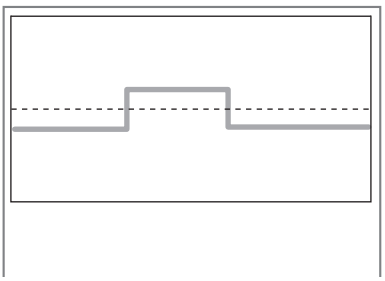
4. Specify the start and end lines.
Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.
ESC Key: Cancels the setting.

The edge level setting screen for the first point appears.



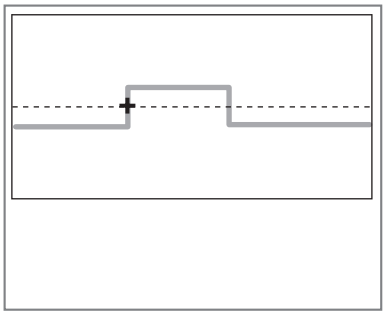
5. Align the dotted line with the edge to be detected.
Up/Down key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)

6. Press the ENT Key to select the setting.

The selections appear.

7. Select the edge search direction.

Points that can be detected at the specified edge level are displayed as measurement point candidates.

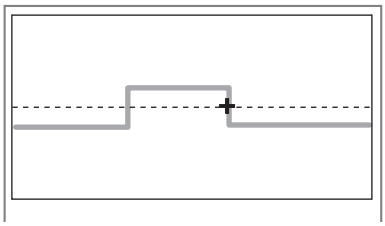


8. Keep pressing the Left or Right key until the cross cursor appears at the edge to be detected.

CHECK! In some cases, the cursor will not be displayed on the intersection point of the edge level and the edge position. However, selection of an arbitrary cursor will give the same measurement result (the intersection point becomes the measurement point), as long as the selected cursor exists near the intersection point.

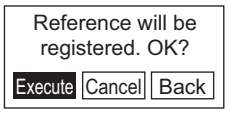
9. Press the ENT Key to select the setting.

The edge level setting screen for the second point appears.



10. Repeat the operations from **4.** to **9.** to specify the edge level and measurement point for the second point.

A confirmation message appears.

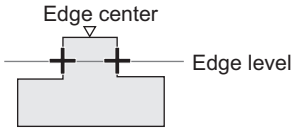


11. Select [Execute].

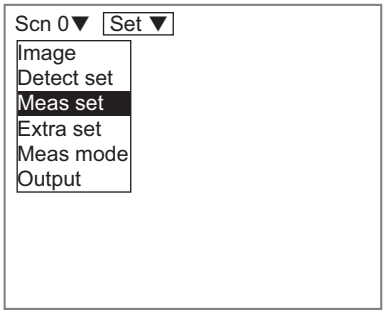
The setting will be registered and the screen display returns to **2**.

Edge Center

The center position between two edges can be measured.
The following conditions will be used as an example for describing the setting procedures.



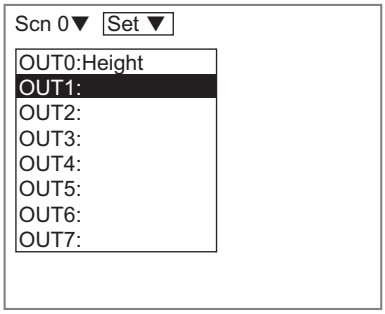
1. Select [Meas set].



A list of outputs appears.

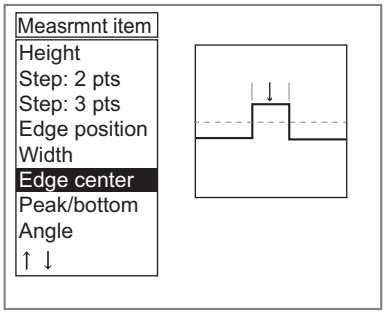
2. Select an output for which [Edge center] is set.

In this example, select [OUT1].



The selections for measurement item appear.

3. Select [Edge center].



The operations from here are the same as **4.** to **11.** for the width measurement.
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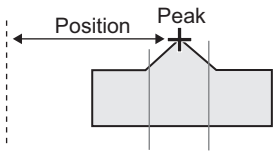
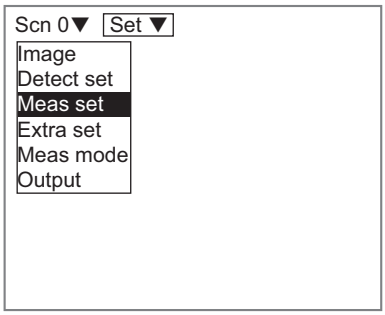
Peak/Bottom

The peak or bottom in the selected region can be measured.
The following conditions will be used as an example for describing the setting procedures.

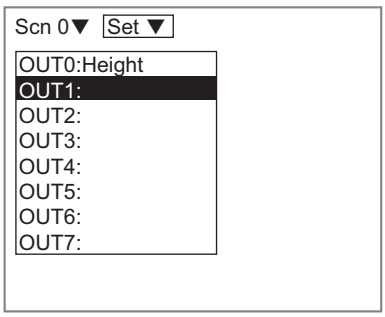


1. Select [Meas set].

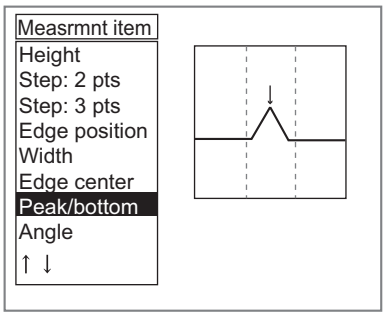


A list of outputs appears.

2. Select an output for which [Peak/bottom] is set.
In this example, select [OUT1].

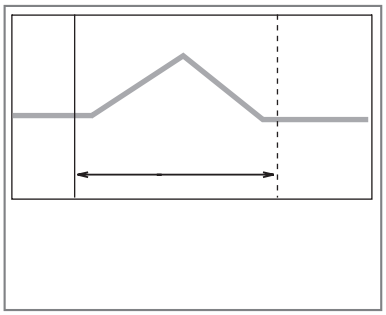


The selections for measurement item appear.



3. Select [Peak/bottom].

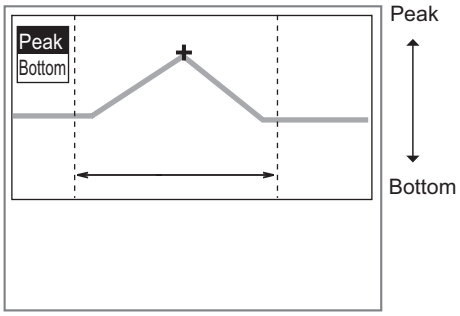
The measurement line setting screen appears.



4. Specify the start and end lines.

Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.
ESC Key: Cancels the setting.

The characteristic quantity setting screen appears.

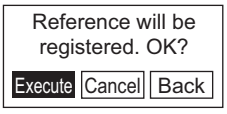


5. Select the measurement point.

Select which position (peak or bottom) within the specified region will be measured.
The cross cursor indicating the measurement point moves according to the selection; therefore, select the position while monitoring the image.

In this example, select [Peak].

A confirmation message appears.

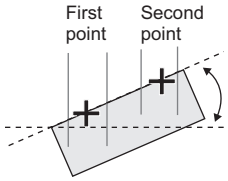


6. Select [Execute].

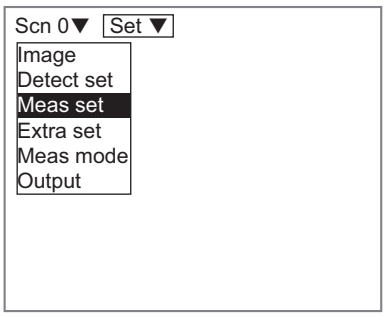
The setting will be registered and the screen display returns to **2**.

Angle

The inclination of the workpiece is measured.
The following conditions will be used as an example for describing the setting procedures.



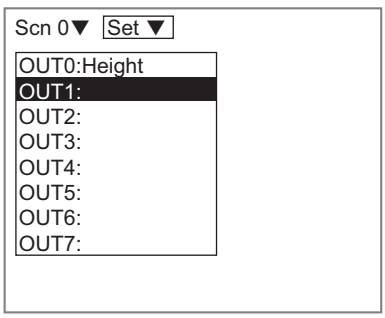
1. Select [Meas set].



A list of outputs appears.

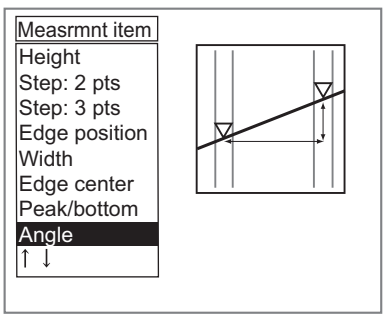
2. Select an output for which [Angle] is set.

In this example, select [OUT1].

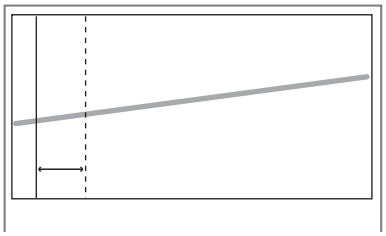


The selections for measurement item appear.

3. Select [Angle].



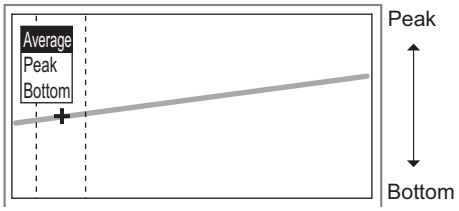
The measurement line setting screen for the first point appears.



4. Specify the start and end lines.

Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.
ESC Key: Cancels the setting.

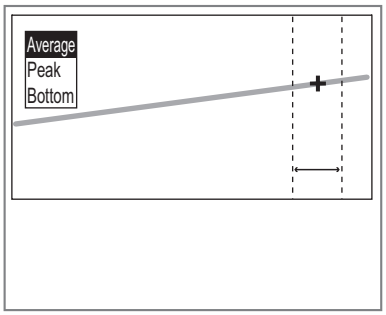
The characteristic quantity setting screen appears.



5. Select the characteristic quantiry for the first point.

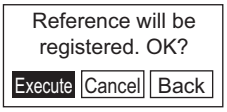
Select which position (peak, bottom, or average) within the specified region will be measured.
The cross cursor indicating the measurement point moves according to the selection; therefore, select the position while monitoring the image.

The measurement line setting screen for the second point appears.



6. Specify the characteristic quantity for the measurement line and measurement point for the second point using the same procedure as in **4.** to **5**.

A confirmation message appears.

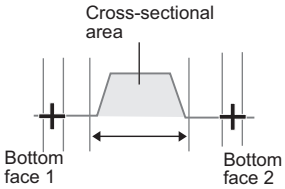


7. Select [Execute].

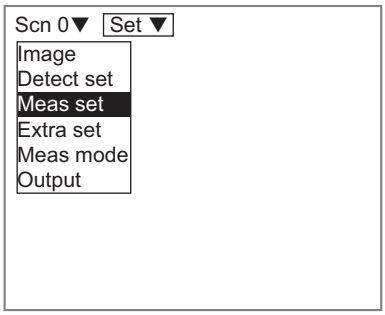
The setting will be registered and the screen display returns to **2**.

Cross-sectional area

The cross-sectional area of the workpiece can be measured.
Specify the bottom face. The cross-sectional area is calculated by integrating the distances between each of the measurement points and the bottom face.
The following conditions will be used as an example for describing the setting procedures.



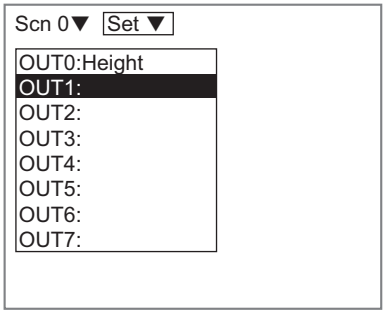
1. Select [Meas set].



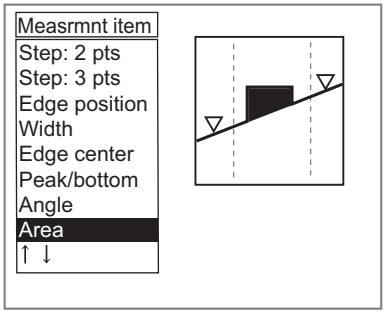
A list of outputs appears.

2. Select an output for which [Area] is set.

In this example, select [OUT1].

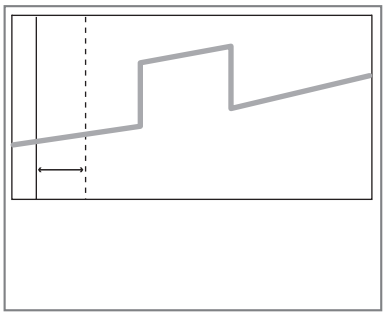


The selections for measurement item appear.



3. Select [Area].

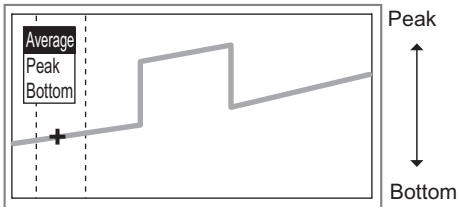
The measurement line setting screen for the first point appears.



4. Specify the start and end lines.

Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.
ESC Key: Cancels the setting.

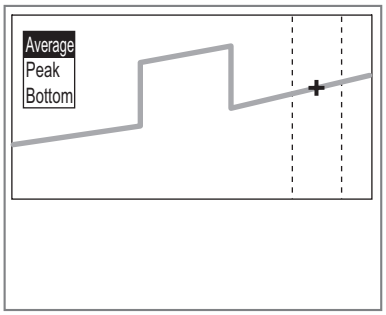
The characteristic quantity setting screen appears.



5. Select the characteristic quantity for the first point.

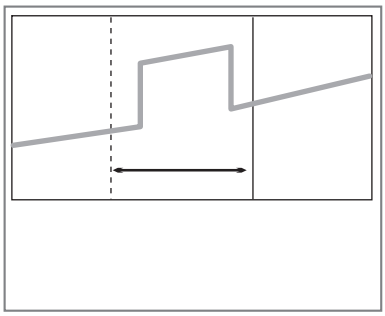
Select which position (peak, bottom, or average) within the specified region will be measured.
The cross cursor indicating the measurement point moves according to the selection; therefore, select the position while monitoring the image.

The measurement line setting screen for the second point appears.



6. Specify the characteristic quantity for the measurement line and measurement point for the second point using the same procedure as in **4.** to **5**.

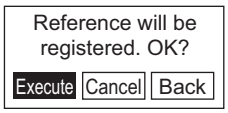
The measurement line setting screen for the cross-sectional area appears.



7. Specify the start and end lines.

Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.

A confirmation message appears.



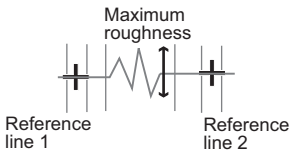
8. Select [Execute].

The setting will be registered and the screen display returns to **2**.

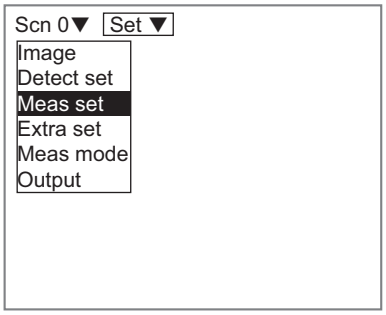
Arithmetic Average Roughness and Maximum Roughness

The distribution (roughness) of the height measurements relative to the reference line can be measured.Select [Roughness Ra] in order to obtain the average roughness, and [Roughness Ry] in order to obtain the maximum roughness value. Operations other than the above are common for both selections.

The following conditions will be used as an example for describing the setting procedures.



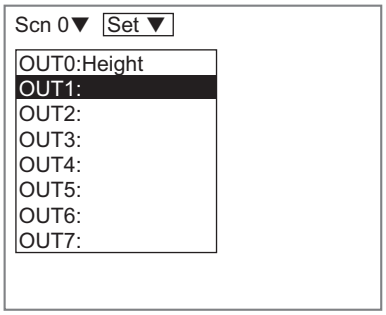
1. Select [Meas set].



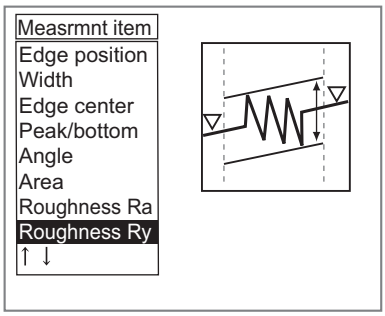
A list of outputs appears.

2. Select an output for which [Roughness Ry] is set.

In this example, select [OUT1].

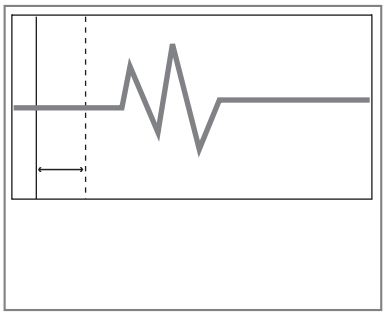


The selections for measurement item appears.



3. Select [Roughness Ry].

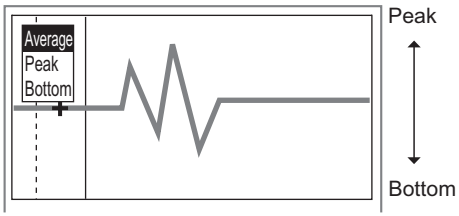
The measurement line setting screen for reference line 1 appears.



4. Specify the start and end lines.

Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.
ESC Key: Cancels the setting.

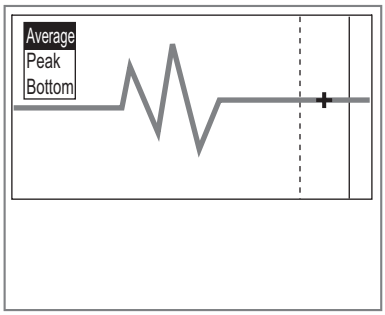
The characteristic quantity setting screen appears.



5. Select the characteristic quality for the first point.

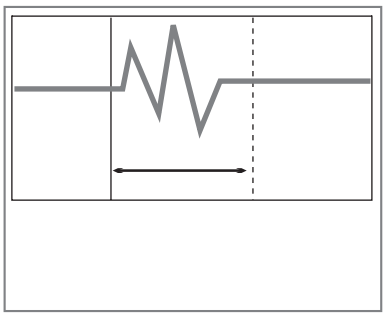
Select which position (peak, bottom, or average) within the specified region will be measured.
The cross cursor indicating the measurement point moves according to the selection; therefore, select the position while monitoring the image.

The measurement line setting screen for reference line 2 appears.



6. Specify the characteristic quantity for the measurement line and measurement point for the second point using the same procedure as in **4.** to **5**.

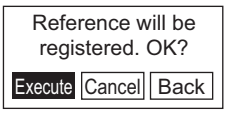
The measurement line setting screen for roughness appears.



7. Specify the start and end lines.

Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.
ESC Key: Cancels the setting.

A confirmation message appears.

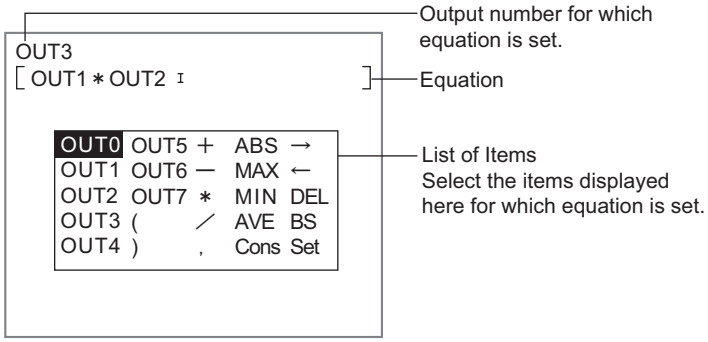


8. Select [Execute].

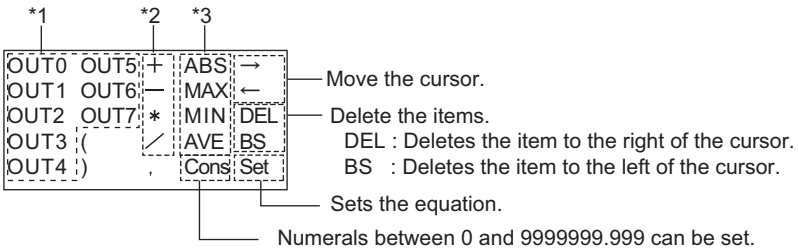
The setting will be registered and the screen display returns to **2**.

Define

It is possible to set up an arithmetic expression using the measurement result of another output.



List of Items



*1 Outputs

It is possible to perform a calculation based on the measurement results (results after calibration) of these outputs.

Note that outputs for which measurement items have not been set cannot be selected.

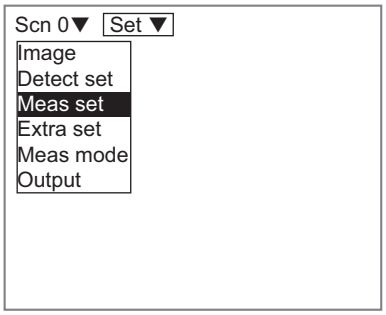
*2 Arithmetic operators

Operator	Calculation
+	Addition
-	Subtraction
*	Multiplication
/	Real number division

*3 Functions

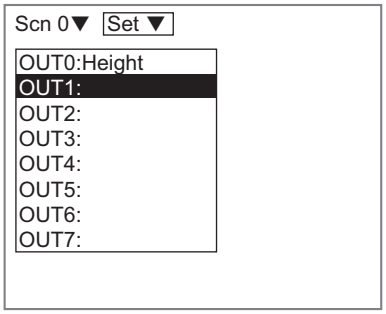
Function	Calculation
ABS	The absolute value is calculated. ABS (argument)
MAX	The largest value among the arguments is returned. MAX (Argument 1, Argument 2, Argument 3,...)
MIN	The smallest value among the arguments is returned. MIN (Argument 1, Argument 2, Argument 3,...)
AVE	The average value of the arguments is calculated. AVE (Argument 1, Argument 2, Argument 3,...)

1. Select [Meas set].



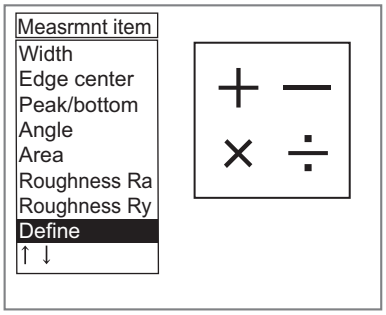
A list of outputs appears.

2. Select an output for which [Define] is set.
In this example, select [OUT1].

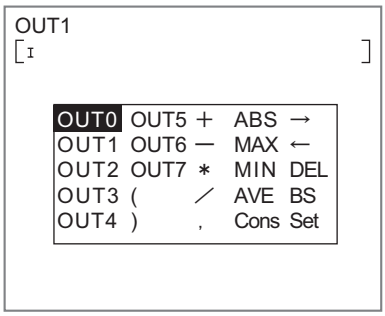


The selections for measurement item appear.

3. Select [Define].



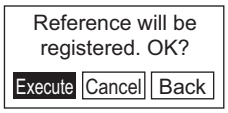
The equation setting screen appears.



4. Select the desired items from the list of items and enter the equation.

5. Select [Set] when the equation has been entered.

A confirmation message appears.



6. Select [Execute].

The setting will be registered and the screen display returns to **2**.

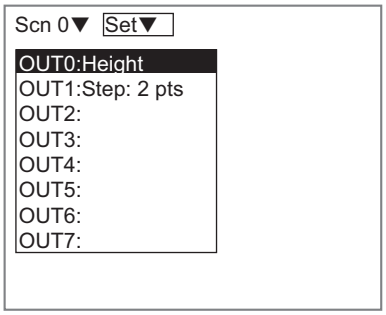
Changing Measurement Items

The measurement items that have been set for the outputs can be changed.

CHECK!

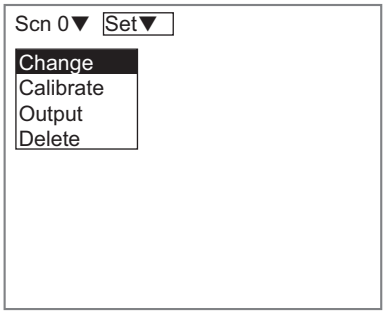
Clear any previously set measurement items in order to assign other measurement items.

1. Move the cursor to the output whose item is to be changed, and press the ENT Key.



The selections appear.

2. Select [Change].



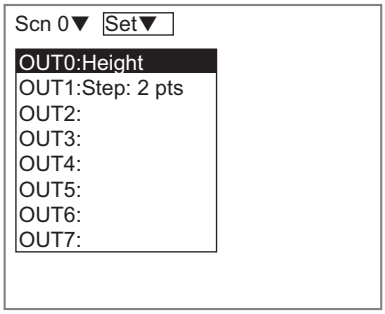
The setting screen for measurement range appears.
The remaining procedures are the same as those for measurement item setting.

Clearing Measurement Items

Clear the measurement items that have been set for the outputs.

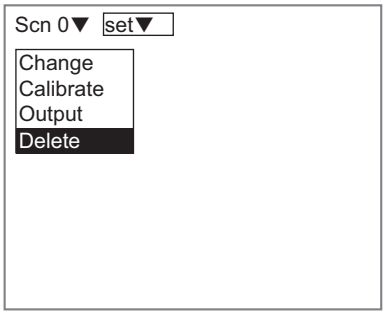
Clearing separately for each scene p.158

1. Move the cursor to the output whose measurement item is to be cleared, and press the ENT Key.



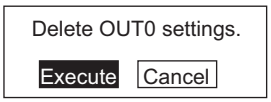
The selections appear.

2. Select [Delete].



A confirmation message appears.

3. Select [Execute].



The measurement item for the selected output is cleared and the screen display will return to **1**.

Setting Calibration

Calibrations can be set to compensate for differences between measurement values and actual dimensions due to the color or material of the measurement workpiece.The setting method varies depending on the measurement item set for the output.

Measurement item	Compensation	Calibration setting method
Height, Edge position, Edge center, Peak/bottom	Compensation for the measured height and position.	For setting, repeat the measurement twice.
Step: 2 pts, Step: 3 pts, Width	Compensation for the measured level difference and width.	For setting, repeat the measurement once.

CHECK!

When calibration is executed, the span and offset will be set automatically. It is also possible to make adjustment using [Output].
It is not possible to execute calibration for the following measurement items: Angle, Area, Arithmetic average roughness, and Define. Adjust the span and offset using [Output].

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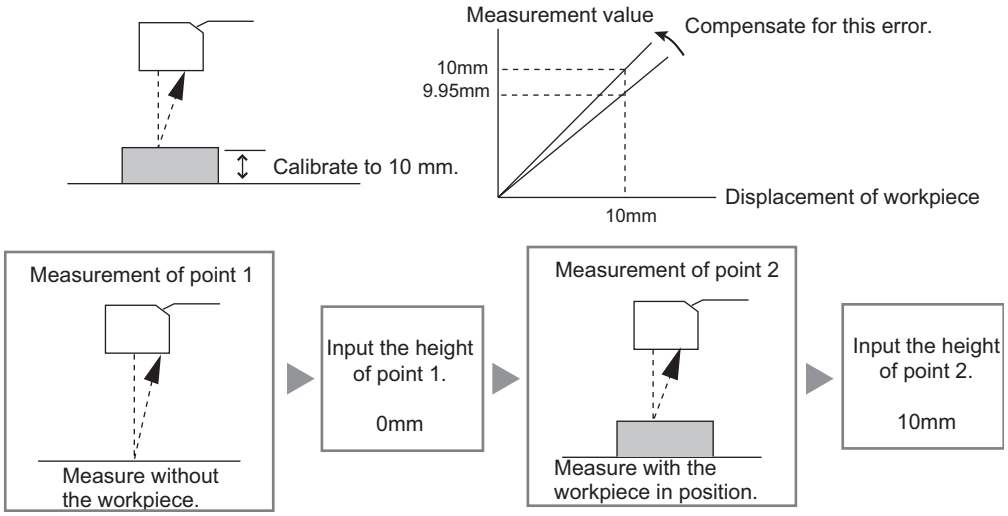
Compensating for Measured Height and Position

To compensate for the error, perform the measurement twice.
Applicable measurement items: Height, Edge position, Edge center, and Peak/bottom

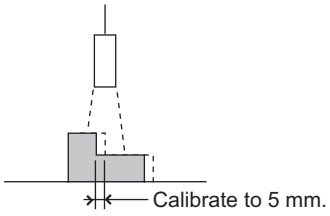
Example 1: In case of [Height]
Height of the workpiece: 10 mm
Compensate for a measured value of 9.95 mm, such that it is registered as 10 mm.

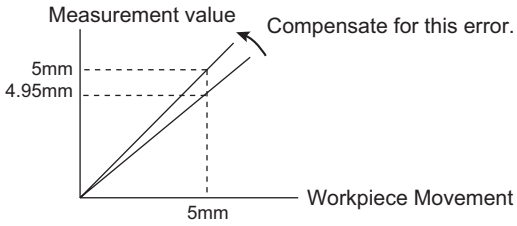


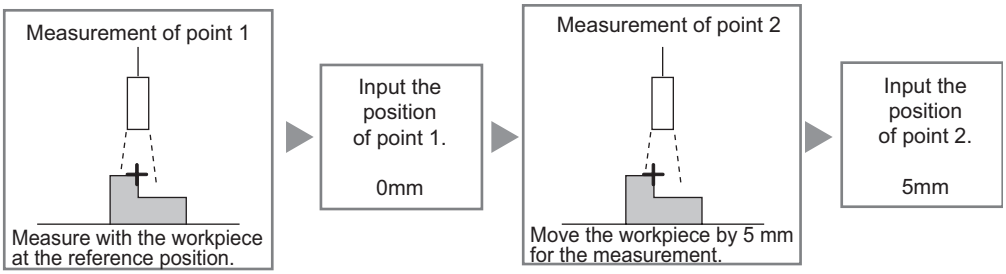
Example 2: In the case of [Edge position]

Edge position: 5 mm

Compensate for a measurement value of 4.95mm, so that it can be registered as 5 mm.



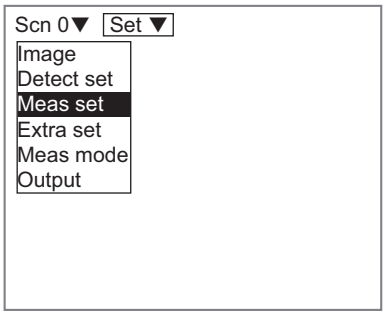




[Height] in Example 1 is used here to describe the setting method.

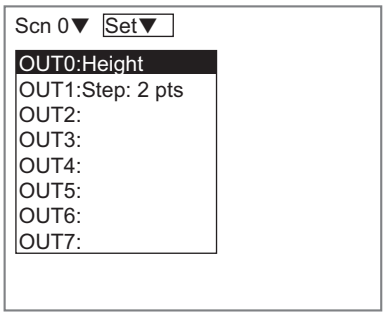
Make the necessary adjustments when setting a different item.

1. Select [Meas set].

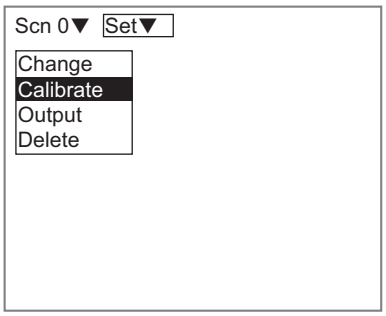


The selections for output appears.

2. Move the cursor to the output for which the calibration is to be set, and press the ENT Key.



The selections appear.

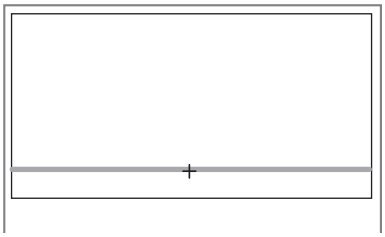


3. Select [Calibrate].

The selections appear.

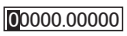
4. Select [Set].

The measurement screen for point 1 appears.



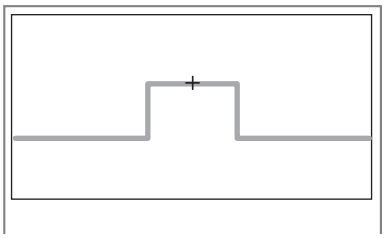
5. Press the ENT Key without a workpiece in position.

The screen for selecting the position of point 1 will be appears.



6. Set the value to 0.00000 and press the ENT Key.

The measurement screen for point 2 appears.



7. Position the workpiece correctly and press the ENT Key.

The screen for selecting the position of point 2 appears.

8. Set the value to 5.00000 and press the ENT Key.

A confirmation message appears.

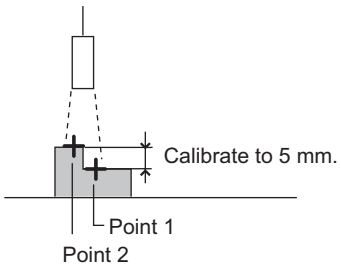
9. Select [Execute].

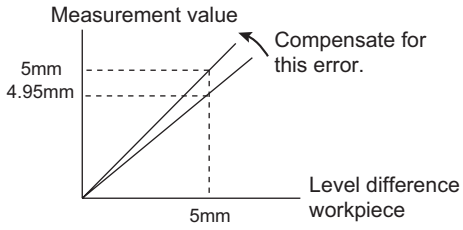
The setting will be registered and the screen display returns to **3**.

Compensate for the Measured Level Difference and Width

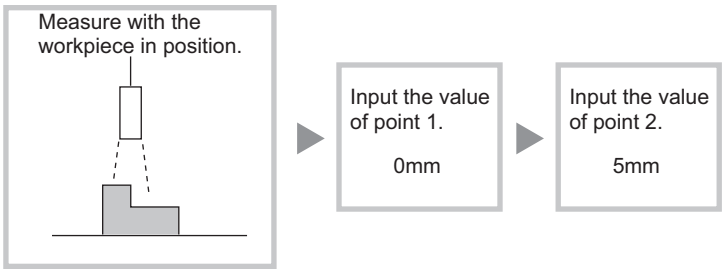
To compensate for the error, perform the measurement once.
Applicable measurement items: Step: 2 pts, Step: 3 pts, Width

Example: In case of [Step: 2 pts]
Difference: 5 mm
Compensate for a measurement value of 4.95 mm, such that it is registered as 5 mm.

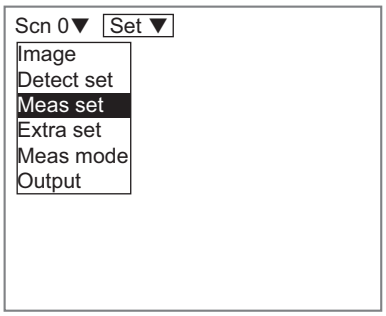




To compensate for this error, perform the measurement once.

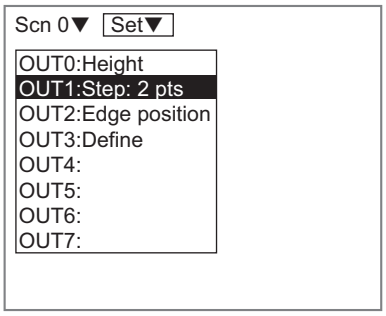


1. Select [Meas set].



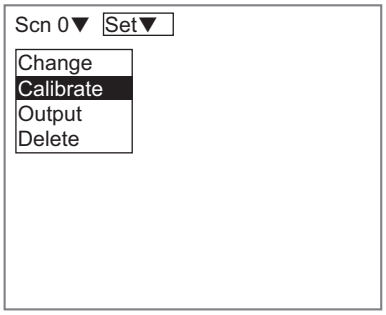
The selections for output appear.

2. Move the cursor to [Step: 2 pts] and press the ENT Key.



The selections appear.

3. Select [Calibrate].

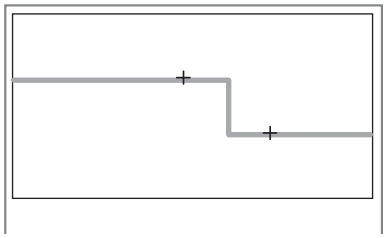


The selections appear.

4. Select [Set].

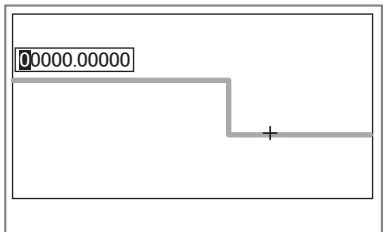
The measurement screen for point 1 appears.

5. Position the workpiece correctly and press the ENT Key.



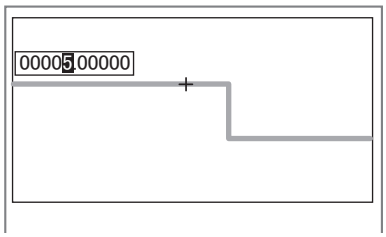
The screen for selecting the position of point 1 appears.

6. Set the value to 0.00000 and press the ENT Key.



The screen for selecting the position of point 2 appears.

7. Set the value to 5.00000 and press the ENT Key.



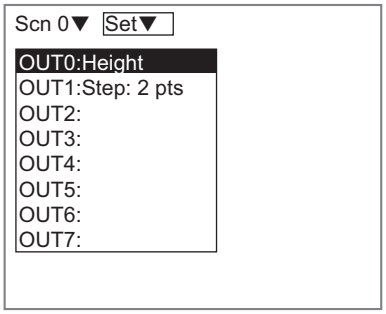
A confirmation message appears.

8. Select [Execute].

The setting will be registered and the screen display returns to **3**.

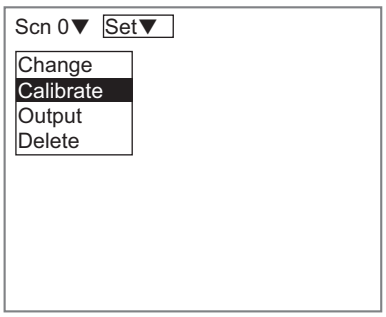
How to Clear Calibration

1. Move the cursor to the output whose calibration setting is to be cleared, and press the ENT Key.



The selections appear.

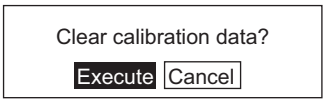
2. Select [Calibrate].



The selections appear.

3. Select [Clear].

A confirmation message appears.

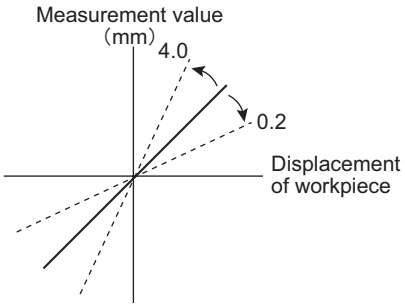
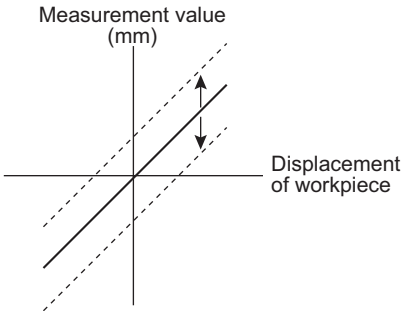


4. Select [Clear].

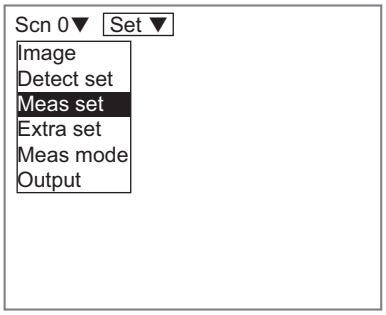
The setting will be cleared and the screen display returns to **2**.

Setting Span and Offset

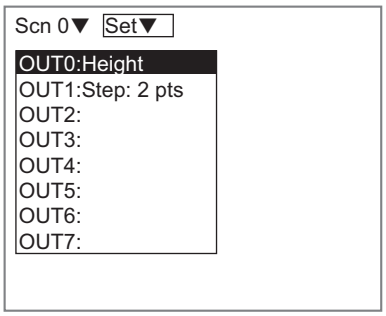
The span and offset can be set in order to fine-tune the measurement values. They can be specified for each output.
They have been set automatically after executing the calibration; make modification as necessary.

Item	Meaning
Span	Gain attribute of the sensor characteristic. (0.20000 to 4.0000, set to 1.000000 by default setting) 
Offset	It is possible to add/subtract a fixed value to/from the measurement value. (-999.999999 to 999.999999, set to 0.000000 by default setting) 

1. Select [Meas set].

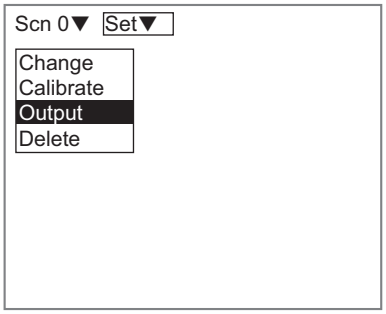


The selections for output appear.



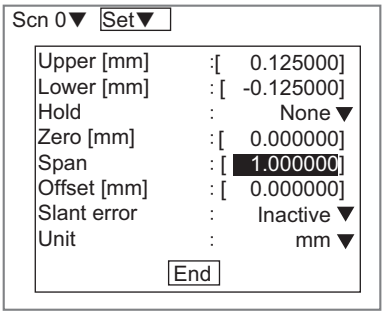
2. Move the cursor to the output to be set and press the ENT Key.

The selections appear.



3. Select [Output].

The setting screen for output conditions appears.



4. Specify [Span] and [Offset].

5. Select [End].

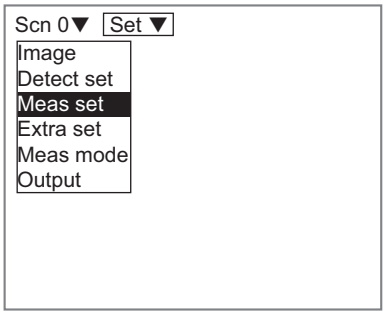
The setting will be registered and the screen display returns to **3**.

Setting the Judgment Conditions

The range of measurement values to be judged as a PASS can be set.(-999.999999 to 999.999999)
The judgment can result in either one of the following three cases.

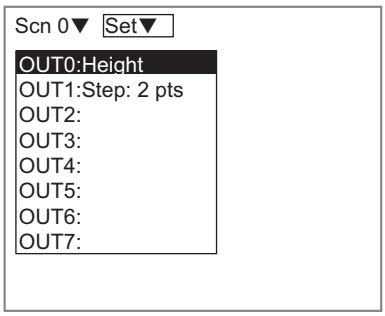
Output	Meaning
PASS	Judgment lower limit ≦ Measurement value ≦ Judgment upper limit
HIGH	Measurement value > Judgment upper limit
LOW	Measurement value < Judgment lower limit

1. Select [Meas set].



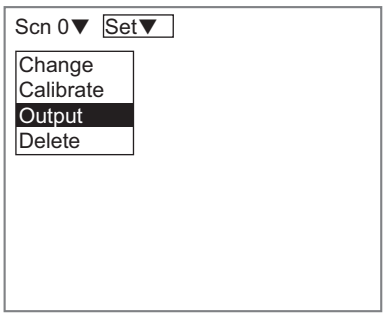
The selections for output appear.

2. Move the cursor to the output to be set and press the ENT Key.

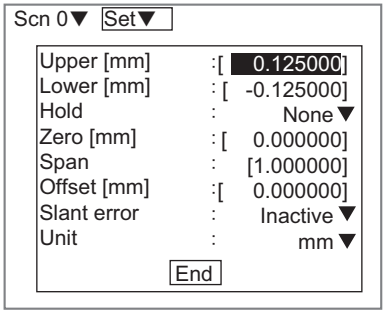


The selections appear.

3. Select [Output].



The setting screen for output conditions appears.



4. Specify [Upper] and [Lower].

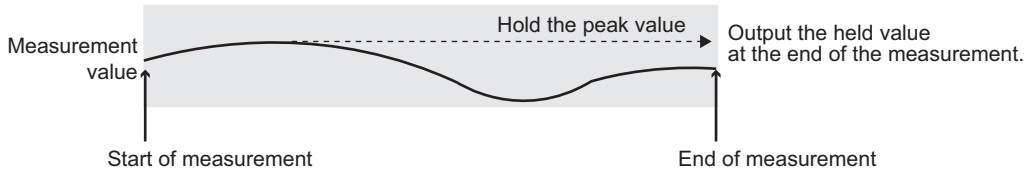
5. Select [End].

The setting will be registered and the screen display returns to **3**.

Selecting Hold Conditions for Measurement Values

The hold function allows holding (maintaining) an arbitrary value, such as the maximum or minimum values, among the measurement values obtained from the start to the end of the measurement, and outputting the value after the measurement is completed.

Example 1: Holding the peak value (used in combination with hold output)



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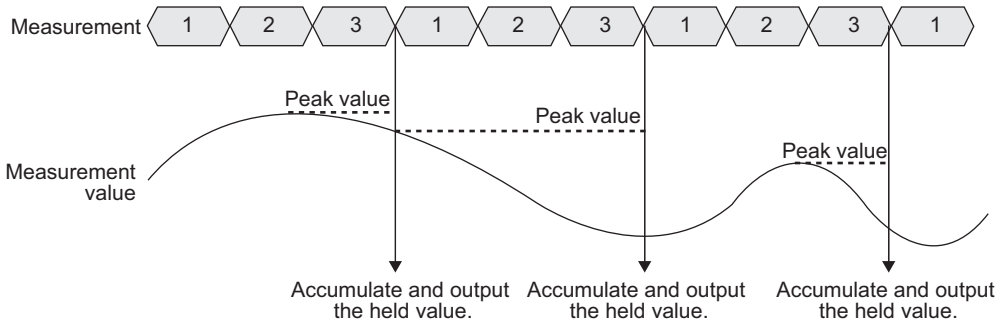
Example 2: Holding the peak value for every three measurements (used in combination with the logging function)

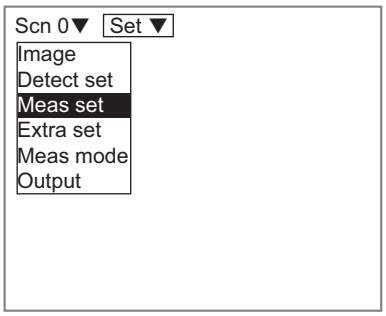


How to set the logging function p.126

It is possible to hold the following five types of values. The item to be held can be specified for each output (OUT0 to 7).

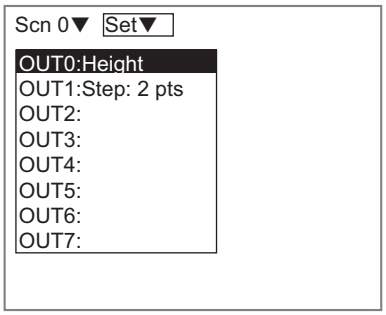
Item	Meaning
Sampling	The value at the start of the measurement is held.
Peak	The highest value measured during the measurement is held.
Bottom	The lowest value measured during the measurement is held.
Peak-Peak	The difference between the highest and lowest values measured during the measurement is held.
Average	The average between the highest and lowest values measured during the measurement is held.
None	Hold measurement is not performed.

1. Select [Meas set].



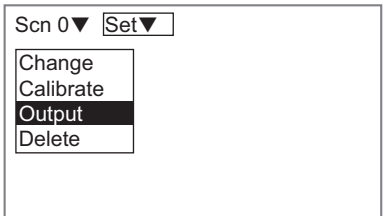
The selections for output appear.

2. Move the cursor to the output to be set and press the ENT Key.



The selections appear.

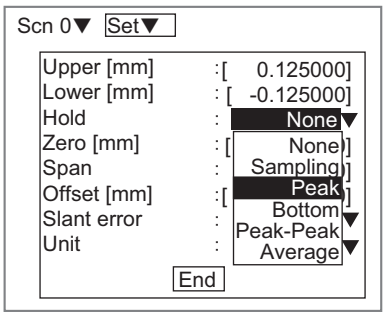
3. Select [Output].



The setting screen for output conditions appears.

4. Select the type of value from the selections for [Hold].

5. Select [End].



The setting will be registered and the screen display returns to **3**.

Selecting Inclination Compensation Error Handing

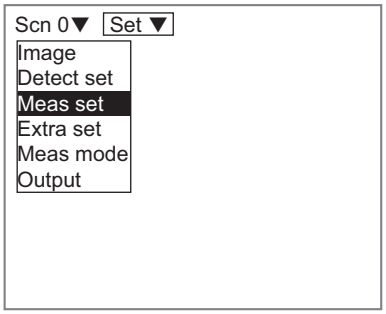
This function is only valid when Inclination compensation has been specified.
Select whether or not to treat the measurement result as an error when it is not possible to measure the reference height of a region.

Option	Measurement of reference height	Measurement processing	Judgment
Inactive	OK	The measurement is made after inclination compensation.	Judgment and output are performed according to the measurement result.
	NG	The measurement is made without performing inclination compensation.	Judgment and output are performed according to the measurement result.
Active	OK	Make the measurement after inclination compensation.	Judgment and output are performed according to the measurement result.
	NG	The measurement is not made.	Judgment and output will result in an error.

CHECK!

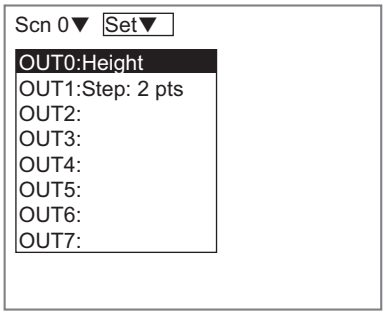
[Slant error] cannot be specified for [Define].Errors are handled according to the [Slant error] settings specified for the other outputs set in the defining equation.

1. Select [Meas set].

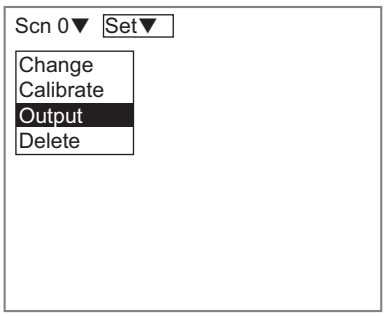


The selections for output appear.

2. Move the cursor to the output to be set and press the ENT Key.

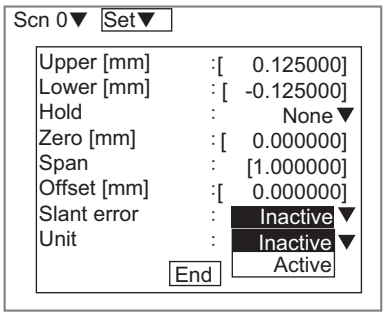


The selections appear.



3. Select [Output].

The setting screen for output conditions appears.



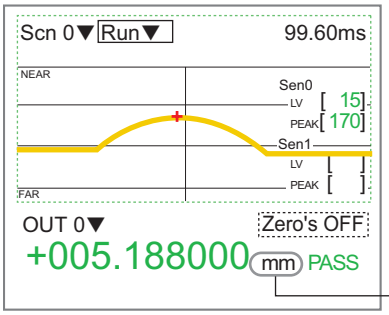
4. Select [Slant error].

5. Select [End].

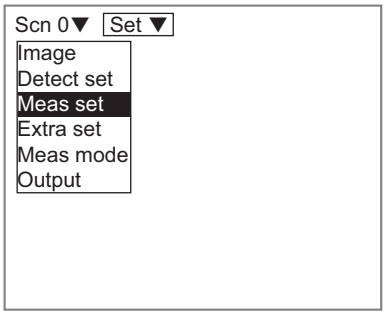
The setting will be registered and the screen display returns to **3**.

Select the Display Unit

The unit of the measured values to be displayed on the monitor screen can be selected.(mm, mm², µm, µm², no unit; mm is set at shipment)
The unit can be specified for each output.

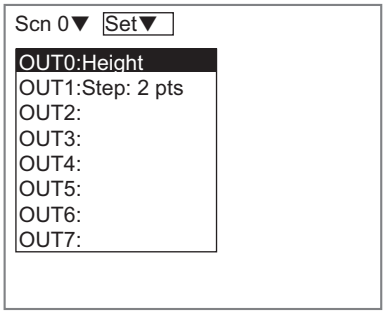


1. Select [Meas set].

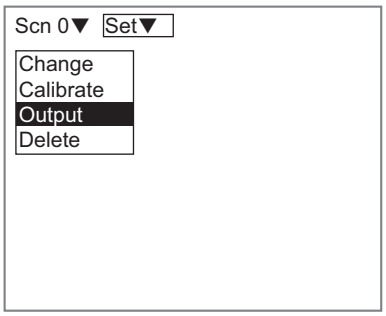


The selections for output appear.

2. Move the cursor to the output to be set and press the ENT Key.

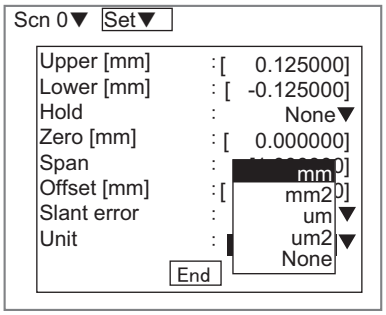


The selections appear.



3. Select [Output].

The setting screen for output conditionsappears.



4. Select the unit from the selections for [Unit].

5. Select [End].

The setting will be registered and the screen display returns to **3**.

Setting Averaging Number

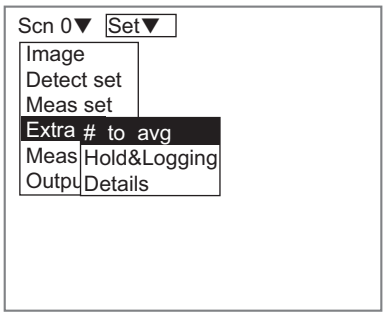
The average of the set number of measurements can be output as the measurement result.
Set this function to disregard sudden changes in the waveform.

Selections for averaging number
1, 2, 4, 8, 16, 32, 64, 128, or 256 measurements (set to eight measurements at shipment)

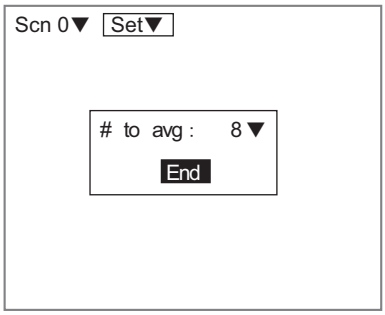
Measurement response time

Averaging number	Measurement response time	Resolution
1 · · · 256	Short ↕ Long	Low ↕ High

1. Select [Extra set/# to avg].



The setting screen for averaging number appears.



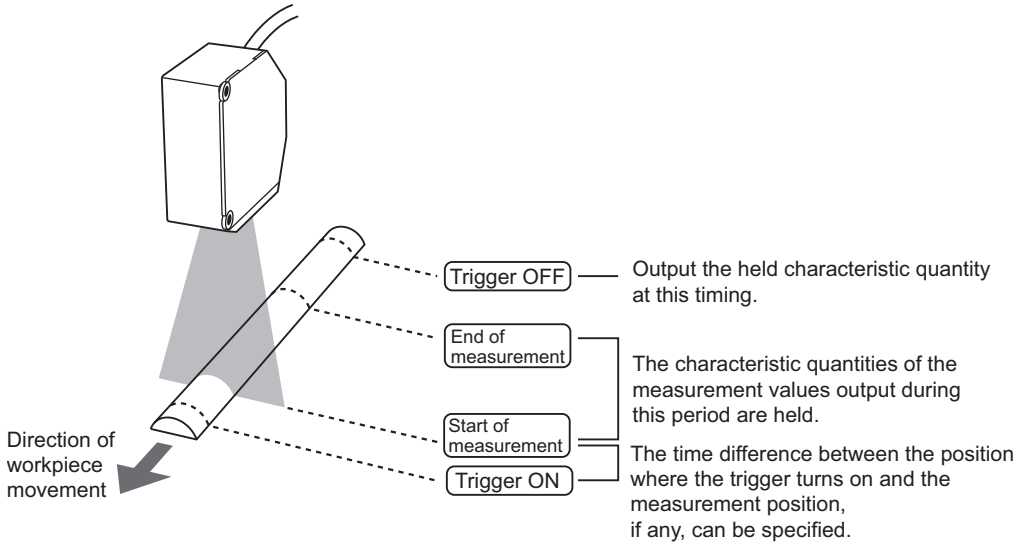
2. Select the averaging number.

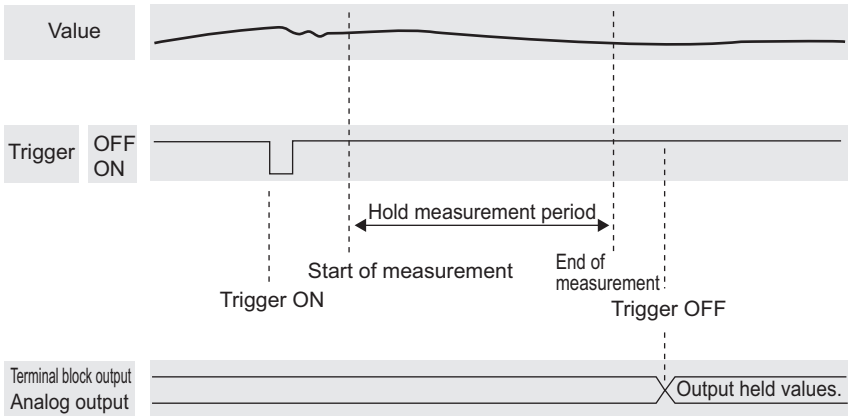
3. Select [End].

The setting will be registered and the screen display returns to **1**.

Setting Trigger for Hold Measurement

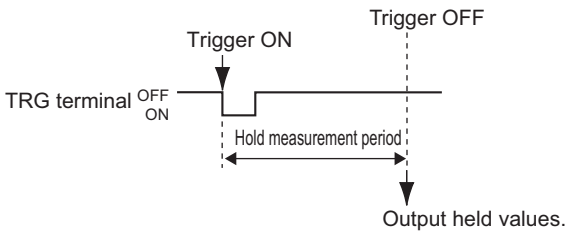
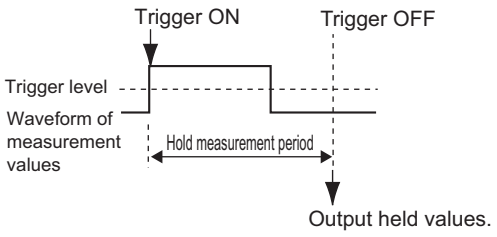
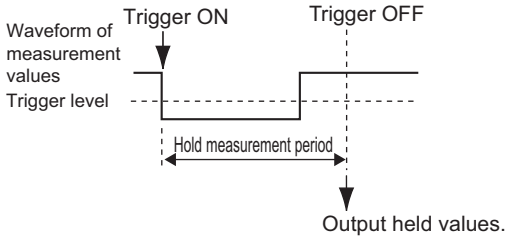
The hold function allows maintaining a certain value obtained during a measurement from the start to end of the measurement. How the timing to start and end the measurement should be entered, is selected here. It is possible to specify the timing at the following four points.





CHECK!

Select the measurement value hold condition for each output.
p.111

<table>
<tr><th colspan="2">Option</th><th>Meaning</th></tr>
<tr><td colspan="2">Hold (External)</td><td>The hold trigger is entered using a synchronous sensor. The hold measurement is started when the TRG terminal of the terminal block is turned on.
The trigger off timing is not synchronized with the TRG terminal. Specify the times at which to turn the trigger on and off in advance.
 
</td></tr>
<tr><td rowspan="2">Hold (Self)</td><td>Up</td><td>The trigger is assumed to have been turned on when the measurement value goes above the trigger level.
The trigger off timing is independent of the trigger level. Specify the times at which to turn the trigger on and off in advance.
 
</td></tr>
<tr><td>Down</td><td>The trigger is assumed to have been turned on when the measurement value goes below the trigger level.
The trigger off timing is independent of the trigger level. Specify the times at which to turn the trigger on and off in advance.
 
</td></tr>
</table>

CHECK!

It is not allowed to use the hold output and logging output together.

Free
Hold(External)
Hold(Self)
Logging

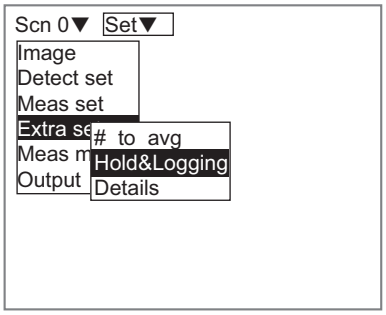
These four selections appear when [Extra set] and then [Hold&Logging] are selected.
Select [Free] if the hold output and logging output are not used.

Logging output p.126

Setting [Hold (External)]

The display start position when the external trigger is turned on can be specified together with the time until the measurement is completed.

1. Select [Extra set/Hold&Logging].



The selections appear.

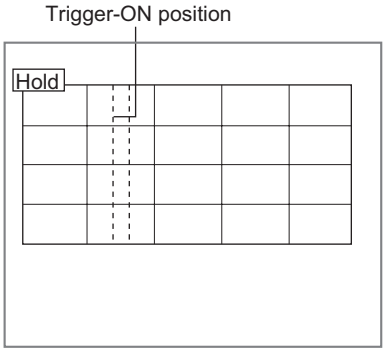
2. Select [Hold (External)].

The screen for specifying the trigger on position appears.

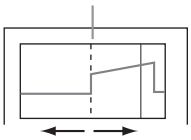
3. Specify the trigger on position.

The waveform display will start from this position when the trigger is turned on.

(Only when the display mode is [Trig])

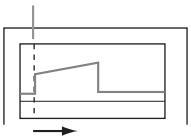


The trigger position is set at the center.



That way, it is possible to view the waveform before and after the trigger is turned on.

The trigger position is set at the left edge.



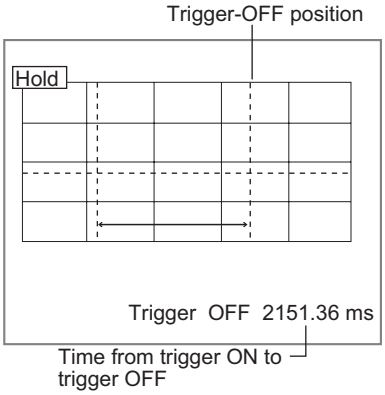
That way, it is possible to focus on the part of the waveform after the trigger is turned on.

Left/Right key: Moves the cursor.

(Press these keys together with the SHIFT Key to move the cursor quickly.)

4. Select the setting by pressing the ENT Key.

The screen for specifying the trigger off position appears.

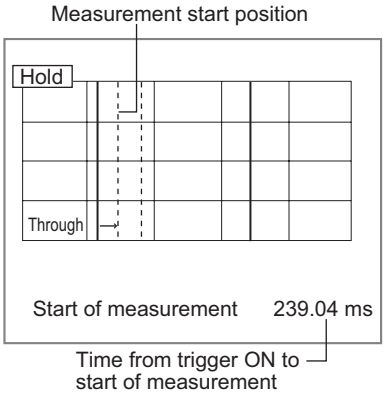


CHECK!

The trigger off timing is not synchronized with the TRG terminal; therefore, specify the times to turn the trigger on and off on this screen.
The time at the cursor position (the time after the trigger is turned on) appears in the lower part of the screen. Specify the trigger off position using this time as reference.

5. Specify the trigger off position.

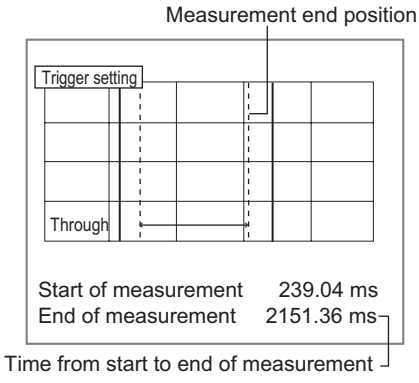
The setting screen for the measurement start position appears.



6. Specify the measurement start position.

If the trigger on position and the measurement target area are different, specify the time difference.
The measurement start position can be the same as the trigger on position if it is not necessary to specify the time difference.

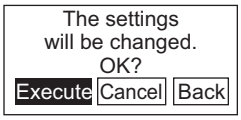
The setting screen for the measurement end position appears.



7. Specify the measurement end position.

Specify the end position when there is a time difference between the completion of the measurement and the trigger off timing.
The measurement end position can be the same as the trigger off position if it is not necessary to specify the time difference.

A confirmation message appears.

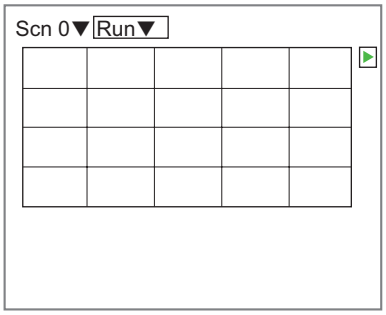


8. Select [Execute].

The setting will be registered and the screen display returns to **1**.

Setting [Hold (Self)]

A waveform of the workpiece shape can be obtained using the Trend Monitor screen, and the self trigger level can be set based on this waveform.

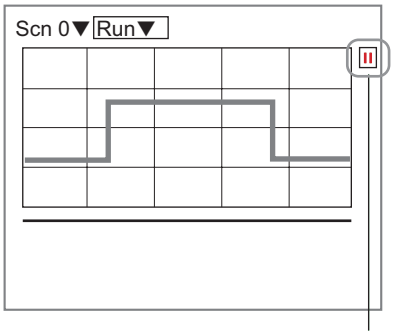


1. Display the Trend Monitor screen.

2. Display the output to be used as the self trigger.

3. Let the workpiece go through, and press the TRIG Key at the instant the waveform representing the workpiece appears.

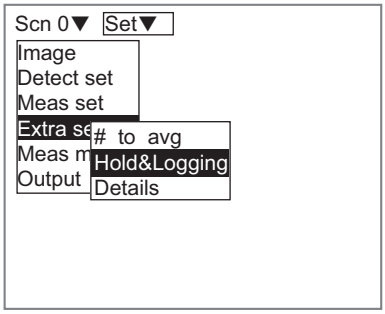
The waveform display is fixed.



The mark changes.

4. Enter the Set mode.

The initial screen of the Set mode appears.

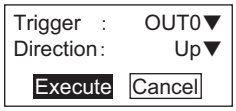


5. Select [Extra set/Hold&Logging].

The selections apepar.

6. Select [Hold (Self)].

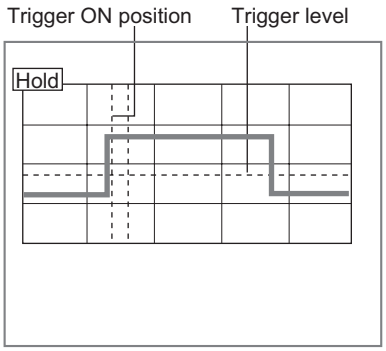
The trigger setting screen appears.



7. Select the output (OUT0 to OUT7) to be used as the trigger and the direction.

8. Select [Execute].

The waveform set in **3.** apepars.



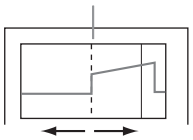
9. Specify the trigger level.

The trigger is assumed to have been turned on when the measurement value goes above (or below) this level.
Up/Down key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)

10. Specify the trigger on position.

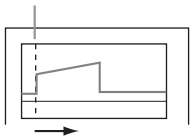
The waveform display will be started from this position when the trigger is turned on.
(Only when the display mode is [Trig])

The trigger position is set at the center.



That way, it is possible to view the waveform before and after the trigger is turned on.

The trigger position is set at the left edge.

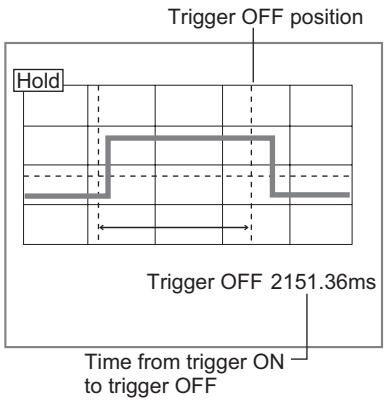


That way, it is possible to focus on the part of the waveform after the trigger is turned on.

Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)

11. Select the setting by pressing the ENT Key.

The screen for specifying the trigger off position appears.

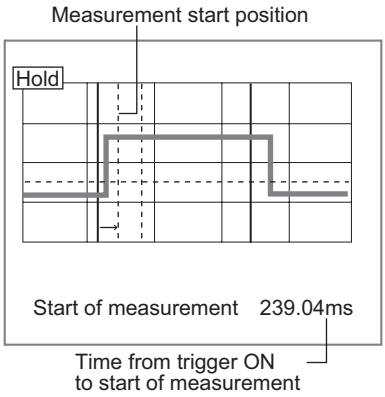


12. Specify the trigger off position.

CHECK!

The trigger off timing is independent of the trigger level; specify the times at which to turn the trigger on and off in this screen.
The time at the cursor position (the time after the trigger is turned on) appears in the lower part of the screen. Specify the trigger off position using this time as reference.

A setting screen for the measurement start position appears.

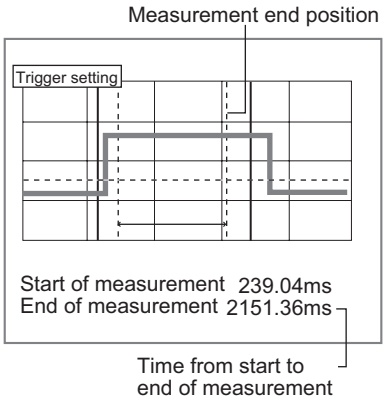


13. Specify the measurement start position.

If the trigger on position and the measurement target area are different, specify the time difference.
The measurement start position can be the same as the trigger on position if it is not necessary to specify the time difference.

▼

A setting screen for the measurement end position appears.

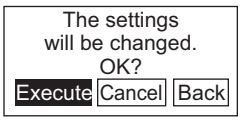


14. Specify the measurement end position.

Specify the end position when there is a time difference between the completion of the measurement and the trigger off timing.
The measurement end position can be the same as the trigger off position if it is not necessary to specify the time difference.

▼

A confirmation message appears.



15. Select [Execute].

▼

The setting will be registered and the screen display returns to **6**.

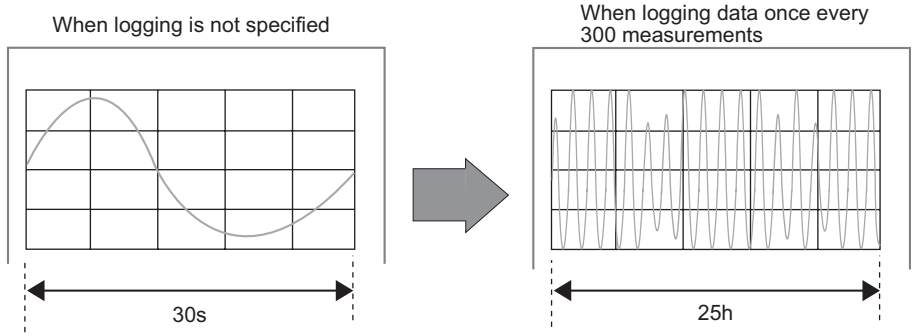
Using the Logging Function

The logging function allows accumulating measurement values while skipping some of them. It is used to observe the fluctuation in measurement results over an extended period of time using the Trend Monitor and Profile Monitor screens.
The amount of data generated in one measurement is different for the Trend Monitor and Profile Monitor screens. The maximum amount of accumulated data for each monitor screen is as follows.

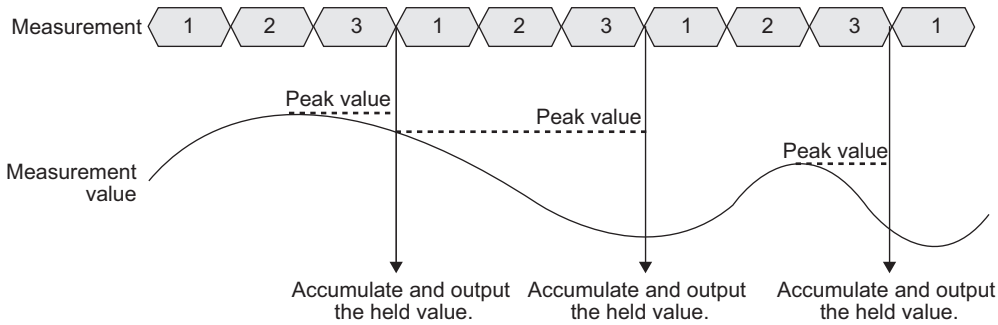
Monitor type	Data generated in one measurement	Maximum amount of accumulated data
Trend Monitor screen	Eight output data points	3000
Profile Monitor screen	1024 height data points	300

Example 1: Accumulation of data once every 300 measurements

Data can be accumulated for up to 30 seconds when the logging function is not used. If the setting is changed to "accumulate once every 300 measurements" using the logging function, it is possible to accumulate data for a day because 100 ms × 300 × 3000 = 90000 sec = 1500 min = 25h.



Example 2: Holding the peak value for every three measurements, and accumulating and outputting the data (used in combination with the hold function)



CHECK!

Select the measurement value hold condition for each output.

p.111

CHECK!

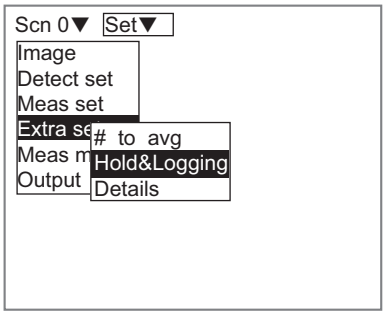
It is not allowed to use the hold output and logging output together.

Free
Hold(External)
Hold(Self)
Logging

These four selections appears when [Extra set] and then [Hold&Logging] are selected. Select [Free] if the hold output and logging output are not used.

Hold output p.118

1. Select [Extra set] and then [Hold&Logging].



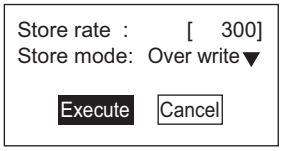
The selections appears.

2. Select [Logging].

The setting screen for logging conditions appears.

3. Set the storing rate.
(1 to 10000 samples)

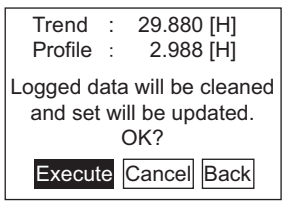
4. Select the action to be taken when the amount of accumulated data reaches the maximum capacity of the memory.



Option	Meaning
Over write	Overwrite data starting with the oldest data.
Write once	The data accumulation is stopped when the maximum amount of accumulated data is exceeded or the maximum capacity of the memory is reached.

The accumulation time based on the specified data is displayed.

5. Select [Execute].

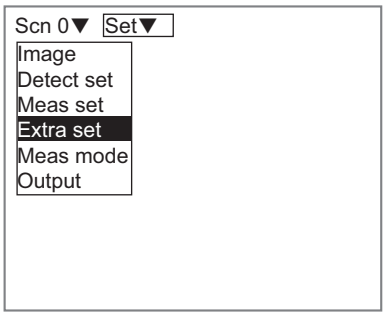


The setting will be registered and the screen display returns to **1**.
The logging data accumulated so far is cleared.

Setting the Detailed Conditions

Noise filtering, outputting measurement failure, and other optional methods can be set in more detail. Adjust the conditions when the measurement cannot be performed properly.

1. Select [Extra set].



The selections are displayed.

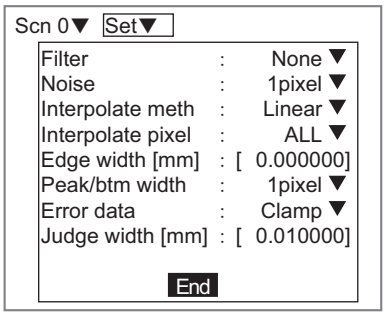
2. Select [Details].

The setting screen for details appears.

3. Make the settings for each item.

Refer to the next page for the details.

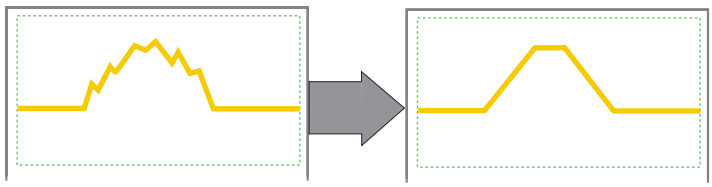
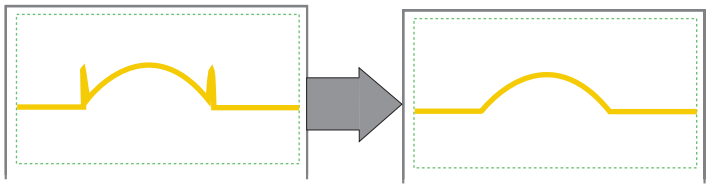
4. Select [End].



The setting will be registered and the screen display returns to **2**.

Filter

The profile data can be made smoother if it is infected with noise.Smoothing is performed in the position direction.

Option		Meaning
None (Set at shipment)		No smoothing.
Average	2, 4,8, 16, 32, 64	Smoothing is performed using the average value of adjacent data. The values to the left indicate the number of data to be averaged over. 
Median	1, 2, 3	Smoothing is performed using the median value of adjacent data. It is effective in removing spikes of noise. 

CHECK!

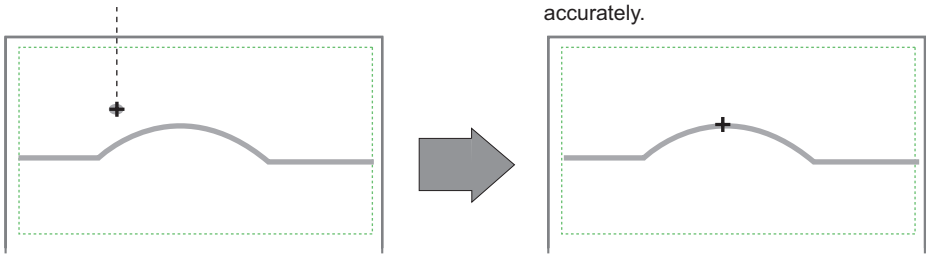
The sampling period varies depending on the filter processing.

Noise Removal

This is used to prevent height measurement errors caused by irregular reflection. Images with less than the specified number of pixels will be regarded as noise and excluded from the measurement.

An image generated through diffused reflection is wrongly measured (1 pixel).

Specify three pixels or less to be treated as noise in order to measure the height accurately.



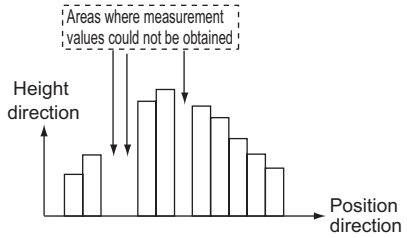
Option
0 pixel, 1pixel (set at shipment), 2 pixels, 3 pixels, 4 pixels, 5 pixels, 6 pixels, 7 pixels

Interpolation Method

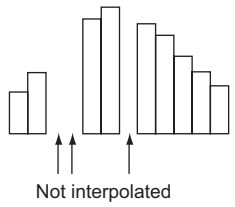
This is used for interpolating between existing data in areas where profile data is missing (areas where measurement is not possible).If there are lines where the workpieces cannot be measured due to different degrees of reflectance or other causes, the data of such lines can be obtained by interpolating between the data acquired from the lines that allow measurement as desired.

Option	Meaning
None	A measurement error signal is output for each area where measurements could not be obtained.
Linear (Set at shipment)	Data for areas where measurements could not be obtained is calculated by linear interpolation between the data to the left and right. Up to 128 missing data values can be obtained by this method.
Previous	Data for areas where measurements could not be obtained is calculated by copying the data to the left.Up to 258 missing data values can be obtained by this method.

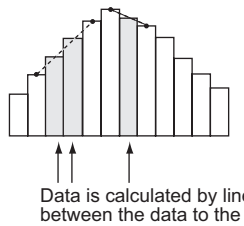
Example: Profile output result when there are areas where measurement data cannot be obtained



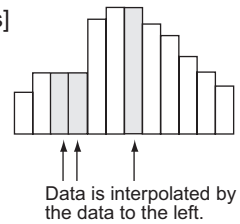
In case of [None]



In case of [Linear]



In case of [Previous]

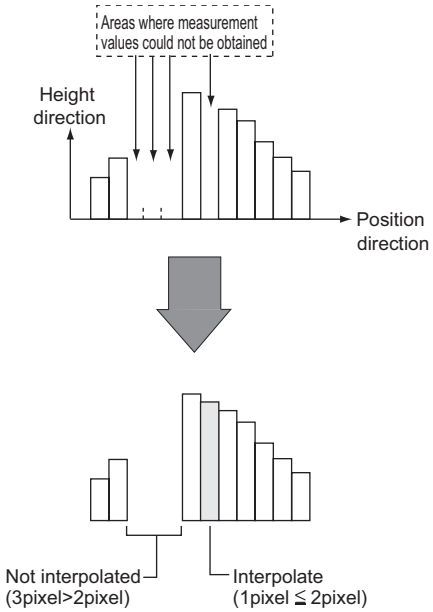


Number of Interpolated Pixels

Profile data is interpolated only if missing areas (areas where measurement data cannot be obtained) contain less than the specified number of pixels. Interpolation is not performed if a greater number of pixels than the specified number cannot be measured continuously.
This function can be applied to the measurement of a workpiece with a hole.Select [ALL] to always interpolate between the existing data regardless of the number of pixels.

Option
1 pixel, 2 pixels, 4 pixels, 8 pixels, 16 pixels, ALL (default setting)

Example: When the number of interpolated pixels is 2

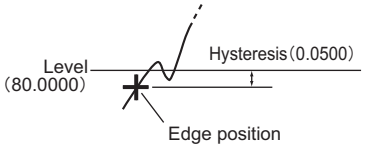


Edge Detection Hysteresis Width (Edge Width)

The hysteresis width of edge detection can be set.
Change the edge width when the edge detection is unstable.

Setting range
0.000000 to 999.999999 (0.000000 is set by default setting)

Example: When the level is 80.0000 mm and the level hysteresis width is 0.0500 mm

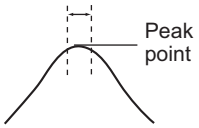


Peak/Bottom Measurement Width

The average over the specified region when measuring the peak or bottom is output as the measurement value.

The region can be specified in pixel units. Setting a larger value will make the measurement more stable.

Setting range
1 pixel (default setting), 5 pixels, 9 pixels, 13 pixels, 17 pixels, 21 pixels, 25 pixels, 29 pixels



Error Data

In cases where the light density is temporarily excessive or insufficient (i.e., measurement is not possible) due to defects or holes in the workpiece, it is possible to set the Controller to hold the previous data.

Option	Meaning
Clamp (Default setting)	An error is displayed and is output.
Hold	The value measured immediately before measurement became impossible is displayed and output.

Contents of Display and Output

Display/output		Hold	Clamp
Judgment results display		The previous status is held.	ERROR is displayed.
Terminal block judgment output *			ERROR is output.
RS-232C output			Measurement error is output.
Analog output	4 to 20 mA		22 mA or more
	±5 V		+6 V or more

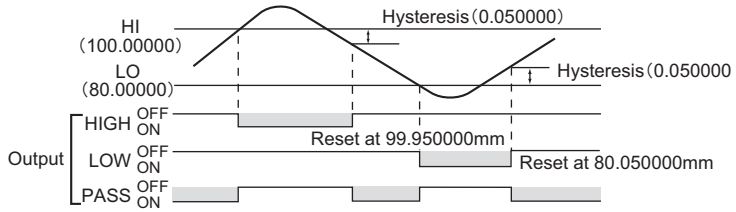
* The numbers of the output terminals vary depending on the outputs.

Judgment Value Hysteresis Width

Set the hysteresis width for judgment upper/lower limit if the HIGH/PASS/LOW judgment does not stabilize near the boundary.

Setting range
0.000000 to 999.999999

Example: When HI is 100.000000 mm, LO is 80.000000 mm, and the judgment value hysteresis value is 0.050000 mm



Selecting Measurement Mode

The measurement trigger signal input method can be selected.
The trigger can be input in the following two ways.

Option	Meaning
Continuous	The measurement is made at a fixed interval when the Controller is placed in the Measurement mode and then the result is output.
Trg (External)	One measurement is performed each time the TRG signal input of the terminal block is turned on and then the result is output. (The upper limit of the communication baud rate for profile data output is 115,200 bps.)
Trg (RS-232C)	One measurement is performed each time the CAPTURE command of RS-232C is entered and then the result is output.(The upper limit of the communication baud rate for profile data output is 38,400 bps.)

CHECK! The timing chart changes depending on the combination of the hold function and/or logging function.

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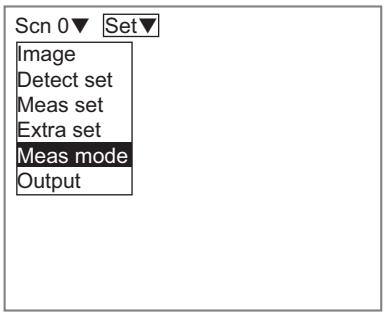
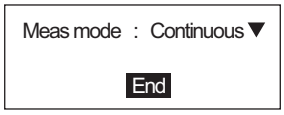
1. Select [Meas mode].



A setting screen appears.

2. Select a measurement mode.



3. Select [End].

he setting will be registered and the screen display returns to **1**.

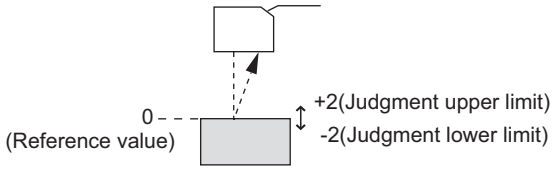
SECTION 4
Other Functions

SECTION 4 describes additional functions provided to make use of the Controller in a more convenient manner.

Using the Force-Zero Function

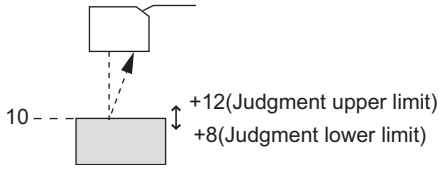
It is possible to register the height of a "0" reference value and output the measurement value as a ± tolerance relative to this reference value.

Example 1: The height of the workpiece is set as the reference value, and the tolerance is output as the measurement value.



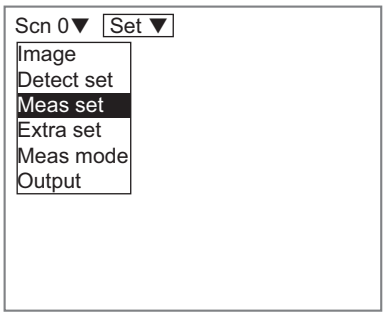
Also, an offset value can be added to the "0" reference value.

Example 2: When "10" is set as the offset

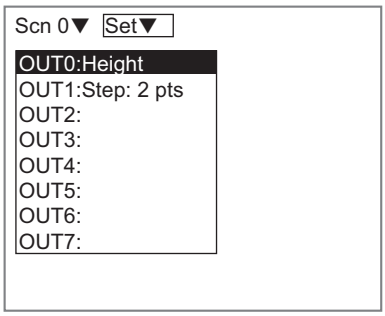


How to Set the Offset Value

1. Enter the Set mode and select [Meas set].

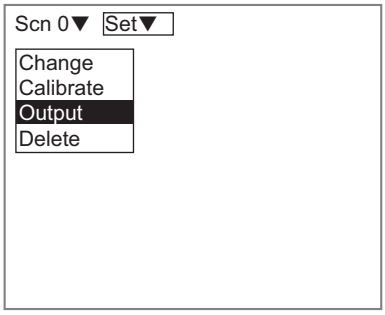


The selections for output appear.



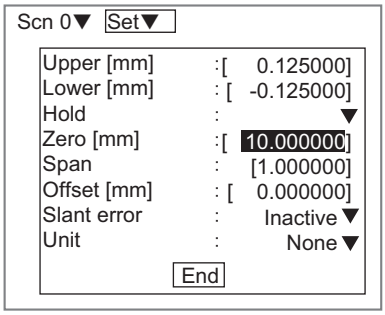
2. Move the cursor to the output to be set and press the ENT Key.

The selections appear.



3. Select [Output].

The setting screen for output conditions appears.



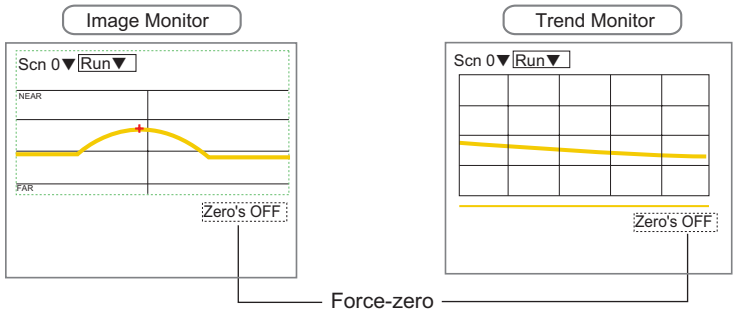
4. Specify the offset value in [Zero].

5. Select [End].

The setting will be registered and the screen display returns to **3**.

How to Execute the Force-Zero Function

Force-zero can be executed from the Image Monitor screen or the Trend Monitor screen.



CHECK! When the force-zero function is executed, the zero value is determined using the latest measurement value even if the hold output or logging output is specified.

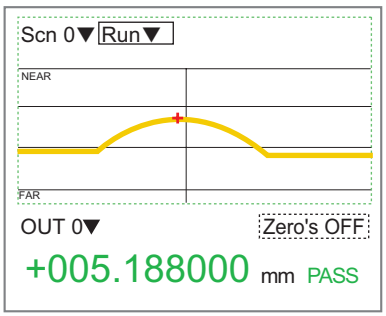
This example shows how to execute the force-zero function from the console when the Image Monitor screen is displayed. It is also possible to specify to use the force-zero function from the terminal block or via RS-232C.

Terminal Block p.190
RS-232C p.208

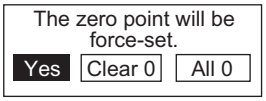
Executing Force-Zero Only for the Output Displayed

1. Position the reference workpiece.

2. Move the cursor to [Zero's OFF] and press the ENT Key.



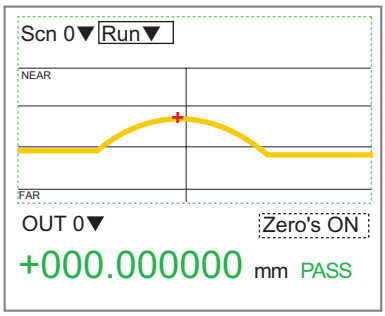
A confirmation message appears.



3. Select [Yes].

The measurement is performed, and the measurement result is registered as the reference value (zero).

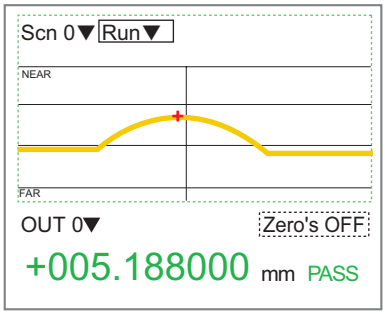
The screen display changes from [Zero's OFF] to [Zero's ON].
The measurement value displayed also changes to "± tolerance relative to the reference value."



■ Executing Force-Zero for All Outputs

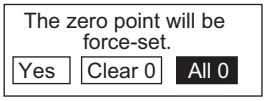
1. Position the reference workpiece.

2. Move the cursor to [Zero's OFF] and press the ENT Key.



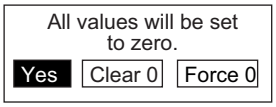
A confirmation message appears.

3. Select [All 0].



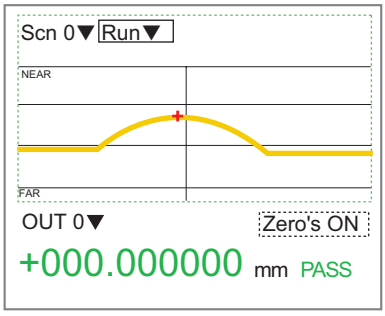
A confirmation message appears.

4. Select [Yes].



The measurement is performed, and the measurement result is registered as the reference value (zero).

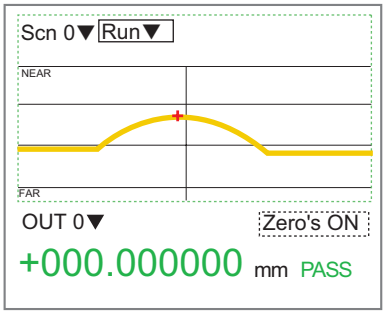
The screen display changes from [Zero's OFF] to [Zero's ON].
The measurement value displayed also changes to "± tolerance relative to the reference value."



How to Cancel the Force-Zero Function

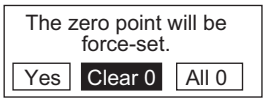
Perform the following operations in order to cancel the force-zero function.

1. Move the cursor to [Zero's ON] and press the ENT Key.

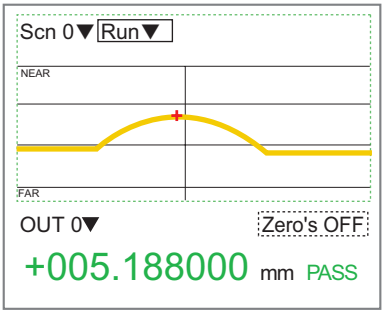


A confirmation message appears.

2. Select [Clear 0].



The force-zero function is canceled.
The screen display changes from [Zero's ON] to [Zero's OFF].



Changing the Screen Display

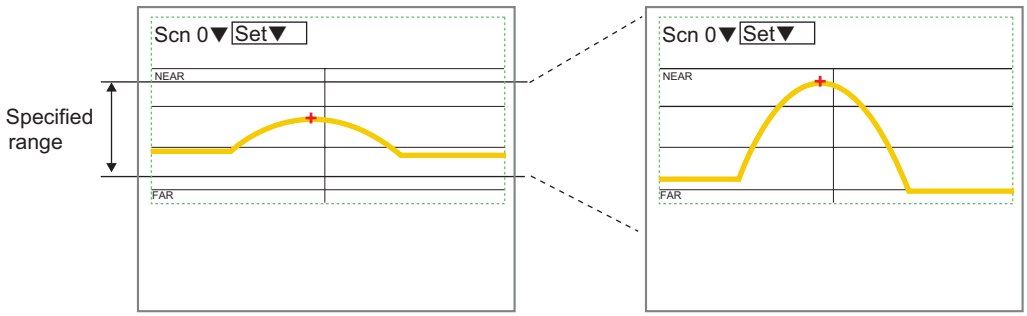
It is possible to change the items displayed on the Image Monitor, Digital Monitor, Trend Monitor, and Profile Monitor screens.
The contents that can be changed vary depending on the type of screen.

Changing the Image Monitor Screen Display

This function can be used for enlarging the profile and line brightness displays. The position of the line brightness cursor can also be changed.

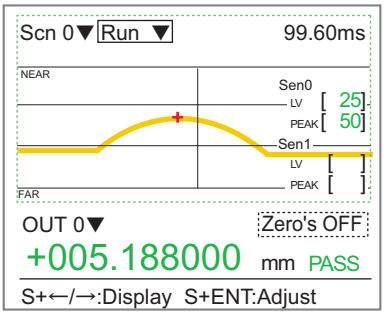
■ Enlarging Display

The profile and line brightness in the specified range are enlarged and displayed.

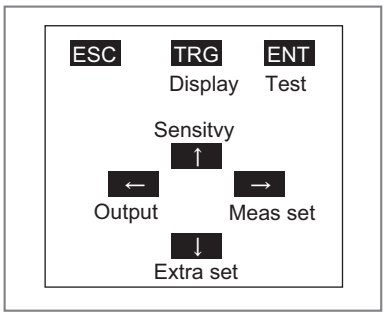


The line brightness graph for the specified range is enlarged in Run Mode.

1. Display the Image Monitor screen and press the SHIFT and ENT Keys.

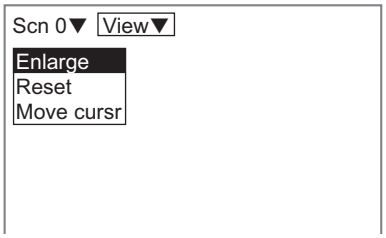


The adjustment menu appears.



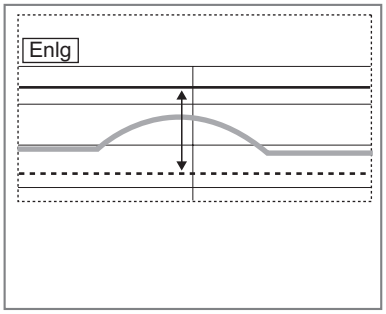
2. Press the TRIG Key.

The View mode screen appears.



3. Select [Enlarge].

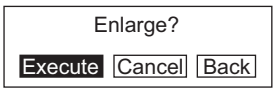
The screen for setting the enlargement range appears.



4. Specify the range you want to enlarge.

Up/Down key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)
ENT Key: Selects the setting.

A confirmation message appears.



5. Select [Execute].

The setting will be registered and the screen display returns to **3**.

6. Press the ESC Key.

The Image Monitor screen is displayed with the specified range enlarged.

Reset

Return the enlarged display to its default setting.

1. Display the Image Monitor screen and enter the View mode.

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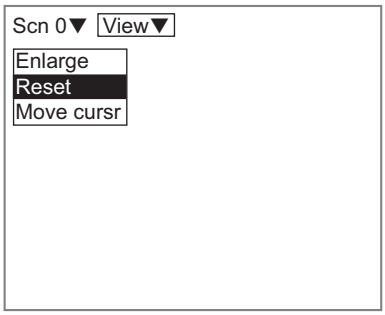
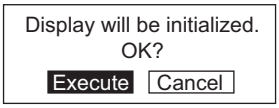
The selections appear.

2. Select [Reset].



A confirmation message appears.

3. Select [Execute].

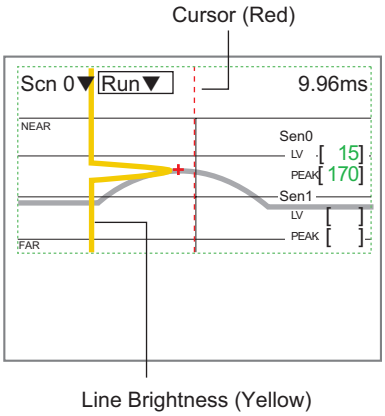


The setting will be registered and the screen display returns to **2**.

4. Press the ESC Key.

The Image Monitor screen appears.
The enlaged display has been reset to the standard size.

Moving the Line Brightness Cursor



1. Display the Image Monitor screen and enter the View mode.

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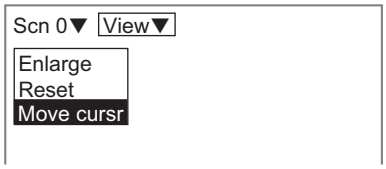
The selections appear.

2. Select [Move cursr].



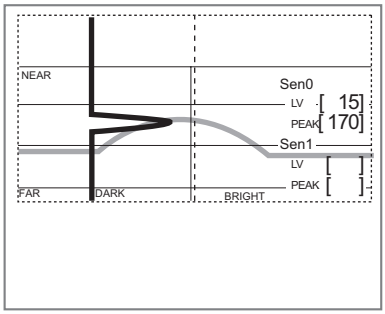
The screen for changing the cursor position appears.

3. Change the cursor position.

Left/Right key: Moves the cursor.

(Press these keys together with the SHIFT Key to move the cursor quickly.)

4. Press the ENT Key.



The setting will be registered and the screen display returns to **2**.

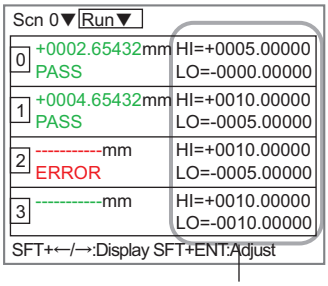
5. Press the ESC Key.

The Image Monitor screen is displayed, showing the line brightness at the changed cursor position.

Changing the Digital Monitor Screen Display

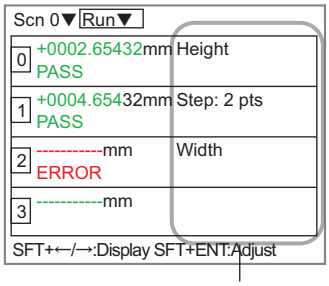
It is possible to change the contents displayed in the left part of the screen display.
The default setting at the shipment is to display the judgment upper and lower limits.To display measurement item names, change the settings.

[Judgment value display] (Default setting)



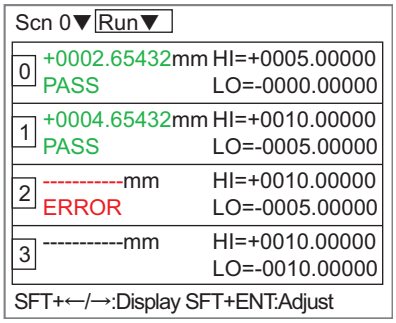
Judgment upper/lower limit

[Measurement item display]



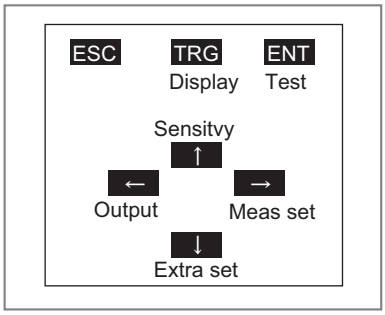
Measurement item name

1. Display the Digital Monitor screen and press the SHIFT and ENT Keys.



The adjustment menu appears.

2. Press the TRIG Key.



The items appear.

3. Press the ENT Key.

The selections appear.

4. Select an item to be displayed.

The setting will be registered and the screen display returns to **3**.

5. Press the ESC Key.

The focus returns to the Digital Monitor screen.

Changing the Trend Monitor Screen Display

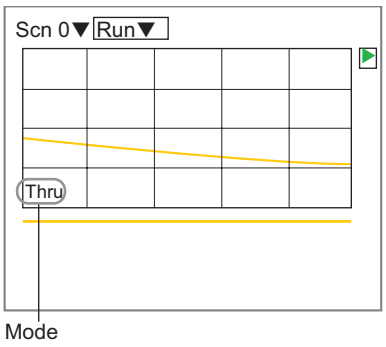
It is possible to change the screen view mode and the waveform display range.

Changing View Mode

The following two types of view modes are provided.
This setting is the same as for the Profile Monitor screen. The setting that has been specified the last will become effective.

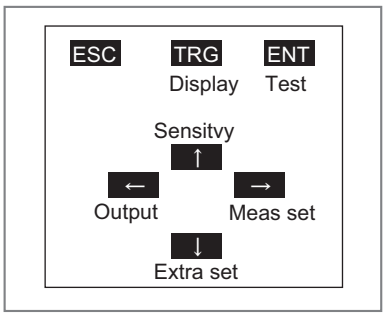
Option	Meaning
Thru (default setting)	Displays the waveform obtained from the sensor continuously.
Trig	Displays a still waveform corresponding to the trigger timing.Updated when the trigger turns on.

1. Display the Trend Monitor screen and press the SHIFT and ENT Keys.

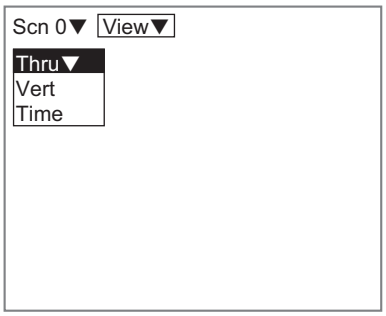


The adjustment menu appears.

2. Press the TRIG Key.



The selections appear.



3. Move the cursor to [Thru ▼] and press the ENT Key.

The selections appear.

4. Select a view mode.

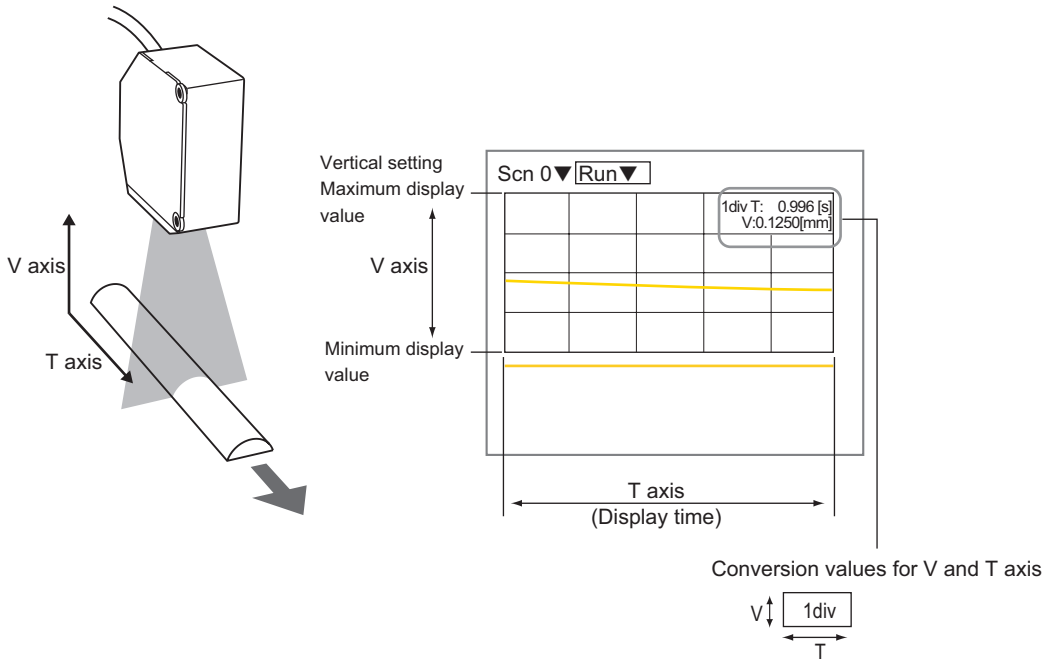
The setting will be registered and the screen display returns to **2**.

5. Press the ESC Key.

The Trend Monitor screen appears.

Setting Display Range

It is possible to change the range of the following two axes displayed on the screen.



Axis	Setting range	Meaning
Vert	-999.999999 to 999.999999	The maximum and minimum values displayed on the screen are set.Different values can be set for each output.The default setting at the shipment varies depending on the model of the sensor connected.
Time	1.50 to 30.00 s (Set to 5.00 s by default setting)	The display time range for the waveform displayed on the screen is set.This setting is the same as for the Profile Monitor screen. The setting that has been specified the last will become effective.

1. Display the Trend Monitor screen and enter the View mode.

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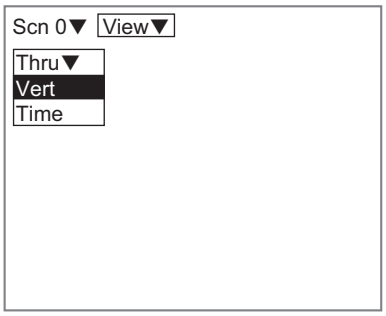
The selections appear.

2. Select either [Vert] or [Time].

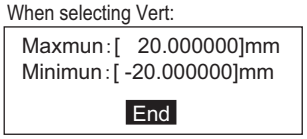


The setting screen appears.

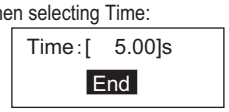
3. Make the settings for each item.

4. Select [End].

When selecting Vert:



When selecting Time:



The setting will be registered and the screen display returns to **2**.

5. Press the ESC Key.

The Trend Monitor screen appears.

Changing the Profile Monitor Screen Display

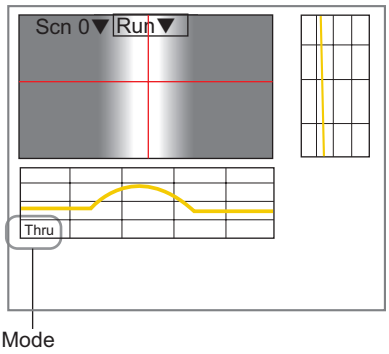
It is possible to change the screen view mode, the display range of a waveform, and the cursor position in the profile or trend display.

Changing View Mode

The following two types of view modes are available.
This setting is the same as for the Trend Monitor screen. The setting that has been specified the last will become effective.

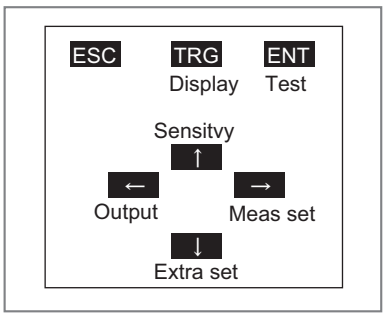
Option	Meaning
Thru (default setting)	The shaded 3D image acquired from the sensor appears continuously.
Trig	The shaded 3D image appears in response to the trigger timing.Updated when the trigger turns ON.

1. Display the Profile Monitor screen and press the SHIFT and ENT Keys.

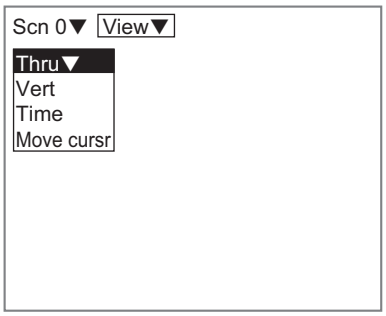


The adjustment menu appears.

2. Press the TRIG Key.



The selections appear.



3. Move the cursor to [Thru ▼] and press the ENT Key.

The selections appear.

4. Select a view mode.

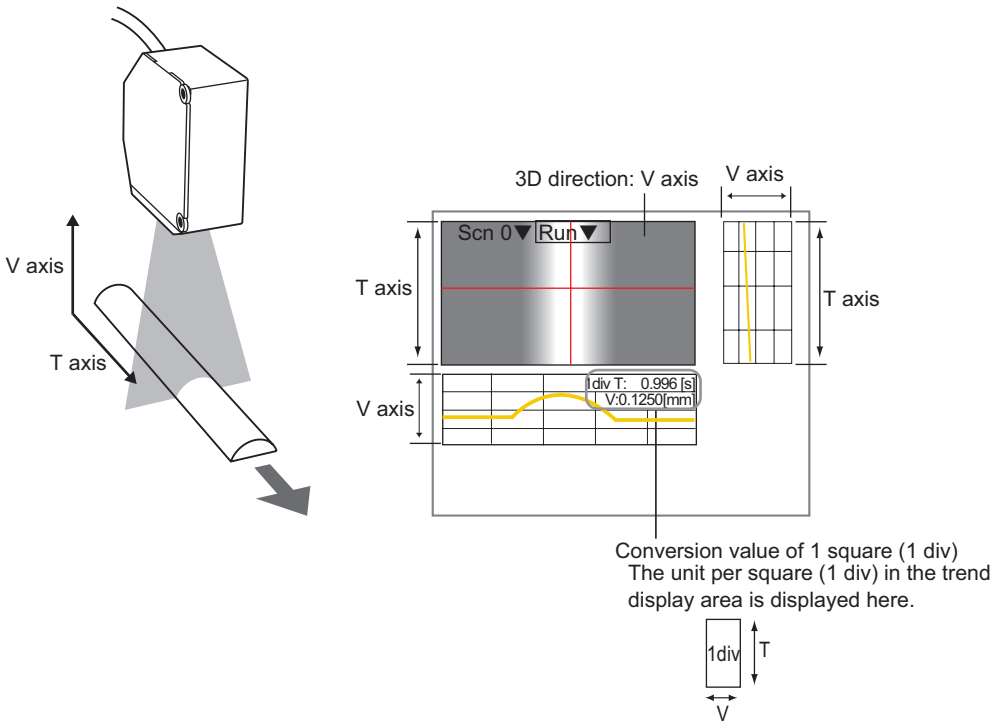
The setting will be registered and the screen display returns to **3**.

5. Press the ESC Key.

The Profile Monitor screen appears.

Setting Display Range

It is possible to change the range of the following two axes displayed on the screen.



Axis	Setting range	Meaning
Vert	-999.999999 to 999.999999	The maximum and minimum values displayed on the screen are set.The default setting at the shipment varies depending on the model of the sensor connected.
Time	1.50 to 30.00 s (Set to 5.00 s by default setting)	The display time range for the waveform displayed on the screen is set.This setting is the same as for the Trend Monitor screen. The setting that has been specified the last will become effective.

1. Display the Profile Monitor screen and enter the View mode.
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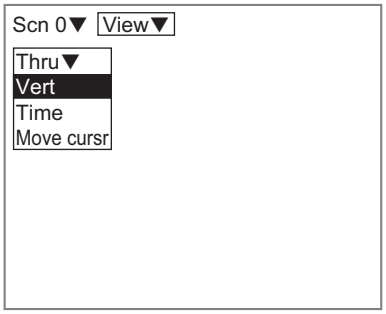
The selections appear.

2. Select either [Vert] or [Time].

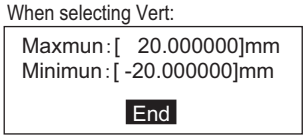


The setting screen appears.

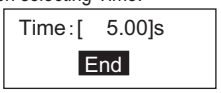
3. Make the settings for each item.

4. Select [End].

When selecting Vert:



When selecting Time:



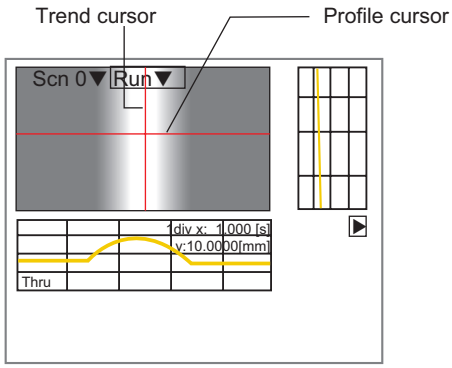
The setting will be registered and the screen display returns to **2**.

5. Press the ESC Key.

The Profile Monitor screen appears.

Moving the Cursor

It is possible to set the profile and trend display positions.



1. Display the Profile Monitor screen and enter the View mode.

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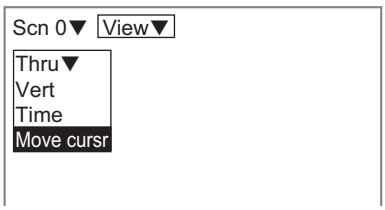
The selections appear.

2. Select [Move cursr].

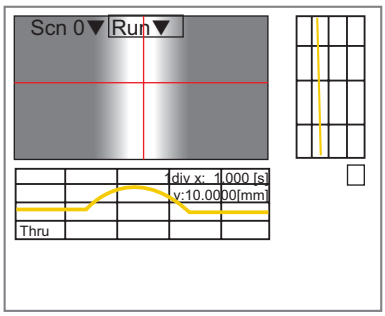


The screen for changing the cursor position appears.

3. Change the cursor position.

Up/Down/Left/Right key: Moves the cursor.
(Press these keys together with the SHIFT Key to move the cursor quickly.)

4. Press the ENT Key.



The setting will be registered and the screen display returns to **2**.

5. Press the ESC Key.

The Profile Monitor screen appears.

Switching Scenes

The different situations (types of measurement workpieces and types of inspections required) in which measurements are performed are called "scenes" and the measurement conditions set in the Set mode are called "scene data." The scene function can be used to set up to 16 types of measurement conditions.
If the measurement conditions change, it is possible to change to a different measurement setup simply by switching scenes.
The methods used to switch, copy, and clear scenes are explained below.

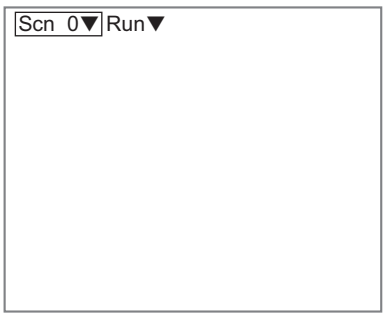
Setting Measurement Conditions for Different Models (Switching Scenes)

Use the scene switching function to inspect different workpieces while switching between different measurement conditions for different measurement setups.Scene 0 is displayed by default when the power supply is turned on, but the Controller also accommodates scenes 1 to 15.
The method for switching the scene on the console is explained below.
The command for switching scenes can also be input from the terminal block or via RS-232C.

Input from the terminal block p.190

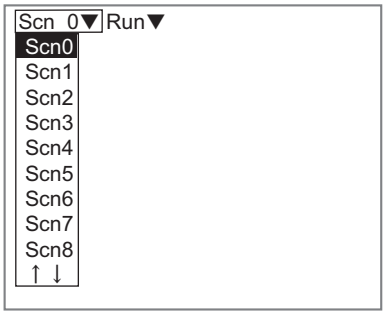
Input from RS-232C p.204

1. Move the cursor to [Scn] and press the ENT Key.



The selections for scenes 0 to 8 appear.
Use the Down key to scroll to display scenes 9 to 15.

2. Move the cursor to the scene to be switched to and press the ENT Key.

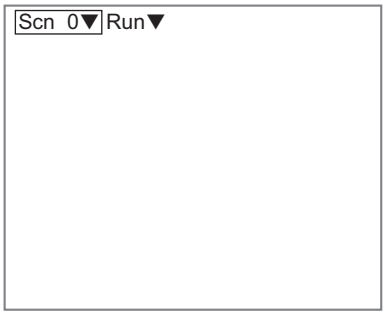


The selected scene appears.

Copying Measurement Conditions to Other Scenes (Copying Scene Data)

This function is useful for creating new scenes by copying scene data from another scene and changing some settings to suit the new requirements.

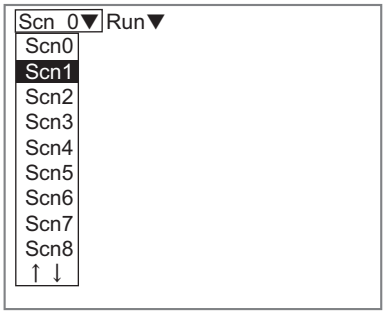
1. Move the cursor to [Scn] and press the ENT Key.



▼

The selections for scenes 0 to 8 appear.
Use the Down key to scroll to display scenes 9 to 15.

2. Move the cursor to the copy destination scene and press the SHIFT and ESC Keys.



▼

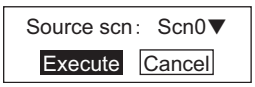
The selections appear.

3. Select [Copy].

▼

The screen for copying appears.

4. Enter the number of the scene to be copied, and select [Execute].



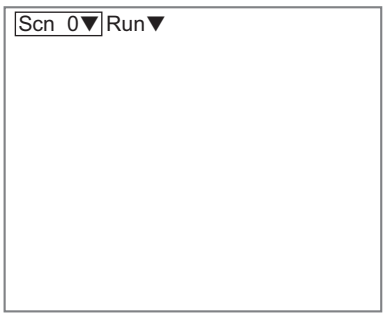
▼

The scene data will be copied.

Initializing Scene Measurement Conditions (Clearing Scenes)

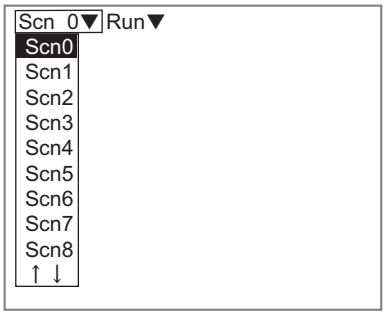
Use the following procedure to clear measurement conditions set in the Set mode, and to return scenes to their default settings.
The measurement conditions must be cleared separately for each scene.

1. Move the cursor to [Scn] and press the ENT Key.



The selections for scenes 0 to 8 appear.
Use the Down key to scroll to display scenes 9 to 15.

2. Move the cursor to the scene to be cleared and press the SHIFT and ESC Keys.

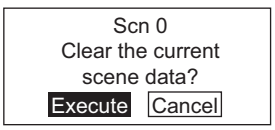


The selections appear.

3. Select [Clear].

A confirmation message appear.

4. Select [Execute].



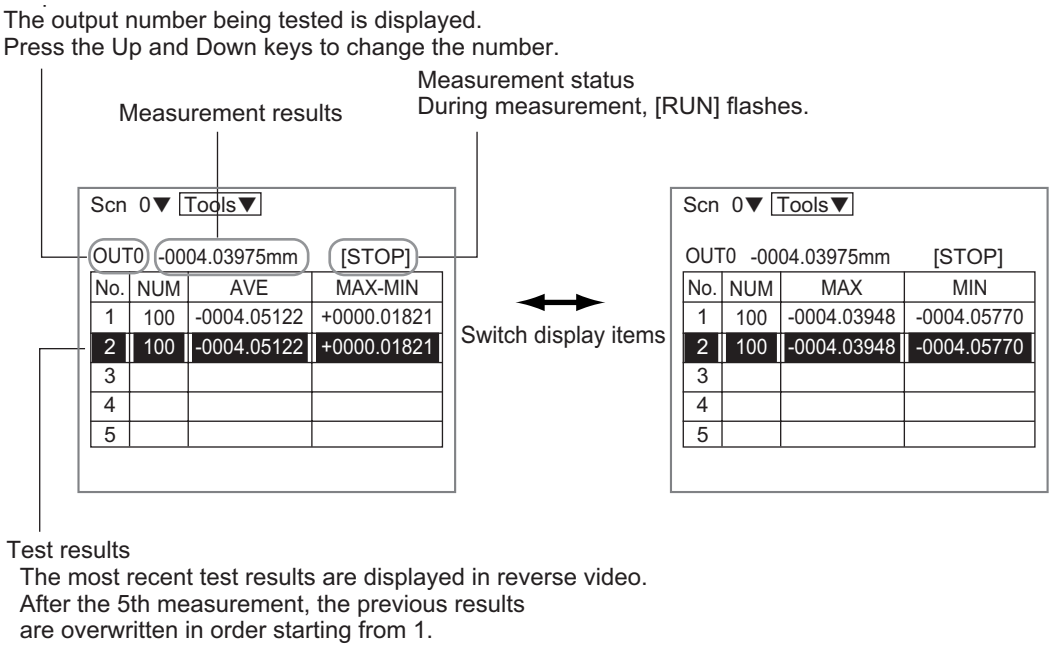
The scene data will be cleared.

Testing Measurement Performance (Test)

Use the following procedure to execute test measurements according to the conditions set for the output currently displayed.The test measurements are completed internally by the Controller and the measurement results are not output via the terminal block or RS-232C.

There are two types of measurement methods.

- Test measurements can be performed continuously for the specified number of measurements only.
- The TRIG Key can be used to specify the start and end of the test measurement period.



Meaning of Test Results

Item	Meaning
NUM	Displays the number of measurements performed during the test measurement period.
AVE	Displays the average measurement value for the test measurement period.
MAX-MIN	Displays the difference in the measurement values (the maximum measurement value minus the minimum measurement value) for the test measurement period.
MAX	Displays the maximum measurement value for the test measurement period.
MIN	Displays the minimum measurement value for the test measurement period.

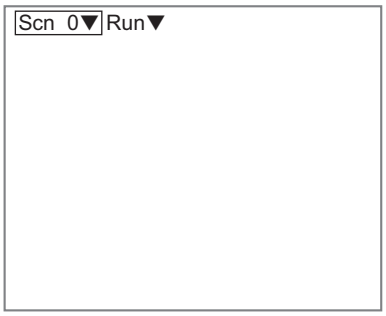
CHECK!

The results of five measurements are displayed as a list; it is convenient in the following situations.

- When evaluating the precision of measurement under partially different conditions
- When comparing the steady state and moving state

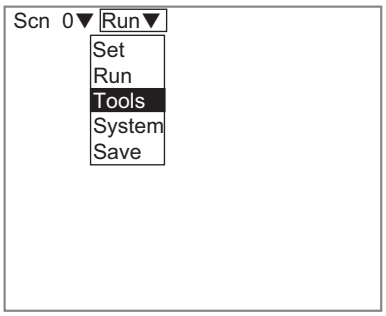
Performing Test Measurements Continuously for the Specified Number of Measurements Only

1. Move the cursor to [Run ▼] and press the ENT Key.



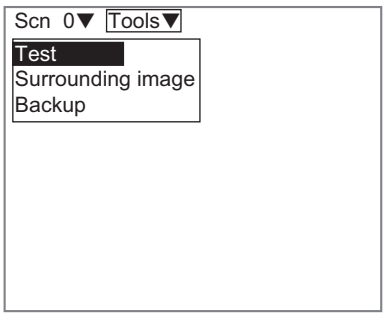
A list of modes appears.

2. Select [Tools].

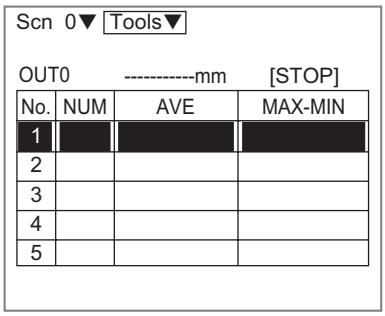


The selections appear.

3. Select [Test].

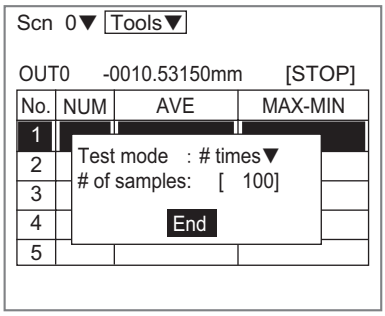


The test measurement screen appears.



4. Position the workpiece to be tested and press the ENT Key.

A menu for selecting test methods appears.



5. Set [Test mode] to [# times].

6. Make the required setting for [# of samples] and select [End].

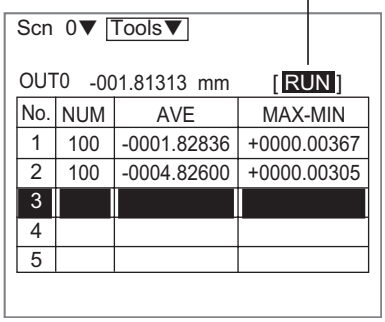
The screen display returns to **4**.

7. Display the output whose measurement value you want to check.
Up/Down key: Switches between outputs.

8. Press the TRIG Key.

The test measurements are performed for the number of times set and the measurement results are displayed.
Press the Left/Right key in order to switch between displays.

When measurement starts, the display changes from [STOP] to [RUN]. During measurement, [RUN] flashes.



9. To continue testing, repeat the operations of **7.** and **8**.

10. To stop the test measurements, press the ESC Key.

The display returns to the Tools mode screen.

Using the TRIG Key to Specify the Start and End of Test Measurements

1. Perform the same operations as those described in 1. to 3. in the procedure for selecting [# times] to display the test method selection menu.
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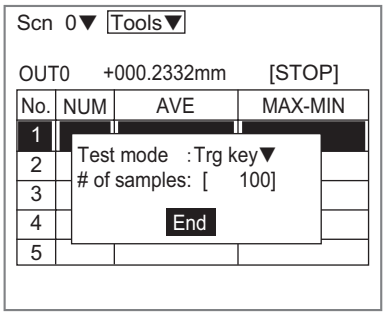
A menu for selecting test methods appears.



2. Set the [Test mode] to [Trg key].

3. Select [End].

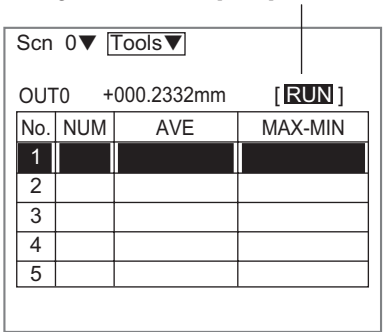
The focus returns to the test measurement screen.

4. Display the output whose measurement value you want to check.
Up/Down key: Switches between outputs.

5. Press the TRIG Key.

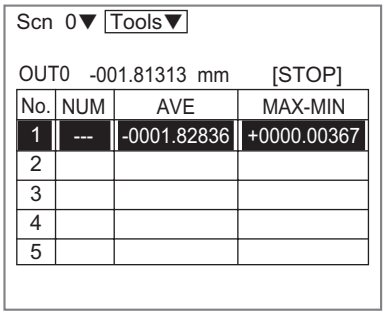
The testing starts and the screen display changes to [RUN].

Press the TRIG Key again.
changes from [STOP] to [RUN].
During measurement, [RUN] flashes.



6. Press the TRIG Key again in order to end the test measurements.

The measurement results appear.
Press the Left/Right key in order to switch between displays.



7. Repeat the operations of **4.** to **6.** in order to perform the test measurements again.

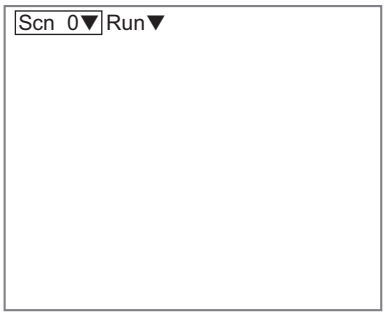
8. To stop the test measurements, press the ESC Key.

The display returns to the Tools mode screen.

Checking the Line Beam Position (Surrounding Image)

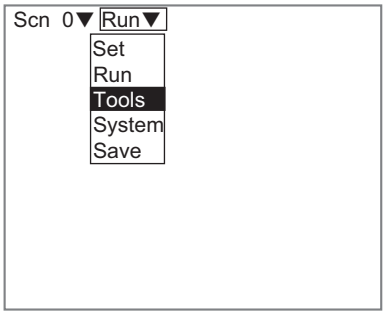
Images of the area surrounding the part that the line beam strikes can be displayed on the screen. Whether or not the beam strikes the part required for measurement can be checked on the screen.This is a convenient function when the sensor is installed inside a device, preventing the measurement area from being checked directly.

1. Move the cursor to [Run ▼] and press the ENT Key.



A list of modes appears.

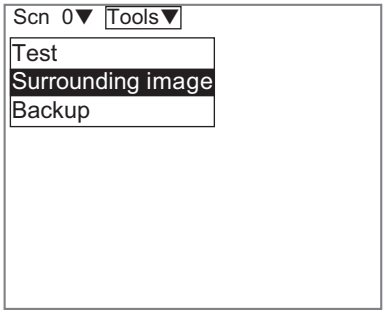
2. Select [Tools].



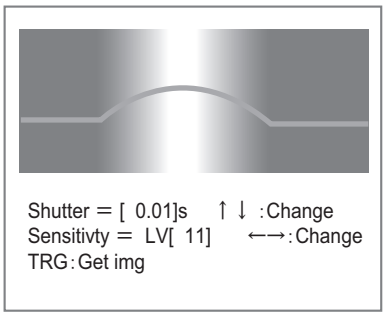
The selections appear.

3. Select [Surrounding image].

The sensor selections are displayed if two sensors are connected.
Select the number of the sensor used for displaying the image.



The screen for capturing images appears.



4. Press the TRIG Key.

The image surrounding the line beam is displayed.

CHECK!

Adjust the shutter time and sensitivity level if the image is not clear.
Up/Down key: Change the shutter time (press these keys together with the SHIFT Key to change the shutter time quickly).
Left/Right key: Adjusts the sensitivity level.
ENT Key: Switches the illumination on and off.

Image	Shutter time	Sensitivity level
Brighter	10 seconds	LV31
↕	↕	↕
Darker	0.05 seconds	LV0

5. To stop displaying the image, press the ESC Key.

The display returns to the Tools mode screen.

Backing up Setting Data

Settings for the three categories shown below can be backed up in a PC.This is a convenient function when it is desired to set many conditions with different measurement setups or perform the same settings on other machines. It is recommended that settings are backed up in a PC as a countermeasure against data corruption and equipment failure as well.

Item	Meaning
Scene data	The settings performed under [Set] for each scene are saved or loaded.
System data	The settings performed under [System] are saved or loaded.
System + scene	Both system and scene data (for scenes 0 to 15) is saved or loaded together.

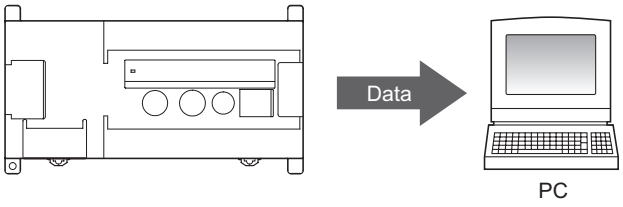
NOTICE Do not turn the power supply off or input a RESET signal while a message is being displayed in any save or load operation.Data in the memory will be destroyed, and the Controller may not operate correctly the next time it is started.

Backing up in a PC

This section describes the data transfer procedures using Hyper Terminal, a standard tool for Windows 95/98 and Windows NT4.0/2000.This example is based on the presumption that an RS-232C cable has been connected to the COM1 port on the PC.
Make the necessary adjustments if the cable is connected to a different port.Refer to the relevant manual if different communication software is to be used.
Data is transferred using the XMODEM(-CRC or -SUM) protocol.
The XMODEM(-1K) protocol is not supported.

Saving

The procedure for saving the scene data for [Scn0] to the PC is explained below.



1. Connect the RS-232C cable to the COM1 port on the PC and the RS-232C port on the Controller.

2. Specify the Controller communication settings.

The default communications settings at the shipment are as shown in the following table.Use the default settings under normal circumstances.

Setting communication specifications p.196

Item	Setting value
Baud rate	38400 (bps)
Data length	8 (bit)
Parity	None
Stop bits	1 (bit)
Delimiter	CR
Flow control	None*

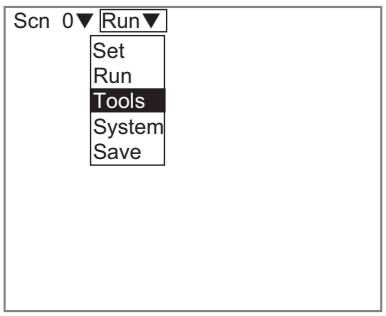
3. Start the Hyper Terminal program on the PC and specify the communication settings as follows.

The same communication settings must be used for both the Controller and the modem on the PC side.

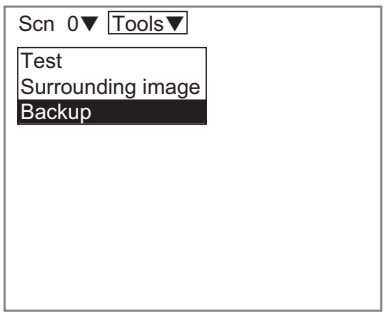
Item	Setting value
Bits per second (B)	38400 (bps)
Data bits (D)	8 (bit)
Parity	None
Stop bits	1 (bit)
Flow control	None*

* The flow control is not performed because the XMODEM protocol is used for the communication.

4. Once the preparations have been completed on the PC, enter the Tools mode.

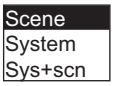


The selections appear.



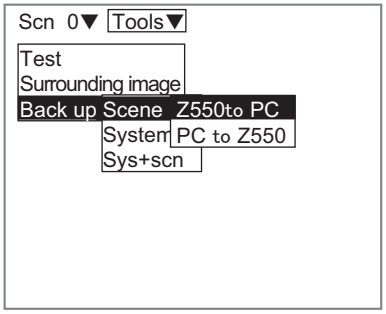
5. Select [Backup].

The selections appear.



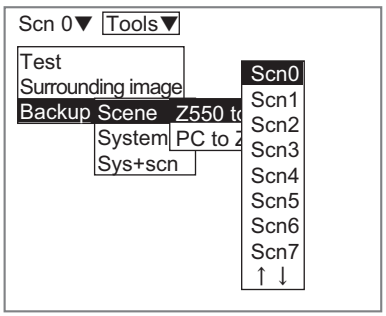
6. Select [Scene].

The selections appear.



7. Select [Z550 to PC].

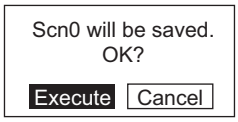
The selections for scenes appear.



8. Select the scene whose data is to be saved in the PC.

Select [Scn0] in this example.

A confirmation message appears.



9. Select [Execute].

A screen showing the transfer progress appears.

10. Select [Transfer/Receive File] from the Hyper Terminal menu on the PC.

11. Specify where the file is to be saved.

12. Set the protocol to [Xmodem].

13. Click [Receive] and enter the file name.

The data will be transferred from the Controller to the PC.

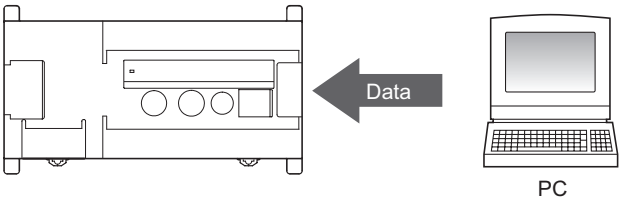
When the transfer has been completed, the screen display returns to **8**.

CHECK!

During the communication, the Controller will generate a timeout error if there is no response from the external device for more than 110 seconds. An error message appears on the screen.

Loading

In the example provided below, the procedure for loading the scene data into scene 2 is explained.



1. Perform the same operations as those described in 1. to 3. in the saving procedure to connect the Controller and PC.

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2. Select [Transfer/Send File] from the Hyper Terminal menu.

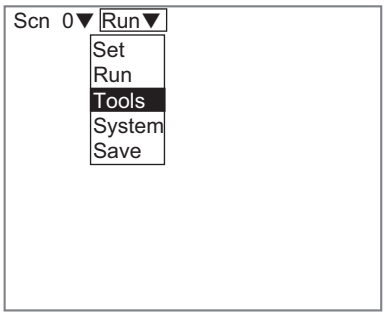
3. Select the file to be loaded.

4. Set the protocol to [Xmodem].

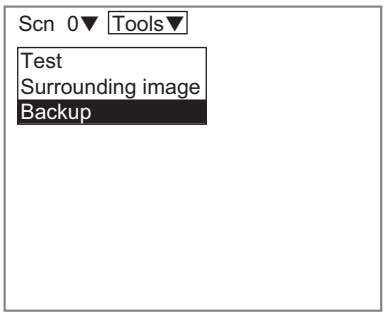
5. Select [Send].

The data transfer screen appears.

6. Once the preparations have been completed on the PC, enter the Tools mode.

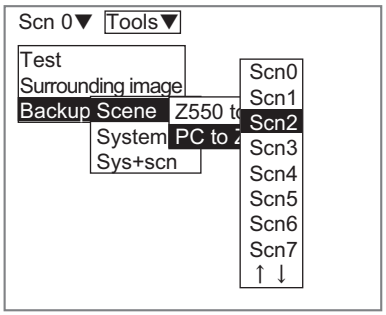


The selections appear.



7. Select [Backup].

The selections appears.



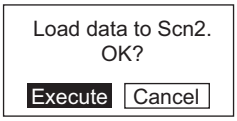
8. Select [Scene].

9. Select [PC to Z550].

10. Select the transfer destination scene.

Select [Scn2] in this example.

A confirmation message appears.



11. Select [Execute].

The data will be transferred from the PC to the Controller.

When the transfer has been completed, the screen display returns to **8**.

CHECK!

During the communication, the Controller will generate a timeout error if there is no response from the external device for more than 110 seconds. An error message appears on the screen.

MEMO

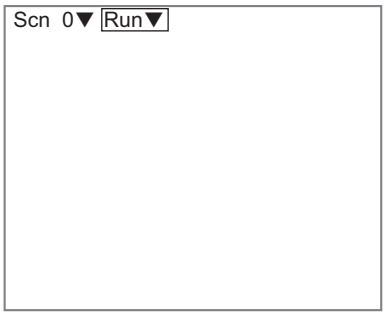
SECTION 5
System Settings

SECTION 5 describes settings related to the system environment.

Entering the System Mode

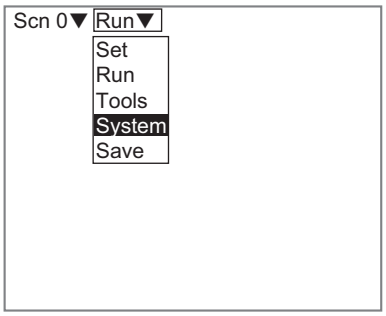
To set conditions related to the system environment, it is necessary to enter the System mode.

1. Move the cursor to [Run ▼] and press the ENT Key.

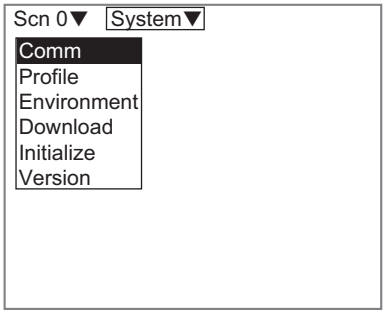


A list of modes appears.

2. Select [System].



The system mode selections appear.



Switching Menus

The Controller is equipped with two types of menus, conversational menu and expert menu.
With the default setting at the shipment, the Controller starts up with the expert menu selected.
The following describes how to switch between these menus.

1. Enter the System mode and select [Environment].
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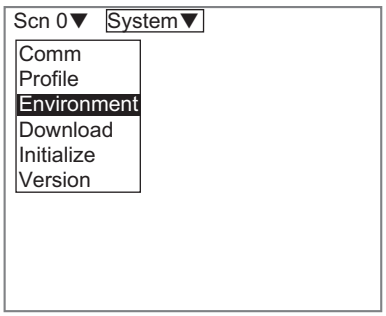
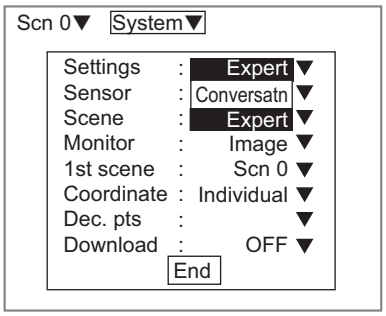


The setting screen appears.

2. Change the setting of [Settings].

3. Select [End].

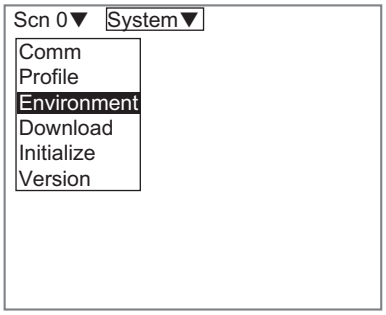


The setting will be registered and the screen display returns to **1**.

Selecting the Sensor Installation Method

Set up the sensor so that it can project and receive laser beams properly so as to obtain correct measurement images. First, select whether the installation status of the connected sensor is "regular (mirror) reflection" or "diffuse reflection."

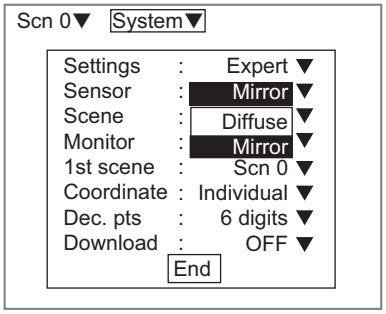
1. Enter the System mode and select [Environment].
p.174



The setting screen appears.

2. Select [Sensor].

3. Select [End].

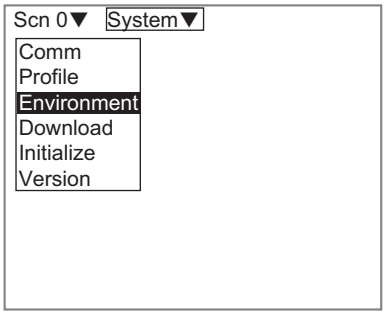


The setting will be registered and the screen display returns to **1**.

Selecting Input Source of Scene Switching

Select whether scenes are switched via the console or using the terminal block.(Set to console at the shipment.)

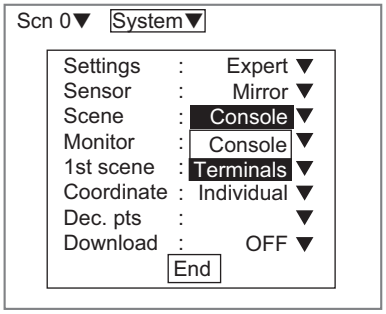
1. Enter the System mode and select [Environment].
p.174



The setting screen appears.

2. Change the setting of [Scene].

3. Select [End].



The setting will be registered and the screen display returns to **1**.

Setting Conditions at Startup

The conditions when the power is turned on can be set up here.By selecting a scene for which measurement conditions have been set in advance, it is possible to start the measurement as soon as the power supply is turned on.

Item	Option	Meaning
Startup Monitor screen	Image Monitor screen (default setting) Digital Monitor screen Trend Monitor screen Profile Monitor screen	The monitor screen that is displayed when the power supply is turned on is specified.
1st scene	Scene 0 to Scene 15 (Scene 0 is set by default setting)	The scene that is displayed when the power supply is turned on is specified.

1. Enter the System mode and select [Environment].
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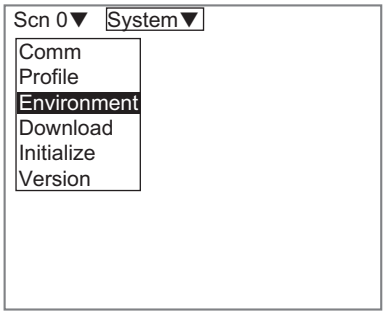
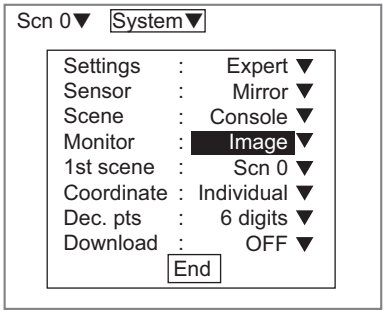


The setting screen appears.

2. Select [Monitor] and [1st scene].

3. Select [End].

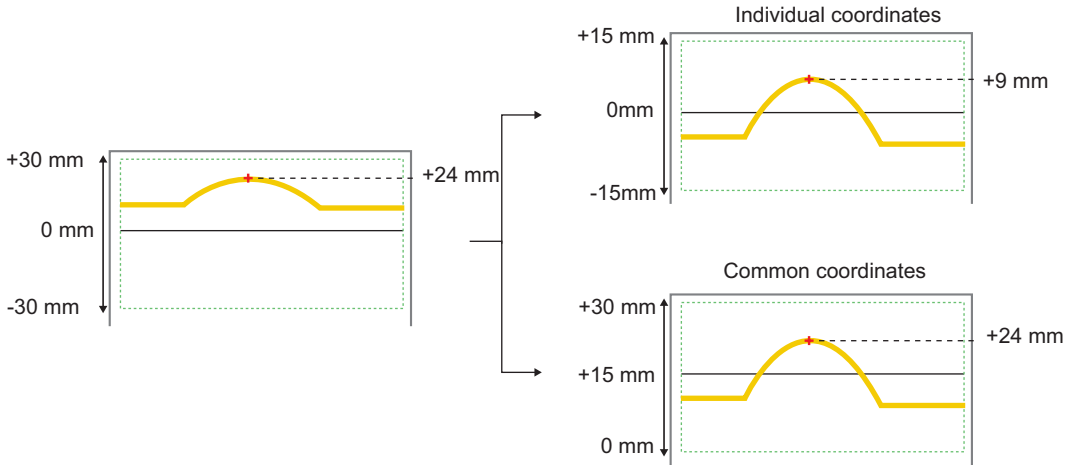


The setting will be registered and the screen display returns to **1.**

Selecting How Height Coordinates are Handled

Select how the height coordinates are handled when the measurement range is changed.

Example: When the measurement range is changed from 60 mm to 30 mm



Option	Meaning
Individual coordinates (default setting)	A separate coordinate system is used for each measurement range.This option is used under normal circumstances.
Common coordinates	One common coordinate system is used for all measurement ranges. (Because images differ according to the measurement range, the measurement values may change if the measurement range is changed.)

1. Enter the System mode and select [Environment].

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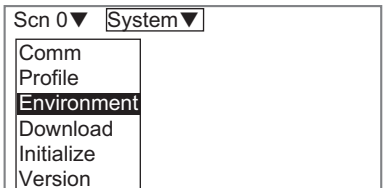
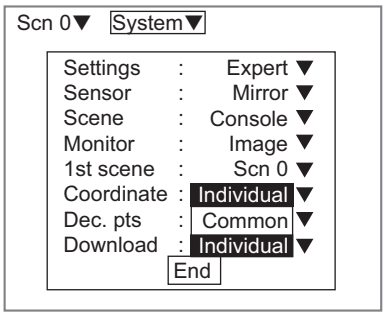


The setting screen appears.

2. Change the setting of [Coordinate].

3. Select [End].

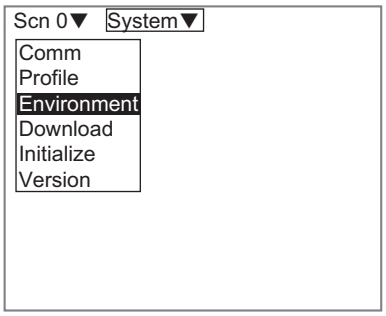


The setting will be registered and the screen display returns to **1**.

Selecting the Displayed Number of Digits (Decimal Part)

Select the lowest digit of the measurement values displayed on the monitor screen (0 to 6 digits, set to 6 digits by default).

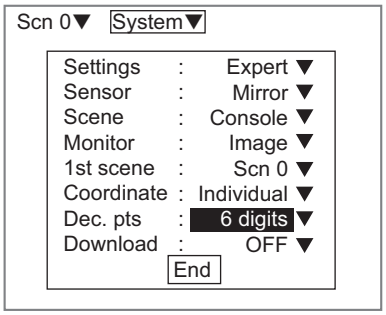
1. Enter the System mode and select [Environment].
p.174



The setting screen appears.

2. Change the setting of [Dec. pts].

3. Select [End].



The setting will be registered and the screen display returns to **1**.

Using the Download Function

The controller acquires information from the sensor at startup. The startup time can be shortened by downloading this information into the controller and storing it.

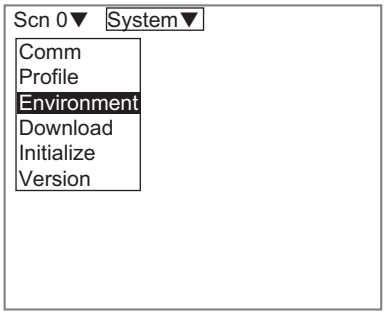
Option	Meaning
OFF (default setting)	Information is acquired via the sensor connection at startup. The startup time will be longer than when the ON function is used.
ON	The information stored inside the controller is acquired at startup. The startup time will be shortened by comparison to when the OFF function is used.

NOTICE To replace the sensor for connection to the controller, perform the following procedure:

1.Turn off the download function.
2.Replace the sensor.
3.Download the new sensor information.
4.Turn on the download function.

If the sensor is replaced while the download function is on, measurements cannot be taken correctly with the new sensor because the old sensor information (such as the measurement range) is still stored.
Also, perform the above procedure when a sensor of the same model is used to replace the existing sensor.

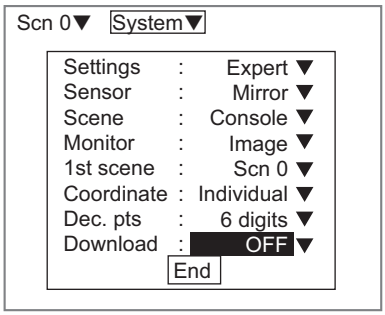
1. Enter the System mode and select [Environment].
p.174



The setting screen appears.

2. Change the setting of [Download].

3. Select [End].

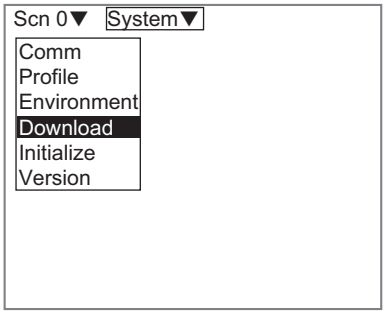


The setting will be registered and the screen display returns to **1**.

Downloading the sensor information to the controller

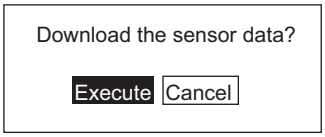
When the download function is on, download the sensor information to the controller in advance.

1. Enter the System mode and select [Download].
p.174



A confirmation message appears.

3. Select [Execute].



The sensor data will be downloaded and the screen display returns to **1**.

Initialization

Use the procedure shown below to return the controller to its default settings.

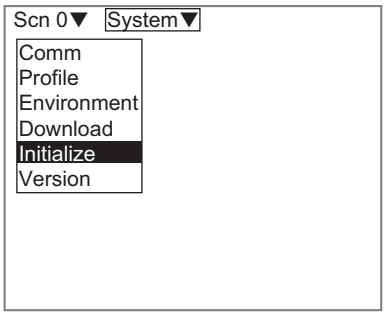
How to clear measurement conditions for each scene p.158

CHECK!

When the Controller is initialized, all the settings return to their default values.To save the settings, back them up in a PC before performing initialization.

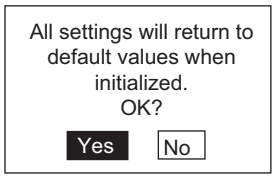
Backing Up Data in a PC p.166

1. Enter the System mode and select [Initialize].
p.174



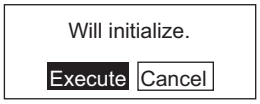
A confirmation message appears.

2. Select [Yes].



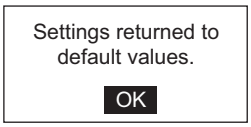
A confirmation message appears.

3. Select [Execute].



The system will be initialized and another confirmation message appears.

4. Select [OK].

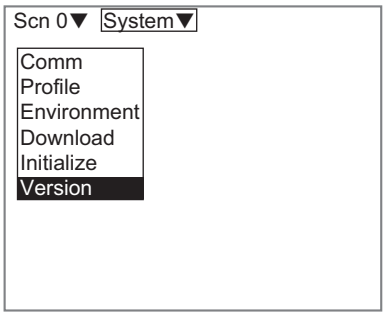


The screen display returns to **1**.

Checking System Version

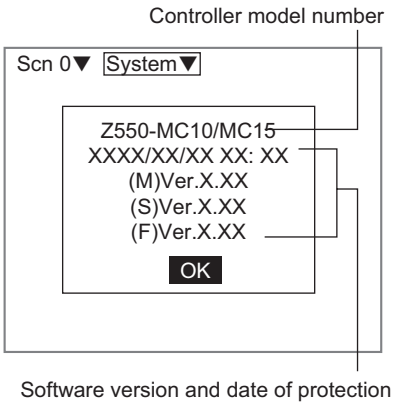
Use the following procedure to display the controller model number and the software version.

1. Enter the System mode and select [Version].
p.174



The version information appears.

2. Select [OK].



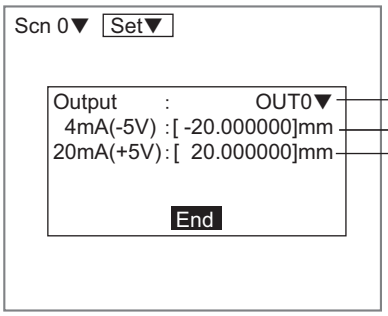
The screen display returns to **1**.

SECTION 6
Communication with External Devices

SECTION 6 provides details on the inputs and outputs used for communication with external devices via terminal blocks, RS-232C, or analog outputs.

Analog Output

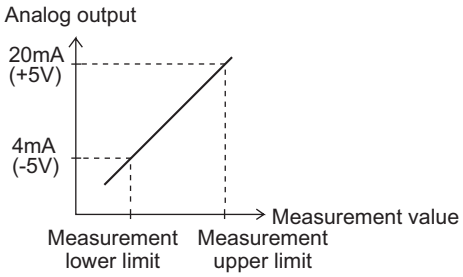
Measurement results can be output as current in the range 4 to 20 mA and as voltage in the range -5 to 5 V.
Only one of the outputs from OUT0 to 7 can be output.
Using the menus, specify the output number whose measurement result you want to output and the scaling value.



Select the desired output (OUT0 to OUT7).

Set the measurement value corresponding to "4 mA/-5 V" in the analog output (-999.999999 to 999.999999 mm).
The default setting at shipment varies depending on the sensor model that is connected.

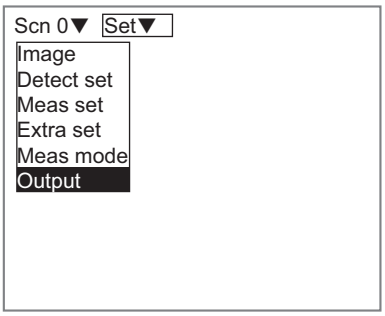
Set the measurement value corresponding to the upper limit of the analog output (20 mA/+5 V)(-999.999999 to 999.999999 mm).
The default setting at shipment varies depending on the sensor model that is connected.



CHECK!

Output during reset input
During restart (approx. 20 seconds after the power supply is turned on), 0 V and 12 mA are output to the analog output terminals.Make sure that these outputs are not treated as actual signals by external devices.

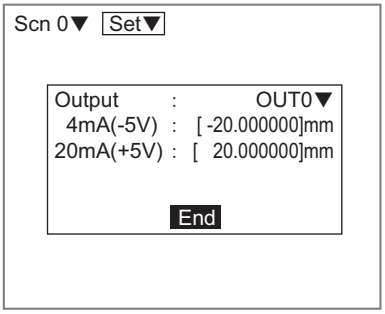
1. Enter the Set mode and select [Output].



The selections appear.

2. Select [Analog].

The setting screen for output data appears.



3. Make the settings for each item.

CHECK! Set the values in such a way that "4mA(-5V) < 20mA(+5V)."

4. Select [End].

The setting will be registered and the screen display returns to **2**.

CHECK! Refer to Timing Charts for details on I/O timings.
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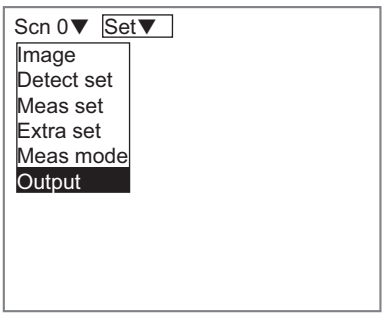
Terminal Block

Setting Output Method and Communication Specifications

The items to be output and the timing of the output can be specified according to the procedure below. The settings are enabled for all outputs.

1. Enter the Set mode and select [Output].



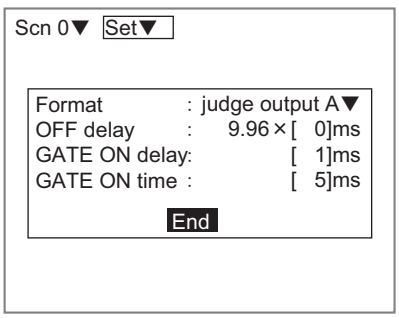
The selections appear.

2. Select [Terminals].

The setting screen for output data appears.

3. Make the settings for each item.

4. Select [End].



The setting will be registered and the screen display returns to **2**.

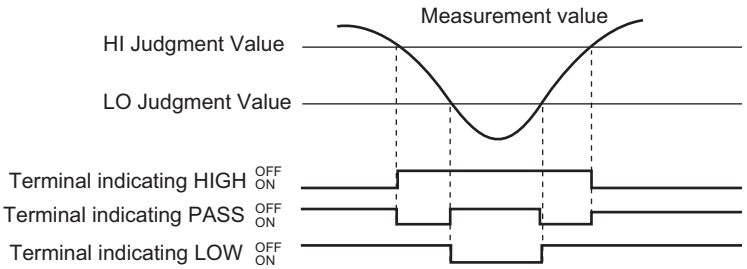
Item	Option/Setting range	Meaning
Format	Judgment output A (Default setting)	When this function is selected, the details of the judgment (HIGH/PASS/LOW/ERROR) are output.Note that the judgment results can only be output for OUT0 to OUT3. The judgment results for OUT4 to OUT7 cannot be output.
	Judgment output B	Judgment results for OUT0 through OUT7 will be output as either OK or NG.
OFF Delay	0 to 99999 (Set to 0 by default setting)	Set a time delay that allows the external device to receive the result. The off delay time is obtained by multiplying the value set here by 9.96 ms.
GATE ON delay *	1 to 1000.0ms (Set to 1 ms by default setting)	Set the time delay from when the result is output to the terminal block to when the GATE signal is turned on. This is the time to wait until stable output data can be obtained.Set this time so that it is longer than the delay time involved in data transmission to external devices.
GATE ON time *	1 to 1000.0ms (Set to 5 ms by default setting)	Set the length of time that the GATE signal remains on. Set a value that allows the external device to receive the measurement result.

* The GATE signal is only output when [Hold (External)] or [Hold (Self)] is specified for [Extra set/Logging/Hold].The GATE signal is always off if [Free] or [Logging] has been selected.

CHECK!

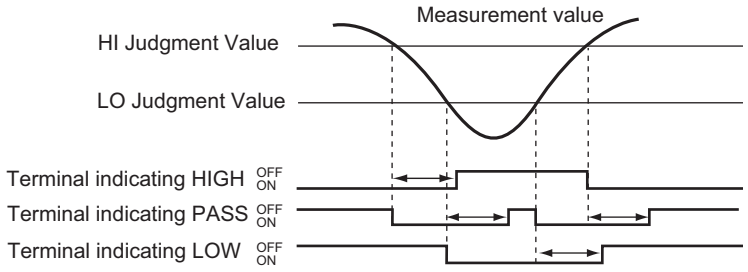
Output timing differences due to off delay time

Example 1: When the off delay time is 0



* The GATE signal is always off.

Example 2: When the off delay time is specified



* The GATE signal is always off.

Input Format

The following types of input are available from the terminal blocks in the Run mode.

Terminal name	Function
$\overline{\text{RESET}}$	The measurement values are cleared and the Controller is restarted. Settings that have not been saved are cleared, and the setting data saved in the flash memory is loaded.
$\overline{\text{TRIGGER}}$	Triggers measurement.
$\overline{\text{LDOFF}}$	The laser diode (LD) is turned off.
$\overline{\text{DI0}}$	Force-zero is performed for OUT0. To cancel the force-zero function, turn this terminal on for at least 1 second. When the force-zero function is executed, the zero value is determined using the latest measurement value even if the hold output or logging output is specified.
$\overline{\text{DI1}}$	Force-zero is performed for all outputs. To cancel the force-zero function, turn this terminal on for at least 1 second. When the force-zero function is executed, the zero value is determined using the latest measurement value even if the hold output or logging output is specified.
$\overline{\text{DI2}}$	(Not used)
$\overline{\text{DI3}}$	
$\overline{\text{DI4}}$ to $\overline{\text{DI7}}$	Used in combination to switch scenes.* The scene switching time is approximately 2 seconds. Change the setting of [Environment/Scene] of the System mode to [Terminals] in advance. p.177

* Scene switching

Scene	DI7	DI6	DI5	DI4
Scene 0	0	0	0	0
Scene 1	0	0	0	1
		• • •		
Scene 14	1	1	1	0
Scene 15	1	1	1	1

0: Off status
1: On status

CHECK!

The time required to turn on an input terminal is "9.96 ms x 2" or more (excluding scene switching).

Output Format

The judgment results are output to DO0 to DO15.
The terminal assignment varies depending on the output method (judgment outputs A and B).

In the Case of Judgment output A

The judgment results for OUT0 to OUT3 are output to DO0 to DO15.
The judgment results for OUT4 to OUT7 cannot be output.

Output data		Output terminal	Remark
OUT0	HIGH	$\overline{DO0}$	—
	PASS	$\overline{DO1}$	
	LOW	$\overline{DO2}$	
	ERROR	$\overline{DO3}$	
OUT1	HIGH	$\overline{DO4}$	
	PASS	$\overline{DO5}$	
	LOW	$\overline{DO6}$	
	ERROR	$\overline{DO7}$	
OUT2	HIGH	$\overline{DO8}$	
	PASS	$\overline{DO9}$	
	LOW	$\overline{DO10}$	
	ERROR	$\overline{DO11}$	
OUT3	HIGH	$\overline{DO12}$	
	PASS	$\overline{DO13}$	
	LOW	$\overline{DO14}$	
	ERROR	$\overline{DO15}$	
ALL-PASS		$\overline{DO16}$	Turns on if the results of all the registered outputs are PASS.This can be used for comprehensive judgment.Note that the off delay does not function for this output.
ERROR		$\overline{DO17}$	Turns on if the judgment result of at least one of the registered outputs is ERROR.This can be used to identify that an error has occurred.Note that the off delay does not function for this output.
RUN		$\overline{DO18}$	Turns on during measurement.Will be turned off while the scene is changed or set.
BUSY		$\overline{DO19}$	Turns on from the start of the measurement to the completion of the profile data output if [Meas mode] is set to [Trg (External)] or [Trg (RS-232C)].

Result	Meaning
HIGH	Turns on when the measurement value is greater than the judgment upper limit.
PASS	Turns on when judgment lower limit ≤ measurement value ≤ judgment upper limit.
LOW	Turns on when the measurement value is less than the judgment lower limit.
ERROR	Turns on if the sensor cannot perform measurement. • The workpiece is out of the measurement range • The light density is insufficient • Sufficient information on the measurement point cannot be obtained, even though the point has been set in the measurement item menu. (The image does not appear in the measurement range, the edge position cannot be detected, and other abnormalities.)

In the Case of Judgment output B

The judgment results for OUT0 to OUT7 (OK or NG) are output to DO0 to DO7.

Output data	Output terminals	Remark
OUT0 OK/NG	$\overline{DO0}$	OK (PASS): Turns off NG (HIGH, LOW, ERROR): Turns on
OUT1 OK/NG	$\overline{DO1}$	
OUT2 OK/NG	$\overline{DO2}$	
OUT3 OK/NG	$\overline{DO3}$	
OUT4 OK/NG	$\overline{DO4}$	
OUT5 OK/NG	$\overline{DO5}$	
OUT6 OK/NG	$\overline{DO6}$	
OUT7 OK/NG	$\overline{DO7}$	
(Not used)	$\overline{DO8 \text{ to } DO15}$	(Not used)
ALL-PASS	$\overline{DO16}$	Turns on if the results of all the registered outputs are PASS.This can be used for comprehensive judgment.Note that the off delay does not function for this output.
ERROR	$\overline{DO17}$	Turns on if the judgment result of at least one of the registered outputs is ERROR.This can be used to identify that an error has occurred.Note that the off delay does not function for this output.
RUN	$\overline{DO18}$	Turns on during measurement.Turns off while the scene is changed or set.
BUSY	$\overline{DO19}$	Turns on from the start of the measurement to the completion of the profile data output if [Meas mode] is set to [Trg (External)] or [Trg (RS-232C)].

CHECK!

All output terminals turn off when the mode is switched to a mode other than Run.The initial signal of the output terminals is off. The terminals, however, may turn on for approximately 0.5 seconds when the power supply is turned on.Make sure that these outputs are not treated as actual signals by external devices.

CHECK!

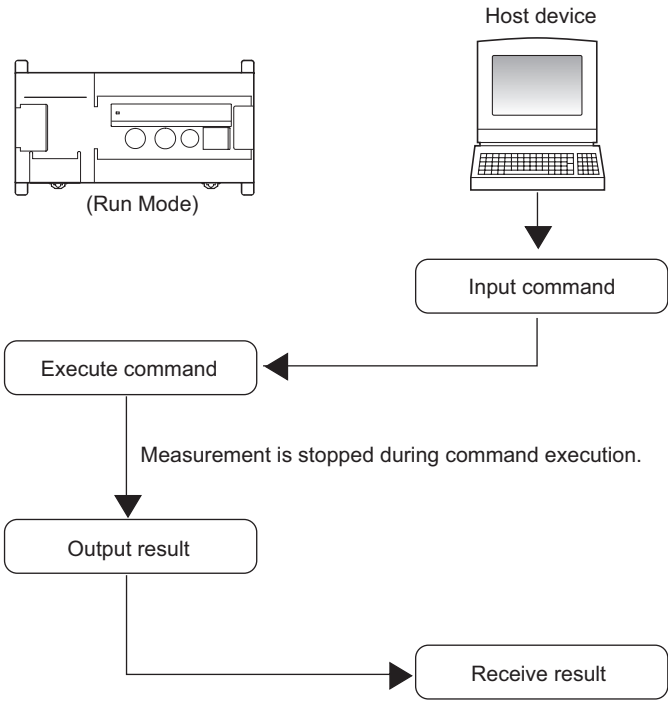
Refer to Timing Charts for details on I/O timings.
p.222

RS-232C

The Controller can perform non-protocol communications with an external device, such as a PC, via RS-232C.

CHECK!

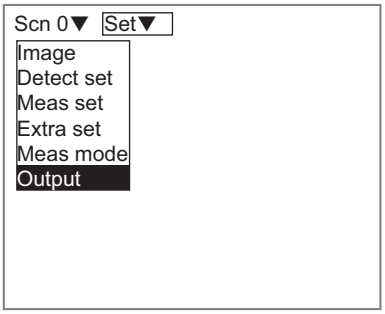
Commands can be input only when the Controller is in the Run mode.Do not use the terminal blocks for input or output during command execution.
At least 100 ms is required to output a measurement result after receiving a command via RS-232C.



Selecting Output Items

Specify items to be output via the RS-232C according to the following procedure.

1. Enter the Set mode and select [Output].



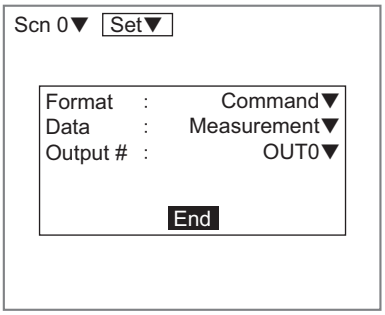
The selections appear.

2. Select [RS-232C].

The setting screen for output data appears.

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

4. Select [End].



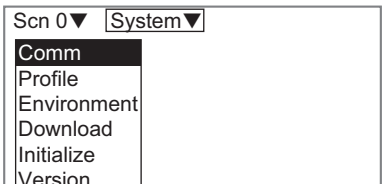
The setting will be registered and the screen display returns to **2**.

Item	Option	Meaning
Format	Command (Default setting)	Measurement data is output only when a data acquisition command (e.g., MEASURE or JUDGE) is input from an external device.
	Trigger OFF	When hold output or logging output is used, the measurement data is output after the profile data is output. It is not necessary to enter a data acquisition command (e.g., MEASURE or JUDGE).
Data	Measurement (Default setting)	Measurement values are output to RS-232C.The output method is the same as for the MEASURE command.
	Result	Judgment results (HIGH/PASS/LOW/ERROR) are output to RS-232C.The output method is the same as for the JUDGE command.
	Measmt + Result	The judgment result is output first, followed by the measurement value.
Output #	OUT0 to OUT7 (Set to OUT0 by default setting)	Select the output (OUT0 to OUT7) whose data is to be output. When [Consecutive] is selected, the data of OUT0 through OUT7 will be output continuously in series.
	Consecutive	

Setting Communication Specifications

The same communications settings must be used for both the Controller and the modem on the external device.

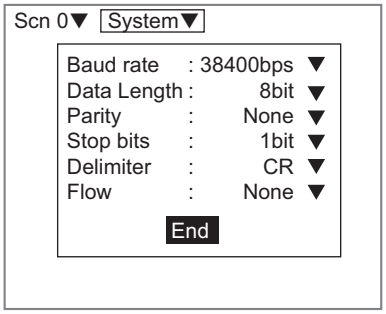
1. Enter the System mode and select [Comm].
p.174



The setting screen appears.

2. Select a value for each item.

3. Select [End].



The setting will be registered and the screen display returns to **1**.

Item	Option/Setting range	Meaning
Baud rate	9600 bps 19200 bps 38400 bps (default setting) 57600 bps 115200 bps	The settings must be the same as on the PC side. Note that 57600 bps and 115200 bps can be used only when the following conditions are met. In other cases, 38400 bps is the upper limit. • The measurement mode is [Trg (External)]. • The profile transmission format is [XMODEM]. • The communication direction is only from the Controller to the external device.
Data length	7 bits, 8 bits (default setting)	The settings must be the same as on the PC side.
Parity	None (default setting) Even, Odd	
Stop bits	1 bit (default setting), 2 bits	
Delimiter	CR (default setting), LF, CR + LF	
Flow	None(default setting)	The flow control is not performed.
	RS/CS	The flow control is performed by the hardware.Use a cable that connects the RS signal of the Controller and the CS signals of the external device.Data is sent when the CS signal from the external device is on.
	Xon/Xoff	The flow control is performed by the software.Data is sent in accordance with the Xon/Xoff code sent from the external device.

Setting the Profile Output Method

Specify the communication method when profile data is output according to the following procedure.

1. Enter the System mode and select [Profile].
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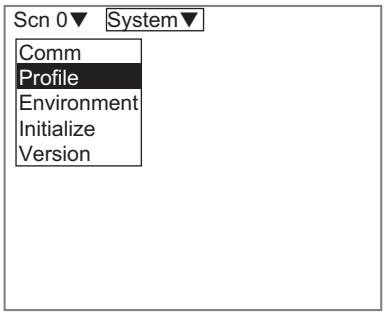
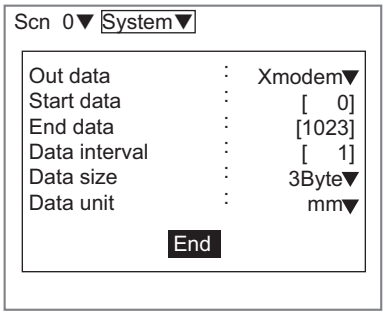


The setting screen appears.

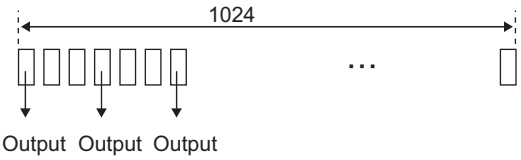
2. Select a value for each item.

3. Select [End].



The setting will be registered and the screen display returns to **1**.

Item	Option/Setting range	Meaning
Out data	Text	The profile data is transmitted in text format.The post-processing will be simple, but the communication time becomes longer as the amount of data is large.
	XMODEM (Default setting)	The profile data is converted to binary format and then transmitted. The number of data items is smaller than for the text format and the communication time is shorter, but the following precautions must be taken. • It is necessary to convert the binary format data in order to perform post-processing. • Software supporting XMODEM communication is required. Communication flow p.212

Item	Option/Setting range	Meaning
Start data	0 to 1023 (Set to 0 by default setting)	Specify the range of transmission target lines. The communication time can be shortened by limiting the range to only the required lines. Specify the range in such a way that the transmission start is equal to or less than the transmission end.
End data	0 to 1023 (Set to 1023 by default setting)	
Data interval (Valid only during XMODEM transmission)	1 to 1024 (Set to 1 by default setting)	Specify the interval at which lines are skipped in the XMODEM communication. When the data is transmitted, the number of lines specified here is skipped for each line sent. Example: When the transmission step is set to "3" 
Data size (Valid only during XMODEM transmission)	3 bytes (default setting) 2 bytes	Select the data size used in the XMODEM transmission. • 3 bytes: Transmitted in 1 μm units. • 2 bytes: Transmitted in 100 μm units.
Data unit (Valid only during text transmission)	mm (default setting) μm	Select the unit used when sending data in the text format.

Command Formats

The following commands can be input from the host device to the Controller.

Commands that Obtain or Change Current Settings

Command	Function	Page
AVE	Obtains or changes the averaging number.	201
JUDPARA	Obtains or changes the judgment upper limit and judgment lower limit.	202
SCENE	Obtains the scene currently displayed.	204
	Switches the scene to be measured.	
SENS	Sets the sensitivity adjustment method to [Auto] and obtains the optimum sensitivity for the workpiece.	205
	Changes the sensitivity level of the sensor, turns off the laser, or changes gradations.	
SENSM	Sets the sensitivity adjustment method to [Multi] and obtains the optimum sensitivity for the workpiece.	206
	Changes the sensitivity level of the sensor, turns off the laser, or changes gradations.	
ZERO	Executes or cancels force-zero.	208

Commands that Obtain Measurement Results

Command	Function	Page
CAPTURE	Performs measurement once and obtains the profile data. (Can only be performed when the measurement mode is [Trg (RS-232C)].)	209
JUDGE (or J)	Obtains the most recent judgment result.	213
MEASURE (or M)	Obtains the most recent measurement value.	214
TREND (or T)	At hold output: Obtains data accumulated in the period from the start to the end of measurement.	215
	At logging output: Obtains logging data from the latest data and up to 3000 points in the past.	
PROFILE or P	Obtains profile data. (Can only be performed when the measurement mode is [Continuous].)	217

Commands that Save and Load Data

Command	Function	Page
DATASAVE	Saves all data in the flash memory.	218
SCNLOAD	Loads scene data into the Controller from the host device.	218
SCNSAVE	Saves scene data from the Controller in a host device.	219
SYSLOAD	Loads system data into the Controller from the host device.	219
SYSSAVE	Saves system data from the Controller in a host device.	220

Other

Command	Function	Page
VERGET	Obtains the system's version information.	221

Input Format

Input the commands in ASCII code.Either upper-case or lower-case characters can be input.

Example:

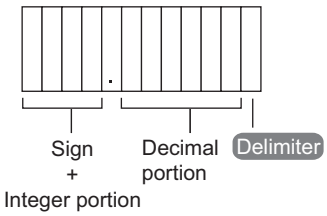
JUDPARA <Output> <Parameter> Delimiter

(1) (2) (3)

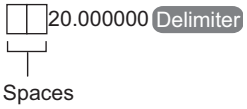
(1) Specify the corresponding values for items enclosed with < >.
(2) Place a space between items. (Delimiter A space is not necessary before.)
(3) Enter Delimiter at the end of a command.

Output Format (Measurement Value)

The measured values will be output with all of them closed to the right.

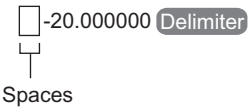


Example 1: In the case of 20.000000



Note: "+" will not be output.

Example 2: In the case of -20.000000



Commands that Obtain or Change Current Settings

AVE

Function 1.....Obtains the averaging number.

Input AVE Delimiter

Output Command executed correctly : Number Delimiter
Command not executed correctly : ER Delimiter

Example:

Input AVE Delimiter

Output 4 Delimiter
The averaging number is 4.

Function 2.....Changes the averaging number.
(The only numbers that can be input are 1, 2, 4, 8, 16, 32, 64, 128, and 256.)

Input AVE <Number> Delimiter

Output Command executed correctly : OK Delimiter
Command not executed correctly : ER Delimiter

Example:

Input AVE 8 Delimiter

Output OK Delimiter
The averaging number is changed to 8.

JUDPARA

Function 1.....Obtains the judgment upper limit and the judgment lower limit.

Input JUDPARA <Output> <Parameter> Delimiter

- Specify an output between 0 and 7.

Output #	Meaning
0	OUT0
1	OUT1
2	OUT2
3	OUT3
4	OUT4
5	OUT5
6	OUT6
7	OUT7

- The meaning of the parameters are as follows:

Parameter	Meaning
H	Judgment upper limit
L	Judgment lower limit

Output Command executed correctly : Judgment value Delimiter
Command not executed correctly : ER Delimiter

Example:

Input JUDPARA 0 H Delimiter
Obtains the judgment upper limit for OUT0.

Output 5.000000 Delimiter
The upper limit is set to 5.000000.

CHECK! The judgment upper limit and judgment lower limit for the currently displayed scene are obtained using this command. Display the required scene before execution.

Function 2.....Changes the judgment upper limit and judgment lower limit.

Input JUDPARA <Output> <Judgment upper limit> <Judgment lower limit> Delimiter

- Specify an output between 0 and 7.

Output #	Meaning
0	OUT0
1	OUT1
2	OUT2
3	OUT3
4	OUT4
5	OUT5
6	OUT6
7	OUT7

- Set the limits so that the judgment upper limit is equal to or greater than the judgment lower limit.
  The setting range is -999.999999 to 999.999999.

Output Command executed correctly : OK Delimiter
Command not executed correctly : ER Delimiter

Example:

Input JUDPARA 0 10.000000 -10.000000 Delimiter
Change the judgment upper limit and judgment lower limit for OUT0 to 10.000000 and -10.000000, respectively.

Output : OK Delimiter


CHECK!

The judgment upper limit and judgment lower limit for the currently displayed scene are changed using this command. Display the required scene before execution.

SCENE

Function 1.....Obtains the scene being displayed.

Input SCENE Delimiter

Output Command executed correctly : Scene Delimiter
Command not executed correctly : ER Delimiter

Example:

Input SCENE Delimiter

Output :4 Delimiter
Scene 4 is being displayed.

Function 2.....Switches the scene to be measured.

Input SCENE <Scene > Delimiter

Specify a scene between 0 and 15.

Output Command executed correctly : OK Delimiter
Command not executed correctly : ER Delimiter

Example:

Input SCENE 2 Delimiter

Output OK Delimiter
In this example, the scene is switched to scene 2.

It is not possible to switch scenes using RS-232C commands if [Environment/Scene] in the System mode is set to [Terminals].(ER is output.)

SENS

Function 1.....Sets the sensitivity adjustment method to [Auto] and obtains the optimum sensitivity for the workpiece.

Input SENS Delimiter

Output Command executed correctly : Sensitivity level (1 to 31) Delimiter
Command not executed correctly : ER Delimiter

Function 2.....Sets the sensitivity adjustment method to [Auto] and changes the sensitivity level of the sensor, turns off the laser, or changes gradations.

Input SENS <Sensitivity levelLower limit> <Sensitivity levelUpper limit> <Gradations> Delimiter

- Specify values in the range between 0 and 31 for the sensitivity level lower limit and sensitivity level upper limit.
  The optimum sensitivity level is set within the range from the lower limit to the upper limit.Set the values so that the lower limit is equal to or less than the upper limit.
  If the same value is set for the lower limit and upper limit, the sensitivity will be fixed at that level.
  If both the lower limit and upper limit are set to 0, the laser will be turned off. (However, a measurement error will be generated.)

- Specify a value in the range between 120 and 220 for gradations as the target value of sensor automatic sensitivity adjustment (Specify 170 under normal circumstances.)

The total delay time for turning the laser off can be shortened with input from the terminal block. If the laser must be turned off instantaneously, use the LD-OFF input terminal block.

How to input from terminal blocks. p.190

Output Command executed correctly : OK Delimiter
Command not executed correctly : ER Delimiter

Perform the following procedure in order to set and fix the optimum sensitivity for the workpiece to be measured.

Example:

Input SENS Delimiter

Output 17 Delimiter
The optimum sensitivity is 17.

Input SENS 15 19 170 Delimiter

Output OK Delimiter
The sensitivity level is automatically adjusted in the range between 15 and 19 with a target light reception level of 170.

SENSM

Function 1.....Sets the sensitivity adjustment method to [Multi] and obtains the optimum sensitivity for the workpiece.

Input SENSM <Priority item> Delimiter

Specify either 0 or 1 for the priority item.

Priority item	Meaning
0	Priority on dynamic range
1	Priority on sampling period (default selection when setting is omitted)

Output Command executed correctly : Sensitivity lower limit, sensitivity upper limit Delimiter
Command not executed correctly : ER Delimiter

Function 2.....Sets the sensitivity adjustment method to [Multi] and changes the sensitivity level of the sensor, turns off the laser, or changes gradations.

Input SENSM <Priority item> <Sensitivity levelLower limit> <Sensitivity levelUpper limit> <Gradations> Delimiter

- Specify the item that has priority at the time of multiple sensitivity adjustment as the priority item.

Priority item	Meaning
0	Priority on dynamic range
1	Priority on sampling period (default selection when setting is omitted)

- Specify values in the range from 0 to 31 (0 to 25 if the sampling period has priority) for the sensitivity level lower limit and sensitivity level upper limit.
  The optimum sensitivity level is set within the range from the lower limit to upper limit.Set the values so that the lower limit is equal to or less than the upper limit.
  If the same value is set for the lower limit and upper limit, the sensitivity will be fixed at that level.
  If both the lower limit and upper limit are set to 0, the laser will be turned off.
  (However, a measurement error will be generated.)

- Specify a value in the range between 120 and 220 for gradations as the target value of sensor sensitivity adjustment.
  (Specify 170 under normal circumstances.)

CHECK! The total delay time for turning the laser off can be shortened more with input from the terminal block. If the laser must be turned off instantaneously, use the LD-OFF input terminal.
How to input from terminal blocks. p.190

Output Command executed correctly : OK Delimiter
Command not executed correctly : ER Delimiter

Perform the following procedure in order to set the optimum sensitivity for the workpiece to be measured.

Example:

Input SENSM 1 Delimiter

Output :17 25 Delimiter
The optimum sensitivity is in the range of 17 to 25.

Input SENSM 1 17 25 170 Delimiter

Output OK Delimiter
The sensitivity level is automatically adjusted in the range between 17 to 25 with a target light reception level of 170 while giving priority to the sampling period.

ZERO

Function 1.....Executes Force-zero.

Input ZERO 0 <Output ><Offset value> Delimiter

- Specify an output between 0 and 8.

Output #	Meaning
0	OUT0
1	OUT1
2	OUT2
3	OUT3
4	OUT4
5	OUT5
6	OUT6
7	OUT7
8	All zero

- Set the offset value used for force-zero execution.Set the value to be added to 0 in the range from -999.999999 to 999.999999.
  If this setting is omitted, the offset value that was set previously will be used.

Output Command executed correctly : OK Delimiter
Command not executed correctly : ER Delimiter

Example:

Input ZERO 0 1 Delimiter
Force-zero is executed for OUT1.

Output OK Delimiter

CHECK! When the force-zero function is executed, the zero value is determined using the latest measurement value even if the hold output or logging output is specified.

Function 2.....Cancels force-zero.

Input ZERO 1 <Output> Delimiter

Specify an output in the same way as in Function 1 (between 0 and 8).

Output Command executed correctly : OK Delimiter
Command not executed correctly : ER Delimiter

Example:

Input ZERO 1 1 Delimiter
Force-zero for OUT1 is canceled.

Output OK Delimiter

Commands that Obtain Measurement Results

CAPTURE

Function 1.....Performs measurement once and obtains the profile data (distribution of height measurements at 1024 points).
(Can only be performed when the measurement mode is [Trg (RS-232C)].)

Input CAPTURE Delimiter

Output (In case of text transmission)
Command executed correctly: Number of measurement values Delimiter
Profile data transmission start line Delimiter
Profile data transmission end line Delimiter
Profile data transmission step Delimiter
Inclination compensation status Delimiter
Measurement value of the start line Delimiter
.
.
Measurement value of the end line Delimiter
OK Delimiter

Other errors : ER Delimiter
LD-OFF : LDOFF Delimiter

Supplementary Explanation ofOutput Items

Item	Output value	Meaning
Inclination compensation status	0	Indicates that the inclination compensation has not been set, or the inclination compensation has been set and compensation has been completed normally.
	1	Indicates that the inclination compensation has been set but compensation has not been completed normally.

Example:

Input CAPTURE Delimiter

Output
1024 Delimiter — Number of measurement values
0 Delimiter — Profile data transmission start line
1023 Delimiter — Profile data transmission end line
1 Delimiter — Profile data transmission step
0 Delimiter — Inclination compensation status
253.531121 Delimiter
.
369.978911 Delimiter — Profile data
OK Delimiter

(In case of XMODEM transmission)
Command executed correctly: READY Delimiter

Binary format
- Offset to data field (4B)
- Number of samples (2B)
- Number of measurement values (2B)
- Profile transmission start line (2B)
- Profile data transmission end line (2B)
- Profile data transmission step (2B)
- XMODEM transmission size (2B)
- Dummy (4B)
- Inclination compensation status (1B)
- Dummy (3B)
- Measurement value of the start line (2 or 3B)
- .
- .
- Measurement value of the end line (2 or 3B)
- OK Delimiter

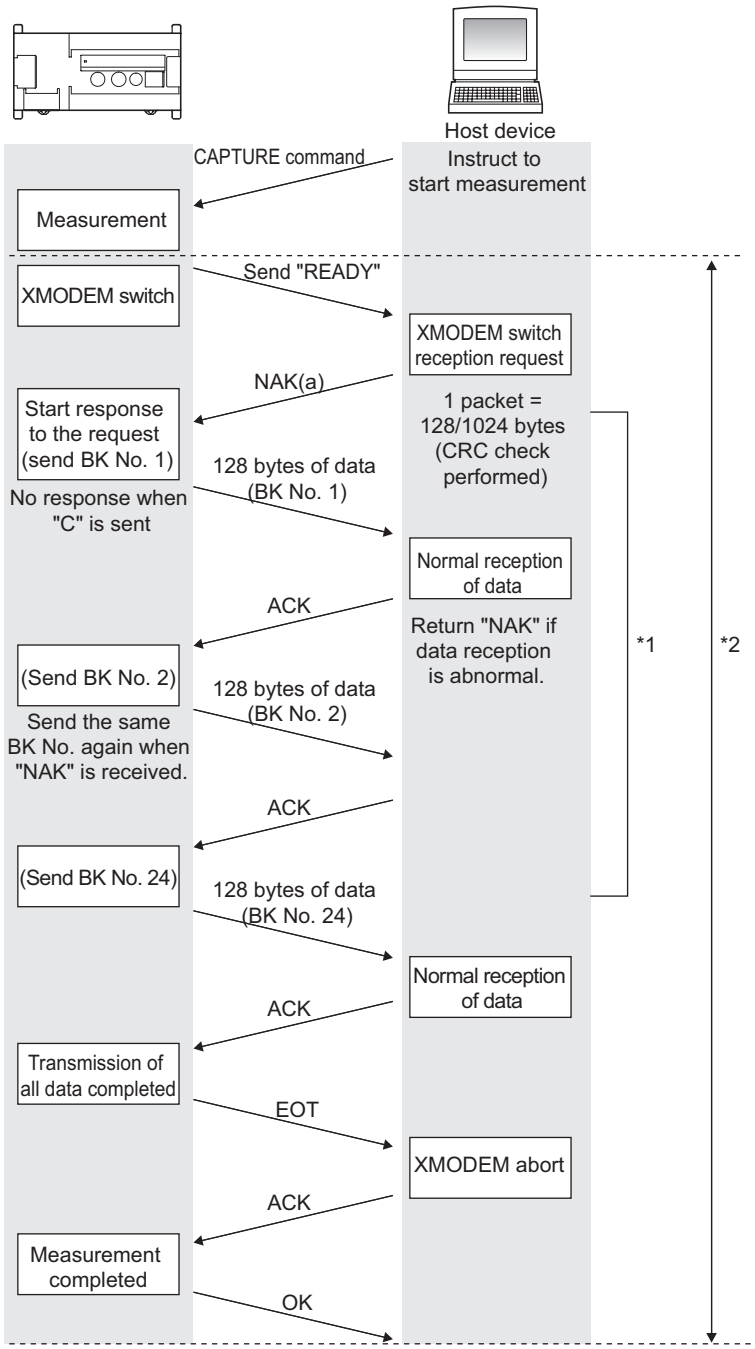
Other errors : ER Delimiter
LD-OFF : LDOFF Delimiter

Supplementary Explanation of Output Items

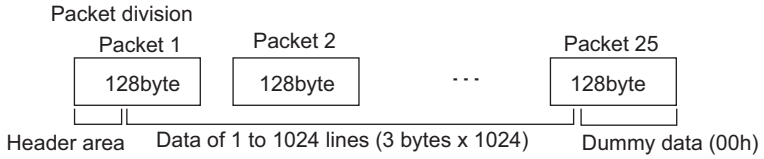
Item	Output value	Meaning
Offset to data field	20 (Fixed value)	Indicates the data length of the header field.
Number of samples	1 (Fixed value)	Indicates the number of samples contained in the profile data to be output.
Dummy	0 (Fixed value)	Has been added in order to adjust the data length.
XMODEM transmission size	0	Indicates that it is set to 3 bytes.
	1	Indicates that it is set to 2 bytes.
Inclination compensation status	0	Indicates that the inclination compensation has not been set, or the inclination compensation has been set and compensation has been completed normally.
	1	Indicates that the inclination compensation has been set but compensation has not been completed normally.

Refer to Timing Charts for details on I/O timings.
p.222

Flow of XMODEM Communication



*1 In the case of 1024 lines, for each line represented by three bytes of data, the measurement data is sent as 25 packets (1024 lines x 24 bits / 128 bytes = 24, plus 1 header packet = 25).
*2 The flow will be the same when profile data is output via XMODEM transmission in the case of the TRG terminal block.



JUDGE (or J)

Function.....Obtains the most recent judgment result.

Input JUDGE(or J) <Output> Delimiter

• Specify an output between 0 and 8.

Output #	Meaning
0	OUT0
1	OUT1
2	OUT2
3	OUT3
4	OUT4
5	OUT5
6	OUT6
7	OUT7
8	OUT0 to 7

Output When the output is set to 0 to 7 : Judgment result Delimiter
When the output is set to 8 : 0, Judgment result Delimiter
1, Judgment result Delimiter
.
.
OK Delimiter
Other errors : ER Delimiter
LD-OFF : LDOFF Delimiter
Measurement not possible : RST Delimiter

• The following judgment results will be output from the Controller.

Output #	Meaning
0	PASS
1	HIGH
2	LOW
3	ERROR

CHECK!
The last value measured is output if hold output is specified.
Values according to the hold setting are output at logging output.

Example:

Input J 1 Delimiter
The judgment result for OUT1 is obtained.
Output 0 Delimiter
The judgment result is within the judgment value range (PASS).

MEASURE (or M)

Function.....Obtains the most recent measurement value.

Input MEASURE (or M) <Output> Delimiter

- Specify an output between 0 and 8.

Output #	Meaning
0	OUT0
1	OUT1
2	OUT2
3	OUT3
4	OUT4
5	OUT5
6	OUT6
7	OUT7
8	OUT0 to 7

Output

When the output is set to 0 to 7 : Measurement value Delimiter

When the output is set to 8 : 0, Measurement value Delimiter
1, Measurement value Delimiter
2, Measurement value Delimiter
.
.
OK Delimiter

At measurement error : -999.9999999 Delimiter

Other errors : ER Delimiter

LD-OFF : LDOFF Delimiter

Measurement not possible : RST Delimiter

Example:

Input M 1 Delimiter
The most recent measurement value for OUT1 is obtained.

Output 111.123456 Delimiter
The measurement value is 111.123456.

CHECK!
- The most recent result of the measurement performed for the currently displayed scene is output.
- The last value measured is output if hold output is specified.
- Values according to the hold setting are output at logging output.

TREND (or T)

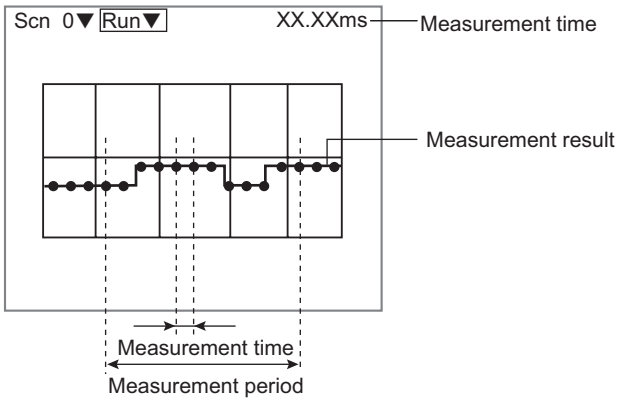
Function.....Obtains the measurement values from the start to the end of the measurement under the Trigger setting.
(Cannot be performed when the setting of [Hold&Logging] is other than [Free].)

Input TREND (or T) <Output> <Output coefficient> Delimiter

- Specify an output between 0 and 7.

Output #	Meaning
0	OUT0
1	OUT1
2	OUT2
3	OUT3
4	OUT4
5	OUT5
6	OUT6
7	OUT7

- Specify an output coefficient between 1 and 1000.
  The output coefficient indicates the intervals between measurements that are output.
  The number of data items that will be output can be calculated using the formula below.
  In the case of hold output
  Measurement period ÷ Measurement time = Number of measurements
  Number of measurements ÷ Measurement coefficient = Number of data items output (The number is rounded up to the nearest integer.)
  In the case of logging output
  Measurement period ÷ Measurement time ÷ Sampling interval = Number of measurements
  Number of measurements ÷ Measurement coefficient = Number of data items output (The number is rounded up to the nearest integer.)



• Different data is output depending on the setting in [Extra set/Hold&Logging].

Setting	Output data
Free	ER
Hold (External)	Data accumulated in the period from the start of measurement to the end of measurement
Hold (Self)	
Logging	Logging data from the latest data and up to 3000 points in the past

Output

Command executed correctly : Number of measurement values Delimiter
Measurement value Delimiter
.
.
.
Measurement value Delimiter
OK Delimiter

At measurement error : -999.999999 Delimiter
Other errors : ER Delimiter
No trigger occurred : RST Delimiter
LD-OFF : LDOFF Delimiter
If the mode is set to [Free] : ER Delimiter
If the mode is set to [Hold (External)] or [Hold (Self)], but this command is executed during the trigger period: ER Delimiter

CHECK!

The accumulated data is cleared under the following circumstances:
• At startup
• When clearing a scene
• When switching a scene
• When loading scene data
• When loading system data
• At initialization
• When changing trigger settings
• When the measurement period is changed

If the measurement is paused (e.g., when changing to the Set mode), logging data is maintained, but the data accumulated by the external trigger and self trigger is cleared.

Example:

Assuming the measurement period is 1000 ms, one sampling period is 9.96 ms, and the total number of outputs is 2.

Input TREND 0 2 Delimiter
Obtains the measurement result of OUT0.

Output 50 Delimiter ——— Number of measurement values
253.531112 Delimiter
497.575653 Delimiter
.
.
.
369.978239 Delimiter
OK Delimiter

50 measurement values (obtained as 50 = 1000 ms ÷ 9.96 ms ÷ 2) are output.

PROFILE or P

Function.....Obtains profile data (distribution of height measurements at 1024 points).
(Can only be performed when the measurement mode is [Continuous].)

Input PROFILE or P Delimiter

Output The output result is the same as for the CAPTURE command. Refer to the explanation of the CAPTURE command.
p.209

Commands that Save and Load Data

DATASAVE

Function.....Saves all data in the flash memory.

Input DATASAVE Delimiter

Output Command executed correctly : OK Delimiter
Command not executed correctly : ER Delimiter

NOTICE Do not turn off the Controller's power supply until a response has been received.

SCNLOAD

Function.....Loads scene data from the host device into the Controller.

Input SCNLOAD <Scene> Delimiter

- Specify a scene between 0 and 15.If the argument is omitted, data is loaded into the scene being displayed.
- The data transfer is performed using the XMODEM (-CRC or -SUM) protocol. The XMODEM (-1K) protocol is not supported.
- The Controller sends a READY signal to the host device when it has completed its initialization. Wait for the READY signal to be received at the host device before starting the data transfer.

Output Command executed correctly : OK Delimiter
Command not executed correctly : ER Delimiter

Example:

Input SCNLOAD 2 Delimiter
Data will be loaded into scene 2 from the host device.

Output OK Delimiter

SCNSAVE

Function.....Saves scene data in the host device from the Controller.

Input SCNSAVE <Scene> Delimiter

- Specify a scene between 0 and 15.If the argument is omitted, the scene data being displayed is saved.
- The data transfer is performed using the XMODEM (-CRC or -SUM) protocol. The XMODEM (-1K) protocol is not supported.
- The Controller sends a READY signal to the host device when it has completed its initialization, and then starts to transfer data.

Output Command executed correctly : OK Delimiter
Command not executed correctly : ER Delimiter

Example:

Input SCNSAVE 2 Delimiter
This example saves the data of scene 2 in the host device.

Output OK Delimiter

SYSLOAD

Function.....Loads system data from the host device into the Controller.

Input SYSLOAD Delimiter

- The data transfer is performed using the XMODEM (-CRC or -SUM) protocol.The XMODEM (-1K) protocol is not supported.
- The Controller sends a READY signal to the host device when it has completed its initialization. Wait for the READY signal to be received at the host device before starting the data transfer.

Output Command executed correctly : OK Delimiter
Command not executed correctly : ER Delimiter

Example:

Input SYSLOAD Delimiter
This example loads the system data from the host device.

Output OK Delimiter

SYSSAVE

Function.....Saves system data in the host device from the Controller.

Input SYSSAVE Delimiter

- The data transfer is performed using the XMODEM (-CRC or -SUM) protocol. The XMODEM (-1K) protocol is not supported.
- The Controller sends a READY signal to the host device when it has completed its initialization, and then starts to transfer data.

Output Command executed correctly : OK Delimiter
Command not executed correctly : ER Delimiter

Example:

Input SYSSAVE Delimiter
This example saves the system data in the host device.

Output OK Delimiter

Other

VERGET

Function.....Obtains the system's version information.

Input VERGET Delimiter

Output Command executed correctly : Version information Delimiter
Command not executed correctly : ER Delimiter

Example:

Input VERGET Delimiter

Output Z550-MC10(M)VerX.XX(S)VerX.XX(F)X.XX Delimiter

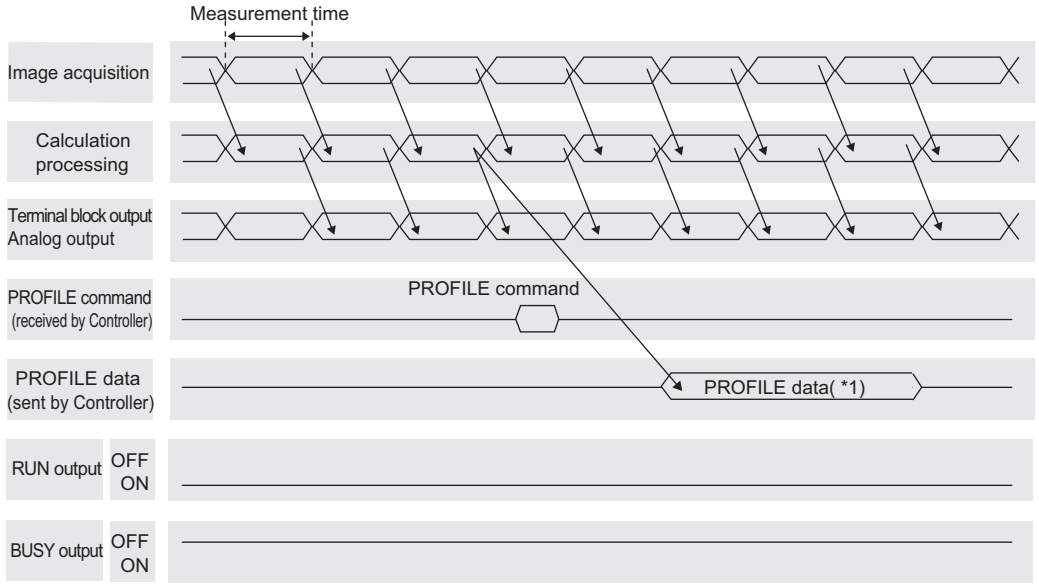
Timing Charts

Measurement mode	Hold&Logging			
	Free	Hold output		Logging output
		External trigger	Self trigger	
Continuous measurement	Timing Chart 1 p.222	Timing Chart 2 p.223	Timing Chart 3 p.224	Timing Chart 4 p.225
Trigger measurement (External)	Timing Chart 5 p.226	Timing Chart 6 p.227	Timing Chart 7 p.228	Timing Chart 8 p.229
Trigger measurement (RS-232C)	Timing Chart 9 p.230	Timing Chart 10 p.231	Timing Chart 11 p.232	Timing Chart 12 p.233

Timing Chart 1

Measurement mode	Hold&Logging
Continuous measurement	Free

Measurements are made at a fixed interval when the Controller is in the Measurement mode, and then the results are output.Hold measurement is not performed.



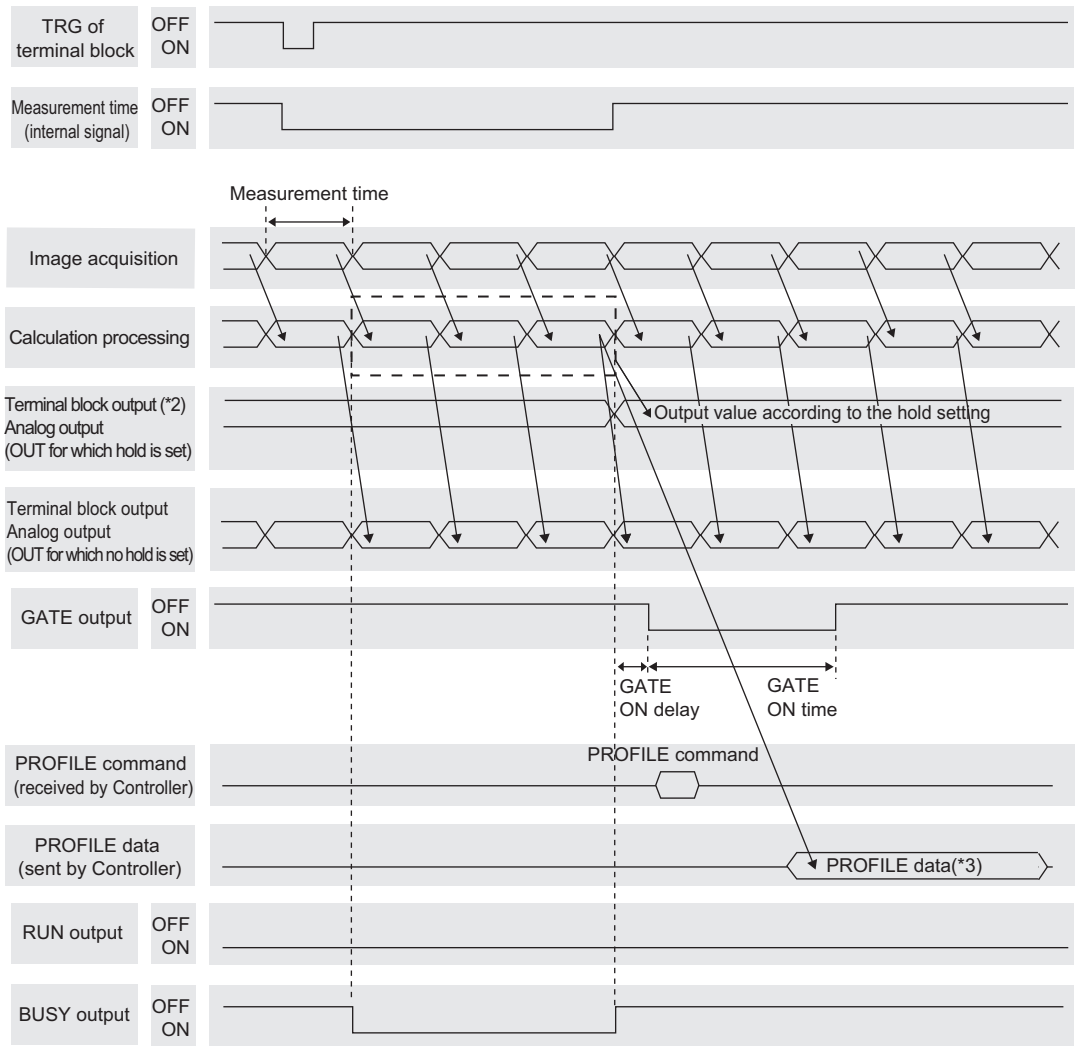
*1 Profile data for which arithmetic processing has been completed when the PROFILE command is received is transmitted.

Timing Chart 2

Measurement mode	Hold&Logging
Continuous measurement	Hold (External)

Hold measurement is performed at the timing when the TRG signal of the terminal block is input during a continuous measurement.

Assuming the measurement duration is specified to three times the measurement time (*1)



*1 Specify the measurement duration to 200 ms when the measurement time is 100 ms in order to set it to three times the measurement time.

*2 ALL-PASS and ERROR outputs are always output at the timing when "hold" is set.

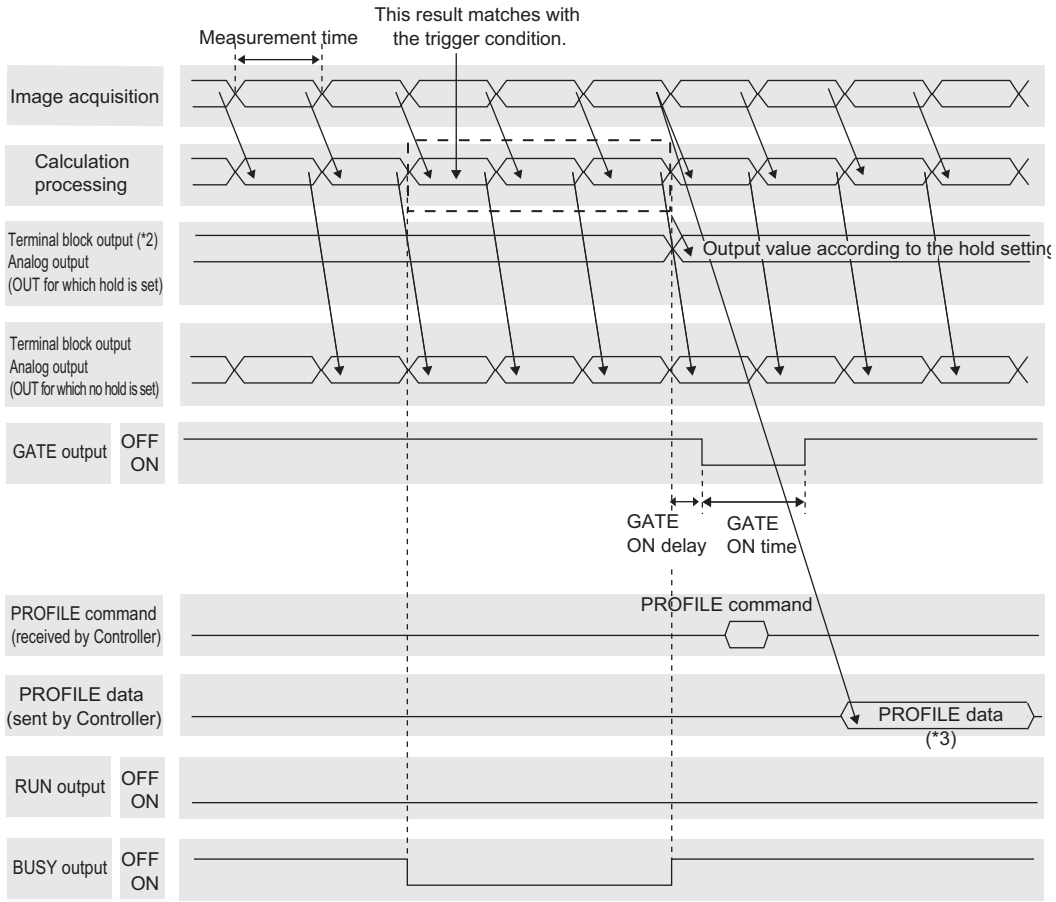
*3 Profile data for which arithmetic processing has been completed when the PROFILE command is received is transmitted.

Timing Chart 3

Measurement mode	Hold&Logging
Continuous measurement	Hold (Self)

Hold measurement is started when the measurement result matches with the trigger conditions during a continuous measurement.

Assuming the measurement duration is specified to three times the measurement time (*1)



*1 Specify the measurement duration to 200 ms when the measurement time is 100 ms in order to set it to three times the measurement time.

*2 ALL-PASS and ERROR outputs are always output at the timing when "hold" is set.

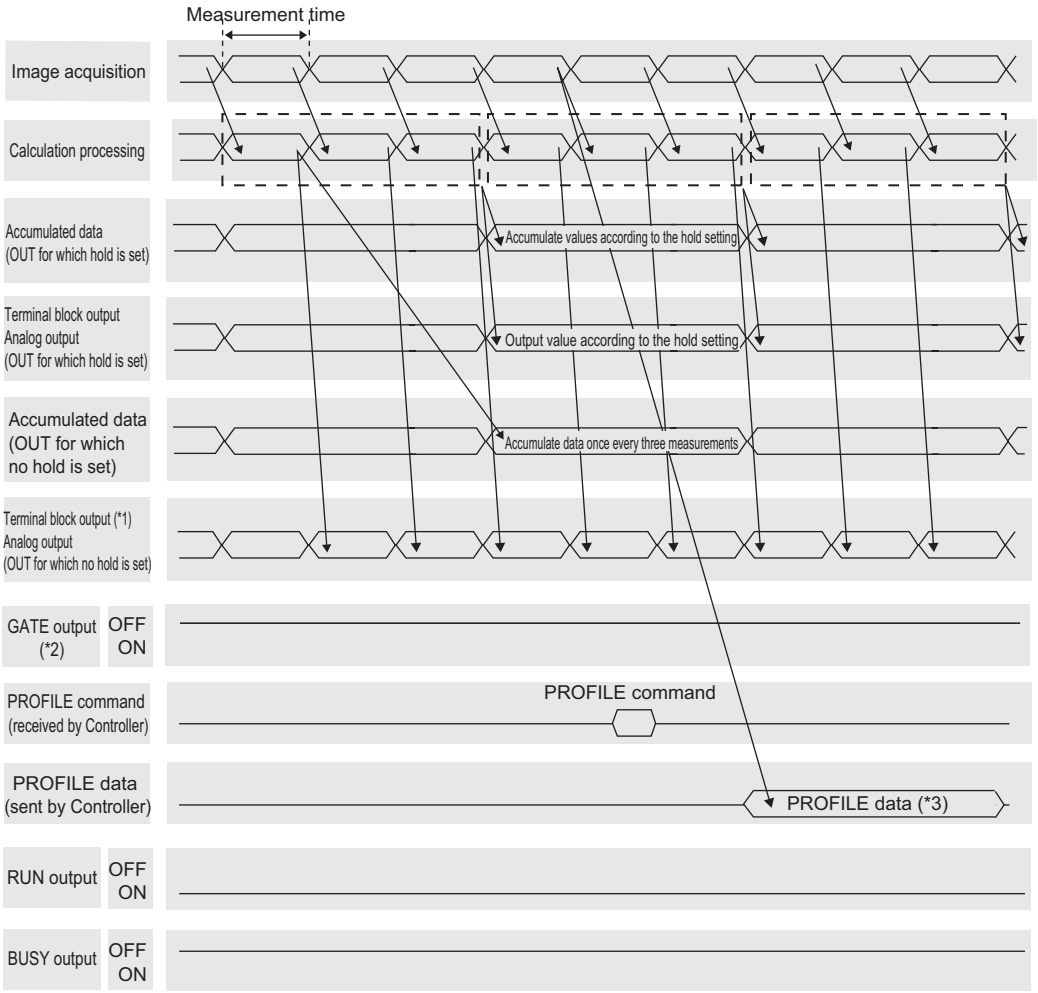
*3 Profile data for which arithmetic processing has been completed when the PROFILE command is received is transmitted.

Timing Chart 4

Measurement mode	Hold&Logging
Continuous measurement	Logging

Measurement values are accumulated and output according to the logging settings during a continuous measurement. When the hold conditions are specified, the corresponding values are held, accumulated, and then output.

Assuming the sampling interval is set to three samples

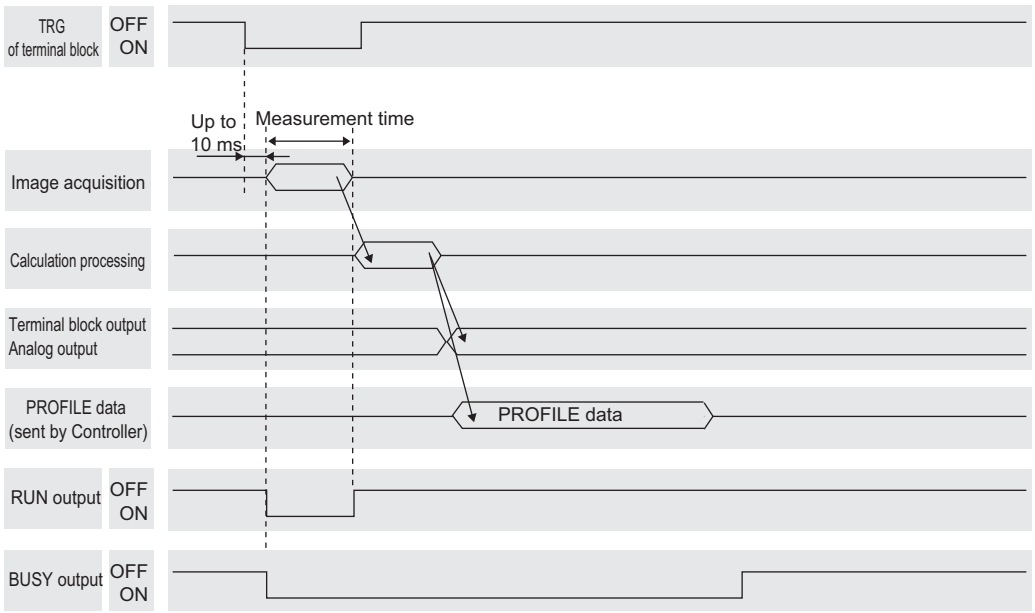


*1 ALL-PASS and ERROR outputs are always output at the timing when "no hold" is set.
*2 The GATE output does not function at logging.
*3 Profile data for which arithmetic processing has been completed when the PROFILE command is received is transmitted.

Timing Chart 5

Measurement mode	Hold&Logging
Trigger measurement (External)	Free

Measurement is performed once when the TRG signal of the terminal block is turned on and the results are output.

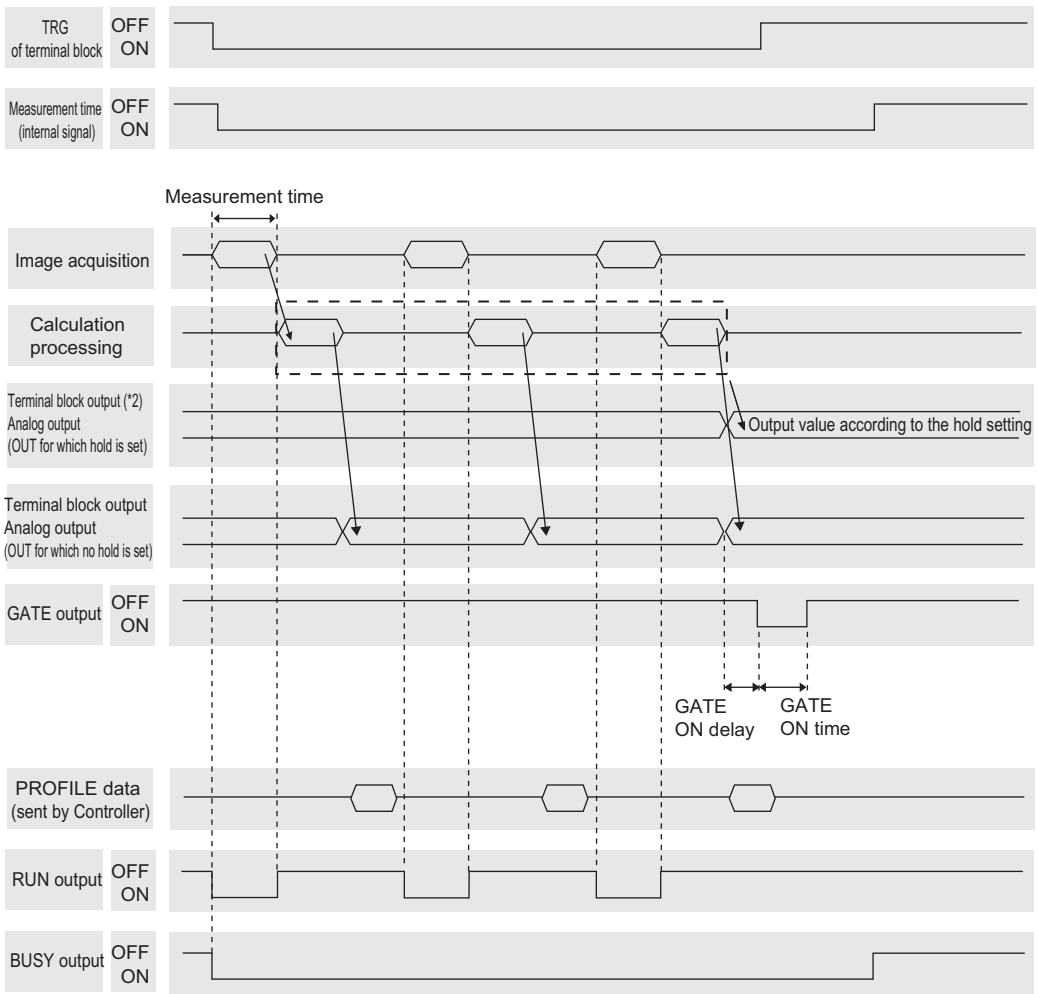


Timing Chart 6

Measurement mode	Hold&Logging
Trigger measurement (External)	Hold (External)

Images for the set measurement time are obtained from the TRG signal input of the terminal block and hold measurement is performed.

Assuming the measurement duration is specified to three times the measurement time (*1)



*1 Specify the measurement duration to 200 ms when the measurement time is 100 ms in order to set it to three times the measurement time.

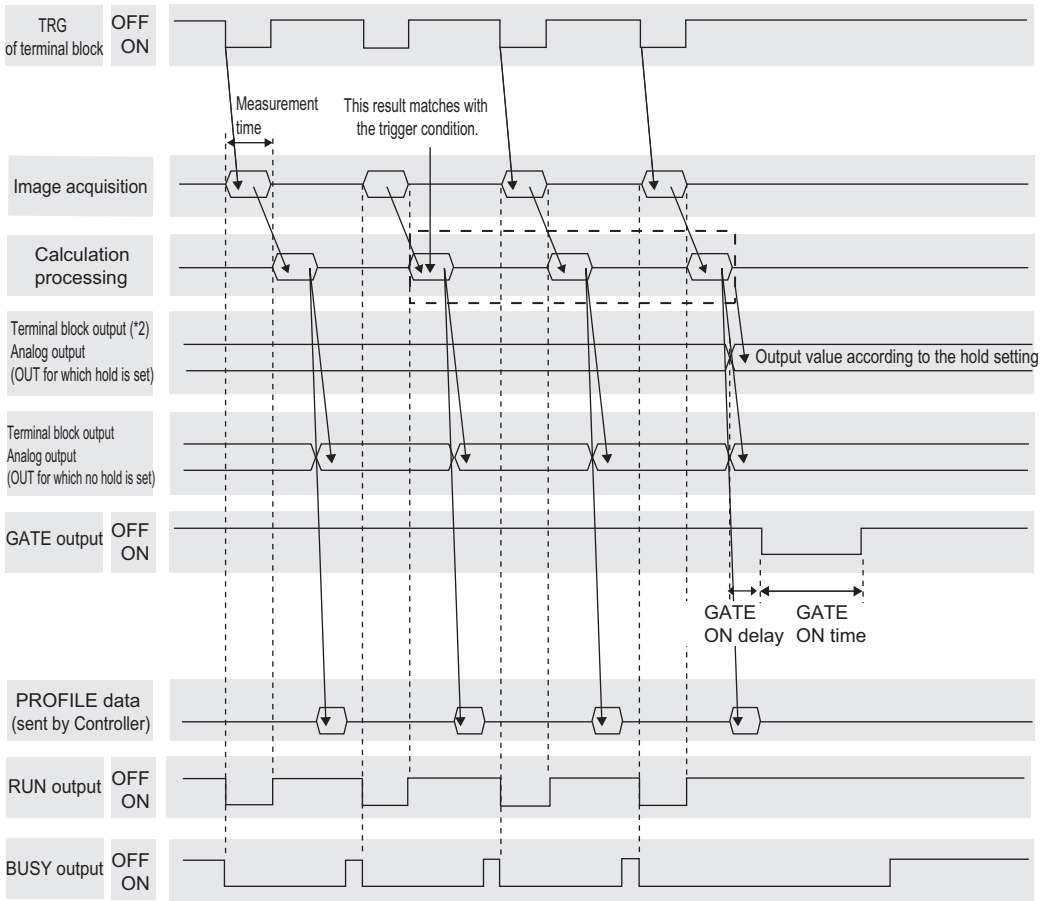
*2 ALL-PASS and ERROR outputs are always output at the timing when "hold" is set.

Timing Chart 7

Measurement mode	Hold&Logging
Trigger measurement (External)	Hold (Self)

Measurement is performed according to the TRG signal of the terminal block, and hold measurement is started when the measurement result matches with the trigger conditions.

Assuming the measurement duration is specified to three times the measurement time (*1)



*1 Specify the measurement duration to 200 ms when the measurement time is 100 ms in order to set it to three times the measurement time.

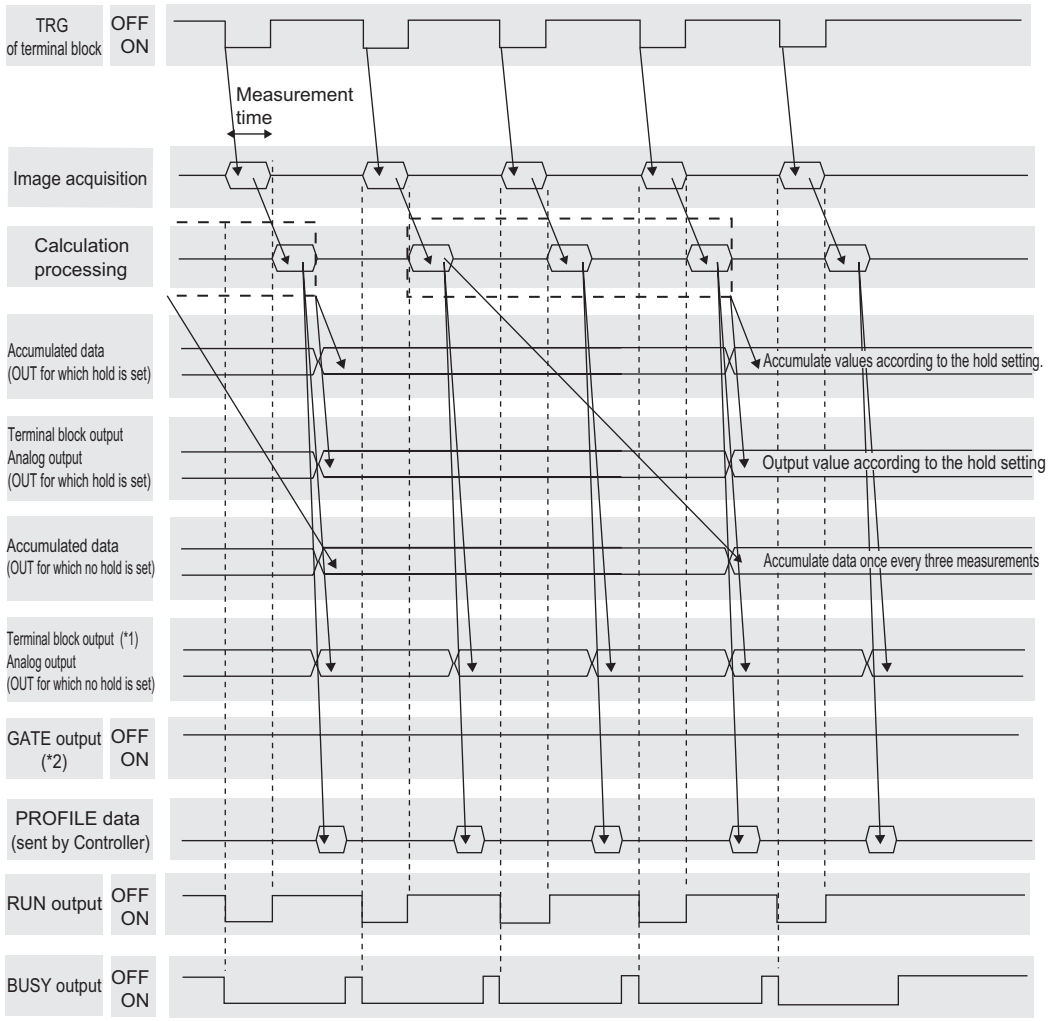
*2 ALL-PASS and ERROR outputs are always output at the timing when "hold" is set.

Timing Chart 8

Measurement mode	Hold&Logging
Trigger measurement (External)	Logging

Measurement is performed according to the TRG signal of the terminal block, and measurement values are accumulated and output according to the specified logging conditions. When the hold conditions are specified, the corresponding values are held, accumulated, and then output.

Assuming the sampling interval is set to three samples



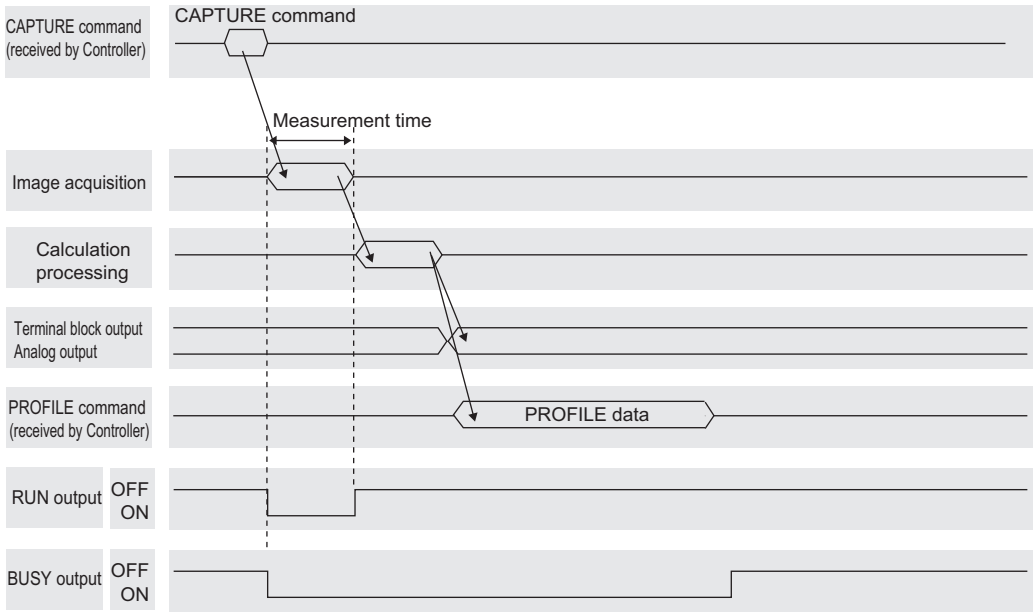
*1 ALL-PASS and ERROR outputs are always output at the timing when "no hold" is set.

*2 The GATE output does not function at logging.

Timing Chart 9

Measurement mode	Hold&Logging
Trigger measurement (RS-232C)	Free

Measurement is performed once when the CAPTURE command of RS-232C is entered, and then the results are output.

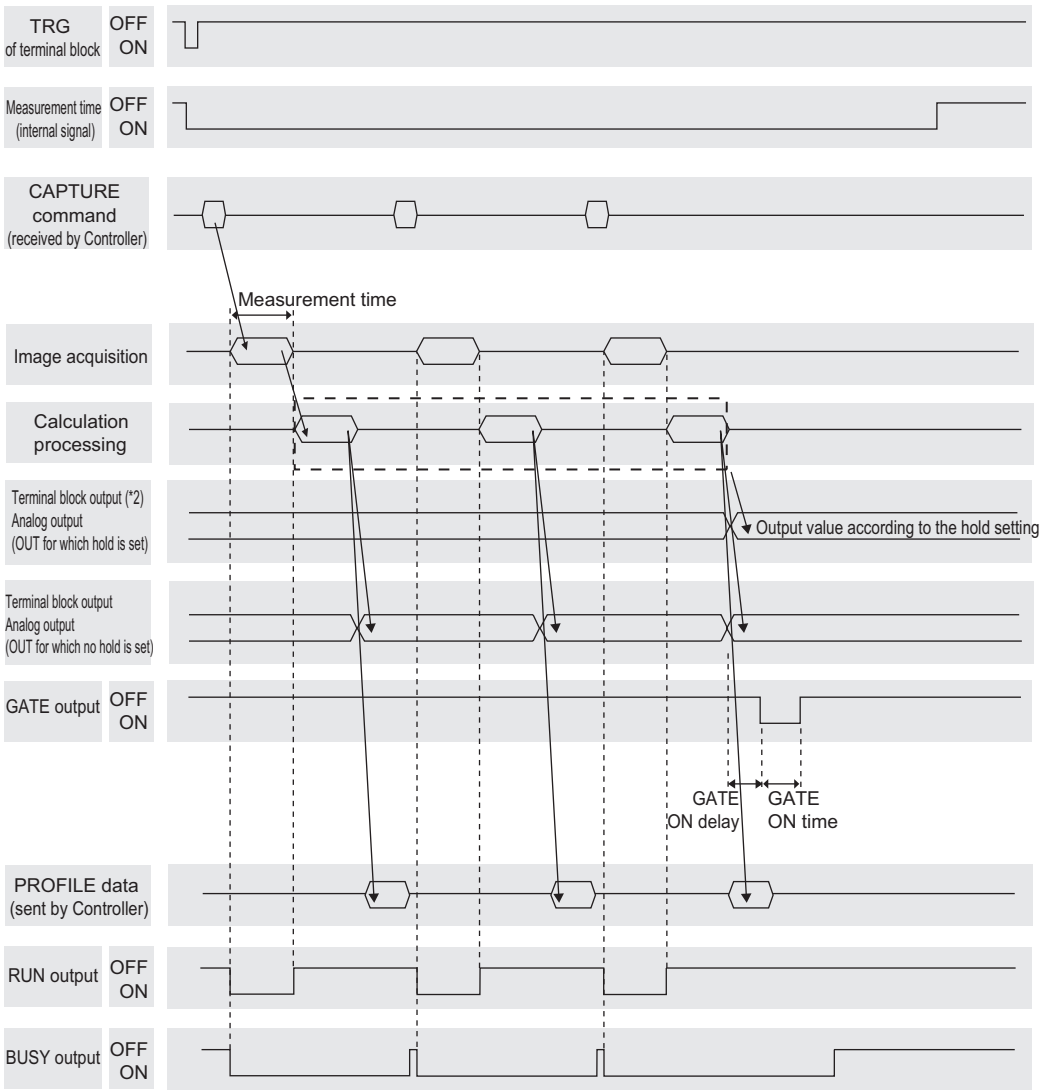


Timing Chart 10

Measurement mode	Hold&Logging
Trigger measurement (RS-232C)	Hold (External)

After the TRG signal of the terminal block is input, hold measurement is performed based on the measurement results obtained by the CAPTURE command of the RS-232C.

Assuming the measurement duration is specified to three times the measurement time (*1)



*1 Specify the measurement duration to 200 ms when the measurement time is 100 ms in order to set it to three times the measurement time.

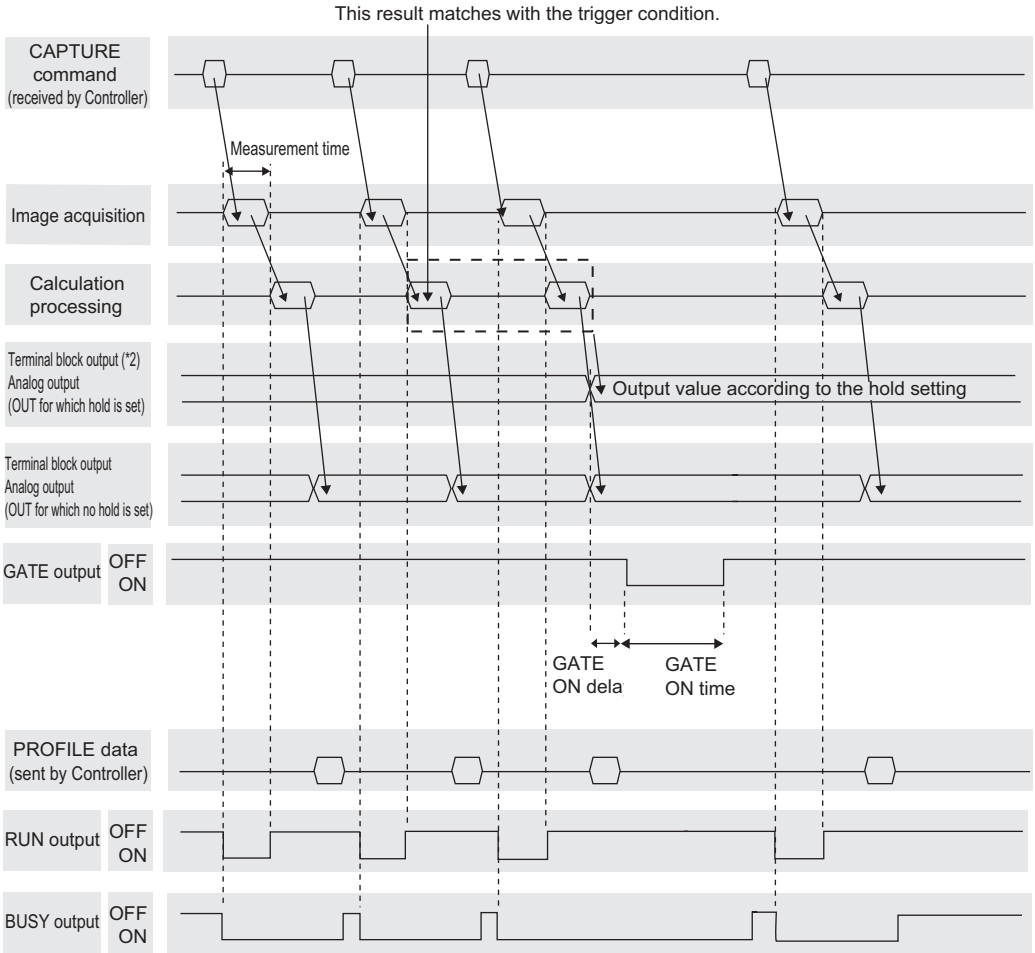
*2 ALL-PASS and ERROR outputs are always output at the timing when "hold" is set.

Timing Chart 11

Measurement mode	Hold&Logging
Trigger measurement (RS-232C)	Hold (Self)

Hold measurement is started when the result obtained by triggering the CAPTURE command of RS-232C matches with the trigger conditions.

Assuming the measurement duration is specified to twice the measurement time (*1)



*1 Specify the measurement duration to 100 ms when the measurement time is 100 ms in order to set it to twice the measurement time.

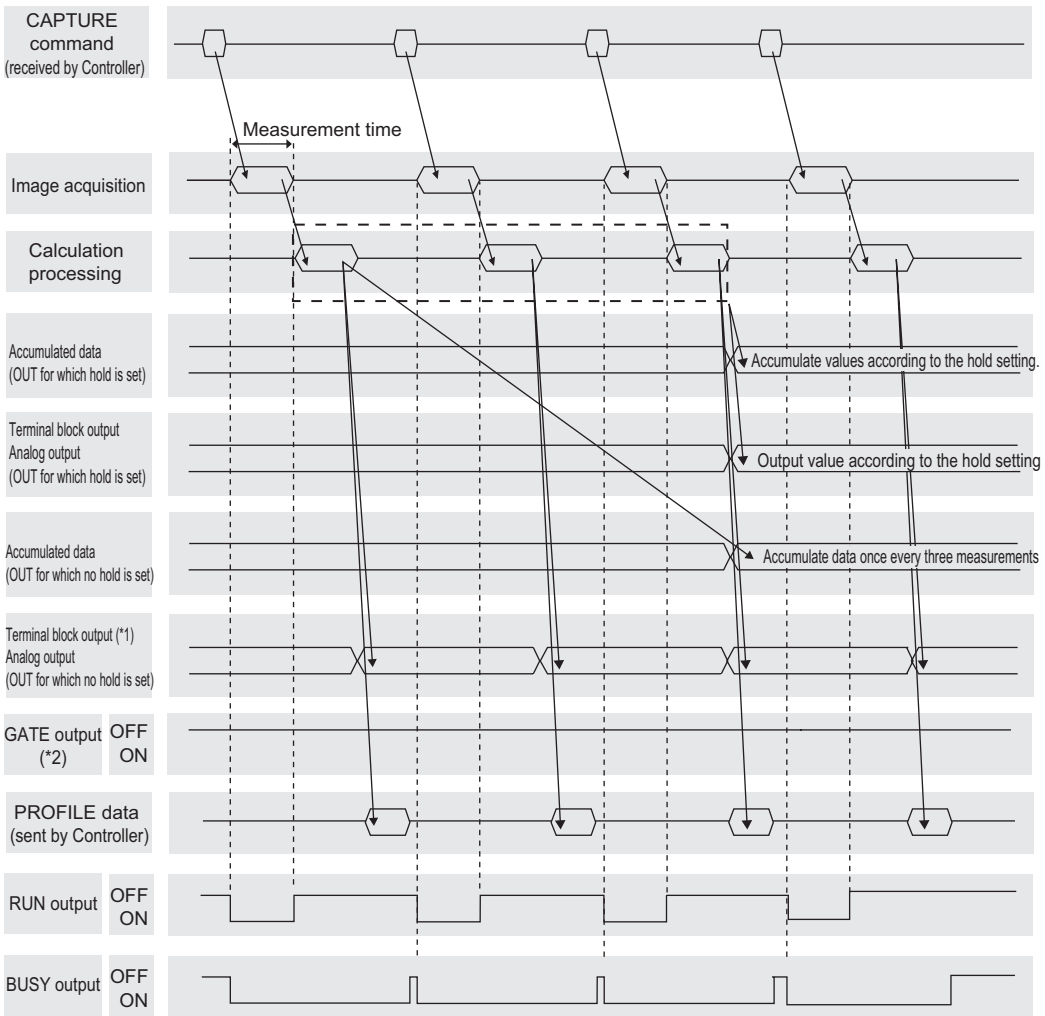
*2 ALL-PASS and ERROR outputs are always output at the timing when "hold" is set.

Timing Chart 12

Measurement mode	Hold&Logging
Trigger measurement (RS-232C)	Logging

Measurement is performed according to the CAPTURE command of the RS-232C, and measurement values are accumulated and output according to the specified logging conditions. When the hold conditions are specified, the corresponding values are held, accumulated, and then output.

Assuming the sampling interval is set to three samples



*1 ALL-PASS and ERROR outputs are always output at the timing of "no hold" is set.

*2 The GATE output does not function at logging.

MEMO

SECTION 7
Troubleshooting and Maintenance

Troubleshooting

This section lists the errors that may occur during Controller operation, along with their probable causes and remedies.
The letters used in the reference page column represent the following reference materials:

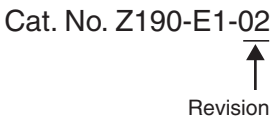
Setup: Setup Manual
Operation: Operation Manual (this manual)

Error message	Causes and remedies	Reference
This controller is not Z550.	The dip switch setting is incorrect. Set it correctly.	Setup:p.20
No edge detected. Redo settings.	• Is the workpiece inside the measurement range? • Is the measurement performed correctly? Check this on the Image Monitor screen. Reason: The edge to be determined as the reference position could not be found during reference registration.	Setup:p.28 Operation: p.26
Environment is set to select scenes via terminal block.	On the [System/Environment] screen, check whether [Scene] has been set correctly.Change the setting to [Console] in order to input the scene switch command from RS-232C.	Operation: p.177
The reference position has been updated. Check the settings for measurement items.	If [Meas set] has already been set, verify that the settings are correct. Reason: Changing the [Reflectance correct/Reference] setting may affect the specification of [Meas set].	Operation: p.70
The reference height and position has been updated. Check the settings for measurement items.	If [Meas set] has already been set, verify that the settings are correct. Reason: Changing the [Height & Pos correct/Reference] setting may affect the specification of [Meas set].	Operation: p.70
Too many items to register. Perform registration after deleting unnecessary items.	Perform settings after deleting unnecessary items. Reason: The number of measurement points exceeds the allowable limit of the Controller.	Operation: p.99
No measurement point detected. Redo settings.	• Is the workpiece inside the measurement range? • Is the measurement performed correctly? Check this on the Image Monitor screen. Reason: The measurement point to be determined as the reference position could not be found during reference registration.	Setup:p.28 Operation: p.26
Measurement method will be changed. All scene data will be cleared.	Data integration cannot be ensured when the sensor installation method is changed. All settings for scene data are returned to their default settings.	-
The detect method has been updated. Check the settings for measurement items and correct data.	If [Reference] for [Height & Pos correct] or [Reflectance correct], or [Meas set] has already been set, verify that the settings are correct. Reason: Changing the detection method ([Height] or [Reflectance]) may affect the specification of [Reference] and/or [Meas set].	Operation: p.56 p.70
No sensor connected.	Turn the power supply off, and then restart the Controller after confirming the following points. • Are the sensor cables connected to the Controller? • Is the sensor cable disconnected from the sensor?	Setup:p.18

Error message	Causes and remedies	Reference
Sensor connection status has changed. Click [Continue] to return all settings to their default values.	To restore the previous connection conditions, turn off the power to the Controller once, and then turn it on again after confirming the following items. • Check that the same model of sensors are connected. • Check that the same number of sensors are connected.	-
	To change the connection conditions, select [Continue].The settings are initialized and the Controller is started.	
Changing sensor installation initializes all scene data. OK?	Data integration cannot be ensured when the sensor installation method is changed. All settings for scene data are returned to their default settings.	-
Downloaded data is invalid. Data will be loaded from sensor.	Although the download function is on, the sensor information has not been downloaded to the controller. Download the sensor information using [System/Download].	Operation: p.181
Measurement is not possible. Reset the reference workpiece.	Check whether or not the workpiece is inside the measurement range. Reason: A measurement error occurred when workpieces were measured for calibration.	Setup:p.28
Adjustment range exceeded. Calibration is not possible.	Perform calibration again so that the span and offset are within the range for which compensation is possible. Reason: The span and offset are beyond the range for which compensation is possible and calibration cannot be performed.	Operation: p.100
Communication error.	Stop operating the Controller and turn the power supply off, then attempt to operate it again after confirming the following items. • Is the cable wired correctly? • Are the communications settings the same as those of the external device? • Is the external device operated correctly? Reason: Data transfer between the Controller and an external device was interrupted because a communication error occurred. If the error cannot be corrected after checking, the Controller may have been damaged. Please consult our branch office or dealer.	Setup:p.38 Operation: p.196
Communication data is wrong.	Select the correct transfer file and re-execute the data transfer. Reason: The wrong file has been selected.	-
The slant correct data has been updated. Check the settings for measurement items and correct data.	If [Reference] for [Height & Pos correct] or [Reflectance correct], or [Meas set] has already been set, verify that the settings are correct. Reason: Changing [Slant correct] (enable/disable) may affect the settings of [Reference] for [Height & Pos correct] or [Reflectance correct], or [Meas set].	Operation: p.60 p.64 p.70
Sensor not supported.	Check whether or not the model of the sensor used is compatible. Reason: An incompatible sensor has been used.	Setup:p.18

Revision History

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



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

Revision code	Revision date	Revised content
01	October, 2003	First edition
02	May, 2005	**Page 198:** Corrected “nm” to “μm” in table.