

Vision Sensor

FZ5 Series

Vision System

Processing Item Function Reference Manual

FZ5-6□□

FZ5-6□□-□□

FZ5-8□□

FZ5-8□□-□□

FZ5-11□□

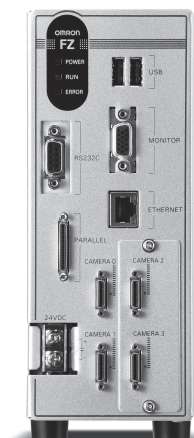
FZ5-11□□-□□

FZ5-12□□

FZ5-12□□-□□

FZ5-L35□

FZ5-L35□-□□



Introduction

Thank you for purchasing the FH/FZ5.

This manual provides information regarding functions, performance and operating methods that are required for using the FH/FZ5.

When using the FH/FZ5, be sure to observe the following:

- The FH/FZ5 must be operated by personnel knowledgeable in electrical engineering.
- To ensure correct use, please read this manual thoroughly to deepen your understanding of the product.
- Please keep this manual in a safe place so that it can be referred to whenever necessary.



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FH/FZ5 Manual Configuration

The following table gives the manual configuration of the FH/FZ5.

Name of Manual	Man.No.	Model	Proposes	Contents
Vision System FH Instruction Sheet	9607479-9	FH-1□□□ FH-1□□□-□□ FH-3□□□ FH-3□□□-□□	To confirm the safety and usage precautions of the Vision System FH series Sensor Controller.	Describes the definitions of basic terms, meaning of signal words, and precautions for correct use of FH series in the manual.
Vision System FH-L Instruction Sheet	9606631-1	FH-L□□□ FH-L□□□-□□	To confirm the safety and usage precautions of the Vision System FH-Lite series Sensor Controller.	Describes the definitions of basic terms, meaning of signal words, and precautions for correct use of FH-L series in the manual.
Vision System FZ5 Instruction Sheet	9524422-4	FZ5-6□□ FZ5-6□□-□□ FZ5-11□□ FZ5-11□□-□□	To confirm the setup procedures, safety and usage precautions of the Vision System FZ5-600, FZ5-1100 series Sensor Controller, including I/O setup and wiring	Describes the definitions of basic terms, meaning of signal words, and precautions for correct use of FZ5-600, FZ5-1100 series in the manual.
Vision System FZ5 Instruction Sheet	9308317-7	FZ5-8□□ FZ5-8□□-□□ FZ5-12□□ FZ5-12□□-□□	To confirm the setup procedures, safety and usage precautions of the Vision System FZ5-800, FZ5-1200 series Sensor Controller, including I/O setup and wiring	Describes the definitions of basic terms, meaning of signal words, and precautions for correct use of FZ5-800, FZ5-1200 series in the manual.
Vision System FZ5-L Instruction Sheet	9910002-2	FZ5-L35□ FZ5-L35□-□□	To confirm the setup procedures, safety and usage precautions of the Vision System FZ5-L Series Sensor Controller, including I/O setup and wiring.	Describes the definitions of basic terms, meaning of signal words, and precautions for correct use of FZ5-L series in the manual.

Name of Manual	Man.No.	Model	Proposes	Contents
Vision System FH/FZ5 Series User's Manual	Z365		When User want to know how to setup the Sensor Controller of the Vision System FH/FZ5 series.	Describes the soft functions, setup, and operations to use Sensor Controller of the Vision System FH/FZ5 series.
Vision System FH/FZ5 series Hardware Setup Manual	Z366	FH-1□□□ FH-1□□□-□□ FH-3□□□ FH-3□□□-□□	When User want to know about the Hard-ware specifications or to setup the Sensor Controller of the Vision System FH/FZ5 series.	Describes FH/FZ5 series specifications, dimensions, part names, I/O information, installation information, and wiring information.
Vision System FH/FZ5 series Macro Customize Functions Programming Manual	Z367	FH-L□□□ FH-L□□□-□□ FZ5-L35□ FZ5-L35□-□□	When User operate or programming using Macro Customise functions.	Describes the functions, settings, and operations for using Macro Customize function of the FH/FH5-series.
Vision System FH/FZ5 series Processing Item Function Reference Manual	Z341	FZ5-6□□ FZ5-6□□-□□ FZ5-11□□ FZ5-11□□-□□	When User confirm the details of each processing items at the create the measurement flow or operate it.	Describes the software functions, settings, and operations for using FH/FH5-series.
Vision System FH/FZ5 Series User's Manual for Communications Settings	Z342	FZ5-12□□ FZ5-12□□-□□	When User confirm the setting of communication functions.	Describes the functions, settings, and communications methods for communicating between FH/FH5 series. The following communication protocol are described. Parallel, PLC Link, EtherNet/IP, EtherCAT, and Non-procedure
Vision System FH Series Operation Manual for Sysmac Studio	Z343	FH-1□□□ FH-1□□□-□□ FH-3□□□ FH-3□□□-□□	When User connect to NJ series via EtherCAT communication.	Describes the operating procedures for setting up and operating FH series Vision Sensors from the Sysmac Studio FH Tools.

Conventions Used in This Manual

Symbols

The symbols used in this manual have the following meanings.

Important Indicates relevant operational precautions that must be followed.

Note Indicates operation-related suggestions from OMRON.

Use of Quotation Marks and Brackets

In this manual, menus and other items are indicated as follows.

[] Menu Indicates the menu names or processing items shown in the menu bar.

" " Item name Indicates the item names displayed on the screen.

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Safety Precautions

For details on Safety Precautions, refer to *Safety Precautions* in the *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z365).

Precautions for Safe Use

For details on Precautions for Safe Use, refer to *Precautions for Safe Use* in the *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z365).

Precautions for Correct Use

For details on Precautions for Correct Use, refer to *Precautions for Correct Use* in the *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z365).

Regulations and Standards

For details on Regulations and Standards, refer to *Regulations and Standards* in the *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z365).

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Input image

This chapter describes how to load images from cameras.

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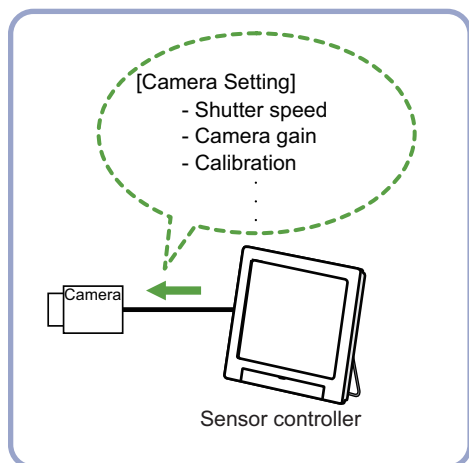
Camera Image Input

This is a processing item specific to the FZ5 Sensor Controller.

Set the conditions for loading images from the camera and for storing images of the measured objects. This processing item must be used when measuring.

In addition, it is possible to shoot images with different shutter speeds, or lighting by adding multiple Camera Image Input to your flow.

Used in the Following Case



Important

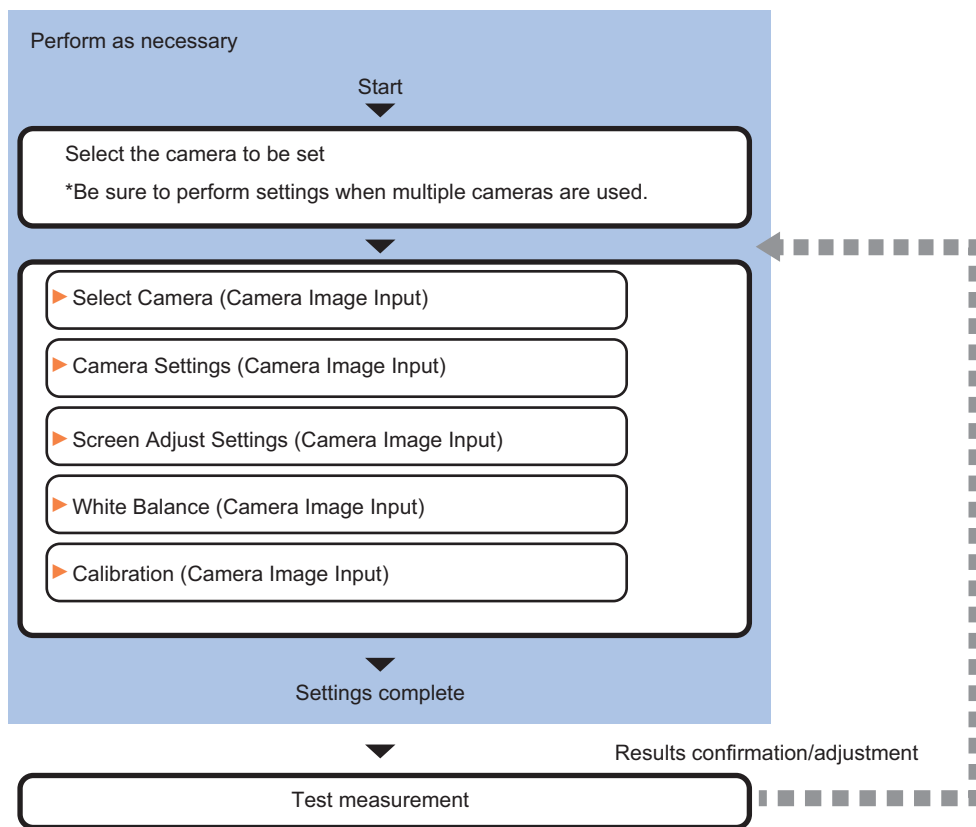
- [Camera Image Input] is preset for Unit 0. Do not set any processing item other than camera image input (camera image input HDR, camera image input HDR Lite) for Unit 0.
 - When switching from a color camera to a monochrome or switching to a camera with a different resolution, reconfigure the settings in the following units.
 - If a camera is connected other than the one for the previous settings, the camera settings are returned to their initial settings.
 - Immediately after starting up the FZ5 Sensor Controller and immediately after changing scenes, there will be no input image. No input image is processed as the same color image as in the factory default state.
 - If you open the Properties Dialog Box before inputting an image, click the Cancel button to close the dialog box. Pressing the OK button in the dialog box will change the setting to the same color camera setting as the factory default setting.
- (Reference: ▶ "FAQ For Measurement The measurement NG (image mismatch) error will result when connecting a monochrome camera" in the "Vision System FH/FZ5 Series User's Manual (Z365)")

Important

- When the Scene data created via FZ series Sensor Controller, i.e.. FZ5 series or FZ5-L series, [Camera Image Input] is automatically converted to [Camera Image Input FH].
- The automatically converted contents is the common items between [Camera Image Input] and [Camera Image Input FH]. The other settings is set to the default settings of the connected camera to the FH-1000, FH-3000, or FH-L series Sensor Controller.
- When you load the created data via FH series Sencor Controller, i.e. FH-L series or FH-1000 series. via FZ series Sensor Controller, the automatically conversion is not performed.

Settings Flow (Camera Image Input)

To set camera image input, follow the steps below.



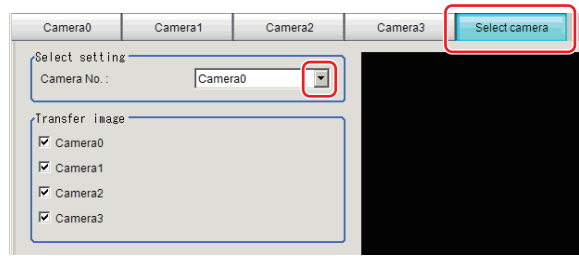
Camera Image Input Item List

Item	Description
Camera 0 to 3	Select the camera to be set.
Select camera	When multiple cameras are connected, select the camera to use for measurement. Reference: ▶ Select Camera (Camera Image Input) (p.26)
Camera setting	Specify the camera settings such as the shutter speed or electronic flash. Reference: ▶ Camera Settings (Camera Image Input) (p.26)
Screen adjust	Adjust the lighting and the lens. Reference: ▶ Screen Adjustment Settings (Camera Image Input) (p.30)
White balance	When using a color camera, adjust the white balance. Reference: ▶ White Balance (Camera Image Input) (p.38)
Calibration	Set when measurements (camera coordinate measurement values) are to be output using actual dimensions. Select the calibration setting method and generate the calibration parameters. Reference: ▶ Calibration (Camera Image Input) (p.40)

Select Camera (Camera Image Input)

When multiple cameras are connected, select the camera to use for measurement.

1 In the Item Tab area, click [Select camera].



2 Click [Camera No.] [▼] and select the camera number.

3 If multiple cameras are connected, the camera to transfer images for can be selected.

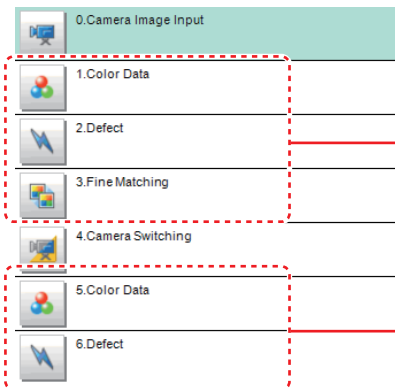
Unchecking the camera check box not being used for current Scene or logging, takt time will be shorten because can reduce the transfer processing time after image input for that camera.

Important

- Transfer of images for Camera 0 is executed at the same time as image input. Therefore, even if you uncheck the checkbox for Camera 0, the image transfer time is not shortened.

Note

- The image from the camera selected in [Select camera] will be the object to be measured in the following units. If you need to switch the camera during the process, insert a [Camera Switching] unit in the scene and switch the image. Reference: ▶ Camera Switching (p.85)



The image selected through the [Select camera] option in the [0 Camera Image Input] is the object to be measured.

The image selected through the [Select camera] option in the [4 Camera Switching] is the object to be measured.

Camera Settings (Camera Image Input)

Set the following photographing conditions for each camera.

- Reference: ▶ Camera Settings (p.27)
- Reference: ▶ Frame/Field - for Monochrome Cameras Only (p.28)
- Reference: ▶ Number of lines to be read (p.29)
- Reference: ▶ Electronic Flash Setting (p.30)

Note

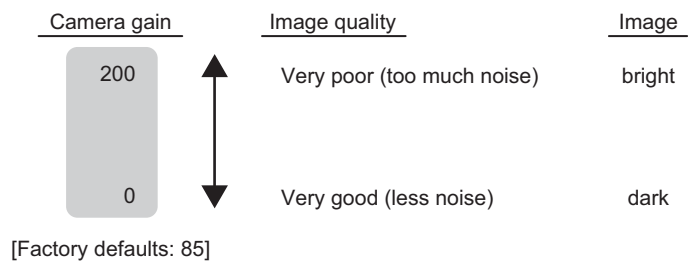
- The displayed items differ depending on the camera type and lighting mode. Perform the following procedure as necessary in accordance with the use environment.

Camera Settings

Adjust the settings related to camera shutter speed and camera gain.

Select the shutter speed appropriate to the speed of the measurement object. Choose a faster shutter speed if the measurement object is moving quickly and the image is blurred.

Adjust the camera gain when images cannot be brightened through the shutter speed, lens aperture, or lighting conditions. Usually, the factory default value can be used.

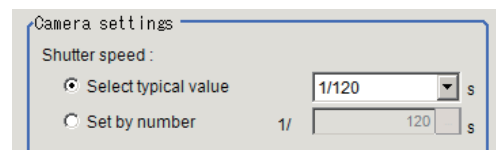


1 In the Item Tab area, click [Camera setting].



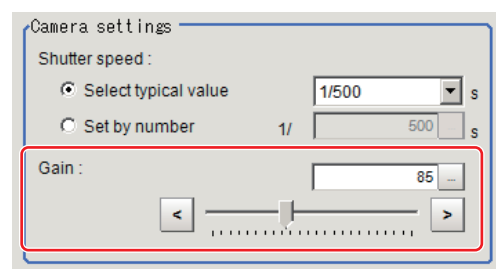
2 In the "Camera settings" area, specify the shutter speed.

The setting methods are to select from the options offered or to set the value directly.



Item	Set value [Factory default]	Description
Shutter speed	FZ-SC/S/SHC/SH • [Typical value] 1/200, [1/500], 1/1000, 1/2000, 1/4000, 1/8000, 1/20000 • Set by number 1/10 to 1/50000	Shutter speed value to set differs by camera type.
	FZ-SC2M/S2M/SC5M□/S5M□/SF□/SP□ • [Typical value] 1/200, [1/500], 1/1000, 1/2000, 1/4000, 1/8000, 1/20000 • Set by number 1/10 to 1/50000	
	FZ-SQ□□□□ • [Typical value] 1/200, 1/500, [1/1000], 1/2000, 1/4000, 1/8000, 1/16000, 1/30000 • Set by number 1/250 to 1/30000	

3 Specify the camera gain while checking the image.



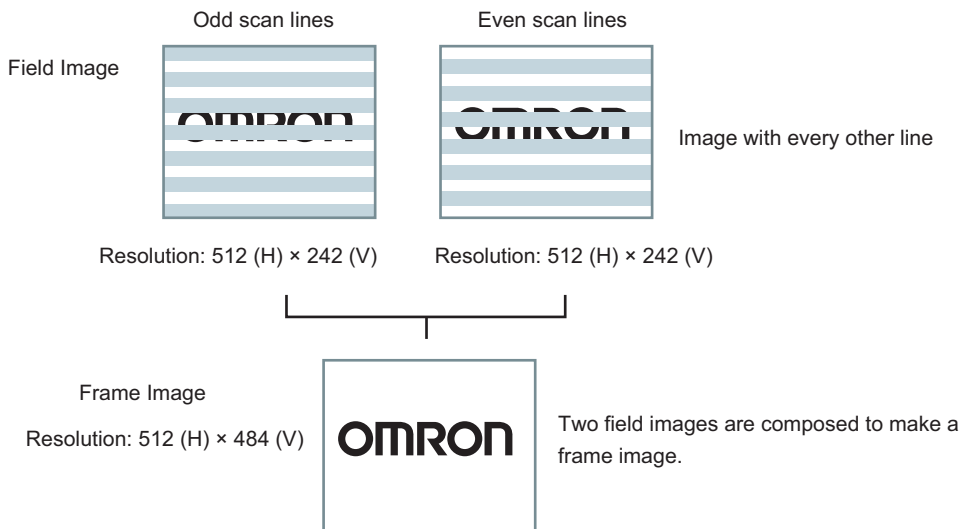
Item	Set value [Factory default]	Description
Gain	<ul style="list-style-type: none"> FZ-SC/S/SHC/SH 0 to 230 [85] FZ-SC2M/S2M/SC5M2/S5M2/SF□/SP□ 0 to 230 [50] FZ-SC5M3 0 to 230 [65] Z-SQ□□□□ 16 to 64 [16] 	Adjust the camera gain when the shutter speed, the lens aperture, and lighting conditions cannot be used to brighten the image. Usually, the factory default value can be used.

Important

- When an Intelligent Compact Digital camera, FZ-SQ□□□□, is connected, we recommend setting the gain value to 16 for stable operations. Measurement values may be different if the recommended value is exceeded. Be sure to thoroughly check the measurement result and set the gain value.

Frame/Field - for Monochrome Cameras Only

There are two methods to transfer one image from a camera to the sensor controller: frame read and field read. Frame read is to read all of the scanned lines of the image. The result is called a frame image. Field read is used to read half of the interlaced scanned lines of the image. The result is called the field image. Here, select the unit to be treated as one image.



1 In the Item Tab area, click [Camera setting].

2 In the "Frame/Field" area, select either "Frame" or "Field".

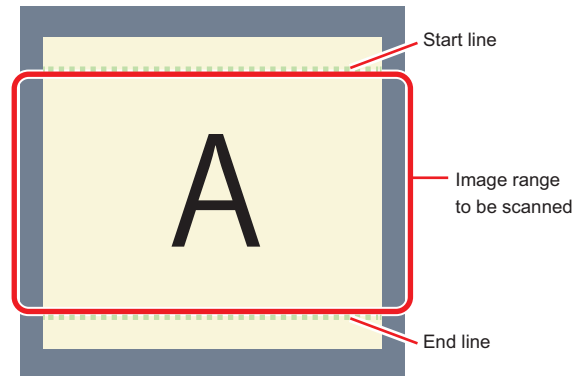
Item	Set value [Factory default]	Description
Frame/Field	[Frame]	Measurements are done in frame units.
	Field	Measurements are done in field units. Select "Field" when you prefer shorter image input time rather than higher accuracy. Processing becomes faster since each image is scanned skipping one scan line per two consecutive lines, but the measurement precision is decreased because the vertical image resolution is lower.

Number of lines to be read

By narrowing the image range to be loaded, the image scan time can be shortened.

Set the range taking the offset of the measurement object into consideration.

The part of the image narrowed down by the start line and the end line will be displayed in the Image Display area of the processing item setting window or the Main screen.



Note

About minimum number of lines

- The minimum number of lines (minimum number of lines between start and end lines) is 12 lines.2043
- For FZ-S□5M2, the end line is fixed from 1921 to 2043.
- With the FZ-S excluding the FZ-SQ series, the minimum number of lines is 12 lines.
- With the FZ-SQ series, the minimum number of lines is 8 lines.
- With the FZ-S□5M3, the minimum number of lines is 4 lines.
- For FZ-S□5M3, the step width of the Start and End lines is 4 lines. When loading a scene created with the FZ-S□5M2, the number of lines loaded will be a maximum of 4 lines.

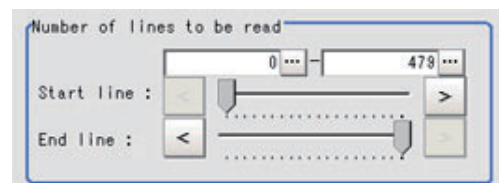
About coordinate values

- The coordinate values displayed as the measurement results are the values of the display position on the monitor.
- The coordinate values do not vary according to the settings for "Number of lines to be read".

1 In the Item Tab area, click [Camera setting].



2 Set the start/end line in the "Number of lines to be read" area.



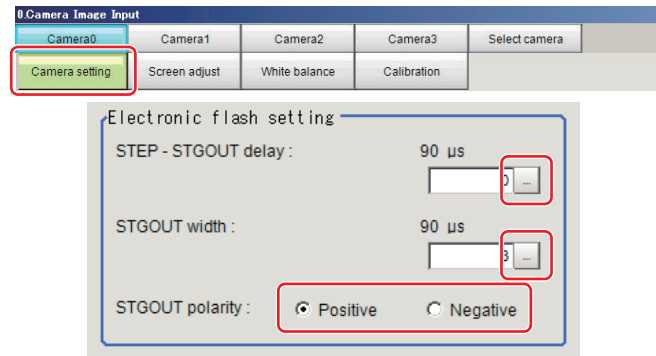
Important

- When the built-in lighting of an FZ-SQ□□□□ is used, it may not be possible to shorten the processing time due to restrictions on the light emission time.

Electronic Flash Setting

This function is set when an electronic flash is used. This sets the output conditions for the signal for synchronizing the measurement and the electronic flash timing.

- 1 In the Item Tab area, click [Camera setting].
- 2 In the "Electronic flash setting" area, specify each item.



Item	Set value [Factory default]	Description
STEP - STGOUT delay	[0] to 511 (1 count 30μs)	Set the waiting time from the time the STEP signal is input until the electronic flash trigger output signal comes ON. Delay Time = Count × 30μs + 90μs The delay time depends on whether the STGOUT pulse polarity is positive or negative. The displayed time is for the positive polarity. Add 35μs to the displayed time if the polarity is negative. The delay time can be set in a range of ±10μs from the setting value.
STGOUT width	1 to 63 [3] (1 count 30μs)	Set the output time for the electronic flash trigger signal.
STGOUT polarity	<ul style="list-style-type: none"> • [Positive] • Negative 	Select the pulse polarity of the electronic flash trigger. Positive polarity: Flashes synchronized with the timing of the electronic flash trigger output signal changing from OFF to ON. Negative: Flashes when the strobe trigger output signal changes from ON to OFF.

Important

- Do not perform next camera image input processing before STGOUT signal output is completed. STGOUT signal may not be output.
Perform camera image input processing after STGOUT signal output completion, or set the STEP-camera delay, STEPSTGOUT delay and STGOUT pulse width so that the electronic flash operates synchronizing with the exposure time.
- When you want the electronic flash to light synchronously with the exposure time, set the delay between STEP and the camera or the delay between STEP and STGOUT, taking into consideration the response time of the external strobe controller.

Screen Adjustment Settings (Camera Image Input)

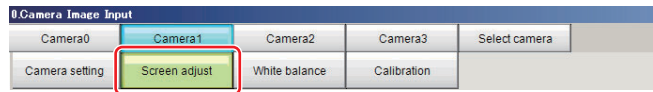
Set the lighting and lens conditions for each camera.

- Reference: ▶ Lighting Control (p.31)
- Reference: ▶ Line Bright (p.37)

Lighting Control

When an Electronic flash controller or Camera-mount Lighting Controller is connected, the light volume of the lighting can be adjusted from the sensor controller. Brightness can be adjusted automatically or one of the preset patterns can be selected.

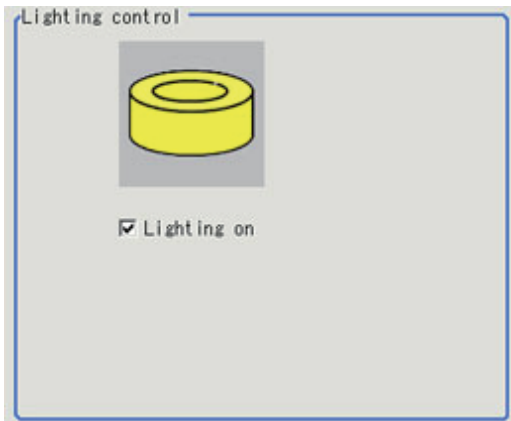
1 In the item tab area, click [Screen adjust].



2 In the "Lighting control" area, specify the brightness.

Displayed contents differ depending on the connected camera, Electronic flash controller or Camara-mount Lighting Controller.

Intelligent Compact Digital Camera FZ-SQ□□□□ is connected:

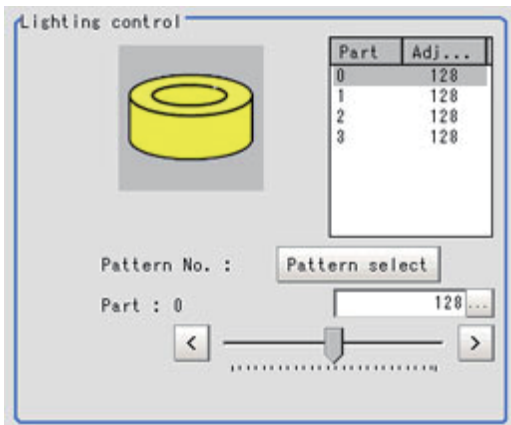


Item	Set value [Factory default]	Description
Lighting on	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Clear the checkbox when no lighting is to be applied.

Important

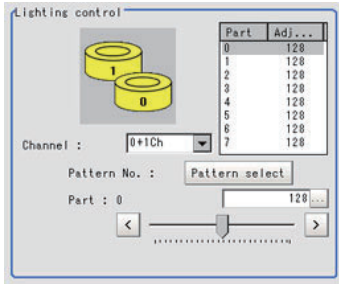
- When the lighting of FZ-SQ□□□□ is used, there are following restrictions.
 - : The measurement can be longer than the measurement with the lighting OFF.
 - : There are restrictions in the operation of Multi-trigger Imaging.
- Reference: ▶ Multi-trigger Imaging (p.89)

Electronic flash controller FZ-LTA100 is connected:

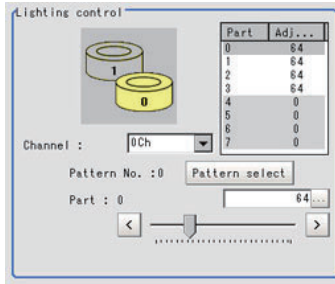


Electronic flash controller FZ-LTA200 is connected:

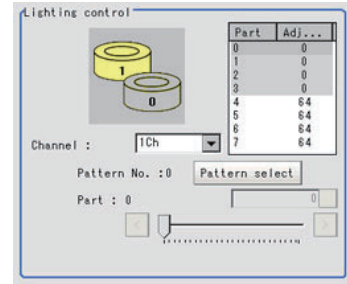
0 +1CH are used:



0CH is used:

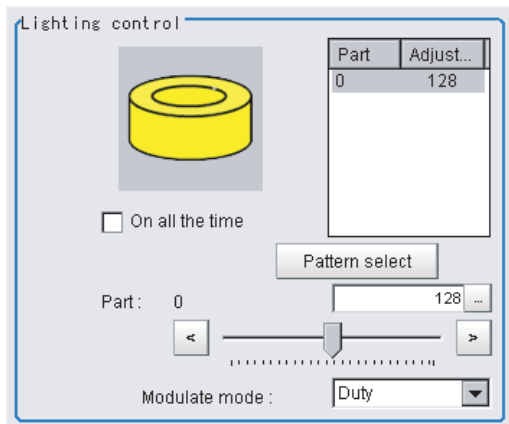


1CH is used:



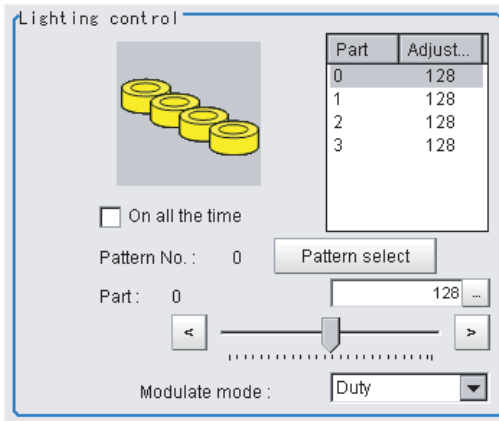
Item	Set value	Description
Pattern select	Pattern 0 to 16	Can be selected from a preset lighting pattern.
Brightness at each part	0 to 255 [0]	When 1 channel is used, the light volume can be adjusted to one of 256 levels. When 2 channels are used, the light volume can be adjusted to one of 128 levels. 0 indicates the lighting is OFF. The larger the number, the higher the brightness.

Camera-mount Lighting Controller FLV-TCC1 is connected:



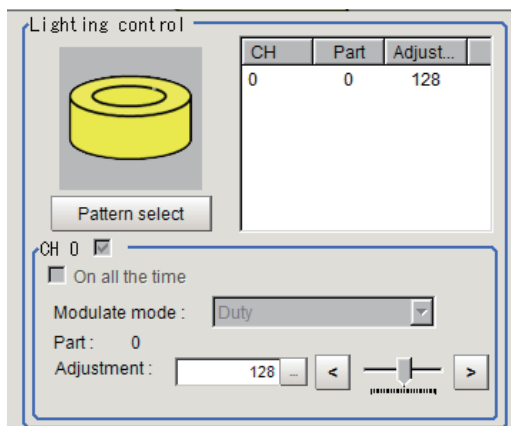
Item	Set value	Description
Pattern select	---	Select from preset lighting patterns.
On all the time	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check here to keep the light turned ON all of the time regardless of the exposure time.
Modulate mode	<ul style="list-style-type: none"> • [Duty] • Voltage / Current 	Select the lighting adjustment method. <ul style="list-style-type: none"> • Duty The brightness of the light is adjusted with 255 levels of the pulse width (PWM frequency: 100 kHz). • Voltage / Current The brightness of the light is adjusted with 255 voltage / current levels. Select voltage lighting adjustment if you will use a high-speed shutter speed.
Part	0 to 255 [128]	Set the brightness for the selected parts.

Camera-mount Lighting Controller FLV-TCC4 is connected:



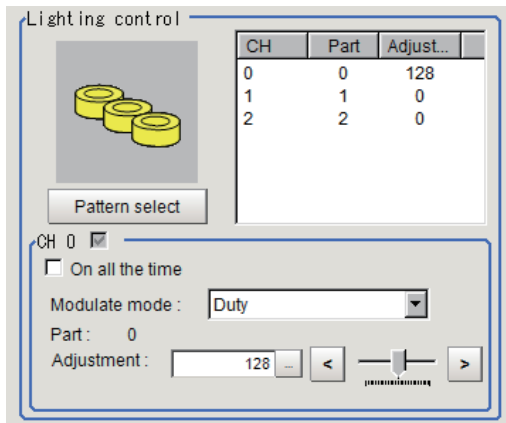
Item	Set value	Description
Pattern select	---	Select from preset lighting patterns.
On all the time	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check here to keep the light turned ON all of the time regardless of the exposure time.
Modulate mode	<ul style="list-style-type: none"> • [Duty] • Voltage / Current 	Select the lighting adjustment method. <ul style="list-style-type: none"> • Duty The brightness of the light is adjusted with 255 levels of the pulse width (PWM frequency: 100 kHz). • Voltage / Current The brightness of the light is adjusted with 255 voltage / current levels. Select voltage lighting adjustment if you will use a high-speed shutter speed.
Part	0 to 255 [128]	Set the brightness for the selected parts.

Camera-mount Lighting Controller FLV-TCC1EP is connected:



Item	Set value	Description
On all the time	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check here to keep the light turned ON all of the time regardless of the exposure time.
Modulate mode	<ul style="list-style-type: none"> • [Duty] • Voltage / Current 	Select the lighting adjustment method. <ul style="list-style-type: none"> • Duty The brightness of the light is adjusted with 255 levels of the pulse width (PWM frequency: 100kHz). • Voltage / Current The brightness of the light is adjusted with 255 voltage / current levels. Select voltage / current adjustment if you will use a high-speed shutter speed.
Part	0 to 255 [128]	Set the brightness for the selected parts.

Camera-mount Lighting Controller FLV-TCC3HB is connected:



Item	Set value	Description
On all the time	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check here to keep the light turned ON all of the time regardless of the exposure time.
Modulate mode	<ul style="list-style-type: none"> • [Duty] • Voltage / Current 	<p>Select the lighting adjustment method.</p> <p>0ch connected:</p> <ul style="list-style-type: none"> • Duty The brightness of the light is adjusted with 255 levels of the pulse width (PWM frequency: 100kHz). • Voltage / Current The brightness of the light is adjusted with 255 voltage / current levels. <p>0ch is the channel for the spot lighting.</p> <p>1ch / 2ch connected:</p> <ul style="list-style-type: none"> • Duty The brightness of the light is adjusted with 255 levels of the pulse width (PWM frequency: 100kHz). • Voltage / Current The brightness of the light is adjusted with 255 voltage / current levels. <p>Select voltage / current adjustment if you will use a high-speed shutter speed.</p>
Part	0 to 255 [128]	Set the brightness for the selected parts.

Important

- There is no restriction on power consumption nor on lighting mode when using lightings with lighting controller FLV-TCC1EP. Restrictions on power consumption and lighting mode differ depending on the product series. See the following table for details.

1. FLV-TCC4/-TCC1

- Without external power supply

Total power consumption	Power consumption per channel	Connectability	Lighting mode ^{*1}			READY OFF time delay ^{*2}
			Always-on lighting mode	Simultaneous lighting mode	Single lighting mode	
Greater than 7.5 W	Greater than 7.5 W	Not connectable	---	---	---	---
	7.5 W or less	Connectable	NA	NA	OK	None
7.5 W or less	Less than 7.5 W	Connectable	OK	OK	OK	None

- With external power supply

Total power consumption	Power consumption per channel	Connectability	Lighting mode ^{*1}			READY OFF time delay ^{*2}
			Always-on lighting mode	Simultaneous lighting mode	Single lighting mode	
Greater than 15 W	Greater than 15 W	Not connectable	---	---	---	---
	15 W or less	Connectable	NA	NA	OK	Yes
	7.5 W or less	Connectable	NA	NA	OK	None
15 W or less	Less than 15 W	Connectable	NA	OK	OK	Yes
	7.5 W or less	Connectable	NA	OK	OK	Yes
7.5 W or less	Less than 7.5 W	Connectable	OK	OK	OK	None

2. FLV-TCC3HB

- Without external power supply
- 0ch (spot lighting) not connected

Total power consumption	Power consumption per channel	Connectability	Lighting mode ^{*1}			READY OFF time delay ^{*2}
			Always-on lighting mode	Simultaneous lighting mode	Single lighting mode	
Greater than 7.5 W	Greater than 7.5 W	Not connectable	---	---	---	---
	7.5 W or less	Connectable	NA	NA	OK	None
7.5 W or less	Less than 7.5 W	Connectable	OK	OK	OK	None

0ch (spot lighting) connected

Total power consumption	Power consumption per channel	Connectability	Lighting mode ^{*1}			READY OFF time delay ^{*2}
			Always-on lighting mode	Simultaneous lighting mode	Single lighting mode	
Greater than 5.5 W	Greater than 7.5 W	Not connectable	---	---	---	---
	7.5 W or less	Connectable	NA	NA	OK	None
5.5 W or less	Less than 5.5 W	Connectable	OK	OK	OK	None

- With external power supply
0ch (spot lighting) not connected

Total power consumption	Power consumption per channel	Connectability	Lighting mode *1			READY OFF time delay *2
			Always-on lighting mode	Simultaneous lighting mode	Single lighting mode	
Greater than 15 W	Greater than 15 W	Not connectable	---	---	---	---
	15 W or less	Connectable	NA	NA	OK	Yes
	7.5 W or less	Connectable	NA	NA	OK	None
15 W or less	Less than 15 W	Connectable	NA	OK	OK	Yes
	7.5 W or less	Connectable	NA	OK	OK	Yes
7.5 W or less	Less than 7.5 W	Connectable	OK	OK	OK	None

0ch (spot lighting) connected

Total power consumption	Power consumption per channel	Connectability	Lighting mode *1			READY OFF time delay *2
			Always-on lighting mode	Simultaneous lighting mode	Single lighting mode	
Greater than 14 W	Greater than 15 W	Not connectable	---	---	---	---
	15 W or less	Connectable	NA	NA	OK	Yes
	7.5 W or less	Connectable	NA	NA	OK	None
14 W or less	Less than 14 W	Connectable	NA	OK	OK	Yes
	7.5 W or less	Connectable	NA	OK	OK	Yes
5.5 W or less	Less than 5.5 W	Connectable	OK	OK	OK	None

*1: Lighting modes

Always-on lighting mode	In this mode, the lights are always turned ON for a specific pulse cycle. The always-on lighting mode is used if you place a check in "On all the time" in the "Lighting control" area.
Simultaneous lighting mode	In this mode, all of the connected lights are turned ON in synchronization with the trigger. Set the "Adjustment" set values in the "Lighting control" area for each light to any value other than 0 for all of the parts.
Single lighting mode	In this mode, only one of the connected lights is turned ON in synchronization with the trigger. Set the "Adjustment" set value in the "Lighting control" area to any value other than 0 for the part for only one channel. The lights will not turn ON if you set two or more channels to an adjustment other than 0.

*2: Turning OFF the READY signal is delayed in comparison with not connecting a camera with lighting controller by approximately the exposure time.

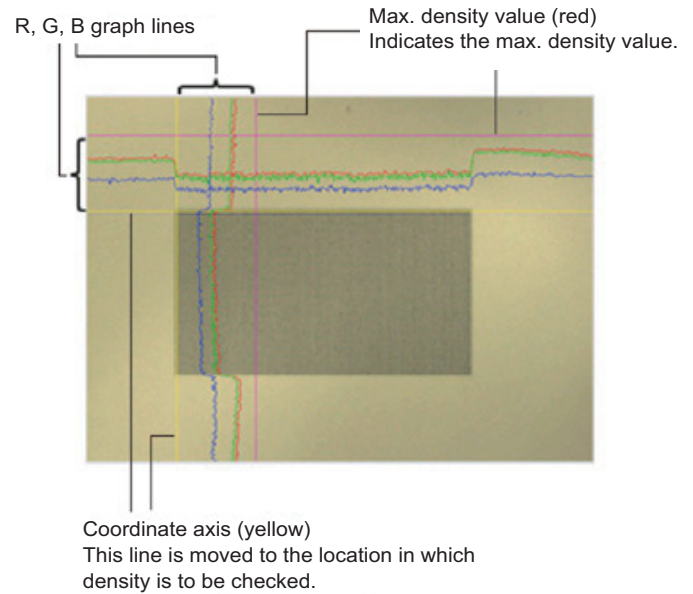
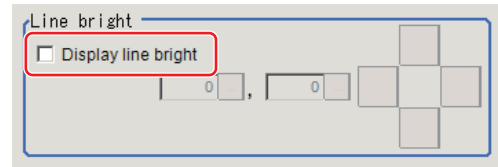
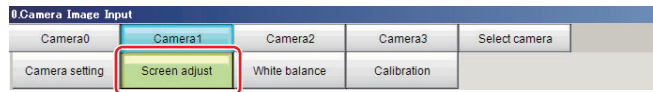
Example: Connection example for connecting an external power supply and the lighting modes

- If four lights with a power consumption of 1 W each are connected to a camera with lighting controller, always-on lighting, simultaneous lighting, and single lighting are all possible.
- If four lights with power consumptions of 2 W, 3 W, 4 W, and 5 W are connected to a camera with lighting controller, simultaneous lighting and single lighting are possible.
- If four lights with power consumptions of 12 W, 1 W, 2 W, and 1 W are connected to a camera with lighting controller, only single lighting is possible.

Line Bright

The graph showing the gray distribution for 1 line in the image is called the "Line bright". You can display the line brights for R, G and B for any horizontal or vertical line.

- 1** In the item tab area, click [Screen adjust].
- 2** Select the [Display line bright] check box.
- 3** Move the line to the position whose density distribution you want to see.



White Balance (Camera Image Input)

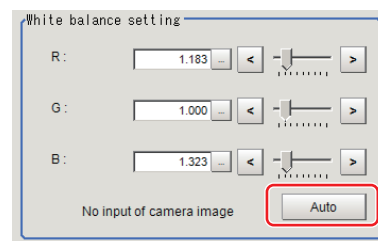
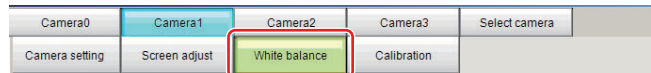
Set the white balance to make white objects look white by calibrating the color of images loaded from cameras. By adjusting the white balance, the appropriate white color can be reproduced under any lighting conditions. Appropriate values can also be set automatically.

Note

- Perform the white balance setting only when a color camera is used.
- In the following cases, make sure to perform white balance.
 - When a new system is installed
 - When the camera or lighting is changed

Since measurement results may vary with changes of the white balance setting, be sure to verify the operation after it has changed.

- 1** In the Item Tab area, click [White balance].
- 2** Shoot a white piece of paper or cloth.
- 3** Click [Auto].



Note

- When the "Too bright" or "Too dark" message is displayed, adjust the iris, shutter speed, gain and/or lighting conditions until "Automatic adjustment is possible" is displayed.

4 Adjust the "R", "G" and "B" values as necessary.

Item	Set value [Factory default]	Description
White balance setting • R • G • B	R, G, and B: 0.001 to 7.999 FZ-SQ□□□□: 0.001 to 3.000 • FZ-SC [R=1.183] [G=1.000] [B=1.323] • FZ-SC2M [R=1.394] [G=1.000] [B=1.222] • FZ-SHC [R=1.375] [G=1.000] [B=1.452] • FZ-SFC and FZ-SPC [R=1.145] [G=1.000] [B=1.889] • FZ-SC5M2 [R=1.351] [G=1.000] [B=2.314] • FZ-SC5M3 [R=1.400] [G=1.000] [B=2.150] • FZ-SQ□□□□ [R=1.000] [G=1.040] [B=1.800]	Adjust the white balance. Whiteness increases when the value of "R", "G", and "B" is increased.

Calibration (Camera Image Input)

By setting the calibration, the measurement result can be converted and output as actual dimensions. The calibration method is selected here.

There are three calibration methods, point, sampling, and parameter.

- Reference: ▶ **Specifying Points and Setting (Point Specification) (p.40)**
- Reference: ▶ **Setting Calibration through Sampling Measurement (Sampling) (p.41)**
- Reference: ▶ **Inputting and Setting Values (Value Setting) (p.43)**
- Reference: ▶ **View Calibration Parameters (p.44)**

Note

- In order to output measurement results in actual dimensions, set [Calibration] to "ON" in [Output parameter] for each processing unit. If [Calibration] is "OFF" (factory default), measurement results are output as camera image coordinate values.

Specifying Points and Setting (Point Specification)

This is a method for performing calibration by specifying arbitrary points (in pixels).

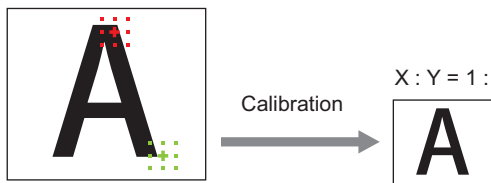
Calibration parameters are calculated automatically when actual coordinates of specified locations are entered.

Up to 3 points can be specified.

- **When magnification is the same in the X and Y directions**

Specify only 2 points.

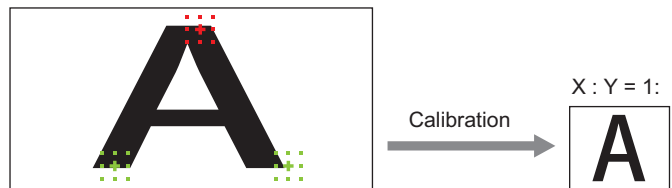
X : Y = 1 : 1



- **When magnification is not the same in the X and Y directions**

Specify 3 points.

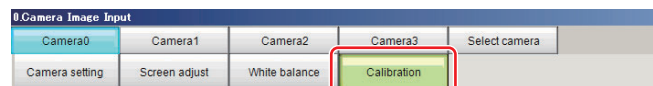
X : Y = 5 : 3



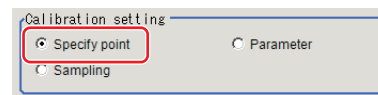
Note

- When 2 points are specified, the coordinate system is set to the left-hand system (forward in the clockwise direction). Specify 3 points to perform calibration including the coordinate system.

1 In the Item Tab area, click [Calibration].



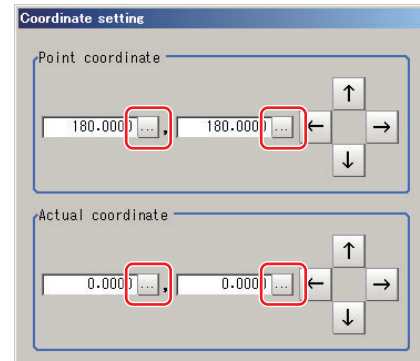
2 In the "Calibration setting" area, select "Specify point".



3 Click the first point on the screen.

4 Input the actual coordinates for the specified point.

The actual coordinate input window is displayed.

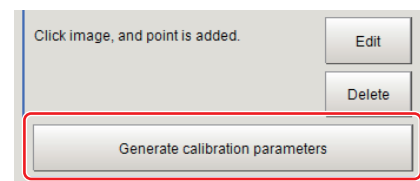


Actual coordinate	Set value [Factory default]
Point coordinate X, Y	0 to 9999.9999 [Point you clicked in the window]
Actual coordinate X, Y	-99999.9999 to 99999.9999 [0]

5 Set the 2nd and 3rd points in the same way.

6 Click [Generate calibration parameters].

The calibration parameters will be generated.

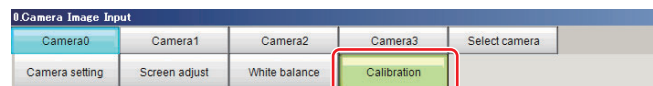


Setting Calibration through Sampling Measurement (Sampling)

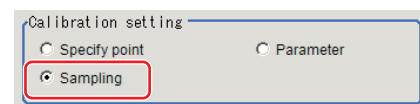
This is a method for setting calibration based on measurement results.

Calibration parameters are calculated automatically when a registered model is searched and the actual coordinates for that position entered.

1 In the Item Tab area, click [Calibration].



2 In the "Calibration setting" area, select "Sampling".

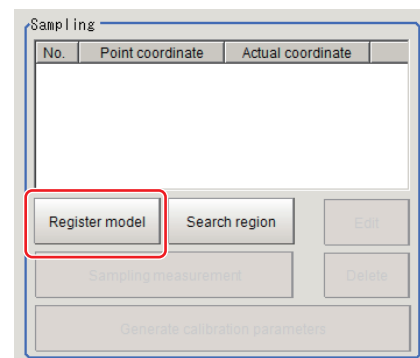


3 In the "Sampling" area, click [Register model].

4 Use the Drawing tools to register the model.

5 Adjust the search region as necessary.

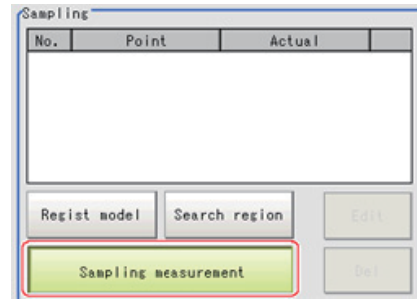
The default value setting is for the entire screen.



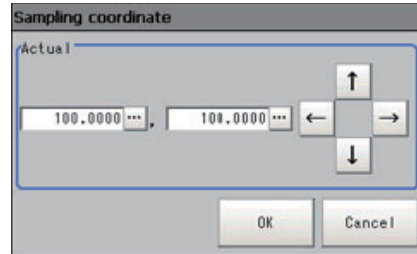
6 Click [Sampling measurement].

Measurement is performed.

The search result (cross-shaped cursor) is displayed in the Image Display area, and the Sampling Coordinate window is displayed.

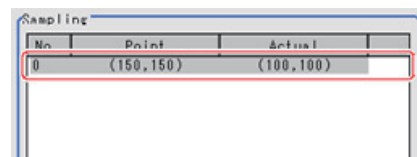


7 In the Sampling Coordinate window, enter the X and Y values.



8 Click [OK].

Point coordinates and actual coordinates are registered in the "Sampling" area.



9 Move the object to be measured and repeat the Steps Reference: ▶ 3 (p.41) to Reference: ▶ 8 (p.42).

10 Click [Generate calibration parameters].

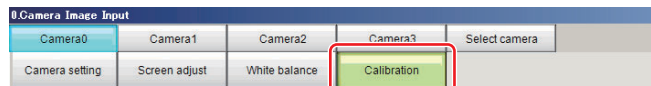
The calibration parameters will be generated.



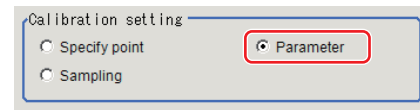
Inputting and Setting Values (Value Setting)

Enter calibration data directly with numerical values.

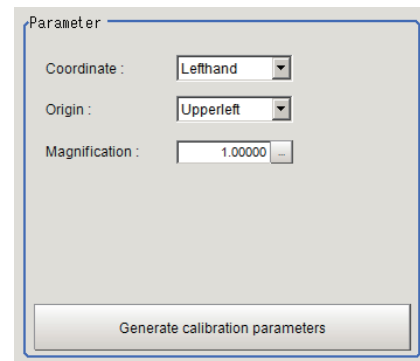
1 In the Item Tab area, click [Calibration].



2 In the "Calibration setting" area, select "Parameter".



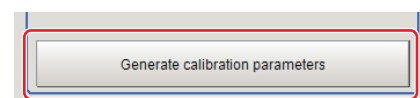
3 In the "Parameter" area, specify values for the "Coordinate", "Origin" and "Magnification".



Item	Set value [Factory default]	Description
Coordinate	<ul style="list-style-type: none"> [Lefthand] Righthand 	<p>Lefthanded</p> <p>Righthanded</p> <p>Left-hand type: Clockwise is forward when specifying the coordinates. Right-hand type: Counter-clockwise is forward when specifying the coordinates.</p>
Origin	<ul style="list-style-type: none"> [Upperleft] Lowerleft Center 	<p>Upper left of screen</p> <p>Select where the origin of the actual coordinates will be.</p>
Magnification	0.00001 to 9.99999	Specify the ratio of 1 pixel to the actual dimensions.

4 Click [Generate calibration parameters].

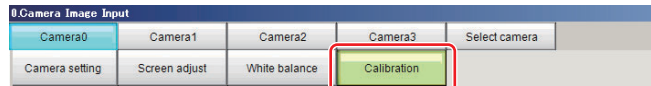
The calibration parameters will be generated.



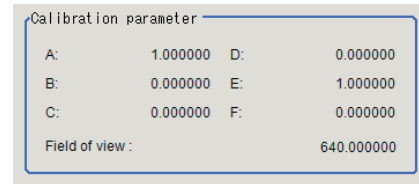
View Calibration Parameters

View the set calibration data.

1 In the Item Tab area, click [Calibration].



2 In the "Calibration parameter" area, confirm the calibration data.

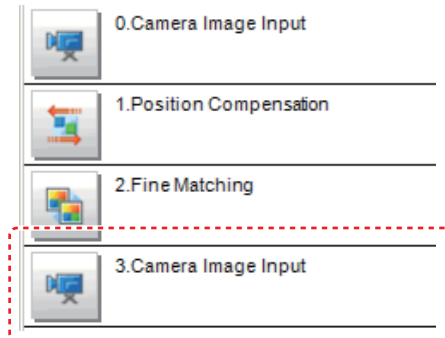


Item	Set value	Description
A	Calculation value	These are calibration conversion values. Camera coordinates are converted to actual coordinates based on these values. The conversion formulas for actual coordinates are as follows: <ul style="list-style-type: none"> • (X, Y): Measurement point (camera coordinates), Unit: pix • (X', Y'): Conversion point (actual coordinates) $X' = A \times X + B \times Y + C$ $Y' = D \times X + E \times Y + F$
B	Calculation value	
C	Calculation value	
D	Calculation value	
E	Calculation value	
F	Calculation value	
Field of view	Calculation value	This is an actual dimension in the X direction.

Additional Explanation (Camera Image Input)

Position Compensation and Camera Image Input

When creating a scene, if a [Camera Image Input] unit is positioned after a [Position Compensation] processing unit, that [Position Compensation] unit will be cancelled, which will cause a new image to be read.



Position compensation of unit 1 is canceled and returns to the position before position compensation.

Camera Image Input FH

This is a processing item specific to the FH Sensor Controller.

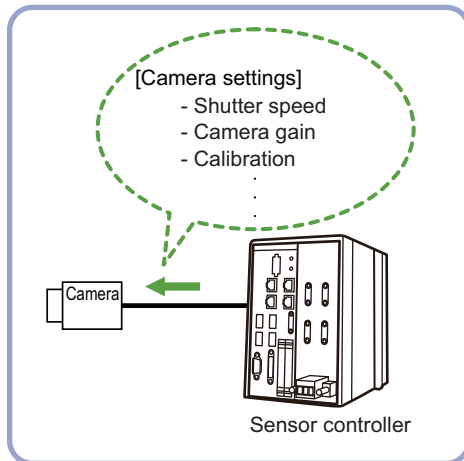
Set the conditions for loading images from the camera and for storing images of the measured objects. This processing item must be used when measuring.

In addition, it is possible to shoot images whose shutter speed, or lighting differ by setting multiple Camera Image Input to your flow.

1

Input Image

Used in the Following Case



Important

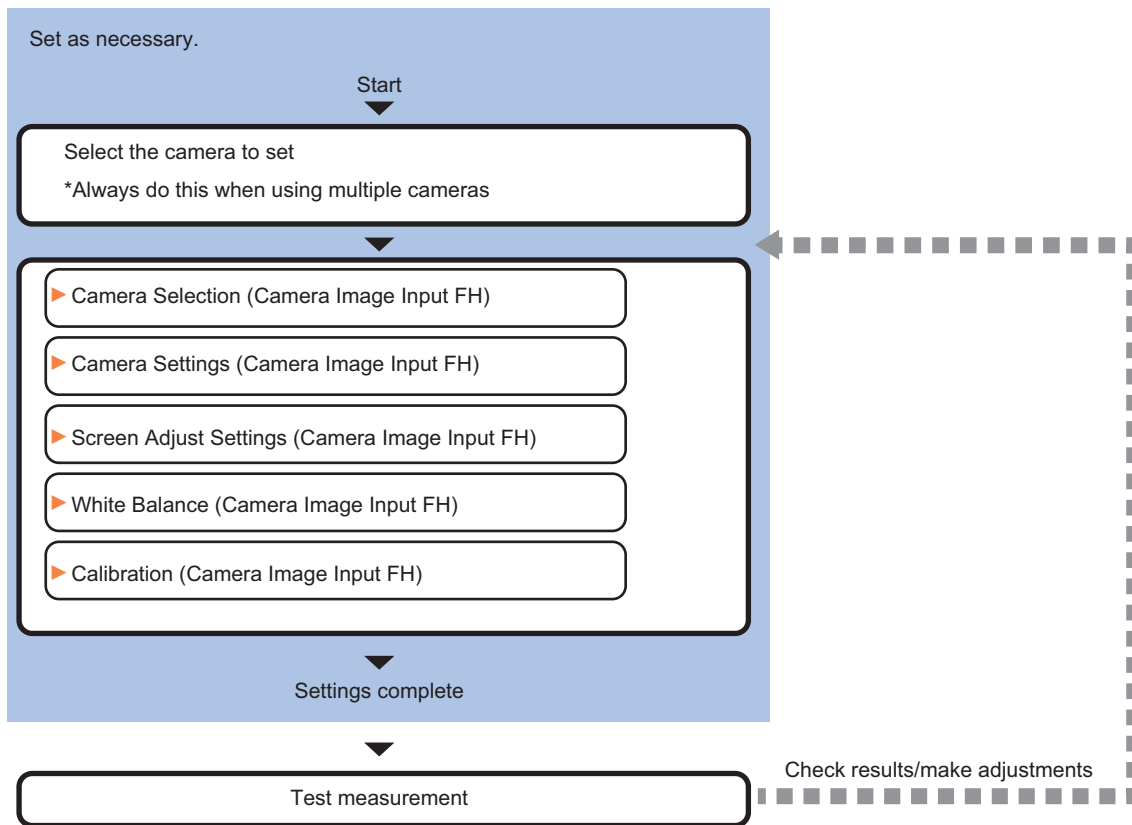
- [Camera Image Input FH] is preset for Unit 0. Do not set any processing item other than camera image input (camera image input FH, camera image input HDR, camera image input HDR Lite) for Unit 0.
 - When switching from a color camera to a monochrome or switching to a camera with a different resolution, reconfigure the settings in the following units.
 - If a camera is connected other than the one for the previous settings, the camera settings are returned to their initial settings.
 - Immediately after starting up the FH Sensor Controller and immediately after changing scenes, there will be no input image. No input image is processed as the same color image as in the factory default state.
 - If you open the Properties Dialog Box before inputting an image, click the Cancel button to close the dialog box. Pressing the OK button in the dialog box will change the setting to the same color camera setting as the factory default setting.
- (Reference: ▶"FAQ For Measurement The measurement NG (image mismatch) error will result when connecting a monochrome camera" in the "Vision System FH/FZ5 Series User's Manual (Z365)")

Important

- When the Scene data created via FZ series Sensor Controller, i.e. FZ5 series or FZ5-L series, [Camera Image Input] is automatically converted to [Camera Image Input FH].
- The automatically converted contents is the common items between [Camera Image Input] and [Camera Image Input FH]. The other settings is set to the default settings of the connected camera to the FH-1000, FH-3000, or FH-L series Sensor Controller.
- When you load the created data via FH series Sencor Controller, i.e. FH-L series or FH-1000 series. via FZ series Sensor Controller, the automatically conversion is not performed.

Settings Flow (Camera Image Input FH)

To set camera image input, follow the steps below.



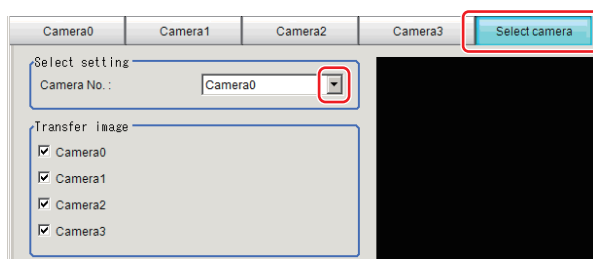
List of Camera Image Input FH Items

Item name	Description
Camera 0 to 7	Select the camera to be set.
Select camera	When multiple cameras are connected, select the camera to use for measurement.
Camera setting	Specify the camera settings such as the shutter speed or electronic flash. Reference: ▶ Camera Settings (Camera Image Input FH) (p.47)
Screen adjust	Set the adjustment of the lighting and the lens. Reference: ▶ Screen Adjustment Settings (Camera Image Input FH) (p.56)
White balance	When using a color camera, set the white balance. Reference: ▶ White Balance (Camera Image Input FH) (p.66)
Calibration	Set when measurements (camera coordinate measurement values) are to be output using actual dimensions. Select the calibration setting method and generate the calibration parameters. Reference: ▶ Calibration (Camera Image Input FH) (p.68)

Camera Selection (Camera Image Input FH)

When multiple cameras are connected, select the camera to use for measurement.

1 In the Item Tab area, click [Select camera].



2 Click [Camera No.] [▼] and select the camera number.

3 If multiple cameras are connected, the camera to transfer images for can be selected.

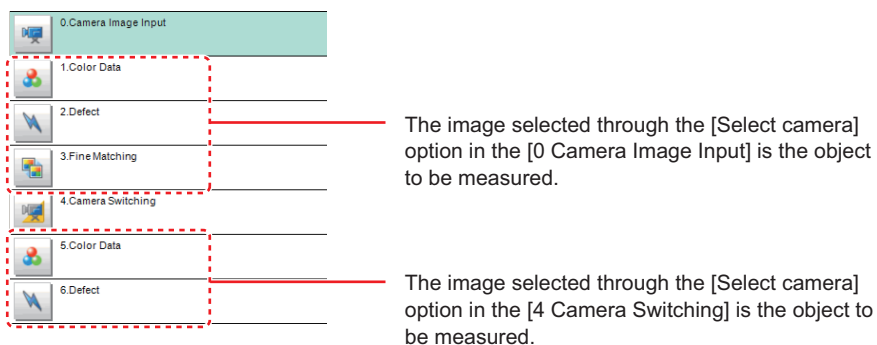
Unchecking the camera check box not being used for current Scene or logging, takt time will be shorten because can reduce the transfer processing time after image input for that camera.

Important

- Transfer of images for Camera 0 is executed at the same time as image input. Therefore, even if you uncheck Camera 0, the image transfer time is not shortened.

Note

- The image from the camera selected in [Select camera] will be the object to be measured in the following units. If you need to switch the camera during the process, insert a [Camera Switching] unit in the scene and switch the image. Reference: ▶ Camera Switching (p.85)



Camera Settings (Camera Image Input FH)

Set the following photographing conditions for each camera.

- Reference: ▶ Camera Settings (p.48)
- Reference: ▶ Binning Settings (for Monochrome Cameras Only) (p.52)
- Reference: ▶ Number of lines to be read (p.52)
- Reference: ▶ Electronic Flash Setting (p.53)

Note

- The displayed items differ depending on the camera type and lighting mode. Specify the setting for the following procedure as necessary in accordance with the use environment.

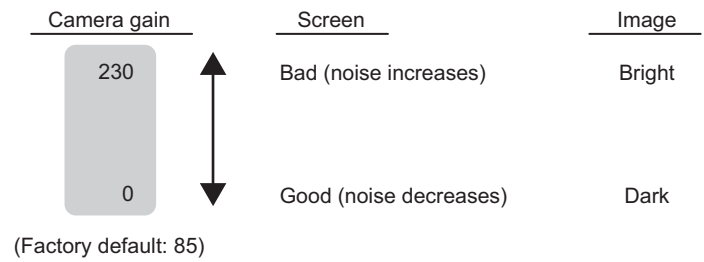
Camera Settings

Adjust the settings related to camera shutter speed and camera gain.

Set the shutter speed appropriate to the speed of the measurement object. Choose a faster shutter speed if the measurement object is moving quickly and the image is blurred.

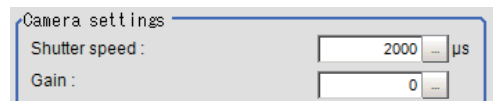
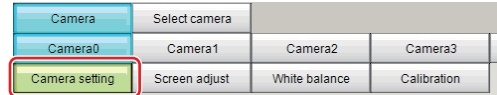
Adjust the camera gain when images cannot be brightened through the shutter speed, lens aperture, or lighting conditions. Usually, the factory default value can be used.

Example Using the FZ-SC



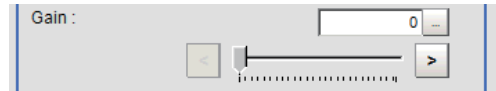
1 In the Item Tab area, click [Camera setting].

2 In the "Camera settings" area, specify the shutter speed.



Item	Setting value [Factory default]	Description
Shutter speed	<ul style="list-style-type: none"> • FZ-SC/S/SHC/SH 20 to 100000 [μs] [2000] • FZ-SC2M/S2M/SC5M□/S5M□/SF□/SP□ 20 to 100000 [μs] [8333] • FZ-SQ□□□□ 35 to 4000 [μs] [1000] • FH-SC02/SM02/SC04/SM04 25 to 100000 [μs] [2000] • FH-SC05R/SM05R 500 to 100000 [μs] by 50 μs unit [8000] • FH-SC12/SM12 60 to 100000 [μs] [12000] 	Shutter speed value to set differs by camera type.

3 Specify the camera gain while checking the image.



Item	Setting value [Factory default]	Description
Gain	<ul style="list-style-type: none"> • FZ-SC/S/SHC/SH 0 to 230 [85] • FZ-SC2M/S2M/SC5M/S5M□/SF□/SP□ 0 to 230 [50] • FZ-SC5M3 0 to 230 [65] • FZ-SQ□□□□ 16 to 64 [16] • FH-SC02/SM02/SC04/SM04/SC12/SM12 0 to 255 [0] • FH-SC05R/SM05R 0 to 63 [0] 	<p>Adjust the camera gain when the shutter speed, the lens aperture, and lighting conditions cannot be used to brighten the image.</p> <p>Usually, the factory default value can be used.</p>

Important

- When an Intelligent Compact Digital camera, FZ-SQ□□□□, is connected, we recommend setting the gain value to 16 for stable operations. Measurement values may be different if the recommended value is exceeded. Be sure to thoroughly check the measurement result and set the gain value.
- Due to the specification of its imaging elements, a CMOS camera generates stripe noises when the gain setting of the camera is raised. You may also find multiple defective pixels, but they do not represent a defect or failure of the product in any way. If stripe noises and defective pixels affect the measurement results, lower the gain setting of the camera or use a CCD camera.

Reset Mode (FH-SC05R/FH-SM05R only)

Change the mode when you capture a mobile object.

Reset Mode :

Rolling Shutter

Global Reset

Item	Setting value [Factory default]	Description
Reset Mode	[Rolling Shutter] Global Reset	Set the Reset Mode of FH-SC05R/FH-SM05R. <ul style="list-style-type: none"> Rolling Shutter: Use this mode when capture static object. Normally, use this mode. Global Reset: Use this mode when capture a mobile object.

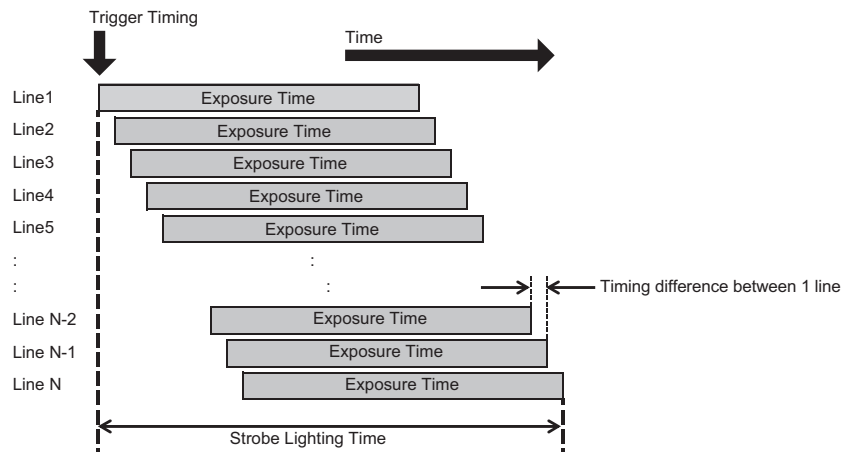
Important

- FH-SC05R/FH-SM05R is a rolling shutter camera.
- The exposure start timing and exposure time between lines varies depending on the reset mode setting.

About exposure time of Rolling Shutter for Reset Mode

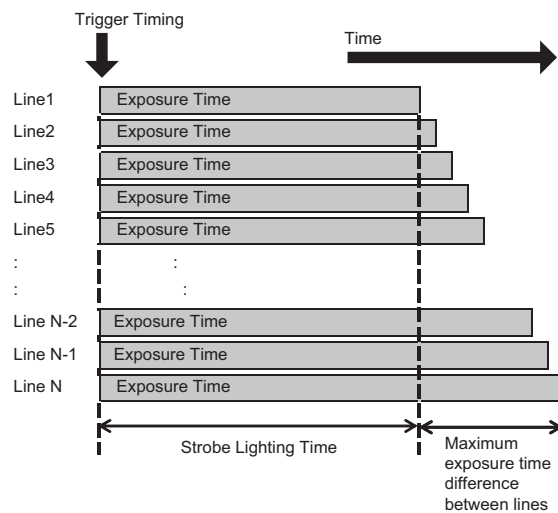
- Although the exposure start timing differs between lines, the exposure time length is the same between the lines.
- Since the exposure start timing is different, please control so that the strobe lighting time is from the start of exposure of Line 1 until completion of exposure of Line N.
- The formula for strobe lighting time is that it should be the difference between exposure time + (number of lines - 1) x 1 line timing.
- The number of lines depends on the Number of lines to be read setting.
- The timing difference between 1 line varies depending on the binning setting.

With Binning 1 line setting: 36.375μs
With Binning 2 line setting: 43.583μs



About exposure time of Global Reset for Reset Mode

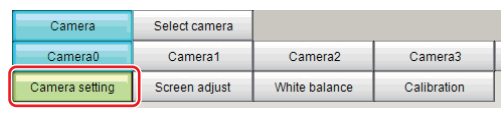
- Exposure for all lines starts at the same time, but the exposure time length differs between lines.
- Since the exposure time is different, please control so that the strobe lighting time is from the start of exposure of Line 1 until completion of exposure of Line 1.



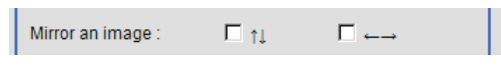
Reverse Conversion (for FH-SC□□/ FH-SM□□ Only)

Set this option when reversing the camera image vertically or horizontally. The order in which imaging elements are read is changed, so there won't be any delay in image transfer.

1 In the Item Tab area, click [Camera setting].



2 In the "Camera settings" area, specify the reverse conversion settings.

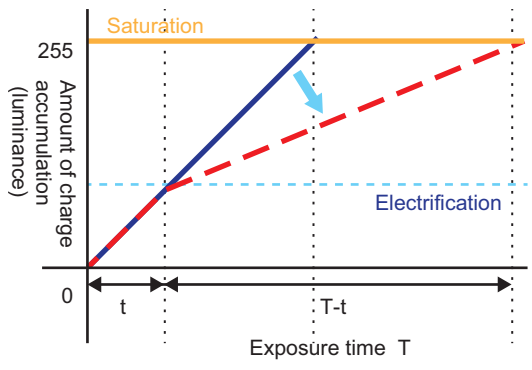


Setting item	Setting value [Factory default]	Description
Mirror an image	↑↓	<ul style="list-style-type: none"> • Checked • [Unchecked] Place a check here when reversing the camera image vertically.
	←→	<ul style="list-style-type: none"> • Checked • [Unchecked] Place a check here when reversing the camera image horizontally.

Setting Multi-slope Function (for Monochrome Cameras of FH-SM□□ Only)

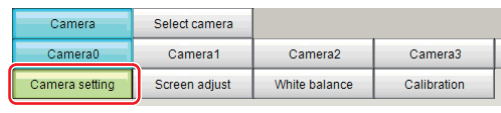
Set this option if you wish to capture a work having a wide dynamic range with a single exposure without causing saturation. Bright pixels that have reached the charge level specified in the CMOS are clipped and the inclination of stored charge is adjusted, to prevent saturation.

When the multi-slope function is set, pixels that saturate on normal images will no longer saturate. The stored charge amount (inclination of brightness) is changed in the CMOS during a single exposure. This function can also be set for mobile objects because, unlike with Camera Image Input HDR or Camera Image Input HDR Lite, there is no need to change the exposure time and capture and combine multiple images.

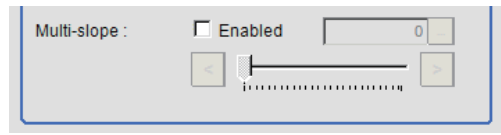


Solid line: normal image
Dotted line: HDR image

1 In the Item Tab area, click [Camera setting].



2 In the "Camera settings" area, specify the Multi-slope settings.



Setting item	Setting value [Factory default]	Description
Multi-slope	Enabled	<ul style="list-style-type: none"> • Checked • [Unchecked] Place a check here to use the multi-slope function.
	Slider	-

Binning Settings (for Monochrome Cameras Only)

Binning is a function for obtaining a single value by adding multiple lines together.

Some cameras give the effect of a higher frame rate by raising the sensitivity of the brightness virtually by adding together and decreasing the amount of data to be transferred.

Important

- The effects that can be obtained with different cameras are as follows.

Camera model	Brightness Sensitivity	Frame rate
Monochrome FZ Camera	Effective	Effective
Monochrome FH Camera (Excluding FH-SM05R)	Effective	No effect
FH-SM05R	No effect	Effective

1 In the Item Tab area, click [Camera setting].

In the "Binning settings" area, select either "1 line" or "2 lines".

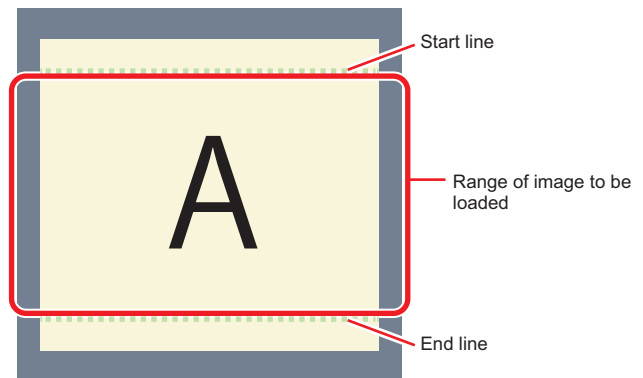
Item	Setting value [Factory default]	Description
Binning setting	[1 line]	Data is transferred line by line.
	2 lines	Data is transferred two lines at a time. Each image is scanned skipping one scan line per two consecutive lines. Measurement precision is decreased because the image resolution in the vertical direction is lower.

Number of lines to be read

By narrowing the image range to be loaded, the image scan time can be shortened.

Set the range taking the offset of the measurement object into consideration.

The part of the image narrowed down by the start line and the end line will be displayed in the Image Display area of the processing item setting window or the Main screen.



Note

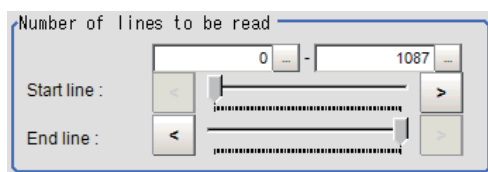
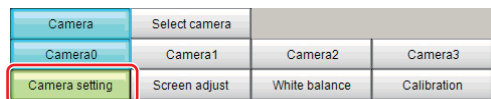
About minimum number of lines

- With the FH-SM□□/ FH-SM□□R, the minimum number of lines (minimum value between the start and end lines) is 4 line.
- With the FH-SC□□/ FH-SC□□R, the minimum number of lines is 4 lines.
- With the FZ-S□□□ excluding the FZ-SQ series and FZ-S□5M3, the minimum number of lines is 12 lines.
- With the FZ-SQ series, the minimum number of lines is 8 lines.
- With the FZ-S□5M3Q series, the minimum number of lines is 4 lines.
- For FZ-S□5M3, the step width of the Start and End lines is 4 lines. When loading a scene created with the FZ-S□5M2, the number of lines loaded will be a maximum of 4 lines.

About coordinate values

- The coordinate values displayed as the measurement results are the values of the display position on the monitor.
- The coordinate values do not vary according to the settings for "Number of lines to be read".

- 1 In the Item Tab area, click [Camera setting].
- 2 Set the start/end line in the "Number of lines to be read" area.



Important

- When the built-in lighting of an FZ-SQ□□□□ is used, it may not be possible to shorten the processing time due to restrictions on the light emission time.

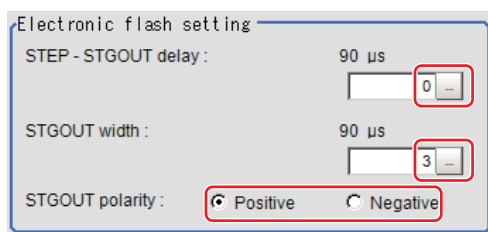
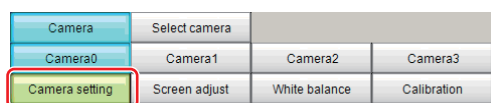
Electronic Flash Setting

This function is set when an electronic flash is used. This sets the output conditions for the signal for synchronizing the measurement and the electronic flash timing. It is possible to assign multiple electronic flashes to a camera and control their flashing.

Important

- The setting here applies when "STGOUT" is selected for the output signal under [Common settings] on the [Output signal settings] page of the camera accessed by selecting [External Tools] - [System].
If "SHTOUT" is selected, the signal is controlled by each value of SHTOUT set for each line.
Reference: ▶ Setting the SHTOUT Signal: [Output Signal Settings] in the Vision System FH/FZ5 Series User's Manual (Z365).

- 1 In the Item Tab area, click [Camera setting].
- 2 In the "Electronic flash setting" area, specify each item.



Item	Setting value [Factory default]	Description
STEP - STGOUT delay	[0] to 511 (1 count 30μs)	Set the waiting time from the time the STEP signal is input until the electronic flash trigger output signal comes ON. Delay Time = Count × 30μs + 90μs The displayed time is for the positive polarity. Add 35μs to the displayed time if the polarity is negative. The delay time can be set in a range of ±10μs from the setting value.
STGOUT width	0 to 43689 [3] (1 count is 30μs)	Set the output time for the electronic flash trigger signal. On the FH series Sensor Controller, if 0 is set, the electronic flash will not flash.
STGOUT polarity	<ul style="list-style-type: none"> • [Positive] • Negative 	Select the pulse polarity of the electronic flash trigger. Positive polarity: Flashes synchronized with the timing of the electronic flash trigger output signal changing from OFF to ON. Negative: Flashes when the strobe trigger output signal changes from ON to OFF.

Important

-
- Do not perform next camera image input processing before STGOUT signal output is completed. STGOUT signal may not be output.
Perform camera image input processing after STGOUT signal output completion, or set the STEP-camera delay, STEPSTGOUT delay and STGOUT pulse width so that the electronic flash operates synchronizing with the exposure time.
-

Assigning Multiple Electronic Flashes to a Camera

It is possible to assign multiple electronic flashes (STGOUT signals) to a camera and select one to use when an image is taken for measurement. This function uses STGOUT signals with which cameras are not connected.

This function can be used only with FH series Sensor Controller.

Follow the setting procedure below.

Important

- The STGOUT signals that can be output are as follows.
 - : FH-1000 and FH-3000 series: SGTOOUT 0 to 7
 - : FH-L series: STGOUT 0 to 3
- STGOUT0 to STGOUT7 is tied to the camera connector number of the sensor controller, not the camera number. When you use CameraLink Medium Configuration or the Multi-line random-trigger mode, confirm the camera connector number that corresponds to the camera number of Sensor Controller.

1 Click [Tool] - [System settings] - [Camera] - [Output signal setting].

Reference: ▶ Setting the SHTOUT Signal: [Output Signal Settings] in the Vision System FH/FZ5 Series User's Manual (Cat. No. Z365).

2 Select [STGOUT] for [Output Signal] in "Common setting" area.

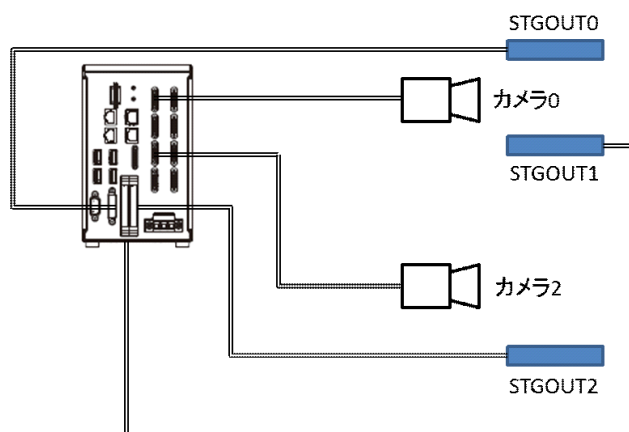
3 Place a check to [Output even if camera is not connected] in "STGOUT setting" area.

With this setting, STGOUT signals (STGOUT0 to STGOUT7) which are not connected with cameras can be used. Configure the STGOUT Width of the STGOUT of corresponding Camera Image Input FH Processing Item.

Reference: ▶ Electronic Flash Setting of the Vision System FH/FZ5 Series Processing Item Function Reference Manual (Cat No. Z341).

Example:

Camera 0 uses STGOUT0 and STGOUT1 and Camera 2 uses STGOUT2.



4 To use STGOUT0 and STGOUT1 for Camera 0, Camera 1 is not connected with a camera.

5 In the [Electronic flash setting] area in the Camera 0 tab of Camera Image Input FH processing item, enter the settings for SGTOOUT 0.

6 In the [Electronic flash setting] area in the Camera 1 tab of Camera Image Input FH processing item, enter the settings for SGTOOUT 1.

7 In the [Electronic flash setting] area in the Camera 2 tab of Camera Image Input FH processing item, enter the settings for SGTOOUT 2.

8 In the [Electronic flash setting] area in the Camera 3 to 7 tab of Camera Image Input FH processing item, set 0 to the STGOUT width.

Note

If an electronic flash is not used or it does not flash, enter 0 to the [STGOUT Width].

Screen Adjustment Settings (Camera Image Input FH)

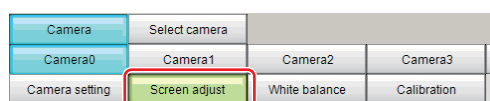
Set the lighting and lens conditions for each camera.

- Reference: ▶ **Lighting Control (p.56)**
- Reference: ▶ **Line Bright (p.65)**

Lighting Control

When an Electronic flash controller or Camera-mount Lighting Controller is connected, the light volume of the lighting can be adjusted from the sensor controller. Brightness can be adjusted automatically or one of the preset patterns can be selected.

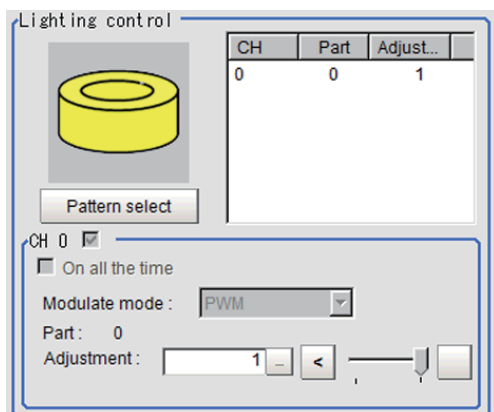
1 In the Item Tab area, click [Screen adjust].



2 In the "Lighting control" area, specify the brightness.

Displayed contents differ depending on the connected camera, Electronic flash controller or Camera-mount Lighting Controller.

Intelligent Compact Digital Camera FZ-SQ□□□□ is connected:

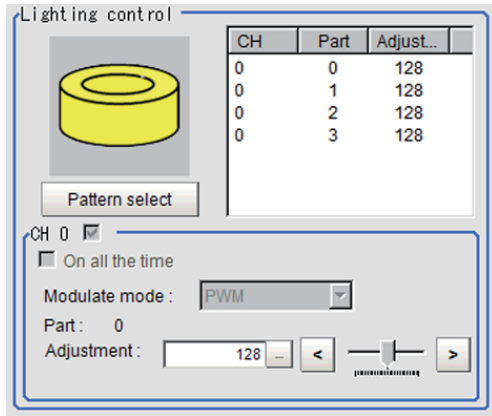


Item	Setting value [Factory default]	Description
Pattern select	Pattern 0 to 1	Select from a preset lighting pattern. Pattern 0: Lit Pattern 1: Unlit
Adjustment	0: Unlit 1: Lit	Adjust the light volume of each part.

Important

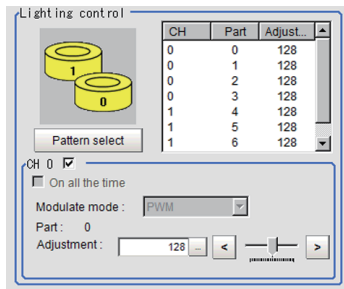
- When the lighting of FZ-SQ□□□□ is used, there are following restrictions.
 - : The measurement can be longer than the measurement with the lighting OFF.
 - : There are restrictions in the operation of Multi-trigger Imaging.
 Reference: ▶ Multi-trigger Imaging (p.89)

Electronic flash controller FZ-LTA100 is connected:

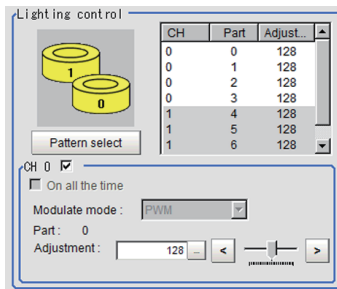


Electronic flash controller FZ-LTA200 is connected:

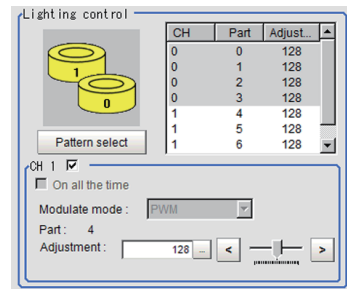
0 + 1CH are used:



0CH is used:

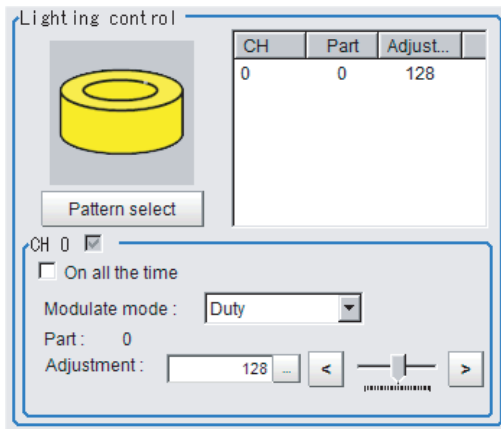


1CH is used:



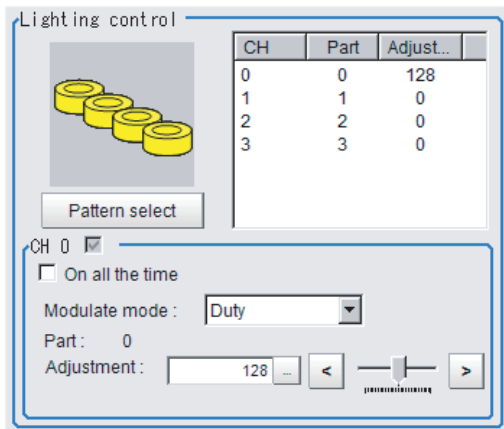
Item	Setting value [Factory default]	Description
Pattern select	Pattern 0 to 16	Select from a preset lighting pattern.
CH	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Place a check here to enable the channel currently selected in the part list.
Adjustment	0 to 255 [128]	When 1 channels are used, the light volume can be adjusted to one of 256 levels. When 2 channels are used, the light volume can be adjusted to one of 128 levels. 0 indicates the lighting is OFF. The larger the number, the higher the brightness.

Camera-mount Lighting Controller FLV-TCC1 is connected:



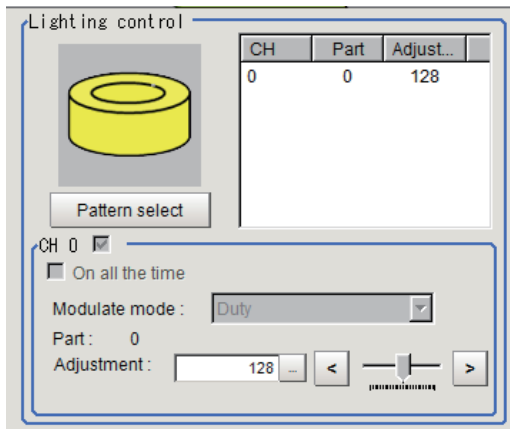
Item	Setting value [Factory default]	Description
Pattern select	---	Select from preset lighting patterns.
On all the time	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check here to keep the light turned ON all of the time regardless of the exposure time.
Modulate mode	<ul style="list-style-type: none"> • [Duty] • Voltage / Current 	Select the lighting adjustment method. <ul style="list-style-type: none"> • Duty The brightness of the light is adjusted with 255 levels of the pulse width (PWM frequency: 100 kHz). • Voltage / Current The brightness of the light is adjusted with 255 voltage / current levels. Select voltage lighting adjustment if you will use a high-speed shutter speed.
Part	0 to 255 [128]	Set the brightness for the selected parts.

Camera-mount Lighting Controller FLV-TCC4 is connected:



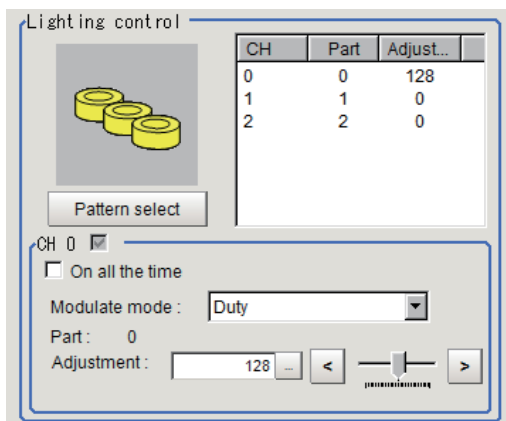
Item	Setting value [Factory default]	Description
Pattern select	---	Select from preset lighting patterns.
On all the time	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check here to keep the light turned ON all of the time regardless of the exposure time.
Modulate mode	<ul style="list-style-type: none"> • [Duty] • Voltage / Current 	Select the lighting adjustment method. <ul style="list-style-type: none"> • Duty The brightness of the light is adjusted with 255 levels of the pulse width (PWM frequency: 100 kHz). • Voltage / Current The brightness of the light is adjusted with 255 voltage / current levels. Select voltage lighting adjustment if you will use a high-speed shutter speed.
Part	0 to 255 [128]	Set the brightness for the selected parts.

Camera-mount Lighting Controller FLV-TCC1EP is connected:



Item	Setting value [Factory default]	Description
On all the time	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check here to keep the light turned ON all of the time regardless of the exposure time.
Modulate mode	<ul style="list-style-type: none"> • [Duty] • Voltage / Current 	Select the lighting adjustment method. <ul style="list-style-type: none"> • Duty The brightness of the light is adjusted with 255 levels of the pulse width (PWM frequency: 100kHz). • Voltage / Current The brightness of the light is adjusted with 255 voltage / current levels. Select voltage / current adjustment if you will use a high-speed shutter speed.
Part	0 to 255 [128]	Set the brightness for the selected parts.

Camera-mount Lighting Controller FLV-TCC3HB is connected:



Item	Setting value [Factory default]	Description
On all the time	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check here to keep the light turned ON all of the time regardless of the exposure time.
Modulate mode	<ul style="list-style-type: none"> • [Duty] • Voltage / Current 	<p>Select the lighting adjustment method.</p> <p>0ch connected:</p> <ul style="list-style-type: none"> • Duty The brightness of the light is adjusted with 255 levels of the pulse width (PWM frequency: 100kHz). • Voltage / Current The brightness of the light is adjusted with 255 voltage / current levels. <p>0ch is the channel for the spot lighting.</p> <p>1ch / 2ch connected:</p> <ul style="list-style-type: none"> • Duty The brightness of the light is adjusted with 255 levels of the pulse width (PWM frequency: 100kHz). • Voltage / Current The brightness of the light is adjusted with 255 voltage / current levels. Select voltage / current adjustment if you will use a high-speed shutter speed.
Part	0 to 255 [128]	Set the brightness for the selected parts.

Important

- There is no restriction on power consumption nor on lighting mode when using lightings with lighting controller FLV-TCC1EP. Restrictions on power consumption and lighting mode differ depending on the product series. See the following table for details.

1. FLV-TCC4/-TCC1

- Without external power supply

Total power consumption	Power consumption per channel	Connectability	Lighting mode ^{*1}			READY OFF time delay ^{*2}
			Always-on lighting mode	Simultaneous lighting mode	Single lighting mode	
Greater than 7.5 W	Greater than 7.5 W	Not connectable	---	---	---	---
	7.5 W or less	Connectable	NA	NA	OK	None
7.5 W or less	Less than 7.5 W	Connectable	OK	OK	OK	None

- With external power supply

Total power consumption	Power consumption per channel	Connectability	Lighting mode ^{*1}			READY OFF time delay ^{*2}
			Always-on lighting mode	Simultaneous lighting mode	Single lighting mode	
Greater than 15 W	Greater than 15 W	Not connectable	---	---	---	---
	15 W or less	Connectable	NA	NA	OK	Yes
	7.5 W or less	Connectable	NA	NA	OK	None
15 W or less	Less than 15 W	Connectable	NA	OK	OK	Yes
	7.5 W or less	Connectable	NA	OK	OK	Yes
7.5 W or less	Less than 7.5 W	Connectable	OK	OK	OK	None

2. FLV-TCC3HB

- Without external power supply

0ch (spot lighting) not connected

Total power consumption	Power consumption per channel	Connectability	Lighting mode ^{*1}			READY OFF time delay ^{*2}
			Always-on lighting mode	Simultaneous lighting mode	Single lighting mode	
Greater than 7.5 W	Greater than 7.5 W	Not connectable	---	---	---	---
	7.5 W or less	Connectable	NA	NA	OK	None
7.5 W or less	Less than 7.5 W	Connectable	OK	OK	OK	None

0ch (spot lighting) connected

Total power consumption	Power consumption per channel	Connectability	Lighting mode ^{*1}			READY OFF time delay ^{*2}
			Always-on lighting mode	Simultaneous lighting mode	Single lighting mode	
Greater than 5.5 W	Greater than 7.5 W	Not connectable	---	---	---	---
	7.5 W or less	Connectable	NA	NA	OK	None
5.5 W or less	Less than 5.5 W	Connectable	OK	OK	OK	None

- With external power supply

0ch (spot lighting) not connected

Total power consumption	Power consumption per channel	Connectability	Lighting mode ^{*1}			READY OFF time delay ^{*2}
			Always-on lighting mode	Simultaneous lighting mode	Single lighting mode	
Greater than 15 W	Greater than 15 W	Not connectable	---	---	---	---
	15 W or less	Connectable	NA	NA	OK	Yes
	7.5 W or less	Connectable	NA	NA	OK	None
15 W or less	Less than 15 W	Connectable	NA	OK	OK	Yes
	7.5 W or less	Connectable	NA	OK	OK	Yes
7.5 W or less	Less than 7.5 W	Connectable	OK	OK	OK	None

0ch (spot lighting) connected

Total power consumption	Power consumption per channel	Connectability	Lighting mode ^{*1}			READY OFF time delay ^{*2}
			Always-on lighting mode	Simultaneous lighting mode	Single lighting mode	
Greater than 14 W	Greater than 15 W	Not connectable	---	---	---	---
	15 W or less	Connectable	NA	NA	OK	Yes
	7.5 W or less	Connectable	NA	NA	OK	None
14 W or less	Less than 14 W	Connectable	NA	OK	OK	Yes
	7.5 W or less	Connectable	NA	OK	OK	Yes
5.5 W or less	Less than 5.5 W	Connectable	OK	OK	OK	None

*1: Lighting modes

Always-on lighting mode	In this mode, the lights are always turned ON for a specific pulse cycle. The always-on lighting mode is used if you place a check in "On all the time" in the "Lighting control" area.
Simultaneous lighting mode	In this mode, all of the connected lights are turned ON in synchronization with the trigger. Set the "Adjustment" set values in the "Lighting control" area for each light to any value other than 0 for all of the parts.
Single lighting mode	In this mode, only one of the connected lights is turned ON in synchronization with the trigger. Set the "Adjustment" set value in the "Lighting control" area to any value other than 0 for the part for only one channel. The lights will not turn ON if you set two or more channels to an adjustment other than 0.

*2: Turning OFF the READY signal is delayed in comparison with not connecting a camera with lighting controller by approximately the exposure time.

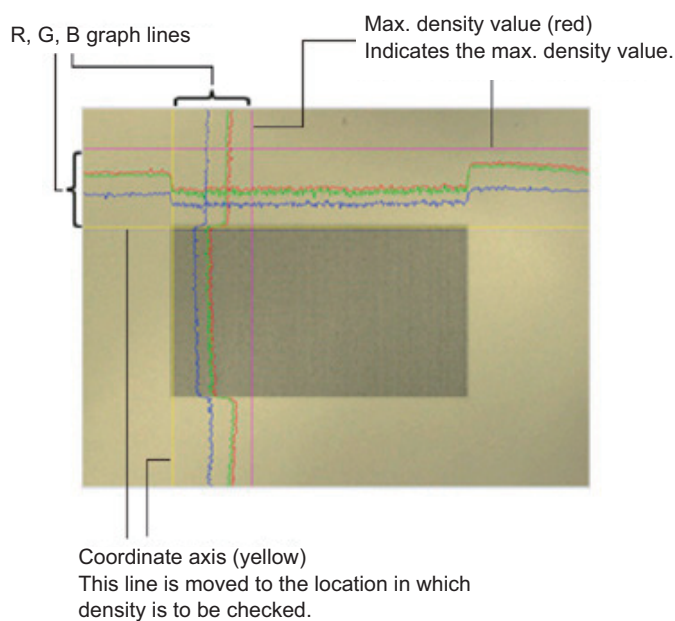
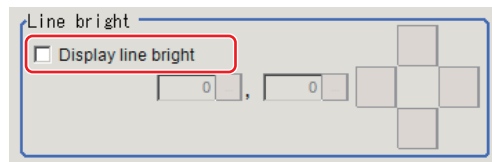
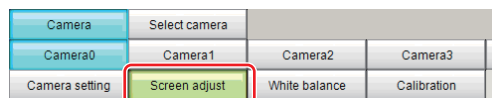
Example: Connection example for connecting an external power supply and the lighting modes

- If four lights with a power consumption of 1 W each are connected to a camera with lighting controller, always-on lighting, simultaneous lighting, and single lighting are all possible.
- If four lights with power consumptions of 2 W, 3 W, 4 W, and 5 W are connected to a camera with lighting controller, simultaneous lighting and single lighting are possible.
- If four lights with power consumptions of 12 W, 1 W, 2 W, and 1 W are connected to a camera with lighting controller, only single lighting is possible.

Line Bright

The graph showing the gray distribution for 1 line in the image is called the "Line bright". You can display the line brights for R, G and B for any horizontal or vertical line.

- 1** In the Item Tab area, click [Screen adjust].
- 2** Place a check at "Display line bright".
- 3** Move the line to the position whose density distribution you want to see.



White Balance (Camera Image Input FH)

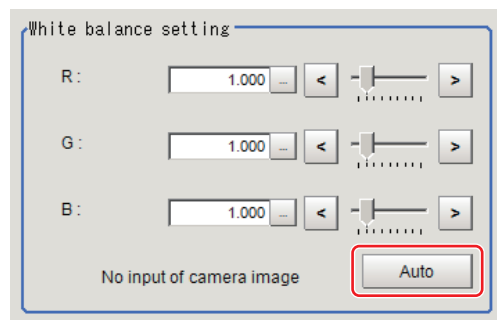
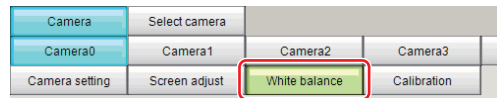
Set the white balance to make white objects look white by calibrating the color of images loaded from cameras. By adjusting the white balance, the appropriate white color can be reproduced under any lighting conditions. Appropriate values can also be set automatically.

Note

- Perform the white balance setting only when a color camera is used.
- In the following cases, make sure to set white balance.
 - When a new system is installed
 - When a camera or lighting has been changed

Since measurement results may vary with changes of the white balance setting, be sure to verify the operation after it has changed.

- 1** In the Item Tab area, click [White balance].
- 2** Shoot a white piece of paper or cloth.
- 3** Click [Auto].



Note

- When the "Too bright" or "Too dark" message is displayed, adjust the iris, shutter speed, gain and/or lighting conditions until "Automatic adjustment is possible" is displayed.

4 Set the "R", "G" and "B" values as necessary.

Item	Setting value [Factory default]	Description
White balance setting • R • G • B	<ul style="list-style-type: none"> • R, G, and B: 0.001 to 7.999 (FZ-SQ□□□□:0.001 to 3.000) • FZ-SC [R=1.183] [G=1.000] [B=1.323] • FZ-SC2M [R=1.394] [G=1.000] [B=1.222] • FZ-SHC [R=1.375] [G=1.000] [B=1.452] • FZ-SFC and FZ-SPC [R=1.145] [G=1.000] [B=1.889] • FZ-SC5M2 [R=1.351] [G=1.000] [B=2.314] • FZ-SC5M3 [R=1.400] [G=1.000] [B=2.150] • FZ-SQ□□□□ [R=1.000] [G=1.040] [B=1.800] • FH-SC□□ [R=1.000] [G=1.000] [B=1.000] 	Set the white balance. Whiteness increases when the value of "R", "G", and "B" is increased.

Calibration (Camera Image Input FH)

By setting the calibration, the measurement result can be converted and output as actual dimensions. The calibration method is selected here.

There are three calibration methods, point, sampling, and parameter.

- Reference: ▶ **Specifying Points and Setting (Point Specification) (p.68)**
- Reference: ▶ **Setting Calibration through Sampling Measurement (Sampling) (p.69)**
- Reference: ▶ **Inputting and Setting Values (Value Setting) (p.71)**
- Reference: ▶ **View Calibration Parameters (p.72)**

Note

- In order to output measurement values in actual dimensions, select [Calibration] to "ON" in [Output parameter] for each processing unit. If [Calibration] is "OFF" (factory default), measurement results are output as camera image coordinate values.

Specifying Points and Setting (Point Specification)

This is a method for performing calibration by selecting arbitrary points (in pixels).

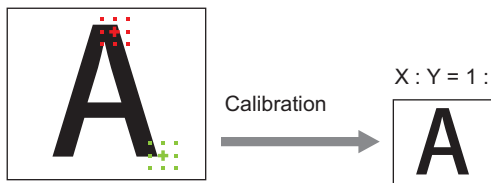
Calibration parameters are calculated automatically when actual coordinates of selected locations are entered.

Up to 3 points can be selected.

- **When magnification is the same in the X and Y directions**

Select only 2 points.

X : Y = 1 : 1



- **When magnification is not the same in the X and Y directions**

Select 3 points.

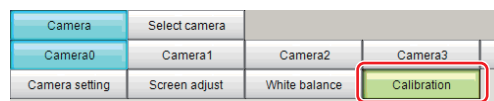
X : Y = 5 : 3



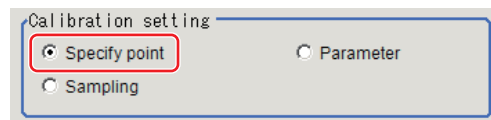
Note

- When 2 points are selected, the coordinate system is set to the left-hand system (forward in the clockwise direction). Select 3 points to perform calibration including the coordinate system.

1 In the Item Tab area, click [Calibration].



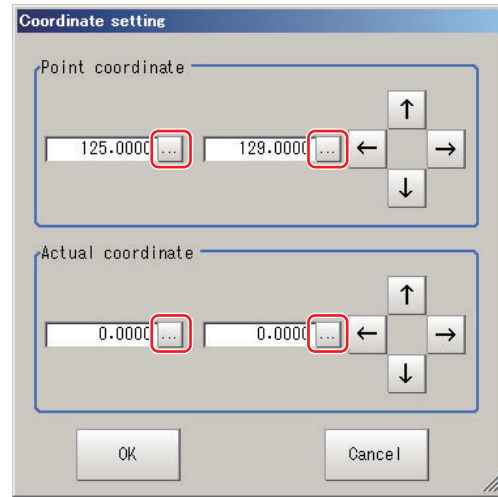
2 In the "Calibration setting" area, select "Specify point".



3 Click the first point on the screen.

4 Set the actual coordinates for the specified point.

The actual coordinate input window is displayed.

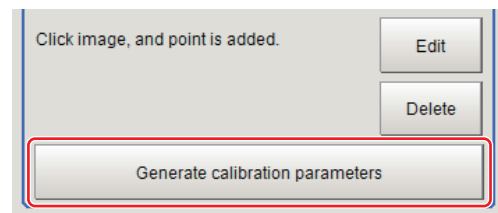


Actual coordinate	Setting value [Factory default]
Point coordinate X, Y	0 to 9999.9999 [Point you clicked in the window]
Actual coordinate X, Y	-99999.9999 to 99999.9999 [0]

5 Set the 2nd and 3rd points in the same way.

6 Click [Generate calibration parameters].

The calibration parameters will be generated.

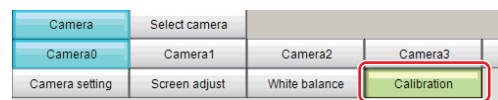


Setting Calibration through Sampling Measurement (Sampling)

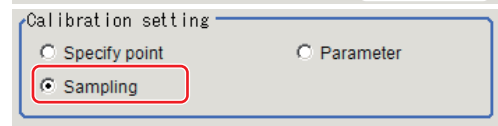
This is a method for setting calibration based on measurement results.

Calibration parameters are calculated automatically when a registered model is searched and the actual coordinates for that position set.

1 In the Item Tab area, click [Calibration].



2 In the "Calibration setting" area, select "Sampling".

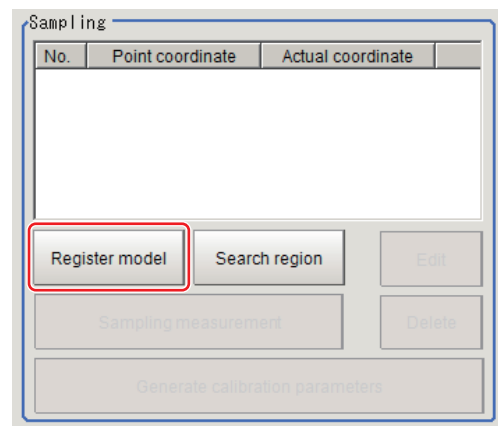


3 In the "Sampling" area, click [Register model].

4 Use the Drawing tools to register the model.

5 Set a search region as necessary.

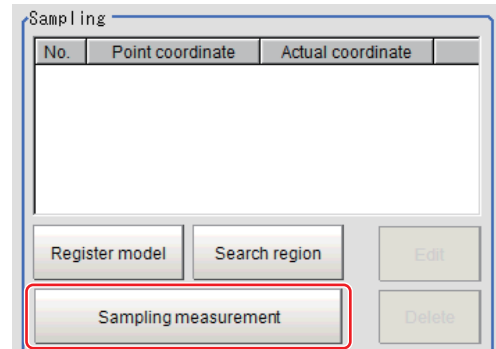
The default value setting is for the entire screen.



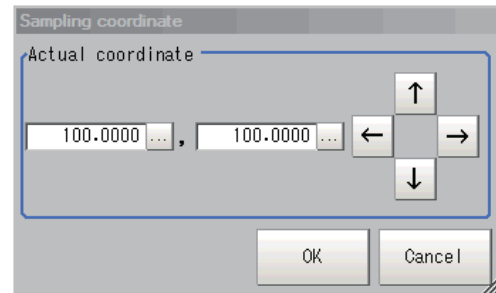
6 Click [Sampling measurement].

Measurement is performed.

The search result (cross-shaped cursor) is displayed in the Image Display area, and the Sampling Coordinate window is displayed.

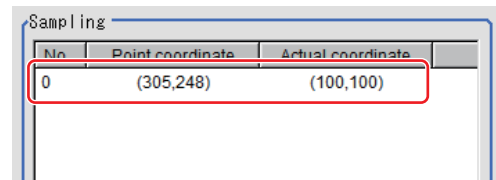


7 In the Sampling Coordinate window, set the X and Y values.



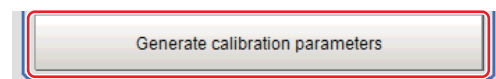
8 Click [OK].

Point coordinates and actual coordinates are registered in the "Sampling" area.



9 Move the object to be measured and repeat the Steps 3 to 8.

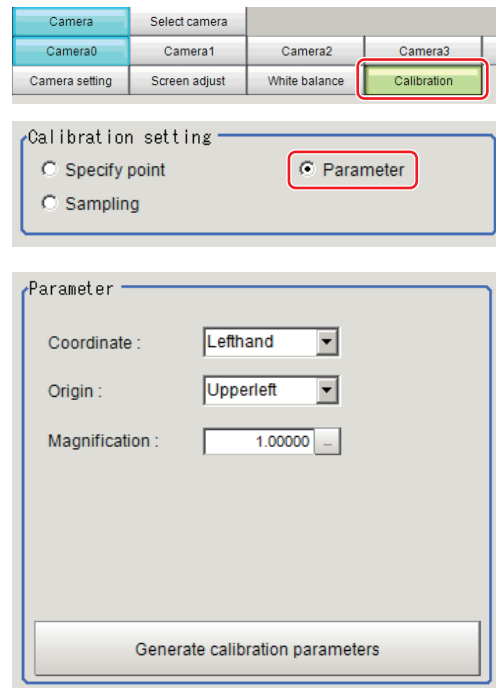
10 Click [Generate calibration parameters].
The calibration parameters will be generated.



Inputting and Setting Values (Value Setting)

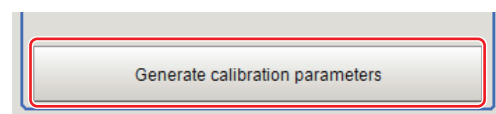
Set calibration data directly with numerical values.

- 1** In the Item Tab area, click [Calibration].
- 2** In the "Calibration setting" area, select "Parameter".
- 3** In the "Parameter" area, specify values for the "Coordinate", "Origin" and "Magnification".



Item	Setting value [Factory default]	Description
Coordinate	<ul style="list-style-type: none"> • [Lefthand] • Righthand 	<p>Lefthand: Clockwise is forward when setting the coordinates.</p> <p>Righthand: Counter-clockwise is forward when setting the coordinates.</p>
Origin	<ul style="list-style-type: none"> • [Upperleft] • Lowerleft • Center 	<p>Upperleft</p> <p>Center</p> <p>Lowerleft</p> <p>Set where the origin of the actual coordinates will be.</p>
Magnification	0.00001 to 9.99999	Specify the ratio of 1 pixel to the actual dimensions.

- 4** Click [Generate calibration parameters].
The calibration parameters will be generated.



View Calibration Parameters

View the set calibration data.

1 In the Item Tab area, click [Calibration].

Camera	Select camera		
Camera0	Camera1	Camera2	Camera3
Camera setting	Screen adjust	White balance	Calibration

2 In the "Calibration parameter" area, confirm the calibration data.

Calibration parameter			
A:	-2.185999	D:	-2.091627
B:	4.481812	E:	4.052848
C:	-158.960192	F:	-134.672272
Field of view :	1936.303258		

Item	Setting value	Description
A	Calculation value	These are calibration conversion values. Camera coordinates are converted to actual coordinates based on these values. The conversion formulas for actual coordinates are as follows: <ul style="list-style-type: none"> • (X, Y): Measurement point (camera coordinates), Unit: pix • (X', Y'): Conversion point (actual coordinates) $X' = A \times X + B \times Y + C$ $Y' = D \times X + E \times Y + F$
B	Calculation value	
C	Calculation value	
D	Calculation value	
E	Calculation value	
F	Calculation value	
Field of view	Calculation value	This is an actual dimension in the X direction.

Camera Image Input HDR

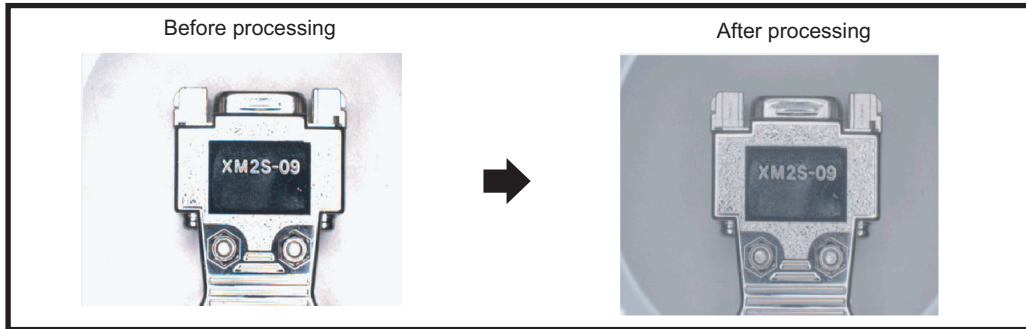
You can acquire a wide dynamic range image by combining images photographed consecutively at different shutter speeds.

With objects that generate halation, images with low-contrast, and environments with fluctuation in the lighting, this processing item is an effective substitute for camera image input.

Used in the Following Case

- **To acquire stable images of objects for which halation occurs easily**

Used to obtain images with a wide dynamic range in which dark areas are made brighter (text areas) and bright areas are made darker (connector areas).



- **To measure images with low-contrast stably**

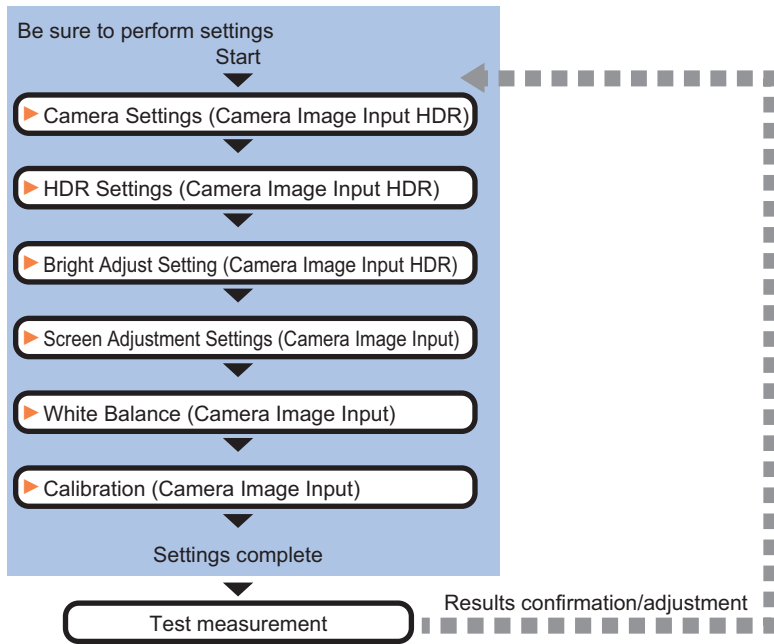
Use high-contrast mode.

Important

- [Camera Image Input] is preset for Unit 0. Do not set any processing item other than camera image input (camera image input HDR, camera image input HDR Lite, camera image input FH) for Unit 0.
 - Immediately after starting up the FH/FZ5 Sensor Controller and immediately after changing scenes, there will be no input image. No input image is processed as the same color image as in the factory default state.
 - If you open the Properties Dialog Box before inputting an image, click the Cancel button to close the dialog box. Pressing the OK button in the dialog box will change the setting to the same color camera setting as the factory default setting.
- (Reference: ▶ "FAQ For Measurement The measurement NG (image mismatch) error will result when connecting a monochrome camera" in the "Vision System FH/FZ5 Series User's Manual (Z365)")

Settings Flow (Camera Image Input HDR)

To set camera image input HDR, follow the steps below.



Camera Image Input HDR Item List

Item name	Description
Camera setting	Specify the camera settings such as the electronic flash. The setting method is the same as for [Camera Image Input]. Please check it. Reference: ▶ Camera Settings (Camera Image Input HDR) (p.75)
HDR setting	Carry out the image combination and photography settings. Reference: ▶ HDR Settings (Camera Image Input HDR) (p.78)
Bright adjust	Specify the brightness follow-up adjustment setting. Reference: ▶ Bright Adjust Setting (Camera Image Input HDR) (p.80)
Screen adjust	Adjust the lighting and the lens. The setting method is the same as for [Camera Image Input]. Please check it. However, the iris cannot be adjusted. Reference: ▶ Screen Adjustment Settings (Camera Image Input) (p.30)
White balance	When using a color camera, adjust the white balance. The setting method is the same as for [Camera Image Input]. Please check it. Reference: ▶ White Balance (Camera Image Input) (p.38)
Calibration	Set when measurements (camera coordinate measurement values) are to be output using actual dimensions. Select the calibration setting method and generate the calibration parameters. The setting method is the same as for [Camera Image Input]. Please check it. Reference: ▶ Calibration (Camera Image Input) (p.40)

Camera Settings (Camera Image Input HDR)

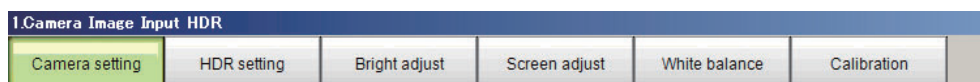
Set the following photographing conditions.

- Reference: ▶ Selection Setting (p.75)
- Reference: ▶ Camera Settings (p.76)
- Reference: ▶ Number of lines to be read (p.29)
- Reference: ▶ Electronic Flash Setting (p.77)

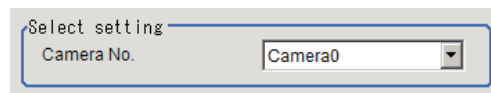
Selection Setting

When multiple cameras are connected, select the camera to use for measurement.

1 In the Item Tab area, click [Camera setting].



2 Click [Camera No.] [▼] and select the camera number.

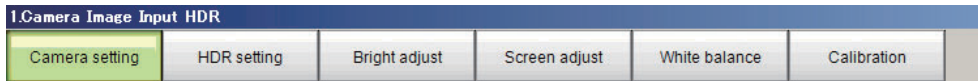


Setting item	Setting value [Factory default]	Description
Camera No.	Cam 0 to 7 [Cam 0]	Select the camera number.

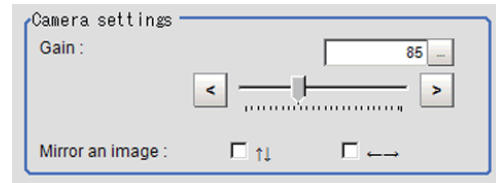
Camera Settings

Specify the camera gain and reverse conversion.

1 In the Item Tab area, click [Camera setting].



2 In the "Camera settings" area, specify the camera gain and reverse conversion settings.



Setting item	Setting value [Factory default]	Description
Gain	<ul style="list-style-type: none"> FZ-SC/S/SHC/SH 0 to 230 [85] FZ-SC2M/S2M/SC5M2/S5M□/SF□/SP□ 0 to 230 [50] FZ-SC5M3 0 to 230 [65] FH-SC02/SM02/SC04/SM04/SC12/SM12 0 to 255 [0] FH-SC05R/SM05R 0 to 63 [0] 	Set the camera gain when the shutter speed, the lens aperture, and lighting conditions cannot be used to brighten the image. Usually, the factory default value can be used.
Mirror an image	↑↓ <ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check here when reversing the camera image vertically.
	←→ <ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check here when reversing the camera image horizontally.

Important

With CMOS cameras, striped bands of noise can arise if the camera gain is set too high, a characteristic inherent in the imaging element specifications.

A number of pixel defects may also occur; however, such defects should not cause problems with product defects or failure. If having problems with striped bands of noise or pixel defects affecting the measurement results, lower the camera gain setting or use a CCD camera.

Electronic Flash Setting

This function is set when an electronic flash is used. This sets the output conditions for the signal for synchronizing the measurement and the electronic flash timing.

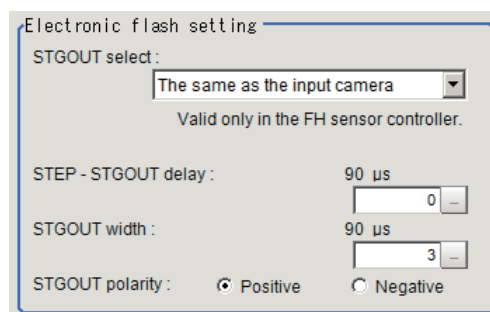
Important

- The STGOUT signals that can be output are as follows.
 - : FH-1000 and FH-3000 series: SGTOUT 0 to 7
 - : FH-L series: STGOUT 0 to 3
- STGOUT0 to STGOUT7 is tied to The camera connector number of the sensor controller, not the camera number. When you use CameraLink Medium Configuration or the Multi-line random-trigger mode, confirm the camera connector number that corresponds to the camera number of sensor Controller.

1 In the Item Tab area, click [Camera setting].



2 In the Electronic flash setting area, set the items of STGOUT signals.



Item	Setting value [Factory default]	Description
STGOUT select	[The same as the input camera] Camera 0 to 7	Select the STGOUT signal to use for Camera Image Input HDR processing item. The same as the input camera: STGOUT that is tied to the input camera is output. Camera 0 to 7: STGOUT signal that is tied to the selected camera is output.
STEP-STGOUT delay	[0] to 511 (1 count is 30μs)	Set the time to wait to turn ON the electronic flash trigger signal after STEP signal is input. Delay time = count number × 30μs + 90μs Delay time changes with the setting of STGOUT polarity. The time displayed is for the polarity of Positive; for Negative, 35μs will be added to the displayed time. Delay time is within the range ±10μs of set value.
STGOUT width	0 to 43689 [3] (1count is 30μs)	Set the time to output the electronic flash trigger signal. For FH series controller, set 0 to disable flashing.
STGOUT polarity	<ul style="list-style-type: none"> [Positive] Negative 	Set the pulse polarity of electronic flash trigger. Positive: flashes synchronizing with the electronic flash trigger output changing from OFF→ON. Negative: flashes synchronizing with the electronic flashing trigger output changing from ON→OFF.

Important

Do not perform next camera image input processing before STGOUT signal output is completed. STGOUT signal may not be output.

Perform camera image input processing after STGOUT signal output completion, or set the STEP-camera delay, STEPSTGOUT delay and STGOUT pulse width so that the electronic flash operates synchronizing with the exposure time.

Note

STGOUT signals are output at each imaging. Therefore, it can be duplicated with the next STGOUT signal output, depending on the STEP-STGOUT delay or STGOUT width settings.

If it duplicates with the next, the number of times for imaging and electronic flashing can differ.

HDR Settings (Camera Image Input HDR)

Specify the image combination method etc.

- 1 In the Item Tab area, click [HDR setting].**
- 2 In the "Mode select" area, specify the mode.**

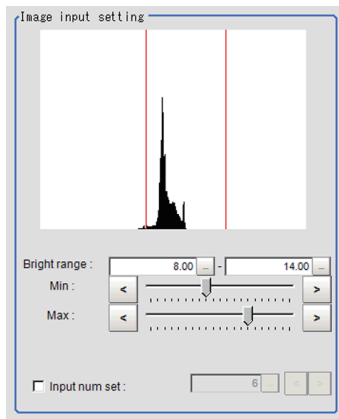
When you select the mode in the "Mode select" area and specify the measurement region on the image, the parameters are set automatically. To finely adjust the parameters, refer to the next items.

Item	Set value [Factory default]	Description
Mode select	[HDR mode]	In halation is likely generated image, select this mode if you want to stabilize the brightness. Generate images with stable brightness by shooting multiple images with different shutter speeds based on the set Bright range.
	High contrast mode	Select this mode if you want to generate image with good contrast. Generate images with good contrast by shooting multiple images with different shutter speeds based on the set Average and Width.

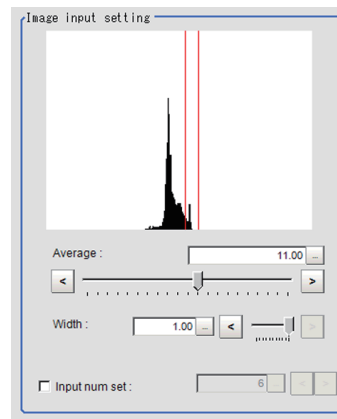
3 In the "Image input setting" area, set the items.

A brightness histogram is displayed as the graph.

HDR



High contrast mode



Item	Set value [Factory default]	Description
Min Bright range	0 to 20 [8]	This item sets the minimum brightness for combining images.
Max Bright range	0 to 20 [14]	This item sets the maximum brightness for combining images.
Input num set	<ul style="list-style-type: none"> • [Unchecked] • Checked 2 to 16 [6]	Place a check to set the number of shots manually. Setting a high shot count provides images with low noise. However, more processing time is required. Setting a low shot count shortens the processing time. However, the image is more easily affected by noise.
Average	0.00 to 20.00 [11.00]	Specify the average brightness for images shot.
Width	0.01 to 1.00 [1.00]	Specify the brightness range for images shot.
Input num set	<ul style="list-style-type: none"> • [Unchecked] • Checked 2 to 16 [6]	Place a check to set the number of shots manually. Setting a high shot count provides images with low noise. However, more processing time is required. Setting a low shot count shortens the processing time. However, the image is more easily affected by noise.

4 In the "Output setting" area, set the combination method.

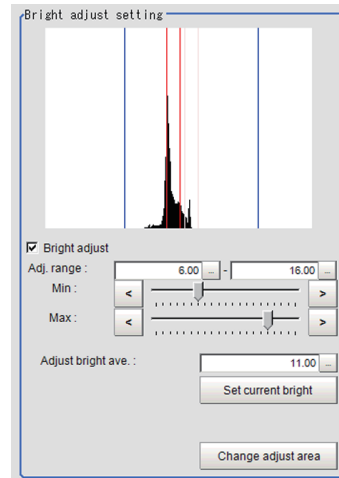
Item	Set value [Factory default]	Description
Combine type	[Normal]	Select the combination method.
	Color	Normal: Standard combination method This compensates the brightness so that dark sections on the combination image do not become all black.
	Linear	Color: This is suitable for inspecting labeling and the Gravity and Area. This compensates the saturation when there is little hue information in the combined image. Linear: This is suitable for fine matching and defect inspection. In order to output the actual brightness of the workpiece, no compensation is performed.

The current shot count and image combination time for the settings are displayed.

Bright Adjust Setting (Camera Image Input HDR)

This sets how far to track the brightness of the loaded images.

- 1 In the Item Tab area, click [Bright adjust].
- 2 Set each item in the "Bright adjust setting" area.



Item	Set value [Factory default]	Description
Bright adjust	<ul style="list-style-type: none"> • [Unchecked] • Checked 	If a check is placed at "Bright adjust", the image is output with its brightness automatically compensated. This makes it possible to obtain images with stable brightness even if the lighting conditions fluctuate, for example due to interfering light.
Min Adj. range	0.00 to 20.00 [6.00]	Specify the follow-up brightness minimum value.
Max Adj. range	0.00 to 20.00 [16.00]	Specify the follow-up brightness maximum value.
Adjust bright ave.	0.00 to 20.00 [11.00]	Specify the target for brightness follow-up. Clicking the [Set current bright] button updates this value.

When a check is placed at the "Bright adjust", the Brightness Adjustment range is displayed with blue lines in the "Histogram" area.

Change the "Adjust bright ave." and brightness adjust area.

Camera Image Input HDR Lite

Camera Image Input HDR Lite is for FZ-SQ□□□□.

You can acquire a wide dynamic range image by combining images photographed consecutively at different shutter speeds.

With objects that generate halation, images with low-contrast, and environments with fluctuation in the lighting, this processing item is an effective substitute for camera image input.

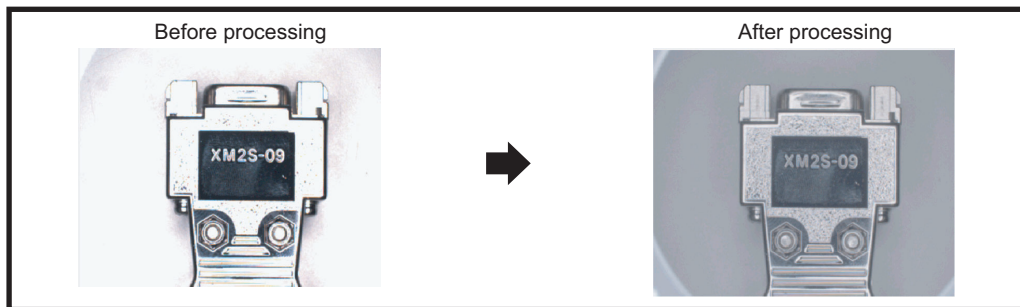
1

Input Image

Used in the Following Case

- To acquire stable images of objects for which halation occurs easily

Used to obtain images with a wide dynamic range in which dark areas are made brighter (text areas) and bright areas are made darker (connector areas).

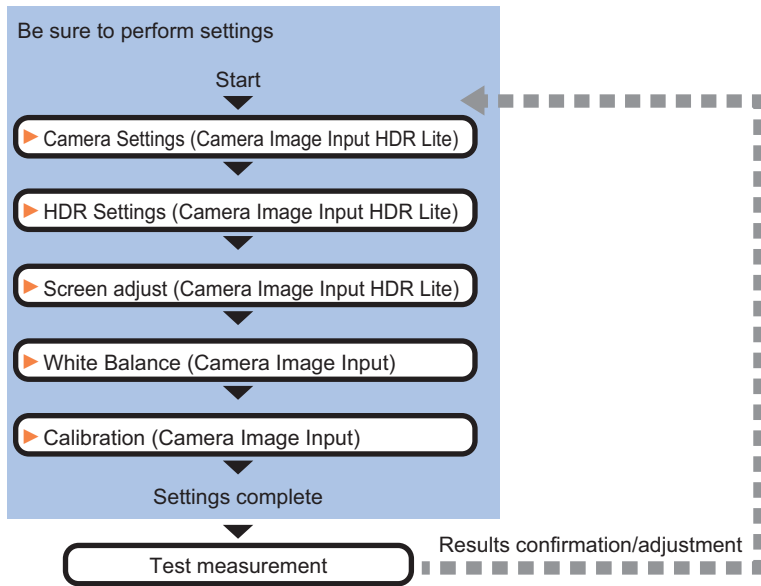


Important

- [Camera Image Input] is preset for Unit 0. Do not set any processing item other than camera image input (camera image input HDR, camera image input HDR Lite and camera image input FH) for Unit 0.
 - Immediately after starting up the FH/FZ5 Sensor Controller and immediately after changing scenes, there will be no input image. No input image is processed as the same color image as in the factory default state.
 - If you open the Properties Dialog Box before inputting an image, click the Cancel button to close the dialog box. Pressing the OK button in the dialog box will change the setting to the same color camera setting as the factory default setting.
- (Reference: ▶ "FAQ For Measurement The measurement NG (image mismatch) error will result when connecting a monochrome camera" in the "Vision System FH/FZ5 Series User's Manual (Z365)")

Settings Flow (Camera Image Input HDR Lite)

To set Camera Image Input HDR Lite, follow the steps below.



Camera Image Input HDR Lite Item List

Item name	Description
Camera settings	Specify the camera settings such as the electronic flash. Reference: ▶ Camera Settings (Camera Image Input HDR Lite) (p.83)
HDR setting	Specify the dynamic range and brightness setting. Specify the HDR automatic setting as necessary. Reference: ▶ HDR settings (Camera Image Input HDR Lite) (p.83)
Screen adjust	Adjust the image with or without the light adjustment or using display line bright. Reference: ▶ Screen adjust (Camera Image Input HDR Lite) (p.84)
White balance	When using a color camera, adjust the white balance. The setting method is the same as for [Camera Image Input]. Please check it. Reference: ▶ White Balance (Camera Image Input) (p.38)
Calibration	Set when measurements (camera coordinate measurement values) are to be output using actual dimensions. Select the calibration setting method and generate the calibration parameters. The setting method is the same as for [Camera Image Input]. Please check it. Reference: ▶ Calibration (Camera Image Input) (p.40)

Camera Settings (Camera Image Input HDR Lite)

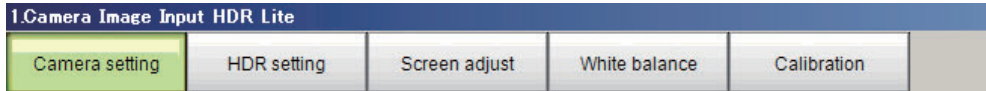
Set the following photographing conditions.

- Reference: ▶ Selection Setting (p.83)
- Reference: ▶ Number of lines to be read (p.29)
- Reference: ▶ Electronic Flash Setting (p.77)

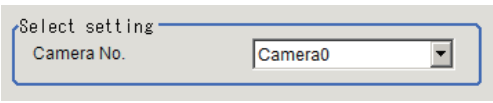
Selection Setting

When multiple cameras are connected, select the camera to use for measurement.

1 In the Item Tab area, click [Camera setting].



2 Click [Camera No.] [▼] and select the camera number.



Setting item	Setting value [Factory default]	Description
Camera No.	Cam 0 to 7 [Cam 0]	Select the camera number.

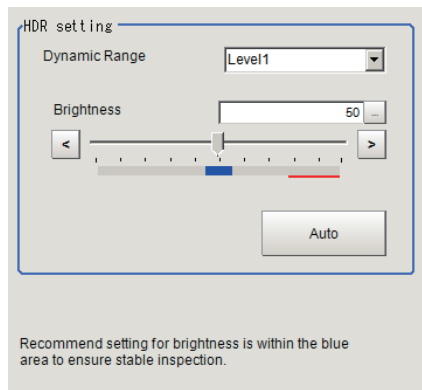
HDR settings (Camera Image Input HDR Lite)

Specify the dynamic range and brightness settings.

1 In the Item Tab area, click [HDR Setting].

2 When automatic is clicked, the dynamic range and the brightness will be automatically set.

If automatic does not produce the desired result, manually adjust the dynamic range and brightness in the HDR settings.



Item	Set value [Factory default]	Description
Dynamic Range	[Level1] to Level4	Specify a dynamic range. The larger the value is, the broader the dynamic range to be combined will be.
Brightness	1 to 100	Specify the brightness settings. The larger the value is in this setting, the longer the exposure time will be. When using a high-speed line, check to make sure that there is no image blur in an actual environment. The degree of image blur can be lowered by decreasing the brightness even when the movement speed of the object is fast.

• **Correlation between the level and the dynamic range**

The larger the value of the level is, the larger the dynamic range to be combined will be, as illustrated below.



Important

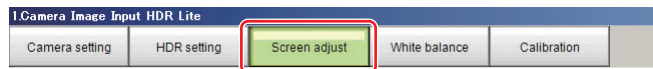
- For stable operations, we recommend setting the brightness within the range where the blue bar does not enter the red region. Measurement values may be different if the recommended range is exceeded. Be sure to thoroughly check the measurement result and set the brightness value.

Screen adjust (Camera Image Input HDR Lite)

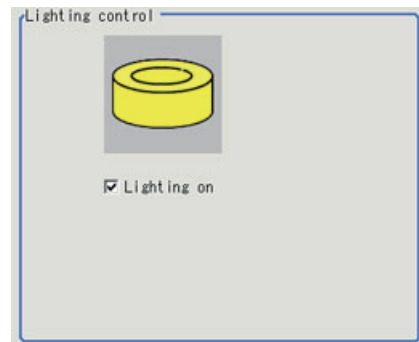
Specify the camera image input HDR Lite lighting and the line bright display settings. Specify whether or not to use the lighting. The setting method for line bright is the same as for [Camera Image Input]. Please check it.

- Reference: ▶ **Line Bright (p.37)**

1 In the Item Tab area, click [Screen adjust].



2 Set [Lighting control] as necessary.

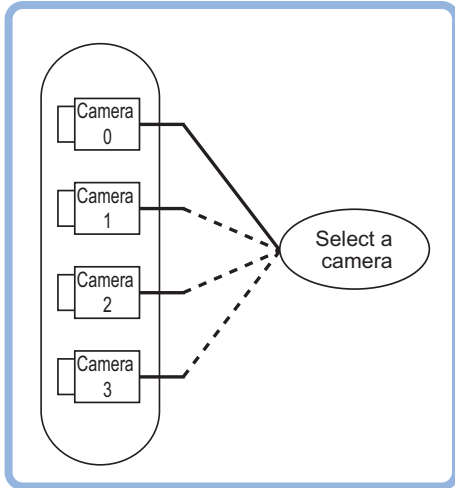


Item	Set value [Factory default]	Description
Lighting on	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Clear the checkbox when no lighting is to be applied.

Camera Switching

Used in the Following Case

- When switching to images on cameras other than that has been set to [Camera Image Input] during scene processing



Important

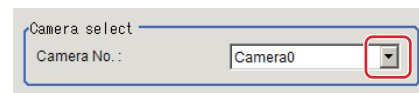
- When switching from a monochrome camera to color camera, reconfigure the settings in the following units.
- Camera switching cannot be used with camera image input HDR.

Camera Selection (Camera Switching)

1 Select the cameras used for measurement.

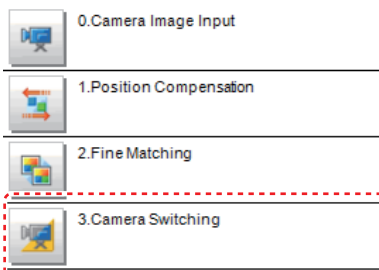
2 Click [OK].

The settings are finalized.



Additional Explanation (Camera Switching)

When creating a scene, [Position Compensation] will be disabled if [Camera Switching] is positioned after a [Position Compensation] unit, and this will restore the image of the measurement object to its former state before the position compensation was applied.



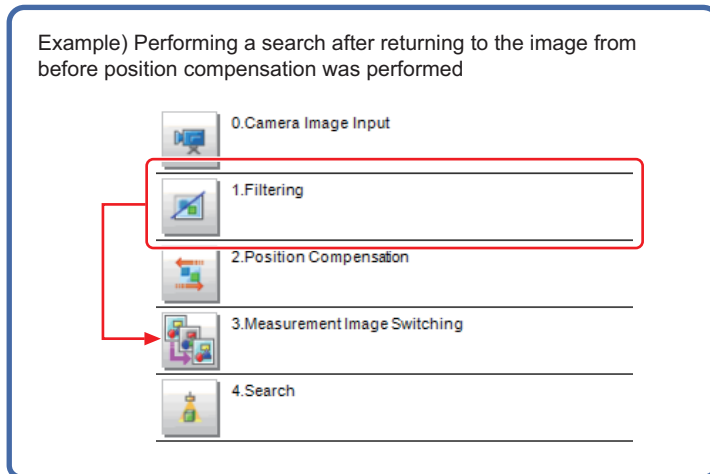
The Position Compensation for Unit 1 is being cancelled, making it restore to its former state before the Position Compensation was applied.

Measurement Image Switching

This sets the output image for the camera image input processing items and specified image conversion related processing items as the input image for the processing items set in the flow from this processing item onward. This is primarily used to return converted images back to their originals and to increase the images that can be selected as conversion targets for image conversion related processing items by placing before the image conversion related processing items.

Used in the Following Case

- To return a converted image to its original

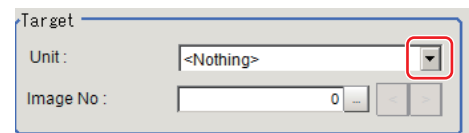


Parameter Settings (Measurement Image Switching)

Specify the processing unit that outputs the images to configure.

Select one that is located in upper position than this processing unit in the flow.

- 1 Select the target unit in the "Target" area.



Item	Set value [Factory default]	Description
Unit	0 to 9999 processing unit [<Nothing>]	Unit that outputs images subject to reset. Select one that is located in upper position than this processing unit in the flow.
Image No.	0 to 9999 [0]	No. of the image that the target unit holds.

Important

- If <Nothing> is left selected, the measurement image switching measurement result is NG. Be sure to select one other than <Nothing>.
- Selectable Camera Image Input or Compensate Image processing items and their image No. are as follows. Reference: ▶ "Macro Reference - List of Image Numbers" in the "Vision System FH/FZ5 Series Macro Customize Functions Programming Manual (Z367)"

Processing items	Image No.	Image
Camera Image Input	0	Camera image
Camera Image Input FH	0	Camera image
Camera Image Input HDR	0	Camera image
Camera Image Input HDR Lite	0	Camera image
Position Compensation	0	Position compensated image
Filtering	0	Filtered image
Background Suppression	0	Background suppressed image
brightness Correct Filter	0	Brightness corrected image
Color Gray Filter	0	Color gray image
Extract Color Filter	0	Color extracted image
Anti Color Shading	0	Anti color shading image
Stripes Removal Filter II	0	Stripes removed image
Polar Transformation	0	Polar transformed image
Trapezoidal Correction	0	Trapezoidal corrected image
Machine Simulator	0	Axis shifted image
Image Subtraction	0	Subtraction image
Advanced filter	0	Output image 0
	1	Output image 1
	2	Output image 2
	3	Output image 3
Panorama	0	Panorama image

2 Click [OK].

The settings are finalized.

Key Points for Test Measurement and Adjustment (Measurement Image Switching)

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image number	Explanation of image to be displayed
0	Reset image
1	Measurement image

External Reference Tables (Measurement Image Switching)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
120	Target unit	Set/Get	Unit that outputs images subject to reset 0 to 9999
121	Image no.	Set/Get	Target image No, that the target unit holds Image no. 0 to 9,999

Multi-trigger Imaging

This function can be used only with FH series/FZ5-800 series/FZ5-1100 series/FZ5-1200 series. The Multi-trigger Imaging processing item captures multiple images at user-defined timings and executes parallel measurement for each image. If you append this processing item in the flow, Multi-trigger Imaging, Multi-trigger Imaging Task, Camera Image Input FH and Multi-trigger Imaging End will be added as a group. Insert the Multi-trigger Imaging to the top of the flow. The Multi-trigger Imaging, Multi-trigger Imaging Task, and Multi-trigger Imaging End cannot be used alone. Please use them as a group.

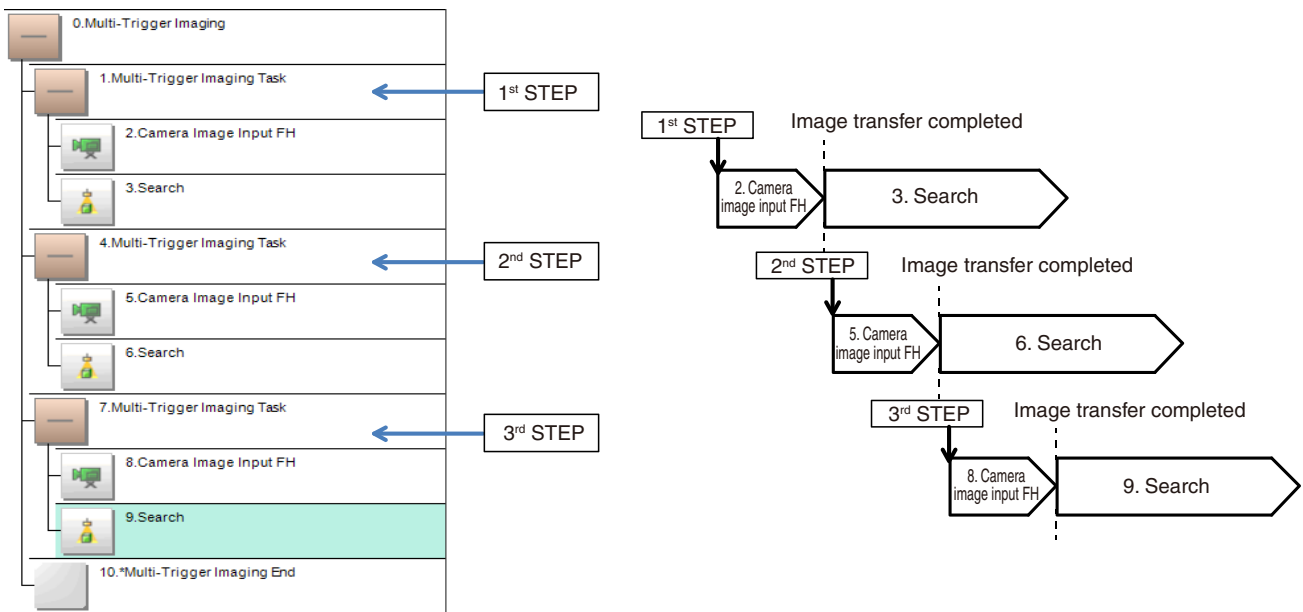
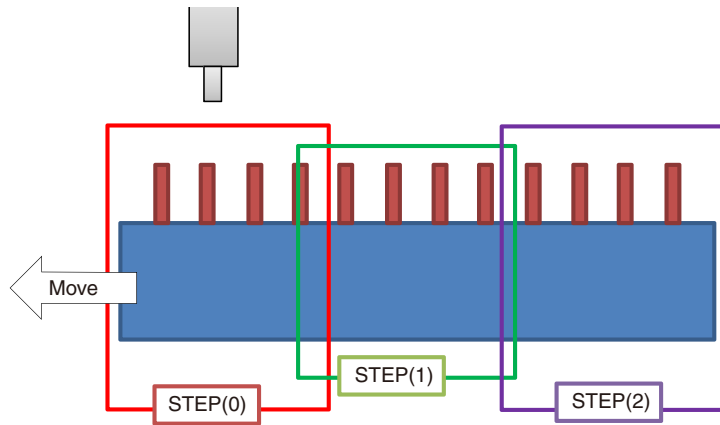
Reference: ▶ *Changing the System Environment - Multi-trigger Imaging Function in the Vision System FH/FZ5 Series User's Manual (Cat. No. Z365).*

Used in the Following Case

Systems which capture multiple images at user-defined timings and executes parallel measurement for each image.

Example:

This function takes multiple images of a long and thin workpiece at certain timings. While the system takes images for multiple times, it executes measurement for each image in parallel. After that, measurement processing is performed based on the measurement results.



Important

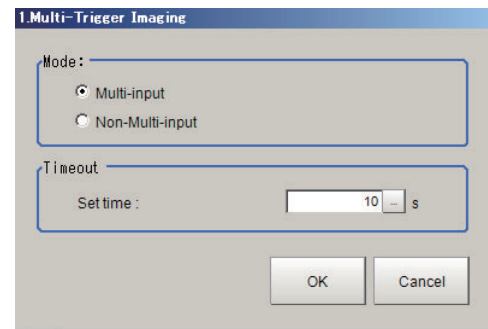
- Multi-trigger Imaging cannot be used when the Operation mode is [Double Speed Multi-input].
- Set the Multi-trigger Imaging processing item to the top (unit 0) of the flow.
- Always set only one Multi-trigger Imaging processing item in one flow.
- The signals that can be used as an image capture trigger are STEP signal of parallel and Trigger signal of EtherCAT. Measurement executed by signals other than these signals or control command does not wait the STEP signal and flow is executed automatically as the controller does in the previous system.
- If the Image mode of the Image Window Setting is set as [Through], flow is executed automatically as the controller does in the previous system.

Mode and timeout (Multi-trigger Imaging)

Configure the Mode and Timeout of Multi-trigger Imaging processing item.

Reference: ► Multi-trigger Imaging Function in the Vision System FH/FZ5 Series User's Manual (Cat. No.Z365)

- 1 On the Main Window (Layout 0), select [Function] - [Edit flow].
- 2 Select a Multi-trigger Imaging processing item.
- 3 Click the [Set] button.
- 4 Configure the Mode and Timeout.



Item	Set value [Factory default]	Description
Mode	<ul style="list-style-type: none"> • [Multi-input] • Non-Multi-input 	<p>Set the processing mode of Multi-trigger Imaging Task.</p> <ul style="list-style-type: none"> • Multi-input mode: Select this if Multi-input mode is used in the Multi-trigger Imaging Task. The Camera setting for the Input image processing item of the first Multi-trigger Imaging Task is applied to that for other Input image processing items that are executed in Multi-trigger Imaging Tasks. • Non-Multi-input: Cameras operate according to their own settings. The Camera setting for the Input image processing item of the Multi-trigger Imaging Task is applied to each execution of Input image processing items. Because Camera setting is executed at each execution of Input image processing item, the time that READY signal stays OFF becomes longer by several ms to several tens of ms compared with that in Multi-input mode.
Timeout	1 to 60s [10]	<p>Set the time for timeout of Multi-trigger Imaging Task block.</p> <p>It is a wait time between a Multi-trigger Imaging Task and the next one. When a STEP signal is not input within the timeout time after the READY signal turns ON, the Multi-trigger Imaging unit judgment will be NG.</p>

Important

- In the following cases, the system operates in Multi-input mode, regardless of the settings for Mode.
 - : Camera Image Input HDR or Camera Image Input HDR Lite is used.
 - : Multiple Input image processing items are used in one Multi-trigger Imaging Task block.
 - : FZ-SQ□□□□ camera is used with its light ON.
 - : Input image processing item is inserted outside of the range between Multi-trigger Imaging and Multi-trigger Imaging End processing items.
- There are restrictions below when FZ-FQ□□□□ camera is used with its light ON.
 - : All Camera Image Input processing items operate with the settings for the Camera Image Input of the first Multi-trigger Imaging Task in the flow.
 - : The system operates in Multi-input mode disabled. (It takes longer time to turn ON the READY signal).
 - : When the light of FZ-FQ□□□□ camera is OFF, the camera operates in the same way as other camera does.

Key Points for Adjustment

Select the adjustment method referring to the following points.

When there is poor image capture results

Parameter to adjust	Description
Edit flow	<p>Verify that there are no additional Camera Image Input units between a Multi-Trigger Imaging block and the first Multi-Trigger Imaging task. If there is a Camera Image Input related unit in this position, image capture results will not be correct.</p> <p>When using Multi-Trigger Imaging, ensure that Camera Image Input related units are contained inside a Multi-Trigger Imaging task.</p> <hr/> <p>The number of Multi-Trigger Imaging tasks does not match the number of STEP signal inputs. Verify that the number of Multi-Trigger Imaging tasks and the number of STEP signal inputs match and try image capture again.</p>

Multi-trigger Imaging Task

This function can be used only with FH series/FZ5-800 series/FZ5-1100 series/FZ5-1200 series. The Multi-trigger Imaging processing item captures multiple images at user-defined timings and executes parallel measurement for each image. If you append this processing item in the flow, Multi-trigger Imaging Task and Camera Image Input FH will be added as a group. The Multi-trigger Imaging Task does not require setting. Insert this processing item to the top of the processing which requires imaging for multiple times. The Multi-trigger Imaging, Multi-trigger Imaging Task, and Multi-trigger Imaging End cannot be used alone. Please use them as a group.

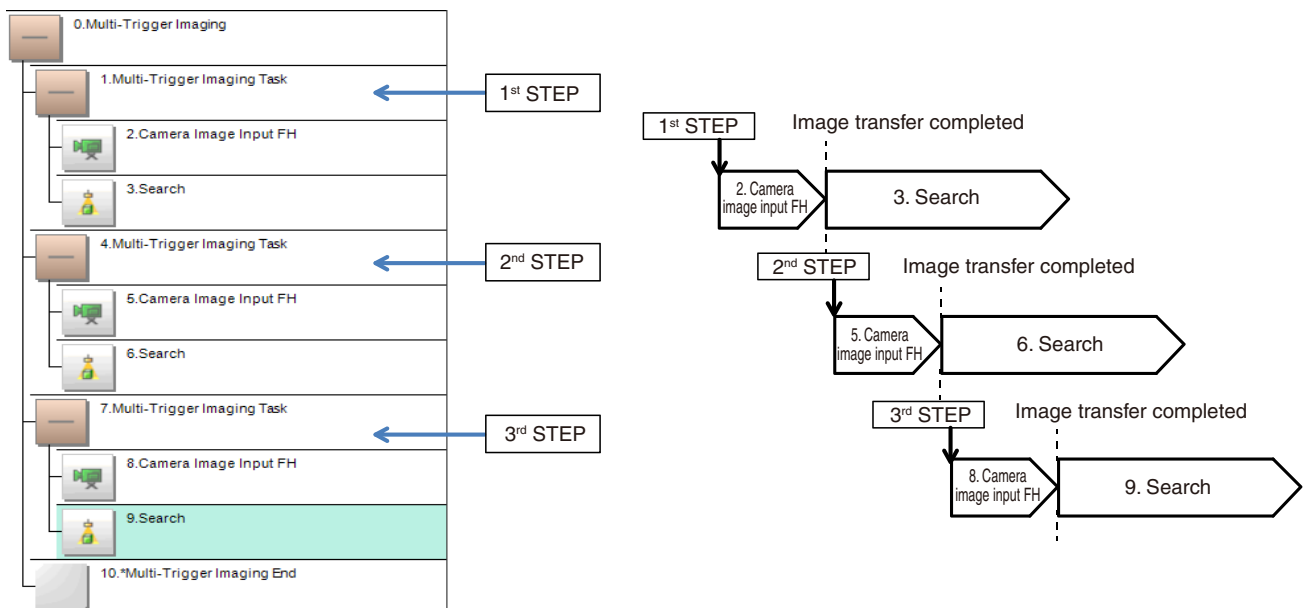
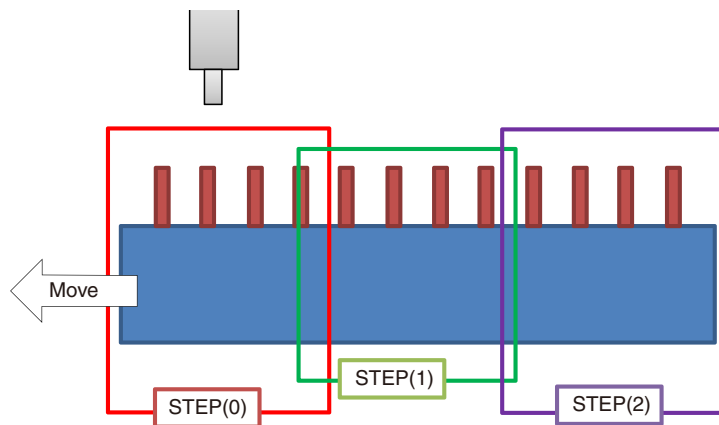
Reference: ▶ *Changing the System Environment - Multi-trigger imaging Function in the Vision System FH/FZ5 Series User's Manual (Cat. No. Z365).*

Used in the Following Case

Systems which capture multiple images at user-defined timings and executes parallel measurement for each image.

Example:

This function takes multiple images of a long and thin workpiece at certain timings. While the system takes images for multiple times, it executes measurement for each image in parallel. After that, measurement processing is performed based on the measurement results.



Important

- The signals that can be used as STEP signals are STEP signal of parallel and Trigger input of EtherCAT. Measurement executed by signals other than STEP signal or control command does not wait the STEP signal and flow is executed automatically as the controller does in the previous system.
- If the Image mode of the Image Window Setting is set as [Through], flow is executed automatically as the controller does in the previous system.

Inspecting and Measuring

This chapter describes how to set up the processing items that execute measurement. In addition, key points for adjustment addressing unstable measurement results and shortening measurement time will also be introduced.

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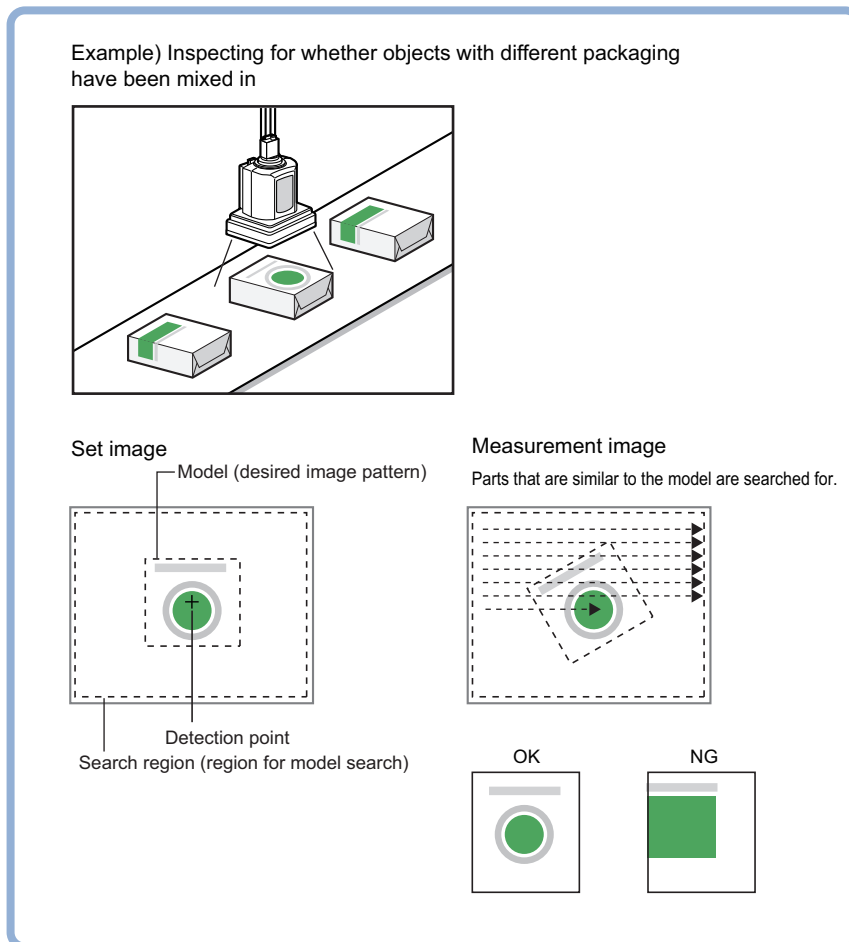
Search

Register the feature sections of the measurement object as an image pattern (model), then find the most similar part to these models from the input images to detect the position.

The correlation value showing the degree of similarity, measurement object position, and inclination can be output.

Used in the Following Case

- When identifying the shape of measurement objects (for detecting defects or foreign matter)



Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

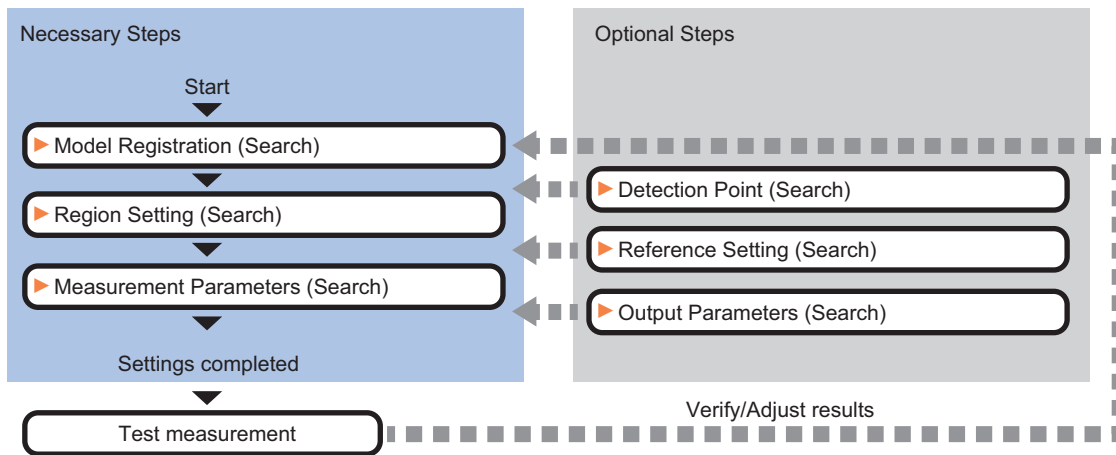
Note

- Search processing basic concepts

Reference: ▶ "Appendixes Measurement Mechanism Search Processing Mechanism" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Settings Flow (Search)

Set up searches according to the following flow.



List of Search Items

Item name	Description
Model register	This item registers the pattern characteristic of the measurement image as a model. Model parameter values can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used. Reference: ▶ Model Registration (Search) (p.99)
Region setting	This item is used to set up the measurement area. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. Reference: ▶ Region Setting (Search) (p.101)
Detection point	This item can be changed if necessary. Specify a position in the model that should be used as the detection coordinates during measurement. Usually, the central position of the set model is registered as the detection coordinates. Reference: ▶ Detection Point (Search) (p.102)
Ref. setting	This item can be changed if necessary. Specify the reference position within the camera's field of view. Reference: ▶ Reference Setting (Search) (p.103)
Measurement	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if the X and Y coordinates and the correlation with the model are OK. Reference: ▶ Measurement Parameters (Search) (p.104)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (Search) (p.106)

Model Registration (Search)

Register the parts to measure as the model.

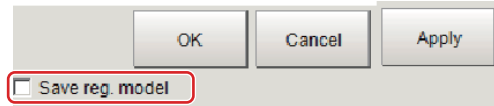
The position at the time of registration is also registered in the model information. Place the measurement object in the correct position when registering a model.

1 In the Item Tab area, click [Model].

When setting a new model, you do not have to click [Model].

2 Use the drawing tools to specify the model registration range.

3 To save the entire image used for model registration, place a check at the "Save reg. model" option.



Note

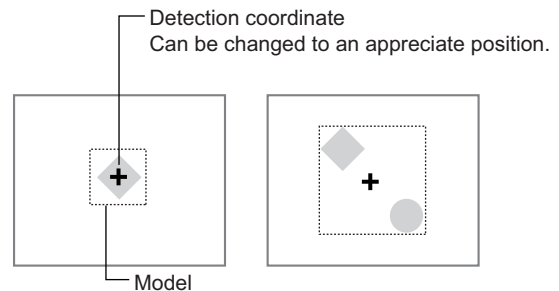
- If you save the registered model image, you can re-register the model with the same image after model parameters are adjusted. Note that the scene data size increases when a registered model image is saved.

4 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Note

- When a model is registered, the central coordinates of the model are registered as the detection point. A detection point is a point output as a measurement value. If multiple figures are combined, the central coordinates of the circumscribed rectangle are registered.

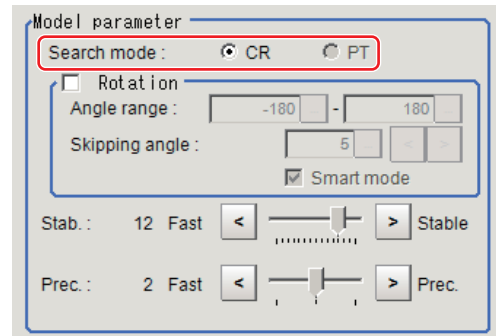


Changing Model Parameters

Model parameter values can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used.

After changing a setting, re-register the model.

- 1 In the "Model parameter" area, select the search mode, then specify a value for each item for that mode.



Setting item	Set value [Factory default]	Description
Search mode	[CR]	Search for normalizing the brightness. This method can provide stable measurement when there is fluctuation in the overall brightness and when the image has low contrast.
	PT	Measures the degree of matching with the profile. This method can measure at higher speed when the rotation angle has a wide range. It is available only when a 0.3 megapixel color camera is connected.

When CR is selected

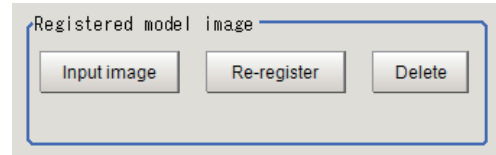
Setting item	Set value [Factory default]	Description
Rotation	<ul style="list-style-type: none"> • Checked • [Unchecked] 	When the measurement object is rotating, place a check at "Rotation" and specify how many degrees the model created rotates each time and through what range of angles. A smaller skipping angle increases stability, but slows down the processing. The forward direction is clockwise.
Angle range	[-180 to 180]	
Skipping angle	1 to 30 [5]	
Smart mode	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Checking the "Smart mode" option enables a high-speed rotation search. However, the stability may be lowered when the model shape aspect ratio is large or when the NOT mask is used.
Stab.	1 to 15 [The default value depend on the connected camera. 9 or 12]	Specify which is to have priority, measurement stability or speed. If lowering stability does not speed up processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab."
Prec.	1 to 3 [2]	Specify which is to have priority, measurement positional precision or speed.

When PT is selected

Setting item	Set value [Factory default]	Description
Angle range	[-180 to 180]	This item specifies the rotation angle range for searching. The normal direction is clockwise.
Stability	1 to 5 [3]	If lowering stability does not speed up processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab."

Displaying/Re-Registering/Deleting a Model

If you save the model registration image, it is easy to re-register the model after model parameters are changed.



Item	Description
Disp model/Input image	The model image display and input image display are switched.
Re-register	When model parameters are modified, display the original model image and re-register the model.
Delete	Deletes a model.

Region Setting (Search)

Use a rectangle to specify the area where the model is searched. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time.

1 In the Item Tab area, click [Region setting].

2 Click [Edit].

The figure setting area is displayed.

3 Specify the area in which to search for the model.

The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.

4 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Detection Point (Search)

Specify a position in the model that should be used as the detection coordinates during measurement. Usually, the central position of the set model is registered as the detection point. This function is used to change to any desired position.

A detection point can be set either directly or by referencing a unit.

Note

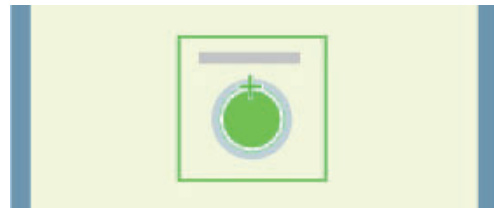
- After changing the detection point coordinates to another position, re-registering the model will change it back to the center coordinates of the model.

Specifying directly

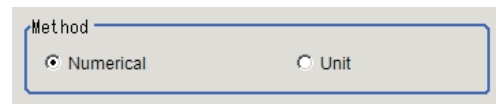
Click a position on the image you want to use as a detection point, or input coordinate data for that point.

- 1 In the Item Tab area, click [Detection point].**

In the Display area, the current detection point is displayed with a crosshair cursor.



- 2 In the "Method" area, select "Numerical".**

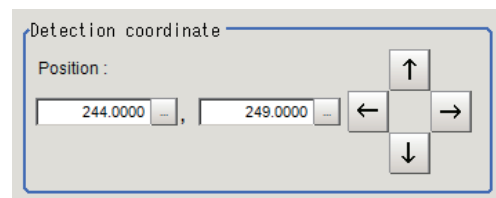


- 3 Click the position to be set as the detection point.**

Note

- Displaying the image enlarged makes this clicking easier.
Reference: ► "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

- 4 Make fine adjustments using numeric value inputs or the arrow buttons as required.**



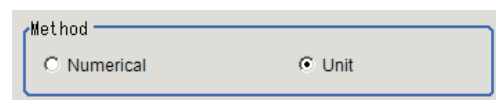
Referencing a unit

Set a detection point by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

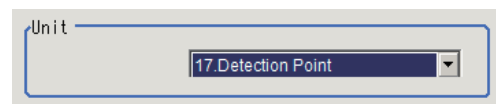
- 1 In the Item Tab area, click [Detection point].**

In the Display area, the current detection point is displayed with a crosshair cursor.

- 2 In the "Method" area, select "Unit".**



- 3 In the scene in the "Unit" area, select a detection point unit.**



- 4 Perform the next measurement, and the detection point will be displayed.**

Reference Setting (Search)

When the model is set, this position is automatically set at the same time as the reference position. This item can be set to change the reference position to any desired position. This is handy for measuring the position deviation from a certain position.

A reference position can be set either directly or by referencing a unit.

Specifying directly

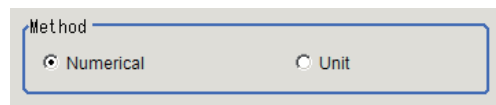
Click a position on the image you want to use as a reference position, or input coordinate data for that point.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.



2 In the "Method" area, select "Numerical".

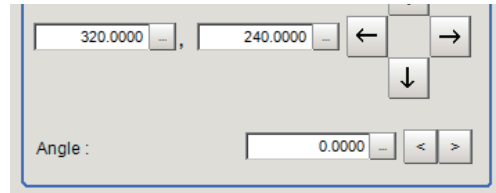


3 Click the position to be set as the reference.

Note

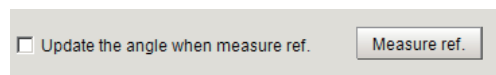
- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

4 Make fine adjustments using numeric value inputs or the arrow buttons as required.

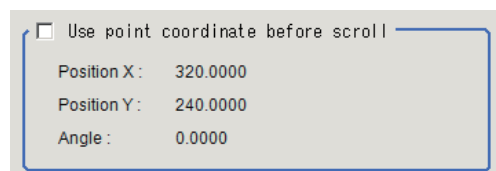


5 Set the reference angle with a numeric value.

6 To remeasure on the displayed image and set the reference, click the [Measure ref.] button. To update the reference angle at the time of reference measurement, place a check at "Update the angle when measure ref.".



7 To use data before position compensation for the reference setting coordinates, place a check at "Use point coordinate before scroll".



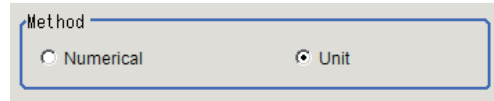
Referencing a unit

Set a reference by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

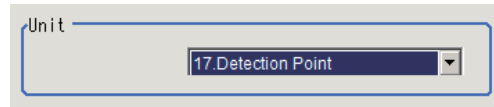
1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.

2 In the "Method" area, select "Unit".



3 In the scene in the "Unit" area, select a detection point unit.



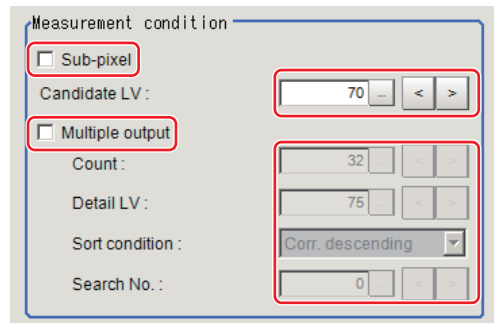
4 Perform the next measurement, and the reference will be displayed.

Measurement Parameters (Search)

Specify the search measurement conditions and the judgement conditions for the measurement results.

1 In the Item Tab area, click [Measurement].

2 In the "Measurement condition" area, specify a value for each item.



Setting item	Set value [Factory default]	Description
Sub-pixel	<ul style="list-style-type: none"> • Checked • [Unchecked] 	When a check is placed at sub-pixel, the position information can be measured in units of sub-pixels. However, this requires more processing time.
Candidate LV	0 to 100 [70]	Specify the threshold value with which to detect candidate points in a rough search. Specify a smaller value when model search results are unreliable.

When executing a multi search

Setting item	Set value [Factory default]	Description
Multiple output	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select to execute a multi searches.
Count	1 to 128 [32]	This executing item is available when Multi search is executed. Specify the maximum number of detections. If it detects more objects than the specified value, these matches are sorted out to output up to the specified value from the top.
Detail LV	0 to 100 [75]	Specify the threshold value with which to detect candidate points in a detail search.

Setting item	Set value [Factory default]	Description
Sort condition	<ul style="list-style-type: none"> • Corr. ascending • [Corr. descending] • X coordinate ascending • X coordinate descending • Y coordinate ascending • Y coordinate descending 	Specify the conditions by which the search number is re-assigned. When sorting referencing the X and Y coordinates, the upper left is the origin.
Search No.	0 to 127 [0]	Specify which of the multiple detection results will be used as measured results.

3 When the setting has been changed, click [Measure] in the Detail area to verify whether measurements can be made correctly.

Test measuring of this item.

Measure

4 Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Setting item	Set value	Description
Count	0 to 128	Specify the number of detections that are judged to be OK.
Measure X	-99999.9999 to 99999.9999	Specify the range of X-axis shifting that is judged to be OK.
Measure Y	-99999.9999 to 99999.9999	Specify the range of Y-axis shifting that is judged to be OK.
Search angle	-180 to 180	Specify the range of angles that are judged to be OK.
Correlation	0 to 100	Specify the range of correlation values that are judged to be OK. However, when the correlation value of the measurement result is 0, the judgement result will be NG regardless of the lower limit setting.

Output Parameters (Search)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none">• [After scroll]• Before scroll	As measurement results, select whether to output coordinate values to external devices before or after the position deflection correction is applied.
Calibration	<ul style="list-style-type: none">• [OFF]• ON	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none">• [ON]• OFF	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgment.

Key Points for Test Measurement and Adjustment (Search)

The following content is displayed in the "Detail result" area as text.

Important

- Executing test measurements will also update the measurement results and the figures in the image.

Displayed item	Description
Judge	Judgement result
Count	Count
Correlation value	Correlation value
Measure X	X coordinate of the position where the model is detected
Measure Y	Y coordinate of the position where the model is detected
Angle θ	Angle of the position where the model is detected

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Searching other positions

Parameter to be adjusted	Remedy
Model parameter	Specify a larger value for the "Prec."
	If the measurement results are unstable only when "Rotation" is selected, specify a smaller value for the "Skipping angle".
	When "Rotation" is selected, if the model shape is complex, uncheck the "Smart mode" option.
	If the image has low contrast or blurred edges, set the "Search mode" to "CR".
	If the model image consists of detailed figures, specify a larger value for "Stab."
Measurement parameter	If the precision is low, place a check at "Sub-pixel".
	If images that should be judged OK vary greatly, specify a smaller value for "Candidate LV".
	If the model image is small and unstable, specify a smaller value for the "Reduction".

The judgement is NG (insufficient memory)

Parameter to be adjusted	Remedy
Region setting	Make the search region as small as possible.
Model parameter	Bring "Stab." close to the factory default value.
	Bring the "Skipping angle" close to the factory default value.
	Specify a smaller value for "Prec."

When the processing speed is slow

Parameter to be adjusted	Remedy
Region setting	Make the search region as small as possible.
Model registration	Make the area to register as the model as small as possible.
Model parameter	If the model image is a simple figure or a large figure, specify a smaller value for "Stab." If lowering stability does not speed up processing, it is likely that many candidates have been detected. Raise the "Candidate LV" in [Measurement].
	When "Rotation" is selected and the model image is a simple figure, specify a larger value for "Skipping angle".
	When "Rotation" is selected and the model image is a simple figure, place a check at "Smart mode".
	If the position precision is high, specify a smaller value for "Prec."
	If the rotation angle range is large, set the "Search mode" to "PT".
Measurement parameter	If images that should be judged OK vary little, specify a larger value for "Candidate LV".
	If the position precision is high, uncheck "Sub-pixel".

Measurement Results for Which Output Is Possible (Search)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement result	JG	Judgement result
Count	C	Number of search items detected If none detected, 0
Correlation value	CR	Correlation value with the model
Measurement coordinate X	X	X coordinate of the position where the model is detected
Measurement coordinate Y	Y	Y coordinate of the position where the model is detected
Measurement angle	TH	Angle of the position where the model is detected
Reference position X	SX	X coordinate of the reference position of the registered model
Reference position Y	SY	Y coordinate of the reference position of the registered model
Reference angle	ST	Angle of the registered model
Detection point RX	RX	X coordinate of the registered model
Detection point RY	RY	Y coordinate of the registered model
Correlation value N (N = 00 to 127)	CRN	Detected search N correlation value (N = 00 to 127)
Position N (N = 00 to 127)	XN	Detected search N position X (N = 00 to 127)
Position N (N = 00 to 127)	YN	Detected search N position Y (N = 00 to 127)
Angle N (N = 00 to 127)	THN	Detected search N angle TH (N = 00 to 127)

External Reference Tables (Search)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
5	Correlation value	Get only	0 to 100
6	Measure X	Get only	-99999.9999 to 99999.9999
7	Measure Y	Get only	-99999.9999 to 99999.9999
8	Measurement angle	Get only	-180 to 180
9	Reference X ^{*1}	Get only	-99999.9999 to 99999.9999
10	Reference Y ^{*1}	Get only	-99999.9999 to 99999.9999
11	Reference angle	Get only	-180 to 180
12	Detected coordinate X	Get only	-99999.9999 to 99999.9999
13	Detected coordinate Y	Get only	-99999.9999 to 99999.9999
14	Count	Get only	0 to 128
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Search mode	Set/Get	0: Correlation 1: Shape
121	With rotation	Set/Get	0: OFF 1: ON
122	Upper limit of the rotation angle	Set/Get	-180 to 180
123	Lower limit of the rotation angle	Set/Get	-180 to 180
124	Skipping angle	Set/Get	1 to 30
125	Smart mode	Set/Get	0: OFF 1: ON
126	Stab. (CR)	Set/Get	1 to 15
127	Prec.	Set/Get	1 to 3
128	Stab. (PT)	Set/Get	1 to 5
129	Reference X ^{*2}	Set/Get	0 to 99999.9999
130	Reference Y ^{*2}	Set/Get	0 to 99999.9999
132	Detection point X	Set/Get	0 to 99999.9999
133	Detection point Y	Set/Get	0 to 99999.9999
134	Sub-pixel	Set/Get	0: OFF 1: ON
135	Candidate Point Level	Set/Get	0 to 100

No.	Data name	Set/Get	Data range
136	Upper limit of measure X	Set/Get	-99999.9999 to 99999.9999
137	Lower limit of measure X	Set/Get	-99999.9999 to 99999.9999
138	Upper limit of measure Y	Set/Get	-99999.9999 to 99999.9999
139	Lower limit of measure Y	Set/Get	-99999.9999 to 99999.9999
140	Upper limit of the angle	Set/Get	-180 to 180
141	Lower limit of the angle	Set/Get	-180 to 180
142	Upper limit of the corr.	Set/Get	0 to 100
143	Lower limit of the corr.	Set/Get	0 to 100
144	Save registered model	Set/Get	0: OFF 1: ON
145	Candidate Point Level	Set/Get	0 to 100
146	Sort order	Set/Get	0: Correlation value ascending 1: Correlation value descending 2: X ascending 3: X descending 4: Y ascending 5: Y descending
147	Search No.	Set/Get	0 to 127
148	Upper limit of count judgement	Set/Get	0 to 128
149	Lower limit of count judgement	Set/Get	0 to 128
150	Multiple output	Set/Get	0: OFF 1: ON
151	Setting unit of reference coordinate	Set/Get	-1 to 9,999
152	Setting type of reference coordinate	Set/Get	0: Numerical 1: Unit
153	Update the reference angle	Set/Get	0: Not update 1: Update
154	Reference angle	Set/Get	-180 to 180
155	Setting unit of detection coordinate	Set/Get	-1 to 9,999
156	Setting type of detection coordinate	Set/Get	0: Numerical 1: Unit
157	Use point coordinate before scroll	Set/Get	0: Not use 1: Use
158	Position X before scroll	Set/Get	-99999.9999 to 99999.9999
159	Position Y before scroll	Set/Get	-99999.9999 to 99999.9999
160	Angle before scroll	Set/Get	-180 to 180
161	Count	Set/Get	1 to 128
1000 + NN × 4 (NN = 0 to 31)	Correlation value	Get only	0 to 100
1001 + NN × 4 (NN = 0 to 31)	Measure X	Get only	-99999.9999 to 99999.9999
1002 + NN × 4 (NN = 0 to 31)	Measure Y	Get only	-99999.9999 to 99999.9999

No.	Data name	Set/Get	Data range
1003 + NN × 4 (NN = 0 to 31)	Measure angle	Get only	-180 to 180
5100	Re-register	Set only	1: Execute
30000	Correlation value	Get only	0 to 100
40000	Edge position X	Get only	0 to 99999.9999
50000	Edge position Y	Get only	0 to 99999.9999
60000	Measure angle	Get only	-180 to 180

*1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.

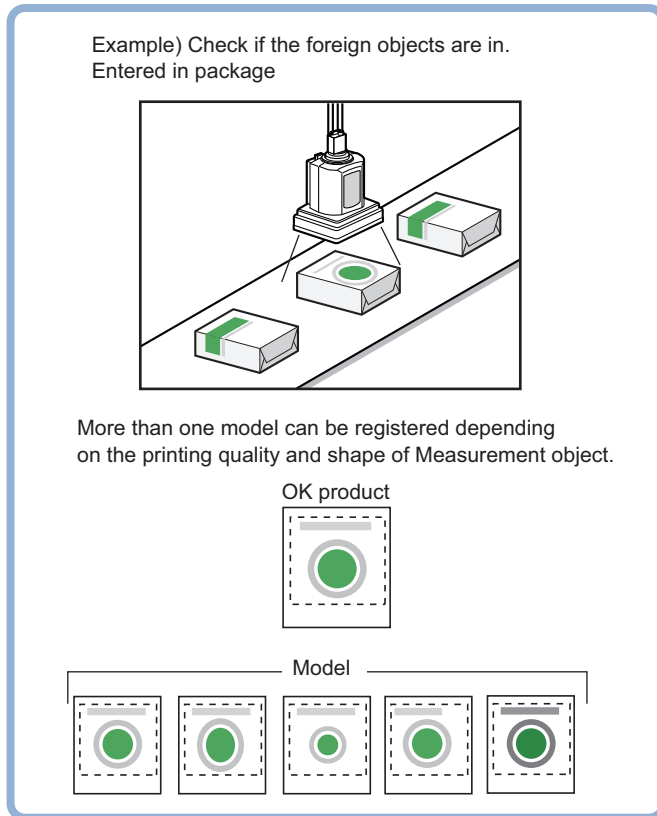
*2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.

Flexible Search

In Flexible Search, multiple measurement object features (models) are registered beforehand. Parts from input images that most resemble the multiple models are searched for, and correlation (similarity) and position are determined.

Used in the Following Case

- To treat models with only slight variations as the same and prevent excessive filtering out.



Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

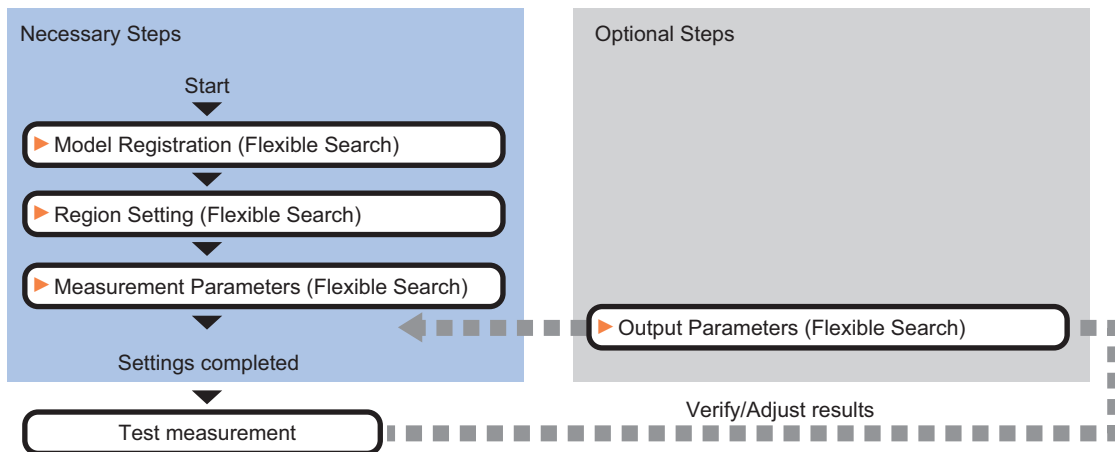
Note

- Search processing basic concepts

Reference: ▶ "Appendix Measurement Mechanism Search Processing Mechanism" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Settings Flow (Flexible Search)

Set up flexible search according to the following steps.



List of Flexible Search Items

Item name	Description
Model register	This item registers the pattern characteristic of the measurement image as a model. Model parameter values can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used. Reference: ▶ Model Registration (Flexible Search) (p.113)
Region setting	This item is used to set up the measurement area. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. Reference: ▶ Region Setting (Flexible Search) (p.115)
Measurement	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if the X and Y coordinates and the correlation with the model are OK. Reference: ▶ Measurement Parameters (Flexible Search) (p.116)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (Flexible Search) (p.117)

Model Registration (Flexible Search)

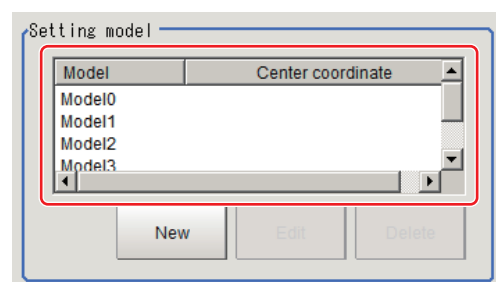
Register the parts to measure as the model.

A total of 5 models, 0 through 4, can be registered, with no restriction on the size.

If a model has different printing qualities and shapes, more than one models should be registered.

The position at the time of registration is also registered in the model information. Place the measurement object in the correct position when registering a model.

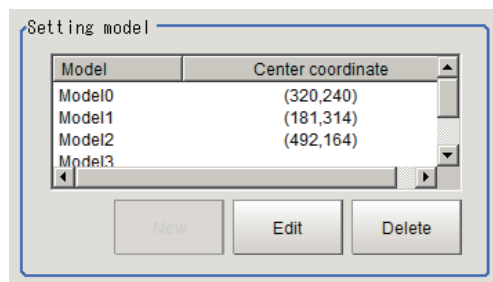
- 1** In the Item Tab area, click [Model register].
- 2** In the "Setting model" area, select a model and click [New].



3 Use the drawing tools to specify the model registration range.

4 Click [OK] in the Figure setting area.

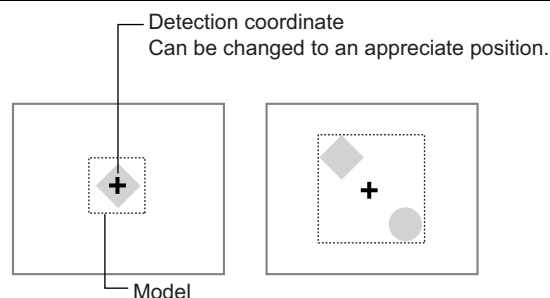
- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.



5 To register two or more models, repeat the Steps Reference: ▶ 2 (p.113) to Reference: ▶ 4 (p.114).

Important

- When a model is registered, the center of the model is registered as the detection point. A detection point is a point output as a measurement value. If multiple figures are combined, the central coordinates of the circumscribed rectangle are registered.

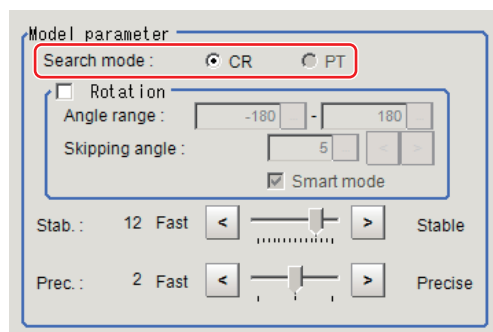


Changing Model Parameters

Model parameter values can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used.

After changing a setting, re-register the model.

1 In the "Model parameter" area, select the search mode, then specify a value for each item for that mode.



Setting item	Set value [Factory default]	Description
Search mode	[CR]	Search for normalizing the brightness. This method can provide stable measurement when there is fluctuation in the overall brightness and when the image has low contrast.
	PT	Measures the degree of matching with the model profile. This method can measure at higher speed when the rotation angle has a wide range. It is available only when a 0.3 megapixel color camera is connected.

When CR is selected

Setting item	Set value [Factory default]	Description
Rotation	<ul style="list-style-type: none"> • Checked • [Unchecked] 	When the measurement object is rotating, place a check at "Rotation" and specify how many degrees the model created rotates each time and through what range of angles. A smaller skipping angle increases stability, but slows down the processing. The normal direction is clockwise.
Angle range	[-180 to 180]	
Skipping angle	1 to 30 [5]	
Smart mode	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Checking the "Smart mode" option enables a high-speed rotation search. However, the stability may be lowered when the model shape aspect ratio is large or when the NOT mask is used.
Stab.	1 to 15 [The default value depend on the connected camera. 9 or 12]	Specify which is to have priority, measurement stability or speed. If lowering stability does not speed up processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab."
Prec.	1 to 3 [2]	Specify which is to have priority, measurement positional precision or speed.

When PT is selected

Setting item	Set value [Factory default]	Description
Angle range	[-180 to 180]	This item specifies the rotation angle range for searching. The normal direction is clockwise.
Stab.	1 to 5 [3]	If lowering stability does not speed up processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate LV" or "Stab."

Region Setting (Flexible Search)

Use a rectangle to specify the area where the model is searched.

Instead of measuring the entire input image, narrowing the measurement area shortens the processing time.

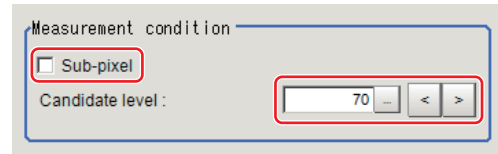
- 1** In the Item Tab area, click [Region setting].
- 2** Click [Edit].
The figure setting area is displayed.
- 3** Specify the area in which to search for the model.
The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.
- 4** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

Measurement Parameters (Flexible Search)

Specify the search measurement conditions and the judgement conditions for the measurement results.

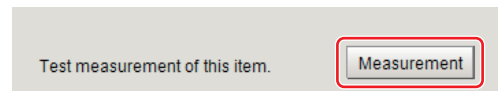
1 In the Item Tab area, click [Measurement].

2 In the "Measurement condition" area, specify a value for each item.



Setting item	Set value [Factory default]	Description
Sub-pixel	<ul style="list-style-type: none"> • Checked • [Unchecked] 	When a check is placed at sub-pixel, the position information can be measured in units of sub-pixels. However, this requires more processing time.
Candidate level	0 to 100 [70]	Specify the threshold value with which to detect candidate points in a rough search. Specify a smaller value when model search results are unreliable.

3 When the setting has been changed, click [Measurement] in the Detail area to verify whether measurements can be made correctly.



4 Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Setting item	Set value	Description
Position X	-99999.9999 to 99999.9999	Specify the range of X-axis shifting that is judged to be OK.
Position Y	-99999.9999 to 99999.9999	Specify the range of Y-axis shifting that is judged to be OK.
Search angle	-180 to 180	Specify the range of angles that are judged to be OK.
Correlation	0 to 100	Specify the range of correlation values that are judged to be OK. However, when the correlation value of the measurement result is 0, the judgement result will be NG regardless of the lower limit setting.

Output Parameters (Flexible Search)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

1 Click [Output parameter] in the Item Tab area.

2 Specify each of the following items.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none">• [After scroll]• Before scroll	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none">• [OFF]• ON	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none">• [ON]• OFF	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgment.

Key Points for Test Measurement and Adjustment (Flexible Search)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Model number	Model No. of the biggest correlation
Correlation	Correlation value
Position X	X coordinate of the position where the model is detected
Position Y	Y coordinate of the position where the model is detected
Angle θ	Angle of the position where the model is detected

Note

- If the model is an ellipse, its circumscribing rectangle is displayed as the search result of the model.

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Searching other positions

Parameter to be adjusted	Remedy
Model parameter	Specify a larger value for the "Prec."
	If the measurement results are unstable only when "Rotation" is selected, specify a smaller value for the "Skipping angle".
	When "Rotation" is selected, if the model shape is complex, uncheck the "Smart mode" option.
	If the image has low contrast or blurred edges, set the "Search mode" to "CR".
	If the model image consists of detailed figures, specify a larger value for "Stab."
Measurement	If the precision is low, place a check at "Sub-pixel".
	If images that should be judged OK vary greatly, specify a smaller value for "Candidate LV".
	If the model image is small and unstable, specify a smaller value for the "Reduction".

The judgement is NG (insufficient memory)

Parameter to be adjusted	Remedy
Region setting	Make the search region as small as possible.
Model parameter	Bring "Stab." close to the factory default value.
	Bring the "Skipping angle" close to the factory default value.
	Specify a smaller value for "Prec."

When the processing speed is slow

Parameter to be adjusted	Remedy
Region setting	Make the search region as small as possible.
Model register	Make the area to register as the model as small as possible.
Model parameter	If the model image is a simple figure or a large figure, specify a smaller value for "Stab." If lowering stability does not speed up processing, it is likely that many candidates have been detected. Raise the "Candidate level" in [Measurement].
	When "Rotation" is selected and the model image is a simple figure, specify a larger value for "Skipping angle".
	When "Rotation" is selected and the model image is a simple figure, place a check at "Smart mode".
	If the position precision is high, specify a smaller value for "Prec."
	If the rotation angle range is large, set the "Search mode" to "PT".
Measurement	If images that should be judged OK vary little, specify a larger value for "Candidate level".
	If the position precision is high, uncheck "Sub-pixel".

Measurement Results for Which Output Is Possible (Flexible Search)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judgement result
Model No.	NO	Model No. of the biggest correlation
Correlation value	CR	Correlation value with the model
Measurement coordinate X	X	X coordinate of the position where the model is detected
Measurement coordinate Y	Y	Y coordinate of the position where the model is detected
Measurement angle	TH	Angle of the position where the model is detected
Reference position X	SX	X coordinate of the reference position of the registered model
Reference position Y	SY	Y coordinate of the reference position of the registered model
Reference angle	ST	Angle of the registered model
Detection point RX	RX	X coordinate of the registered model
Detection point RY	RY	Y coordinate of the registered model

External Reference Tables (Flexible Search)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Model No.	Get only	0 to 4 -1: No models found
6	Correlation value	Get only	0 to 100
7	Measure X	Get only	-99999.9999 to 99999.9999
8	Measure Y	Get only	-99999.9999 to 99999.9999
9	Measure angle	Get only	-180 to 180
10	Reference X	Get only	-99999.9999 to 99999.9999
11	Reference Y	Get only	-99999.9999 to 99999.9999
12	Reference angle	Get only	-180 to 180
13	Detection point X	Get only	-99999.9999 to 99999.9999
14	Detection point Y	Get only	-99999.9999 to 99999.9999
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Search mode	Set/Get	0: Correlation 1: Shape
121	With rotation	Set/Get	0: OFF 1: ON
122	Upper limit of the rotation angle	Set/Get	-180 to 180
123	Lower limit of the rotation angle	Set/Get	-180 to 180

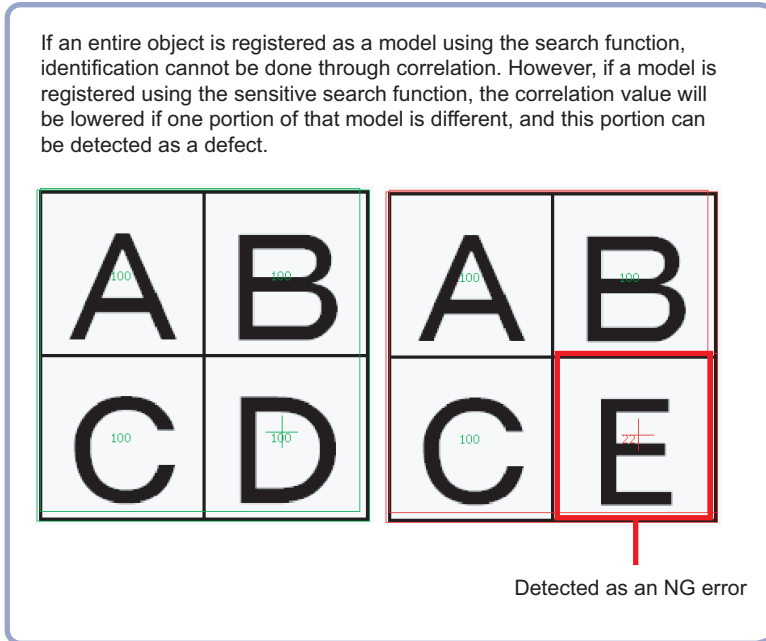
No.	Data name	Set/Get	Data range
124	Skipping angle	Set/Get	1 to 30
125	Smart mode	Set/Get	0: OFF 1: ON
126	Stab. (CR)	Set/Get	1 to 15
127	Prec.	Set/Get	1 to 3
128	Stab. (PT)	Set/Get	1 to 5
134	Sub-pixel	Set/Get	0: OFF 1: ON
135	Candidate Point Level	Set/Get	0 to 100
136	Upper limit of measure X	Set/Get	-99999.9999 to 99999.9999
137	Lower limit of measure X	Set/Get	-99999.9999 to 99999.9999
138	Upper limit of measure Y	Set/Get	-99999.9999 to 99999.9999
139	Lower limit of measure Y	Set/Get	-99999.9999 to 99999.9999
140	Upper limit of the angle	Set/Get	-180 to 180
141	Lower limit of the angle	Set/Get	-180 to 180
142	Upper limit of the corr.	Set/Get	0 to 100
143	Lower limit of the corr.	Set/Get	0 to 100

Sensitive Search

The registered models are automatically finely divided and matched in detail. Of the divided models, the one with the lowest correlation is output. Sensitive search is suitable when the difference between the model image and measurement image is small and regular searches do not produce differences in correlation.

Used in the Following Case

- When identifying the shape of the divided area

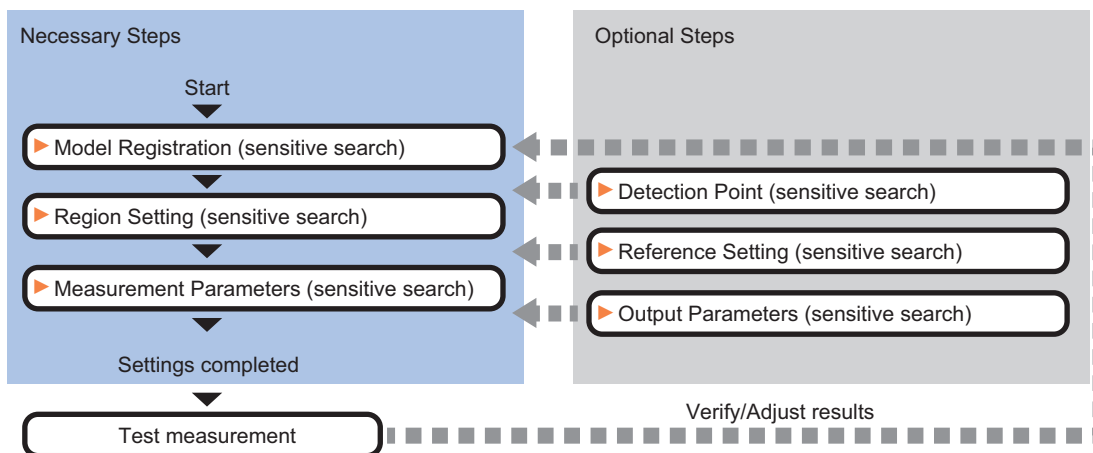


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Sensitive Search)

Set up sensitive search according to the following steps.



List of Sensitive Search Items

Item name	Description
Model	This item registers the pattern characteristic of the measurement image as a model. Model parameter values can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used. Reference: ▶ Model Registration (Sensitive Search) (p.122)
Region setting	This item is used to set up the measurement area. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. Reference: ▶ Region Setting (Sensitive Search) (p.125)
Detection point	This item can be changed if necessary. Specify a position in the model that should be used as the detection coordinates during measurement. Usually, the central position of the set model is registered as the detection coordinates. Reference: ▶ Detection Point (Sensitive Search) (p.125)
Ref. setting	This item can be changed if necessary. Specify the reference position within the camera's field of view. Reference: ▶ Reference Setting (Sensitive Search) (p.126)
Measurement	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if the X and Y coordinates and the correlation values with the model are OK. Reference: ▶ Measurement Parameters (Sensitive Search) (p.128)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (Sensitive Search) (p.129)

Model Registration (Sensitive Search)

Register the parts to measure as the model.

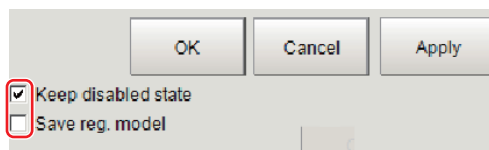
The position at the time of registration is also registered in the model information. Place the measurement object in the correct position when registering a model.

1 In the Item Tab area, click [Model].

When setting a new model, you do not have to click [Model].

2 Use the drawing tools to specify the model registration range.

3 To save the entire image used for model registration, place a check at the "Save reg. model" option. Also, when registering a model but not holding the disable setting for the sub-region set during the last time the model was registered, uncheck the "Keep disabled state" option.



Setting item	Set value [Factory default]	Description
Keep disabled state	<ul style="list-style-type: none"> • [Checked] • [Unchecked] 	When the model is registered, this holds the disable setting for the sub-region set during the last time the model was registered.
Save reg. model	<ul style="list-style-type: none"> • [Checked] • [Unchecked] 	To save the entire image used for model registration, place a check at this option.

4 Click [OK] / [Apply] in the Figure setting area.

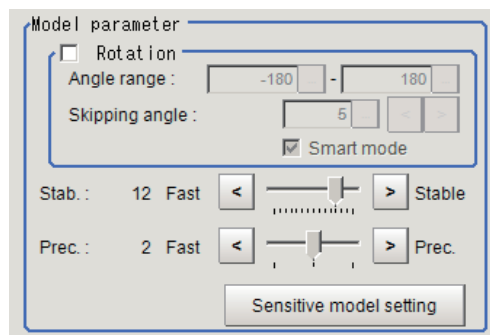
- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.1

Changing Model Parameters

Model parameter values can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used.

After changing a setting, re-register the model.

- 1 In the "Model parameter" area, set each item.

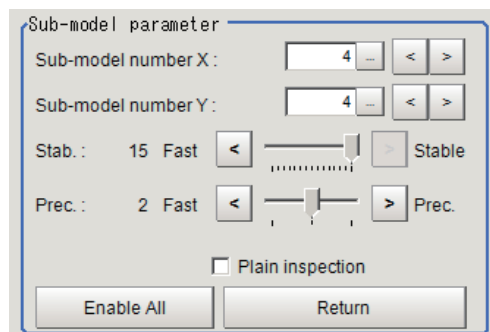


Setting item	Set value [Factory default]	Description
Rotation	<ul style="list-style-type: none"> • Checked • [Unchecked] 	When the measurement object is rotating, place a check at "Rotation" check box and specify how many degrees the model created rotates each time and through what range of angles. A smaller skipping angle increases stability, but slows down the processing. The normal direction is clockwise.
Angle range	[-180 to 180]	
Skipping angle	1 to 30 [5]	
Smart mode	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Checking the "Smart mode" option enables a high-speed rotation search. However, the stability may be lowered when the model shape aspect ratio is large or when the NOT mask is used.
Stab.	1 to 15 [The default value depend on the connected camera. 9 or 12]	Specify which is to have priority, measurement stability or speed. If lowering stability does not speed up processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate level" or "Stab."
Prec.	1 to 3 [2]	Specify which is to have priority, measurement positional precision or speed.

Changing Sub-model parameter

Set the "Sensitive model setting" as necessary.

- 1 Click [Sensitive model setting] in the model parameter.
- 2 Set up the Sub-model parameter.



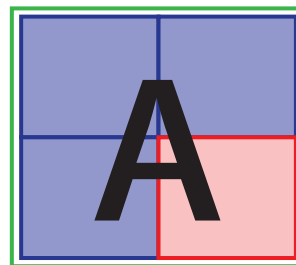
Setting item	Set value [Factory default]	Description
Sub-model number X	0 to 10 [4]	This sets the number of divisions of the registered model in the X direction.
Sub-model number Y	0 to 10 [4]	This sets the number of divisions of the registered model in the Y direction.
Stab.	1 to 15 [The default value depend on the connected camera. 12 or 15]	Specify which is to have priority, measurement stability or speed. If lowering stability does not speed up processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate level" or "Stab."
Prec.	1 to 3 [2]	Specify which is to have priority, measurement positional precision or speed.
Plain inspection	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Specify whether or not to inspect the plain region.

Disabled setting

You can specify enable/disable of each sub-region.

- 1 Click the region you wish to disable and select "Disabled".**

To release the disabling of a region, click "Enable All".

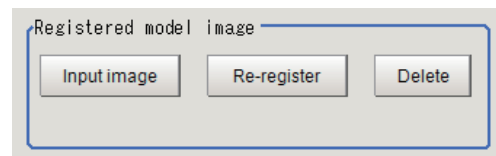


←Set as invalid

Divided model regions

Displaying/Re-Registering/Deleting a Model

If you save the model registration image, it is easy to re-register the model after model parameters are changed.



Item	Description
Disp model/Input image	The model image display and input image display are switched.
Re-register	When model parameters are modified, display the original model image and re-register the model.
Delete	Deletes a model.

Region Setting (Sensitive Search)

Use a rectangle to specify the area where the model is searched.

Instead of measuring the entire input image, narrowing the measurement area shortens the processing time.

1 In the Item Tab area, click [Region setting].

2 Click [Edit].

The figure setting area is displayed.

3 Specify the area in which to search for the model.

The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.

4 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Detection Point (Sensitive Search)

Specify a position in the model that should be used as the detection coordinates during measurement. Usually, the center position of the set model is registered as the detection point. This function is used to change to any desired position.

A detection point can be set either directly or by referencing a unit.

Note

- After changing the detection point coordinates to another position, re-registering the model will change it back to the center coordinates of the model.

Specifying directly

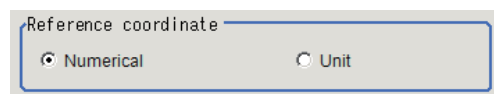
Click a position on the image you want to use as a detection point, or input coordinate data for that point.

1 In the Item Tab area, click [Detection point].

In the Display area, the current detection point is displayed with a crosshair cursor.



2 In the "Method" area, select "Numerical".

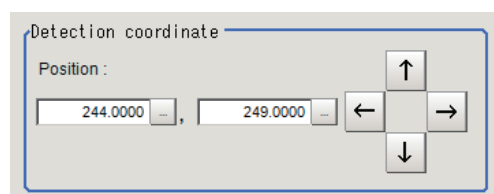


3 Click the position to be set as the detection point.

Note

- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

4 Make fine adjustments using numeric value inputs or the arrow buttons as required.



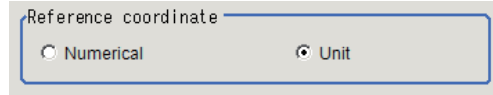
Referencing a unit

Set a detection point by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

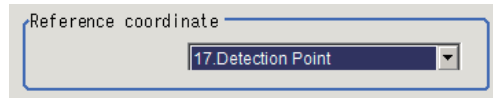
1 In the Item Tab area, click [Detection point].

In the Display area, the current detection point is displayed with a crosshair cursor.

2 In the "Method" area, select "Unit".



3 In the scene in the "Reference coordinate" area, select a detection point unit.



4 Perform the next measurement, and the detection point will be displayed.

Reference Setting (Sensitive Search)

When the model is set, this position is automatically set at the same time as the reference position. This item can be used to change the reference position to any desired position. This is handy for measuring the position deviation from a certain position.

A reference position can be set either directly or by referencing a unit.

Specifying directly

Click a position on the image you want to use as a reference position, or set coordinate data for that point.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.



2 In the "Method" area, select "Numerical".

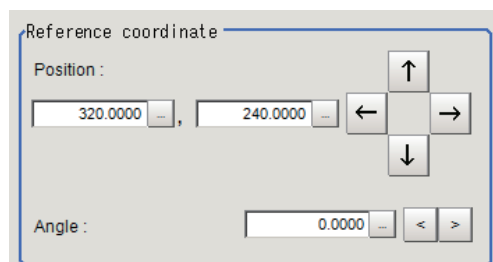


3 Click the position to be set as the reference.

Note

- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

4 Make fine adjustments using numeric value inputs or the arrow buttons as required.



5 Set the reference angle with a numeric value.

6 To remeasure on the displayed image and set the reference, click the [Measure ref.] button. To update the reference angle at the time of reference measurement, place a check at "Update the angle when measure ref.".

Update the angle when measure ref. Measure ref.

7 To use data before position compensation for the reference setting coordinates, place a check at "Use point coordinate before scroll".

Use point coordinate before scroll

Position X : 320.0000
Position Y : 240.0000
Angle : 0.0000

Referencing a unit

Set a reference by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.

2 In the "Method" area, select "Unit".

Method

Numerical Unit

3 In the scene in the "Unit" area, select a detection point unit.

Unit

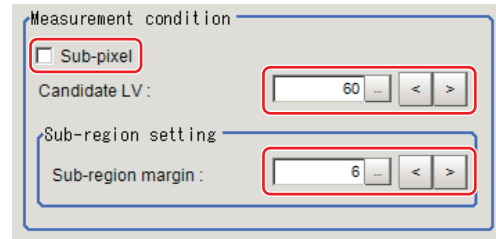
1.Detection Point

4 Perform the next measurement, and the reference will be displayed.

Measurement Parameters (Sensitive Search)

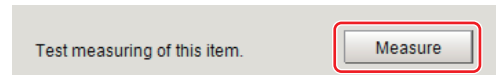
Specify the sensitive search measurement conditions and the judgement conditions for the measurement results.

- 1 In the Item Tab area, click [Measurement].
- 2 In the "Measurement condition" area, specify a value for each item.



Setting item	Set value [Factory default]	Description
Sub-pixel	<ul style="list-style-type: none"> • Checked • [Unchecked] 	When a check is placed at sub-pixel, the position information can be measured in units of sub-pixels. However, this requires more processing time.
Candidate LV	0 to 100 [60]	Specify the threshold value with which to detect candidate points in a rough search. Specify a smaller value when model search results are unstable.
Sub-region margin	0 to 10 [6]	How large a region to use for the divided model search range for the divided model size is specified in units of pixels. If 6 is set, an area that is the model size expanded by 6 pixels up, down, left, and right is the search range.

- 3 When the setting has been changed, click [Measure] in the "Detail" area to verify whether measurements can be made correctly.



- 4 Set up the judgement condition.

Setting item	Set value	Description
Measure X	-99999.9999 to 99999.9999	Specify the range of X-axis shifting that is judged to be OK.
Measure Y	-99999.9999 to 99999.9999	Specify the range of Y-axis shifting that is judged to be OK.
Search angle	-180 to 180	Specify the range of angles that are judged to be OK.
Correlation	0 to 100	Specify the range of correlation values that are judged to be OK. However, when the correlation value of the measurement result is 0, the judgement result will be NG regardless of the lower limit setting.
Deviation	For color cameras: 0 to 221 For monochrome cameras: 0 to 127	Specify the range of density deviations that are judged to be OK. The higher the proportion of plain sections, the higher this value. This is enabled when plain inspection is set in the sensitive model settings.
NG Sub-region	0 to 100	Specify the range of NG sub-region that are judged to be OK.

Output Parameters (Sensitive Search)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Set value [Factory default]	Description	
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position deflection correction is applied.	
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.	
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgment.	
Display cursor setting			
	Position	<ul style="list-style-type: none"> • [ON] • OFF 	The measurement coordinate position of the detected model is displayed at the cursor.
	Sub-region	<ul style="list-style-type: none"> • Display • [OFF] 	The coordinate position of the region with the lowest correlation value of the sub-regions is displayed at the cursor.

Key Points for Test Measurement and Adjustment (Sensitive Search)

The following content is displayed in the "Detail result" area as text.

Note

- Executing test measurements will also update the measurement results and the figures in the image.

Displayed items	Description
Judge	Judgement result
Correlation	Lowest correlation value in the sub-region
Position X	X coordinate of the position where the model is detected
Position Y	Y coordinate of the position where the model is detected
Angle θ	Angle of the position where the model is detected
Deviation	Highest density deviation in the sub-region
NG Sub-region	NG region count

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Searching other positions

Parameter to be adjusted	Remedy
Model parameter	Specify a larger value for the "Prec."
	If the measurement results are unstable only when "Rotation" is selected, specify a smaller value for the "Skipping angle".
	When "Rotation" is selected, if the model shape is complex, uncheck the "Smart mode" option.
	If the model image consists of detailed figures, specify a larger value for "Stab."
Sub-model parameter	If images that should be judged OK vary greatly, specify a larger value for "Sub-model number X" and "Sub-model number Y".
Measurement	If the precision is low, place a check at "Sub-pixel".
	If images that should be judged OK vary greatly, specify a smaller value for "Candidate level".
	If images that should be judged OK vary greatly, specify a larger value for "Sub-region margin".

The judgement is NG (insufficient memory)

Parameter to be adjusted	Remedy
Region setting	Make the search region as small as possible.
Model parameter	Bring "Stab." close to the factory default value.
	Bring the "Skipping angle" close to the factory default value.
	Specify a smaller value for "Prec."
Sub-model parameter	Specify a larger value for "Sub-model number X" and "Sub-model number Y".

When the processing speed is slow

Parameter to be adjusted	Remedy
Region setting	Make the search region as small as possible.
Model Registration	Make the area to register as the model as small as possible.
Model parameter	If the model image is a simple figure or a large figure, specify a smaller value for "Stab." If lowering stability does not speed up processing, it is likely that many candidates have been detected. Raise the "Candidate level" in [Measurement].
	When "Rotation" is selected and the model image is a simple figure, specify a larger value for "Skipping angle".
	When "Rotation" is selected and the model image is a simple figure, place a check at "Smart mode".
	If the position precision is high, specify a smaller value for "Prec."
Sub-model parameter	If images that should be judged OK vary greatly, specify a larger value for "Sub-model number X" and "Sub-model number Y".
Measurement parameter	If images that should be judged OK vary little, specify a larger value for "Candidate LV".
	If the position precision is high, uncheck "Sub-pixel".

Measurement Results for Which Output Is Possible (Sensitive Search)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judgement result
Correlation value	CR	Correlation value with the model
Deviation	DV	Deviation
Measurement coordinate X	X	X coordinate of the position where the model is detected
Measurement coordinate Y	Y	Y coordinate of the position where the model is detected
Measurement angle	TH	Angle of the position where the model is detected
Reference position X	SX	X coordinate of the reference position of the registered model
Reference position Y	SY	Y coordinate of the reference position of the registered model
Reference angle	ST	Angle of the registered model
Detection point coordinate X	RX	X coordinate of the registered model
Detection point coordinate Y	RY	Y coordinate of the registered model
NG sub-region	CT	NG region count
Sub-region Number	AN	Region number with the lowest correlation value
Sub-region Number(X)	ANX	X direction column number for the output region
Sub-region Number(Y)	ANY	Y direction line number for the output region
Sub-region Pos. X	DX	X coordinate of the detected sub-region
Sub-region Pos. Y	DY	Y coordinate of the detected sub-region
Correlation (sub-region N) (N = 0 to 99)	CRN	Correlation (sub-region N)
Deviation (sub-region N) (N = 0 to 99)	DVN	Deviation (sub-region N)

External Reference Tables (Sensitive Search)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
1	Correlation value	Get only	0 to 100
2	Deviation	Get only	For color cameras: 0.000 to 219.9705 For monochrome cameras: 0.000 to 127.000
3	Measure X	Get only	-99999.9999 to 99999.9999
4	Measure Y	Get only	-99999.9999 to 99999.9999
5	Measurement angle	Get only	-180 to 180
6	Detection point X	Get only	-99999.9999 to 99999.9999
7	Detection point Y	Get only	-99999.9999 to 99999.9999
8	Reference X ^{*1}	Get only	-99999.9999 to 99999.9999
9	Reference Y ^{*1}	Get only	-99999.9999 to 99999.9999
10	Reference angle	Get only	-180 to 180
11	NG Sub-region	Get only	0 to 100
12	Sub-region Number	Get only	0 to 99
13	Sub-region Number(X)	Get only	0 to 9
14	Sub-region Number(Y)	Get only	0 to 9
15	Sub-region Pos. X	Get only	-99999.9999 to 99999.9999
16	Sub-region Pos. Y	Get only	-99999.9999 to 99999.9999
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
121	With rotation	Set/Get	0: OFF 1: ON
122	Upper limit of the rotation angle	Set/Get	-180 to 180
123	Lower limit of the rotation angle	Set/Get	-180 to 180
124	Skipping angle	Set/Get	1 to 30
125	Smart mode	Set/Get	0: OFF 1: ON
126	Stability	Set/Get	1 to 15
127	Precision	Set/Get	1 to 3
129	Reference X ^{*2}	Set/Get	0 to 99999.9999
130	Reference Y ^{*2}	Set/Get	0 to 99999.9999
132	Detection point X	Set/Get	0 to 99999.9999
133	Detection point Y	Set/Get	0 to 99999.9999
134	Sub-pixel	Set/Get	0: OFF 1: ON
135	Candidate Point Level	Set/Get	0 to 100

No.	Data name	Set/Get	Data range
136	Upper limit of measure X	Set/Get	-99999.9999 to 99999.9999
137	Lower limit of measure X	Set/Get	-99999.9999 to 99999.9999
138	Upper limit of measure Y	Set/Get	-99999.9999 to 99999.9999
139	Lower limit of measure Y	Set/Get	-99999.9999 to 99999.9999
140	Upper limit of the angle	Set/Get	-180 to 180
141	Lower limit of the angle	Set/Get	-180 to 180
142	Upper limit of the corr.	Set/Get	0 to 100
143	Lower limit of the corr.	Set/Get	0 to 100
144	Save registered model	Set/Get	0: OFF 1: ON
145	Upper limit of deviation	Set/Get	For color cameras: 0 to 221 For monochrome cameras: 0 to 127
146	Lower limit of deviation	Set/Get	For color cameras: 0 to 221 For monochrome cameras: 0 to 127
147	Upper limit of NG Sub-region	Set/Get	0 to 100
148	Lower limit of NG Sub-region	Set/Get	0 to 100
149	Sub-region stab.	Set/Get	1 to 15
150	Sub-region prec.	Set/Get	1 to 3
151	Sub-model number X	Set/Get	1 to 10
152	Sub-model number Y	Set/Get	1 to 10
153	Plain inspection	Set/Get	0: OFF 1: ON
154	NG Sub-region (155,156 setting/ acquisition target)	Set/Get	0 to 99
155	Enabled/disabled of sub-region	Set/Get	0: Disabled 1: Enabled
157	Display cursor (position)	Set/Get	0: OFF 1: ON
158	Display cursor (Sub-region Pos.)	Set/Get	0: OFF 1: ON
159	Sub-region margin	Set/Get	0 to 10
165	Disabled region retention flag	Set/Get	0: Not retained 1 : Retained
1000 + N (N = 0 to 99)	Correlation value of sub-region	Get only	0 to 100
1100 + N (N = 0 to 99)	Deviation of sub-region	Get only	For color cameras: 0.000 to 219.9705 For monochrome cameras: 0.000 to 127.000

*1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.

*2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.

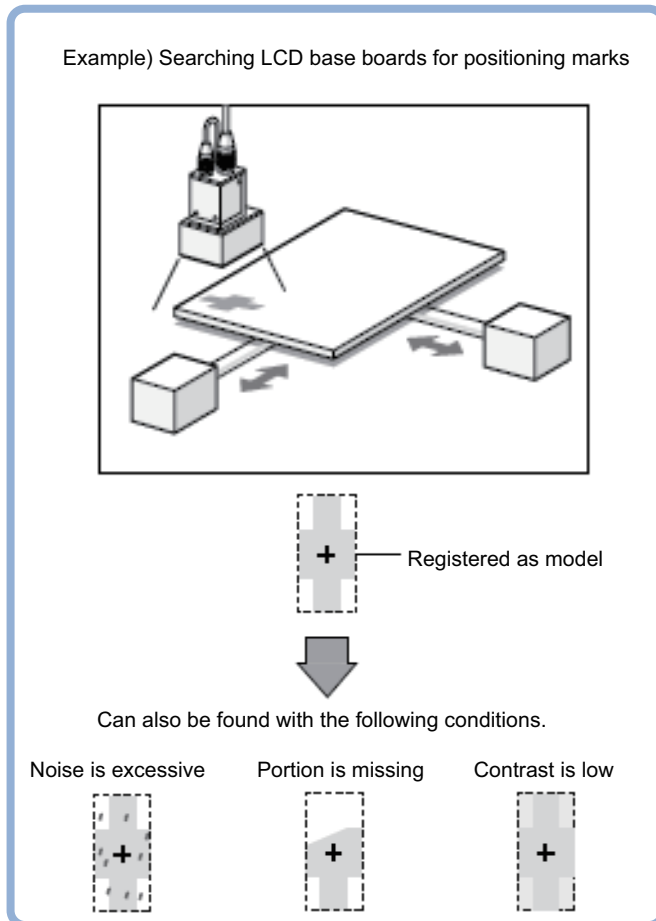
ECM Search

This processing item searches the input image for parts having a high degree of similarity to the target mark (model), and measures its correlation value (similarity) and position.

In a normal search, image pattern models are used that look at the color and light/dark information, but in an ECM search, models are used that look at the profile information. Therefore, this processing assures a reliable search even for low-contrast or noisy images.

Used in the Following Case

- To measure the location of a mark

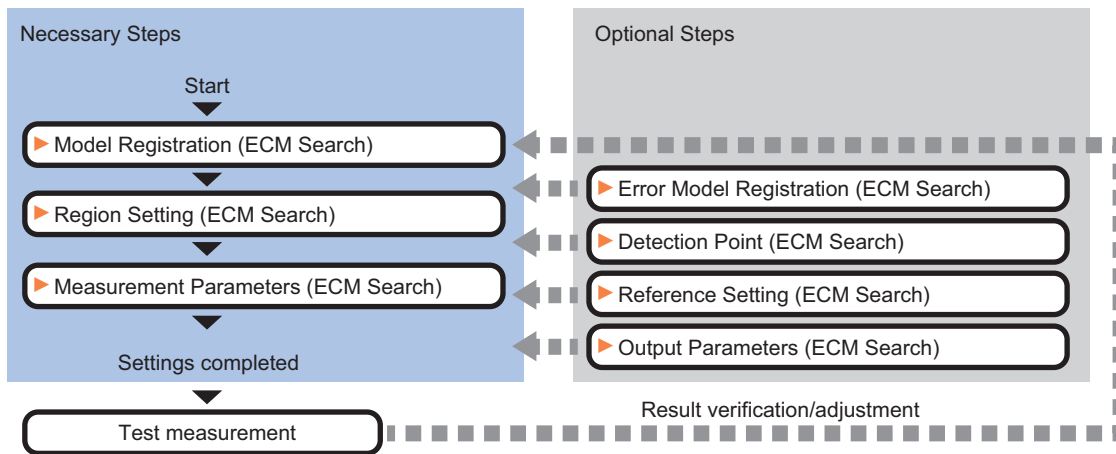


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (ECM Search)

Set up ECM search according to the following steps.



List of ECM Search Items

Item name	Description
Model register	This item registers the pattern characteristic of the measurement image as a model. Model parameter values can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used. Reference: ▶ Model Registration (ECM Search) (p.136)
Error model	This item can be changed if necessary. As an error model, register a model with similar characteristics to the registered one, but with its correlation value lowered when measured. Reference: ▶ Error Model Registration (ECM Search) (p.139)
Region setting	This item is used to set up the measurement area. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. Reference: ▶ Region Setting (ECM Search) (p.139)
Detection point	This item can be changed if necessary. Usually, the central position of the registered model is registered as the search detection point. Reference: ▶ Detection Point (ECM Search) (p.140)
Ref. setting	This item can be changed if necessary. Usually, the central position of the registered region is registered as the reference position. Reference: ▶ Reference Setting (ECM Search) (p.141)
Measurement	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if the X and Y coordinates and the correlation values with the model are OK. Reference: ▶ Measurement Parameters (ECM Search) (p.142)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (ECM search) (p.143)

Model Registration (ECM Search)

Register the pattern characteristic of the measurement object as a model. In an ECM search, only the image profile information is registered.

Important

- For ECM search, 6 pixels at each end of an image cannot be registered as a part of the model.
- If a model is re-registered, the error model is deleted. Register error models when re-registering a model.

1 In the Item Tab area, click [Model register].

When setting a new model, you do not have to click [Model register].

2 Use the drawing tools to specify the model registration range.

3 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

4 Click [Edge extraction], then confirm the edge extraction image.

If there is a break in the outline of the measurement object, adjust the edge level.

Reference: ▶ Adjusting the Edge Level (p.138)

5 If there is unnecessary profile information in the model, click [Mask register] to set the mask.

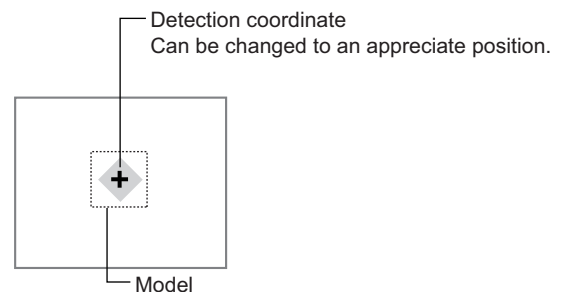
Reference: ▶ Mask any Unnecessary Items. (p.138)

6 To check the model display, click [Display model].

The registered model image is displayed in the image display area.

Note

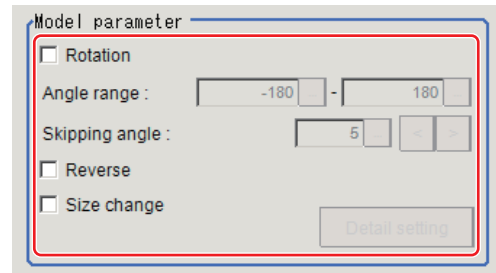
- When a model is registered, the center coordinate of the model is registered as the detection point coordinate. A detection point is a point output as a measurement value.



Changing Model Parameters

Model parameter values can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used. After changing a setting, check whether measurement can be done properly by performing an actual measurement.

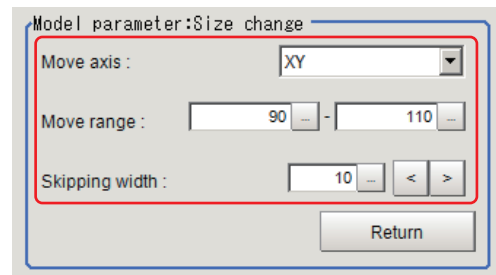
- 1** In the "Model parameter" area, specify a value for each item.



Setting item		Set value [Factory default]	Description
Rotation		<ul style="list-style-type: none"> • Checked • [Unchecked] 	When the measurement object is rotating, select the "Rotation" check box and specify how many degrees the model created rotates each time and through what range of angles. A smaller skipping angle increases stability, but slows down the processing. The normal direction is clockwise.
Angle range	Upper limit value	-180 to [180]	
	Lower limit value	[-180] to 180	
Skipping angle		1 to 30 [5]	Specify how many degrees the model created rotates each time. A smaller angle increases stability, but slows down the processing.
Reverse		<ul style="list-style-type: none"> • Checked • [Unchecked] 	Specify whether to allow the reverse of light and dark for the model.
Size change		<ul style="list-style-type: none"> • Checked • [Unchecked] 	Specify whether to allow size change for the model. When checked, click [Detail setting] and specify a value for each item.

- 2** When the "Size change" option is checked, click [Detail setting].

The "Model parameter: Size change" area is displayed.



Setting item	Set value [Factory default]	Description
Move axis	<ul style="list-style-type: none"> • [XY] • X • Y 	Specify the model variable direction.
Move range	50 to 150 [90,110]	Specify the range in which to change the model size.
Skipping width	1 to 99 [10]	Specify the skipping percentage within the move range by which to change models being created. A smaller skipping width increases precision, but slows down the processing.

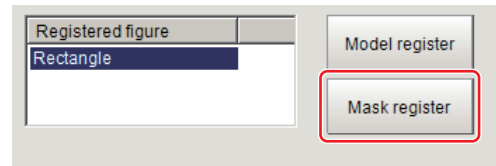
- 3** Click [Return].

The "Model parameter" area is displayed.

Mask any Unnecessary Items.

By registering a mask, the part you do not want included in the model is excluded.

1 Click [Mask register].



2 Draw the mask figure using the drawing tools.

3 Click [OR/NOT].

The mask figure is displayed in red.

4 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Adjusting the Edge Level

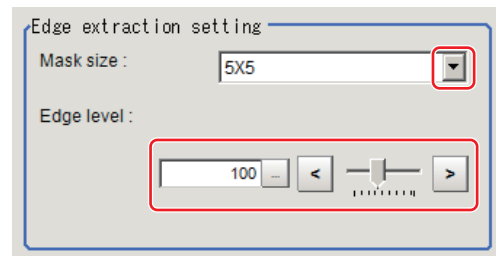
In an ECM search, processing is executed on the edge extraction image. Change this item as necessary when the edge is not extracted or is extracted along with noise.

Important

- In model registration, extract as much of the edge as possible, then delete noise etc. in the mask registration to register the entire edge of the model. On the other hand, when measuring, even if the edge has skips, an image with the noise suppressed makes it possible to search the model stably. To set separate edge extraction conditions for model registration and for measuring, after registering the model, change the edge extraction conditions.

1 In the Item Tab area, click [Edge extraction].

2 Set the items in the "Edge extraction setting" area.



Setting item	Set value [Factory default]	Description
Mask size	<ul style="list-style-type: none"> • 3 × 3 • [5 × 5] • 7 × 7 • 9 × 9 	Select the range of pixels which are used to extract the edge. With a larger mask size, search is less affected by variation in pixels.
Edge level	0 to 255 [100]	Change this when the edge is hard to see due to low contrast against the background or when unnecessary background noise must be removed. The smaller the value, the easier it is to find edges. The larger the value, the less noise will affect finding edges.

Error Model Registration (ECM Search)

Even for an image pattern with similar feature sections (for example "P" and "R"), if the model is registered as an error model, the correlation value is lower and measurement mistakes can be prevented. Only one error model can be registered.

1 In the Item Tab area, click [Error model].

2 Display the error model image.

Register the error model with the same procedure as for model registration.

Important

- Upon re-registering a model, error models are deleted. Register error models when re-registering a model. Register error models when re-registering a model.

Region Setting (ECM Search)

Use a rectangle to specify the area where the model is searched.

Instead of measuring the entire input image, narrowing the measurement area shortens the processing time.

1 In the Item Tab area, click [Region setting].

2 Click [Edit].

The figure setting area is displayed.

3 Specify the area in which to search for the model.

The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.

4 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Detection Point (ECM Search)

Specify a position in the model that should be used as the detection coordinates during measurement. Usually, the center position of the set model is registered as the detection point. This function is used to change to any desired position.

A reference position can be set either directly or by referencing a unit.

Note

- After changing the detection point coordinates to another position, re-registering the model will change it back to the center coordinates of the model.

Specifying directly

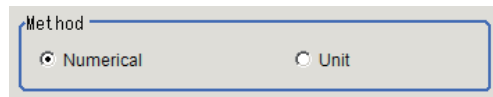
Click a position on the image you want to use as a reference position, or set coordinate data for that point.

1 In the Item Tab area, click [Detection point].

In the Display area, the current detection point is displayed with a crosshair cursor.



2 In the "Method" area, select "Numerical".

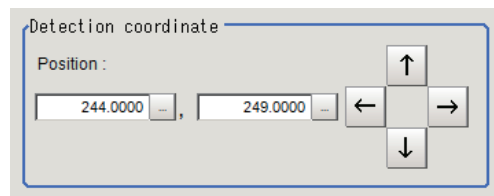


3 Click the position to be set as the detection point.

Note

- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

4 Make fine adjustments using numeric value inputs or the arrow buttons as required.



Referencing a unit

Set a detection point by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

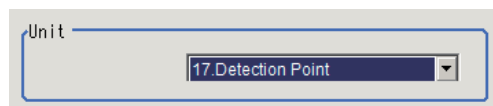
1 In the Item Tab area, click [Detection point].

In the Display area, the current detection point is displayed with a crosshair cursor.

2 In the "Method" area, select "Unit".



3 In the scene in the "Unit" area, select a detection point unit.



4 Perform the next measurement, and the detection point will be displayed.

Reference Setting (ECM Search)

When the measurement region is set, this position is automatically set at the same time as the reference position. This item can be used to change the reference position to any desired position. This is handy for measuring the position deviation from a certain position.

A reference position can be set either directly or by referencing a unit.

Specifying directly

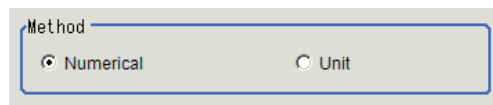
Click a position on the image you want to use as a reference position, or set coordinate data for that point.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.



2 In the "Method" area, select "Numerical".

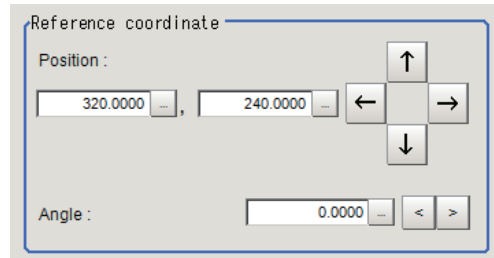


3 Click the position to be set as the reference.

Note

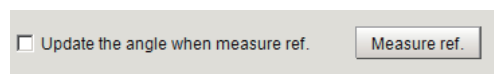
- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendix Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

4 Make fine adjustments using numeric value inputs or the arrow buttons as required.

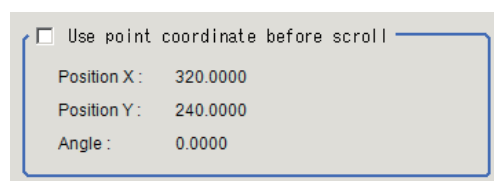


5 Input the reference angle with a numeric value.

6 To remeasure on the displayed image and set the reference, click the [Measure ref.] button. To update the reference angle at the time of reference measurement, place a check at "Update the angle when measure ref.".



7 To use data before position compensation for the reference setting coordinates, place a check at "Use point coordinate before scroll".



Referencing a unit

Set a reference by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.

2 In the "Method" area, select "Unit".

3 In the scene in the "Unit" area, select a detection point unit.

4 Perform the next measurement, and the reference will be displayed.

Measurement Parameters (ECM Search)

This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if the X and Y coordinates and the correlation values with the model are OK.

1 In the Item Tab area, click [Measurement].

2 In the "Measurement condition" area, specify a value for each item.

Setting item	Set value [Factory default]	Description
Candidate point level	0 to 99 [40]	Specify the threshold value with which to detect candidate points in a rough search. Specify a smaller value for candidate point level when model search results are unstable.
Reduction	10 to 100 [50]	Specify the percentage to which the input image and the model image are reduced during a rough search. The more the image is reduced, the faster the processing becomes, but search results may be unstable with a smaller image.
Model skipping	1 to 19 [4]	Specify how many pixels should be skipped when performing a rough search.
Search skipping	1 to 9 [2]	Specify how many pixels are skipped when performing a search for the "Search region".

3 When the setting has been changed, click [Measurement] in the "Detail" area to verify whether measurements can be made correctly.

4 Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Setting item	Set value	Description
Measure pos X	-99999.9999 to 99999.9999	Specify the range of X-axis shifting that is judged to be OK.
Measure pos Y	-99999.9999 to 99999.9999	Specify the range of Y-axis shifting that is judged to be OK.
Measure angle	-180 to 180	Specify the range of angles that are judged to be OK.
Correlation [Note 1]	0 to 100	Specify the range of correlation values that are judged to be OK.

[Note 1]: When the ECM correlation value of the measurement result is 0, the judgement result will be NG regardless of the measurement parameters setting.

Output Parameters (ECM search)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgment.

Key Points for Test Measurement and Adjustment (ECM Search)

The following content is displayed in the "Detail result" area as text.

Displayed item	Description
Judge	Judgement result
Correlation	Correlation value
Position X	X coordinate of the position where the model is detected
Position Y	Y coordinate of the position where the model is detected
Angle θ	Angle of the position where the model is detected

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image number.	Explanation of image to be displayed
0	Measurement image
1	Measurement image displayed with matching models overlaid Green: Matched model points Red: Unmatched model points

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Parameter to be adjusted	Remedy
Measurement	If images that should be judged OK vary greatly, specify a smaller value for "Candidate level".
	If the model image is small and unstable, specify a smaller value for the "Reduction".
Model register	Mask any unnecessary items.
	Lower the edge level.
	Register the error model.
Model parameter	If the measurement results are unstable only when "Rotation" is selected, specify a smaller value for the "Skipping angle".

When the processing speed is slow

Parameter to be adjusted	Remedy
Region setting	Make the search region as small as possible.
Model parameter	If images that should be judged OK vary little, specify a larger value for "Candidate level".
	When "Rotation" is selected and the model image is a simple figure, specify a larger value for "Skipping angle".
Measurement	Specify a smaller value of the "Reduction".
	Specify a larger value of the "Model skipping".
	Specify a larger value of the "Search skipping".

When Using Measurement Results Externally (ECM Search)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Correlation value	CR	Correlation value with the model
Measure X	X	X coordinate of the position where the model is detected
Measure Y	Y	Y coordinate of the position where the model is detected
Measurement angle	TH	Angle of the position where the model is detected
Measurement magnification MX	MX	X-axis magnification of the detected model
Measurement magnification MY	MY	Y-axis magnification of the detected model
Reference coordinate X	SX	X coordinate of the reference position of the registered model
Reference coordinate Y	SY	Y coordinate of the reference position of the registered model
Reference angle	ST	Angle of the registered model
Detection point RX	RX	X coordinate of the registered model
Detection point RY	RY	Y coordinate of the registered model

External Reference Tables (ECM Search)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Correlation value	Get only	0 to 100
6	Measure X	Get only	-99999.9999 to 99999.9999
7	Measure Y	Get only	-99999.9999 to 99999.9999
8	Angle θ	Get only	-180 to 180
9	Magnification X	Get only	50 to 150
10	Magnification Y	Get only	50 to 150
11	Reference X^1	Get only	-99999.9999 to 9999.9999
12	Reference Y^1	Get only	-99999.9999 to 9999.9999
13	Reference angle	Get only	-180 to 180
14	Detection point X	Get only	-99999.9999 to 9999.9999
15	Detection point Y	Get only	-99999.9999 to 9999.9999
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Mask size	Set/Get	0: 3×3 1: 5×5 2: 7×7 3: 9×9
121	Edge Level	Set/Get	0 to 255
122	Detection point X^2	Set/Get	0 to 99999.9999
123	Detection point Y^2	Set/Get	0 to 99999.9999
124	Reference X	Set/Get	0 to 99999.9999
125	Reference Y	Set/Get	0 to 99999.9999
126	Upper limit of the corr.	Set/Get	0 to 100
127	Lower limit of the corr.	Set/Get	0 to 100
128	Upper limit of measure X	Set/Get	-99999.9999 to 99999.9999
129	Lower limit of measure X	Set/Get	-99999.9999 to 99999.9999
130	Upper limit of measure Y	Set/Get	-99999.9999 to 99999.9999
131	Lower limit of measure Y	Set/Get	-99999.9999 to 99999.9999
132	Upper limit of the angle	Set/Get	-180 to 180
133	Lower limit of the angle	Set/Get	-180 to 180
134	Candidate Point Level	Set/Get	0 to 99
135	Model skipping	Set/Get	1 to 9
136	Region skipping	Set/Get	1 to 19
137	Reduction	Set/Get	10 to 100

No.	Data name	Set/Get	Data range
138	With rotation	Set/Get	0: No rotation 1: With rotation
139	Lower limit of the rotation angle	Set/Get	-180 to 180
140	Upper limit of the rotation angle	Set/Get	-180 to 180
141	Skipping angle	Set/Get	1 to 30
142	Move axis	Set/Get	0: No size change 1: XY change 2: X change 3: Y change
143	Upper limit of the size change	Set/Get	50 to 150
144	Lower limit of the size change	Set/Get	50 to 150
145	Size change skipping	Set/Get	1 to 99
146	Reverse	Set/Get	0: No reverse 1: Reverse

*1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.

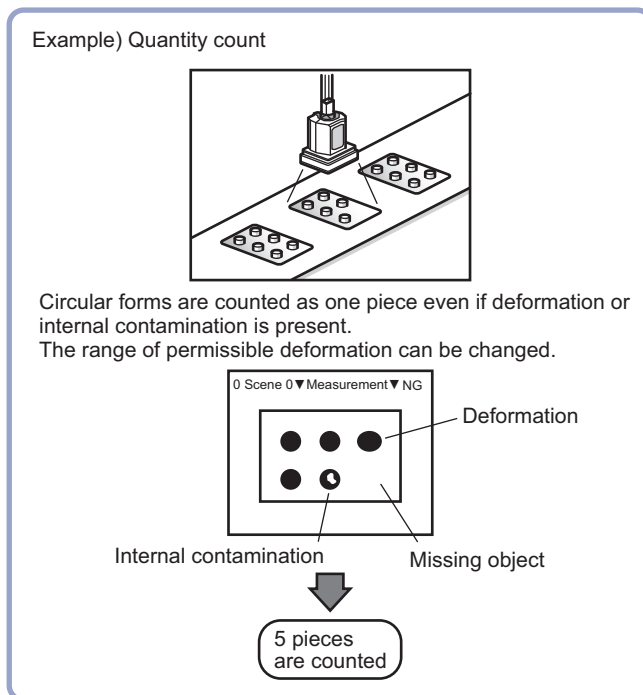
*2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.

EC Circle Search

This processing item searches the input image for parts having a high degree of similarity to the target circle mark (model), and measures its circle evaluated value (similarity) and position. In a normal search, image pattern models are used that look at the color and light/dark information. In EC Circle Search, however, models are used that look at the profile. Therefore, this processing assures a reliable search even for low-contrast or noisy images. It is also possible to measure the number of circles in the input image.

Used in the Following Case

- This counts how many circles there are of the specified size. Since circles are extracted with the shape information of "Round", the circles being deformed or dirty does not affect counting.

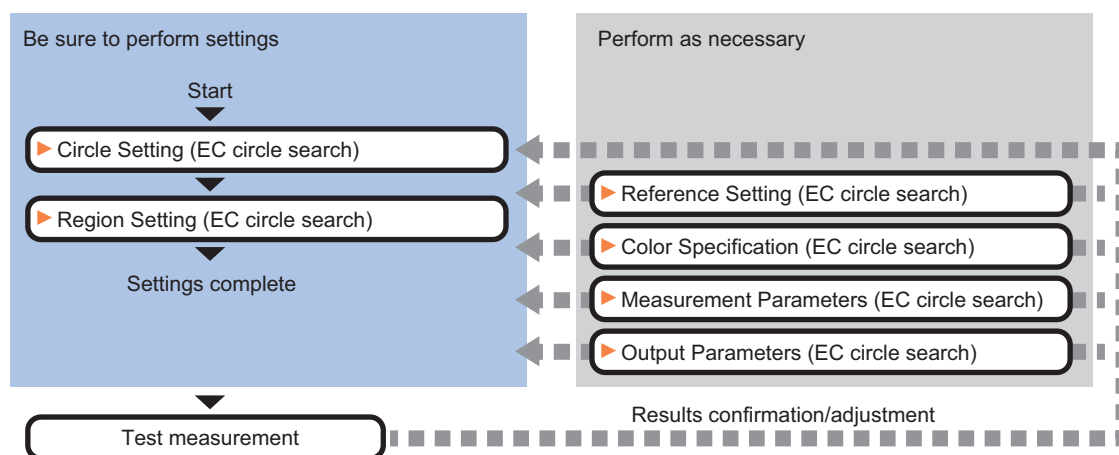


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (EC Circle Search)

Set up EC circle search according to the following steps.



List of EC Circle Search Items

EC circle search items are explained below.

Item name	Description
Circle setting	This item sets the size of the circle to search for. Reference: ▶ Circle Setting (EC Circle Search) (p.149)
Region setting	This item is used to set up the measurement area. Narrowing the measurement area instead of measuring the entire input screen shortens the processing time. Reference: ▶ Region Setting (EC Circle Search) (p.150)
Ref. setting	This item can be changed if necessary. Usually, the central position of the registered region is specified as the reference position. Reference: ▶ Reference Setting (EC Circle Search) (p.150)
Color setting	This item can be changed if necessary. Select the color of the circle and the background color. If no check is placed at color setting, the circle (edge) is extracted with the brightness difference. Reference: ▶ Color Specification (EC Circle Search) (p.151)
Measurement parameter	This item changes the measurement parameter as necessary when the measurement result is unstable. Reference: ▶ Measurement Parameters (EC Circle Search) (p.152)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (EC Circle Search) (p.154)

Circle Setting (EC Circle Search)

Registers the size of the circle to search for.

Set the circle size only with the circumference figure.

1 In the Item Tab area, click [Circle register].

When setting a new circle, you do not need to click [Circle register].

2 Set the search circumference using the drawing tools.

3 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

4 Click [Edge extraction] and set values.

Reference: ▶ Extracting Edges (p.149)

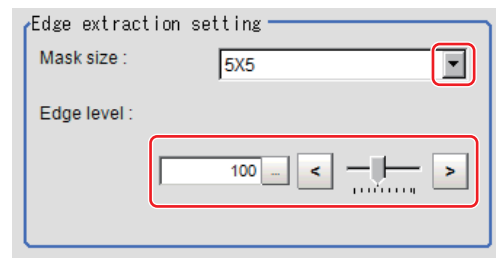
Extracting Edges

In an EC circle search, processing is executed on the edge extraction image. Change this item as necessary when the edge is not extracted or is extracted along with noise.

1 In the Item Tab area, click [Edge extraction].

2 In the "Edge extraction setting" area, click [...] or [▼] and specify a value for each item.

The "Edge level" value can be specified by dragging the slider or clicking one of the buttons at either end of the slider.



Setting item	Set value [Factory default]	Description
Mask size	<ul style="list-style-type: none"> • 3 × 3 • [5 × 5] • 7 × 7 • 9 × 9 	Select the range of pixels which are used to extract the edge. With a larger mask size, search is less affected by variation in pixels.
Edge level	0 to 255 [100]	Change this when the edge is hard to see due to low contrast against the background or when unnecessary background noise must be removed. The smaller the value, the easier it is to find edges. The larger the value, the less noise will affect finding edges.

Region Setting (EC Circle Search)

Specify the rectangular area in which to search for the circle.

Instead of measuring the entire input image, narrowing the measurement area shortens the processing time.

1 In the Item Tab area, click [Region setting].

2 Click [Edit].

The figure setting area is displayed.

3 Specify the area in which to search for the model.

The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.

4 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Reference Setting (EC Circle Search)

When the model is set, this position is automatically set at the same time as the reference position. This item can be used to change the reference position to any desired position. This is handy for measuring the position deviation from a certain position.

A reference position can be set either directly or by referencing a unit.

Specifying directly

Click a position on the image you want to use as a reference position, or set coordinate data for that point.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.



2 In the "Method" area, select "Numerical".

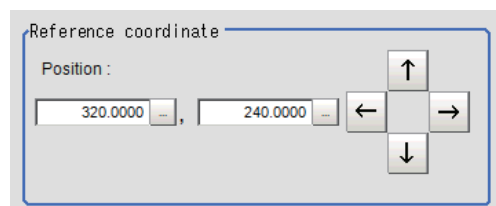


3 Click the position to be set as the reference.

Note

- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

4 Make fine adjustments using numeric value inputs or the arrow buttons as required.



5 To remeasure on the displayed image and set the reference, click the [Measure ref.] button.

- 6 To use data before position compensation for the reference setting coordinates, place a check at "Use point coordinate before scroll".**

Use point coordinate before scroll

Position X: 320.0000

Position Y: 240.0000

Referencing a unit

Set a reference by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

- 1 In the Item Tab area, click [Ref. setting].**

In the display area, the current reference position will be displayed as the crosshair cursor.

- 2 In the "Method" area, select "Unit".**

Method

Numerical Unit

- 3 In the scene in the "Unit" area, select a detection point unit.**

Unit

1.Detection Point

- 4 Perform the next measurement, and the reference will be displayed.**

Color Specification (EC Circle Search)

This item can be changed if necessary.

Select the color of the circle and the background color. If no check is placed at color setting, the circle (edge) is extracted with the brightness difference.

- 1 In the Item Tab area, click [Color setting].**
- 2 If necessary, check "Color setting" in the "Color setting" area.**

Color setting

Color setting

Circle color

Color selection bar showing a rainbow spectrum.

- 3 Specify a color.**

Enclose the location on the image to be set as the circle and the background color with a rectangle. The average color of the enclosed range is set for R, G, and B.

R, G, and B values can also be set with numbers. To input the values, click [...] for each of "R" (red), "G" (green), and "B" (blue). Specify the circle color and the background color separately.

Value input method: Reference: See the ► "Appendixes Basic Knowledge about Operations Inputting Values" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Measurement Parameters (EC Circle Search)

This item specifies the judgement conditions for measurement results. Specify to what degree OK is still judged in relation to measurement result coordinates (X,Y) and the circle evaluation value with the model.

1 In the Item Tab area, click [Measurement].

2 Select the search type.

Search type

Single search Multi search

Setting item	Set value [Factory default]	Description
Search type	[Single search]	This is set when there is one circle in the measurement range.
	Multi search	This is set when there are multiple circles in the measurement range.

3 Set the measurement conditions.

For single search

Measurement conditions

Radius : 120

Radius range : 1

Advanced setting

Grouping distance : 4

Sticking out circle isn't detected

For multi search

Measurement conditions

Radius : 120

Radius range : 1

Candidate level : 0

Sort condition : Eva. descending

Advanced setting

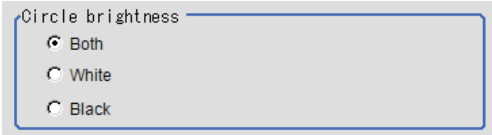
Grouping distance : 4

Sticking out circle isn't detected

Setting item	Set value [Factory default]	Description
Radius	1 to 9999 [Radius drawn using circle resister]	This item sets the radius of the circle measured. This is displayed on the screen with a solid blue line.
Radius range	[1] to 9999	This measures the measured circle radius \pm the permitted radius width. This is displayed on the screen with a broken blue line.
Candidate level (Multi search only)	[0] to 100	Specify the threshold value used when detecting candidate points in an EC circle search. Specify a smaller value when model search results are unstable.
Sort condition (Multi search only)	<ul style="list-style-type: none"> • X ascending • X descending • Y ascending • Y descending • Eva. ascending • [Eva. descending] • Radius ascending • Radius descending 	Specify the conditions by which label number is re-assigned. When sorting referencing the X and Y coordinates, the upper left is the origin.
Advanced setting	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check at setting the grouping distance.
Grouping distance	1 to 10 [4]	When circles measured overlap, this sets the distance for distinguishing circles. The smaller this value, the easier to distinguish circles.
Sticking out circle isn't detected	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check here to include circles within the range only.

For monochrome cameras:

For a monochrome camera only, the circle color parameters are displayed.



Setting item	Set value [Factory default]	Description
Circle brightness	<ul style="list-style-type: none"> • [Both] • White • Black 	This sets the circle color with the brightness.

4 Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limits.

Setting item	Set value	Description
Measure pos X	-99999.9999 to 99999.9999	Specify the range of X-axis shifting that is judged to be OK.
Measure pos Y	-99999.9999 to 99999.9999	Specify the range of Y-axis shifting that is judged to be OK.
Evaluation	0 to 100	Specify the range of circle evaluated values that are judged to be OK.
Radius	0 to 99999.9999	Set the range of radiuses that is judged to be OK.
Search count	0 to 256	Specify the range of quantities that is judged to be OK.

5 Perform the display setting if required.

Setting item	Set value [Factory default]	Description
Display parameter	<ul style="list-style-type: none"> • [None] • Radius • Evaluation 	Select the type of measurement result to display on the image. The display setting applies only to the settings dialog box.

Output Parameters (EC Circle Search)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify a value for the items.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none">• [After scroll]• Before scroll	As measurement results, select whether to output coordinate values to external devices before or after the position deflection correction is applied.
Calibration	<ul style="list-style-type: none">• [OFF]• ON	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to the overall judgement	<ul style="list-style-type: none">• [ON]• OFF	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgment.

Note

- For output coordinates and calibration, Reference: ▶ "Appendixes Measurement Mechanism Handling Coordinates" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Key Points for Test Measurement and Adjustment (EC Circle Search)

The following content is displayed in the "Detail result" area as text.

Displayed item	Description
Judge	Judgement result
Position X	X coordinate of the position where the model is detected
Position Y	Y coordinate of the position where the model is detected
Evaluation	Circle evaluated value of circles detected
Radius	Radius of circles detected
Search count	Quantity of circles detected

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Parameter to be adjusted	Processing
Measurement	If images that should be judged OK vary greatly, specify a smaller value for "Evaluation".
Circle setting	Mask any unnecessary items. Lower the edge level.

When the processing speed is slow

Parameter to be adjusted	Processing
Region setting	Make the search region as small as possible.
Measurement	If images that should be judged OK vary little, specify a larger value for "Evaluation".

Measurement Results for Which Output Is Possible (EC Circle Search)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Measurement coordinate X	X	X coordinate of the position where the circle is detected
Measurement coordinate Y	Y	Y coordinate of the position where the circle is detected
Reference position X	SX	X coordinate of the reference position of the registered circle
Reference position Y	SY	Y coordinate of the reference position of the registered circle
EC correlation value	CR	Evaluated value of circle detected
Radius	RA	Radius of circles detected
Count	CT	Quantity of circles detected
Position N	XN	Detected circle N position X (N = 0 to 255)
Position N	YN	Detected circle N position Y (N = 0 to 255)
Evaluation N	CRN	Detected circle N circle evaluated value (N = 0 to 255)
Radius N	RAN	Detected circle N circle radius (N = 0 to 255)

External Reference Tables (EC Circle Search)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
5	Position X	Get only	-99999.9999 to 99999.9999
6	Position Y	Get only	-99999.9999 to 99999.9999
8	Reference coordinate X ^{*1}	Get only	-99999.9999 to 99999.9999
9	Reference coordinate Y ^{*1}	Get only	-99999.9999 to 99999.9999
15	Evaluation	Get only	0 to 100
18	Radius	Get only	0 to 99999.9999
19	Count	Get only	0 to 256
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
140	Reference X ^{*2}	Set/Get	-99999.9999 to 99999.9999
141	Reference Y ^{*2}	Set/Get	-99999.9999 to 99999.9999
142	Target	Set/Get	0: Black 1: White 2: Black and white
143	Edge color specification	Set/Get	0: Yes 1: No
144	Circle color R	Set/Get	0 to 255
145	Circle color G	Set/Get	0 to 255
146	Circle color B	Set/Get	0 to 255
147	Background color R	Set/Get	0 to 255
148	Background color G	Set/Get	0 to 255
149	Background color B	Set/Get	0 to 255
150	Mask size	Set/Get	0: 3 × 3 1: 5 × 5 2: 7 × 7 3: 9 × 9
151	Edge level	Set/Get	0 to 255
153	Upper limit of position X	Set/Get	-99999.9999 to 99999.9999
154	Lower limit of position X	Set/Get	-99999.9999 to 99999.9999
155	Upper limit of position Y	Set/Get	-99999.9999 to 99999.9999
156	Lower limit of position Y	Set/Get	-99999.9999 to 99999.9999
159	Upper limit of evaluation	Set/Get	0 to 100
160	Lower limit of evaluation	Set/Get	0 to 100

No.	Data name	Set/Get	Data range
161	Upper limit of count	Set/Get	0 to 256
162	Lower limit of count	Set/Get	0 to 256
165	Upper limit of radius	Set/Get	0 to 99999.9999
166	Lower limit of radius	Set/Get	0 to 99999.9999
171	Search type	Set/Get	0: Single search 1: Multi search
172	Candidate point level	Set/Get	0 to 100
173	Sort type	Set/Get	0: X ascending 1: X descending 2: Y ascending 3: Y descending 4: Eva. ascending 5: Eva. descending 6: Radius ascending 7: Radius descending
176	Grouping distance	Set/Get	1 to 10
177	Radius range	Set/Get	1 to 9999
178	Radius	Set/Get	1 to 9999
180	Sticking out circle isn't detected	Set/Get	0: OFF 1: ON
181	Setting unit of reference coordinate	Set/Get	-1 to 9999
182	Reference type of reference coordinate	Set/Get	0: Numerical 1: Unit reference
183	Use point coordinate before scroll	Set/Get	0: Not used 1: Used
184	Position X before scroll	Set/Get	-99999.9999 to 99999.9999
185	Position Y before scroll	Set/Get	-99999.9999 to 99999.9999
1000 + N × 4 (N = 0 to 255)	Position X	Get only	-99999.9999 to 99999.9999
1001 + N × 4 (N = 0 to 255)	Position Y	Get only	-99999.9999 to 99999.9999
1002 + N × 4 (N = 0 to 255)	Evaluation	Get only	0 to 100
1003 + N × 4 (N = 0 to 255)	Radius	Get only	0 to 99999.9999
6002	Format	Set/Get	1: monochrome camera 0: color camera

*1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.

*2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.

Shape Search II

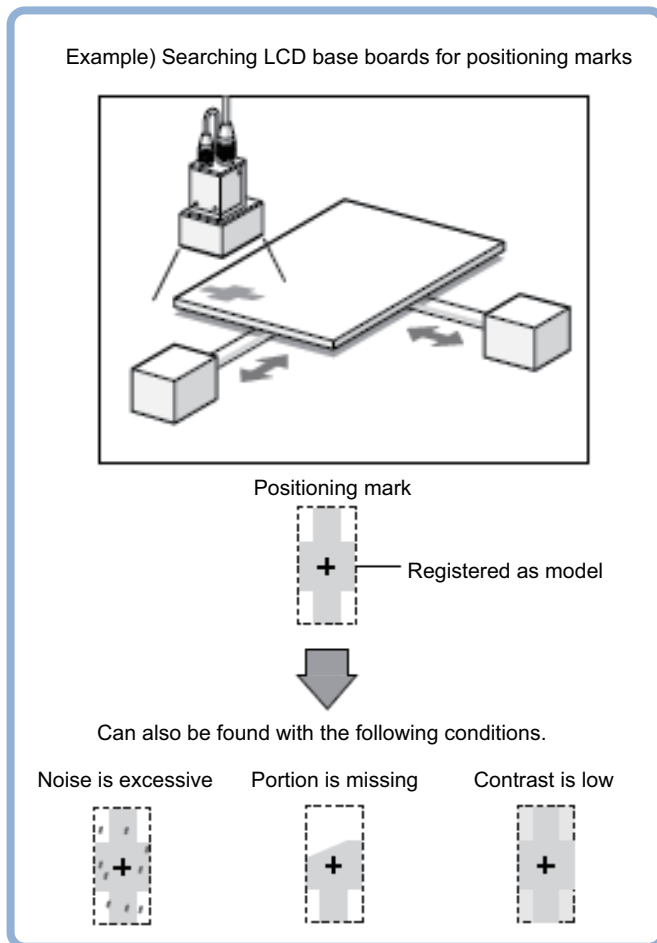
This function is for detecting user-defined target to estimate target position and pose precisely. The correlation value indicating the degree of similarity, measurement target position, and orientation can be output.

In shape search II, edge information is used as features, whereas in a normal search mode, color and texture information are used.

Since state-of-the-art object detection algorithm is exploited in shape search III, it can provides much more reliable position and pose estimation with higher speed compared to shape search II. Furthermore, it has much more parameter to tune to support a wider variety of applications.

Used in the Following Case

- Alignment mark detection and precise position estimation.



Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

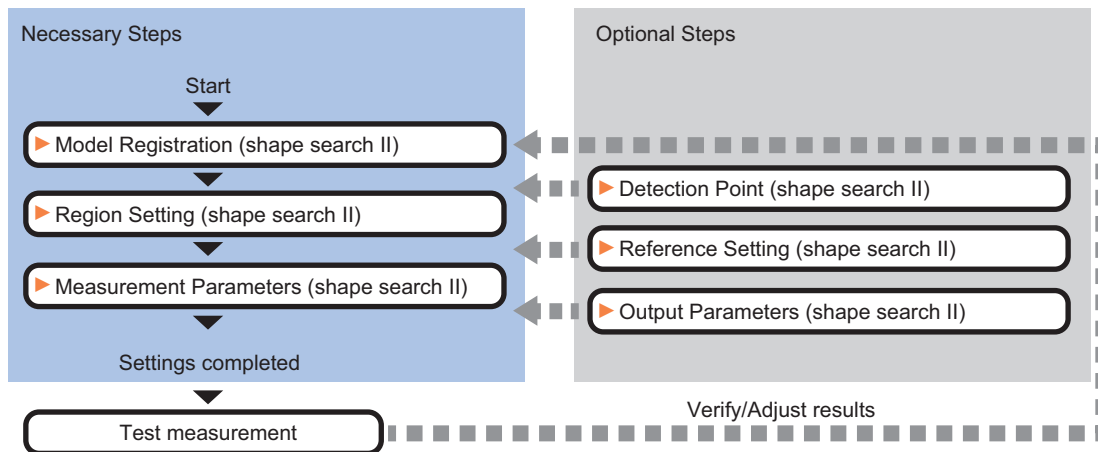
Note

- Search processing basic concepts

Reference: ▶ "Appendixes Measurement Mechanism Search Processing Mechanism" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Settings Flow (Shape Search II)

Set up shape search II according to the following steps.



List of Shape Search II Items

Item name	Description
Model	This item registers the pattern characteristic of the measurement image as a model. Change the model parameter (black and white reverse) as necessary. Reference: ▶ Model Registration (Shape Search II) (p.160)
Region setting	This item is used to set up the measurement area. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. Reference: ▶ Region Setting (Shape Search II) (p.161)
Detection point	This item can be changed if necessary. Specify a position in the model that should be used as the detection coordinates during measurement. Usually, the central position of the set model is registered as the detection coordinates. Reference: ▶ Detection Point (Shape Search II) (p.162)
Ref. setting	This item can be changed if necessary. Specify the reference position within the camera's field of view. Reference: ▶ Reference Setting (Shape Search II) (p.163)
Measurement	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if the X and Y coordinates and the correlation values with the model are OK. Reference: ▶ Measurement Parameters (Shape Search II) (p.164)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (Shape Search II) (p.166)

Model Registration (Shape Search II)

Register the parts to measure as the model.

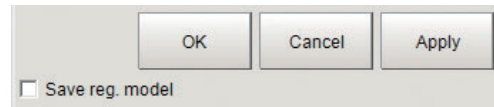
The model information includes the position of the model. So place the target in the correct position in the registration process.

1 Click [Model] tab.

When setting a new model, you do not have to click [Model]. The tab is already being selected.

2 Use the Drawing tools to specify the model registration range.

3 To save the entire image used for model registration, place a check at the "Save reg. model" option.



Note

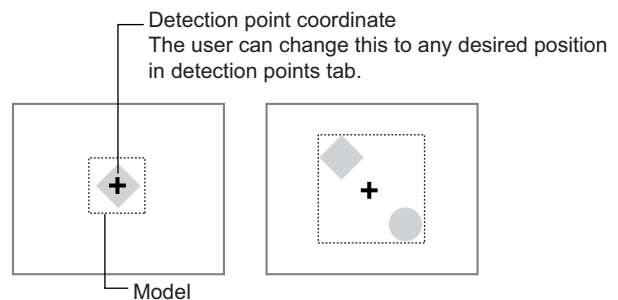
- If you save the registered model image, you can re-register the model with the same image after model parameters are adjusted. Note that the scene data size increases when a registered model image is saved.

4 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Note

- When a model is registered, the central coordinates of the model are registered as the detection point. A detection point is a point output as a measurement value. If multiple targets are included in the same model, the detection points become the central coordinate of the bounding box that circumscribing these targets.

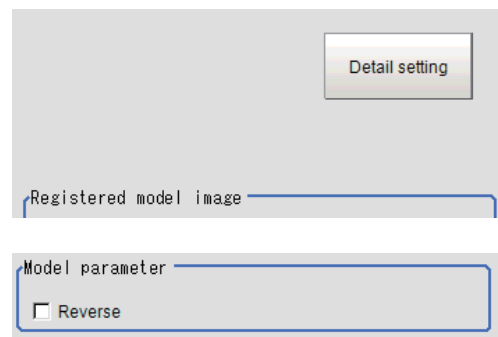


Changing model parameters

If the light and dark of the background and the workpiece, such as a shiny workpiece, reverses, specify the "Reverse" setting as necessary.

After changing a setting, re-register the model.

1 Click [Detail setting].

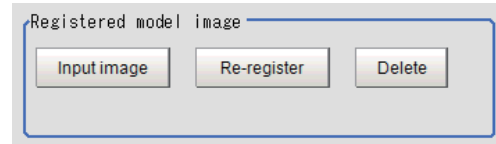


2 In the "Model parameter" area, set "Reverse".

Setting item	Set value [Factory default]	Description
Reverse	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Set whether to allow the reverse of light and dark for the model.

Displaying/Re-Registering/Deleting a Model

If you save the model registration image, it is easy to re-register the model after model parameters are changed.



Item	Description
Disp model/Input image	The model image display and input image display are switched.
Re-register	When model parameters are modified, display the original model image and re-register the model.
Delete	Deletes a model.

Region Setting (Shape Search II)

Use a rectangle to specify the area where the model is searched. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time.

1 In the Item Tab area, click [Region setting].

2 Click [Edit].

The figure setting area is displayed.

3 Specify the model search range.

The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.

4 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Detection Point (Shape Search II)

Specify a position in the model that should be used as the detection coordinates during measurement. Usually, the center position of the set model is registered as the detection point. This function is used to change to any desired position.

A detection point can be set either directly or by referencing a unit.

Note

- After changing the detection point coordinates to another position, re-registering the model will change it back to the center coordinates of the model.

Specifying directly

Click a position on the image you want to use as a detection point, or set coordinate data for that point.

- 1 In the Item Tab area, click [Detection point].**

In the Display area, the current detection point is displayed with a crosshair cursor.



- 2 In the "Method" area, select "Numerical".**

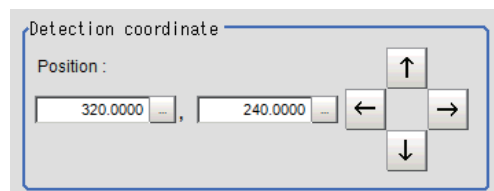


- 3 Click the position to be set as the detection point.**

Note

- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

- 4 Make fine adjustments using numeric value inputs or the arrow buttons as required.**



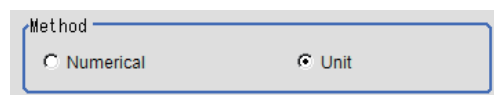
Referencing a unit

Set a detection point by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

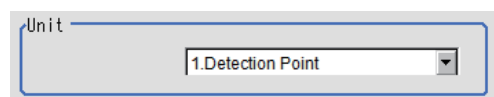
- 1 In the Item Tab area, click [Detection point].**

In the Display area, the current detection point is displayed with a crosshair cursor.

- 2 In the "Method" area, select "Unit".**



- 3 In the scene in the "Unit" area, select a detection point unit.**



- 4 Perform the next measurement, and the detection point will be displayed.**

Reference Setting (Shape Search II)

When the model is set, this position is automatically set at the same time as the reference position. This item can be set to change the reference position to any desired position. This is handy for measuring the position deviation from a certain position.

A reference position can be set either directly or by referencing a unit.

Specifying directly

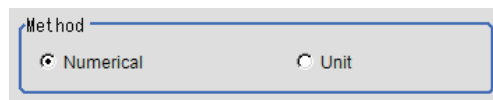
Click a position on the image you want to use as a reference position, or set coordinate data for that point.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.



2 In the "Method" area, select "Numerical".

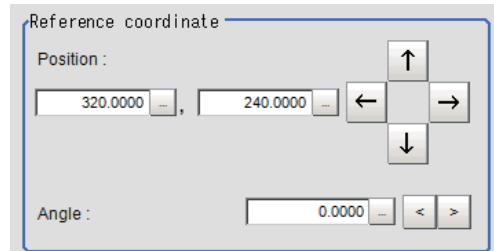


3 Click the position to be set as the reference.

Note

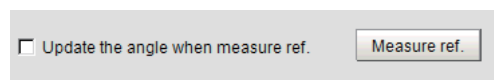
- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

4 Make fine adjustments using numeric value inputs or the arrow buttons as required.

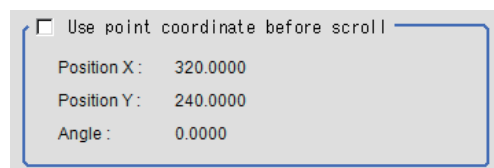


5 Set the reference angle with a numeric value.

6 To remeasure on the displayed image and set the reference, click the [Measure ref.] button. To update the reference angle at the time of reference measurement, place a check at "Update the angle when measure ref.".



7 To use data before position compensation for the reference setting coordinates, place a check at "Use point coordinate before scroll".



Referencing a unit

Set a reference by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.

2 In the "Method" area, select "Unit".

3 In the scene in the "Unit" area, select a detection point unit.

4 Perform the next measurement, and the reference will be displayed.

Measurement Parameters (Shape Search II)

Specify the search measurement conditions and the judgement conditions for the measurement results.

1 In the Item Tab area, click [Measurement].

2 In the "Measurement condition" area, specify a value for each parameter.

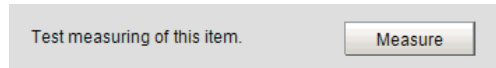
Setting item	Set value [Factory default]	Description
Candidate LV	0 to 100 [50]	Specify the threshold value with which to detect candidate points in a rough search. Specify a smaller value when the detection is unstable.
High-Prec.	• [Checked] • [Unchecked]	"High-Prec" mode enables sub-pixel and sub-degree order position and pose estimation. There is just a slight increase of processing time.
Rotation	• [Checked] • Unchecked	Select the parameter when the target may be rotated and set appropriate range in "Angle range".
Angle range	-180 to 180 [-180] to [180]	Specify the angle range when "Rotation" is checked.

When executing a multi search

Setting item	Set value [Factory default]	Description
Multiple output	• [Checked] • Unchecked	Check this parameter enables multiple target detection.
Count	1 to 32 [32]	Specify the maximum number of detections.

Setting item	Set value [Factory default]	Description
Sort condition	<ul style="list-style-type: none"> • Corr. ascending • [Corr. descending] • X ascending • X descending • Y ascending • Y descending 	Specify the method by which the search number is re-assigned. When sorting based on the X and Y coordinates, the upper left is the origin.
Search No.	0 to 31 [0]	Specify which of the multiple detection results will be used as measured results.

3 When the setting has been changed, click [Measure] in the "Detail" area to verify whether measurements can be made correctly.



4 Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Setting item	Set value [Factory default]	Description
Count	0 to 32 [0] to [32]	Specify the number of detections that are judged to be OK.
Measure X	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Specify the range of X-axis shifting that is judged to be OK.
Measure Y	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Specify the range of Y-axis shifting that is judged to be OK.
Search angle θ	-180 to 180 [-180] to [180]	Specify the range of angles that are judged to be OK.
Correlation	0 to 100 [60] to [100]	Specify the range of correlation values that are judged to be OK. However, when the correlation value of the measurement result is 0, the judgement result will be NG regardless of the lower limit setting.

Output Parameters (Shape Search II)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	Select output coordinate for external devices. If "after scroll" is chose here shape search III outputs coordinates after position compensation.
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgment.

Key Points for Test Measurement and Adjustment (Shape Search II)

The following content is displayed in the "Detail result" area as text.

Important

- Executing test measurements will update the measurement results and the figures in the image.

Displayed items	Description
Judge	Judgement result
Count	Number of detections
Correlation	Correlation value
Position X	X coordinate of the position where the model is detected
Position Y	Y coordinate of the position where the model is detected
Angle	Angle of the position where the model is detected

The image specified in the Sub-image number in image display setting is displayed in the Image Display area.

Sub image number.	Explanation of image to be displayed
0	Measurement image

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Searching other positions

Parameter to be adjusted	Remedy
Measurement parameter	If the precision is low, check "High-Prec."
	If detection or resulting judgement are unstable, set a smaller value for "Candidate LV", specify a smaller value for "Candidate LV".

The judgement is NG (insufficient memory)

Parameter to be adjusted	Remedy
Region setting	Make the search region as small as possible.

When the processing speed is slow

Parameter to be adjusted	Remedy
Region setting	Make the search region as small as possible.
Model registration	Make the area to register as the model as small as possible.
Measurement parameter	If images that should be judged OK vary little, specify a larger value for "Candidate LV".
	If the position precision is high, uncheck "High-Prec."

Measurement Results for Which Output Is Possible (Shape Search II)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Count	C	Number of search items detected If none detected, 0
Correlation	CR	Correlation value with the model
Position X	X	X coordinate of the position where the model is detected
Position Y	Y	Y coordinate of the position where the model is detected
Angle θ	TH	Angle of the position where the model is detected
Ref. position X	SX	X coordinate of the reference position of the registered model
Ref. position Y	SY	Y coordinate of the reference position of the registered model
Ref. angle	ST	Angle of the registered model
Detection point RX	RX	X coordinate of the registered model
Detection point RY	RY	Y coordinate of the registered model
Correlation value N (N = 00 to 31)	CRN	Detected search N correlation value (N = 00 to 31)
Position XN (N = 00 to 31)	XN	Detected search N position X (N = 00 to 31)
Position YN (N = 00 to 31)	YN	Detected search N position Y (N = 00 to 31)
Angle THN (N = 00 to 31)	THN	Detected search N angle TH (N = 00 to 31)

External Reference Tables (Shape Search II)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
5	Correlation value	Get only	0 to 100
6	Measurement coordinate X	Get only	-99999.9999 to 99999.9999
7	Measurement coordinate Y	Get only	-99999.9999 to 99999.9999
8	Measurement angle	Get only	-180 to 180
9	Reference coordinate X ^{*1}	Get only	-99999.9999 to 99999.9999
10	Reference coordinate Y ^{*1}	Get only	-99999.9999 to 99999.9999
11	Reference angle	Get only	-180 to 180
12	Detection coordinate X	Get only	-99999.9999 to 99999.9999
13	Detection coordinate Y	Get only	-99999.9999 to 99999.9999
14	Number of detections	Get only	0 to 32
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	With rotation	Set/Get	0: OFF 1: ON
121	Upper limit value of the rotation angle	Set/Get	-180 to 180
122	Lower limit value of the rotation angle	Set/Get	-180 to 180
124	Reverse	Set/Get	0: Do not allow black and white reverse 1: Allow black and white reverse
126	High-Prec.	Set/Get	0: OFF 1: ON
127	Reference coordinate X ^{*2}	Set/Get	0 to 99999.9999
128	Reference coordinate Y ^{*2}	Set/Get	0 to 99999.9999
133	Candidate point level	Set/Get	0 to 100
134	Detection point X	Set/Get	0.0000 to 9999.0000
135	Detection point Y	Set/Get	0.0000 to 9999.0000
136	Sort condition	Set/Get	0: Correlation value ascending 1: Correlation value descending 2: Measurement coordinate X ascending 3: Measurement coordinate X descending 4: Measurement coordinate Y ascending 5: Measurement coordinate Y descending
137	Search No.	Set/Get	0 to 31

No.	Data name	Set/Get	Data range
138	Judgement upper limit for correlation value	Set/Get	0 to 100
139	Judgement lower limit for correlation value	Set/Get	0 to 100
140	Judgement upper limit for number of detections	Set/Get	0 to 32
141	Judgement lower limit for number of detections	Set/Get	0 to 32
142	Judgement upper limit for measurement coordinate X	Set/Get	-99999.9999 to 99999.9999
143	Judgement lower limit for measurement coordinate X	Set/Get	-99999.9999 to 99999.9999
144	Judgement upper limit for measurement coordinate Y	Set/Get	-99999.9999 to 99999.9999
145	Judgement lower limit for measurement coordinate Y	Set/Get	-99999.9999 to 99999.9999
146	Judgement upper limit for measurement angle	Set/Get	-180 to 180
147	Judgement lower limit for measurement angle	Set/Get	-180 to 180
161	Number of detections	Set/Get	0 to 32
168	Multiple output	Set/Get	0: OFF 1: ON
171	Save the model registration image	Set/Get	0: None 1: Save
1000 + NN (NN = 0 to 31)	Correlation value	Get only	0 to 100
1100 + NN (NN = 0 to 31)	Measurement X	Get only	-99999.9999 to 99999.9999
1200 + NN (NN = 0 to 31)	Measurement Y	Get only	-99999.9999 to 99999.9999
1300 + NN (NN = 0 to 31)	Measurement angle	Get only	-180 to 180

*1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.

*2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.

Shape Search III

This function registers a model of an image pattern based on its contour information and detect parts of inputted images that most closely match the model. The correlation value indicating the degree of similarity, measurement target position, and orientation can be output.

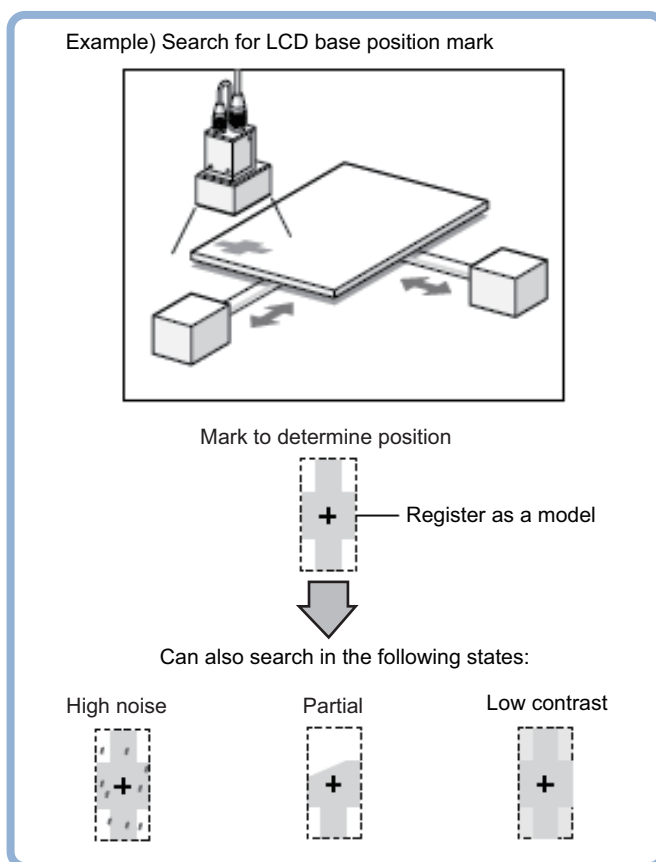
In shape search III, edge information is used as features, whereas in a normal search mode, color and texture information are used.

It enables highly robust and fast detection robust to environmental variations including shadings, reflections, lightings, shape deformations, pose and noises.

Since state-of-the-art object detection algorithm is exploited in shape search III, it can provides much more reliable position and pose estimation with higher speed compared to shape search II. Furthermore, it has much more parameter to tune to support a wider variety of applications.

Used in the Following Case

- **Alignment mark detection and precise position estimation.**



Important

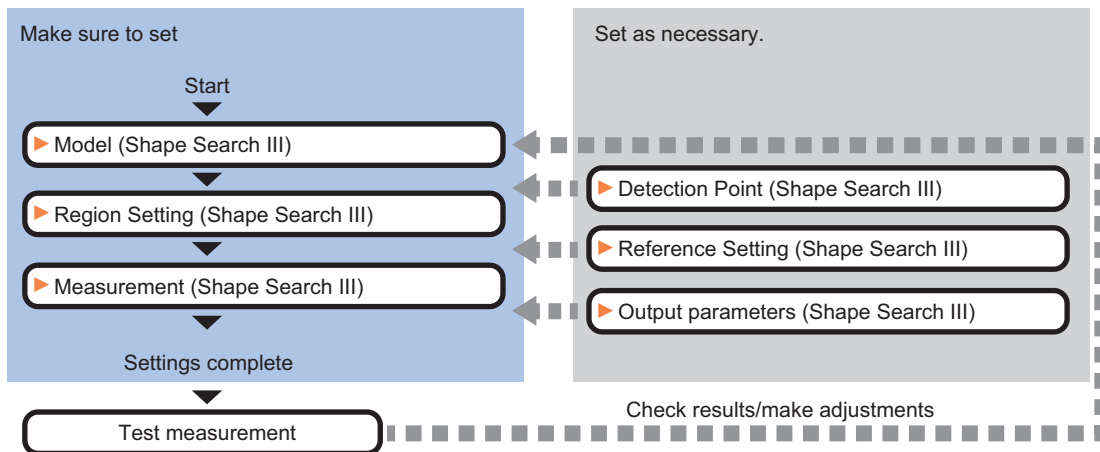
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.
- When the measurement region is changed, the Position X and Position Y can differ. Be sure to check functionality thoroughly before starting operation.

Note

- Search processing basic concepts
Reference: ▶ "Appendixes Measurement Mechanism Search Processing Mechanism" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Settings Flow (Shape Search III)

Set up shape search III according to the following steps.



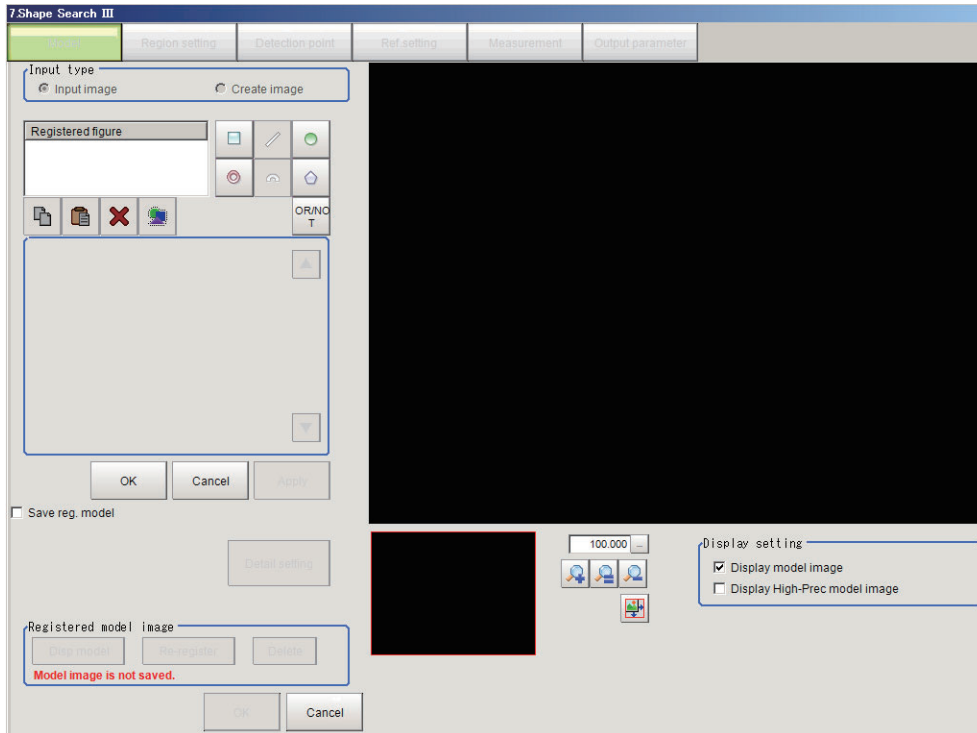
List of Shape Search III Items

Item name	Description
Model	This item registers the pattern characteristic of the measurement image as a model. It changes the model parameter as necessary. Reference: ▶ Model (Shape Search III) (p.172)
Region setting	This item is used to set up the measurement area. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. Reference: ▶ Region Setting (Shape Search III) (p.178)
Detection point	This item can be changed if necessary. It sets a position in the model that should be used as the detection coordinates during measurement. Usually, the central position of the set model is registered as the detection coordinates. Reference: ▶ Detection Point (Shape Search III) (p.179)
Ref. setting	This item can be changed if necessary. It sets the reference position within the camera's field of view. Reference: ▶ Reference Setting (Shape Search III) (p.180)
Measurement parameter	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if the X and Y coordinates and the correlation values with the model are OK. Reference: ▶ Measurement parameter (Shape Search III) (p.181)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameter (Shape Search III) (p.185)

Model (Shape Search III)

Register the specific parts of the image to measure as the Model.

Before registering as a Model, verify the position to inspect on the workpiece. Position information entered at Model registration time is included in the Model information. If the position to detect at measurement time differs from the registered position, it will not be accurately detected.



Model Registration

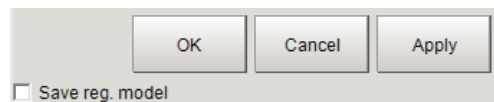
There are two methods for Model Registration. One is to use the input image. The other is to use an image from a previously provided graphic pattern. In most cases it is recommended to use the input image.

Register the Model image (Input image)

When registering a model image using the Input image.
Verify the position of the workpiece before measuring.

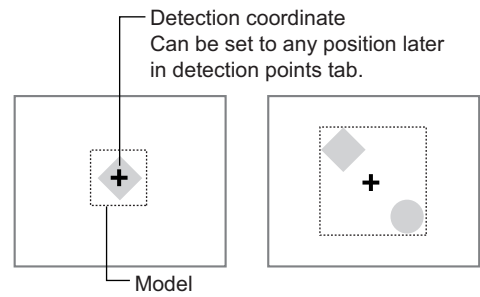
- 1** Click [Model] tab.
- 2** Choose [Input image] in the Input type area.
- 3** Click [Edit].
- 4** Select the area of the image to register as the Model using the Drawing tool.
- 5** Check the “Save reg. model” box for later verification of the image used as a Model.
- 6** Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.



Note

- By saving the Registered model image, the same image, with any detailed setting updates, can be used when re-registering a model.
- Saving the Registered model image will increase the Scene data size.
- When registering the model, the Center point of the registered model is also automatically registered as the Detection point and Reference coordinates. These can be changed.



Registering a model through image generation (Create image)

You can register a model using shapes provided in Shape Search III. Use this function when the captured image has excessive noise, or the shape in the image to register as the model is unclear, or is missing a part.

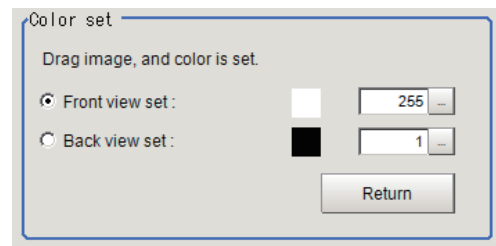
- 1 In the [Input type] area, select [Create image].
- 2 Adjust each setting in the [Figure type] area.

Setting item	Setting value [Factory default]	Description
Figure type	<ul style="list-style-type: none"> • [Cross] • Circle • Rectangle • Diamond 	Select the type of figure to be used for the generated image model.
Empty middle	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select whether or not to make the generated image hollow. Select the setting according to the shape of the detection object.
Offset	0 to 99 [5]	Set how much margins will be provided for the model when it is registered. Set a value that is larger than the smooth count. If you set a rotation angle, increase the value even more. Model registration will not be possible if the model region extends beyond the image. If that occurs, reduce the value.
Smooth count	0 to 9 [1]	Set the level of smoothing applied to the generated figure according to the condition of the outline of the detection object. If the outline is clear, reduce the value. If the outline is not clear, increase the value.
Equal XY	<ul style="list-style-type: none"> • Checked • [Unchecked] 	If you place a check here, the length and width settings will become the same for X and Y.

Setting item	Setting value [Factory default]	Description
Outside (Cross) Length X (Cross) Length Y (Cross) Width X (Cross) Width Y (Circle) Radius (Rectangle) Length X (Rectangle) Length Y (Diamond) Length X (Diamond) Length Y	0 to 9999 [100] [100] [20] [20] [50] [100] [50] [100] [50]	Specify the distance from the center to the outline of the shape to determine the size of the outline. Unit of measure: pixel When you specify the length X to 100, the total X direction of figure is 201 pixels: ± 100 pixels from the center of figures.
Middle (Cross) Length X (Cross) Length Y (Cross) Width X (Cross) Width Y (Circle) Radius (Rectangle) Length X (Rectangle) Length Y (Diamond) Length X (Diamond) Length Y	0 to 9999 [80] [80] [10] [10] [25] [50] [25] [50] [25]	Specify the distance from the center to the outline of the hollow to determine the size of the hollow. Unit of measure: pixel When you specify the length X to 100, the total X direction of figure is 201 pixels: ± 100 pixels from the center of figures.

3 Click [Color set].

4 In the [Color set] area, specify colors of the created image.



Setting item	Setting value [Factory default]	Description
Color set	<ul style="list-style-type: none"> • [Front view set] • Back view set 	Drag the image, and the brightness information set here will be updated.
Front view set	1 to 255 [255]	Set the foreground color of the generated image.
Back view set	1 to 255 [1]	Set the background color of the generated image.

5 Click [Return] in the [Color set] area.

6 On the image, click the position you want to use as the center coordinate of the shape.

7 Specify the position in detail by entering values or clicking arrows in the [Set center position] area.

8 Set [Rotation angle] by entering the value in the [Set center position] area.

9 Select the [Save reg. model] check box if you want to keep the image used for model registration for future reference.

10 Click [Save image] to save the created image.

11 Click [Regist].

Model registration is finished successfully.

If the [Save reg. model] check box is selected, the registered model image is also saved besides the model.

Adjusting settings for model registration (detail setting)

Adjust detail settings for model registration when you want to stabilize measurements or speed up processing. Otherwise, keep the factory default settings. After adjustments, verify the settings by performing actual measurement.

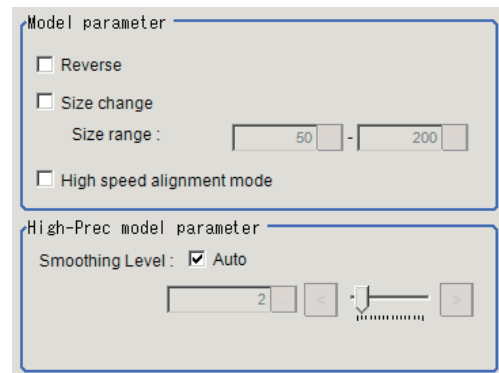
Changing Model Parameters

Tuning model parameters enables improvement of unstable detection or faster processing. Re-register the model after the adjustment.

1 Click [Detail setting].



2 Adjust each setting under [Model parameter] and [High-Prec model parameter].



Setting item	Setting value [Factory default]	Description
Reverse	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select this check box when detecting objects whose dark areas and bright areas are fluctuating due to glossiness, etc.
Size change	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select this check box when the size of target objects vary.
Size range	50 to 200 [50] to [200]	This setting is available when the [Size change] check box is selected. Set the upper and lower limit of the size fluctuation.
Smoothing Level	1 to 16 [4]	This setting is available when the [Smoothing Level: Auto] check box is cleared. You can adjust the smoothing level of High-Prec model images used when the [High-Prec.] check box is selected in the Measurement Parameter tab page.
Smoothing Level: Auto	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Select this check box to automatically adjust the Smoothing Level. If the result of the auto-adjustment is not as desired, clear this check box and adjust [Smoothing level].
High speed alignment mode	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select this check box when detecting simple shapes such as alignment marks. Clear this check box when detecting complex patterns or shapes with only few pixel wide thin lines.

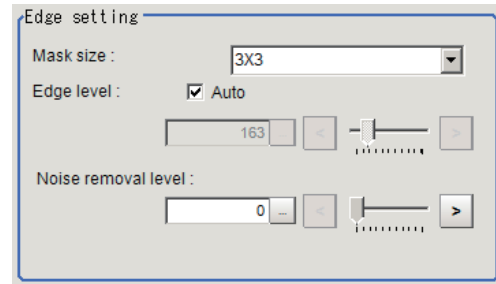
Note

- In High speed alignment mode, detection speed is faster, while maintaining accuracy and detection capability by simplifying the model and eliminating its complex feature information. This is effective especially when detecting simple shapes such as alignment marks.

Changing the Edge Extraction Setting

Adjust the edge extraction settings when you cannot detect edges when registering a model, or when detected edges are broken. Re-register the model after the adjustment.

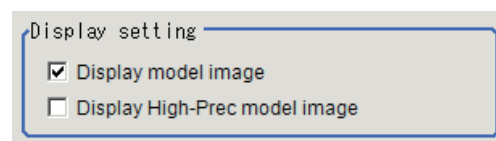
- 1 Click [Detail setting].
- 2 Adjust each setting under [Edge setting].



Setting item	Setting value [Factory default]	Description
Mask size	<ul style="list-style-type: none"> • [3 × 3] • 5 × 5 • 7 × 7 	Select the range of pixels to use for edge detection. Select a large size when the brightness varies greatly among pixels.
Edge level: Auto	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Select this check box to adjust [Edge level] automatically. If edges are not detected under the auto settings, clear this check box and adjust value of [Edge level].
Edge level	0 to 1024	This setting is enabled when the [Auto] check box is cleared in the [Edge setting] area. Set the lower limit of edge level to recognize as edge. Edges are recognized when their edge level is above this value. The smaller the value, the easier it is to find edges. The larger the value, the less noise will affect finding edges.
Noise removal level	0 to 100 [0]	Specify the upper limit of noise level to eliminate. Noise whose noise level is below this value will be eliminated. In the noise removal process, edges are connected and divided into a set of groups of line segments, and then these line segments are removed one by one from shorter segments. Setting a larger value removes larger noise.

Verifying the model on the image

- 1 In the [Display setting] area, adjust each setting.

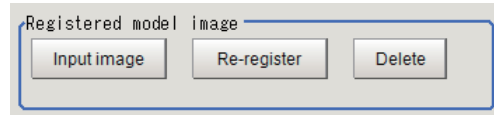


Setting item	Setting value [Factory default]	Description
Display model image	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Select this check box to display and confirm the model image.
Display input image	<ul style="list-style-type: none"> • [Checked] • Unchecked 	This check box is available when the [Create image] check box is selected in the [Input type] area. Select this check box to check the captured image while also the created image is displayed.
Display High-Prec model image	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select this check box to display the high precision model which is used when the [High-Prec.] check box is selected in the Measurement tab page.

- 2 Confirm the model image on display, and register as a model.

Displaying, re-registering, and detecting a model (model registration image)

The buttons described in the following table are available when a model registration image is saved. You can use these buttons to reconfirm images used for model registration, or re-registering the model after adjusting detail settings. For more information, refer to *Model Registration (Shape Search III)*.

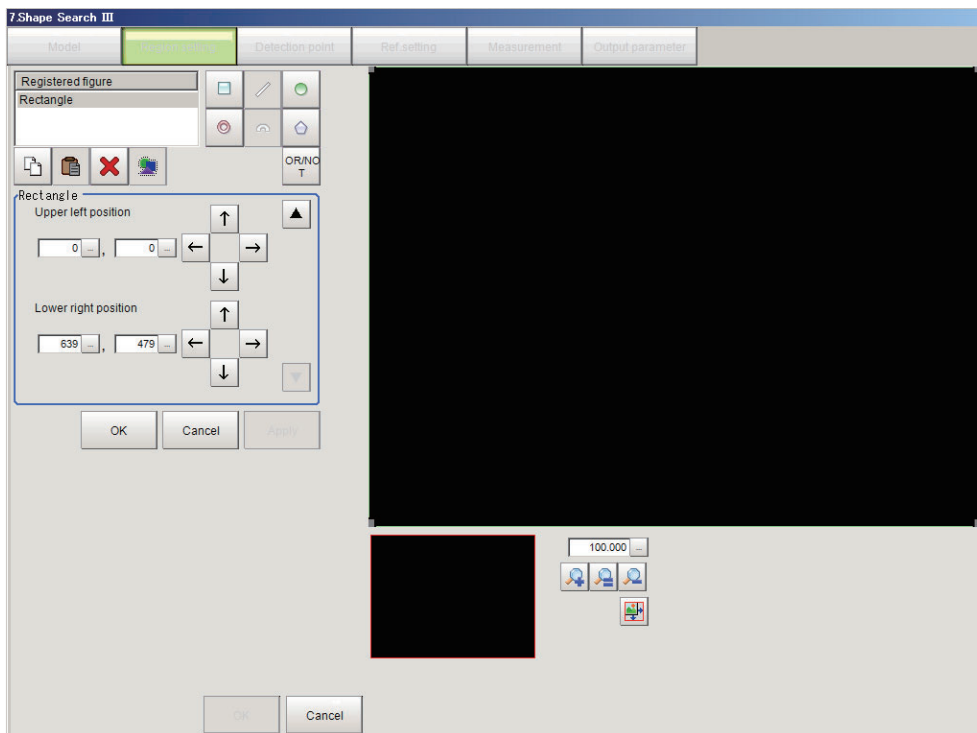


Item	Description
Disp model/Input image	Switches the model image view and input image view.
Re-register	Re-registers a model using the model registration image. When model parameters are changed, you can display the model registration image and re-register. This button is available when the model registration image is displayed.
Delete	Deletes a model.

Region Setting (Shape Search III)

Sets the measurement region of Model.

Measurement entirely Input image is available. To limit the measurement range, you can shorten the processing time.



- 1** Click [Region setting] tab.
- 2** Click [Edit].
- 3** Set the measurement range to detect Model.
- 4** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

Detection Point (Shape Search III)

You can change the detection point on the Detection Point tab page. Set the detection point by specifying a point in the detected model to use as a measurement coordinate. In default setting, the center position of the registered model is set as the detection point.

The detection point can either be set directly, or by referring to a unit.

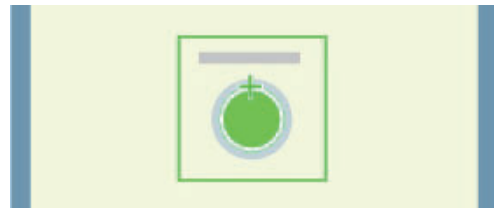
Important

- When you register a model, the center coordinate of the model will automatically be set as a detection point. If you want to use other point, make sure to re-set it after a model registration.

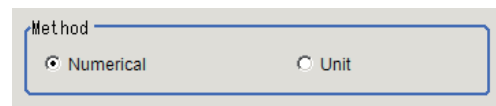
Set the detection point by directly entering numerical values (Numerical)

Click a position on the image you want to use as a detection point, or input coordinate data for that point.

1 Click the Detection point tab.

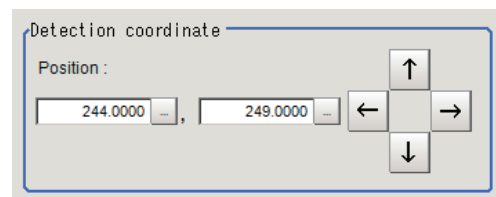


2 In the [Method] area, select [Numerical].



3 Click the position to be set as the detection point.

4 Make fine adjustments using numeric value inputs or the arrow buttons as required.



Note

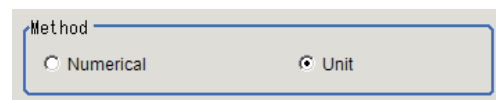
- You can enlarge the image so that it is easier to click.
Reference: ▶ *Appendixes Basic Knowledge about Operations Using the Zoom Function in the Vision System FH/FZ5 Series User's Manual (Cat. No. Z365)*

Set the detection point by referencing processing unit (Unit)

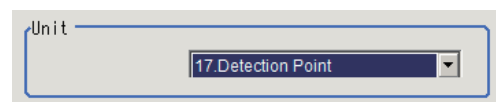
Set the detection point by referencing the Detection Point processing unit set in the measurement flow. In this method, the position and angle are set based on measurement results, and thus they are more accurately set than the Numerical setting method.

1 Click the Detection point tab.

2 In the [Method] area, select [Unit].



3 In the [Unit] area, select the Detection Point processing unit in the current Scene.



4 Perform the next measurement, and then the detection point will be applied.

Reference Setting (Shape Search III)

You can change the reference coordinates on the Ref. setting tab page. Set the reference point and angle within the camera FOV as the reference coordinate. When you register a model, the center point of the registered model is automatically set as the reference point. This reference point is used to measure deviation from a certain point.

A reference position can be set either directly or by referencing a unit.

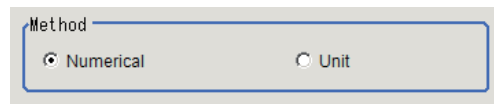
Set the reference point by directly entering numerical values (Numerical)

Click a position on the image you want to use as a reference position, or input coordinate data for that point.

1 Click the Ref. setting tab.

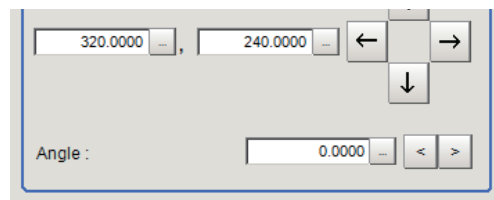


2 In the [Method] area, select [Numerical].



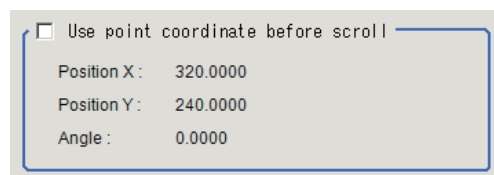
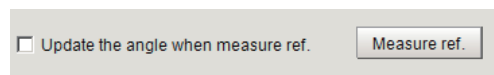
3 Click the position to be set as the reference.

4 Make fine adjustments using numeric value inputs or the arrow buttons as required.



5 Set the reference angle using numeric value inputs in the [Reference coordinate] area.

6 To use the reference coordinate as the coordinate before the position compensation, select the [Use point coordinate before scroll] check box.



Note

- You can enlarge the image so that it is easier to click.
Reference: ▶ *Appendixes Basic Knowledge about Operations Using the Zoom Function in the Vision System FH/FZ5 Series User's Manual (Cat. No. Z365)*
- When using the Position Compensation processing item, the coordinates after position compensation will be the reference point. When the coordinates before the position compensation are needed for alignment, etc., select the [Use point coordinate before scroll] check box.

Updating the reference coordinate by measuring the displayed image (reference measurement)

Measure the image displayed on the setting window and use the measurement result as the reference coordinate.

- 1** When you want to update the reference angle besides the reference point, select the [Update the angle when measure ref.] check box.
- 2** Click [Measure ref.].
The reference coordinate will be updated.
- 3** If you want to use the reference coordinate as the coordinate before the position compensation, select the [Use point coordinate before scroll] check box.

Note

- When using the Position Compensation processing item, the coordinates after position compensation will be the reference point. When the coordinates before the position compensation is needed for alignment, etc., select the [Use point coordinate before scroll] check box.

Set the reference point by referencing processing unit (Unit)

Set the reference point by referencing the Detection Point processing unit set in the measurement flow. In this method, the position and angle are set based on measurement results, and thus they are more accurately set than the Numerical setting method.

- 1** Click the Ref. setting tab.
- 2** In the [Method] area, select [Unit].
- 3** In the [Unit] area, select the Detection Point processing unit in the current Scene.
- 4** Perform the next measurement, and then the reference point will be applied.

Measurement parameter (Shape Search III)

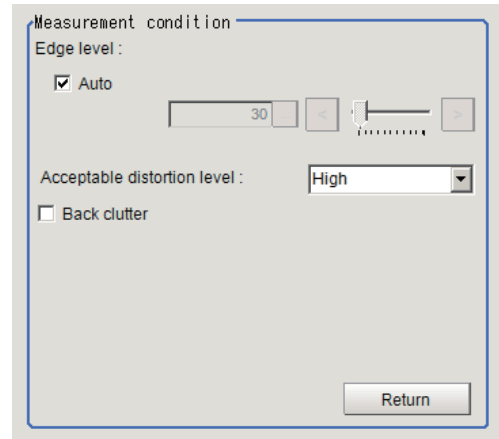
Set the measurement conditions or judgment condition in this Measurement parameter.

Set the Measurement conditions

- 1 Click [Measurement] in Item Tab area.
- 2 Set the desired value for each setting.

Setting item	Setting value [Factory default]	Description
Candidate LV	0 to 100 [50]	Set the threshold to detect candidate points in a rough search. Set this Item to a smaller value when the detection is unstable.
High-Prec.	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Check [High-Prec.] to output more accurate position information. Note that the processing time will normally be faster if [High-Prec.] is left unchecked.
Rotation	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Check this item when the direction differs of the inspection object differs from the registered model.
Angle range	-180 to 180 [-180] to [180]	Check this item to be active, then set the measurement angle range.
Multiple output	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Check this item when you want to detect multiple objects in a single measurement.
Count	1 to 128 [32]	Sets the maximum number of detections. If more objects than the set value are detected, all detected candidates are sorted out. Then within Candidates from the top of counted number are outputted as the measurement result.
Sort condition	<ul style="list-style-type: none"> • Corr. ascending • [Corr. descending] • X ascending • X descending • Y ascending • Y descending 	Select this item to set for the Sort condition when Multiple output is executed. When sorting based on the X and Y coordinates, the upper left is the origin.
Re-sort	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Check this item when you want to re-sort in other conditions. Only the result that selected in [Count] function are output.
Re-sort condition	<ul style="list-style-type: none"> • Corr. ascending • [Corr. descending] • X ascending • X descending • Y ascending • Y descending 	Select the Re-sort condition.
Search No.	0 to 127 [0]	Set the sort order number of output result from the sort or re-sort.
Overlay judgement	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Check this item to distinguish the detected result from the overlap result.
Overlay rejection(%)	1 to 100 [100]	Adjust the overlap rejection percentage. Increase this value when you want to reject a small overlap.
Show overlap judg. area	<ul style="list-style-type: none"> • [Checked] • Unchecked 	This function is applied when you check [Overlay judgement]. When you check [Show overlap judg. area], the area is displayed as dashed line.

- 3** Click [Detail setting] in the Measurement condition area, then set the setting value.



Setting item	Setting value [Factory default]	Description
Edge level: Auto	<ul style="list-style-type: none"> • [Checked] • [Unchecked] 	In this function, you can set [Edge level] automatically. If edge recognize is not making good progress, un-check this item and set [Edge Level].
Edge level	0 to 1024 [30]	This function will be enable when you un-check [Auto] check box. Set the lower limit to recognize the [Edge level]. Edges is higher than set value are recognized. Decrease the setting value when it is difficult to find edge. Increase the setting value when inspection object takes many noise effects.
Acceptable distortion level	<ul style="list-style-type: none"> • Low • Medium • [High] 	Selects the degree of influence of correlation values when Model edge has small uneven patterns. To avoid reduction of correlation value, set [High] in this item.
Back clutter	<ul style="list-style-type: none"> • [Checked] • [Unchecked] 	<p>Check this item to get stable condition of measurement result when there are many edges in the background of Model.</p> <p>Note</p> <p>For the FZ5-L35□ or FZ5-6□□, a warning message will be displayed if you place a check here. If you place a check for [Back clutter], memory may not be sufficient. If the measurement result is [NG (insufficient memory)], perform the following adjustments to remedy the situation.</p> <ul style="list-style-type: none"> • Make the measurement region smaller. (Reference: ▶ Region Setting (Shape Search III) (p.178)) • Increase the candidate level. (Reference: ▶ Model (Shape Search III) (p.172)) • Decrease the range of the image that varies radically (Reference: ▶ Model (Shape Search III) (p.172))

- 4** Click [Measure], then check the measurement.

Test measuring of this item.

Measure

Confirm the measurement result on the display (Display setting)

- 1 Set the check box in the Display setting area.
- 2 Confirm the measurement processing condition, then set Measurement condition.

Setting item	Setting value [Factory default]	Description
Display edge image	<ul style="list-style-type: none">• Checked• [Unchecked]	Check this item when you confirm extracted edge set in [Edge level] on the display.
Display corresponding model	<ul style="list-style-type: none">• Checked• [Unchecked]	Check this item when you confirm detected Model on the display.

Set Judgment condition

Set the upper and lower values to judge the measurement result. When the measurement result value is within the upper and lower value, Judgment is [OK] (pass). When the measurement result value exceeds either the upper, or lower value Judgment is [NG] (failed). About The Judgment result for the Processing Unit is [OK] when the judgment for all measurements is [OK], however it will be [NG] if any measurement result is [NG].

- 1 Set the value in the Judgment area.

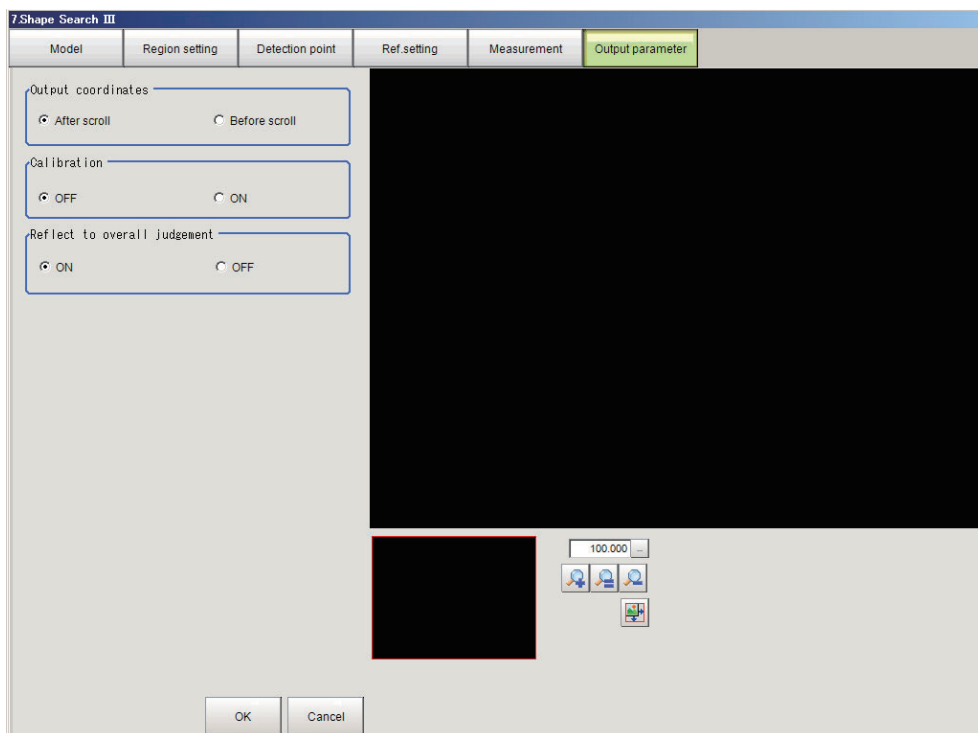
Setting item	Setting value [Factory default]	Description
Count	0 to 128 [0] to [32]	Set the upper and lower values of number of detected Model.
Measure X	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Set the upper and lower values of detected Model on X coordinate.
Measure Y	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Set the upper and lower values of detected Model on Y coordinate.
Search angle	-180 to 180 [-180] to [180]	Set the upper and lower values of detected Model angle.
Correlation	0 to 100 [60] to [100]	Set the upper and lower correlation values of detected Model. Judgment will be [NG] instead of the lower value when the measurement result correlation is zero.

Note

- Measurement result will be displayed on the right of the Judgment items. You can set the Judgment condition refer to this value.

Output Parameter (Shape Search III)

Set how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.



- 1 Click [Output parameter] in Item Tab area.
- 2 Set each item's value.

Setting item	Setting value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	Select the timing for applying Position compensation to the output value.
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether, or not the Calibration results affect the output values. ON: Output not the camera's coordinates into actual dimensions based on the Calibration result.
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Selects whether, or not Shape Search III Judgment results affect the Scene's Overall Judgment.

Note

- Measurement result may change if you change the Output parameter after setting the Measurement parameter. You need to change.

Key Points for Test Measurement and Adjustment (Shape Search III)

To improve measurement accuracy, or speed adjust the parameter confirming the measurement test result. Refer to the following points when making adjustments.

For measurement result display or output contents, refer to Capable of output measurement result (Shape Search III) on p.108.

Note

- When using Test Measurement, the detailed information displayed and the image displayed will be updated according to the measurement result.

Content displayed in the Detail result area

The following measurement results are displayed in the Detail result area as text.

Displayed Items	Description
Judge	Judgement result
Count	Number of detections
Correlation	Correlation value
Position X	X coordinate of the position where the model is detected.
Position Y	Y coordinate of the position where the model is detected.
Angle θ	Angle of the position where the model is detected.

Displayed contents in the Image display area

The following images are displayed with set the Sub image number in the Image display area.

Sub image number	Description
0	Measurement image
1	Measurement image with detection results overlaid.
2	Edge image
3	Edge image with detection results overlaid. Green: Matched model points Yellow: Model points matched but with different directions Red: Unmatched model points

For adjustment of measurement accuracy or uneven

There are the following methods to adjust the measurement accuracy or uneven.

When the measurement results are unstable.

Parameter to be adjusted	Troubleshooting
Measurement parameter Reference: ▶ Measurement parameter (Shape Search III) (p.181)	<ul style="list-style-type: none"> • If the variability for good workpieces is large. Decrease [Candidate LV]. • If there are large differences in the shape of individual workpieces. Raise [Acceptable distortion level], if the correlating value is decreased when you change the work Piece. • Except for the work pieces shape can be detected. Raise [Edge Level], if work's dirty point or fine patterns are miss-detected. • It could be not able to measure in pixel unit. Check [High-Prec.], if the accuracy of measurement coordinates is low.

In the case of searching other position

Parameter to be adjusted	Troubleshooting
Measurement parameter Reference: ▶ Measurement parameter (Shape Search III) (p.181)	<ul style="list-style-type: none"> • Detected target can be found too much. Raise [Acceptable distortion level] if miss-detected is occurred, e.g. place where is no work piece or similar to work piece shape are detected. • Miss-detection can be occurred because there are many edges back on work pieces P target edges are not able to be detected.

Adjusting of the measurement processing speed

You can use the following methods to improve measurement processing speed.

When the processing speed is late

Parameter to be adjusted	Troubleshooting
Region setting Reference: ▶ Region Setting (Shape Search III) (p.178)	<ul style="list-style-type: none"> Measurement processing time takes long time because the measurement region is broad. Set the measurement region as narrow as possible.
Model Reference: ▶ Model (Shape Search III) (p.172)	<ul style="list-style-type: none"> Measurement processing time takes long time because the measurement region is broad. Set the Model region as narrow as possible. A complicated shape is registered as a Model. Check [High speed alignment mode] in Model parameter if target pattern is not a complex one.
Measurement Reference: ▶ Measurement parameter (Shape Search III) (p.181)	<ul style="list-style-type: none"> If there are too many false detections in a rough search. Raise [Acceptable distortion level] if workpieces that should be judged OK vary little. The measurement process is longer for high precision measurement than it is for sub-pixel measurement. Uncheck [High-Prec.] when the position accuracy is enough high. There is a possibility that needless rotational work piece is measured its angle. Uncheck [Rotation] in this case. A work piece that its angle range is narrow is measured with huge angle range. Set upper and lower level of [Angle range] to small when point-symmetry work pieces are measured.

Adjustments for other than measurement processing speed

There are the following methods to adjust for other than measurement processing speed.

When Judgment result is NG (insufficient memory)

Parameter to be adjusted	Troubleshooting
Region setting Reference: ▶ Region Setting (Shape Search III) (p.178)	<ul style="list-style-type: none"> Memory use is too high due to the measurement region being too large. Set the measurement region as narrow as possible.
Model Reference: ▶ Model (Shape Search III) (p.172)	<ul style="list-style-type: none"> Memory use is too high due to the size of the model being large. Set the Model region or [Size change] of [Size change] as narrow as possible.
Measurement Reference: ▶ Measurement parameter (Shape Search III) (p.181)	<ul style="list-style-type: none"> Memory use is too high when [Back clutter] is checked. Uncheck [Back clutter] and process the edge using processing units for compensate image (refer to Chapter 3).

Measurement Results for Which Output is Possible (Shape Search III)

The measurement result of Shape Search III is the following. This result is displayed on the measurement result area, and output to extra device is possible by using processing units related on output result.

Measurement items	Character string	Description
Judge	JG	Judgement result
Number of detections	C	Number of search items detected If none detected, 0
Correlation value	CR	Correlation value with the model
Position X ^{*1}	X	X coordinate of the position where the model is detected
Position Y ^{*1}	Y	Y coordinate of the position where the model is detected
Angle θ	TH	Angle of the position where the model is detected
Reference X	SX	X coordinate of the reference position of the registered model
Reference Y	SY	Y coordinate of the reference position of the registered model
Reference angle	ST	Angle of the registered model
Detection point RX	RX	X coordinate of the registered model
Detection point RY	RY	Y coordinate of the registered model
Correlation value N (N = 00 to 127)	CRN	Detected search N correlation value (N = 00 to 127)
Position N (N = 00 to 127)	XN	Detected search N position X (N = 00 to 127)
Position N (N = 00 to 127)	YN	Detected search N position Y (N = 00 to 127)
Angle N (N = 00 to 127)	THN	Detected search N angle TH (N = 00 to 127)

External Reference Tables (Shape Search III)

Setting the number of Processing unit data setting / Control command or acquisition function, you can refer the following data.

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
5	Correlation value	Get only	0 to 100
6	Position X	Get only	-99999.9999 to 99999.9999
7	Position Y	Get only	-99999.9999 to 99999.9999
8	Measure angle	Get only	-180 to 180
9	Reference position X ^{*1}	Get only	-99999.9999 to 99999.9999
10	Reference position Y ^{*1}	Get only	-99999.9999 to 99999.9999
11	Reference angle	Get only	-180 to 180
12	Detection coordinate X	Get only	-99999.9999 to 99999.9999
13	Detection coordinate Y	Get only	-99999.9999 to 99999.9999
14	Count	Get only	0 to 128
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	With rotation	Set/Get	0: OFF 1: ON
121	Upper limit of the rotation angle	Set/Get	-180 to 180
122	Lower limit of the rotation angle	Set/Get	-180 to 180
123	Edge level (model)	Set/Get	0 to 1024
124	Reverse	Set/Get	0: Do not allow black and white reverse 1: Allow black and white reverse
126	High-Prec.	Set/Get	0: OFF 1: ON
127	Reference X ^{*2}	Set/Get	0 to 99999.9999
128	Reference Y ^{*2}	Set/Get	0 to 99999.9999
129	Reference angle θ	Set/Get	-180.0 to 180.0
130	With/without size change	Set/Get	0: OFF 1: ON
131	Upper limit of the size change	Set/Get	50 to 200(%)
132	Lower limit of the size change	Set/Get	50 to 200(%)
133	Candidate Point Level	Set/Get	0 to 100
134	Detection point X	Set/Get	0.0000 to 9999.0000

No.	Data name	Set/Get	Data range
135	Detection point Y	Set/Get	0.0000 to 9999.0000
136	Sort condition	Set/Get	0: Correlation value ascending 1: Correlation value descending 2: Measurement coordinate X ascending 3: Measurement coordinate X descending 4: Measurement coordinate Y ascending 5: Measurement coordinate Y descending
137	Search No.	Set/Get	0 to 127
138	Judgement upper limit for correlation value	Set/Get	0 to 100
139	Judgement lower limit for correlation value	Set/Get	0 to 100
140	Judgement upper limit for number of detections	Set/Get	0 to 128
141	Judgement lower limit for number of detections	Set/Get	0 to 128
142	Judgement upper limit for measurement coordinate X	Set/Get	-99999.9999 to 99999.9999
143	Judgement lower limit for measurement coordinate X	Set/Get	-99999.9999 to 99999.9999
144	Judgement upper limit for measurement coordinate Y	Set/Get	-99999.9999 to 99999.9999
145	Judgement lower limit for measurement coordinate Y	Set/Get	-99999.9999 to 99999.9999
146	Judgement upper limit for measurement angle	Set/Get	-180 to 180
147	Judgement lower limit for measurement angle	Set/Get	-180 to 180
150	Edge level (measurement)	Set/Get	0 to 1024
161	Count	Set/Get	0 to 128
168	Multiple output	Set/Get	0: OFF 1: ON
171	Save registered model	Set/Get	0: None 1: Save
172	Edge level (measurement) auto setting	Set/Get	0: OFF 1: ON
173	High-speed alignment mode	Set/Get	0: OFF 1: ON
174	Filter size	Set/Get	0: 3 × 3 1: 5 × 5 2: 7 × 7
177	Smoothing level	Set/Get	1 to 16
178	Edge level (model) auto setting	Set/Get	0: OFF 1: ON

No.	Data name	Set/Get	Data range
180	Allowable distortion level	Set/Get	0: Low 1: Medium 2: High
181	Noise removal level	Set/Get	0 to 100
182	Display search model image	Set/Get	0: OFF 1: ON
183	Complex background	Set/Get	0: OFF 1: ON
227	Re-sort	Set/Get	0: OFF 1: ON
228	Re-sort condition	Set/Get	0: Correlation value ascending 1: Correlation value descending 2: X ascending 3: X descending 4: Y ascending 5: Y descending
229	Overlap judgement	Set/Get	0: OFF 1: ON
230	Allowable overlap ratio	Set/Get	1 to 100
231	Reference unit number for reference coordinate	Set/Get	-1 to 9999
232	Reference type of reference coordinate	Set/Get	0: Set by number 1: Unit reference
233	Reference angle update	Set/Get	0: Not update 1: Update
234	Reference unit number for detection point coordinate	Set/Get	-1 to 9999
235	Reference type of detection point coordinate	Set/Get	0: Set by number 1: Unit reference
236	Use coordinates before position compensation	Set/Get	0: Not used 1 : Used
237	Coordinate X before position compensation	Set/Get	-99999.9999 to 99999.9999
238	Coordinate Y before position compensation	Set/Get	-99999.9999 to 99999.9999
239	Angle before position compensation	Set/Get	-180 to 180
249	Show overlap judg. area	Set/Get	0: OFF (Hide overlap judg. area) 1: ON (Show overlap jdug. area)
1000 + NN (NN = 0 to 127)	Correlation value	Get only	0 to 100
1100 + NN (NN = 0 to 127)	Position X	Get only	-99999.9999 to 99999.9999
1200 + NN (NN = 0 to 127)	Position Y	Get only	-99999.9999 to 99999.9999
1300 + NN (NN = 0 to 127)	Measure angle	Get only	-180 to 180
30000 + NN (NN = 0 to 127)	Correlation value	Get only	0 to 100
40000 + NN (NN = 0 to 127)	Edge position X	Get only	-99999.9999 to 99999.9999
50000 + NN (NN = 0 to 127)	Edge position Y	Get only	-99999.9999 to 99999.9999
60000 + NN (NN = 0 to 127)	Measure angle	Get only	-180 to 180

*1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.

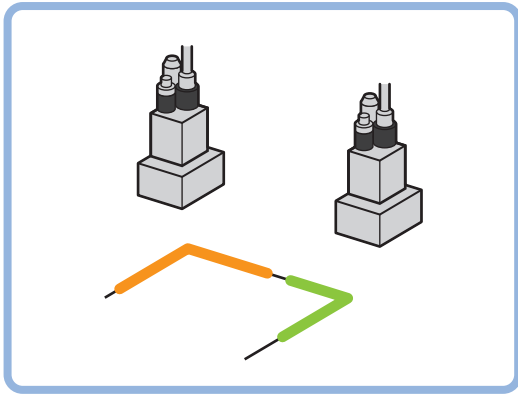
*2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.

Ec Corner

This processing item measures a corner position (corner) of a work. The intersection of two lines generated from the edge information of two sides of a square work is measured. A desired corner can be measured by setting the length, direction, edge intensity and other conditions.

Used in the Following Case

- When you want to align the work position based on the feature of its corner

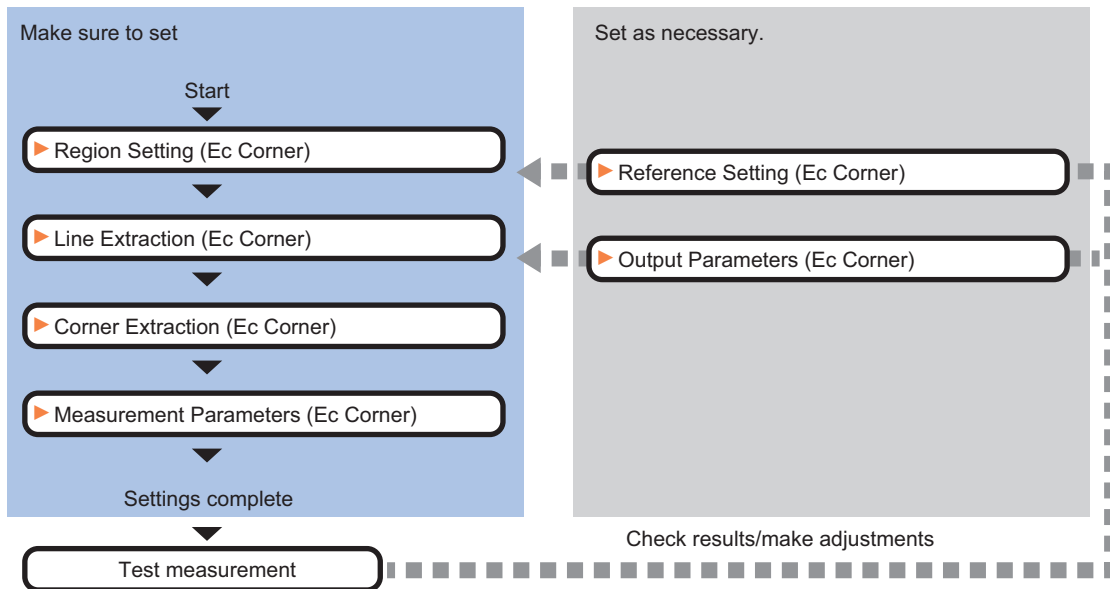


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Ec Corner)

Set up EC corner according to the following steps.



List of Ec Corner Items

Item name	Description
Region setting	This item is used to set up the measurement area. Reference: ▶ Region Setting (Ec Corner) (p.193)
Ref. setting	Change as necessary. This is changed when measuring the position deviation from a certain position. Reference: ▶ Reference Setting (Ec Corner) (p.194)
Line extraction	This item sets the conditions for extracting a line. Reference: ▶ Line Extraction (Ec Corner) (p.195)
Corner extraction	This item sets the conditions for extracting a corner. Reference: ▶ Corner Extraction (Ec Corner) (p.196)
Measurement	Set the sort conditions/judgement conditions of corners. Data of the specified number is output as measurement data. Reference: ▶ Measurement Parameters (Ec Corner) (p.198)
Output parameter	This item can be changed if necessary. Select the measurement result coordinates and set how to handle the coordinates. Reference: ▶ Output Parameters (Ec Corner) (p.199)

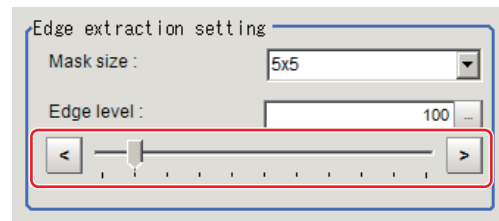
Region Setting (Ec Corner)

This item is used to set up the measurement area.

Use the rectangle to set up the measurement region for [Ec corner].

- 1** In the Item Tab area, click [Region setting].
- 2** Use the drawing tools to set the measurement region.
- 3** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.
- 4** Click [Edge extraction], then confirm the edge extraction image.

If the profile of the measurement object is interrupted or has too many edges, adjust the edge level.



Setting item	Setting value [Factory default]	Description
Mask size	<ul style="list-style-type: none"> • 3 × 3 • [5 × 5] • 7 × 7 • 9 × 9 	Select the range of pixels which are used to extract the edge. With a larger mask size, search is less affected by variation in pixels.
Edge level	0 to 1000 [100]	Change this when the edge is hard to see due to low contrast against the background or when unnecessary background noise must be removed. The smaller the value, the easier it is to find edges. The larger the value, the less noise will affect finding edges.

Reference Setting (Ec Corner)

When the model is set, this position is automatically set at the same time as the reference position. This item can be set to change the reference position to any desired position. This is handy for measuring the position deviation from a certain position.

A reference position can be set either directly or by referencing a unit.

Specifying directly

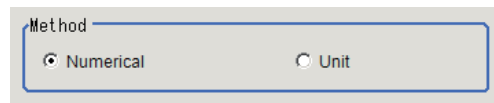
Click the position on the image that you want to set as the reference position, or set the coordinates.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.



2 In the "Method" area, select "Numerical".

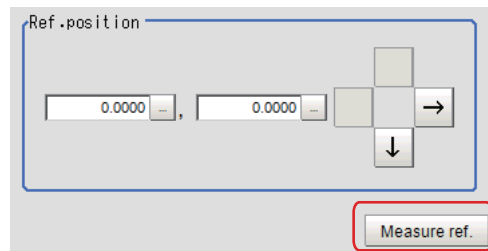


3 Click the position to be set as the reference.

Note

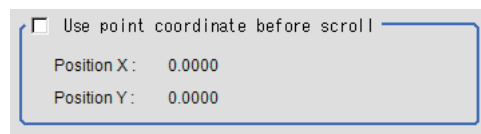
- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

4 Make fine adjustments using numeric value inputs or the arrow buttons as required.



5 To remeasure on the displayed image and set the reference, click the [Measure ref.] button.

6 To use data before position compensation for the reference setting coordinates, place a check at "Use point coordinate before scroll".



Referencing a unit

Set a reference by referencing a detection point unit with registered X coordinate and Y coordinate.

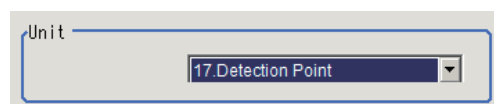
1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.

2 In the "Method" area, select "Unit".



3 In the scene in the "Unit" area, select a detection point unit.

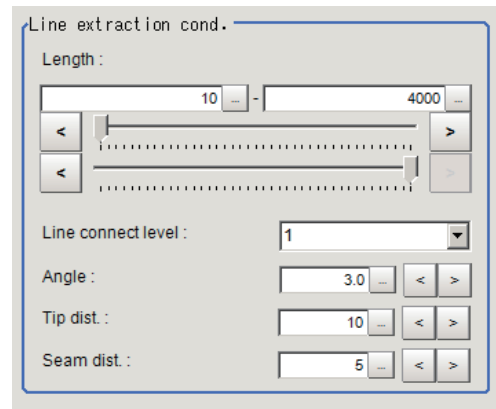


4 Perform the next measurement, and the reference will be displayed.

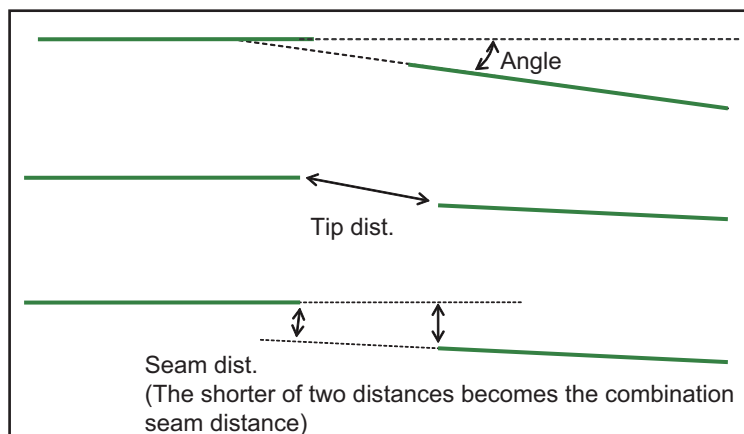
Line Extraction (Ec Corner)

This item sets the conditions for extracting a line.

- 1 In the Item Tab area, click [Line extraction].
- 2 In the "Line extraction cond." area, set the conditions for extracting a line.



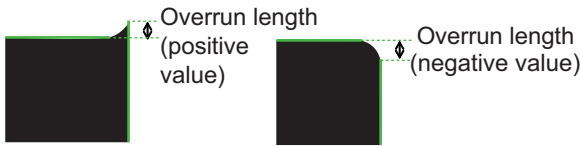
Setting item	Setting value [Factory default]	Description
Length	5 to 4000 [10] to [4000]	Set the length of edges to be extracted.
Line connect level	<ul style="list-style-type: none"> • [1] • 2 • 3 • 4 • 5 • Custom 	Select the degree to which fragmented lines detected by edge extraction are connected. The higher the level, the more likely the lines are connected.
Angle	0.0 to 30.0 [3.0]	Set the angle range to be used when two lines are connected. Increasing this value allows two lines of different inclinations to be connected.
Tip dist.	0 to 1000 [10]	Set the vertex distance to be used when two lines are connected. Increasing this value allows distant lines to be connected.
Seam dist.	0 to 1000 [5]	Set the distance condition to be used when two lines are connected, where an extension of one line comes closest to the vertex of the other line. Increasing this value allows lines offset vertically to the lines to be connected.



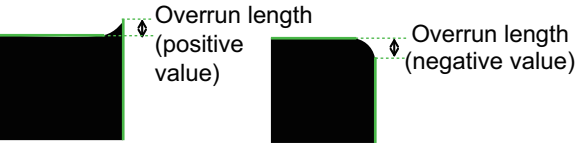
Corner Extraction (Ec Corner)

This item sets the conditions for extracting a corner.

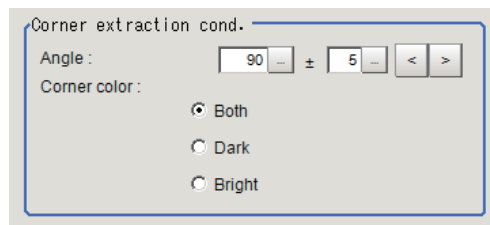
- 1** In the Item Tab area, click [Corner extraction].
- 2** In the "Line 0 cond." area, set the conditions for line 0.

Setting item	Setting value [Factory default]	Description
Length	5 to 4000 [10] to [4000]	Set the length for extracting line 0.
Angle	[0] to 359	Set the angle for extracting line 0.
Overrun	-1000 to 1000 [-10] to [10]	Set the length range to be used when specifying whether the tips of two lines that constitute a corner have penetrated through the corner or are not reaching the corner (unit: pix). If the tips have penetrated through the corner, the overrun length becomes a positive value; whereas, if the tips are not reaching the corner, the overrun length becomes a negative value. 

- 3** In the "Line 1 cond." area, set the conditions for line 1.

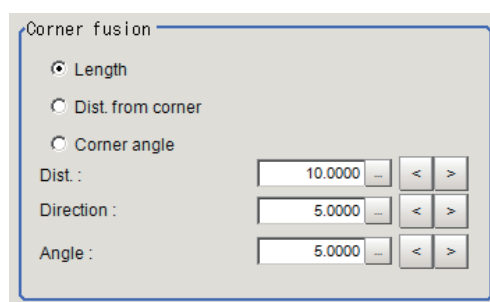
Setting item	Setting value [Factory default]	Description
Length	5 to 4000 [10] to [4000]	Set the length for extracting line 1.
Angle	[0] to 359	Set the angle for extracting line 1.
Overrun	-1000 to 1000 [-10] to [10]	Set the length range to be used when specifying whether the tips of two lines that constitute a corner have penetrated through the corner or are not reaching the corner (unit: pix). If the tips have penetrated through the corner, the overrun length becomes a positive value; whereas, if the tips are not reaching the corner, the overrun length becomes a negative value. 

- 4** In the "Corner extraction cond." area, set the conditions for corners.



Setting item	Setting value [Factory default]	Description
Angle	10 to 350 [90]	Set the angle range for a corner.
±	0 to 180 [5]	Set the margin of angle error.
Corner color	<ul style="list-style-type: none"> • [Both] • Dark • Bright 	Select the light/dark relationship of the corner and background.

- 5** If necessary, click [Advanced setting] and set the intersection fusion condition.



Setting item	Setting value [Factory default]	Description
Corner fusion	<ul style="list-style-type: none"> • Length • Dist. from corner • Corner angle 	<p>If all detected corners include two corners that each meet all of the three conditional relationships of "Fusion distance," "Fusion line angle range" and "Fusion corner angle range," fuse the corners into one according to the priorities specified below.</p> <p>Length: Keep the corner with the longer total length of the two lines constituting the corner.</p> <p>Dist. from corner: Keep the corner with the smaller total overrun of the two lines.</p> <p>Corner angle: Keep the corner whose angle formed by the two lines is closer to the "Angle range" set as a corner condition.</p>
Dist.	0 to 1000.0000 [10.0000]	Set the linear distance between the corners.
Direction	0 to 20.0000 [5.0000]	Set the difference between the angles formed by the two sets of lines constituting the corners.
Angle	0 to 20.0000 [5.0000]	Set the angle difference between the corners.

Measurement Parameters (Ec Corner)

Set the sort conditions/judgement conditions of corners.

Data of the specified number is output as measurement data.

- 1 In the Item Tab area, click [Measurement].
- 2 In the "Sort cond." area, set the sorting conditions.

Sort cond.

Order : ▾

Ascendin Descendi

Corner No. : - >

Setting item	Setting value [Factory default]	Description
Order	<ul style="list-style-type: none"> • [Corner X] • Corner Y • Length 	Select the sorting method for the measurement results.
	<ul style="list-style-type: none"> • [Ascending] • Descending 	
Corner No.	[0] to 99	Set the corner number for the data to be output.

- 3 When the setting has been changed, click [Measure] to verify whether measurements can be made correctly.
- 4 Set up the judgement condition.

Test measuring of this item.

Measure

Setting item	Setting value [Factory default]	Description
Corner X	[-99999.9999] to [99999.9999]	Set the range of X coordinates of corner that is judged to be OK.
Corner Y	[-99999.9999] to [99999.9999]	Set the range of Y coordinates of corner that is judged to be OK.
Angle	[0.0000] to [360.0000]	Specify the formed angles that are judged to be OK.
Count	[1] to [100]	Specify the number of detections of corner that is judged to be OK.

Output Parameters (Ec Corner)

Set how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Setting value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Specify whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Ec Corner)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Corner X	X Coordinate of measured corner
Corner Y	Y coordinate of measured corner
Angle	Formed angle of measured corner
Number of detections	Number of detections of corner

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image.	Explanation of image to be displayed
0	Measurement image

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Parameter to be adjusted	Troubleshooting
Measurement	Reduce the distance between the upper and lower limits of line length range for extracting lines, to reduce false detections.
	Raise the line connection level to prevent the lines constituting the corners to be detected from being interrupted.
	Set the narrowest possible conditions for extracting corners, to reduce false detections.

When the processing speed is slow

Parameter to be adjusted	Troubleshooting
Region setting	Specify as small a value as possible for FigureInfo=Region.
Measurement	Minimize the distance between the upper and lower limits of line length range for extracting lines.
	Minimize the distance between the upper and lower limits of overrun range for extracting corners.
	Minimize the distance between the upper and lower limits of length range for extracting corners.
	Minimize the distance between the upper and lower limits of angle range for extracting corners.

When judgement is NG

State	Parameter to be adjusted	Troubleshooting
There are lines but they are not detected	Corner extraction	Expand and extend the overrun range in both the positive direction and negative direction so that corners can be formed.

Measurement Results for Which Output Is Possible (Ec Corner)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Corner X	X	Corner coordinate X
Corner Y	Y	Corner coordinate Y
Angle	TH	Formed angle of measured corner
Number of detections	CT	Number of detections
Reference X	SX	Reference X
Reference Y	SY	Reference Y
Corner XN (N = 0 to 99)	XN	Corner coordinate XN
Corner YN (N = 0 to 99)	YN	Corner coordinate YN
Angle N (N = 0 to 99)	THN	Formed angle N of measured corner
Angle N of line 0 (N = 0 to 99)	DIRLN	Inclination N of line 0
Angle N of line 1 (N = 0 to 99)	DIRRN	Inclination N of line 1

External Reference Tables (Ec Corner)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Number of detections	Get only	0 to 100
6	Corner coordinate X	Get only	-99999.9999 to 99999.9999
7	Corner coordinate Y	Get only	-99999.9999 to 99999.9999
8	Angle	Get only	0 to 360
9	Reference position X coordinate *1	Get only	-99999.9999 to 99999.9999
10	Reference position Y coordinate *1	Get only	-99999.9999 to 99999.9999
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Edge level	Set/Get	0 to 1000
121	Filter size	Set/Get	0: 3 × 3 1: 5 × 5 2: 7 × 7 3: 9 × 9
122	Lower limit of line length	Set/Get	5 to 4000
123	Upper limit of line length	Set/Get	5 to 4000
124	Combination angle	Set/Get	0.0 to 30.0
125	Combination tip distance	Set/Get	0 to 1000
126	Combination seam distance	Set/Get	0 to 1000
127	Line 0 condition Lower limit of length range	Set/Get	5 to 4000
128	Line 0 condition Upper limit of length range	Set/Get	5 to 4000
129	Line 1 condition Lower limit of length range	Set/Get	5 to 4000
130	Line 1 condition Upper limit of length range	Set/Get	5 to 4000
131	Line 0 condition Line angle	Set/Get	0 to 359
132	Line 0 condition Line angle range	Set/Get	0 to 180
133	Line 1 condition Line angle	Set/Get	0 to 359
134	Line 1 condition Line angle range	Set/Get	0 to 180
135	Formed angle	Set/Get	10 to 350
136	Formed angle range	Set/Get	0 to 180

No.	Data name	Set/Get	Data range
137	Line 0 condition Lower limit of overrun range	Set/Get	-1000 to 1000
138	Line 0 condition Upper limit of overrun range	Set/Get	-1000 to 1000
139	Line 1 condition Lower limit of overrun range	Set/Get	-1000 to 1000
140	Line 1 condition Upper limit of overrun range	Set/Get	-1000 to 1000
141	Detection object color	Set/Get	0: Both 1: Corner (dark) - Background (light) 2: Corner (light) - Background (dark)
149	Sort order	Set/Get	0: Cross point X 1: Cross point Y 2: Line length
150	Sort sequence	Set/Get	0: Ascending 1: Descending
151	Output number	Set/Get	0 to 99
155	With/without intersection fusion	Set/Get	0: OFF 1: ON
156	Fusion distance	Set/Get	0 to 1000
157	Fusion line angle range	Set/Get	0 to 20
158	Fusion corner angle range	Set/Get	0 to 20
159	Intersection fusion condition	Set/Get	0: Priority on line length 1: Priority on distance from intersection 2: Priority on corner angle
160	Judgement condition: Lower limit of corner X	Set/Get	-99999.9999 to 99999.9999
161	Judgement condition: Upper limit of corner X	Set/Get	-99999.9999 to 99999.9999
162	Judgement condition: Lower limit of corner Y	Set/Get	-99999.9999 to 99999.9999
163	Judgement condition: Upper limit of corner Y	Set/Get	-99999.9999 to 99999.9999
164	Judgement condition: Lower limit of angle	Set/Get	0 to 360
165	Judgement condition: Upper limit of angle	Set/Get	0 to 360
166	Judgement condition: Lower limit of number of detections	Set/Get	0 to 100
167	Judgement condition: Upper limit of number of detections	Set/Get	0 to 100
168	Reference X^2	Set/Get	0 to 99999.9999
169	Reference Y^2	Set/Get	0 to 99999.9999
171	Line connection level	Set/Get	0: 1 1: 2 2: 3 3: 4 4: 5 5: Custom

No.	Data name	Set/Get	Data range
173	Reference unit number for reference coordinate	Set/Get	-1 to 9999
174	Reference type of reference coordinate	Set/Get	0: Set by number 1: Unit reference
176	Use coordinates before position compensation	Set/Get	0: Not used 1 : Used
177	Coordinate X before position compensation	Set/Get	-99999.9999 to 99999.9999
178	Coordinate Y before position compensation	Set/Get	-99999.9999 to 99999.9999
10000 + N (N = 0 to 99)	Position	Get only	-99999.9999 to 99999.9999
10100 + N (N = 0 to 99)	Position	Get only	-99999.9999 to 99999.9999
10200 + N (N = 0 to 99)	Formed angle N	Get only	0 to 360

*1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.

*2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.

Ec Cross

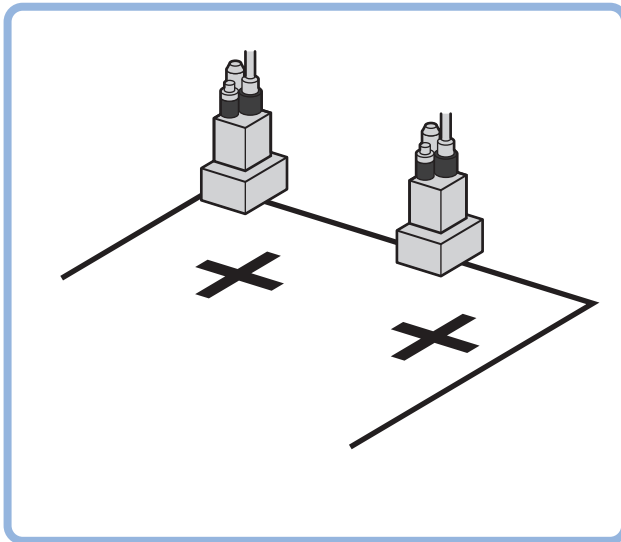
Detect crosshair shapes created by crosshair marks and other edges.

The center position of a crosshair shape is measured using the lines created by the edge information on each side of the crosshair.

A desired crosshair shape can be measured by specifying the length, direction, edge intensity and other conditions.

Used in the Following Case

- When you want to align the work position based on a crosshair-shaped mark

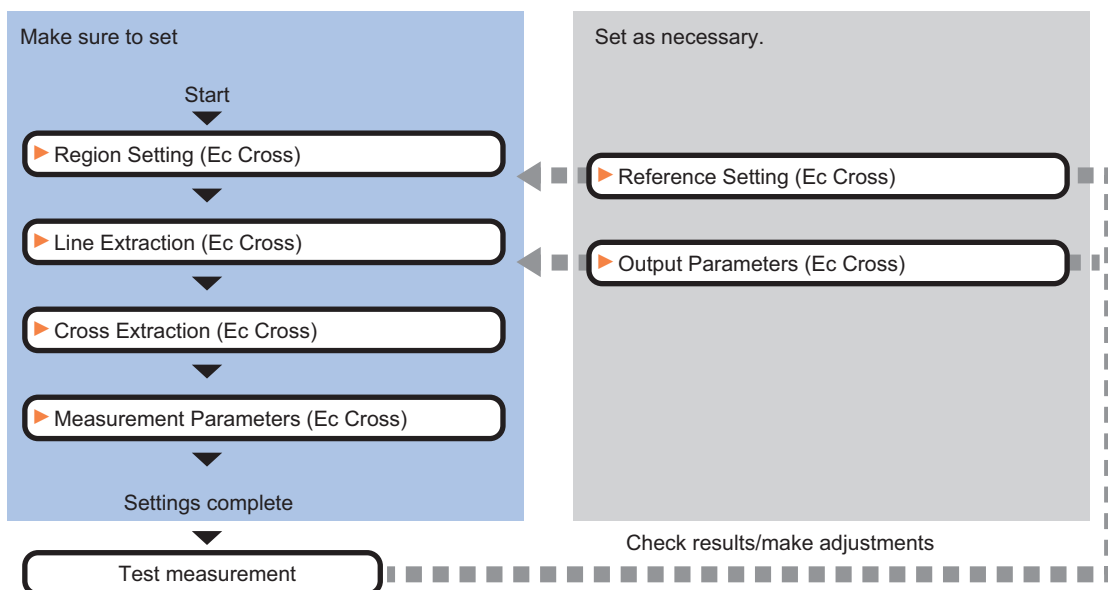


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Ec Cross)

Set up EC cross according to the following steps.



List of Ec Cross Items

Item name	Description
Region setting	This item is used to set up the measurement area. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. Reference: ▶ Region Setting (Ec Cross) (p.205)
Ref. setting	Change as necessary. This is changed when measuring the position deviation from a certain position. Reference: ▶ Reference Setting (Ec Cross) (p.206)
Line extraction	This item sets the conditions for extracting a line. Reference: ▶ Line Extraction (Ec Cross) (p.208)
Cross extraction	Set the conditions for extraction a crosshair shape. Reference: ▶ Cross Extraction (Ec Cross) (p.209)
Measurement	Set the sort conditions/judgement conditions of crosshair shapes. Data of the specified number is output as measurement data. Reference: ▶ Measurement Parameters (Ec Cross) (p.211)
Output parameter	This item can be changed if necessary. Select the measurement result coordinates and set how to handle the coordinates. Reference: ▶ Output Parameters (Ec Cross) (p.211)

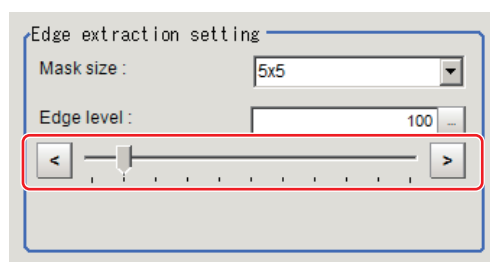
Region Setting (Ec Cross)

This item is used to set up the measurement area.

Use the rectangle to set up the measurement region for [Ec Cross].

- 1** In the Item Tab area, click [Region setting].
- 2** Use the Drawing tools to set the measurement region.
- 3** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.
- 4** Click [Edge extraction], then confirm the edge extraction image.

If the profile of the measurement object is interrupted or has too many edges, adjust the edge level.



Setting item	Setting value [Factory default]	Description
Mask size	<ul style="list-style-type: none"> • 3 × 3 • [5 × 5] • 7 × 7 • 9 × 9 	Select the range of pixels which are used to extract the edge. With a larger mask size, search is less affected by variation in pixels.
Edge level	0 to 1000 [100]	Change this when the edge is hard to see due to low contrast against the background or when unnecessary background noise must be removed. The smaller the value, the easier it is to find edges. The larger the value, the less noise will affect finding edges.

Reference Setting (Ec Cross)

When the model is set, this position is automatically set at the same time as the reference position. This item can be set to change the reference position to any desired position. This is handy for measuring the position deviation from a certain position.

A reference position can be set either directly or by referencing a unit.

Specifying directly

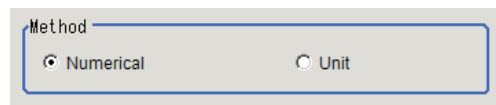
Click the position on the image that you want to set as the reference position, or set the coordinates.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.



2 In the "Method" area, select "Numerical".

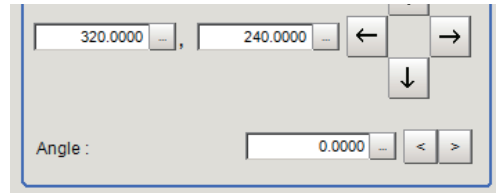


3 Click the position to be set as the reference.

Note

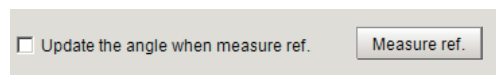
- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

4 Make fine adjustments using numeric value inputs or the arrow buttons as required.

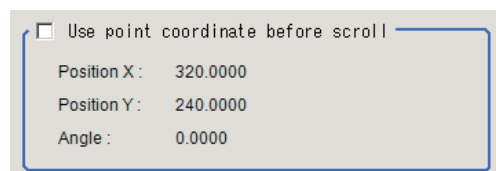


5 Set the reference angle with a numeric value.

6 To remeasure on the displayed image and set the reference, click the [Measure ref.] button. To update the reference angle at the time of reference measurement, place a check at "Update the angle when measure ref.".



7 To use data before position compensation for the reference setting coordinates, place a check at "Use point coordinate before scroll".



Referencing a unit

Set a reference by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

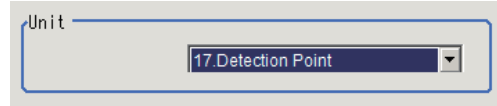
1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.

2 In the "Method" area, select "Unit".



3 In the scene in the "Unit" area, select a detection point unit.

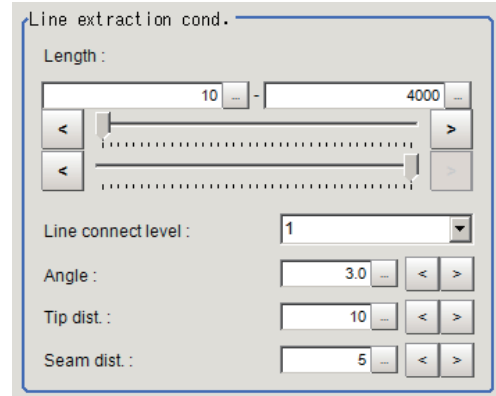


4 Perform the next measurement, and the reference will be displayed.

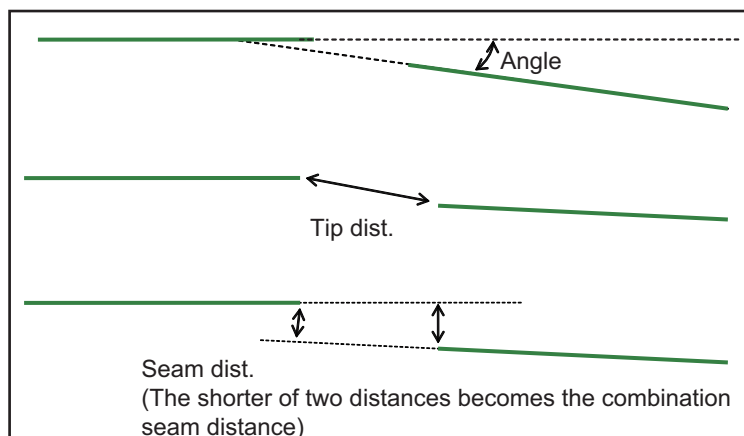
Line Extraction (Ec Cross)

This item sets the conditions for extracting a line.

- 1 In the Item Tab area, click [Line extraction].
- 2 In the "Line extraction cond." area, set the conditions for extracting a line.



Setting item	Setting value [Factory default]	Description
Length	5 to 4000 [10] to [4000]	Set the length of edges to be extracted.
Line connect level	<ul style="list-style-type: none"> • [1] • 2 • 3 • 4 • 5 • Custom 	Select the degree to which fragmented lines detected by edge extraction are connected. The higher the level, the more likely the lines are connected.
Angle	0.0 to 30.0 [3.0]	Set the angle range to be used when two lines are connected. Increasing this value allows two lines of different inclinations to be connected.
Tip dist.	0 to 1000 [10]	Set the vertex distance to be used when two lines are connected. Increasing this value allows distant lines to be connected.
Seam dist.	0 to 1000 [5]	Set the distance condition to be used when two lines are connected, where an extension of one line comes closest to the vertex of the other line. Increasing this value allows lines offset vertically to the lines to be connected.



Cross Extraction (Ec Cross)

Set the conditions for intersecting lines.

- 1 In the Item Tab area, click [Cross extraction].
- 2 In the "Line 0 cond." area, set the conditions for parallel line 0.

Line 0 cond.

Length: -

Width: -

Setting item	Setting value [Factory default]	Description
Length	5 to 4000 [10] to [4000]	Set the length of parallel line 0.
Width	1 to 1000 [10] to [100]	Set the width of parallel line 0.

- 3 In the "Line 1 cond." area, set the conditions for parallel line 1.

Line 1 cond.

Length: -

Width: -

Setting item	Setting value [Factory default]	Description
Length	5 to 4000 [10] to [4000]	Set the length of parallel line 1.
Width	1 to 1000 [10] to [100]	Set the width of parallel line 1.

- 4 In the "Advanced cond." area, set the detection conditions.

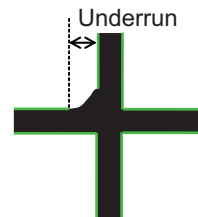
Advanced cond.

Underrun0: -

Underrun1: -

Detection line count: < >

Setting item	Setting value [Factory default]	Description
Underrun 0	[0] to [1000]	Set the level to which a cross with a rounded or pointed intersection or intersection concealed due to external disturbance is allowed. Set the range of crosses not reaching the intersection that are still recognized as crosses.
Underrun 1	[0] to [1000]	



Setting item	Setting value [Factory default]	Description
Detection line count	<ul style="list-style-type: none"> • 2 • 3 • [4] 	<p>Set a number of parallel line sets that are judged forming a cross. If the image does not have external disturbances, a total of four sets of parallel lines, which configure the cross, are detected, and those parallel lines are at the top, bottom, left, and right sides when looked from the center of the cross.</p> <p>When a straight line is not detected by being hidden or broken by an external disturbance, detection of a cross becomes possible by changing a number of detection lines.</p> <p>At least 2 sets must be set. (In case of 2 sets, each set of parallel lines has to be straight.)</p>

5 In the "Cross brightness" area, set the brightness relationship of the crosshair and background.



Setting item	Setting value [Factory default]	Description
Cross brightness	<ul style="list-style-type: none"> • [Both] • Dark • Bright 	Select the light/dark relationship of the crosshair and background.

Measurement Parameters (Ec Cross)

Set the sort conditions/judgement conditions of crosshairs.

- 1 In the Item Tab area, click [Measurement].
- 2 In the "Sort cond." area, set the sorting conditions.

Setting item	Setting value [Factory default]	Description
Order	<ul style="list-style-type: none"> • [Cross X] • Cross Y • Length 	Select the sorting method to be applied to those measurement results where there are multiple intersections.
	<ul style="list-style-type: none"> • [Ascending] • Descending 	
Cross No.	[0] to 9	Set the cross number for the data to be output.

- 3 When the setting has been changed, click [Measure] to verify whether measurements can be made correctly.
- 4 Set up the judgement condition.

Test measuring of this item.

Measure

Setting item	Setting value [Factory default]	Description
Cross X	[-99999.9999] to [99999.9999]	Set the range of X coordinates of crosshair that is judged to be OK.
Cross Y	[-99999.9999] to [99999.9999]	Set the range of Y coordinates of crosshair that is judged to be OK.
Angle	[-45] to [45]	Set the crosshair angles that are judged to be OK.
Count	[1] to [10]	Set the number of detections of crosshair that is judged to be OK.

Output Parameters (Ec Cross)

Set how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Setting value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Specify whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Ec Cross)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Cross X	X coordinate of measured crosshair
Cross Y	Y coordinate of measured crosshair
Angle	Angle of measured crosshair
Number of detections	Number of detections of crosshair

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image.	Explanation of image to be displayed
0	Measurement image

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Parameter to be adjusted	Troubleshooting
Measurement	Reduce the distance between the upper and lower limits of line length range for extracting lines, to reduce false detections.
	Raise the line connection level to prevent the lines constituting the corners to be detected from being interrupted.
	Set the narrowest possible conditions for extracting crosses, to reduce false detections.

When the processing speed is slow

Parameter to be adjusted	Troubleshooting
Region setting	Specify as small a value as possible for FigureInfo=Region.
Measurement	Minimize the distance between the upper and lower limits of line length range for extracting lines.
	Minimize the range between the upper and lower limits of underrun distance set as part of cross extracting conditions.
	Minimize the range between the upper and lower limits of cross extracting width.
	Minimize the range between the upper and lower limits of cross extracting length.
	Specify as large a value as possible for the number of detection lines for extracting crosses.

When judgement is NG

State	Parameter to be adjusted	Troubleshooting
There are lines but they are not detected	Cross extraction	Expand and extend the overrun range in both the positive direction and negative direction so that corners can be formed.

Measurement Results for Which Output Is Possible (Ec Cross)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Cross coordinate X	X	Cross coordinate X
Cross coordinate Y	Y	Cross coordinate Y
Angle	TH	Angle
Number of detections	CT	Number of detections
Reference X	SX	Reference X
Reference Y	SY	Reference Y
Reference angle	ST	Reference angle
Cross coordinate XN (N = 0 to 99)	XN	Cross coordinate XN
Cross coordinate YN (N = 0 to 99)	YN	Cross coordinate YN
Angle N (N = 0 to 99)	THN	Angle N

External Reference Tables (Ec Cross)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Number of detections	Get only	0 to 10
6	Cross coordinate X	Get only	-99999.9999 to 99999.9999
7	Cross coordinate Y	Get only	-99999.9999 to 99999.9999
8	Angle	Get only	-45 to 45
9	Reference position X coordinate* ¹	Get only	-99999.9999 to 99999.9999
10	Reference position Y coordinate* ¹	Get only	-99999.9999 to 99999.9999
11	Reference angle	Get only	-180 to 180
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Edge level	Set/Get	0 to 1000

No.	Data name	Set/Get	Data range
121	Filter size	Set/Get	0: 3 × 3 1: 5 × 5 2: 7 × 7 3: 9 × 9
122	Lower limit of line length	Set/Get	5 to 4000
123	Upper limit of line length	Set/Get	5 to 4000
124	Combination angle	Set/Get	0.0 to 30.0
125	Combination tip distance	Set/Get	0 to 1000
126	Combination seam distance	Set/Get	0 to 1000
127	Conditions for parallel line 0 Lower limit of length range	Set/Get	5 to 4000
128	Conditions for parallel line 0 Upper limit of length range	Set/Get	5 to 4000
129	Conditions for parallel line 1 Lower limit of length range	Set/Get	5 to 4000
130	Conditions for parallel line 1 Upper limit of length range	Set/Get	5 to 4000
138	Number of detection lines	Set/Get	2 to 4
139	Conditions for parallel line 0 Lower limit of underrun range	Set/Get	0 to 1000
140	Conditions for parallel line 0 Upper limit of underrun range	Set/Get	0 to 1000
141	Conditions for parallel line 1 Lower limit of underrun range	Set/Get	0 to 1000
142	Conditions for parallel line 1 Upper limit of underrun range	Set/Get	0 to 1000
143	Conditions for parallel line 0 Min. width	Set/Get	1 to 1000
144	Conditions for parallel line 0 Max. width	Set/Get	1 to 1000
145	Conditions for parallel line 1 Min. width	Set/Get	1 to 1000
146	Conditions for parallel line 1 Max. width	Set/Get	1 to 1000
148	Detection object color	Set/Get	0: Both 1: Cross (dark) - Background (light) 2: Cross (light) - Background (dark)
156	Sort order	Set/Get	0: Cross X 1: Cross Y 2: Line length
157	Sort sequence	Set/Get	0: Ascending 1: Descending
158	Output number	Set/Get	0 to 99
162	Fusion distance	Set/Get	0 to 1000
163	Judgement condition: Lower limit of cross X	Set/Get	-99999.9999 to 99999.9999
164	Judgement condition: Upper limit of cross X	Set/Get	-99999.9999 to 99999.9999

No.	Data name	Set/Get	Data range
165	Judgement condition: Lower limit of cross Y	Set/Get	-99999.9999 to 99999.9999
166	Judgement condition: Upper limit of cross Y	Set/Get	-99999.9999 to 99999.9999
167	Judgement condition: Lower limit of angle	Set/Get	-45 to 45
168	Judgement condition: Upper limit of angle	Set/Get	-45 to 45
169	Judgement condition: Lower limit of number of detections	Set/Get	0 to 10
170	Judgement condition: Upper limit of number of detections	Set/Get	0 to 10
171	Reference X ²	Set/Get	0 to 99999.9999
172	Reference Y ²	Set/Get	0 to 99999.9999
173	Reference angle	Set/Get	-180 to 180
174	Line connection level	Set/Get	0: 1 1: 2 2: 3 3: 4 4: 5 5: Custom
176	Reference unit number for reference coordinate	Set/Get	-1 to 9999
177	Reference type of reference coordinate	Set/Get	0: Set by number 1: Unit reference
178	Reference angle update	Set/Get	0: Not update 1: Update
179	Use coordinates before position compensation	Set/Get	0: Not used 1 : Used
180	Coordinate X before position compensation	Set/Get	-99999.9999 to 99999.9999
181	Coordinate Y before position compensation	Set/Get	-99999.9999 to 99999.9999
182	Angle before position compensation	Set/Get	-180 to 180
10000 + N (N = 0 to 9)	Position	Get only	-99999.9999 to 99999.9999
10100 + N (N = 0 to 9)	Position	Get only	-99999.9999 to 99999.9999
10200 + N (N = 0 to 9)	Angle N	Get only	-45 to 45

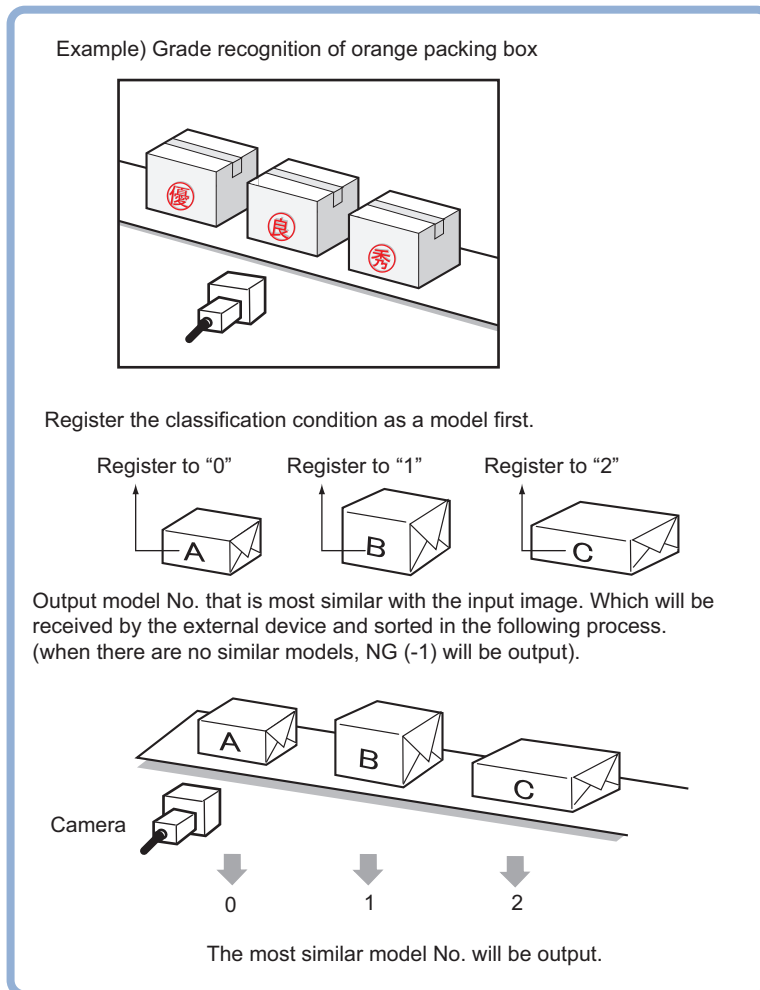
*1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.

*2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.

Classification

Used in the Following Case

- When various kinds of products on a production line need to be classified and identified

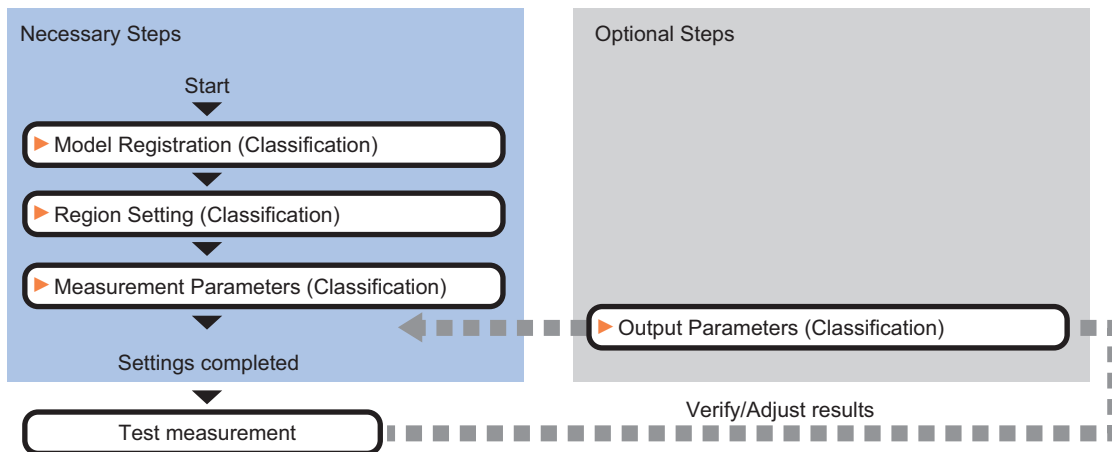


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Classification)

Classification can be set up as follows.



List of Classification Items

Item name	Description
Model	This item registers the pattern characteristic of the measurement image as a model. Model parameter values can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used. Reference: ▶ Model Registration (Classification) (p.217)
Region setting	This item is used to set up the measurement area. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. Reference: ▶ Region Setting (Classification) (p.220)
Measurement	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if the X and Y coordinates and the correlation values with the model are OK. Reference: ▶ Measurement Parameters (Classification) (p.221)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (Classification) (p.222)

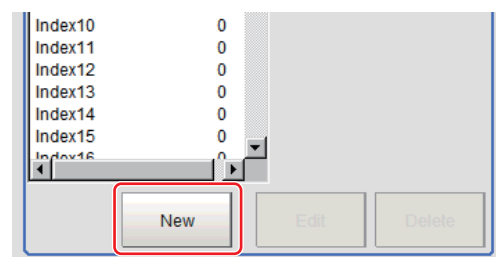
Model Registration (Classification)

Pre-register as models the sections to be used as reference for classification.

Models can be registered with any of 200 indexes, from 0 to 199, and up to 5 models can be registered for each index.

When there is variation among the model print quality and shapes, pre-register multiple models for the same index.

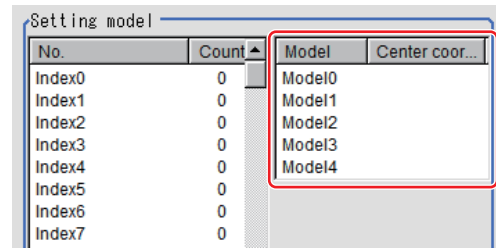
- 1** In the Item Tab area, click [Model].
- 2** In the "Setting model" area, select a model and click [New].



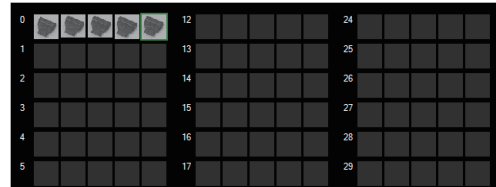
- 3** Use the Drawing tools to specify the model registration range.

4 Click [OK].

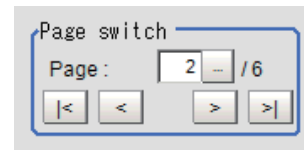
The model is registered and its central X and Y coordinate values are displayed in the "Setting model" area.



The image specified for the model is displayed in the Image Display area.



Set the page in the Switch Page area to display models with index numbers 36 or more.



Note

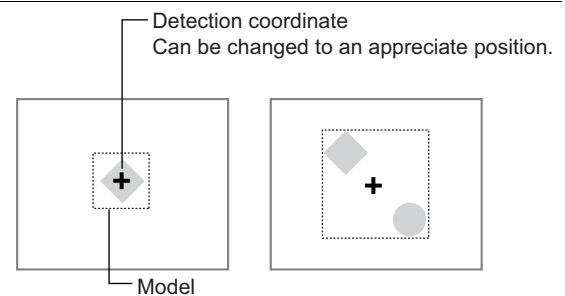
Model Status and Measurement Processing

- Measurement time and accuracy may be affected by the status of model in the following ways. Please select measurement objects that are in good condition (clean) for Model Registration.
- In the case of large or complicated models, processing time is prolonged.
- With extremely small models or models without features, search processing is unstable.

5 To register two or more models, repeat the Steps Reference: ▶ 2 (p.217) to Reference: ▶ 4 (p.218).

Note

- When a model is registered, the central coordinates of the model are registered as the detection point. A detection point is a point output as a measurement value. If multiple figures are combined, the central coordinates of the circumscribed rectangle are registered.

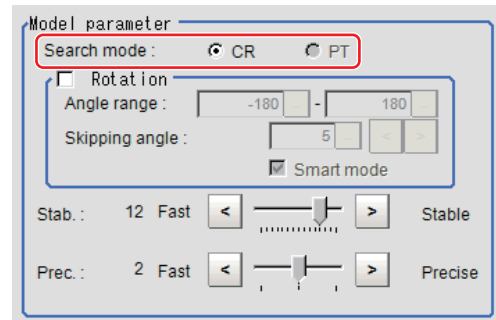


Changing Model Parameters

Model parameter values can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used.

After changing a setting, re-register the model.

- 1 In the "Model parameter" area, select the search mode, then specify a value for each item for that mode.



Setting item	Set value [Factory default]	Description
Search mode	[CR]	Search normalizing the brightness. This method can provide stable measurement when there is fluctuation in the overall brightness and when the image has low contrast.
	PT	Measures with the degree of matching to the profile of the model. This method can measure at higher speed when the rotation angle has a wide range. It is available only when a 0.3 megapixel color camera is connected.

When CR is selected

Setting item	Set value [Factory default]	Description
Rotation	<ul style="list-style-type: none"> • Checked • [Unchecked] 	When the measurement object is rotating, select the "Rotation" check box and specify how many degrees the model created rotates each time and through what range of angles. A smaller skipping angle increases stability, but slows down the processing. The normal direction is clockwise.
Angle range	[-180 to 180]	
Skipping angle	1 to 30 [5]	
Smart mode	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Checking the "Smart mode" option enables a high-speed rotation search. However, the stability may be lowered when the model shape aspect ratio is large or when the NOT mask is used.
Stab.	1 to 15 [The default value depend on the connected camera. 9 or 12]	Specify which is to have priority, measurement stability or speed. If lowering stability does not speed up processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate level" or "Stab."
Prec.	1 to 3 [2]	Specify which is to have priority, measurement positional precision or speed.

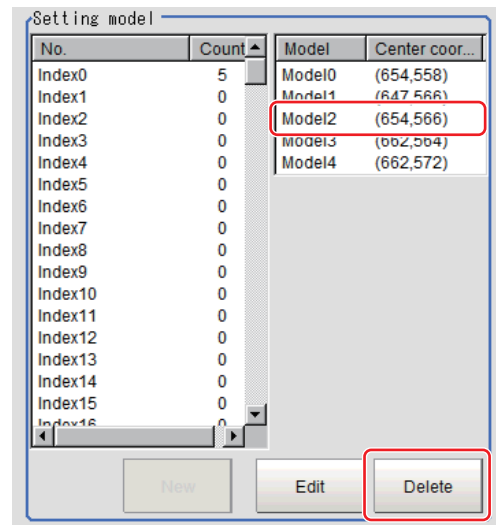
When PT is selected

Setting item	Set value [Factory default]	Description
Angle range	[-180 to 180]	This item specifies the rotation angle range for searching. The normal direction is clockwise.
Stability	1 to 5 [3]	If lowering stability does not speed up processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate level" or "Stab."

Deleting a Model

Deletes a registered model.

- 1 Select the model from the list and click [Delete].



Region Setting (Classification)

Use the rectangle to set up the measurement region for [Classification].

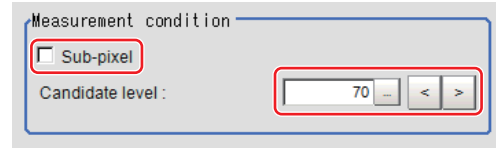
- 1 In the Item Tab area, click [Region setting].
- 2 Click [Edit].
The figure setting area is displayed.
- 3 Specify the area in which to search for the model.
The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.
- 4 Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

Measurement Parameters (Classification)

Specify the search measurement conditions and the judgement conditions for the measurement results.

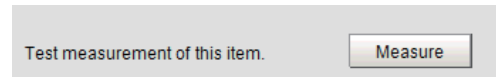
1 In the Item Tab area, click [Measurement].

2 In the "Measurement condition" area, specify a value for each item.



Setting item	Set value [Factory default]	Description
Sub-pixel	<ul style="list-style-type: none"> • Checked • [Unchecked] 	When a check is placed at sub-pixel, the position information can be measured in units of sub-pixels. However, this requires more processing time.
Candidate level	0 to 100 [70]	Specify the threshold value with which to detect candidate points in a rough search. Specify a smaller value when model search results are unreliable.

3 When the setting has been changed, click [Measure] in the "Detail" area to verify whether measurements can be made correctly.



4 Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Setting item	Set value	Description
Position X	-99999.9999 to 99999.9999	Specify the range of X-axis shifting that is judged to be OK.
Position Y	-99999.9999 to 99999.9999	Specify the range of Y-axis shifting that is judged to be OK.
Search angle	-180 to 180	Specify the range of angles that are judged to be OK.
Correlation	0 to 100	Specify the range of correlation values that are judged to be OK. However, when the correlation value of the measurement result is 0, the judgement result will be NG regardless of the lower limit setting.

Output Parameters (Classification)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none">• [After scroll]• Before scroll	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none">• [OFF]• ON	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none">• [ON]• OFF	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Classification)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Index	Index No. of the biggest correlation
Model number	Model No. of the biggest correlation
Correlation value	Correlation value with the model
Position X	X coordinate of the position where the model is detected
Position Y	Y coordinate of the position where the model is detected
Angle θ	Angle of the position where the model is detected

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Searching other positions

Parameter to be adjusted	Remedy
Model parameter	Specify a larger value for the "Prec."
	If the measurement results are unstable only when "Rotation" is selected, specify a smaller value for the "Skipping angle".
	When "Rotation" is selected, if the model shape is complex, uncheck the "Smart mode" option.
	If the image has low contrast or blurred edges, set the "Search mode" to "CR".
	If the model image consists of detailed figures, specify a larger value for "Stab."
Measurement	If the precision is low, place a check at "Sub-pixel".
	If images that should be judged OK vary greatly, specify a smaller value for "Candidate level".
	If the model image is small and unstable, specify a smaller value for the "Reduction".

The judgement is NG (insufficient memory)

Parameter to be adjusted	Remedy
Region setting	Make the search region as small as possible.
Model parameter	Bring "Stab." close to the factory default value.
	Bring the "Skipping angle" close to the factory default value.
	Specify a smaller value for "Prec."

When the processing speed is slow

Parameter to be adjusted	Remedy
Region setting	Make the search region as small as possible.
Model	Make the area to register as the model as small as possible.
Model parameter	If the model image is a simple figure or a large figure, specify a smaller value for "Stab." If lowering stability does not speed up processing, it is likely that many candidates have been detected. Raise the "Candidate level" in [Measurement].
	When "Rotation" is selected and the model image is a simple figure, specify a larger value for "Skipping angle".
	When "Rotation" is selected and the model image is a simple figure, place a check at "Smart mode".
	If the position precision is high, specify a smaller value for "Prec."
	If the rotation angle range is large, set the "Search mode" to "PT".
Measurement	If images that should be judged OK vary little, specify a larger value for "Candidate level".
	If the position precision is high, uncheck "Sub-pixel".

Measurement Results for Which Output Is Possible (Classification)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Index	IN	Index No. with the highest correlation value
Model No.	NO	Model No. with the highest correlation value
Correlation value	CR	Correlation value with the model
Measurement position X	X	X coordinate of the position where the model is detected
Measurement position Y	Y	Y coordinate of the position where the model is detected
Measurement angle	TH	Angle of the position where the model is detected
Reference position X	SX	Reference coordinate X of the registered model
Reference position Y	SY	Reference coordinate Y of the registered model
Detection point RX	RX	X coordinate of the registered model
Detection point RY	RY	Y coordinate of the registered model

External Reference Tables (Classification)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Index	Get only	-1: No models found 0 to 199
6	Model No.	Get only	-1: No models found 0 to 4
7	Correlation value	Get only	0 to 100
8	Measure X	Get only	-99999.9999 to 99999.9999
9	Measure Y	Get only	-99999.9999 to 99999.9999
10	Angle θ	Get only	-180 to 180
11	Reference X	Get only	-99999.9999 to 99999.9999
12	Reference Y	Get only	-99999.9999 to 99999.9999
13	Reference angle	Get only	-180 to 180
14	Detection coordinate X	Get only	-99999.9999 to 99999.9999
15	Detection coordinate Y	Get only	-99999.9999 to 99999.9999
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Search mode	Set/Get	0: Correlation 1: Shape
121	With rotation	Set/Get	0: OFF 1: ON

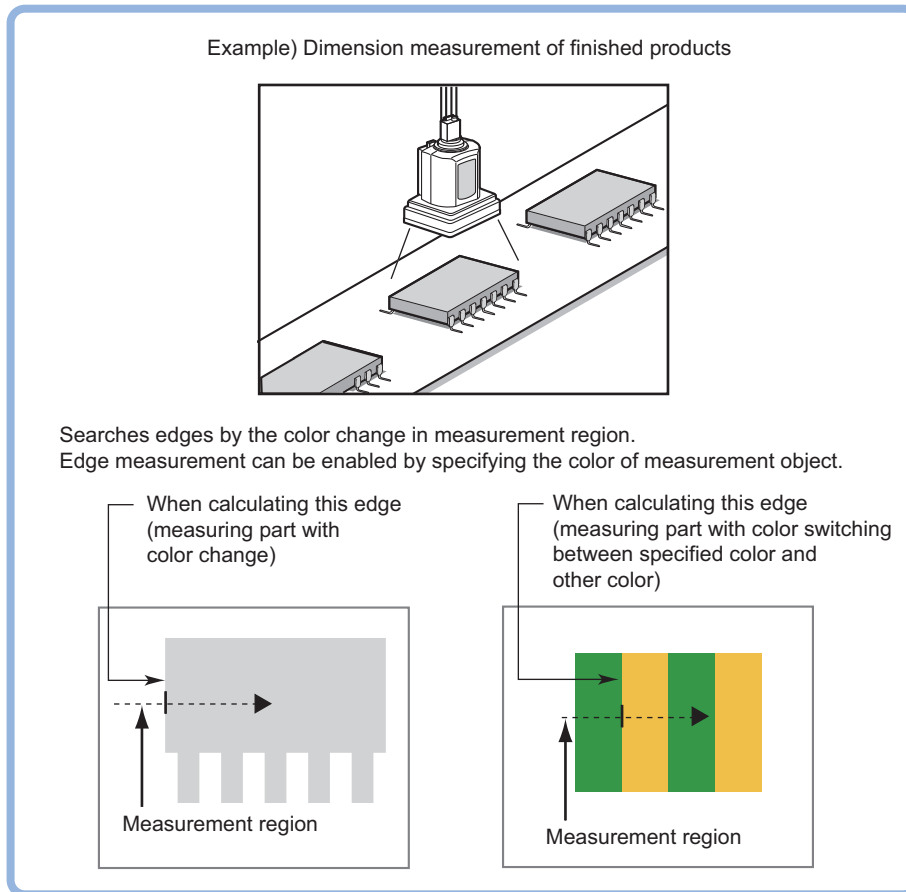
No.	Data name	Set/Get	Data range
122	Upper limit of the rotation angle	Set/Get	-180 to 180
123	Lower limit of the rotation angle	Set/Get	-180 to 180
124	Skipping angle	Set/Get	1 to 30
125	Smart mode	Set/Get	0: OFF 1: ON
126	Stab. (CR)	Set/Get	1 to 15
127	Prec.	Set/Get	1 to 3
128	Stab. (PT)	Set/Get	1 to 5
134	Sub-pixel	Set/Get	0: OFF 1: ON
135	Candidate Point Level	Set/Get	0 to 100
136	Upper limit of measure X	Set/Get	-99999.9999 to 99999.9999
137	Lower limit of measure X	Set/Get	-99999.9999 to 99999.9999
138	Upper limit of measure Y	Set/Get	-99999.9999 to 99999.9999
139	Lower limit of measure Y	Set/Get	-99999.9999 to 99999.9999
140	Upper limit of the angle	Set/Get	-180 to 180
141	Lower limit of the angle	Set/Get	-180 to 180
142	Upper limit of the corr.	Set/Get	0 to 100
143	Lower limit of the corr.	Set/Get	0 to 100

Edge Position

This processing item detects the position of the measurement object by using the change in color within the measurement region.

Used in the Following Case

- To calculate edge coordinates of measurement objects



- To find the width of a measurement object

Using a Expression, the width of a measurement object can be calculated from the difference between two edge positions.

Important

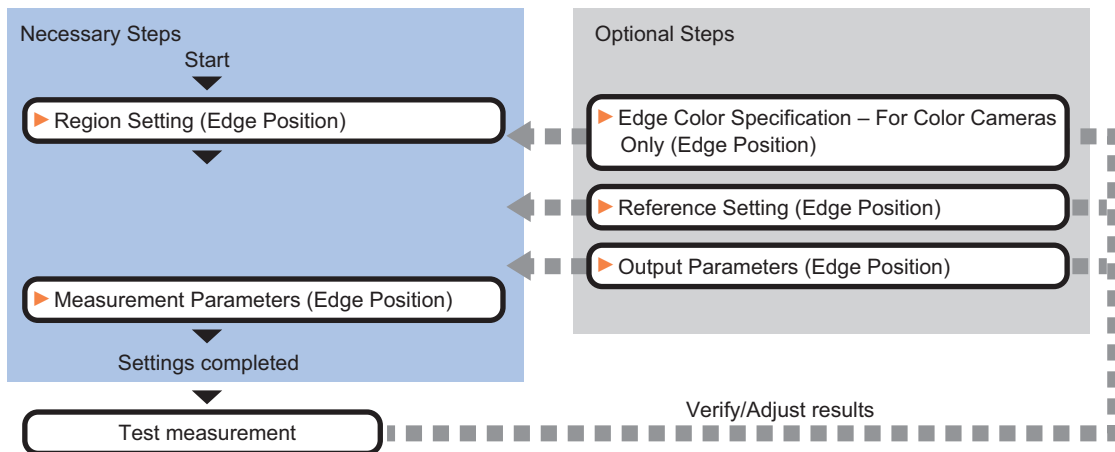
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Note

- Edge processing basic concepts
Reference: ▶"Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Settings Flow (Edge Positions)

Set the edge position with the following steps.



List of Edge Position Items

Item name	Description
Region setting	This item is used to set up the measurement area. Reference: ▶ Region Setting (Edge Position) (p.228)
Edge color (for color cameras only)	If the color of the edges to be detected is decided, specify the color. Reference: ▶ Edge Color Specification - For Color Cameras Only (Edge Position) (p.229)
Ref. setting	The edge position is registered as the reference when the region is set. Change as necessary. Reference: ▶ Reference Setting (Edge Positions) (p.229)
Measurement	This item specifies the judgement condition for measurement results. Measurement parameter can be changed as needed to address unstable measurement results. The displayed items depend on whether your camera is a color or monochrome camera. Normally, the factory default value will be used. Reference: ▶ Measurement Parameters (Edge Positions) (p.231)
Output parameter	This item can be changed if necessary. Normally, the factory default value may be used. Select the measurement result coordinates and set how to handle the coordinates. Reference: ▶ Output Parameters (Edge Position) (p.233)

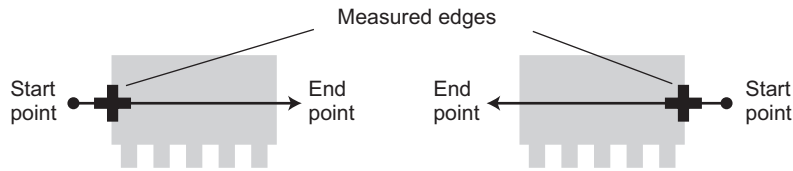
Region Setting (Edge Position)

This item is used to set up the measurement area.

Use a straight line (arrow), circumference, or arc to specify a measurement region for [Edge position].

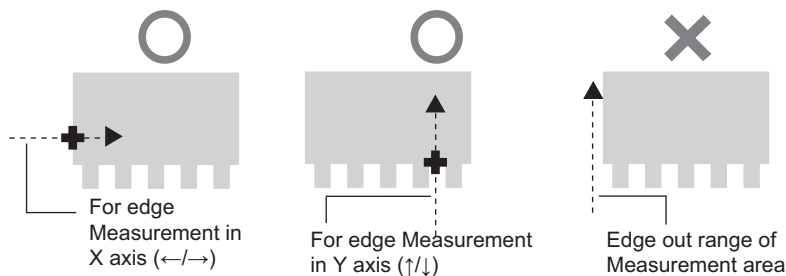
Note

- The edge is scanned from the start point of the area toward the end point.
When setting up the measurement region, pay attention to the detection direction of the edge.



Drawing the line from left to right and from right to left will lead to different measured edges.

- Measurement cannot be performed if there is no edge within the measurement region. When determining the size and position of the measurement region, take into account the movement range of the measurement object.



-----▶: Measurement region

- In the Item Tab area, click [Region setting].
- Use the Drawing tools to specify the measurement region.
- Click [OK] in the Figure setting area.

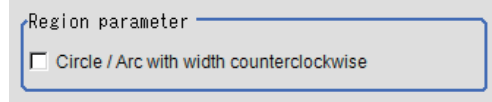
- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Note

- Use the zoom function if the measurement region is too small to identify the direction of the arrow.
Reference: ▶"Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

- When a circumference or arc is selected as the registered figure, select the edge search direction.

If a check is placed at the "Circle/Arc with width counterclockwise" option, the edge is searched counterclockwise. If this option is unchecked, the edge is searched clockwise.

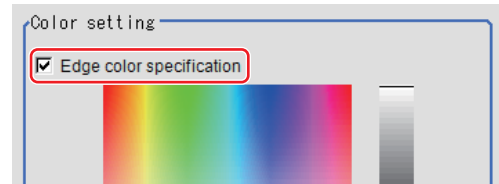


Edge Color Specification - For Color Cameras Only (Edge Position)

This item selects the color of the edges to be detected.

If the target color changes, this setting is not necessary. If the color is not specified, positions in the measurement region where the color changes drastically are detected as an edge.

- 1 In the Item Tab area, click [Edge color].
- 2 Place a check at "Edge color specification" in the "Color setting" area.



- 3 This item selects the color to be detected as edges.

Setting method	Description
Image Display area	Specify a region on the image that includes the target color. The average color of the specified region is registered.
Color chart	Click the reference color on the color chart to specify it. The RGB values for the specified color are displayed at the bottom.
R, G, B	The color to be detected is set with the RGB values.
Difference R, G, B	This sets the allowable color difference for detecting the edge, using the specified color as the reference. The larger the difference values, the larger the color range that is used to detect the edge.
Detection mode	<p>Color IN: The position where a color other than the specified color changes to the specified color is detected as the edge.</p> <p>Color OUT: The position where the specified color changes to a color other than the specified color is detected as the edge.</p> <p>For "Color IN" edge measurement mode</p> <p>For "Color OUT" edge measurement mode</p>

Reference Setting (Edge Positions)

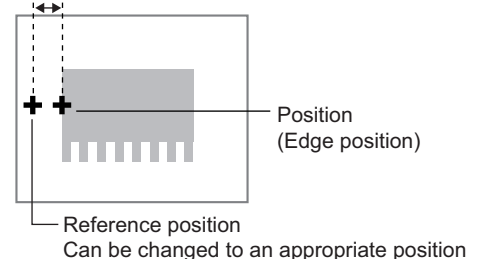
When the measurement region is set, this position is automatically set at the same time as the reference position. This item can be used to change the reference position to any desired position.

Note

Reference position usage method: Measuring the distance from a specific position

- Positional deviation can be inspected by calculating the difference between the reference position and the measured position with an expression.

After changing the reference position to any desired position, changing the measurement region will automatically change it back to the default position.



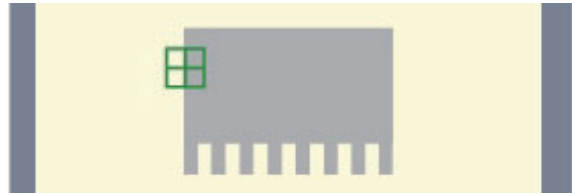
A reference position can be set either directly or by referencing a unit.

Specifying directly

Click a position on the image you want to use as a reference position, or set coordinate data for that point.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.



2 In the "Method" area, select "Numerical".

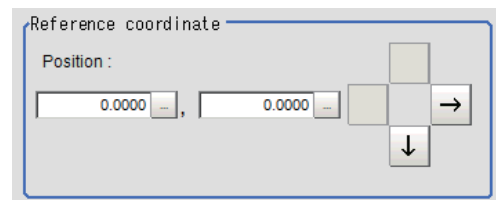


3 Click the position to be set as the reference.

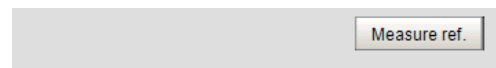
Note

- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

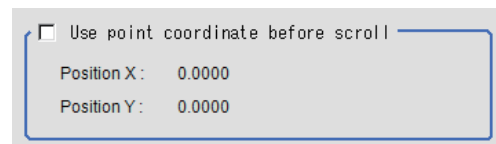
4 Make fine adjustments using numeric value inputs or the arrow buttons as required.



5 To remeasure on the displayed image and set the reference, click the [Measure ref.] button.



6 To use data before position compensation for the reference setting coordinates, place a check at "Use point coordinate before scroll".



Referencing a unit

Set a reference by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

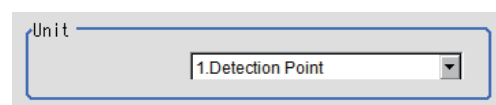
1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.

2 In the "Method" area, select "Unit".



3 In the scene in the "Unit" area, select a detection point unit.



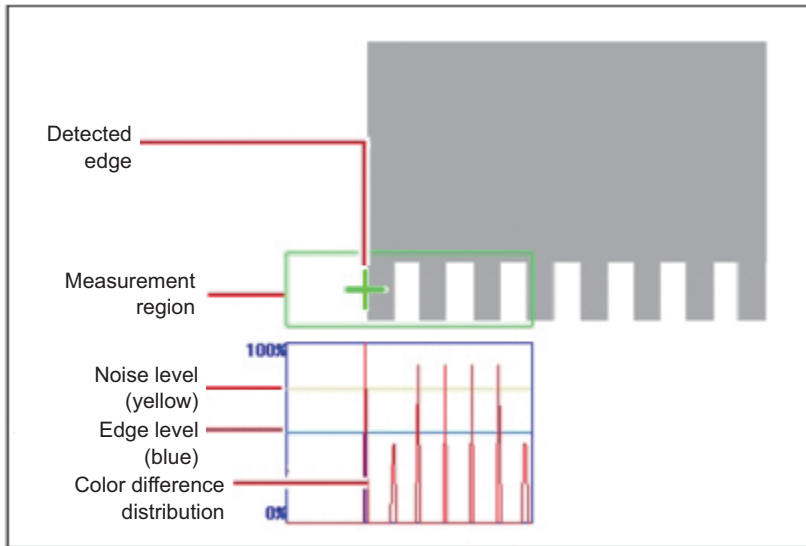
4 Perform the next measurement, and the reference will be displayed.

Measurement Parameters (Edge Positions)

This item specifies the judgement condition for measurement results. Measurement parameter can be changed as needed to address unstable measurement results.

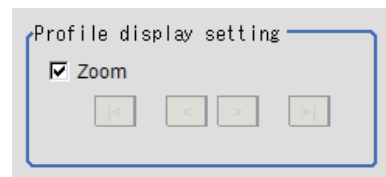
1 In the Item Tab area, click [Measurement].

The edge profile of the measurement region is displayed as a graph in the Image Display area.



Note

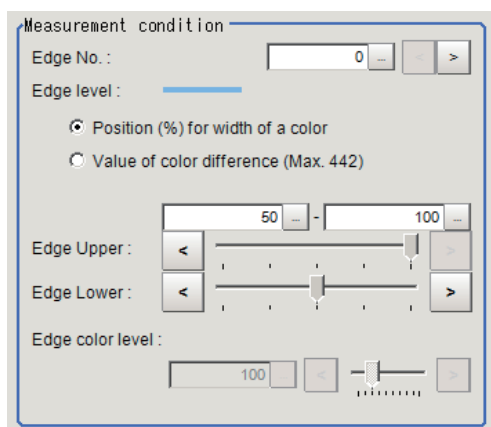
- When the region is a circumference or arc, you can display the graph enlarged in the vertical direction. Place a check at "Zoom" and click the button to adjust.



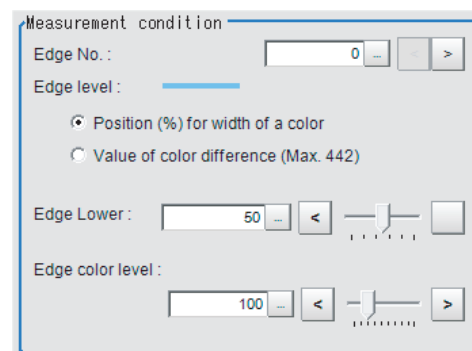
2 If necessary, specify a value for each item in the "Measurement condition" area.

For color cameras:

Edge Color Not Specified



Edge Color Specified

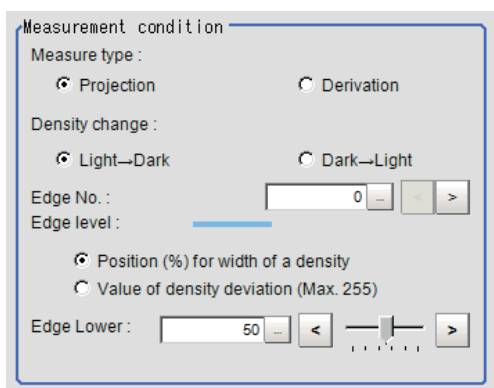


Setting item	Set value [Factory default]	Description
Edge No.	0 to 99 [0]	Specify the edge number used to extract edges. Edge numbers are assigned to detected edges starting from 0 and going on in the direction from the start point (the arrow point) to the end point (the direction of arrow) in the selected area.

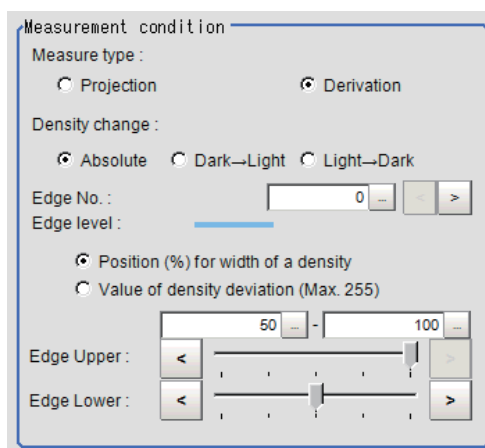
Setting item	Set value [Factory default]	Description
Edge Upper (only when edge color is not specified) Edge Lower	<ul style="list-style-type: none"> Position (%) for width of a color 0 to 100 [50] to [100] Value of color 0 to 442 [20] to [442] 	Set a range of a color difference level with which the edge is detected. Reference: ▶"Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Edge color level	0 to 442 [100]	This emphasis level can be specified only if the edge color to detect is specified.

For monochrome cameras:

When the measurement method is "Projection"

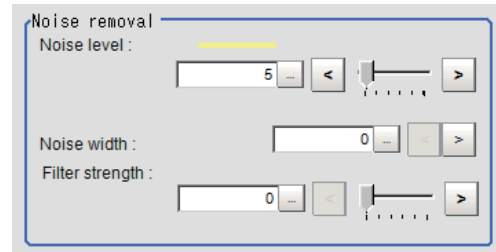


When the measurement method is "Derivation"



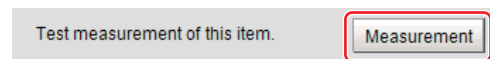
Setting item	Set value [Factory default]	Description
Measure type	<ul style="list-style-type: none"> [Projection] Derivation 	As the measurement type, specify either projection or derivation. Reference: ▶"Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Density change	Absolute (only when the measurement method is "Derivation") <ul style="list-style-type: none"> [Dark→Light] Light→Dark 	Select whether a black-to-white change or a white-to-black change should be recognized as a density change in the specified region.
Edge No.	0 to 99 [0]	Specify the edge number used to extract edges. Edge numbers are assigned to detected edges starting from 0 and going on in the direction from the start point (the arrow point) to the end point (the direction of arrow) in the selected area.
Edge Upper Edge Lower	<ul style="list-style-type: none"> Position (%) for width of a density 0 to 100 [50] to [100] Value of density 0 to 255 [20] to [255] 	Select the density change level to be detected as edges. The upper limit of edges can be set only when the measurement method is "Derivation". Reference: ▶"Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

3 If necessary, set each item in the "Noise removal" area.



Setting item	Set value [Factory default]	Description
Noise level	<ul style="list-style-type: none"> For color cameras: 0 to 442 [5] For monochrome cameras: 0 to 255 [5] 	When edges are incorrectly detected due to noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Level" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Noise width	0 to 9999 [0]	Set the width for judging noise. When detection is affected by noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Width" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Filter strength	0 to 100 [0]	If a valley appears in the histogram around the edge threshold value due to noises, smoothen the edge profile using a filter to prevent wrong error detection from being detected. Strengthening the filter smoothen the edge profile further.

4 When the setting has been changed, click [Measurement] in the Detail area to verify whether measurements can be made correctly.



5 Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Setting item	Set value	Description
Edge position X	-99999.9999 to 99999.9999	Specify the range of X-axis shifting that is judged to be OK.
Edge position Y	-99999.9999 to 99999.9999	Specify the range of Y-axis shifting that is judged to be OK.

Output Parameters (Edge Position)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Edge Position)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Edge position X	X coordinate of the measured edge position
Edge position Y	Y coordinate of the measured edge position

The image specified in the Sub-image number in image display setting is displayed in the Image Display area.

Sub image number	Explanation of image to be displayed
0	Measurement image
1	Profile display

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Parameter to be adjusted	Remedy
Measurement	If the color of the edges to be detected is decided, specify the color with [Edge color]. If results are not stable even with the color specified, specify a larger value for the color variance range.
	If noise is detected as an edge, specify larger values for "Noise level" and "Noise width".

Measurement Results for Which Output Is Possible (Edge Position)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Edge position X	X	X coordinate of the measured edge position
Edge position Y	Y	Y coordinate of the measured edge position
Reference coordinate X	SX	Reference X
Reference coordinate Y	SY	Reference Y

External Reference Tables (Edge Position)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
5	Edge position X	Get only	0 to 99999.9999
6	Edge position Y	Get only	0 to 99999.9999
7	Reference X ^{*1}	Get only	0 to 99999.9999
8	Reference Y ^{*1}	Get only	0 to 99999.9999
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF, 1: ON
103	Reflect to overall judgement	Set/Get	0: ON, 1: OFF
120	Edge color specification	Set/Get	0: OFF 1: ON
121	Edge color R	Set/Get	0 to 255
122	Edge color G	Set/Get	0 to 255
123	Edge color B	Set/Get	0 to 255
124	Difference R	Set/Get	0 to 127
125	Difference G	Set/Get	0 to 127
126	Difference B	Set/Get	0 to 127
127	Edge detection mode	Set/Get	0: Color IN 1: Color OUT
129	Reference X ^{*2}	Set/Get	0 to 99999.9999
130	Reference Y ^{*2}	Set/Get	0 to 99999.9999
131	Edge No.	Set/Get	0 to 99
132	Edge Level	Set/Get	0 to 100
133	Noise level	Set/Get	Color camera: 0 to 442 Monochrome camera: 0 to 255
134	Noise width	Set/Get	0 to 9999
135	Edge color level	Set/Get	0 to 442
136	Upper limit of the edge position X	Set/Get	-99999.9999 to 99999.9999
137	Lower limit of the edge position X	Set/Get	-99999.9999 to 99999.9999
138	Upper limit of the edge position Y	Set/Get	-99999.9999 to 99999.9999
139	Lower limit of the edge position Y	Set/Get	-99999.9999 to 99999.9999
140	Monochrome edge detection mode	Set/Get	0: Light→Dark 1: Dark→Light

No.	Data name	Set/Get	Data range
141	Edge level absolute value	Set/Get	Color camera: 0 to 442 Monochrome camera: 0 to 255
142	Edge level specification method	Set/Get	0: % 1: Absolute value
143	Clockwise/ Counterclockwise	Set/Get	0: Clockwise 1: Counterclockwise
144	Measure type	Set/Get	0: Projection 1: Derivation
145	Monochrome Projection edge detection mode	Set/Get	0: Absolute 1: Dark→Light 2: Light→Dark
146	Edge Level Upper limit *3	Set/Get	0 to 100
147	Edge level Upper limit absolute value *4	Set/Get	Color camera: 0 to 442 Monochrome camera: 0 to 255
148	Filter Strength	Set/Get	0 to 100
158	Setting unit of reference coordinate	Set/Get	-1 to 9999
159	Setting type of reference coordinate	Set/Get	0: Numerical 1: Unit
160	Use point coordinate before scroll	Set/Get	0: Not use 1: Use
161	Position X before scroll	Set/Get	-99999.9999 to 99999.9999
162	Position Y before scroll	Set/Get	-99999.9999 to 99999.9999
6002	Format	Set/Get	1: monochrome camera 2: color camera

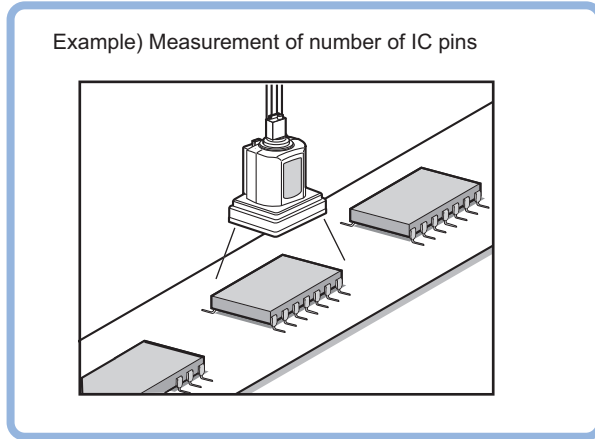
- *1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.
- *2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.
- *3: On the [Measurement] tab of the Properties Dialog Box, this data is displayed as [Edge Upper] when you choose the [Position (%) for width of a color].
- *4: On the [Measurement] tab of the Properties Dialog Box, this data is displayed as [Edge Upper] when you choose the [Value (442 at the maximum) of color].

Edge Pitch

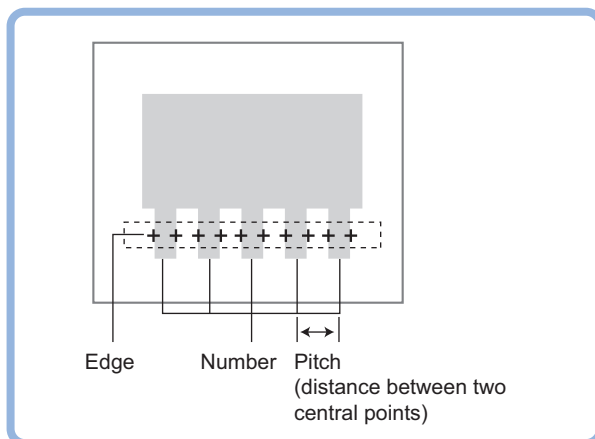
Finds and counts the edges by measuring the color change within the measurement region.

Used in the Following Case

- When calculating number of pins of IC or connectors



- To calculate the pin width and the distance (pitch) between mid-points between two pins



Important

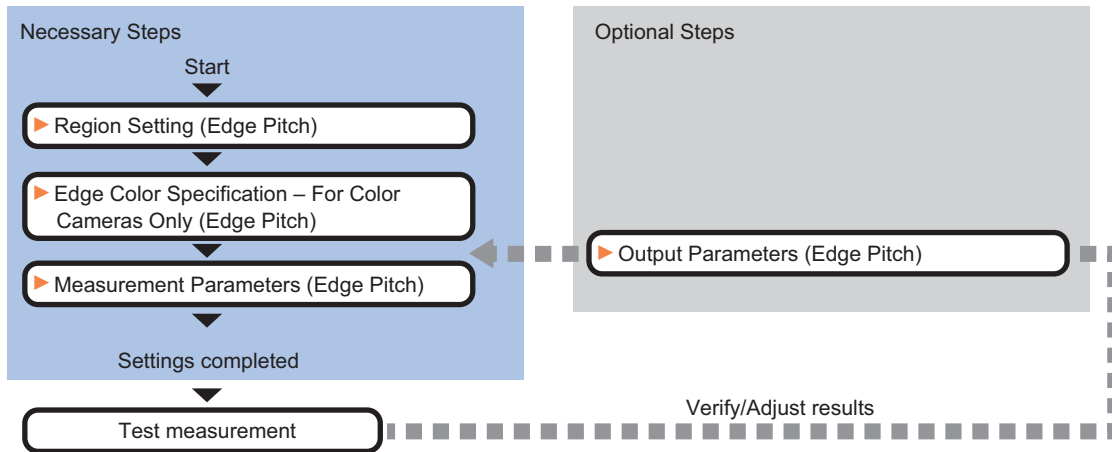
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Note

- Edge image measurement processing mechanism
Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Settings Flow (Edge Pitch)

Set the Edge Pitch with the following steps.



Item List for Edge Pitch

Item name	Description
Region setting	This item is used to set up the measurement area. Reference: ▶ Region Setting (Edge Pitch) (p.238)
Edge color (for color cameras only)	This item selects the color information for the edges to be detected. Reference: ▶ Edge Color Specification - For Color Cameras Only (Edge Pitch) (p.239)
Measurement	This item specifies the judgement condition for measurement results. Measurement parameter can be changed as needed to address unstable measurement results. Specify the pitch and width for counting edges. The displayed items depend on whether your camera is a color or monochrome camera. Normally, the factory default value will be used. Reference: ▶ Measurement Parameters (Edge Pitch) (p.239)
Output parameter	This item can be changed if necessary. Normally, the factory default value may be used. Select the measurement result coordinates and set how to handle the coordinates. Reference: ▶ Output Parameters (Edge Pitch) (p.242)

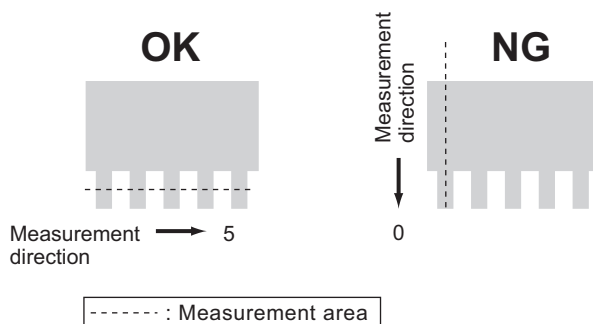
Region Setting (Edge Pitch)

This item is used to set up the measurement area.

Use a straight line, circumference, or arc to specify a measurement region for [Edge Pitch].

Note

- When setting up a measurement region, please include all the edges to be detected.



- 1** In the Item Tab area, click [Region setting].
- 2** Use the Drawing tools to specify the measurement region.
- 3** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

Edge Color Specification - For Color Cameras Only (Edge Pitch)

Specify the target color to be counted.

- 1** In the Item Tab area, click [Edge color].
- 2** Specify the target color for the edges to be counted (used as the reference color for edge detecting).

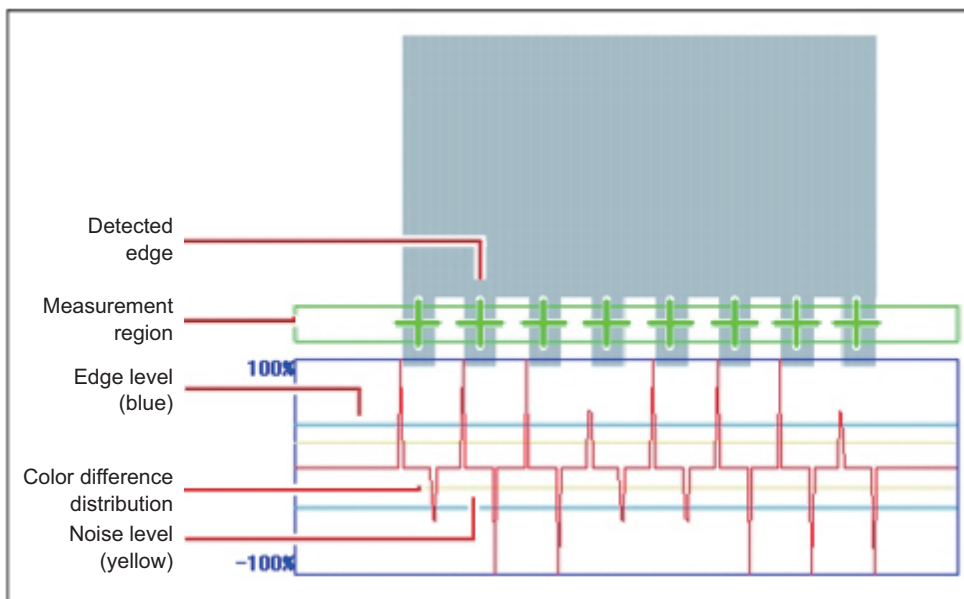
Setting method	Description
Image Display area	Specify a region on the image that includes the target color. The average color of the specified region is registered.
Color chart	Click the color on the color chart to specify it. The RGB values for the specified color are displayed at the bottom.
R, G, B	The color to be detected is set with the RGB values.
Difference R, G, B	This sets the allowable color difference for detecting the edge, using the specified color as the reference. The larger the difference values, the larger the color range that is used to detect the edge.

Measurement Parameters (Edge Pitch)

This item specifies the judgement condition for measurement results. Also specify the range for positions to be judged as OK.

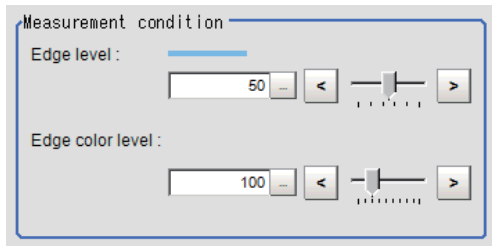
- 1** In the Item Tab area, click [Measurement].

The edge profile of the measurement region (straight line) is displayed in the Image Display area.



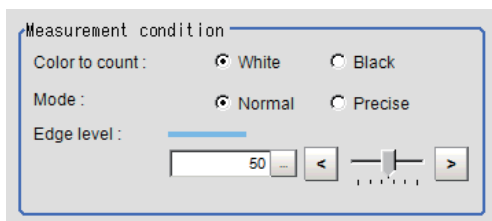
2 If necessary, specify a value for each item in the "Measurement condition" area.

For color cameras:



Setting item	Set value [Factory default]	Description
Edge level	0 to 100 [50]	Specify a color changing level with which the edge is detected. When the measurement result is lower than the actual number of edges, specify a smaller value for the edge level. On the other hand, when the measurement result is higher than the actual number of edges, specify a larger value for the edge level. Reference: ▶ "Appendixes Measurement Mechanism Edge Level" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Edge color level	0 to 442 [100]	Set the emphasis level for the edge color specified with [Edge color].

For monochrome cameras:

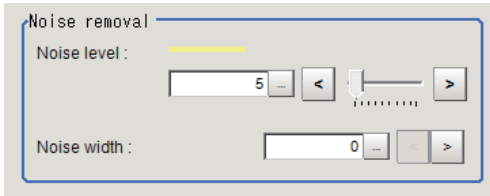


Important

- Up to 1000 edges can be measured, but only a maximum of 256 can be displayed on the screen.

Setting item	Set value [Factory default]	Description
Color to count	<ul style="list-style-type: none"> • [White] • Black 	Select an edge color to be measured.
Mode	<ul style="list-style-type: none"> • [Normal] • Precise 	If the pin width or gap is less than 2 pixels, select precise.
Edge level	0 to 100 [50]	Specify the density change level to be detected as edges. When the measurement result is lower than the actual number, specify a smaller value for the edge level (or the minimum level). On the other hand, when the measurement result is higher than the actual number, specify a larger value for the edge level (or the minimum level). Reference: ▶ "Appendixes Measurement Mechanism Edge Level" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

3 If necessary, set each item in the "Noise removal" area.



Setting item	Set value [Factory default]	Description
Noise level	0 to 442 [5]	When detection is affected by noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Level" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Noise width	0 to 9999 [0]	Set the width for judging noise. When detection is affected by noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Width" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

4 When the setting has been changed, click [Measurement] in the "Detail" area to verify whether measurements can be made correctly.

Test measurement of this item.

Measurement

5 Set up the judgement condition.

Setting item	Set value	Description
Edges	0 to 999	<p>Pitch Width (Distance between two central points) Number</p>
Pitch	0 to 99999.9999	
Ave pitch	0 to 99999.9999	
Width	0 to 99999.9999	
Ave width	0 to 99999.9999	

6 If a circumference with a width or an arc with a width is set for the region, set the profile display settings as required.

Setting item	Set value [Factory default]	Description
Enlarged display	[Not Visible]	If you place a check here, the profile will be displayed for the length along the circumference of the circumference with a width or arc with a width. Use an enlarged display to check the details of the profile.
	Visible	

Output Parameters (Edge Pitch)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position deflection correction is applied.
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Edge Pitch)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Number of edges	Number of edges
Average pitch	Average edge pitch
Max. pitch	Edge maximum pitch
Min. pitch	Edge minimum pitch
Average width	Average edge width
Max. width	Edge maximum width
Min. width	Edge minimum width

The image specified in the Sub-image number in image display setting is displayed in the Image Display area.

Sub image number	Explanation of image to be displayed
0	Measurement image
1	Profile display

Key Points for Adjustment

Select the adjustment method referring to the following points.

Parameter to be adjusted	Remedy
Edge color	If edges cannot be detected properly, specify a larger value for the color variance range.
Measurement	If noise is detected as an edge, specify a larger value for "Noise level" and "Noise width".
Edge level	When the measurement result is lower than the actual number of edges, specify a smaller value for the "Edge level". On the other hand, when the measurement result is higher than the actual number of edges, specify a larger value for the "Edge level".

Measurement Results for Which Output Is Possible (Edge Pitch)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judgement result
Number of Edge Pins	N	Number of detected edges
Average pitch	P	Average pitch of detected edges
Max. pitch	PH	Maximum pitch of detected edges
Min. pitch	PL	Minimum pitch of detected edges
Average width	W	Average width of detected edges
Max. width	WH	Maximum width of detected edges
Min. width	WL	Minimum width of detected edges

External Reference Tables (Edge Pitch)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error(Image format mismatch) -11: Error(unregistered model) -12: Error(insufficient memory) -20: Error(other errors)
5	Number of Edge Pins	Get only	0 to 999
6	Average pitch	Get only	0 to 99999.9999
7	Max. pitch	Get only	0 to 99999.9999
8	Min. pitch	Get only	0 to 99999.9999
9	Average width	Get only	0 to 99999.9999
10	Max. width	Get only	0 to 99999.9999
11	Min. width	Get only	0 to 99999.9999
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF

No.	Data name	Set/Get	Data range
120	Edge color R	Set/Get	0 to 255
121	Edge color G	Set/Get	0 to 255
122	Edge color B	Set/Get	0 to 255
123	Edge color difference R	Set/Get	0 to 127
124	Edge color difference G	Set/Get	0 to 127
125	Edge color difference B	Set/Get	0 to 127
127	Edge Level	Set/Get	0 to 100
128	Noise Level	Set/Get	0 to 442
129	Noise width	Set/Get	0 to 9999
130	Upper limit of edge pitch	Set/Get	0 to 1000
131	Lower limit of edge pitch	Set/Get	0 to 1000
132	Upper limit of average pitch	Set/Get	0 to 99999.9999
133	Lower limit of average pitch	Set/Get	0 to 99999.9999
134	Upper limit of the pitch	Set/Get	0 to 99999.9999
135	Lower limit of the pitch	Set/Get	0 to 99999.9999
136	Upper limit of average width	Set/Get	0 to 99999.9999
137	Lower limit of Average width	Set/Get	0 to 99999.9999
138	Upper limit of the width	Set/Get	0 to 99999.9999
139	Lower limit of the width	Set/Get	0 to 99999.9999
140	Edge color level	Set/Get	0 to 442
141	Color to count	Set/Get	0: White 1: Black
142	Mode	Set/Get	0: Normal 1: Precise

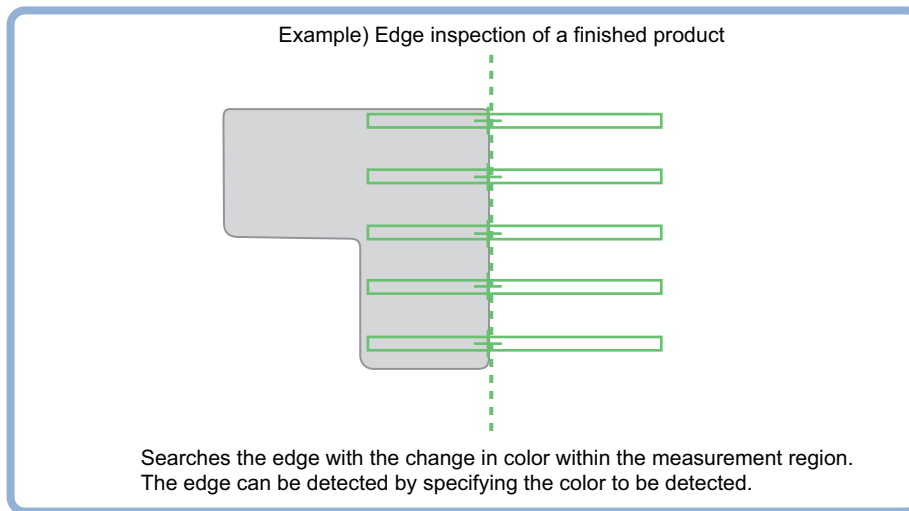
Scan Edge Position

This processing item detects the position of the measurement object by using the change in color within the measurement region. By dividing the measurement region, the following effects can be expected compared to ordinary edge position measurement.

- Detailed information, such as the closest point or furthest point from the measurement start point, can be calculated.
- The inclination or degree of unevenness of the measured object can be calculated.

Used in the Following Case

- To calculate multiple edge positions of the measurement object from statistical data



Important

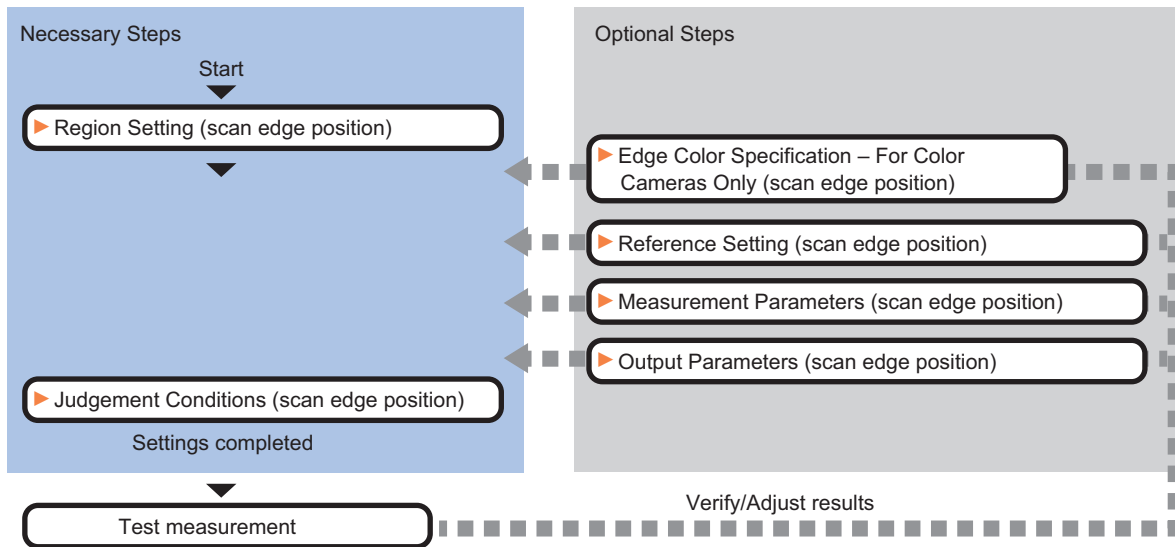
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Note

- Edge image measurement processing mechanism
Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Settings Flow (Scan Edge Position)

Set the scan edge position with the following steps.



Item List for Scan Edge Position

Item name	Description
Region setting	This item is used to set up the measurement area. Reference: ▶ Region Setting (Scan Edge Position) (p.247)
Edge color (for color cameras only)	If the color of the edges to be detected is decided, specify the information for the edge color to be detected. Reference: ▶ Edge Color Specification - For Color Cameras Only (Scan Edge Position) (p.248)
Ref. setting	This item can be changed if necessary. The edge position measured once is registered when the region is set. Reference: ▶ Reference Setting (Scan Edge Position) (p.249)
Measurement	This item changes the measurement parameter as necessary when the measurement result is unstable. The displayed items depend on whether your camera is a color or monochrome camera. Normally, the factory default value will be used. Reference: ▶ Measurement Parameters (Scan Edge Positions) (p.250)
Judgement	This item specifies the judgement condition for measurement results. Reference: ▶ Judgement Conditions (Scan Edge Position) (p.253)
Output parameter	This item can be changed if necessary. Normally, the factory default value may be used. Select the measurement result coordinates and set how to handle the coordinates. Reference: ▶ Output Parameters (Scan Edge Position) (p.254)

Region Setting (Scan Edge Position)

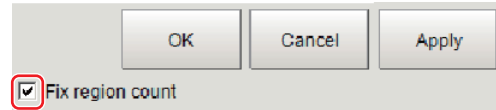
This item is used to set up the measurement area.

Specify the measurement region for [Scan Edge Position] by using wide straight lines.

1 In the Item Tab area, click [Region setting].

2 Use the Drawing tools to specify the measurement region.

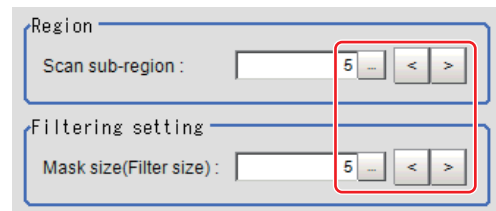
To align with the measurement area and change the number of measurement points, uncheck this. If the width of the measurement region is changed with the checkbox unchecked, the number of measurement points in Scan-sub-region is changed to minimize the amount of change of the scanned region interval.



3 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

4 Set the measurement point and the filter size for the region.



Setting item	Set value [Factory default]	Description
Scan sub-region	1 to 100 [5]	Set the measurement point for the region.
Mask size	0 to 200 [5]	Set the filter size when smoothing the measurement point vicinity. When 5 is set, smoothing is processed for a total of 11 points: the measurement point and the 5 pixels before and after it.

5 The region is divided equally.

Division of Scan Area

The scan region, when the number of measurement points is 1



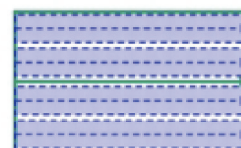
The scan region, when the number of measurement points is 2



The scan region, when the number of measurement points is 3

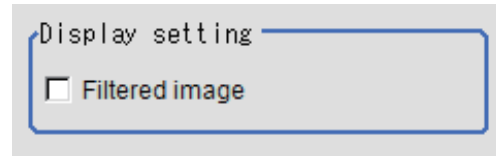


The scan region, when the number of measurement points is 4



6 Perform the display setting if required.

Placing a check at [Filtered image] makes it easier to change the filtering setting.



Setting item	Set value [Factory default]	Description
Filtered image	<ul style="list-style-type: none"> • [Unchecked] • Checked 	If checked, the filtered image of the ranges set with the Scan sub-region and Filter size after smoothing is displayed.

Note

- You can specify enable/disable for each edge measurement number. Clicking edge measurement points displays the following screen.

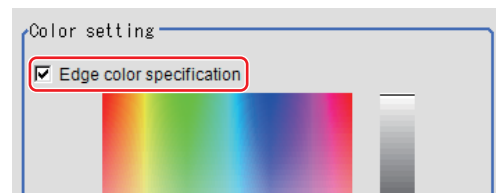


Edge Color Specification - For Color Cameras Only (Scan Edge Position)

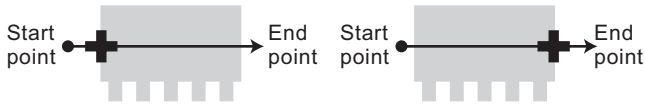
This item selects the color of the edges to be detected.

If the target color changes, this setting is not necessary. If the color is not specified, positions in the measurement region where the color changes drastically are detected as an edge.

- In the Item Tab area, click [Edge color].
- Place a check at "Edge color" in the "Color setting" area.



- This item selects the color to be detected as edges.

Setting methods	Description
Image Display area	Specify a region on the image that includes the target color. The average color of the specified region is registered.
Color chart	Click the reference color on the color chart to specify it. The RGB values for the specified color are displayed at the bottom.
R, G, B	The color to be detected is set with the RGB values.
Difference R, G, B	This sets the allowable color difference for detecting the edge, using the specified color as the reference. The larger the difference values, the larger the color range that is used to detect the edge.
Detection mode	<p>Color IN: The position where a color other than the specified color changes to the specified color is detected as the edge.</p> <p>Color OUT: The position where the specified color changes to a color other than the specified color is detected as the edge.</p>  <p>For "Color IN" edge measurement mode</p> <p>For "Color OUT" edge measurement mode</p>

Reference Setting (Scan Edge Position)

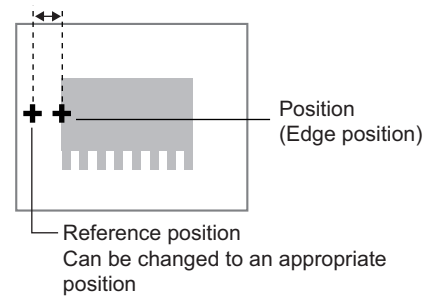
When the measurement region is set, this position is automatically set at the same time as the reference position. This item can be used to change the reference position to any desired position.

Note

Reference position usage method: Measuring the distance from a specific position

- Positional deviation can be inspected by calculating the difference between the reference position and the measured position with an expression.

After changing the reference position to any desired position, changing the measurement region will automatically change it back to the default position.



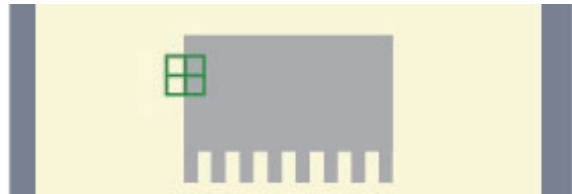
A reference position can be set either directly or by referencing a unit.

Specifying directly

Click a position on the image you want to use as a reference position, or set coordinate data for that point.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.



2 In the "Method" area, select "Numerical".

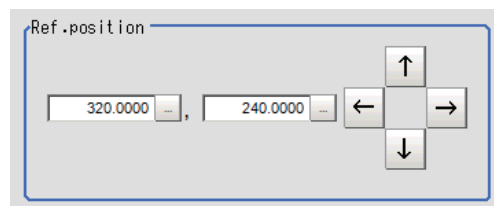


3 Click the position to be set as the reference.

Note

- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

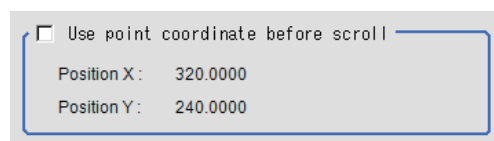
4 Make fine adjustments using numeric value inputs or the arrow buttons as required.



5 To remeasure on the displayed image and set the reference, click the [Measure ref.] button.



6 To use data before position compensation for the reference setting coordinates, place a check at "Use point coordinate before scroll".



Referencing a unit

Set a reference by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

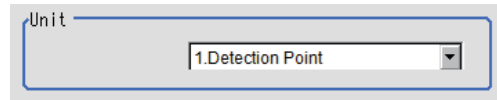
1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.

2 In the "Method" area, select "Unit".



3 In the scene in the "Unit" area, select a detection point unit.



4 Perform the next measurement, and the reference will be displayed.

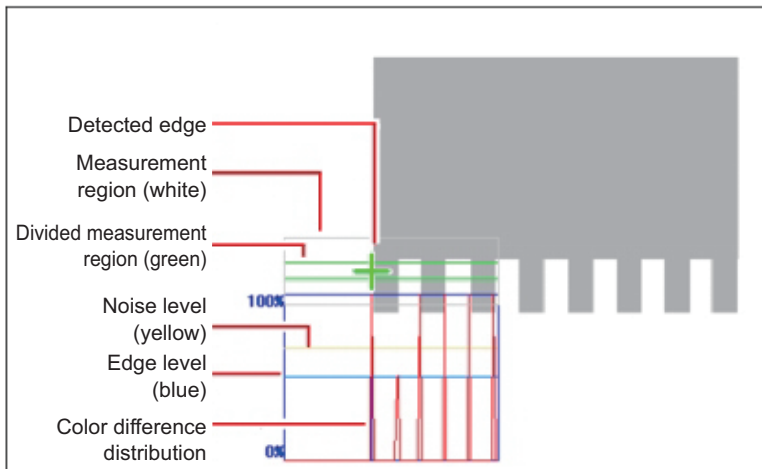
Measurement Parameters (Scan Edge Positions)

Measurement parameters can be changed as needed to address unstable measurement results. Normally, the factory default value will be used.

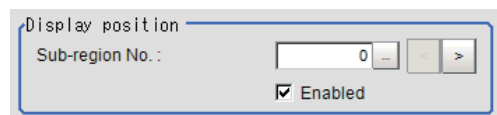
After changing a setting, check whether measurement can be done properly by performing an actual measurement.

1 In the Item Tab area, click [Measurement].

The edge profile of the measurement region is displayed as a graph in the Image Display area.



2 Set the value of each item in the Display position area.

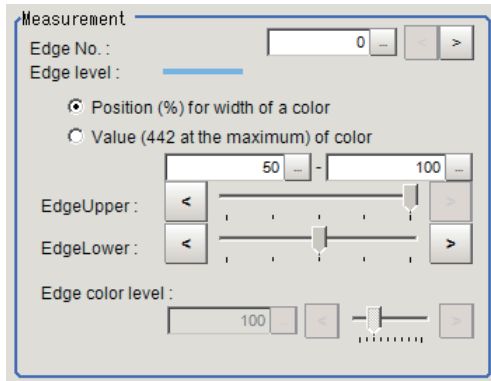


Setting item	Set value [Factory default]	Description
Sub-region No.	[0] to 99	Specify the edge measurement number for which the edge profile is displayed.
Enabled	<ul style="list-style-type: none"> [Checked] [Unchecked] 	Specify enable/disable for the displayed edge measurement number. When disabled (unchecked) is specified, that edge measurement number is not measured.

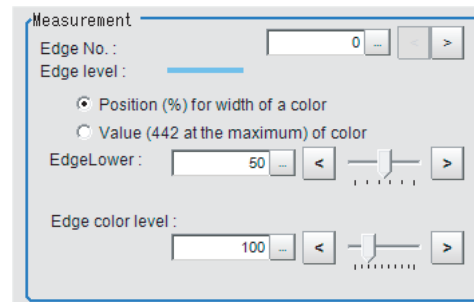
3 Set the value of each item in the "Measurement" area.

For color cameras:

Edge Color Not Specified



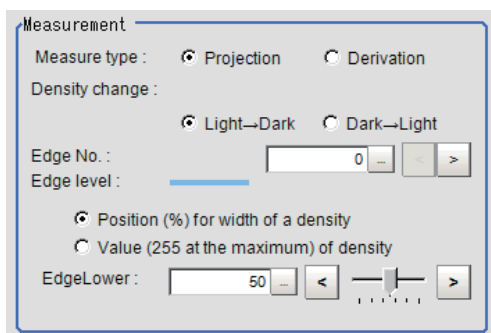
Edge Color Specified



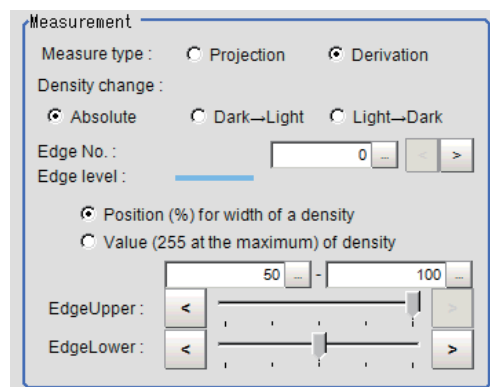
Setting item	Set value [Factory default]	Description
Edge No.	0 to 99 [0]	Specify the edge number used to extract edges. Edge numbers are assigned to detected edges starting from 0 and going on in the direction from the start point (the arrow point) to the end point (the direction of arrow) in the selected area.
Edge Upper (only when edge color is not specified) Edge Lower	<ul style="list-style-type: none"> Position (%) for width of a color 0 to 100 [50] to [100] Value of color 0 to 442 [20] to [442] 	Set a range of a color difference level with which the edge is detected. Reference: ▶"Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Edge color level	0 to 442 [100]	This emphasis level can be specified only if the edge color to detect is specified.

For monochrome cameras:

When the measurement method is "Projection"



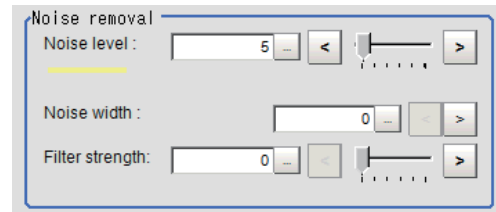
When the measurement method is "Derivation"



Setting item	Set value [Factory default]	Description
Measure type	<ul style="list-style-type: none"> [Projection] Derivation 	As the measurement type, specify either projection or derivation. Reference: ▶"Appendixes Measurement Mechanism Edge Detection Method" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

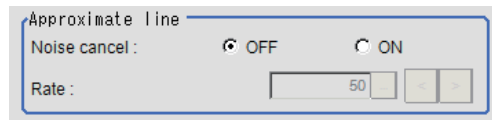
Setting item	Set value [Factory default]	Description
Density change	<ul style="list-style-type: none"> Absolute (only when the measurement method is "Derivation") [Light→Dark] Dark→Light 	Select whether a black-to-white change or a white-to-black change should be recognized as a density change in the specified region.
Edge No.	0 to 99 [0]	Specify the edge number used to extract edges. Edge numbers are assigned to detected edges starting from 0 and going on in the direction from the start point (the arrow point) to the end point (the direction of arrow) in the selected area.
Edge Upper Edge Lower	<ul style="list-style-type: none"> Position (%) for width of a density 0 to 100 [50] to [100] Value of density 0 to 255 [20] to [255] 	Select the density change level to be detected as edges. The upper limit of edges can be set only when the measurement method is "Derivation". Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

4 If necessary, set each item in the "Noise removal" area.



Setting item	Set value [Factory default]	Description
Noise level	0 to 442 [5]	When detection is affected by noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Level" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Noise width	0 to 9999 [0]	Set the width for judging noise. When detection is affected by noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Width" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Filter strength	0 to 100 [0]	If a valley appears in the histogram around the edge threshold value due to noises, smoothen the edge profile using a filter to prevent wrong error detection from being detected. Strengthening the filter smoothen the edge profile further.

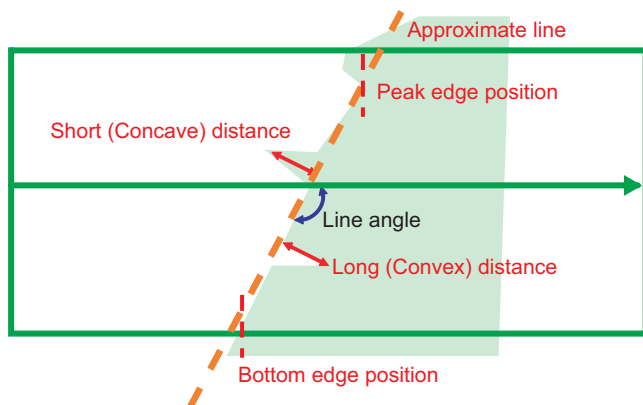
5 In the "Approximate line" area, specify the point to be used for the calculation of approximate lines.



Setting item	Set value [Factory default]	Description
Noise cancel	<ul style="list-style-type: none"> • ON • [OFF] 	When a check is placed at [ON], an approximate line is found by excluding the points with large deviation among the measured points.
Extraction rate	0 to 100 [50]	Set the ratio of measurement points used for approximate straight line calculation to all measurement points. When there is considerable noise, reducing this value enables calculation of an approximate straight line with many of the noise points removed. When there is little noise, increasing this value enables calculation of a high-accuracy straight line using many measurement points.

Judgement Conditions (Scan Edge Position)

Specify the range to be judged as OK.



- 1** In the Item Tab area, click [Judgement].
- 2** Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limits.

Setting item	Set value	Description
Peak edge position X	-99999.9999 to 99999.9999	Specify the X-axis upper and lower limits of the peak edge position X judged to be OK.
Peak edge position Y	-99999.9999 to 99999.9999	Specify the Y-axis upper and lower limits of the peak edge position Y judged to be OK.
Bottom edge position X	-99999.9999 to 99999.9999	Specify the X-axis upper and lower limits of the bottom edge position X judged to be OK.
Bottom edge position Y	-99999.9999 to 99999.9999	Specify the Y-axis upper and lower limits of the bottom edge position Y judged to be OK.
Edge position X Ave.	-99999.9999 to 99999.9999	Specify the X-axis upper and lower limits of the average edge position judged to be OK.
Edge position Y Ave.	-99999.9999 to 99999.9999	Specify the Y-axis upper and lower limits of the average edge position judged to be OK.

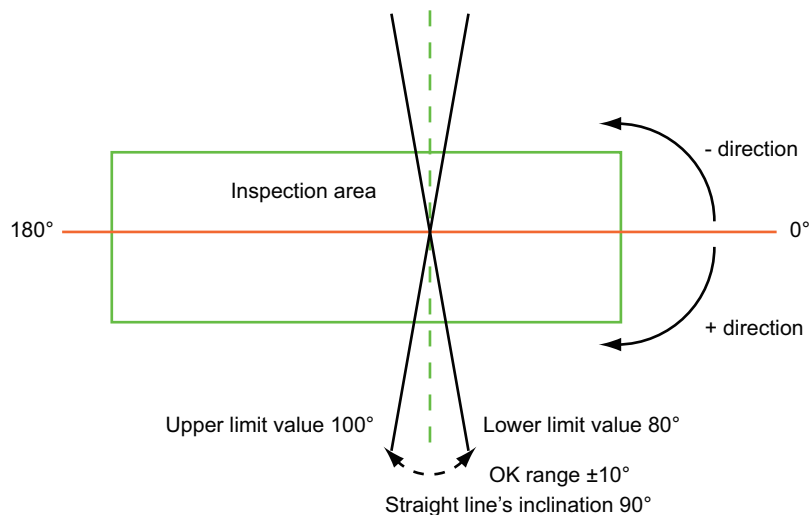
Setting item	Set value	Description
Long distance Max.	0 to 99999.9999	Specify the upper and lower limits of the long distance maximum judged to be OK.
Long distance Min.	0 to 99999.9999	Specify the upper and lower limits of the long distance minimum judged to be OK.
Short distance Max.	0 to 99999.9999	Specify the upper and lower limits of the short distance maximum judged to be OK.
Short distance Min.	0 to 99999.9999	Specify the upper and lower limits of the short distance minimum judged to be OK.
Deviation	0 to 99999.9999	Specify the upper and lower limits of the deviation judged to be OK.
Line angle	-180 to 180	Specify the upper and lower limits of the line angle judged to be OK.
Lost point count	0 to 100	Specify the upper and lower limits of the lost point count judged to be OK.

Note

- Judgement condition of the straight line's inclination

To set $90^\circ \pm 10^\circ$ (80° to 90° , -80° to -90°) range as OK, set the judgement condition to 80° to 100° .

The range of straight line's inclination is -89.999° to 90° . Internally, the angle X of -90° to 0° is the same value as $X + 180^\circ$, the angle X of 90° to 180° is the same value as $X - 180^\circ$.



Output Parameters (Scan Edge Position)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

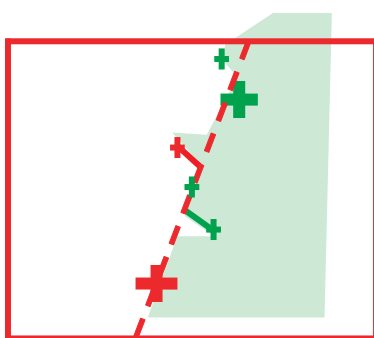
1 Click [Output parameter] in the Item Tab area.

2 Specify each of the following items.

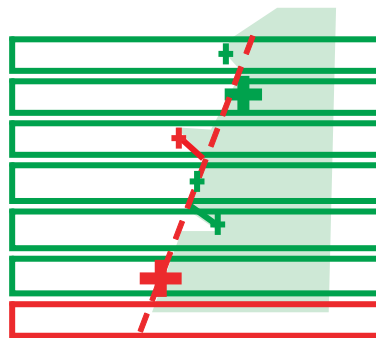
Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgment results of this processing unit is reflected in the scene overall judgment.

Key Points for Test Measurement and Adjustment (Scan Edge Position)

In addition to the camera input image, the measured region, a graphic display of the measured results, and the edge position (the crosshair cursor) are also displayed as results in the Image Display area.



Edge position display (Sub image 0)



Display of edge position in each divided part (Sub image 1)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Peak edge position X	X coordinate of the edge that is the furthest from the start point of the measurement region
Peak edge position Y	Y coordinate of the edge that is the furthest from the start point of the measurement region
Bottom edge position X	X coordinate of the edge that is the closest to the start point of the measurement region
Bottom edge position Y	Y coordinate of the edge that is the closest to the start point of the measurement region
Edge position X Ave.	The average of X coordinates of all the edges
Edge position Y Ave.	The average of Y coordinates of all the edges
Long distance Max.	The maximum distance between the approximate line and edge position (plus direction)
Short distance Max.	The minimum distance between the approximate line and the edge position (minus direction)
Deviation	Deviations in concavity and convexity (Value of the standard deviation for the distance of each edge point from the linear regression)
Line angle	The straight line's inclination against the measurement region
Lost point count	Number of parts for which the detection of edges has failed

The image specified in the Sub-image number in image display setting is displayed in the Image Display area.

Sub image number.	Explanation of image to be displayed
0	Measurement image
1	Scan region

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Parameter to be adjusted	Remedy
Measurement	If the color of the edges to be detected is decided, specify the color with [Edge color]. If results are not stable even with the color specified, specify a larger value for the color variance range.
	If noise is detected as an edge, specify larger values for "Noise level" and "Noise width".

Measurement Results for Which Output Is Possible (Scan Edge Position)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judgement result
Peak edge position X	PEAKX	X coordinate of the edge that is the furthest from the start point of the measurement region
Peak edge position Y	PEAKY	Y coordinate of the edge that is the furthest from the start point of the measurement region
Bottom edge position X	BOTTOMX	X coordinate of the edge that is the closest to the start point of the measurement region
Bottom edge position Y	BOTTOMY	Y coordinate of the edge that is the closest to the start point of the measurement region
Edge position X Ave.	X	The average of X coordinates of all the edges
Edge position Y Ave.	Y	The average of Y coordinates of all the edges
Reference coordinate	SX	X coordinate of the reference coordinates
Reference coordinate	SY	Y coordinate of the reference coordinates
Long distance Max.	PMAXD	The maximum distance between the approximate line and edge position (plus direction)
Long distance Min.	PMIND	The minimum distance between the approximate line and the edge position (plus direction)
Short distance Max.	BMAXD	The maximum distance between the approximate line and the edge position (minus direction)
Short distance Min.	BMIND	The minimum distance between the approximate line and the edge position (minus direction)
Deviation	DEV	Deviations in concavity and convexity
Angle	TH	The straight line's inclination against the measurement region
Lost point count	LOST	Number of parts for which the detection of edges has failed
Line Param. A	A	A in the expression for the approximate line $AX + BY + C = 0$.
Line Param. B	B	B in the expression for the approximate line $AX + BY + C = 0$.
Line Param.C	C	C in the expression for the approximate line $AX + BY + C = 0$.

External Reference Tables (Scan Edge Position)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
1	Peak edge position X	Get only	0 to 99999.9999
2	Peak edge position Y	Get only	0 to 99999.9999
3	Bottom edge position X	Get only	0 to 99999.9999
4	Bottom edge position Y	Get only	0 to 99999.9999
5	Edge position X Ave.	Get only	-1 to 99999.9999
6	Edge position Y Ave.	Get only	-1 to 99999.9999
7	Long distance Max.	Get only	-1 to 99999.9999
8	Long distance Min.	Get only	-1 to 99999.9999
9	Short distance Max.	Get only	-1 to 99999.9999
10	Short distance Min.	Get only	-1 to 99999.9999
11	Deviation	Get only	-1 to 99999.9999
12	Angle	Get only	-180 to 180
13	Lost point	Get only	0 to 100
14	Linear coefficient A	Get only	-99999.9999 to 99999.9999
15	Linear coefficient B	Get only	-99999.9999 to 99999.9999
16	Linear coefficient C	Get only	-99999.9999 to 99999.9999
17	Reference X * ¹	Get only	0 to 99999.9999
18	Reference Y * ¹	Get only	0 to 99999.9999
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Edge color specification	Set/Get	0: OFF 1: ON
121	Edge color R	Set/Get	0 to 255
122	Edge color G	Set/Get	0 to 255
123	Edge color B	Set/Get	0 to 255
124	Difference R	Set/Get	0 to 127
125	Difference G	Set/Get	0 to 127
126	Difference B	Set/Get	0 to 127
127	Detection mode	Set/Get	0: Color IN 1: Color OUT
129	Reference X * ²	Set/Get	0 to 99999.9999
130	Reference Y * ²	Set/Get	0 to 99999.9999

No.	Data name	Set/Get	Data range
131	Edge No.	Set/Get	0 to 99
132	Edge level lower limit	Set/Get	0 to 100
133	Noise level	Set/Get	Color camera: 0 to 442 Monochrome camera: 0 to 255
134	Noise width	Set/Get	0 to 9999
135	Edge color level	Set/Get	0 to 442
136	Upper limit of the maximum edge position X	Set/Get	-99999.9999 to 99999.9999
137	Lower limit of the maximum edge position X	Set/Get	-99999.9999 to 99999.9999
138	Upper limit of the maximum edge position Y	Set/Get	-99999.9999 to 99999.9999
139	Lower limit of the maximum edge position Y	Set/Get	-99999.9999 to 99999.9999
140	Upper limit of the minimum edge position X	Set/Get	-99999.9999 to 99999.9999
141	Lower limit of the minimum edge position X	Set/Get	-99999.9999 to 99999.9999
142	Upper limit of the minimum edge position Y	Set/Get	-99999.9999 to 99999.9999
143	Lower limit of the minimum edge position Y	Set/Get	-99999.9999 to 99999.9999
144	Upper limit of the edge position X Ave.	Set/Get	-99999.9999 to 99999.9999
145	Lower limit of the edge position X Ave.	Set/Get	-99999.9999 to 99999.9999
146	Upper limit of the edge position Y Ave.	Set/Get	-99999.9999 to 99999.9999
147	Lower limit of the edge position Y Ave.	Set/Get	-99999.9999 to 99999.9999
148	Upper limit of the long distance Max.	Set/Get	0 to 99999.9999
149	Lower limit of the long distance Max.	Set/Get	0 to 99999.9999
150	Upper limit of the short distance Max.	Set/Get	0 to 99999.9999
151	Lower limit of the short distance Max.	Set/Get	0 to 99999.9999
152	Upper limit of the deviation	Set/Get	0 to 99999.9999
153	Lower limit of the deviation	Set/Get	0 to 99999.9999
154	Upper limit of the angle	Set/Get	-180 to 180
155	Lower limit of the angle	Set/Get	-180 to 180
156	Upper limit of the lost point	Set/Get	0 to 100
157	Lower limit of the lost point	Set/Get	0 to 100
158	Monochrome edge detection mode	Set/Get	0: Light→Dark 1: Dark→Light

No.	Data name	Set/Get	Data range
159	Edge level lower limit absolute value	Set/Get	0 to 442
160	Edge level specification method	Set/Get	0: % 1: Absolute value
162	Scan sub-region	Set/Get	1 to 100
163	Mask size	Set/Get	0 to 200
164	Display area	Set/Get	0 to 99
165	Noise cancel	Set/Get	0: OFF 1: ON
166	Measure type	Set/Get	0: Projection 1: Differential
167	Fix region count	Set/Get	0: Not fixed 1: Fixed
168	Edge level upper limit *3	Set/Get	0 to 100
169	Edge level upper limit absolute value *4	Set/Get	0 to 442
170	Monochrome Derivation edge detection mode	Set/Get	0 to 2
171	FNC Rate	Set/Get	0 to 100
177	Filter Strength	Set/Get	0 to 100
178	Setting unit of reference coordinate	Set/Get	-1 to 9,999
179	Setting type of reference coordinate	Set/Get	0: Numerical 1: Unit
180	Use point coordinate before scroll	Set/Get	0: Not use 1: Use
181	Position X before scroll	Set/Get	-99999.9999 to 99999.9999
182	Position Y before scroll	Set/Get	-99999.9999 to 99999.9999
6002	Format	Set/Get	1: monochrome camera 2: color camera

*1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.

*2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.

*3: On the [Measurement] tab of the Properties Dialog Box, this data is displayed as [Edge Upper] when you choose the [Position (%)] for width of a color].

*4: On the [Measurement] tab of the Properties Dialog Box, this data is displayed as [Edge Upper] when you choose the [Value (442 at the maximum)] of color].

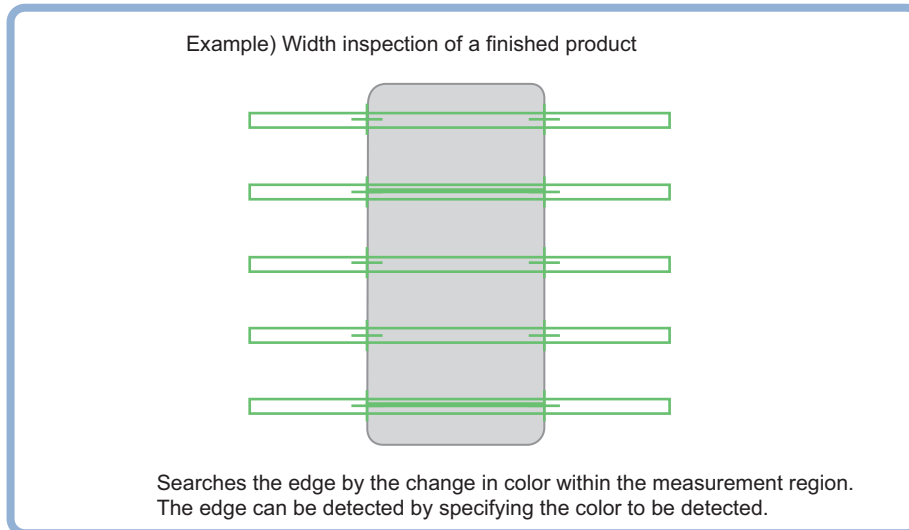
Scan Edge Width

This processing item detects the position of the measurement object by using the change in color within the measurement region. By dividing the measurement region, you can get the following values.

- Local width of the work
- Average width of the work

Used in the Following Case

- When getting several widths of a measurement object



- To find the width of a measurement object

Using a Expression, the width of a measurement object can be calculated from the difference between two edge positions.

Important

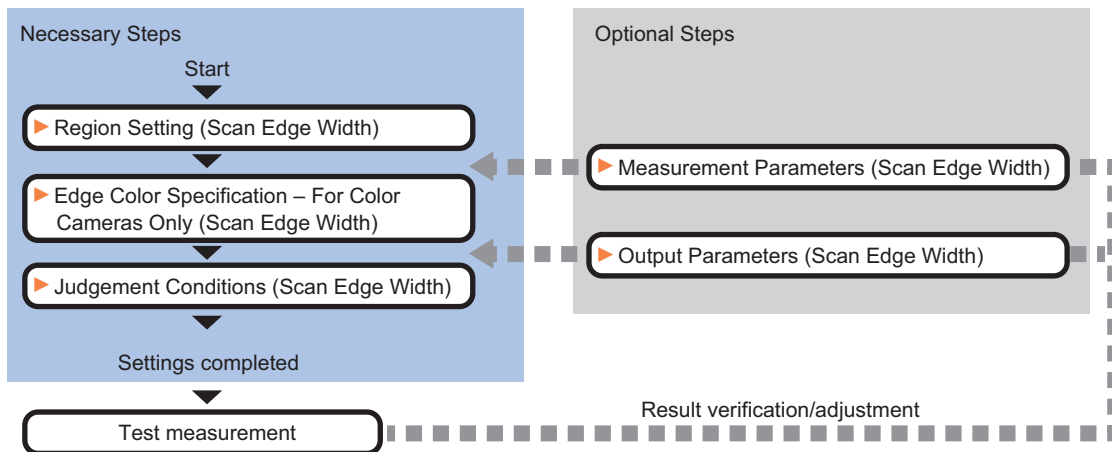
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Note

- Edge image measurement processing mechanism
Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Settings Flow (Scan Edge Width)

Set the scan edge width with the following steps.



Item List for Scan Edge Width

Item name	Description
Region setting	This item is used to set up the measurement area. Reference: ▶ Region Setting (Scan Edge Width) (p.261)
Edge color (for color cameras only)	This item selects the color information for the edges to be detected. Reference: ▶ Edge Color Specification - For Color Cameras Only (Scan Edge Width) (p.262)
Measurement	This item changes the measurement parameter as necessary when the measurement result is unstable. The displayed items depend on whether your camera is a color or monochrome camera. Normally, the factory default value will be used. Reference: ▶ Measurement Parameters (Scan Edge Width) (p.263)
Judgement	This item specifies the judgement condition for measurement results. Reference: ▶ Judgement Conditions (Scan Edge Width) (p.266)
Output parameter	This item can be changed if necessary. Normally, the factory default value may be used. Select the measurement result coordinates and set how to handle the coordinates. Reference: ▶ Output Parameters (Scan Edge Width) (p.266)

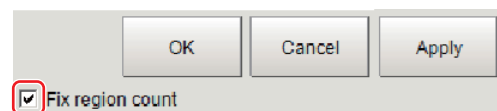
Region Setting (Scan Edge Width)

This item is used to set up the measurement area.

Specify the measurement region of [Scan Edge Width] by using a wide line.

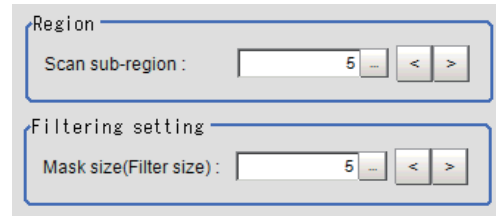
- 1** In the Item Tab area, click [Region setting].
- 2** Use the Drawing tools to specify the measurement region.

To align with the measurement area and change the number of measurement points, uncheck this.



- 3** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

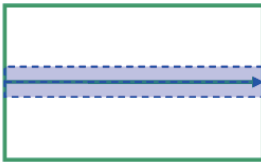
4 Set the measurement point and the filter size for the region.



Setting item	Set value [Factory default]	Description
Scan sub-region	1 to 100 [5]	Set the measurement point for the region.
Mask size	1 to 200 0 to 200 [5]	Set the filter size when smoothing the measurement point vicinity. When 5 is set, smoothing is processed for a total of 11 points: the measurement point and the 5 pixels before and after it.

5 The region is divided equally.

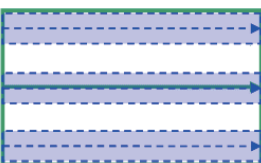
The scan region, when the number of measurement points is 1



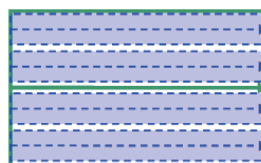
The scan region, when the number of measurement points is 2



The scan region, when the number of measurement points is 3

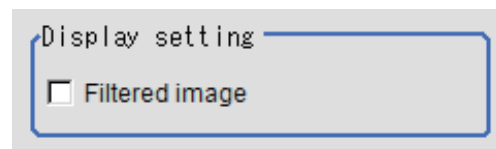


The scan region, when the number of measurement points is 4



6 Perform the display setting if required.

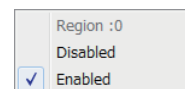
Placing a check at [Filtered image] makes it easier to change the filtering setting.



Setting item	Set value [Factory default]	Description
Filtered image	• [Unchecked] • Checked	If checked, the filtered image of the ranges set with the Scan sub-region and Filter size after smoothing is displayed.

Note

- You can specify enable/disable for each edge measurement number. Clicking edge measurement points displays the following screen.



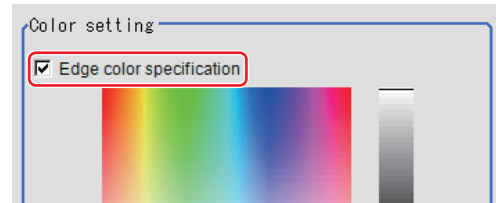
Edge Color Specification - For Color Cameras Only (Scan Edge Width)

This item selects the color of the edges to be detected.

If the target color changes, this setting is not necessary. If the color is not specified, positions in the measurement region where the color changes drastically are detected as an edge.

1 In the Item Tab area, click [Edge color].

2 Place a check at "Edge color specification" in the "Color setting" area.



3 This item selects the color to be detected as edges.

Setting methods	Description
Image Display area	Specify a region on the image that includes the target color. The average color of the specified region is registered.
Color chart	Click the reference color on the color chart to specify it. The RGB values for the specified color are displayed at the bottom.
R, G, B	The color to be detected is set with the RGB values.
Difference R, G, B	This sets the allowable color difference for detecting the edge, using the specified color as the reference. The larger the difference values, the larger the color range that is used to detect the edge.
Detection mode	<p>Color IN: The position where a color other than the specified color changes to the specified color is detected as the edge.</p> <p>Color OUT: The position where the specified color changes to a color other than the specified color is detected as the edge.</p> <p>For "Color IN" edge measurement mode</p> <p>For "Color OUT" edge measurement mode</p>

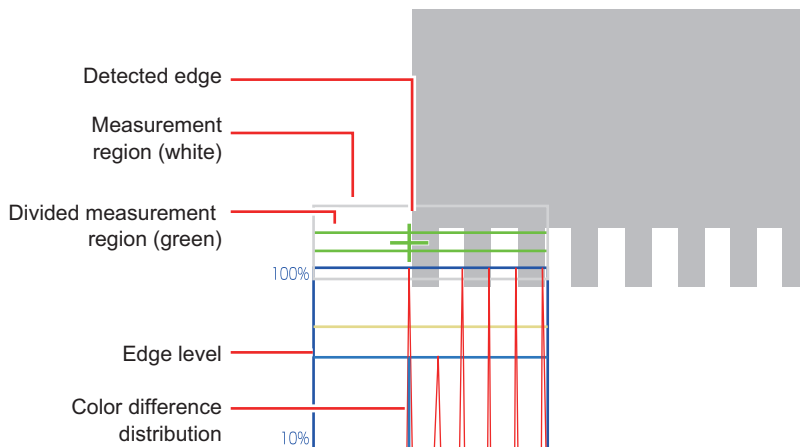
Measurement Parameters (Scan Edge Width)

Measurement parameters can be changed as needed to address unstable measurement results. Normally, the factory default value will be used.

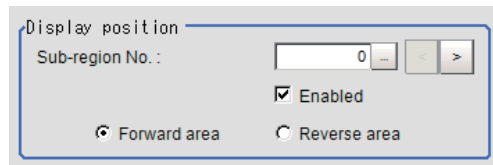
After changing a setting, check whether measurement can be done properly by performing an actual measurement.

1 In the Item Tab area, click [Measurement].

The edge profile of the measurement region is displayed as a graph in the Image Display area.



2 You can specify enable/disable for each edge measurement number.

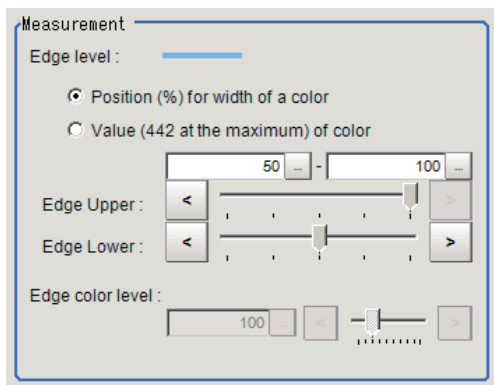


Setting item	Set value [Factory default]	Description
Sub-region No.	[0] to 99	Set the edge measurement number for which the edge profile is displayed.
Enabled	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Specify enable/disable for the displayed edge measurement number. When disabled (unchecked) is specified, measurement is not performed.
	<ul style="list-style-type: none"> • [Forward area] • Reverse area 	Forward area: The edge is searched for from the start point of the area toward the end point. Reverse area: The edge is searched for from the end point of the area toward the start point.

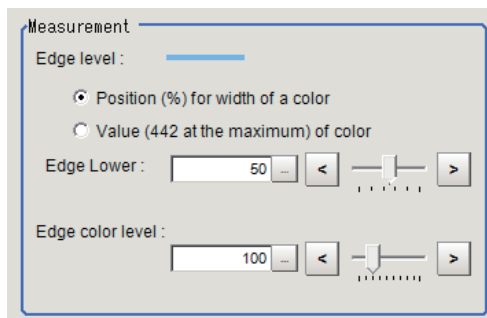
3 Set the value of each item in the "Measurement" area.

For color cameras:

Edge color specification is OFF.



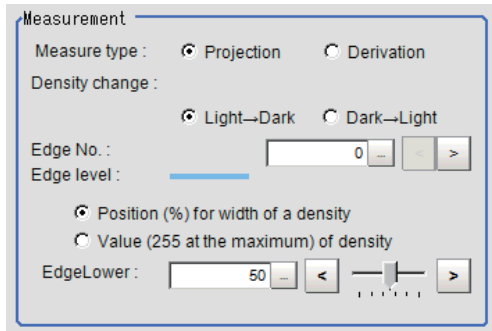
Edge color specification is ON.



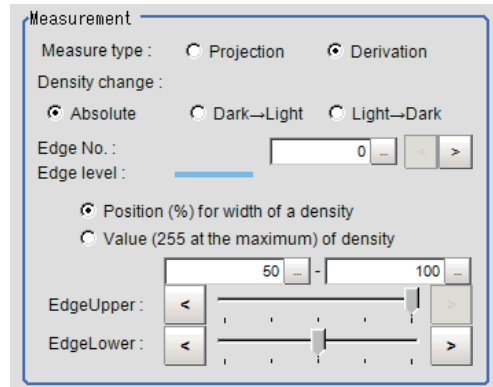
Setting item	Set value [Factory default]	Description
Edge Upper Edge Lower	<ul style="list-style-type: none"> • Position (%) for width of a color 0 to 100 [50] to [100] • Value of color 0 to 442 [20] to [442] 	Set a range of a color difference level with which the edge is detected. Reference: ► "Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Edge color level	0 to 442 [100]	This emphasis level can be specified only if the edge color to detect is specified.

For monochrome cameras:

When the measurement method is "Projection"

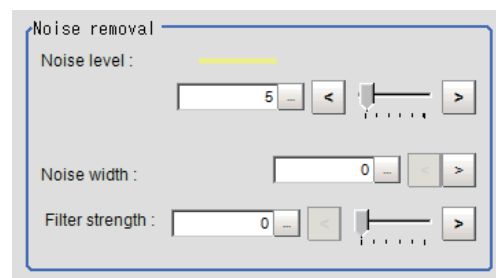


When the measurement method is "Derivation"



Setting item	Set value [Factory default]	Description
Measure type	<ul style="list-style-type: none"> • [Projection] • Derivation 	As the measurement type, specify either projection or derivation. Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Method" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Density change	<ul style="list-style-type: none"> • Absolute (only when the measurement method is "Derivation") • [Light→Dark] • Dark→Light 	Select whether a black-to-white change or a white-to-black change should be recognized as a density change in the specified region.
Edge Upper Edge Lower	<ul style="list-style-type: none"> • Position (%) for width of a density 0 to 100 [50] to [100] • Value of density 0 to 255 [20] to [255] 	Select the density change level to be detected as edges. The upper limit of edges can be set only when the measurement method is "Derivation". Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

4 If necessary, set each item in the "Noise removal" area.



Setting item	Set value [Factory default]	Description
Noise level	0 to 442 [5]	When detection is affected by noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Level" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Noise width	0 to 9999 [0]	Set the width for judging noise. When detection is affected by noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Width" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Setting item	Set value [Factory default]	Description
Filter strength	0 to 100 [0]	If a valley appears in the histogram around the edge threshold value due to noises, smoothen the edge profile using a filter to prevent wrong error detection from being detected. Strengthening the filter smoothen the edge profile further.

Judgement Conditions (Scan Edge Width)

Specify the range to be judged as OK.

- 1** In the Item Tab area click [Judgement].
- 2** Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Setting item	Set value	Description
Edge width Max.	0 to 99999.9999	Specify the upper and lower limits of the maximum width judged to be OK.
Edge width Min.	0 to 99999.9999	Specify the upper and lower limits of the minimum width judged to be OK.
Edge width Ave.	0 to 99999.9999	Specify the upper and lower limits of the average width judged to be OK.
Lost width count	0 to 100	Specify the upper and lower limits of the lost width count judged to be OK.

Output Parameters (Scan Edge Width)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- 1** Click [Output parameter] in the Item Tab area.
- 2** Specify each of the following items.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position deflection correction is applied.
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Scan Edge Width)

The following contents can be displayed as text in the "Detail result" area.

Displayed items	Description
Judge	Judgement result
Edge width Max.	The maximum value of edge width
Edge width Min.	The minimum value of edge width
Edge width Ave.	The average value of all the edge width
Lost width count	The number of the scanned areas for which the detection of width failed

The image specified in the Sub-image number in image display setting is displayed in the Image Display area.

Sub image number	Explanation of image to be displayed
0	Measurement image
1	Scan region

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Parameter to be adjusted	Remedy
Measurement	If the color of the edges to be detected is decided, specify the color with [Edge color]. If results are not stable even with the color specified, specify a larger value for the color variance range.
	If noise is detected as an edge, specify larger values for "Noise level" and "Noise width".

Measurement Results for Which Output Is Possible (Scan Edge Width)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Edge width Max.	MAXW	The maximum value of edge width
Edge width Min.	MINW	The minimum value of edge width
Edge width Ave.	AVEW	The average value of all the edge width
Lost width count	LOST	The number of the scanned areas for which the detection of width failed

External Reference Tables (Scan Edge Width)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
1	Edge width Max.	Get only	0 to 99999.9999
2	Edge width Min.	Get only	0 to 99999.9999
3	Edge width Ave.	Get only	0 to 99999.9999
4	Lost width count	Get only	0 to 100
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Edge color specification	Set/Get	0: OFF 1: ON
121	Edge color R	Set/Get	0 to 255
122	Edge color G	Set/Get	0 to 255
123	Edge color B	Set/Get	0 to 255
124	Difference R	Set/Get	0 to 127
125	Difference G	Set/Get	0 to 127
126	Difference B	Set/Get	0 to 127
127	Detection mode	Set/Get	0: Color IN 1: Color OUT
129	Edge level lower limit	Set/Get	0 to 100
130	Noise level	Set/Get	Color camera: 0 to 442 Monochrome camera: 0 to 255
131	Noise width	Set/Get	0 to 9999
132	Edge color level	Set/Get	0 to 442
133	Upper limit of the Max. width	Set/Get	0 to 99999.9999
134	Lower limit of the Max. width	Set/Get	0 to 99999.9999
135	Upper limit of the Min. width	Set/Get	0 to 99999.9999
136	Lower limit of the Min. width	Set/Get	0 to 99999.9999
137	Upper limit of the average width	Set/Get	0 to 99999.9999
138	Lower limit of the average width	Set/Get	0 to 99999.9999
139	Upper limit of the lost width count	Set/Get	0 to 100
140	Lower limit of the lost width count	Set/Get	0 to 100

No.	Data name	Set/Get	Data range
141	Monochrome edge detection mode	Set/Get	0: Light→dark 1: Dark→light
142	Edge level lower limit absolute value	Set/Get	Color camera:0 to 442 Monochrome camera: 0 to 255
143	Edge level specification method	Set/Get	0: % 1: Absolute value
145	Measurement point	Set/Get	1 to 100
146	Mask size	Set/Get	0 to 200
147	Display area	Set/Get	1 to 99
148	Display area (direction)	Set/Get	0: Forward 1: Reverse
149	Measure type	Set/Get	0: Projection 1: Derivation
150	Fix region count	Set/Get	0: Not fixed 1: Fixed
151	Monochrome Derivation edge detection mode	Set/Get	0: Absolute 1: Dark→Light 2: Light→Dark
152	Edge level upper limit *1	Set/Get	0 to 100
153	Edge level upper limit absolute value *2	Set/Get	Color camera:0 to 442 Monochrome camera: 0 to 255
154	Filter Strength	Set/Get	0 to 100
6002	Format	Set/Get	1: monochrome camera 2: color camera

*1: On the [Measurement] tab of the Properties Dialog Box, this data is displayed as [Edge Upper] when you choose the [Position (%) for width of a color].

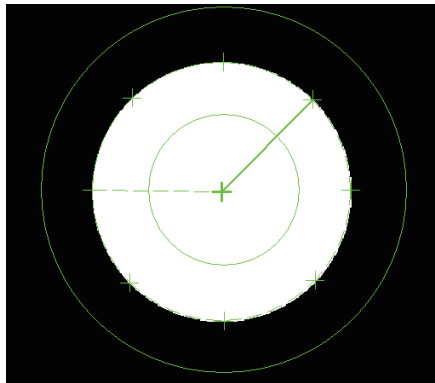
*2: On the [Measurement] tab of the Properties Dialog Box, this data is displayed as [Edge Upper] when you choose the [Value (442 at the maximum) of color].

Circular Scan Edge Position

This processing item detects the position of the circular measurement object by using the change in color within the measurement region.

Used in the Following Case

- To obtain the center of the circle and the radius from multiple edges of a circular measurement object



Searches the edge with the change in color within the measurement region.
The edge can be detected by specifying the color to be detected.

Important

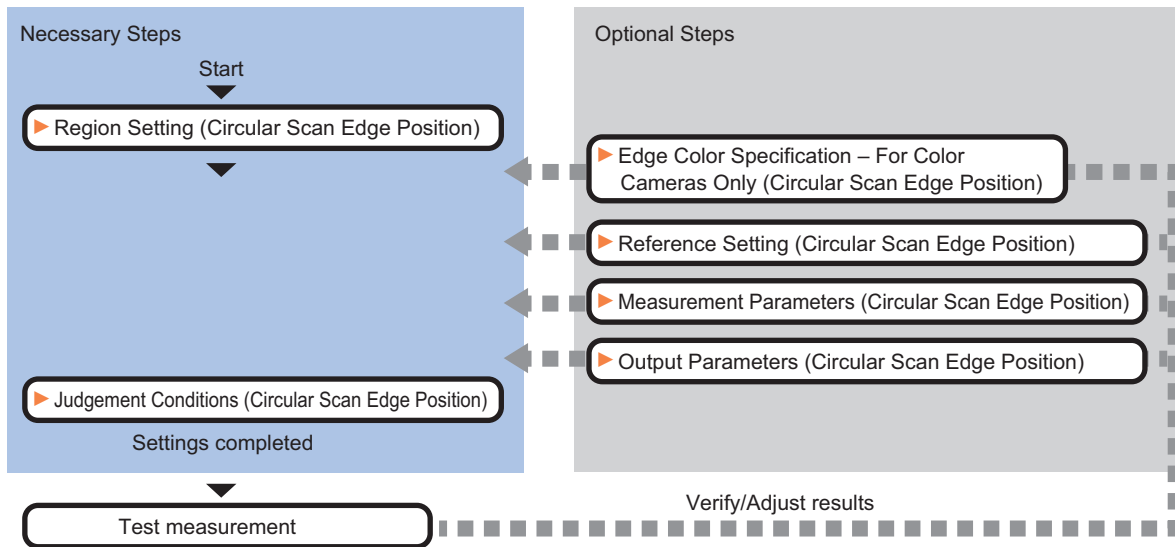
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Note

- Edge image measurement processing mechanism
Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Settings Flow (Circular Scan Edge Position)

Set the circular scan edge position with the following steps.



Item List for Circular Scan Edge Position

Item name	Description
Region setting	This item is used to set up the measurement area. Reference: ▶ Region Setting (Circular Scan Edge Position) (p.272)
Edge color (for color cameras only)	If the color of the edges to be detected is decided, specify the information for the edge color to be detected. Reference: ▶ Edge Color Specification - For Color Cameras Only (Circular Scan Edge Position) (p.273)
Ref. setting	This item can be changed if necessary. The edge position measured once is registered when the region is set. Reference: ▶ Reference Setting (Circular Scan Edge Position) (p.274)
Measurement	This item changes the measurement parameter as necessary when the measurement result is unstable. The displayed items depend on whether your camera is a color or monochrome camera. Normally, the factory default value will be used. Reference: ▶ Measurement Parameters (Circular Scan Edge Position) (p.275)
Judgement	This item specifies the judgement condition for measurement results. Reference: ▶ Judgment Conditions (Circular Scan Edge Position) (p.278)
Output parameter	This item can be changed if necessary. Normally, the factory default value may be used. Select the measurement result coordinates and set how to handle the coordinates. Reference: ▶ Output Parameters (Circular Scan Edge Position) (p.279)

Region Setting (Circular Scan Edge Position)

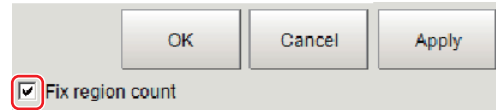
This item is used to set up the measurement area.

Specify the measurement region for [Circular Scan Edge Position] by using circular shapes.

1 In the Item Tab area, click [Region setting].

2 Use the Drawing tools to specify the measurement region.

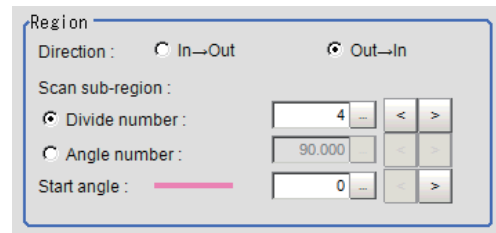
To align with the measurement area and specify the measurement point again, uncheck "Fix region count".



3 Click [OK] in the Figure setting area.

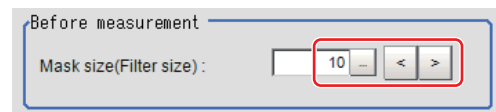
- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

4 Specify the method of measurement, the measurement point, and the start angle for the region.



Setting item	Set value [Factory default]	Description
Direction	<ul style="list-style-type: none"> • [Out→In] • In→Out 	Set the measurement direction.
Scan sub-region		Set the measurement point. Use either the "Divide num" or the "Divide angle" for this setting.
	Divide number 3 to 360 [4]	Set the number of divisions for the circle. The specified value is used as the measurement point.
	Angle number 1.000 to 179.999 [90.000]	Set the skipping angle for the circle. The measurement point is determined based on the specified angle.
Start angle	0 to 359 [0]	Set the start angle to specify a region.

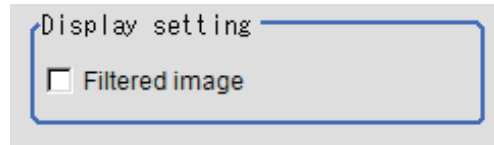
5 Set the mask size for the region.



Setting item	Set value [Factory default]	Description
Mask size	0 to 1000 [10]	Set the filter size when smoothing the measurement point vicinity. When 5 is set, smoothing is processed for a total of 11 points: the measurement point and the 5 pixels before and after it.

6 Perform the display setting if required.

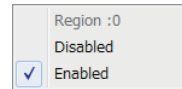
Placing a check at [Filtered image] makes it easier to change the filtering setting.



Setting item	Set value [Factory default]	Description
Filtered image	<ul style="list-style-type: none"> [Unchecked] Checked 	If checked, the filtered image of the ranges set with the Scan sub-region and Filter size after smoothing is displayed.

Note

- Enable or disable setting can be specified for each edge measurement number. Clicking edge measurement points displays the following screen.

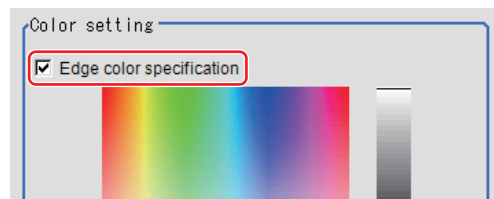


Edge Color Specification - For Color Cameras Only (Circular Scan Edge Position)

This item selects the color of the edges to be detected.

If the target color changes, this setting is not necessary. If the color is not specified, positions in the measurement region where the color changes drastically are detected as an edge.

- 1 In the Item Tab area, click [Edge color].
- 2 Place a check at "Edge color specification" in the "Color setting" area.



- 3 This item selects the color to be detected as edges.

Item	Set value [Factory default]	Description
Image Display area	-	Specify a region on the image that includes the target color. The average color of the specified region is registered.
Color chart	-	Click the reference color on the color chart to specify it. The RGB values for the specified color are displayed at the bottom.
R, G, B	0 to 255 [255]	The color to be detected is set with the RGB values.
Difference R, G, B	0 to 127 [5]	This sets the allowable color difference for detecting the edge, using the specified color as the reference. The larger the difference values, the larger the color range that is used to detect the edge.
Detection mode	<ul style="list-style-type: none"> [Color IN] Color OUT 	<p>Color IN: The position where a color other than the specified color changes to the specified color is detected as the edge.</p> <p>Color OUT: The position where the specified color changes to a color other than the specified color is detected as the edge.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>For "Color IN" edge measurement mode</p> </div> <div style="text-align: center;"> <p>For "Color OUT" edge measurement mode</p> </div> </div>

Reference Setting (Circular Scan Edge Position)

When the measurement region is set, this position is automatically set at the same time as the reference position. This item can be used to change the reference position to any desired position. This is handy for measuring the position deviation from a certain position.

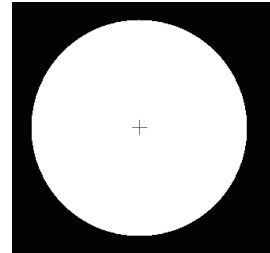
A reference position can be set either directly or by referencing a unit.

Specifying directly

Click a position on the image you want to use as a reference position, or set coordinate data for that point.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.



2 In the "Method" area, select "Numerical".

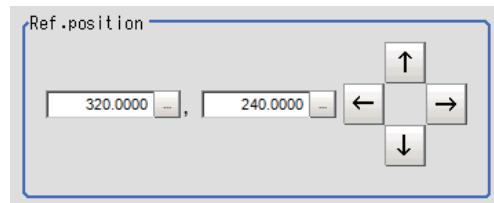


3 Click the position to be set as the reference.

Note

- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendix Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

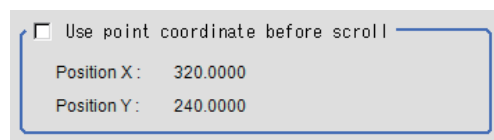
4 Make fine adjustments using numeric value inputs or the arrow buttons as required.



5 To remeasure on the displayed image and set the reference, click the [Measure ref.] button.



6 To use data before position compensation for the reference setting coordinates, place a check at "Use point coordinate before scroll".



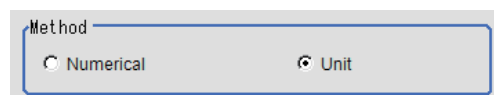
Referencing a unit

Set a reference by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

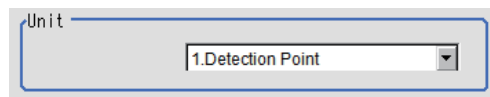
1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.

2 In the "Method" area, select "Unit".



- In the scene in the "Unit" area, select a detection point unit.



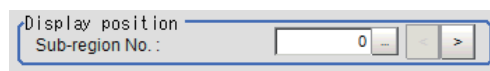
- Perform the next measurement, and the reference will be displayed.

Measurement Parameters (Circular Scan Edge Position)

Measurement parameters can be changed as needed to address unstable measurement results. Normally, the factory default value will be used.

After changing a setting, check whether measurement can be done properly by performing an actual measurement.

- In the Item Tab area, click [Measurement].



The edge profile of the measurement region is displayed as a graph in the Image Display area.

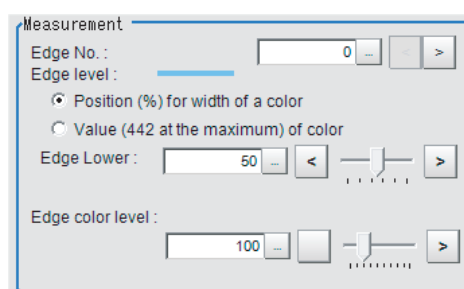
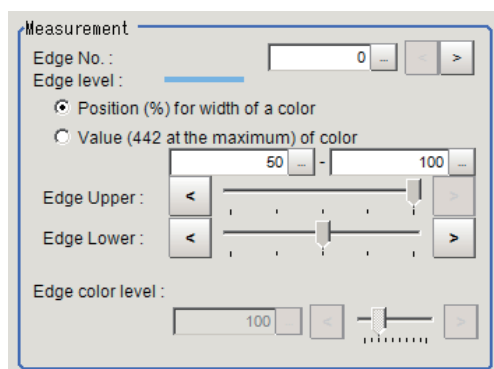
Setting item	Set value [Factory default]	Description
Sub-region No.	0 to 359 [0]	Specify the edge measurement number for which the edge profile is displayed.

- Set the value of each item in the "Measurement" area.

For color cameras:

Edge Color Not Specified

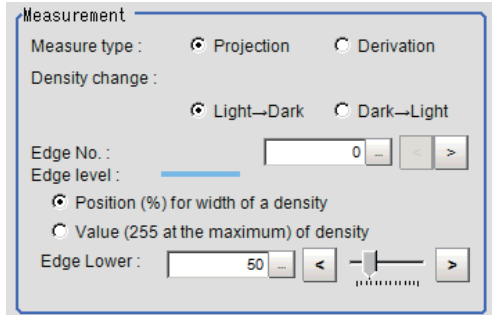
Edge Color Specified



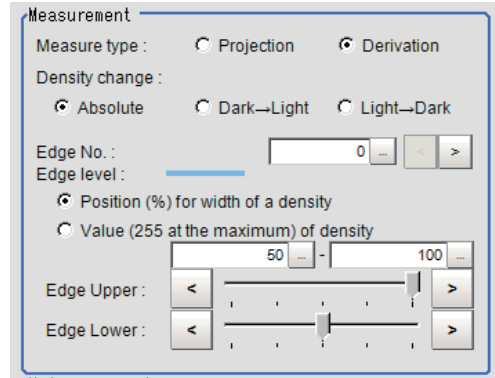
Setting item	Set value [Factory default]	Description
Edge No.	0 to 99 [0]	Specify the edge number used to extract edges. Edge numbers are assigned to detected edges starting from 0 and in the direction from the start point (the arrow) to the end point (the arrow point) in the selected region.
Edge Upper (only when edge color is not specified) Edge Lower	<ul style="list-style-type: none"> Position (%) for width of a color 0 to 100 [50] to [100] Value of color 0 to 442 [20] to [442] 	Set a range of a color difference level with which the edge is detected. Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Edge color level	0 to 442 [100]	This emphasis level can be set only if the edge color to detect is specified.

For monochrome cameras:

When the measurement method is "Projection"

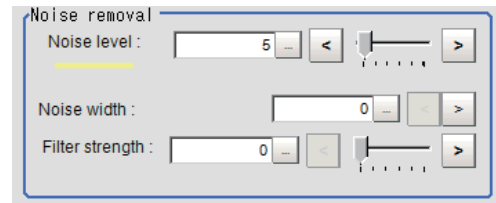


When the measurement method is "Derivation"



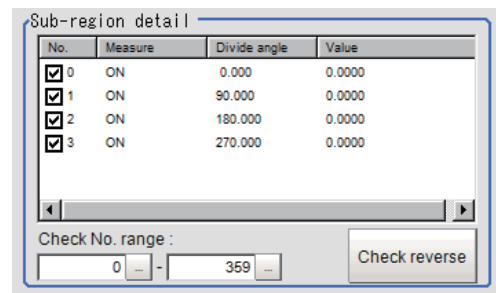
Setting item	Set value [Factory default]	Description
Measure type	<ul style="list-style-type: none"> • [Projection] • Derivation 	As the measurement type, specify either projection or derivation. Reference: ▶"Appendixes Measurement Mechanism Edge Detection Method" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Density change	<ul style="list-style-type: none"> • Absolute (only when the measurement method is "Derivation") • [Light→Dark] • Dark→Light 	Set whether a black-to-white change or a white-to-black change should be recognized as a density change in the specified region.
Edge No.	0 to 99 [0]	Specify the edge number used to extract edges. Edge numbers are assigned to detected edges starting from 0 and in the direction from the start point (the arrow) to the end point (the arrow point) in the selected region.
Edge Upper Edge Lower	<ul style="list-style-type: none"> • Position (%) for width of a density 0 to 100 [50] to [100] • Value of density 0 to 255 [20] to [255] 	Set the density change level to be detected as edges. The upper limit of edges can be set only when the measurement method is "Derivation". Reference: ▶"Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

3 If necessary, set each item in the "Noise removal" area.



Setting item	Set value [Factory default]	Description
Noise level	<ul style="list-style-type: none"> For color cameras 3 to 442 [5] For monochrome cameras 0 to 255 [5] 	When detection is affected by noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Level" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Noise width	0 to 9999 [0]	Set the width for judging noise. When detection is affected by noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Width" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Filter strength	0 to 100 [0]	If a valley appears in the histogram around the edge threshold value due to noises, smoothen the edge profile using a filter to prevent wrong error detection from being detected. Strengthening the filter smoothen the edge profile further.

4 In the "Sub-region detail" area, set enable or disable measurement as required.

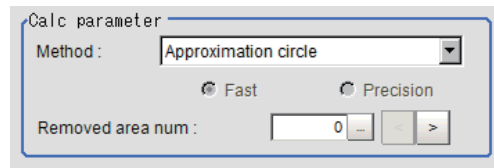


Setting item	Set value [Factory default]	Description
Check No. range	0 to 359 [0] to [359]	Specify the edge measurement number for which to perform batch reversing of the enable or disable measurement setting. Click [Check reverse] to reverse the check box settings of the edge measurement number within the range.

Judgment Conditions (Circular Scan Edge Position)

Specify the range to be judged as OK.

- 1 In the circle calculation parameter, set the calculation method as required.



Setting item	Set value [Factory default]	Description
Calc parameter	<ul style="list-style-type: none"> • [Approximation circle] • Smallest enclosing circle 	Specify the circle calculation method. When the calculation from the smallest enclosing circle is selected, specify fast speed or high precision. <ul style="list-style-type: none"> • Circular Regression: The circle is calculated with the least square method. • Smallest enclosing circle (Fast): A circle that encloses all points is calculated. • Smallest enclosing circle (High precision): A circle that encloses all points and that circumscribes three points is calculated.
	<ul style="list-style-type: none"> • [Fast] • Precision 	
Removed area num	0 to 360 [0]	Set the number of regions to remove. The differences from the circular regression calculated from all measurement points are eliminated in the order of the largest to the smallest.

- 2 Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Setting item	Set value [Factory default]	Description
Center X	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Set the range of center coordinate Xs that are judged to be OK.
Center Y	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Set the range of center coordinate Ys that are judged to be OK.
Radius	0 to 99999.9999 [0] to [99999.9999]	Set the range of radiuses that is judged to be OK.
Radius Max.	0 to 99999.9999 [0] to [99999.9999]	Set the maximum radius that is judged to be OK.
Radius Min.	0 to 99999.9999 [0] to [99999.9999]	Set the minimum radius that is judged to be OK.
Decentration X	-99999.999 to 99999.9999 [-99999.9999] to [99999.9999]	Decentration X is the difference between the X coordinate position of the reference setting and the X coordinate position of the calculated circle center. Set the range of decentration Xs that is judged to be OK.
Decentration Y	-99999.999 to 99999.9999 [-99999.9999] to [99999.9999]	Decentration Y is the difference between the Y coordinate position of the reference setting and the Y coordinate position of the calculated circle center. Set the range of decentration Ys that is judged to be OK.
Lost point count	0 to 360 [0] to [360]	Set the range for the number of lost points that is judged to be OK.

Output Parameters (Circular Scan Edge Position)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

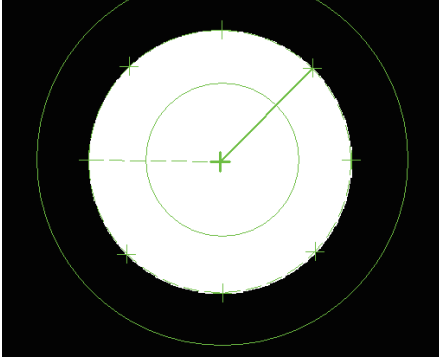
1 Click [Output parameter] in the Item Tab area.

2 Specify each of the following items.

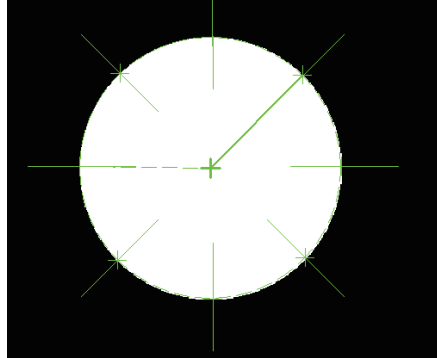
Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none">• [After scroll]• Before scroll	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none">• [OFF]• ON	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none">• [ON]• OFF	Enables choosing whether or not the judgment results of this processing unit is reflected in the scene overall judgment.

Key Points for Test Measurement and Adjustment (Circular Scan Edge Position)

In addition to the camera input image, the measured region, a graphic display of the measured results, and the edge position (the crosshair cursor) are also displayed as results in the Image Display area.



Edge position display (Sub image 0)



Display of edge position in each divided part (Sub image 1)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Center coordinate X	The center X coordinate of the calculation result
Center coordinate Y	The center Y coordinate of the calculation result
Radius	The radius of the calculation result
Maximum radius	The maximum radius of the calculation result
Minimum radius	The minimum radius of the calculation result
Decentration X	The decentration X of the calculation result
Decentration Y	The decentration Y of the calculation result
Number of lost points	Number of parts for which the detection of edges has failed

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Parameter to be adjusted	Remedy
Measurement	If the color of the edges to be detected is decided, specify the color with [Edge color]. If results are not stable even with the color specified, specify a larger value for the color variance range.
	If noise is detected as an edge, specify larger values for "Noise level" and "Noise width".

Measurement Results for Which Output Is Possible (Circular Scan Edge Position)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	1: OK 0: Not yet measured -1: NG
Center coordinate X	X	The center X coordinate of the calculation result
Center coordinate Y	Y	The center Y coordinate of the calculation result
Radius	R	The radius of the calculation result
Maximum radius	MAXR	The maximum radius of the calculation result
Minimum radius	MINR	The minimum radius of the calculation result
Decentration X	DEX	The decentration X of the calculation result
Decentration Y	DEY	The decentration Y of the calculation result
Number of lost points	LOST	Number of parts for which the detection of edges has failed
Reference coordinate X	SX	X coordinate of the reference coordinates
Reference coordinate Y	SY	Y coordinate of the reference coordinates
Maximum radius region number	MAXNO	The region number for the maximum radius
Minimum radius region number	MINNO	The region number for the minimum radius

External Reference Tables (Circular Scan Edge Position)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Central X	Get only	-99,999.9999 to 99,999.9999
6	Central Y	Get only	-99,999.9999 to 99,999.9999
7	Radius	Get only	0 to 99,999.9999
8	Max. radius	Get only	0 to 99,999.9999
9	Min. radius	Get only	0 to 99,999.9999
10	Deviation X	Get only	-99,999.9999 to 99,999.9999
11	Deviation Y	Get only	-99,999.9999 to 99,999.9999
12	Lost point	Get only	0 to 360
13	Reference X *1	Get only	0 to 99,999.9999
14	Reference Y *1	Get only	0 to 99,999.9999
15	Max. radius region No.	Get only	0 to 359
16	Min. radius region No.	Get only	0 to 359
17	Approx. radius	Get only	0 to 99,999.9999
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON

No.	Data name	Set/Get	Data range
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
125	Display region	Set/Get	0 to 359
127	Fix region count	Set/Get	0: Not fixed 1: Fixed
140	Disabled region	Set/Get	0 to 360
141	Reference X *2	Set/Get	0 to 99,999.9999
142	Reference Y *2	Set/Get	0 to 99,999.9999
143	Method	Set/Get	0: Approximation circle 1: Smallest enclosing circle
144	Method	Set/Get	0: Fast 1: Fine
145	Upper limit of center X	Set/Get	-99,999.9999 to 99,999.9999
146	Lower limit of center X	Set/Get	-99,999.9999 to 99,999.9999
147	Upper limit of center Y	Set/Get	-99,999.9999 to 99,999.9999
148	Lower limit of center Y	Set/Get	-99,999.9999 to 99,999.9999
149	Upper limit of radius	Set/Get	0 to 99,999.9999
150	Lower limit of radius	Set/Get	0 to 99,999.9999
151	Upper limit of Max. radius	Set/Get	0 to 99,999.9999
152	Lower limit of Max. radius	Set/Get	0 to 99,999.9999
153	Upper limit of Min. radius	Set/Get	0 to 99,999.9999
154	Lower limit of Min. radius	Set/Get	0 to 99,999.9999
155	Upper limit of deviation X	Set/Get	-99,999.9999 to 99,999.9999
156	Lower limit of deviation X	Set/Get	-99,999.9999 to 99,999.9999
157	Upper limit of deviation Y	Set/Get	-99,999.9999 to 99,999.9999
158	Lower limit of deviation Y	Set/Get	-99,999.9999 to 99,999.9999
159	Upper limit of the lostwidth	Set/Get	0 to 360
160	Lower limit of the lostwidth	Set/Get	0 to 360
200	Edge color specification	Set/Get	0: OFF 1: ON
201	Edge color R	Set/Get	0 to 255
202	Edge color G	Set/Get	0 to 255
203	Edge color B	Set/Get	0 to 255
204	Difference R	Set/Get	0 to 127
205	Difference G	Set/Get	0 to 127
206	Difference B	Set/Get	0 to 127
207	Edge detection mode	Set/Get	0: Color IN 1: Color OUT
208	Edge No.	Set/Get	0 to 99
209	Edge Level Lower limit	Set/Get	0 to 100
210	Noise level	Set/Get	color camera: 0 to 442 monochrome camera: 0 to 255
211	Noise width	Set/Get	0 to 9,999
212	Edge color level	Set/Get	0 to 442

No.	Data name	Set/Get	Data range
213	Monochrome edge detection mode	Set/Get	0: Light→Dark 1: Dark→Light
214	Edge level Lower limit absolute value	Set/Get	color camera: 0 to 442 monochrome camera: 0 to 255
215	Edge level specification method	Set/Get	0: % 1: Absolute value
216	Measure type	Set/Get	0: Projection 1: Derivation
217	Monochrome Derivation edge detection mode	Set/Get	0: Absolute 1: Dark→Light 2: Light→Dark
218	Edge Level Upper limit *3	Set/Get	0 to 100
219	Edge level Upper limit absolute value *4	Set/Get	color camera: 0 to 442 monochrome camera: 0 to 255
220	Filter Strength	Set/Get	0 to 100
221	Setting unit of reference coordinate	Set/Get	-1 to 9,999
222	Setting type of reference coordinate	Set/Get	0: Numerical 1: Unit
223	Use point coordinate before scroll	Set/Get	0: Not use 1: Use
224	Position X before scroll	Set/Get	-99,999.9999 to 99,999.9999
225	Position Y before scroll	Set/Get	-99,999.9999 to 99,999.9999
6002	Format	Set/Get	1: monochrome camera 2: color camera

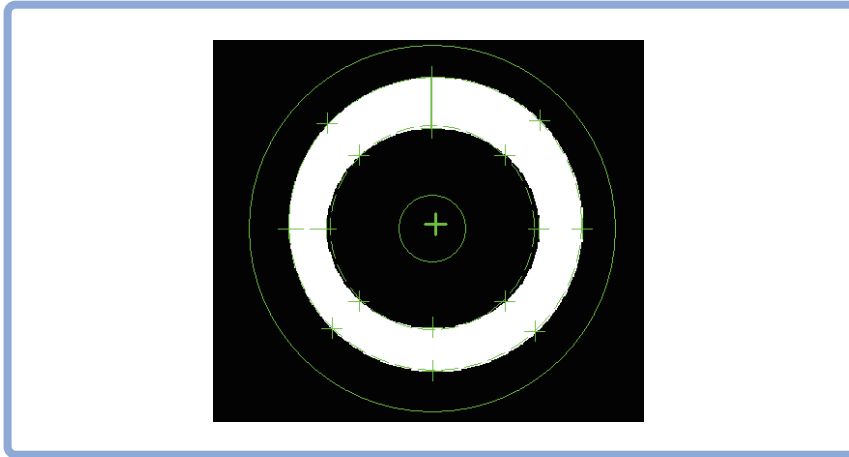
- *1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.
- *2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.
- *3: On the screen, this data is displayed as [Edge Upper] when you choose [Position (%) for width of a color] of [Measurement].
- *4: On the screen, this data is displayed as [Edge Upper] when [Value of color difference(Max.244)] of [Measurement].

Circular Scan Edge Width

This processing item detects the width of the measurement object by using the change in color within the measurement region.

Used in the Following Case

- When getting multiple widths of a circular object



Important

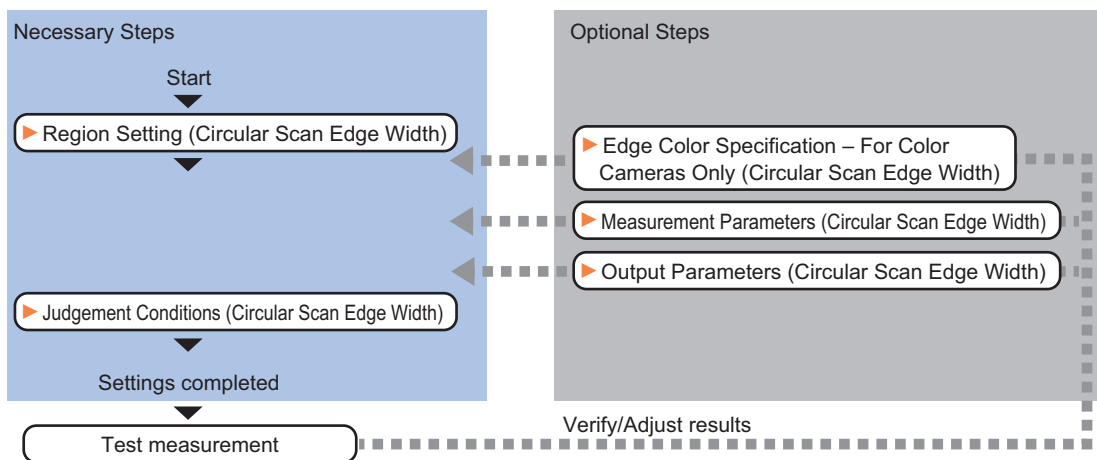
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Note

- Edge image measurement processing mechanism
Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Settings Flow (Circular Scan Edge Width)

Set the circular scan edge width with the following steps.



Item List for Circular Scan Edge Width

Item name	Description
Region setting	This item is used to set up the measurement area. Reference: ▶ Region Setting (Circular Scan Edge Width) (p.285)
Edge color (for color cameras only)	This item selects the color information for the edges to be detected. Reference: ▶ Edge Color Specification - For Color Cameras Only (Circular Scan Edge Width) (p.287)
Measurement	This item changes the measurement parameter as necessary when the measurement result is unstable. The displayed items depend on whether your camera is a color or monochrome camera. Normally, the factory default value will be used. Reference: ▶ Measurement Parameters (Circular Scan Edge Width) (p.288)
Judgement	This item specifies the judgement condition for measurement results. Reference: ▶ Judgement Conditions (Circular Scan Edge Width) (p.290)
Output parameter	This item can be changed if necessary. Normally, the factory default value may be used. Select the measurement result coordinates and set how to handle the coordinates. Reference: ▶ Output Parameters (Circular Scan Edge Width) (p.291)

Region Setting (Circular Scan Edge Width)

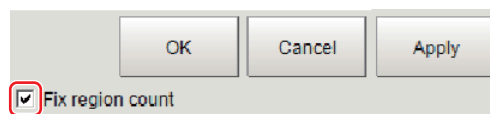
This item is used to set up the measurement area.

Specify the measurement region of [Circular Scan Edge Width] by using circular shapes.

1 In the Item Tab area, click [Region setting].

2 Use the Drawing tools to specify the measurement region.

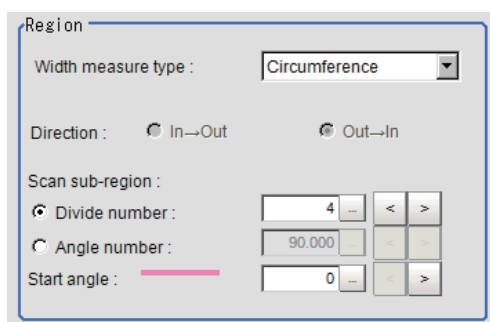
To align with the measurement area and specify the measurement point again, uncheck "Fix region count".



3 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

4 In the "Region" area, specify a value for each item.



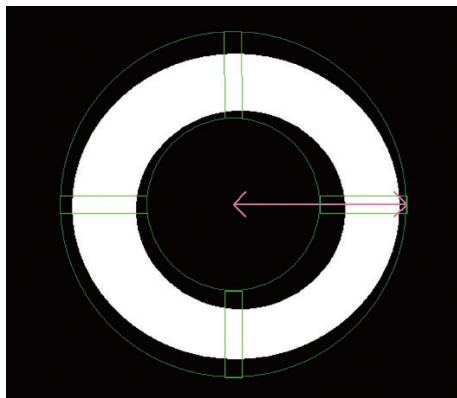
Setting item	Set value [Factory default]	Description
Width measure type	<ul style="list-style-type: none"> • [Circumference] • Diameter 	Select the measurement target for the workpiece.
Direction	<ul style="list-style-type: none"> • In→Out • [Out→In] 	Set the measurement direction when [Diameter] is selected.

Setting item	Set value [Factory default]	Description
Scan sub-region		Set the measurement point. Use either the "Divide num" or the "Divide angle" for this setting.
Divide number	3 to 360 [4]	Set the number of divisions for the circle. The specified value is used as the measurement point.
Angle number	When the width measure type is circumference 1.000 to 179.999 When the width measure type is diameter 1.000 to 90.000 [90.000]	Set the skipping angle for the circle. The measurement point is determined based on the specified angle.
Start angle	0 to 359 [0]	Set the start angle to specify a region.

Important

- When the width measurement target is set to "Diameter" and the number of divisions and the skipping angle are set to an odd number value, 1 will be added to these settings so that they become even numbers.

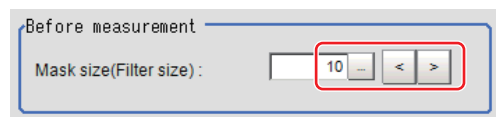
The region is divided by the specified number of points.



Explanations of the display

- Green solid line:
Represents the circular region.
- Rectangle:
Represents the sub-region.
- Pink solid line:
Represents the angle and the measurement direction (arrow) to specify the region.

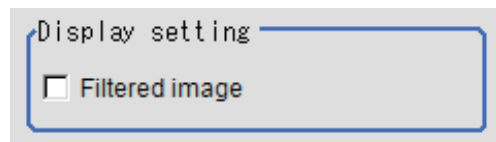
5 Specify the filtering settings as necessary.



Setting item	Set value [Factory default]	Description
Mask size	0 to 1000 [10]	Set the filter size when smoothing the measurement point vicinity. When 5 is set, smoothing is processed for a total of 11 points: the measurement point and the 5 pixels before and after it.

6 Perform the display setting if required.

Placing a check at [Filtered image] makes it easier to change the filtering setting.



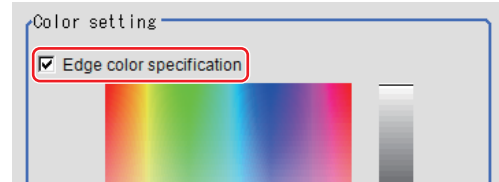
Setting item	Set value [Factory default]	Description
Filtered image	• [Unchecked] • Checked	If checked, the filtered image of the ranges set with the Scan sub-region and Filter size after smoothing is displayed.

Edge Color Specification - For Color Cameras Only (Circular Scan Edge Width)

This item selects the color of the edges to be detected.

If the target color changes, this setting is not necessary. If the color is not specified, positions in the measurement region where the color changes drastically are detected as an edge.

- 1 In the Item Tab area, click [Edge color].
- 2 Place a check at "Edge color specification" in the "Color setting" area.



- 3 This item selects the color to be detected as edges.

Setting method	Set value [Factory default]	Description
Image Display area	-	Specify a region on the image that includes the target color. The average color of the specified region is registered.
Color chart	-	Click the reference color on the color chart to specify it. The RGB values for the specified color are displayed at the bottom.
R, G, B	0 to 255 [255]	The color to be detected is set with the RGB values.
Difference R, G, B	0 to 127 [5]	This sets the allowable color difference for detecting the edge, using the specified color as the reference. The larger the difference values, the larger the color range that is used to detect the edge.
Detection mode	<ul style="list-style-type: none"> • [Color IN] • Color OUT 	<p>Specified color IN: The position where a color other than the specified color changes to the specified color is detected as the edge. Specified color OUT: The position where the specified color changes to a color other than the specified color is detected as the edge.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Start point → End point</p> <p>For "Color IN" edge measurement mode</p> </div> <div style="text-align: center;"> <p>Start point → End point</p> <p>For "Color OUT" edge measurement mode</p> </div> </div>

Measurement Parameters (Circular Scan Edge Width)

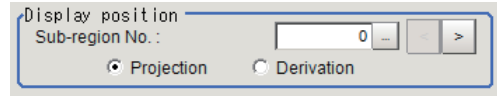
Measurement parameters can be changed as needed to address unstable measurement results. Normally, the factory default value will be used.

After changing a setting, check whether measurement can be done properly by performing an actual measurement.

1 In the Item Tab area, click [Measurement].

The edge profile of the measurement region is displayed as a graph in the Image Display area.

2 In the "Display position" area, specify a value for each item.



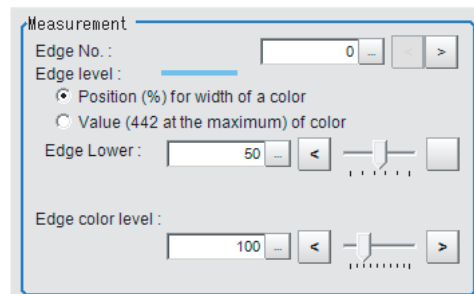
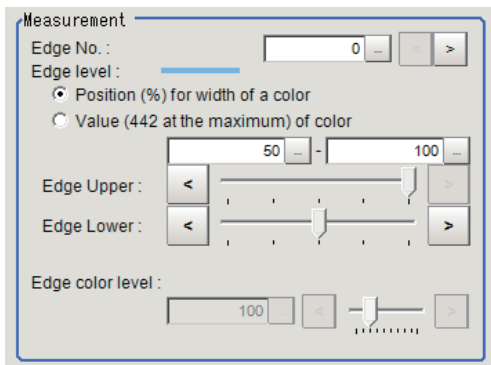
Setting item	Set value [Factory default]	Description
Sub-region No.	0 to 359 [0]	Set the edge measurement number for which the edge profile is displayed.
	<ul style="list-style-type: none"> [Projection] Derivation 	Projection: The edge is searched from the center toward the outside direction. Derivation: The edge is searched from the outside of the circle toward the center.

3 Set the value of each item in the "Measurement" area.

For color cameras:

Edge Color Not Specified

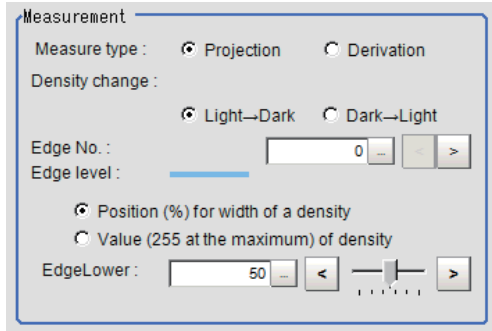
Edge Color Specified



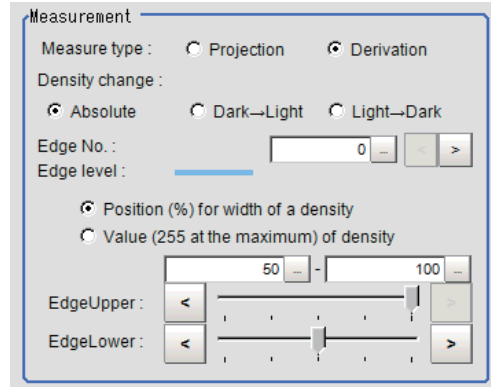
Setting item	Set value [Factory default]	Description
Edge No.	0 to 99 [0]	Specify the edge number used to extract edges. Edge numbers are assigned to detected edges starting from 0 and in the direction from the start point (the arrow) to the end point (the arrow point) in the selected region.
Edge Upper (only when edge color is not specified) Edge Lower	<ul style="list-style-type: none"> Position (%) for width of a color 0 to 100 [50] to [100] Value of color 0 to 442 [20] to [442] 	Set a range of a color difference level with which the edge is detected. Reference: ► "Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Edge color level	0 to 442 [100]	This emphasis level can be set only if the edge color to detect is specified.

For monochrome cameras:

When the measurement method is "Projection"

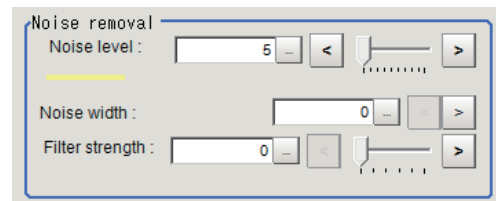


When the measurement method is "Derivation"



Setting item	Set value [Factory default]	Description
Measure type	<ul style="list-style-type: none"> • [Projection] • Derivation 	As the measurement type, specify either projection or derivation. Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Method" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Density change	<ul style="list-style-type: none"> • Absolute (only when the measurement method is "Derivation") • [Light→Dark] • Dark→Light 	Set whether a black-to-white change or a white-to-black change should be recognized as a density change in the specified region.
Edge No.	0 to 99 [0]	Specify the edge number used to extract edges. Edge numbers are assigned to detected edges starting from 0 and in the direction from the start point (the arrow) to the end point (the arrow point) in the selected region.
Edge Upper Edge Lower	<ul style="list-style-type: none"> • Position (%) for width of a density 0 to 100 [50] to [100] • Value of density 0 to 255 [20] to [255] 	Set the density change level to be detected as edges. The upper limit of edges can be set only when the measurement method is "Derivation". Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

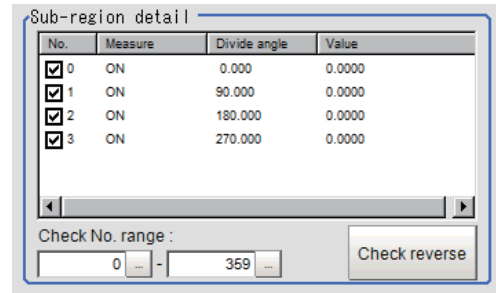
4 If necessary, set each item in the "Noise removal" area.



Setting item	Set value [Factory default]	Description
Noise level	<ul style="list-style-type: none"> • For color cameras 0 to 442 [5] • For monochrome cameras 0 to 255 [5] 	When detection is affected by noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Level" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Setting item	Set value [Factory default]	Description
Noise width	0 to 9999 [0]	Set the width for judging noise. When detection is affected by noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Width" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Filter strength	0 to 100 [0]	If a valley appears in the histogram around the edge threshold value due to noises, smoothen the edge profile using a filter to prevent wrong error detection from being detected. Strengthening the filter smoothen the edge profile further.

5 In the "Sub-region detail" area, set enable or disable measurement as required.



Setting item	Set value [Factory default]	Description
Check No. range	0 to 359 [0] to [359]	Specify the edge measurement number for which to perform batch reversing of the enable or disable measurement setting. Click [Check reverse] to reverse the check box settings of the edge measurement number within the range.

Judgement Conditions (Circular Scan Edge Width)

Specify the range to be judged as OK.

- 1** In the Item Tab area click [Judgement].
- 2** Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Setting item	Set value [Factory default]	Description
Edge width Max.	0 to 99999.9999 [0] to [99999.9999]	Specify the upper and lower limits of the maximum width judged to be OK.
Edge width Min.	0 to 99999.9999 [0] to [99999.9999]	Specify the upper and lower limits of the minimum width judged to be OK.
Edge width Ave.	0 to 99999.9999 [0] to [99999.9999]	Specify the upper and lower limits of the average width judged to be OK.
Lost width count	0 to 360 [0] to [360]	Specify the upper and lower limits of the lost width count judged to be OK.

Output Parameters (Circular Scan Edge Width)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Set value [Factory default]	Description
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgment results of this processing unit is reflected in the scene overall judgment.

Key Points for Test Measurement and Adjustment (Circular Scan Edge Width)

The following contents can be displayed as text in the "Detail result" area.

Displayed items	Description
Judge	Judgement result
Edge width Max.	The maximum value of edge width
Edge width Min.	The minimum value of edge width
Edge width Ave.	The average value of all the edge width
Lost width count	The number of the scanned areas for which the detection of width failed

The image specified in the Sub-image number in image display setting is displayed in the Image Display area.

Sub image number.	Explanation of image to be displayed
0	Measurement image
1	Scan region

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Parameter to be adjusted	Remedy
Measurement	If the color of the edges to be detected is decided, specify the color with [Edge color]. If results are not stable even with the color specified, specify a larger value for the color variance range.
	If noise is detected as an edge, specify larger values for "Noise level" and "Noise width".

Measurement Results for Which Output Is Possible (Circular Scan Edge Width)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Edge width Max.	MAXW	The maximum value of edge width
Edge width Min.	MINW	The minimum value of edge width
Edge width Ave.	AVEW	The average value of all the edge width
Lost width count	LOST	The number of the scanned areas for which the detection of width failed
Edge width Max. region No.	MAXNO	Region number of maximum edge width
Edge width Min. region No.	MINNO	Region number of minimum edge width

External Reference Tables (Circular Scan Edge Width)

No.	Data name	Set/Get	Data range
0	Overall judgement result	Get only	1: OK 0: Not yet measured -1: NG
5	Edge width Max.	Get only	0 to 99999.9999
6	Edge width Min.	Get only	0 to 99999.9999
7	Edge width Ave.	Get only	0 to 99999.9999
10	Lost width count	Get only	0 to 360
11	Region number of maximum edge width	Get only	0 to 359
12	Region number of minimum edge width	Get only	0 to 359
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
125	Region that displays the edge profile	Set/Get	0 to 359
127	Fix region count	Set/Get	0: Not fixed 1: Fixed
140	Width measure type	Set/Get	0: Circle width 1: Diameter
141	Edge profile display direction	Set/Get	0: Forward 1: Reverse
142	Upper limit of maximum edge width	Set/Get	0 to 99999.9999
143	Lower limit of maximum edge width	Set/Get	0 to 99999.9999
144	Upper limit of minimum edge width	Set/Get	0 to 99999.9999
145	Lower limit of minimum edge width	Set/Get	0 to 99999.9999
146	Upper limit of average edge width	Set/Get	0 to 99999.9999
147	Lower limit of average edge width	Set/Get	0 to 99999.9999
148	Upper limit of number of lost width count	Set/Get	0 to 360

No.	Data name	Set/Get	Data range
149	Lower limit of number of lost width count	Set/Get	0 to 360
200	Edge color specification	Set/Get	0: No color specification 1: With color specification
201	Edge color R	Set/Get	0 to 255
202	Edge color G	Set/Get	0 to 255
203	Edge color B	Set/Get	0 to 255
204	Difference R	Set/Get	0 to 127
205	Difference G	Set/Get	0 to 127
206	Difference B	Set/Get	0 to 127
207	Edge detection mode	Set/Get	0: Specified color IN 1: Specified color OUT
208	Edge No.	Set/Get	0 to 99
209	Edge Level	Set/Get	0 to 100
210	Noise level	Set/Get	0 to 442
211	Noise width	Set/Get	0 to 9999
212	Edge color enhancement level	Set/Get	0 to 442
213	Monochrome edge detection mode	Set/Get	0: Light→Dark 1: Dark→Light
214	Edge level absolute value	Set/Get	0 to 442
215	Edge level specification method	Set/Get	0: % 1: Absolute value
216	Measure type	Set/Get	0: Projection 1: Differential
217	Monochrome Derivation edge detection mode	Set/Get	0: Absolute 1: Dark→Light 2: Light→Dark
218	Edge Level Upper limit *1	Set/Get	0 to 100
219	Edge level Upper limit absolute value *2	Set/Get	0 to 442
220	Filter Strength	Set/Get	0 to 100

*1: On the [Measurement] tab of the Properties Dialog Box, this data is displayed as [Edge Upper] when you choose the [Position (%) for width of a color].

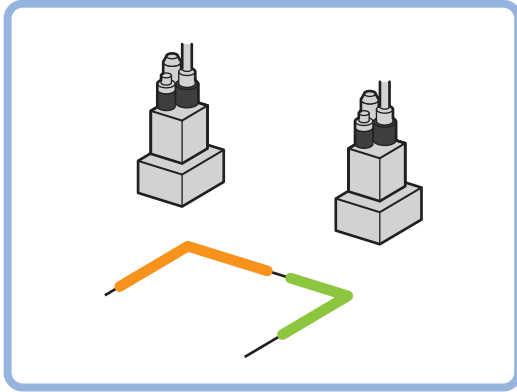
*2: On the [Measurement] tab of the Properties Dialog Box, this data is displayed as [Edge Upper] when you choose the [Value (442 at the maximum) of color].

Intersection

This processing item measures a corner position (corner) of a work. Calculate approximate lines from the edge information on two sides of a square work to measure the angle formed at the intersection of the two lines.

Used in the Following Case

- When you want to align the work position based on the feature of its corner

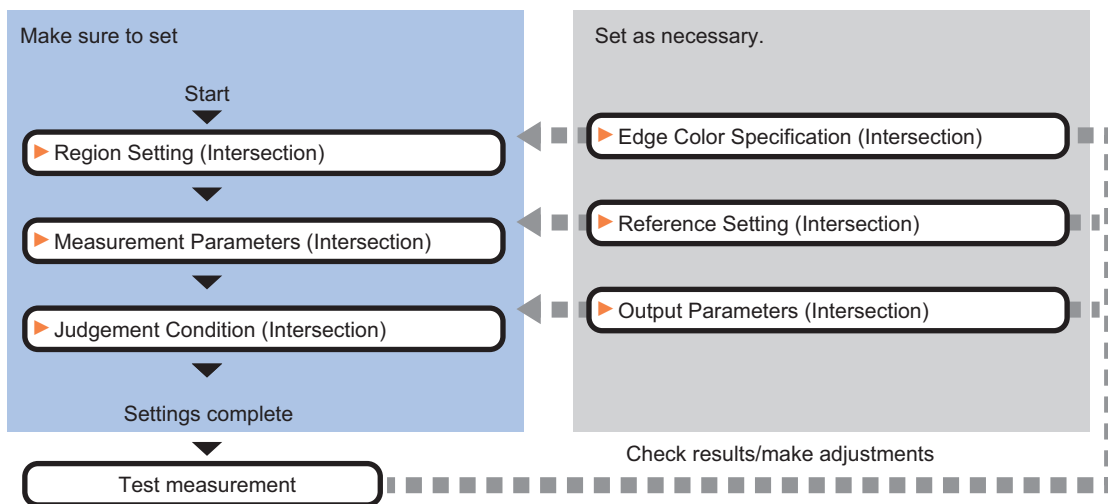


Important

Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Intersection)

Follow the steps below to set up intersection coordinates.



List of Intersection Items

Item name	Description
Region setting	This item sets the scan edge area (wide line) for each the two sides to be measured. Reference: ▶ Region Setting (Intersection) (p.295)
Edge color	This item sets the color of the edges to be detected. If the target color changes, this setting is not necessary. If the color is not set, positions in the measurement region where the color changes drastically are detected as an edge. Reference: ▶ Edge Color Specification - For Color Cameras Only (Intersection) (p.296)
Ref. setting	The edge position is registered as the reference when the region is set. Change as necessary. This is changed when measuring the position deviation from a certain position. Reference: ▶ Reference Setting (Intersection) (p.297)
Measurement	This item sets the parameters relating to edge measurement and Line Regression calculation to measure the intersection coordinates. Reference: ▶ Measurement Parameters (Intersection) (p.298)
Judgement	This item specifies the judgement condition for measurement results. Reference: ▶ Judgement Condition (Intersection) (p.301)
Output parameter	This item can be changed if necessary. Select the measurement result coordinates and set how to handle the coordinates. Reference: ▶ Output Parameters (Intersection) (p.302)

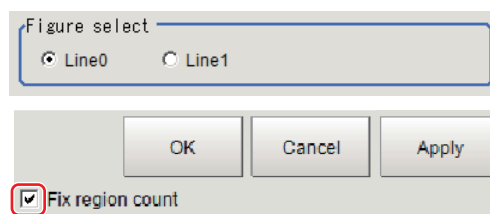
Region Setting (Intersection)

This item is used to set up the measurement area.

Specify the measurement region for [Intersection Coordinates] by using wide lines.

1 In the Item Tab area, click [Region setting].

2 Select the figure to be set.



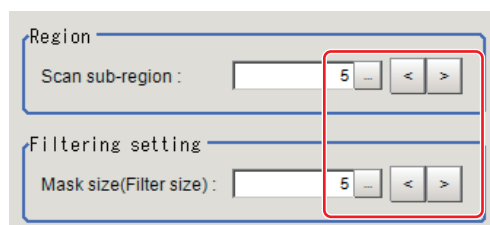
3 Use the Drawing tools to set the measurement region.

To align with the measurement area and change the number of measurement points, uncheck this.

4 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

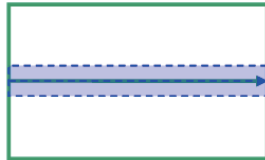
5 Set the measurement point and the filter size for the region.



Setting item	Setting value [Factory default]	Description
Scan sub-region	1 to 100 [5]	Set the measurement point for the region.
Mask size (Filter size)	1 to 1000 [5]	Set the filter size when smoothing the measurement point vicinity. When 5 is set, smoothing is processed for a total of 11 points: the measurement point and the 5 pixels before and after it.

6 The region is divided equally.

Scan region when scan sub-region is 1



Scan region when scan sub-region is 2



Scan region when scan sub-region is 3

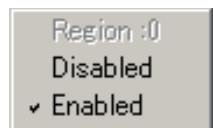


Scan region when scan sub-region is 4



Note

- Enable or disable setting can be specified for each edge measurement number. Clicking edge measurement points displays the following screen.



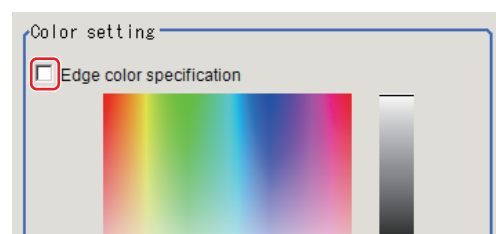
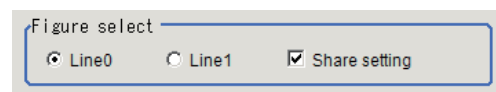
7 Repeat steps 2 to 6, and set the region of line 1.

Edge Color Specification - For Color Cameras Only (Intersection)

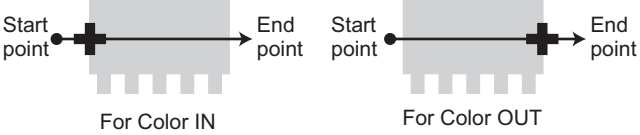
This item sets the color of the edges to be detected.

If the target color changes, this setting is not necessary. If the color is not set, positions in the measurement region where the color changes drastically are detected as an edge.

- 1 In the Item Tab area, click [Edge color].
- 2 Select the figure to be color specified. Uncheck "Share setting" if you want to use different settings for line 0 and line 1.
- 3 Place a check at [Edge color specification] in the "Color setting" area.



4 Set the color to be detected as edges.

Setting Methods	Description
Image Display area	Set a region on the image that includes the target color. The average color of the set region is registered.
Color chart	Click the reference color on the color chart to set it. The RGB values for the set color are displayed at the bottom.
R, G, B	The color to be detected is set with the RGB values.
Difference R, G, B	Set the allowable color difference for detecting the edge, using the set color as the reference. The larger the difference values, the larger the color range that is used to detect the edge.
Detection mode	<p>Color IN: The position where a color other than the specified color changes to the specified color is detected as the edge.</p> <p>Color OUT: The position where the specified color changes to a color other than the specified color is detected as the edge.</p> 

Reference Setting (Intersection)

When the measurement region is set, this position is automatically set at the same time as the reference position. This item can be used to change the reference position to any desired position.

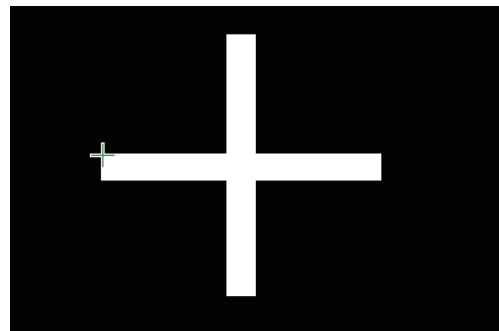
A reference position can be set either directly or by referencing a unit.

Specifying directly

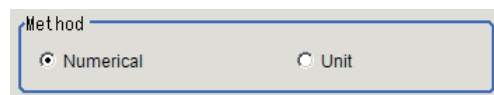
Click a position on the image you want to use as a reference position, or set coordinate data for that point.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.



2 In the "Method" area, select "Numerical".

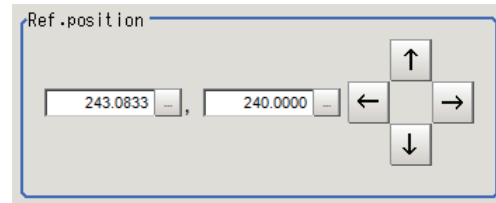


3 Click the position to be set as the reference.

Note

- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

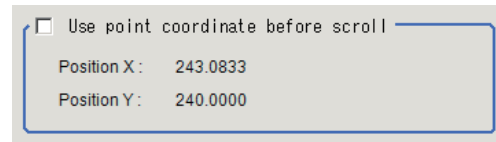
4 If necessary, finely adjust with numeric input and the arrow buttons.



5 To remeasure on the displayed image and set the reference, click the [Measure ref.] button.



6 To use data before position compensation for the reference setting coordinates, place a check at "Use point coordinate before scroll".



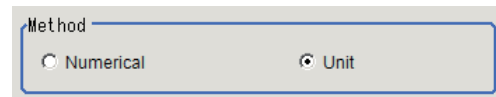
Referencing a unit

Set a reference by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

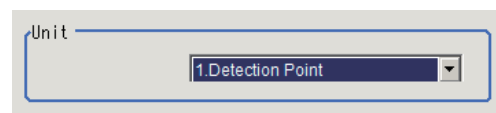
1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.

2 In the "Method" area, select "Unit".



3 In the scene in the "Unit" area, select a detection point unit.



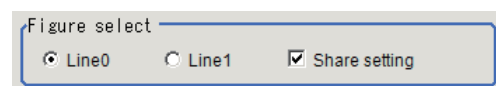
4 Perform the next measurement, and the reference will be displayed.

Measurement Parameters (Intersection)

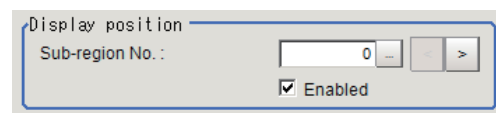
Set the measurement conditions of intersection coordinates.

1 In the Item Tab area, click [Measurement].

2 In the "Figure select" area, select the lines to be set.



3 In the "Display position" area, set the region number if the region is enabled.



Setting item	Setting value [Factory default]	Description
Sub-region No.	[0] to 99	Set the edge measurement number for which the edge profile is displayed.
Enabled	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Select enable/disable for the displayed edge measurement number. When disabled (unchecked) is selected, that edge measurement number is not measured.

4 Set the value of each item in the "Measurement" area.

For color cameras:

Edge Color Not Specified

Edge Color Specified

Setting item	Setting value [Factory default]	Description
Edge No.	0 to 99 [0]	Set the edge number used to extract edges. Edge numbers are assigned to detected edges starting from 0 and in the direction from the start point (the arrow) to the end point (the arrow point) in the selected region.
Edge Upper (only when edge color is not specified) Edge Lower	<ul style="list-style-type: none"> Position (%) for width of a color 0 to 100 [50] to [100] Value (442 at the maximum) of color [20] to [442] 	Set a range of a color difference level with which the edge is detected. Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Edge color level	0 to 442 [100]	This emphasis level can be set only if the edge color to detect is set.

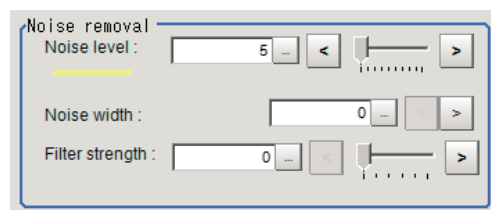
For monochrome cameras:

When the measurement method is "Projection"

When the measurement method is "Derivation"

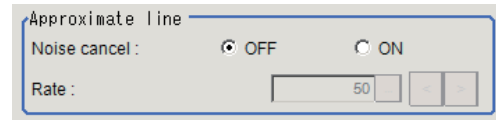
Setting item	Setting value [Factory default]	Description
Measure type	<ul style="list-style-type: none"> • [Projection] • Derivation 	As the measurement type, select either projection or derivation. Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Method" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Density change	<ul style="list-style-type: none"> • Absolute value (only when the measurement method is "Derivation") • [Light → Dark] • Dark → Light 	Select whether a black-to-white change or a white-to-black change should be recognized as a density change in the specified region.
Edge No.	0 to 99 [0]	Set the edge number used to extract edges. Edge numbers are assigned to detected edges starting from 0 and in the direction from the start point (the arrow) to the end point (the arrow point) in the selected region.
Edge Upper Edge Lower	<ul style="list-style-type: none"> • Position (%) for width of a density 0 to 100 [50] to [100] • Value (255 at the maximum) of density [20] to [255] 	Set the density change level to be detected as edges. The upper limit of edges can be set only when the measurement method is "Derivation". Reference: ▶ "Appendixes Measurement Mechanism Edge Detection Measurement" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

5 If necessary, set each item in the "Noise removal" area.



Setting item	Setting value [Factory default]	Description
Noise level	0 to 442 [5]	When detection is affected by noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Level" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Noise width	0 to 9999 [0]	Set the width for judging noise. When detection is affected by noise, increase this value. Reference: ▶ "Appendixes Measurement Mechanism Noise Width" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
Filter strength	0 to 100 [0]	Set the filter strength. Specifying a larger value here makes the change in color difference (density) distribution more gradual.

- 6** In the "Approximate line" area, select the point to be used for the calculation of approximate lines.



Setting item	Setting value [Factory default]	Description
Noise cancel	<ul style="list-style-type: none"> • ON • [OFF] 	When a check is placed at [ON], an approximate line is found by excluding the points with large deviation among the measured points.
Rate	0 to 100 [50]	Set the rate for all of the measurement points used to calculate the approximate line. If there is a lot of noise, set a smaller value to eliminate a lot of noise points when calculating the approximate line. If there is little noise, set a larger value to use more measurement points to increase the accuracy when calculating the approximate line.

Judgement Condition (Intersection)

Specify the range to be judged as OK.

- 1** In the Item Tab area, click [Judgement].
- 2** Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Setting item	Setting value	Description
Intersection X	-99999.9999 to 99999.9999	Set the range of X coordinates of intersection that is judged to be OK.
Intersection Y	-99999.9999 to 99999.9999	Set the range of Y coordinates of intersection that is judged to be OK.
Angle	0.0000 to 180.0000	Set the angle formed by two lines that are judged to be OK.
Lost point count (Line 0)	0 to 100	Set the lost point count to be judged as OK.
Lost point count (Line 1)		

Output Parameters (Intersection)

Set how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Setting value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Specify whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Intersection)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Intersection coordinate X	X coordinate of measured intersection
Intersection coordinate Y	Y coordinate of measured intersection
Angle	Angle of measured 2 lines
Lost point count (line 0)	Lost point count of measured line 0
Lost point count (line 1)	Lost point count of measured line 1

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

State	Parameter to be adjusted	Troubleshooting
Approximate lines are not stable due to noise.	Measurement	Use the noise removal function to make sure approximate lines are measured stably.

When judgement is NG

Parameter to be adjusted	Troubleshooting
Region setting	Confirm that the approximate line calculated for line 0 intersects with the approximate line calculated for line 1. If the approximate lines are parallel, a judgement will be NG.

Measurement Results for Which Output Is Possible (Intersection)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Intersection coordinate X	X	X coordinate of intersection
Intersection coordinate Y	Y	Y coordinate of intersection
Angle	TH	Angle between two lines
Reference X	SX	X coordinate of the reference coordinates
Reference Y	SY	Y coordinate of the reference coordinates
Peak edge position X of line 0	PEEKX0	X coordinate of the edge of line 0 that is the furthest from the start point of the measurement region
Peak edge position Y of line 0	PEEKY0	Y coordinate of the edge of line 0 that is the furthest from the start point of the measurement region
Bottom edge position X of line 0	BOTTOMX0	X coordinate of the edge of line 0 that is the closest from the start point of the measurement region
Bottom edge position Y of line 0	BOTTOMY0	Y coordinate of the edge of line 0 that is the closest from the start point of the measurement region
Edge position X Ave. of line 0	AVEX0	The average of X coordinates of all the edges of line 0
Edge position Y Ave. of line 0	AVEY0	The average of Y coordinates of all the edges of line 0
Long distance Max. of line 0	PMAXD0	The maximum distance between the approximate line and edge position of line 0 (plus direction)
Long distance Min. of line 0	PMIND0	The minimum distance between the approximate line and edge position of line 0 (plus direction)
Short distance Max. of line 0	BMAXD0	The maximum distance between the approximate line and edge position of line 0 (minus direction)
Short distance Min. of line 0	BMIND0	The minimum distance between the approximate line and edge position of line 0 (minus direction)
Deviation of line 0	DEV0	Concave and convex deviation of line 0
Angle of line 0	LINETH0	The line 0's inclination against the measurement region
Lost point count of line 0	LOST0	Number of parts for which the detection of edges of line 0 has failed
Line parameter A of line 0	A0	A in the expression for the approximate line of line 0 $AX + BY + C = 0$.
Line parameter B of line 0	B0	B in the expression for the approximate line of line 0 $AX + BY + C = 0$.
Line parameter C of line 0	C0	C in the expression for the approximate line of line 0 $AX + BY + C = 0$.
Peak edge position X of line 1	PEEKX1	X coordinate of the edge of line 1 that is the furthest from the start point of the measurement region
Peak edge position Y of line 1	PEEKY1	Y coordinate of the edge of line 1 that is the furthest from the start point of the measurement region
Bottom edge position X of line 1	BOTTOMX1	X coordinate of the edge of line 1 that is the closest from the start point of the measurement region
Bottom edge position Y of line 1	BOTTOMY1	Y coordinate of the edge of line 1 that is the closest from the start point of the measurement region
Edge position X Ave. of line 1	AVEX1	The average of X coordinates of all the edges of line 1
Edge position Y Ave. of line 1	AVEY1	The average of Y coordinates of all the edges of line 1

Measurement items	Character string	Description
Long distance Max. of line 1	PMAXD1	The maximum distance between the approximate line and edge position of line 1 (plus direction)
Long distance Min. of line 1	PMIND1	The minimum distance between the approximate line and edge position of line 1 (plus direction)
Short distance Max. of line 1	BMAXD1	The maximum distance between the approximate line and edge position of line 1 (minus direction)
Short distance Min. of line 1	BMIND1	The minimum distance between the approximate line and edge position of line 1 (minus direction)
Deviation of line 1	DEV1	Concave and convex deviation of line 1
Angle of line 1	LINETH1	The line 1's inclination against the measurement region
Lost point count of line 1	LOST1	Number of parts for which the detection of edges of line 1 has failed
Line parameter A of line 1	A1	A in the expression for the approximate line of line 1 $AX + BY + C = 0$.
Line parameter B of line 1	B1	B in the expression for the approximate line of line 1 $AX + BY + C = 0$.
Line parameter C of line 1	C1	C in the expression for the approximate line of line 1 $AX + BY + C = 0$.

External Reference Tables (Intersection)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
1	Intersection coordinate X	Get only	-99999.9999 to 99999.9999
2	Intersection coordinate Y	Get only	-99999.9999 to 99999.9999
3	Angle	Get only	0 to 180
4	Reference X * ¹	Get only	0.0000 to 9999.0000
5	Reference Y * ¹	Get only	0.0000 to 9999.0000
10	Peak edge position X of line 0	Get only	0.0000 to 99999.9999
11	Peak edge position Y of line 0	Get only	0.0000 to 99999.9999
12	Bottom edge position X of line 0	Get only	0.0000 to 99999.9999
13	Bottom edge position Y of line 0	Get only	0.0000 to 99999.9999
14	Edge position X Ave. of line 0	Get only	-1.0000 to 99999.9999
15	Edge position Y Ave. of line 0	Get only	-1.0000 to 99999.9999
16	Long distance Max. of line 0	Get only	-1.0000 to 99999.9999
17	Long distance Min. of line 0	Get only	-1.0000 to 99999.9999
18	Short distance Max. of line 0	Get only	-1.0000 to 99999.9999
19	Short distance Min. of line 0	Get only	-1.0000 to 99999.9999
20	Deviation of line 0	Get only	-1.0000 to 99999.9999
21	Angle of line 0	Get only	-180 to 180
22	Lost point count of line 0	Get only	0 to 100
23	Linear coefficient A of line 0	Get only	-99999.9999 to 99999.9999
24	Linear coefficient B of line 0	Get only	-99999.9999 to 99999.9999
25	Linear coefficient C of line 0	Get only	-99999.9999 to 99999.9999
30	Peak edge position X of line 1	Get only	0.0000 to 99999.9999

No.	Data name	Set/Get	Data range
31	Peak edge position Y of line 1	Get only	0.0000 to 99999.9999
32	Bottom edge position X of line 1	Get only	0.0000 to 99999.9999
33	Bottom edge position Y of line 1	Get only	0.0000 to 99999.9999
34	Edge position X Ave. of line 1	Get only	-1.0000 to 99999.9999
35	Edge position Y Ave. of line 1	Get only	-1.0000 to 99999.9999
36	Long distance Max. of line 1	Get only	-1.0000 to 99999.9999
37	Long distance Min. of line 1	Get only	-1.00000 to 99999.9999
38	Short distance Max. of line 1	Get only	-1.0000 to 99999.9999
39	Short distance Min. of line 1	Get only	-1.0000 to 99999.9999
40	Deviation of line 1	Get only	-1.0000 to 99999.9999
41	Angle of line 1	Get only	-180 to 180
42	Lost point count of line 1	Get only	0 to 100
43	Linear coefficient A of line 1	Get only	-99999.9999 to 99999.9999
44	Linear coefficient B of line 1	Get only	-99999.9999 to 99999.9999
45	Linear coefficient C of line 1	Get only	-99999.9999 to 99999.9999
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Reference X *2	Set/Get	0.0000 to 99999.9999
121	Reference Y *2	Set/Get	0.0000 to 99999.9999
122	Share setting (Edge color specification)	Set/Get	0: Not shared 1: Shared
123	Share setting (Measurement parameter)	Set/Get	0: Not shared 1: Shared
124	Line number currently selected	Set/Get	0: Line 0 1: Line 1
130	Upper limit of intersection X coordinate	Set/Get	-99999.9999 to 99999.9999
131	Lower limit of intersection X coordinate	Set/Get	-99999.9999 to 99999.9999
132	Upper limit of intersection Y coordinate	Set/Get	-99999.9999 to 99999.9999
133	Lower limit of intersection Y coordinate	Set/Get	-99999.9999 to 99999.9999
134	Angle upper limit	Set/Get	0 to 180
135	Angle lower limit	Set/Get	0 to 180
136	Upper limit of lost point count (line 0)	Set/Get	0 to 100
137	Lower limit of lost point count (line 0)	Set/Get	0 to 100
138	Upper limit of lost point count (line 1)	Set/Get	0 to 100
139	Lower limit of lost point count (line 1)	Set/Get	0 to 100
200	Edge color specification (line 0)	Set/Get	0: No color specification 1: With color specification

No.	Data name	Set/Get	Data range
201	Edge color R (line 0)	Set/Get	0 to 255
202	Edge color G (line 0)	Set/Get	0 to 255
203	Edge color B (line 0)	Set/Get	0 to 255
204	Difference R (line 0)	Set/Get	0 to 127
205	Difference G (line 0)	Set/Get	0 to 127
206	Difference B (line 0)	Set/Get	0 to 127
207	Edge detection mode (line 0)	Set/Get	0: Specified color IN 1: Specified color OUT
208	Edge number (line 0)	Set/Get	0 to 99
209	Edge level (line 0)	Set/Get	0 to 100
210	Noise level (line 0)	Set/Get	0 to 442
211	Noise width (line 0)	Set/Get	0 to 9999
212	Edge color enhancement level (line 0)	Set/Get	0 to 442
213	Monochrome edge detection mode (line 0)	Set/Get	0: Light→Dark 1: Dark→Light
214	Edge level absolute value (line 0)	Set/Get	0 to 442
215	Edge level specification method (line 0)	Set/Get	0: % 1: Absolute value
216	Scan sub-region (line 0)	Set/Get	1 to 100
217	Filter size (line 0)	Set/Get	1 to 1000
218	Display range (line 0)	Set/Get	0 to 99
219	Noise cancel (line 0)	Set/Get	0: OFF 1: ON
220	Measure type (line 0)	Set/Get	0: Projection 1: Differential
221	Fix region count (line 0)	Set/Get	0: Not fixed 1: Fixed
222	Monochrome Derivation edge detection mode (line 0)	Set/Get	0: Absolute 1: Dark→Light 2: Light→Dark
223	Edge Level Upper limit (line 0) * ³	Set/Get	0 to 100
224	Edge level Upper limit absolute value (line 0) * ⁴	Set/Get	0 to 442
225	Filter Strength (line 0)	Set/Get	0 to 100
226	Rate (line 0)	Set/Get	0 to 100
250	Edge color specification (line 1)	Set/Get	0: No color specification 1: With color specification
251	Edge color R (line 1)	Set/Get	0 to 255
252	Edge color G (line 1)	Set/Get	0 to 255
253	Edge color B (line 1)	Set/Get	0 to 255
254	Difference R (line 1)	Set/Get	0 to 127
255	Difference G (line 1)	Set/Get	0 to 127
256	Difference B (line 1)	Set/Get	0 to 127
257	Edge detection mode (line 1)	Set/Get	0: Specified color IN 1: Specified color OUT

No.	Data name	Set/Get	Data range
258	Edge number (line 1)	Set/Get	0 to 99
259	Edge level (line 1)	Set/Get	0 to 100
260	Noise level (line 1)	Set/Get	0 to 442
261	Noise width (line 1)	Set/Get	0 to 9999
262	Edge color level (line 1)	Set/Get	0 to 442
263	Monochrome edge detection mode (line 1)	Set/Get	0: Light→Dark 1: Dark→Light
264	Edge level absolute value (line 1)	Set/Get	0 to 442
265	Edge level specification method (line 1)	Set/Get	0: % 1: Absolute value
266	Scan sub-region (line 1)	Set/Get	1 to 100
267	Filter size (line 1)	Set/Get	1 to 1000
268	Display range (line 1)	Set/Get	0 to 99
269	Noise cancel (line 1)	Set/Get	0: OFF 1: ON
270	Measure type (line 1)	Set/Get	0: Projection 1: Differential
271	Fix region count (line 1)	Set/Get	0: Not fixed 1: Fixed
272	Monochrome derivation edge detection mode (line 1)	Set/Get	0: Absolute value 1: Dark → Light 2: Light → Dark
273	Upper limit of edge level (line 1) * ³	Set/Get	0 to 100
274	Upper limit absolute value of edge level (line 1) * ⁴	Set/Get	0 to 442
275	Filter strength (line 1)	Set/Get	0 to 100
276	Extraction ratio (line 1)	Set/Get	0 to 100
278	Reference unit number for reference coordinate	Set/Get	-1 to 9999
279	Reference type of reference coordinate	Set/Get	0: Set by number 1: Unit reference
280	Use coordinates before position compensation	Set/Get	0: Not used 1: Used
281	Coordinate X before position compensation	Get only	-99999.9999 to 99999.9999
282	Coordinate Y before position compensation	Get only	-99999.9999 to 99999.9999

*1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.

*2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.

*3: On the [Measurement] tab of the Properties Dialog Box, this data is displayed as [Edge Upper] when you choose the [Position (%)] for width of a color].

*4: On the [Measurement] tab of the Properties Dialog Box, this data is displayed as [Edge Upper] when you choose the [Value (442 at the maximum)] of color].

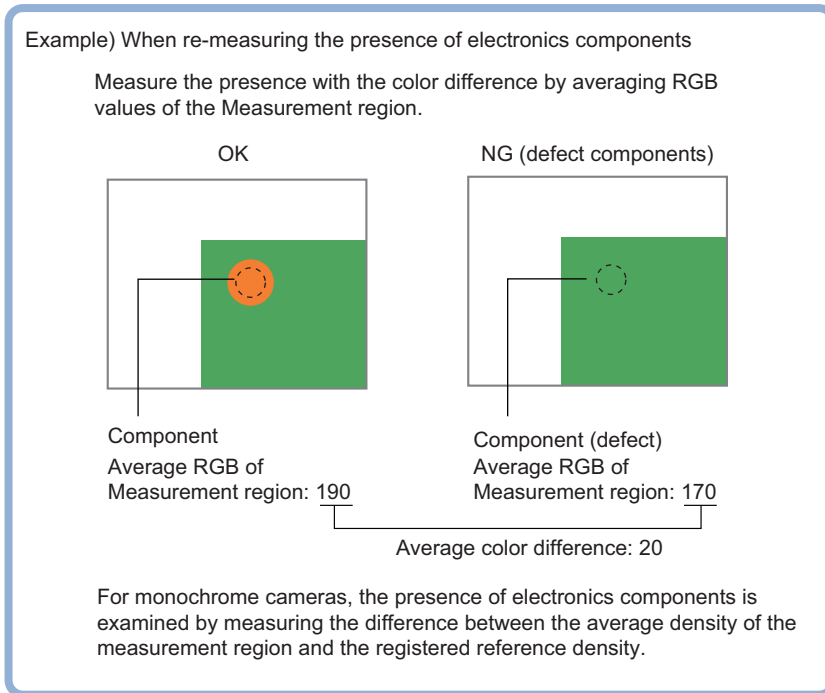
Color Data

Inspect by finding the average color of the measurement region and using its difference from the registered reference color and the color variation in the measurement area. Alternatively, you can only detect the color tone while neglect the effect of image brightness.

For monochrome cameras, examination is performed by measuring the difference between the average density of the measurement region and the registered reference density (density average), and the density deviation in the measurement region (density deviation).

Used in the Following Case

- When measuring the presence of measurement objects

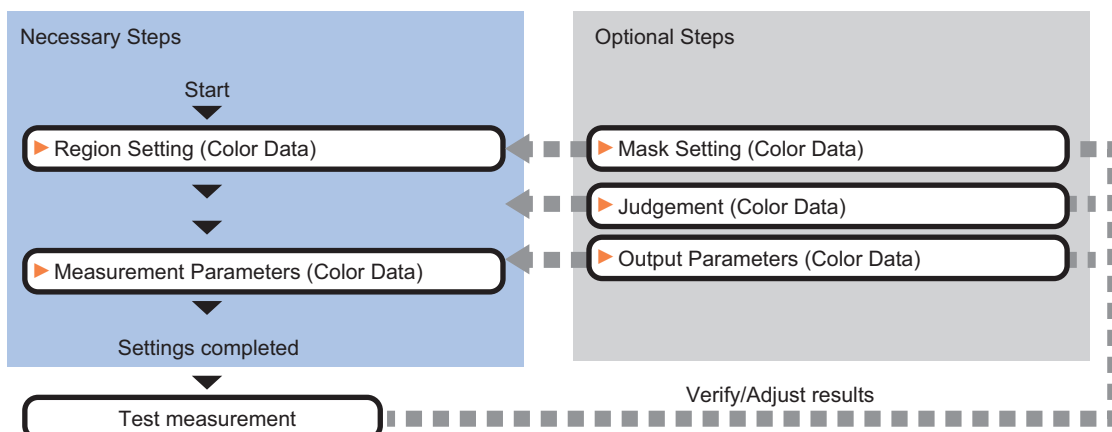


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Color Data)

Set the color data with the following steps.



List of Color Data Items

Item name	Description
Region setting	This item is used to set up the measurement area. While the input image can be measured as a whole, a quick and reliable measurement can be performed by set up the measured range. Reference: ▶ Region Setting (Color Data) (p.309)
Mask setting	Set it when masking a region. The measurement result of another processing item can also be used for masking. Reference: ▶ Mask Setting (Color Data) (p.310)
Measurement	Measurement parameters can be changed as needed to address unstable measurement results or for faster processing. Reference: ▶ Measurement Parameters (Color Data) (p.313)
Judgement	This item can be changed if necessary. Normally, the factory default value will be used. This item specifies the judgement condition for measurement results. <ul style="list-style-type: none"> • For color cameras Set the average color (RGB) value and deviation and set what the maximum difference is for judging the object to be OK. The measurement result of HSV can be judged to be OK. • For monochrome cameras Specify the average density value and deviation and set what the maximum difference is for judging the object to be OK.
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Specify whether to reflect the judgement result to the overall judgement of the scene. Reference: ▶ Output Parameters (Color Data) (p.315)

Region Setting (Color Data)

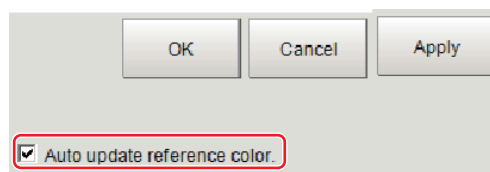
This item is used to set up the measurement area. It is possible to measure the entire input image, but restricting the range enables accurate measurement in a short period of time.

A measurement region for [Color Data] can be specified as a rectangle, circle (ellipse), circumference, or polygon.

Note

- Up to 8 graphs can be used together to draw the measured region. Complex areas can be drawn through image integration or by removing unnecessary sections from the measurement region.

- 1** In the Item Tab area, click [Region setting].
- 2** Select a button in the Drawing tools.
- 3** In the figure setting area, specify a region to be measured.
- 4** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.
- 5** To register a color in the region as a reference color, place a check at "Auto update reference color."



Note

- When a check is placed at "Auto update reference color.", the average color within the region is automatically registered as the reference color when the region is registered. Each time the region is updated, the reference color is updated.
To hold the reference color constant, uncheck this option and register the reference color with the measurement parameters.
Reference: ▶ Measurement Parameters (Color Data) (p.313)

Mask Setting (Color Data)

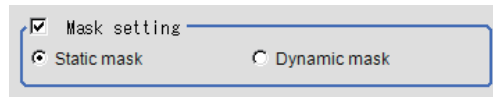
Mask the measurement region when measuring it.

There are two types of masks, namely, a static mask that sets the mask region independent of measurement and a dynamic mask that uses images generated in another unit for each measurement.

Creating a static mask

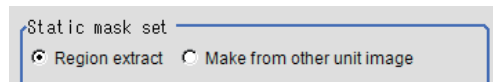
A static mask can be created manually or from an image of another unit.

- 1 In the Mask setting area, select "Static mask".**



Generating a mask manually

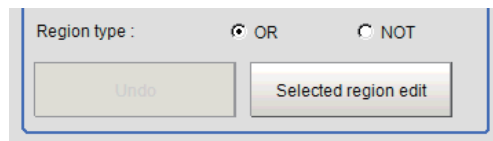
- 1 In the Static mask set area, select "Region extract".**



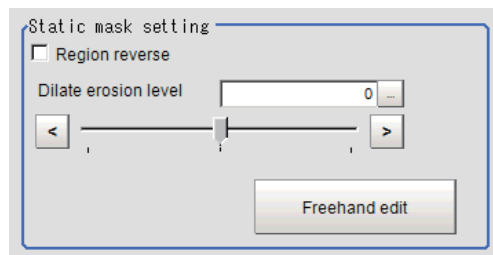
- 2 Select the selection region type OR or NOT and drag an image directly.**

A region is created along successive similar colors from the selected place. It is not masked if the selection region type is OR. It is masked if the selection region type is NOT.

To deselect a selected region, click [Undo].
To edit a region selected with OR/NOT, click [Selected region edit].



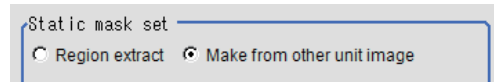
- 3 Adjust the mask created in the Static mask setting area.**



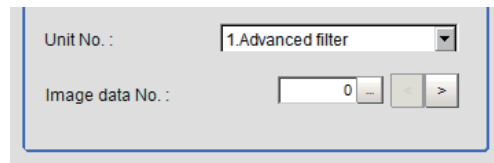
Setting item	Setting value [Factory default]	Description
Region reverse	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check to revert the created mask region.
Dilate erosion level	-10 to 10 [0]	Perform fine adjustment on the mask region using expansions/shrinkage. The region is expanded if a positive value is set. The region is shrunk if a negative value is set.

Creating a static mask from an image of another unit

- 1 In the Static mask set area, select "Make from other unit image".



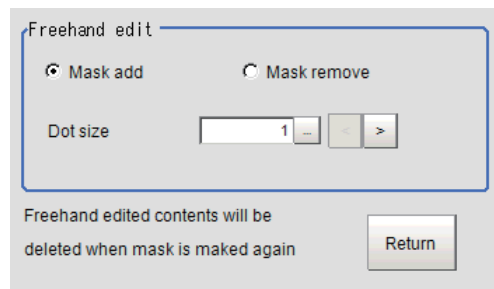
- 2 Set the unit number and image data number.



Setting item	Setting value [Factory default]	Description
Unit No.	-	Specify the number of the unit whose image will be referenced. The reference unit should be able to output binarized images. For example, select a labeling filter processing image for advanced filtering.
Image data No.	0 to 3 [0]	If the unit supports advanced filtering, numbers 0 to 3 can be set. Otherwise, it is fixed to 0.

Performing fine adjustment on a static mask

- 1 To perform fine adjustment on a mask region, click [Freehand edit] in the Static mask setting area.



Setting item	Setting value [Factory default]	Description
Freehand edit	<ul style="list-style-type: none"> • Mask add] • Mask remove 	Select a process performed using the free hand edit.
Dot size	1 to 20 [1]	Set the size of dots used when drawing images on the screen.

- 2 Click [Return] to exit the free hand edit.

Clearing the static mask setting

To clear the static mask setting, click [Clear].

Creating a dynamic mask

- 1 In the Mask setting area, select "Dynamic mask".
- 2 Set the unit number and image data number in the Unit reference area.

The screenshot shows two UI panels. The top panel, titled 'Mask setting', contains a checked checkbox for 'Mask setting' and two radio buttons: 'Static mask' (unselected) and 'Dynamic mask' (selected). The bottom panel, titled 'Unit reference', contains a dropdown menu for 'Unit No.' with '1.Advanced filter' selected, and a numeric input field for 'Image data No.' with '0' entered and increment/decrement buttons.

Setting item	Setting value [Factory default]	Description
Unit No.	-	Set the number of the unit being referred to for the mask region. The reference unit should be able to output binarized images. For example, select a labeling filter processing image for advanced filtering.
Image data No.	0 to 3 [0]	If the unit supports advanced filtering, numbers 0 to 3 can be set. Otherwise, it is fixed to 0.

Setting display

Perform the display setting if required.

The screenshot shows a 'Show setting' panel with two dropdown menus. The first is labeled 'Image type' and is set to 'Mask and image'. The second is labeled 'Mask region color' and is set to 'Black'.

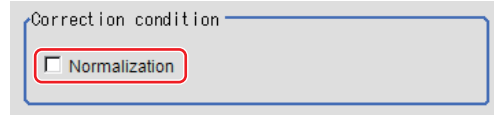
Setting item	Setting value [Factory default]	Description
Image type	<ul style="list-style-type: none"> • Measure image • Mask binary image • [Mask and image] 	Select the type of an image to be displayed. Measure image: Measured image Mask binary image: Binarized image for masking Mask and image: Post-masking image
Mask region color	<ul style="list-style-type: none"> • [Black] • White • Red • Green • Blue 	Select the display color of the mask region. A part of color which is specified in [Mask region color] is not measured.

Measurement Parameters (Color Data)

Set the reference color and judgment conditions.

For color cameras:

- 1 In the Item Tab area, click [Measurement].
- 2 If necessary, check the "Normalization" option in the "Correction condition" area.

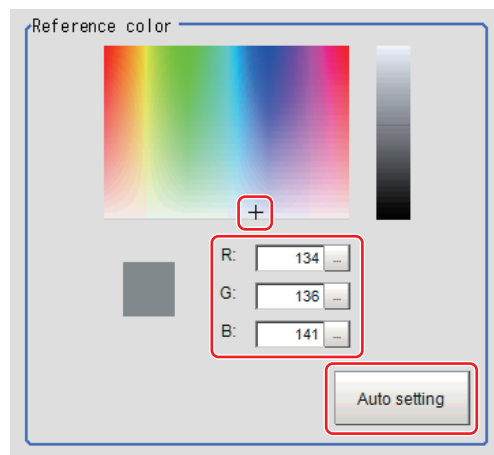


Normally, the factory default value will be used. After changing a setting, check whether measurement can be done properly by performing an actual measurement.

Setting item	Set value [Factory default]	Description
Normalization	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Specify whether to normalize the brightness in calculating the color difference. When checked, the result is not affected by the total brightness and only the color tone can be detected.

- 3 In the "Reference color" area, specify the reference color.

This operation is not needed when there is a check at "Auto update reference color." when the region is registered.



Setting method	Description
Color chart	Clicking the color chart displays the RGB values for the specified color at the bottom.
R, G, B	Set the RGB values with numbers.
Auto setting	If you click [Auto setting], the average color of the measurement region is displayed as the reference color.

Judgement Condition (Color Data)

This item specifies the judgement condition for measurement results.

- 1 When the setting has been changed, click [Measurement] to verify whether measurements can be made correctly.

Test measurement of this item.

Measurement

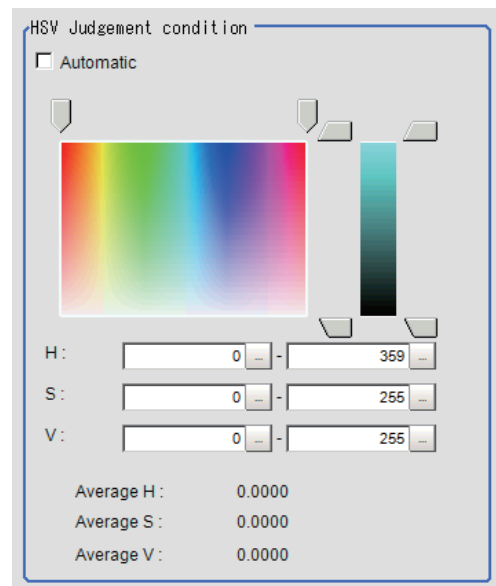
- 2 In the RGB Judgement condition area, set the judgement condition.

Setting item	Setting value	Description
Color difference	0 to 442	Specify the upper and lower limit values for the difference between the average color of the measurement region and the reference color.
Color deviation	0 to 221	Specify the upper and lower limit values for the deviation of the average color in the measurement region.

HSV parameters can also be used to set the judgement condition.

- 1 Place a check at [Automatic].
- 2 In the Image Display area, specify the color range you want to detect by dragging the cursor from the upper left corner to the lower right corner of that area.

The color of the specified area is automatically set.



Setting item	Setting value [Factory default]	Description
Automatic	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Specifying the color to be measured on the image automatically sets the hue, saturation, and brightness.
H	0 to 359	Set the color phase (difference of color hues).
S	0 to 255	Set color saturation (difference of color saturation).
V	0 to 255	Set the brightness (difference of brightness).

For monochrome cameras

- 1 When the setting has been changed, click [Measurement] to verify whether measurements can be made correctly.
- 2 Set up the judgement condition.

Setting item	Setting value	Description
Density average	0 to 255	Specify the upper and lower limit values for judging the average density of the measurement region.
Density deviation	0 to 127	Specify the upper and lower limit values for the deviation of the average density in the measurement region.

Output Parameters (Color Data)

Specifies whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Choose whether or not to reflect this in the scene overall judgement in "Reflect to overall judgement" area.

Setting item	Set value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Color Data)

The following content can be confirmed in the "Detail result" area using text.

For color cameras

Displayed items	Description
Judge	Judgement result
Average R	R (red) element average value
Average G	G (green) element average value
Average B	B (blue) element average value
Color difference	The color difference between the average color and reference color in the measurement region
Color deviation	Color deviation in the measurement region
H average	Average H (Hue) component value
S average	Average S (Saturation) component value
V average	Average V (Value) component value

For monochrome cameras

Displayed items	Description
Judge	Judgement result
Density average	Difference between the average density and the reference density in the measurement region
Density deviation	Density deviation in the measurement region

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Parameter to be adjusted	Remedy
Measurement	For a color camera, place a check at [Normalization].

When the processing speed is slow

Parameter to be adjusted	Remedy
Region setting	Set the measurement region to be as small as possible.

Measurement Results for Which Output Is Possible (Color Data)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

For color cameras

Measurement items	Character string	Description
Judge	JG	Judgement result
R average	AR	R (red) element average value
G average	AG	G (green) element average value
B average	AB	B (blue) element average value
Color difference	AD	The color difference between the average color and reference color in the measurement region
Color deviation	DV	Color deviation in the measurement region
H average	AH	Average H (Hue) component value
S average	AS	Average S (Saturation) component value
V average	AV	Average V (Value) component value

For monochrome cameras

Measurement items	Character string	Description
Judge	JG	Judgement result
Density average	AD	Difference between the average density and the reference density in the measurement region
Density deviation	DV	Color deviation in the measurement region

External Reference Tables (Color Data)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
5	Average R component value	Get only	0 to 255

No.	Data name	Set/Get	Data range
6	Average G component value	Get only	0 to 255
7	Average B component value	Get only	0 to 255
8	Color difference	Get only	0 to 442
9	Color deviation	Get only	0 to 221
10	Density average (for monochrome cameras only)	Get only	0 to 255
11	Density deviation value (for monochrome cameras only)	Get only	0 to 127
12	Reference average value	Get only	0 to 255
13	Reference deviation value	Get only	0 to 127
14	Density average difference	Get only	0 to 255
15	Density deviation difference	Get only	0 to 127
16	H average value	Get only	0 to 359
17	S average value	Get only	0 to 255
18	V average value	Get only	0 to 255
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Normalization	Set/Get	0: OFF 1: ON
121	Reference color R	Set/Get	0 to 255
122	Reference color G	Set/Get	0 to 255
123	Reference color B	Set/Get	0 to 255
124	Upper limit for color difference	Set/Get	0 to 442
125	Lower limit for color difference	Set/Get	0 to 442
126	Upper limit for color deviation	Set/Get	0 to 221
127	Lower limit for color deviation	Set/Get	0 to 221
128	Reference density average	Set/Get	0 to 255
129	Reference density deviation	Set/Get	0 to 127
130	Upper limit for density average (for monochrome cameras only)	Set/Get	0 to 255
131	Lower limit for density average (for monochrome cameras only)	Set/Get	0 to 255

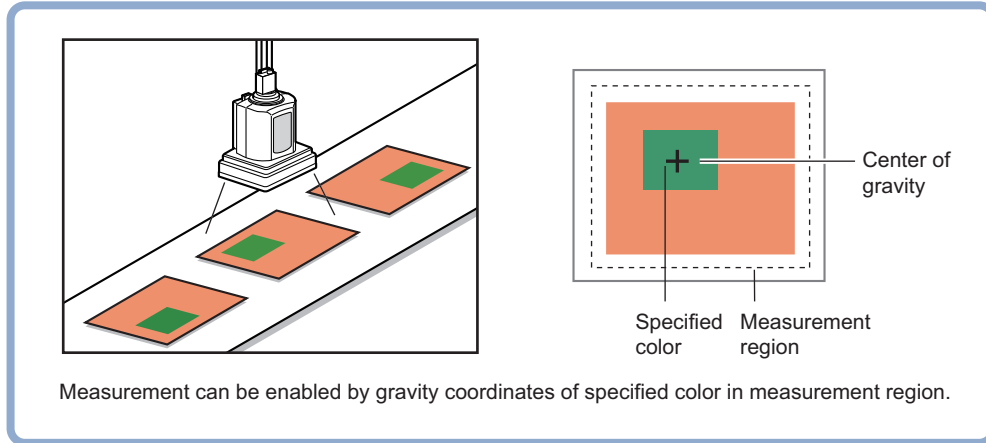
No.	Data name	Set/Get	Data range
132	Upper limit for density deviation (for monochrome cameras only)	Set/Get	0 to 127
133	Lower limit for density deviation (for monochrome cameras only)	Set/Get	0 to 127
136	Upper limit for H average value	Set/Get	0 to 359
137	Lower limit for H average value	Set/Get	0 to 359
138	Upper limit for S average value	Set/Get	0 to 255
139	Lower limit for S average value	Set/Get	0 to 255
140	Upper limit for V average value	Set/Get	0 to 255
141	Lower limit for V average value	Set/Get	0 to 255
150	Region reverse	Set/Get	0: Not reverse 1: Reverse
151	Dilate erosion level	Set/Get	-10 to 10
152	Static mask type	Set/Get	0: Region extract 1: Region of image reference
153	Static mask unit reference no	Set/Get	-1 to 9999
154	Static mask image no	Set/Get	0 to 99
155	Dynamic mask unit reference no	Set/Get	-1 to 9999
156	Dynamic mask image no	Set/Get	0 to 99
157	Mask type	Set/Get	0: Static mask 1: Dynamic mask
158	Display image type	Set/Get	0: Measure image 1: Mask binary image 2: Mask and image
163	Is mask	Set/Get	0: OFF 1: ON
164	Mask region display color	Set/Get	0: Black 1: White 2: Red 3: Green 4: Blue
6002	Format	Set/Get	1: monochrome camera 2: color camera

Gravity and Area

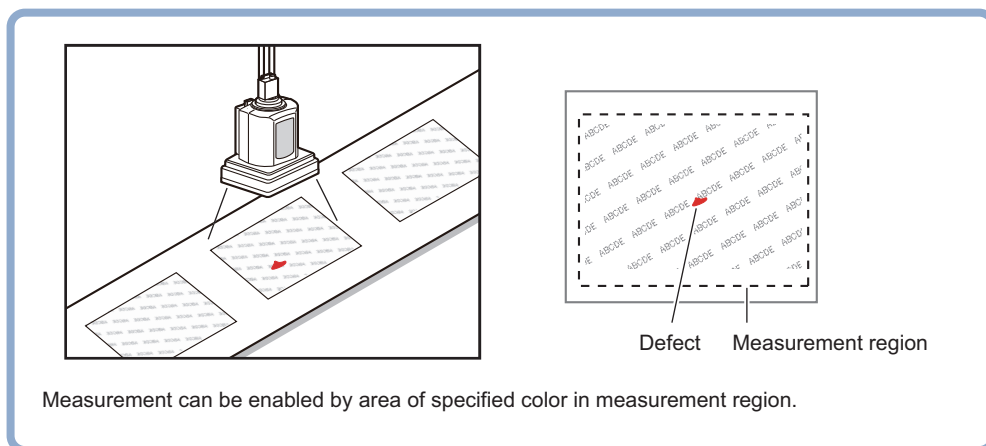
Inspect using the area of the specified color.

Used in the Following Case

- Label deviation measurement



- Detection of defects, contamination, and stains of measurement objects whose appearance is not defined

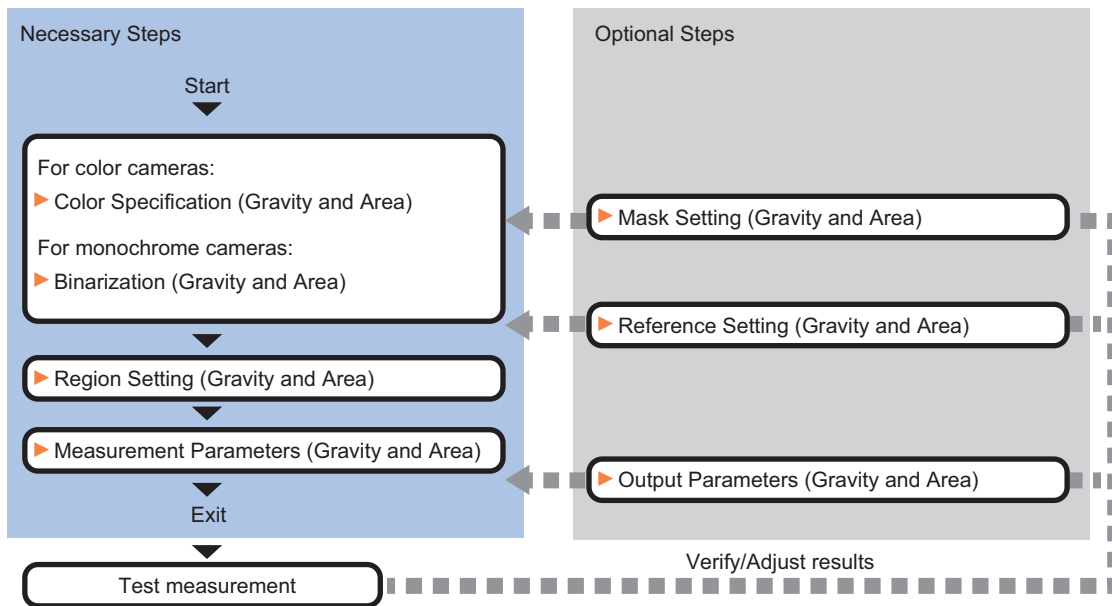


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Gravity and Area)

Set the Gravity and Area with the following steps.



List of Gravity and Area Items

Item name	Description
Color (for color cameras only)	This item selects the color whose area and center of gravity are to be measured. Since the color hue, color saturation, and brightness can be selected, then fine-tuning can be performed to colors. Reference: ▶ Color Specification (Gravity and Area) (p.321)
Binary (for monochrome cameras only)	This item specifies the binary level for converting 256-tone grayscale images input from the camera into binary images. Converted white pixels are measured. Adjust the binary level so that the measurement object is converted to white pixels. Reference: ▶ Binarization (Gravity and Area) (p.323)
Region setting	This item is used to set up the measurement area. While the input image can be measured as a whole, a quick and reliable measurement can be performed by set up the measured range. Reference: ▶ Region Setting (Gravity and Area) (p.323)
Mask setting	Set it when masking a region. The measurement result of another processing item can also be used for masking. Reference: ▶ Mask Setting (Gravity and Area) (p.324)
Ref. setting	This item can be changed if necessary. Usually, the central position of the registered region is registered as the reference position. Reference: ▶ Reference Setting (Gravity and Area) (p.326)
Measurement	This item specifies the judgement condition for measurement results. Specify the upper and lower limit values for the area and the gravity center X/Y. Measurement parameters can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used. Reference: ▶ Measurement Parameters (Gravity and Area) (p.327)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (Gravity and Area) (p.329)

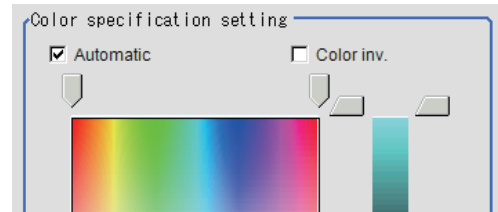
Color Specification (Gravity and Area)

When connecting a color camera, specify the color to be measured. There are two specification methods: specifying the color to be extracted in the image or specifying the color with the hue, saturation, and brightness values.

This section describes how to specify colors in an image and gives an example of the procedure for finely adjusting with numeric input afterwards.

- 1** In the Item Tab area, click [Color].
- 2** Place a check at [Automatic].
- 3** In the Image Display area, specify the color range you want to detect by dragging the cursor from the upper left corner to the lower right corner of that area.

The color of the specified area is automatically set.

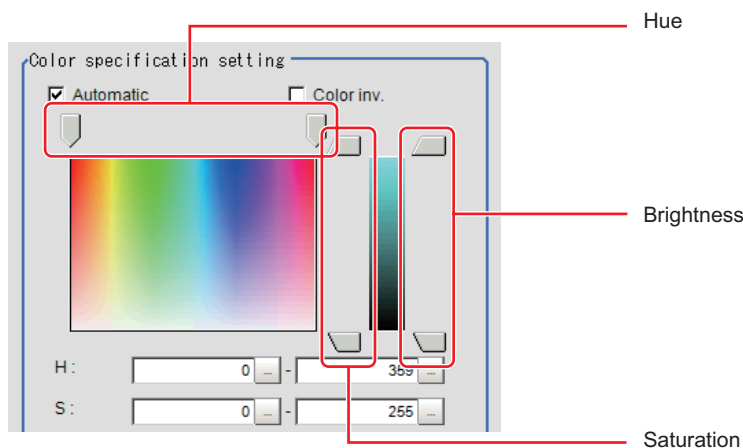


- 4** Finely adjust the hue, saturation, and brightness if necessary.

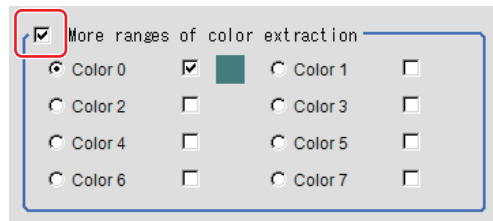
Adjust either by adjusting on the color chart or by inputting numbers.

Item	Set value [Factory default]	Description
H	0 to 359	Specify the color phase (difference of color hues).
S	0 to 255	Specify color saturation (difference of color saturation).
V	0 to 255	Specify the brightness (difference of brightness).
Automatic	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Specifying the color to be measured on the image automatically sets the hue, saturation, and brightness.
Color inv.	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Everything other than the specified color becomes the measurement target.

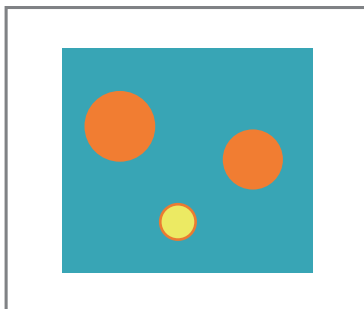
About color charts



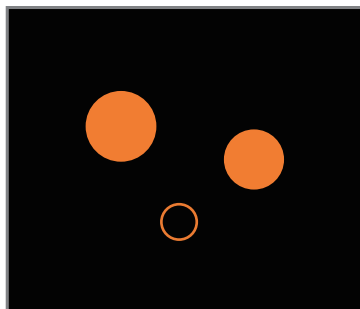
5 To specify multiple colors, place a check at "More ranges of color extraction".



Setting item	Set value [Factory default]	Description
More ranges of color extraction	<ul style="list-style-type: none"> • Checked • [Unchecked] 	If you place a check at this option, you can set up to 8 colors.

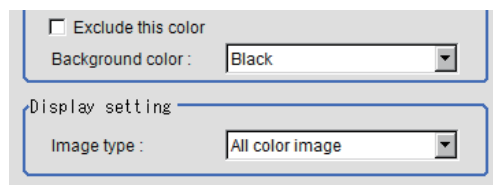


Extract image
(before specifying colors)



Extract image
(after specifying colors – background color: black)

6 If necessary, set the display conditions for displayed images.



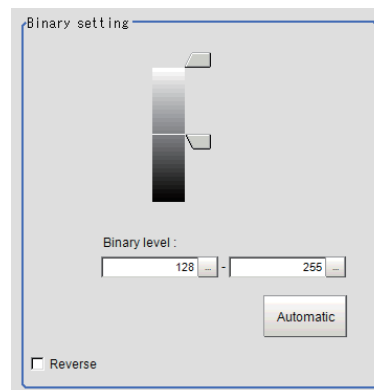
Setting item	Set value [Factory default]	Description
Exclude this color	<ul style="list-style-type: none"> • Checked • [Unchecked] 	If you place a check at this option, pixels within the HSV range are excluded from color extraction. The priority order for exclusion is that the higher color extraction range numbers are given priority. This setting is disabled if "More ranges of color extraction" is unchecked.
Background color	<ul style="list-style-type: none"> • [Black] • White • Red • Green • Blue 	The background section outside the extracted image is filled with the specified colors.
Image type	<ul style="list-style-type: none"> • Measurement image • [All color image] • Selected color image • Binary image 	This sets the state of the image to display.

Binarization (Gravity and Area)

When a monochrome camera is connected, the 256-tone grayscale images taken in from the camera are converted into binary black-and-white images before the images are measured. Converted white pixels are measured.

This specifies the level for converting grayscale images into binary images.

- 1** In the Item Tab area, click [Binary].
- 2** In the "Binary setting" area, specify the reference density range.



Item		Set value [Factory default]	Description
Binary level	Upper limit value	0 to 255 [255]	Specify the level for converting 256-tone grayscale images to binary images. Adjust the binary level so that the measurement object is converted to white pixels. You can also set the binary level so that only intermediate density is measured.
	Lower limit value	0 to 255 [128]	
Automatic		-	Optimum binary levels are calculated automatically and set.
Reverse		<ul style="list-style-type: none"> • Checked • [Unchecked] 	This item reverses black and white colors.

Region Setting (Gravity and Area)

This item is used to set up the measurement area. It is possible to measure the entire input image, but restricting the range enables accurate measurement in a short period of time.

Use a rectangle, circle (ellipse), circumference, or polygon to specify a measurement region for [Gravity and Area]. Up to 8 figures can be combined to draw the measurement region.

- 1** In the Item Tab area, click [Region setting].
- 2** Use the Drawing tools to specify the measurement region.
- 3** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.
- 4** If necessary, in the "Display setting" area, set up display settings for the images displayed in the Image Display area.

Setting item	Set value [Factory default]	Description
Extract image	<ul style="list-style-type: none"> • [Checked] • Unchecked 	If you place a check at this option, image set with the color specification is displayed.

Mask Setting (Gravity and Area)

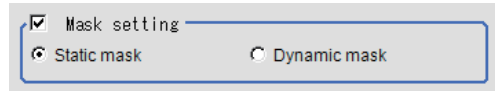
Mask the measurement region when measuring it.

There are two types of masks, namely, a static mask that sets the mask region independent of measurement and a dynamic mask that uses images generated in another unit for each measurement.

Creating a static mask

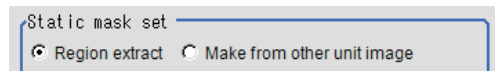
A static mask can be created manually or from an image of another unit.

- 1 In the Mask setting area, select "Static mask".



Generating a mask manually

- 1 In the Static mask set area, select "Region extract".

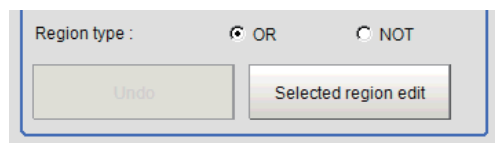


- 2 Select the selection region type OR or NOT and drag an image directly.

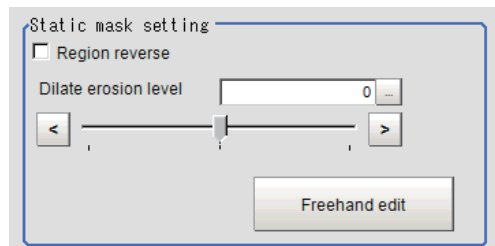
A region is created along successive similar colors from the selected place. It is not masked if the selection region type is OR. It is masked if the selection region type is NOT.

To deselect a selected region, click [Undo].

To edit a region selected with OR/NOT, click [Selected region edit].



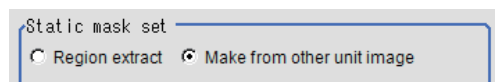
- 3 Adjust the mask created in the Static mask setting area.



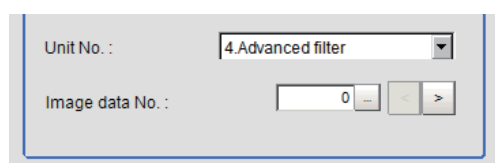
Setting item	Setting value [Factory default]	Description
Region reverse	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check to revert the created mask region.
Dilate erosion level	-10 to 10 [0]	Perform fine adjustment on the mask region using expansions/shrinkage. The region is expanded if a positive value is set. The region is shrunk if a negative value is set.

Creating a static mask from an image of another unit

- 1 In the Static mask set area, select "Make from other unit image".



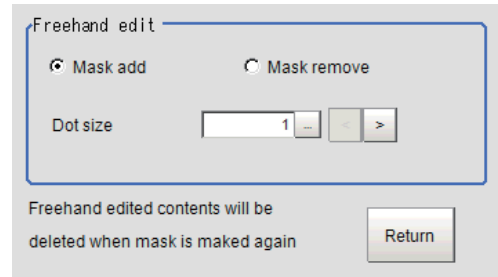
- 2 Set the unit number and image data number.



Setting item	Setting value [Factory default]	Description
Unit No.	-	Specify the number of the unit whose image will be referenced. The reference unit should be able to output binarized images. For example, select a labeling filter processing image for advanced filtering.
Image data No.	0 to 3 [0]	If the unit supports advanced filtering, numbers 0 to 3 can be set. Otherwise, it is fixed to 0.

Performing fine adjustment on a static mask

- 1 To perform fine adjustment on a mask region, click [Freehand edit] in the Static mask setting area.



Setting item	Setting value [Factory default]	Description
Freehand edit	<ul style="list-style-type: none"> • [Mask add] • Mask remove 	Select a process performed using the free hand edit.
Dot size	1 to 20 [1]	Set the size of dots used when drawing images on the screen.

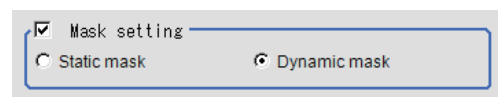
- 2 Click [Return] to exit the free hand edit.

Clearing the static mask setting

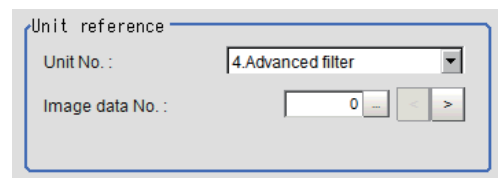
To clear the static mask setting, click [Clear].

Creating a dynamic mask

- 1 In the Mask setting area, select "Dynamic mask".



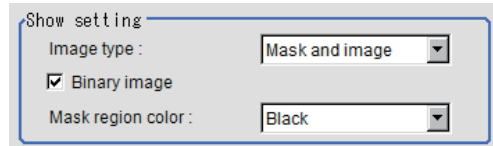
- 2 Set the unit number and image data number in the Unit reference area.



Setting item	Setting value [Factory default]	Description
Unit No.	-	Set the number of the unit being referred to for the mask region. The reference unit should be able to output binarized images. For example, select a labeling filter processing image for advanced filtering.
Image data No.	0 to 3 [0]	If the unit supports advanced filtering, numbers 0 to 3 can be set. Otherwise, it is fixed to 0.

Setting display

Perform the display setting if required.



Setting item	Setting value [Factory default]	Description
Image type	<ul style="list-style-type: none"> • Measure image • Mask binary image • [Mask and image] 	Select the type of an image to be displayed. Measure image: Measured image Mask binary image: Binarized image for masking Mask and image: Post-masking image
Mask region color	<ul style="list-style-type: none"> • [Black] • White • Red • Green • Blue 	Select the display color of the mask region. A part of color which is specified in [Mask region color] is not measured.

Reference Setting (Gravity and Area)

When the measurement region is set, the center of gravity is automatically set at the same time as the reference position. This item is used to change the reference position to any desired position. This is handy for measuring the position deviation from a certain position. In the same way for the reference area, when the region settings are made, they are set automatically based on the measurement region.

A reference position can be set either directly or by referencing a unit.

Specifying directly

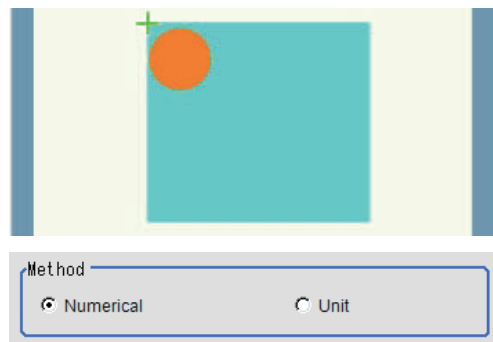
Click a position on the image you want to use as a reference position, or set coordinate data for that point.

1 In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.

2 In the "Method" area, select "Numerical".

3 Click the position to be set as the reference.



Note

- Displaying the image enlarged makes this clicking easier.
Reference: ▶ "Appendixes Basic Knowledge about Operations Using the Zoom Function" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

- 4** Make fine adjustments using numeric value inputs or the arrow buttons as required.

Reference coordinate setting

Reference area :

Ref.pos :

,

Navigation arrows: ↑, ↓, ←, →

- 5** To remeasure on the displayed image and set the reference, click the [Measure ref.] button.

Measure ref.

- 6** To use data before position compensation for the reference setting coordinates, place a check at "Use point coordinate before scroll".

Use point coordinate before scroll

Position X : 320.0000

Position Y : 240.0000

Referencing a unit

Set a reference by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

- 1** In the Item Tab area, click [Ref. setting].

In the display area, the current reference position will be displayed as the crosshair cursor.

- 2** In the "Method" area, select "Unit".

Method

Numerical Unit

- 3** In the scene in the "Unit" area, select a detection point unit.

Unit

Reference area :

Unit :

- 4** Perform the next measurement, and the reference will be displayed.

Measurement Parameters (Gravity and Area)

This item specifies the judgement condition for measurement results. Specify the upper and lower limit values for the area and the gravity center X/Y.

Measurement parameters can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used.

- 1** In the Item Tab area, click [Measurement].

- 2** If necessary, in the "Measurement condition" area, select an option for [Fill profile].

If the measurement target has holes in it, specify how to process the holes. Normally, the factory default value will be used.



Measurement condition

Fill profile :

None

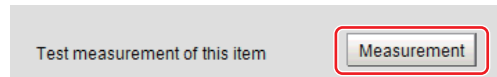
Fill outline

Filling up holes

Setting item	Set value [Factory default]	Description
Fill profile	[None]	The empty section in the center is not filled in.
	Fill outline	<p>In the measurement region, the part between the extracted-color start point and end point in the X-axis direction is measured as having the extracted color. Since filling is applied only to the X-axis direction, the processing is faster than filling up holes.</p> <p>Input image Fill profile image</p> 
	Filling up holes	<p>The part surrounded by the extracted color, like a doughnut hole, is filled with the extracted color.</p> <p>Input image Image after filling up hole</p> 

3 If necessary, in the "Display setting" area, set up display settings for the images displayed in the Image Display area.

4 When the setting has been changed, click [Measurement] in the "Detail" area to verify whether measurements can be made correctly.



5 Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limits.

Setting item	Set value	Description
Area	0 to 9999999999.9999	Specify the area to be judged as OK.
Gravity X	-99999.9999 to 99999.9999	Specify the range of X-axis shifting that is judged to be OK.
Gravity Y	-99999.9999 to 99999.9999	Specify the range of Y-axis shifting that is judged to be OK.

Output Parameters (Gravity and Area)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgment results of this processing unit is reflected in the scene overall judgment.

Key Points for Test Measurement and Adjustment (Gravity and Area)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Area	Area
Gravity X	Gravity X
Gravity Y	Gravity Y

The image specified in the Sub-image number in image display setting is displayed in the Image Display area.

Sub image number.	Explanation of image to be displayed
0	Measurement image
1	Extract image

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

For color cameras:

Parameter to be adjusted	Remedy
Color	Click the area whose color will be sampled and the area whose color will not be sampled. The setup should be such that two stable sections of hue, saturation and brightness are formed.

For monochrome cameras:

Parameter to be adjusted	Remedy
Binary	Adjust the binary level.

Measurement Results for Which Output Is Possible (Gravity and Area)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Area	AR	Area
Gravity X	X	Center of gravity X coordinate
Gravity Y	Y	Center of gravity Y coordinate
Reference area	SA	Reference area
Reference point X	SX	Reference position X coordinate
Reference point Y	SY	Reference position Y coordinate

External Reference Tables (Gravity and Area)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
5	Area	Get only	0 to 999999999.9999
6	Gravity X	Get only	-99999.9999 to 99999.9999
7	Gravity Y	Get only	-99999.9999 to 99999.9999
8	Reference area	Get only	0 to 999999999
9	Reference X ^{*1}	Get only	-99999.9999 to 99999.9999
10	Reference Y ^{*1}	Get only	-99999.9999 to 99999.9999
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Register the max. color hue	Set/Get	0 to 359
121	Register the min. color hue	Set/Get	0 to 359
122	Register the max. color saturation	Set/Get	0 to 255
123	Register the min. color saturation	Set/Get	0 to 255
124	Register the max. color brightness	Set/Get	0 to 255
125	Register the min. color brightness	Set/Get	0 to 255
126	Extract image	Set/Get	0: OFF 1: ON

No.	Data name	Set/Get	Data range
127	Background color	Set/Get	0: Black 1: White 2: Red 3: Green 4: Blue
128	Fill profile	Set/Get	0: OFF 1: Fill profile 2: Filling up holes
129	Color inv. (reverse for monochrome)	Set/Get	0: OFF 1: ON
132	Reference area	Set/Get	0 to 999999999
133	Reference X^2	Set/Get	0 to 99999.9999
134	Reference Y^2	Set/Get	0 to 99999.9999
135	Upper limit of the area	Set/Get	0 to 999999999.9999
136	Lower limit of the area	Set/Get	0 to 999999999.9999
137	Upper limit of gravity X	Set/Get	-99999.9999 to 99999.9999
138	Lower limit of gravity X	Set/Get	-99999.9999 to 99999.9999
139	Upper limit of gravity Y	Set/Get	-99999.9999 to 99999.9999
140	Lower limit of gravity Y	Set/Get	-99999.9999 to 99999.9999
141	Upper limit of the binary level	Set/Get	0 to 255
142	Lower limit of the binary level	Set/Get	0 to 255
143	Binary image	Set/Get	0: ON 1: OFF
144	Image type	Set/Get	0: Measurement image 1: All color image 2: Selection color image 3: Binary image
145	Multiple selections	Set/Get	0: Multiple selections disabled 1: Multiple selections enabled
$160 + N^{*1} \times 10$	Flag N^{*1} used for registered color	Set/Get	0: Not used 1: Used
$161 + N^{*1} \times 10$	Flag N^{*1} for registered color OR/NOT	Set/Get	0: OR 1: NOT
$162 + N^{*1} \times 10$	Register the max. color hue N^{*3}	Set/Get	0 to 359
$163 + N^{*1} \times 10$	Register the min. color hue N^{*3}	Set/Get	0 to 359
$164 + N^{*1} \times 10$	Register the max. color saturation N^{*3}	Set/Get	0 to 255
$165 + N^{*1} \times 10$	Register the min. color saturation N^{*3}	Set/Get	0 to 255
$166 + N^{*1} \times 10$	Register the max. color brightness N^{*3}	Set/Get	0 to 255
$167 + N^{*1} \times 10$	Register the min. color brightness N^{*3}	Set/Get	0 to 255
$168 + N^{*1} \times 10$	Background color N^{*1}	Set/Get	0: Black 1: White 2: Red 3: Green 4: Blue
301	Setting unit of reference coordinate	Set/Get	-1 to 9999
302	Setting type of reference coordinate	Set/Get	0: Numerical 1: Unit

No.	Data name	Set/Get	Data range
303	Use point coordinate before scroll	Set/Get	0: Not use 1: Use
304	Position X before scroll	Set/Get	-99999.9999 to 99999.9999
305	Position Y before scroll	Set/Get	-99999.9999 to 99999.9999
311	Region reverse	Set/Get	0: Not reverse 1: Reverse
312	Dilate erosion level	Set/Get	-10 to 10
313	Static mask type	Set/Get	0: Region extract 1: Region of image reference
314	Static mask unit reference no	Set/Get	-1 to 9999
315	Static mask image no	Set/Get	0 to 99
316	Dynamic mask unit reference no	Set/Get	-1 to 9999
317	Dynamic mask image no	Set/Get	0 to 99
318	Mask type	Set/Get	0: Static mask 1: Dynamic mask
319	Display image type	Set/Get	0: Measure image 1: Mask binary image 2: Mask and image
324	Is mask	Set/Get	0: OFF 1: ON
325	Mask region display color	Set/Get	0: Black 1: White 2: Red 3: Green 4: Blue
6002	Format	Set/Get	1: monochrome camera 2: color camera

*1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.

*2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.

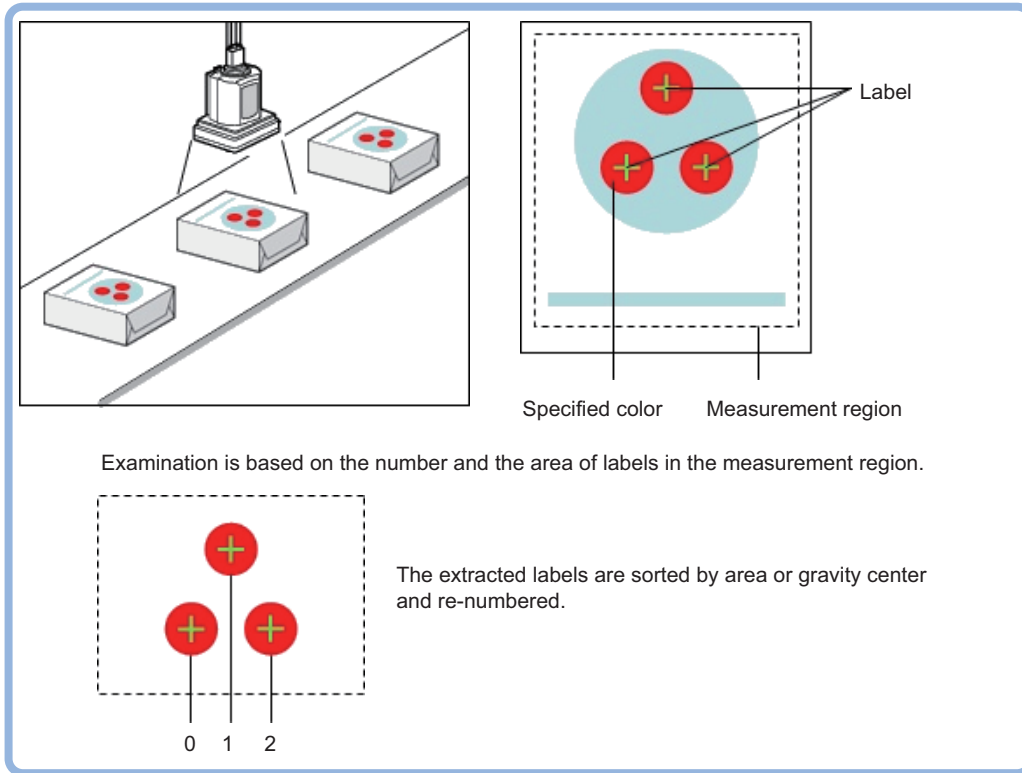
*3: N = 0 - 7 (color extraction range 0 to 7)

Labeling

You can count the number of labels with a specified color or find the area and center of gravity of a specified label number.

Used in the Following Case

- Label count inspection

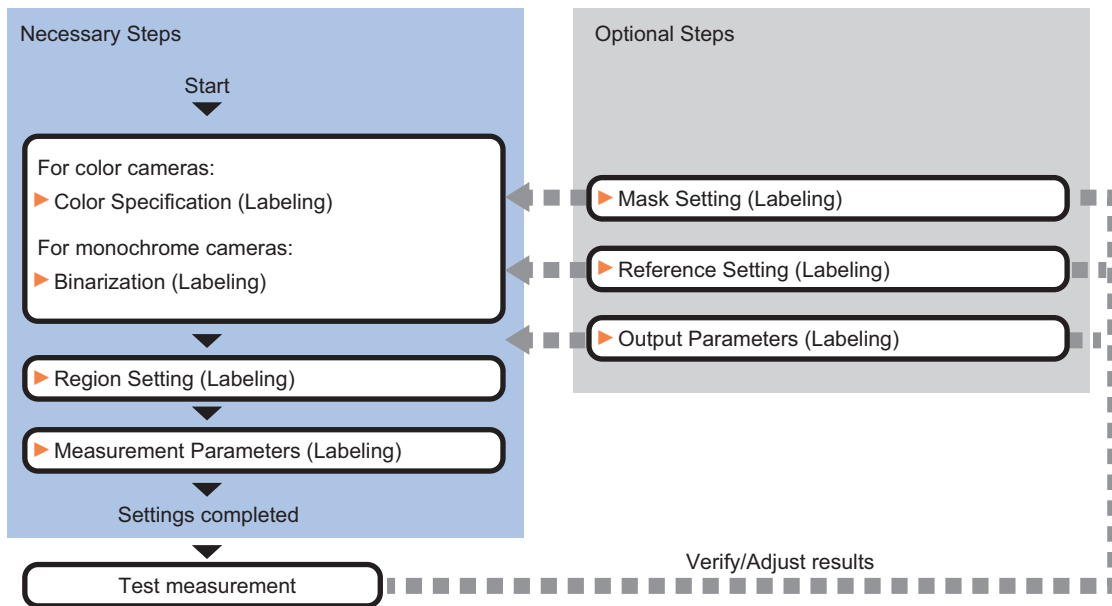


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Labeling)

Labeling can be set up as follows.



List of Labeling Items

Item name	Description
Color (for color cameras only)	This item selects the color whose area and center of gravity are to be measured. Since the color hue, color saturation, and brightness can be selected, then fine-tuning can be performed to colors. Reference: ▶ Color Specification (Labeling) (p.335)
Binary (for monochrome cameras only)	This item specifies the binary level for converting 256-tone grayscale images input from the camera into binary images. Converted white pixels are measured. Adjust the binary level so that the measurement object is converted to white pixels. Reference: ▶ Binarization (Labeling) (p.337)
Region setting	This item is used to set up the measurement area. While the input image can be measured as a whole, a quick and reliable measurement can be performed by set up the measured range. Reference: ▶ Region Setting (Labeling) (p.338)
Mask setting	Set it when masking a region. The measurement result of another processing item can also be used for masking. Reference: ▶ Mask Setting (Labeling) (p.339)
Ref. setting	This item can be changed if necessary. Usually, the central position of the registered region is registered as the reference position. Reference: ▶ Reference Setting (Labeling) (p.341)
Measurement	This item specifies the judgement condition for measurement results. It specifies the upper and lower limit values for the number of labels, the area and the center of gravity X and Y. Measurement parameters can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used. Reference: ▶ Measurement Parameters (Labeling) (p.342)
Output parameter	This item can be changed if necessary. Normally, the factory default value may be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (Labeling) (p.346)

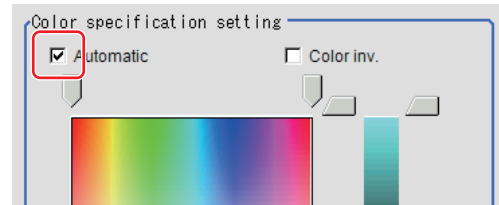
Color Specification (Labeling)

When connecting a color camera, specify the color to be measured. There are two specification methods: specifying the color to be extracted in the image or specifying the color with the hue, saturation, and brightness values.

This section describes how to specify colors in an image and gives an example of the procedure for finely adjusting with numeric input afterwards.

- 1** In the Item Tab area, click [Color].
- 2** Place a check at [Automatic].
- 3** In the Image Display area, specify the color range you want to detect by dragging the cursor from the upper left corner to the lower right corner of that area.

The color of the specified area is automatically set.

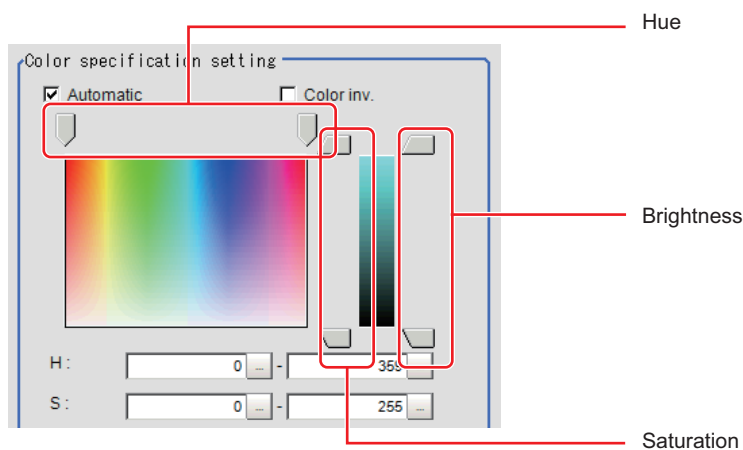


- 4** Finely adjust the hue, saturation, and brightness if necessary.

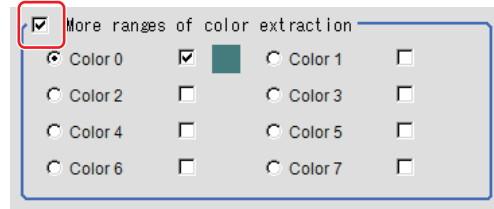
Adjust either by adjusting on the color chart or by inputting numbers.

Item	Set value [Factory default]	Description
H	0 to 359	Specify the color phase (difference of color hues).
S	0 to 255	Specify color saturation (difference of color saturation).
V	0 to 255	Specify the brightness (difference of brightness).
Automatic	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Specifying the color to be measured on the image automatically sets the hue, saturation, and brightness.
Color inv.	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Everything other than the specified color becomes the measurement target.

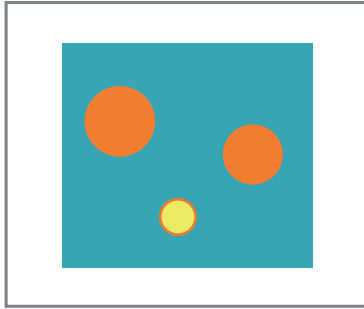
About color charts



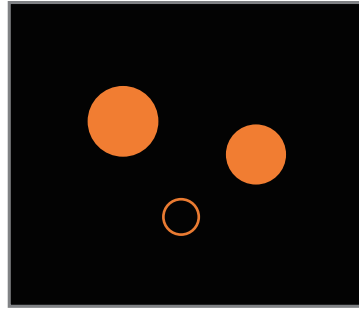
5 To specify multiple colors, place a check at "More ranges of color extraction".



Setting item	Set value [Factory default]	Description
More ranges of color extraction	<ul style="list-style-type: none"> • Checked • [Unchecked] 	If you place a check at this option, you can set up to 8 colors.

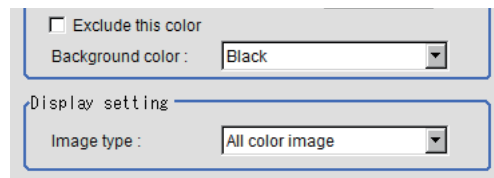


Extract image
(before specifying colors)



Extract image
(after specifying colors – background color: black)

6 If necessary, set the display conditions for displayed images.



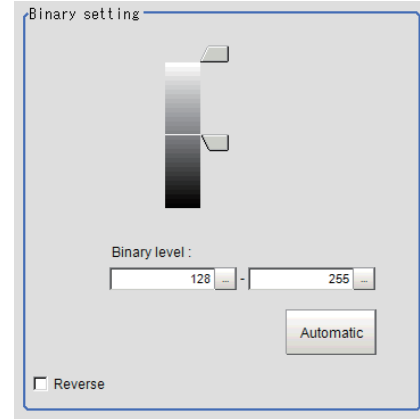
Setting item	Set value [Factory default]	Description
Exclude this color	<ul style="list-style-type: none"> • Checked • [Unchecked] 	If you place a check at this option, pixels within the HSV range are excluded from color extraction. The priority order for exclusion is that the higher color extraction range numbers are given priority. This setting is disabled if "More ranges of color extraction" is unchecked.
Background color	<ul style="list-style-type: none"> • [Black] • White • Red • Green • Blue 	The background section outside the extracted image is filled with the specified colors.
Image type	<ul style="list-style-type: none"> • Measurement image • [All color image] • Selected color image • Binary image 	This sets the state of the image to display.

Binarization (Labeling)

When a monochrome camera is connected, the 256-tone grayscale images taken in from the camera are converted into binary black-and-white images before the images are measured. Converted white pixels are measured.

This specifies the level for converting grayscale images into binary images.

- 1** In the Item Tab area, click [Binary].
- 2** In the "Binary setting" area, specify the reference density range.



Item		Set value [Factory default]	Description
Binary level	Upper limit value	0 to 255 [255]	Specify the level for converting 256-tone grayscale images to binary images. Adjust the binary level so that the measurement object is converted to white pixels. You can also set the binary level so that only intermediate density is measured.
	Lower limit value	0 to 255 [128]	
Automatic		-	Optimum binary levels are calculated automatically and set.
Reverse		<ul style="list-style-type: none"> • [Checked] • Unchecked 	This item reverses black and white colors.

Region Setting (Labeling)

This item is used to set up the measurement area. It is possible to measure the entire input image, but restricting the range enables accurate measurement in a short period of time.

Use a rectangle, straight line, circle (ellipse), wide circle, or polygon to specify a measurement region for [Labeling].

- 1** In the Item Tab area, click [Region setting].
- 2** Use the Drawing tools to specify the measurement region.
- 3** In the figure setting area, specify a region to be measured.
- 4** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.
- 5** If necessary, in the "Display setting" area, set up display settings for the images displayed in the Image Display area.

For color cameras:



Setting item	Set value [Factory default]	Description
Extract image	<ul style="list-style-type: none">• [Checked]• Unchecked	If you place a check at this option, image set with the color specification are displayed.

For monochrome cameras:



Setting item	Set value [Factory default]	Description
Binary image	<ul style="list-style-type: none">• [Checked]• Unchecked	The image is displayed in binary with black and white.

Mask Setting (Labeling)

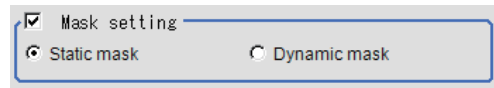
Mask the measurement region when measuring it.

There are two types of masks, namely, a static mask that sets the mask region independent of measurement and a dynamic mask that uses images generated in another unit for each measurement.

Creating a static mask

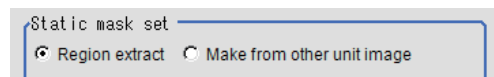
A static mask can be created manually or from an image of another unit.

- 1 In the Mask setting area, select "Static mask".



Generating a mask manually

- 1 In the Static mask set area, select "Region extract".

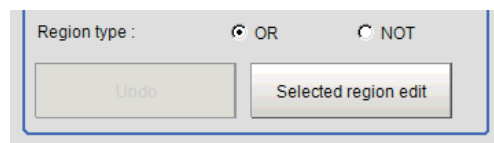


- 2 Select the selection region type OR or NOT and drag an image directly.

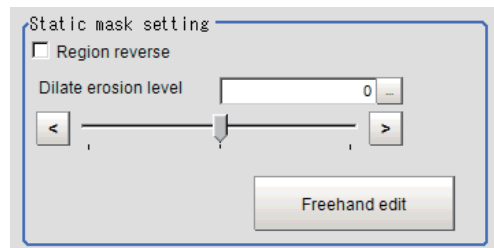
A region is created along successive similar colors from the selected place. It is not masked if the selection region type is OR. It is masked if the selection region type is NOT.

To deselect a selected region, click [Undo].

To edit a region selected with OR/NOT, click [Selected region edit].



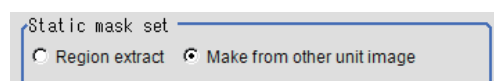
- 3 Adjust the mask created in the Static mask setting area.



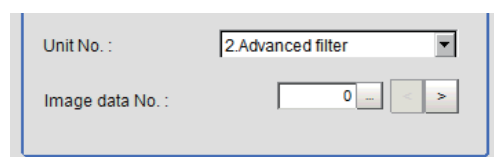
Setting item	Setting value [Factory default]	Description
Region reverse	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check to revert the created mask region.
Dilate erosion level	-10 to 10 [0]	Perform fine adjustment on the mask region using expansions/shrinkage. The region is expanded if a positive value is set. The region is shrunk if a negative value is set.

Creating a static mask from an image of another unit

- 1 In the Static mask set area, select "Make from other unit image".



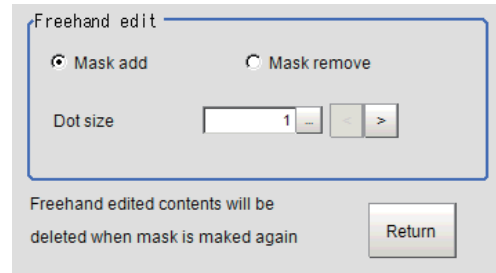
- 2 Set the unit number and image data number.



Setting item	Setting value [Factory default]	Description
Unit No.	-	Specify the number of the unit whose image will be referenced. The reference unit should be able to output binarized images. For example, select a labeling filter processing image for advanced filtering.
Image data No.	0 to 3 [0]	If the unit supports advanced filtering, numbers 0 to 3 can be set. Otherwise, it is fixed to 0.

Performing fine adjustment on a static mask

- 1 To perform fine adjustment on a mask region, click [Freehand edit] in the Static mask setting area.



Setting item	Setting value [Factory default]	Description
Freehand edit	<ul style="list-style-type: none"> • [Mask add] • Mask remove 	Select a process performed using the free hand edit.
Dot size	1 to 20 [1]	Set the size of dots used when drawing images on the screen.

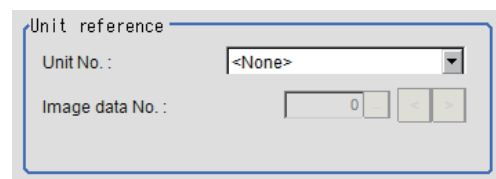
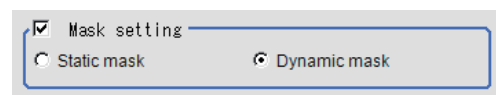
- 2 Click [Return] to exit the free hand edit.

Clearing the static mask setting

To clear the static mask setting, click [Clear].

Creating a dynamic mask

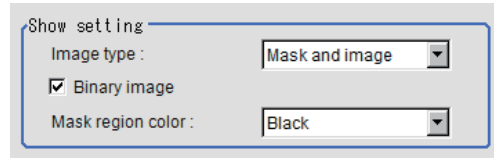
- 1 In the Mask setting area, select "Dynamic mask".
- 2 Set the unit number and image data number in the Unit reference area.



Setting item	Setting value [Factory default]	Description
Unit No.	-	Set the number of the unit being referred to for the mask region. The reference unit should be able to output binarized images. For example, select a labeling filter processing image for advanced filtering.
Image data No.	0 to 3 [0]	If the unit supports advanced filtering, numbers 0 to 3 can be set. Otherwise, it is fixed to 0.

Setting display

Perform the display setting if required.



Setting item	Setting value [Factory default]	Description
Image type	<ul style="list-style-type: none"> • Measure image • Mask binary image • [Mask and image] 	Select the type of an image to be displayed. Measure image: Measured image Mask binary image: Binarized image for masking Mask and image: Post-masking image
Mask region color	<ul style="list-style-type: none"> • [Black] • White • Red • Green • Blue 	Select the display color of the mask region. A part of color which is specified in [Mask region color] is not measured.

Reference Setting (Labeling)

This item can be changed if necessary. When the region is set, the reference position is automatically set at the center of gravity of the measurement region. In the same way for the reference area, when the region settings are made, they are set automatically based on the measurement region.

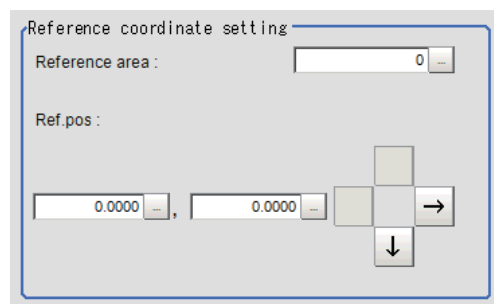
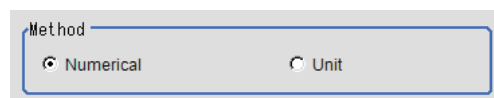
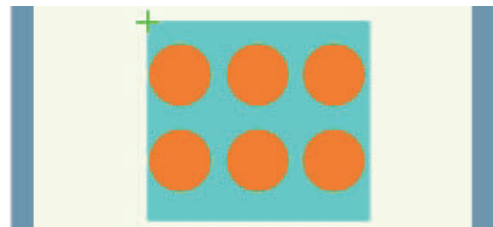
This item can be used to change the reference position to any desired position.

A reference position can be set either directly or by referencing a unit.

Specifying directly

Click a position on the image you want to use as a reference position, or set coordinate data for that point.

- 1** In the Item Tab area, click [Ref. setting].
In the display area, the current reference position will be displayed as the crosshair cursor.
- 2** In the "Method" area, select "Numerical".
- 3** Click the position to be set as the reference.
- 4** Make fine adjustments using numeric value inputs or the arrow buttons as required.



- 5 To use data before position compensation for the reference setting coordinates, place a check at "Use point coordinate before scroll".**

Use point coordinate before scroll

Position X : 0.0000

Position Y : 0.0000

Referencing a unit

Set a reference by referencing a detection point unit with registered X coordinate, Y coordinate and angle data.

- 1 In the Item Tab area, click [Ref. setting].**

In the display area, the current reference position will be displayed as the crosshair cursor.

- 2 In the "Method" area, select "Unit".**

Method

Numerical Unit

- 3 In the scene in the "Unit" area, select a detection point unit.**

Unit

Reference area :

Unit :

- 4 Perform the next measurement, and the reference will be displayed.**

Measurement Parameters (Labeling)

This item specifies the judgement condition for measurement results.

Measurement parameters can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used.

- 1 In the Item Tab area, click [Measurement].**

- 2 If necessary, in the "Labeling condition" area, specify a value for each item.**

Labeling condition


Filling up holes Outside trimming

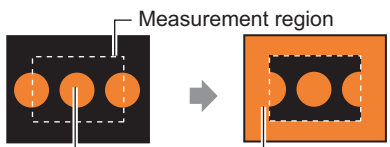
Sort condition :

Sort order : Ascending Descending

Label No. :

Label maximum :

Setting item	Set value [Factory default]	Description
Filling up holes	<ul style="list-style-type: none"> • Checked • [Unchecked] 	<p>Select the process method for the part encircled by the designated color circle.</p> <p>When checked, the hole is processed as having the specified color.</p> <p>Input image Image after filling up hole</p> 

Setting item	Set value [Factory default]	Description
Outside trimming	<ul style="list-style-type: none"> • Checked • [Unchecked] 	<p>This option can be used only when there is a section of the designated color in the measurement region that does not need to be measured.</p> <p>When "Checked" is set, the whole area outside of the measurement region is extracted as having the specified color.</p>  <p>When calculating the position and area of this label</p> <p>The area outside of the measurement region turns the color of the measurement target. Sort mode: Area descending Label No.: 1 With the settings above, the position and area of the middle label will be measured.</p>
Sort condition	<ul style="list-style-type: none"> • [Area] • X • Y • Elliptic major axis • Elliptic minor axis • Elliptic ratio • Rectangle width • Rectangle height • Rectangle X1 • Rectangle Y1 • Perimeter • Circularity • Fit rect major axis • Fit rect minor axis • Fit rect ratio • Inscribed circle X • Inscribed circle Y • Inscribed circle R • Circum. circle X • Circum. circle Y • Circum. circle R • Number of holes 	<p>Specify the conditions by which label number is re-assigned.</p> <p>When sorting referencing the X and Y coordinates, the upper left is the origin.</p>
Sort order	<ul style="list-style-type: none"> • Ascending • [Descending] 	<p>Set the direction for sorting.</p> <p>Ascending: Numbers are assigned from smaller values to larger. Descending: Numbers are assigned from larger values to smaller.</p>
Label No.	FZ5-L Series / FZ5-600 Series: 0 to 2499 [0] FH Series / FZ5-800 Series / FZ5-1100 Series / FZ5-1200 Series: 0 to 9998 [0]	Set the label number for the data to be output.
Label maximum	FZ5-L Series / FZ5-600 Series: 1 to 2500 [2500] FH Series / FZ5-800 Series / FZ5-1100 Series / FZ5-1200 Series: 1 to 9999 [2500]	Set the maximum number of labels to be output.

3 If necessary, in the "Display setting" area, set up display settings for the images displayed in the Image Display area.

4 Set the extraction conditions.

Setting item	Set value [Factory default]	Description
Extraction condition	<ul style="list-style-type: none"> • [Not selected] • Area • Gravity X • Gravity Y • Elliptic major axis • Elliptic minor axis • Elliptic ratio • Rectangle width • Rectangle height • Rectangle X1 • Rectangle Y1 • Perimeter • Circularity • Fit rect major axis • Fit rect minor axis • Inscribed circle R • Circum. circle R • Number of holes 	Set the extraction conditions.
Extraction condition setting	<ul style="list-style-type: none"> • [AND] • OR 	Set the "Extraction conditions". AND: When all the set "Extraction conditions" are fulfilled. OR: When any of the set "Extraction conditions" is fulfilled.

5 When the setting has been changed, click [Measurement] in the "Detail" area to verify whether measurements can be made correctly.

Test measurement of this item.

Measurement

Judgement Conditions (Labeling)

1 In the Item Tab area, click [Judgement].

2 If necessary, specify a value for each item.

To set feature quantities 4-7, click the [Feature data 4-7] button.

Setting item	Set value [Factory default]	Description
Judgement condition		
<ul style="list-style-type: none"> • [None] • Number of labels • Total area • Area • Gravity X • Gravity Y • Elliptic axis angle • Elliptic major axis • Elliptic minor axis • Elliptic ratio • Rectangle width • Rectangle height • Rectangle X1 • Rectangle Y1 • Perimeter • Circularity • Fit rect major axis • Fit rect minor axis • Fit rect ratio • Inscribed circle X • Inscribed circle Y • Inscribed circle R • Circum. circle X • Circum. circle Y • Circum. circle R • Number of holes 	0.000 to 9999999.999	Set up the judgement condition.

3 If necessary, in the "Display setting" area, set up display settings for the images displayed in the Image Display area.

Output Parameters (Labeling)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

1 Click [Output parameter] in the Item Tab area.

2 Specify each of the following items.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none">• [After scroll]• Before scroll	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none">• [OFF]• ON	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none">• [ON]• OFF	Enables choosing whether or not the judgment results of this processing unit is reflected in the scene overall judgment.

Key Points for Test Measurement and Adjustment (Labeling)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Number of labels	Number of labels
Area	Area
Gravity X	Gravity X
Gravity Y	Gravity Y

The image specified in the Sub-image number in image display setting is displayed in the Image Display area.

Sub image number.	Explanation of image to be displayed
0	Measurement image
1	Extracted image

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

For color cameras:

Parameter to be adjusted	Remedy
Color	Click the area whose color will be sampled and the area whose color will not be sampled. The setup should be such that two stable sections of hue, saturation and brightness are formed.

For monochrome cameras:

Parameter to be adjusted	Remedy
Binary	Adjust the binary level.

Measurement Results for Which Output Is Possible (Labeling)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Number of labels	L	Number of labels
Total area	TAR	Total area
Area	AR	Area
Gravity X	X	Center of gravity X coordinate
Gravity Y	Y	Center of gravity Y coordinate
Reference area	SA	Reference area
Reference X	SX	Reference position X coordinate
Reference Y	SY	Reference position Y coordinate
Feature quantity 0 to 7	FDA to FDH	Measurement value of Feature data which is selected in Judgement condition.
Feature quantity 0 to 7 [0]	FDA0 to FDH0	Measurement date of feature quantity

Measurement items	Character string	Description
Feature quantity 0 to 7 [1]	FDA1 to FDH1	Measurement date of feature quantity
Feature quantity 0 to 7 [2]	FDA2 to FDH2	Measurement date of feature quantity
•	•	•
•	•	•
•	•	•
Feature quantity 0 to 7 [99]	FDA99 to FDH99	Measurement date of feature quantity

External Reference Tables (Labeling)

No.	Data name	Set/Get	Data range
0	Judge	Get	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
5	Number of labels	Get	0 to 2500 (For FZ5-3xx, FZ5-6xx) 0 to 9999 (For FH-1xxx, FH-3xxx, FZ5-8xx, FZ5-11xx, FZ5-12xx)
6	Area	Get	0 to 9999999999.9999
7	Gravity X	Get	-99999.9999 to 99999.9999
8	Gravity Y	Get	-99999.9999 to 99999.9999
9	Reference area	Get	0 to 9999999999.9999
10	Reference X ^{*1}	Get	-99999.9999 to 99999.9999
11	Reference Y ^{*1}	Get	-99999.9999 to 99999.9999
50 + N (N=0 to 7)	Feature data N	Get	-9999999999.9999 to 9999999999.9999
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Max. color difference	Set/Get	0 to 359
121	Min. color difference	Set/Get	0 to 359
122	Max. saturation	Set/Get	0 to 255
123	Min. saturation	Set/Get	0 to 255
124	Max. brightness	Set/Get	0 to 255
125	Min. brightness	Set/Get	0 to 255
126	Extract image	Set/Get	0: OFF 1: ON
127	Background color	Set/Get	0: Black 1: White 2: Red 3: Green 4: Blue
128	Reference area	Set/Get	0 to 9999999999
129	Reference X ^{*2}	Set/Get	0 to 99999.9999

No.	Data name	Set/Get	Data range
130	Reference Y ²	Set/Get	0 to 99999.9999
131	Color inv. (reverse for monochrome)	Set/Get	0: OFF 1: ON
132	Filling up holes	Set/Get	0: OFF 1: ON
133	Outside trimming	Set/Get	0: OFF 1: ON
134	Upper limit of the object area range	Set/Get	0 to 999999999
135	Lower limit of the object area range	Set/Get	0 to 999999999
136	Sort condition	Set/Get	0: Area ascending 1: Area descending 2: X-coordinate ascending 3: X-coordinate descending 4: Y-coordinate ascending 5: Y-coordinate descending 6: Elliptic major axis ascending 7: Elliptic major axis descending 8: Elliptic minor axis ascending 9: Elliptic minor axis descending 10: Elliptic ratio ascending 11: Elliptic ratio descending 12: Rectangle width ascending 13: Rectangle width descending 14: Rectangle height ascending 15: Rectangle height descending 16: Rectangle X1 ascending 17: Rectangle X1 descending 18: Rectangle Y1 ascending 19: Rectangle Y1 descending 20: Perimeter ascending 21: Perimeter descending 22: Circularity ascending 23: Circularity descending 24: Fit rect major axis ascending 25: Fit rect major axis descending 26: Fit rect minor axis ascending 27: Fit rect minor axis descending 28: Fit rect ratio ascending 29: Fit rect ratio descending 30: Inscribed circle X ascending 31: Inscribed circle X descending 32: Inscribed circle Y ascending 33: Inscribed circle Y descending 34: Inscribed circle R ascending 35: Inscribed circle R descending 36: Circum. circle X ascending 37: Circum. circle X descending 38: Circum. circle Y ascending 39: Circum. circle Y descending 40: Circum. circle R ascending 41: Circum. circle R descending 42: Number of holes ascending 43: Number of holes descending

No.	Data name	Set/Get	Data range
137	Label No.	Set/Get	0 to 2499 (For FZ5-3xx, FZ5-6xx) 0 to 9998 (For FH-1xxx, FH-3xxx, FZ5-8xx, FZ5-11xx, FZ5-12xx)
138	Upper limit of the number of labels	Set/Get	0 to 2500 (For FZ5-3xx, FZ5-6xx) 0 to 9999 (For FH-1xxx, FH-3xxx, FZ5-8xx, FZ5-11xx, FZ5-12xx)
139	Lower limit of the number of labels	Set/Get	0 to 2500 (For FZ5-3xx, FZ5-6xx) 0 to 9999 (For FH-1xxx, FH-3xxx, FZ5-8xx, FZ5-11xx, FZ5-12xx)
140	Upper limit of the area	Set/Get	0 to 999999999.9999
141	Lower limit of the area	Set/Get	0 to 999999999.9999
142	Upper limit of the gravity X	Set/Get	-99999.9999 to 99999.9999
143	Lower limit of the gravity X	Set/Get	-99999.9999 to 99999.9999
144	Upper limit of the gravity Y	Set/Get	-99999.9999 to 99999.9999
145	Lower limit of the gravity Y	Set/Get	-99999.9999 to 99999.9999
146	Upper limit of the binary level (for monochrome cameras only)	Set/Get	0 to 255
147	Lower limit of the binary level (for monochrome cameras only)	Set/Get	0 to 255
148	Binary image (for monochrome cameras only)	Set/Get	0: OFF 1: ON
149	Image kind	Set/Get	0: Measurement image 1: All color image 2: Selection color image 3: Binary image
150	Multiple selections	Set/Get	0: Multiple selections disabled 1: Multiple selections enabled
154	Label maximum	Set/Get	1 to 9999
$160 + N^{*3} \times 10$	Flag N^{*3} used for registered color	Set/Get	0: Not used 1: Used
$161 + N^{*3} \times 10$	Flag N^{*3} for registered color OR/NOT	Set/Get	0: OR 1: NOT
$162 + N^{*3} \times 10$	Register the max. color hue N^{*3}	Set/Get	0 to 359
$163 + N^{*3} \times 10$	Register the min. color hue N^{*3}	Set/Get	0 to 359
$164 + N^{*3} \times 10$	Register the max. color saturation N^{*3}	Set/Get	0 to 255
$165 + N^{*3} \times 10$	Register the min. color saturation N^{*3}	Set/Get	0 to 255
$166 + N^{*3} \times 10$	Register the max. color brightness N^{*3}	Set/Get	0 to 255
$167 + N^{*3} \times 10$	Register the min. color brightness N^{*3}	Set/Get	0 to 255

No.	Data name	Set/Get	Data range
168 + N ^{*3} × 10	Background color N ^{*3}	Set/Get	0: Black 1 : White 2: Red 3: Green 4: Blue
301	Setting unit of reference coordinate	Set/Get	-1 to 9999
302	Setting type of reference coordinate	Set/Get	0: Numerical 1: Unit
303	Use point coordinate before scroll	Set/Get	0: Not use 1: Use
304	Position X before scroll	Set/Get	-99999.9999 to 99999.9999
305	Position Y before scroll	Set/Get	-99999.9999 to 99999.9999
311	Region reverse	Set/Get	0: Not reverse 1: Reverse
312	Dilate erosion level	Set/Get	-10 to 10
313	Static mask type	Set/Get	0: Region extract 1: Region of image reference
314	Static mask unit reference no	Set/Get	-1 to 9999
315	Static mask image no	Set/Get	0 to 99
316	Dynamic mask unit reference no	Set/Get	-1 to 9999
317	Dynamic mask image no	Set/Get	0 to 99
318	Mask type	Set/Get	0: Static mask 1: Dynamic mask
319	Display image type	Set/Get	0: Measure image 1: Mask binary image 2: Mask and image
324	Is mask	Set/Get	0: OFF 1: ON
325	Mask region display color	Set/Get	0: Black 1: White 2: Red 3: Green 4: Blue
501 + N ^{*3} × 10	Extraction condition N ^{*3}	Set/Get	0: OFF 1: Area 2: Gravity X 3: Gravity Y 4: Elliptical approximate major axis 5: Elliptical approximate minor axis 6: Ratio for flat approximate ellipse 7: Width of circumscribed rectangle 8: Height of circumscribed rectangle 9: Rectangle X1 10: Rectangle Y1
503 + N ^{*3} × 10	Extraction condition upper limit N ^{*3}	Set/Get	-999999999.9999 to 999999999.9999
504 + N ^{*3} × 10	Extraction condition lower limit N ^{*3}	Set/Get	-999999999.9999 to 999999999.9999

No.	Data name	Set/Get	Data range
600 + N ⁴ × 10	Judgement condition N ⁴	Set/Get	0: OFF 1: Number of labels 2: Total area 3: Area 4: Gravity X 5: Gravity Y 6: Elliptic axis angle 7: Elliptical approximate major axis 8: Elliptical approximate minor axis 9: Ratio for flat approximate ellipse 10: Width of circumscribed rectangle 11: Height of circumscribed rectangle 12: Upper left X coordinate of circumscribed rectangle 13: Upper left Y coordinate of circumscribed rectangle
601 + N ⁴ × 10	Judgement condition display flag N ⁴	Set/Get	0: OR 1: NOT
602 + N ⁴ × 10	Judgement condition upper limit N ⁴	Set/Get	-999999999.9999 to 999999999.9999
603 + N ⁴ × 10	Judgement condition lower limit N ⁴	Set/Get	-999999999.9999 to 999999999.9999
1000 + N ⁵	Feature data	Set/Get	-999,999,999.9999 to +999,999,999.9999
1100 + N ⁵	Feature data	Set/Get	-999,999,999.9999 to +999,999,999.9999
1200 + N ⁵	Feature data	Set/Get	-999,999,999.9999 to +999,999,999.9999
1300 + N ⁵	Feature data	Set/Get	-999,999,999.9999 to +999,999,999.9999
1400 + N ⁵	Feature data	Set/Get	-999,999,999.9999 to +999,999,999.9999
1500 + N ⁵	Feature data	Set/Get	-999,999,999.9999 to +999,999,999.9999
1600 + N ⁵	Feature data	Set/Get	-999,999,999.9999 to +999,999,999.9999
1700 + N ⁵	Feature data	Set/Get	-999,999,999.9999 to +999,999,999.9999
6002	Format	Set/Get	1: monochrome camera 2: color camera

- *1: The reference coordinates based on the selection in the Method area of the [Ref.setting] tab can be Get only.
- *2: The reference coordinates based on the selection of Numerical in the Method area of the [Ref.setting] tab can be Set/Get.
- *3: N = 0 - 2 (Extraction condition 0 to 2)
- *4: N = 0 - 7 (Judgement condition 0 to 7)
- *5: N = 0 - 99

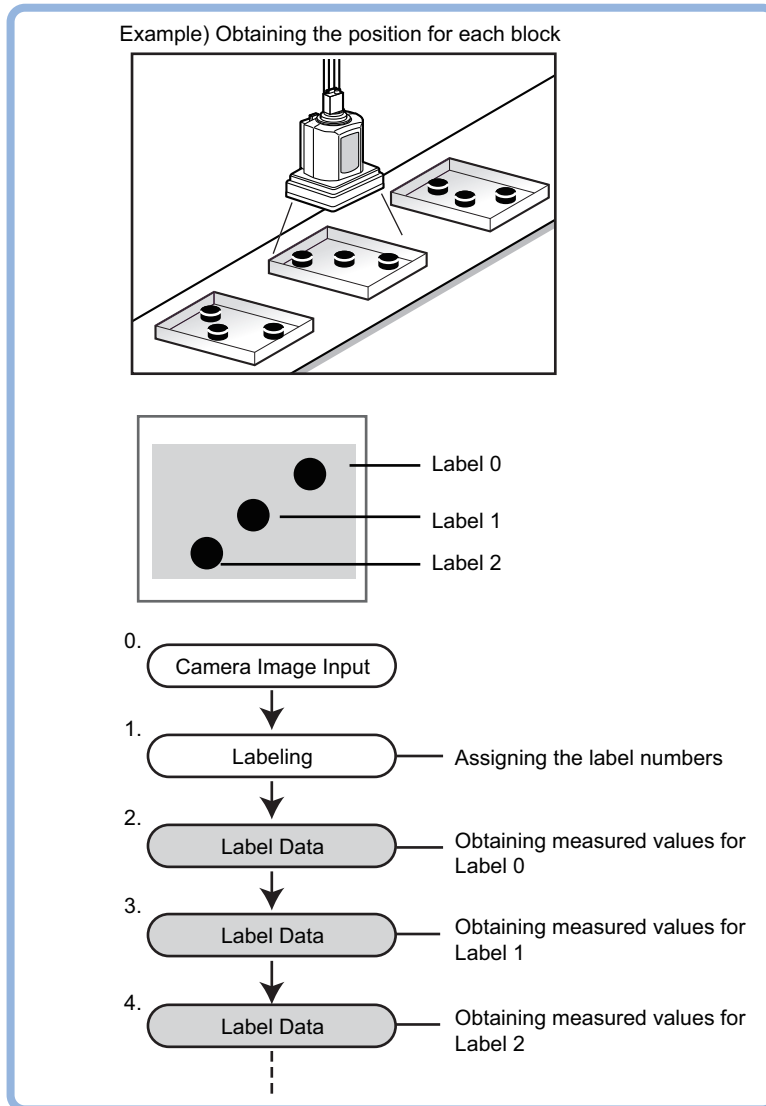
Label Data

You can specify a desired label number and obtain measurement values for that label stored by other processing units. The processing items that can be set up as reference objects are the following items that perform the labeling processing.

- Labeling

Used in the Following Case

- Label position acquisition



Important

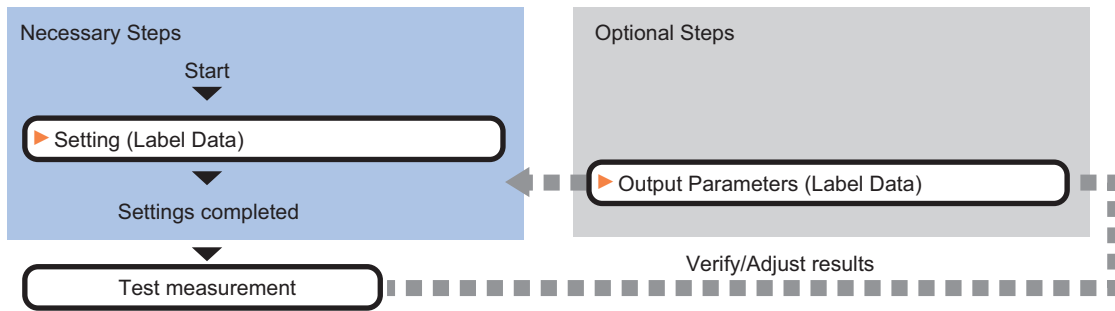
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Note

- Do not insert the following processing items between Label Data and Labeling units.
 - Camera Image Input
 - Camera Switching
 - Position Compensation
 - Color Gray Filter
 - Filtering

Settings Flow (Label Data)

Set up the label data with the following steps.



List of Label Data Items

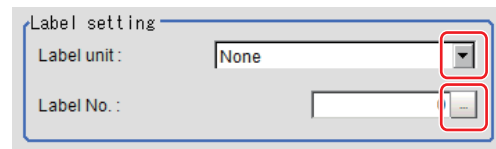
Item name	Description
Setting	Specify the unit number and label number of the processing unit that is designated as the reference object. In addition, specify the judgement conditions for measurement results. Specify the upper and lower limit values for the area and the gravity center X/Y. Reference: ▶ Setting (Label Data) (p.354)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (Label Data) (p.355)

Setting (Label Data)

Specify the unit number and label number of the unit set for labeling reference. In addition, specify the judgement conditions for measurement results.

After changing a setting, check whether measurement can be done properly by performing an actual measurement.

- 1 In the Item Tab area, click [Setting].
- 2 In the "Label setting" area, specify each item.



Setting item	Set value [Factory default]	Description
Label unit	[None] to 9999	Specify the number of the unit for which the reference object processing item has been set up. As an option, display the number of the unit for which the following processing items have been set up. • Labeling
Label No.	[0] to 2499 (For FZ5-3xx, FZ5-6xx) [0] to 9998 (For FH-1xxx, FH-3xxx, FZ5-8xx, FZ5-11xx, FZ5-12xx)	Specify the number of the label for the reference object.

- 3** When the setting has been changed, click [Measure] in the Detail area to verify whether measurements can be made correctly.

Test measuring of this item.

Measure

- 4** Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Setting item	Set value	Description
Area	0 to 999999999.9999	Specify the area to be judged as OK.
Gravity X	-99999.9999 to 99999.9999	Specify the range of X-axis shifting that is judged to be OK.
Gravity Y	-99999.9999 to 99999.9999	Specify the range of Y-axis shifting that is judged to be OK.

Output Parameters (Label Data)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- 1** Click [Output parameter] in the Item Tab area.

- 2** Specify each of the following items.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> [After scroll] Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none"> [OFF] ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> [ON] OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Test Measurement (Label Data)

The following contents are displayed as text in the "Detail result" area.

Displayed items	Description
Judge	Judgement result
Area	Area
Gravity X	Gravity X
Gravity Y	Gravity Y

Measurement Results for Which Output Is Possible (Label Data)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Label No.	LN	Label No.
Area	AR	Area
Gravity X-coordinate	X	Center of gravity X position
Gravity Y-coordinate	Y	Center of gravity Y position

External Reference Tables (Label data)

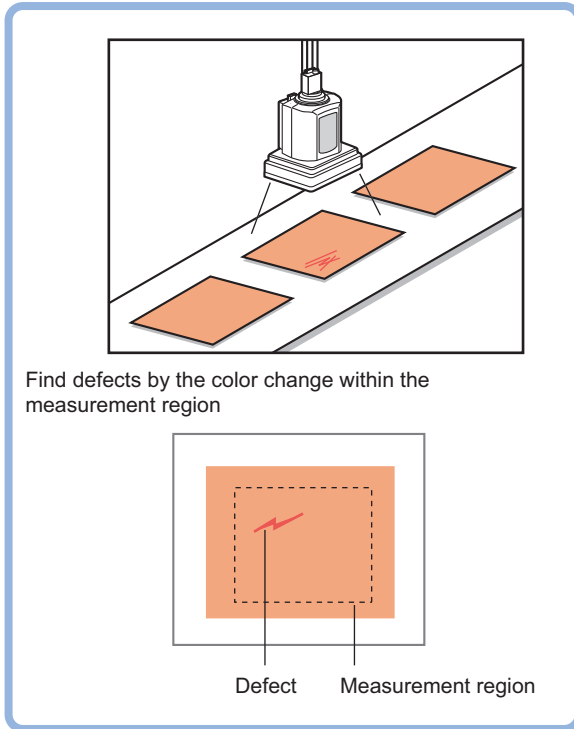
No.	Data name	Set/Get	Data range
0	Judge	Get	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Label No.	Get	0 to 2499 (For FZ5-3xx, FZ5-6xx) 0 to 9998 (For FH-1xxx, FH-3xxx, FZ5-8xx, FZ5-11xx, FZ5-12xx)
6	Area	Get	0 to 999999999.9999
7	Gravity X	Get	-99999.9999 to 99999.9999
8	Gravity Y	Get	-99999.9999 to 99999.9999
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Label unit	Set/Get	-1: None 0 to 9999
121	Label No.	Set/Get	0 to 2499 (For FZ5-3xx, FZ5-6xx) 0 to 9998 (For FH-1xxx, FH-3xxx, FZ5-8xx, FZ5-11xx, FZ5-12xx)
122	Upper limit of the area	Set/Get	0 to 999999999.9999
123	Lower limit of the area	Set/Get	0 to 999999999.9999
124	Upper limit of gravity X	Set/Get	-99999.9999 to 99999.9999
125	Lower limit of gravity X	Set/Get	-99999.9999 to 99999.9999
126	Upper limit of gravity Y	Set/Get	-99999.9999 to 99999.9999
127	Lower limit of gravity Y	Set/Get	-99999.9999 to 99999.9999

Defect

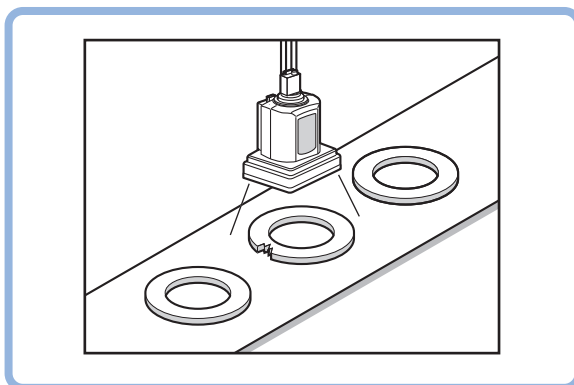
Detect defects and contamination using color variation within the measurement region. This is real color processing, so even if defect and contamination colors change or the background color changes, stable inspection is possible.

Used in the Following Case

- Detecting defects, contaminations and spots on plain measurement objects



- Measure appearance defects and defects of parts



Important

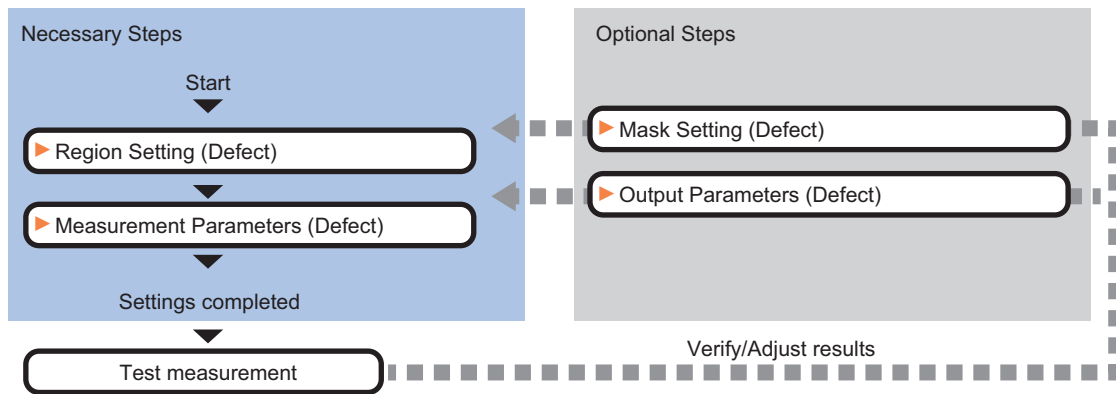
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Note

- With Defect, defects and contamination on patterns and characters can not be detected.

Settings Flow (Defect)

Make the defect/contamination settings with the following flow.



List of Defect Items

Item name	Description
Region setting	This item is used to set up the measurement area. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. Reference: ▶ Region Setting (Defect) (p.359)
Mask setting	Set it when masking a region. The measurement result of another processing item can also be used for masking. Reference: ▶ Mask Setting (Defect) (p.360)
Measurement	This item specifies the judgement condition for measurement results. Measurement parameters can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used. Reference: ▶ Measurement Parameters (Defect) (p.363)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (Defect) (p.365)

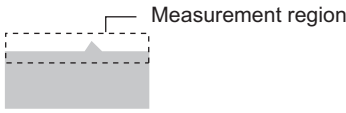
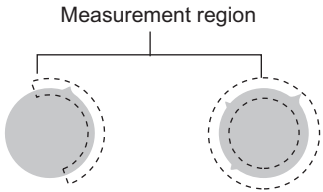
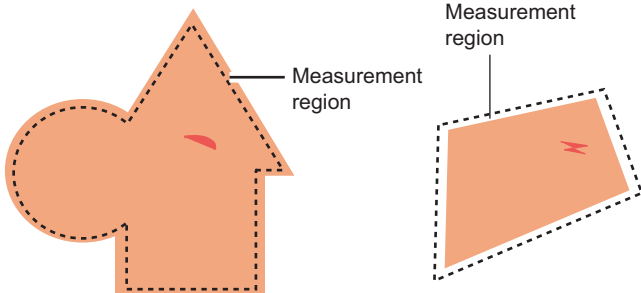
Region Setting (Defect)

This item is used to set up the measurement area.

Use a rectangle, wide line, ellipse (circle), wide circle, wide arc or polygon to specify a measurement region for [Defect]. Up to 8 figures can be drawn.

Important

A mask cannot be made with only one region specified using Wide line, Wide circle, or Arc, as the figure.

PT	Description
Wide line	<p>Selected when detecting defects and burrs of the measurement objects.</p> 
Wide circle, wide arc	<p>Selected when detecting defects and burrs of the circle measurement objects.</p> 
Rectangle, ellipse (circle), polygon	<p>Selected when detecting the overall defects of specified zones and measurement objects.</p> 

- 1** In the Item Tab area, click [Region setting].
- 2** Use the Drawing tools to specify the measurement region.
Up to 8 figures can be combined.
- 3** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

Mask Setting (Defect)

Mask the measurement region when measuring it.

There are two types of masks, namely, a static mask that sets the mask region independent of measurement and a dynamic mask that uses images generated in another unit for each measurement.

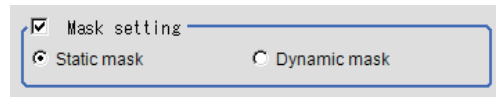
Important

A mask cannot be made with only one region specified using Wide line, Wide circle, or Arc, as the figure.

Creating a static mask

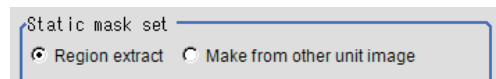
A static mask can be created manually or from an image of another unit.

- 1 In the Mask setting area, select "Static mask".



Generating a mask manually

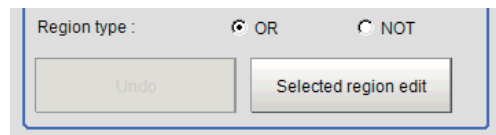
- 1 In the Static mask set area, select "Region extract".



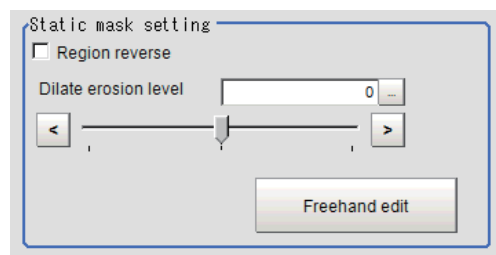
- 2 Select the selection region type OR or NOT and drag an image directly.

A region is created along successive similar colors from the selected place. It is not masked if the selection region type is OR. It is masked if the selection region type is NOT.

To deselect a selected region, click [Undo].
To edit a region selected with OR/NOT, click [Selected region edit].



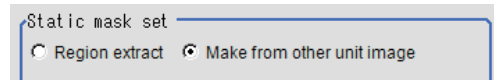
- 3 Adjust the mask created in the Static mask setting area.



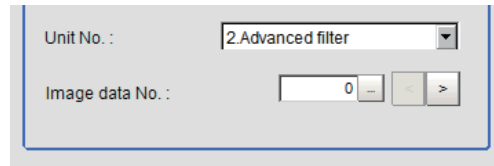
Setting item	Setting value [Factory default]	Description
Region reverse	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check to revert the created mask region.
Dilate erosion level	-10 to 10 [0]	Perform fine adjustment on the mask region using expansions/shrinkage. The region is expanded if a positive value is set. The region is shrunk if a negative value is set.

Creating a static mask from an image of another unit

- 1 In the Static mask set area, select "Make from other unit image".



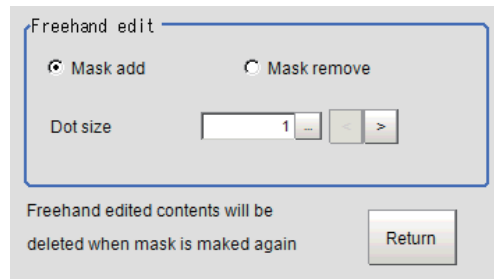
- 2 Set the unit number and image data number.



Setting item	Setting value [Factory default]	Description
Unit No.	-	Specify the number of the unit whose image will be referenced. The reference unit should be able to output binarized images. For example, select a labeling filter processing image for advanced filtering.
Image data No.	0 to 3 [0]	If the unit supports advanced filtering, numbers 0 to 3 can be set. Otherwise, it is fixed to 0.

Performing fine adjustment on a static mask

- 1 To perform fine adjustment on a mask region, click [Freehand edit] in the Static mask setting area.



Setting item	Setting value [Factory default]	Description
Freehand edit	<ul style="list-style-type: none"> • [Mask add] • Mask remove 	Select a process performed using the free hand edit.
Dot size	1 to 20 [1]	Set the size of dots used when drawing images on the screen.

- 2 Click [Return] to exit the free hand edit.

Clearing the static mask setting

To clear the static mask setting, click [Clear].

Creating a dynamic mask

- 1 In the Mask setting area, select "Dynamic mask".

- 2 Set the unit number and image data number in the Unit reference area.

Setting item	Setting value [Factory default]	Description
Unit No.	-	Set the number of the unit being referred to for the mask region. The reference unit should be able to output binarized images. For example, select a labeling filter processing image for advanced filtering.
Image data No.	0 to 3 [0]	If the unit supports advanced filtering, numbers 0 to 3 can be set. Otherwise, it is fixed to 0.

Setting display

Perform the display setting if required.

Setting item	Setting value [Factory default]	Description
Image type	<ul style="list-style-type: none"> • Measure image • Mask binary image • [Mask and image] 	Select the type of an image to be displayed. Measure image: Measured image Mask binary image: Binarized image for masking Mask and image: Post-masking image
Mask region color	<ul style="list-style-type: none"> • [Black] • White • Red • Green • Blue 	Select the display color of the mask region. A part of color which is specified in [Mask region color] is not measured.

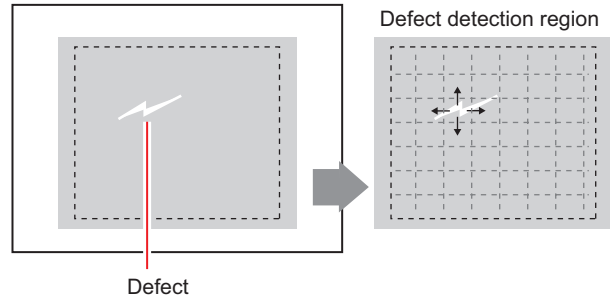
Measurement Parameters (Defect)

This item specifies the judgement condition for measurement results. Measurement parameters can be changed as needed to address unstable measurement results or to increase the processing speed.

Note

Defect detection mechanism

- After measurement region is drawn, a rectangle (defect detection region) is automatically formed in this region. While moving the defect detection region around, calculate the RGB color averages at each location and find the defect detection difference with surrounding defects. This difference is called the defect level. Calculate the defect level for all defect detection areas. If the maximum value exceeds the judgement value, it is judged that there are defects in the measurement region.



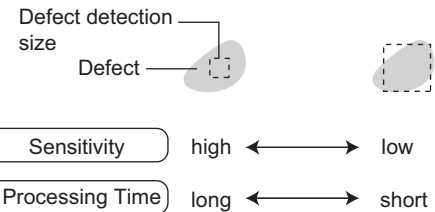
2

Inspecting and Measuring

- In the Item Tab area, click [Measurement].
- Set the value of each item in the "Defect size" area.

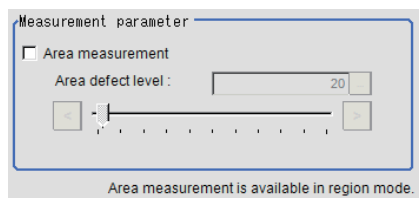


Setting item	Set value [Factory default]	Description
Defect size	<ul style="list-style-type: none"> • 4 • 8 • 12 • 16 • 24 • 32 • 64 [4] to [64]	Specify the upper and lower limits of defect detection size based on the size of scratch or contamination to be detected. A defect detection region is automatically created with the number of pixels for the defects size. The larger the difference between upper and lower limits, the easier to detect defects/contamination of various sizes. For both upper and lower limits, higher values for defect detection size limits leads to weaker detection sensitivity and shorter processing time.

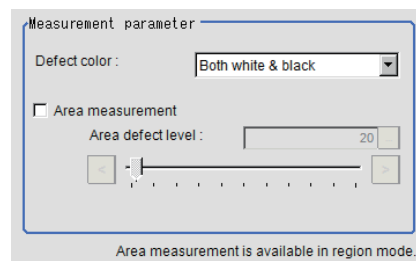


- If necessary, set the value of each item in the "Measurement parameter" area.

For color cameras:



For monochrome cameras:

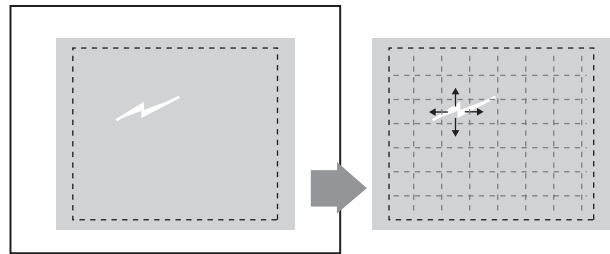


Setting item	Set value [Factory default]	Description
Area measurement	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check when you want to measure the size of defects. This item can divide the high defect detection regions into groups and output the surface and center of gravity coordinates of the group with the largest area. However, when only one region is specified with "Wide line", "Wide circle", or "Arc", area measurement is not possible.
Area defect level	0 to 999 [20]	If you place a check at Area Measurement, set defect level counted in the defect area.
Detect color (for monochrome cameras only)	Black only	Select this value to detect defects that look darker than the background.
	White only	Select this value to detect defects that look lighter than the background.
	[Both white & black]	Select this value when the brightness of defects is not known.

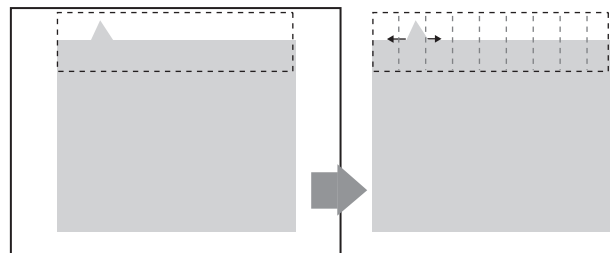
Note

Region inspection mode

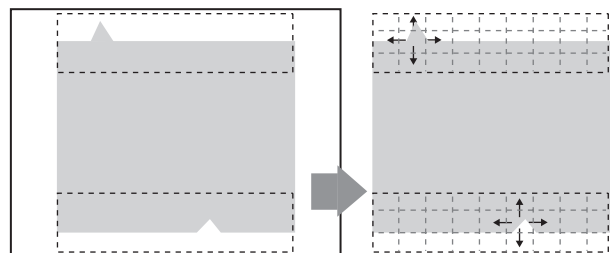
The comparison direction depends on the measurement region shapes and number.
For a rectangle, ellipse or polygon, comparison is with the defect detection regions above, below, left and right. This is called region inspection mode.



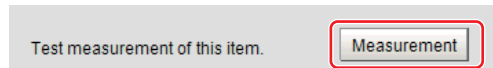
For a wide line, wide arc or wide circle, comparison is only with the two neighboring defect detection regions.



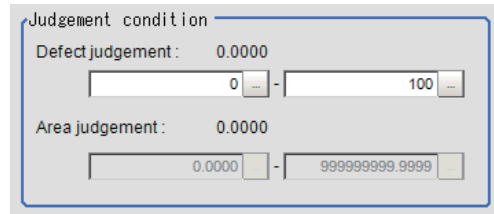
However, even for a wide line, wide arc or wide circle, when two or more figures are drawn, measurement is in region inspection mode.



4 When the setting has been changed, click [Measurement] in the Detail area to verify whether measurements can be made correctly.



5 Set up the judgement condition.



Item	Set value [Factory default]	Description
Defect judgement	0 to 999 [0] to [100]	Specify the range of defect judgement values that are judged to be OK.
Area judgement	0 to 307200 (for a 0.3-megapixel camera) 0 to 1920000 (for a 2-megapixel camera) 0 to 4320000 (for a 5-megapixel camera)	Specify the range of area judgement values that are judged to be OK.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Output Parameters (Defect)

Specifies whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

- Click [Output parameter] in the Item Tab area.
- Choose whether or not to reflect this in the scene overall judgement in "Reflect to overall judgement" area.

Setting item	Set value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> [ON] [OFF] 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Defect)

In the "Detail result" area on the Main screen, you can confirm the following contents in text.

Displayed items	Description
Judge	Judgement result
Defect	Measured defect level
Position X	X Coordinate of measured defect position
Position Y	Y coordinate of measured defect position
Area	The measured maximum defect area
Gravity X	The center of gravity X coordinates of the measured maximum defect area
Gravity Y	The center of gravity Y coordinates of the measured maximum defect area

The image specified in the Sub-image number in image display setting is displayed in the Image Display area.

Sub image number.	Explanation of image to be displayed
0	Measurement image
1	Defect profile [when area measurement is present]

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Noise is detected as defects.

Parameter to be adjusted	Remedy
Measurement	Specify a larger value for "Defect judgement" in the judgement conditions.

Judgement will be NG.

Parameter to be adjusted	Remedy
Measurement	Make the measurement region larger than the lower limit of the defect size. Or make the lower limit of the defect detection size smaller than the measurement region.

When the processing speed is slow

Parameter to be adjusted	Remedy
Measurement	Specify a larger value for the "Defect size".
	Reduce the difference between the upper and lower limits of [Defect size].

Measurement Results for Which Output Is Possible (Defect)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judgement result
Defect	F	Measured defect level
Position of defect	X	X Coordinate of measured defect position
Position of defect	Y	Y coordinate of measured defect position
Defect area	AR	The measured maximum defect area
Defect gravity	GX	The center of gravity X coordinates of the measured maximum defect area
Defect gravity	GY	The center of gravity Y coordinates of the measured maximum defect area

External Reference Tables (Defect)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
5	Defect	Get only	0 to 999
6	Position X	Get only	0 to 99999.9999
7	Position Y	Get only	0 to 99999.9999
8	Defect area	Get only	0 to 999999999.9999
9	Defect gravity X	Get only	0 to 99999.9999
10	Defect gravity Y	Get only	0 to 99999.9999
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Upper limit of defect size	Set/Get	0: 4 1: 8 2: 12 3: 16 4: 24 5: 32 6: 64
121	Lower limit of defect size	Set/Get	0: 4 1: 8 2: 12 3: 16 4: 24 5: 32 6: 64
122	Upper limit of defect judgement	Set/Get	0 to 999
123	Defect color	Set/Get	0: Both 1: White 2: Black
124	Area measurement	Set/Get	0: OFF 1: ON
125	Area meas, LV	Set/Get	0 to 999
126	Upper limit of area judgement	Set/Get	0 to 999999999.9999
127	Lower limit of area judgement	Set/Get	0 to 999999999.9999
128	Lower limit of defect judgement	Set/Get	0 to 999
150	Region reverse	Set/Get	0: Not reverse 1: Reverse
151	Dilate erosion level	Set/Get	-10 to 10
152	Static mask type	Set/Get	0: Region extract 1: Region of image reference

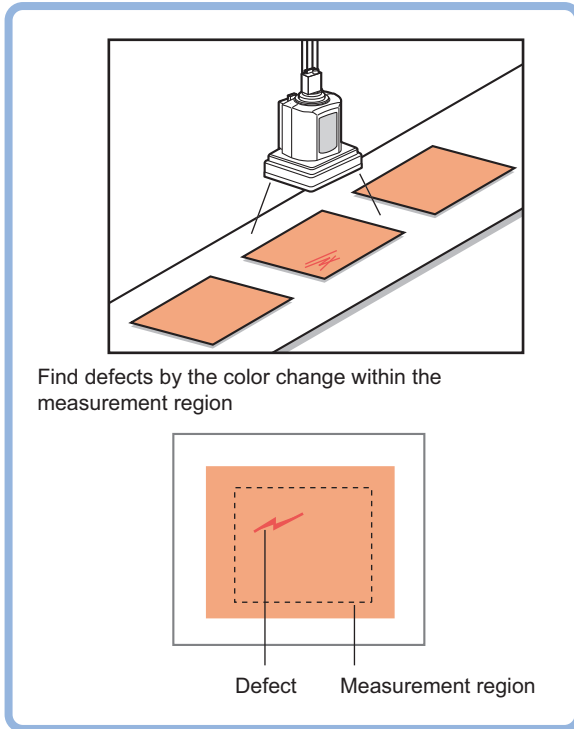
No.	Data name	Set/Get	Data range
153	Static mask unit reference no	Set/Get	-1 to 9999
154	Static mask image no	Set/Get	0 to 99
155	Dynamic mask unit reference no	Set/Get	-1 to 9999
156	Dynamic mask image no	Set/Get	0 to 99
157	Mask type	Set/Get	0: Static mask 1: Dynamic mask
158	Display image type	Set/Get	0: Measure image 1: Mask binary image 2: Mask and image
163	Is mask	Set/Get	0: OFF 1: ON
164	Mask region display color	Set/Get	0: Black 1: White 2: Red 3: Green 4: Blue
6002	Format	Set/Get	1: monochrome camera 2: color camera

Precise Defect

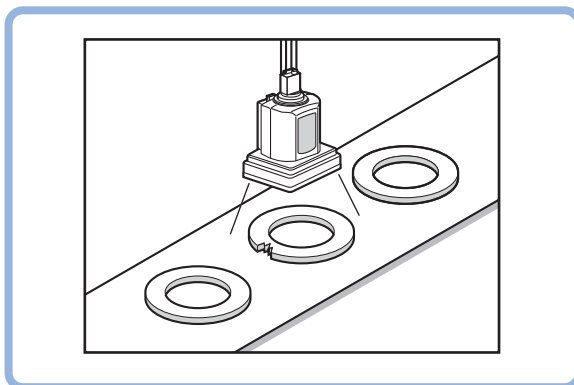
Defects and contamination on plain measurement objects can be detected with high precision by performing differential processing on the image. By changing the size of elements used for detection, comparison intervals, etc., fine customization of speed and precision is possible.

Used in the Following Case

- Detecting defects, contaminations and spots on plain measurement objects



- Measure appearance defects and defects of parts

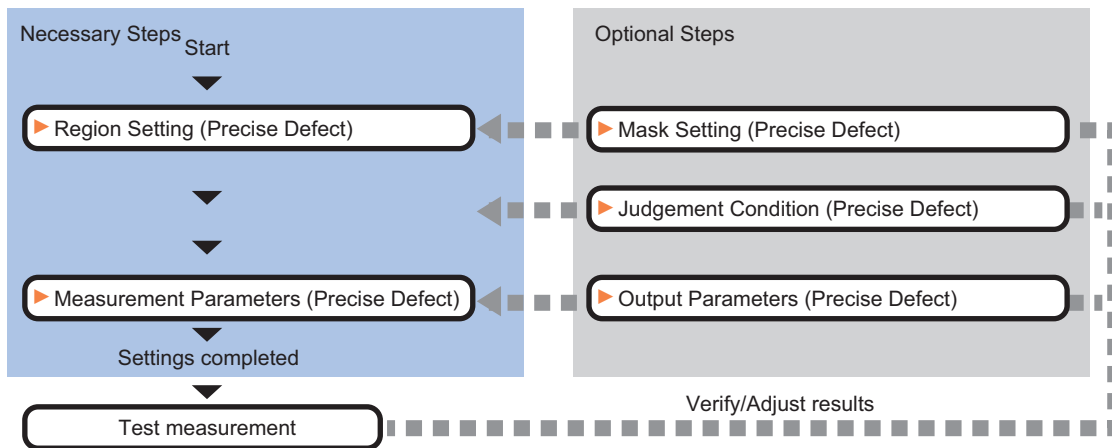


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Precise Defect)

Precise Defect settings are made with the following flow.



List of Precise Defect Items

Item name	Description
Region setting	This item is used to set up the measurement area. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. Reference: ▶ Region Setting (Precise Defect) (p.371)
Mask setting	Set it when masking a region. The measurement result of another processing item can also be used for masking. Reference: ▶ Mask Setting (Precise Defect) (p.372)
Measurement	This item specifies the judgement condition for measurement results. Measurement parameters can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used. Reference: ▶ Measurement Parameters (Precise Defect) (p.374)
Judgement condition	This item can be changed if necessary. Normally, the factory default value will be used. This item specifies the judgement condition for measurement results. Reference: ▶ Judgement Condition (Precise Defect) (p.376)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (Precise Defect) (p.378)

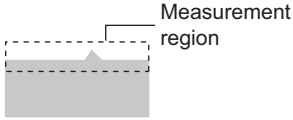
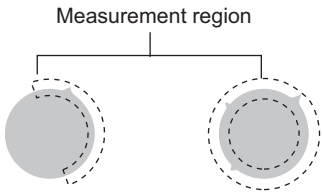
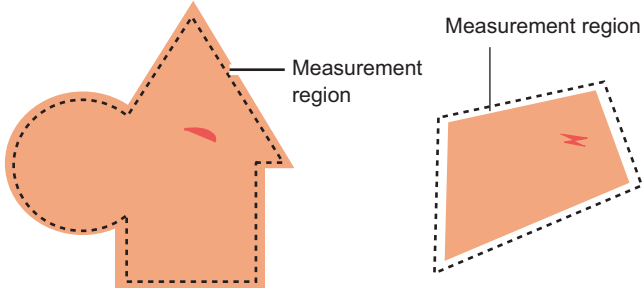
Region Setting (Precise Defect)

This item is used to set up the measurement area.

Use a rectangle, wide line, ellipse (circle), wide circle, wide arc or polygon to specify a measurement region for [Precise Defect]. Up to 8 figures can be drawn.

Important

A mask cannot be made with only one region specified using Wide line, Wide circle, or Arc, as the figure.

PT	Description
Wide line	<p>Selected when detecting defects and burrs of the measurement objects. Measurement can be performed in region mode by checking "Measure in region mode".</p> 
Circumference, Wide arc	<p>Selected when detecting defects and burrs of the circle measurement objects. Measurement can be performed in region mode by checking "Measure in region mode".</p> 
Rectangle, Ellipse (circle), Polygon	<p>Selected when detecting the overall defects of specified zones and measurement objects.</p> 

- 1** In the Item Tab area, click [Region setting].
- 2** Use the Drawing tools to specify the measurement region.
Up to 8 figures can be combined.
- 3** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.
- 4** When performing measurement in region mode for wide line, wide circle or arc in a single figure, check "Area" in the Measure Mode area.



Note

In Precise Defect, the measurement mode depends on the number and type of registered region figures. The method for creating elements differs depending on the measurement mode.
Reference: ▶ Measurement mode (p.375)

Mask Setting (Precise Defect)

Mask the measurement region when measuring it.

There are two types of masks, namely, a static mask that sets the mask region independent of measurement and a dynamic mask that uses images generated in another unit for each measurement.

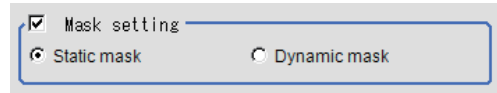
Important

A mask cannot be made with only one region specified using Wide line, Wide circle, or Arc, as the figure.

Creating a static mask

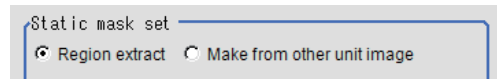
A static mask can be created manually or from an image of another unit.

- 1 In the Mask setting area, select "Static mask".



Generating a mask manually

- 1 In the Static mask set area, select "Region extract".

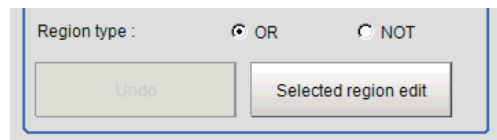


- 2 Select the selection region type OR or NOT and drag an image directly.

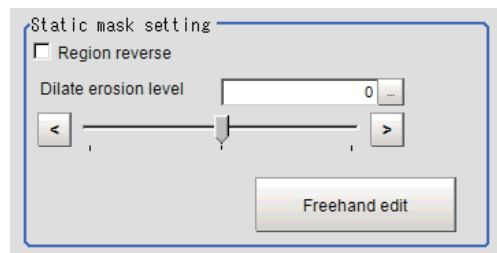
A region is created along successive similar colors from the selected place. It is not masked if the selection region type is OR. It is masked if the selection region type is NOT.

To deselect a selected region, click [Undo].

To edit a region selected with OR/NOT, click [Selected region edit].



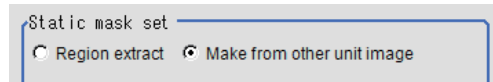
- 3 Adjust the mask created in the Static mask setting area.



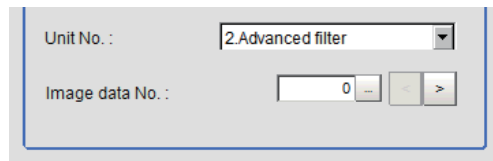
Setting item	Setting value [Factory default]	Description
Region reverse	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check to revert the created mask region.
Dilate erosion level	-10 to 10 [0]	Perform fine adjustment on the mask region using expansions/shrinkage. The region is expanded if a positive value is set. The region is shrunk if a negative value is set.

Creating a static mask from an image of another unit

- 1 In the Static mask set area, select "Make from other unit image".



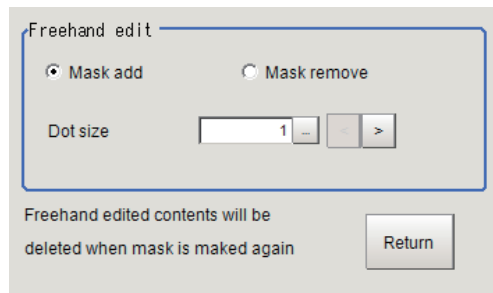
- 2 Set the unit number and image data number.



Setting item	Setting value [Factory default]	Description
Unit No.	-	Specify the number of the unit whose image will be referenced. The reference unit should be able to output binarized images. For example, select a labeling filter processing image for advanced filtering.
Image data No.	0 to 3 [0]	If the unit supports advanced filtering, numbers 0 to 3 can be set. Otherwise, it is fixed to 0.

Performing fine adjustment on a static mask

- 1 To perform fine adjustment on a mask region, click [Freehand edit] in the Static mask setting area.



Setting item	Setting value [Factory default]	Description
Freehand edit	<ul style="list-style-type: none"> • [Mask add] • Mask remove 	Select a process performed using the free hand edit.
Dot size	1 to 20 [1]	Set the size of dots used when drawing images on the screen.

- 2 Click [Return] to exit the free hand edit.

Clearing the static mask setting

To clear the static mask setting, click [Clear].

Creating a dynamic mask

- 1 In the Mask setting area, select "Dynamic mask".



2 Set the unit number and image data number in the Unit area.

Setting item	Setting value [Factory default]	Description
Unit No.	-	Set the number of the unit being referred to for the mask region. The reference unit should be able to output binarized images. For example, select a labeling filter processing image for advanced filtering.
Image data No.	0 to 3 [0]	If the unit supports advanced filtering, numbers 0 to 3 can be set. Otherwise, it is fixed to 0.

Setting display

Perform the display setting if required.

Setting item	Setting value [Factory default]	Description
Image type	<ul style="list-style-type: none"> • Measure image • Mask binary image • [Mask and image] 	Select the type of an image to be displayed. Measure image: Measured image Mask binary image: Binarized image for masking Mask and image: Post-masking image
Mask region color	<ul style="list-style-type: none"> • [Black] • White • Red • Green • Blue 	Select the display color of the mask region. A part of color which is specified in [Mask region color] is not measured.

Measurement Parameters (Precise Defect)

This item specifies the judgement condition for measurement results. Measurement parameters can be changed as needed to address unstable measurement results or to increase the processing speed.

1 In the Item Tab area, click [Measurement].

2 Set the detection parameters.

Setting item	Set value [Factory default]	Description
Size X	4 to 64 [16]	Specify the X-axis size of defects/contamination to be detected. The higher this value, the higher the degree of defects for large defects. Specify in units of pixels.
Size Y	4 to 64 [16]	Specify the Y-axis size of defects/contamination to be detected. The higher this value, the higher the degree of defects for large defects. Specify in units of pixels.
Sampling interval X	1 to 64 [2]	Specify the interval for creating elements along the X axis. The smaller this value, the greater the defect detection performance, but the slower the processing speed. Specify in units of pixels.
Sampling interval Y	1 to 64 [2]	Specify the interval for creating elements along the Y axis. The smaller this value, the greater the defect detection performance, but the slower the processing speed. Specify in units of pixels.
Comparing interval X	1 to 32 [10]	Set the number of neighboring elements compared with when the degree of defect is calculated, For example, if the sampling interval X is set to 4 and the comparing interval X is set to 2, comparison is with separate elements of $4 \times 2 = 8$ pixels along the X axis.
Comparing interval Y	1 to 32 [10]	This sets the number of neighboring elements compared with when the degree of defect is calculated, For example, if the sampling interval Y is set to 4 and the comparing interval Y is set to 2, comparison is with separate elements of $4 \times 2 = 8$ pixels along the Y axis.
Direction	<ul style="list-style-type: none"> • X (circumferential) • Y (radial) • Diagonal 	Set the direction for detecting defects. The smaller the direction setting count, the shorter the processing time.

Note

- Measurement mode

In Precise Defect measurement, the measurement mode depends on the number of registered region figures and their types. The way to make elements depends on the measurement mode. The relationship between the figure and measurement mode is as in the table below.

	Single figure						Multiple figures
	Line	Circumference	Arc	Ellipse	Rectangle	Polygon	
Measurement mode	Line	Wide circle and arc	Wide circle and arc	Region	Region	Region	Region

Line mode:

- The direction parallel to the measurement region straight line is the X axis and the direction perpendicular is the Y axis. The shape of elements is rectangular. The element width and length are the number of pixels specified with the element size X and Y.

Wide circle and arc mode:

- The circumferential direction along the measurement region wide circle (arc) is the X axis and the radial direction is the Y axis. The shape of elements is fan-shaped. If the circumference length of the wide circle (arc) of the measurement region is set to N, the element circumferential direction width is $360 \text{ degrees} \times \frac{\text{element size X}}{N}$. The element radial direction width is the number of pixels specified with the element size Y. The element circumferential direction width is defined as an angle, so the closer the element to the outer circumference, the larger the element.

Region mode:

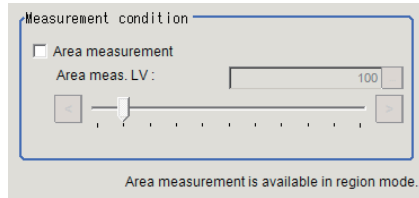
- The direction parallel to the measurement region is the X axis and the direction perpendicular is the Y axis. The shape of elements is rectangular. The element width and length are the number of pixels specified with the element size X and Y.

3 If necessary, set the value of each item in the "Measurement condition" area.

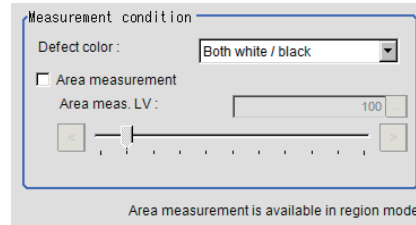
Value input method: Reference: ▶ "Appendixes Basic Knowledge about Operations Inputting Values" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

The "Area meas. LV" can be set also by dragging the slider or by clicking the buttons at the ends of the slider.

For color cameras:



For monochrome cameras:



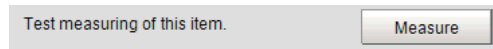
Setting item	Set value [Factory default]	Description
Defect color (for monochrome cameras only)	Black	Select this value when defects look blackish compared to the background.
	White	Select this value when defects look whitish compared to the background.
	[Both white / black]	Select this value when the brightness of defects is not known.
Area measurement	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check when you want to measure the size of defects. This item can divide the high defect detection regions into groups and output the surface and center of gravity coordinates of the group with the largest area. Area measurement is not possible with only one region specified using Wide line, Wide circle, or Arc, as the figure. However, if "Area mode" is checked, Area measurement can be performed with only one of the above figures.
Area meas. LV	0 to 999 [100]	If you place a heck at Area Measurement, set defect level counted in the defect area.

Judgement Condition (Precise Defect)

This item specifies the judgement condition for measurement results.

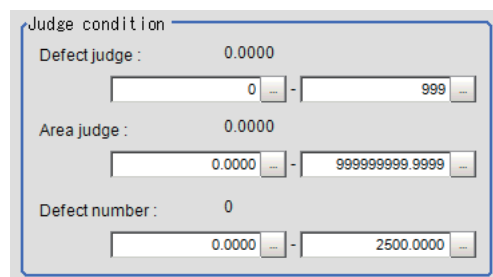
1 In the Item Tab area, click [Judgement condition].

2 When the setting has been changed, click [Measure] in the "Detail" area to verify whether measurements can be made correctly.



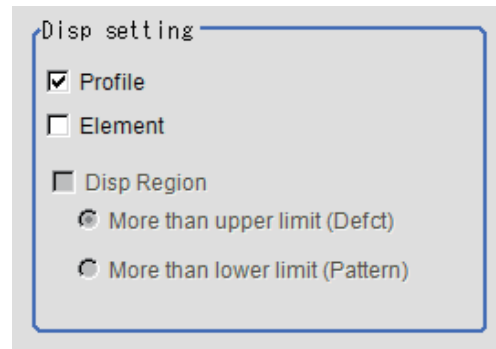
3 Set up the judgement condition.

[Area judge] and [Defect Number] are allowable only when you check the [Area measurement] in Measurement parameter.



Setting item	Setting value [Factory default]	Description
Defect judge	0 to 999	Specify the range of defect judgement values that are judged to be OK.
Area judge	0 to 999,999,999.9999 0 to 307,200 (0.3 megapixel cameras) 0 to 1,920,000 (2 megapixel cameras) 0 to 4,320,000 (5 megapixel cameras)	Specify the range of area judgement values that are judged to be OK.
Defect number	0 to 2,500	Specify the range of the number of defects that are judged to be OK.

4 If necessary, set the display conditions for displayed images.



Setting item	Set value [Factory default]	Description
Profile	<ul style="list-style-type: none"> • [Checked] • Unchecked 	<p>Set the profile display.</p> <p>The maximum degree of defect along the X(circumferential) and Y(radial) is displayed with red lines. If you click in the measurement region on the image area, the profile in the XY directions from this point is displayed with yellow lines.</p>
Element	<ul style="list-style-type: none"> • Checked • [Unchecked] 	<p>Set the comparison element display. Elements are created automatically during measurement. The density is calculated for each element and the position of defects/contamination is detected from the degree of their variation.</p>
Disp Region	<ul style="list-style-type: none"> • [Checked] • Unchecked 	<p>Place a check to display the defect area. If checked, specify More than upper limit (Defct) or More than lower limit (Pattern).</p>

Output Parameters (Precise Defect)

Specifies whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Choose whether or not to reflect this in the scene overall judgement in "Reflect to overall judgement" area.

Setting item	Set value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Precise Defect)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Defect value	Measured defect level
Position X	X Coordinate of measured defect position
Position Y	Y coordinate of measured defect position
Defect Area	The measured maximum defect area
Gravity X	The center of gravity X coordinates of the measured maximum defect area
Gravity Y	The center of gravity Y coordinates of the measured maximum defect area
Defect number	Number of measured defects

The image specified in the Sub-image number in image display setting is displayed in the Image Display area.

Sub image number	Explanation of image to be displayed
0	Measurement image
1	Defect profile [when area measurement is present] If the region display is enabled, the defect area display image specified [when no area measurement].

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Noise is detected as defects.

Parameter to be adjusted	Remedy
Measurement	Specify a larger value for "Defect judge" in the judgement conditions.

Judgement will be NG.

Parameter to be adjusted	Remedy
Measurement	Make the measurement region larger than the value of the element size.

When the processing speed is slow

Parameter to be adjusted	Remedy
Measurement	Specify a larger value for the element creation interval.

Measurement Results for Which Output Is Possible (Precise Defect)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judgement result
Defect	F	Measured defect level
Measurement coordinate X	X	X Coordinate of measured defect position
Measurement coordinate Y	Y	Y coordinate of measured defect position
Defect area	AR	The measured maximum defect area
Gravity X	GX	The center of gravity X coordinates of the measured maximum defect area
Gravity Y	GY	The center of gravity Y coordinates of the measured maximum defect area
Defect number	NM	Number of measured defects

External Reference Tables (Precise Defect)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
5	Defect	Get only	0 to 999
6	Position X	Get only	0 to 999999999.9999
7	Position Y	Get only	0 to 999999999.9999
8	Area	Get only	0 to 999999999.9999
9	Gravity X	Get only	0 to 999999999.9999
10	Gravity Y	Get only	0 to 999999999.9999
11	Defect number	Get only	0 to 2500
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Size X	Set/Get	4 to 64
121	Size Y	Set/Get	4 to 64
122	Sampling interval X	Set/Get	1 to 64
123	Sampling interval Y	Set/Get	1 to 64
124	Comparing interval X	Set/Get	1 to 32
125	Comparing interval Y	Set/Get	1 to 32
126	Detection object color (for monochrome cameras only)	Set/Get	0: Both white/black 1: White 2: Black
127	Defect detection direction X	Set/Get	0: OFF 1: ON
128	Defect detection direction Y	Set/Get	0: OFF 1: ON

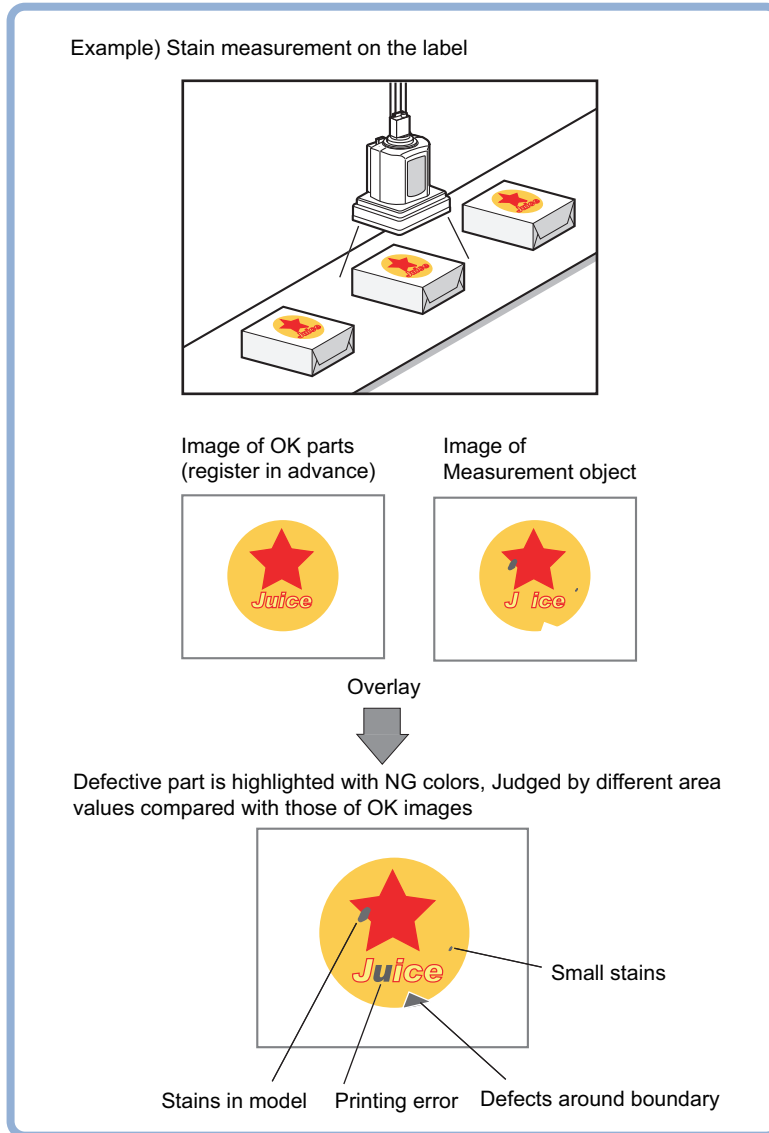
No.	Data name	Set/Get	Data range
129	Inclined defect detection direction	Set/Get	0: OFF 1: ON
130	Upper limit of defect judgement value	Set/Get	0 to 999
131	Area measurement	Set/Get	0: OFF 1: ON
132	Area meas, LV	Set/Get	0 to 999
133	Upper limit of area judgement	Set/Get	0 to 999999999.9999
134	Profile display	Set/Get	0: OFF 1: ON
135	Element display	Set/Get	0: OFF 1: ON
136	Lower limit of area judgement	Set/Get	0 to 999999999.9999
137	Lower limit of defect judgement value	Set/Get	0 to 999
138	Area mode	Set/Get	0: OFF 1: ON
139	Region display	Set/Get	0: OFF 1: ON
140	Defect number Lower Judge	Set/Get	0 to 2500
141	Defect number Upper Judge	Set/Get	0 to 2500
142	Display defect kind	Set/Get	0: More than upper limit (Defect) 1: More than lower limit (Pattern)
150	Region reverse	Set/Get	0: Not reverse 1: Reverse
151	Dilate erosion level	Set/Get	-10 to 10
152	Static mask type	Set/Get	0: Region extract 1: Region of image reference
153	Static mask unit reference no	Set/Get	-1 to 9999
154	Static mask image no	Set/Get	0 to 99
155	Dynamic mask unit reference no	Set/Get	-1 to 9999
156	Dynamic mask image no	Set/Get	0 to 99
157	Mask type	Set/Get	0: Static mask 1: Dynamic mask
158	Display image type	Set/Get	0: Measure image 1: Mask binary image 2: mask and image
163	Is mask	Set/Get	0: OFF 1: ON
164	Mask region display color	Set/Get	0: Black 1: White 2: Red 3: Green 4: Blue

Fine Matching

Differences can be detected in a fast and highly precise way by overlapping registered fine images with input images (matching).

Used in the Following Case

- To precisely detect trivial defects at the edges of text and patterns

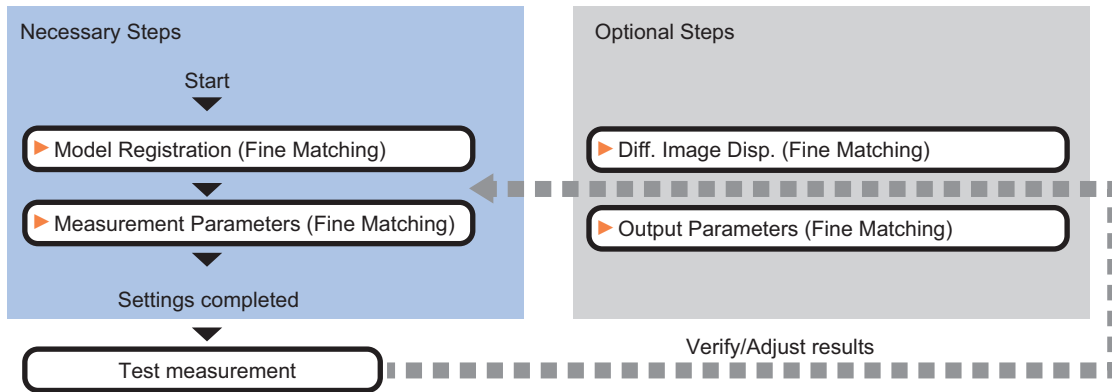


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Fine Matching)

Set up fine matching in the follow steps.

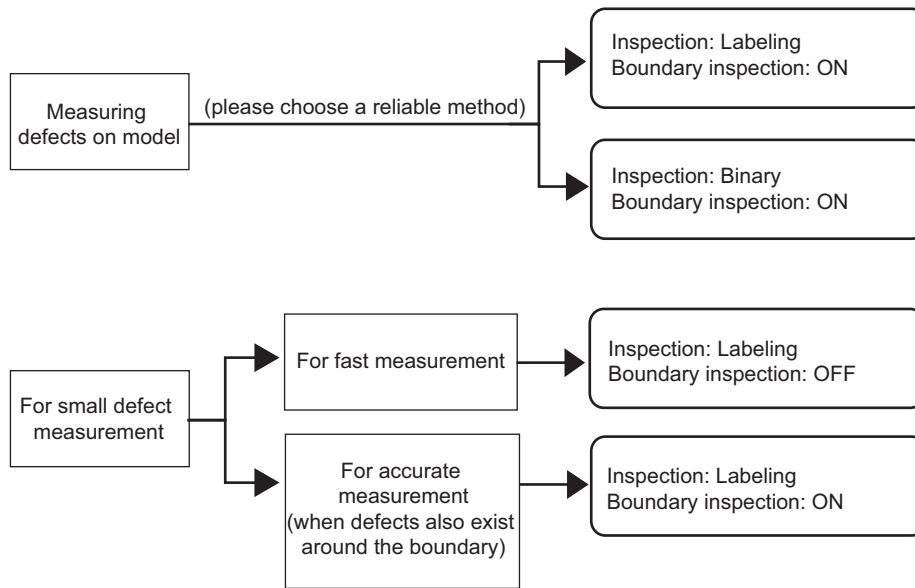


List of Fine Matching Items

Item name	Description
Model register	This item registers the pattern characteristic of the measurement image as a model. Model parameter values can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used. Reference: ▶ Model Registration (Fine Matching) (p.383)
Diff. image disp.	Modify this setting as necessary when defects cannot be detected successfully. This sets the reference grayscale used when calculating differences between the model and the inspected object image. Normally, the factory default value will be used. Reference: ▶ Difference Image Display (Fine Matching) (p.385)
Measurement	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if the X and Y coordinates and the correlation values with the model are OK. Measurement parameters can be changed as needed to address unstable measurement results or to increase the processing speed. Reference: ▶ Measurement Parameters (Fine Matching) (p.387)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (Fine Matching) (p.389)

Note

- Specify [Boundary inspection] in [Model register] and [Inspection] in [Measurement] according to the inspection objectives.



Model Registration (Fine Matching)

Register a fine image as the model. By matching this model with input images, unmatched parts will be detected as defects during inspection.

Note

Ranges that can be registered as models

- The two pixels on the edge of the screen are not registered as a model.
- The registering range will be lower if the images of measurement object are set with Filtering. When you set the image reading range using a camera with the partial scanning function, the range is also limited. Reference: ▶ Filtering (p.515)
- When figures are drawn overlapping, the settings for objects set up afterward are enabled. Reference: ▶ "Appendixes Setting Figures" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

1 In the Item Tab area, click [Model register].

When setting a new model, you do not have to click [Model register].

2 Use the Drawing tools to specify the model registration range.

3 Click [OK] in the Figure setting area.

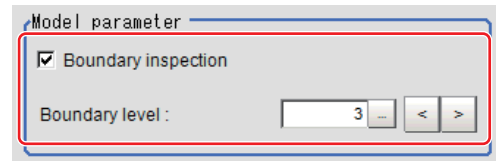
- [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.
- The model is registered.

Changing Model Parameters

The range can be changed as needed to address unstable measurement results. Normally, the factory default value will be used.

After changing a setting, check whether measurement can be done properly by performing an actual measurement.

- 1 In the "Model parameter" area, specify a value for each item.



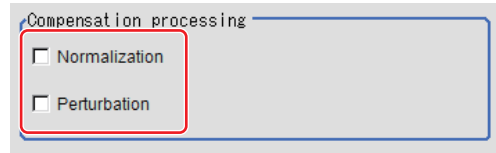
Setting item	Set value [Factory default]	Description
Boundary inspection	[Checked]	Defects around boundaries with color changes can also be detected. The edges similar to those in the model image are not regarded as defects. Check this option when inspecting defects around boundaries, such as chips and burrs. Defects along a direction different from the model image profile are detected in the range of pixels of profile \pm boundary level.
	Unchecked	<p>Boundary areas are excluded from the inspection. This can prevent matching mistakes due to positional deviation of measurement objects, but defects around boundaries cannot be detected. "Boundary level" can be used to specify how many pixels around boundaries should be excluded from the inspection.</p> <div style="text-align: center;"> </div> <p>Measurement image</p> <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 10px;"> </div> <div> <p>If the measurement object moves up slightly, its difference with the model will be detected as the edge part.</p> </div> </div> <div style="display: flex; align-items: flex-start; margin-top: 10px;"> <div style="margin-right: 10px;"> </div> <div> <p>When setting Edge Measurement to "Disabled", the range of the "Model edge \pm Boundary level" will be outside of the measurement object. Example) When "Edge level" is 3, the range with a width of 6 pixels will not be outside of the measurement object.</p> </div> </div>
Boundary level	0 to 9 [3]	Select the degree of assimilation of variations around boundaries. Depending on the "Boundary inspection" value, the meaning is different.




Difference Image Display (Fine Matching)

This sets the reference grayscale used when calculating differences between the model and the inspected object image. Modify this setting as necessary when defects cannot be detected successfully. Normally, the factory default value will be used.

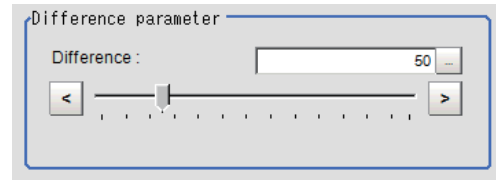
After changing a setting, check whether measurement can be done properly by performing an actual measurement.



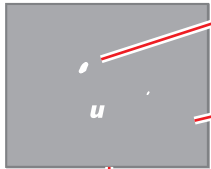
- 1 In the Item Tab area, click [Diff. image disp.].
- 2 In the "Compensation processing" area, select a value for each item.



Setting item	Set value [Factory default]	Description
Normalization	<ul style="list-style-type: none"> • Checked • [Unchecked] 	<p>Specify whether to perform normalization based on the brightness in the registered model.</p> <p>When Normalization is checked, the density is adjusted before matching, so that the matching is not affected by changes in the total image brightness or the lighting fluctuations.</p> <p>When normalization is performed on the measured objects without patterns, the total image brightness is changed and the measurement does not work correctly.</p> <div style="text-align: center;"> <p>Model image</p>  <p>Measurement image (When the whole image turns dark)</p>  <p>Normalization processing →</p>  </div>
Perturbation	<ul style="list-style-type: none"> • Checked • [Unchecked] 	<p>If you place a check here, in order to prevent mistaken detection of slight positional deviation of measurement objects as differences, slight positional deviations are corrected before matching. However, this requires more processing time.</p>

3 Input the "Difference" in the "Difference parameter" area.

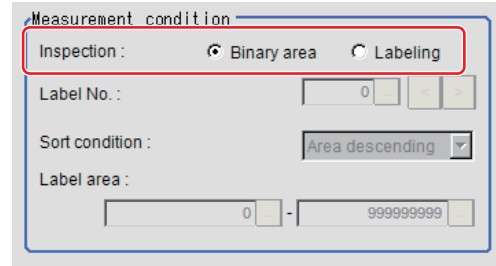


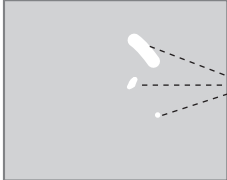
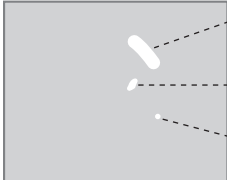
Item	Set value [Factory default]	Description
Difference	0 to 255 [50]	<p>This sets the reference grayscale used when calculating differences between the model and the inspected object image. Pixels with a difference equal to or greater than Difference are converted to white and other pixels are converted to black, so that only defects are converted to white and measured.</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Model Image</p>  </div> <div style="text-align: center;"> <p>Inspected object image</p>  </div> </div> <p style="text-align: center;">↓</p> <div style="display: flex; align-items: center;"> <div style="text-align: center;"> <p>Difference</p>  </div> <div style="margin-left: 20px;"> <p>Pixels with difference equals to or greater than Difference are white</p> <p>Other pixels (with smaller difference with the model) are black</p> <p>Adjust the parameter with an NG image displayed, so that you can refer to the difference image.</p> </div> </div>

Measurement Parameters (Fine Matching)

This item specifies the judgement conditions for measurement conditions and measurement results.

- 1 In the Item Tab area, click [Measurement].
- 2 Select "Inspection" in the "Measurement condition" area.

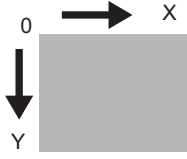
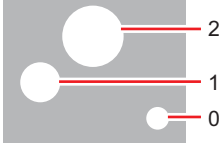
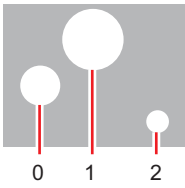
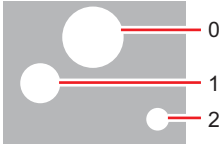


Setting item	Set value [Factory default]	Description
Inspection		Images that are different from the model will be converted into binary images internally. "Inspection" that is used to detect binary images should be selected.
	[Binary area]	Defect is judged based on the total area of white pixels. 
	[Labeling]	A white pixel will be detected as 1 label, which is then compared with a label which is consistent with the set conditions to determine whether or not it is a defect. 

If "Binary area" is selected, the following operations are not necessary.

When Labeling is selected, the following items are set.

Item	Set value [Factory default]	Description
Label No.	0 to 2499 [0]	Specify the label number used to determine whether defects exist. Different settings for "Sort condition" will lead to different number assignment.

Item	Set value [Factory default]	Description
Sort condition		Specify the conditions by which label number is re-assigned. When sorting referencing the X and Y coordinates, the upper left is the origin. This will not affect the coordinate systems set up through the [Camera Image Input] calibration. 
	Area ascending	Number re-assigning begins from the labels with smaller areas. 
	[Area descending]	Number re-assigning begins from labels with larger area.
	X ascending	Number re-assigning begins from the label with a smaller gravity X coordinate. 
	X descending	Number re-assigning begins from the label with a larger gravity X coordinate.
	Y ascending	Number re-assigning begins from the label with a smaller gravity Y coordinate. 
	Y descending	Number re-assigning begins from the label with a larger gravity Y coordinate.
Label area	[0] to [999999999]	Specify the range of the area to be judged as a label.

3 When the setting has been changed, click [Measurement] in the Detail area to verify whether measurements can be made correctly.

Test measurement of this item.

Measurement

4 Set up the judgement condition.

Setting item	Set value	Description
Quantity	0 to 9999	Specify the range of the number of labels that is judged to be OK. When "Binary area" is used, the white pixels as a whole will be regarded as one label.
Area	0 to 9999999999.9999	Specify the range of the area that is judged to be OK. When the "Labeling" is used, the area of the label number will be specified instead.

Setting item	Set value	Description
Defect pos X	-99999.9999 to 99999.9999	Specify the X and Y axis move ranges for the center of gravity positions that are judged to be OK. When the "Labeling" is used, the center of gravity position of the label number will be specified instead.
Defect pos Y	-99999.9999 to 99999.9999	Specify the X and Y axis move ranges for the center of gravity positions that are judged to be OK. When the "Labeling" is used, the center of gravity position of the label number will be specified instead.

Note

- Defect coordinates give the center of gravity position of detected defects.

Output Parameters (Fine Matching)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- Click [Output parameter] in the Item Tab area.
- Specify each of the following items.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> [After scroll] Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none"> [OFF] ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> [ON] OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Fine Matching)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Quantity	Number of defects
Area	Defect area
Defect coordinate X	Defect coordinate X
Defect coordinate Y	Defect coordinate Y

The image specified in the Sub-image number in image display setting is displayed in the Image Display area.

Sub image number.	Explanation of image to be displayed
0	Measurement image
1	Difference image display

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

When non-existent defects are detected around the boundary

Parameter to be adjusted	Remedy
Model	Uncheck "Boundary inspection".
Measurement	Set "Labeling" as the "Inspection".

When noise is detected as defects/defects cannot be detected

Parameter to be adjusted	Remedy
Diff. image disp.	Adjust "Difference".

Measurement object near plain area

Parameter to be adjusted	Remedy
Diff. image disp.	Uncheck "Normalization".

When the processing speed is slow

Parameter to be adjusted	Remedy
Model	Uncheck "Boundary inspection".
Measurement	Set "Labeling" as the "Inspection".

Measurement Results for Which Output Is Possible (Fine Matching)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judgement result
Quantity	DA	Number of labeling
Area	AR	Area
Defect position	X	X coordinate of center of gravity position of measured defects
Defect position	Y	Y coordinate of center of gravity position of measured defects

External Reference Tables (Fine Matching)

No.	Data name	Set/Get	Data range
0	Judgement result	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Number of labeling	Get only	0 to 9999
6	Area	Get only	0 to 999999999.9999
7	Position X	Get only	-99999.9999 to 99999.9999
8	Position Y	Get only	-99999.9999 to 99999.9999
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Boundary inspection	Set/Get	0: OFF 1: ON
121	Boundary level	Set/Get	0 to 9
122	Normalization	Set/Get	0: OFF 1: ON
123	Perturbation processing	Set/Get	0: OFF 1: ON
124	Difference	Set/Get	0 to 255
125	Inspection	Set/Get	0: Binary 1: Labeling
126	Label No.	Set/Get	0 to 2499
127	Sort condition	Set/Get	0: Area ascending 1: Area descending 2: X ascending 3: X descending 4: Y ascending 5: Y descending
128	Upper limit of label area condition	Set/Get	0 to 999999999.9999
129	Lower limit of label area condition	Set/Get	0 to 999999999.9999
130	Upper limit of quantity judgement	Set/Get	0 to 9999
131	Lower limit of quantity judgement	Set/Get	0 to 9999
132	Upper limit of area judgement	Set/Get	0 to 999999999.9999
133	Lower limit of area judgement	Set/Get	0 to 999999999.9999
134	Upper limit of position X	Set/Get	-99999.9999 to 99999.9999
135	Lower limit of position X	Set/Get	-99999.9999 to 99999.9999
136	Upper limit of position Y	Set/Get	-99999.9999 to 99999.9999
137	Lower limit of position Y	Set/Get	-99999.9999 to 99999.9999

Character Inspection

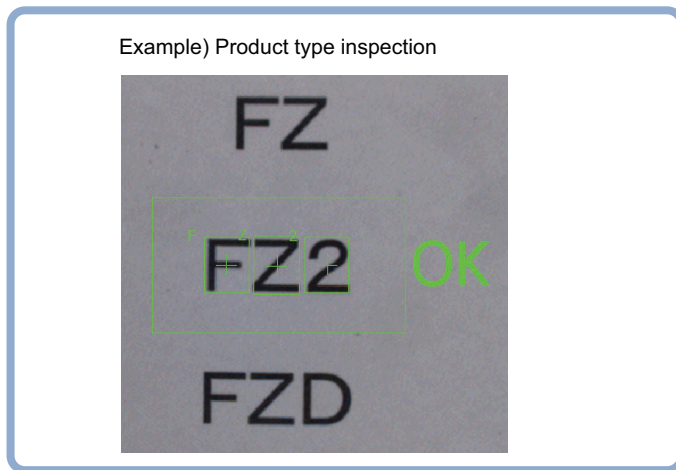
Using model images registered in a [Model Dictionary], this processing item performs character recognition by correlation searches.

Important

- The model dictionary needs to be created in advance.
Reference: ▶ Model Dictionary (p.413)

Used in the Following Case

- When identifying standard character data (check of product model name)

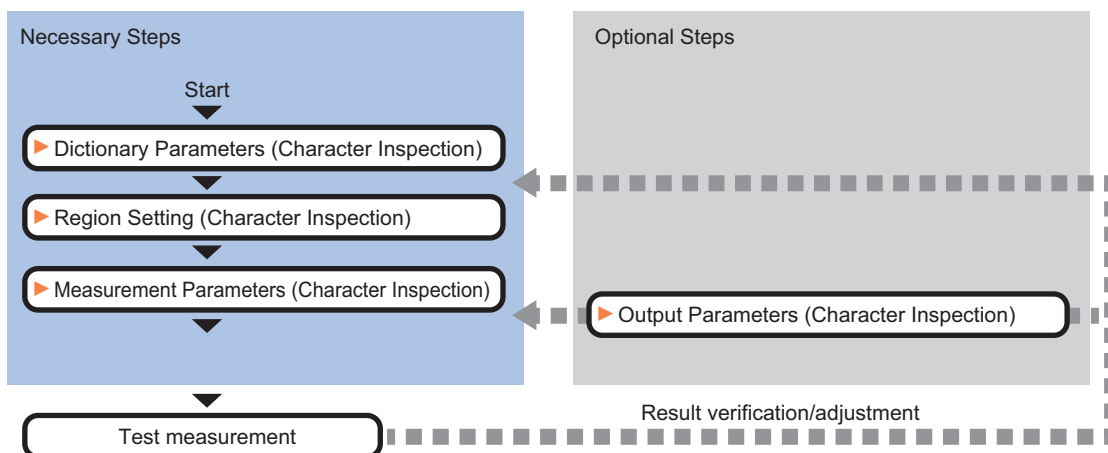


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Character Inspection)

The setting procedure for character inspection is as follows:



List of Character Inspection Items

Item name	Description
Dictionary	This item specifies the processing unit number for the model dictionary to use for character recognition. Reference: ▶ Dictionary Parameters (Character Inspection) (p.393)
Region setting	This item is used to set up the measurement area. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. Reference: ▶ Region Setting (Character Inspection) (p.394)
Measurement	This item specifies the judgement condition for measurement results. Specify the criteria to judge the measurement result if the X and Y coordinates and the correlation values with the model are OK. Reference: ▶ Measurement Parameters (Character Inspection) (p.394)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (Character Inspection) (p.396)

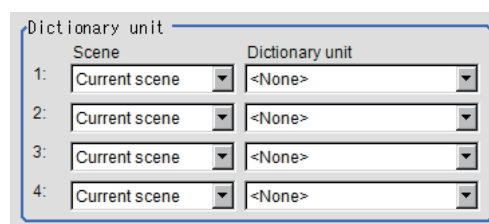
Dictionary Parameters (Character Inspection)

This item selects the processing unit number for the model dictionary to use for character inspection.

1 In the Item Tab area, click [Dictionary].

2 In the "Dictionary unit" area, select the unit number.

A dictionary unit other than the currently used scene can also be used.



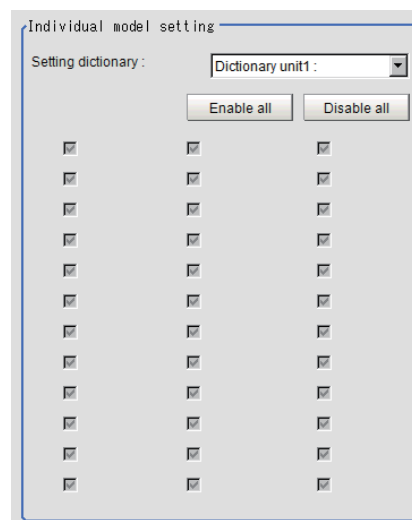
3 If necessary, specify an index to use.

1 Click [▼] and select the dictionary unit to be specified.

The following character strings are registered.

2 Place a check at the character(s) to use for character inspection.

Click the [Enable all]/[Disable all] button to enable/disable all registered characters.



4 Click [OK].

The model dictionary to use is set.

Region Setting (Character Inspection)

This item is used to set up the measurement area.

Instead of measuring the entire input image, narrowing the measurement area shortens the processing time.

This item specifies the measurement region of [Character Inspection] using a rectangle.

1 In the Item Tab area, click [Region setting].

2 Click [Edit].

The figure setting area is displayed.

3 Specify the area in which to search for the model.

The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.

4 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Note

Number of characters that can be inspected

- Up to 32 characters can be inspected in the measurement region.

Measurement Parameters (Character Inspection)

Set the character inspection contents, the trimming method and the judgement conditions for the measurement results.

1 In the Item Tab area, click [Measurement].

2 In the "Inspection condition" area, specify a value for each item.

Setting item	Set value [Factory default]	Description
Inspection mode	<ul style="list-style-type: none"> • [OCR] • OCR + Count • OCV 	Select the inspection mode of characters. <ul style="list-style-type: none"> • OCR: The character string is read in. • OCR + Count: The character string is read in. Also, the number of characters is inspected. • OCV: Inspects whether or not the same characters are lined up as the preset correct character string combination.
Direction	<ul style="list-style-type: none"> • [→] • ↓ • ← • ↑ 	Specify the direction of character reading.

Setting item	Set value [Factory default]	Description
Horizontal succession	[0] to 99	If characters are too close together to read in well, set a larger value. Specify the allowable overlapping width possible to read models in the unit of pixel. This item is valid when "Direction" is [→] [←].
Vertical succession	[0] to 99	Specify the allowable overlapping width possible to read models in the unit of pixel. This item is valid when "Direction" is [↓] [↑].
Dictionary candidate	<ul style="list-style-type: none"> • [Unchecked] (Not used) • Checked (Used) 	Specify whether to use candidate point levels specified in the Model Dictionary or not.
Rough candidate	0 to 100 [40]	When "Dictionary candidate" is unchecked, specify a value for the Rough candidate.
Detail candidate	0 to 100 [60]	When "Dictionary candidate" is unchecked, specify a value for the Detailed candidate.

3 Set up the judgement condition.

Setting item	Set value [Factory default]	Description
Dictionary correlation	<ul style="list-style-type: none"> • [Unchecked] (Not used) • [Checked] (Used) 	Specify whether to use the correlation lower limit set in the Model Dictionary or not.
Correlation	0 to 100 [60]	When "Dictionary correlation" is unchecked, specify the Correlation.
Lower limit of stability	0 to 100 [0]	<p>The displayed stability value is the value obtained by subtracting the correlation value of the second candidate from the correlation value of the first candidate for the read character.</p> <p>The stability is low when the difference between the candidate correlation values is small, and there is a possibility that the character was misread.</p> <p>A stability higher than the lower limit of stability is OK.</p>
Character count	1 to 32	When "Inspection mode" is "OCR + Count", specify the judgement condition for the number of characters.
Verification string	A string with up to 32 characters. [(None)]	When "Inspection mode" is "OCV", specify the Verification string. "*" in the Verification string is a wild card. Verification of whether a character is "*" is not possible. For sections to be judged OK no matter what characters are present and to just inspect whether or not there are characters at all, use "*".

Output Parameters (Character Inspection)

Select how measurement results are output to an external device. This item can be changed if necessary. Normally, the factory default value will be used.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify a value for each item.

Setting item	Set value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Select whether have the judgement result of this processing unit reflected in the overall judgement of the scene.
Character output	<ul style="list-style-type: none"> • [Unchecked] • Checked 	Specify whether to output read-in character strings to an external device.
	Output device	<ul style="list-style-type: none"> • [RS-232C/RS-422] • Ethernet <p>When "Character output" is checked (output), this specifies the device to which strings are output. A character string is output as an ASCII code character string plus a delimiter. When kanji or other characters that are not ASCII codes are included, they are not output correctly. When Ethernet is selected, the destination IP address is determined by the system settings. Reference: ▶ <i>Non-procedure Communications in the Vision System FH/FZ5 Series User's Manual for Communications Settings</i> (Cat. No. Z342).</p>

Note

- For character output, if there was no read character string, then the delimiter is output.

Key Points for Test Measurement and Adjustment (Character Inspection)

The following content is displayed in the "Detail result" area as text.

Displayed items	Color of display	Description
Judge	OK/Unmeasured: Black NG: Red	Judgement result
NG cause	0: Black Other than 0: Red	The following character strings are displayed. When there are multiple factors, the output is ORed. If both the correlation value and the character count are NG, "3" is output. 0: OK 1: Correlation values NG 2: Character count NG 4: Verification NG 8: OCV NG 8: Stability NG
Chara count	When the NG cause is the character count NG: Red Other NG: Black	The number of measured characters is displayed.
Read string	When the NG cause is verification NG: Red Other NG: Black	A character string read from the target unit is displayed.
Correlation value	When the NG cause for each character is the correlation value NG: Red Other NG: Black	The correlation values for each character are displayed. Example) When 0123 is read Correlation values: 0(99) 1(56) 2(80) 3(27)
Stability	When the NG cause of each character is stability NG: Red Otherwise: Black	Shows the stability of each character.

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

When the reading is unstable

Parameter to be adjusted	Remedy
Measurement	If characters are close, specify larger values for "Horizontal succession", "Vertical succession".

The judgement is NG (insufficient memory).

Parameter to be adjusted	Remedy
Region setting	Specify as small a value as possible for FigureInfo=Region.

When the processing speed is slow

Parameter to be adjusted	Remedy
Region setting	Specify as small a value as possible for FigureInfo=Region.

Measurement Results for Which Output Is Possible (Character Inspection)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judgement result
Chara. Num	NUM	Chara. Num
NG cause	NG	NG cause
For following items, additional expression data with 32 characters is allocated for each character. (* represents the character number.)		
Unit No.*	CUNO*	Detected unit No. for the *th character
Index No.*	CINDEX*	Detected index number for the *th character
Model No.*	CMODEL*	Detected model number for the *th character
Chara. code*	CCHAR*	Character code for the *th character Reference: ▶ "Appendixes Character Code Table" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
NG Cause *	CNG*	NG cause for the *th character

Output of Character String in PLC Link

In PLC Link communication, if you check the [Character output] for output parameters, the character string and NULL(0x00) are output to the data output area of PLC Link.

Reference: ▶ Output Parameters (Character Inspection) (p.396)

1 Output Format

Take the following case as an example. Number of measurement is one. Reading character string is 32. Command: Read character strings 0123456789...UV, Command, Response, and Data Output area are as follows.

Reference: ▶ Communicating with PLC Link, Command Details for PLC Link, EtherNet/IP, and EtherCAT in Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342).

Command (PLC to Sensor Controller)

Top Channel		Description
+3	+2	
0010	1010	Performs one measurement.

Response (Sensor Controller to PLC)

Top Channel		Description
Top channel	Data	
+2	1010	Command Code
+3	0010	Target command code is responded.
+4	0000	Response code
+5	0000	Command execution result.

Data Output Area (Sensor Controller to PLC)

When read the 32 character strings (0123456789...UV), the result continues as follows.
ASCII code data + NULL (0x00)

Top channel	Name	Description
+0	1st character, 2nd character	3031 (ASCII code of the character 0, ASCII code of the character 1)
+1	3rd character, 4th character	3233 (ASCII code of the character 2, ASCII code of the character 3)
⋮		
+15	31st character, 32th character	5556 (ASCII code of the character U, ASCII code of the character V)
+16	NULL	0x00 (NULL)

Note

If no character string, NULL(0x00) is output.

2 How to get the character string

Perform the Data Output Request (DSA) and Data Output Completion (GATE) as in the case of Data Output.

All character string is included in one data. Thereby, Data Output Request (DSA) is performed once if there is one Character Inspection unit.

Output of Character string with Non-procedure Communications

Check the [Character output] in Output parameter to output the character string with Non-procedure communication.

Reference: ▶ Output Parameters (Character Inspection) (p.396)

1 Output Format

Take the following case as an example. Number of measurement is one.

Reading character string is 32. Command, Response, and Data Output area are

Reference: ▶ Non-procedure Communications and MEASURE or M in Non-procedure Command Details in Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342).

Command (PLC to Sensor Controller)

M E A S U R E ^{C_R} or M ^{C_R}

Response (Sensor Controller to PLC)

O K ^{C_R}

0123456789...UV(Character string data) ^{C_R}

Note

- If no character string, refer to the following.

O K ^{C_R}

^{C_R}

Output of Character string with EtherNet/IP Message Communications

In EtherNet/IP message communication, output of character string is possible using UNITDATA command which acquires the measurement value.

Outputs the character string data measured in Character Inspection and NULL (0x00).

Reference: ▶ Communicating with the Sensor Controller with EtherNet/IP Message Communications, Non-procedure Communications and UNITDATA or UD in Non-procedure Command Details in Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342).

1 Output Format

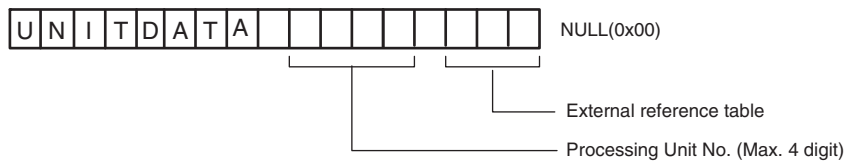
Take the following case as an example. Number of measurement is one.

Reading character string is 32. Command: Read character strings 0123456789...UV, Command, Response, and Data Output area are as follows.

Described example is only a part of Attribute.

Command (PLC to Sensor Controller)

Specify the command character string equivalent to a non-procedure command. Attach NULL(0x00) at the end of the character string. No line feed code is required. The size of the send data includes the NULL(0x00) at the end of the character string.



Response (Sensor Controller to PLC)

Character string data equivalent to the Non-procedure command reception character string is returned. Null (0x00) is inserted in the reception character string delimiter section. The size of the reception data includes the final NULL(0x00).

0123456789...UV(Character string data) NULL(0x00) O(0x4F) K(0x4b) NULL(0x00)

Note

- If no character string, refer to the following.

NULL(0x00) O(0x4F) K(0x4b) NULL(0x00)

- When output the multiple lines, change the external reference table No. of UNITDATA, and then read the character strings.

External Reference Tables (Character Inspection)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
1	Chara. Num	Get only	0 to 32
2	NG cause	Get only	0x0000 to 0x000F
3	Read string	Get only	Character string
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120 to 123	Dictionary unit number	Set/Get	-1: OFF 0 to 9999
124	Inspection mode	Set/Get	0: OCR 1: OCR + Count 2: OCV
125	Direction	Set/Get	0: → 1: ↓ 2: ← 3: ↑
126	Character output	Set/Get	0: OFF 1: ON
127	Character output destination	Set/Get	0: RS-232C/RS-422 1: Ethernet
129	Horizontal succession	Set/Get	0 to 99
130	Vertical succession	Set/Get	0 to 99
132	Dictionary candidate point level usage flag	Set/Get	0: Not used 1 : Used
133	Rough candidate	Set/Get	0 to 100
134	Detail candidate	Set/Get	0 to 100
135	Dictionary correlation usage flag	Set/Get	0: Not used 1 : Used
136	Lower limit value of correlation value	Set/Get	0 to 100
137	Upper limit of chara. Num	Set/Get	1 to 32
138	Lower limit of chara. Num	Set/Get	1 to 32
139	Verification string	Set/Get	Character string with 32 characters or less
140+N (N=0 to 35)	Model 1 usage flag	Set/Get	0: Not used 1 : Used
176+N (N=0 to 35)	Model 2 usage flag	Set/Get	0: Not used 1 : Used
212+N (N=0 to 35)	Model 3 usage flag	Set/Get	0: Not used 1 : Used
248+N (N=0 to 35)	Model 4 usage flag	Set/Get	0: Not used 1 : Used
284+N (N=0 to 3)	Scene No.	Set/Get	-1: Current scene 0 to 9999
288	Lower limit of stability	Set/Get	0 to 100

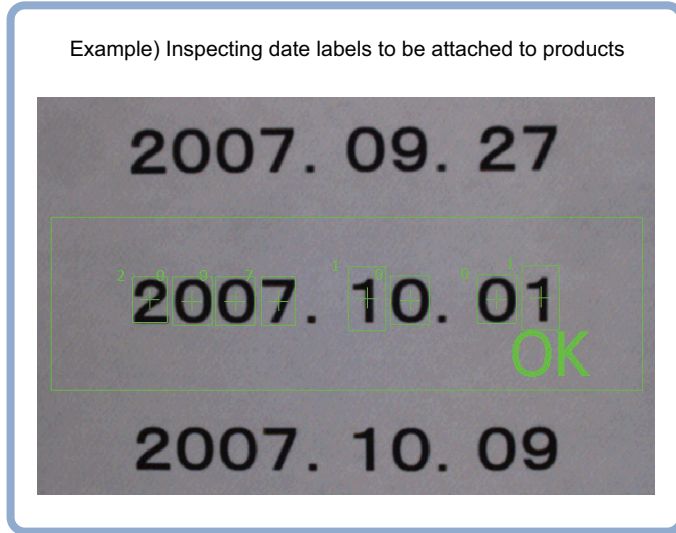
No.	Data name	Set/Get	Data range
1000+N (N=0 to 31)	Unit No.	Get only	-1: None 0 to 9999
1032+N (N=0 to 31)	Detected index	Get only	0 to 35
1064+N (N=0 to 31)	Detected model No.	Get only	0 to 4
1096+N (N=0 to 31)	Chara. code	Get only	0 to 0xFFFF (UTF-16 code)
1128+N (N=0 to 31)	Detected NG cause	Get only	0 to 15
1160+N (N=0 to 31)	Correlation value	Get only	0 to 100
1192+N (N=0 to 31)	Detected coordinate X	Get only	-99999.9999 to 99999.9999
1224+N (N=0 to 31)	Detected coordinate Y	Get only	-99999.9999 to 99999.9999
1256+N (N=0 to 31)	Detected angle	Get only	-180 to 180
1288+N (N=0 to 31)	Reference X	Get only	-99999.9999 to 99999.9999
1320+N (N=0 to 31)	Reference Y	Get only	-99999.9999 to 99999.9999
1352+N (N=0 to 31)	Reference angle	Get only	-180 to 180
1384+N (N=0 to 31)	Detected scene No.	Get only	-1: Current scene 0 to 9999
1416+N (N=0 to 31)	Second correlation value	Get only	0 to 100
1448+N (N=0 to 31)	Second index No.	Get only	0 to 35
1480+N (N=0 to 31)	Stability	Get only	0 to 100

Date Verification

This processing item creates a target string from the current date/time and compares it with read-in strings.

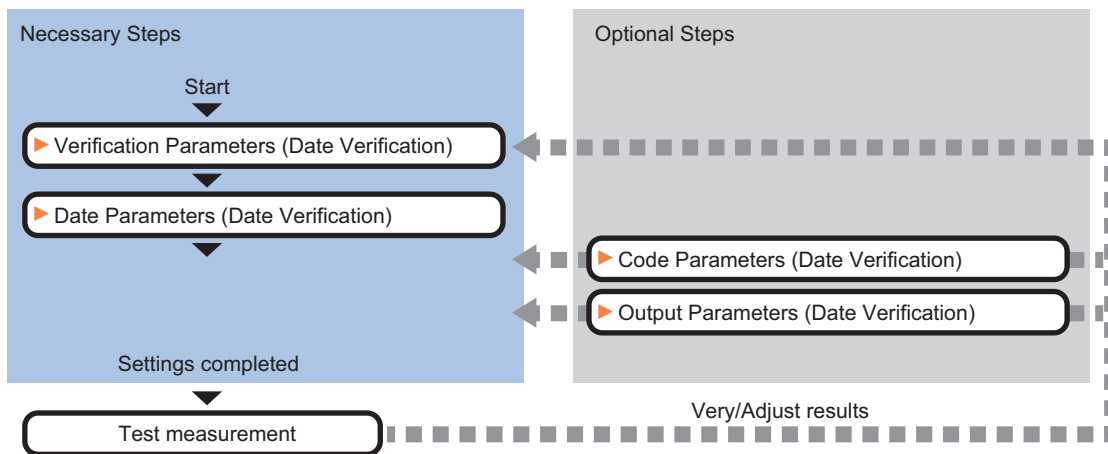
Used in the Following Case

- When inspecting date of manufacture



Settings Flow (Date Verification)

Follow the steps below to set up [Date Verification].



List of Date Verification Items

Item name	Description
Verification	This item sets parameters of the verification string. Reference: ▶ Verification Parameters (Date Verification) (p.404)
Date parameter	This item sets the date/time format and update conditions. Reference: ▶ Date Parameters (Date Verification) (p.406)
Code parameter	Set this to print the date encrypted in such a way that it is difficult for the user to recognize. Setting what codes show also makes possible automatic updating. Reference: ▶ Code Parameters (Date Verification) (p.408)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Use the output parameter to specify how to handle the coordinates. Reference: ▶ Output Parameters (Date Verification) (p.410)

Verification Parameters (Date Verification)

This item sets the verification target and the verification source character string.
The character string read in Character Inspection is the target for verification.

- 1 In the Item Tab area, click [Verification].
- 2 This item sets the general OCR unit for verification.

Note

- Always set Character Inspection in a unit before the Date Verification unit.

- 3 In the "Target string setting" area, click [...] for "Target string expression".
The String setting dialog is displayed.

- 4 This item sets the character string that is the source for verification.

Input the date format and the preceding and following character strings.

Label	Description
0 to 9	Normal numeric value input
A to Z	Normal alphabet input
' - . : /	Normal mark input
*	Character presence judgement
\$	Number judgement
mYY	The last two digits of the current year
mYYYY	Four digits of the current year
mHH	Two digits of the current year in the Japanese Heisei calendar
mMM	Current month
mDD	Current day
mRR	Current hour
mNN	Current minute
vYY	The last two digits of the year after a set period of time
vYYYY	Four digits of the year after a set period of time
vHH	Two digits of the year after a set period of time in the Japanese Heisei calendar
vMM	Month after a set period of time
vDD	Day after a set period of time
eY1	Encrypted year 1
eM1	Encrypted month 1
eD1	Encrypted day 1
eR1	Encrypted hour 1
eN1	Encrypted minute 1
eY2	Encrypted year 2
eM2	Encrypted month 2
eD2	Encrypted day 2
eR2	Encrypted hour 2
eN2	Encrypted minute 2
iY1	Encrypted year 1 after a set period of time
iM1	Encrypted month 1 after a set period of time
iD1	Encrypted day 1 after a set period of time
iY2	Encrypted year 2 after a set period of time
iM2	Encrypted month 2 after a set period of time
iD2	Encrypted day 2 after a set period of time

5 Click [OK].

Date Parameters (Date Verification)

This item sets the date/time format and update conditions.

- 1 In the Item Tab area, click [Date parameter].
- 2 When comparing with character strings with an expiration date limit, set each item in the "Period setting" area.

Setting item	Set value [Factory default]	Description
Year	0 to 99 [0]	This item sets the usage period from the current date.
Month	0 to 99 [0]	
Day	-999 to 999 [0]	

- 3 In the "Date setting" area, specify a value for each item.

Setting item	Set value [Factory default]	Description
Auto Update	<ul style="list-style-type: none"> • Not update • First measure • [Always update] 	<p>Set the year, month and day updating conditions. The clock time is always updated.</p> <ul style="list-style-type: none"> • Not update: The date is stored into memory when the processing unit is registered. The date is not updated until the next time date update is executed with the menu. • First measure: The date is updated during the first measurement after start up. • Always update: The date is updated every measurement.
Zero suppress	<ul style="list-style-type: none"> • [0] • Space 	Set how the tens digits of the month and day are displayed.
Calculation order	<ul style="list-style-type: none"> • [Month->Day] • Day->Month 	Set whether to calculate the month first or the day first when the usage period is set. (This affects calculation of end of month.)
Month end adjust	<ul style="list-style-type: none"> • [Last day of current month] • First day of next month • Gap day of next month 	Set the adjustment method that will be used if the result of the expiration date calculation is an invalid date.

Note

Use the following examples as reference for setting of the date parameter.

E.g.1 Measurement is performed on 9/30, and the period setting is: Year: 1, Month: 1, Day: 1.

- [Month→Day]: A month is added to 9/30, and the result will be 10/30.
A day is added to 10/30, and the result will be 10/31.
- [Day→Month]: A day is added to 9/30, and the result will be 10/1.
A month is added to 10/1, and the result will be 11/1.

E.g.2 Measurement is performed on 1/31, and the period setting is: Year: 0, Month: 1, Day: 1.

- [Month→Day]: A month is added to 1/31, and the result will be 2/31.
The month end adjustment will be applied since 2/31 does not exist.
The result of the month end adjustment plus 1 will be the verification string.

Month end adjust	Result
Last day of current month	2/28
First day of next month	3/1
Gap day of next month	3/3

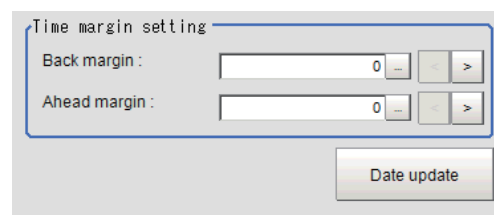
- [Day→Month]: A day is added to 1/31, and the result will be 2/1.
The month end adjustment will not be applied since 2/31 exists.
A month is added to 2/1, and the result will be 3/1.

E.g.3 Measurement is performed on 10/30, and the period setting is: Year: 0, Month: 1, Day: 1.

- [Month→Day]: A month is added to 10/30, and the result will be 11/30.
The month end adjustment will not be applied since 11/30 exists.
A day is added to 11/30, and the result will be 12/1.
- [Day→Month]: A day is added to 10/30, and the result will be 10/31.
A month is added to 10/31, and the result will be 11/31.
The month end adjustment will be applied since 11/31 does not exist.

Month end adjust	Result
Last day of current month	11/30
First day of next month	12/1
Gap day of next month	12/1

4 Set the time margin.



Setting item	Set value [Factory default]	Description
Back margin	0 to 99 [0]	Sets a time range up to the current time to be judged OK. The unit is minutes. Example) When set to 10, a character string from 0 to 10 minutes before the Verification string time is judged: OK.
Ahead margin	0 to 99 [0]	Sets a time range up to the current time to be judged OK. The unit is minutes. Example) When set to 10, a character string from 0 to 10 minutes before the Verification string time is judged: OK.

Clicking [Date update] updates the date information of the verification string.

Code Parameters (Date Verification)

Preset what the codes show so that date verification is possible even when printing the date encrypted in such a way that it is difficult for the user to recognize.

The setting methods are to set on the screen or set with a PC.

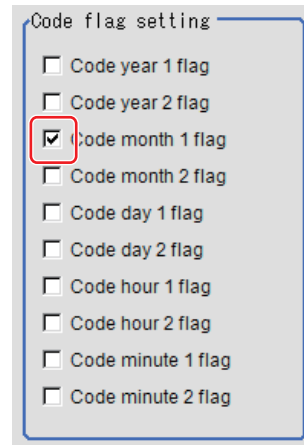
Important

- If a usage period is set, encrypted characters cannot be used for character verification.

Setting on the Screen

This describes the setting method, using an example in which October is encrypted as X.

- 1** In the Item Tab area, click [Code parameter].
- 2** Place a check at "Code month 1 flag".

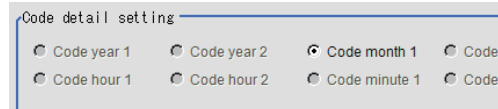


Note

Code month 1 and code month 2

- Set up code files for 2 patterns in order to be ready for setup changes. Select a check at the one to use.

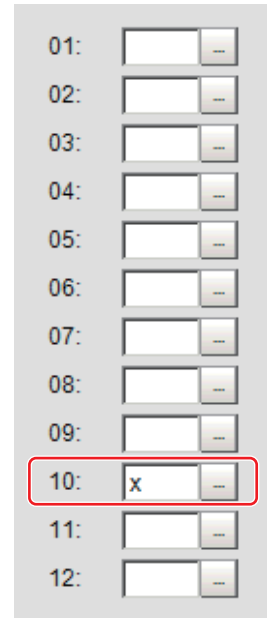
- 3** Place a check at "Code month 1" in the "Code detail setting" area.



- 4** Click [...] for "10".

The software keyboard is displayed. Input "X".

Input a character string of up to 4 characters.



Setting with a PC

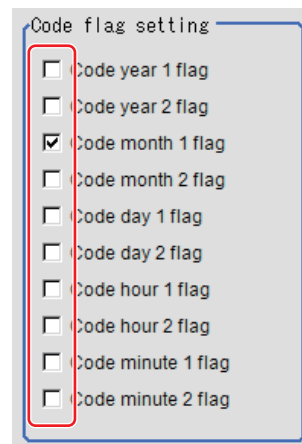
Code files are complex, so performing the settings with a PC makes file editing easier and minimizes mistakes. Saving an empty CSV file first and then editing and reading it with a PC makes setting the values more efficient.

Saving code files

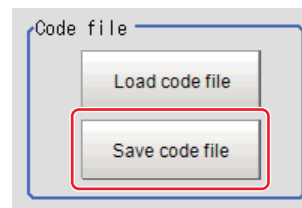
Make an empty file for editing on the PC.

If encryption parameters are already set on the screen, a file reflecting those settings is saved.

- 1** In the Item Tab area, click [Code parameter].
- 2** Place a check at the flag used in the encrypted character strings to be edited.



- 3** In the "Code file" area, click [Save code file].



- 4** Set the save destination folder and file name, and click [OK].
The code file is saved (in CSV format).

Code file format

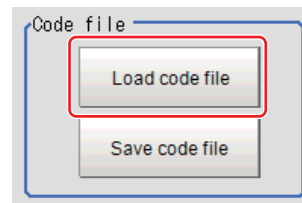
- The first line shows the "Code".
- The second line shows the "Flag". Input "1" when used.
- The third line and subsequent lines contain codes for each number.

Months and days start from "1".

5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
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29											
30											
31											
32											
.											
.											
.											
98											
99											

Reading code files

- 1 In the Item Tab area, click [Code parameter].
- 2 In the "Code file" area, click [Load code file].



- 3 In the file selection window, select the code file (in CSV format) to read and click [OK].
The code file is read and the content is displayed in the window.

Output Parameters (Date Verification)

Specifies whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Choose whether or not to reflect this in the scene overall judgement in "Reflect to overall judgement" area.

Setting item	Set value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Test Measurement (Date Verification)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Target string	Target string setting is displayed.
Read string	A character string read from the OCR unit is displayed.

Measurement Results for Which Output Is Possible (Date Verification)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference Tables (Date Verification)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
1	Verification string	Get only	Character string with 32 characters or less
2	Read string	Get only	Character string with 32 characters or less
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	OCR unit number	Set/Get	-1: OFF 0 to 9999
125	Term year	Set/Get	0 to 99
126	Term month	Set/Get	0 to 99
127	Term day	Set/Get	0 to 999
128	Auto Update	Set/Get	0: Not update 1: First measurement after startup 2: Always update
129	Zero suppress	Set/Get	0: 0 1: Space
130	Calculation order	Set/Get	0: Month→Day 1: Day→Month
131	Month end adjust	Set/Get	0: Last day of now 1: First day of next 2: Gap day of next
132	Back margin	Set/Get	0 to 99
133	Ahead margin	Set/Get	0 to 99
134	Code year 1 flag	Set/Get	0: Not used 1 : Used
135	Code year 2 flag	Set/Get	0: Not used 1 : Used

No.	Data name	Set/Get	Data range
136	Code month 1 flag	Set/Get	0: Not used 1 : Used
137	Code month 2 flag	Set/Get	0: Not used 1 : Used
138	Code day 1 flag	Set/Get	0: Not used 1 : Used
139	Code day 2 flag	Set/Get	0: Not used 1 : Used
140	Code hour 1 flag	Set/Get	0: Not used 1 : Used
141	Code hour 2 flag	Set/Get	0: Not used 1 : Used
142	Code minute 1 flag	Set/Get	0: Not used 1 : Used
143	Code minute 2 flag	Set/Get	0: Not used 1 : Used
150	Character string year 1 flag	Set/Get	0: Not used 1 : Used
151	Character string year 2 flag	Set/Get	0: Not used 1 : Used
152	Character string month 1 flag	Set/Get	0: Not used 1 : Used
153	Character string month 2 flag	Set/Get	0: Not used 1 : Used
154	Character string day 1 flag	Set/Get	0: Not used 1 : Used
155	Character string day 2 flag	Set/Get	0: Not used 1 : Used
156	Character string hour 1 flag	Set/Get	0: Not used 1 : Used
157	Character string hour 2 flag	Set/Get	0: Not used 1 : Used
158	Character string minute 1 flag	Set/Get	0: Not used 1 : Used
159	Character string minute 2 flag	Set/Get	0: Not used 1 : Used
160	Operation code number	Set/Get	0 to 99

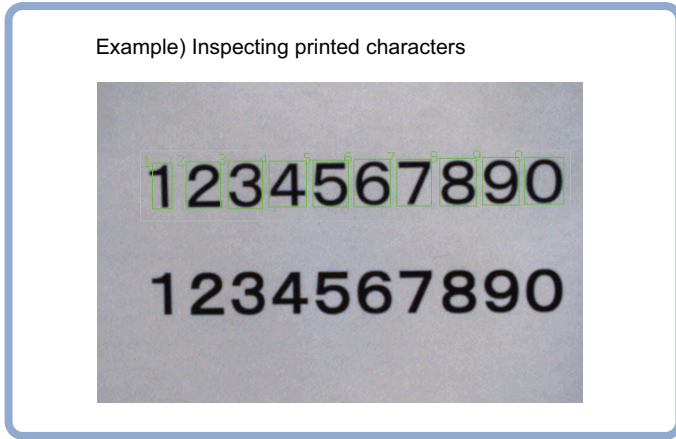
Model Dictionary

Register a model to use for [Character Inspection].

Model data registered in the [Model Dictionary] can be referred to from multiple [Character Inspection] items in the same scene.

Used in the Following Case

- To create the dictionary to be used for Character Inspection and Date Verification

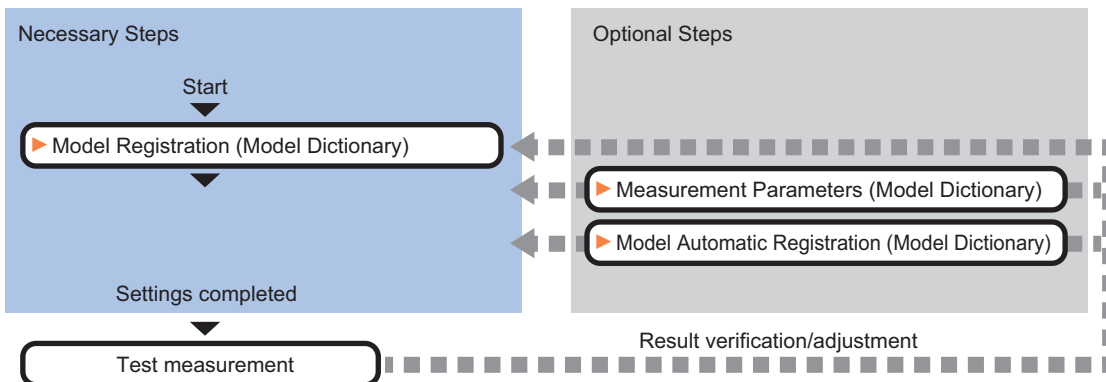


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Model Dictionary)

Follow the steps below to set up [Model Dictionary].



List of Model Dictionary Items

Model Dictionary items are explained below.

Item name	Description
Model	Register the characters and marks as the model. Model parameter values can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used. Reference: ▶ Model Registration (Model Dictionary) (p.414)

Item name	Description
Measurement	This item can be changed if necessary. Reference: ▶ Measurement Parameters (Model Dictionary) (p.416)
Auto registration	When registering multiple characters as models, auto registration is handy. This method encloses a character string, cuts out one character at a time from it and registers them as models. Reference: ▶ Model Automatic Registration (Model Dictionary) (p.417)

Model Registration (Model Dictionary)

Register the characters and marks as the model.

Models can be registered with any of 36 indexes, from 0 to 35, and up to 5 models can be registered for each index.

Select the character type.

By factory default, 0 to 9 and A to Z are assigned to indexes 0 to 35. These assignments can be changed as necessary with the "%" and "#" codes.

0	C	O
1	D	P
2	E	Q
3	F	R
4	G	S
5	H	T
6	I	U
7	J	V
8	K	W
9	L	X
A	M	Y
B	N	Z

Index 0 to 11 Index 12 to 23 Index 24 to 35

1 In the Item Tab area, click [Model].

When setting a new model, you do not have to click [Model].

2 Set the character type.

Registering a Model

This method is for registering models one character at a time.

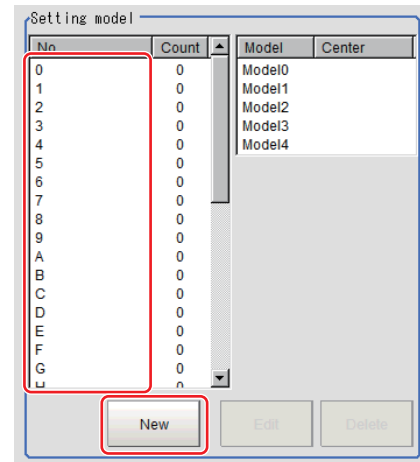
Note

- When registering multiple characters as models, auto registration is handy.
Reference: ▶ Model Automatic Registration (Model Dictionary) (p.417)

- 1 In the Item Tab area, click [Model].
- 2 When the measurement object is rotating, set the Angle range for the "Model parameter" area.

Reference: ▶ Changing Model Parameters (p.416)

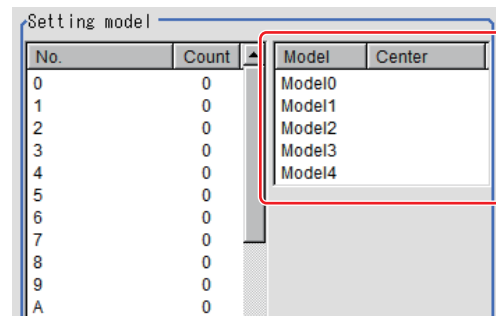
- 3 Select the index to register the model in, then click [New].



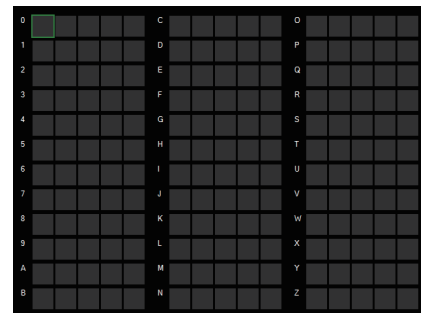
- 4 Use the Drawing tools to specify the model registration range.

- 5 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.



The image specified for the model is displayed in the Image Display area.



- 6 To register two or more models, repeat the Steps Reference: ▶ 3 (p.415) to Reference: ▶ 5 (p.415) .

Changing Model Parameters

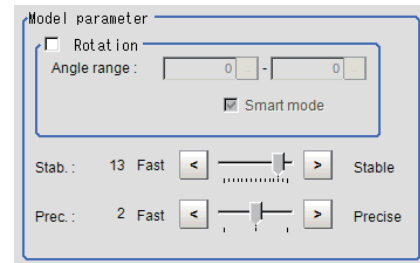
Model parameter values can be changed as needed to address unstable measurement results or to increase the processing speed. Normally, the factory default value will be used.

After changing a setting, check whether measurement can be done properly by performing an actual measurement.

Important

- After model parameters are modified, re-register all models.

1 In the "Model parameter" area, specify a value for each item.



Setting item	Set value [Factory default]	Description
Rotation	<ul style="list-style-type: none"> • Checked • [Unchecked] 	When the measurement object rotates, place a check at "Rotation" and set the Angle range during a search. The normal direction is clockwise.
Angle range	-45 to 45 [0]	
Smart mode	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Checking the "Smart mode" option enables a high-speed rotation search. The stability may be lowered when the model shape aspect ratio is large or when the NOT mask is used.
Stab.	1 to 15 [13]	Specify which is to have priority, detection stability or speed. If lowering stability does not speed up processing, it is likely that many candidates have been detected. In this case, specify a larger value for "Candidate level" or "Stab."
Prec.	1 to 3 [2]	Specify which is to have priority, measurement positional precision or speed.

Measurement Parameters (Model Dictionary)

This item can be changed if necessary. Normally, the factory default value will be used.

1 In the Item Tab area, click [Measurement].

2 In the "Measurement condition" area, specify a value for each item.

Setting item	Set value [Factory default]	Description
Batch setting	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Specify whether to set all Measurement values at the same time. <ul style="list-style-type: none"> • Checked: The same contents are set for all indexes. • Unchecked: The contents are only set for the selected index.
Correlation	0 to 100 [60]	Specify the lower limit of correlation values that are judged to be OK. This is the threshold for whether or not the candidate can be read in as a character.
Rough candidate	0 to 100 [40]	Specify the threshold value with which to detect candidate points in a rough search. Specify a smaller value when model search results are unstable.
Detail candidate	0 to 100 [60]	Specify the threshold value with which to detect candidate points in a detail search. Only the candidate points higher than this level are extracted as characters.

Model Automatic Registration (Model Dictionary)

This method encloses a character string, cuts out one character at a time from it and registers them as models. When an auto extraction region is set enclosing the character string, the characters are automatically extracted one at a time. Register each character in the appropriate character index. If 5 models have already been registered for an index, auto registration cannot be set.

- 1** In the Item Tab area, click [Auto registration].
- 2** In the Detail area, select "Auto extract region".



- 3** Click [Edit].



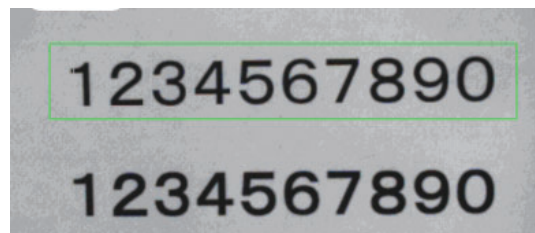
- 4** Specify the range to register as the auto extract region using the Drawing tools.

- 5** In the figure setting area, click [OK].

The auto extract region is registered.

- 6** Click [Extract model].

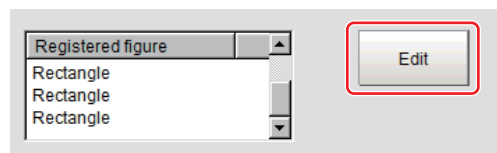
A model is extracted automatically and the extracted result (gray frame) is displayed in the Image Display area.



- 7** In the Detail area, select "Auto model region".

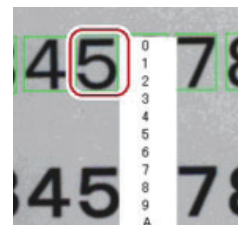


- 8** To adjust an extracted region, click [Edit].



- 9** Click the model region in the Image Display area.

An index list is displayed.



- 10** Select the index to register to.

- 11** Click [Register model].

A message which indicates the number of registered models is displayed.

- 12** Click [OK].

The model is registered.

With the same operation, register the models for the other extraction regions.

Key Points for Test Measurement and Adjustment (Model Dictionary)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Parameter to be adjusted	Remedy
Model	If the model image consists of detailed figures, specify a larger value for "Stab.".
	When "Rotation" is selected, if the model shape is complex, uncheck the "Smart mode" option.
Measurement	If images that should be judged OK vary greatly, specify a smaller value for "Candidate level".

When the processing speed is slow

Parameter to be adjusted	Remedy
Model	If the model image is a simple figure or a large figure, specify a smaller value for "Stab." If lowering stability does not speed up processing, it is likely that many candidates have been detected. Raise the "Candidate level" in [Measurement].
	When "Rotation" is selected, if the model shape is simple, place a check at the "Smart mode" option.
Measurement	If images that should be judged OK vary little, specify a larger value for "Candidate level".

Measurement Results for Which Output Is Possible (Model Dictionary)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judgement result

External Reference Tables (Model Dictionary)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
121	With rotation	Set/Get	0: OFF 1: ON
122	Upper limit of the rotation angle	Set/Get	-45 to 45
123	Lower limit of the rotation angle	Set/Get	-45 to 45
125	Smart mode	Set/Get	0: OFF 1: ON
126	Stab.	Set/Get	1 to 15
127	Prec.	Set/Get	1 to 3

2D Code

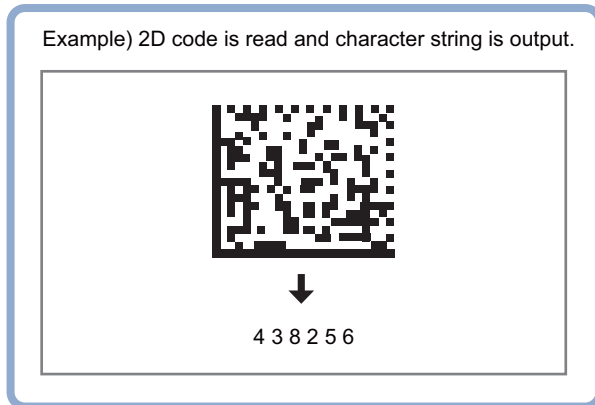
Read in 2D Code.

Processing can also classify the read-in results.

With 2D Code, detailed communication and reading result can be output.

Used in the Following Case

- To classify with 2D Code

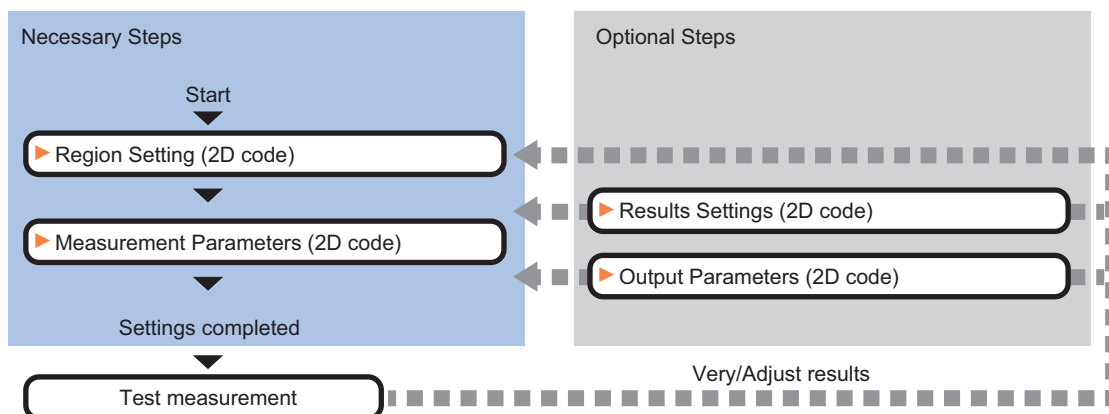


Important

- Does not support 2D Code with Japanese included. Supports 2D Code that are composed entirely of ASCII code.
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (2D Code)

The setting procedure for 2D Code is as follows.



List of 2D Code Items

Item name	Description
Region setting	This item is used to set up the measurement area. Restricting the measurement range can shorten the processing time. Reference: ▶ Region Setting (2D Code) (p.420)

Item name	Description
Measurement	This item specifies the judgement condition for measurement results. Set the code type and the number of characters to be judged as OK. Reference: ▶ Measurement Parameters (2D Code) (p.420)
Result setting	Set the measurement results. Judgement results can be classified. Reference: ▶ Results Settings (2D Code) (p.424)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Reference: ▶ Output Parameters (2D Code) (p.424)

Region Setting (2D Code)

Specify the rectangular area in which to search for 2D Code.

Restricting the measurement range can shorten the processing time.

1 In the Item Tab area, click [Region setting].

2 Click [Edit].

The figure setting area is displayed.

3 Specify the area in which to search for 2D Code.

The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.

4 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Important

- Normal (DataMatrix/QRCode/MicroQR/PDF417/MicroPDF417):
Set the measurement region to be 1600 × 1200 or less.
- DPM mode (DataMatrix/QRCode):
Set the measurement region to be 2448 × 2044 or less.
- Set the measurement region such that it contains only 1 2D Code.
If there is more than one 2D Code in the measurement region, measurement may not be performed correctly.

Measurement Parameters (2D Code)

This item specifies the judgement conditions for measurement conditions and measurement results.

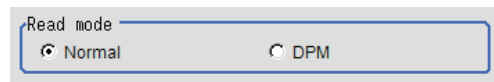
When the [Teaching] button is pressed, detailed settings are set automatically.

If you then click the [Measurement] button, measurement is executed, the detected 2D Code region is displayed on the image and the measurement results are displayed as measurement value of the judgement condition.

If measurement cannot be carried out successfully with this procedure, adjust the parameters shown below.

1 In the Item Tab area, click [Measurement].

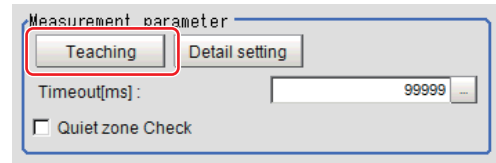
2 Select the read mode.



Setting item	Set value [Factory default]	Description
Read mode	<ul style="list-style-type: none"> • [Normal] • DPM 	Usually, set this to "Normal". Select DPM to read 2D code to which direct parts marking (DPM) was applied.

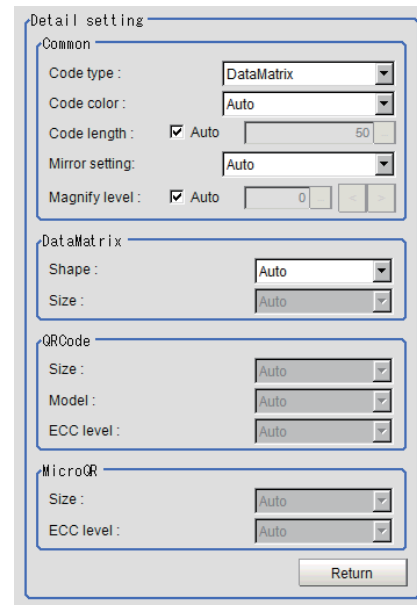
3 To teach, click [Teaching].

The detailed settings are set automatically.



Setting item	Set value [Factory default]	Description
Timeout	50 to 99999 [99999]	Stop and terminate the process if the measurement for this processing item cannot be completed within the specified time period. Note that the actual timeout time may be longer than the specified time period.
Quiet zone Check (only when the read mode is Normal)	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Check if there is any space around 2D code. (When code type is PDF417/MicroPDF417, this function is disable.)

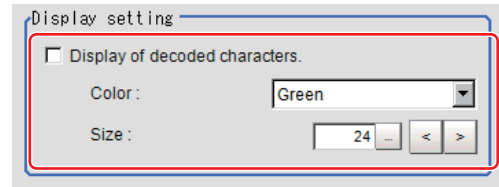
4 When making the detailed settings, click "Detail setting" and set each item.



Setting item	Set value [Factory default]	Description
Common		
Code type	<ul style="list-style-type: none"> • [Auto] • DataMatrix • QRCode • MicroQR • PDF417 • MicroPDF 	Set the code type. The readable size for each code type are as follows. <ul style="list-style-type: none"> • Symble size <ul style="list-style-type: none"> DataMatrix: 64 × 64 cells or less QRCode: 57 × 57 cells (Version.10) or less • Size of 1 cell <ul style="list-style-type: none"> Normal (DataMatrix/QRCode/MicroQR) : Image more than 4 × 4 pix. DPM (DataMatrix/QRCode) : Image more than 4 × 4 pix. • Module size <ul style="list-style-type: none"> Normal (PDF417/MicroPDF417) : Set aspect ratio to be greater than 3:1, then print it. Capture image with a horizontal length greater than 3 pix.
Code color	<ul style="list-style-type: none"> • [Auto] • Black • White 	Specify the color of the 2D Code to read. Auto: Select to automatically determine the color setting. Black: Select this for black 2D Code with white background. White: Select this for white 2D Code with black background.
Code length: Auto	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Place a check when automatically determining the code length.

Setting item		Set value [Factory default]	Description
	Code length	50 to 2448 [50]	Specify the code length.
	Mirror setting	<ul style="list-style-type: none"> • [Auto] • Normal • Reverse 	Specify whether to reverse the image horizontally.
	Magnify level: Auto	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Select whether to automatically set the reduction ratio of images when reading code.
	Magnify level	<ul style="list-style-type: none"> • 0 to 4 • [0] 	Set the reduction ratio for images when reading code. It is determined by the teaching process.
DataMatrix			Specify when DataMatrix is selected for Code type.
	Shape	<ul style="list-style-type: none"> • [Auto] • Square • Rectangle 	Set the shape of DataMatrix.
	Size	For DM square <ul style="list-style-type: none"> • [Auto] • 10 × 10 • 12 × 12 • : • 64 × 64 For DM rectangle: <ul style="list-style-type: none"> • [Auto] • 8 × 18 • 8 × 32 • : • 16 × 48 	Set the size of DataMatrix.
QRCode			Specify when QRCode is selected for Code type.
	Size	<ul style="list-style-type: none"> • [Auto] • 21 × 21 • 25 × 25 • : • 57 × 57 	Set the size of QR code.
	Model	<ul style="list-style-type: none"> • [Auto] • Model 1 • Model 2 	Set the model of QR code.
	ECC level	<ul style="list-style-type: none"> • [Auto] • M • L • H • Q 	Specify the ECC level (error correction level) for QR code.
MicroQR			Specify when MicroQR is selected for Code type.
	Size	<ul style="list-style-type: none"> • [Auto] • 11 × 11 • 13 × 13 • 15 × 15 • 17 × 17 	Select the size of MicroQR.
	ECC level	<ul style="list-style-type: none"> • [Auto] • L • M • Q 	Select the ECC level (error correction level) for MicroQR.

5 Make the display settings for read-in character strings.



Setting item	Set value [Factory default]	Description
Display of decoded characters.	<ul style="list-style-type: none"> • [Unchecked] • Checked 	Place a check when displaying the read-in character strings on the screen.
Color	<ul style="list-style-type: none"> • Black • White • Red • [Green] • Blue 	Specify the color of characters displayed on the screen.
Size	10 to 200 [24]	Set the display size for character strings.

6 To read codes containing group separators, set a group separator replacement condition.

Setting item	Set value [Factory default]	Description
Replace group separator with specified character string	<ul style="list-style-type: none"> • [Checked] • Unchecked 	If you select [Normal] for the reading mode, check this checkbox to replace each group separator with another character string.
Replacement character string	---	Set the character string to replace group separators with.

Note

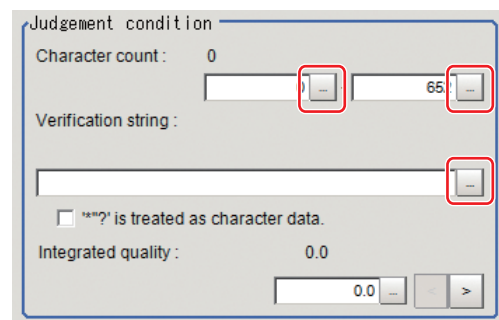
Replacing each group separator (control character) with the specified character string enables codes containing group separators to be read and compared to a comparison character string.

7 When the setting has been changed, click [Measure] in the "Detail" area to verify whether measurements can be made correctly.

Test measuring of this item.

Measure

8 Set up the judgement condition.



Setting item	Set value	Description
Character count	0 to 652	Specify the character count to be judged as OK.
Verification string	---	Specify the classification strings to be judged as OK. Up to 652 characters can be set.
? is treated as character data.	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Checked: '' and '?' are handled as normal characters. Unchecked: '*' and '?' are handled as special characters. '*?': Substitution for character string (with 0 or more characters) '?': Substitution for 1 character

Setting item	Set value	Description
Integrated quality (lower limit value) (only when the read mode is Normal)	0.0 to 4.0 [0]	Specify the integrated quality to be judged as OK. It can be set when the code type is DataMatrix, PDF417 or MicroPDF417.

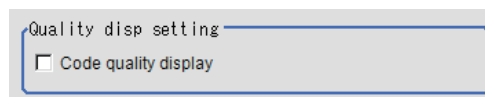
Results Settings (2D Code)

Results can be classified according to the judgement results.

- 1 In the Item Tab area, click [Result setting].
- 2 Register the character string that will be the reference for classification.

Setting item	Set value	Description
Classification string	-	Set the Comparison character string. Up to 652 characters can be set.
** '?' is treated as character data.	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Checked: '*' and '?' are handled as normal characters. Unchecked: '*' and '?' are handled as special characters. **: Substitution for character string (with 0 or more characters) ?': Substitution for 1 character

- 3 If necessary, set the quality display for the Detail Result Pane.



Setting item	Set value	Description
Code quality display	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select whether or not to display the integrated quality.

Note

All of the items cannot be displayed due to the displayed items is too many in the Detail Result Pane. When display all of the items, change the Detail Result Pane size. For details, refer to ► *Arranging Windows* in the *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z365).

Output Parameters (2D Code)

Select how measurement results are output to an external device. This item can be changed if necessary. Normally, the factory default value will be used.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Set value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.
Character output	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Set whether to output character strings.

Setting item	Set value [Factory default]	Description
Communication output	<ul style="list-style-type: none"> • [RS-232C/RS-422] • Ethernet 	<p>Set the output destination.</p> <p>When Ethernet is selected, the destination IP address is determined by the system settings.</p> <p>Reference: ► <i>Non-procedure Communications in the Vision System FH/FZ5 Series User's Manual for Communications Settings</i> (Cat. No. Z342).</p>
Header	<ul style="list-style-type: none"> • [None] • STX • ESC 	Set the header of communication output.
Footer	<ul style="list-style-type: none"> • [CR] • CR+LF • ETX • LF 	Set the footer of communication output.
FCS	<ul style="list-style-type: none"> • Available • [None] 	<p>Set whether to output FCS (frame check sequence). FCS performs an XOR of each byte from the beginning to the end of data and converts the result (8 bits) into two ASCII format characters.</p> <p>The reliability of communication can be increased by adding FCS to the output data.</p>
Reading character output		
Reading character output	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Set whether to output character strings.
Output range specify	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Set when specifying the range of character strings to be output. This can be set to a range of 1 to 652.
Output range specify	1 to 652 [1] to [652]	Specify the range of output character count. This can be set to a range of 1 to 652.
Character count output	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Specify whether to output the character count of the character string.
Character code size	<ul style="list-style-type: none"> • [2bytes] • 4bytes 	Select the character code size for character output.
Code quality output	<ul style="list-style-type: none"> • [Checked] • Unchecked 	<p>The setting is enabled if you select [DPM] for the measurement parameter read mode.</p> <p>Set whether to output the 2D Code quality.</p>
Output when reading error occurs		
Error character output	<ul style="list-style-type: none"> • Checked • [Unchecked] 	<p>Specify whether to output the specified character string when there is a reading error. If a check is placed, the character string entered in the lower frame is output.</p> <p>Up to 20 characters can be input.</p>
Error code output	<ul style="list-style-type: none"> • Checked • [Unchecked] 	<p>Set whether to output error codes.</p> <p>Error codes are as follows:</p> <p>0: Normal termination</p> <p>-1: 2D Code not found</p> <p>-3: Timeout</p> <p>-7: Processing terminated due to too much data</p>

Character Output

Characters are output in the ASCII format as follows:

- **When read successfully**

Header + character count + code quality + reading characters + FCS + footer + delimiters

- **When not read successfully**

Header + error code + error characters + FCS + footer + delimiters

Item	Description
Header	What is specified for the Header is output. (None may be specified.) None is output for PLC link.
Character count	This is output only when "Character count output" is specified. Only the reading characters are counted as part of the character count, and if "Output range specify" is specified, the character count of only that range is output. For example, if no character is present in the output range, such as when the read character count is 1 and the output range is 2 to 3, 0 will be output. If "Reading character output" is not specified, 0 will be output. If kanji characters are included in the reading characters, one kanji character is counted as 1. (This is different from byte count.) The output can be switched between 2 bytes and 4 bytes. 0 is added to the left digit if the character count is less than the byte count (Example: 0010 for 10). "--" is output if the character count in 2-byte output reaches 100 or more.
Code quality	This is output only when the "Code quality output" is specified. The output format is "CxxxFxxxExxx". C represents the contrast, while F and E represent the focus and the cell recognition rate, respectively. xxx represents each value (0 to 100), and 0 is added to the left digit if the value is less than 3 digits (Example: 005 for 5).
Reading character	This is output only if "Reading character output" is specified. If "Output range specify" is specified, only the characters of that range are output. For example, if no character is present in the output range, such as when the read character count is 1 and the output range is 2 to 3, no character will be output.
Error code	This is output only when "Error code output" is specified.
Error character	This is output only when "Error character output" is specified.
FCS	This is output only when "FCS" is set to "Available". The value obtained through an XOR in unit of bytes is output. The applicable range includes the character count, code quality, reading characters, error codes and error characters. 0 will be output if nothing that can be output is present in the applicable range. None is output for PLC link.
Footer	What is specified for the Footer is output. None is output for PLC link.
Delimiter	The delimiters specified in the system data are added only for serial communication non-procedure output.

Key Points for Test Measurement and Adjustment (2D Code)

The following contents are displayed in the Detail Result Pane.

Displayed items	Description
Judge	Judgement result
Index	Index matched as the result of comparison with the classification comparison character strings
Detected character count	Number of characters detected
Detected character strings	Character strings detected
Cell recognition rate ^{*1}	A value used to check the error correction rate. The fewer the words whose errors corrected, the better the recognition rate.
Contrast ^{*1}	Evaluate the sharpness of an image. If an image is defocused, code cannot be identified. The displayed value will be smaller as it becomes defocused.
Focus ^{*1}	Evaluate the number of false cell detections in the finder pattern, timing pattern and data region. The displayed value is smaller when there are many false cell detections and reading is unstable.
Overall quality ^{*2}	An overall quality grade for the read code. This is given the lowest weight of the various quality grades.
Decode ^{*2}	A quality decode which shows whether the decode is successful or not.
Contrast ^{*2}	A quality grade which shows the contrast. The grade will be high when the difference of highest and lowest brightness are large in code region.
Modulation ^{*2}	A quality grade which shows the uniformity of cells brightness.
Fixed pattern damage ^{*2}	A quality grade which shows the damage level of the followings: <ul style="list-style-type: none"> • Finder pattern • Timing pattern • Quiet zone
Axis non-uniformity ^{*2}	A quality grade which shows the ratio of code width and height. A cell figure which is close-to-square has high grade.
Error correction during unused time ^{*2}	A quality grade which shows the amount of vertical displacement from the ideal position.
Print Scale ^{*2}	A quality grade that shows the percentage of error corrected items. Fewer error-corrected words results in a higher grade.
Print expansion/contraction X ^{*2}	A quality grade which shows the uniformity of black cell size and white cell size in the X direction results in a higher grade.
Print expansion/contraction Y ^{*2}	A quality grade which shows the uniformity of black cell size and white cell size in the Y direction results in a higher grade.
Scan ^{*2}	---
Overall quality ^{*3}	An overall quality grade for the read code. This is given the lowest weight of the various quality grades.
Decode ^{*3}	A quality grade which shows whether the start pattern, stop pattern, or specified line were successfully decoded, or not.
RAP contrast ^{*3}	A quality grade which shows whether the start pattern, stop pattern, or specified line were successfully decoded, or not. The grade will be high when the difference of highest and lowest brightness are large in pattern region.
RAP reflectance ^{*3}	A quality grade which shows the contrast of the start pattern, stop pattern, or specified line. The grade will be high when the difference of highest and lowest brightness are large in pattern region.

Displayed items	Description
RAP edge contrast ^{*3}	A quality grade which shows the contrast of the start pattern, stop pattern, or specified line. Verify the smallest contrast between bar and space.
RAP modulation ^{*3}	A quality grade which shows the brightness uniformity of the start pattern, stop pattern, or specified line. Verify the lowest edge contrast as against to the symbol contrast.
RAP defect ^{*3}	A quality grade which shows the brightness uniformity of the start pattern, stop pattern, or specified line. Verify the uniformity of brightness between bar and space.
RAP decodability ^{*3}	A quality grade which shows the printed accuracy of start pattern, stop pattern, or specified lines. A grade is high when the width of bar or space is close to the standard values.
RAP additionail ^{*3}	A quality grade which shows whether there is a sufficient Quiet zone for start pattern, stop pattern, or specified line.
RAP overall quality ^{*3}	An overall quality grade for parts of the start pattern, stop pattern, or specified line.
Code word yield ^{*3}	A grade quality which shows the efficiency to read the data by scanning the record. An evaluation of the number of code is successful decoded when repeat to scan the code.
Unused error correction ^{*3}	A quality grade that shows the percentage of error corrected items. A grade which is less errors is high grade.
Decodability ^{*3}	A quality grade which shows the printed accuracy of codes parts. A grade is high when the width of bar or space is close to the standard values.
Defect ^{*3}	A quality grade which shows the uniformity of codes brightness. Verify the uniformity of brightness between bar and space.
Modulation ^{*3}	A quality grade which shows the uniformity of codes brightness. Verify the lowest edge contrast as against to the symbol contrast.

*1: Read mode: Only displayed in DPM mode.

*2: Read mode: Displayed if it is standard, the code type is DM and "Code quality display" is selected.

*3: Read mode: Displayed if it is standard, the code type is PDF417/MicroPDF417 and "Code quality display" is selected.

The display items checked in the result settings tab Grade display setting are displayed.

The grade code is displayed with a letter with numeric expression in parentheses, such as "A (4) to F (0)".

Note

When the reading mode is DPM, a red circle is displayed on the cell where the judgment of the white cell / black cell is corrected in the image display area.

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

When codes cannot be read in correctly

Parameter to be adjusted	Remedy
Region setting	Check whether there are codes to read in the measurement region.
Measurement parameter	Check if the settings, such as "Code type", "Code color", "Code length", and "Mirror setting", are specified correctly.
Timeout	Check to make sure that the specified time is not too short.

Important

- Codes may not be recognized if the code size is set too small or too large.
 - Use input images with a size of 2500 × 2500 pixels or less. Images as described below would not be measurable.
 - Images taken by a camera with five mega-pixel, or higher resolution.
 - Images that have been merged by function of [Panorama] and [Polar Transformation] etc., and whose size exceeds 2500 × 2500 pixels.
-

Measurement Results for Which Output Is Possible (2D Code)

Measurement items	Character string	Description
Judgement result	JG	Judgement result
Decoded character count	DN	Character count
Index	IDX	Index matched as the result of comparison with the classification comparison character strings
Cell recognition rate	CRR	The rate is calculated based on the "the number of error code word to be correctable", which is determined by the size and the error correction level, and the number of error code words that are actually corrected. $(1 - (\text{number of error code words corrected}) / (\text{number of error code words that can be corrected})) \times 100$
Contrast	CT	Contrast
Focus	FCS	Focus
Overall quality	GD0	This is given the lowest weight of the various quality grades. This grades value is most small in each qualities.
Decode	GD1	A quality grade which shows whether the decode is successful or not.
Contrast	GD2	A quality grade which shows the contrast. The grade will be high when the difference of highest and lowest brightness are large in code region.
Modulation	GD3	A quality grade which shows the uniformity of cells brightness.
Fixed pattern damage	GD4	A quality grade which shows the damage level of the followings: <ul style="list-style-type: none"> • Finder pattern • Timing pattern • Quiet zone
Axis non-uniformity	GD5	A quality grade which shows the ratio of code width and height. A cell figure which is close-to-square has high grade.
Grid non-uniformity	GD6	A quality grade which shows the amount of vertical displacement from the ideal position.
Unused error correction	GD7	A quality grade that shows the percentage of error corrected items. A grade which is less errors is high grade.
Print Scale	GD8	A quality grade that shows the percentage of error corrected items. A grade which is less errors is high grade.
Print Scale X	GD9	A quality grade which shows the uniformity of black cell size and white cell size. This grade value is a Print expansion/contraction X or Print expansion/contraction XY.
Print Scale Y	GD10	A grade is high when the white and black cell of Y direction.
Overall quality	GP0	This overall grade is a code to be read. This is given the lowest weight of the various quality grades.
Decode	GP1	A quality grade which shows whether the start pattern, stop pattern, or specified line were successfully decoded, or not.
RAP contrast	GP2	A quality grade which shows whether the start pattern, stop pattern, or specified line were successfully decoded, or not. The grade will be high when the difference of highest and lowest brightness are large in pattern region.
RAP minimum reflection rate	GP3	A quality grade which shows the contrast of the start pattern, stop pattern, or specified line.

Measurement items	Character string	Description
RAP edge contrast	GP4	A quality grade which shows the contrast of the start pattern, stop pattern, or specified line. Verify the smallest contrast between bar and space.
RAP modulation	GP5	A quality grade which shows the brightness uniformity of the start pattern, stop pattern, or specified line. Verify the lowest edge contrast as against to the symbol contrast.
RAP defection	GP6	A quality grade that shows the percentage of error corrected items. A grade which is less errors is high grade.
RAP decidability	GP7	A quality grade which shows whether there is a sufficient Quiet zone for start pattern, stop pattern, or specified line. A grade is high when the width of bar or space is close to the standard values.
RAP additional	GP8	A quality grade which shows whether there is a sufficient Quiet zone for start pattern, stop pattern, or specified line.
RAP overall quality	GP9	An overall quality grade for parts of the start pattern, stop pattern, or specified line.
Code word yield	GP10	A quality grade that shows the percentage of error corrected items. An evaluation of the number of code is successful decoded when repeat to scan the code.
Unused error correction	GP11	A quality grade that shows the percentage of error corrected items. A grade which is less errors is high grade.
Decidability	GP12	A quality grade which shows the printed accuracy of codes parts. A grade is high when the width of bar or space is close to the standard values.
Defect	GP13	A quality grade which shows the uniformity of codes brightness. Verify the uniformity of brightness between bar and space.
Modulation	GP14	A quality grade which shows the brightness uniformity of the start pattern, stop pattern, or specified line. Verify the lowest edge contrast as against to the symbol contrast.

Output of Character String in PLC Link

In PLC Link communication, check the [Character output] to output the character string.
Reference: ▶ Output Parameters (2D Code) (p.424)

1 Output Format

Take the following case as an example.

Number of measurement is one. Reading character string is 32. Command: Read character strings 0123456789...UV, Command, Response, and Data Output area are as follows.

In this case, the following conditions are applied.

[Reading character output] is checked.

[Character count output] and [Error character output] are unchecked.

Reference: ▶ Communicating with PLC Link, Command Details for PLC Link, EtherNet/IP, and EtherCAT in Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342).

Command (PLC to Sensor Controller)

Top Channel		Description
+3	+2	
0010	1010	Performs one measurement.

Response (Sensor Controller to PLC)

Response Area		Description
Top channel	Data	
+2	1010	Command Code
+3	0010	Target command code is responded.
+4	0000	Response code
+5	0000	Command execution result.

Data Output Area (Sensor Controller to PLC)

When read the 32 character strings (0123456789...UV), the result continues as follows.

ASCII code data + NULL (0x00)

Top channel	Name	Description
+0	1st character, 2nd character	3031 (ASCII code of the character 0 , ASCII code of the character 1)
+1	3rd character, 4th character	3233 (ASCII code of the character 2 ASCII code of the character 3)
⋮		
+15	31st character, 32th character	5556 (ASCII code of the character U ASCII code of the character V)
+16	NULL	0x00 (NULL)

Note

- If no character string, data is not output and no updating of data.
When check the [Error character output], output the error character string + NULL(0x00).
- When the character string is 2 bytes, i.e. Shift-JIS. the maximum number of character string is 16. Outputs one character per one channel.

2 How to get the character string

Perform the Data Output Request (DSA) and Data Output Completion (GATE) as in the case of Data Output via PLC Link serial data output.

All character string is included in one data. Thereby, Data Output Request (DSA) is performed once there is only one 2D Code unit.

Output of Character String with Non-procedure Communications

Check the [Character output] in Output parameter to output the character string with Non-procedure communication.

Reference: ▶ Output Parameters (2D Code) (p.424)

1 Output Format

Take the following case as an example. Number of measurement is one.

Reading character string is 32. Read character strings 0123456789...UV, Command, Response, and Data Output area are as follows.

In this case, the following conditions are applied.

[Reading character output] is checked.

[Character count output] and [Error character output] are unchecked.

Reference: ▶ Non-procedure Communications and MEASURE or M in Non-procedure Command Details in Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342).

Command (PLC to Sensor Controller)

M E A S U R E ^{C_R} or M ^{C_R}

Response (Sensor Controller to PLC)

O K ^{C_R}

Header + 0123456789...UV(Character string data) + Footer ^{C_R}

Note

- If no character string, data is not output and no updating of data.

O K ^{C_R}

Header + Footer ^{C_R}

- When check the [Error character output], as follow.

O K ^{C_R}

Header + Error character string + Footer ^{C_R}

Output of Character string with EtherNet/IP Message Communications

In EtherNet/IP message communication, output of character string is possible using UNITDATA command which acquires the measurement value.

Outputs the character string data which is measured in Character Inspection and NULL (0x00).

Reference: ▶ Communicating with the Sensor Controller with EtherNet/IP Message Communications, Non-procedure Communications and UNITDATA or UD in Non-procedure Command Details in Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342).

1 Output Format

Take the following case as an example. Send UNITDATA command. Reading character string is 32.

Command: Read character strings 0123456789...UV, Command, Response, and Data Output area are the followings.

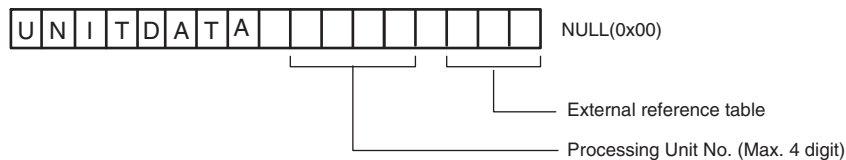
Described example is only a part of Attribute.

Command (PLC to Sensor Controller)

Specify the command character string equivalent to a non-procedure command.

Attach NULL (0x00) at the end of the character string. No line feed code is required.

The size of the send data includes the NULL (0x00) at the end of the character string.



Response (Sensor Controller to PLC)

Character string data equivalent to the Non-procedure command reception character string is returned.

Null (0x00) is inserted in the reception character string delimiter section. The size of the reception data includes the final NULL (0x00).

0123456789...UV(Character string data) NULL(0x00) O(0x4F) K(0x4b) NULL(0x00)

Note

- If no character string, refer to the following.

NULL(0x00) O(0x4F) K(0x4b) NULL(0x00)

- When output the multiple lines, change the external reference table No. of UNITDATA, and then read the character strings.

External Reference Tables (2D Code)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
6	Decoded character count	Get only	Number of characters included in code detected
7	Decoded character string	Get only	Character string included in code detected
8	Index	Get only	0 to 35 -1: Where there was no match with any of the index comparison strings, or the index comparison string has not been set up.
9	Error code	Get only	0: Completed successfully -1: The 2D code cannot be found. -3: Timeout -7: Process could not be completed with too large a volume of data.
18	Cell recognition rate	Get only	The rate is calculated based on the "the number of error code word to be correctable", which is determined by the size and the error correction level, and the number of error code words that are actually corrected. $(1 - (\text{number of error code words corrected}) / (\text{number of error code words that can be corrected})) \times 100$
19	Contrast	Get only	0 to 100
20	Focus	Get only	0 to 100
21	Overall quality (Normal:DM)	Get only	0 to 4
22	Decode (Normal:DM)	Get only	0 to 4
23	Contrast	Get only	0 to 4
24	Modulation	Get only	0 to 4
25	Fixed pattern damage	Get only	0 to 4
26	Axial nonuniformity	Get only	0 to 4
27	Grid nonuniformity	Get only	0 to 4
28	Unused error correction	Get only	0 to 4
29	Print Scale	Get only	0 to 4
30	Print Scale X	Get only	0 to 4
31	Print Scale Y	Get only	0 to 4
33	Overall quality (Normal:PDF417/ MicroPDF417)	Get only	0 to 4
34	Decode (Normal:PDF417/ MicroPDF417)	Get only	0 to 4
35	RAP contrast	Get only	0 to 4
36	RAP reflectance	Get only	0 to 4
37	RAP edge contrast	Get only	0 to 4
38	RAP modulation	Get only	0 to 4
39	RAP defect	Get only	0 to 4
40	RAP decodability	Get only	0 to 4
41	RAP additional	Get only	0 to 4

No.	Data name	Set/Get	Data range
42	RAP overall quality	Get only	0 to 4
43	Code word yield	Get only	0 to 4
44	Unused error correction	Get only	0 to 4
45	Decodability	Get only	0 to 4
46	Defect	Get only	0 to 4
47	Modulation	Get only	0 to 4
80	GS1 flag	Get only	0: Normal 1: GS1 code
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Code type	Set/Get	Normal 0: DataMatrix 1: QRCode 2: MicroQR 3: PDF417 4: MicroPDF417 DPM 0: Auto 1: DataMatrix 2: QRCode
121	Code color	Set/Get	0: Automatic 1: Black 2: White
122	Symbol size (for DM square)	Set/Get	0: Automatic 1: 10 × 10 2: 12 × 12 ... 16: 64 × 64
123	Symbol size (for DM rectangle)	Set/Get	0: Automatic 1: 8 × 18 2: 8 × 32 ... 6: 16 × 48
124	Symbol size (for QR)	Set/Get	0: Automatic 1: 21 × 21 2: 25 × 25 ... 10: 57 × 57
125	DM code shape	Set/Get	0: Automatic 1: DM square 2: DM rectangle
126	QR code shape	Set/Get	0: Automatic 1: Square
127	Code length	Set/Get	Number of pixels for the size of the code (Longer side for a rectangle)
128	Mirror setting	Set/Get	0: Automatic 1: Normal 2: Reverse
129	QR code model	Set/Get	0: Automatic 1: Model 1 2: Model 2

No.	Data name	Set/Get	Data range
130	QR code ECC level	Set/Get	0: Automatic 1: M 2: L 3: H 4: Q
131	Timeout	Set/Get	50 to 99999 ms
133	Character output flag	Set/Get	0: Not output 1: Output
134	Output range specify	Set/Get	0: Not set 1: Set
135	Output ending digit	Set/Get	1 to 652
136	Output starting digit	Set/Get	1 to 652
137	Output device	Set/Get	0: RS-232C/422 1: Ethernet
138	Error character output flag	Set/Get	0: Not output 1: Output
139	Message output while outputting an error	Set/Get	Output character string when error occurred
140	Automatic code length setting	Set/Get	1: Automatic 0: The specified code length is applied.
141	Error code output flag	Set/Get	0: Not output 1: Output
142	Magnify level	Set/Get	0 to 4
143	Magnify level auto	Set/Get	0: Use the Magnify level specified value. 1: Auto
144	Quiet zone	Set/Get	0: OFF 1: ON
145	Integrated quality	Set/Get	0 to 4
146	Read mode	Set/Get	0: Normal 1: DPM
147	MicroQR size	Set/Get	0: Auto 1: 11 × 11 2: 13 × 13 3: 15 × 15 4: 17 × 17
148	ECC level	Set/Get	0: Auto 1: L 2: M 3: Q
170	Upper limit of number of characters detected	Set/Get	0 to 652
171	Lower limit of number of characters detected	Set/Get	0 to 652
172	Judgement comparison character string	Set/Get	Comparison string used for judgement
173	Flag used for special character judgement	Set/Get	0: "*" and "?" are considered to be wild cards. 1: "*" and "?" are considered to be character strings.
174	Flag used for special character classification	Set/Get	0: "*" and "?" are considered to be wild cards. 1: "*" and "?" are considered to be character strings.

No.	Data name	Set/Get	Data range
175	Flag showing character string display results	Set/Get	0 : Not displayed 1 : Displayed
176	Character string display color	Set/Get	0: Black 1 : White 2: Red 3: Green 4: Blue
177	Character string display size	Set/Get	10 to 200
178	Communication header	Set/Get	0: OFF 1: STX 2: ESC
179	Communication footer	Set/Get	0: CR 1: CR + LF 2: ETX 3: LF
180	FCS flag	Set/Get	0: OFF 1: ON
181	Character count output flag	Set/Get	0: OFF 1: 2 bytes 2: 4 bytes
182	Code quality output flag	Set/Get	0: OFF 1: ON
183	Code quality display flag	Set/Get	0: OFF 1: ON
184	Character external output flag	Set/Get	0: OFF 1: ON
185	Replace GS1 with specified character string	Set/Get	0: OFF 1: ON
186	Replacement character string	Set/Get	Character string to replace GS1 with
300 to 335	Classification comparison character string	Set/Get	Comparison character string used for classification

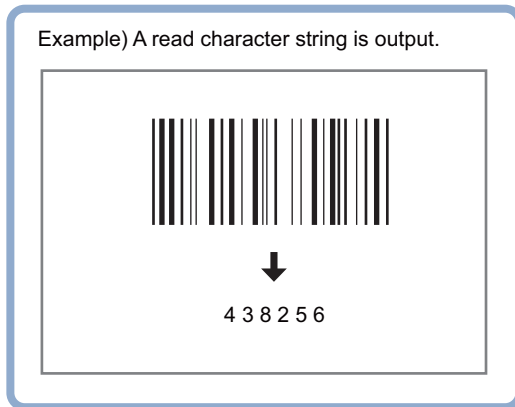
Barcode

Read in barcodes.

Processing can also classify the read-in results.

Used in the Following Case

- To read in barcodes and output them to an external device

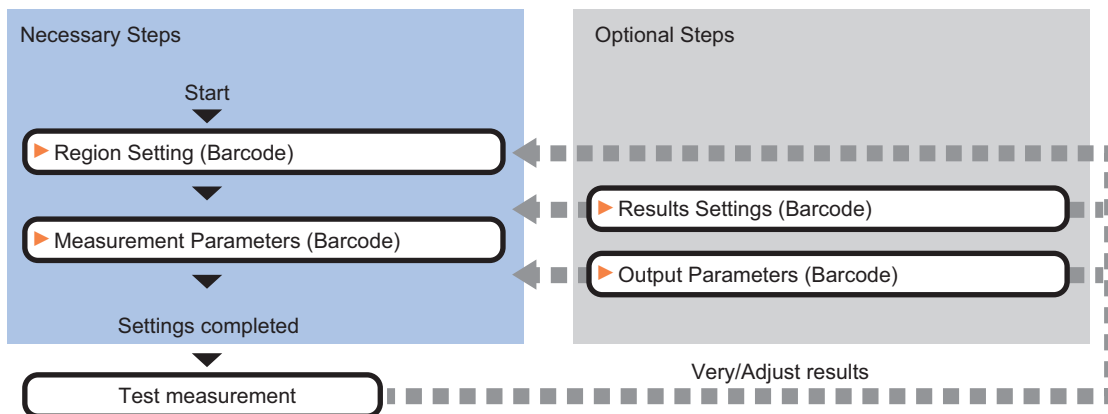


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Barcode)

Barcode can be set up as follows.



List of Barcode Items

Item name	Description
Region setting	This item is used to set up the measurement area. Restricting the measurement area can shorten the processing time. Reference: ► Region Setting (Barcode) (p.440)
Measurement	This item specifies the judgement condition for measurement results. Set the code type and the number of characters to be judged as OK. Reference: ► Measurement Parameters (Barcodes) (p.441)
Result setting	Set the measurement results. Judgement results can be classified. Reference: ► Results Settings (Barcode) (p.444)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Reference: ► Output Parameters (Barcode) (p.444)

Region Setting (Barcode)

Specify the rectangular area in which to search for the barcodes.
Restricting the measurement area can shorten the processing time.

- 1 In the Item Tab area, click [Region setting].**
- 2 Click [Edit].**
The figure setting area is displayed.
- 3 Specify the area in which to search for the barcodes.**
The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.
- 4 Click [OK] in the Figure setting area.**
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

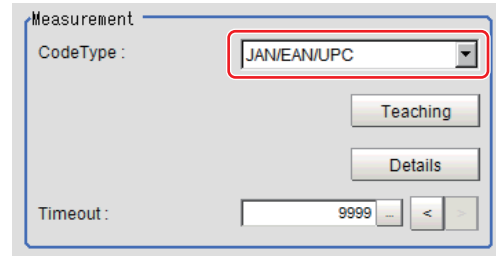
Important

- Set the measurement region to be 2448 × 2044, or less.
- Set the measurement region such that it contains only 1 barcode.
If there is more than one bar code in the measurement region, measurement may not be performed correctly.
- Set the measurement region such that it includes a quiet zone.

Measurement Parameters (Barcodes)

This item sets the judgement conditions for measurement conditions and measurement results. When the Teaching button is pressed, the code type and advanced settings are set automatically. If you then click the Measure button, measurement is executed, the detected barcode region is displayed on the image and the measurement results are displayed as measurement value of the judgement condition. If measurement cannot be carried out successfully with this procedure, adjust the parameters shown below.

- 1 In the Item Tab area, click [Measurement].
- 2 In the "Measurement" area, set the Code Type.



Setting item	Set value [Factory default]	Description
Code Type	<ul style="list-style-type: none"> • [JAN/EAN/UPC] • Code39 • Codabar • ITF • Code93 • Code 128/GS1-128 • GS1 DataBar • Pharmacode 	<p>Select the code type for the code to read.</p> <ul style="list-style-type: none"> • JAN/EAN/UPC: Read JAN/EAN/UPC-format barcodes. • Code39: Read Code39-format barcodes. • Codabar: Read Codabar(NW-7)-format barcodes. • ITF: Read ITF(Interleaved 2 of 5)-format barcodes. • Code93: Read Code93-format barcodes. • Code 128/GS1-128: Read barcodes in the Code128/GS-128 and GS1-128 Composite Code (CC-A, CC-B, CC-C) formats. • GS1 DataBar: Read barcodes in the GS1 DataBar* (Truncated, Stacked, Omni-directional, Stacked Omni-directional, Limited, Expanded, Expanded Stacked) and GS1-DataBar Composite Code (CC-A, CC-B) formats. • Pharmacode: Read Pharmacode-format barcodes.

Note

- The designations of the following code types are standardized to those conforming to GS1Databar from 2010. With FH/FZ5, current designation "GS1Databar" and old designation "RSS" are both indicated. Select each code type of a new designation conforming to GS1DataBar.
- GS1 Databar code type new/old comparison table

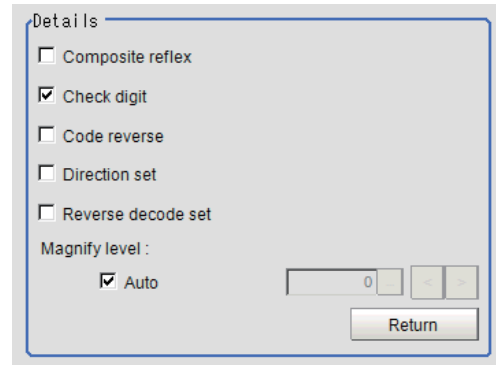
Code type name	Official name
GS1 DataBar (RSS-14)	GS1 DataBar Omni-directional
GS1 DataBar (RSS Lim.)	GS1 DataBar Limited
GS1 DataBar (RSS Exp.)	GS1 DataBar Expanded

- 3 To set measurement parameters automatically, click [Teaching].

The following setting items have their detailed settings automatically set.

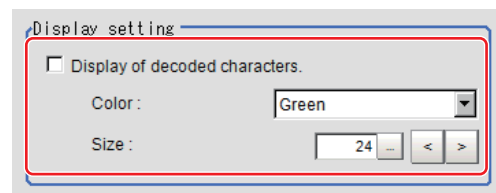
- Code Type
- Composite reflex
- Auto Magnify level
- Magnify level

4 When making the detailed settings, click "Details" and set each item.



Setting item	Set value [Factory default]	Description
Composite reflex	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select whether or not to read composite code.
Check digit	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Select whether or not to perform check using the check digit. When check is performed, the check digit is not included in the read character string.
Code reverse	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select whether or not to read reversed black/white code.
Direction set	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select the direction in which to read barcodes. Reading is performed horizontally when there is no check. Reading is performed vertically when there is a check. This item is selectable when the code type is "Pharmacode."
Reverse decode set	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select whether or not to use reverse mode. This item is selectable when the code type is "Pharmacode."
Auto magnify level	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Select whether or not to set the image magnify level automatically when reading code. Stable reading is enabled if there is a check, but the processing time will increase.
Magnify level	0 to 4 [4]	Set the image magnify level to be applied when reading code. If reading the code is difficult for a high-resolution Camera or image, increase the value. The value is updated when teaching is performed.

5 When changing the display settings, set each item in the "Display setting" area.



Setting item	Set value [Factory default]	Description
Color	<ul style="list-style-type: none"> • Black • White • Red • [Green] • Blue 	Select the display color for character strings.
Size	10 to 200 [24]	Set the display size for character strings.

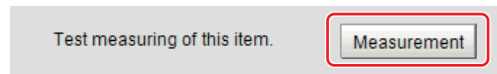
6 If you select [GS1 DataBar] or [GS1-128] for the code type, set a group separator replacement condition.

Setting item	Set value [Factory default]	Description
Replace group separator with specified character string	<ul style="list-style-type: none"> • [Checked] • Unchecked 	If you select [GS1-128] or [GS1 DataBar] for the code type, check this checkbox to replace each group separator with another character string.
Replacement character string	---	Set the character string to replace group separators with.

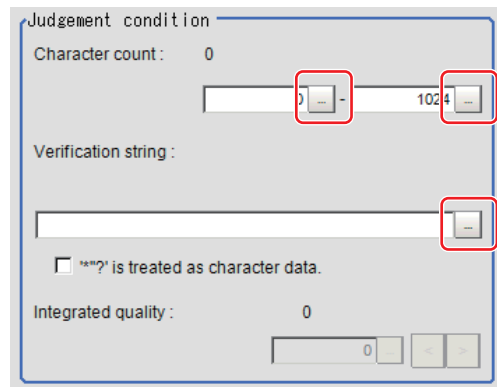
Note

Replacing each group separator (control character) with the specified character string enables codes containing group separators to be read and compared to a comparison character string.

7 When the setting has been changed, click [Measurement] in the "Detail" area to verify whether measurements can be made correctly.



8 Set up the judgement condition.



Setting item	Set value	Description
Character count	0 to 1024 [1024]	Specify the character count to be judged as OK.
Verification string	Up to 1023 characters can be set.	Specify the character strings to be judged as OK.
*** '?' is treated as character data.	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Checked: '*' and '?' are handled as normal characters. Unchecked: '*' and '?' are handled as special characters. '*': Substitution for character string (with 0 or more characters) '?': Substitution for 1 character
Integrated quality	0 to 4 [4]	Specify the integrated quality to be judged as OK.

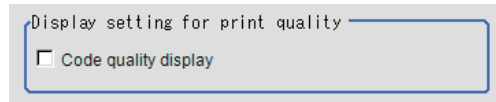
Results Settings (Barcode)

Results can be classified according to the judgement results.

- 1 In the Item Tab area, click [Result setting].
- 2 Register the character string that will be the reference for classification.

Setting item	Set value	Description
Classification string	-	Set the Verification string. Up to 1023 characters can be set.
** '?' is treated as character data.	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Checked: '*' and '?' are handled as normal characters. Unchecked: '*' and '?' are handled as special characters. **: Substitution for character string (with 0 or more characters) ?!: Substitution for 1 character

- 3 If necessary, set the quality display for the "Detail result" display area.



Setting item	Set value	Description
Code quality display	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select whether or not to display integrated quality.

Output Parameters (Barcode)

Select how measurement results are output to an external device. This item can be changed if necessary. Normally, the factory default value will be used.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Set value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.
Character output	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Set whether to output character strings.
Error output	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Set whether to output errors.
Error output character string	---	Input the character string output when there is an error. Up to 20 characters can be input.
Output device	<ul style="list-style-type: none"> • [RS-232C/RS-422] • Ethernet 	When "Character output" is checked (character strings are output), specify the device to which character strings are output. A character string is output as an ASCII code character string plus a delimiter. When Ethernet is selected, the destination IP address is determined by the system settings. Reference: ▶ <i>Non-procedure Communications in the Vision System FH/FZ5 Series User's Manual for Communications Settings</i> (Cat. No. Z342).

Key Points for Test Measurement and Adjustment (Barcode)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Index	Index matched as the result of comparison with the classification comparison character strings
Character count	Number of characters detected
Read string	Character strings detected Up to 40 characters are displayed (with a new line after every 15th character). From the 41st character on is displayed as "...". Example) Detected character strings <ul style="list-style-type: none"> • 123456789012345 • 123456789012345 • 1234567890... (□ indicates a double-byte space.)
Overall quality [Note 1]	Result of overall quality

[Note 1]: This is displayed only when "Code quality display" check box is selected in the result setting (Barcode).

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

After teaching has been executed, the read-in character contents are different.

Parameter to be adjusted	Remedy
Measurement	The code type may have been detected incorrectly. <ul style="list-style-type: none"> • Select the code type manually, then measure again. • Set the Narrow bar size and Wide bar size in the Advanced setting to match the displayed barcode image, then execute teaching again. • If the bars are too narrow or there is not much difference in density between the background and the image, correct the image with filtering and execute teaching.

Measurement Results for Which Output Is Possible (Barcode)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judgement result
Number of decoded character	DN	Number of characters detected
Index	IDX	Index matched as the result of comparison with the classification comparison character strings
Integrated quality	GT	Integrated quality
Integrated quality	GB0	Integrated quality 1D
Decode	GB1	Decode 1D
Symbol contrast	GB2	Symbol contrast 1D
Minimum reflection ratio	GB3	Minimum reflection ratio 1D
Minimum edge contrast	GB4	Minimum edge contrast 1D
Modulation	GB5	Modulation 1D
Defect	GB6	Defect 1D
Decodability	GB7	Decodability 1D
Additional	GB8	Additional 1D
Integrated quality	GP0	Integrated quality 2D
Decode	GP1	Decode 2D
RAP symbol contrast	GP2	RAP symbol contrast
RAP minimum reflection ratio	GP3	RAP minimum reflection ratio
RAP minimum edge contrast	GP4	RAP minimum edge contrast
RAP modulation	GP5	RAP modulation
RAP defect	GP6	RAP defect
RAP decodability	GP7	RAP decodability
RAP additional	GP8	RAP additional
RAP overall quality	GP9	RAP overall quality
Code word yield	GP10	Code word yield
Unused error correction	GP11	Unused error correction
Decodability	GP12	Decodability 2D
Defect	GP13	Defect 2D
Additional	GP14	Modulation 2D

Output of Character String in PLC Link

In PLC Link communication, check the [Character output] to output the character string and NULL(0x00) to the data output area of PLC Link.

Reference: ▶ Output Parameters (Barcode) (p.444)

1 Output Format

Take the following case as an example.

Number of measurement is one. Reading character string is 32. Command: Read character strings 0123456789...UV, Response, and Data Output area are as follows.

Reference: ▶ Communicating with PLC Link, Command Details for PLC Link, EtherNet/IP, and EtherCAT in Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342).

Command (PLC to Sensor Controller)

Top channel		Description
+3	+2	
0010	1010	Performs one measurement.

Response (Sensor Controller to PLC)

Response Area		Description
Top channel	Data	
+2	1010	Command Code
+3	0010	Target response is responded.
+4	0000	Response code
+5	0000	Command execution result.

Data Area (Sensor Controller to PLC)

When output the 32 character strings (0123456789...UV), the result continues as follows.
ASCII code data + NULL (0x00)

Top channel	Name	Description
+0	1st character, 2nd character	3031 (ASCII code of the character 0 , ASCII code of the character 1)
+1	3rd character, 4th character	3233 (ASCII code of the character 2 ASCII code of the character 3)
⋮		
+15	31st character, 32th character	5556 (ASCII code of the character U ASCII code of the character V)
+16	NULL	0x00 (NULL)

Note

If no character string, data is not output and no updating of data.

When check the [Error character output], output the error character string + NULL (0x00).

2 How to get the character string

Perform the Data Output Request (DSA) and Data Output Completion (GATE) as in the case of Data Output.

All character string are included one data. Thereby, Data Output Request (DSA) is performed once if there is only one Barcode unit.

Output of Character string with Non-procedure Communications

Check the [Character output] in Output parameter to output the character string with Non-procedure communication.

Reference: ▶ Output Parameters (Barcode) (p.444)

1 Output Format

Take the following case as an example. Number of measurement is one.

Reading character string is 32. Read character strings 0123456789... UV, Command, Response, and Data Output area are as follows.

In this case, the following conditions are applied.

[Reading character output] is checked.

[Character count output] and [Error character output] are unchecked.

Reference: ▶ Non-procedure Communications and MEASURE or M in Non-procedure Command Details in Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342).

Command (PLC to Sensor Controller)

M E A S U R E ^{C_R} or M ^{C_R}

Response (Sensor Controller to PLC)

O K ^{C_R}

0123456789...UV(Character string data) ^{C_R}

Note

- If [Error output] is not checked and no character string, refer to the following.

O K ^{C_R}

^{C_R}

- If [Error output] is checked and no character string, refer to the following.

O K ^{C_R}

(Error character string data) ^{C_R}

Output of Character string with EtherNet/IP Message Communications

In EtherNet/IP message communication, output of character string is possible using UNITDATA command which acquires the measurement value.

Outputs the character string data which measured in Character Inspection and NULL(0x00).

Reference: ▶ Communicating with the Sensor Controller with EtherNet/IP Message Communications, Non-procedure Communications and UNITDATA or UD in Non-procedure Command Details in Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342).

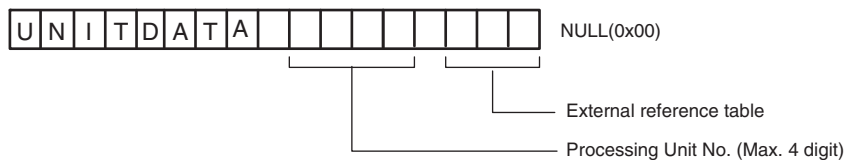
1 Output Format

Take the following case as an example. Send UNITDATA command. Reading character string is 32: Read character string 01233456789... UV, Command, Response, and Data Output area are the followings. Described example is only a part of Attribute.

Command (PLC to Sensor Controller)

Specify the command character string equivalent to a non-procedure command. Attach NULL (0x00) at the end of the character string. No line feed code is required.

The size of the send data includes the NULL (0x00) at the end of the character string.



Response (Sensor Controller to PLC)

Character string data equivalent to the Non-procedure command reception character string is returned. Null (0x00) is inserted in the reception character string delimiter section.

The size of the reception data includes the final NULL (0x00).

If no character string, refer to the following.

0123456789...UV(Character string data) NULL(0x00) O(0x4F) K(0x4b) NULL(0x00)

Note

- If no character string, refer to the following.

NULL(0x00) O(0x4F) K(0x4b) NULL(0x00)

- When output the multiple lines, change the external reference table No. of UNITDATA, and then read the character strings.

External Reference Tables (Barcode)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error(image format mismatch) -11: Error(unregistered model) -12: Error(insufficient memory) -20: Error(other errors)
6	Decoded character count	Get only	Number of characters detected
7	Decoded character string	Get only	Character strings detected
8	Index	Get only	0 to 127: Index matched as the result of comparison with the classification comparison character strings -1: Where there was no match with any of the index comparison strings, or the index comparison string has not been set up.
9	Integrated quality	Get only	0 to 4
10	Integrated 1D	Get only	0 to 4
11	Decode 1D	Get only	0 to 4
12	Symbol contrast 1D	Get only	0 to 4
13	Minimum reflection ratio 1D	Get only	0 to 4
14	Minimum edge contrast 1D	Get only	0 to 4
15	Modulation 1D	Get only	0 to 4
16	Defect 1D	Get only	0 to 4
17	Decodability 1D	Get only	0 to 4
18	Additional 1D	Get only	0 to 4
19	Integrated 2D	Get only	0 to 4
20	Decode 2D	Get only	0 to 4
21	RAP symbol contrast	Get only	0 to 4
22	RAP minimum reflection ratio	Get only	0 to 4
23	RAP minimum edge contrast	Get only	0 to 4
24	RAP modulation	Get only	0 to 4
25	RAP defect	Get only	0 to 4
26	RAP decodability	Get only	0 to 4
27	RAP additional	Get only	0 to 4
28	RAP overall quality	Get only	0 to 4
29	Code word yield	Get only	0 to 4
30	Unused error correction	Get only	0 to 4
31	Decodability 1D	Get only	0 to 4
32	Defect 1D	Get only	0 to 4
33	Modulation 1D	Get only	0 to 4
80	GS1 flag	Get only	0: Normal 1: GS1 code

No.	Data name	Set/Get	Data range
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Code type	Set/Get	0: JAN/EAN/UPC 1: Code39 2: Codabar 3: ITF 4: Code93 5: Code128/GS1-128 6: GS1 DataBar 7: Pharmacode
121	Flag used for special character judgement	Set/Get	0: "*" are considered to be wild cards 1: "*" are considered to be character strings
122	Flag used for special character classification	Set/Get	0: "*" are considered to be wild cards 1: "*" are considered to be character strings
123	Flag showing character string display results	Set/Get	Flag regarding whether or not character string is displayed
124	Character string display color	Set/Get	0: Black 1 : White 2: Red 3: Green 4: Blue
125	Character string display size	Set/Get	10 to 100
136	Check digit	Set/Get	0: Check digit is not used 1: Check digit is used
137	Number of characters detected setting	Set/Get	1 to 1024
162	Upper limit of number of characters detected	Set/Get	0 to 1024
163	Lower limit of number of characters detected	Set/Get	0 to 1024
164	Judgement comparison character string	Set/Get	Comparison string used for judgement
170	Code color	Set/Get	0: Black 1: White
171	Composite code read flag	Set/Get	0: OFF 1: ON
172	Timeout	Set/Get	0 to 9999
173	Direction set (Pharmacode only)	Set/Get	0: Horizontal direction 1: Vertical direction
174	Reverse decode set (Pharmacode only)	Set/Get	0: OFF 1: ON
175	Lower limit for overall grade	Set/Get	0 to 4
190	Overall quality set	Set/Get	0: Not displayed 1: Displayed
191	Replace GS1 with specified character string	Set/Get	0: OFF 1: ON
192	Replacement character string	Set/Get	Character string to replace GS1 with

No.	Data name	Set/Get	Data range
200	Auto	Set/Get	0: OFF 1: ON
201	Magnify level	Set/Get	0 to 4
300 to 335	Classification comparison character string	Set/Get	Verification string used for classification
400	Character output flag	Set/Get	0: Not output 1: Output
401	Output device	Set/Get	0: RS-232C 1: Ethernet
402	Error output	Set/Get	Error output flag
403	Error message	Set/Get	Message output while outputting an error

OCR User Dictionary

Use the OCR user dictionary to store dictionary data to be used in [OCR].

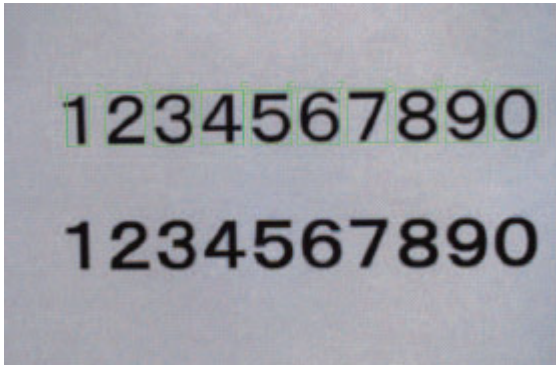
Use this function when you need to recognize special font characters or other characters that cannot be recognized using the built-in dictionary for [OCR].

The dictionary data stored in the [OCR User Dictionary] can be referenced from multiple instances of [OCR].

Used in the Following Case

- To create an OCR user dictionary to be used in OCR.

Example: Inspecting printed characters

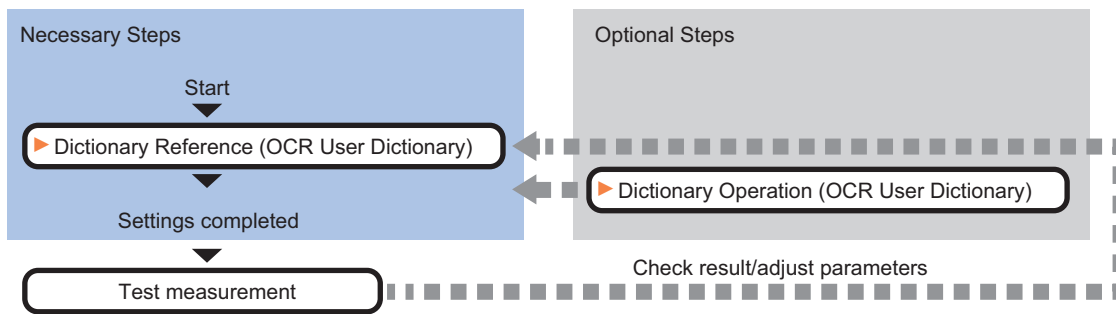


Important

- Dictionary data cannot be shared between the OCR user dictionary and the model dictionary.
- The OCR user dictionary can be used for OCR. It cannot be used for general character inspection.
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (OCR User Dictionary)

Set up the OCR user dictionary according to the following steps.



List of OCR User Dictionary Items

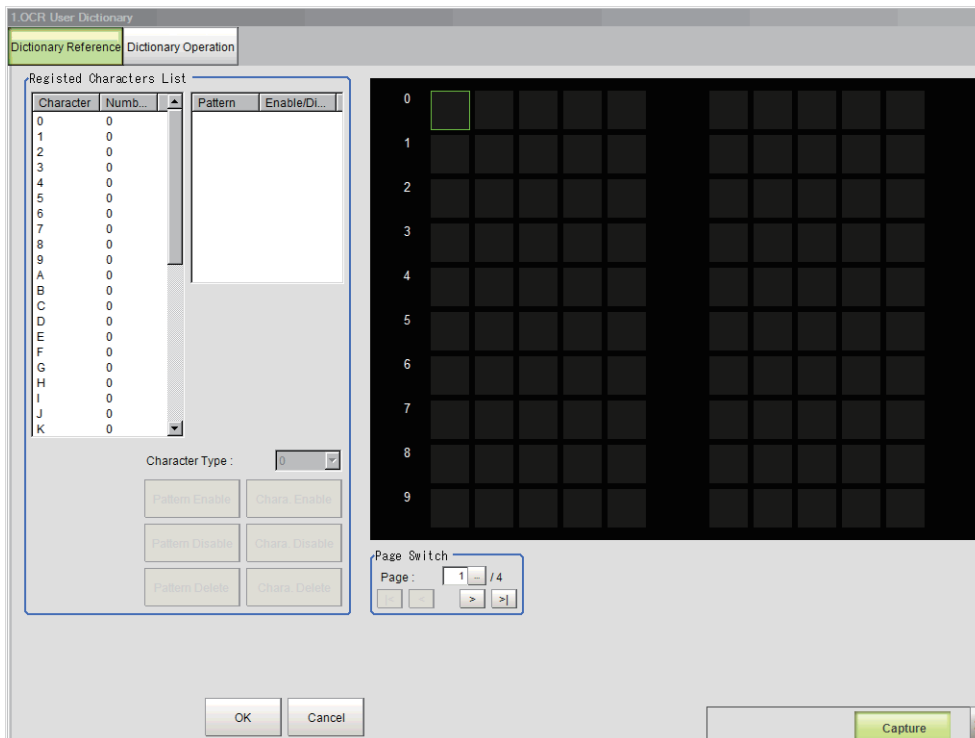
The following items can be set in the OCR user dictionary.

Item name	Description
Dictionary Reference	Configure the dictionary data browse settings, character data enable settings used for dictionary reference, and other settings. Reference: ▶ Dictionary Reference (OCR User Dictionary) (p.454)
Dictionary Operation	Dictionary operations are saving dictionary data to a file and loading dictionary data from a file. Reference: ▶ Dictionary Operation (OCR User Dictionary) (p.456)

Dictionary Reference (OCR User Dictionary)

Configure the dictionary data browse settings, character data enable settings used for dictionary reference, and other settings. Dictionary data that can be referenced is data stored using dictionary registration in the OCR processing item.

Reference: ▶ Dictionary Registration (OCR) (p.470)



Setting Pattern Enable/Disable

For each character type, enable the patterns that you want to use for OCR and disable the patterns that you do not want to use.

- 1** In the Item Tab area, click [Dictionary Reference].
- 2** Select the character type from the list in the registered characters list area.
- 3** Set the items in the registered characters list area.

Setting item	Setting value [Factory default]	Description
Pattern enable/disable	<ul style="list-style-type: none"> • [ON] • OFF 	If you do not want to use a pattern for OCR, remove the checkmark from "Pattern".
Character Code	0 to 9, A to Z, :/)(Set the character code of the character type.

Note

- Up to 10 patterns can be used for each character type.

Changing a Character Code Registered in a Pattern

A character code registered in one of the multiple patterns in each character type can be changed to a different character code.

- 1** Select the character type from the list in the registered characters list area.
- 2** Select the pattern that you want to change from the pattern list.
- 3** Select the character code in [Character Code].

The character code of the character pattern selected in the list is changed.

Setting Character Type Enable/Disable

Enable character types that you want to use for OCR and disable character types that you do not want to use.

- 4** Select the character type from the list in the registered characters list area.
- 5** Click [Chara. Disable].

The character type selected in the list is disabled. To enable the character type, click [Chara. Enable].

Deleting a Character Type

You can delete a character type that has been registered in the dictionary.

- 1** Select the character type from the list in the registered characters list area.
- 2** Click [Chara. Delete].

The character type selected in the list is deleted.

Dictionary Operation (OCR User Dictionary)

Dictionary operations are saving dictionary data to a file and loading dictionary data from a file.

The screenshot shows a dialog box titled "OCR User Dictionary" with a tab labeled "Dictionary Operation". The dialog is divided into two main sections: "Save Dictionary" and "Load Dictionary". Each section contains a "Filename:" label, a text input field with a file selection icon, and a button labeled "Save Dictionary" or "Load Dictionary". At the bottom of the dialog, there are "OK", "Cancel", and "Capture" buttons.

Saving Dictionary Data to a File

The dictionary data of an OCR user dictionary processing unit can be saved to a file.

- 1 In the Item Tab area, click [Dictionary Operation].
- 2 In the save dictionary area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Filename	-	Set the file name used to saved the dictionary data of the processing unit.

- 1 Click [Save Dictionary].
The dictionary data is saved under the file name in the location specified in "Filename".

Loading Dictionary Data From a File

You can load a dictionary data file and use the data as dictionary data of the OCR user dictionary processing unit.

- 1 In the load dictionary area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Filename	-	Set the name of the dictionary data file to be loaded as dictionary data of the processing unit.

- 2 Click [Load Dictionary].
The dictionary data of the file specified by the file name is loaded.

Note

- Dictionary data can be saved and loaded as a file with the extension “cbd”.

Key Points for Test Measurement and Adjustment (OCR User Dictionary)

You can adjust the parameters while you perform test measurements and check the measurement results to increase the measurement precision and speed.

Select the adjustment method by considering the following point.

Check the measurement results that can be displayed and output in “Measurement Results for Which Output Is Possible”.

Items Displayed in the Detail Result Area

The following measurement results are displayed in the “Detail result” area as text.

Displayed Item	Description
Judge	Displays the judgement result for the processing unit.

Items Displayed in the Image Display Area

You can specify a sub-image number to display the next image in the image display area.

Sub image number	Description
0	The measurement image appears.

Measurement Results for Which Output Is Possible (OCR User Dictionary)

The measurement results provided by OCR user dictionary are shown below. The measurement results appear in the “Detail Result” area, and you can also use result output processing items to output the measurement results to an external device.

Refer to Reference: ▶ External Reference Table (OCR User Dictionary) (p.457) for the parameters that can be referenced, including measurement results.

Measurement result	Character string	Description
Judge	JG	The judgement result for the processing unit

External Reference Table (OCR User Dictionary)

By specifying a number, you can access the following data from processing items that support processing unit data setting/acquisition, and from control commands.

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG

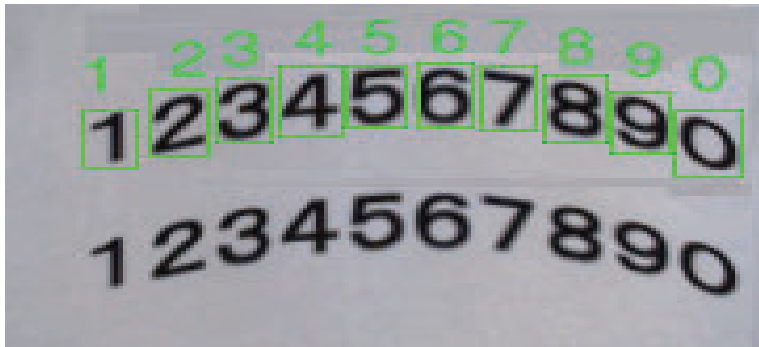
Characters in images can be recognized and read as text information using the internal font information without the need to prepare dictionary data. Using your own dictionary data (OCR User Dictionary), you can also recognize characters in a special font.

OCR provides a higher level of recognition stability than character inspection when reading closely spaced characters, curved text strings, and other deviational characters. Setup is easy because there is no need to create a dictionary.

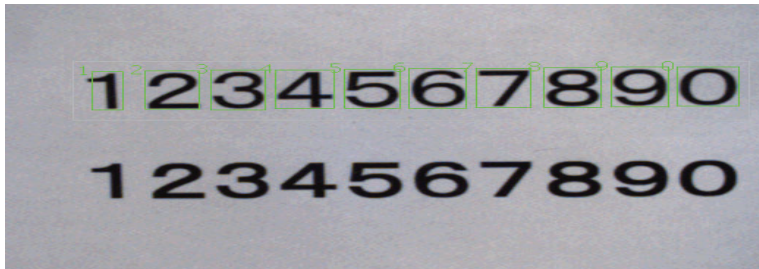
Used in the Following Case

- **Reading characters printed on a product**

Example: Inspection of expiration date, lot number, or other text printed on a curved surface such as a can or bottle.



Example: Inspection of manufacturing date, expiration date, or other text printed on a package or label.



Important

- The following characters are acceptable for OCR function.
 - Letters (A to Z)
 - Numbers (0 to 9)
 - Period (.)
 - Colon (:)
 - Hyphen (-)
 - Apostrophe (')
 - Left parentheses (()
 - Rightparentheses ())
 - Slash (/)
- Note that measurement cannot be done on a continuing sequence of the following symbols.
 - Period (.)
 - Colon (:)
 - Hyphen (-)
 - Apostrophe (')
 - Left parentheses (()
 - Rightparentheses ())
 - Slash (/)

Example

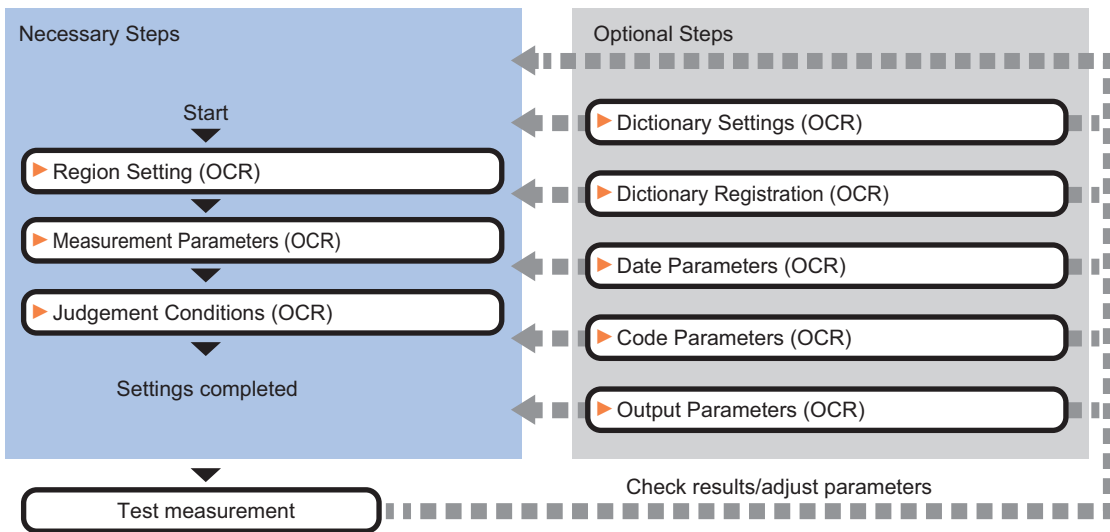
123./ABC

└─ Period and slash are contiguous.

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (OCR)

Set up OCR according to the following steps.



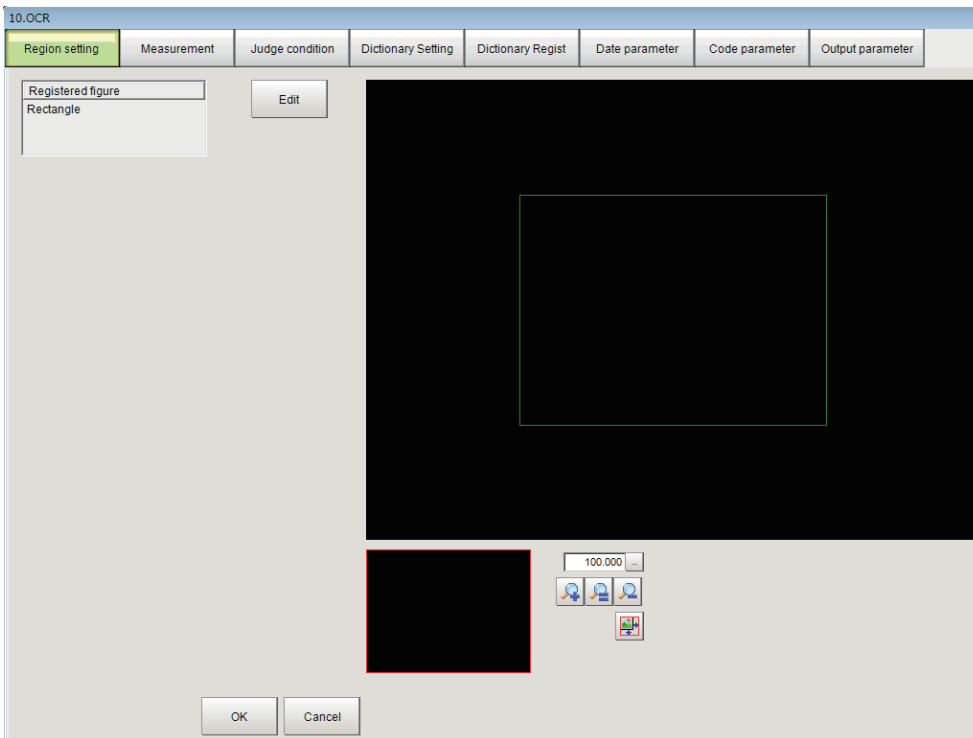
List of OCR Items

The following items can be set in OCR.

Item name	Description
Region setting	For the measurement region, set the region of the image over which you want to detect characters. By narrowing the measurement region (as opposed to measuring the entire input image), this function allows you to shorten the processing time. Reference: ▶ Region Setting (OCR) (p.460)
Measurement	Set the measurement conditions. Reference: ▶ Measurement Parameters (OCR) (p.461)
Judgement condition	Set the conditions for judging the measurement results. Reference: ▶ Judgement Conditions (OCR) (p.466)
Dictionary Setting	Use this item to change the dictionary setting. Set the dictionary to be used for OCR. Reference: ▶ Dictionary Settings (OCR) (p.469)
Dictionary Regist	Use this item to perform dictionary registration. Registers characters to OCR User Dictionary as the registered dictionary. Reference: ▶ Dictionary Registration (OCR) (p.470)
Date parameter	Set the date and time format and update conditions. Reference: ▶ Date Parameters (OCR) (p.471)
Code parameter	Use this item to change code parameters. For the code parameters, set the format of code characters used to measure coded dates. Reference: ▶ Code Parameters (OCR) (p.473)
Output parameter	Use this item to change the output parameters. Set the conditions and parameters for outputting measurement results to other processing units or external devices. Reference: ▶ Output Parameters (OCR) (p.476)

Region Setting (OCR)

For the measurement region, set the region of the image over which you want to detect characters.. By narrowing the measurement region (as opposed to measuring the entire input image), this function allows you to shorten the processing time.



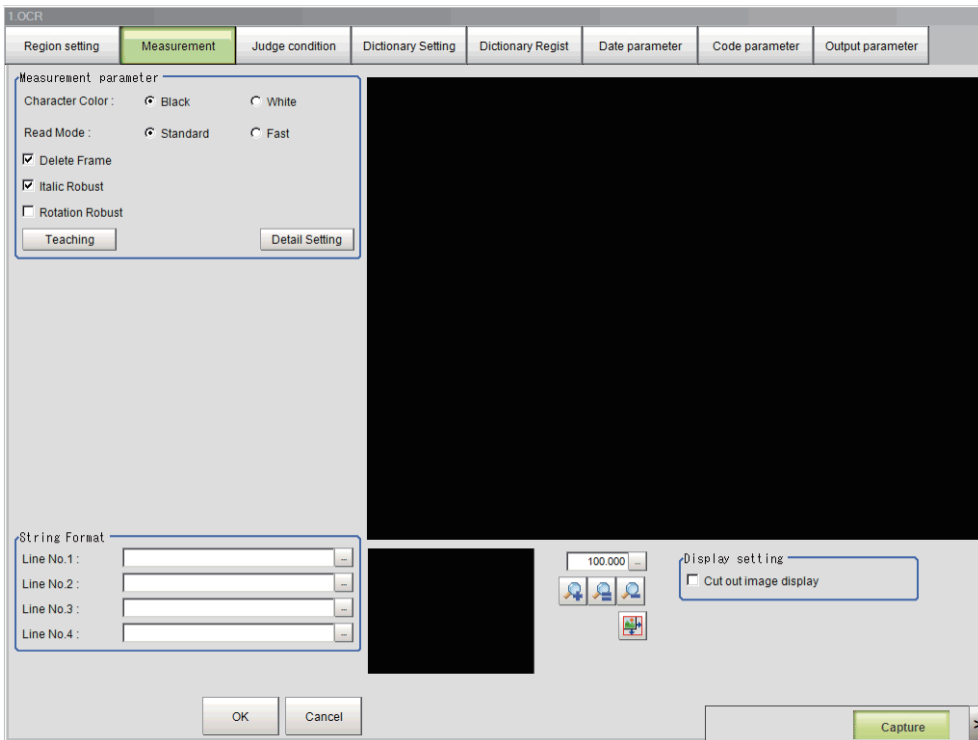
- 1** In the Item Tab area, click [Region setting].
- 2** Click [Edit].
- 3** Set the region over which the model is to be searched for.
- 4** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

Important

- The size of the measurement region should be at least 30 x 30 pixels.
- The measurement region should not include characters that exceed 32 characters x four lines.

Measurement Parameters (OCR)

Set the measurement conditions.



Setting the Measurement Parameters

Set the conditions for measurement processing and the parameters that are required for measurement.

- 1 Click [Measurement] in the Item Tab area.
- 2 In the measurement area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Character Color	<ul style="list-style-type: none"> • [Black] • White 	Set the color of the characters to be recognized.
Read Mode	<ul style="list-style-type: none"> • [Normal] • Fast 	Set the read mode used for OCR. When there is a large interval between characters, set "Fast".
Delete Frame	<ul style="list-style-type: none"> • Unchecked • [Checked] 	To remove as noise black pixels that border the measurement region, select "Delete Frame".
Italic Robust	<ul style="list-style-type: none"> • Unchecked • [Checked] 	If the characters you want to recognize are in italics, select "Italic Robust".
Rotation Robust	<ul style="list-style-type: none"> • [Unchecked] • Checked 	If the characters you want to recognize are rotated, select "Rotation Robust". The rotation range is ± 15 degrees.

- 3 Click "... " on each line from the first line to the fourth line in the string format area.

The "String setting" (character string settings) dialog box appears.

- 4 Set each character string.

Enter formats of the alphabetical characters or date to be read.

Examples of Acceptable Formats

To recognize the text string "2014/01/01," enter "2014/01/01" in the string format area.

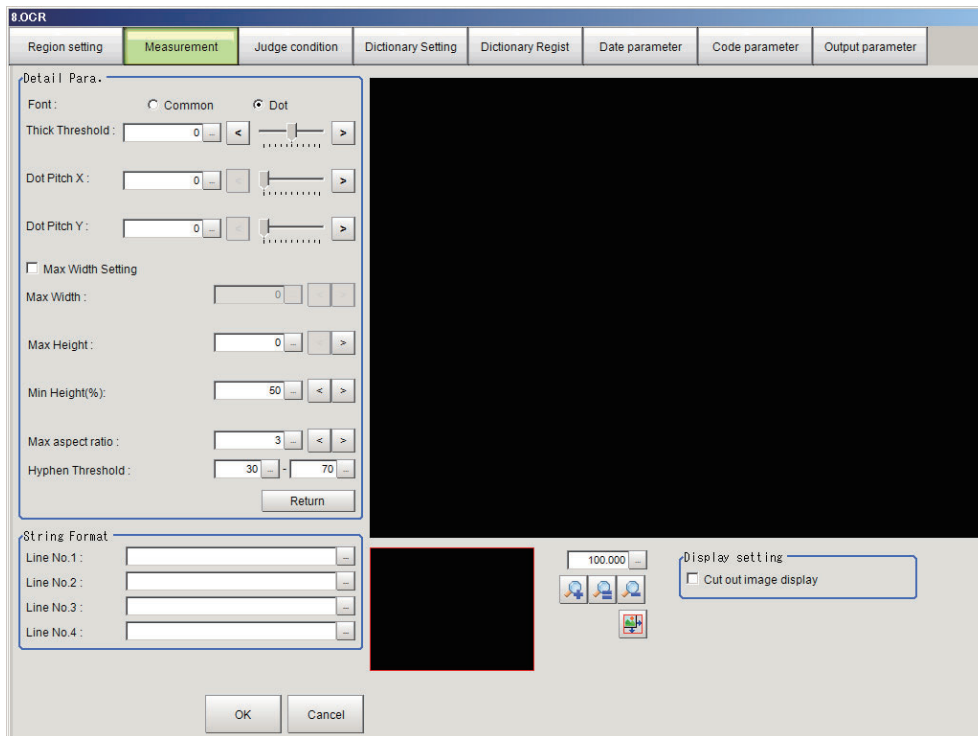
To recognize four-digit numbers, enter as [####], where each "#" represents a number, in the string format area.

To recognize a character string <a three alphabetic code>-<a four-digit current year>-<current month>, enter ""\$\$\$-mYYYY/mMM"" in the string format area."

Label	Description
0 to 9	Normal numeric value input
A to Z	Normal alphabetic character input
' - . : / ()	Normal symbol input
*	Uppercase alphabetic character judgement, Numeric character judgement and Symbol judgement
\$	Uppercase alphabetic character judgement
#	Numeric character judgement
?	Uppercase alphabetic character judgement and numeric character judgement
@	Symbol judgement
mYY	Current year, 2 digits
mYYYY	Current year, 4 digits
mHH	Current year of the Heisei imperial era, 2 digits
mMM	Current month
mDD	Current day
mRR	Current hour
mNN	Current minute
vYY	Year after set interval, 2 digits
vYYYY	Year after set interval, 4 digits
vHH	Year of the Heisei imperial era after set interval, 2 digits
vMM	Month after set interval
vDD	Day after set interval
eY1	Coded year 1
eM1	Coded month 1
eD1	Coded day 1
eR1	Coded hour 1
eN1	Coded minute 1
eY2	Coded year 2
eM2	Coded month 2
eD2	Coded day 2
eR2	Coded hour 2
eN2	Coded minute 2
iY1	Coded year after set interval 1
iM1	Coded month after set interval 1
iD1	Coded day after set interval 1
iY2	Coded year after set interval 2
iM2	Coded month after set interval 2
iD2	Coded day after set interval 2

5 Click [OK].

6 Click [Detail setting] in the measurement area and set each item.



Setting item	Setting value [Factory default]	Description
Font	<ul style="list-style-type: none"> • Common • [Dot] 	Set the font of the characters to be recognized.
Thick Threshold	-128 to 128 [0]	Set the thickness of the characters to be recognized. If the cut-out characters have a fine shape or are broken, increase the "Thick Threshold" setting. To check the shape of cut-out characters, select "Cut out image display" in "Display setting".
Dot Pitch X	0 to 99 [0]	Set the horizontal dot pitch of characters to be recognized. When the font is "Common", set the horizontal width of character breaks. When the font is "Dot", set the horizontal dot interval.
Dot Pitch Y	0 to 99 [0]	Set the vertical dot pitch of characters to be recognized. When the font is "Common", set the vertical width of character breaks. When the font is "Dot", set the vertical dot interval.
Max Width Setting	<ul style="list-style-type: none"> • [Unchecked] • Checked 	Select this checkbox to set a maximum width for characters to be recognized.
Max Width	0 to 9,999 [0]	Set the maximum width of characters to be recognized.
Max Height	0 to 9,999 [0]	Set the maximum height of characters to be recognized.
Min Height(%)	0 to 100 [50]	Set the minimum height of characters to be recognized. Set the relative value (%) with respect to the maximum "Max Height". Characters below the Min Height(%) are recognized as symbols.
Max aspect ratio	1 to 10 [3]	Set the maximum aspect ratio (calculated from height/width) of characters to be recognized. Characters with an aspect ratio greater than the "Max aspect ratio" are recognized as special characters or symbols. Special characters and symbols are determined by the specified character string format. <ul style="list-style-type: none"> • When number is specified, special characters are recognized as "I" or "J". • When alphabetical character is specified, special characters are recognized as "1". • When symbol is specified, special characters are recognized as ".".

Setting item	Setting value [Factory default]	Description
Hyphen Threshold	0 to 100 [30] to [70]	Set an upper and lower height limit as a percentage of the neighboring character for recognition of characters as hyphens (-). Characters that fit between the upper and lower limits of the [Hyphen Threshold] are recognized as hyphens. Characters that are above the upper limit of the "Hyphen Threshold" are recognized as apostrophes ('), and characters that are below the lower limit of the "Hyphen Threshold" are recognized as periods.*

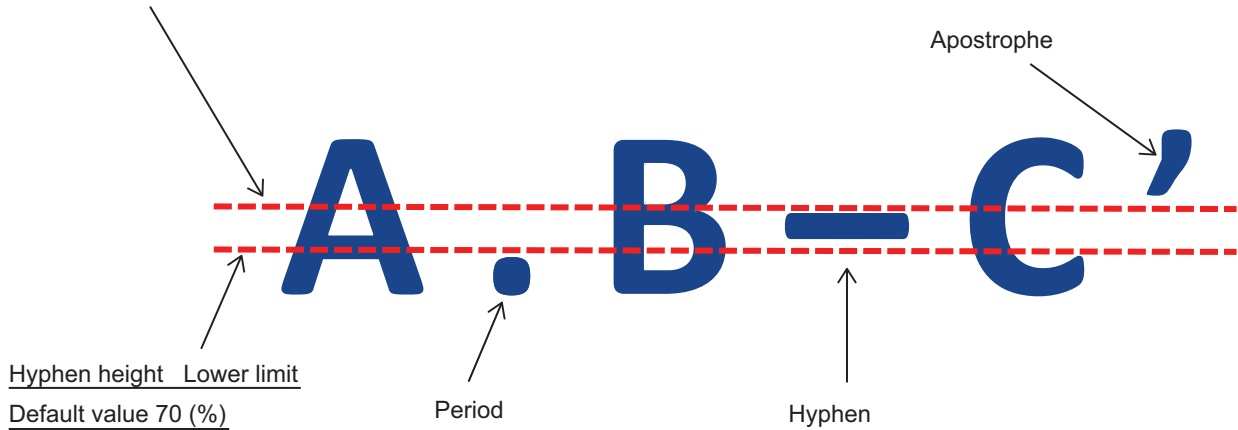
*Hyphen Threshold value

Hyphen height Upper limit

Default value 30 (%)

Hyphen height Lower limit

Default value 70 (%)



Teaching of Characters to be Recognized

The optimum measurement parameters can be set by teaching characters included in the image.

1 In the measurement area, click [Teaching].

The teaching screen appears.

Setting item	Setting value [Factory default]	Description
Teach without correct result	<ul style="list-style-type: none">• Unchecked• [Checked]	Select this checkbox to teach without the correct result. If recognition does not stabilize, remove the checkmark and set the correct string.

2 Click “...” for the correct string on each line from the first line to the fourth line.

The character string setting screen appears.

3 Set the character string that is the correct result for teaching.

4 Click [OK].

The string setting screen closes and the correct string is set. To set the measurement result of this processing unit as the correct string, click “Measure Result Reflect”.

5 Click [OK].

Teaching is executed and the teaching screen closes. The teaching information is applied to the detailed parameters.

Checking Measurement Results in the Image (Display Setting)

You can change the display settings to check the processing conditions for measurements on the image.

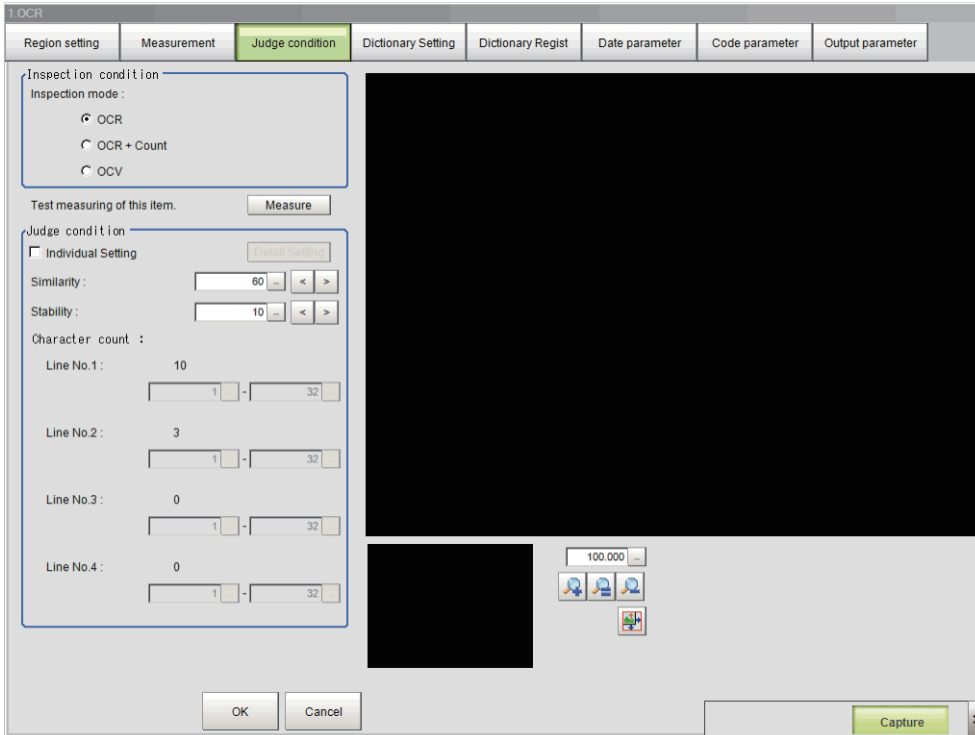
1 In the display setting area, set a value for each item.

2 Check the conditions of measurement processing on the image and set the measurement parameters.

Setting item	Setting value [Factory default]	Description
Cut out image display	<ul style="list-style-type: none">• Checked• [Unchecked]	To check the shape of cut-out characters, select the “Cut out image display” checkbox. The gray region displayed in the cutout image display is the region bounded by the [Dot Pitch Y] and [Dot Pitch X] parameters.

Judgement Conditions (OCR)

Set the conditions for judging the measurement results.



- 1 In the Item Tab area, click [Judgement condition].
- 2 In the inspection condition area, set a value for each item.

Setting item	Setting value [Factory default]	Description
Inspection mode	• [OCR]	Read the printed character strings and inspect them with the Judge condition.
	• OCR + Count	Read the characters and check if the number of the characters is within the range set in Judge condition.
	• OCV	Read the characters and check if the character string is same as the verification string set in Judge condition.

*1: The Count inspection does not give judgment for the presence of character strings. If you set the number of characters for Line No.1 to No.4 as judge condition, when the system read the three lines of characters, inspection is executed for those three lines. No character is read for Line No. 4; however the judgment will not be NG.

Setting All Judgement Conditions by Line

Set judgement conditions for all characters by line.

- 1 In the judgement condition area, set a value for each item.

If you want to set the similarity and stability judgement conditions separately, click “Detail setting”.

Setting item	Setting value [Factory default]	Description
Individual Setting	<ul style="list-style-type: none"> • [Unchecked] • Checked 	<p>If you want to set the similarity and stability judgement conditions separately for each character, select the “Individual setting” checkbox.</p> <p>When the [Individual setting] checkbox is selected, “Detail setting” is enabled.</p>

Setting item	Setting value [Factory default]	Description
Similarity	0 to 100 [60]	Set a lower limit value for the similarity. The similarity is the level of resemblance of the character that is read to the font information of the correct string. The more the read character resembles the font information of the correct string, the higher the similarity.
Stability	0 to 100 [10]	Set a lower limit value for the stability. The stability is expressed as the value that results when the similarity of the second candidate for the read character is subtracted from the similarity of the first candidate. The lower the amount of difference in similarities between candidates, the higher the possibility that a character reading error will occur. If the 2nd candidate can not be detected, the stability is output as 100 regardless of the correlation of the 1st candidate. The result is "OK" when the stability is higher than the "Stability".
Chara. Num(Line No.1)	1 to 32 [1] to [32]	This can be set when "OCR + Count" is selected for the inspection mode. Set the judgement condition for the number of characters on the 1st line.
Chara. Num(Line No.2)	1 to 32 [1] to [32]	This can be set when "OCR + Count" is selected for the inspection mode. Set the judgement condition for the number of characters on the 2nd line.
Chara. Num(Line No.3)	1 to 32 [1] to [32]	This can be set when "OCR + Count" is selected for the inspection mode. Set the judgement condition for the number of characters on the 3rd line.
Chara. Num(Line No.4)	1 to 32 [1] to [32]	This can be set when "OCR + Count" is selected for the inspection mode. Set the judgement condition for the number of characters on the 4th line.
OCV Condition	<ul style="list-style-type: none"> • [Direct set] • Unit 	This can be set when "OCV" is selected for the inspection mode. Select the specification method for specifying the character verification string. Use [Unit] if wanting to use the measurement results for other processing units in the measurement flow as the character verification string.
Unit	<ul style="list-style-type: none"> • [<None>] • Processing unit in the measurement flow 	The setting is enabled if [OCV] is specified for the inspection mode and [Unit] is specified for the OCV condition. Select the processing unit with the measurement results that are to be used for the character verification string. A list of processing items that can be selected for the reference unit is given below. <ul style="list-style-type: none"> • 2DCode • Barcode
Compare String(Line No.1)	---	This can be set when "OCV" is selected for the inspection mode. Set the character string that you want to verify on the 1st line.
Compare String(Line No.2)	---	This can be set when "OCV" is selected for the inspection mode. Set the character string that you want to verify on the 2nd line.
Compare String(Line No.3)	---	This can be set when "OCV" is selected for the inspection mode. Set the character string that you want to verify on the 3rd line.
Compare String(Line No.4)	---	This can be set when "OCV" is selected for the inspection mode. Set the character string that you want to verify on the 4th line.

Setting item	Setting value [Factory default]	Description
Verification limits 1	<ul style="list-style-type: none"> • [Unchecked] • Checked 	The setting is enabled if [OCV] is specified for the inspection mode and [Unit] is specified for the OCV condition. Click on the [Verification limits 1] checkbox to turn it ON to verify the character string on the first line.
	1 to 1024 [1] to [1024]	The setting is enabled if [OCV] is specified for the inspection mode, [Unit] is specified for the OCV condition, and the [Verification limits 1] checkbox is checked. Set the range for the character string that is to be used as the character verification string on the first line of the measurement results for the processing unit specified by the reference unit.
Verification limits 2	<ul style="list-style-type: none"> • [Unchecked] • Checked 	The setting is enabled if [OCV] is specified for the inspection mode and [Unit] is specified for the OCV condition. Click on the [Verification limits 2] checkbox to turn it ON to verify the character string on the second line.
	1 to 1024 [1] to [1024]	The setting is enabled if [OCV] is specified for the inspection mode, [Unit] is specified for the OCV condition, and the [Verification limits 2] checkbox is checked. Set the range for the character string that is to be used as the character verification string on the second line of the measurement results for the processing unit specified by the reference unit.
Verification limits 3	<ul style="list-style-type: none"> • [Unchecked] • Checked 	The setting is enabled if [OCV] is specified for the inspection mode and [Unit] is specified for the OCV condition. Click on the [Verification limits 3] checkbox to turn it ON to verify the character string on the third line.
	1 to 1024 [1] to [1024]	The setting is enabled if [OCV] is specified for the inspection mode, [Unit] is specified for the OCV condition, and the [Verification limits 3] checkbox is checked. Set the range for the character string that is to be used as the character verification string on the third line of the measurement results for the processing unit specified by the reference unit.
Verification limits 4	<ul style="list-style-type: none"> • [Unchecked] • Checked 	The setting is enabled if [OCV] is specified for the inspection mode and [Unit] is specified for the OCV condition. Click on the [Verification limits 4] checkbox to turn it ON to verify the character string on the fourth line.
	1 to 1024 [1] to [1024]	The setting is enabled if [OCV] is specified for the inspection mode, [Unit] is specified for the OCV condition, and the [Verification limits 4] checkbox is checked. Set the range for the character string that is to be used as the character verification string on the fourth line of the measurement results for the processing unit specified by the reference unit.

Setting Judgement Conditions Individually by Character

Set judgement conditions for all characters individually by character.

- 1 In the judgement condition area, click [Detail setting].**
The individual judgement condition area appears.
- 2 Set the items in the individual judgement condition area.**

Setting item	Setting value [Factory default]	Description
Batch setting	<ul style="list-style-type: none"> • Unchecked • [Checked] 	If you want to set the similarity and stability judgement conditions at once for all characters, select the “Batch setting” checkbox.
Lower limit of similarity	0 to 100 [60]	Set a lower limit value for the similarity.
Lower limit of stability	0 to 100 [10]	Set a lower limit value for the stability.

Note

- Each time a measurement is performed, the measurement result is displayed next to each item. You can use these values as a reference when setting the judgement conditions.

Dictionary Settings (OCR)

Use this item to change the dictionary settings.
Set the dictionary to be used for OCR.

Individually Selecting the Index Used for OCR

Individually set each index that is used and each index that is not used in the dictionary used for OCR.

- 1** In the Item Tab area, click [Dictionary Setting].
- 2** In the dictionary setting area, set a value for each item.

Setting item	Setting value [Factory default]	Description
Scene	-1 to 127 [-1: Current scene]	Set the scene number in which the dictionary unit to be used in OCR is registered
Dictionary unit	-1 to 9999 [-1: <None>]	Set the Processing Unit number for the OCR Dictionary Unit you want to use for OCR.

Setting item	Setting value [Factory default]	Description
Character type specification	<ul style="list-style-type: none"> • Unchecked • [Checked] 	<p>Select the checkbox of the character type that you want to use for OCR.</p> <p>Unchecking the checkmark will cause the characters specified in [OCR user dictionary] to be disabled from use.</p>

3 Click [Measure].

A test measurement of the measurement image is executed using the current settings, and the measurement results appear on the image. Check if the measurement is correct.

Selecting All Indexes Used for OCR at Once

Set all indexes that are used and not used at once in the dictionary used for OCR.

1 Click [Number ON].

The checkboxes for all numbers in the indexes are selected. Click “Number ON”, “Letter ON”, or “Symbol ON” depending on which type you want to select at once.

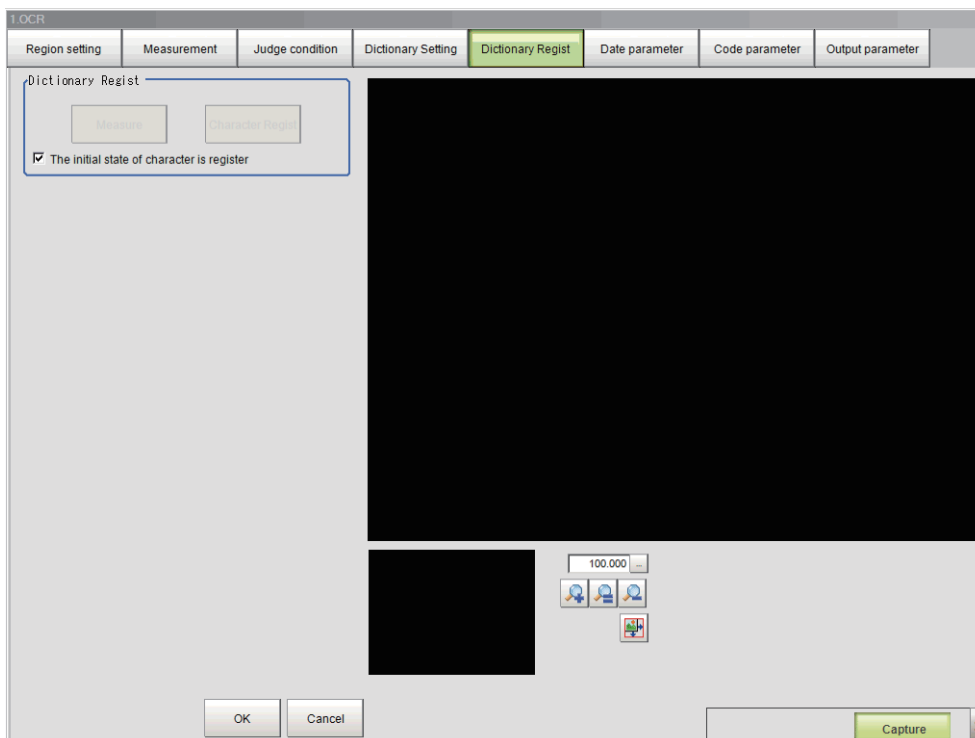
To remove all checkmarks, click “Number OFF”, “Letter OFF”, or “Symbol OFF” depending on which type you want to unselect at once.

Dictionary Registration (OCR)

Use this item to perform dictionary registration.

Dictionary registration consists of registering characters in a OCR user dictionary.

Set when you want to measure characters in a special font or when characters are incorrectly recognized.



1 In the Item Tab area, click [Dictionary Regist].

2 In the dictionary setting area, set a value for each item.

Setting item	Setting value [Factory default]	Description
The initial state of code is register	<ul style="list-style-type: none"> • [Checked] • Unchecked 	To register all successfully measured characters in the dictionary after confirmation measurement, select the “The initial state of code is register” checkbox. The registration state of each character after confirmation measurement will be “register”.

3 Click [Measure].

Measurement is executed and the results appear on the image.

4 Click the characters on the image.

You can set “Register or not” and “Character” for the clicked characters.

Setting item	Setting value [Factory default]	Description
Register or not	<ul style="list-style-type: none"> • unregist • [register] 	To register the characters in the dictionary, select “register”.
Character	0 to 9, A to Z, :/()	Set the character code of the character you want to register.

5 Click [Character Regist].

The characters set with “regist” in “Register or not” and the character codes set with “Code” are registered in the OCR user dictionary processing unit set in “Dictionary unit” on the “Dictionary Setting” item tab, and the number of characters that were registered appears.

Important

- If the settings are not configured on the “Dictionary Setting” item tab, [OCR User Dictionary] cannot be clicked. Always configure the dictionary settings before registering characters in the dictionary.

Date Parameters (OCR)

Set the date and time format and update conditions.

1 Click [Date parameter] in the Item Tab area.

2 In the Select Line (line selection) area, set a value for each item.

Setting item	Setting value [Factory default]	Description
Select Line	<ul style="list-style-type: none"> • [Line No.1] • Line No.2 • Line No.3 • Line No.4 	Set the line to which the usage period that will be set in the subsequent step applies.

3 In the period setting area, set a value for each item.

Setting item	Setting value [Factory default]	Description
Year	0 to 99 [0]	Set the usage period from the current date.
Month	0 to 99 [0]	Set the usage period from the current date.
Day	-999 to 999 [0]	Set the usage period from the current date.

4 In the date setting area, set a value for each item.

Setting item	Setting value [Factory default]	Description
Zero suppress	<ul style="list-style-type: none"> • [0] • Space 	Set the display method for the 10's digit when the month or day is a one-digit number.
Calculation order	<ul style="list-style-type: none"> • [Month→Day] • Day→Month 	Set whether calculation starts from the month or the day when a usage period is set. The usage expiration date varies depending on the order of calculation, such as when the usage period spans a month that has 31 days and a month that has 30 days. Select this setting based on the calculation method used for the usage expiration date.
Month end adjust	<ul style="list-style-type: none"> • [Last day of current month] • First day of next month • Gap day of next month 	Select the adjustment method to be used when a non-existent month and day result from calculation of the usage expiration date. Select this setting based on your actual management procedure. Example: January 31, usage expiration date is one month "Last day of current month" = February 28 "First day of next month" = March 1 "Gap day of next month" = March 3

5 In the common setting area, set a value for each item.

Setting item	Setting value [Factory default]	Description
Auto Update	<ul style="list-style-type: none"> • Not update • First measure • [Always update] 	Select the condition for updating the date. The time is always updated. <ul style="list-style-type: none"> • Not update The date is not automatically updated. Update the date using the menu. • First measure The date is updated at the first measurement after the sensor controller is started up. When the controller is not kept running more than one day, the date is updated the first time measurement is performed after the controller is started up following a change of date. • [Always update] The date is updated when measurement is performed. When the controller is kept running more than one day, the date is updated the first time measurement is performed after the date changes.

Setting item	Setting value [Factory default]	Description
Back margin	0 to 99 [0]	Set an appropriate count back time from the current time. Set in units of minutes. Set this when the printing time is different from the inspection time.
Ahead margin	0 to 99 [0]	Set an appropriate count forward time from the current time. Set in units of minutes. Set this when the printing time is different from the inspection time.

Click [Date update] to update the date information used for the verification characters.

Code Parameters (OCR)

Use this item to change code parameters.

For the code parameters, set the format of code characters used to measure coded dates.

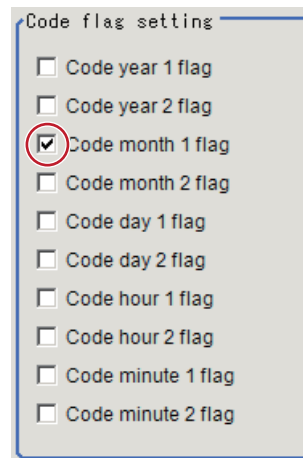
Important

- When a usage period is set, coded characters cannot be used in OCV.

Setting on the Screen

The setting procedure is explained below using the example of X as the code for October.

- 1 Click [Code parameter] in the Item Tab area.
- 2 Select the “Code month 1 flag” checkbox.

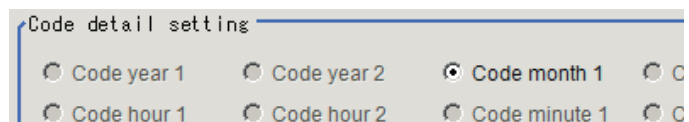


Note

Code month 1 and Code month 2

- Two code file patterns can be set to enable readiness for a setup change. Select the checkbox of the file to be used.

- 3 In the code detail setting area, select the “Code month 1 flag” checkbox.



4 Click [...] next to "10".

A software keyboard appears. Enter "X".

A maximum of four characters can be entered.



A vertical list of input fields labeled 01 through 12. The field for '10' contains the character 'X' and is highlighted with a red rectangular box.

Setting on a computer

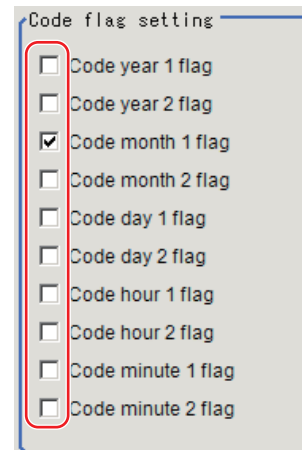
Code files are complex. Using a computer to configure settings reduces mistakes and allows easy editing. By saving a blank CSV file, editing the file on a computer, and then loading the file, you can efficiently configure settings.

Saving a Code File

Create a blank file for editing on a computer.

If code parameters are already set on the screen, those settings are applied to the file that is saved.

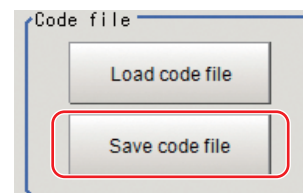
- 1 Click [Code parameter] in the Item Tab area.
- 2 Select the checkboxes of the flags of the code character strings to be edited.



A dialog box titled 'Code flag setting' with a list of checkboxes. The 'Code month 1 flag' checkbox is checked and highlighted with a red rectangular box.

<input type="checkbox"/>	Code year 1 flag
<input type="checkbox"/>	Code year 2 flag
<input checked="" type="checkbox"/>	Code month 1 flag
<input type="checkbox"/>	Code month 2 flag
<input type="checkbox"/>	Code day 1 flag
<input type="checkbox"/>	Code day 2 flag
<input type="checkbox"/>	Code hour 1 flag
<input type="checkbox"/>	Code hour 2 flag
<input type="checkbox"/>	Code minute 1 flag
<input type="checkbox"/>	Code minute 2 flag

- 3 Click [Save code file] in the code file area.



A dialog box titled 'Code file' with two buttons: 'Load code file' and 'Save code file'. The 'Save code file' button is highlighted with a red rectangular box.

- 4 Set the folder and file name and click [OK].

The code file (CSV format) is saved.

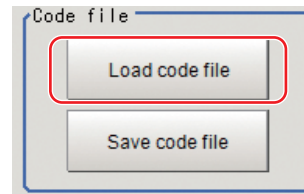
Format of the Code File

- “Item” appears on the 1st line.
- “Flag” appears on the 2nd line. To use the item, set “1”.
- On the 3rd and following lines, the code corresponding to each number appears.
The month and day start from “1”.

3										
4										
5										
6										
7										
8										
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10										
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.										
98										
99										

Loading a Code File

- 1 Click [Code parameter] in the Item Tab area.
- 2 Click [Load code file] in the code file area.

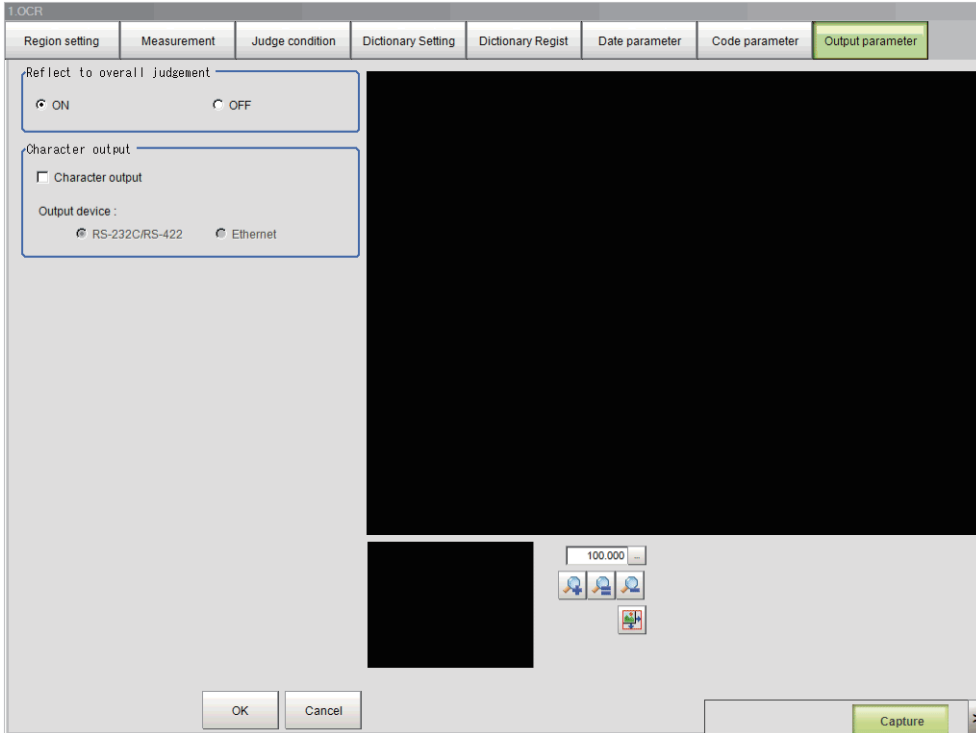


- 3 Select the code file (CSV format) to be loaded in the file selection screen, and click [OK].
The code file is loaded and displayed on the screen.

Output Parameters (OCR)

Use this item to change the output parameters.

The output parameters are the conditions and parameters for outputting measurement results to other processing units or external devices. Normally, the factory default values can be used.



- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify a value for each item.

Setting item	Setting value [Factory default]	Description
Reflect to the overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Set whether the judgement result from this processing unit is applied to the overall scene judgement.
Character output	<ul style="list-style-type: none"> • [Unchecked] • Checked 	Select whether recognized character strings are externally output.
	Output device	<ul style="list-style-type: none"> • [RS-232C/RS-422] • Ethernet <p>This can be set when the [Character output] checkbox is selected. Select the character output destination. Any characters such as kanji that are not ASCII code characters will not be correctly output. When Ethernet is selected, the destination IP address is determined by the system settings. Reference: ▶ <i>Non-procedure Communications in the Vision System FH/FZ5 Series User's Manual for Communications Settings</i> (Cat. No. Z342).</p> <p>The character string is output as follows.</p> <ul style="list-style-type: none"> • When only one line is output <ul style="list-style-type: none"> Normal: String + NULL + Delimiter (CR) PLCLink: String + NULL + NULL • When two lines are output <ul style="list-style-type: none"> Normal: String + NULL + String + NULL + Delimiter (CR) PLCLink: string + NULL + string + NULL + NULL

Note

- If there are no character strings that have been read when character output is executed, NULL (0x00) is output.

Key Points for Test Measurement and Adjustment (OCR)

You can adjust the parameters while you perform test measurements and check the measurement results to increase the measurement precision and speed.

Select the adjustment method by considering the following point.

Check the measurement results that can be displayed and output in “Measurement Results for Which Output Is Possible”.

(Reference: ► Measurement Results for Which Output is Possible (OCR) (p.479))

Note

- When you perform test measurement, the display of the details and image are updated according to the measurement results.

Items Displayed in the Detail Result Area

The following measurement results are displayed in the “Detail result” area as text.

Displayed items	Description
Judge	Displays the judgement result for the processing unit.
NG cause	When the judgement result of the processing unit is NG, a description of the NG is shown as the NG cause. 0: OK 1: OCV NG 2: Similarity NG 4: Stability NG 8: Character count NG When there are multiple NG causes, the sum of the NG cause values is output. Example: When a Similarity NG (2) and a Character count NG (8) occur, 10 is output in the NG cause.
Character count	Displays the number of characters in the detected character string.
Read string	Displays the detected character string.
Target string	Displays the verification string.

Items Displayed in the Image Display Area

You can specify a sub-image number to display the next image in the image display area.

Sub image number	Description
0	The measurement image appears.

When the Measurement Results Deviate or are Imprecise

You can use the following methods to improve measurement precision and stability.

When the measurement results are unstable

Parameter to be adjusted	Troubleshooting
Measurement (Reference: ▶ Measurement Parameters (OCR) (p.461))	If the measurement region is large, excessive time may be required for measurement processing. Set as small a measurement region as possible.
	The [String format] (character string format) setting or correct string may not match the characters being read. Set a character format string that matches the characters being read, and check the teaching results.
	You may be using “Fast” mode to measure a character string with a small interval between characters. Set the read mode to “Normal”.
	The characters being measured may have a large height or a large width. Set a maximum aspect ratio for “Max aspect ratio” in “Detail setting” so that the ratio accords with the length and width of the characters being read. You can check the shape of the characters in the cut-out image display.

When a specific character is misrecognized

Parameter to be adjusted	Troubleshooting
Dictionary Regist (Reference: ▶ Dictionary Registration (OCR) (p.470))	The character being read may be similar to another character in the dictionary in the processing item. Register the character being read in the dictionary.

The result of date verification does not stabilize

Parameter to be adjusted	Troubleshooting
Date parameter (Reference: ▶ Date Parameters (OCR) (p.471))	One-digit and two-digit formats may be mixed together in the printed month/day. In the date settings, change the “Zero suppress” (10’s digit display) setting to match the actual printed format.

Adjusting the Processing Speed of Measurements

You can use the following methods to improve the measurement processing speed.

When the processing speed is slow

Parameter to be adjusted	Troubleshooting
Region setting (Reference: ▶ Region Setting (OCR) (p.460))	If the measurement region is large, excessive time may be required for measurement processing. Set as small a measurement region as possible.
Measurement (Reference: ▶ Measurement Parameters (OCR) (p.461))	You may be using “Normal” mode to measure a character string with a large interval between characters. Set the read mode to “Fast”.

Parameter to be adjusted	Troubleshooting
Date parameter (Reference: ► Date Parameters (OCR) (p.471))	In date verification, the margin set before and after the date may be too large. For date verification, set the “Back margin” and “Ahead margin” to a smaller value.

Adjusting Parameters Other Than Measurement Precision and Speed

You can use the following methods to adjust parameters other than measurement precision and speed.

When teaching fails

Parameter to be adjusted	Troubleshooting
Measurement (Reference: ► Measurement Parameters (OCR) (p.461))	You may be using “Fast” mode to measure a character string with a small interval between characters. Set the read mode to “Normal”.
	The [String format] (character string format) setting or correct string may not match the characters being read. Set a character format string that matches the characters being read, and set the appropriate correct string.
	The characters being measured may have a large height or a large width. Set a maximum aspect ratio for “Max aspect ratio” in “Detail setting” so that the ratio accords with the length and width of the characters being read. You can check the shape of the characters in the cut-out image display.
	It is possible that a hyphen “-” or colon “:” is misrecognized. In “Detail setting”, set upper and lower limits for “Hyphen Threshold” (hyphen height) that accord with the characters being read.
	The characters being read may have a long and thin shape. Set a maximum character height for “Max Height” that accords with the shape of the characters being read. You can check the shape of the characters in the cut-out image display.
	The characters being read may be in close proximity to peripheral characters. Set the following parameters in the detailed settings. <ul style="list-style-type: none"> • Set a smaller value for “Thick Threshold” (the thickness level). • Set a smaller value for “Dot Pitch X” (the vertical dot interval) or “Dot Pitch Y” (the horizontal dot interval). • Select the “Max Width Setting” (maximum character width) checkbox and set the maximum character width.
	It is possible that the characters being read are faint, fine, or broken. Set the following parameters in the detailed settings. <ul style="list-style-type: none"> • Set a larger value for “Thick Threshold” (the thickness level). • Set a larger value for “Dot Pitch X” (the vertical dot interval) or “Dot Pitch Y” (the horizontal dot interval).
Dictionary Regist (Reference: ► Dictionary Registration (OCR) (p.470))	The character being read may be similar to another character in the dictionary in the processing item. Register the character being read in the dictionary.

Measurement Results for Which Output is Possible (OCR)

The measurement results provided by OCR are shown below. The measurement results appear in the “Detail Result” area, and you can also use result output processing items to output the measurement results to an external device.

Refer to the “External Reference Tables” for the parameters that can be referenced, including measurement results.

(Reference: ▶ External Reference Table (OCR) (p.484))

Measurement item	Character string	Description
Judge	JG	The judgement result of the processing unit
Chara. Num(Line No.1)	NUM0	Number of characters on the 1st line
Chara. Num(Line No.2)	NUM1	Number of characters on the 2nd line
Chara. Num(Line No.3)	NUM2	Number of characters on the 3rd line
Chara. Num(Line No.4)	NUM3	Number of characters on the 4th line
NG Cause(Line No.1)	LNG0	1st line NG cause
NG Cause(Line No.2)	LNG1	2nd line NG cause
NG Cause(Line No.3)	LNG2	3rd line NG cause
NG Cause(Line No.4)	LNG3	4th line NG cause

Output of Character String in PLC Link

In PLC Link communication, check the [Character output] to output the character string and NULL(0x00) +delimiter (NULL (0x00)) are output to the data output area of PLC Link.

Reference: ▶ Output Parameters (OCR) (p.476)

1 Output Format

Take the following case as an example.

Number of measurement is one. Reading character string is 32. Command: Read character strings 0123456789... UV, Response, and Data Output area are as follows.

Reference: ▶ Communicating with PLC Link, Command Details for PLC Link, EtherNet/IP, and EtherCAT in Vision System FH/FZ5 Series User’s Manual for Communications Settings (Z342).

Command (PLC to Sensor Controller)

Top channel		Description
+3	+2	
0010	1010	Performs one measurement.

Response (Sensor Controller to PLC)

Response Area		Description
Top channel	Data	
+2	1010	Command Code
+3	0010	Target response is responded.
+4	0000	Response code
+5	0000	Command execution result.

Data Output Area (Sensor Controller to PLC)

When output the 32 character strings (0123456789...UV), the result continues as follows. ASCII code data + NULL (0x00) +delimiter (NULL (0x00)).

Top channel	Name	Description
+0	1st character, 2nd character	3031 (ASCII code of the character 2 ASCII code of the character 1)

Top channel	Name	Description
+1	3rd character, 4th character	3233 (ASCII code of the character 2 ASCII code of the character 3)
⋮		
+15ch	31st character, 32th character	5556 (ASCII code of the character U ASCII code of the character V)
+16ch	NULL, NULL	0x0000 (NULL, NULL)

Note

- If no character string, outputs NULL(0x00) + Delimiter NULL(0x00).
When check the [Error character output], output the error character string + NULL(0x00).
- When the character string is 2 bytes, i.e. Shift-JIS. the maximum number of character string is 16.
Outputs one character per one channel.

2 How to get the character string

Perform the Data Output Request (DSA) and Data Output Completion (GATE) as in the case of Data Output.

All character string is included one data. Thereby, Data Output Request (DSA) is performed once if there is only one OCR unit.

Note

- When output the multiple lines, NULL(0x00) is inserted between the lines and at the end of the last line.
When the following case, output result is "ABC0x001230x000x00".
 - 1st line is "ABC"
 - 2nd line is "123"
- Cannot skip the blank lines. Lines after the blank line is not output.
- When the following case, output result is "ABC0x000x00".
 - 1st characters are "ABC"
 - 2nd characters are "DEF"
 - 3rd characters are "123"
 - 4th characters are "456" and 2nd line cannot be read.

Output of Character string with Non-procedure Communications

Check the [Character output] in Output parameter to output the character string and NULL (0x00) with Non-procedure communication.

Reference: ▶ Output Parameters (OCR) (p.476)

1 Output Format

Take the following case as an example. Number of measurement is one.

Reading character string is 32. Read character strings 0123456789...UV, Command, Response, and Data Output area are as follows.

Reference: ▶ Non-procedure Communications and MEASURE or M in Non-procedure Command Details in Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342).

Command (PLC to Sensor Controller)

M E A S U R E ^C R or M ^C R

Response (Sensor Controller to PLC)

O	K	C _R
---	---	----------------

0123456789...UV(Character string data) NULL (0x00)	C _R
--	----------------

Note

- If no character string, the response is as follows.

O	K	C _R
---	---	----------------

C _R

- When output the multiple lines, NULL(0x00) is inserted between the lines and at the end of the last line. When the following case, output result is "ABC0x001230x00x00".
 - 1st line is "ABC"
 - 2nd line is "123"

ABC0x001230x00	C _R
----------------	----------------

- Cannot skip the blank lines. Lines after the blank line is not output. When the following case, output result is "ABC0x00".
 - 1st characters are "ABC"
 - 2nd characters are "DEF"
 - 3rd characters are "123"
 - 4th characters are "456" and 2nd line cannot be read.

ABC0x00	C _R
---------	----------------

Output of Character string with EtherNet/IP Message Communications

In EtherNet/IP message communication, output of character string is possible using UNITDATA command which acquires the measurement value.

Outputs the character string data which is measured with OCR and NULL(0x00).

Reference: ▶ Communicating with the Sensor Controller with EtherNet/IP Message Communications, Non-procedure Communications and UNITDATA or UD in Non-procedure Command Details in Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342).

1 Output Format

Take the following case as an example. Send UNITDATA command. Reading character string is 32. Command, Response, and Data Output area are the followings.

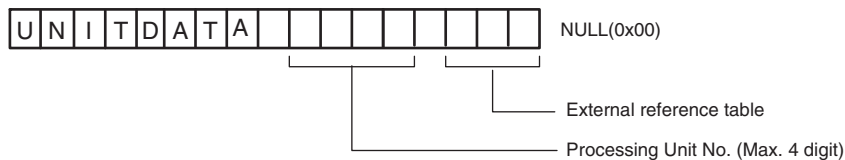
Described example is only a part of Attribute.

Command (PLC to Sensor Controller)

Specify the command character string equivalent to a non-procedure command.

Attach NULL(0x00) at the end of the character string. No line feed code is required.

The size of the send data includes the NULL(0x00) at the end of the character string.



Response (Sensor Controller to PLC)

Character string data equivalent to the Non-procedure command reception character string is returned.

Null (0x00) is inserted in the reception character string delimiter section.

The size of the reception data includes the final NULL(0x00).

0123456789...UV(Character string data) NULL(0x00) O(0x4F) K(0x4b) NULL(0x00)

Note

- If no character string, refer to the following.

NULL(0x00) O(0x4F) K(0x4b) NULL(0x00)

- When output the multiple lines, change the external reference table No. of UNITDATA, and then read the character strings.

External Reference Table (OCR)

By specifying a number, you can access the following data from processing items that support processing unit data setting/acquisition, and from control commands.

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
1	Chara. Num(Line No.1)	Get only	0 to 32
2	Chara. Num(Line No.2)	Get only	0 to 32
3	Chara. Num(Line No.3)	Get only	0 to 32
4	Chara. Num(Line No.4)	Get only	0 to 32
5	NG Cause(Line No.1)	Get only	0x0000 to 0x000F
6	NG Cause(Line No.2)	Get only	0x0000 to 0x000F
7	NG Cause(Line No.3)	Get only	0x0000 to 0x000F
8	NG Cause(Line No.4)	Get only	0x0000 to 0x000F
20	Read string(Line No.1)	Get only	Read character string in the first line
21	Read string(Line No.2)	Get only	Read character string in the second line
22	Read string(Line No.3)	Get only	Read character string in the third line
23	Read string(Line No.4)	Get only	Read character string in the fourth line
30	Verification string(Line No.1)	Get only	Read character string in the first line
31	Verification string(Line No.2)	Get only	Read character string in the second line
32	Verification string(Line No.3)	Get only	Read character string in the third line
33	Verification string(Line No.4)	Get only	Read character string in the fourth line
103	Reflect to the overall judgement	Set/Get	0: Reflected in the overall judgement 1: Not reflected in the overall judgement
104	Character output	Set/Get	0: Text output OFF 1: Text output ON
105	Character output destination	Set/Get	0: RS-232C/RS-422 1: Ethernet
110	Read Mode	Set/Get	0: Normal (suitable for closely spaced characters) 1: Fast
120	Character color	Set/Get	0: Black 1: White
121	Delete Frame	Set/Get	Select whether to delete or keep the black frame around the measurement area. 0: Use frame 1: Delete frame
122	Italic Robust	Set/Get	0: OFF 1: ON
123	Rotation Robust	Set/Get	0: OFF 1: ON

No.	Data name	Set/Get	Data range
124	Upper Limit of Hyphen and Character Height	Set/Get	0 to 100
125	Lower Limit of Hyphen and Character Height	Set/Get	0 to 100
126	Built-in Dictionary Type	Set/Get	0: Standard dictionary 1: Dot dictionary
127	Thick Threshold	Set/Get	-128 to 128
128	Dot Pitch X	Set/Get	0 to 99
129	Dot Pitch Y	Set/Get	0 to 99
130	Max Width Setting Flag	Set/Get	0: OFF 1: ON
131	Max Width	Set/Get	0 to 9999
132	Max Height	Set/Get	0 to 9999
133	Min Height	Set/Get	0 to 100
135	Max aspect ratio	Set/Get	1 to 10
136	Inspection mode	Set/Get	0: OCR 1: OCR + Count 2: OCV
137	Similarity/Stability Individual setting	Set/Get	0: OFF 1: ON
138	Lower Limit of similarity	Set/Get	0 to 100
139	Lower Limit of stability	Set/Get	0 to 100
140	Dictionary Scene No.	Set/Get	-1: Current scene 0 to 9999
141	Dictionary registration processing unit	Set/Get	-1: None 0 to 9999
142	Teach without correct result	Set/Get	0: OFF 1: ON
143	The initial state of code is register	Set/Get	0: OFF 1: ON
144	Character specification method for character verification	Set/Get	0: Numerical 1: Unit
145	Character verification reference unit number	Set/Get	-1: None 0 to 9999
200	Teaching String(Line No.1)	Set/Get	Character string
201	Teaching String(Line No.2)	Set/Get	Character string
202	Teaching String(Line No.3)	Set/Get	Character string
203	Teaching String(Line No.4)	Set/Get	Character string
210	Format String(Line No.1)	Set/Get	Character string
211	Format String(Line No.2)	Set/Get	Character string

No.	Data name	Set/Get	Data range
212	Format String(Line No.3)	Set/Get	Character string
213	Format String(Line No.4)	Set/Get	Character string
220	Verification string(Line No.1)	Set/Get	Character string
221	Verification string(Line No.2)	Set/Get	Character string
222	Verification string(Line No.3)	Set/Get	Character string
223	Verification string(Line No.4)	Set/Get	Character string
230	Lower Limit of Chara. Num(Line No.1)	Set/Get	1 to 32
231	Lower Limit of Chara. Num(Line No.2)	Set/Get	1 to 32
232	Lower Limit of Chara. Num(Line No.3)	Set/Get	1 to 32
233	Lower Limit of Chara. Num(Line No.4)	Set/Get	1 to 32
240	Upper Limit of Chara. Num(Line No.1)	Set/Get	1 to 32
241	Upper Limit of Chara. Num(Line No.2)	Set/Get	1 to 32
242	Upper Limit of Chara. Num(Line No.3)	Set/Get	1 to 32
243	Upper Limit of Chara. Num(Line No.4)	Set/Get	1 to 32
250	Lower limit of verification string(Line No.1)	Set/Get	1 to 1024
251	Lower limit of verification string(Line No.2)	Set/Get	1 to 1024
252	Lower limit of verification string(Line No.3)	Set/Get	1 to 1024
253	Lower limit of verification string(Line No.4)	Set/Get	1 to 1024
260	Upper limit of verification string(Line No.1)	Set/Get	1 to 1024
261	Upper limit of verification string(Line No.2)	Set/Get	1 to 1024
262	Upper limit of verification string(Line No.3)	Set/Get	1 to 1024

No.	Data name	Set/Get	Data range
263	Upper limit of verification string(Line No.4)	Set/Get	1 to 1024
270	Verification string(Line No.1) flag	Set/Get	0: Disabled 1: Enabled
271	Verification string(Line No.2) flag	Set/Get	0: Disabled 1: Enabled
272	Verification string(Line No.3) flag	Set/Get	0: Disabled 1: Enabled
273	Verification string(Line No.4) flag	Set/Get	0: Disabled 1: Enabled
300+NN (NN=0 to 39)	Lower limit of similarity NN	Set/Get	0 to 100
400+NN (NN=0 to 39)	Lower limit of stability NN	Set/Get	0 to 100
500+NN (NN=0 to 39)	Customized user dictionary, Enable setting NN	Set/Get	0: Not used 1: Used
1125	Term year	Set/Get	0 to 99
1126	Term month	Set/Get	0 to 99
1127	Term day	Set/Get	-999 to 999
1128	Auto Update	Set/Get	0: Not update 1: First measure 2: Always update
1129	Zero suppress	Set/Get	0: 0 1: Space
1130	Calculation order	Set/Get	0: MonthDay 1: DayMonth
1131	Month end adjust	Set/Get	0: Last day of current month 1: First day of next month 2: Gap day of next month
1132	Back margin	Set/Get	0 to 99
1133	Ahead margin	Set/Get	0 to 99
1134	Code year 1 flag	Set/Get	0: Not used 1: Used
1135	Code year 2 flag	Set/Get	0: Not used 1: Used
1136	Code month 1 flag	Set/Get	0: Not used 1: Used
1137	Code month 2 flag	Set/Get	0: Not used 1: Used
1138	Code day 1 flag	Set/Get	0: Not used 1: Used
1139	Code day 2 flag	Set/Get	0: Not used 1: Used
1140	Code hour 1 flag	Set/Get	0: Not used 1: Used

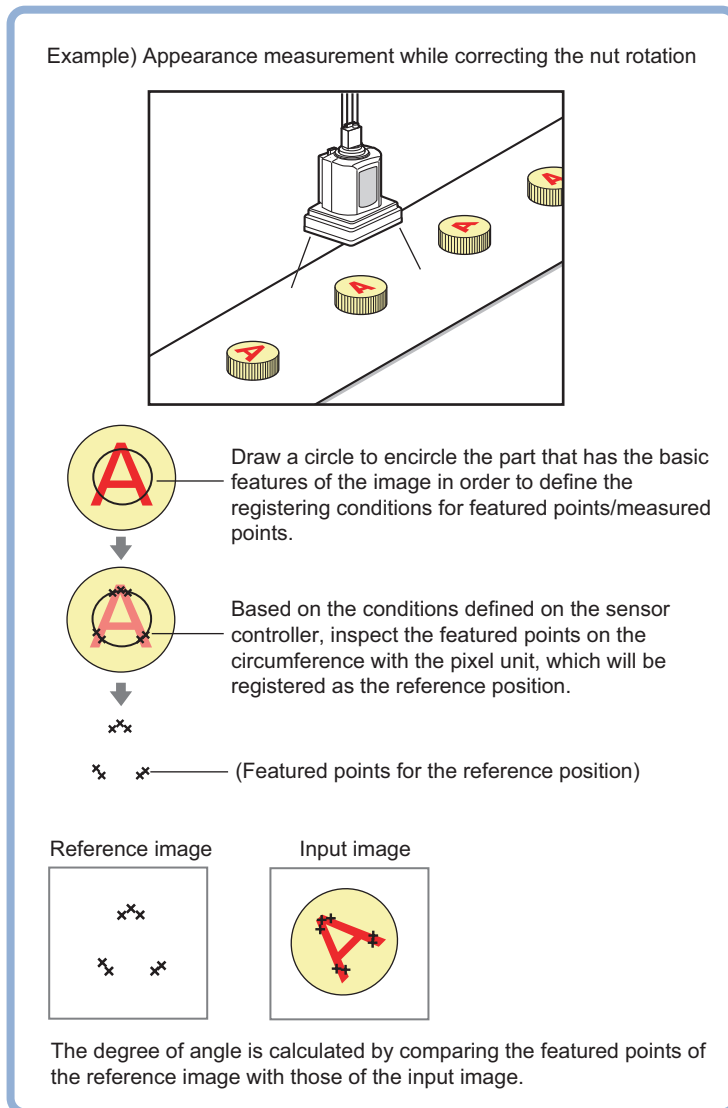
No.	Data name	Set/Get	Data range
1141	Code hour 2 flag	Set/Get	0: Not used 1: Used
1142	Code minute 1 flag	Set/Get	0: Not used 1: Used
1143	Code minute 2 flag	Set/Get	0: Not used 1: Used
1150	String year 1 flag	Set/Get	0: Not used 1: Used
1151	String year 2 flag	Set/Get	0: Not used 1: Used
1152	String month 1 flag	Set/Get	0: Not used 1: Used
1153	String month 2 flag	Set/Get	0: Not used 1: Used
1154	String day 1 flag	Set/Get	0: Not used 1: Used
1155	String day 2 flag	Set/Get	0: Not used 1: Used
1156	String hour 1 flag	Set/Get	0: Not used 1: Used
1157	String hour 2 flag	Set/Get	0: Not used 1: Used
1158	String minute 1 flag	Set/Get	0: Not used 1: Used
1159	String minute 2 flag	Set/Get	0: Not used 1: Used
1160	Operation code number	Set/Get	0 to 99
10000+NN (NN=0 to 31)	NNth character code of first line	Get only	0 to 0xFFFF
11000+NN (NN=0 to 31)	NNth character code of second line	Get only	0 to 0xFFFF
12000+NN (NN=0 to 31)	NNth character code of third line	Get only	0 to 0xFFFF
13000+NN (NN=0 to 31)	NNth character code of fourth line	Get only	0 to 0xFFFF
20000+NN (NN=0 to 31)	NNth character NG cause of first line	Get only	0 to 15
21000+NN (NN=0 to 31)	NNth character NG cause of second line	Get only	0 to 15
22000+NN (NN=0 to 31)	NNth character NG cause of third line	Get only	0 to 15
23000+NN (NN=0 to 31)	NNth character NG cause of fourth line	Get only	0 to 15
30000+NN (NN=0 to 31)	NNth character similarity of first line	Get only	0 to 100
31000+NN (NN=0 to 31)	NNth character similarity of second line	Get only	0 to 100

No.	Data name	Set/Get	Data range
32000+NN (NN=0 to 31)	NNth character similarity of third line	Get only	0 to 100
33000+NN (NN=0 to 31)	NNth character similarity of fourth line	Get only	0 to 100
40000+NN (NN=0 to 31)	NNth character stability of first line	Get only	0 to 100
41000+NN (NN=0 to 31)	NNth character stability of first line	Get only	0 to 100
42000+NN (NN=0 to 31)	NNth character stability of first line	Get only	0 to 100
43000+NN (NN=0 to 31)	NNth character stability of first line	Get only	0 to 100

Circle Angle

Used in the Following Case

- To correct the tilting of circle measurement objects



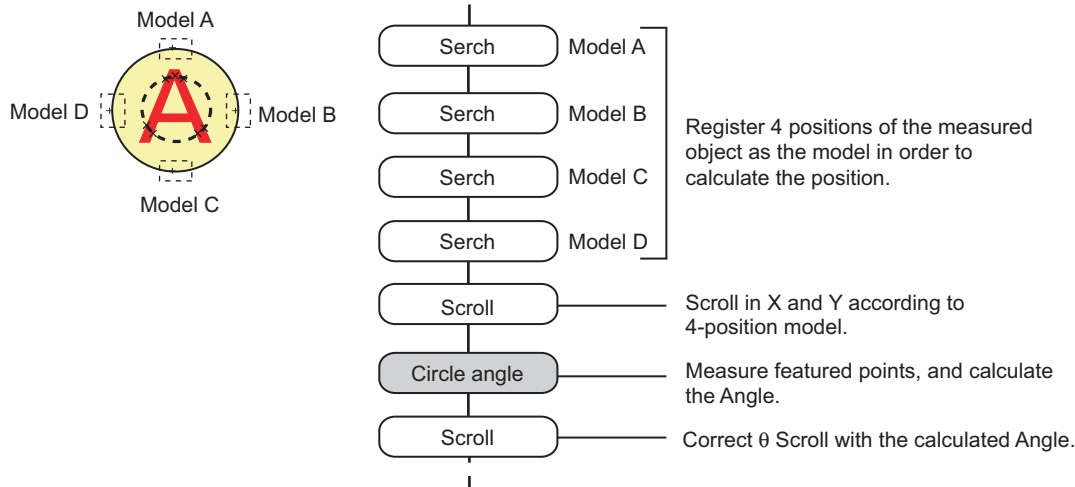
Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Note

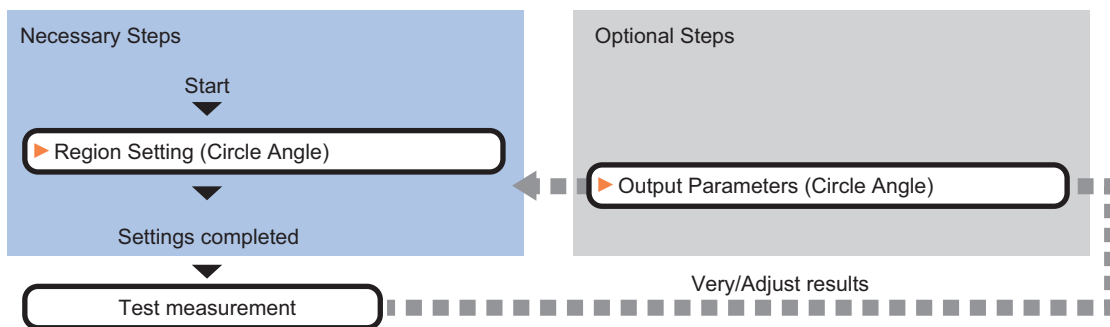
- The center position of the measured object should be always fixed in order to efficiently use the Circle Angle. Prior to Circle Angle, processing items related to position correction should be performed, making the central coordinates of the measurement object stay at a fixed position.

Example)



Settings Flow (Circle Angle)

The Circle Angle should be set up with the following procedure.



List of Circle Angle Items

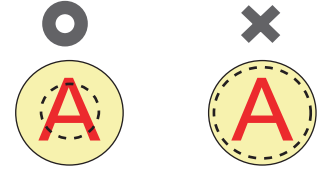
Item name	Description
Region setting	This item is used to set up the measurement area. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time. If measurement results are unstable, change detection conditions as needed. Normally, the factory default value will be used. Reference: ▶ Region Setting (Circle Angle) (p.492)
Output parameter	This item can be changed if necessary. Normally, the factory default value may be used. Select the measurement result coordinates and set how to handle the coordinates. Reference: ▶ Output Parameters (Circle Angle) (p.493)

Region Setting (Circle Angle)

This item is used to set up the measurement area. This item specifies the measurement region for [Circle Angle] with a circle. Ellipses cannot be set. If measurement results are unstable, change detection conditions as needed.

Note

- When drawing the measurement region, the featured part should lie on the circumference.

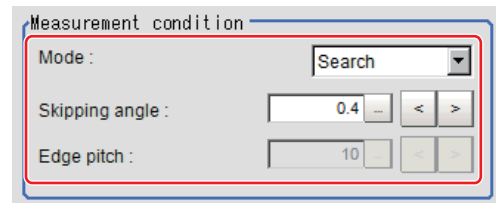


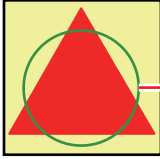
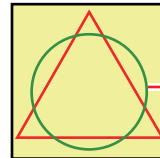
- In the Item Tab area, click [Region setting].
- Use the Drawing tools to specify the measurement region.
- Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

- If necessary, set a value for each item in the "Measurement condition" area.

After changing a setting, check whether measurement can be done properly by performing an actual measurement.



Setting item	Set value [Factory default]	Description
Mode	[Search]	This option compares the color difference with the surrounding pixels and determines the angle based on the color information.
	Edge	<p>The angle is determined based on the position of the points with a large color difference from the neighboring pixels.</p>  <p>This mode is suitable for the following types of measurement objects.</p>
	Defect	<p>The angle is determined based on the position of the points with a large color difference from the surrounding pixels.</p>  <p>This mode is suitable for the following types of measurement objects.</p>

Setting item	Set value [Factory default]	Description
Skipping angle	0.1 to 10 [0.4]	<p>Specify the interval degrees for extracting points. The color of all the points on the circumference (360° circumference/skipping angle) corresponding to the set skipping angle.</p> <p>Example) When the scale unit is 0.6° Measure 600 point on this line in the pixel unit.</p> <p>360° (600 point)</p> <p>Calculate the color for every other point.</p> <p>For the initial setting, the optimal value will be automatically set up based on the radius of the drawn circle. The bigger the value set, the faster the processing, but the lower the detection angle and rotation precision.</p>
Edge pitch	1 to 99 [10]	<p>Specify the spacing for calculating the color difference. This item is enabled only when "Mode" is set to "Edge" or "Defect".</p>

[Note 1]: Comparison is with the pixel separated by exactly the comparison interval (the value set in "Edge Pitch").

Output Parameters (Circle Angle)

Specify how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

Important

- After setting up the measurement parameters, changing the output parameters will cause measurement results to vary accordingly. If the output parameters have been changed, re-specify the measurement, too.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Set up each item.

Setting item	Set value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position deflection correction is applied.
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	<p>Select whether to reflect the calibration in the values output to the external device as measurement results.</p> <p>ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.</p>

Key Points for Test Measurement and Adjustment (Circle Angle)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Rotation angle	Measured Angle
Center position X	Center position X of circle in measurement results
Center position Y	Center position Y of circle in measurement results
Reference angle	Angle of the circle drawn as the measurement region
Reference X	Reference position X of the circle drawn as the measurement region
Reference Y	Reference position Y of the circle drawn as the measurement region

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are unstable

Parameter to be adjusted	Remedy
Region setting	Specify a smaller value for the "Skipping angle".
Measurement flow	When the center position of measurement objects is not fixed, add position compensation to the flow so that the central coordinates of the measurement objects give a fixed position.

When the processing speed is slow

Parameter to be adjusted	Remedy
Region setting	Specify a larger value for the "Skipping angle".
	Set the "Mode" to "Edge" or "Defect".

Measurement Results for Which Output Is Possible (Circle Angle)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judgement result
Center position X	X	Center position X of circle in measurement results
Center position Y	Y	Center position Y of circle in measurement results
Rotation angle	TH	Angle of measurement results Output range -180° to 180°
Reference position X	SX	Reference position X of the circle drawn as the measurement region [Note 1]
Reference position Y	SY	Reference Y of the circle drawn as the measurement region [Note 1]
Reference angle	ST	Angle drawn as the measurement region

[Note 1]: Since measuring is performed at the same position every time for Circle Angle, "Center X = Reference SX, Center Y = Reference SY".

External Reference Tables (Circle Angle)

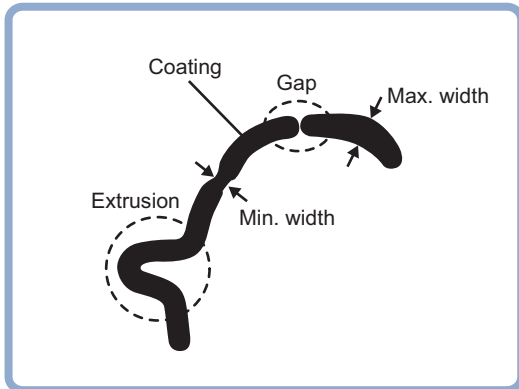
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Center position X	Get only	0 to 99999.9999
6	Center position Y	Get only	0 to 99999.9999
7	Rotation angle	Get only	-180 to 180
8	Reference X	Get only	0 to 99999.9999
9	Reference Y	Get only	0 to 99999.9999
10	Reference angle	Get only	-180 to 180
101	Output coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
120	Mode	Set/Get	0: Search 1: Edge 2: Defect
121	Skipping angle	Set/Get	0.1 to 10
122	Edge pitch	Set/Get	1 to 99

Glue Bead Inspection

Inspect the coated condition of coating (sealer, etc.). You can inspect coating of a specified color for gaps or runoffs along the coating path. In addition to inspecting the above, you can also measure the maximum width, minimum width and average of coating.

Used in the Following Case

- When you want to inspect coating for gaps and runoffs

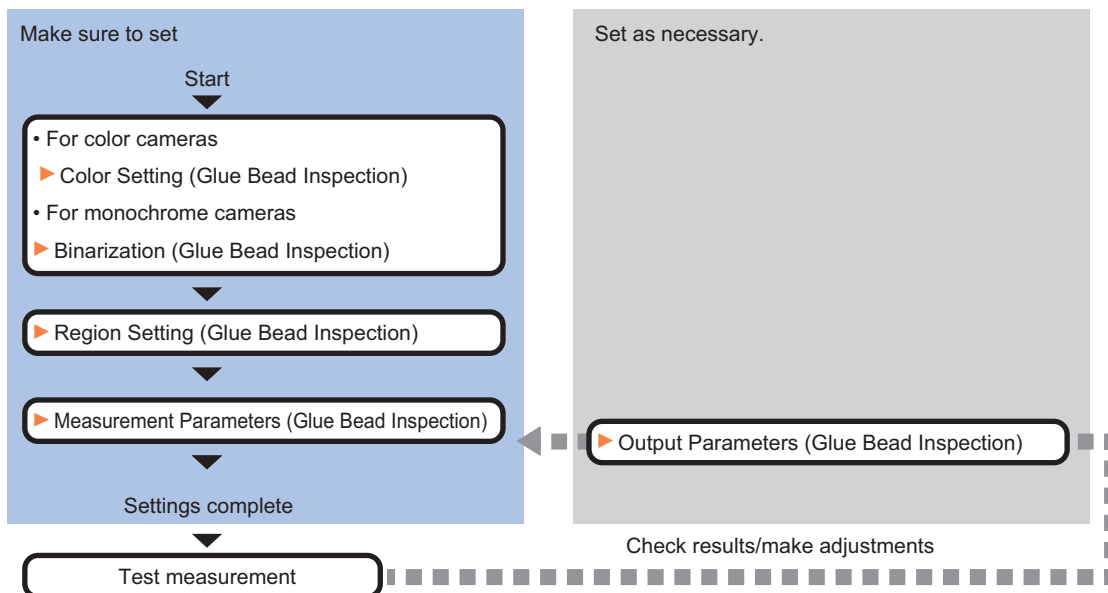


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Glue Bead Inspection)

Setting of coating gap inspection follows the flow shown below.



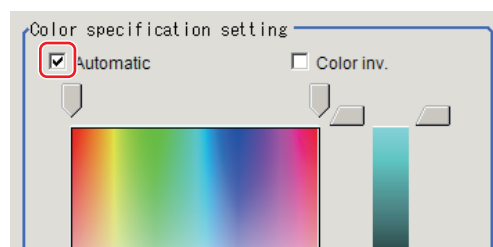
List of Glue Bead Inspection Items

Item name	Description
Color (for color cameras only)	Set the color of coating to be extracted. Reference: ▶Color Setting (Glue Bead Inspection) (p.497)
Binarization (for monochrome cameras only)	This item specifies the binary level for converting 256-tone grayscale images input from the camera into binary images. Converted white pixels are measured. Adjust the binary level so that the measurement object is converted to white pixels. Reference: ▶Binarization (Glue Bead Inspection) (p.499)
Region setting	Set the inspection region. Reference: ▶Region Setting (Glue Bead Inspection) (p.500)
Measurement	Set up the measurement condition and judgement condition. Reference: ▶Measurement Parameters (Glue Bead Inspection) (p.502)
Output parameter	Specifies whether or not the judgement results of the processing unit is reflected in the scene overall judgement. Reference: ▶Output Parameters (Glue Bead Inspection) (p.503)

Color Setting (Glue Bead Inspection)

Set the color of coating to be extracted. Make sure the regions other than coating will be shown in the specified background color. There are two setting methods: setting the color to be extracted in the image or setting the color with the hue, saturation, and brightness values. This section describes with an example of the procedure for setting colors in an image and adjusting with numeric input afterwards.

- 1 In the Item Tab area, click [Color].**
- 2 Place a check at [Automatic].**



- 3 In the Image Display area, specify the color range you want to detect by dragging the cursor from the upper left corner to the lower right corner of that area.**

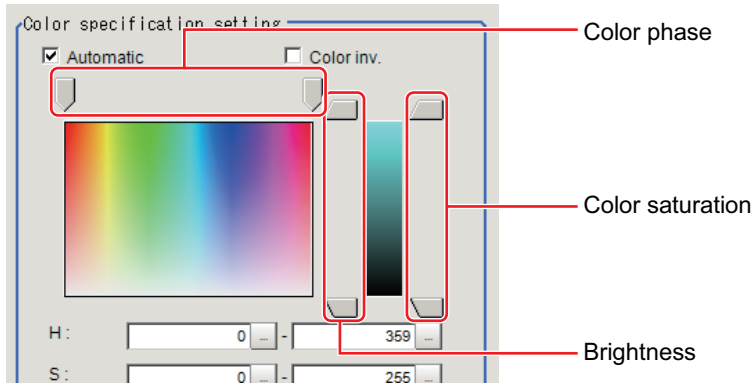
The color of the specified area is automatically set.

- 4 Finely adjust the hue, saturation, and brightness if necessary.**

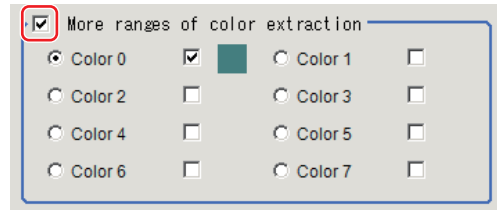
Adjust either by adjusting on the color chart or by inputting numbers.

Setting item	Setting value [Factory default]	Description
H	0 to 359	Set the color phase (difference of color hues).
S	0 to 255	Set color saturation (difference of color saturation).
V	0 to 255	Set the brightness (difference of brightness).
Automatic	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Setting the color to be extracted on the image automatically sets the hue, saturation, and brightness.
Color inv.	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Everything other than the specified color becomes the extraction target.

About color charts

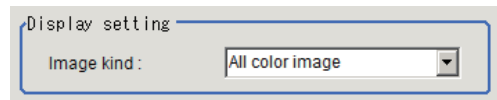
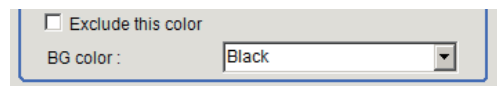


5 In multiple setting areas, specify each item.



Setting item	Setting value [Factory default]	Description
More ranges of color extraction	Checked [Unchecked]	If you place a check at this option, you can set up to 8 colors.

6 If necessary, set the display conditions for displayed images.



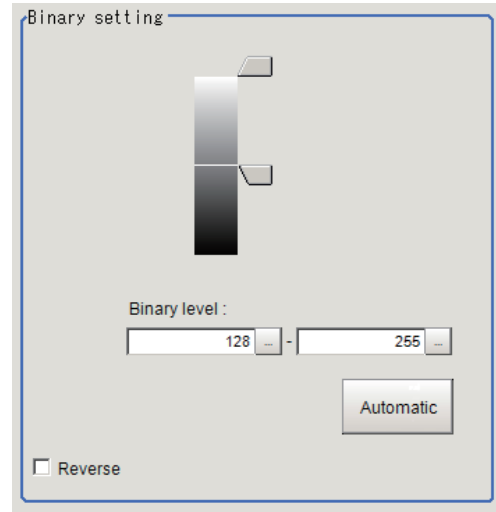
Setting item	Setting value [Factory default]	Description
Exclude this color	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Placing a check here excludes the pixels in the specified color range from the extraction target. The priority order for exclusion is that the higher color extraction range numbers are given priority. This setting is disabled if "More ranges of color extraction" is unchecked.
BG color	<ul style="list-style-type: none"> • [Black] • White • Red • Green • Blue 	The background section outside the extracted image is filled with the selected colors.
Image kind	<ul style="list-style-type: none"> • Measurement image • [All color image] • Selection color image • Binary image 	This selects the state of the image to display.

Binarization (Glue Bead Inspection)

When a monochrome camera is connected, the 256-tone grayscale images taken in from the camera are converted into binary black-and-white images before the images are measured. Converted white pixels are measured.

This specifies the level for converting grayscale images into binary images.

- 1 In the Item Tab area, click [Binary].
- 2 In the "Binary setting" area, set the reference density range.



Setting item		Setting value [Factory default]	Description
Binary level	Upper limit	0 to 255 [128]	Specify the level for converting 256-tone grayscale images to binary images. Set the binary level so that the measurement object is converted to white pixels. You can also set the binary level so that only intermediate density is measured.
	Lower limit	0 to 255 [128]	
Automatic		-	Optimum binary levels are calculated automatically and set.
Reverse		<ul style="list-style-type: none"> • Checked • [Unchecked] 	This item reverses black and white colors.

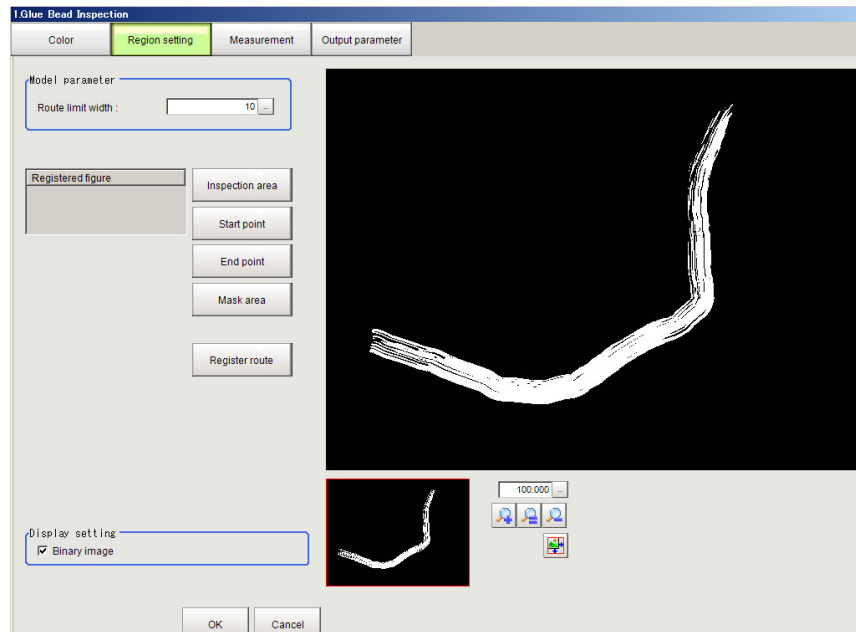
- 3 If necessary, set up display settings for the images displayed in the "Display setting" area.



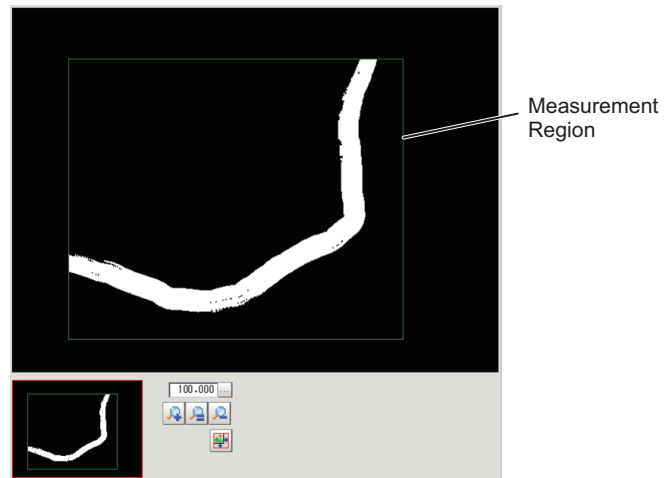
Setting item		Setting value [Factory default]	Description
Binary image		<ul style="list-style-type: none"> • [Checked] • Unchecked 	The image is displayed in binary with black and white.

Region Setting (Glue Bead Inspection)

Set the inspection region and extract the coating path. All you need is register three items--measurement region, start line and end line--and then click [Register route], and a path will be extracted automatically.

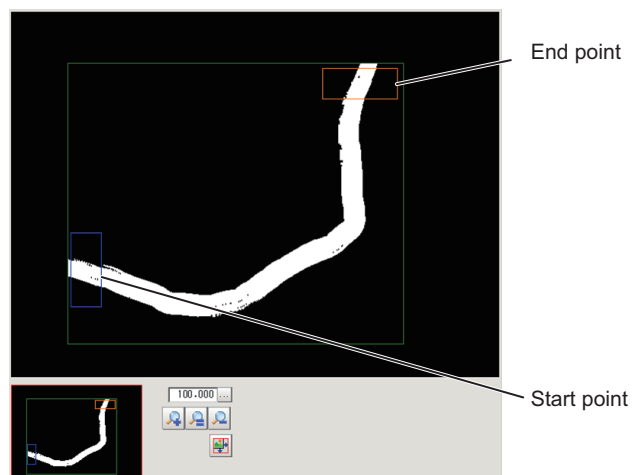


- 1 Click [Region setting] in the item tab area.
- 2 Click [Inspection area] and register the measurement region.



- 3 Register the start position of the region with [Start point] and the end position with [End point].

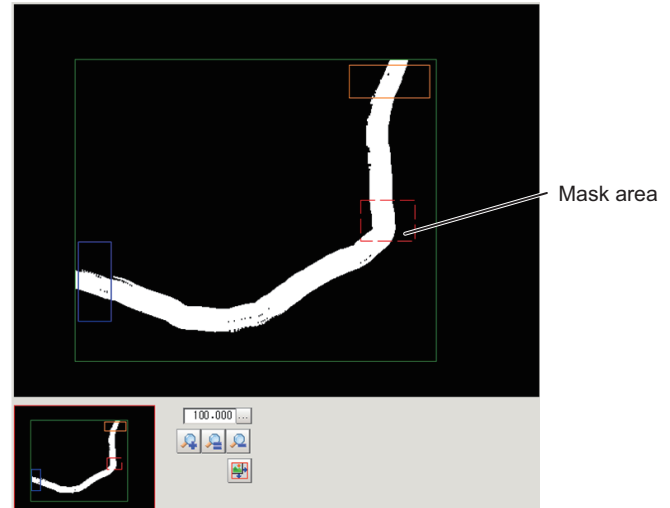
Register the positions so that they perpendicularly bisect the glueing.



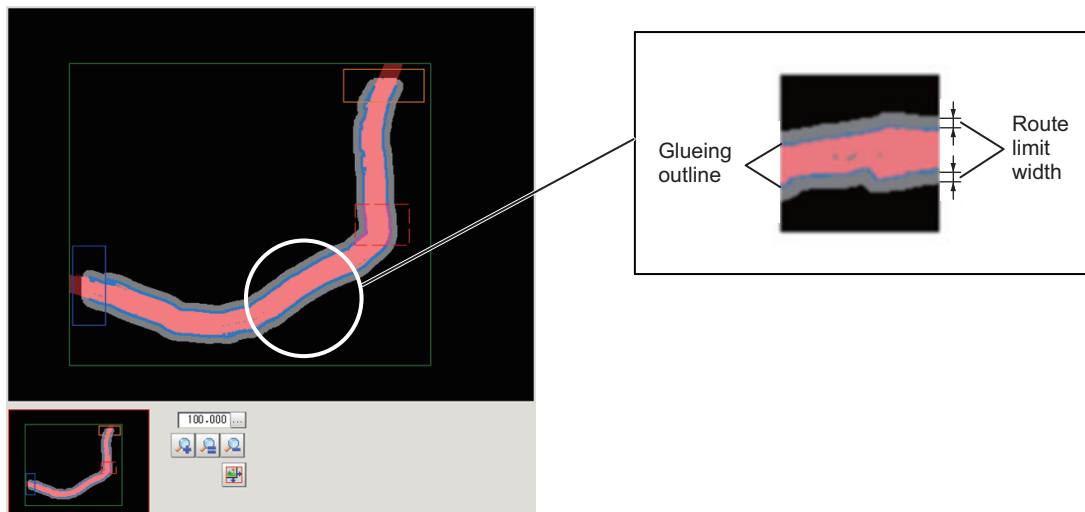
Important

- Make sure that nothing protrudes from the measurement region.
- If they diagonally bisect the glueing, the areas will become the maximum width making it impossible to accurately measure the area.
- Set the distance between the start line and end line wider than expected glue break width. To inspect glue bead in made in round shape, register two Glue Bead Inspection processing items to perform inspection in two regions.

- 4** If necessary, use [Mask area] to register the mask region (region in which the measurement results get ignored).



- 5** Click [Register route].
Create an outline of the glueing.



Glueing outline (blue, mask region is red): Calculates the width based on this outline information
Route limit width (gray): The outline + route limit width outline areas are registered. When the glueing goes exceeding this width, it is recognized that the glueing is applied outside of the route and an error occurs.

6 If necessary, set the following parameters in the "Model parameter" area.

Setting item	Setting value [Factory default]	Description
Route limit width	2 to 100 [10]	Specify a glueing route width to be judged as "OK". When it exceeds the set area the inspection result will be "NG". The unit is pixel.

7 If necessary, set up display settings for the images in the "Display setting" area.

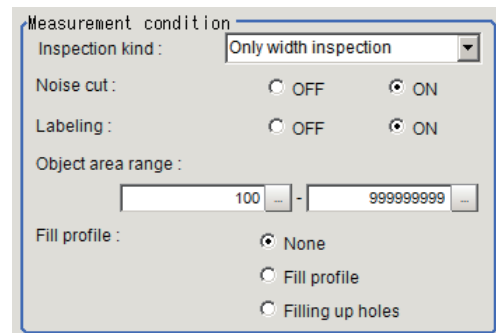
Setting item	Setting value [Factory default]	Description
Binary image	<ul style="list-style-type: none"> • [Checked] • Unchecked 	When checked, the binary image is displayed.

Measurement Parameters (Glue Bead Inspection)

Set the inspection measurement conditions and the judgement conditions for the measurement results.

1 In the Item Tab area, click [Measurement].

2 In the "Measurement condition" area, specify a value for each item.



Setting item	Setting value [Factory default]	Description
Inspection kind	<ul style="list-style-type: none"> • [Only width inspection] • Only route inspection • Both inspection 	Select the inspection type.
Noise cut	<ul style="list-style-type: none"> • OFF • [ON] 	Select whether or not to process noise removal. Set this option if fine pixel noises generate. Basically the processing should be set to "ON" to ensure stable measurement.
Labeling	<ul style="list-style-type: none"> • OFF • [ON] 	Select whether or not to process noise removal using the labeling filter. Set this option if noises generate. You can use this processing to measure only the labels in the range set in "Object area range ". Basically the processing should be set to "ON" to ensure stable measurement.
Object area range	0 to 99999999 [100 to 99999999]	Set the area range of labels to be measured.
Fill profile	<ul style="list-style-type: none"> • [None] • Fill profile • Filling up holes 	Select the fill profile method. You can use the Fill profile setting item when the Labeling setting item is set to ON.

- 3** In the "Display setting" area, set the image display settings.

Display setting
 Binary image

Setting item	Setting value [Factory default]	Description
Binary image	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Use this option when binary images are displayed.

- 4** When the setting has been changed, click [Measure] in the "Detail" area to verify whether measurements can be made correctly.

Test measuring of this item.

Measure

- 5** Set up the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Setting item	Setting value [Factory default]	Description
Route len. (Long)	0.0000 to 99999.9999 [0.0000] to [99999.9999]	Set the range of path lengths (long) that is judged to be OK.
Route len. (Short)	0.0000 to 99999.9999 [0.0000] to [99999.9999]	Set the range of path lengths (short) that is judged to be OK.
Min. width	0.0000 to 99999.9999 [0.0000] to [99999.9999]	Set the minimum width that is judged to be OK.
Max. width	0.0000 to 99999.9999 [0.0000] to [99999.9999]	Set the maximum width that is judged to be OK.
Avg. width	0.0000 to 99999.9999 [0.0000] to [99999.9999]	Set the average width that is judged to be OK.
Gap width	0.0000 to 99999.9999 [0.0000]	Set the gap width along a path that are judged to be OK.

Output Parameters (Glue Bead Inspection)

Set how measurement results are output to an external device. This item can be changed if necessary. Normally, the factory default value will be used.

- 1** Click [Output parameter] in the Item Tab area.
- 2** Specify each of the following items.

Setting item	Setting value [Factory default]	Description
Output coordinates	<ul style="list-style-type: none"> • [After scroll] • Before scroll 	As measurement results, select whether to output coordinate values to external devices before or after the position compensation is applied.
Calibration	<ul style="list-style-type: none"> • [OFF] • ON 	Select whether to reflect the calibration in the values output to the external device as measurement results. ON: Output the coordinates converted into actual dimensions. OFF: Output the camera coordinate values.
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Specify whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Glue Bead Inspection)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
State	Coated condition of measured coating
Min. width	Maximum width of measured coating
Max. width	Minimum width of measured coating
Gap width	Gap width of measured coating

Key Points for Adjustment

Select the adjustment method referring to the following points.

When a path creation error occurs

State	Parameter to be adjusted	Troubleshooting
Either the start position or end position is set outside the measurement region.	Region setting	Set the start position or end position, whichever is applicable, inside the measurement region.
Either the start position or end position is yet to be registered.	Region setting	Set the start position or end position, whichever is applicable.
Either the start position or end position is inappropriate to fully enclose coating.	Region setting	Register the start position or end position, whichever is applicable, so that the two positions are set vertically across coating.
Coating is gapped between the start position and end position.	Region setting	If coating is gapped in the middle, register multiple coating gap inspections and set separate inspection parts.
Width between paths of a spiral path is sometimes measured.	Region setting	Divide the spiral into regions corresponding to individual turns and set a unit for each region.

When judgement is NG

State	Parameter to be adjusted	Troubleshooting
The judgement is NG (insufficient memory)	Region setting	Adjust the region so that the reference path becomes shorter.

Measurement Results for Which Output is Possible (Glue Bead Inspection)

Measurement items	Character string	Description
Judge	JG	1: OK 0: Unmeasured -1: NG
State	ST	Condition of measured result 0: Detectable 1: Gapped 2: Path error -1: Unmeasured -2: Region not yet registered -3: Coating not yet detected -4: Excessive path (insufficient memory)
Min. width	MINWD	Min. width
Max. width	MAXWD	Max. width
Average width	AVGWD	Average width
Gap width	GAPWD	Gap width
Coordinate X1 with the minimum width	MINX1	X coordinate X 1 with the minimum width
Coordinate Y with the minimum width	MINY1	Y Coordinate Y1 with the minimum width
Coordinate X2 with the minimum width	MINX2	X coordinate X2 with the minimum width
Coordinate Y2 with the minimum width	MINY2	Y coordinate Y2 with the minimum width
Coordinate X1 with the maximum width	MAXX1	X coordinate X 1 with the maximum width
Coordinate Y1 with the maximum width	MAXY1	Y coordinate Y1 with the maximum width
Coordinate X2 with the maximum width	MAXX2	X coordinate X2 with the maximum width
Coordinate Y2 with the maximum width	MAXY2	Y coordinate Y2 with the maximum width
Coordinate X1 of gap width	GAPX1	X coordinate X1 of gap width
Coordinate Y1 of gap width	GAPY1	Y coordinate Y1 of gap width
Coordinate X2 of gap width	GAPX2	X coordinate X2 of gap width
Coordinate Y2 of gap width	GAPY2	Y coordinate Y2 of gap width

External Reference Tables (Glue Bead Inspection)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Status of measure result	Get only	-
6	Min. width of measure result	Get only	-
7	Max. width of measure result	Get only	-
8	Average width of measure result	Get only	-
9	Lack width of measure result	Get only	-
10	Route len. (Long)	Get only	-
11	Route len. (Short)	Get only	-
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Register the max. color hue	Set/Get	0 to 359
121	Register the min. color hue	Set/Get	0 to 359
122	Register the max. color saturation	Set/Get	0 to 255
123	Register the min. color saturation	Set/Get	0 to 255
124	Register the max. color brightness	Set/Get	0 to 255
125	Register the min. color brightness	Set/Get	0 to 255
126	Extract image	Set/Get	0: OFF 1: ON
127	Background color	Set/Get	0: Black 1: White 2: Red 3: Green 4: Blue
128	With/without fill profile	Set/Get	0: OFF 1: Fill profile 2: Filling up holes
129	Inverse area presence	Set/Get	0: OFF 1: ON
130	With/without noise removal	Set/Get	0: OFF 1: ON
131	Allowable path width	Set/Get	2 to 100
132	Upper limit of the minimum width	Set/Get	0.0000 to 99999.9999
133	Lower limit of the minimum width	Set/Get	0.0000 to 99999.9999

No.	Data name	Set/Get	Data range
134	Upper limit of the maximum width	Set/Get	0.0000 to 99999.9999
135	Lower limit of the maximum width	Set/Get	0.0000 to 99999.9999
136	Upper limit of average width	Set/Get	0.0000 to 99999.9999
137	Lower limit of Average width	Set/Get	0.0000 to 99999.9999
138	Upper limit of gap width	Set/Get	0.0000 to 99999.9999
139	Lower limit of gap width	Set/Get	0.0000 to 99999.9999
142	Upper limit of the binary level	Set/Get	0 to 255
143	Lower limit of the binary level	Set/Get	0 to 255
144	Binary image	Set/Get	0: OFF 1: ON
145	Scanning direction for line 0	Set/Get	0: Clockwise 1: Counterclockwise
146	Scanning direction for line 1	Set/Get	0: Clockwise 1: Counterclockwise
147	Upper limit of the Route len. (Long)	Set/Get	0.0000 to 99999.9999
148	Lower limit of the Route len. (Long)	Set/Get	0.0000 to 99999.9999
149	Upper limit of the Route len. (Short)	Set/Get	0.0000 to 99999.9999
150	Lower limit of the Route len. (Short)	Set/Get	0.0000 to 99999.9999
151	Multiple selections	Set/Get	0: Multiselect NG 1: MultiSelect OK
152	Display image type	Set/Get	0: Measurement image 1: All color image 2: Color selected image 3: Binary image
153	Upper limit of the object area range	Set/Get	0 to 999999999
154	Lower limit of the object area range	Set/Get	0 to 999999999
155	Labeling	Set/Get	0: OFF 1: ON
156	Inspection kind	Set/Get	0: Width's inspection only 1: Route's inspection only 2: Width and route's inspection
160 + N × 10 (N = 0 to 7)	Flag N used for registered color	Set/Get	0: OFF 1: ON
161 + N × 10 (N = 0 to 7)	Flag N for registered color OR/NOT	Set/Get	0: OR 1: NOT
162 + N × 10 (N = 0 to 7)	Register the max. color hue N	Set/Get	0 to 359
163 + N × 10 (N = 0 to 7)	Register the min. color hue N	Set/Get	0 to 359
164 + N × 10 (N = 0 to 7)	Register the max. color saturation N	Set/Get	0 to 255

No.	Data name	Set/Get	Data range
165 + N × 10 (N = 0 to 7)	Register the min. color saturation N	Set/Get	0 to 255
166 + N × 10 (N = 0 to 7)	Register the max. color brightness N	Set/Get	0 to 255
167 + N × 10 (N = 0 to 7)	Register the min. color brightness N	Set/Get	0 to 255
168 + N × 10 (N = 0 to 7)	Background color N	Set/Get	0: Black 1: White 2: Red 3: Green 4: Blue
1000 + N × 2 (N = 0 to 1)	Min. width XN	Get only	-
1001 + N × 2 (N = 0 to 1)	Min. width YN	Get only	-
1004 + N × 2 (N = 0 to 1)	Max. width XN	Get only	-
1005 + N × 2 (N = 0 to 1)	Max width YN	Get only	-
1008 + N × 2 (N = 0 to 1)	Gap pos. XN	Get only	-
1009 + N × 2 (N = 0 to 1)	Gap pos. YN	Get only	-

Compensate image

This chapter describes how to apply positional compensation for measurement objects in the input image in order to measure accurately.

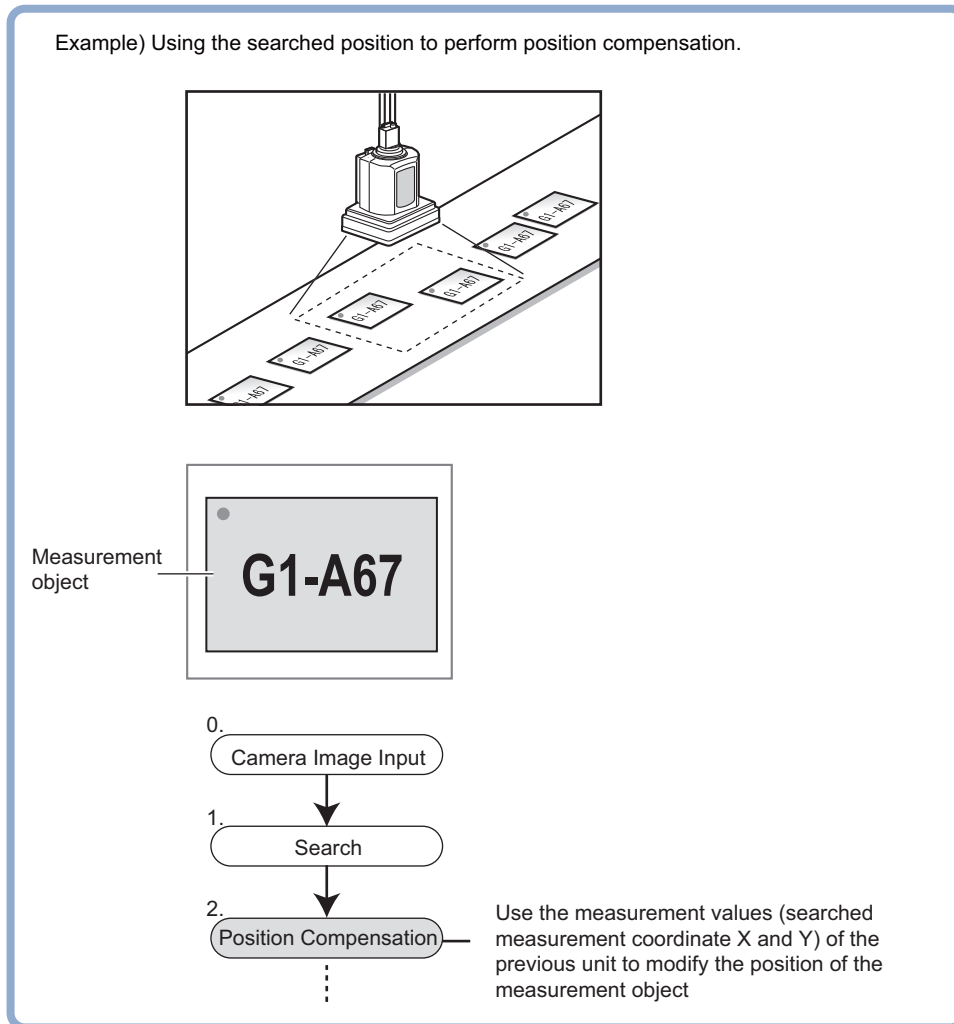
Position Compensation	510
Filtering	515
Background Suppression	520
Brightness Correct Filter	523
Color Gray Filter	526
Extract Color Filter	529
Anti Color Shading	534
Stripes Removal Filter II.....	537
Polar Transformation	542
Trapezoidal Correction.....	545
Machine Simulator.....	552
Image Subtraction	558
Advanced Filter.....	565
Panorama	600

Position Compensation

The positional deviation of measurement objects can be corrected using measured values saved by other processing units. Compare the measured coordinates with the reference coordinates of the applicable processing unit, and move the image by the amount of the difference.

Used in the Following Case

- **Even with different positions for the same measurement object, correct measurement can still be performed by correcting the position of the input image. There is no need to reposition the measurement object itself.**



Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Processing Units That Can Be Combined with Position Compensation

Position compensation corrects positions according to measured values (coordinates) from the immediately preceding processing unit. Combining the following processing units with position compensation is effective.

Processing unit type	Processing item name
Processing unit that performs search or matching (called "Search processing unit" hereafter.)	Reference: ▶ Search (p.97) Reference: ▶ Flexible Search (p.112) Reference: ▶ ECM Search (p.134) Reference: ▶ Circle Angle (p.490)
Processing unit that detects edge positions (called "Edge position processing unit" hereafter.)	Reference: ▶ Edge Position (p.226) Reference: ▶ Scan Edge Position (p.245)
Processing unit to detect the center of gravity (called "processing unit for gravity center detection".)	Reference: ▶ Gravity and Area (p.319) Reference: ▶ Labeling (p.333)

Important

- When the position compensation method ([Method]) is set to [1 unit scroll] or [2 unit scroll], position compensation will not be performed correctly if units other than the above unit(s) are present immediately before the [Position Compensation] unit within the scene.
- For processing units that are used in combination with position compensation, set [Calibration] to "OFF" in [Output parameter].
- The position compensation method causes some processing items to be NG when areas outside the image are included within the region. (Edge position/number of edge pins/fine matching/defects and contamination/ high-precision defects and contamination detection/area gravity center/labeling/sophisticated labeling+/color average and deviation/scan edge position/scan edge width/circular shape angle acquisition)

Region Setting (Position Compensation)

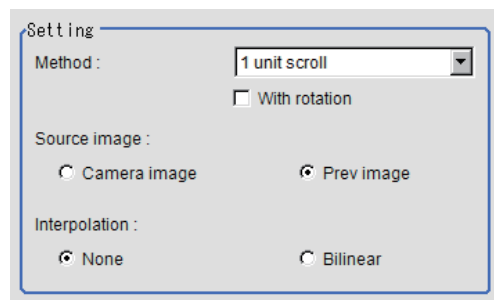
When position compensation is set, the position is shifted by exactly the amount of the compensation, then measurement is performed. Restricting the region in which the image is moved can shorten the processing time.

- 1 In the Item Tab area, click [Region setting].**
- 2 Use the Drawing tools to specify the measurement region.**
- 3 Click [OK] in the Figure setting area.**
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

Scroll Method (Position Compensation)

Set the compensation method for position compensation.

- 1 In the Item Tab area, click [Scroll method].**
- 2 Set the parameters.**



Setting item	Set value [Factory default]	Description
Method	[1 unit scroll]	This performs a position compensation by referring to the coordinates measured with the search processing unit or edge position processing unit [Note 1] immediately before the [Position Compensation] (automatic processing unit). This moves the image by the difference between the measured coordinates and the reference coordinates of the referring search processing unit or edge position processing unit.
	2 unit scroll	This performs a position compensation by referring to the coordinates measured with the search processing unit or edge position processing unit [Note 1] immediately before or two units before the [Position Compensation] (automatic processing unit).
	Calculation	Set whichever position compensation you prefer. Set the reference coordinates and measurement coordinates.
	Reset scroll	The image for the immediately preceding image input (Camera image input/Camera switching) is displayed. When position compensation has been performed, the status returns to that from before position compensation. If Filtering or Color Gray Filter had been performed, the original image with Filtering or Color Gray Filter released is displayed.
With rotation	<ul style="list-style-type: none"> • Checked • [Unchecked] 	When "1 unit scroll" or "2 unit scroll" is selected as the setting method, place a check for executing position compensation in the rotation direction in addition to the XY directions.
Source image	Camera image	The camera input image that has not been subject to filtering is subject to compensation as is.
	[Prev image]	Images to which filtering and position compensation processing are applied in units even before the "Position Compensation" being set are the targets.
Interpolation	[None]	Position compensation is performed in units of pixels.
	Bilinear	This option joins more than one point with a line in order to find a desired approximate value. The image will become smoother.

[Note 1]Reference: ► Processing Units That Can Be Combined with Position Compensation (p.511)

When you choose the "Calculation" option

3 Using expressions, specify the "Reference" and "Position" which are used to determine the position compensation.

Differences between the respective values in the "Reference" and "Position" areas give the amount of position compensation to be performed.

Reference: ► Layout of Setting Expression Window (p.615)

Key Points for Test Measurement and Adjustment (Position Compensation)

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image number.	Explanation of image to be displayed
0	After compensation
1	Before compensation

Measurement Results for Which Output Is Possible (Position Compensation)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Scroll X	DX	Scroll X
Scroll Y	DY	Scroll Y
Scroll θ	DT	Scroll θ
Measurement coordinate X	X	Measured value X coordinate
Measurement coordinate Y	Y	Measured value Y coordinate
Measurement angle θ	TH	Measure angle θ
Reference position X	SX	Reference X coordinate
Reference position Y	SY	Reference Y coordinate
Reference angle θ	ST	Reference angle θ

External Reference Tables (Position Compensation)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Scroll X	Get only	-99999.9999 to 99999.9999
6	Scroll Y	Get only	-99999.9999 to 99999.9999
7	Scroll θ	Get only	-999.9999 to 999.9999
8	Position X	Get only	0 to 99999.9999
9	Position Y	Get only	0 to 99999.9999
10	Measurement θ	Get only	-360 to 360
11	Reference X	Get only	-99999.9999 to 99999.9999
12	Reference Y	Get only	-99999.9999 to 99999.9999
13	Reference θ	Get only	-999.9999 to 999.9999
120	Interpolation	Set/Get	0: None 1: Bilinear
121	Method	Set/Get	0: 1 unit scroll 1: 2 unit scroll 2: Expression 3: Reset scroll
122	Scroll target	Set/Get	0: Camera image 1: Prev. unit image

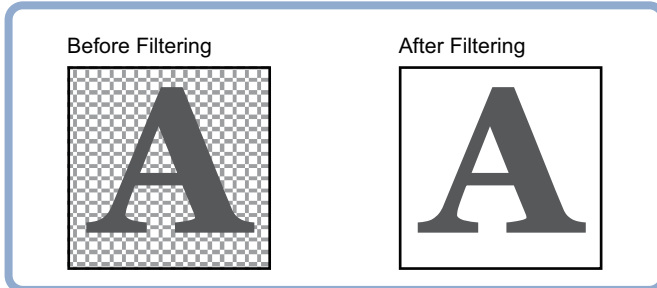
No.	Data name	Set/Get	Data range
123	With rotation	Set/Get	0: OFF 1: ON
124	Reference position X	Set/Get	Exp. character string
125	Reference position Y	Set/Get	Exp. character string
126	Reference angle	Set/Get	Exp. character string
127	Measurement position X	Set/Get	Exp. character string
128	Measurement position Y	Set/Get	Exp. character string
129	Measurement angle	Set/Get	Exp. character string

Filtering

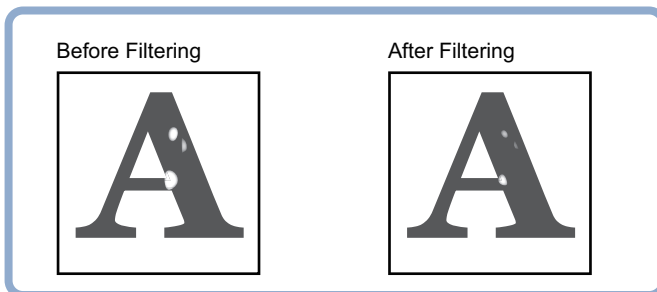
Process the images acquired from cameras in order to make them easier to measure.

Used in the Following Case

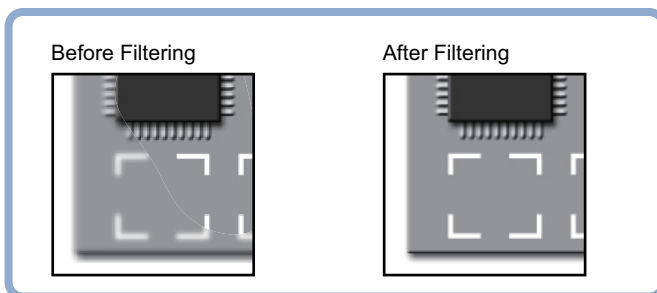
- Cutting out unnecessary background images to exclude them from the measurement region



- When noise is to be removed



- When the edges of marks you want to find cannot be found even though other edges have been extracted.



Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Filtering Parameters (Filtering)

Treat the images loaded from the camera in order to make them easier to measure.

You can select from 10 filtering methods to match the image state.

1 In the Item Tab area, click [Filter parameter].

2 Set each item while checking the image.

Setting item	Set value [Factory default]	Description
Display	Through image display	The latest image is always input from the camera and displayed.
	[Freeze image display]	The image that was scanned in the immediately preceding measurement is displayed. Images can be updated at any time during measurement.
Target for filtering	[Camera image]	Filtering is applied to the images input from the camera that is set before this unit ([Filtering]) in the scene. Filtering is not performed.
	Previous image	Filtering is applied to the images which have been processed by the [Position Compensation] and [Filtering] units that are set before this unit ([Filtering]) in the scene.
Order of filtering	<ul style="list-style-type: none"> • [Filtering → BGS] • BGS → Filtering 	Select the sequence of background suppression/filtering.
Filtering	<ul style="list-style-type: none"> • [OFF] • Weak smoothing • Strong smoothing • Dilate • Erosion • Median • Extract edges • Extract horizontal edges • Extract vertical edges • Enhance edges 	Select the type of filtering. Reference: ► Filtering Options and Examples (p.517)
Filter size	<ul style="list-style-type: none"> • [3 × 3] • 5 × 5 	Select whether to use information from several surrounding pixels. With mask size, the larger the setting value, the more of the surrounding pixel variation that can be assimilated.
BGS level	[0] to [255]	While looking at your image, specify the upper and lower limits for RGB to suppress as the background. Reference: ► Background Suppression Level (p.518)

Filtering Options and Examples

Treat the images loaded from the camera in order to make them easier to measure.

Types of filtering	The problems to be treated	Filtering description	Example
Weak smoothing Strong smoothing	Small flecks on the measurement object	Makes flecks less visible.	Makes stable searching possible and stable area measurement possible.
Dilate	Dark noise exists	This filtering removes dark noise by enlarging brighter areas.	Removing noise from measurement objects
Erosion	Brighter noise exists	This filtering removes brighter noise by shrinking brighter areas.	
Median	Small flecks on the measurement object	This filtering keep the profile and weaken flecks.	Edge positioning (Accuracy is not reduced)
Extract edges	Due to a comparatively lower image contrast, defects are difficult to extract	Extracts the boundary lines of the image (light and shade).	Defect inspection
Extract horizontal edges	Due to a comparatively lower image contrast, defects are difficult to extract	Extracts the boundary lines horizontal to the image (light and shade).	
Extract vertical edges	Due to a comparatively lower image contrast, defects are difficult to extract	Extracts the boundary lines vertical to the image (light and shade).	
Enhance edges	The measurement object is blurry (due to changes such as lighting fluctuation).	Clearly delineates the boundary lines between the light and dark in the image.	Edge positioning

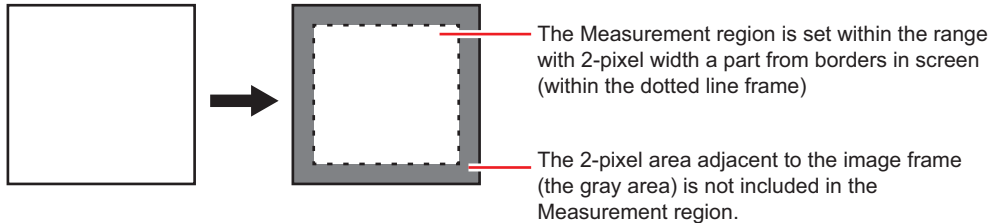
Notes on Filtering Setting

If filtering is applied to the image, the area around the image frame will become unstable. When a [Filtering] processing item has been set in the scene, ensure that measurement ranges, etc. set for other processing items are not included in the area around the image frame.

The width not included in the measurement range will vary depending on the mask size settings.

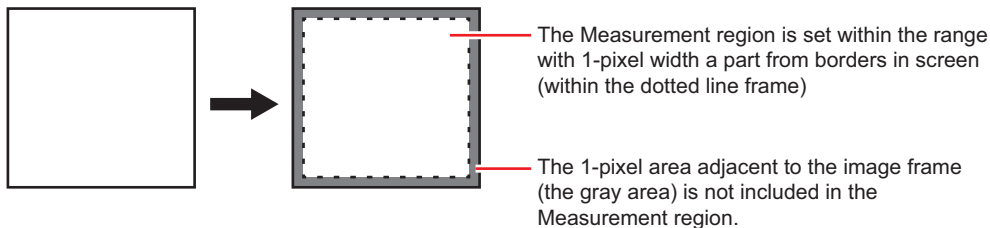
- **Filter size: 5 × 5**

Make settings so that a width around the image frame equal to 2 pixels is not included in the measurement range.



- **Filter size: 3 × 3**

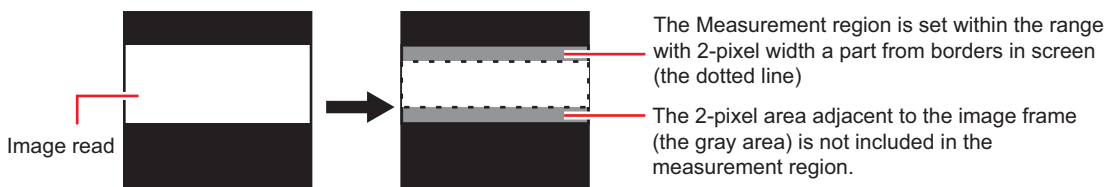
Make settings so that a width around the image frame equal to 1 pixels is not included in the measurement range.



When a partial scan is used to limit the load range

Set so as to not include the image loading range surroundings.

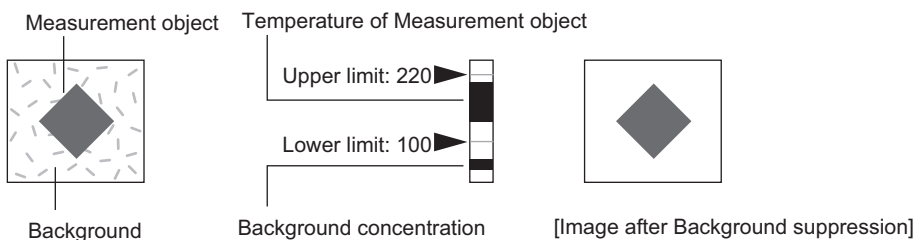
The width that will not be included in the measurement range is the same as the above. (In the following figure, filter size: 5 × 5).



Background Suppression Level

The images below the lower limit and above the upper limit will be set to the lower and upper limits of brightness, respectively.

Example) lower limit: 100 upper limit: 220



Only images with a density of 100 to 220 can be measurement objects.

Region Setting (Filtering)

It is possible to target the entire screen, but restricting the range can shorten the processing time.

- 1** In the Item Tab area, click [Region setting].
- 2** Use the Drawing tools to specify the measurement region.
- 3** Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

External Reference Tables (Filtering)

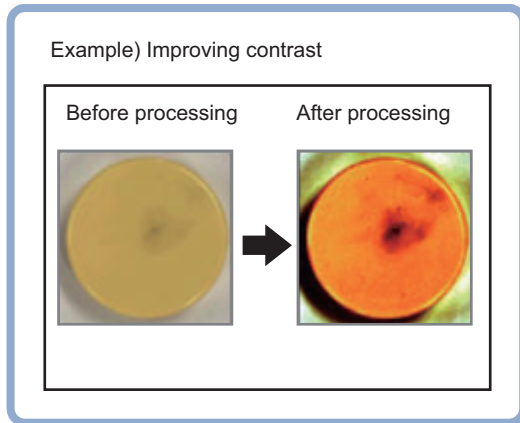
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
120	Target	Set/Get	0: Camera image 1: Prev. unit image
121	Filtering	Set/Get	0: OFF 1: Weak smoothing 2: Strong smoothing 3: Dilation 4: Erosion 5: Median 6: Extract vertical edges 7: Extract horizontal edges 8: Extract edges 9: Enhance edges
122	Filtering order	Set/Get	0: Filtering to BGS 1: BGS to Filtering
123	Filter size	Set/Get	0: 3 * 3 1: 5 * 5
124	Lower limit for BGS levels	Set/Get	0 to 255
125	Upper limit for BGS levels	Set/Get	0 to 255

Background Suppression

Specifying a brightness range to use for measurement eliminates the section outside that range as background. In addition, the extracted range is converted into values of 0 to 255, so the contrast can be emphasized.

Used in the Following Case

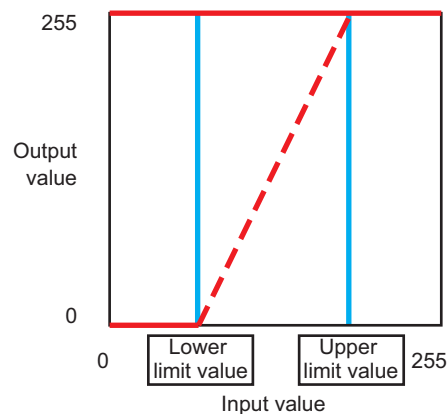
- By extracting a specific brightness range, the contrast on the image can be improved, unnecessary background eliminated, etc.



Basic concept of background suppression

Because input values from 0 to [Lower] are converted to level 0 and values from [Upper] to 255 are converted to level 255, the background in this range is eliminated.

Together with this, only [Lower] to [Upper] from the input values 0 to 255 are taken and those are converted to output values of 0 to 255, so the contrast within this range is emphasized.



Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Filter Setting (Background Suppression)

This item sets the filter.

- 1 In the Item Tab area, click [Filter Setting].
- 2 In the "Display" area, click [Change display] to switch between camera image types.

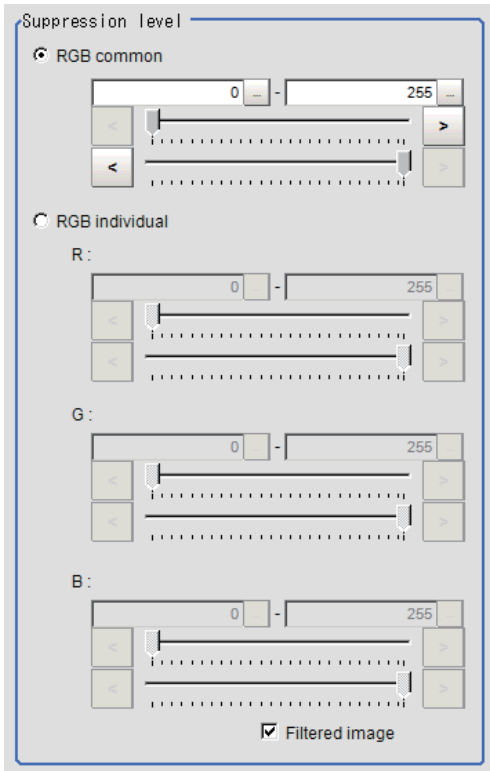
The displayed contents of the Image Display area will be switched.

Setting item	Set value [Factory default]	Description
Display	Through image display	The latest image is always input from the camera and displayed.
	[Freeze image display]	The image that was scanned in the immediately preceding measurement is displayed.

3 Set the background suppression level.

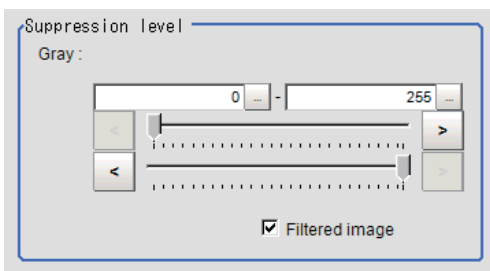
There are two setting methods: specifying the section in the image whose contrast is to be emphasized or specifying the extraction range with numeric values.

For color cameras:



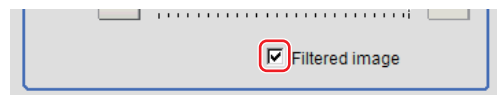
Item	Set value [Factory default]	Description
Suppression level	RGB common 0 to 255	The upper and lower limits for the background suppression level are set in common for RGB. The range from the set minimum to the set maximum is converted to 0 to 255.
	RGB individual 0 to 255	The maximum and minimum for the background suppression level are independently for RGB. The range from the set minimum to the set maximum is converted to 0 to 255.

For monochrome cameras:



Setting item	Set value [Factory default]	Description
Gray	0 to 255	The set range is converted to 0 to 255.

4 As necessary, set the display image.



Region Setting (Background Suppression)

It is possible to target the entire screen, but restricting the range can shorten the processing time.

- 1** In the Item Tab area, click [Region setting].
- 2** Use the Drawing tools to specify the measurement region.
- 3** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

Measurement Results for Which Output Is Possible (Background Suppression)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference Tables (Background Suppression)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
121	Color setting mode	Set/Get	0: RGB common 1: RGB individual
122	Lower limit for common colors	Set/Get	0 to 255
123	Upper limit for common colors	Set/Get	0 to 255
124	MIN R	Set/Get	0 to 255
125	MAX R	Set/Get	0 to 255
126	MIN G	Set/Get	0 to 255
127	MAX G	Set/Get	0 to 255
128	MIN B	Set/Get	0 to 255
129	MAX B	Set/Get	0 to 255
130	Lower limit for shading	Set/Get	0 to 255
131	Upper limit for shading	Set/Get	0 to 255
132	Filtered image	Set/Get	0: Image prior to transfer 1: Image after transfer
200	Transfer source image number	Set/Get	0 to 9
201	Transfer destination image number	Set/Get	0 to 9

Brightness Correct Filter

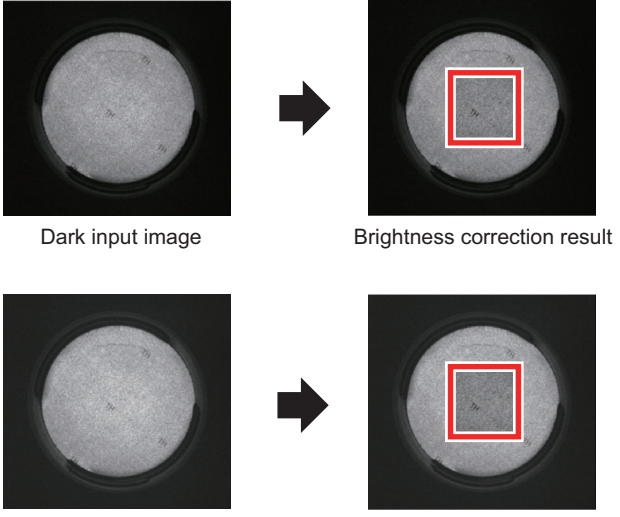
The filter can be used to correct the effect of the material and shape of the lighting and the measurement object.

Used in the Following Case

- This is used when the image is non-uniform due to the effect of the material and shape of the lighting and the measurement object.

• Brightness correction

Even if the brightness of the measurement object changes due to the impact of the surrounding environment, consistent measurement results can be obtained by applying correction to a certain brightness.



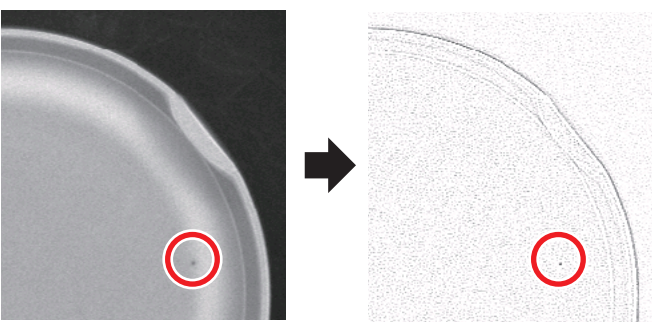
Dark input image → Brightness correction result

Bright input image → Brightness correction result

■ Setting region

• Unevenness removal

If the image is uneven due to the influence of the shape, material, or the like of the measurement object, this function can be used to remove the unevenness and make defects easier to detect.



Input image → Unevenness removal

Important

- This processing item is for monochrome only. When using a color camera, insert a color gray filter before this processing item. If a color image is input, it is NG (incompatible image).
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

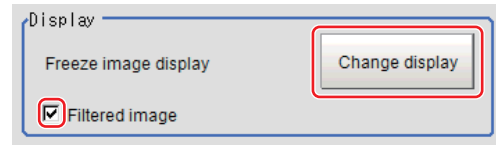
Filter Setting (Brightness Correct Filter)

This item sets the filter.

1 In the "Item Tab" area, click [Filter setting].

2 In the "Display" area, click [Change display] to switch between camera image types.

The displayed contents of the image display area will be switched.



Setting item	Setting value [Factory default]	Description
Display	Through image display	The latest image is always input from the camera and displayed.
	[Freeze image display]	The image that was scanned in the immediately preceding measurement is displayed.
Filtered image	<ul style="list-style-type: none"> • [Checked] • Unchecked 	To display the original image, uncheck here.

3 Set the target image.



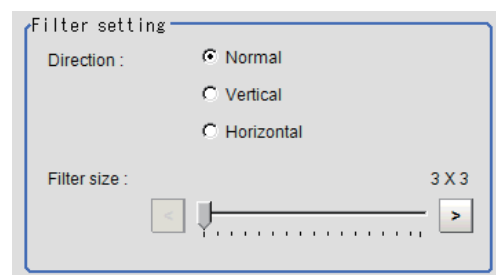
Setting item	Setting value [Factory default]	Description
Target	Camera image	The camera input image that has not been subject to filtering is subject to compensation as is.
	[Prev. unit image]	Images to which processing is applied in units even before the "Brightness correction" being set are the targets.

4 Set the correction method.



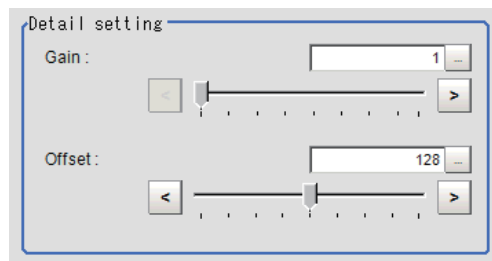
Setting item	Setting value [Factory default]	Description
Uneven removal	<ul style="list-style-type: none"> • Checked • [Unchecked] 	When this is checked, unevenness removal is performed in addition to brightness correction.

5 Specify the filtering setting (only for "Uneven removal").



Setting item	Setting value [Factory default]	Description
Direction	<ul style="list-style-type: none"> • [Normal] • Vertical • Horizontal 	Usually, set this to "Normal". If the direction of change of the unevenness is one direction, select the setting that is perpendicular to the direction of change of the unevenness.
Filter Size	3 to 255 [3]	Specify a larger value to match the size of the defects to be extracted. Only an odd number value can be specified.

6 Set the details.



Setting item	Setting value [Factory default]	Description
Gain	1 to 63 [1]	Adjust the contrast of an image after the correction. Specifying a larger value emphasizes the density differences within the image.
Offset	0 to 255 [128]	Adjust the brightness of an image after the correction. Specifying a larger value increases the brightness of the image.

Region Setting (Brightness Correct Filter)

It is possible to target the entire screen, but restricting the range can shorten the processing time.

- 1 In the Item Tab area, click [Region setting].
- 2 Use the drawing tools to specify the measurement region.
- 3 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

External Reference Tables (Brightness Correct Filter)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (not yet measured) 1: Judgement result OK -1: Judgement result NG
120	Unevenness removal (correction method)	Set/Get	0: Do not perform unevenness removal. (Perform brightness correction.) 1: Perform unevenness removal.
121	Direction	Set/Get	0: Vertical and horizontal 1: Horizontal 2: Vertical
122	Filter Size	Set/Get	3 to 255
123	Gain	Set/Get	1 to 63
124	Offset	Set/Get	0 to 255
200	Transfer source image number	Set/Get	0 to 9
201	Image number after transfer	Set/Get	0 to 9
202	Target image	Set/Get	0: Camera input image 1: Previous unit image
203	Display image	Set/Get	0: Display the image before processed. 1: Display the image after processed.

Color Gray Filter

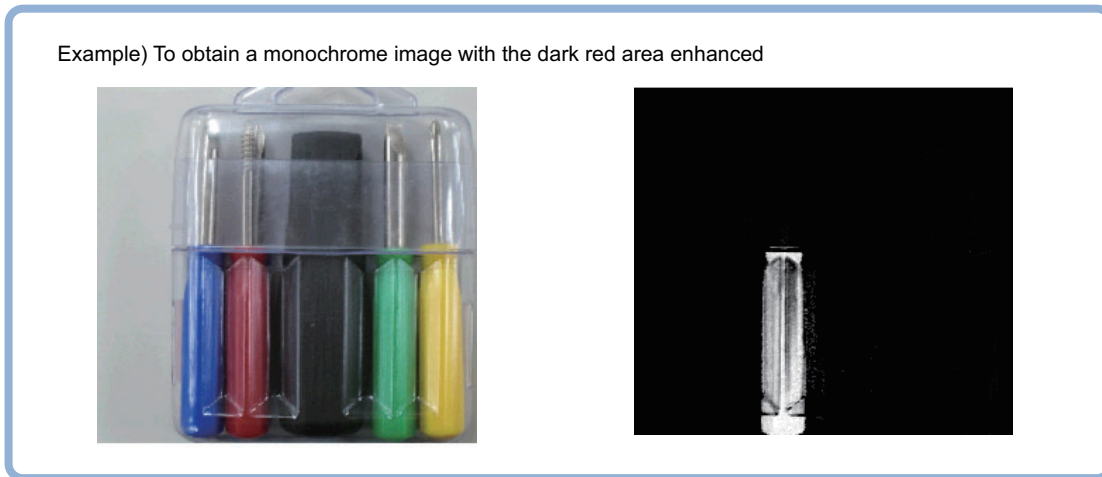
This processing item converts a color image input from a color camera into a monochrome image. The available filters are "Primary color filter (RGB)", "Complementary color filter (CMY)", "Brightness filter", and "HSV filter". This processing item cannot be used with monochrome images. Such use causes a judgement of NG (incompatible image).

Note

- The processing items after Color Gray Filter are the same as when a monochrome camera is connected.

Used in the Following Case

- To convert a color image to a monochrome image with a specific color enhanced



Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

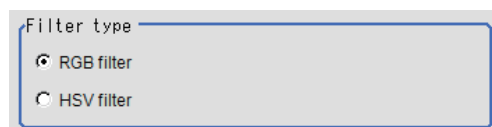
Filter Setting (Color Gray Filter)

This item sets the filter.

- In the Item Tab area, click [Filter Setting].
- In the "Display mode" area, click [Change display] to switch between camera image types. The displayed contents of the Image Display area will be switched.

Setting item	Set value [Factory default]	Description
Display mode	Through image display	The latest image is always input from the camera and displayed.
	[Freeze image display]	The image that was scanned in the immediately preceding measurement is displayed.

- Select the type of filter in the "Filter type" area.

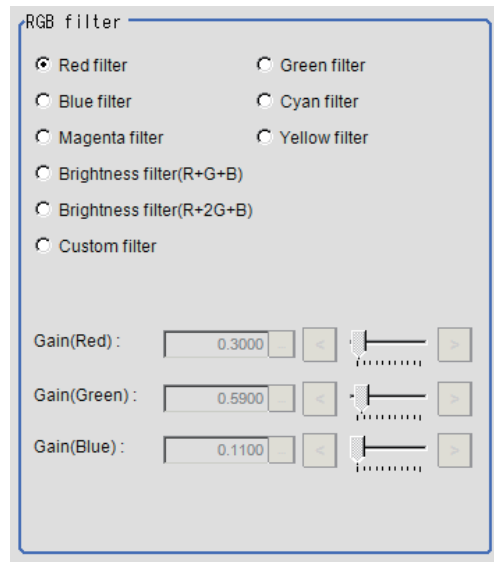


Setting item	Set value [Factory default]	Description
Filter type	[RGB filter]	Specify the color extraction range with R, G, and B.
	HSV filter	Specify the color extraction range with hue and color chroma.

When RGB is selected

4 Select the type of color filter in the "RGB filter" area.

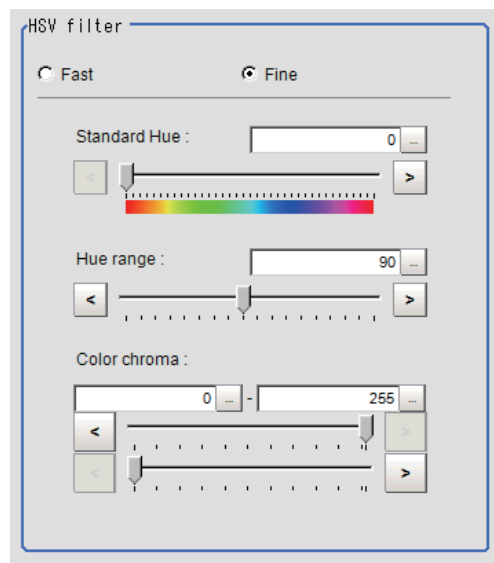
If "Custom filter" is selected, set the "Gain (Red)", "Gain (Green)", and "Gain (Blue)" as necessary.



Setting item	Set value [Factory default]	Description
RGB Filter	<ul style="list-style-type: none"> • [Red filter] • Green filter • Blue filter • Cyan filter • Magenta filter • Yellow filter • Brightness filter(R+G+B) • Brightness filter (R+2G+B) • Custom filter 	This item produces the same effects as using the selected optical filters.
Gain (Red)	0.0001 to 9.9999 [0.3]	RGB gain values when processing with a custom filter. The density of the color component increases as the value increases. This can be set only when "Custom filter" is selected for RGB filter.
Gain (Green)	0.0001 to 9.9999 [0.59]	
Gain (Blue)	0.0001 to 9.9999 [0.11]	

When you choose the HSV option

5 Select the type of filter in the "HSV filter" area.



Setting item	Set value [Factory default]	Description
HSV filter	<ul style="list-style-type: none"> • Fast • [Fine] 	"Fast": The color extraction range is set only by hue. "Fine": Extraction is set by standard hue, hue range, and color chroma.
Standard Hue	[0] to 359	Specify the standard hue (tone) for the HSV filter. The density decreases as the difference in hue from the standard hue (difference in tone) increases.
Hue range	10 to 180 [90]	Specify the hue range (difference in tone) of the HSV filter. The hue difference is obtained by dividing the specified hue range into 255 subranges with the standard hue as the center subrange. The density of the hue outside the hue range is 0. This can only be set when "Fine" is selected.
Color chroma	[0] to [255]	Specify the upper and lower limits for saturation (vividness). This can only be set when "Fine" is selected.

External Reference Tables (Color Gray Filter)

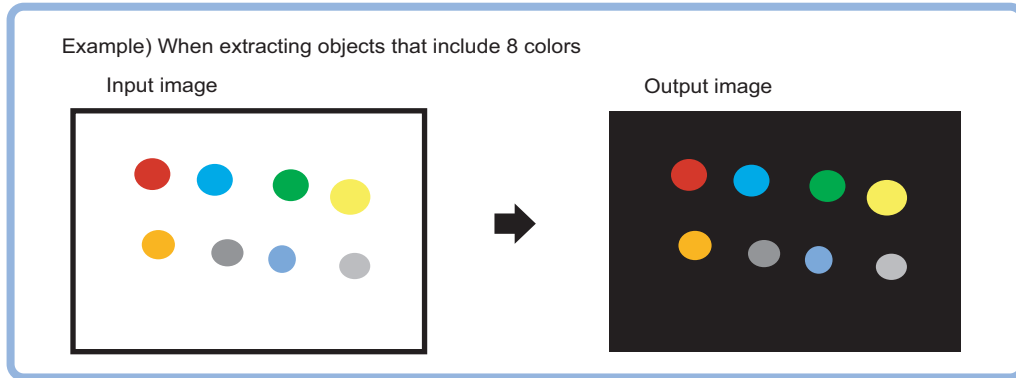
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
100	Filter kind	Set/Get	0: RGB filter 1: HSV filter
101	RGB filter kind	Set/Get	0: Red filter 1: Green filter 2: Blue filter 3: Cyan filter 4: Magenta filter 5: Yellow filter 6: Brightness filter (R+G+B) 7: Brightness filter (R+2G+B) 8: Custom filter
102	Gain (Red)	Set/Get	0.0001 to 9.9999
103	Gain (Green)	Set/Get	0.0001 to 9.9999
104	Gain (Blue)	Set/Get	0.0001 to 9.9999
105	HSV system filter kind	Set/Get	0: Fast 1: Fine
106	Standard Hue	Set/Get	0 to 359
107	Hue range	Set/Get	10 to 180
108	Upper Limit for Saturation	Set/Get	0 to 255
109	Lower Limit for Saturation	Set/Get	0 to 255
200	Transfer source image number	Set/Get	0 to 9
201	Transfer destination image number	Set/Get	0 to 9

Extract Color Filter

The color image is extracted by color. Up to 8 ranges can be set. However, this processing item cannot be used with monochrome images.

Used in the Following Case

- To extract an object of different color.



Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

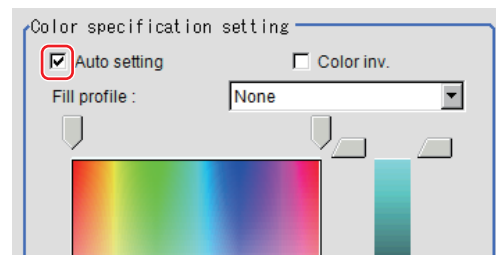
Color Specification (Extract Color Filter)

When connecting a color camera, specify the color to be measured. There are two specification methods: specifying the color to be extracted in the image or specifying the color with the hue, saturation, and brightness values.



This section describes how to specify colors in an image and gives an example of the procedure for finely adjusting with numeric input afterwards.

- 1** In the Item Tab area, click [Color setting].
- 2** Place a check at [Auto setting].
- 3** In the Image Display area, specify the color range you want to detect by dragging the cursor from the upper left corner to the lower right corner of that area.

The color of the specified area is automatically set.



4 As necessary, select Fill profile.

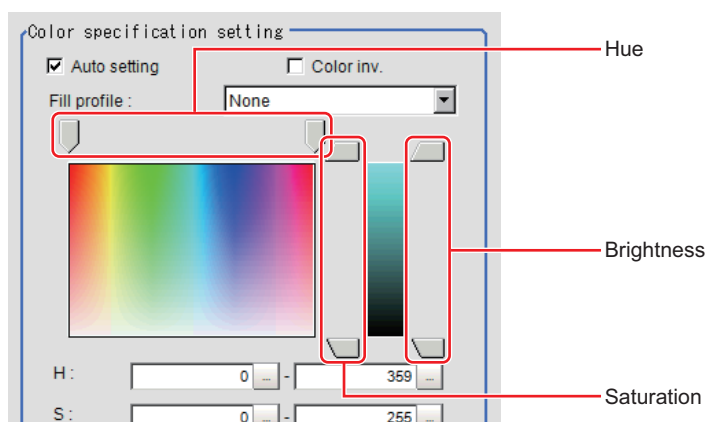
Item	Set value [Factory default]	Description
Fill profile	[None]	The empty section in the center is not filled in.
	Fill outline	<p>In the measurement region, the part between the extracted-color start point and end point in the X-axis direction is measured as having the extracted color. Since filling is applied only to the X-axis direction, the processing is faster than filling up holes.</p> <p>Input image File profile image</p> 
	Filling up holes	<p>The part surrounded by the extracted color, like a doughnut hole, is filled with the extracted color.</p> <p>Input image Image after filling up hole</p> 

5 Finely adjust the hue, saturation, and brightness if necessary.

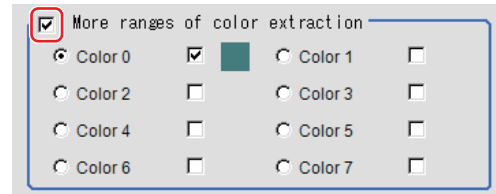
Adjust either by adjusting on the color chart or by inputting numbers.

Item	Set value [Factory default]	Description
H	0 to 359	Specify the color phase (difference of color hues).
S	0 to 255	Specify color saturation (difference of color saturation).
V	0 to 255	Specify the brightness (difference of brightness).
Auto setting	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Specifying the color to be measured on the image automatically sets the hue, saturation, and brightness.
Color inv.	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Everything other than the specified color becomes the measurement target.

About color charts

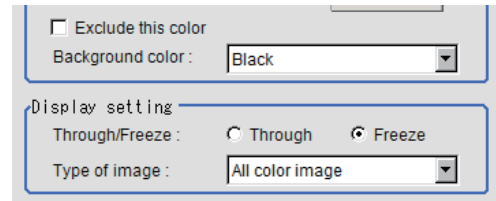


6 To specify multiple colors, place a check at "More ranges of color extraction".



Setting item	Set value [Factory default]	Description
More ranges of color extraction	<ul style="list-style-type: none"> • Checked • [Unchecked] 	If you place a check at this option, you can set up to 8 colors.

7 If necessary, set the display conditions for displayed images.



Setting item	Set value [Factory default]	Description
Exclude this color	<ul style="list-style-type: none"> • Checked • [Unchecked] 	If you place a check at this option, pixels within the HSV range are excluded from color extraction. The priority order for exclusion is that the higher color extraction range numbers are given priority. This setting is disabled if "More ranges of color extraction" is unchecked.
Background color	<ul style="list-style-type: none"> • [Black] • White • Red • Green • Blue 	The background section outside the extracted image is filled with the specified colors. The background colors that can be set depend on the display settings. When "Color selected image" is selected, the background color can be set for each selected color. When All color image is selected, the background color for color extraction range 0 is used.
Through/Freeze	<ul style="list-style-type: none"> • Through • [Freeze] 	For Through, the latest image from the camera is always displayed; for Freeze, the image that was scanned in the immediately preceding measurement is displayed.
Type of image	<ul style="list-style-type: none"> • Measurement image • [All color image] • Color selected image • Binary image 	This sets the state of the image to display.

Region Setting (Extract Color Filter)

Use a rectangle to specify the area where the model is searched. Instead of measuring the entire input image, narrowing the measurement area shortens the processing time.

- 1 In the Item Tab area, click [Region setting].**
- 2 Click [Edit].**
The figure setting area is displayed.
- 3 Specify the area in which to search for the model.**
The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.

4 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Output Image (Extract Color Filter)

Setting item	Set value [Factory default]	Description
Output image setting	<ul style="list-style-type: none"> • [Binary image] • All color image 	This sets the state of the image output.

Key Points for Test Measurement and Adjustment (Color Extraction Filter)

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image number.	Explanation of image to be displayed
0	Color extraction image
1	Measurement image

Measurement Results for Which Output Is Possible (Extract Color Filter)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference Tables (Extract Color Filter)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
120	Fill profile	Set/Get	0: OFF 1: Fill profile 2: Filling up holes
121	Inverse area presence	Set/Get	0: OFF 1: ON
122	Image kind	Set/Get	0: Measurement image 1: All color image 2: Selection color image 3: Binary image
123	Multiple selections	Set/Get	0: Multiple selections disabled 1: Multiple selections enabled
124	Output image	Set/Get	0: Binary image 1: All color image
130 + 10 × N (N = 0 to 7)	Usage flag [N] (N = 0 to 7)	Set/Get	0: Not used 1 : Used Default value 1 only for [0] Default value 0 for all others

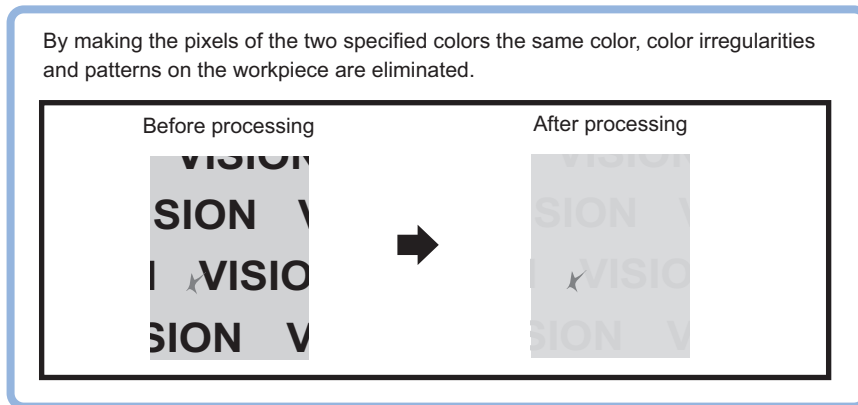
No.	Data name	Set/Get	Data range
131 + 10 × N (N = 0 to 7)	OR/NOT setting [N] (N = 0 to 7)	Set/Get	0: OR 1: NOT
132 + 10 × N (N = 0 to 7)	Register the max. color hue [N] (N = 0 to 7)	Set/Get	0 to 359
133 + 10 × N (N = 0 to 7)	Register the min. color hue [N] (N = 0 to 7)	Set/Get	0 to 359
134 + 10 × N (N = 0 to 7)	Register the max. color saturation [N] (N = 0 to 7)	Set/Get	0 to 255
135 + 10 × N (N = 0 to 7)	Register the min. color saturation [N] (N = 0 to 7)	Set/Get	0 to 255
136 + 10 × N (N = 0 to 7)	Register the max. color brightness [N] (N = 0 to 7)	Set/Get	0 to 255
137 + 10 × N (N = 0 to 7)	Register the min. color brightness [N] (N = 0 to 7)	Set/Get	0 to 255
138 + 10 × N (N = 0 to 7)	Register the BG color [N] (N = 0 to 7)	Set/Get	0: Black 1 : White 2: Red 3: Green 4: Blue
5000	RGB value pixel density data	Set/Get	Characteristic application The RGB value for the coordinate specified during set up is saved in measurement data. When acquiring, the data saved in measurement data is returned.
5001	Selected color extraction range	Set/Get	Characteristic application The color extraction range number selected during set up is saved in measurement data. When acquiring, the data saved in measurement data is returned.

Anti Color Shading

This filter eliminates color unevenness in the image. Unevenness is eliminated either by converting the two specified colors toward the color midway between them or by converting one of the two specified colors to approach the other. However, this processing item cannot be used with monochrome images.

Used in the Following Case

- This is used when a work that would be expected to have uniform color has a non-uniform image due to the effect of tilting, uneven paint, or the like.



Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Filter Setting (Anti Color Shading)

This item sets the filter.

- 1 In the Item Tab area, click [Filter setting].
- 2 In the "Display" area, click [Change display] to switch between camera image types.

The displayed contents of the Image Display area will be switched.

Setting item	Set value [Factory default]	Description
Display	Through image display	The latest image is always input from the camera and displayed.
	[Freeze image display]	The image that was scanned in the immediately preceding measurement is displayed.

- 3 The section with color contrast on the image is enclosed.

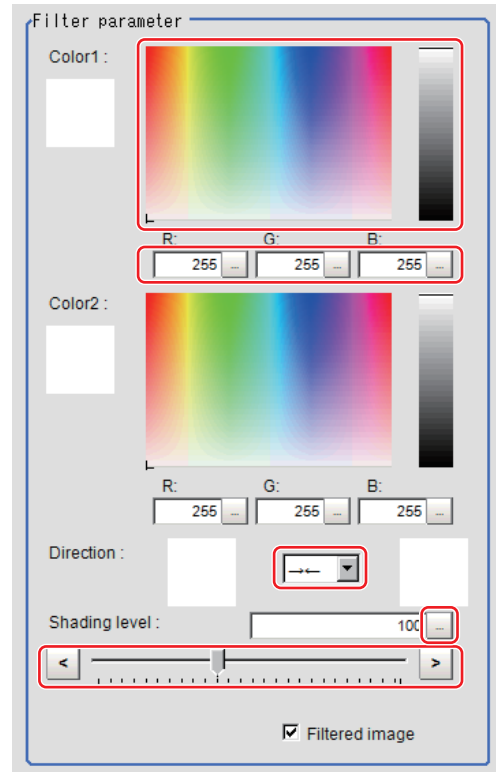
The image with the contrast suppressed is displayed.



4 Adjust the color, conversion direction, and Anti Color Shading level as necessary.

The picked up 2 colors are displayed at Color 1 and Color 2.

Fine adjustments can also be made to the R, G, and B values and on the color chart.



Setting item	Set value [Factory default]	Description
Color1	<ul style="list-style-type: none"> • R 0 to [255] • G 0 to [255] • B 0 to [255] 	The most separate two colors are picked up from the specified region.
Color2	<ul style="list-style-type: none"> • R 0 to [255] • G 0 to [255] • B 0 to [255] 	The sections corresponding to these colors in the region are converted to the color midway between the two.
Direction	<ul style="list-style-type: none"> • [→←] ∞→ ∞← 	Select the conversion method for the set Color 1 and Color 2. →←: Color 1 and Color 2 are converted to the color midway between the two. →: Color 1 is converted to Color 2. ←: Color 2 is converted to Color 1.
Shading level	0 to 255 [100]	Set the level for suppressing color contrast. The larger this value, the less the color contrast.

5 As necessary, set the display image.



Setting item	Set value [Factory default]	Description
Filtered image	<ul style="list-style-type: none"> • [Checked] • Unchecked 	To display the original image, uncheck here.

Region Setting (Anti Color Shading)

It is possible to target the entire screen, but restricting the range can shorten the processing time.

- 1** In the Item Tab area, click [Region setting].
- 2** Use the Drawing tools to specify the measurement region.
- 3** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

Key Points for Test Measurement and Adjustment (Anti Color Shading)

The following content is displayed in the "Detail result" area as text.

Displayed item	Description
Judge	Judgement result

Measurement Results for Which Output Is Possible (Anti Color Shading)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference Tables (Anti Color Shading)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
100	Specified color R1	Set/Get	0 to 255
101	Specified color G1	Set/Get	0 to 255
102	Specified color B1	Set/Get	0 to 255
103	Specified color R2	Set/Get	0 to 255
104	Specified color G2	Set/Get	0 to 255
105	Specified color B2	Set/Get	0 to 255
106	Direction	Set/Get	0: Color 1→←Color 2 1: Color 1→Color 2 2: Color 1←Color 2
107	Shading level	Set/Get	0 to 255
108	Filtered image	Set/Get	0: OFF 1: ON

Stripes Removal Filter II

Eliminating a striped pattern or other background makes it possible to stably extract just the defect without it being affected by the background.

Used in the Following Case

- To eliminate vertical stripes, or horizontal stripes from the target.

• Thin stripe pattern suppression filter

○ When the filter size is larger than the stripes and the defects are larger than the filter size, vertical filter stripes can be removed.

✕ If the filter size is smaller than the stripes, the stripes cannot be removed.

Filter shape (size) Defect

• Thick stripe pattern suppression filter

○ If defects are larger than the filter size and smaller than the stripe width, the stripes can be removed.

✕ If the filter size is larger than the stripe width, the stripes cannot be removed.

Filter shape (size) Defect

Important

- This processing item is for monochrome only. When using a color camera, insert a color gray filter before this processing item. If a color image is input, it is NG (incompatible image).
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

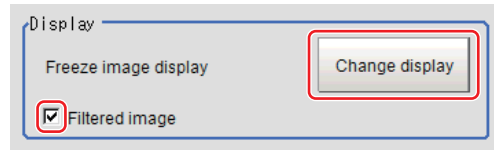
Filter Setting (Stripes Removal Filter II)

This item sets the filter.

1 In the "Item Tab" area, click [Filter Setting].

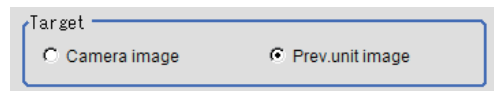
2 In the "Display" area, click [Change display] to switch between camera image types.

The displayed contents of the image display area will be switched.



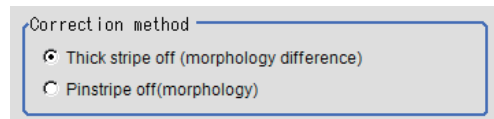
Setting item	Setting value [Factory default]	Description
Display	Through image display	The latest image is always input from the camera and displayed.
	[Freeze image display]	The image that was scanned in the immediately preceding measurement is displayed.
Filtered image	<ul style="list-style-type: none"> • [Checked] • Unchecked 	To display the original image, uncheck here.

3 Set the target image.



Setting item	Setting value [Factory default]	Description
Target	Camera image	The camera input image that has not been subject to filtering is subject to compensation as is.
	[Prev. unit image]	Images to which processing is applied in units even before the "Stripes Removal Filter II" being set are the targets.

4 Set the correction method.

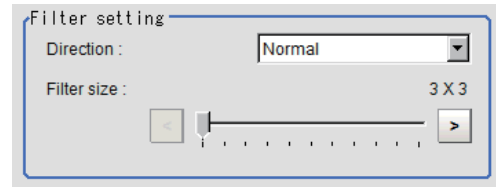


Setting item	Setting value [Factory default]	Description
Correction method	[Thick stripe off]	This item sets the filter size based on the size of the expected defect and removes the striped pattern.
	Pinstripe off	This item sets the filter size based on the width of the stripes and removes the striped pattern.

Important

- When this setting is changed, the filter setting and the detail setting will be reset to the factory default values.

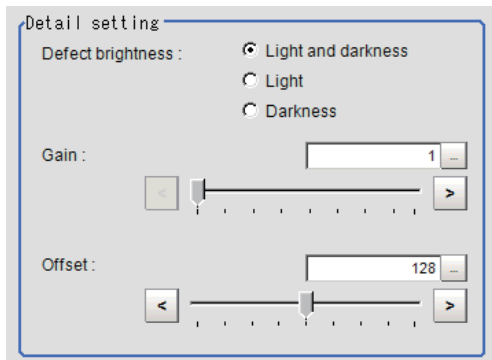
5 This sets the filter settings.



Setting item	Setting value [Factory default]	Description
Direction	<ul style="list-style-type: none"> • [Normal] • Vertical • Horizontal • Upper right • Lower right 	Specify the filter direction.
Filter Size	3 to 63 [3]	<p>The value is set based on the size of the defect to be extracted or the size of the stripes. Only an odd number value can be specified.</p> <p>For "Pinstripe off": Select a filter size larger than the width of the striped pattern.</p> <p>For "Thick stripe off": Select a filter size larger than the size of the defect to be detected.</p>

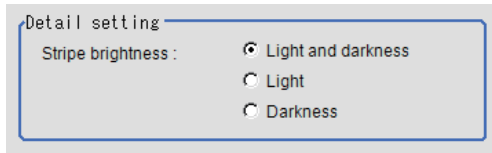
6 Set the details.

Correction method: For "Thick stripe off"



Setting item	Setting value [Factory default]	Description
Defect brightness	<ul style="list-style-type: none"> • [Light and darkness] • Light • Darkness 	Set the brightness of defects to be extracted from the background. To detect both white defects and black defects, select "Light and darkness".
Gain	1 to 63 [1]	Adjust the contrast of an image after the pattern suppression. Specifying a larger value emphasizes the density differences within the image.
Offset	0 to 255 [128]	Adjust the brightness of an image after the pattern suppression. Specifying a larger value increases the brightness of the image.

Correction method: For "Pinstripe off"



Setting item	Setting value [Factory default]	Description
Stripe brightness	<ul style="list-style-type: none">• [Light and darkness]• Light• Darkness	This item selects the color of the stripes to be deleted.

Region Setting (Stripes Removal Filter II)

It is possible to target the entire screen, but restricting the range can shorten the processing time.

- 1** In the Item Tab area, click [Region setting].
- 2** Use the drawing tools to specify the measurement region.
- 3** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

Test Measurement (Stripes Removal Filter II)

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image No.	Explanation of image to be displayed
0	Filtered image

External Reference Tables (Stripes Removal Filter II)

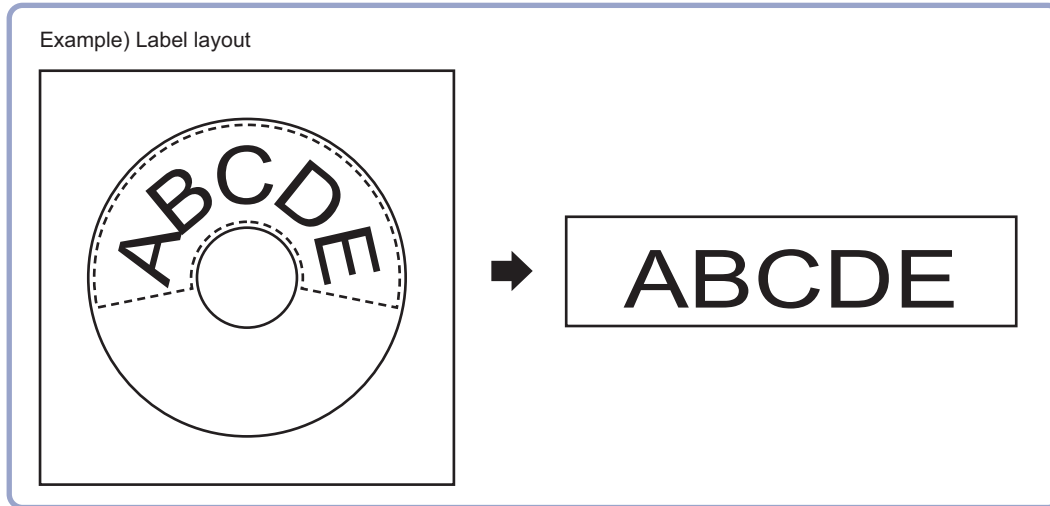
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (not yet measured) 1: Judgement result OK -1: Judgement result NG
120	Correction method	Set/Get	0: Thick striped pattern suppression 1: Thin striped pattern suppression
121	Direction	Set/Get	0: Vertical and horizontal 1: Horizontal 2: Vertical 3: Slant (upper right) 4: Slant (lower right)
122	Filter Size	Set/Get	3 to 63
123	Defect brightness	Set/Get	0: Light and dark 1: Light 2: Dark
124	Gain	Set/Get	1 to 63
125	Offset	Set/Get	0 to 255
200	Transfer source image number	Set/Get	0 to 9
201	Image number after transfer	Set/Get	0 to 9
202	Target image	Set/Get	0: Camera input image 1: Previous. unit image
203	Display image	Set/Get	0: Display the image before processed. 1: Display the image after processed.

Polar Transformation

Wide circle and fan shape images are transformed in polar coordinates and converted into orthogonal coordinate images. The converted image is a measurement object for processing units in later stages.

Used in the Following Case

- This is used for judging characters printed around the circumference of caps and the like.



Important

- When using polar transformation and a position list, display with [Polar Transformation].
If the image is displayed with [Camera Image Input] or the like before the [Polar Transformation], the graphic is not displayed correctly.
- Polar Transformation is always performed in a clockwise direction regardless of Region settings.
- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Region Setting (Polar Transformation)

Set a region enclosing the character string that is lined up along a circle. Polar Transformation's Region setting includes Circumference and Wide arc selections.

- 1 Use the Drawing tools to specify the measurement region.**
- 2 Enclose the characters in the image.**



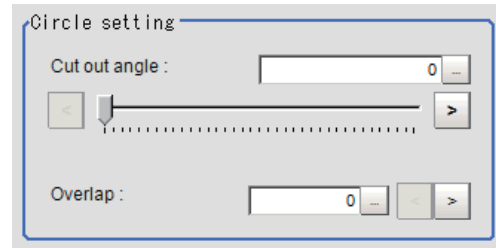
- 3 Click [OK] in the Figure setting area.**

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

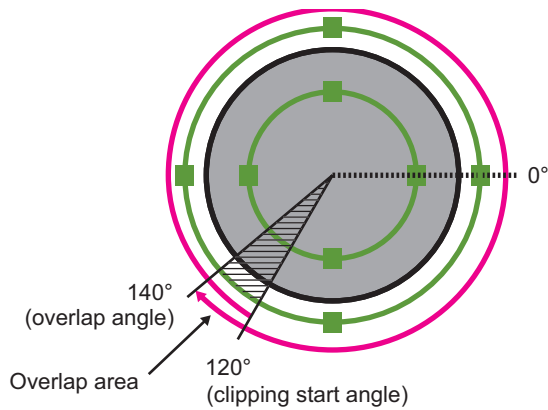
The measurement region is registered and displayed in the Image Display area.

4 When Circumference is selected, set the items in the "Circle setting" area.

When Wide arc is selected, detailed settings are not required.



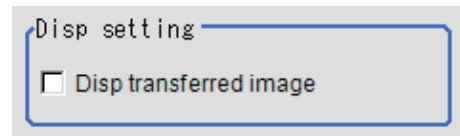
Setting item	Set value [Factory default]	Description
Cut out angle	[0] to 359	Set the angle for starting extraction when the figure is a wide circle.
Overlap	[0] to 180	Set the angle for overlap when the figure is a wide circle. The overlap angle indicates the end angle of the measurement range. This is set to measure extra overlapping from the start angle. Basically, set this larger than the extraction angle.



5 Place a check at [Disp transferred image].

Displays the polar transformed image in the image window.

The vertical and horizontal image sizes (in pixels) are displayed overlapped.



Key Points for Test Measurement and Adjustment (Polar Transformation)

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image number	Explanation of image to be displayed
0	Post-conversion image
1	Measurement image

Measurement Results for Which Output Is Possible (Polar Transformation)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference Tables (Polar Transformation)

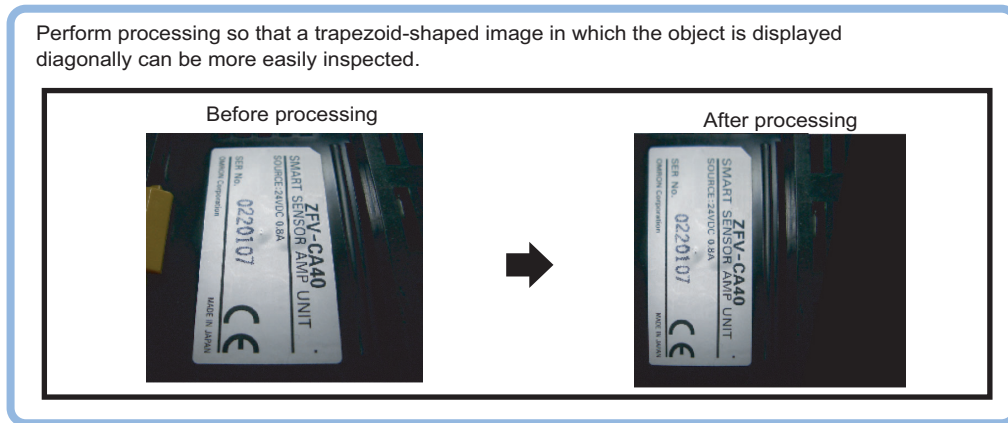
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
120	Cut out angle	Set/Get	0 to 359
122	Overlap	Set/Get	0 to 360
123	Disp transferred image	Set/Get	0: Image prior to transfer 1: Image after transfer

Trapezoidal Correction

If measurement is performed with the measurement object tilted or the camera tilted, the input image is converted to orthogonal coordinates.

Used in the Following Case

- Processing a trapezoidal image shot tilted to make it easier to inspect



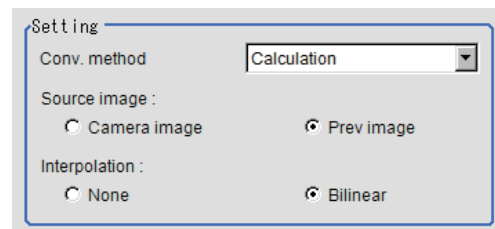
Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Conversion Method (Trapezoidal Correction)

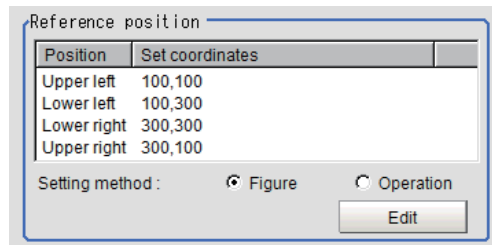
Set the input image conversion method.

- 1 In the Item Tab area, click [Conv. method].**
When making a new setting, you do not need to click [Conv. method].
- 2 As necessary, set the parameters.**



Setting item	Set value [Factory default]	Description
Conv. method	<ul style="list-style-type: none"> • 4 unit reference • [Calculation] 	<p>Set the expression used for image conversion</p> <p>4-unit reference: The parameters are set referencing the reference coordinates and measurement coordinates for the immediately preceding 4 units. Confirm that the units are arranged according to the upper left coordinate, lower left coordinate, lower right coordinate and upper right coordinate. To modify the expression for the reference position and measurement position set with 4-unit reference, select the Expression.</p>
Source image	<ul style="list-style-type: none"> • Camera image • [Prev image] 	Set the image to be compensated.
Interpolation	<ul style="list-style-type: none"> • None • [Bilinear] 	<p>Set the interpolation between pixels for image conversion.</p> <p>To reduce conversion time more than raise compensation precision, set "None".</p>

3 Set the reference position.



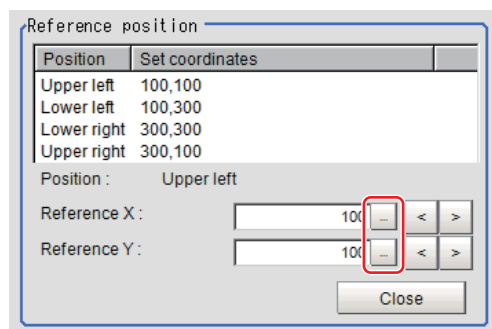
Setting item	Set value [Factory default]	Description
Setting method	<ul style="list-style-type: none"> • [Figure] • Operation 	<p>Set the method for setting the reference position.</p> <p>When fixed value is selected, specify the vertex position on the image.</p> <p>After setting with an expression, if the setting is changed to a fixed value, the result of the expression is reflected as a fixed value.</p>

When Operation is chosen

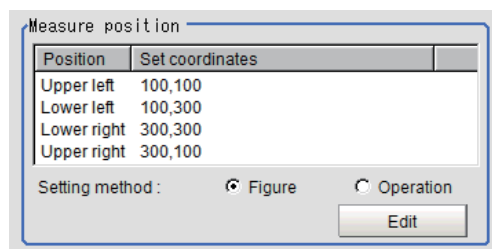
Click [Edit].

Click [...] and set the expression.

Reference: ▶ Layout of Setting Expression Window (p.615)

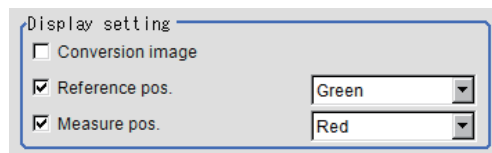


4 Set the measure position.



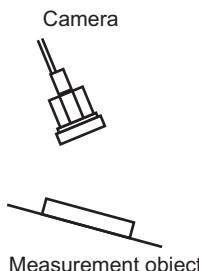
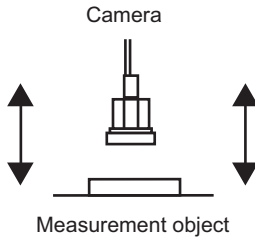
Setting item	Set value [Factory default]	Description
Setting method	<ul style="list-style-type: none"> • [Figure] • Operation 	<p>Set the method for setting the measurement position.</p> <p>When fixed value is selected, specify the vertex position on the image.</p> <p>After setting with an expression, if the setting is changed to a fixed value, the result of the expression is reflected as a fixed value.</p>

5 Set the display settings as necessary.



Example of Setting

The setting examples for the reference position and measurement position.

	Pattern 1	Pattern 2
Setting item	Camera: Fixed tilt Work: No chatter 	Camera: Fixed vertical Work: Chatter 
Reference position	Figure	Figure
Measure position	Figure	Operation

Pattern 1:

When the camera is installed tilted and there is no chatter in the work

- See the Reference: ► **Setting Example for when There Is No Chatter in the Work (p.547) for when there is no chatter in the work.**

Pattern 2:

When the camera is installed vertical and there is chatter in the work

- See the Reference: ► **Setting Example for when There Is Chatter in the Work (p.548) for when there is chatter in the work.**

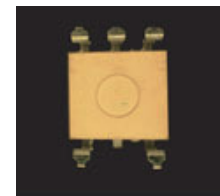
Setting Example for when There Is No Chatter in the Work

Even when there is a mechanical structure and the camera cannot be installed from the front, 4-point position information can be used to compensate for distortion in the image.

When you specify the four points used for distortion compensation and specify the positions where those four points should be as reference positions, the parameters for distortion compensation are set automatically. Each time a measurement is made, the distortion is automatically compensated for using these parameters.

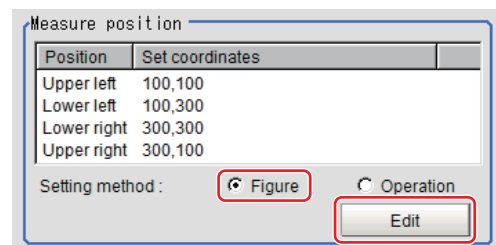


Crooked image



After revision

- 1 Select "Figure" for the measure position and click Edit.



- Specify on the image which four points whose information to use for distortion compensation.



- Select "Figure" for the reference position and click Edit.

Reference position

Position	Set coordinates
Upper left	100,100
Lower left	100,300
Lower right	300,300
Upper right	300,100

Setting method : Figure Operation

- On the image, specify which information for the positions where the four specified points should be to use for distortion compensation.

When concrete coordinate positions are known or to measure them and find accurate positions, it is possible to set "Expression" and substitute measurement values from other processing units.



- Place a check at "Conversion image" in the display settings and check the image in which the distortion has been compensated for.

Display setting

Conversion image

Reference pos. Green

Measure pos. Red

Setting Example for when There Is Chatter in the Work

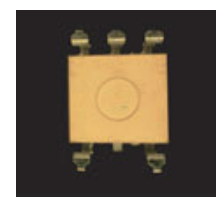
Even when there is chatter in the work during transport and error is generated in the distance to the camera, 4-point position information can be used to compensate for distortion in the image.

Preset in other units so that when you specify the positions where the four points used for distortion compensation should be as reference positions, the 4-point position information can be acquired.

Compensate for the distortion in the image so that the position information for the four points aligns with the reference positions when measurements are made. With this setting, 3D position deviation can be compensated for.



Crooked image



After revision

- Select "Operation" for the measure position and click Edit.

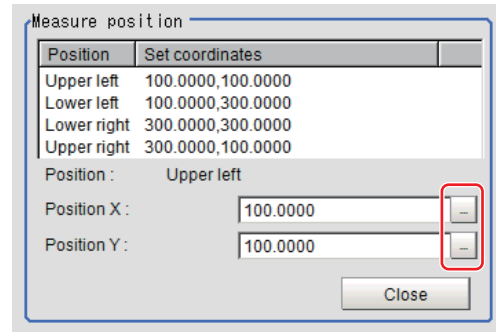
Measure position

Position	Set coordinates
Upper left	100.0000,100.0000
Lower left	100.0000,300.0000
Lower right	300.0000,300.0000
Upper right	300.0000,100.0000

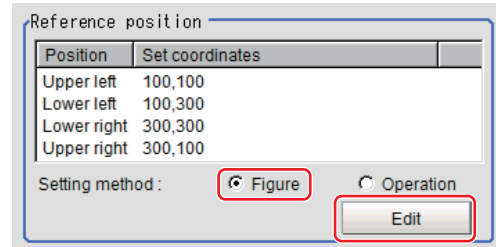
Setting method : Figure Operation

2 Specify with the expression which four points to use the information of for compensation.

Set the processing unit for acquiring the positions before the processing unit for trapezoidal distortion compensation.

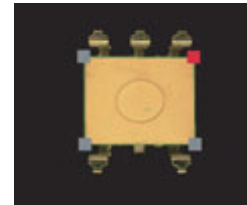


3 Select "Figure" for the reference position and click Edit.

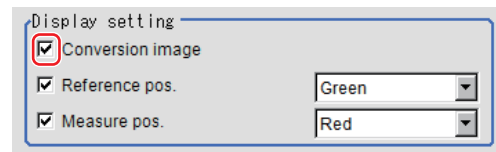


4 On the image, specify which information for the positions where the four specified points should be to use for distortion compensation.

When concrete coordinate positions are known or to measure them and find accurate positions, it is possible to set "Operation" and substitute measurement values from other processing units.



5 Place a check at "Conversion image" in the display settings and check the image in which the distortion has been compensated for.



Region Setting (Trapezoidal Correction)

Specify as a rectangle the range for compensating in the image.

Narrowing the compensation range instead of measuring the entire input image shortens the processing time.

1 In the Item Tab area, click [Region setting].

2 Click [Edit].

The figure setting area is displayed.

3 Specify the area in which to search for the model.

The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.

4 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Key Points for Test Measurement and Adjustment (Trapezoidal Correction)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image number	Explanation of image to be displayed
0	Post-conversion image

Measurement Results for Which Output Is Possible (Trapezoidal Correction)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference Tables (Trapezoidal Correction)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
120	Interpolation mode	Set/Get	0: None 1: Linear interpolation
121	Method	Set/Get	0: See unit 4 1: Expression
122	Input image	Set/Get	0: Camera image 1: Prev image
123	Reference position setting method	Set/Get	0: Figure 1: Expression
124	Measurement position setting method	Set/Get	0: Figure 1: Expression
125	Reference coordinate display	Set/Get	0 : Not displayed 1 : Displayed
126	Reference coordinate display color	Set/Get	0: Black 1 : White 2: Red 3: Green 4: Blue
127	Measurement coordinate display	Set/Get	0 : Not displayed 1 : Displayed
128	Measurement coordinate display color	Set/Get	0: Black 1 : White 2: Red 3: Green 4: Blue
129	Filtered image	Set/Get	0: Disp input image 1: Filtered image
200 + N (N = 0 to 3)	X coordinate of the reference coordinate N	Set/Get	Character string for expression (*1)
300 + N (N=0 to 3)	Y coordinate of the reference coordinate N	Set/Get	Character string for expression (*1)
400 + N (N = 0 to 3)	X coordinate of the measurement coordinate N	Set/Get	Character string for expression (*1)
500 + N (N = 0 to 3)	Y coordinate of the measurement coordinate N	Set/Get	Character string for expression (*1)

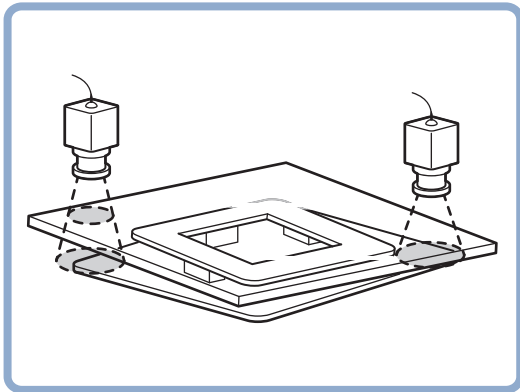
*1: Numerical data can also be set in the data setting processing items for the processing unit, etc.

Machine Simulator

You can simulate the movement of an alignment mark and verify the operation of alignment-related processing items without an actual stage or robot. Actual coordinate system conditions (origin position, magnification, axis angle) can be set as desired in this processing item group. For the origin position, set the rotating center of the stage.

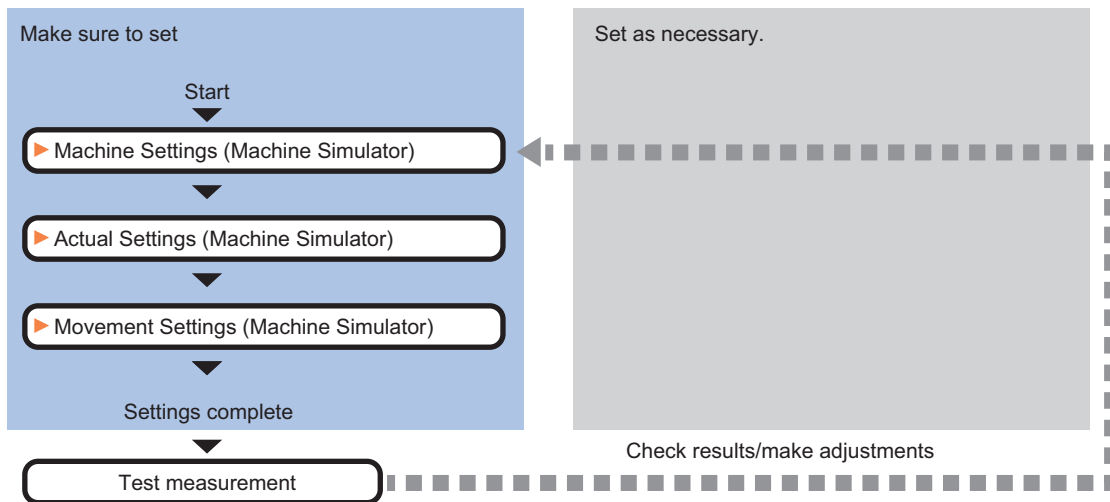
Used in the Following Case

- Check alignment operations before connecting the stage
- Create scene data before connecting the stage



Settings Flow (Machine Simulator)

Set up the machine simulator with the following steps.



List of Machine Simulator Items

Item name	Description
Machine setting	Select a processing item (stage data or robot data) under which external device information needed for calculation of travel distance of the actuator is held. Reference: ▶ Machine Setting (Machine Simulator) (p.553)
Actual setting	Set the origin position, magnification and the axis angle of the real coordination system. Set the conditions for the coordinate system of the stage or robot used. Reference: ▶ Actual Setting (Machine Simulator) (p.554)
Movement setting	Set the movement amount of each axis needed to move the image. When simulating a movement from other than the origin return position, also set the current axis position. Reference: ▶ Movement Setting (Machine Simulator) (p.555)

Machine Setting (Machine Simulator)

Select a processing item (stage data or robot data) under which external device information needed for calculation of travel distance of the actuator is held.

1 In the Item Tab area, click [Machine setting].

2 Select a processing unit holding external device information.

Information of the selected processing unit is displayed in the reference data display area. Displayed contents will be change depending on selected type of Robot or Stage.

Machine setting data

Reference scene No. : Present scene

Reference unit No. : 1.Stage data

Setting item	Setting value [Factory default]	Description
Reference scene No.	[Present scene] Scenes 0 to 127	Select a scene number (stage data or robot data) under which external device information needed for calculation of travel distance of the actuator is held.
Reference unit No.	-	From among the referenced scene numbers, select a processing item (stage data or robot data) under which external device information needed for calculation of travel distance of the actuator is held.

Note

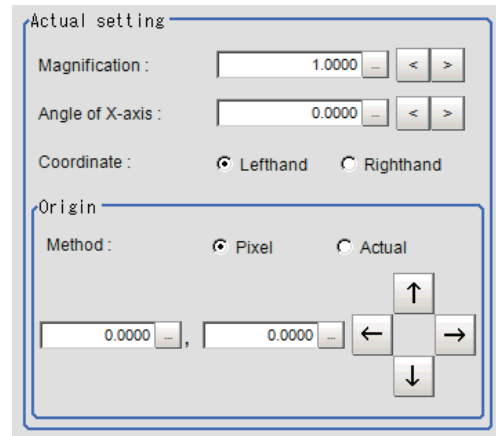
- If the number of scenes is increased using the scene group conversion tool, the maximum value that can be selected in "Reference scene No." changes.

Actual Setting (Machine Simulator)

Use the procedure below to set actual-coordinate conditions (origin position, magnification, axis angle) in camera coordinates. Set the conditions for the coordinate system of the stage or robot used. Camera coordinates are the coordinates of the image captured by the camera, as measured in pixels. The camera-coordinate origin is at camera top-left. The X-axis is the horizontal axis. X-coordinate values increase from left to right. The Y-axis is the vertical axis. Y-coordinate values increase from top to bottom.

- 1** In the Item Tab area, click [Actual setting].
- 2** In the Actual setting area, set the conditions for the actual coordinate system.

When the setting is changed, the correction result is displayed in the image display area.



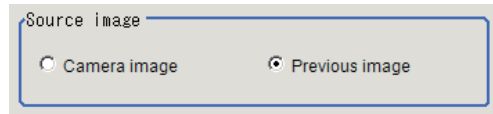
Setting item	Setting value [Factory default]	Description
Magnification	0.0001 to 9.9999 [1.0000]	Specify the ratio of 1 pixel to the actual dimensions. For example, if 1 pixel in the camera coordinates corresponds to an actual dimension of 1 mm, set 1. If 1 pixel in the camera coordinates corresponds to an actual dimension of 0.1 mm, set 0.1.
Angle of X-axis	-180.0000 to 180.0000 [0.0000]	If the movement amount of each axis is 0, set the X axis angle in the actual coordinate system of the camera.
Coordinate	<ul style="list-style-type: none"> • [Lefthand] • Righthand 	Select the coordinate system to be used. Lefthand: Clockwise is forward when specifying the angles. Righthand: Counter-clockwise is forward when specifying the angles.
Method	<ul style="list-style-type: none"> • [Pixel] • Actual 	Set the specification method for specifying the position of the center (origin) of the stage returned to the origin position. Pixel: Sets the pixel value for the origin in the camera coordinate system. Actual: Sets the value for the actual coordinates and not the pixel value for the origin on the camera image.
X Y	-99999.9999 to 99999.9999 [0.0000]	Set the coordinates for the method selected in [Method].

Movement Setting (Machine Simulator)

Set the movement amount of each axis needed to move the image. When simulating a movement from other than the origin return position, also set the current axis position.

1 In the Item Tab area, click [Movement setting].

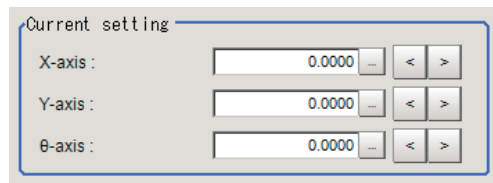
2 Select the target image to move in the Source image area.



Setting item	Setting value [Factory default]	Description
Source image	Camera image	The unfiltered input image from the camera directly becomes the target image to move.
	[Previous image]	The image filtered by a processing item before the "External device simulator" currently set before this item.

3 Set the current position of each axis in the Current setting area.

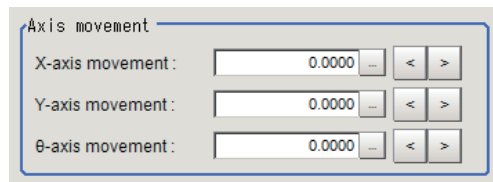
The setting items vary depending on the type of stage or robot.



Setting item	Setting value [Factory default]	Description
X-axis	-99999.9999 to 99999.9999 [0.0000]	Set the current position of each stage/robot axis.
Y-axis	-99999.9999 to 99999.9999 [0.0000]	
θ-axis	-180.0000 to 180.0000 [0.0000]	

4 In the "Axis movement" area, set the movement amount of each axis.

The setting items vary depending on the type of stage or robot.



Setting item	Setting value [Factory default]	Description
X-axis movement	-99999.9999 to 99999.9999 [0.0000]	Set the movement amount of each stage/robot axis.
Y-axis movement	-99999.9999 to 99999.9999 [0.0000]	
θ-axis movement	-360.0000 to 360.0000 [0.0000]	

Key Points for Test Measurement and Adjustment (Machine Simulator)

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image.	Explanation of image to be displayed
0, 2 to 31	Measurement image (Same when a list of positions is displayed)
1	Input image

Key Points for Adjustment

Adjust the setting parameters referring to the following points.

The image is not compensated correctly

State	Parameter to be adjusted	Troubleshooting
The corrected image is completely different	Actual setting	The conditions for the actual coordinate system (origin position, magnification, axis angle) may not be set correctly. Check for input errors. In factory default, the real coordination system is same as the camera coordination.
The corrected image is slightly different	Movement setting	The current axis position may not be set correctly. Set this condition when simulating a movement from other than the origin return position. The current axis position is a parameter required for accurate calculation of the travel distance of the actuator.

Other

State	Parameter to be adjusted	Troubleshooting
The reference unit number is <"None"> and cannot be selected.	Machine setting	Check if the reference scene number is selected correctly. Check if stage data processing items or robot data processing items are registered in the selected reference scene.
The reference unit number does not change during flow editing.	Machine setting	The system is designed this way. While a scene other than the current scene is referenced, the reference unit number does not change according to the editing of the flow. Change the flow so that the current scene will be referenced, or set the reference unit number again.

Measurement Results for Which Output Is Possible (Machine Simulator)

The following values can be output using processing items related to results output. It is also possible to refer to measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgment result

External Reference Tables (Machine Simulator)

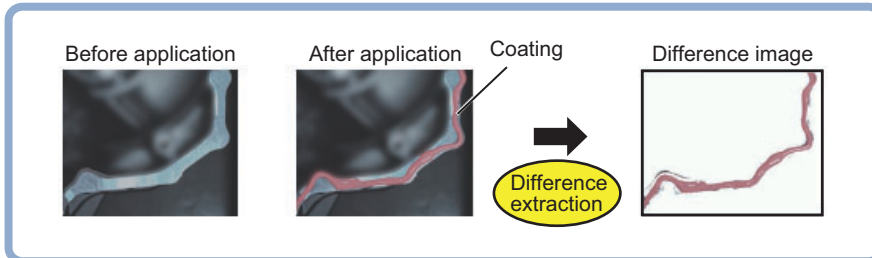
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
120	Reference scene No.	Set/Get	-1: Current scene referred 0 to 9,999: Pointed scene referred
121	Reference unit No.	Set/Get	-1: No reference 0 to 9,999: Pointed unit referred
122	Magnification	Set/Get	0.0001 to 9.9999
123	Angle of X-axis	Set/Get	-180.0000 to 180.0000
124	Coordinate	Set/Get	0: Lefthand 1: Righthand
125	Origin X (pix)	Set/Get	-99,999.9999 to 99,999.9999
126	Origin Y (pix)	Set/Get	-99,999.9999 to 99,999.9999
127	Source image	Set/Get	0: Camera image 1: Previous image
128	X-axis movement	Set/Get	-99,999.9999 to 99,999.9999
129	Y-axis movement	Set/Get	-99,999.9999 to 99,999.9999
130	θ -axis movement	Set/Get	-360.0000 to 360.0000
131	θ -axis (linear drive)	Set/Get	-99,999.9999 to 99,999.9999
132	U-axis movement	Set/Get	-99,999.9999 to 99,999.9999
133	V-axis movement	Set/Get	-99,999.9999 to 99,999.9999
134	W-axis movement	Set/Get	-99,999.9999 to 99,999.9999
135	R-axis movement	Set/Get	-99,999.9999 to 99,999.9999
136	Current X-axis movement	Set/Get	-99,999.9999 to 99,999.9999
137	Current Y-axis movement	Set/Get	-99,999.9999 to 99,999.9999
138	Current θ -axis movement	Set/Get	-180.0000 to 180.0000
139	Current θ -axis (linear drive)	Set/Get	-99,999.9999 to 99,999.9999
140	Current U-axis movement	Set/Get	-99,999.9999 to 99,999.9999
141	Current V-axis movement	Set/Get	-99,999.9999 to 99,999.9999
142	Current W-axis movement	Set/Get	-99,999.9999 to 99,999.9999
143	Current R-axis movement	Set/Get	-99,999.9999 to 99,999.9999
144	Origin X (Actual)	Set/Get	-99,999.9999 to 99,999.9999
145	Origin Y (Actual)	Set/Get	-99,999.9999 to 99,999.9999
146	Setting method of origin	Set/Get	0: Pixel 1: Actual

Image Subtraction

The registered model image and measurement image are compared and only the different pixels are extracted and converted to an image.

Used in the Following Case

- When you want to extract from the image only the parts that are to be inspected

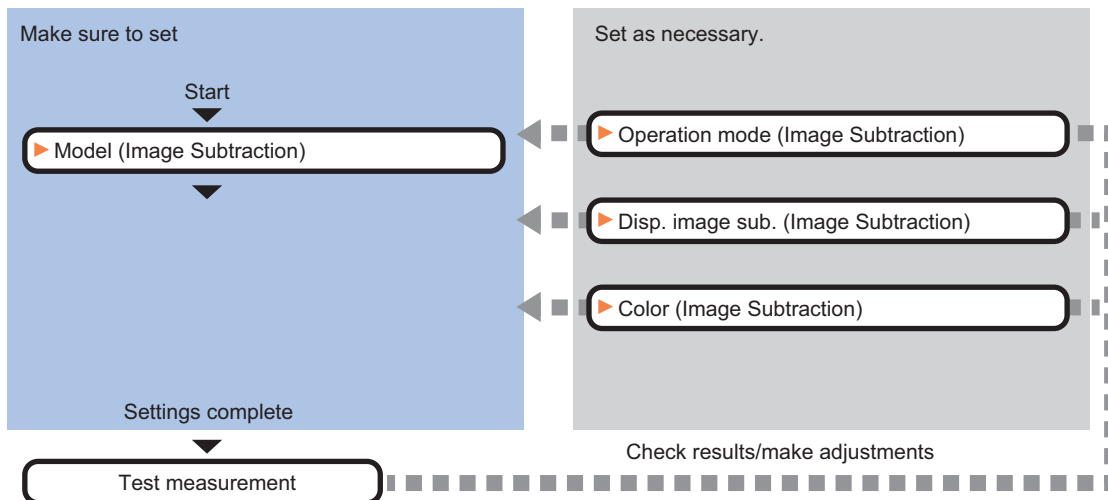


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.
- Even if the image before the Image subtraction is a monochrome image, it becomes a color image after the Image subtraction.

Settings Flow (Image Subtraction)

Follow the steps below to set up difference extraction.



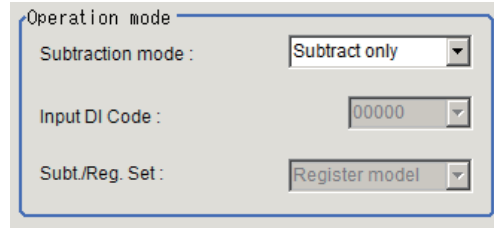
List of Image Subtraction Items

Item name	Description
Operation mode	This item sets the operation mode during measurement. Reference: ▶ Operation Mode (Image Subtraction) (p.559)
Model	This item registers model images. Reference: ▶ Model (Image Subtraction) (p.560)
Disp. image sub.	This item sets the method for extracting the difference images. Reference: ▶ Disp. Image Sub. (Image Subtraction) (p.561)
Color	This item sets the background color of the difference images. Reference: ▶ Color (Image Subtraction) (p.562)

Operation Mode (Image Subtraction)

Set how to switch model registration and difference extraction at the time of measurement.

- 1 In the Item Tab area, click [Operation mode].
- 2 Set each item in the "Operation mode" area.



Setting item	Setting value [Factory default]	Description
Subtraction mode	[Subtract only]	Always use the initially registered model image to perform difference extraction processing. The model is registered in the setting mode and difference extraction processing is always performed with respect to the captured measurement target image in the operation mode.
	DI Register	Check the DI input (4 to 0) during measurement processing and register the model only when the signal input corresponds to the pattern set under "Input DI Code". In all other cases, difference extraction processing is performed. A model image is captured and registered during operation, after which difference processing is performed.
	Subt./Reg.	Execution of model registration - difference extraction processing is switched every time measurement is performed. Select this option when performing second measurement using the logging image. The model image and measurement image can be read alternately, meaning that model registration - measurement can be performed offline.
Input DI Code	00000 to 11111 (binary numbers) [00000]	Set the DI input pattern you want to use for model registration. This option can be set only when "Subtraction mode" is set to "DI Register".
Subt./Reg. Set	<ul style="list-style-type: none"> • [Register model] • Subtract 	Select whether to perform model registration or difference extraction when measurement is performed next time. This option can be set only when "Subtraction mode" is set to "Subt./Reg.".

Important

- When the operation mode is Double Speed Multi-input mode or Non-stop Adjustment mode, "Subtraction mode: Subt./Reg." cannot be used.

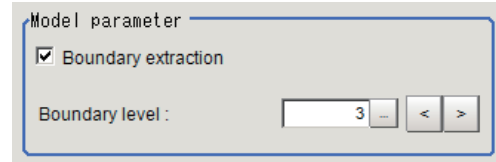
- 3 Click [OK].

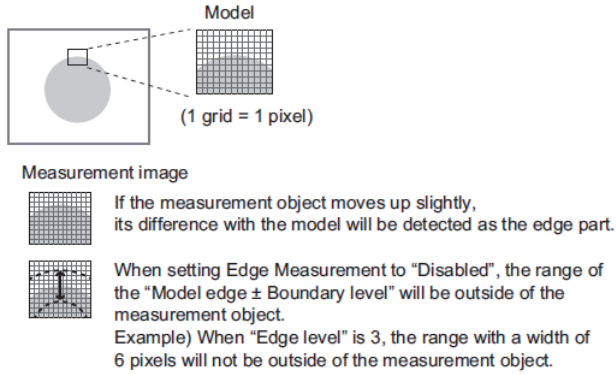
Model (Image Subtraction)

Register the region you want to compare, as a model.

Normally the background image (image not showing what you want to extract at the time of measurement) is registered as a model.

- 1 In the Item Tab area, click [Model].
- 2 In the "Model parameter" area, set model parameters.



Setting item	Setting value [Factory default]	Description
Boundary extraction	[Checked]	Under this method, the difference image is used directly. If the registered model and coated object can be captured at the exact same position, there is no offsetting of images and therefore noises will not generate due to difference extraction. In this case, more accurate measurement is possible when the difference image is used directly.
	Unchecked	Under this method, pixels corresponding to specified values are deleted from the outline of the extracted difference image. This option is set to remove noises resulting from offset images when the inspection object or camera has moved slightly. Since information of several pixels are deleted from the difference image, the measured coating width becomes smaller than the actual width. 
Boundary level	0 to 9 [3]	Set the degree of assimilation of variations around boundaries. Depending on the "Boundary inspection" value, the meaning is different.

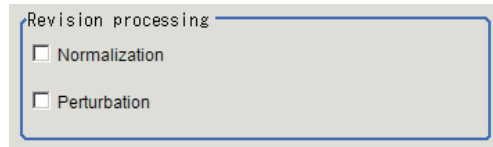
- 3 Click [Edit].
- 4 Use the Drawing tools to set the model registration range.
- 5 Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

Disp. Image Sub. (Image Subtraction)

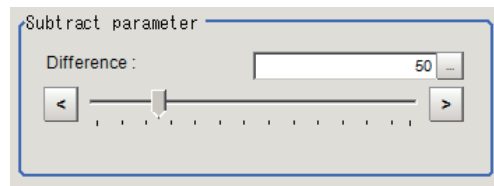
Set the method for extracting the difference images. Set this option when the difference cannot be extracted correctly such as when there are a lot of noises.

- 1 In the Item Tab area, click [Disp. image sub.].
- 2 Set each item in the "Revision processing" area.



Setting item	Setting value [Factory default]	Description
Normalization	<ul style="list-style-type: none"> • Checked • [Unchecked] 	<p>Select whether to perform normalization based on the brightness in the registered model.</p> <p>When "Checked" is selected, the density is adjusted before difference extraction, so that the difference extraction is not affected by changes in the total image brightness or the lighting fluctuations.</p> <p>When normalization is performed on the measured objects without patterns, the total image brightness is changed and the extraction does not work correctly.</p>
Perturbation	<ul style="list-style-type: none"> • Checked • [Unchecked] 	<p>If you place a check here, in order to prevent mistaken detection of slight positional deviation of measurement objects as differences, corrections are made before difference extraction.</p> <p>However, this requires more processing time.</p>

- 3 Set the difference judgement value in the "Subtract parameter" area.

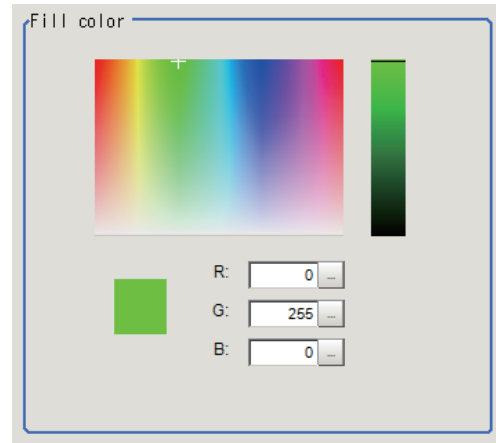


Setting item	Setting value [Factory default]	Description
Difference	0 to 255 [50]	<p>This sets the reference grayscale used when calculating differences between the model and the inspected object image.</p> <p>Pixels with a difference equal to or greater than Difference are converted to white and other pixels are converted to black, so that only defects are converted to white and measured.</p>

Color (Image Subtraction)

Set the background color of the difference image (color of the parts not recognized as differences).
Set this option if necessary, such as when the background color is similar to the color of the extraction object and the object is difficult to see.

- 1** In the Item Tab area, click [Color].
- 2** Specify the desired background color on the color chart.



- 3** Finely adjust the R, G and B if necessary.

Adjust either by adjusting on the color chart or by inputting numbers.

Setting item	Setting value [Factory default]	Description
R	0 to 255 [0]	Set a value for R (red).
G	0 to 255 [255]	Set a value for G (green).
B	0 to 255 [0]	Set a value for B (blue).

Key Points for Adjustment (Image Subtraction)

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the extraction is unstable

State	Parameter to be adjusted	Troubleshooting
Affected by lighting change	Disp. image sub.	Turn ON the normalization. The density is adjusted before difference extraction, so that the extraction is not affected by changes in the total image brightness or the lighting fluctuations.

When the processing speed is slow

Parameter to be adjusted	Troubleshooting
Model	Make the area to register as the model as small as possible.
Disp. image sub.	Turn OFF the perturbation processing.

When judgement is NG

State	Parameter to be adjusted	Troubleshooting
The judgement is NG (insufficient memory)	Model	Make the area to register as the model as small as possible.

Measurement Results for Which Output Is Possible (Image Subtraction)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference Tables (Image Subtraction)

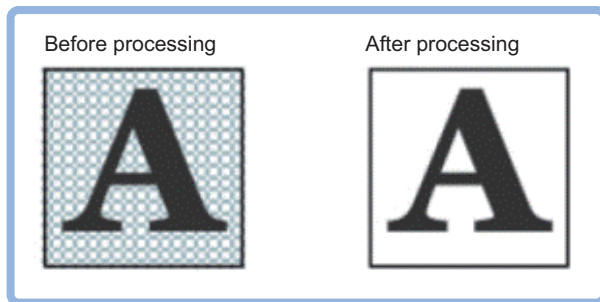
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
120	Boundary inspection	Set/Get	0: OFF 1: ON
121	Boundary level	Set/Get	0 to 9
122	Normalization	Set/Get	0: OFF 1: ON
123	Perturbation processing	Set/Get	0: OFF 1: ON
124	Difference	Set/Get	0 to 255
125	Model register	Get only	0: Not registered 1: Registered
126	Fill profile color R	Set/Get	0 to 255
127	Fill profile color G	Set/Get	0 to 255
128	Fill profile color B	Set/Get	0 to 255
129	Extract image	Set/Get	0: OFF 1: ON
130	Operation mode	Set/Get	0: Always extract differences 1: Register at DI input 2: Switch at every measurement
131	Model registration DI input	Set/Get	0 to 31
132	Next measurement processing	Set/Get	0: Model 1: Difference extraction

Advanced Filter

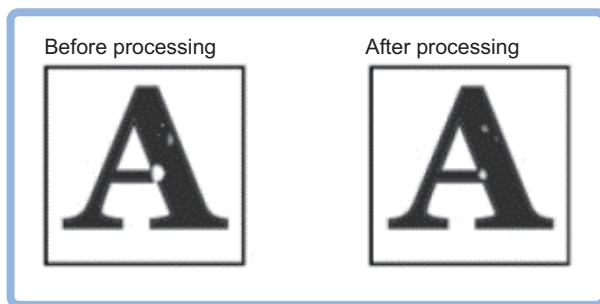
This function filters images acquired from the camera to facilitate measurement. With advanced filter, up to 16 image filter libraries such as “Filtering”, “Color/Gray Filter”, and “Background Suppression” can be set and used in a single processing item. By combining image filters, highly flexible filter processing can be performed, and custom filters can be used to create your own customized filtering.

Used in the Following Cases

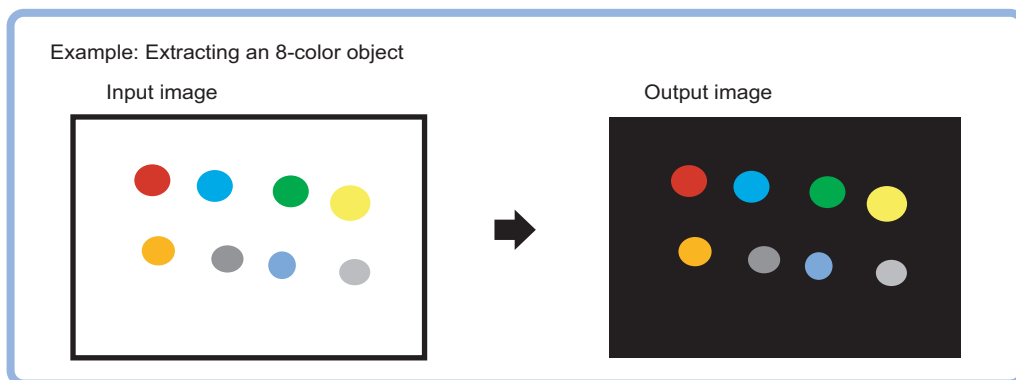
- **Eliminating unwanted background images from the measurement target**



- **Removing noise, uneven color, and image non-uniformity**



- **Extracting only the measurement target**

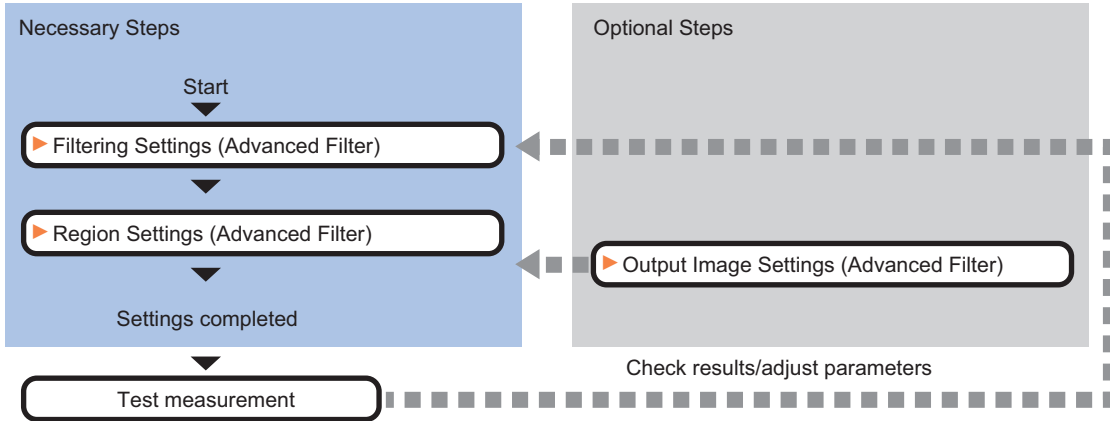


Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Settings Flow (Advanced Filter)

Set up advanced filter settings according to the following steps.



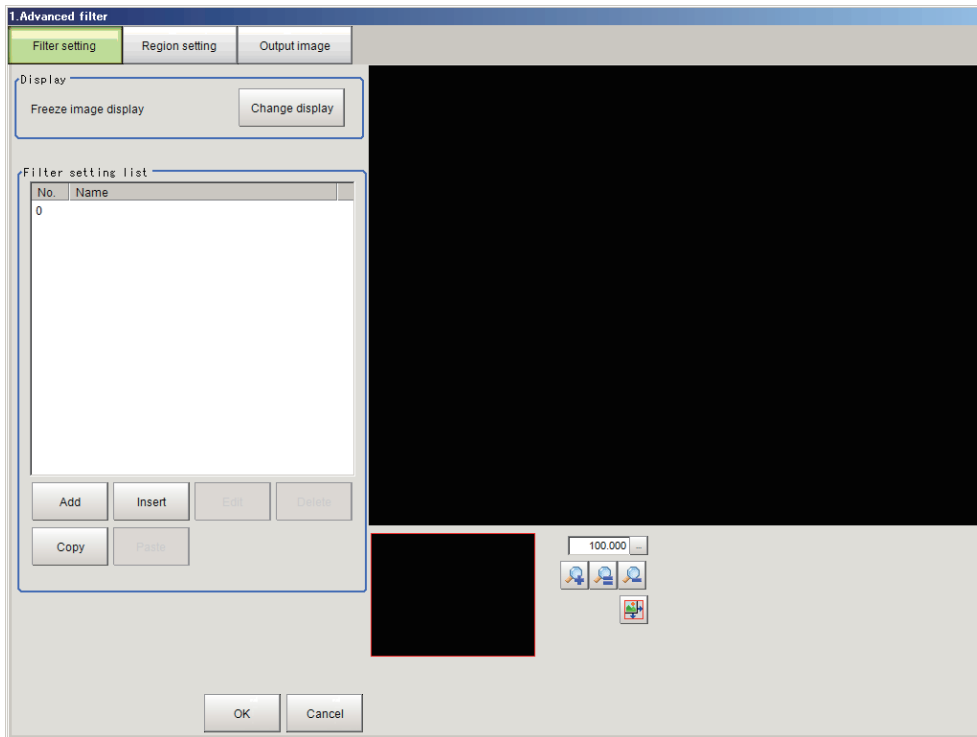
List of Advanced Filter Items

The following items can be set in advanced filter.

Item name	Description
Filter setting	This function filters the image acquired from the camera to make it easier to measure. The filtering method can be selected as appropriate for the image condition. Reference: ▶ Filtering Settings (Advanced Filter) (p.567)
Region setting	Use this function to set, as the measurement area, the area on the image that you want to filter. By narrowing the measurement region (as opposed to measuring the entire input image), this function allows you to shorten the processing time. Reference: ▶ Region Settings (Advanced Filter) (p.595)
Output image	Use this item to change the output image settings. These settings specify the image that is output as the measurement result. The image set as the output image can be used as the measurement image on other processing units of the measurement flow. Reference: ▶ Output Image Settings (Advanced Filter) (p.596)

Filtering Settings (Advanced Filter)

This function filters the image acquired from the camera to make it easier to measure. The filtering method can be selected as appropriate for the image condition.



3

Compensate image

Adding a Filter

Image filtering methods can be added by selecting filters from the filter list.

Note

- Up to 16 filters can be added to the filter settings list.

- 1** In the Item Tab area, click [Filter setting].
- 2** Click [Change display] in the display area and select the camera image type.
The image display area changes.

Setting item	Setting value [Factory default]	Description
Display	<ul style="list-style-type: none"> • Through image • [Freeze image] 	Set the camera image type that is displayed in the setting screen. <ul style="list-style-type: none"> • Through image display Continuously acquires the most recent image from the camera. • Freeze image display Displays the image acquired in the previous measurement.

Adding/Inserting Filters Selected from the List

To add a new filter, select the filter from the list and add.

1 Click [Add] in the filter setting list area.

If you want to insert a filter in a position selected in the list, click [Insert].

The “Select filter” screen appears.

2 In the “Select filter” screen, select the filter details that you want to add.

Setting item	Description
Weak smoothing	Same function as the weak smoothing filter in the “Filtering” processing item. Smooths the image to reduce unevenness. Reference: ▶ Changing the Filter Settings (p.574)
Strong smoothing	Same function as the strong smoothing filter in the “Filtering” processing item. Smooths the image to reduce unevenness. Reference: ▶ Changing the Filter Settings (p.574)
Dilate	Same function as the dilate filter in the “Filtering” processing item. Dilates bright areas to reduce dark noise. Reference: ▶ Changing the Filter Settings (p.574)
Erosion	Same function as the erosion filter in the “Filtering” processing item. Contracts bright areas to reduce bright noise. Reference: ▶ Changing the Filter Settings (p.574)
Median	Same function as the median filter in the “Filtering” processing item. Reduces unevenness while maintaining the outline. Reference: ▶ Changing the Filter Settings (p.574)
Edge extraction	Same function as the edge extraction filter in the “Filtering” processing item. Extracts edges (bright-dark) in the image. Reference: ▶ Changing the Filter Settings (p.574)
Extract horizontal edges	Same function as the extract horizontal edges filter in the “Filtering” processing item. Extracts horizontal edges (bright-dark) in the image. Reference: ▶ Changing the Filter Settings (p.574)
Extract vertical edges	Same function as the extract vertical edges filter in the “Filtering” processing item. Extracts vertical edges (bright-dark) in the image. Reference: ▶ Changing the Filter Settings (p.574)
Enhance edges	Same function as the enhance edges filter in the “Filtering” processing item. Enhances bright-dark edges in the image. Reference: ▶ Changing the Filter Settings (p.574)
Prewitt	Edge filter similar to the extract edges filter in the “Filtering” processing item. Suppresses noise and extracts edges (bright-dark) in the image. Reference: ▶ Changing the Edge Filter Settings (p.574)
Roberts	Edge filter similar to the extract edges filter in the “Filtering” processing item. Suppresses noise and extracts diagonal edges (bright-dark) in the image. Reference: ▶ Changing the Edge Filter Settings (p.574)
Laplacian	Edge filter similar to the extract edges filter in the “Filtering” processing item. Uniformly extracts edges (bright-dark) in the image. Reference: ▶ Changing the Edge Filter Settings (p.574)
Background Suppression	Same function as the background suppression filter in the “Background Suppression” processing item. Parts of the image that are outside the specified bright-dark range are treated as background and suppressed. Reference: ▶ Changing the Background Suppression Filter Settings. (p.576)

Setting item	Description
Brightness Correct Filter	Filter for monochrome images. Same function as the brightness correct filter in the “Filtering” processing item. Corrects the effects of lighting as well as properties of the object of measurement such as material and shape. Reference: ▶ Changing the Brightness Correct Filter Settings (Monochrome Images Only) (p.577)
Stripes Removal Filter II	Filter for monochrome images. Same function as the stripes removal filter in the “Stripes Removal Filter II” processing item. Removes a striped background. Reference: ▶ Changing the Stripes Removal Filter II Settings (Monochrome Images Only) (p.578)
Labeling Filter	Filter that binarizes the image based on the same extraction conditions as the Labeling processing item. Reference: ▶ Changing the Labeling Filter Settings (p.579)
Custom Linear Filter	Linear filter that allows you to set custom filter coefficients. You can set a filter count, mask size, offset, and other parameters for filtering. Reference: ▶ Changing the Custom Linear Filter Settings (p.585)
Custom Rank Filter	Rank filter that allows you to set custom filter coefficients. You can set a filter count, mask size, processing method, and other parameters for filtering. Reference: ▶ Changing the Custom Rank Filter Settings (p.586)
Image operation	Filter that converts the image by calculating pixel values. Reference: ▶ Changing the Image Operation Filter Settings (p.587)
2 images operation	Filter that converts the image by calculating the paired pixel values of two images. Reference: ▶ Changing the 2 Images Operation Settings (p.589)
Binary	Filter for monochrome images. Binarizes the image. Reference: ▶ Changing the Binary Filter Settings (Monochrome Images Only) (p.590)
Color gray filter	Filter for color images. Same function as Color Gray filter in the “Color Gray filter” processing item. Converts color images to monochrome. Reference: ▶ Changing the Color Gray Filter Settings (Color Images Only) (p.591)
Extract Color Filter	Filter for color images. Same function as the extract color filter in the “Extract Color Filter” processing item. Extracts color from color images. Reference: ▶ Changing the Extract Color Filter Settings (Color Images Only) (p.592)
Anti Color Shading	Filter for color images. Same function as the Anti Color Shading filter in the “Anti Color Shading” processing item. Removes uneven color in the image. Reference: ▶ Changing the Anti Color Shading Filter Settings (Color Images Only) (p.594)

3 Click [OK].

The filter is added to the end of list in the filter setting list area.

When [Insert] is clicked to add the filter, the filter is added to the selected position in the list.

4 Select the filter in the list in the filter setting list area.

5 Click [Edit].

The filter edit screen appears.

Reference: ▶ Changing the Filter Settings (p.570)

Adding a copy of an already-set filter

To use the filter settings of a filter that has already been set in the list in the filter setting list area, copy the settings and add the filter.

- 1 Select the filter that you want to copy in the list in the filter setting list area.**
- 2 Click [Copy].**
[Paste] is enabled.
- 3 Select the filter number where you want to insert the filter in the list in the filter setting list area.**
- 4 Click [Paste].**
The copied filter is inserted in the list in the filter setting list area.

Deleting a Filter

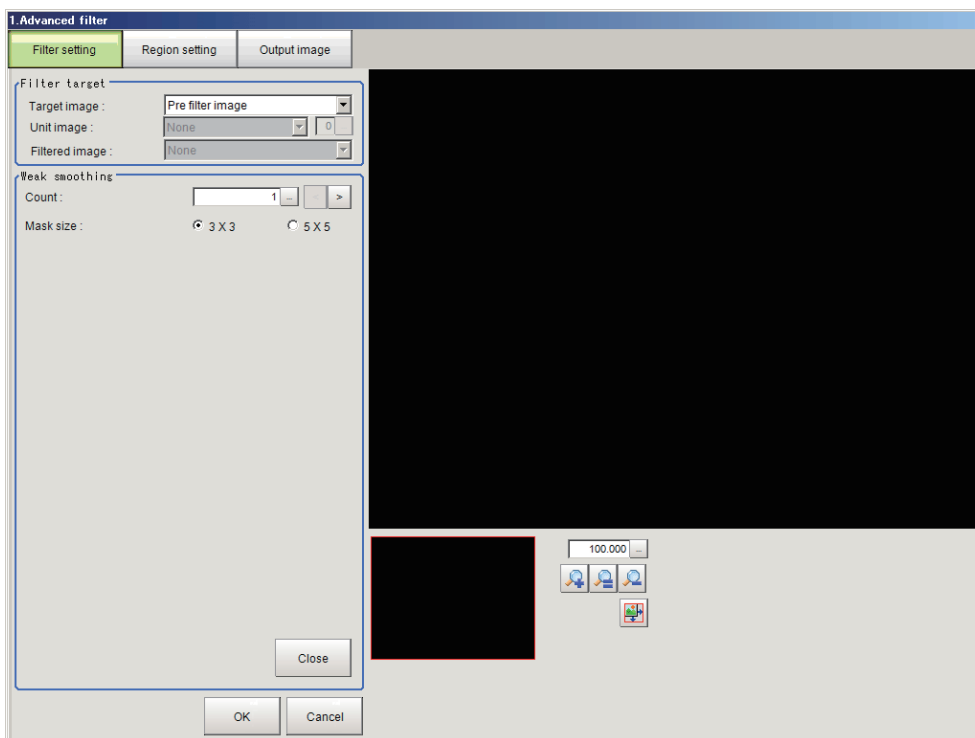
You can delete a filter that has been added to the filter list.

- 1 Select the filter that you want to delete in the list in the filter setting list area.**
- 2 Click [Delete].**
The deletion confirmation screen appears.
- 3 Click [OK] in the deletion confirmation screen.**
The selected filter is deleted from the filter setting list.

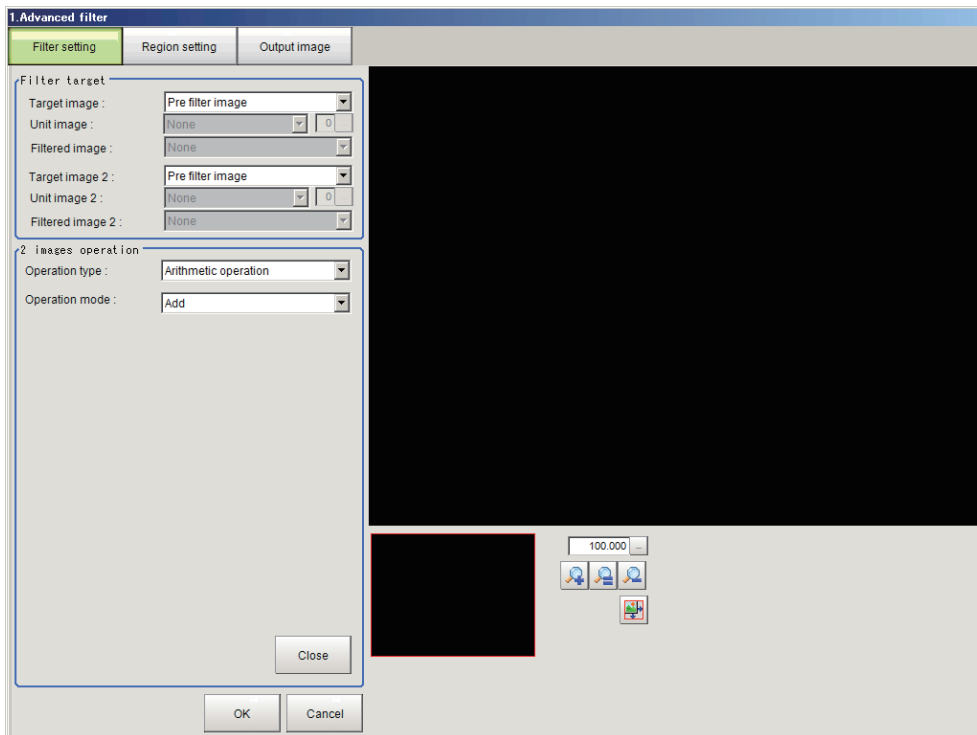
Changing the Filter Settings

You can change the settings of an added filter. The setting screen that appears varies depending on the filter.

Normal filter setting screen



2 images operation filter setting screen



- 1** Select the filter whose settings you want to change in the list in the filter setting list area.
- 2** Click [Edit].
The filter edit screen appears.
- 3** Specify a value for each item in the filter edit screen.

Setting items for filters other than 2 images operation

Setting item	Setting value [Factory default]	Description
Target	<ul style="list-style-type: none"> • Measurement image • [Pre filter image] • Other unit image • Filtered image 	Set the image that is filtered in "Target". <ul style="list-style-type: none"> • Measurement image Filters the measurement image for the processing unit. • Pre filter image Filters the previously processed image. • Other unit image Filters a processing unit image held by another processing unit. • Filtered image Filters the filtered image of the specified filter number in the filter setting list.
Other unit image	<ul style="list-style-type: none"> • [None] • 0 to 9,999 	This can be set when "Other unit image" is selected for "Target". Set the processing unit that holds the image used as the target image. A processing unit of an image input processing item or image conversion processing item can be selected. If the selected processing unit does not hold an image, invalid image occurs and a black image is displayed.
Other unit image number	0 to 3 [0]	This can be set when "Other unit image" is selected for "Target". Set the image number of the image that is used as the target image. If the processing unit does not hold the image of the set image number, invalid image occurs and a black image is displayed.
Filtered image	<ul style="list-style-type: none"> • [None] • 0 to 14 	This can be set when "Filtered image" is selected for "Target". Set the processing unit that holds the image used as the target image. A processing unit that performed processing prior to the current processing unit can be selected.

Setting Items for 2 Images Operation Filter

Setting item	Setting value [Factory default]	Description
Target image 2	<ul style="list-style-type: none"> • Measurement image • [Pre filter image] • Other unit image • Filtered image 	<p>This can be set when “2 images operation filter” is selected in “Filter Setting”.</p> <p>As target image 2, set the image that is used with the target image in the operation.</p> <p>The setting values that can be selected are the same as for “Target”.</p>
Unit image 2	<ul style="list-style-type: none"> • [None] • 0 to 9,999 	<p>This can be set when “Filter Setting” is “2 images operation filter” and “Processing unit image” is selected for “Target image 2”.</p> <p>Set the processing unit that holds the image used as target image 2. A processing unit of an image input processing item or image conversion processing item can be selected. If the selected processing unit does not hold an image, invalid image occurs and a black image is displayed.</p>
Unit image number 2	0 to 3 [0]	<p>This can be set when “Filter Setting” is “2 images operation filter” and “Processing unit image” is selected for “Target image 2”.</p> <p>Set the image number of the image that is used as target image 2. If the processing unit does not hold the image of the set image number, invalid image occurs and a black image is displayed.</p>
Filtered image 2	<ul style="list-style-type: none"> • [None] • 0 to 14 	<p>This can be set when “Filter Setting” is “2 images operation filter” and “Filtered image” is selected for “Target image 2”.</p> <p>Set the processing unit that holds the image used as target image 2. A processing unit that performed processing prior to the current processing unit can be selected.</p>
Operation type	<ul style="list-style-type: none"> • [Operation] • Bit operation 	Select the type of operation for 2 “Images Operation Filter”.
Operation mode	<ul style="list-style-type: none"> • [Add] • Subtraction • Subtraction (Absolute) • Multiplication • Multiplication (Normalization) • Average • Maximum • Minimum 	<p>This setting becomes valid if “Operation” is selected for “Operation type”.</p> <p>The pixel values of two images are calculated in Operation mode and the result is used as the pixel values after conversion.</p>
Bit operation mode	<ul style="list-style-type: none"> • [AND] • OR • XOR • NAND • NOR • XNOR 	<p>This setting becomes valid if “Bit operation” is selected for “Operation type”.</p> <p>The pixel values of two images are calculated in Bit operation mode and the result is used as the pixel values after conversion.</p>

Note

The Output coordinates (Before/After scroll and Calibration ON/OFF) of the measurement unit for the image after performing 2 images operation are calculated with the image selected in "Target" of 2 images operation.

Example:
Image operation in Operation mode

Target image			Target image1		
230	20	100	30	10	50
64	128	196	120	240	60
150	50	1	100	150	200



Add			Subtraction		
255	30	150	200	10	50
184	255	255	1	1	136
250	200	201	50	1	1

When exceed 255,
outputs 255.

Subtraction (Absolute)			Multiplication		
200	10	50	255	200	255
56	112	136	255	255	255
50	100	199	255	255	200

When less than 1,
outputs 1.

Multiplication (Normalization)			Average		
57	1	41	130	15	75
63	255	97	92	184	128
124	62	1	125	100	101

For Multiplication (Normalization),
normalizes the maximum pixel
values of result within the
measurement region to 255.

Maximum			Minimum		
230	20	100	30	10	50
120	240	196	64	128	60
150	150	200	100	50	1

Rounds after the decimal
point of result.

Example:
Image operation in Bit operation mode

Target image			Target image1		
230	20	100	255	255	255
64	128	196	1	1	1
150	50	1	255	255	255



AND			OR		
230	20	100	255	255	255
1	1	1	65	129	197
150	50	1	255	255	255

XOR			NAND		
230	20	100	25	235	155
190	126	58	255	255	255
150	50	1	105	205	254

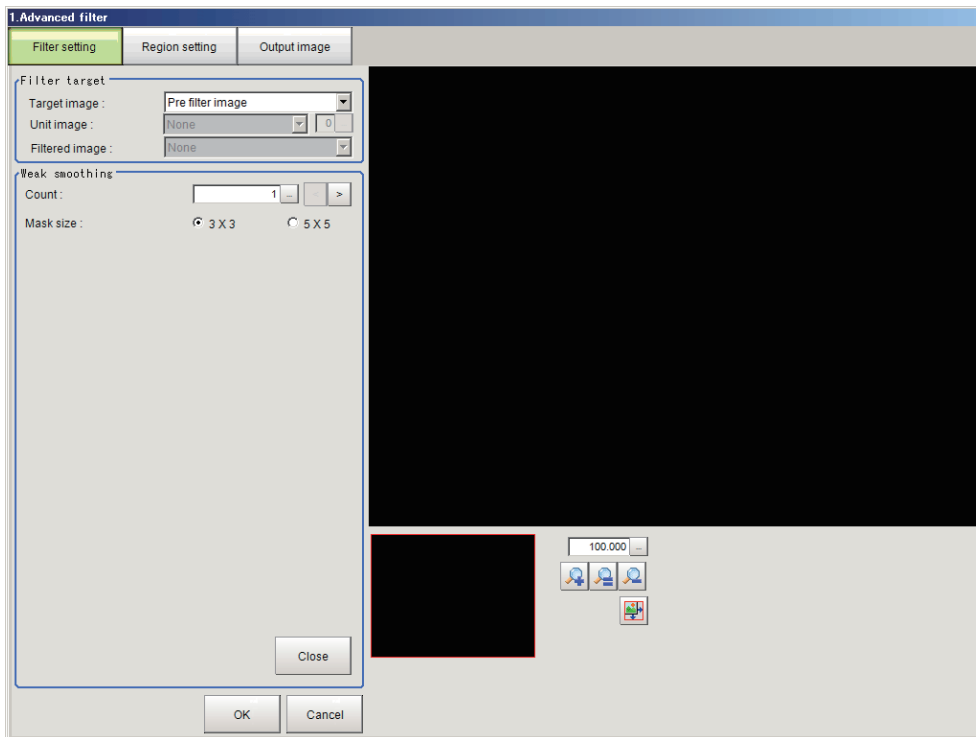
NOR			XNOR		
1	1	1	25	235	155
190	126	58	65	129	197
1	1	1	105	205	254

Changing the Filter Settings

The same filter settings as in the “Filtering” processing item can be changed.

The following setting screen appears if the “Weak smoothing”, “Strong smoothing”, “Dilate”, “Erosion”, “Median”, “Edge extraction”, “Extract horizontal edges”, “Extract vertical edges”, or “Enhance edges” filter settings are edited.

Reference: ► Filtering Options and Examples (p.517)

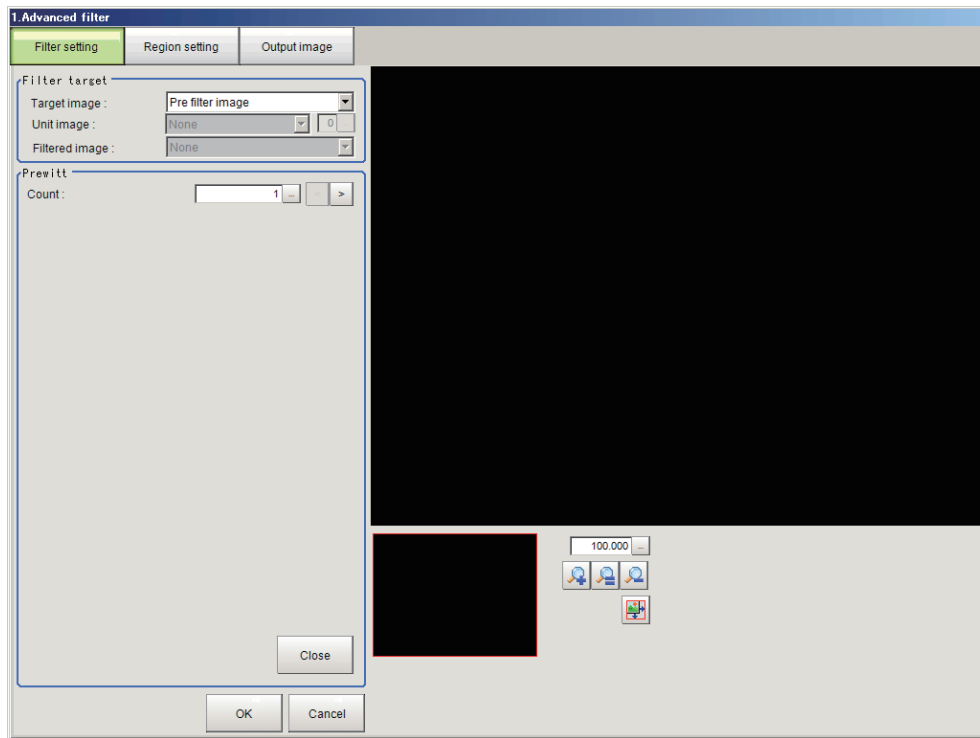


Setting item	Setting value [Factory default]	Description
Count	1 to 9 [1]	Set the number of times the filter is applied.
Mask size	<ul style="list-style-type: none"> • [3×3] • 5×5 	Set the mask size of the filter. If there are large variations in the brightness of peripheral pixels, increase the “Mask size” setting.

Changing the Edge Filter Settings

Edge filter settings similar to the extract edges filter in the “Filtering” processing item can be changed.

The following setting screen appears if the “Prewitt”, “Roberts”, or “Laplacian” filter settings are edited.

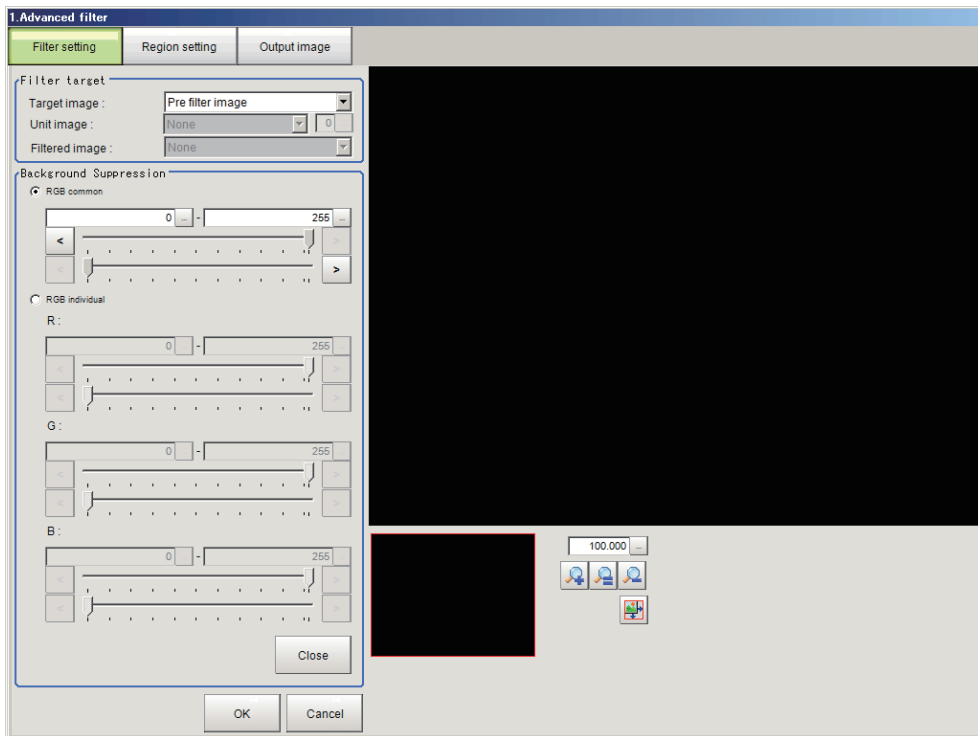


Setting item	Setting value [Factory default]	Description
Count	1 to 9 [1]	Set the number of times the filter is applied.

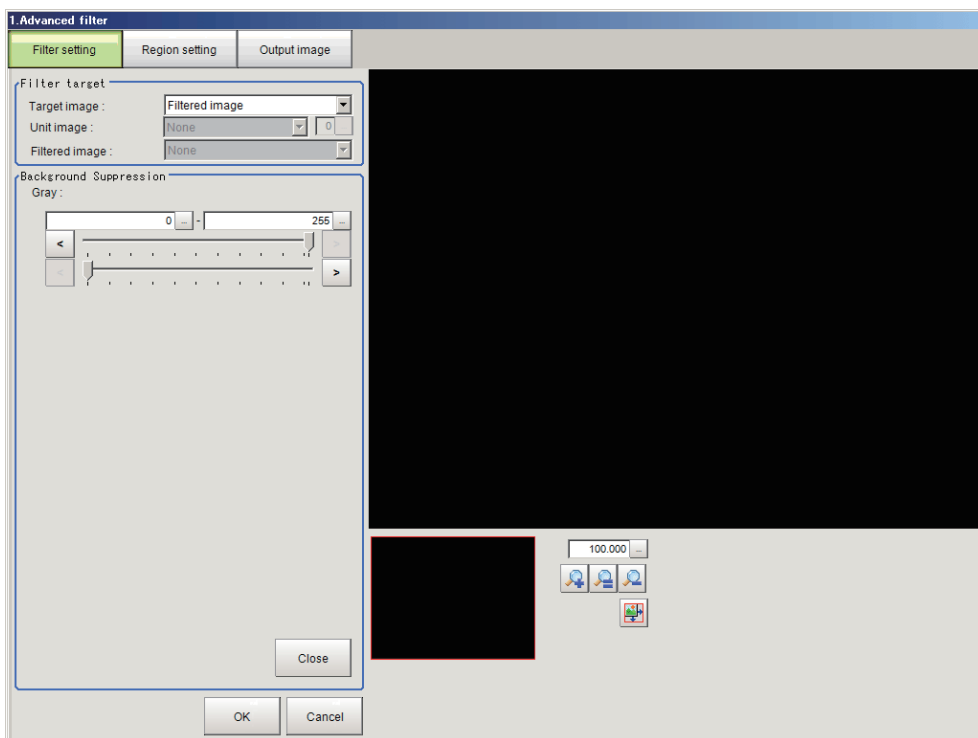
Changing the Background Suppression Filter Settings.

The same filter settings as in the “Background Suppression” processing item can be changed.

Color images



Monochrome images



Color images

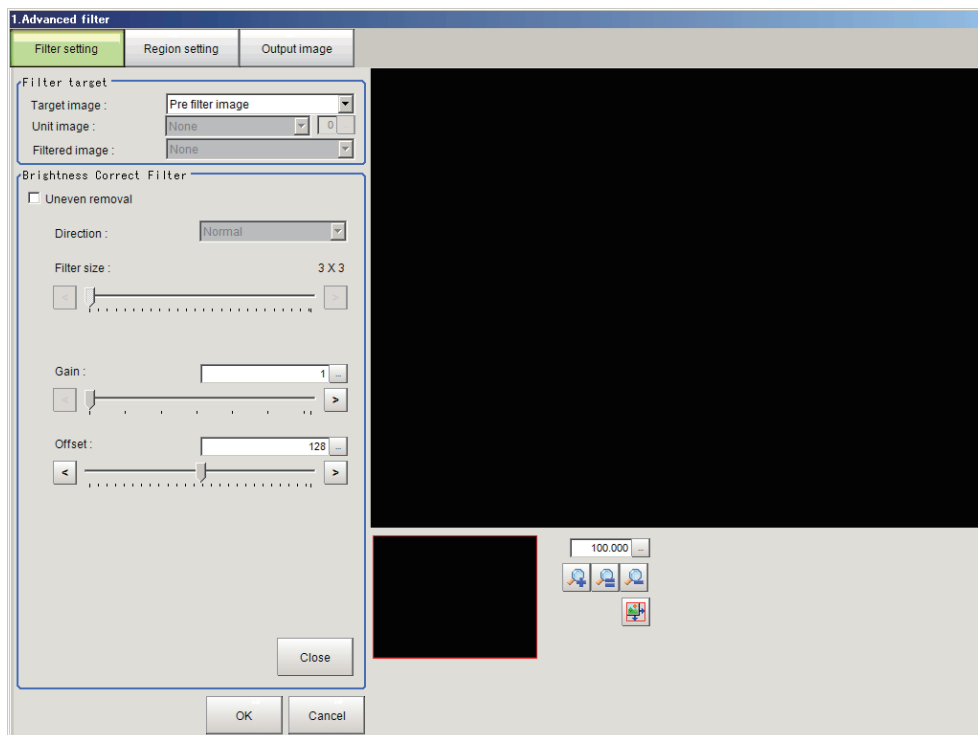
Setting item	Setting value [Factory default]	Description
RGB common/RGB individual	<ul style="list-style-type: none"> • [RGB common] • RGB individual 	Select whether the RGB upper limit and lower limit values are set to RGB common or RGB individual.
RGB common	[0] to [255]	Enabled when “RGB common” is selected in “RGB common / RGB individual”. Set the upper and lower limit values of the background suppression level. The same limits will be used for all RGB colors. The set range from the lower limit value to the upper limit value is converted to 256 gradation levels.
RGB individual	[0] to [255]	Enabled when “RGB individual” is selected in “RGB common / RGB individual”. Set the upper and lower limit values of the background suppression level for each RGB color. The set range from the lower limit value to the upper limit value is converted to 256 gradation levels.

Monochrome images

Setting item	Setting value [Factory default]	Description
Gray	[0] to [255]	Set the upper and lower limit values of the density. The set range from the lower limit value to the upper limit value is converted to 256 gradation levels.

Changing the Brightness Correct Filter Settings (Monochrome Images Only)

The same filter settings as in the “Brightness Correct Filter” processing item can be changed.

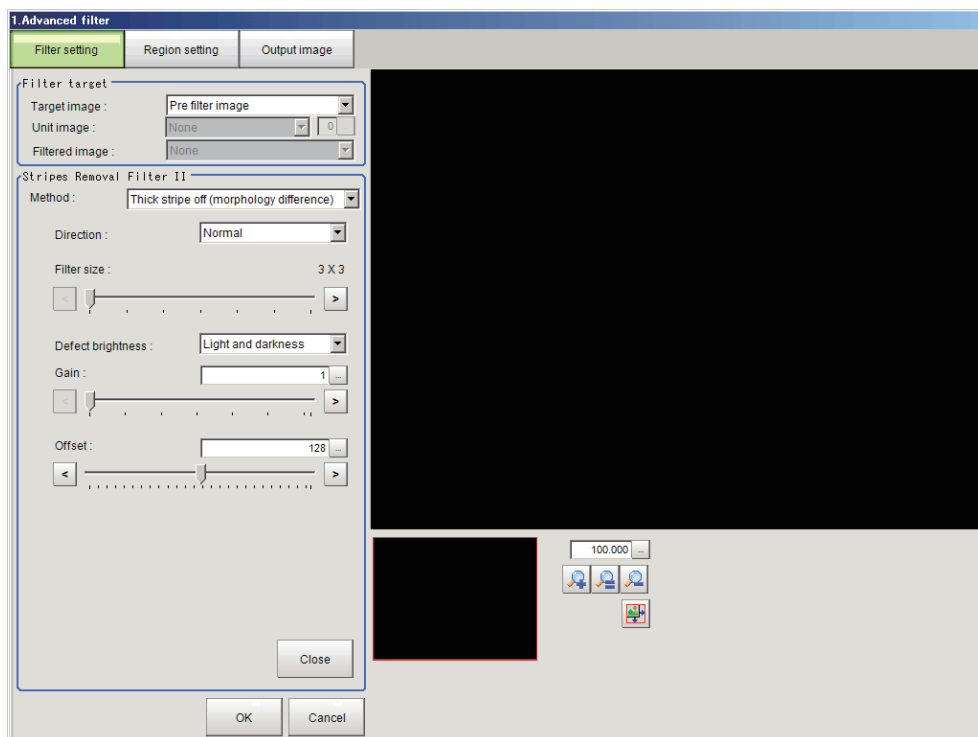


Setting item	Setting value [Factory default]	Description
Uneven removal	<ul style="list-style-type: none"> • Checked • [Unchecked] 	To remove dark/light unevenness when brightness correction is performed, select the “Uneven removal” checkbox.

Setting item	Setting value [Factory default]	Description
Filter direction	<ul style="list-style-type: none"> • [Normal] • Vertical • Horizontal 	This can be set when the “Uneven removal” checkbox is selected. Set the direction of filtering of the image. Set the direction that is perpendicular to the direction of the changes in darkness and lightness of the unevenness.
Filter size	3×3 to 255×255 [3×3]	This can be set when the “Uneven removal” checkbox is selected. Set an odd value for the size of the filter mask. If the size of the unevenness is large, increase the “Mask size” setting.
Gain	1 to 63 [1]	Adjust the contrast of the filtered image. To increase the contrast, set a larger value for the “Gain”.
Offset	0 to 255 [128]	Adjust the brightness of the filtered image. To make the image brighter, increase the “Offset” setting.

Changing the Stripes Removal Filter II Settings (Monochrome Images Only)

The same filter settings as in the “Stripes Removal Filter II” processing item can be changed.



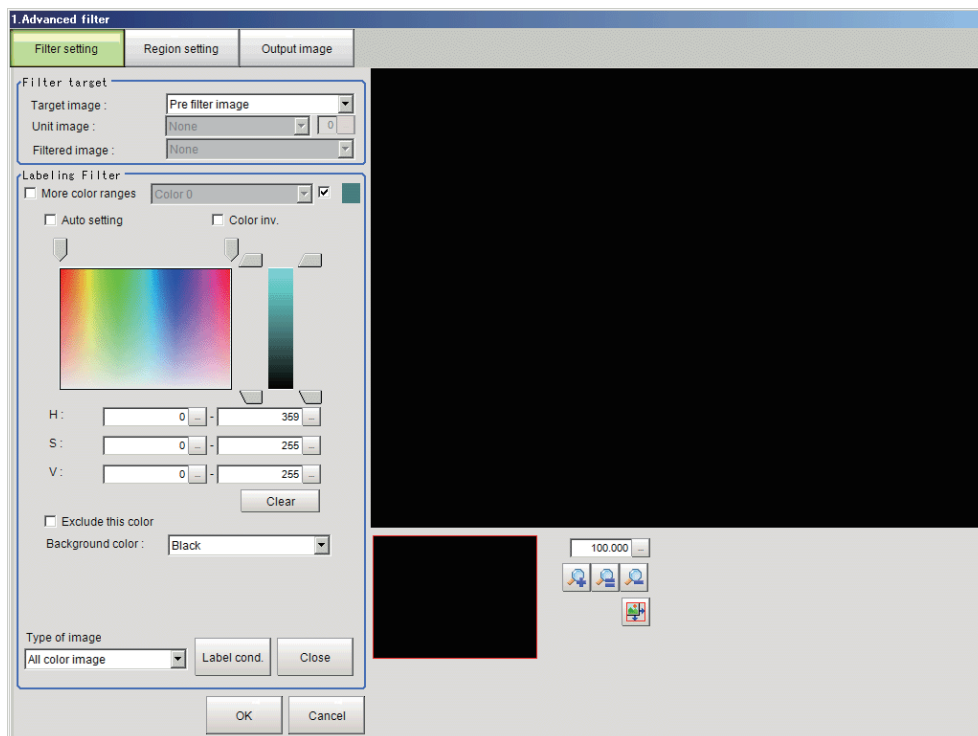
Setting item	Setting value [Factory default]	Description
Correction method	<ul style="list-style-type: none"> • [Thick stripe off (morphology difference)] • Pinstripe off (morphology) 	<p>Set the correction method.</p> <ul style="list-style-type: none"> • Thick stripe off (morphology difference) Set the filter size based on the size of expected defects. The striped pattern is removed accordingly. • Pinstripe off (morphology) Set the filter size based on the width of the stripes. The striped pattern is removed accordingly.
Filter direction	<ul style="list-style-type: none"> • [Normal] • Vertical • Horizontal • Upper right • Lower right 	Set the direction of filtering of the image. Set the direction that is perpendicular to the direction of the changes in darkness and lightness of the stripes.

Setting item	Setting value [Factory default]	Description
Filter size	3×3 to 63×63 [3×3]	Set an odd value for the size of the filter for stripes and defects. <ul style="list-style-type: none"> Thick stripe off (morphology difference) Set a “Filter size” larger than the size of the stripes and defects that you want to detect. Pinstripe off (morphology) Set a “Filter size” larger than the width of the stripes that you want to detect.
Brightness	<ul style="list-style-type: none"> [Light and darkness] Light Dark 	This can be set when “Thick stripe off (morphology difference)” is selected in “Correction method”. Set a brightness for the background of defects that you want to detect. To detect both white defects and black defects, set “Light and darkness”.
Stripe brightness	<ul style="list-style-type: none"> [Light and darkness] Light Dark 	This can be set when “Pinstripe off (morphology)” is selected in “Correction method”. Set the brightness of the stripes you want to suppress. When the stripes are brighter than the background, set “Light”.
Gain	1 to 63 [1]	This can be set when “Thick stripe off (morphology difference)” is selected in “Correction method”. Adjust the contrast of the filtered image. To increase the contrast, set a larger value for the “Gain”.
Offset	0 to 255 [128]	This can be set when “Thick stripe off (morphology difference)” is selected in “Correction method”. Adjust the brightness of the filtered image. To make the image brighter, increase the “Offset” setting.

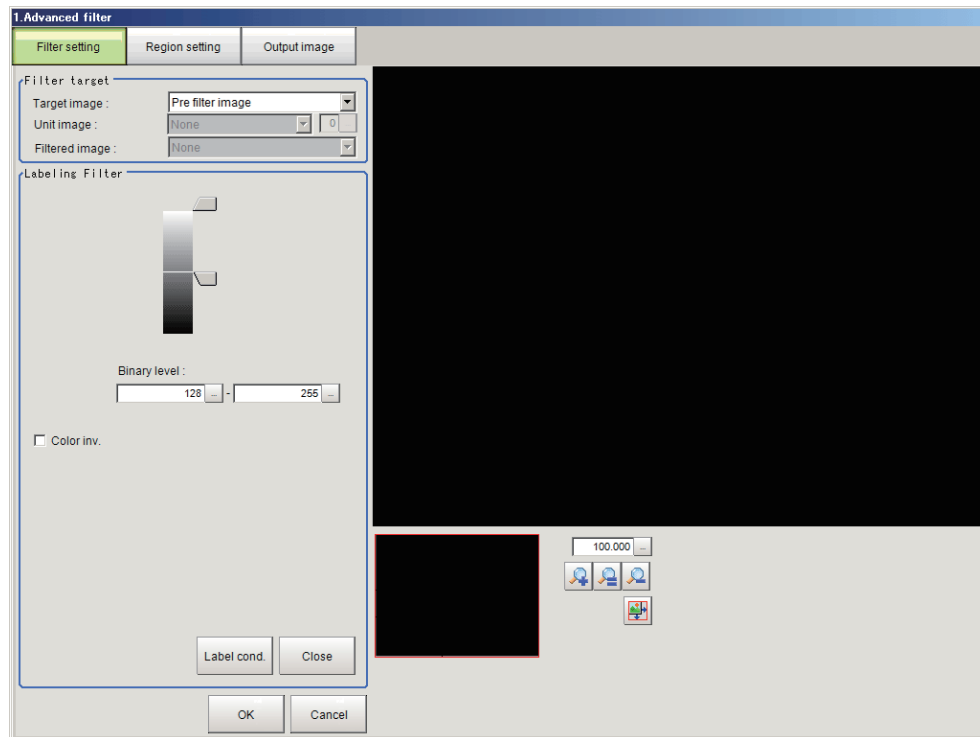
Changing the Labeling Filter Settings

You can change the settings of the filter that binarizes the image using the same extraction conditions as the “Labeling” processing item.

Color extraction settings screen for color images



Binarization settings screen for monochrome images



Setting items in the [Color Ext.] (color extraction) settings screen for color images

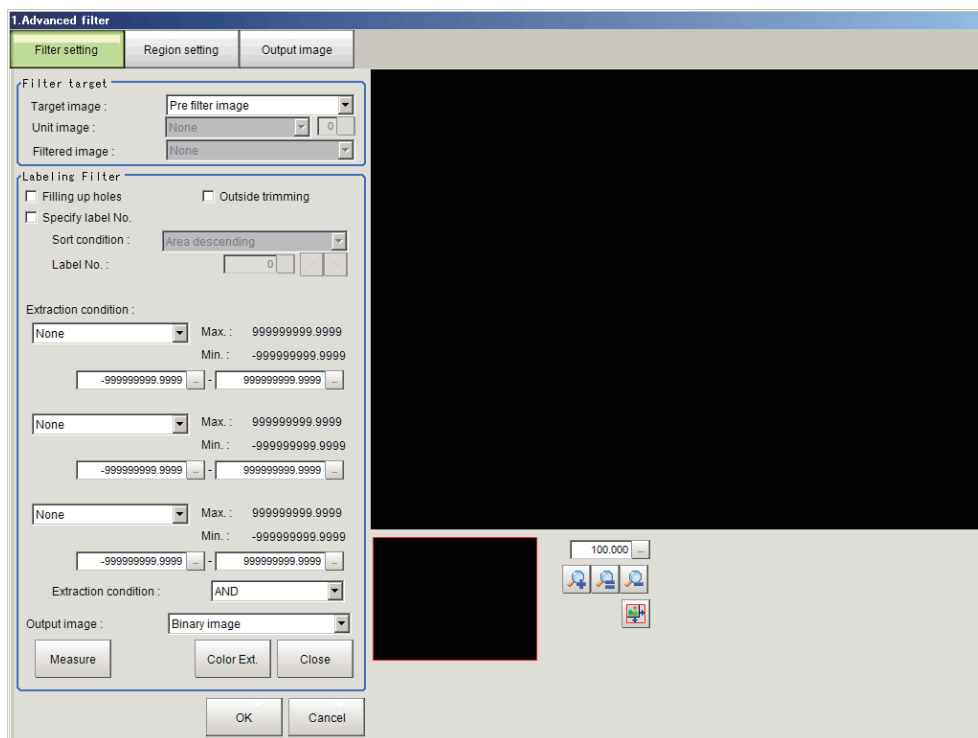
Setting item	Setting value [Factory default]	Description
More color ranges	<ul style="list-style-type: none"> • [Checked] • [Unchecked] 	To extract multiple colors, select the “More color ranges” checkbox.
Color extraction range	Color 0 to Color 7 [Color 0]	This can be set when the “More color ranges” checkbox is selected. Set the color ranges to be extracted.
Select	<ul style="list-style-type: none"> • [Checked] • [Unchecked] 	This can be set when the “More color ranges” checkbox is selected. Select the “Select” checkbox to extract color using a color extraction range selected in “Color extraction range”.
Auto	<ul style="list-style-type: none"> • [Checked] • [Unchecked] 	Select the “Auto” checkbox to set a color specified in an image as a color to be measured.
Color inv.	<ul style="list-style-type: none"> • [Checked] • [Unchecked] 	To measure colors other than a specified color, select the “Color inv.” checkbox.
H	[0] to [359]	Set the hue (difference in hue).
S	[0] to [255]	Set the saturation (difference in saturation).
V	[0] to [255]	Set the vividness (difference in vividness).
Exclude this color	<ul style="list-style-type: none"> • [Checked] • [Unchecked] 	To exclude a selected color extraction range from the extracted colors, select “Exclude this color”.
Background color	<ul style="list-style-type: none"> • [Black] • White • Red • Green • Blue 	Set the color used to cover background color parts other than the color to be extracted. When “Color selected image” is selected in “Display”, the background color can be set for each selected color. When “All color image” is selected in “Display”, background color parts are covered with the background color of Color 0.

Setting item	Setting value [Factory default]	Description
Display	<ul style="list-style-type: none"> • Measurement image • [All color image] • Color selected image • Binary image 	Set the image that you want to display in the settings screen.

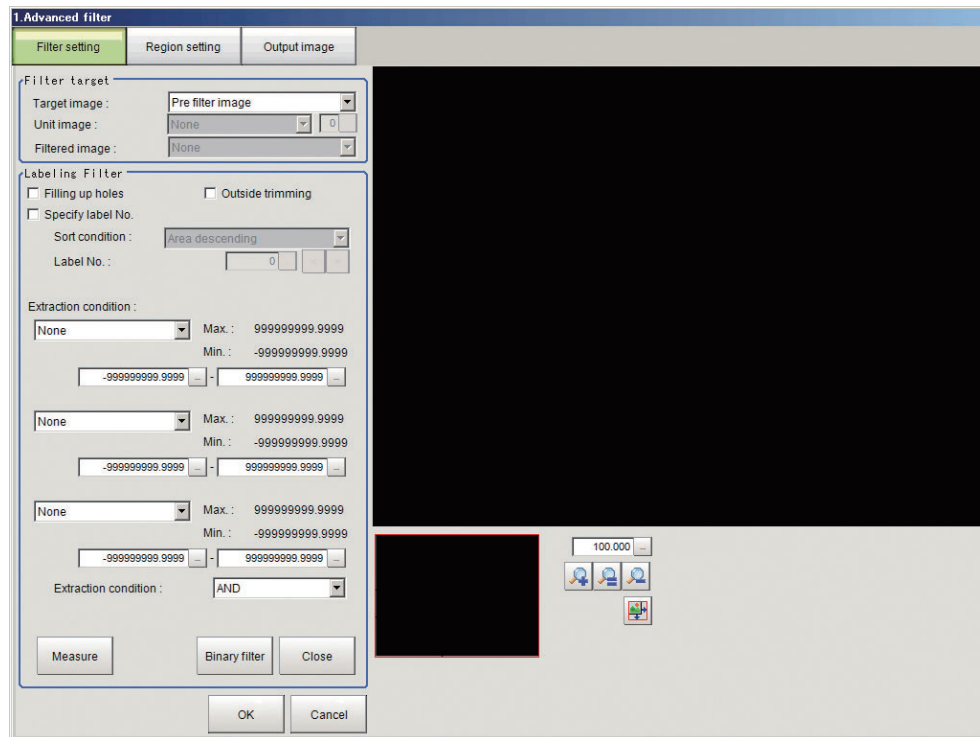
Setting Items in the Binarization Settings Screen for Monochrome Images

Setting item	Setting value [Factory default]	Description
Binary level	0 to 255 [128] to [255]	Set the level for conversion of a 256 gradation grayscale image to a binary image. Set the “Binary level” so that the pixels of the measurement target are white.
Reverse	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select the “Reverse” checkbox to reverse black and white.

Label condition settings screen for color images



Label condition settings screen for monochrome images



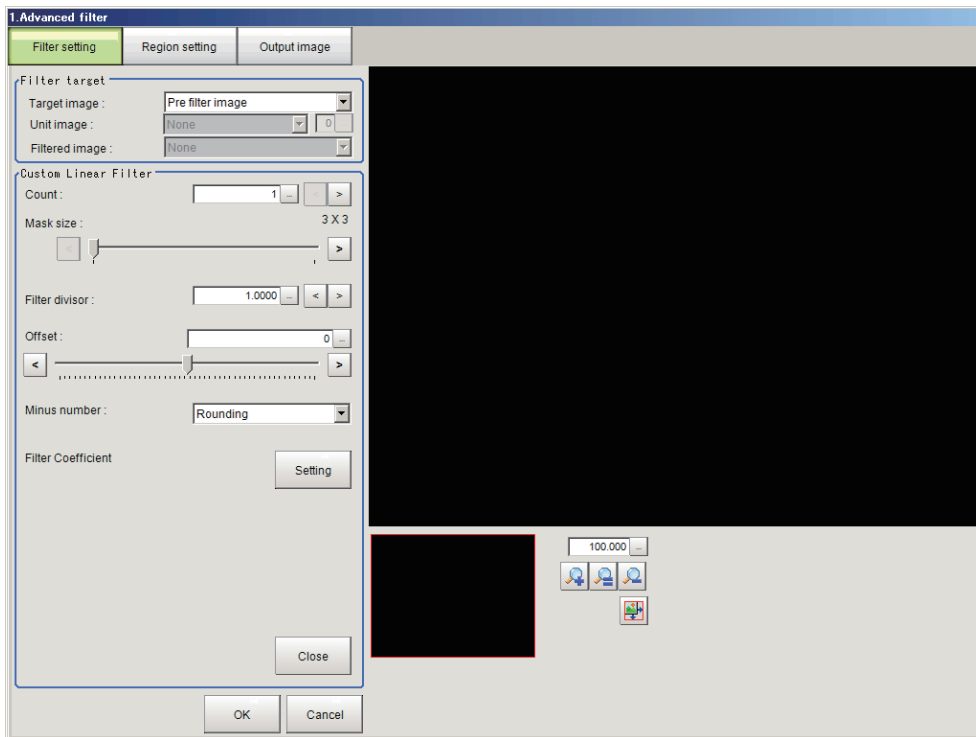
Setting item	Setting value [Factory default]	Description
Filling up holes	<ul style="list-style-type: none"> • Checked • [Unchecked] 	To fill the blank “donut hole” surrounded by the extracted color with the extracted color, select the “Filling up holes” checkbox.
Outside trimming	<ul style="list-style-type: none"> • Checked • [Unchecked] 	If there is a part you do not want to measure in the place where the color is extracted inside the measurement region, select the “Outside trimming” checkbox.
Specify label No.	<ul style="list-style-type: none"> • Checked • [Unchecked] 	To use only a specified label as the extraction target, select the “Specify label No.” checkbox.

Setting item	Setting value [Factory default]	Description
Sort condition	<ul style="list-style-type: none"> • Area ascending • [Area descending] • X ascending • X descending • Y ascending • Y descending • Elliptic major axis ascending • Elliptic major axis descending • Elliptic minor axis ascending • Elliptic minor axis descending • Elliptic ratio ascending • Elliptic ratio descending • Rectangle width ascending • Rectangle width descending • Rectangle height ascending • Rectangle height descending • Rectangle X1 ascending • Rectangle X1 descending • Rectangle Y1 ascending • Rectangle Y1 descending • Perimeter ascending • Perimeter descending • Circularity ascending • Circularity descending • Fit rect major axis ascending • Fit rect major axis descending • Fit rect minor axis ascending • Fit rect minor axis descending • Fit rect ratio ascending • Fit rect ratio descending • Inscribed circle X ascending • Inscribed circle X descending • Inscribed circle Y ascending • Inscribed circle Y descending • Inscribed circle R ascending • Inscribed circle R descending • Circum. circle X ascending • Circum. circle X descending • Circum. circle Y ascending • Circum. circle Y descending • Circum. circle R ascending • Circum. circle R descending • Number of holes ascending • Number of holes descending 	<p>This can be set when the [Specify label No.] checkbox is selected. In order to specify a label, set the condition for sorting labels.</p>
Label No.	0 to 2,499 [0]	<p>This can be set when the [Specify label No.] checkbox is selected. Set the number of the label to be specified.</p>

Setting item	Setting value [Factory default]	Description
Extraction condition	<ul style="list-style-type: none"> • [None] • Area • X • Y • Elliptic major axis • Elliptic minor axis • Elliptic ratio • Rectangle width • Rectangle height • Rectangle X1 • Rectangle Y1 • Perimeter • Circularity • Fit rect major axis • Fit rect minor axis • Inscribed circle R • Circum. circle R • Number of holes 	Set the conditions for extracting a label. Up to three extraction conditions can be set.
Extraction condition upper/lower limit	[-999,999,999.9999] to [999,999,999.9999]	Set the upper limit and lower limit of the condition for extracting a label.
Extraction condition setting	<ul style="list-style-type: none"> • [AND] • OR 	Set the condition for combining extraction conditions. <ul style="list-style-type: none"> • AND Labels meeting all extraction conditions are extracted. • OR Labels meeting any one of the extraction conditions are extracted.
Output image	<ul style="list-style-type: none"> • [Binary image] • All color image 	Appears when the settings are for a color image. Set the image that is output as the image filtered by the labeling filter.

Changing the Custom Linear Filter Settings

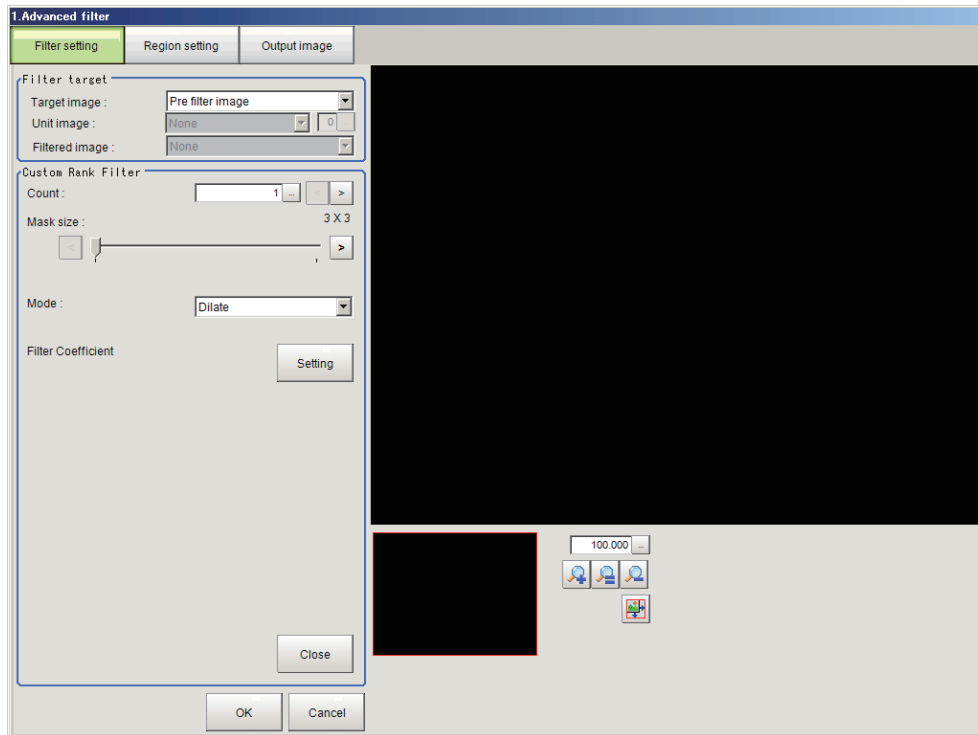
You can change the linear filter settings that allow you to set custom filter coefficients. To set the filter coefficients, click the “Setting” button.



Setting item	Setting value [Factory default]	Description
Count	1 to 9 [1]	Set the number of times the filter is applied.
Mask size	3×3 to 21×21 [3×3]	Set an odd value for the size of the filter mask. If there are large variations in the brightness of peripheral pixels, increase the “Mask size” setting.
Filter divisor	0.0001 to 99,999.9999 [1.0000]	Set the divisor for pixel values after masking. The value that results from dividing the result of masking by the “Filter divisor” and adding the offset is the filtered pixel value. Set together with the filter coefficients.
Offset	-255 to 255 [0]	Set the offset value for masked pixel values. The value that results from dividing the result of masking by the “Filter divisor” and adding the offset is the filtered pixel value.
Minus number	<ul style="list-style-type: none"> • [Rounding] • Absolute 	Set the processing that takes place when filtering results in a negative pixel value. <ul style="list-style-type: none"> • Rounding Round the pixel value to 1. • Absolute Use the absolute value of the pixel value.
Set all	<ul style="list-style-type: none"> • Checked • [Unchecked] 	To set all filter values at once, select the “Set all” checkbox.
Filter Coefficient	-128 to 127 [0]	For the coefficients for the pixel values in masking, set the number of coefficients that is equal to the mask size. Set together with the filter divisor.

Changing the Custom Rank Filter Settings

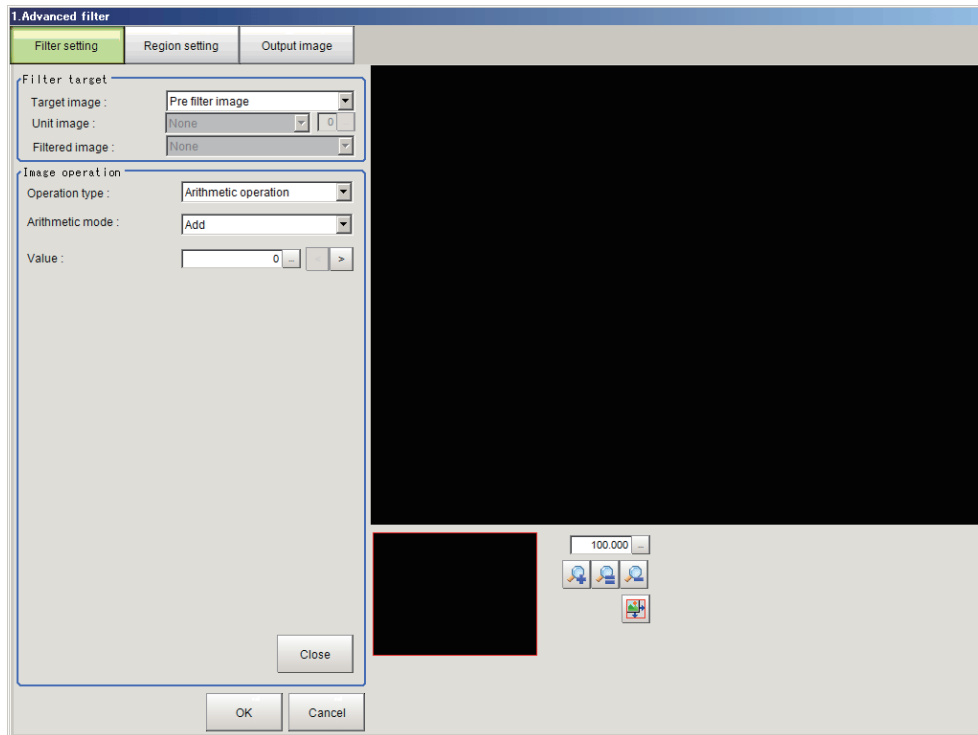
You can change the rank filter settings that allow you to set custom filter coefficients.



Setting item	Setting value [Factory default]	Description
Count	1 to 9 [1]	Set the number of times the filter is applied.
Mask size	3×3 to 21×21 [3×3]	Set an odd value for the size of the filter mask. If there are large variations in the brightness of peripheral pixels, increase the “Mask size” setting.
Mode	<ul style="list-style-type: none"> • [Dilate] • Erosion 	Set the filter mode.
Set all	<ul style="list-style-type: none"> • Checked • [Unchecked] 	To set all filter values at once, select the “Set all” checkbox.
Filter Coefficient	0 to 1 [1]	Set the dilate/erosion shape used for masking. Set a number of filter coefficients that is equal to the mask size.

Changing the Image Operation Filter Settings

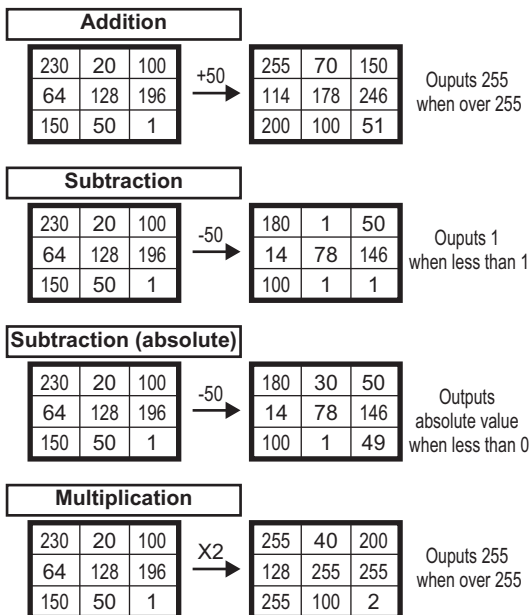
You can change the settings for the filter that converts the pixel values of an image.



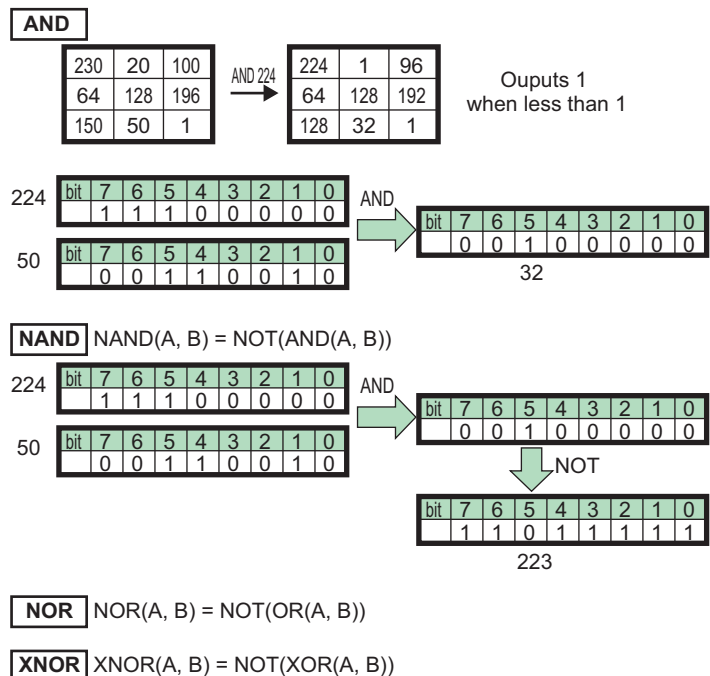
Setting item	Setting value [Factory default]	Description
Operation type	<ul style="list-style-type: none"> • [Arithmetic operation] • Bit operation • Bit shift • Change pixel value 	Set the type of operation that is used for pixel calculation.
Arithmetic mode	<ul style="list-style-type: none"> • [Add] • Subtraction • Subtraction (absolute) • Multiplication 	This can be set when "Arithmetic operation" is selected for "Operation type". Set the operation method.
Value	-255 to 255 [0]	This can be set when "Arithmetic operation" is selected for "Operation type". Set the calculation value used to convert the pixel value. The result of the operation on the pixel value using the calculation value and the operation method of the operation mode is the converted pixel value.
Operation mode	<ul style="list-style-type: none"> • [NOT] • AND • OR • XOR • NAND • NOR • XNOR 	This can be set when "Bit operation" is selected for "Operation type". Set the operation method for bit operation.
Value	0 to 255 [0]	This can be set when "Bit operation" is selected for "Operation type". Set the calculation value used to convert the pixel value. The result of the operation on the pixel value using the bit operation value and the operation method of the bit operation mode is the converted pixel value.

Setting item	Setting value [Factory default]	Description
Bit shift mode	<ul style="list-style-type: none"> [Right bit shift] Left bit shift 	<p>This can be set when "Bit shift" is selected for "Operation type". Set the bit shift method.</p> <ul style="list-style-type: none"> Right bit shift Bit shift to the right. This makes the pixel values smaller and the image darker. Left bit shift Bit shift to the left. This makes the pixel values larger and the image brighter.
Shift value	1 to 8 [1]	<p>This can be set when "Bit shift" is selected for "Operation type". Set the shift value used to convert the pixel values. The result of bit shifting of each pixel value according to the bit shift mode, and repeated the number of times set with the shift value, is the converted pixel value.</p>
Change mode	<ul style="list-style-type: none"> [Change inside bounds] Change outside bounds 	<p>This can be set when "Change pixel value" is selected for "Operation type". Set the method used to convert the pixel values.</p> <ul style="list-style-type: none"> Change inside bounds Pixel values inside the range set in "Change bounds" are converted using the "Change value". Change outside bounds Pixel values outside the range set in "Change bounds" are converted using the "Change value".
Change value	1 to 255 [128]	<p>This can be set when "Change pixel value" is selected for "Operation type". Set the value used to convert the pixel values. The pixel values that are specified by the "Change mode" are converted to the value set in "Change value".</p>
Change bounds	[1] to [255]	<p>This can be set when "Change pixel value" is selected for "Operation type". Set the range of pixel values to be converted.</p>

Example: Pixel calculation when arithmetical operations are performed

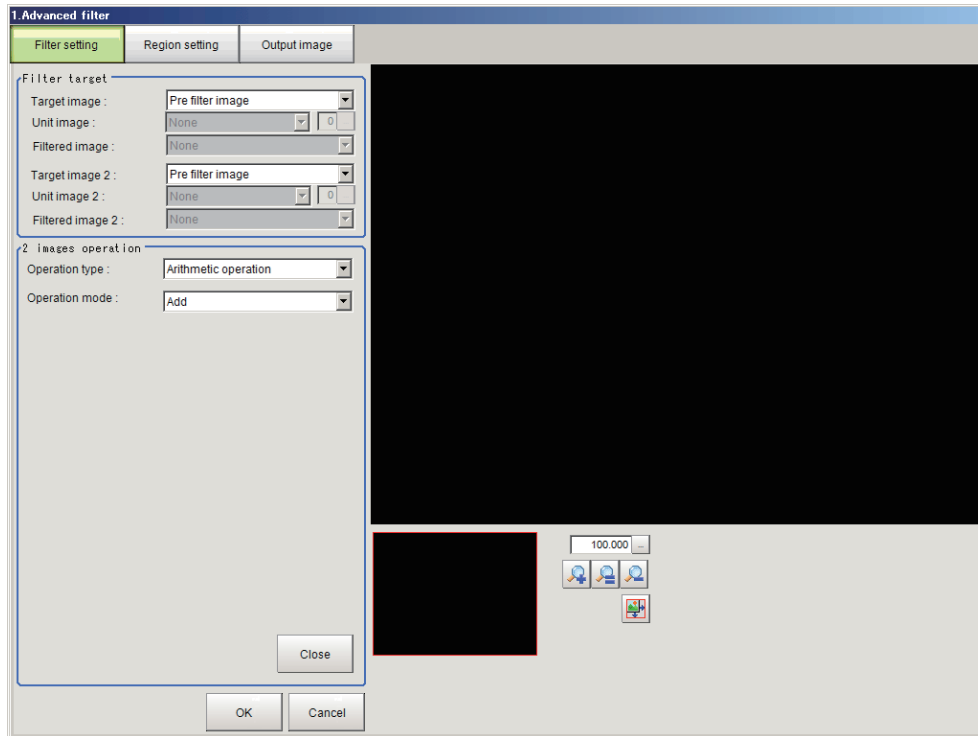


Example: Pixel calculation when bit operations are performed



Changing the 2 Images Operation Settings

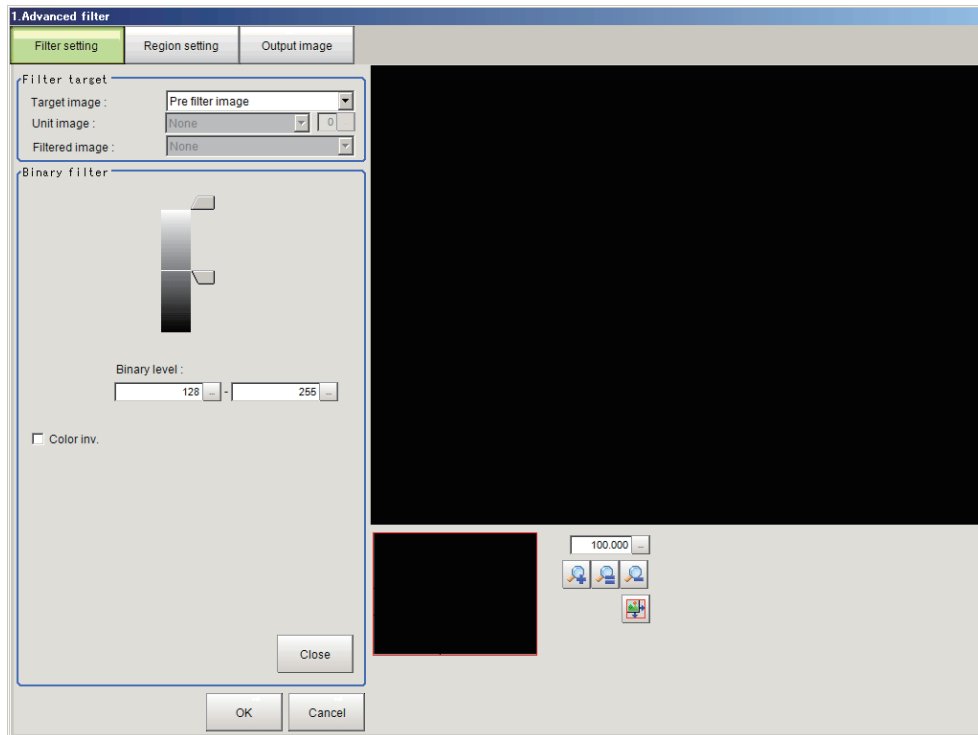
You can change the settings for the filter that operates on paired pixel values of two images.



Setting item	Setting value [Factory default]	Description
Operation type	<ul style="list-style-type: none"> • [Calculation] • Bit operation 	Set the type of operation that is used for 2 images operation.
Operation mode	<ul style="list-style-type: none"> • [Add] • Subtraction • Subtraction (absolute) • Multiplication • Multiplication (Normalization) • Average • Maximum • Minimum 	This can be set when "Calculation" is selected for "Operation type". Set the operation method.
Operation mode	<ul style="list-style-type: none"> • [AND] • OR • XOR • NAND • NOR • XNOR 	This can be set when "Bit operation" is selected for "Operation type". Set the operation method for bit operation.

Changing the Binary Filter Settings (Monochrome Images Only)

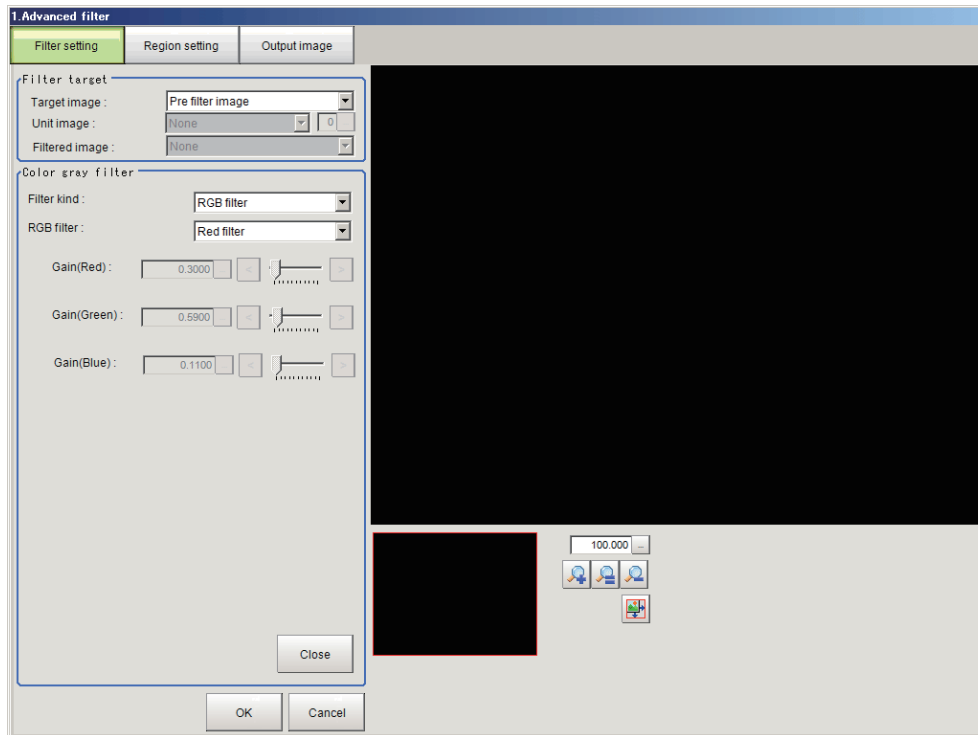
You can change the settings of the filter that binarizes images.



Setting item	Setting value [Factory default]	Description
Binary level	0 to 255 [128] to [255]	Set the level for conversion of a 256 gradation grayscale image to a binary image. Set the "Binary level" so that the pixels of the measurement target are white.
Reverse	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select the "Reverse" checkbox to reverse black and white.

Changing the Color Gray Filter Settings (Color Images Only)

The same filter settings as in the “Color Gray Filter” processing item can be changed.

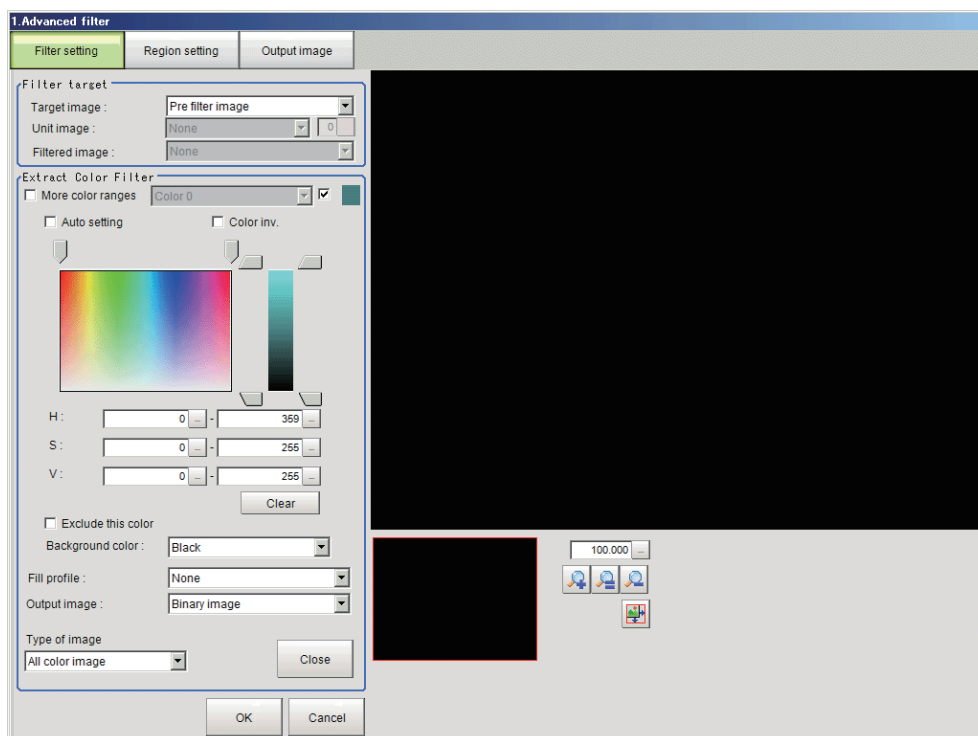


Setting item	Setting value [Factory default]	Description
Filter type	<ul style="list-style-type: none"> • [RGB filter] • HSV filter 	Set the filter type. <ul style="list-style-type: none"> • RGB filter Set the color extraction range using R, G, B. • HSV filter Set the color extraction range using H, S, V.
RGB filter	<ul style="list-style-type: none"> • [Red filter] • Green filter • Blue filter • Magenta filter • Yellow filter • Brightness filter (R + G + B) • Brightness filter (R + 2G + B) • Custom filter 	This can be set when “RGB filter” is selected for “Filter type”. Set the type of filter used as the Color Gray filter.
Gain (Red)	0.0001 to 9.9999 [0.3]	This can be set when “Custom filter” is selected for “RGB filter”. Set the gain of R, G, B. To strengthen an RGB component, set a larger value for the gain of that component.
Gain (Green)	0.0001 to 9.9999 [0.59]	
Gain (Blue)	0.0001 to 9.9999 [0.11]	
HSV filter	<ul style="list-style-type: none"> • Fast • [Precision] 	This can be set when “HSV filter” is selected for “Filter type”. Set the type of filter used as the Color Gray filter. <ul style="list-style-type: none"> • Fast Set the color extraction range using standard hue only. • Precision Set the color extraction range in detail using standard hue, hue range, and color chroma.

Setting item	Setting value [Factory default]	Description
Standard Hue	0 to 359 [0]	This can be set when “HSV filter” is selected for “Filter type”. Set the standard hue (tone). The greater the difference in hue from the standard hue (difference in tone), the smaller the density value.
Hue range	10 to 180 [90]	This can be set when “Precision” is selected for “HSV filter”. Set the hue (tone) range. The difference in hue is calculated using a hue range of 255 divisions centered on the “Standard Hue”. Hues outside the hue range have a density value of 0.
Color chroma	[0] to [255]	This can be set when “Precision” is selected for “HSV filter”. Set the upper and lower limits of the color chroma (saturation).

Changing the Extract Color Filter Settings (Color Images Only)

The same filter settings as in the “Extract Color Filter” processing item can be changed.

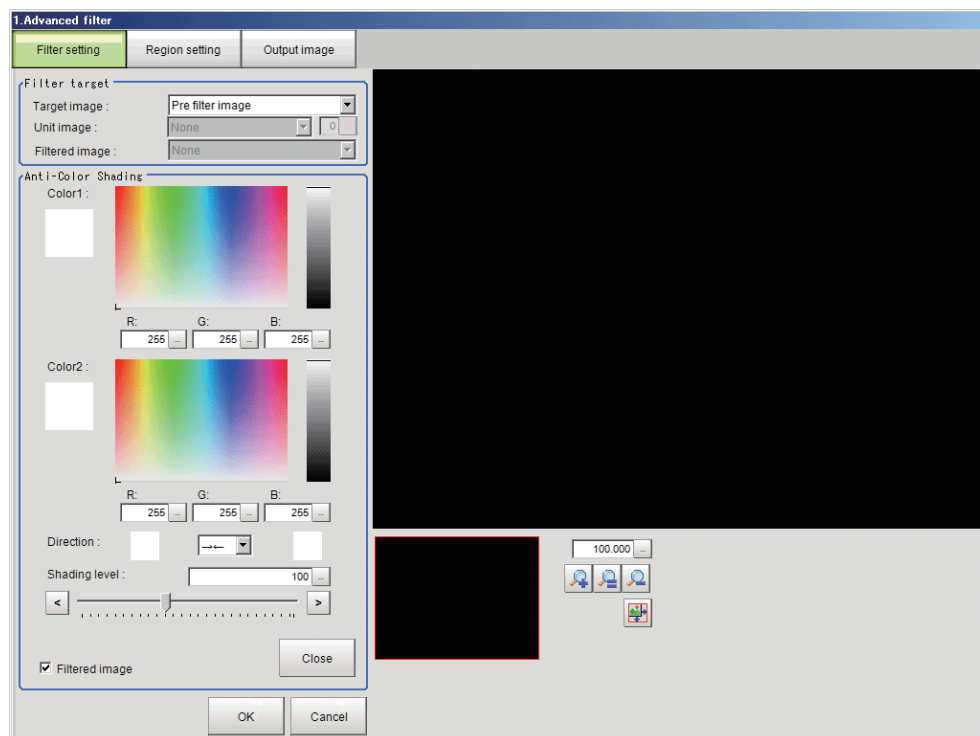


Setting item	Setting value [Factory default]	Description
More color ranges	<ul style="list-style-type: none"> • Checked • [Unchecked] 	To extract multiple colors, select the “More color ranges” checkbox.
Color extraction range	Color 0 to Color 7 [Color 0]	This can be set when the “More color ranges” checkbox is selected. Set the color ranges to be extracted.
Select	<ul style="list-style-type: none"> • [Checked] • Unchecked 	This can be set when the “More color ranges” checkbox is selected. Select the “Select” checkbox to extract color using a color extraction range selected in “Color extraction range”.
Auto	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Select the “Auto” checkbox to set a color specified in an image as a color to be measured.
Color inv.	<ul style="list-style-type: none"> • Checked • [Unchecked] 	To measure colors other than a specified color, select the “Color inv.” checkbox.
H	[0] to [359]	Set the hue (difference in hue).

Setting item	Setting value [Factory default]	Description
S	[0] to [255]	Set the saturation (difference in saturation).
V	[0] to [255]	Set the vividness (difference in vividness).
Exclude this color	<ul style="list-style-type: none"> • Checked • [Unchecked] 	To exclude a selected color extraction range from the extracted colors, select "Exclude this color".
Background color	<ul style="list-style-type: none"> • [Black] • White • Red • Green • Blue 	Set the color used to cover background color parts other than the color to be extracted. When "Color selected image" is selected in "Display", the background color can be set for each selected color. When "All color image" is selected in "Display", background color parts are covered with the background color of Color 0.
Fill profile	<ul style="list-style-type: none"> • [OFF] • Fill profile • Filling up holes 	Set the fill method for filling a central blank part of an image. <ul style="list-style-type: none"> • OFF Do not fill central blank part. • Fill profile As the extracted color, measure the interval between the extract color start point and extract color end point in the direction of the X axis in the measurement region. Filling only takes place in the direction of the X axis, and thus this method is faster than "Filling up holes". • Filling up holes Fill the blank "donut hole" surrounded by the extracted color with the extracted color
Output image	<ul style="list-style-type: none"> • [Binary image] • All color image 	Set the image that is output after filtering by the Extract Color filter.
Display	<ul style="list-style-type: none"> • Measurement image • [All color image] • Selected color image • Binary image 	Set the image that you want to display in the settings screen.

Changing the Anti Color Shading Filter Settings (Color Images Only)

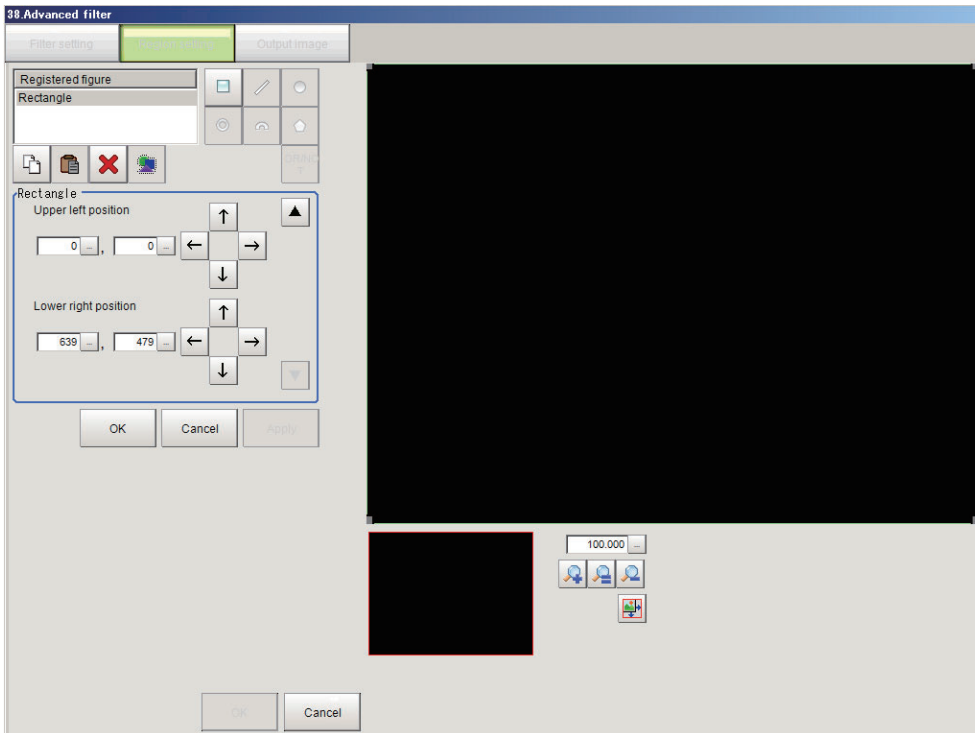
The same filter settings as in the “Anti Color Shading” processing item can be changed.



Setting item	Setting value [Factory default]	Description
Color 1 RGB	0 to 255 [255]	After the range is set, the two colors that are furthest apart in the set range are picked out.
Color 2 RGB	0 to 255 [255]	
Direction	<ul style="list-style-type: none"> • [→←] • → • ← 	Set the conversion method used for Color 1 and Color 2. →←: Convert Color 1 and Color 2 to the middle color. →: Convert Color 1 to Color 2. ←: Convert Color 2 to Color 1.
Shading level	0 to 255 [100]	Set the level for suppressing color shading. To suppress shading, increase the “Shading level” setting.
Filtered image	<ul style="list-style-type: none"> • [Checked] • Unchecked 	To display the original image, remove the checkmark from “Filtered image”.

Region Settings (Advanced Filter)

Use this setting to set, as the measurement area, the area on the image that you want to filter. By narrowing the measurement region (as opposed to measuring the entire input image), this function allows you to shorten the processing time.

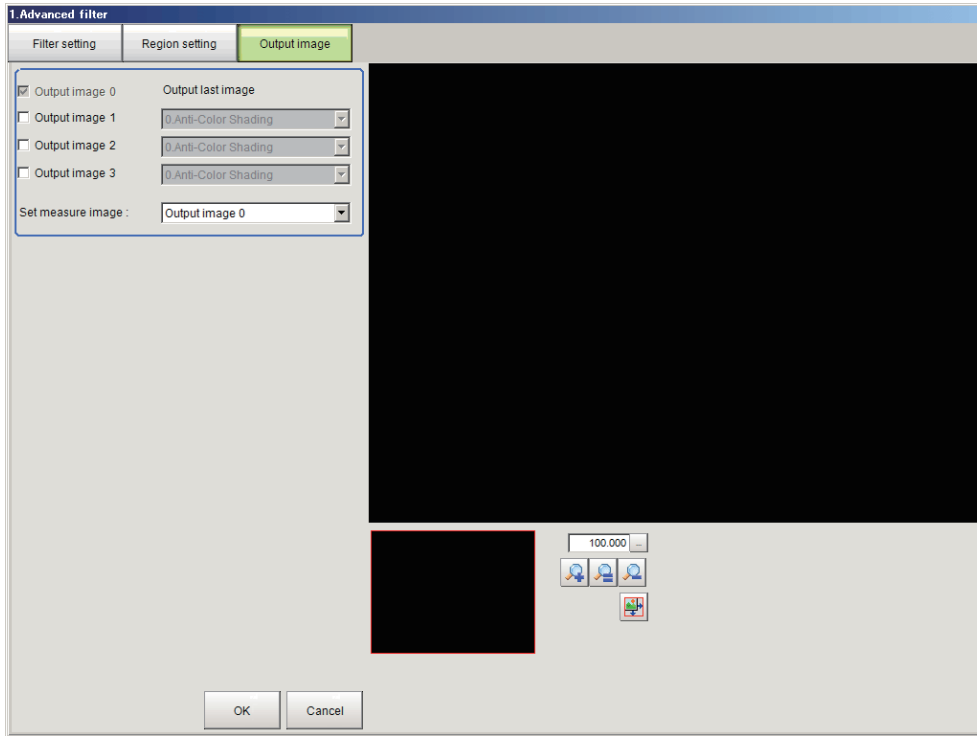


- 1** In the Item Tab area, click [Setting].
- 2** Click [Edit].
- 3** Set the area to be filtered.
- 4** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

Output Image Settings (Advanced Filter)

You can change the output image settings.

These settings specify the image that is output as the measurement result. The image set as the output image can be used as the measurement image on other processing units of the measurement flow.



Setting item	Setting value [Factory default]	Description
Output image 0	• Enabled (fixed)	As the final image, set the image to which all added filters have been applied.
Output images 1 to 3	• [Disabled] • Enabled	Select to output an image filtered by a specific filter.
Output filters 1 to 3	• Filter number	This can be set when one of the Output images 1 to 3 checkboxes is selected. Set the number of the filter used to filter the output image.
Set measure image	• [Output image 0] • Output image 1 • Output image 2 • Output image 3	From the output images, select the image to be used as the advanced filter image. The image specified with this setting can be used as the measurement image for measurement in processing units that follow the current processing unit.

Measurement Results for Which Output Is Possible (Advanced Filter)

The measurement results provided by advanced filter are shown below. The measurement results appear in the “Detail Result” area, and you can also use result output processing items to output the measurement results to an external device.

Refer to the “External Reference Tables” for the parameters that can be referenced, including measurement results.

(Reference: ► External Reference Table (Advanced Filter) (p.599))

Items Displayed in the Detail Result Area

The following measurement results are displayed in the “Detail result” area as text.

Displayed item	Description
Judge	Displays the judgement result for the processing unit.

Items Displayed in the Image Display Area

You can specify a sub-image number to display the next image in the image display area.

Sub image number	Description
0	The advanced filter image appears.
1	The image of output image 0 appears.
2	The image of output image 1 appears.
3	The image of output image 2 appears.
4	The image of output image 3 appears.
5	The measurement image appears.

Output of measurement results

There are no measurement results that can be output.

Key Points for Test Measurement and Adjustment (Advanced Filter)

You can adjust the parameters while you perform test measurements and check the measurement results to increase the measurement precision and speed.

Select the adjustment method by considering the following point.

Check the measurement results that can be displayed and output in “Measurement Results for Which Output is Possible”.

(Reference: ▶ Measurement Results for Which Output Is Possible (Advanced Filter) (p.596))

Note

- When you perform test measurement, the display of the details and image are updated according to the measurement results.

Adjusting the Processing Speed of Measurements

You can use the following methods to improve the measurement processing speed.

When the processing speed is slow

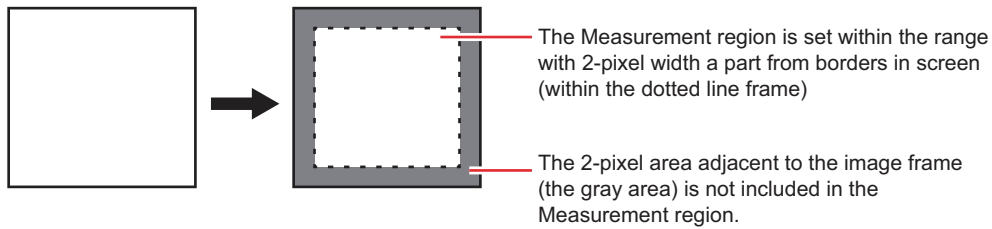
Parameter to be adjusted	Description
Region setting (Reference: ▶ Region Settings (Advanced Filter) (p.595))	If the measurement region is large, excessive time may be required for measurement processing. Set as small a measurement region as possible.

Notes on Advanced Filter

If Advanced Filter is applied to the image, the area around the image frame will become unstable. When a [Filtering] processing item has been set in the scene, ensure that measurement ranges, etc. set for other processing items are not included in the area around the image frame. The width not included in the measurement range will vary depending on the mask size settings.

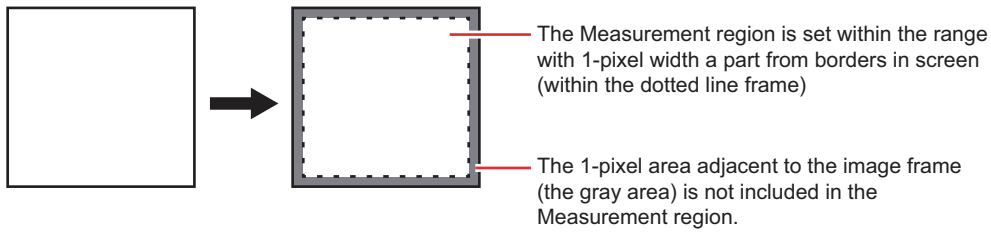
- **Mask size: 5 × 5**

Make settings so that a width around the image frame equal to 2 pixels is not included in the measurement range.



• **Mask size: 3 × 3**

Make settings so that a width around the image frame equal to 1 pixels is not included in the measurement range.

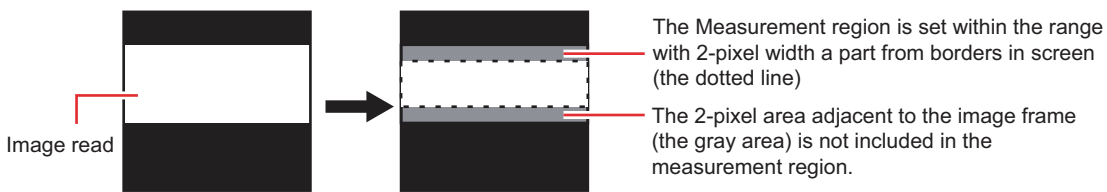


When a partial scan is used to limit the load range

Set so as not to include the image loading range surroundings.

The width that will not be included in the measurement range is the same as the above.

(In the following figure, mask size:5 × 5).



External Reference Table (Advanced Filter)

By specifying a number, you can access the following data from processing items that support processing unit data setting/acquisition, and from control commands.

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (Insufficient memory) -20: Error (Other error)
121	Set measure image	Set/Get	0 to 3
131	Output image 1	Set/Get	0: Not output 1: Output
132	Output image 2	Set/Get	0: Not output 1: Output
133	Output image 3	Set/Get	0: Not output 1: Output
135	Output image 1 No.	Set/Get	0 to 15
136	Output image 2 No.	Set/Get	0 to 15
137	Output image 3 No.	Set/Get	0 to 15

Panorama

Images from multiple cameras are combined into one image.

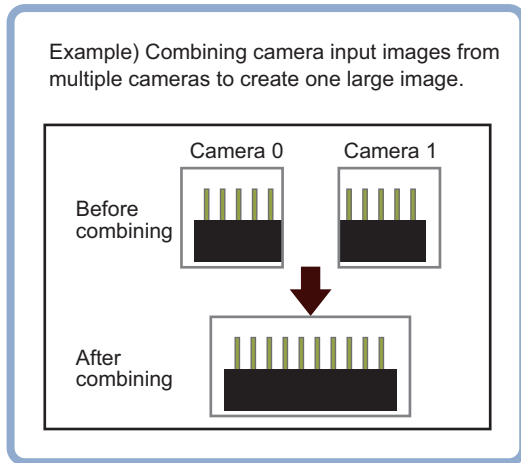
Pay attention to the characteristics of images to compensate the image positions and angles when combining them. Therefore, users can acquire precise combined images without strictly designing the camera placing positions.

Intelligent Compact Digital Camera, FZ-SQ□□□□ cannot be used.

With panorama, only camera images of the same type can be input.

Used in the Following Case

- To combine the input images from multiple cameras



Important

- The first processing after the sensor controller is started may take longer than the second and subsequent processing even though the same image is measured.
- To save an image converted into a panorama, use the image convert logging processing item.

Camera arrangement

There are two camera arrangement methods. Either can be selected.

Item	Description									
two line	<p>Placement combining two images vertically and two images horizontally. One pattern.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Camera allotment number 0</td> <td></td> <td>Camera allotment number 1</td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td>Camera allotment number 2</td> <td></td> <td>Camera allotment number 3</td> </tr> </table>	Camera allotment number 0		Camera allotment number 1				Camera allotment number 2		Camera allotment number 3
Camera allotment number 0		Camera allotment number 1								
Camera allotment number 2		Camera allotment number 3								

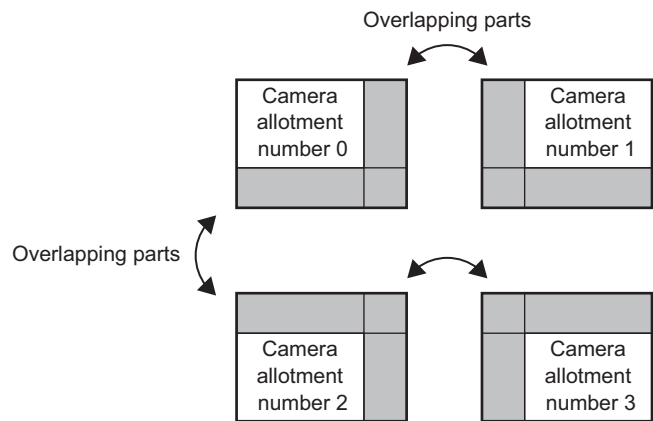
Item	Description															
one line	<p>Placement combining images arranged horizontally. Three patterns: two images, three images, and four images.</p> <div style="display: flex; flex-direction: column; align-items: center;"> <table border="1" style="margin-bottom: 10px;"> <tr> <td style="padding: 5px;">Camera allotment number 0</td> <td style="width: 10px; height: 10px; background-color: #ccc;"></td> <td style="padding: 5px;">Camera allotment number 1</td> </tr> </table> <table border="1" style="margin-bottom: 10px;"> <tr> <td style="padding: 5px;">Camera allotment number 0</td> <td style="width: 10px; height: 10px; background-color: #ccc;"></td> <td style="padding: 5px;">Camera allotment number 1</td> <td style="width: 10px; height: 10px; background-color: #ccc;"></td> <td style="padding: 5px;">Camera allotment number 2</td> </tr> </table> <table border="1"> <tr> <td style="padding: 5px;">Camera allotment number 0</td> <td style="width: 10px; height: 10px; background-color: #ccc;"></td> <td style="padding: 5px;">Camera allotment number 1</td> <td style="width: 10px; height: 10px; background-color: #ccc;"></td> <td style="padding: 5px;">Camera allotment number 2</td> <td style="width: 10px; height: 10px; background-color: #ccc;"></td> <td style="padding: 5px;">Camera allotment number 3</td> </tr> </table> </div>	Camera allotment number 0		Camera allotment number 1	Camera allotment number 0		Camera allotment number 1		Camera allotment number 2	Camera allotment number 0		Camera allotment number 1		Camera allotment number 2		Camera allotment number 3
Camera allotment number 0		Camera allotment number 1														
Camera allotment number 0		Camera allotment number 1		Camera allotment number 2												
Camera allotment number 0		Camera allotment number 1		Camera allotment number 2		Camera allotment number 3										

Camera installation and image combination method

Camera arrangement (two line)

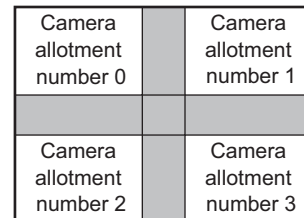
1 Set the camera arrangement.

Determine how the cameras should be placed so that the fields of vision of adjacent cameras, whose camera numbers are each assigned to a camera allotment number, overlap each other vertically and horizontally by at least 1/4.



2 Adjust the image positions.

Use the Offset X and Y buttons on the setting screen to align the overlapping parts of the adjacent images that are being combined.



3 Combine the images.

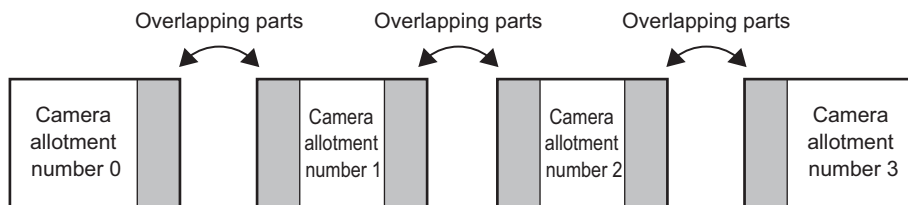
Click the Combine button on the setting screen.

Camera arrangement (one line)

1 Set the camera arrangement.

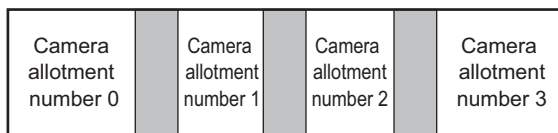
This layout is explained using the example of combining four images.

Determine how the cameras should be placed so that the fields of vision of adjacent cameras, whose camera numbers are each assigned to a camera allotment number, overlap each other vertically and horizontally by at least 1/4.



2 Adjust the image positions.

Use the Offset X and Y buttons on the setting screen to align the overlapping parts of the adjacent images that are being combined.



3 Combine the images.

Click the Combine button on the setting screen.

Camera Arrangement (Panorama)

Set the camera placement.

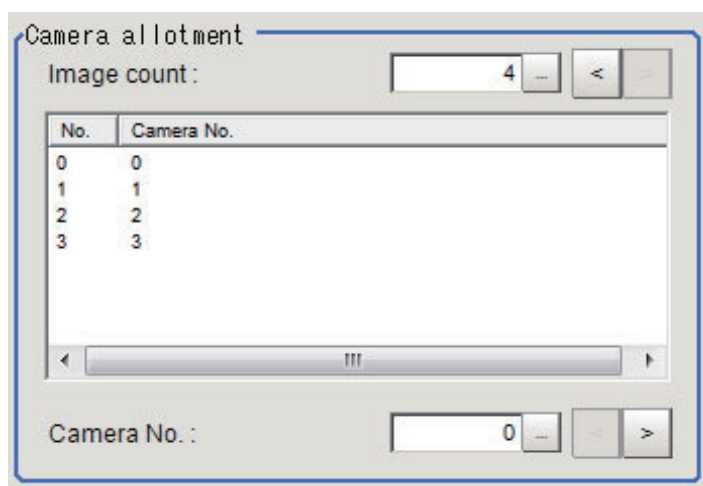
1 In the Item Tab area, click [Arrangement].

2 In the "Display" area, click [Change display] to switch between camera image types.

The displayed contents of the Image Display area will be switched.

Setting item	Set value [Factory default]	Description
Display	Through	The latest image is always input from the camera and displayed.
	[Freeze]	The image that was scanned in the immediately preceding measurement is displayed.

3 Set the image count in the camera allotment display area.



When the number of images is set, camera allotment numbers automatically appear based on the set number of images.

Setting item	Setting [factory default]	Description
Number of images	<ul style="list-style-type: none"> • [2] • 3 • 4 	Specify the number of images that are combined. 2: Combine the images of camera allotment numbers 0 and 1. 3: Combine the images of camera allotment numbers 0, 1, and 2. 4: Combine the images of camera allotment numbers 0, 1, 2, and 3.

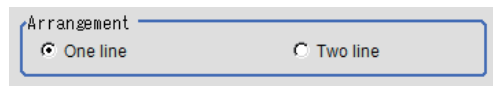
4 Set a camera number for each camera allotment number.

The camera allotment numbers indicate the positions where the cameras are placed in the camera arrangement, and are fixed.

Assign the desired camera number to the camera allotment number.

Setting item	Setting [factory default]	Description
Camera number	Camera allotment number 0 • 0 to 7 [0] Camera allotment number 1 • 0 to 7 [1] Camera allotment number 2 • 0 to 7 [2] Camera allotment number 3 • 0 to 7 [3]	Set the desired camera number for the camera allotment number.

5 Set the camera arrangement.



Setting item	Set value [Factory default]	Description
Arrangement	<ul style="list-style-type: none"> [One line] Two line 	<p>Set the camera image placement. The camera allotment numbers are placed as shown below, and are fixed.</p> <p>(one line) Camera arrangement</p> <p>Camera allotment number 0 Camera allotment number 1 Camera allotment number 2 Camera allotment number 3</p> <p>(two line) Camera arrangement</p> <p>Camera allotment number 0 Camera allotment number 1 Camera allotment number 2 Camera allotment number 3</p>

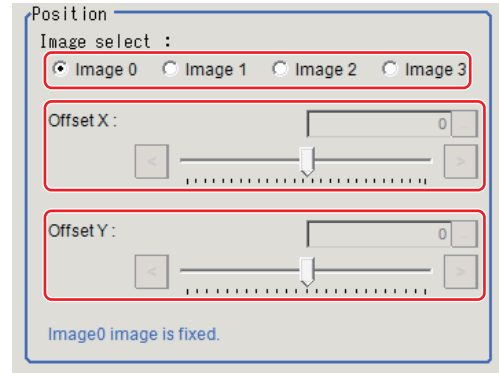
Important

- If the configuration of the connected camera is changed, the measurement result is NG (incompatible image). Press the initialize button and re-do the settings.
- Do not set [Camera Image Input] or [Camera Image Input HDR] after [Panorama].

Image Combination (Panorama)

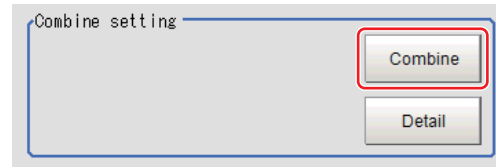
Set the image combination method.

- 1 In the "Item Tab" area, click [Combine].
- 2 Set each item in the "Position" area.



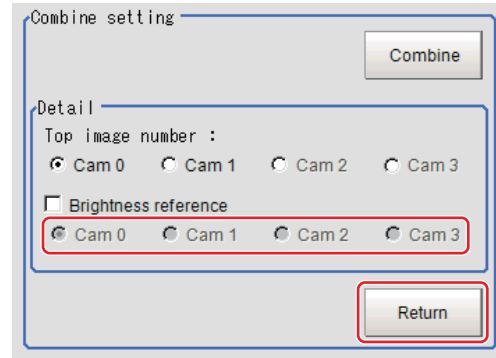
Setting item	Set value [Factory default]	Description
Image select	<ul style="list-style-type: none"> • [Image 0] • Image 1 • Image 2 • Image 3 	Select the camera allotment number of the position to be adjusted. Camera allotment number 0 is fixed. Adjust camera allotment numbers 1 and higher to move to the positions that you want to combine. The camera allotment numbers that can be selected depend on the number of images of the camera arrangement.
Offset X	0.3 megapixel CCD cameras: -640 to 640 [0] 2 megapixel CCD cameras: -1600 to 1600 [0] 5 megapixel CCD cameras: -2448 to 2448 [0] 0.3 megapixel CMOS cameras: -640 to 640 [0] 2 megapixel CMOS cameras: -2040 to 2040 [0] 4 megapixel CMOS cameras: -2040 to 2040 [0]	Adjust the selected camera image in the X direction.
Offset Y	0.3 megapixel CCD cameras: -480 to 480 [0] 2 megapixel CCD cameras: -1200 to 1200 [0] 5 megapixel CCD cameras: -2048 to 2048 [0] 0.3 megapixel CMOS cameras: -480 to 480 [0] 2 megapixel CMOS cameras: -1088 to 1088 [0] 4 megapixel CMOS cameras: -2048 to 2048 [0]	Adjust the selected camera image in the Y direction.

3 In the "Combine setting" area, set the combination method.



Setting item	Description
Combine	This option combines images panoramically so that the detected feature points (same location on the object as positioned differently on the different images) line up with each other in the combined image.

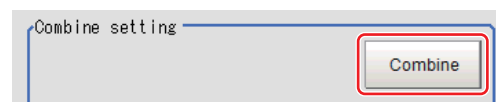
4 Set details as necessary.



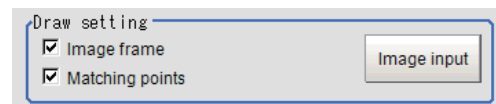
Setting item	Set value [Factory default]	Description
Top image number	<ul style="list-style-type: none"> • [Cam 0] • Cam 1 • Cam 2 • Cam 3 	Select the number of the camera image to be displayed on top. The selected number order changes the order of the images.
Brightness reference	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check here where there is brightness variation among the camera images.
	<ul style="list-style-type: none"> [Cam 0] Cam 1 Cam 2 Cam 3 	Set the number of the camera to be used as reference for brightness compensation. The brightness of the selected camera image is used as reference to adjust the brightness of the other cameras.

Restoring settings to their initial states

Clicking [Initialize] restores settings to their initial states.



5 Make the drawing settings as necessary.



Setting item	Set value [Factory default]	Description
Image frame	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Set whether to display the image frame.
Matching points	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Set whether to display feature points.

Key Points for Test Measurement and Adjustment (Panorama)

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image number	Explanation of image to be displayed
0	Post-combination image

Key Points for Adjustment

Select the adjustment method referring to the following points.

If grid point combination fails

State	Parameter to be adjusted	Troubleshooting
The width of the overlapping portion of images is small	Offset X, Offset Y	Set the offset so that one-fourth of each image overlaps with each other. Set the camera so that the one-fourth of the field of views between cameras overlaps with each other.
Overlapping part of images has no characteristics	Input image	Use characteristic images when setting it.

Measurement Results for Which Output Is Possible (Panorama)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference Tables (Panorama)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (insufficient memory) -20: Error (other errors)
100	Image count	Set/Get	2 to 4
101	Camera arrange kind	Set/Get	0: (1 × 4) arrange 1: (2 × 2) arrange
102	Image select	Set/Get	0 to 3: Camera0 to Camera3
103	OffsetX	Set/Get	-4092 to +4092
104	OffsetY	Set/Get	-3072 to +3072
107	Display frame flag	Set/Get	0 to 1
108	Display feature flag	Set/Get	0 to 1
109	Brightness reference flag	Set/Get	0 to 1
110	Brightness reference image number	Set/Get	0 to 3
112	Valid image number	Get only	0 to 4
200	Top image number	Set/Get	0 to 3
201 + N × 1 (N=0 to 3)	Camera No.	Set/Get	0 to 7

MEMO

Support Inspection and Measurement

This chapter explains how to set calculations and how to get or view data.

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Unit Macro

User's original measurement processing can be performed.

Unit macros are convenient if you want to build a new measurement processing by combining filters and measurement processing's, create a complex display that cannot be realized with the result display processing items, or write original text in the detail text display.

Used in the Following Case

- **Processing performed by multiple processing items such as looping and branching can be consolidated into one.**

Example) Perform search processing after carrying out filter processing multiple times

- Using a flow: Combine filtering, calculation, Set Unit Data and search.
- Using unit macros: Add filtering and search to a flow and define a processing where search measurement processing is performed after carrying out filter processing multiple times.

A flow can be made simpler using unit macros.

Important

- Unit Macros cannot be edited by remote operation.

For the specifications of the Unit Macro, and for details on Unit Macro settings, refer to the following:

Reference: ► *Description of the Setting Screen of the "Unit Macro" Processing Item and How to Configure Settings* in the *Vision System FH/FZ5 Series Macro Customize Functions Programming Manual* (Cat. No. Z367)

Unit Calculation Macro

You can perform calculations, as well as setting/acquiring.

This function is convenient when the user wants to calculate a value using an original calculation formula or change the set value or system data of a processing item.

Used in the Following Case

- **Calculations that use multiple processing items including looping and conditional branch can be consolidated into one.**

Example) When you want to use a different calculation formula depending on the condition

- Using a flow: Realized by combining Conditional Branch and Calculation.
- Using unit calculation macro: Define in a unit calculation macro processing item a calculation processing that uses a calculation formula appropriate for each condition.

A flow can be made simpler using unit calculation macro.

- **A set of multiple processing items can be consolidated into one processing when, for example, changing the settings of multiple processing depending on the condition.**

Example) When you want to change the labeling extraction condition depending on the sorting result

- Using a flow: Realized by combining Conditional Branch, Calculation and Set Unit Data.
- Using unit calculation macro: Register a reference variable representing the labeling extraction conditions and define a processing that assigns a value to the variable according to each condition.

A flow can be made simpler using unit calculation macro.

For the specifications of the Unit Calculation Macro, and for details on Unit Calculation Macro settings, refer to the following:

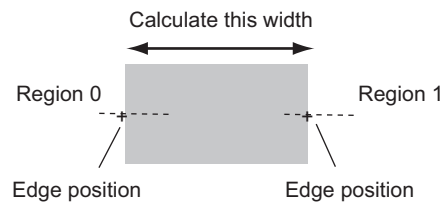
Reference: ▶ *Description of the Setting Screen of the "Unit Calculation Macro" Processing Item and How to Configure Settings in the Vision System FH/FZ5 Series Macro Customize Functions Programming Manual (Cat. No. Z367)*

Calculation

Used in the Following Case

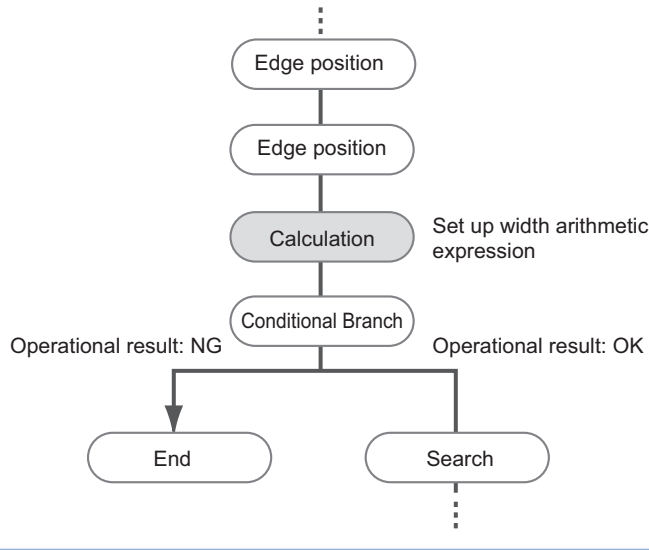
- When changing the inspection details through use of calculation results

Example) Calculating the width of the measurement object Width calculation can be performed by first calculating two edge positions and setting up the arithmetic expression which is used to calculate the edge position difference.



Width = the edge position of Area 0 – the edge position of Area 1

By combining Calculation and Conditional Branch, the following measurement contents can be changed based on the operational result.



- When performing calculation by using the calculation results of other processing units.

Settings (Calculation)

Up to 8 expressions "Calculation 0" to "Calculation 7" can be set up in one single unit.

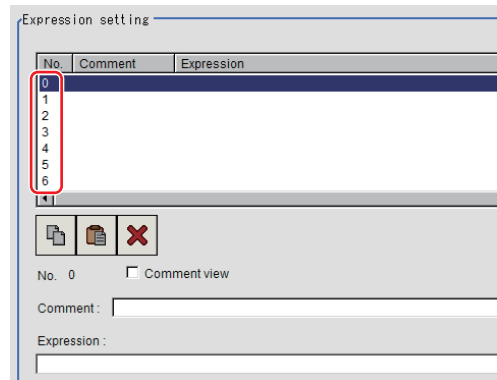
Note

- Calculation results cannot be output to external devices when you only set up expressions. When calculation results are output to external devices, set processing items related to results output in units after "Expression" with flow editing. Reference: ▶ Output result (p.863)

1 In the Item Tab area, click [Setting].

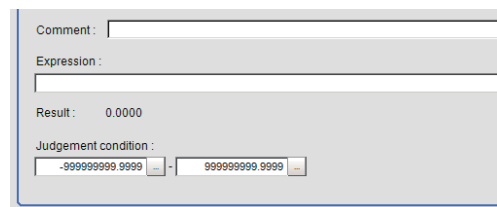
2 Click the "No." for setting up the expression from the list in the "Expression setting" area

The number selected will be displayed below the list.



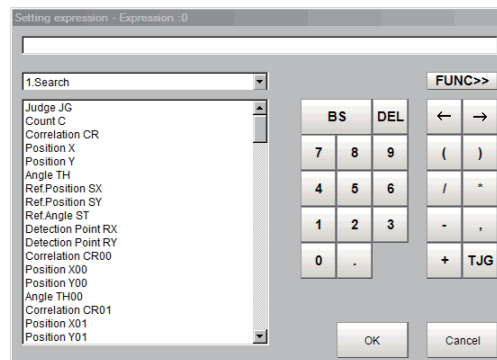
3 Click [...] for the Expression.

The Setting Expression window is displayed.



4 Set up the expression.

Sub-menus that can be set in expressions depending on the processing unit are displayed. When the sub-menu is clicked, it is added to the Expression.



Reference: ▶ Layout of Setting Expression Window (p.615)

5 After setting up the expression, click [OK].

The expression is confirmed.

Note

If an error message is displayed, please check the following points.

- Unit value, numbers, function or TJG settings should be just before or just behind operator.
- Operators and commas ", " should not be placed at the start or end of an expression.
- Operators cannot be input continuously.
- TJG/Unit value/Functions cannot be input continuously.
- The left and right parentheses "()" should be used together.
- Please ensure that the function argument is set.

6 Click [...] for "Comment" and input an explanation of the expression as necessary.

- 7** To display comments in the "Detail result display" area, check "Comment view".

No. 0	<input checked="" type="checkbox"/> Comment view
Comment:	Measure

- 8** Set up the judgement upper limit and the judgement lower limit for "Judgement condition".

Setting item	Set value	Description
Judgement condition	-999999999.9999 to 999999999.9999	This is a judgement condition for the expression. Set upper and lower limits for judging as OK.

- 9** Repeat the Steps Reference: ▶ 2 (p.614) to Reference: ▶ 8 (p.615) and set up the expression.

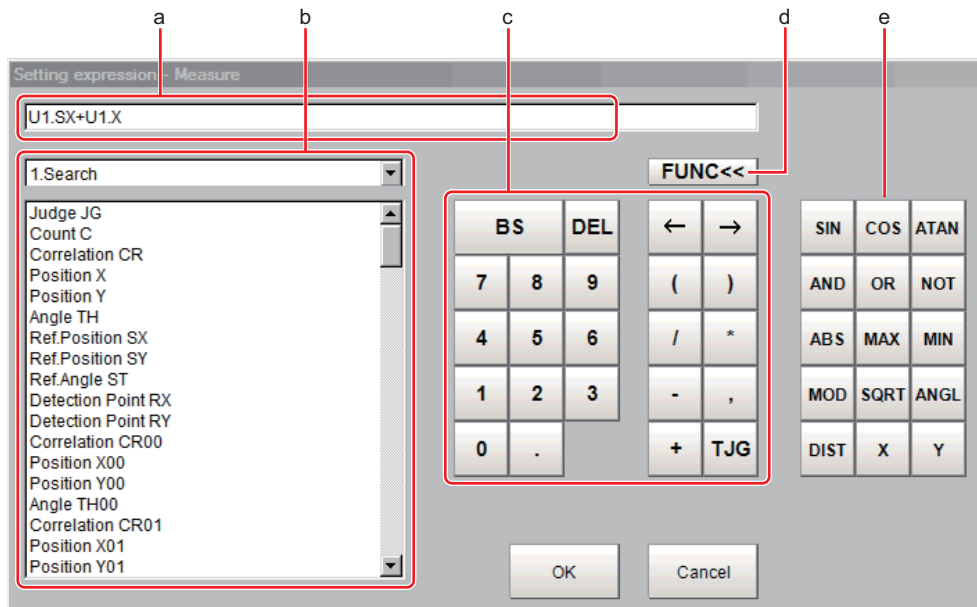
Output Parameters (Calculation)

Specifies whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Choose whether or not to reflect this in the scene overall judgement in "Reflect to overall judgement" area.

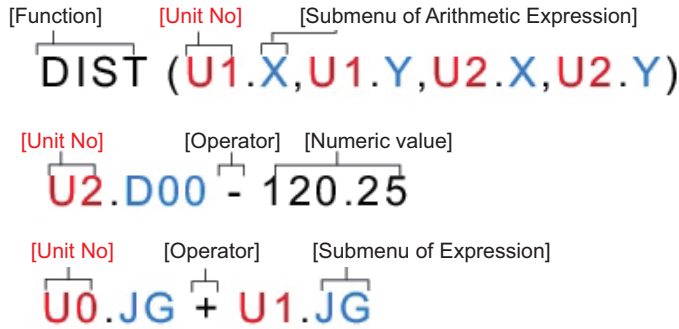
Setting item	Set value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Layout of Setting Expression Window



a Expression Display Area

This area is for setting expressions. The expressions are displayed in the following manner.



b Unit Area

This area is where processing item values set in unit are selected. Clicking [▼] displays the unit number and unit name that have been set up in the currently displayed scene. Select the unit and then select items from sub-menus displayed for use in calculation.

Reference: Each processing item "Measurement Results for Which Output Is Possible"

c General Button Area

These common buttons are required for editing expressions. Numbers and operators can be input here.

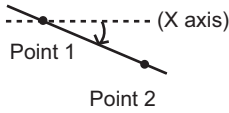
Button	Type	Description
BS	-	Deletes the item directly in the front of the cursor in the expression display area.
DEL	-	Deletes the item directly behind the cursor in the expression display area.
0 to 9	Numerical number	Numbers will be displayed at the cursor position in the expression display area. The number range that can be set up is from -999999999.9999 to 999999999.9999.
.	Symbol	A dot "." will be displayed at the cursor position in the expression display area.
←	Movement	The cursor in the expression display area moves one space to the left.
→	Movement	The cursor in the expression display area moves one space to the right.
(Symbol	Used to set off the numerical expression. Used in pairs with ")".
)	Symbol	Used to set off the numerical expression. Used in pairs with "(".
/	Operator	Indicates division for real numbers.
*	Operator	Indicates multiplication.
-	Operator	Indicates subtraction.
,	Symbol	A comma "," will be displayed at the cursor position in the expression display area.
+	Operator	Indicates addition.
TJG	-	Acquires the overall judgement result for all units ahead of the unit number in which an expression has been set. Reference: ► Conditional Branch Settings Examples (p.828)

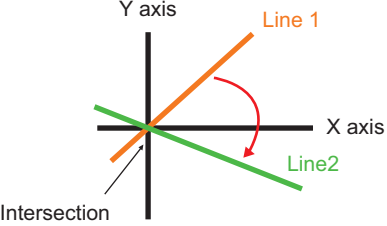
d [FUNC]

Display/Hide the function button area.

e Function Button Area

Buttons for inputting functions.

Function	Description
SIN (equation)	Calculates the sine. The result will be returned within the range of -1 to 1. Indicates the angle designated in the numerical expression in degrees.
COS (equation)	Calculates the cosine. The result will be returned within the range of -1 to 1. Indicates the angle designated in the numerical expression in degrees.
ATAN (Y-axis component, X-axis component)	Calculates the arc tangent of the Y-axis component/X-axis component. The result will be returned in radians within the range of $-\pi$ and π . (Example) For calculation of the angle between the X axis and the straight line that joins the centers of gravity of region 0 and region 1. ATAN (R1.Y-R0.Y, R1.X-R0.X) When both operands equal 0, calculation will return a result of 0 and OK will display.
AND (operand 1, operand 2)	Calculates the logical product. When one of two operands is 0, calculation will return a result of 0, and for all other cases, will return a result of -1.
OR (operand 1, operand 2)	Calculates the logical sum. When both operands are 0, calculation will return a result of 0 and for all other cases, will return a result of -1.
NOT (operand)	Calculates the logical NOT. When the operands equal 0, calculation will return a result of -1 and for all other cases, will return a result of 0 be returned.
ABS (operand)	Calculates the absolute value.
MAX (operand 1, operand 2)	The larger of 2 operands will be returned.
MIN (operand 1, operand 2)	The smaller of 2 operands will be returned.
MOD (dividend, divisor)	Calculates the remainder when dividing the dividend with the divisor. To calculate the remainder, if the number being used is a real number, round off the portion after the decimal point of the real number and then execute the calculation. The result is the remainder after division of the integer. (Example) MOD (13.4) Result: 1 (the remainder when dividing 13 by 4) MOD (25.68,6.99) Result: 5 (the remainder when dividing 26 by 7)
SQRT (operand)	Calculates the square root. When the operand is a negative number, calculation will return a result of 0. Judgement will be NG.
ANGL (Y-axis component, X-axis component)	Calculates the angle made by straight line that connects 2 points (center of gravity/center of model). Calculates the angle relative to the X axis. The result will be returned within the range of -180 to 180. (Example) When calculating the angle produced by the straight lines that join the gravity of Area 0 and that Area 1 ANGL (R1.Y-R0.Y, R1.X-R0.X)  When both the two operands are equal to 0, "0" will be returned, and the judge will become NG.

Function	Description
ANGL (first linear coefficient A, first linear coefficient B, first linear coefficient C, second linear coefficient A, second linear coefficient B, second linear coefficient C)	<p>Calculate the angle of Line 1 and Line 2 in the part that does not go across the Y axis. The same angle can be obtained from both Line 1 and Line 2.</p>  <p>(Example) Use line data at scan edge position 1 and scan edge position 2 to obtain the angle formed by the two lines ANGL (U1.A, U1.B, U1.C, U2.A, U2.B,U2.C)</p>
DIST (X-coordinate of first point, Y-coordinate of first point, X-coordinate of second point, Y-coordinate of second point)	<p>Calculates the distance between 2 points (center of gravity/center of model).</p> <p>(Example) When calculating the distance between the gravity of Area 0 and that of Area 1.</p> <p>DIST (R0.X,R0.Y,R1.X,R1.Y)</p> <p>The following calculation will be performed internally.</p> $\sqrt{(R1.X-R0.X)^2 + (R1.Y-R0.Y)^2}$
DIST (Linear coefficient A, linear coefficient B, linear coefficient C, X coordinate, Y coordinate)	<p>A line and a point are specified to obtain the vertical distance between the line and point.</p> <p>(Example) Obtain the distance between the linear regression at scan edge position 1 and edge position 2 DIST (U1.A, U1.B, U1.C, U2.X, U2.Y)</p>
X (first linear coefficient A, first linear coefficient B, first linear coefficient C, second linear coefficient A, second linear coefficient B, second linear coefficient C)	<p>Calculates intersection (X coordinate) of data for 2 lines (Example) Obtain the X coordinate of the intersection between the lines at scan edge position 1 and scan edge position 2 X (U1.A,U1.B,U1.C,U2.A,U2.B,U2.C)</p>
Y (first linear coefficient A, first linear coefficient B, first linear coefficient C, second linear coefficient A, second linear coefficient B, second linear coefficient C)	<p>Calculates intersection (Y coordinate) of data for 2 lines (Example) Obtain the Y coordinate of the intersection between the lines at scan edge position 1 and scan edge position 2 Y (U1.A,U1.B,U1.C,U2.A,U2.B,U2.C)</p>

Expression Usage Examples

Perform Judgement by Combining Unit Judgement Results

Example 2: Perform judgement by combining the judgement results of unit 0 and unit 1

If a judgement of OK for both unit 0 and unit 1 is achieved, a judgement of OK for the calculation will be achieved.

Expression setting

No.	Comment	Expression
0	Measure	U0.JG+U1.JG
1		
2		
3		
4		
5		
6		

No. 0 Comment view

Comment : Measure

Expression : U0.JG+U1.JG

Result : 0.0000

Judgement condition : -99999999.9999 - 99999999.9999

Step1: The sum of the judgement results (U0.JG, U1.JG) for unit 0 and unit 1 is set up in the expression. The sum of adding the judgement value (1: OK/-1: NG) based on the unit 0 judgement conditions and the judgement value (1: OK/-1: NG) based on the unit 1 judgement conditions is displayed in "Result".

Step2: The expression result of step 1 is judged based on judgement upper and lower limits.

When "2" is set for both the judgement upper and lower limits, the calculation judgement of OK is achieved when both units 0 and 1 are judged as OK.

Judgement results of unit 0 (Judgement value)	Judgement results of unit 1 (Judgement value)	Expression result (Summation results of judgement values for units 0 and 1)	Judgement result of expression
OK (1)	OK (1)	2	OK
NG (-1)	OK (1)	0	NG
OK (1)	NG (-1)	0	NG
NG (-1)	NG (-1)		NG





Using Values of Other Expressions

Up to 8 expressions can be set in 1 expression unit.

The value of other expressions set within the same unit can also be used.

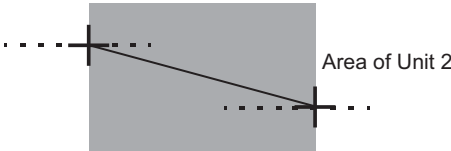
Since expression results obtained by the expression are displayed as D00 to D07 and judgement results of expression are displayed as J00 to J07, this is set to "U3.D00" (results of expression 0 set for processing item [Calculation] of unit number "3") using "unit number calculation results".

For the following scene settings:

	0.Camera Image Input FH
	1.Edge Position
	2.Edge Position
	3.Calculation

Example 1: Calculate the reference position distance and measurement results distance for the edge position and output the difference between the two.

Area of Unit 1



No. 0 Comment view

Comment :

Expression :
DIST(U1.SX,U1.SY,U2.SX,U2.SY)

Result : 385.6323

Judgement condition :
 -

No. 1 Comment view

Comment :

Expression :
DIST(U1.X,U1.Y,U2.X,U2.Y)

Result : 0.0000

Judgement condition :
 -

No. 2 Comment view

Comment :

Expression :
U3.D00-U3.D01

Substitute the operational results of Expression 0 (D00) and Expression 1 (D01)

Set expressions in the following manner.

- **Calculation 0: DIST (U1.SX, U1.SY, U2.SX, U2.SY)**

This expression is used to calculate the distance between the reference positions of unit 1 and unit 2. The function "DIST" calculates the distance between 2 points.

- **Calculation 1: DIST (U1.X,U1.Y,U2.X,U2.Y)**

This expression is used to calculate the distance between the measurement positions of unit 1 and unit 2. The function "DIST" calculates the distance between 2 points.

- **Calculation 2: U3.D01-U3.D00**

(Unit 3: Calculation [Calculation 1] - Unit 3: Calculation [Calculation 0])

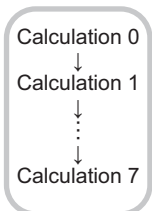
This equation is used to calculate the difference between results of Calculation 1 and Calculation 0 in unit 3 (in this example, Operation).

Note

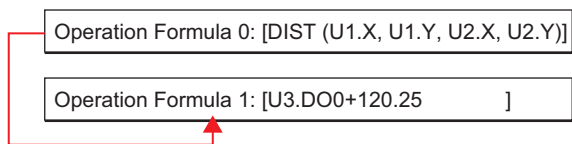
Calculating order of expressions

- Express that use the express results of other expressions must be set with an expression number that is higher than that of the substituted expression. If it is set with a number smaller than the number of the substituted expression, previous expression results of the substituted expression will be inserted.

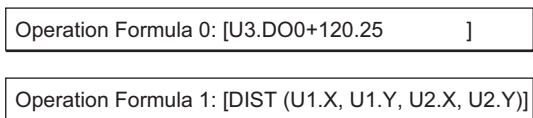
Calculating order



Calculate the distance between the two points in the inspection region in

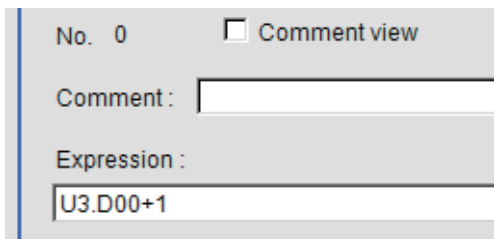


When you substitute these equations with each other



Since the calculation of operation formula 0 is earlier than operation formula 1, the last operation result of operation formula 1 will be substituted into U3 D01

Counting Number of Measurements



The measurement count is counted by adding "1" to each calculation number 0.

Note

- When expression results are cleared or the power is turned off, U3.D00 will return to "0" and the measurement counts will also be reset.

Key Points for Test Measurement and Adjustment (Calculation)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Expression0	Expression result of Expression 0
Expression1	Expression result of Expression 1
Expression2	Expression result of Expression 2
Expression3	Expression result of Expression 3
Expression4	Expression result of Expression 4
Expression5	Expression result of Expression 5
Expression6	Expression result of Expression 6
Expression7	Expression result of Expression 7

Measurement Results for Which Output Is Possible (Calculation)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judgement result
Data 0	D00	Expression result of expression 0
Data 1	D01	Expression result of expression 1
Data 2	D02	Expression result of expression 2
Data 3	D03	Expression result of expression 3
Data 4	D04	Expression result of expression 4
Data 5	D05	Expression result of expression 5
Data 6	D06	Expression result of expression 6
Data 7	D07	Expression result of expression 7
Judge 0	J00	Judgement result of expression 0
Judge 1	J01	Judgement result of expression 1
Judge 2	J02	Judgement result of expression 2
Judge 3	J03	Judgement result of expression 3
Judge 4	J04	Judgement result of expression 4
Judge 5	J05	Judgement result of expression 5
Judge 6	J06	Judgement result of expression 6
Judge 7	J07	Judgement result of expression 7

External Reference Tables (Calculation)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5 to 12	Expression result of Expression 0 - Expression result of Expression 7	Set/Get	-999999999.9999 to 999999999.9999
13 to 20	Judgement result of Expression 0 - Judgement result of Expression 7	Get only	0: Unmeasured, 1: OK, -1: NG
103	Reflect to overall judgement	Set/Get	0: ON, 1: OFF
120	Upper limit 0 for judgement	Set/Get	-999999999.9999 to 999999999.9999
121	Lower limit 0 for judgement	Set/Get	-999999999.9999 to 999999999.9999
122	Upper limit 1 for judgement	Set/Get	-999999999.9999 to 999999999.9999
123	Lower limit 1 for judgement	Set/Get	-999999999.9999 to 999999999.9999
124	Upper limit 2 for judgement	Set/Get	-999999999.9999 to 999999999.9999
125	Lower limit 2 for judgement	Set/Get	-999999999.9999 to 999999999.9999
126	Upper limit 3 for judgement	Set/Get	-999999999.9999 to 999999999.9999
127	Lower limit 3 for judgement	Set/Get	-999999999.9999 to 999999999.9999
128	Upper limit 4 for judgement	Set/Get	-999999999.9999 to 999999999.9999
129	Lower limit 4 for judgement	Set/Get	-999999999.9999 to 999999999.9999
130	Upper limit 5 for judgement	Set/Get	-999999999.9999 to 999999999.9999
131	Lower limit 5 for judgement	Set/Get	-999999999.9999 to 999999999.9999
132	Upper limit 6 for judgement	Set/Get	-999999999.9999 to 999999999.9999
133	Lower limit 6 for judgement	Set/Get	-999999999.9999 to 999999999.9999
134	Upper limit 7 for judgement	Set/Get	-999999999.9999 to 999999999.9999
135	Lower limit 7 for judgement	Set/Get	-999999999.9999 to 999999999.9999
136 + N × 1 (N = 0 to 7)	Expressions comment	Set/Get	Character string
144 + N × 1 (N = 0 to 7)	Expressions	Set/Get	Exp. character string
160 + N × 1 (N = 0 to 7)	Comment view N	Set/Get	0: OFF 1: ON

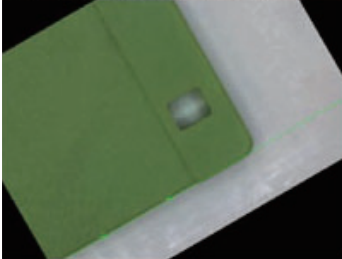
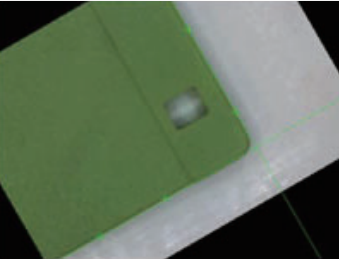
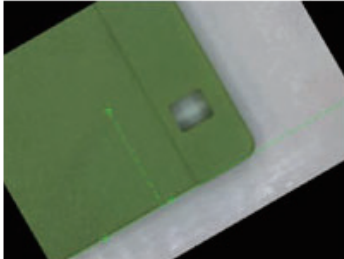
Line Regression

Calculates the line that generates the shortest total distance from multiple measurement coordinates (Line Regression).

It can also calculate the intersection and angle between two lines and the distance between a line and a point.

Used in the Following Case

- For computing a line and for calculating the intersection and distance of lines

<ul style="list-style-type: none"> • Approximate multiple measurement coordinates with a straight line 	<ul style="list-style-type: none"> • Calculate the intersection and angles of two lines. 	<ul style="list-style-type: none"> • Calculate the distance from the line to the point
		

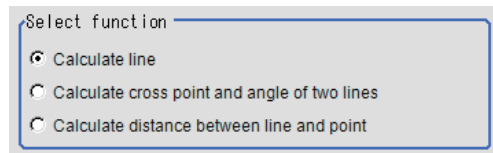
Important

- Do not set processing units that perform affine transformations such as position compensation between Line Regression and a unit that inputs for Line Regression.

Function Selection (Line Regression)

Functions are selected depending on application.

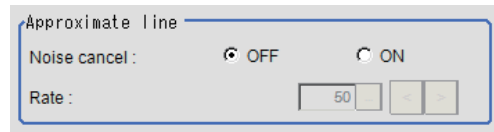
- 1 In the Item Tab area, click [Select function].
- 2 Select a function in the "Select function" area.



Setting item	Set value [Factory default]	Description
Select function	<ul style="list-style-type: none"> • [Calculate line] 	Calculates a straight line providing the shortest distance from multiple points (Line Regression). Set the Line 0 tab.
	<ul style="list-style-type: none"> • Calculate cross point and angle of two lines 	Calculates the intersection and angle between 2 Line Regressions. Set the Line 0 tab and Line 1 tab. The angle is measured from Line 0 to Line 1 in clockwise order.
	<ul style="list-style-type: none"> • Calculate distance between line and point 	Calculates the distance between a Line Regression and a point. Set the Line 0 and Point tab.

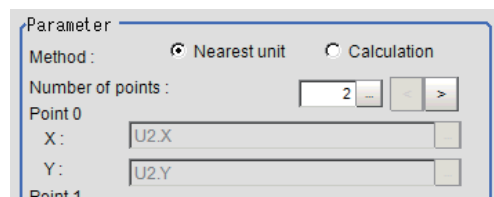
Line 0 (Line Regression)

- 1 In the Item Tab area, click [Line 0].
- 2 Set it to remove noise points when calculating lines.



Setting item	Set value [Factory default]	Description
Noise cancel	<ul style="list-style-type: none"> • [OFF] • ON 	When a check is placed at [ON], an approximate line is found by excluding the points with large deviation among the measured points.
Rate	0 to 100 [50]	Specify the ratio (%) of the points that are removed as noise.

- 3 Set each item in the "Parameter" area.



Setting item	Set value [Factory default]	Description
Method	<ul style="list-style-type: none"> • [Nearest unit] • Calculation 	<p>Nearest unit: Calculated from data of several continuous coordinate measurement units that were just performed. The number of units referenced is indicated by the Number of points. If a unit where coordinate measurement is not performed is included in Nearest unit, calculation will not be performed properly and measurement will be NG.</p> <p>Calculation: Calculated from expression set up.</p> <p>Reference: ▶ When Calculation is Selected (p.625)</p>
Number of points	[2] to 8	Set up the number of coordinate points used for calculation.

- 4 Click [OK].

When Calculation is Selected

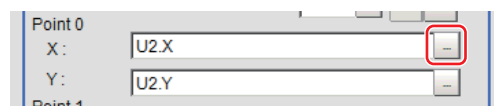
- 1 Click [...] for the expression and set the expression.

The Setting Expression window is displayed.

Reference: ▶ Layout of Setting Expression Window (p.615)

- 2 After setting up the expression, click [OK].

The expression is confirmed.



Line 1 (Line Regression)

"Line 1" is only valid if "Calculate cross point and angle of two lines" is selected in Select function.

- The set up method is the same as for [Line 0].
- Reference: ▶ Line 0 (Line Regression) (p.625)

Point (Line Regression)

"Point" is only valid if "Calculate distance between line and point" is selected in "Select function".

- 1** Click [Point] in the Item Tab area.
- 2** Click [...] for the expression and set the expression.

The Setting Expression window is displayed.

- 3** After setting up the expression, click [OK].

The expression is confirmed.

Key Points for Test Measurement and Adjustment (Line Regression)

The following content can be confirmed in the "Detail result" area using text.

Displayed items	Description
Judge	Judgement result
Line parameter 0 A	Parameter A of line 0
Line parameter 0 B	Parameter B of line 0
Line parameter 0 C	Parameter C of line 0
Line parameter 1 A	Parameter A of line 1 (only displayed when calculating the intersection of 2 lines)
Line parameter 1 B	Parameter B of line 1 (only displayed when calculating the intersection of 2 lines)
Line parameter 1 C	Parameter C of line 1 (only displayed when calculating the intersection of two lines)
Cross point X	X coordinate of intersection (only displayed when calculating the intersection of two lines or calculating the distance between a line and a point)
Cross point Y	Y coordinate of intersection (only displayed when calculating the intersection of two lines or calculating the distance between a line and a point)
Angle	Angle between two lines (only displayed when calculating the intersection of two lines)
Point X	X coordinate of input point (only displayed when calculating the distance between a line and a point)
Point Y	Y coordinate of input point (only displayed when calculating the distance between a line and a point)
Distance	Distance between line 0 and an input point (only displayed when calculating the distance between a line and a point)

Measurement Results for Which Output Is Possible (Line Regression)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judge
Line Param. 0	A	Parameter A of line 0
Line Param. 0	B	Parameter B of line 0
Line Param. 0	C	Parameter C of line 0
Line Param. 1	A1	Parameter A of line 1
Line Param. 1	B1	Parameter B of line 1
Line Param. 1	C1	Parameter C of line 1
Cross point X	CX	X coordinate of intersection
Cross point Y	CY	Y coordinate of intersection
Angle	TH	Angle between two lines
Point X	PX	X coordinate of input point
Point Y	PY	Y coordinate of input point
Distance	DS	Distance between line 0 and input point

External Reference Tables (Line Regression)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Line Param. 0 A	Get only	-99999.9999 to 99999.9999
6	Line Param. 0 B	Get only	-99999.9999 to 99999.9999
7	Line Param. 0 C	Get only	-99999.9999 to 99999.9999
8	Line Param. 1 A	Get only	-99999.9999 to 99999.9999
9	Line Param. 1 B	Get only	-99999.9999 to 99999.9999
10	Line Param. 1 C	Get only	-99999.9999 to 99999.9999
11	Cross point X	Get only	-99999.9999 to 99999.9999
12	Cross point Y	Get only	-99999.9999 to 99999.9999
13	Angle	Get only	0.0000 to 180.0000
14	Point X	Get only	-99999.9999 to 99999.9999
15	Point Y	Get only	-99999.9999 to 99999.9999
16	Distance	Get only	0.0000 to 99999.9999
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
120	Function type	Set/Get	0: Calculate line 1: Calculate cross point and angle of two lines 2: Calculate distance between line and point

No.	Data name	Set/Get	Data range
121	Noise cancel 0	Set/Get	0: Noise cancel OFF 1: Noise cancel ON
122	Noise cancel 1	Set/Get	0: Noise cancel OFF 1: Noise cancel ON
123	Number of points 0	Set/Get	2 to 8
124	Number of points 1	Set/Get	2 to 8
125	Method 0	Set/Get	0: Nearest unit 1: Expression
126	Method 1	Set/Get	0: Nearest unit 1: Expression
130	Expressions (Line 0 Point 0 coordinate X)	Set/Get	Exp. character string
131	Expressions (Line 0 Point 0 coordinate Y)	Set/Get	Exp. character string
132	Expressions (Line 0 Point 1 coordinate X)	Set/Get	Exp. character string
133	Expressions (Line 0 Point 1 coordinate Y)	Set/Get	Exp. character string
134	Expressions (Line 0 Point 2 coordinate X)	Set/Get	Exp. character string
135	Expressions (Line 0 Point 2 coordinate Y)	Set/Get	Exp. character string
136	Expressions (Line 0 Point 3 coordinate X)	Set/Get	Exp. character string
137	Expressions (Line 0 Point 3 coordinate Y)	Set/Get	Exp. character string
138	Expressions (Line 0 Point 4 coordinate X)	Set/Get	Exp. character string
139	Expressions (Line 0 Point 4 coordinate Y)	Set/Get	Exp. character string
140	Expressions (Line 0 Point 5 coordinate X)	Set/Get	Exp. character string
141	Expressions (Line 0 Point 5 coordinate Y)	Set/Get	Exp. character string
142	Expressions (Line 0 Point 6 coordinate X)	Set/Get	Exp. character string
143	Expressions (Line 0 Point 6 coordinate Y)	Set/Get	Exp. character string
144	Expressions (Line 0 Point 7 coordinate X)	Set/Get	Exp. character string
145	Expressions (Line 0 Point 7 coordinate Y)	Set/Get	Exp. character string
146	Expressions (Line 1 Point 0 coordinate X)	Set/Get	Exp. character string
147	Expressions (Line 1 Point 0 coordinate Y)	Set/Get	Exp. character string
148	Expressions (Line 1 Point 1 coordinate X)	Set/Get	Exp. character string

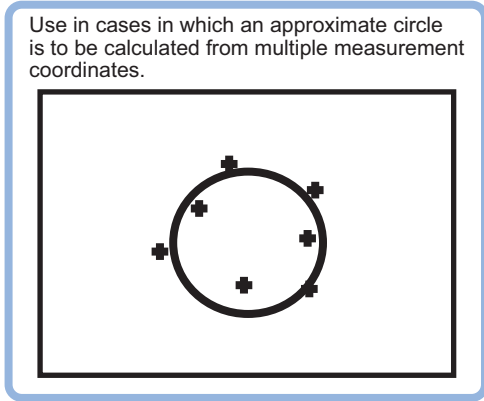
No.	Data name	Set/Get	Data range
149	Expressions (Line 1 Point 1 coordinate Y)	Set/Get	Exp. character string
150	Expressions (Line 1 Point 2 coordinate X)	Set/Get	Exp. character string
151	Expressions (Line 1 Point 2 coordinate Y)	Set/Get	Exp. character string
152	Expressions (Line 1 Point 3 coordinate X)	Set/Get	Exp. character string
153	Expressions (Line 1 Point 3 coordinate Y)	Set/Get	Exp. character string
154	Expressions (Line 1 Point 4 coordinate X)	Set/Get	Exp. character string
155	Expressions (Line 1 Point 4 coordinate Y)	Set/Get	Exp. character string
156	Expressions (Line 1 Point 5 coordinate X)	Set/Get	Exp. character string
157	Expressions (Line 1 Point 5 coordinate Y)	Set/Get	Exp. character string
158	Expressions (Line 1 Point 6 coordinate X)	Set/Get	Exp. character string
159	Expressions (Line 1 Point 6 coordinate Y)	Set/Get	Exp. character string
160	Expressions (Line 1 Point 7 coordinate X)	Set/Get	Exp. character string
161	Expressions (Line 1 Point 7 coordinate Y)	Set/Get	Exp. character string
162	Expressions(Point coordinateX)	Set/Get	Exp. character string
163	Expressions(Point coordinateY)	Set/Get	Exp. character string
164	Rate 0	Set/Get	0 to 100
165	Rate 0	Set/Get	0 to 100

Circle Regression

Calculates the circle that generates the shortest total distance from multiple measurement coordinates (Circle Regression).

Used in the Following Case

- This is used when calculating the center and radius of a circle.

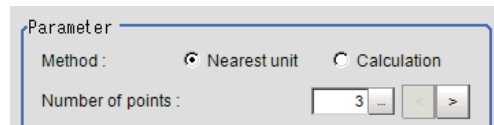


Important

- Do not set processing units that perform affine transformations such as position compensation between Circle Regression and a unit that inputs for Circle Regression.

Parameter Settings (Circle Regression)

- 1 Set each item in the "Parameter" area.



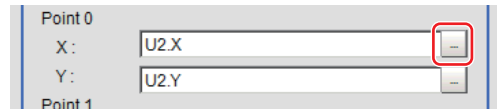
Setting item	Set value [Factory default]	Description
Method	<ul style="list-style-type: none"> • [Nearest unit] • Calculation 	<p>Nearest unit: calculated from the unit data of several continuous coordinates that were just measured. The number of units referenced is indicated by the Number of points. If a unit where coordinate measurement is not performed is included in Nearest unit, calculation will not be performed properly and measurement will be NG.</p> <p>Calculation: Calculated from expression set up.</p> <p>Reference: ► When Calculation is Selected (p.625)</p>
Number of points	[3] to 8	Set up the number of coordinate points used for calculation.

- 2 Click [OK].

When Calculation is Selected

- 1 Click [...] for the expression and set the expression.

The Setting Expression window is displayed.



- 2 After setting up the expression, click [OK].

The expression is confirmed.

Key Points for Test Measurement and Adjustment (Circle Regression)

The following content can be confirmed in the "Detail result" area using text.

Displayed items	Description
Judge	Judgement result
Central X	Central X
Central Y	Central Y
Radius R	Radius

Measurement Results for Which Output Is Possible (Circle Regression)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judgement	JG	Judge
Center Axis	X	Center Axis X
Center Axis	Y	Center Axis Y
Radius	R	Radius

External Reference Tables (Circle Regression)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Central X	Get only	-99999.9999 to 99999.9999
6	Central Y	Get only	-99999.9999 to 99999.9999
7	Radius	Get only	0 to 99999.9999
101	Output Coordinates	Set/Get	0: After scroll 1: Before scroll
102	Calibration	Set/Get	0: OFF 1: ON
121	Number of points	Set/Get	3 to 8
122	Method	Set/Get	0: Nearest unit 1: Expression
130	Expressions (Point0 coordinate X)	Set/Get	Exp. character string
131	Expressions (Point0 coordinate Y)	Set/Get	Exp. character string
132	Expressions (Point 1 coordinate Y)	Set/Get	Exp. character string
133	Expressions (Point 1 coordinate X)	Set/Get	Exp. character string
134	Expressions (Point 2 coordinate X)	Set/Get	Exp. character string
135	Expressions (Point 2 coordinate Y)	Set/Get	Exp. character string
136	Expressions (Point 3 coordinate X)	Set/Get	Exp. character string
137	Expressions (Point 3 coordinate Y)	Set/Get	Exp. character string
138	Expressions (Point 4 coordinate X)	Set/Get	Exp. character string
139	Expressions (Point 4 coordinate Y)	Set/Get	Exp. character string
140	Expressions (Point 5 coordinate X)	Set/Get	Exp. character string
141	Expressions (Point 5 coordinate Y)	Set/Get	Exp. character string
142	Expressions (Point 6 coordinate X)	Set/Get	Exp. character string
143	Expressions (Point 6 coordinate Y)	Set/Get	Exp. character string
144	Expressions (Point 7 coordinate X)	Set/Get	Exp. character string
145	Expressions (Point 7 coordinate Y)	Set/Get	Exp. character string

Precise Calibration

This corrects for camera tilt, and also corrects image distortion caused by the camera lens. Also, by setting the calibration, the measurement result can be converted and output as actual dimensions.

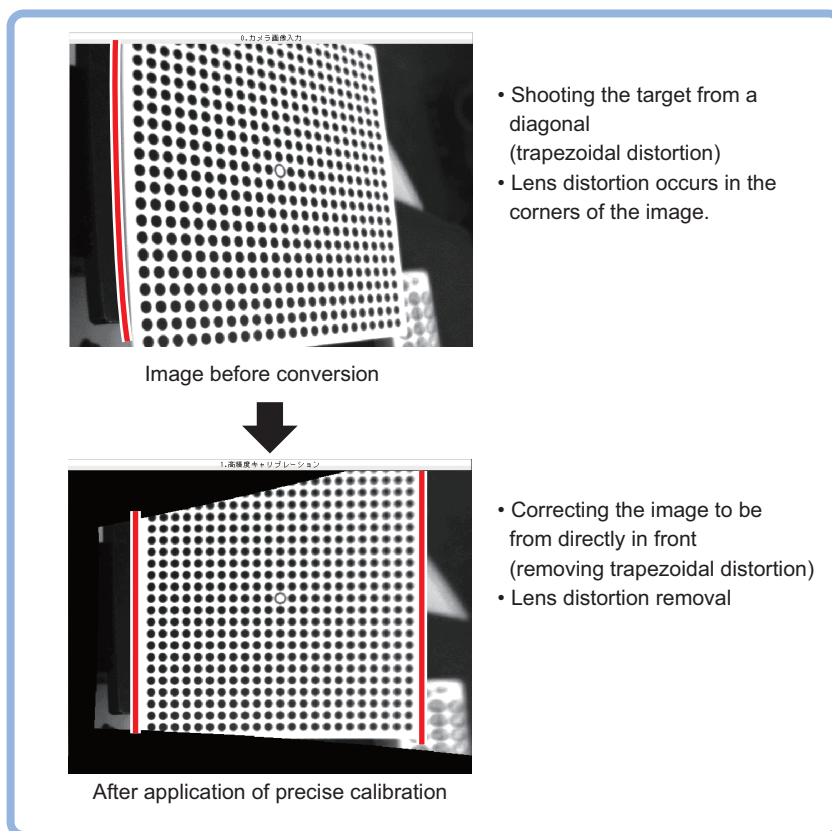
A calibration parameter that corrects the X and Y coordinates is generated in this processing item. There is no correction for angle, area, line and distance.

Make sure to set 5 or more actual coordinates when you perform Precise Calibration.

Calibration is also available for camera image input and the calibration data from just prior to the unit referencing calibration data becomes effective.

Used in the Following Case

- Processing a trapezoidal image shot tilted to make it easier to inspect
- Processing an image that has lens distortion to make it easier to inspect
- Setting calibration for an image in which there is lens distortion or trapezoidal distortion



Note

A square-matrix calibration plate pattern (Pattern) printed by the Calibration Plate Print Tool (refer to: *the Calibration Plate Print Tool in the Vision Sensor FH Series Operation Manual for Sysmac Studio* (Cat. No. Z343-E1)) can be used in this processing item.

The accuracy of the calibration will be affected by the accuracy of the Calibration Plate. If the Pattern is printed on paper, the quality of the paper and/or degree of print jitter also affects the accuracy of the calibration.

If sub-pixel level accuracy is required, use OMRON pattern plate (FZD-CAL 3D Calibration Tool).

Important

- If these processing items are performed for an image for which other processing items are also being performed, the correction may not be performed correctly. Always perform these processing items immediately after image input from the camera.
- Please make sure the points taught for calibration are distributed evenly on the screen. If they are distributed unevenly, the correction may not be performed properly.
- About limits on the number of precise calibration used

For the FZ5-L3□□/6□□ series models, the number of precise calibration processing items that can be used in the same scene group is limited according to the camera in use. Do not exceed this limitation. In the case of the FH series/ FZ5-800 series/ FZ5-1100 series/ FZ5-1200 series, the number of processing items is not limited and can be registered as long as there is sufficient free memory.

If the amount of used memory increases and the amount of free memory becomes insufficient, it may cause errors in operation mode switching or in adding Processing Units into the measurement flow. Please check the memory consumption when you create scenes.

Type of sensor controller	0.3 megapixel camera	Intelligent Compact Digital Camera	2 megapixel camera	5 megapixel camera	0.3 megapixel camera (FH)	2 megapixel camera (FH)	4 megapixel camera (FH)
FZ5-L35□ FZ5-6□□	30	28	7	2	---	---	---

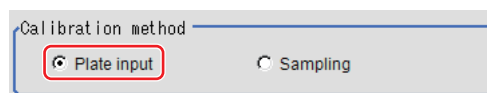
Calibration (Precise Calibration)

Set the input image conversion method (calibration parameters). This only calculates the parameters used in calibration. The actual correction is performed from the image correction tab.

Setting with the Pattern Plate

The parameters are calculated automatically by shooting the Omron pattern plate (FZD-CAL 3D Calibration tool).

- 1** In the Item Tab area, click [Calibration settings].
- 2** In the "Calibration method" area, select "Plate input".



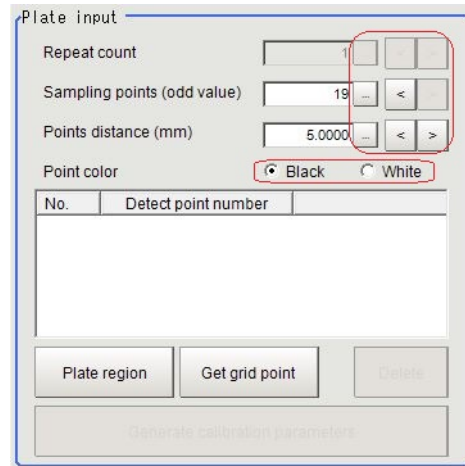
Setting item	Set value [Factory default]	Description
Calibration method	<ul style="list-style-type: none"> • [Plate input] • Sampling 	Set the calibration parameter setting method.

- 3** In the "Display" area, click [Change display] to switch between camera image types.

The displayed contents of the image display area will be switched.

Setting item	Set value [Factory default]	Description
Display	Through image display	The latest image is always input from the camera and displayed.
	[Freeze image]	The image that was scanned in the immediately preceding measurement is displayed.

4 Shoot the pattern plate and set each item.



Setting item	Set value [Factory default]	Description
Repeat count	1 to 10 [1]	Shooting the plate multiple times enables detection with grid points stabilized even for images with high noise levels. Set the number of repetitions.
Sampling points	1.0000 to 1000.0000 [5.0000]	Set the point string count for the pattern plate.
Points distance	1 to 1000 [5]	Set the point interval for the pattern plate. The unit is in millimeters (mm).
Point color	<ul style="list-style-type: none"> • [Black] • White 	Set the color of the circle marks on the pattern plate.

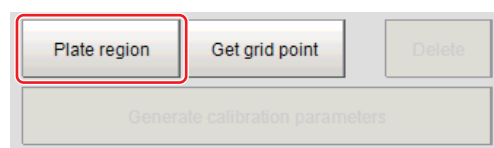
5 Set the plate region as necessary.

The default value setting is for the entire screen.

Note

- Grid point extraction may fail if anything other than the pattern plate appears in the image. Specify the plate region in this case.
- Grid point extraction may fail if a circle mark on the pattern plate appears incomplete or unclear. Exclude the problem circle mark from the plate region in this case.
- Grid point extraction may fail if the brightness difference between white and black regions on the pattern plate is small, or if there is variation in brightness. Adjust the lighting or camera settings in this case.

Click [Plate region].



Use the drawing tools to specify the pattern plate range.

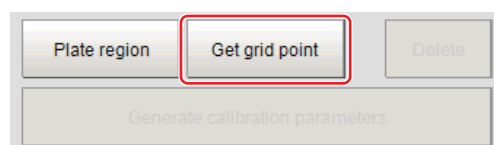
Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
- [Cancel]: Changes are discarded. Returns to the previous menu.
- [Apply]: Updates the settings without leaving edit window.

The pattern plate range is registered.

6 Click [Get grid point].

The grid points gotten are listed in the Plate input area.



Note

- When the plate is small relative to the field of view, the plate is moved and the grid point is extracted multiple times. By selecting a through image and repeating Operations 4-6, the information can be scanned in for plates laid out at different positions.

7 Delete grid points as necessary.**Important**

- After generating calibration parameters, if you delete grid points or change settings, the calibration parameters are deleted. In this case, it is necessary to generate new calibration parameters.
- The deleted grid points are deleted from the list.

Set the grid points to be deleted from the list.
Click [Delete].

No.	Detect point number
0	(361)

8 Click [Generate calibration parameters].

The calibration parameters will be generated.

Setting Calibration through Sampling Measurement (Sampling)

This is a method for setting calibration based on measurement results.

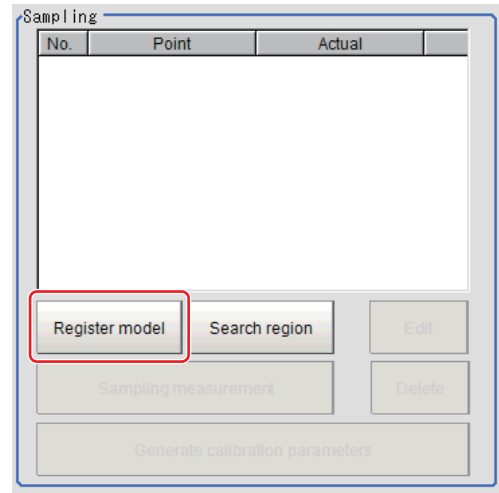
Calibration parameters are calculated automatically when a registered model is searched and the actual coordinates for that position entered.

For actual coordinate input, input as at least two straight lines that make up straight lines parallel with the X and Y coordinates. Also, input at least 3 points for each straight line.

1 In the Item Tab area, click [Calibration settings].

2 In the "Calibration method" area, select "Sampling".

- 3** In the "Sampling" area, click [Register model].



- 4** Use the Drawing tools to register the model.

- 5** Adjust the search region as necessary.

The default value setting is for the entire screen.

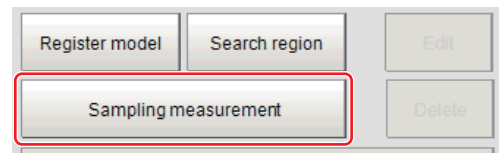
Click [Search region].

Use the drawing tools to specify the measurement region.

Click [OK] in the Figure setting area.

- [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.
- The area in which to perform filtering is registered.

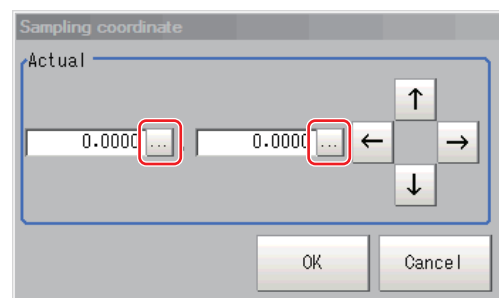
- 6** Click [Sampling measurement].



Measurement is performed.

The search result (cross-shaped cursor) is displayed in the image display area, and the Sampling Coordinate window is displayed.

- 7** In the sampling coordinate window, enter the X and Y values.



- 8** Click [OK].

Point coordinates and actual coordinates are registered in the "Sampling" area.

- 9** Move the measurement object and repeat the Steps Reference: ▶ 3 (p.637) to Reference: ▶ 8 (p.637).

- 10** Edit or delete coordinates as necessary.

Important

- After generating calibration parameters, if you edit or delete coordinates, the calibration parameters are updated.
- The deleted coordinates are deleted from the list.

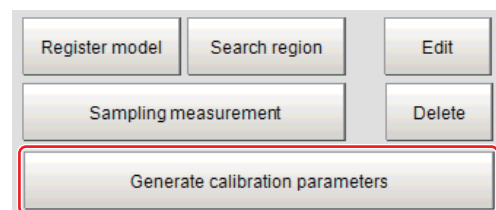
Set the grid points to be edited or deleted from the list.

Click [Edit] or [Delete].

No.	Point	Actual
0	(153,29)	(0,0)
1	(509,404)	(500,400)
2	(273,253)	(200,300)
3	(426,363)	(450,360)

If you clicked [Edit], execute StepReference: ▶ 7. (p.637)

11 Click [Generate calibration parameters].



The calibration parameters will be generated.

Calibration status		
Calibration parameters are generated		
Precision error	X max. (mm)	0.0110
	Y max. (mm)	0.0100

Note

- If the precision of input grid points is poor, parameter generation may fail. Set again so that the grid points are shown clearly.
- The precision error is a yardstick for calibration, not a guarantee of actual precision.

Height Adjustment (Precise Calibration)

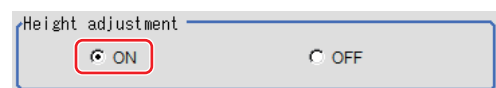
Even if the plane height is different for calibration and for measurement, adjust so that the correct coordinates can be corrected for.

Important

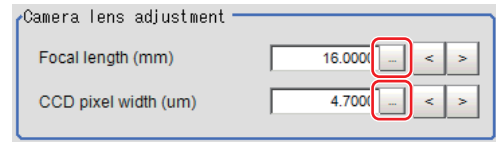
- The height adjustment is only valid when the camera is facing the measurement object level. If the camera is tilted, it may be impossible to correct the image accurately.
- The results of height adjustment are not applied to image correction.

1 In the Item Tab area, click [Height adjustment].

2 Select "ON" in the Height adjustment area.

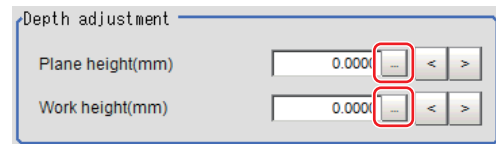


3 Input the numeric values in the Camera lens adjustment area.



Setting item	Set value [Factory default]	Description
Focal length	3.0000 to 200.0000 [16]	Input the focal distance of the camera used for shooting in mm.
CCD pixel width	1.0000 to 15.0000 [4.7]	Set the camera pixel size. Input in μm .

4 Input the numeric values in the Depth adjustment area.



Setting item	Set value [Factory default]	Description
Plane height	-100.0000 to 100.0000 [0.0000]	Input the plate height in mm.
Work height	-100.0000 to 100.0000 [0.0000]	Input the measurement object height in mm.

Important

- For the depth adjustment, input the height from the reference surface where the work is placed. Set the plate height and the work height from the reference surface.

Image Correction (Precise Calibration)

Execute actual image correction based on the parameters generated with the [Calibration settings] tab.

- 1 In the Item Tab area, click [Image correction].
- 2 Select "ON" in the Correction settings area.

When the calibration parameters generation is complete, the corrected image is displayed according to the settings.



Important

- If the grid points were distributed unevenly when the parameters were created, the image may not be corrected properly.
- When the image correction function is ON, only the left-hand coordinate system is supported when entering X and Y on the Sampling Coordinate window. If X and Y are entered in the right-hand coordinate system, the image is not converted normally.

Measurement Results for Which Output Is Possible (Precise Calibration)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference Tables (Precise Calibration)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (not yet measured) 1: Judgement result OK -1: Judgement result NG
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Coordinate indication method	Set/Get	Select the grid point detection method. 0: Sampling 1: Pattern plate
121	Correction settings	Set/Get	0: Corrected image not output 1: Corrected image output
183	Grid point average repetition count	Set/Get	1 to 10
240	Focal distance of lens [mm]	Set/Get	3.0000 to 200.0000
241	CCD1 pixel size [μm]	Set/Get	1.0000 to 15.0000
242	Plate height [mm]	Set/Get	-100.0000 to 100.0000
243	Workpiece height [mm]	Set/Get	-100.0000 to 100.0000
244	Depth settings	Set/Get	0: Off 1: On
260	Margin/X maximum	Get only	-1.0000 to -1.0000
261	Margin/Y maximum	Get only	-1.0000 to -1.0000

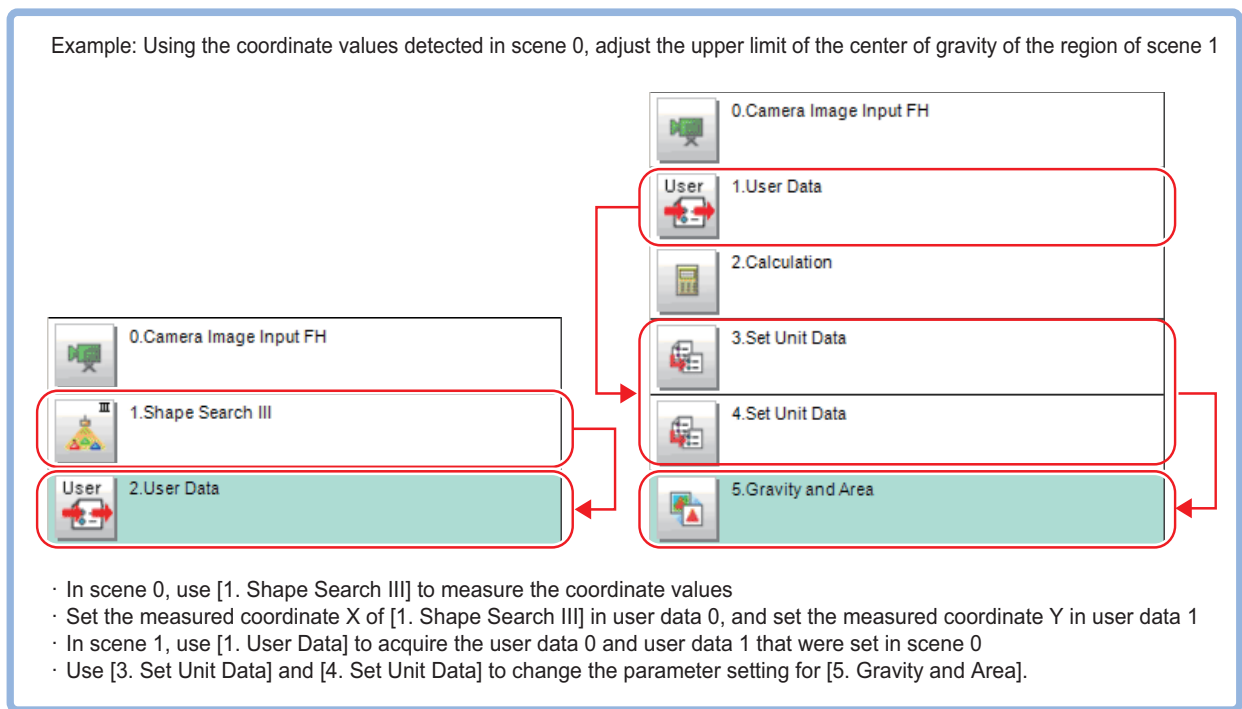
User Data

User data is data that can be shared by scenes in the sensor controller. User data values are stored as system data, and the same user data can be accessed from different scenes. User data processing items can be used to set and acquire user data. If you want to set default values or comments in user data, use the User Data Tool in addition to the user data processing items.

For details on the communication commands, refer to Reference: ▶ “Using User Data Tool [How to Set User Data]” in “Section 4 Using Tools” in the “Vision System FH/FZ5 Series User’s Manual (Cat. No. Z365).”

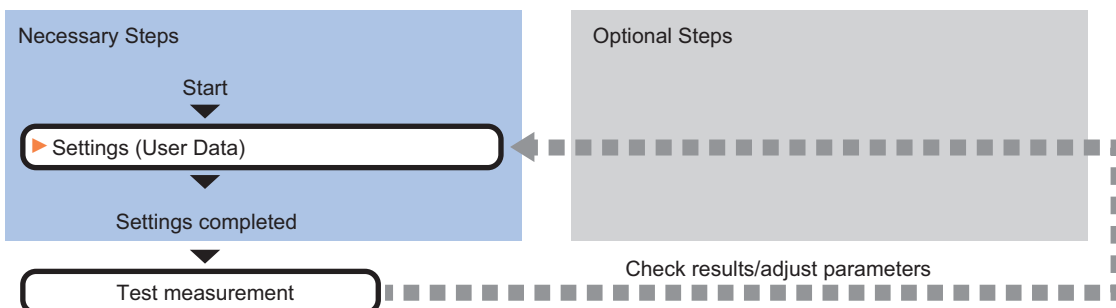
Used in the Following Case

- When you want to share any set data among multiple processing units



Settings Flow (User Data)

Set up user data according to the following steps.



List of User Data Items

The following items can be set in user data.

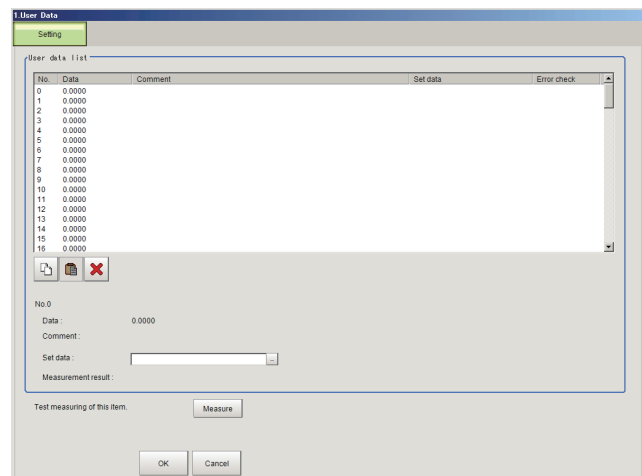
Item name	Description
Setting	Set the values and calculation expressions to be set as user data. The number of user data items that can be used is 100. Reference: ► Settings (User Data) (p.642)

Settings (User Data)

Set the values and calculation expressions to be set as user data. The number of user data items that can be used is 100.

- 1** In the Item Tab area, click [Setting].
- 2** In the User Data List area, select the calculation expression to be set as user data.
- 3** In the User Data List area, click [...] next to the setting data.
- 4** Set the calculation expression.
- 5** When you have finished setting the calculation expression, click [OK].

The entered calculation expression is finalized.



Note

- If the calculation expression in the setting data is invalid when the setting screen is opened, an “Setting error in the set data.” message will appear. The error symbol “E” will also appear in the error check field. Correct the calculation expression for which “E” appears. The error message will not clear until there are no “E” symbols.
- If you do not set a calculation expression, you can acquire the raw values of the corresponding user data number as measurement results. If you set a calculation expression, you can acquire as measurement results the user data values with the calculation results applied.

Key Points for Test Measurement and Adjustment (User Data)

You can adjust the parameters while you perform test measurements and check the measurement results to increase the measurement precision and speed.

Select the adjustment method by considering the following point.

Check the measurement results that can be displayed and output in “Measurement Results for Which Output Is Possible”.

Note

- When you perform test measurement, the display of the details and image are updated according to the measurement results.

Items Displayed in the Detail Result Area

The following measurement results are displayed in the “Detail result” area as text.

Displayed item	Description
Judge	Displays the judgement result for the processing unit.

Items Displayed in the Image Display Area

You can specify a sub-image number to display the next image in the image display area.

Sub image number	Description
0	The measurement image appears.

Measurement Results For Which Output Is Possible (User Data)

The measurement results provided by user data are shown below. The measurement results appear in the “Detail Result” area, and you can also use result output processing items to output the measurement results to an external device.

Refer to the “External Reference Tables” for the parameters that can be referenced, including measurement results.

(Reference: ► External Reference Table (User Data) (p.643))

Measurement item	Character string	Description
Judge	JG	The judgement result for the processing unit
Setting data 00 to Setting data 99	DT00 to DT99	Values of user data 00 to User data 99

Note

- When a calculation expression is not set in the setting data, the raw values of the user data can be acquired as measurement results. When a calculation expression is set, you can acquire as measurement results the user data values with the calculation results applied.

External Reference Table (User Data)

By specifying a number, you can access the following data from processing items that support processing unit data setting/acquisition, and from control commands.

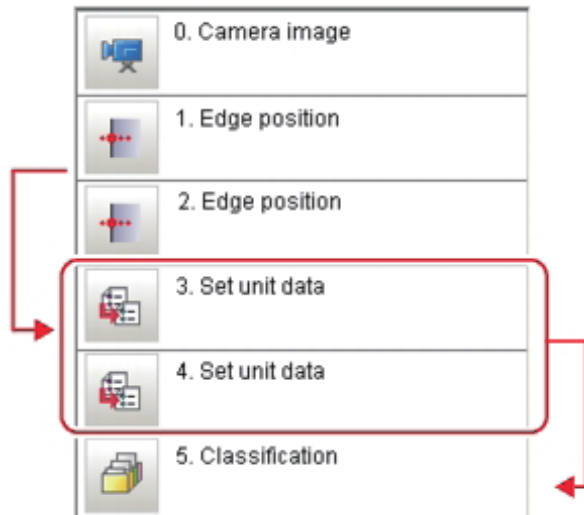
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
200+N (N=0 to 99)	User Data	Set/Get	Expression character string
1000 to 1099	Calculation result	Get only	-999,999,999.9999 to 999,999,999.9999

Set Unit Data

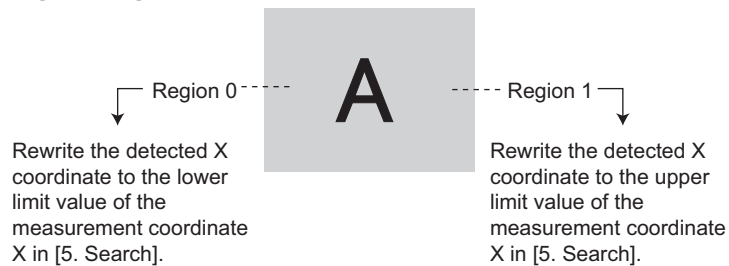
Used in the Following Case

- When you want to overwrite processing unit data while measuring

Example) Adjust the search range based on the size of measurement object.



- Measurement the width of the measurement object by "1 Edge position" and "2 Edge position"
- Adjust the judgement condition of the measurement coordinate X in [5. Search] based on the result.

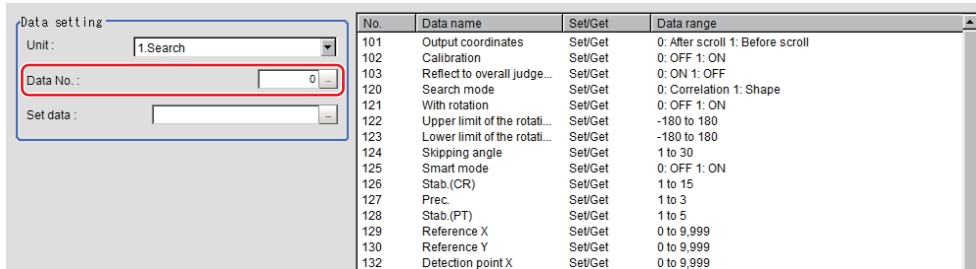


Parameter Settings (Set Unit Data)

1 In the "Data setting" area, select the target unit to overwrite.

The data number, data name, and data range that can be used in the target units are displayed on the right side.

2 Click [...] for "Data No." and set the target data number.



The designated data No. will be different depending on the processing item.

► For more details, refer to External Reference Table for each processing item.

Important

- Only numeric data can be used for the processing unit data setting.
- To get character string data, use the macro customize functions.
- Those items whose data range are described as "Character String" in the external reference data list are character string data.

3 In the "Data setting" area, overwrite details are set up using an expression.

Reference: ► Layout of Setting Expression Window (p.615)

4 Click [OK].

The settings are finalized.

Measurement Results for Which Output Is Possible (Set Unit Data)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Latest processing unit judgement result
Data	DT	Calculation result of setup data (formula)

External Reference Tables (Set Unit Data)

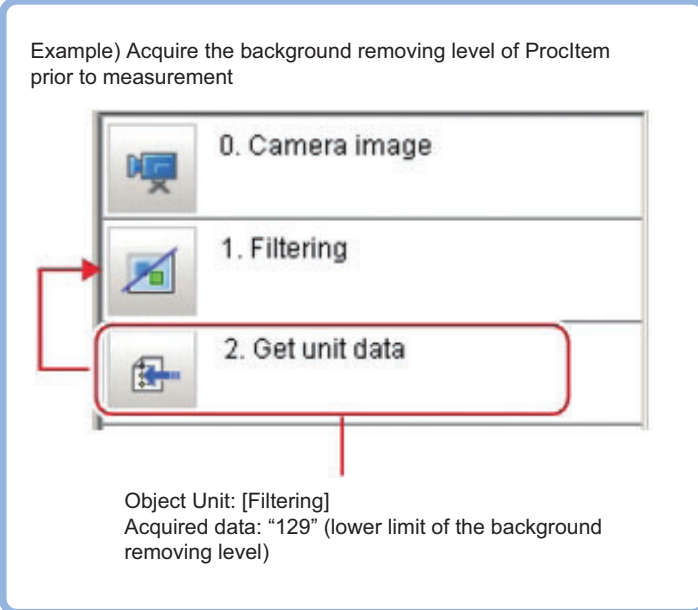
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgment (unmeasured) 1: Judgment result OK -1: Judgment result NG
5	Data	Get only	-999999999.9999 to 999999999.9999
120	Unit	Set/Get	0 to 9999
121	Data No.	Set/Get	0 to 99999
122	Expressions	Set/Get	Expression character string

Get Unit Data

Used in the Following Case

- When you want to acquire processing unit data while measuring

Example) Acquire the background removing level of Procltem prior to measurement



Object Unit: [Filtering]
Acquired data: "129" (lower limit of the background removing level)

Parameter Settings (Get Unit Data)

- 1** In the "Data setting" area, click the "Get data number" [...] or [>] to set the number of target data.

The data number, data name, and data range that can be used in the target units are displayed on the right side.

- 2** From the list, click the "No." of the data for which you are setting the acquisition target.

The No. selected will be displayed below the list.

- 3** Click [▼] for "Scene" and specify the scene number of the desired processing unit.

For more details, refer to External Reference Tables for each processing item.

- 4** Click [▼] for "Unit" and specify the desired unit.

- 5** Click [...] for "Data No." and specify the desired data No.

The designated data No. will be different depending on the processing item.

For more details, refer to External Reference Tables for each processing item.

Get data number : ... < >

No.	Scene	Unit	Data No.
0	Current scene	0.Camera Image I...	0

No.	Scene	Unit	Data No.
0	Current scene	0.Camera Image I...	0
1	Current scene	0.Camera Image I...	0
2	Current scene	0.Camera Image I...	0

Scene : ▼

Unit : ▼

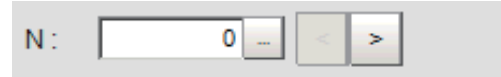
Data No. : ...

Important

- Only numeric data can be obtained for the processing unit data acquisition.
- To get character string data, use the macro customize functions.
- Those items whose data range are described as "Character String" in the external reference data list are character string data.

Note

- Clicking the desired data on the list enters the "Data No." of the clicked position.
- If ">" of "N" at the bottom of the list is clicked, the "Data No." with the N value of the number taken into account can be set.



6 Click [OK].

The settings are finalized.

Measurement Results for Which Output Is Possible (Get Unit Data)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Data 00 to 15	DT00 to DT15	The values in the data 00 to 15

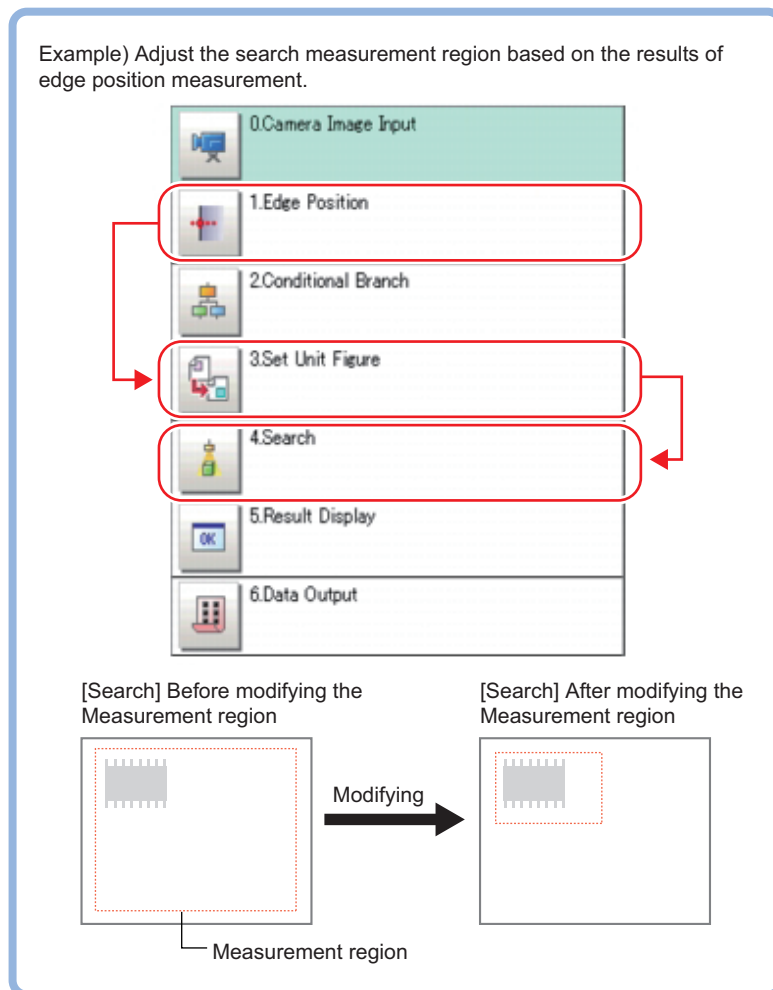
External Reference Tables (Get Unit Data)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgment (unmeasured) 1: Judgement result OK -1: Judgement result NG
5 + N (N = 0 to 15)	Data	Get only	-999,999,999.9999 to +999,999,999.9999
220	Number of acquired data	Set/Get	1 to 16
221 + N (N = 0 to 15)	Scene	Set/Get	-1 to 9,999 If it is -1, refers to the current scene.
321 + N (N = 0 to 15)	Unit	Set/Get	0 to 9,999
421 + N (N = 0 to 15)	Data No.	Set/Get	0 to 99,999

Set Unit Figure

Used in the Following Case

- When changing the measurement area based on the measurement results



Important

- Do not insert "Input image" processing items or "Compensate image" processing items between the "Set Unit Figure" and the target processing unit. The processing unit figure may go out. The processing unit figure may go out.

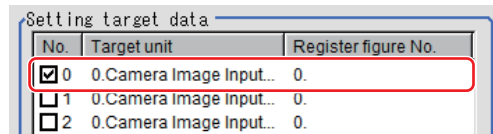
Reference: ▶ Input image (p.23)

Reference: ▶ Compensate image (p.509)

Parameter Settings (Set Unit Figure)

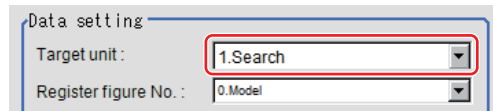
Up to 8 figures can be set for each set unit figure.
To set multiple figures for one target unit,
set different register figure Nos.

1 Click the target unit in the "Setting target data" area and check the No. column.



2 In the "Data setting" area, click the [Target unit] [▼] to select the target unit.

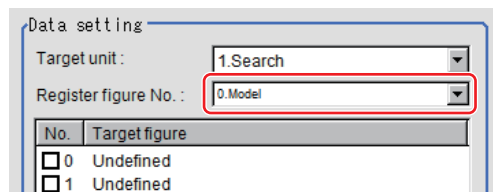
The target unit name in the "Setting target data" area is also reflected automatically.



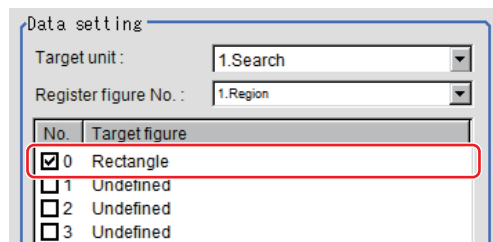
3 In the "Data setting" area, click the [Register figure No.] [▼] to select the figure to be registered.

Target figures included in the selected figure are displayed.

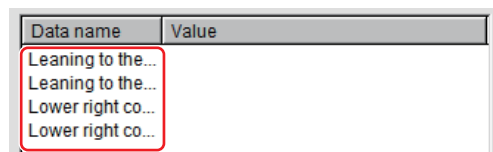
The registered figure name in the "Setting target data" area is also reflected automatically.



4 Click the target figure whose data you want to set and check the No. column.

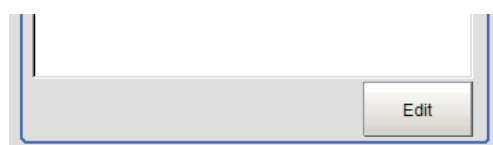


5 Click the name of the data that you want to rewrite.



6 Click [Edit] to set up the overwrite details using an expression.

Reference: ▶ Layout of Setting Expression Window (p.615)



7 Click [OK].

An area is displayed on the image based on settings.

Key Points for Test Measurement and Adjustment (Set Unit Figure)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgment result
Setting target data 0	Judgment result
Setting target data 1	Judgment result
Setting target data 2	Judgment result
Setting target data 3	Judgment result
Setting target data 4	Judgment result
Setting target data 5	Judgment result
Setting target data 6	Judgment result

Key Points for Adjustment

Select the adjustment method referring to the following point.

Judgement will be NG.

Parameter to be adjusted	Troubleshooting
Setting parameters for figures	<ul style="list-style-type: none">• Check if the values entered for the setting figure are correct. If the setting figure is a rectangle, check that coordinates are specified in the order from top-left (X, Y) to bottom-right (X, Y). To refer to the measurement coordinates X and Y from other units, the set order may be the top-right coordinates (X, Y) to bottom-left coordinates (X, Y). If the setting figure is a circle, check that no negative value is specified as the radius. <ul style="list-style-type: none">• Check that anything other than images are not included in the set figure.• Check that figure size limit of the setting target is not exceeded.

Measurement Results for Which Output Is Possible (Set Unit Figure)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	The latest processing unit judgement result
Number of data items	DNO	Number of data items setup
Data 0	DT0	Calculation result of setup data 0
Data 1	DT1	Calculation result of setup data 1
Data 2	DT2	Calculation result of setup data 2
Data 3	DT3	Calculation result of setup data 3
Data 4	DT4	Calculation result of setup data 4
Data 5	DT5	Calculation result of setup data 5
Data 6	DT6	Calculation result of setup data 6
Data 7	DT7	Calculation result of setup data 7
Data 8	DT8	Calculation result of setup data 8
Data 9	DT9	Calculation result of setup data 9
Data 10	DT10	Calculation result of setup data 10
Data 11	DT11	Calculation result of setup data 11
Data 12	DT12	Calculation result of setup data 12
Data 13	DT13	Calculation result of setup data 13
Data 14	DT14	Calculation result of setup data 14
Data 15	DT15	Calculation result of setup data 15
Data 16	DT16	Calculation result of setup data 16
Data 17	DT17	Calculation result of setup data 17
Data 18	DT18	Calculation result of setup data 18
Data 19	DT19	Calculation result of setup data 19

External Reference Tables (Set Unit Figure)

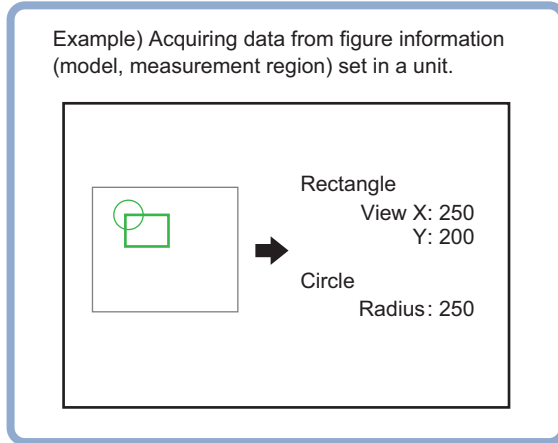
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (un measured) 1: Judgement result OK -1: Judgement result NG
5 to 24	Data 0 to 19	Get only	-999999999.9999 to 999999999.9999
120	Target unit	Set/Get	0 to 9999
121	Register figure No.	Set/Get	0 to 999
122	Target figure No.	Set/Get	0 to 7
123	Number of setting data items	Get only	0 to 20

Get Unit Figure

Acquires and displays figures drawn by other processing units.

Used in the Following Case

- When you want to acquire data such as coordinates from figure information



Parameter Settings (Get Unit Figure)

- 1 In the "Data setting" area, click the [Unit] [▼] to set the number of the registered figure you want to acquire.

The screenshot shows the 'Data setting' dialog box. The 'Unit:' dropdown menu is highlighted with a red box and shows '1.Search'. The 'Register figure No.:' dropdown menu shows '0.Model'.

- 2 Click [▼] for [Resister figure No.] and specify Register figure No. you would like to acquire.

Key Points for Test Measurement and Adjustment (Get Unit Figure)

The following content can be confirmed in the "Detail result" area using text.

Displayed items	Description
Judge	Judgement result
Target unit	Target unit which acquired figure
Register figure No.	Acquired figure number

Measurement Results for Which Output Is Possible (Get Unit Figure)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	The latest processing unit judgement result
Number of figures	NUM	Number of figures acquired
Size of figures	SIZ	Size of figures acquired (number of bytes)
Figure N type (N = 0 to 9)	FNT	Type of figure N 0x0000→Undefined 0x0001→Point 0x0002→Line 0x0004→Wide line 0x0008→Rectangle 0x0010→Ellipse 0x0020→Circle 0x0040→Wide circle 0x0080→Arc 0x0100→Wide arc 0x0200→Polygon Set to 0 if no figures are acquired.
Figure N mode (N = 0 to 9)	FNM	Figure N drawing mode 0: OR 1: NOT Set to 0 if no figures are acquired.
Figure N data 00 to 20 (N = 0 to 9)	FND 00 to FND 20	Data 0 to 20 of figure N <ul style="list-style-type: none"> • For points <ul style="list-style-type: none"> 0: X coordinate 1: Y coordinate • For lines <ul style="list-style-type: none"> 0: X coordinate for first point 1: Y coordinate for first point 2: X coordinate for second point 3: Y coordinate for second point • For wide lines <ul style="list-style-type: none"> 0: X coordinate for first point 1: Y coordinate for first point 2: X coordinate for second point 3: Y coordinate for second point 4: Width • For rectangles <ul style="list-style-type: none"> 0: X coordinate for upper left point 1: Y coordinate for upper left point 2: X coordinate for lower right point 3: Y coordinate for lower right point

Measurement items	Character string	Description
Figure N data 00 to 20 (N = 0 to 9)	FND 00 to FND 20	<ul style="list-style-type: none"> • For ellipses <ul style="list-style-type: none"> 0: X coordinate for center point 1: Y coordinate for center point 2: Radius in X direction 3: Radius in Y direction • For circles <ul style="list-style-type: none"> 0: X coordinate for center point 1: Y coordinate for center point 2: Radius • For wide circles <ul style="list-style-type: none"> 0: X coordinate for center point 1: Y coordinate for center point 2: Radius 3: Width • For arcs <ul style="list-style-type: none"> 0: X coordinate for center point 1: Y coordinate for center point 2: Radius 3: Start angle of arc 4: End angle of arc • For wide arcs <ul style="list-style-type: none"> 0: X coordinate for center point 1: Y coordinate for center point 2: Radius 3: Start angle of arc 4: End angle of arc 5: Width • For polygons <ul style="list-style-type: none"> 0: Number of vertexes 1: X coordinate for vertex 0 2: Y coordinate for vertex 0 3: X coordinate for vertex 1 4: Y coordinate for vertex 1 5: X coordinate for vertex 2 6: Y coordinate for vertex 2 : : 19: X coordinate for vertex 9 20: Y coordinate for vertex 9 <p>Set to 0 if disabled or no figures are acquired.</p>

External Reference Tables (Get Unit Figure)

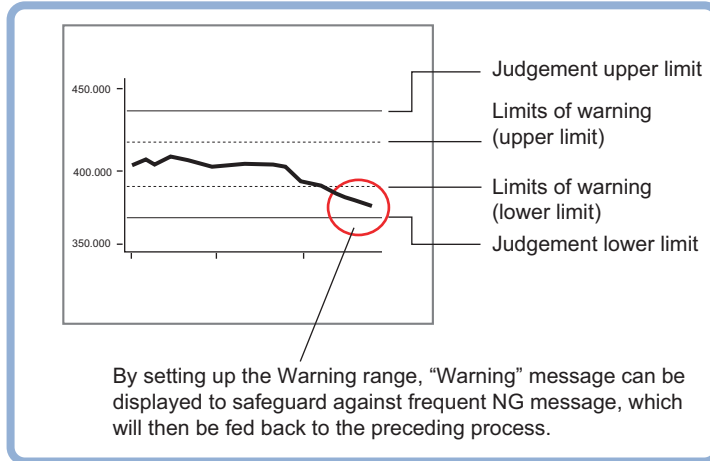
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
1	Number of figures	Get only	Number of figures acquired
2	Size of figures	Get only	Size of figures acquired
120	Target processing unit No.	Set/Get	0 to 9999
121	Target figure No.	Set/Get	0 to 999
1000 + 100 × N (N = 0 to 9)	Figure N type (N = 0 to 9)	Get only	Figure 0 type 0x0000→Undefined 0x0001→Point 0x0002→Line 0x0004→Wide line 0x0008→Rectangle 0x0010→Ellipse 0x0020→Circle 0x0040→Wide circle 0x0080→Arc 0x0100→Wide arc 0x0200→Polygon Set to 0 if no figures are acquired.
1001 + 100 × N (N = 0 to 9)	Figure N drawing mode (N = 0 to 9)	Get only	Figure N drawing mode
1002 + 100 × N to 1022 + 100 × N (N = 0 to 9)	Figure N data 00 to figure N data 20 (N = 0 to 9)	Get only	Figure N data 0 to 20 The amount of valid data differs with data type. Set to 0 if disabled or no figures are acquired.

Trend Monitor

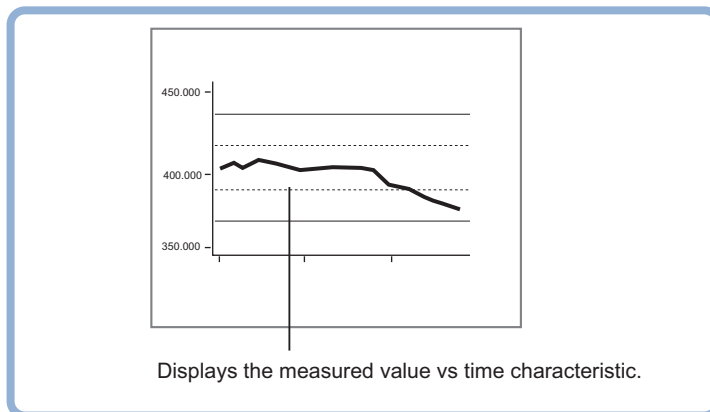
Enables the history of the measurement results to be displayed on the monitor.

Used in the Following Case

- When you want to prevent repeated occurrences of failed product



- When you want to analyze the cause of NG



List of Trend Monitor Items

Item name	Description
Measurement	Select the measurement value to be displayed on the trend monitor. Reference: ▶ Measurement Value (Trend Monitor) (p.657)
Display range	Specify the display range. You can scroll the display range of a graph up and down or zoom in/out. Reference: ▶ Display Range (Trend Monitor) (p.658)
Judgement	Set the conditions for deciding when measurement results are judged as OK, and set the warning range for issuing a caution before there are many NG occurrences. Reference: ▶ Judgement (Trend Monitor) (p.660)
History display	Display measurement history. Reference: ▶ Measurement History Display (Trend Monitor) (p.661)
Data save	Save the measurement results recorded in the trend monitor to the external memory device, i.e. USB memory. Reference: ▶ Data Save (Trend Monitor) (p.663)

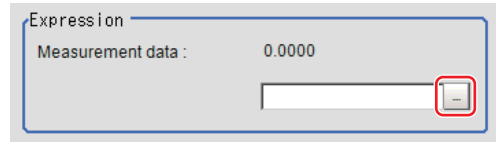
Item name	Description
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Specify whether to reflect the judgement result to the overall judgement of the scene. Reference: ▶ Output Parameters (Trend Monitor) (p.664)

Measurement Value (Trend Monitor)

Select the measurement value to be viewed on the trend monitor.
One item can be displayed for each trend monitor unit.

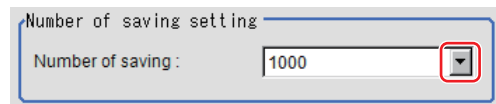
1 Click [Measurement] in the Item Tab area.

2 In the "Expression" area, click [...] in "Measurement data", and measurement values to be monitored are set up using an expression.



The Setting Expression window is displayed.
Select a unit number processed before [Trend Monitor]. Even if the unit number after [Trend Monitor] is selected, the graph will not display.

3 Set up number of items to save as necessary.



Setting item	Set value	Description
Number of saving	<ul style="list-style-type: none"> • [1000] • 5000 • 10000 • 50000 • 100000 	Set the number of measurement values to save. A maximum of 5000 items can be displayed on the main screen. Measurements that exceed 5000 items are displayed using toggling of pages.

Important

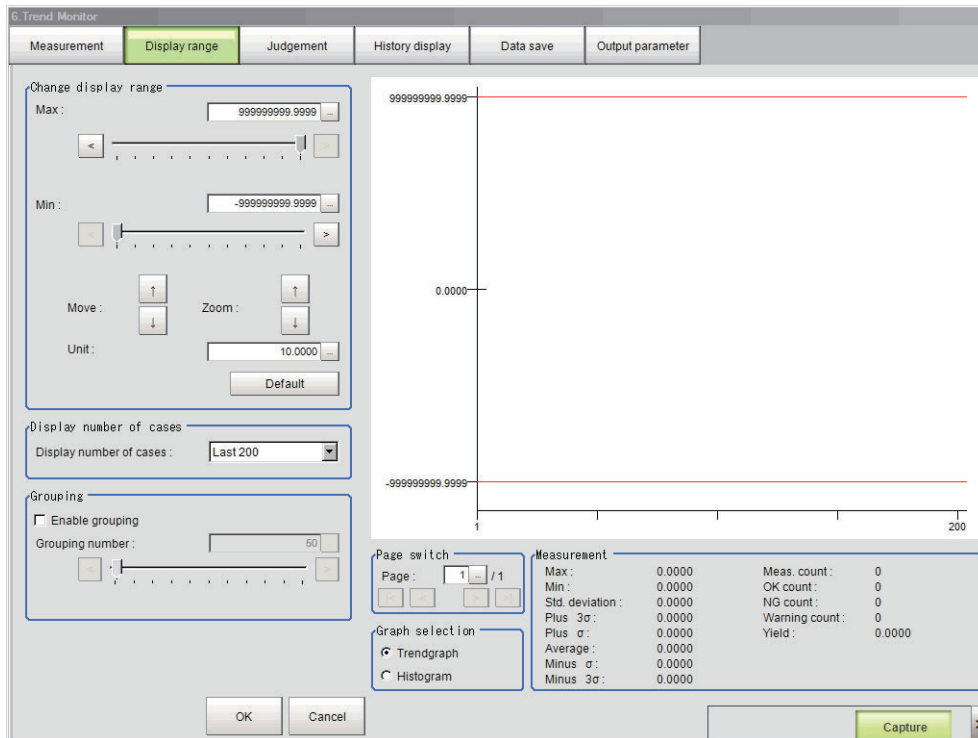
- Trade offs between number of items saved and the sensor controller performance include the following.
- There is a difference in amount of memory used of approximately 2 MB between 1000 items and 100000 items. Please confirm the amount of memory remaining prior to performing set up.

Display Range (Trend Monitor)

If what you want to see is not on the screen, scroll the graph up and down or zoom in/out. Also, items displayed horizontally can be toggled.

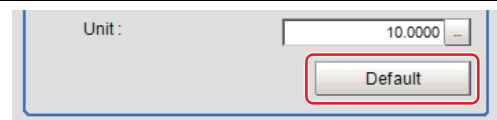
1 In the Item Tab area, click [Display range].

A graph is displayed in the "Image Display" area.



Note

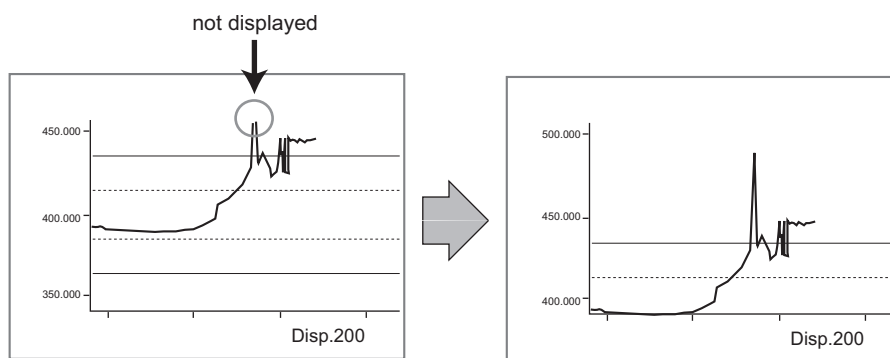
- If the window is entered after measurement is performed a few times and [Default] is clicked on, a display range suitable for these measurement values is automatically set.



Setting item	Set value [Factory default]	Description	
Change display range	Max	-999999999.9999 to 999999999.9999	
	Min		
	Move	<ul style="list-style-type: none"> • ↑ • ↓ 	Moves up and down the graph itself.
	Zoom	<ul style="list-style-type: none"> • ↑ • ↓ 	Zooms the graph itself in and out.
	Unit	1 to 1000000.0000	Sets the amount of variation generated when the up/down buttons for moving or zooming in/out are pushed.
	Default	-	If several measurements have already been made, an optimal display range is automatically set based on the measurement results.

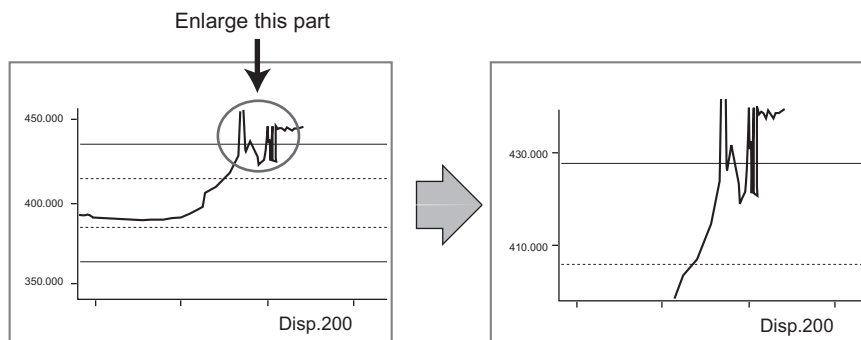
Setting item	Set value [Factory default]	Description
Display number of cases	<ul style="list-style-type: none"> • [Last 200] • Last 1000 • Last 5000 • Last 10000 • Last 50000 • Last 100000 	Select the number of items displayed in the horizontal direction on the graph.
Enable grouping	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Draws a rectangle that shows the maximum and minimum of measurement data for every set number of items. This enables viewing the maximum and minimum in a section at a glance.
	0 to 5000 [50]	Sets the number of items that can be grouped.

Move

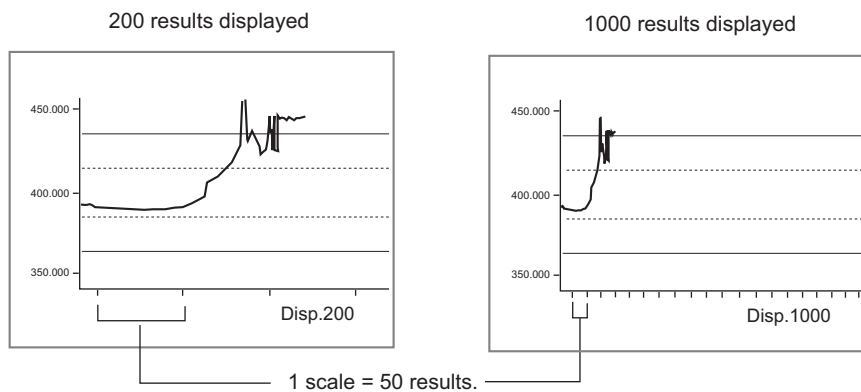


Zoom

Example: Enlarging a part where measurement results were unstable

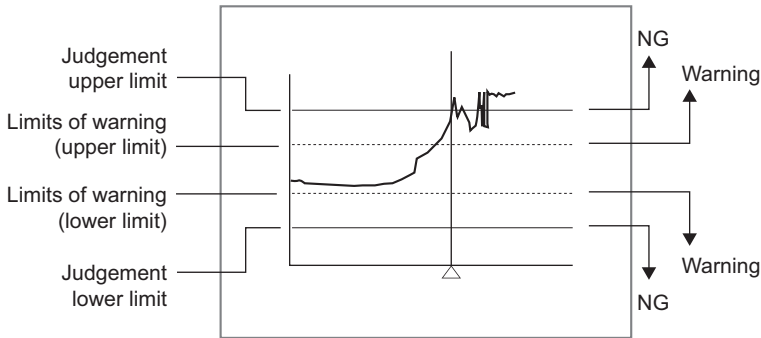


Horizontal



Judgement (Trend Monitor)

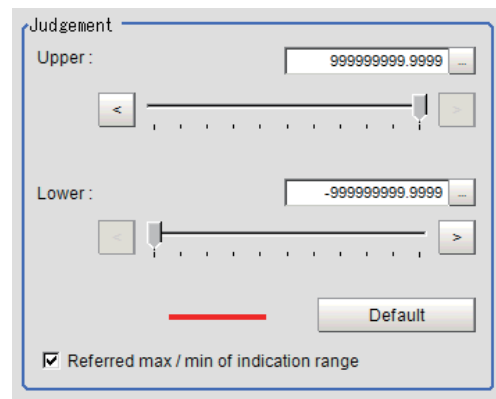
Sets the warning range for prompting caution before large numbers of NGs occur as well as OK/NG judgement conditions.



Note

- When a warning occurs, the message "Limits of Warning" is displayed on the screen. Notification that an alarm has occurred can also be output to external devices if output-related processing units such as "Parallel Judgement Output" are used to set an arithmetic expression to output measurement results (warnings) from the trend monitor.

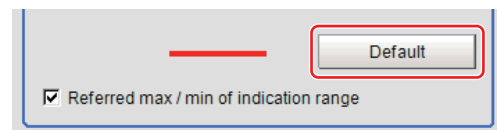
- In the Item Tab area, click [Judgement].
- Set up the judgement condition.



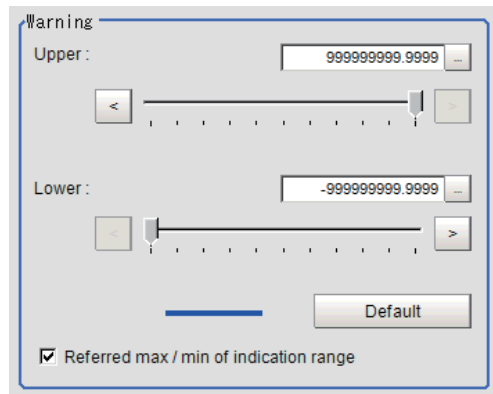
Setting item	Set value [Factory default]	Description
Upper	-999999999.9999 to 999999999.9999	Specify the range where the measurement result is judged to be OK.
Lower	-999999999.9999 to 999999999.9999	
Referred max / min of indication range	<ul style="list-style-type: none"> [Checked] Unchecked 	When checked, the judgement range that can be set with the upper and lower values becomes the same as the max. and min. values set in [Display range].

Note

- If the window is entered after measurement is performed a few times and [Default] is clicked on, optimal judgement conditions including maximum and minimum measurement values are automatically set.



3 In the "Warning" area, specify values for "Upper" and "Lower".



The setup method is the same as the setup method for the "Judgement" area.

Setting item	Set value [Factory default]	Description
Upper	-999999999.9999 to [999999999.9999]	Specify the warning range for encouraging caution before frequent occurrence of NGs.
Lower	[-999999999.9999] to 999999999.9999	
Referred max / min of indication range	<ul style="list-style-type: none"> • [Checked] • Unchecked 	When checked, the judgement range that can be set with the upper and lower values becomes the same as the max. and min. values set in [Display range].

Measurement History Display (Trend Monitor)

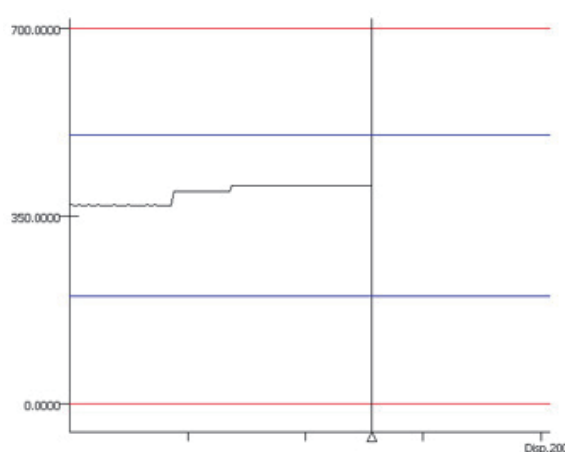
Displays measurement history.

- 1** Click [History display] in the Item Tab area.
- 2** Click judgement displayed in the "Measurement history" area.

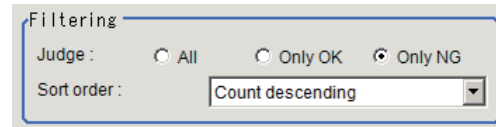
Judge	Count	Value	Time
OK	761	320.0000	18:28:57
OK	760	321.0000	18:28:57
OK	759	321.0000	18:28:57
OK	758	321.0000	18:28:57
OK	757	321.0000	18:28:57
OK	756	316.0000	18:28:57
OK	755	320.0000	18:28:56
OK	754	320.0000	18:28:56
OK	753	321.0000	18:28:56
OK	752	321.0000	18:28:56
OK	751	320.0000	18:28:56
OK	750	321.0000	18:28:56
OK	749	321.0000	18:28:56
OK	748	320.0000	18:28:56
OK	747	321.0000	18:28:56

The measurement values and time are displayed.

In the Image Display area, longitudinal lines displayed at NG positions in the graph show where NG have occurred.

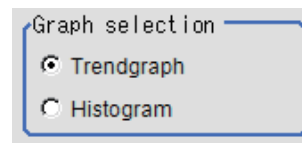


3 Set up a filter as necessary.



Setting item	Set value [Factory default]	Description
Judge	<ul style="list-style-type: none"> • All • Only OK • [Only NG] 	Sets the judgement results that are displayed.
Sort order	<ul style="list-style-type: none"> • Count ascending • [Count descending] • Value ascending • Value descending 	Sets the sort order for the judgement results to display.

4 Sets up a display graph as necessary.



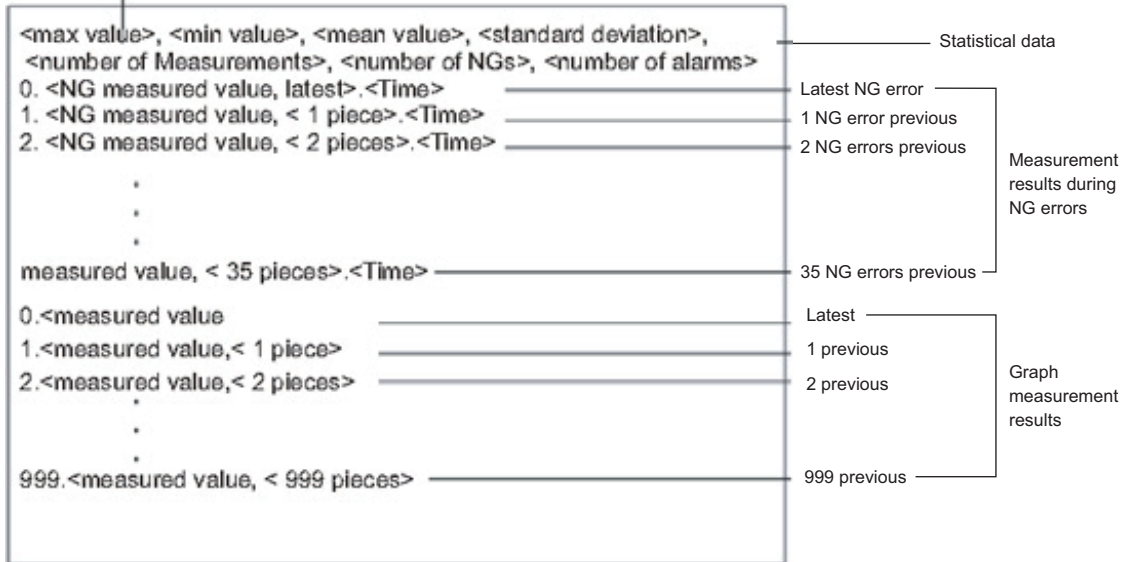
Setting item	Set value [Factory default]	Description
Graph selection	• [Trendgraph]	<p>The vertical direction shows measurement values and horizontal direction shows number of items. This is convenient for showing time elapse and changes in measurement.</p>
	• Histogram	<p>The vertical direction shows number of items and horizontal direction shows measurement values. This is convenient for showing distribution.</p>

Data Save (Trend Monitor)

The measurement results recorded in the trend monitor can be saved in a USB memory stick or SD card (for FH series). Since the data is saved in CSV format, it can be edited on the PC.

The data to be saved includes all the statistical data, the value and time stamp when NG occurs (up to 36 items) and the measurement result on the graph (up to 1000 items). Up to 100000 items of measurement results can be saved in extended format. The format is as follows.

Data is partitioned using commas.



Important

- Insert a USB memory stick or SD memory card before saving data.
For information on the position of the USB connector and SD card memory, refer to ► the *Vision System FH/FZ5 series Hardware Setup Manual* (Cat. No. Z366) or Instruction sheet.

1 In the Item Tab area, click [Data save].

2 Specify format in the "Save setting" area.

Standard format

Line	Text	Description
1	<Maximum>, <Minimum>, <Average>, <Deviation>, <Count>, <NG count>, <Warning count>	Statistical data
2		
3	0, <NG measured value, latest>, <Time>	Last NG
4	1, <Last 1 NG measurement>, <Time>	Last 1 NG
5	2, <Last 2 NG measurement>, <Time>	Last 2 NG
:	:	:
38	35, <Last 35 NG measurement>, <Time>	Last 35 NG
39		
40	0, <measured value, latest>	Last
41	1, <Last 1 measurement>	Last 1
42	2, <Last 2 measurement>	Last 2
:	:	:
1039	999, <Last 999 measurement>	Last 999

Extended format

Line	Text	Description	
1	<Maximum>, <Minimum>, <Deviation>, <Plus 3σ>, <Plus σ>, <Average>, <Minus σ>, <Minus 3σ>, <Count>, <OK count>, <NG count>, <Warning count>, <Yield>	Statistical data	
2			
3	0, <judgement result, latest>, <measured value, latest>, <Time>	Last	Measurement result (Max: 100000 items)
4	1, <Last 1 judgement result>, <Last 1 Measurement>, <Time>	Last 1	
5	2, <Last 2 judgement result>, <Last 2 Measurement>, <Time>	Last 2	
:	:	:	
100002	99999, <Last 99999 judgement result>, <Last 99999 Measurement>, <Time>	Last 99999	

Note

- The default for the file name is the data save date (example: 0410.csv). If it is half-width alphanumeric characters, it can be changed arbitrarily.

3 In the "Save setting" area, click [Save].

Data is saved to a USB memory stick or SD Memory Card.

Output Parameters (Trend Monitor)

Specifies whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

- Click [Output parameter] in the Item Tab area.
- Choose whether or not to reflect this in the scene overall judgement in "Reflect to overall judgement" area.

Setting item	Set value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> [ON] OFF 	Enables choosing whether or not the judgment results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Trend Monitor)

The following content can be confirmed in the "Detail result" area using text.

Displayed items	Description
Judge	Judgement result
Measurement	Latest measured value
Max	Max. measurement value during recording period
Mini	Min. measurement value during recording period
Standard deviation	Standard deviation for measurement values during recording period
Plus 3σ	Average of measurement values during period recorded + standard deviation of the measurement values × 3
Plus σ	Average of measurement values during period recorded + standard deviation of the measurement values
Average	Average value for measurement values during recording period

Displayed items	Description
Minus σ	Average of measurement values during period recorded - standard deviation of the measurement values
Minus 3σ	Average of measurement values during period recorded - standard deviation of the measurement values $\times 3$
Measurement count	Measure count since the beginning of measurement
OK count	Number of measurements since starting to make measurements - NG count in number of measurements
NG count	Number of NG occurrences within the measurement count
Warning count	Warning count within the measurement count
Yield	OK count in number of measurements / Number of measurements since starting to make measurements

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image number	Explanation of image to be displayed
0	Trend graph
1	Histogram

Measurement Results for Which Output Is Possible (Trend Monitor)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Measurement	DT	Latest measured value
Warning	WN	Existence of warning occurrence
Maximum	MX	Max. measurement value during recording period
Minimum	MN	Min. measurement value during recording period
Deviation	DV	Standard deviation for measurement values during recording period
Plus 3σ	AP3	Average of measurement values during period recorded + standard deviation of the measurement values $\times 3$
Plus σ	AP1	Average of measurement values during period recorded + standard deviation of the measurement values
Average	AV	Average value for measurement values during recording period
Minus σ	AM1	Average of measurement values during period recorded - standard deviation of the measurement values
Minus 3σ	AM3	Average of measurement values during period recorded - standard deviation of the measurement values $\times 3$
Measurement count	MC	Measure count since the beginning of measurement
OK count	OC	Number of measurements since starting to make measurements - NG count in number of measurements
NG count	NC	Number of NG occurrences within the measurement count
Warning count	WC	Warning count within the measurement count
Yield	YD	OK count in number of measurements / Number of measurements since starting to make measurements

Important

- If the total measurement value data exceeds -1.0×10^{11} to 1.0×10^{11} , the measurement will be disabled (NG). Regularly clear the measurement values so that the total measurement value data stays within the range.

External Reference Tables (Trend Monitor)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Measurement	Get only	-999999999.9999 to 999999999.9999
6	Warning	Get only	0: OFF 1: ON
7	Maximum	Get only	-999999999.9999 to 999999999.9999
8	Minimum	Get only	-999999999.9999 to 999999999.9999
9	Average	Get only	-999999999.9999 to 999999999.9999
10	Deviation	Get only	-999999999.9999 to 999999999.9999
11	Count	Get only	0 to 999999999
12	NG count	Get only	0 to 999999999
13	Warning count	Get only	0 to 999999999
14	Measurement value average plus 3σ	Get only	-999999999.9999 to 999999999.9999
15	Measurement value average plus σ	Get only	-999999999.9999 to 999999999.9999
16	Measurement value average minus σ	Get only	-999999999.9999 to 999999999.9999
17	Measurement value average minus 3σ	Get only	-999999999.9999 to 999999999.9999
18	OK count	Get only	0 to 999999999
19	Yield	Get only	0 to 1
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
121	Upper limit of the judgement	Set/Get	-999999999.9999 to 999999999.9999
122	Lower limit of the judgement	Set/Get	-999999999.9999 to 999999999.9999
123	Warning upper limit	Set/Get	-999999999.9999 to 999999999.9999
124	Warning lower limit	Set/Get	-999999999.9999 to 999999999.9999
125	Upper limit of the display range	Set/Get	-999999999.9999 to 999999999.9999
126	Lower limit of the display range	Set/Get	-999999999.9999 to 999999999.9999
127	Amount of change to display range	Set/Get	1 to 1000000
128	Horizontal	Set/Get	0: Display 200 results 1: Display 1000 results

No.	Data name	Set/Get	Data range
129	Grouping flag	Set/Get	0: OFF 1: ON
130	Grouping count	Set/Get	-999999999.9999 to 100000
131	Number saved	Set/Get	0: 1,000 1: 5,000 2: 10,000 3: 50,000 4: 100,000
132	Save format	Set/Get	0: Standard format 1: Extended format

Image Logging

This is used when saving measurement images to on-board memory, RAMDisk or USB memory. This enables preparation of logging conditions using an expression and is more flexible than the system image logging conditions settings.

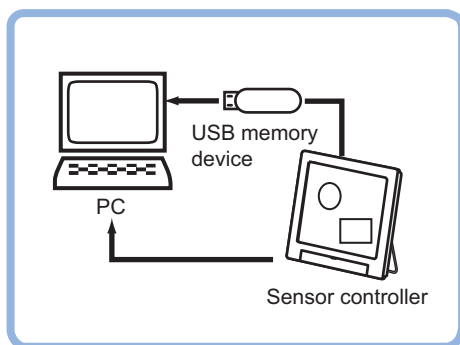
However, the settings of this unit are enabled if "None" is set on the [Image logging] in [Logging setting] of [System] menu.

Reference: ▶ "Chapter 3 Logging Measurement Values and Measurement Images instruction" in the *Vision Sensor FH/FZ5 Series Vision System User's Manual (Z365)*.

If settings that perform image logging for multiple units during measurement are executed, the last settings executed are enabled.

Used in the Following Case

- This is used when saving logging images under specific conditions.



Important

- If several image logging units are set in the flow, saving is performed based on the last image logging conditions executed.
- When [Multiple image logging] in [Logging setting] of [System] is [ON], refer to the followings.
 - All of the transferred images will be saved according to [Image logging] setting.
 - Latest images that exceed Sensor Controller memory size will be deleted because all of the transferred images will be saved temporarily.
- When [Save to memory + FTP Server] is selected for destination, specify the destination folder name and prefix of the image logging file using only single-byte alphanumeric characters and numbers.

Logging Conditions (Image Logging)

Indicate the image to perform logging for. If 4 cameras are connected, image logging is performed for 4 cameras each time.

- 1 Click [Logging condition] in the Item Tab area.
- 2 Set the logging conditions.

Setting item	Set value [Factory default]	Description
Condition	• [None]	No images are saved.
	• Only NG	Saves images only if an NG occurs. If an NG occurs downstream from the image logging processing unit, image logging is not performed. Insert image logging as close to the end of the scene as possible
	• All	All measured images are saved.

- 3 When "Only NG" is selected, click [...] to set up the expression.
The Setting Expression window is displayed.
- 4 After setting up the expression, click [OK].
The expression is confirmed.
- 5 Set up the judgement upper limit and the judgement lower limit for "Judgement condition".

Setting item	Set value [Factory default]	Description
Judgement condition	-99999999.9999 to 99999999.9999	This is a judgement condition for the expression. Set upper and lower limits for judging as OK.

Save Destination (Image Logging)

Note

- The save file name is the prefix and measurement ID.
Reference: ▶ Output Format (Data Logging) (p.679)

- 1 Click [Destination] in the Item Tab area.
- 2 Set the logging images save destination.

Enabled when "Save to memory + file" is selected as the save destination in the system image logging settings.

Setting item	Set value [Factory default]	Description
Sub folder name	-	Designates sub folder names. Creates a sub folder in the save destination in system logging settings. (Max: 32 characters) The following characters cannot be set. \\ : * ? " < >
Prefix	-	Sets the prefix for the save file name. (Max: 31 characters) The set character string is added at the beginning of the name of the save file. If the system logging settings designate a prefix, the file name is set to [prefix designated by image logging] + [prefix designated by system logging settings] + image logging file name.

- 3 Set the File count in folder, if necessary.

Saving a large number of files in the [Save Destination] sub-folder does degrade performance and visibility.

Therefore, you can create more folders within sub-folders to prevent performance and visibility loss.

Setting item	Set value [Factory default]	Description
File count in folder	0 to 999 [200]	<ul style="list-style-type: none"> Set the upper limit for the number of files in folders automatically generated in the [Save Destination] folder. The number of files is not the number of files stored in the automatically generated folder but the total number of generated image files. The name of the folder to be automatically generated will be the same as that of the first image logging file to be stored in that folder. Furthermore, if 0 is specified, folders are not automatically generated.

Note

- When the number of files in the folder is other than 0, in the following cases, the number of files saved in the folder generated in the sub-folder may be less than the number of files in the folder.
:When you execute the Clear measurement result function from the main screen menu, folders are automatically generated in the sub-folder regardless of the setting of the number of files in the folder.
Reference: ▶ "Clearing Measurement Results" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
: When folder distribution is set in [Logging setting] of [System setting], folders are automatically generated in the sub-folder according to the total number of generated image files.
Reference: ▶ "Logging Conditions" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Important

- If conditional branching is used, the number of files saved may vary from the specified number.
- If the operation mode is [Double Speed Multi-input mode], images taken by odd-numbered measurements are stored in a file different from one containing images taken by even-numbered measurements.
- If the operation mode is [Non-stop adjustment mode], the number of files in the folder may vary from the specified number before and after non-stop adjustment.

Key Points for Test Measurement and Adjustment (Image Logging)

The following content can be confirmed in the "Detail result" area using text.

Displayed items	Description
Judge	Judgment result
Expression	Calculation result of conditional expression

Measurement Results for Which Output Is Possible (Image Logging)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgment result
Data	D00	Conditional expression data
Judge	J00	Conditional expression Judgment

External Reference Tables (Image Logging)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No Judgment (unmeasured) 1: Judgment result OK -1: Judgment result NG
5	Calculation result	Get only	-99999.9999 to 99999.9999
6	Judgement result	Get only	0: No Judgment (unmeasured) 1: Judgment result OK -1: Judgment result NG
120	Logging condition	Set/Get	0: None 1: Only NG 2: All
121	Judge expression	Set/Get	Expression character string
122 to 123	Upper limit of conditions calculation	Set/Get	-99999.9999 to 99999.9999
	Lower limit of conditions calculation	Set/Get	-99999.9999 to 99999.9999
124	Sub directory name	Set/Get	Character string
125	Prefix	Set/Get	Character string

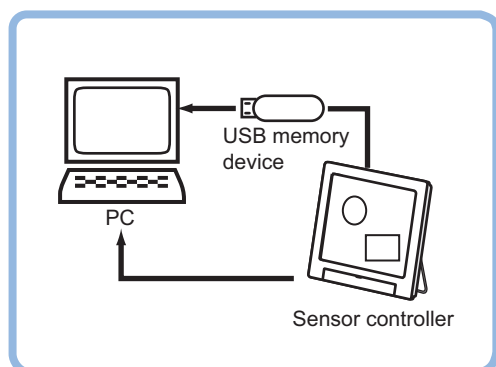
Image Conversion Logging

This processing item is used to save a measurement processing image in RAM Disk or USB memory. This enables preparation of logging conditions using an expression and is more flexible than the system image logging conditions settings. The save range within the image can be specified in rectangle and the image save format (BMP or JPG) can be specified.

Used in the Following Case

- **This is used when saving measurement images under specific conditions.**

The measurement image is saved when Image conversion logging is registered in the flow. Filtering and position compensation are also reflected.



Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Save Condition (Image Conversion Logging)

Indicate the image to perform logging for.

Important

- Only one image per processing unit can be saved in image conversion logging.
Note, however, that multiple images can be saved if more than one processing unit is set up in the flow.
- Even if you set [Multiple image logging] to [ON] in [Logging setting] of [System], only one image will be saved.
- Image in this function means an inputted image when Image Conversion Logging function is performed.

1 Click [Save condition] in the Item Tab area.

2 Set save conditions.

The screenshot shows the 'Save condition' dialog box. It has the following fields and options:

- Condition :** Three radio buttons: None, Only NG, All. The 'None' option is selected and highlighted with a red box.
- Arithmetic expression :** An empty text input field.
- Arithmetic result :** A text input field containing the value '0.0000'.
- Judgement condition :** Two text input fields containing '-99999999.9999' and '99999999.9999', separated by a minus sign '-'.

Setting item	Set value [Factory default]	Description
Condition	• [None]	No images are saved.
	• Only NG	Saves the images only if an NG occurs. If an NG occurs downstream from the image conversion logging processing unit, image conversion logging is not performed. Judgement uses the measurement value at the point in time when measurement processing is executed for image convert logging.
	• All	All measured images are saved.

3 When [Only NG] is selected, click [...] to set up the expression.

The Setting Expression window is displayed.

4 Logging conditions are set using an expression.

Reference: ▶ Layout of Setting Expression Window (p.615)

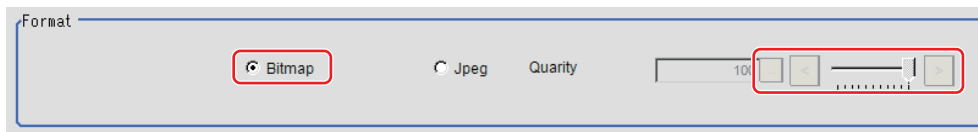
5 After setting up the expression, click [OK].

The expression is confirmed.

6 Set up the judgement upper limit and the judgement lower limit for Judgement.

Setting item	Set value [Factory default]	Description
Judgement condition	-999999999.9999 to 999999999.9999	This is a judgement condition for the expression. Set upper and lower limits for judging as OK.

7 In the Format area, set save format.



Setting item	Set value [Factory default]	Description
Format	• [Bitmap] • Jpeg	Select the image format to be saved.
Quality	0 to 100 [100]	Specify the quality of the Jpeg image to be saved.

Destination (Image Conversion Logging)

Note

- The save file name is the prefix, measurement ID and extension.
Reference: ▶ Output Format (Data Logging) (p.679)

1 Set the logging images save destination.

Setting item	Set value [Factory default]	Description
Folder name	-	Specify the name of the folder to which the image is to be saved. (Max: 32 characters) The following characters cannot be set. \\ : * ? " < >
Prefix	-	Sets the prefix for the save file name. (Max: 32 characters) The set character string is added at the beginning of the name of the save file. Any prefix specified in the system's logging setting will be ignored.

2 Set the number of files in the folder, if necessary.

Saving a large number of files in the [Save Destination] sub-folder does degrade performance and visibility.
Therefore, you can create more folders within sub-folders to prevent performance and visibility loss.

Setting item	Set value [Factory default]	Description
File count in folder	0 to 999 [200]	<ul style="list-style-type: none"> Set the upper limit for the number of files in folders automatically generated in the [Save Destination] folder. The number of files is not the number of files stored in the automatically generated folder but the total number of generated image files. The name of the folder to be automatically generated will be the same as that of the first image logging file to be stored in that folder. Furthermore, if 0 is specified, folders are not automatically generated.

Note

- When the number of files in the folder is other than 0, in the following cases, the number of files saved in the folder generated in the sub-folder may be less than the number of files in the folder.
:When you execute the Clear measurement result function from the main screen menu, folders are automatically generated in the sub-folder regardless of the setting of the number of files in the folder.
Reference ▶ "Clearing Measurement Results" in the "Vision System FH/FZ5 Series User's Manual (Z365)"
: When folder distribution is set in [Logging setting] of [System setting], folders are automatically generated in the sub-folder according to the total number of generated image files.
Reference ▶ "Logging Conditions" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Important

- If the operation mode is [Double Speed Multi-input mode], images taken by odd-numbered measurements are stored in a file different from one containing images taken by even-numbered measurements.
- If the operation mode is [Non-stop adjustment mode], the number of files in the folder may vary from the specified number before and after non-stop adjustment.

Area Setting (Image Conversion Logging)

Specify the range of images to be logged.

- 1** In the Item Tab area, click [Area Setting].
- 2** Use the drawing tools to specify the Image Conversion Logging range.
- 3** Click [OK] in the Figure setting area.
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.The range in which to perform logging is registered.

Key Points for Test Measurement and Adjustment (Image Conversion Logging)

The following content can be confirmed in the "Detail result" area using text.

Displayed item	Description
Judge	Judgement result
Expression	Calculation result of conditional expression

Measurement Results for Which Output Is Possible (Image Conversion Logging)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgment result
Data	D00	Conditional expression data
Judge	J00	Conditional expression judgment

External Reference Tables (Image Conversion Logging)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (not yet measured) 1: Judgement result OK -1: Judgement result NG
5	Calculation result	Get only	-99999.9999 to 99999.9999
6	Judgement result	Get only	0: No judgement (not yet measured) 1: Judgement result OK -1: Judgement result NG
120	Save Condition	Set/Get	0: None 1: Only NG 2: All
122 to 123	Upper limit of conditions calculation	Set/Get	-99999.9999 to 99999.9999
	Lower limit of conditions calculation	Set/Get	-99999.9999 to 99999.9999
124	Folder name	Set/Get	Character string
125	Prefix	Set/Get	Character string
130	File count in folder	Set/Get	0 to 999
131	Image saving format	Set/Get	0: Bitmap 1: Jpeg
132	Jpeg quality	Set/Get	0 to 100

Data Logging

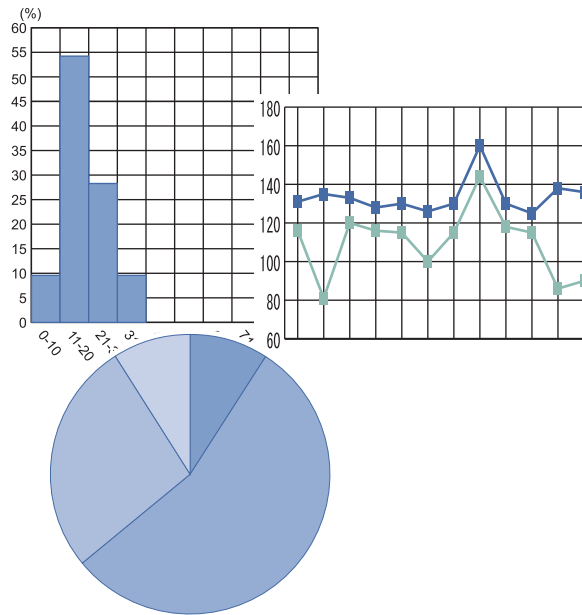
This is used to save measurement data in storage or USB memory.

Used in the Following Case

- When performing analysis using measurement data

Logging is performed for measurement results and these are read into an external device such as a PC.

Example: Analysis using spreadsheet program statistical processing



Important

- If you prefer to use the Data Logging processing item, click [System settings] - [Other] - [Logging setting] - [Data Logging] and configure the logging conditions.
- Insert data logging as close to the end of the flow as possible. If "Only NG" is selected in logging timing conditions and an NG occurs after the data logging processing unit, it will not be logged.
- Setting data logging settings to save [Image logging] makes simultaneous confirmation of measurement data and image data convenient.

Reference: ▶ "Chapter 3 Performing Test Measurement/Starting Operation - Useful Functions for Operation - Logging Measurement Values and Measurement Images - Setting Logging Conditions [Logging Setting]" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

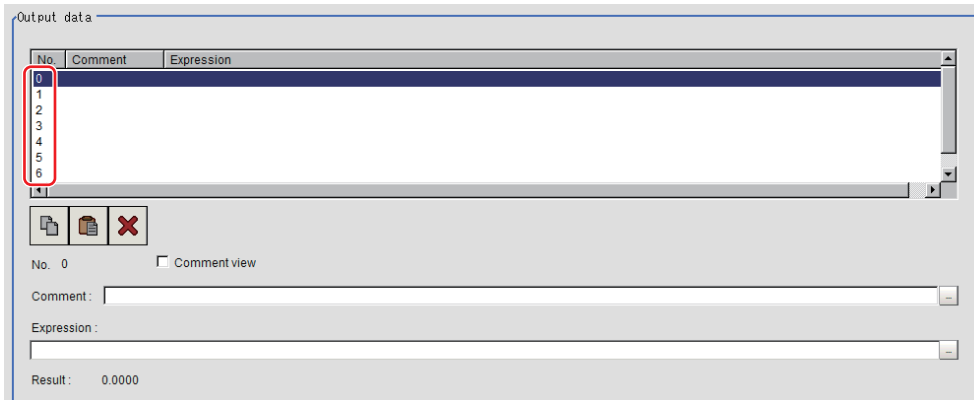
Settings (Data Logging)

Indicate the data to perform logging for. Logging can be performed for up to 8 data using one "Data logging" processing item.

Note

- If you want to perform logging for 9 or more data using one record
Reference: ▶ Additional Explanation (Data Logging) (p.681)

- 1** In the Item Tab area, click [Setting].
- 2** In the list, click the output No. for which the expression is to be set.



The selected output No. is displayed under the list.

- 3** Click [...] for the expression and set the data to be logged with the expression.
The Setting Expression window is displayed.
- 4** Input "Comment" as necessary.
- 5** To display comments in the "Detail result display" area, check "Comment view".
- 6** Repeat steps Reference: ▶ 2 (p.678) to Reference: ▶ 5 (p.678) and set up the output contents for each output number.

Output Format (Data Logging)

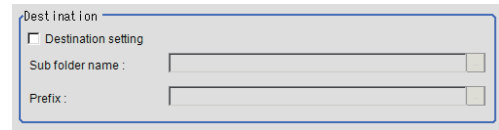
Sets the output format for logging data.

- 1 In the Item Tab area, click [Output format].
- 2 Set up each item as necessary.

Setting item	Set value [Factory default]	Description
File name	datalog.csv	Half-width alphanumeric characters are used for File name. (Max: 128 characters) Set the folder name and file name such that they are no more than 255 characters combined.
Digits of Integer	1 to [10]	Specify the digits of the integer part including the sign. For positive numbers, the plus sign is not output. Example Setting: 4 digits, Data: -5619 -999 is output.
Digits of Decimal	0 to [4]	Specify the number of output digits in the decimal part. Decimals are rounded up and output. When 0 is selected, the decimal digits will be rounded off.
Measurement ID	<ul style="list-style-type: none"> • [Available] • None 	Select whether to output the measurement ID at the head of the output data. Measurement ID : measurement time YYYY-MM-DD_HH-MM-SS-XXXX (YYYY: Calendar, MM: Month, DD: Day, HH: Hour, MM: Minute, SS: Second, XXXX: Millisecond and Line number.) Example Measurement time: 11:10:25.500 AM, December 24, 2007 and Line 0, the measurement ID is "2007-12-24_11-10-25-5000". Since the file name of the logging image also includes the same measurement ID, confirmation of the measurement data and image data can be performed with the measurement ID.
Minus	<ul style="list-style-type: none"> • [-] • 8 	Select what is displayed in the sign column for a negative number.
0 suppress	<ul style="list-style-type: none"> • Available • [None] 	Select the method for adjusting when there is a blank to the left of the output data. Available: Insert 0 into the blank digit space. None: Insert a space in the location with no character. Example When integer section setting: 5 digits, decimal section setting: 3 digits, data is 100.000 Available: 00100.000 None: _100.000 (_ represents a space)

Setting item	Set value [Factory default]	Description
Field separator	<ul style="list-style-type: none"> • OFF • [Comma] • Tab • Space • CR+LF 	Select the separator for output data.
Record separator	<ul style="list-style-type: none"> • OFF • Comma • Tab • Space • [CR+LF] 	Select the separator each time data is output.
Set comment as title	<ul style="list-style-type: none"> • [Unchecked] • Checked 	Place a check here to output comments as the titles on the first line of the data logging file.

3 If necessary, set the save destination of the logging data.



Setting item	Setting value [Factory default]	Description
Destination setting	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Place a check here to set the destination and prefix.
Sub folder name	-	Sets sub folder names. Creates a sub folder in the save destination in system logging settings. (Max: 32 characters) The following characters cannot be set. \\ / : * ? " < > ?
Prefix	-	Sets the prefix for the save file name. (Max: 32 characters) The set character string is added at the beginning of the name of the save file. The following characters cannot be set. \\ / : * ? " < > ?

Note

- The actual data output is in the ASCII format with the following type of header added.

Measurement ID, Data1 Data N + delimiter

Measurement ID : measurement time YYYY-MM-DD_HH-MM-SS-XXXX

(YYYY: Calendar, MM: Month, DD: Day, HH: Hour, MM: Minute, SS: Second, XXXX: Millisecond and Line number.)

Example

Measurement time: 11:10:25.500 AM, December 24, 2007 and Line 0, the measurement ID is "2007-12-24_11-10-25-5000".

- Logging timing and saving destination

Reference: ▶ "Chapter 3 Performing Test Measurement/Starting Operation Useful Functions for Operation Logging Measurement Values and Measurement Images" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

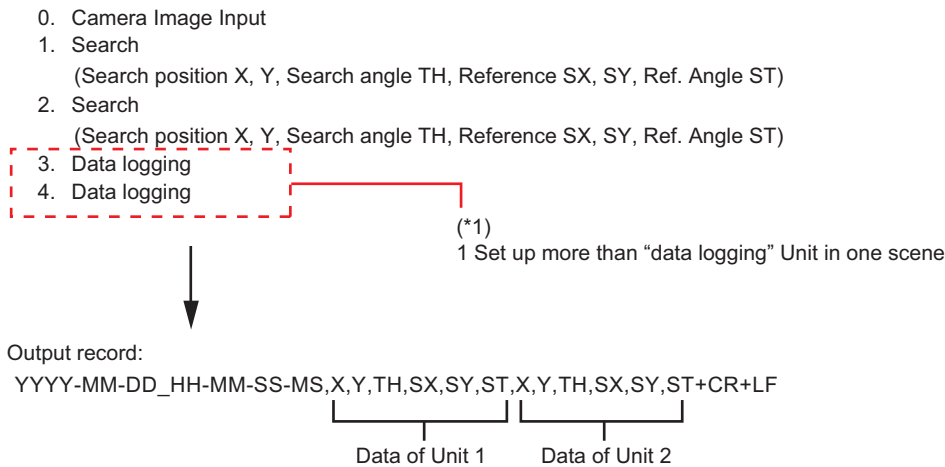
Additional Explanation (Data Logging)

When 9 or More Data Items Are Output as One Record

Up to 8 Value can be output with one [Data Logging] Processing Item. When 9 or more data items are to be output as 1 record, perform settings in the following manner.

- Registers two or more [Data Logging] units in one scene. (*1)
- Set [File name] of [Data Logging] so that it is identical. (*2)
- This prepares set up to attach "Record separator (CR+LF)" to the end of all data output. (*3)

Example) When outputting the coordinate data for 12 points acquired in two "Search" of measurements performed on substrate arrangement in 1 record.



Unit 3 [Data logging] setting details		Unit 4 [Data logging] setting details		Remarks
<Condition setting>		<Condition setting>		
Output Destination (File name)	datalog.csv	Output Destination (File name)	datalog.csv	(*2) Make the path and file name the same.
Integer	8	Integer	8	
Decimal	3	Decimal	3	
Measurement ID	ON	Measurement ID	OFF	
Minus	-	Minus	-	
0 suppress	OFF	0 suppress	OFF	
Field separator	Comma	Field separator	Comma	
Record separator	Comma	Record separator	CR+LF	(*3) Set "Record separator (CR+LF)" in unit 4 which contains the last data
<Output data>		<Output data>		
Calculation 0. U1.X (Search position X) Calculation 1. U1.Y (Search position Y) Calculation 2. U1.TH (Angle θ) Calculation 3. U1.SX (reference X) Calculation 4. U1.SY (reference Y) Calculation 5. U1.ST (Reference angle θ) Calculation 6. U2.X (Search position X) Calculation 7. U2.Y (Search position Y)		Calculation 0. U2.TH (Search angle θ) Calculation 1. U2.SX (reference X) Calculation 2. U2.SY (reference Y) Calculation 3. U2.ST (Reference angle θ)		The data not included in Unit 3 will be output as Calculation 0 to 3 in Unit 4

Unit 3 [Data logging] setting details	Unit 4 [Data logging] setting details	Remarks
127 + N (N = 0 to 7)	Comment	Character string
135 + N (N = 0 to 7)	Expression	Expression character string
143	Output destination file name	Character string
144	Sub folder name	Character string
145	Prefix	Character string
146	Specifying destination	0: Not specified 1: Specified

Measurement Results for Which Output Is Possible (Data Logging)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement item	Character string	Description
Judge	JG	Judgement result
Result of Expression 0 - Result of Expression 7	D00 to D07	Expression result of expression 0 to Expression result of expression 7

External Reference Tables (Data Logging)

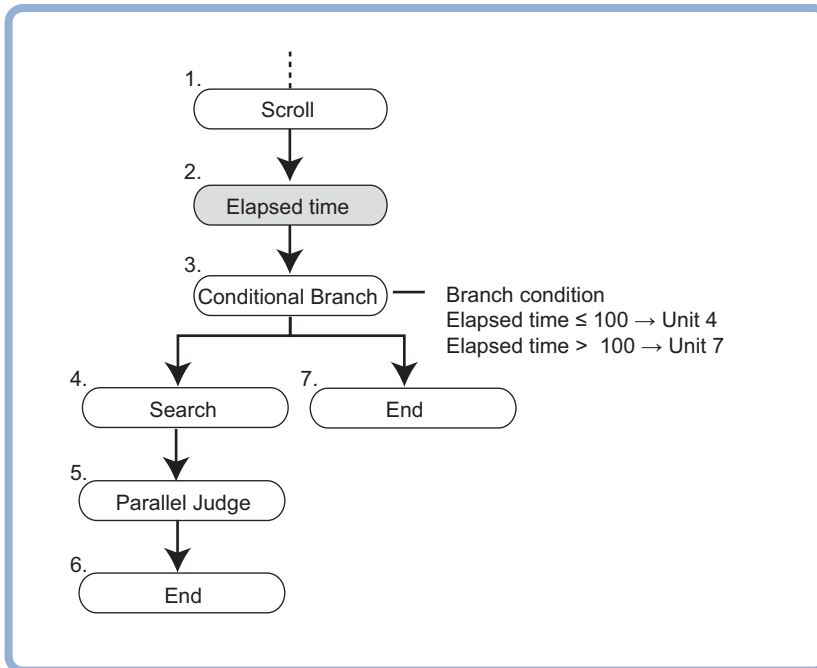
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5 to 12	Result of Expression 0 - Result of Expression 7	Get only	Calculation results of expressions
120	Measurement ID	Set/Get	0: OFF, 1: ON
121	Integer	Set/Get	1 to 10
122	Decimal	Set/Get	0: 0 to 4: 4
123	Minus	Set/Get	0: -, 1:8
124	Field separator	Set/Get	0: OFF, 1: Comma, 2: Tab, 3: Space, 4: CR+LF
125	Record separator	Set/Get	0: OFF 1: Comma, 2: Tab, 3: Space, 4: CR+LF
126	0 suppress	Set/Get	0: OFF, 1: ON
127 + N (N = 0 to 7)	Comment	Set/Get	Character string
135 + N (N = 0 to 7)	Expressions	Set/Get	Exp. character string
143	File name	Set/Get	Character string
144	Sub directory name	Set/Get	Character string
145	Prefix	Set/Get	Character string
146	Destination setting	Set/Get	0: Not setting 1: Setting

Elapsed Time

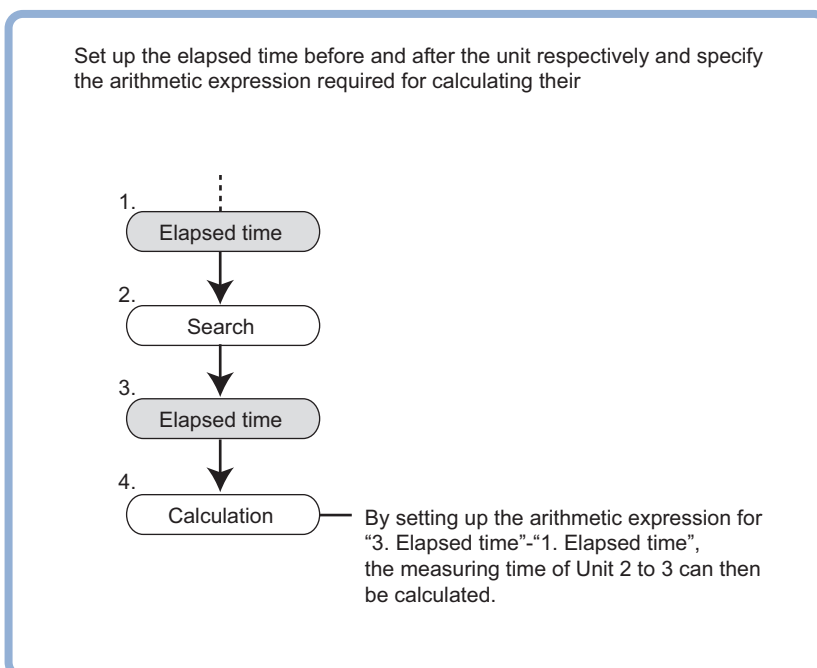
Calculate the elapsed time in milliseconds after the measurement starts. You can add this processing item to a scene and setup is not required.

Used in the Following Case

- When combining with the conditional branch for stopping measurement after the specified processing time has elapsed.



- When calculating the processing execution time of a unit



Note

- Time elapse can be confirmed on the main screen "Detail result" area.

```
[11.Elapsed Time]
Judge : OK
Elapsed time : 33ms
```

Measurement Results for Which Output Is Possible (Elapsed Time)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Latest processing unit judgement result
Elapsed Time	TM	Elapsed time from start of measurement (ms)

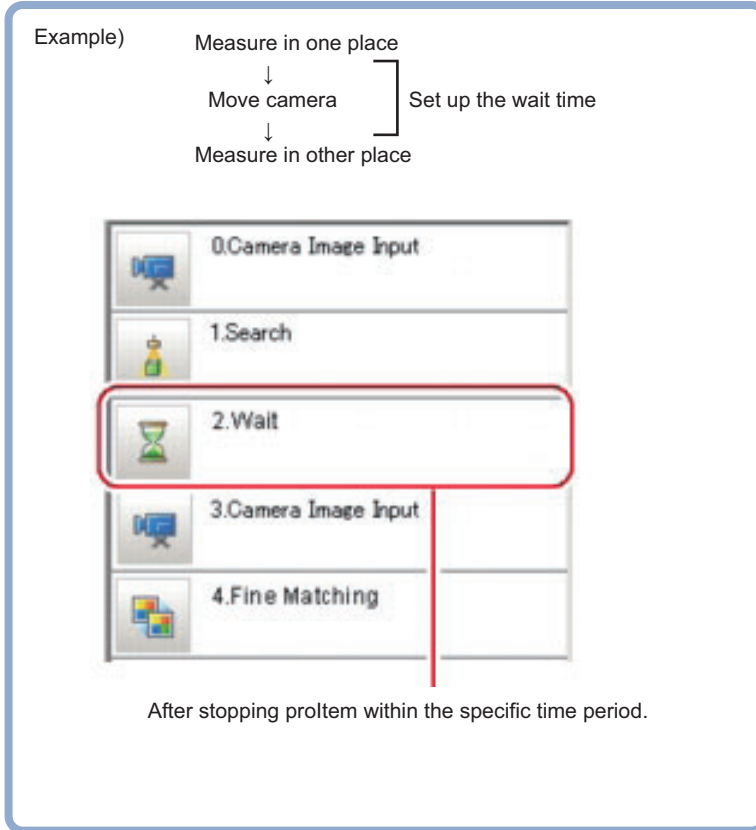
External Reference Tables (Elapsed Time)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Elapsed Time	Get only	0 to 999999

Wait

Used in the Following Case

- When pausing the measurement flow and setting processing in standby for a specific period of time



Settings (Wait)

- 1 Set the temporary stop time for flow in the "Waiting time" area.**

Please specify the time in ms.
This can be set to a range of 0 to 9999.



- 2 Click [OK].**

The settings are finalized.

External Reference Tables (Wait)

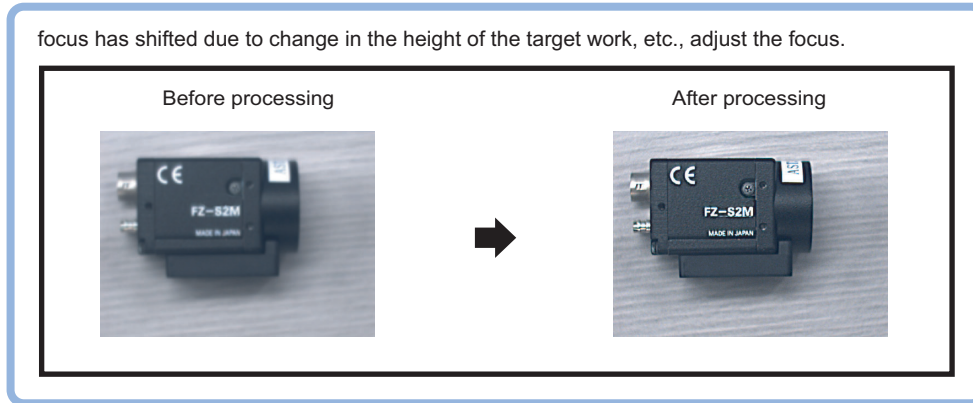
No.	Data name	Set/Get	Data range
120	Waiting time	Set/Get	0 to 9999 (ms)

Focus

This function helps you bring the camera into focus.

Used in the Following Case

- Use this function to make adjustments so as to facilitate inspection of input images that tend to become out of focus.



Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

Measurement Parameters (Focus)

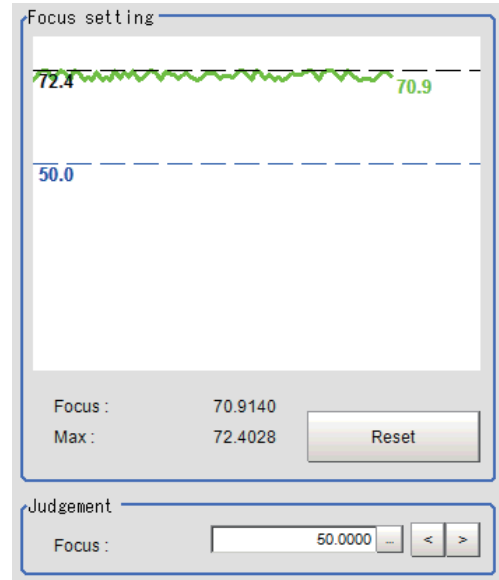
Measurement parameters can be changed as needed to address unstable focus values.

- 1 In the Item Tab area, click [Measurement].
- 2 In the "Display" area, click [Change display] to switch between camera image types.
(Re-measurement images are not shown on the setting window.)

Setting item	Set value	Description
ON	Through	The latest image is always input from the camera and displayed.
	Freeze	The image that was scanned in the immediately preceding measurement is displayed.

3 Set the focus value.

The focus value is displayed chronologically in real time in the graph area.



4 Set up the judgement condition.

Setting item	Set value [Factory default]	Description
Focus	0.0000 to 255.0000 [50.0000]	This item specifies the judgement value for focus.

Region Setting (Focus)

Set the range of focus adjustment.

- 1 In the Item Tab area, click [Region setting].**
- 2 Click [Edit].**
The figure setting area is displayed.
- 3 Specify the range of focus adjustment.**
The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.
- 4 Click [OK] in the Figure setting area.**
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

Output Parameters (Focus)

Specifies whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

- 1** Click [Output parameter] in the Item Tab area.
- 2** Choose whether or not to reflect this in the scene overall judgement in "Reflect to overall judgement" area.

Setting item	Set value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Enables choosing whether or not the judgment results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Focus)

Displayed items	Description
Judge	Judgement result
Focus	Focus value

External Reference Tables (Focus)

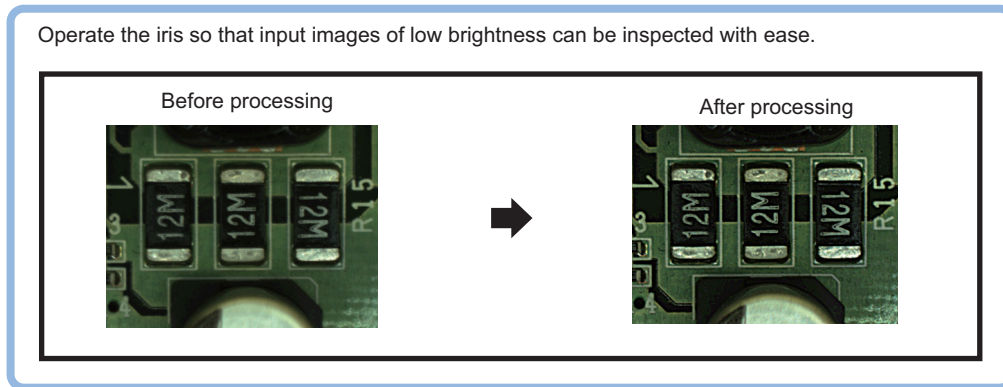
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
1	Measurement data Focus value	Get only	0 to 255
2	Focus maximum value	Get only	0 to 255
3	Last focus value	Get only	0 to 255
103	Setting data Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Setting data Focus value Lower limit	Set/Get	0 to 255

Iris

This function assists the aperture operation to adjust the amount of light taken in by the camera according to the change in illumination intensity.

Used in the Following Case

- When brightness at the measurement site changes:



Important

- Processing is different for color images and monochrome images. If the camera type, color camera, or monochrome camera, was changed from a previous setup, a reset of some settings may be needed.

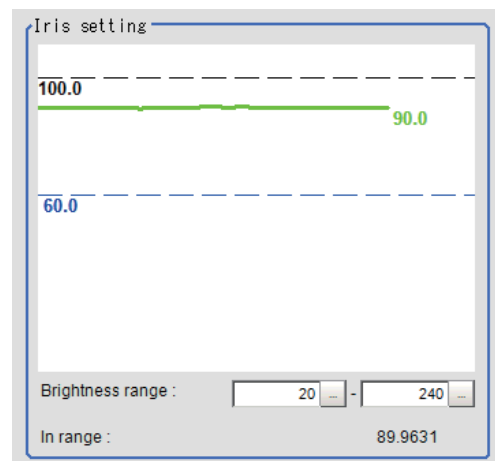
Measurement Parameters (Iris)

Adjust the amount of light taken in through the lens. Change the measurement parameter as necessary.

- 1 In the Item Tab area, click [Measurement].
- 2 In the "Display" area, click [Change display] to switch between camera image types.
(Re-measurement images are not shown on the setting window.)

Setting item	Set value	Description
Display	Through	The latest image is always input from the camera and displayed.
	Freeze	The image that was scanned in the immediately preceding measurement is displayed.

- 3 Set the valid brightness range.
The valid pixels are displayed chronologically in real time in the graph area.



Setting item		Set value [Factory default]	Description
Brightness range	Upper limit	0 to 255 [240]	Set the range used to determine whether or not the brightness of pixels is valid.
	Lower limit	0 to 255 [20]	

4 Set up the judgement condition.

For color cameras:

Setting item		Set value [Factory default]	Description
In range		0.0000 to 100.0000 [60.0000]	Set the minimum number of pixels to be made valid. Valid pixels indicate the percentage (%) of pixels inside the valid brightness range in the region.
R average	Upper limit	0 to 255 [255.000]	Set the R, G and B ranges to be made valid.
	Lower limit	0 to 255 [0.000]	
G average	Upper limit	0 to 255 [255.000]	
	Lower limit	0 to 255 [0.000]	
B average	Upper limit	0 to 255 [255.000]	
	Lower limit	0 to 255 [0.000]	

For monochrome cameras:

The screenshot shows a 'Judge' window with the following settings:

- In range :** 60.0000 (with left and right arrow buttons)
- Average :** 0.0000
- A range from 0.0000 to 255.0000 (with left and right arrow buttons)

Setting item		Set value [Factory default]	Description
In range		0.0000 to 100.0000 [60.0000]	Set the minimum number of pixels to be made valid. Valid pixels indicate the percentage (%) of pixels inside the valid brightness range in the region.
Average	Upper limit	0 to 255 [255.000]	Set the average brightness range to be made valid.
	Lower limit	0 to 255 [0.000]	

Region Setting (Iris)

Set the range of iris adjustment.

- 1 In the Item Tab area, click [Region setting].**
- 2 Click [Edit].**

The figure setting area is displayed.
- 3 Specify the range of iris adjustment.**

The rectangle covering the entire screen is set. Adjust the size and position of the rectangle.
- 4 Click [OK] in the Figure setting area.**
 - [OK]: Changes the settings and returns to the previous menu.
 - [Cancel]: Changes are discarded. Returns to the previous menu.
 - [Apply]: Updates the settings without leaving edit window.

Output Parameter (Iris)

Specifies whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

- 1 Click [Output parameter] in the Item Tab area.**
- 2 Choose whether or not to reflect this in the scene overall judgement in "Reflect to overall judgement" area.**

Setting item	Set value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none">• [ON]• OFF	Enables choosing whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Iris)

Displayed items	Description
Judge	Judgement result
In range	Percentage inside the valid brightness range
R average	R average in the region
G average	G average in the region
B average	B average in the region

External Reference Tables (Iris)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
1	Count	Get only	0 to 100
2	Average	Get only	---
3	Average R component value	Get only	0 to 255
4	Average G component value	Get only	0 to 255
5	Average B component value	Get only	0 to 255
6	Recent count	Get only	---
7	Recent average	Get only	---
8	Recent average R	Get only	---
9	Recent average G	Get only	---
10	Recent average B	Get only	---
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Brightness range Min.	Set/Get	0 to 255
121	Brightness range Max.	Set/Get	0 to 255
122	In range Min.	Set/Get	0 to 100
123	Average Min.	Set/Get	0 to 255.0
124	Average Max.	Set/Get	0 to 255.0
125	R average Min.	Set/Get	0 to 255.0
126	R average Max.	Set/Get	0 to 255.0
127	G average Min.	Set/Get	0 to 255.0
128	G average Max.	Set/Get	0 to 255.0
129	B average Min.	Set/Get	0 to 255.0
130	B average Max.	Set/Get	0 to 255.0

Parallelize

This processing item is used exclusively for the FH/FZ5-8□□/FZ5-11□□/FZ5-12□□.

The measurement time can be reduced by dividing one part of the measurement flow to two or more tasks and doing each one in parallel.

Measurement processing of the processing unit can be done in parallel when the operation mode's parallel processing is ON. When parallel processing is OFF, measurement processing of the processing unit is processed in series according to the execution order of the measurement flow.

You can add this processing item to a scene and setup is not required. Place it at the beginning of the process that you want to run in parallel.

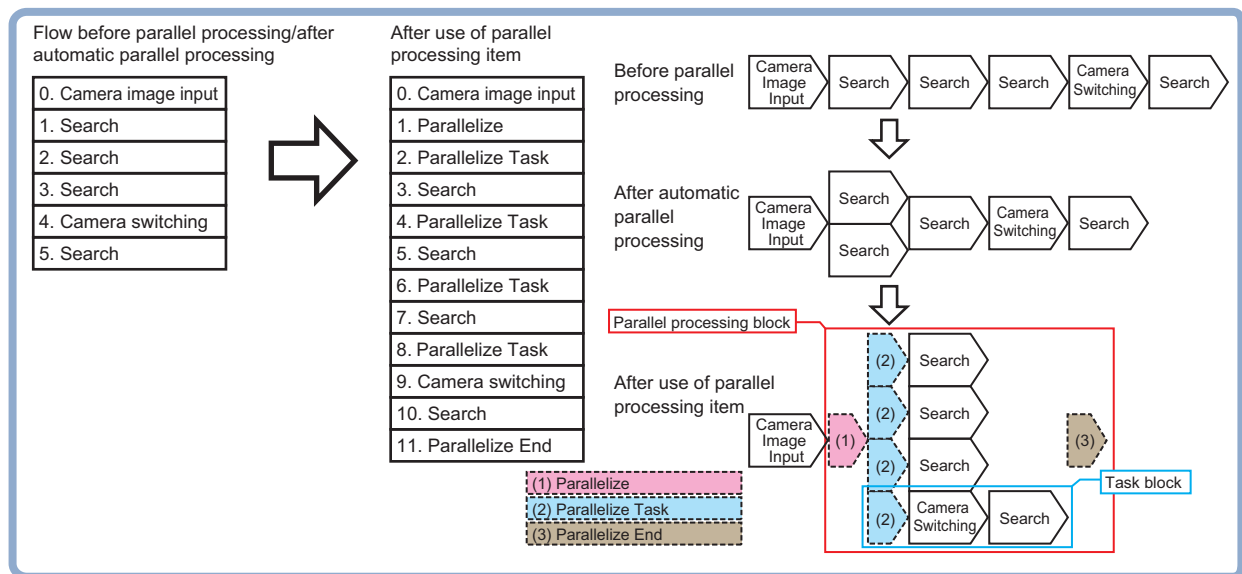
Parallel processing, parallel processing tasks, and parallel processing end cannot be used separately. Make sure to use them together as a set.

Reference: See ▶ "Parallel Processing" in "Chapter 6 Changing the System Environment" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Used in the Following Case

- When you want to reduce the overall processing time when there are multiple measurement processing items in the measurement flow

Example) Reducing the overall processing time, instead of performing series processing, by processing multiple searches in parallel.



Processing units can be executed in parallel by properly combining parallel processing, parallel processing tasks, and parallel processing end.

Parallelize Task

This processing item is used exclusively for the FH/FZ5-8□□/FZ5-11□□/FZ5-12□□.

The measurement time can be reduced by dividing one part of the measurement flow to two or more tasks and doing each one in parallel.

Measurement processing of the processing unit can be done in parallel when the operation mode's parallel processing is ON. When parallel processing is OFF, measurement processing of the processing unit is processed in series according to the execution order of the measurement flow.

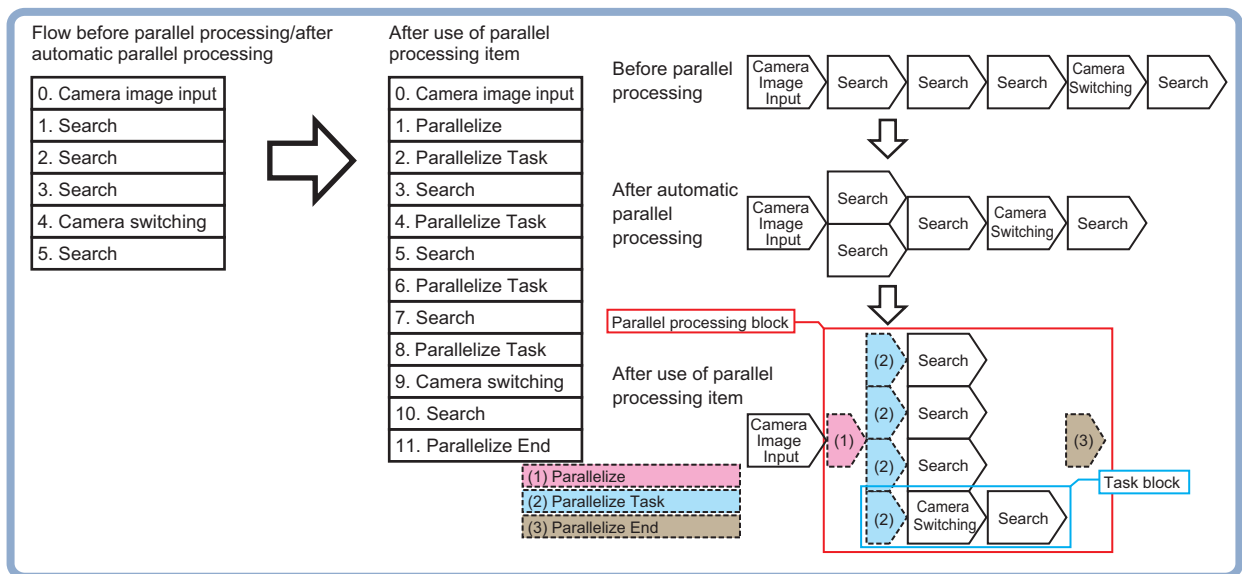
You can add this processing item to a scene and setup is not required. Place this right before the process you want to perform in parallel, between the parallel processing item and parallel processing end processing item. Parallel processing, parallel processing tasks, and parallel processing end cannot be used separately. Make sure to use them together as a set.

Reference: See ▶ "Parallel Processing" in "Chapter 6 Changing the System Environment" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Used in the Following Case

- **When you want to reduce the overall processing time when there are multiple measurement processing items in the measurement flow**

Example) Reducing the overall processing time, instead of performing series processing, by processing multiple searches in parallel.



Processing units can be executed in parallel by properly combining parallel processing, parallel processing tasks, and parallel processing end.

Statistics

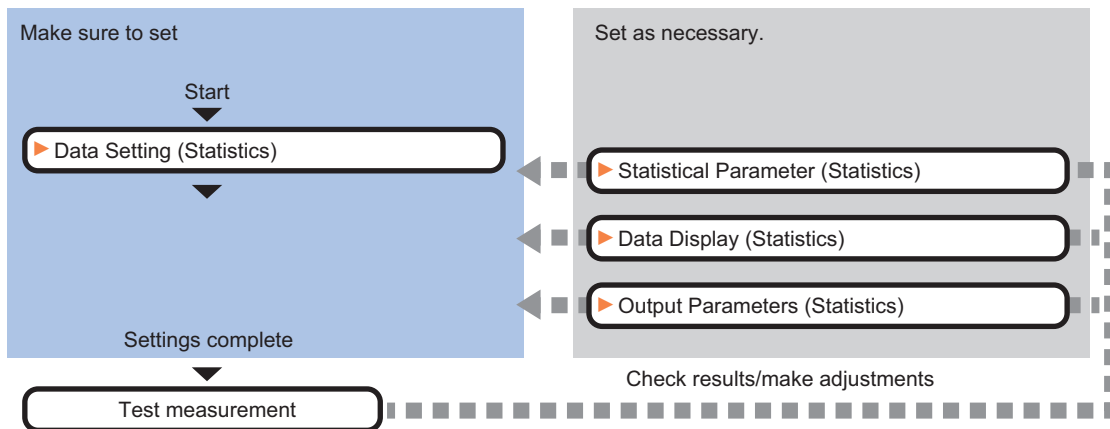
To reduce measurement variation of a given measurement processing item, multiple measurement results are stored in the processing item and statistical processing is performed at a specified timing. Up to 8 data can be set for statistical processing per processing item.

Used in the Following Case

- When you want to use an average of multiple measurement results as the measurement value because the work is vibrating

Settings Flow (Statistics)

Set up statistical processing according to the following flow.



List of Statistics Items

Item name	Description
Statistical parameter	Set the number of data to be stored as well as processing timing. Reference: ▶ Statistical Parameters (Statistics) (p.696)
Data setting	Set the data to be processed using a calculation formula. Reference: ▶ Data Setting (Statistics) (p.697)
Data display	Set up for checking of stored data using a graph. Reference: ▶ Data Display (Statistics) (p.697)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Reference: ▶ Output Parameters (Statistics) (p.698)

Statistical Parameters (Statistics)

Set the number of data to be stored as well as processing timing. The greater the number of data held, the less the measurement variation becomes.

1 Click [Statistical parameter] in the Item Tab area.

2 Set the maximum number of data to be saved in the "Max. data count" area.

Setting item	Setting value [Factory default]	Description
Max. data count	1 to 100 [10]	Set the maximum number of stored data to be saved to one processing target data.

3 Set the timing of statistical processing in the "Calculate timing" area.

Setting item	Setting value [Factory default]	Description
Calculate timing	<ul style="list-style-type: none"> • Every time • [Reach max. data count] 	Select the timing at which to perform statistical processing.

4 Click [OK].

Data Setting (Statistics)

Set the data to be processed using a calculation formula. Up to 8 data can be set.

- 1 In the Item Tab area, click [Data setting].
- 2 In the "Data setting" area, specify each item.

Up to 8 data can be set.

Setting item	Setting value [Factory default]	Description
Comment	-	Set a comment explaining the expression to be applied to the data to be processed.
Expression	-	Set the expression to be applied to the data to be processed.

- 3 To display comments in the "Detail result display" area, check "Comment view".

Data Display (Statistics)

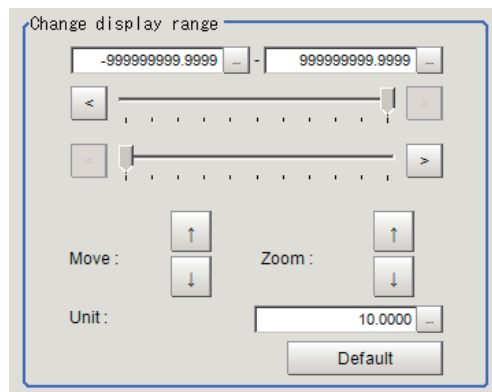
Set up for checking of stored data using a graph. Also, set the judgement range while checking the graph. Data outside the judgement range will not be processed.

- 1 In the Item Tab area, click [Data display].
- 2 In the "Data display" area, set the data number to be used as the target of [Data setting].

Setting item	Setting value [Factory default]	Description
Data No.	0 to 7 [0]	Set the data number to be used as the target of data setting.
Expression	-	Set data of the expression corresponding to the data number is displayed.
Comment	-	Set data of the comment corresponding to the data number is displayed.

3 In the "Change display range" area, set the upper and lower limit values of graph display range.

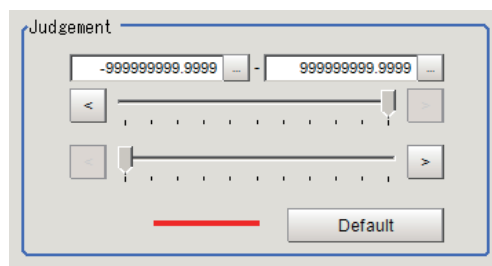
If the window is entered after measurement is performed a few times and [Default] is clicked, a display range suitable for these measurement values is automatically set.



Setting item	Setting value [Factory default]	Description
Upper and lower limit values of the graph display range	-999999999.9999 to 999999999.9999	Set the upper and lower limit values of the display range of the graph corresponding to the data number.
Unit	1.0000 to 1000000.0000 [10.0000]	Set how much the value will change when the Move or Zoom arrow button is clicked.

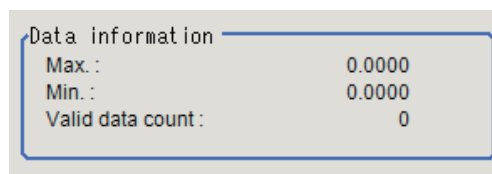
4 In the "Judgement" area, set the upper and lower limit values of set data judgement range.

If the window is entered after measurement is performed a few times and [Default] is clicked, a judgement range suitable for these measurement values is automatically set.



Setting item	Setting value [Factory default]	Description
Upper and lower limit values of the judgement range	-999999999.9999 to 999999999.9999	Set the upper and lower limit values of the judgement range corresponding to the data number.

5 The value reflecting the setting changes appears in the "Data information" area.



Output Parameters (Statistics)

Select how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

- 1** Click [Output parameter] in the Item Tab area.
- 2** Select the "Reflect to overall judgement".

Setting item	Setting value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Specify whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Statistics)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Calculated time	Number of measurements performed
Statistical result 0	Statistical processing result of data 0
Statistical result 1	Statistical processing result of data 1
Statistical result 2	Statistical processing result of data 2
Statistical result 3	Statistical processing result of data 3
Statistical result 4	Statistical processing result of data 4
Statistical result 5	Statistical processing result of data 5
Statistical result 6	Statistical processing result of data 6
Statistical result 7	Statistical processing result of data 7

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are false

State	Parameter to be adjusted	Troubleshooting
Not all data is included in the calculation	Data display	Data outside the judgement range will not be processed. If any necessary data is outside the judgement range, set the judgement range again.
The measurement result remains 0.0	Statistical parameter	If the calculation timing is "Only when the maximum number of data is reached," the measurement result remains 0.0 while the number of measurements is yet to reach the maximum number saved. Change the calculation timing on the statistical parameter tab to "Every time," and the measurement result will be calculated every time.

When the graph displays are false

State	Parameter to be adjusted	Troubleshooting
A graph showing a flat line appears even when the value is changing.	Data display	Change the graph display range to an appropriate range. If the initial values remain unchanged, the display range is too wide and the graph will show a flat line. Perform measurement at least twice, and then click the default range button on the data display tab.

Measurement Results for Which Output Is Possible (Statistics)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Calculated time	CT	Count
Statistic value N (N = 0 to 7)	DTN (N = 0 to 7)	Statistical processing result 0 to 7
Valid data N (N = 0 to 7)	OCN (N = 0 to 7)	Number of valid statistical processing data 0 to 7
Maximum N (N = 0 to 7)	MXN (N = 0 to 7)	Stored data maximum value 0 to 7
Minimum N (N = 0 to 7)	MNN (N = 0 to 7)	Stored data minimum value 0 to 7

External Reference Tables (Statistics)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Calculated time	Get only	0 to 100
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Maximum number of stored data	Set/Get	1 to 100
121	Data No.	Set/Get	0 to 7
122	Calculation timing	Set/Get	0 to 1
131 + N × 10 (N = 0 to 7)	Data expression N	Set/Get	Exp. character string
132 + N × 10 (N = 0 to 7)	Data N Upper limit of the judgement range	Set/Get	-999999999.9999 to 999999999.9999
133 + N × 10 (N = 0 to 7)	Data N Lower limit of the judgement range	Set/Get	-999999999.9999 to 999999999.9999
134 + N × 10 (N = 0 to 7)	Data N Upper limit of the display range	Set/Get	-999999999.9999 to 999999999.9999
135 + N × 10 (N = 0 to 7)	Data N Upper limit of the display range	Set/Get	-999999999.9999 to 999999999.9999
136 + N × 10 (N = 0 to 7)	Amount of change in data N display range	Set/Get	1 to 1000000
137 + N × 10 (N = 0 to 7)	Data N Measurement value	Set/Get	-999999999.9999 to 999999999.9999
138 + N × 10 (N = 0 to 7)	Expressions comment N	Set/Get	Character string
1000 + N × 10 (N = 0 to 7)	Measurement	Set/Get	-999999999.9999 to 999999999.9999
1001 + N × 10 (N = 0 to 7)	Statistical value	Set/Get	-999999999.9999 to 999999999.9999

No.	Data name	Set/Get	Data range
1002 + N × 10 (N = 0 to 7)	Number of valid data	Set/Get	0 to 100
1003 + N × 10 (N = 0 to 7)	Maximum	Set/Get	-999999999.9999 to 999999999.9999
1004 + N × 10 (N = 0 to 7)	Minimum	Set/Get	-999999999.9999 to 999999999.9999
10000 + N × 1 (N = 0 to 99)	Stored data N of data 0	Get only	-999999999.9999 to 999999999.9999
11000 + N × 1 (N = 0 to 99)	Stored data N of data 1	Get only	-999999999.9999 to 999999999.9999
12000 + N × 1 (N = 0 to 99)	Stored data N of data 2	Get only	-999999999.9999 to 999999999.9999
13000 + N × 1 (N = 0 to 99)	Stored data N of data 3	Get only	-999999999.9999 to 999999999.9999
14000 + N × 1 (N = 0 to 99)	Stored data N of data 4	Get only	-999999999.9999 to 999999999.9999
15000 + N × 1 (N = 0 to 99)	Stored data N of data 5	Get only	-999999999.9999 to 999999999.9999
16000 + N × 1 (N = 0 to 99)	Stored data N of data 6	Get only	-999999999.9999 to 999999999.9999
17000 + N × 1 (N = 0 to 99)	Stored data N of data 7	Get only	-999999999.9999 to 999999999.9999

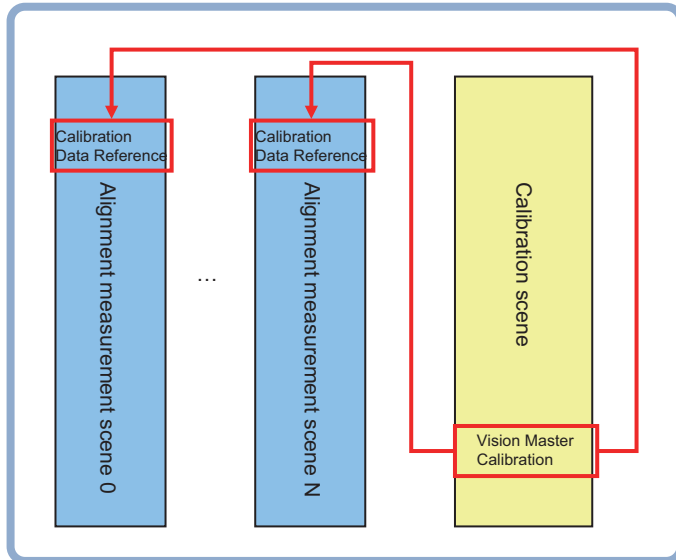
Calibration Data Reference

Calibration data and distortion compensation data held under other processing items can be referenced. Referenced data will be used to perform coordinate conversion processing and distortion compensation processing on measurement results after this processing unit.

As for distortion compensation processing, you can select not only "Compensate measurement result," but also "Compensate measurement image".

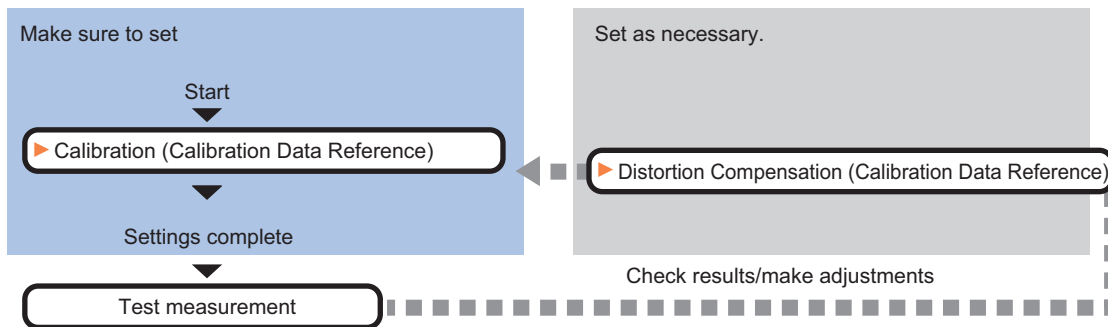
Used in the Following Case

- When you want to position the FPD panel



Settings Flow (Calibration Data Reference)

Calibration reference can be set up as follows.



List of Calibration Data Reference Items

Item name	Description
Calibration	Select the processing unit which holds calibration data. Data can be referenced not only from the current scene, but also from other scenes. Reference: ▶ Distortion Correction (Calibration Data Reference) (p.704)
Distortion correction	Select the processing unit in which the distortion compensation data to be referenced is held. Data can be referenced not only from the current scene, but also from other scenes. One of the two compensation methods, namely image correction and measurement value correction, can be selected. Reference: ▶ Distortion Correction (Calibration Data Reference) (p.704)

Calibration (Calibration Data Reference)

Select the processing unit in which the calibration data to be referenced is held.

- 1 In the Item Tab area, click [Calibration].
- 2 Select the reference scene No., reference unit No., and reference data No.

Item name	Description
Scene No.	Select the scene number to be referenced to obtain calibration data.
Unit No.	Select the unit number to be referenced to obtain calibration data. Units that can be referenced include camera image input, camera image input FH, camera image input HDR, camera image input HDR Lite, image master calibration, PLC master calibration, camera calibration and precise calibration.
Data No.	Select the position of the calibration data to be referenced among the data held in the unit to be referenced.
Reference data	Display the referenced calibration data. This display is updated when the reference scene number is changed, reference unit number is changed, or reference calibration data number is changed. If "None" is selected, the initial value is displayed. <ul style="list-style-type: none"> • Affine transformation parameter (A to F): Value (up to the sixth decimal place) • XY magnification: Value (up to the sixth decimal place) • Origin XY: Value (up to the sixth decimal place) • X axis angle, Y axis angle, XY angle: Value (up to the sixth decimal place)

Important

When the data referenced as a parameter by Calibration and the data referenced as a parameter by Distortion correction differs, specify data for Calibration Reference using an image that has already had Distortion correction applied.

Distortion Correction (Calibration Data Reference)

Select the processing unit in which the distortion compensation data to be referenced is held.

- 1 In the Item Tab area, click [Distortion correction].
- 2 Place a check at [Distortion correction] and select the reference scene number and reference unit number.

Item name	Description
Distortion correction	Place a check at [Distortion correction] if one of the conditions below is met: <ul style="list-style-type: none"> • Vision master calibration was performed with "Trapezoidal distortion" or "Lens distortion" selected under [Distortion correction setting]. • Precise calibration was performed with the correction settings turned "ON" on the [Image correction] tab.
Scene No.	Select the number of the scene to be referenced to obtain distortion compensation data.
Unit No.	Select the number of the unit to be referenced to obtain distortion compensation data. A high-precision calibration unit or image master calibration unit can be referenced.
Data No.	0 to 7 This item can be specified only when an image master calibration unit is selected for reference.
Using referred data	Initial value Checked
Height adjustment	Select "ON" to perform height adjustment using the reference data. Initial value OFF
Image correction	Select "ON" to perform image correction. Initial value OFF

Important

- When image correction is OFF, coordinate distortion compensation process is executed only for coordinate values.
- Note that no distortion compensation process is executed for other feature quantities such as an area.

Key Points for Test Measurement and Adjustment (Calibration Data Reference)

The following content is displayed in the "Detail result" area as text.

Setting item	Description
Judge	Judge
A	Affine transformation parameter A
B	Affine transformation parameter B
C	Affine transformation parameter C
D	Affine transformation parameter D
E	Affine transformation parameter E
F	Affine transformation parameter F
X magnification	X magnification.
Y magnification	Y magnification.
Origin X	Origin X.
Origin Y	Origin Y.
X axis angle	X axis angle.
Y axis angle	Y axis angle.
XY axis angle	XY axis angle.

Measurement Results for Which Output Is Possible (Calibration Data Reference)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Setting item	Character string	Description
Judge	JG	Judge

External Reference Tables (Calibration Data Reference)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error (image format mismatch) -11: Error (unregistered model) -12: Error (insufficient memory) -20: Error (other errors)
5	A	Get only	-
6	B	Get only	-
7	C	Get only	-
8	D	Get only	-
9	E	Get only	-
10	F	Get only	-
11	X magnification	Get only	-
12	Y magnification	Get only	-
13	Origin X	Get only	-

No.	Data name	Set/Get	Data range
14	Origin Y	Get only	-
15	X-axis angle	Get only	0.000000 to 360.000000
16	Y-axis angle	Get only	0.000000 to 360.000000
17	XY-axis angle	Get only	0.000000 to 180.000000
18	Lens focus [mm]	Get only	-
19	CCD1 pixel size [μm]	Get only	-
20	Plate height [mm]	Get only	-
21	Depth setting	Get only	-
22	Image correction setting	Get only	-
23	Work height [mm]	Get only	-
120	Scene No.(Calibration)	Set/Get	-1: Refer to present scene 0 to 9,999:Refer to scene No.
121	Unit No.(Calibration)	Set/Get	-1: No reference 0 to 9,999:Refer to unit No.
122	Data No.(Calibration)	Set/Get	0 to 7:Refer to data No.
123	Scene No (Distortion correction)	Set/Get	-1: Refer to present scene 0 to 9,999:Refer to scene No.
124	Unit No.(Distortion correction)	Set/Get	-1: No reference 0 to 9,999:Refer to unit No.
125	Distortion correction setting	Set/Get	0: OFF 1: ON
126	Depth setting without reference	Set/Get	0: OFF 1: ON
127	Using refered data	Set/Get	0: OFF 1: ON
128	Image correction setting without reference	Set/Get	0: OFF 1: ON
129	Work height without reference	Set/Get	-100 to 100
130	Data No.(Distortion correction)	Set/Get	0 to 7:Refer to data No.

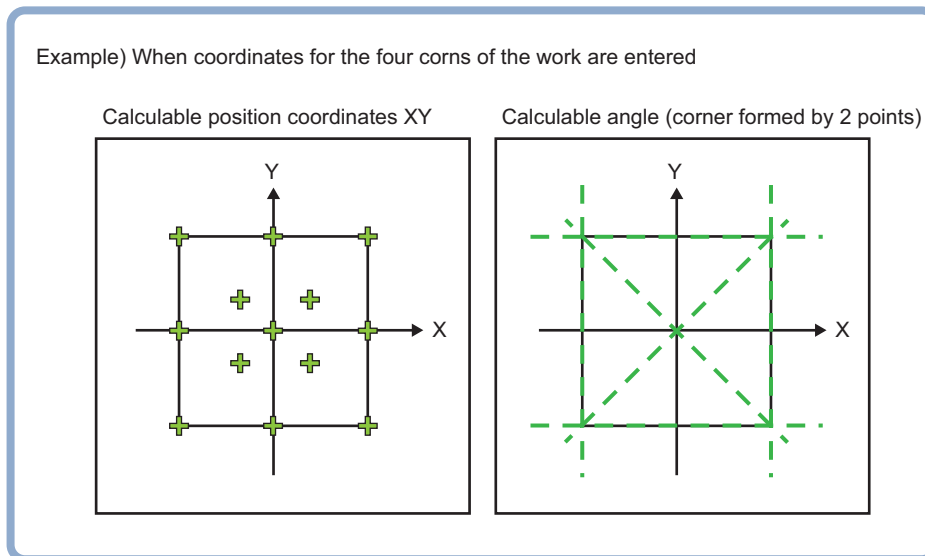
Position Data Calculation

Calculates position data and angle data used in the Position Data Calculation based on the measurement results of multiple processing items. Up to 4 measurement results can be used for the calculation.

It lets users easily calculate "The angle of a line between 2 points" and "the center point of two points" that are often used in alignment applications.

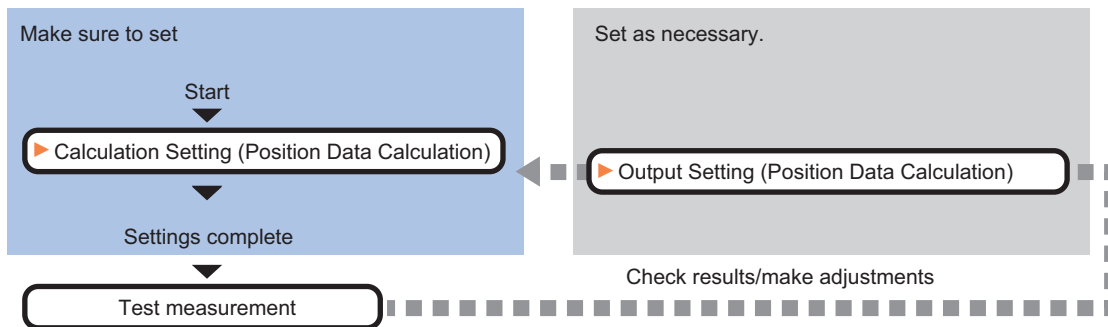
Used in the Following Case

- When you want to position the FPD panel



Settings Flow (Position Data Calculation)

The position/angle calculation should be set up with the following procedure.



List of Position Data Calculation Items

Item name	Description
Calculation setting	Set the data to be processed using a calculation formula. Up to 4 data can be set. The position data to be output is calculated by calculating the average of the position data of the points selected in "Calculation target position selection". The angle data to be output is calculated using the method selected in "Angle calculation method selection". Reference: ▶ Calculation Setting (Position Data Calculation) (p.708)
Output setting	This item can be changed if necessary. Normally, the factory default value will be used. Select whether to reflect the judgement result to the overall judgement of the scene. Reference: ▶ Output Setting (Position Data Calculation) (p.710)

Calculation Setting (Position Data Calculation)

Calculates position data and angle data used in the axis movement amount calculation based on the measurement results of multiple processing items.

1 In the Item Tab area, click [Calculation setting].

2 In the "Select calculation target position" area, select points to be used in the position calculation.

3 Select the angle calculation method in the "Select angle calculation method" area. Angle data is calculated using the selected method and the result is output.

Setting item	Setting value [Factory default]	Description
Select angle calculation method	<ul style="list-style-type: none"> • Points 0-3 • Line (point0-point1) • Line (point0-point2) • Line (point0-point3) • Line (point1-point0) • Line (point1-point2) • Line (point1-point3) • Line (point2-point0) • Line (point2-point1) • Line (point2-point3) • Line (point3-point0) • Line (point3-point1) • Line (point3-point2) 	Select the method for calculating the angle. Line (point0-point1) indicates an angle created by connecting Point 0 and Point 1.

Note

- As for the calculation of the angle formed by points, "Line (point0--point1)" and "Line (point1-point0)" output different angles. Use the suitable one.

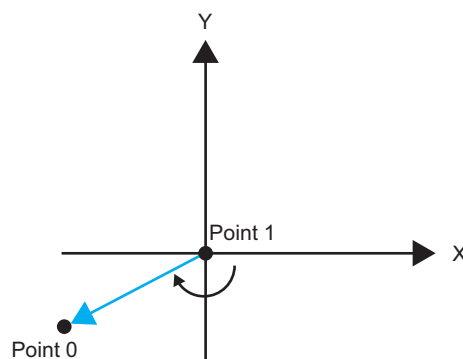
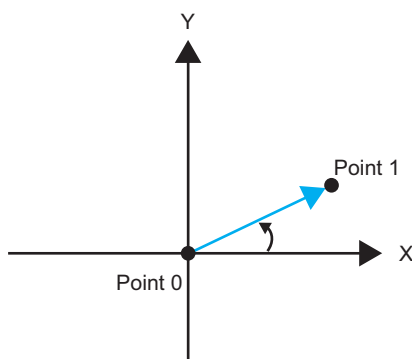


Fig. 1 angle of a side line formed by Point 0 – 1 Fig. 2 angle of a side line formed by Point 1 – 0

- As for data necessary for the calculation, the points X and Y for the points checked for position data calculation must not be empty. The angle data is as shown in the table in the next page.

Data necessary for angle data (○: data needed to be entered)								
Angle calculation method selection	Point 0		Point 1		Point 2		Point 3	
	Position XY	Angle	Position XY	Angle	Position XY	Angle	Position XY	Angle
Point 0		○						
Point 1				○				
Point 2						○		
Point 3								○
Side line formed by Points 0-1	○		○					
Side line formed by Points 0-2	○				○			
Side line formed by Points 0-3	○						○	
Side line formed by Points 1-0	○		○					
Side line formed by Points 1-2			○		○			
Side line formed by Points 1-3			○				○	
Side line formed by Points 2-0	○				○			
Side line formed by Points 2-1			○		○			
Side line formed by Points 2-3					○		○	
Side line formed by Points 3-0	○						○	
Side line formed by Points 3-1			○				○	
Side line formed by Points 3-2					○		○	

4 Set the position information of Points 0 to 3 as needed.

5 If the setting has been changed, click [Measure] to check the calculation result.

Test measuring of this item

Measure

6 Set up the judgement condition.

Setting item	Setting value [Factory default]	Description
Calculate position X	-99999.9999 to 99999.9999	Specify the range of X-axis calculation positions that is judged to be OK.
Calculate position Y	-99999.9999 to 99999.9999	Specify the range of Y-axis calculation positions that is judged to be OK.
Calculate angle	-180.0000 to 180.0000	Specify the range of calculation angles that is judged to be OK.

Output Setting (Position Data Calculation)

Specifies whether or not the judgement results of this processing unit is reflected in the overall judgement.

- 1** Click [Output setting] in the Item Tab area.
- 2** Choose whether or not to reflect the judgement result in the scene overall judgement in "Reflect to overall judgement" area.

Setting item	Setting value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Specify whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Position Data Calculation)

The following content is displayed in the "Detail result" area as text.

Setting item	Description
Judge	Judge
Calculation position X	Calculation position X
Calculation position Y	Calculation position Y
Calculation angle	Calculation angle

Measurement Results for Which Output Is Possible (Position Data Calculation)

The following values can be output using processing items related to the "output result" processing item. It is also possible to reference measurement values from expressions and other processing units.

Setting item	Character string	Description
Judge	JG	Judge
Calculation position X	X	Calculation position X
Calculation position Y	Y	Calculation position Y
Calculation angle	TH	Calculation angle
Calculation angle (Point 0)	TH0	Calculation angle for Point 0
Calculation angle (Point 1)	TH1	Calculation angle for Point 1
Calculation angle (Point 2)	TH2	Calculation angle for Point 2
Calculation angle (Point 3)	TH3	Calculation angle for Point 3
Calculation angle (Point 0-1)	TH01	Angle created by connecting Point 0-1.
Calculation angle (Point 0-2)	TH02	Angle created by connecting Point 0-2.
Calculation angle (Point 0-3)	TH03	Angle created by connecting Point 0-3.
Calculation angle (Point 1-0)	TH10	Angle created by connecting Point 1-0.
Calculation angle (Point 1-2)	TH12	Angle created by connecting Point 1-2.
Calculation angle (Point 1-3)	TH13	Angle created by connecting Point 1-3.
Calculation angle (Point 2-0)	TH20	Angle created by connecting Point 2-0.
Calculation angle (Point 2-1)	TH21	Angle created by connecting Point 2-1.
Calculation angle (Point 2-3)	TH23	Angle created by connecting Point 2-3.
Calculation angle (Point 3-0)	TH30	Angle created by connecting Point 3-0.

Setting item	Character string	Description
Calculation angle (Point 3-1)	TH31	Angle created by connecting Point 3-1.
Calculation angle (Point 3-2)	TH32	Angle created by connecting Point 3-2.

External Reference Tables (Position Data Calculation)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Calculate position X	Get only	-99,999.9999 to 99,999.9999
6	Calculate position Y	Get only	-99,999.9999 to 99,999.9999
7	Calculation angle	Get only	-180.0000 to 180.0000
8	Calculate angle(point 0)	Get only	-
9	Calculate angle(point 1)	Get only	-
10	Calculate angle(point 2)	Get only	-
11	Calculate angle(point 3)	Get only	-
12	Calculate angle(point0-point1)	Get only	-
13	Calculate angle(point0-point2)	Get only	-
14	Calculate angle(point0-point3)	Get only	-
15	Calculate angle(point1-point0)	Get only	-
16	Calculate angle(point1-point2)	Get only	-
17	Calculate angle(point1-point3)	Get only	-
18	Calculate angle(point2-point0)	Get only	-
19	Calculate angle(point2-point1)	Get only	-
20	Calculate angle(point2-point3)	Get only	-
21	Calculate angle(point3-point0)	Get only	-
22	Calculate angle(point3-point1)	Get only	-
23	Calculate angle(point3-point2)	Get only	-
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Position calculation method:point 0	Set/Get	0: NOT checked 1: Checked
121	Position calculation method:point 1	Set/Get	0: NOT checked 1: Checked
122	Position calculation method:point 2	Set/Get	0: NOT checked 1: Checked
123	Position calculation method:point 3	Set/Get	0: NOT checked 1: Checked
124	Angle calculation method	Set/Get	0 to 15
125	Upper limit of calculate position X	Set/Get	-99,999.9999 to 99,999.9999
126	Lower limit of calculate position X	Set/Get	-99,999.9999 to 99,999.9999
127	Upper limit of calculate position Y	Set/Get	-99,999.9999 to 99,999.9999
128	Lower limit of calculate position Y	Set/Get	-99,999.9999 to 99,999.9999
129	Upper limit of calculate angle	Set/Get	-180.0000 to 180.0000

No.	Data name	Set/Get	Data range
130	Lower limit of calculate angle	Set/Get	-180.0000 to 180.0000
131	Point 0:X	Set/Get	Exp. character string
132	Point 0:Y	Set/Get	Exp. character string
133	Point 0:Angle	Set/Get	Exp. character string
141	Point 1:X	Set/Get	Exp. character string
142	Point 1:Y	Set/Get	Exp. character string
143	Point 1:Angle	Set/Get	Exp. character string
151	Point 2:X	Set/Get	Exp. character string
152	Point 2:Y	Set/Get	Exp. character string
153	Point 2:Angle	Set/Get	Exp. character string
161	Point 3:X	Set/Get	Exp. character string
162	Point 3:Y	Set/Get	Exp. character string
163	Point 3:Angle	Set/Get	Exp. character string

Stage Data

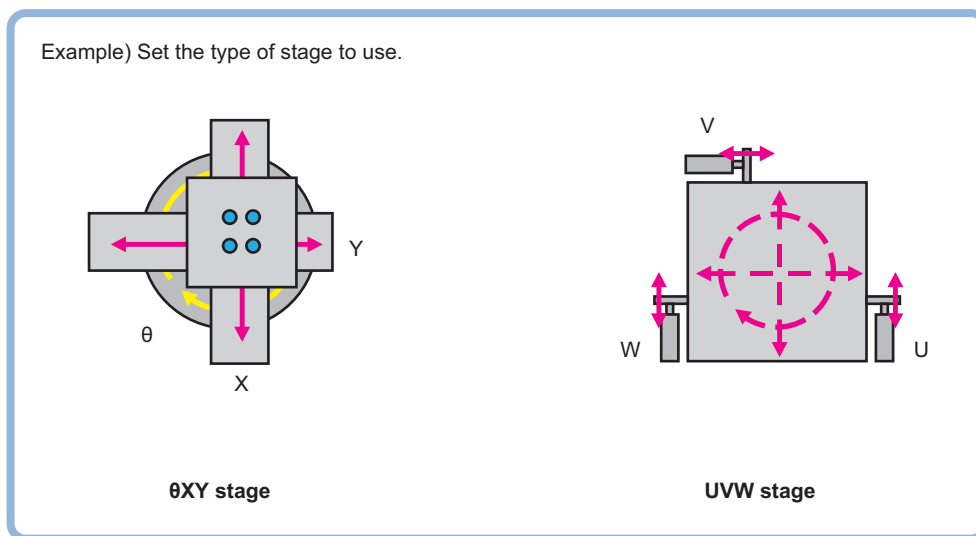
Stage data is a processing item that sets and preserves the data related to the stage of connecting to the Sensor controller. Set the data based on the specifications of the stage you are going to use.

When using a processing item which operates stages like the ones below, or which uses stage data, refer to this processing item.

- Vision master calibration
- PLC master calibration
- Calibration Data Reference
- Transfer Position Data
- Calc Axis Move
- Calc Axis Move by Multipoint

Used in the Following Case

- When setting parameters for the stage type and the rotation polarity



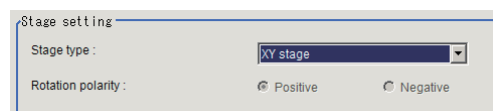
Data Setting (Stage Data)

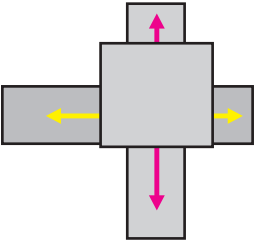
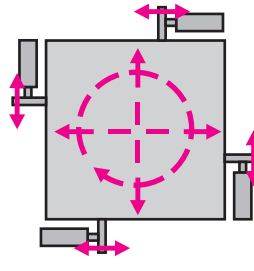
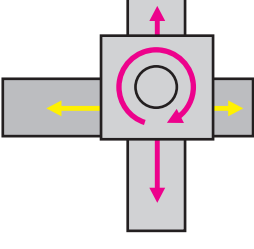

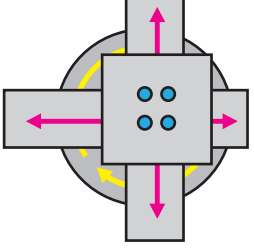
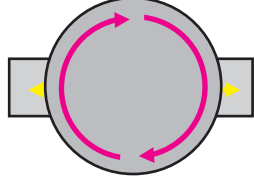
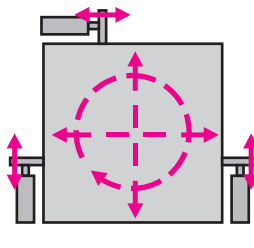
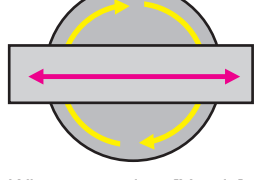
This item sets the stage type to be used and parameters. Select the stage you want to use and set the parameters according to the selected stage.

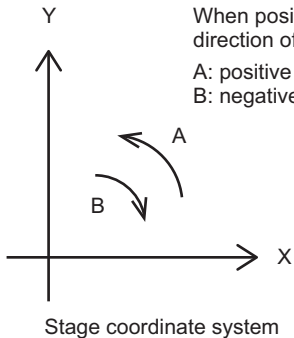
When operating a stage or using stage data, refer to this processing item from among the processing items.

Selecting a Stage Type (Stage Data)

- 1** In the Stage setting area, click [▼] in the [Stage type], and select your desired stage. Stages that can be used with this device are displayed.
- 2** If you select XY θ , θ XY, X θ (Y θ) or θ X(θ Y) stage, the rotation polarity becomes selectable. Select the appropriate polarity.



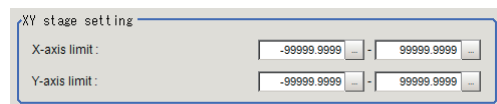
Setting item	Setting value [Factory default]	Description
Stage type	<ul style="list-style-type: none"> • [XY stage] • [XYθ stage] • [θXY stage] • [UVW stage] • [UVWR stage] • [X(Y) stage] • [Xθ(Yθ) stage] • [θX(θY) stage] 	<p>Usable "Stage types" are displayed. Select a stage. Usable "Stage types" are as follows:</p> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <p>XY stage</p>  </div> <div style="width: 50%;"> <p>UVWR stage</p>  </div> <div style="width: 50%;"> <p>XYθ stage</p>  </div> <div style="width: 50%;"> <p>X(Y) stage</p>  <p>When you select [X-axis] as measurement axis, [X-stage] is set. When you select [Y-axis] as measurement axis, [Y-stage] is set.</p> </div> <div style="width: 50%;"> <p>θXY stage</p>  </div> <div style="width: 50%;"> <p>Xθ(Yθ) stage</p>  <p>When you select [X-axis] as measurement axis, [Xθ-stage] is set. When you select [Y-axis] as measurement axis, [Yθ-stage] is set.</p> </div> <div style="width: 50%;"> <p>UVW stage</p>  </div> <div style="width: 50%;"> <p>θX(θY) stage</p>  <p>When you select [X-axis] as measurement axis, [θX-stage] is set. When you select [Y-axis] as measurement axis, [θY-stage] is set.</p> </div> </div> <p>When XY stage, UVW stage, UVRW stage or X(Y) stage is selected, the rotation polarity selection becomes disabled.</p>

Setting item	Setting value [Factory default]	Description
Rotation poiarity	<ul style="list-style-type: none"> • [Positive] • Negative 	<p>Select the rotation direction defined in the equipment is positive or negative compared to the rotation direction in the stage coordinate system.</p> <p>Polarities are as follows: Positive polarity/negative polarity</p>  <p>When positive rotation direction of the device is A: positive polarity B: negative polarity</p> <p>Stage coordinate system</p>

Setting the Data for Each Stage (XY Stage)

You can set 2-axis stage, i.e. XY stage in this function.

- 1** If XY stage is selected, the XY stage setting area is displayed.



- 2** Click [...] in [X-axis limit] in the XY stage setting area to set the upper and lower limit values.
- 3** Likewise click [...] in [Y-axis limit] to set the upper and lower limit values.

Setting item	Setting value [Factory default]	Description
X-axis limit	99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Set the upper and lower limit values for the X axis movement range of the XY stage. Units of the coordinate system set in calibration is used.
Y-axis limit	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Set the upper and lower limit values for the Y axis movement range of the XY stage. Units of the coordinate system set in calibration is used.

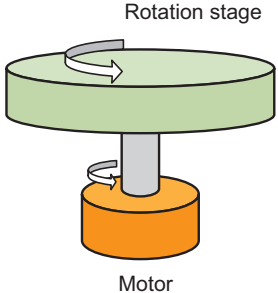
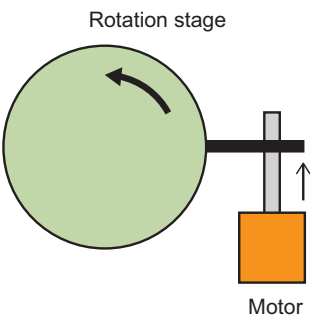
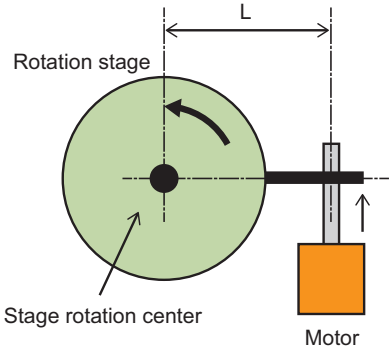
Setting the Data for Each Stage (XYθ Stage and θXY Stage)

You can set 3-axis stage, i.e. XYθ stage and θXY stage in this function.

- 1** If XYθ stage or θXY stage is selected, the XYθ stage setting area is displayed.

- 2** Click [...] in [X-axis limit] in the XYθ stage setting area to set the upper and lower limit values.
- 3** Likewise click [...] in [Y-axis limit] to set the upper and lower limit values.
- 4** Likewise click [...] in [θ-axis limit] to set the upper and lower limit values.
- 5** Select the θ axis drive system from the [θ-axis type].
- 6** If linear drive is selected in the θ axis type, [Distance from rotation center to linear axis] can be set. Click [...] and set a numeric value.
- 7** If the camera is moved, select the axis to which the camera is attached from [Camera movement axis].

Setting item	Setting value [Factory default]	Description
X-axis limit	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Set the upper and lower limit values for the X axis movement range of the XYθ stage. Units of the coordinate system set in calibration is used.
Y-axis limit	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Set the upper and lower limit values for the Y axis movement range of the XYθ stage. Units of the coordinate system set in calibration is used.
θ-axis limit	-180.0000 to 180.0000 [-180.0000] to [180.0000]	Set the upper and lower limit values for the θ axis angle movement range of the XYθ stage. The unit is degree.

Setting item	Setting value [Factory default]	Description				
θ axis type	<ul style="list-style-type: none"> • [Direct drive] • Linear drive 	<p>Select the θ axis drive type.</p> <p>Direct drive: A drive system which matches the θ axis rotation with the motor's axis of rotation.</p>  <p>Linear drive: A system which controls the θ axis rotation by linear movement.</p> 				
Distance from rotation center to linear axis	0.0000 to 99999.9999 [0.0000]	<p>For the linear drive system, set the distance (L) from the stage rotation center to the linear axis.</p> 				
Camera movement axis	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="287 1541 454 1617" style="width: 50%;">X-axis</td> <td data-bbox="454 1541 911 1617"> <ul style="list-style-type: none"> • Checked • [Unchecked] </td> </tr> <tr> <td data-bbox="287 1617 454 1713">Y-axis</td> <td data-bbox="454 1617 911 1713"> <ul style="list-style-type: none"> • Checked • [Unchecked] </td> </tr> </table>	X-axis	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Y-axis	<ul style="list-style-type: none"> • Checked • [Unchecked] 	<p>Enable this setting if the camera moves instead of the stage axis.</p> <p>If this is disabled, calculation for movement amount and so on is performed on the premises that the stage moves.</p>
X-axis	<ul style="list-style-type: none"> • Checked • [Unchecked] 					
Y-axis	<ul style="list-style-type: none"> • Checked • [Unchecked] 					

Setting the Data for Each Stage (UVW Stage and UVWR Stage)

You can set 3-axis stage, i.e. UVW stage and 4-axis stage, i.e. UVWR stage in this function.

- 1** If UVW stage or UVWR stage is selected, the "UVW or UVWR stage specific settings" area is displayed.

UVWR stage setting

Fulcrum type: Linear Rotation

U-axis direction: X-axis positive U-axis limit: -99999.9999 99999.9999

V-axis direction: X-axis positive V-axis limit: -99999.9999 99999.9999

W-axis direction: X-axis positive W-axis limit: -99999.9999 99999.9999

R-axis direction: X-axis positive R-axis limit: -99999.9999 99999.9999

Axis parameter setting: Setting by XY coordinate system Setting by Polar coordinate system

Setting by XY coordinate system

UX: 0.000000 UY: 0.000000

VX: 0.000000 VY: 0.000000

WX: 0.000000 WY: 0.000000

RX: 0.000000 RY: 0.000000

Rotation center X: 0.000000 Rotation center Y: 0.000000

Setting by Polar coordinate system

R1: 0.000000 theta1: 0.000000

R2: 0.000000 theta2: 0.000000

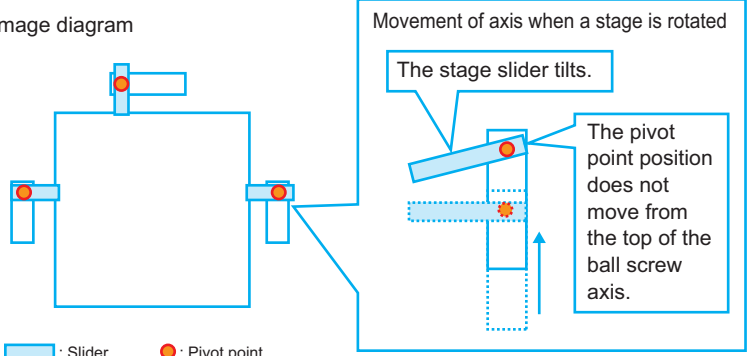
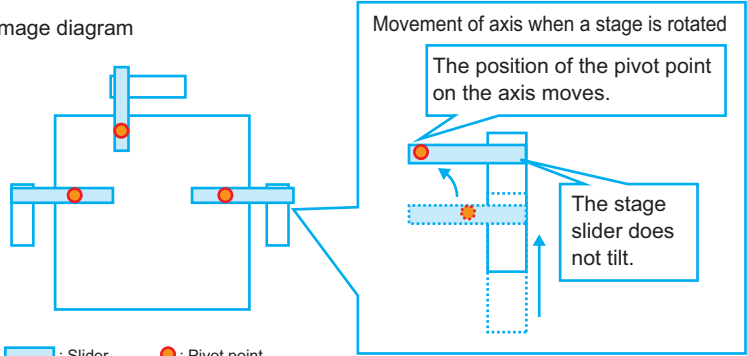
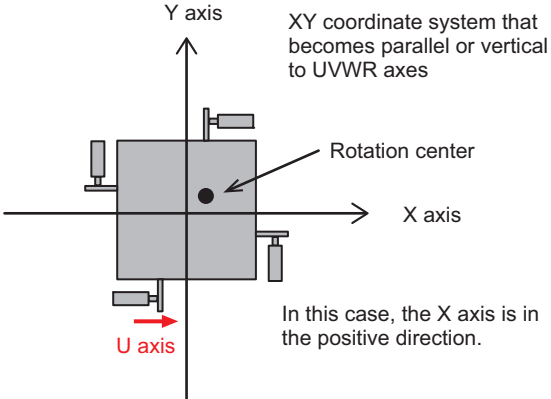
R3: 0.000000 theta3: 0.000000

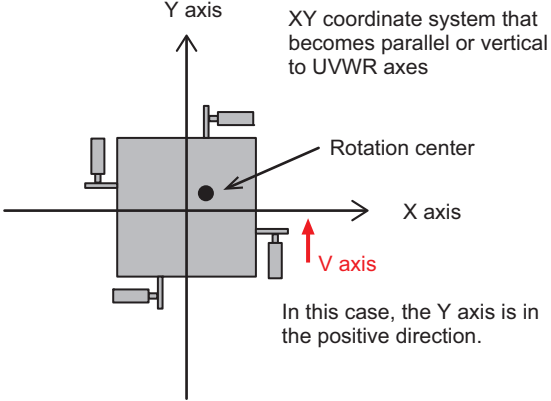
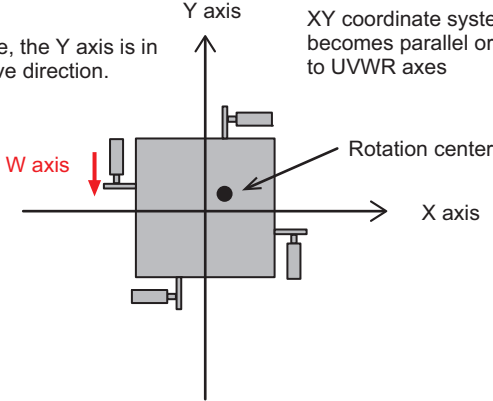
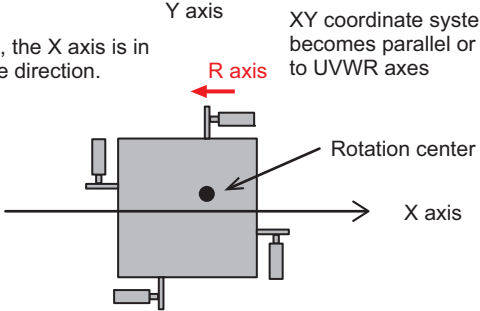
R4: 0.000000 theta4: 0.000000

Return before

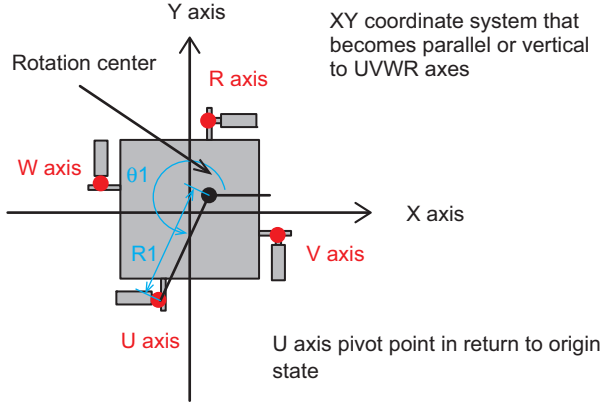
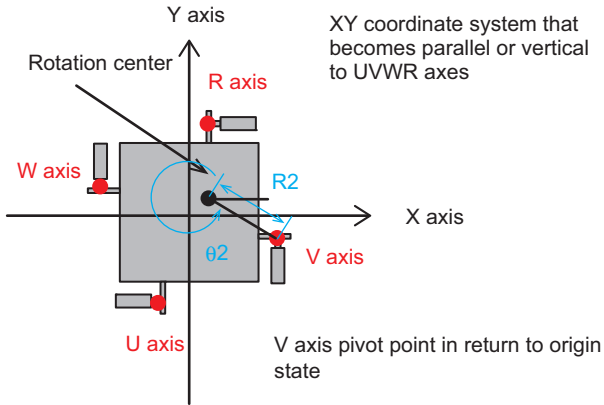
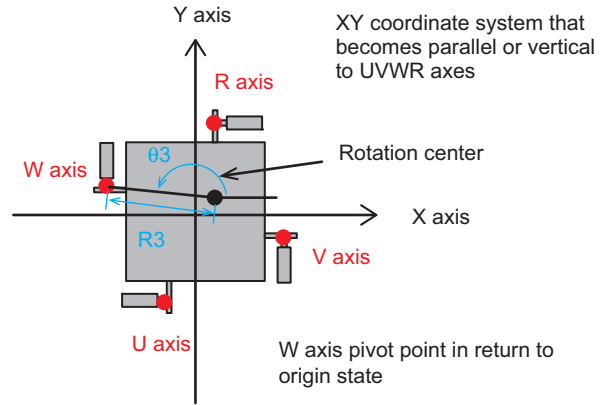
- 2** Select the slider type from the [Fulcrum type].
- 3** Click [▼] in [U-axis direction], and set the axis direction of the U axis to either forward or backward with respect to the X axis or Y axis direction in the XY coordinate system that is parallel or perpendicular to each UVWR axis.
- 4** Click [...] in [U-axis limit] to set the upper and lower limit values.
- 5** Likewise, click [▼] in [V-axis direction], and set the axis direction of the V axis to either forward or backward with respect to the X axis or Y axis direction in the XY coordinate system that is parallel or perpendicular to each UVWR axis.
- 6** Click [...] in [V-axis limit] to set the upper and lower limit values.
- 7** Likewise, click [▼] in [W-axis direction], and set the axis direction of the W axis to either forward or backward with respect to the X axis or Y axis direction in the XY coordinate system that is parallel or perpendicular to each UVWR axis.
- 8** Click [...] in [W-axis limit] to set the upper and lower limit values.
- 9** Likewise, click [▼] in [R-axis direction], and set the axis direction of the R axis to either forward or backward with respect to the X axis or Y axis direction in the XY coordinate system that is parallel or perpendicular to each UVWR axis.
- 10** Click [...] in [R-axis limit] to set the upper and lower limit values.
- 11** From the [Axis parameter setting], set the pivot point parameter of each UVWR axis either by coordinate setting or direct setting.
- 12** The Setting by XY coordinate system area is enabled if [Setting by XY coordinate system] is selected in [Axis parameter setting].
- 13** Click [...] in [UX] in the Setting by XY coordinate system area to set a value.
- 14** Likewise, click [...] in [UY] in the Setting by XY coordinate system area to set a value for the U axis pivot point's Y coordinate in the return to origin status.
- 15** Likewise, click [...] in [VX] in the Setting by XY coordinate system area to set a value for the V axis pivot point's X coordinate in the return to origin status.

- 16** Likewise, click [...] in [VY] in the Setting by XY coordinate system area to set a value for the V axis pivot point's Y coordinate in the return to origin status.
- 17** Likewise, click [...] in [WX] in the Setting by XY coordinate system area to set a value for the W axis pivot point's X coordinate in the return to origin status.
- 18** Likewise, click [...] in [WY] in the Setting by XY coordinate system area to set a value for the W axis pivot point's Y coordinate in the return to origin status.
- 19** Likewise, click [...] in [RX] in the Setting by XY coordinate system area to set a value for the R axis pivot point's X coordinate in the return to origin status.
- 20** Likewise, click [...] in [RY] in the Setting by XY coordinate system area to set a value for the R axis pivot point's Y coordinate in the return to origin status.
- 21** Likewise, click [...] in [Rotation center X] in the Setting by XY coordinate system area to set a value for the rotation center's X coordinate in the return to origin status.
- 22** Likewise, click [...] in [Rotation center Y] in the Setting by XY coordinate system area to set a value for the rotation center's Y coordinate in the return to origin status.
- 23** The Setting by Polar coordinate system area is enabled if [Setting by Polar coordinate system] is selected in [Axis parameter setting].
- 24** Click [...] in [R1] in the Setting by Polar coordinate system area to set the distance between the U axis pivot point and rotation center in the return to origin status.
- 25** Likewise, click [...] in [R2] in the Setting by Polar coordinate system area to set the distance between the V axis pivot point and rotation center in the return to origin status.
- 26** Likewise, click [...] in [R3] in the Setting by Polar coordinate system area to set the distance between the W axis pivot point and rotation center in the return to origin status.
- 27** Likewise, click [...] in [R4] in the Setting by Polar coordinate system area to set the distance between the R axis pivot point and rotation center in the return to origin status.
- 28** Likewise, click [...] in [$\theta 1$] in the Setting by Polar coordinate system area to set a value.
- 29** Likewise, click [...] in [$\theta 2$] in the Setting by Polar coordinate system area to set a value.
- 30** Likewise, click [...] in [$\theta 3$] in the Setting by Polar coordinate system area to set a value.
- 31** Likewise, click [...] in [$\theta 4$] in the Setting by Polar coordinate system area to set a value.

Setting item	Setting value [Factory default]	Description
Fulcrum type	<ul style="list-style-type: none"> • Linear • [Rotation] 	<p>Select the slider operation type when the stage is rotated.</p> <p>Linear</p> <p>Image diagram</p>  <p>Movement of axis when a stage is rotated</p> <p>The stage slider tilts.</p> <p>The pivot point position does not move from the top of the ball screw axis.</p> <p>Rotation</p> <p>Image diagram</p>  <p>Movement of axis when a stage is rotated</p> <p>The position of the pivot point on the axis moves.</p> <p>The stage slider does not tilt.</p> <p>Legend: ▬ : Slider ● : Pivot point</p>
U-axis direction	<ul style="list-style-type: none"> • [X-axis positive] • X-axis negative • Y-axis positive • Y-axis negative 	<p>For the axis direction of the U axis, set the rotation center to the point of origin then set it to either forward or backward with respect to the X axis or Y axis direction in the XY coordinate system that is parallel or perpendicular to each UVWR axis.</p>  <p>Y axis</p> <p>XY coordinate system that becomes parallel or vertical to UVWR axes</p> <p>Rotation center</p> <p>X axis</p> <p>U axis</p> <p>In this case, the X axis is in the positive direction.</p>
U-axis limit	<p>-99999.9999 to 99999.9999</p> <p>[-99999.9999] to [99999.9999]</p>	<p>Set the upper and lower limit values for the U axis movement range. Units of the coordinate system set in calibration is used.</p>

Setting item	Setting value [Factory default]	Description
V-axis direction	<ul style="list-style-type: none"> • [X-axis positive] • X-axis negative • Y-axis positive • Y-axis negative 	<p>Set the axis direction of the V axis to either forward or backward with respect to the X axis or Y axis direction in the XY coordinate system that is parallel or perpendicular to each UVWR axis.</p>  <p>The diagram shows a 2D coordinate system with a vertical Y axis and a horizontal X axis. A grey rectangular block represents the rotation center. A red arrow labeled 'V axis' points upwards from the rotation center. Text labels include 'Y axis', 'XY coordinate system that becomes parallel or vertical to UVWR axes', 'Rotation center', and 'X axis'. A note states: 'In this case, the Y axis is in the positive direction.'</p>
V-axis limit	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	<p>Set the upper and lower limit values for the V axis movement range. Units of the coordinate system set in calibration is used.</p>
W-axis direction	<ul style="list-style-type: none"> • [X-axis positive] • X-axis negative • Y-axis positive • Y-axis negative 	<p>Set the axis direction of the W axis to either forward or backward with respect to the X axis or Y axis direction in the XY coordinate system that is parallel or perpendicular to each UVWR axis.</p>  <p>The diagram shows a 2D coordinate system with a vertical Y axis and a horizontal X axis. A grey rectangular block represents the rotation center. A red arrow labeled 'W axis' points downwards from the rotation center. Text labels include 'Y axis', 'XY coordinate system that becomes parallel or vertical to UVWR axes', 'Rotation center', and 'X axis'. A note states: 'In this case, the Y axis is in the negative direction.'</p>
W-axis limit	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	<p>Set the upper and lower limit values for the W axis movement range. Units of the coordinate system set in calibration is used.</p>
R-axis direction	<ul style="list-style-type: none"> • [X-axis positive] • X-axis negative • Y-axis positive • Y-axis negative 	<p>Set the axis direction of the R axis to either forward or backward with respect to the X axis or Y axis direction in the XY coordinate system that is parallel or perpendicular to each UVWR axis.</p>  <p>The diagram shows a 2D coordinate system with a vertical Y axis and a horizontal X axis. A grey rectangular block represents the rotation center. A red arrow labeled 'R axis' points to the left from the rotation center. Text labels include 'Y axis', 'XY coordinate system that becomes parallel or vertical to UVWR axes', 'Rotation center', and 'X axis'. A note states: 'In this case, the X axis is in the negative direction.'</p>

Setting item	Setting value [Factory default]	Description
R-axis limit	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Set the upper and lower limit values for the R axis movement range. Units of the coordinate system set in calibration is used.
Axis parameter setting	<ul style="list-style-type: none"> • [Setting by XY coordinate system] • Setting by Polar coordinate system 	Select the pivot point parameter of each UVWR axis either by coordinate setting or direct setting.
UX	-99999.999999 to 99999.999999	<p>Set the X coordinate value of the U axis pivot point in the return to origin status.</p>
UY	-99999.999999 to 99999.999999 [0.000000]	Set the Y coordinate value of the U axis pivot point in the return to origin status.
VX	-99999.999999 to 99999.999999 [0.000000]	Set the X coordinate value of the V axis pivot point in the return to origin status.
VY	-99999.999999 to 99999.999999 [0.000000]	Set the Y coordinate value of the V axis pivot point in the return to origin status.
WX	-99999.999999 to 99999.999999 [0.000000]	Set the X coordinate value of the W axis pivot point in the return to origin status.
WY	-99999.999999 to 99999.999999 [0.000000]	Set the Y coordinate value of the W axis pivot point in the return to origin status.
RX	-99999.999999 to 99999.999999 [0.000000]	Set the X coordinate value of the R axis pivot point in the return to origin status.
RY	-99999.999999 to 99999.999999 [0.000000]	Set the Y coordinate value of the R axis pivot point in the return to origin status.
Rotation center X	-99999.999999 to 99999.999999 [0.000000]	Set the X coordinate value of the rotation center in the return to origin status.
Rotation center Y	-99999.999999 to 99999.999999 [0.000000]	Set the Y coordinate value of the rotation center in the return to origin status.

Setting item	Setting value [Factory default]	Description
R1	0.000000 to 99999.999999 [0.000000]	<p>Set the length of line segment connecting the stage rotation center and U axis pivot point in the return to origin (each axis' movement amount is 0) status.</p>  <p>XY coordinate system that becomes parallel or vertical to UVWR axes</p> <p>U axis pivot point in return to origin state</p>
theta1	-360.000000 to 360.000000 [0.000000]	<p>Set the angle from the X axis of the line segment connecting the stage rotation center and U axis pivot point in the return to origin (each axis' movement amount is 0) status. As for the angle, the X axis is set to 0° and the direction from X axis forward to Y axis forward is set to +.</p>
R2	0.000000 to 99999.999999 [0.000000]	<p>Set the length of line segment connecting the stage rotation center and V axis pivot point in the return to origin (each axis' movement amount is 0) status.</p>  <p>XY coordinate system that becomes parallel or vertical to UVWR axes</p> <p>V axis pivot point in return to origin state</p>
theta2	-360.000000 to 360.000000 [0.000000]	<p>Set the angle from the X axis of the line segment connecting the stage rotation center and V axis pivot point in the return to origin (each axis' movement amount is 0) status. As for the angle, the X axis is set to 0° and the direction from X axis forward to Y axis forward is set to +.</p>
R3	0.000000 to 99999.999999 [0.000000]	<p>Set the length of line segment connecting the stage rotation center and W axis pivot point in the return to origin (each axis' movement amount is 0) status.</p>  <p>XY coordinate system that becomes parallel or vertical to UVWR axes</p> <p>W axis pivot point in return to origin state</p>

Setting item	Setting value [Factory default]	Description
θ3	-360.000000 to 360.000000 [0.000000]	Set the angle from the X axis of the line segment connecting the stage rotation center and W axis pivot point in the return to origin (each axis' movement amount is 0) status. As for the angle, the X axis is set to 0° and the direction from X axis forward to Y axis forward is set to +.
R4	0.000000 to 99999.999999 [0.000000]	Set the length of line segment connecting the stage rotation center and R axis pivot point in the return to origin (each axis' movement amount is 0) status.
θ4	-360.000000 to 360.000000 [0.000000]	Set the angle from the X axis of the line segment connecting the stage rotation center and R axis pivot point in the return to origin (each axis' movement amount is 0) status. As for the angle, the X axis is set to 0° and the direction from X axis forward to Y axis forward is set to +.

Set parameters depending on each of Stage (X(Y) Stage)

In this setting area, set X Stage and Y Stage.

1 Selecting [XY stage] in [Stage type], [XY stage setting] is displayed.

Set parameters in [XY stage setting] area.

When you select [X-axis]

When you select [Y-axis]

2 Select type of Stage in [Movement axis] in [X(Y) stage setting] area.

Selecting [X-axis] as [Movement axis] and set [Y-axis] to X stage, then [Y-axis] is set to Y stage.

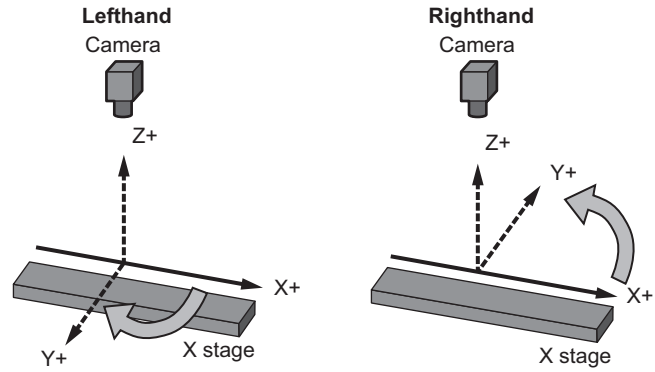
Parameter name in [X(Y) stage setting] area will change depending on selected [Movement axis]. *1, *2, *3

3 Select [Lefthand] or [Righthand] in [Coordinate].

Camera position is Z-axis respects to the surface where put on the work piece including movement axis.

[Lefthand]: Clockwise from camera vision.

[Righthand]: Counterclockwise from camera vision.



4 Clicking [...] in [Y-axis relative angle(X-axis standard)], set relative angle of X-axis. *1

Set an angle configured X-axis and virtually-calculated Y-axis. The orthogonal coordinate is normally 90°.

5 Clicking [...] in [Y-axis relative angle(X-axis standard)], set relative angle of X-axis. *2

Set an angle configured X-axis and virtually-calculated Y-axis. The orthogonal coordinate is normally 90°.

6 Clicking [...] in [X-axis limit], set both upper and lower limit of movement axis (X-axis). *3

Setting Item	Setting value [Factory default]	Description
Movement axis	<ul style="list-style-type: none"> • [X-axis] • Y-axis 	This parameter is for selecting type of Stage. When you select X-axis, set as X Stage. When you select Y-axis, set as Y Stage.
Coordinate	<ul style="list-style-type: none"> • [Lefthand] • Righthand 	Set coordinate. [Lefthand]: Clockwise from camera vision. [Righthand]: Counterclockwise from camera vision.
Y-axis relative angle (X-axis standard) *1	0.000001 to 180.000000 [90.000000]	When you select X-axis as Movement axis, set an angle virtually-calculated of Y-axis. When you select Y-axis as Movement axis, set an angle virtually-calculated of X-axis.
Y-axis relative angle magnification (X-axis standard) *2	0.100000 to 9.999999 [1.000000]	When you select X-axis as Movement axis, set a relative angle virtually-calculated of Y-axis. When you select Y-axis as Movement axis, set a relative angle virtually-calculated of X-axis.
X-axis limit *3	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	When you select X-axis as Movement axis, set upper and lower limit of X-axis. When you select Y-axis as Movement axis, set upper and lower limit of Y-axis. Unit is a coordinate set in calibration function.

*1, *2, *3: Those function name are displayed on the screen. If you select Y-axis in Movement axis, those name will change as below.

	Select X-axis as Measurement axis	Select Y-axis as Measurement axis
*1	Y-axis relative angle (X-axis standard)	X-axis relative angle (Y-axis standard)
*2	Y-axis relative angle magnification (X-axis standard)	X-axis relative angle magnification (Y-axis standard)
*3	X-axis limit	Y-axis limit

Set parameters depending on each of Stage (X θ stage and Y θ stage)

In this setting area, set X θ stage and Y θ stage.

1 Selecting [X θ stage] in [Stage type], [X θ (Y θ) stage setting] is displayed.

Set parameters in [X θ (Y θ) stage setting] area.

Stage setting

Stage type : X θ (Y θ) stage

Rotation polarity : Positive Negative

X θ (Y θ) stage setting

Movement axis : X-axis Y-axis

Coordinate : Lefthand Righthand

Y-axis relative angle(X-axis standard) : 90.000000

Y-axis relative magnification(X-axis standard) : 1.000000

X-axis limit : -99999.9999 99999.9999

θ -axis limit : -180.0000 180.0000

θ -axis type : Direct drive Linear drive

Distance from rotation center to linear axis : 0.000000

Camera movement axis : X-axis Y-axis

2 Select type of Stage in [Movement axis] in [X θ (Y θ) stage setting] area.

Selecting [X-axis] as [Movement axis] and set [Y-axis] to X θ stage. Selecting [Y-axis] is set to Y θ stage.

Parameter name in [X θ (Y θ) stage setting] area will change depending on selected [Movement axis]. *1, *2, *3

When you select [X-axis]

X θ (Y θ) stage setting

Movement axis : X-axis Y-axis

Coordinate : Lefthand Righthand

Y-axis relative angle(X-axis standard) : 90.000000

Y-axis relative magnification(X-axis standard) : 1.000000

X-axis limit : -99999.9999 99999.9999

θ -axis limit : -180.0000 180.0000

θ -axis type : Direct drive Linear drive

Distance from rotation center to linear axis : 0.000000

Camera movement axis : X-axis Y-axis

When you select [Y-axis]

X θ (Y θ) stage setting

Movement axis : X-axis Y-axis

Coordinate : Lefthand Righthand

X-axis relative angle(Y-axis standard) : 90.000000

X-axis relative magnification(Y-axis standard) : 1.000000

Y-axis limit : -99999.9999 99999.9999

θ -axis limit : -180.0000 180.0000

θ -axis type : Direct drive Linear drive

Distance from rotation center to linear axis : 0.000000

Camera movement axis : X-axis Y-axis

3 Select [Lefthand] or [Righthand] in [Coordinate].

4 Clicking [...] in [Y-axis relative angle(X-axis standard)], set relative angle of X-axis. *1

5 Clicking [...] in [Y-axis relative angle(X-axis standard)], set relative angle of X-axis. *2

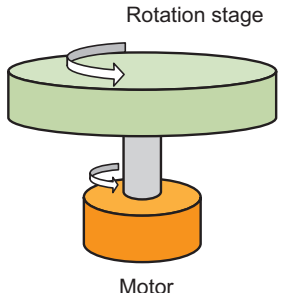
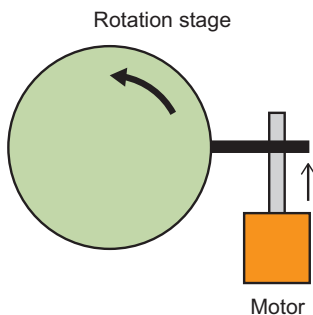
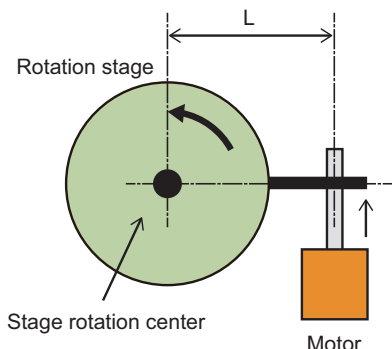
6 Clicking [...] in [X-axis limit], set both upper and lower limit of movement axis (X-axis). *3

7 Clicking [...] in [θ -axis limit], set both upper and lower limit of movement axis (θ -axis) on the X θ stage.

8 Select moving method of θ -axis in [θ -axis type].

9 Selecting [Linear drive] in [θ -axis type], [Distance from rotation center to linear axis] is applied, the you can set values by clicking [...].

Setting Item	Setting value [Factory default]	Description
Movement axis	<ul style="list-style-type: none"> • [X-axis] • Y-axis 	<p>This parameter is for selecting type of Stage.</p> <p>When you select X-axis, set as Xθ stage.</p> <p>When you select Y-axis, set as Yθ stage.</p>
Coordinate	<ul style="list-style-type: none"> • [Lefthand] • Righthand 	<p>Set coordinate.</p> <p>[Lefthand]: Clockwise from camera vision.</p> <p>[Righthand]: Counterclockwise from camera vision.</p>
Y-axis relative angle (X-axis standard) *1	0.000001 to 180.000000 [90.000000]	<p>When you select X-axis as Movement axis, set an angle virtually-calculated of Y-axis.</p> <p>When you select Y-axis as Movement axis, set an angle virtually-calculated of X-axis.</p> <p>Unit is angle.</p>
Y-axis relative angle magnification (X-axis standard) *2	0.100000 to 9.999999 [1.000000]	<p>When you select X-axis as Movement axis, set a relative angle virtually-calculated of Y-axis.</p> <p>When you select Y-axis as Movement axis, set a relative angle virtually-calculated of X-axis.</p>
X-axis limit *3	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	<p>When you select X-axis as Movement axis, set upper and lower limit of X-axis.</p> <p>When you select Y-axis as Movement axis, set upper and lower limit of Y-axis.</p> <p>Unit is a coordinate set in calibration function.</p>
θ -axis (linear drive) limit	-180.0000 to 180.0000 [-180.0000] to [180.0000]	<p>Set upper and lower limit of θ-axis.</p> <p>Unit is angle.</p>

Setting Item	Setting value [Factory default]	Description
θ-axis type	<ul style="list-style-type: none"> • [Direct drive] • Linear drive 	Select the q axis drive type. [Direct drive]: Movement method combering rotation of θ-axis to rotation axis of motor. 
		Linear drive: Control rotation of θ-axis with linear movement of motor rotation. 
Distance from rotation center to linear axis	0.0000 to 99999.9999 [0.0000]	When you select [Linear], set the distance (L) from rotation center to linear axis. 

*1, *2, *3: Those function name are displayed on the screen. If you select Y-axis in Movement axis, those name will change as below.

	Select X-axis as Measurement axis	Select Y-axis as Measurement axis
*1	Y-axis relative angle(X-axis standard)	X-axis relative angle(Y-axis standard)
*2	Y-axis relative angle magnification(X-axis standard)	X-axis relative angle magnification(Y-axis standard)
*3	X-axis limit	Y-axis limit

Set parameters depending on each of Stage (θX stage and θY stage)

In this setting area, set θX stage and θY stage.

1 Selecting [$\theta X(\theta Y)$ stage] in [Stage type], [$\theta X(\theta Y)$ stage setting] is displayed.

Set parameters in [$\theta X(\theta Y)$ stage setting] area.

2 Select type of Stage in [Movement axis] in [$\theta X(\theta Y)$ stage setting] area.

Selecting [X-axis] as [Movement axis] and set [Y-axis] to $Y\theta$ stage. Selecting [Y-axis] is set to $Y\theta$ stage.

Parameter name in [$\theta X(\theta Y)$ stage setting] area will change depending on selected [Movement axis]. *1, *2, *3

When you select [X-axis]

When you select [Y-axis]

3 Select [Lefthand] or [Righthand] in [Coordinate].

4 Clicking [...] in [Y-axis relative angle(X-axis standard)], set relative angle of X-axis. *1

5 Clicking [...] in [Y-axis relative angle(X-axis standard)], set relative angle of X-axis. *2

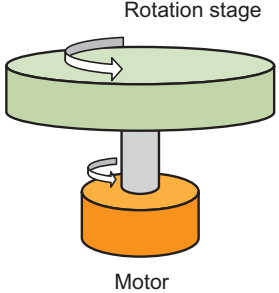
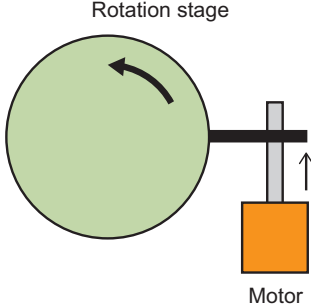
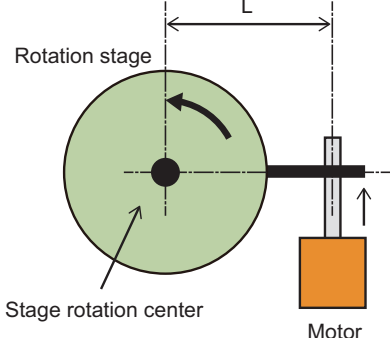
6 Clicking [...] in [X-axis limit], set both upper and lower limit of movement axis (X-axis). *3

7 Clicking [...] in [θ-axis limit], set both upper and lower limit of movement axis (θ-axis) on the $X\theta$ stage.

8 Select moving method of θ-axis in [θ-axis type].

9 Selecting [Linear drive] in [θ-axis type], [Distance from rotation center to linear axis] is applied, the you can set values by clicking [...].

Setting Item	Setting value [Factory default]	Description
Movement axis	<ul style="list-style-type: none"> • [X-axis] • Y-axis 	<p>This parameter is for selecting type of Stage.</p> <p>When you select X-axis, set as Xθ stage.</p> <p>When you select Y-axis, set as Yθ stage.</p>
Coordinate	<ul style="list-style-type: none"> • [Lefthand] • Righthand 	<p>Set coordinate.</p> <p>[Lefthand]: Clockwise from camera vision.</p> <p>[Righthand]: Counterclockwise from camera vision.</p>
Y-axis relative angle (X-axis standard) *1	0.000001 to 180.000000 [90.000000]	<p>When you select X-axis as Movement axis, set an angle virtually-calculated of Y-axis.</p> <p>When you select Y-axis as Movement axis, set an angle virtually-calculated of X-axis.</p> <p>Unit is angle.</p>
Y-axis relative angle magnification (X-axis standard) *2	0.100000 to 9.999999 [1.000000]	<p>When you select X-axis as Movement axis, set a relative angle virtually-calculated of Y-axis.</p> <p>When you select Y-axis as Movement axis, set a relative angle virtually-calculated of X-axis.</p>
X-axis limit *3	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	<p>When you select X-axis as Movement axis, set upper and lower limit of X-axis.</p> <p>When you select Y-axis as Movement axis, set upper and lower limit of Y-axis.</p> <p>Unit is a coordinate set in calibration function.</p>
θ -axis (linear drive) limit	-180.0000 to 180.0000 [-180.0000] to [180.0000]	<p>Set upper and lower limit of θ-axis.</p> <p>Unit is angle.</p>

Setting Item	Setting value [Factory default]	Description
θ-axis type	<ul style="list-style-type: none"> • [Direct drive] • Linear drive 	Select the q axis drive type. [Direct drive]: Movement method comforting rotation of θ-axis to rotation axis of motor. 
		Linear drive: Control rotation of θ-axis with linear movement of motor rotation. 
Distance from rotation center to linear axis	0.0000 to 99999.9999 [0.0000]	When you select [Linear], set the distance (L) from rotation center to linear axis. 

*1, *2, *3: Those function name are displayed on the screen. If you select Y-axis in Movement axis, those name will change as below.

	Select X-axis as Movement axis	Select Y-axis as Movement axis
*1	Y-axis relative angle(X-axis standard)	X-axis relative angle(Y-axis standard)
*2	Y-axis relative angle magnification(X-axis standard)	X-axis relative angle magnification(Y-axis standard)
*3	X-axis limit	Y-axis limit

Measurement Results for Which Output Is Possible (Stage Data)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference Tables (Stage Data)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
120	Stage type	Set/Get	0: XY stage 1: XYθ stage 2: θXY stage 3: UVW stage 4: UVWR stage 5: Xθ (Yθ) stage 6: θX (θY) stage 7: X (Y) stage
121	Rotation polarity	Set/Get	-1: Negative 1: Positive
122	Distance from rotation center to linear axis	Set/Get	0.000000 to 99,999.999999
123	Axis parameter setting	Set/Get	0: Setting by XY coordinate 1: Setting by Polar coordinate system.
124	Rotation center X	Set/Get	-99,999.999999 to 99,999.999999
125	Rotation center Y	Set/Get	-99,999.999999 to 99,999.999999
126	Fulcrum type	Set/Get	0: Rotation 1: Linear
127	θ-axis type	Set/Get	0: Direct drive 1: Linear drive
128	Camera movement axis X-axis	Set/Get	0: Camera moving axis X is not used 1: Camera moving axis X is used
129	Camera movement axis Y-axis	Set/Get	0: Camera moving axis Y is not used 1: Camera moving axis Y is used
130	R1	Set/Get	0.000000 to 99,999.999999
131	θ1	Set/Get	-360.000000 to 360.000000
132	R2	Set/Get	0.000000 to 99,999.999999
133	θ2	Set/Get	-360.000000 to 360.000000
134	R3	Set/Get	0.000000 to 99,999.999999
135	θ3	Set/Get	-360.000000 to 360.000000
136	R4	Set/Get	0.000000 to 99,999.999999
137	θ4	Set/Get	-360.000000 to 360.000000
150	UX	Set/Get	-99,999.999999 to 99,999.999999
151	UY	Set/Get	-99,999.999999 to 99,999.999999
152	VX	Set/Get	-99,999.999999 to 99,999.999999
153	VY	Set/Get	-99,999.999999 to 99,999.999999
154	WX	Set/Get	-99,999.999999 to 99,999.999999
155	WY	Set/Get	-99,999.999999 to 99,999.999999
156	RX	Set/Get	-99,999.999999 to 99,999.999999
157	RY	Set/Get	-99,999.999999 to 99,999.999999

No.	Data name	Set/Get	Data range
170	U-axis direction	Set/Get	0: X-axis positive 1: X-axis negative 2: Y-axis positive 3: Y-axis negative
171	V-axis direction	Set/Get	0: X-axis positive 1: X-axis negative 2: Y-axis positive 3: Y-axis negative
172	W-axis direction	Set/Get	0: X-axis positive 1: X-axis negative 2: Y-axis positive 3: Y-axis negative
173	R-axis direction	Set/Get	0: X-axis positive 1: X-axis negative 2: Y-axis positive 3: Y-axis negative
180	Lower limit of X-axis movement	Set/Get	-99,999.999999 to 99,999.999999
181	Upper limit of X-axis movement	Set/Get	-99,999.999999 to 99,999.999999
182	Lower limit of Y-axis movement	Set/Get	-99,999.999999 to 99,999.999999
183	Upper limit of Y-axis movement	Set/Get	-99,999.999999 to 99,999.999999
184	Lower limit of θ -axis movement	Set/Get	-180.0000 to 180.0000
185	Upper limit of θ -axis movement	Set/Get	-180.0000 to 180.0000
186	Lower limit of θ -axis(linear drive) movement	Set/Get	-99,999.999999 to 99,999.999999
187	Upper limit of θ -axis(linear drive) movement	Set/Get	-99,999.999999 to 99,999.999999
190	Lower limit of U-axis movement	Set/Get	-99,999.999999 to 99,999.999999
191	Upper limit of U-axis movement	Set/Get	-99,999.999999 to 99,999.999999
192	Lower limit of V-axis movement	Set/Get	-99,999.999999 to 99,999.999999
193	Upper limit of V-axis movement	Set/Get	-99,999.999999 to 99,999.999999
194	Lower limit of W-axis movement	Set/Get	-99,999.999999 to 99,999.999999
195	Upper limit of W-axis movement	Set/Get	-99,999.999999 to 99,999.999999
196	Lower limit of R-axis movement	Set/Get	-99,999.999999 to 99,999.999999
197	Upper limit of R-axis movement	Set/Get	-99,999.999999 to 99,999.999999
300	Movement axis	Set/Get	0: X-axis 1: Y-axis
301	Coordinate	Set/Get	0: Lefthand 1: Righthand
302	relative angle	Set/Get	1.000000 to 179.000000
303	relative magnification	Set/Get	0.100000 to 9.999999

Robot Data

Sets and stores data related to robots.

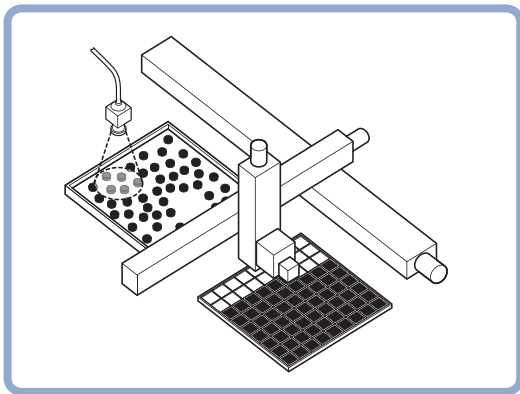
This processing item is required when using the following processing items in an equipment environment containing robots.

- Vision master calibration
- PLC master calibration
- Calibration Data Reference
- Transfer Position Data
- Calc Axis Move
- Calc Axis Move by Multipoint

Used in the Following Case

- **When setting parameters for robots to be used and the rotation polarity**

Example: palletizing of electronic parts

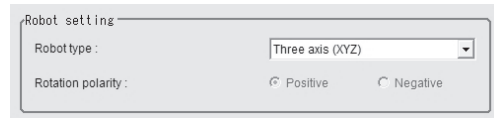


Data Setting (Robot Data)

Set data based on the specification of the robot.

- 1 In the Item Tab area, click [Data setting].
- 2 Select the type of the robot in the "Robot setting" area.

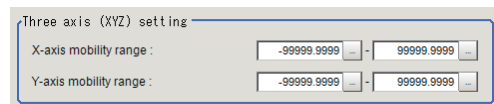
Selecting "four axis (XYZR) robot" will enable you to select the rotation polarity.



Setting item	Setting value [Factory default]	Description
Robot type	<ul style="list-style-type: none"> • [Three axis (XYZ)] • Four axis (XYZR) 	Select the type of the robot to be used.
Rotation polarity	<ul style="list-style-type: none"> • [Positive] • Negative 	<p>Select the rotation direction defined in the equipment is positive or negative compared to the rotation direction in the robot coordinate system.</p> <p>Positive: From the X axis to Y axis Negative: From the Y axis to X axis</p> <p>When positive rotation direction of the device is</p> <p>A: positive polarity B: negative polarity</p> <p>Stage coordinate system</p>

3-axis (XYZ) robot

- 1 Selecting "Three axis (XYZ)" will display the "Three axis (XYZ) setting" area.
- 2 Click [...] in X-axis limit in the Three axis (XYZ) setting area to set the upper and lower limit values.
- 3 Likewise click [...] in Y-axis limit to set the upper and lower limit values.



Setting item	Setting value [Factory default]	Description
X-axis limit	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Set the upper and lower limit values for the X axis movement range. Units of the coordinate system set in calibration is used.
Y-axis limit	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Set the upper and lower limit values for the Y axis movement range. Units of the coordinate system set in calibration is used.

4-axis (XYZR) robot

1 Selecting "Four axis (XYZR)" will display the "Four axis (XYZR) setting" area.

2 Click [...] in X-axis limit in the "Four axis (XYZR) setting" area to set the upper and lower limit values.

3 Likewise click [...] in Y-axis limit to set the upper and lower limit values.

4 Likewise click [...] in θ -axis limit to set the upper and lower limit values.

5 Select the control method for the robot from the "Picking method".

6 If the camera is moved, select the axis to which the camera is attached from Camera movement axis.

Setting item	Setting value [Factory default]	Description
X-axis limit	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Set the upper and lower limit values for the X axis movement range. Units of the coordinate system set in calibration is used.
Y-axis limit	-99999.9999 to 99999.9999 [-99999.9999] to [99999.9999]	Set the upper and lower limit values for the Y axis movement range. Units of the coordinate system set in calibration is used.
θ -axis limit	-180.0000 to 180.0000 [-180.0000] to [180.0000]	Set the upper and lower limit values for the θ axis angle range. The unit is degree.
Picking method	<ul style="list-style-type: none"> • Picking at a fixed position • Picking at a measurement position 	<p>Select the robot control method. The robot control settings change depending on at which phase position alignment is performed from "the workpiece grasping phase" to "movement phase".</p> <p>(1) Go to a fixed position to pick up an object If the robot is controlled using the Sensor Controller measurement result, so that the robot can go to the same position every time during workpiece to pick up an object and place it on a specific position after grasping the object, select this. This is some kind of palletizing application. Specifically speaking, in this setting, the same calculation as the XYθ stage is used.</p> <p>(2) Go to the measurement position of workpiece to pick up an object If the robot is controlled so that the robot goes to grasp the workpiece and then places it on a specific position after grasping it using the measurement result of this vision sensor every time, select this. This is some kind of depalletizing application. Specifically speaking, in this setting, the same calculation as the θXY stage is used.</p>
Camera movement axis		
	X-axis	<ul style="list-style-type: none"> • Checked • [Unchecked] Enable this setting if the camera moves instead of the robot axis.
	Y-axis	<ul style="list-style-type: none"> • Checked • [Unchecked] If this is disabled, calculation for movement amount and so on is performed on the premises that the stage moves.

Measurement Results for Which Output Is Possible (Robot Data)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference Tables (Robot Data)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement(unmeasured) 1: Judgement result OK -1: Judgement result NG
120	Robot type	Set/Get	0: Three axis (XYZ) robot 1: Four axis (XYZR) robot
121	Rotation polarity	Set/Get	-1: Negative 1: Positive
122	Picking method	Set/Get	0: Picking at a fixed position 1: Picking at a measurement position
123	Camera movement axis X-axis	Set/Get	0: Camera moving axis X is not used 1: Camera moving axis X is used
124	Camera movement axis Y-axis	Set/Get	0: Camera moving axis X is not used 1: Camera moving axis X is used
130	Lower limit of X-axis movement	Set/Get	-99,999.9999 to 99,999.9999
131	Upper limit of X-axis movement	Set/Get	-99,999.9999 to 99,999.9999
132	Lower limit of Y-axis movement	Set/Get	-99,999.9999 to 99,999.9999
133	Upper limit of Y-axis movement	Set/Get	-99,999.9999 to 99,999.9999
134	Lower limit of θ -axis movement	Set/Get	-180.0000 to 180.0000
135	Upper limit of θ -axis movement	Set/Get	-180.0000 to 180.0000

Vision Master Calibration

This processing item is specifically provided for calibration between the camera coordination system and the control equipment coordinate system.

This processing item automatically calculates the entire axis movement amount of the control equipment necessary for calibration.

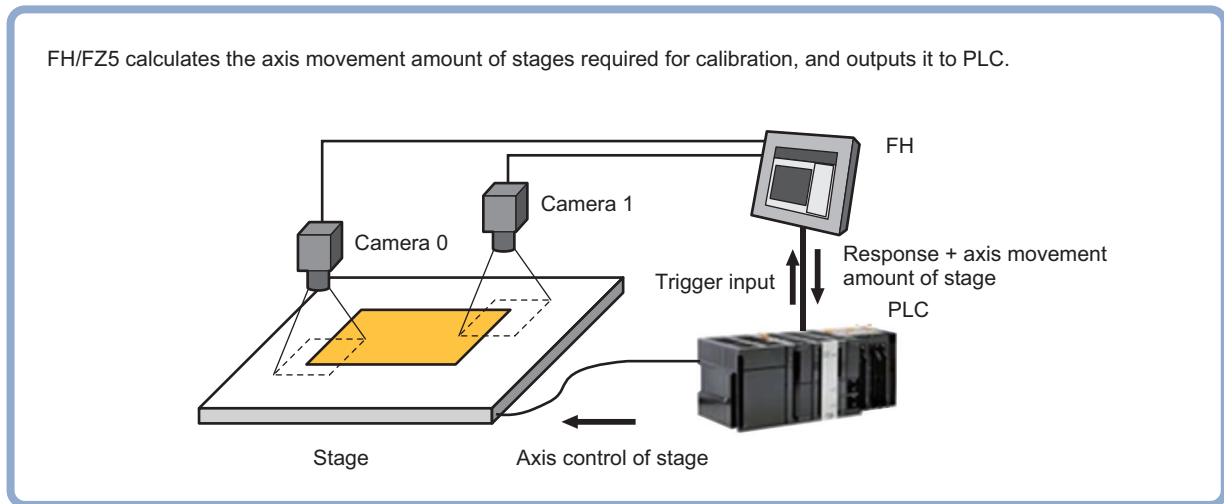
For that reason, it possible to perform accurate calibration more easily than previously.

Important

- The calibration data created with this processing item is referred to using [Calibration Data Reference]. Unlike other calibration-related processing items, note that this processing item cannot use the calibration data on its own.
- This function refers to the processing item having external device information for axis movement calculation, e.g. Stage Data or Robot Data. If you change those data, setting contents of this function will be changed. In this case, needs to check those data.

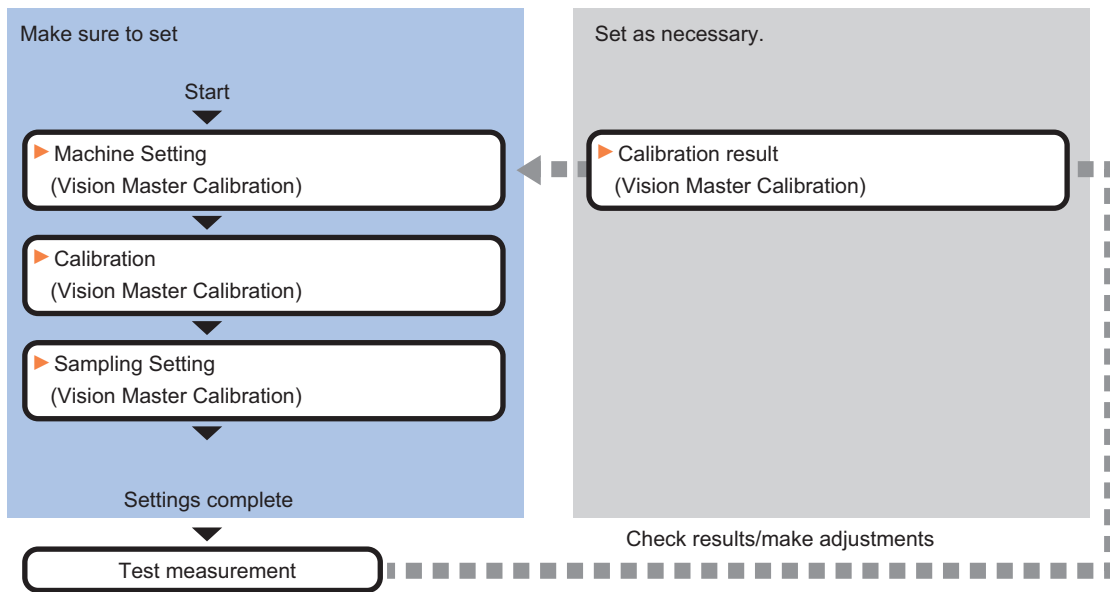
Used in the Following Case

- **When you want to position the FPD panel**



Settings Flow (Vision Master Calibration)

Set the image master calibration with the following steps.



List of Vision Master Calibration Items

Item name	Description
Machine setting	Select a processing item (stage data or robot data) under which external device information needed for calculation of axis movement amount is held. Reference: ▶ Machine Setting (Vision Master Calibration) (p.740)
Calibration	This item sets data related to calibration. Sets the number of calibration data to be created and the measurement processing items to be used for sampling in the arithmetic expression. Also sets the output method for the calculated axis movement amount. Reference: ▶ Calibration (Vision Master Calibration) (p.740)
Sampling setting	This item sets data related to sampling. Also makes the sampling settings for the initial calibration and this calibration. Reference: ▶ Sampling Setting (Vision Master Calibration) (p.744)
Calibration result	This item confirms the calibration data you created. The calibration data can be adjusted directly using the Edit function. It is also possible to confirm the sampling data used for the calculation. Reference: ▶ Calibration Result (Vision Master Calibration) (p.750)

Machine Setting (Vision Master Calibration)

Select a processing unit (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.

Important

- [Vision Master Calibration] refers to [Stage Data] or [Robot Data]. Be sure to register [Stage Data] or [Robot Data] with a given scene.

1 In the Item Tab area, click [Machine setting].

2 Select the processing unit that retains information on external device.

Information of the selected processing unit is displayed in the reference data display area. Displayed contents will be change depending on selected type of Robot or Stage.

Setting item	Setting value [Factory default]	Description
Scene No.	[Present scene] Scenes 0 to 127	Select a scene number (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.
Unit No.	---	From among the referenced scene numbers, select a processing item (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.

Note

- If the number of scenes is increased using the scene group conversion tool, the maximum value that can be selected in "Scene No." changes.

Calibration (Vision Master Calibration)

This item sets data related to calibration. Sets the number of calibration data to be created and the measurement processing items to be used for sampling in the arithmetic expression. Also sets the output method for the calculated axis movement amount.

Displayed contents will be change depending on selected type of Robot or Stage.

1 In the Item Tab area, click [Calibration].

2 Check the calibration data items that you want to set.

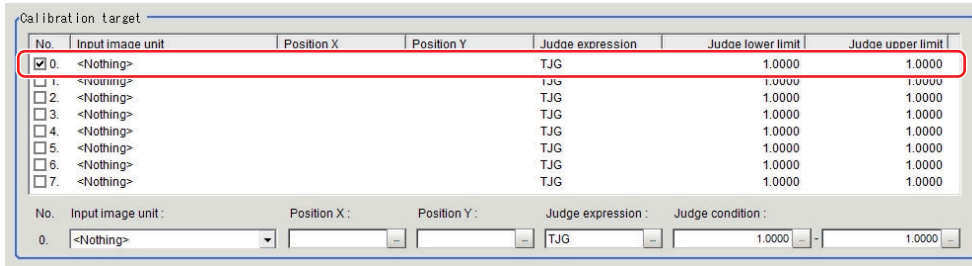
Calibration data is created for the checked numbers.

No.	Input image unit	Position X	Position Y	Judge expression	Judge lower limit	Judge upper limit
<input checked="" type="checkbox"/> 0	<Nothing>			TJG	1.0000	1.0000
<input type="checkbox"/> 1	<Nothing>			TJG	1.0000	1.0000
<input type="checkbox"/> 2	<Nothing>			TJG	1.0000	1.0000
<input type="checkbox"/> 3	<Nothing>			TJG	1.0000	1.0000
<input type="checkbox"/> 4	<Nothing>			TJG	1.0000	1.0000
<input type="checkbox"/> 5	<Nothing>			TJG	1.0000	1.0000
<input type="checkbox"/> 6	<Nothing>			TJG	1.0000	1.0000
<input type="checkbox"/> 7	<Nothing>			TJG	1.0000	1.0000

No. Input image unit: Position X: Position Y: Judge expression: Judge condition:

0. <Nothing> [] [] TJG [] 1.0000 [] - [] 1.0000 []

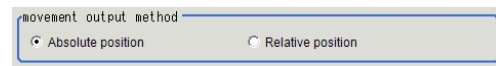
3 Select the line of the calibration data that you want to set.



4 Set each item in the "Calibration target" area.

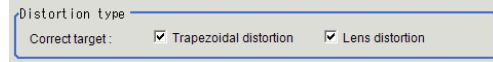
Setting item	Setting value [Factory default]	Description
Input image unit	[<Nothing>]	Select an image input unit to be used for sampling measurement.
Position X	-	Set the arithmetic expression that obtains camera coordinate X used for sampling.
Position Y	-	Set the arithmetic expression that obtains camera coordinate Y used for sampling.
Judge expression	[TJG]	Set the arithmetic expression to determine whether sampling was successful or not. If calibration fails during the initial value TJG, set the unit judgement JG of the processing unit from which positions X and Y are referred.
Judge condition	-999999999.9999 to 999999999.9999 [1.0000] to [1.0000]	Set the upper and lower limit values to determine whether sampling was successful or not. If TJG or JG is set to the judgement expression, use the initial values.

5 Select the output method for movement amount in the movement output method area.



Setting item	Setting value [Factory default]	Description
movement output method	<ul style="list-style-type: none"> [Absolute position] [Relative position] 	<p>Select the calculation method for the axis movement amount output to the external device next time.</p> <p>The movement amount output method affects the "Next movement amount" that can be obtained by calculation.</p> <p>The setting must be changed according to the specifications of the control equipment used.</p> <ul style="list-style-type: none"> Absolute position It always outputs the axis movement amount from the origin return position (0 axis movement amount) to the next sampling position. Relative position Outputs the axis movement amount from the current sampling position to the next sampling position.

6 Select whether or not to output distortion compensation parameters in the Distortion type area.



Setting item	Setting value [Factory default]	Description
Trapezoidal distortion	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Select whether or not to output trapezoidal compensation parameters set for each data.
Lens distortion	<ul style="list-style-type: none"> • [Checked] • Unchecked 	Select whether or not to output lens distortion compensation parameters set for each data.

Note

- Distortion compensation function is not applied for X, Y, X θ , Y θ , θ X and θ Y Stages. Therefore measurement accuracy may be decreased if surface workpiece is on and the optic axis are at an incline to each other. Set the camera optic axis perpendicular to the workpiece surface, including move axis.

Important

Limit on the number of calibration data when distortion compensation is turned on

For the FZ5-L3□□/6□□ series models, the number of distortion compensation calibration data (when compensation for either trapezoidal distortion or lens distortion has been specified) that can be used in the same scene group is limited according to the camera in use. Do not exceed this limitation. You can delete created distortion compensation data by redoing calibration with both settings unselected. In the case of the FH series/FZ5-800 series/FZ5-1100 series/FZ5-1200 series, the number of processing items is not limited and can be registered as long as there is sufficient free memory.

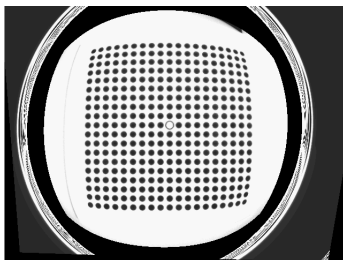
If the amount of used memory increases and the amount of free memory becomes insufficient, it may cause errors in operation mode switching or in adding Processing Units into the measurement flow. Please check the memory consumption when you create scenes.

Type of controller	0.3 megapixel camera	Intelligent Compact Digital Camera	2 megapixel camera	5 megapixel camera	0.3 megapixel camera (FH)	2 megapixel camera (FH)	4 megapixel camera (FH)
FZ5-L35□ Or FZ5-6□□	30	28	7	2	---	---	---

Distortion compensation function

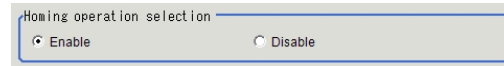
Because compensation is performed using the same algorithm with the high-precision calibration processing item in this processing item, sampling points are biased toward the center of the screen when the effective range of the field of view is extremely narrow and image compensation cannot be performed normally.

Widen the effective range of the field of view so that sampling points are located in the entire screen and perform calibration again.



If the effective range of the field of view is extremely narrow, a circular virtual image shown left may appear.

7 Select [Enable] or [Disable] in Homing operation selection area.



Setting Item	Setting value [factory default]	Description
Homing operation selection	<ul style="list-style-type: none"> • [Enable] • Disable 	Select [Enable] or [Disable] during sampling. Enable: Outputs the Homing operation output flag. Disable: Not output the Homing operation output flag, then turns OFF it constantly.

Homing operation selection

Selecting [Enable] for the Homing operation selection turns the Homing operation output flag to ON and forces the Homing operation to be done from the PLC when switching the Sampling movement type. Specifically, the FH/FZ Sensor Controller will turn on the Homing operation output flag when switching between Parallel movement sampling and Rotational movement sampling, and vice-versa. This can reduce the effect of positional shifting due to backlash associated with the movement of the conveyor, or stage. If a highly precise stage, or conveyor is being used, or the effect of backlash can be mitigated by some other means, you can select [Disable] for this function.

Example for Homing operation output

For example for Homing operation output depending on sampling settings, refer to the following table.

All of the sampling processing is at the same time

Sampling processing	Output flag (Homing operating selection: Enable)	Output flag (Homing operating selection: Disable)
Output after reference position sampling	OFF	OFF
Output of first parallel moving position 1 sampling	OFF	OFF
Output of first parallel moving position 2 sampling	ON	OFF
Output of first rotary moving position 1 sampling	ON	OFF
Output of parallel moving position 1 sampling	OFF	OFF
Output of parallel moving position 2 sampling	OFF	OFF
Output of parallel moving position 3 sampling	ON	OFF
Output of rotary moving position 1 sampling	OFF	OFF
Output of rotary moving position 2 sampling	ON	OFF

Sampling processing is one by one

Sampling processing	Output flag (Homing operating selection: Enable)	Output flag (Homing operating selection: Disable)
Output after reference position sampling	OFF	OFF
Output of first parallel moving position 1 sampling	OFF	OFF
Output of first parallel moving position 2 sampling	ON	OFF
Output of first rotary moving position 1 sampling	ON	OFF
Output after reference position sampling	OFF	OFF
Output of parallel moving position 1 sampling	OFF	OFF
Output of parallel moving position 2 sampling	OFF	OFF
Output of parallel moving position 3 sampling	ON	OFF
Output of rotary moving position 1 sampling	OFF	OFF
Output of rotary moving position 2 sampling	ON	OFF

Note

- A moving amount after Homing operation is output when Homing operation selection is [Enable] after calibration is complete. If [Disable] is selected, output the moving amount of next position from current position.
- Output the moving amount 0 after turning ON the Homing operation output flag. [Disable] is selected. the moving amount 0 is output leaving the homing operation flag.

Sampling Setting (Vision Master Calibration)

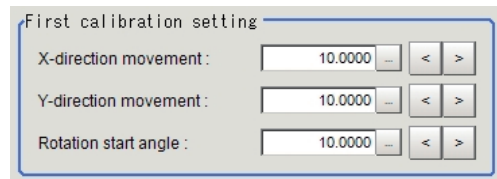
This item sets data related to sampling.

Also makes the sampling settings for the initial calibration and this calibration.

Displayed contents will be change depending on selected type of Robot or Stage.

1 In the Item Tab area, click [Sampling Setting].

2 In the First calibration setting area, specify each item.

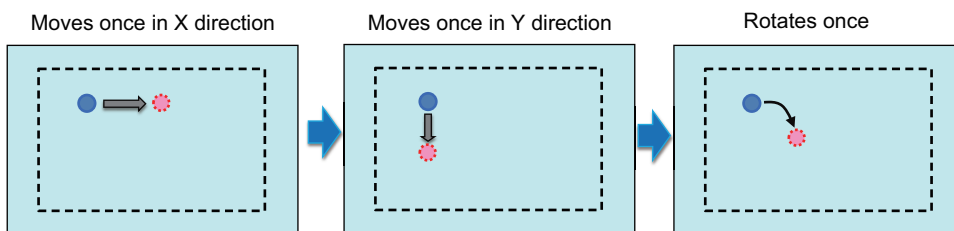


Setting item	Setting value [Factory default]	Description
X-direction movement	-99999.9999 to 99999.9999 [10.0000]	Set the X axis movement amount in the initial calibration.
Y-direction movement	-99999.9999 to 99999.9999 [10.0000]	Sets the Y axis movement amount in the initial calibration.
Rotation start angle	-180.0000 to 180.0000 [10.0000]	Set the rotation movement start angle in the initial calibration.

Note

- When you select X, Y, Xθ, Yθ, θX or θY Stage, non-existent axis will be grayed out and you cannot set it. Only settings for existing axis can be changed.

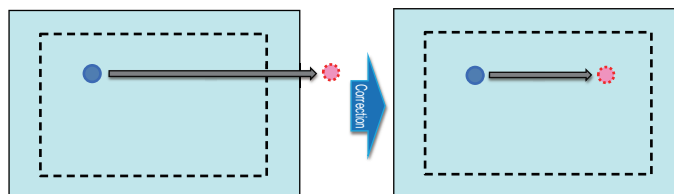
Calculates calibration data used to perform high-precision calibration in the initial calibration.



Note

If the sampling for the First calibration fails, sampling will be executed again with the movement amount and angle values reduced by 50%.

If the sample's amount of initial movement amount is too large and outside the range of the camera's field of view, the movement amount automatically corrects and the sample moves again.



3 In this Precise calibration setting area, specify each item.

In this calibration, there are two methods for sampling. Creatable calibration data limit 8. One method is creating sample one by one. Other one is creating all samples at the same time.

[One by one] in [Sampling method]

This function widens the sampling measurement area more than [All at once] because it calculates the visual field range for each of calibration data.

Note

- This calibration can be [NG] (failed) when inapplicable measurement processing unit data is [NG].
- In this case, change the determining method in [Calibration target] area. Set the unit judgment [JG] for measurement sampling to each judgment methods of calibration data. By setting this, normalizes calibration processing even if inapplicable measurement processing unit data is judged as [NG].
(Reference: ▶ Calibration (Vision Master Calibration) (p.740))

[All at once] in [Sampling method]

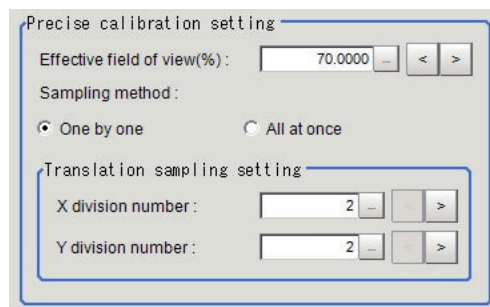
This function is able to create the calibration data faster than [One by one] because all of the calibration data are simultaneously created.

Note

- However, normalization of measurement processing unit may not complete for each of calibration data.
- In this case, confirm evaluation value or maximum error detection value and retry to calibrate.
(Reference: ▶ Error detection values (p.752))

(1)

- When you select the XY or X(Y) stages in Stage Data function.
- When you select 3-axis robot in Robot Data function.



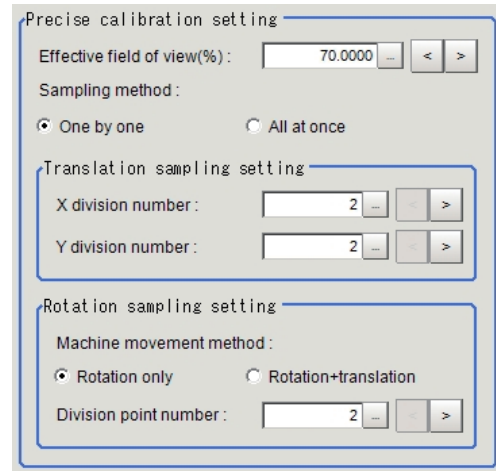
Setting item	Setting value [Factory default]	Description
Effective field of view(%)	1 to 100 [70.0000]	Set the effective range of the field of view for the image input unit.
Sampling method	<ul style="list-style-type: none"> • [One by one] • All at once 	Select the Sampling method.
Translation sampling setting	-	This setting item is a sampling method that Stage has to move to X or T axis. This method is composed of parallel row to X axis and parallel column to Y axis. An intersection point of its row and column will be sampling point.
X division number	2 to 10 [2]	Sets the number of lines divided during parallel movement sampling in this calibration.
Y division number	2 to 10 [2]	Set the number of columns divided during parallel movement sampling in this calibration.

Note

- When you select X(Y) Stage and set X axis as movement axis, only [Y division number] can be applied. In this case, [X division number] is grayed out. When you select Y axis to the movement axis, [Y division number] is grayed out.

(2)

- When you select the XYθ, θXY, UVW or UVWR stages in Stage Data function.
- When you select 4-axis robot in Robot Data function.

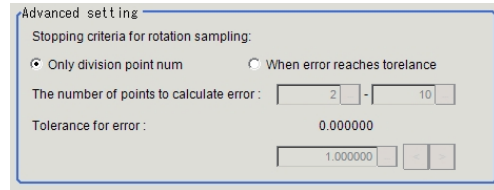


Setting item	Setting value [Factory default]	Description
Effective field of view(%)	1 to 100 [70.0000]	Set the effective range of the field of view for the image input unit.
Sampling method	<ul style="list-style-type: none"> • [One by one] • All at once 	Select the Sampling method.
Translation sampling setting	-	This setting item is a sampling method that Stage has to move to X or T axis. This method is composed of parallel row to X axis and parallel column to Y axis. An intersection point of its row and column will be sampling point
X division number	2 to 10 [2]	Sets the number of lines divided during parallel movement sampling in this calibration.
Y division number	2 to 10 [2]	Set the number of columns divided during parallel movement sampling in this calibration. When data are selected one by one, Measuring Processing Unit of data not targeted for sampling may be NG.
Rotation sampling setting	-	-
Machine moving method	<ul style="list-style-type: none"> • [Rotation only] • Rotation+translation 	Set the external device movement method for rotational sampling in this calibration.
Division point number	2 to 100 [2]	Sets the number of division points for rotational sampling in this calibration. This setting is grayed out and is not applied when you select [All at once].

Note

- When you select Xθ(Yθ) or θX(θY) Stage and set X axis as movement axis, only [Y division number] can be applied. In this case, [X division number] is grayed out. When you select Y axis to the movement axis, [Y division number] is grayed out.

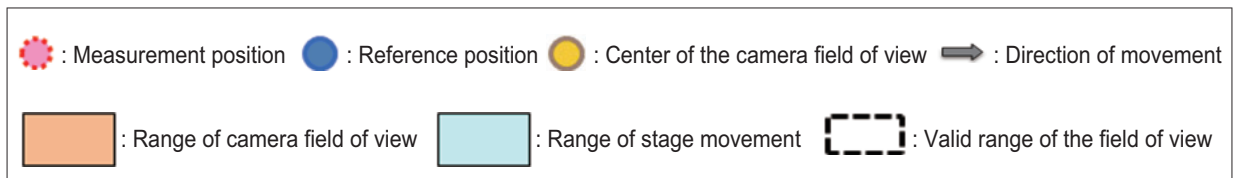
4 If necessary, set each item in the Advanced setting area.



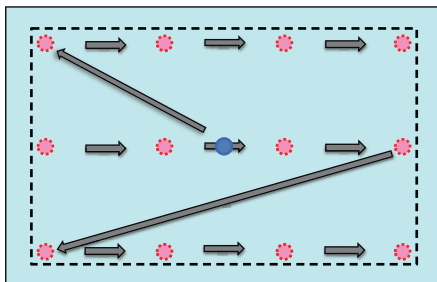
Setting item	Setting value [Factory default]	Description
Stopping criteria for rotation sampling	<ul style="list-style-type: none"> • [Only division point num] • When error reaches tolerance 	Select the end condition for rotational movement in this calibration.
The number of points to calculate error	2 to 100 [2] to [10]	[Stopping criteria for rotation sampling], calculates error within the range of [The number of points to calculate error].
Tolerance for error	0 to 99999.999999 [1.000000]	Specify the upper limit value for the error detection.

The movement amount necessary for sampling measurement

Movement amount necessary for sampling measurement is calculated using the number of divided lines (N) and the number divided lines (M).



Parallel movement per 1 data



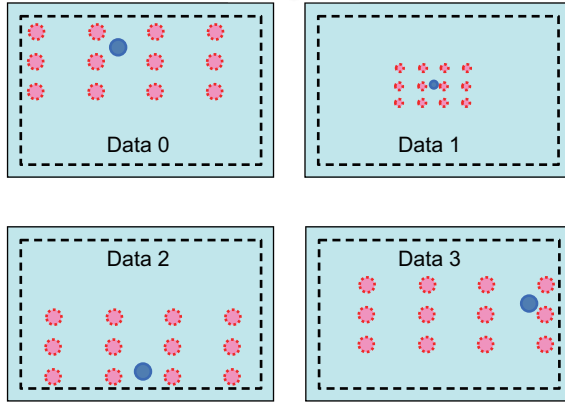
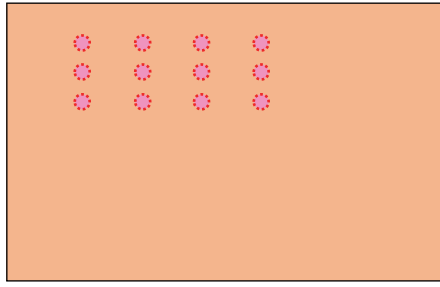
Number of movement points = $N \times M$
 Number of movement times = The number of data items checked in [Calibration target].

When the parallel movement sampling by one data is executed.

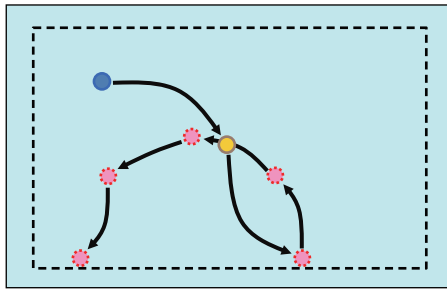
- Samples in every using camera.
- Calculates the sampling moving amount as the maximum moving range of the number of movement point in parallel movement sampling settings and the effective view range of camera.
- Reference position is the axis position of the center view.

Reference position will be center of vision.

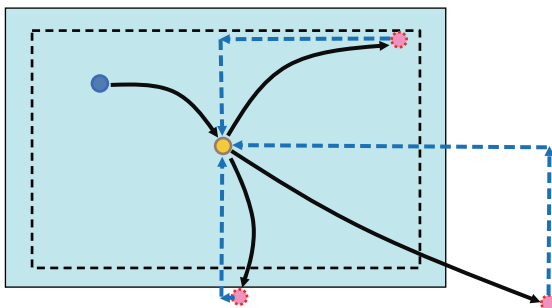
Simultaneous parallel movement for all data



Rotational movement per 1 data rotation only



Rotational movement per 1 data rotation + parallel



Number of movement points = $N \times M$

Number of movement times = 1

When the parallel movement sampling at [All at once] is selected.

- Samples all data at once movement.
- The Sampling movement range is the maximum movement range based on the number of movement points set in the parallel movement sampling settings and the Effective field of view in the First calibration setting.
- Reference position is the axis position when calibration is initiated.

When simultaneous sampling for all data is set, sampling of all data is executed in one movement. Movement range of sampling is automatically calculated to find a range that allows the largest movement within available view range including all sampling data.

Movement order is determined based on the actual coordinate system.

The movement is different from the case when sampling is executed for each data one by one. Reference position will be the axis position at start of calibration.

Number of movement points = Division points
Number of movement times = Number of calibration data set in [Calibration] area.

When the Rotational movement per 1 data rotation only.

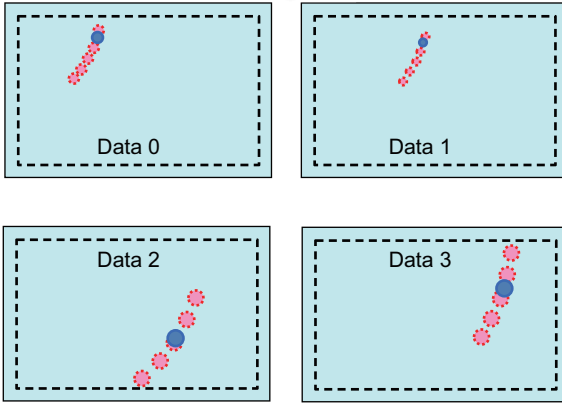
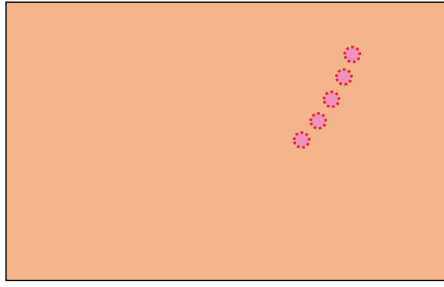
- Samples in every using camera.
- First, moves to the center of view due to the image accuracy of the center is high.
- Calculates the sampling moving amount as the maximum moving range of the number of movement point in parallel movement sampling settings and the effective view range of camera.
- Reference position is the axis position of the center view.

Number of movement points = Division points
Number of movement times = Number of calibration data set in [Calibration] area.

When you executes [One by one] in Rotation movement + Parallel movement

- Samples by using camera.
- Executes the parallel movement sampling after Rotation movement sampling and moved to the axis position of the center view when rotation movement + parallel movement.
- Calculates the sampling movement as the maximum movement range using Rotation movement sampling settings, movement point of the parallel movement and effective view range.
- Reference position is the axis position of the center view.

Simultaneous parallel movement for all data
Rotation only is one method of rotational movement



Number of movement points = Division points
Number of movement times = 1

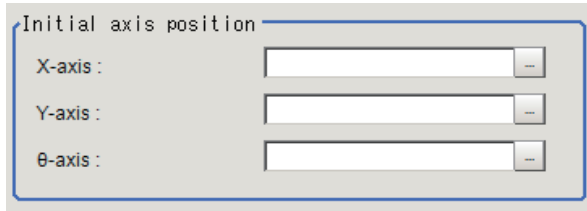
When you select [All at once] on the Rotation movement sampling.

- Samples all data at once movement.
- Calculates the sampling moving amount as the maximum moving range of the number of movement point in parallel movement sampling settings and the effective view range of camera.
- Reference position is the axis position of the center view.

5 In the Initial axis position area, specify the starting axis position of each axis with expressions.

The axis position setting menu changes depending on the settings of the processing unit selected in Unit No. in the "Machine setting data" area. If the workpiece used for sampling is not within the camera field of view in the return to origin position (all axes in 0,0 position), set the axis position after moving as the starting axis position.

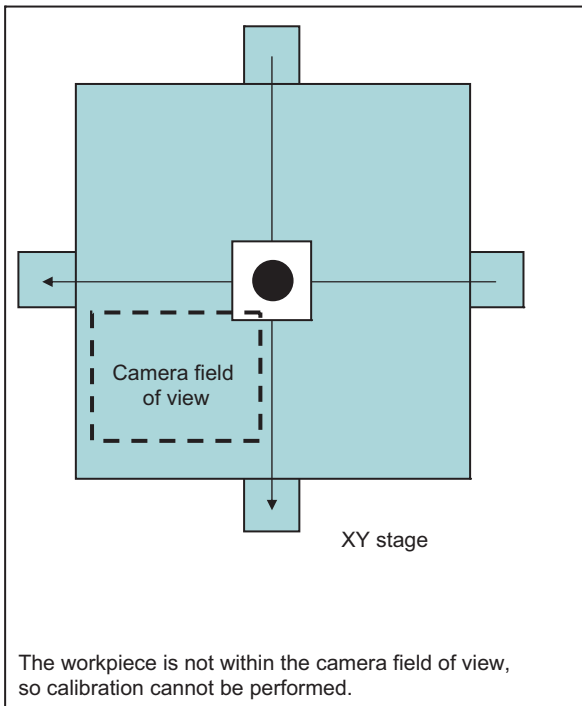
Example: When XYθ stage is selected with the stage data



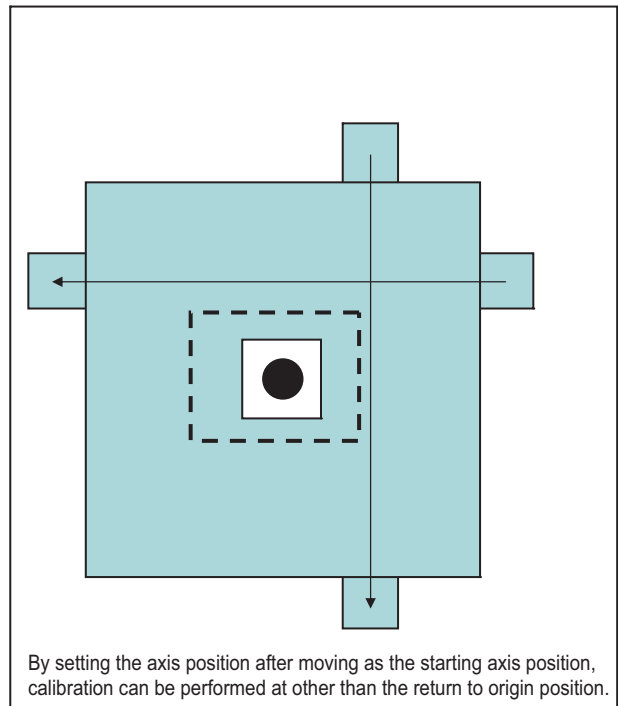
Usage example

When the workpiece used for sampling is not within the camera field of view in the return to origin position (axis movement amount 0)

Return to origin position



Move the stage to make the workpiece enter the camera field of view



Calibration Result (Vision Master Calibration)

This item confirms the calibration data you created. The calibration data can be adjusted directly using the Edit function.

It is also possible to confirm the sampling data used for the calculation.

Displayed contents will be change depending on selected type of Robot or Stage.

- 1** In the Item Tab area, click [Calibration result].
- 2** This item confirms the calibration data you created.

Display setting
Data No.:

First calibration data				Precise calibration data			
A:	1.000000	D:	0.000000	A:	1.000000	D:	0.000000
B:	0.000000	E:	1.000000	B:	0.000000	E:	1.000000
C:	0.000000	F:	0.000000	C:	0.000000	F:	0.000000
X magnification:	1.000000	X-axis angle:	0.000000	X magnification:	1.000000	X-axis angle:	0.000000
Y magnification:	1.000000	Y-axis angle:	90.000000	Y magnification:	1.000000	Y-axis angle:	90.000000
Origin X:	0.000000	XY-axis angle:	90.000000	Origin X:	0.000000	XY-axis angle:	90.000000
Origin Y:	0.000000			Origin Y:	0.000000	Error evaluation	-
				X max error:	0.000000		
				Y max error:	0.000000		

Sampling data list						
No.	Data type	X-direction move...	Y-direction move...	TH-direction mov...	Camera X	Camera Y
0.	Standard position	0.0000	0.0000	0.0000	0.0000	0.0000
1.	First translation positi...	10.0000	0.0000	0.0000	0.0000	0.0000
2.	First translation positi...	0.0000	10.0000	0.0000	0.0000	0.0000
3.	Translation position1	0.0000	0.0000	0.0000	0.0000	0.0000
4.	Translation position2	0.0000	0.0000	0.0000	0.0000	0.0000
5.	Translation position3	0.0000	0.0000	0.0000	0.0000	0.0000
6.	Translation position4	0.0000	0.0000	0.0000	0.0000	0.0000

Next measurement: Standard position

Setting item		Setting value [Factory default]	Description
Display setting	Display setting Data No.	0 to 7 [0]	Sets the calibration data number that displayed the calculation results.

Item	Description
First calibration data	Displays details of the first calibration parameter.
Precise calibration data	Displays details of the calibration data.
A to F	Displays details about the calibration parameters. Clicking [Edit enable] will let you change the numbers for A to F. If any number has been changed, the message "This data has been edited" appears at the left of [Edit enable].
X magnification	This magnification is the coordinates of X axis direction after calibration.
Y magnification	This magnification is the coordinates of Y axis direction after calibration.
X-axis angle	This angle is camera coordinate of X-axis and the coordinates of X axis direction after calibration.
Y-axis angle	This angle is camera coordinate of Y-axis and the coordinates of X axis direction after calibration.
Origin X	This is an origin X after calibration.
Origin Y	This is an origin Y after calibration.
XY-axis angle	This is XY-axis angle after calibration.
Error evolution	Maximum value of distance calculated standard position and sampling result. Stage is not set to θ axis, [-] is displayed because calculation is impossible.
X max error	Maximum error of X-axis coordinate position calculated standard position and sampling result. Stage is not set to X axis, [-] is displayed because calculation is impossible.
Y max error	Maximum error of Y-axis coordinate position calculated standard position and sampling result. Stage is not set to X axis, [-] is displayed because calculation is impossible.
Sampling data list	Displays sampling data used for creating the calibration parameters. Reference position displays the movement amount from the origin return position (all axes at 0.0 position). Data other than the reference position displays the movement amount from the reference position when [One by one] is selected as the sampling method. Reference position is re-set before this calibration is executed. Normally, non-existing axis value is 0 when $X\theta$, $Y\theta$, θX , θY , X or Y stage is selected.
[Clear step counter] button	Set back the reference position as the next measurement target and start over calibrations

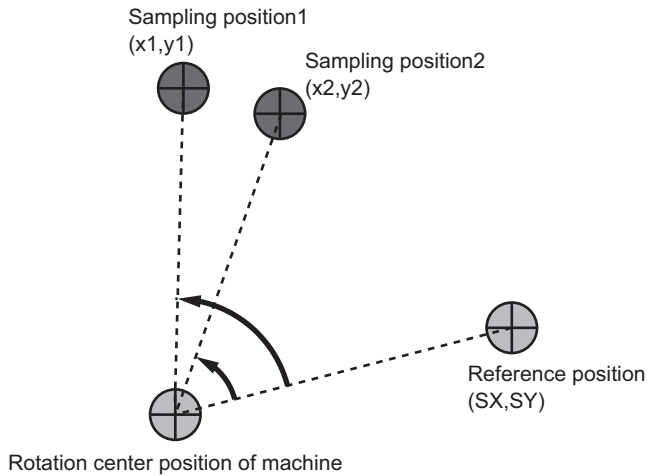
Error detection values

This value is for confirming the accuracy of calibration result.
Output the error detection values when the Stage has θ -axis.

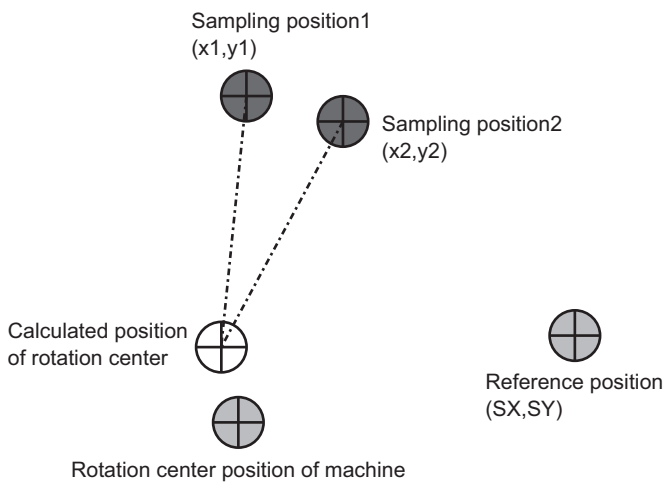
This value is calculated using a calibration data calculated in Master calibration and a measurement result sampled rotation movement.

If a problem of magnification, axis angle or center position of rotation is occurred, this value may be larger.

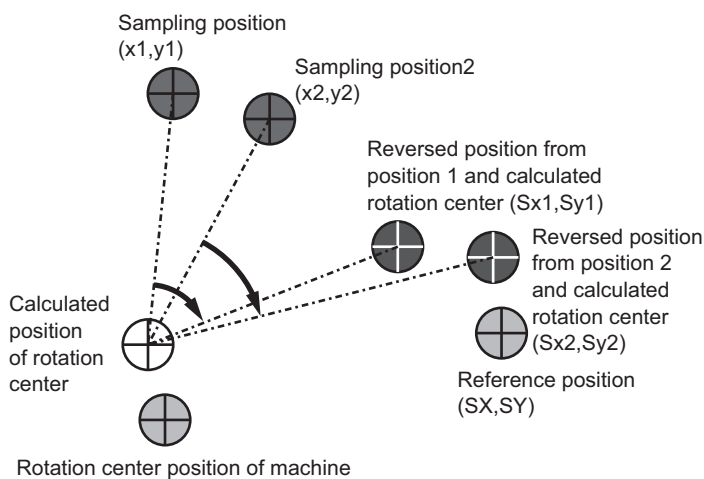
In the followings, describe the calculation method in the case of sampling time is 2 as an example.



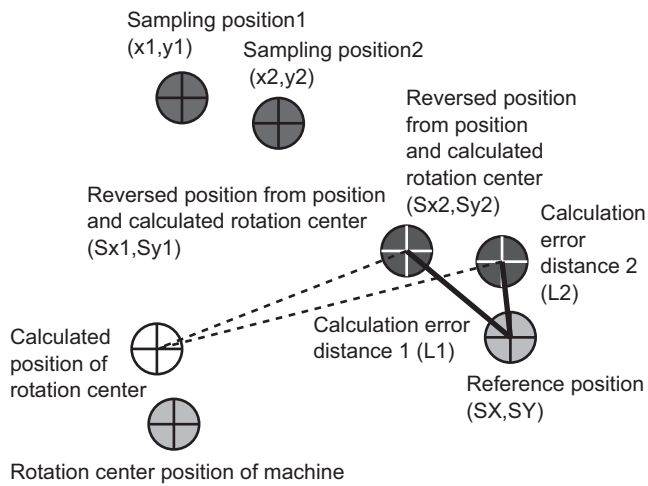
- 1) Rotation sampling is executed based on sampling settings. A reference position may change depending on sampling method.



- 2) Calculates the center position of rotation from sampling result.



- 3) Calculates the reverse rotation point from the calculated rotation point each of sampled points.



- 4) The absolute distance value of each coordinate from calibration conversion result and sampling position.
- 5) Defines a maximum value of X coordinate side as X maximum error detection value. Y coordinate side is same as X coordinate side.

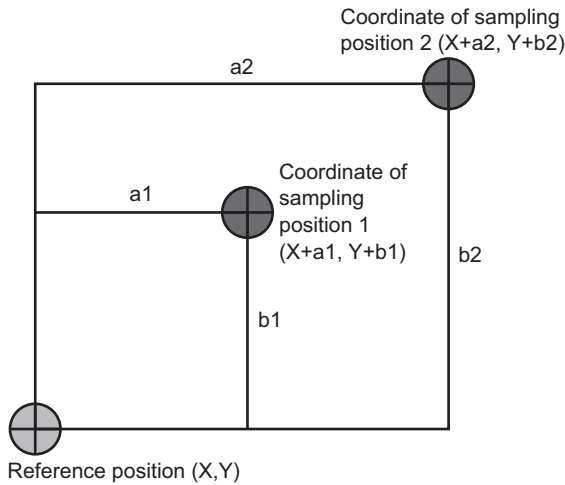
Maximum error detection values

This value is for confirming the accuracy of calibration result.

Output X and Y maximum error detection values when the Stage has X or Y axis.

This value is calculated using a calibration data calculated in Master calibration and a measurement result sampled parallel movement.

If a problem of magnification, axis angle or center position of rotation is occurred, this value may be larger.



- 1) Parallel sampling is executed based on sampling settings. Reference position may change depending on sampling method.

Sampling position 2
Coordinate of camera
(x2, y2)



Sampling position 1
Coordinate of camera
(x1, y1)



Reference position (X,Y)

Sampling position 2
Coordinate of camera (x2, y2)



Sampling position 1
Coordinate of Calibration
Convert result (x1, y1)



Sampling position 2
Coordinate of Calibration
Convert result (x2, y2)

Sampling position 1
Coordinate of camera
(x1, y1)



Reference position (X,Y)

Sampling position2
Coordinate (X+a2,Y+b2)



Sampling position1
A result afeter calibration
conversion.
Coordinate (X1,Y1)



Sampling position2
A result afeter calibration
conversion.
Coordinate (X2,Y2)

Sampling position1
Coordinate (X+a1,Y+b1)



Reference position (X,Y)

2) Sampling measurement is executed.

3) Calibration is executed from the sampling result, converts sampling position to coordinate.

4) Calculates the absolute value' s distance of reference position and reverse rotation point.

5) Defines the maximum value of X coordinate side as X-inaccuracy, and the maximum value of Y coordinate side as Y-inaccuracy.

- X-inaccuracy is given the more larger value of $[X+a1-X1]$ or $[X+a2-X2]$.
- Y-inaccuracy is given the more larger value of $[Y+b1-Y1]$ or $[Y+a2-Y2]$.

Causes and remedies when differ of Error detection value and Maximum error detection value is large.

If Error detection value or Maximum error detection value is bigger than the required accuracy of application, refer to the following table.

The error value may be large when the sampling measurement failed. In this case, confirm its measurement.

In addition, the error value may change depending on Stage, Robot, setting condition or loading condition. In this case, confirm the below remedies.

Maximum error value of X(Y)	Error detection value	Causes and remedies
Large	Large	<p>The accuracy of magnification, axis angle or center position of rotation are sometimes insufficiency.</p> <p>All of the sampling measurement results need to be successful.</p> <p>Stage data and Robot data need to be same as those setting contents.</p> <p>Recheck the setting contents of rotation movement sampling or parallel movement sampling. Confirm the measurement result of parallel and rotation movement sampling results.</p> <p>Reference: ▶ Data Setting (Stage Data) (p.713)</p> <p>Reference: ▶ Sampling Setting (Vision Master Calibration) (p.744)</p> <p>Reference: ▶ Calibration Result (Vision Master Calibration) (p.750)</p>
Small	Large	<p>The accuracy of center position of rotation is sometimes insufficiency.</p> <p>All of the sampling measurement results need to be successful.</p> <p>Stage data and Robot data need to be same as those setting contents.</p> <p>Recheck the setting content of rotation movement sampling and its result.</p> <p>Reference: ▶ Data Setting (Stage Data) (p.713)</p> <p>Reference: ▶ Sampling Setting (Vision Master Calibration) (p.744)</p> <p>Reference: ▶ Calibration Result (Vision Master Calibration) (p.750)</p>

Key Points for Test Measurement and Adjustment (Vision Master Calibration)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgment result
Next measurement	Next measurement target
NG cause	<p>Displayed only when Judgment is NG</p> <ul style="list-style-type: none"> -1: Setting NG -2: Sequence NG -3: Mobility NG -4: Calibration NG -5: Evaluation NG -6: Sampling NG -100: Other NG

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image.	Explanation of image to be displayed
0	Measurement image + calibration progress status display
1	Measurement image only

Key Points for Adjustment

Select the adjustment method referring to the following points.

While executing calibration

State	Parameter to be adjusted	Troubleshooting
Unit judgment NG occurred during calibration	Refer to the write sentence.	<p>Confirm the "NG cause" appears in the detail result display and perform appropriate countermeasures.</p> <p>Setting NG</p> <ul style="list-style-type: none"> The processing item setting is not correct. Check if the settings are correct including the processing items being referred to. <p>Sequence NG</p> <ul style="list-style-type: none"> Measurement is executed regardless of whether calibration has been completed. Be sure that no measurement is performed when the calibration completion flag is 1. <p>Mobility NG</p> <ul style="list-style-type: none"> The axis movement range is not correct. Check if the stage data being referred to and the movement range of the robot data are correct. <p>Calibration NG</p> <ul style="list-style-type: none"> Calibration data calculation has failed. Check if the camera coordinates in the sampling data list in the Calculation Result Confirmation Tab are set correctly. If any data is set incorrectly, the processing items used in measurement may not be set properly. Check that the settings are correct. <p>Evaluation NG</p> <ul style="list-style-type: none"> If the end condition of the rotational sampling is "The error detection value is lower than the setting value," the error detection value is not lower than the setting value when the upper limit values for the number of measurement points are measured. Adjust the overall flow setting, for example, by using the average of multiple measurement results to improve the measurement accuracy. <p>Sampling NG</p> <ul style="list-style-type: none"> The sampling measurement has failed. Adjust the setting data so that the processing items used in the measurement is not NG. If it still continues to occur, the judgement formula and condition may not be set correctly. Check that the settings are correct.
To start all over again	Calculation result confirmation	Click Clear step counter or execute the measurement result clearing.

Other

State	Parameter to be adjusted	Troubleshooting
It cannot be selected because the reference unit No. is <none>.	Machine setting	Check if the reference scene number is selected correctly. Check if stage data processing items or robot data processing items are registered in the selected reference scene.
The reference unit number does not change during flow editing.	Machine setting	The system is designed this way. While a scene other than the current scene is referenced, the reference unit number does not change according to the editing of the flow. Change the flow so that the current scene will be referenced, or set the reference unit number again.

Measurement Results for Which Output Is Possible (Vision Master Calibration)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Origin return output flag	ORIF	Origin return output flag
Calibration end flag	ENDF	Calibration completion output flag
Error evaluation value X	EX	Error evaluation value X
Error detection value Y	EY	Error detection value Y
Next X axis movement	NMX	Next X axis movement amount
Next Y axis movement	NMY	Next Y axis movement amount
Next θ axis angle movement	NMT	Next θ axis angle movement amount
Next θ axis linear movement	NML	Next θ axis linear movement amount
Next U axis movement	NMU	Next U axis movement amount
Next V axis movement	NMV	Next V axis movement amount
Next W axis movement	NMW	Next W axis movement amount
Next R axis movement	NMR	Next R axis movement amount
NG cause	CNG	NG cause -1: Setting NG -2: Sequence NG -3: Mobility NG -4: Calibration NG -5: Evaluation NG -6: Sampling NG -100: Other NG
Measurement execution flag	MF	Measurement execution flag

External Reference Tables (Vision Master Calibration)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement(unmeasured) 1: Judgement result OK -1: Judgement result NG
6	Origin return flag	Get only	0 to 1
7	Calibration end flag	Get only	0 to 1
10	Next X-axis Movement	Get only	-
11	Next Y-axis Movement	Get only	-
12	Next θ -axis Movement	Get only	-
13	Next θ -axis (Linear Drive) Movement	Get only	-
14	Next U-axis Movement	Get only	-
15	Next V-axis Movement	Get only	-
16	Next W-axis Movement	Get only	-
17	Next R-axis Movement	Get only	-
18	Next Calibration Operation	Get only	-

No.	Data name	Set/Get	Data range
19	Calibration step No.	Get only	-
20	NG cause	Get only	-
21	Data no.	Get only	-
123	Scene No.	Set/Get	-1: Current scene referred 0 to 9,999: Pointed unit referred
124	Unit No.	Set/Get	-1: No reference 0 to 9,999: Pointed unit referred
128	movement output method	Set/Get	0: Absolute position 1: Relative position
137	First calibration movement X	Set/Get	-99,999.9999 to 99,999.9999
138	First calibration movement Y	Set/Get	-99,999.9999 to 99,999.9999
139	First calibration rotation start angle	Set/Get	-180.0000 to 180.0000
140	Effective field of view(%)	Set/Get	1 to 100
141	Sampling method	Set/Get	0: One by one 1: All at once
142	X division number	Set/Get	2 to 10
143	Y division number	Set/Get	2 to 10
144	Division point number	Set/Get	2 to 100
145	Machine movement method	Set/Get	0: Rotation only 1: Rotation+translation
146	Homing operation selection	Set/Get	0: Disable 1: Enable
150	Calibration start X-axis position	Set/Get	Exp. character string
151	Calibration start Y-axis position	Set/Get	Exp. character string
152	Calibration start θ -axis angle position	Set/Get	Exp. character string
153	Calibration start θ -axis (linear drive) position	Set/Get	Exp. character string
154	Calibration start U-axis position	Set/Get	Exp. character string
155	Calibration start V-axis position	Set/Get	Exp. character string
156	Calibration start W-axis position	Set/Get	Exp. character string
157	Calibration start R-axis position	Set/Get	Exp. character string
158	Making flag of trapezoidal distortion correction parameter	Set/Get	0: No 1: Yes
159	Making flag of lens distortion correction parameter	Set/Get	0: No 1: Yes
160	Stopping criteria for rotation sampling	Set/Get	0: Only division point num 1: When error reaches torelance
161	Min number of points to calculate error	Set/Get	2 to 100
162	Max number of points to calculate error	Set/Get	2 to 100
163	Upper limit of rotation center error evaluation	Set/Get	0 to 99,999.999999
200+Nx10 (N: 0 to 7)	Calibration target flag of data N	Set/Get	0: No 1: Yes
201+Nx10 (N: 0 to 7)	Position X of data N	Set/Get	Exp. character string

No.	Data name	Set/Get	Data range
202+Nx10 (N: 0 to 7)	Position Y of data N	Set/Get	Exp. character string
203+Nx10 (N: 0 to 7)	Sampling judge expression of dataN	Set/Get	Exp. character string
204+Nx10 (N: 0 to 7)	Sampling judge lower of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999
205+Nx10 (N: 0 to 7)	Sampling judge upper of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999
206+Nx10 (N: 0 to 7)	Input image no. of dataN	Set/Get	-1 to 9,999
11301+Nx10000 (N: 0 to 7)	First calibration parameter A of dataN	Get only	-99999.999999 to 99999.999999
11302+Nx10000 (N: 0 to 7)	First calibration parameter B of dataN	Get only	-99999.999999 to 99999.999999
11303+Nx10000 (N: 0 to 7)	First calibration parameter C of dataN	Get only	-99999.999999 to 99999.999999
11304+Nx10000 (N: 0 to 7)	First calibration parameter D of dataN	Get only	-99999.999999 to 99999.999999
11305+Nx10000 (N: 0 to 7)	First calibration parameter E of dataN	Get only	-99999.999999 to 99999.999999
11306+Nx10000 (N: 0 to 7)	First calibration parameter F of dataN	Get only	-99999.999999 to 99999.999999
11307+Nx10000 (N: 0 to 7)	First X magnification of dataN	Get only	-
11308+Nx10000 (N: 0 to 7)	First Y magnification of dataN	Get only	-
11309+Nx10000 (N: 0 to 7)	First origin X of dataN	Get only	-
11310+Nx10000 (N: 0 to 7)	First origin Y of dataN	Get only	-
11311+Nx10000 (N: 0 to 7)	First X-axis angle of dataN	Get only	-
11312+Nx10000 (N: 0 to 7)	First Y-axis angle of dataN	Get only	-
11313+Nx10000 (N: 0 to 7)	First XY-axis angle of dataN	Get only	-
14001+Nx10000 (N: 0 to 7)	Calibration parameter A of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999
14002+Nx10000 (N: 0 to 7)	Calibration parameter B of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999
14003+Nx10000 (N: 0 to 7)	Calibration parameter C of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999
14004+Nx10000 (N: 0 to 7)	Calibration parameter D of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999
14005+Nx10000 (N: 0 to 7)	Calibration parameter E of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999
14006+Nx10000 (N: 0 to 7)	Calibration parameter F of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999

No.	Data name	Set/Get	Data range
14007+Nx10000 (N: 0 to 7)	X magnification of dataN	Get only	-
14008+Nx10000 (N: 0 to 7)	Y magnification of dataN	Get only	-
14009+Nx10000 (N: 0 to 7)	Origin X of dataN	Get only	-
14010+Nx10000 (N: 0 to 7)	Origin Y of dataN	Get only	-
14011+Nx10000 (N: 0 to 7)	X-axis angle of dataN	Get only	-
14012+Nx10000 (N: 0 to 7)	Y-axis angle of dataN	Get only	-
14013+Nx10000 (N: 0 to 7)	XY-axis angle of dataN	Get only	-
14016+Nx10000 (N: 0 to 7)	Error evaluation of dataN	Get only	-
14017+Nx10000 (N: 0 to 7)	X max error of dataN	Get only	-
14018+Nx10000 (N: 0 to 7)	Y max error of dataN	Get only	-
14019+Nx10000 (N: 0 to 7)	Sampling number of X max error of dataN	Get only	0 to 204
14020+Nx10000 (N: 0 to 7)	Sampling number of Y max error of dataN	Get only	0 to 204

PLC Master Calibration

This processing item is specifically provided for calibration between the camera coordination system and the control equipment coordination system.

In this processing item, the axis movement amount of the control equipment necessary for calibration can be set freely.

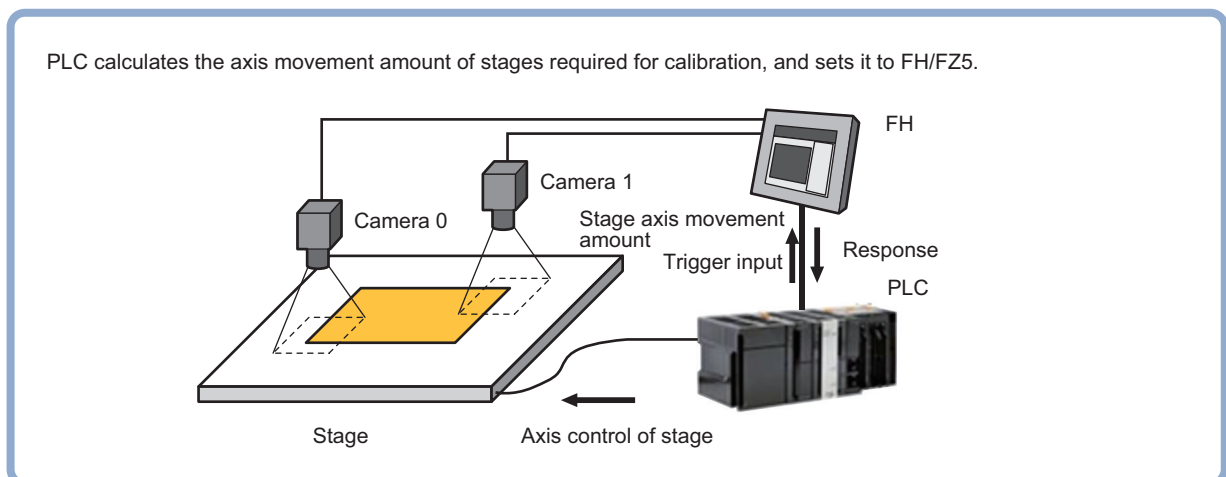
If how to move the calibration mark has already been determined and it cannot be changed, use this processing item. If it can be changed, we recommend you to use [Vision master calibration].

Important

- The calibration data created with this processing item can be referred from [Calibration Data Reference]. Unlike other calibration-related processing items, note that this processing item cannot use the calibration data on its own.
- This function refers processing items, e.g. Stage Data or Robot Data, having external device information required the calculation of movement distance. If you change those items, setting contents of PLC Master Calibration will change. Rechecking settings is required.

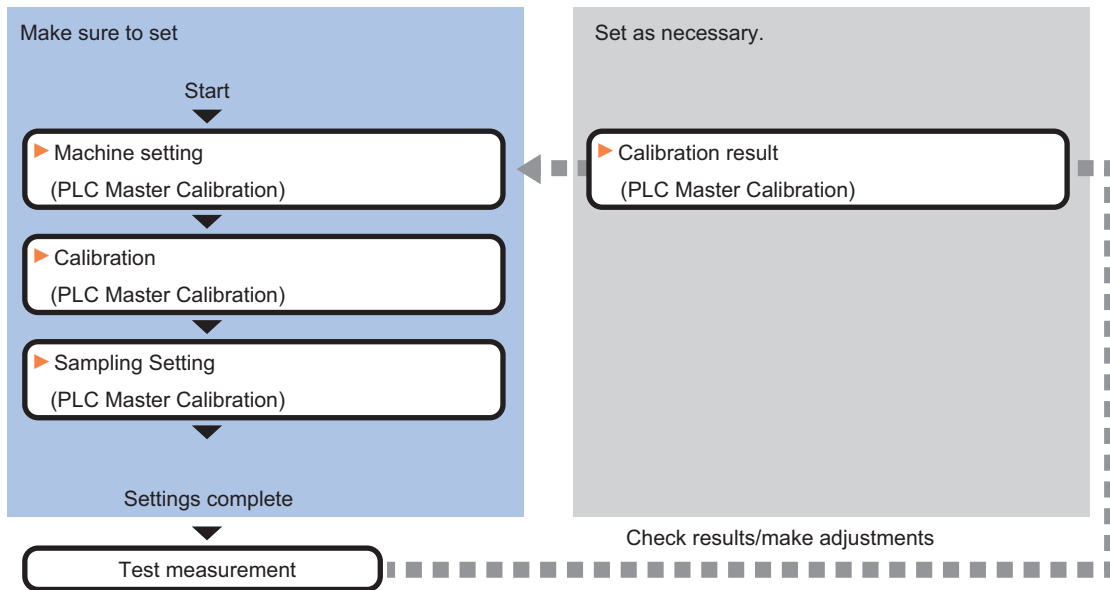
Used in the Following Case

- When you want to position the FPD panel



Settings Flow (PLC Master Calibration)

Set the PLC master calibration with the following steps.



List of PLC Master Calibration Items

Item name	Description
Machine setting	Select a processing item (stage data or robot data) under which external device information needed for calculation of axis movement amount is held. Reference: ▶ Machine Setting (PLC Master Calibration) (p.763)
Calibration	This item sets data related to calibration. Sets the number of calibration data to be created and the measurement processing items to be used for sampling in the arithmetic expression. Reference: ▶ Calibration (PLC Master Calibration) (p.763)
Sampling setting	This item sets data related to sampling. Set the number of samplings and the actual coordinate positions for each sampling. Reference: ▶ Sampling Setting (PLC Master Calibration) (p.765)
Calibration result	The created calibration data is displayed in this item. The calibration data can be adjusted directly using the Edit function. It is also possible to confirm the sampling data used for the calculation. Reference: ▶ Calibration Result (PLC Master Calibration) (p.766)

Machine Setting (PLC Master Calibration)

Select a processing item (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.

Important

- [PLC Master Calibration] refers to [Stage Data] or [Robot Data]. Be sure to register [Stage Data] or [Robot Data] with a given scene.

1 In the Item Tab area, click [Machine setting].

2 Select the processing unit that retains information on external device.

Information of the selected processing unit is displayed in the reference data display area. Displayed contents may change depending on selected type of Robot or Stage.

Setting item	Setting value [Factory default]	Description
Scene No.	[Present scene] Scenes 0 to 127	Select a scene number (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.
Unit No.	---	From among the referenced scene numbers, select a processing item (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.

Note

- If the number of scenes is increased using the scene group conversion tool, the maximum value that can be selected in "Scene No." changes.

Calibration (PLC Master Calibration)

This item sets data related to calibration. Sets the number of calibration data to be created and the measurement processing items to be used for sampling in the arithmetic expression. Also sets the output method for the calculated axis movement amount.

1 In the Item Tab area, click [Calibration].

2 Select the calibration method in the "Calibration type" area.

Setting item	Setting value [Factory default]	Description
Calibration type	[Normal]	Perform calibration by combining the "measurement command" and "set unit data command" from the control equipment (PLC).
	Easy	Perform calibration by using the "measurement command" only.

3 Check the calibration data items that you want to set.

Calibration data is created for the checked numbers.

Calibration target

No.	Position X	Position Y	Judge expression	Judge lower limit	Judge upper limit
<input checked="" type="checkbox"/> 0.			TJG	1.0000	1.0000
<input type="checkbox"/> 1.			TJG	1.0000	1.0000
<input type="checkbox"/> 2.			TJG	1.0000	1.0000
<input type="checkbox"/> 3.			TJG	1.0000	1.0000
<input type="checkbox"/> 4.			TJG	1.0000	1.0000
<input type="checkbox"/> 5.			TJG	1.0000	1.0000
<input type="checkbox"/> 6.			TJG	1.0000	1.0000
<input type="checkbox"/> 7.			TJG	1.0000	1.0000

No. Position X: Position Y: Judge expression: Judge condition:

0. [] [] TJG [1.0000] - [1.0000]

4 Select the line of the calibration data that you want to set.

Calibration target

No.	Position X	Position Y	Judge expression	Judge lower limit	Judge upper limit
<input checked="" type="checkbox"/> 0.			TJG	1.0000	1.0000
<input type="checkbox"/> 1.			TJG	1.0000	1.0000
<input type="checkbox"/> 2.			TJG	1.0000	1.0000
<input type="checkbox"/> 3.			TJG	1.0000	1.0000
<input type="checkbox"/> 4.			TJG	1.0000	1.0000
<input type="checkbox"/> 5.			TJG	1.0000	1.0000
<input type="checkbox"/> 6.			TJG	1.0000	1.0000
<input type="checkbox"/> 7.			TJG	1.0000	1.0000

No. Position X: Position Y: Judge expression: Judge condition:

0. [] [] TJG [1.0000] - [1.0000]

5 Set each item in the "Calibration target" area.

Setting item	Setting value [Factory default]	Description
Position X	---	Set the arithmetic expression that obtains camera coordinate X used for sampling.
Position Y	---	Set the arithmetic expression that obtains camera coordinate Y used for sampling.
Judge expression	---	Set the arithmetic expression to determine whether sampling was successful or not. If calibration fails during the initial value TJG, set the unit judgement JG of the processing unit from which positions X and Y are referred.
Judge condition	-999999999.9999 to 999999999.9999 [1.0000] to [1.0000]	Set the upper and lower limit values to determine whether sampling was successful or not. If TJG or JG is set to the judgement expression, use the initial values.

Sampling Setting (PLC Master Calibration)

This item sets data related to sampling.

Set the number of samplings and the actual coordinate positions for each sampling.

Displayed contents may change depending on selected type of Robot or Stage.

1 In the Item Tab area, click [Sampling setting].

2 Set each item in the Measurement number area.

Measurement number

The number of translation :

The number of rotational motion :

Setting item	Setting value [Factory default]	Description
The number of translation	2 to 100 [2]	Set the number of samplings performed by moving the calibration work in parallel.
The number of rotation motion	2 to 100 [2]	Set the number of samplings performed by rotating the calibration work.

3 Set the value for parallel or rotational movement in the Machine movement setting area.

Select the item you want to set in the list and set the movement amount from the reference position.

Machine movement setting

No.	Data type	X-direction move...	Y-direction move...	TH-direction mov...
0	Standard position	0.0000	0.0000	0.0000
1.	Translation position1	0.0000	0.0000	0.0000
2.	Translation position2	0.0000	0.0000	0.0000
3.	Rotation position1	0.0000	0.0000	0.0000
4	Rotation position2	0.0000	0.0000	0.0000

No. 0. X-direction movement : Y-direction movement : TH-direction movement :

Setting item	Setting value [Factory default]	Description
X-direction movement	-99999.9999 to 99999.9999 [0.0000]	Set the X axis movement amount from the reference position.
Y-direction movement	-99999.9999 to 99999.9999 [0.0000]	Set the Y axis movement amount from the reference position.
TH-direction movement	-180.0000 to 180.0000 [0.0000]	Set the θ axis movement amount from the reference position.

Note

- When the selected stage is the X stage, Y stage, X θ stage, Y θ stage, θ X stage, or θ Y stage, non-existing axis will be greyed out and cannot be changed.
Non-existing axial direction is not displayed.

Calibration Result (PLC Master Calibration)

The created calibration data is displayed in this item. The calibration data can be adjusted directly using the Edit function.

It is also possible to confirm the sampling data used for the calculation.

- 1 In the Item Tab area, click [Calibration result].
- 2 This item confirms the calibration data you created.

Display setting

Data No.:

Calibration data

A:	1.000000	D:	0.000000
B:	0.000000	E:	1.000000
C:	0.000000	F:	0.000000
X magnification:	1.000000	X-axis angle:	0.000000
Y magnification:	1.000000	Y-axis angle:	90.000000
Origin X:	0.000000	XY-axis angle:	90.000000
Origin Y:	0.000000		

Sampling data list

No.	Data type	X-axis movement	Y-axis movement	TH-axis movement	Camera X	Camera Y
0.	Standard position	0.0000	0.0000	0.0000	0.0000	0.0000
1.	Parallel position1	0.0000	0.0000	0.0000	0.0000	0.0000
2.	Parallel position2	0.0000	0.0000	0.0000	0.0000	0.0000
3.	Rotation position1	0.0000	0.0000	0.0000	0.0000	0.0000
4.	Rotation position2	0.0000	0.0000	0.0000	0.0000	0.0000

	Setting item	Setting value [Factory default]	Description	
	Display setting	Display setting Data No.	0 to 7 [0]	Sets the calibration data number that displayed the calculation results.

Item	Description
Calibaraiton data	Displays details about the calibration parameters. Clicking [Enable direct edit] will let you change the numbers for A to F. If any number has been changed, the message "This data has been directly edited" appears at the left of [Enable direct edit].
Sampling data list	Displays sampling data used for creating the calibration parameters. Normally, non-existing axis value will be 0 when Xθ, Yθ, θX, θY. X or Y stage is selected.

Key Points for Test Measurement and Adjustment (PLC Master Calibration)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgment result
Calibration method	Calibration method

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image.	Explanation of image to be displayed
0	Measurement image + calibration progress status
1	Measurement image only

Key Points for Adjustment

Select the adjustment method referring to the following points.

While executing calibration

State	Parameter to be adjusted	Troubleshooting
Unit judgement NG occurred during calibration	Refer "Troubleshooting"	<p>Confirm the "NG cause" appears in the detail result display and perform appropriate countermeasures.</p> <p>Setting NG</p> <ul style="list-style-type: none"> The processing item setting is not correct. Check if the settings are correct including the processing items being referred to. <p>Sequence NG</p> <ul style="list-style-type: none"> Measurement is executed regardless of whether calibration has been completed. Do not execute the measurement with the Next Calibration type is selected 3 (Calibration is completed) in the external reference table. <p>Calibration calculation NG</p> <ul style="list-style-type: none"> Calibration data calculation has failed. Check if the camera coordinates in the sampling data list in the Calculation Result Confirmation Tab are set correctly. If any data is set incorrectly, the processing items used in measurement may not be set properly. Check that the settings are correct. <p>Sampling NG</p> <ul style="list-style-type: none"> The sampling measurement has failed. Adjust the setting data so that the processing items used in the measurement is not NG. If it still continues to occur, the judgement formula and condition may not be set correctly. Check if the settings are correct or not.
To start all over again	---	Execute the clear measurement result or external reference data #5009 "Clear step counter".

Other

State	Parameter to be adjusted	Troubleshooting
It cannot be selected because the reference unit No. is <none>.	Machine setting	Check if the reference scene number is selected correctly. Check if stage data processing items or robot data processing items are registered in the selected reference scene.
The reference unit number does not change during flow editing.	Machine setting	The system is designed this way. While a scene other than the current scene is referenced, the reference unit number does not change according to the editing of the flow. Change the flow so that the current scene will be referenced, or set the reference unit number again.

Measurement Results for Which Output Is Possible (PLC Master Calibration)

The following values can be output using processing items related to results output. It is also possible to refer to measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgment result
NG cause	CNG	NG cause -1: Setting NG -2: Sequence NG -3: Mobility NG -4: Calibration NG -5: Evaluation NG -6: Sampling NG -100: Other NG

External Reference Tables (PLC Master Calibration)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement(unmeasured) 1: Judgement result OK -1: Judgement result NG
18	Next Calibration Operation	Get only	---
19	Calibration step No.	Get only	---
20	NG cause	Get only	---
120	Calibration target flag	Set/Get	0: Not process 1: Process
121	The number of translation	Set/Get	2 to 100
122	The number of rotational motion	Set/Get	2 to 100
123	Scene No.	Set/Get	-1: Current scene referred 0 to 9,999: Pointed scene referred
124	Unit No.	Set/Get	-1: No reference 0 to 9,999: Pointed unit referred
125	Calibration type	Set/Get	0: Normal 1: Easy
200 + N × 10 (N: 0 to 7)	Calibration target flag of data N	Set/Get	0: No 1: Yes
201 + N × 10 (N: 0 to 7)	Position X of data N	Set/Get	Exp. character string
202 + N × 10 (N: 0 to 7)	Position Y of data N	Set/Get	Exp. character string
203 + N × 10 (N: 0 to 7)	Judge expression of data N	Set/Get	Exp. character string
204 + N × 10 (N: 0 to 7)	Upper limit of judge condition of data N	Set/Get	-999,999,999.9999 to 999,999,999.9999
205 + N × 10 (N: 0 to 7)	Lower limit of judge condition of data N	Set/Get	-999,999,999.9999 to 999,999,999.9999
1000 + N × 10 (N: 0 to 99)	X-direction movement of parallel position No.N	Set/Get	-999,999,999.9999 to 999,999,999.9999

No.	Data name	Set/Get	Data range
1001 + N × 10 (N: 0 to 99)	Y-direction movement of parallel position No.N	Set/Get	-999,999,999.9999 to 999,999,999.9999
2000 + N × 10 (N: 0 to 99)	X-direction movement of rotation position No.N	Set/Get	-999,999,999.9999 to 999,999,999.9999
2001 + N × 10 (N: 0 to 99)	Y-direction movement of rotation position No.N	Set/Get	-999,999,999.9999 to 999,999,999.9999
2002 + N × 10 (N: 0 to 99)	TH-direction movement of rotation position No.N	Set/Get	-180.0000 to 180.0000
5000	Calibration start/end	Set only	0: Calibration end 1: Calibration start
5001	Set calibration target	Set only	0 to 255
5002 *1	Set standard position	Set only	1 to 1
5003	Set parallel position	Set only	1 to 100
5004	Set rotation position	Set only	1 to 100
5005 *1	Calculate calibration data	Set only	1: Execute
5006 *1	Calculate deflection data	Set only	1: Execute
5007 *1	Clear sampling data	Set only	1: Clear
5009 *1	Clear step counter	Set only	1: Clear
14000 + N × 10000 (N: 0 to 7)	Deflection of dataN	Get only	---
14001 + N × 10000 (N: 0 to 7)	Calibration parameter A of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999
14002 + N × 10000 (N: 0 to 7)	Calibration parameter B of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999
14003 + N × 10000 (N: 0 to 7)	Calibration parameter C of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999
14004 + N × 10000 (N: 0 to 7)	Calibration parameter D of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999
14005 + N × 10000 (N: 0 to 7)	Calibration parameter E of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999
14006 + N × 10000 (N: 0 to 7)	Calibration parameter F of dataN	Set/Get	-999,999,999.9999 to 999,999,999.9999
14007 + N × 10000 (N: 0 to 7)	X magnification of dataN	Get only	---
14008 + N × 10000 (N: 0 to 7)	Y magnification of dataN	Get only	---
14009 + N × 10000 (N: 0 to 7)	Origin X of dataN	Get only	---
14010 + N × 10000 (N: 0 to 7)	Origin Y of dataN	Get only	---
14011 + N × 10000 (N: 0 to 7)	X-axis angle of dataN	Get only	---
14012 + N × 10000 (N: 0 to 7)	Y-axis angle of dataN	Get only	---
14013 + N × 10000 (N: 0 to 7)	XY-axis angle of dataN	Get only	---

*1: If you set the external reference table and execute the applicable Processing unit item, confirm the current Processing unit item is same as the selected Scene.

Transfer Position Data

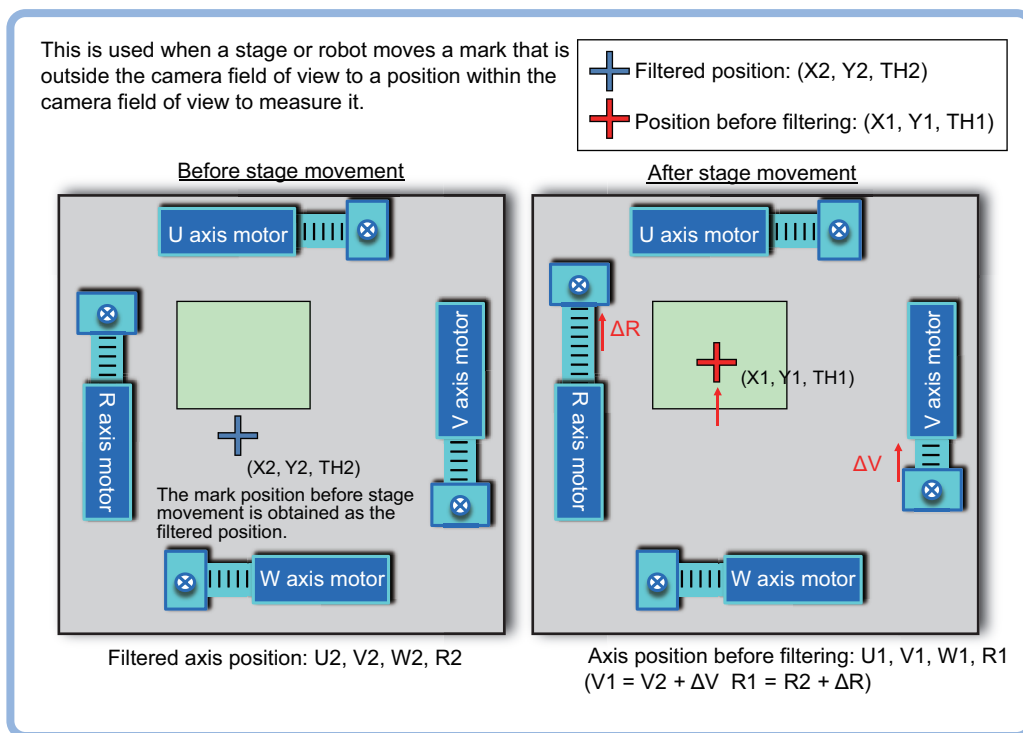
Calculates the post movement position/angle data when each axis of a stage or robot is moved for a given distance. Use this when you want to measure the stage after moving a given distance and obtain the pre-movement position/angle data.

At least 2 or 3 measurement points are needed to calculate axis movement amounts. Axis movement amounts can usually be stably calculated by installing a camera at each measurement point and measuring 4 or 5 measurement points.

The basic approach is to calculate movement amounts at high precision with the same number of cameras as there are measurement points. But it is also possible to measure multiple measurement points contained in a single camera's field of view.

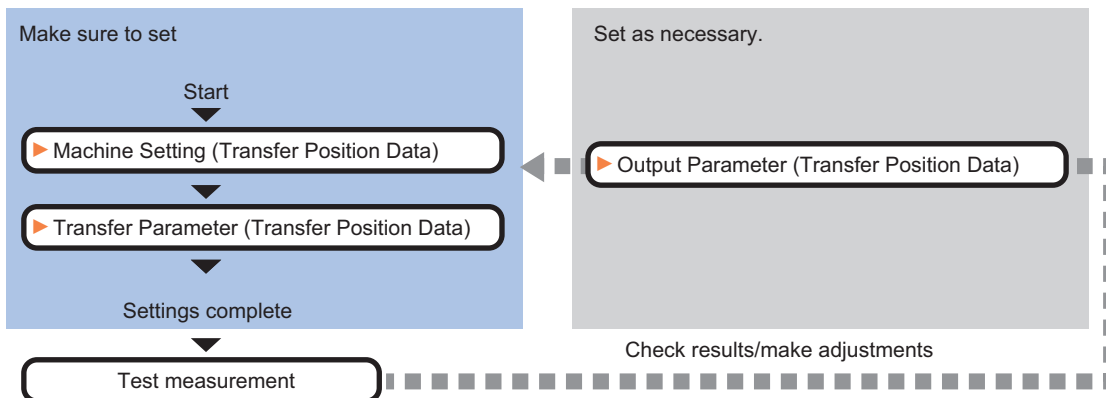
Used in the Following Case

- When you want to position the FPD panel



Settings Flow (Transfer Position Data)

The position/angle conversion should be set up with the following procedure.



Item list of Transfer Position Data

Item name	Description
Machine setting	Select a processing item (stage data or robot data) under which external device information needed for calculation of axis movement amount is held. Reference: ▶ Machine Setting (Transfer Position Data) (p.771)
Transfer parameter	The item sets data related to conversion. Sets a calculation formula using the pre-conversion position and axis position and post-conversion axis position. Reference: ▶ Transfer Parameter (Transfer Position Data) (p.772)
Output parameter	Select whether or not the judgement results of this processing unit is reflected in the scene overall judgement. Reference: ▶ Output Parameter (Transfer Position Data) (p.776)

Machine Setting (Transfer Position Data)

Select a processing item (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.

Important

- [Transfer Position Data] refers to [Stage Data] or [Robot Data]. Be sure to register [Stage Data] or [Robot Data] in the referenced scene.

1 In the Item Tab area, click [Machine setting].

2 Select the processing unit that retains information on external device.

Information of the selected processing unit is displayed in the reference data display area. Displayed contents may change depending on the selection type; Robot, or Stage in Stage Data or Robot Data.

Setting item	Setting value [Factory default]	Description
Reference scene No.	[Present scene] Scenes 0 to 127	Select a scene number (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.
Reference unit No.	-	From among the referenced scene numbers, select a processing item (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.

Note

- If the number of scenes is increased using the scene group conversion tool, the maximum value that can be selected in "Reference scene No." changes.

Transfer Parameter (Transfer Position Data)

The item sets data related to conversion. Sets a calculation formula using the pre-conversion position and axis position and post-conversion axis position.

- 1 Click [Transfer parameter] in the Item Tab area.
- 2 Set each item in the Current point position area.

Setting item	Setting value [Factory default]	Description
Position X	-	Set the calculation formula that obtains the position X of the conversion target.
Position Y	-	Set the calculation formula that obtains the position Y of the conversion target.
Position angle	-	Set the calculation formula that obtains the angle of the conversion target. To convert positions X and Y only, set 0 as the angle.

- 3 Set each item in the Current axis position area before conversion.

Set how far each axis moved from the origin return state (all axes are at the origin point) when [Current angle] is measured.

If the stage type of the reference data is the XY stage or the robot type is 3-axis robot

Setting item	Setting value [Factory default]	Description
X-axis	-	Set how far the X axis position moved from the origin.
Y-axis	-	Set how far the Y axis position moved from the origin.

If the stage type of the reference data is the XYθ stage, θXY stage or the robot type is 4-axis robot

Setting item	Setting value [Factory default]	Description
X-axis	-	Set how far the X axis position moved from the origin.
Y-axis	-	Set how far the Y axis position moved from the origin.
θ-axis	-	Set how far the θ axis position moved from the origin.

If the stage type of the reference data is the UVW stage

Setting item	Setting value [Factory default]	Description
U-axis	-	Set how far the U axis position moved from the origin.
V-axis	-	Set how far the V axis position moved from the origin.
W-axis	-	Set how far the W axis position moved from the origin.

If the stage type of the reference data is the UVWR stage

Setting item	Setting value [Factory default]	Description
U-axis	-	Set how far the U axis position moved from the origin.
V-axis	-	Set how far the V axis position moved from the origin.
W-axis	-	Set how far the W axis position moved from the origin.
R-axis	-	Set how far the R axis position moved from the origin.

Selects X-axis as movement axis when X(Y) Stage is set in reference data.

Setting item	Setting value [Factory default]	Description
X-axis	-	Set the measurement distance of X-axis from homign operation.

Selects Y-axis as movement axis when X(Y) Stage is set in reference data.

Setting item	Setting value [Factory default]	Description
Y-axis	-	Set the measurement distance of Y-axis from homign operation.

Selects X-axis as movement axis when Xθ(Yθ) or θX(θY) Stage are set in reference data.

Setting item	Setting value [Factory default]	Description
X-axis	-	Set the measurement distance of X-axis from homign operation.
θ-axis	-	Set the measurement distance of θ-axis from homign operation.

Selects Y-axis as movement axis when Xθ(Yθ) or θX(θY) Stage are set in reference data.

Current axis position

Y-axis:

θ-axis:

Setting item	Setting value [Factory default]	Description
Y-axis	-	Set the measurement distance of Y-axis from homign operation.
θ-axis	-	Set the measurement distance of θ-axis from homign operation.

4 Set each item in the Transferred axis position area.

Set how far each axis in the "Post-correction position/angle" moved from the origin return state (all axes are at the origin point).

If the stage type of the reference data is the XY stage or the robot type is 3-axis robot

Transferred axis position

X-axis:

Y-axis:

Setting item	Setting value [Factory default]	Description
X-axis	-	Set how far the X axis position moved from the origin.
Y-axis	-	Set how far the Y axis position moved from the origin.

If the stage type of the reference data is the XYθ stage, θXY stage or the robot type is 4-axis robot

Transferred axis position

X-axis:

Y-axis:

θ-axis:

Setting item	Setting value [Factory default]	Description
X-axis	-	Set how far the X axis position moved from the origin.
Y-axis	-	Set how far the Y axis position moved from the origin.
θ-axis	-	Set how far the θ axis position moved from the origin.

If the stage type of the reference data is the UVW stage

Transferred axis position

U-axis:

V-axis:

W-axis:

Setting item	Setting value [Factory default]	Description
U-axis	-	Set how far the U axis position moved from the origin.
V-axis	-	Set how far the V axis position moved from the origin.
W-axis	-	Set how far the W axis position moved from the origin.

If the stage type of the reference data is the UVWR stage

Transferred axis position

U-axis :

V-axis :

W-axis :

R-axis :

Setting item	Setting value [Factory default]	Description
U-axis	-	Set how far the U axis position moved from the origin.
V-axis	-	Set how far the V axis position moved from the origin.
W-axis	-	Set how far the W axis position moved from the origin.
R-axis	-	Set how far the R axis position moved from the origin.

Selects X-axis as movement axis when X(Y) Stage is set in reference data.

Current axis position

X-axis :

Setting item	Setting value [Factory default]	Description
X-axis	-	Set the measurement distance of X-axis from homing operation.

Selects Y-axis as movement axis when X(Y) Stage is set in reference data.

Current axis position

Y-axis :

Setting item	Setting value [Factory default]	Description
Y-axis	-	Set the measurement distance of Y-axis from homing operation.

Selects X-axis as movement axis when Xθ(Yθ) or θX(θY) Stage are set in reference data.

Current axis position

X-axis :

θ-axis :

Setting item	Setting value [Factory default]	Description
X-axis	-	Set the measurement distance of X-axis from homing operation.
θ-axis	-	Set the measurement distance of θ-axis from homing operation.

Selects Y-axis as movement axis when Xθ(Yθ) or θX(θY) Stage are set in reference data.

Current axis position

Y-axis :

θ-axis :

Setting item	Setting value [Factory default]	Description
Y-axis	-	Set the measurement distance of Y-axis from homing operation.
θ-axis	-	Set the measurement distance of θ-axis from homing operation.

5 Click [Measure] to check the measurement results.

6 Set the judgement condition.

Note

- The values beside each item are measurement results of the displayed image. Take these values into consideration to determine the upper and lower limit values.

Setting item	Setting value	Description
Transferred position X	-99999.9999 to 99999.9999	Specify the range of X-axis conversion that is judged to be OK.
Transferred position Y	-99999.9999 to 99999.9999	Specify the range of Y-axis conversion that is judged to be OK.
Transferred angle	-180.0000 to 180.0000	Specify the range of angle conversion that is judged to be OK.

Output Parameter (Transfer Position Data)

Select whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Choose whether or not to reflect the judgement result in the scene overall judgement in "Reflect to overall judgement" area.

Setting item	Setting value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Specify whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Key Points for Test Measurement and Adjustment (Transfer Position Data)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgment result
Transferred position X	Displays the position X of the post-conversion measurement data.
Transferred position Y	Displays the position Y of the post-conversion measurement data.
Transferred angle	Displays the angle of the post-conversion measurement data.

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image.	Explanation of image to be displayed
0	Measurement image

Key Points for Adjustment

Select the adjustment method referring to the following points.

State	Parameter to be adjusted	Troubleshooting
Judgment was NG.	Calculation setting	The arithmetic expression may be empty. Set the correct arithmetic expression.
It cannot be selected because the reference unit No. is <none>.	Machine setting	Check if the reference scene number is selected correctly. Check if stage data processing items or robot data processing items are registered in the selected reference scene.
The reference unit number does not follow during flow editing.	Machine setting	The system is designed this way. While a scene other than the current scene is referenced, the reference unit number does not change according to the editing of the flow. Change the flow so that the current scene will be referenced, or set the reference unit number again.

Measurement Results for Which Output Is Possible (Transfer Position Data)

The following values can be output using processing items related to results output. It is also possible to refer to measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgment result
Transferred position X	X	Post-conversion position X
Transferred position Y	Y	Post-conversion position Y
Transferred angle	TH	Post-conversion angle

External Reference Tables (Transfer Position Data)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Transferred position X	Get only	-
6	Transferred position Y	Get only	-
7	Transferred angle	Get only	-
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Reference scene No.	Set/Get	-1:Current scene refered 0 to 9,999:Pointed scene refered
121	Reference unit No.	Set/Get	-1:No reference 0 to 9,999:Pointed unit refered
122	Current position X	Set/Get	Exp. character string
123	Current position Y	Set/Get	Exp. character string
124	Current angle	Set/Get	Exp. character string
130	Current X-axis	Set/Get	Exp. character string
131	Current Y-axis	Set/Get	Exp. character string
132	Current θ -axis(angle)	Set/Get	Exp. character string

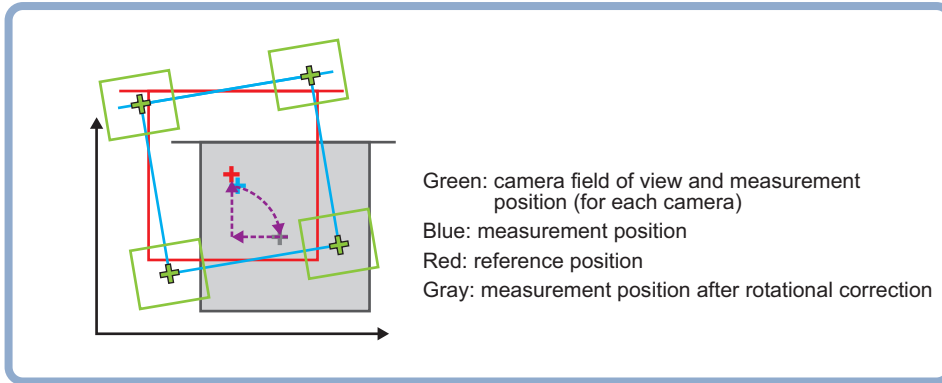
No.	Data name	Set/Get	Data range
133	Current θ -axis(linear drive)	Set/Get	Exp. character string
134	Current U-axis	Set/Get	Exp. character string
135	Current V-axis	Set/Get	Exp. character string
136	Current W-axis	Set/Get	Exp. character string
137	Current R-axis	Set/Get	Exp. character string
140	Transferred X-axis	Set/Get	Exp. character string
141	Transferred Y-axis	Set/Get	Exp. character string
142	Transferred θ -axis(angle)	Set/Get	Exp. character string
143	Transferred θ -axis(linear drive)	Set/Get	Exp. character string
144	Transferred U-axis	Set/Get	Exp. character string
145	Transferred V-axis	Set/Get	Exp. character string
146	Transferred W-axis	Set/Get	Exp. character string
147	Transferred R-axis	Set/Get	Exp. character string
150	Upper limit of transferred position X	Set/Get	-99,999.9999 to 99,999.9999
151	Lower limit of transferred position X	Set/Get	-99,999.9999 to 99,999.9999
152	Upper limit of transferred position Y	Set/Get	-99,999.9999 to 99,999.9999
153	Lower limit of transferred position Y	Set/Get	-99,999.9999 to 99,999.9999
154	Upper limit of transferred position angle	Set/Get	-180.0000 to 180.0000
155	Lower limit of transferred position angle	Set/Get	-180.0000 to 180.0000

Calc Axis Move

Calculate the movement amount of each axis of the external device necessary to adjust the measurement position and angle to the reference position and angle. Set the measurement position/angle and reference position/angle using an arithmetic expression.

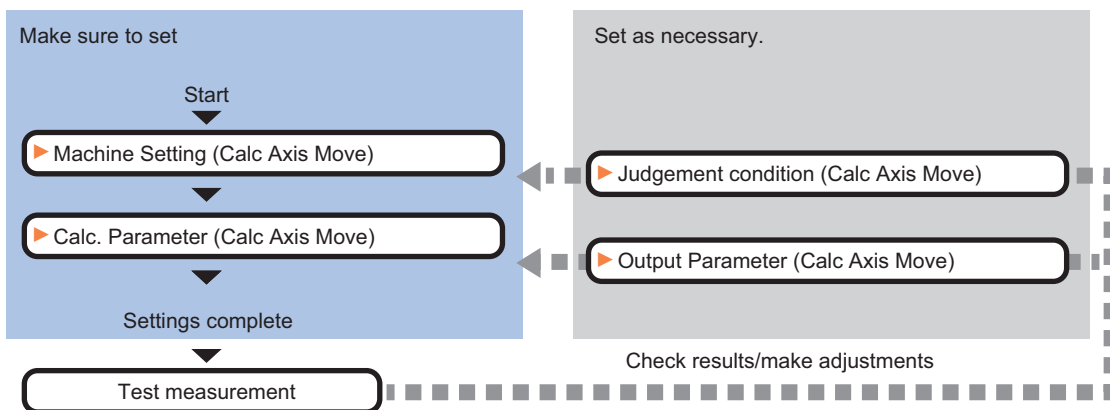
Used in the Following Case

- When you want to position the FPD panel



Settings Flow (Calc Axis Move)

Set the axis movement amount calculation following the procedure below.



List of Calc Axis Move Items

Item name	Description
Machine setting	Select a processing item (stage data or robot data) under which external device information needed for calculation of axis movement amount is held. Reference: ▶ Machine Setting (Calc Axis Move) (p.780)
Calc. parameter	Set the reference position/angle and measurement position/angle using an arithmetic expression. If multiple cameras are used, the setting data can be created easily by using the position/angle calculation processing items. Reference: ▶ Calc. Parameter (Calc Axis Move) (p.781)
Judgement condition	This item specifies the judgement condition for measurement results. Reference: ▶ Judgement Condition (Calc Axis Move) (p.785)
Output parameter	This item can be changed if necessary. Set whether or not the judgement results of this processing unit is reflected in the scene overall judgement. Reference: ▶ Output Parameter (Calc Axis Move) (p.786)

Machine Setting (Calc Axis Move)

Select a processing item (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.

1 In the Item Tab area, click [Machine setting].

2 Select the reference scene No. and reference unit No.

Information of the selected processing unit is displayed in the reference data display area.

Displayed contents differ depending on selected type of Robot or Stage.

Setting item	Setting value [Factory default]	Description
Reference scene No.	[Present scene] Scenes 0 to 127	Select a scene number (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.
Reference unit No.	-	From among the referenced scene numbers, select a processing item (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.

Note

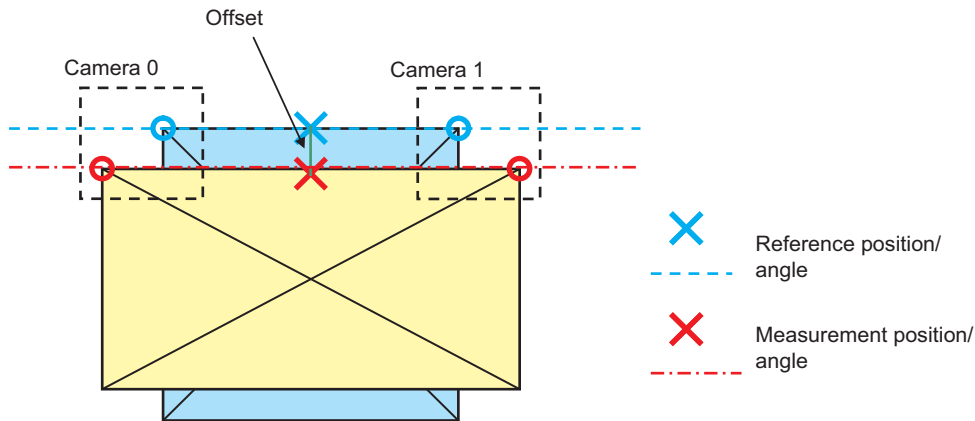
- If the number of scenes is increased using the scene group conversion tool, the maximum value that can be selected in "Reference scene No." changes.

Calc. Parameter (Calc Axis Move)

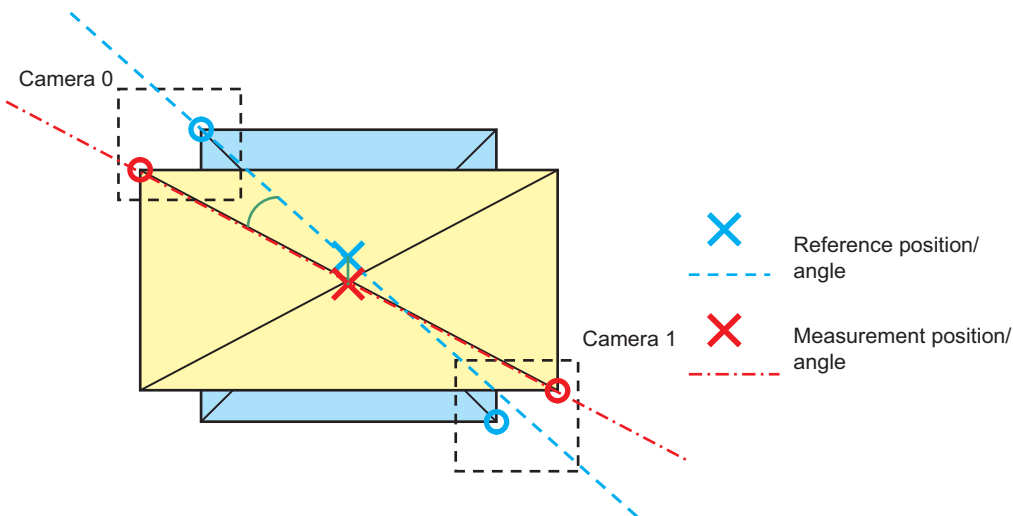
Set the reference position/angle and measurement position/angle using an arithmetic expression. If multiple cameras are used, the setting data can be created easily by using the position/angle calculation processing items.

In case there is a difference between the reference position/angle and the measurement position/angle, you can compensate it by setting the offset. Example 1 shows the application to align the center of a couple of sheets which have the different size. In this case, a precise alignment can be realized by setting the vertical offset as below. In example 2, the angular offset is necessary in addition.

Example 1) When an offset in the vertical direction is required



Example 2) When offsets in the vertical direction and angle direction are required



- 1 Click [Calc. parameter] in the Item Tab area.
- 2 Set each parameters using arithmetic expressions.

The screenshot shows a software interface with five main sections, each containing input fields with a minus sign button:

- Reference position:** Position X, Position Y, Angle.
- Reference offset:** Position X, Position Y, Angle, Initial angle.
- Measurement position:** Position X, Position Y, Angle.
- Measurement offset:** Position X, Position Y, Angle, Initial angle.
- Current axis position:** X-axis, Y-axis, θ -axis.

If no reference data is selected

The following parameters are displayed in this menu based on the stage type.

Displayed content	Not selected	XY	XY θ	θ XY	UVW	UVWR	X(Y)	X θ (Y θ)	θ X(θ Y)	3 axes	4 axes
Reference setting											
Position X	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Position Y	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Angle	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Measure setting											
Position X	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Position Y	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Angle	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Reference offset setting											
Position X	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Position Y	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Angle	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Initial angle	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Measure offset setting											
Position X	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Position Y	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Angle	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Initial angle	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Displayed content	Not selected	XY	XYθ	θXY	UVW	UVWR	X(Y)	Xθ(Yθ)	θX(θY)	3 axes	4 axes
Current axis position											
X-axis	×	○	○	○	×	×	○ (X-axis is selected as the Movement axis)	○ (X-axis is selected as the Movement axis)	○ (X-axis is selected as the Movement axis)	○	○
Y-axis	×	○	○	○	×	×	○ (Y-axis is selected as the Movement axis)	○ (Y-axis is selected as the Movement axis)	○ (Y-axis is selected as the Movement axis)	○	○
θ-axis	×	×	○	○	×	×	×	○	○	×	○
U-axis	×	×	×	×	○	○	×	×	×	×	×
V-axis	×	×	×	×	○	○	×	×	×	×	×
W-axis	×	×	×	×	○	○	×	×	×	×	×
R-axis	×	×	×	×	×	○	×	×	×	×	×

○: Show, ×: Hide

Initial angle

Initial angle is an angle when the offset amount is calculated.

Example) Positioning of a ceramic chip by using the angle of the diagonal line and the center position.

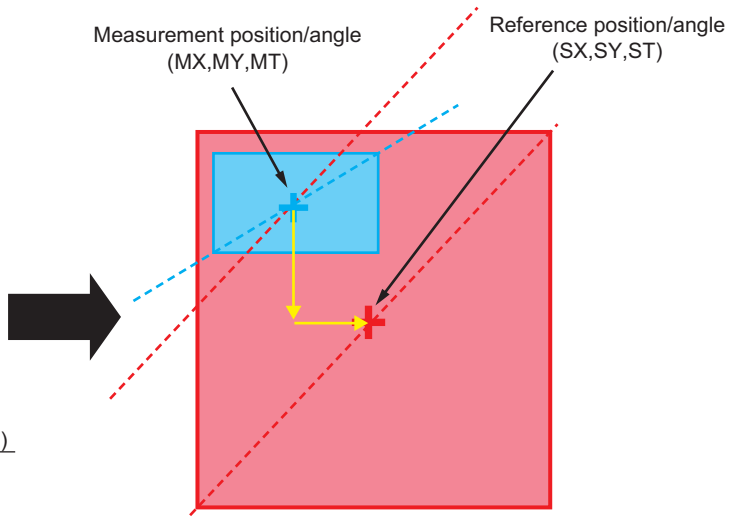
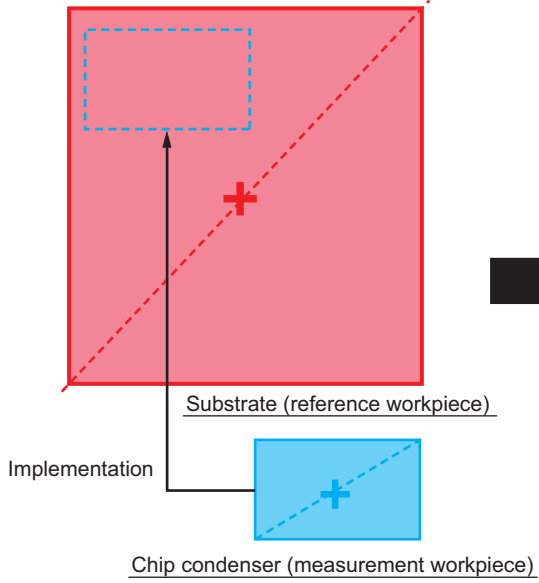
Definition of symbol in the following figure

- Measurement position/angle of when the offset amount is calculated (MX, MY, MT)
- Reference position/angle when the offset amount is calculated (SX, SY, ST)
- Offset amount of measurement position/angle (OMX, OMY, OMT)
- Offset amount of the reference position/angle (OSX, OSY, OST)

Setting contents for "Measurement position offset setting" of the Calc Axis Move

- Position X : $OMX = SX - MX$
- Position Y : $OMY = SY - MY$
- Angle : $OMT = ST - MT$
- Angle at the definition time : MT

Application example)
Chip condenser implementation on substrate



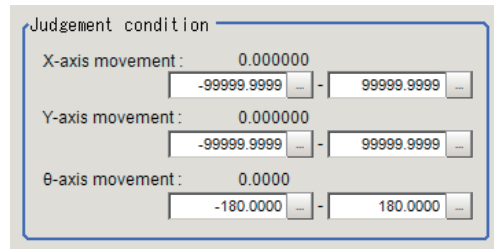
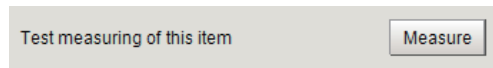
Measurement position offset amount (OMX, OMY, OMT)
= (SX - MX, SY - MY, ST - MT)

Reference position offset amount (OSX, OSY, OST)
= (MX - SX, MY - SY, MT - ST)

Judgement Condition (Calc Axis Move)

This item specifies the judgement condition for measurement results.

- 1 When the setting has been changed, click [Measure] to verify whether measurements can be made correctly.
- 2 In the "Judgement condition" area, set each item.



If the reference data is the XYθ stage

The following parameters are displayed in this menu based on the stage type.

Displayed content	Not selected	XY	XYθ	θXY	UVW	UVWR	X(Y)	Xθ(Yθ)	θX(θY)	3 axes	4 axes
X axis movement amount Judgement upper/lower limit values	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Y axis movement amount Judgement upper/lower limit values	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
θ axis angle movement amount Judgement upper/lower limit values	<input type="radio"/>	<input checked="" type="checkbox"/>	<input type="radio"/> (θ axis direct drive)	<input type="radio"/> (θ axis direct drive)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/> (θ axis direct drive)	<input type="radio"/> (θ axis direct drive)	<input checked="" type="checkbox"/>	<input type="radio"/>
θ axis linear movement amount Judgement upper/lower limit values	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/> (θ axis linear drive)	<input type="radio"/> (θ axis linear drive)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/> (θ axis linear drive)	<input type="radio"/> (θ axis linear drive)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
U axis movement amount Judgement upper/lower limit values	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
V axis movement amount Judgement upper/lower limit values	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
W axis movement amount Judgement upper/lower limit values	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
R axis movement amount Judgement upper/lower limit values	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

○: Show, ×: Hide

Output Parameter (Calc Axis Move)

Set how to treat the coordinates to be output to the external device as measurement results. This item can be changed if necessary. Normally, the factory default value will be used.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Setting value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Select to reflect this function's judgment result to Scene's Overall judgement.
Output type	<ul style="list-style-type: none"> • [Relative position] • Absolute position 	Relative position: Calculates the movement amount form the current axis position. Absolute position: Calculates the movement amount from the homing operation position.

Key Points for Test Measurement and Adjustment (Calc Axis Move)

The following results are displayed.

Displayed item	Character string	Description
Judgement	JG	Judgement result
Position X difference	DX	Position X difference
Position Y difference	DY	Position Y difference
Angle difference	DT	Angle difference
Measurement X	X	Measurement X
Measurement Y	Y	Measurement Y
Measure angle	TH	Angle θ
Reference X	SX	Reference X
Reference Y	SY	Reference Y
Reference angle	ST	Reference angle θ
X axis movement	MX	X axis movement amount *
Y axis movement	MY	Y axis movement amount *
θ axis angle movement	MT	θ axis angle movement amount *
θ axis linear movement	ML	θ axis movement amount *
U axis movement	MU	U axis movement amount *
V axis movement	MV	V axis movement amount *
W axis movement	MW	W axis movement amount *
R axis movement	MR	R axis movement amount *

* The following parameters are displayed in this menu based on the stage type.

Displayed content	XY	XY θ	θ XY	UVW	UVWR	X(Y)	X θ (Y θ)	θ X(θ Y)	3 axes	4 axes
X axis movement	○	○	○	×	×	○	○	○	○	○
Y axis movement	○	○	○	×	×	○	○	○	○	○

Displayed content	XY	XYθ	θXY	UVW	UVWR	X(Y)	Xθ(Yθ)	θX(θY)	3 axes	4 axes
θ axis angle movement	×	○ (θ axis direct drive)	○ (θ axis direct drive)	×	×	×	○ (θ axis direct drive)	○ (θ axis direct drive)	×	○
θ axis linear movement	×	○ (θ axis linear drive)	○ (θ axis linear drive)	×	×	×	○ (θ axis linear drive)	○ (θ axis linear drive)	×	×
U axis movement	×	×	×	○	○	×	×	×	×	×
V axis movement	×	×	×	○	○	×	×	×	×	×
W axis movement	×	×	×	○	○	×	×	×	×	×
R axis movement	×	×	×	×	○	×	×	×	×	×

○: Show, ×: Hide

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are false

State	Parameter to be adjusted	Troubleshooting
The sign of the measurement result (positive/negative) output is opposite.	-	The reference position/angle and measurement position/angle may be set in reverse. The axis movement amount calculates the movement amount from the measurement position/angle to the reference position/angle.

Other

State	Parameter to be adjusted	Troubleshooting
The reference unit number is <"None"> and cannot be selected.	Machine setting	Check if the reference scene number is selected correctly. Check if stage data processing items or robot data processing items are registered in the selected reference scene.
The reference unit number does not follow during flow editing.	Machine setting	The system is designed this way. While a scene other than the current scene is referenced, the reference unit number does not change according to the editing of the flow. Change the flow so that it refers to from the current scene or set the reference unit number again.

Measurement Results for Which Output Is Possible (Calc Axis Move)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Displayed item	Character string	Description
Judge	JG	Judgement result
Position X difference	DX	Position X difference
Position Y difference	DY	Position Y difference
Angle difference	DT	Angle difference
Measurement position X	X	Measurement position X
Measurement position Y	Y	Measurement position Y
Measure angle	TH	Angle θ
Reference X	SX	Reference X
Reference Y	SY	Reference Y
Reference angle	ST	Reference angle θ
X axis movement	MX	X axis movement amount *
Y axis movement	MY	Y axis movement amount *
θ axis angle movement	MT	θ axis angle movement amount *
θ axis linear movement	ML	θ axis linear movement amount *
U axis movement	MU	U axis movement amount *
V axis movement	MV	V axis movement amount *
W axis movement	MW	W axis movement amount *
R axis movement	MR	R axis movement amount *

* The following parameters are displayed in this menu based on the stage type.

Output contents	XY	XY θ	θ XY	UVW	UVWR	X(Y)	X θ (Y θ)	θ X(θ Y)	3 axes	4 axes
X axis movement	○	○	○	×	×	○	○	○	○	○
Y axis movement	○	○	○	×	×	○	○	○	○	○
θ axis angle movement	×	○ (θ axis direct drive)	○ (θ axis direct drive)	×	×	×	○ (θ axis direct drive)	○ (θ axis direct drive)	×	○
θ axis liner drive	×	○ (θ axis linear drive)	○ (θ axis linear drive)	×	×	×	○ (θ axis linear drive)	○ (θ axis linear drive)	×	×
U axis movement	×	×	×	○	○	×	×	×	×	×
V axis movement	×	×	×	○	○	×	×	×	×	×
W axis movement	×	×	×	○	○	×	×	×	×	×
R axis movement	×	×	×	×	○	×	×	×	×	×

○: Output, ×: Do not output

External Reference Tables (Calc Axis Move)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	X-axis movement	Get only	-
6	Y-axis movement	Get only	-
7	θ-axis movement	Get only	-180.0000 to 180.0000
8	θ-axis(linear drive)	Get only	-
9	U-axis movement	Get only	-
10	V-axis movement	Get only	-
11	W-axis movement	Get only	-
12	R-axis movement	Get only	-
13	Reference X	Get only	-
14	Reference Y	Get only	-
15	Reference angle	Get only	-
16	Measurement X	Get only	-
17	Measurement Y	Get only	-
18	Measurement angle	Get only	-
19	Position X difference	Get only	-
20	Position Y difference	Get only	-
21	Angle difference	Get only	-
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Reference scene No.	Set/Get	-1: Current scene referred 0 to 9999:Pointed scene referred
121	Reference unit No.	Set/Get	-1: No reference 0 to 9999:Pointed unit referred
130	Reference X	Set/Get	Exp. character string
131	Reference Y	Set/Get	Exp. character string
132	Reference angle	Set/Get	Exp. character string
133	Measurement X	Set/Get	Exp. character string
134	Measurement Y	Set/Get	Exp. character string
135	Measurement angle	Set/Get	Exp. character string
140	Reference X offset	Set/Get	Exp. character string
141	Reference Y offset	Set/Get	Exp. character string
142	Reference angle offset	Set/Get	Exp. character string
143	Measurement X offset	Set/Get	Exp. character string
144	Measurement Y offset	Set/Get	Exp. character string
145	Measurement angle offset	Set/Get	Exp. character string
146	Initial angle(Reference position)	Set/Get	Exp. character string
147	Initial angle(Measurement position)	Set/Get	Exp. character string

No.	Data name	Set/Get	Data range
150	Current X-axis movement	Set/Get	Exp. character string
151	Current Y-axis movement	Set/Get	Exp. character string
152	Current θ -axis movement	Set/Get	Exp. character string
153	Current θ -axis(linear drive)	Set/Get	Exp. character string
154	Current U-axis movement	Set/Get	Exp. character string
155	Current V-axis movement	Set/Get	Exp. character string
156	Current W-axis movement	Set/Get	Exp. character string
157	Current R-axis movement	Set/Get	Exp. character string
160	Upper limit of X-axis movement	Set/Get	-99,999.9999 to 99,999.9999
161	Lower limit of X-axis movement	Set/Get	-99,999.9999 to 99,999.9999
162	Upper limit of Y-axis movement	Set/Get	-99,999.9999 to 99,999.9999
163	Lower limit of Y-axis movement	Set/Get	-99,999.9999 to 99,999.9999
164	Upper limit of θ -axis movement	Set/Get	-180.0000 to 180.0000
165	Lower limit of θ -axis movement	Set/Get	-180.0000 to 180.0000
166	Upper limit of θ -axis(linear drive)	Set/Get	-99,999.9999 to 99,999.9999
167	Lower limit of θ -axis(linear drive)	Set/Get	-99,999.9999 to 99,999.9999
168	Upper limit of U-axis movement	Set/Get	-99,999.9999 to 99,999.9999
169	Lower limit of U-axis movement	Set/Get	-99,999.9999 to 99,999.9999
170	Upper limit of V-axis movement	Set/Get	-99,999.9999 to 99,999.9999
171	Lower limit of V-axis movement	Set/Get	-99,999.9999 to 99,999.9999
172	Upper limit of W-axis movement	Set/Get	-99,999.9999 to 99,999.9999
173	Lower limit of W-axis movement	Set/Get	-99,999.9999 to 99,999.9999
174	Upper limit of R-axis movement	Set/Get	-99,999.9999 to 99,999.9999
175	Lower limit of R-axis movement	Set/Get	-99,999.9999 to 99,999.9999
176	Output type	Set/Get	0: Relative position 1: Absolute position

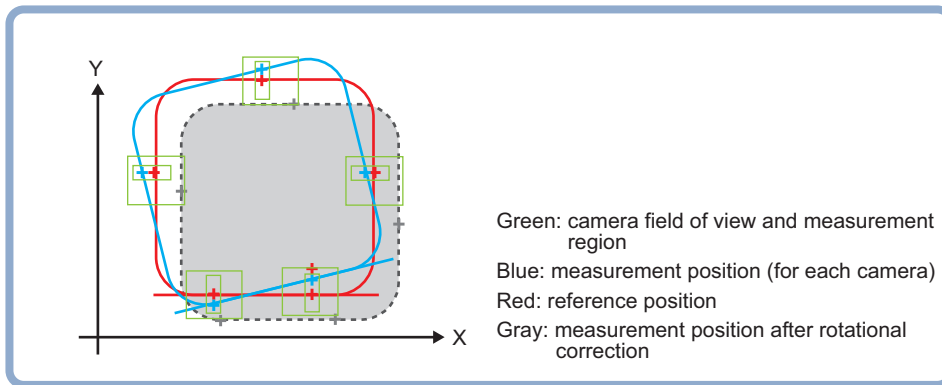
Calc Axis Move by Multipoint

Calculate the movement amount of each axis of the external device necessary to adjust the measurement position to the reference position. Set the measurement position and reference position using an arithmetic expression.

At least 2 or 3 measurement points are needed to calculate axis movement amounts. Axis movement amounts can usually be stably calculated by installing a camera at each measurement point and measuring 4 or 5 measurement points. The basic approach is to calculate movement amounts at high precision with the same number of cameras as there are measurement points. But it is also possible to measure multiple measurement points contained in a single camera's field of view.

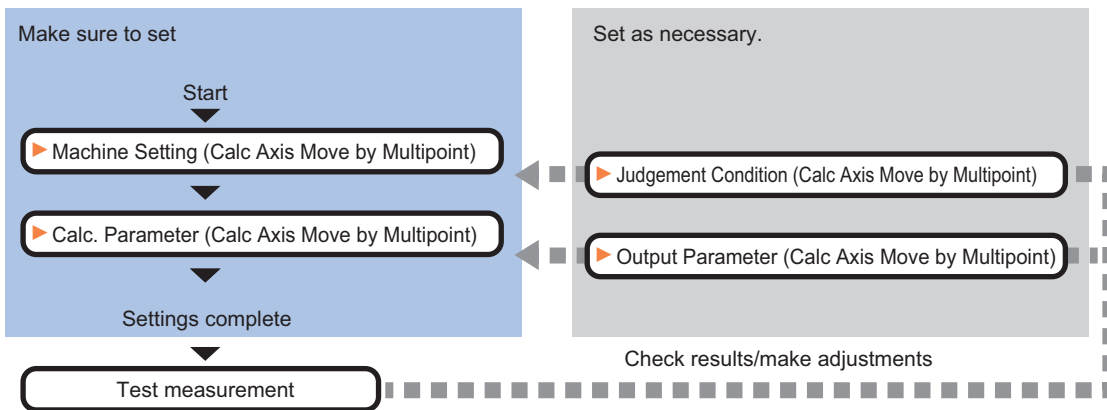
Used in the Following Case

- When you want to position the FPD panel



Settings Flow (Calc Axis Move by Multipoint)

Set the axis movement amount calculation following the procedure below.



List of Calc Axis Move by Multipoint Items

Item name	Description
Machine setting	Select the processing items (stage or robot data) containing information about external device necessary to calculate the axis movement amount. Reference: ▶ Machine Setting (Calc Axis Move by Multipoint) (p.792)
Calc. parameter	Set the reference position and measurement position using an arithmetic expression. Reference: ▶ Calc. Parameter (Calc Axis Move by Multipoint) (p.793)
Judgement condition	This item specifies the judgement condition for measurement results. Reference: ▶ Judgement Condition (Calc Axis Move by Multipoint) (p.798)
Output parameter	This item can be changed if necessary. Set whether or not the judgement results of this processing unit is reflected in the scene overall judgement. Reference: ▶ Output Parameter (Calc Axis Move by Multipoint) (p.799)

Machine Setting (Calc Axis Move by Multipoint)

Select a processing item (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.

- 1** In the Item Tab area, click [Machine setting].
- 2** Select the reference scene No. and reference unit No.

Information of the selected processing unit is displayed in the reference data display area.
Displayed contents differs depending on selected type of robot or stage.

Setting item	Setting value [Factory default]	Description
Reference scene No.	[Present scene] Scenes 0 to 127	Select a scene number (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.
Reference unit No.	---	From among the referenced scene numbers, select a processing item (stage data or robot data) under which external device information needed for calculation of axis movement amount is held.

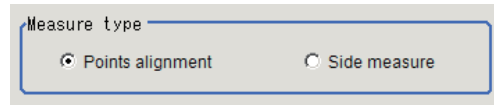
Note

- If the number of scenes is increased using the scene group conversion tool, the maximum value that can be selected in "Reference scene No." changes.

Calc. Parameter (Calc Axis Move by Multipoint)

Set the reference position and measurement position using an arithmetic expression.
The displayed parameters differ depending on the selected stage type.

- 1 Click [Calc. parameter] in the Item Tab area.
- 2 Select the measurement method in the "Measure type" area.

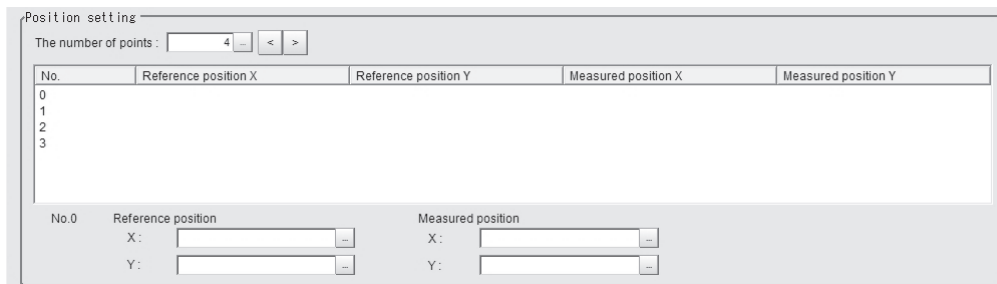


Setting item	Setting value [Factory default]	Description
Measure type	<ul style="list-style-type: none"> • [Points alignment] • Side measure 	<p>Select the measurement method for the maximum error in the judgement condition.</p> <ul style="list-style-type: none"> • Points alignment Calculate the movement amount from the measurement position to the reference position based on the support position information. It is suitable when distances between all points should be within a specified value. • Side measure Alignment method based on the edges of the workpiece. This method could be used when "No alignment mark" or "Workpiece angle cannot be measured" exists.

Points alignments

Use the procedure below to measure position and angle by detecting a point you want to position on the object to measure. The movement amount of each axis is calculated from the measurement results. Use a measurement processing item such as Search (which outputs the measured XY coordinates) for point measurement. A measurement processing item that outputs measured XY coordinates for each measurement point must be registered and used in the measurement flow.

- 1 Set the reference position and measurement position in the "Position setting" area.

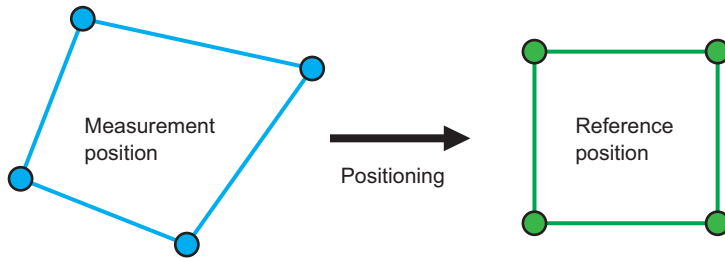


Setting item	Setting value [Factory default]	Description
The number of points	2 to 8 [4]	Set the number of points
Reference position X	[-]	Set the X coordinate of the reference position.
Reference position Y	[-]	Set the Y coordinate of the reference position.
Measured position X	[-]	Set the X coordinate of the measurement position.
Measured position Y	[-]	Set the Y coordinate of the measurement position.

2 Set each item in the "Matching method" area.

Matching method
 Least square method Maximum error minimization

Setting item	Setting value [Factory default]	Description
Matching method	<ul style="list-style-type: none"> [Least square method] Maximum error minimization 	<ul style="list-style-type: none"> Least square method Execute positioning as sum of squares of errors in all points (*) become the minimum. Maximum error minimization Execute positioning as the maximum value of the errors in all points (*) become the minimum. * Errors in all points ... Distance between the reference position and the measurement position



Positioning result image

<p><u>Least square method</u></p> <p>The sum of squares of errors become the minimum. Reduces effects of noise point.</p>	<p><u>Maximum error minimization</u></p> <p>The maximum value of errors of all points become the minimum. Points with extremely large errors are not generated.</p>
---	---

3 Set the noise reduction method in the "Noise removal Setting" area.

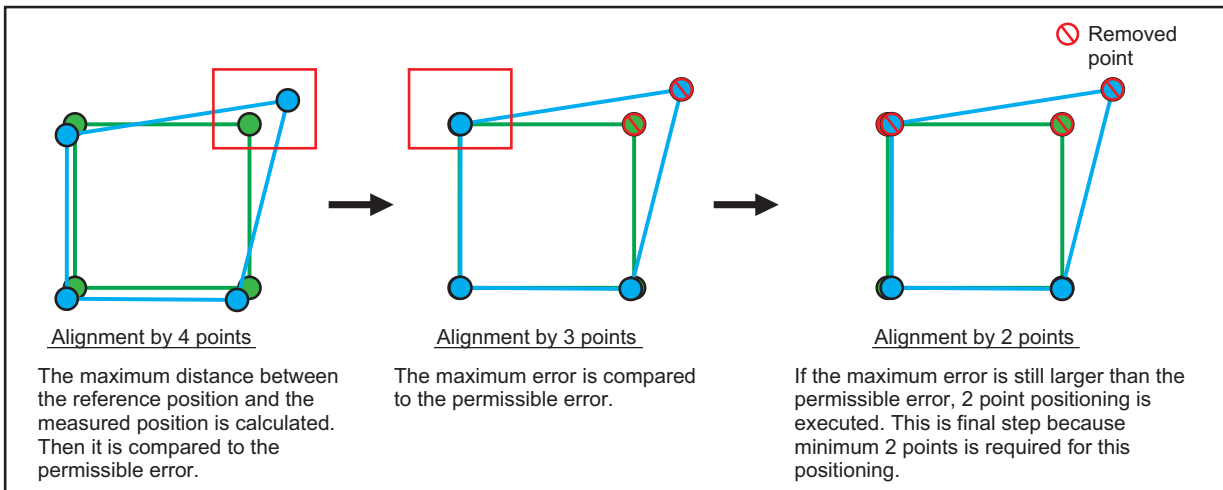
Noise removal Setting

Required point number for calc.: < >

Error tolerance: < >

Setting item	Setting value [Factory default]	Description
Required point number for calc	2 to 8 [4]	This means the available mark number after the noise point removal. For example, when you need minimum 3 points for positioning and set 4 as a number of points in "Position setting" area, maximum 1 point could be removed as a noise.
Error tolerance	0 to 99999.9999 [0.0000]	Set allowable error (distance of measurement position and reference position) is set. Calibrate by removing the noise points repeatedly until the required minimum number of points is reached. If you set the Error tolerance to 0.0000, all of the points are calculated and the result with the smallest error value is output.

The noise removal flow is explained by using a sample case that the required minimum points is 2 points, and that the allowable error is 10.0.
Flow of noise removal



4 Set the current axis position.

Set the axis position of an external device.

Current axis position

X-axis:

Y-axis:

Note

- Only specified movement axis or exist axial direction are applied to set in the case of X, Y, X θ , Y θ , θ X and θ Y stages. Not exist axial direction is not displayed.

Side measurement

Use the procedure below to measure position and angle by detecting the edges of the sides of a rectangular or square object to measure. Set at least two of the measurement points so as to measure the same side. Use the Edge Position processing item for edge measurement. For each measurement point, the Edge Position processing item must be registered and used in the measurement flow. The movement amount may not be calculated correctly if you use a processing item other than the Edge Position processing item.

1 Set a number of points, Measured axis, reference position, and Measured position in the "Position setting" area.

Position setting

The number of points :

No.	Measured axis	Reference position X	Reference position Y	Measured position X	Measured position Y
0	X-axis side1				
1	X-axis side1				
2	X-axis side1				
3	X-axis side1				
4	X-axis side1				

No.0 Measure axis : X-axis side1 X-axis side2 Y-axis side1 Y-axis side2

Reference position X: Y:

Measured position X: Y:

Setting item	Setting value [Factory default]	Description
The number of points	3 to 8 [5]	Used to set the number of locations to measure in the four sides.
Measured axis	<ul style="list-style-type: none"> • [X-axis side 1] • X-axis side 2 • Y-axis side 1 • Y-axis side 2 	Set the measurement axis. The measurement axis must be set to the actual coordinate axis that is parallel to the direction of the measurement region of the Edge Position processing item used for measurement.
Reference position X	---	Set the X coordinate of the reference position.
Reference position Y	---	Set the Y coordinate of the reference position.
Measured position X	---	Set the X coordinate of the measurement position.
Measured position Y	---	Set the Y coordinate of the measurement position.

2 In "Angle setting" area, specify the measurement axis and setting type.

Angle setting

Measure axis : X-axis Y-axis

Setting type : 2 points setting Calculation setting

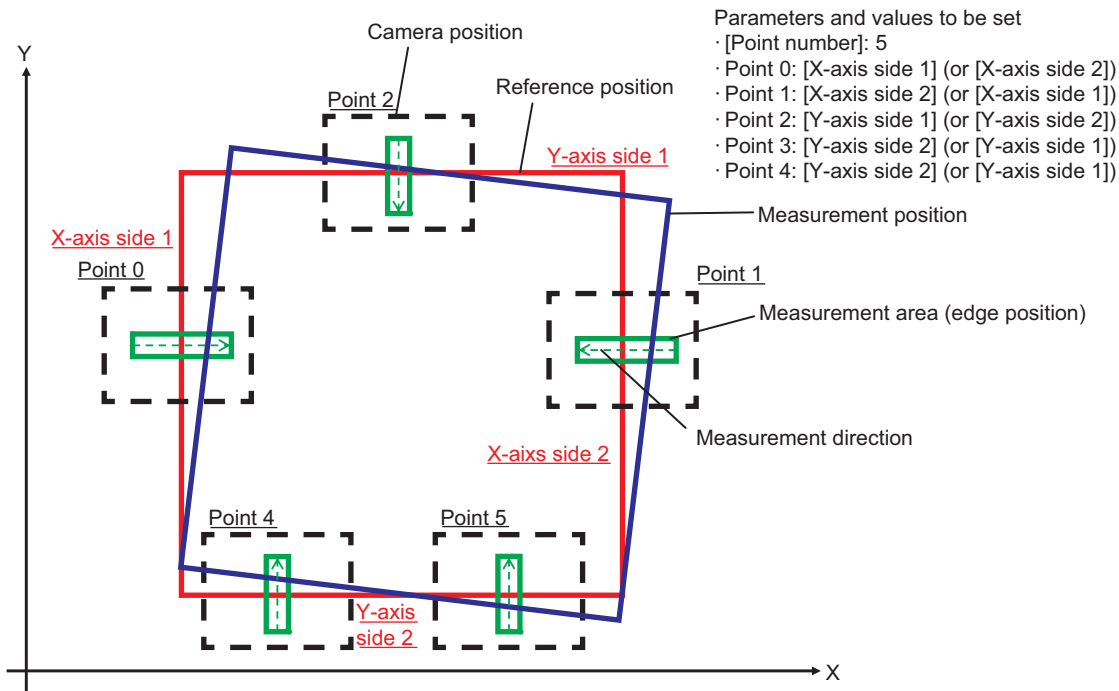
Point 0 :

Point 1 :

Setting item	Setting value [Factory default]	Description
Measure axis	<ul style="list-style-type: none"> • [X-axis] • Y-axis 	Used to set the measurement axis used for angle calculation. This setting item is enabled when [2 points setting] is specified for the method.
Setting type	<ul style="list-style-type: none"> • [2 points setting] • Calculation setting 	Set the method for angle specification. <ul style="list-style-type: none"> • 2 points setting: A method in which the measurement axis used for angle calculation is set by specifying two points on the same side. • Calculation setting: A method in which the reference angle and measurement angle are each set by a calculation expression.

Setting item	Setting value [Factory default]	Description
Point 0	---	This setting is enabled when [2 points setting] is selected. Select each of the two points among the points set in the position setting area. The two points selected must be measurement points used to measure the same side.
Point 1	---	
Reference angle	---	This setting is enabled when [Calculation setting] is selected. Used to set the reference angle and measurement angle by calculation expressions.
Measured angle	---	

Example: When measuring edge positions at five points on the sides



Important

- Use the Edge Position processing item for edge measurement. The movement amount will not be calculated correctly if you use a processing item other than Edge Position.

Note

- For measurement regions of two locations on one edge used for angle calculations, the precision with which the angle is calculated increases in proportion to the interval between measurement regions.

3 Set the current axis position. Set the axis position of external device.

Current axis position

X-axis:

Y-axis:

Note

- Only specified movement axis or exist axial direction are applied to set in the case of X, Y, Xθ, Yθ, θX and θY stages. Not exist axial direction is not displayed.

Judgement Condition (Calc Axis Move by Multipoint)

This item specifies the condition for measurement results.

- 1 In the Item Tab area, click [Judgement condition].
- 2 In the "Judgement condition" area, set each item.

If the reference data is the UVWR stage

Setting item	Setting value [Factory default]	Description
X/Y-axis movement	[-99999.9999] to [99999.9999]	Used to set upper and lower limit values for the movement amount in the axis direction. The axes that can be set will vary according to the processing item containing the external device information specified by [Machine setting].
Error max.	0 to 99999.9999 [99999.9999]	This setting is enabled when [Measure type] in the [Calc. parameter] tab is set to [Points alignment]. It is used to set the upper and lower limit values for the difference between the points at which the difference between the reference position and measurement position is a maximum.

The following parameters are displayed in this menu based on the stage type.

Displayed content	Not selected	XY	XY θ	θ XY	UVW	UVWR	X(Y)	X θ (Y θ)	θ X(θ Y)	3 axes	4 axes
X axis movement amount Judgement upper/lower limit values	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Y axis movement amount Judgement upper/lower limit values	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
θ axis angle movement amount Judgement upper/lower limit values	<input type="radio"/>	<input checked="" type="checkbox"/>	<input type="radio"/> *1	<input type="radio"/> *1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/> *1	<input type="radio"/> *1	<input checked="" type="checkbox"/>	<input type="radio"/>
θ axis linear movement amount Judgement upper/lower limit values	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/> *2	<input type="radio"/> *2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/> *2	<input type="radio"/> *2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
U axis movement amount Judgement upper/lower limit values	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Displayed content	Not selected	XY	XY θ	θ XY	UVW	UVWR	X(Y)	X θ (Y θ)	θ X(θ Y)	3 axes	4 axes
V axis movement amount Judgement upper/lower limit values	×	×	×	×	○	○	×	×	×	×	×
W axis movement amount Judgement upper/lower limit values	×	×	×	×	○	○	×	×	×	×	×
R axis movement amount Judgement upper/lower limit values	×	×	×	×	×	○	×	×	×	×	×

○: Show, ×: Hide

*1: Displayed only when the θ axis type is direct drive.

*2: Displayed only when the θ axis type is linear drive.

Output Parameter (Calc Axis Move by Multipoint)

Set how the coordinates output to external equipment as measurement results are treated. Change this item as needed. Normally, the factory default value will be used.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify each of the following items.

Setting item	Setting value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Specify whether or not the judgement results of this processing unit is reflected in the scene overall judgement.
Output type	<ul style="list-style-type: none"> • [Opposite moving] • Absolute moving 	Opposite moving: Calculates the movement amount from the current axis position. Absolute moving: Calculates the movement amount from the origin.

Key Points for Test Measurement and Adjustment (Calc Axis Move by Multipoint)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgment result
X axis movement	X axis movement amount
Y axis movement	Y axis movement amount
θ axis angle movement	θ axis angle movement amount *1
θ axis movement	θ axis linear movement amount *1
U axis movement	U axis movement amount
V axis movement	V axis movement amount
W axis movement	W axis movement amount
R axis movement	R axis movement amount
Position X difference	Position X difference
Position Y difference	Position Y difference
Angle difference	Angle difference
Maximum error	Maximum error

*1: The displayed contents differ depending on the stage type.

Output contents	XY	XY θ	θ XY	UVW	UVWR	X(Y)	X θ (Y θ)	θ X(θ Y)	3 axes	4 axes
θ axis angle movement amount	×	○ (θ axis direct drive)	○ (θ axis direct drive)			×	○ (θ axis direct drive)	○ (θ axis direct drive)		○
θ axis linear movement amount	×	○ (θ axis linear drive)	○ (θ axis linear drive)	×	×	×	○ (θ axis linear drive)	○ (θ axis linear drive)	×	×

○: Show, ×: Hide

Key Points for Adjustment

Select the adjustment method referring to the following points.

When the measurement results are false

State	Parameter to be adjusted	Troubleshooting
The sign of the measurement result (positive/negative) that has been output is opposite.	---	The reference position and measurement position may be set in reverse. The axis movement amount calculates the movement amount from the measurement position to the reference position.

Other

State	Parameter to be adjusted	Troubleshooting
The reference unit number is <"None"> and cannot be selected.	Machine setting	Check if the reference scene number is selected correctly. Check if stage data processing items or robot data processing items are registered in the selected reference scene.
The reference unit number does not follow during flow editing.	Machine setting	The system is designed this way. While a scene other than the current scene is referenced, the reference unit number does not change according to the editing of the flow. Change the flow so that the current scene will be referenced, or set the reference unit number again.

Measurement Results for Which Output Is Possible (Calc Axis Move by Multipoint)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Displayed item	Character string	Description
Judge	JG	Judgment result
X axis movement	MX	X axis movement amount
Y axis movement	MY	Y axis movement amount
θ axis angle movement	MT	θ axis angle movement amount ^{*1}
θ axis (linear drive)	ML	θ axis linear movement amount ^{*1}
U axis movement	MU	U axis movement amount
V axis movement	MV	V axis movement amount
W axis movement	MW	W axis movement amount
R axis movement	MR	R axis movement amount
Position X difference	DX	Position X difference
Position Y difference	DY	Position Y difference
Angle difference	DT	Angle difference
Error max.	MAXE	Maximum error
Error min.	MINE	Minimum error
Error ave.	AVEE	Average error
Number of removed points	RPN	Number of removed points

*1: The contents that can be output differ depending on the stage type.

Output contents	XY	XY θ	θ XY	UVW	UVWR	X(Y)	X θ (Y θ)	θ X(θ Y)	3 axes	4 axes
θ axis angle movement amount	×	○ (θ axis direct drive)	○ (θ axis direct drive)			×	○ (θ axis direct drive)	○ (θ axis direct drive)		○
θ axis linear movement amount	×	○ (θ axis linear drive)	○ (θ axis linear drive)	×	×	×	○ (θ axis linear drive)	○ (θ axis linear drive)	×	×

○: Output, ×: Do not output

External Reference Tables (Calc Axis Move by Multipoint)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement(unmeasured) 1: Judgement result OK -1: Judgement result NG
5	X-axis movement	Get only	-
6	Y-axis movement	Get only	-
7	θ -axis movement	Get only	-180.0000 to 180.0000
8	θ -axis(linear drive)	Get only	-
9	U-axis movement	Get only	-
10	V-axis movement	Get only	-
11	W-axis movement	Get only	-
12	R-axis movement	Get only	-
13	Position X difference	Get only	-
14	Position Y difference	Get only	-
15	Angle difference	Get only	-
16	Error max.	Get only	-
17	Error min.	Get only	-
18	Error ave.	Get only	-
19	The number of removal points	Get only	-
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Reference scene No.	Set/Get	-1: Current scene referred 0 to 9999:Pointed scene referred
121	Reference unit No.	Set/Get	-1: No reference 0 to 9999:Pointed unit referred
122	Measure type	Set/Get	0: Side measure 1: Points alignment
123	Expressions of reference angle	Set/Get	Exp. character string
124	Expressions of measurement angle	Set/Get	Exp. character string
125	Measure axis	Set/Get	0 to 1
126	Setting type	Set/Get	0 to 1
127	Point 0	Set/Get	-1 to 7
128	Point 1	Set/Get	-1 to 7
129	Side alignment's point number	Set/Get	3 to 8
130	Reauired points number for calc.	Set/Get	2 to 8
131	The number of min. necessary points	Set/Get	2 to 8
132	Error tolerance	Set/Get	0 to 9,9999.9999
133	Upper limit of error	Set/Get	0 to 9,9999.9999
134	Matching method	Set/Get	0: Least square method 1: Maximum error minimization
150	Current X-axis movement	Set/Get	Exp. character string

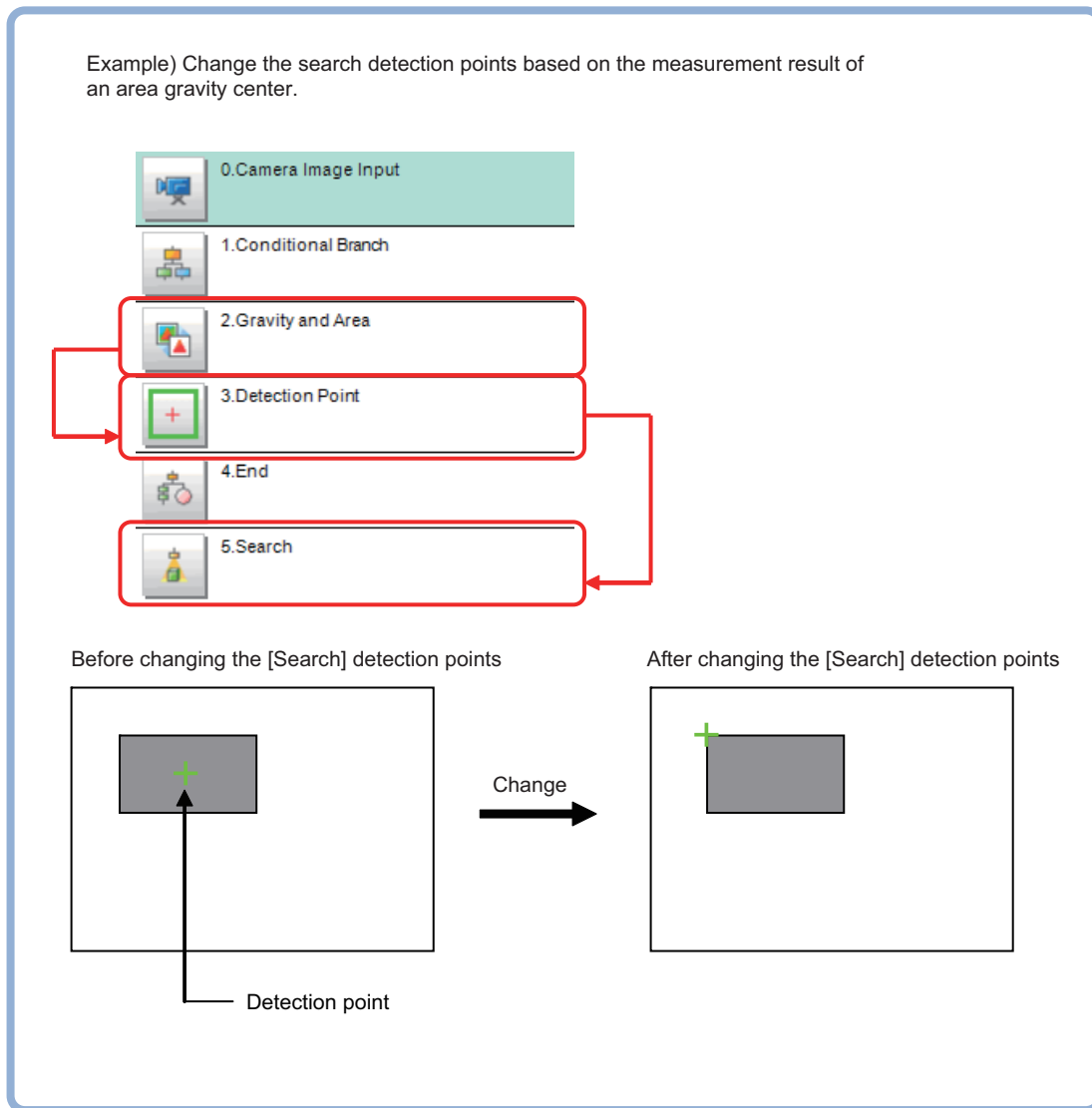
No.	Data name	Set/Get	Data range
151	Current Y-axis movement	Set/Get	Exp. character string
152	Current θ -axis movement	Set/Get	Exp. character string
153	Current θ -axis (linear drive)	Set/Get	Exp. character string
154	Current U-axis movement	Set/Get	Exp. character string
155	Current V-axis movement	Set/Get	Exp. character string
156	Current W-axis movement	Set/Get	Exp. character string
157	Current R-axis movement	Set/Get	Exp. character string
160	Upper limit of X-axis movement	Set/Get	-99,999.9999 to 99,999.9999
161	Lower limit of X-axis movement	Set/Get	-99,999.9999 to 99,999.9999
162	Upper limit of Y-axis movement	Set/Get	-99,999.9999 to 99,999.9999
163	Lower limit of Y-axis movement	Set/Get	-99,999.9999 to 99,999.9999
164	Upper limit of θ -axis movement	Set/Get	-180.0000 to 180.0000
165	Lower limit of θ -axis movement	Set/Get	-180.0000 to 180.0000
166	Upper limit of θ -axis (linear drive)	Set/Get	-99,999.9999 to 99,999.9999
167	Lower limit of θ -axis (linear drive)	Set/Get	-99,999.9999 to 99,999.9999
168	Upper limit of U-axis movement	Set/Get	-99,999.9999 to 99,999.9999
169	Lower limit of U-axis movement	Set/Get	-99,999.9999 to 99,999.9999
170	Upper limit of V-axis movement	Set/Get	-99,999.9999 to 99,999.9999
171	Lower limit of V-axis movement	Set/Get	-99,999.9999 to 99,999.9999
172	Upper limit of W-axis movement	Set/Get	-99,999.9999 to 99,999.9999
173	Lower limit of W-axis movement	Set/Get	-99,999.9999 to 99,999.9999
174	Upper limit of R-axis movement	Set/Get	-99,999.9999 to 99,999.9999
175	Lower limit of R-axis movement	Set/Get	-99,999.9999 to 99,999.9999
176	Output type	Set/Get	0: Relative position 1: Absolute position
200 + N \times 1 (N: 0 to 7)	Expression N of reference position X	Set/Get	Exp. character string
300 + N \times 1 (N: 0 to 7)	Expression N of reference position Y	Set/Get	Exp. character string
400 + N \times 1 (N: 0 to 7)	Expression N of measurement position X	Set/Get	Exp. character string
500 + N \times 1 (N: 0 to 7)	Expression N of measurement position Y	Set/Get	Exp. character string
600 + N \times 1 (N: 0 to 7)	Measure axis N	Set/Get	0 to 3 0: X-axis side1 1: X-axis side2 2: Y-axis side1 3: Y-axis side2

Detection Point

Obtains position/angle information by referring to the coordinate values measure with the Measurement Processing Unit. Measurement can be performed based on precise detection points and reference position data by making the Measurement Processing Unit with the detection point and reference position data refer to the Detection Point Processing Unit.

Used in the Following Case

- When using the measurement result of another Processing Unit as a detection point



Parameter Setting (Detection Point)

Set how to acquire position/angle data necessary to set detection points.

- 1 Select the setting method for detection points in the [Setting type] area.**

Setting item	Setting value [Factory default]	Description
Setting type	[Nearest unit]	Calculate the position and angle used as the detection point from data in the previous Processing Unit. If the previous Processing Unit has not calculation strings X/Y, judgement in this Processing Unit will be NG during measurement.
	Calculation	Calculate the position and angle used as the detection point using the calculation formula. Selecting the arithmetic expression enables the "Position/Angle" area.

When you choose [Calculation] as the setting method.

- 2 Set the position and angle used as the detection point in the [Position angle] area using the arithmetic expression.**

Reference: ▶ Layout of Setting Expression Window (p.615)

- 3 The position/angle values used as the detection point can be confirmed in the [Setting data] area.**

The calculation result specified in the [Setting type] and [Position angle] areas is displayed. If the value is not updated, exit the setting screen once and display it again after executing the measurement.

Measurement Results for Which Output Is Possible (Detection Point)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Position X	X	X coordinate of the detection position to be retained
Position Y	Y	Y coordinate of the detection position to be retained
Angle	TH	Detection angle to be retained

External Reference Tables (Detection Point)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Position X	Get only	-99999.9999 to 99999.9999
6	Position Y	Get only	-99999.9999 to 99999.9999
7	Angle	Get only	-180 to 180
120	Method	Set/Get	0: Nearest unit 1: Expression
121	Position X	Set/Get	Exp. character string
122	Position Y	Set/Get	Exp. character string
123	Angle	Set/Get	Exp. character string

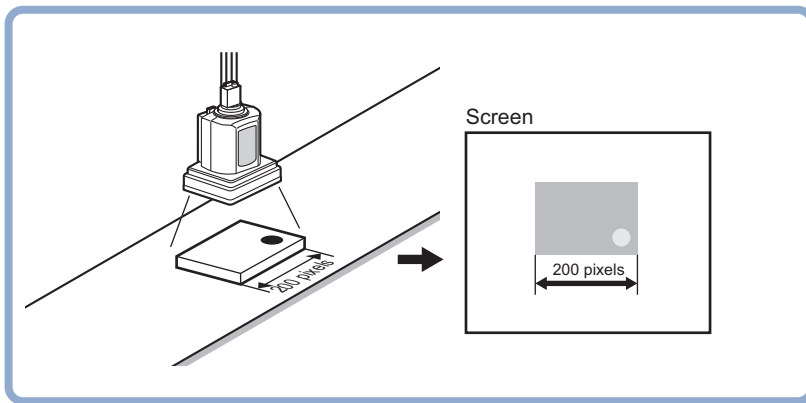
Camera Calibration

By setting the camera calibration, the measurement result can be converted and output as actual dimensions. It allows users to perform more flexible adjustment and edit using the measurement flow compared to the calibration function provided as the camera image input processing item.

- The sampling function can be used in combination with the Measurement Processing Unit in the measurement flow.
- Scaling can be calculated from the measured work width and actual work width.
- Generated calibration data can be adjusted or edited.

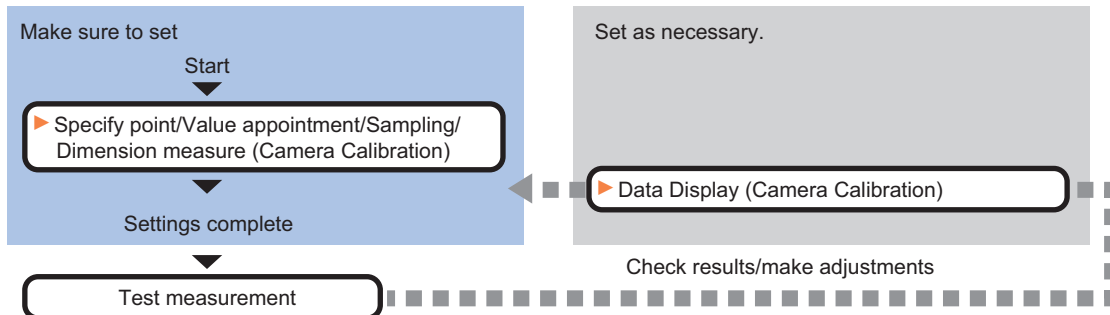
Used in the Following Case

- **When you want to output the measurement result of a Processing Unit as actual dimensions**
Example) When you want to output the measurement result of the Processing Unit as actual dimensions.



Settings Flow (Camera Calibration)

Set the camera calibration with the following steps.



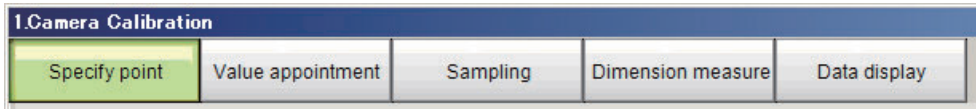
List of Camera Calibration Items

Item name	Description
Specify point	Set a given pixel to make the calibration setting. Calibration parameters are calculated automatically when actual coordinates of specified locations are set. Reference: ▶ Specify point (Camera Calibration) (p.809)
Value appointment	Set the magnification ratio as a numeric value to make the calibration setting. Reference: ▶ Value Appointment (Camera Calibration) (p.810)
Sampling	Make the calibration setting based on the measurement results. After measuring a position using the measurement processing items in the measurement flow, set the position as an actual coordinates to calculate calibration data. Reference: ▶ Sampling (Camera Calibration) (p.811)
Dimension measure	Make the calibration setting based on the measurement results. After measuring work width using the measurement processing items in the measurement flow, set the actual work width to calculate calibration data. Reference: ▶ Dimension Measure (Camera Calibration) (p.813)
Data display	Display the generated calibration data. The calibration data can be adjusted or edited as necessary. Reference: ▶ Data Display (Camera Calibration) (p.816)

Specify point (Camera Calibration)

Specify a given pixel to make the calibration setting. Calibration parameters can be calculated by setting the actual coordinates of specified locations. Up to 100 points can be set.

- 1 In the Item Tab area, click [Specify point].



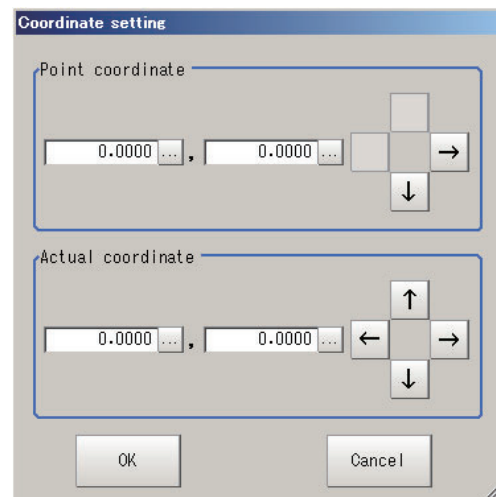
- 2 In the [Display] area, click [Change display] to select the camera image type.

Setting item	Setting value [Factory default]	Description
Display	Through image display	The latest image is always input from the camera and displayed.
	[Freeze image display]	The image that was scanned in the immediately preceding measurement is displayed.

- 3 Click the first point on the screen.

- 4 Set the actual coordinates for the specified point.

The actual coordinate input window is displayed.



Actual coordinate	Setting value [Factory default]
Point coordinate X, Y	0 to 9999.9999 [Point you clicked in the window]
Actual coordinate X, Y	-99999.9999 to 99999.9999 [0]

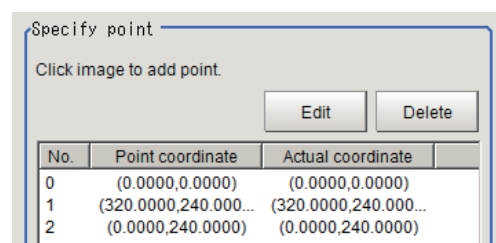
- 5 Set the 2nd, 3rd and subsequent points in the same way.

- 6 Edit or delete the coordinates as required.

Select the points to be edited or deleted from the list.

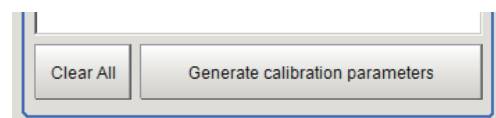
Click [Edit] or [Delete].

To delete all points, click [Clear All].



- 7 Click [Generate calibration parameters].

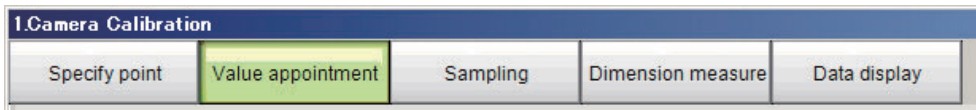
The calibration parameters will be generated.



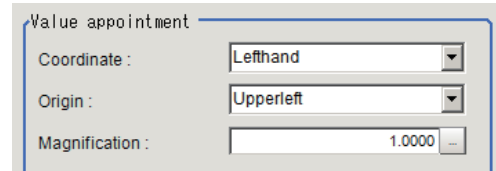
Value Appointment (Camera Calibration)

Set the magnification ratio as a numeric value to make the calibration setting.

1 In the Item Tab area, click [Value appointment].



2 Set the [Value appointment] area.



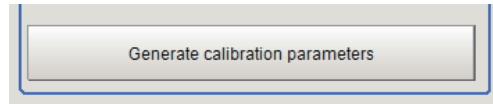
Setting item	Setting value [Factory default]	Description
Coordinate	<ul style="list-style-type: none"> • [Lefthand] • Righthand 	<p>Lefthand: Clockwise is forward when specifying the coordinates. Righthand: Counter-clockwise is forward when specifying the coordinates.</p>
Origin	<ul style="list-style-type: none"> • [Upperleft] • Lowerleft • Center • Specify point 	<p>Select where the origin of the actual coordinates will be.</p>
Magnification	0.0001 to 9.9999 [1.0000]	Specify the ratio of 1 pixel to the actual dimensions.

If "Specify point" is selected for [Origin].

Setting item	Setting value [Factory default]	Description
Camera X and Y	-99999.9999 to 99999.9999 [0]	Set the camera coordinates for a given point. If the origin of the actual coordinates is included in the field of view, measure the origin position of the actual coordinates in advance and set them to the camera coordinates X and Y.
Changed X and Y	-99999.9999 to 99999.9999 [0]	Set the actual coordinate values set as the camera coordinates. If the origin position of the actual coordinates is set as the camera coordinates, set (0.0, 0.0).

3 Click [Generate calibration parameters].

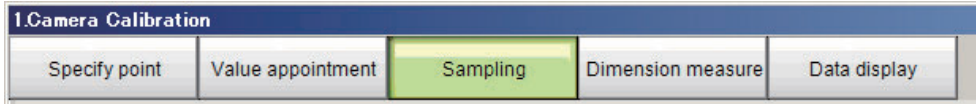
The calibration parameters will be generated.



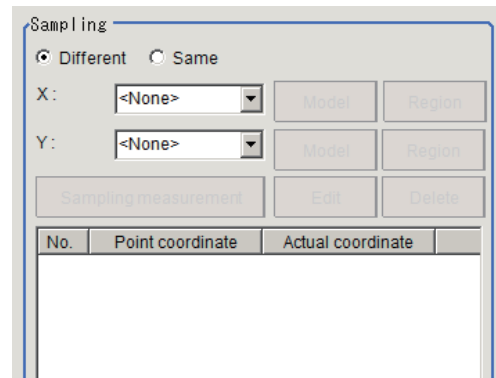
Sampling (Camera Calibration)

Make the calibration setting based on the measurement results. After measuring a position using the measurement processing items in the measurement flow, set the position as an actual coordinates to calculate calibration data.

1 In the Item Tab area, click [Sampling].



2 Set the [Sampling] area.



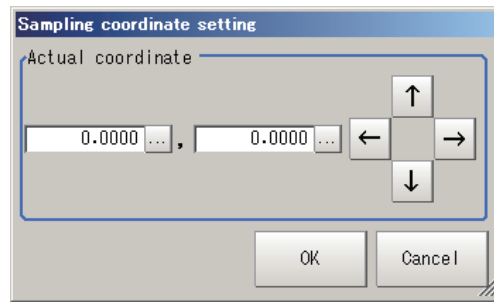
Setting item	Setting value [Factory default]	Description
XY specification method	<ul style="list-style-type: none"> • [Different] • Same 	Different: Set X and Y individually. Same: Use the measurement results of the Processing Unit selected for X specification to specify Y.
X specification	<ul style="list-style-type: none"> • Processing Unit that can measure positions during the measurement flow. • [None] 	Select the Processing Unit in the measurement flow used to sample the X coordinate.
Y specification	<ul style="list-style-type: none"> • Processing Unit that can measure positions during the measurement flow. • [None] 	Select the Processing Unit in the measurement flow used to sample the Y coordinate. If "Same" is specified as the XY specification method, this cannot be selected.

3 Click [Model] and [Region] as needed to set sampling measurement conditions.

4 Click [Sampling measurement].

5 Set the actual coordinates for the specified point.

The actual coordinate input window is displayed.



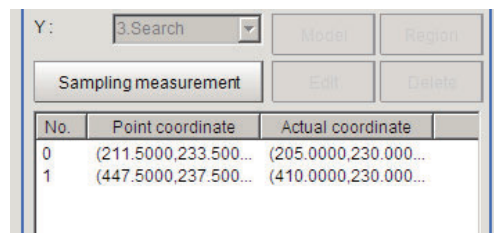
Actual coordinate	Setting value [Factory default]
Actual coordinate X, Y	-99999.9999 to 99999.9999 [0]

The measurement result is added to the list.

6 Set the 2nd, 3rd and subsequent points in the same way.

7 Edit or delete the coordinates as required.

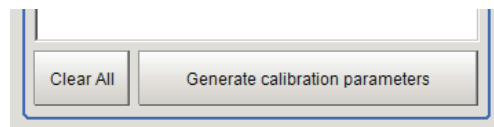
Select the points to be edited or deleted from the list.



Click [Edit] or [Delete].

To delete all points, click [Clear All].

8 Click [Generate calibration parameters].



The calibration parameters will be generated.

9 Changes display settings as needed.

Setting item	Setting value [Factory default]	Explanation
Display setting	<ul style="list-style-type: none"> • [Input image] • X unit image • Y unit image 	Select the type of image to display in the Image display area. The display setting is valid only in the sampling tab screen.

Note

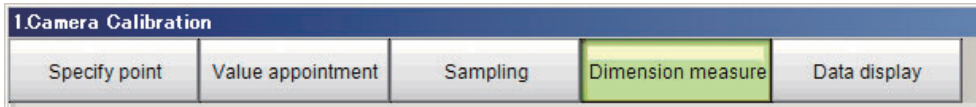
The following processing items can be used for two point measurement in sampling.

- Search
- EC Circle Search
- ECM Search
- Ec Corner
- Ec Cross
- Shape Search II
- Shape Search III
- Edge Position
- Scan Edge Position
- Gravity and Area
- Labeling

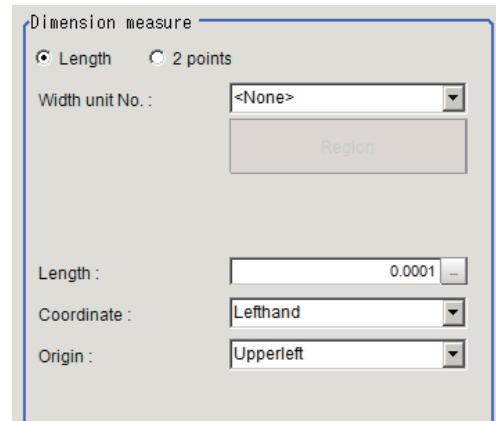
Dimension Measure (Camera Calibration)

Make the calibration setting based on the measurement results. After measuring work width using the measurement processing items in the measurement flow, set the actual work width to calculate calibration data.

1 In the Item Tab area, click [Dimension measure].



2 Set the [Dimension measure] area.



Setting item	Setting value [Factory default]	Description
Dimension measure	<ul style="list-style-type: none"> • [Length] • 2 points 	<p>Length: Measures dimensions using the measurement results of the Processing Unit that measures the width. The width reference unit selection and area measurement buttons are displayed.</p> <p>2 points: Measures dimensions using the measurement results of the processing unit that measures points. The select point reference units 1/2 and area measurement buttons are displayed.</p>
Length	0.0001 to 99999.9999 [0.0001]	Set actual dimensions as the work dimensions.
Coordinate	<ul style="list-style-type: none"> • [Lefthand] • Righthand 	<p>Lefthand: Clockwise is forward when specifying the coordinates.</p> <p>Righthand: Counter-clockwise is forward when specifying the coordinates.</p>
Origin	<ul style="list-style-type: none"> • [Upperleft] • Lowerleft • Center • Specify point 	<p>Select where the origin of the actual coordinates will be.</p>

If "Length" is selected for [Dimension measure].

Setting item	Setting value [Factory default]	Description
Width unit No.	<ul style="list-style-type: none"> Width reference unit in the measurement flow [<None>] 	Select the scan edge width processing unit in the current scene.

If "2 points" is selected for [Dimension measure].

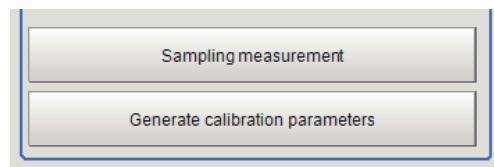
Setting item	Setting value [Factory default]	Description
Point 1 and 2 unit No.	<ul style="list-style-type: none"> Point width measurement unit in the measurement flow [<None>] 	Select the processing unit that can perform point measurement in the current scene.

If "Specify point" is selected for [Origin].

Setting item	Setting value [Factory default]	Description
Camera X and Y	-99999.9999 to 99999.9999 [0]	Set the camera coordinates for a given point. If the origin of the actual coordinates is included in the field of view, measure the origin position of the actual coordinates in advance and set them to the camera coordinates X and Y.
Changed X and Y	-99999.9999 to 99999.9999 [0]	Set the actual coordinate values set as the camera coordinates. If the origin position of the actual coordinates is set as the camera coordinates, set (0.0, 0.0).

3 Click [Region] as needed to set sampling measurement conditions.

4 Click [Sampling measurement].



5 Click [Generate calibration parameters].

The calibration parameters will be generated.
9 Changes display settings as needed.

Setting item	Setting value [Factory default]	Explanation
Display setting	<ul style="list-style-type: none"> [Input image] X unit image Y unit image 	Select the type of image to display in the Image display area. The display setting is valid only in the sampling tab screen.

Note

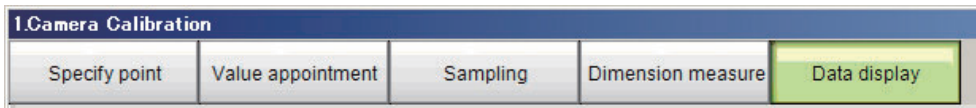
The following processing items can be used for two point measurement in sampling.

- Search
 - EC Circle Search
 - ECM Search
 - Ec Corner
 - Ec Cross
 - Shape Search II
 - Shape Search III
 - Edge Position
 - Scan Edge Position
 - Gravity and Area
 - Labeling
-

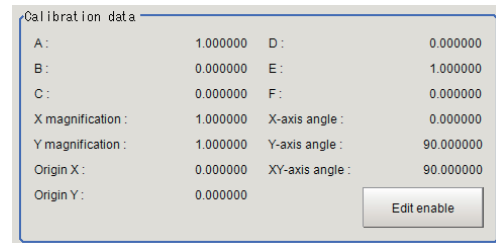
Data Display (Camera Calibration)

Display the generated calibration data. The calibration data can be adjusted or edited as necessary.

- 1 In the Item Tab area, click [Data display].



- 2 In the [Calibration data] area, confirm the calibration data.



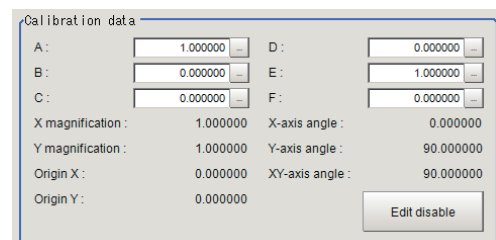
Item	Description
A	These are calibration conversion values. Camera coordinates are converted to actual coordinates based on these values. The conversion formulas for actual coordinates are as follows: (X, Y): Measurement point (camera coordinates), Unit: pix (X', Y'): Conversion point (actual coordinates)
B	
C	
D	
E	
F	
X magnification	Magnification ratio for the X axis in the coordinate system after calibration
Y magnification	Magnification ratio for the Y axis in the coordinate system after calibration
Origin X	The origin X position in the coordinate system after calibration
Origin Y	The origin Y position in the coordinate system after calibration
X-axis angle	The X axis angle in the coordinate system after calibration
Y-axis angle	The Y axis angle in the coordinate system after calibration
XY-axis angle	Angle created by the X and Y axes in the coordinate system after calibration.

Edit the calibration result

If, for example, you already know calibration parameters, you can directly edit the generated calibration parameters.

- 1 Click [Edit disable] in the [Calibration data] area.

This will enable you to edit calibration parameters A to F.



2 In the [Calibration data] area, confirm the modification made.

Calibration data			
A :	1.000000	D :	0.000000
B :	0.000000	E :	1.000000
C :	0.000000	F :	0.000000
X magnification :	1.000000	X-axis angle :	0.000000
Y magnification :	1.000000	Y-axis angle :	90.000000
Origin X :	0.000000	XY-axis angle :	90.000000
Origin Y :	0.000000		

Compensate the calibration result

The calibration result can be compensated by setting the compensation amounts such as magnification ratios and offsets for the actual dimensions and actual coordinates.

1 Set the compensation values in the [Parameter] area.

Parameter	
Corrected X magnification :	<input type="text" value="1.0000"/>
Corrected Y magnification :	<input type="text" value="1.0000"/>
Corrected X-axis angle :	<input type="text" value="0.0000"/>
Corrected Y-axis angle :	<input type="text" value="0.0000"/>
Origin X offset :	<input type="text" value="0.0000"/>
Origin Y offset :	<input type="text" value="0.0000"/>

Setting item	Setting value [Factory default]	Description
Corrected X/Y magnification	0.5000 to 1.5000 [1.0000]	Set the compensation amounts for the X axis ratio and Y axis ratio respectively.
Corrected X/Y-axis angle	-180.0000 to 180.0000 [0]	Set the compensation amounts for the X axis angle and Y axis angle respectively.
Origin X/Y offset	-9999.9999 to 9999.9999 [0]	Set the compensation amounts for the X and Y coordinates of the origin respectively.

2 In the [Calibration data] area, confirm the compensation result.

Note

The following relational expressions can be made for calibration parameters and compensation values. Be careful about the relationships between the pre-compensation and post-compensation parameters when adjusting parameters.

Before adjustment: A1, B1, C1, D1, E1, F1

After adjustment: A2, B2, C2, D2, E2, F2

Compensation ratio X: KX, Compensation ratio Y: KY

Compensation angle X: θX , Compensation angle Y: θY

X origin offset setting: OX

Y origin offset setting: OY

- $A2 = KX \times (A1 \times \cos\theta X - D1 \times \sin\theta X)$
- $B2 = KY \times (B1 \times \cos\theta Y - E1 \times \sin\theta Y)$
- $C2 = C1 - OX$
- $D2 = KX \times (A1 \times \sin\theta X + D1 \times \cos\theta X)$
- $E2 = KY \times (B1 \times \sin\theta Y + E1 \times \cos\theta Y)$
- $F2 = F1 - OY$

Measurement Results for Which Output Is Possible (Camera Calibration)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result

External Reference Tables (Camera Calibration)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK 2: Judgement result NG
5	Calibration parameter A (after compensation)	Get only	-
6	Calibration parameter B (after compensation)	Get only	-
7	Calibration parameter C (after compensation)	Get only	-
8	Calibration parameter D (after compensation)	Get only	-
9	Calibration parameter E (after compensation)	Get only	-
10	Calibration parameter F (after compensation)	Get only	-
11	X magnification ratio (after compensation)	Get only	-
12	Y magnification ratio (after compensation)	Get only	-
13	Origin X (after compensation)	Get only	-
14	Origin Y (after compensation)	Get only	-
15	X axis angle (after compensation)	Get only	-
16	Y axis angle (after compensation)	Get only	-
17	XY angle (after compensation)	Get only	-
120	Number of point specifications	Set/Get	0 to 100
121	Operational point number	Set/Get	-1 to 99
130	Coordinate	Set/Get	0: Right-hand type 1: Left-hand type
131	Origin	Set/Get	0: Upperleft 1: Lowerleft 2: Center 3: Specify the coordinates
132	Magnification	Set/Get	0.0001 to 9.9999
134	Camera coordinate X	Set/Get	-99999.9999 to 99999.9999
135	Camera coordinate Y	Set/Get	-99999.9999 to 99999.9999
136	Post-conversion coordinate X	Set/Get	-99999.9999 to 99999.9999
137	Post-conversion coordinate Y	Set/Get	-99999.9999 to 99999.9999

No.	Data name	Set/Get	Data range
140	Number of sampling specifications	Set/Get	0 to 100
141	Operational sampling number	Set/Get	-1 to 99
142	Sampling unit X	Set/Get	-1: OFF 0 to 9999
144	Sampling unit Y	Set/Get	-1: OFF 0 to 9999
146	Maximum number of figure data	Get only	-
147	Sampling mode	Set/Get	0: Individual 1: Global
150	Coordinate	Set/Get	0: Right-hand type 1: Left-hand type
151	Origin	Set/Get	0: Upperleft 1: Lowerleft 2: Center 3: Specify the coordinates
152	Actual width	Set/Get	0.0001 to 99999.9999
154	Camera coordinate X	Set/Get	-99999.9999 to 99999.9999
155	Camera coordinate Y	Set/Get	-99999.9999 to 99999.9999
156	Post-conversion coordinate X	Set/Get	-99999.9999 to 99999.9999
157	Post-conversion coordinate Y	Set/Get	-99999.9999 to 99999.9999
158	Width reference unit	Set/Get	-1: OFF 0 to 9999
159	Point reference unit 1	Set/Get	-1: OFF 0 to 9999
160	Point reference unit 2	Set/Get	Point 2 reference unit No.
161	Dimensional measurement mode	Set/Get	0: Width specification 1: 2-point specification
170	Calibration parameter A (before compensation)	Set/Get	-99999.999999 to 99999.999999
171	Calibration parameter B (before compensation)	Set/Get	-99999.999999 to 99999.999999
172	Calibration parameter C (before compensation)	Set/Get	-99999.999999 to 99999.999999
173	Calibration parameter D (before compensation)	Set/Get	-99999.999999 to 99999.999999
174	Calibration parameter E (before compensation)	Set/Get	-99999.999999 to 99999.999999
175	Calibration parameter F (before compensation)	Set/Get	-99999.999999 to 99999.999999
176	X magnification ratio (before compensation)	Get only	-
177	Y magnification ratio (before compensation)	Get only	-
178	Origin X (before compensation)	Get only	-
179	Origin Y (before compensation)	Get only	-
180	X axis angle (before compensation)	Get only	-
181	Y axis angle (before compensation)	Get only	-

No.	Data name	Set/Get	Data range
182	XY angle (before compensation)	Get only	-
183	Compensation ratio X	Set/Get	0.5000 to 1.5000
184	Compensation Y	Set/Get	0.5000 to 1.5000
185	Compensation angle X	Set/Get	-180.0000 to 180.0000
186	Compensation angle Y	Set/Get	-180.0000 to 180.0000
187	Origin offset X	Set/Get	-9999.9999 to 9999.9999
188	Origin offset Y	Set/Get	-9999.9999 to 9999.9999
200 + N × 1 (N = 0 to 99)	Camera coordinate X for Point N (point specification)	Set/Get	0.0000 to 99999.9999
300 + N × 1 (N = 0 to 99)	Camera coordinate Y for Point N (point specification)	Set/Get	0.0000 to 99999.9999
400 + N × 1 (N = 0 to 99)	Actual coordinate X for Point N (point specification)	Set/Get	-99999.9999 to 99999.9999
500 + N × 1 (N = 0 to 99)	Actual coordinate Y for Point N (point specification)	Set/Get	-99999.9999 to 99999.9999
600 + N × 1 (N = 0 to 99)	Camera coordinate X for sampling N (sampling)	Set/Get	0.0000 to 99999.9999
700 + N × 1 (N = 0 to 99)	Camera coordinate Y for sampling N (sampling)	Set/Get	0.0000 to 99999.9999
800 + N × 1 (N = 0 to 99)	Actual coordinate X for sampling N (sampling)	Set/Get	-99999.9999 to 99999.9999
900 + N × 1 (N = 0 to 99)	Actual coordinate Y for sampling N (sampling)	Set/Get	-99999.9999 to 99999.9999

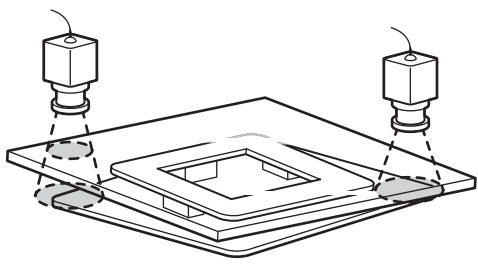
Data Save

Set data that you want to manage or store in units of scenes in this processing item using an arithmetic expression.

The set data can be saved in the controller main unit or as scene data.

Used in the Following Case

- If you want to store measurement values and count values even after powering off the controller



Use example)

- Calculate in a flow without using the reference position of measurement processing unit
→ Retains the calculated reference position.
- To use offset function in an axis movement amount calculation
→ Retains the offset value.

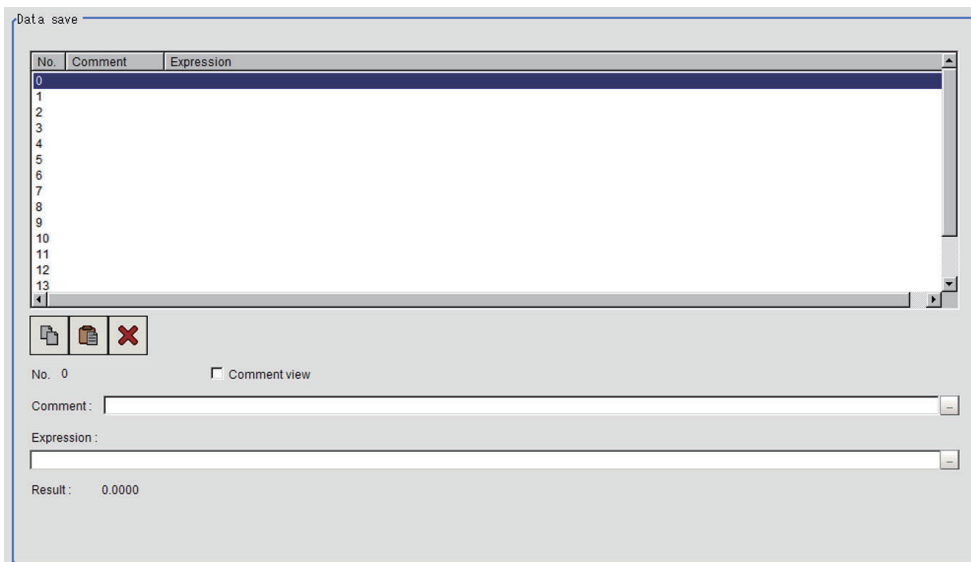
Setting (Data Save)

Set data retained in this processing item.

It can be set freely using expressions.

- 1** In the Item Tab area, click [Setting].
- 2** Set each item in the "Data save" area.

Up to 16 data can be saved.



The screenshot shows a software interface titled "Data save". At the top, there is a table with three columns: "No.", "Comment", and "Expression". The table contains rows numbered 0 through 13. Below the table, there are three icons: a document, a trash can, and a red 'X'. Underneath these icons, there is a "No." field with the value "0" and a "Comment view" checkbox. Below that are input fields for "Comment:" and "Expression:". At the bottom, there is a "Result:" field showing the value "0.0000".

Setting item	Setting value [Factory default]	Description
Comment	-	Set a comment that describes the expression for the data to be saved.
Expression	-	Set the expression of the data to be saved.

- 3** To display comments in the "Detail result display" area, check "Comment view".

No. 0	<input checked="" type="checkbox"/> Comment view
Comment :	Measure

Key Points for Test Measurement and Adjustment (Data Save)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Judge	Judgement result
Save data N (N = 0 to 15)	Stored data

Key Points for Adjustment

Select the adjustment method referring to the following points.

State	Parameter to be adjusted	Troubleshooting
Saved data is updated unintentionally.	-	Update can be controlled by setting the following flow. Example) 0. Camera image input 1. Input condition branching : N. Measurement completion N+1. Save data Control the DI signal so that it branches to saving data when updating saved data.

Measurement Results for Which Output Is Possible (Data Save)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Save data N (N = 0 to 15)	D00 to D15	Stored data

External Reference Tables (Data Save)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5 + N (N = 0 to 15)	Expression result of expression N (N = 0 to 15)	Get only	-999999999.9999 to 999999999.9999
120 + N (N=0 to 15)	Save data calculation N	Set/Get	Exp. character string (*)
168 + N (N=0 to 15)	Expressions comment N	Set/Get	Character string
200 + N (N=0 to 15)	Comment view N	Set/Get	0:OFF 1:ON

* Numeric data can be set by the processing item of the processing unit data setting.

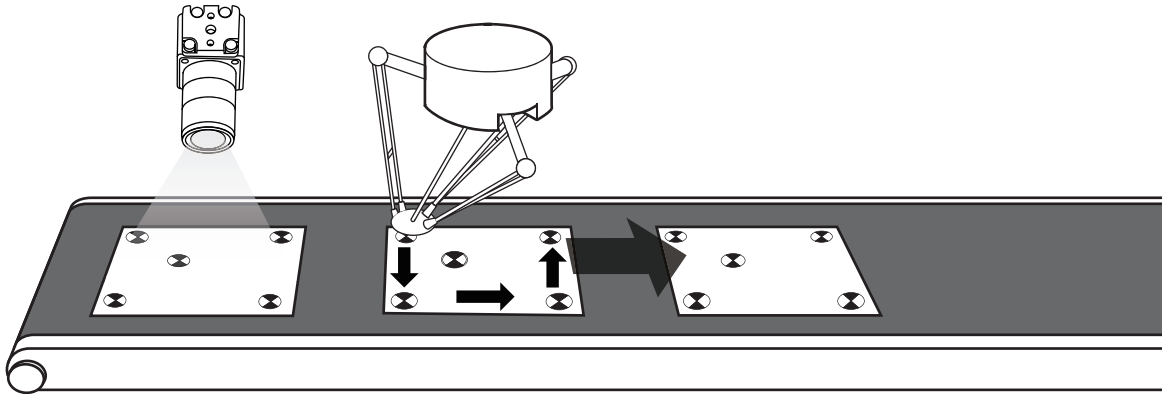
Conveyor Calibration

Conveyor Calibration is an FH Sensor Controller processing item exclusively for conveyor tracking application. Conveyor Calibration cannot be launched from an FH Sensor Controller User Interface. Use Sysmac Studio for this function.

For more information, refer to: ► the *Vision Sensor FH Series Conveyor Tracking Application Sample Scene and Sample Macro User's Guide*

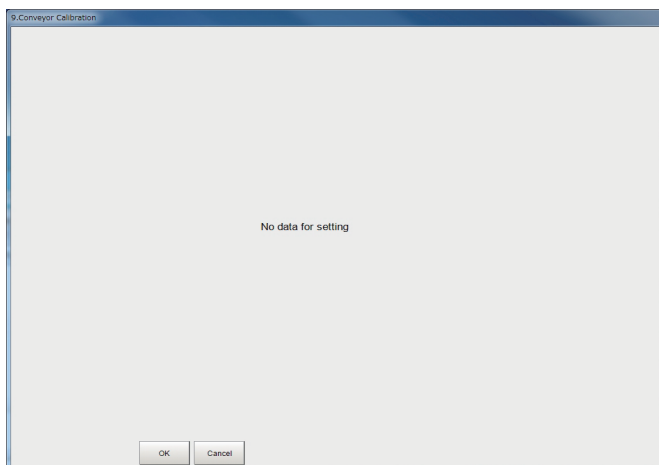
Used in the Following Case

Conveyor Calibration is used to calibrate camera, conveyor, and robots for conveyor tracking application.



Note

- You can choose exclusive processing items for conveyor tracking application on the Edit Flow Window on the FH/FZ5 Sensor Controller. However, properties setting is unavailable on the FH/FZ5 Sensor Controller. The following image is the Properties Setting window when it is opened on the FH/FZ5 Sensor Controller.



MEMO

Branch

This chapter describes setting methods for when branch processing is performed.

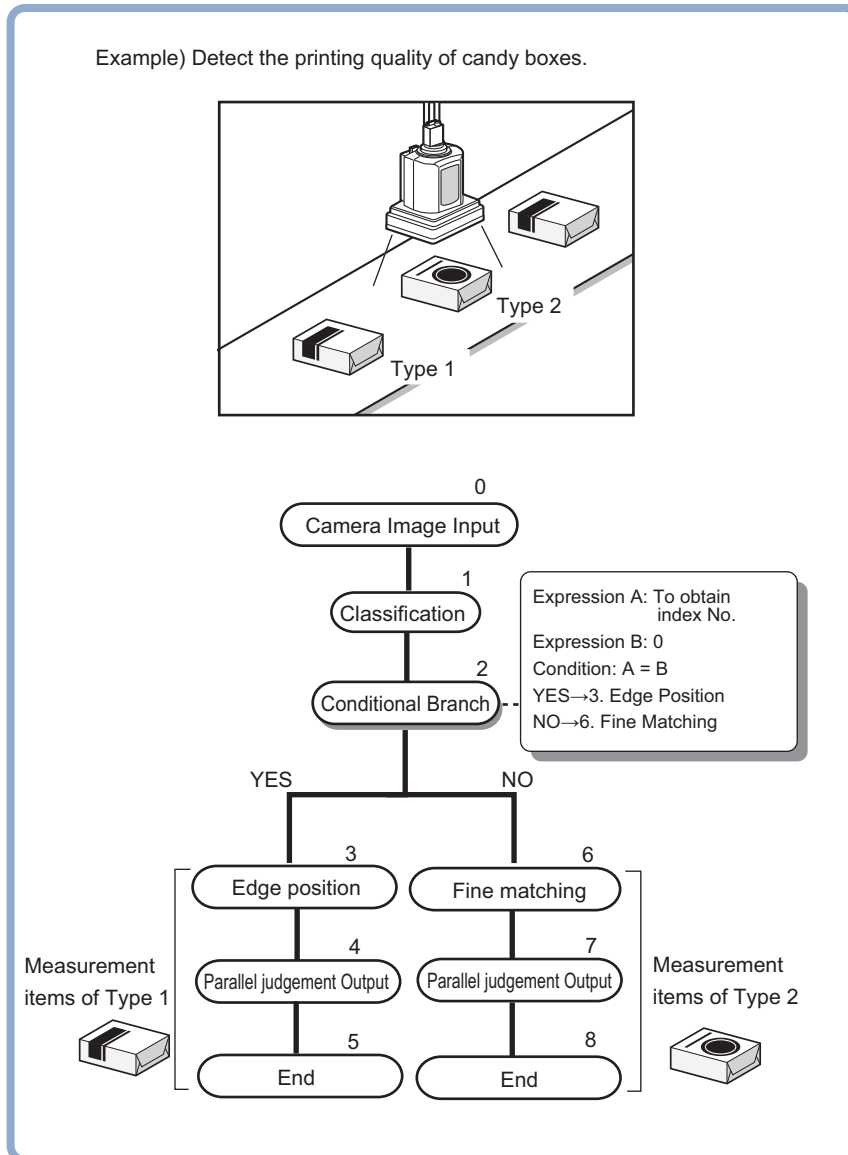
Conditional Branch	826
End.....	831
DI Branch.....	832
Control Flow Normal	835
Control Flow PLC Link	840
Control Flow Parallel.....	846
Control Flow Fieldbus.....	851
Selective Branch.....	858

Conditional Branch

Expressions and conditions are set, and processing after this processing item is divided into two according to the comparison calculation.

Used in the Following Case

- When two more types of products are on the production line and inspection is to be performed separately for each



List of Conditional Branch Items

Set	Set value [Factory default]	Description
Condition	<ul style="list-style-type: none"> • $[A = B]$ • $A \leq B$ • $A < B$ • $A \geq B$ • $A > B$ 	Select the method to compare expression A and B. Compare two data items that are obtained through conditional expressions.

Set		Set value [Factory default]	Description
Expression A		Up to 256 characters	Set the evaluation expression that is to be the basis for branching. Set the expression through calculation. Reference: ► Settings (Calculation) (p.614)
Expression B			
Destination unit	YES	<ul style="list-style-type: none"> -1: [End processing] 0 to 32767: unit No. 	Select the destination unit number for when the result of the comparison is true.
	NO	<ul style="list-style-type: none"> -1: [End processing] 0 to 32767: unit No. 	Select the destination unit number for when the result of the comparison is false.

Conditional Branch

Specify expression A and B for the branching conditions.

1 Set expression A and B separately.

Reference: ► Layout of Setting Expression Window (p.615)

2 Click [icon] to set up conditions.

Condition	Description
A=B	If the value from expression A is equal to that from expression B, moves to the unit in which "Destination unit" is YES. If not, moves to the NO unit.
A<=B	If the value from expression A is equal to that of expression B, or if the value of A is lower than that of B, moves to the unit in which "Destination unit" is "YES". If A is larger, moves to the unit with "NO".
A<B	If the value from expression A is lower than the value from expression B, moves to the unit in which "Destination unit" is YES. If A is equal to or greater than B, moves to the NO unit.
A>=B	If the value from expression A is equal to that of expression B, or if the value of A is higher than that of B, moves to the unit in which "Destination unit" is "YES". If B is higher, moves to the unit with "NO".
A>B	If the value from expression A is higher than the value from expression B, moves to the unit in which "Destination unit" is YES. If A is equal to or less than B, moves to the NO unit.

3 Set the branch destination.

Important

- In order to avoid measurement processing looping, for the branch destination, set a processing unit number that is after the [Conditional Branch].
- Make sure to set "End" at the last branch destination to indicate the end of the branch.
Reference: ► End (p.831)

Note

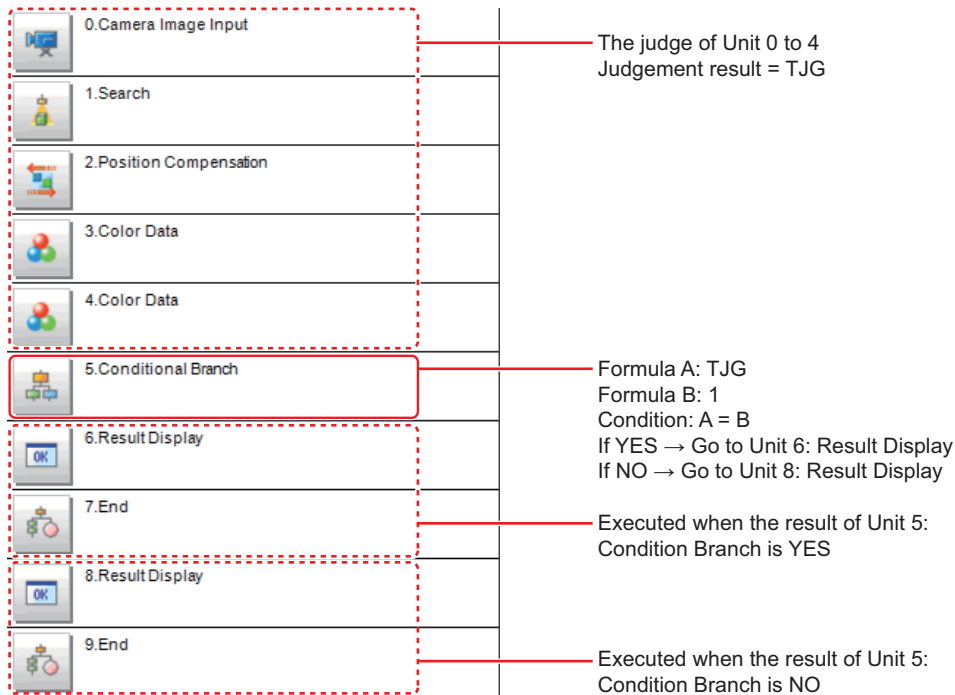
- The judgement result for a processing unit is finalized when that processing unit is processed.
- The overall judgement is finalized when all processing unit measurement is complete.

Conditional Branch Settings Examples

The overall judgement result for processing up to the unit number in which the expression is set is acquired and subsequent measurement is branched according to the result.

For example, condition branching is performed based on the overall judgement result of Units 0 to 4.

Sample Display



1 Set [Conditional Branch] in Unit 5. Set the following expressions in Expression A and B, respectively.

• **Expression A: TJG**

Acquire the overall judgement results from Unit 0 to Unit 4. The overall results based on the judgement results of Unit 0 to Unit 4 are output in the following manner.

Result of unit 0 to unit 4	TJG output
All the unit's judgement results are OK	1
The judgement results of one or more units are NG	-1

• **Expression B: 1**

Set the value that will be compared with the value of A (TJG value).

2 Set the condition of the conditional expression to "A = B".

A = B, which means that TJG = 1, is set as the condition. As a result, if all the unit judgement results from 0 to 4 are OK, then the condition judgement result will be "YES".

3 Set each of the Conditional Branch destinations.

If "Yes", branch to unit 6. If "No", branch to unit 8.

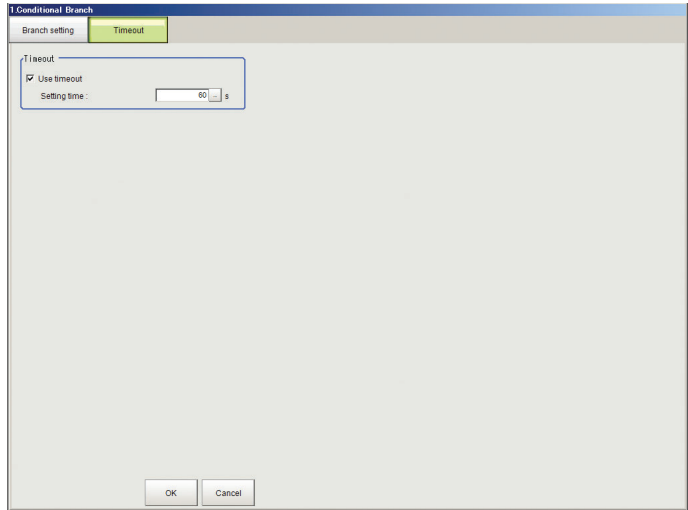
Important

- Parameters for units that do not pass through a conditional branch
The measurement results other than the unit judgement result (JG) retain the measurement results from the previous time the unit passed through the conditional branch. The JG for units that do not pass through the condition branch becomes unmeasured (0). Note, however, that the unit JG becomes unmeasured at the point in time when all the measurement processing ends. During flow processing, the previous time judgement (JG) is retained.

Timeout (Conditional Branch)

Set the conditions under which the branching processing times out.

1 In the Item Tab area, click [Timeout].



2 In the "Timeout" area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Use timeout	<ul style="list-style-type: none"> Unchecked [Checked] 	Click on the [Use timeout] checkbox to turn it ON if you want the branching processing to time out after a set amount of time passes.
Setting time	1 to 3600 [60]	This can be set when the "Use timeout" checkbox is selected. Set the length of time until the measurement process times out on the selected processing unit in seconds. When the measurement process for this processing unit is executed, a timeout occurs once the amount of time that passes since the start of the measurement exceeds the set [Setting time]. If a timeout occurs to disrupt the measurement process, the judgement results in NG.

Important

- Normally the "Use timeout" check box should be selected. Unchecking the [Use timeout] checkbox may cause the measurement flow to become stuck in an infinite loop when measurements are started depending on the branching processing settings.
- If using conditional branching within the block for the parallelization task in the measurement flow, set it up so that branching occurs only within the relevant block for the parallelization task. Attempting to introduce branching across blocks for the parallelization task may cause the timeout function to stop working even with the [Use timeout] checkbox checked.

Measurement Results for Which Output Is Possible (Conditional Branch)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Expression A result	D0	Operational result of expression selected in expression A
Expression B result	D1	Operational result of expression selected in expression B
Comparison result	RS	Result from comparing the expressions (0: NO, 1: YES)
Destination unit No.	BU	Unit No. at destination based on the compares results of expressions

External Reference Tables (Conditional Branch)

No.	Data name	Set/Get	Data range
0	Judge	Get	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	Expression A result	Get	Maximum 256 characters (result of calculation selected in expression A)
6	Expression B result	Get	Maximum 256 characters (result of calculation selected in expression B)
7	Comparison result	Get	0: NO 1: YES
8	Destination unit No.	Get	0 to 32767
120	Condition type	Set/Get	0: A = B 1: A ≤ B 2: A < B 3: A ≥ B 4: A > B
121	YES branch destination Unit No.	Set/Get	-1: End processing 0 to 32767: unit No.
122	NO Destination Unit No.	Set/Get	-1: End processing 0 to 32767: unit No.
123	Expression A	Set/Get	Expression character string
124	Expression B	Set/Get	Expression character string
125	Timeout	Set/Get	0: Not used 1: Used
126	Timeout time [s]	Set/Get	1 to 3600

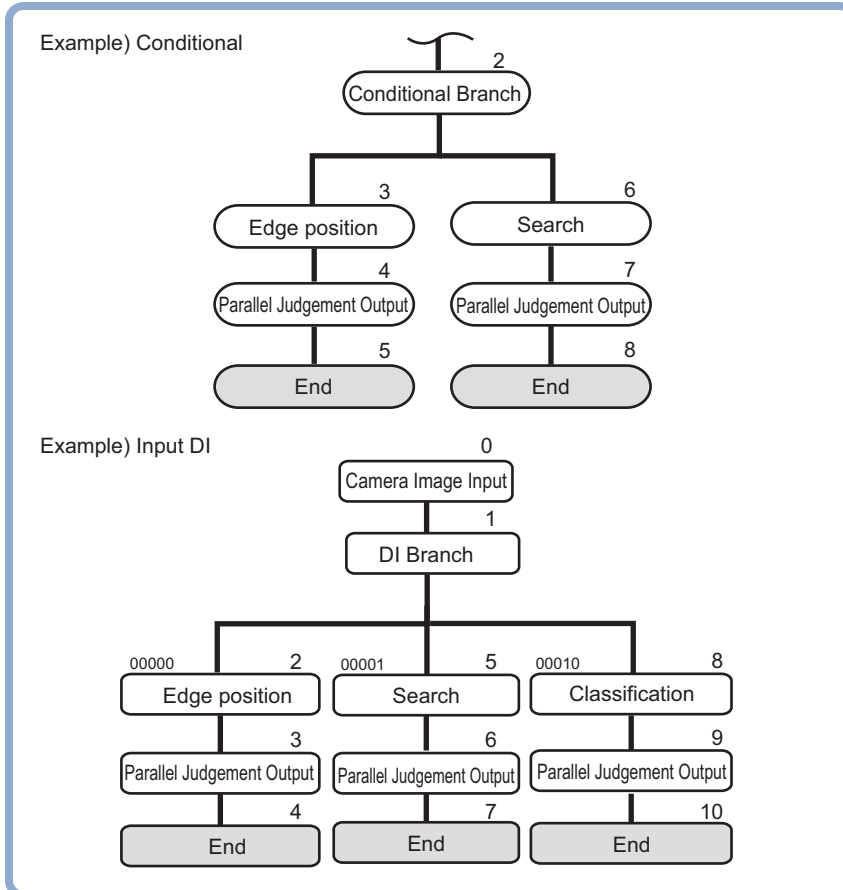
End

This processing item only needs to be added to the scene. Operations such as condition setting are unnecessary.

Please set at the last unit of each branch.

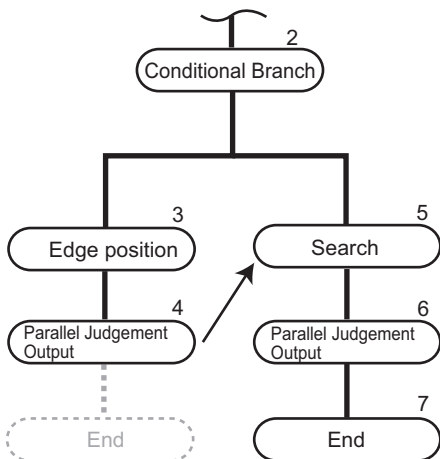
Used in the Following Case

- When finishing the last Processing Item of a branch



Note

- If [End] is not set at the end of a branch, the processing in the scene will continue to move to the next unit No. even if the branch has been completed.

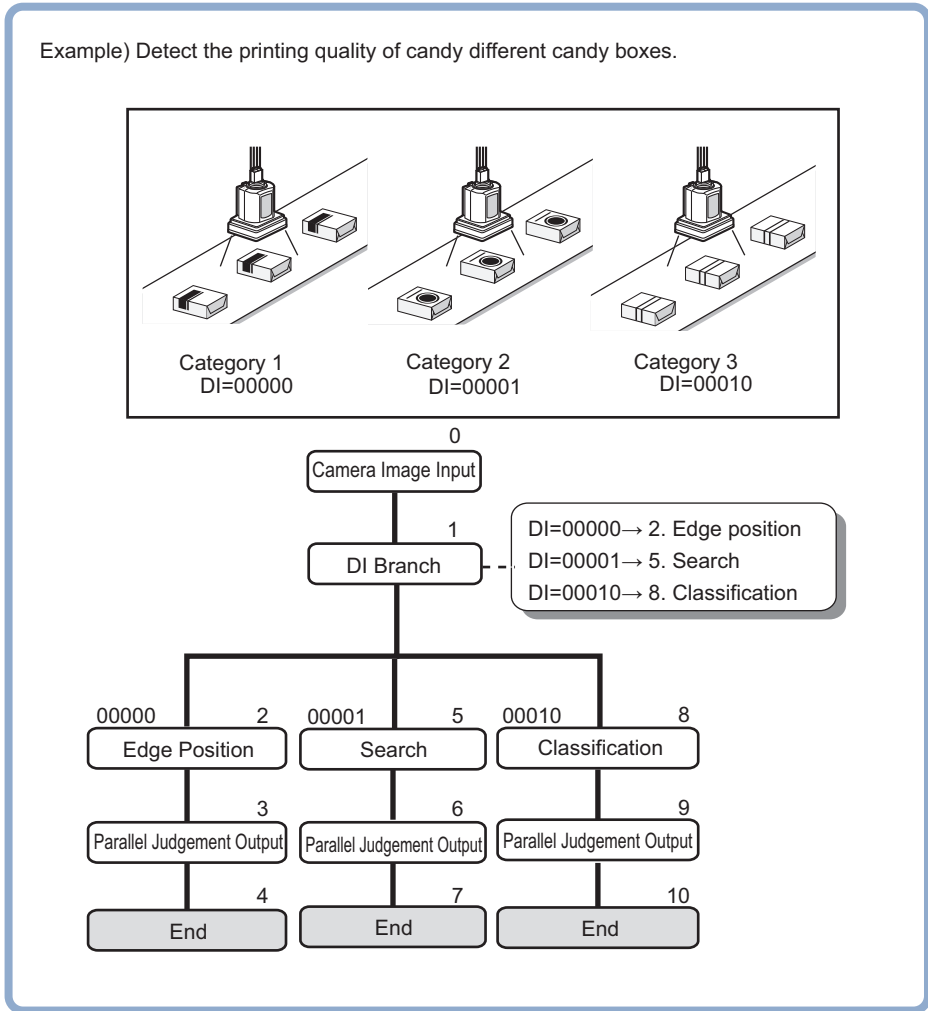


DI Branch

Starting from this processing item, processing is branched according to the information input to terminal blocks DI0 to DI4. Up to 32 branch destinations can be set.

Used in the Following Case

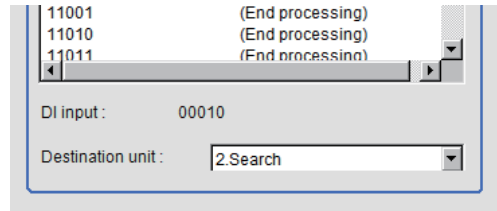
- When products on one production line are to be inspected according to a time interval



Settings (DI Branch)

Select the destination unit. Perform settings according to the information input in DI.

- 1 In the item tab area, click [Setting].
- 2 Click the DI input from the input signal list for which the branch destination is to be set up.
- 3 At "Destination unit", click [▼] and set the destination unit.



Important

- In order to avoid measurement processing looping, for the branch destination, set a processing unit number that is after the [DI Branch].
- Make sure to set "End" at the last branch destination to indicate the end of the branch.
Reference: ► End (p.831)
- If the operation mode (FZ series) is set to [Multi-line random-trigger mode], DI inputs are handled differently as follows.
Line 0: Conform to the statuses of DI0 and 1 inputs.
Line 1: Conform to the statuses of DI2 and 3 inputs.
- If the operation mode (FZ5-8□□/ FZ5-11□□/ FZ5-12□□) is set to [Multi-line random-trigger mode], DI inputs are handled differently as follows.
Line 0: Conform to the statuses of DI0 and 1 inputs.
Line 1: Conform to the statuses of DI2 and 3 inputs.

- 4 Repeat the steps Reference: ► 2 (p.833) to Reference: ► 3 (p.833) and set the destination units for other input signals.

Note

- Up to 32 (0 to 31) branch destinations can be set.
- The controller references the DI signal when the [DI Branch] measurement is executed.

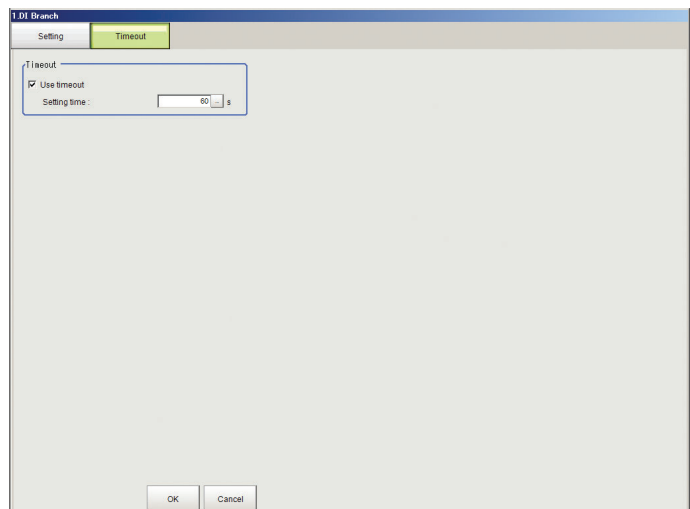
- 5 Click [OK].

The settings are finalized.

Timeout (DI Branch)

Set the conditions under which the branching processing times out.

- 1 In the Item Tab area, click [Timeout].



2 In the "Timeout" area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Use timeout	<ul style="list-style-type: none"> • Unchecked • [Checked] 	Click on the [Use timeout] checkbox to turn it ON if you want the input condition branching processing to time out after a set amount of time passes.
Setting time	1 to 3600 [60]	<p>This can be set when the "Use timeout"checkbox is selected.</p> <p>Set the length of time until the measurement process times out on the selected processing unit in seconds.</p> <p>When the measurement process for this processing unit is executed, a timeout occurs once the amount of time that passes since the start of the measurement exceeds the set [Setting time]. If a timeout occurs to disrupt the measurement process, the judgement results in NG.</p>

Important

- Normally the "Use timeout" check box should be selected. Unchecking the [Use timeout] checkbox may cause the measurement flow to become stuck in an infinite loop when measurements are started depending on the input condition branching processing settings.
- If using input condition branching within the block for the parallelization task in the measurement flow, set it up so that branching occurs only within the relevant block for the parallelization task. Attempting to introduce branching across blocks for the parallelization task may cause the timeout function to stop working even with the [Use timeout] checkbox checked.

Measurement Results for Which Output Is Possible (DI Branch)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
DI input No.	DI	Number (decimal) corresponding to DI input (00000 - 11111)
Unit No	BU	Unit number at destination corresponding to DI input

External Reference Tables (DI Branch)

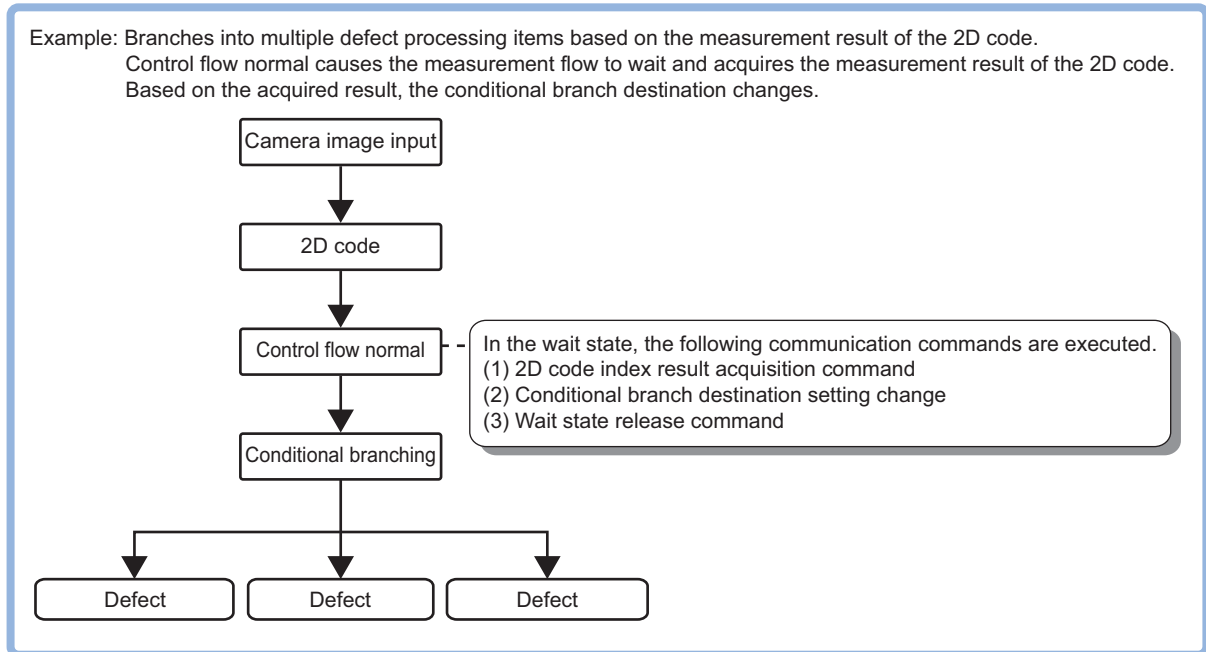
No.	Data name	Set/Get	Data range
0	Judge	Get	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	DI input No.	Get	Number (decimal) corresponding to DI input (00000 - 11111)
6	Unit No	Get	Unit number at destination corresponding to DI input
120 to151	Destination Unit No. 0 - Destination Unit No. 31	Set/Get	-1: End processing 0 to 9999: Unit number
200	Timeout	Set/Get	0: Not used 1: Used
201	Timeout time [s]	Set/Get	1 to 3600

Control Flow Normal

This function is used to put the currently executed measurement flow in the wait state to allow execution of a specific communication command from an external device.

Used in the Following Case

- To execute a communication command during measurement flow processing



This processing item is compatible with measurement flow control using the communication modules below.

Parallel	PLC Link	EtherNet/IP	EtherCAT	Non-procedure
NA	NA	NA	NA	OK

In the wait state, the communication commands below can be executed. For details on the communication commands, refer to Reference: ▶ “List of Commands” in “Section 3 Appendixes - Command Control” in the “Vision System FH/FZ5 Series User’s Manual for Communications Settings (Cat. No. Z342).”

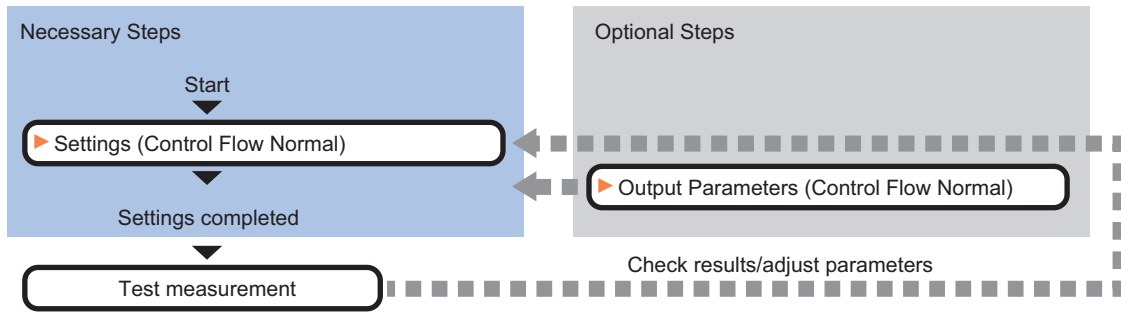
Command name	Function
Get Unit Data	Gets the parameters and measurement values of the processing unit.
Set Unit Data	Sets the parameters and measurement values of the processing unit.
Return to Start of Flow	Branches to the start of the measurement flow (processing unit 0)

To clear the wait state, use the Set Unit Data command. The wait state can be cleared by setting the “Wait state clear command” to “1” in the External Reference Table.

Reference: ▶ External Reference Table (Control Flow Normal) (p.839)

Settings Flow (Control Flow Normal)

Set up control flow normal according to the following steps.



List of Control Flow Normal Items

The following items can be set in control flow normal.

Item name	Description
Setting	Set communication and timeout conditions for controlling the measurement flow. Reference: ▶ Settings (Control Flow Normal) (p.836)
Output parameter	You can set this item to change the output parameters. Set the conditions and parameters for outputting measurement results to other processing units or external devices. Reference: ▶ Measurement Results for Which Output Is Possible (Control Flow Normal) (p.838)

Settings (Control Flow Normal)

Set communication and timeout conditions for controlling the measurement flow.

1 In the Item Tab area, click [Setting].

2 In the “Communication method” area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Communication method	<ul style="list-style-type: none"> [RS-232C/RS-422] Ethernet 	Select the communication method used for controlling the measurement flow from an external device.

3 In the “Timeout” area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Use timeout	<ul style="list-style-type: none"> • [Checked] • Unchecked 	<p>If you want to clear the measurement flow wait state after a certain period of time elapses, select the “Use timeout” check box.</p> <p>This should normally be used with the check box selected.</p>
Setting time	0 to 120,000 [5,000]	<p>This item can be set when the [Use timeout] check box is selected.</p> <p>Set the time in ms after which the wait state on the processing unit is cleared.</p> <p>When a timeout is used, the wait state is cleared when the time set in “Setting time” elapses after the measurement unit starts measurement processing.</p> <p>When the wait state is cleared, the measurement flow resumes.</p>
Unit judgement in timeout	<ul style="list-style-type: none"> • [NG] • OK 	<p>This item can be set when the [Use timeout] check box is selected.</p> <p>Select whether the judgement result of the processing unit is NG or OK when the processing unit times out after the “Setting time” in measurement processing.</p>

Important

- Normally the “Use timeout” check box should be selected. When the check mark is removed from “Use timeout”, the wait state can only be cleared by executing a “Wait state clear command” from an external device.

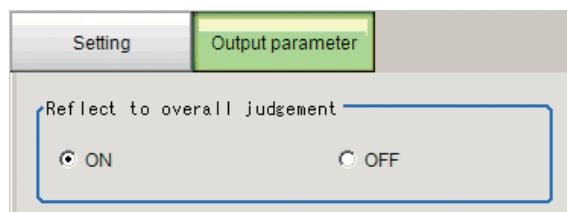
Output Parameters (Control Flow Normal)

You can set this item to change the output parameters.

The output parameters are the conditions and parameters for outputting measurement results to other processing units or external devices. Normally, the factory default values can be used.

1 Click [Output parameter] in the Item Tab area.

2 Specify a value for each item.



Setting item	Setting value [Factory default]	Description
Reflect to the overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Set whether the judgement result from this processing unit is applied to the overall scene judgement.

Key Points for Test Measurement and Adjustment (Control Flow Normal)

You can adjust the parameters while you perform test measurements and check the measurement results to increase the measurement precision and speed.

Select the adjustment method by considering the following point.

Check the measurement results that can be displayed and output in “Measurement Results for Which Output Is Possible”.

Items Displayed in the Detail Result Area

The following measurement results are displayed in the “Detail result” area as text.

Displayed item	Description
Judge	Displays the judgement result for the processing unit.

Items Displayed in the Image Display Area

You can specify a sub-image number to display the next image in the image display area.

Sub image number	Description
0	The measurement image appears.

Measurement Results for Which Output Is Possible (Control Flow Normal)

Measurement results in control flow normal are as shown below. The measurement results appear in the “Detail Result” area, and you can also use result output processing items to output the measurement results to an external device.

Refer to the “External Reference Tables” for the parameters that can be referenced, including measurement results.

(Reference: ► External Reference Table (Control Flow Normal) (p.839))

Measurement item	Character string	Description
Judge	JG	The judgement result for the processing unit

External Reference Table (Control Flow Normal)

By specifying a number, you can access the following data from processing items that support processing unit data setting/acquisition, and from control commands.

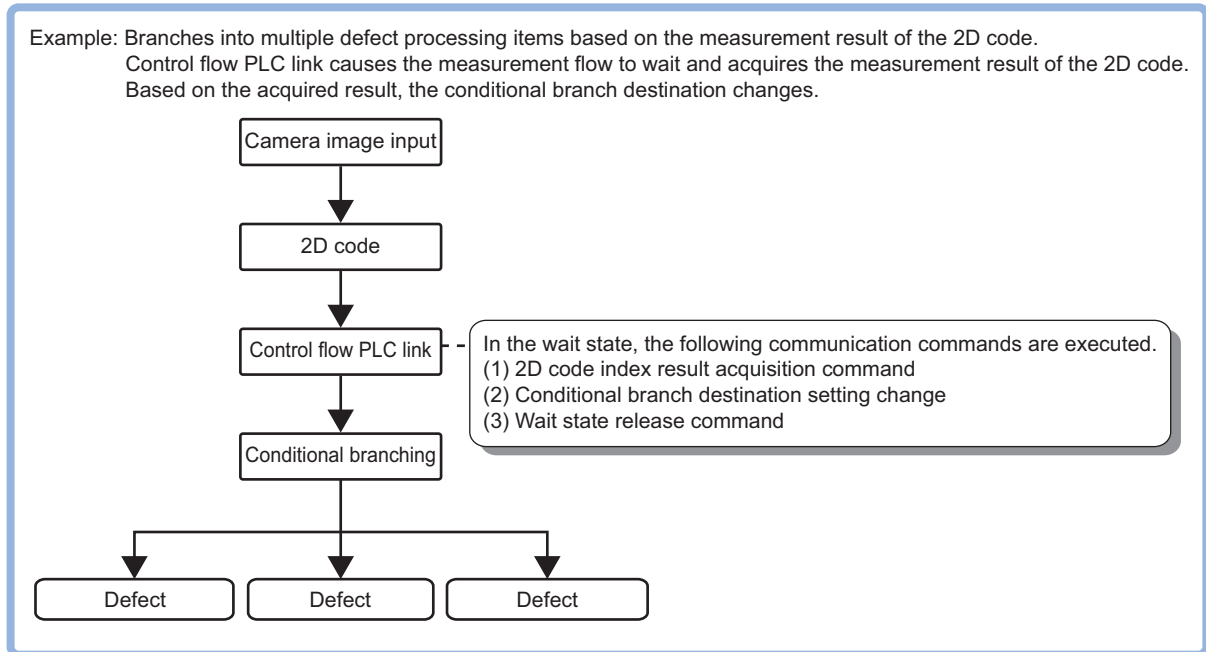
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	State	Get only	0: Flow not stopped 1: Flow stopped
103	Reflect to the overall judgement	Set/Get	0: ON 1: OFF
120	Timeout	Set/Get	0: Not used 1: Used
121	Timeout time (ms)	Set/Get	Timeout time (0 to 120,000)
122	Communication method	Set/Get	0: RS-232C/RS-422 1: Ethernet
123	Unit judgement in timeout	Set/Get	0: NG 1: OK
5000	Wait state clear command	Set only	1: Clear the wait state

Control Flow PLC Link

This function is used to put the currently executed measurement flow in the wait state to allow execution of a specific communication command from an external device.

Used in the Following Case

- To execute a communication command during measurement flow processing



This processing item is compatible with measurement flow control using the communication modules below.

Parallel	PLC Link	EtherNet/IP	EtherCAT	Non-procedure
NA	OK	NA	NA	NA

In the wait state, the communication commands below can be executed. For details on the communication commands, refer to Reference: ▶ “List of Commands” in “Section 3 Appendixes - Command Control” in the “Vision System FH/FZ5 Series User’s Manual for Communications Settings (Cat. No. Z342).”

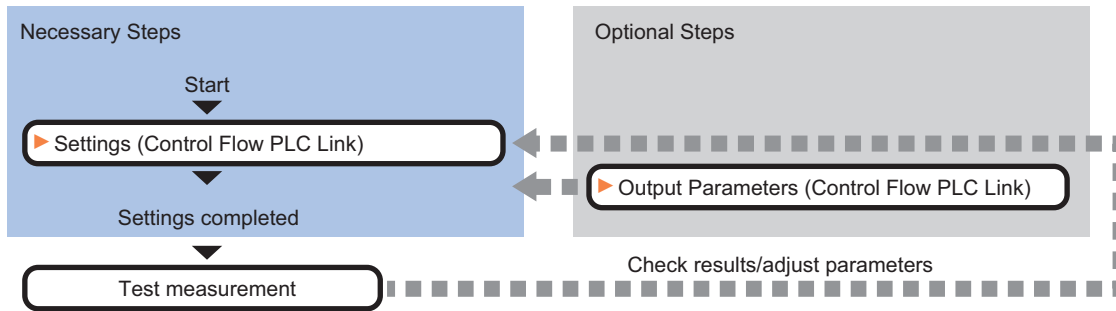
Command name	Function
Get Unit Data	Gets the parameters and measurement values of the processing unit.
Set Unit Data	Sets the parameters and measurement values of the processing unit.
Return to Start of Flow	Branches to the start of the measurement flow (processing unit 0)

To clear the wait state, use the Set Unit Data command. The wait state can be cleared by setting the “Wait state clear command” to “1” in the External Reference Table.

Reference: ▶ External Reference Table (Control Flow PLC Link) (p.843)

Settings Flow (Control Flow PLC Link)

Set up control flow PLC link according to the following steps.



List of Control Flow PLC Link Items

The following items can be set in control flow PLC link.

Item name	Description
Setting	Set communication and timeout conditions for controlling the measurement flow. Reference: ▶ Settings (Control Flow PLC Link) (p.841)
Output parameter	You can set this item to change the output parameters. Set the conditions and parameters for outputting measurement results to other processing units or external devices. Reference: ▶ Measurement Results for Which Output Is Possible (Control Flow PLC Link) (p.843)

Settings (Control Flow PLC Link)

Set communication and timeout conditions for controlling the measurement flow.

1 In the Item Tab area, click [Setting].

2 In the “Communication method” area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Communication method	<ul style="list-style-type: none"> [RS-232C/RS-422] Ethernet 	Select the communication method used for controlling the measurement flow from an external device.

3 In the “Timeout” area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Use timeout	<ul style="list-style-type: none"> • [Checked] • Unchecked 	<p>If you want to clear the measurement flow wait state after a certain period of time elapses, select the “Use timeout” check box.</p> <p>This should normally be used with the check box selected.</p>
Setting time	0 to 120,000 [5,000]	<p>This item can be set when the [Use timeout] check box is selected.</p> <p>Set the time in ms after which the wait state on the processing unit is cleared.</p> <p>When a timeout is used, the wait state is cleared when the time set in “Setting time” elapses after the measurement unit starts measurement processing.</p> <p>When the wait state is cleared, the measurement flow resumes.</p>
Unit judgement in timeout	<ul style="list-style-type: none"> • [NG] • OK 	<p>This item can be set when the [Use timeout] check box is selected.</p> <p>Select whether the judgement result of the processing unit is NG or OK when the processing unit times out after the “Setting time” in measurement processing.</p>

Important

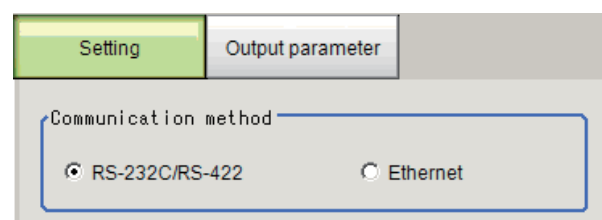
- Normally the “Use timeout” check box should be selected. When the check mark is removed from “Use timeout”, the wait state can only be cleared by executing a “Wait state clear command” from an external device.

Output Parameters (Control Flow PLC Link)

You can set this item to change the output parameters.

The output parameters are the conditions and parameters for outputting measurement results to other processing units or external devices. Normally, the factory default values can be used.

1 Click [Output parameter] in the Item Tab area.



2 Specify a value for each item.

Setting item	Setting value [Factory default]	Description
Reflect to the overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Set whether the judgement result from this processing unit is applied to the overall scene judgement.

Key Points for Test Measurement and Adjustment (Control Flow PLC Link)

You can adjust the parameters while you perform test measurements and check the measurement results to increase the measurement precision and speed.

Select the adjustment method by considering the following point.

For the display of measurement results and the results that are output, check Reference: ► Measurement Results for Which Output Is Possible (Control Flow PLC Link) (p.843).

Items Displayed in the Detail Result Area

The following measurement results are displayed in the “Detail result” area as text.

Displayed item	Description
Judge	Displays the judgement result for the processing unit.

Items Displayed in the Image Display Area

You can specify a sub-image number to display the next image in the image display area.

Sub image number	Description
0	The measurement image appears.

Measurement Results for Which Output Is Possible (Control Flow PLC Link)

The measurement results provided by control flow PLC link are shown below. The measurement results appear in the “Detail Result” area, and you can also use result output processing items to output the measurement results to an external device.

Refer to the “External Reference Tables” for the parameters that can be referenced, including measurement results.

(Reference: ► External Reference Table (Control Flow PLC Link) (p.843))

Measurement item	Character string	Description
Judge	JG	The judgement result for the processing unit

External Reference Table (Control Flow PLC Link)

By specifying a number, you can access the following data from processing items that support processing unit data setting/acquisition, and from control commands.

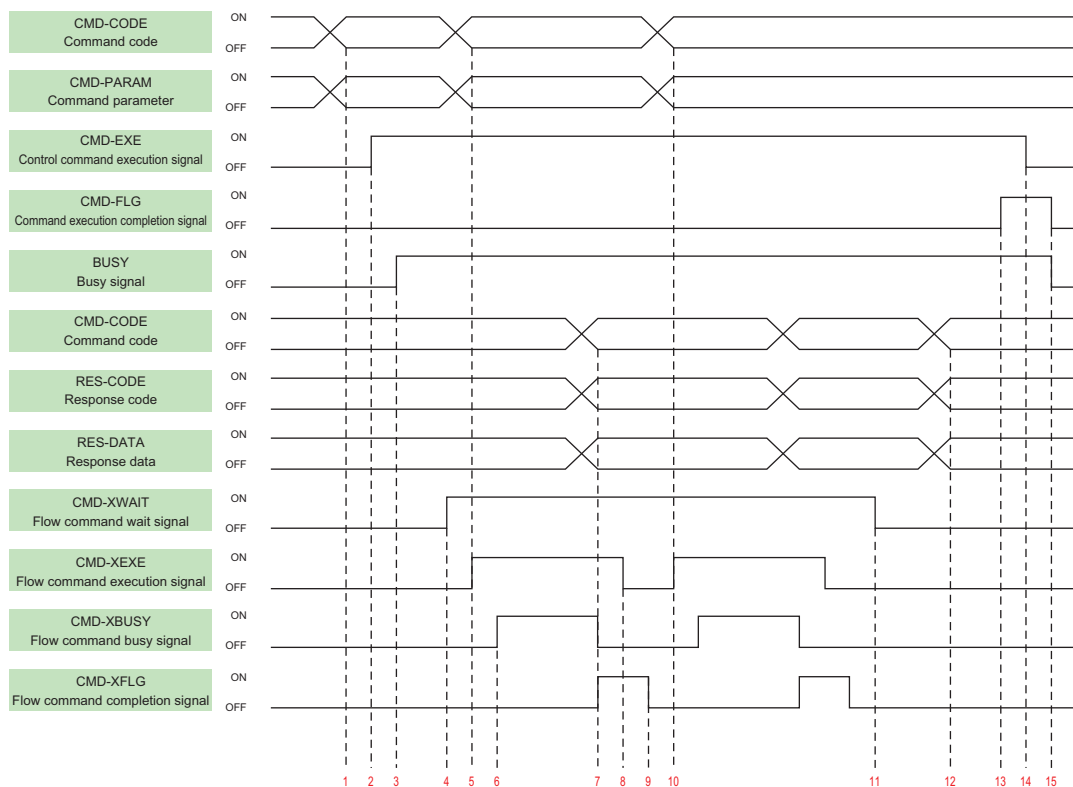
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	State	Get only	0: Flow not stopped 1: Flow stopped
103	Reflect to the overall judgement	Set/Get	0: ON 1: OFF
120	Timeout	Set/Get	0: Not used 1: Used
121	Timeout time (ms)	Set/Get	Timeout time (0 to 120,000)
122	Communication method	Set/Get	0: RS-232C/RS-422 1: Ethernet

No.	Data name	Set/Get	Data range
123	Unit judgement in timeout	Set/Get	0: NG 1: OK
5000	Wait state clear command	Set only	1: Clear the wait state

Timing Chart (Control Flow PLC Link)

To execute a command using a Control Flow PLC Link processing item during a measurement flow, control the sensor controller paying attention to the timing of the signals from the external device. Refer to the timing chart below.

Example: The measurement command is executed by PLC Link, and the processing unit data setting command is executed by Control Flow PLC Link processing during measurement.



1. Set the command code and command parameters to be executed by the user (PLC). (In the above example, this is the measurement command.)
2. The user (PLC) turns ON the control command execution signal (EXE signal).
3. The sensor controller turns ON the processing busy signal (BUSY signal).
4. When the processing unit is executed inside the measurement flow, the sensor controller turns ON the measuring command standby signal (XWAIT signal).
5. The user (PLC) sets the command code to be executed during measurement and the command parameters, during measurement, and turns ON the measuring command execution signal (XEXE signal). (In the above example, this is the Set Unit Data command.)
6. The sensor controller turns ON the measuring command executing signal (XBUSY signal).
7. After setting the command code executed during measurement, the response code, and response data, the sensor controller turns ON the flow command completion signal (XFLG signal), and turns OFF the measuring command executing signal (XBUSY signal).
8. The user (PLC) turns OFF the flow command execution signal (XEXE signal). If the signal does not turn OFF within the set timeout time, the control flow advances directly to step 14.
9. The sensor controller turns OFF the measuring command completion signal (XFLG signal).

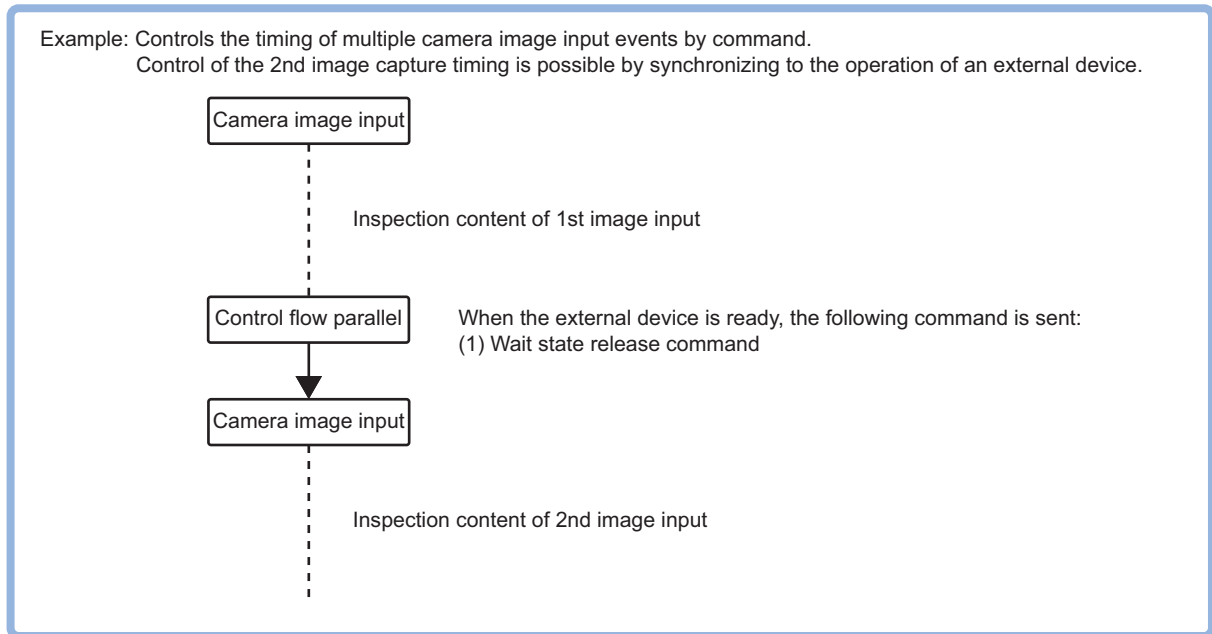
10. The user (PLC) sets the command code to be executed during measurement and the command parameters, during measurement, and turns ON the measuring command execution signal (XEXE signal). (In the above example, this is clearing of the wait state by the processing unit data setting command.) After this, steps 6 through 9 are performed.
11. When the processing unit finishes measurement processing, the sensor controller turns OFF the measuring command standby signal (XWAIT signal).
12. The sensor controller sets the executed command code, response code, and response data.
13. The sensor controller turns ON the command completion signal (FLG signal).
14. The user (PLC) turns OFF the command execution signal (EXE signal).
15. The sensor controller turns OFF the command completion signal (FLG signal), and turns OFF the processing busy signal (BUSY signal).

Control Flow Parallel

This function is used to put the currently executed measurement flow in the wait state to allow execution of a specific communication command from an external device.

Used in the Following Case

- To execute a communication command during measurement flow processing



This processing item is compatible with measurement flow control using the communication modules below.

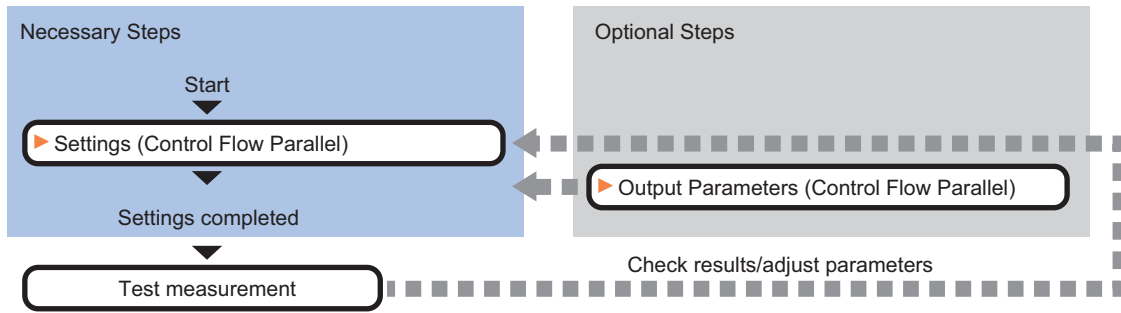
Parallel	PLC Link	EtherNet/IP	EtherCAT	Non-procedure
OK	NA	NA	NA	NA

Measurement flow processing is placed in a wait state to allow certain commands to be executed. There are two ways to clear the wait state, either through use of a command or through use of a set timeout time. In the wait state, the communication commands below can be executed.

Item	Description	Input Format (DI7 to DI0)			Input Example (DI7 to DI0)
		Execution (DI7)	Command (DI6, DI5)	Command Data (DI4 to DI0)	
Wait state release	Clears the wait state for processing items for control flow parallel.	1	10	01111	1101111

Settings Flow (Control Flow Parallel)

Set up control flow parallel according to the following steps.



List of Control Flow Parallel Items

The following items can be set in control flow parallel.

Item name	Description
Setting	Set communication and timeout conditions for controlling the measurement flow. Reference: ▶ Settings (Control Flow Parallel) (p.847)
Output parameter	You can set this item to change the output parameters. Set the conditions and parameters for outputting measurement results to other processing units or external devices. Reference: ▶ Output Parameters (Control Flow Normal) (p.837)

Settings (Control Flow Parallel)

Set communication and timeout conditions for controlling the measurement flow.

- 1 In the Item Tab area, click [Setting].
- 2 In the “Timeout” area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Use timeout	<ul style="list-style-type: none"> • [Checked] • Unchecked 	<p>If you want to clear the measurement flow wait state after a certain period of time elapses, select the “Use timeout” check box.</p> <p>This should normally be used with the check box selected.</p>
Setting time	0 to 120,000 [5,000]	<p>This item can be set when the [Use timeout] check box is selected.</p> <p>Set the time in ms after which the wait state on the processing unit is cleared.</p> <p>When a timeout is used, the wait state is cleared when the time set in “Setting time” elapses after the measurement unit starts measurement processing.</p> <p>When the wait state is cleared, the measurement flow resumes.</p>
Unit judgement in timeout	<ul style="list-style-type: none"> • [NG] • OK 	<p>This item can be set when the [Use timeout] check box is selected.</p> <p>Select whether the judgement result of the processing unit is NG or OK when the processing unit times out after the “Setting time” in measurement processing.</p>

Important

- Normally the “Use timeout” check box should be selected. When the check mark is removed from “Use timeout”, the wait state can only be cleared by executing a “Wait state clear command” from an external device.

3 In the “DO Signal Setting” area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Wait signal	<ul style="list-style-type: none"> • [Checked] • Unchecked 	<p>To use a DO signal as a Flow Command Wait signal, select the “WAIT signal” (a signal indicating that a command is available during a flow) checkbox.</p> <p>This should normally be used with the check box selected.</p>
Signal No.	DO0 to DO15 [DO0]	Set the signal that is used as a WAIT signal. The signal set here can be used as a Flow Command Wait signal.
FLG signal	<ul style="list-style-type: none"> • [Checked] • Unchecked 	<p>To use a DO signal as a Flow Command Completion signal, select the “FLG signal” (a signal indicating a flow command completion) checkbox.</p> <p>This should normally be used with the check box selected.</p>
Signal No.	DO0 to DO15 [DO1]	Set the signal that is used as the FLG signal. The signal set here can be used as a Flow Command Completion signal.

Note

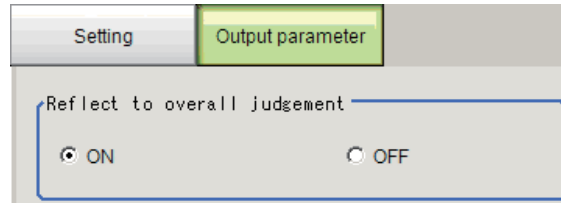
- If the same signal is set for the WAIT signal and the FLG signal, a “Same Signals are Assigned” error message will appear. Assign different signals for each.

Output Parameters (Control Flow Parallel)

You can set this item to change the output parameters.

The output parameters are the conditions and parameters for outputting measurement results to other processing units or external devices. Normally, the factory default values can be used.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Specify a value for each item.



Setting item	Setting value [Factory default]	Description
Reflect to the overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Set whether the judgement result from this processing unit is applied to the overall scene judgement.

Key Points for Test Measurement and Adjustment (Control Flow Parallel)

You can adjust the parameters while you perform test measurements and check the measurement results to increase the measurement precision and speed.

Select the adjustment method by considering the following point.

For the display of measurement results and the results that are output, check Reference: ► Measurement Results for Which Output Is Possible (Control Flow Parallel) (p.850).

Items Displayed in the Detail Result Area

The following measurement results are displayed in the “Detail result” area as text.

Displayed item	Description
Judge	Displays the judgement result for the processing unit.

Items Displayed in the Image Display Area

You can specify a sub-image number to display the next image in the image display area.

Sub image number	Description
0	The measurement image appears.

Measurement Results for Which Output Is Possible (Control Flow Parallel)

The measurement results provided by control flow parallel are shown below. The measurement results appear in the “Detail Result” area, and you can also use result output processing items to output the measurement results to an external device.

Refer to the “External Reference Tables” for the parameters that can be referenced, including measurement results.

(Reference: ► External Reference Table (Control Flow Parallel) (p.850))

Measurement item	Character string	Description
Judge	JG	The judgement result for the processing unit

External Reference Table (Control Flow Parallel)

By specifying a number, you can access the following data from processing items that support processing unit data setting/acquisition, and from control commands.

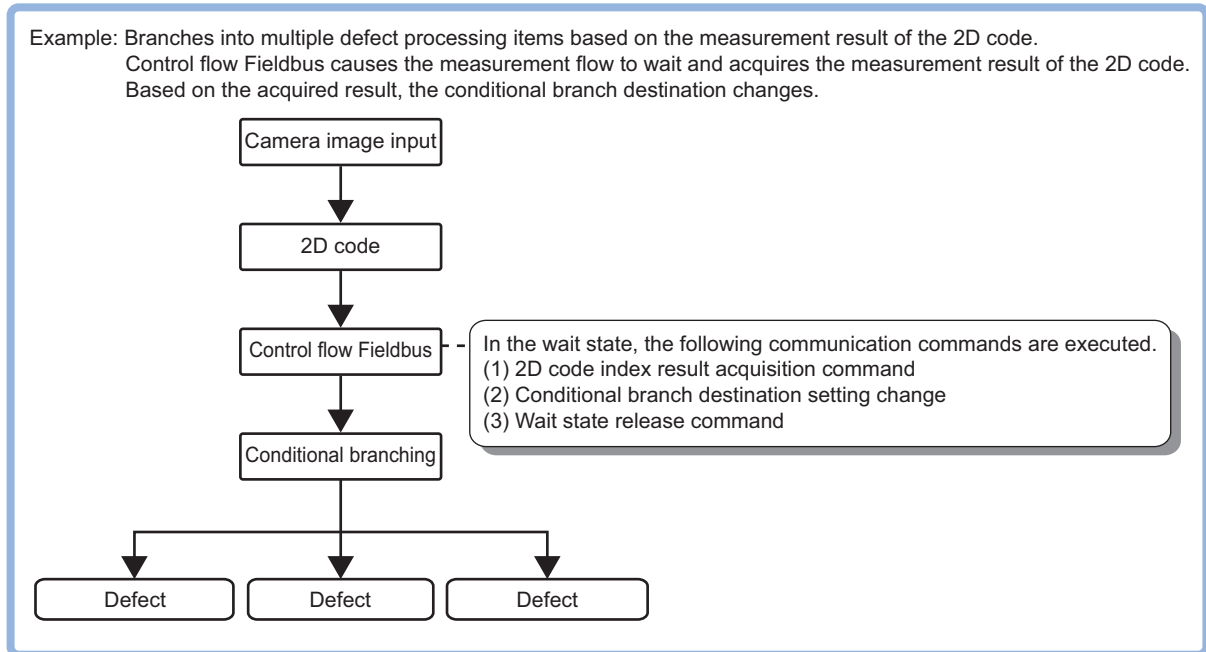
No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	State	Get only	0: Flow not stopped 1: Flow stopped
103	Reflect to the overall judgement	Set/Get	0: ON 1: OFF
120	Timeout	Set/Get	0: Not used 1: Used
121	Timeout time (ms)	Set/Get	Timeout time (0 to 120,000)
122	WAIT signal	Set/Get	0: Not used 1: Used
123	WAIT signal number	Set/Get	0 to 15
124	FLG signal	Set/Get	0: Not used 1: Used
125	FLG signal number	Set/Get	0 to 15
126	Unit judgement in timeout	Set/Get	0: NG 1: OK
5000	Wait state clear command	Set only	1: Clear the wait state

Control Flow Fieldbus

This function is used to put the currently executed measurement flow in the wait state to allow execution of a specific communication command from an external device.

Used in the Following Case

- To execute a communication command during measurement flow processing



This processing item is compatible with measurement flow control using the communication modules below.

Parallel	PLC Link	EtherNet/IP	EtherCAT	Non-procedure
NA	NA	OK	OK	NA

In the wait state, the communication commands below can be executed. For details on the communication commands, refer to Reference: ▶ “List of Commands” in “Section 3 Appendixes - Command Control” in the “Vision System FH/FZ5 Series User’s Manual for Communications Settings (Cat. No. Z342).”

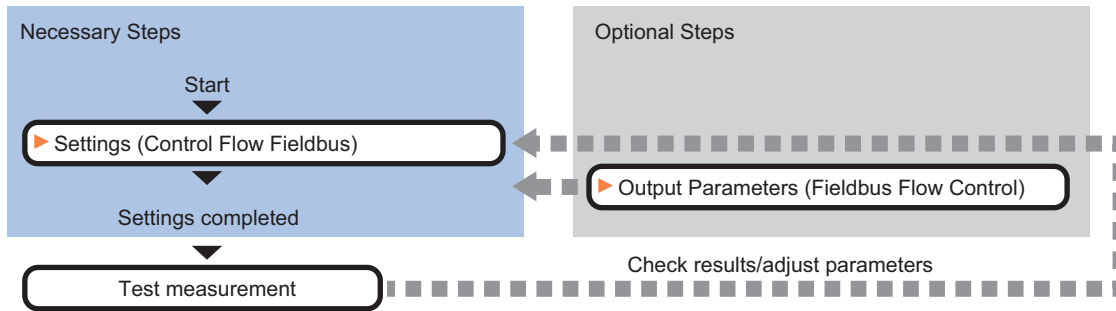
Command name	Function
Get Unit Data	Gets the parameters and measurement values of the processing unit.
Set Unit Data	Sets the parameters and measurement values of the processing unit.
Return to Start of Flow	Branches to the start of the measurement flow (processing unit 0)

To clear the wait state, use the Set Unit Data command. The wait state can be cleared by setting the “Wait state clear command” to “1” in the External Reference Table.

Reference: ▶ External Reference Table (Control Flow Fieldbus) (p.854)

Settings Flow (Control Flow Fieldbus)

Set up control flow Fieldbus according to the following steps.



List of Control Flow Fieldbus Items

The following items can be set in control flow Fieldbus.

Item name	Description
Setting	Set communication and timeout conditions for controlling the measurement flow. Reference: ▶ Settings (Control Flow Fieldbus) (p.852)
Output parameter	You can set this item to change the output parameters. Set the conditions and parameters for outputting measurement results to other processing units or external devices. Reference: ▶ Measurement Results for Which Output Is Possible (Control Flow Fieldbus) (p.854)

Settings (Control Flow Fieldbus)

Set communication and timeout conditions for controlling the measurement flow.

1 In the Item Tab area, click [Setting].

2 In the “Communication method” area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Communication method	<ul style="list-style-type: none"> • [EtherNet/IP] • EtherCAT 	Select the communication method used for controlling the measurement flow from an external device. “EtherCAT” can only be selected on the FH.

3 In the “Timeout” area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Use timeout	<ul style="list-style-type: none"> • [Checked] • Unchecked 	If you want to clear the measurement flow wait state after a certain period of time elapses, select the “Use timeout” check box. This should normally be used with the check box selected.
Setting time	0 to 120,000 [5,000]	This item can be set when the [Use timeout] check box is selected. Set the time in ms after which the wait state on the processing unit is cleared. When a timeout is used, the wait state is cleared when the time set in “Setting time” elapses after the measurement unit starts measurement processing. When the wait state is cleared, the measurement flow resumes.
Unit judgement in timeout	<ul style="list-style-type: none"> • [NG] • OK 	This item can be set when the [Use timeout] check box is selected. Select whether the judgement result of the processing unit is NG or OK when the processing unit times out after the “Setting time” in measurement processing.

Important

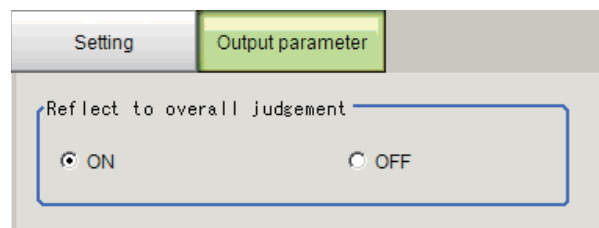
- Normally the “Use timeout” check box should be selected. When the check mark is removed from “Use timeout”, the wait state can only be cleared by executing a “Wait state clear command” from an external device.

Output Parameters (Control Flow Fieldbus)

You can set this item to change the output parameters.

The output parameters are the conditions and parameters for outputting measurement results to other processing units or external devices. Normally, the factory default values can be used.

1 Click [Output parameter] in the Item Tab area.



2 Specify a value for each item.

Setting item	Setting value [Factory default]	Description
Reflect to the overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Set whether the judgement result from this processing unit is applied to the overall scene judgement.

Key Points for Test Measurement and Adjustment (Control Flow Fieldbus)

You can adjust the parameters while you perform test measurements and check the measurement results to increase the measurement precision and speed.

Select the adjustment method by considering the following point.

For the display of measurement results and the results that are output, check Reference: ▶ Measurement Results for Which Output Is Possible (Control Flow Fieldbus) (p.854).

Items Displayed in the Detail Result Area

The following measurement results are displayed in the “Detail result” area as text.

Displayed item	Description
Judge	Displays the judgement result for the processing unit.

Items Displayed in the Image Display Area

You can specify a sub-image number to display the next image in the image display area.

Sub image number	Description
0	The measurement image appears.

Measurement Results for Which Output Is Possible (Control Flow Fieldbus)

The measurement results provided by control flow parallel are shown below. The measurement results appear in the “Detail Result” area, and you can also use result output processing items to output the measurement results to an external device.

Refer to the “External Reference Tables” for the parameters that can be referenced, including measurement results.

(Reference: ▶ External Reference Table (Control Flow Fieldbus) (p.854))

Measurement item	Character string	Description
Judge	JG	The judgement result for the processing unit

External Reference Table (Control Flow Fieldbus)

By specifying a number, you can access the following data from processing items that support processing unit data setting/acquisition, and from control commands.

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5	State	Get only	0: Flow not stopped 1: Flow stopped
103	Reflect to the overall judgement	Set/Get	0: ON 1: OFF
120	Timeout	Set/Get	0: Not used 1: Used
121	Timeout time (ms)	Set/Get	Timeout time (0 to 120,000)
122	Communication method	Set/Get	0: EtherNet/IP 1: EtherCAT

No.	Data name	Set/Get	Data range
123	Unit judgement in timeout	Set/Get	0: NG 1: OK
5000	Wait state clear command	Set only	1: Clear the wait state

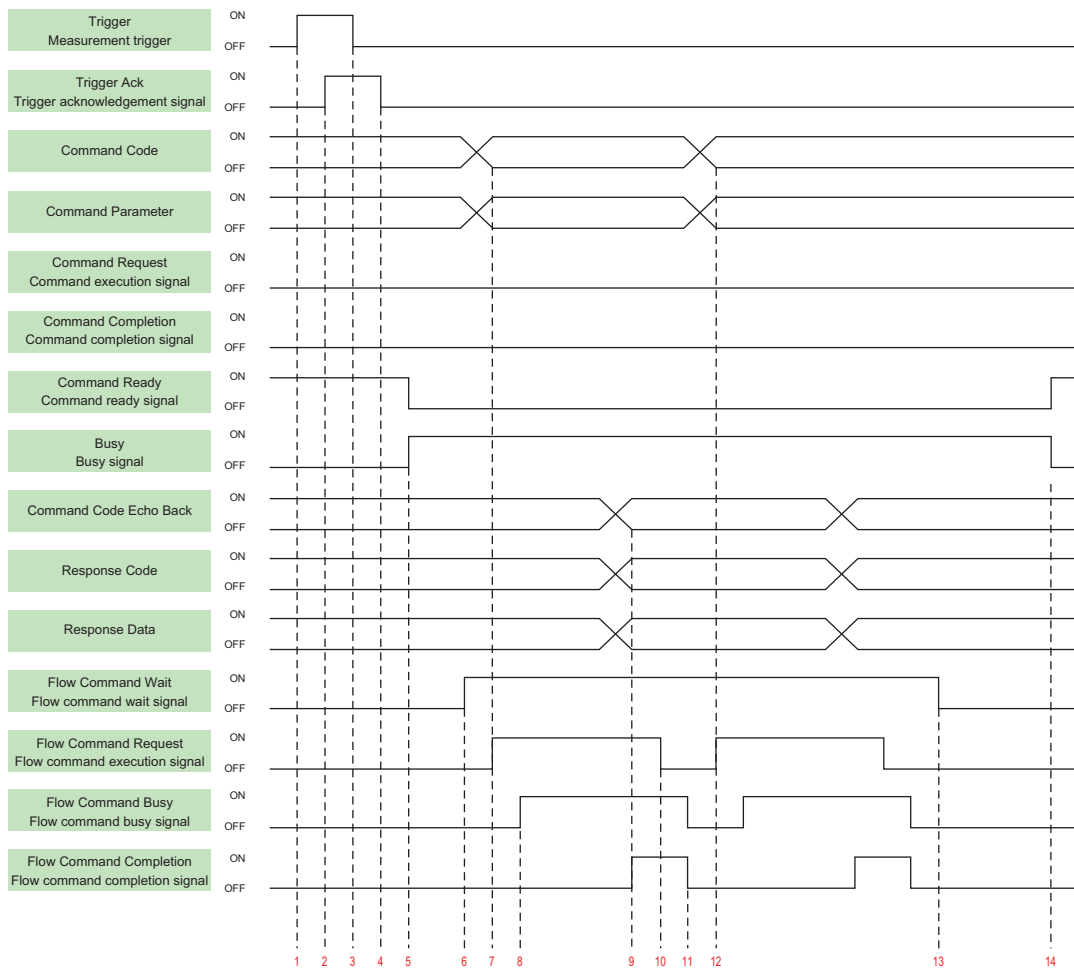
Timing Chart (Control Flow Fieldbus Flow)

To execute a command using a Control Flow Fieldbus processing item during a measurement flow, control the sensor controller paying attention to the timing of the signals from the external device. Refer to the timing chart below.

Flow Control in EtherCAT Communication

The basic timing chart when Control Flow Fieldbus is used with EtherCAT communication is shown below. EtherCAT communication can only be used on the FH.

Example: A measurement trigger is input by EtherCAT, and the Set Unit Data command is executed by Flow Control Fieldbus processing during measurement.



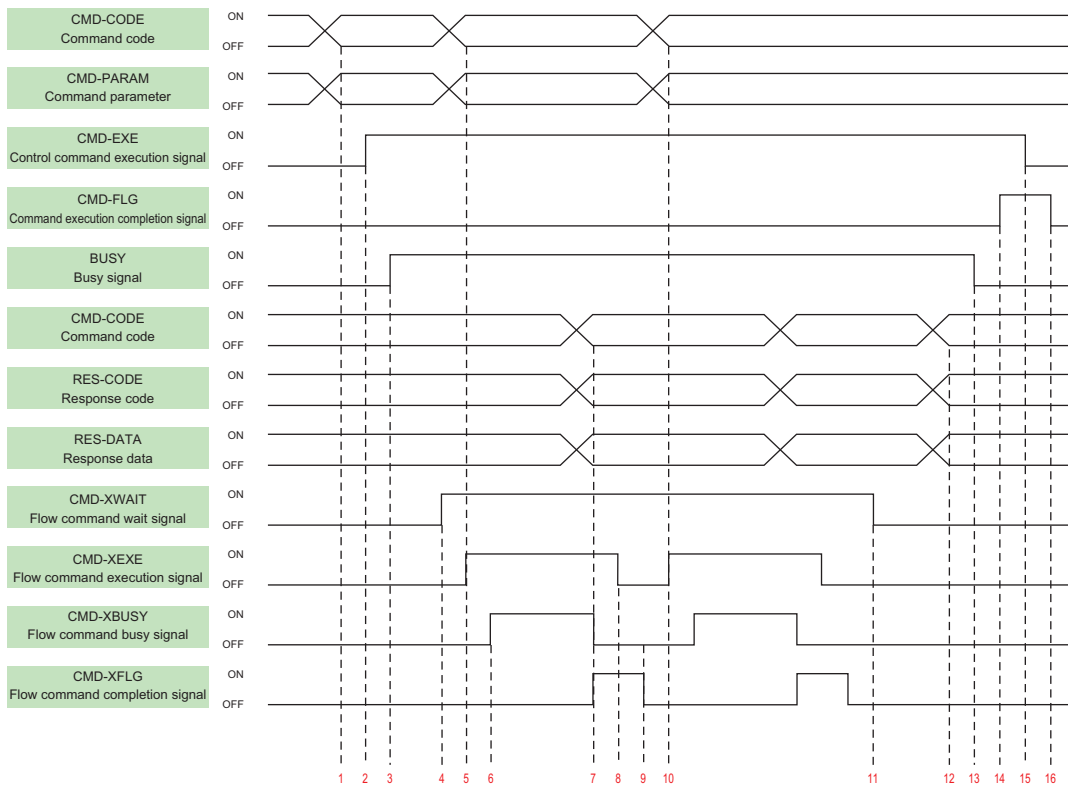
1. The controller (master) turns ON the measurement trigger signal (Trigger signal).
2. The sensor controller (slave) turns ON the trigger acknowledge signal (Trigger Ack signal).
3. The controller (slave) turns OFF the measurement trigger signal (Trigger signal).
4. The sensor controller (slave) turns OFF the trigger acknowledge signal (Trigger Ack signal).
5. The sensor controller (slave) turns ON the processing signal (Busy signal).
6. When the processing unit is executed inside the measurement flow, the sensor controller (slave) turns ON the flow command wait signal (Flow Command Wait signal).

7. The controller (master) sets the command code and command parameters to be executed during measurement, and turns ON the measuring command execution signal (Flow Command Request signal). (In the above example, this is the Set Unit Data command.)
8. The sensor controller (slave) turns ON the measuring command executing signal (Flow Command Busy signal).
9. After setting the echo back of the command code executed during measurement, the response code, and response data, the sensor controller turns ON the flow command completion signal (Flow Command Completion signal), and turns OFF the flow command busy signal (Flow Command Busy signal).
10. The controller (master) turns OFF the flow command execution signal (Flow Command Request signal). If the signal does not turn OFF within the set timeout time, the control flow advances directly to step 13.
11. The sensor controller (slave) turns OFF the measuring command completion signal (Flow Completion Busy signal).
12. The controller (master) sets the command code and command parameters to be executed during measurement, and turns ON the measuring command execution signal (Flow Command Request signal). (In the above example, the wait state is cleared by Set Unit Data command.)
After this, steps 8 through 11 are performed.
13. When the processing unit finishes measurement processing, the sensor controller (slave) turns OFF the measuring command standby signal (Flow Command Wait signal).
14. When execution of the measurement flow ends, the sensor controller (slave) turns OFF the Command executing signal (Busy signal).

Flow Control in EtherNet/IP Communication

The basic timing chart when Control Flow Fieldbus is used with EtherNet/IP communication is shown below.

Example: The measurement command is executed by EtherNet/IP, and the Set Unit Data command is executed by Flow Control Fieldbus processing during measurement.



1. Set the command code and command parameters to be executed by the user (PLC). (In the above example, this is the measurement command.)
2. The user (PLC) turns ON the control command execution signal (EXE signal).
3. The sensor controller turns ON the processing busy signal (BUSY signal).
4. When the processing unit is executed inside the measurement flow, the sensor controller turns ON the measuring command standby signal (XWAIT signal).
5. The user (PLC) sets the command code to be executed during measurement and the command parameters, during measurement, and turns ON the measuring command execution signal (XEXE signal). (In the above example, this is the Set Unit Data command.)
6. The sensor controller turns ON the measuring command executing signal (XBUSY signal).
7. After setting the command code executed during measurement, the response code, and response data, the sensor controller turns ON the flow command completion signal (XFLG signal), and turns OFF the measuring command executing signal (XBUSY signal).
8. The user (PLC) turns OFF the flow command execution signal (XEXE signal). If the signal does not turn OFF within the set timeout time, the control flow advances directly to step 14.
9. The sensor controller turns OFF the measuring command completion signal (XFLG signal).
10. The user (PLC) sets the command code to be executed during measurement and the command parameters, during measurement, and turns ON the measuring command execution signal (XEXE signal). (In the above example, this is clearing of the wait state by the Set Unit Data command.)
After this, steps 6 through 9 are performed.
11. When the processing unit finishes measurement processing, the sensor controller turns OFF the measuring command standby signal (XWAIT signal).
12. The sensor controller sets the executed command code, response code, and response data.
13. The sensor controller turns OFF the command executing signal (BUSY signal).
14. The sensor controller turns ON the command completion signal (FLG signal).
15. The user (PLC) turns OFF the command execution signal (EXE signal).
16. The sensor controller turns OFF the command completion signal (FLG signal).

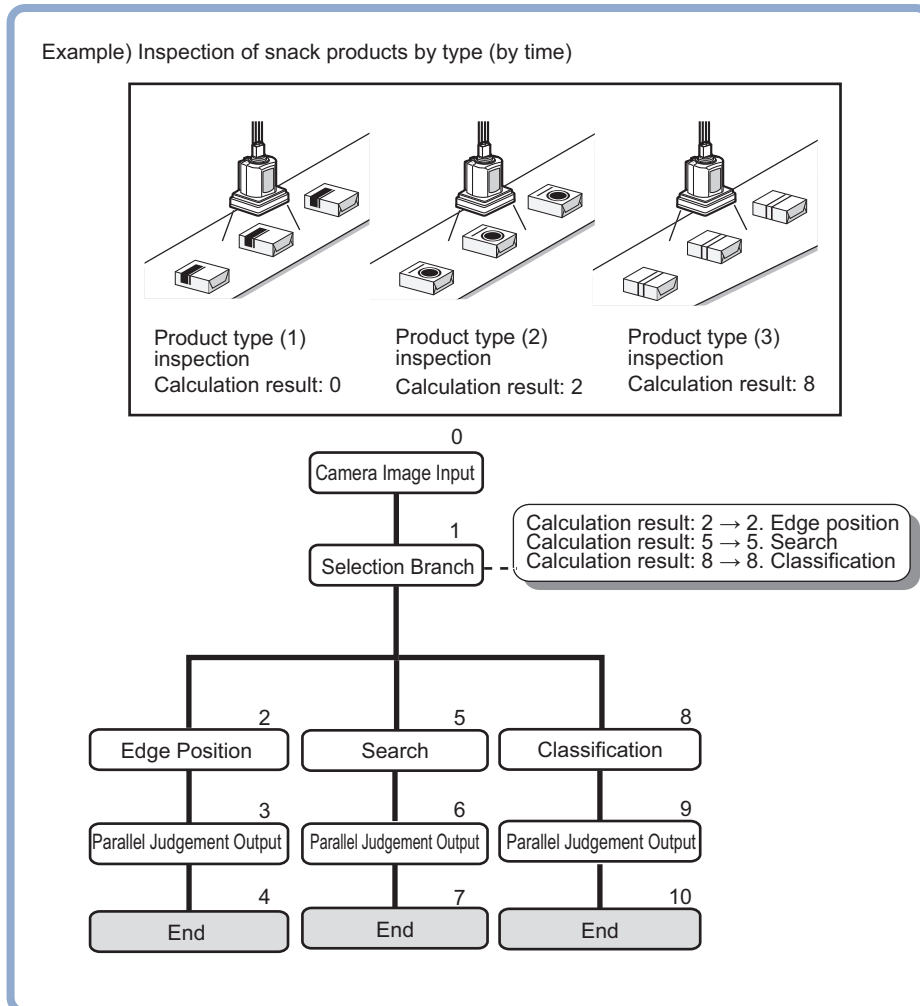
Selective Branch

The calculation and selection value are set, and based on the matching results of the calculation result and selection value, they branch out from this processing item.

Up to 32 branch destinations can be set.

Used in the Following Case

- When products on one production line are to be inspected according to a time interval



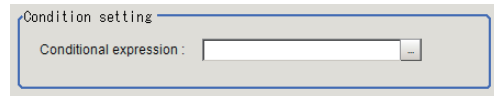
List of Selective Branch Items

Item name	Description
Selective Branch	This item sets the branch conditions. Reference: ▶ Selective Branch (Selective Branch) (p.859)
Output parameter	This item can be changed if necessary. Normally, the factory default value will be used. Reference: ▶ Output Parameter (Selective Branch) (p.860)
Timeout	Set the conditions under which the branching processing times out. Reference: ▶ Timeout (Selective Branch) (p.860)

Selective Branch (Selective Branch)

This item sets the branch conditions. Up to 32 branch destinations can be set. Branch destinations can be easily enabled or disabled using the checkboxes. Only set the necessary items.

- 1 In the Item Tab area, click [Selective Branch].
- 2 In the "Condition setting" area, set the expression of the condition to branch.

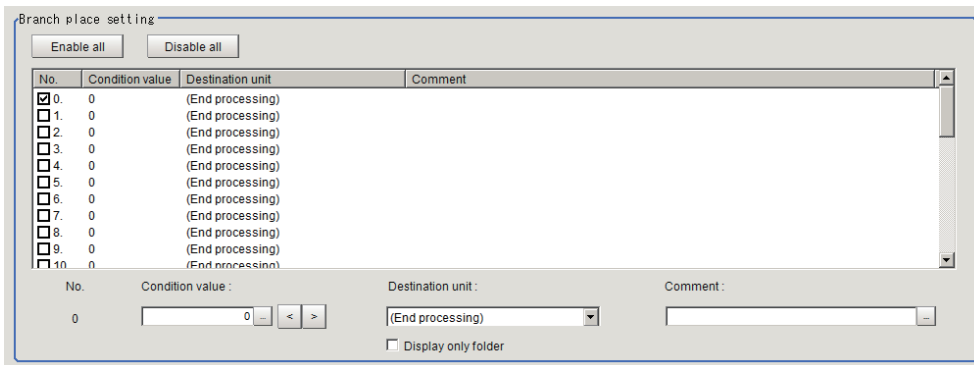


Condition setting

Conditional expression :

- 3 In the "Branch place setting" area, click the number of the branch destination that will set the condition to branch.

Clicking [Enable all] will enable all branch destinations.
Clicking [Disable all] will enable all branch destinations.



Branch place setting

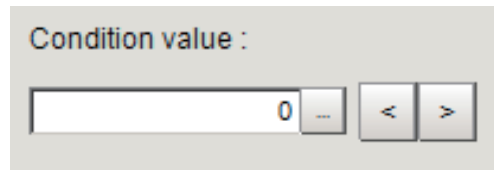
No.	Condition value	Destination unit	Comment
<input checked="" type="checkbox"/> 0	0	(End processing)	
<input type="checkbox"/> 1	0	(End processing)	
<input type="checkbox"/> 2	0	(End processing)	
<input type="checkbox"/> 3	0	(End processing)	
<input type="checkbox"/> 4	0	(End processing)	
<input type="checkbox"/> 5	0	(End processing)	
<input type="checkbox"/> 6	0	(End processing)	
<input type="checkbox"/> 7	0	(End processing)	
<input type="checkbox"/> 8	0	(End processing)	
<input type="checkbox"/> 9	0	(End processing)	
<input type="checkbox"/> 10	0	(End processing)	

No. Condition value : Destination unit : Comment :

0 (End processing)

Display only folder

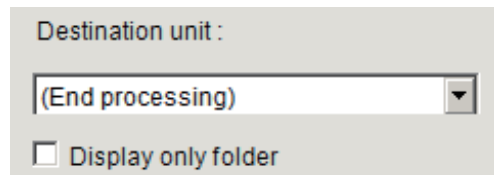
- 4 Click [] or [, or click [, in [Condition value] to set the selection value.



Condition value :

- 5 Click [] in [Destination unit] and select the destination unit.

If [Display only folder] is checked, only the folder first unit will be set.




Destination unit :

(End processing)

Display only folder

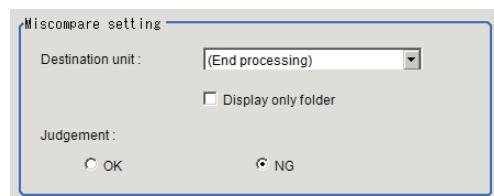
- 6 Click [, in [Comment] to enter a comment.



Comment :

- 7 Click [] in [Destination unit] in the "Miscompare setting" area and set the destination unit.

If [Display only folder] is checked, only the folder first unit will be set.



Miscompare setting

Destination unit : (End processing)

Display only folder

Judgement :

OK NG

- 8 Select [Judgement].
- 9 Click [OK].

Output Parameter (Selective Branch)

Specifies whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

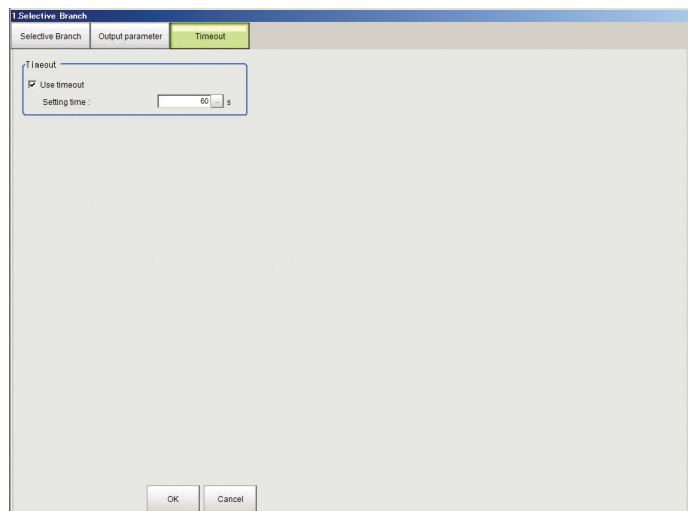
- 1 Click [Output parameter] in the Item Tab area.
- 2 Select the "Reflect to overall judgement".

Setting item	Setting value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none"> • [ON] • OFF 	Specify whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

Timeout (Selective Branch)

Set the conditions under which the branching processing times out.

- 1 In the Item Tab area, click [Timeout].



- 2 In the "Timeout" area, specify a value for each item.

Setting item	Setting value [Factory default]	Description
Use timeout	<ul style="list-style-type: none"> • Unchecked • [Checked] 	Click on the [Use timeout] checkbox to turn it ON if you want the selective branching to time out after a set amount of time passes.
Setting time	1 to 3600 [60]	This can be set when the "Use timeout" checkbox is selected. Set the length of time until the measurement process times out on the selected processing unit in seconds. When the measurement process for this processing unit is executed, a timeout occurs once the amount of time that passes since the start of the measurement exceeds the set [Setting time]. If a timeout occurs to disrupt the measurement process, the judgement results in NG.

Important

- Normally the “Use timeout” check box should be selected. Unchecking the [Use timeout] checkbox may cause the measurement flow to become stuck in an infinite loop when measurements are started depending on the selective branching settings.
- If using selective branching within the block for the parallelization task in the measurement flow, set it up so that branching occurs only within the relevant block for the parallelization task. Attempting to introduce conditional branching across blocks for the parallelization task may cause the timeout function to stop working even with the [Use timeout] checkbox checked.

Key Points for Adjustment (Selective Branch)

Select the adjustment method referring to the following points.

When the system freezes after executing the measurement

Parameter to be adjusted	Troubleshooting
Selection branch	An infinite loop occurs when the branch destination unit is incorrect. In order to avoid a measurement processing looping, for the branch destination, set a processing unit number that is after the [Selection branch].

When measurement processing of an unintended unit is executed

Parameter to be adjusted	Troubleshooting
-	If [End] is not registered at the end of a branch, the processing in the scene will continue to move to the next unit No. even if the branch has been completed. Make sure to set "End" at the last branch destination.

When the judgement results (JG) of the unit within the flow is updated or not updated

Parameter to be adjusted	Troubleshooting
-	The system is designed this way. For results other than the unit's judgement results (JG), the measurement result during the previous pass is retained. The JG for units that do not pass through the condition branch becomes unmeasured (0). Note, however, that the unit JG becomes unmeasured at the point in time when all the measurement processing ends. During flow processing, the previous time judgement (JG) is retained.

Measurement Results for Which Output Is Possible (Selective Branch)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Condition No	JN	Condition number that matches the selection condition expression result
Destination	BU	Branch destination unit number of the condition that matches the selection condition expression result
Conditional expression	DJ	Expression result of the selection conditional expression

External Reference Tables (Selective Branch)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG -10: Error(image format mismatch) -11: Error(unregistered model) -12: Error(insufficient memory) -20: Error(other errors)
5	Condition No.	Get only	-1 to 31
6	Branch place	Get only	-1 to 9,999
7	Conditional expression	Get only	-
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Miscompare branch place	Set/Get	-1 to 9,999
121	Miscompare judgement	Set/Get	0: NG 1: OK
122	Condition value judge	Set/Get	Exp. character string
123	Timeout	Set/Get	0: Not used 1: Used
124	Timeout time[s]	Set/Get	1 to 3,600
130 + N × 10 (N = 0 to 31)	Destination unit No. N	Set/Get	-1: Complete processing 0 to 9999: Unit No.
131 + N × 10 (N = 0 to 31)	Condition value N	Set/Get	-9,999 to 9,999
132 + N × 10 (N = 0 to 31)	Comment N	Set/Get	Character string
133 + N × 10 (N = 0 to 31)	Validation Flag N	Set/Get	0: No validation 1: Validation

Output result

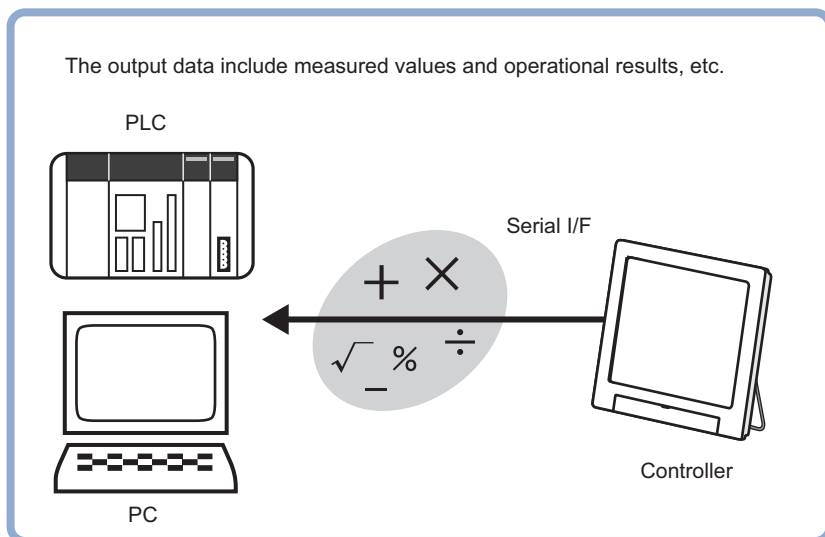
This chapter describes setting methods for when measurement results are output to the external devices.

Data Output	864
Parallel Data Output	865
Parallel Judgement Output.....	866
Fieldbus Data Output	867

Data Output

Used in the Following Case

- Output data to the external devices such as programmable controller and PC with the no-order mode via the serial interface. With serial data output, output starts immediately after the end of processing of serial data output in the flow.

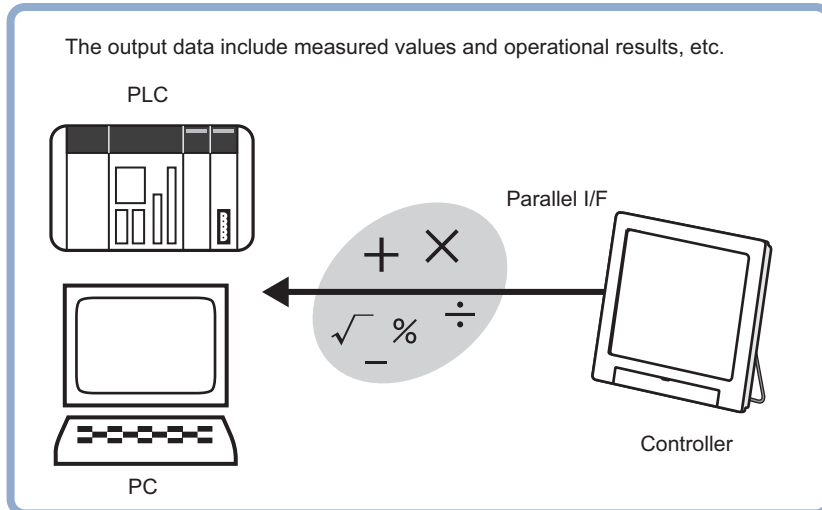


Reference: ▶ The settings for the serial data output, refer to "Chapter 2 Methods for Connecting and Communicating with External Devices" in the "Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342)"

Parallel Data Output

Used in the Following Case

- Used when outputting data to external devices such as a programmable controller or a PC via the parallel interface.

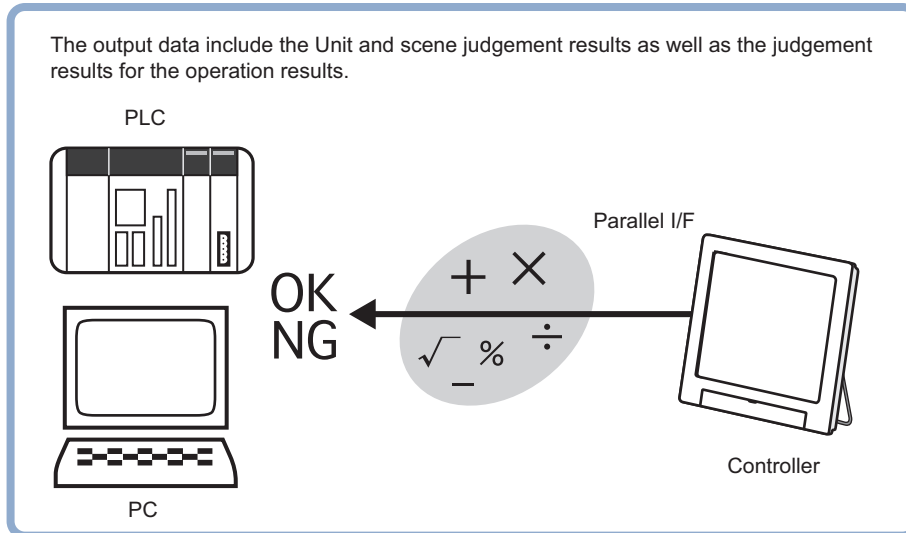


Reference: ▶ The settings for the parallel data output, refer to "Chapter 2 Methods for Connecting and Communicating with External Devices Parallel Communications" in the "Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342)"

Parallel Judgement Output

Used in the Following Case

- Used when outputting judgement results to external devices such as a programmable controller or PC via the parallel interface.

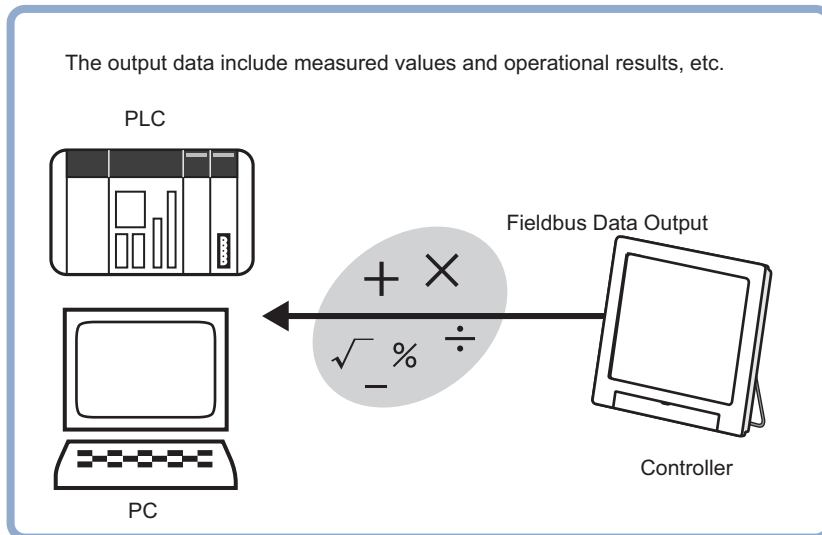


Reference: ▶ The settings for the parallel judgement output, refer to "Chapter 2 Methods for Connecting and Communicating with External Devices Parallel Communications" in the "Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342)"

Fieldbus Data Output

Used in the Following Case

- Used when outputting data to an external device, such as a programmable controller, via the Fieldbus interface.



Reference: ▶ The settings for the Fieldbus data output, refer to "Chapter 2 Methods for Connecting and Communicating with External Devices EtherCAT Connections (FH Only) / Communicating with EtherNet/IP" in the "Vision System FH/FZ5 Series User's Manual for Communications Settings (Z342)"

Display result

This chapter describes how to display strings and figures in the window that displays the measurement results.

Result Display	870
Display Image File	875
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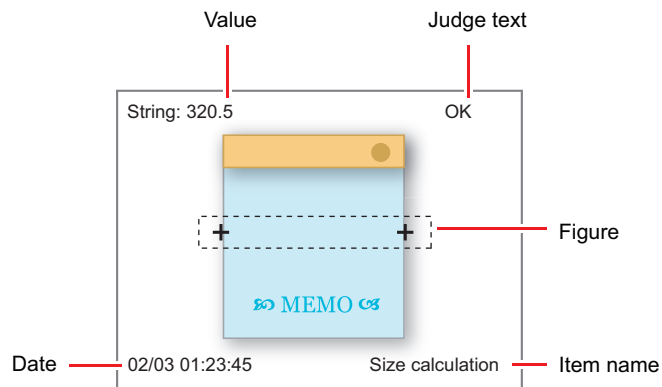
Result Display

Used in the Following Case

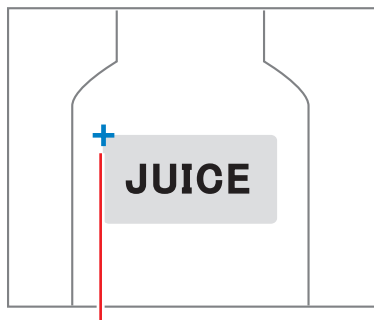
For your convenience in verifying measurement results, text and figures will be displayed in the "Image display" area.

The following content can be displayed.

Example) Displaying options, such as Display string, Display value, Display judge, Display item name, Display date, on screen.



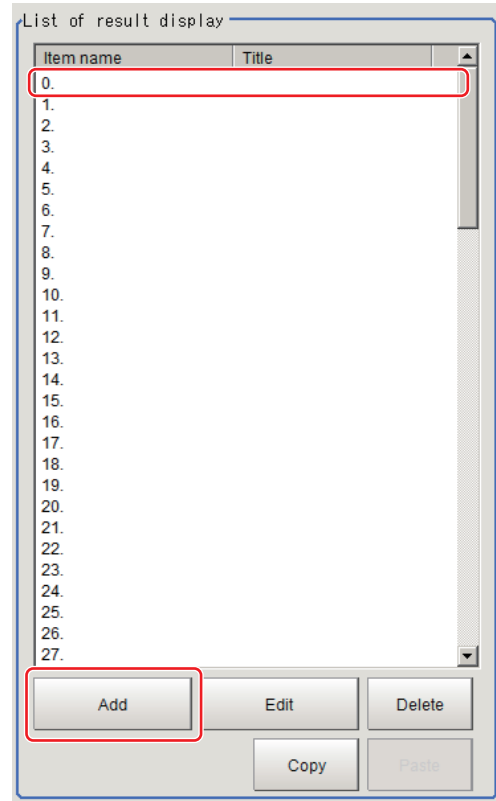
Example) Display the cross-shaped cursor at the measured position of the label.



Display the cross-shaped cursor at the measured position.

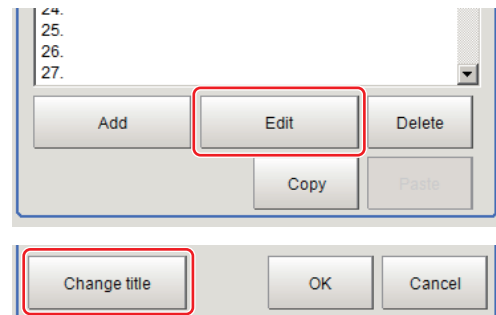
Result Display

- 1 In the "List of result display" area, select the number with which to set the object and click [Add].



- 2 Select the object to be added in the Select Items to Display window and click [OK].
The selected object is added to the "List of result display" area and the Image Display area.
- 3 In the "List of result display" area, select the object and click [Edit].

Setting options are displayed. The setting items are different depending on the object.



- 4 Click [Change title] as necessary to change titles displayed in the list of result display.

Up to 31 characters can be entered.

When Display Rectangle, Line, Circle, Ellipse, Arc, Cursor Display or Display Cross Line Is Selected

Specify display position, style, width, and color of figure.

Setting item	Setting item	Description
Display position Disp pos	Figure (or Numerical)	Select this if you would like the figure to always display in the same location. Methods for specifying display position include drawing the figure on the window and indicating coordinates numerically. If you would like to always display the figure in a reference position, set up an expression using "Operation".
	Operation	Select this when you would like to change display position for each measurement based on the measured value. Set up the expression to specify the display position.

Setting item	Setting item	Description
Style	<ul style="list-style-type: none"> • Solid line • Dashed line 	Select the line type.
Width	1 to 10	Modify the line width.
Color	OK Color	Displayed in green.
	NG Color	Displayed in red.
	Judgement	Displayed using OK color or NG color based on the judgment results. Specify measurement values subject to judgment and set up respective judgment conditions.
	Arbitrary color	Displayed using specified color. Methods for specifying color include specifying by clicking on a color chart and specifying RGB values.

Display cross line

Setting item	Setting item	Description
Scale display	-	Place a check to show the scale.
Unit	<ul style="list-style-type: none"> • [Calibration] • Pixels 	Select the unit used when grids are displayed.
Interval	0.0000 to 9999.9999 [50.0000]	Set the intervals of the scale on the grids.
Line length	0.0000 to 9999.9999 [10.0000]	Set the length of the scale line on the grids.

When Display String, Value, Item name, Judge, Date or Display Unit string Is Selected

Sets display position, size, and color etc. of characters.

Common settings

Setting item	Setting item	Description
Display position	Figure (or Numerical)	Select this if you would like the figure to always display in the same location. Methods include specifying by clicking on the window and specifying coordinate values. However, if you would like to always display the figure in a reference position, set an expression using "Operation".
	Operation	Select this when you would like to change display position for each measurement based on the measured value. Set up the expression to specify the display position.

Detail

Setting item	Setting item	Description
Align	<ul style="list-style-type: none"> • Top • Bottom • Left • Center • Right 	Specify the alignment of the text.
Size	10 to 200	Specify the font size.
Angle	0 to 359	Specify the display angle.

Setting item	Setting item	Description
Style	<ul style="list-style-type: none"> • Bold • Italic • Under line • Mark out 	Specify the character decoration.
Color	OK Color	Displayed in green.
	NG Color	Displayed in red.
	Judgement	Displayed using OK color or NG color based on the judgment results. Specify measurement values subject to judgment and set up respective judgment conditions.
	Arbitrary color	Displayed using specified color. Methods for specifying color include specifying by clicking on a color chart and specifying RGB values.

Display string

Setting item	Description
Set letter	Set characters within 64 characters.

Display judge

Setting item	Description
Judge type	Specify measurement values subject to judgment and set up respective judgment conditions. Displays using OK letter or NG letter based on the judgment results.
Judgement condition	
OK letter	Sets characters displayed for the case that judgment results are OK.
NG letter	Sets characters displayed for the case that judgment results are NG.

Display date

Setting item	Setting item	Description
Date kind	<ul style="list-style-type: none"> • Month/Day/Hour/Minute/Second • Month/Day/Hour/Minute • Hour/Minute/Second • Hour/Minute 	Select display format Please adjust the calendar time that comes with the controller in advance. Reference: ▶"Chapter 6 Changing the System Environment Setting the System Operation Environment Setting the Date and Time [Date-time Setting]" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

Display value

Setting item	Setting item	Description
Measurement	-	Specify the measurement value you would like to display using expression.
Digits of integer	1 to 10	Specify the digits of the integer part including the sign. For positive numbers, the plus sign is not output. Example Setting: 4 digits, data -5619 -999 is output.
Decimal	0 to 4	Set the number of decimal fraction digits. Decimals are rounded up and output. When 0 is selected, the decimal digits will be rounded off.

Display item name

Setting item	Description
Processing item	Choose processing item name from among the scenes being displayed.

Display Unit String

Setting item	Description
Item	Select the processing item name from among the scenes being displayed. Processing items for barcode, 2D code, and character inspection can be selected.
Set unit string	Select a character string contained in the selected processing item name. <ul style="list-style-type: none"> • Character inspection: Reading string, verification string • Barcode : Reading string, comparison string, error output character string • 2D code : Reading string, comparison string, error output character string
String range specify	Place a check to set the display range of character string. Specify a number in the range of 1 to 999.

When Display unit graphic is Selected

Specify unit number and image number.

Display unit graphic

Setting item	Setting value [Factory default]	Description
processing item	0 to 9999 [0]	Select the processing item name from among the scenes being displayed.
Sub number	-1 to 99 [0]	Select the sub image number you want to display for the selected processing item.

Toggling between Show/Hide by judgement

Show/Hide can be toggled by judgement.

Setting item	Setting item	Description
Display condition	<ul style="list-style-type: none"> • [Always display] • Only OK display • Only NG display 	Place a check to show the scale.
Judge exp.	-	Set an expression to determine whether it is OK or NG.
Judge condition	-999999999.99999 to 999999999.99999	Specify the range where the measurement result is judged to be OK.

External Reference Tables (Result Display)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK

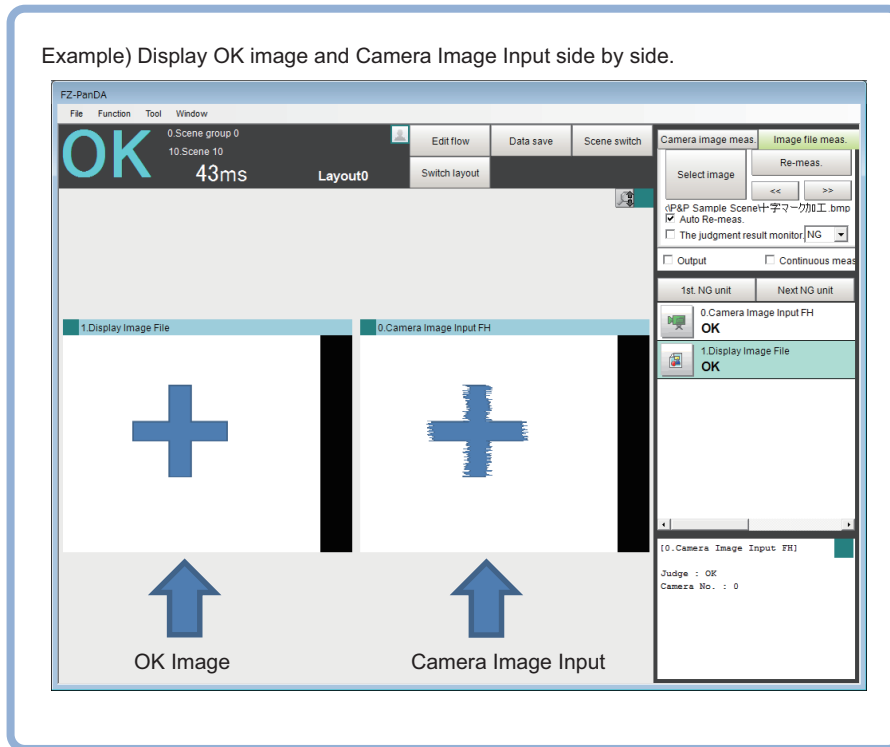
Display Image File

Displays image files in the external memory device, i.e. USB memory or RAMDisk.

Used in the Following Case

- Use when you want to display camera input images to be used as reference or work images that are OK or NG (Judgment is Passed or Failed).

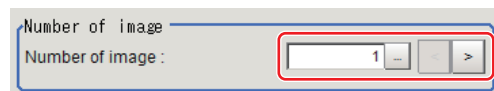
Example) Display OK image and Camera Image Input side by side.



Select Image (Display Image File)

- 1 Set the number of image files to be registered.

Up to 4 images can be selected by entering [Number of image]

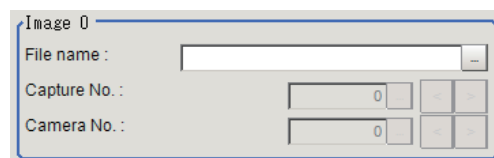


- 2 Specify image to be displayed.

If [System Settings]-[Logging setting]-[Multiple image logging] is set to [ON] and there are multiple images in an image file, an image can be selected by entering the [Capture No.]^{*1} and [Camera No.]

*1: Input the number of Camera input image to [Capture No.].

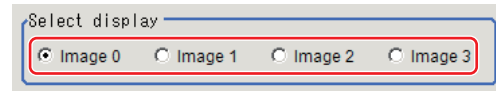
Reference: ▶ "Appendixes Image file" in the *Vision Sensor FH/FZ5 Series Vision System User's Manual* (Z365)



Important

- Only image logging files (ifz format) and BMP format image files for which the region size is 1600 × 1200 or less can be specified.

3 Select the image to be displayed on the Properties Dialogue Box.



Important

- The images in image file 0 to 3 can be displayed by specifying the sub image number on the RUN window/ ADJUST window.
Reference: ▶"Chapter 3 Performing Test Measurement/Starting Operation Arranging the Window Changing Display Contents, such as Image Mode" in the "Vision System FH/FZ5 Series User's Manual (Z365)"

4 Click [OK].

The settings are finalized.

Key Points for Test Measurement and Adjustment (Display Image File)

The following content can be confirmed in the "Detail result" area using text.

Displayed item	Description
Judge	Judgement result

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image number.	Explanation of image to be displayed
0	Image 0
1	Image 1
2	Image 2
3	Image 3

External Reference Tables (Display Image File)

No.	Data name	Set/Get	Data range
120	Number of files	Set/Get	1 to 4
121	Camera No. [0]	Set/Get	0 to 3
122	Camera No. [1]	Set/Get	0 to 3
123	Camera No. [2]	Set/Get	0 to 3
124	Camera No. [3]	Set/Get	0 to 3
125	File name [0]	Set/Get	Character string
126	File name [1]	Set/Get	Character string
127	File name [2]	Set/Get	Character string
128	File name [3]	Set/Get	Character string
129	Capture No. [0]	Set/Get	0 to 9999 (maximum depend on image file)
130	Capture No. [1]	Set/Get	0 to 9999 (maximum depend on image file)
131	Capture No. [2]	Set/Get	0 to 9999 (maximum depend on image file)
132	Capture No. [3]	Set/Get	0 to 9999 (maximum depend on image file)

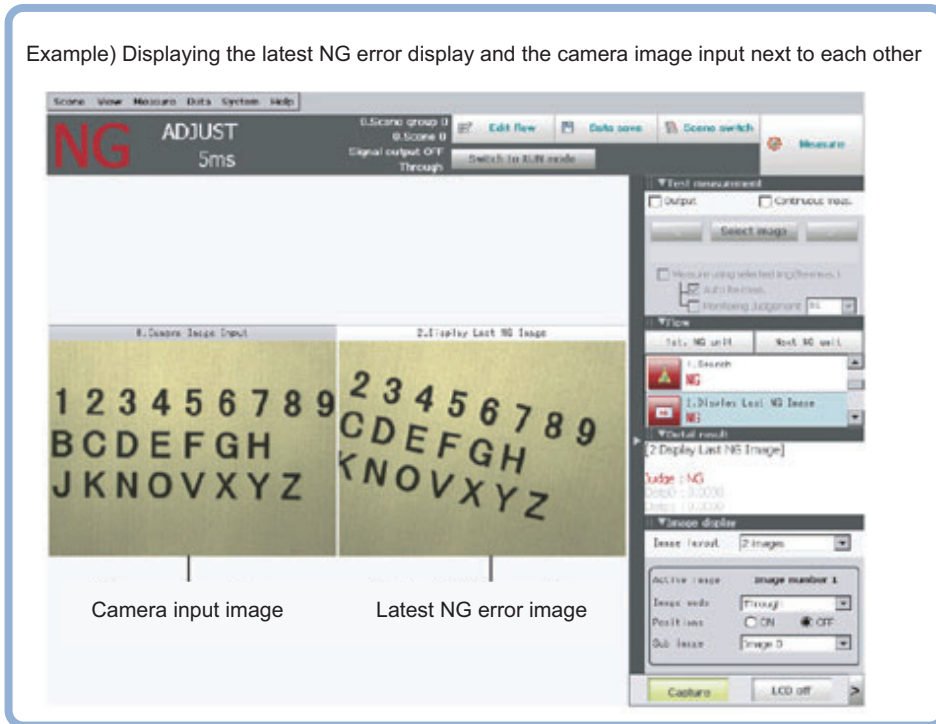
Display Last NG Image

You can store the Specified the measurement image of Processing Unit, maximum 4 images, or specified data by arithmetic expression. Since the stored images or data are remained even if you operate the window.

Used in the Following Case

- Image and data for NG case are saved.

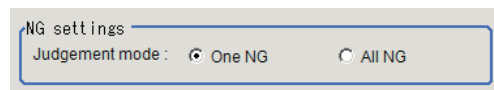
Example) Displaying the latest NG error display and the camera image input next to each other



NG Error Judgement (Display Last NG Image)

Sets conditions for NG judgement.

- 1 Click [Judge NG] in the Item Tab area.
- 2 Set the judgment mode in the NG settings area.

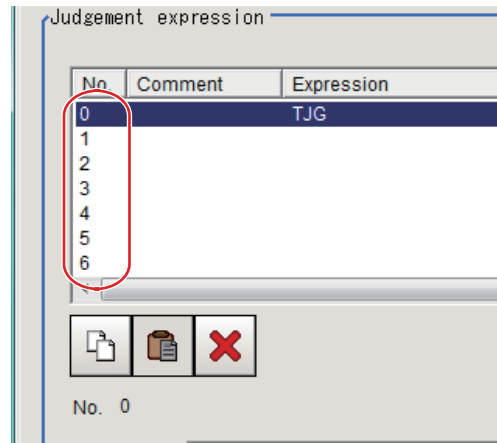


Setting item	Set value [Factory default]	Description
Judgement mode	[One NG]	The image is saved even if only one of the judgment criteria set using "Judgment expression" has a judgment of NG.
	All NG	The image is saved if all of the judgment criteria set using "Judgment expression" have a judgment of NG.

Expression Settings

The measurement details used for NG judgment are set up using an expression.

- 1 Click [No.] to set the expression on the [Judgement expression] area.



The No. selected will be displayed below the list.

- 2 Click [...] for the expression and set the expression.

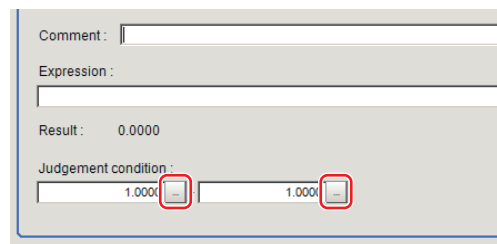
An expression setting window appears.

- 3 After setting up the expression, click [OK].

The expression is confirmed.

- 4 Click [...] for Comment and input an explanation of the expression as necessary.

- 5 Set up the judgement upper limit and the judgement lower limit for "Judgement".



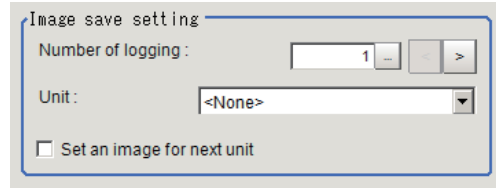
Setting item	Setting value [Factory default]	Description
Judgement condition	-999999999.9999 to 999999999.9999	This is a judgement condition for the expression. Set upper and lower limits for judging as OK.

- 6 Repeat the Reference: ▶ 1 (p.878) to Reference: ▶ 6 (p.878) and set up the expression.

Image Saving (Display Last NG Image)

Specifies the target unit to be saved and number of times images are saved when an NG occurs.

- 1 Click [Image save] in the Item Tab area.
- 2 Specify each of the following items.



Setting item	Set value [Factory default]	Description
Number of logging	[1] to 4	Sets the number of NG images that are saved. A maximum of 4 NG images consisting of Last NG, Last 1 NG, Last 2 NG, Last 3 NG can be saved.
Unit	-	Specifies target processing unit for saving image. Select the unit (camera input image, image with pre-processing or position compensation) with the image you would like to save. Please select a unit from earlier than the unit being processed as the target unit.
Set an image for next unit	<ul style="list-style-type: none"> • Checked • [Unchecked] 	Check when using an image acquired by a processing unit after this unit.

3 Set up the expression.

Reference: ► Expression Settings (p.878)

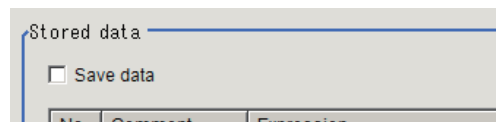
Note

- Saved images are stored in Sub-image number 0 to 3.
Details of Sub-images are the following:
0: Last NG
1: Previous NG image
2: NG error image from 2 previous
3: NG error image from 3 previous
To display Sub-image number, refer to the ► Chapter 3 Performing Test Measurement/Starting Operation Arranging the Window Changing Display Contents, such as Image Mode in the Vision System FH/FZ5 Series User's Manual (Z365).

Data Saving (Display Last NG Image)

Sets data to be saved when NG occurs.

- 1 Click [Saving data] in the Item Tab area.
- 2 Specify each of the following items.



Setting item	Set value [Factory default]	Description
Save data	<ul style="list-style-type: none"> [Unchecked] Checked 	Check when saving measurement data using an expression when NG occurs. In conjunction with the number of saves, a maximum of 4 items of measurement data from Last NG, Last 1 NG, Last 2 NG, Last 3 NG can be saved for one expression. Please set the expression to reference a unit prior to the unit currently being processed.

3 Set up the expression.

Reference: ► Expression Settings (p.878)

4 Set up the judgement condition.

Note

- For stored data, refer to *Measurement Results for Which Output Is Possible (Display Last NG Image)* on p.881.

Output Parameters (Display Last NG Image)

Specifies whether or not the judgement results of this processing unit is reflected in the scene overall judgement.

- 1 Click [Output parameter] in the Item Tab area.
- 2 Choose whether or not to reflect the judgement result in the scene overall judgement in "Reflect to overall judgement" area.

Setting item	Set value [Factory default]	Description
Reflect to overall judgement	<ul style="list-style-type: none">• [ON]• OFF	Enables choosing whether or not the judgment results of this processing unit is reflected in the scene overall judgment.

Key Points for Test Measurement and Adjustment (Display Last NG Image)

The following content is displayed in the "Detail result" area as text.

Displayed items	Description
Data 0 comment	Expression result of Expression 0
Data 1 comment	Expression result of Expression 1
Data 2 comment	Expression result of Expression 2
Data 3 comment	Expression result of Expression 3
Data 4 comment	Expression result of Expression 4
Data 5 comment	Expression result of Expression 5
Data 6 comment	Expression result of Expression 6
Data 7 comment	Expression result of Expression 7
Data 8 comment	Expression result of Expression 8
Data 9 comment	Expression result of Expression 9
Data 10 comment	Expression result of Expression 10
Data 11 comment	Expression result of Expression 11
Data 12 comment	Expression result of Expression 12
Data 13 comment	Expression result of Expression 13
Data 14 comment	Expression result of Expression 14
Data 15 comment	Expression result of Expression 15

The image specified in the Sub-image number in image display setting is displayed in the image display area.

Sub image number.	Explanation of image to be displayed
0	Last NG
1	Previous NG error image (Displayed when there are 2 or more saved images. Otherwise, "Last NG" is displayed.)
2	NG error image from 2 previous (Displayed when there are 3 or more saved images. Otherwise, "Last NG" is displayed.)
3	NG error image from 3 previous (Displayed when there are 4 or more saved images. Otherwise, "Last NG" is displayed.)

Measurement Results for Which Output Is Possible (Display Last NG Image)

The following values can be output using processing items related to results output. It is also possible to reference measurement values from expressions and other processing units.

Measurement items	Character string	Description
Judge	JG	Judgement result
Judge data 00 to 07	JD 00 to 07	Calculation data 00 to 07 for inclusion 0
Judge judge 00 to 07	JJ 00 to 07	Calculation judgment 00 to 07 for inclusion 0
Last NG data 00 to 15	D000 to 15	NG data 00 to 15
Last NG judge 00 to 15	J000 to 15	Judge NG 00 to 15
Last 1 NG data 00 to 15	D100 to 15	Last N NG data 00 to 15
Last 1 NG judge 00 to 15	J100 to 15	Last N NG judge 00 to 15
Last 2 NG data 00 to 15	D200 to 15	Last N NG data 00 to 15
Last 2 NG judge 00 to 15	J200 to 15	Last N NG judge 00 to 15
Last 3 NG data 00 to 15	D300 to 15	Last N NG data 00 to 15
Last 3 NG judge 00 to 15	J300 to 15	Last N NG judge 00 to 15

External Reference Tables (Display Last NG Image)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
5 to 12	Judge data N (N = 0 to 7)	Set/Get	-999999999.9999 to 999999999.9999
13 to 20	Judge judge N (N = 0 to 7)	Set/Get	0: No judgement (unmeasured) 1: Judgement result OK -1: Judgement result NG
103	Reflect to overall judgement	Set/Get	0: ON 1: OFF
120	Judgement mode	Set/Get	0: One NG 1: All NG
121	Save type	Set/Get	0: Image 1: Image + data
122	Number of logging	Set/Get	1 to 4
123	Target processing unit number	Set/Get	-1 to 9999 -1: Save the image of itself
124	Image memory setting flag	Set/Get	0: OFF 1: ON
140 to 147	Condition exp N (N = 0 to 7)	Set/Get	Exp character string for inclusion processing unit 0
148 to 163	Upper limit of condition calculation M (M = 0 to 15)	Set/Get	Even number is upper limit, odd number is lower limit Exp upper and lower limits for inclusion processing unit 0
	Lower limit of condition calculation M (M = 0 to 15)	Set/Get	

No.	Data name	Set/Get	Data range
164 to 171	Condition comment M (M = 0 to 15)	Set/Get	Exp comment character string for inclusion processing unit 0
180 to 195	Data exp M (M = 0 to 15)	Set/Get	Exp character string for inclusion processing unit 1/2 First half is 1, second half is 2.
196 to 227	Upper limit for data calculation M (M = 0 to 15)	Set/Get	Even number is upper limit, odd number is lower limit Exp upper and lower limits for inclusion processing unit 1/2 First half is 1, second half is 2.
	Lower limit for data calculation M (M = 0 to 15)	Set/Get	
228 to 243	Data comment M (M = 0 to 15)	Set/Get	Exp comment character string for inclusion processing unit 1/2. First half is 1, second half is 2.
500 to 515	NG data [] [M] (M = 0 to 15)	Set/Get	-999999999.9999 to 999999999.9999

Conveyor Panorama Display

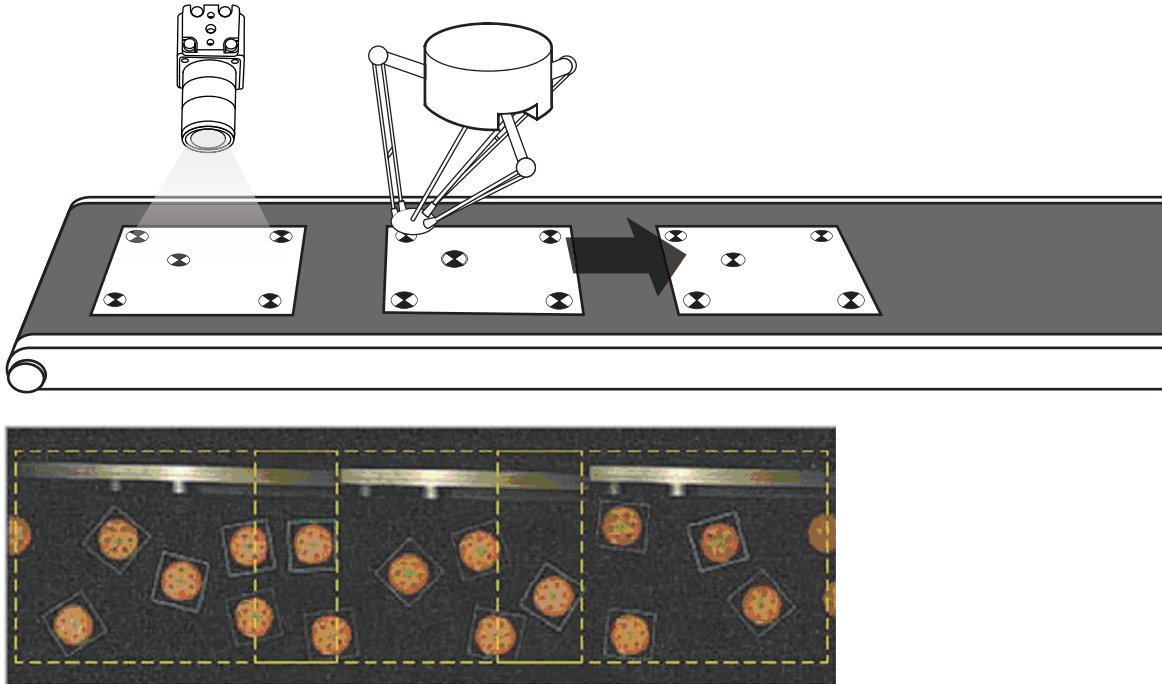
Conveyor Panorama Display is a processing item exclusively for the FH Sensor Controller and is specifically used for the conveyor tracking application.

Conveyor Panorama Display cannot be operated on the FH Sensor Controller. Use Sysmac Studio.

For more information, refer to: ▶ the *Vision Sensor FH Series Conveyor Tracking Application Sample Scene and Sample Macro User's Guide*

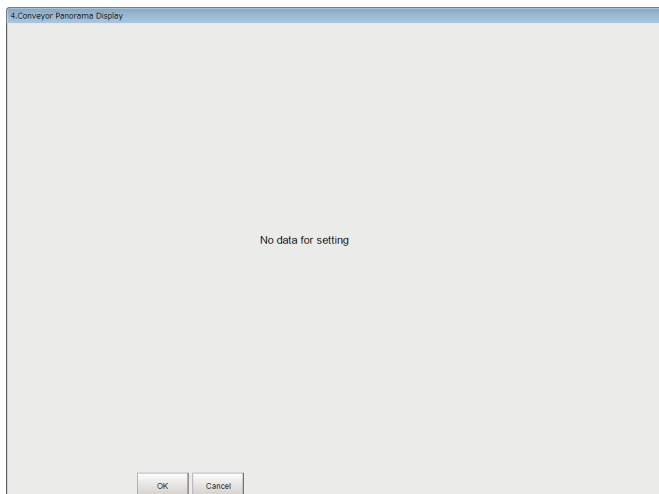
Used in the Following Case

Use Conveyor Panorama Display when you want to show images of the tracking area as a panoramic image to help in the adjusting of the conveyor speed and trigger interval.



Note

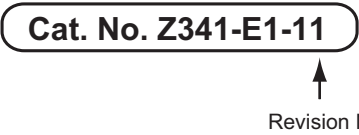
- Processing items exclusively for conveyor tracking application can be selected on the Edit Flow Window of the FH/FZ5 Sensor Controller. However, the properties setting is unavailable on the FH/FZ5 Sensor Controller. The Properties Dialog Box will appear as the following figure.



MEMO

Manual Revision History

The manual revision symbol is an alphabet appended at the end of the manual number found in the bottom left-hand corner of the front or back cover.



Rev. No.	Reprint symbol	Rev. Date	Revision Contents	Software Version
01	(1)	Jul. 2013	Original production	Ver. 5.00
02	(1)	Aug. 2013	Additions for lighting controllers.	Ver. 5.10
03	(1)	Aug. 2013	Additions for software version upgrade.	Ver. 5.10
04	(1)	Sep. 2013	Additions for software version upgrade.	Ver. 5.12
05	(1)	Jan. 2014	Additions for software version upgrade.	Ver. 5.20
06	(1)	Jun. 2014	Additions for software version upgrade.	Ver. 5.30
07	(1)	Oct. 2015	Additions for software version upgrade.	Ver. 5.50
08	(1)	Apr. 2016	Additions for software version upgrade and description of FH-L series.	Ver. 5.60
09	(1)	Mar. 2017	Additions for software version upgrade.	Ver. 5.71
10	(1)	Mar. 2017	Corrected mistakes.	Ver. 5.71
11	(1)	Jun. 2017	Additions for software version upgrade.	Ver. 5.72

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