

Robotics packaging line solution

# Vision Sensor FH series Operation Manual Sysmac Studio Conveyor Tracking Calibration Wizard Tool

FH-1□□□

FH-3□□□

SYSMAC-SE20□□

SYSMAC-RA401L

NJ501-4□□□

R88D-KN□-ECT




Startup  
Guide

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Revision History

Revision Symbol	Revision Date	Reason for Revision and Revised Page
01	December 1, 2015	First edition

# 1. Introduction

## 1.1. Introduction

Thank you for purchasing FH/FZ5 Series product.

This manual provides information regarding functions, performance and operating methods that are required for using FH/FZ5 Series product. When using FH/FZ5 Series product, be sure to observe the following:

- FH/FZ5 Series product 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.

This Manual does not contain safety information and other details that are required for actual use of a FH/FZ5 Series Controller. Thoroughly read and understand the manuals for all of the devices that are used in this Manual to ensure that the system is used safely. Review the entire contents of these materials, including all safety precautions, precautions for safe use, and precautions for correct use.

Any part or whole of this operation manual may not be copied, reproduced, or reprinted without permission.

The contents of this manual, including product specifications, are subject to change based on improvements of the product without prior notice. Your understanding is appreciated

We are committed to providing precise information. Should you have any questions or concerns regarding the contents of this document, please do not hesitate to contact us. When you contact us, please be sure to provide us with the Catalog number printed on the back cover.

## 1.2. Conventions Used in This Manual

Symbols in this manual are used as follows:



### Safety Information

Things that should be done or avoided to safely use the product.



### Precautions for Use

Things that should be done or avoided to prevent malfunction or other negative effects to the product.



### Useful Information

Things that may apply to certain situations. Information and tips that help you use the product

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seamlessly. This information is provided to increase understanding or make operation easier.

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#### Reference

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Location of detailed or related information.

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## **1.3. Terms and Conditions Agreement**

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### **1.3.1. Warranty, Limitations of Liability**

#### **■ Warranties**

##### **● Exclusive Warranty**

Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied.

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### 1.4. Meanings of Signal Words

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For details on Meanings of Signal Words, refer to Meanings of Signal Words in *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z340-E1-08 or later).

### 1.5. Precautions for Safe Use

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For details on Precautions for Safe Use, refer to Precautions for Safe Use in *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z340-E1-08 or later).

### 1.6. Precautions for Correct Use

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For details on Precautions for Correct Use, refer to Precautions for Correct Use in *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z340-E1-08 or later).

### 1.7. Regulations and Standards

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For details on Regulations and Standards, refer to Regulations and Standards in *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z340-E1-08 or later).

### 1.8. Related Manuals

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The following manuals are also helpful when using Conveyor Tracking Calibration Wizard. Use these manuals for reference.

Cat. No.	Manual name	Content	Application
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Z340-E1	Vision System FH/FZ5 Series User's Manual	Describes how to configure settings on the sensor controller of FH/FZ5 Series Vision Sensors.	To learn how to configure FH/FZ5 Series Vision Sensors.
Z341-E1	Vision System FH/FZ5 Series Processing Item Function Reference Manual	Describes how to configure settings for processing items for FH/FZ5 Series Vision Sensors.	To learn how to configure settings for processing items for FH/FZ5 Series Vision Sensors.
Z342-E1	Vision System FH/FZ5 Series User's Manual (Communications Settings)	Describes how to configure communication settings on the sensor controller of FH/FZ5 Series Vision Sensors.	To learn how to configure communication settings for FH/FZ5 Series Vision Sensors.
Z343-E1	Vision System FH Series Operation Manual Sysmac Studio	Describes how to configure FH Series Sensor Controllers on Sysmac Studio.	To learn how to configure FH Series Sensor Controllers.
W504-E1	Sysmac Studio Version 1 Operation Manual	Describes the operation of Sysmac Studio.	To learn the operation and functions of Sysmac Studio.
Z369-E1	Vision Sensor FH Series Operation Manual Sysmac Studio Calibration Plate Print Tool	Describes how to configure and operate Calibration Plate Print Tool on Sysmac Studio on FH Sensor Controllers.	To learn the setup procedure for printing the Pattern on a Calibration Plate used for calibration for cameras and robots on Sysmac Studio.
Z370-E1	Vision Sensor FH Series Operation Manual Sysmac Studio Conveyor Tracking Calibration Wizard Tool (This manual)	Describes how to configure and operate Conveyor Tracking Calibration Wizard on Sysmac Studio on FH Sensor Controllers.	To learn the setup procedure of the wizard style calibration for cameras, robots, or conveyors.
Z371-E1	Vision Sensor FH Series Operation Manual Sysmac Studio Conveyor Panorama Display Tool	Describes how to configure and operate the Conveyor Panorama Display tool on Sysmac Studio on FH Sensor Controllers.	To learn the setup procedure of panorama display for image capture of targets on conveyors.

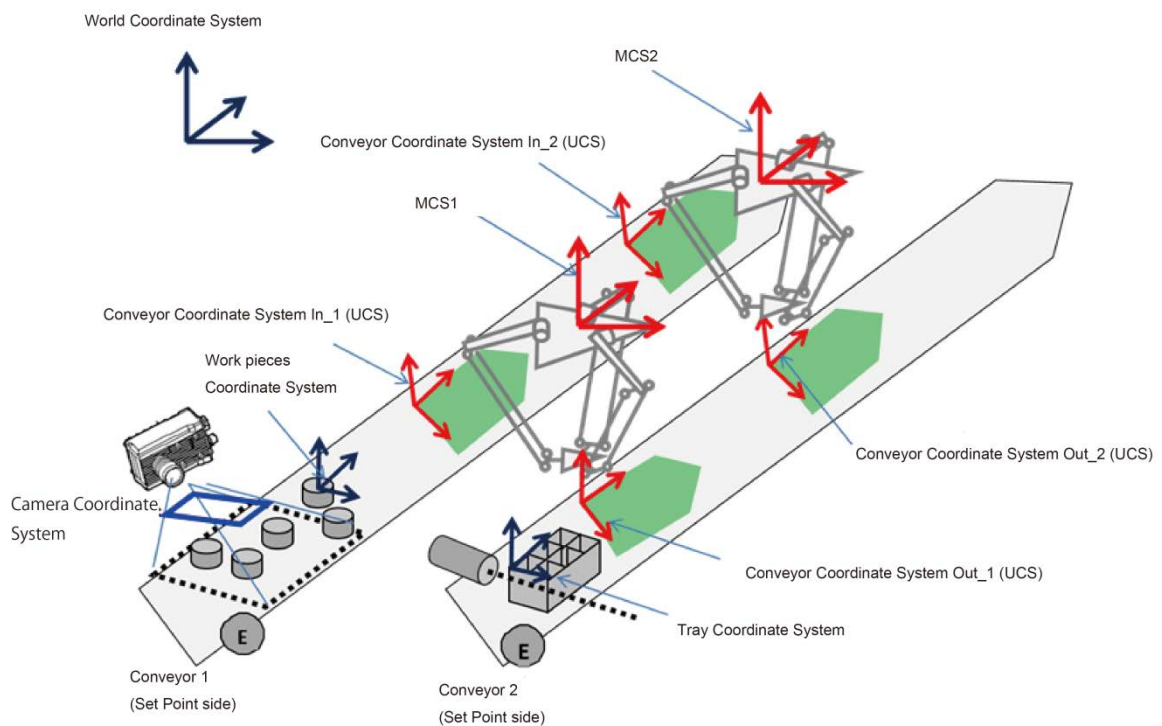
Z368-E1	Vision Sensor FH Series Conveyor Tracking Application Programming Guide	Describes the setting procedure of sample senses or sample macros used for applications of conveyor tracking on FH Sensor Controllers.	To learn the setting procedure of sample senses or sample macros for conveyor tracking.
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## 2. About Conveyor Tracking Calibration Wizard

### 2.1. Overview

Conveyor Tracking Calibration Wizard is a wizard-style calibration tool for reciprocally converting different coordinate systems between vision sensors, conveyors, and robots. This calibration uses processing items of FH Sensor Controller.

This tool calibrates the machine coordinate system (MCS) for picking robots, and the camera coordinate system for vision sensors.



If there are more than one MCS, follow the below procedure.

1. Calibrate an MCS with the camera coordinate system.
2. Calibrate a previously calibrated MCS with another MCS.

To use Conveyor Tracking Calibration Wizard, a Calibration Plate is needed. Create a Calibration Plate according to the camera field of view (FOV) and conveyor using the Calibration Plate Print Tool. For more information, refer to the *Operation Manual Sysmac Studio Calibration Plate Print Tool*.



## Useful Information

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To perform calibration without using Conveyor Tracking Calibration Wizard, refer to the *Conveyor Tracking Application Sample Scene and Sample Macro User's Guide*, and create scenes and ladder program.

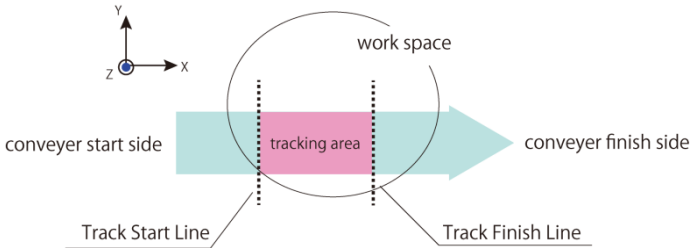
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## 2.2. Target Readers and Expected Skill Level

Target readers of this manual include developers of visual conveyor tracking systems, and engineers and programmers who support end users of visual conveyor tracking systems.

## 2.3. Terminology

Term	Explanation
Conveyor Tracking	A function that enables a robot to track targets moving on a conveyor. Transfer of targets from/to moving conveyors is enabled by combining the conveyor tracking function and the Pick and Place function.
Visual Conveyor Tracking	A conveyor tracking system for production lines that use vision sensors.
Calibration	A process that generates parameters to reciprocally convert coordinates that differ from the camera coordinate system.
Conveyor Tracking Calibration	Collective term for calibrations for conveyor tracking operation. Conveyor tracking calibration includes camera calibration such as lens distortion correction, camera-robot calibration, and robot-conveyor calibration. On the user interface, it is called conveyor calibration to meet the character count limit.
Calibration Plate	A plate-shaped reference jig with a calibration pattern printed that is used with Conveyor Tracking Calibration Wizard.
Pick-side Conveyor	Conveyor on which target objects of Pick and Place move.
Camera Coordinate System	A 2D coordinate system used by vision sensors. Its origin point is the upper left corner of the captured image. From there, the horizontal line is determined to be the x axis, and the vertical line is determined to be the y axis. The unit of measure: pixel.

Conveyor Coordinate System	A coordinate system for conveyors set per tracking area, and is used to adjust the angle of the conveyor with respect to the machine coordinate system (MCS) of the conveyor. It is set as User Coordinate System (UCS).
Machine Coordinate System (MCS)	A coordinate system used by robots controlled by FH Sensor Controller. It is set as machine coordinate system (MCS). The unit of measure: mm.
Robot	Robot which picks and places target objects for conveyor tracking.
Set Point	Operations to have a robot touch the target object to make the robot learn and input its position information. During conveyor tracking calibration between the camera and robot, the Calibration Plate is moved into the tracking area, and a robot performs Set Point to specified Marks.
Tracking Area	<p>An area where robots can pick and place target objects.</p> <p>It is the overlapped area of the conveyor and the workspace of the robot. The entry border of the area is called Track Start Line, and the exit border is called Track Finish Line, and the tracking area is the space in between two lines.</p> 
Track Start Line	It is a virtual entry border to the tracking area, over which objects will be targets of the robot's Pick and Place operation.
Track Finish Line	It is a virtual exit border from the tracking area, over which objects will no longer be targets of the robot's Pick and Place operation.

## 2.4. Restrictions and Precautions

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Item	Explanation
Precautions when launching Conveyor Tracking Calibration Wizard	To perform conveyor tracking calibration, the FH Sensor Controller must have a Scene that includes the following processing items. 0: Camera Image Input 1: Precise Calibration 2: Conveyor Tracking Calibration
Restrictions on encoder value	<ul style="list-style-type: none"><li>• The encoder value must be between 0 to 2147483647.</li><li>• Once reaching its maximum value (2147483647), the encoder value returns to 0 (ring count).</li></ul>

## 3. Using the Tool

### 3.1. Setup Procedure and User Interface of Conveyor Tracking Calibration Wizard

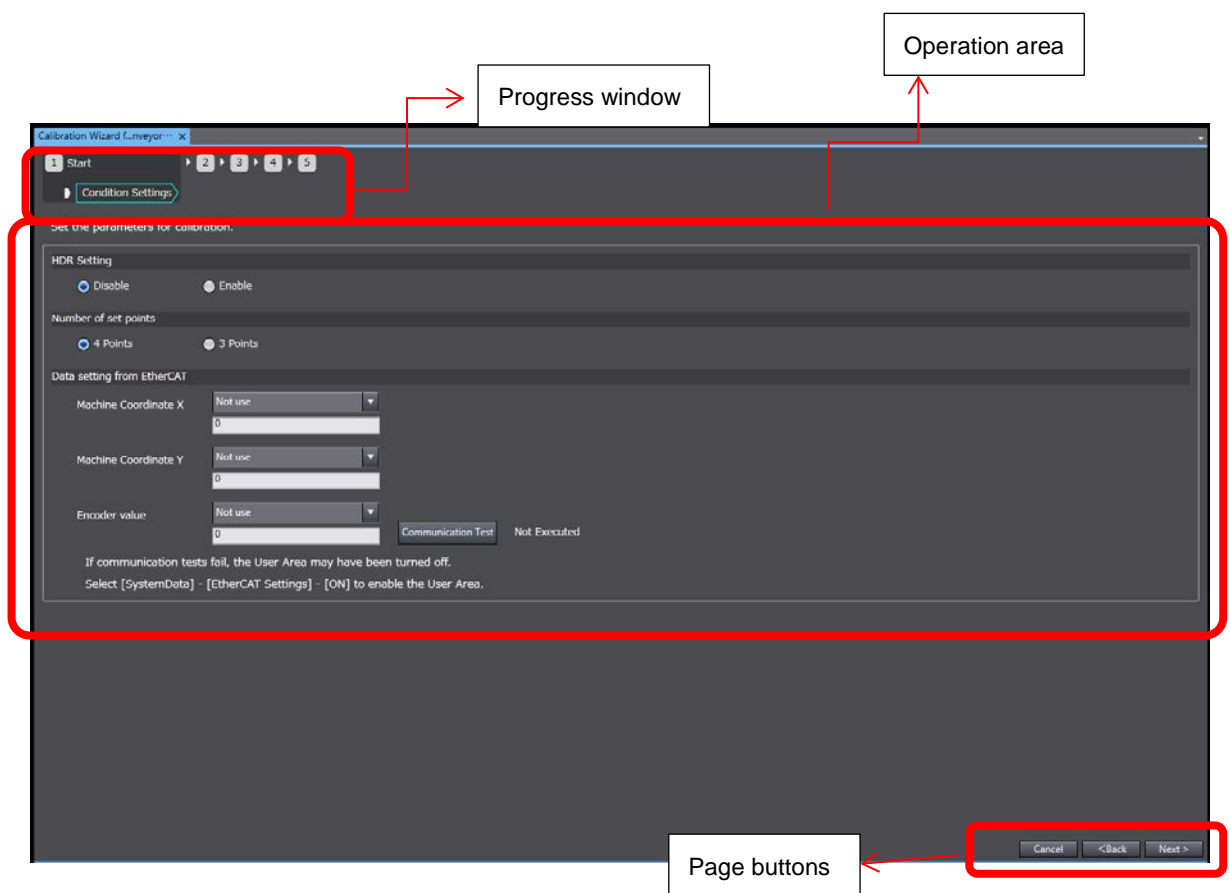
The setup procedure of Conveyor Tracking Calibration Wizard is as follows. After launching Conveyor Tracking Calibration Wizard:

1. Create a Scene to perform calibration.
2. Select the type and other conditions of calibration.
3. Adjust settings to measure Marks.
4. Inspect the location of Mark.
5. Select Marks to use for calibration parameter calculation.
6. Move the Calibration Plate towards the Track Start Line side in the tracking area.
7. Perform Set Point (teaching) to Marks on the Calibration Plate.
8. Move the Calibration Plate towards the Track Finish Line side in the tracking area.
9. Perform Set Point (teaching) to Marks on the Calibration Plate.
10. Perform calibration.

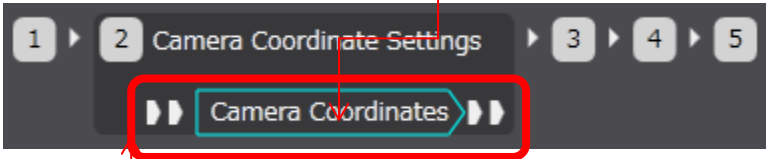
Step	Explanation
Creating a Scene to perform calibration	Create a Scene to perform calibration using Conveyor Tracking Calibration Wizard.
Selecting the type and other conditions of calibration	Select task(s) you want to perform by Conveyor Tracking Calibration Wizard.
Adjusting settings to measure marks	Adjust parameters for the camera with the Calibration Plate placed in the FOV.
Measuring location of Marks	Measure the location of Marks on the Calibration Plate.
Selecting Marks to use for calibration parameter calculation	Set the encoder value for image capture and also point(s) to which Set Point will be performed using captured images.
Moving the Calibration Plate towards the Track Start Line side in the tracking area	Move the Calibration Plate towards the Track Start Line side in the tracking area.
Perform Set Point (teaching) to Marks on the Calibration Plate.	Perform Set Point to the Marks measured or specified by the encoder value.

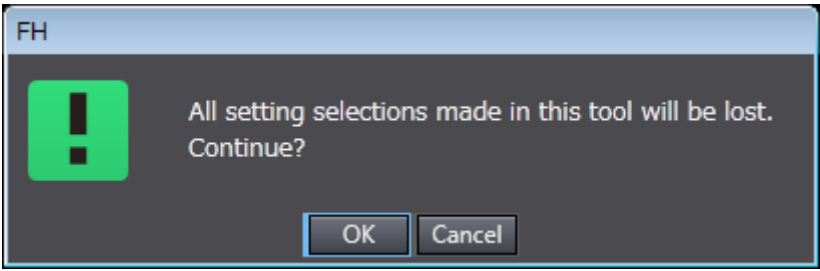
Moving the Calibration Plate towards the Track Finish Line side in the tracking area	Move the Calibration Plate towards the Track Finish Line side in the tracking area.
Performing calibration	

The following figure shows the user interface of Conveyor Tracking Calibration Wizard.





UI elements	Explanation
<p>Progress window</p>	<p>An area to show the progress of the wizard. The upper part indicates the progress of primary steps, and the lower part shows the progress of sub steps.</p> <p style="text-align: center;">Progress of primary steps</p>  <p style="text-align: center;">Progress of sub steps</p> <p>In the above figure, the second primary step (Camera Coordinate Settings) is being processed. Two white arrow symbols before and after the sub step window indicate that there are total of five sub steps, and the third sub step (camera coordinate) is currently being processed.</p>
<p>Operation area</p>	<p>Area where settings, image display, and other wizard operations are performed. For more details about this area, refer to the next section.</p>

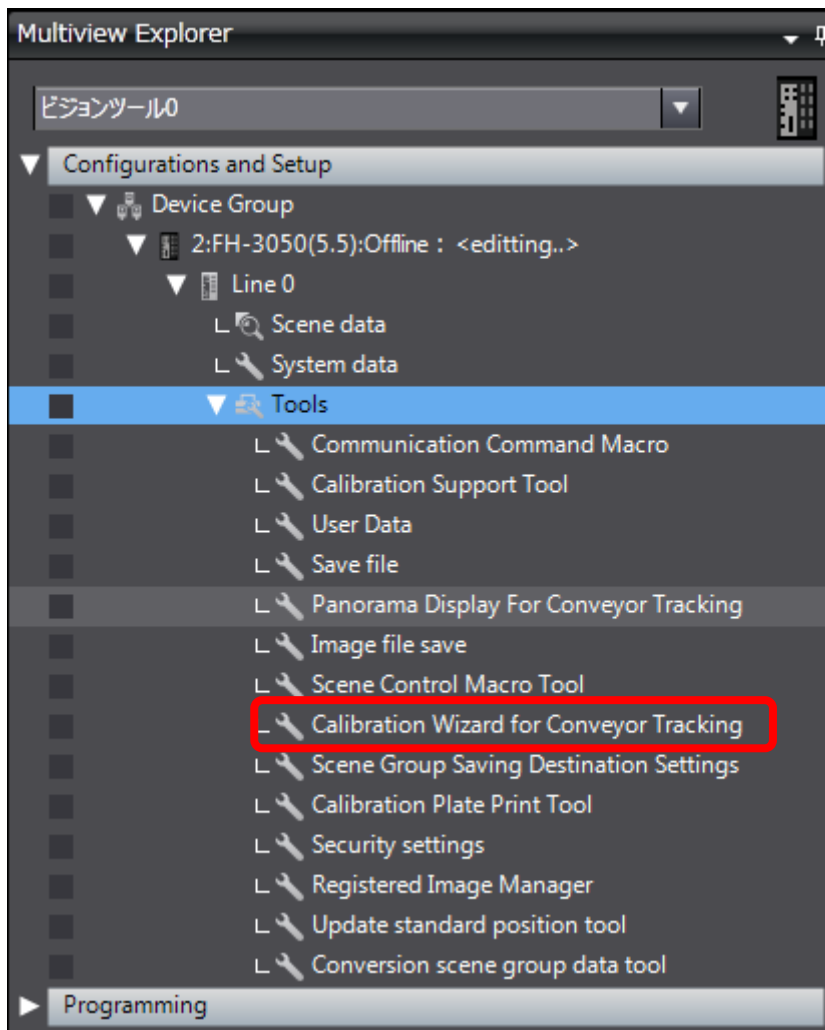
Page buttons	<p>Buttons to control pages of the wizard.</p> <p>When you click...</p> <ul style="list-style-type: none"><li>• Cancel: The FH warning dialog shown below will appear.</li></ul>  <p>On the FH warning dialog, if you click OK, all the settings adjusted by Conveyor Tracking Calibration Wizard will be discarded and the procedure goes back to the primary step 1. If you click Cancel, the dialog will disappear.</p> <ul style="list-style-type: none"><li>• &lt; Back: You will go back to the previous step.</li><li>• Next &gt;: You will go to the next step.</li></ul>
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### 3.2. Starting Conveyor Tracking Calibration Wizard

Launch Conveyor Tracking Calibration Wizard from the FH Sensor Controller you are using.

1. On the main window of FH Sensor Controller, select Tool under Multiview Explorer.

Available tools will be displayed. Double click **Calibration Wizard for Conveyer Tracking**.



### 3.3. Creating a Scene to Perform Calibration

To launch Conveyor Tracking Calibration Wizard, an exclusive Scene needs to be created on FH Sensor Controller. This process corresponds to the step 1 in *4.1. Setup Procedure and User Interface of Conveyor Tracking Calibration Wizard*.

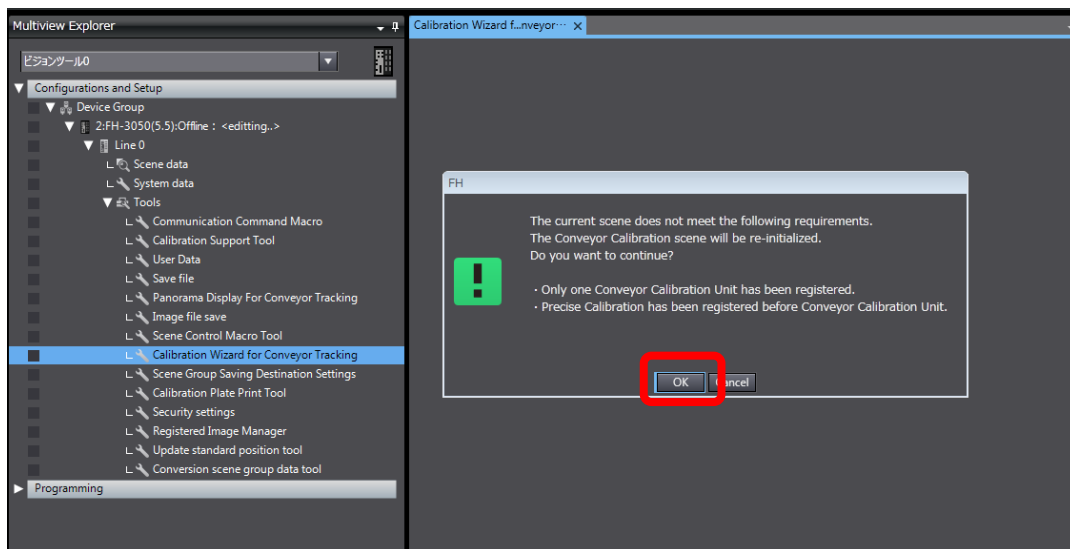
#### 1. Double click **Calibration Wizard for Conveyor Tracking**.

A warning dialog will appear if there are not processing items for conveyor tracking calibration in the current Scene. See 2.

If there are processing items for conveyor tracking calibration, Conveyor Tracking Calibration Wizard will start. See 4.

#### 2. A warning dialog will appear.

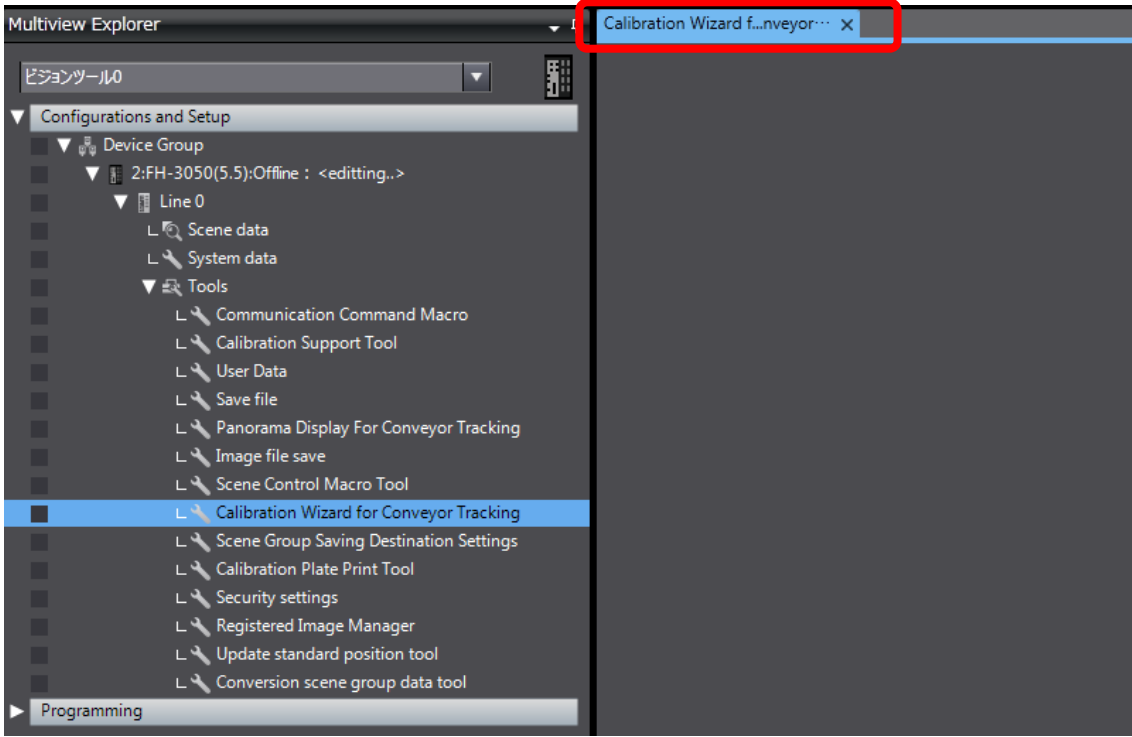
If you click OK in the warning dialog, the Scene automatically will be initialized to a Scene for conveyor tracking calibration. Conveyor Tracking Calibration Wizard will start. See 4.



3. If you click Cancel on the warning dialog, the Scene will not be switched.

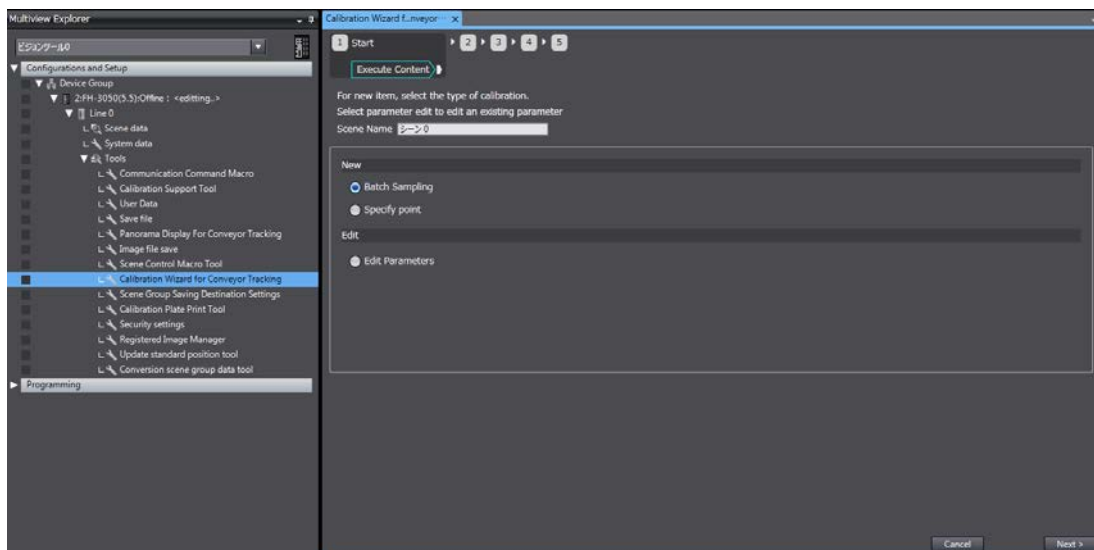
The **Calibration Wizard for Conveyor Tracking** tab will open.

Click the close button (x) to exit.



4. If the exclusive Scene is currently selected when **Calibration Wizard for Conveyor Tracking** is double-clicked, Conveyor Tracking Calibration Wizard will launch.

The Conveyor Tracking Calibration Wizard tab will open, and the [Start] [Execute Content] page will be displayed.





## Useful Information

The minimum configuration of a Scene for conveyor tracking calibration is as follows:

- 0: Camera Image Input
- 1: Precise Calibration
- 2: Conveyor Tracking Calibration

You can also add a preprocessor-type processing item after Unit 0 to stabilize the performance of the Precise Calibration processing item.

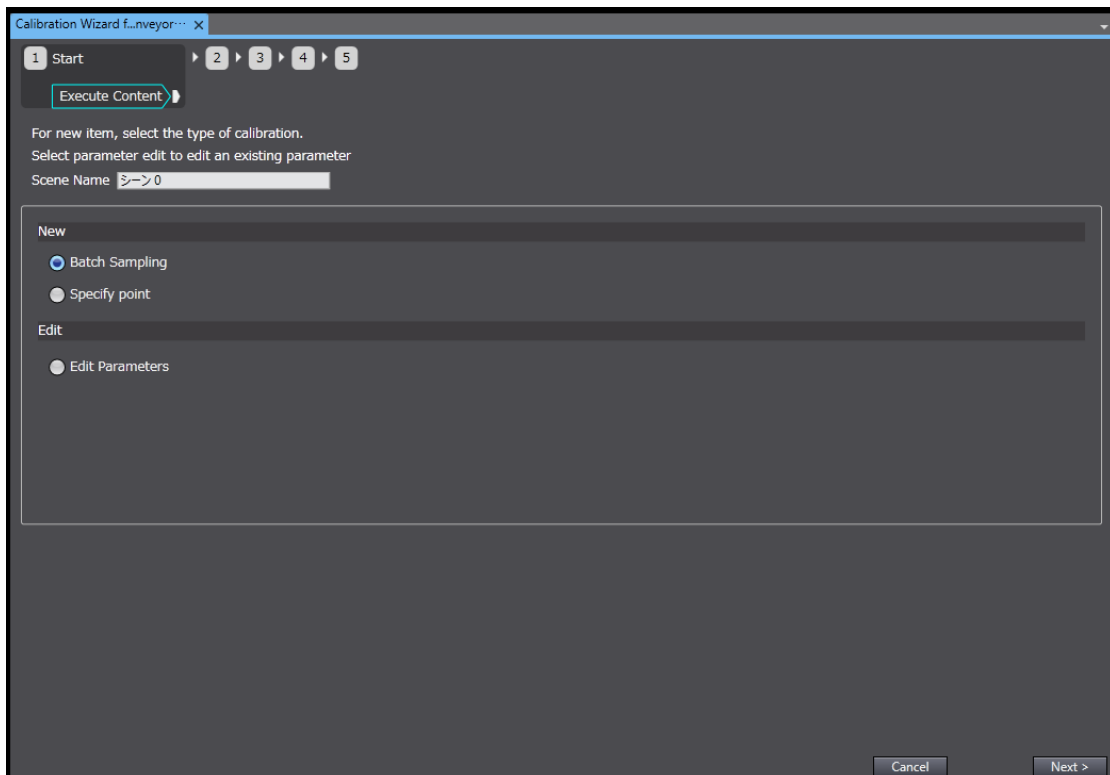
Refer to 3. *Compensate image* in the *Vision System Processing Item Function Reference Manual* (Cat. No. Z341-E1).

### 3.4. Selecting the Type and Other Conditions of Calibration

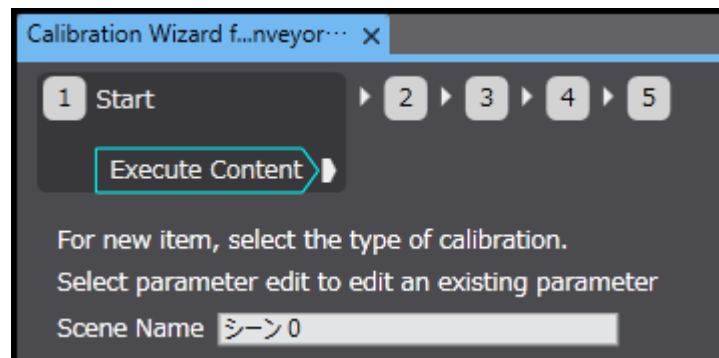
Select task(s) you want to perform by Conveyor Tracking Calibration Wizard.

This process corresponds to the step 2 in 4.1. *Setup Procedure and User Interface of Conveyor Tracking Calibration Wizard*.

1. When Conveyor Tracking Calibration Wizard is launched, the [Start] [Execute Content] page opens.



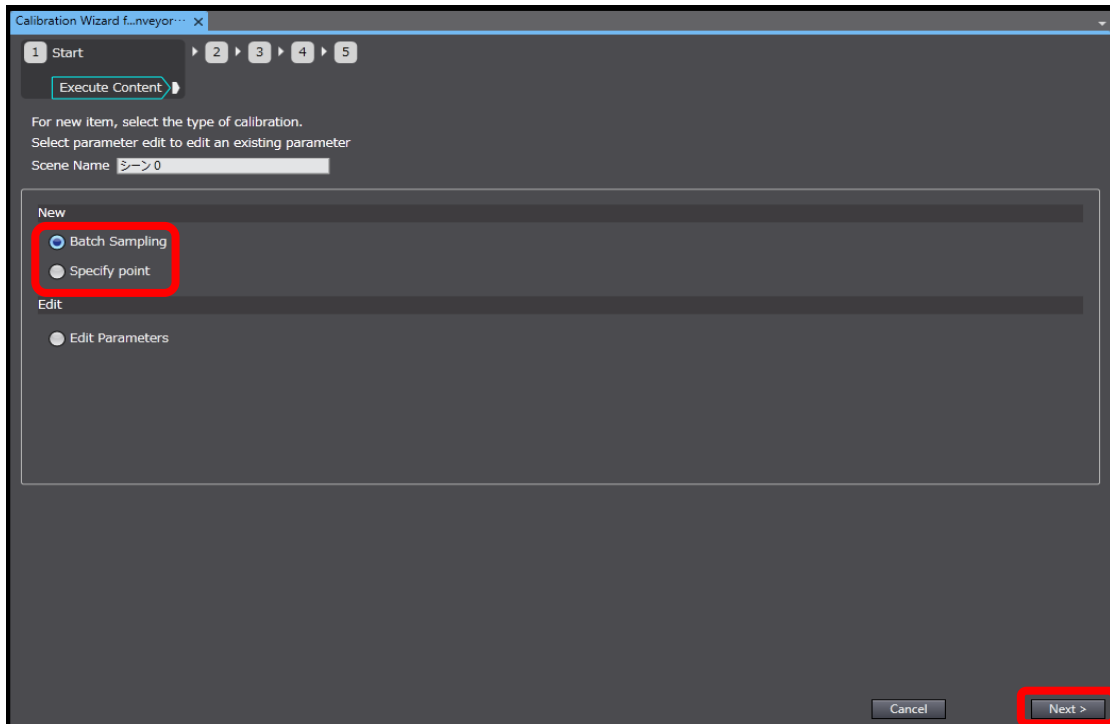
- The name of the Scene with which Conveyor Tracking Calibration Wizard started is displayed in the Scene Name box. To rename the Scene, directly enter a new name into the box.



Parameter	Value [Factory Default]	Explanation
Scene Name	・ [Scene 0]	The name of the exclusive Scene for conveyor tracking calibration. To rename, enter the new name that consists of 0 to 15 characters.

- The procedure for creating calibration parameters in the wizard is different from that for manual entry of calibration parameters.  
To proceed with the wizard-style operation, see 4.  
To proceed with the manual entry of calibration parameters, after clicking the **Edit** bottom the **Edit parameter(s)** option. For details, see 12.

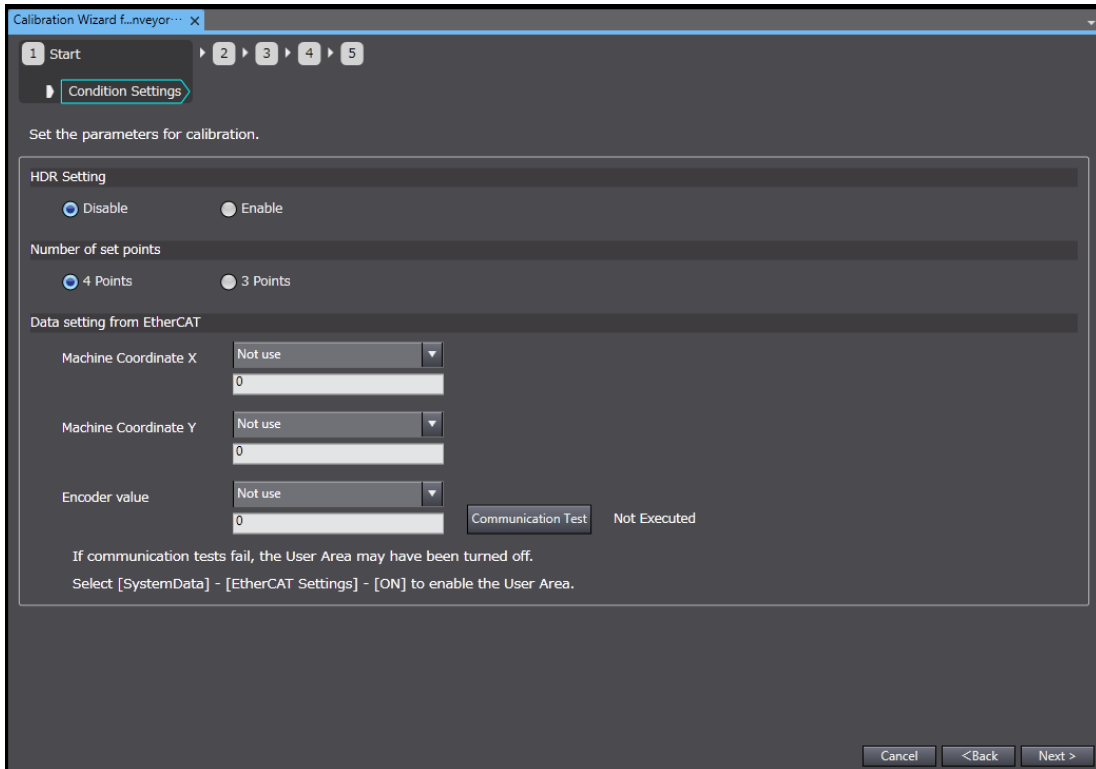
4. Select Batch Sampling or Specify Point under New, and then click Next >.



Parameter	Value [Factory Default]	Explanation
New	<ul style="list-style-type: none"> <li>• [Batch Sampling]</li> <li>• Specify Point</li> </ul>	<p>Select an option from radio buttons to create calibration parameters from scratch.</p> <p>Basically, select Batch Sampling when you use the Calibration Plate, and select Specify Point(s) when you do not.</p> <ul style="list-style-type: none"> <li>• Batch Sampling: Performs sampling using the Calibration Plate to find calibration parameters.</li> <li>• Specify Point(s): Determines calibration parameters using user-specified points.</li> </ul>
Edit	<ul style="list-style-type: none"> <li>• Edit Parameter</li> </ul>	Select this option when entering or editing previously calculated calibration parameters.



5. A page where you can set up calibration parameters ([Start] [Condition Settings] page) will be displayed.



6. Select an option under HDR Setting.

Parameter	Value [Factory Default]	Explanation
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HDR Setting	<ul style="list-style-type: none"> <li>▪ [Disable]</li> <li>▪ [Enable]</li> </ul>	<p>HDR is a function to capture a series of images with varying shutter speeds, and merge the images to produce an image with a broad dynamic range.</p> <p>Select an appropriate option according to the image capture environment for which you will perform calibration.</p> <p>Refer to <i>Camera Image Input HDR</i> on page 61-66 in the <i>Vision Sensor FH/FZ5 Series Vision System Processing Item Function Reference Manual</i> (Cat. No. Z341-E1).</p>
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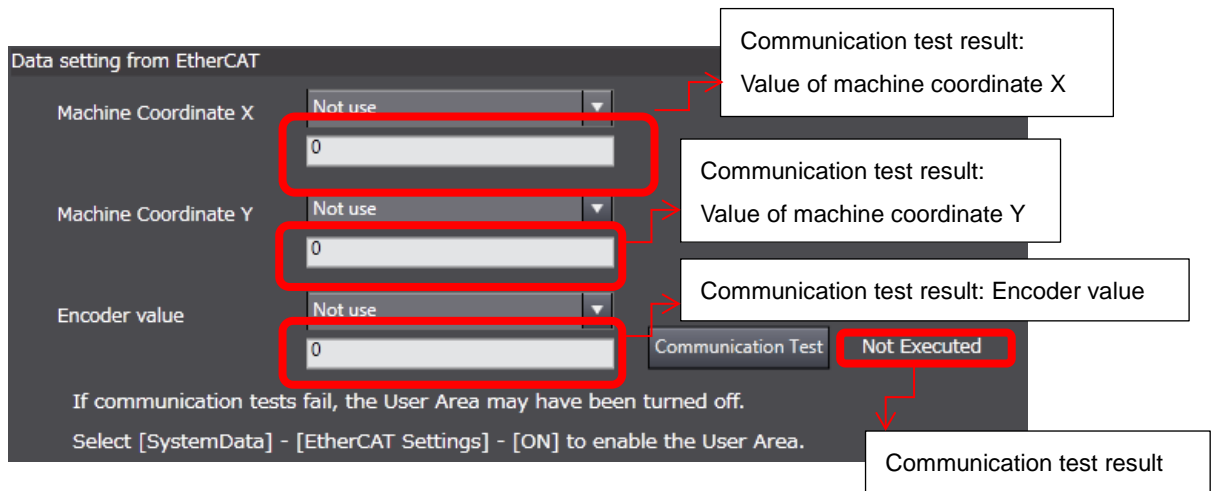
7. Select Number of Set Points

Parameter	Value [Factory Default]	Explanation
Number of set points	<ul style="list-style-type: none"> <li>· [4 Points]</li> <li>· 3 Points</li> </ul>	<p>Select the number of Set Point times the robot will perform for calibration between the robot and the camera.</p> <p>Set Point will be performed for the number of times set here in the Track Start Line side of the tracking area.</p> <p>elect an appropriate option according to the shape of the tracking area.</p>

8. Set the parameters under Data setting from EtherCAT.

Parameter	Value [Factory Default]	Explanation
Data setting from EtherCAT Machine Coordinate X	<ul style="list-style-type: none"> <li>· User Input Area 0 to 5</li> <li>· Not use</li> <li>· [User Input Area 0]</li> </ul>	<p>Select the user input area where the machine coordinate X is saved from the drop-down list by clicking.</p> <ul style="list-style-type: none"> <li>· If you will not use this function, select <b>Not use</b>.</li> </ul>
Data setting from EtherCAT Machine Coordinate Y	<ul style="list-style-type: none"> <li>· User Input Area 0 to 5</li> <li>· Not use</li> <li>· [User Input Area 0]</li> </ul>	<p>Select the user input area where the machine coordinate Y is saved from the drop-down list by clicking.</p> <p>If you will not use this function, select <b>Not use</b>.</p>
Data setting from EtherCAT Encoder value	<ul style="list-style-type: none"> <li>· User Input Area 0 to 5</li> <li>· [Not use]</li> </ul>	<p>Select the user input area where the encoder value is saved from the drop-down list by clicking.</p> <p>If you will not use this function, select <b>Not use</b>.</p>

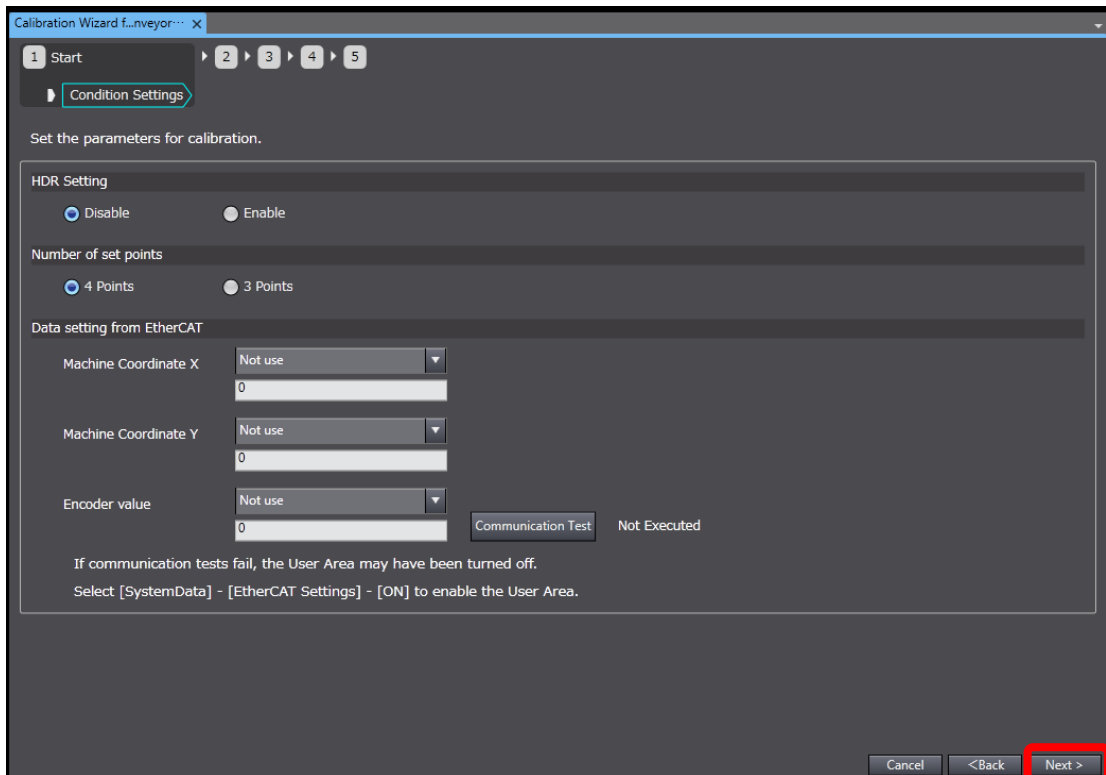
9. After setting parameters under Data setting from EtherCAT, click Communication Test. The result of the communication test will be displayed.



For information about communication settings, refer to the *FH/FZ5 Series Vision System User's Manual for Communications Settings* (Cat. No. Z342-E1), or, *FH Series Vision System Operation Manual for Sysmac Studio* (Cat. No. Z343-E1).

Communication test messages	Explanation
Not Executed	The <b>Communication Test</b> button has not been clicked since launching Conveyor Tracking Calibration Wizard.
Communication Succeeded	The <b>Communication Test</b> button is clicked, and values are successfully obtained from the specified user input area.
Communication Failed	The <b>Communication Test</b> button is clicked, and obtaining values from the specified user input area failed.

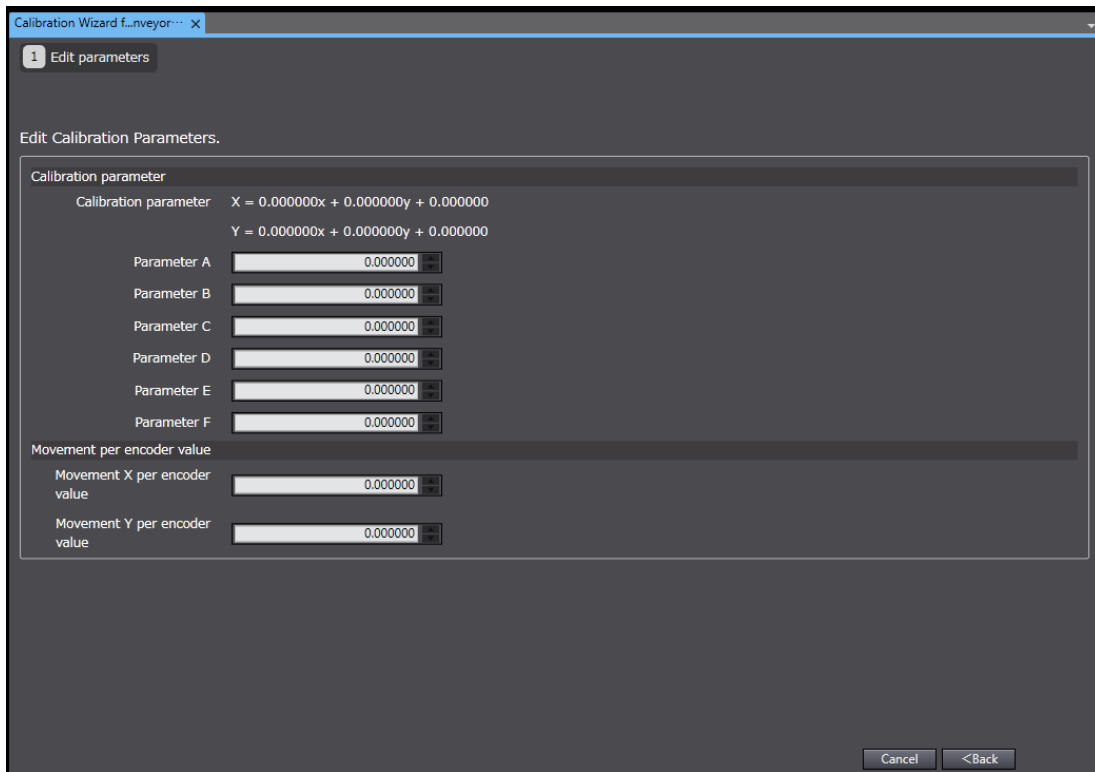
10. After setting of each item, click **Next>**.



11. The [Start] [Camera Settings] page appears.

This is the last page for settings of calibration parameters.  
Refer to 4.5. *Adjusting Settings to Measure Marks.*

12. The Edit parameters page appears.



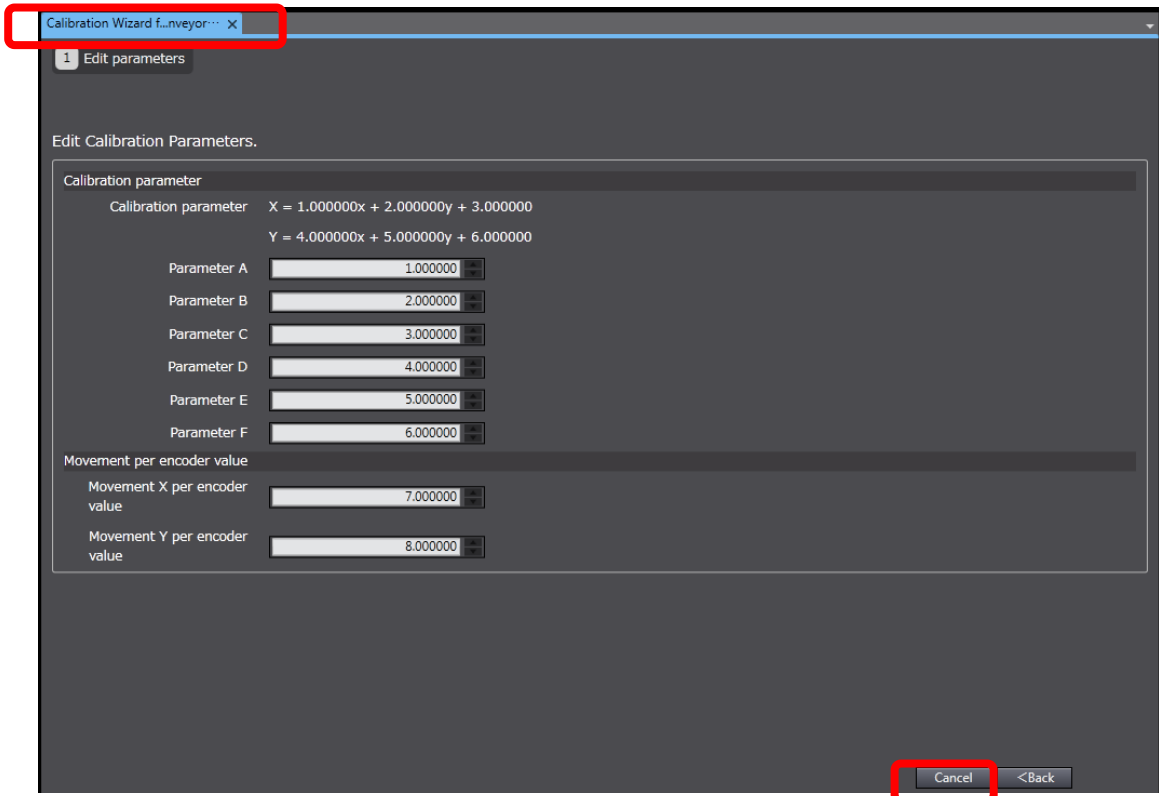
13. Adjust values for each calibration parameter in the spin box.

Click ▲ and ▼ to change the value, or manually enter it to the box.

Parameter	Value [Factory Default]	Explanation
Parameter A Parameter B Parameter C Parameter D Parameter E Parameter F	<ul style="list-style-type: none"> <li>• -99999999.999999 to 99999999.999999</li> <li>• [0.000000]</li> </ul>	<p>Set up the calibration parameters to convert the camera coordinates (x, y) to machine coordinates (X, Y).</p> <p><math>X = \text{Parameter Ax} + \text{Parameter Bx}y + \text{Parameter C}</math></p> <p><math>Y = \text{Parameter Dx}x + \text{Parameter Ex}y + \text{Parameter F}</math></p>
Movement X per encoder value	<ul style="list-style-type: none"> <li>• -99999.9999 to 99999.9999</li> <li>• [0.0000]</li> </ul>	<p>Set up the movement of MCS to the X axis direction per encoder value on the pick-side conveyor that will be calibrated. The unit of measure: mm.</p>
Movement Y per encoder value	<ul style="list-style-type: none"> <li>• -99999.9999 to 99999.9999</li> <li>• [0.0000]</li> </ul>	<p>Set up the movement of MCS to the Y axis direction per encoder value on the pick-side conveyor that will be calibrated. The unit of measure: mm.</p>

14. After setting up each parameter, click the close (x) button of the **Calibration Wizard for Conveyor Tracking** tab to save settings. Settings will be saved and you will exit Conveyor Tracking Calibration Wizard.

If you click **Cancel**, the settings will be discarded and you will go back to the [Start] [Execute Content] page.



### Precautions for Use

If you click **< Back** on the Calibration Parameter Edit page, settings will be temporarily kept, and you will go back to the [Start] [Execute Content] page.

If you want to save settings, click the close (x) button of the **Calibration Wizard for Conveyor Tracking** tab. Settings will be saved and you will exit Conveyor Tracking Calibration Wizard.

### 3.5. Adjusting Settings to Measure Marks

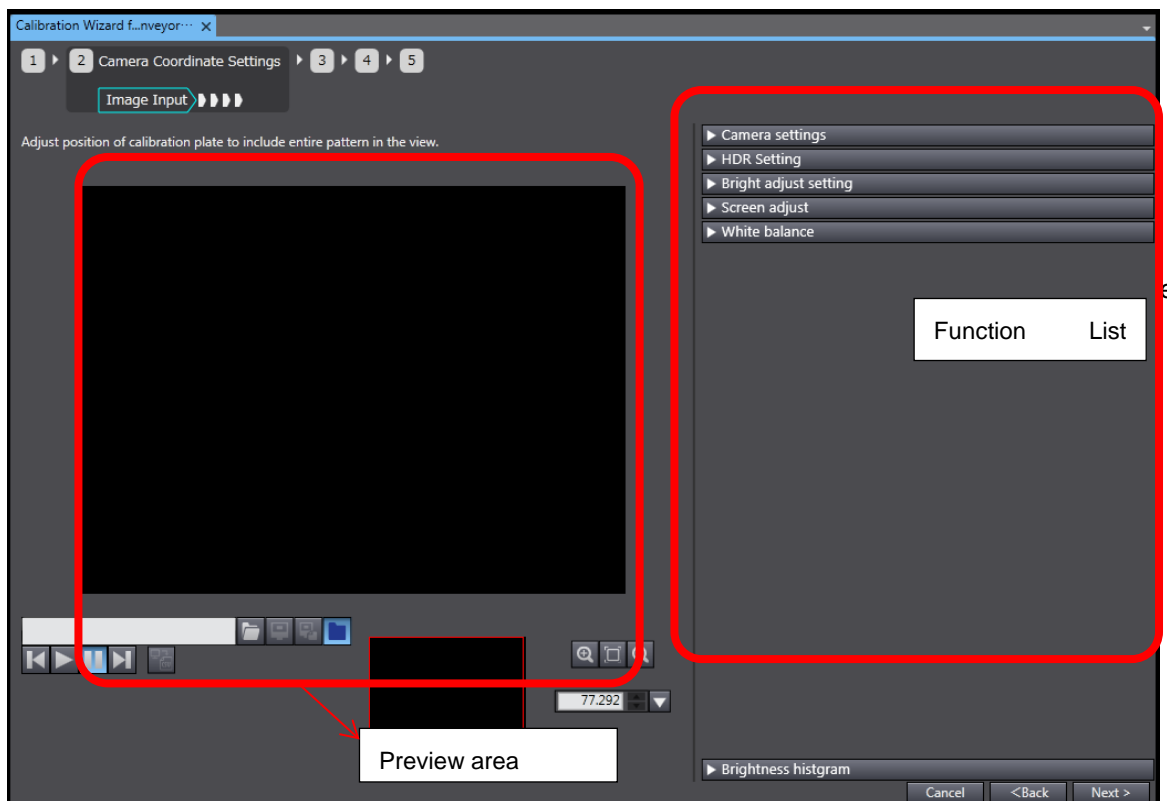
Adjust parameters for the camera with the Calibration Plate placed in the FOV.  
This process corresponds to the step 3 in *4.1. Setup Procedure and User Interface of Conveyor Tracking Calibration Wizard*.



#### Precautions for Use

Capture Marks clearly, and move the Calibration Plate to include many Marks within the FOV to improve the calibration accuracy. Avoid the following situations.

- Marks appear chipped in the captured image.
- Marks appear vague in the captured image.
- Unnecessary objects other than the pattern are in the captured image.
- The contrast of the black area and white area on the Calibration Plate is low.
- The contrast of the black area and white area on the Calibration Plate is inconsistent.



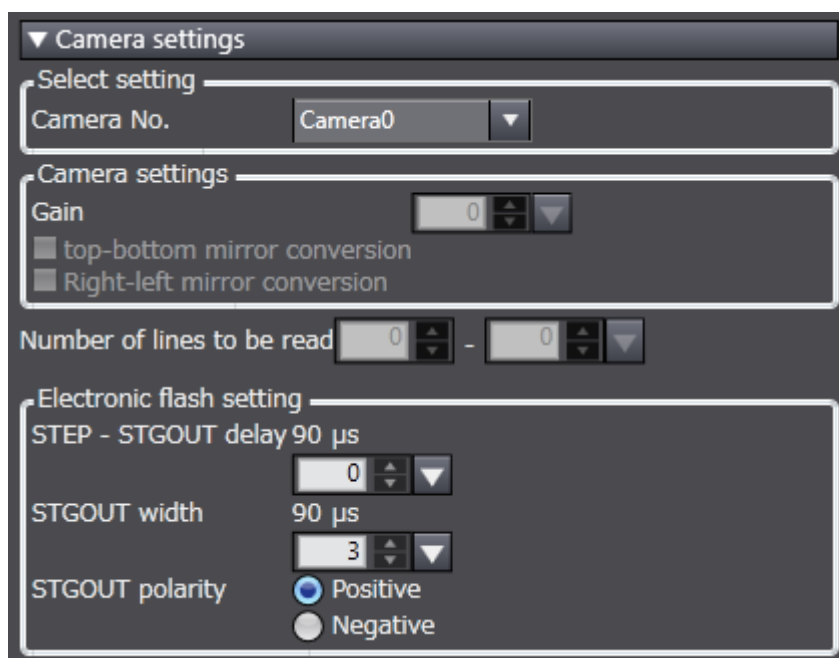
2. Click ► **next** to each parameter label in the Function List View to show the detailed parameters.



3. Set the parameters under **Camera settings**.

These parameters must be set to perform calibration.

For more information about setting these parameters, refer to the *Camera Settings (Camera Image Input FH)* on page 42-46 in the *Vision Sensor FH/FZ5 Series Vision System Processing Item Function Reference Manual (Cat. No. Z341-E1)*.



Parameter	Value [Factory Default]	Explanation
Select setting Camera No.	<ul style="list-style-type: none"> <li>Camera 0 to 7</li> <li>[Camera 0]</li> </ul>	From the drop-down list, select the camera number to use for calibration image capture that is connected to the FH Sensor Controller by clicking ▼.
Camera settings Gain	The value differs depending on the connected camera. For more information, refer to the above manual.	Adjust the gain of cameras connected to the FH Sensor Controller you are using for image capture for calibration. Click ▼ to show a slider and move it, or, click ▲ and ▼ to adjust the value. You can also enter the value into the box. Adjust the gain when you cannot make captured images brighter by changing the shutter speed, iris, or lighting. It is usually best to use the factory default values.

Camera settings top-bottom mirror conversion	<ul style="list-style-type: none"> <li>· [Cleared]</li> <li>· Selected</li> </ul>	Select to vertically invert the image captured by FH-SCxx or FH-SMxx camera.
Camera settings Right-left mirror con- version	<ul style="list-style-type: none"> <li>· [Cleared]</li> <li>· Selected</li> </ul>	Select to horizontally invert the image captured by FH-SCxx or FH-SMxx camera.
Number of lines to be read	<p>Start line - End line</p> <p>The value of Start line and End line differ depending on the connected camera.</p> <p>For more information, refer to the above manual.</p>	<p>Set the image capture area for the camera to use for calibration by adjusting the value for Start line and End line in the spin box.</p> <p>Click ▼ to show a slider and move it, or, click ▲ and ▼ to adjust the value.</p> <p>You can also enter the value into the box.</p> <p>Limiting the area of the image to capture shortens the image capture time.</p> <p>Consider the fluctuation of the target object's position when deciding the range.</p> <p>Images in the set range will be displayed in the preview window.</p>
Electronic flash setting STEP-STGOUT delay 90µs	<ul style="list-style-type: none"> <li>· 0 to 511</li> <li>· [0]</li> </ul> <p>(One increment = 30 µs)</p>	<p>Set the delay time since the STEP signal input to the electronic flash trigger signal ON. Adjust values in the spin box. Value changes by 30 µs per click.</p> <p>Click ▼ to show a slider and move it, or, click ▲ and ▼ to adjust the Delay time. You can also enter the value into the box.</p> <p>Delay time = Count x 30 µs + 90 µs</p> <p>Delay time differs depending on the STGOUT pulse polarity (negative or positive). The displayed time is for the positive polarity. To find the time for the negative polarity, add 35 µs to the displayed time.</p> <p>The delay time can be the value in a range of ±10 µs from the set value.</p>
Electronic flash setting STGOUT width	<ul style="list-style-type: none"> <li>· 1 to 63</li> <li>· [3]</li> </ul> <p>(One count = 30 µs)</p>	<p>Set the length of the electronic flash trigger output signal. Adjust values in the spin box. Value changes by 30µs per click.</p> <p>Click ▼ to show a slider and move it, or, click ▲ and ▼ to adjust the Delay time. You can also enter the value into the box.</p> <p>You can also enter the value into the box.</p>

Electronic flash setting STGOUT polarity	<ul style="list-style-type: none"> <li>• [Positive]</li> <li>• Negative</li> </ul>	Select the pulse polarity of the electronic flash trigger from the radio buttons. <ul style="list-style-type: none"> <li>• Positive: Flashes synchronized with the timing of the electronic flash trigger output signal changing from OFF to ON.</li> <li>• Negative: Flashes when the strobe trigger output signal changes from ON to OFF.</li> </ul>
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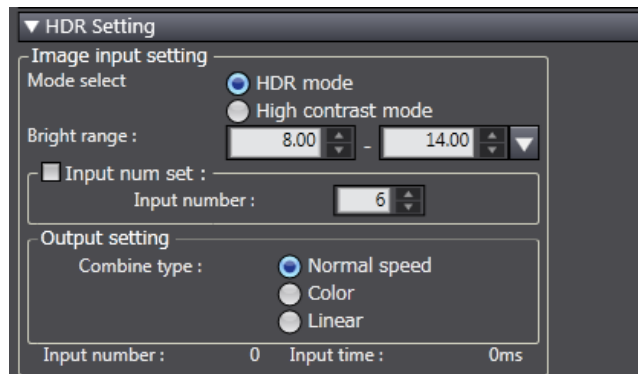
4. Set up parameters under HDR Setting.

The HDR parameter is available only when **HDR Setting** is enabled on the [Start] [Execute Content] page.

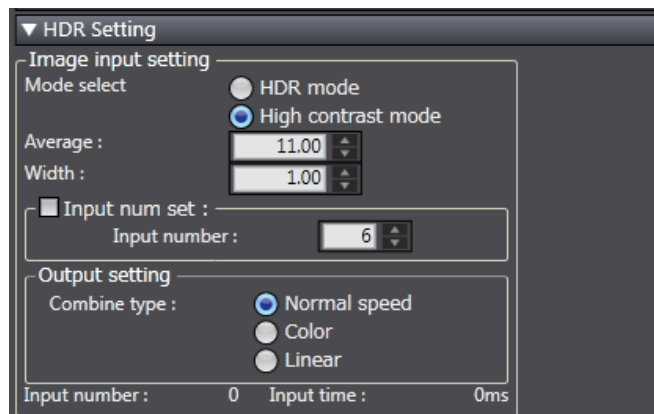
For more information about setting these parameters, refer to the *Camera Image Input HDR* on page 61-66 in the *Vision Sensor FH/FZ5 Series Vision System Processing Item Function Reference Manual* (Cat. No. Z341-E1).

5. The available parameters of **HDR setting** differ depending on the **Mode Select** setting under **Image Capture Settings**.

HDR Mode



High contrast mode



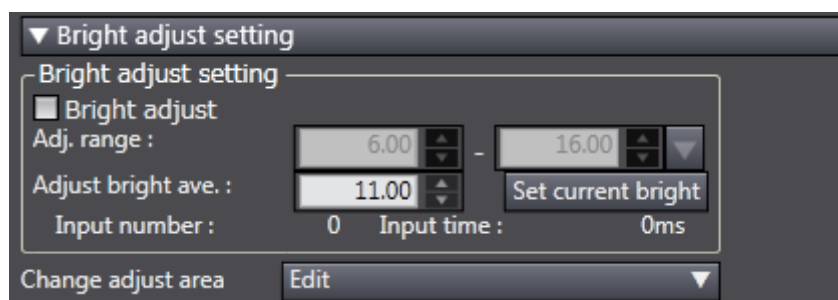
Parameter	Value [Factory Default]	Explanation
Image input setting Mode select	<ul style="list-style-type: none"> <li>• [HDR Mode]</li> <li>• High contrast mode</li> </ul>	<p>From the radio buttons, select a method to merge images. Select an appropriate option according to the image capture environment for which you will perform calibration.</p> <ul style="list-style-type: none"> <li>• <b>HDR Mode:</b> Create images with stable brightness by shooting multiple images with different shutter speed based on the specified brightness range.</li> <li>• <b>High Contrast Mode:</b> Used to improve the contrast within an image. Specify the average brightness and brightness range, fix the shutter speed, shoot multiple images, and generate images with good contrast.</li> </ul>
Image Capture Settings Bright range	<p>Min. Bright range - Max. Bright range</p> <ul style="list-style-type: none"> <li>• 0 to 20</li> <li>• [8] to [14]</li> </ul>	<p>Set the brightness for merging images. This setting is available only when HDR mode is enabled.</p> <p>Set the minimum and maximum brightness. Click ▼ to show a slider and move it, or, click ▲ and ▼ to adjust the value. You can also enter the value into the box.</p>
Image Capture Settings Average	<ul style="list-style-type: none"> <li>• 0.00 to 20.00</li> <li>• [11.00]</li> </ul>	<p>Set the average brightness of images. This setting is available only when <b>HDR mode</b> is enabled.</p> <p>Click ▼ to show a slider and move it, or, click ▲ and ▼ to adjust the value. You can also enter the value into the box.</p>
Image Capture Settings Width	<ul style="list-style-type: none"> <li>• 0.00 to 20.00</li> <li>• [1.00]</li> </ul>	<p>Set the brightness range of images. This setting is available only when HDR mode is enabled.</p> <p>Click ▼ to show a slider and move it, or, click ▲ and ▼ to adjust the value. You can also enter the value into the box.</p>
Image input settings Input num set	<ul style="list-style-type: none"> <li>• [Cleared]</li> <li>• Selected</li> </ul>	<p>Select the check box to manually set the number of images to capture.</p>

<p>Image input settings Input num set</p>	<ul style="list-style-type: none"> <li>• 2 to 16</li> <li>• [6]</li> </ul>	<p>This setting is available only when the <b>Input num</b> set check box is selected. Set the value from the spin box.</p> <p>Click ▲ and ▼ to adjust the value. You can also enter the value into the box. Setting a high image capture count provides images with low noise.</p> <p>However, more processing time is required.</p> <p>Setting a low image capture count shortens the processing time. However, the image is more easily affected by noise.</p>
<p>Image input settings Output setting Combination type</p>	<ul style="list-style-type: none"> <li>• [Normal speed]</li> <li>• Color</li> <li>• Linear</li> </ul>	<p>From the radio buttons, select a method to merge images.</p> <ul style="list-style-type: none"> <li>• <b>Normal:</b> Standard combination method. This corrects the brightness so that dark sections on the combination image do not become all black.</li> <li>• <b>Color:</b> This is suitable for inspection using the Labeling processing item and the Gravity and Area processing item. This corrects the saturation when there is little hue information in the combined image.</li> <li>• <b>Linear:</b> This is suitable for fine matching and defect inspection. In order to output the actual brightness of the workpiece, no compensation is performed.</li> </ul>

6. Set up parameters under **Bright adjust setting**.

The HDR parameter is available only when HDR Setting is enabled on the [Start] [Execute Content] page.

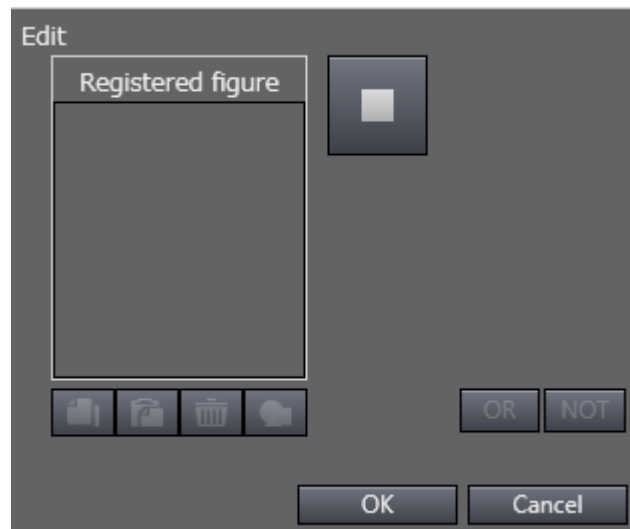
For more information about setting these parameters, refer to the *Camera Image Input HDR* on page 61-66 in the *Vision Sensor FH/FZ5 Series Vision System Processing Item Function Reference Manual* (Cat. No. Z341-E1).



Parameter	Value [Factory Default]	Explanation
Bright adjust setting Bright adjust	<ul style="list-style-type: none"> <li>• [Cleared]</li> <li>• Selected</li> </ul>	<p>Select whether or not to auto-adjust the image brightness. When selected, the brightness of images will be auto-adjusted before output.</p> <p>This provides images with stable brightness even in an environment with inconsistent lighting condition.</p>
Bright adjust setting Adj. range	<p>Min Adj. range - Max Adj. range</p> <ul style="list-style-type: none"> <li>• 0.00 to 20.00</li> <li>• [6.00] to [16.00]</li> </ul>	<p>Set the area on the captured image where the brightness adjustment will be performed.</p> <p>This setting is available only when the <b>Bright adjust</b> check box is selected.</p> <p>Set the minimum and maximum brightness.</p> <p>Click ▼ to show a slider and move it, or, click ▲ and ▼ to adjust the value.</p> <p>You can also enter the value into the box.</p>
Bright adjust setting Adjust bright ave.	<ul style="list-style-type: none"> <li>• 0.00 to 20.00</li> <li>• [11.00]</li> </ul>	<p>Set the average brightness of images.</p> <p>This setting is available only when the <b>Bright adjust</b> check box is selected.</p> <p>Click ▼ to show a slider and move it, or, click ▲ and ▼ to adjust the value.</p> <p>You can also enter the value into the box.</p> <p>When you click <b>Set current bright</b>, the average brightness of captured images will be calculated and the value of <b>Adjust bright ave.</b> will be updated with the found value.</p>
Need to check the Japanese source and specification	-	<p>Click <b>Edit</b> to set the area to adjust brightness.</p> <p>A rectangle for the editable region will be created.</p>

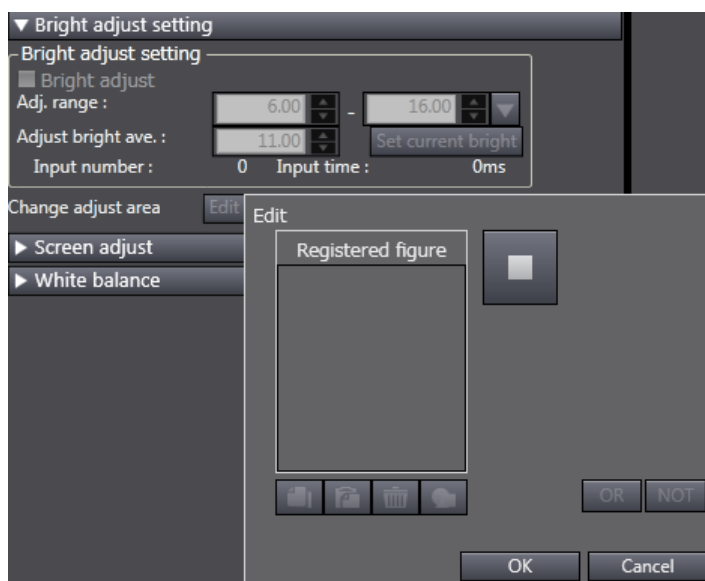
7. If you want to change the area to apply brightness adjustment, click **Edit** under

**Change adjust area.** The Edit dialog appears.



### Precautions for Use

The Edit dialog for the adjustment area change appears at the right side of the **Edit** button under **Change adjust area**.



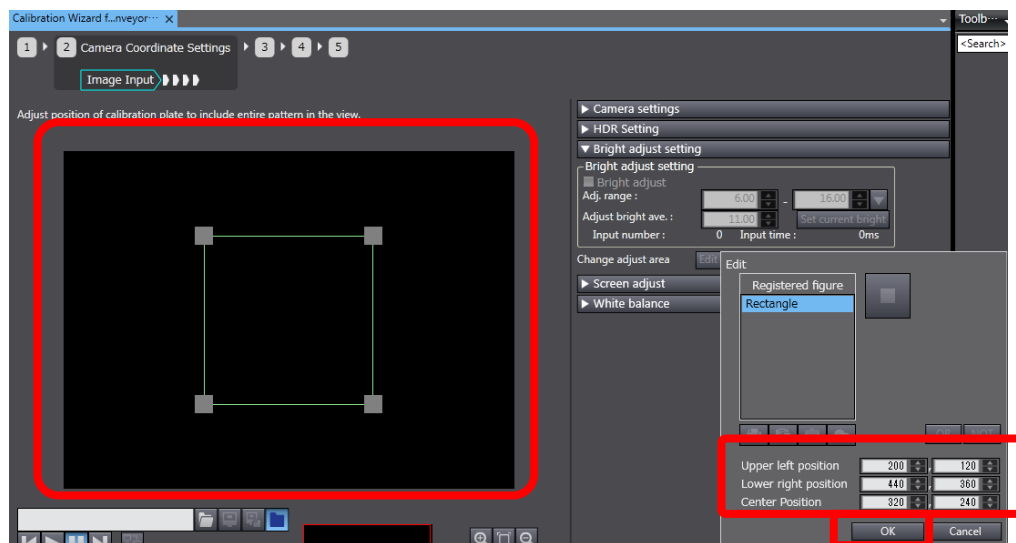
Part of the **Edit** dialog may be outside your computer screen depending on the position of the Sysmac Studio window. If that occurs, point to the hidden area to show the hidden part of the dialog again.

8. To add a region, click the Drawing tool (■) button.



9. In the **Registered figure** section in the **Edit** dialog, a rectangle is added. In the Preview area, a rectangle for the editable region (pattern region) is created.

Adjust the position of the region by checking the preview. You can directly edit the rectangle region in the preview. When completed, click **OK**.





Parameter	Value [Factory Default]	Explanation
Upper left position	· The setting range differs depending on the camera.	Set the camera coordinates of the upper left corner point of the rectangle region. Click ▲ and ▼ to adjust the value. You can also enter the value into the box.
Lower right position	· The setting range differs depending on the camera.	Set the camera coordinates of the lower right corner point of the rectangle region. Click ▲ and ▼ to adjust the value. You can also enter the value into the box.
Center Position	· The setting range differs depending on the camera.	Set the camera coordinates of the center point of the rectangle region. Click ▲ and ▼ to adjust the value. You can also enter the value into the box.



### Useful Information

When you open the **Edit** dialog again, only the coordinate boxes will be displayed, and the drawing tool button will not be displayed.

### 10. Set the parameters under **Screen adjust**.

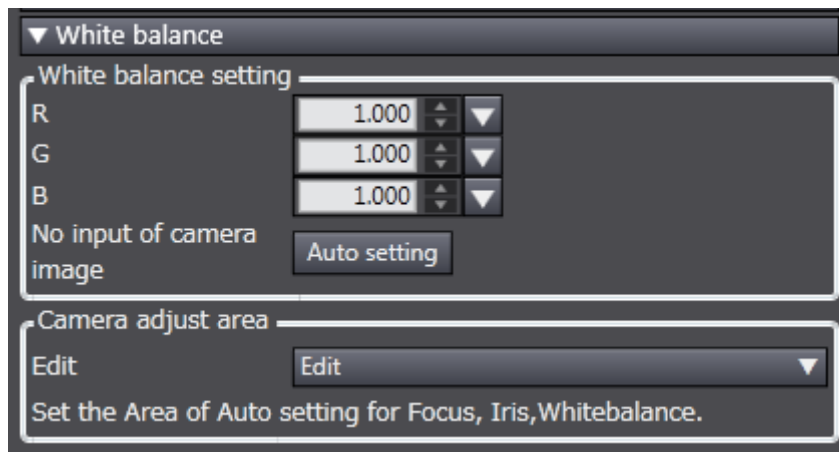
These parameters must be set to perform calibration. For more information about setting these parameters, refer to the *Screen Adjustment Settings (Camera Image Input FH)* on page 47-54 in the *Vision Sensor FH/FZ5 Series Vision System Processing Item Function Reference Manual* (Cat. No. Z341-E1).

Parameter	Value [Factory Default]	Explanation
Lighting Control	Differs depending on the connected light. For more information, refer to the above manual.	If a camera with a built-in light or camera with lighting controller is used, the light amount can be controlled.
Line bright Display line bright	· [Cleared] · Selected	Select this check box to display the density distribution along a virtual line in the image.
Line bright Line bright position X and Y	Differs depending on the connected camera. For more information, refer to the above manual.	Specify the position of the Line bright by specifying the camera coordinates in the spin box. This spin box is available only when Display line bright is enabled. Click ▲ and ▼ to adjust the value. You can also enter the value into the box.

11. Set up parameters under **White Balance**.

These parameters must be set to perform calibration.

For more information about setting these parameters, refer to the *White Balance (Camera Image Input FH)* on page 55 in the *Vision Sensor FH/FZ5 Series Vision System Processing Item Function Reference Manual* (Cat. No. Z341-E1).



Parameter	Value [Factory Default]	Explanation
White balance setting	The Lighting Control setting differs depending on the connected light. For more information, refer to the above manual.	If a camera with a built-in light or camera with lighting controller is used, the amount of light can be controlled.
Auto setting	-	Automatically adjusts the white balance setting.
Camera adjust area Edit	-	Click <b>Edit</b> , then the Edit dialog will appear. Set a region where the focus, iris, and white balance settings will be adjusted. A rectangle for the editable region will be created.  This procedure is the same as the procedure of setting a range for brightness adjustment, which is described Step 7 to 9.

## 12. Confirm Brightness Histogram.

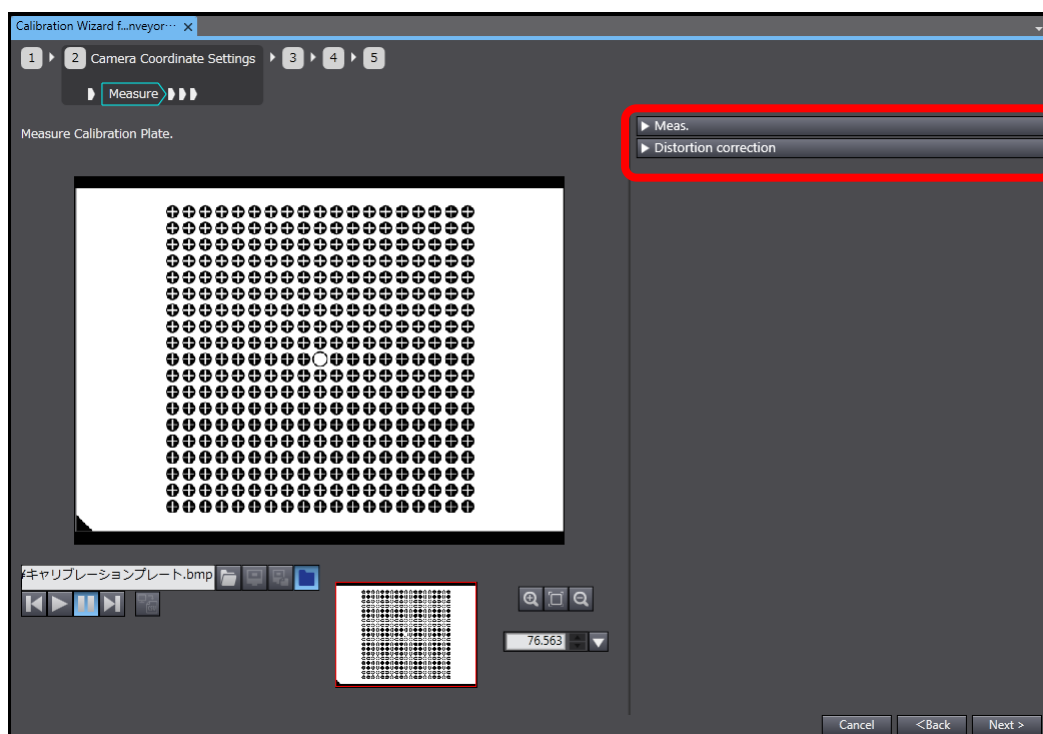
The **Brightness Histogram setting** is available only when **HDR Setting** is enabled on the Execute Content of Start menu.

### 3.6. Measuring Location of Marks

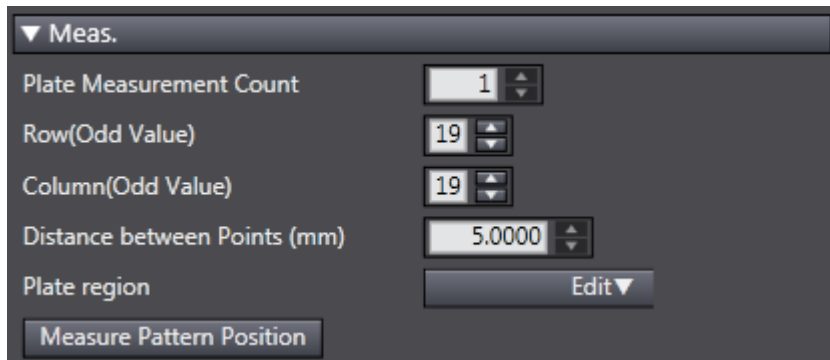
Capture an image of Calibration Plate. This process corresponds to the step 4 in 4.1. *Setup Procedure and User Interface of Conveyor Tracking Calibration Wizard.*

1. The [Camera Coordinate Settings] [Measure] page appears.

Click ► next to each parameter label in the Function List View to show the detailed parameters.



2. Set the parameters under Measurement.



Parameter	Value [Factory Default]	Explanation
Plate Measurement Count	<ul style="list-style-type: none"> <li>• 1 to 10</li> <li>• [1]</li> </ul>	<p>Set the number of times to measure the Calibration Plate in integers 1 to 10.</p> <p>Adjust values in the spin box. Click ▲ and ▼ to adjust the value. You can also enter the value into the box.</p> <p>If measurement is unstable due to noise, or if you want to improve the calibration accuracy, increase the measurement number count.</p>
Row(Odd Value)	<ul style="list-style-type: none"> <li>• 5 to 19</li> <li>• [5]</li> </ul>	<p>Set the number of Marks per row on the Calibration Plate in integer (odd number) 5 to 19.</p> <p>Adjust values in the spin box. Click ▲ and ▼ to adjust the value. You can also enter the value into the box.</p>
Column(Odd Value)	<ul style="list-style-type: none"> <li>• 5 to 19</li> <li>• [5]</li> </ul>	<p>Set the number of Marks per column on the Calibration Plate in integer (odd number) 5 to 19.</p> <p>Adjust values in the spin box. Click ▲ and ▼ to adjust the value. You can also enter the value into the box.</p>
Distance between Points (mm)	<ul style="list-style-type: none"> <li>• 1 to 200</li> <li>• [5]</li> </ul>	<p>Set distance between centers of Marks on the Calibration Plate in integer 1 to 200. The unit of measure: mm.</p> <p>Adjust values in the spin box. Click ▲ and ▼ to adjust the value. You can also enter the value into the box.</p>

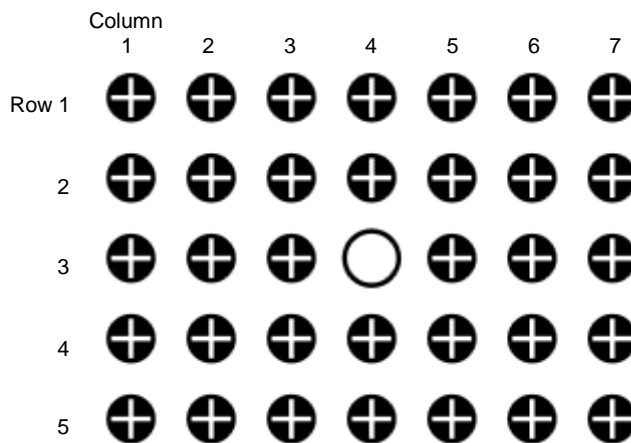
Plate region	• [Full]	Click <b>Edit</b> to set the pattern region on the Calibration Plate. When there are unnecessary objects other than the calibration pattern captured in images, calibration may fail. In that case, setting the pattern region may effectively solve the issue.
Measure Pattern Position	-	Click <b>Measure Pattern Position</b> to set the pattern position on the Calibration Plate.



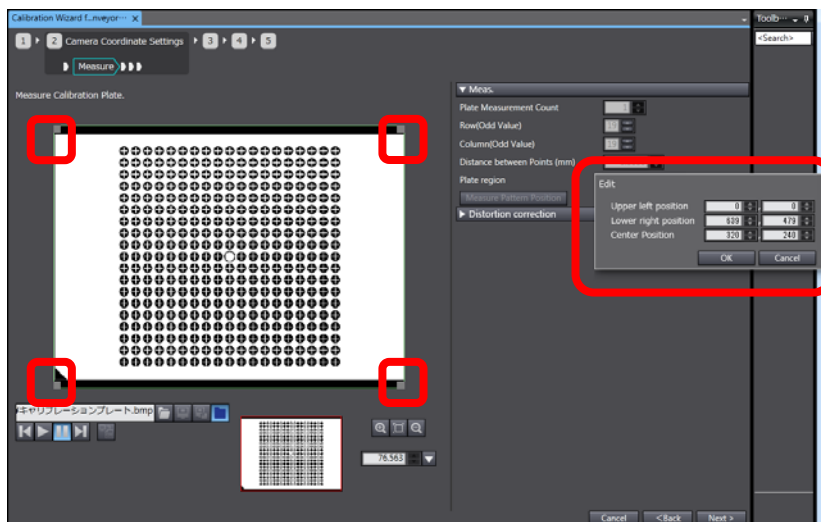
### Useful Information

Only odd numbers are allowed for the **Row(Odd value)** Row points setting and **Column(Odd Value)** (Marks per row/column setting) of the Pattern to have a Mark as the center point.

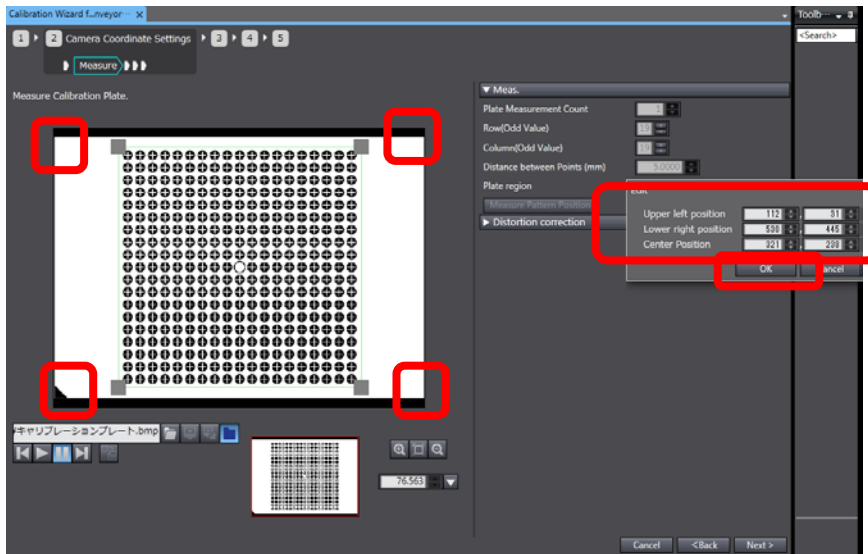
The horizontal lines are rows, and vertical lines are columns. In the following figure, Marks per row: **Row(Odd value)** is set to 7, and Marks per column: **Column(Odd Value)**, is set to 5, making five rows and seven columns.



- To set the pattern region under **Measurement** item, click **Edit** on the **Plate region**. The **Edit** dialog appears, and a rectangle for the editable region (pattern region) is created and shown over the preview image.



5. While checking the preview image, position the pattern region so as to avoid unnecessary objects other than the Pattern. You can directly edit the rectangle region on the preview image. When completed, click **OK**.



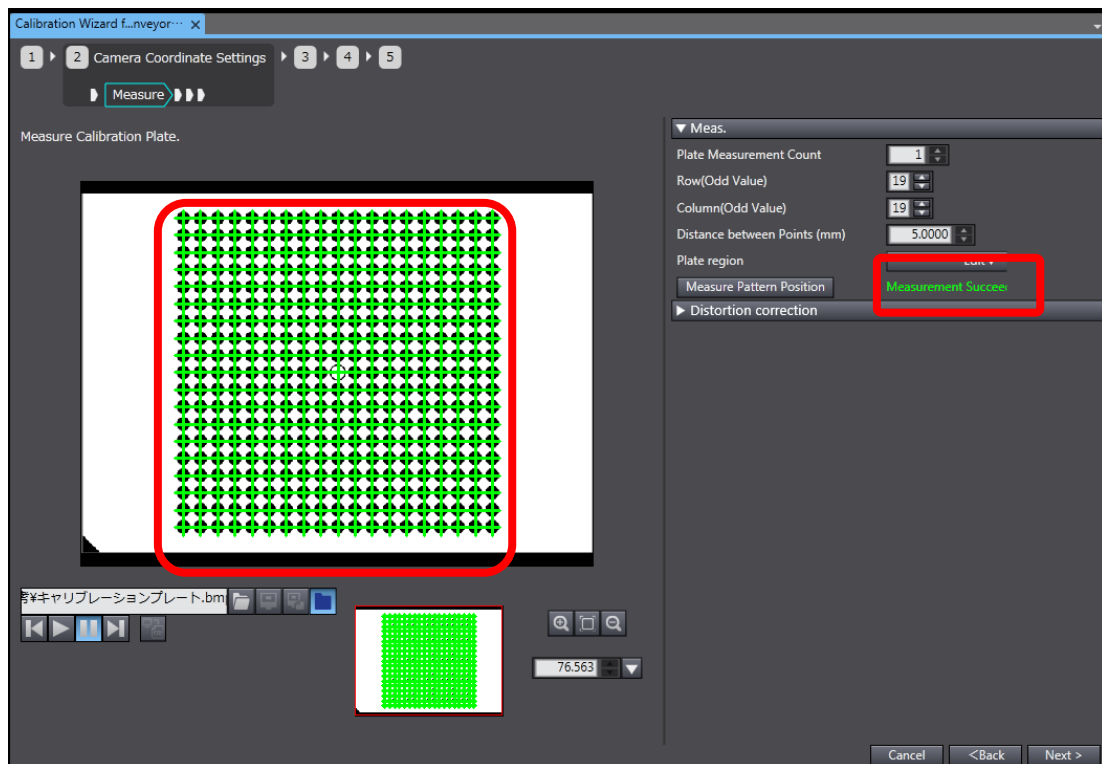
Parameter	Value [Factory Default]	Explanation
Upper left position	<ul style="list-style-type: none"> <li>The setting range differs depending on the camera.</li> <li>X coordinate, Y coordinate: [0]</li> </ul>	<p>Set the camera coordinates of the upper left corner point of the rectangle region.</p> <p>Click ▲ and ▼ to adjust the value.</p> <p>You can also enter the value into the box.</p>
Lower right position	<ul style="list-style-type: none"> <li>The setting range differs depending on the camera.</li> <li>X coordinate, Y coordinate: [Full].</li> </ul>	<p>Set the camera coordinates of the lower right corner point of the rectangle region in the spin box.</p> <p>Click ▲ and ▼ to adjust the value.</p> <p>You can also enter the value into the box.</p>
Center Position	<ul style="list-style-type: none"> <li>The setting range differs depending on the camera.</li> </ul>	<p>Set the camera coordinates of the center point of the rectangle region in the spin box.</p> <p>Click ▲ and ▼ to adjust the value.</p> <p>You can also enter the value into the box.</p>

## 6. Click **Measure Pattern Position**.

Marks of the Calibration Plate will be measured with the adjusted settings.

The result of the pattern measurement will be displayed in the Preview window and the Measurement page.

If the measurement is successful, the measurement results are shown on the center of each Mark.



## **Precautions for Use**

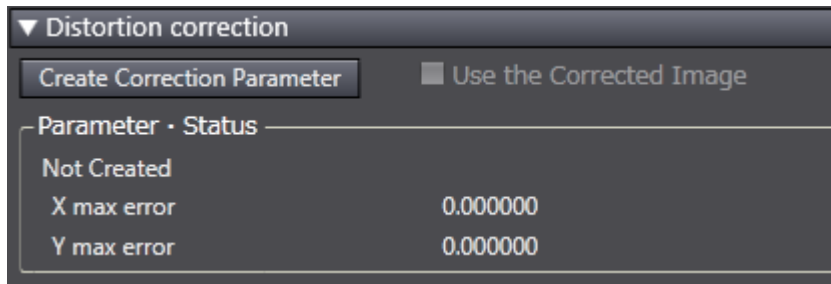
After the pattern measurement, confirm that centers of the entire target Marks are measured.

Any missing Marks may cause calibration to fail or degrade the accuracy, such as X max error or Y max error

If that occurs, re-adjust the [Start] [Camera Settings] page.



7. Set the parameters under Distortion correction.



Parameter	Value [Factory Default]	Explanation
Create Correction Parameter	-	Click this button to create parameters for distortion correction using measured data by clicking Measure Pattern Position under Measurement. This button is available only when the pattern position measurement was successful. Set parameters will be displayed in the Parameter · Status section.
Use the Corrected Image	<ul style="list-style-type: none"> <li>· [Cleared]</li> <li>· Selected</li> </ul>	Select this check box when you want to use the parameters for distortion correction.
Parameter · Status	-	<ul style="list-style-type: none"> <li>· <b>Not Created:</b> If the distortion correction parameters are not set, this message appears in white.</li> <li>· <b>Create Succeeded:</b> If the distortion correction parameters are successfully set, this message appears in green.</li> <li>· <b>Create Succeeded:</b> If setting the distortion parameters fails, this message appears in red.</li> <li>· <b>X max error:</b> The maximum error of mark measurement in the x axis direction. The unit of measure: mm.</li> <li>· <b>Y max error:</b> The maximum error of mark measurement in the y axis direction. The unit of measure: mm.</li> </ul>

## Precautions for Use



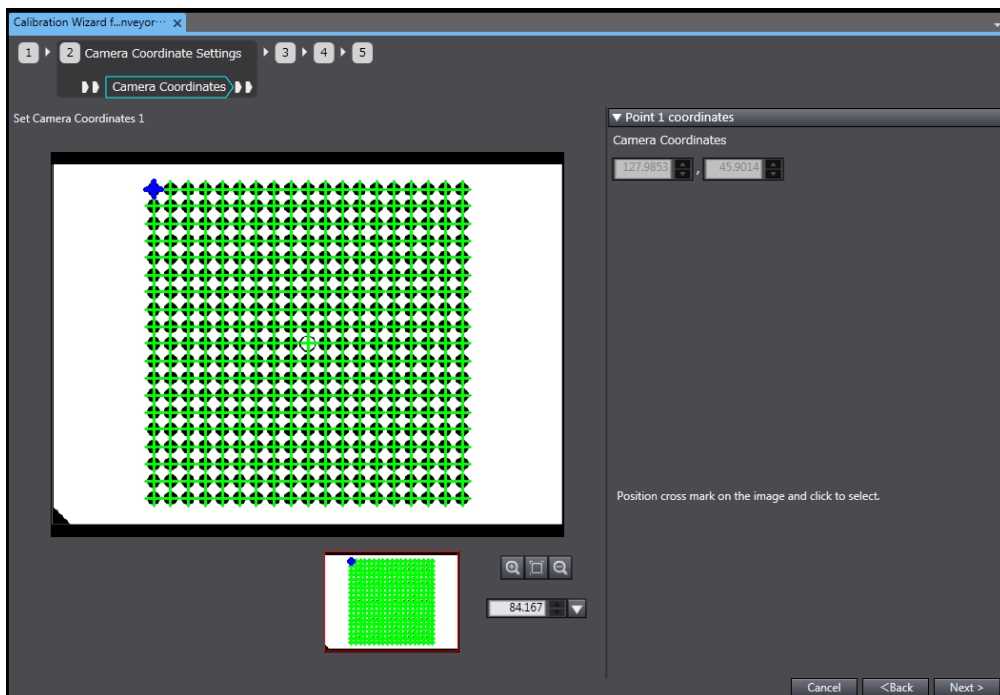
The displayed values in the **Parameter** ▪ **Status** section are merely samples found by using the result of **Measure Pattern Position**. The values can be referenced to estimate the result of calibration, however, keep in mind that they are not guaranteed values.

8. After completing settings for the **Measure** and **Distortion correction** parameters, click **Next** >.

## 3.7. Selecting Marks to Use for Calibration Parameter Calculation


Set the encoder value for image capture and also point(s) to which Set Point will be performed using captured images. This process corresponds to the step 5 in 4.1. *Setup Procedure and User Interface of Conveyor Tracking Calibration Wizard*.


1. The **Camera Coordinate** page of the **Camera Coordinate Settings** appears. The measurement result when the **Measure Pattern Position** button, which is on the **Measure** item of the **Camera Coordinate** settings, is clicked.

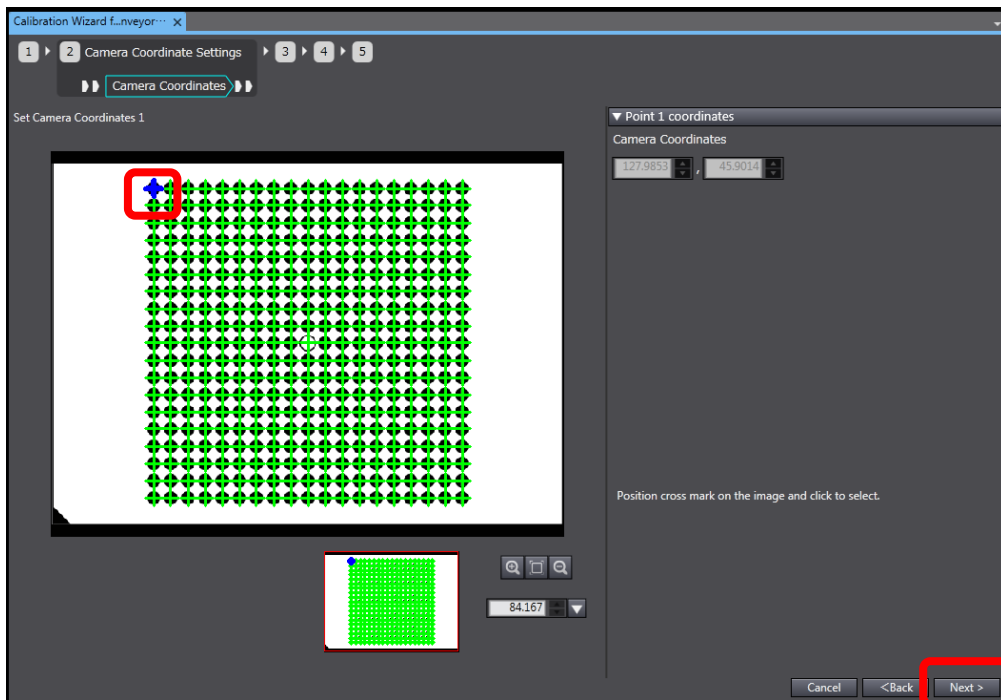


2. Set **Point 1 coordinates** for robot to perform the first Set Point.

On the displayed **Measure Pattern Position** a Mark is automatically selected, and the se-

lected Mark looks like this: . If the desired point for the first Set Point is the same as

the selected Mark () , click Next >. If not, click a Mark on which you want to perform the first Set Point. You can also specify the point in the Camera Coordinate box.



Parameter	Value [Factory Default]	Explanation
Point 1 coordinates Camera Coordinates	<ul style="list-style-type: none"> <li>[The center point of the upper left Mark on the result image of the pattern measurement performed by clicking Measure Pattern Position]</li> </ul>	<p>Specify the point to which the robot will perform Set Point after moving the Calibration Plate into the tracking area by clicking the preview image.</p> <p>You can also specify the point in the <b>Camera Coordinate</b> box.</p> <p>Click ▲ and ▼ to adjust the value, or enter the value into the box.</p>

Point 2 coordinates Camera coordinates	<ul style="list-style-type: none"> <li>[The center point of the upper right Mark on the result image of the pattern measurement performed by clicking Measure Pattern Position]</li> </ul>	<p>Specify the point to which the robot will perform Set Point after moving the calibration Plate into the tracking area by clicking the preview image. You can also specify the point in the <b>Camera Coordinate</b> box.</p> <p>Click ▲ and ▼ to adjust the value, or enter the value into the box.</p>
Point 3 coordinates Camera coordinates	<ul style="list-style-type: none"> <li>[The center point of the lower left Mark on the result image of the pattern measurement performed by clicking Measure Pattern Position]</li> </ul>	<p>Specify the point to which the robot will perform Set Point after moving the calibration Plate into the tracking area by clicking the preview image. You can also specify the point in the <b>Camera Coordinate</b> box.</p> <p>Click ▲ and ▼ to adjust the value, or enter the value into the box.</p>
Point 4 coordinates Camera coordinates	<ul style="list-style-type: none"> <li>[The center point of the lower right Mark on the result image of the pattern measurement performed by clicking Measure Pattern Position]</li> </ul>	<p>Specify the point to which the robot will perform Set Point after moving the calibration Plate into the tracking area by clicking the preview image. You can also specify the point in the <b>Camera Coordinate</b> box.</p> <p>Click ▲ and ▼ to adjust the value, or enter the value into the box.</p> <p>This setting is available only when Number of Set Points is set to 4 on the <b>Start</b> of the <b>Contents</b> menu</p>

- Specify coordinates of points on which the robot will perform Set Point by clicking the preview image. You can specify three or four points. If Number of Set Points is set to 4 on the **Condition settings** of the **Start** menu page, you need to specify four points.

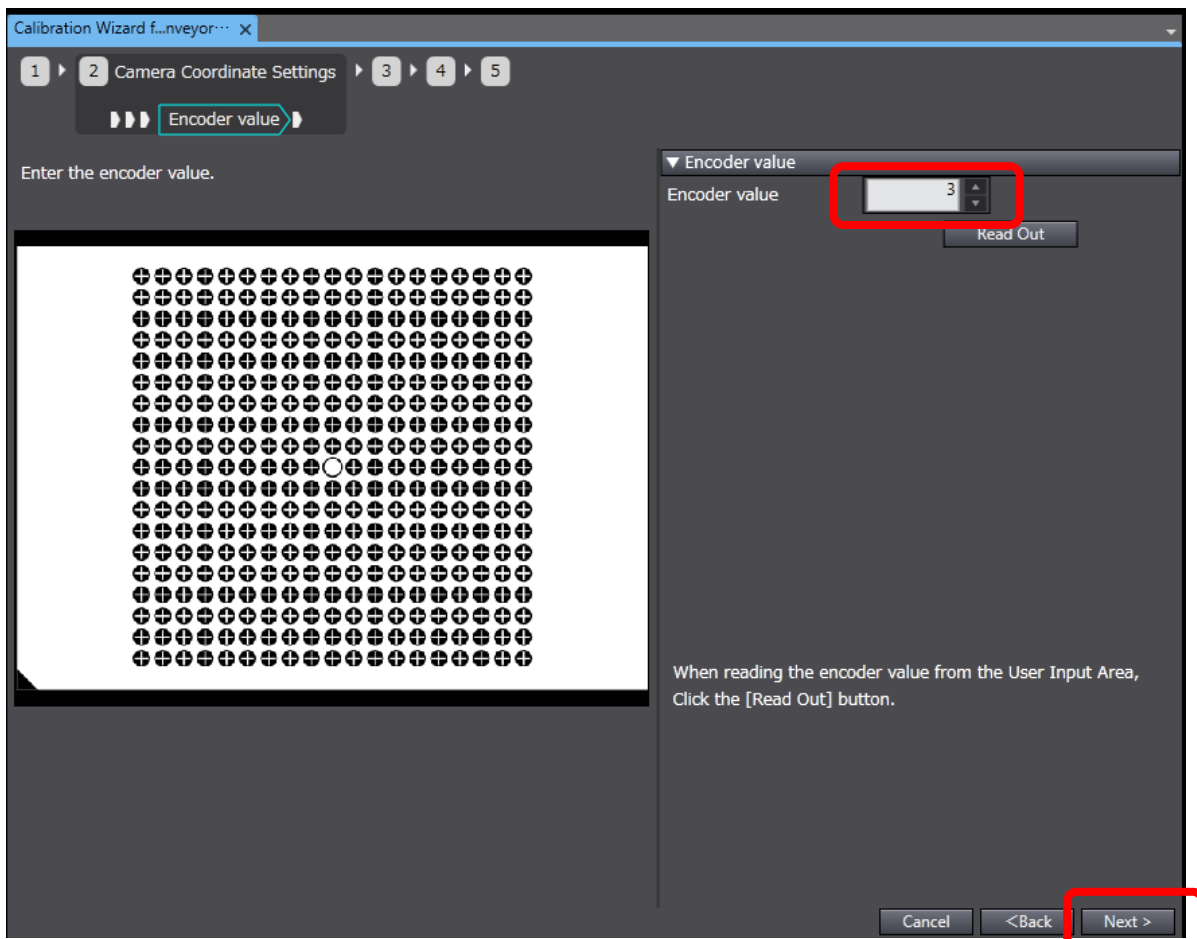


### Precautions for Use

The specified coordinates will be used for the Set Point operation in tracking areas in both the Track Start Line side and Track Finish Line side.

Consider the shape of the tracking area when specifying the coordinates.

- The **Encoder value** of the **Camera Coordinate Settings** menu page will be displayed. Set the encoder value for the current camera position in the **Encoder Value** box. After completing the encoder value setting, click **Next >**.



Parameter	Value [Factory Default]	Explanation
Encoder value	<ul style="list-style-type: none"> <li>• 0 to 2147483647</li> <li>• [0]</li> </ul>	<p>Set the encoder value for the camera position from which the Calibration Plate was captured.</p> <p>Click ▲ and ▼ to adjust the value, or, enter the value into the box.</p> <p>The encoder value can be up to 2147483647. Once the encoder value reaches that value, it goes back to 0 (ring counter system).</p>

Read Out	-	<p>Click this button to <b>Read out</b> the encoder value based on the <b>Encoder value</b> setting under Data setting from EtherCAT on the <b>Condition settings</b> page.</p> <p>The result of the read out will be displayed on the left of the <b>Read Out</b> button.</p> <ul style="list-style-type: none"> <li>• <b>Read Out Succeeded:</b> If read out is successful, this message appears in green, and the Encoder value will be updated with the read out value.</li> <li>• <b>Read Out Failed:</b> If read out fails, this message appears in red. The Encoder value will not be updated.</li> </ul>
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### 3.8. Moving the Calibration Plate into the Tracking Area

Move the Calibration Plate into the tracking area. This process corresponds to the step 6 and 8 in *4.1. Setup Procedure and User Interface of Conveyor Tracking Calibration Wizard*.

The Calibration Plate can be moved to two places:

The Track Start Line side and Track Finish Line side of the tracking area.

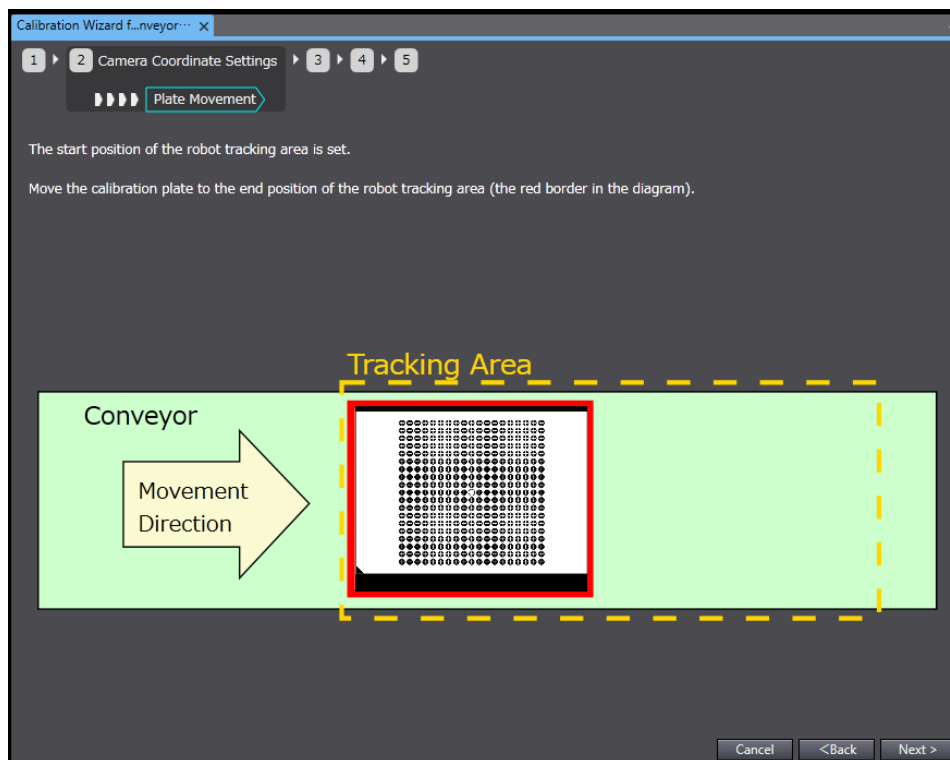
1. The **Plate Movement** of the **Camera Coordinate Settings** page appears.

In the lower half of the page (Plate Movement Display), the preview image created based on the pattern position measurement described in *4.6. Measuring Location of Marks* is displayed.

This process corresponds to the step 6 in *4.1. Setup Procedure and User Interface of Conveyor Tracking Calibration Wizard*.

Move the Calibration Plate to the Track Start Line side of the tracking area by following the instruction.

When completed, click **Next>**.



2. The **Machine Coordinates Settings (Track Start Line Side)** of the **Plate Movement** menu

In the preview window, the preview image created based on the **Measure Pattern Position** described in 4.6. *Measuring Location of Marks* is displayed.

3. Perform Set Point. For more information, refer to 4.9. *Performing Set Point (Teaching) to Marks Using the Calibration Plate*.

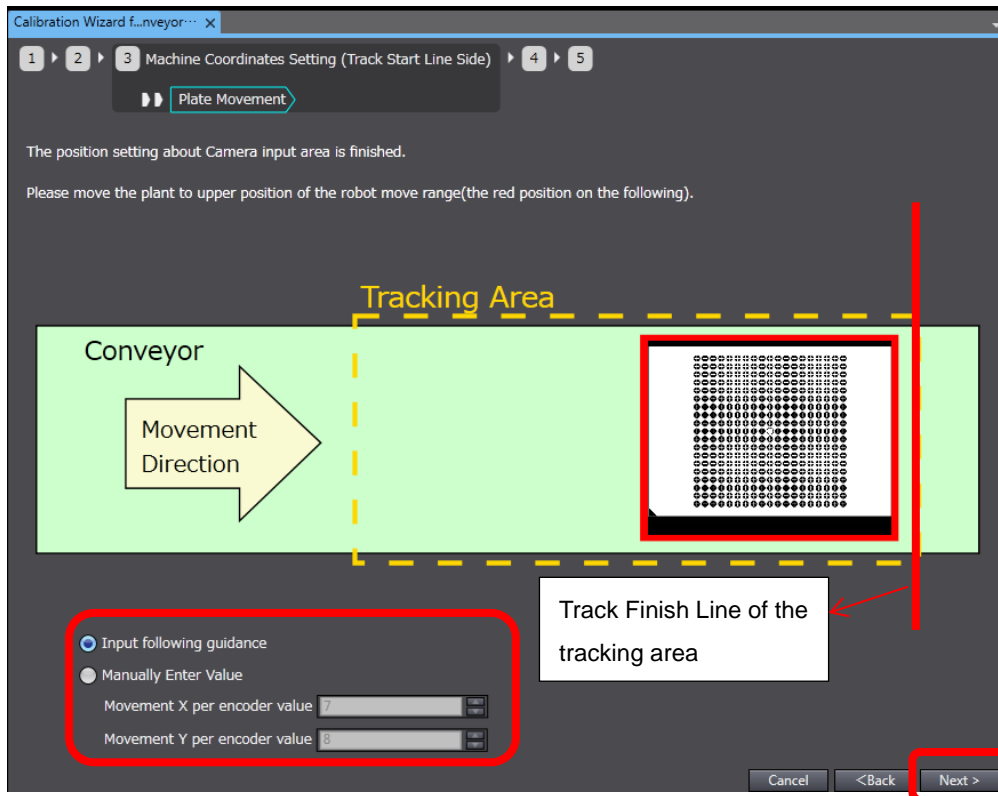
4. **Plate Movement** page of the **Machine Coordinates Settings (Track Start Line Side)** menu appears.

In this page, the result which proceeded on the **Measure Pattern Position** of the **Measure** menu. For this **Measure Pattern Position**, described on 4-6 *Measuring Location of Marks*.

This process corresponds to the step 8 in 4.1. *Setup Procedure and User Interface of Conveyor Tracking Calibration Wizard*.

To also perform Set Point on the Track Finish Line side, select the Input following guidance option, and click **Next >**, and see 5.

To enter the movement per encoder value manually, select the **Manually Enter Value** option, and see 7.



Parameter	Value [Factory Default]	Explanation
Input following guidance	<ul style="list-style-type: none"> <li>• [Cleared]</li> <li>• Selected</li> </ul>	<p>Select when you want to specify new points to perform Set Point.</p> <p>After selecting this option, click <b>Next &gt;</b>. You will go to the Plate Movement page of the Camera Coordinates Setting (Trace Start Line Side) step. Specify the points for Set Point.</p>
Manually Enter Value	<ul style="list-style-type: none"> <li>• [Cleared]</li> <li>• Selected</li> </ul>	<p>Select when you want to enter the movement per encoder value on MCS without specifying the Set Points.</p>
Movement X per encoder value	<ul style="list-style-type: none"> <li>• -99999.9999 to 99999.9999</li> </ul>	<p>Set the movement in the x axis direction of MCS per encoder value in the spin box.</p> <p>Click ▲ and ▼ to adjust the value, or enter the value into the box.</p>
Movement Y per encoder value	<ul style="list-style-type: none"> <li>• -99999.9999 to 99999.9999</li> </ul>	<p>Set the movement in the y axis direction of MCS per encoder value in the spin box.</p> <p>Click ▲ and ▼ to adjust the value, or enter the value into the box.</p>

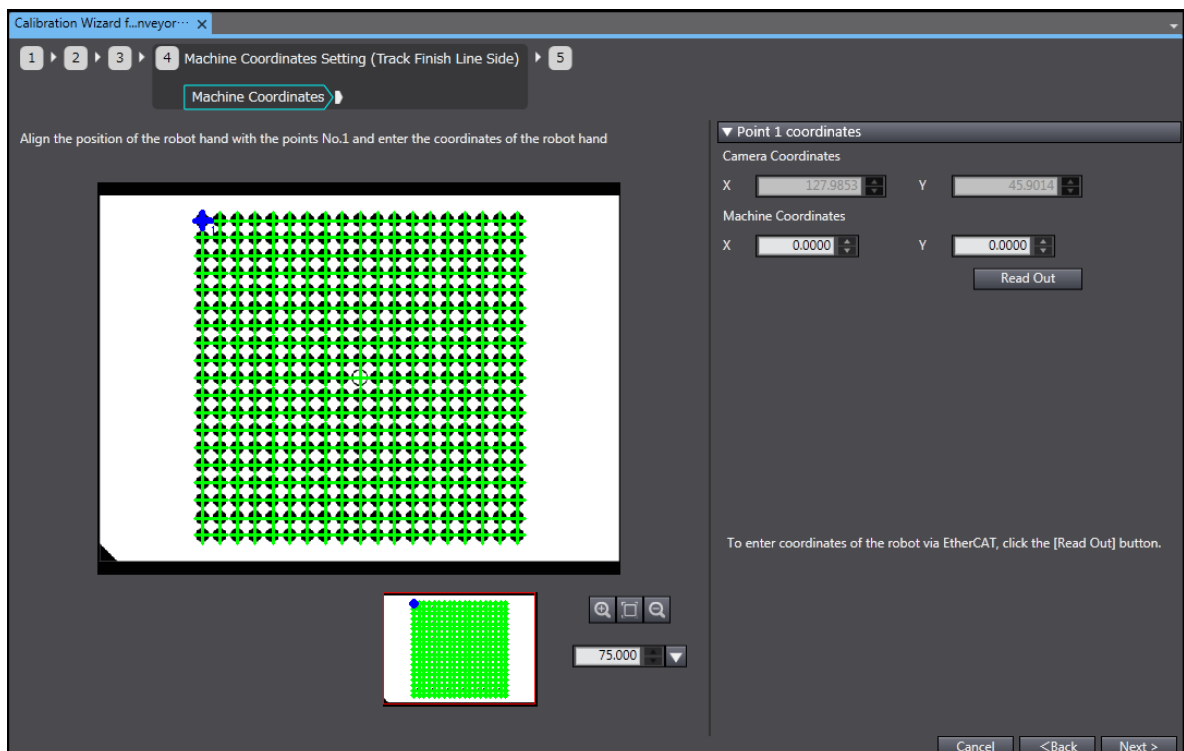


5. If the Input following guidance option is selected, the **Machine Coordinates** of the **Machine Coordinates Settings (Track Finish Line Side)** menu will appear.
  
6. Perform Set Point. Make sure that stop the machine and conveyer when Set Point is performed. For details, refer to 4.9. *Performing Set Point (Teaching) to Marks Using the Calibration Plate.*
  
7. Set the movement per encoder value and then click **Next >**.  
Refer to 4.10 *Performing Calibration.*

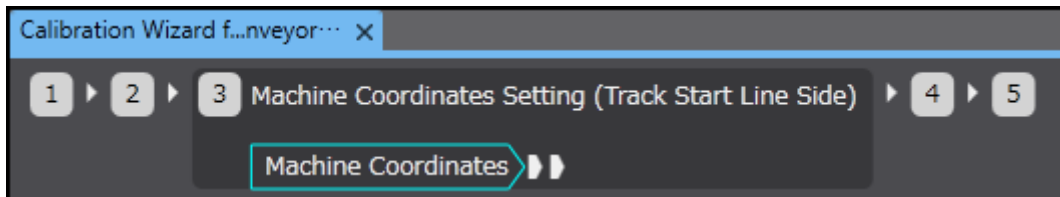
### 3.9. Performing Set Point (Teaching) to Marks Using the Calibration Plate

Perform Set Point to the points measured or specified by the encoder value. You can also enter the value into the box. This process corresponds to the step 7 and 9 in 4.1. *Setup Procedure and User Interface of Conveyor Tracking Calibration Wizard.*

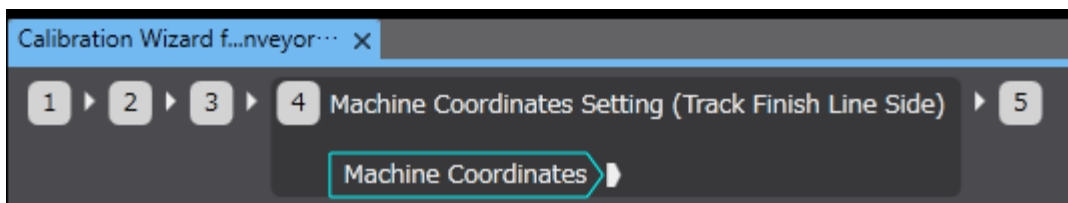
1. The **Machine Coordinates** of the **Machine Coordinates Settings (Track Start Line Side)** menu appears. In the preview window, the preview image created based on the pattern position measurement described in 4.6. *Measuring Location of Marks* is displayed.



To adjust settings for the Track Start Line side, go to the **Machine Coordinates Settings (Track Start Line Side)** step pages.



To adjust settings for the Track Finish Line side, go to the **Machine Coordinates Settings (Track Finish Line Side)** step pages.



2. Click ▼ on the **Point 1 coordinate**, select your attempt number of the coordinate, and set the parameters.

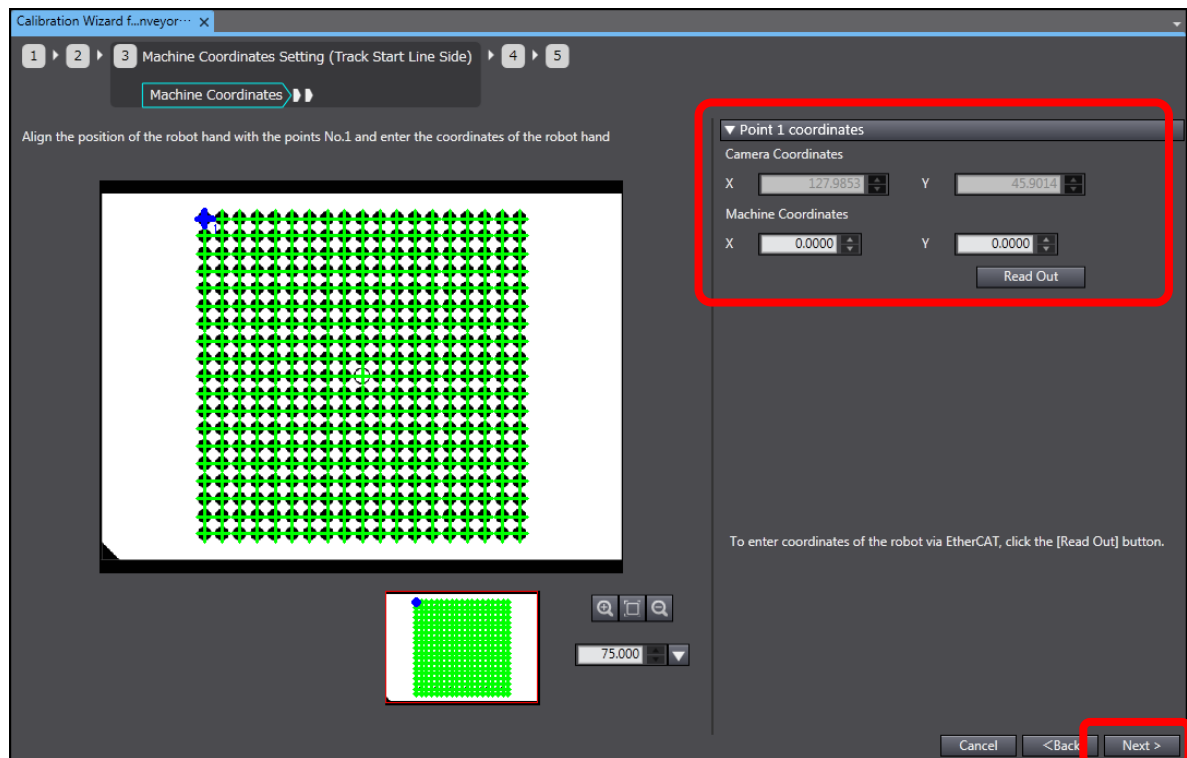
Perform Set Point to teach the robot the coordinates specified in the steps described in 4.7.

*Selecting Marks for Calibration Parameter Calculation.*

Click **Next >**.

When you use **Machine Coordinates Settings (Track Start Line Side)**, the number of Set Point action specified on the **Number of Set Points** parameter, is required. For Number of Set Points settings, refer to 4.4 *Selecting the Type and Other Conditions of Calibration*.

The number of Set Point action of the mark position, specified on **Point 1 coordinate** parameter, is required.



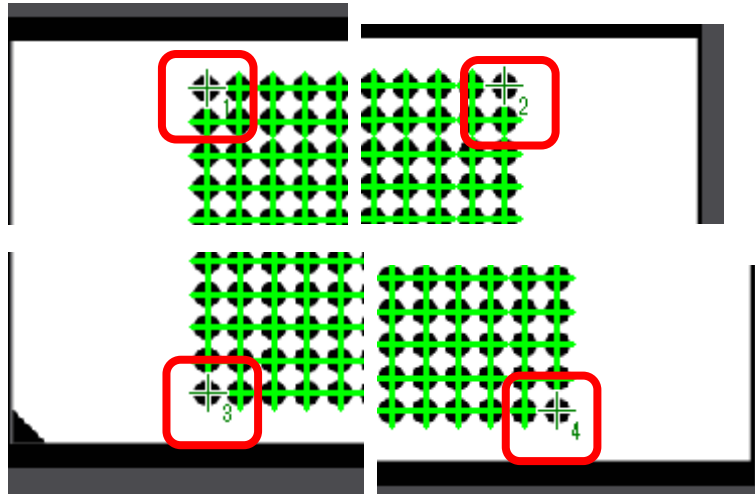
Parameter	Value [Factory Default]	Explanation
Camera Coordinates X Camera Coordinates Y	• -99999.9999 to 99999.9999	Perform Set Point to teach the robot the coordinates specified in the steps described in 4.7. <i>Selecting Marks for Calibration Parameter Calculation</i> . Set the x coordinate on MCS in the spin box. .Click ▲ and ▼ to adjust the value, or enter the value into the box.
Machine Coordinates Y	• -99999.9999 to 99999.9999	Perform Set Point to teach the robot the coordinates specified in the steps described in 4.7. <i>Selecting Marks for Calibration Parameter Calculation</i> . Set the y coordinate on MCS in the spin box. .Click ▲ and ▼ to adjust the value, or enter the value into the box.

Read Out	-	<p>Click this button to read out the machine coordinate x/y based on the <b>Machine Coordinates X</b> and <b>Machine Coordinates Y</b> setting under Data setting from EtherCAT on the <b>Condition settings</b> page.</p> <p>The result of the read out will be displayed on the left of the Read Out button.</p> <ul style="list-style-type: none"> <li>• <b>Read Out Succeeded:</b> If read out is successful, this message appears in green, and <b>Machine Coordinates X</b> and <b>Machine Coordinates Y</b> will be updated with the read out value.</li> <li>• <b>Read Out Failed:</b> If read out fails, this message appears in red. <b>Machine Coordinates X</b> and <b>Machine Coordinates Y</b> will not be updated</li> </ul>
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## Useful Information

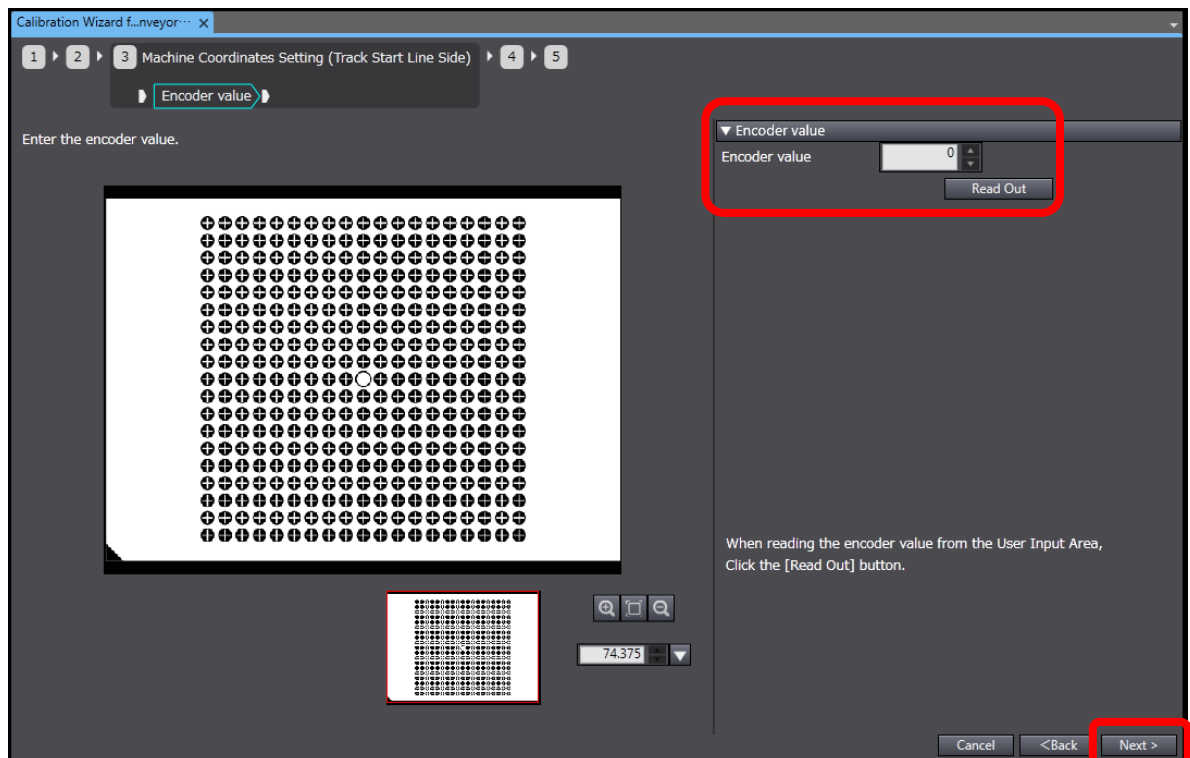
During the Set Point for the Track Start Line side, the order of the Set Point is displayed in the preview image.



3. The **Encoder value** of the **Machine Coordinates Settings (Track Start Line Side)** page will be displayed.

Set the encoder value for the current position (position of the Calibration Plate).

After completing the encoder value setting, click **Next >**.



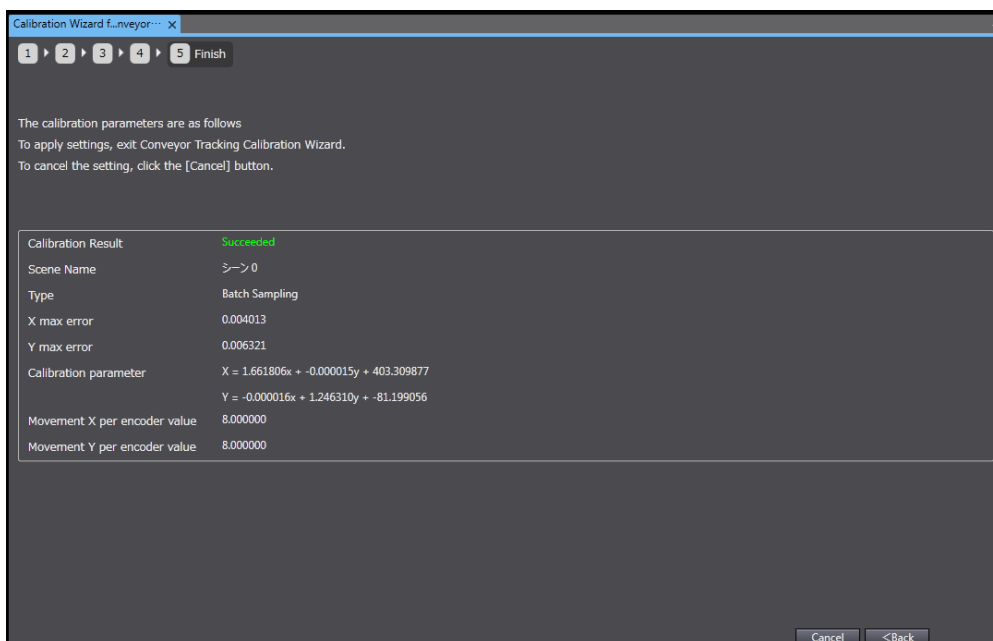
Parameter	Value [Factory Default]	Explanation
Encoder value	<ul style="list-style-type: none"> <li>• 0 to 2147483647</li> <li>• [0]</li> </ul>	<p>Set the encoder value for the camera position from which the Calibration Plate was captured. Click ▲ and ▼ to adjust the value. or enter the value into the box.</p> <p>The encoder value can be up to 2147483647. Once the encoder value reaches that value, it goes back to 0 (ring counter system).</p>
Read Out	-	<p>Click this button to read out the encoder value based on the Encoder Value setting under Data setting from EtherCAT on the <b>Condition settings</b> page.</p> <p>The result of the read out will be displayed on the left of the <b>Read Out</b> button.</p> <ul style="list-style-type: none"> <li>• <b>Read Out Succeeded:</b> If read out is successful, this message appears in green, and the Encoder value will be updated with the read out value.</li> <li>• <b>Read Out Failed:</b> If read out fails, this message appears in red. The Encoder value will not be updated.</li> </ul>

### 3.10. Performing Calibration

Perform calibration with the settings explained in preceding sections.

This process corresponds to the step 10 in 4.1. *Setup Procedure and User Interface of Conveyor Tracking Calibration Wizard*.

1. Confirm the result of conveyor tracking calibration.



Parameter	Explanation
Calibration Result	<p>Displays the result of conveyor tracking calibration.</p> <ul style="list-style-type: none"> <li>• <b>Succeeded:</b> If the conveyor tracking calibration was successful, this message appears in green.</li> <li>• <b>Failed:</b> If the conveyor tracking calibration failed, this message appears in red.</li> </ul>
Scene Name	Displays the current Scene that is used in Conveyor Tracking Calibration Wizard.
Type	<p>Displays the type of calibration set on the <b>Execute Condition</b> of the <b>Start</b> menu.</p> <ul style="list-style-type: none"> <li>• Batch Sampling</li> <li>• Specify Point(s)</li> </ul>

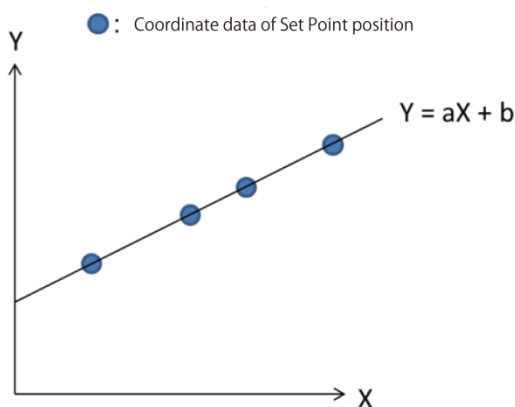
X max error	Displays the maximum error in the x axis direction between coordinates calculated using calculated calibration parameters and sampled coordinates as a value on MCS. The unit of measure: mm.
Y max error	Displays the maximum error in the y axis direction between coordinates calculated using calculated calibration parameters and sampled coordinates as a value on MCS. The unit of measure: mm.
Calibration parameter	Displays the calibration parameters to convert the camera coordinates (x, y) to machine coordinates (X, Y). <ul style="list-style-type: none"> <li>• <math>X = \text{Parameter Ax} + \text{Parameter B}y + \text{Parameter C}</math></li> <li>• <math>Y = \text{Parameter D}x + \text{Parameter E}y + \text{Parameter F}</math></li> </ul>
Movement X per encoder value	Displays the movement amount of the machine coordinate to the X axis direction per encoder value on the conveyor from which target objects will be picked up by a robot that will be calibrated. The unit of measure: mm.
Movement Y per encoder value	Displays the movement amount of the machine coordinate to the Y axis direction per encoder value on the pick-side conveyor that will be calibrated. The unit of measure: mm.



### Precautions for Use

When calibration fails, confirm the followings and perform calibration again.

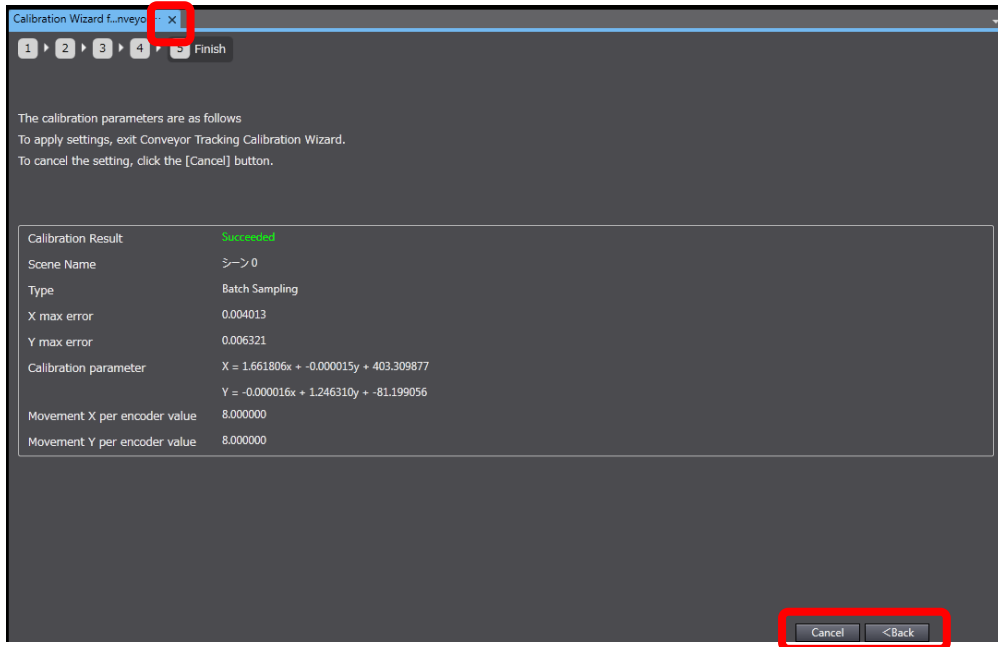
- Set Point cannot be performed on overlapped points. Confirm that the same point is not repeatedly specified for a Set Point, which are set in steps described in 4.7. *Selecting Marks for Calibration Parameter Calculation* or 4.9. *Performing Set Point (Teaching) to Marks Using the Calibration Plate*.
- Set Point cannot be performed on aligned points. Confirm that the target points are not aligned for Set Point, which are set in steps described in 4.7. *Selecting Marks for Calibration Parameter Calculation* or 4.9. *Performing Set Point (Teaching) to Marks Using the Calibration Plate*.





- If re-calibration is not necessary after confirming the above points, click the close (x) button on the **Conveyor Calibration Tracking Wizard** tab. The calibration result will be saved, and Conveyor Tracking Calibration Wizard will close.

If you want to re-calibrate, click **Cancel** or **< Back**.



### 3.11. Measurement results can be output (Conveyor Tracking Calibration Wizard Tool)

Measurement item	Character strings]	Description
Judgment result	JG	Show the judgment result.

### 3.12. External Reference Table (Conveyor Tracking Calibration Wizard Tool)

No.	Data name	Set/Get	Data range
0	Judge	Get only	0 : No judgement(Unmeasured) 1 : Judgement Result OK
5	Number of marks	Get only	The detected number of the calibration marks is acquired when the sample measurement is executed.
6	Machine coordinate X (Get from User Input Area)	Get only	Machine coordinate X when is acquired from the User area.
7	Machine coordinate Y (Get from User Input Area)	Get only	Machine coordinate Y when is acquired from the User area.
8	Encoder value Machine coordinate X (Get from User Input Area)	Get only	The encoder value when is acquired from the User defined area
120	Number of set points	Get only	3 : Select 3 points 4 : Select 4 points
122	Sampling unit No.	Set/Get	Sampling processing item number (This data is applied only for the Precise Calibration function.) -1 : No reference 0~9,999 : Sampling unit No.
123	User Input Area for machine coordinate X	Set/Get	User Input Areas for the machine coordinate X. -1 : None 0 : User Input Area 0 : 5 : User Input Area 5
124	User Input Area for machine coordinate Y	Set/Get	User Input Areas for the machine coordinate Y. -1 : None 0 : User Input Area 0 : 5 : User Input Area 5
125	User Input Area for the encoder value	Set/Get	User Input Areas for the encoder value. -1 : None 0 : User Input Area of the encoder value 0 : 5 : User Input Area of the encoder value 5

126	Calculation method of movement per encoder value	Set/Get	Entering method for the movement amount per one encoder value. 0 : Auto calculation (Enter the value following the guidance.) 1 : Manual entry (Enter the value manually.)
127	Movement X per encoder value	et/Get	-999,999,999.999999 ~999,999,999.999999
128	Movement Y per encoder value	Set/Get	-999,999,999.999999 ~999,999,999.999999
150	A (uncorrected)	Set/Get	Calculation result of the calibration parameter A
151	B (uncorrected)	Set/Get	Calculation result of the calibration parameter B
152	C (uncorrected)	Set/Get	Calculation result of the calibration parameter C
153	D (uncorrected)	Set/Get	Calculation result of the calibration parameter D
154	E (uncorrected)	Set/Get	Calculation result of the calibration parameter E
155	F (uncorrected)	Set/Get	Calculation result of the calibration parameter F
156	X magnification(uncorrected)	Get only	The calculated X magnification using the calibration data before correction. (The calculation method is same as the Camera Calibration function.) Reference : ▶ <i>Camera Calibration</i> in the <i>FH/FZ5 Processing Item Function Reference Manual</i> .
157	Y Magnification (uncorrected)	Get only	The calculated Y magnification using the calibration data before correction. (The calculation method is same as Camera Calibration function.)
158	Origin X magnification(uncorrected)	Get only	The calculated origin X magnification using the calibration data before correction. (The calculation method is same as Camera Calibration function.)
159	Origin Y magnification (uncorrected)	Get only	The calculated origin Y magnification using the calibration data before correction. (The calculation method is same as Camera Calibration function.)

160	X-axis angle (uncorrected)	Get only	The calculated X-axis angle using the calibration data before correction. (The calculation method is same as Camera Calibration function.)
161	Y-axis angle (uncorrected)	Get only	The calculated Y-axis angle using the calibration data before correction. (The calculation method is same as Camera Calibration function.)
162	XY-axis angle (uncorrected)	Get only	The calculated XY-axis angle using the calibration data before correction. (The calculation method is same as Camera Calibration function.)
163	X max error	Get only	X maximum error at the calibration. (The calculation method is same as the Vision Master Calibration function.) (Reference : ▶ <i>Vision Master Calibration</i> in the <i>FH/FZ5 Processing Item Function Reference Manual</i> )
164	Y max error	Get only	Y maximum error at the calibration. (The calculation method is same as the Vision Master Calibration function.)
165	Corrected X magnification	Set/Get	The corrected value of X magnification. (The calculation method is same as Camera Calibration.) Reference : ▶ <i>Camera Calibration</i> in the <i>FH/FZ5 Processing Item Function Reference Manual</i> .
166	Corrected Y magnification	Set/Get	The corrected value of Y magnification. (The calculation method is same as Camera Calibration function.)
167	Corrected X-axis angle	Set/Get	The corrected value of X-angle angle. (The calculation method is same as Camera Calibration function.)
168	Corrected Y-axis angle	Set/Get	The corrected value of Y-angle angle. (The calculation method is same as Camera Calibration function.)
169	Origin X offset	Set/Get	The corrected value of the Origin X. (The calculation method is same as Camera Calibration function.)
170	Origin Y offset	Set/Get	The corrected value of the Origin Y. (The calculation method is same as Camera Calibration function.)

171	A(corrected)	Get only	Re-calculated calibration parameter A using Calibration data before correction, Corrected magnification, Corrected angle, and Origin offset] (The calculation method is same as Camera Calibration function.)
172	B(corrected)	Get only	Re-calculated calibration parameter B using Calibration data before correction, Corrected magnification, Corrected angle, and Origin offset]  (The calculation method is same as Camera Calibration function.)
173	C(corrected)	Get only	Re-calculated calibration parameter C using Calibration data before correction, Corrected magnification, Corrected angle, and Origin offset] (The calculation method is same as Camera Calibration function.)
174	D(corrected)	Get only	Re-calculation calibration parameter D using Calibration data before correction, Corrected magnification, Corrected angle, and Origin offset] (The calculation method is same as Camera Calibration function.)
175	E(corrected)	Get only	Re-calculation calibration parameter E using Calibration data before correction, Corrected magnification, Corrected angle, and Origin offset] (The calculation method is same as Camera Calibration function.)
176	F(corrected)	Get only	Re-calculation calibration parameter F using Calibration data before correction, Corrected magnification, Corrected angle, and Origin offset] (The calculation method is same as Camera Calibration function.)
177	X magnification (corrected)	Get only	Re-calculated X magnification using calibration data after correction. (The calculation method is same as Camera Calibration function.)

178	Y magnification (corrected)	Get only	Re-calculated Y magnification using calibration data after correction. (The calculation method is same as Camera Calibration function.)
179	Origin X (corrected)	Get only	Re-calculated origin X using calibration data after correction. (The calculation method is same as Camera Calibration function.)
180	Origin Y (corrected)	Get only	Re-calculated origin Y using calibration data after correction. (The calculation method is same as Camera Calibration function.)
181	X-axis angle (corrected)	Get only	Re-calculated X-axis angle using calibration data after correction. (The calculation method is same as Camera Calibration function.)
182	Y-axis angle (corrected)	Get only	Re-calculated Y-axis angle using calibration data after correction. (The calculation method is same as Camera Calibration function.)
183	XY-axis angle (corrected)	Get only	Re-calculated XY-axis angle using calibration data after correction. (The calculation method is same as Camera Calibration function.)
200+N×1 (N=0~99)	Camera X	Set/Get	Camera coordinate X (N+1) at time Set Point performed using image capture.
300+N×1 (N=0~99)	Camera Y	Set/Get	Camera coordinate X (N+1) at time Set Point performed using image capture.
400+N×1 (N=0~99)	Machine coordinate X (Track start line side)	Set/Get	The machine coordinate X (N+1) at time Set Point performed on the Track start line side.
500+N×1 (N=0~99)	Machine coordinate Y (Track start line side)	Set/Get	The machine coordinate Y (N+1) at time Set Point performed on the Track start line side.
600	Machine coordinate X (Track finish line side)	Set/Get	The machine coordinate X of the first set position on the Track finish line of the tracking area.
601	Machine coordinate Y (Track finish line side)	Set/Get	The machine coordinate Y of the first set position on the Track finish line of the tracking area.

602	Encoder value (Camera position)	Set/Get	Encoder value of camera position.
603	Encoder value (Track start line side)	Set/Get	Encoder value of the Track Start Line of tracking area.
604	Encoder value (Track finish line side)	Set/Get	Encoder value of the Track Finish Line of tracking area.
5000	Calculate calibration parameter	Get only	Getting this value, the following processes are executed. <b>【Executing contents】</b> Calculates the calibration parameter using camera coordinate XY, Machine coordinate XY, Encoder value, and the movement amount XY per one encoder value. <b>【Data】</b> 0: Succeeds the calculation of calibration parameter. -1: Fails the calculation of calibration parameter.
5002	Execute sampling	Get only	Getting this value, the following processes are executed. <b>【Executing contents】</b> 1. Copies the Pattern Position XY measured on the Precise Calibration function to the camera coordinates buffer. 2. Stores the marks to the measurement data. 3. Set the initialize value to the camera coordinate XY. (Search the calibration 4 mark coordinates on the calibration pattern. Set the coordinates to the camera coordinate XNN/YNN according to the number of Set Point actions.)

5003	Initialize camera coordinates buffer	Get only	<p>Getting this value, the following processes are executed.</p> <p><b>【Executing contents】</b>  Clear the camera coordinates buffer.  The cleared object are the following;</p> <ul style="list-style-type: none"> <li>▪ Camera coordinate X buffer (All) = 0.0</li> <li>▪ Camera coordinate Y buffer (All) = 0.0</li> <li>▪ Number of marks = 0</li> </ul> <p><b>【Data】</b>  0: Normally finished  -1: Abnormally finished</p>
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