OMRON

Robotics packaging line solution

Vision Sensor FH series
Operation Manual Sysmac Studio
Calibration Plate Print Tool

FH-1□□□
FH-3□□□

SYSMAC-SE20□□

SYSMAC-RA401L

NJ501-4□□□

R88D-KN□-ECT

Startup Guide

SYSMAC always in control

Z369-E1-01

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1. Revision History

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

2. Introduction

2.1. 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.

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.

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

Reference

Location of detailed or related information.

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2.4. Meanings of Signal Words

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).

2.5. Precausions for Safe Use

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).

2.6. Precausions for Correct Use

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).

2.7. Regulations and Standards

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

2.8. Related Manuals

The following manuals are related to the FH-series Sensor Controllers. Use these manuals for reference.

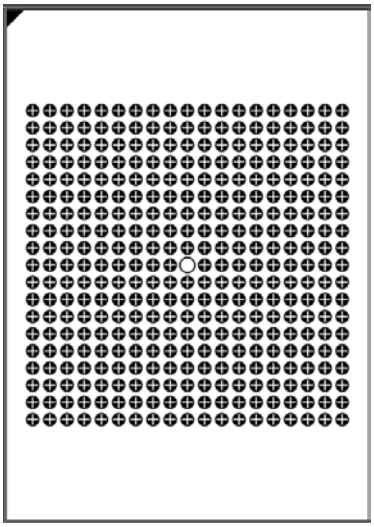
Cat. No.	Manual name	Content	Application
Z340-E1	Vision System FH/FZ5 Series User's Manual	Describes how to configure settings on the sensor controller of FH/FZ5 Series Vision Sensors.	To learn how to configure FH/FZ5 Series Vision Sensors.
Z341-E1	Vision System FH/FZ5 Series Processing Item Function 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 (This manual)	Describes how to configure and operate Calibration Plate Print 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	Describes how to configure and operate Conveyor Calibration Wizard Tool 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 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 macros used for applications of conveyor tracking on FH Sensor Controllers.	To learn the setting procedure of sample macros for conveyor tracking.

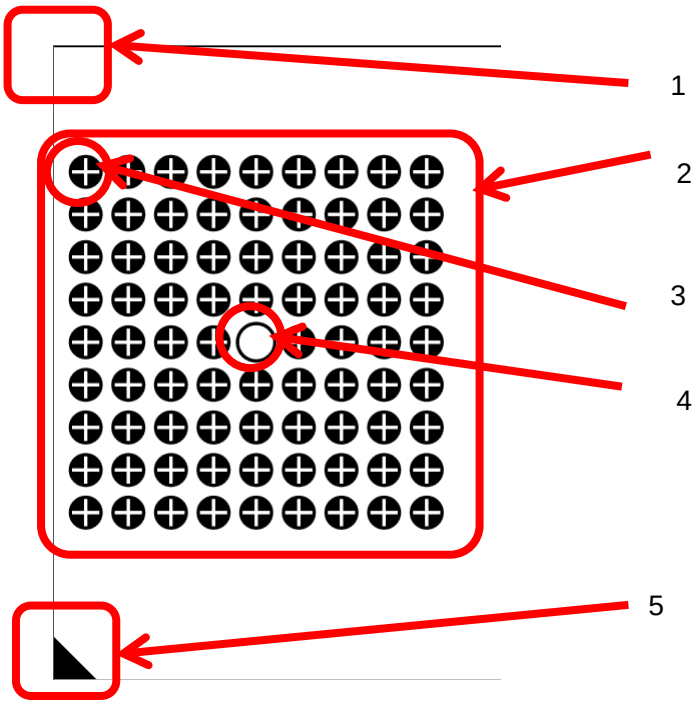
3. About Calibration Plate Print

3.1. Overview

Calibration Plate Print is a tool to print a Pattern onto a Calibration Plate. The Calibration Plate is used for distortion correction of camera image and calibration of the coordinate system used for image capture and conveyor tracking.



The following illustration depicts the Calibration Plate and its components. You can adjust the parameter for each component and print out the Pattern based on the settings.



No	Part	Explanation
1	Origin	The origin point of the coordinate system for camera is located at the top left corner of Calibration Plate.
2	Pattern	The whole pattern printed on Calibration Plate.
3	Mark	Dots which comprise the Pattern. The center of the top left mark functions as the offset.
4	Center point	A Mark located at the center of Pattern.
5	Orientation Guide	The isosceles right triangles located at the four corners of Calibration Plate that are used as guide to grasp the orientation of Calibration Plate on captured images.

You can set up the print size and Pattern according to the width of the conveyor and camera field of view (FOV) using the Calibration Plate Print, and print it out with a printer installed on your PC by clicking the **Print** button.

3.2. 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.

3.3. Terminology

Term	Definition
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 & Place function.
Visual Conveyor Tracking	A conveyor tracking system for production lines that use vision sensors.
Calibration	A process that generates parameters to correct camera image distortion and reciprocally convert coordinate systems that differ from the camera coordinate system.
Calibration Plate	A plate-shaped reference jig that is used for calibration of vision sensors.

3.4. Restrictions and Precautions for Use

Item	Restriction
Pattern	You can specify the number of columns and rows of Pattern as you want within the limit. ・Minimum pattern: 5 columns x 5 rows ・Maximum pattern: 19 columns x 19 rows
Mark	The radius and interval of marks are expressed in millimeter.
Precise Calibration	If Pattern is a square matrix, it can be used for the Precise Calibration processing item on FH Sensor Controller.

Precautions for Use

・The printing is based on a zoom factor of 100 percent.

・Depending on the printer settings for the margins and others, and the settings of the calibration pattern, the following symptoms may occur:

: The printed calibration pattern is blurred or out of focus.

: The margins are included in reducing the size, causing a change in the point distance and the radius.

・Thus, after the printing, check that the size and distance of the calibration marks are the same as the settings, using a measuring tool, such as a ruler.

・The quality of Calibration Plate affects the accuracy of calibration. If Calibration Plate is printed on paper, the quality of the paper and print gaps will affect the calibration accuracy.

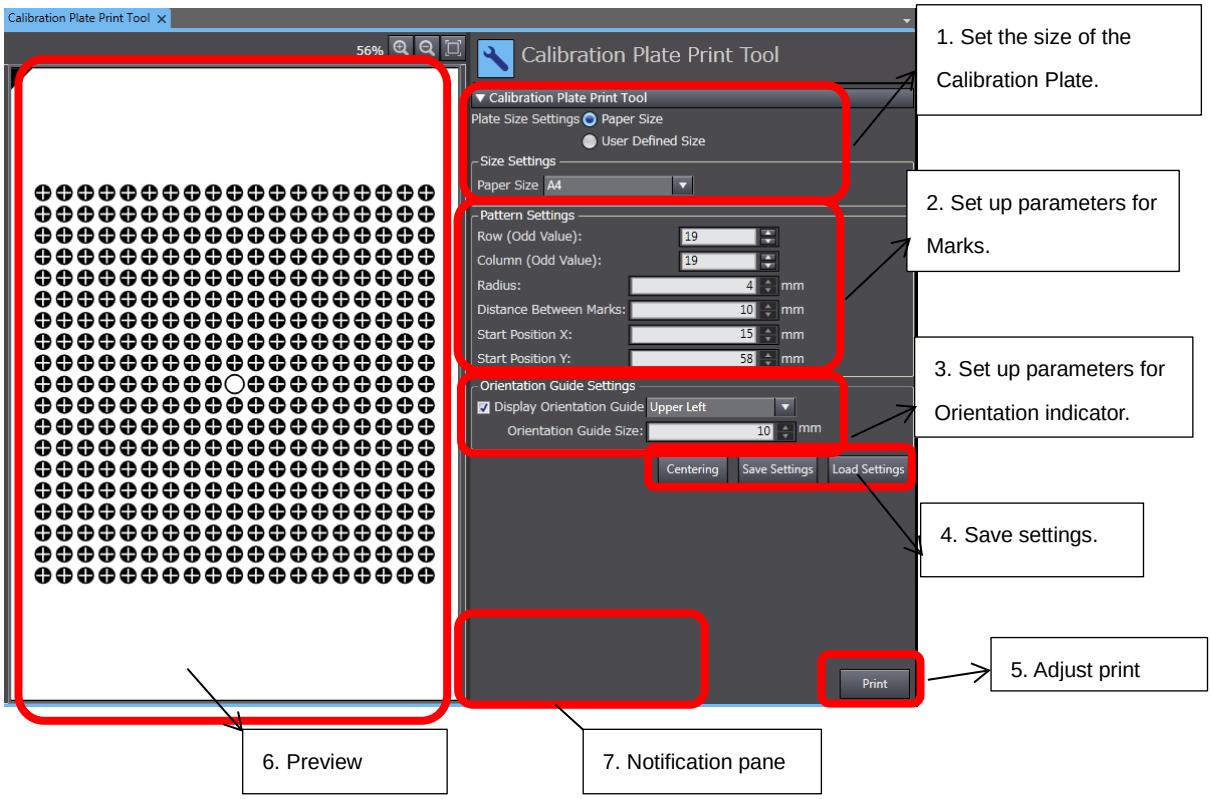
4. Using Tools

4.1. Setup Procedure and User Interface of Calibration Plate Print

After launching the Calibration Plate Print, follow the below procedure.

1. Set the size of the Calibration Plate.
2. Set up the parameters for Calibration Marks.
3. Set up parameters for Orientation indicator.
4. Save settings.
5. Adjust print settings.

The following illustration shows the user interface of Calibration Plate Print.



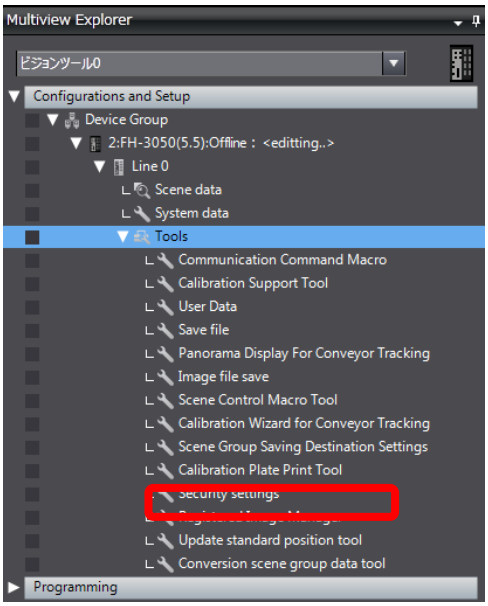
Item	Explanation
Size Settings	Sets the size of Calibration Plate.
Pattern Settings	Sets up parameters for Marks, such as the position and count.
Orientation Guide Settings	Enable/disable the Orientation Guide, and set up position parameters.
Save Settings and Load Settings	Saves and loads the settings.

Print	Prints out the set Calibration Plate using a printer installed on your PC.
Preview	Shows a print image of Calibration Plate reflecting settings you are adjusting.
Notification pane	Shows notifications for each parameter.

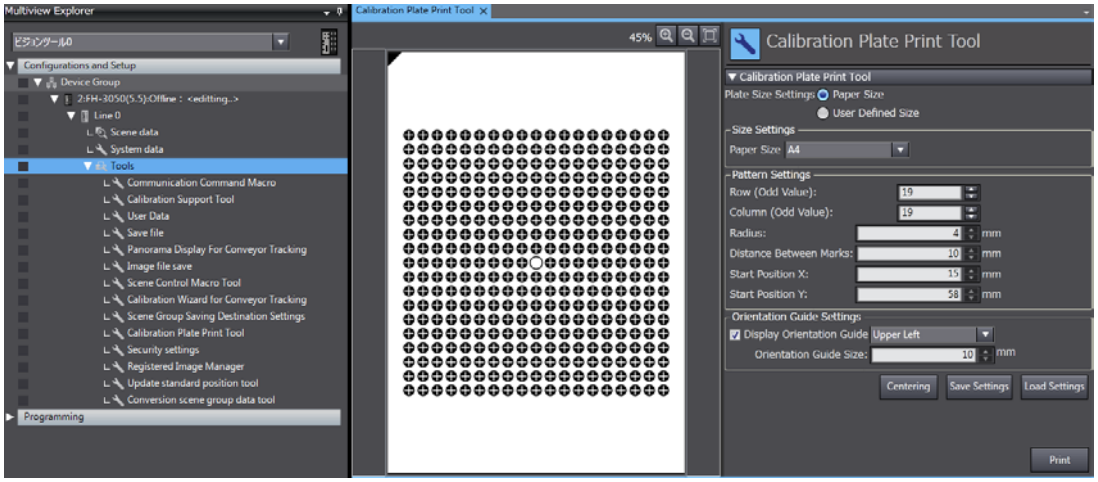
4.2. Starting Calibration Plate Print

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

1. Under **Multiview Explorer,** click **Tool** for the target FH Sensor Controller.
   Available tools will be displayed.



2. Double click **Calibration Plate Print Tool**. **Calibration Plate Print Tool** will start and the Calibration Plate Print tab page will be displayed.

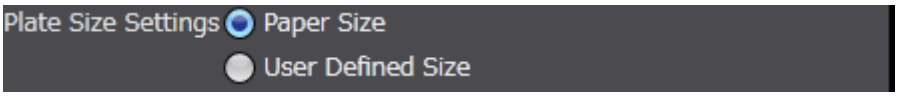


4.3. Setting Up the Calibration Plate Size

You can specify the size of a Calibration Plate according to the FOV and the size of conveyor you are using.

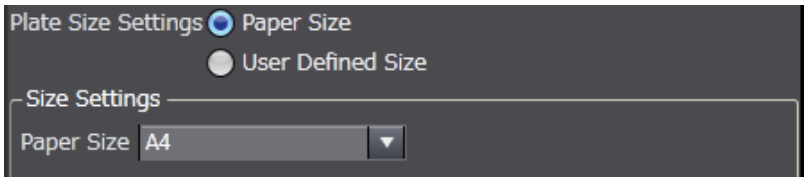
1. Select the desired option from **Calibration Plate Size Settings**.
   The **Size Settings** parameter changes corresponding to the selected option.

- If you select **Paper Size**, see 2.
- If you select **User Defined Size**, see 3.



Setting	Value [Factory Default]	Explanation
Plate Size Settings	・ [Paper Size] ・ User Defined Size	Sets the size of Calibration Plate. If you select **Paper Size**, you can select the paper size from A0 to A7 from the **Paper Size** drop-down list under **Size Settings**. If you select **User Defined Size**, you can adjust the width and height of Calibration Plate under **Size Settings**.

2. Select the desired paper size under **Paper Size**. Click ▼, and then select the paper size from the opened drop-down list.

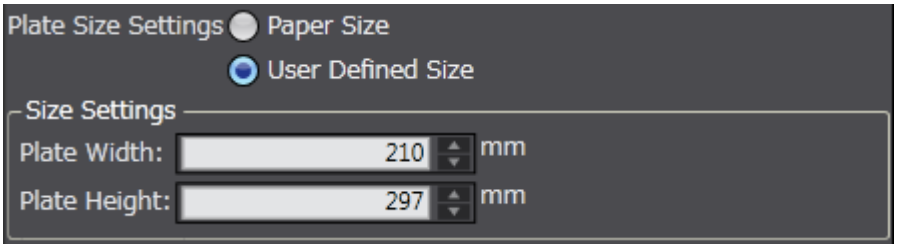


Parameter	Value [Factory Default]	Explanation
Size Settings Paper Size	・ A0 ・ A1 ・ A2 ・ A3 ・ [A4] ・ A5 ・ A6 ・ A7	Sets the size of Calibration Plate between the paper sizes of A0 to A7. The following data is each size: width × height. A0（841 × 1189 mm） A1（594 × 841 mm） A2（420 × 594 mm） A3（297 × 420 mm） A4（210 × 297 mm） A5（148 × 210 mm） A6（105 × 148 mm） A7（74 × 105 mm）

Precautions for Use

The size and Mark Setting is set to A4 (210 x 297 mm) as factory default. Therefore, if you select a size smaller than A4, an error message, "Be sure not to exceed the paper size when adjusting parameters." appears in the Notification pane. Adjust the Mark Setting according to the paper size.

3. Set the desired width and height from the **Plate Width:** box and the **Plate Height:** box under **Size Settings**. Adjust the value by clicking ▲ and ▼, or type it into the boxes.



Parameter	Value [Factory Default]	Explanation
Size Settings Plate Width:	・ 30 to 2000 ・ [210]	Set the width of the Calibration Plate in integers from 30 to 2000 mm. Values outside this range are not allowed.
Size Settings Plate Height:	・ 30 to 2000 ・ [297]	Set the height of the Calibration Plate in integers from 30 to 2000 mm. Values outside this range are not allowed.

Precautions for Use

If the size of Pattern exceeds the paper size or if Marks overlap each other or the Orientation indicator, either of the following error messages will appear. "Be sure not to exceed the paper size when adjusting parameters." or "Be sure not to overlap the pattern and orientation guide when adjusting parameters".

If that happens, adjust parameters to be within the allowable range.

Useful Information

Make the size of Calibration Plate as close to the FOV as possible. Calibrating using the entire FOV may improve calibration accuracy.

4.4. Setting Up Parameters for Mark

You can set up the count and size of Marks that will be printed on Calibration Plate.

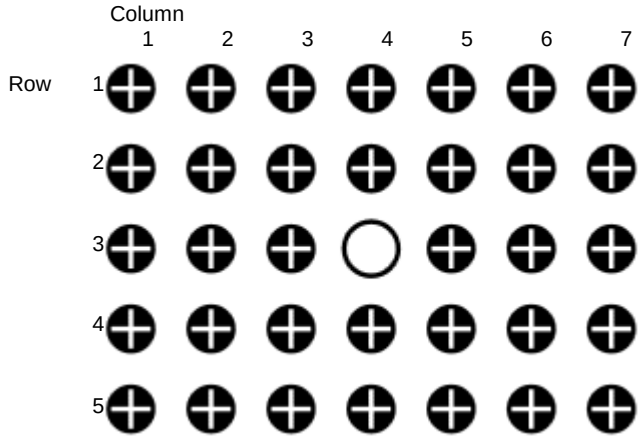
1. Specify the number of Marks per row from the **Row(Odd Value)** box.
   Adjust the value by clicking ▲ and ▼, or type it into the box.

2. Specify the number of Marks per column from the **Column(Odd Value)** box.
   Adjust the value by clicking ▲ and ▼, or type it into the box.

Parameter	Value [Factory Default]	Explanation
Row(Odd Value)	5 to 19 [19]	Sets the number of rows of Marks in the range of integer 5 to 19. Values outside the range are not allowed.
Column(Odd Value)	5 to 19 [19]	Sets the number of columns of Marks in the range of integer 5 to 19. Values outside the range are not allowed.

Useful Information

- Include many Marks so that the Calibration Pattern occupies a large area of the FOV. This improves the accuracy of camera distortion correction.
- Only odd numbers are allowed for specifying the number of Marks per row or per column so that the Calibration Pattern has a center point determined based on the values.
- The horizontal line of Calibration Pattern is called row, and the vertical line of that is called column. In the following figure, the number of marks per row **(Row Points)** is set to 7, and number of marks per column (**Column Points**) is set to 5, creating seven columns and five rows.



3. Set the Mark radius from the **Radius** box. Adjust the value by clicking ▲ and ▼, or type it into the box.

4. Set the distance between Marks from the **Distance Between Marks:** box. Adjust the value by clicking ▲ and ▼, or type it into the box.

Parameter	Value [Factory Default]	Explanation
Radius	・ 1 to 200 ・ [4]	Sets the radius of Mark (integer, range: 1 to 200. Unit of Measure: mm). Values outside this range are not allowed.
Delete [:]	・ 1 to 200 ・ [10]	Sets the distance between Marks (integer, range: 1 to 200. Unit of Measure: mm). Values outside this range are not allowed.

Useful Information

Make Marks large, but be sure that they do not overlap with adjacent ones. Setting a larger radius stabilizes the measurement and improves accuracy.

5. Select the point to start printing Pattern (the center of the top left Mark) from the option boxes. The top left corner of Calibration Plate is the origin point. From there, the horizontal line is the x axis, and the vertical line is the y axis. Adjust the value by clicking ▲ and ▼, or type it into the boxes.

Parameter	Value [Factory Default]	Explanation
Start Position X	・ 1 to 2000 ・ [15]	The x coordinate of the start point of Pattern print (the center of the top left Mark) specified as an integer from 1 to 2000. Unit of Measure: mm. Values outside this range are not allowed.
Start Position Y	・ 1 to 2000 ・ [58.5]	The y coordinate of the start point of Pattern print (the center of the top left Mark) specified as an integer from 1 to 2000. Unit of Measure: mm. Values outside this range are not allowed.

Precautions for Use

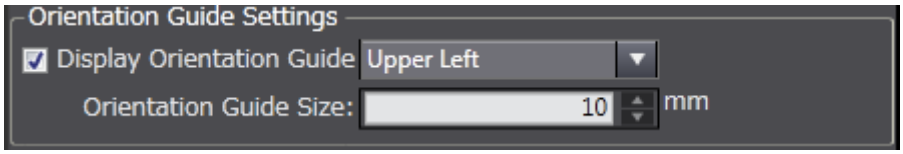
If the size of Pattern exceeds the paper size, or if Marks overlap each other or the Orientation indicator, either of the following error messages may appear. "Be sure not to exceed the paper size when adjusting parameters." or "Be sure not to overlap the pattern and orientation guide when adjusting parameters". If that happens, adjust parameters to be within allowable range.

Useful Information

Value of **Start Position Y:** changes 1 mm per click of ▲ or ▼. Manual entry is also available only by 1 mm.

4.5. Setting Up Parameters for Orientation Guide

You can select whether or not to show a symbol to indicate the orientation (Orientation Guide) on the corners of Calibration Plate, and also the size of Orientation indicator.



1. If you want to specify the orientation of Calibration Plate using Orientation indicator, select the **Display Orientation Guide** check box.

2. Select the desired position of Orientation Guide from the drop-down list by clicking ▼.

3. Adjust the size of Orientation Guide from the **Orientation Guide Size:** box. Adjust the value by clicking ▲ and ▼, or type it into the box.

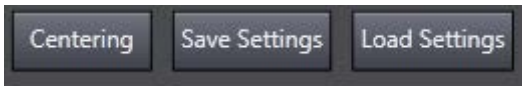
Parameter	Value [Factory Default]	Explanation
Display Orientation Guide	・ [Selected] ・ Not selected	Select if you want to specify the orientation of Calibration Plate using Orientation indicator. If it is not selected, the following parameters will be unavailable.
Display Orientation Guide	・ [Upper Left] ・ Upper Right ・ Lower Left ・ Lower Right	Sets the location of Orientation indicator.
Orientation Guide Size:	・ 1 to 2000 ・ [10]	Sets the size of Orientation indicator in integer from 1 to 2000 Unit of Measure: mm This value is the length of two equal sides of the isosceles triangle. Values outside this range are not allowed.

Precautions for Use

If the size of Pattern exceeds the paper size or if Marks overlap each other or the Orientation indicator, either of the following error messages may appear. "Be sure not to exceed the paper size when adjusting parameters." or "Be sure not to overlap the pattern and orientation guide when adjusting parameters." If that happens, adjust parameters to be within allowable range.

4.6. Save and Load Parameter Settings

You can center, save, and load the parameters set by Calibration Plate Print using the following buttons.



1. Click **Centering** to place the set Pattern at the center of the paper size or manually entered size determined under **Size Settings**. Pattern will be centered.

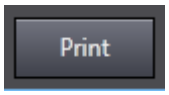
2. Click **Save Settings** to save parameters set by Calibration Plate Print.
Then, the **Save as** dialog box appears. Select a folder in your PC, enter the parameter file in the ini format, and then click **Save**.
The default name of the parameter file is "FZ-CalibrationPlate.ini".

3. Click **Load Settings** to load parameters saved in the ini format.
Then, the **Open** dialog box appears. Select the parameter file saved in the ini format, and click **Open**.

Button	Explanation
Centering	Aligns the Pattern to the center of the standard paper size, or custom paper size set in the **Size Settings** menu.
Save Settings	Saves parameters configured by Calibration Plate Print in the [.ini] format. The file is saved with the name "FZ-CalibrationPlate.ini".
Load Settings	Loads parameters saved in the [.ini] file format.

4.7. Adjusting Print Settings

You can print the Pattern with the settings selected in the Calibration Plate Print.

Click **Print.** 

The **Print** dialog box will appear. Select a printer to use from **Printer Name.**
Adjust settings under **Print Name**, and execute printing.

Button	Explanation
Print	Prints out Pattern. You can do this from the **Print** dialog box on your PC.

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