



RICOH Stereo Camera Software

R-Stereo-GigE-Calibration

User's Guide

RICOH Industrial Solutions Inc.

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1. Function Overview

The reference camera and comparison camera of the stereo camera need to be calibrated to output correct distance images. The stereo camera is delivered already calibrated but slight camera movement may occur due to environmental conditions. If that happens, calibration will need to be performed again to prevent a deterioration in distance accuracy. You can prevent the deterioration of distance accuracy by performing calibration again with this software and the supplied calibration plate.

The main functions of this R-Stereo-GigE-Calibration software are as follows.

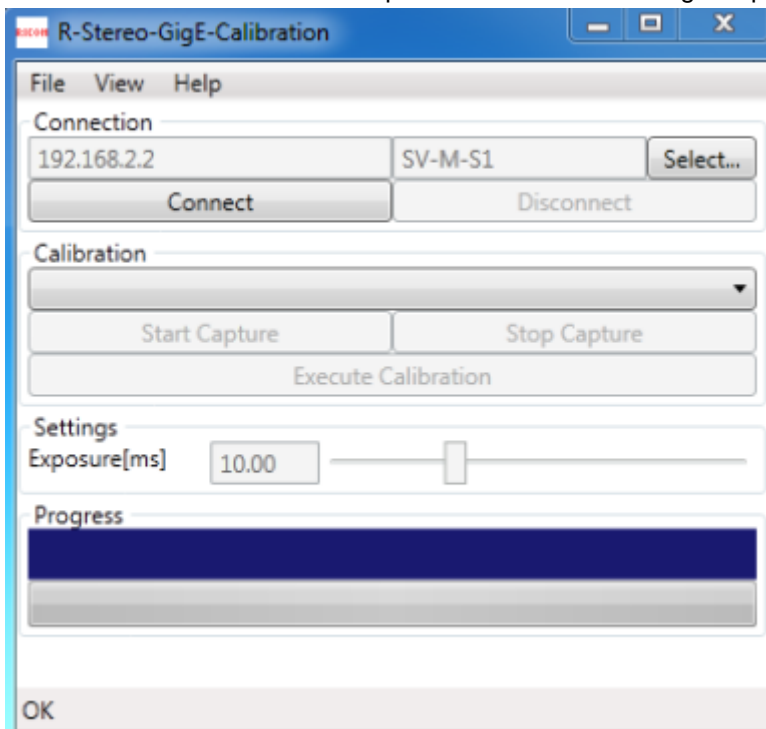
- Image display:
Displays intensity images of the reference camera and comparison camera of the stereo camera.
- Camera calibration execution:
Captures images for camera calibration and then calculates the calibration data.
- Camera calibration data management:
Downloads camera calibration data from the camera to the PC or uploads camera calibration data from the PC to the camera.

1.1 Operating Environment

An environment with lighting that is sufficiently bright is required for this software to operate correctly. However, adjust the lighting so that light does not reflect off the calibration plate because such a reflection may have an adverse effect on calibration accuracy.

2. Operating Procedures

- 2.1 Select "Start" - "All Programs" - "R-Stereo-GigE-Package X.X.X.XX" - "Maintenance" - "Camera Calibration" to launch R-Stereo-GigE-Calibration.
- 2.2 The operation window and image display windows of R-Stereo-GigE-Calibration appear. In addition, the Browse Folder dialog box appears. Select a folder for saving the intermediate data file of camera calibration and then click "OK." Please note that the operation window and image display windows can be moved separately and resized.



Operation window

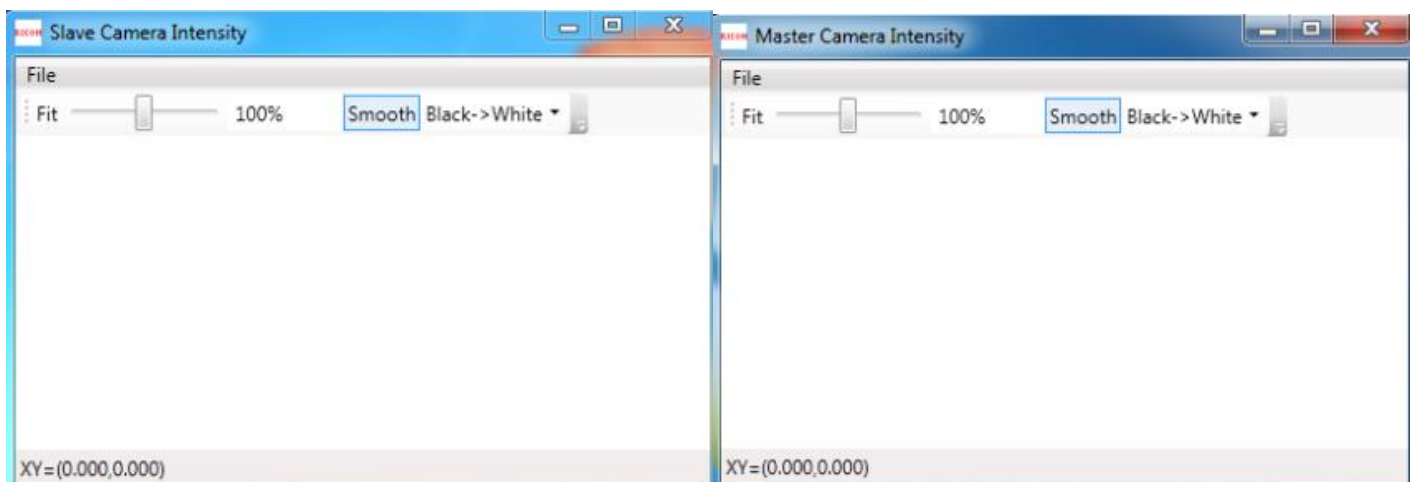
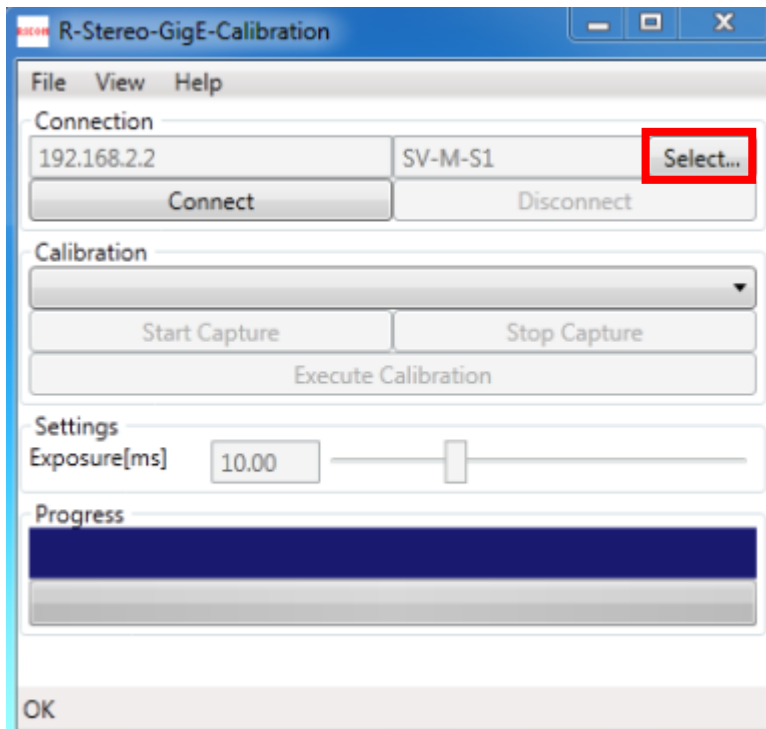


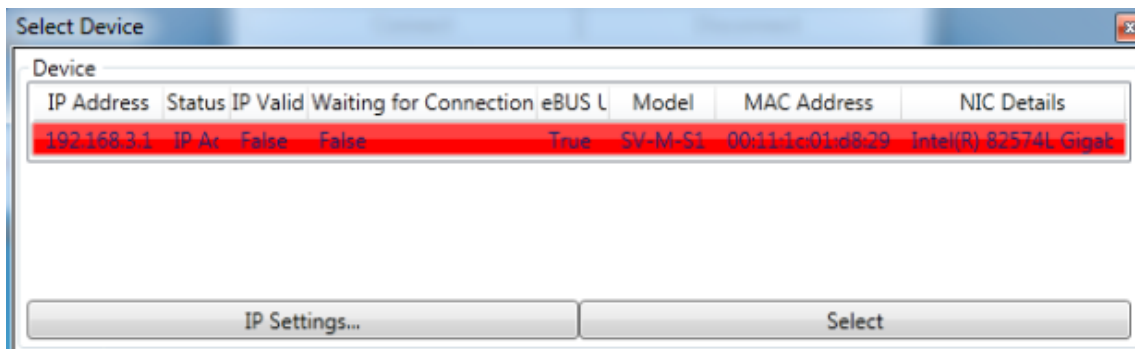
Image display window (slave camera)

Image display window (master camera)

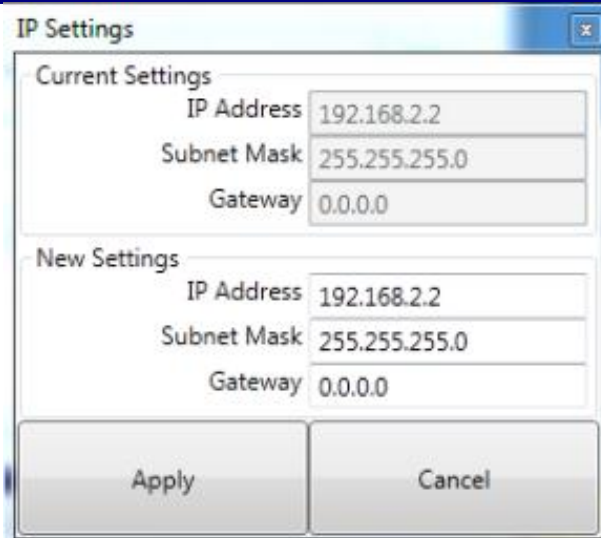
Select the save folder and then click the Select button in the operation window of R-Stereo-Camera-Calibration.



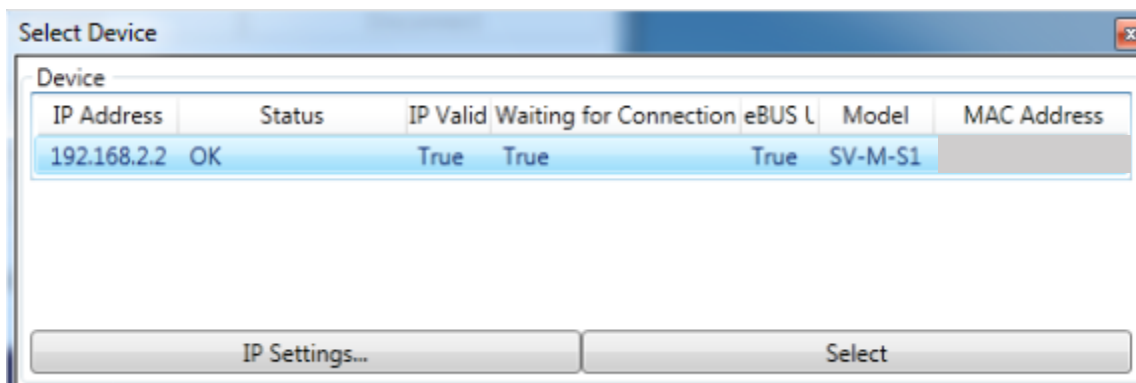
When the Select Device dialog box appears, click the IP Settings button.



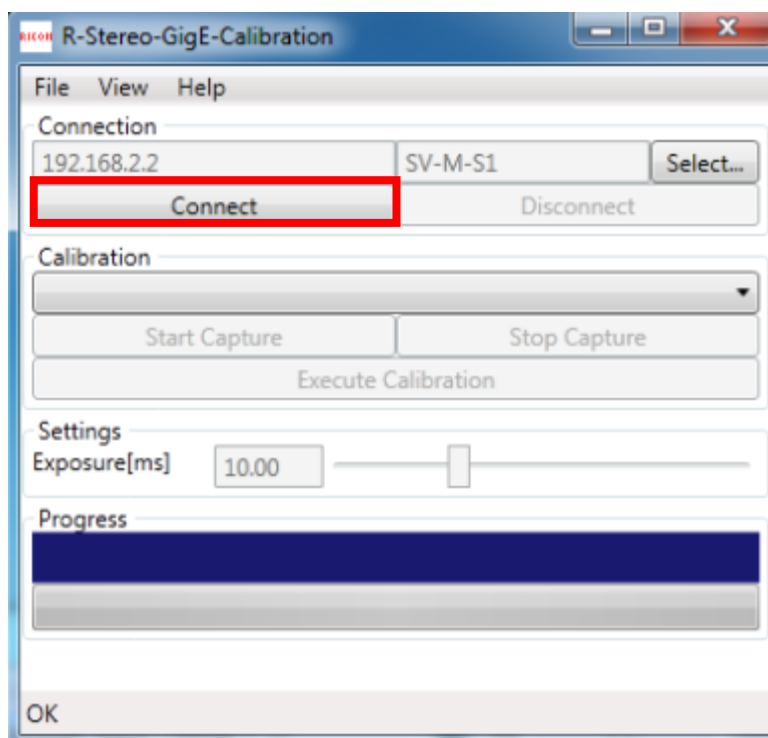
2.3 When the IP Settings dialog box opens, set an IP address and subnet mask for "New settings" that match your PC environment. After configuring the settings, click the Apply button.



- 2.4 If the status changes to OK, the IP settings are complete.
Click the Select button to close the dialog box.



2.5 Click the Connect button.



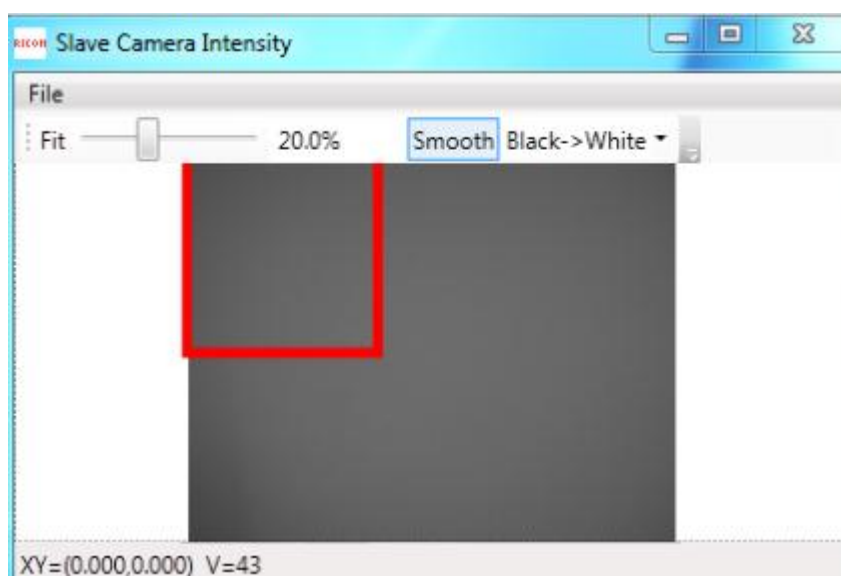
If the Disconnect button becomes available, the connection is successful.

When a connection to the camera is established, the new calibration begins. Please note that any data that exists in the specified intermediate folder will be overwritten.

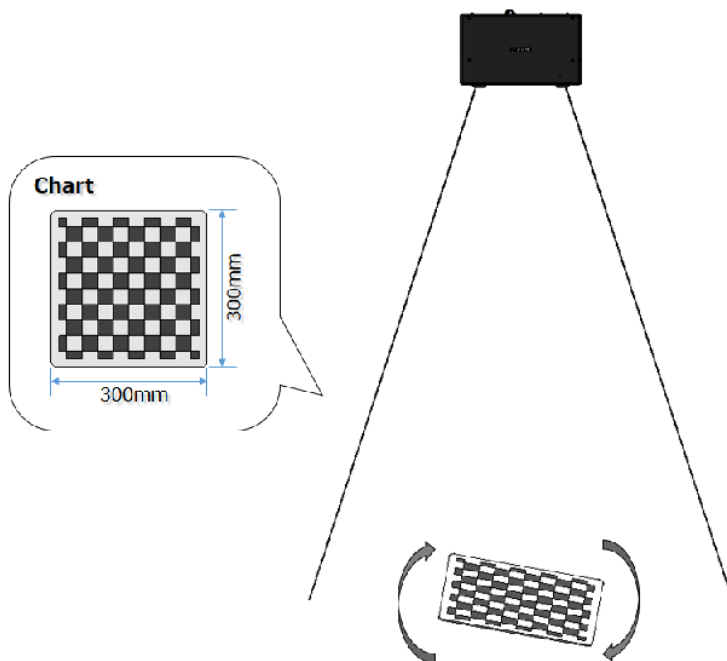
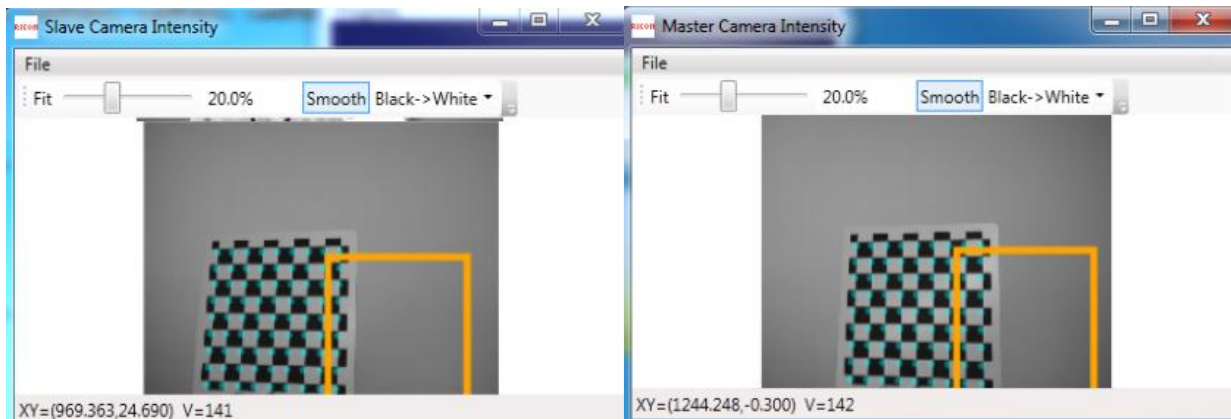
After the connection is established, the camera begins the capturing of shot 01 automatically.

The current camera image is displayed in real time in the image display windows.

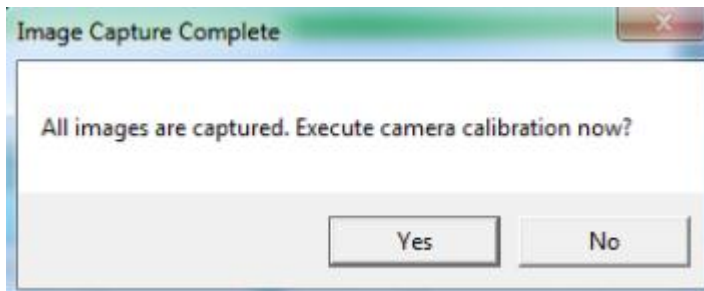
In addition, a color indication guide square is displayed.



2.6 Adjust the position, angle, and distance of the plate so that the frame of the plate is over the guide square while looking at the position, angle, and size of the plate displayed on the image.
When the image is displayed correctly, proceed to capturing the next shot.



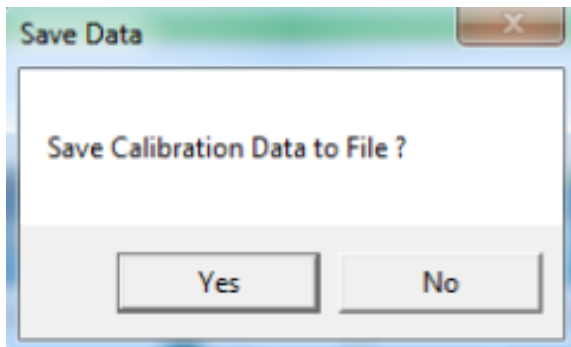
2.7 When all of the shots have been captured, execute the calibration process.



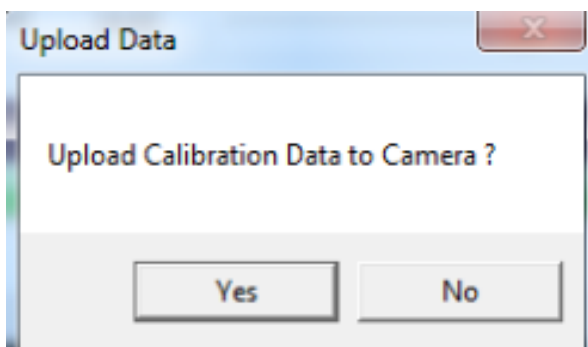
Click "Yes."

Depending on the captured images, a warning message may be displayed to notify you that the accuracy of the calculated calibration data is not good. If that happens, we recommend not using the acquired calibration data.

2.8 Next, select whether to save the calibration results to a file.
We recommend saving the calibration results to a file.



2.9 Finally, select whether to upload the calibration results to the camera.

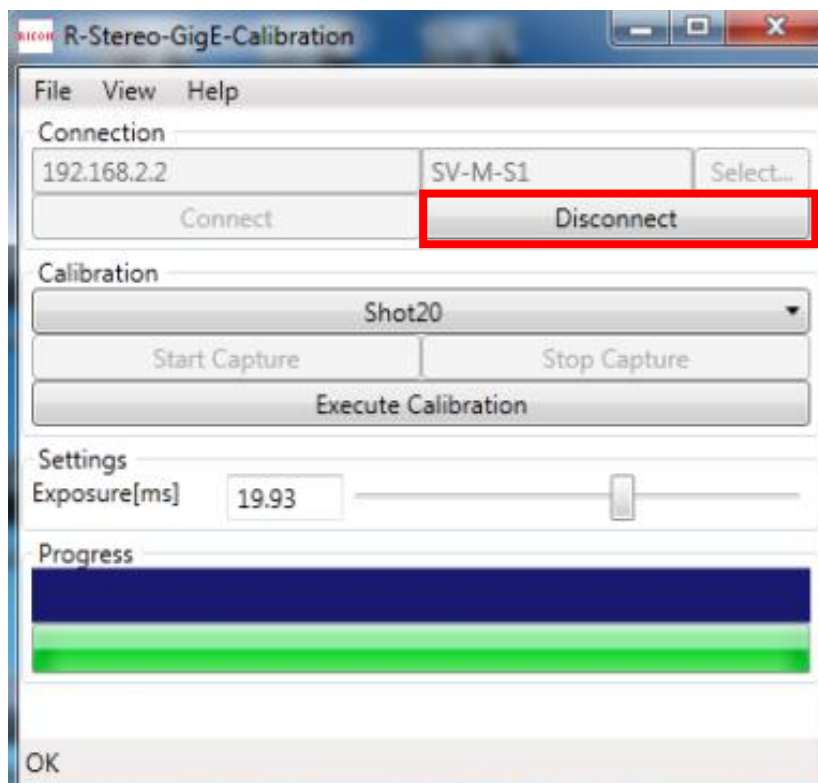


If the results are uploaded, the existing calibration data in the camera will be overwritten. The new calibration data is reflected immediately after it is uploaded.

Calibration is now complete.

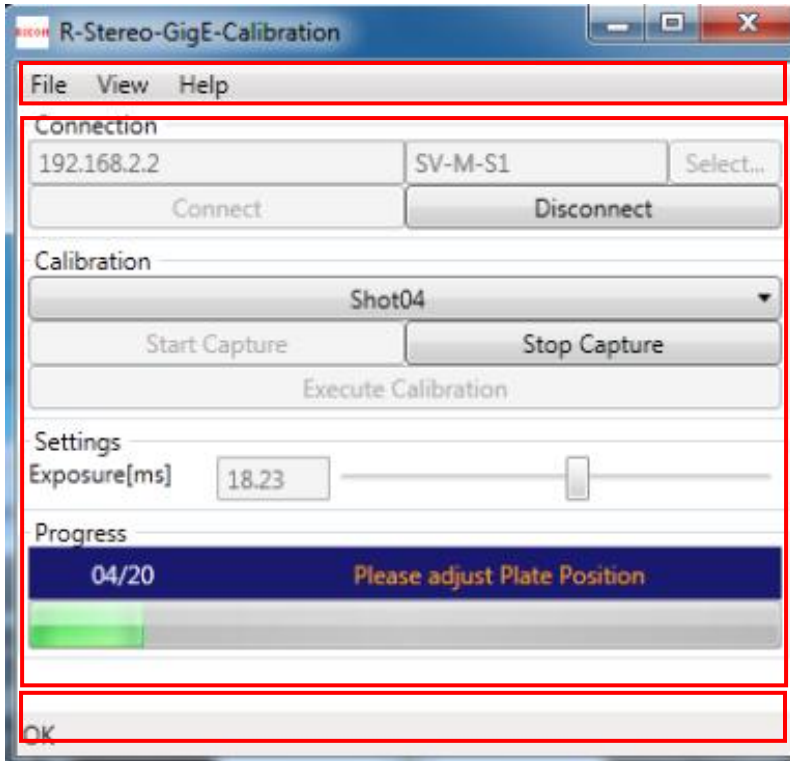
2.10 To disconnect from the camera, click the Disconnect button.

If the operation window is closed, the camera is disconnected automatically and the application ends.



3. Reference

This section describes how to use the operation window and image display windows.



Menu bar
Refer to section 3.1

Operation panel

- Connection**
Refer to section 3.2.1
- Calibration**
Refer to section 3.2.2
- Settings**
Refer to section 3.2.3
- Progress**
Refer to section 3.2.4

Status bar
Refer to section 3.3

3.1 Menu Bar

3.1.1 File Menu



Refer to section 3.1.1.1

Refer to section 3.1.1.2

Refer to section 3.1.1.3

3.1.1.1 Selecting the Save Data Folder

Set the folder to save the intermediate data.

The intermediate data for calibration (calibration data and image files) is saved automatically to the intermediate data folder. The save folder can be selected only while there is no connection to the camera.

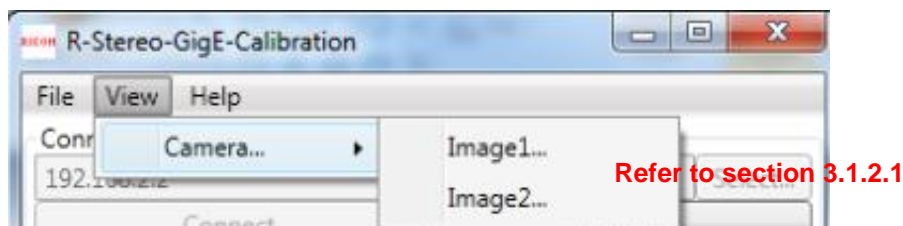
3.1.1.2 Saving the Camera Calibration Data to a File

Download the camera internal calibration data to the PC and save it to the specified file. This operation is possible only while there is a connection to the camera.

3.1.1.3 Overwriting Camera Calibration Data

Select a calibration data file on the PC and upload it to the camera. Please note that the existing calibration data in the camera will be overwritten. We recommend downloading the existing calibration data to the PC beforehand. This operation is possible only while there is a connection to the camera.

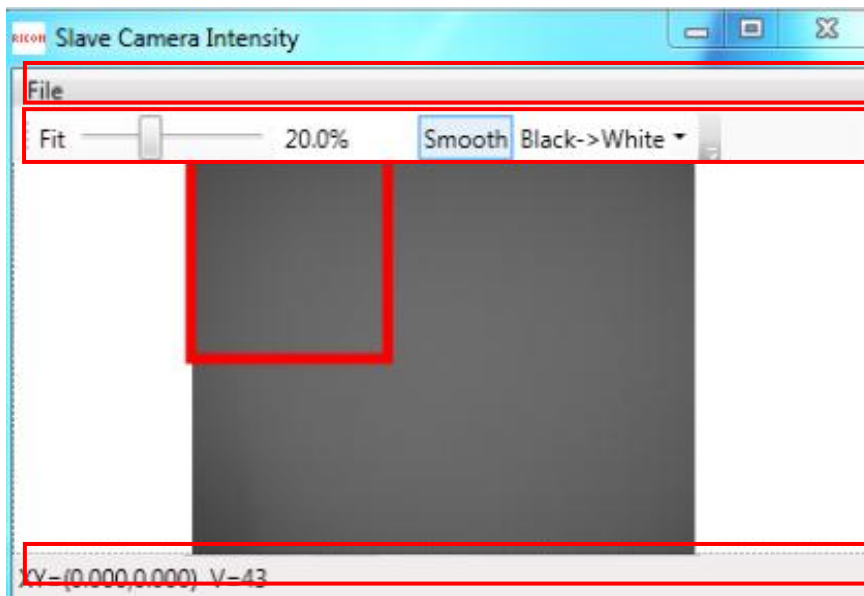
3.1.2 View Menu



3.1.2.1 Image 1/Image 2

The windows of image 1 and image 2 are displayed when R-Stereo-GigE-Calibration is started. To display them again after they have been closed, select these menu items.

The intensity image is displayed in the image display windows.



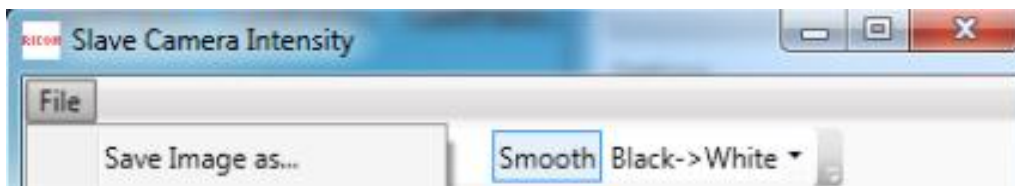
Menu bar
Refer to section 3.1.2.1.1
Operation panel
Refer to section 3.1.2.1.2
Guide
Refer to section 3.1.2.1.3

Status bar
Refer to section 3.1.2.1.4

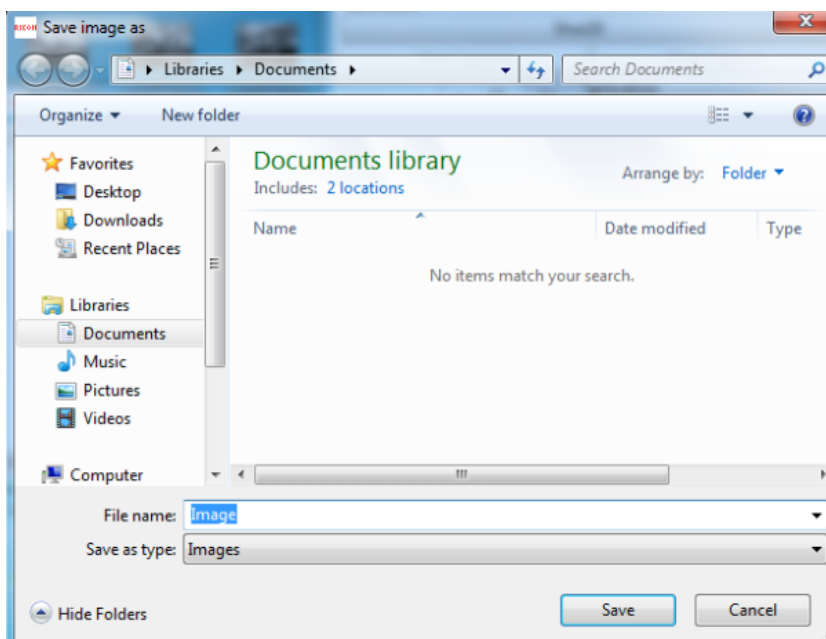
3.1.2.1.1 Menu Bar

Save the displayed image.

a) Select "File" - "Save As."



b) When the dialog box appears, specify the save destination and file name and then click the Save button.



3.1.2.1.2 Operation Panel

3.1.2.1.2.1 Image Size Adjustment

Click the Fit button to automatically adjust the image size to fit the image display window size.

3.1.2.1.2.2 Zoom In/Zoom Out

Adjust the magnification of the displayed image.

Adjust the magnification by entering a value in the text box or dragging the slide bar.

3.1.2.1.2.3 Smoothing

Smooth the displayed image.

If you zoom in, you will be able to confirm that the jagged edges have been removed.

Each press of the Smoothing button turns smoothing on or off.

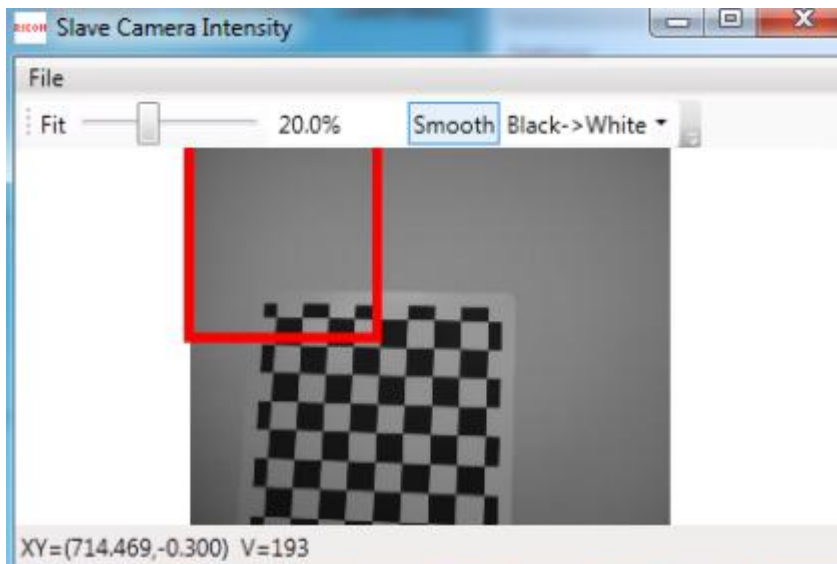
The initial setting is on.

3.1.2.1.2.4 Display Color

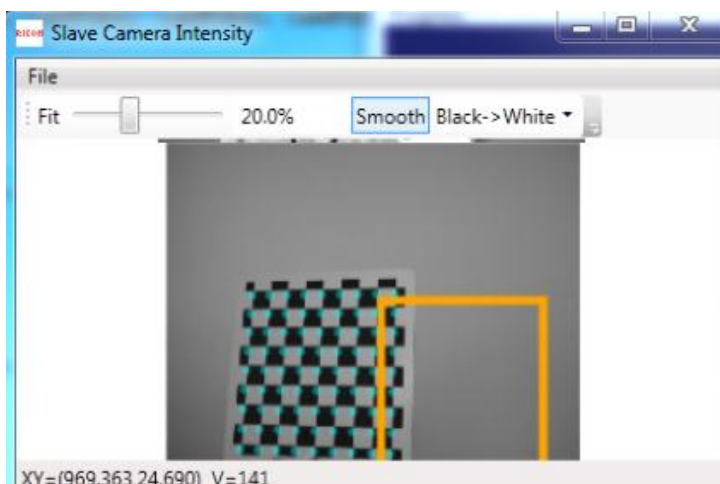
You can select the display color of the image.

3.1.2.1.3 Guide

Display the target position of the calibration plate.



Adjust the position, distance, and angle of the calibration plate so that it is over the displayed frame on the image. The target position indicated by the guide changes for each shot. Furthermore, you need to adjust the plate so that it enters both the guide of the reference camera and the guide of the comparison camera at the same time.

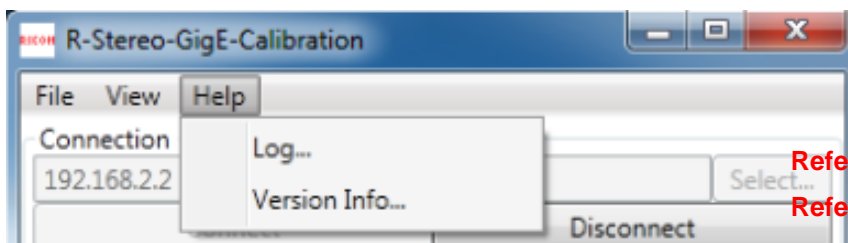


The guide color varies depending on the image analysis result. For details, refer to section 3.2.4.

3.1.2.1.4 Status Bar

The X and Y coordinates and image value are displayed in the status bar when you move the mouse pointer over the displayed image.

3.1.4 Help Menu



3.1.4.1 Log

Select "Log" to display the log information.

3.1.4.2 Version Information

Select "About R-Stereo-GigE-Calibration" to display the version information of the software.

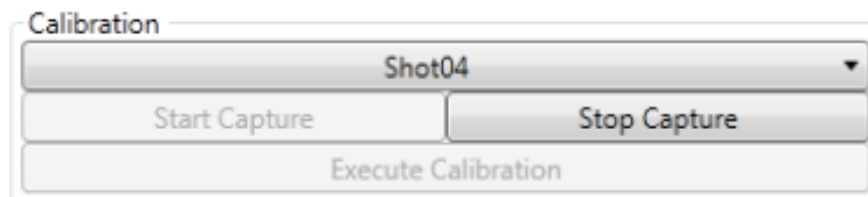
3.2 Operation Panel

3.2.1 Connection

For details, refer to "2. Startup Procedure."

3.2.2 Calibration

Resume or stop capturing and execute calibration with the displayed shot.



After a connection to the camera is established, the application starts the capturing of shot 1 automatically. Adjust the position and angle of the calibration plate so that the frame of the plate is over the guide frame. During plate position adjustment, the application automatically captures images and determines whether or not the position is correct. When the plate is captured at the correct position, the application proceeds to the next shot automatically. Capturing a calibration image is possible while the camera image is displayed in real time in the image display window. When the camera image is not updated, capturing is in a stopped state (confirming already captured image or after error occurred).

If capturing has stopped because an error occurred, click the Start Capturing button to resume capturing. Furthermore, you can stop capturing at any time by clicking the Stop Capturing button.

If you select an already captured shot in the "Shot xx" combo box, capturing stops and the already captured shot is displayed. If you select the selectable item with the highest number in the "Shot xx" combo box, capturing of that shot resumes automatically.

When the required number of shots has been correctly captured, click the Execute Calibration button to execute the calibration process. After the process is complete, you can upload and apply the calibration results to the camera. You can also save the calibration results to a file on the PC.

3.2.3 Settings

The exposure time (shutter speed) of the camera can be adjusted by dragging the slide bar.

Please note that the exposure time is adjusted automatically when the calibration plate is detected over an image.

3.2.4 Progress

The progress of calibration is indicated.

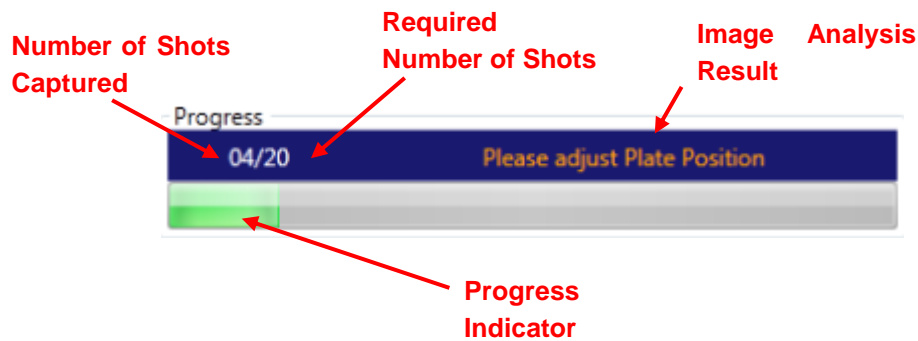


Image analysis result:

The analysis result becomes one of the following depending on the image.

1. "Detection failed": This mainly occurs at the following times.
When the calibration plate is not completely displayed on the reference and comparison camera images, when the plate is very far away or close, when the plate is at a very tilted angle, when the brightness distribution is such that the image is far too bright or dark, when diffuse reflection is displayed on the plate, and when the image was captured while the plate was moving.
Countermeasure: Make adjustments so that the plate is clearly displayed in the middle of the image. If necessary, adjust the exposure time manually.
2. "Adjust the position of the plate": Move the plate closer to the target position because the plate was detected but it was detected at a place away from the target position.
3. Detection accuracy determined to be low": This result is displayed mainly when part of the plate is hidden or diffuse reflection is displayed on the plate. Take care to ensure that the plate is clearly displayed and the pattern is not hidden. Lighting for which local diffuse reflection does not occur is suitable. It may be possible to prevent the diffuse reflection by finely adjusting the angle of the plate.
4. "Automatically adjusting brightness": The exposure time is adjusted automatically. Do not move the plate when it is already displayed within the guide frame. However, when diffuse reflection is displayed on the plate, finely adjust the angle so that the brightness of the plate becomes uniform.
5. "OK": The image is added to the calibration process images and the application proceeds to capturing of the next shot.

There is a delay of about 1 second until the analysis result is displayed after capturing, so when the plate enters the guide frame, do not move it until the analysis result has been displayed.

3.3 Status Bar

3.3.1 Execution Result

The result of executing "Connect" or other operation is displayed at the left side of the status bar.

If the operation ends successfully, "OK" is displayed. If an error occurs, the details of the error are displayed.

Revision History

Rev.	Date	Changes	Note
1.00	March 24, 2015	● Newly issued	