



Suruga OptGauge User's Manual

Smart LPS 3D H720 Version

Thank you for choosing our products.

Before using the Products, read this manual, thoroughly.

After reading this manual, please keep it close for your immediate future reference.

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1 Introduction

This document is the user's manual for the companion software, "Suruga OptGauge", with the measuring instruments by Suruga Seiki Co., Ltd.

This "User's Manual" (thereafter, "this Manual") provides the information and basic operation methods for the "Suruga OptGauge."

To operate the Products effectively and safely, please read this Manual carefully and fully understand its contents before using the Products.

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The Suruga OptGauge User's manual

Issue Date	2026 June
Guide Version	004E

Revision History

Date	Revision	Details
2025. June	001E	1 st edition
2025. July	002E	· Installation PC System Requirements - Removed “Pro” - Added Windows 11 version - Added note that the potential dysfunctionalities depend on version · Symptoms and Solutions - Added details on dysfunctionalities depending on Windows version and countermeasures · Added interlock control specifications · Added external trigger mode
2025. September	003E	Added 1/e ² beam divergence calculation function and the rotation angle calculation function
2026. June	004E	Function added · Measurement Start/Stop · Trigger Mode · Custom Log Output · Streaming Output of Measurement Results · Background Operation · Multiple Spots Association for Transparent Objects Function Enhanced · Settings for automatic dimming methods and LDPW added · Support multilayer thickness measurement Software Startup · Quick Start instructions added · Notes for version upgrades added Operating Environment · Compatible with .NET 10

NOTICE

All information contained in this Manual is deemed correct at the time of publication.

The SURUGA SEIKI Co. Ltd. (thereafter, “the SURUGA”) reserves the right to change specifications without notice the users of the Product.

For the latest version of this Manual and the Software, you can obtain by downloading them from our website (<http://jpn.surugaseiki.com/>) or (<https://eng.surugaseiki.com/>).

1.1 Warning Labels Addressed in this Manual

 Warning	Serious damage, data loss, or unsafe conditions may occur.
 Careful	Unstable or unexpected results, but not fatal, may occur in the software operations.
Attention	Points users may overlook and important notes about specification limitations. Information that won't cause danger or trouble but knowing it will make operation smoother.

1.2 Overview of the Suruga OptGauge

The Suruga OptGauge is the application software that you can configure parameters and monitor measurement results with the measuring instruments. You can configure parameters and monitor measurement results from the supported measuring instrument connected to a computer.

■ Functions and Features

This section describes the notable features of the Suruga OptGauge.

- Monitoring functions for measurement results

You can acquire measurement results from the supported instrument. Measurement results can be obtained in a .csv file or others.

Ex.: For the H420 Series, they are angle and divergence measurements

- Monitoring functions for the waveform of a received light.

The sensor camera detects and monitors the waveform of a light beam.

- Parameter settings

You may configure operational settings for the sensor cameras to fully detect a light beam and/or configure criteria for a pass/fail test. Multiple sets of parameter settings can be saved. You may select one for a measuring target and another, and restore it again.

Ex. : exposure time, noise threshold value and averaging out of a light beam

- Acquiring measurement results with external devices and setting parameters for them.

You can acquire measurement results or configure parameters with the commands from two computers via the RS232C and/or TCP/IP communications

- Other convenient functions

You may utilize the functions such as the "Origin Offset" parameter that specifies the reference positions of a monitoring waveform or the "Automatic Brightness" control that enables automatic brightness according to your specified range of luminance of a detected light beam or the save function that you can store the image of an acquired waveform.

1.3 Software - Installation of the Suruga OptGauge



If downgrading of the Software, setting information added to a newer version may not be correctly loaded. If downgrading to an earlier version of the Software, it would not read correctly the settings only available to the newer versions so that the software would not even start up.

Therefore, please be advised to back up the folder with your option files being stored, to delete the original option file folder and then to re-installing an earlier version.

[Folder Path]

C:/Users/[*UserName*]/Documents/Suruga/OptGauge/[*Product Serial No.*]

1.3.1 Software License

To use the Suruga OptGauge (hereafter as "the Software"), the customer must consent to the following software license agreement (hereafter as "this agreement").

When installing or copying all or part of the Software on a computer, or using the Software after installation, it is considered that the customer has consented to all terms of this agreement, and the agreement is bilaterally concluded.

Article 1 (Permissions)

The Software is free of charge.

The copyright for the Software, its manual, and other documents concerning the Software belong to SURUGA SEIKI Co., Ltd. (hereafter as "the SURUGA").

The SURUGA grants all users for non-proprietary rights to the use of the Software.

Article 2 (Usage Restrictions)

The SURUGA permits the use of the Software only for the purposes of operating the Products and collecting data.

The SURUGA prohibits the use of the Software for any other purposes than that the SURUGA's intended.

Article 3 (Reproduction and Modification)

The Software can be copied only to the computers using the Products. The SURUGA prohibits modification, redistribution, and reverse engineering.

Article 4 (Disclaimers)

Users make the use of the Software on their own responsibility.

The SURUGA bears no responsibility and is not liable for any direct, indirect, incidental, special, supervenient, or punitive damage including but not limited to; data loss, business interruptions, and loss of profit, incurred arising out of or failure to use the Software.

In addition, The SURUGA bears no responsibility and is not liable for any damage incurred arising out of software bugs, errors, viruses, malfunctions due to illicit third-party access, or security issues with the Software.

The SURUGA holds no responsibility and is not liable to damages incurred upon modification of the Software.

Article 5 (Support)

The SURUGA provides technical support for the Software. However, there is no guarantee that our technical support will achieve the customer's purpose.

Article 6 (Termination of Agreement)

The right to use the Software will be, immediately, terminated upon violation of the conditions of this agreement.

1.3.2 Installation PC System Requirements

[Recommended System Requirements]*¹

Hardware requirements	Supported OS	Windows 11 64-bit, Version 24H2 or later* ⁴
	CPU	Intel Core i5 - 1345U CPU 1.6 GHz or higher 10-core 12-thread
	RAM	16GB or higher
	Storage capacity	1GB or higher
	Display resolution	1920 x 1080
	USB	USB3.0 (type A) port: 2 or more
Software requirements	Framework	.NET10.0* ³

[Minimum System Requirements]*²

Hardware requirements	Supported OS	Windows 10 Pro 64bit, Windows 11 64-bit, Version 24H2 or later* ⁴
	CPU	Intel Core i5 - 8265U CPU 1.6GHz or higher 4-core 8-thread
	RAM	8GB or higher
	Storage capacity	1GB or higher
	Display resolution	1920 x 1080 or more
	USB	USB3.0 (type A) port: 2 or more
Software requirements	Framework	.NET10.0* ³

*¹ “Recommended System Requirements” refers to a level where waiting times are minimal and operation is comfortable.

*² “Minimum System Requirements” refers to a level where the software can start and perform basic functions.

*³ If .NET10.0 is not installed on your computer, install “.NET Desktop Runtime 10.x.x.” from the Microsoft website

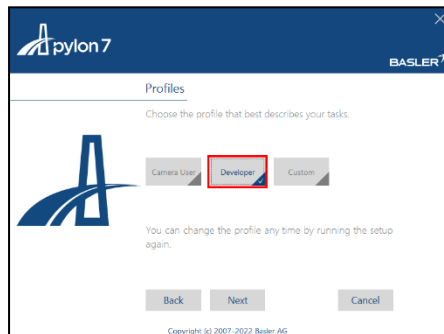
*⁴ The Software may not operate properly on Windows 11 Version 23H2 due to differences in certain system components and operating specifications. Please update to the Windows version (24H2 or later).

1.3.3 Installation of the USB device driver

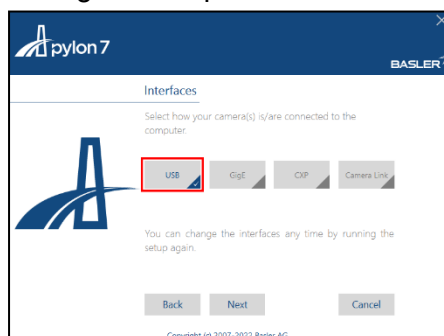
1. Double-click the "... ¥Driver" "Basler_pylon_7.0.0.24651.exe" to begin installation.



2. Consent to your installation on the confirmation screen.
3. Set the installation method (Profiles) to "Developer".



4. Set the sensor camera connection method (Interfaces) to "USB." Thereafter, use the default settings to complete the installation.



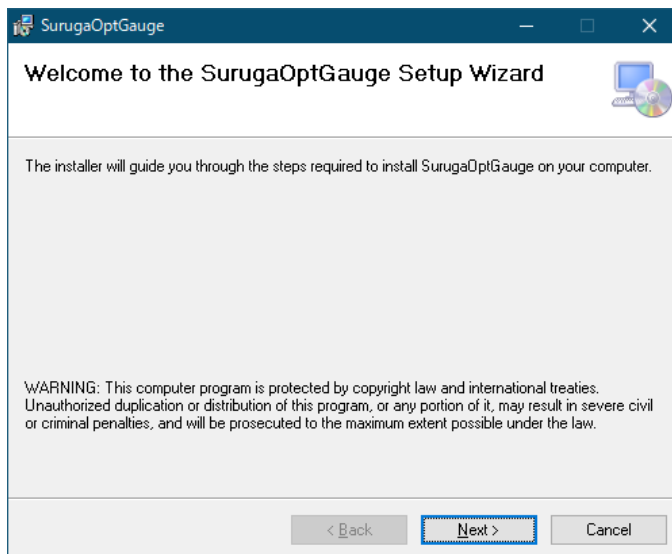
1.3.4 Installation of the Suruga OptGauge.

Install the Software, the Suruga OptGauge.

1. Double-click "SurugaOptGaugeSetup_x.x.xx.msi" in the directory "... /Application".

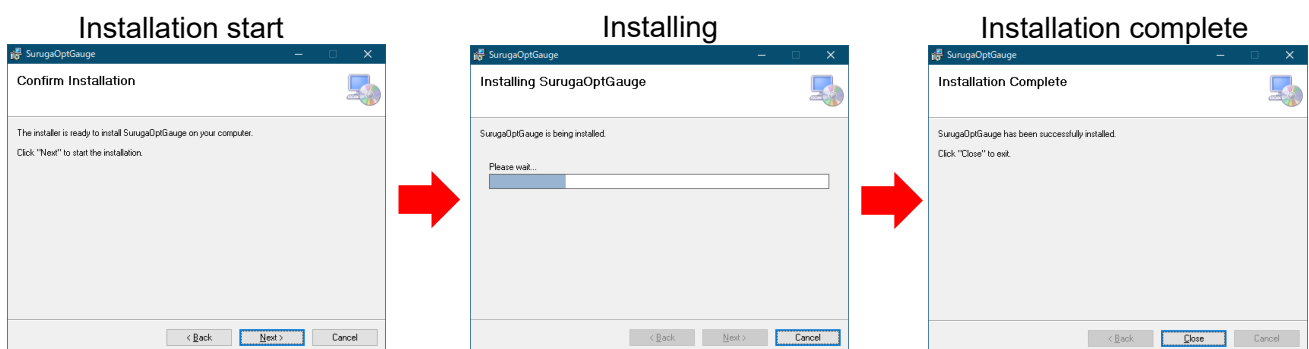
名前	更新日時	種類	サイズ
 SurugaOptGaugeSetup_x.x.x.msi	2023/11/28 19:12	Windows インストー...	61,590 KB

2. Click "Next>".



Click "Next>" to begin installation.

When installation is complete, click "Close".



3. Suruga OptGauge will be created on the desktop. The installation procedures are complete.



1.3.5 Copying the Device Authentication File

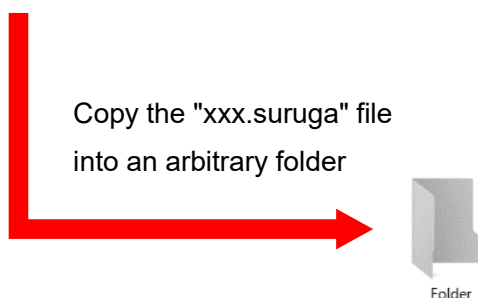
Attention

Authentication File

For this product, calibration values are set for each device. Therefore, the "Suruga OptGauge" requires reading of a "device authentication file (dot suruga extension)" in which the unique information of individual device is stored

To load the device authentication file into the installed the Suruga OptGauge, copy the file "xxx.suruga" in the "... /AuthenticationFile" to an arbitrary file location.

名前	更新日時	種類	サイズ
xxx.suruga	2023/09/28 10:55	SURUGA ファイル	6 KB



Note

If your security policy does not allow the device authentication file to be copied to your PC, you can read the file directly from the USB memory device provided with the product. In this case, this procedure is not required.

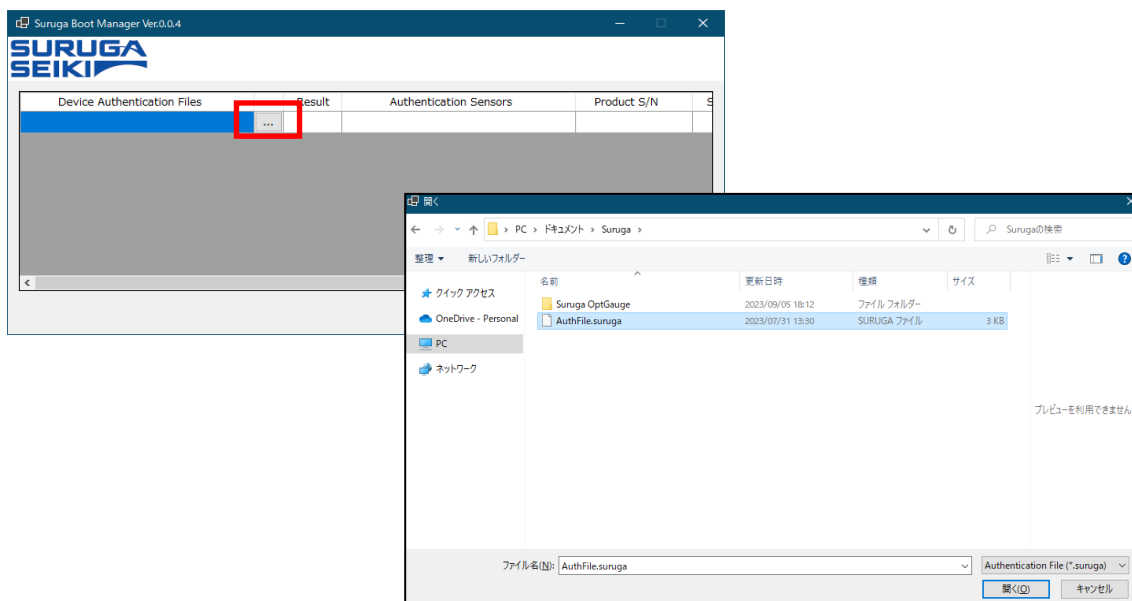
1.3.6 Starting up and Closing down the Suruga OptGauge

1. Double-click the "SurugaOptGauge" in the "...¥Desktop".

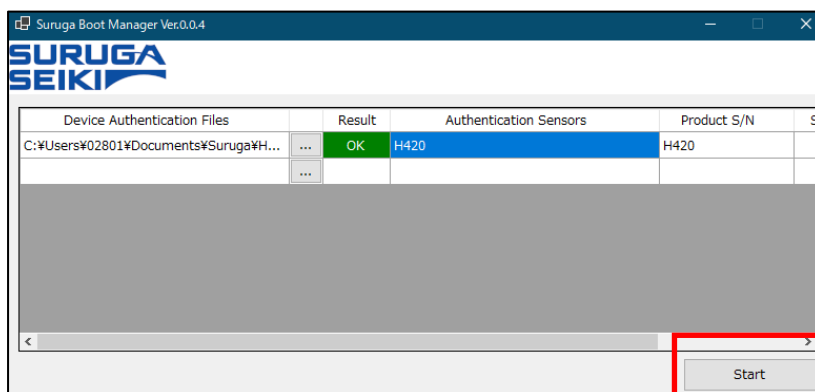


2. Click on "..." in the item "Device Authentication File" and select the extension ".suruga" in the folder in which the unique "Device Authentication File" was copied.

If not able to copy the device authentication file to your computer, select it directly from the USB memory stick.



3. Confirm that the "Result" is "OK" and click "Start".

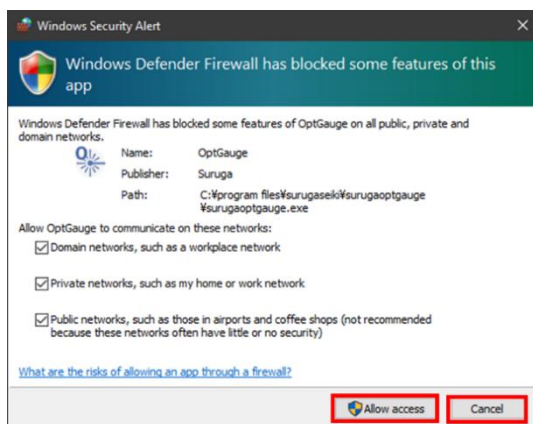


Attention

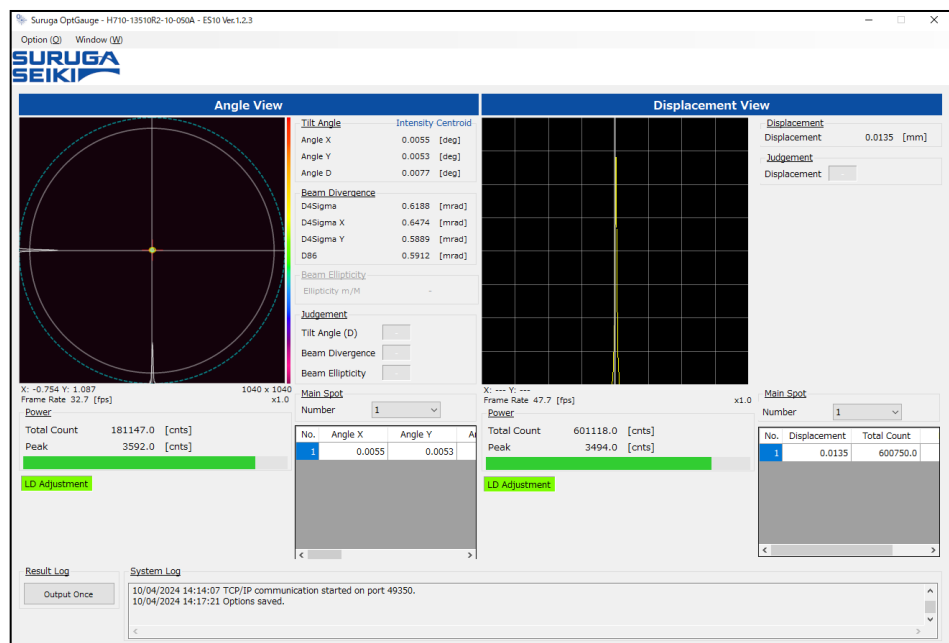
The Software incorporates TCP/IP communication control. Therefore, depending on your PC's security settings, the following warning may appear upon initial startup.

If your computer and network environment allow the TCP/IP communication permission, check all, and click "Allow access". If not, click "Cancel".

(Changes can be made after the fact in "Control Panel / All Control Panel Items / Windows Defender Firewall / Allowed Apps".)

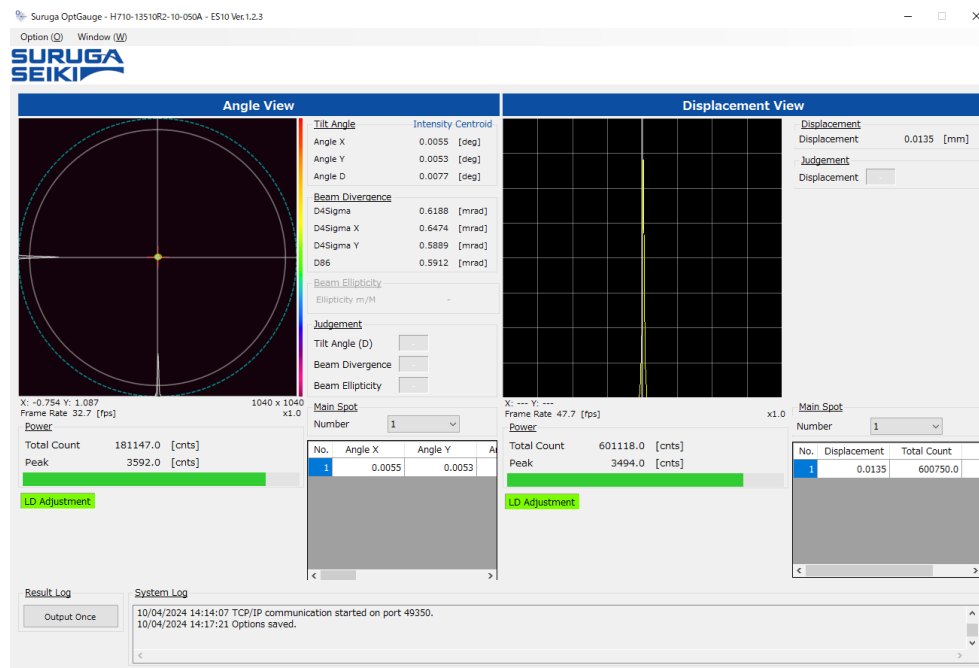


4. The Software will start up.



Closing the Suruga OptGauge

1. Click the "x" button to shut down the Suruga OptGauge.

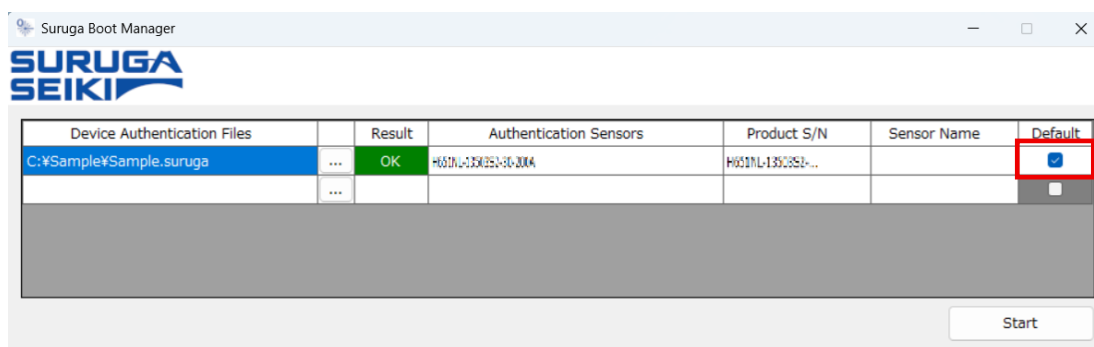


1.3.7 Quick Start

Quick Start is a feature that allows you to pre-select the authentication file used at software startup with the Boot Manager.

By configuring Quick Start, you can skip selecting the authentication file in the Boot Manager and pressing [Start] at the next startup.

When you enable Default for the relevant authentication file, Quick Start will be applied from the next startup.



Disabling Quick Start

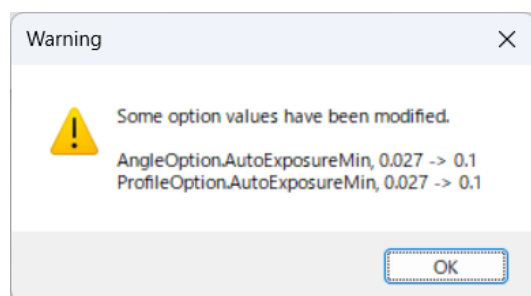
Even if Quick Start is enabled, you can still open the Boot Manager by starting the software while holding down the Shift key (hold down the Shift key until the Boot Manager screen appears).

By using this method, you can temporarily disable Quick Start and select the authentication file in the Boot Manager before starting the software.

1.4 Notes on Version Upgrades

Warning Message Displayed at Startup

When updating from an older version (~Ver.1.3.6) to the latest version, the following warning message will be displayed at startup.



This message informs you that some optional settings have been changed due to the version upgrade.

■Changed Options

Option	Before	After	Products applied
Auto Exposure -> Min (Angle)	0.027	0.1	H651 / H720
Auto Exposure -> Min (Profile)	0.027	0.1	H651

■Reason for the Change

This change was made to **stabilize the operation of auto exposure (Auto Exposure)**.

By revising the minimum exposure time, the dimming process has been improved for faster and more stable operation.

■How to deal with

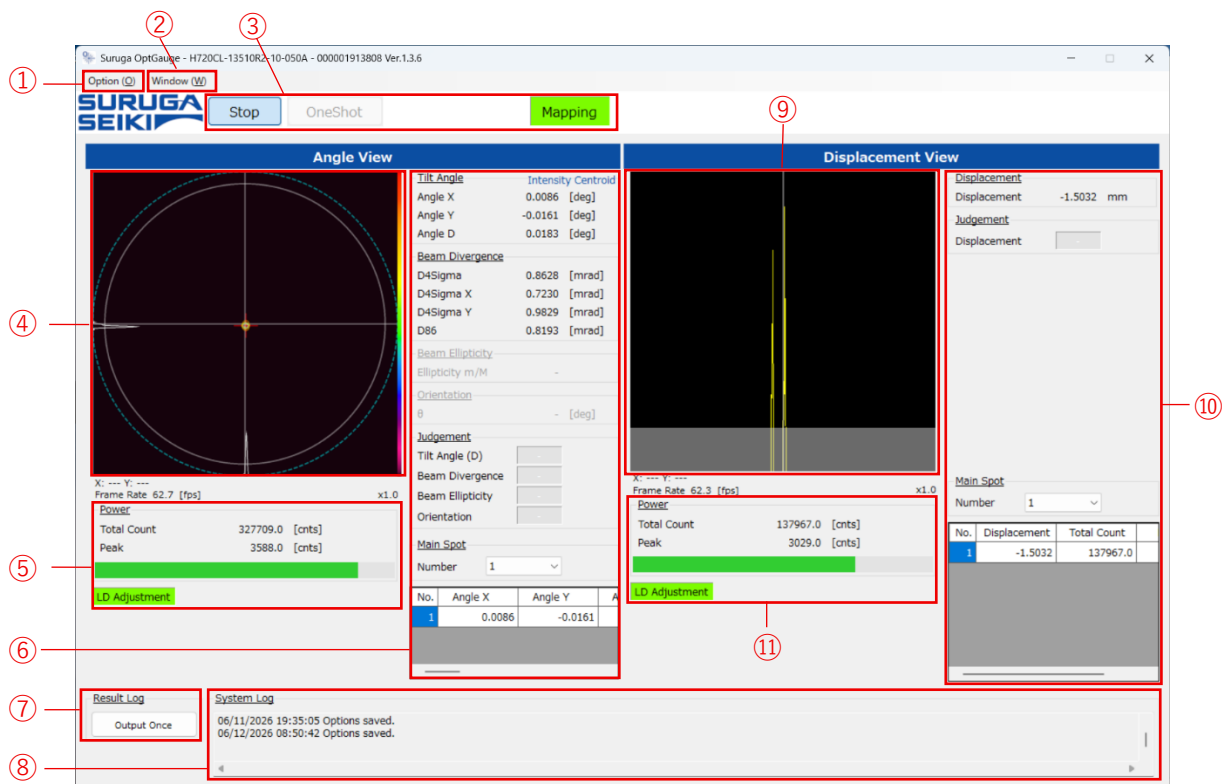
- Normally, you can continue using the software as usual.
- If necessary, please readjust the exposure time or dimming settings.

In addition

- This change is applied automatically to maintain compatibility.
- You can continue to use the software as is after confirming the message.
- This message does not indicate any abnormality.

2 Screen Components

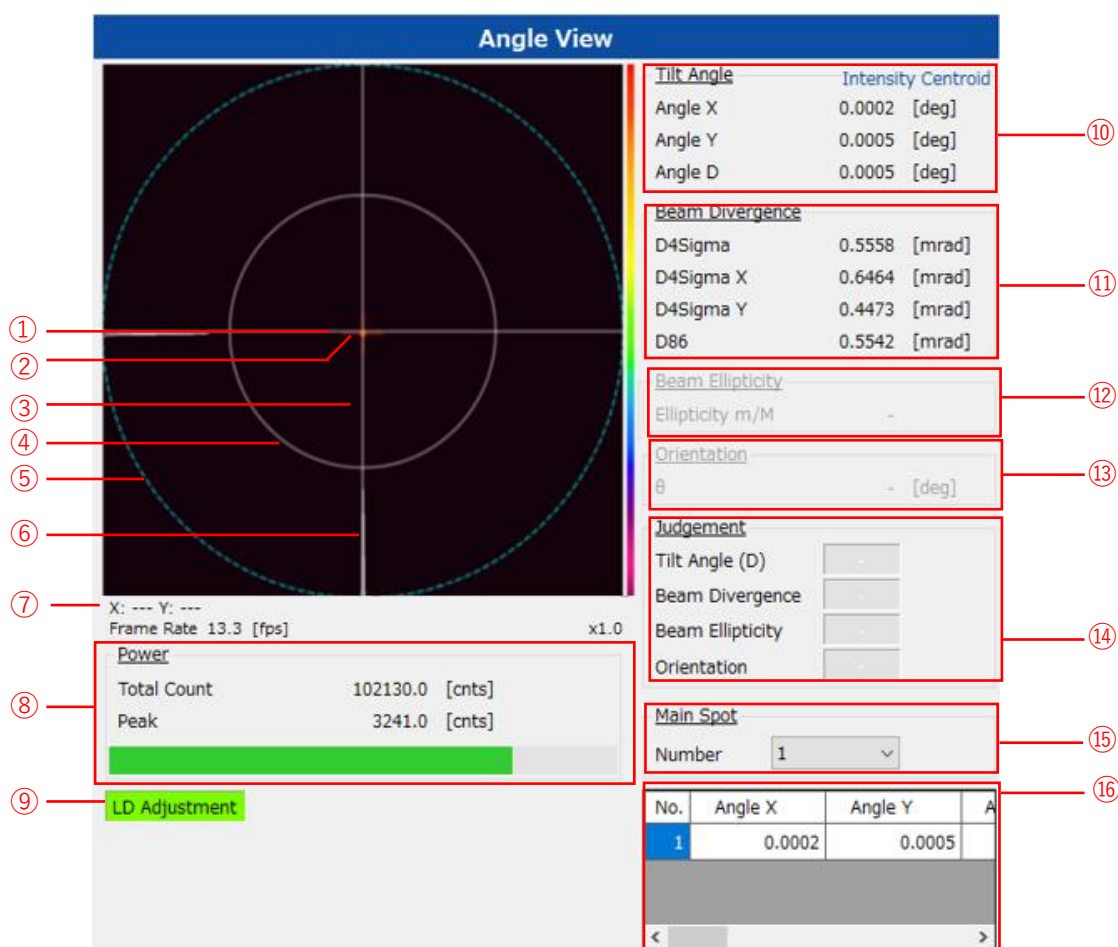
2.1 Main screen



① Option	Opens the option dialog box
② Window	Opens dialog boxes related to device authentication and window size.
③ Measurement Operation / Status Display	A display area with buttons of measurement operations and indicators the measurement status
④ Angle View	Display area for an image taken by the angle sensor camera
⑤ Angle Power	Display area for beam strength measured by the angle sensor camera
⑥ Angle Measurement Results Display	Angle measurement results display area
⑦ Result Log	Outputs measurement results and measurement images to the designated folder on the computer
⑧ System Log	Display area for the Suruga OptGauge operation log
⑨ Displacement View	Display area for an image taken by the displacement sensor camera
⑩ Displacement Measurement Results Display	Display area for the displacement measurement results

⑪ Displacement Power	Display area for the beam strength measured by the profile sensor camera
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2.1.1 Angle View

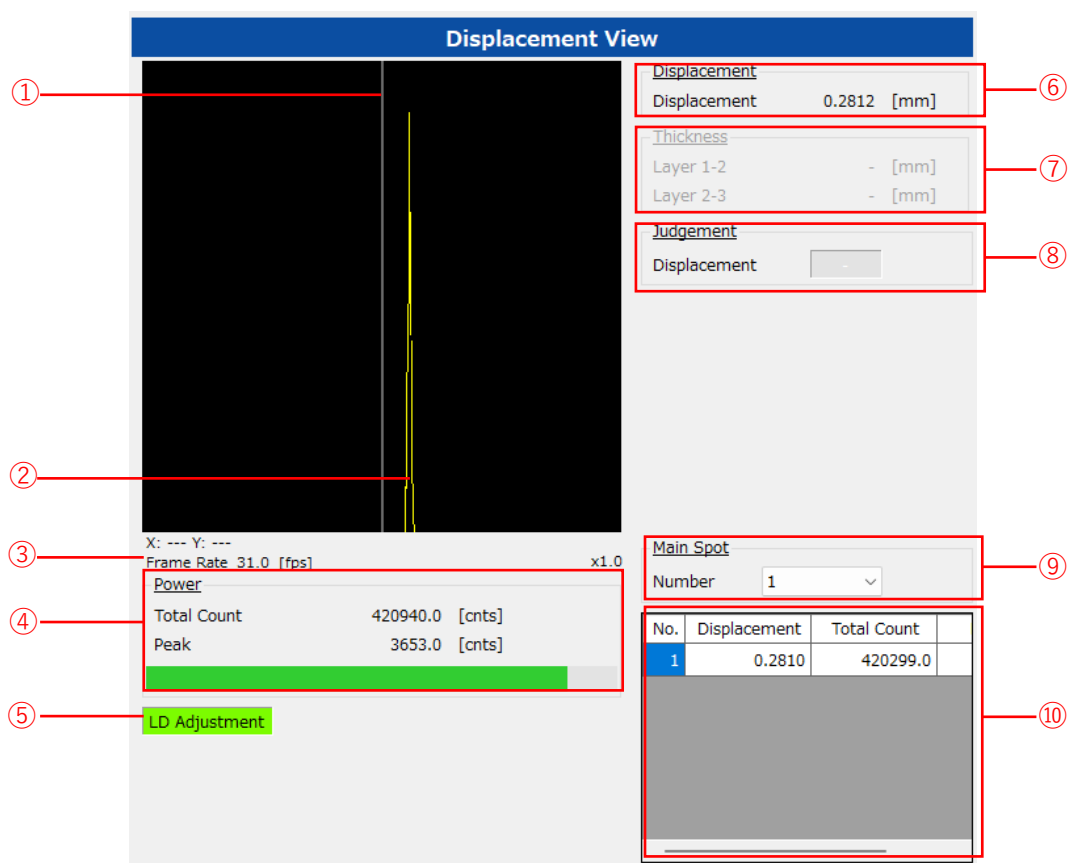


① Cross (red)		Displays the position of the light beam centroid.
② Auto Aperture (orange)		Displays the aperture if the Auto Aperture settings are enabled
③ Cross (white)		Displays the center position of the coordinate
④ Aperture (white)		Displays the range of angle measurement
⑤ ROI (blue)		Displays the aperture if the ROI settings are enabled
⑥ Profile		Displays the strength distribution of the light beam

⑦ XY Coordinates	Displays the coordinates where the mouse cursor points at	
Frame Rate	Displays the image refresh rate per second from image data acquisition to completion of measurement data calculation	
⑧ Power	Total Count	Displays the beam total count by the value from 0 to 4,429,152,000.
	Peak	Displays the maximum light beam luminance by the value from 0 to 4095. If the value is below the Peak value set in the " Judgement ", the indicator turns green (OK), otherwise, it turns red (NG).
⑨ LD Adjustment	Displays the status of the dimming function (Green = Pass, Yellow = Under adjusting and Red = Fail)	
⑩ Tilt Angle	Angle X	Displays the angle X from the X-axis component of the cross (white)
	Angle Y	Displays the angle Y from the Y-axis component of the cross (white)
	Angle D	Displays the angle from the center of the cross (white)
⑪ Beam Divergence	The " Orientation " in the Option Settings is enabled, it alters the measurement mode	
	If the "D4Sigma" is selected at the beam divergence " Type " configuration in the Option Settings, it displays following.	
	D4Sigma	Displays the beam divergence by $D4\sigma$ of half angle
	D4Sigma X(M)	Displays the beam divergence by $D4\sigma$ X(M) of half angle
	D4Sigma Y(m)	Displays the beam divergence by $D4\sigma$ Y(m) of half angle
	If the "1/e^2" is selected at the beam divergence " Type " configuration in the Option Settings, it displays following.	
	1/e^2	Displays the beam divergence by $1/e^2$ of half angle
	1/e^2 X (M)	Displays the beam divergence by $1/e^2$ X(M) of half angle
	1/e^2 Y (m)	Displays the beam divergence by $1/e^2$ Y(m) of half angle
	D86	Displays the beam divergence by D86 of half

		angle.
⑫ Beam Ellipticity	Operates while the " Orientation " in the Option Settings is enabled	
	Ellipticity m/M	Displays the light beam width by $D4\sigma$ or $1/e^2$
⑬ Orientation	Operates if the " Orientation " in the Option Settings is enabled	
	θ	Displays the rotation angle of the light beam
⑭ Judgement	Operates while the measurement data to evaluate, at the " Judgement " in the Option Settings, are checked, ☒ , thereafter, you specify evaluation criteria for 0.0000 .	
	Tilt Angle (D)	Displays "OK" if the configured evaluation criteria are satisfied or "NG" if not satisfied.
	Beam Divergence	
	Beam Ellipticity	
	Orientation	
⑮ Main Spot	Number	Specify the beam spots to display measurement results while measuring multiple beams.
⑯ Multi Spot Measurement Display	When multiple beams are detected, the measurement results for each beam spot are automatically listed and displayed	

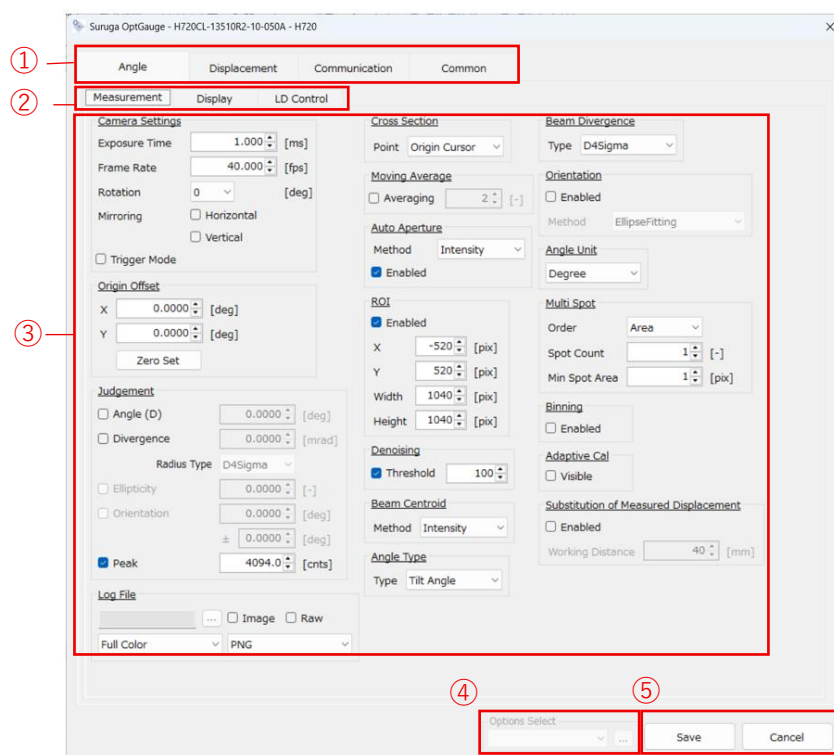
2.1.2 Displacement View



① Center line (thick white)		Displays the center position of the coordinates
② Profile		Displays the intensity distribution of the light beam.
③ XY Coordinates	Displays the coordinates where the mouse cursor pointing at. * The "X" represents the Z-coordinate (displacement) and the "Y" represents the (peak) luminance value.	
Frame Rate	Displays the image refresh rate per second from image data acquisition to completion of measurement data calculation	
④ Power	Total Count	Displays the beam Total Count value from 0 to 4,429,152,000.
	Peak	Displays beam maximum luminance value from 0 to 4095. If the value is equal to or below the Peak value set in " Judgement ", the indicator will display green (OK); otherwise, it will display red (NG).
⑤ LD Adjustment	Displays the status of the dimming function.	

	(Green: Pass, Yellow: Under adjusting and Red: Fail)	
⑥ Displacement	Displays displacement Z with the centerline as the displacement reference	
⑦ Thickness	Displays the Thickness, T, while the thickness measurement mode is enabled.	
⑧ Judgement	Operates while the measurement data that you want to evaluate, at the " Judgement " in the option settings, are checked, ☒ , and also, you specify evaluation criteria after 0.0000 .	
	Displacement	Displays "OK" when the set judgement criteria are satisfied and "NG" if not.
⑨ Main Spot	Number	Specifies the beam spots to display measurement results while measuring multiple beams.
⑩ Multi Spot Measurement Display	When multiple beams are detected, measurement results for each beam spot are automatically listed and displayed.	

2.2 Option Settings



① Option Tab	Select the tab to display options.	
	Angle	The option tab of Angle settings
	Displacement	The option tab of Displacement settings
	Communication	The option tab of Communication settings
② Subcategory Tab(s)	Common	The option tab of Common settings of the entire software
	Displays the option subcategories organized such as the Angle option, and the measurement, the display and the LD control in the displacement options	
	③ Settings	Measurement conditions can be changed
	④ Option Select	By creating an options list in advance, you can switch between the various settings in ③ (see “Options List”).
⑤ Save/Cancel	Changing the option settings (③ and ④) will activate the button. After changing the option settings, clicking the “Save” button will save the changes.	
	To cancel the changes, click the “Cancel” button.	

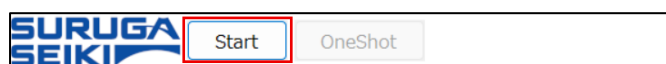
※For details on options, refer to "[Option](#)"

3 How to Use the Functions

3.1 Common

3.1.1 Measurement Start/Stop

By pressing the Start/Stop button at the top of the screen, you can switch between starting and stopping Angle measurement and Displacement measurement. *Immediately after launching the software, the measurement state is in started.



Measurement Start																									
Measurement is started. In this state, pressing the [Stop] button will stop the measurement, and the screen display will turn gray.	The 'Angle View' screen displays a circular target with a crosshair. The right side of the screen shows measurement data: <table><thead><tr><th colspan="2">Tilt Angle</th></tr><tr><th>Angle X</th><th>Intensity Centroid</th></tr></thead><tbody><tr><td>-</td><td>-</td></tr><tr><td>Angle Y</td><td>-</td></tr><tr><td>Angle D</td><td>-</td></tr></tbody></table> Beam Divergence <table><tbody><tr><td>D4Sigma</td><td>- [mrad]</td></tr><tr><td>D4Sigma X</td><td>- [mrad]</td></tr><tr><td>D4Sigma Y</td><td>- [mrad]</td></tr><tr><td>D86</td><td>- [mrad]</td></tr></tbody></table> Beam Ellipticity <table><tbody><tr><td>Ellipticity m/M</td><td>-</td></tr></tbody></table> Orientation <table><tbody><tr><td>θ</td><td>- [deg]</td></tr></tbody></table> Judgement <table><tbody><tr><td>Tilt Angle (D)</td><td>OK</td></tr></tbody></table>	Tilt Angle		Angle X	Intensity Centroid	-	-	Angle Y	-	Angle D	-	D4Sigma	- [mrad]	D4Sigma X	- [mrad]	D4Sigma Y	- [mrad]	D86	- [mrad]	Ellipticity m/M	-	θ	- [deg]	Tilt Angle (D)	OK
Tilt Angle																									
Angle X	Intensity Centroid																								
-	-																								
Angle Y	-																								
Angle D	-																								
D4Sigma	- [mrad]																								
D4Sigma X	- [mrad]																								
D4Sigma Y	- [mrad]																								
D86	- [mrad]																								
Ellipticity m/M	-																								
θ	- [deg]																								
Tilt Angle (D)	OK																								

| Measurement Stop | |
| Measurement is stopped. In this state, pressing the [Start] button will start measurement, and the screen display will turn active. | The 'Angle View' screen displays a circular target with a crosshair. The right side of the screen shows measurement data: | Tilt Angle | | |------------|--------------------| | Angle X | Intensity Centroid | | - | - | | Angle Y | - | | Angle D | - | Beam Divergence | | | |-----------|----------| | D4Sigma | - [mrad] | | D4Sigma X | - [mrad] | | D4Sigma Y | - [mrad] | | D86 | - [mrad] | Beam Ellipticity | | | |-----------------|---| | Ellipticity m/M | - | |-----------------|---| Orientation | | | |----------|---------| | θ | - [deg] | |----------|---------| Judgement | | | |----------------|----| | Tilt Angle (D) | OK | |----------------|----| |

In addition, starting and stopping measurement can also be controlled by commands.

3.1.2 Trigger Mode

This function allows switching the measurement timing and measurement method.

By switching the measurement method according to the application, you can accommodate various operations such as single measurements, continuous measurements, and coordination with external devices.

Attention

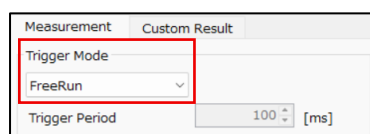
The following modes of this function are only available on products shipped after July 13, 2026:

- Trigger mode : **One Shot**
- Trigger mode : **Continuous**
- For products that do not support these modes, the corresponding options will not be displayed.

■ Types of Trigger Modes

The following trigger modes can be selected.

Trigger mode can only be changed while measurement is stopped. Option->Common->Measurement



Trigger Mode	Trigger	Detail
Free Run	—	Measurements are performed continuously and results are output sequentially.
One Shot	Internal trigger	A single measurement is performed and the result is output.
Continuous		Measurements are repeated at fixed intervals and results are output.
Alternate		Measurements are performed while alternately switching the light source for Angle/Displacement.
External Trigger	External trigger	Measurements are performed in response to the timing of external signal input.

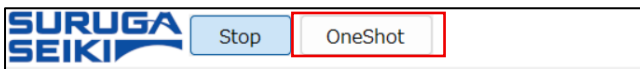
■ Features of Each Mode

Free Run

- Performs measurements continuously.
- Measurement results from each Angle/Displacement sensor are output asynchronously.
- Suitable for normal real-time measurement.

One Shot (One time Measurement)

- Performs a single measurement only.
- Used when it is needed to measure just once at a required timing.
- Measurement results from each Angle/Displacement sensor are output synchronously.
- Can be executed by pressing the One Shot button or by command.



Continuous (Continuous Measurement)

- Performs measurements periodically at fixed intervals.
- Measurement results from each Angle/Displacement sensor are output synchronously.

Alternate (Alternating laser emission)

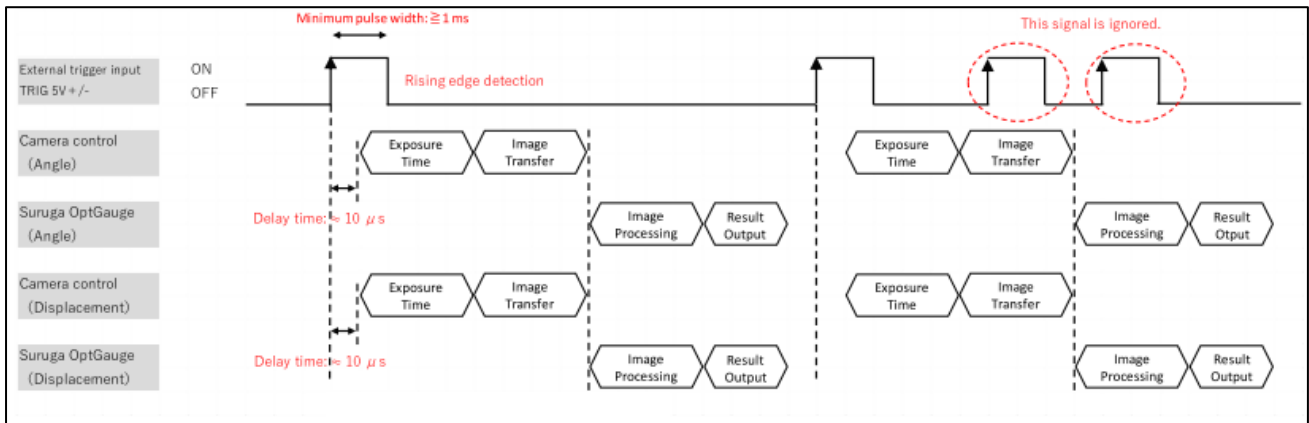
- Alternately turn on the laser light sources for Angle and Displacement during measurement.
- For details, refer to "[Alternate Laser emission Function](#)".

External Trigger

- Performs measurements in response to signals input from external devices.
- Measurement results from each Angle/Displacement sensor are output synchronously.

The system detects the rising edge (OFF → ON) of the external trigger input, then captures the image, and outputs the measurement result.

When inputting triggers continuously, leave at least one frame interval between triggers to prevent overlapping measurement timing.



■Frame Rate Control

In Continuous (continuous measurement), Alternate (alternating laser emission), and External Trigger modes, the camera's frame rate is automatically set to the maximum.

- In these modes, the frame rate cannot be changed manually.
- For Continuous (continuous measurement) and Alternate (alternating laser emission) modes, the measurement cycle is controlled by the "[sampling interval](#)" rather than the frame rate.

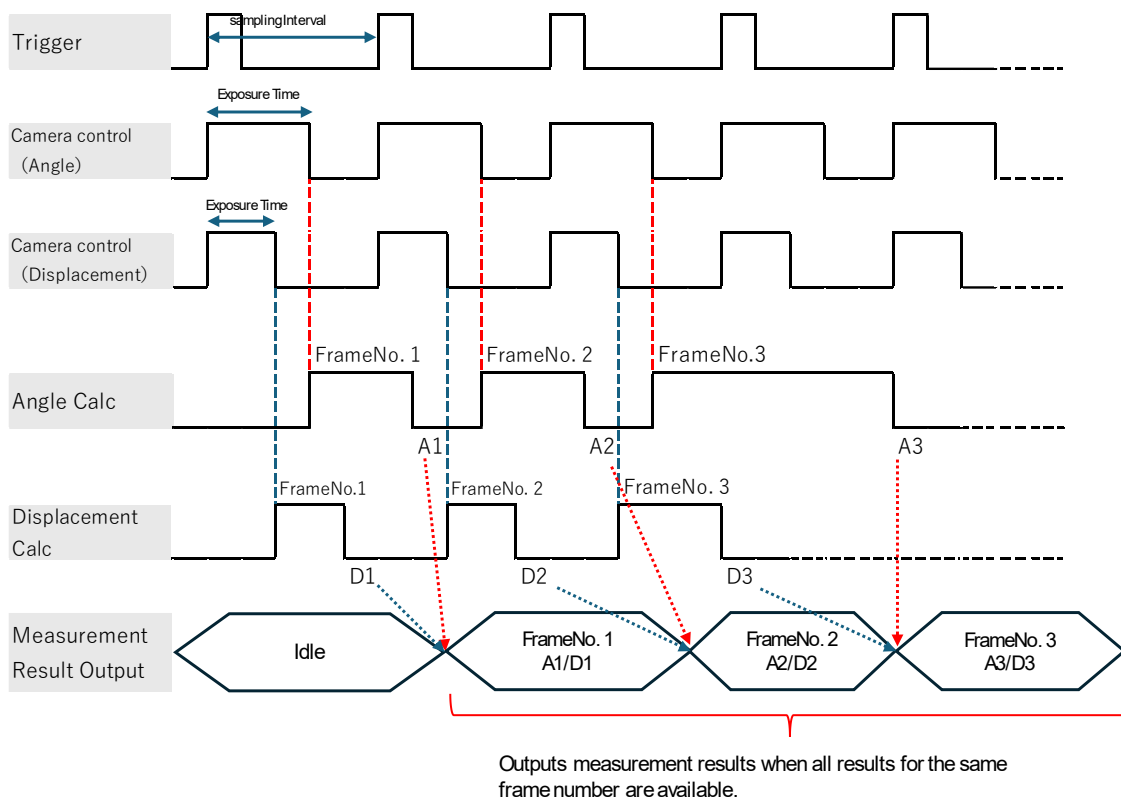
3.1.2.1 Synchronous/Asynchronous Output

The output method for measurement results varies depending on the trigger mode.

Trigger Mode	Output Method
Free Run	Asynchronous
One Shot	Synchronous
Continuous	Synchronous
Alternate	Asynchronous
External Trigger	Synchronous

■ Synchronous Output

In synchronous output, the Angle and Displacement sensors capture images at the same timing, and the results are output when both measurement results are available. **Synchronized measurement results are also assigned to the same frame number.**



Frame Number Reset

The frame number is reset in the following cases:

- When measurement is stopped
- After resetting, numbering will start again from frame number 1

Handling of Frame Numbers Depending on Measurement Result Output Method

The handling of frame numbers varies depending on the output method:

- For streaming output, to ensure data responsiveness, not only the latest frame number but also results from previous frame numbers may be output due to processing requirements.
- For measurement result output using the [Output Once] button or for screen display, only the results with the latest frame number are always output.

■Asynchronous Output

In asynchronous output, the Angle and Displacement sensors capture images at different timings, and the measurement results are output individually in the order they are obtained.

- Measurement results are output independently.
- measurement results from different sensors may not be available at the same timing.
- Frame numbers are not assigned.

■Timeout Error

In trigger modes with synchronous output, results are output when measurement results for images captured at the same timing are available. If the measurement results are not ready within a certain period (1.5 seconds), a timeout error is notified.

Notification Details

Notification Area	Detail
System Log	Measurement result timeout: incomplete results for Frame ID=xxx (timeout = 1500 ms).
Streaming Output	ER,8

Behavior

- Even if a timeout error occurs, measurement will continue.
- The frame number for which the timeout error occurred will be discarded.

Main Causes

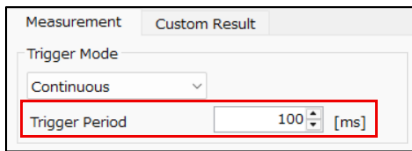
- Measurement processing is taking too long.
- The sampling interval is too short

Solutions

- Increase the sampling interval
- Adjust the measurement conditions

3.1.2.2 Sampling Interval (Continuous Measurement / Alternating Laser Emission)

In Continuous (continuous measurement) and Alternate (alternating laser emission) modes, you can set the interval at which measurements are performed (sampling interval). Option -> Common -> Trigger Period.



The following relationship applies between the sampling interval and exposure time:

Exposure time < Sampling interval

Due to this restriction, the following behaviors occur:

Behaviors

- If the sampling interval is too short, the settable exposure time will be limited.
- As a result, the adjustable range of the exposure time becomes narrower, and auto exposure may not converge.

Solutions

- By setting a longer sampling interval, you can widen the adjustable range of the exposure time.

Notes

- Trigger mode can **only be changed while measurement is stopped**.
- In continuous measurement, alternating laser emission, and external trigger modes, the frame rate is automatically set to the maximum and cannot be changed manually.
- The following restrictions apply to the sampling interval and exposure time:
 - Exposure time must be set shorter than the sampling interval.
 - If the sampling interval is short, the settable exposure time will be limited.
- When using auto exposure together, there may be restrictions on the sampling interval.
- If measurement results cannot achieve synchronization during synchronous measurement, a timeout error may occur.
- Frame numbers **are reset when measurement is stopped**.

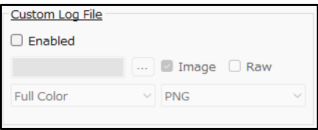
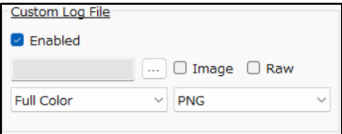
Summary

- **To acquire measurement results synchronously** → Use One Shot, Continuous, or External Trigger
- **To change the trigger mode** → Only possible while measurement is stopped
- **To reset the frame number** → Stop the measurement

3.1.3 Custom Log Output

This function allows users to freely select and edit the measurement result output items, **enabling output of only the required measurement items in the specified order**. It supports CSV file output, image data saving, command output, and streaming output, making it suitable for integration with external systems and data analysis purposes.

Differences Between Normal Output and Custom Output

Normal Output: When Custom Log File is “Disabled”
• All measurement result items corresponding to the View type are output. 
Custom Output: When Custom Log File is “Enabled”
• Outputs data in the format set on the Custom Result editing window. • Output items and their order follow the user settings. • The settings of saving image data and raw image data also follow the Custom Log File settings. 

Basic Usage (CSV Output)

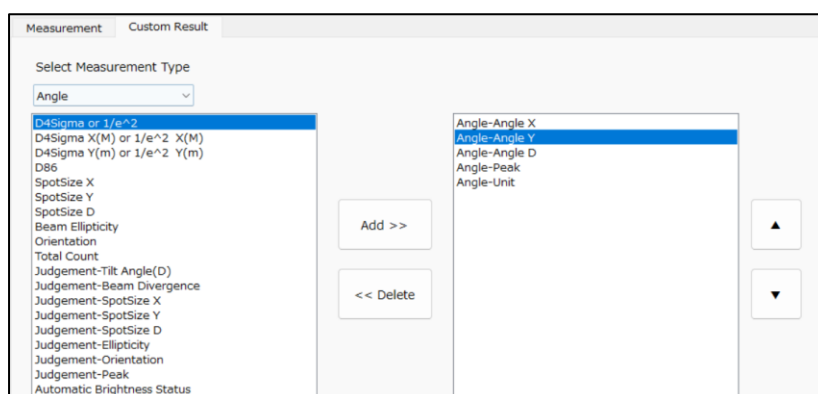
1. Open the Custom Result settings window

Open the Option window and go to the Common -> Custom Result tab.

2. Set the output items (Custom Result Output)

1. Select the measurement type (Angle or Displacement)
2. Select the items you want to output from the "Output Item List".
3. Add them to the "Edited Result List" using the **Add** button
4. Adjust the order as needed using the ▲ (up) / ▼ (down) buttons.

※ Items added to the Edited Result List will no longer be shown in the Output Item List.



3. Enable the Custom Log File

Set "Enabled" to ON for the Custom Log File.

- Set the output file path
- Set whether to output Image and Raw data
- Set the image output format (PNG/BMP/TIFF) and color type (Full Color/Gray Scale)

4. Save the settings

The Custom Result settings **will not be enabled unless the Option settings are saved.**

After making changes, be sure to click Save.

If not saved, the output will follow the previously saved settings.

5. Output the measurement results

When you press the Output Once button on the View screen, a CSV file will be output in the configured format.

- Each time the button is pressed, the measurement results are appended to **the end of the existing file**
- If the output items are changed, **the header row will be output again**

Output during measurement stop

If Output Once is executed while measurement is stopped, the result immediately before the measurement was stopped is output.

Operation during streaming output

When the Streaming function is ON, the same format as set in Custom Result will be output to the streaming port.

※ For streaming output, the custom format is used regardless of whether Custom Log File is ON or OFF.

About Image Data Saving

When the Custom Log File is enabled, the following image data can be saved together with the measurement results:

- Image data from the View screen (.png/.bmp/.tiff)
- Raw image data (CSV format)

Notes

- Changes to Custom Result settings become effective **only after saving in Options**
- When the output format is changed, the header will be output again
- A directory containing the product serial number is automatically added to the output path

Summary

- **To output only the required items** → Edit with Custom Result
- **To manage saving formats collectively** → Enable Custom Log File
- **Always save after changing settings**
- **The same format can be used for both Output Once and Streaming**

3.1.4 Measurement Result Streaming Output

This function enables measurement results to be transmitted in real time and continuously to an external control system.

When this function is enabled, measurement results are automatically sent each time a measurement is completed, allowing data to be received without the need for sequential acquisition by commands. It is suitable for integration with external control systems and data collection software.

Features of Streaming Output

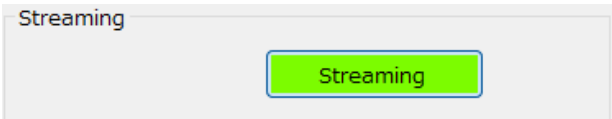
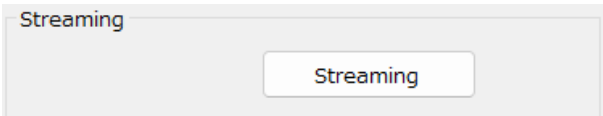
- **Automatic, continuous transmission** of measurement results
- **Real-time output** via TCP/IP communication
- Output content **can be customized** using the Custom Result settings
- Errors, warnings, and interlock statuses can also be notified

Enabling/Disabling the Streaming Function

1. Open the Option screen.
2. Click the "Streaming" button on the Communication tab.

※ This mode can be toggled using both the UI and command operations.

Operation Overview

Streaming ON
Measurement results are sent from the streaming port each time they are generated. 
Streaming OFF
No streaming transmission is performed. 

Streaming Output Timing

Streaming output is automatically performed **whenever measurement results are calculated**.

- Measurement result calculated
 - Output data created
 - Sent to the streaming port

Output Data Content

The data content output by streaming follows the format set in "**Custom Result**".

- Angle frame number (hyphen for asynchronous output)
- Angle measurement date and time (yyyy/MM/dd HH:mm:ss.fff), e.g., 2026/04/1 10:15:30.123
- Displacement frame number (hyphen for asynchronous output)
- Displacement measurement date and time (yyyy/MM/dd HH:mm:ss.fff), e.g., 2026/04/1 10:15:30.123
- Output items set in Custom Result

About the Streaming Communication Port

Streaming output uses a different TCP port than regular command communication.

- The port number for streaming is set automatically
- It can be checked on the Communication tab of the Option window
- The software sets the port standby when it launches

The connection status is displayed in the System Log.

About Notification Output

In addition to measurement results, the following notification information is also sent via streaming output:

- **Interlock Notification**

Interlock detected	Interlock,1
Interlock released	Interlock, 0

- **Error Notification**

System error	ER,-1
Sensor disconnection error	ER,7
Timeout error*	ER,8

*For details about timeout errors, refer to "[Trigger Mode](#)".

Warning Notification

Unperformed correction warning	WA,1
-----------------------------------	------

Notification data is sent from the streaming port in the same way as measurement results.

Notes

- The content of streaming output **depends on** the settings in "Custom Result."
- After changing settings, be sure to save the Option settings.
- The measurement process is prioritized over the communication environment, so older data may be discarded.

Summary

- **To acquire data in real time** → Turn Streaming ON
- **To edit the output content** → Configure Custom Result
- **To link with an external control system without stopping measurement** → Use streaming output

3.1.5 Background Operation

This function allows the software to start and operate in background without displaying the UI.

By combining it with command control from an external control system or streaming output, it can be used for automatic measurement and equipment integration without relying on the UI.

Main Applications

- **Fully automated control** from a host system
- **Light operation** without UI display
- **Background operation** when embedded in equipment
- Measurement operation as an always-on process

How to Start Background Operation

To run in background mode, specify command line arguments (startup options) when launching from the command line.

Startup command example:	SurugaOptGauge.exe -Hide "path of authentication file"
---------------------------------	--

※When this software is installed, the executable file (SurugaOptGauge.exe) is placed by default in the following folder:

- C:\Program Files\SurugaSeiki\SurugaOptGauge\

Description of Command Line Arguments (Startup Options)

UI Hide Option (-Hide)
• Specify -Hide as an argument, the software will start in the background without displaying the UI. • Uppercase and lowercase letters are not distinguished (e.g., -hide, -HIDE are also acceptable). • If -Hide is not specified, the software will start with the normal UI display.
Authentication File Selection
• Specify the authentication file enclosed in double quotation marks. • The software will start using the sensor linked to the specified authentication file.

※ The order of arguments is arbitrary.

Authentication File Selection and Behavior on Startup

Startup with UI Display

The authentication file used depends on the startup method in the following order:

1. **If the authentication file is specified via command line at startup**
→The specified authentication file is used to start the software.
2. **If no authentication file is specified via command line at startup**
→If Quick Start is configured, the specified authentication file is used to start the software.
3. **If no authentication file specified by neither the command line nor Quick Start**
→The Boot Manager will launch.

Startup with UI Hidden (Background Operation)

Startup is basically performed via command line.

1. **If the authentication file is specified via command line at startup**
→The specified authentication file is used to start the software.
2. **If no authentication file is specified via command line at startup**
→If Quick Start is configured, the specified authentication file is used to start the software.
3. **If no authentication file specified by neither the command line nor Quick Start**
→ The software will not launch. (An error code will be output.)

Display and Operation During Startup

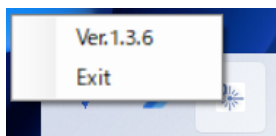
Task Tray Display

- When starting without UI, the software **displays an icon only in the task tray**.
- It will not be shown on the taskbar.

Task Tray Operation

Right-click the icon in the task tray, the following operations are available:

- Show version
- Exit (close the application)



How to Operate (During Background Operation)

While running in the background, **operation from the screen is not possible**.

Operate using the following methods:

- Command control from external devices
- Turn on streaming output to obtain measurement results

How to Exit Background Operation

While running in the background, this software can be exited in the following ways:

- Right-click the icon in the task tray → Exit
- Send an application exit command

Notes

- Even if there are unsaved option settings, the software will exit **without saving them**.
(It is recommended to execute the option save command before exiting.)
- When started with the UI displayed, the application exit command cannot be used.

Behavior When Startup Fails

If startup fails in UI hidden mode (background operation), an error code will be output to the command line.

Command format error	1
Authentication file does not exist / not specified	2
Sensor already in use	3
Software already started	4
Sensor not connected / authentication file loading failed	5
Invalid option file detected	6

Notes

- During background operation, UI operation is not possible.
- Control is **only possible via commands**.
- Not specifying an authentication file will cause startup failure.

Summary

- **If want to run without using the UI** → Start in background with the -Hide option
- **For automatic measurement or equipment integration** → Use in combination with streaming output
- **Exit via task tray or command**

3.1.6 Multiple Point Association for Transparent Objects

This function is used to **correctly compensate displacement measurement values** by associating angle measurement data with displacement measurement data. When measuring transparent objects, multiple reflected beams occur, so it is necessary to accurately match the angle and displacement measurement results.

■Why Association is Necessary

- Displacement: The order of the surfaces is clear (they are arranged in order of distance)
- Angle: It is not possible to distinguish which surface the reflection is from

Therefore, **the user must set the correspondence in advance**, and the association is performed automatically during measurement.

3.1.6.1 Operation Overview

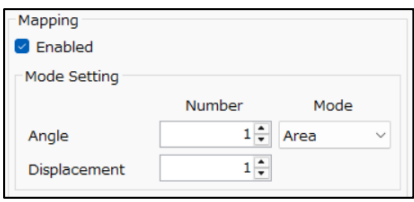
When this function is enabled, the angle spot number is associated with the displacement peak (surface order), and correction is performed automatically during measurement.

If correction is successful, the measurement result is displayed numerically.

3.1.6.2 Setting Items

■Operating Conditions

This function becomes effective under the following conditions.

Mapping = Enabled	Notes
 Common->Measurement ->Mapping	• When Mapping is enabled, the following settings are automatically changed: Order is set to "Near" • While Mapping is enabled, the following restrictions apply: Order cannot be changed to anything other than "Near"
Beam detection for both Angle and Displacement	
• Number of detected angle light spots = 1 or more • Number of detected displacement peaks = 1 or more	

※If this function is disabled, correction will be performed using the currently selected Main Spot Number.

※If any settings are changed, verify the Order setting before performing a measurement.

■Mode Setting (Association Mode Setting)

In Mode Setting, you configure the number of light spots to use for association and the sorting method to be used as the basis for association.

Number = 1~7

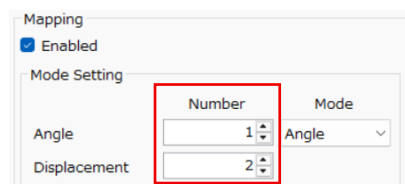
Set the number of points to be used for association for both Angle and Displacement.

Angle :

Set the number of angle light spots to use for association.

Displacement :

Set the number of displacement peaks to use for association.



Common->Measurement ->Mapping->Mode Setting

These settings determine which range of data will be subject to association.

Mode

Select the basis for associating angle light spots in Mode.

Angle :

Associates by sorting according to angle magnitude.

Area :

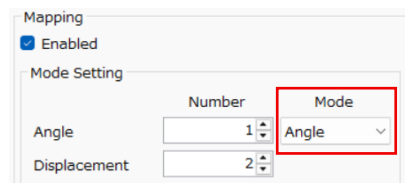
Associates based on the size of the received beam.

Peak :

Associates based on the intensity (Peak) of the received beam.

Total Count :

Associates based on the Total Count of the received beam.



Common->Measurement ->Mapping->Mode Setting

※ The Mode setting is linked to the "Order" setting in Option settings.

■ Mapping Setting

In Mapping Setting, you can set the corresponding angle light spot number for each displacement peak.

Displacement

On the displacement side, fixed items (Displacement 1–7) are displayed.

These mean:

- Displacement 1 : The surface closest to the sensor
- Displacement 2 : The next surface
- Displacement 3 : The surface after that

(and so on)

※The Angle items become available for input according to the "Displacement" value set in Mode Setting -> Number.

The screenshot shows the 'Mapping Setting' screen. It has two columns: 'Displacement' and 'Angle'. The 'Displacement' column lists numbers 1 through 7. The 'Angle' column has corresponding input fields, each with a small up/down arrow icon. A red rectangular box highlights the 'Displacement' column.

Displacement	Angle
1	1
2	2
3	3
4	4
5	5
6	6
7	7

Common->Measurement ->Mapping->Mode Setting

Angle ※Title follows Mode Setting -> Mode

For each displacement, enter the corresponding angle light spot number.

Input range:

The angle light spot numbers that can be set are within the range set by Angle (number of light spots) in Mode Setting -> Number.

The screenshot shows the 'Mapping Setting' screen. It has two columns: 'Displacement' and 'Angle'. The 'Displacement' column lists numbers 1 through 7. The 'Angle' column has corresponding input fields, each with a small up/down arrow icon. A red rectangular box highlights the 'Angle' column.

Displacement	Angle
1	1
2	2
3	3
4	4
5	5
6	6
7	7

Common->Measurement ->Mapping->Mode Setting

■ Timing for Applying the Association

The association settings are applied when the options are saved.

If the following conditions are met, the settings are considered incomplete, will not be saved, and a warning message will be displayed:

- Mapping Setting is not entered Associations are not set for all specified light spot and peak numbers

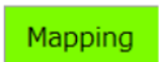
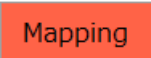
Warning message
The Mapping configuration is incomplete. Changes will not be saved.

3.1.6.3 Association Status During Measurement

■ Display of Association Status

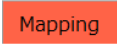
When multiple point association (Mapping) is enabled, you can check the status of association and correction during measurement.



Main screen	Status
	Association and correction are being performed normally
	Association cannot be performed and correction is not being performed
Streaming output	Status
WA,1	Association cannot be performed and correction is not being performed (Warning for unperformed displacement correction)

If the number of spots changes during measurement and the set associations become invalid, the status will be notified as an association failure.

Note

If the number of detected beams does not match the number of light spots or peaks specified in “Mode Setting ->Number”,  is displayed. However, correction is performed for any light spots and peaks that can be successfully matched.

3.1.6.4 How To Use (Example)

Ex1: When the Order of Angular Magnitude Is Known

Example Workpiece Configuration

A workpiece consisting of a cover glass and a sensor surface.

Characteristics

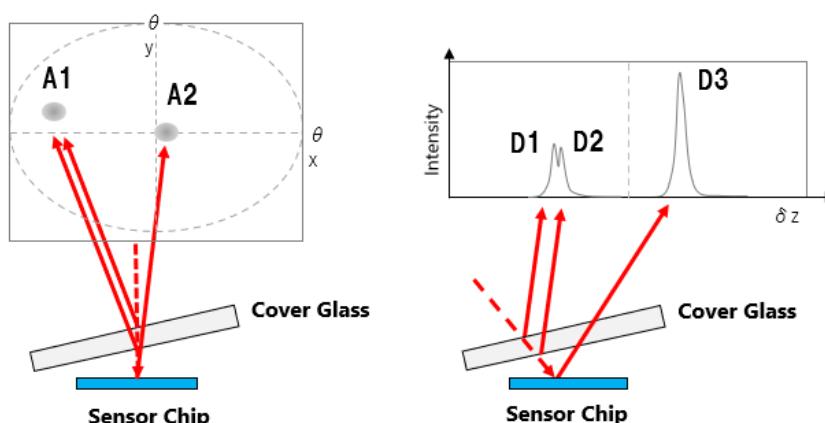
In angle measurement, the front and rear surfaces of the cover glass have the same angle and are therefore detected as a single spot (A1).

In contrast, reflections from the sensor surface are detected at a different angle and are therefore detected as a separate spot (A2).

As a result, the reflecting surfaces can be identified based on the order of the measured angles.

By setting Mode Setting → Mode to "Angle", mapping can be performed according to the angular order from A1 to A2.

In displacement measurement, the reflecting surfaces are detected as D1 → D2 → D3, in order from the surface closest to the sensor.



Configuration Example

Mode Setting

	Number	Mode
Angle	2 (A1, A2)	Angle
Displacement	3 (D1, D2, D3)	

Mapping Setting

Displacement	Angle
1 (D1)	1 (A1)
2 (D2)	1 (A1)
3 (D3)	2 (A2)

Configuration Example

Mapping
☒ Enabled

Mode Setting

Number
Mode

Angle
2
Angle

Displacement
3

Mapping Setting

Displacement
Angle

1
1

2
1

3
2

Mapping Result

- D1 — A1
- D2 — A1
- D3 — A2

Mapping and correction are automatically performed based on the order of angular magnitude.

Ex 2: When Reflecting Surfaces Can Be Distinguished by Differences in Received Beam Size

Example Workpiece Configuration

A workpiece consisting of a cover glass and a sensor surface.

Characteristics

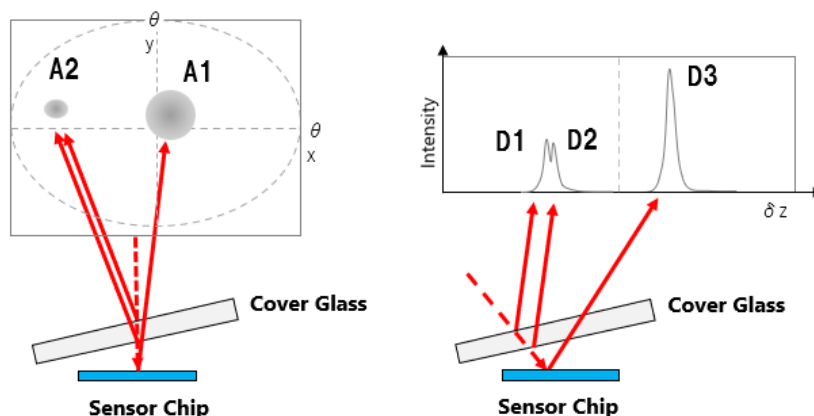
In angle measurement, the front and rear surfaces of the cover glass have the same angle and are therefore detected as a single spot (A2).

In contrast, reflections from the sensor surface produce a larger received beam profile due to the periodic structure of the sensor surface and are therefore detected as a separate spot (A1).

As a result, the reflecting surfaces can be identified based on differences in the received beam size.

By setting Mode Setting → Mode to "Area", mapping can be performed according to the beam size order from A1 to A2.

In displacement measurement, the reflecting surfaces are detected as D1 → D2 → D3, in order from the surface closest to the sensor.



Configuration Example

Mode Setting

	Number	Mode
Angle	2 (A1, A2)	Area
Displacement	3 (D1, D2, D3)	

Mapping Setting

Displacement	Angle
1 (D1)	2 (A2)
2 (D2)	2 (A2)
3 (D3)	1 (A1)

Configuration Example

Mapping
☒ Enabled

Mode Setting

Number
Mode

Angle
2
Area

Displacement
3

Mapping Setting

Displacement
Area

1
2

2
2

3
1

Mapping Result

- D1 — A2
- D2 — A2
- D3 — A1

Mapping and correction are automatically performed based on differences in the received beam size.

Notes

- Association settings **must be saved with all items configured**.
- If the required light spot numbers are not assigned, the settings will not be saved.
- If the number of spots changes during measurement, correction may not be performed.
- When Mapping is enabled, the order of displacement cannot be changed.

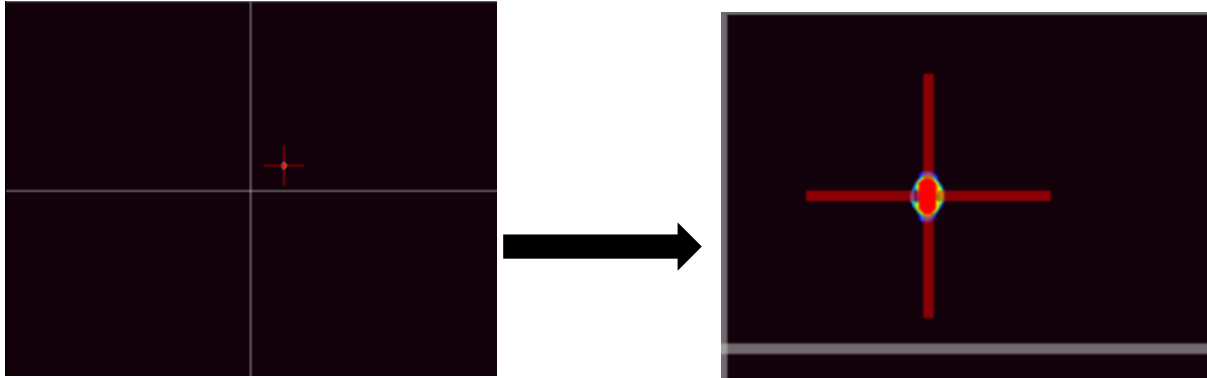
Tips

- Use this function when measuring multiple surfaces simultaneously.
- Set the number of light spots and peaks according to the actual measurement conditions.
- If correction is not performed, check the Mapping settings or the spot detection status.

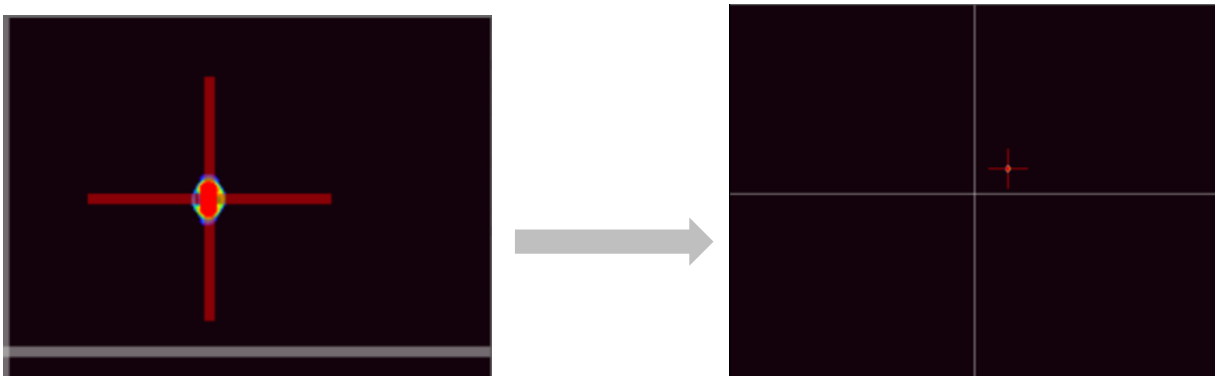
3.1.7 Zoom In

A zoom function is available for observation of the light beam status on the View screen.

1. To zoom in, hold down the Ctrl key and scroll the mouse wheel forward (upward) on the View screen.
2. You can adjust the display position by dragging the mouse.



3. To zoom out, hold down the Ctrl key and scroll the mouse wheel backward (downward) on the View screen. You can continue the Zooming Out until the display to its original size.



4. To exit the zoom mode, right-click on the mouse in the View screen.

3.2 Angle View

3.2.1 Angle Measurement

You may select the "Tilt Angle"^{*1} for measuring a reflection angle.

To measure a reflection angle

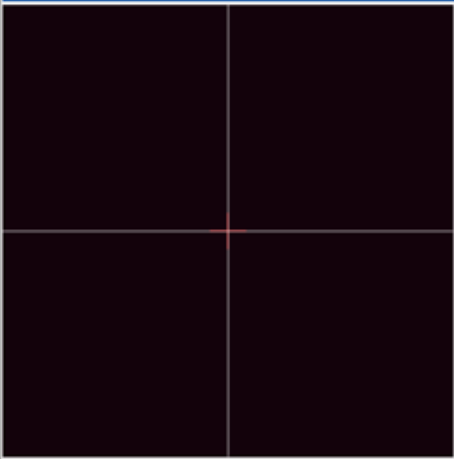
You may select [Tilt Angle]^{*1} in the "Angle Type" in the option setting.

Angle Type

Type Tilt Angle ▼

It starts measuring the reflection angle.

Angle View



Tilt Angle

Intensity Centroid

Angle X	-0.4091 [deg]
Angle Y	0.4091 [deg]
Angle D	0.5786 [deg]

Beam Divergence

D4Sigma	40.5876 [mrad]
D4Sigma X	39.9275 [mrad]
D4Sigma Y	41.2370 [mrad]
D86	37.5164 [mrad]

Beam Ellipticity

Ellipticity m/M -

Judgement

Tilt Angle (D)	-
Beam Divergence	-
Beam Ellipticity	-

^{*1} The Products has only [Tilt Angle] available.

3.2.2 Divergence

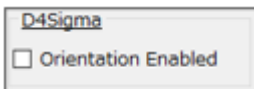
Divergence indicates how much the light beam expands at an angle as it propagates.

A light beam with small divergence means that there is little expansion during propagation over long distance while a beam with a large divergence expands rapidly over short distance.

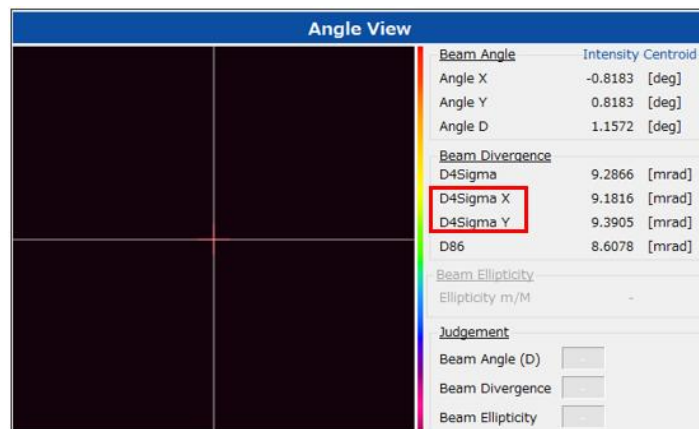
The Products display divergence in a half-angle with mrad (milli radian). It has two modes of measurement.

To measure $D4\sigma$ beam diameter (elliptical beam) of divergence along with X-axis and Y-axis directions.

Set "Orientation Enabled" in the option settings to "Disabled".

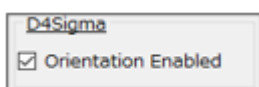


Measures beam divergence with "D4Sigma X" and "D4Sigma Y" *1

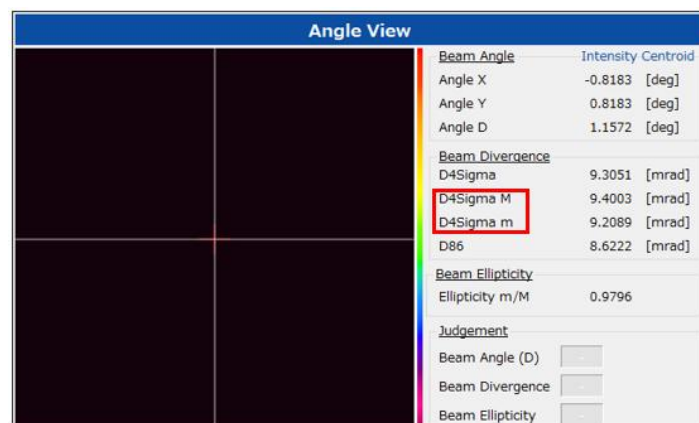


To measure a $D4\sigma$ beam diameter (elliptical beam) of divergence along with M (major: long axis) and m (minor: short axis).

Set "Orientation Enabled" in the option settings to Enabled".



Measures beam divergence with "D4Sigma M" and "D4Sigma m" *1



*1 You may select either " $D4\sigma$ " or $1/e^2$ to measure the diameter of the light beam

Applications

By analyzing the spread of reflection of the internal light on a measuring surface, the sensor distinguishes spots on the surface with subtle differences of their scattering characteristics.

3.2.3 Beam Centroid

The center position of a light spot can be selected by the type either beam area (area centroid) and beam intensity (luminance centroid) in the "Beam Centroid" in the option setting. We recommend selecting the type of "Beam Centroid" according to an object to be measured.

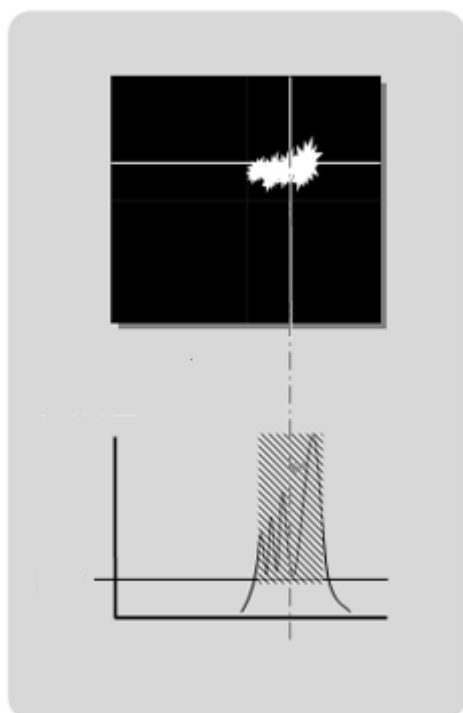
Area Centroid (Area)

For the area centroid of a light beam, its center position is calculated from an irradiated area higher luminance than the denoising threshold value. Therefore, by raising the threshold value, the effects of the edges of the peak profile can be minimized.

We recommend selecting this type of measurement for objects such mirror with uniform surface and reflect a light beam without blur or smudge*.

Optically, blur or smudge is defined as, for instance, luminous point with elongating edge profile in normal distribution, half-width deviating largely from normal distribution, or objects with irregular profiles which are not smooth.

Detection example



Recommended Device Under Tests



Mirror



Glass

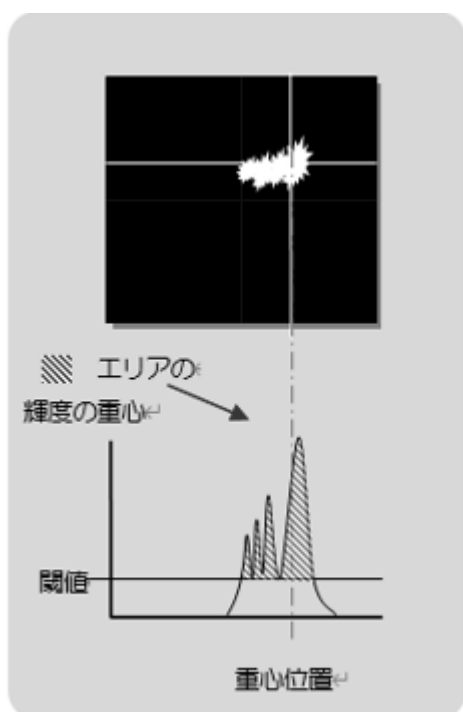
Intensity Centroid

For luminance [Intensity] centroid, the center position of a light beam is calculated from the beam intensity with higher luminance than the denoising threshold value.

By lowering the threshold value, the intensity centroid can include the luminous point peripheral area causing blur or smudge.

We recommend selecting this type of measurement mode for objects such as resin with non-uniform surfaces which reflects a light beam with blur or smudge.

Detection example



Recommended Device Under Test



Concave Lens

3.2.4 Beam Ellipticity

Beam Ellipticity determines how far the light beam shape is deformed from circular to elliptical.

The Formula for Beam Ellipticity

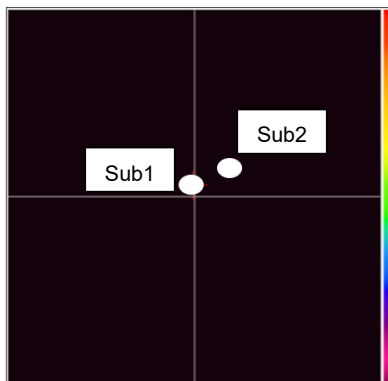
$$\text{Beam Ellipticity} = D4 \sigma m \text{ (minor) beam diameter} / D4 \sigma M \text{ (major) beam diameter}$$

The following describes its use.

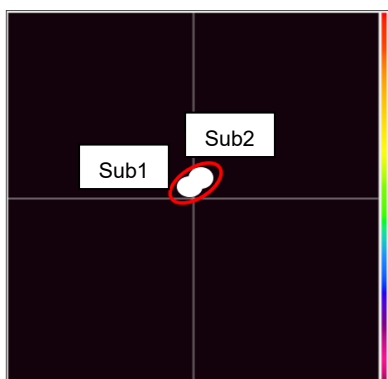
Beam Ellipticity Usage

The "Beam Ellipticity" will be selected to measure the parallelism of two or more measured targets.

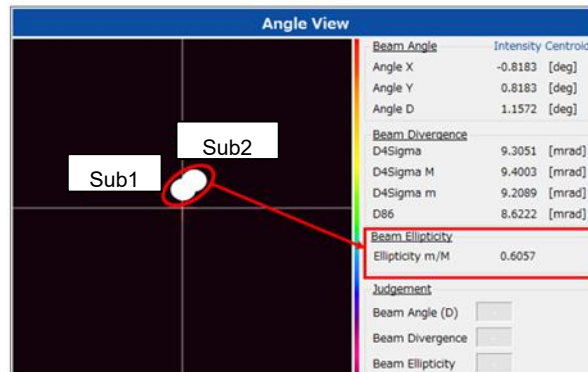
1. The beam spots of "Sub 1" and "Sub 2" shown in the right are incident lights on the Products, and the angles of each can be measured. By moving the two beam spots close to each other, the Sub1 and Sub2 are nearly parallel.



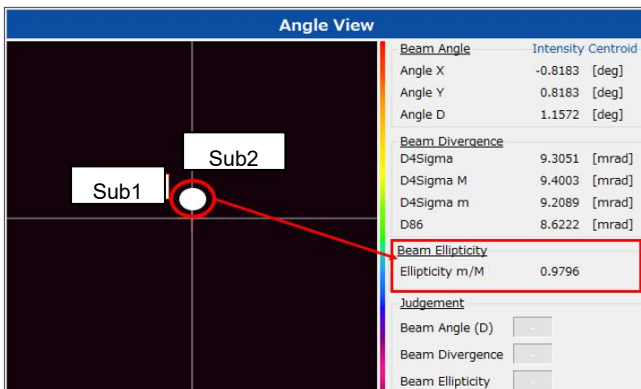
2. As the two light spots are getting closer like in the illustrated frame, the sensor recognizes them as a single elliptical light spot.



- When No.2 above occurs, conduct No. 4 while confirming the beam ellipticity figures.



- Move the two beams even closer together. Closer the ellipticity to "1.000" and the two targets are nearer to parallel.



For ellipticity measurement

Set "Orientation Enabled" in option settings to "Enabled".

Orientation

☒ Enabled

Angle View

Beam Angle		Intensity Centroid
Angle X	-0.8183	[deg]
Angle Y	0.8183	[deg]
Angle D	1.1572	[deg]

Beam Divergence	
D4Sigma	9.3051 [mrad]
D4Sigma M	9.4003 [mrad]
D4Sigma m	9.2089 [mrad]
D86	8.6222 [mrad]

Beam Ellipticity	
Ellipticity m/M	0.9796

Judgement

Beam Angle (D)

Beam Divergence

Beam Ellipticity

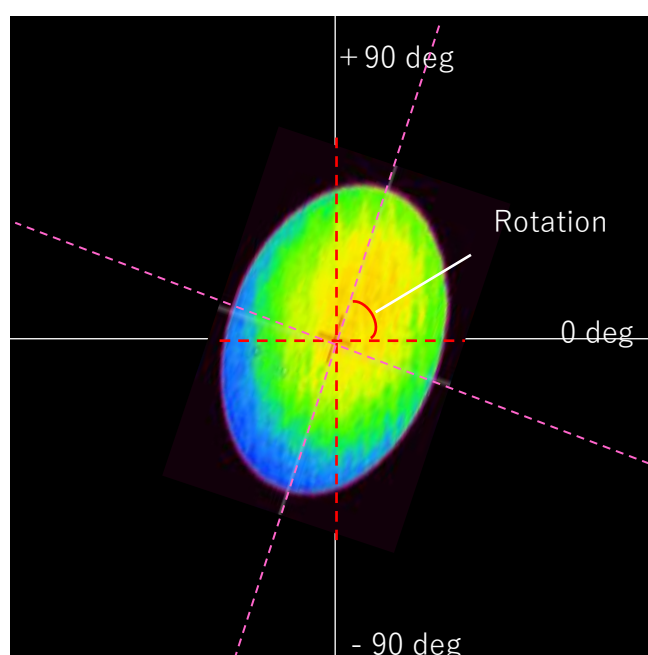
3.2.5 Rotational Angle Measurement

This function measures the rotation angle of the elliptical beam based on images captured by the camera and displays it on the screen.

The rotation angle measurement is only available when the “Orientation” option setting is enabled.

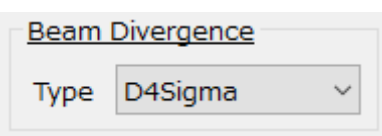
The Definition of Rotation Angle

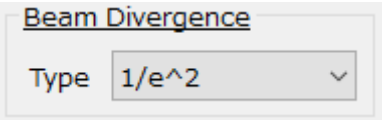
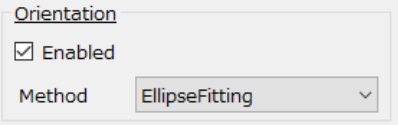
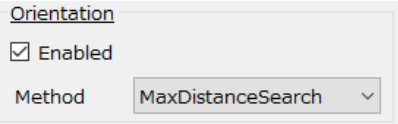
It is defined as the angle between the beam's principal axis in the rightward direction and the horizontal rightward direction. A positive (+) value is assigned when the principal axis points upward relative to the horizontal direction, and a negative (-) value when it points downward. The beam's major axis and minor axis are considered mutually perpendicular, and the rotation angle is expressed within the range of $\pm 90^\circ$.



Measurement Method

There are two types of measurement methods for a rotational angle.

Rotational Angle Measurement Compliant with ISO standards	
Select [D4Sigma] for the “Beam Divergence” in the Option Settings as below. 	Only when [D4 Sigma] is selected, Will the rotation angle be measured in accordance with ISO 11146-2.
Rotational Angle Measurement NOT Compliant with ISO standards	

Select [1/e²] for the “Beam Divergence” in the Option Settings as below. 	Only when [1/e²] is selected, will the following two non-ISO-compliant rotation angles be measured.*¹
	[Ellipse Fitting]  This method performs elliptical fitting on a beam region exceeding 13.5% of its peak value and calculates a rotational angle as the inclination of the major axis of the resulting ellipse. Advantage It obtains a high-precision rotational angle when a shape is close to an ideal ellipse, as this method considers an overall beam shape.
	[Maximum Distance of Two Points Search Method]  For beam regions exceeding 13.5% of its peak value, the main axis is defined as the straight line passing through the centroid that maximizes the distance between two points where it intersects the beam boundary. The rotation angle is calculated based on the slope of the main axis. Advantage Although the beam shape contains distortion or noise, it easily obtains a stable rotation angle with minimal variation in the direction of the main axis.

*¹ If a beam spot is small (approximately 3x3 pixels or less), the error increases due to reduced pixel resolution.

3.2.6 Judgement

The judgement function is available in an intuitively understandable expression of whether the measurement value is within the target range or not.

Here, as examples, we have the procedures for Angle (D) and Peak.

Angle View	
	Beam Angle Intensity Centroid
	Angle X -0.8183 [deg] Angle Y 0.8183 [deg] Angle D 1.1572 [deg]
	Beam Divergence
	D4Sigma 9.2701 [mrad] D4Sigma M 9.3874 [mrad] D4Sigma m 9.1513 [mrad] D86 8.5790 [mrad]
	Beam Ellipticity
	Ellipticity m/M 0.9748
Judgement	
Beam Angle (D) OK	
Beam Divergence 	
Beam Ellipticity 	

Angle View	
	Beam Angle Intensity Centroid
	Angle X -0.8183 [deg] Angle Y 0.8183 [deg] Angle D 1.1572 [deg]
	Beam Divergence
	D4Sigma 9.2417 [mrad] D4Sigma M 9.2906 [mrad] D4Sigma m 9.1925 [mrad] D86 8.5695 [mrad]
	Beam Ellipticity
	Ellipticity m/M 0.9894
Judgement	
Beam Angle (D) NG	
Beam Divergence 	
Beam Ellipticity 	

For Angle (D)

1. Adjusting the angle and aim to set the "Angle(D)" of the measurement result to less than 0.5000. Enabling the "Angle(D)" in the "Judgement Settings" in the Option setting and enter the value to be "0.5000 deg".

Suruga OptGauge - H710-13510R2-10-0508 - H710-13510R2-10-0508 Ver.1.2.4 64bit Options - Debug

Angle Displacement Communication

Measurement Display LD Control

Camera Settings

Exposure Time 0.027 [ms]
Frame Rate 40.000 [fps]
Rotation 0 [deg]
Mirroring ☐ Horizontal ☐ Vertical
☐ Trigger Mode

Origin Offset

X 0.0000 [deg]
Y 0.0000 [deg]
Zero Set

Judgement

☒ Angle (D) 0.5000 [deg]
☐ Divergence 0.0000 [mrad]
Radius Type D4Sigma
☐ Ellipticity 0.0000 [-]
☒ Peak 4094.0 [cnts]

Log File

... ☐ Image ☐ Raw
Full Color PNG

Cross Section

Point Origin Cursor

Moving Average

☐ Averaging 2 [-]

Auto Aperture

Method Intensity
☒ Enabled

ROI

☒ Enabled
X -520 [pix]
Y 520 [pix]
Width 1040 [pix]
Height 1040 [pix]

Angle Type

Type Tilt Angle

Denoising

☒ Threshold 100

Beam Centroid

Method Intensity

D4Sigma

☐ Orientation Enabled

Angle Unit

Degree

Multi Spot

Order Area
Spot Count 1 [-]
Min Spot Area 1 [pix]

Binning

☐ Enabled

Adaptive Cal

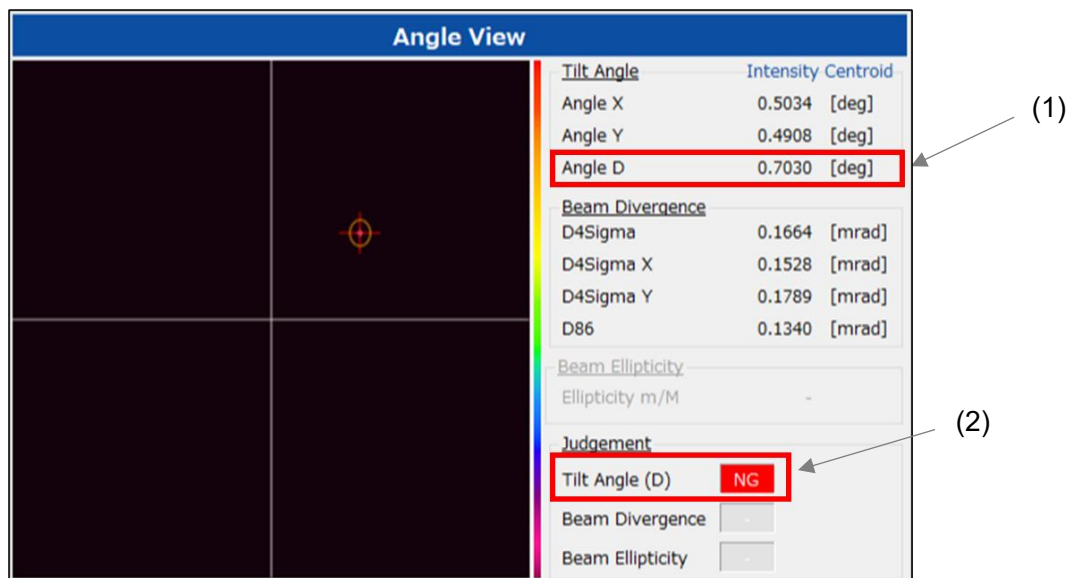
☐ Visible

Substitution of Measured Displacement

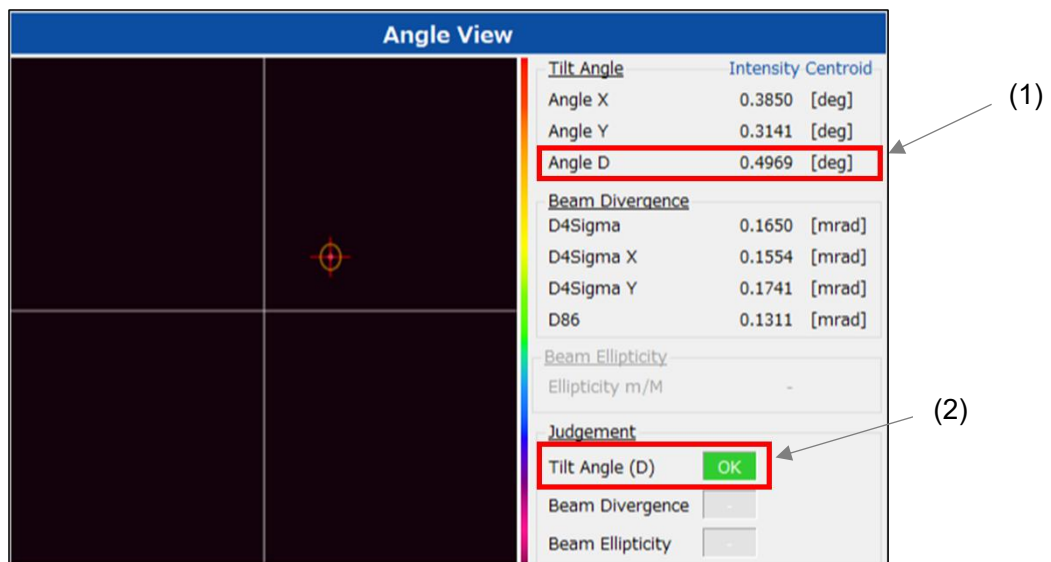
☐ Enabled
Working Distance 30 [mm]

Options Select Save Cancel

2. As a result of adjusting the angle, the result of Angle D on the measurement screen is not less than 0.5000 deg (1), so the judgment result is "NG" (2) at the "Tilt Angle(D)" of the "Judgement".



3. As a result of adjusting the angle one more time, the result of Angle D on the measurement screen is less than 0.5000 deg (1), so the judgment result of "Tilt Angle(D)" in "Judgement" is displayed as OK (2).



For Peak

1. Adjusting the light intensity and set the “Peak” of the measurement result to be less than 3500. Set “Peak” to “Enable” in the “Judgement Settings” option and set it to “3500.0”.

Suruga OptGauge - H710-13510R2-10-050B - H710-13510R2-10-050B Ver.1.2.4 64bit Options - Debug

Angle Displacement Communication

Measurement Display LD Control

Camera Settings

Exposure Time 0.027 [ms]
Frame Rate 40.000 [fps]
Rotation 0 [deg]
Mirroring ☐ Horizontal ☐ Vertical
☐ Trigger Mode

Origin Offset

X 0.0000 [deg]
Y 0.0000 [deg]
Zero Set

Judgement

☐ Angle (D) 0.5000 [deg]
☐ Divergence 0.0000 [mrad]
Radius Type D4Sigma
☐ Ellipticity 0.0000 [-]
☒ Peak 3500.0 [cnts]

Log File

Full Color PNG

Cross Section

Point Origin Cursor

Moving Average

☐ Averaging 2 [-]

Auto Aperture

Method Intensity
☒ Enabled

ROI

☒ Enabled
X -520 [pix]
Y 520 [pix]
Width 1040 [pix]
Height 1040 [pix]

Angle Type

Type Tilt Angle

Denoising

☒ Threshold 100

Beam Centroid

Method Intensity

D4Sigma

☐ Orientation Enabled

Angle Unit

Degree

Multi Spot

Order Area
Spot Count 1 [-]
Min Spot Area 1 [pix]

Binning

☐ Enabled

Adaptive Cal

☐ Visible

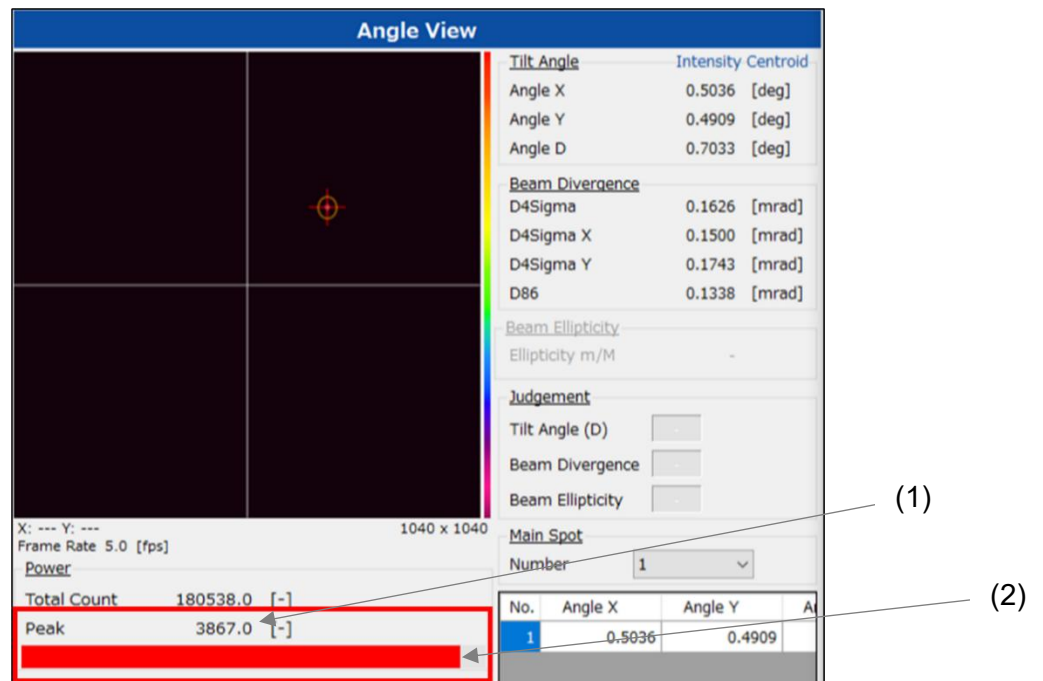
Substitution of Measured Displacement

☐ Enabled
Working Distance 30 [mm]

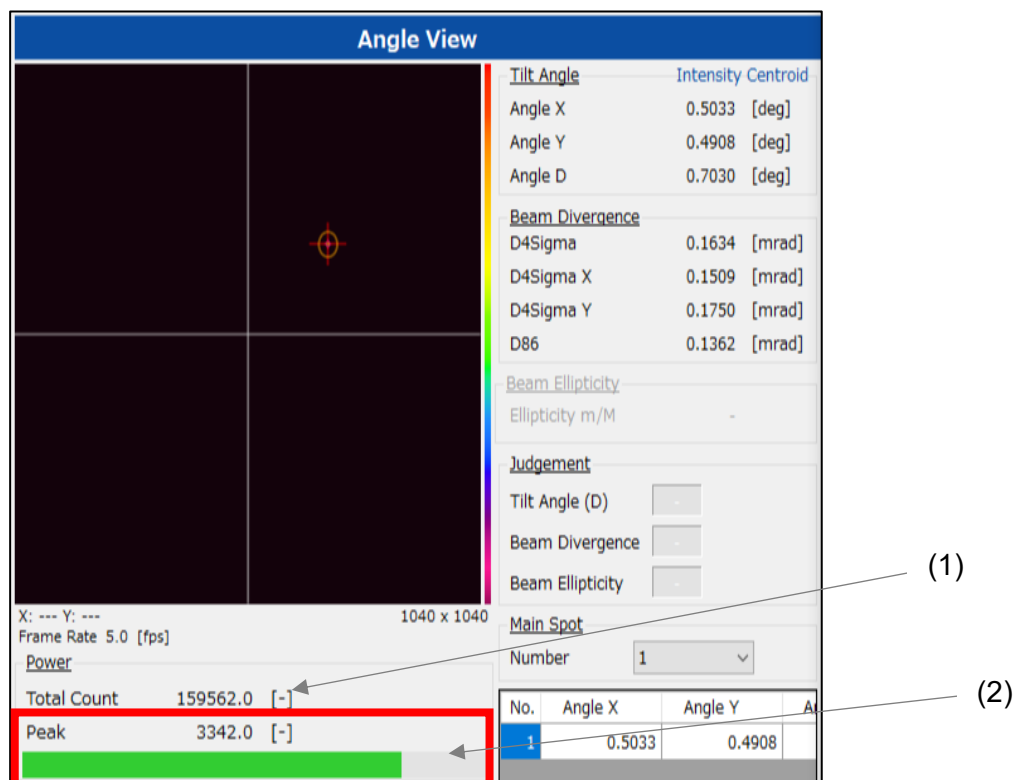
Options Select

Save Cancel

- Because the result of Peak light intensity adjustment on the measurement screen is not less than 3500.0 (1), the judgement result is “NG,” and the peak bar is in red (2).



- When the result of repeated Peak light intensity adjustment on the measurement screen is less than 3500.0 (1), the judgement result is “OK” and the peak bar is in green (2).

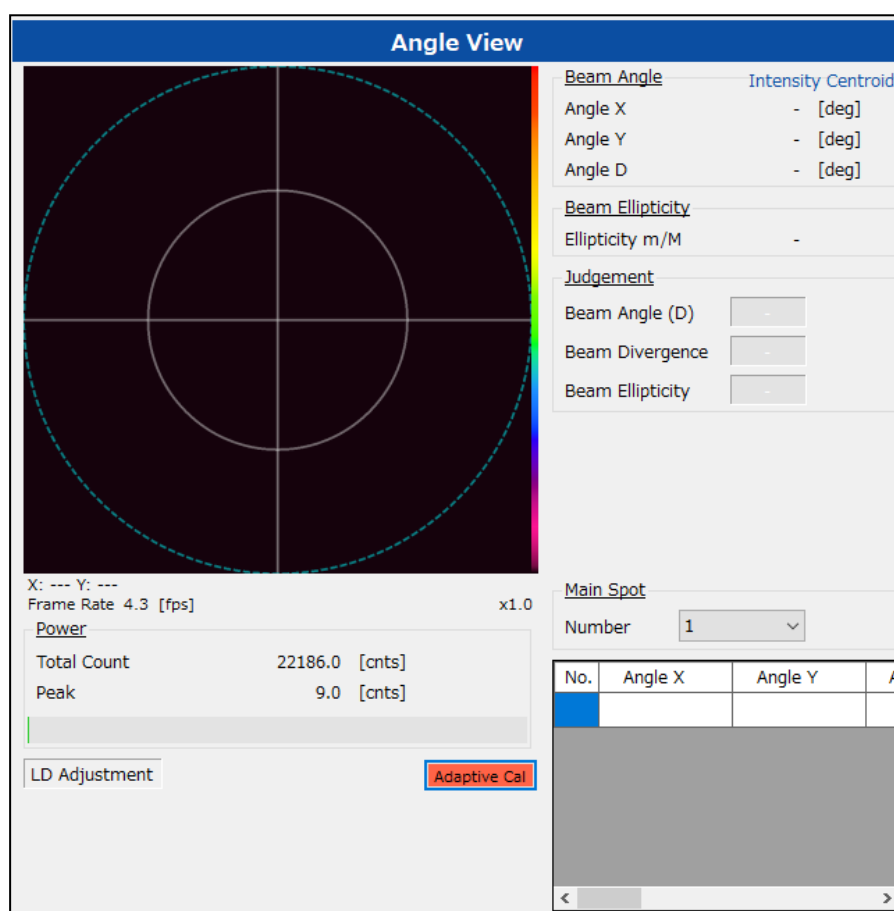


3.2.7 Adaptive Cal

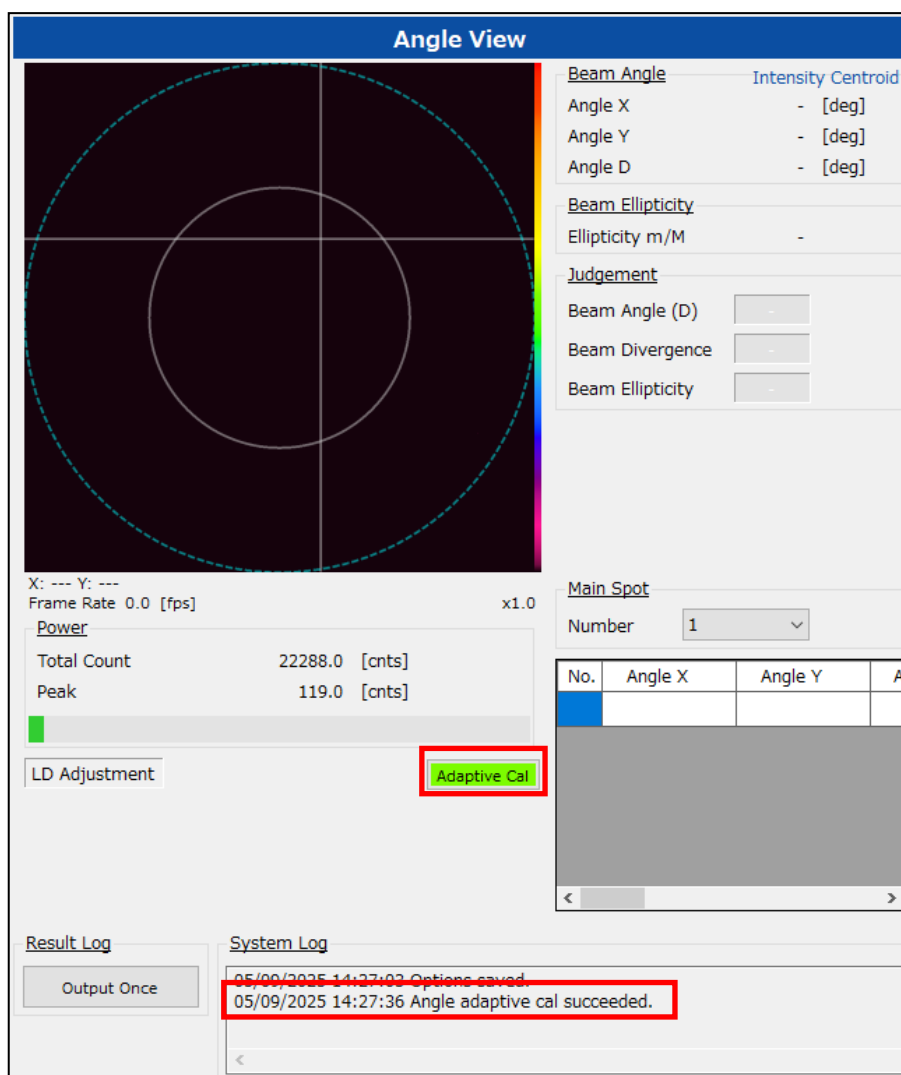
The "Adaptive Cal" is a function that improves beam calculation accuracy by removing noise from the entire sensor. This function is an automatic denoising function that calculates the baseline correction value from the entire sensor and offsets it from the pixel data of each pixel.

This function must be executed when starting up the Software and every time the exposure time in the camera settings is changed.

1. Set [Trigger Mode](#) to "Free Run."
2. Set the beam not to enter the product.
3. Check "Adaptive Cal --> Visible" in the option settings. Click the "Adaptive Cal" button.



4. When adaptive calibration is executed, the button color changes.
5. When "Adaptive Calibration succeeded" is displayed in the System Log, the process is complete.
6. Thereafter, set the beam incoming to the product and begin measurement.



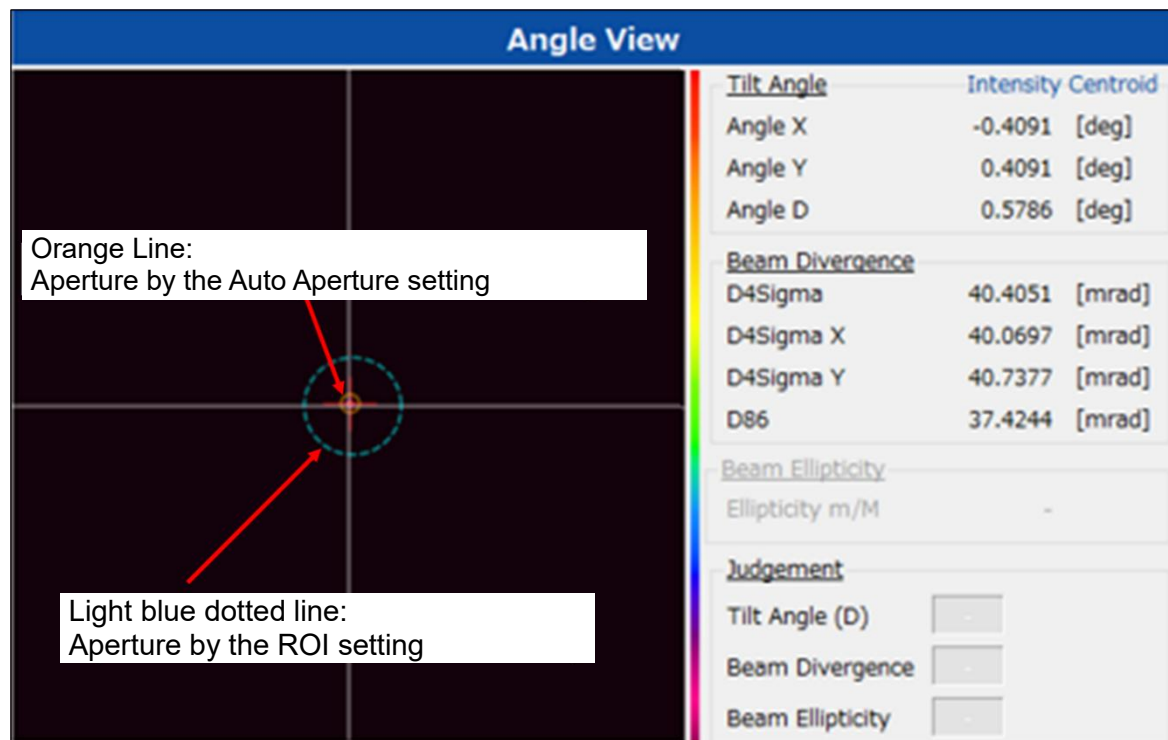
Attention

If the beam is incoming to the product or the ambient light is causing serious noise, adaptive calibration will not succeed. Execute in an environment where light does not enter the sensor camera. Also, disable the denoising function for use.

3.2.8 Aperture

The “Auto Aperture” and “ROI” settings are available to make sure that the effects of noise such as ambient light are not included in the beam divergence measurement results.

By using these two functions, measurement excluding ambient light can be done.



Aperture Explanation

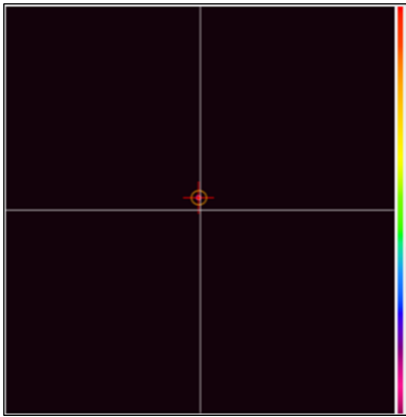
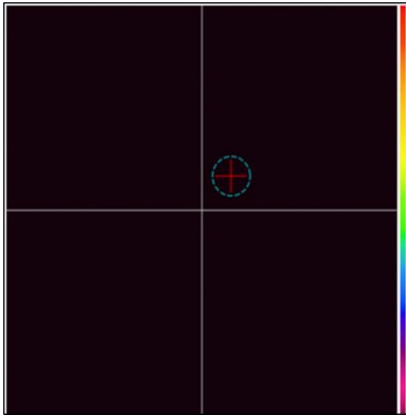
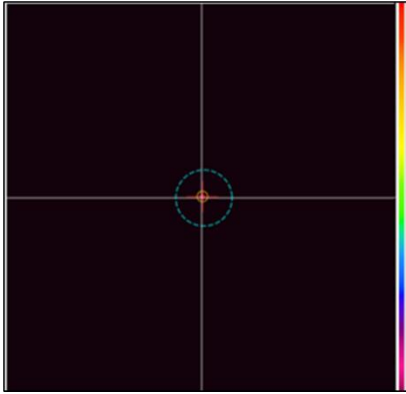
Auto Aperture	This function is suitable for measuring dynamic beams in which the position, size, shape, or intensity of the beam may vary over time. It automatically adjusts aperture.
ROI	This function is suitable for measuring beams in which position, size, shape, and intensity rarely vary with time. The aperture must be adjusted manually.

Info

Auto Aperture and ROI together can enhance only the important parts of the beam intensity, shape, and position, and by minimizing noise and interference it improves the accuracy of measurement.

We recommend that both be used simultaneously in situations where the beam position does not change.

Setting Methods

For Setting Auto Aperture	
Set "Auto Aperture" in option settings to [Enabled] <u>Auto Aperture</u> ☒ Enabled	
For Setting ROI	
Enable "ROI" in the option settings and set the X, position, width, Height (size) to enclose the beam. <u>ROI</u> ☒ Enabled X 28 [pix] Y 137 [pix] Width 100 [pix] Height 100 [pix]	
For Setting Auto Aperture and ROI	
To enclose the light beam, set "Auto Aperture" and "ROI" to "Enable" in the Option Settings, and set the X,Y (location), Width, and Height (size) of the "ROI".	

3.2.9 Origin Offset

The Origin Offset function offsets the center position of the sensor camera from the default position to any position as desired.

By using the offset function, an arbitrary position can be aligned as the reference position.

There are three offset methods.

Setting Methods

For Setting from the Option Screen

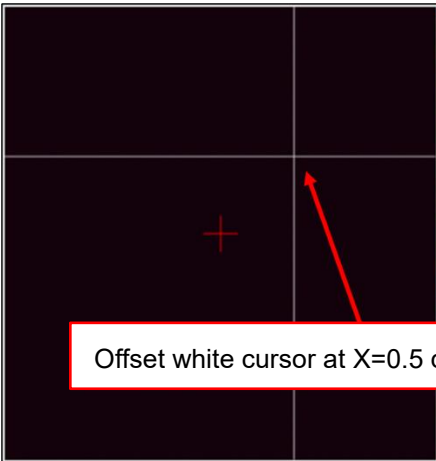
Set "Origin Offset" in option settings to the desired values

Origin Offset

X 0.0000 [deg]

Y 0.0000 [deg]

Ex.: Set at X = 0.5deg, Y = 0.5deg



Tilt Angle		Intensity Centroid
Angle X	-0.5008	[deg]
Angle Y	-0.5004	[deg]
Angle D	0.7080	[deg]

Beam Divergence	
D4Sigma	13.8399 [mrad]
D4Sigma X	13.7931 [mrad]
D4Sigma Y	13.8865 [mrad]
D86	12.8666 [mrad]

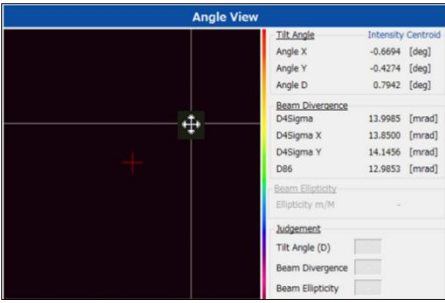
Beam Ellipticity	
Ellipticity m/M	-

Beam Divergence []

Beam Ellipticity []

For Setting from the View Screen

1. Open the option setting screen.
2. Target the view screen cross (white) with cursor.
3. When the mouse icon changes, perform "drag and drop."



Tilt Angle		Intensity Centroid
Angle X	-0.6694	[deg]
Angle Y	-0.4274	[deg]
Angle D	0.7942	[deg]

Beam Divergence	
D4Sigma	13.9985 [mrad]
D4Sigma X	13.8500 [mrad]
D4Sigma Y	14.1456 [mrad]
D86	12.9853 [mrad]

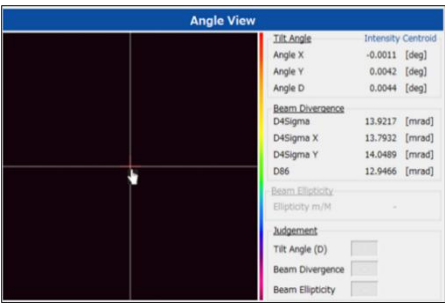
Beam Ellipticity	
Ellipticity m/M	-

Judgement

Tilt Angle (D) []

Beam Divergence []

Beam Ellipticity []



Tilt Angle		Intensity Centroid
Angle X	-0.0011	[deg]
Angle Y	0.0042	[deg]
Angle D	0.0044	[deg]

Beam Divergence	
D4Sigma	13.9217 [mrad]
D4Sigma X	13.7932 [mrad]
D4Sigma Y	14.0489 [mrad]
D86	12.9466 [mrad]

Beam Ellipticity	
Ellipticity m/M	-

Judgement

Tilt Angle (D) []

Beam Divergence []

Beam Ellipticity []

4. Once changing "Origin Offset", save the Option settings.

Origin Offset

X 0.6747 [deg]

Y 0.4445 [deg]

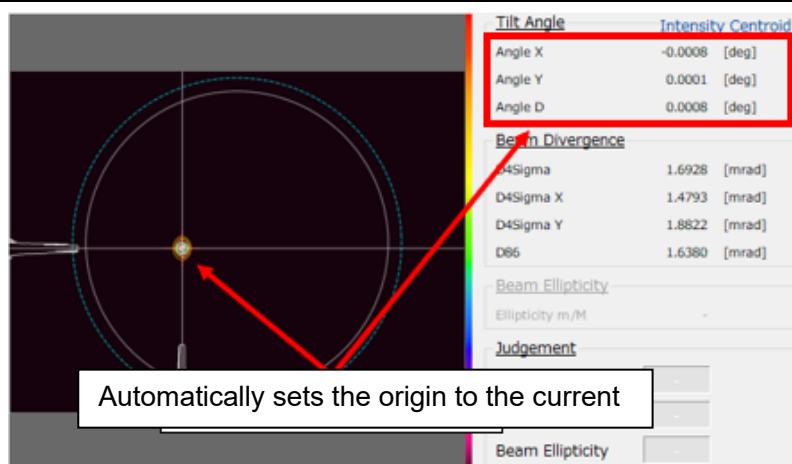
For Setting from the Zero Set Button

Press the “Zero Set Button” in option settings.

Origin Offset

X	0.0000	[deg]
Y	0.0000	[deg]
Zero Set		

*The values of Origin Offset X and Origin Offset Y will be automatically set to the current measurement coordinates.



3.2.10 Multi Spot

The Products support multi-spot measurement of up to 100 spots simultaneously.

The use of the Multi Spot setting enables the measurement results screen display order and number to be set.

Detection conditions can also be set to filter measurement targets.

Ex. Explaining the screen for detection of multiple beams (4 spots)

The screenshot displays the Suruga OptGauge software interface. The main window is titled "Angle View" and shows a 1040 x 1040 pixel measurement area with four red arrows pointing to detected spots. A text box labeled "4 incidents" is overlaid on the measurement area. To the right of the measurement area, there are several data fields and a table.

Angle View Data:

Tilt Angle		Intensity Centroid
Angle X	-0.2488	[deg]
Angle Y	0.0363	[deg]
Angle D	0.2514	[deg]

Beam Divergence:

D4Sigma	40.4051	[mrad]
D4Sigma X	40.0697	[mrad]
D4Sigma Y	40.7377	[mrad]
D86	37.4244	[mrad]

Beam Ellipticity:

Ellipticity m/M	-
-----------------	---

Judgement:

Tilt Angle (D)	☐
Beam Divergence	☐
Beam Ellipticity	☐

Main Spot:

Number: 1

Measurement Results Table:

No.	Angle X	Angle Y	A
1	-0.2488	0.0363	
2	-0.2334	-0.6836	
3	0.3464	-0.0292	
4	-0.2423	0.0422	

Power:

Total Count	27148.0	[-]
Peak	12.0	[-]

LD Adjustment: ☐ **Adaptive Cal:** ☐

Annotations:

- By changing "Number", the corresponding Number (No.) in the list below can be displayed in the Title Angle at the top.
- Displays the measurement results of 4 spots on the measurement results screen. The list is automatically updated with the number of detected beams.

Setting method

To enter the number of measuring spots to be displayed

Change "Spot Count"
in option settings

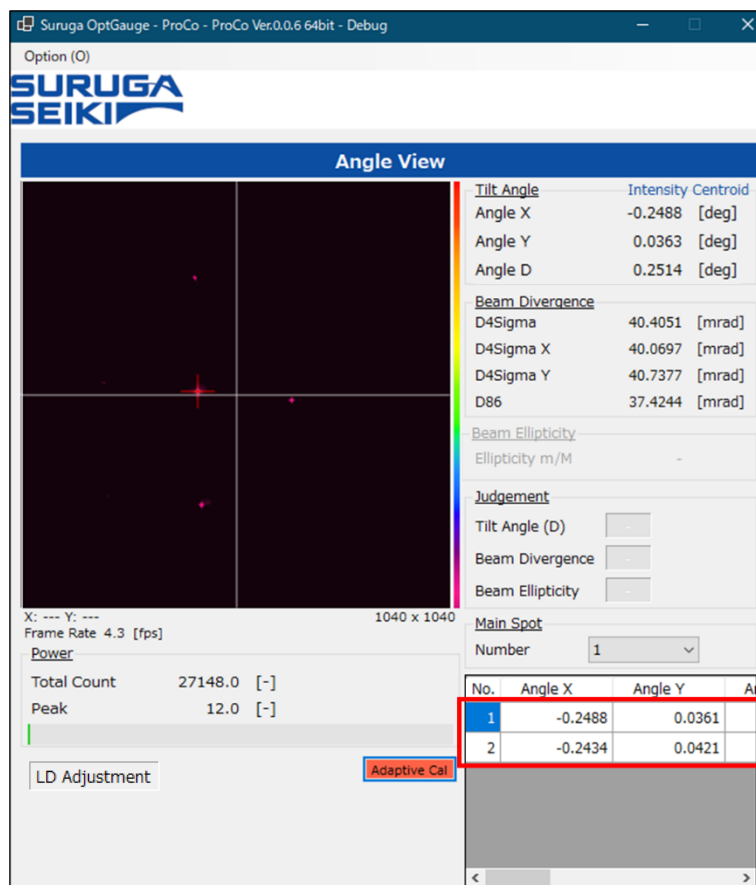
Multi Spot

Order Area ▼

Spot Count 2 [-]

Min Spot Area 64 [-]

Changing "Spot Count" enables the number displayed on the measurement results screen to be designated.



To enter the conditions (size) of the beams to be detected as measurement targets

Change "Min Spot Area"
in option settings.

Multi Spot

Order: Area

Spot Count: 4 [-]

Min Spot Area: 200

Changing "Min Spot Area" enables the conditions of the beams to be detected as measurement targets to be designated.



Info

Use pixels for the values set for beam conditions.
The setting example detects beam areas of 200 pix or higher received by the camera as measurement targets.

3.2.11 Automatic Brightness control

The Products enables use of the “Automatic Brightness control,” which adjusts exposure time and LD output (power) as well as automatically adjusting beam luminance value (peak) to the designated luminance value.

Also, when the measurement target reflectance is unclear for “Reflectivity” in the “LD Adjustment” group, input the initial value, 100.

3.2.11.1 Brightness Control Methods

There are two methods for automatic brightness control.

Control Method	Features
Adjustment for the entire image	Makes it less likely for saturation to occur across the whole camera image
Adjustment for Main Spot	Adjusts the peak value of the specified Main Spot to the target value, optimizing the brightness of the spot to be measured

The brightness control method is switched according to the setting in Option Settings -> “Order.”

Order	brightness control method applied
Angle / Area	Adjustment for the entire image
Peak / Total Count	Adjustment for Main Spot

3.2.11.2 Operating Environment

The brightness control method operates in the following sequence.

1. Selection of LD output (Power)
2. Adjustment of exposure time
3. Re-adjustment of LDPW

Finally, the beam brightness value (Peak) is adjusted so that it falls within the target value (Target) ± allowable range (Range).

3.2.11.3 Setting Items

■LDPW Output Setting

Selection of LD output (Power) can be set as follows:

Option->Angle->LD Control->LD Power Selection

Mode	Details
Auto	Automatically selects LD output (Power) from Low / Standard / Medium / High according to the target brightness

	※In "Auto" mode, Auto Exposure -> Min is used as the initial value for exposure time adjustment
Low	LD output (Power) = 520
Standard	LD output (Power) = 870
Medium	LD output (Power) = 1720
High	LD output (Power) = 4095
User Specified	Any desired LD output (Power) can be specified with Auto LD Power -> User Specified

※Normally, it is recommended to use "Auto."

■ Use Previous Value

When "Use Previous Value" is enabled, the LD output (Power) and exposure time (Exposure Time) determined during the previous auto brightness control are used as the initial values. If the measurement conditions or adjustment environment have not changed significantly since the last time, this can shorten the time required to complete auto brightness control.

LD Adjustment

☐ Auto

Target [-]

Range [-]

Reflectivity [%]

☒ Use Previous Value

Tune

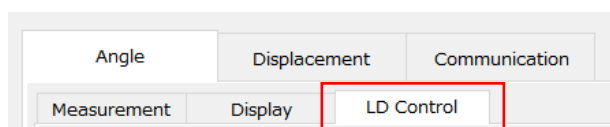
Note that the previous values will be reset if any of the following related settings are changed:

- LD Control->Camera Settings
- LD Control->Internal Light Source
- LD Control->LD Adjustment
- LD Control->LD Power Selection
- LD Control->Auto Exposure
- LD Control->Auto LD Power

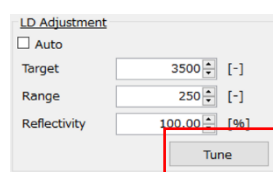
3.2.11.4 Automatic Brightness Control (Single Execution)

The following procedure explains how to manually execute the Automatic Brightness control at an arbitrary timing.

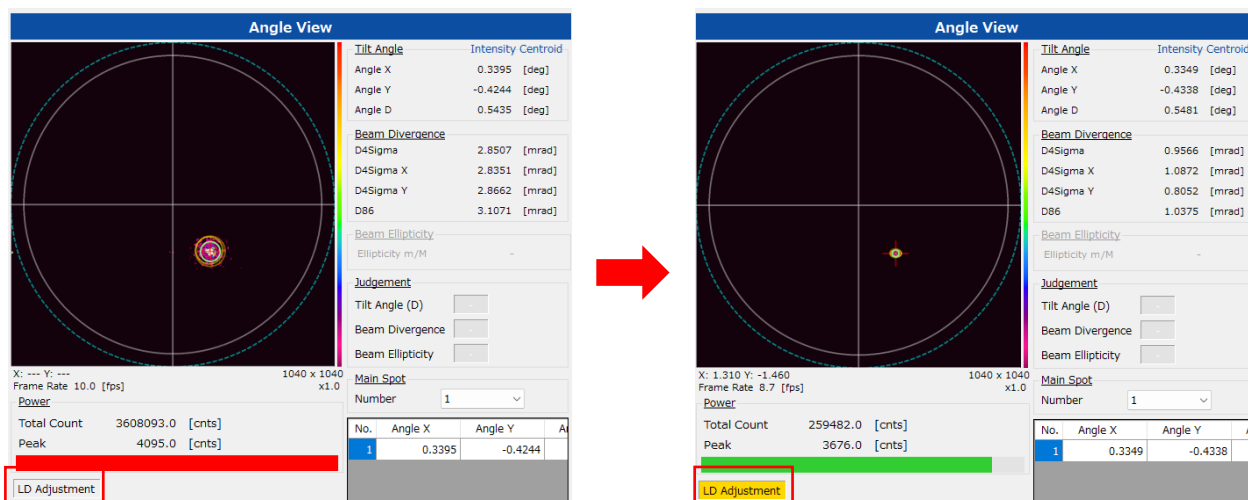
1. Open the **Options** window and select the **LD Control** tab.



2. Click the **Tune** button in the **LD Adjustment** group.



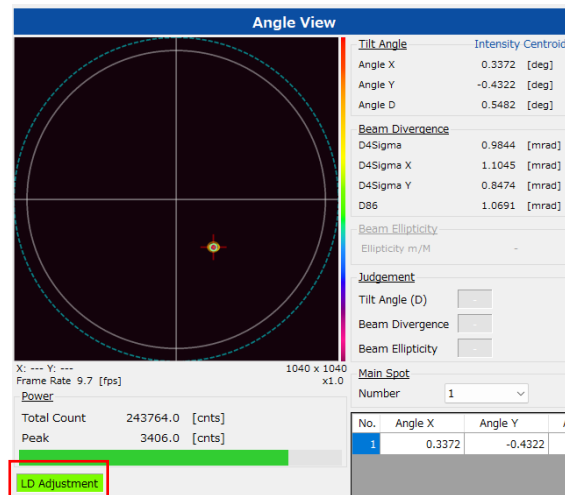
3. Automatic Brightness control starts.



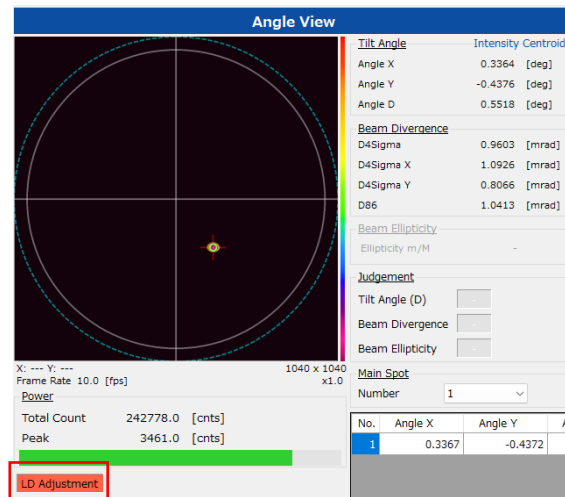
The LD Adjustment section on the main screen will be grayed out if Automatic Brightness control has not yet been executed.

When Automatic Brightness control starts, the LD Adjustment section will be displayed in yellow, indicating that the adjustment is in progress.

4. Automatic Brightness control completes.



Note: After completing the adjustment, successfully, the LD Adjustment section will be turned to green, indicating the successful completion.



Note: If the adjustment fails, the LD Adjustment section will be turned red to indicate the failure.

Note

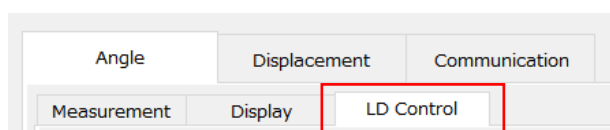
- To avoid incorrect brightness adjustment results, do not change the Main Spot or the Option setting for "Order" while dimming is in progress.

3.2.11.5 Automatic Brightness Control (Continuous Execution)

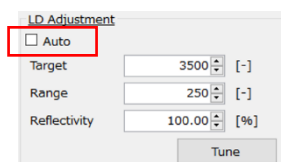
When the beam light moves due to angle or displacement, the luminance value may increase or decrease. To retain the luminance value at the designated value even when the beam light moves, execute constant automatic brightness.

The usage method for constant automatic brightness is indicated below.

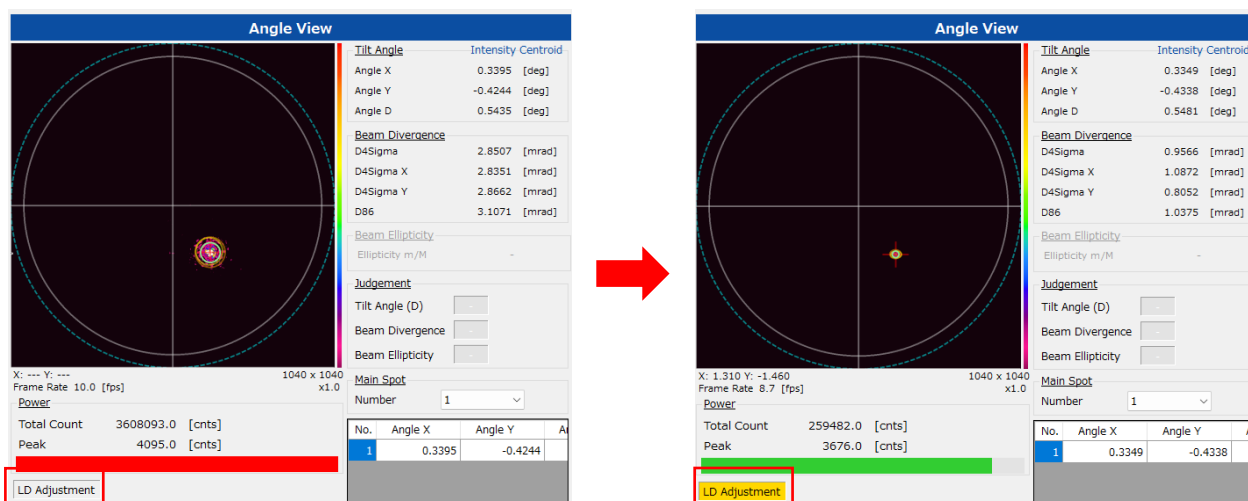
1. Open the Options window and display the LD Control tab.



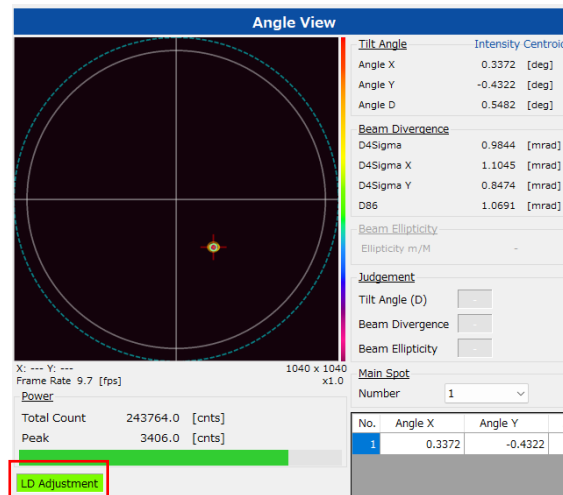
2. Click the Auto checkbox in the LD Adjustment group.



3. The Automatic Brightness control starts.



4. The Automatic Brightness control completes.



From this point onward, the Automatic Brightness control will be executed when the measured brightness value goes beyond the range specified in the Range option. The brightness range is set beforehand in the Target Option in the LD Adjustment Window.

Notes

- Automatic brightness control assumes that the spot is correctly detected.
- The control method changes according to the Order setting. If the intended brightness is not achieved, please check the settings.
- When automatic brightness control settings are changed, the previous convergence values are reset.
- When the LD is turned OFF during Automatic Brightness Control (continuous Execution), only the Exposure Time is used for brightness control.

Summary

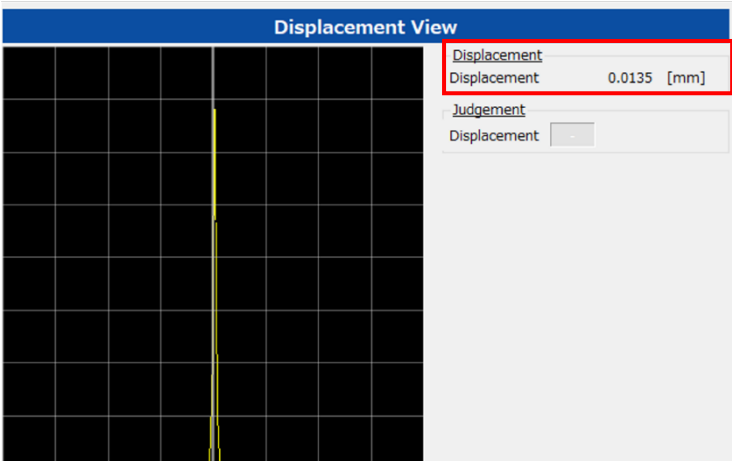
- **To adjust brightness of the entire image** → Set Order to Angle or Area
- **To adjust brightness of a specified spot** → Set Order to Peak or Total Count
- **For LDPW output setting (LD Power Selection), "Auto" is recommended**
- **To further shorten auto adjusting time** → If measurement conditions or adjustment environment have not changed much after one auto dimming, set "Use Previous Value"
- **To perform automatic brightness control only once** → Use LD Adjustment -> Tune
- **To keep automatic brightness control always on** → Use LD Adjustment -> Auto

3.3 Displacement View

3.3.1 Displacement Measurement

The displacement of this sensor and the measurement target can be measured.

Displacement is displayed in [mm] or [μm] as the amount of displacement of the beam entering the sensor from the origin position.

To change displacement units	
Select “Millimeter” or “Micrometer” from “Length Unit” in the option settings. Length Unit Millimeter ▾	Displayed in [mm] or [μm] Displacement View 

3.3.2 Thickness Measurement

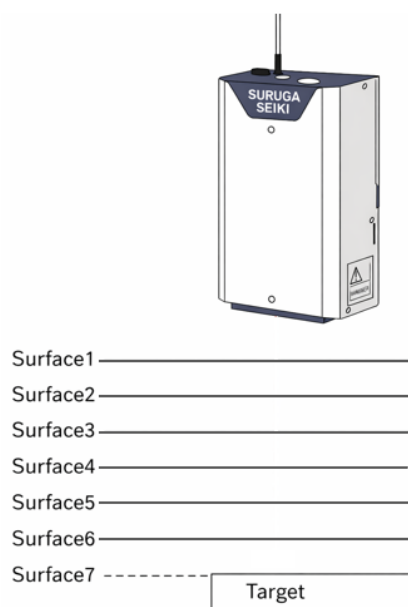
This function obtains the distance between each surface of a transparent object, allowing you to measure the thickness of the workpiece and the distance between each layer.

Even if multiple surfaces are present, you can select and display the thickness between any chosen surfaces (up to 7 surfaces).

3.3.2.1 Operating Environment

For thickness measurement, the thickness is calculated from the distance information of each surface, and the results for the specified measurement target are displayed and output.

When measuring a transparent object, the displayed thickness is corrected according to the refractive index, rather than being a simple distance.

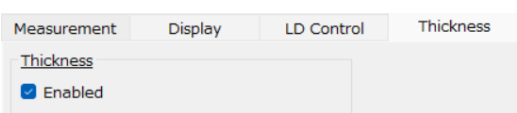
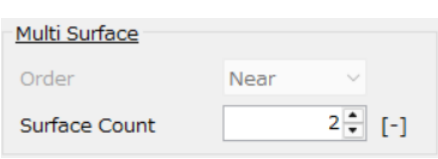


You can select and measure the thickness between any surfaces numbered 1 to 7.

Setting Items

■ Measurement Conditions

Thickness measurement is enabled when the following conditions are met.

Thickness = Enabled	Notes
 Displacement->Thickness->Thickness	When thickness measurement is enabled, the following settings are automatically changed: • Order is set to "Near" • If Surface Count is "1", it is changed to "2"
Surface Count = 2 or more  Displacement->Thickness->Multi Surface	

※If any settings are changed, verify the Order setting before performing a measurement.

■ Selection of Measurement Target

For thickness measurement, you can select which surfaces to measure between.

Target Settings

Multiple targets can be selected at the same time.

Target Surface

- ☐ Surface 1-2 ☐ Surface 2-3 ☐ Surface 3-4 ☐ Surface 4-5 ☐ Surface 5-6 ☐ Surface 6-7
- ☐ Surface 1-3 ☐ Surface 2-4 ☐ Surface 3-5 ☐ Surface 4-6 ☐ Surface 5-7
- ☐ Surface 1-4 ☐ Surface 2-5 ☐ Surface 3-6 ☐ Surface 4-7
- ☐ Surface 1-5 ☐ Surface 2-6 ☐ Surface 3-7
- ☐ Surface 1-6 ☐ Surface 2-7
- ☐ Surface 1-7

Displacement->Thickness->Target Settings

■ Setting the Refractive Index

When measuring transparent objects, it is necessary to set the refractive index.

Refractive Index

If the refractive index is not set appropriately, there may be a difference between the actual thickness and the measurement result.

Refractive Index

Sensor to Surface 1	1.000000	↑	↓	[-]
Surface 1-2	1.000000	↑	↓	[-]
Surface 2-3	1.000000	↑	↓	[-]
Surface 3-4	1.000000	↑	↓	[-]
Surface 4-5	1.000000	↑	↓	[-]
Surface 5-6	1.000000	↑	↓	[-]
Surface 6-7	1.000000	↑	↓	[-]

Displacement->Thickness-> Refractive Index

3.3.2.2 How to Use

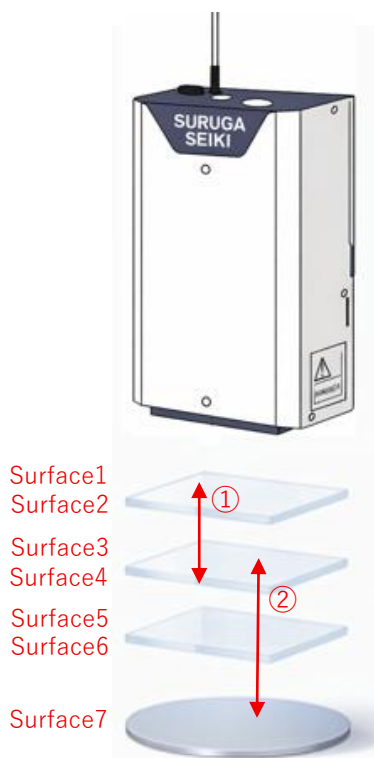
■Usage Example 1

Example of measurement conditions: One transparent object (such as glass) + mirror									
<table border="1"> <thead> <tr> <th colspan="2">Configuration</th></tr> </thead> <tbody> <tr> <td>Surface1</td><td>Transparent object (front surface)</td></tr> <tr> <td>Surface2</td><td>Transparent object (back surface)</td></tr> <tr> <td>Surface3</td><td>Mirror</td></tr> </tbody> </table>	Configuration		Surface1	Transparent object (front surface)	Surface2	Transparent object (back surface)	Surface3	Mirror	① When measuring the distance from the mirror (as the reference position) to the back surface of the transparent object ■ Measurement targets: Surface2、Surface3 ■ Operation: Perform [Zero Set] at the position of Surface 3 (see Origin Offset) ■ Settings - Surface Count Surface Count = 3 - Target Settings Surface 2-3 = Enabled - Refractive Index Surface 2-3 = 1.0 (air) ■ Measurement results: Output on the main screen and in the measurement results
Configuration									
Surface1	Transparent object (front surface)								
Surface2	Transparent object (back surface)								
Surface3	Mirror								
	② When measuring the thickness (front and back surfaces) of the transparent object ■ Measurement targets: Surface1、Surface2 ■ Operation: Perform [Zero Set] at the position of Surface 3 (see Origin Offset) ■ Settings - Surface Count Surface Count = 3 - Target Settings Surface 1-2 = Enabled - Refractive Index Surface 1-2 = 1.5 (example for glass) Surface 2-3 = 1.0 (air) ※ Please set the refractive index according to the measurement target ■ Measurement results: Output on the main screen and in the measurement results								

■Usage Example 2

Example of measurement conditions: Three transparent objects (such as glass) + mirror

Configuration	
Surface1	First transparent object (front surface)
Surface2	First transparent object (back surface)
Surface3	Second transparent object (front surface)
Surface4	Second transparent object (back surface)
Surface5	Third transparent object (front surface)
Surface6	Third transparent object (back surface)
Surface7	Mirror



①When measuring the distance from the front surface of the first transparent object to the back surface of the second transparent object

■**Measurement targets:** Surface1、Surface2、Surface3、Surface4

■**Operation:** Perform [Zero Set] at the position of Surface 7 (see Origin Offset)

■Settings

- Surface Count

Surface Count = 7

- Target Settings

Surface 1-4 = Enabled

- Refractive Index

Surface 1-2 = 1.5 (example for glass)

Surface 2-3 = 1.0 (air)

Surface 3-4 = 1.5 (example for glass)

Surface 4-5 = 1.0 (air)

Surface 5-6 = 1.5 (example for glass)

Surface 6-7 = 1.0 (air)

※ Please set the refractive index according to the measurement target

■**Measurement results:** Output on the main screen and in the measurement results

②When measuring the distance from the front surface of the second transparent object to the mirror

■**Measurement targets:** Surface3、Surface4、Surface5、Surface6、Surface7

■**Operation:** Perform [Zero Set] at the position of Surface 7 (see Origin Offset)

■Settings

- Surface Count

Surface Count = 7

- Target Settings

Surface 3-7 = Enabled

- Refractive Index

Surface 3-4 = 1.5 (example for glass))

	Surface 4-5 = 1.0 (air) Surface 5-6 = 1.5 (example for glass) Surface 6-7 = 1.0 (air) ※ Please set the refractive index according to the measurement target ■Measurement results: Output on the main screen and in the measurement results
--	--

3.3.3 Judgement

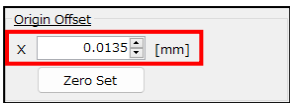
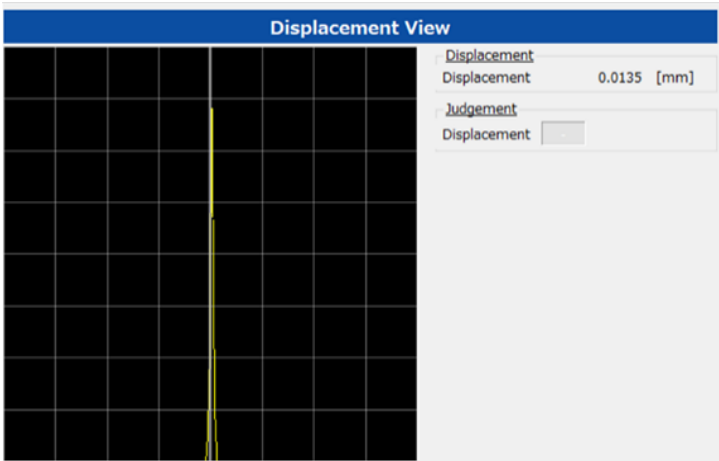
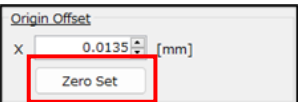
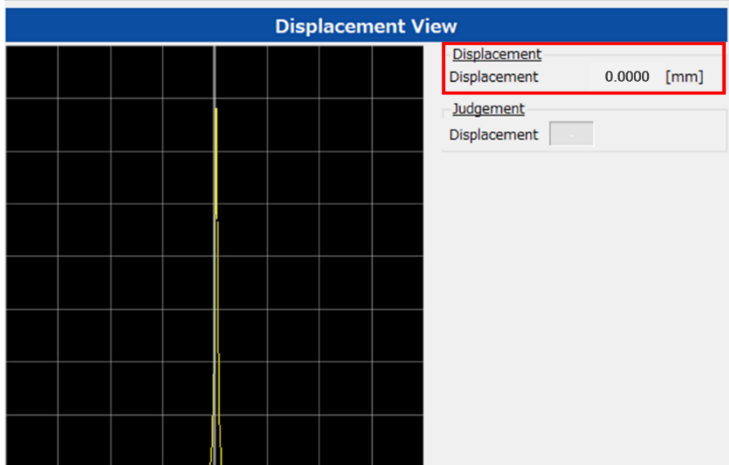
The judgment function is used to provide an intuitively understandable expression of whether the measurement value is within the target range.

See “Angle View ->[Judgement](#)” for a setting example.

3.3.4 Origin Offset

The Origin Offset function offsets the sensor camera center position from the default position to any position as desired.

By using the offset function, an arbitrary position can be aligned as the reference position.

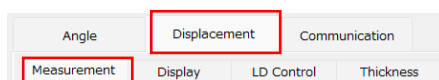
For offset at an arbitrary position	
Set an arbitrary value for “Origin Offset X” in option settings. 	Ex.: Set to X = 0.0135 mm 
For offset to measurement coordinates with the zero set button	
Press the “Zero Set” button within “Origin Offset” in option settings.  *The “Origin Offset X” value will be automatically set to the current measurement coordinates.	Displayed in [mm] or [μm] 

3.3.5 Mask

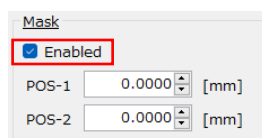
The Displacement View screen features the Mask function that limits the measurement range, allowing you to configure measurements to be taken only within the mask area. When a mask area is set, areas outside the measurement range are shown in gray.

■ The Mask Function Usage

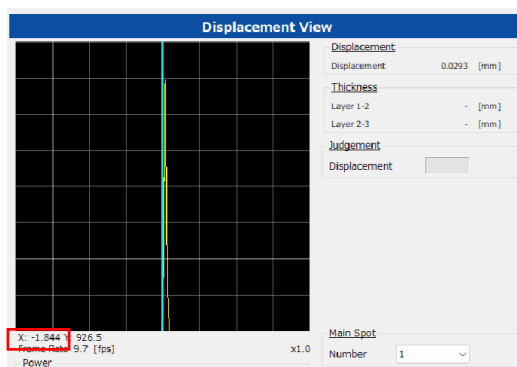
1. Select the “Measurement” tab from within the “Displacement” tab when the option screen is displayed.



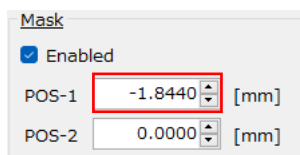
2. Enter a ☒ in the “Enabled” checkbox in the “Mask” group.



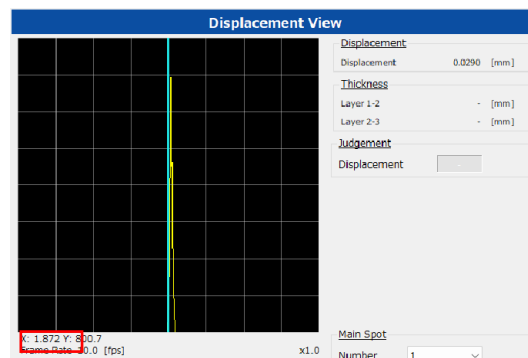
3. Display “Displacement View,” move the mouse cursor to the position to be set, and confirm the X coordinate value.



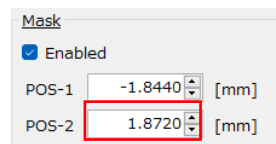
4. Input the coordinate confirmed in the 3 above. to POS-1.



5. Display "Displacement View," move the mouse cursor to the position to be set, and confirm the X coordinate value.



5. Input the coordinate confirmed in the 5. to POS-2.



3.3.6 Multi Spot

The Products supports multi-spot measurement, allowing simultaneous measurement of up to 100 points.

In Multi Spot mode, you can configure the “Display Order” and “Number of Points Displayed” shown on the measurement results screen. You can also set “Detection Conditions” to narrow down the measurement targets.

For details, refer to the “[Multi Spot](#)” section in the Angle View.

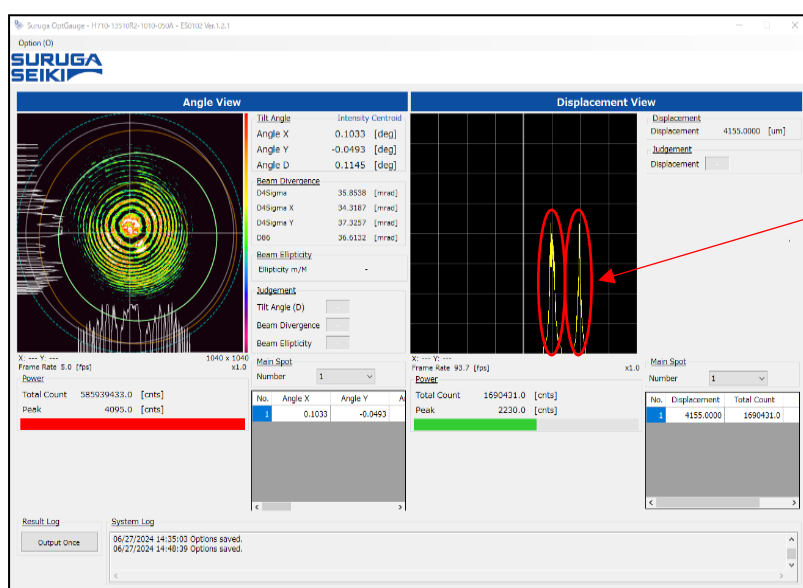
3.3.7 Alternating Laser Emission Function

When the measured object exhibits diffuse reflection, under conditions such as a strong angle-side beam or long exposure time, the angle-side beam may enter the displacement-side sensor and cause interference, potentially preventing normal displacement measurement.

Alternating the emission of each beam to prevent the angle-side beam from interfering with the displacement-side sensor can improve displacement measurement conditions.

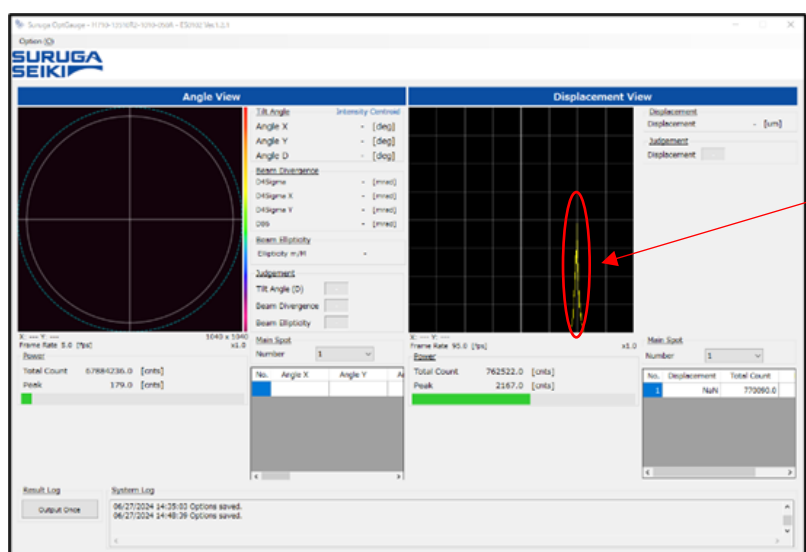
*This function does not guarantee that measurement will be possible with all measurement targets.

- Measurement example when angle side beam light interferes with displacement side sensor (white ceramic piece)



Two beam lights are detected by displacement side sensor

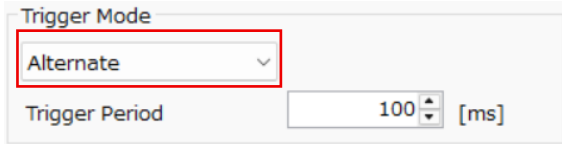
- Example when using alternating laser emission function



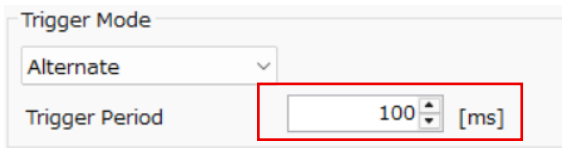
Angle side beam light disappears

■ Alternating Laser Emission Function Usage Method

1. Stop measurement, open the options screen, and set Common->Measurement->Trigger Mode to "Alternate".



2. Set the Trigger Period, which determines the emission interval.



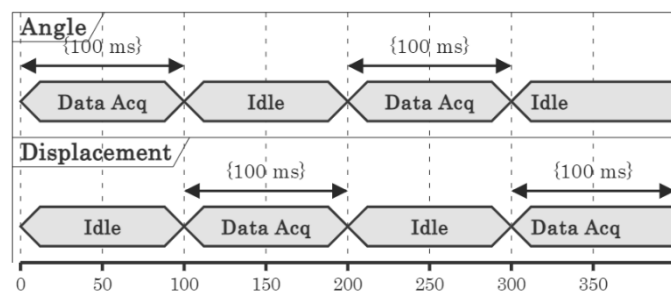
- ※ When alternate laser emission is enabled, the maximum value of "Exposure Time" is restricted to less than the value set for "Trigger Period" in conjunction with the "Trigger Period" setting.

■ Trigger Interval and Frame Rate

The trigger interval includes the total processing time for each sensor to acquire images (beam light ON, exposure time, data acquisition).

Therefore, the frame rate may decrease according to the trigger interval setting values.

Ex.: When trigger interval is set to 100 ms



Because each sensor conducts data acquisition and standby every 100 ms, the maximum frame rate per second is 5 frames.

*The frame rate may fall below 5 frames depending on the processing power of the measurement computer.

3.3.8 Automatic Brightness Control

The Products feature an “Auto Function” that automatically adjusts the beam's peak brightness value to a specified level by regulating exposure time and LED output power.

■Brightness Control Methods

There are two methods for automatic brightness control.

Brightness Control Method	Features
Adjustment for the entire image	Saturation is less likely to occur across the entire camera image.
Adjustment for Main Spot	The peak value of the specified Main Spot can be adjusted to the target value, optimizing the brightness of the spot to be measured.

The brightness control method is switched according to the Option settings -> “Order”.

Order	Brightness Control Method Applied
Area / Near / Far	Adjustment for the entire image
Peak / Total Count	Adjustment for Main Spot

■LDPW Output Settings

LD output (Power) can be set as follows:Option->Angle->LD Control->LD Power Selection

Mode	Details
Auto	Automatically selects LD output (Power) from Low / Standard / Medium / High according to the target brightness※When “Auto” is selected, Auto Exposure -> Min is used as the initial value for exposure time adjustment
Low	LD output (Power) = 1550
Standard	LD output (Power) = 2300
Medium	LD output (Power) = 2820
High	LD output (Power) = 4095
User Specified	Specify any desired LD output (Power) in Auto LD Power -> User Specified

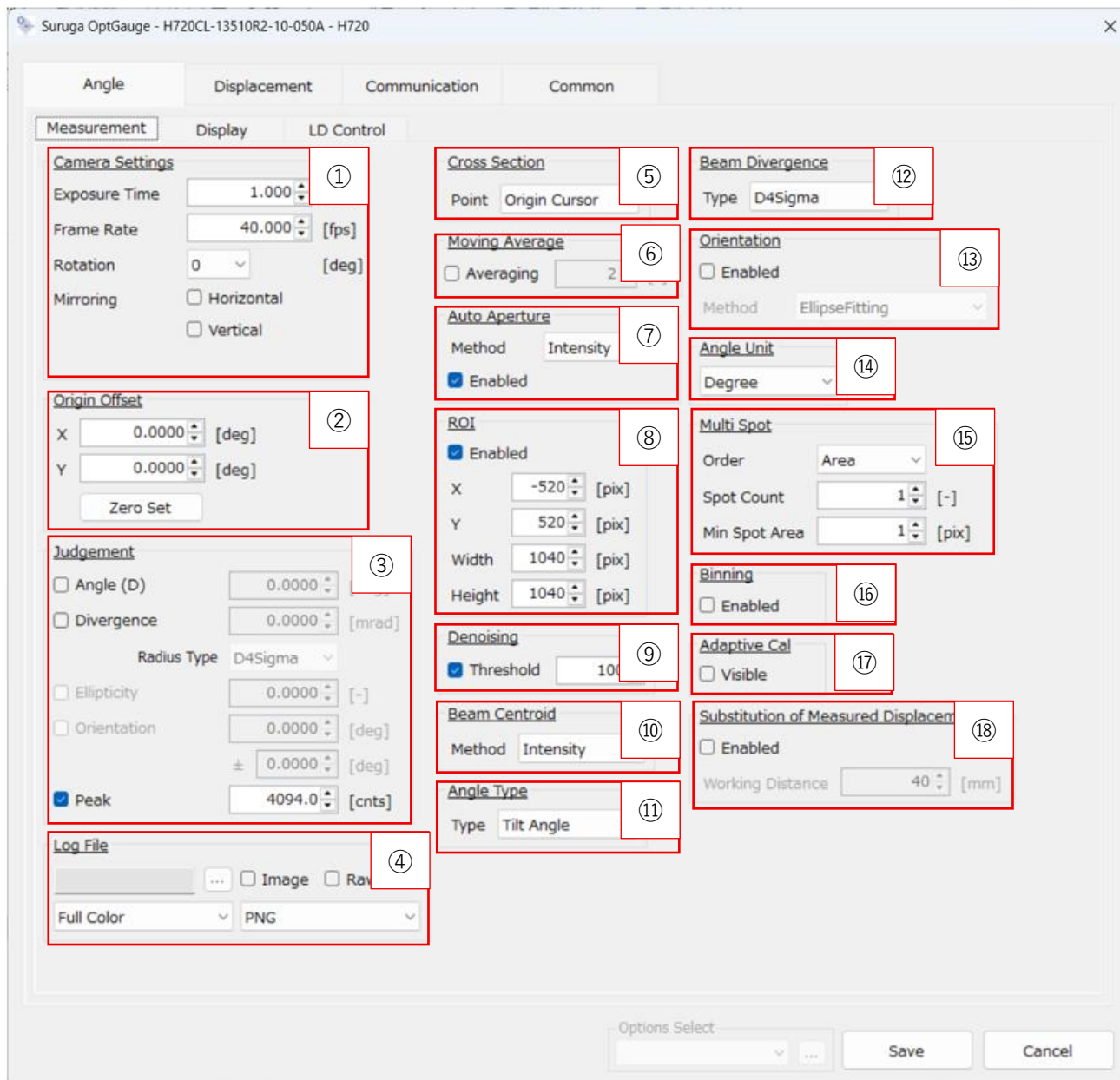
※Normally, “Auto” is recommended.For more details, refer to “Angle View -> Auto Brightness Adjustment”.

4 Option

4.1 Names and Functions of Each Option

4.1.1 Angle

4.1.1.1 Measurement



① Camera Settings			
Exposure Time	Sets the sensor camera exposure time. (def. = 1.0) Setting range: 0.027 to 2000.000		
Frame Rate	Sets the sensor camera frame rate. (def.=40.000) Setting range: 0.1 to 100.000		
Rotation	Sets the display rotation of the image		
	0 (def.)	No Rotation.	
	90	Rotate the image clockwise by 90 degrees	
	180	Rotate the image clockwise by 180 degrees	
	270	Rotate the image clockwise by 270 degrees	
Mirroring	Horizontal	Vertical	Sets mirroring
	Disabled (def.)	Disabled (def.)	No mirroring
	Enabled	Disabled	Horizontal mirroring
	Disabled	Enabled	Vertical mirroring
	Enabled	Enabled	Vertical and horizontal mirroring
Trigger Mode	It enables or disables the external trigger input for the sensor camera		
	Enabled	It enables the external trigger input	
	Disabled (def.)	It disables the external trigger input	
② Origin Offset	Offsets coordinate center position (white cross).		
	X	Sets the center of the sensor camera as “0.0000 (def.)” and adjusts (Offset) the position of the crosshair (white) in the X direction. Setting range: -10.0000 to 10.0000	
	Y	Sets the center of the sensor camera as “0.0000 (def.)” and adjusts (Offset) the position of the crosshair (white) in the Y direction. Setting range: -10.0000 to 10.0000	
	Zero Set	Offsets to the current measurement coordinates	
③ Judgement			
Angle (D)	Sets OK / NG evaluation for the angle (def. = 0.0000). Setting range: 0.0000 to 10.0000		
	Enabled	Enables the judgement.	
	Disabled (def.)	Disables the judgement.	

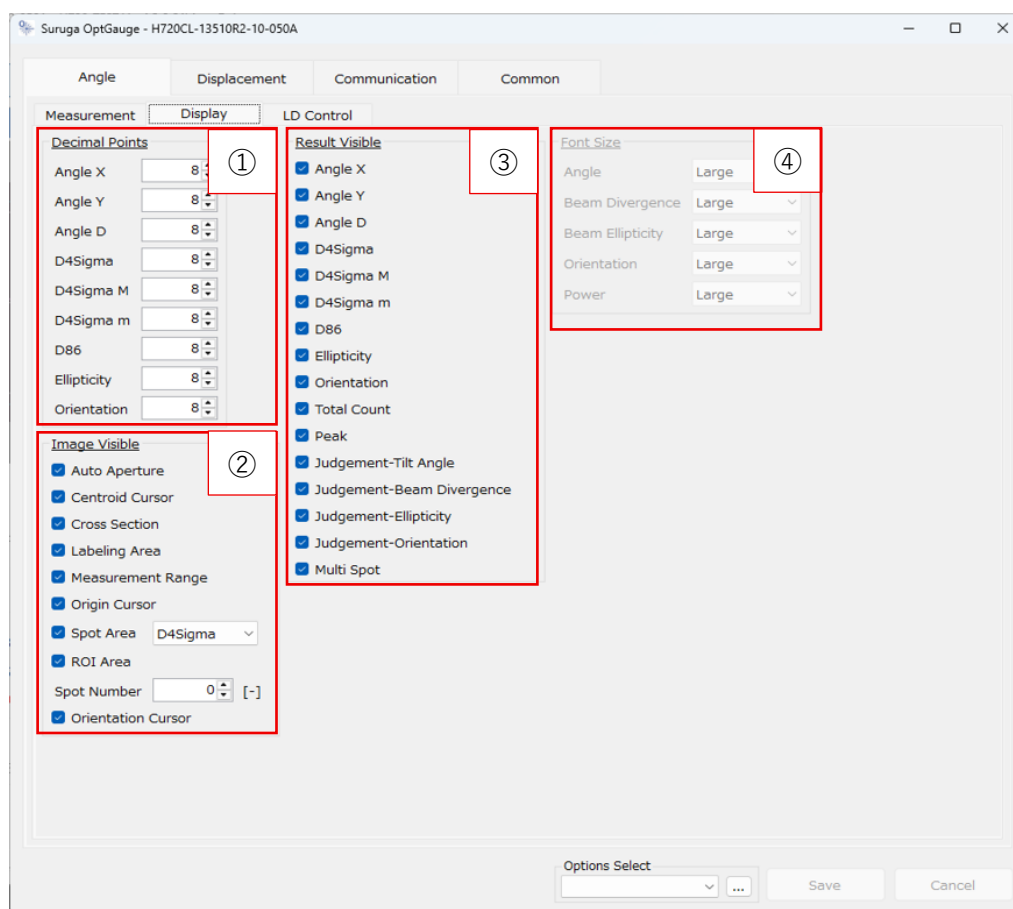
Divergence	Sets OK / NG evaluation for the D4Sigma, $1/e^2$, or D86 Setting range: 0.0000 to 1000.0000 (def. 0.0000)	
	Enabled	Enables the Judgement.
	Disabled (def.)	Disables the Judgement.
Radius Type	D4 Sigma (def.)	Sets the D4Sigma to evaluate "Divergence".
	$1/e^2$	Sets the $1/e^2$ to evaluate "Divergence".
	D86	Sets the D86 to evaluate "Divergence".
Ellipticity	Sets the "OK/NG" evaluation for the "Beam Ellipticity". Setting range: 0.0000 to 1.0000 (def. 0.0000)	
	Enabled	Enables the judgement.
	Disabled (def.)	Disables the judgement.
Orientation	Set the OK/NG evaluation for the Orientation The evaluation is made by combining the set angle and Range ($\pm$) Setting range: - 90.0000 to + 90.0000 (def. 0.0000)	
	Range [$\pm$]	Setting range: - 90.0000 to + 90.0000 (def. 0.0000)
	Enabled	Enables the judgement.
	Disabled (def.)	Disables the judgement.
Peak	Sets the "OK/NG" evaluation for the "Peak". Setting range: 0.0 to 4095.0	
	Enabled	Enables the judgement.
	Disabled (def.)	Disables the judgement.
④ Log File		
	To specify outputs where to save the measurement results (CSV).	
Image	Enabled	Outputs image data at the Angle View along with the measurement results
	Disabled (def.)	Does not output the Angle View image data
	Full Color (def.)	Outputs the image data in 24-bit full color
	Gray Scale	Outputs the image data in 8-bit grayscale
	PNG(def.)	Outputs the image data in PNG format

	BMP	Outputs the image data in BMP format
	TIFF	Outputs the image data in TIFF format
Raw	Enabled	Outputs Angle View luminance value data (CSV)* along with measurement results (CSV). Outputs luminance values as text data in CSV format, not as binary data.
	Disabled (def.)	Does not output the Angle View raw image data (CSV)
⑤ Cross Section	Sets the display location for the beam intensity distribution	
	Origin Cursor (def.)	Displays the coordinate center position for the beam strength distribution.
	Beam Cursor	Display the beam intensity distribution at the beam centroid
⑥ Moving Average	Sets averaging process (moving average) for measurement values. Setting range: 2 to 262144 (def. = 2)	
	Enabled	Enables the averaging process.
	Disabled (def.)	Disables the averaging process.
⑦ Auto Aperture	Sets the Auto Aperture.	
	Enabled (def.)	Enables the Auto Aperture setting.
	Disabled	Disables the Auto Aperture setting.
	Area	Set the Auto Aperture based on the center position calculated using the area centroid processing
	Intensity(def.)	Sets Auto Aperture from centroid position calculated with intensity weighed process
⑧ ROI	Sets "ROI." If enabled, it evaluates a light beam by these range settings	
	Enabled (def.)	Enables ROI setting
	Disabled	Disables ROI setting
	X	Sets the ROI X direction setting position. Range: -3000 to 3000 (def.=520)
	Y	Sets the ROI Y direction setting position. Range: -3000 to 3000 (def.=520)
	Width	Sets the ROI horizontal width. Setting range: 0 to 3000 (def.=1040)
	Height	Sets the ROI vertical width. Setting range: 0 to 3000 (def.=1040)
⑨ Denoising	Sets the thresholds.	

	When enabled, it derives the measurement values using the pixels of the pixel values higher than the set value. Setting range: 1 to 4095 (def. = 100)	
	Enabled (def.)	Enables the denoising settings
	Disabled	Disables the denoising settings
⑩ Beam Centroid	Sets the calculation method for the Centroid position of a light beam	
	Area	Calculates the centroid position with the Area of Centroid process
	Intensity (def.)	Calculates the centroid position with the intensity weighing process
⑪ Angle Type	Sets targets for the angle measurement	
	Tilt Angle	Sets for the reflection angle measurement.
	(def.)	Sets 1/2 of an incident beam as the measured target angle
⑫ Beam Divergence		
Type	Sets the type of the beam divergence	
	D4Sigma (def.)	Displaying the beam divergence by $D4\sigma$
	$1/e^2$	Displaying the beam divergence by $1/e^2$
⑬ Orientation		
Enabled	Toggle either "Beam Ellipticity," or "Orientation" for the measurement of the Beam divergence	
	Enabled	Display the beam divergence in M (Major) and m (Minor) Enable Beam Ellipticity Enable Orientation
	Disabled	Display Beam Divergence in X and Y Disable Beam Ellipticity Disable Orientation
Method	Sets the non-ISO compliant rotation angle measurement method *Only effective if the " Type " is set to the $1/e^2$ in the Beam Divergence	
	Ellipse Fitting(def.)	Takes the measurements by using the elliptical fitting method
	MaxDistanceSearch	Takes the measurement using the search method of the maximum distance between two points
⑭ Angle Unit	Sets the angle unit for measurement values	
	Degree(def.)	Sets for decimal degree unit

	DegMinSec	Sets for degrees-minutes-seconds unit
	Milliradian	Sets for milli radian unit
⑮ Multi Spot		
Order	Sets the sorting type of the measurement result list to be displayed when detecting multiple beams	
	Area(def.)	Sorts by beam area from the largest size
	Angle	Sorts in ascending order of beam centroid position.
	Peak	Sorts in descending order of Peak
	Total Count	Sorts in descending order of Total Count
Spot Count	Sets the number to display on the measurement results screen when detecting multiple beams. Setting range: 1 to 100 (def. = 1)	
Min Spot Area	Sets the threshold value for the beam size (pixels) conditions of the beam is detected (def. = 1). Setting range: 1 to 1023	
⑯ Binning	Sets the Binning function (2x2) of the sensor camera. Enabling binning combines adjacent pixels to reduce camera noise and improve sensitivity. Additionally, the image size is reduced to 1/4, lowering data volume and improving frame rate	
	Enabled	Enables the binning function
	Disabled (def.)	Disables the binning function
⑰ Adaptive Cal	Sets "Adaptive Cal" button show/hide. Attention	
	Please be advised to disable the "Denoising" for your operation.	
	Enabled	Shows the "Adaptive Cal" button
	Disabled (def.)	Hides the "Adaptive Cal" button
⑱ Substitution of Measured Displacement	Sets the working distance (W.D.) applied to the correction [revised calculations].	
	Enabled	Applies the entry value in the "Working Distance." *If a displacement measurement result is available, a working distance will be derived from it.
	Disabled (def.)	The working distance will be automatically derived from the displacement measurement result.
	Working Distance	Sets the working distance used for revised calculations (def. = 40). The setting range: 40 to 60.

4.1.1.2 Display



① Decimal Points

Specify the number of decimal places for the outputs of the measurement results*

Setting range: 0 to 8 (default=8)

*Note: Outputting measurement results refers to results output via the [Output Once] button (CSV) and output via communication for control by external devices.

Angle X	Sets the number of decimal places for the Angle X measurement results
Angle Y	Sets the number of decimal places for the Angle Y measurement results
Angle D	Sets the number of decimal places for the Angle D measurement results
D4Sigma	Sets the number of decimal places for the D4Sigma measurement results
D4Sigma X(M)	Sets the number of decimal places for the D4SigmaX(M) measurement results
1/e ² X(M)	Sets the number of decimal places for the 1/e ² X(M) measurement results
D4Sigma Y(m)	Sets the number of decimal places for the D4SigmaY(m) measurement output
1/e ² Y(m)	Sets the number of decimal places for the 1/e ² Y(m) measurement output
D86	Sets the number of decimal places for the D86 measurement results
Ellipticity	Sets the number of decimal places for the Ellipticity measurement results
Orientation	Sets the number of decimal places for the Orientation measurement results

② Image Visible		
Auto Aperture	Sets the Auto Aperture to display or hide	
	Enabled (def.)	Displays the Auto Aperture
	Disabled	Hides the Auto Aperture
Centroid Cursor	Sets the Centroid Cursor to display or hide	
	Enabled (def.)	Displays the Centroid Cursor
	Disabled	Hides the Centroid Cursor
Cross Section	Sets the Cross Section to display or hide	
	Enabled (def.)	Displays the Cross Section
	Disabled	Hides the Cross Section
Labeling Area	Sets the Labeling Area to display or hide	
	Enabled (def.)	Displays the Labeling Area to display or hide
	Disabled	Hides the Labeling Area
Measurement Range	Sets the Measurement Range to display or hide	
	Enabled (def.)	Displays the Measurement Range
	Disabled	Hides the Measurement Range
Origin Cursor	Sets the display / hide of the Origin Cursor to display or hide	
	Enabled (def.)	Displays the Origin Cursor
	Disabled	Hides the Origin Cursor
Spot Area	Sets the Spot Area to display or hide	
	D4Sigma (def.)	Sets the beam diameter calculation method for the Spot Area display to D4Sigma
	1/e ²	Sets the beam diameter calculation method for the Spot Area display to 1/e ²
	D86	Sets the beam diameter calculation method for the Spot Area display to D86
	Enabled (def.)	Displays the Spot Area
	Disabled	Hides the Spot Area
ROI Area	Sets the ROI Area to display or hide	
	Enabled (def.)	Displays the ROI Area
	Disabled	Hides the ROI Area
Spot Number	Sets the number of serial number labels to display if light beams are measured (def. = 0). The setting range: 0 to 100	
Orientation Cursor	Set the Orientation Cursor to display or hide	
	Enabled (def.)	Displays the Orientation Cursor

	Disabled	Hides the Orientation Cursor
③ Result Visible		
Sets the display / hide of the measurement result.		
Angle X	Enabled (def.)	Displays the Angle X of measurement result
	Disabled	Hides the Angle X of measurement result
Angle Y	Enabled (def.)	Displays the Angle measurement result
	Disabled	Hides the Angle Y measurement result
Angle D	Enabled (def.)	Displays the Angle D measurement result
	Disabled	Hides the Angle D measurement result
D4Sigma	Enabled (def.)	Displays the D4Sigma measurement result
	Disabled	Hides the D4Sigma measurement result
1/e ²	Enabled (def.)	Displays the 1/e ² measurement result
	Disabled	Hides the 1/e ² measurement result
D4Sigma X(M)	Enabled (def.)	Displays the D4Sigma X(M) measurement result
	Disabled	Hides the D4Sigma X(M) measurement result
1/e ² X(M)	Enabled (def.)	Displays the 1/e ² X(M) measurement result
	Disabled	Hides the 1/e ² X(M) measurement result
D4Sigma Y(m)	Enabled (def.)	Displays the D4Sigma Y(m) measurement result
	Disabled	Hides the D4Sigma Y(m) measurement result
1/e ² Y(m)	Enabled (def.)	Displays the 1/e ² Y(m) measurement result
	Disabled	Hides the 1/e ² Y(m) measurement result
D86	Enabled (def.)	Displays the D86 measurement result
	Disabled	Hides the D86 measurement result
Ellipticity	Enabled (def.)	Displays the Ellipticity measurement result
	Disabled	Hides the Ellipticity measurement result
Orientation	Enabled (def.)	Displays the Orientation measurement result
	Disabled	Hides the Orientation measurement result
Total Count	Enabled (def.)	Displays the Total Count measurement result
	Disabled	Hides the Total Count measurement result
Peak	Enabled (def.)	Displays the Peak measurement result
	Disabled	Hides the Peak measurement result
Judgement – Tilt Angle	Enabled (def.)	Displays the measurement results for Judgement – Tilt Angle
	Disabled	Does not display the measurement results for Judgement – Tilt Angle

Judgement – Beam Divergence	Enabled (def.)	Displays the measurement results for Judgement – Beam Divergence
	Disabled	Does not display the measurement results for Judgement – Beam Divergence
Judgement - Ellipticity	Enabled (def.)	Displays the measurement results for Judgement – Ellipticity
	Disabled	Does not display the measurement results for Judgement – Ellipticity
Judgement – Orientation	Enabled (def.)	Displays the measurement results for Judgement – Orientation
	Disabled	Does not display the measurement results for Judgement – Orientation
Multi Spot	Enabled (def.)	Displays the measurement results for Multi Spot
	Disabled	Does not display the measurement results for Multi Spot
④ Font Size ※Not used		

4.1.1.3 LD Control

The screenshot shows the 'LD Control' tab in the 'Suruga OptGauge' software. The interface is divided into several sections, each with a numbered callout:

- 1. Camera Settings:** Includes 'Exposure Time' (0.1) and 'Frame Rate' (70.0).
- 2. Internal Light Source:** Includes 'Power' (8) and a button to toggle the light source.
- 3. LD Adjustment:** Includes 'Auto' checkbox, 'Target' (350), 'Range' (250 [-]), 'Reflectivity' (100.00 [%]), and 'Use Previous Value' checkbox.
- 4. LD Power Selection:** Includes 'Mode' (Auto) and a button to select power.
- 5. Auto Exposure:** Includes 'Initial' (1.00), 'Max' (15.00), and 'Min' (0.100 [ms]).
- 6. Auto LD Power:** Includes 'User Specified' checkbox, 'Max' (4), and 'Min' (1 [-]).

At the bottom, there is an 'Options Select' dropdown, 'Save', and 'Cancel' buttons.

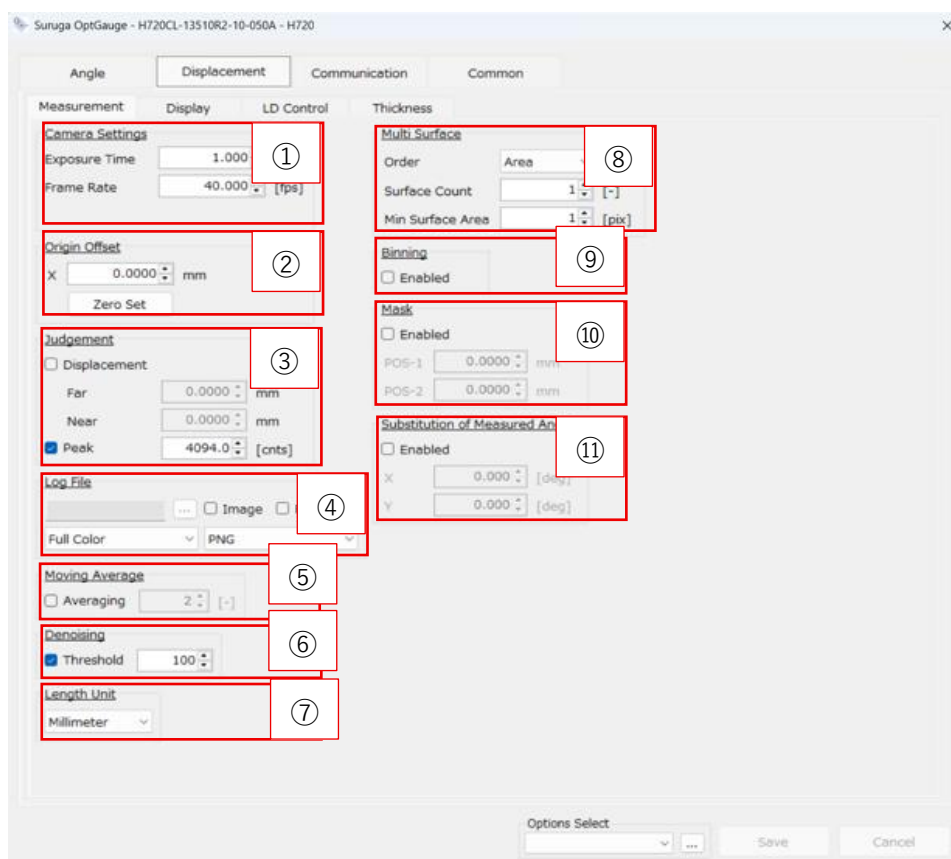
① Camera Settings		
Exposure Time	Sets the sensor camera exposure time. (def. = 1. 000) Setting range: 0.027 to 2000.000	
Frame Rate	Sets the sensor camera frame rate. (def. = 40. 000) Setting range: 0.1 to 100. 000	
Trigger Mode	Enabled	Enables the external trigger input
	Disabled (def.)	Disables the external trigger input
② Internal Light Source		
Power	Sets the internal light source power (def. = 400). The setting range : 0 to 4095	
LD	Sets ON / OFF of the internal light source. The button and text colors indicate the status of the internal light source	
	Green (text black)	Sets internal light source to ON.
	Gray (text black)	Sets internal light source to OFF.
	Gray (text gray)	The Internal light source cannot be controlled. Please check the status of the sensor power supply.

③ LD Adjustment		
Auto	It enables / disables the Automatic Brightness control at all times	
	Enabled	Keeps the Automatic Brightness control enabled
	Disabled (def.)	Keeps the Automatic Brightness control disabled
Target	Sets the upper limit of peak luminance (def. = 3500) The setting range: 1000 to 3500	
Range	Sets the range of the dimming adjustment complete (def. = 250) It adjusts [light beams] within the target dimming range. The setting range: 100 to 1000	
Reflectivity	Sets the reflectance of the measuring target (def. = 100). Sets the reflectance of the measuring object optimizes the time required for light adjustment. The setting range: 0.05 to 100	
Use Previous Value	The results of the previous automatic brightness control (Power, Exposure Time) are set as the initial values.	
	Enabled	The results of the previous auto-brightness adjustment are enabled
	Disabled (def.)	The results of the previous auto-brightness adjustment are disabled
Tune	If the Auto feature is not enabled, clicking the Tune button will activate auto-brightness each time.	
④ LD Adjustment		
Mode	Set the LD output (Power) during auto-brightness adjustment execution	
	Auto(def.)	Automatically selects the LD output (Power) from Low / Standard / Medium / High according to the target brightness
	Low	LD output (Power) = 520
	Standard	LD output (Power) = 870
	Medium	LD output (Power) = 1720
	High	LD output (Power) = 4095
	User Specified	Specify any desired LD output (Power)
⑤ Auto Exposure		
Initial	Sets the initial exposure time applied in the auto-brightness control for the first time (default = 1.000). Setting range: 0.1 to 15.000	
Max	Sets the maximum value for the exposure time adjusted at the automatic brightness (def. = 15.000).	

	Its setting range: Min to 15.000
Min	Sets the minimum value for the exposure time adjusted at the automatic brightness (def. = 0.1). Its setting range: 0.1 to Max
⑥ Auto LD Power	
User Specified	Set the initial value for power during the first automatic brightness control (default = 400) Setting range: 0 to 4095
Max	Sets the maximum value for the power adjusted upon automatic brightness (def. = 4095). Its setting range: Min to 4095
Min	Sets the minimum value for the power adjusted upon automatic brightness (def. = 1). Its setting range: 0 to Max

4.1.2 Displacement

4.1.2.1 Measurement



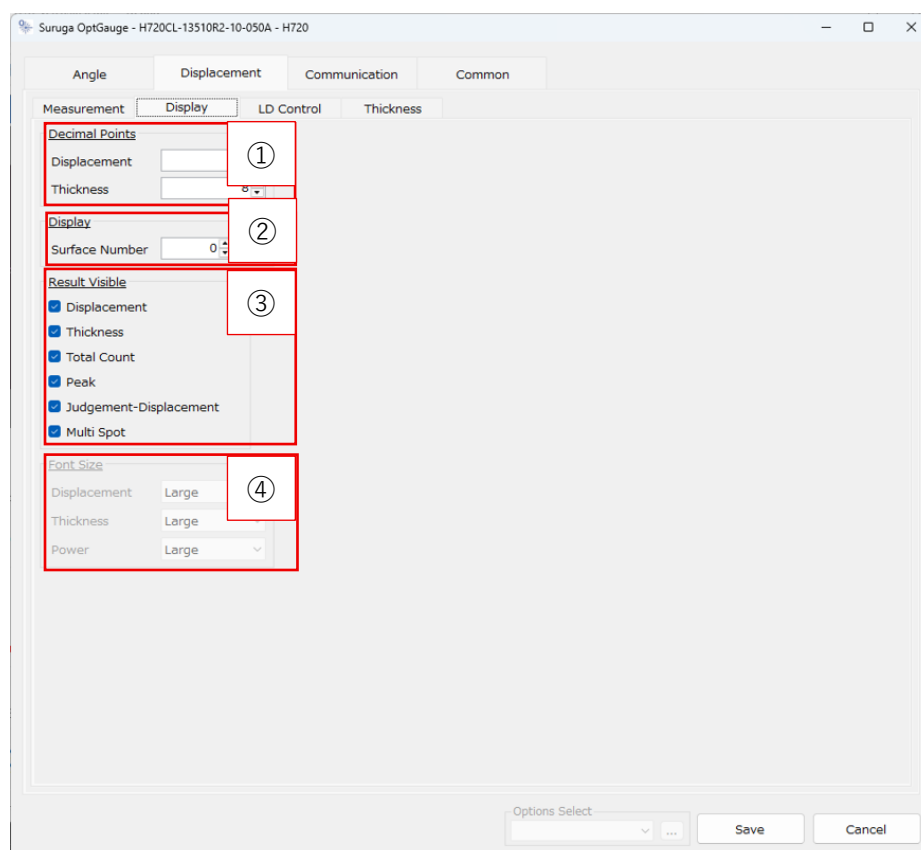
① Camera Settings		
Exposure Time	Sets the sensor camera exposure time (def. = 1. 000). Setting range: 0.027 to 2000.000	
Frame Rate	Sets the sensor camera frame rate (def. = 40. 000). Setting range: 0.1 to 100. 000	
Trigger Mode	Enabled	Enables the external trigger input
	Disabled (def.)	Disables the external trigger input
② Origin Offset	Offsets the center position (white cross) of the coordinates	
	X	With the sensor camera center as "0.0000 (def.)", adjusts (offsets) white cross position in X direction. Setting range: -20.0000 to 20.0000
	Zero Set	Offsets to the current measurement coordinates
③ Judgement		

Displacement	Sets OK / NG evaluation on the displacement (def. = 0.0000). The setting range: 0.0000 to 20.0000	
	Attention Please be advised that the Near and Far settings to be Near < Far.	
	Enabled	Enables the judgment.
	Disabled (def.)	Disables the judgment.
	Far	Sets the far-side evaluation value.
	Near	Sets the near-side evaluation value.
Peak	Sets the Peak OK / NG judgement for the Power (def. 4094.0). Setting range: 0.0 to 4095.0	
	Enabled	Enables the Judgement
	Disabled (def.)	Disables the Judgement.
④ Log File		
		To specify outputs where to save the measurement results (CSV).
Image	Enabled	Outputs image data at the Displacement View along with the measurement results (.csv)
	Disabled (def.)	Does not output Displacement View image data (PNG)
	Full Color (def.)	Outputs image data in 24-bit full color.
	Gray Scale	Outputs image data in 8-bit grayscale.
	PNG(def.)	Outputs image data in PNG format.
	BMP	Outputs image data in BMP format.
	TIFF	Outputs image data in TIFF format.
	Enabled	Outputs image data at the Displacement View along with the measurement results (.csv)
	Disabled (def.)	Does not output Displacement View image data (PNG)
Raw	Enabled	Outputs Displacement View raw image data (CSV)* with measurement results (CSV) * Outputs luminance values per pixel
	Disabled (def.)	Does not output Displacement View raw image data (PNG)

⑤ Moving Average	Sets the averaging process (moving average) for measurement values. Setting range: 2 to 262,144 (def. = 2)	
	Enabled	Enables the averaging process.
	Disabled (def.)	Disables the averaging process.
⑥ Denoising	Sets thresholds. If enabled, it derives the measurement values using the pixels of the pixel values higher than the set value. Setting range: 1 to 4,095 (def. = 100)	
	Enabled (def.)	Enables the Denoising setting.
	Disabled	Disables the Denoising setting.
⑦ Length Unit	Sets the displaying unit of distance for measurement values.	
	Millimeter(def.)	Sets "mm", millimeter, as the unit of distance.
	Micrometer	Sets " μm ", micrometer, as the unit of distance.
⑧ Multi Surface		
Order	Sets the sorting type of measurement results displayed when detecting multiple beams.	
	Area	Sorts by beam area from the largest size.
	Near(def.)	It sorts from the near end of the measurement range.
	Far	It sorts from the far end of the measurement range.
	Peak	Sorts in descending order of Peak
	Total Count	Sorts in descending order of Total Count
Surface Count	Sets the number to be displayed on the measurement results screen when detecting multiple beams. Setting range: 1 to 100 (def. = 1)	
Min Spot Area	Sets the threshold value for the beam size (pixels) conditions of the beam to be detected. Setting range: 1 to 1023(def. = 1)	
⑨ Binning	Sets the Binning function (2x2) of the sensor camera. When binning is "enabled", adjacent pixels are combined to increase the noise sensitivity of the camera. It also improves the frame rate by reducing the image size by 1/4 and reducing the data volume.	
	Enabled	Enables binning function.
	Disabled (def.)	Disables binning function.
⑩ Mask	Sets the mask range used to calculate measurement results. It calculates measurement results within the set range from POS-1 to POS-2 (def. = 0).	

	Setting range: -20 to 20	
	Enabled	Enables the mask function
	Disabled (def.)	Disables the mask function
	POS-1	Specifies an arbitrary position within the displacement measurement range
	POS-2	Specifies an arbitrary position within the displacement measurement range
⑪ Substitution of Measured Angle	Sets an angle for revised calculations	
	Enabled	Applies the angle inputs in the "X" and "Y" *. *When the angle measurement results are available, the operating distance will be applied based on those results.
	Disabled (def.)	Measured angle results are used for revised calculations.
	X	Sets an angle used for revised calculations (def. = 0.000). Its setting range: - 1.35 to + 1.35
	Y	Sets an angle used for revised calculations (def. = 0.000). Its setting range: - 1.35 to + 1.35

4.1.2.2 Display



① Decimal Points

It specifies the number of decimal places when outputting^{*Note} measurement results.

Its setting range: 0 to 8 (def. = 8)

^{*Note}: Measurement results output indicates the results (.csv) output with the [Output Once] button icon and the output via communication controlled from external devices.

② Display

Surface
Number

Sets the number of serial number labels to display if light beams are measured (def. = 0).
Its setting range: 0 to 100

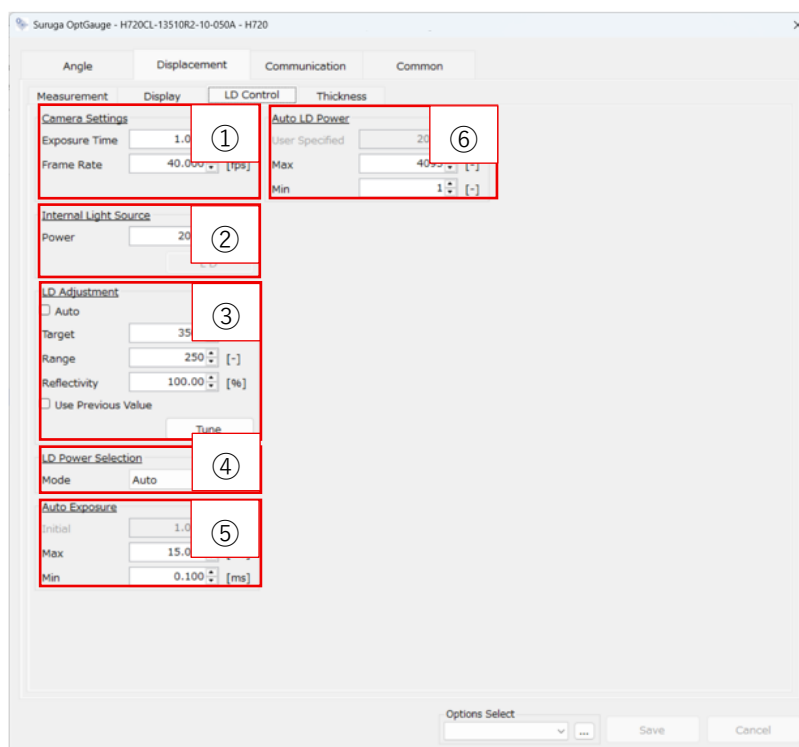
③ Result Visible

Sets the display / hide of the measurement results.

Displacement	Enabled (def.)	Displays the displacement measurement results.
	Disabled	Hides the displacement measurement results.
Thickness	Enabled (def.)	Displays the thickness measurement results.
	Disabled	Hides the thickness measurement results.
Total Count	Enabled (def.)	Displays the Total Count measurement results.
	Disabled	Hides the Total Count measurement results.
Peak	Enabled (def.)	Displays the peak measurement results.

	Disabled	Hides the peak measurement results.
Judgement – Displacement	Enabled (def.)	Displays the measurement results for Judgement – Displacement
	Disabled	Does not display the measurement results for Judgement – Displacement
Multi Spot	Enabled (def.)	Displays the measurement results for Multi Spot
	Disabled	Does not display the measurement results for Multi Spot
④ Font Size ※Not used		

4.1.2.3 LD Control

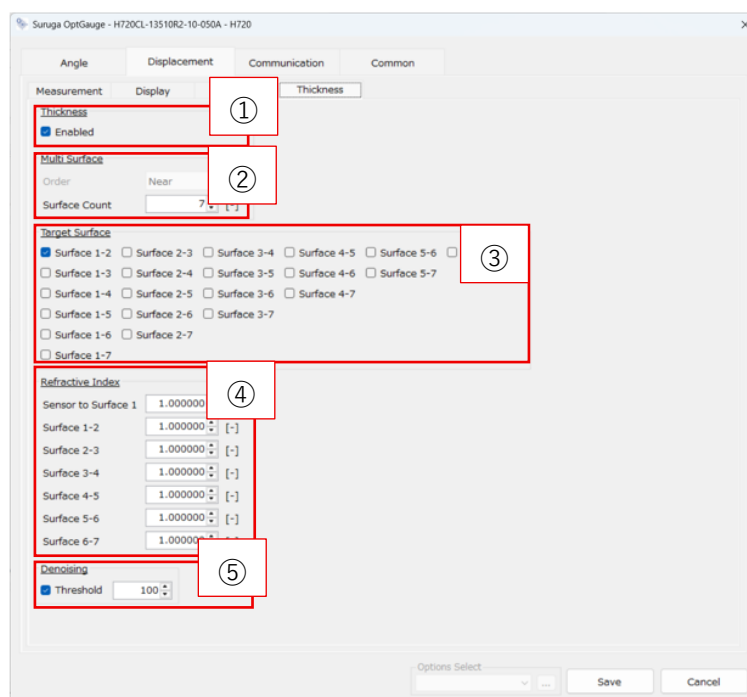


① Camera Settings		
Exposure Time	Sets the sensor camera exposure time. (def. = 1. 000) Setting range: 0.027 to 2000.000	
Frame Rate	Sets the sensor camera frame rate. (def. = 40. 000) Setting range: 0.1 to 100. 000	
Trigger Mode	Enabled	Enables the external trigger input.
	Disabled (def.)	Disables the external trigger input.
② Internal Light Source		
Power	Sets the light beam intensity of the internal light source (def. = 2000). Setting range: 0 to 4095	
LD	Sets ON / OFF of the internal light source. It indicates the status of the internal light source according to the color indicated in the button icons and the texts within.	
	Green (text black)	Sets internal light source to ON
	Gray (text black)	Sets internal light source to OFF
	Gray (text gray)	The internal light source cannot be controlled. Please be advised to the sensor power supply status.

③ LD Adjustment		
Auto	It keeps the Automatic Brightness control enabled / disabled.	
	Enabled	It keeps the Automatic Brightness control (always) enables
	Disabled (def.)	It keeps disabling the Automatic Brightness control.
Target	Sets the peak of luminance for the dimming adjustment (def. = 3500) Setting range: 1000 to 3500	
Range	Sets the dimming adjustment complete range (def. = 250). Dims so that the dimming target is within the set range. Setting range: 100 to 1000	
Reflectivity	Set the reflectance of the measurement target (default=100) Setting optimizes the time required to adjusting the light brightness of the light by the reflectance of the measurement target. Setting range: 0.05 to 100	
Use Previous Value	The results of the previous auto-brightness control (Power, Exposure Time) are set as the initial values.	
	Enabled	The results of the previous auto-brightness adjustment are enabled
	Disabled (def.)	The results of the previous auto-brightness adjustment are disabled
Tune	If the auto-brightness control is not enabled, clicking the Tune button will activate auto-brightness each time.	
④ LD Power Selection		
Mode	Sets the LD output (Power) during auto-brightness control execution	
	Auto(def.)	Automatically selects the LD output (Power) from Low / Standard / Medium / High according to the target brightness
	Low	LD output (Power) = 1550
	Standard	LD output (Power) = 2300
	Medium	LD output (Power) = 2820
	High	LD output (Power) = 4095
	User Specified	Specify any desired LD output (Power)
⑤ Auto Exposure		
Initial	Sets the initial exposure time value for the first time automatic brightness is executed (def. = 1.000). Setting range: 0.1 to 15.000	
Max	Sets the maximum value for the exposure time adjusted upon automatic brightness (def. = 15.000). Setting range: Min to 15.000	

Min	Sets the minimum value for the exposure time adjusted upon automatic brightness (def. = 0.1). Setting range: 0.1 to Max
⑥ Auto LD Power	
User Specified	Set the initial value for power during the first auto-brightness control (default = 2000) Setting range: 0 to 4095
Max	Sets the maximum value for the power adjusted at the automatic brightness (def. = 4095). Setting range: Min to 4095
Min	Sets the minimum value for the power adjusted upon automatic brightness (def. = 1). Setting range: 0 to Max
⑦ Alternative Data Acquisition ※Not used	

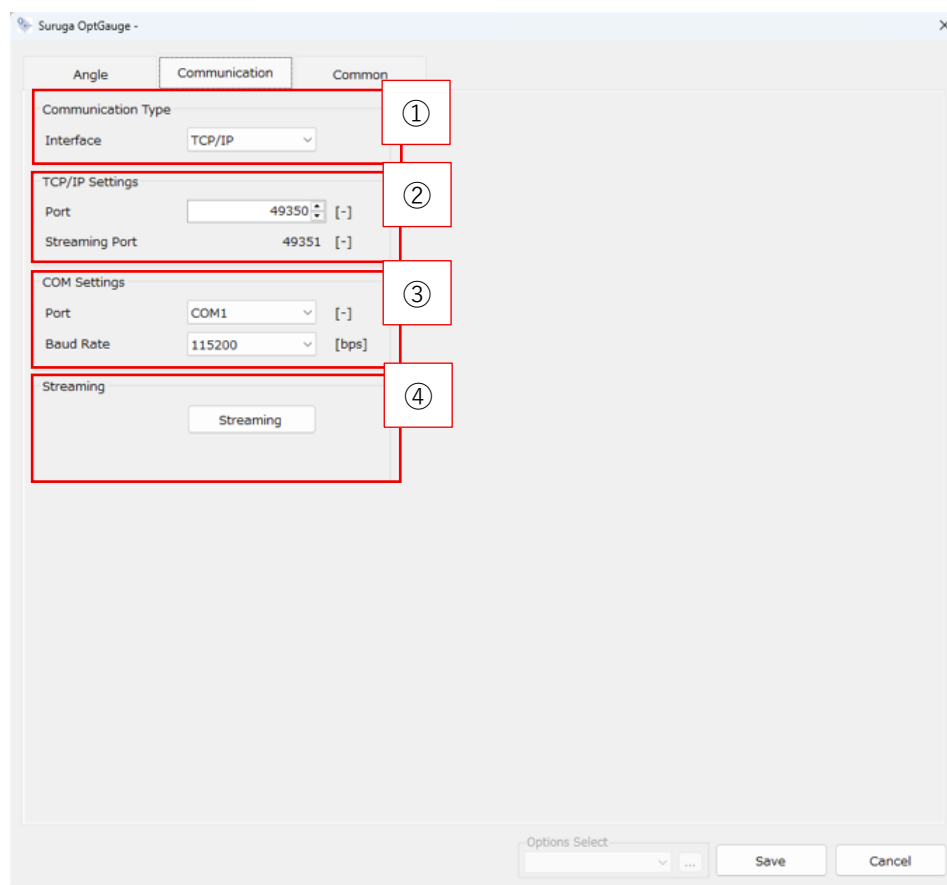
4.1.2.4 Thickness



① Thickness		
Thickness	Enables or disables the thickness measurement mode	
	Enabled	Enables the thickness measurement mode
	Disabled (def.)	Disables the thickness measurement mode
② Multi Surface		
Order	Sets the sort type for the measurement result list when detecting multiple beams ※If Thickness = Enabled, it is fixed to Near.	
	Area	Sorts in descending order of beam area
	Near(def.)	Sorts from the near side of the measurement range
	Far	Sorts from the far side of the measurement range
	Peak	Sorts in descending order of Peak
	Total Count	Sorts in descending order of Total Count
Surface Count	Sets the number of results to display on the measurement result screen when detecting multiple beams If Thickness = Enabled, setting range: 2–100	
③ Target Settings		
Target Settings	Selects which surfaces to measure between Surface 1-2 ~ Surface 6-7	
	Enabled	Enables measurement
	Disabled (def.)	Disables measurement

④ Refractive Index		
Sensor to Surface 1	Sets the refractive index of the layer between the sensor and Surface 1 (default = 1.000000)	
	Setting range: 0.000001–5.000000	
Surface 1-2 ~ Surface 6-7	Sets the refractive index of the layer between each surface (default = 1.000000)	
	Setting range: 0.000001–5.000000	
⑤ Denoising		
Threshold	When enabled, measurement values are calculated using pixels with pixel values higher than the set value (default = 100)	
	Enabled (def.)	Enables the Denoising setting
	Disabled	Disables the Denoising setting

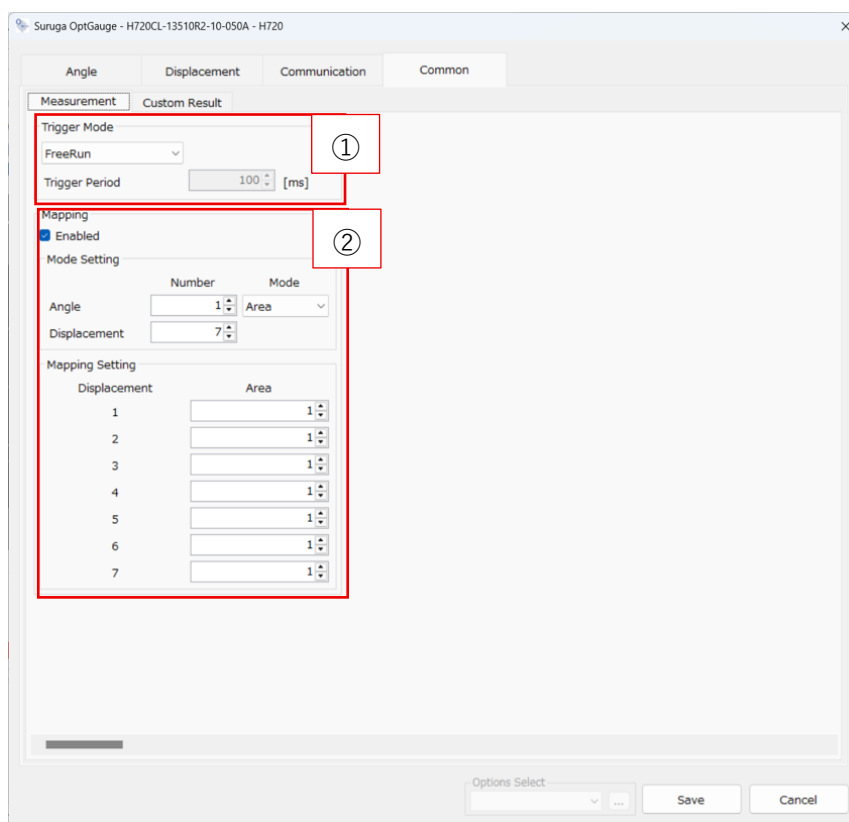
4.1.3 Communication



① Communication Type		
Interface	Select the interface used for communication with external devices	
	TCP/IP	Uses TCP/IP communication (def.)
	COM	Uses serial communication (RS 232C)
② TCP/IP Settings		
Port	Set the TCP port number Setting Range: 49152–65535 (def. = 49350)	
Streaming Port	TCP port number used for Streaming output (automatic)	
③ COM Settings		
Port	Set the COM port to use	
Baud Rate	Set the communication speed 9600/19200/38400/57600/115200(def.)	
④ Streaming		
Streaming	Switch Streaming output ON/OFF (def.=OFF) For details, refer to “ Measurement Result Streaming Output ”	

4.1.4 Common

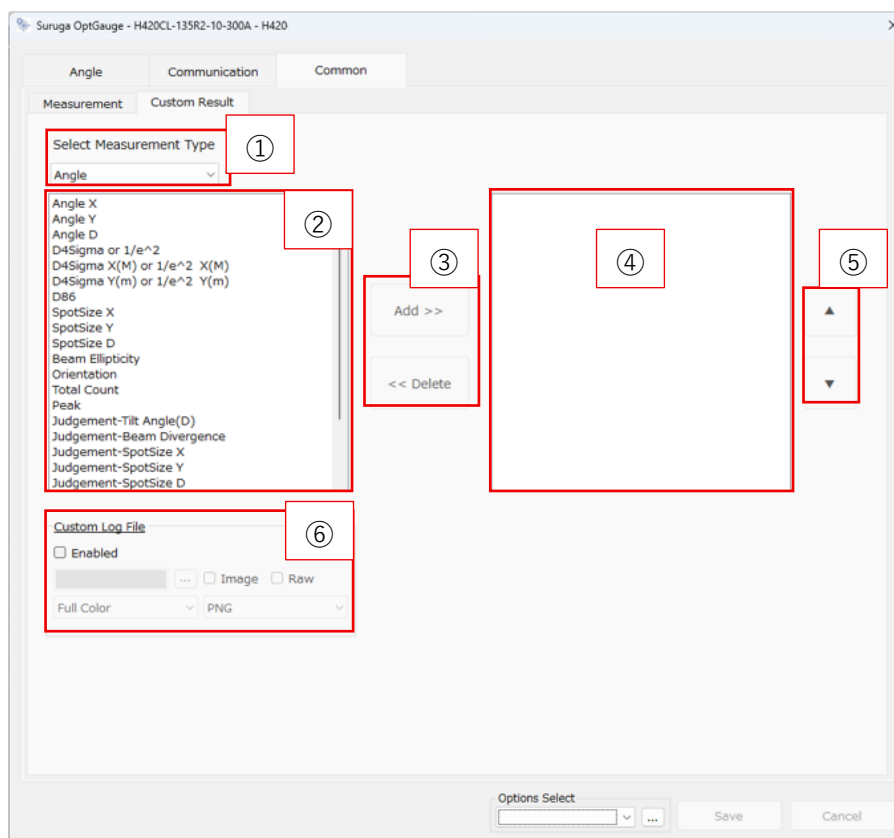
4.1.4.1 Measurement



① Trigger Mode		
Trigger Mode	Selects the trigger mode. For details, refer to “ Trigger Mode ”.	
	Free Run(def.)	Performs continuous measurement and outputs results sequentially
	One Shot	Performs measurement once and outputs the result
	Continuous	Repeats measurement at fixed intervals and outputs results
	Alternate	Alternately switches between Angle/Displacement light sources during measurement
	External Trigger	Performs measurement according to the timing of external signal input
Trigger Period	Sets the sampling interval Setting range: 16–1000 ms (def.=16) For details, refer to “ Sampling Interval ”	
② Mapping		
Mapping	Enables or disables multi-point mapping for transparent objects For details, refer to “ Multiple Point Association for Transparent Objects ”	

	Enabled	Enables multi-point mapping for transparent objects	
	Disabled (def.)	Disables multi-point mapping for transparent objects	
Mode Setting	Sets the number of light spots and the sorting method used as the basis for mapping Number		
	Number	Angle	Sets the number of angle light spots Setting range: 1–7 (def.=1)
		Displacement	Sets the number of peaks Setting range: 1–7 (def.=1)
	Mode	Angle(def.)	Mapping is performed in order of increasing angle
		Area	Mapping is performed based on the size of the received beam
		Peak	Mapping is performed based on the intensity (Peak) of the received beam's reflected light
		Total Count	Mapping is performed based on the Total Count of the received beam
Mapping Setting	Displacement	Displays the peak number to be mapped (cannot be set)	
	Angle	Sets the angle spot number corresponding to Displacement Setting range: 1–7 (def.=1) ※The title corresponds to the selected Mode	

4.1.4.2 Custom Result



① Custom Result You can freely edit and set the output items and their order for measurement results. ※For details, refer to Custom Log Output .		
② Select Measurement Type	Angle(def.)	Sets the measurement type to Angle for editing
	Displacement	Sets the measurement type to Displacement for editing
	Select the items you wish to output from the list.	
④ Add / Delete	Add	Adds the selected item to the edited result list
	Delete	Removes the selected item from the edited result list
⑤ Edited Result List	Check the items to be output.	
⑥ ▲ / ▼	▲	Move the selected output item up one position (multiple selections possible)
	▼	Move the selected output item down one position (multiple selections possible)
⑦ Custom Log File		

Set the measurement result output (CSV) performed with the Output Once button. ※For details, refer to Custom Log Output .		
Enabled	Enabled	Enables custom log output
	Disabled (def.)	Disables custom log output
	Specify the destination to save measurement result outputs (CSV) using the custom log output function.	
Image	Enabled	Outputs image data from Angle View and Displacement View together with the measurement results (CSV)
	Disabled (def.)	Does not output image data from Angle View and Displacement View
	Full Color (def.)	Outputs image data in 24-bit full color
	Gray Scale	Outputs image data in 8-bit grayscale
	PNG(def.)	Outputs image data in PNG format
	BMP	Outputs image data in BMP format
	TIFF	Outputs image data in TIFF format
Raw	Enabled	Outputs luminance data (CSV)* from Angle View and Displacement View together with measurement results (CSV) * Luminance values are output as CSV text data, not binary data
	Disabled (def.)	Does not output raw image data (CSV) from Angle View and Displacement View

4.2 The Option List

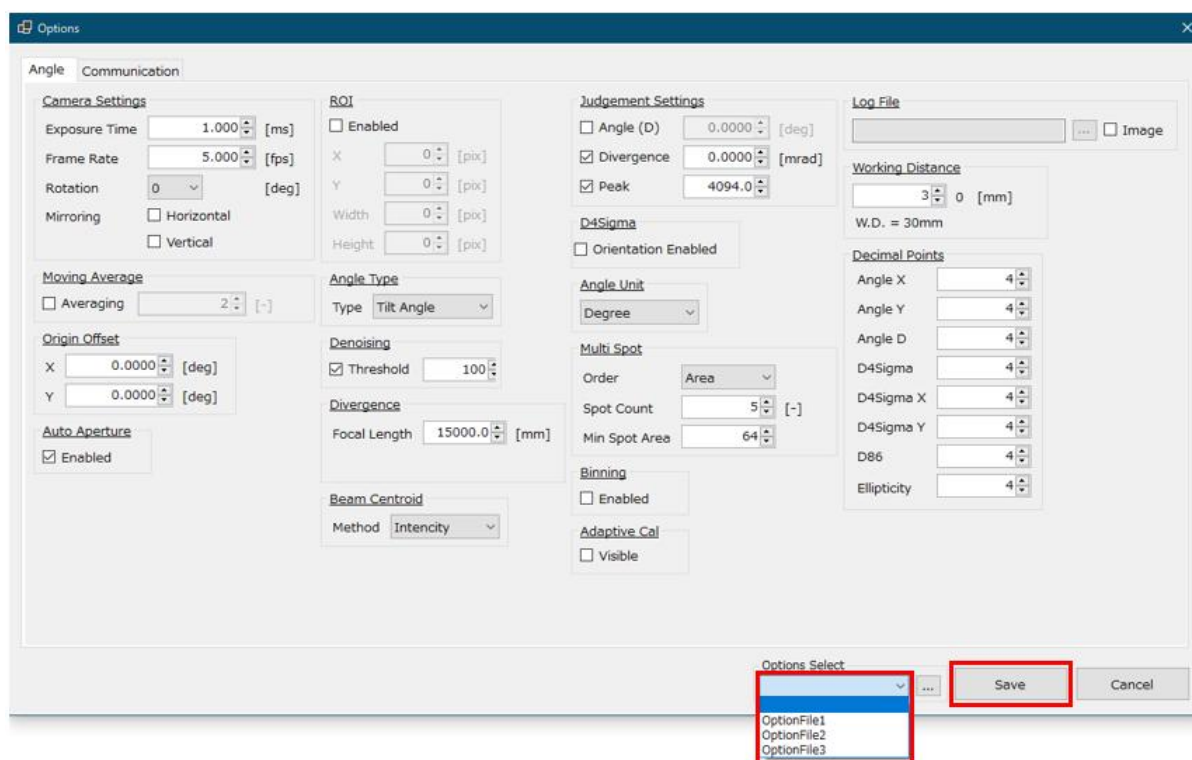
Multiple option lists can be available to the Suruga OptGauge and you can switch between them. When you may apply different option settings based on the measurement target or wavelength by switching to another option list while the Suruga OptGauge is running.

This chapter describes how to switch between multiple option lists, register it, or delete it.

4.2.1 Switching the Option Lists

This section describes how to switch option lists.

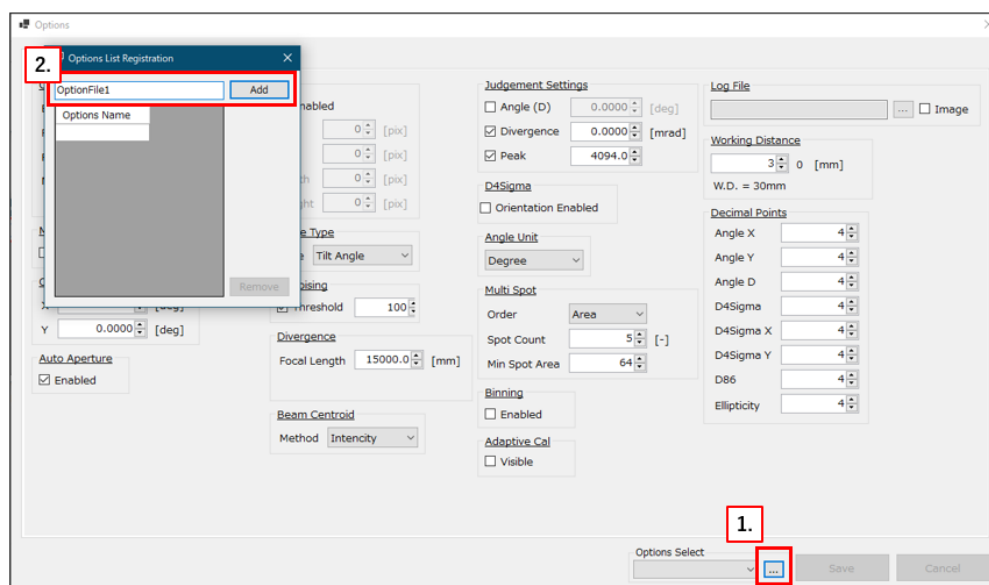
1. From the "Options Select" pulldown menu, select the desired option list name.
2. Click the "Save" button.



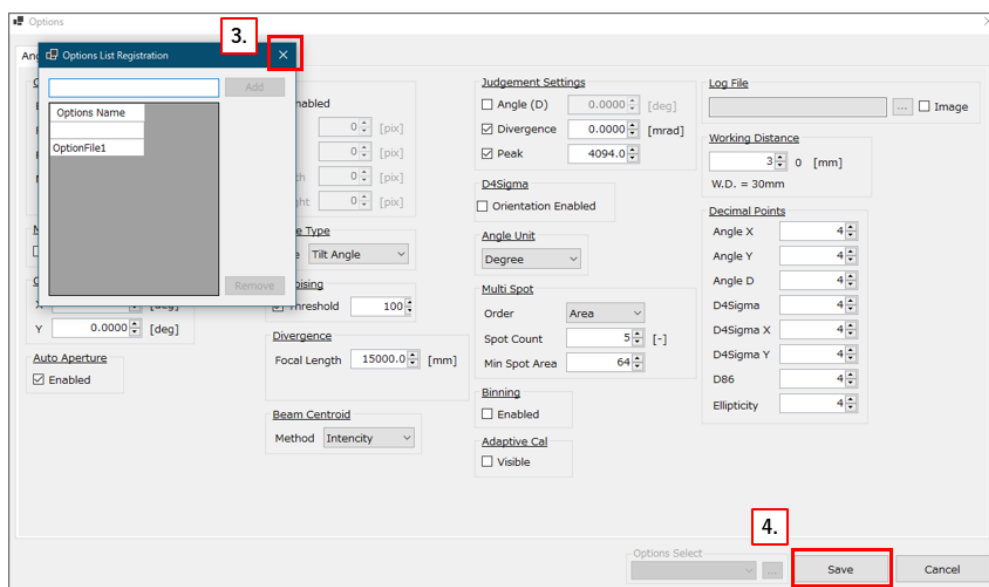
4.2.2 Registering an Option List

This section describes how to register an option list. It holds up to 31 option lists to be registered.

1. Click the [...] button.
2. Enter an arbitrary option name and click the [Add] button.



3. Click the [X] button.
4. Click the [Save] button.

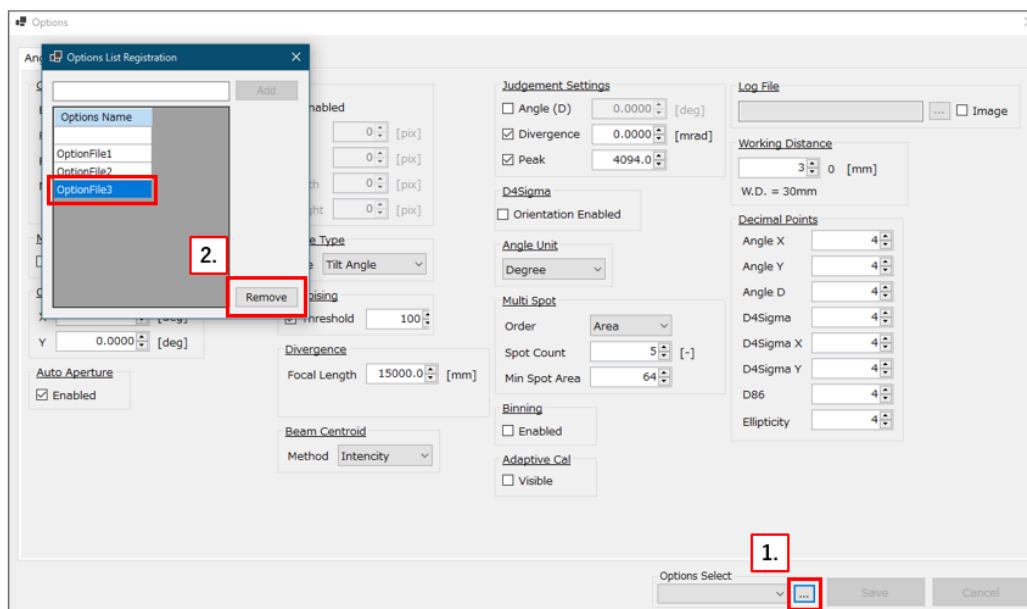


5. The list is now registered in "Options Select" to choose (*See "[Switching Option Lists](#)").

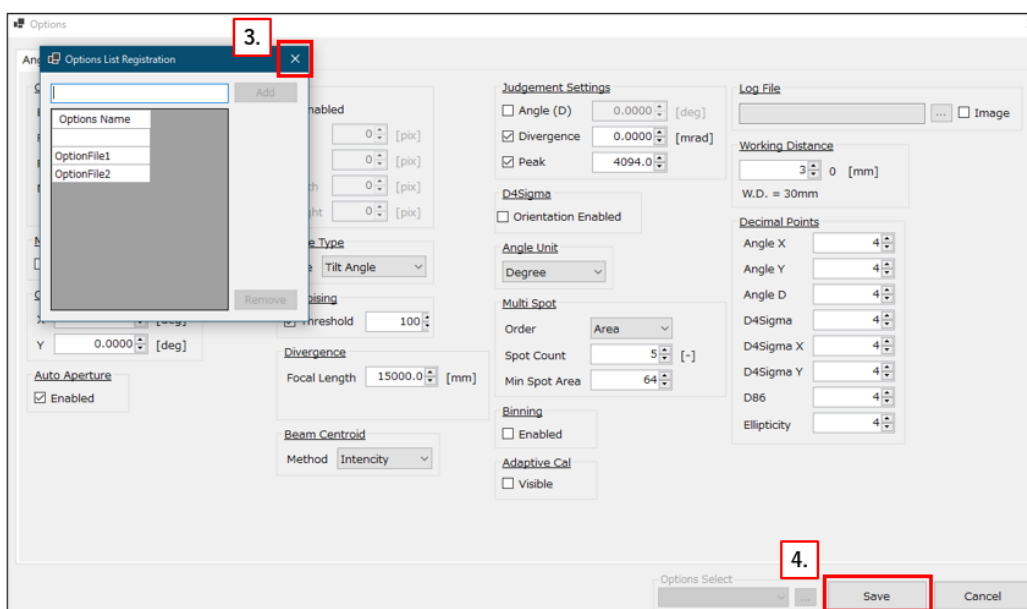
4.2.3 Deleting an Option List

This section describes how to delete an option list.

1. Click the [...] button while selecting an option other than the one you wish to delete.
2. Select the option name you want to remove and click the [Remove] button.



3. Click the [X] button.
4. Click the [Save] button.



5 Controlling from External Devices

The Products enable command communication with external devices via serial communication (RS232C) or TCP/IP communication, allowing sending and receiving data.

5.1 RS232C

The RS232C connections can be broadly categorized into two patterns. After connecting, use terminal software* to send and receive data via serial communication with the Suruga OptGauge.

*Note: Terminal software must be provided by the customer.

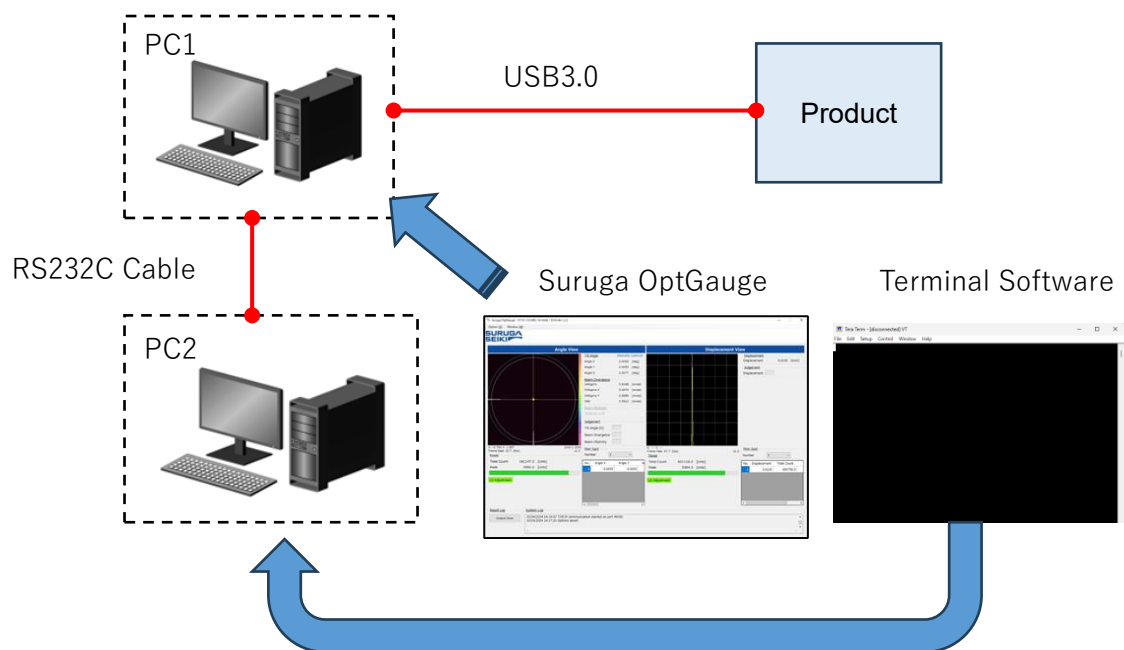
5.1.1 Communication Specifications

Item	Content
Synchronization method	Asynchronous
Transmission code	UTF-8
Data type	8 bits
Stop bit	1 bit
Parity	None
Flow control	None
Baud rate (bps)	9600 / 19200 / 38400 / 57600 / 115200

5.1.2 Example: connections via the RS232C communication

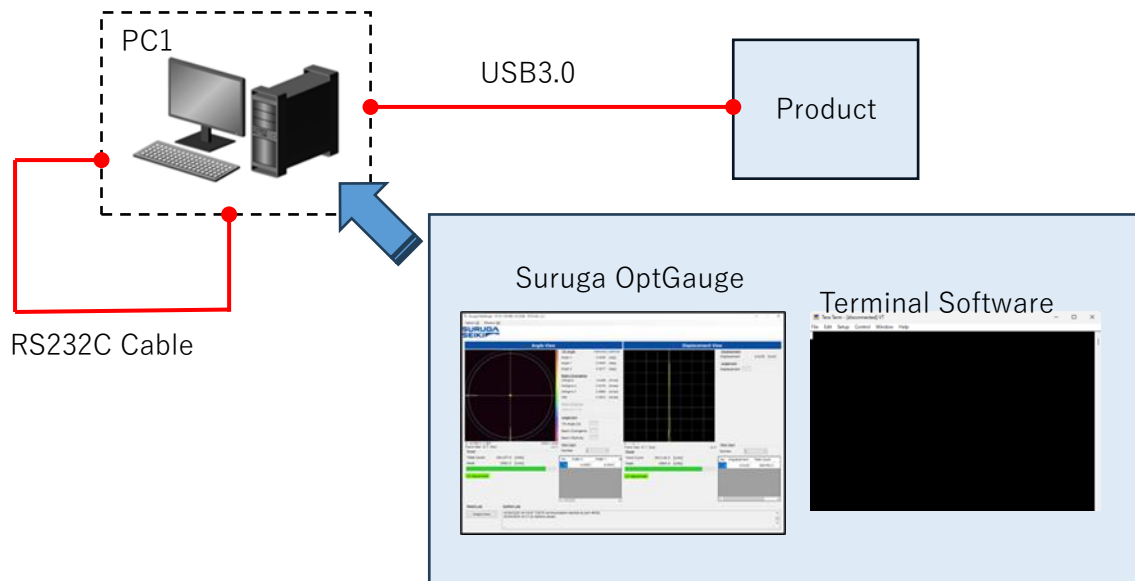
■ Using external PCs for communication

1. Set up two computers and connect with an RS232C cable.
2. Connect this product to one of the computers, launch the Suruga OptGauge, and start measurements.
3. Prepare terminal software on the other computer.
4. Configure the command communication settings and initiate communication.



■ Using the same computer for communication

1. Connect the sensor head to one computer and then connect the RS232C cable to your computer.
2. Launch the Suruga OptGauge and start measurement.
3. Prepare terminal software on the computer.
4. Configure the communication settings to command and begin communication.



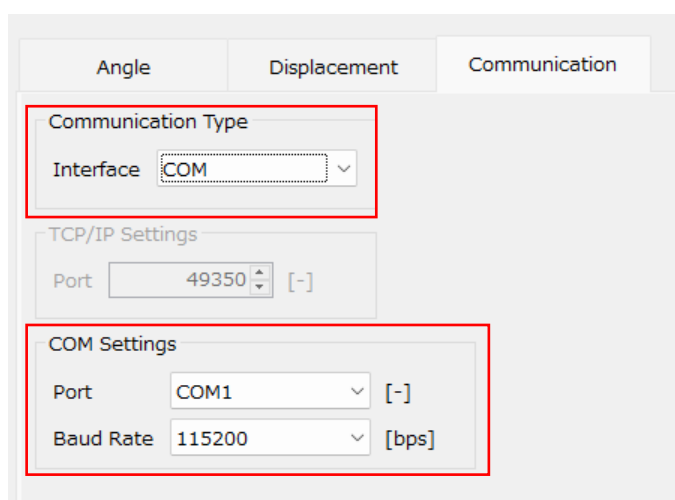
5.1.3 Command Communication Setting Method

This section describes how to configure the Suruga OptGauge and terminal software to command communication.

■ The Suruga OptGauge

1. Select the [Communication] tab in option settings.
2. Set the "Interface" to "COM" at the Communication Type.
3. Set "Port" and "Baud Rate" (arbitrary) in the COM settings.

*"Port" automatically displays the connected port candidates when RS232C is connected.



The screenshot shows the 'Communication' tab of the Suruga OptGauge settings window. It features three main sections: 'Communication Type', 'TCP/IP Settings', and 'COM Settings'. The 'Communication Type' section has a dropdown menu for 'Interface' set to 'COM'. The 'TCP/IP Settings' section has a 'Port' field set to '49350'. The 'COM Settings' section has a 'Port' dropdown set to 'COM1' and a 'Baud Rate' dropdown set to '115200'. Red boxes highlight the 'Communication Type' and 'COM Settings' sections.

■ Terminal Software

The terminal software, to be provided by the customer, is to be set as below.

1. Set the COM port which matches the "Port" setting in the Suruga OptGauge.
2. Set the same baud rate as the "Baud Rate" setting in the Suruga OptGauge.
3. For settings other than the above, see the "[Communication Specifications](#)".

5.2 TCP/IP

TCP/IP supports three main connection patterns. After establishing a connection, data transmission is performed using terminal software* to exchange commands with the Suruga OptGauge via TCP/IP communication.

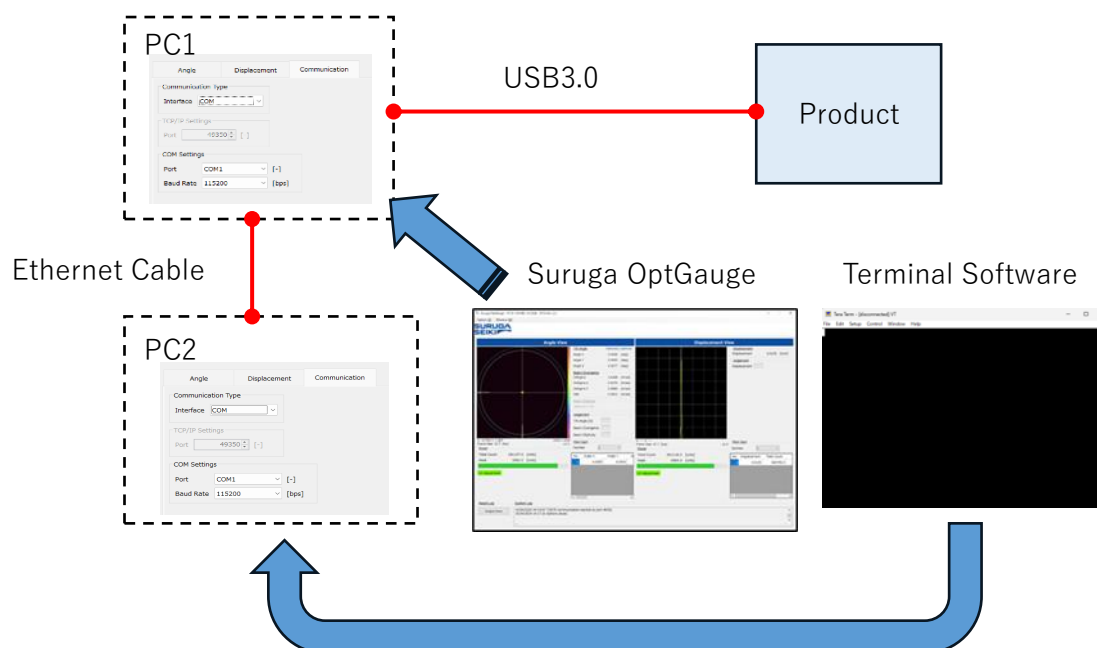
*Note: Terminal software must be provided by the customer.

5.2.1 Communication Specifications

Item	Details
Protocol	TCP
IPv4 Address	See " Command Communication Setting Method "
Subnet Mask	
Default Gateway	
DNS Server Address	
Port Number	Private Port of (49152-65535) Range

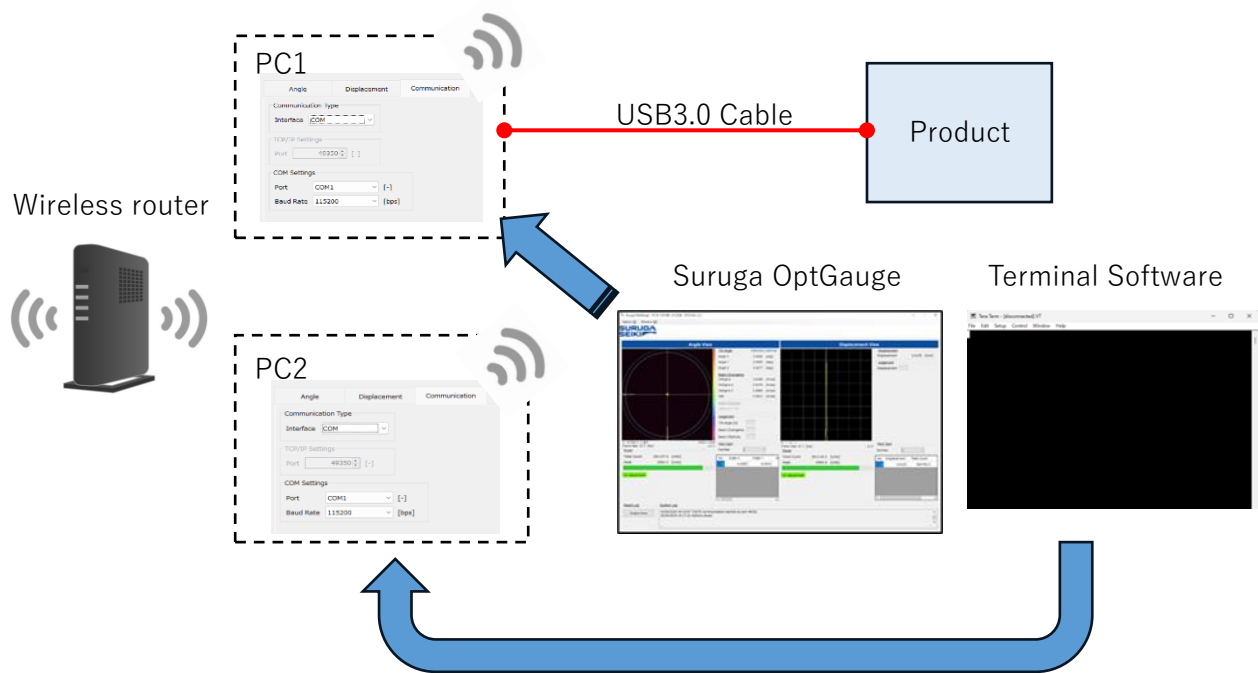
5.2.2 Example: connections via the TCP/IP communication

- Using external devices for communication via Ethernet cable.
- 1. Set up two computers and connect them with an Ethernet cable.
- 2. Connect this product to one of the computers, launch the Suruga OptGauge, and start measurements.
- 3. Prepare terminal software on the other computer.
- 4. Configure the communication settings to command and start communication.



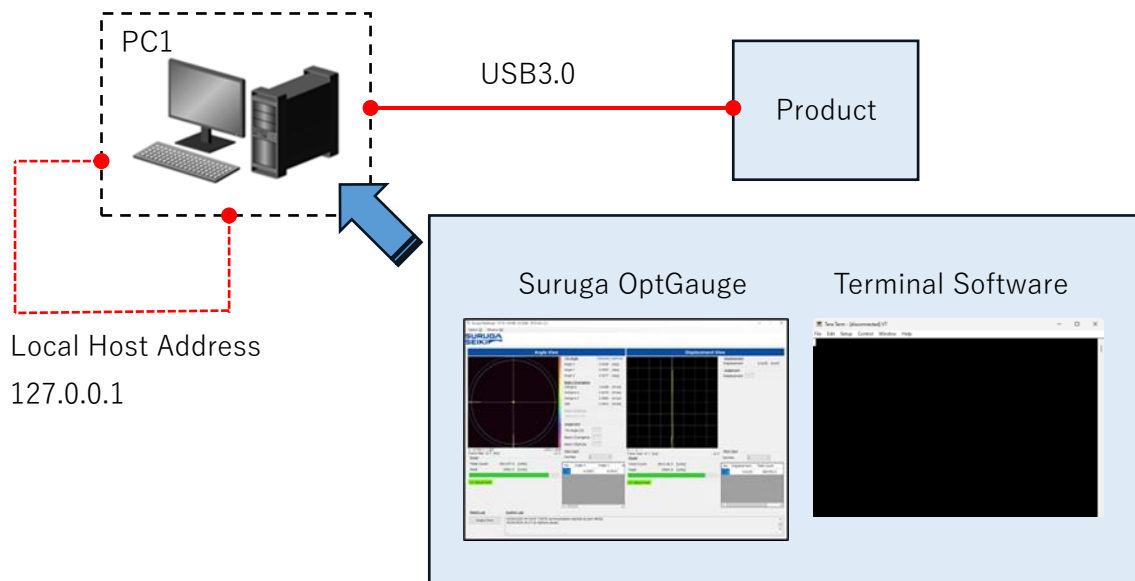
■ Using external devices for communication: Wireless router

1. Set up two computers and connect them via a wireless router.
2. Connect the Product to one of the computers, launch Suruga OptGauge, and start measurements.
3. Prepare terminal software on the other computer.
4. Configure the communication settings for the command and start communication.



■ Using the Same Computer for Communication

1. Connect the Product to one computer.
(There is nothing to connect, as the local host address is used).
2. Launch the Suruga OptGauge and start measurement.
3. Prepare terminal software on the computer.
4. Configure the communication settings to command and start communication.



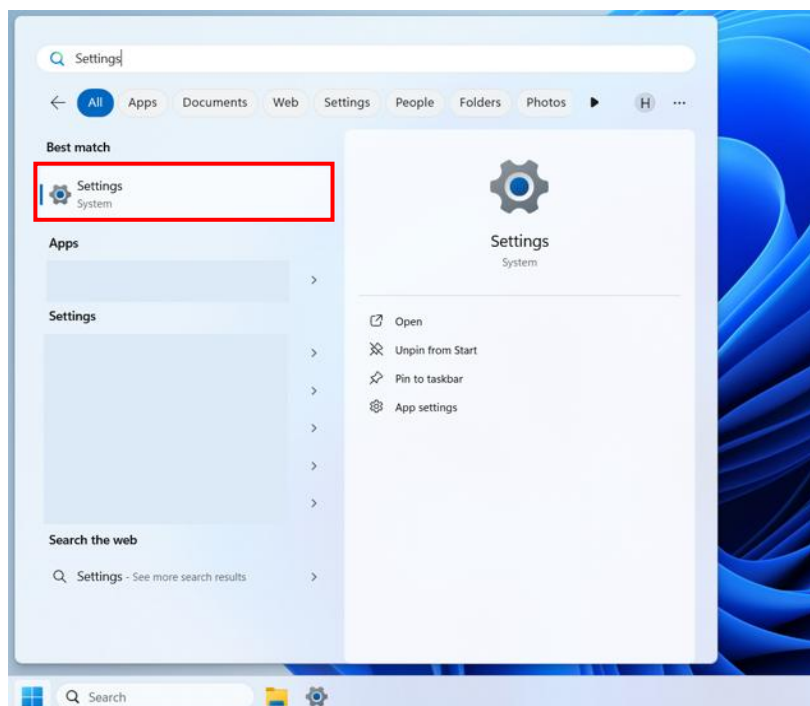
5.2.3 Command Communication Setting Method

This section describes how to configure the PC, the Suruga OptGauge, and terminal software to command communication.

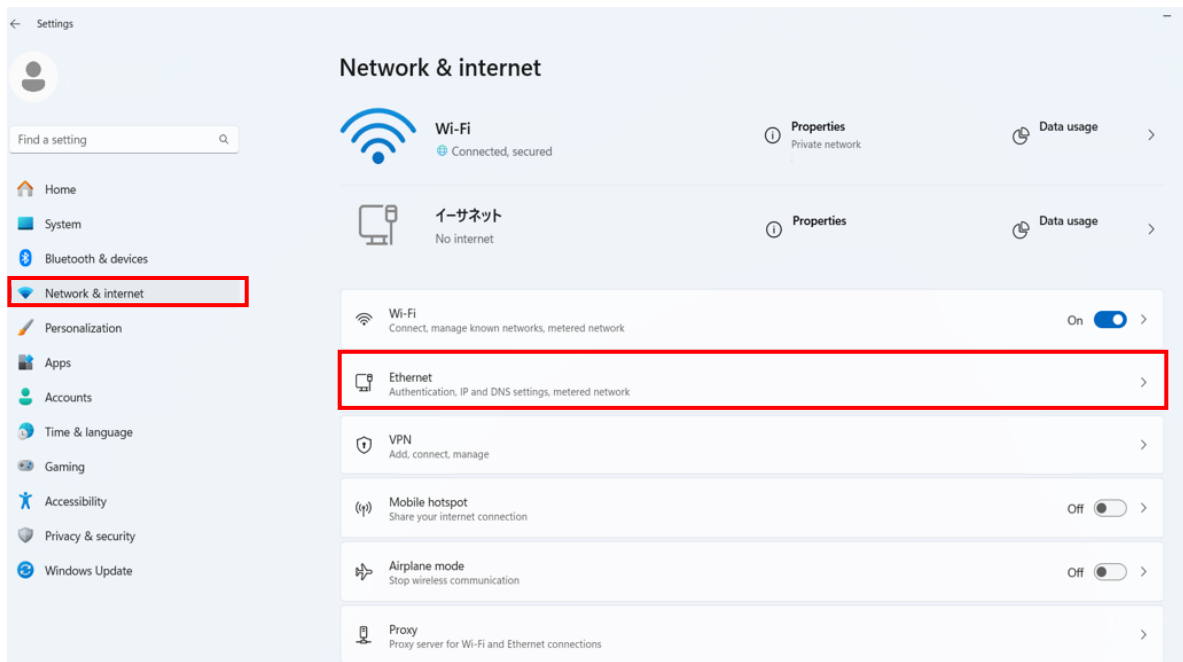
5.2.3.1 When communicating using an external device

PC Settings

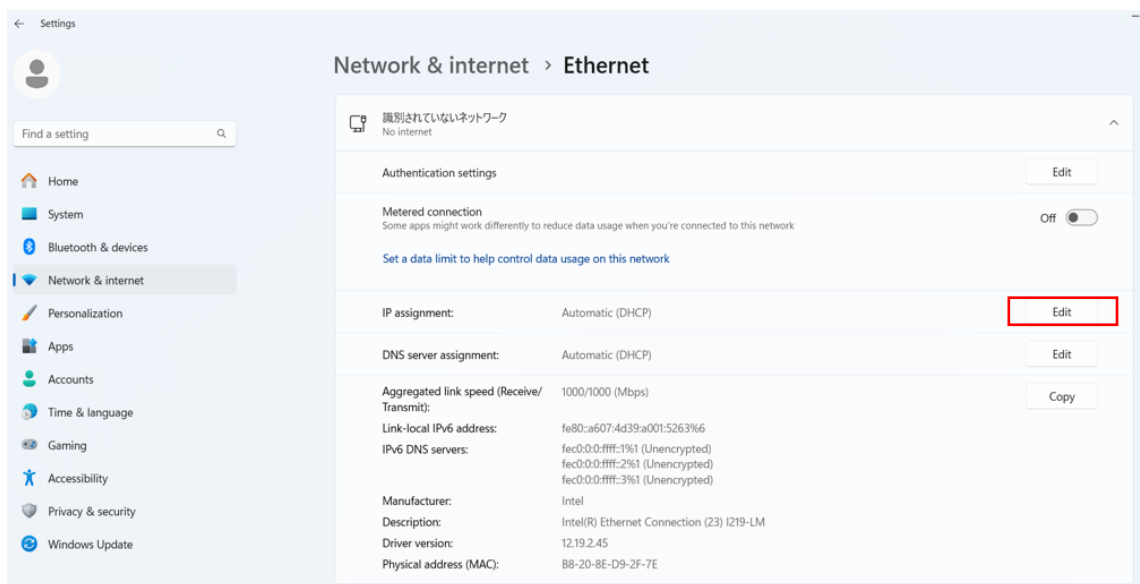
1. Click the [Start] button and select [Settings].



2. Select [Network & Internet], and then select [Ethernet]. If you are using a wireless LAN router, select [Wi-Fi] → [Hardware Properties].



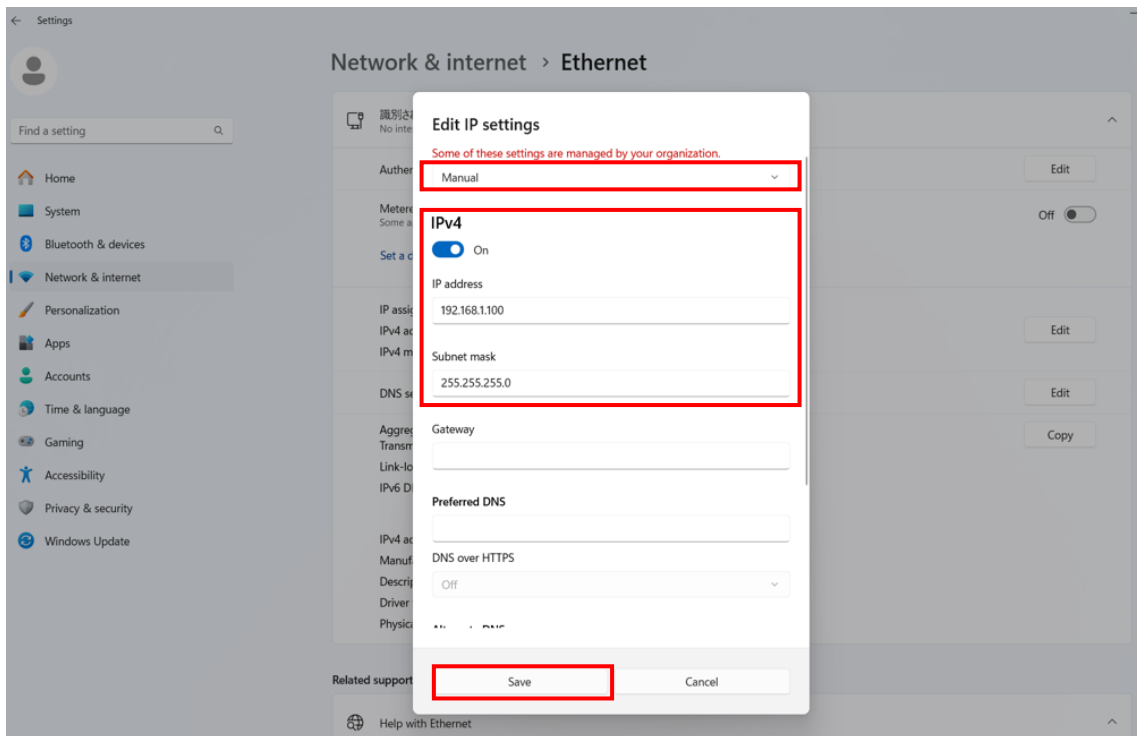
3. Click [Edit] under [IP Assignment].



4. Select [Internet Protocol Version 4 (TCP/IPv4)] and then select [Properties].
Example)

IP address: 192.168.1.100

Subnet mask: 255.255.255.0



5. Click [Save].

The settings for the PC to which the product is connected are complete.

6. Perform steps 1 through 5 on the other PC as well.

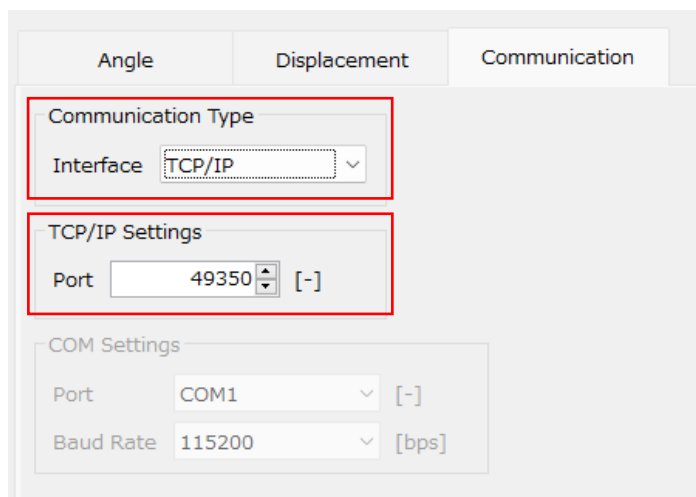
However, when configuring the IP address in step 5, ensure it does not duplicate the following:

EX. IP address: 192.168.1.101 (*change only the last number)

Subnet mask: 255.255.255.0

Setting the Suruga OptGauge

1. Select the [Communication] tab in option settings.
2. Set "Communication Type - Interface" to "TCP/IP".
3. Set "Port" (arbitrary) in TCP/IP settings.
4. If you change the "Port", please restart the software.



Terminal Software

For the terminal software you provide yourself, please configure the following settings:

- Specify the IP address set on the PC to which this product is connected, as configured in 'PC Settings ~ When Communicating Using External Devices ~', as the destination address.
- Configure the same TCP port as the 'Port' set on the Suruga OptGauge.

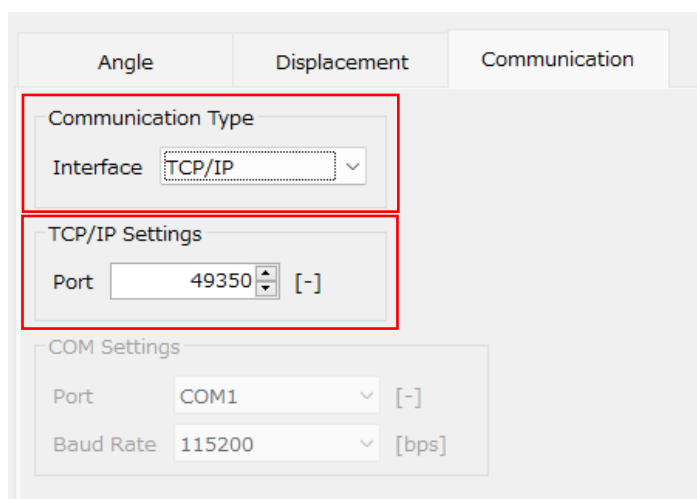
Note: This constitutes the minimum configuration required for command communication using the TCP/IP. As this involves network communication.

Please be advised to consider security and other settings appropriate to your specific application.

5.2.3.2 Using the same computer for communication

Setting the Suruga OptGauge

1. Select the [Communication] tab in option settings.
2. Set "Communication Type - Interface" to "TCP/IP".
3. Set "Port" (arbitrary) in TCP/IP settings.
4. If you change the "Port", please restart the software.



Terminal Software

The terminal software, to be provided by the customer, is to be set as below.

- Local host address: Set **127.0.0.1**
- Set the TCP port which matches the "Port" setting in Suruga OptGauge.

5.3 Command Format

Commands are sent in the following format.

<Format Definition>

[CommandType],[Parameter0],[Parameter1], ... ,[ParameterXX]<CR><LF>

<Field Description>

Field	Content
CommandType	Command type
Parameter0	First argument
Parameter1	Second argument
ParameterXX	XX-th argument
CR	Carriage Return (0x0D)
LF	Line Feed (0x0A)

※ Each field is separated by a comma (0x2C)

※ All characters must be ASCII

5.4 Command List

5.4.1 List of Reading Commands

5.4.1.1 Common

< Read Commands >

Command					Content	Reading Information	
Type	Parameter						
	0	1	2	3			
RD	VS				Reads version information	See “ Command Request/Response Details ”	
	OL				Reads option list information		
	CR				Custom Result Output		
	CO	CLF				Custom Log File enabled	0=disabled、 1=enabled
		RFP				[Custom Log File] Log File Output Path	Log File Path Strings
		IOE				[Custom Log File] Image file output enabled	0=disabled、 1=enabled
		IOC				[Custom Log File] Image file output color	0= Full Color 1= Gray Scale
		IOF				[Custom Log File] Image file output format	0= png 1= bmp 2= tiff
		RAE				[Custom Log File] RAW data output enabled	0=disabled、 1=enabled
		ACM				Trigger Mode	0=External Trigger 1=Alternate 2=Free Run 3=One Shot 4=Repeat
		ITP				Internal trigger sampling interval	Sampling interval [ms]
		MCE				Multi-point mapping enabled	0=disabled、 1=enabled
		MAN				Number of angle light spots for multi-point mapping	1~7
		MDN				Number of displacement peaks for multi-point mapping	1~7
		MSA	1~7			Angle light spot number for multi-point mapping	1~7

5.4.1.2 Angle

< Read Commands >

Command					Content	Reading Information	
Type	Parameter						
	0	1	2	3			
RD	AR				Angle Measurement Results	See “ Command Request/Response Details ”	
		MLT			Angle Multi Spot Measurement Results		
		ASC			Angle Multi Spot Count		
	AS	LAS			Automatic Brightness Status		
	AO	EXT			Sensor Camera Exposure Time	0.027～2000	
		FRA			Sensor Camera Frame Rate	0.1～100	
		ROT			Rotation	0 = OFF 1= Rotation right 90° 2 = Rotation right 180° 3 = Rotation right 270°	
			MHE			Mirroring Horizontal	0=OFF 1= Horizontal Mirroring
			MVE			Mirroring Vertical	0=OFF 1= Vertical Mirroring
			MAV			Number of Averaging Times	2～262144
		MAE			Averaging Processing Enabled	0=disabled、 1=enabled	
		CSP			Cross Section Point	0=Origin Cursor 1=Beam Cursor	
		OOX			Origin Offset X Value	-20～20	
		OOY			Origin Offset Y Value	-20～20	
		AAM			Auto Aperture Method	0= Area、 1= Luminance	
		AAE			Auto Aperture Enabled	0=disabled、 1=enabled	
		ROE			ROI Enabled	0=disabled、 1=enabled	
		RAX			ROI X Value	(- 3000 to 3000) or (- 1500 to 1500) if Binning is enabled	
		RAY			ROI Y Value	(- 3000 to 3000) or (- 1500 to 1500) if Binning is enabled	
		RAW			ROI Width	(0 to 3000) or (0 to 1500)	

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
						if Binning is enabled
	RAH				ROI Height	(0 to 3000) or (0 to 1500) if Binning is enabled
	ANT				Angle Type	0= Tilt Angle
	AJE				Angle Judgement Enabled	0=disabled、 1=enabled
	AJV				Angle Judgement Value	Angle judgement value (0 to 10)
	DJE				Divergence Judgement Enabled	0=disabled、 1=enabled
	DJV				Divergence Judgement Value	0.0000～1000.0000
	BRT				Radius Type Judgment	0= D4Sigma or 1/e 2 1= D86
	EJE				Ellipticity Judgment Enabled	0=disabled、 1=enabled
	EJV				Ellipticity Judgement Value	0.0000～1.0000
	OJE				Rotation Angle Judgement Enabled	0=disabled、 1=enabled
	OJV				Rotation Angle Judgement Criteria Value	-90.0000～90.0000
	OJR				Rotation Angle Judgement Value Range	0.0000～90.0000
	PJE				Peak Judgment Enabled	0=disabled、 1=enabled
	PJV				Peak Judgement Value	0.0～4095.0
	RFP				Log File Output Path	Log File Path Strings
	IOE				Image File Output Enabled	0=disabled、 1=enabled
	RAE				RAW Data Output Enabled	0=disabled、 1=enabled
	IOC				Image File Output Color	0= Full Color 1= Gray Scale
	IOF				Image File output format	0= png 1= bmp 2= tiff
	CNM				Beam Centroid	0= Area、 1= Intensity
	ANU				Angle Unit	0= Degree 1= DegMinSec 2= Milliradian
	DNE				Denoising Enabled	0=disabled、 1=enabled
	DNT				Denoising Threshold Value	1～4095

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
		DAX			Number of Decimal Places for the Angle X	0~8
		DAY			Number of Decimal Places for the Angle Y	0~8
		DAD			Number of Decimal Places for the Angle D	0~8
		DDS			Number of Decimal Places for the (Beam Divergence) D4Sigma or 1/e ²	0~8
		DDX			Number of Decimal Places for the (Beam Divergence) D4Sigma or 1/e ² X(M)	0~8
		DDY			Number of Decimal Places for the (Beam Divergence) D4Sigma or 1/e ² Y(m)	0~8
		DD8			Number of Decimal Places for the (Beam Divergence) D86	0~8
		DEL			Number of Decimal Places for the Ellipticity	0~8
		DOR			Number of Decimal Places for the Rotation Angle Measurement	0~8
		MSO			(Multi Spot) Order	0= Area 1= Angle 2=Peak 3=Total Count
		MSC			(Multi Spot) Spot Count	1~100
		MSM			(Multi Spot) Min Spot Area	1~1023
		ACE			Adaptive Cal Execution Button Display Enabled	0=disabled、 1=enabled
		BDT			Beam Diameter Type	0=D4Sigma 1=1/e ²
		DOE			Orientation Enabled	0=disabled、 1=enabled
		OCM			Rotation Angel Measurement Method	0= Ellipse Fitting 1= Max Distance Search
		BIE			Binning Enabled	0=disabled、 1=enabled

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
		VAA			Auto Aperture Display	0=disabled、 1=enabled
		VCC			Centroid Cursor Display	0=disabled、 1=enabled
		VCS			Cross Section Display	0=disabled、 1=enabled
		VLA			Labeling Area Display	0=disabled、 1=enabled
		VMR			Measurement Range Display	0=disabled、 1=enabled
		VOC			Origin Cursor Display	0=disabled、 1=enabled
		VSA			Spot Area Display	0=disabled、 1=enabled
		IST			Spot Area Display Type	0= D4Sigma or 1/e ² 1= D86
		VRA			ROI Area Display	0=disabled、 1=enabled
		VOU			Rotation Angle Cursor Display Enabled	0=disabled、 1=enabled
		DSN			Display Spot Number	0~100
		VAX			Angle X Result Display	0=disabled、 1=enabled
		VAY			Angle Y Result Display	0=disabled、 1=enabled
		VAD			Angle D Result Display	0=disabled、 1=enabled
		VDS			(Beam Divergence) D4Sigma or 1/e ² Result Display	0=disabled、 1=enabled
		VDX			(Beam Divergence) D4Sigma or 1/e ² X(M) Result Display	0=disabled、 1=enabled
		VDY			(Beam Divergence) D4Sigma or 1/e ² Y(m) Result Display	0=disabled、 1=enabled
		VD8			(Beam Divergence) D86 Result Display	0=disabled、 1=enabled
		VEL			Ellipticity Result Display	0=disabled、 1=enabled
		VOR			Rotation Angle Result Display	0=disabled、 1=enabled
		VTC			Total Count Result Display	0=disabled、 1=enabled
		VPE			Peak Result Display	0=disabled、 1=enabled
		FAN			Font Size for the Angle	0= Small 1= Medium 2= Large
		FBD			Font Size for the Beam Divergence	0= Small 1= Medium 2= Large

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
		FBE			Font size for the Beam Ellipticity	0= Small 1= Medium 2= Large
		FOR			Font Size for the Rotation Angle	0= Small 1= Medium 2= Large
		FPO			Font Size for the Power	0= Small 1= Medium 2= Large
		TRM			External Trigger Mode Enabled	0=disabled、 1=enabled ※Support discontinued: Please use ACM.
		LDP			LD Output Value	0~4095
		LDE			LD Output Enabled	0=disabled、 1=enabled
		LAE			Automatic Brightness Execution Enabled	0=disabled、 1=enabled
		LAV			Automatic Brightness Peak Target Value	1000~3500
		LAR			Automatic Brightness Peak Target Range	100~1000
		LRV			Reflectance of the target	0.05~100
		UPV			Adopt previous convergence values used in auto-brightness adjustment	0=disabled、 1=enabled
		LSM			LDPW output settings used in auto-brightness adjustment	0=Auto 1=Low 2=Standard 3=Medium 4=High 5=User Specified
		LEI			Initial Exposure Time Value applied in the Automatic Brightness	0.100~15.000
		LEX			maximum value of exposure time applied in automatic brightness	0.100~15.000
		LEN			minimum value of Exposure time	0.100~15.000

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
					applied in the Automatic Brightness	
		LLI			LD Initial Output Value Applied in the Automatic Brightness	0~4095
		LLX			LD Maximum Output Value Applied in the Automatic Brightness	0~4095
		LLN			LD Minimum Output Value Applied in the Automatic Brightness	0~4095
		SWE			Displacement Measurement Applied in Revising Calculations Enabled	0=disabled、 1=enabled
		SWD			Working Distance Applied in Revising Calculations When the Displacement Measurement Fails	40~60

5.4.1.3 Displacement

< Read Commands >

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
RD	DR				Displacement Measurement Results	See “ Command Request/Response Details ”
		MLT			Displacement Multi Spot Measurement Results	
		DSC			Displacement Multi Spot Measurement Results	
	DS	LAS			Automatic Brightness Status	
	DO	EXT			Sensor Camera Exposure Time	0.027～2000
		FRA			Sensor Camera Frame Rate	0.1～100
		OOX			Origin Offset X Value	-20～20
		DJE			Displacement Judgement Enabled	0=disabled、 1=enabled
		DJF			Displacement Judgement Far Side Value	-20～20
		DJN			Displacement Judgement Near Side	-20～20
		PJE			Peak Judgment Enabled	0=disabled、 1=enabled
		PJV			Peak Judgement Value	0.0～4095.0
		RFP			Log File Output Path	Log File Path Strings
		IOE			Image File Output Enabled	0=disabled、 1=enabled
		RAE			RAW Data Output Enabled	0=disabled、 1=enabled
		IOC			Image File Output Color	0= Full Color 1= Gray Scale
		IOF			Image File output format	0= png 1= bmp 2= tiff
		MAE			Averaging Processing Enabled	0=disabled、 1=enabled
		MAV			Number of Averaging Times	2～262144
		DNE			Denoising Enabled	0=disabled、 1=enabled
		DNT			Denoising Threshold Value	1～4095
		LNU			Length Unit	0=Millimeter 1=Micrometer
		MSO			(Multi Spot) Order	0= Area 1= Near 2=Far

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
						3=Peak 4=Total Count
	MSC				(Multi Spot) Spot Count	1～100
	MSM				(Multi Spot) Min Spot Area	1～1023
	BIE				Binning Enabled	0=disabled、 1=enabled
	DPD				Number of Decimal Places for the Displacement	0～8
	DPT				Decimal Places of the Thickness	0～8
	DSN				Display Spot Number	0～100
	MSE				Mask Processing Enabled	0=disabled、 1=enabled
	MP1				Mask Pos-1	-20～20
	MP2				Mask Pos-2	-20～20
	VDS				Displacement Result Display	0=disabled、 1=enabled
	VTM				Thickness Measurement Result Display	0=disabled、 1=enabled
	VTC				Total Count Result Display	0=disabled、 1=enabled
	VPE				Peak Result Display	0=disabled、 1=enabled
	FDS				Font Size for the Displacement	0= Small 1= Medium 2= Large
	FTM				Font size for the Thickness	0= Small 1= Medium 2= Large
	FPO				Font Size for the Power	0= Small 1= Medium 2= Large
	TRM				External Trigger Mode Enabled	0=disabled、 1=enabled ※Support discontinued: Please use ACM.
	LDP				LD Output Value	0～4095
	LDE				LD Output Enabled	0=disabled、 1=enabled
	LAE				Automatic Brightness Execution Enabled	0=disabled、 1=enabled

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
		LAV			Automatic Brightness Peak Target Value	1000～3500
		LAR			Automatic Brightness Peak Target Range	100～1000
		LRV			Reflectance of the target	0.05～100
		UPV			Adopt previous convergence values used in auto-brightness adjustment	0=disabled、 1=enabled
		LSM			LDPW output settings used in auto-brightness adjustment	0=Auto 1=Low 2=Standard 3=Medium 4=High 5=User Specified
		LEI			Initial Exposure Time Value applied in the Automatic Brightness	0.100～20.000
		LEX			maximum value of exposure time applied in automatic brightness	0.100～20.000
		LEN			minimum value of exposure time applied in automatic brightness	0.100～20.000
		LLI			LD Initial Output Value Applied in the Automatic Brightness	0～4095
		LLX			LD Maximum Output Value Applied in the Automatic Brightness	0～4095
		LLN			LD Minimum Output Value Applied in the Automatic Brightness	0～4095
		BLE			Alternating Lighting Function Enabled	0=無効、 1=有効 ※Support discontinued: Please use ACM.
		BLP			Alternating Lighting interval	10～1000 ※Support discontinued: Please use ITP.
		SAE			Correction, being Revised from the Angle Measurement Results, Enabled Configuration	0=disabled、 1=enabled

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
		SAX			Correction, Being Revised from the Horizontal Angle if the Angle Measurement Fails, Configuration	-1.35～1.35
		SAY			Correction, Being Revised from the vertical Angle if the Angle Measurement Fails, Configuration	-1.35～1.35
		TME			Thickness Measurement Enabled Configuration	0=disabled、 1=enabled
		TTS	1～6	2～7	Selection of measurement surfaces for thickness measurement	0=disabled、 1=enabled See Command Request/Response Details
		TRI	※		Refractive index for thickness measurement	0.000001～5.000000 ※See Command Request/Response Details

5.4.2 List of Write Commands

5.4.2.1 Common

< Write Commands >

Command					Content
Type	Parameter				
	0	1	2	3	
WR	OL	※1			※1 : See " Command Request/Response Details "
	CO	CLF	0=disabled 1=enabled		Custom Log File enabled
		RFP	Log File Path Strings		[Custom Log File] Log File Output Path
		IOE	0=disabled 1=enabled		[Custom Log File] Image file output enabled
		IOC	0= Full Color 1= Gray Scale		[Custom Log File] Image file output color
		IOF	0= png 1= bmp 2= tiff		[Custom Log File] Image file output format
		RAE	0=disabled 1=enabled		[Custom Log File] RAW data output enabled
		ACM	0=External Trigger 1=Alternate 2=Free Run 3=One Shot 4=Repeat		Trigger Mode
		ITP	16~1000		Internal trigger sampling interval
		MCE	0=disabled 1=enabled		Multi-point mapping enabled
		MAN	1~7		Number of angle light spots for multi-point mapping
		MDN	1~7		Number of displacement peaks for multi-point mapping
		MSA	1~7(displacement peak)	1 ~ 7(angle spot)	Angle light spot number for multi-point mapping

5.4.2.2 Angle

< Write Commands >

Command					Content
Type	Parameter				
	0	1	2	3	
WR	AO	EXT	0.027~2000		Sensor Camera Exposure Time
		FRA	0.1~100		Sensor Camera Frame Rate
		ROT	0 = OFF 1= Rotation right 90° 2 = Rotation right 180° 3 = Rotation right 270°		Rotation
		MHE	0=OFF 1= Horizontal Mirroring		Mirroring Horizontal
		MVE	0=OFF 1= Vertical Mirroring		Mirroring Vertical
		MAV	2~262144		Number of Averaging Times
		MAE	0=disabled、 1=enabled		Averaging Processing Enabled
		CSP	0=Origin Cursor 1=Beam Cursor		Cross Section Point
		OOX	-20~20		Origin Offset X Value
		OOY	-20~20		Origin Offset Y Value
		AAM	0= Area、 1= Luminance		Auto Aperture Method
		AAE	0=disabled、 1=enabled		Auto Aperture Enabled
		ROE	0=disabled、 1=enabled		ROI Enabled
		RAX	(- 3000 to 3000) or (- 1500 to 1500) if Binning is enabled		ROI X Value
		RAY	(- 3000 to 3000) or (- 1500 to 1500) if Binning is enabled		ROI Y Value
		RAW	(0 to 3000) or (0 to 1500) if Binning is enabled		ROI Width
		RAH	(0 to 3000) or (0 to 1500) if Binning is enabled		ROI Height
		ANT	0= Tilt Angle		Angle Type
		AJE	0=disabled、 1=enabled		Angle Judgement Enabled
		AJV	Angle judgement value (0		Angle Judgement Value

Command					Content
Type	Parameter				
	0	1	2	3	
			to 10)		
	DJE	0=disabled、 1=enabled			Divergence Judgement Enabled
	DJV	0.0000～1000.0000			Divergence Judgement Value
	BRT	0= D4Sigma or 1/e 2 1= D86			Radius Type Judgment
	EJE	0=disabled、 1=enabled			Ellipticity Judgment Enabled
	EJV	0.0000～1.0000			Ellipticity Judgement Value
	OJE	0=disabled、 1=enabled			Rotation Angle Judgement Enabled
	OJV	-90.0000～90.0000			Rotation Angle Judgement Criteria Value
	OJR	0.0000～90.0000			Rotation Angle Judgement Value Range
	PJE	0=disabled、 1=enabled			Peak Judgment Enabled
	PJV	0.0～4095.0			Peak Judgement Value
	RFP	Log File Path Strings			Log File Output Path
	IOE	0=disabled、 1=enabled			Image File Output Enabled
	RAE	0=disabled、 1=enabled			RAW Data Output Enabled
	IOC	0= Full Color 1= Gray Scale			Image File Output Color
	IOF	0= png 1= bmp 2= tiff			Image File output format
	CNM	0= Area、 1= Intensity			Beam Centroid
	ANU	0= Degree 1= DegMinSec 2= Milliradian			Angle Unit
	DNE	0=disabled、 1=enabled			Denoising Enabled
	DNT	1～4095			Denoising Threshold Value
	DAX	0～8			Number of Decimal Places for the Angle X
	DAY	0～8			Number of Decimal Places for the Angle Y
	DAD	0～8			Number of Decimal Places for the Angle D
DDS	0～8			Number of Decimal Places for the (Beam Divergence) D4Sigma or 1/e ²	

Command					Content
Type	Parameter				
	0	1	2	3	
		DDX	0~8		Number of Decimal Places for the (Beam Divergence) D4Sigma or 1/e ² X(M)
		DDY	0~8		Number of Decimal Places for the (Beam Divergence) D4Sigma or 1/e ² Y(m)
		DD8	0~8		Number of Decimal Places for the (Beam Divergence) D86
		DEL	0~8		Number of Decimal Places for the Ellipticity
		DOR	0~8		Number of Decimal Places for the Rotation Angle Measurement
		MSO	0= Area 1= Angle 2=Peak 3=Total Count		(Multi Spot) Order
		MSC	1~100		(Multi Spot) Spot Count
		MSM	1~1023		(Multi Spot) Min Spot Area
		ACE	0=disabled、 1=enabled		Adaptive Cal Execution Button Display Enabled
		BDT	0=D4Sigma 1=1/e ²		Beam Diameter Type
		DOE	0=disabled、 1=enabled		Orientation Enabled
		OCM	0= Ellipse Fitting 1= Max Distance Search		Rotation Angel Measurement Method
		BIE	0=disabled、 1=enabled		Binning Enabled
		VAA	0=disabled、 1=enabled		Auto Aperture Display
		VCC	0=disabled、 1=enabled		Centroid Cursor Display
		VCS	0=disabled、 1=enabled		Cross Section Display
		VLA	0=disabled、 1=enabled		Labeling Area Display
		VMR	0=disabled、 1=enabled		Measurement Range Display
		VOC	0=disabled、 1=enabled		Origin Cursor Display
		VSA	0=disabled、 1=enabled		Spot Area Display
		IST	0= D4Sigma or 1/e ²		Spot Area Display Type

Command					Content
Type	Parameter				
	0	1	2	3	
			1= D86		
		VRA	0=disabled、 1=enabled		ROI Area Display
		DSN	0=disabled、 1=enabled		Rotation Angle Cursor Display Enabled
		VOU	0～100		Display Spot Number
		VAX	0=disabled、 1=enabled		Angle X Result Display
		VAY	0=disabled、 1=enabled		Angle Y Result Display
		VAD	0=disabled、 1=enabled		Angle D Result Display
		VDS	0=disabled、 1=enabled		(Beam Divergence) D4Sigma or 1/e ² Result Display
		VDX	0=disabled、 1=enabled		(Beam Divergence) D4Sigma or 1/e ² X(M) Result Display
		VDY	0=disabled、 1=enabled		(Beam Divergence) D4Sigma or 1/e ² Y(m) Result Display
		VD8	0=disabled、 1=enabled		(Beam Divergence) D86 Result Display
		VEL	0=disabled、 1=enabled		Ellipticity Result Display
		VOR	0=disabled、 1=enabled		Rotation Angle Result Display
		VTC	0=disabled、 1=enabled		Total Count Result Display
		VPE	0=disabled、 1=enabled		Peak Result Display
		FAN	0= Small 1= Medium 2= Large		Font Size for the Angle
		FBD	0= Small 1= Medium 2= Large		Font Size for the Beam Divergence
		FBE	0= Small 1= Medium 2= Large		Font size for the Beam Ellipticity
		FOR	0= Small 1= Medium 2= Large		Font Size for the Rotation Angle
		FPO	0= Small 1= Medium 2= Large		Font Size for the Power
		TRM	0=disabled、 1=enabled		External Trigger Mode Enabled

Command					Content
Type	Parameter				
	0	1	2	3	
					※Support discontinued: Please use ACM.
		LDP	0～4095		LD Output Value
		LDE	0=disabled、 1=enabled		LD Output Enabled
		LAE	0=disabled、 1=enabled		Automatic Brightness Execution Enabled
		LAV	1000～3500		Automatic Brightness Peak Target Value
		LAR	100～1000		Automatic Brightness Peak Target Range
		LRV	0.05～100		Reflectance of the target
		UPV	0=disabled、 1=enabled		Adopt previous convergence values used in auto-brightness adjustment
		LSM	0=Auto 1=Low 2=Standard 3=Medium 4=High 5=User Specified		LDPW output settings used in auto-brightness adjustment
		LEI	0.100～15.000		Initial Exposure Time Value applied in the Automatic Brightness
		LEX	0.100～15.000		maximum value of exposure time applied in automatic brightness
		LEN	0.100～15.000		minimum value of Exposure time applied in the Automatic Brightness
		LLI	0～4095		LD Initial Output Value Applied in the Automatic Brightness
		LLX	0～4095		LD Maximum Output Value Applied in the Automatic Brightness
		LLN	0～4095		LD Minimum Output Value Applied in the Automatic Brightness
	SWE	0=disabled、 1=enabled		Displacement Measurement Applied in Revising Calculations Enabled	
	SWD	40～60		Working Distance Applied in Revising Calculations When the Displacement Measurement Fails	

5.4.2.3 Displacement

< Write Commands >

Command						Content
Type	Parameter					
	0	1	2	3	4	
WR	DO	EXT	0.027~2000			Sensor Camera Exposure Time
		FRA	0.1~100			Sensor Camera Frame Rate
		OOX	-20~20			Origin Offset X Value
		DJE	0=disabled 1=enabled			Displacement Judgement Enabled
		DJF	-20~20			Displacement Judgement Far Side Value
		DJN	-20~20			Displacement Judgement Near Side
		PJE	0=disabled、 1=enabled			Peak Judgment Enabled
		PJV	0.0~4095.0			Peak Judgement Value
		RFP	Log File Path Strings			Log File Output Path
		IOE	0=disabled 1=enabled			Image File Output Enabled
		RAE	0=disabled 1=enabled			RAW Data Output Enabled
		IOC	0= Full Color 1= Gray Scale			Image File Output Color
		IOF	0= png 1= bmp 2= tiff			Image File output format
		MAE	0=disabled 1=enabled			Averaging Processing Enabled
		MAV	2~262144			Number of Averaging Times
		DNE	0=disabled 1=enabled			Denoising Enabled
		DNT	1~4095			Denoising Threshold Value
		LNU	0=Millimeter 1=Micrometer			Length Unit
		MSO	0= Area			(Multi Spot) Order

Command						Content
Type	Parameter					
	0	1	2	3	4	
			1= Near 2=Far			
		MSC	1～100			(Multi Spot) Spot Count
		MSM	1～1023			(Multi Spot) Min Spot Area
		BIE	0=disabled 1=enabled			Binning Enabled
		DPD	0～8			Number of Decimal Places for the Displacement
		DPT	0～8			Decimal Places of the Thickness
		DSN	0～100			Display Spot Number
		MSE	0=disabled 1=enabled			Mask Processing Enabled
		MP1	-20～20			Mask Pos-1
		MP2	-20～20			Mask Pos-2
		VDS	0=disabled 1=enabled			Displacement Result Display
		VTM	0=disabled 1=enabled			Thickness Measurement Result Display
		VTC	0=disabled 1=enabled			Total Count Result Display
		VPE	0=disabled 1=enabled			Peak Result Display
		FDS	0= Small 1= Medium 2= Large			Font Size for the Displacement
		FTM	0= Small 1= Medium 2= Large			Font size for the Thickness
		FPO	0= Small 1= Medium 2= Large			Font Size for the Power
		TRM	0=disabled 1=enabled			External Trigger Mode Enabled
		LDP	0～4095			LD Output Value

Command						Content
Type	Parameter					
	0	1	2	3	4	
		LDE	0=disabled 1=enabled			LD Output Enabled
		LAE	0=disabled 1=enabled			Automatic Brightness Execution Enabled
		LAV	1000~3500			Automatic Brightness Peak Target Value
		LAR	100~1000			Automatic Brightness Peak Target Range
		LRV	0.05~100			Reflectance of the target
		UPV	0=disabled 1=enabled			Adopt previous convergence values used in auto-brightness adjustment
		LSM	0=Auto 1=Low 2=Standard 3=Medium 4=High 5=User Specified			LDPW output settings used in auto-brightness adjustment
		LEI	0.100~20.000			Initial Exposure Time Value applied in the Automatic Brightness
		LEX	0.100~20.000			maximum value of exposure time applied in automatic brightness
		LEN	0.100~20.000			minimum value of exposure time applied in automatic brightness
		LLI	0~4095			LD Initial Output Value Applied in the Automatic Brightness
		LLX	0~4095			LD Maximum Output Value Applied in the Automatic Brightness
		LLN	0~4095			LD Minimum Output Value Applied in the Automatic

Command						Content
Type	Parameter					
	0	1	2	3	4	
						Brightness
		BLE	0=disabled 1=enabled			Alternating Lighting Function Enabled ※Support discontinued: Please use ACM.
		BLP	10~1000			Alternating Lighting interval ※Support discontinued: Please use ITP.
		SAE	0=disabled、 1=enabled			Correction, being Revised from the Angle Measurement Results, Enabled Configuration
		SAX	-1.35~1.35			Correction, Being Revised from the Horizontal Angle if the Angle Measurement Fails, Configuration
		SAY	-1.35~1.35			Correction, Being Revised from the vertical Angle if the Angle Measurement Fails, Configuration
		TME	0=disabled、 1=enabled			Thickness Measurement Enabled Configuration
		TTS	(Measurement surface)1~6	(Measurement surface) 2~7	0=Disabled 1=Enabled	Selection of measurement surfaces for thickness measurement ※See Command Request/Response Details
		TRI	※	※		Refractive index for thickness measurement※See Command Request/Response Details

5.4.3 List of Execution Commands

5.4.3.1 Common

< Execution Commands>

Command					Content
Type	Parameter				
	0	1	2	3	
EX	SV				Save Options
	RO				Output Measurement Log
	CM	STA			Start Measurement
		STO			Stop Measurement
	ST	STA			Start Streaming
		STO			Stop Streaming
	SD				Exit application during background operation
	OS				Single measurement

5.4.3.2 Angle

<Execution Commands>

Command					Content
Type	Parameter				
	0	1	2	3	
EX	AL				Automatic Brightness for the Angle Measurement
	AR	MSN	1~100		Angle Main Spot Number Switching
	AZ				Angle Zero Set

5.4.3.3 Displacement

<Execution Commands>

Command					Content
Type	Parameter				
	0	1	2	3	
EX	DL				Automatic Brightness for the Displacement Measurement
	DR	MSN	1~100		Displacement Main Spot Number Switching
	DZ				Displacement Zero Set

5.4.4 List of Error Commands

<Error Commands>

Command					Content
Type	Parameter				
	0	1	2	3	
ER	—	1			System Error
	2				Setting Data Error
	3				Command Format Error
	4				Execution Error
	5				State Error
	7				Sensor Disconnection Error
	8				Timeout Error
	9				Unsupported

※See [Command Request/Response Details](#)

5.5 Command Request/Response Details

5.5.1 Reading

5.5.1.1 Common

Version Information

<Request>

R	D	,		V	S	CR	LF
---	---	---	--	---	---	----	----

<Response>

R	D	,	*1	,	*2	,	*3	CR	LF
---	---	---	----	---	----	---	----	----	----

*1 : Major number

*2 : Minor number

*3 : Build number

Option List Information

<Request>

R	D	,	O	L	CR	LF
---	---	---	---	---	----	----

<Response>

R	D	,	*1	,	*2	,	*3	CR	LF
---	---	---	----	---	----	---	----	----	----

*1 : Number of option lists

*2 : Option name (includes many option names as there are option lists, separated with commas)

*3 : Index indicating selected options

Custom Result Output Measurement results

<Request>

R	D	,	C	R	CR	LF
---	---	---	---	---	----	----

<Response>

R	D	,	*1	,	*2	,	*3	,	*4	,	*5	.	.	.	CR	LF
---	---	---	----	---	----	---	----	---	----	---	----	---	---	---	----	----

*1 : Frame No. (Angle)

*2 : Measurement date and time (Angle)

*3 : Frame No. (Displacement)

*4 : Measurement date and time (Displacement)

*5 : Measurement results (the measurement results selected in Custom Result under Option settings are included and separated by “,”)

Common Option

<Request>

R	D	,	C	O	,	*1	CR	LF
---	---	---	---	---	---	----	----	----

*1 : See List of Reading Commands

<Response>

R	D	,	*1	CR	LF
---	---	---	----	----	----

*1 : Currently configured option settings (See List of Reading Commands)

5.5.1.2 Angle

Measurement results

<Request>

R	D	,	D	R	CR	LF
---	---	---	---	---	----	----

<Response>

R	D	,		*1	,	*2	,	*3	.	.	.	*16	,		*17	CR	LF
---	---	---	--	----	---	----	---	----	---	---	---	-----	---	--	-----	----	----

*1: Tilt Angle: Angle X measurement value

*2: Tilt Angle: Angle Y measurement value

*3: Tilt Angle: Angle D measurement value

*4: Beam Divergence: D4Sigma or $1/e^2$ measurement value

*5: Beam Divergence: D4Sigma X(M) or $1/e^2$ X(M) measurement value

*6: Beam Divergence: D4Sigma Y (m) or $1/e^2$ Y(m) measurement value

*7: Beam Divergence: D86 measurement value

*8: Beam Ellipticity measurement value

*9: Beam: Total count value

*10: Beam: Peak value

*11: Judgement: Tilt angle (D) judgement result (OK / NG)

*12: Judgement: Beam divergence judgement result (OK / NG)

*13: Judgement: Ellipticity judgement result (OK / NG)

*14: Judgement: Peak judgement result (OK / NG)

*15: Angle Unit (degree / DegMinSec / milli-radian)

*16: Orientation Measurement value

*17: Orientation Judgement result (OK / NG)

Multi Spot Measurement Results

<Request>

R	D	,	A	R	,	M	L	T	,	*1	,	*2	CR	LF
---	---	---	---	---	---	---	---	---	---	----	---	----	----	----

*1 : Acquisition Start Spot Number (1 to 100)

*2 : Consecutive Spot Count to Read from *1 (1 to 100)

<Response>

R	D	,	*3	,	*4	,	*5	.	.	.	*19	*20	CR	LF
---	---	---	----	---	----	---	----	---	---	---	-----	-----	----	----

*3: Tilt Angle: Angle X measurement value

*4: Tilt Angle: Angle Y measurement value

*5: Tilt Angle: Angle D measurement value

*6: Beam Divergence: D4Sigma or $1/e^2$ measurement value

*7: Beam Divergence: D4Sigma X(M) or $1/e^2$ X(M) measurement value

*8: Beam Divergence: D4Sigma Y (m) or $1/e^2$ Y(m) measurement value

*9: Beam Divergence: D86 measurement value

*10: Beam Ellipticity measurement value

*11: Beam: Total Count value

*12: Beam: Peak value

*13: Judgement: Tilt Angle (D) judgement result (OK / NG)

*14: Judgement: Beam Divergence judgement result (OK / NG)

*15: Judgement: Ellipticity judgement result (OK / NG)

*16: Judgement: Peak judgement result (OK / NG)

*17: Angle Unit (degree / DegMinSec / milli-radian)

*18: Orientation measurement value

*19: Judgement : Orientation judgement result (OK / NG)

*20: Measurement Results of *3 to *19 specified in *2 (The specified number of results will be included, separated by “,”)

Multi Spot Measurement Spot Number

<Request>

R	D	,	A	R	,	A	S	C	CR	LF
---	---	---	---	---	---	---	---	---	----	----

<Response>

R	D	,	*1	CR	LF
---	---	---	----	----	----

*1 : Number of measured Spot Count (0 to 100)

Auto Brightness Control Status

<Request>

R	D	,	A	S	,	L	A	S	CR	LF
---	---	---	---	---	---	---	---	---	----	----

<Response>

R	D	,	*1	CR	LF
---	---	---	----	----	----

*1 : Dimming status

("0" = dimming complete, "1" = dimming in process, "2" = dimming failed, "3" = dimming not started)

Angle Option

<Request>

R	D	,	A	O	,	*1	CR	LF
---	---	---	---	---	---	----	----	----

*1 : See List of Reading Commands

<Response>

R	D	,	*1	CR	LF
---	---	---	----	----	----

*1 : Currently configured option settings (See List of Reading Commands)

5.5.1.3 Displacement

Measurement Results

<Request>

R	D	,	D	R	CR	LF
---	---	---	---	---	----	----

<Response>

R	D	,	*1	,	*2	,	*3	.	.	.	*8	,		*9	CR	LF
---	---	---	----	---	----	---	----	---	---	---	----	---	--	----	----	----

*1: Displacement: Displacement measurement value

*2: Thickness measurement results: Layers 1 to 2

*3: Thickness measurement results: Layers 2 to 3

*4: Beam: Total Count value

*5: Beam: Peak value

*6: Judgement: Displacement judgement result (OK / NG)

*7: Judgement: Peak judgement result (OK / NG)

*8: Accuracy guaranteed range judgement result (OK / NG)

*9: Unit of distance (millimeter/micrometer)

Multi Spot Measurement Results

<Request>

R	D	,	D	R	,	M	L	T	,	*1	,	*2	CR	LF
---	---	---	---	---	---	---	---	---	---	----	---	----	----	----

*1 : Acquisition of the first Spot number (1 to 100)

*2 : Spot number continuously read from *1 (1 to 100)

<Response>

R	D	,	*3	,	*4	,	*5	.	.	.	*11	*12	CR	LF
---	---	---	----	---	----	---	----	---	---	---	-----	-----	----	----

*3: Displacement: Displacement measurement value

*4: Thickness measurement results: Layer 1 to 2

*5: Thickness measurement results: Layer 2 to 3

*6: Beam: Total Count value

*7: Beam: Peak value

*8: Judgement: Displacement judgement result (OK / NG)

*9: Judgement: Peak judgement result (OK / NG)

*10: Accuracy guaranteed range judgment result (OK / NG)

*11: Distance unit (millimeter/micrometer)

*12: *3 to *11 measurement results for the number specified in *2 (specified number of measurement results, separated with “”)

Multi Spot Measurement Spot Number

<Request>

R	D	,	D	R	,	D	S	C	CR	LF
---	---	---	---	---	---	---	---	---	----	----

<Response>

R	D	,	*1	CR	LF
---	---	---	----	----	----

* 1 : Measured spots (0 to 100)

Auto Brightness Control Status

<Request>

R	D	,	D	S	,	L	A	S	CR	LF
---	---	---	---	---	---	---	---	---	----	----

<Response>

R	D	,	*1	CR	LF
---	---	---	----	----	----

*1 : Dimming status ("0" = dimming complete, "1" = dimming in process, "2" = dimming failed, "3" = dimming not started)

Displacement Option

<Request>

R	D	,	D	O	,	*1	,	*2	,	*3	CR	LF
---	---	---	---	---	---	----	---	----	---	----	----	----

*1,*2,*3 : See List of Reading Commands

<Response>

R	D	,	*1	CR	LF
---	---	---	----	----	----

*1 : Currently configured option settings (See [List of Reading Commands](#))

5.5.2 Writing

5.5.2.1 Common

Option List

<Request>

W	R	,	O	L	,	*1	CR	LF
---	---	---	---	---	---	----	----	----

*1 : Option list Index number

<Response>

W	R	CR	LF
---	---	----	----

Common Option

<Request>

W	R	,	C	O	,	*1	,	*2	,	*3	CR	LF
---	---	---	---	---	---	----	---	----	---	----	----	----

*1,*2,*3 : See [List of Writing Commands](#)

<Response>

W	R	CR	LF
---	---	----	----

5.5.2.2 Angle

Angle Option

<Request>

W	R	,	A	O	,	*1	,	*2	CR	LF
---	---	---	---	---	---	----	---	----	----	----

*1,*2 : See List of Writing Commands

<Response>

W	R	CR	LF
---	---	----	----

5.5.2.3 Displacement

Displacement Option

<Request>

W	R	,	D	O	,	*1	,	*2	,	*3	,	*4	CR	LF
---	---	---	---	---	---	----	---	----	---	----	---	----	----	----

*1,*2,*3,*4 : See List of Writing Commands

<Response>

W	R	CR	LF
---	---	----	----

■ Selection of measurement surfaces for thickness measurement

<Request>

W	R	,	D	O	,	T	T	S	,	*1	,	*2	,	*3	CR	LF
---	---	---	---	---	---	---	---	---	---	----	---	----	---	----	----	----

*1 : 1~6

*2 : 2~7

*3 : "0"=Disabled、"1"=Enabled

Request Example :

When enabling measurement surfaces of "Surface 1-7" . . . **WR,DO,TTS,1,7,1<CR><LF>**

<Response>

W	R	CR	LF
---	---	----	----

■ Refractive index for thickness measurement

<Request>

W	R	,	D	O	,	T	R	I	,	※1	,	※2	CR	LF
---	---	---	---	---	---	---	---	---	---	----	---	----	----	----

※1 : 1~7

- 1 : Sensor to Surface 1
- 2 : Surface 1 to Surface 2
- 3 : Surface 2 to Surface 3
- 4 : Surface 3 to Surface 4
- 5 : Surface 4 to Surface 5
- 6 : Surface 5 to Surface 6
- 7 : Surface 6 to Surface 7

※2 : 0.000001~5.000000

Request Example :

When setting refractive index surfaces of" Surface 2 to Surface 3" to 0.01 . . .

WR,DO,TRI,3,0.01<CR><LF>

<Response>

W	R	CR	LF
---	---	----	----

5.5.3 Execution

5.5.3.1 Common

Option Save

<Request>

E	X	,	S	V	CR	LF
---	---	---	---	---	----	----

<Response>

E	X	CR	LF
---	---	----	----

Measurement Results Log Output

<Request>

E	X	,	R	O	CR	LF
---	---	---	---	---	----	----

<Response>

E	X	CR	LF
---	---	----	----

Measurement Start / Stop

<Start Request>

E	X	,	C	M	,	S	T	A	CR	LF
---	---	---	---	---	---	---	---	---	----	----

<Stop Request>

E	X	,	C	M	,	S	T	O	CR	LF
---	---	---	---	---	---	---	---	---	----	----

<Response>

E	X	CR	LF
---	---	----	----

Streaming Start / Stop

<Start Request>

E	X	,	S	T	,	S	T	A	CR	LF
---	---	---	---	---	---	---	---	---	----	----

<Stop Request>

E	X	,	S	T	,	S	T	O	CR	LF
---	---	---	---	---	---	---	---	---	----	----

<Response>

E	X	CR	LF
---	---	----	----

Application Close (Background Operation)

<Request>

E	X	,	S	D	CR	LF
---	---	---	---	---	----	----

<Response>

E	X	CR	LF
---	---	----	----

Single Measurement

<Request>

E	X	,	O	S	CR	LF
---	---	---	---	---	----	----

<Response>

E	X	CR	LF
---	---	----	----

5.5.3.2 Angle

Auto Brightness Control (Tune)

<Request>

E	X	,	A	L	CR	LF
---	---	---	---	---	----	----

<Response>

E	X	CR	LF
---	---	----	----

Main Spot Number Switch

<Request>

E	X	,	A	R	,	M	S	N	,	※1	CR	LF
---	---	---	---	---	---	---	---	---	---	----	----	----

※1 : Main Spot Number(1~100)

<Response>

E	X	CR	LF
---	---	----	----

Zero Set

<Request>

E	X	,	A	Z	CR	LF
---	---	---	---	---	----	----

<Response>

E	X	CR	LF
---	---	----	----

5.5.3.3 Displacement

Auto Brightness Control (Tune)

<Request>

E	X	,	D	L	CR	LF
---	---	---	---	---	----	----

<Response>

E	X	CR	LF
---	---	----	----

Main Spot Number Switch

<Request>

E	X	,	D	R	,	M	S	N	,	※1	CR	LF
---	---	---	---	---	---	---	---	---	---	----	----	----

※1 : Main Spot Number(1~100)

<Response>

E	X	CR	LF
---	---	----	----

Zero Set

<Request>

E	X	,	D	Z	CR	LF
---	---	---	---	---	----	----

<Response>

E	X	CR	LF
---	---	----	----

5.5.4 Error Commands

When a command was not successfully received or could not be executed, the Products will return error information in the following format.

<Error Response>

E	X		,	*1	CR	LF
---	---	--	---	----	----	----

The error codes appear in *1 as below.

"-1": System Error

- The command could not be processed successfully. (Please contact support.)

"2": Setting Data Error

- Value outside setting range was set.

"3": Command Format Error

- Number of commas from header to [CRLF] does not match.
- Command not in command list, or non-alphanumeric characters.
- Text after header includes characters not in list above.

"4": Execution Error

- The command could not be executed successfully.

"5": State Error

- The command cannot be accepted due to the current configuration or operating state.

"7" : Sensor Disconnection Error

- Communication with the sensor was lost.

"8" : Timeout Error

- Processing was not completed within the specified time.

"9" : Unsupported

- Support has ended.

6 System Log

6.1 System Log List

System Log	Content
Angle view initialize succeeded	Angle screen initialization was successful. Measurement starts normally
Displacement view initialize succeeded	Displacement screen initialization was successful. Measurement starts normally
Angle view initialize failed. Please check the connection with the Suruga OptGauge.	Angle screen initialization failed. Check the sensor head and computer connection.
Displacement view initialize failed. Please check the connection with the Suruga OptGauge.	Initializing Displacement screen failed. Check the connection between this product and the computer.
Angle result output succeeded	By pressing the [Output Once] button icon, it executes the output of the Angle measurement results, successfully.
Displacement result output succeeded	By pressing the [Output Once] button icon, it executes the output of the displacement measurement results, successfully
Angle result output failed	Measurement results output with [Output Once] button failed.
Displacement result output failed	By pressing the [Output Once] button icon, it failed the output of the displacement measurement results
Adaptive Cal succeeded	Adaptive calibration with [Adaptive Cal] button was successful
Adaptive Cal failed	Adaptive Cal with [Adaptive Cal] button failed
It is necessary to block the light	Adaptive Cal failure: Block the light
[WARN] Interlock detected. LD turned OFF. Check the external equipment's interlock condition.	The LD was turned OFF because an interlock was detected. Please check the interlock conditions on your equipment.
[INFO] Interlock cleared. LD remains OFF. User action is required to enable the LD.	The interlock has been released. The LD remains OFF. Please turn the LD ON as needed.
Measurement result timeout: incomplete results for Frame ID=xxx (timeout = 1500 ms).	Among the measurement results for Frame ID = xx, the calculation process for synchronization did not complete within 1500 ms. The measurement process may be taking too long. Please review the measurement conditions and other related settings.

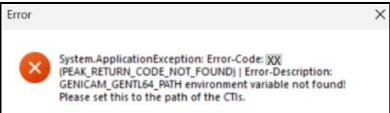
6.2 Error Messages and Countermeasures

Error message	Cause	Countermeasure
Angle view initialize failed. Please check the connection with the Suruga OptGauge.	The Product and computer are not connected.	Check that the Product and computer are connected and restart the Suruga OptGauge.
Displacement view initialize failed. Please check the connection with the Suruga OptGauge.		If this error is repeatedly generated, the Product interior camera may not be working properly. Contact the Suruga Seiki Optical Device Business Division Sales Section.
Angle result output failed.	Measurement results output file (.csv) is open.	Please close the measurement results output file (.csv) if opened and execute outputting measurement results.
Displacement result output failed.		
Adaptive Cal failed. It is necessary to block the light.	Because the light is not blocked, the Adaptive Cal cannot be executed.	Check that the beam is not incoming to the Products. Also, make sure before measurement that there is no unwanted exterior light or other laser light source interfering with the sensor.

7 Failures? Frequently Asked Questions

7.1 Symptoms and Countermeasures

Useful information for troubleshooting is listed below. Check if the table below shows your trouble.

Symptom	Cause	Countermeasure
Internal light source power is NOT turned on.	AC adapter or power cable is not correctly connected.	DC12V is not supplied.
	DC12V is not supplied.	Correctly connect the DC12V power source.
Application does not start.	USB cable is not correctly connected.	Connect the USB cable to the USB3.0 port.
	Device authentication file is not being read.	Read: device authentication file (.suruga) corresponding to the purchased the Product.
The following message appears when starting this software and it cannot be launched: 	The camera driver may not be installed.	Please install the camera driver. (Installation of the USB device driver) After installation, please restart your PC.
Application stops during startup	With Windows 11 Version 23H2, due to differences in some system components and specifications, the Software may not function properly.	Please update to the latest Windows version (24H2 or later).
	USB cable disconnected.	Close the application, connect the USB cable correctly, and restart the application.
Beam is not displayed on screen	The LD is not turned ON.	Turn ON the LD in the software settings.
	Exposure Time is too short.	Adjust the Exposure Time to the optimal speed.
	Large tilt on the target.	Adjust the tilt angle of the target so that the reflected light beam enters within a viewing range.
Measurement target centroid	Noise is causing serious	Enable the Threshold in the

is unstable	effects	Denoising settings and adjust the threshold.
The detected peak is unstable, causing large fluctuations in the measurement value.	Small signals or noise may be detected as measurement targets depending on the sorting setting.	Set the Order setting to "Area" or "Peak".
	Noise may be detected as a measurement target because the Denoising Threshold setting is too low.	Enable the Threshold in the Denoising settings and adjust the threshold.
RS232C communication is not working	RS232C cable is not correctly connected	Correctly connect RS232C cable.
	Computer communication conditions are not set correctly.	Set the communication settings correctly on the PC.
TCP/IP communication is not working	Ethernet cable is not correctly connected.	Correctly connect the Ethernet cable.
	Computer communication conditions are not met correctly.	Set the communication settings correctly on the PC.

8 Warranty - After-Sales Service

8.1 Warranty Terms, Conditions and Coverage

- Before contacting us, please confirm the serial number of the individual product.
- The warranty period is one year after delivery.
- However, the following cases are not covered by the warranty and will be repaired for a fee.
 - Failure or damage caused by misuse, modification or repair by someone other than the company's designated persons from us.
 - Failure or damage caused by improper handling, such as dropping the Products during transportation or moving.
 - Failure or damage caused by fire, salt damage, gas damage, abnormal voltage, earthquake, lightning, wind, flood, or other natural disasters
 - In the event of a malfunction or damage caused by improper handling contrary to the methods and precautions described in the instruction manual.

We reserve the right to revise, modify, or amend these Warranty Terms and Conditions (hereinafter referred to as "Revisions, etc."), and in the event of such revisions, etc., we shall promptly post the revised Warranty Terms and Conditions in this catalog or on our website (<http://jpn.surugaseiki.com/>). If you place an order for the Products after such revision, you shall be deemed to have accepted the revision.

8.2 After-Sales Service

Before requesting repair, please check the items in "[Failures? Frequently Asked Questions](#)". If you have any questions, please contact our Optical Instruments Division Sales Department.

<During the Warranty Period>

When damage occurs under a normal use state following the cautions/warnings/notes written in this manual, the SURUGA conducts a repair service for free. For any damages out of warranty period mentioned above, the SURUGA charges a fee for any repair service.

<After the Warranty Period>

A repair service is available with a fee to maintain the functionalities of the Products up on your requests.

< If repair is required>

For repair and calibration inquiries, please contact to the following address.

info@suruga-g.co.jp

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