



The Suruga OptGauge

User's Manual

H651 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.

1 Index

1 Introduction	5
1.1 Warning labels addressed in this Manual	7
1.2 Overview of Suruga OptGauge	7
1.3 Software - Installation of the Suruga OptGauge	9
1.3.1 Software License	9
1.3.2 Installation PC System Requirements	11
1.3.3 Installation of the USB Device Driver	12
1.3.4 Installation of the Suruga OptGauge	13
1.3.5 Copying the Device Authentication File	14
1.3.6 Starting Up and Closing the Suruga OptGauge	15
1.3.7 Quick Start	18
1.4 Notes on Version Upgrades	19
2 Screen Components	20
2.1 Main screen	20
2.1.1 Angle View	22
2.1.2 Profile View	25
2.2 Option Settings	28
3 How to Use the Functions	29
3.1 Common	29
3.1.1 Measurement Start/Stop	29
3.1.2 Trigger Mode	30
3.1.3 Custom Log Output	35
3.1.4 Measurement Result Streaming Output	38
3.1.5 Background Operation	41
3.1.6 Zoom In	44
3.2 Angle View	45
3.2.1 Angle Measurement	45
3.2.2 Divergence	46
3.2.3 Beam Centroid	47
3.2.4 Beam Ellipticity	49
3.2.5 Rotation Angle	51
3.2.6 Judgement	53
3.2.7 Adaptive Cal	57
3.2.8 Aperture	59
3.2.9 Origin Offset	61
3.2.10 Multi Spot	63

3.2.11 Automatic Brightness Control	66
3.3 Profile View	72
3.3.1 Beam Centroid	72
3.3.2 Beam Diameter	73
3.3.3 Beam Ellipticity	74
3.3.4 Rotation Angle Measurement	75
3.3.5 Line Position Measurement	77
3.3.6 Judgement	80
3.3.7 Adaptive Cal	80
3.3.8 Aperture.....	82
3.3.9 Origin Offset	82
3.3.10 Multi Spot	82
3.3.11 Automatic Brightness Control	82
4 Option	83
4.1 Names and Functions of Each Option	83
4.1.1 Angle	83
4.1.2 Profile	96
4.1.3 Communication	108
4.1.4 Common.....	109
4.2 Option List	112
4.2.1 Switching Option Lists.....	112
4.2.2 Registering Option Lists.....	113
4.2.3 Deleting Option Lists.....	114
5 Controlling from External Devices.....	115
5.1 RS232C	115
5.1.1 Communication Specifications.....	115
5.1.2 Example: Connections via the RS232C Communication	116
5.1.3 Communication Commands Setting Method	118
5.2 TCP/IP	119
5.2.1 Communication Specifications.....	119
5.2.2 Example: Connections via TCP/IP Communication	120
5.2.3 Command Communication Setting Method.....	123
5.3 Command Format	128
5.4 Command List	129
5.4.1 List of Reading Commands.....	129
5.4.2 List of Write Commands.....	141
5.4.3 List of Execution Commands	153
5.4.4 List of Error Commands	154

5.5	Command Request/Response Details	155
5.5.1	Reading	155
5.5.2	Writing	165
5.5.3	Execution	167
5.5.4	Error Commands	171
6	System Log	172
6.1	System Log List	172
6.2	Error Messages and Countermeasures	173
7	Failures? Frequently Asked Questions	174
7.1	Symptoms and Countermeasures	174
8	Warranty - After-Sales Service	176
8.1	Warranty Terms, Conditions and Coverage	176
8.2	After-Sales Service	176

1 Introduction

This document is the user's manual for the companion software, "Suruga OptGauge", with the measuring

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.

[COPYRIGHT]

Copyright © SURUGA SEIKI Co. Ltd. All rights reserved.

The Suruga OptGauge User's manual

Issue Date	2026 June
Guide Version	004E

Revision History

Date	Revision	Details
2024 January	001E	1 st Version
2025 July	002E	Installation PC System Requirements: - Remove "Pro" - Add Windows 11 version - Add note stating it may not function correctly depending on version Symptoms and Solutions: Add details of issues where it may not function correctly depending on the Windows version and their countermeasures
2025 September	003E	Add function: • 1/e2, Orientation, Line Position Add functions for H651: • LD output value setting • LD output setting for use with auto-dimming • External trigger mode

2026. June	004E	Suruga OptGauge Ver.1.3.7 Support Instructions for using functions have been migrated from the "User's Manual," and the following features have been added: • Measurement Start/Stop • Trigger Mode • Custom Log Output • Measurement Result Streaming Output • Background Operation Feature Enhancements • Added brightness adjustment methods and LDPW selection settings for Angle Auto Brightness Control 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 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 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 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 4-core 8-thread
	RAM	8GB 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

*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 we acknowledge that this 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).

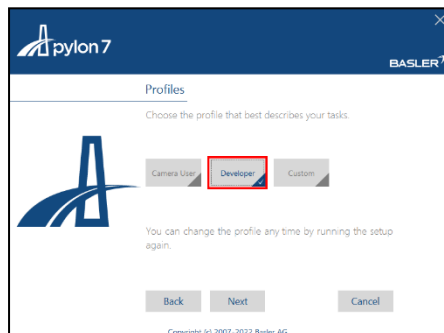
1.3.3 Installation of the USB Device Driver

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

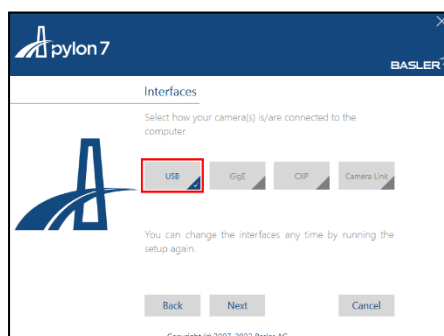


2. Consent to your installation on the confirmation screen.

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.



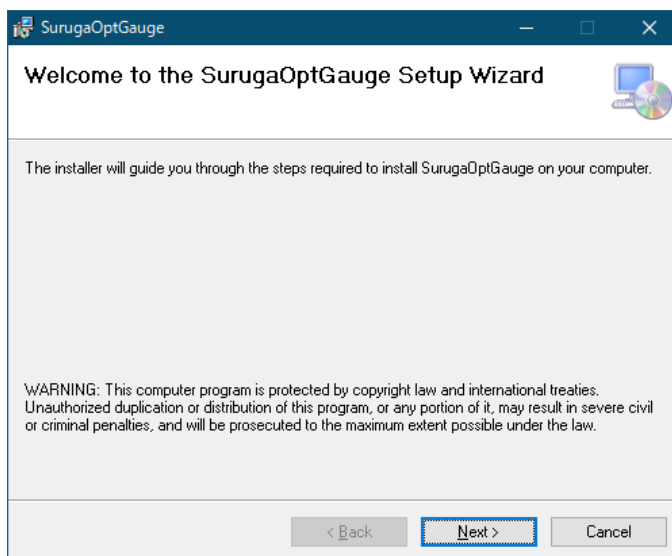
1.3.4 Installation of the Suruga OptGauge

Install the Software, the Suruga OptGauge.

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

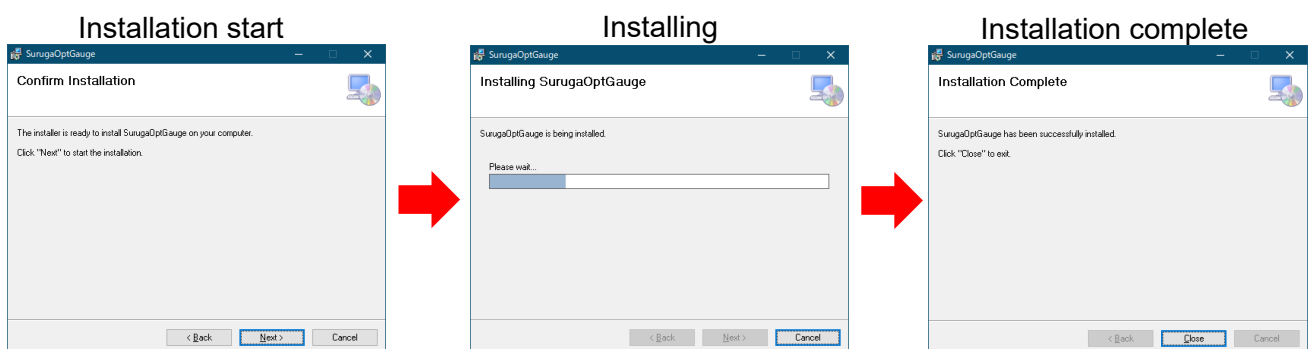
名前	更新日時	種類	サイズ
 SurugaOptGaugeSetup_x.x.x.msi	2023/11/28 19:12	Windows インストー...	61,590 KB

2. Click "Next>".



Click "Next>" to begin installation.

When installation is complete, click "Close".



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



1.3.5 Copying the Device Authentication File

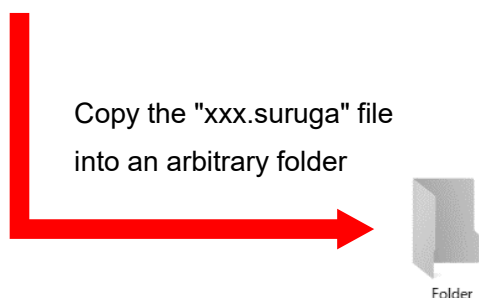
Attention

About Authentication File

For the Products, calibration values are set for each unit. 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 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.

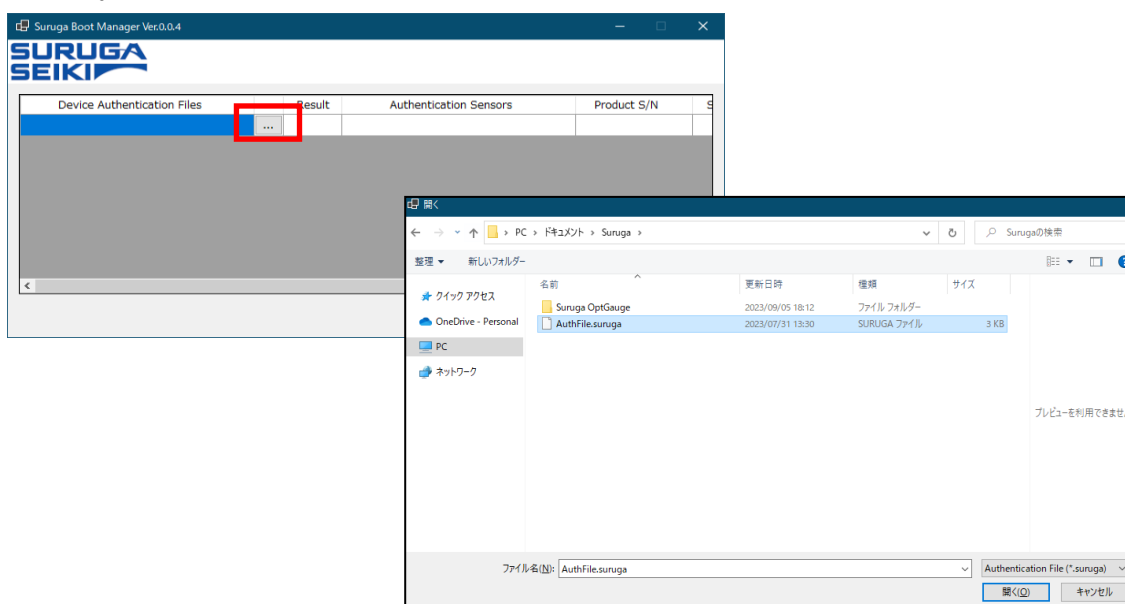
1.3.6 Starting Up and Closing the Suruga OptGauge

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

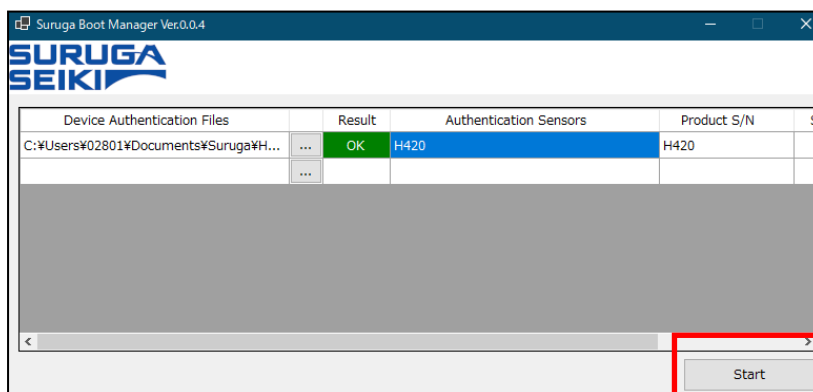


2. Click on "..." in the item "Device Authentication File" and select the extension ".suruga" in the folder in which the unique "Device Authentication File" was copied.

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

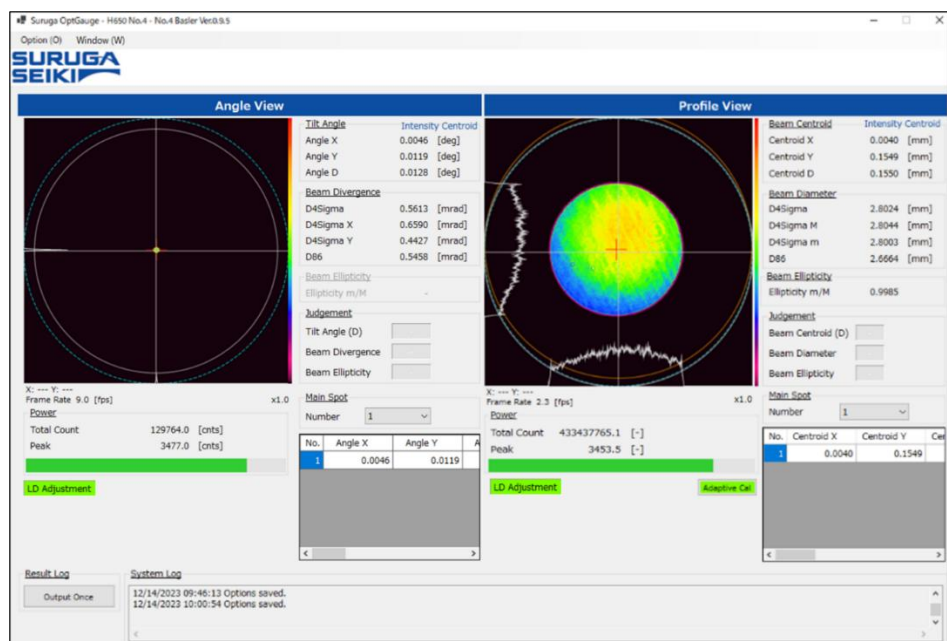
The Software incorporates TCP/IP communication control. Therefore, depending on your PC's security settings, the following warning may appear upon initial startup.

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").

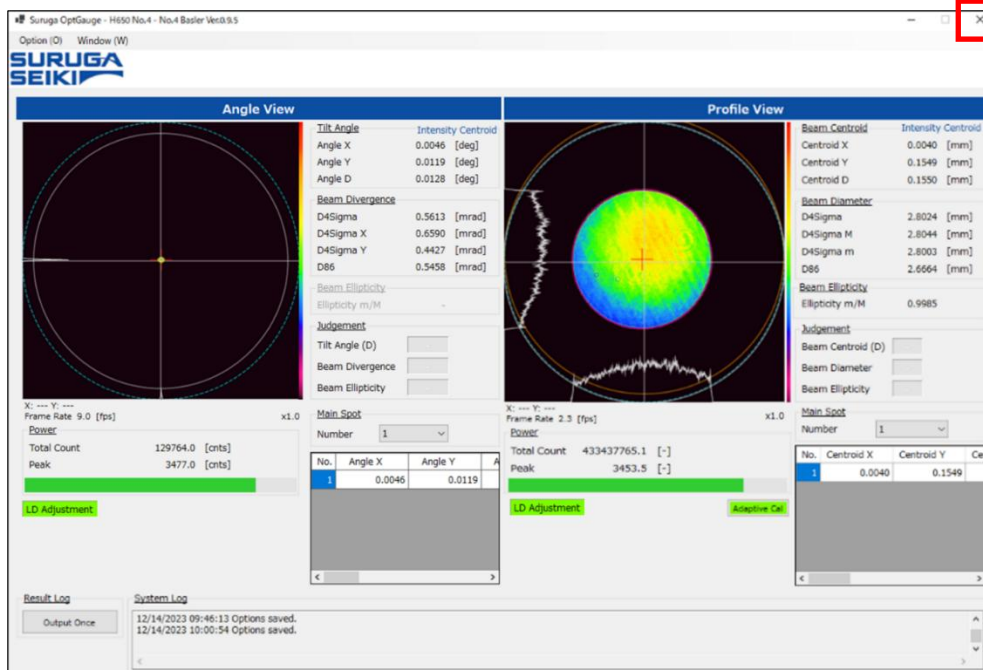


4. The application starts up.



Closing the Suruga OptGauge

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

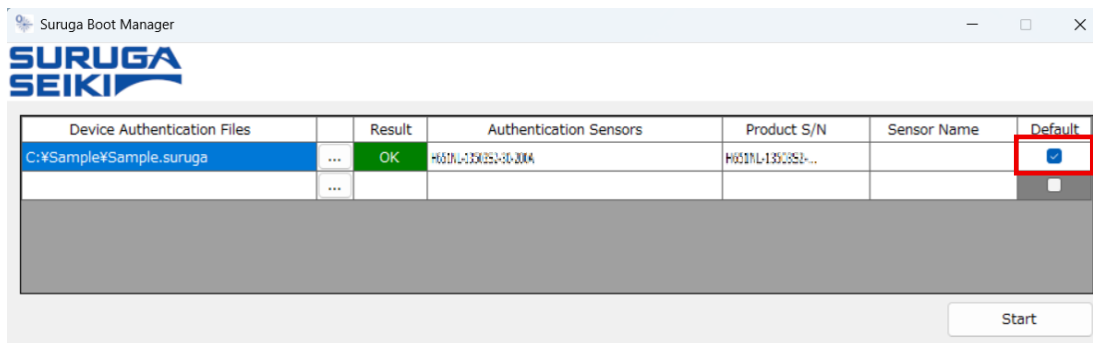


1.3.7 Quick Start

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

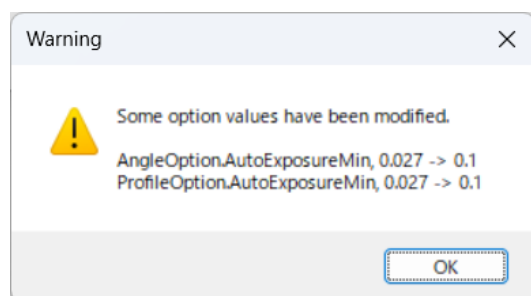
Even if Quick Start is enabled, you can still open the Boot Manager by starting the software while holding down the Shift key (hold down the Shift key until the Boot Manager screen appears).

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

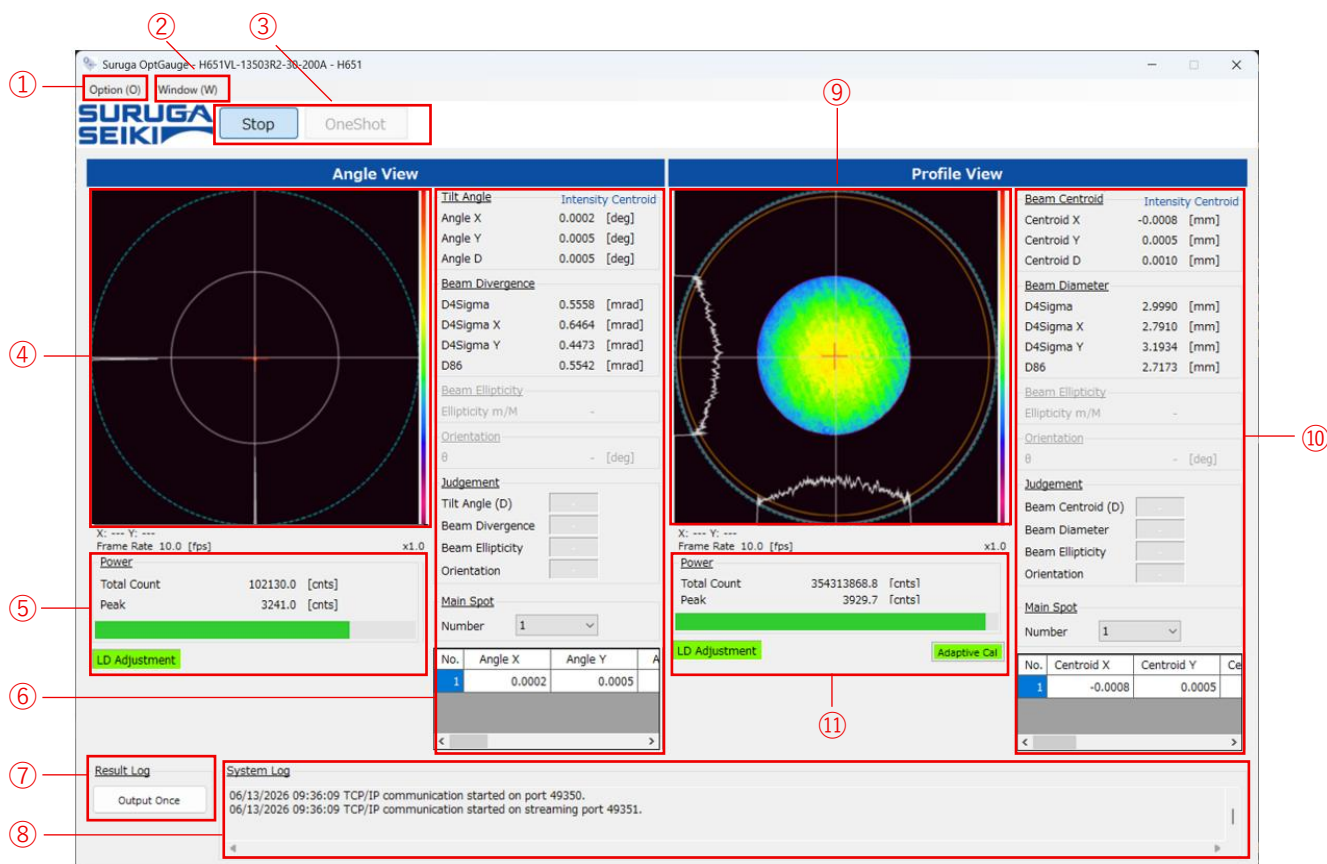
- Normally, you can continue using the software as usual.
- If necessary, please readjust the exposure time or dimming settings.

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

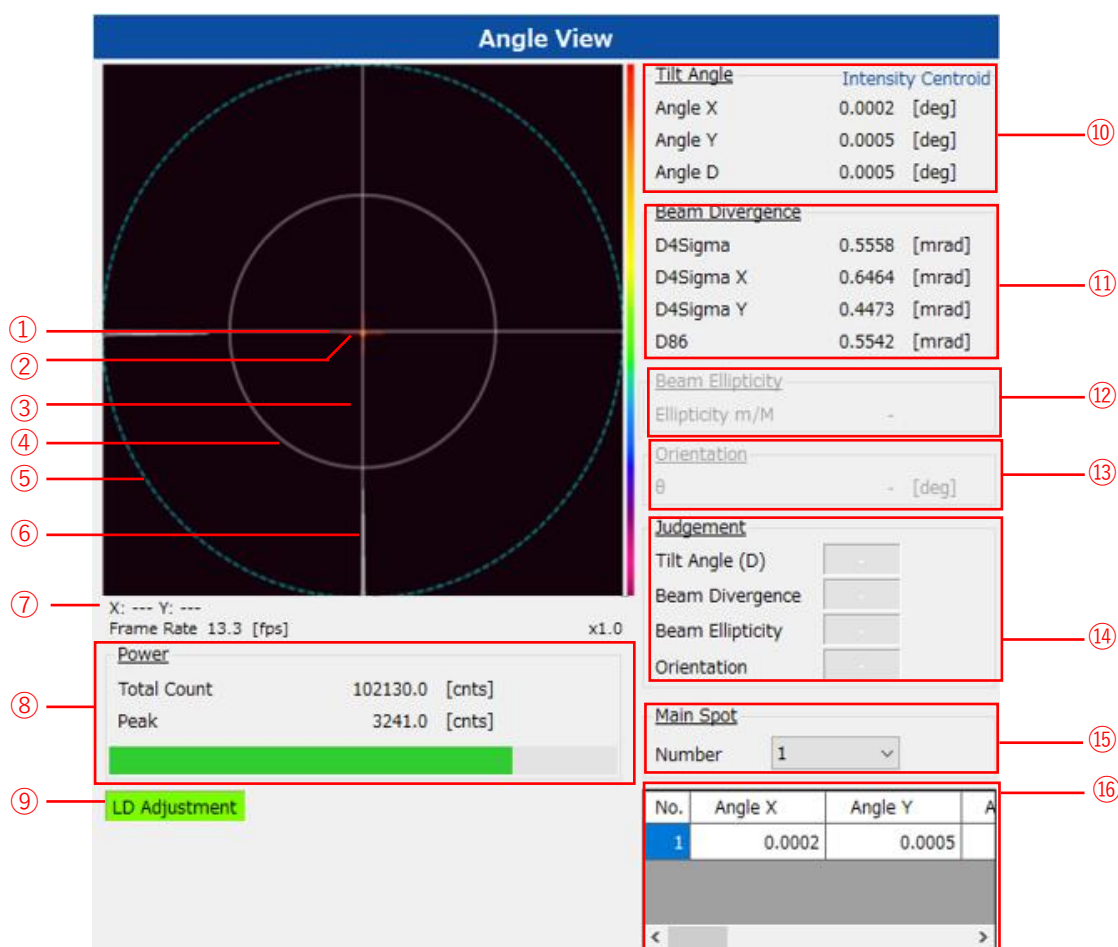
2.1 Main screen



① Option	Opens the option dialog box
② Window	Opens the device authentication dialog box
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 section
⑤ Angle Power	Display area for beam strength measured by the angle sensor camera section
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 Profile View	Display area for an image taken by the profile sensor camera section

⑩ Profile Measurement Results Display	Profile measurement results display area
⑪ Profile Power	Display area for beam strength measured by the profile sensor camera section

2.1.1 Angle View

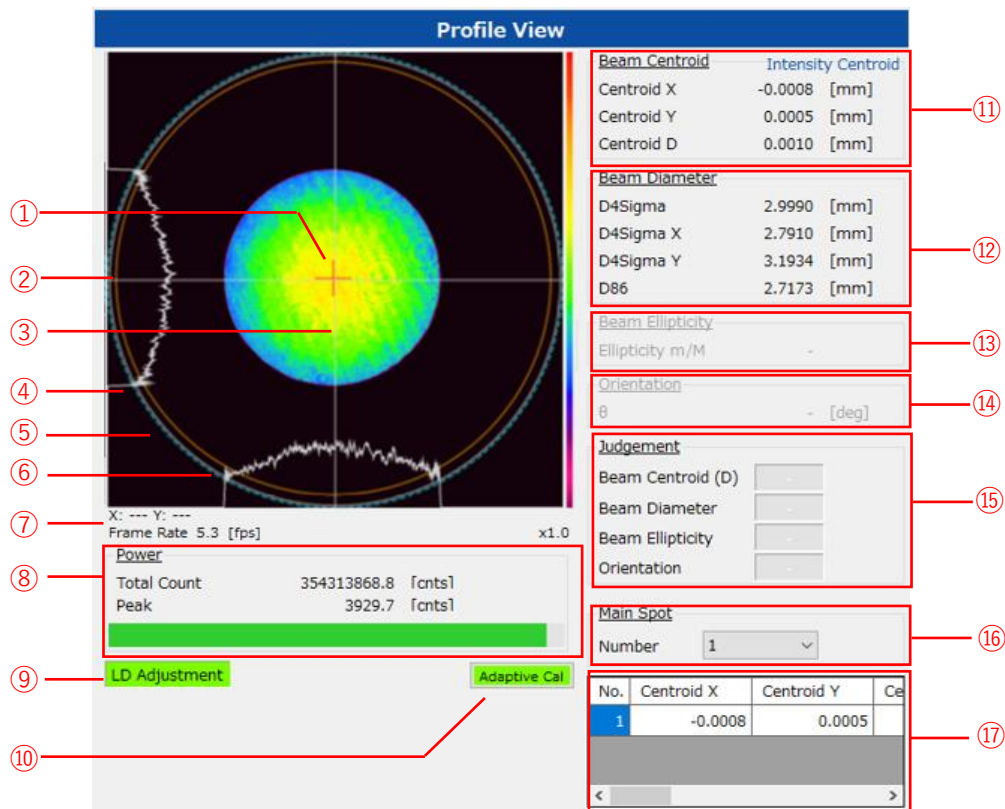


① Cross(red)		Displays the position of the light beam centroid.
② Auto Aperture (orange)		Displays the aperture if the Auto Aperture settings are enabled
③ Cross (white)		Displays the center position of the coordinate
④ Aperture (white)		Displays the range of angle measurement
⑤ ROI (blue)		Displays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

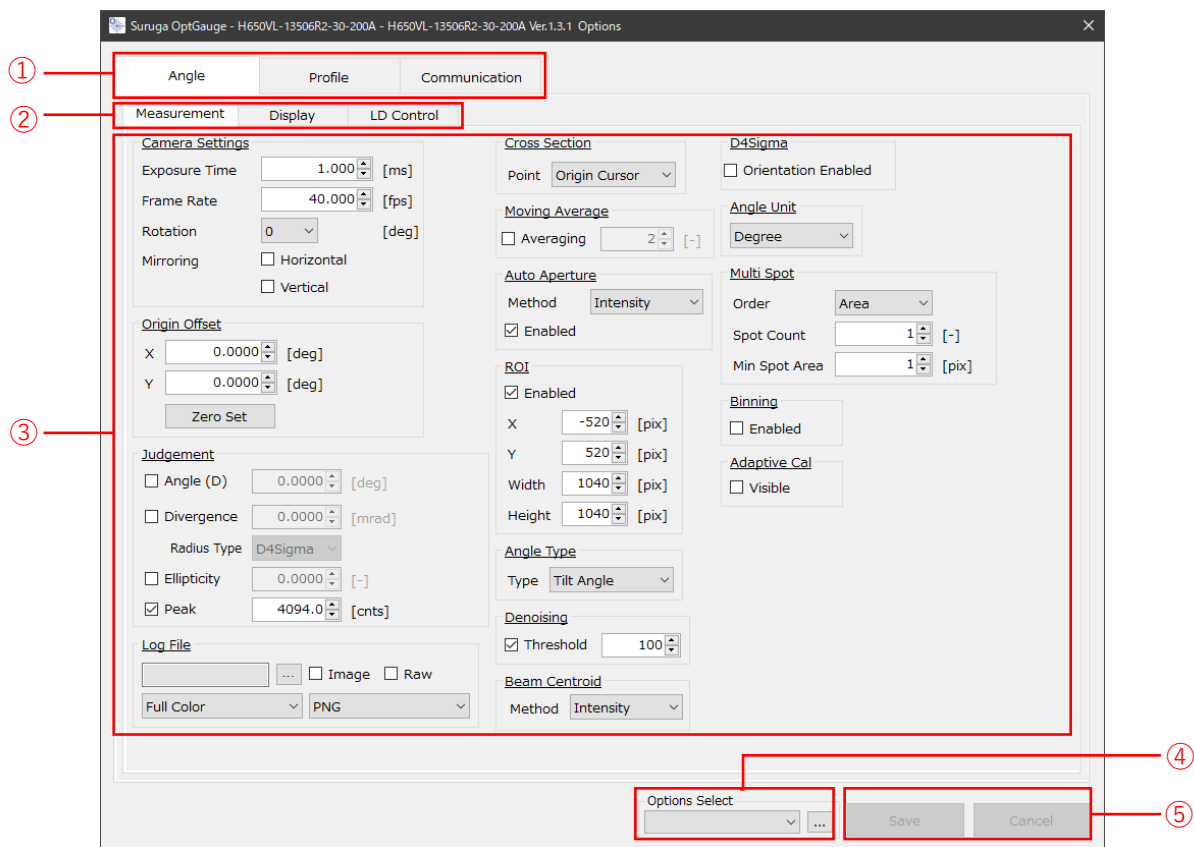


① Cross (red)		Displays beam center position
② Auto Aperture (orange)		Displays the aperture while the Auto Aperture setting is enabled
③ Cross (white)		Displays a coordinate center position
④ Aperture (white)		Displays the range of profile measurement
⑤ ROI (blue)		Displays the aperture if the ROI is enabled
⑥ Profile		Displays the strength distribution of a light beam

⑦ XY Orientation	Displays the coordinates where the mouse cursor pointing 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 counts 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 brightness function (Green: Pass, Yellow : Under adjusting and Red : Fail)	
⑩ Adaptive Cal	Improve calculation accuracy by removing overall noise from an image captured by the sensor	
⑪ Beam Centroid	Centroid X	The centroid X centered at the X-axis component of the cross (white).
	Centroid Y	The centroid Y centered at the Y-axis component of the cross (white)
	Centroid D	The centroid centered at the cross (white).
⑫ Beam Diameter	If the " Orientation " setting in the option menu is enabled, it alters the measurement mode	
	If the " Type " setting in the Beam Diameter is D4Sigma, it displays the following:	
	D4Sigma	Displays $D4\sigma$ beam diameter.
	D4Sigma X(M)	Displays $D4\sigma X(M)$ beam width.
	D4Sigma Y(m)	Displays $D4\sigma Y(m)$ beam width.
	If the " Type " setting in the Beam Diameter is $1/e^2$, it displays the following:	
	$1/e^2$	Displays the $1/e^2$ beam diameter.
	$1/e^2 X(M)$	Displays the $1/e^2 X(M)$ beam width.
	$1/e^2 Y(m)$	Displays the $1/e^2 Y(m)$ beam width.
	D86	Displays D86 beam width beam diameter
⑬ Line Position	Operates while the " Image Processing Mode " in the option settings is enabled.	
	Line X	Displays the linear position X centered on the X-axis

		component of the crosshair (white).
	Line Y	Displays the linear position Y centered on the Y-axis component of the crosshair (white).
⑬ Beam Ellipticity	Operates while Orientation Enabled in the option settings is checked.	
	Ellipticity m/M	Displays ellipticity of $D4\sigma$ or $1/e^2$ beam width
⑭ Orientation	Operates while the Orientation setting in the options menu is enabled	
	θ	Displays the rotation angle of the beam
⑮ 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 .	
	Beam Centroid (D)	Displays "OK" when the set judgement criteria are satisfied and "NG" if not.
	Beam Diameter	
	Beam Ellipticity	
	Orientation	
⑯ Main Spot	Number	Specifies the beam spots to display measurement results while measuring multiple beams.
⑰ Multi Spot Measurement Display	Automatically lists and displays beam spot measurement results for if multiple beam spots are detected.	

2.2 Option Settings



① Option Tab	Select the tab to display options.	
	Angle	The option tab of Angle settings
	Profile	The option tab of Profile settings
	Communication	The option tab of Communication settings
	Common	The option tab of Common settings of the entire software
② Subcategory Tab	Displays subcategories for the angle and profile options, such as measurement, display, and LD control.	
③ Various Settings	Changes the measurement conditions	
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	Button is enabled as the option contents (③, ④) are changed. Click the "Save" icon after settings changes to save the changes or to cancel settings changes, click the "Cancel" icon.	

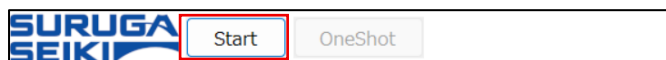
※For details on options, refer to "[Option](#)"

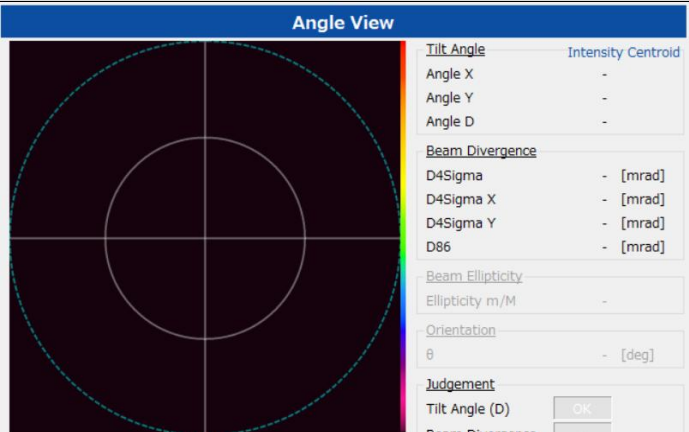
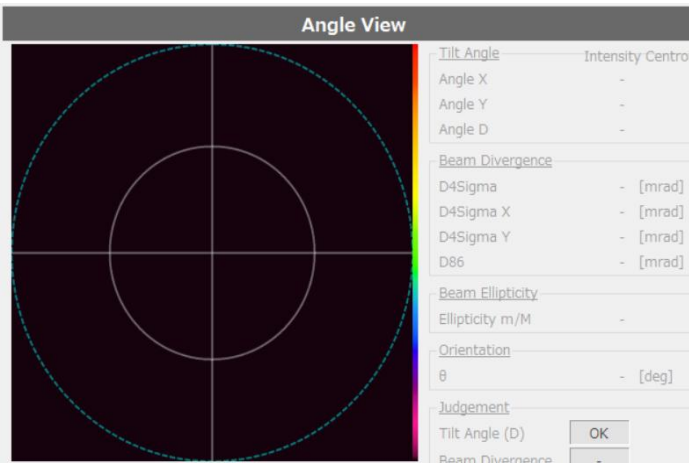
3 How to Use the Functions

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 Profile 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.	
Measurement Stop	
Measurement is stopped. In this state, pressing the [Start] button will start measurement, and the screen display will turn active.	

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

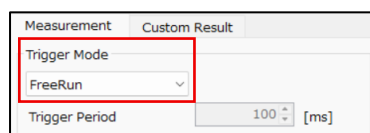
The following modes of this function are only available on products shipped after July 13, 2026:

- 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.
External Trigger	External trigger	Measurements are performed in response to the timing of external signal input.

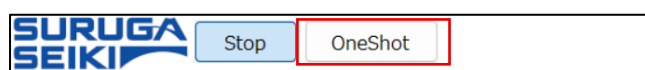
■ Features of Each Mode

Free Run

- Performs measurements continuously.
- Measurement results from each Angle/Profile 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/Profile sensor are output synchronously.
- Can be executed by pressing the One Shot button or by command.



Continuous (Continuous Measurement)

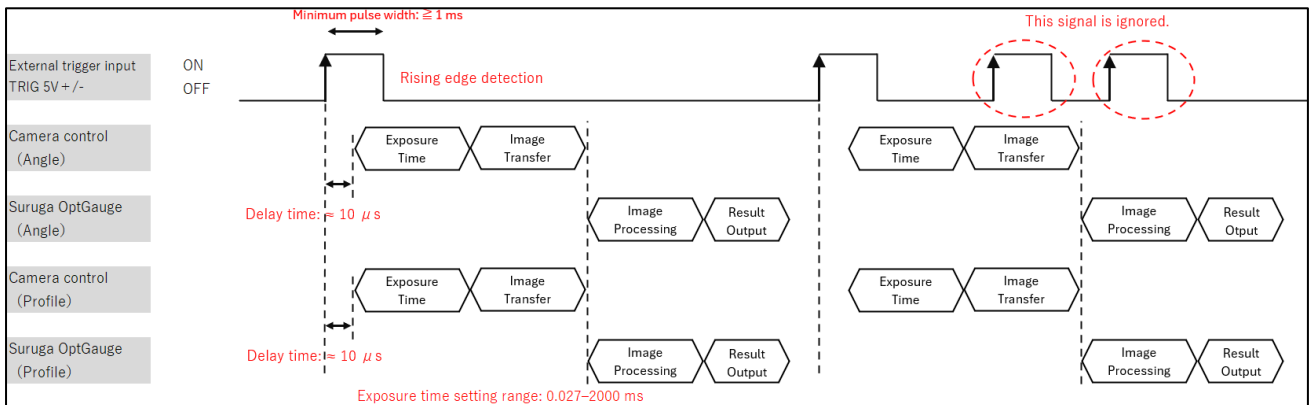
- Performs measurements periodically at fixed intervals.
- Measurement results from each Angle/Profile sensor are output synchronously.

External Trigger

- Performs measurements in response to signals input from external devices.
- Measurement results from each Angle/Profile 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) 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) mode, the measurement cycle is controlled by the "[sampling interval](#)" rather than the frame rate.

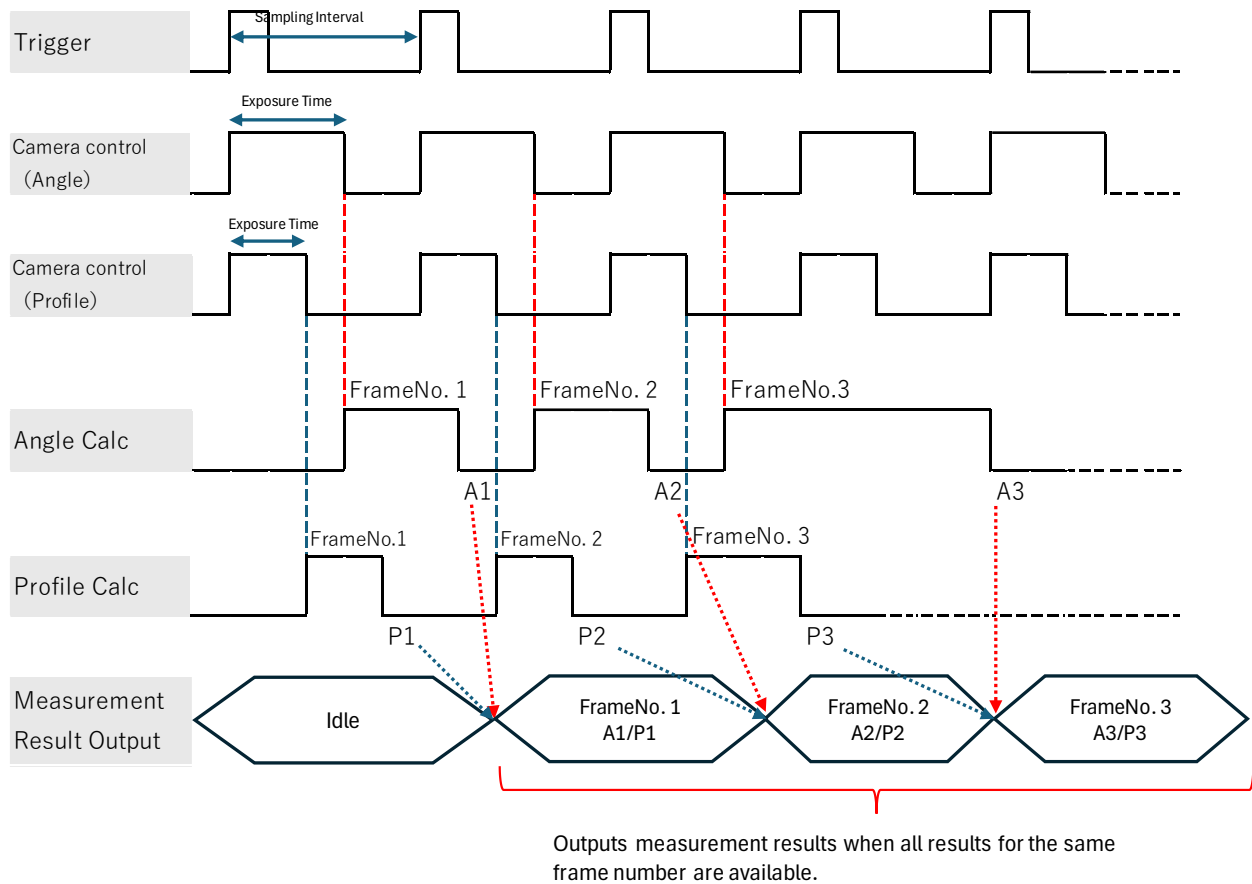
3.1.2.1 Synchronous/Asynchronous Output

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

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

■Synchronous Output

In synchronous output, the Angle and Profile 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 Profile 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

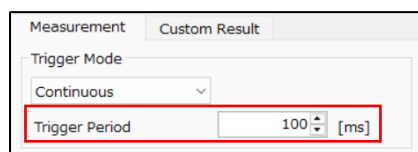
- Measurement processing is taking too long.
- The sampling interval is too short

Solutions

- Increase the sampling interval
- Adjust the measurement conditions

3.1.2.2 Sampling Interval (Continuous Measurement)

In Continuous (continuous measurement) mode, 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**.

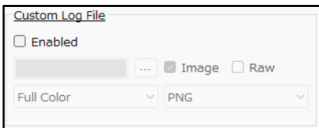
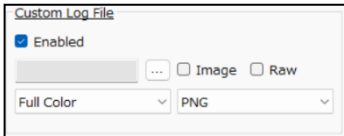
Summary

- **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.  A screenshot of the 'Custom Log File' settings window. The 'Enabled' checkbox is unchecked. Below it is a file path input field with a browse button (...). To the right are radio buttons for 'Image' (selected) and 'Raw'. At the bottom are two dropdown menus: 'Full Color' and 'PNG'.
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.  A screenshot of the 'Custom Log File' settings window. The 'Enabled' checkbox is checked. Below it is a file path input field with a browse button (...). To the right are radio buttons for 'Image' (selected) and 'Raw'. At the bottom are two dropdown menus: 'Full Color' and 'PNG'.

Basic Usage (CSV Output)

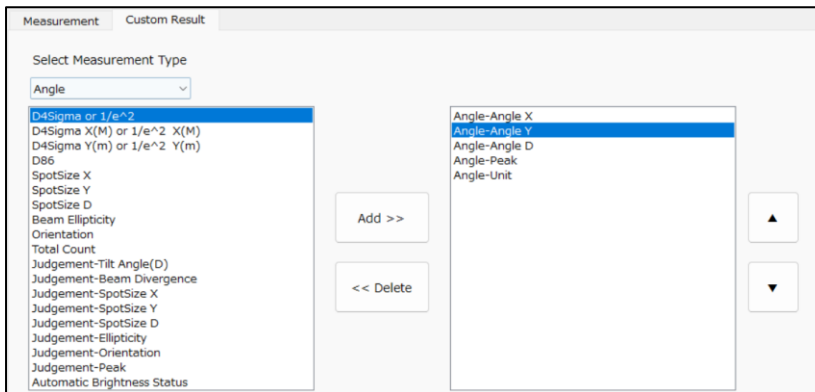
1. Open the Custom Result settings window

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 Profile)
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

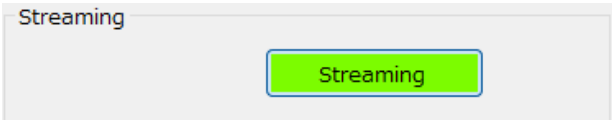
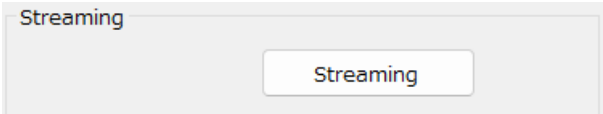
- **Automatic, continuous transmission** of measurement results
- **Real-time output** via TCP/IP communication
- Output content **can be customized** using the Custom Result settings
- Errors, warnings, and interlock statuses can also be notified

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
- Profile frame number (hyphen for asynchronous output)
- Profile 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](#)".

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.

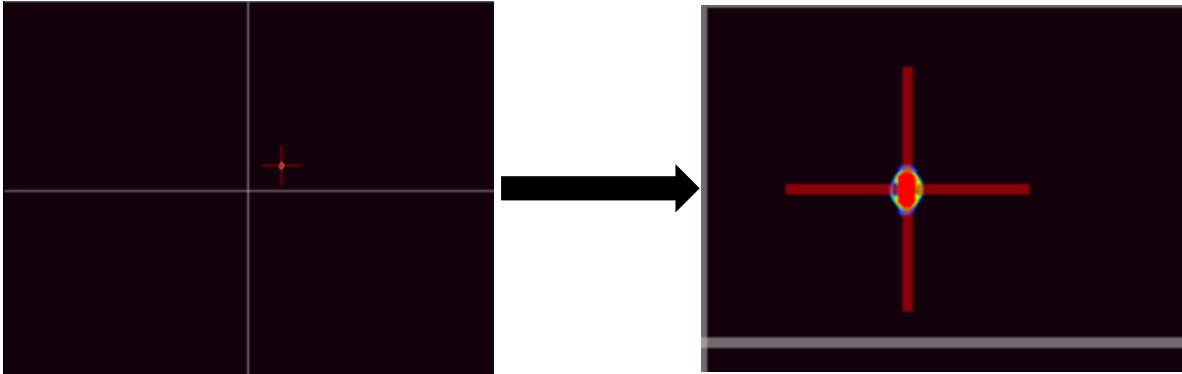
Summary

- **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**

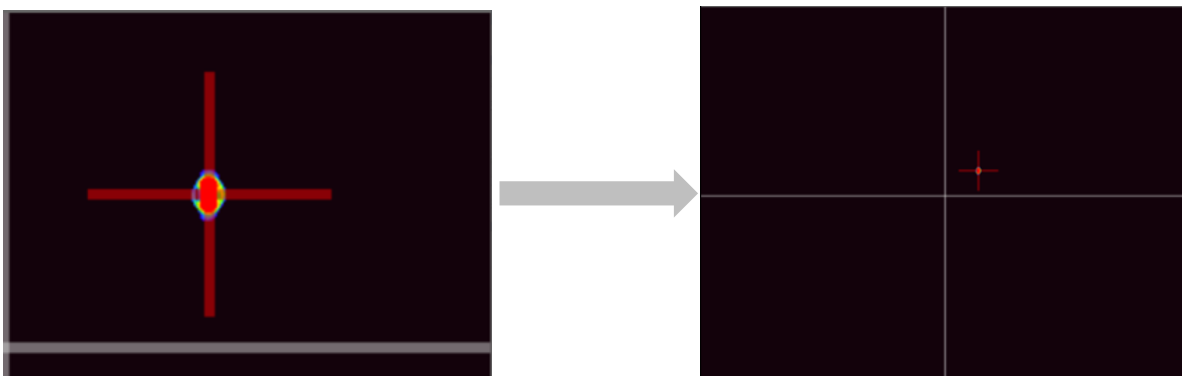
3.1.6 Zoom In

The 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 need to change the measurement mode according to your measuring purpose.

For the reflection angle measurement, select "Tilt Angle".

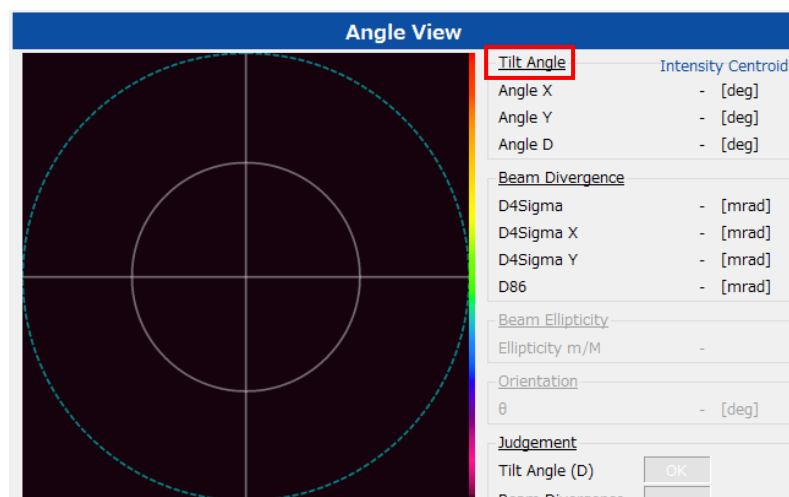
For the external light angle measurement, select "Beam Angle".

Measuring a reflection angle

You may select [Tilt Angle] in the "Angle Type" in the Option setting.

Angle Type
Type Tilt Angle ▼

Starting reflection angle measurement.

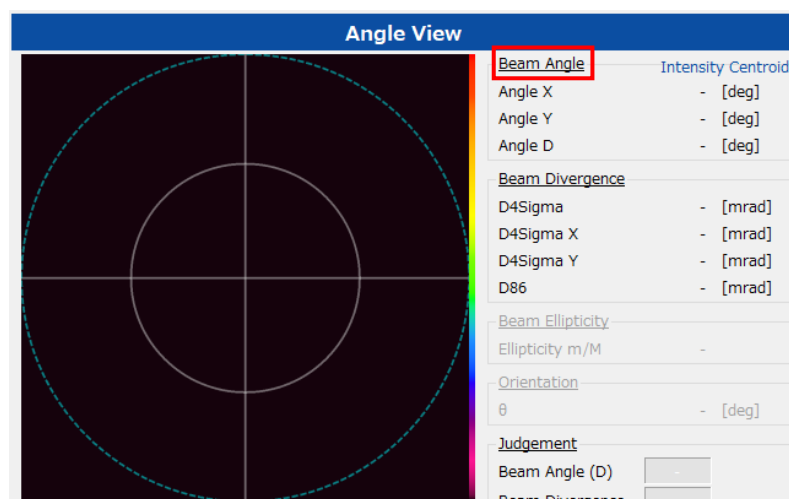


Measuring an external light angle

You may select [Beam Angle] in the "Angle Type" in the Option setting.

Angle Type
Type Beam Angle ▼

Starting external light angle measurement.



3.2.2 Divergence

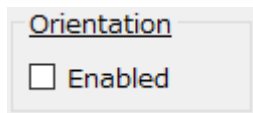
Divergence indicates how much the light beam expands at an angle as it propagates.

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.

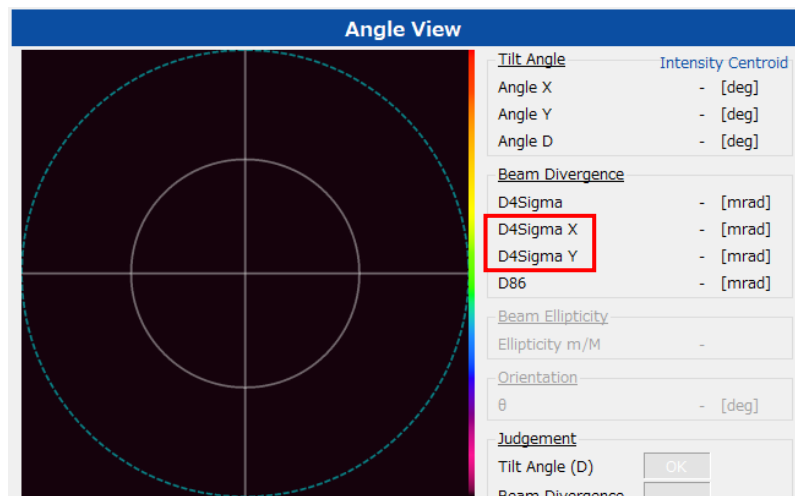
The Products display divergence in a half-angle with mrad (milli radian). It has two modes of measurement.

Measuring a $D4\sigma$ beam diameter^{*1} (elliptical beam) of divergence along with X-axis and Y-axis directions.

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

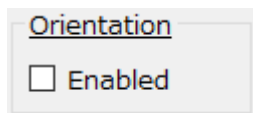


Measures beam divergence by "D4Sigma X" and "D4Sigma Y" ^{*1}

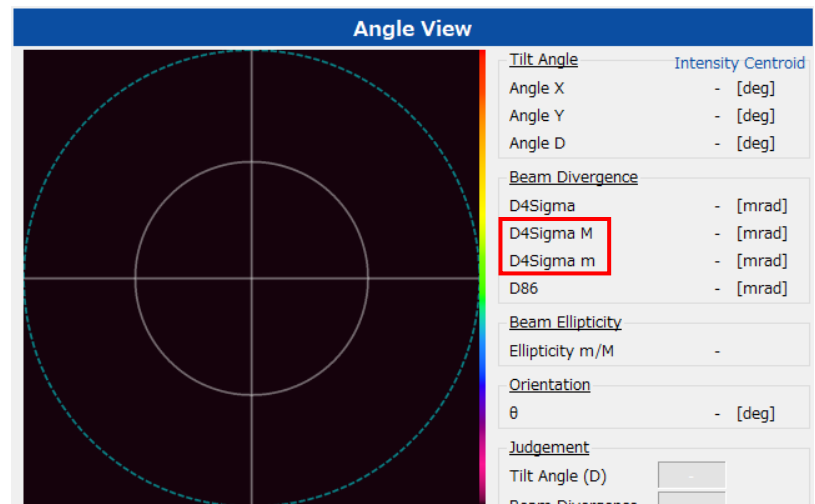


Measuring a $D4\sigma$ beam diameter^{*1} (elliptical beam) of divergence along with M (major: long axis) and m (minor: short axis).

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



Measures beam divergence by "D4Sigma M" and "D4Sigma m" ^{*1}



^{*1} The beam diameter can be selected as $D4\sigma$ or $1/e^2$.

3.2.3 Beam Centroid

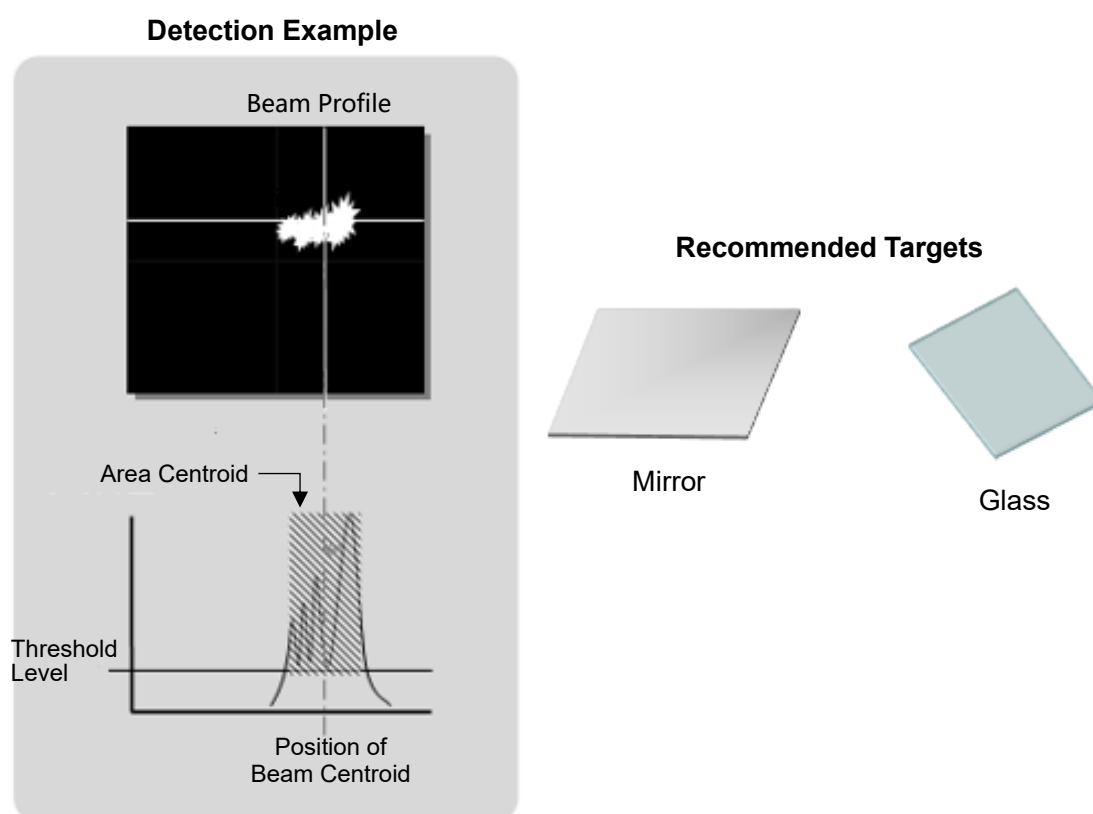
The method for determining the center position of a light spot can be selected by the type either beam area (area centroid) and beam intensity (luminance centroid) at the "Beam Centroid" in the Option setting. We recommend selecting the type of "Beam Centroid" according to an target to be measured.

Area Centroid (Area)

For the area centroid of a light beam, its centroid position is calculated from an irradiated area higher luminance than the denoising threshold value and results as an angle. 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 targets such mirror with uniform surface and to 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.



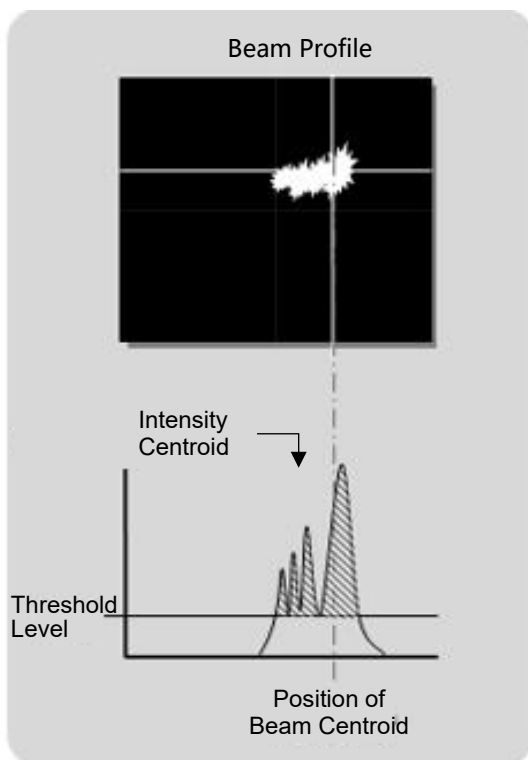
Intensity Centroid

For the center position of the intensity is calculated from pixels with intensity higher than the noise reduction threshold and displayed as an angle.

Lowering the threshold allows obtaining the center surrounding area of blurred or smeared light spots.

We recommend measuring targets which exhibit blurring or smearing in the light spot due to reflections from surfaces that are not uniform, such as resin surfaces.

Detection Example



Recommended Target



Concave Lens

3.2.4 Beam Ellipticity

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

Beam Ellipticity Equation:

$$\text{Beam Ellipticity} = m \text{ (minor) beam diameter} / M \text{ (major) beam diameter}^{*1}$$

The following describes its use.

**1 The beam diameter can be selected as $D4\sigma$ or $1/e^2$.*

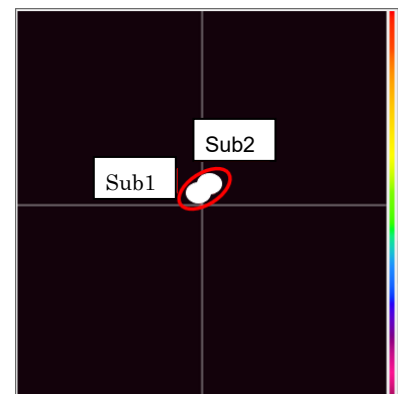
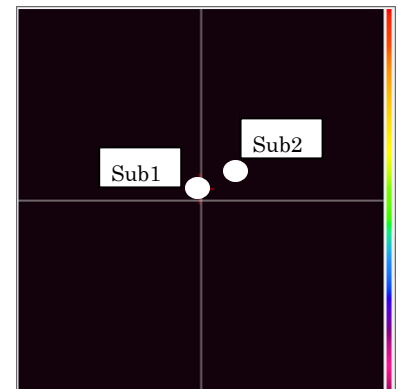
Beam Ellipticity Usage

You may select it to measure the parallelism of two or more measured targets.

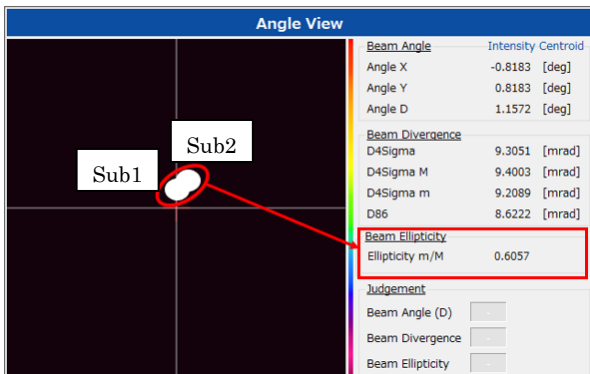
1. The beam spots of "Sub 1" and "Sub 2" shown in the right are incident lights on the sensor head, and the angles of each can be measured.

We move the two beam spots close to each other so that the Sub1 and Sub2 are nearly parallel.

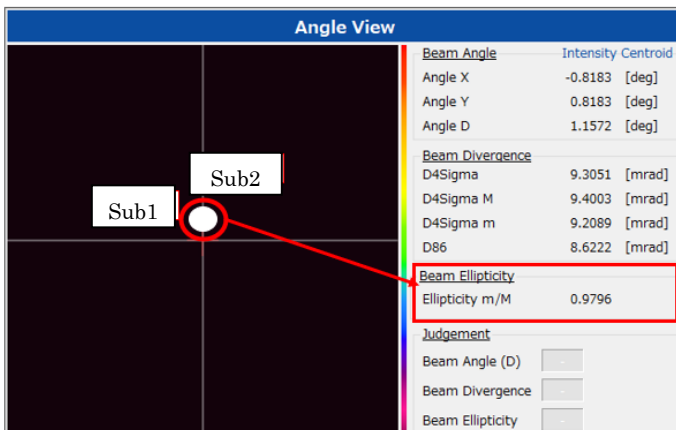
2. As the two light spots are getting closer like in the illustrated frame, the sensor recognizes them as a single elliptical light spot.



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

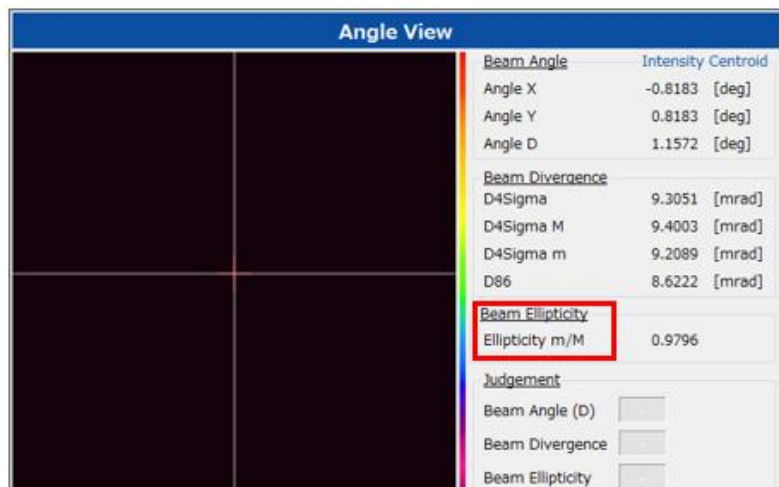
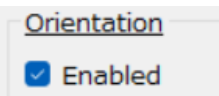


4. Move the two beams even closer together. Closer the ellipticity to "1.000" and the two targets are nearer to parallel.



For Ellipticity Measurement

Check the box, " Enabled" in Orientation option setting.



3.2.5 Rotation Angle

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

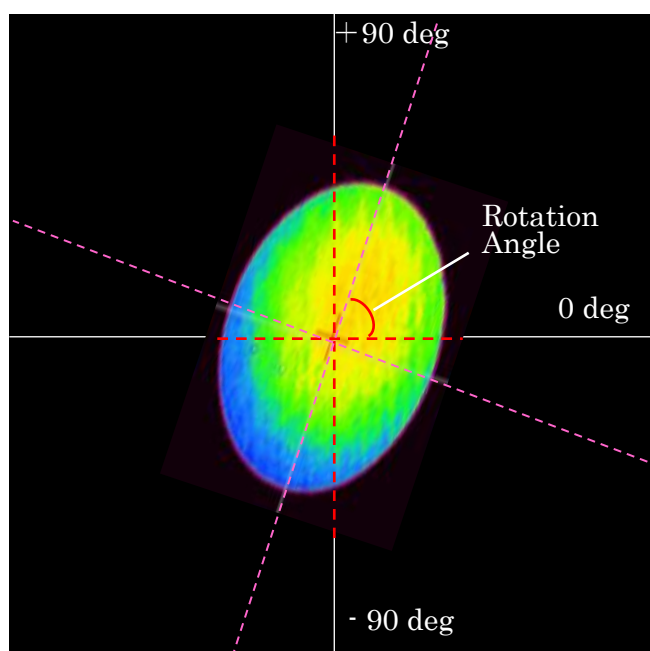
Rotation angle measurement is only available when the “Orientation” option setting is enabled.

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.

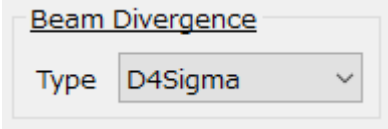
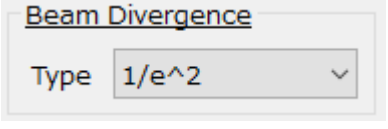
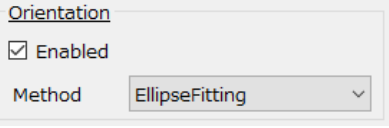
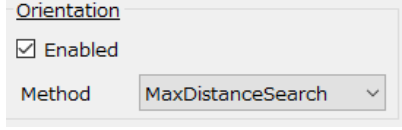
A positive (+) value is assigned when the principal axis points upward relative to the horizontal direction, and a negative (-) value when it points downward.

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 Methods

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

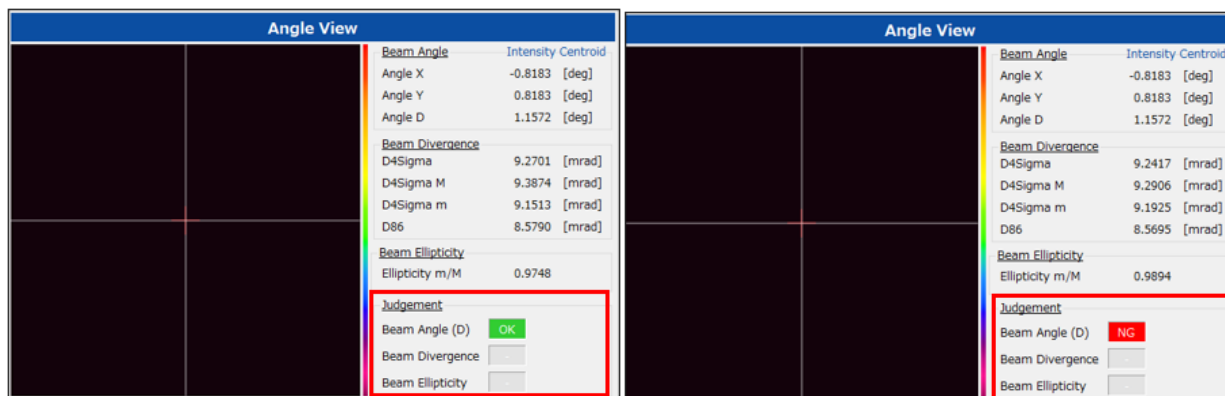
Rotational Angle Measurement Compliant with ISO standards	
Select [D4 Signal] for the “Beam Divergence” in the Option settings as below. 	Only if [D4 Sigma] is selected, Will the rotation angle be measured in accordance with ISO 11146-2.
Rotational Angle Measurement NOT Compliant with ISO standards	
Select [1/e²] for the “Beam Divergence” in the Option setting as below. 	Only if [1/e²] is selected, will the following two non-ISO-compliant rotation angles be measured.*¹
	[Ellipse Fitting]  This method performs elliptical fitting on the 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 if a shape is close to an ideal ellipse, as it 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 When the beam spot is small (about 3x3 pixels or less), the error increases due to reduced pixel resolution.

3.2.6 Judgement

The judgement function is available in intuitively understandable expression of whether the measurement value is within the target range.

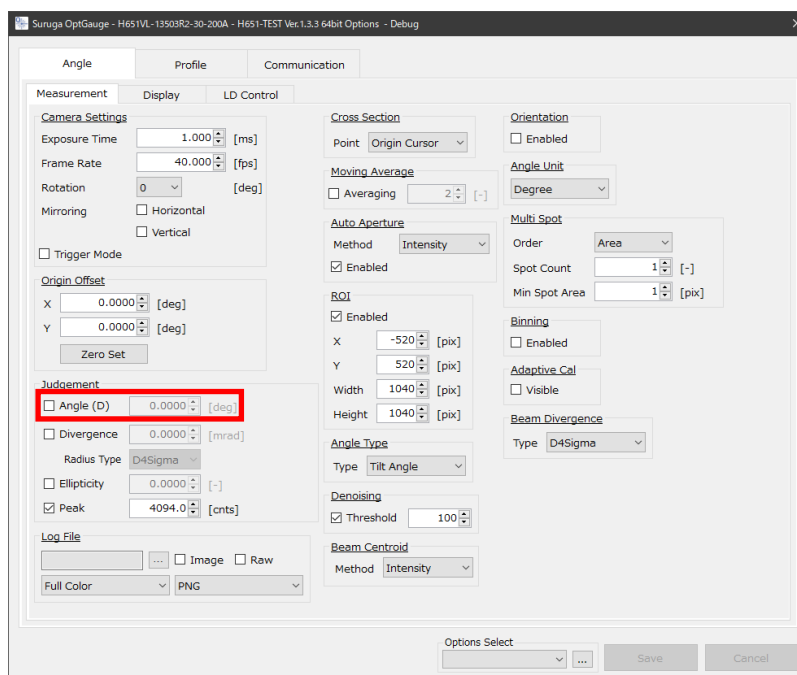
Here, as examples, we have the procedures for Angle (D) and Peak.



Selecting the 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".



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".

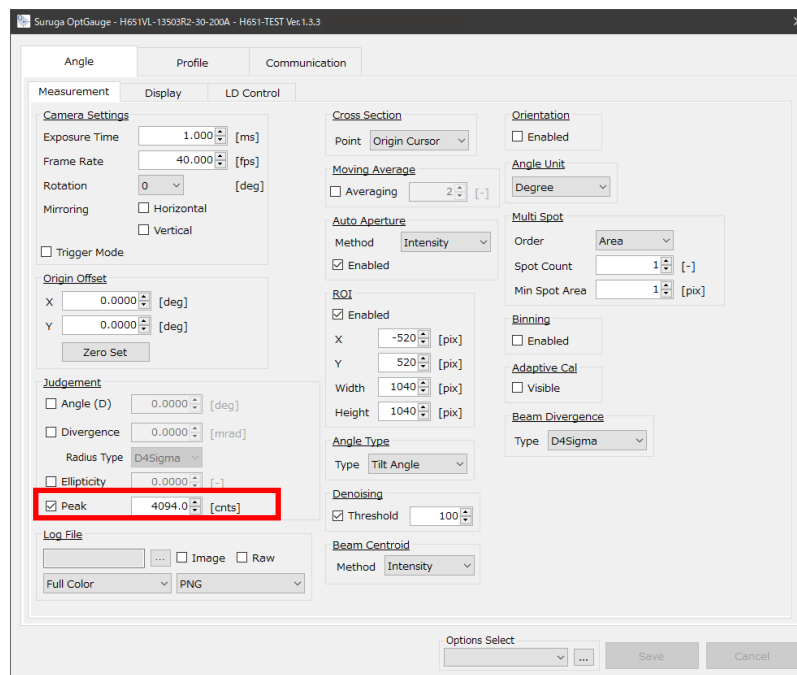


3. As a result of adjusting the angle one more time, the result of Angle D on the measurement screen is less than 0.5000 deg (1), so the judgment result of "Tilt Angle(D)" in "Judgement" is displayed as OK (2).

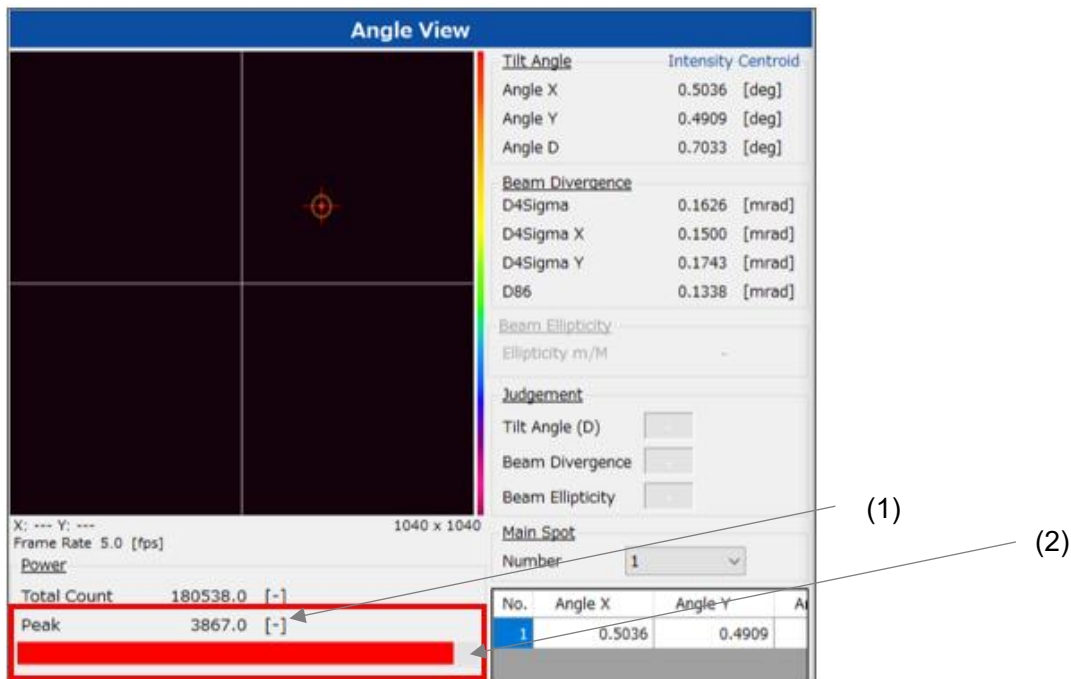


Selecting the Peak

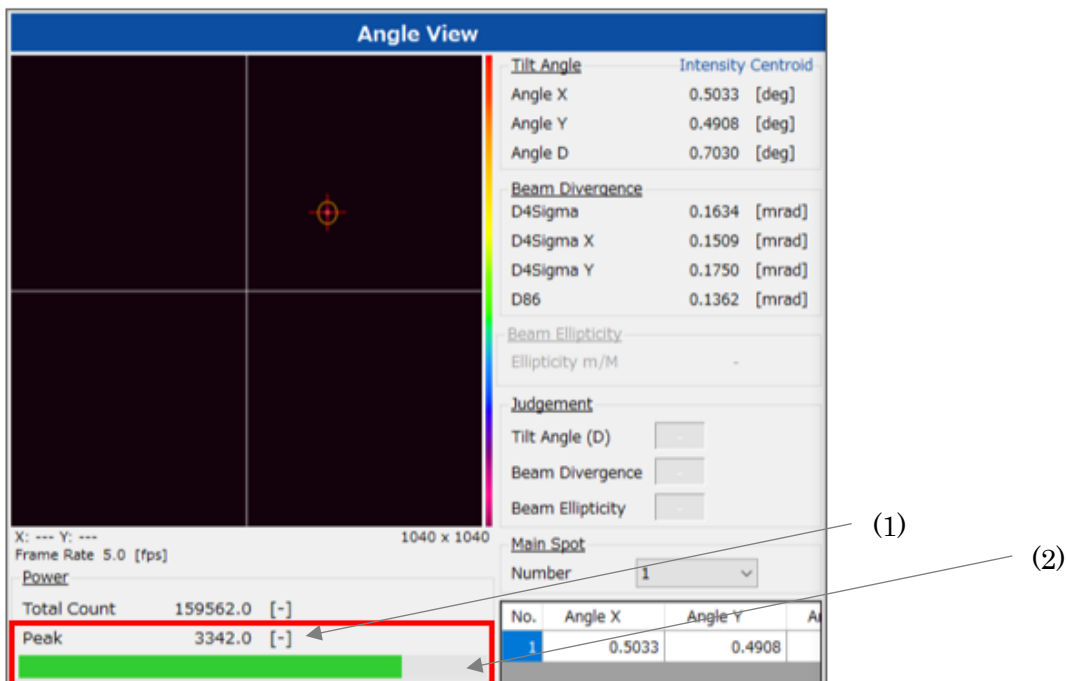
1. Adjusting the light intensity and set the “Peak” of the measurement result to be less than 3500.
Set “Peak” to “Enable” in the “Judgement Settings” option and set it to “3500.0”.



- As result of adjusting the light intensity, the Peak value on the measurement goes below 3500.0 (shown as 1), so the judgement takes N.G., and the Peak display bar turns red (shown as 2)



- As result of re-adjusting the light intensity, the Peak value on the measurement exceeds 3500.0 (shown as 1), so the judgement takes O.K., and the Peak display bar turns green (shown as 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. Prevent the beam to enter into the Sensor Head.
3. Enable the Adaptive Cal by clicking [Adaptive Cal] in the option settings.

Angle View

Tilt Angle Intensity Centroid

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

Beam Divergence

D4Sigma - [mrad]
D4Sigma X - [mrad]
D4Sigma Y - [mrad]
D86 - [mrad]

Beam Ellipticity

Ellipticity m/M -

Orientation

θ - [deg]

Judgement

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

Main Spot

Number 1

Power

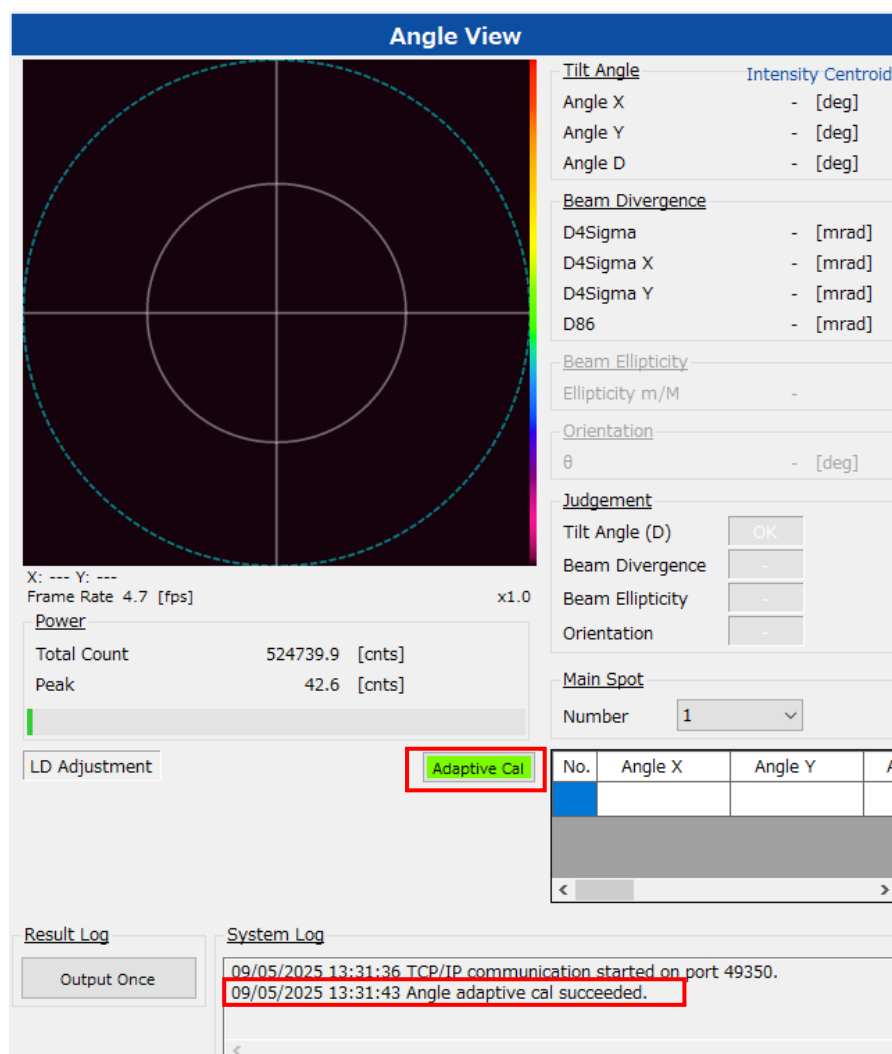
Total Count 32515.0 [cnts]
Peak 46.0 [cnts]

LD Adjustment

Adaptive Cal

No.	Angle X	Angle Y	A

4. When Adaptive Cal is executed, the button color will change.
5. Completion is indicated when 'Angle adaptive cal succeeded.' appears in the System Log.
6. Thereafter, direct the beam into the Product and commence measurement.



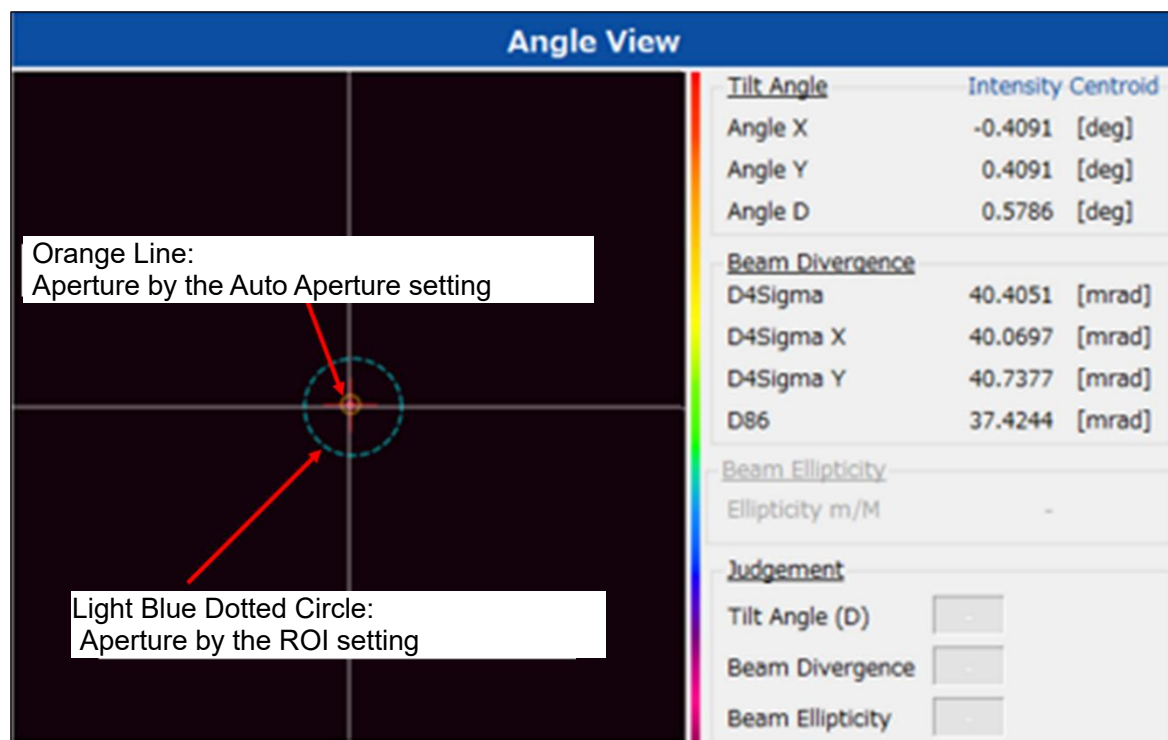
Attention

If the beam light enters into the Product or ambient light is causing serious noise, the adaptive calibration will not be succeeded. Please conduct it in an environment where lights interfere with the sensor camera. It is also notable to disable the denoising function for this purpose.

3.2.8 Aperture

The “Auto Aperture” and “ROI” settings are available for measuring a light beam divergence to eliminate the effects of noise such as ambient lights.

By using these two functions, measurement reducing ambient lights can be achieved.



Aperture Explains

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

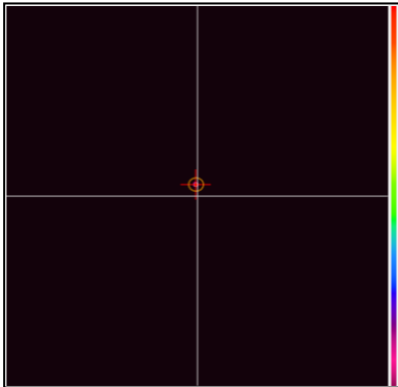
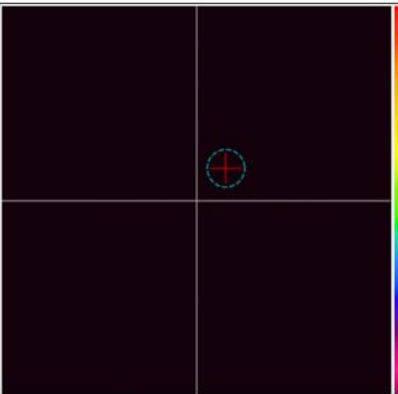
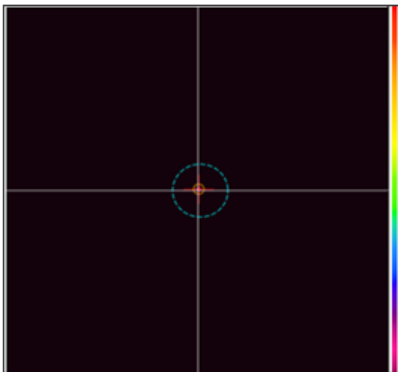
Info

Using Auto Aperture and ROI simultaneously allows you to emphasize only the critical aspects of beam intensity, shape, and position, thereby minimizing the impact of noise and interference.

As results, the measurement improves the accuracy.

If the beam position remains unchanged, we recommend using both simultaneously.

Setting Methods

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

3.2.9 Origin Offset

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

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

There are three offset methods as below.

Setting Methods

Setting from the Option Screen

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

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

Origin Offset

X 0.0000 [deg]

Y 0.0000 [deg]

Tilt Angle

Angle X -0.5008 [deg]

Angle Y -0.5004 [deg]

Angle D 0.7080 [deg]

Intensity Centroid

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 -

Offset the white cursor at X=0.5 deg. and Y=0.5 deg.

Beam Divergence

Beam Ellipticity

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."

Angle View

Tilt Angle

Angle X -0.0011 [deg]

Angle Y 0.0042 [deg]

Angle D 0.0044 [deg]

Intensity Centroid

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

Angle View

Tilt Angle

Angle X -0.6694 [deg]

Angle Y -0.4274 [deg]

Angle D 0.7942 [deg]

Intensity Centroid

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

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

Origin Offset

X 0.6747 [deg]

Y 0.4445 [deg]

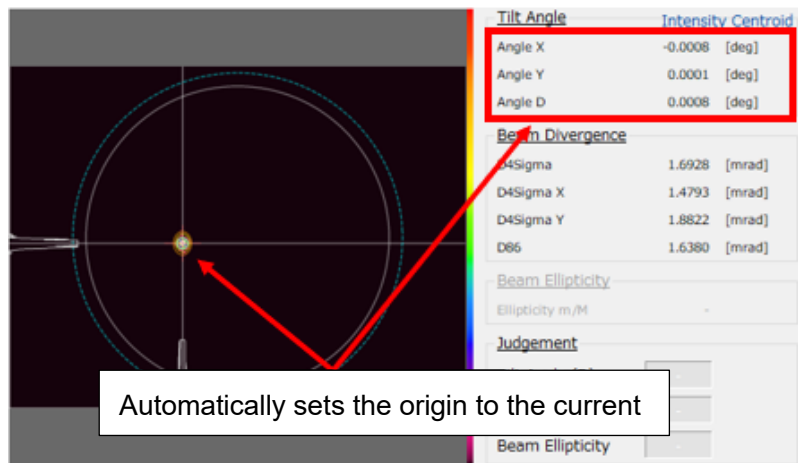
Setting from the Zero Set Button

Click the “Zero Set” in the Origin Offset option settings.

Origin Offset

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

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



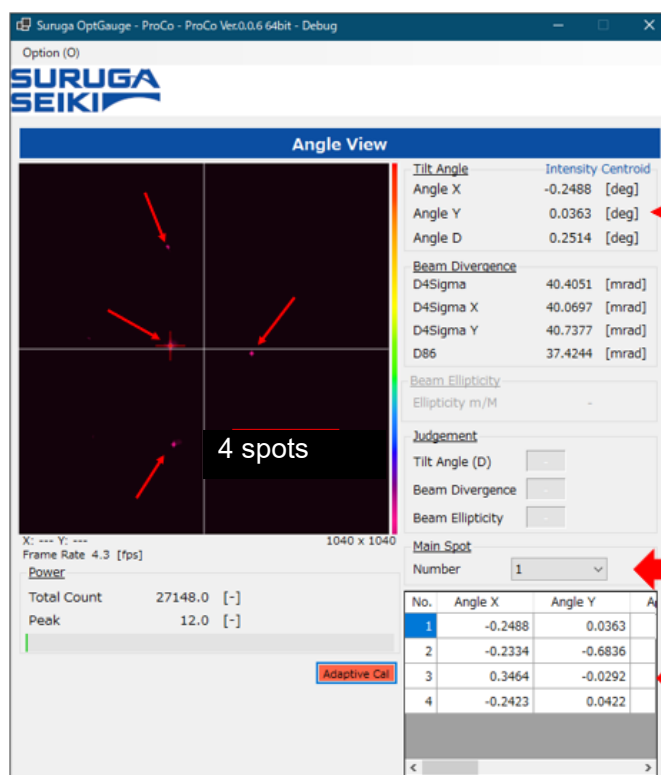
3.2.10 Multi Spot

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)



By changing "Number", the corresponding Number (No.) in the list below can be displayed in the Title Angle at the top.

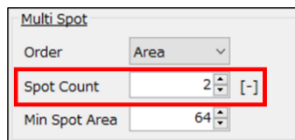
Displays the measurement results of 4 spots on the measurement results screen.

The list is automatically updated with the number of detected beams.

Setting Method

To Enter the Number of Measuring Spots to Display

Changing the "Spot Count"
in the Multi Spot
settings.



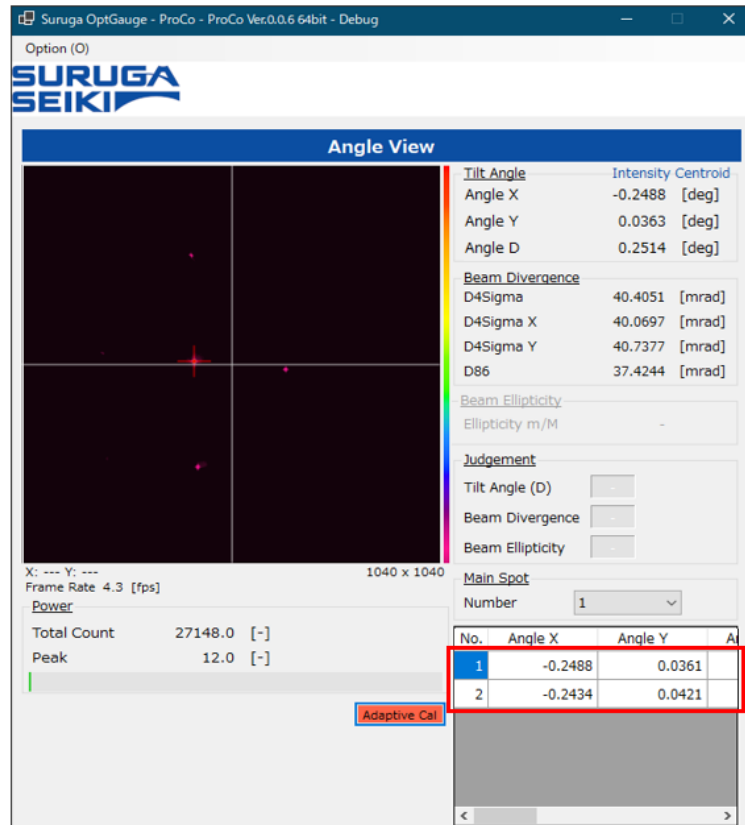
Multi Spot

Order: Area

Spot Count: 2 [-]

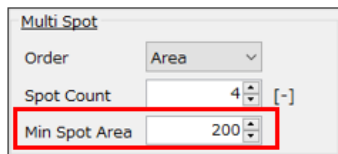
Min Spot Area: 64

By changing the "Spot Count", you can specify the number of spots displayed on the measurement results screen.

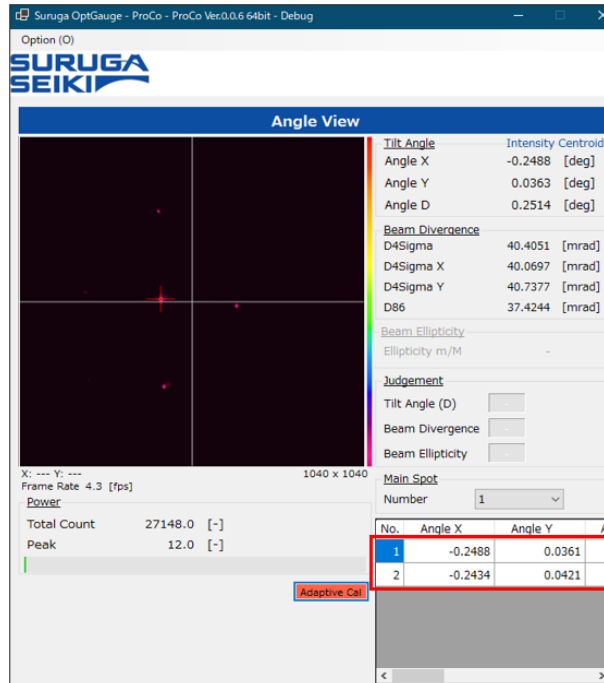


To Enter the Conditions (size) of the Beams to Detect for the Measurement Targets

Changing the "Min Spot Area" in option settings.



By changing the 'Min Spot Area', you can specify the conditions for the beam to be detected as the measurement target.



Info

The beam condition (size) should be considered as the set value in terms of area (pixels).

In the example setting, the sensor camera will detect the spots as measuring targets if the area of spot is over 200 pixels.

3.2.11 Automatic Brightness Control

The “Automatic Brightness” function is available for the Products to adjust the peak brightness of the light beam to a specified value by automatically regulating the exposure time and the LD output power. Note that if the reflectance of the target is unknown, be advised to enter 100 as the default value for the ‘Reflectivity’ in the ‘LD Adjustment’ group.

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	内容
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) = 190 (H651NL) 、 450 (H651VL)
Standard	LD Output (Power) = 890 (H651NL) 、 580 (H651VL)
Medium	LD Output (Power) = 4095 (H651NL) 、 1480 (H651VL)

High	LD Output (Power) = 4095 (H651NL) 、 4095 (H651VL)
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

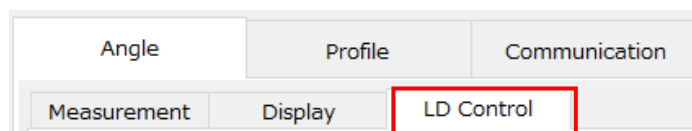
Tune

- 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

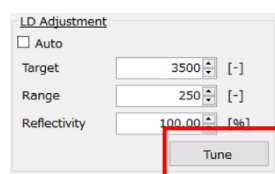
3.2.11.4 Automatic Brightness Control (Single Execution)

The following procedure describes how to manually execute the Automatic Brightness control at your desired moment.

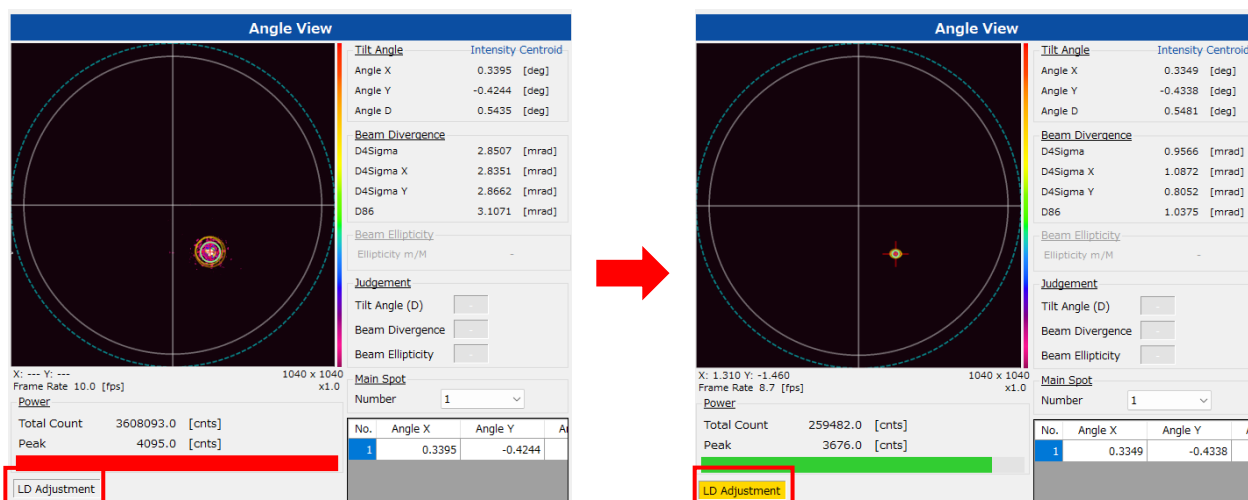
1. Open the Options window and select the LD Control tab.



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

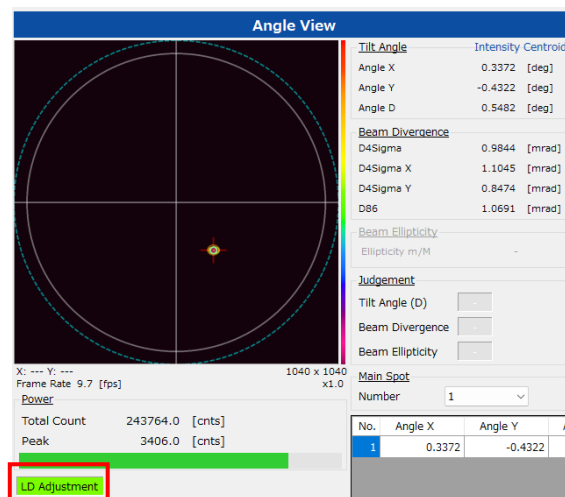


3. The Automatic Brightness control starts.

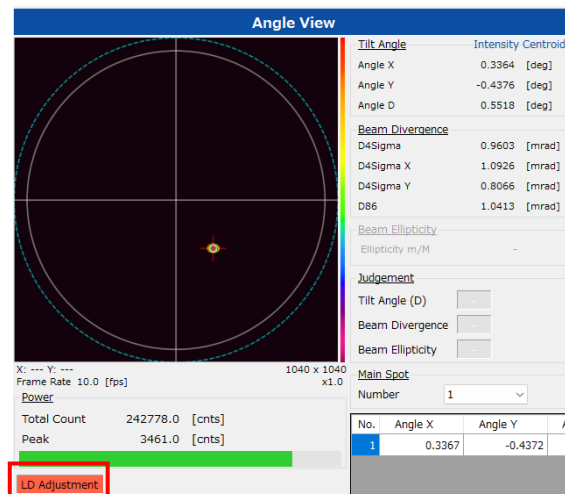


- * The LD Adjustment section on the main screen will be grayed out if Automatic Brightness control has not yet been executed.
- * When Automatic Brightness control starts, the LD Adjustment section will be displayed in yellow, indicating that the adjustment is in progress.

4. Automatic Brightness control completes.



After the adjustment successfully completes, the LD Adjustment section turns to green indicating the successful completion.



*If the adjustment fails, the LD Adjustment section turns red indicating 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.

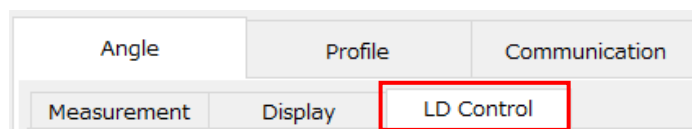
3.2.11.5 Automatic Brightness Control (Continuous Execution)

When the beam spot moves due to angle or displacement, the brightness may increase or decrease.

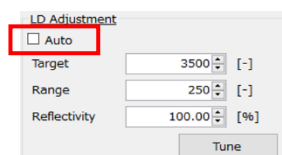
To retain the brightness at a specified value even when the beam spot moves, perform the Continuous Automatic Brightness to keep it at the desired level.

To perform the method of the constant automatic brightness is shown below.

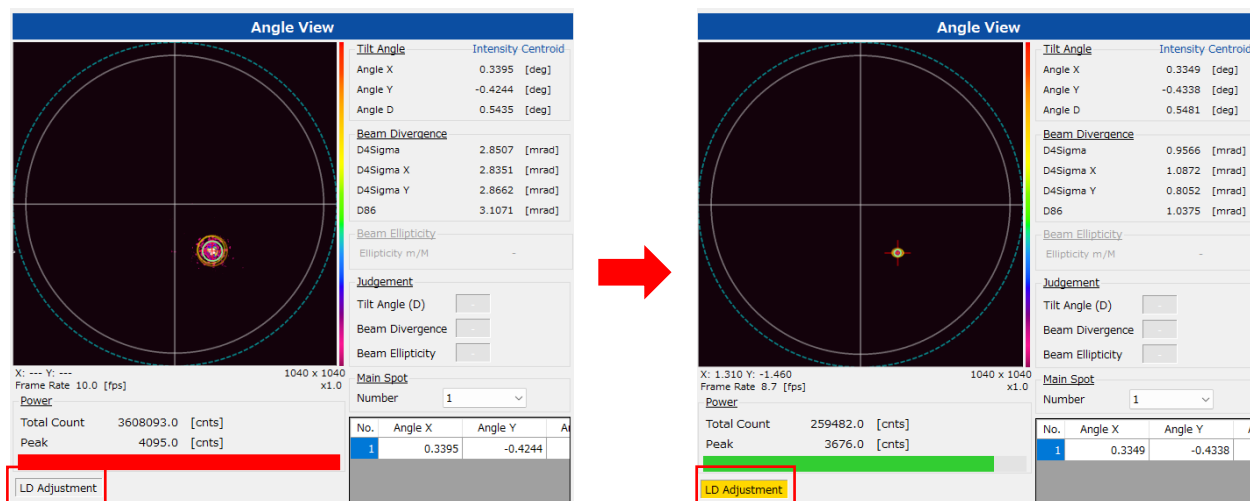
1. Open the Options window and display the LD Control tab.



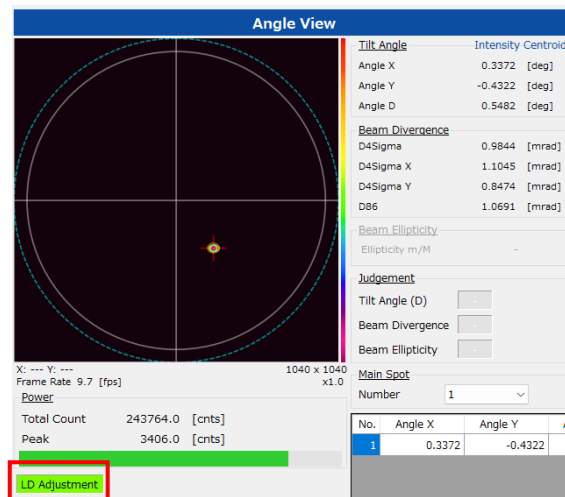
2. Click the Auto checkbox in the LD Adjustment group.



3. The Automatic Brightness control starts.



4. The Automatic Brightness control completes.



Thereafter, the Automatic Brightness adjustment will be executed when the measured brightness value falls outside the range specified in the "Range" option, using the brightness value of the "Target" option within the LD Adjustment group as the reference.

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 Profile View

3.3.1 Beam Centroid

It determines the beam centroid.

It indicates the distance between the center of an incident beam and the coordinate origin.

The method for determining the center of the light spot can be selected from the Area Centroid or the Intensity Centroid via the Beam Centroid option settings. We recommend configuring the 'Beam Centroid' settings depending on the target.

For details on Area Centroid and Intensity Centroid, refer to the "[Beam Centroid](#)" in the Angle View.

3.3.2 Beam Diameter

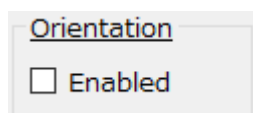
It is available for measuring the beam diameter.

It is the size measurement of an incident beam to the Profile sensor in the unit of “mm” or “ μm ”.

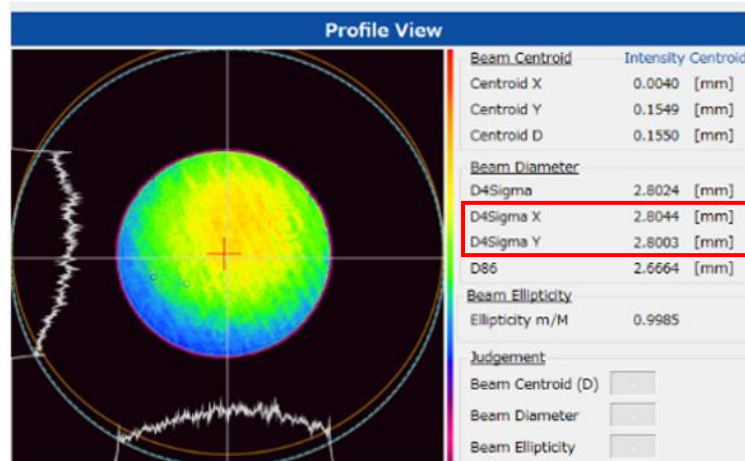
The measurement consists of two modes.

To Measure the Beam Widths in X-axis and Y-axis Directions at $D4\sigma$ Beam Diameter*¹ (elliptical beam)

Uncheck the “Enabled” in the “Orientation” option setting.

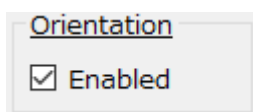


To measure the beam diameter by “D4Sigma X” and “D4Sigma Y”

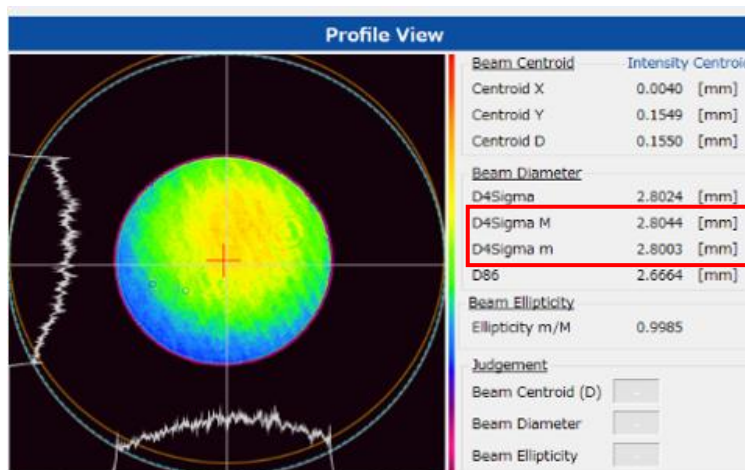


To Measure the Beam Widths in the M (major axis) and m (minor axis) at the $D4\sigma$ Beam Diameter (elliptical beam)*¹

Check the “Enabled” in the “Orientation” option setting.



To measure the beam diameter By “D4Sigma M” and “D4Sigma m”



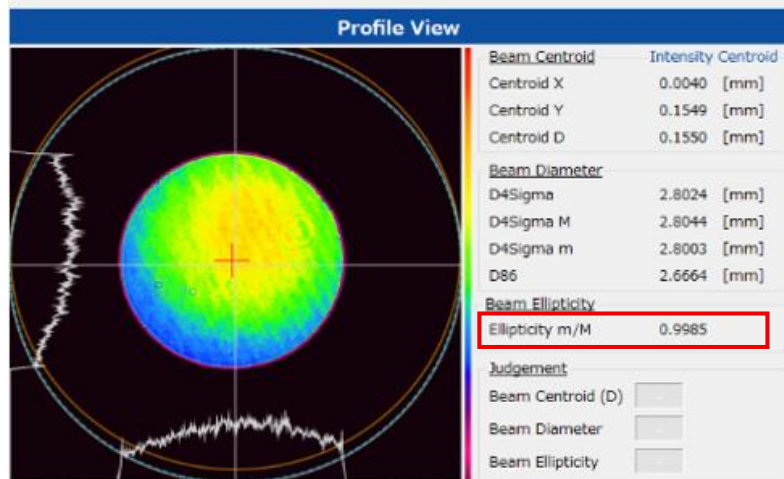
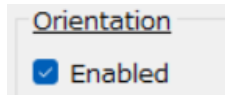
*¹ the methods measuring the beam diameter can be selected either the $D4\sigma$ or the $1/e^2$.

3.3.3 Beam Ellipticity

The Beam Ellipticity (hereafter referred to as "Ellipticity") indicates how much the beam shape is biased from circular to elliptical.

To Measure Ellipticity

Check "Enabled" in the "Orientation" option setting.



3.3.4 Rotation Angle Measurement

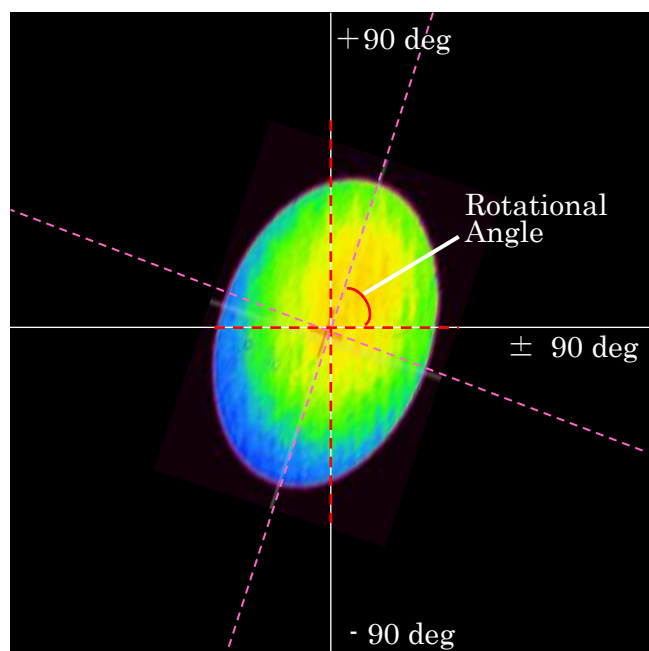
This function measures the rotation angle of an elliptical beam based on an image captured by the camera and displays it on the screen.

The Rotation angle measurement is only available if the "Orientation" option setting is enabled.

The Definition of Rotation Angle

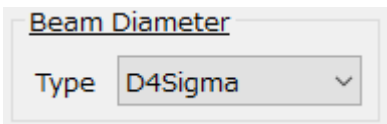
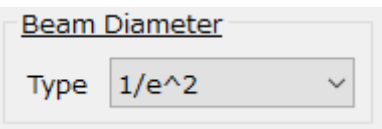
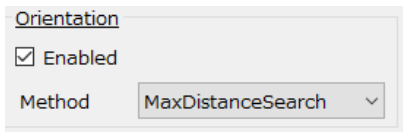
It is defined as the angle between the beam's principal axis in the rightward direction and the horizontal rightward direction. A positive (+) value is assigned when the principal axis lies above the horizontal plane, and a negative (-) value when it lies below.

The beam's major and minor axes are assumed to be mutually perpendicular, and the rotation angle is expressed within the range of $\pm 90^\circ$. 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 Methods

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

Rotational Angle Measurement Compliant with ISO standards	
Select [D4 Signal] for the “Beam Diameter” in the Option Settings as below. 	Only If the “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 Diameter” in the Option Settings as below. 	Only if the “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 the 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 the peak value, the method calculates the rotation angle by taking as the principal axis the straight line passing through the centroid that maximizes the distance between two points where it intersects the beam boundary and uses this as the rotation angle.  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 When the beam spot is small (about 3x3 pixels or less), the error increases due to reduced pixel resolution.

3.3.5 Line Position Measurement

This function measures the linear position on the beam's cross-section.

The Line position measurement is only available when 'Image Processing Mode' in the optional setting is enabled. A measurement result display area for 'Beam Diameter' is switched to display the results from this function.

Displaying Result: Beam Diameter

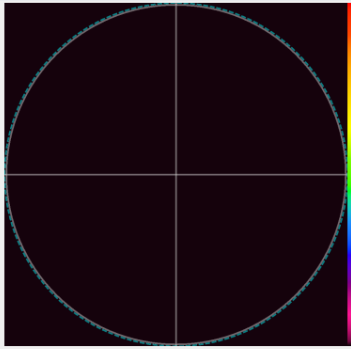
Uncheck the "Enabled" in the option setting.

Image Processing Mode

☐ Enabled

Threshold

Profile View



X: --- Y: ---

Beam Centroid		Intensity Centroid
Centroid X	-	[mm]
Centroid Y	-	[mm]
Centroid D	-	[mm]

Beam Diameter

D4Sigma - [mm]

D4Sigma X - [mm]

D4Sigma Y - [mm]

D86 - [mm]

Beam Ellipticity

Ellipticity m/M -

Orientation

θ - [deg]

Judgement

Beam Centroid (D)

Beam Diameter

Displaying Result: Line Position

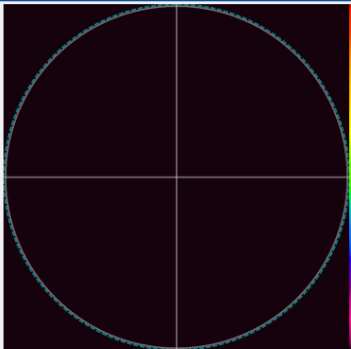
Check the "Enabled" in the option setting.

Image Processing Mode

☒ Enabled

Threshold

Profile View



X: --- Y: ---

Beam Centroid		Intensity Centroid
Centroid X	-	[mm]
Centroid Y	-	[mm]
Centroid D	-	[mm]

Line Position

Line X - [mm]

Line Y - [mm]

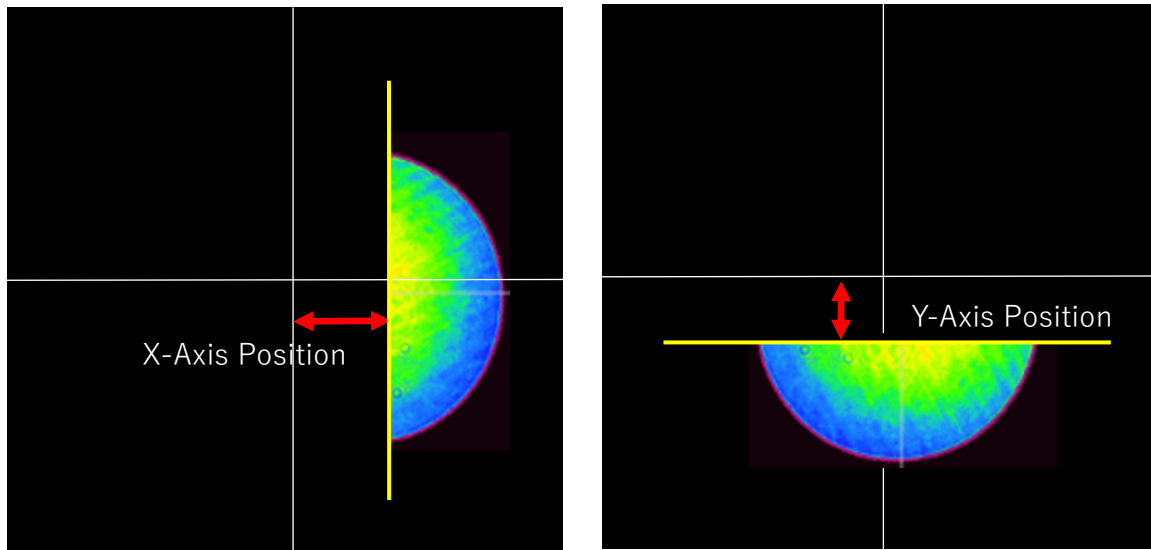
Judgement

Beam Centroid (D)

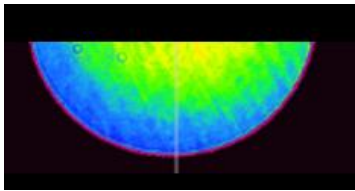
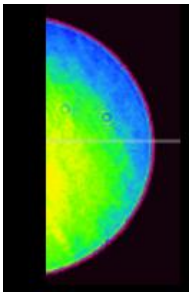
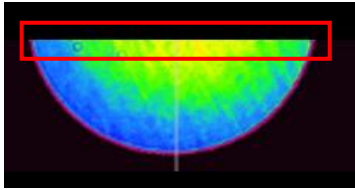
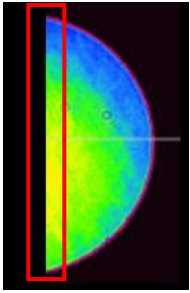
Line Position

Main Spot

Measurement Targets



The shapes and measurement locations of a target that this function detects are as follows.

Target Shape		
A shape with a partially circular or elliptical outline, where part of the circle or ellipse is cut off at the top and bottom or left and right.		
Measurement Site		
Straight edges that are not arcs *The slope of straight lines shall be limited to within $\pm 10^\circ$ of horizontal or vertical; any deviation beyond this range shall be excluded from measurement.		

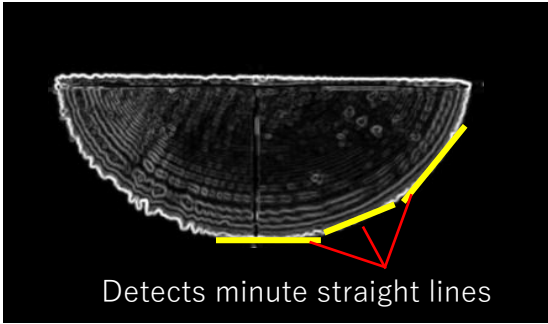
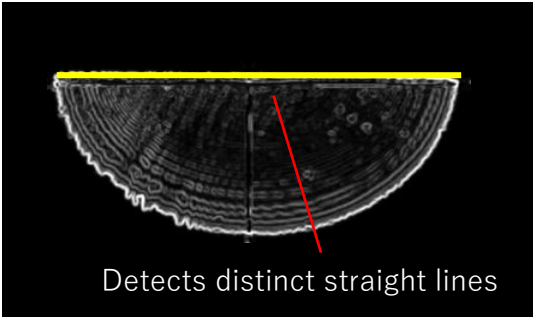
The Definition of the Line Position Measurement

The position of the 'measurement area' is displayed on the screen as coordinates.

If horizontal cut, the X-axis direction is used as the reference; if vertical cut, the Y-axis direction is used as the reference. The representative position of the detected straight line is displayed as the line position.

Line Detection Sensitivity

The sensitivity of the line detection can be adjusted by modifying the Threshold in the Image Processing Mode option setting.

The Threshold of the Image Processing Mode	
Reducing the value makes it easier to detect fine straight lines. <u>Image Processing Mode</u> ☒ Enabled Threshold 30	 Detects minute straight lines
Increasing the value will result in detecting more distinct straight lines. <u>Image Processing Mode</u> ☒ Enabled Threshold 80	 Detects distinct straight lines

If the value is too large, the target line may not be detected as the system seeks a line with minimal noise.

3.3.6 Judgement

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

See "[Judgement](#) in the Angle View" for a setting example.

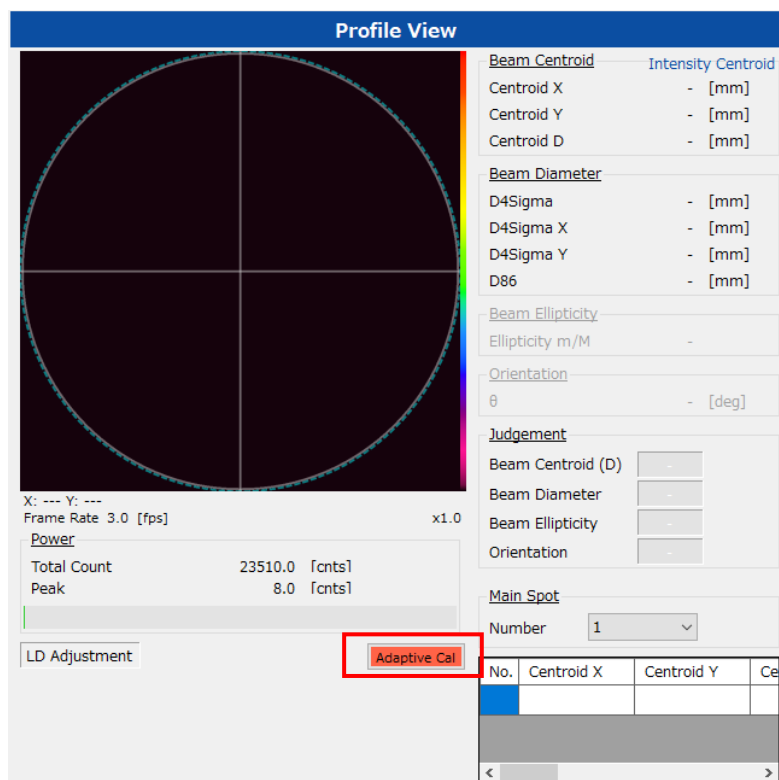
3.3.7 Adaptive Cal

The Adaptive Cal is a function that reduces measurement errors caused by noise by removing a certain amount of noise from the entire image data acquired by the sensor camera.

It has an automatic noise reduction feature that calculates a baseline correction value and offsets each pixel data by that amount.

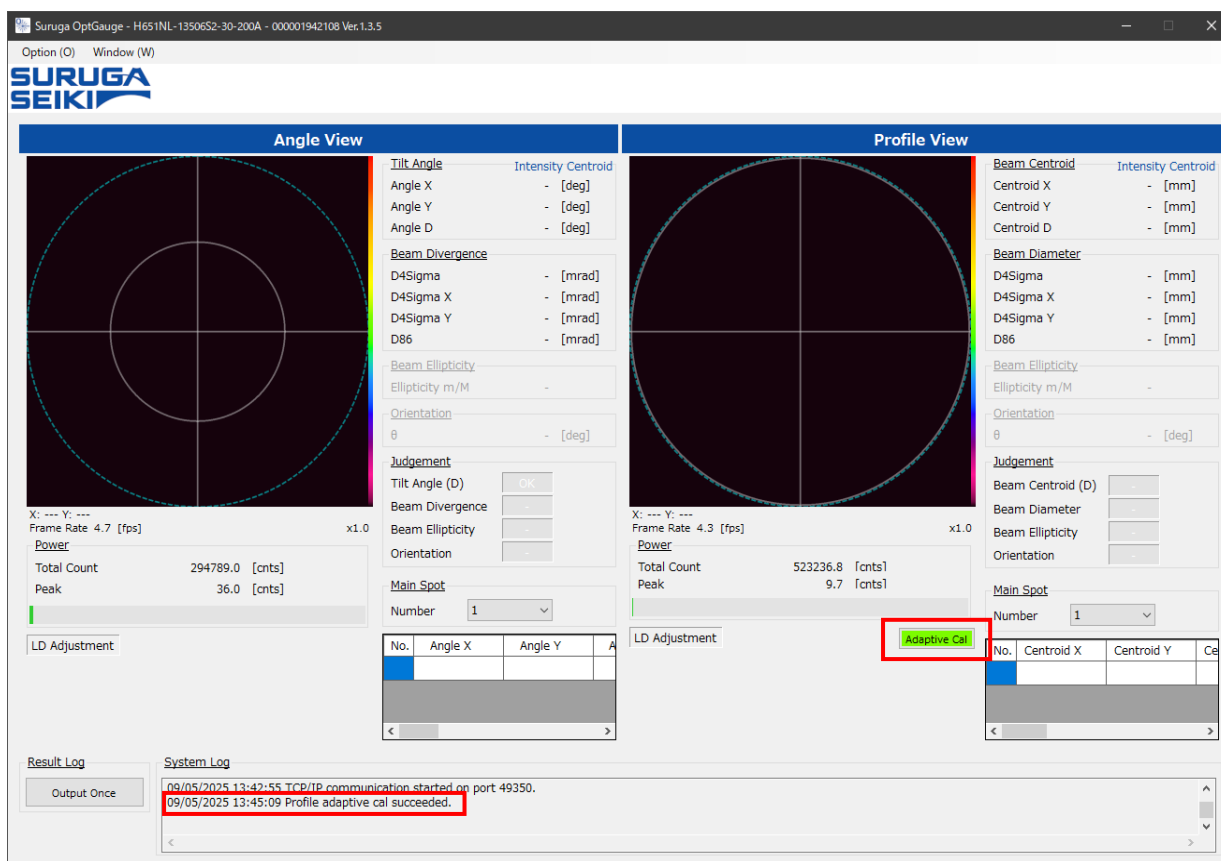
It must be executed each time the exposure time in the camera settings is changed when launching the Software.

1. Set [Trigger Mode](#) to "Free Run."
2. Prevent the beam to enter into the Product.
3. Enable the Adaptive Cal by clicking [Adaptive Cal] in the option settings.



4. When the Adaptive Cal is enabled, the icon color changes.
5. When "Adaptive Cal succeeded" is displayed in the System Log, the process is complete.

6. Thereafter, set the beam incoming to the sensor head and begin measurement.



*1 For details of the optional features, please refer to the separate software manual *the 'Suruga Opt Gauge User's Manual'*.

Attention

If the beam light enters into the sensor or ambient light is causing serious noise, the adaptive calibration will not be succeeded. Please conduct it in an environment where lights interfere with the sensor camera. It is also notable to disable the denoising function for this purpose.

3.3.8 Aperture

The settings for the Auto Aperture and the ROI are provided to exclude the influence of extraneous light and other noise from the measurement results for the beam diameter.

By using these two functions, measurements can be performed while eliminating noise caused by ambient light, etc.

See "[Aperture](#)" at the Angle View section for details.

3.3.9 Origin Offset

The Origin Offset function allows the center position of the sensor camera to be offset from its factory default position to any desired location.

By utilizing the offset function, alignment can be performed using any chosen point as the reference point.

See "[Origin Offset](#)" at the Angle View section for details.

3.3.10 Multi Spot

The Products support Multi Spot measurement, enabling simultaneous measurements of up to 100 points.

Using the Multi Spot settings, you can configure the "display order" and "number of points displayed" on the measurement results screen.

Furthermore, you can set "detection conditions" to narrow down the measurement targets.

See "[Multi Spot](#)" in the Angle View for details.

3.3.11 Automatic Brightness Control

The Products support an external trigger function, allowing measurements to be performed in response to trigger signals (pulse input) from external devices. By using this function, measurement timing can be controlled on the user's system side.

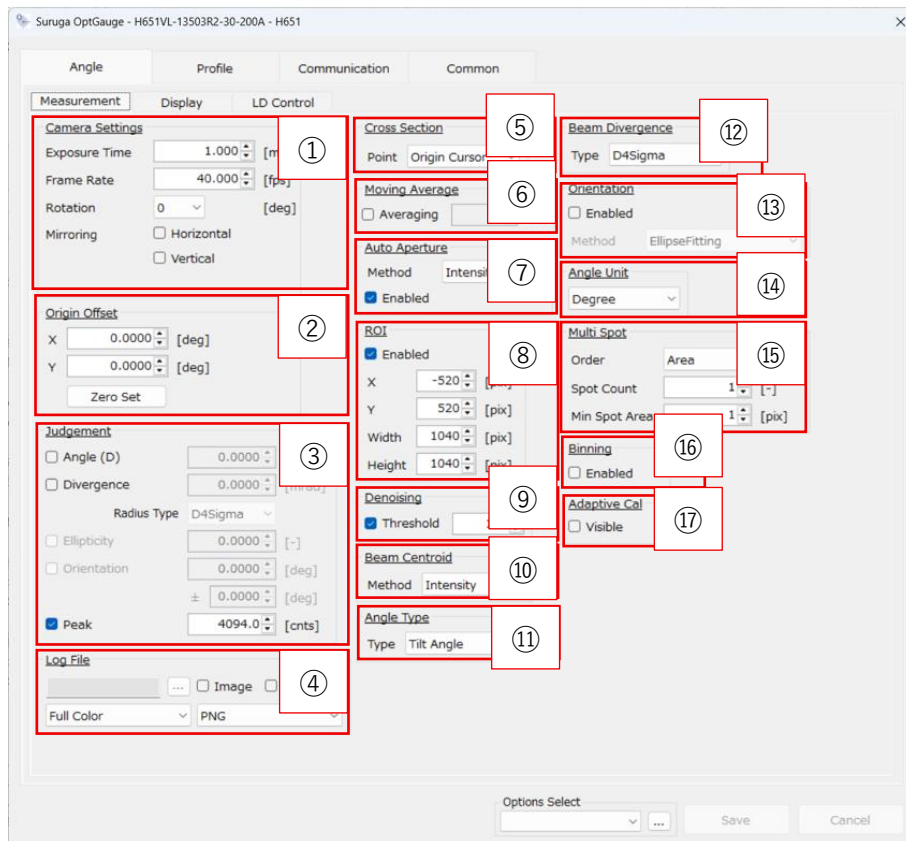
See "Angle View --> "[Automatic Brightness Control](#)"for details.

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. = 1.000) Setting range: 0.027 to 2000.000	
Frame Rate	Sets the sensor camera frame rate. (def. = 40.000) Setting range: 0.100 to 100.000	
Rotation	Sets image rotation.	
	0 (def.)	No image rotation
	90	Rotate 90° clockwise with the center of the sensor camera as the origin
	180	Rotate 180° clockwise with the center of the sensor camera as the origin
	270	Rotate 270° clockwise with the center of the sensor camera as the origin

Mirroring	Horizontal	Vertical	Sets image mirroring
	Disabled (def.)	Disabled (def.)	No mirroring
	Enabled	Disabled	Horizontal mirroring
	Disabled	Enabled	Vertical mirroring
	Enabled	Enabled	Vertical and horizontal mirroring
Trigger Mode	Enables or disables the external trigger input for the sensor camera.		
	Enabled	Enables external trigger input	
	Disabled (def)	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 adjust (Offset) the position of the cross (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 adjust (Offset) the position of the cross (white) in the Y direction. Setting range: - 10.0000 to + 10.0000.	
	Zero Set	Offset to the current measurement coordinates	
③ Judgement			
Angle (D)	Sets OK / NG judgement on the Angle (def. = 0.0000). Setting range: 0.0000 to 10.0000.		
	Enabled	Enables the judgement	
	Disabled (def.)	Disables the judgement	
Divergence	Sets the D4Sigma or the 1/e ² or the D86 OK / NG judgement on the beam divergence. 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 judge the Divergence	
	1/e ²	Sets the 1/e ² to judge the Divergence	
	D86	Sets the D86 to judge the Divergence	

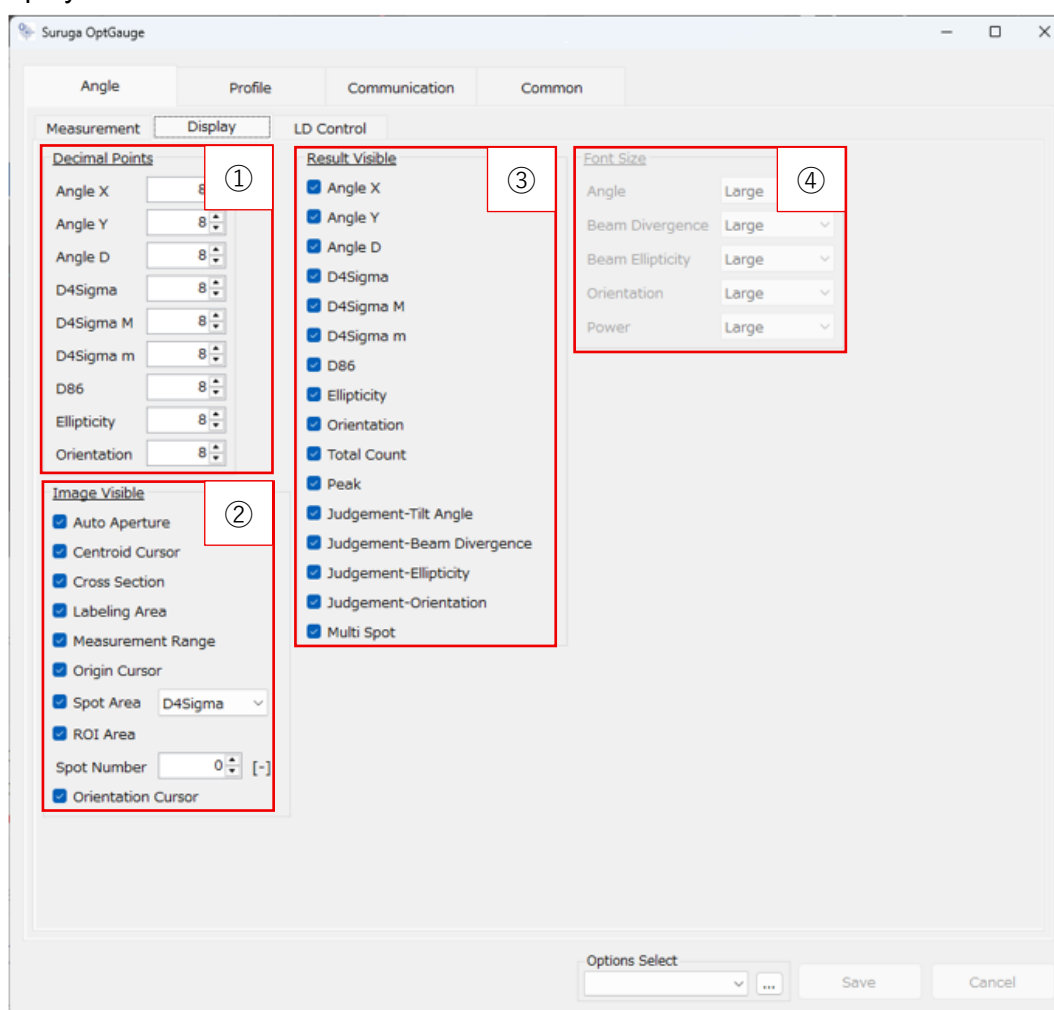
Ellipticity	Sets OK / NG judgment for the Beam Ellipticity. Setting range: 0.0000 to 1.0000 (def. 0.0000)	
	Enabled	Enables the judgement
	Disabled (def.)	Disables the judgement
Orientation	Set OK / NG determination for the Orientation Determination is made by combining the set angle and Range ($\pm$)	
	Set Angle: Set range: - 90.0000 to + 90.0000 (default 0.0000)	
	Range [$\pm$]	Sets range: 0.0000 to 90.0000 (def.0.0000)
	Enable	Enables the judgement
	Disable (def)	Disables the judgement
Peak	Sets OK / NG judgment 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 (.csv)
	Disabled (def.)	Does not output Angle 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
Raw	Enabled	Outputs Angle View raw image data (CSV)* with measurement results (CSV) * Outputs luminance values per pixel
	Disabled (def.)	Does not output raw image data (CSV) for the Angle View
⑤ Cross Section	Sets the sectional view display location.	
	Origin Cursor (def.)	Displays coordinate center position beam strength distribution.
	Beam Cursor	Displays the centroid of a beam strength distribution.

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	Sets the Auto Aperture based on the centroid position calculated with the area centroid method
	Intensity (def.)	Sets the Aperture based on the centroid position calculated by luminance weighted method
⑧ ROI	Sets the ROI. If enabled, beam lights are detected within the range of the settings	
	Enabled (def.)	Enables the ROI settings
	Disabled	Disables the ROI settings
	X	Sets the X-axis installation position of the ROI. Range: - 3000 to + 3000 (def. = - 520)
	Y	Sets the Y-axis installation position of the ROI. Range: - 3000 to + 3000 (def. = 520)
	Width	Sets the width of the ROI Setting range: 0 to 3000 (def. = 1040)
	Height	Sets the vertical height of the ROI Setting range: 0 to 3000 (def. = 1040)
⑨ Denoising	Sets thresholds. If enabled, measurements are calculated using pixels with values higher than the set threshold Setting range: 1 to 4095 (default = 100).	
	Enabled (def.)	Enables the Denoising setting
	Disable	Disables the Denoising setting
⑩ Beam Centroid	Sets the calculation method for the Centroid position of a light beam.	
	Aria	Calculates the centroid position by the area centroid method
	Intensity (def.)	Calculates the centroid position by luminance weighted method.
⑪ Angle Type	Sets targets for the angle measurement	

	Tilt Angle (def.)	Sets for the reflection angle measurement. Sets 1/2 of an incident beam as the measured target angle.
	Beam Angle	Sets for the external light angle measurement. Sets the incident beam angle as the measurement target angle.
⑫ Beam Divergence		
Type	Set the type of beam divergence	
	D4Sigma (def.)	Sets the $D4\sigma$ for the Beam Divergence
	$1/e^2$	Sets the $1/e^2$ for the Beam Divergence
⑬ Orientation		
Enabled	Enables or disables the measurement configuration of the Beam Divergence measurements, the Beam Ellipticity and the Orientation	
	Enabled	Displays the beam divergence by D4 Sigma M (major) and D4 Sigma m (minor). Enables the Beam Ellipticity. Enables the Orientation.
	Disabled (def.)	Displays the Beam Divergence.by X and Y. Disables the Beam Ellipticity. Disables the Orientation.
Method	Sets the non-ISO-compliant rotation angle measurement method *Only effective the “ Type ” in the Beam Divergence is set to the $1/e^2$	
	Ellipse Fitting (def.)	Measurements are performed by the elliptical fitting method
	MaxDistanceSearch	Measurement is performed by the maximum distance of two points search method
⑭ Angle Unit	Sets the angle unit for measurement values	
	Degree (def.)	Sets the unit to decimal degree
	DegMinSec	Sets the unit to degrees-minutes-seconds
	Milliradian	Sets the unit to milli radian
⑮ Multi Spot		
Order	Sets the sorting type of measurement results 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 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).	
⑩ Binning	Sets the Binning function (2x2) of the sensor camera. If enabled, the 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 binning function.
	Disabled (def.)	Disables binning function.
⑪ Adaptive Cal	Sets "Adaptive Cal" button show / hide. Attention Please be advised to disable the " Denoising " while the Adaptive Cal is enabled.	
	Enabled	Shows the "Adaptive Cal" button
	Disabled (def.)	Hides the "Adaptive Cal" button

4.1.1.2 Display



① Decimal Points

It specifies the number of decimal places when outputting measurement results*

Setting range: 0 to 8 (default=8)

*Note: the "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 output
Angle Y	Sets the number of decimal places for the Angle Y measurement output
Angle D	Sets the number of decimal places for the Angle D measurement output
D4Sigma	Sets the number of decimal places for the D4Sigma measurement output
1/e ²	Sets the number of decimal places for the 1/e ² measurement output
D4Sigma X(M)	Sets the number of decimal places for the D4Sigma X(M) measurement output
1/e ² X(M)	Sets the number of decimal places for the 1/e ² X(M) measurement output

D4Sigma Y(m)	Sets the number of decimal places for the D4Sigma Y(m) measurement output	
1/e^2 Y(m)	Sets the number of decimal places for the 1/e^2Y(m) measurement output	
D86	Sets the number of decimal places for the D86 measurement output	
Ellipticity	Sets the number of decimal places for the Ellipticity measurement output	
Orientation	Sets the number of decimal places for the Orientation measurement output	
② Image Visible		
Auto Aperture	Sets to display or hide the Auto Aperture	
	Enabled (def.)	<u>D</u> isplays the Auto Aperture
	Disabled	Hides the Auto Aperture
Centroid Cursor	Sets to display or hide the Centroid Cursor	
	Enabled (def.)	Displays the Centroid Cursor
	Disabled	Hides the Centroid Cursor
Cross Section	Sets to display or hide the Cross Section	
	Enabled (def.)	Displays the Cross Section
	Disabled	Hides the Cross Section
Labeling Area	Sets to display or hide the Labeling Area	
	Enabled (def.)	Displays the Labeling Area
	Disabled	Hides the Labeling Area
Measurement Range	Sets to display or hide the Measurement Range	
	Enabled (def.)	Displays the Measurement Range
	Disabled	Hides the Measurement Range
Origin Cursor	Sets to display or hide the Origin Cursor	
	Enabled (def.)	Displays the Origin Cursor
	Disabled	Hides the Origin Cursor
Spot Area	Sets to display or hide the Spot Area	
	D4Sigma(def.)	Sets beam diameter calculation method in the D4Sigma to display the Spot Area.
	1/e^2	Sets beam diameter calculation method in the 1/e^2 to display the Spot Area
	D86	Sets beam diameter calculation method in the D86 to display the Spot Area

	Enabled (def.)	Displays the Spot Area
	Disabled	Hides the Spot Area
ROI Area	Sets to display or hide the ROI Area	
	Enabled (def.)	Displays the ROI Area
	Disabled	Hides the ROI Area
Spot Number	Sets the number of label numbers to display when beam light is detected (default = 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 the measurement result
	Disabled	Hides the Angle X of the measurement result
Angle Y	Enabled (def.)	Displays the Angle Y of the measurement result
	Disabled	Hides the Angle Y of the measurement result
Angle D	Enabled (def.)	Displays the Angle D of the measurement result
	Disabled	Hides the Angle D of the measurement result
D4Sigma	Enabled (def.)	Displays the D4Sigma of the measurement result
	Disabled	Hides the D4Sigma of the measurement result
1/e ²	Enabled (def.)	Displays the 1/e ² of the measurement results.
	Disabled	Hides the 1/e ² of the measurement result
D4Sigma X(M)	Enabled (def.)	Displays the D4Sigma X(M) of the measurement result
	Disabled	Hides the D4Sigma X(M) of the measurement result
1/e ² X(M)	Enabled (def.)	Displays the 1/e ² X(M) of the measurement result
	Disabled	Hides the 1/e ² X(M) of the measurement result
D4Sigma Y(m)	Enabled (def.)	Displays the D4Sigma Y(m) of the measurement result
	Disabled	Hides the D4Sigma Y(m) of the measurement result
1/e ² Y(m)	Enabled (def.)	Displays the 1/e ² Y(m) of the measurement result
	Disabled	Hides the 1/e ² Y(m) of the measurement result
D86	Enabled (def.)	Displays the D86 of the measurement result

	Disabled	Hides the D86 of the measurement result
Ellipticity	Enabled (def.)	Displays the Ellipticity of the measurement result
	Disabled	Hides the Ellipticity of the measurement result
Orientation	Enabled (def.)	Displays the Orientation measurement result
	Disabled	Hides the Orientation measurement result
Total Count	Enabled (def.)	Displays the Total Count of the measurement result
	Disabled	Hides the Total Count of the measurement result
Peak	Enabled (def.)	Displays the Peak of the measurement result
	Disabled	Hides the Peak of the 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

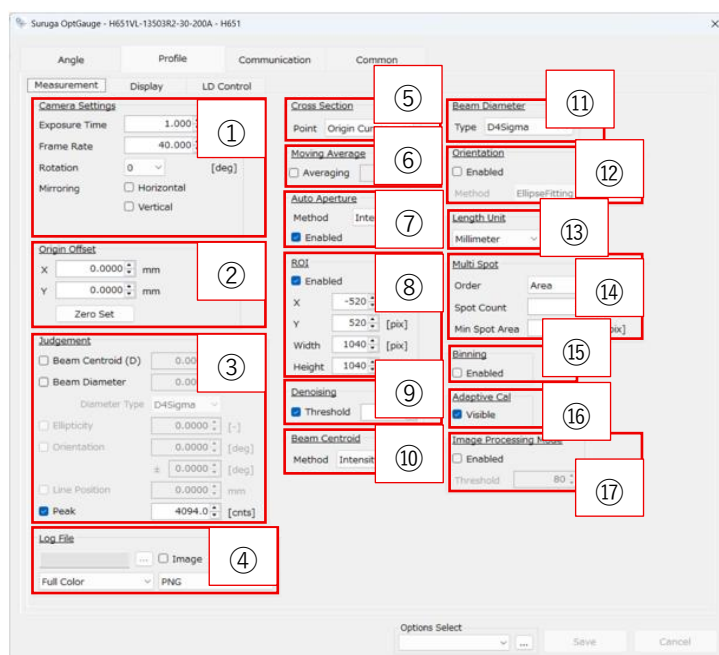
① Camera Settings		
Exposure Time	Sets the sensor camera exposure time. (def. = 1. 000). Setting range: 0.027 to 2000.000.	
Frame Rate	Sets the sensor camera frame rate. (def. = 40. 000). Setting range: 0.1 to 100. 000.	
② Internal Light Source		
Power	Set the internal light source power (default=400). Setting range: 0 to 4095.	
LD	Set the internal light source to be on or off. The status of the internal light source is indicated by the color of the buttons and text.	
	Green	Sets the internal light source is ON
	Gray (Black txt.)	Sets the internal light source is OFF
	Gray (gray txt.)	The internal light source cannot be controlled. Please check the power supply status to the sensor.
③ LD Adjustment		
Auto	Always enables / disables the Automatic Brightness control	
	Enabled	Keeps enabling the Automatic Brightness control

	Disabled (def.)	Keeps disabling the Automatic Brightness control.
Target	Sets the upper limit of the 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 Power Selection		
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) = 190 (H651NL)、450 (H651VL)
	Standard	LD output (Power) = 890 (H651NL)、580 (H651VL)
	Medium	LD output (Power) = 4095 (H651NL)、1480 (H651VL)
	High	LD output (Power) = 4095 (H651NL)、4095 (H651VL)
	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: 0.027 to 20.000	
Max	Sets the maximum value for the exposure time adjusted at the automatic brightness (def. = 20.000). Its setting range: Min to 20.000	
Min	Sets the minimum value for the exposure time adjusted at the automatic brightness (def. = 0.027). Its setting range: 0.027 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 Profile

4.1.2.1 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 display image rotation	
	0 (def.)	No Rotation.
	90	Rotate 90° clockwise with the center of the sensor camera as the origin
	180	Rotate 180° clockwise with the center of the sensor camera as the origin
	270	Rotate 270° clockwise with the center of the sensor camera as the origin

Mirroring	Horizontal	Vertical	Sets image mirroring
	Disabled (def.)	Disabled (def.)	No mirroring
	Enabled	Disabled	Horizontal mirroring
	Disabled	Enabled	Vertical mirroring
	Enabled	Enabled	Vertical and horizontal mirroring
Trigger Mode	Enables/Disables the external trigger input for the sensor camera		
	Enabled	Enables the external trigger inputs	
	Disabled (def.)	Disables the external trigger inputs	
② Origin Offset	Offsets the center position of the coordinates (the cross (white))		
	X	Sets the center of the sensor camera as 0.0000 (def.) and offsets the position of the cross (white) in the X direction. Setting range: - 20.0000 to + 20.0000.	
	Y	Sets the center of the sensor camera as “0.0000(def.)” and offsets the position of the cross (white) in the Y direction. Setting range: - 20.0000 to + 20.0000.	
	Zero Set	Offsets to the current measurement coordinates	
③ Judgement			
Beam Centroid (D)	Sets OK or NG judgement on the centroid (def. = 0.0000). Setting range: 0.0000 to 20.0000 (def. 0.0000)		
	Enabled	Enables the judgement.	
	Disabled (def.)	Disables the judgement.	
Beam Diameter	Sets the OK or NG judgement on the D4Sigma or the 1/e ² or the D86. Setting range: 0.0000 to 20.0000		
	Enabled	Enables the judgement.	
	Disabled (def.)	Disables the judgement.	
Diameter Type	D4Sigma (def.)	Sets the D4Sigma for the judged diameter.	
	1/e ²	Sets the 1/e ² for the judged diameter.	
	D86	Sets the D86 for the judged diameter.	
Ellipticity	Sets OK / NG judgment on the Beam Ellipticity. Setting range: 0.0000 to 1.0000 (def. 0.0000).		
	Enabled	Enables the judgement	
	Disabled (def.)	Disables the judgement	
Orientation	Set OK / NG judgement on the Orientation.		

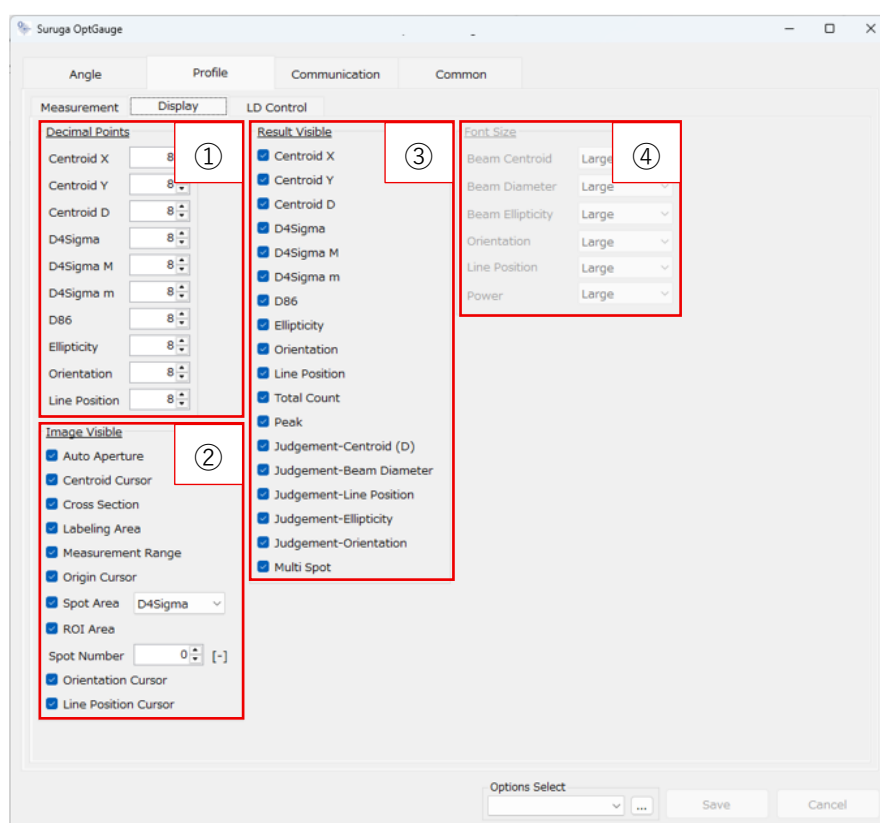
	Decision is made by considering the set angle and range ($\pm$).	
	Set angle Setting range: - 90.0000 to + 90.0000 (def. 0.0000).	
	Range [$\pm$]	Setting range: 0.0000 to 90.0000 (def. 0.0000)
	Enable	Enables the judgement
	Disable (def.)	Disables the judgement
Line Position	Set OK / NG judgement on the Line Position. Setting range: - 20.0000 to + 20.0000 (def. 0.0000)	
	Enable	Enables the judgement
	Disable (def.)	Disables the judgement
Peak	Sets OK / NG judgment on the Peak (def. = 4094.0). Setting range: 0.0 to 4095.0	
	Enabled	Enables the judgement
	Disabled (def.)	Disables the judgement
④ Log File		
	Specifies the saving location for measurement results output (CSV) for the Output Once	
Image	Enabled	Outputs the Profile View image data along with measurement results (CSV)
	Disabled (def.)	The Profile View image data will not be output
	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 the brightness value data (CSV)* from the Profile View along with measurement results (CSV). <i>*Outputs brightness values as text data in CSV format, not as binary data.</i>
	Disabled (def.)	Does not output Angle View raw image data (PNG)
⑤ Cross Section	Sets the display location for the beam intensity distribution	
	Origin Cursor (def.)	Displays the beam intensity distribution at the center position of the coordinates

	Beam Cursor	Displays the beam intensity distribution at the beam' centroid
⑥ Moving Average	Sets averaging process (moving average) for measurement values (def. = 2). Setting range: 2 to 262144.	
	Enabled	Enables the averaging process
	Disabled (def.)	Disables the averaging process
⑦ Auto Aperture	Sets the Auto Aperture	
	Enabled (def.)	Enables the Auto Aperture settings
	Disabled	Disables the Auto Aperture settings
	Area	Sets Auto Aperture from the centroid position calculated with the Area Centroid process
	Intensity(def.)	Sets Auto Aperture from centroid position calculated by luminance weighed method
⑧ ROI	Sets the ROI. If enabled, beam lights are detected within the range of the settings	
	Enabled (def.)	Enables ROI settings
	Disabled	Disables ROI settings
	X	Sets ROI X direction setting position. Range: - 3000 to + 3000 (def. = - 520)
	Y	Sets ROI Y direction setting position. Range: -3000 to + 3000 (def. = + 520)
	Width	Sets ROI horizontal width. Setting range: 0 to 3000 (def. = 1040)
	Height	Sets ROI vertical width. Setting range: 0 to 3000 (def. = 1040)
⑨ Denoising	Sets the thresholds. If enabled, the measurement value is calculated using pixels with values higher than the set threshold (def. = 100). Setting range: 1 to 4095.	
	Enabled (def.)	Enables denoising setting.
	Disabled	Disables denoising setting.
⑩ Beam Centroid	Sets the calculation method for the centroid position of a light beam	
	Area	Calculates its position by area centroid method
	Intensity (def.)	Calculate the position by luminance weighted centroid method
⑪ Beam Diameter		

Type	Set the type of Beam Diameter	
	D4Sigma (def.)	Displays the $D4\sigma$ beam diameter
	$1/e^2$	Displays the $1/e^2$ beam diameter
⑫ Orientation		
Enabled	Enables or disables the Beam Diameter measurements, the Beam Ellipticity and the Orientation	
	Enabled	Displays D4 Sigma M (major) and D4 Sigma m (minor) of the beam diameter. Enables the Beam Ellipticity. Enables the Orientation
	Disabled (def.)	Displays X and Y of the beam diameter. Disables Ellipticity. Disables the Orientation.
Method	Configure non-ISO compliant rotation angle measurement method. *Only effective if the Type in the Beam Diameter is set to $1/e^2$.	
	Ellipse Fitting(def.)	Measurements are taken using the elliptical fitting method
	MaxDistanceSearch	Measurement is performed using the maximum distance of two points search method
⑬ Length Unit	Sets the distance unit for the measurement values	
	Millimeter (def.)	Sets the unit to millimeter (mm)
	Micrometer	Sets the unit to micrometer (μm)
⑭ Multi Spot		
Order	Sets numbers to the measurement results to display When detecting multiple beam lights (default = 1). Setting range: 1 to 100.	
	Area(def.)	Sorts by beam area from the largest size
	Centroid	Sorts by Centroid values closest to the center
	Peak	Sorts in descending order of Peak
	Total Count	Sorts in descending order of Total Count
Spot 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 beam size condition using the pixel threshold when detecting a beam light (def. = 1). Setting range: 1 to 1023(def. = 1)	
⑮ Binning	Sets the binning function (2x2) of the sensor camera.	

	It 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
	Disabled (def.)	Disables the Binning
⑩ Adaptive Cal	Sets "Adaptive Cal" button display or hide.	
	Attention Please be advised to disable the " Denoising " while enabling the Adaptive Cal.	
	Enabled(def.)	Displays the "Adaptive Cal" button.
	Disabled	Hides the "Adaptive Cal" button.
⑪ Image Processing Mode		
Enabled	Set the Image Processing Mode	
	Enabled	Enables the Image Processing Mode
	Disabled (def)	Disables the Image Processing Mode
Threshold	Adjusts the sensitivity for detecting straight lines in the Line Position. Higher values detect only clearly defined straight lines (def. = 80) Setting range: 30 to 300	

4.1.2.2 Display



① Decimal Points

Designates the number of decimal places when outputting measurement results*.

Setting range: 0 to 8 (def. = 8)

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

Centroid X	Sets the number of decimal places for the Centroid X measurement results
Centroid Y	Sets the number of decimal places for the Centroid Y measurement results
Centroid D	Sets the number of decimal places for the Centroid D measurement results
D4Sigma	Sets the number of decimal places for the D4Sigma measurement results
1/e ²	Sets the number of decimal places for the 1/e ² 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 D4Sigma Y(m) measurement results
1/e ² Y(m)	Sets the number of decimal places for the 1/e ² Y(M) measurement results
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	Set the number of decimal places for the Orientation measurement results	
Line Position	Set the number of decimal places for the Line Position measurement results	
② Image Visible		
Auto Aperture	Sets the display/hide of the Auto Aperture.	
	Enabled (def.)	Displays the Auto Aperture
	Disabled	Hides the Auto Aperture
Centroid Cursor	Sets the display/hide of the Centroid Cursor	
	Enabled (def.)	Displays the Centroid Cursor
	Disabled	Hides the Centroid Cursor
Cross Section	Sets the display/hide of the Cross Section	
	Enabled (def.)	Displays the Cross Section
	Disabled	Hides the Cross Section
Labeling Area	Sets the display/hide of the Labeling Area	
	Enabled (def.)	Displays the Labeling Area
	Disabled	Hides the Labeling Area
Measurement Range	Sets the display/hide of the Measurement Range	
	Enabled (def.)	Displays the Measurement Range
	Disabled	Hides the Measurement Range
Origin Cursor	Sets the display/hide of the Origin Cursor	
	Enabled (def.)	Displays the Origin Cursor
	Disabled	Hides the Origin Cursor
Spot Area	Sets the display/hide of the Spot Area	
	D4Sigma(def.)	Sets beam diameter calculation method in the D4Sigma to display the Spot Area
	1/e^2	Set the beam diameter calculation method for the Spot Area display to 1/e².
	D86	Sets beam diameter calculation method in the D86 to display the Spot Area.
	Enabled (def.)	Displays the Spot Area.
	Disabled	Hides the Spot Area.
ROI Area	Sets the display/hide of the ROI Area.	

	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	Sets the display/hide the Orientation Cursor	
	Enabled	Displays the Orientation Cursor
	Disabled (def.)	Hides the Orientation Cursor
Line Cursor	Sets the display/hide the Line Cursor	
	Enabled	Displays the Line Cursor.
	Disabled (def.)	Hides the Line Cursor.
③ Result Visible		
Sets the display/hide of the measurement result.		
Centroid X	Enabled (def.)	Displays the X of a centroid measurement result
	Disabled	Hides the X of a centroid measurement result
Centroid Y	Enabled (def.)	Displays the Y of a centroid measurement result
	Disabled	Hides the Y of a centroid measurement result
Centroid D	Enabled (def.)	Displays the D of a centroid measurement result
	Disabled	Hides the D of a centroid 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 X(M) of D4Sigma measurement result
	Disabled	Hides the X(M) of D4Sigma 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 Y(m) of D4Sigma measurement result
	Disabled	Hides the Y(m) of D4Sigma 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 results
	Disabled	Hides the Orientation measurement results
Line Position	Enabled (def.)	Displays the X of D4Sigma measurement result
	Disabled	Hides the X of D4Sigma 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 – Centroid	Enabled (def.)	Displays the measurement results for Judgement – Centroid
	Disabled	Does not display the measurement results for Judgement – Centroid
Judgement – Beam Diameter	Enabled (def.)	Displays the measurement results for Judgement – Beam Diameter
	Disabled	Does not display the measurement results for Judgement – Beam Diameter
Judgement – Line Position	Enabled (def.)	Displays the measurement results for Judgement – Line Position
	Disabled	Does not display the measurement results for Judgement – Line Position
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		

4.1.2.3 LD Control

Suruga OptGauge - H651VL-13503R2-30-200A - H651

Angle Profile Communication Common

Measurement Display LD Control

Camera Settings

Exposure Time 1.000

Frame Rate 40.000 [1/sec]

LD Adjustment

☐ Auto

Target 3500

Range 250 [-]

Reflectivity 100.00 [%]

☐ Use Previous Value

Tune

Auto Exposure

Initial 1.000

Max 100.000 [ms]

Min 0.100 [ms]

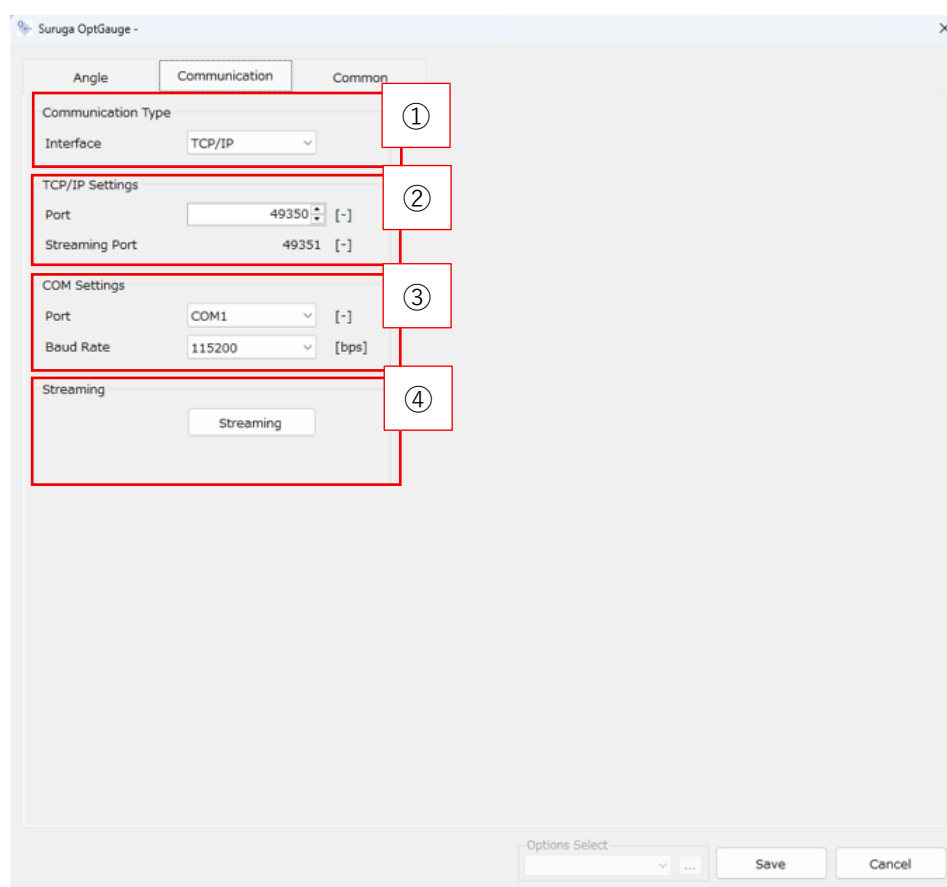
Options Select

Save Cancel

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	Sets enable /disable the external trigger input for the sensor cameras.	
	Enabled	Enables the external trigger input.
	Disabled (def.)	Disables the external trigger input.
② LD Adjustment		
Auto	Always enables / disables the Automatic Brightness control.	
	Enabled	Always enables the Automatic Brightness control
	Disabled (def.)	Always disables the Automatic Brightness control
Target	Sets the upper limit of the Peak luminance (def. = 3500). The setting range: 1000 to 3500	
Range	Sets the range of the brightness adjustment complete. (def. = 250) It adjusts [light beams] within the target dimming range. The setting range: 100 to 1000	
Reflectivity	Sets the reflectance of a measuring target (def. = 100) By setting the reflectance of a measuring target, it optimizes dimming time required.	

	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 Automatic Brightness control is not enabled, a click on the Tune button icon executes the automatic brightness.	
③ Auto Exposure		
Initial	Sets an initial value of the exposure time of the automatic brightness executed for the first time (def. = 1.000). Its setting range: 0.1 to 2000.000	
Max	Sets the maximum value for the exposure time adjusted at the automatic brightness (def. = 99.000). Its setting range: Min to 2000.000	
Min	Sets the minimum value for the exposure time adjusted at the automatic brightness (def. = 0.1). Its setting range: 0.1 to Max	

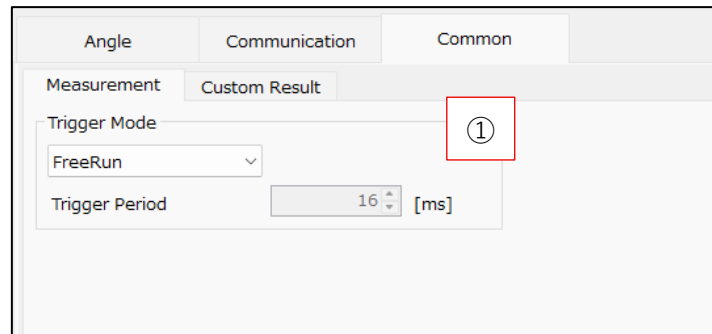
4.1.3 Communication



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 ”	

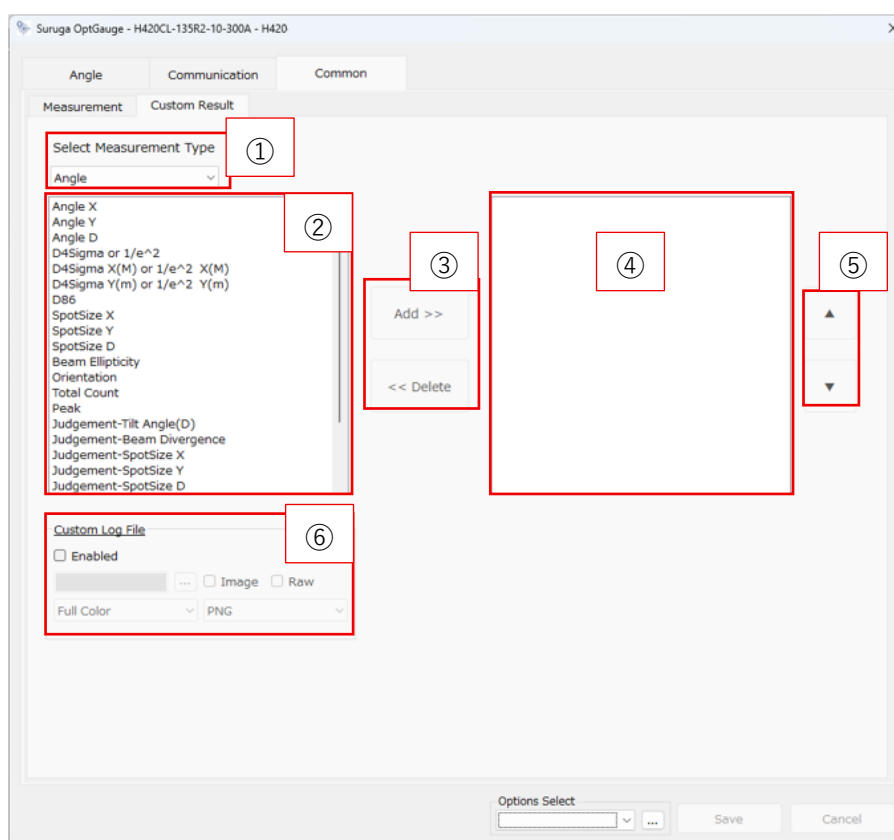
4.1.4 Common

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
	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”	

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
	Profile	Sets the measurement type to Profile for editing
③ Output Item List	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 Profile View together with the measurement results (CSV)
	Disabled (def.)	Does not output image data from Angle View and Profile 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 Profile 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 Profile View

4.2 Option List

The Suruga OptGauge can hold multiple option lists and switch between them.

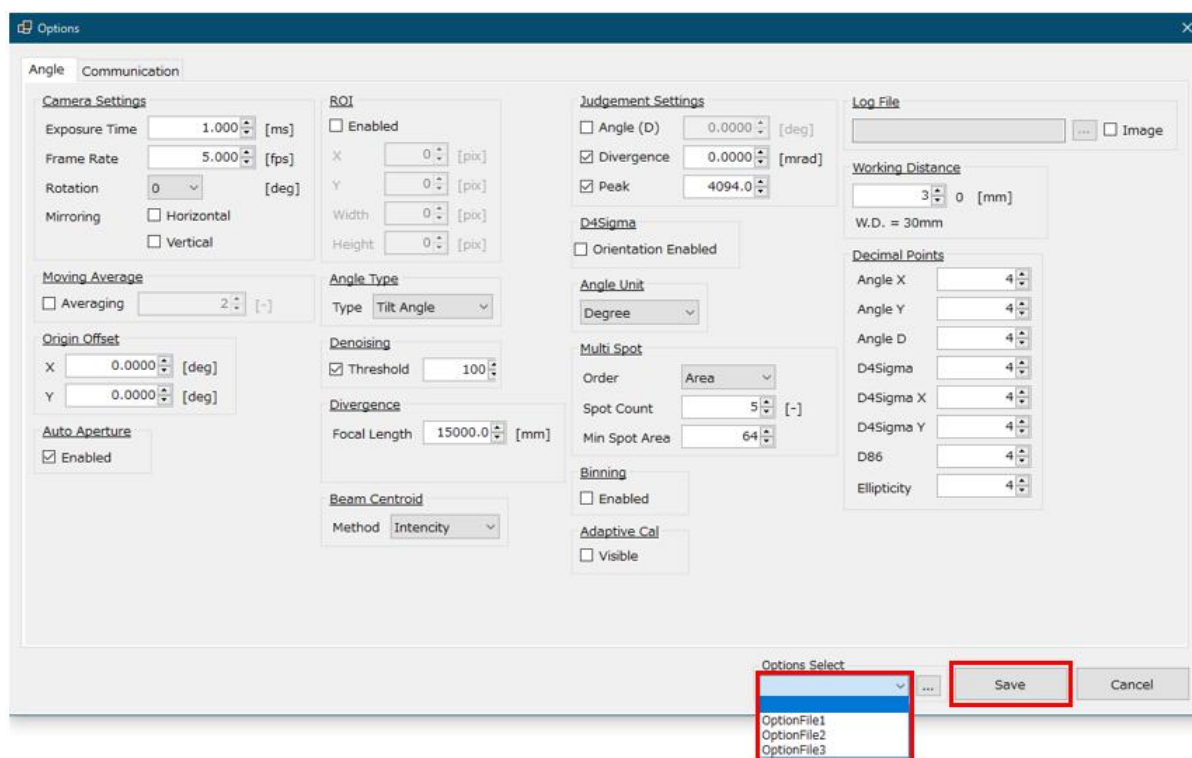
When you want to apply different option settings based on the measurement target or wavelength, you can switch option lists while the Suruga OptGauge is running.

This section describes how to switch between multiple option lists, register them, and delete them.

4.2.1 Switching Option Lists

This section explains how to switch option lists.

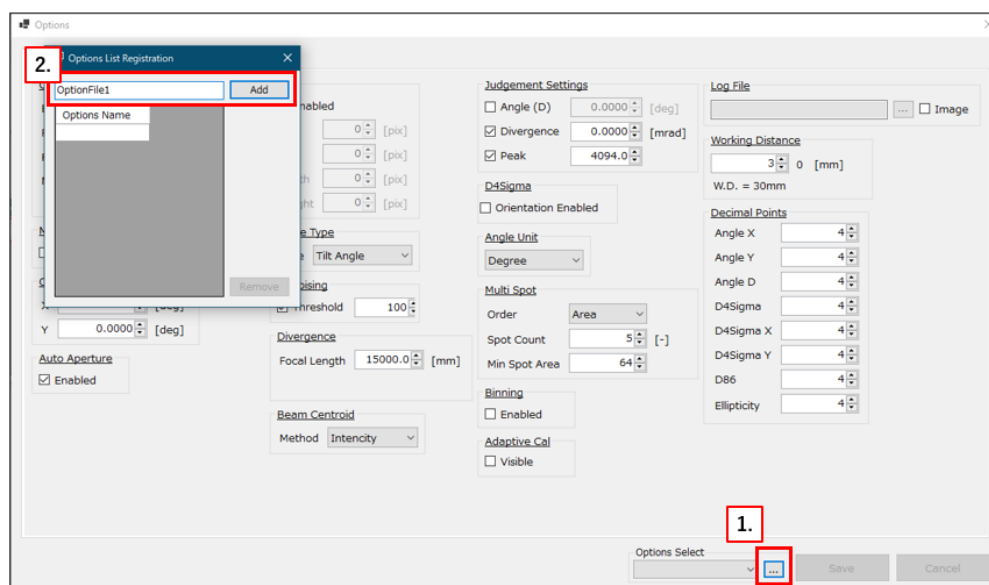
1. From the "Options Select" pulldown menu, select the desired option list name.
2. Click the "Save" button.



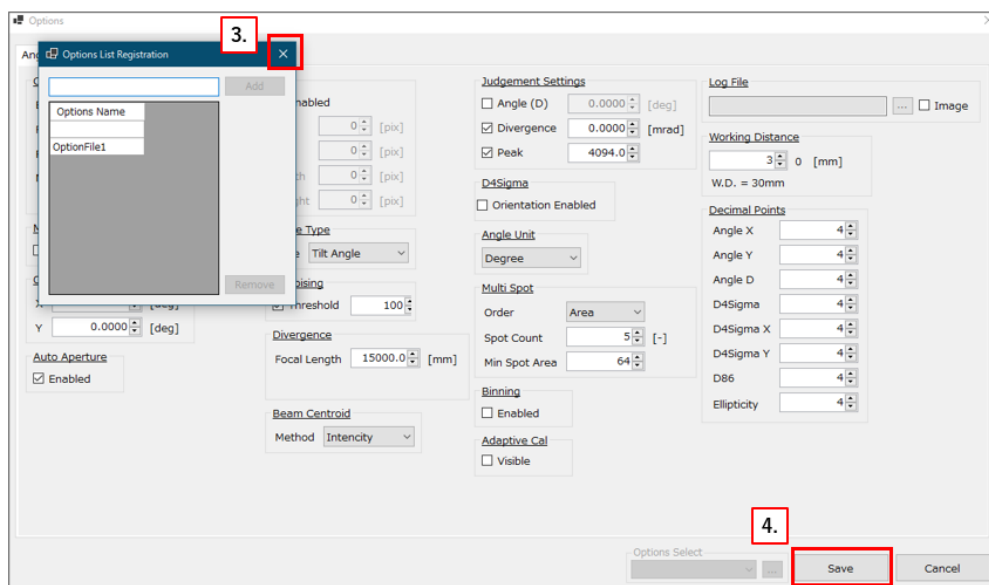
4.2.2 Registering Option Lists

This section explains how to register option lists. Up to 31 option lists can 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.

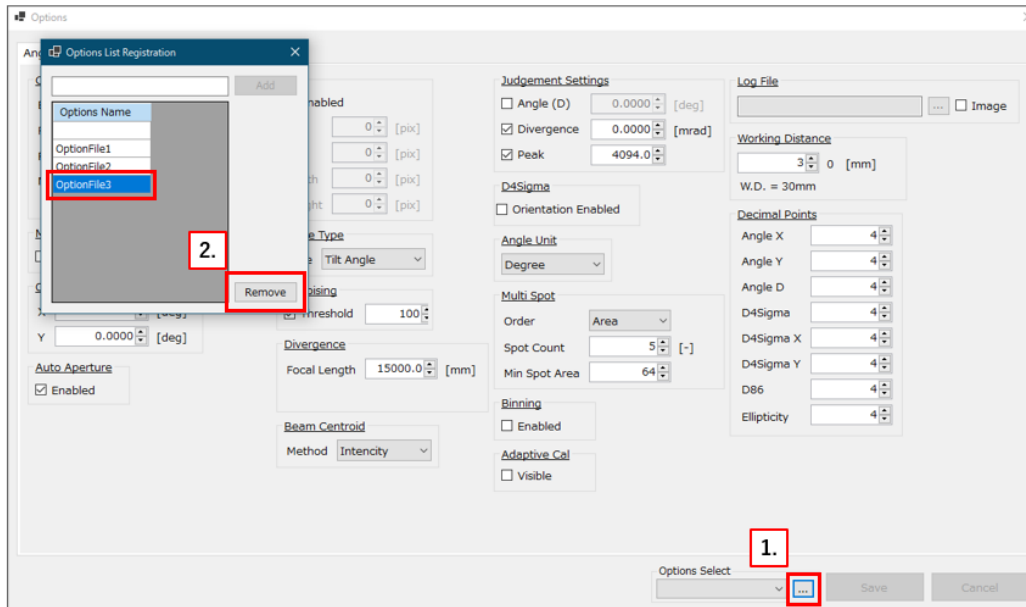


5. The list is now registered in "Options Select" for selection.
(*See "[Switching Option Lists](#)")

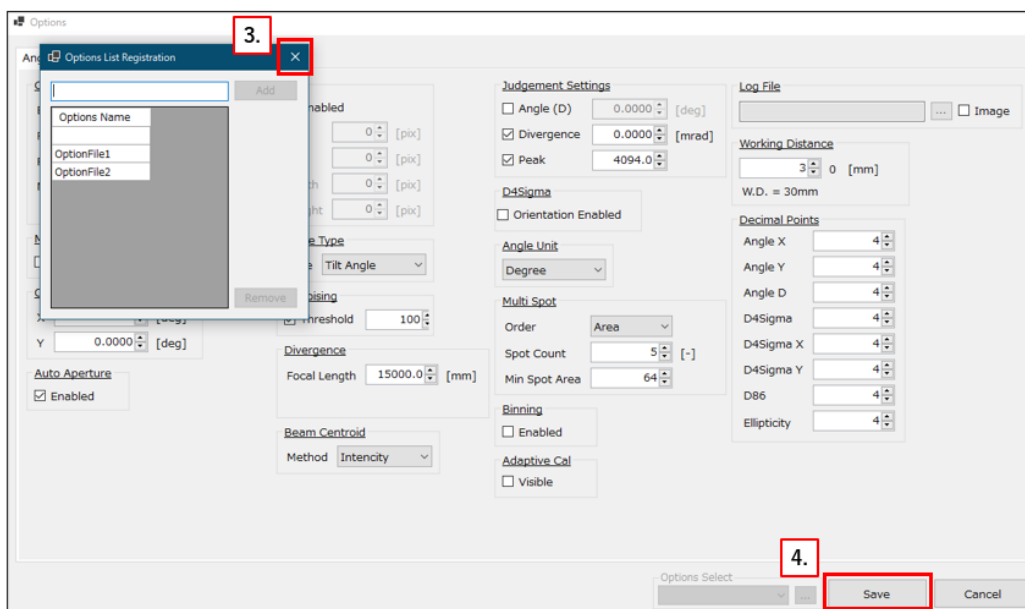
4.2.3 Deleting Option Lists

This section explains how to delete option lists.

1. Select all but the option name to be deleted and click the [...] button.
2. Select the option name to be deleted and click the [Remove] button.



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



5 Controlling from External Devices

5.1 RS232C

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

**Note: Terminal software must be provided by users.*

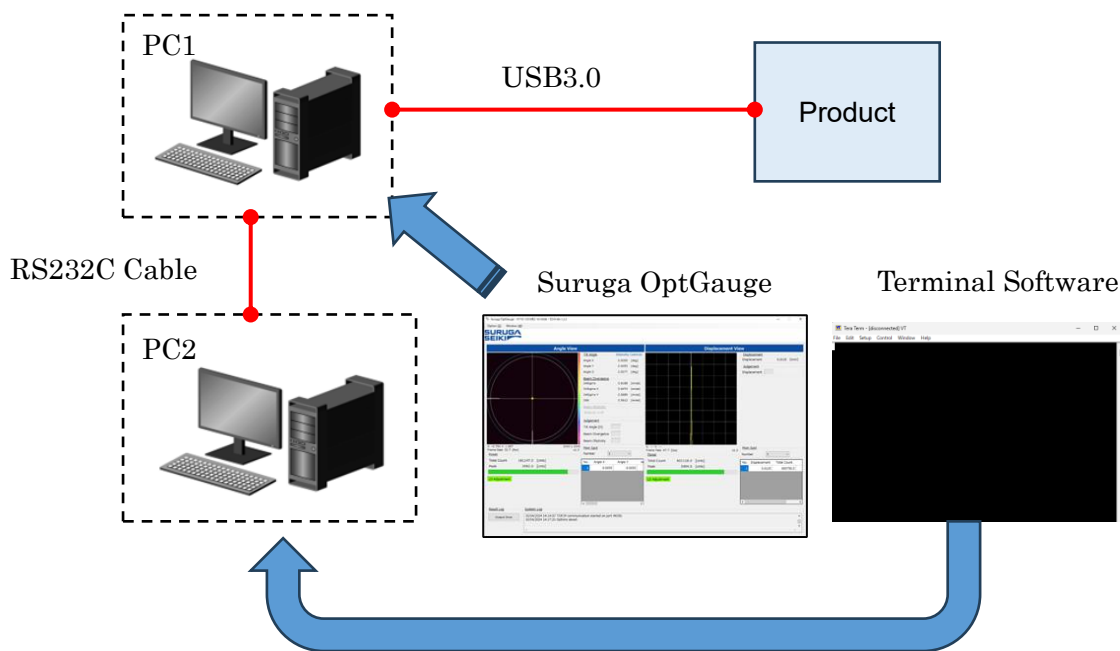
5.1.1 Communication Specifications

Item	Detail
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

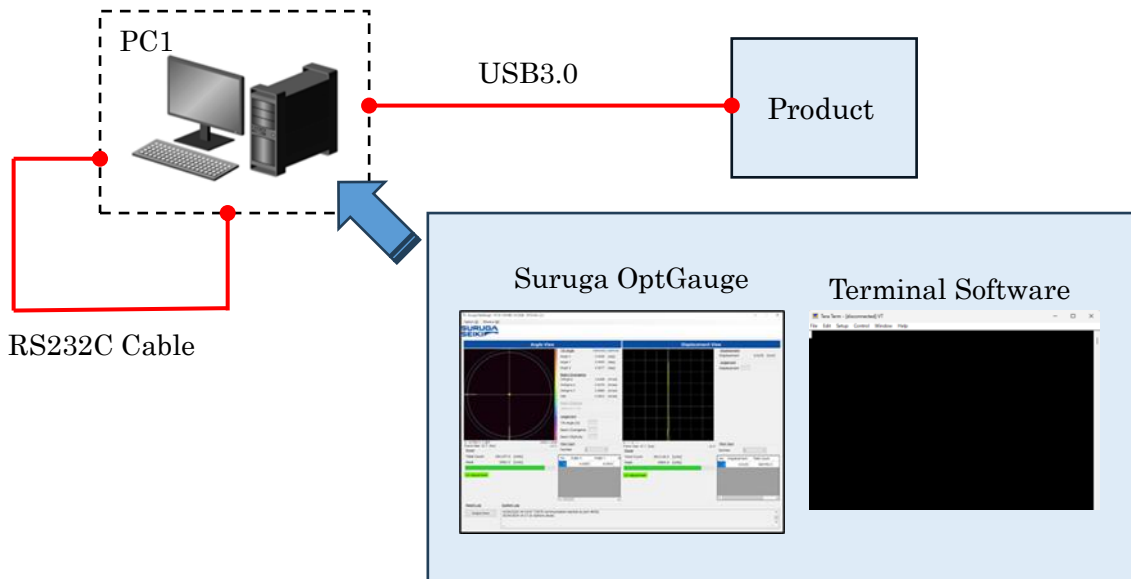
■ Using external PCs for communication

1. Set up two computers and connect with an RS232C cable.
2. Connect the Products to one of the computers, launch Suruga OptGauge, and start measurement.
3. Prepare terminal software on the other computer.
4. Set the communication settings for the command and begin communication.



■ Using the same computer for communication

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



5.1.3 Communication Commands Setting Method

This section describes how to configure the Suruga OptGauge and terminal software for 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 RS-232C is connected.

The screenshot shows the 'Communication' tab of the Suruga OptGauge settings. The 'Communication Type' section has 'Interface' set to 'COM'. The 'TCP/IP Settings' section has 'Port' set to '49350'. The 'COM Settings' section has 'Port' set to 'COM1' and 'Baud Rate' 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 Suruga OptGauge.
2. Set the same baud rate as the "Baud Rate" setting in 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 is sent and received using terminal software* via TCP/IP communication to exchange commands with the Suruga OptGauge.

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

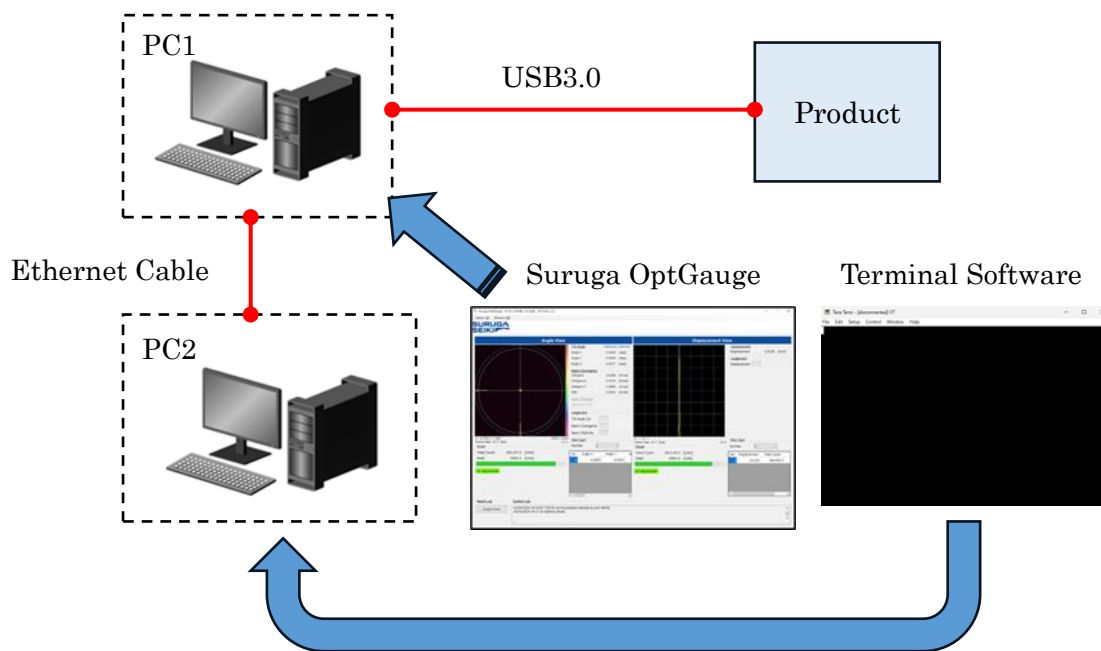
5.2.1 Communication Specifications

Item	Details
Protocol	TCP
IPv4 address	See " Command communication setting method "
Subnet mask	
Default gateway	
DNS server address	
Port Number	Private port range: 49152 to 65535

5.2.2 Example: Connections via TCP/IP Communication

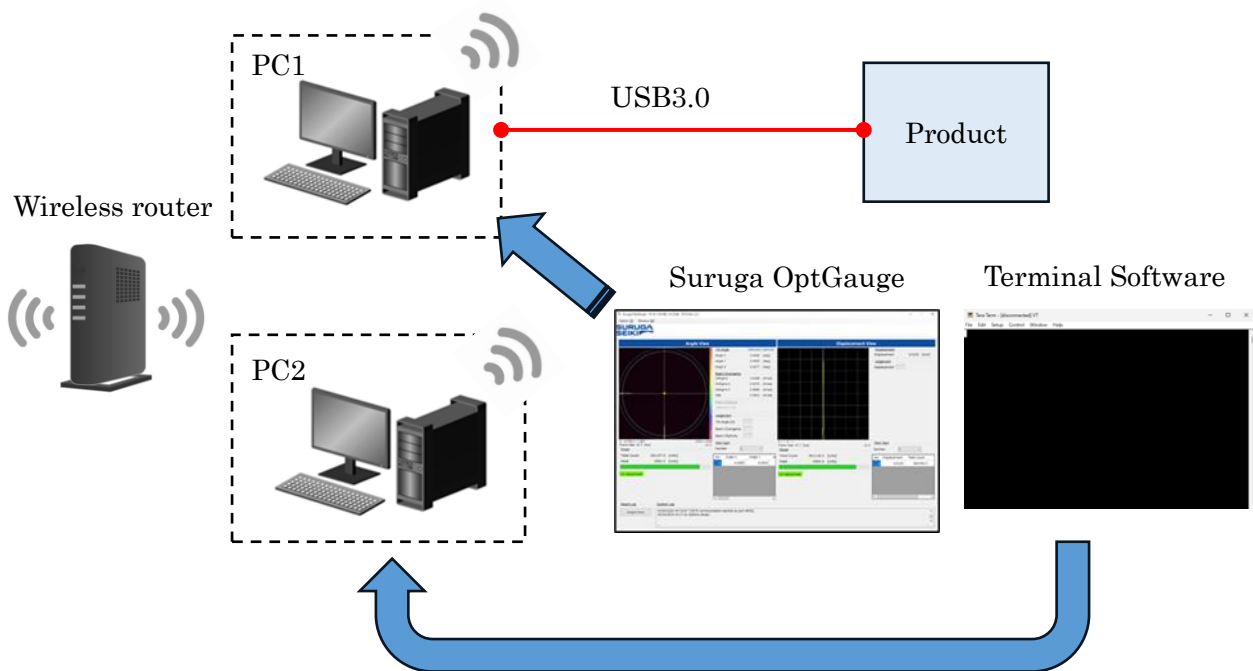
■ Using external devices for communication: Ethernet cable.

1. Set up two computers and connect them with an Ethernet cable.
2. Connect the Products to one of the computers, launch Suruga OptGauge, and start measurement.
3. Prepare terminal software on the other computer.
4. Set the communication settings for the command and start communication.



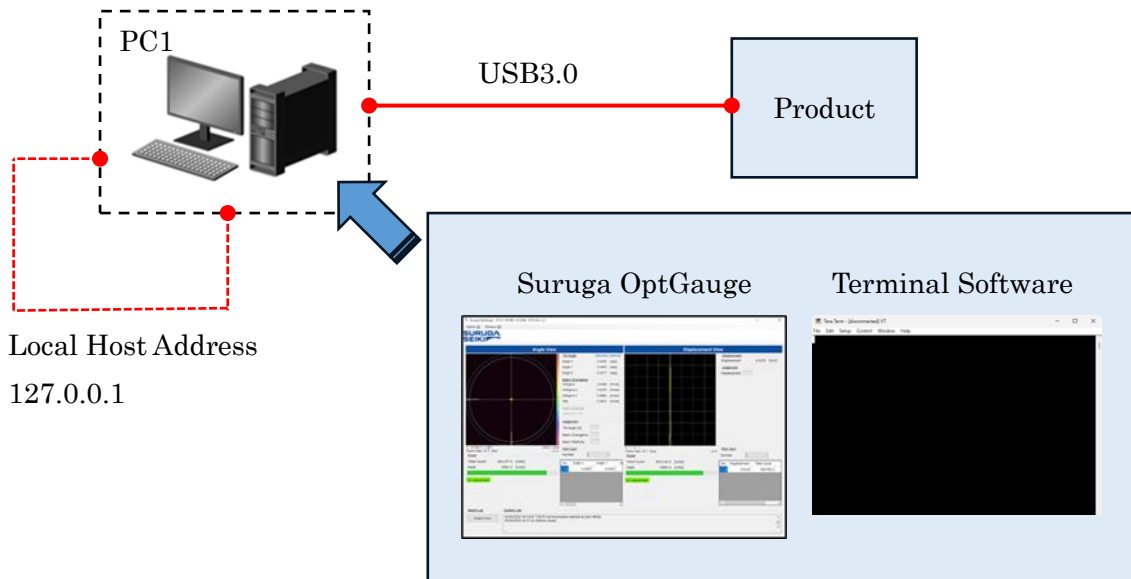
■ Using external devices for communication: Wireless router

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



■ Using the same computer for communication

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

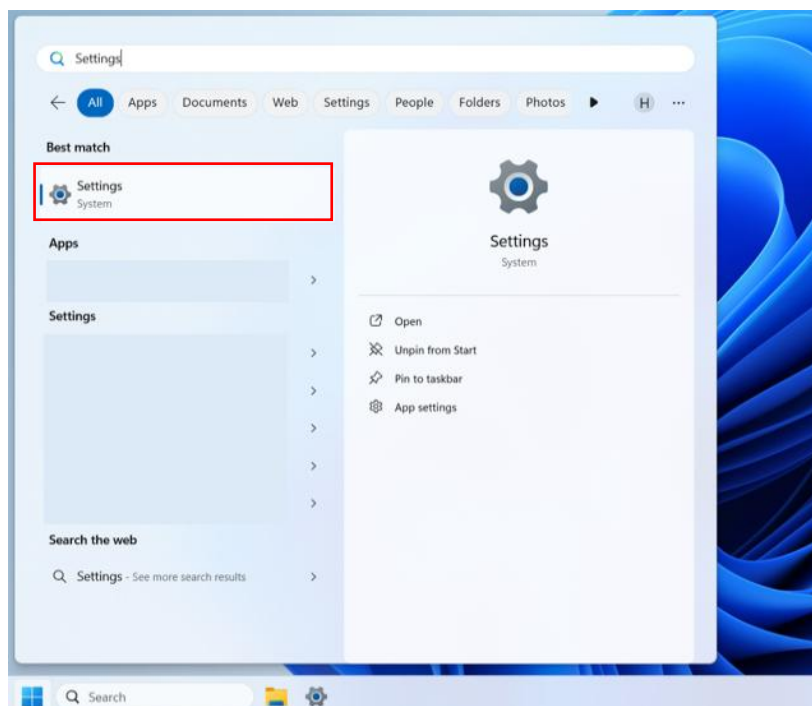


5.2.3 Command Communication Setting Method

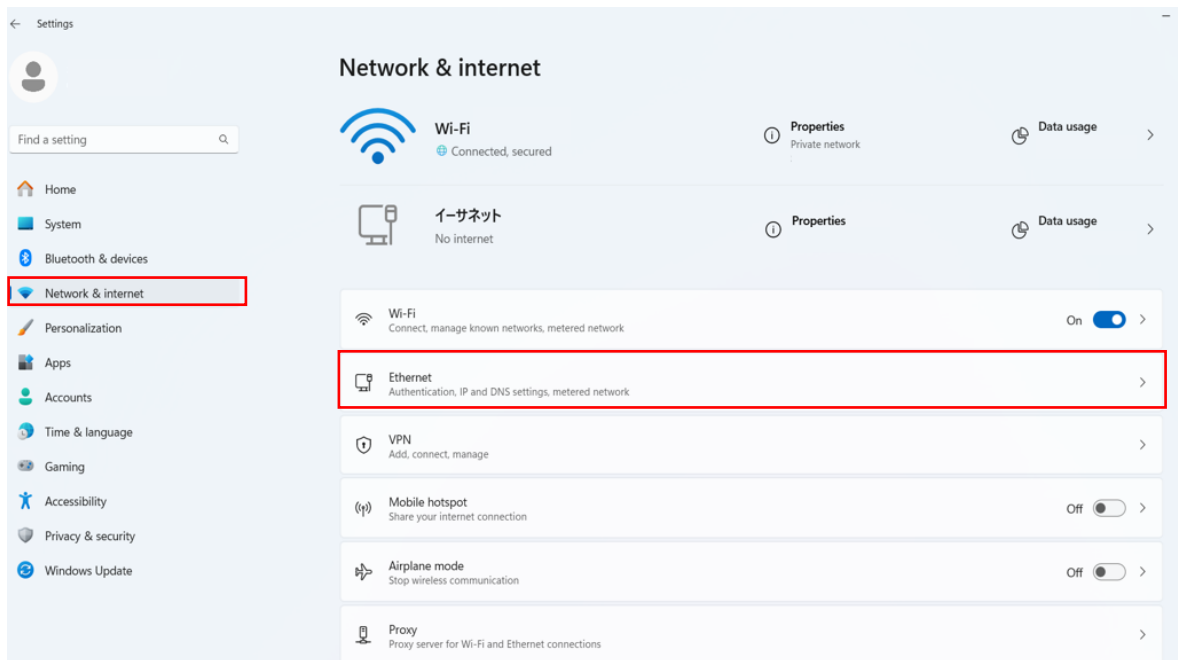
5.2.3.1 Using external devices for communication

PC Settings

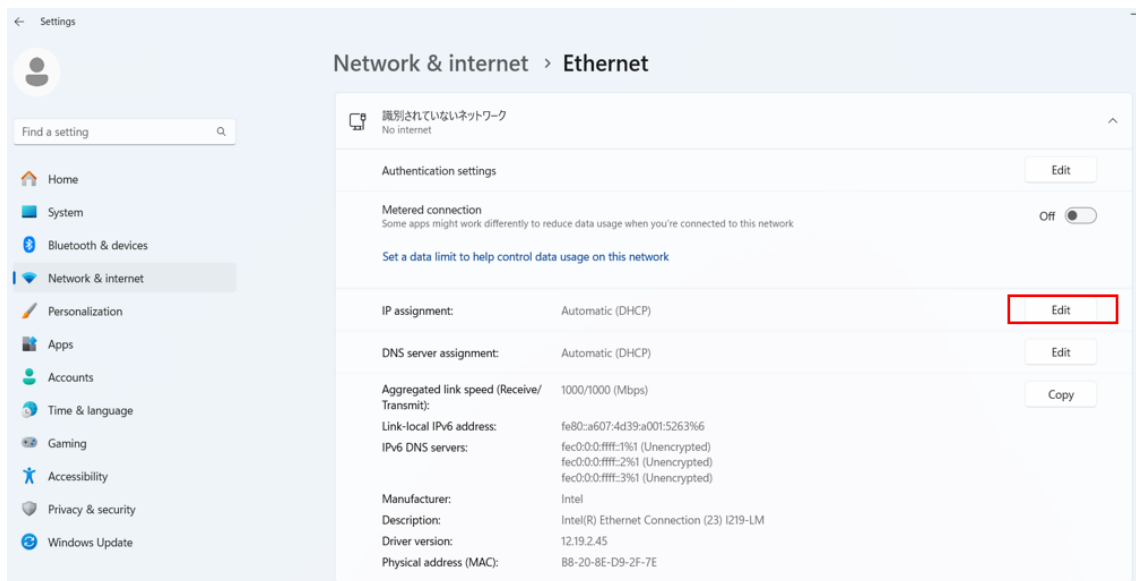
1. Click the [Start] button and select [Settings].



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].

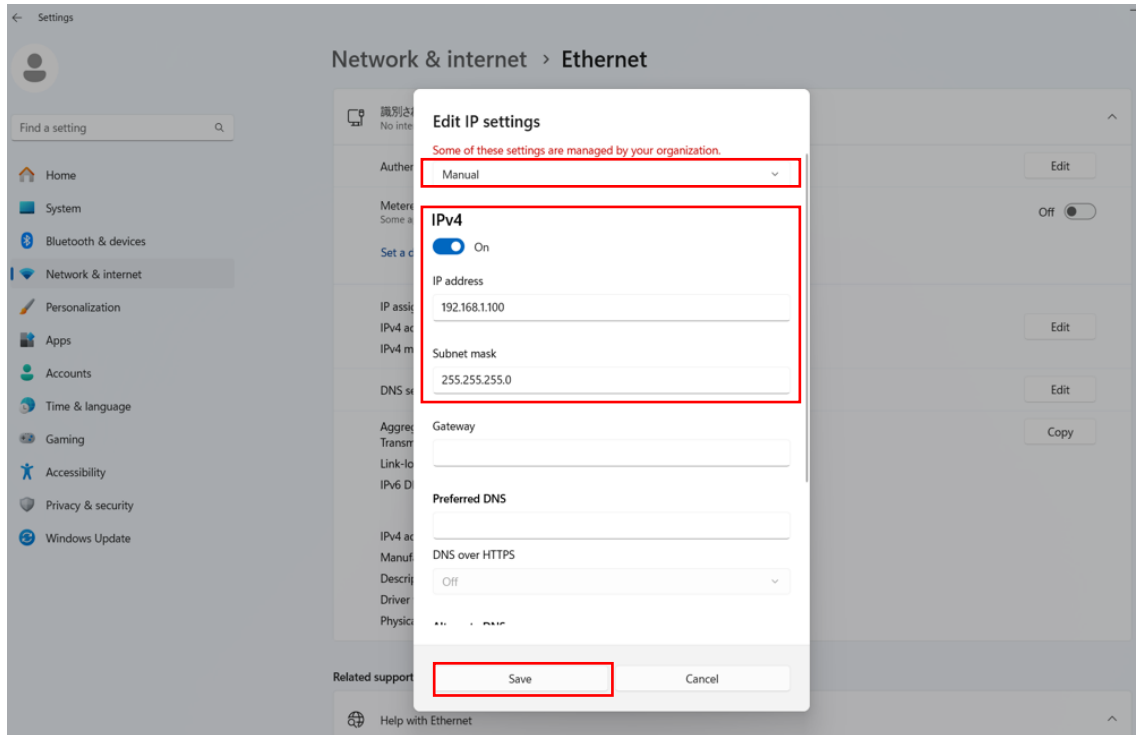


4. Select [Internet Protocol Version 4 (TCP/IPv4) and then select [Properties].

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.

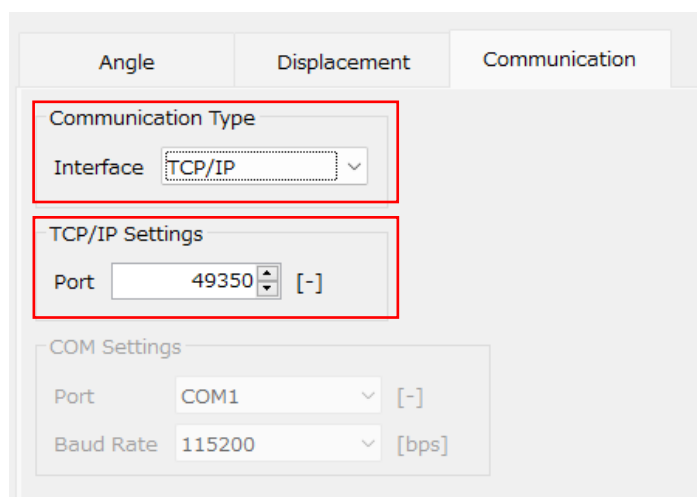
However, when configuring the IP address in step 5, ensure it does not duplicate the following:

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

Subnet mask: 255.255.255.0

Setting up 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.



The screenshot displays the 'Communication' tab of the Suruga OptGauge software. 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 'TCP/IP'. 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 'Interface' dropdown and the 'Port' field in the 'TCP/IP Settings' section.

Terminal Software

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

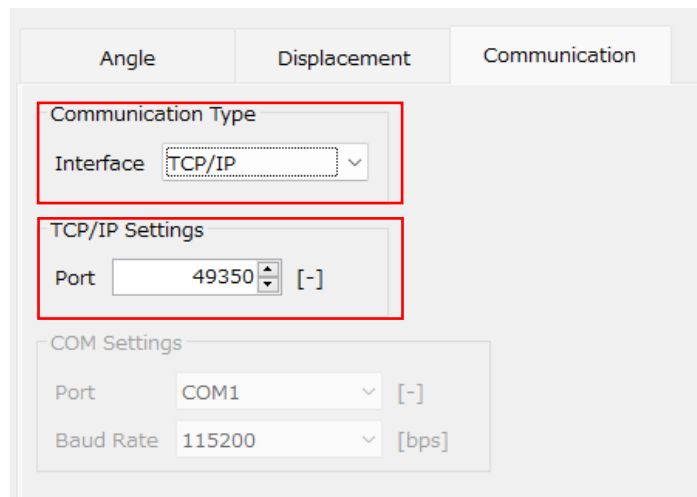
- Designate the IP address set on the computer to which the sensor head is connected, in "Computer settings - When using external devices for communication," as the connection destination.
- Set the TCP port which matches the "Port" setting in the Suruga OptGauge.

**This is the minimum configuration required for command communication using TCP/IP. As this involves network communication. The users are responsible for implementing security and other settings appropriate for their specific use case.*

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 users, 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 2=Free Run 3=One Shot 4=Repeat
ITP					Internal trigger sampling interval	Sampling interval [ms]	

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) if Binning is enabled

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
		RAH			ROI Height	(0 to 3000) or (0 to 1500) if Binning is enabled
		ANT			Angle Type	0= Tilt Angle 1= Beam Angle
		AJE			Angle Judgement Enabled	0=disabled、 1=enabled
		AJV			Angle Judgement Value	If the Angle Type is Tilt Angle, (0 to 10.0000). If the Angle Type is Beam Angle, (0 to 20.0000)
		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

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
		DNE			Denoising Enabled	0=disabled、 1=enabled
		DNT			Denoising Threshold Value	1～4095
		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

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
		BIE			Binning Enabled	0=disabled、1=enabled
		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
		DSN			Display Spot Number	0～100
		VOU			Rotation Angle Cursor Display Enabled	0=disabled、1=enabled
		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 結果表示	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	0.1～2000
		LEX			maximum value of exposure time applied in automatic brightness	0.1～2000
		LEN			minimum value of exposure time applied in automatic brightness	0.1～2000

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
		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

5.4.1.3 Profile

[Read Commands]

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
RD	PR				Profile Measurement Results	See “Command Request/Response Details”
		MLT			Profile Multi Spot Measurement Results	
		PSC			Profile Multi Spot Count	
	PS	LAS			Automatic Brightness Status	
	PO	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) if Binning is enabled

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
		RAH			ROI Height	(0 to 3000) or (0 to 1500) if Binning is enabled
		CJE			Centroid Judgement Enabled	0=disabled、1=enabled
		CJV			Centroid Judgement Value	0～20.0000
		JDE			Judgement Diameter 有効	0=disabled、1=enabled
		DJV			Judgement Diameter 判定値	0.0000～20.0000
		DJT			Judgement Diameter Type	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
		LJE			Line Position Judgment Enabled	0=disabled、1=enabled
		LJV			Line Position Judgment value	-20.0000～20.0000
		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
		LNU			Length Unit	0= Millimeter 1= Micrometer
		DNE			Denoising Enabled	0=disabled、1=enabled
		DNT			Denoising Threshold Value	1～4095
		DCX			Number of Decimal Places for the Centroid X	0～8

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
		DCY			Number of Decimal Places for the Centroid Y	0~8
		DCD			Number of Decimal Places for the Centroid 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
		DLP			Number of Decimal Places for the Line Position 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
		LPE			Line Position Measurement Enabled	0=disabled、 1=enabled
		LPT			Line Position measurement	-30~300

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
					straightness Threshold	
	BIE				Binning Enabled	0=disabled、1=enabled
	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
	VLC				Line Position Cursor Display	0=disabled、1=enabled
	DSN				Display Spot Number	0~100
	VCX				Centroid X Result Display	0=disabled、1=enabled
	VCY				Centroid Y Result Display	0=disabled、1=enabled
	VCD				Centroid D Result Display	0=disabled、1=enabled
	VDS				(Beam Diameter) D4Sigma or 1/e ² Result Display	0=disabled、1=enabled
	VDX				(Beam Diameter) D4Sigma or 1/e ² X(M) Result Display	0=disabled、1=enabled
	VDY				(Beam Diameter) D4Sigma or 1/e ² Y(m) Result Display	0=disabled、1=enabled
	VD8				(Beam Diameter) D86 Result Display	0=disabled、1=enabled
	VEL				Ellipticity Result Display	0=disabled、1=enabled
	VOR				Rotation Angle Result Display	0=disabled、1=enabled
	VLP				Line Position Result Display	0=disabled、1=enabled
	VTC				Total Count Result Display	0=disabled、1=enabled
	VPE				Peak Result Display	0=disabled、1=enabled
	FCE				Font Size for the Centroid	0= Small 1= Medium 2= Large

Command					Content	Reading Information
Type	Parameter					
	0	1	2	3		
		FBD			Font Size for the Beam Diameter	0= Small 1= Medium 2= Large
		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
		FLP			Font Size for the Line Position	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.
		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
		LEI			Initial Exposure Time Value applied in the Automatic Brightness	0.1～2000
		LEX			maximum value of exposure time applied in automatic brightness	0.1～2000
		LEN			minimum value of Exposure time applied in the Automatic Brightness	0.1～2000

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 2=Free Run 3=One Shot 4=Repeat		Trigger Mode
		ITP	100~1000		Internal trigger sampling interval

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

Command					Content
Type	Parameter				
	0	1	2	3	
		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 1= Beam Angle		Angle Type
		AJE	0=disabled、 1=enabled		Angle Judgement Enabled
		AJV	If the Angle Type is Tilt Angle, (0 to 10.0000). If the Angle Type is Beam Angle, (0 to 20.0000)		Angle Judgement Value
		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、		RAW Data Output Enabled		

Command					Content
Type	Parameter				
	0	1	2	3	
			1=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
		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

Command					Content
Type	Parameter				
	0	1	2	3	
		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 1= D86		Spot Area Display Type
		VRA	0=disabled、 1=enabled		ROI Area Display
		DSN	0~100		Display Spot Number
		VOU	0=disabled、 1=enabled		Rotation Angle Cursor Display Enabled
		VAX	0=disabled、 1=enabled		Angle X Result Display

Command					Content
Type	Parameter				
	0	1	2	3	
		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

Command					Content
Type	Parameter				
	0	1	2	3	
		TRM	0=disabled、 1=enabled		External Trigger Mode Enabled ※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	0.1~2000.000		Initial Exposure Time Value applied in the Automatic Brightness
		LEX	0.1~2000.000		maximum value of exposure time applied in automatic brightness
		LEN	0.1~2000.000		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 Brightness

5.4.2.3 Profile

< Write Commands >

Command					Content
Type	Parameter				
	0	1	2	3	
WR	PO	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
		CJE	0=disabled、 1=enabled		Centroid Judgement Enabled
		CJV	0~20.0000		Centroid Judgement Value

Command					Content
Type	Parameter				
	0	1	2	3	
		JDE	0=disabled、 1=enabled		Diameter Judgement Enabled
		DJV	0.0000～20.0000		Diameter Judgement Value
		DJT	0= D4Sigma or 1/e 2 1= D86		Diameter Judgement Type
		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
		LJE	0=disabled、 1=enabled		Line Position Judgment Enabled
		LJV	-20.0000～20.0000		Line Position Judgment value
		PJE	0=disabled、 1=enabled		Peak Judgment Enabled
		PJV	0.0～4095.0		Peak Judgement Value
		RFP	260 Words		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
		LNU	0= Millimeter 1= Micrometer		Length Unit
		DNE	0=disabled、 1=enabled		Denoising Enabled
		DNT	1～4095		Denoising Threshold Value
		DCX	0～8		Number of Decimal Places for the Centroid X
		DCY	0～8		Number of Decimal Places for the Centroid Y
		DCD	0～8		Number of Decimal Places for the Centroid D
		DDS	0～8		Number of Decimal Places for the

Command					Content
Type	Parameter				
	0	1	2	3	
					(Beam Divergence) D4Sigma or 1/e ²
		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
		DLP	0~8		Number of Decimal Places for the Line Position 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 Enable
		OCM	0= Ellipse Fitting 1= Max Distance Search		Rotation Angel Measurement Method
		LPE	0=disabled、 1=enabled		Line Position Measurement Enabled
		LPT	-30~300		Line Position measurement straightness Threshold
		BIE	0=disabled、 1=enabled		Binning Enabled
		VAA	0=disabled、 1=enabled		Auto Aperture Display
		VCC	0=disabled、 1=enabled		Centroid Cursor Display

Command					Content
Type	Parameter				
	0	1	2	3	
		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 1= D86		Spot Area Display Type
		VRA	0=disabled、 1=enabled		ROI Area Display
		DSN	0~100		Display Spot Number
		VOU	0=disabled、 1=enabled		Rotation Angle Cursor Display Enabled
		VLC	0=disabled、 1=enabled		Line Position Cursor Display
		VCX	0=disabled、 1=enabled		Centroid X Result Display
		VCY	0=disabled、 1=enabled		Centroid Y Result Display
		VCD	0=disabled、 1=enabled		Centroid D Result Display
		VDS	0=disabled、 1=enabled		(Beam Diameter) D4Sigma or 1/e ² Result Display
		VDX	0=disabled、 1=enabled		(Beam Diameter) D4Sigma or 1/e ² X(M) Result Display
		VDY	0=disabled、 1=enabled		(Beam Diameter) D4Sigma or 1/e ² Y(m) Result Display
		VD8	0=disabled、 1=enabled		(Beam Diameter) D86 Result Display
		VEL	0=disabled、 1=enabled		Ellipticity Result Display
		VOR	0=disabled、 1=enabled		Rotation Angle Result Display
		VLP	0=disabled、 1=enabled		Line Position Result Display
		VTC	0=disabled、 1=enabled		Total Count Result Display
		VPE	0=disabled、 1=enabled		Peak Result Display
		FCE	0= Small 1= Medium 2= Large		Font Size for the Centroid
		FBD	0= Small 1= Medium 2= Large		Font Size for the Beam Diameter
		FBE	0= Small 1= Medium		Font Size for the Beam Ellipticity

Command					Content
Type	Parameter				
	0	1	2	3	
			2= Large		
		FOR	0= Small 1= Medium 2= Large		Font Size for the Rotation Angle
		FLP	0= Small 1= Medium 2= Large		Font Size for the Line Position
		FPO	0= Small 1= Medium 2= Large		Font Size for the Power
		TRM	0=disabled、 1=enabled		External Trigger Mode Enabled ※Support discontinued: Please use ACM.
		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
		LEI	0.1～2000.000		Initial Exposure Time Value applied in the Automatic Brightness
		LEX	0.1～2000.000		maximum value of exposure time applied in automatic brightness
		LEN	0.1～2000.000		minimum value of Exposure time applied in the Automatic Brightness

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

5.4.3.1 Profile

< Execution Commands >

Command					Content
Type	Parameter				
	0	1	2	3	
EX	PL				Automatic Brightness for the Profile Measurement
	PR	MSN	1~100		Profile Main Spot Number Switching
	PZ				Profile 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. (Profile)

*4 : Measurement date and time (Profile)

*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	,	A	R	CR		LF
---	---	---	---	---	----	--	----

<Response>

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

*1: Tilt Angle/Beam Angle: Angle X measurement value.

*2: Tilt Angle/Beam Angle: Angle Y measurement value.

*3: Tilt Angle/Beam Angle: Angle D measurement value.

*4: Beam Divergence: D4Sigma measurement value.

*5: Beam Divergence: D4Sigma X(M) measurement value.

*6: Beam Divergence: D4Sigma 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 results.

*17: Orientation judgement result.

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 / Beam Angle: Angle X measurement value.

*4: Tilt Angle / Beam Angle: Angle Y measurement value.

*5: Tilt Angle / Beam Angle: Angle D measurement value.

*6: Beam Divergence: D4Sigma or 1/e2 measurement value.

*7: Beam Divergence: D4Sigma X(M) or 1/e2 X(M) measurement value.

*8: Beam Divergence: D4Sigma Y (m) or 1/e2 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 the *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 : 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 Profile

Measurement Results

■Measurement Results (Image Processing Mode = Disabled)

<Request>

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

<Response>

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

*1: Beam Centroid: Centroid X measurement value.

*2: Beam Centroid: Centroid Y measurement value.

*3: Beam Centroid: Centroid D measurement value.

*4: Beam Diameter: D4Sigma measurement value.

*5: Beam Diameter: D4Sigma X(M) measurement value.

*6: Beam Diameter: D4Sigma Y(m) measurement value.

*7: Beam Diameter: D86 measurement value.

*8: Beam Ellipticity measurement value.

*9: Beam: Total Count value.

*10: Beam: Peak value.

*11: Judgement: Centroid (D) judgement result (OK / NG).

*12: Judgement: Diameter judgement result (OK / NG).

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

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

*15: Distance unit (Millimeter / Micrometer).

*16: Orientation measurement value.

*17: Judgement : Orientation judgement result (OK / NG).

■Measurement Results (Image Processing Mode = Enabled)

<Request>

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

<Response>

R	D	,	I	P	M	,	*1	,	*2	,	*3	.	.	.	*10	,	*11	CR	LF
---	---	---	---	---	---	---	----	---	----	---	----	---	---	---	-----	---	-----	----	----

*1 : Beam Centroid: Centroid X measurement value.

*2 : Beam Centroid: Centroid Y measurement value.

*3 : Beam Centroid: Centroid D measurement value.

*4 : Line Position : Line X measurement value.

*5 : Line Position : Line Y measurement value.

*6 : Beam: Total count value.

*7 : Beam: Peak value.

*8 : Judgement: Centroid(D) judgement result (OK / NG).

*9 : Judgement: Line Position judgement result (OK / NG).

*10 : Judgement: Peak judgement result (OK / NG).

*11 : Distance unit (Millimeter / Micrometer).

Multi Spot Measurement Results

■Measurement Results (Image Processing Mode = Disabled)

<Request>

R	D	,	P	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: Beam Centroid: Centroid X measurement value.

※4: Beam Centroid: Centroid Y measurement value.

※5: Beam Centroid: Centroid D measurement value.

※6: Beam Diameter: D4Sigma measurement value.

※7: Beam Diameter: D4Sigma X(M) measurement value.

※8: Beam Diameter: D4Sigma Y(m) measurement value.

※9: Beam Diameter: D86 measurement value.

※10: Beam Ellipticity measurement value.

※11: Beam: Total count value.

※12: Beam: Peak value.

※13: Judgement: Centroid(D) judgement result (OK / NG).

※14: Judgement: Diameter judgement result (OK / NG).

※15: Judgement: Ellipticity judgement result (OK / NG).

※16: Judgement: Peak judgement result (OK / NG).

※17: Distance unit (Millimeter / Micrometer).

※18: Orientation measurement value.

※19: Judgement : Orientation judgement result (OK / NG).

※20: Measurement Results of ※3 to ※19 for the Number Specified in ※2 (The specified number of results will be included, separated by “,”).

■Measurement Results (Image Processing Mode = Enabled)

<Request>

R	D	,	P	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	,	I	P	M	,	*3	,	*4	,	*5	· · ·	*13	*14	CR	LF
---	---	---	---	---	---	---	----	---	----	---	----	-------	-----	-----	----	----

*3 : Beam Centroid: Centroid X measurement value.

*4 : Beam Centroid: Centroid Y measurement value.

*5 : Beam Centroid: Centroid D measurement value.

*6 : Line Position : Line X measurement value.

*7 : Line Position : Line Y measurement value.

*8 : Beam: Total count value.

*9 : Beam: Peak value.

*10 : Judgement: Centroid(D) judgement result (OK / NG).

*11 : Judgement: Line Position judgement result (OK / NG).

*12 : Judgement: Peak judgement result (OK / NG).

*13 : Distance unit (Millimeter / Micrometer).

*14 : Measurement Results of *3 to *13 for the Number Specified in *2 (The specified number of results will be included, separated by “,”).

Multi Spot Measurement Spot Number

<Request>

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

<Response>

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

* 1 : Spot Count (1 to 100).

Auto Brightness Control Status

<Request>

R	D	,	P	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).

Profile Option

<Request>

R	D	,	P	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 Profile

Profile Option

<Request>

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

*1,*2,*3,*4 : See [List of Writing Commands](#)

<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

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 Profile

Auto Brightness Control (Tune)

<Request>

E	X	,	P	L	CR	LF
---	---	---	---	---	----	----

<Response>

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

Main Spot Number Switch

<Request>

E	X	,	P	R	,	M	S	N	,	*1	CR	LF
---	---	---	---	---	---	---	---	---	---	----	----	----

*1 : Main Spot Number(1~100)

<Response>

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

Zero Set

<Request>

E	X	,	P	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	Details
Angle view initialize succeeded.	Angle screen initialization was successful. Measurement starts normally.
Profile view initialize succeeded.	Profile 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.
Profile view initialize failed. Please check the connection with the Suruga OptGauge.	Profile screen initialization failed. Check the sensor head and computer connection.
Angle result output succeeded.	By pressing the [Output Once] button icon, it executes the output of the Angle measurement results, successfully.
Profile result output succeeded.	By pressing the [Output Once] button icon, it executes the output of the Profile measurement results, successfully.
Angle result output failed.	Measurement results output with [Output Once] button failed.
Profile result output failed.	Measurement results output with [Output Once] button failed.
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

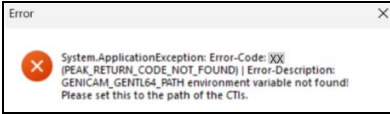
Error Message	Cause	Counter Measure
Angle view initialize failed. Please check the connection with the Suruga OptGauge.	The Products and computer are not connected.	Check that the Products and computer are connected and restart the Suruga OptGauge. If this error is repeatedly generated, the Products interior camera may not be working properly. Contact the Suruga Seiki Optical Device Business Division Sales Section.
Profile view initialize failed. Please check the connection with the Suruga OptGauge.		
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.
Profile 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	Counter Measure
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 the device authentication file (.suruga) corresponding to the purchased the Products.
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, this 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 is unstable	Noise is causing serious effects	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 for 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, Suruga conducts a repair service for free. For any damages out of warranty period mentioned above, Suruga charges a fee for any repair service.

<After the Warranty Period>

A repair service is available with a fee to maintain the functionaries 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

SURUGA SEIKI CO., LTD.

HEAD OFFICE

505, Nanatsushinya, Shimizu-ku,

Shizuoka City, Shizuoka 424-8566, Japan

Tel : +81-54-344-0332 Fax : +81-54-346-1196

<https://eng.surugaseki.com/>