



Laser Positioning Sensor 3D

Smart LPS 3D H720

The User's Manual

Thank you for choosing our products.

Before using the Products, read this manual, thoroughly.

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



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Introduction

This document is the "User's Manual" for the H720 series - Laser Positioning Sensor 3D (hereafter, referred to as "the Products").

This "User's Manual" (hereafter referred to as "this Manual") provides information and basic operation methods for the Products, which prefixed with H720

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

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H720 User's Manual

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Revision History

Date	Revision	Details
2025. June	V.1.0.0	1 st edition
2025. July	V.1.0.1	<ul style="list-style-type: none">· Installation PC System Requirements- Removed “Pro”- Added Windows 11 version- Added note that the potential dysfunctionalities depend on version· Symptoms and Solutions- Added details on dysfunctionalities depending on Windows version and countermeasures· Added interlock control specifications· Added external trigger mode
2025. September	V.1.1.0	Added $1/e^2$ beam divergence calculation function and the rotation angle calculation function

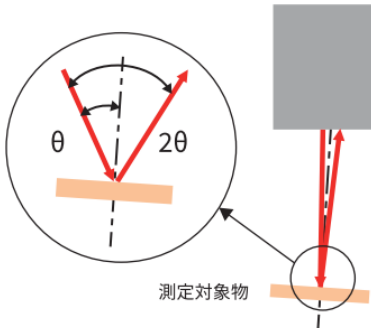
NOTICE

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/>).

0. Definitions (terms and abbreviations)

Terms and Abbreviations	Definitions
Reflection Angle Measurement	 <p>A method to measure the angle of a beam from an internal light source reflected up on a device under test (DUT). The angle of 2θ is measured to calculate θ.</p>
The Software	The Suruga OptGauge Software
This Manual	The User's Manual for Smart LPS H720 series
Sensor Camera	Internal sensor camera embedded in this product.

1. For your Safety – Precautions of Use

1.1. Warning labels addressed in this Manual

 Warning	May result in severe injury, damage to equipment, or other severe damage.
 Careful	May result in minor physical injury or equipment damage.
Attention	Instructions for safe handling are provided for the product.

1.2. Managing the Products

The Products use a laser diode for its internal light source. We recommend that the Products are in an environment where appropriate safety measures are taken for the laser before any use.

- The SURUGA shall not guarantee the functions and performance of the Products if used in a manner other than that specified in this Manual, or if modified.
- When other equipment is combined with the Products, the functions and the SURUGA shall not guarantee the performance of the Products, depending on your design, operating conditions, and environment.
- Do not subject each device, including peripherals, to sudden temperature changes, which may cause condensation and equipment failure.
- Do not wipe the Products with a wet rag, benzene, thinner, or the alike, which may cause discoloration or deformation of the Products. If the Products is heavily soiled, wring out a cloth with diluted pH-neutral detergent and wipe off the stain, then dry the Products with a soft cloth.
- If you suspect the Products being malfunctioning, please contact our local sales office.

1.3. Precautions

1.3.1. Ambient Temperature and Illuminance

- Changes in ambient temperature can cause measurement errors. Please be advised to keep the ambient temperature, always, at a constant level.
- Avoid using the Product near lighting equipment that repeatedly turns on and off at high frequencies. If this is not possible, use a light shield or similar device to avoid being affected.

1.3.2. Power Supply



- Use the correct power supply voltage. Otherwise, fire, electric shock, or malfunction may occur.
- Be sure to turn off the power to and devices connected to the Product when connecting or disconnecting various connecting wires. Otherwise, the Products may be damaged.
- Do not turn off the power while setting items. Sudden power cut-off while setting data, part or all configuration data may be lost.

1.3.3. Disassembly / Modification



Do not disassemble or modify any unit of the Products. Disassembly or modification may cause fire or electric shock. The warranty is void if the Products are disassembled or modified by anyone other than our employees or our certified third party.

1.3.4. Effects of dust and dirt

The following cases may cause measurement errors due to the influence of dust, dirt, water, oil, etc.

- Dust and dirt on the cover glass: Use dry-clean air to blow off any dirt on the cover glass. If the cover glass is heavily soiled, wipe it off with a soft cloth soaked in thin alcohol.
- Adhesion on the surface of the object to be measured: Blow it off with clean air or wipe off the dirt.
- Intrusion into the optical axis area by floating or by splashing: Take measures such as installing a protective cover or air purging.

1.3.5. Influence of Vibration

Vibration transmitted either to the Products or to a measurement target (or both) may cause measured values unstable. In such cases, please be advised that, in order to obtain stable results, you may take extra efforts such as suppressing the vibration or averaging out result values upon

increasing the number of measurements.

1.3.6. Disturbance by the air fluctuation

The influence of slow air fluctuation may cause the measured value to vary. In such cases, covering the measuring section with an airproof cover is advised.

1.3.7. Not waterproof or explosion-proof



The Products are not intended for use in areas where explosion protection is required. Do not use the Products in locations where flammable gases or other explosive atmospheres exist.

The Products are not waterproof. Do not use the Products in locations where liquids may splash or flow into the Products.

1.3.8. Actions in case of abnormality



In the following cases, immediately turn off the power and disconnect the USB cable.

Continuing to use the Products in an abnormal state may cause damage.

- When abnormal sounds, strange smells, or smoke is detected.
- If the power cord is damaged.
- If water or other liquid is spilled on the Product.

1.3.9. Repair

For repair, please contact our local sales office,

- When water or foreign objects get inside the main unit.
- When the Products are damaged due to being dropped or external impact.
- When there is a strange odor due to smoke emission.

1.3.10. Disposal of the Products

- When disposing of the Products, treat it as industrial waste. Please follow in accordance with laws and regulations or by any other appropriate methods. The SURUGA shall not collect the Products for purpose.
- Please dispose of all materials used to package the Products in accordance with the law or by other appropriate methods. The SURUGA shall not collect these materials.

1.3.11. Residual Risks

Attention

This document does not disclose all risks associated with the Products. For residual or unexpected risks, or any other risks involved, please implement the safety design of machinery in accordance with ISO 12100 or your appropriate industrial safety standards.

1.3.12. CE Marking

The Products comply with the CE marking for the following standards and conditions.

When the Products are applied in the EU countries, the following conditions must be met.

- EN IEC 61000-6-4:2019(EMI)
- EN IEC 61000-6-2:2019(EMS)
- EN IEC 61326-1:2021(EMI : Class A, EMS:INDUSTRIAL ELECTROMAGNETIC ENVIRONMENT)

※ The length of all input and output cables, including the power cable connected to the Products, must be less than 30 meters."

1.4. Use of Laser Products for Your Safety

1.4.1. Corresponding laser classes for the Products

The following describes the hazards of the laser classes in the Products.

For your safety, precautions for the laser class, please follow your occupational safety regulations.



Laser Class	Precautions
Class 2	Normally, your eyes are protected and safe due to aversion reactions such as blinking. Laser products that may cause temporary visual impairment or risk of secondary injury due to aversive reactions if the user intentionally stares at the laser beam.

Ref : IEC 60825:2014 (JIS C 6802 : 2018) *Safety of Laser Products*

1.4.2. Laser Class Identification Labels on the Products

The description contents of the laser class identification labels and the warning label, and their posting positions are illustrated below.



The descriptions of the laser class identifications and the content of the warning label are as below.

Laser C lass Identification Labels	Warning Label
<p>Laser Class 2</p>	

Labeling method and contents conform to IEC60825-1:2014 (JIS C 6802:2018)

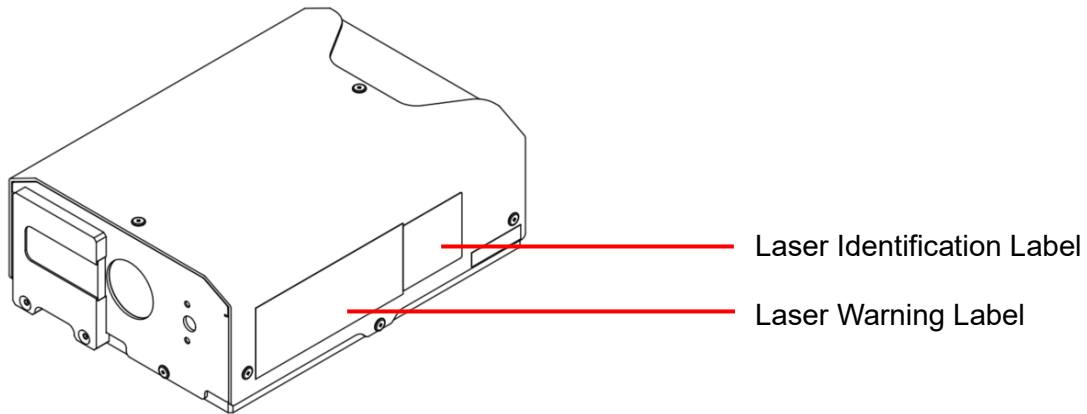


About KC correspondence : Class A
<p>사용자 안내문</p> <p>이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.</p>
<p>Reference English translation:</p> <p>User guide This equipment has been conformity-assessed for use in a professional environment and Interference may occur.</p>



The pasting positions of the labels

The warning label and laser class identification label are pasted on the right side of the Products when viewed from the front.



2. Preparations

2.1. Functions and Features

The Products are a multifunctional sensor which derives the displacement and angle of a target object by an incoming beam light to the sensor camera. The following are its notable features.

■ Angle Measurement

Measurement range: $\pm 1.35^\circ$ (circular Area)

Linearity : 0.25 % of F.S. (when measuring at F.S. = 2.7° with the internal light source wavelength of $660 \text{ nm} \pm 10 \text{ nm}$)

Repeatability : 1 sec. (within 6σ of the averaging times = 256 measurements)

See "[Specifications of the Products and Accessories](#)"

■ Displacement Measurement

■ W.D. 50 mm Model

Measurement range: $50 \text{ mm} \pm 10 \text{ mm}$ (when $T_x/T_y = 0^\circ$)

Linearity: $\pm 0.05\%$ of F.S. (F.S. = 20 mm)

Repeatability: $0.2 \mu\text{m}$ (when measuring with 1σ and number of averaging times = 256)

- See "[Specifications of the Products and Accessories](#)"

■ Measurement of multiple luminous points is feasible

- See "Angle View -> [Multi Spot](#)"

■ The Software installed in the PC with connecting the Products is capable of the measurements.

- See "Preparations - [System Configuration Example](#)"

■ Divergence measurement is available

Measurement range: 20 mrad or less

Linearity: 5% of F.S. (F.S. = 20 mrad)

- See "Angle View -> [Divergence](#)"


List of Functions		Details
Measurement	Angle measurement	See “ Angle Measurement ” in the Angle View section
	Displacement Measurement	See “ Displacement Measurement ” in the Displacement View section
	Thickness Measurement	See “ Thickness Measurement ” in the Displacement View section
	Beam Divergence Measurement	See “ Divergence ” in the Angle View section
	Rotational Angle Measurement	See “ Rotational Angle Measurement ” in the Angle View section
Convenient Functions	ROI	See Aperture in the Angle View section
	Auto Aperture	
	Adaptive Cal	See “ Adaptive Cal ” in the Angle View section
	Automatic Brightness	See “ Automatic Brightness control ”
	Alternating Lights	See “ Alternating Light Function ” in the Displacement View section
	Maximum Luminance Value Measurement	*1
	Total Count Measurement	
	Binning	
	External Trigger	
	Denoising	
	Storing Measurement Results	
Display	Zero Offset	See “ Origin Offset ” in the Angle View section See “ Origin Offset ” in the Displacement section
	Screen Image Zoom	See “ Zoom In ” in the Angle View section
	Unit Conversion	*1
	Rotation Display	
	Mirroring Display	
Judgement	Angle Judgement	See “ Judgement ” in the Angle View section
	Displacement Judgment	
	Beam Divergence Judgement	See “ Judgment ” in the Displacement View section
	Maximum Luminance Judgement Value	
Communication	RS232C	*1
	TCP/IP	

*1 see "The Suruga OptGauge User's Manual" in the separate software manual for details.

2.2. Packaged Items

The shipping box will contain the main unit, a USB memory stick, and an AC/DC adapter specifically for the internal light source.

1.  The Product

2.  A USB memory stick contents: the Suruga OptGauge (the sensor application), camera driver, device authentication file and this Manual).

*The latest version can be downloaded from the SURUGA website (<http://jpn.surugaseiki.com/>)

3. An AC/DC power supply for the Internal light source (12 V DC Output)

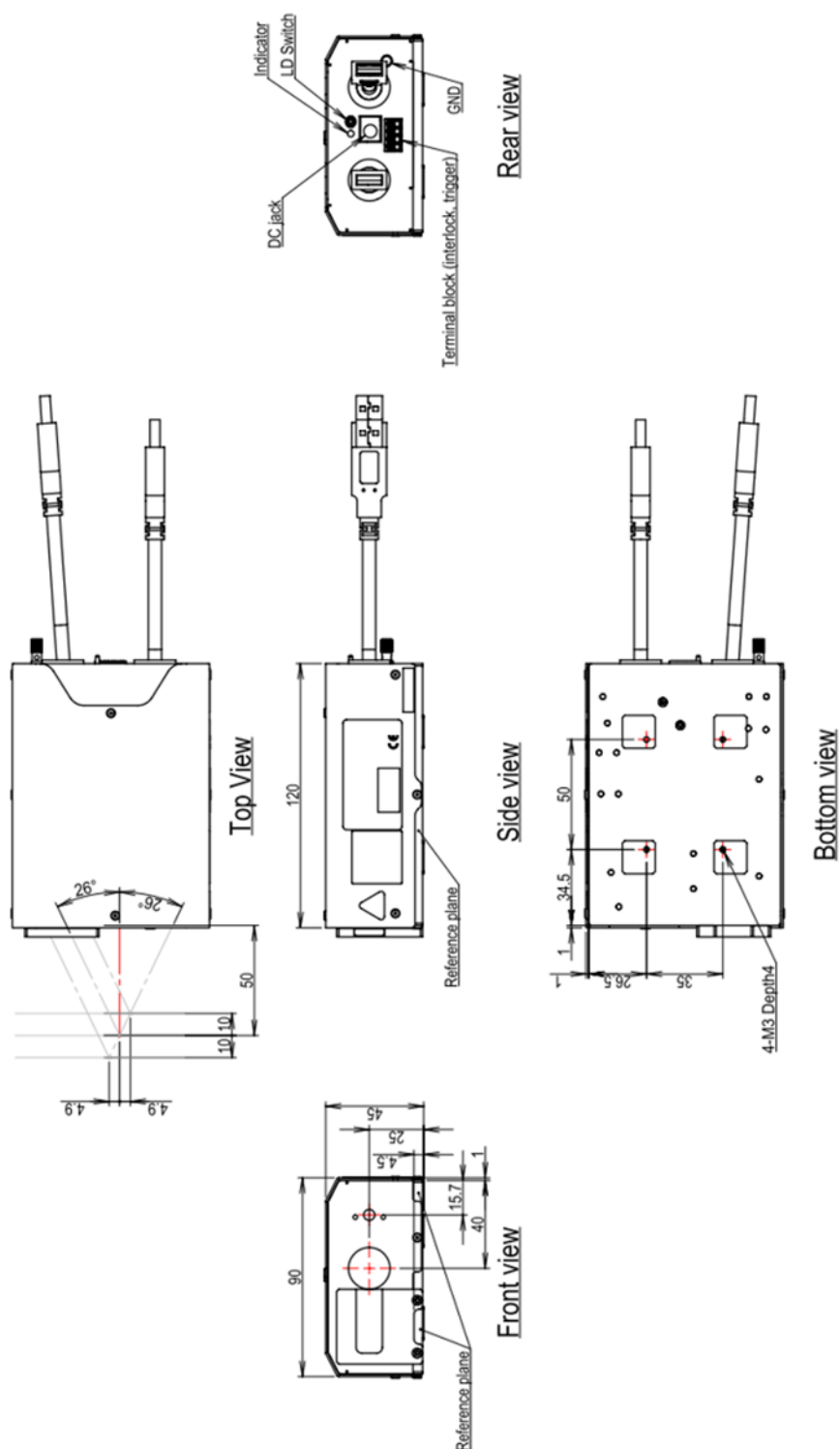
2.3. Overview Specifications of the Products

Specifications Table of the Products

External dimensions (mm)	90 x 120 x 45
Product weight	0.8kg
Main power source	DC12 V
Power consumption	6 W or below
Laser class	Class 2
Protective functions	Short-circuit protection, polarity reversed connection protection
Communication functions	USB3.0 standard
Operating temperature/humidity	0 to +40 °C、 35% to 85% RH (no condensation)
Storage temperature and humidity	-10 to +60 °C、 35% to 85% RH (no condensation)
Atmosphere	Avoid direct sunlight, corrosive or inflammable gases, liquids, powders/dust, and other toxic substances
Housing Material	Aluminum

2.4. External Dimensions of the Products

W.D. with the 50 mm model (H720CL-13510R2-10-050A)



2.5. Names and functions of each part of the Products

① Internal light source switch

Turns the power supply for the internal light source ON and OFF.

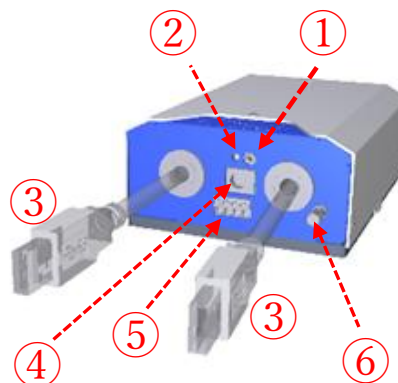
② Indicators

Displays the internal light source status with 3 colors.

Green : the internal light source is OFF (initial status)

Orange : the internal light source is ON

Red : Detecting interlock (*Internal light source cannot be activated while being interlocked)



③ USB connector x 2

It connects the Products to your computer

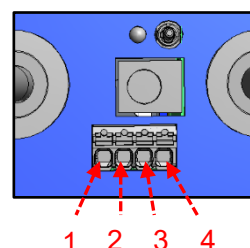
④ Power inlet for internal light source

A terminal for the AC/DC adapter for the internal light source.

⑤ The Interlock and trigger input connector

You may connect the interlock trigger inputs as follows.

1. INTERLOCK (+)
2. INTERLOCK (-)
3. TRIG 5V (+)
4. TRIG 5V (-)



*For the connecting wires, please see the following sections in this Manual:

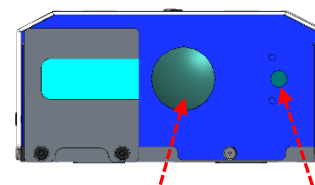
["Specifications of the Products and Accessories"](#) and ["Interlock control specifications."](#)

⑥ FG Terminal

Connecting to a frame ground to reduce electrical noise and to prevent malfunction.

⑦ Laser emission port

The port Irradiates the laser when the internal light source is ON.

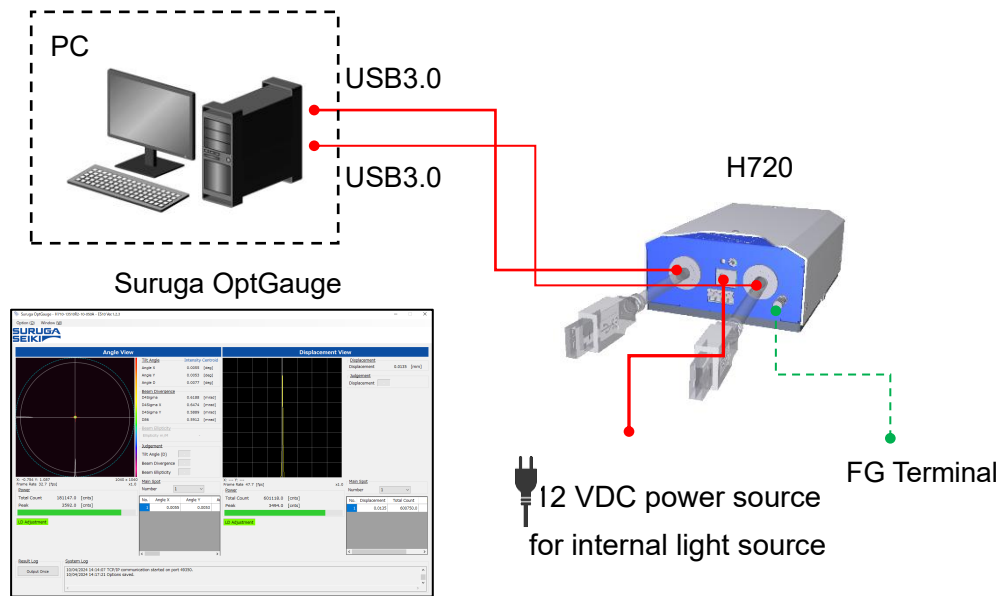


Laser emission port (angle) (displacement)



Do not irradiate the human body, eyes, skin, or any other object before safety is confirmed.

2.6. System Configuration Example



2.7. Required Parts for Configuration

- The H720 Sensor Head
- The 12VDC power source for internal light source (the AC/DC adapter included).
- A computer, a monitor, and a keyboard for the Products.
- The Suruga OptGauge : the measuring Software for the Products.

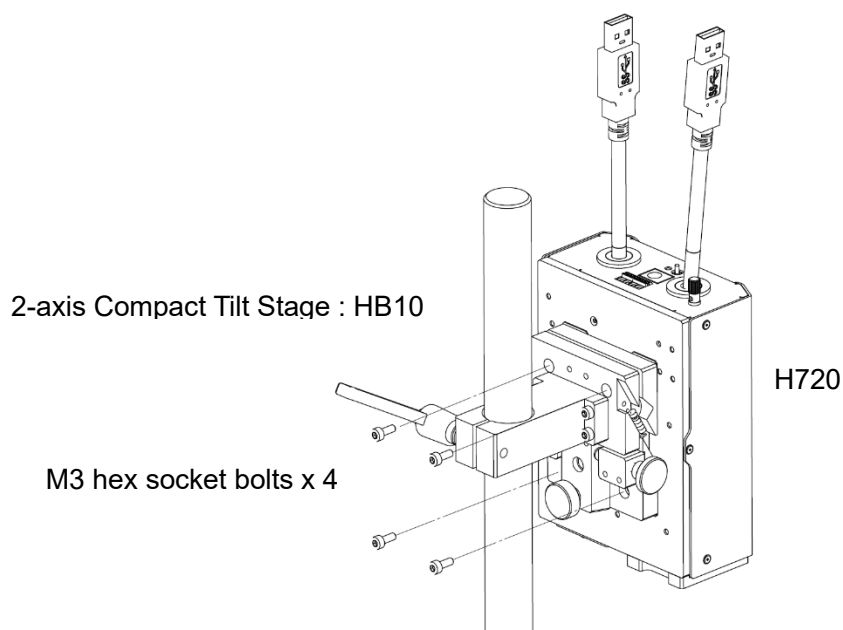
2.8. Installation Method (Example)

This section illustrates mounting methods for the Products.

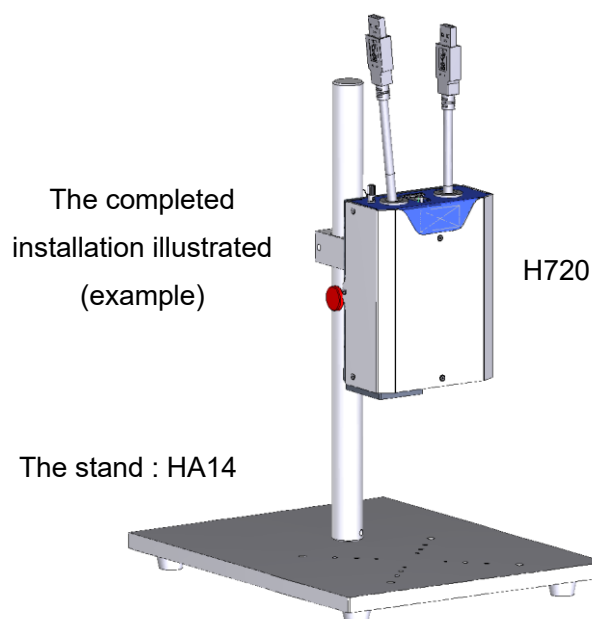
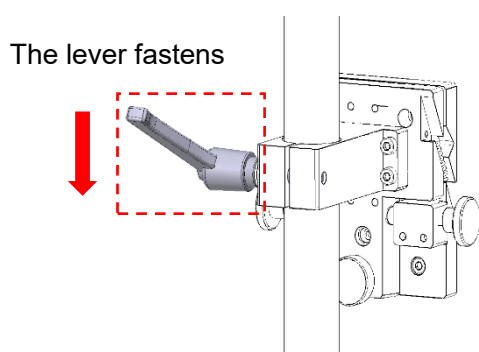
You may install the Products (H720 body) on the 2-axis Compact Tilt Stage (model: HB10) along with the Stand (model: HA14), which are the common optical accessories by the SURUGA.

1. The H720 body may be installed to HB10 with hex socket bolts.

*Please note that you may use M3 hex socket bolts (length: 8mm).



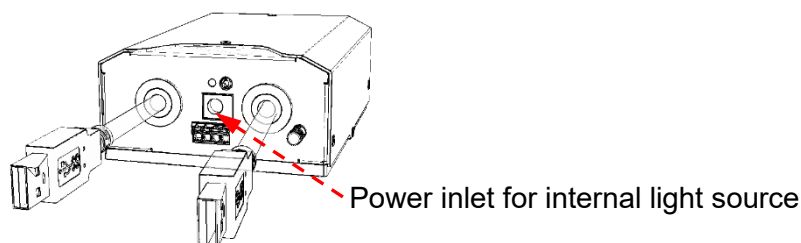
2. The lever fastens the HA14 to the HB10.



2.9. Connecting Power to the Internal Light Source

Please connect to the designated AC/DC adapter, only.

Insert the DC plug of the AC/DC adapter into the designated socket before inserting the AC side into an outlet. Note: you should ground the FG terminal.



Attention

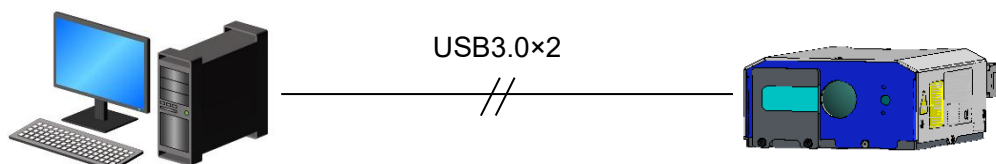
Do not turn on the AC adapter until the Suruga OptGauge installation is complete.

Please ground the FG terminal to prevent malfunctions caused by electrical noise.

2.10. Connection to a Computer

Connect the USB3.0 cable to a USB port compatible with USB3.0.

Be sure to use a computer with a USB3.0-compatible port.



Attention

Do NOT disconnect the USB cable while the Suruga OptGauge is running. Normal operation will be disrupted. If the USB cable disconnects, close the application, reinsert the USB cable, and restart the Suruga OptGauge.

2.11. The 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.*]

2.11.1. Software License

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

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

Article 1 (Permissions)

The Software is free of charge.

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

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

Article 2 (Usage Restrictions)

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

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

Article 3 (Reproduction and Modification)

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

Article 4 (Disclaimers)

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

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

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

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

Article 5 (Support)

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

Article 6 (Termination of Agreement)

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

2.11.2. PC System Requirements for your installation

[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	.NET8.0* 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	.NET8.0* 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 .NET8.0 is not installed on your computer, install “.NET Desktop Runtime 8.x.x.” from the Microsoft website

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

2.11.3. Installation of the Software

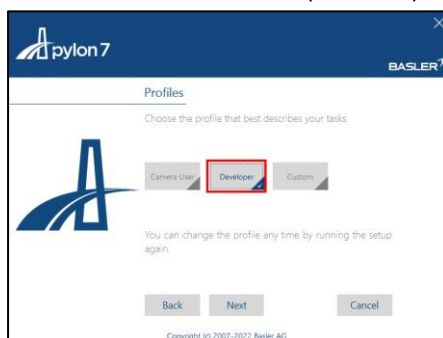
Installation of the USB device driver

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

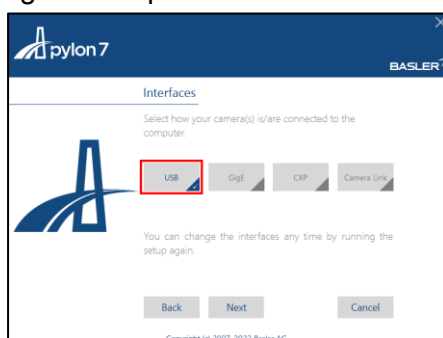


2. Consent to your installation on the confirmation screen.

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.



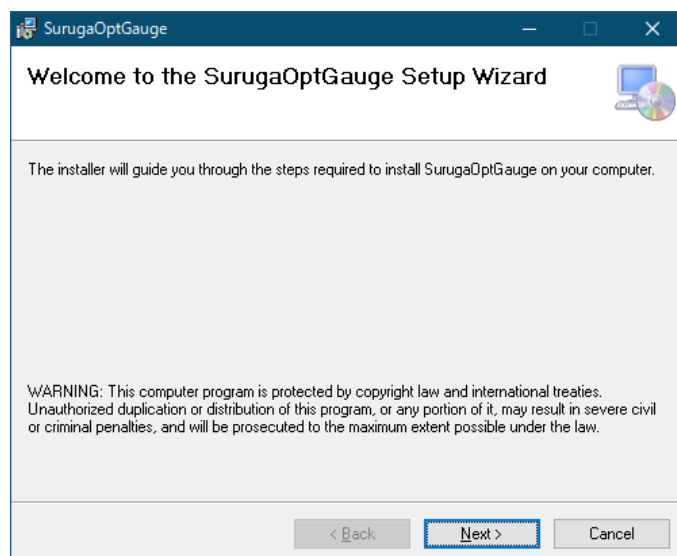
Installation of the Software from the online Download

Installing the Software.

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

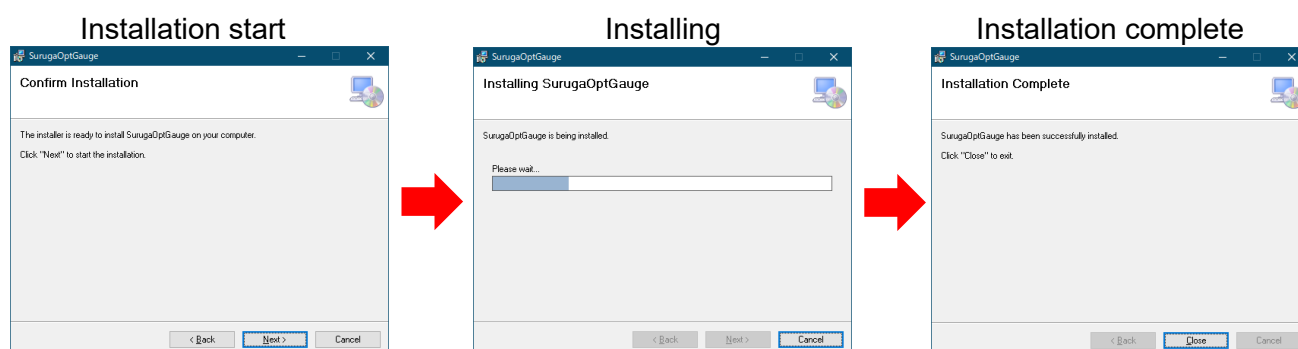
Name	Date Modified	Type	Size
 SurugaOptGaugeSetup_x.x.x.msi		Windows インストー...	61,590 KB

2. Click "Next>".

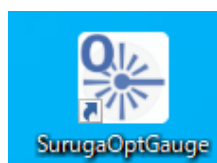


3. Click "Next>" to begin installation.

When installation is complete, click "Close".



4. The "SurugaOptGauge" will be created on the desktop. The installation is completed.



Copying the Device Authentication File

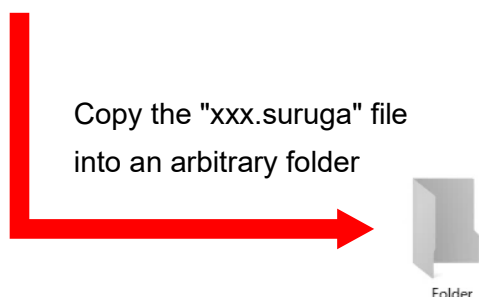
Attention

An Authentication File

For the Products, calibration values are set for each device. Therefore, the Software requires reading of a "device authentication file (.suruga)" in which the unique individual device information is stored.

To load the device authentication file into the Software, copy the file "xxx.suruga" in the ".../Authentication File" 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

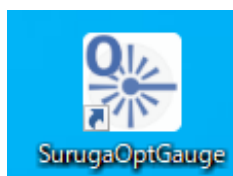


Note

If your security does not allow you to copy the device authentication file into your PC, this procedure is not necessary because the file can be read directly from the USB memory stick provided included in the Products.

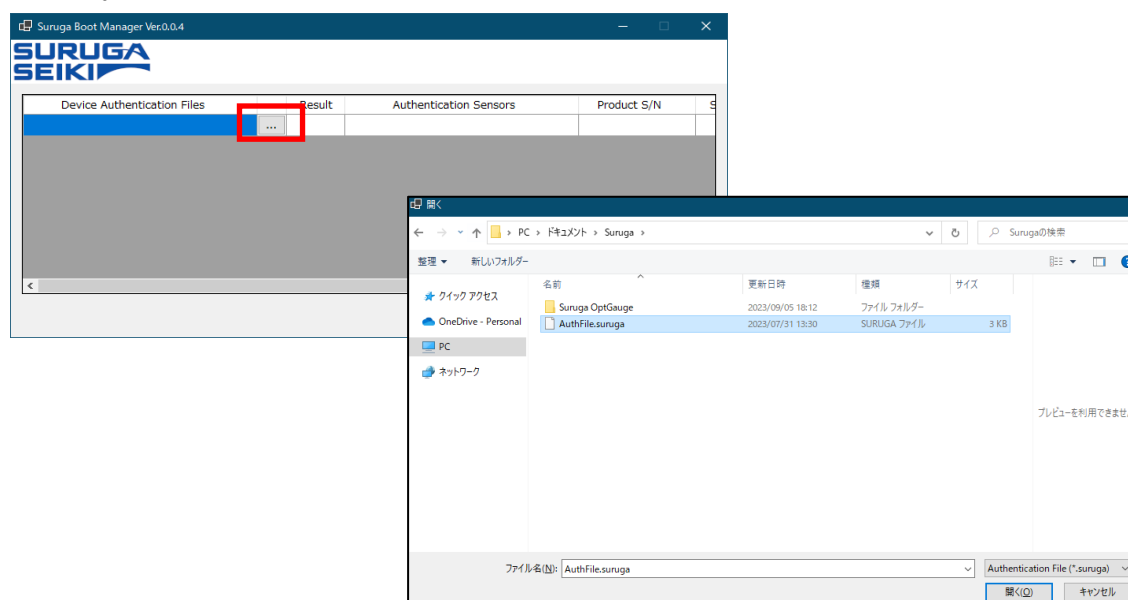
Starting up and Closing down the Suruga OptGauge

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

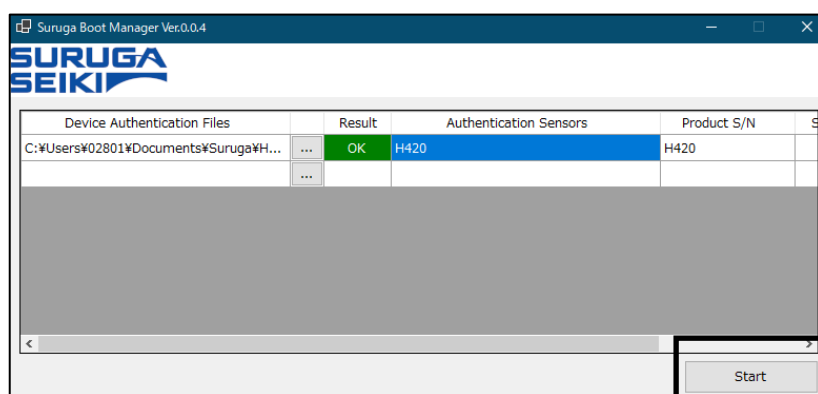


2. Click on "..." in the item "Device Authentication File" and select the extension ".suruga" in the folder in which the unique "Device Authentication File" was copied.

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."

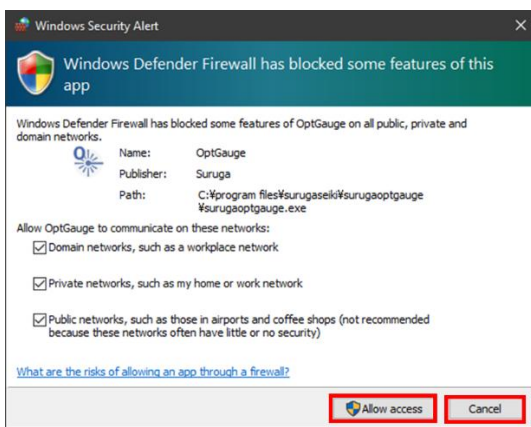


Attention

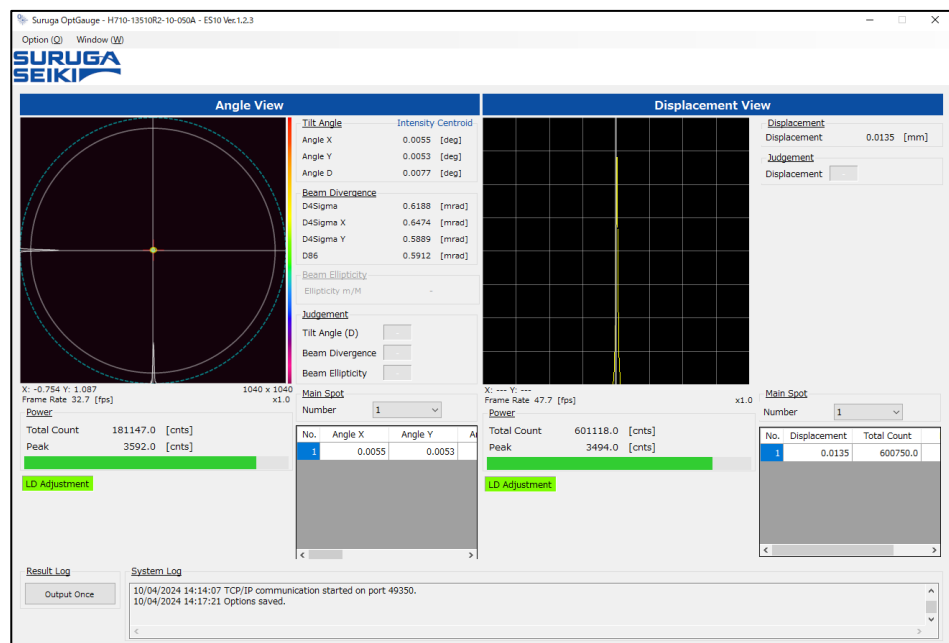
The Software incorporates TCP/IP communication control. Therefore, depending on your PC's security settings, the following warning may appear upon initial startup.

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

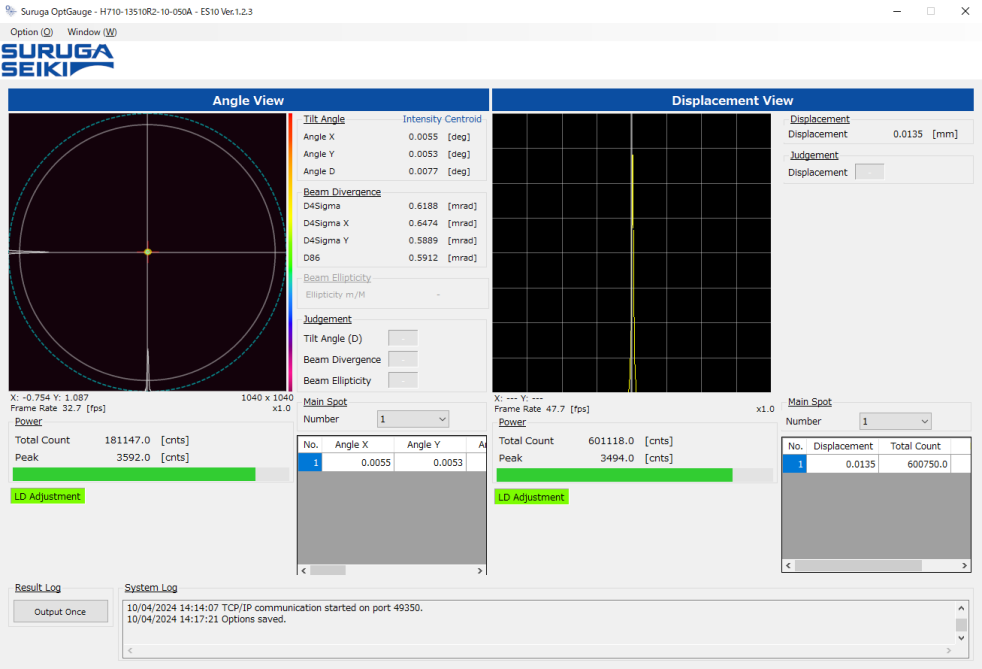
(Changes can be made after the fact in "Control Panel / All Control Panel Items / Windows Defender Firewall / Allowed Apps".)



4. The application will start up.



Closing the Suruga OptGauge.
Click the "x" icon to shut down OptGauge.

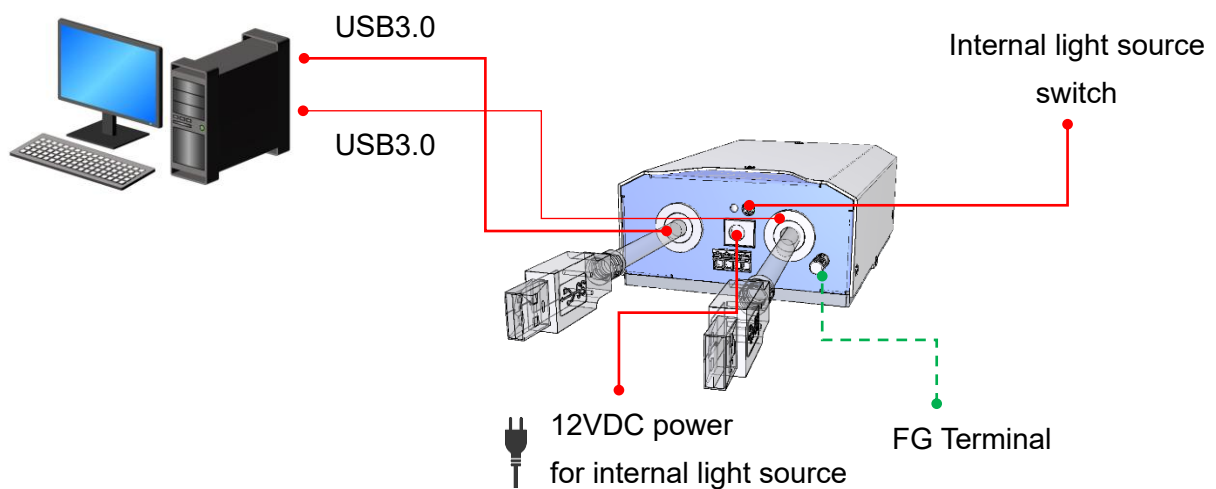


2.12. Turning on the Power



Do not turn on this Product power until the Products and the Software installation on your PC are completed and a supervisor has confirmed work safety

To turn on the internal light source, connect the DC12V power adapter for internal light source to an outlet and set the internal light source ON/OFF switch to ON.

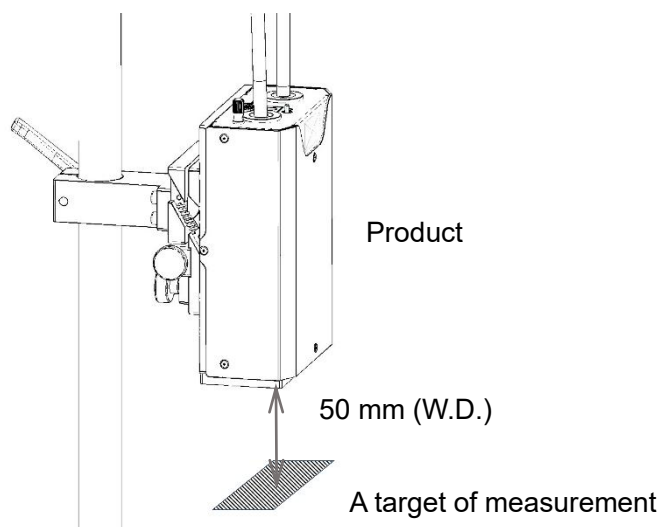


3. Measurement

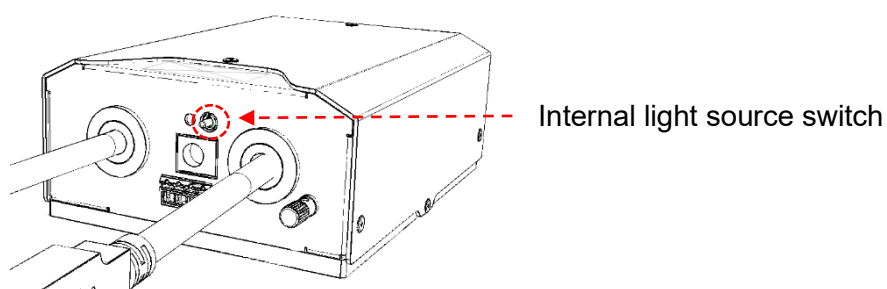
3.1. Precautions and Setting (Installation) of the Products

This section describes how to configure the Products, using the Software.

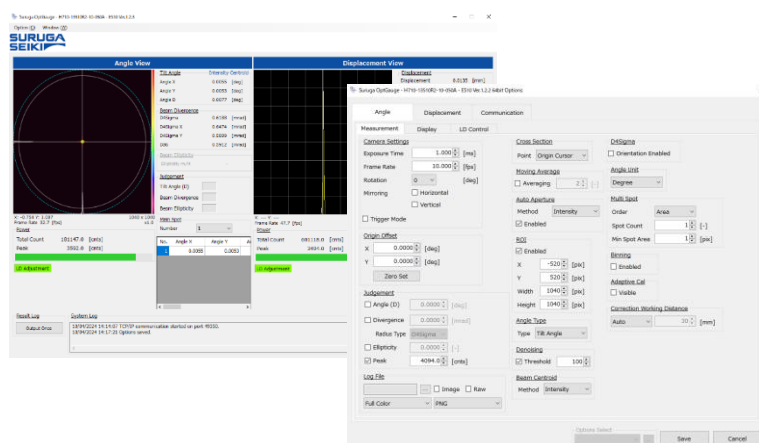
1. After connecting the USB cables to a computer, turn off the internal light source of the sensor, and the sensor will be placed at the distance between the measurement target and the sensor to the working distance.



2. When installation is complete, turn ON the internal light source switch.



3. Launch the Software to open the option screen.



4. At the Angle tab in the Option screen, select the LD Control subcategory tab.
5. Click the Tune button*1 in the LD Adjustment group box.
6. At the Displacement tab in the Option screen, select the LD Control subcategory tab.
7. Click the Tune button*1 in the LD Adjustment group box.
8. 90 minutes warm-up time to ensure stable measurements (no additional operations necessary).

*1 see the separate software manual, “the Suruga OptGauge User’s Manual” for option content details

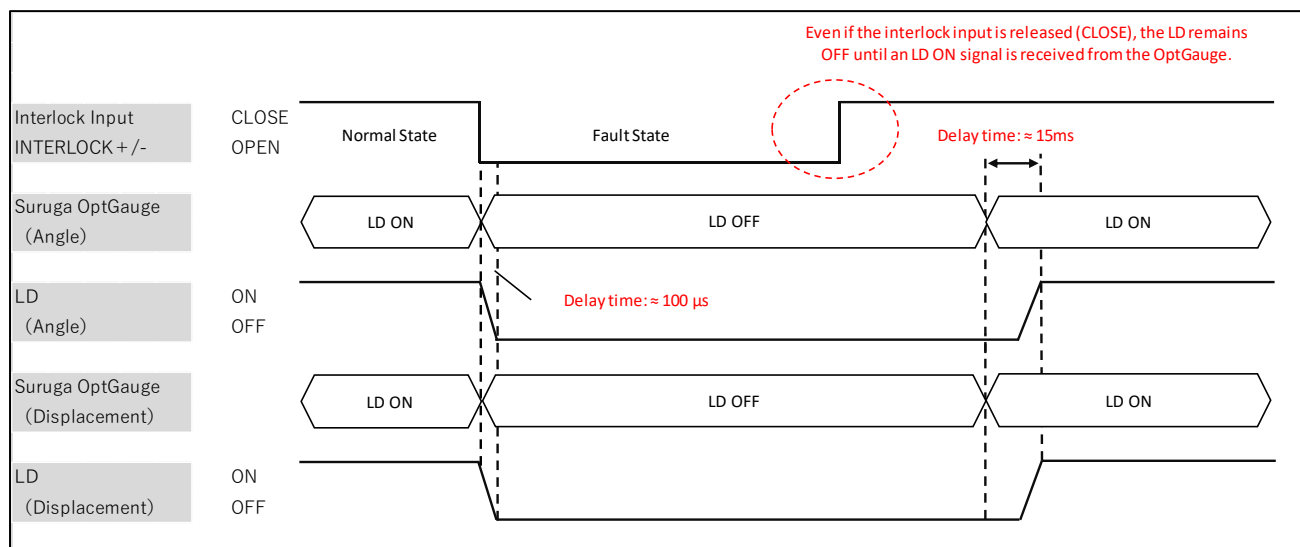
The settings are complete.

Attention

The Products are designed and intended with only a single unit connected per use; multiple units cannot be connected for measurements at any given time.

3.1.1. Interlock control specifications

To ensure your safe operation, the Products use interlock control to manage the activation and deactivation of the internal light source (LD). For details on the timing of the interlock, the Software, and the internal light source (LD) control, refer to the timing chart below.




3.2. Measurement Overview

3.2.1. Angle View

3.2.1.1. Angle Measurement

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

To measure a reflection angle	
<p>You may select [Tilt Angle]^{*1} in the "Angle Type" in the option setting.</p> <div><p>Angle Type</p><p>Type Tilt Angle ▼</p></div>	<p>It starts measuring the reflection angle.</p> <div></div>

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

3.2.1.2. Divergence

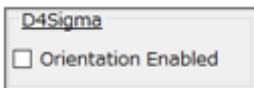
Divergence indicates how much the light beam expands at an angle as it propagates.

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

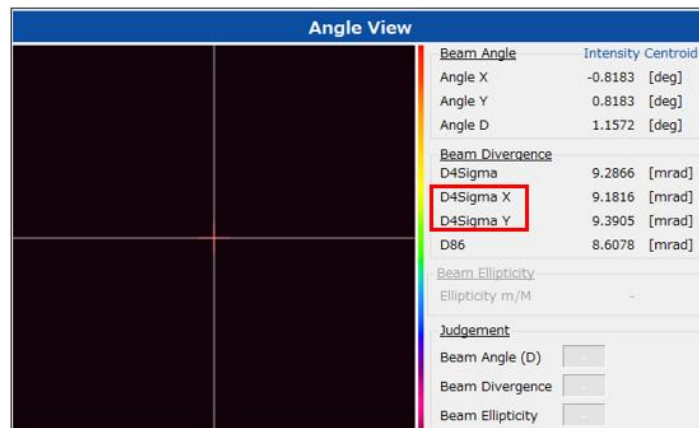
The Products display divergence in a half-angle with mrad (milli radian). It has two modes of measurement.

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

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



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

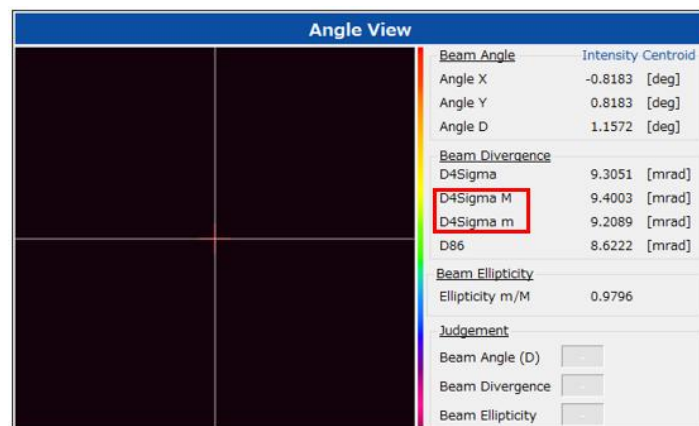


To measure a $D4\sigma$ beam diameter (elliptical beam) of divergence along with M (major: long axis) and m (minor: short axis).

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



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



*1 You may select either " $D4\sigma$ " or $1/e^2$ to measure the diameter of the light beam. For more details, please refer to the separate software manual "Suruga OptGauge User's Manual"

Applications

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

3.2.1.3. Beam Centroid

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

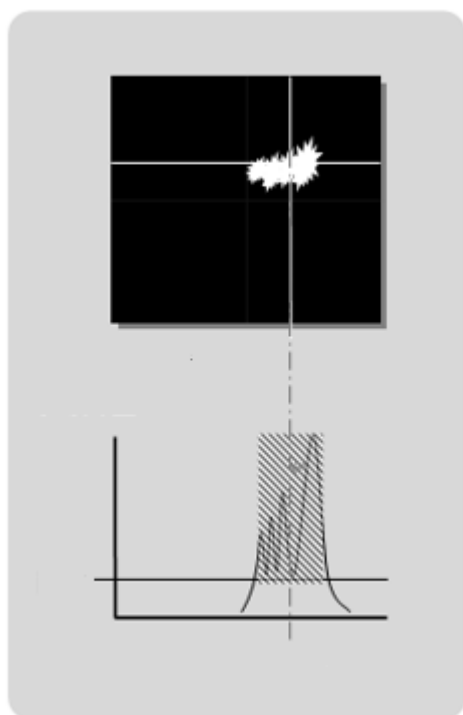
Area Centroid (Area)

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

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

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

Detection example



Recommended Device Under Tests



Mirror



Glass

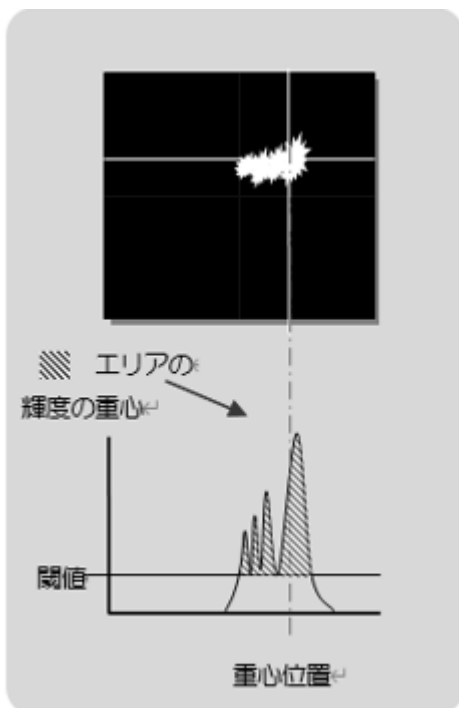
Intensity Centroid

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

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

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

Detection example



Recommended Device Under Test



Concave Lens

3.2.1.4. Beam Ellipticity

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

The Formula for Beam Ellipticity

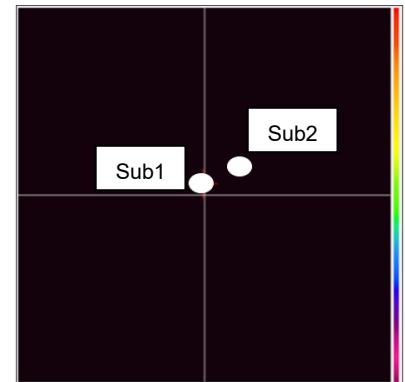
$$\text{Beam Ellipticity} = D4 \sigma m \text{ (minor) beam diameter} / D4 \sigma M \text{ (major) beam diameter}$$

The following describes its use.

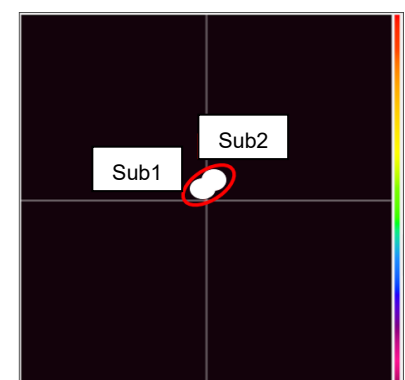
Beam Ellipticity Usage

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

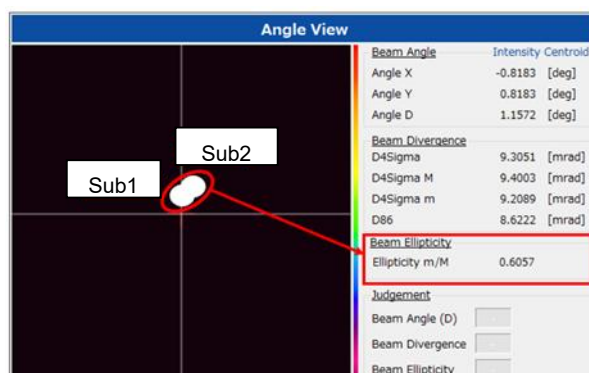
1. The beam spots of "Sub 1" and "Sub 2" shown in the right are incident lights on the Products, and the angles of each can be measured. By moving the two beam spots close to each other, the Sub1 and Sub2 are nearly parallel.



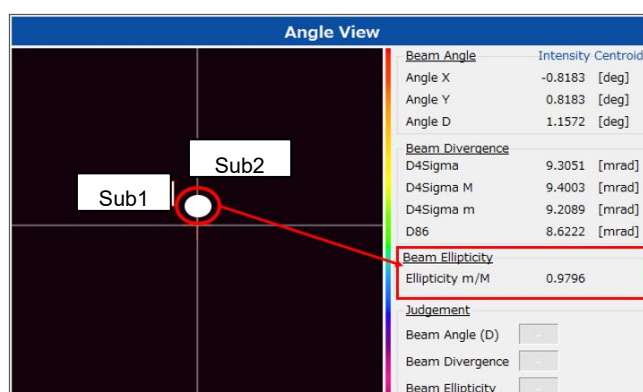
2. As the two light spots are getting closer like in the illustrated frame, the sensor recognizes them as a single elliptical light spot.



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



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



For ellipticity measurement

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

D4Sigma

☒ Orientation Enabled

Angle View

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

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

Beam Ellipticity	
Ellipticity m/M	0.9796

Judgement

Beam Angle (D)	<input type="text"/>
Beam Divergence	<input type="text"/>
Beam Ellipticity	<input type="text"/>

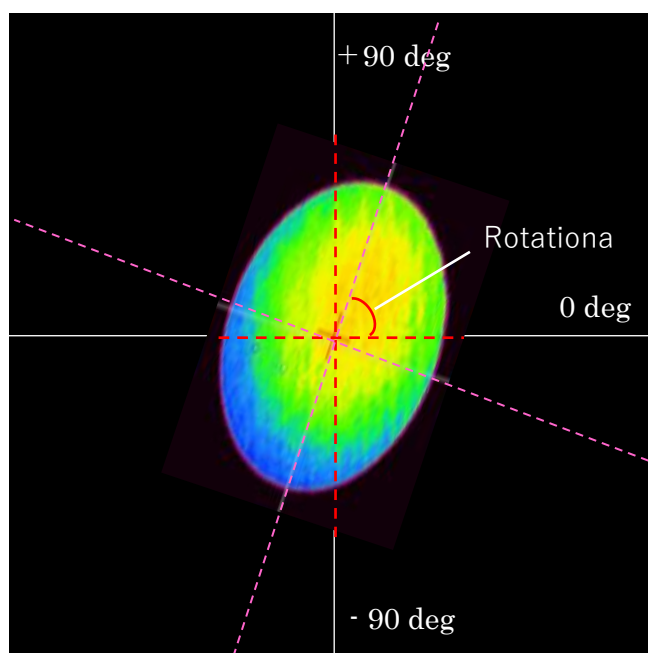
3.2.1.5. Rotational Angle Measurement

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

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

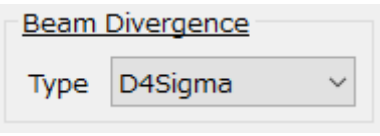
The Definition of Rotation Angle

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

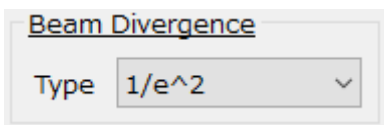


Measurement Methos

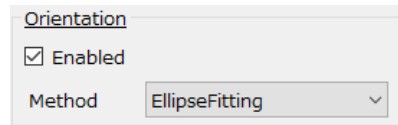
There are two types of measurement methos for a rotational angle.

Rotational Angle Measurement Compliant with ISO standards	
Select [D4Sigma] for the “Beam Divergence” in the Option Settings as below. 	Only when [D4 Sigma] is selected, Will the rotation angle be measured in accordance with ISO 11146-2.
Rotational Angle Measurement NOT Compliant with ISO standards	
Select [1/e^2] for the “Beam Divergence” in the	Only when [1/e^2] is selected, will the following two non-ISO-compliant rotation angles be measured.*1

Option Settings as below.

A screenshot of a software interface for 'Beam Divergence'. It features a title bar 'Beam Divergence' and a 'Type' dropdown menu currently set to '1/e^2'.

[Ellipse Fitting]

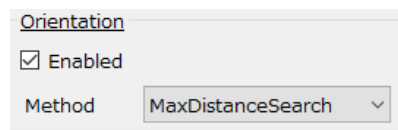
A screenshot of a software interface for 'Ellipse Fitting'. It features a title bar 'Orientation', a checked 'Enabled' checkbox, and a 'Method' dropdown menu set to 'EllipseFitting'.

This method performs elliptical fitting on a beam region exceeding 13.5% of its peak value and calculates a rotational angle as the inclination of the major axis of the resulting ellipse.

Advantage

It obtains a high-precision rotational angle when a shape is close to an ideal ellipse, as this method considers an overall beam shape.

[Maximum Distance of Two Points Search Method]

A screenshot of a software interface for 'Maximum Distance of Two Points Search Method'. It features a title bar 'Orientation', a checked 'Enabled' checkbox, and a 'Method' dropdown menu set to 'MaxDistanceSearch'.

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.

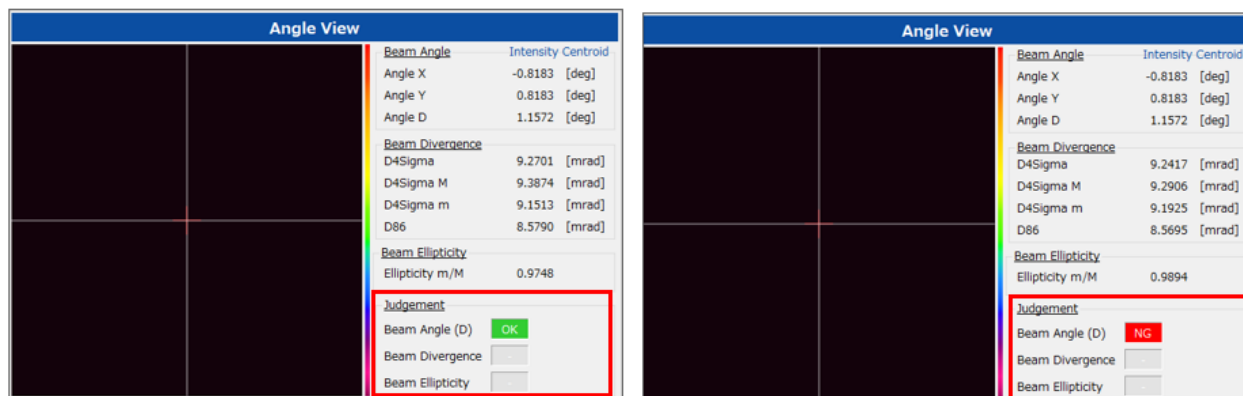
Advantage

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.

3.2.1.6. Judgement

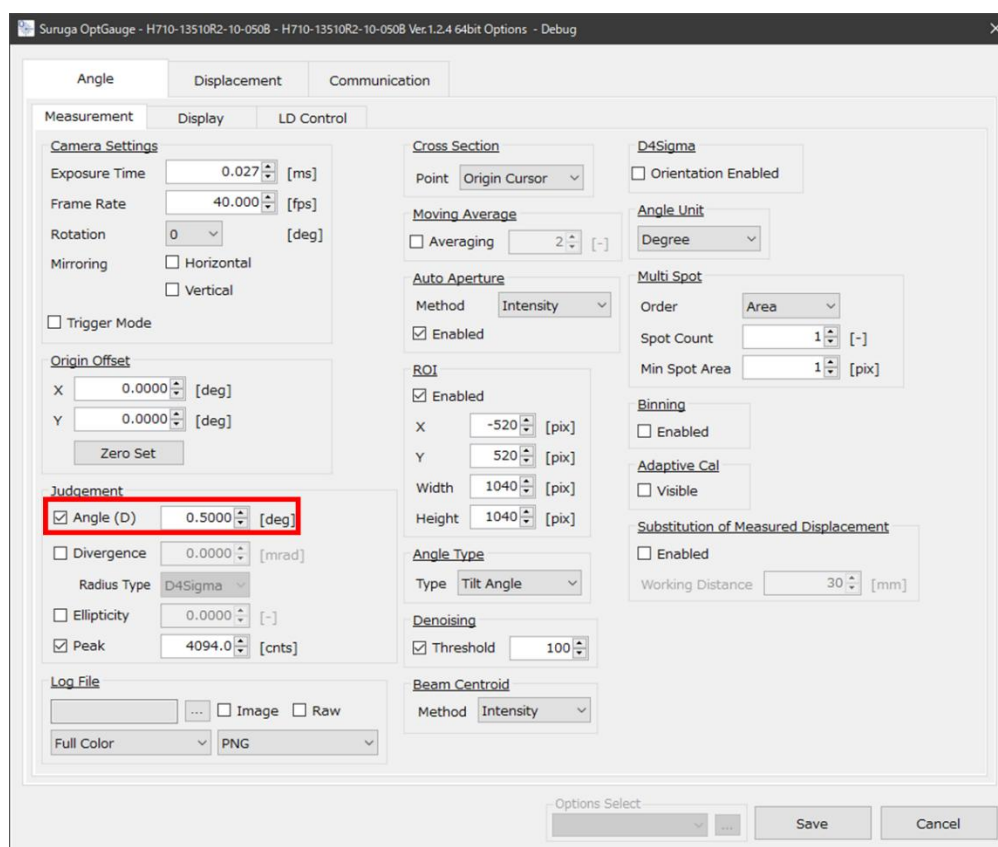
The judgement function is available in an intuitively understandable expression of whether the measurement value is within the target range or not.

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

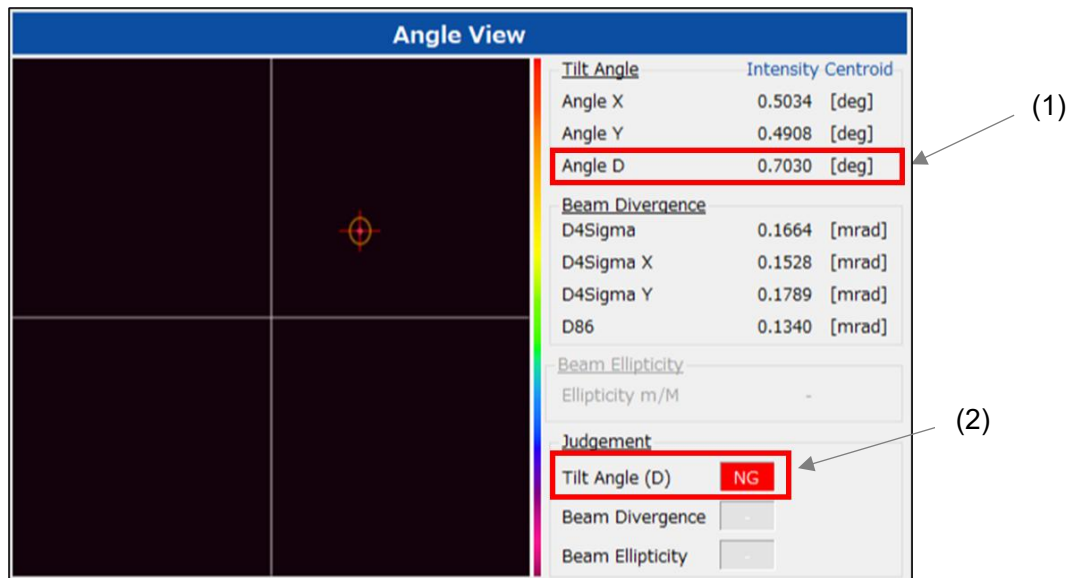


For Angle (D)

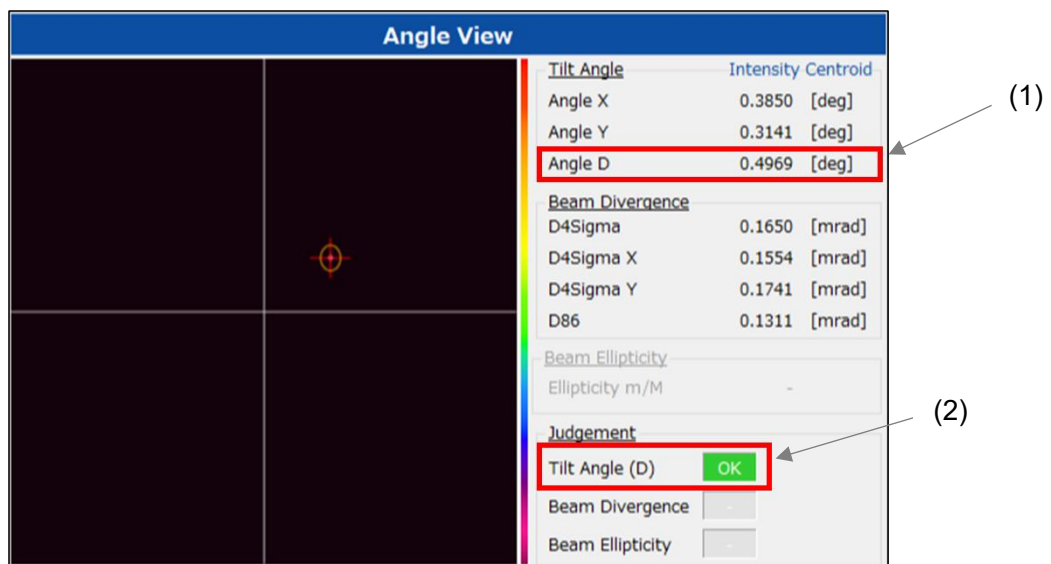
1. Adjusting the angle and aim to set the "Angle(D)" of the measurement result to less than 0.5000. Enabling the "Angle(D)" in the "Judgement Settings" in the Option setting and enter the value to be "0.5000 deg".



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



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



For Peak

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

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

Angle Displacement Communication

Measurement Display LD Control

Camera Settings

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

Origin Offset

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

Judgement

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

Log File

Full Color PNG

Cross Section

Point Origin Cursor

Moving Average

☐ Averaging 2 [-]

Auto Aperture

Method Intensity
☒ Enabled

ROI

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

Angle Type

Type Tilt Angle

Denoising

☒ Threshold 100

Beam Centroid

Method Intensity

D4Sigma

☐ Orientation Enabled

Angle Unit

Degree

Multi Spot

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

Binning

☐ Enabled

Adaptive Cal

☐ Visible

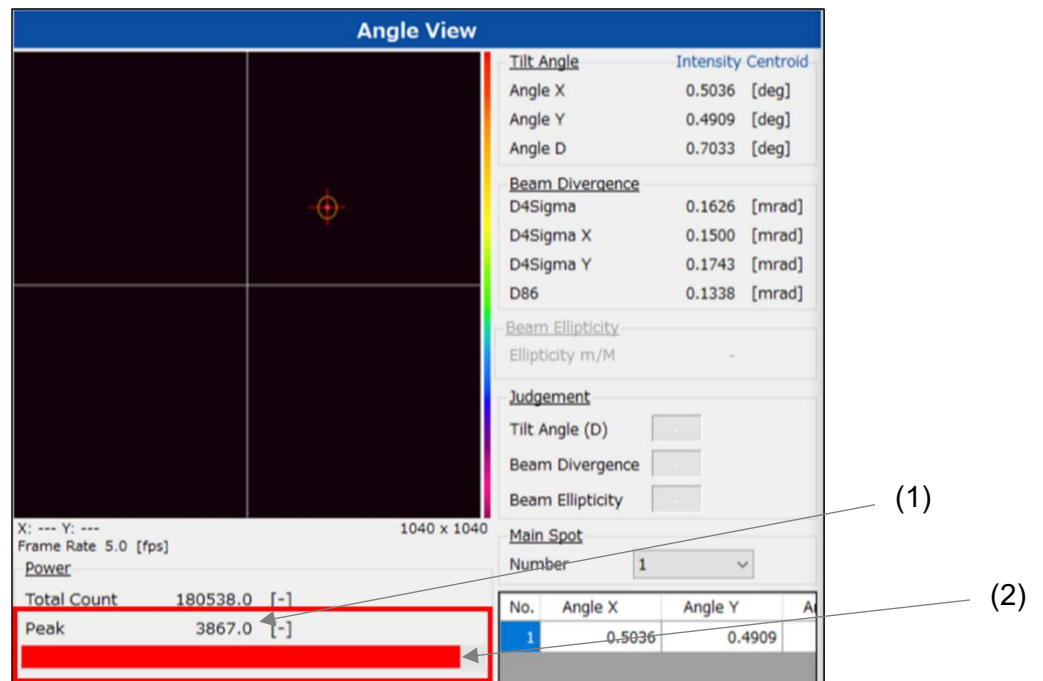
Substitution of Measured Displacement

☐ Enabled
Working Distance 30 [mm]

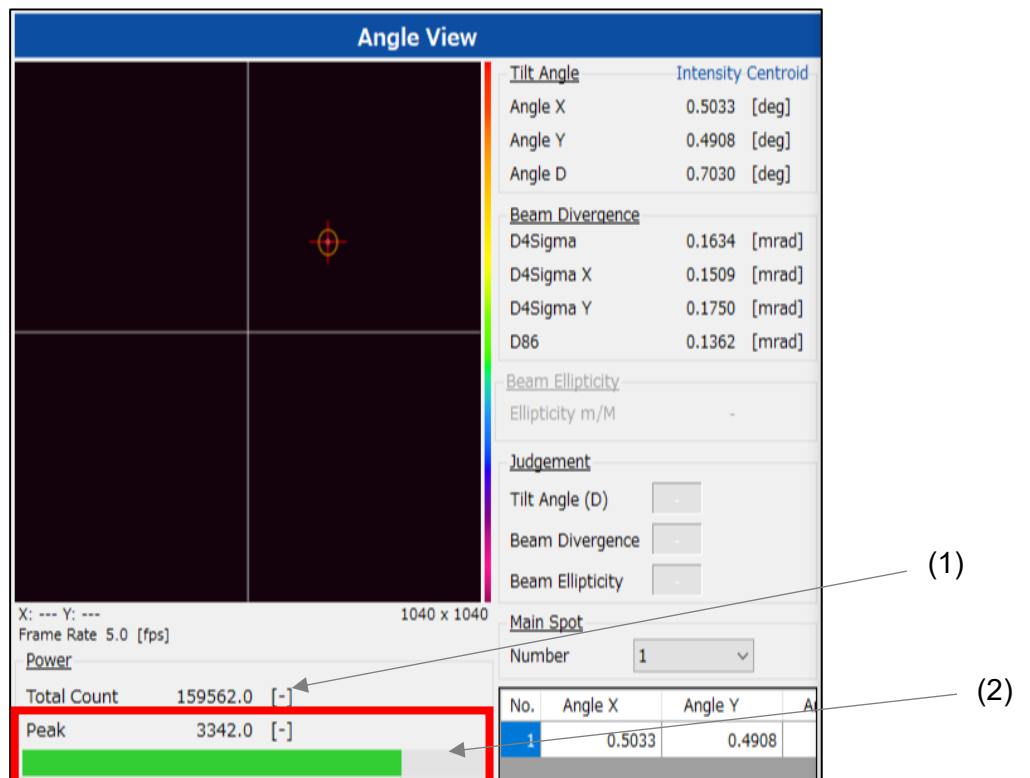
Options Select

Save Cancel

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



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

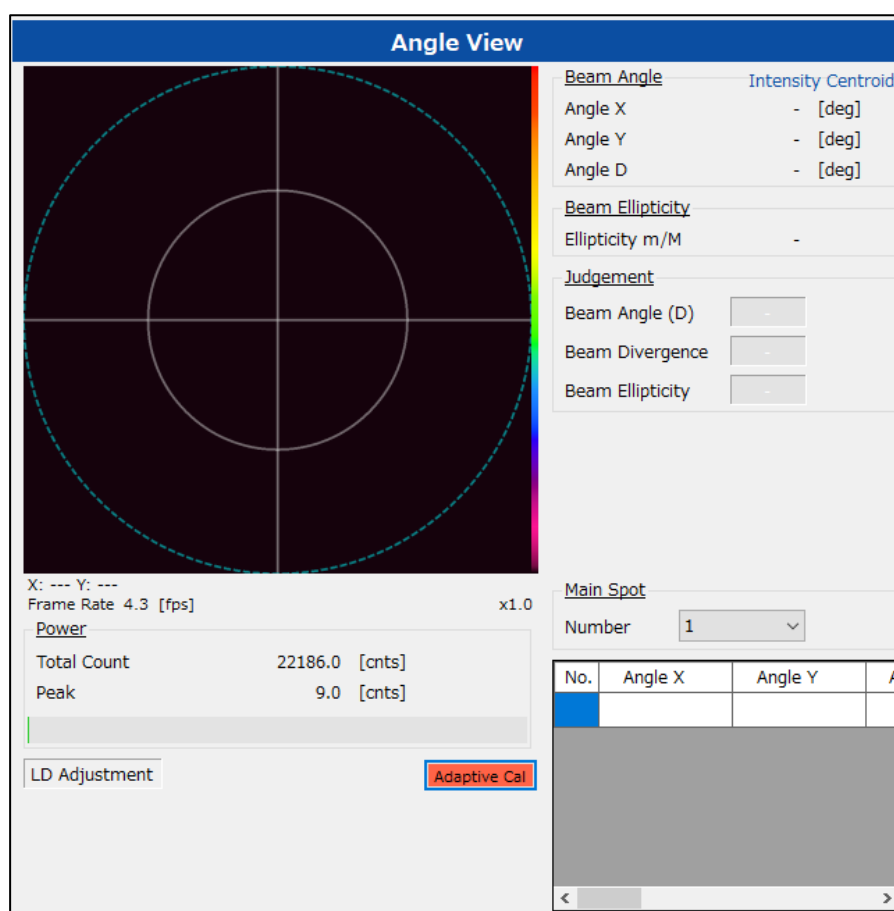


3.2.1.7. Adaptive Cal

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.

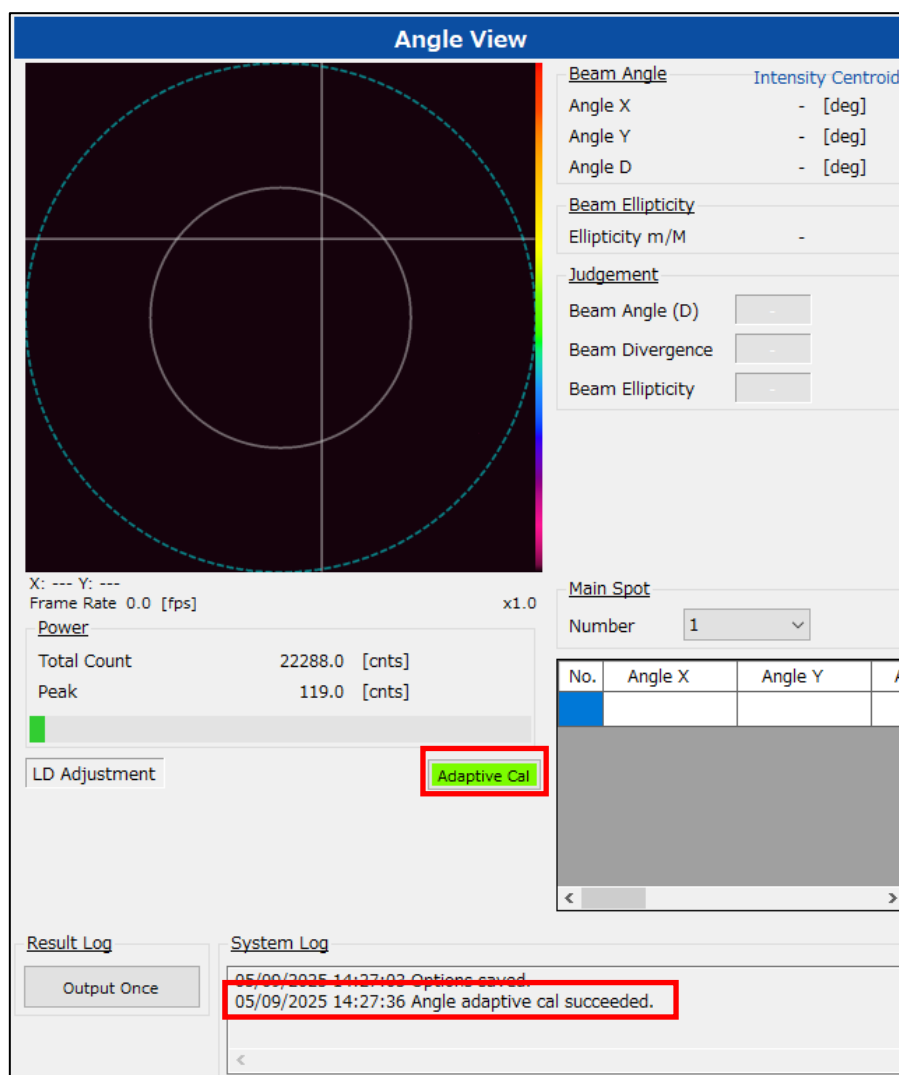
This function must be executed when starting up the Software and every time the exposure time in the camera settings is changed.

1. Set the beam not to enter the product.
2. Check "Adaptive Cal --> Visible" in the option settings. Click the "Adaptive Cal" button.



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

*1 For details on the option contents, refer to the separate software manual "the Suruga OptGauge User's Manual".



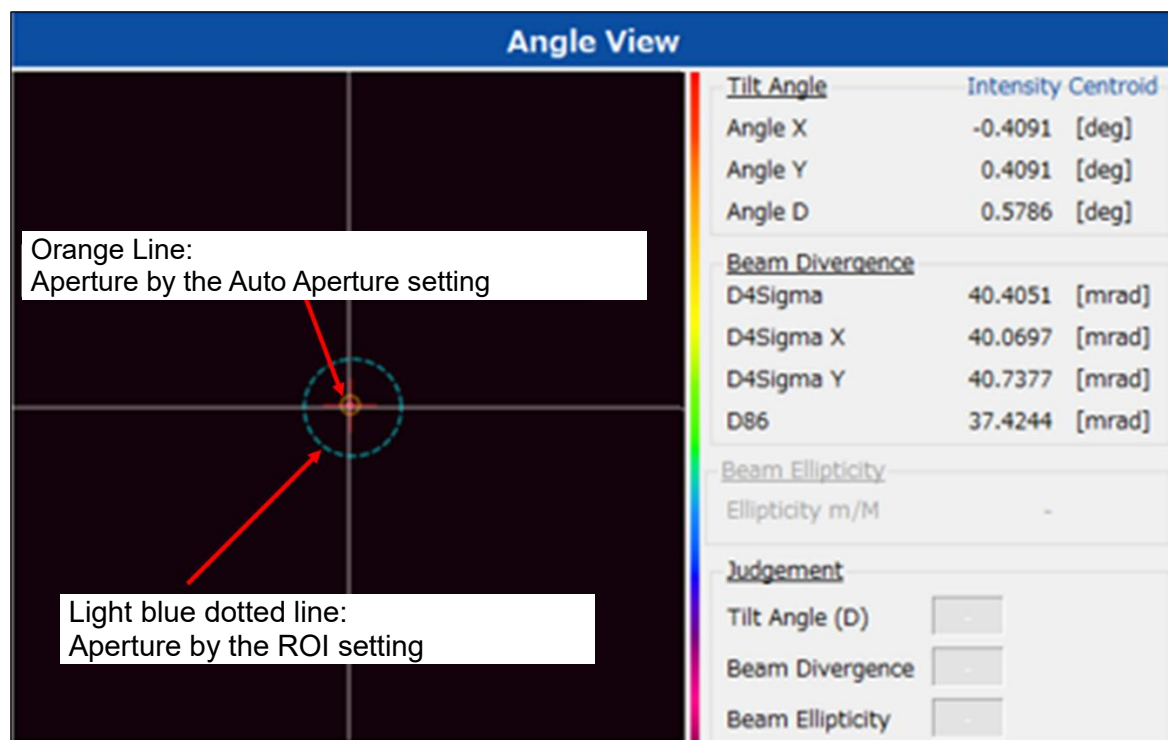
Attention

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

3.2.1.8. Aperture

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

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



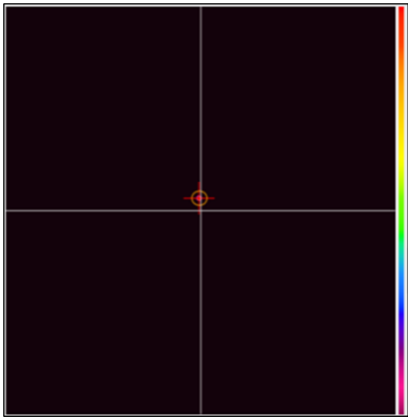
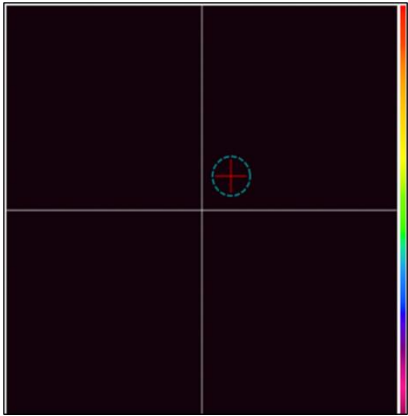
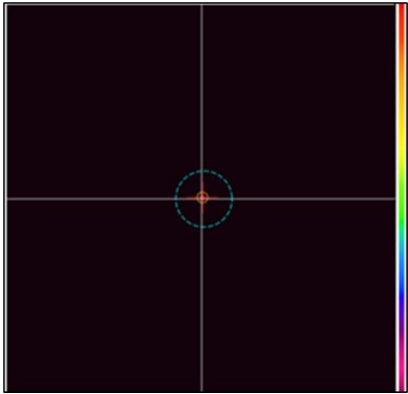
Aperture Explanation

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

Info

Auto Aperture and ROI together can enhance only the important parts of the beam intensity, shape, and position, and by minimizing noise and interference it improves the accuracy of measurement. We recommend that both be used simultaneously in situations where the beam position does not change.

Setting Methods

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

3.2.1.9. Origin Offset

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

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

There are three offset methods.

Setting Methods

For Setting from the Option Screen

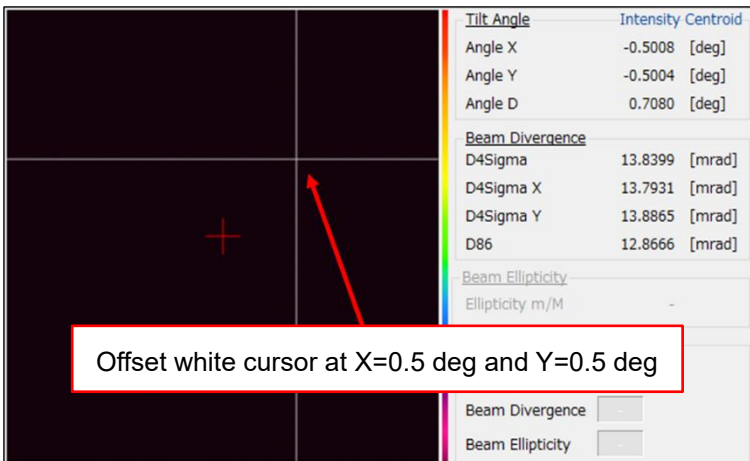
Set "Origin Offset" in option settings to the desired values

Origin Offset

X 0.0000 [deg]

Y 0.0000 [deg]

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



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

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

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

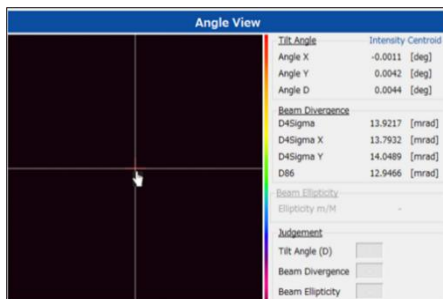
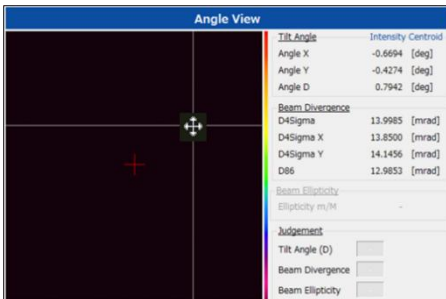
Beam Ellipticity	
Ellipticity m/M	-

Beam Divergence

Beam Ellipticity

For Setting from the View Screen

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



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

Origin Offset

X 0.6747 [deg]

Y 0.4445 [deg]

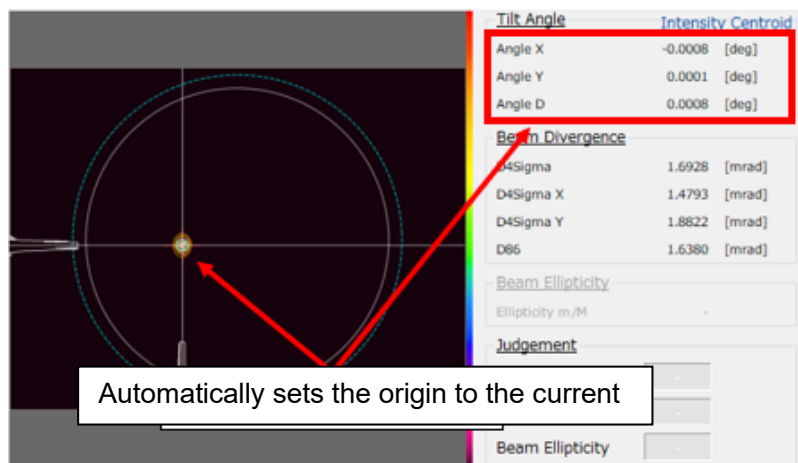
For Setting from the Zero Set Button

Press the “Zero Set Button” in option settings.

Origin Offset

X	0.0000	[deg]
Y	0.0000	[deg]
<div>Zero Set</div>		

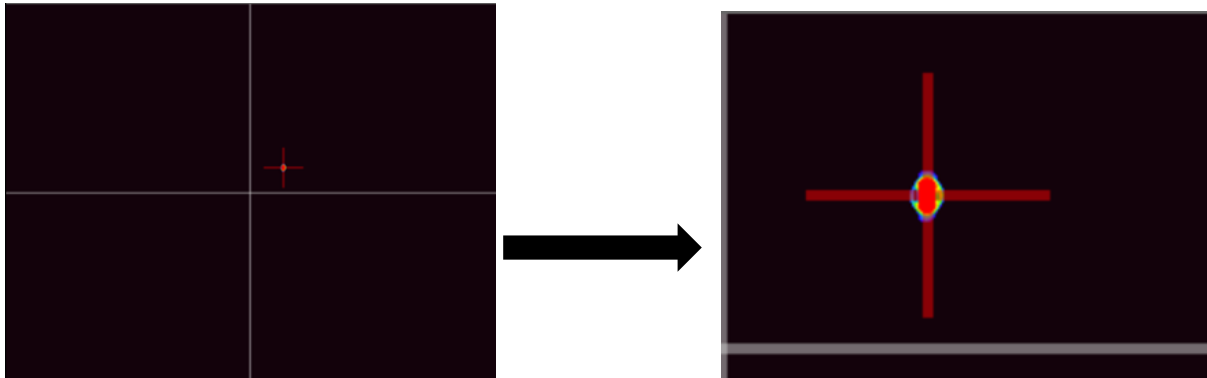
*The values of Origin Offset X and Origin Offset Y will be automatically set to the current measurement coordinates.



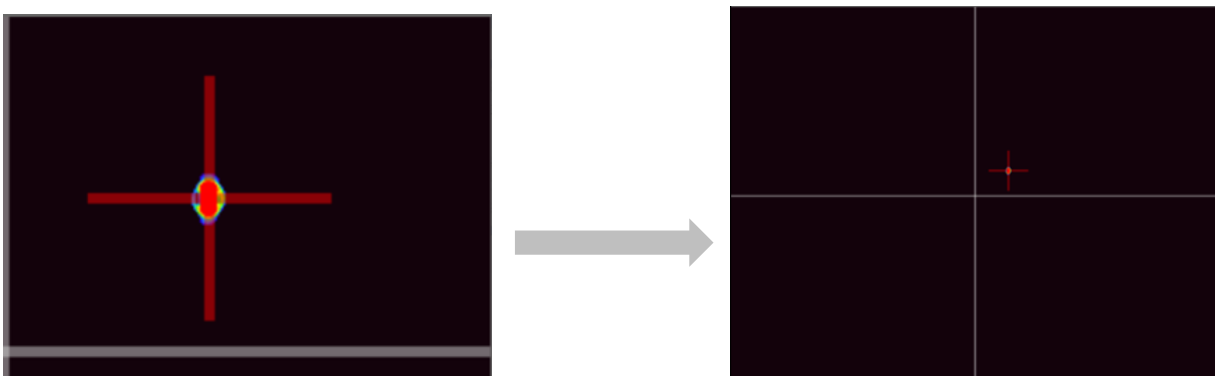
3.2.1.10. Zoom In

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

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



1. 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.



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

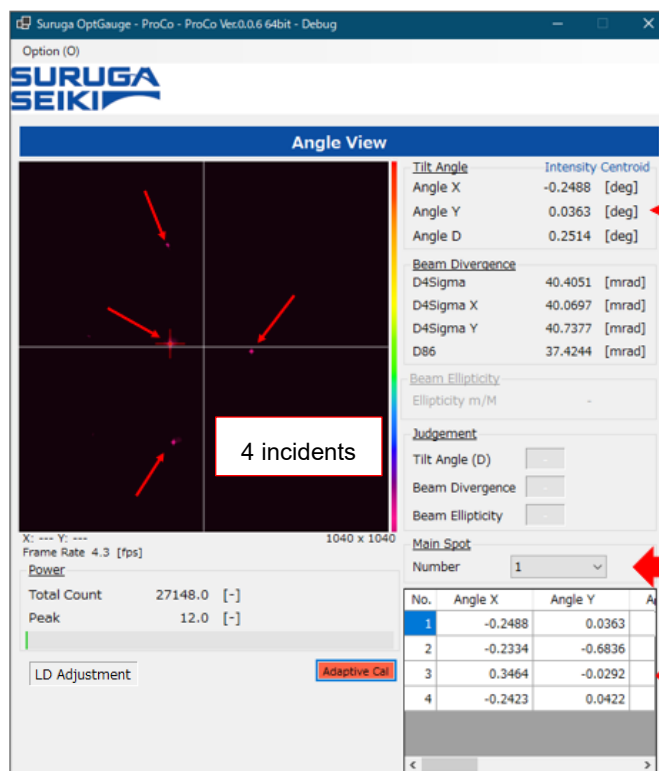
3.2.1.11. Multi Spot

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 be displayed

Change "Spot Count"
in option settings

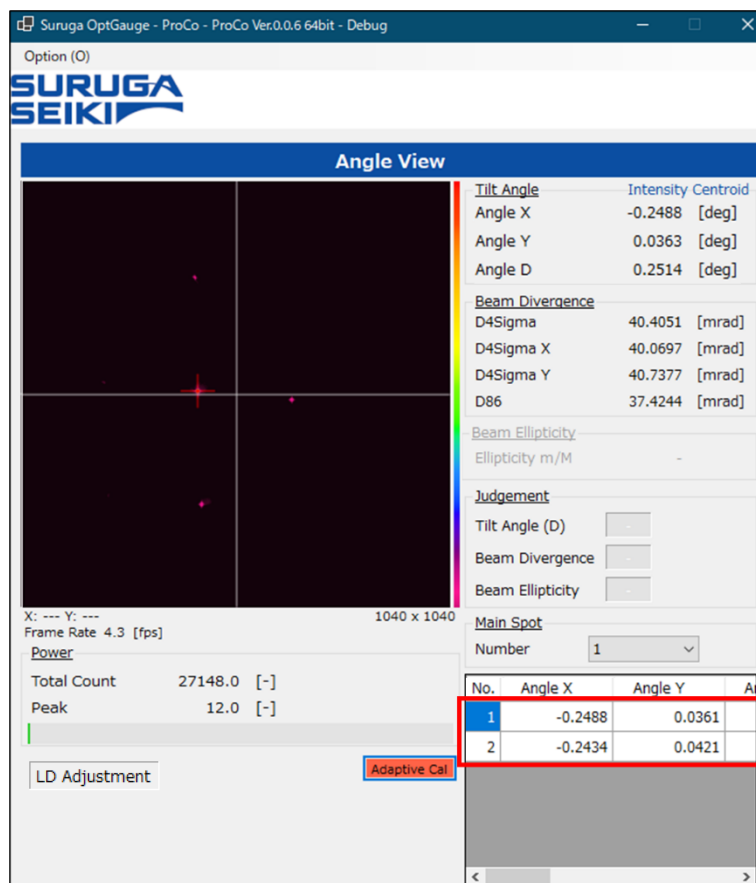
Multi Spot

Order Area ▼

Spot Count 2 [-]

Min Spot Area 64 [-]

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



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

Change "Min Spot Area"
in option settings.

Multi Spot

Order Area ▾

Spot Count 4 [-]

Min Spot Area 200 [-]

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



Info

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

3.2.1.12. Automatic Brightness control

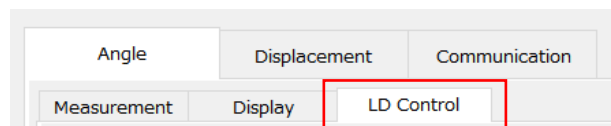
The Products enables use of the “Automatic Brightness control,” which adjusts exposure time and LD output (power) as well as automatically adjusting beam luminance value (peak) to the designated luminance value.

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

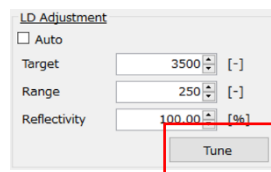
■ One-Time Execution of Automatic Brightness control

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

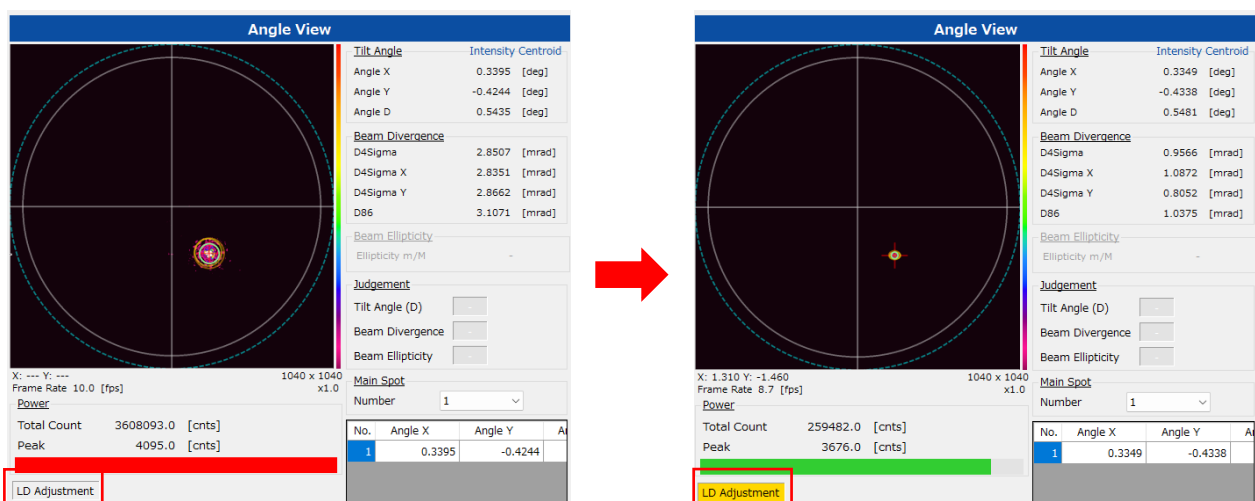
1. Open the **Options** window and select the **LD Control** tab.



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



3. Automatic Brightness control starts.

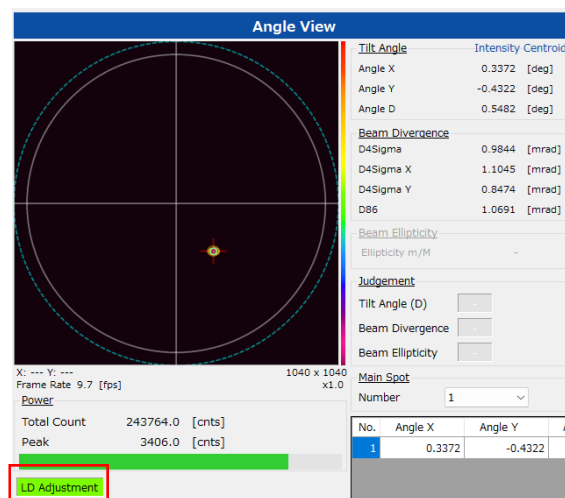


The LD Adjustment section on the main screen will be grayed out if Automatic Brightness control has not yet been executed.

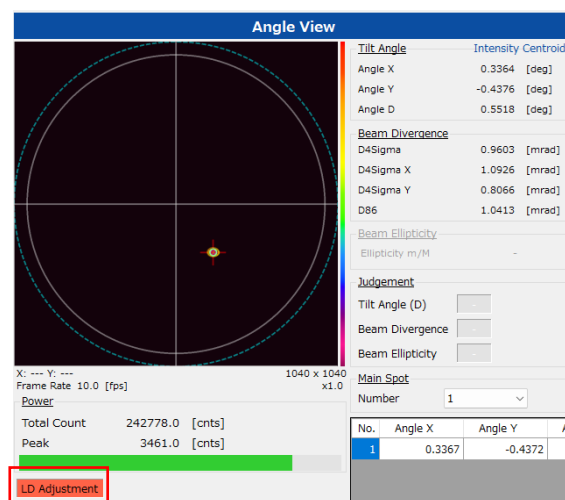
When Automatic Brightness control starts, the LD Adjustment section will be displayed in yellow,

indicating that the adjustment is in progress.

4. Automatic Brightness control completes.



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



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

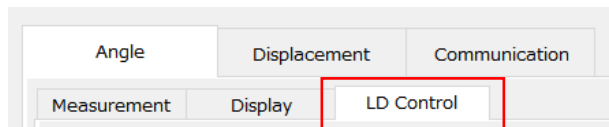
■ Continuous Automatic Brightness Control

When the beam light moves due to angle or displacement, the luminance value may increase or decrease.

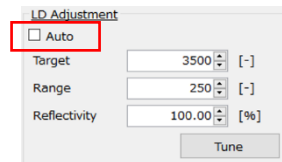
To retain the luminance value at the designated value even when the beam light moves, execute constant automatic brightness.

The usage method for constant automatic brightness is indicated below.

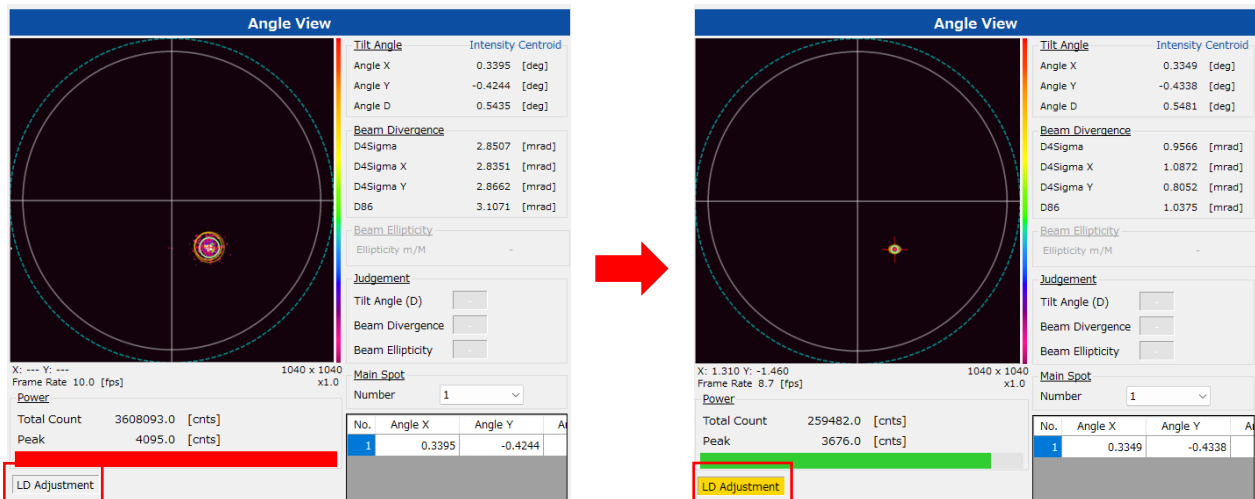
1. Open the Options window and display the LD Control tab.



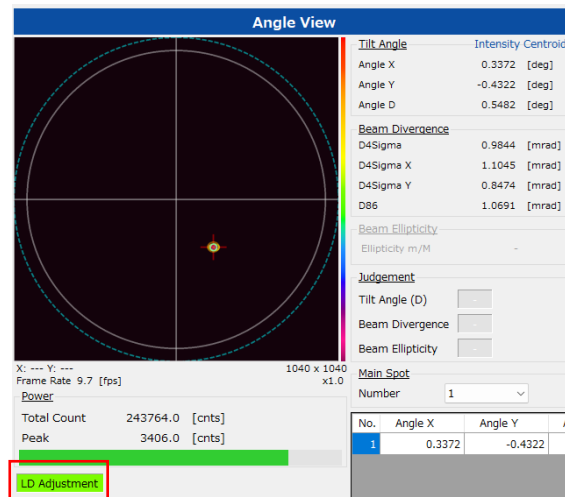
2. Click the Auto checkbox in the LD Adjustment group.



3. The Automatic Brightness control starts.



4. The Automatic Brightness control completes.

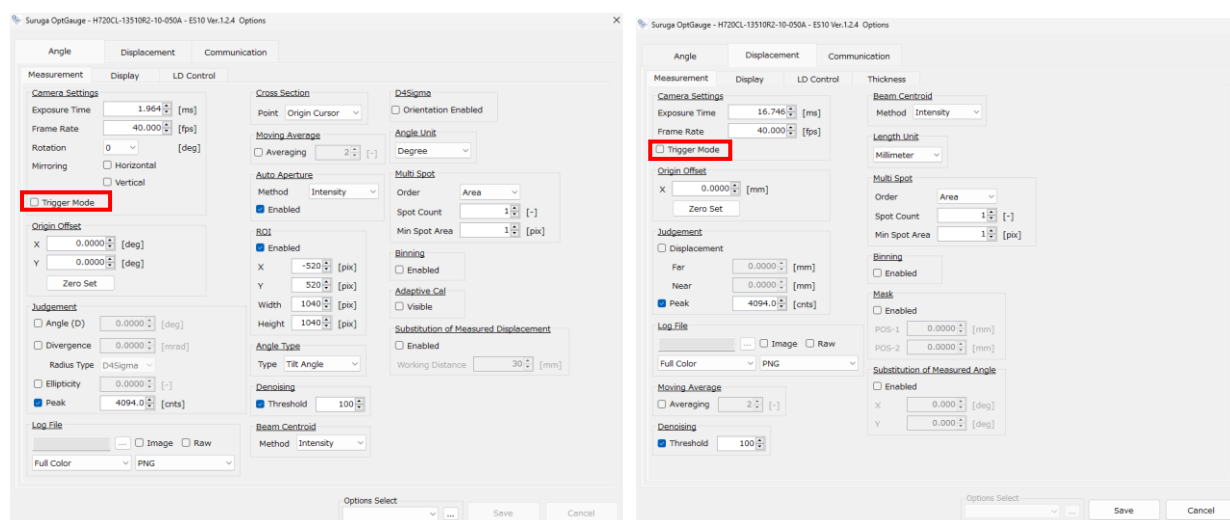


From this point onward, the Automatic Brightness control will be executed when the measured brightness value goes beyond the range specified in the Range option. The brightness range is set beforehand in in the Target Option in the LD Adjustment Window.

3.2.1.13. External Trigger Model

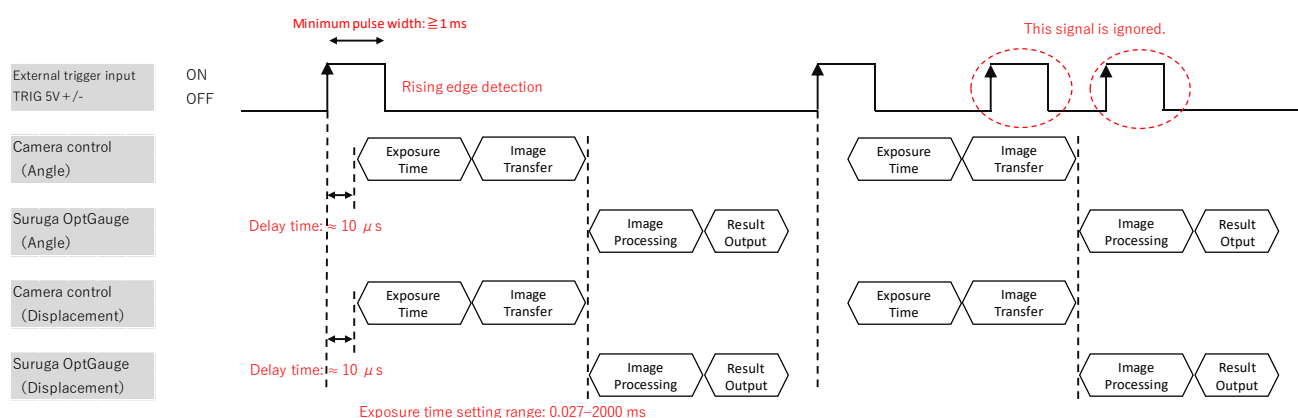
The external trigger function is available for the Products, allowing measurements to be performed in response to trigger signals (pulse input) from external devices. By using this function, measurement timing can be controlled on the user's system side.

To enable the external trigger, please activate the Trigger Mode option for Angle and the Trigger Mode option for Displacement.



By rising edge (OFF→ON) of the external trigger input is detected, it captures the image and returns the measurement results.

When inputting triggers consecutively, please ensure that there is at least a one-frame interval between triggers so that measurement timing does not overlap.

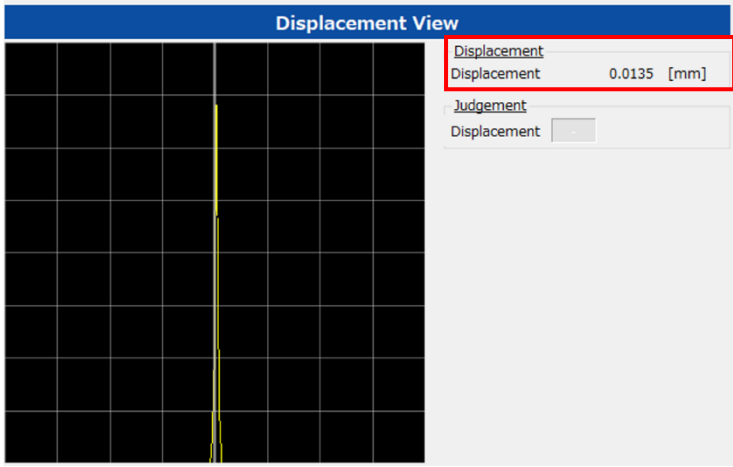


3.2.2. Displacement View

3.2.2.1. Displacement Measurement

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

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

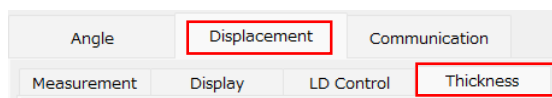
To change displacement units	
<p>Select “Millimeter” or “Micrometer” from “Length Unit” in the option settings.</p> <div><p>Length Unit</p><p>Millimeter ▾</p></div>	<p>Displayed in [mm] or [μm]</p> <div><p>Displacement View</p></div>

3.2.2.2. Thickness Measurement

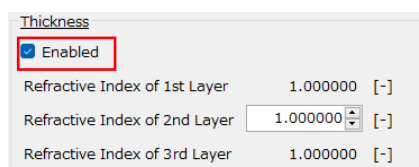
The thickness of the measurement target can be measured.

The beam light detected when thickness measurement is enabled displays thickness in either [mm] or [μm].

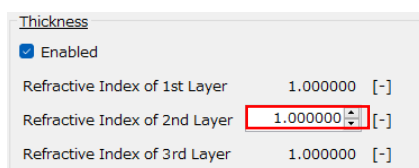
1. Select the “Thickness” tab from within the “Displacement” tab when the option screen is displayed.



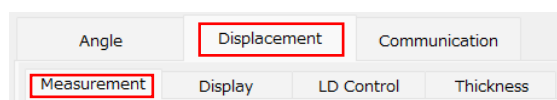
2. Enter a ☒ in the “Enabled” checkbox in the “Thickness” group.



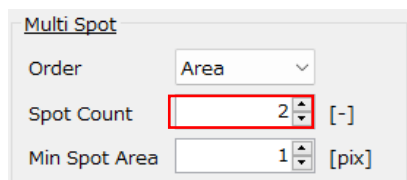
3. Enter the target object's index of refraction in “Refractive Index of 2nd Layer.”



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



Set the “Spot Count” within the “Multi Spot” group to at least 2.



3.2.2.3. Judgment

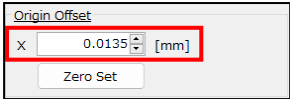
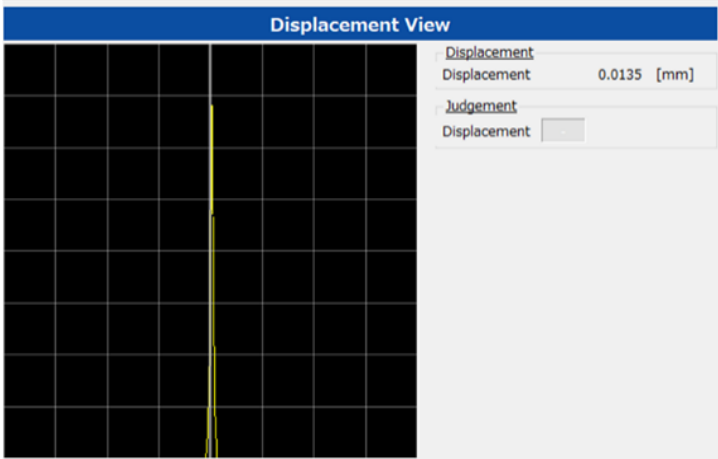
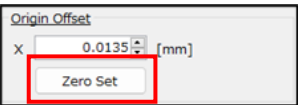
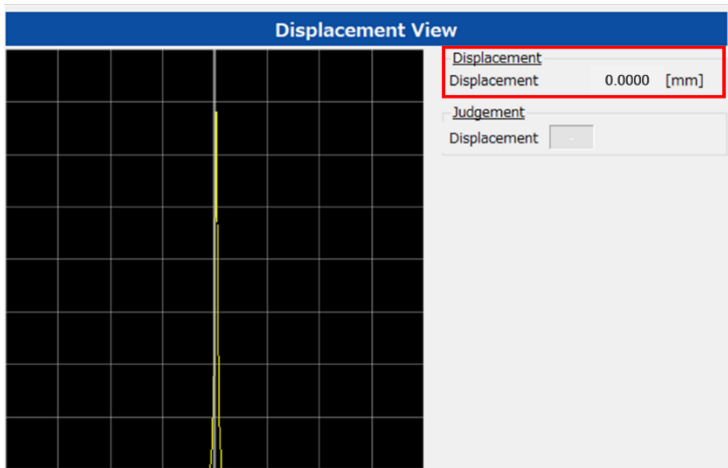
The judgment function is used to provide an intuitively understandable expression of whether the measurement value is within the target range.

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

3.2.2.4. Origin Offset

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

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

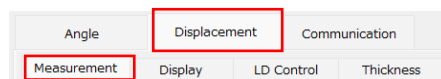
For offset at an arbitrary position	
<p>Set an arbitrary value for “Origin Offset X” in option settings.</p> 	<p>Ex.: Set to X = 0.0135 mm</p> 
For offset to measurement coordinates with the zero set button	
<p>Press the “Zero Set” button within “Origin Offset” in option settings.</p>  <p>*The “Origin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

3.2.2.5. Mask

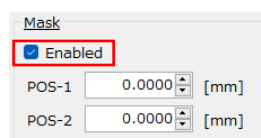
The Displacement View screen features the Mask function that limits the measurement range, allowing you to configure measurements to be taken only within the mask area. When a mask area is set, areas outside the measurement range are shown in gray.

■ The Mask Function Usage

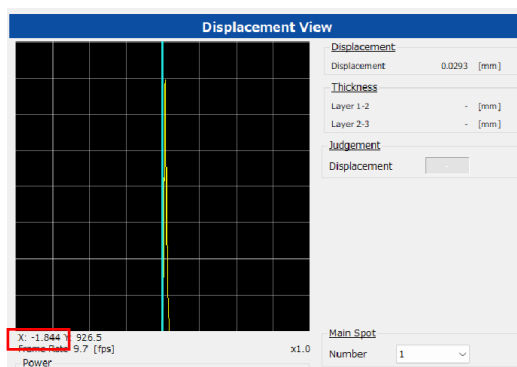
1. Select the “Measurement” tab from within the “Displacement” tab when the option screen is displayed.



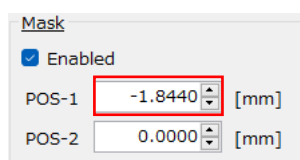
2. Enter a ☒ in the “Enabled” checkbox in the “Mask” group.



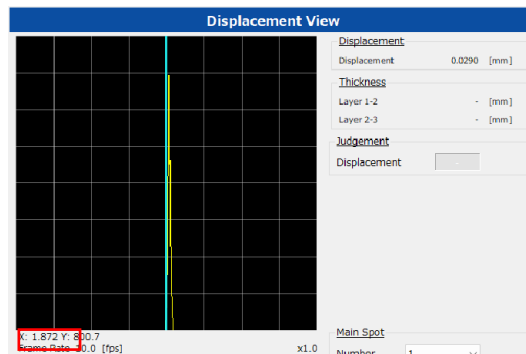
3. Display “Displacement View,” move the mouse cursor to the position to be set, and confirm the X coordinate value.



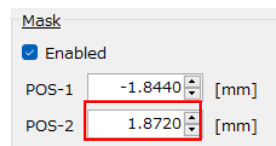
4. Input the coordinate confirmed in the 3 above. to POS-1.



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



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



3.2.2.6. Multi Spot

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

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

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

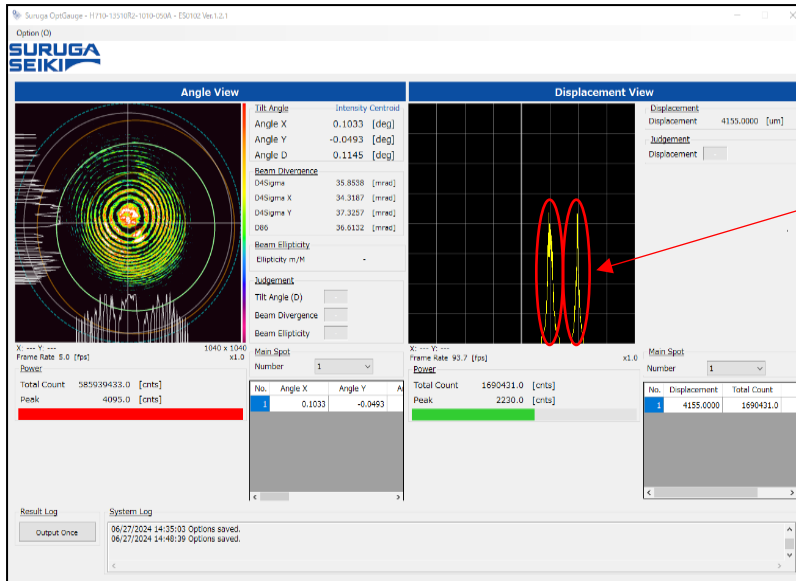
3.2.2.7. Alternating Lights Function

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

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

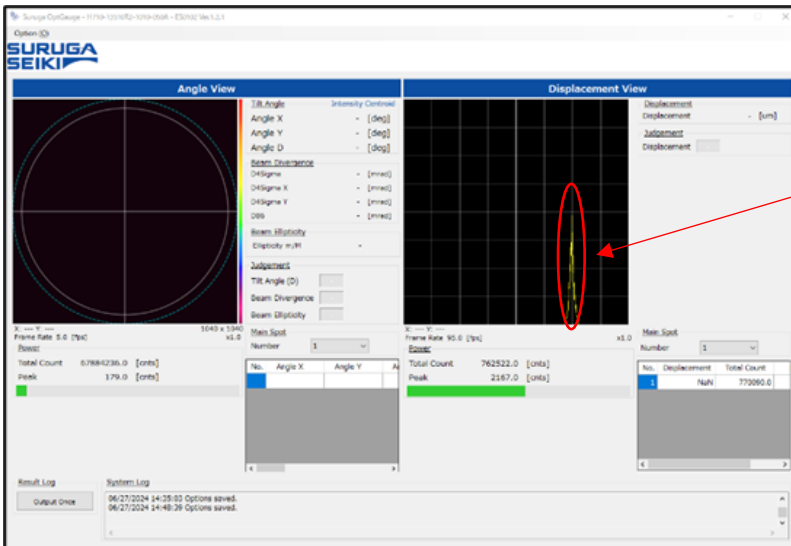
*This function does not guarantee that measurement will be possible with all measurement targets.

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



Two beam lights are detected by displacement side sensor

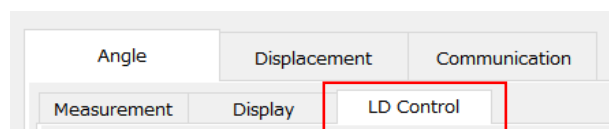
■ Example when using alternating lights function



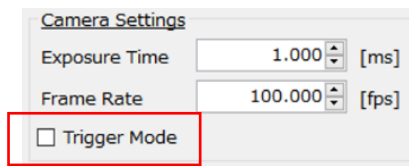
Angle side beam light disappears

■ Alternating Lights Function Usage Method

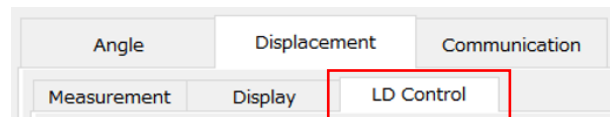
1. Select the "LD Control" tab from within the "Angle" tab when the option screen is displayed.



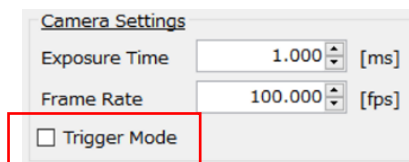
2. Enter a ☒ in the “Trigger Mode” checkbox in the “Camera Settings” group.



3. Select the “LD Control” tab within the “Displacement” tab.



4. Enter a ☒ in the “Trigger Mode” checkbox in the “Camera Settings” group.



5. Enter a ☒ in the “Enabled” checkbox in the “Alternate Data Acquisition” group*1.



*1 The “Alternate Data Acquisition” group is enabled only when “Trigger Mode” is enabled within both the “Angle” and “Displacement” tabs.

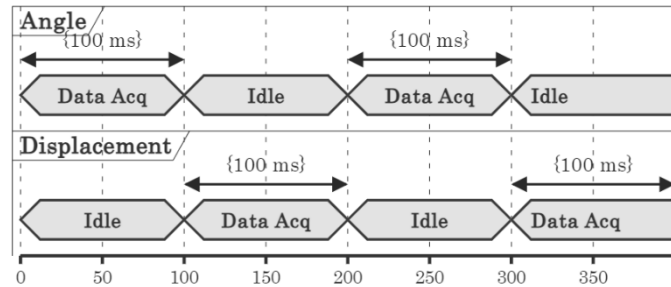
* When alternating lights are enabled, the maximum “Exposure Time” value will be restricted to the “Trigger Period” setting value or below, in linkage with the “Trigger Period.”

■ Trigger Interval and Frame Rate

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

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

Ex.: When trigger interval is set to 100 ms



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

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

3.2.2.8. Automatic Brightness

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

For details, refer to “Angle View->[Automatic Brightness control](#)”.

3.2.2.9. External Trigger Model

The Products features an external trigger function, enabling measurements to be executed in response to trigger signals (pulse inputs) from external devices. This function allows the measurement timing to be controlled from the user's system side.

For details, refer to “[External Trigger Mode](#)” in the Angle View section.

4. Specifications of the Products and Accessories

4.1. Specifications of the Products

Item		Specifications
Internal light source	Wave length	660 nm
	Diameter	Φ 1 mm
	Radiant flux of the light emission	1 mW or below (Class 2)
	Emission position (angle)	40 mm x 25 mm (distance from the reference plane)
	Emission position (displacement)	16.7 mm x 25 mm (distance from the reference plane)
Angle measurement	Measurement range	$\pm 1.35^\circ$ (circular range)
	Linearity ^{*1}	$\pm 0.25\%$ of F.S. (F.S. = 2.7°)
	Repeatability (6σ) ^{*2}	1 sec.
Divergence measurement	Measurement range	20 mrad or less
	Linearity	5% of F.S. (F.S. = 20 mrad)
Displacement measurement (W.D. 50 mm model)	Viewing Angle	± 10 mm
	Linearity ^{*1}	$\pm 0.05\%$ of F.S. (F.S. = 20 mm)
	'Repeatability (1σ) ^{*2}	0.2 μ m
Working distance (W.D. 50 mm Model)		50 mm \pm 10 mm
Frame rate		20 to 30Hz (with the recommended computer specifications)
Interlock input terminal INTERLOCK + INTERLOCK –		Interlock input (none-voltage contact, the laser emission starts with the short circuit of +/-) Internal voltage: 3.3 V Short circuit current: 2 mA Open input conditions: "10 k Ω or more" or "2.6 V or above" Short-circuit input conditions: "0.5 k Ω or less" or "1.0 V or below"
Trigger input terminal TRIG 5V + TRIG 5V –		The trigger input for a measurement starts (rising edge detection to start a measurement in the 5V signal system) Input voltage: 0 V to 6 V Input current: 4 mA (at 5 V input) ON voltage: 3.0 V or above

		OFF voltage: 1.0 V or below
Environmental Conditions	Operating environment* ³	0 to + 40°C and 35 to 85% RH
	Storage environment	- 10 to + 60°C
	Vibration resistance	Frequency range: 10 to 500 Hz Maximum acceleration: 2 G, X/Y/Z three directions (10 sweeps)
Dimensions (mm)		90 x 120 x 45
Weight		0.8kg

*1 By measurements with the wavelength of 660 nm ± 10 nm

*2 Averaging times of 256 measurements

*3 Inspection Environment for shipping: 22 to 24°C and 35 to 85% RH

4.2. AC/DC Converter Electrical Specifications

AC adapter Specifications Overview	
Rated Input (AC)	100 V to 240 V
Rated Output (DC)	12 V / 3.0 A
Acquired Industrial Standards	PSE, BSMI, cUL, FCC, KC, CE, GS, RCM, CCC
Protective Functions	Short-circuit protection, overcurrent protection, overvoltage protection
RoHS	RoHS10
AC Side Plug Shape	Type-A
Product Dimensions (mm)	99 x 50 x 33
DC Cable Length	1.5 m +/- 30 mm
DC Plug Polarity	Center Positive

4.3. The Products and Cable Electrical Specifications

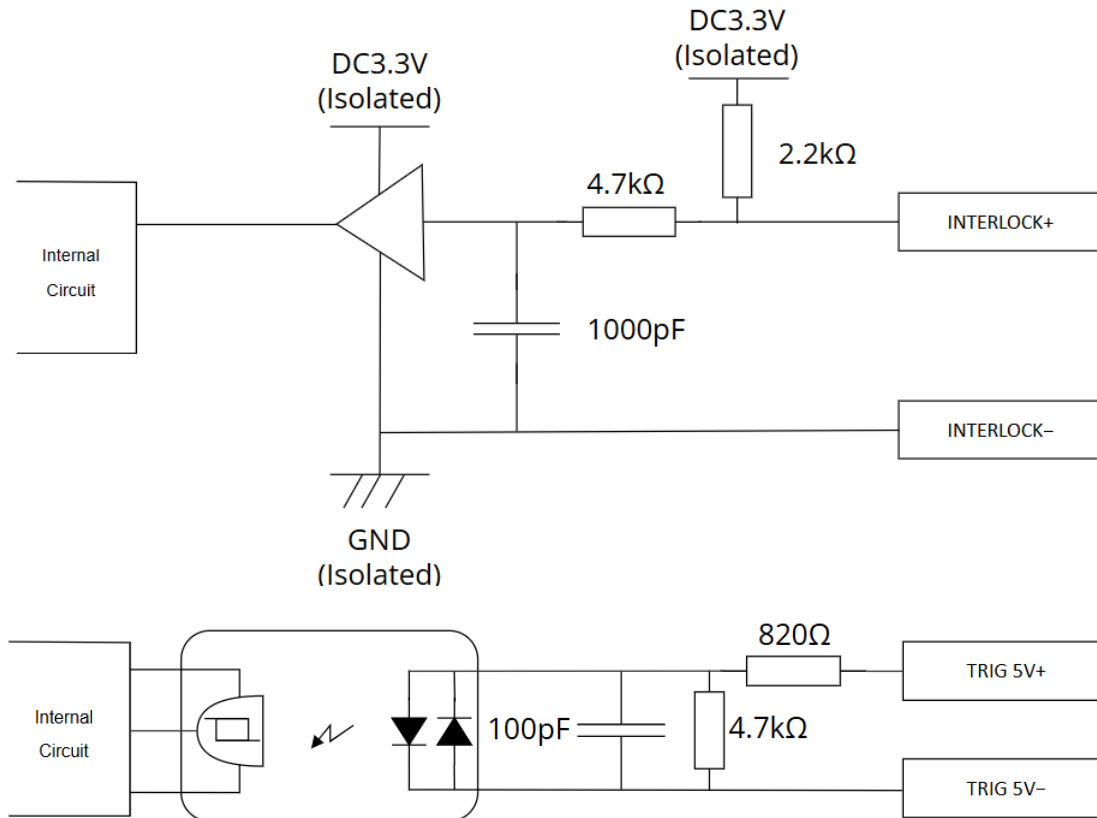
The Products and cable specifications overview	
Rated input (power consumption)	12 VDC / 3 A (5 W or below)
Cable Type	USB cable compliant with USB3.0 (5Gbps) standard
Connector	USB3.0 Type A
Cable Length	3.0 m

4.4. The specifications of the applicable wire range for the interlock and trigger inputs

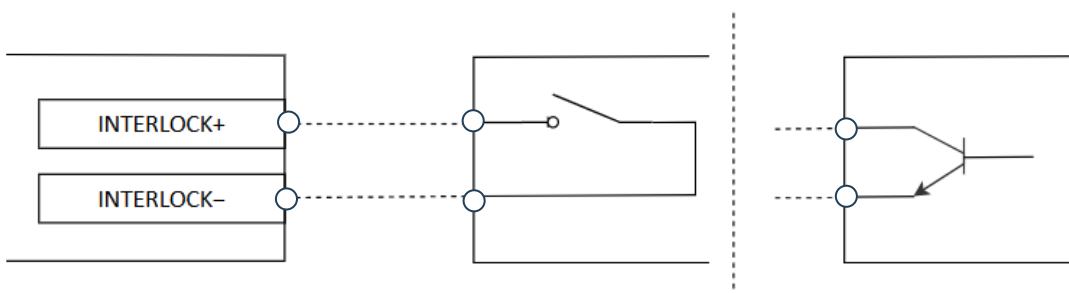
Stranded wire	0.2 mm ² to 1.5 mm ² (AWG24 to 16)
Solid wire	0.2 mm ² to 1.5 mm ² (AWG24 to 16)
Stranded wire with a ferrule terminal without insulation sleeve	0.2 mm ² to 1.5 mm ² (AWG24 to 16)
Stranded wire with a ferrule terminal with insulation sleeve	0.2 mm ² to 0.75 mm ² (AWG24 to 18)
Stripping length of outer sheath	8 mm

4.5. Equivalent Circuit Diagram

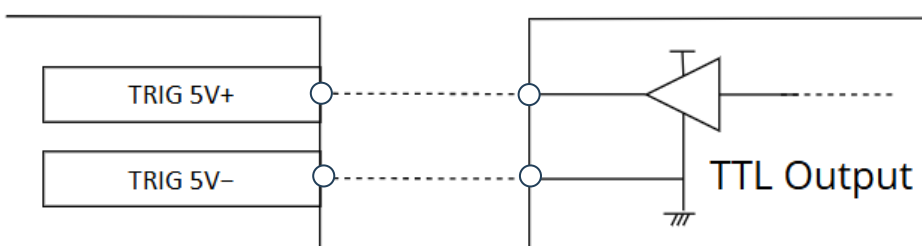
This section illustrates the circuit diagrams and connection examples for the interlock inputs and trigger inputs of the terminals.



INTERLOCK+/- connection example



TRIG 5V+/- connection example



5. Failures? Frequently Asked Questions

5.1. Symptoms and Countermeasures

Useful information for troubleshooting is listed below.

Check if the table below shows your trouble.

Symptom	Cause	Countermeasure
Internal light source power is NOT turned on.	AC adapter or power cable is not correctly connected.	DC12V is not supplied.
	DC12V is not supplied.	Correctly connect the DC12V power source.
Application does not start.	USB cable is not correctly connected.	Connect the USB cable to the USB3.0 port.
	Device authentication file is not being read.	Read the device authentication file (.suruga) corresponding to the purchased sensor head.
The Software does not start correctly	The sensor camera may be malfunctioning (check all cable connections)	Please contact our sales representative from the optical equipment division for further assistance.
Application stops during startup	With Windows 11 Version 23H2, due to differences in some system components and specifications, the Software may not function properly.	Please update to the latest Windows version (24H2 or later).
	USB cable disconnected.	Close the application, connect the USB cable correctly, and restart the application.
Beam is not displayed on screen	Exposure Time* ¹ is too short.	Adjust the exposure time* ¹ 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 of +/- 1.35°.
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 RS-232C 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.

*1 see "Suruga OptGauge User's Manual" in the separate software manual for details.

6. Warranty - After-Sales Service

6.1. Warranty Terms, Conditions and Coverage

- Before contacting us, please confirm the serial number of an 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.

6.2. After-Sales Service

Before requesting repair, please check the items in "[Failures? Frequently Asked Questions](#)".

If you have any questions, please contact our Optical Instruments Division Sales Department.

<During the Warranty Period>

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

<After the Warranty Period>

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

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

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