



Laser Autocollimator

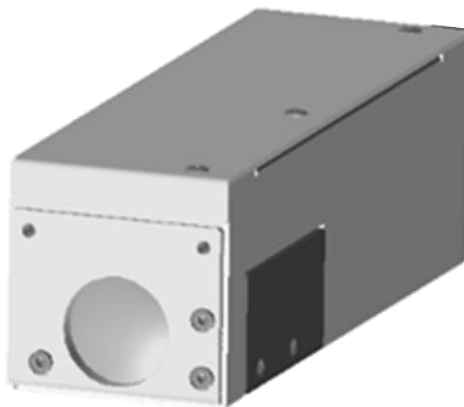
*Smart LAC H420 Series*

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

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This document is the "User's Manual" for the H420 series - Laser Autocollimator (hereafter, referred to as "the products" or "the sensor head").

This "User's Manual" (hereafter referred to as "this manual") provides information and basic operating instructions for the products.

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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#### H420 Series User's Manual

Issue Date	2025, September
Manual Version	V.2.1.0

## Revision History

Date	Revision	Details
2024 January	V.1.0.0	1 <sup>st</sup> version
2024 March	V.1.1.0	The Suruga OptGauge Ver.1.1.0 supported
2025 January	V.1.1.1	Repair Notice Added
2025 February	V.1.2.0	<p>The Suruga OptGauge Ver. 1.1.3 supporter</p> <ul style="list-style-type: none"> <li>• In “Measurement Option Setting Details” <ul style="list-style-type: none"> <li>- Log File -&gt; Image”</li> <li>- “Full Color/Gray Scale and PNG/BMP/TIFF” are added.</li> </ul> </li> <li>• In “Controlling from External Devices,</li> <li>• Read &amp; Write Commands, “MLT/ASC/RFP/IOE/RAE/IOC/IOF” added</li> <li>• In Execute Commands, “AR, MSN/RO” are added</li> </ul>
2025 July	V.2.0.0	<ul style="list-style-type: none"> <li>• Separation and independent documentation of software (the Suruga OptGauge) content from this manual</li> <li>• Recommended operating environment for the installation PC</li> <li>• Title amended to the Installation Operating Environment.</li> <li>• Changed to [Recommended Operating Environment] and [Minimum Operating Environment].</li> <li>• Correction of typographical errors and omissions</li> </ul>
2025 July	V.2.0.1	<ul style="list-style-type: none"> <li>• Installation PC System Requirements <ul style="list-style-type: none"> <li>- Remove Pro</li> <li>- Add Windows 11 version</li> <li>- Add note stating it may not function correctly depending on version</li> </ul> </li> <li>• Symptoms and Solutions <ul style="list-style-type: none"> <li>- Add details of issues where it may not function correctly depending on Windows version and their countermeasures</li> </ul> </li> </ul>
2025 July	V.2.1.0	<ul style="list-style-type: none"> <li>• Added 1/e<sup>2</sup> beam diameter calculation function</li> <li>• Added rotation angle calculation function</li> </ul>

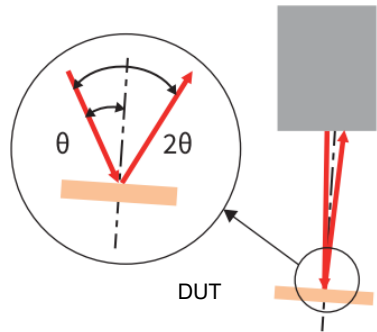
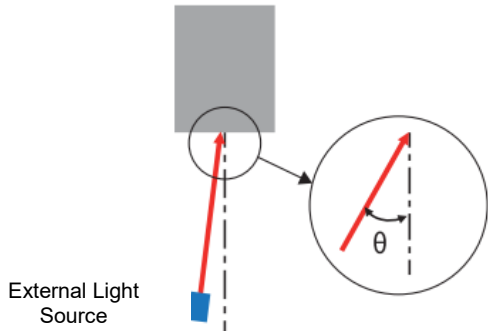
## NOTICE

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

SURUGA SEIKI CORPORATION reserves the right to change specifications without notice to the user of the Product offered.

The latest version of this Manual can be downloaded from our WEB site  
(<http://jpn.surugaseiki.com/>).



## 0. Definitions (terms and abbreviations)

Terms and Abbreviations	Definitions
Reflection Angle Measurement	 <p>Fig. 1</p> <p>A measurement method that uses an internal light source to measure the angle of reflected light from an object. The <math>2\theta</math> is measured, and the <math>\theta</math> is calculated from this measurement result, as shown in Fig. 1.</p>
External Light Angle Measurement	 <p>Fig.2</p> <p>A measurement method that directly utilizes laser or LED light beams to determine angles. As shown in Fig. 2, the angle <math>\theta</math> of the externally incident light is taken as the measurement result.</p>
The Products	The Smart LAC H420 serie
The Software	The Suruga OptGauge software
This Manual	The user's manual for the Smart LAC H420 serie
Reference Plane	Mounting reference surface on the front of the Products.
Sensor Camera	Internal sensor camera embedded in the Products.



# 1. For your Safety – Precautions of Use

## 1.1 Warning labels addressed in this Manual

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

## 1.2 Managing this Product

- This product uses a laser diode for its internal light source. We recommend that this product is in an environment where appropriate safety measures are taken for the laser before any use.
- Suruga Seiki shall not guarantee the functions and performance of this product if used in a manner other than that specified in this manual, or if modified.
- When other equipment combines this product, the functions and Suruga Seiki shall not guarantee the performance of this product, 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 this product with a wet rag, benzene, thinner, or the alike, which may cause discoloration or deformation of this product. If this product is heavily soiled, wring out a cloth with diluted pH-neutral detergent and wipe off the stain, then dry this product with a soft cloth.
- If you suspect this product 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 Products 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, this product 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 this product. Disassembly or modification may cause fire or electric shock. The warranty is void if this product is 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 this product 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 Waterproof and Explosionproof



- This product is not intended for use in areas where explosion protection is required. Do not use this product in locations where flammable gases or other explosive atmospheres exist.
- This product is not waterproof. Do not use this product 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 device 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 matter gets inside the main unit,
- When this product is damaged due to being dropped or external impact, and
- When there is a strange odor due to smoke emission.

### **1.3.10 Disposal of this Product**

When disposing of this product, treat it as industrial waste. Please follow in accordance with laws and regulations or by any other appropriate methods. Suruga Seiki shall not collect this product for purpose.

Please dispose of all materials used to package this product in accordance with the law or by other appropriate methods. Suruga Seiki shall not collect these materials for the purpose.

### **1.3.11 Residual Risks**

<b>Attention</b>
------------------

This document does not disclose all risks associated with this product. 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.

## 1.4 Use of Laser Products for Your Safety

### 1.4.1. Corresponding Laser Classes for Autocollimator H420 series



The following describes the hazards of the laser classes in the H420 series.

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



Table for Laser Class, Precautions, and the Corresponding Products

Laser Class	Precautions
Class 1	<b>Safe under reasonably foreseeable conditions</b> A Laser product which is safe for use with observation optics such as a loupe and binoculars  Applicable products: All models with a built-in laser at the wavelength of 405 nm
Class 2	<b>Normally, your eyes are protected and safe due to aversion reactions such as blinking.</b> 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.  Applicable products: All models with a built-in laser at the wavelength of 660 nm



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


### 1.4.2. Laser Class Identification Labels

The contents and affixing position of the laser class identification label on this unit are shown below. The label contents differ depending on the product model. Please verify the applicable product model.



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

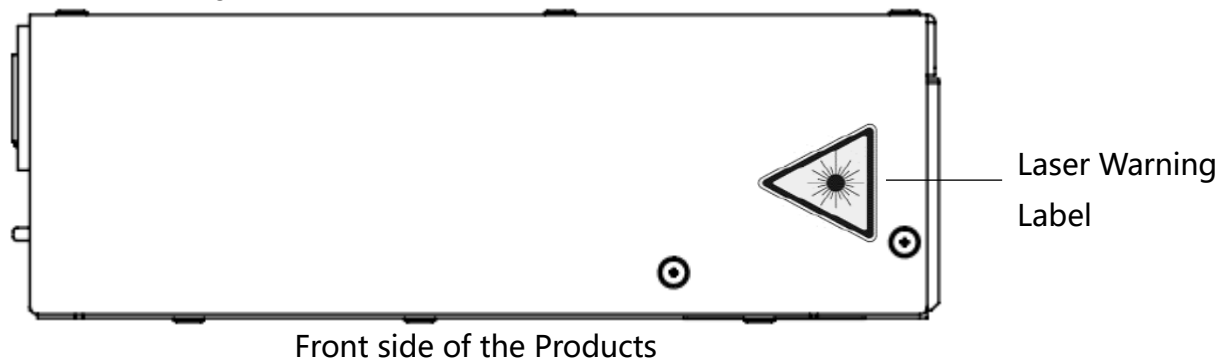
Laser Class Identification Labels	
Laser Class 1	Laser Class 2
 <p>Background Color: Yellow Text Color: Black</p>	 <p>Background Color: Yellow Text Color: Black</p>

Warning Label
 <p>Background Color: Yellow Text Color: Black</p>

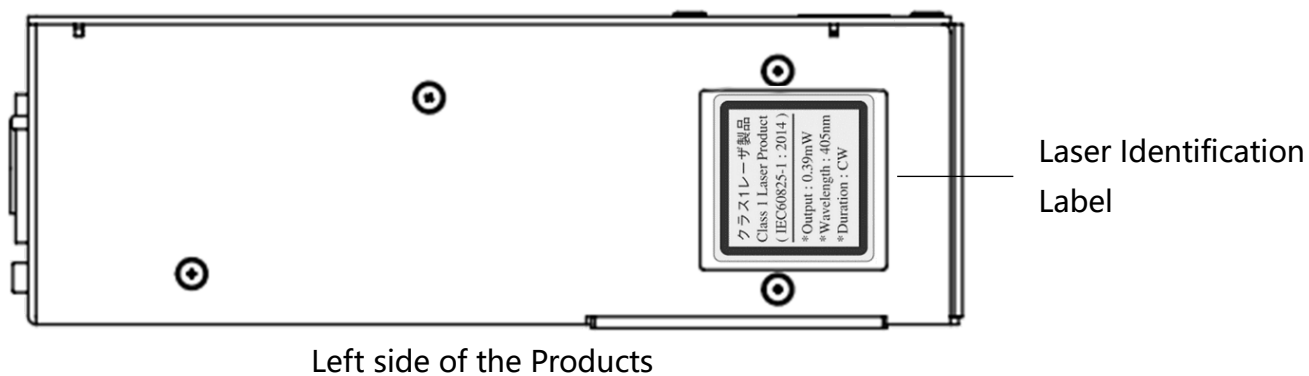
Labeling method and contents conform to IEC60825-1:2014 (JIS C 6802:2014)

Common locations for the laser labels to all models

The laser warning label is attached to the top of the Products.



The laser identification label for the specific laser class is attached to the left side of the Products on the laser emission port side.



## 2. Preparations

### 2.1 Functions and Features

The Products are autocollimator which derives oblique of a target object from the incident light to the sensor. The following are its notable features.

#### ■ Angle measurements

- Measurement range:  $\pm 1.35^\circ$  (circular Area)
- Linearity:  $\pm 0.25\%$  of F.S. (F.S. = 2.7 degrees, Working Distance at 100 mm)
- Repeatability: 1 sec .(within  $6\sigma$  of the averaging times = 256 measurements)

\*See "[Specifications for H420 Series Sensor Head and Accessories](#)" for more details.

#### ■ Divergence measurement is feasible

- Measurement range:  $\leq 20$  mrad
- Linearity: 5 % of F.S. (F.S. = 20 mrad)

\*See "[Divergence](#)" in the Measurement Overview.

#### ■ The software installed in the PC with connecting this product is capable of the measurements.

\* See "[System Configuration Example](#)" the Preparations.

#### ■ Measurement of multiple luminous points is feasible.

\* See "[Multi Spot](#)" in the Measurement Overview.

#### ■ The reflection angle measurement and the external light angle measurement are available.

- For reflection angle measurement, use the internal light source to measure the angle of its reflected light.

\*See "[For reflection angle measurement](#)".

- For external light angle measurement, the angle of the beam of laser or LED can be measured directly.

\*See "[For external light angle measurement](#)".






## List of Functions

Function		Details
Measurement	Angle measurement	See " <a href="#">Angle Measurement</a> " in the Measurement Overview
	Beam divergence measurement	See " <a href="#">Divergence</a> " in the Measurement Overview
Convenient Functions	ROI	See " <a href="#">Aperture</a> " in the Measurement Overview
	Auto Aperture	
	Automatic Brightness	See " <a href="#">Automatic Brightness</a> " in the Measurement Overview
	Adaptive Cal	See " <a href="#">Adaptive Cal</a> " in the Measurement Overview
	Maximum luminance value measurement	*1
	Total count measurement	
	Binning	
	Denoising	
	Measurement results storage	
Display	Zero offset	See " <a href="#">Origin Offset</a> " in the Measurement Overview
	Screen image zoom	See " <a href="#">Zoom In</a> " in the Measurement Overview
	Unit conversion	*1
	Rotation display	
	Mirroring display	
Judgement	Angle judgement	See " <a href="#">Judgement</a> " in the Measurement Overview
	Beam divergence judgement	
	Maximum luminance value judgement	
Communication	RS232C	*1
	TCP/IP	

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

## 2.2 Contents of the Package

In addition to the product itself, the package delivered to the customer contains an adjusting screwdriver for the internal light source and a USB memory stick.

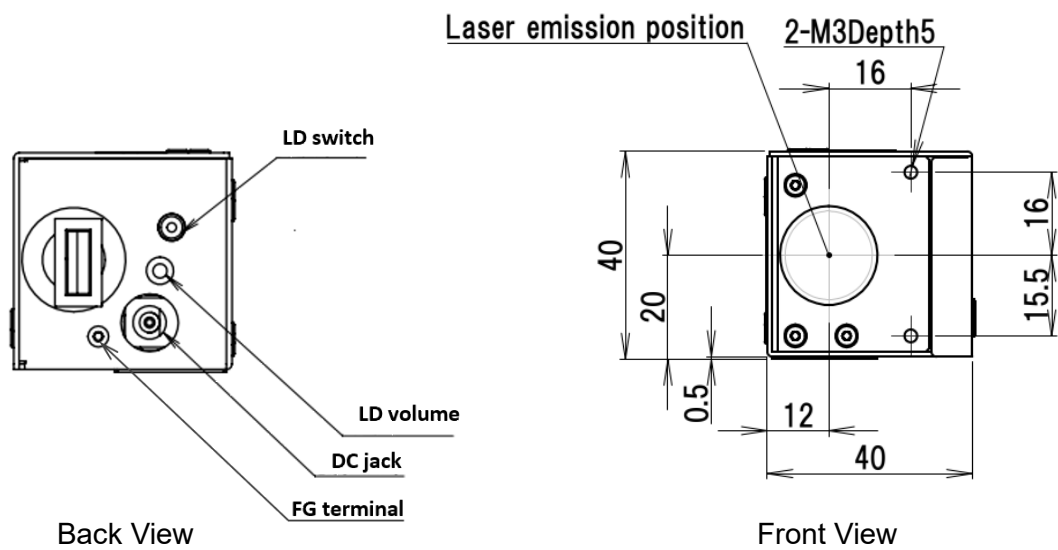
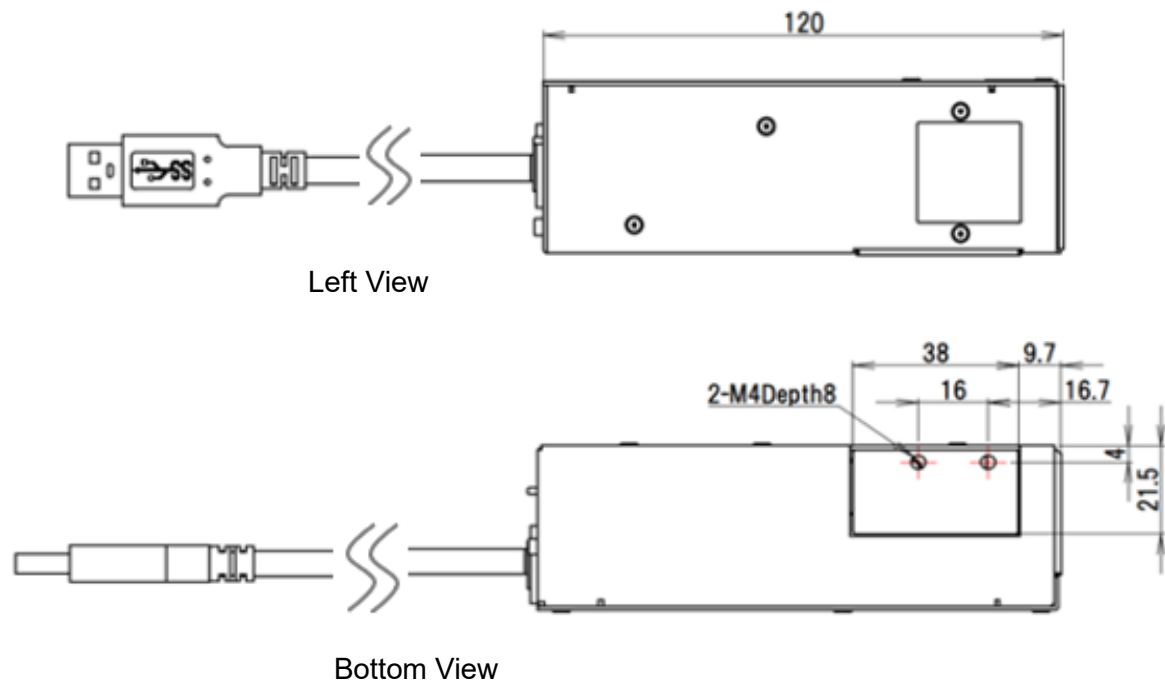
1.  The Products
2.  A screwdriver for the light intensity adjustment
3.  A USB memory stick contents:  
the Suruga OptGauge (the Software), camera driver, device authentication file and this Manual).  
\*The latest version can be downloaded from the Suruga Seiki website (<http://jpn.surugaseiki.com/>).
4. The AC/DC power supply for the Internal light source

## 2.3 Overview Specifications of this Product

Specifications Table of this product

External dimensions	120 mm x 40 mm x 40 mm
Product weight	400 g
Main power source	12 VDC
Power consumption	5 W or below
Laser class	Class 1 or Class 2 (differs with model)
Protective functions	Short-circuit protection, polarity reversed connection protection
Communication functions	USB3.0 standard
Operating temperature and humidity	5 to 40 °C, 35% to 85% RH (no condensation)
Storage Temperature and humidity	-10 to 65 °C and 10% to 85% RH (no condensation)
Atmosphere	Avoid direct sunlight, corrosive or inflammable gases, liquids, powders/dust, and other toxic substances
Housing Material	Aluminum

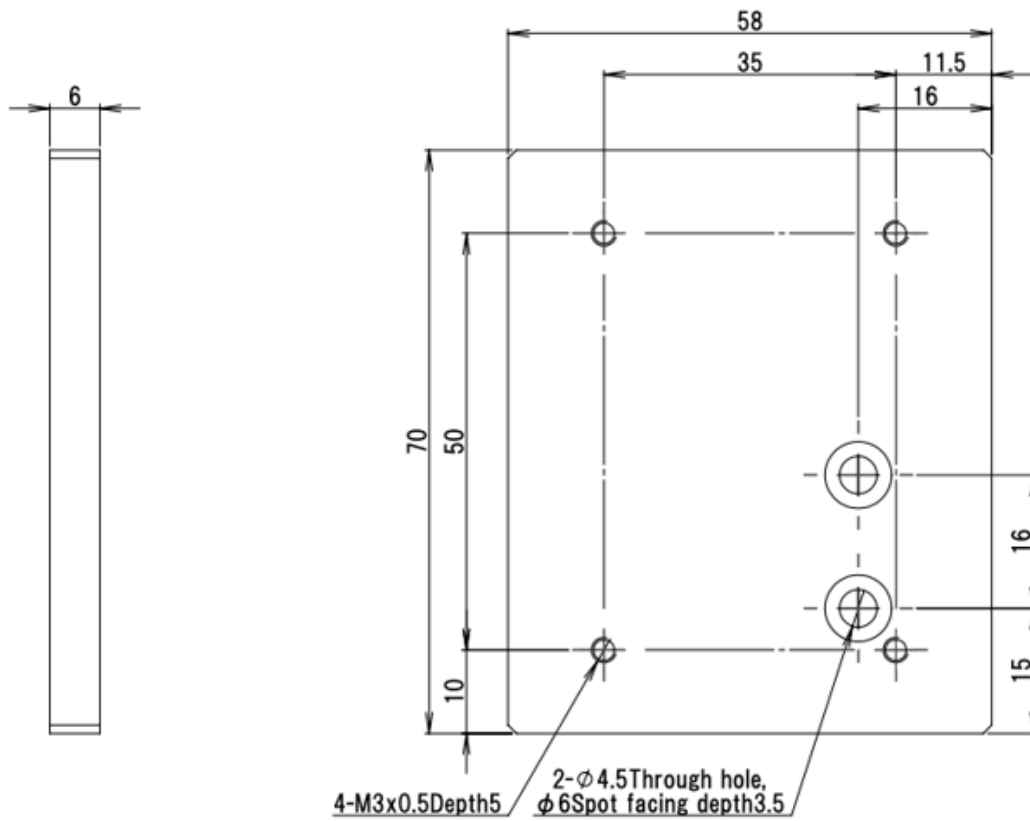
## 2.4 External Dimensions of the Products



HB10 Mounting Adapter Plate (Model: H420-AP) (sold separately)

\*For installation methods using the HB10 Mounting Adapter Plate, refer to [Installation Method \(Example\)](#).

#### H420-AP Adapter Plate Dimensions



## 2.5 Names for the Sensor Head Parts and their functions

- ① Internal light source ON/OFF switch  
When turned ON, the switch lights up orange as the internal light source is powered.

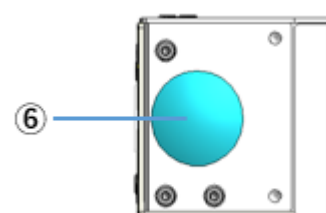
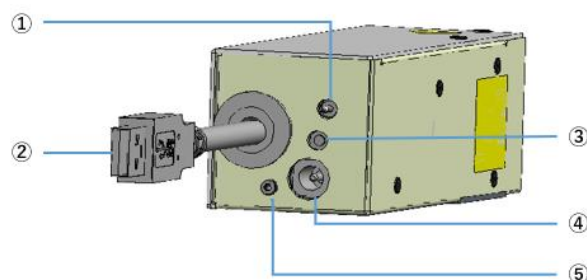
- ② USB connector  
Connect your PC to the Products.

- ③ The internal light source brightness adjustment knob  
Adjust the brightness of the internal light source. Turning clockwise increases brightness, while turning anticlockwise decreases it.

- ④ Power inlet for internal light source  
The AC/DC adapter terminal for the internal light source.

- ⑤ FG Terminal  
The frame ground to reduce electrical noise and to prevent malfunction.

- ⑥ Laser emission port  
The laser irradiates when the internal light source is ON.

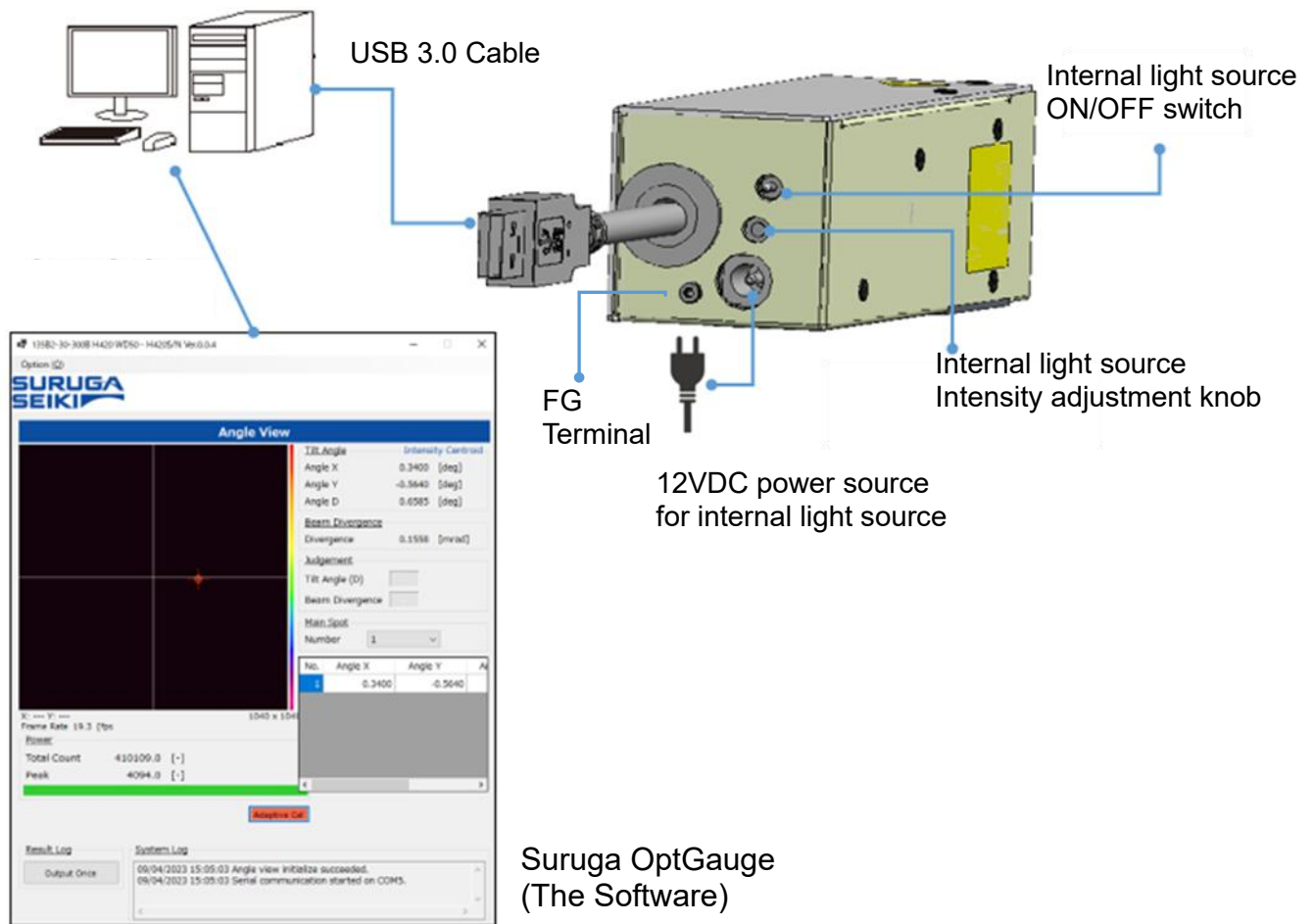


Laser emission  
surface (front)



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

## 2.6 System Configuration Example



## 2.7 Required Parts for Configuration

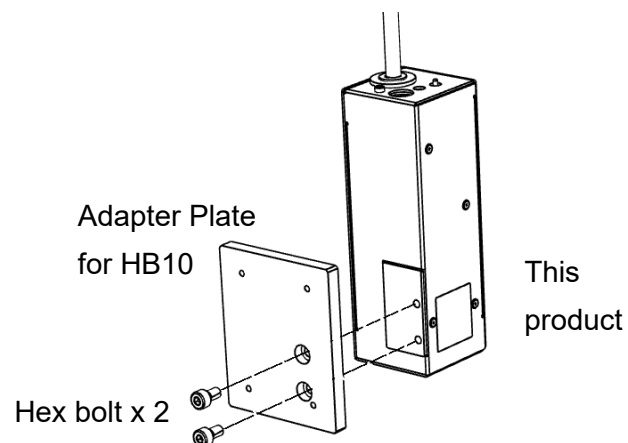
- Main unit
- Dedicated power supply for internal light source (supplied AC/DC adapter)
- PC, PC monitor, PC keyboard for connecting to the main unit
- The Suruga OptGauge (Measurement software)

## 2.8 Installation Method (Example)

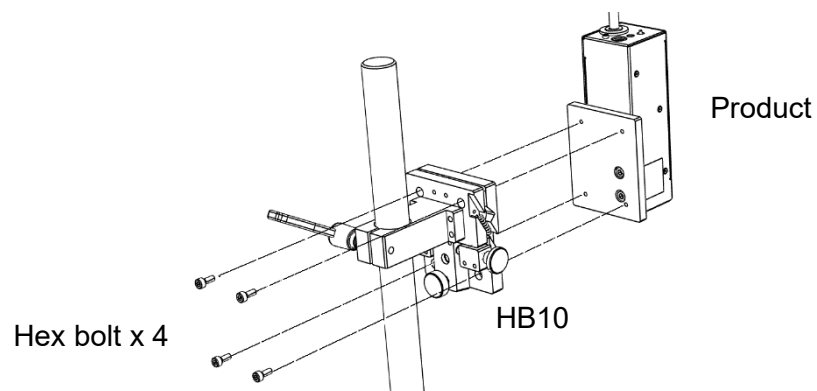
This section illustrates mounting methods for the products.

Secure the main unit and the 2-axis compact tilt stage (Model: HB10), an optical sensor sharing accessory sold by our company, to the high-rigidity stand (Model: HA14).

1. Mount the Product to the HB10 adapter plate (sold separately) with the hex socket head cap bolts (model: CBM4 x 8).



2. Mount the HB10 and HB10 mounting adapter plate at four points using square bolts.



### 3. Fasten the HB10.

Fasten with the lever

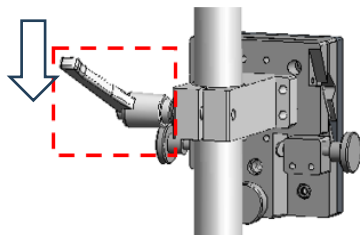


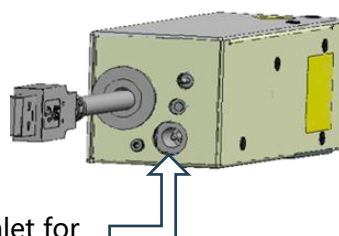
Image of the assembled devices



## 2.9 Connecting Power to the Internal Light Source

Please use only the proper AC/DC adapter.

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

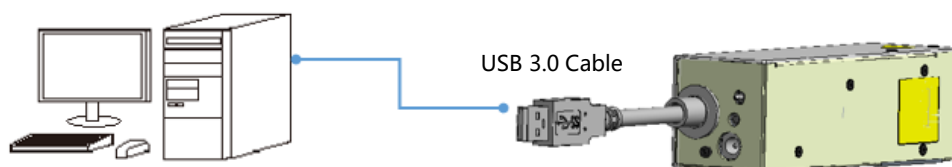
Do NOT CONNECT the AC adapter power until the installation of the Suruga OptGauge is complete.

Please be advised to ground the FG terminal to prevent malfunction caused by noise.

## 2.10 Connection to a Computer

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

Please ensure that you use a USB 3.0-compatible port on the PC.



### Attention

Do not disconnect the USB cable while the Software is running. Normal operation will be disrupted.

If the cable disconnects, close the application, reinsert the USB cable, and restart the application.



## 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 Installation PC System Requirements

[Recommended System Requirements]\*<sup>1</sup>

Hardware requirements	Supported OS	Windows 11 64-bit, Version 24H2 or later* <sup>4</sup>
	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: 1 or more
Software requirements	Framework	.NET8.0* <sup>3</sup>

[Minimum System Requirements]\*<sup>2</sup>

Hardware requirements	Supported OS	Windows 10 Pro 64bit, Windows 11 64-bit, Version 24H2 or later* <sup>4</sup>
	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: 1 or more
Software requirements	Framework	.NET8.0* <sup>3</sup>

\*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.

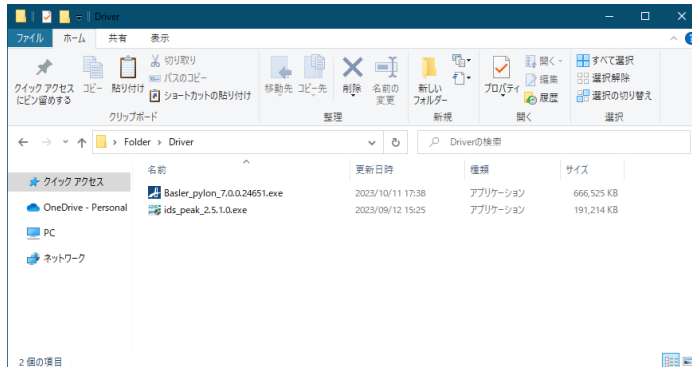
\*3 If .NET8.0 is not installed on your computer, install “.NET Desktop Runtime 8.x.x.” from the Microsoft website

\*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).

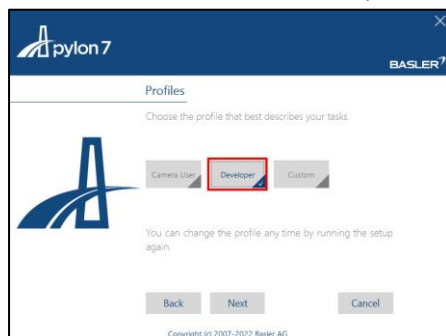
## 2.11.3 Installation of the Software

### 2.11.3.1 Installation of the USB device driver

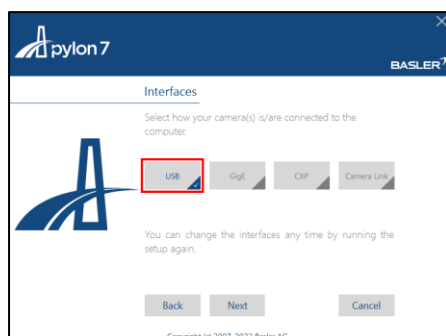
1. Double-click the "... ¥Driver" "Basler\_pylon\_7.0.0.24651.exe" to begin installation.



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.




### 2.11.3.2 From the Download

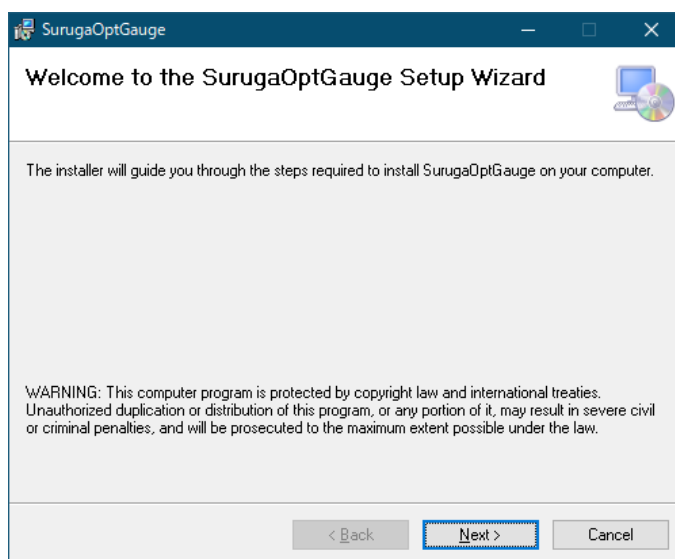
Where to download: the Suruga website (<http://jpn.surugaseiki.com/>).

### 2.11.3.3 Installation of the Software

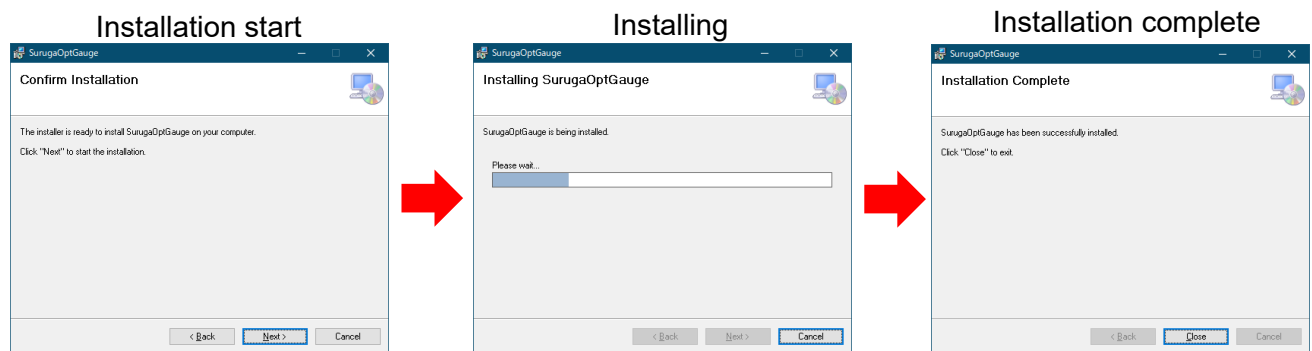
1. Double-click "SurugaOptGaugeSetup\_x.x.xx.msi" in the directory "... ¥Application".

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. OptGauge will be created on the desktop.



The installation procedures are complete.

#### 2.11.3.4 Copying the Device Authentication File

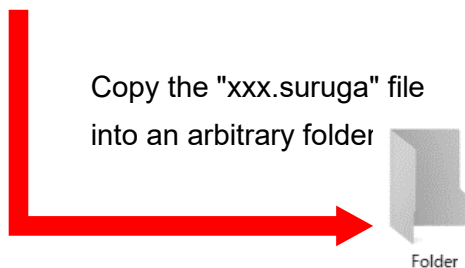
##### Attention

Authentication file

For this product, 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		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.

### 2.11.3.5 Starting Up and Shutting Down the Suruga OptGauge

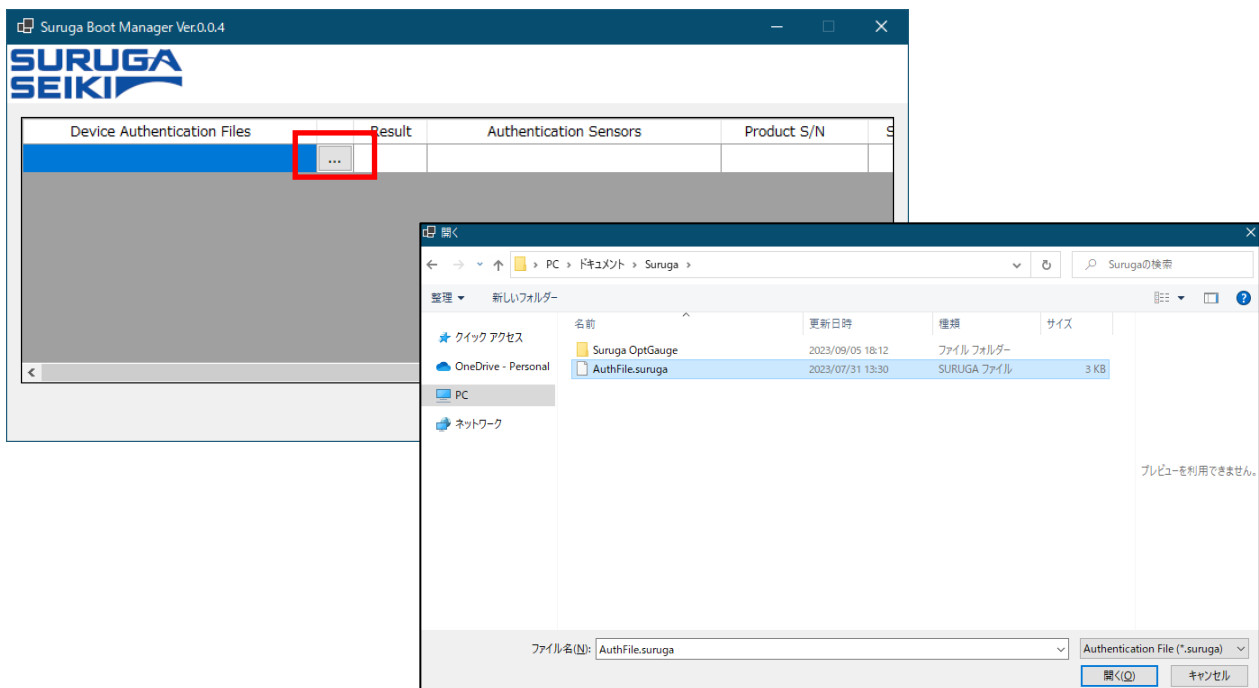
#### OptGauge startup

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



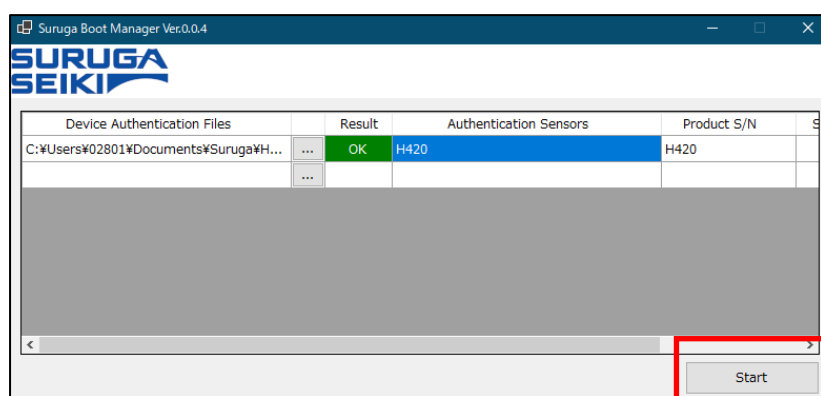
2. Select and open the file with the extension; ".suruga", within the folder copied using the 'Copy Device Authentication File' option in the 'Device Authentication File' section.

Note: If you are unable to copy the device authentication file to your PC, please select it directly from the USB memory stick.





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

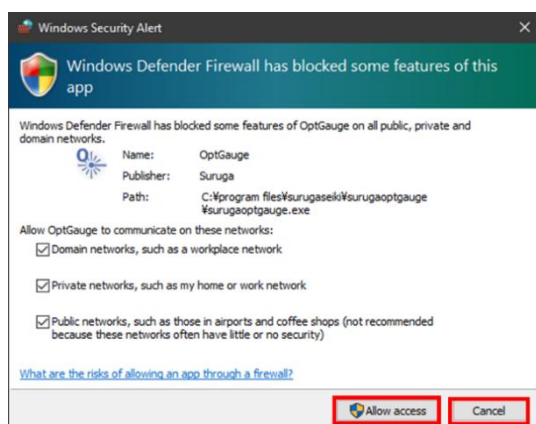


## Attention

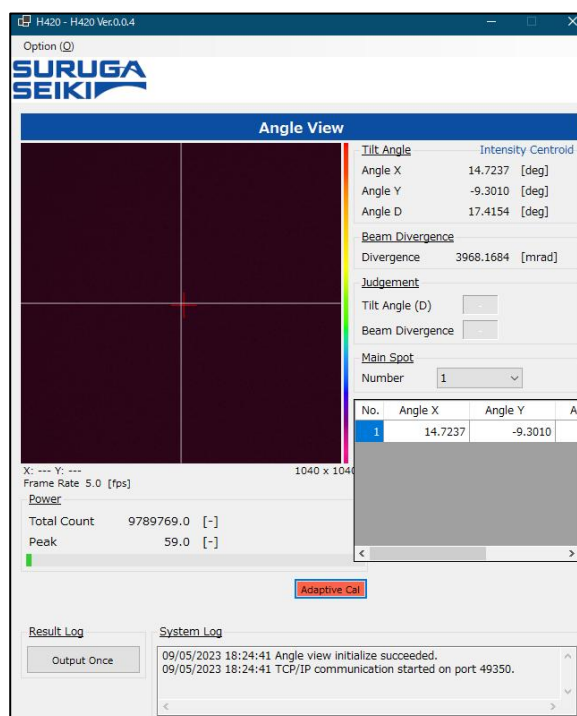
The Software incorporates TCP/IP communication control. Consequently, upon initial launch, the following warning may appear depending on your PC's security settings.

If your PC or network environment permits TCP/IP communication, please tick all boxes and click "Allow access". If you cannot permit it, please click "Cancel".

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

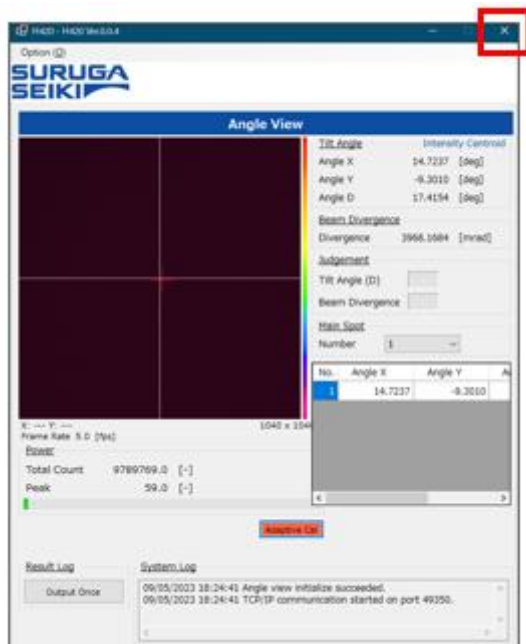


4. The application will start up.



Shutting Down the Suruga OptGauge.

1. Click the "x" button to shut down the Software.

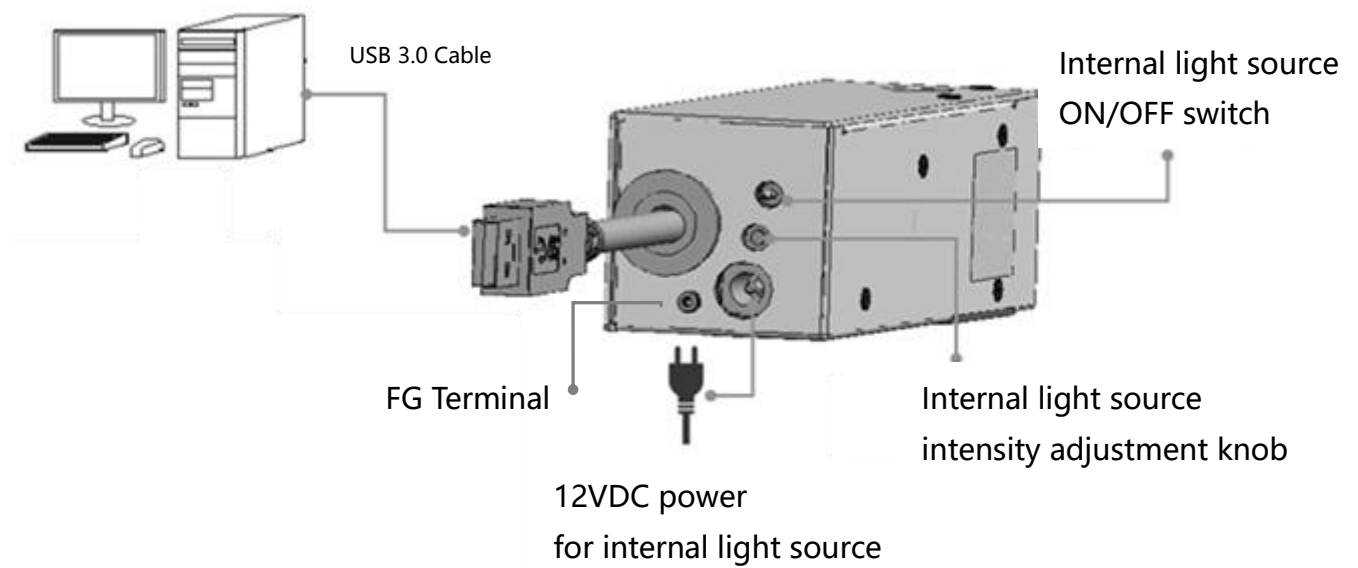


## 2.12 Turning the Power On



**Do not turn on the sensor head 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. Settings

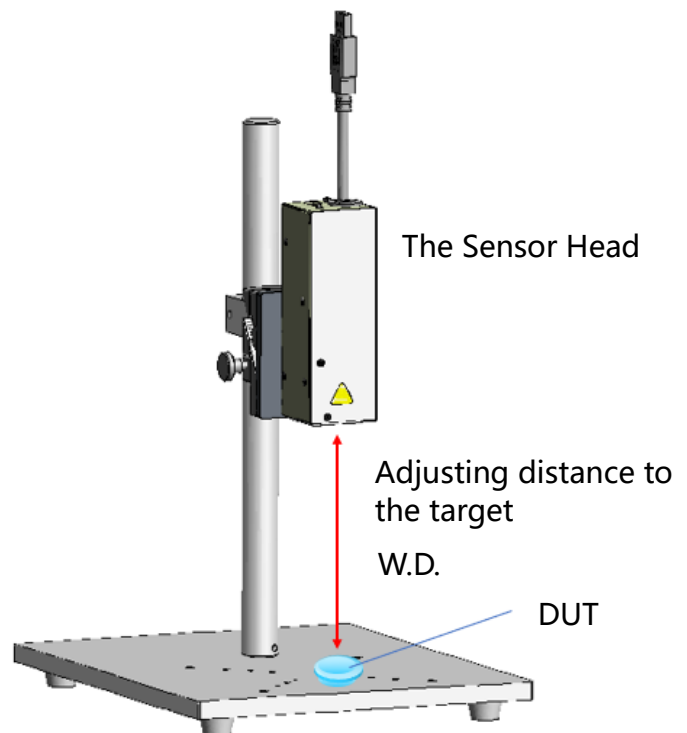
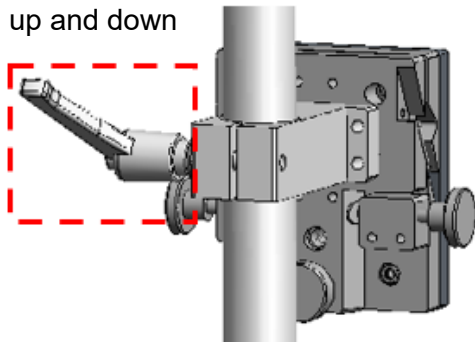
This section describes the setting method for the Products, using the Software.

### 3.1 Usage Precautions and Setting (Installation) by Model

#### 3.1.1. Mounting (with HB10)

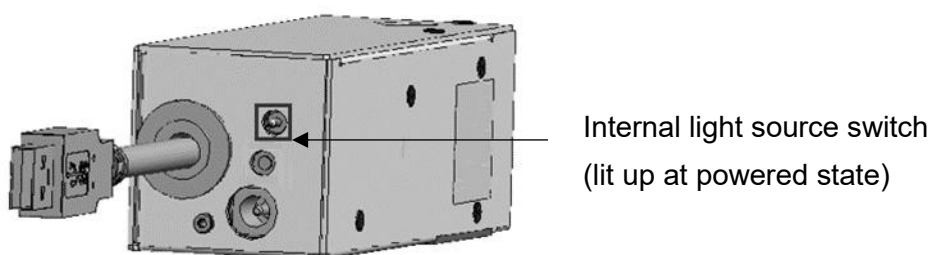
After connecting the USB cable to the PC, switch off the internal light source of the Product and adjust the working distance (W.D.) between the Product and the target being measured by raising and lowering the HB10 (the Tilt Stage).

Loosen the lever and move the Product up and down

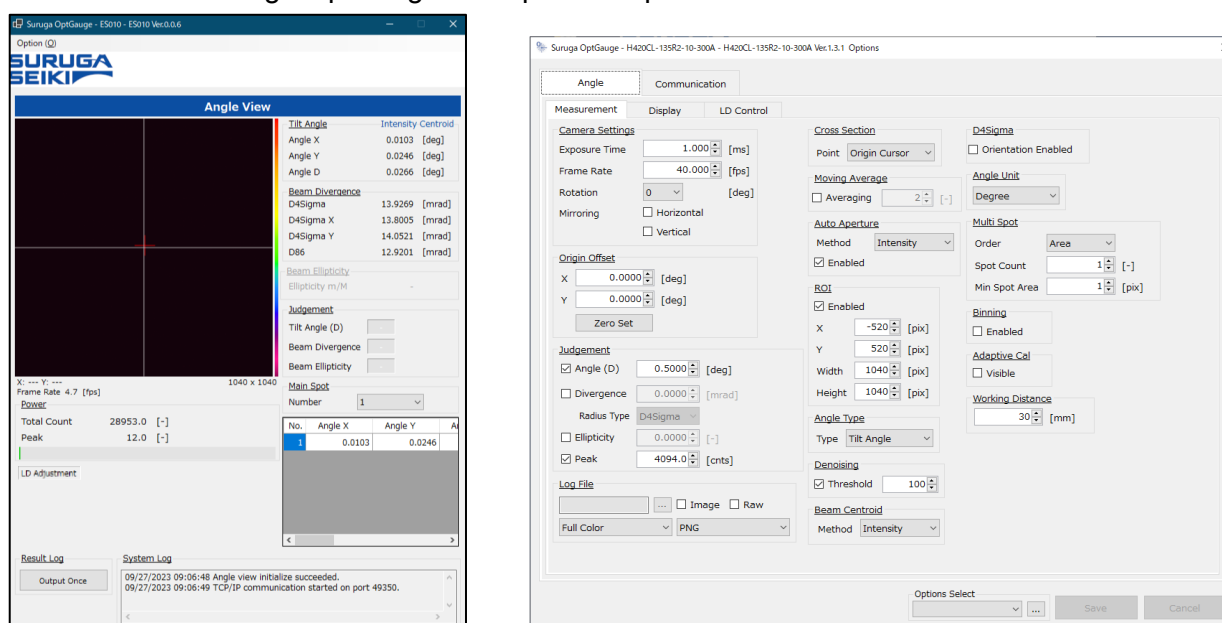


### 3.1.2. For Reflection Angle Measurement

1. After installation is complete, turn the internal light source switch ON.



2. Launch the Suruga OptGauge and open the option screen.

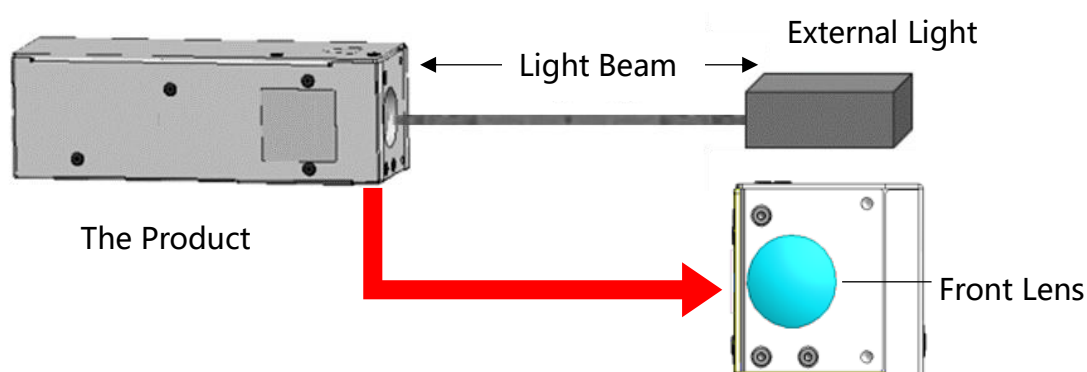


3. Input the working distance (W.D.) between the sensor head and the target into "Working Distance\*1" in the option screen.
4. Set the Angle Type to "Tilt Angle" in the Option screen.  
(see the "[Angle Measurement](#)" in the Measurement Overview)
5. elect the LD Control subcategory tab within the Angle tab on the Option screen.
6. To adjust the light intensity of the internal light source, click the Tune button\*1 in the LD Adjustment window, and set it to "3500-3800" (optimal value) while observing the Peak\*1 on the measurement screen.

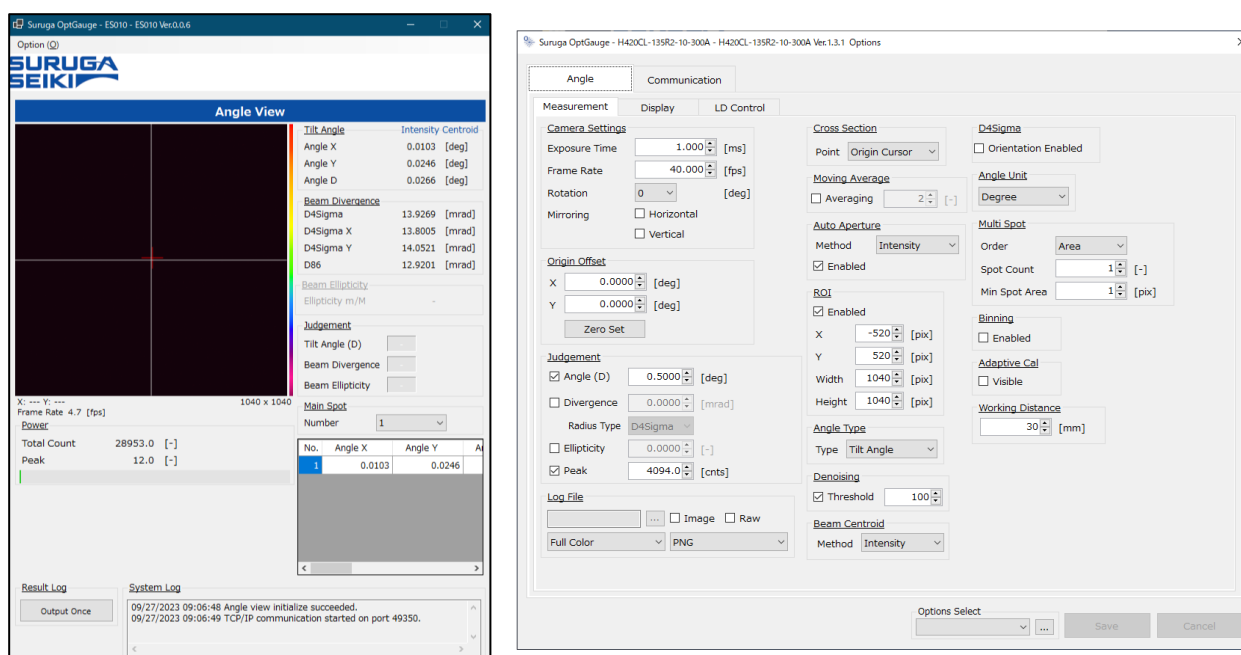
\*1 see the separate software manual, "The Suruga OptGauge User's Manual", in details.

### 3.1.3. For External Light Angle Measurement

- Turn OFF internal light source of this product and irradiate a beam from an external light source to the front lens of the Products.



- Launch the Suruga OptGauge and open the Option screen.



- Adjust the focal point of the beam light to align with the lens of the Product, then input the distance between the external light source and the Product into the Working Distance\*1 field in the Option screen.
- Set the Angle Type in the Option screen to the "Beam Angle".  
(see the "[Angle Measurement](#)" in the Measurement Overview)

8. Select the LD Control subcategory tab in the Angle tab on the Option screen.
9. Adjust the intensity of the external light source, then click the Tune button\*1 within the LD Adjustment group box. While observing the Peak\*1 value on the measurement screen, set it to '3500–3800' (the optimum value).

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

## 3.2 Measurement Overview

### 3.2.1 Angle Measurement

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

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

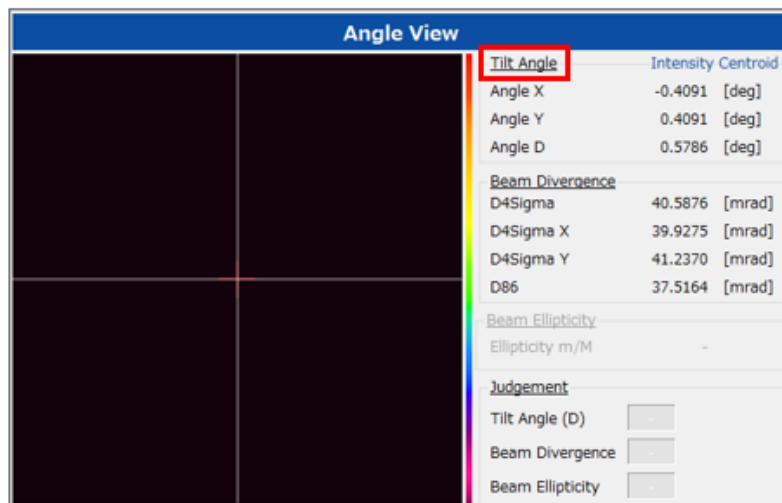
For the external light angle measurement, select the "Beam Angle".

#### To measure a reflection angle

Select [Tilt Angle]<sup>\*1</sup> in the "Angle Type" in the option setting.

Angle Type  
Type

It starts reflection angle measurement.

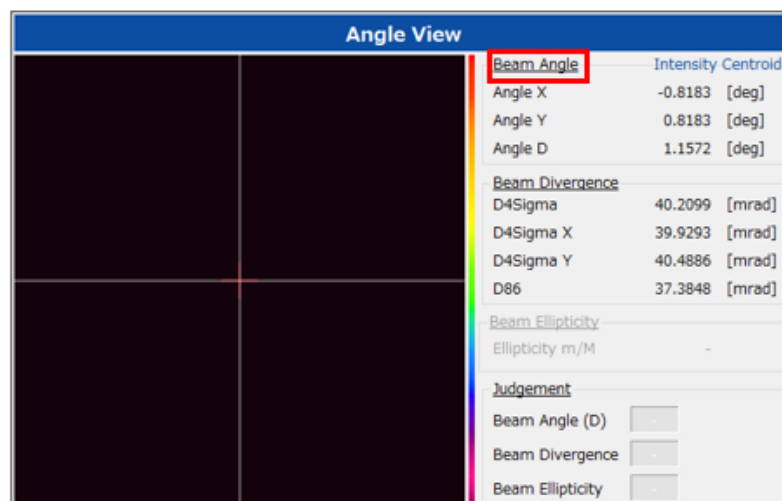


#### To measure an external light angle

Select [Beam Angle]<sup>\*1</sup> in the "Angle Type" in the option setting.

Angle Type  
Type

Starts 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.

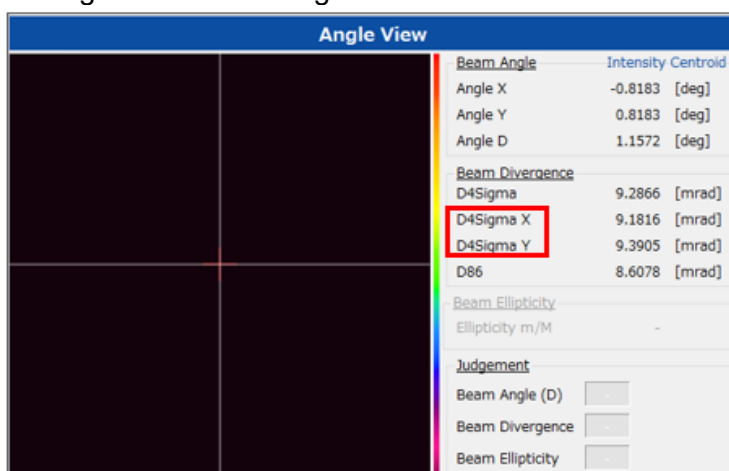
The Products display divergence in a half-angle with mrad (milli radian). It has two modes of measurement.

**To measure the divergence in the X-axis and Y-axis directions from a  $D4\sigma$  beam diameter\*1 (elliptical beam)**

Uncheck the box for the Orientation Enabled in the D4Sigma option setting.

D4Sigma  
☐ Orientation Enabled

Allowing to measure the beam divergence with "D4Sigma X" and "D4Sigma Y" \*1

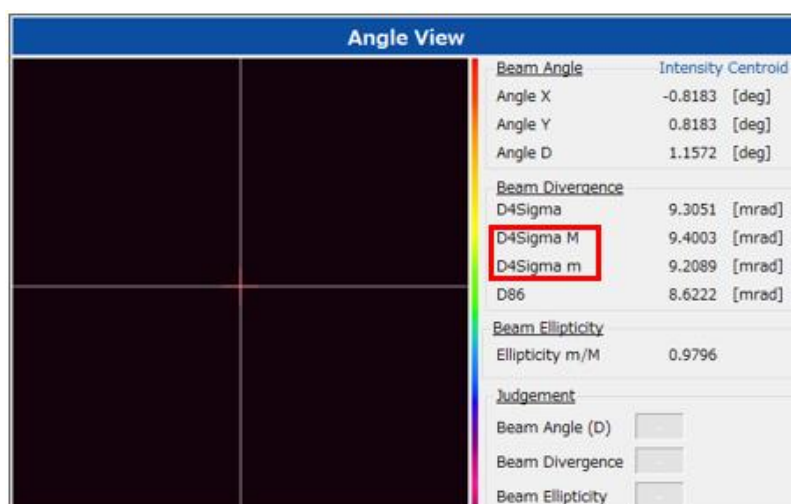


**To measure the divergence of the M (major axis) and m (minor axis) of a  $D4\sigma$  beam diameter\*1 (elliptical beam)**

Check the box for the Orientation Enabled in the D4Sigma option setting.

D4Sigma  
☒ Orientation Enabled

Allowing to measure the 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"

### 3.2.3 Beam Centroid

The method for determining the center of the light spot can be selected via the 'Beam Centroid' option setting, choosing between the Area Centroid and the Intensity Centroid. It is recommended to switch the 'Beam Centroid' setting depending on the object being measured.

We recommend selecting the type of "Beam Centroid" according to a target to be measured.

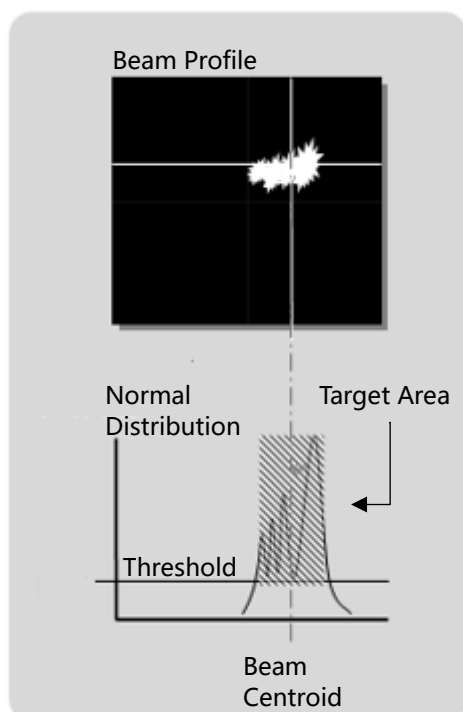
#### Area Centroid (Area)

The position of the area center of the light beam is calculated from pixels with brightness higher than the noise removal threshold 'Threshold' and displayed as an angle for the Area Centroid. Increasing the 'Threshold' reduces the influence of the tail end of the peak profile.

We recommend such measurement method for the targets with reflections from surfaces as uniform as a mirror surface, where the light spot exhibits no blurring or smearing.

Note : 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 Targets



Mirror



Glass

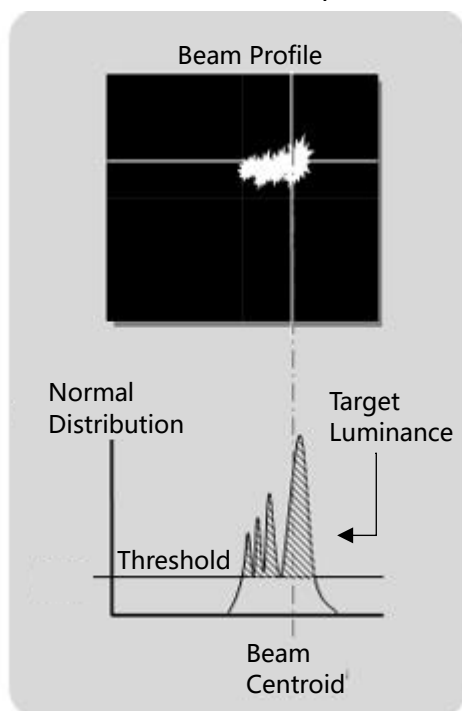
## Intensity Centroid

The centroid position of a light beam is calculated from the beam intensity with higher luminance than the denoising threshold value and results as an angle for the for intensity centroid.

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

We recommend this type of measurement mode for the targets such mirror with uniform surfaces which reflects a light beam without blur or smudge\*.

Detection example



Recommended Target



Concave Lens

### 3.2.4 Beam Ellipticity

It determines the degree to which the beam shape deviates from a circular form towards an elliptical one.

Beam Ellipticity Formula

$$\text{Beam Ellipticity} = (\text{minor}) \text{ beam diameter} / (\text{major}) \text{ beam diameter}$$

The following describes its use.

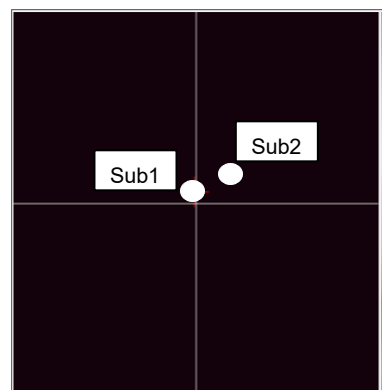
Note: A Beam diameter can be selected as  $D4\sigma$  or  $1/e^2$ . For details, refer to the separate software manual, the "Suruga OptGauge User's Manual".

#### Beam Ellipticity Usage

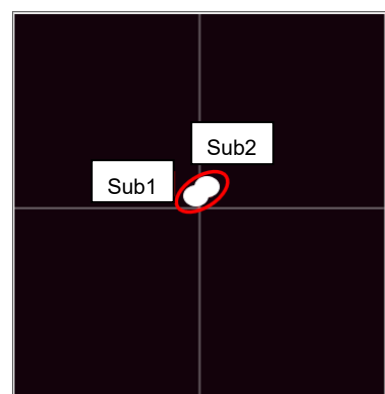
The "Beam Ellipticity" is used to measure the parallelism of two or more measured targets.

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.

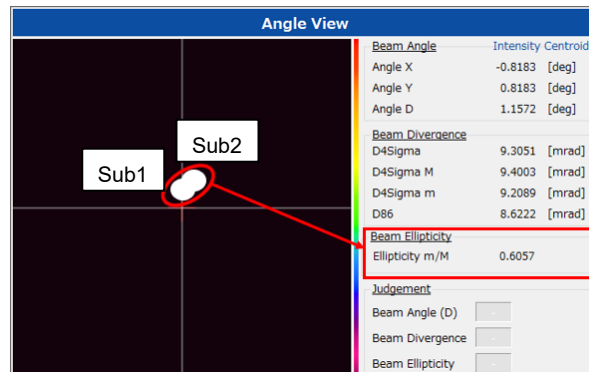
We move the two beam spots close to each other so that the Sub1 and Sub2 are nearly parallel.



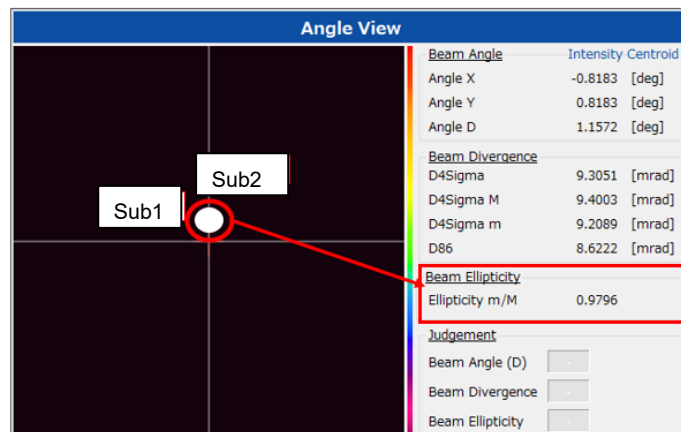
2. As the two light spots are getting closer like in the illustrated frame, the sensor recognizes them as a single elliptical light spot.



3. When the .2 above occurs, use the Beam Ellipticity function. It displays the light beam by the ellipticity.



4. Bring the two beams even closer together. The closer the ellipticity is to "1.000", the closer the two measured objects are to being parallel.



### For ellipticity measurement

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

Orientation

☐ Enabled

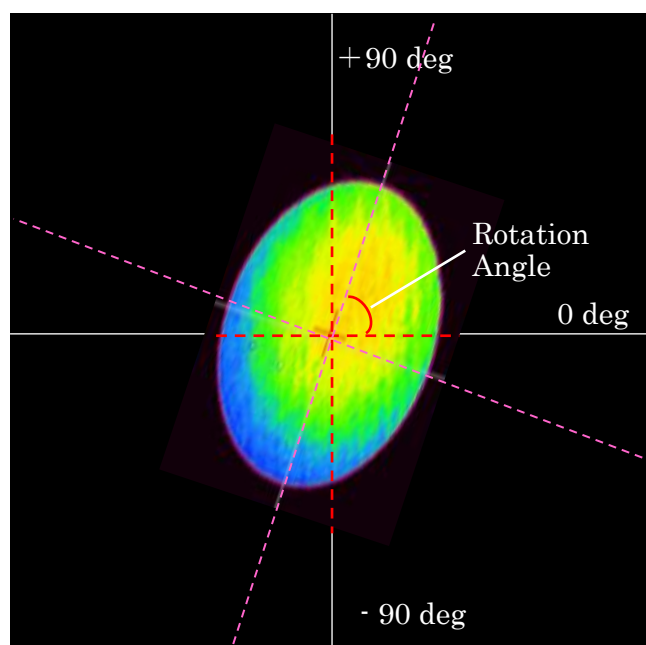


### 3.2.5 Rotation Angle Measurement

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 if the “Orientation” option setting is enabled.

#### The Definition of Rotation Angle

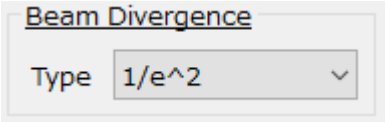
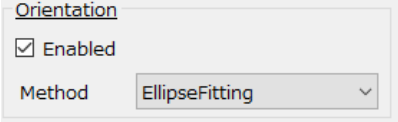
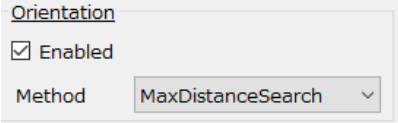
It is defined as the angle between the beam's principal axis in the rightward direction and the horizontal rightward direction. A positive (+) value is assigned when the principal axis points upward relative to the horizontal direction, and a negative (-) value when it points downward. The beam's major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



#### Measurement Method

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

Rotational Angle Measurement Compliant with ISO standards	
<p>Select [ D4Sigma] for the “Beam Divergence” in the option setting as below.</p> <div><div>Beam Divergence</div><div>Type D4Sigma</div></div>	<p>Only if [D4 Sigma] is selected, Will the rotation angle be measured in accordance with ISO 11146-2.</p>

Rotational Angle Measurement NOT Compliant with ISO standards	
<p>Select [ <math>1/e^2</math> ] for the “Beam Divergence” in the Option Settings as below.</p> 	<p>Only if [ <math>1/e^2</math> ] is selected, will the following two non-ISO-compliant rotation angles be measured.*1</p>
	<p><b>[ Ellipse Fitting ]</b></p>  <p>This method performs elliptical fitting on the beam regions exceeding 13.5% of its peak value and calculates a rotational angle as the inclination of the major axis of the resulting ellipse.</p> <p><b>Advantage</b></p> <p>It obtains a high-precision rotational angle when a shape is close to an ideal ellipse, as this method considers an overall beam shape.</p>
	<p><b>[ Maximum Distance of Two Points Search Method ]</b></p>  <p>For the 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.</p> <p><b>Advantage</b></p> <p>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.</p>

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

### 3.2.6 Judgement

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

Here, for example, describes the procedures for Angle (D) and Peak.

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

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

#### For Angle (D)

1. Adjusting the angle and aim to set the "Angle(D)" of the measurement result to less than 0.5000.

Enabling the "Angle(D)" in the "Judgement Settings" in the Option setting and enter the value to be "0.5000 deg".

Suruga OptGauge - H420CL-135R2-10-300A - H420CL-135R2-10-300A Ver.1.3.1 Options

Angle Communication

Measurement Display LD Control

Camera Settings

Exposure Time 1.000 [ms]

Frame Rate 40.000 [fps]

Rotation 0 [deg]

Mirroring ☐ Horizontal ☐ Vertical

Origin Offset

X 0.0000 [deg]

Y 0.0000 [deg]

Zero Set

Judgement

☒ Angle (D) 0.5000 [deg]

☐ Divergence 0.0000 [mrad]

Radius Type D4Sigma

☐ Ellipticity 0.0000 [-]

☒ Peak 4094.0 [cnts]

Log File

☐ Image ☐ Raw

Full Color PNG

Cross Section

Point Origin Cursor

Moving Average

☐ Averaging 2 [-]

Auto Aperture

Method Intensity

☒ Enabled

ROI

☒ Enabled

X -520 [pix]

Y 520 [pix]

Width 1040 [pix]

Height 1040 [pix]

Angle Type

Type Tilt Angle

Denoising

☒ Threshold 100

Beam Centroid

Method Intensity

D4Sigma

☐ Orientation Enabled

Angle Unit

Degree

Multi Spot

Order Area

Spot Count 1 [-]

Min Spot Area 1 [pix]

Binning

☐ Enabled

Adaptive Cal

☐ Visible

Working Distance

30 [mm]

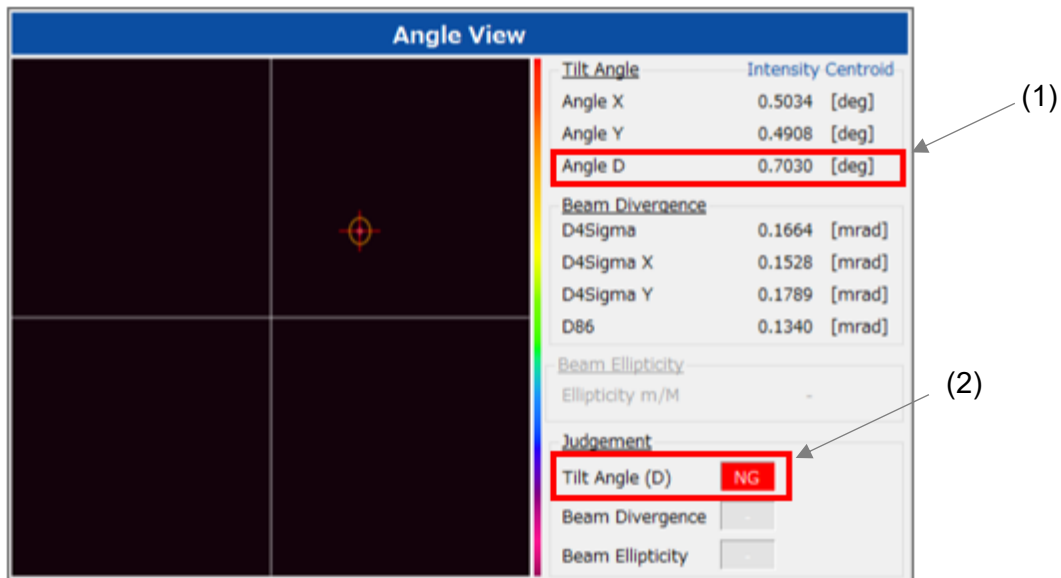
Options Select

Save Cancel

2.



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.

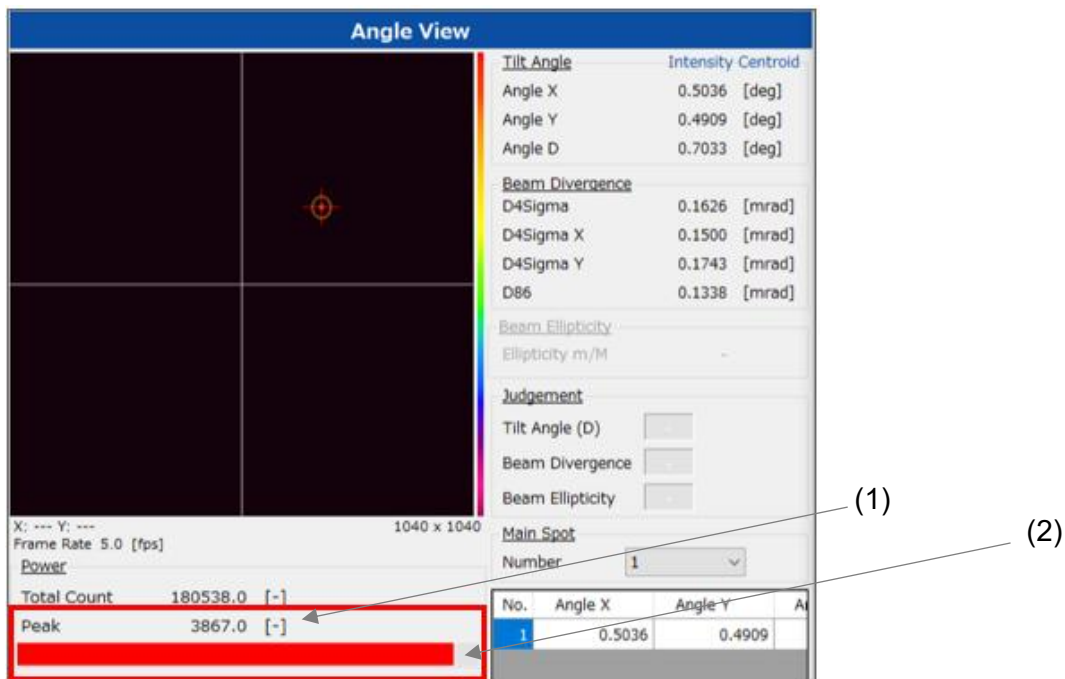
Set the “Peak” to be enabled in the “Judgement” configuration and the set its value to 3500.0.

The screenshot shows the 'Options' dialog box for 'Suruga OptGauge - H420CL-135R2-10-300A'. The 'Angle' tab is selected, and the 'Judgement' section is expanded. In the 'Judgement' section, the 'Peak' checkbox is checked, and its value is set to 3500.0 [cnts]. Other settings include 'Angle (D)' at 0.5000 [deg], 'Divergence' at 0.0000 [mrad], 'Radius Type' set to 'D4Sigma', and 'Ellipticity' at 0.0000 [-]. The 'Log File' section shows 'Full Color' and 'PNG' format. The 'Cross Section' section has 'Point' set to 'Origin Cursor'. The 'Moving Average' section has 'Averaging' set to 2 [-]. The 'Auto Aperture' section has 'Method' set to 'Intensity' and 'Enabled' checked. The 'ROI' section has 'Enabled' checked, with X at -520 [pix], Y at 520 [pix], Width at 1040 [pix], and Height at 1040 [pix]. The 'Angle Type' section has 'Type' set to 'Tilt Angle'. The 'Denoising' section has 'Threshold' set to 100. The 'Beam Centroid' section has 'Method' set to 'Intensity'. The 'D4Sigma' section has 'Orientation Enabled' unchecked. The 'Angle Unit' section has 'Degree' selected. The 'Multi Spot' section has 'Order' set to 'Area', 'Spot Count' at 1 [-], and 'Min Spot Area' at 1 [pix]. The 'Binning' section has 'Enabled' unchecked. The 'Adaptive Cal' section has 'Visible' unchecked. The 'Working Distance' section has '30 [mm]'.

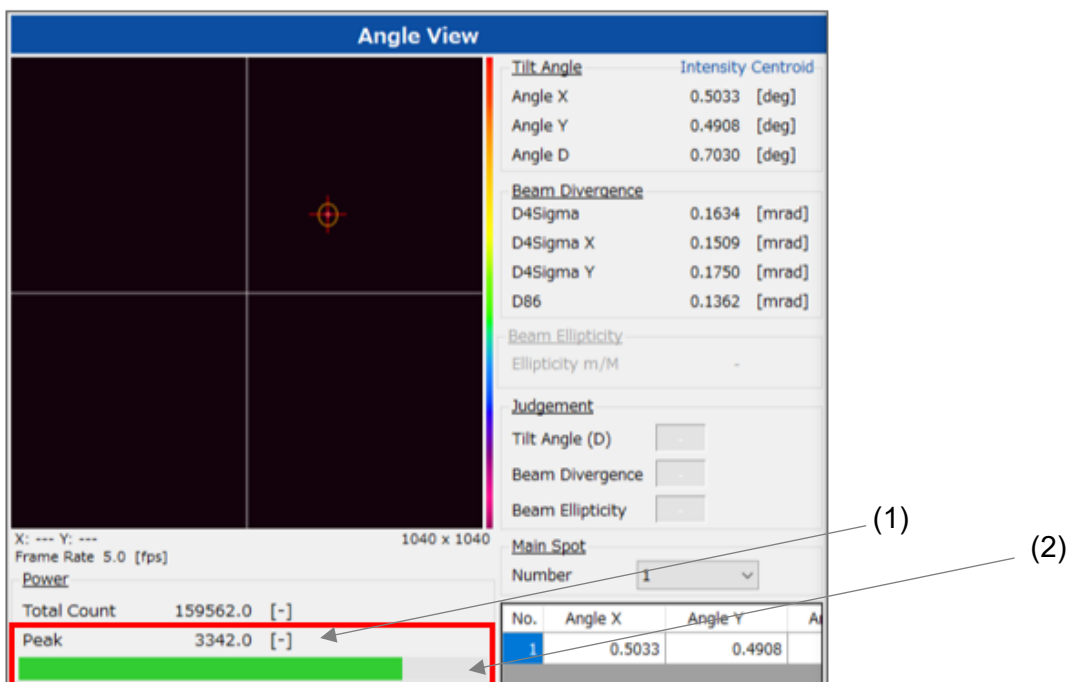
Options Select

Save Cancel

- Following light level adjustment, the Peak result on the measurement screen is not below 3500.0 (1), resulting in a non-conforming assessment. Consequently, the Peak bar indicator displays red (2).



- After readjusting the light intensity once more, the Peak reading on the measurement screen fell below 3500.0 (1), resulting in an OK judgement. Consequently, the Peak bar indicator will display green (2).



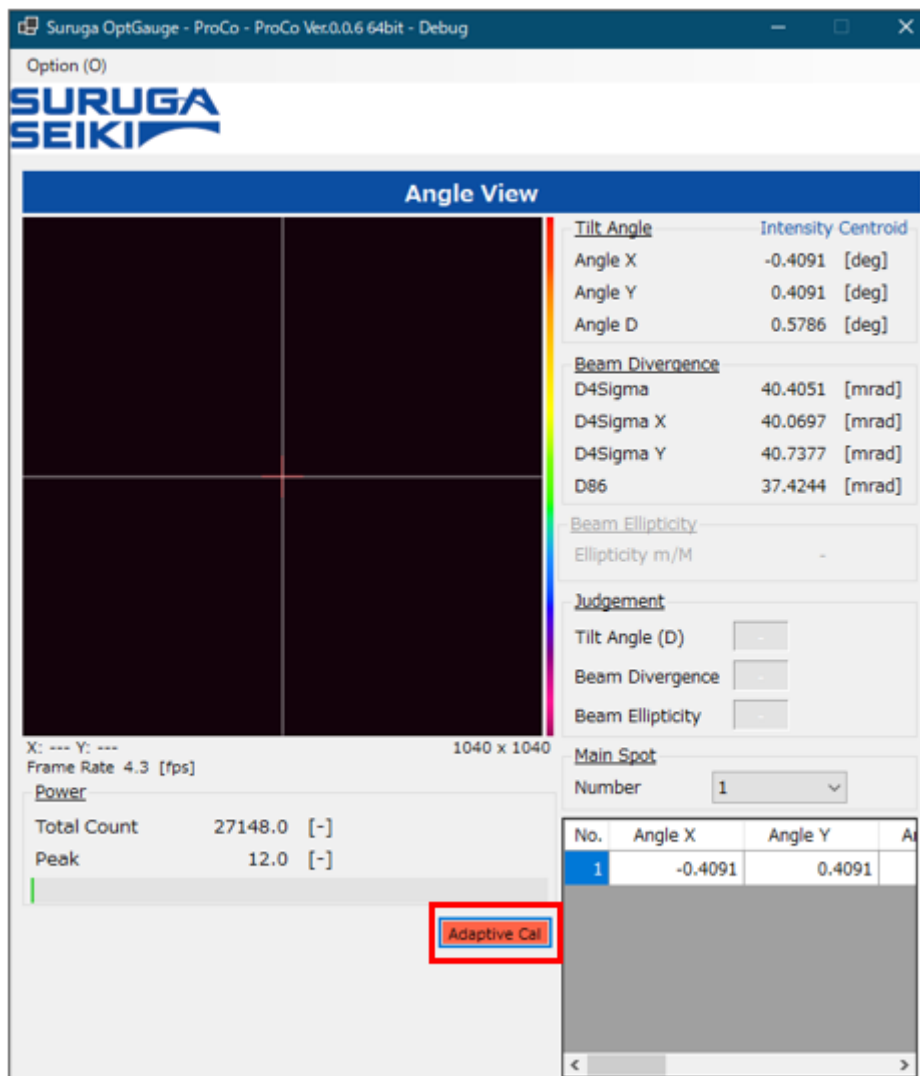
### 3.2.7 Adaptive Cal

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

It is also an automatic noise reduction function that calculates a baseline correction value and offsets this amount from each pixel data.

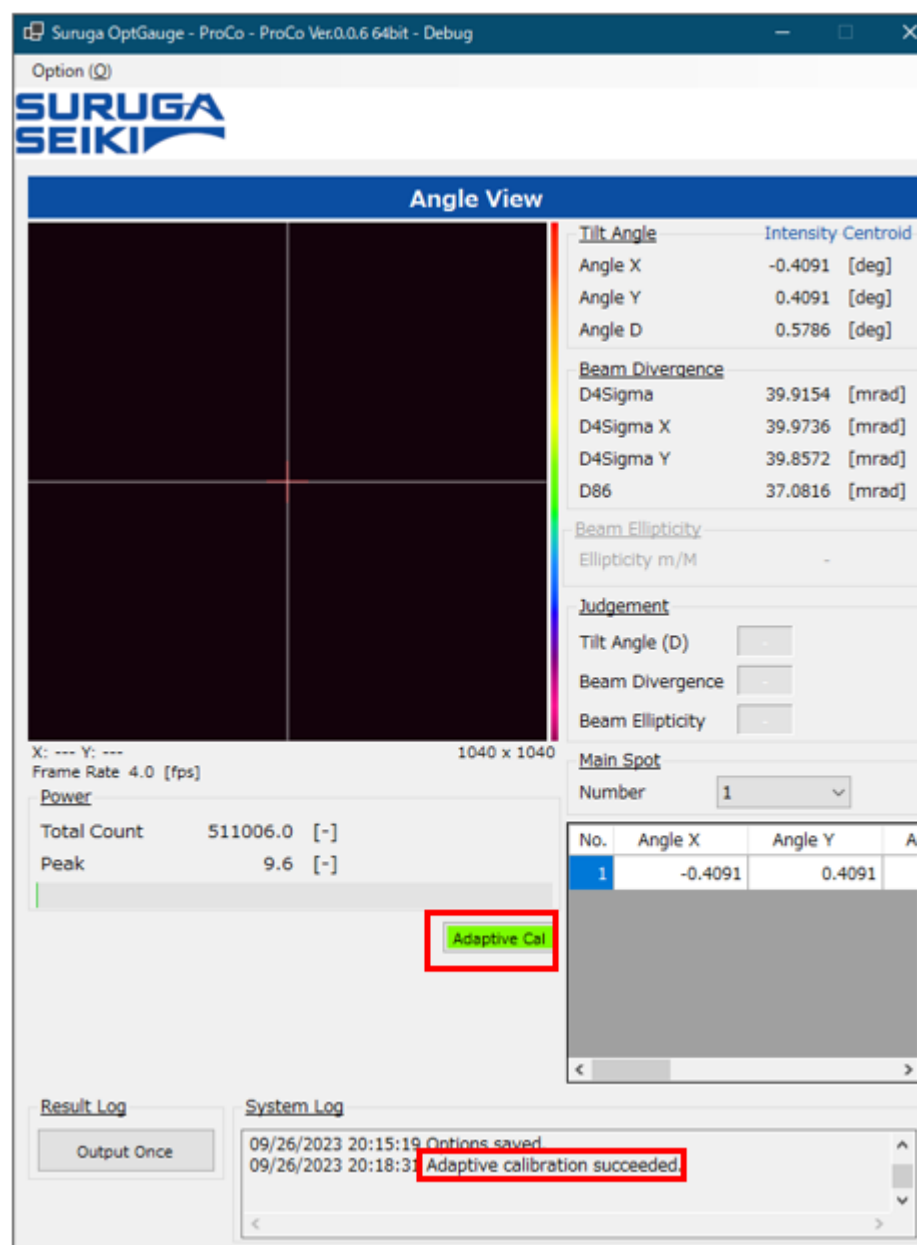
It must be executed each time the exposure time in the camera settings is changed after launching the Software.

1. Ensure the beam light is not incident on this product.
2. Enable the optional Adaptive Cal\*1 setting and click the [Adaptive Cal] button.



3. When Adaptive Cal is executed, the button color changes.
4. When the system log shows “Angle adaptive cal succeeded” the Active Cal is executed.
5. Thereafter, set the light beam incoming to the product and begin measurement.

Note: \*1 For details of optional features, refer to the separate software manual, the “Suruga OptGauge User's Manual”.

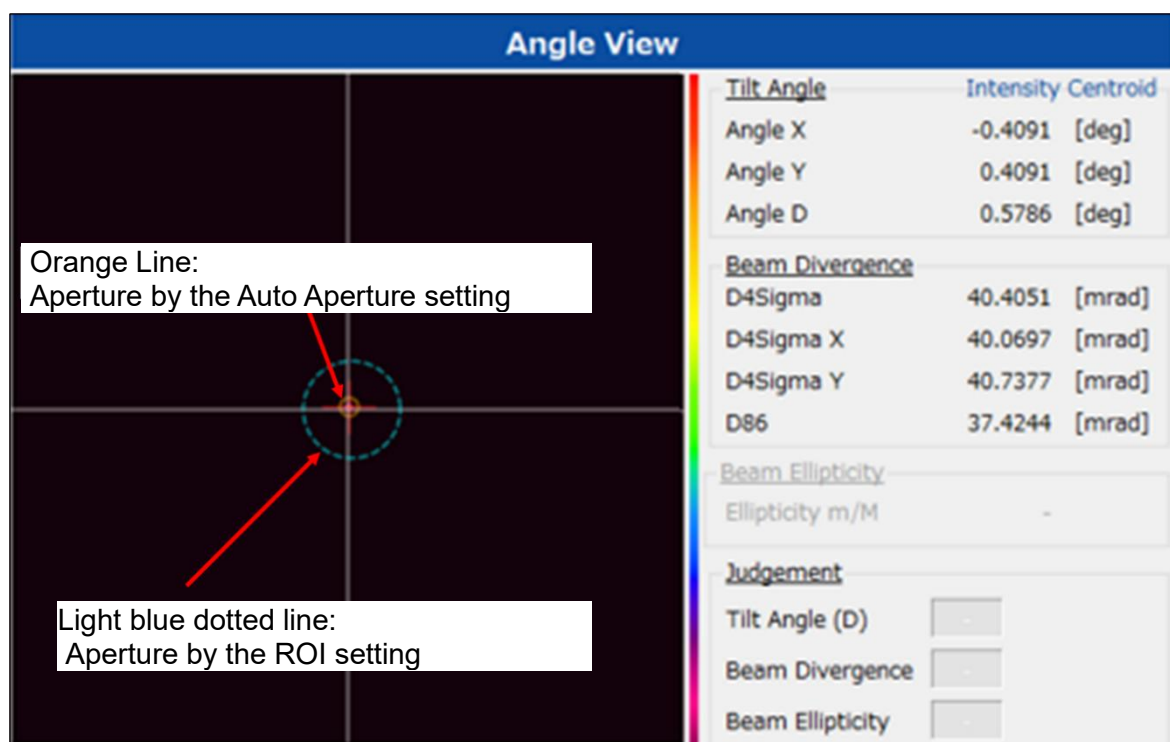


## Attention

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.

### 3.2.8 Aperture

The “Auto Aperture” and “ROI” settings are available to eliminate 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 achieved.



Aperture Explains.

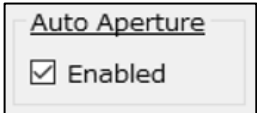
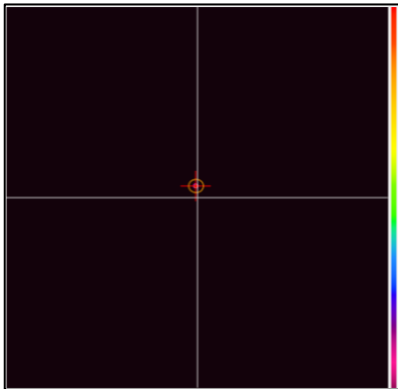
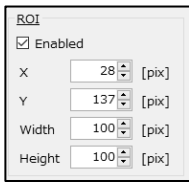
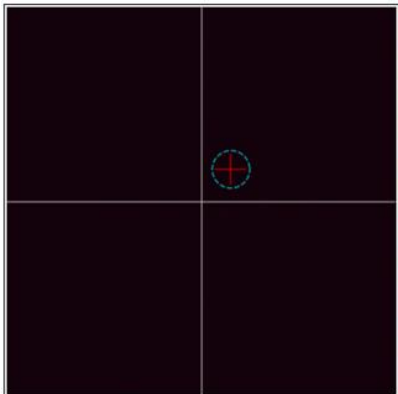
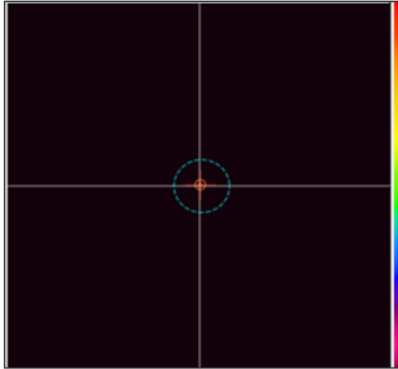
Auto Aperture	<p>It is suitable for measuring dynamic beams in which the position, size, shape, or intensity of the beam may vary over time.</p> <p>It automatically adjusts aperture.</p>
ROI	<p>It is suitable for measuring beams in which position, size, shape, and intensity rarely vary with time.</p>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

#### Info

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

This results in improved measurement accuracy. When the beam position remains unchanged, we recommend using both simultaneously.

## Setting Methods

For Setting Auto Aperture	
<p>Check the box [Enabled] in the "Auto Aperture" option setting</p> 	
For Setting ROI	
<p>Enable "ROI" in the option settings and set the X, position, width, Height (size) to enclose the beam.</p> 	
For Setting Auto Aperture and ROI	
<p>To enclose the light beam, set the "Auto Aperture" and "ROI" to "Enabled" in the option settings, and set the X,Y (location), Width, and Height (size) of the "ROI".</p>	

### 3.2.9 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.

There are three offset methods.

#### Setting Methods

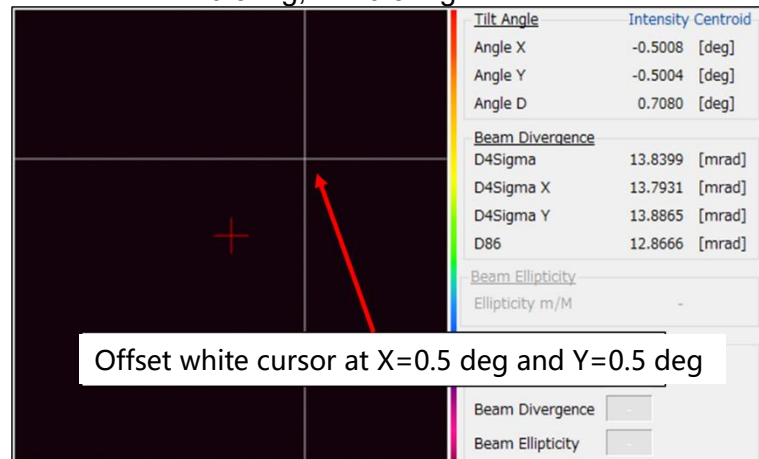
##### For Setting from the Option Screen

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

Origin Offset

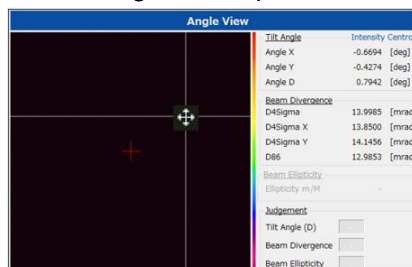
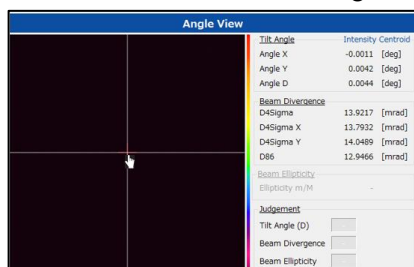
X	0.0000	[deg]
Y	0.0000	[deg]

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



##### 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 by the Zero Set button

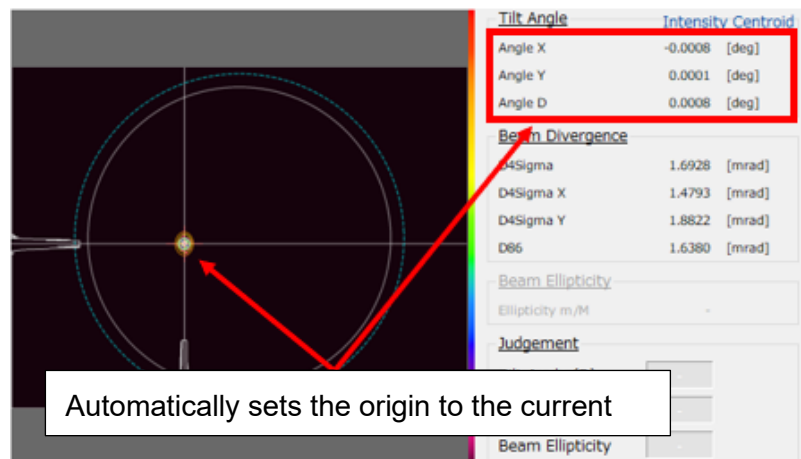
Press the “Zero Set” button in the option settings.

Origin Offset

X	0.0000	[deg]
Y	0.0000	[deg]

Zero Set

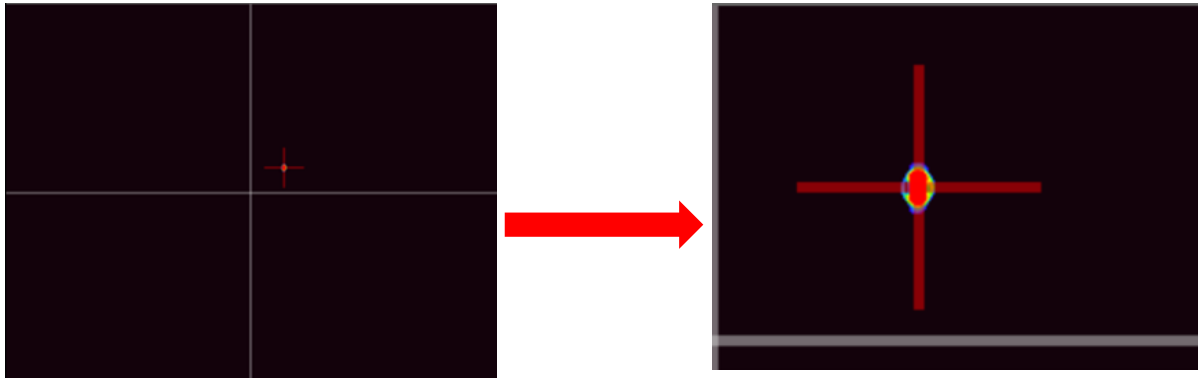
\*The values of Origin Offset X and Origin Offset Y will be automatically set to the current measurement coordinates.



### 3.2.10 Zoom In

A zoom function is available for the 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 using mouse drag operations.



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.

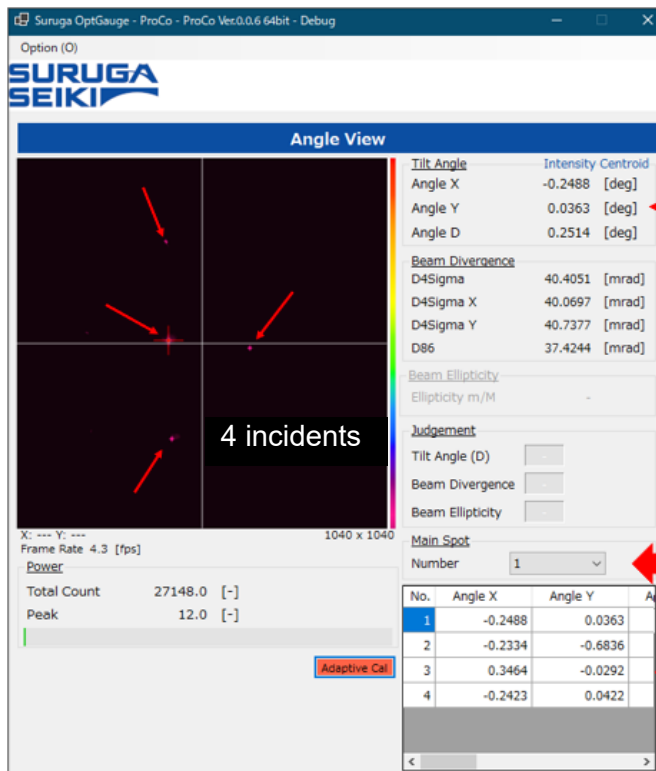
### 3.2.11 Multi Spot

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 the option settings.

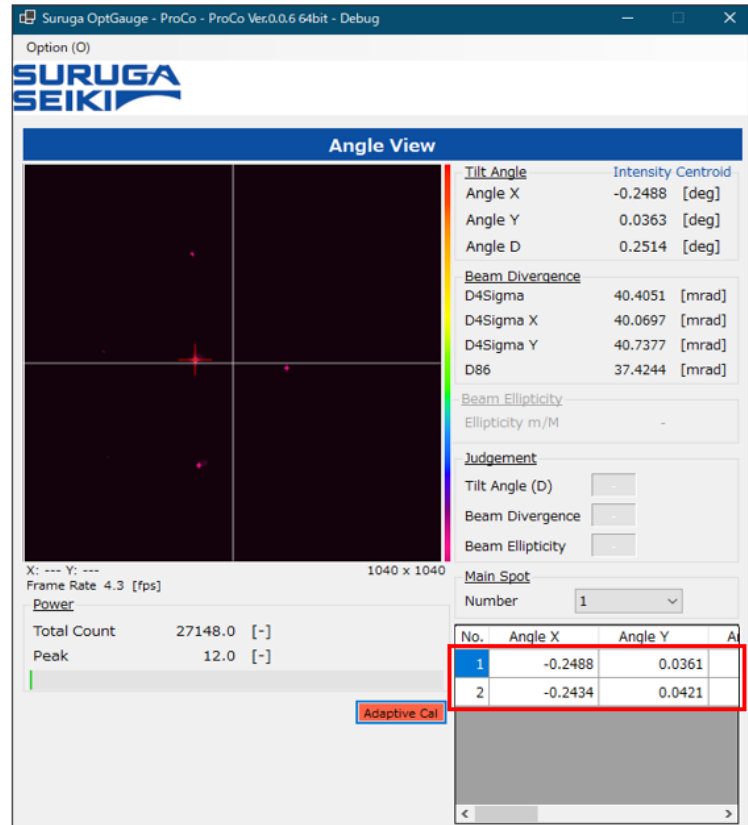
Multi Spot

Order Area ▾

Spot Count 2 [-]

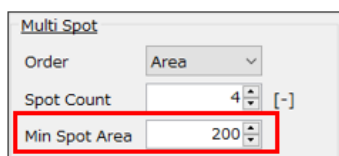
Min Spot Area 64

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 the option settings.



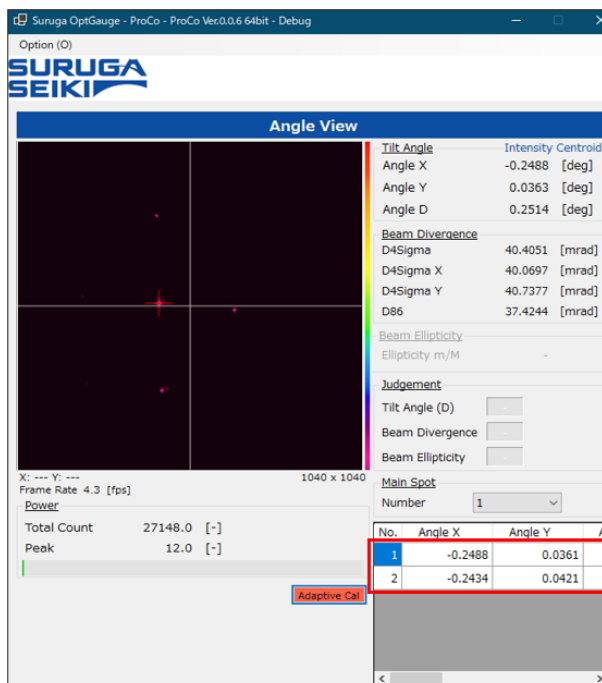
Multi Spot

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.

### 3.2.12 Automatic Brightness Control

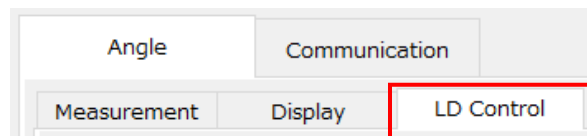
The Products regulate the exposure time and automatically adjust the beam's peak brightness value to a specified level.

Note that within the 'LD Adjustment' group, if the reflectance of the measurement target is unknown, please input the default value of 100 for 'Reflectivity'.

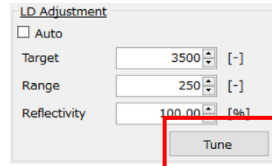
#### ■ One-Time Execution of the Automatic Brightness control

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

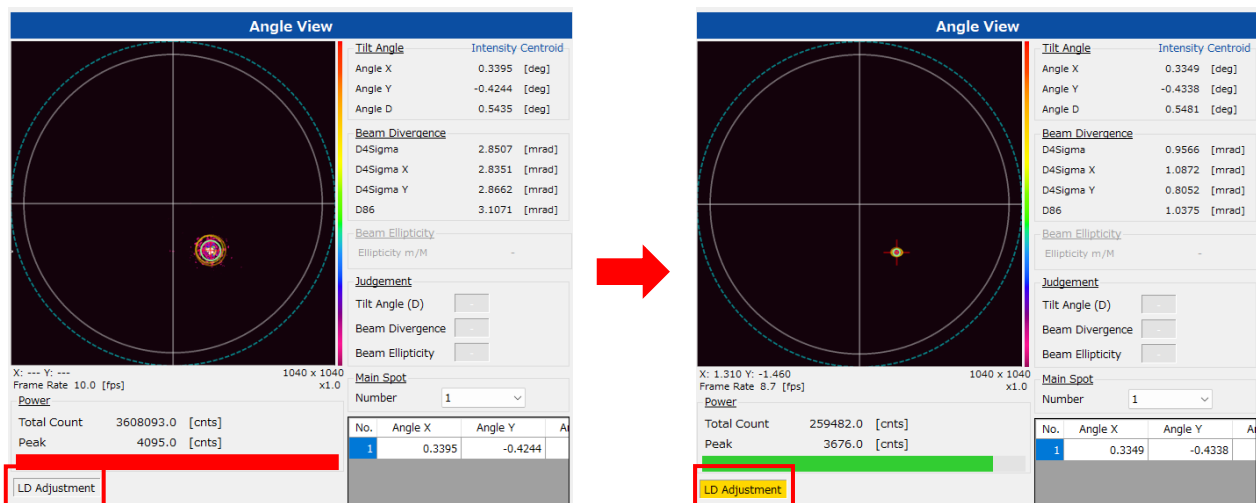
1. Open the Options window and select the LD Control tab.



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



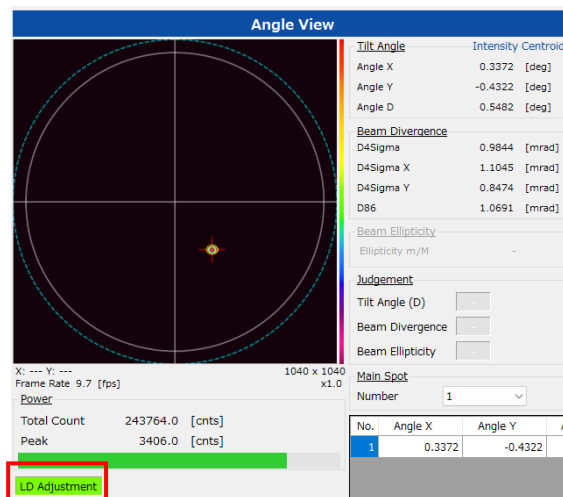
3. Automatic Brightness control starts.



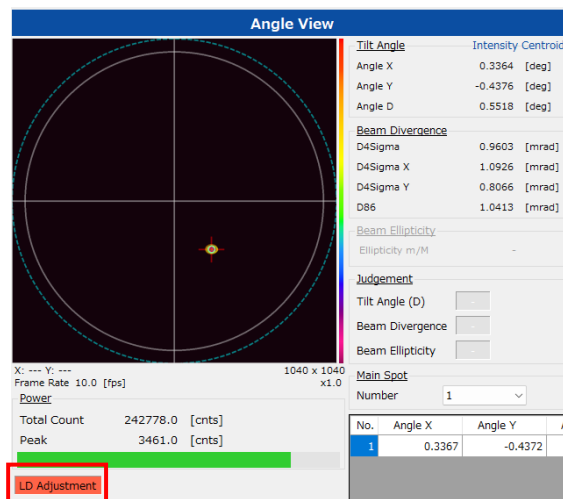
Note1: The 'LD Adjustment' option on the main screen will appear greyed out when the automatic brightness is not in operation.

Note2: Once the automatic brightness is commenced, the 'LD Adjustment' will display in yellow, indicating that automatic dimming is active.

#### 4. Automatic Brightness control completes.



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



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

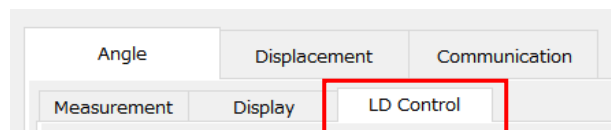
## ■ Continuous Automatic Brightness Control

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

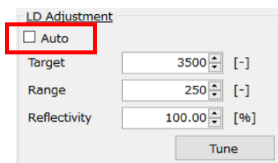
To retain the luminance value at the designated value even when the beam light moves, execute constant automatic brightness.

The usage method for constant automatic brightness is indicated below.

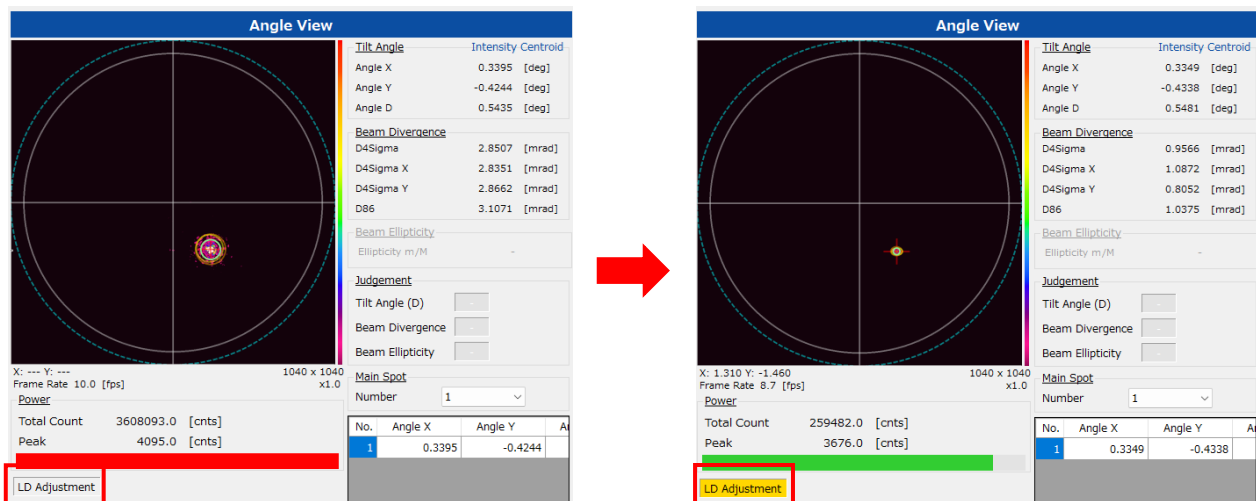
1. Open the Options window and display the LD Control tab.



2. Checkbox for the Auto LD Adjustment enter values.

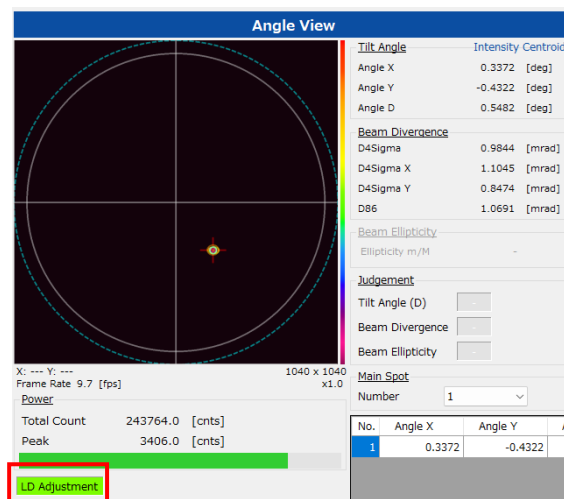


3. The Automatic Brightness control starts.





4. The Automatic Brightness control completes.



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

## 4. Specifications of the Products and Accessories

### 4.1. Sensor Head Specifications

Item		Specifications	
Light Source	Wavelength	405 nm or 660 nm	
	Emitted light	405 nm	660 nm
	Intensity	< 0.39 mW	< 1 mW
	Emission Position	12 mm × 20 mm (distance from the reference plane) (see "External Dimensions of this product")	
Angle Measurement	Range	+/- 1.35°: Measurement distance < W.D. = 0 to 150 (mm) +/- 1.00°: Measurement distance < W.D. = 150 to 200 (mm) +/- 0.75°: Measurement distance < W.D. = 200 to 250 (mm) +/- 0.50°: Measurement distance < W.D. = 250 to 300 (mm) At measuring reflection angles	
	Repeatability	1sec (6σ)* <sup>1</sup>	
	Linearity (Ave.)	+/- 0.25% of F.S. (F.S. = 2.7°) * <sup>2</sup>	
Divergence	Range	≤ 20 mrad	
	Linearity	5% of F.S. (F.S. = 20 mrad)	
Beam Diameter		Collimated light specification (Model: H-420-CL)	
		0.5 mm (only 405 nm), 1.0 mm and 3.0 mm * <sup>3</sup>	
Frame Rate		20 to 30 Hz (with the recommended computer specifications)	
Environmental Conditions	Operating Environment * <sup>4</sup>	0 to +40 °C and 35 to 85% RH	
	Storing Environment	-10 to +60 °C	
	Vibration Resistance	Frequency range: 10 Hz to 500 Hz Maximum acceleration: 2 G in X,Y,Z three directions (10 sweeps)	
Weight		0.4 kg	

\*1 Averaging times of 256 measurements

\*2 When measuring at W.D. of 100 mm

\*3 When measuring at W.D. of 300 mm

\*4 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 and CCC
Protective Functions	Short-circuit protection, overcurrent protection and 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. Cable Electrical Specifications for the Products

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

## 5. Failures? Frequently Asked Questions

### 5.1 Symptoms and Countermeasures

Useful information for troubleshooting is listed below. Please be advised 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 the 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 cable is not correctly connected	Correctly connect RS232C cable.

RS232C communication is not working	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 the separate software manual, "SurugaOptGauge User's Manual" for details.

## 6 Warranty - After-Sales Service

### 6.1 Warranty Terms, Conditions and Coverage

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

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

### 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, 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 functionalities of the Products up on your requests.

< If Repair is Required >

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

[info@suruga-g.co.jp](mailto:info@suruga-g.co.jp)

# Misumi Group

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