



Laser Autocollimator Beam Profiler Smart ProCo H650 Series User's Manual

Thank you for purchasing our product.

Before using the product, read this manual thoroughly.

After reading this manual, store it for your future immediate reference.

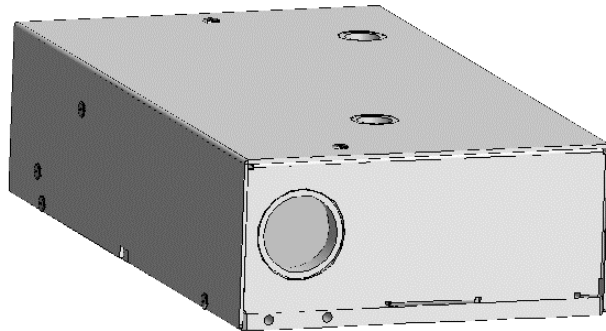


Table of Contents

Introduction	4
0. Definitions (terms and abbreviations)	7
1. For your Safety – Precautions of Use	8
1.1 Warning labels addressed in this Manual	8
1.2 Managing this Product	8
1.3 Precautions.....	9
1.3.1 Ambient Temperature and Illuminance.....	9
1.3.2 Power Supply	9
1.3.3 Disassembly/Modification.....	9
1.3.4 Effects of dust and dirt.....	9
1.3.5 Influence of Vibration	9
1.3.6 Disturbance by the air fluctuation.....	10
1.3.7 Waterproof and Explosionproof	10
1.3.8 Actions in case of abnormality.....	10
1.3.9 Repair	10
1.3.10 Disposal of the Products.....	10
1.3.11 Residual Risks.....	11
1.3.12 CE Marking.....	11
1.4 Use of Laser Products for Your Safety	11
1.4.1 Corresponding laser classes for Autocollimator H650 series	11
1.4.2 Laser Class Identification Labels on the Products	12
2. Preparing	14
2.1 Functions and Features.....	14
2.2 Checking the Package	15
2.3 Overview Specifications of this Product.....	15
2.4 External Dimensions of this Product	16
2.5 Names for the Sensor Head Parts and their functions	17
2.6 System Configuration Example	18
2.7 Components Required for the Configuration	18
2.8 Installation Method (Example)	19
2.9 Connecting Power to the Internal Light Source	20
2.10 Connection to a Computer	20
2.11 Software - Installation of Suruga OptGauge.....	21
2.11.1 Software License Agreement.....	21
2.11.2 Installation PC System Requirements	23
2.11.3 Installation of the Software.....	24

2.12	Turning on the Power	32
3.	Measurement	33
3.1	Sensor Head Usage Precautions and Setting (Installation)	33
3.1.1	For reflection angle measurement.....	33
3.1.2	For external light angle measurement.....	35
3.2	Measurement Method	37
4.	Specifications of this Product and its Accessories	38
4.1.	Sensor Head Specifications	38
4.2.	AC/DC Converter Electrical Specifications	39
4.3.	Sensor Head and Cable Electrical Specifications	39
5.	Failures? Frequently Asked Questions	40
5.1	Symptoms and Countermeasures	40
6.	Warranty - After-Sales Service	42
6.1	Warranty Terms, Conditions and Coverage.....	42
6.2	After-Sales Service	42

Introduction

This document is the "User's Manual" for the H650 series - Laser Autocollimator and Beam Profiler (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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H650 Series User's Manua

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Revision History

日付	改訂	内容
2024 February	001E	1 st version
2024 March	002E	Revised for Suruga OptGauge Ver.1.1.0
2024 December	003E	CE/KC Compliance Added
2025 January	004E	Repair Notice Added
2025 February	005E	Suruga OptGauge Ver. 1.1.3 Support • <u>Measurement Option Setting Details</u> Log File -> Image Added: Full Color/Gray Scale, PNG/BMP/TIFF • <u>Controlling from External Devices</u> Read/Write Commands Added: MLT/ASC/PSC/RFP/IOE/RAE/IOC/IOF Execute Commands Added: AR, MSN/PR,MSN/RO
2025 July	006E	Separated the software (Suruga OptGauge) contents from this manual and created an independent document. Changed [Recommended Operating Environment] and [Required Operating Environment]. Changed the title to Installation Operating Environment. Corrected typographical errors.
2025 July	007E	Installation PC operating environment: • Removed "Pro". • Added Windows 11 version. • Added a note regarding possible malfunctions depending on the Windows version. Symptoms and Countermeasures: • Added information on malfunctions depending on the Windows version and their countermeasures.
2025 September	008E	• Added a 1/e² beam diameter calculation feature • Added a rotation angle calculation feature • Added a line position calculation feature
2026 June	009E	Operating Environment • Compatible with .NET 10 Software Startup • Added Quick Start instructions Measurement Method • For usage instructions, refer to the "Suruga OptGauge User's Manual" Sensor Head Specifications • Frame rate changed to 10~20 Hz

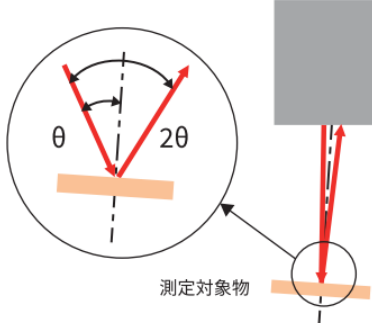
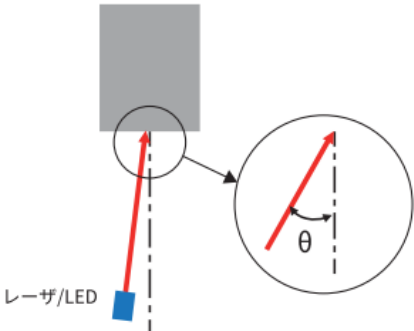
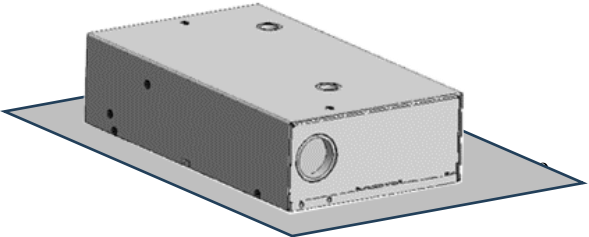
NOTICE

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	図 1  The diagram shows a light beam reflecting off a surface. A circular inset provides a magnified view of the reflection point. In this inset, a vertical dashed line represents the normal. Two red arrows represent the incident and reflected beams. The angle between the incident beam and the normal is labeled θ. The angle between the reflected beam and the normal is labeled 2θ. The surface is labeled '測定対象物' (Measurement Object). 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.
外部入射光角度測定	 The diagram shows an external light source, labeled 'レーザー/LED' (Laser/LED), emitting a beam towards a device. A circular inset shows a magnified view of the beam's path. A vertical dashed line represents the normal. The angle between the incident beam and the normal is labeled θ. A method to measure the angle θ of a beam from external light source such as laser or LED.
基準面	 The image shows a rectangular electronic device, the Smart ProCo H650, resting on a flat surface. The surface it rests on is the reference plane. It is the plane at the base plate of the H650
This product	Smart ProCo H650 serie products
Sensor Camera	Internal sensor camera embedded in this product.
Sensor Camera	Internal sensor camera embedded in this product.
Def.	Default

1. For your Safety – Precautions of Use

1.1 Warning labels addressed in this Manual

 Warning	May result in serious injury, damage to equipment, or other serious damage.
 Careful	May result in minor physical injury or equipment damage.
Attention	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 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 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 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, 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,
- When there is a strange odor due to smoke emission

1.3.10 Disposal of the Products

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 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 shall not collect these materials for the purpose.

1.3.11 Residual Risks

Attention

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.

1.3.12 CE Marking

Attention

This product complies with CE marking for the following complying standards and conditions.

When this product is used in EU countries, keep the following conditions.

- EMI : EN 55011:2016/A1:2017/A2:2021 Group 1 Class A
- EMS : EN IEC 61000-6-1:2019
- ※ The length of all input and output cables, including the power cable connected to this product, must be less than 30 meters."

1.4 Use of Laser Products for Your Safety

1.4.1 Corresponding laser classes for Autocollimator H650 series

The following describes the hazards of the laser class in the H650 series.

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



Laser Class	Precautions
Class 2	Normally, blinking, or other aversive reactions protect the eyes and make the laser beam safe. Intentional staring at the laser beam may cause temporary visual impairment and risk of secondary injury due to aversion reactions.

Ref : IEC 60825:2014 / JIS C 6802 : 2014 : *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.



Laser Labels and Descriptions

Laser Class Identification Label
Class2
 Background color: Yellow Text color: Black

Warning Label
 Background color: Yellow Text color: Black

The notation method and description of the label conform to JIS C 6802:2014

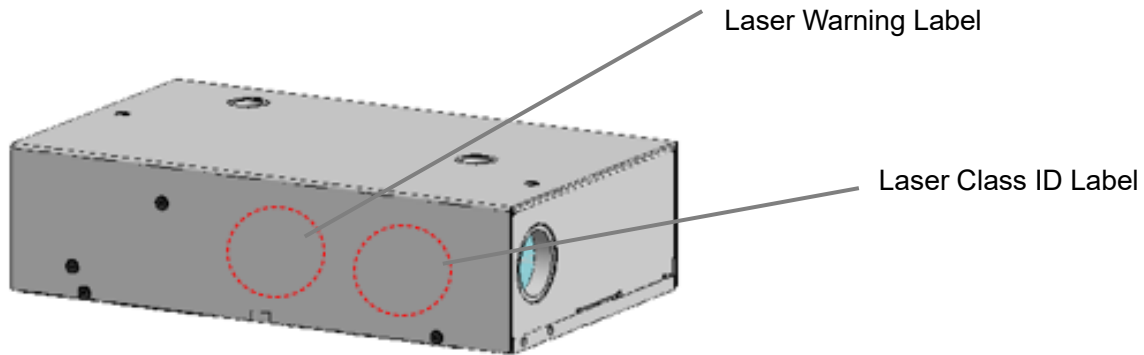


About KC correspondence : Class A
사용자 안내문 이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.
Reference English translation: User guide This equipment has been conformity-assessed for use in a professional environment and Interference may occur.



Common locations for the laser labels to all models

The warning label for the laser emission port and the identification label for the laser class are attached to the left side of the product when viewed from the front.



2. Preparing

2.1 Functions and Features

The Products are multifunctional instrument that measuring the angle of an object, divergence, position, and beam diameter from the laser beam incident on sensors. The following are its notable features.

- Angle measurement ($\Phi 3$ mm diameter if an external light beam)
 - Measurement range: $\pm 1.5^\circ$ (circular Area)
 - Linearity: $\pm 0.45\%$ of F.S. (F.S.= 3.0°)
 - Repeatability: 1sec (within 6σ of the averaging times = 256 measurements)

*See "[Specifications of this Product and its Accessories](#)" for more details.
- Divergence measurement
 - Measurement range: ≤ 20 mrad
 - Linearity: 5% of F.S. (F.S.=20 mrad)

*Refer to "Divergence" in the Function Details section.
- Position measurement (when using $\Phi 3$ mm beam)
 - Viewing range: $\Phi 6$ mm
 - Repeatability: 1 μ m (6σ , when measured with averaging = 256 times)
 - Linearity: $\pm 0.5\%$ of F.S. (F.S.=3 mm)

*See "[Specifications of this Product and its Accessories](#)" for more details.
- Beam Diameter Measurement
 - Measurement range: $\Phi 0.06$ mm to $\Phi 6$ mm (we recommend that the Spot diameter should be less than 1/2 of viewing range when Auto Aperture is applied).

*Refer to "[Specifications of this Product and its Accessories](#)" for more details .
- The sensor head cable can be connected to PC for measurement with the software.
 - * See "Preparations - [System Configuration Example](#)".
- Measurement of multiple luminous points is feasible.
- 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.
For external light angle measurement, the angle of the beam of laser or LED can be measured directly.

2.2 Checking 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.  This Product
2.  A screwdriver for light intensity adjustment
3.  A USB memory stick contents: 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/>).

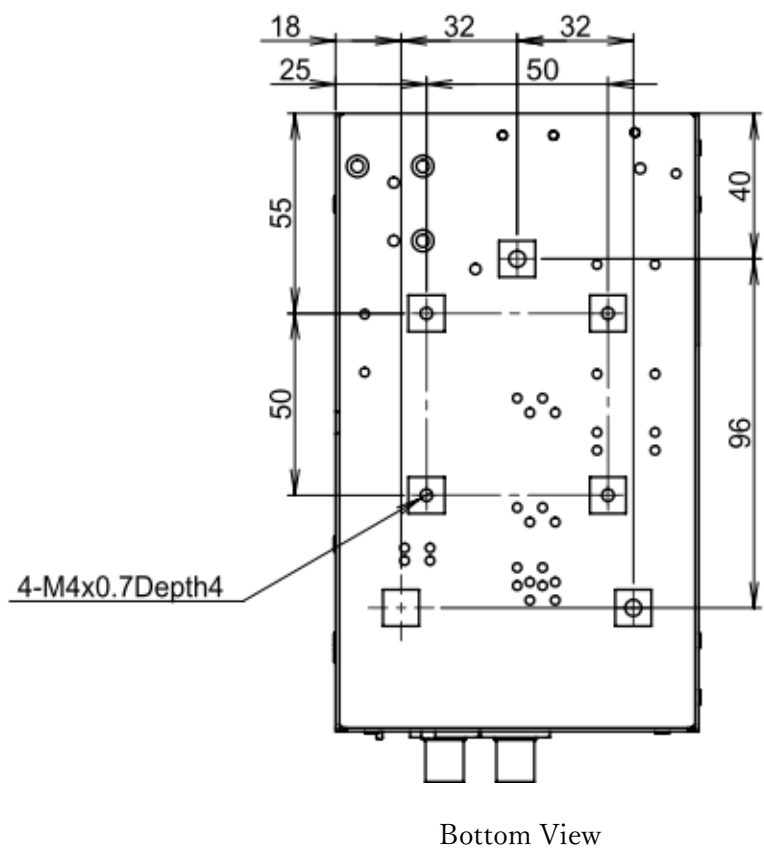
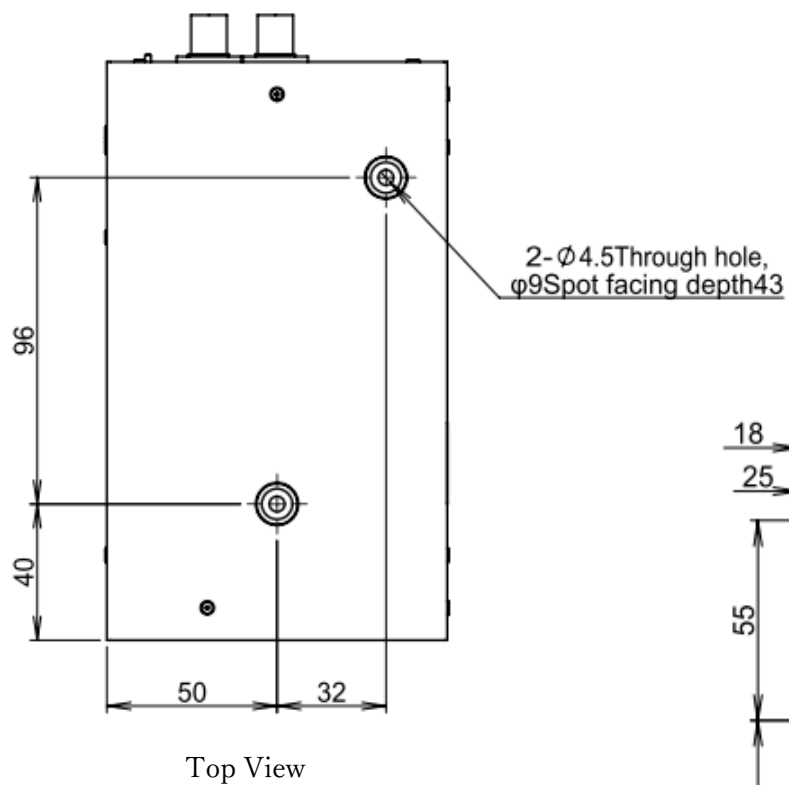
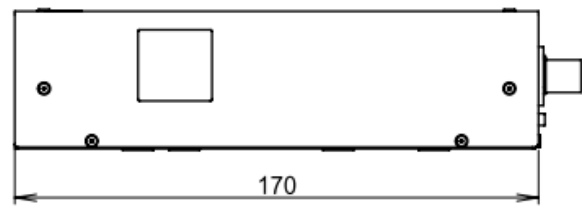
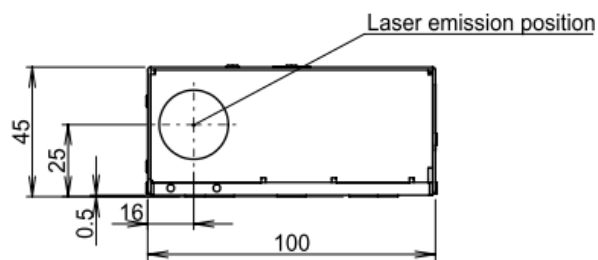
4. An AC/DC power supply for the Internal light source

2.3 Overview Specifications of this Product

Specifications Table of this product

External dimensions	170 mm x 100 mm x 45 mm
Body Weight	1.0 kg
Power Supply	12 VDC
Power Consumption	5 W or below
Laser Class	Class2
Protective functions	Short-circuit protection and reverse polarity protection
Communication functions	USB3.0 standard
Operating temperature/humidity	0°C to +40°C、 35% to 85% RH (no condensation)
Storage Temperature and humidity	-10°C 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 this Product



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 connectors x 2
It connects this product to a computer of a customer.

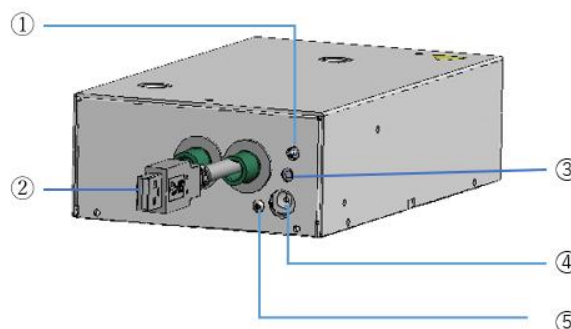
- ③ A knob for Internal light source intensity adjustment
It adjusts the internal light source intensity. Turn clockwise to increase its intensity and counterclockwise to decrease it.

*For the adjustment, use the screwdriver included in accessories.

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

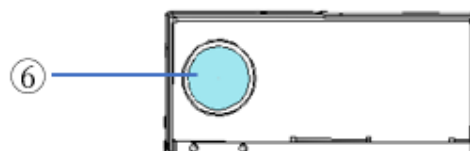
- ⑤ FG Terminal
A frame ground to reduce electrical noise and to prevent malfunction.

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



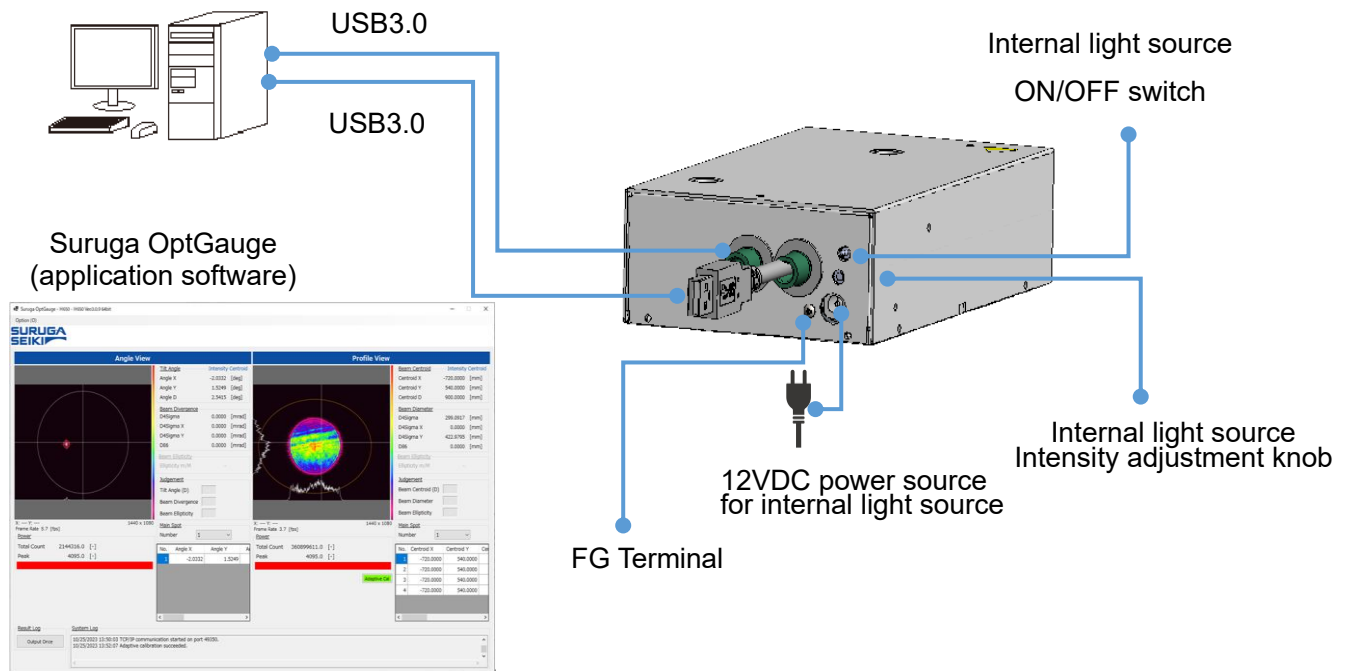
Careful

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



Laser emission surface
(front)

2.6 System Configuration Example



2.7 Components Required for the Configuration

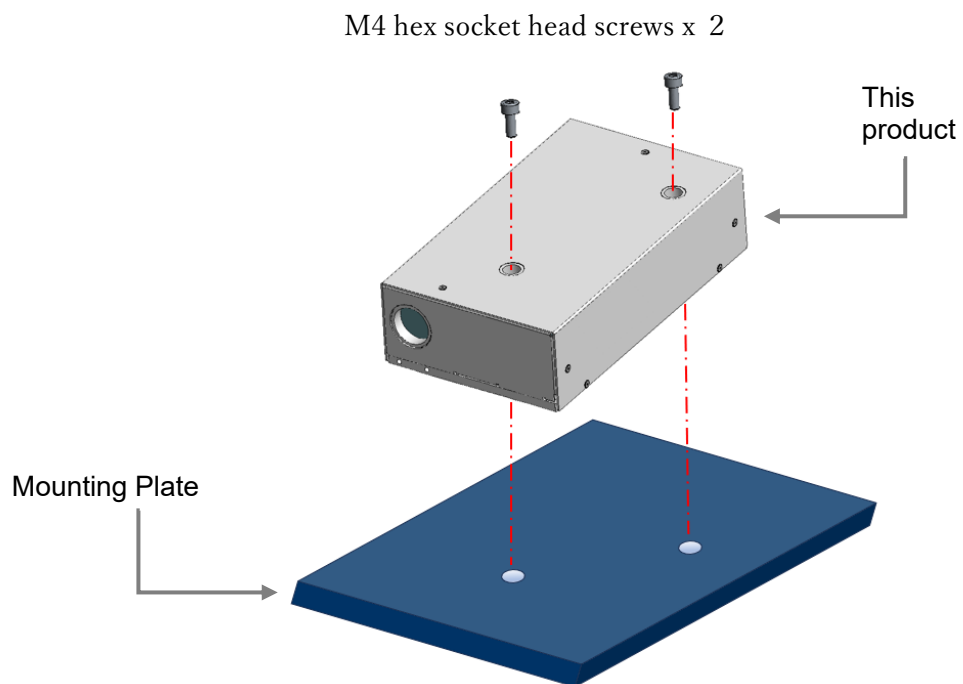
- The body of H650
- The 12VDC power source for internal light source (the AC/DC adapter included).
- A computer, a monitor, and a keyboard for this product.
- Suruga OptGauge; measurement software for this product.

2.8 Installation Method (Example)

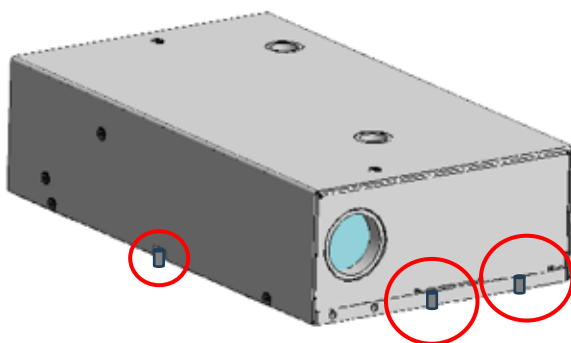
本項では、本製品の固定方法例を紹介しています。

1. Place the Product on a mounting plate prepared by the customer.
Use M4 hex socket head cap screws (length: 8-10 mm).

*See [External Dimensions of this Product](#)"



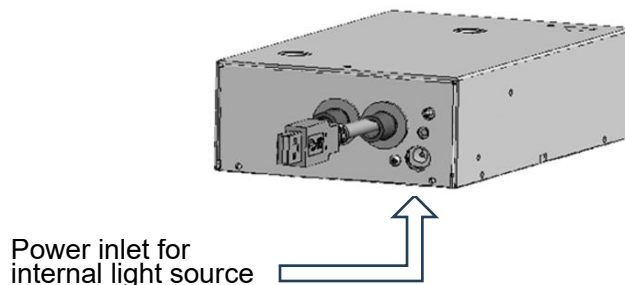
2. The reference position is the base plate on the front, left side of this product.. Fasten the bolt with a parallel pin or other means pressed against it.



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

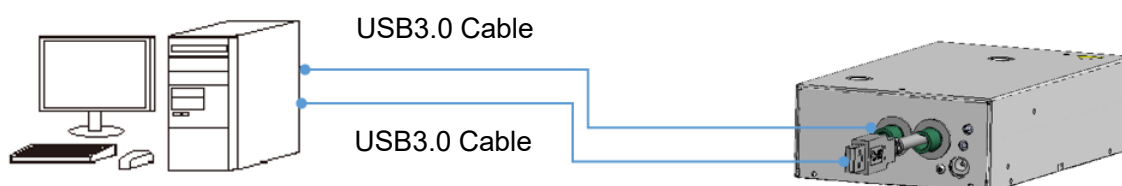
Do not turn on the AC/DC adapter until this software installation is complete.

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 this 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 Software - Installation of Suruga OptGauge



If downgrading of this software, setting information added to a newer version may not be correctly loaded so that this software may fail to start up.

Be sure to back up the folder where option files are saved and then to install the older version after deleting the relevant folder.

<the path to the save folder>

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

2.11.1 Software License Agreement

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

When installing or copying all or part of this software on a computer, or using this 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)

This software is free of charge.

The copyright for this software, its manual, and other documents concerning this software belongs to SURUGA SEIKI Co., Ltd. (hereafter as "SURUGA").

SURUGA grants all users for non-proprietary rights to the use of this software.

Article 2 (Usage Restrictions)

SURUGA permits this software to use only for the purposes of operating this product and collecting data.

SURUGA prohibits use of this software for any other than SURUGA's intended purposes.

Article 3 (Reproduction and Modification)

This software can be copied only to the computers using the Products. SURUGA prohibits Modification, redistribution, and reverse engineering.

Article 4 (Disclaimers)

1. Users make use of this software on their own responsibility.

2. 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 this software.
3. In addition, 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 this software.
4. SURUGA bears no responsibility and is not liable to damages incurred upon modification of the software.

Article 5 (Support)

SURUGA provides technical support for this 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 this software will be, immediately, terminated upon violation of the conditions of this agreement.

2.11.2 Installation PC System Requirements

[Recommended System Requirements]*¹

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

[Minimum System Requirements]*²

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

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

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

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

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

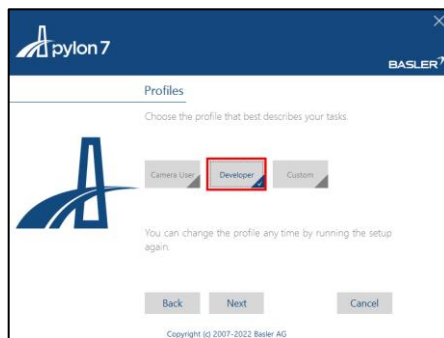
2.11.3 Installation of the Software

2.11.3.1 Installation of the USB device driver

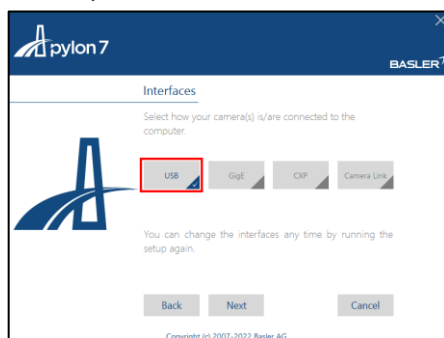
1. Double-click the "... ¥Driver" "Basler_pylon_7.0.0.24651.exe" to begin installation.



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 Download

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

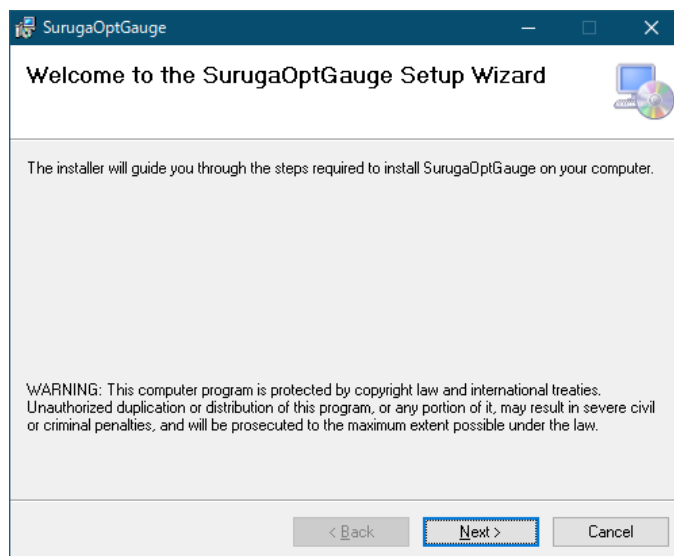
2.11.3.3 Installation of the Software

Installing the Software.

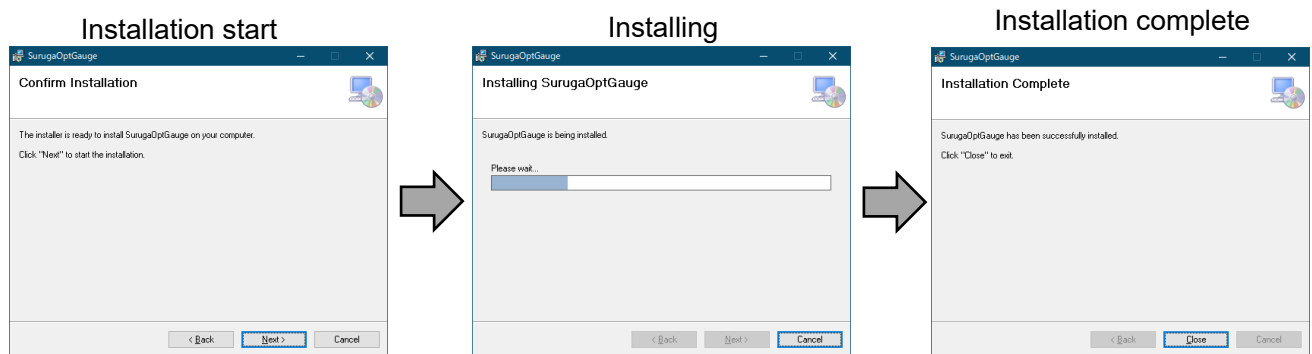
1. Double-click "Suruga OptGaugeSetup_x.x.xx.msi" in the directory "... /Application".

名前	更新日時	種類	サイズ
 SurugaOptGaugeSetup_x.x.xx.msi	2023/11/28 19:12	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.



2.11.3.4 Copying the Device Authentication File

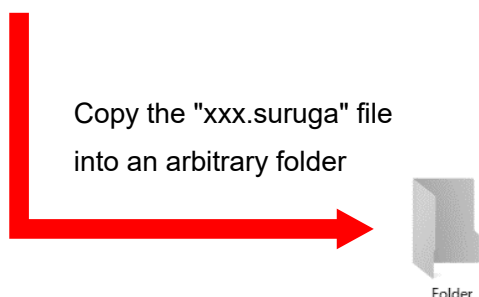
Attention

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

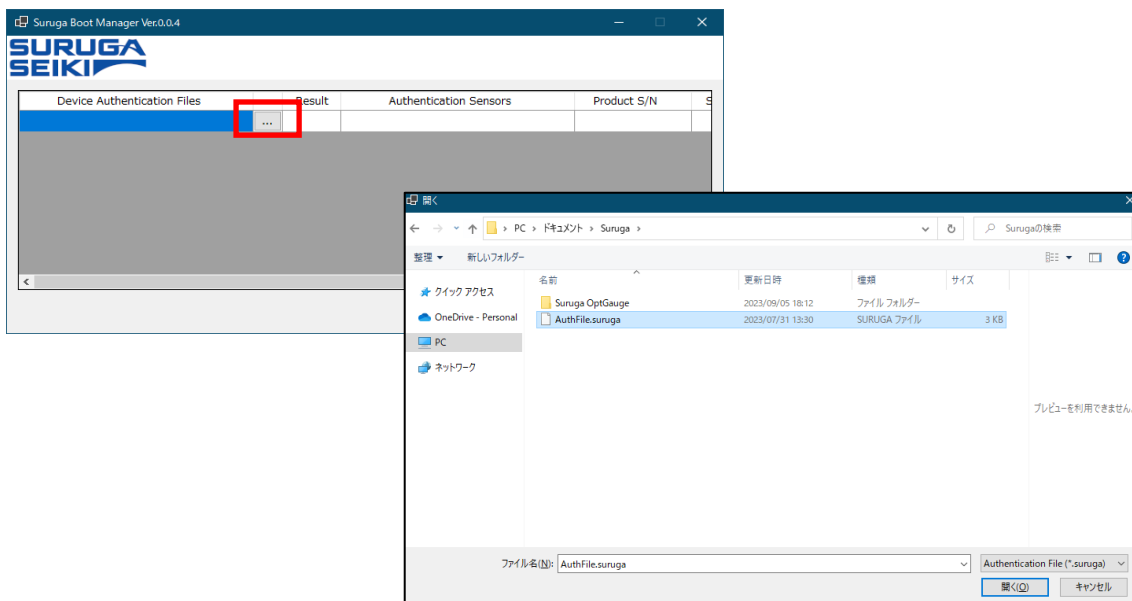
2.11.3.5 Starting up and Closing down the Suruga OptGauge

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

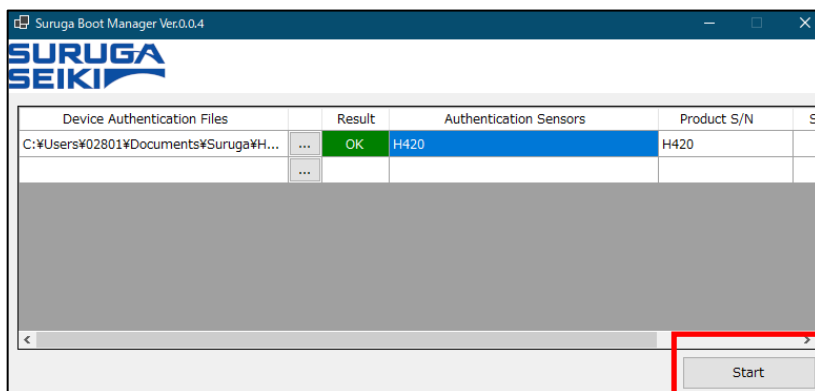


2. Click on "..." in the item "Device Authentication File" and select the extension ".suruga" in the folder in which the unique "Device Authentication File" was copied.

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

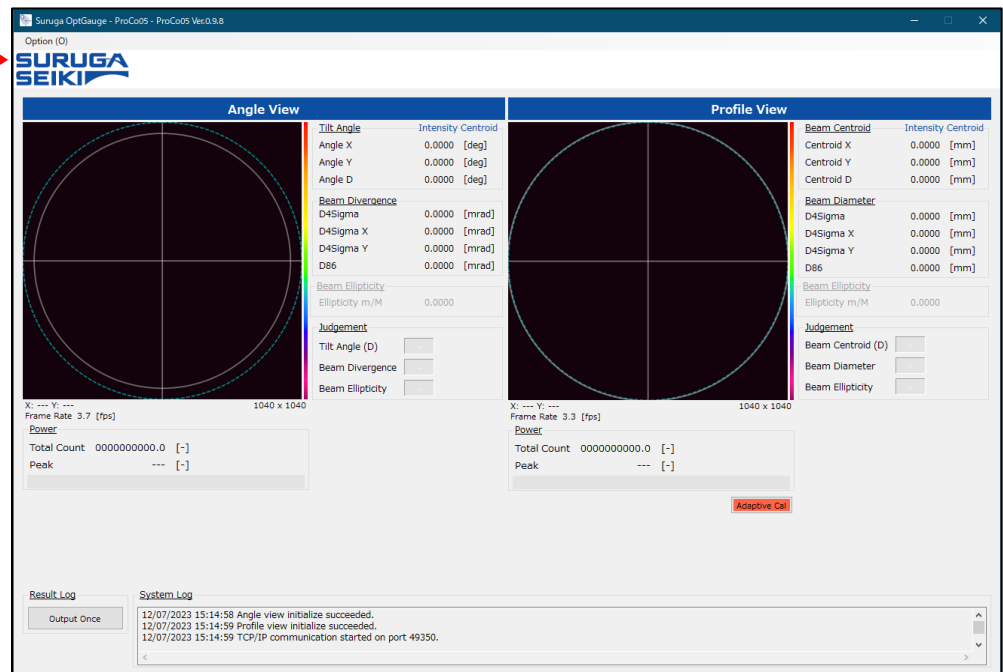
The Software incorporates TCP/IP communication control. Therefore, depending on your PC's security settings, the following warning may appear upon initial startup.

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".)

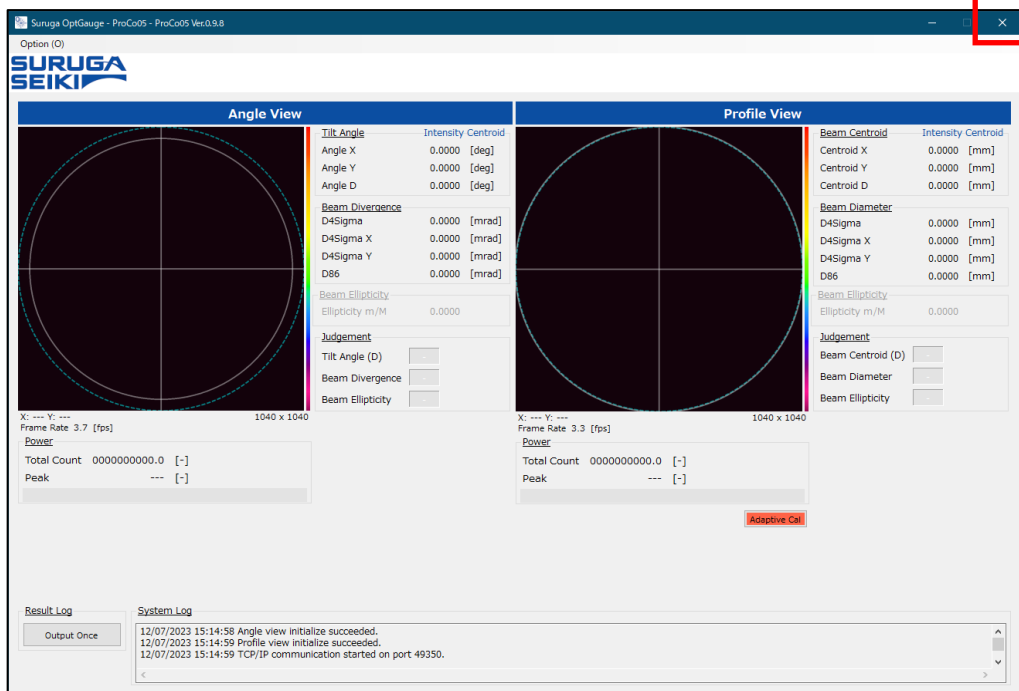


4. The application will start up.



Closing the Suruga OptGauge.

Click the "x" icon to shut down OptGauge.

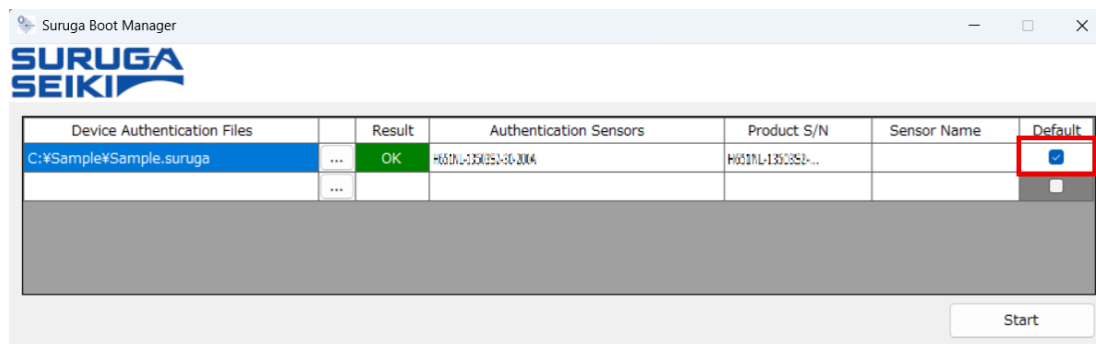


2.11.3.6 クイックスタート

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

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

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



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

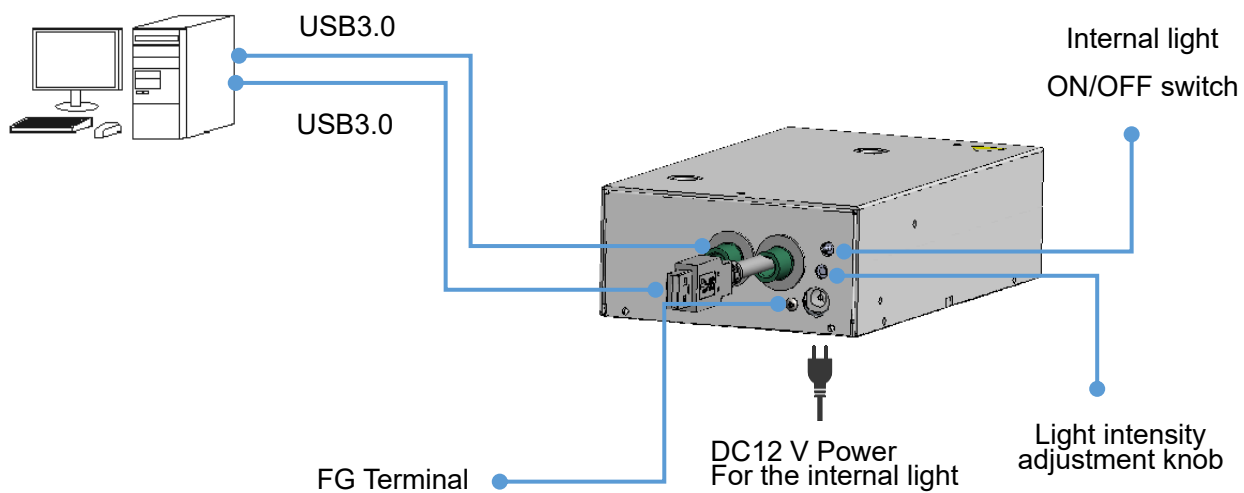
By using this method, you can temporarily disable Quick Start and select the authentication file in the Boot Manager before starting the software.

2.12 Turning on the Power



Do not turn on the sensor head power until this product and this 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 ON/OFF switch to ON.



3. Measurement

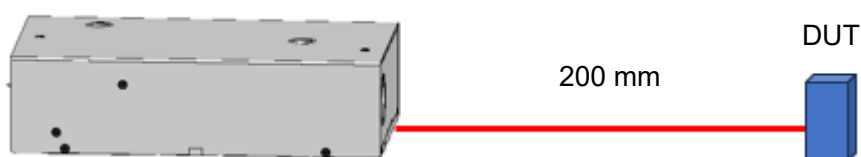
3.1 Sensor Head Usage Precautions and Setting (Installation)

This section describes the setting method for this product, using this software.

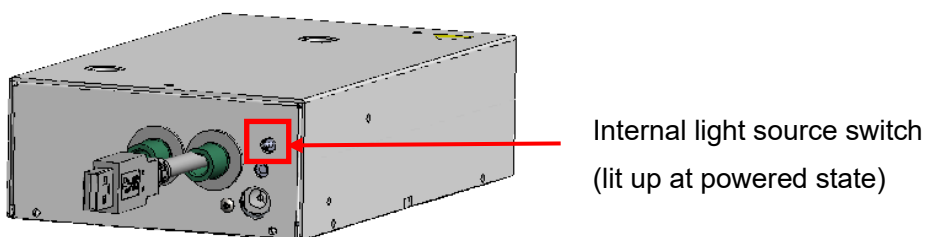
3.1.1 For reflection angle measurement

1. Turn off the internal light source and set a device under test to be 200 mm away from the reference plane.

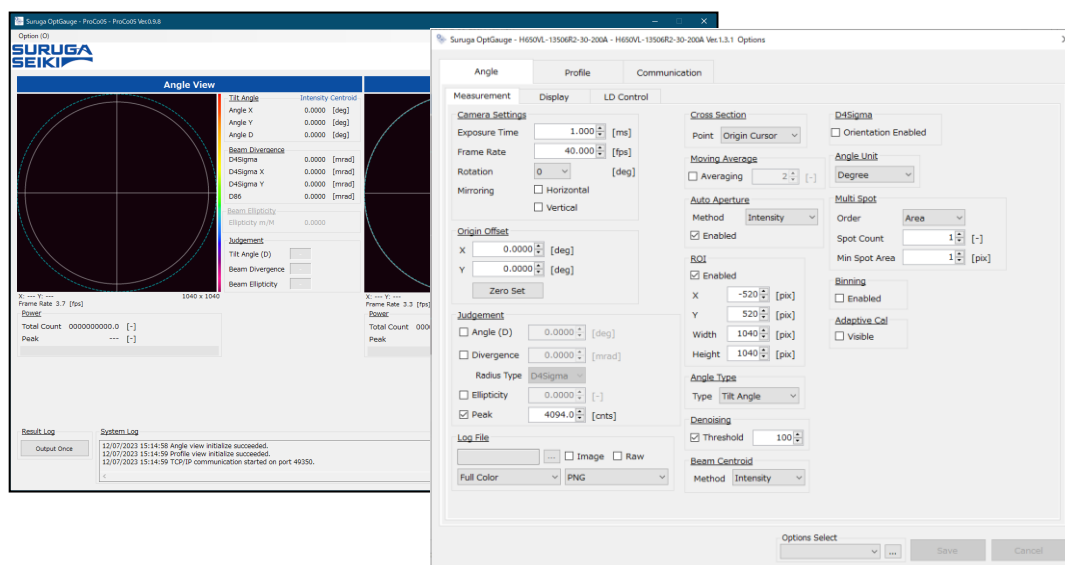
If the reflectance of the device under test is low, measurement may not be possible.
(Reflectance of 10% or higher is recommended.)



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



3. Launch OptGauge and open the option screen.

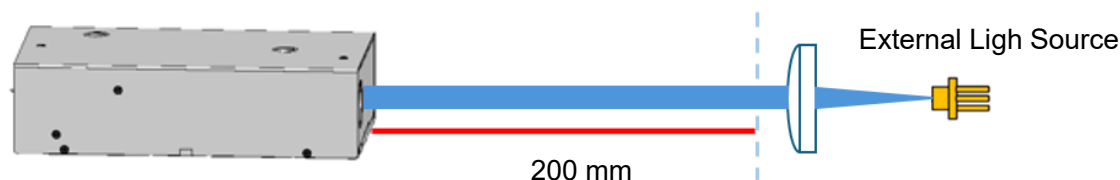


4. Set the Angle Type to "Tilt Angle^{*2}" on the Angle tab in the Option screen.
5. Select the LD Control sub-tab in the Angle tab of the Option screen.
6. To adjust the light intensity of the internal light source, click the Tune button^{*1} in the LD Adjustment window, and set it to "3500-3800" (optimal value) while observing the Peak^{*1} on the measurement screen.
7. Select the LD Control sub-tab in the Profile tab of the Option screen.
8. 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.

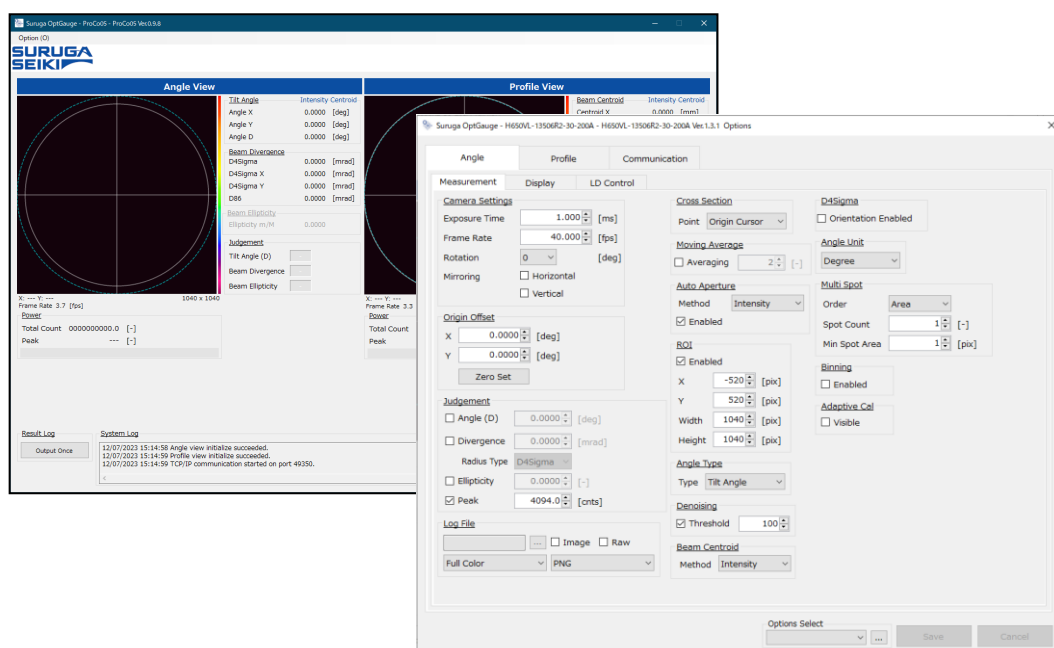
^{*1} see "SurugaOptGauge User's Manual" in the separate software manual for details.

3.1.2 For external light angle measurement

1. Turn off the internal light source and set the distance between the front edge of the sensor head reference plane and the beam position you wish to measure to be 200 mm away



2. Launch OptGauge and open the option screen.



3. Set the Angle Type to "Beam Angle*2" on the Angle tab in the Option screen.
4. Select the LD Control sub-tab in the Angle tab of the Option screen.
5. Adjust the light intensity of the external light source, click the Tune button*¹ in the LD Adjustment group box, and set it to "3500–3800" (optimal value) while observing the Peak*¹ on the measurement screen.
6. Select the LD Control sub-tab in the Angle tab of the Option screen.
7. Adjust the light intensity of the external light source, click the Tune button*¹ in the LD Adjustment group box, and set it to "3500–3800" (optimal value) while observing the Peak*¹ on

the measurement screen.

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

3.2 Measurement Method

For instructions on using each measurement-related function, please refer to the separate software manual "SurugaOptGauge User's Manual".

4. Specifications of this Product and its Accessories

4.1. Sensor Head Specifications

Item		Specifications	
Model No.		H650VL-13506R2-30-200A	H650NL-13506R2-30-200A
Measurable External Light Source	Wavelength	VIS: 400 to 700 nm	NIR: 700 to 1000 nm
	Mix. Diameter	6 mm	
	Light Intensity	0.05 to 1.0 mW	
Internal Light Source	Wavelength	660 nm	
	Diameter	Φ3 mm	
	Emission Intensity	1 mW or less (Class2)	
	Emission Position	16 mm (distance from the side surface reference) 25 mm (distance from the bottom surface reference) (see External Dimensions of this Product)	
Angle Measurement	Range ^{*1}	+/- 1.5°(circular range)	
	Repeatability ^{*3}	1 s (6σ)	
	Linearity ^{*2}	+/- 0.45% of F.S. (F.S.=3.0°)	
Divergence	Range	≤ 20 mrad	
	Linearity	5% of F.S. (F.S.=20 mrad)	
Location Measurement	Viewing Range	Φ6 mm	
	Repeatability	1μm (6σ)	
	Linearity	+/- 0.5% of F.S. (F.S.=3 mm)	
Beam Diameter Measurement	Actual Spot Size ^{*4}	Φ0.06 mm to Φ6mm	
Working Distance		200 mm +/- 4 mm	
Frame Rate		8~10 Hz (with the recommended computer specifications)	
Environment Conditions	Operating Condition ^{*5}	0 to +40°C、35 to 85% RH	
	Storing Condition	-10 to +60 °C	
	Vibration Resistance	Frequency range: 10 Hz to 500 Hz Max. acceleration: 2 G in X,Y,Z 3 directions (10 sweeps)	
Weight		1.0 kg	

*1 When measuring with Φ3 mm external laser beam

*2 When measuring with wavelength at 660 +/- 10 nm

*3 Averaging times of 256 measurements

*4 With Auto Aperture, we recommend that measuring SPOT diameter at 1/2 or less of the field of view

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

4.2. AC/DC Converter Electrical Specifications

AC / DC Converter Specifications Overview	
Rated Input (AC)	AC100~240 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)	99mm x 50mm x 33mm
DC Cable Length	1.5 m +/- 30 mm
DC Plug Polarity	Center Positive

4.3. Sensor Head and Cable Electrical Specifications

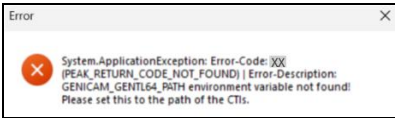
Sensor Head and Cable Specifications Overview	
Rated Input (power consumption)	DC12 V / 3 A (5 W or below)
Cable Type	USB cable compliant with USB3.0 (5Gbps) standard
Connector	USB3.0 Type A
Cable Length	3.0 m

5. Failures? Frequently Asked Questions

5.1 Symptoms and Countermeasures

Useful information for troubleshooting is listed below.

Check if the table below shows your trouble.

症状	原因	対策
Internal light source power is NOT turned on.	AC/DC 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 following message appears when starting this software and it cannot be launched: 	The camera driver may not be installed.	Please install the camera driver. (Installation of the USB device driver) After installation, please restart your PC.
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.
本ソフトウェア起動中に固まった	Windows 11 Version 23H2 では、一部のシステムコンポーネントや仕様の違いにより、本ソフトウェアが正常に動作しない。	最新の Windows バージョン (24H2 以降) にアップデートしてください。
	USB ケーブルの接続が外れた。	本ソフトウェアを終了して USB ケーブルを正しく接続し、再度本ソフトウェアを起動してください。
Beam is not displayed on screen	Exposure Time* ¹ is too short.	Adjust the exposure time* ¹ to the optimal speed.

症状	原因	対策
	Large tilt on the target.	Adjust the tilt angle of the target so that the reflected light beam enters within a viewing range of +/- 1.5°.
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 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

SURUGA SEIKI CO., LTD.

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