SG-Imaging

——Software User Manual

V1.2.8

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When the client uses some or all of the functions of the software (hereinafter referred to as "this Software") "SG-Imaging", it shall be deemed that the client has agreed to all the contents specified in this Agreement and this Agreement comes into effect.

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Introduction

Please be sure to read this User Manual before using the software.
After reading the manual, keep it safe for your future reference.

This Software User Manual of SG Series laser products provides clients with operating instructions for the settings of SG series point laser "SG-Imaging".

The contents of this Manual have been prepared with the aim of accuracy. But if you find any unclear, incorrect, or ambiguous contents, please contact our Sales Department. If there are missing pages or binding errors, we will provide replacement services.

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The Purpose of the User Manual

By reading this manual, users can become familiar with the basic operations of the SG-Imaging software for sensing products of machine vision and be able to perform measurement settings in actual engineering projects.

Users of the Manual

This user manual is suitable for engineering personnel who have a certain understanding of software debugging operations.

The Main Contents of the User Manual

This manual consists of five sections. It describes in detail the installation, startup, basic operations, parameter settings of SG-Imaging software.

Relevant Documents

For the hardware installation of the SG series point laser, please refer to the "SG Series Laser Displacement Sensor - Hardware User Manual" that comes with this product.

Document Version

S/N	Version Number	Revision Date
	1.0.1	December 26, 2019
	1.0.2	January 7th, 2020
	1.1.1	March 3, 2020
	1.2.1	April 2, 2020
	1.2.2	March 10, 2021
	1.2.3	June 28, 2021
	1.2.4	July 12, 2021
	1.2.5	October 29, 2021
	1.2.6	April 12, 2022
	1.2.7	October 20, 2022
	1.2.8	November 29, 2023

Table of Contents

1 Preparation Before Operation

1.1 Software Installation

This section describes the steps to install SG-Imaging on a PC.

Notes:

- This step describes the installation process on Windows 7 operation system.
- Before starting the installation, please close other running applications.
- When installing on a Windows system, you must log in with administrator privileges.

1. **Start Windows operation system and double-click the SG-Imaging installation program.**
   The installation wizard interface is displaying.
2. **Follow the instructions on the screen for operation.**

3. **When the "Installation Wizard is Completing" appears, click "Finish".**

Now, the installation of SG-Imaging software is completed.

➢ By default, SG-Imaging will be installed in C:\Program Files (x86)\SG-Imaging.

Uninstalling

This section describes the steps to uninstall SG-Imaging from a PC.

Notes:

- This step describes the uninstallation process on Windows 7 32-bit operation system.
- Before starting the uninstallation, please close other running applications.
- When uninstalling on a Windows system, you must log in with administrator privileges.

1. **Double click on "Programs and Features" on the Control Panel.**
   The "Uninstall or Change a Program" screen appears.
2. **Select SG-Imaging and right-click to select "Uninstall".**
   The "Confirm Uninstall" dialog box appears.

3. **Click "Yes"**
   Uninstallation begins.

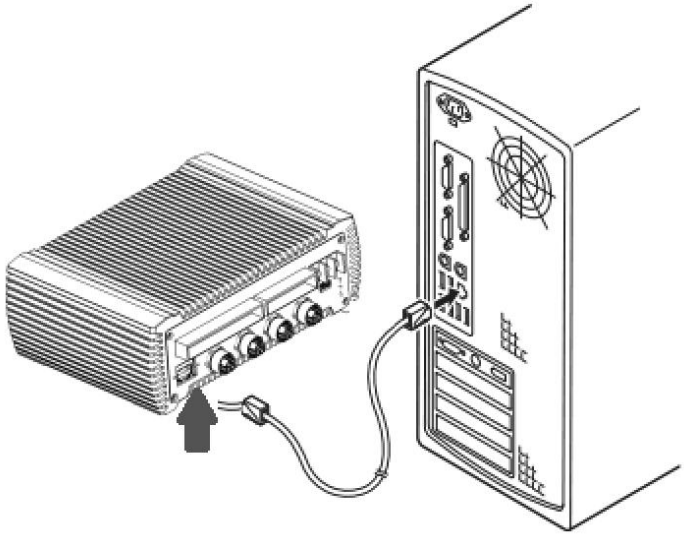
1.2 Connecting the Controller and PC

This section describes the method of connecting the controller and PC: Ethernet connection.
Multiple controllers can be connected on a single PC through an Ethernet interface. The communication protocol is TCP/IP, and the connection method is point-to-point.

Notes:

- Do not set the same IP address on the controller and PC.
- It is not possible to operate multiple controllers simultaneously on a single PC.
- It is not possible to operate a controller simultaneously on multiple PCs.

Connection method



1. Insert a commercial Ethernet cable (CAT-5 crossover cable) into the Ethernet interface on the controller.

2. Insert the other end of the Ethernet cable into the LAN interface of the PC.

■ Connect two or more controllers

A hub that supports 100BASE-TX or 10BASE-T.
To connect the controller to the hub or the PC to the hub, use a commercial straight-through Ethernet cable.

2 Basic Operation

2.1 Process Before Measurement

Preparation before measurement

- Install SG-Imaging on the computer.

  [Software Installation] (Page 6)
- Connect the controller and sensing head.

  [Connecting the Controller and PC] (Page 7)

▼

Set measurement conditions

According to the [Measurement Settings] of SG-Imaging, set the system and measurement method as needed.

[STEP1: System Settings] (Page 24)

▼

[STEP2: Measuring Method] (Page 26)

▼

Display measurement results

According to the measurement settings, display the measurement results on SG-Imaging.

[The Names and Functions of Each Part of the Master Interface] (Page 12)

[Measured Value Monitoring] (Page 53)

[Data Memory] (Page 58)

2.2 Start and Exit

This section describes the methods for starting and exiting SG-Imaging.

Start

Notes:

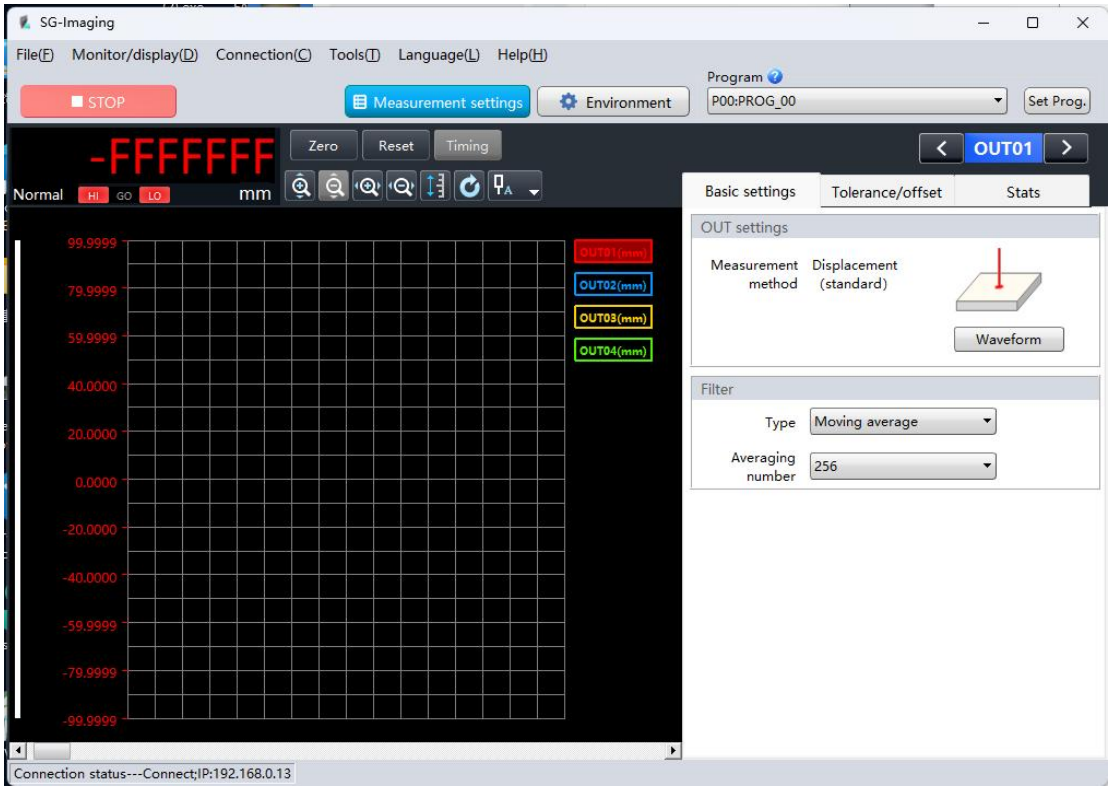
- It's unable to run multiple SG-Imaging instances.
- When you start two or more SG-Imaging instances, the screen will display a message indicating that [SG-Imaging has been started].
- The controller cannot communicate when in "Program Setting Mode".

Starting in online mode

1. **Connect the computer and controller with SG-Imaging installed using an Ethernet cable.**
   [PC Communication Settings] (Page 57).

2. **From the Windows Start menu, select "All Programs" - "SG-Imaging" - "SG-Imaging.exe". Alternatively, double-click the SG-Imaging icon on the desktop.**

SG-Imaging starts and automatically reads the settings of the controller.



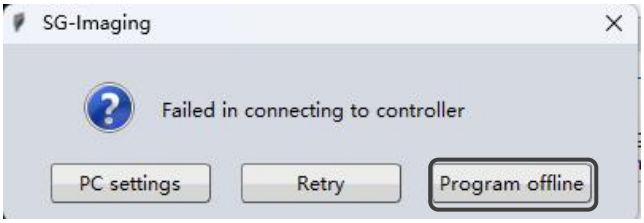
If the connection to the controller fails, please click [PC Communication Settings] to confirm if the IP address of the controller is correct.

■ Starting in offline mode

1. **Ensure that the computer with SG-Imaging installed is not connected to the controller.**
2. **From the Windows Start menu, select "All Programs" - "SG-Imaging" - "SG-Imaging.exe". Alternatively, double-click the SG-Imaging icon on the desktop.**

SG-Imaging starts and displays a prompt message.

3. **Click [to Offline Mode].**

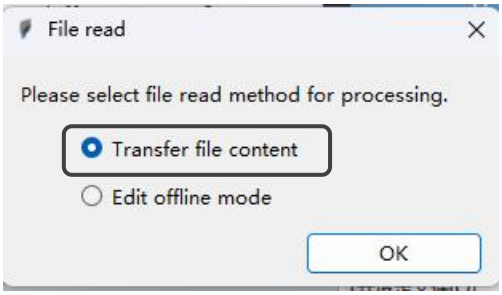


Display the [Settings Selection] screen.

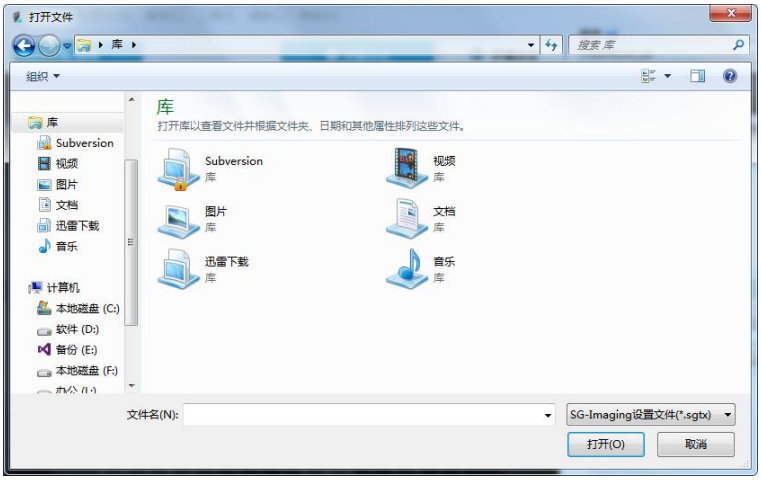
4. **Select the settings displayed at startup**

- **When reading from a file**

Select [Reading a File], click [OK].



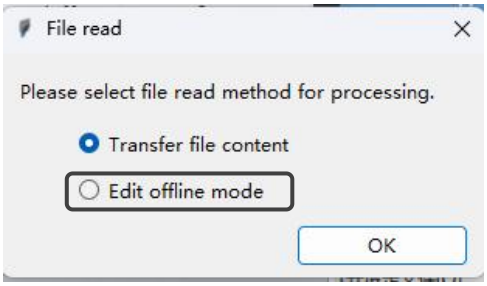
Please select the "SG-Imaging settings file (*.sgtx)" on the [Open Files] dialog box, and then click [Open].



🕮 If you click [Cancel], it will start with default values.

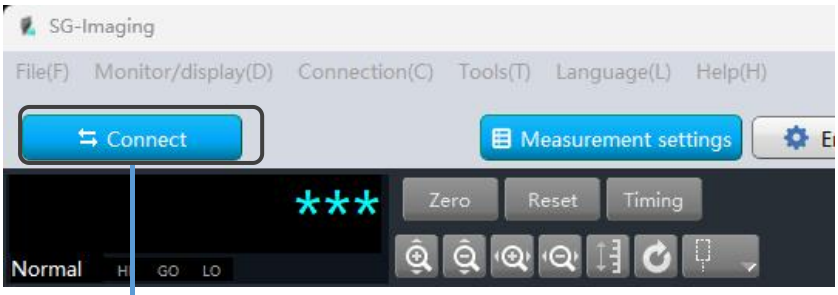
- **When starting with default values**

  Select [Start with default values] and click OK.



  📖 After selecting [Start with default values], the settings of the computer will become the default values. The settings of the controller will not be initialized.

5. **Confirm to start SG-Imaging in offline mode**

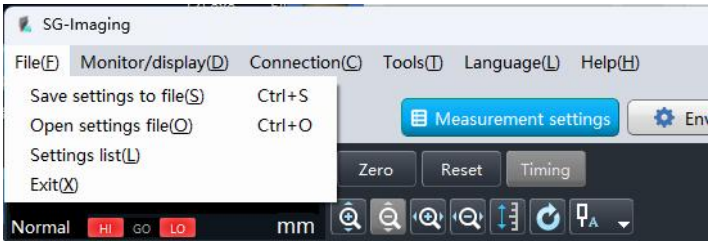


Starting without connecting to the controller (offline mode)

Exit

1. If it's in measuring, click [Stop] to stop SG-Imaging from running.

2. Select the [File] menu ->[Exit].



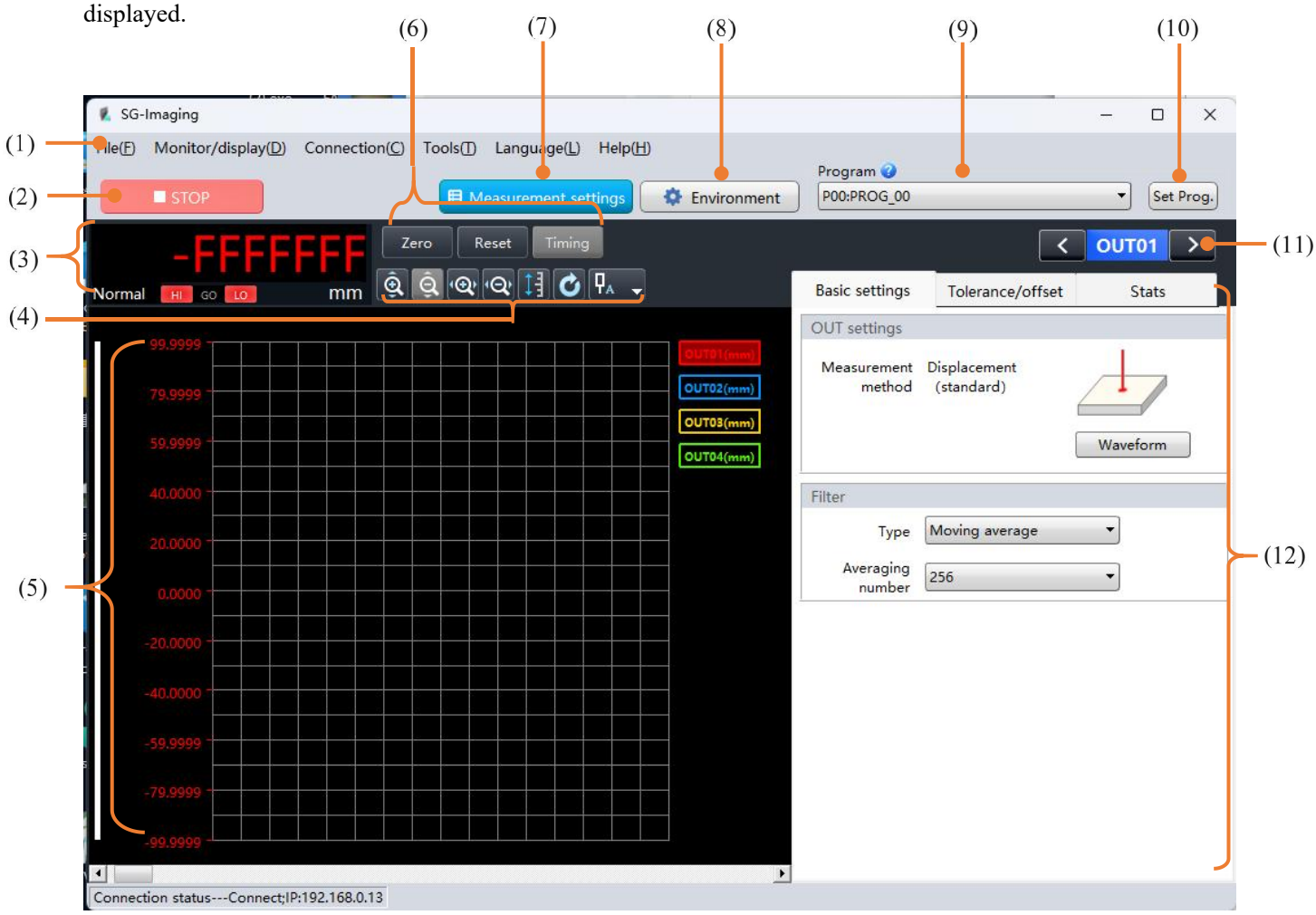
Display the [Confirm Exit] dialog box.

3. **Click "OK"**

Close the screen and exit SG-Imaging.

2.3 The Names and Functions of Each Part of the Master Interface

If the controller is connected and measurement begins, the current measurement value and trend chart will be displayed.



(1) Menu Bar

Select menus for settings. (Page 13)

(2) [START] / [STOP] button

Switch to start or obtain measurement values from the trend chart. (When communication is not established, display the [Connect] button for starting communication.)

(3) Measurement values display area

Display the current measured values and determined results. (Page 15)

(4) Buttons to change waveform display

Change the display mode of the waveform. (Page 16)

(5) Trend chart displaying area

Use a trend chart to display the temporal variation of measured values.

(6) Buttons for measurement processing

Perform "zero", "timed", and "reset" processing on the measured values. (Page 16)

(7) [Measurement Settings] button

Set the program content currently in use (system settings, measurement methods). (Page 22)

(8) [Environment Settings] Button

Display the [Environment Settings] screen. (Page 44)

(9) Programs displaying area

Display the program currently in use. The program used can be changed from the drop-down menu. (Page 19)

(10) [Settings] Button

Display the [Program Settings] screen and perform program initialization, copying, etc. (Page 16)

(11) Displaying OUT number

Display the OUT changes in the trend chart, and you can use < > to switch the OUT number.

(12) Data displaying area

1) [Basic Settings] tab, [Tolerance/Offset] tab

Display the main setting conditions. If the setting is changed, it will be applied immediately.

2) [Statistics] tab

Display statistical information for cursor A/B.

Menu Bar

Select menus for settings.

[File] Menu

Options	Description
Save settings to a file	[Save settings to a file] (Page 51)
Open settings file	[Read Setting Files] (Page 51)
List of setting values	[Display settings content] (Page 52)
Exit	[Exit SG-Imaging] (Page 11)

[Monitor / Display] Menu

Options	Description
Measured value monitoring	[Measured value monitoring] (Page 53)

[Communication] Menu

Options	Description
PC communication settings	🕮 [PC Communication Settings] (Page 57)
Connect/Disconnect	Switching connections or disconnecting from controllers
Send the set value to the controller	Send the set values created on SG-Imaging to the controller
Receive set values from the controller	Read the set values from the controller into SG-Imaging.
Factory reset	Restore the settings to factory settings. (The content of the environment settings will be initialized)

[Tools] Menu

Options	Description
Data memory	🕮 [Data memory] (Page 58)

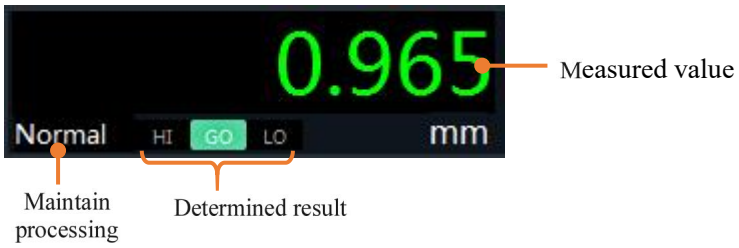
[Help] Menu

Options	Description
Display "Help"	Display "Help" for SG-Imaging (this Manual).
Version	Display the version information of SG-Imaging.
Upgrading	Upgrading for the controller and sensing head.
Registration	Registration for Software License

Measured value displaying area

Display the current measured values and determined results.

When the measured value is within the tolerance range, the measured value is displayed as "green", and the [GO] highlights for the determined result.



When the measured value is outside the tolerance range

The measured value is displayed in "red", and the [HI] or [LO] highlights for the determined result.

When it's unable to measure

The display of the measured value changes to "-FFFFFF", and [HI] and [LO] highlight for the determined result.

When the determination in standby mode

The display of the measured value changes to "------", no signs highlight anyway.

Buttons to change waveform display

Display the current measured values and determined results.

Options	Description
 **Vertical zoom in**	Zoom in/out on the vertical direction of the trend chart.
 **Vertical zoom out**	
 **Horizontal zoom in**	Zoom in/out on the horizontal direction of the trend chart.
 **Horizontal zoom out**	
 **Vertical automatic adjustment**	Automatically adjust the vertical scale of the trend chart according to the measured values.
 **Restore**	Restore the display of the trend chart.
 **Hide the cursor**	Switch the display and selection of the cursor on the trend chart.
 **Select cursor A**	
 **Select cursor B**	
 **Select cursor AB**	

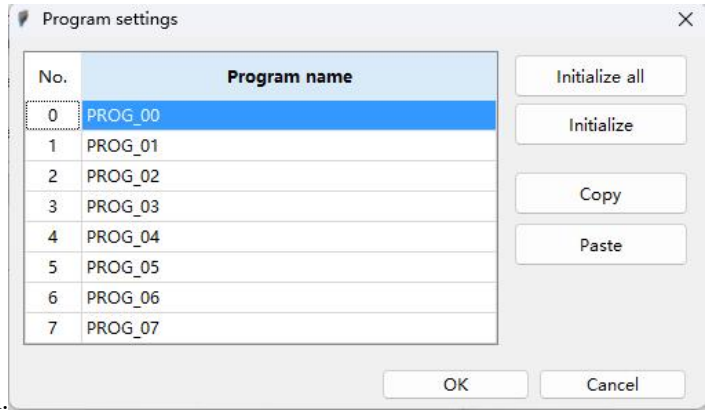
Buttons for measurement processing

Options	Description
	Switch the enable/disable of the zero function. [Automatic zeroing function] (Page 19)
	Switch the enable/disable of timed input. [Maintain processing] (Page 39)
	Restore inputs [Maintain processing] (Page 39)

Settings button

Click the [Settings] button to display the [Program Settings]

screen.



Initialize All

Perform initialization processing on all programs.

Initialize

Perform initialization processing on the selected program.

Copy

Copy the settings of the selected program.

Paste

Paste the copied program settings onto the selected program.

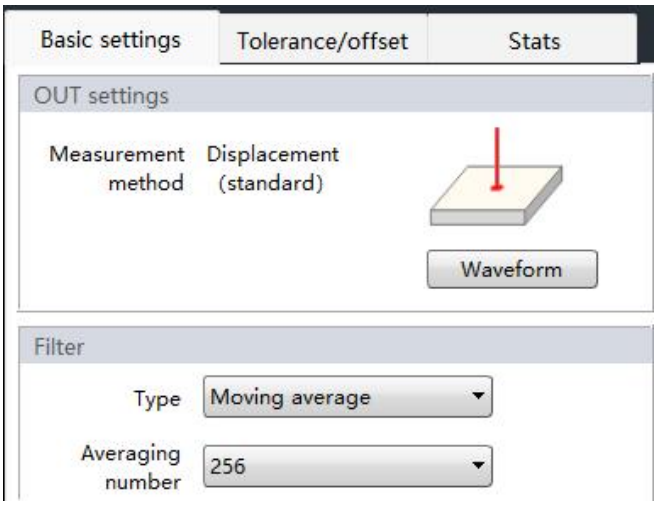
📖 [Environment Setting] is not a processing object for initializing/copying/pasting.

Data displaying area

[Basic Settings] tab

Display information on the [OUT Settings] and [Filter] of the current program being used.

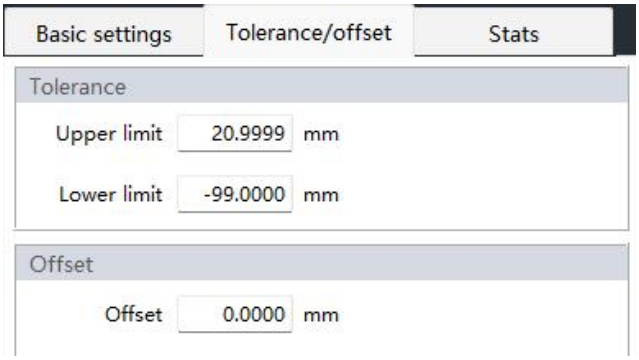
- If the setting of the filter is changed, it will be applied immediately.
- You can also confirm the display of the photosensitive waveform.



[Tolerance/Offset] tab

Display information on the current [Tolerance] and [Offset] of the program being used.

If the setting is changed, it will be applied immediately.

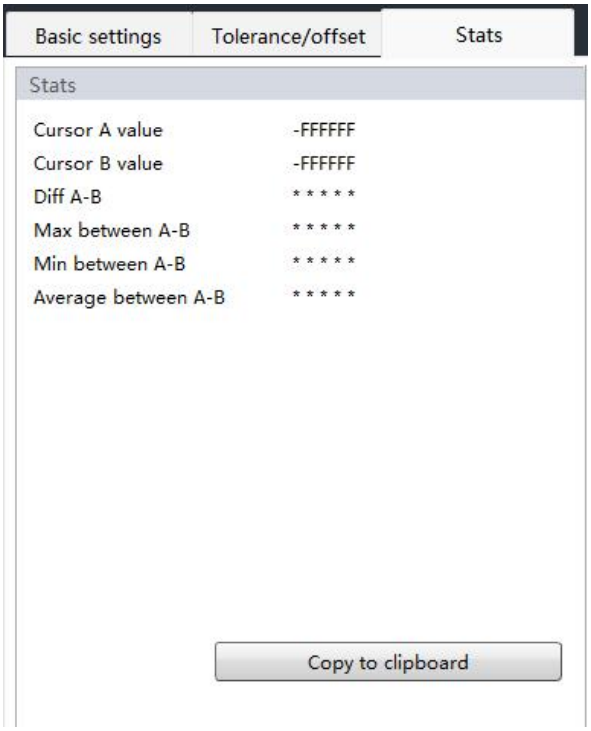


[Statistics] tab

Display the [statistics] of the current program being used.

Click [Copy to clipboard], the statistical information will be copied to the clipboard in text format.

Statistical information can also be pasted into Excel files or other locations using the paste operation (Ctrl+V).



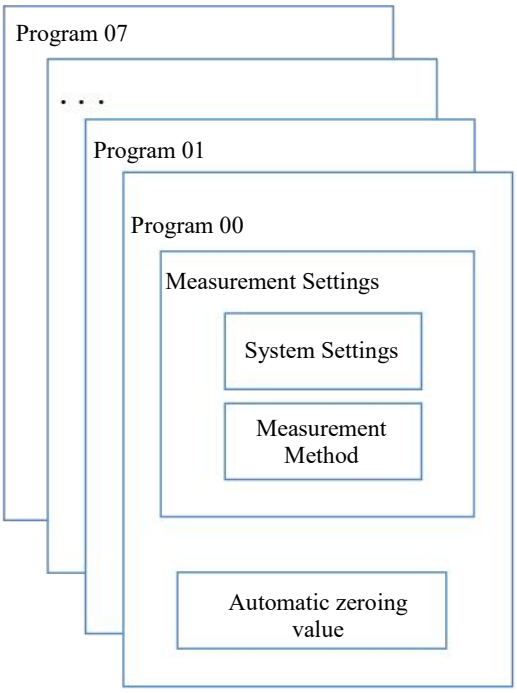
The following is an example of pasting into an Excel form.

Cursor A measured value	0.973	
Cursor B measured value	0.973	
Cursor A-B	0.000	
Maximum value between cursor A-B	0.973	
Minimum value between cursor A-B	0.973	
Average value between cursor A-B	0.973	

Program functions

This machine can switch between 8 programs (program numbers 00 ~ 07).

Log in various settings corresponding to different measurement objects as programs. You can call up the program to change settings as needed.



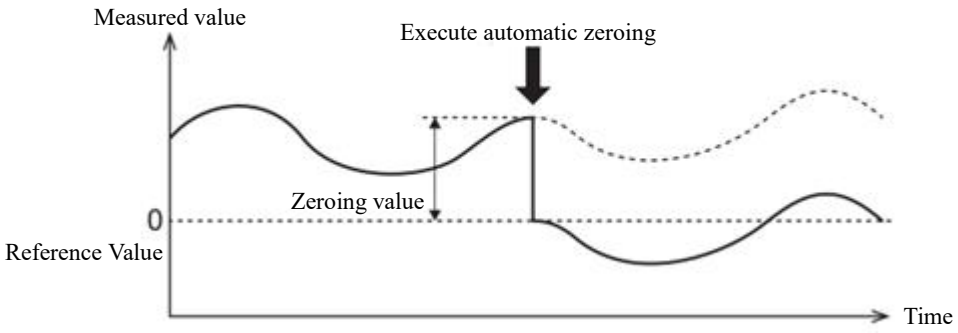
🕮 Environment settings are shared among all programs and it's not switched for any single program.

You can switch programs through the following methods.

- SG-Imaging： 🕮 [The Names and Functions of Each Part of the Master Interface] (Page 12)
- Communication commands: 🕮 [Switch program number] (Page 74)

Automatic zeroing function

This function can instantly change the measured value to 0.



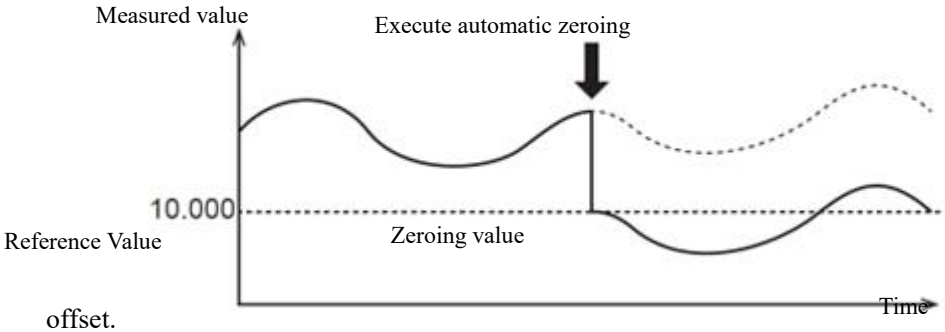
- Under the following circumstances, automatic zeroing cannot be performed (automatic zeroing can be released).
  - Checking standby mode (display ------)

- Outside the display range (display ±FFFFFF)
- Invalid data (display -FFFFFF)

- The values that are automatically zeroed will be saved according to each program number and each OUT number.
- The values that are automatically zeroed will also be saved when the power is turned off.
- When the Maintain processing is not normal, the system will enter standby mode ("------") after setting automatic zero.
- Automatic zeroing is the process performed on measured values that have already undergone Maintain processing (Page 39)

Usage example

When aligning the standard workpiece at 10.000, please perform automatic zeroing after setting the offset.



Execute/Release Automatic Zeroing

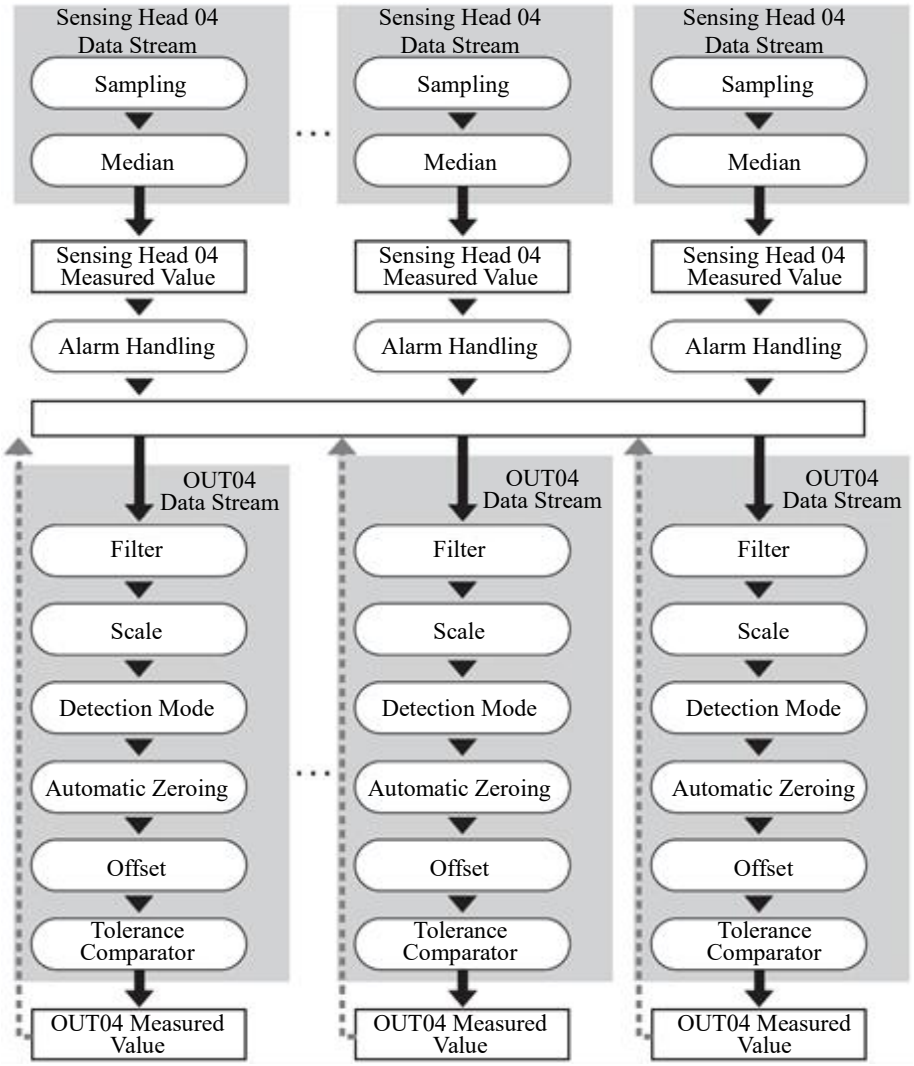
The following methods can be used to execute/deactivate automatic zeroing.

- **Reset to zero through communication commands**
  - Set **ON/OFF** for automatic zeroing as "**ON**", execute the automatic zeroing request and perform automatic zeroing on any specified OUT.
  - Set **ON/OFF** for automatic zeroing as "**OFF**", execute the automatic zeroing request and release automatic zeroing on any specified OUT.
- Reset to zero through button operation on SG-Imaging
  - **Click on the synchronous zero button on the "measured value monitoring" screen**
    Switch execution or release automatic zeroing for the specified synchronization setting of the OUT.
  - **Click the [Zero] button in each OUT display area**
    Switch execution or release automatic zeroing for each displayed OUT.

3 Measurement Settings

3.1 Processing Flow of the Measured Data

Up to 4 sensing heads can be used for synchronous measurement on this machine. Additionally, up to 4 measurement methods (OUT01 ~ OUT04) can be used simultaneously to perform measurements. Each sensing head can perform measurements separately and calculate measurement values between sensing heads.

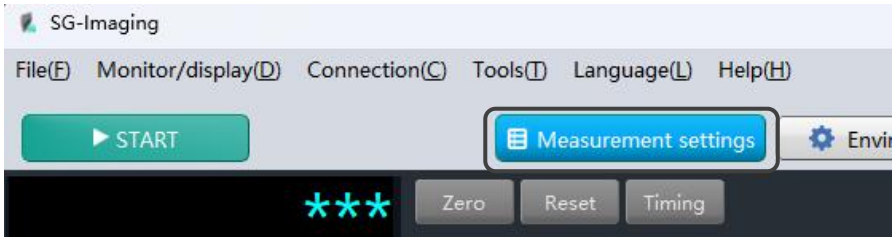


🕮 The measurement values from OUT01 to OUT04 can be used up to three times in the calculation.

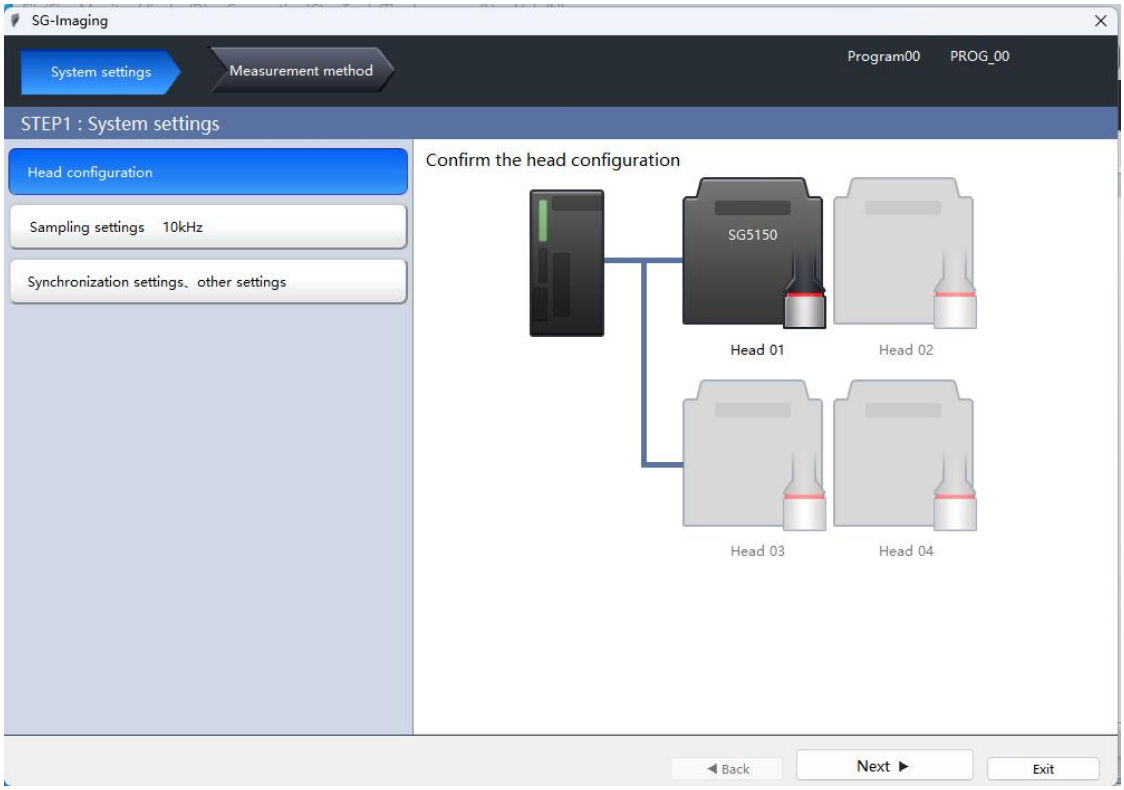
3.2 Process of Measurement Setting

Click the [Measurement Settings] button on the master screen to display the settings screen for each STEP.
Set according to the screen display, and then transmit the set content to the controller to perform measurements.

1. Click the [Measurement Settings] button



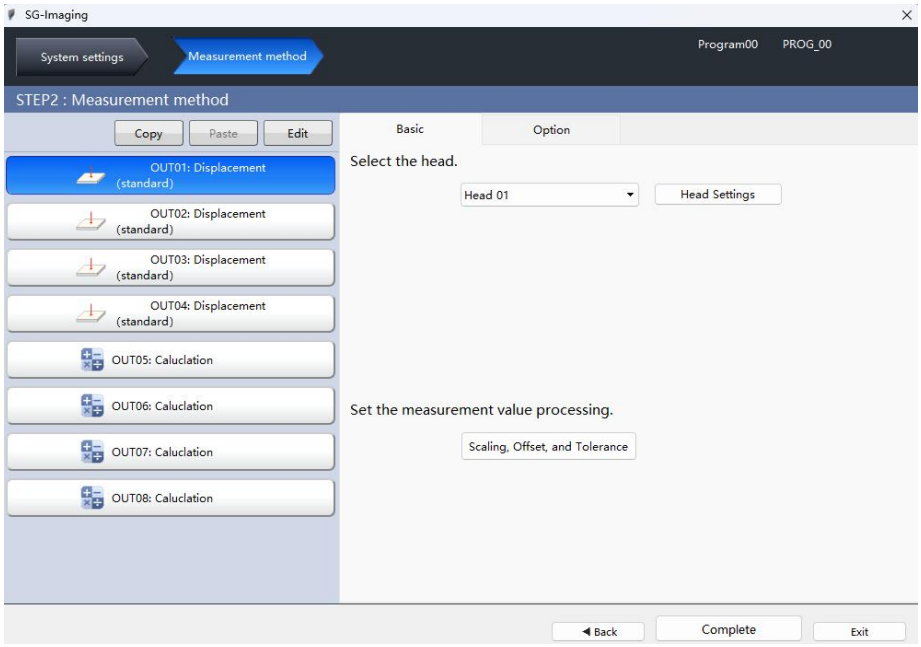
2. Execute [STEP1: System Settings].



［STEP1: System Settings］(Page 24)

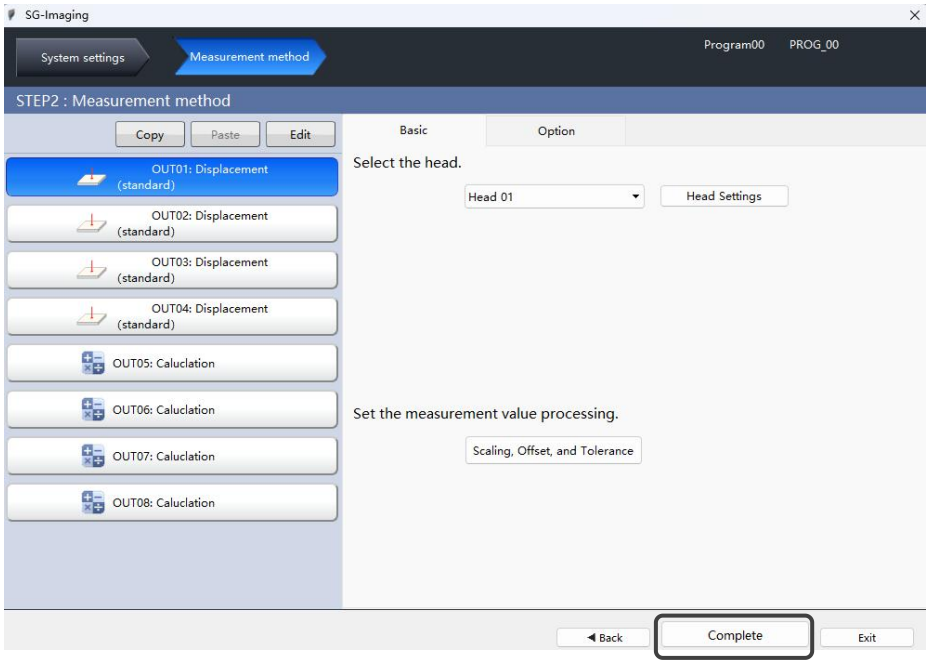
3. After setting, click [Forward].

4. Execute [STEP2: Measurement Method].



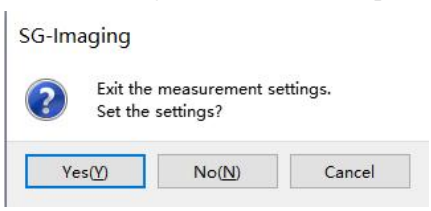
[STEP2: Measurement Method] (Page 26)

5. After setting, click [Completed].



Perform measurements based on the set content.

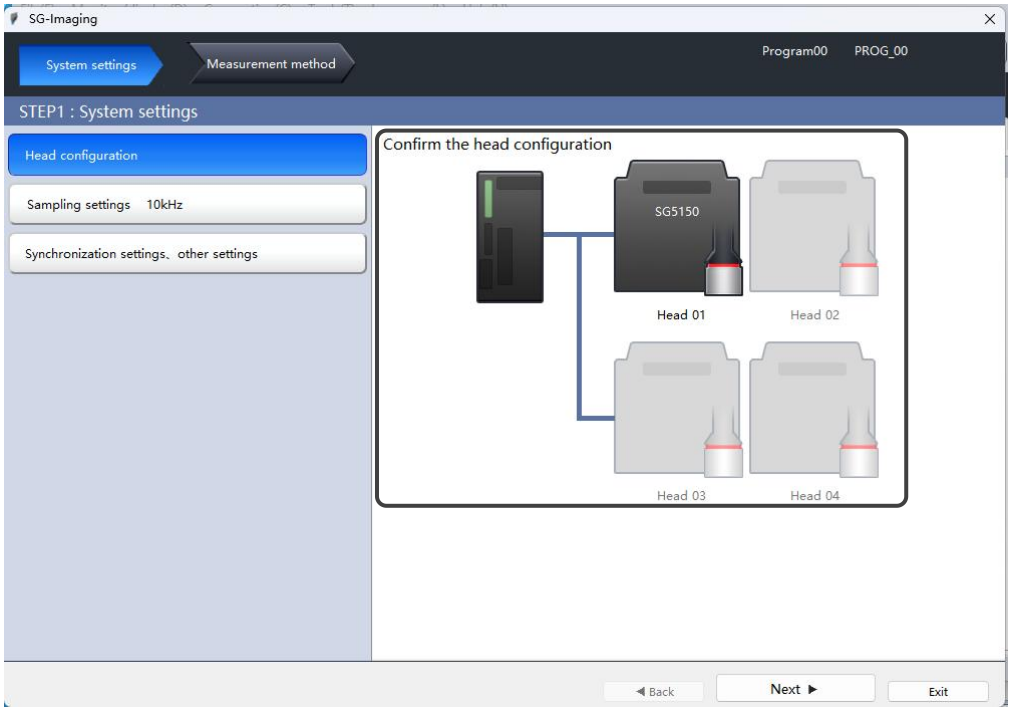
If you click [Exit] during the setting process, a confirmation screen will be displayed. If you need to send the current settings to the controller, please click [Yes] button.



3.3 STEP 1: System Settings

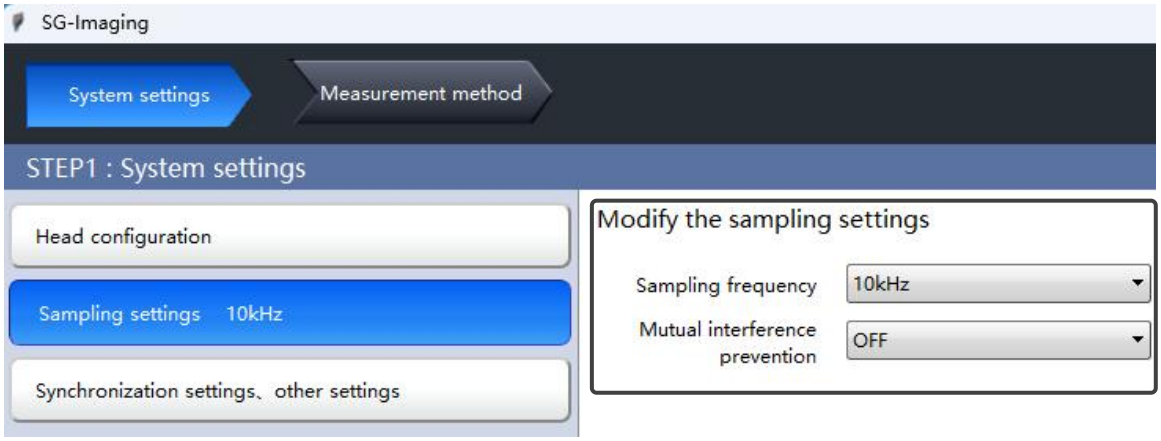
Sensing Head Configuration

Confirm if the configuration of the sensing head connected to the controller is consistent.



Sampling Settings

The sampling period includes the time to obtain the photosensitive waveform and measure the distance to the measured object.



Sampling frequency

Select the sampling frequency.

(SG5000 series: 590kHz/400kHz/200kHz/88kHz/50kHz/20kHz/10kHz/5kHz/2kHz/1kHz)

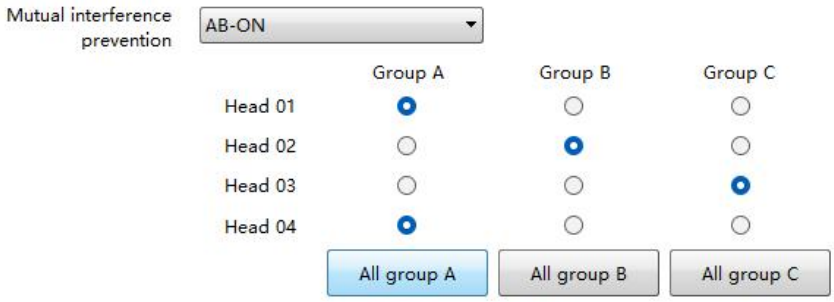
(SG3000/SGI series: 88kHz/50kHz/20kHz/10kHz/5kHz/5kHz/2kHz/1kHz)

(SC series: 10kHz/5kHz/2kHz/1kHz/0.5kHz)

Prevent mutual interference

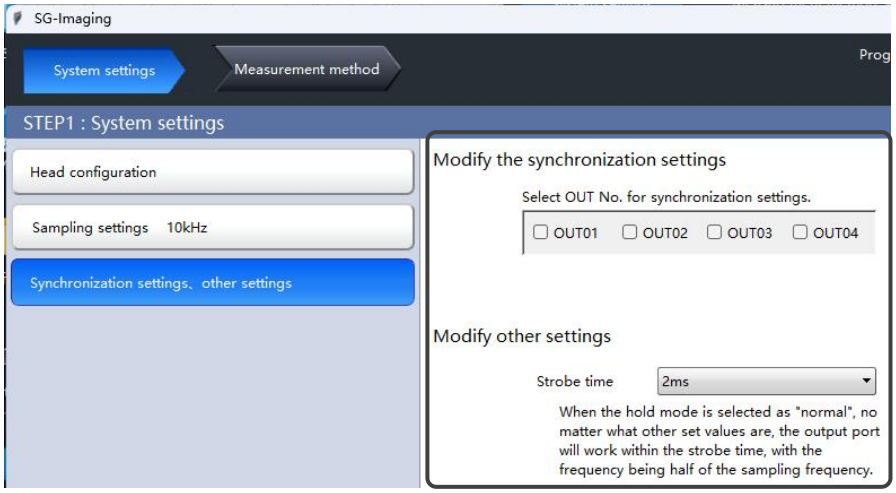
By using this function, it is possible to avoid the illumination time of multiple sensor heads when using them simultaneously, in order to avoid the mutual influence of sensor head light.

- OFF: Simultaneously emit light and sample.
- ON: Assign each sensing head from Group A to Group C. This setting can assign the sensing head to up to three groups A to C and allow these groups to alternately emit light to prevent interference with each other.



When setting the anti-interference function to AB-ON, the sampling period is twice the specified value; When the anti-interference function is set to ABC-ON, the sampling time is three times the specified value.

Synchronous settings, other settings



Synchronous settings

This function is used to set whether to use synchronous input control for each OUT.

Gating time

This function is used to set the time to turn on the gating output (single pulse output time).

There are four types of pulse widths available: 2ms/5ms/10ms/20ms.

3.4 STEP 2: Measuring Method

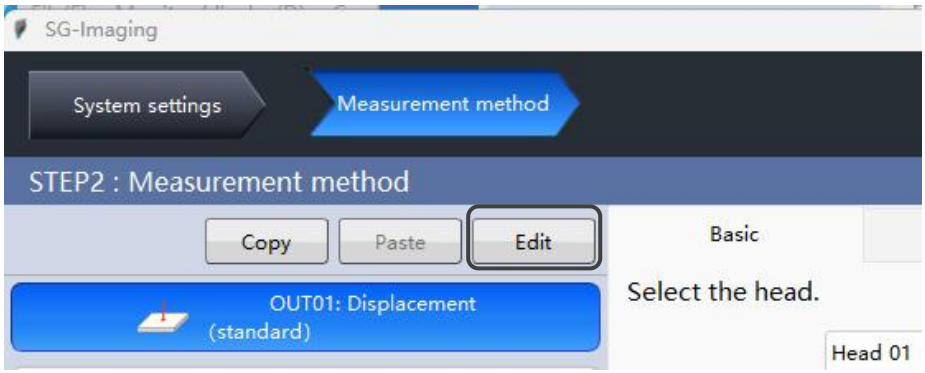
Four measurement methods (OUT01 ~ OUT04) can be set. There are six measurement methods.

📖[Displacement (standard)] (Page 26)
📖 [Displacement (semi-transparent object)] (Page 28)
📖[Displacement (Transparent Object)] (Page 29)
📖 [Displacement (Transparent Object 2)] (Page 31)
📖[Displacement (reflective resin)] (Page 31)
📖 [Calculation] (Page 31)

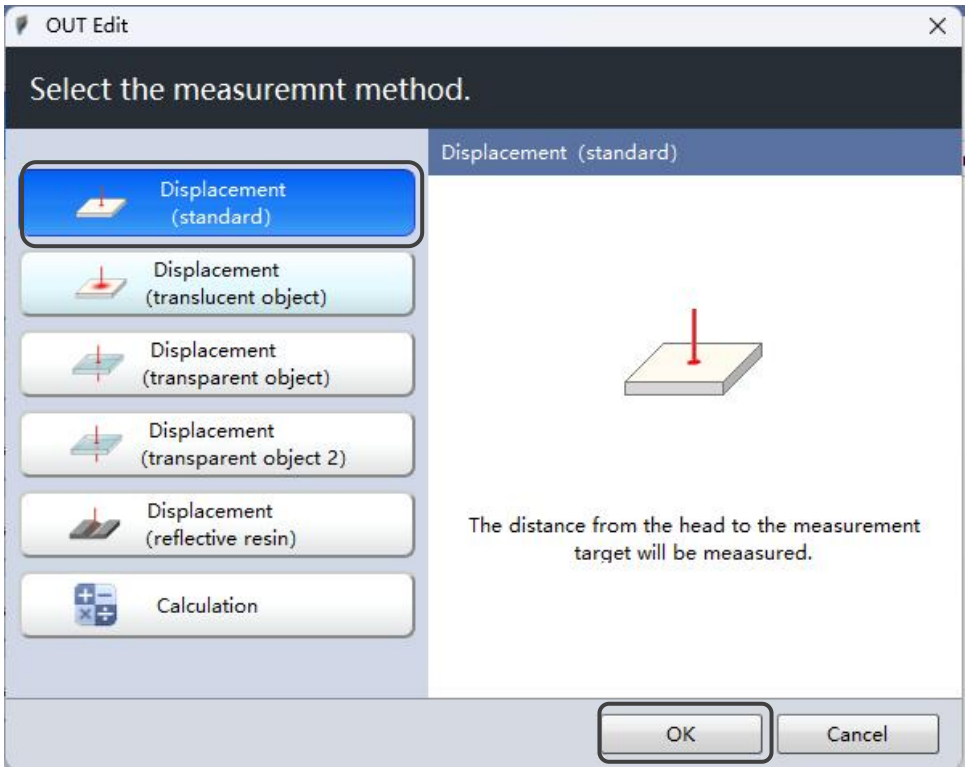
Displacement (standard)

When measuring the height, displacement, positioning, vibration, bending, shape, etc. of an object (non-transparent object), select this option.

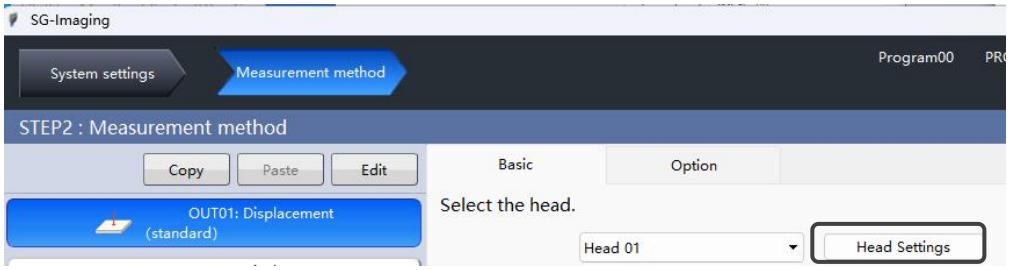
1. Click the OUT button you want to set, such as OUT01, and click [Edit].



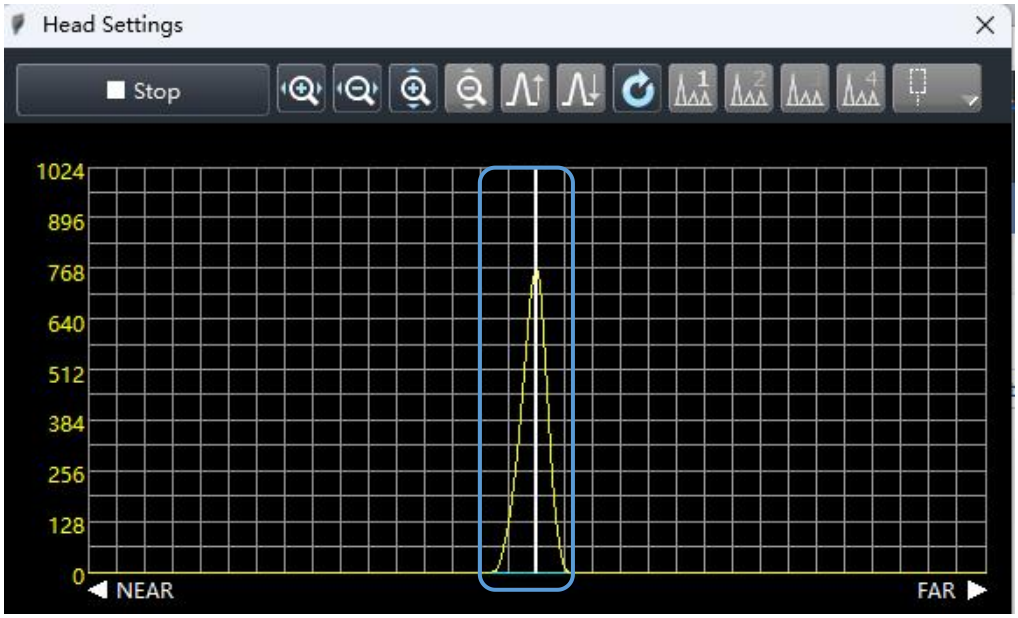
2. Select [Displacement (standard)] and click [OK].



3. Click on [Sensing Head Setting Value].



4. Confirm that a "white line" is displayed on the peak waveform.



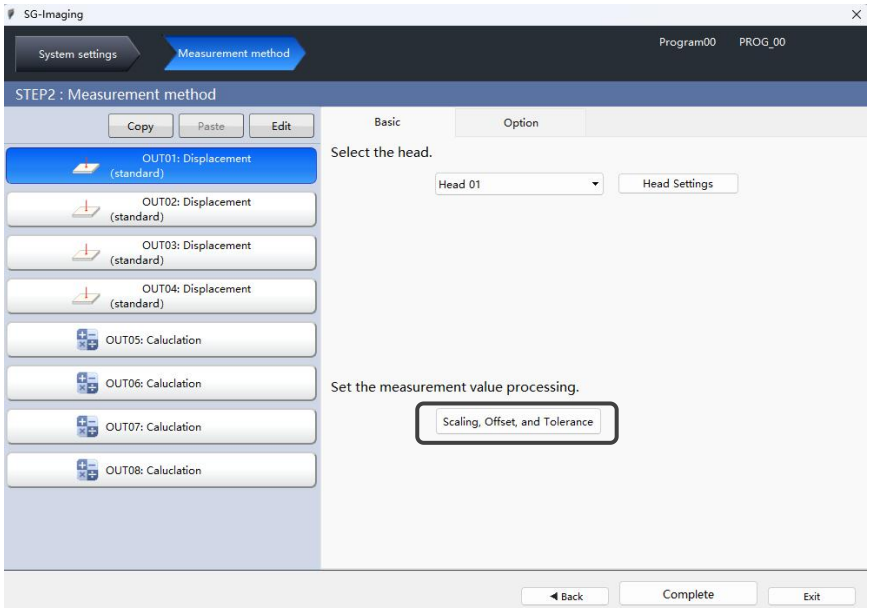
For details, please refer to 🕮 [Sensing Head Setting Value] (Page 33).

🕮 If there is no "white line", it may be mainly caused by the following reasons.

Reasons	Troubleshooting
The measurement object is outside the measurement range	Please check the location of the measurement object
The amount of reflected light of the measured object is too low	Please reduce the sampling frequency

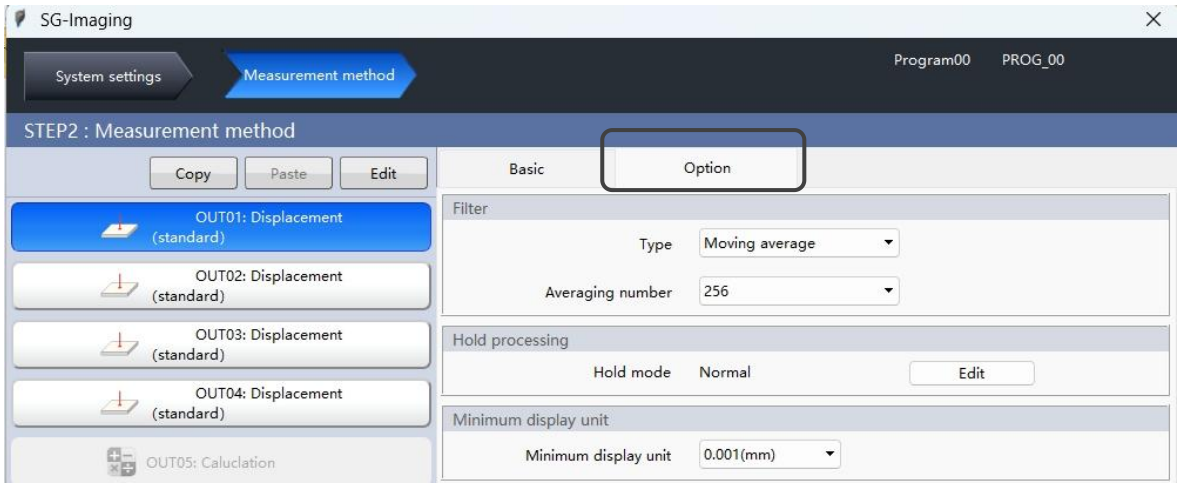
5. Click [OK] to close the [Sensing Head Setting Values] screen.

6. Click on [Zoom, Tolerance Settings] as needed to set the processing of measured values.



For details, please refer to 🕮 [Zoom, Tolerance Settings] (Page 38).

7. Click on the [Options] tab as needed to set the options.



For details, please refer to 🕮[Option settings] (Page 39).

Displacement (Semi-transparent Object)

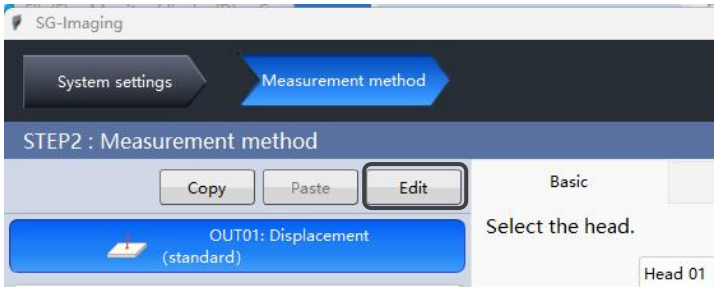
Use this option when the target will absorb laser brightness, such as semi-transparent plastics.

Please refer to 🕮 [Displacement (standard)] (Page 26) for the measurement method settings of semi-transparent objects.

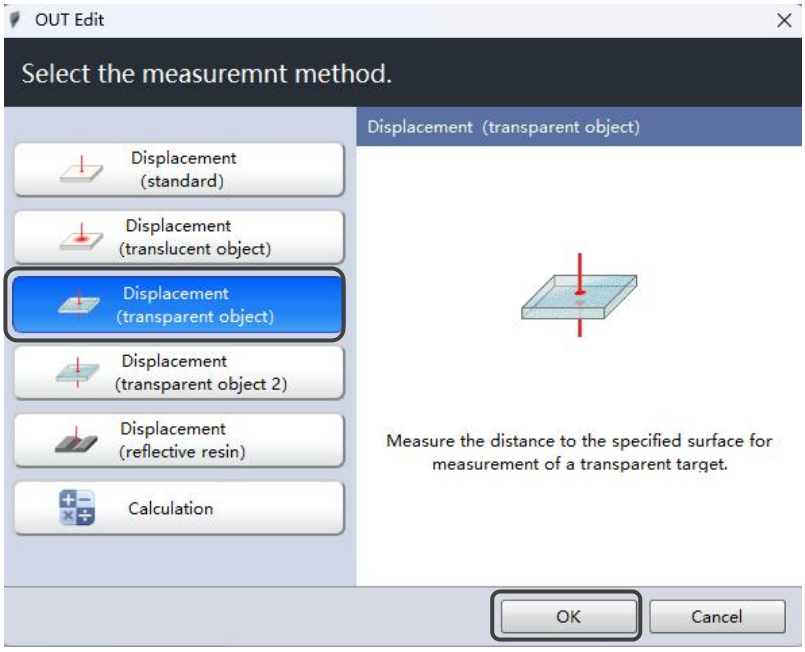
Displacement (Transparent Object)

When measuring the height, displacement, positioning, vibration, bending, shape, etc. of transparent objects, select this option. This option is used when the reflectivity values of multiple surfaces of transparent objects are the same.

1. Click the OUT button you want to set, such as OUT01, and click [Edit].

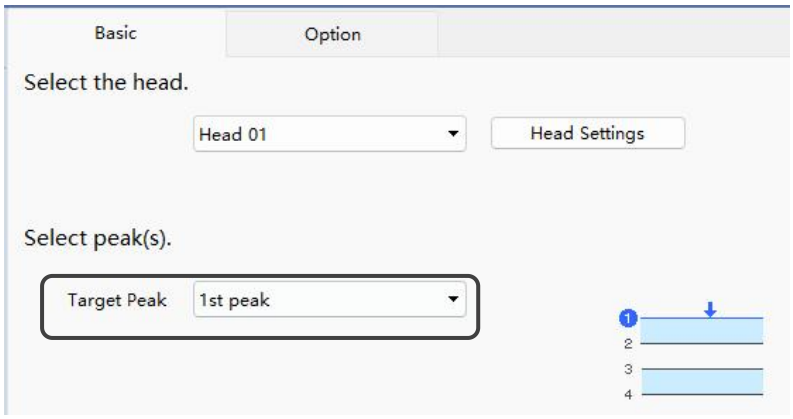


2. Select [Displacement (Transparent Object)] and click [OK].

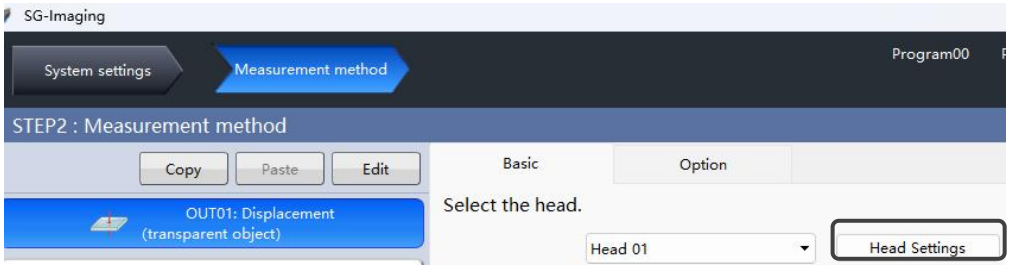


3. Set the surface you want to measure.

- When measuring the displacement on the surface of a transparent object, set the peak value of the measured object to [The first peak value] as shown in the following picture.
- When measuring the displacement of the back of a transparent object, set the peak value of the measured object to [The second peak value].

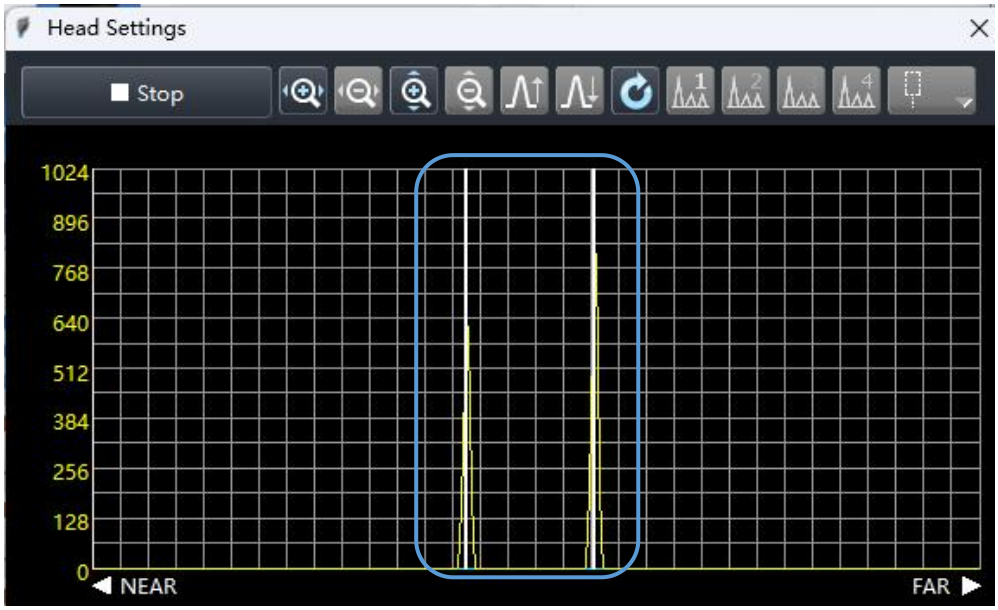


4. Click on [Sensing Head Setting Value].



5. Confirm that "white lines" are displayed on both peak waveforms.

When the measured surface (of transparent object) is detected, the two peak waveforms of "surface reflection" and "back reflection" of the transparent object will display "white lines" respectively.



For details, please refer to 🕮 [Sensing Head Setting Value] (Page 33).

🕮 If there is no "white line", it may be mainly caused by the following reasons.

Reasons	Troubleshooting
The measurement object is outside the measurement range	Please check the location of the measurement object
The amount of reflected light of the measured object is too low	Please reduce the sampling frequency

6. Click [OK] to close the [Sensing Head Setting Values] screen.

7. Click on [Zoom, Tolerance Settings] as needed to set the processing of measured values.

For details, please refer to 🕮 [Zoom, Tolerance Settings] (Page 38).

8. Click on the [Options] tab as needed to set the options.

For details, please refer to 🕮[Option settings] (Page 39).

Displacement (Transparent Object 2)

When measuring the height, displacement, positioning, vibration, bending, shape, etc. of transparent objects, select this option. This option is used for multiple surfaces of transparent objects, such as when the reflectivity values of the front and back are different (up to four surfaces).

🕮 The sampling frequency of transparent object 2 cannot exceed 20kHz.

Please refer to 🕮 [Displacement (Transparent Object)] (Page 29) for the measurement method settings of Transparent Object 2.

Displacement (Reflective Resin)

This option is suitable for plastic objects with strong surface reflection.

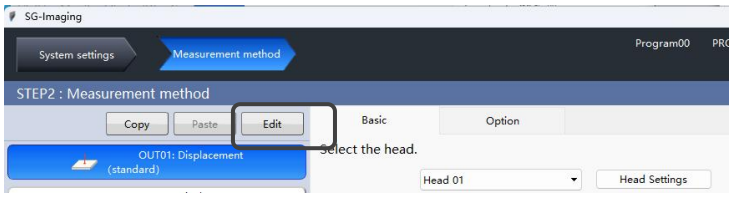
Please refer to 🕮 [Displacement (standard)] (Page 26) for the measurement method settings of reflective resin objects.

Calculation

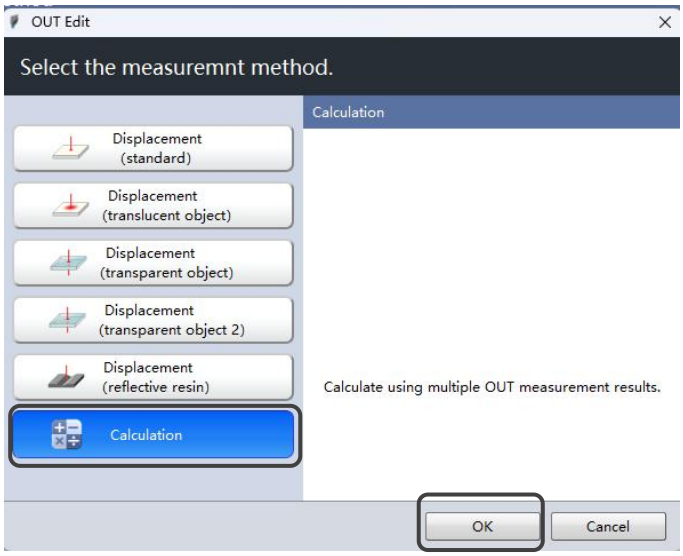
When only one OUT (measurement method) cannot obtain the desired value, select this option.

- **It's unable to set only calculations for OUT.**
- **Please set the OUT calculation when other measurement methods have already been set.**

1. Click the OUT button you want to set, such as OUT01, and click [Edit].



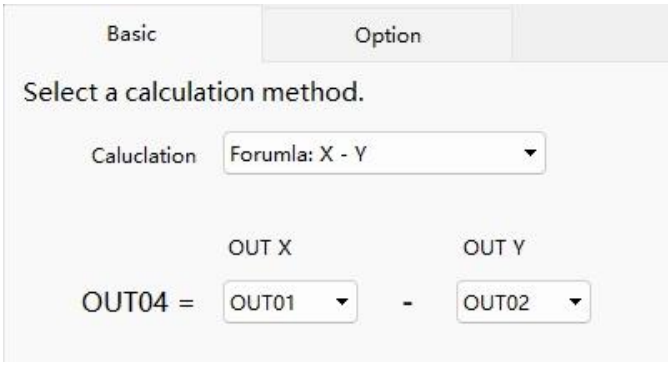
2. Select [Calculation], and then click [OK].



3. Select the calculation method and set [Formula] or [Object OUT].

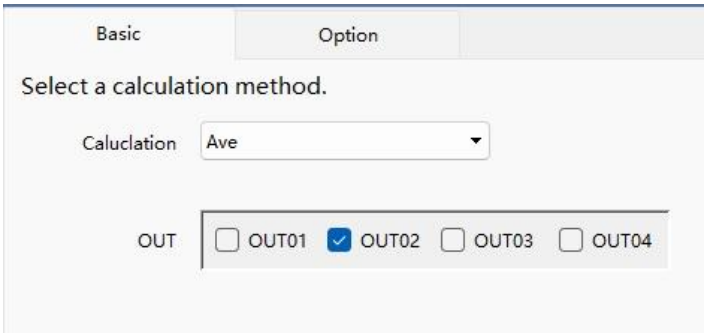
When selecting [Formula]

Set the Object OUT used in the formula.



When selecting [Ave/P-P/Max/Min]

Check the checkbox for the Object OUT of the calculation.



- Ave: Calculate the average value of the Object OUT.
- P-P: Calculate the maximum - minimum value of the Object OUT.
- Max: Calculate the maximum value of the Object OUT.
- Min: Calculate the minimum value of the Object OUT.

Usage example

Use three sensing heads to measure the left, center, and right ends of the object at three points. When calculating the bending amount of the measured object, set it as follows.

- OUT01: Using the sensing head 01
- OUT02: Using the sensing head 02
- OUT03: Using the sensing head 03
- OUT04: [Measurement Method] Calculation: P-P
  [Object OUT] OUT01, OUT02, OUT03

4. Click on [Zoom, Tolerance Settings] as needed to set the processing of measured values.

For details, please refer to 🕮 [Zoom, Tolerance Settings] (Page 38).

5. Click on the [Options] tab as needed to set the options.

For details, please refer to 🕮 [Option settings] (Page 39).

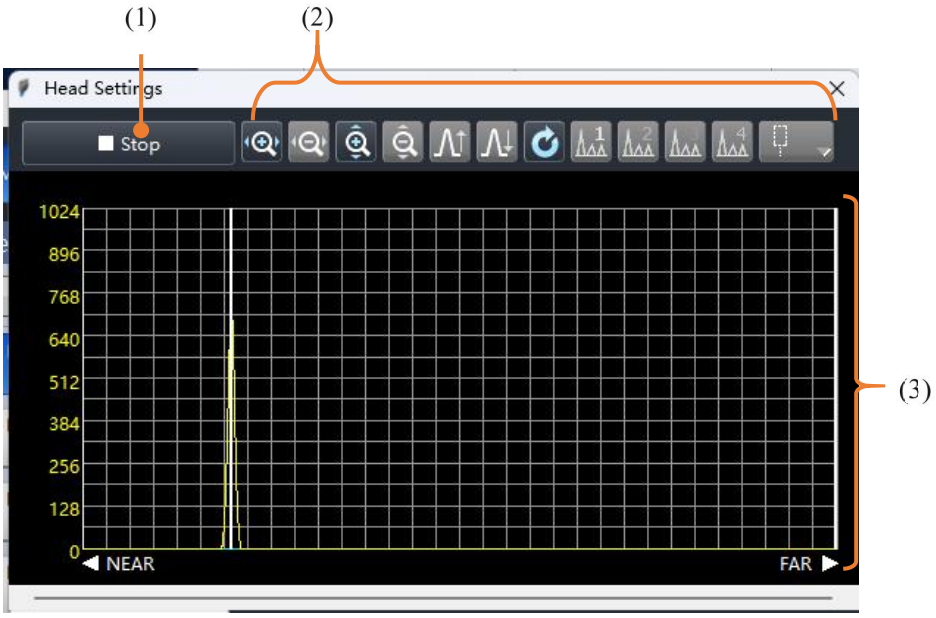
Universal Setting Items

Waveform displaying area

As a standard for determining whether the measurement is correct, confirm the waveform of the photosensitive peak from the measured surface.

All of the following conditions must be met.

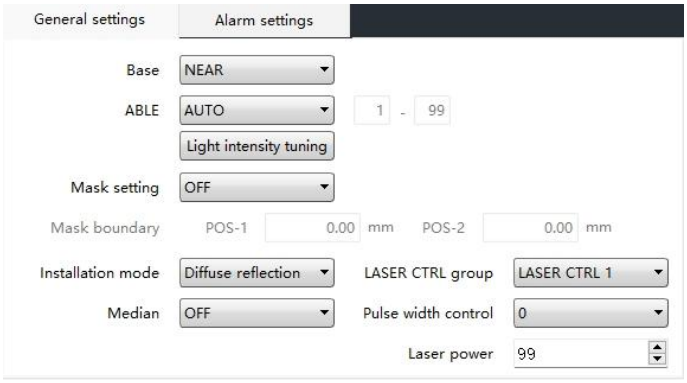
- Stable white line displayed on the photosensitive peak.
- The height of the photosensitive peak is above 10.
- The waveform of the photosensitive peak does not show significant distortion, such as it's divided into two halves around the peak.



📖 When the measurement method is for transparent object 2, it can display the photosensitive peak waveform after processing four ABLE values.

No.	Options	Description
(1)	[Obtaining terminated] / [Obtaining started]	Switch to start/stop obtaining the photosensitive peak waveform.
(2)	Buttons to change waveform display	Change the display mode of the waveform.
(3)	Peak waveform	Display the photosensitive peak waveform.

[Universal Settings] Options



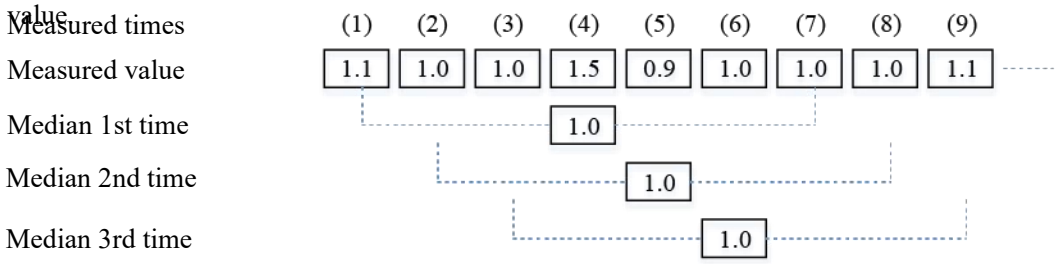
Median

Applying median filters of 7, 15, or 31 points to the measured values can remove sharp changes in the measured values and suppress deviations in the measured values. Set this item when the measured object is moving at high speed.

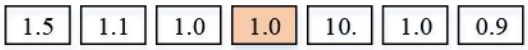
- Setting range: OFF (default), 7, 15, 31

Example of using a median filter with 7 points

Arrange the measured results at 7 points in ascending order, with the central value as the measured value



For example, when the median is executed for the first time, the order from (1) to (7) becomes the following, with the central value of "1.0" being the measured value.



ABLE (Light Quantity Control)

Choose the type for adjusting the amount of light and sensitivity.

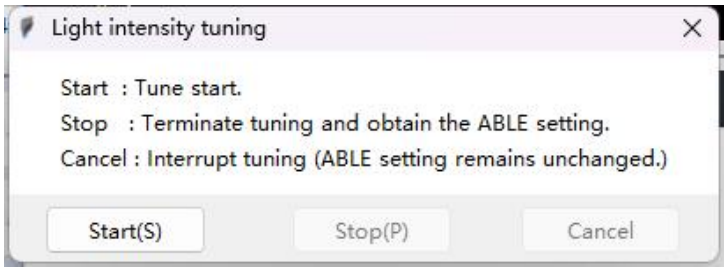
- AUTO: Automatically adjust the appropriate amount of light and sensitivity.
- MANUAL: Adjust the amount of light and sensitivity within the range of 1-99. Choose this option when the period of measuring the reflectivity of an object is fast and there is a significant change.

📖 When measured objects with high reflectivity (mirrors, etc.) are outside the measurement range and an incorrect measured value is detected, select [MANUAL] to lower the upper limit value, which can sometimes be resolved the incorrect measured value.

Tuning the amount of light

Optimize the adjustment range of light amount and sensitivity by measuring the actual measured object.

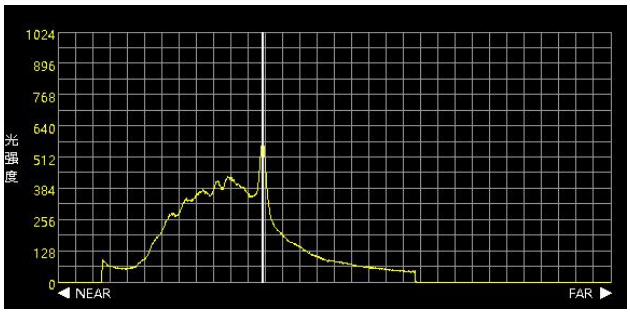
Click [Start] while capturing the actual measured object. After any time, please click [Stop].



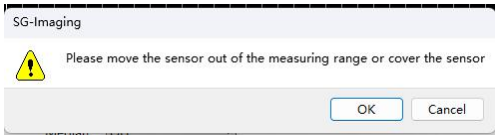
Dark (Only supports SC series point spectral sensors)

By measuring background light and setting an effective threshold, the influence of background light can be eliminated.

When the waveform of the light intensity displayed on the measured object is shown in the following figure, it indicates that the system is affected by background light.

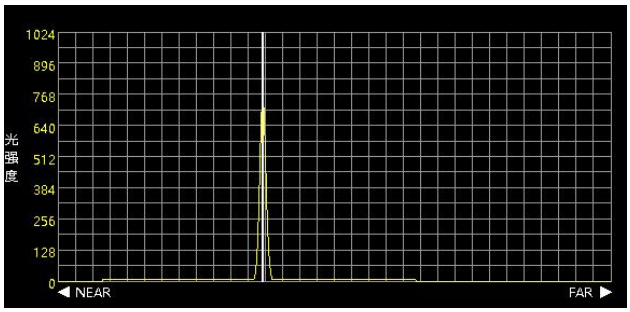


When moving the sensing head out of the measurement range or when the sensing head is obstructed, Dark click and the following prompt will pop up:



After confirming the status of the sensing head, click [OK] to enter the automatic detection process (as shown below).

After completion, the waveform of the light intensity displayed on the measured object is shown in the following figure.



Shielding Settings

Set boundaries and mask the measurement range.

Shielding Boundary

When [Shielding Setting] is ON, specify the shielding boundary with [Boundary 1] and [Boundary 2].

- When [Boundary 1] < [Boundary 2]: the outer sides of [Boundary 1] and [Boundary 2] are shielded.
- When [Boundary 1] > [Boundary 2]: the area between [Boundary 1] and [Boundary 2] are shielded.
- When [Boundary 1] = [Boundary 2]: No shielding is performed.

📖 The boundary of shielding can be set in units of 0.01mm. When it is less than 0.01mm, automatic processing will be performed internally.

Datum point

If there are multiple peaks when using the measurement method of a transparent object, the peak of the distance sensing head NEAR or FAR can be used as the reference point.

LASER CTRL Group

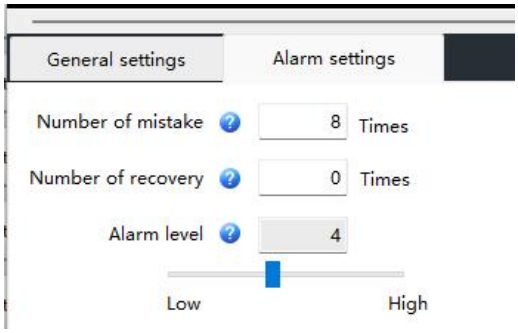
This function is used to control laser operations, such as dividing two or more sensing heads into two groups for on/off operations. This is very useful when the sensing head is used on different production lines.

Reflective selection mode (does not support SC series point spectral sensors)

Set the installation mode of the sensing head (diffuse or mirror reflection).

Choose mirror reflection mode when the object is a mirror, glass panel, or other similar object.

[Alarm Error] Tab



Number of Mistakes

Set the number of cycles to retain the latest valid measured values (setting range: 0 to 9999).

Number of Mistakes	Operation
0	Handle alarms immediately
1~9998	Keep the latest valid measured values
9999	No alarm to be handled

Recovery times

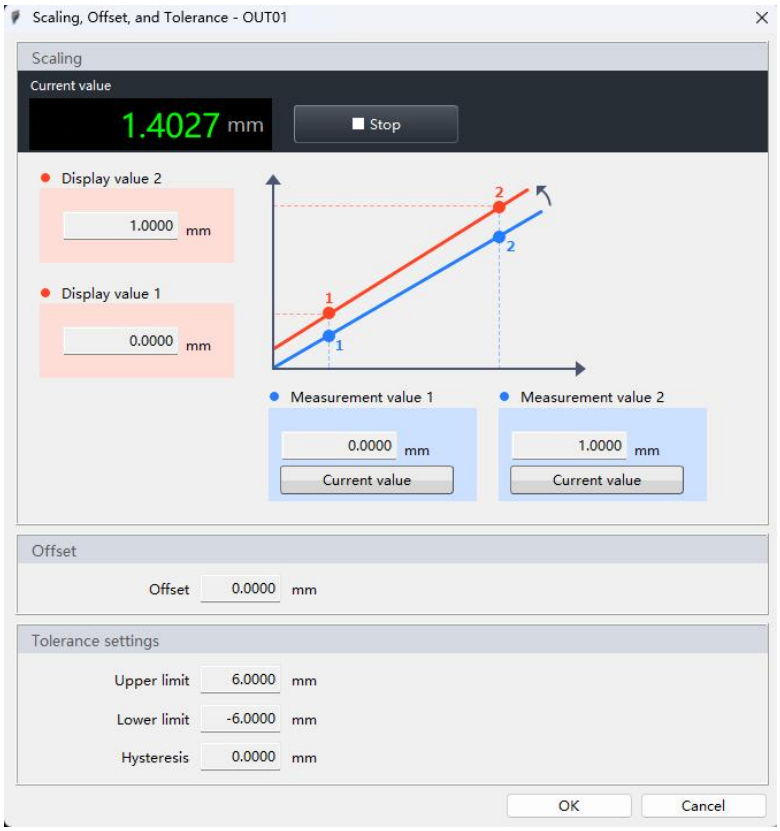
Set the number of cycles measured before recovering from the alarm state (setting range: 0 to 99).

Alarm Level

Set alarm sensitivity from low (0) to high (9) (default value: 4).

- Low (0): reduce the sensitivity of alarm detection
- High (9): Enhance the sensitivity of alarm detection

Zoom, Tolerance Settings



Zoom

The display value of each OUT measured value can be scaled arbitrarily. It is to scale the displayed values for any two points separately.

The measured values obtained by clicking on [Set from Current Value] can be assigned to [Actual Value 1] and [Actual Value 2]

- Scaling must meet the following conditions, otherwise please reset.
  - Actual Value 1 – Actual Value 2 ≠ 0
  - | Display value 2 – Display value 1 | / | Display value 2 – Display value 1 | ≤ 2

Tolerance Comparator

Upper/lower limit value

Set the tolerance (upper limit value, lower limit value) used to determine the measured value.

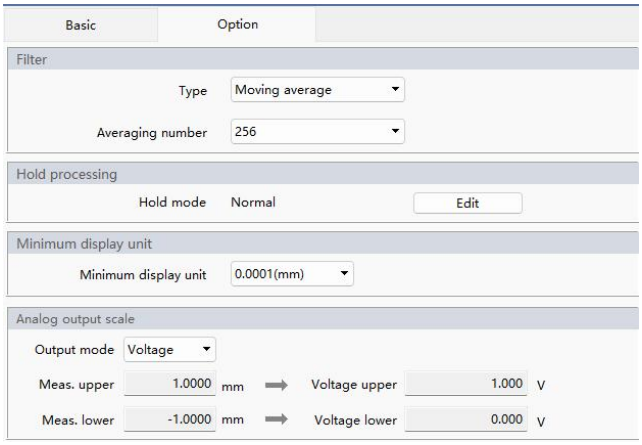
Measured values can be determined according to the following three levels, and the results can be displayed and output.

- When it is above the upper limit value (HI)
- When within the tolerance range (GO)
- When it is below the lower limit value (LO)

Delay

If the measured value is located near the determined value of tolerance and moves up and down, sometimes the determined output will repeatedly between ON or OFF. Setting [Delay] can prevent the occurrence of this state. The defaut delay value before out of factory is set to "None (0.000 mm)"

Option Settings



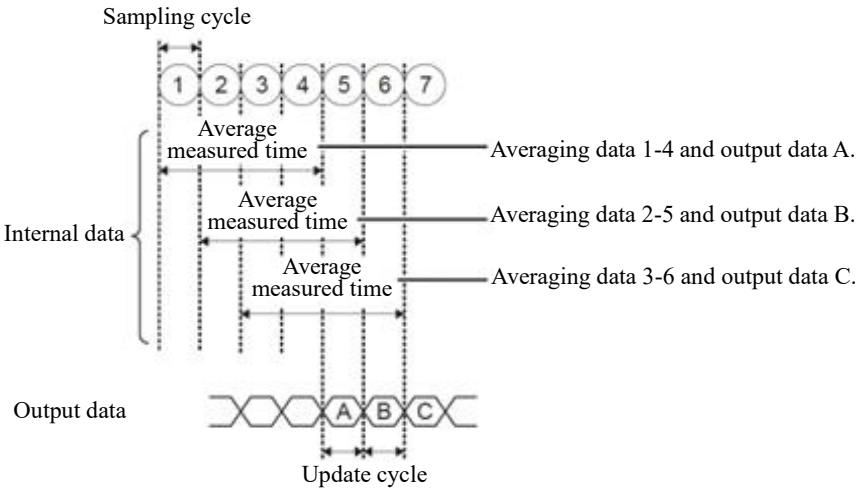
Filter

Perform moving average filtering on the measured values.

- Times of Average: Set the number of measured values to be averaged.

The processing method of moving average

Perform moving average processing on the measured values within the range of 1-262144 times.
The processing for setting 4 averages is as follows.

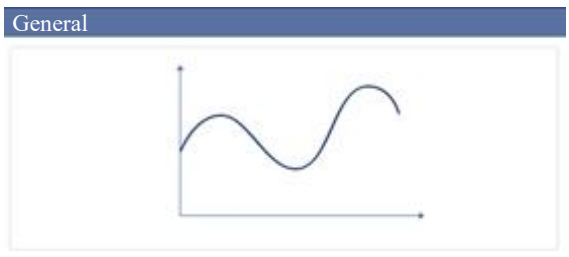


Maintain processing

Choose a method to maintain processing.

General

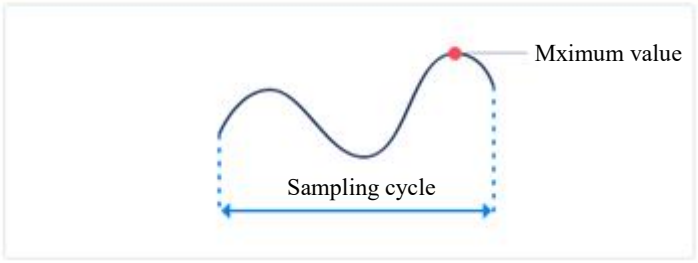
Continuously output measured values.



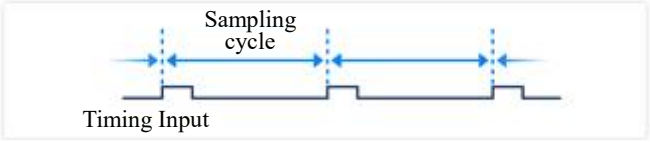
Peak Hold

Output the maximum value during the sampling period.

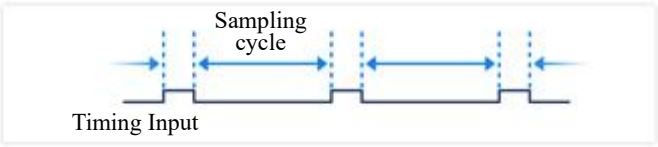
Peak Hold



- Update condition: [External timing 1]



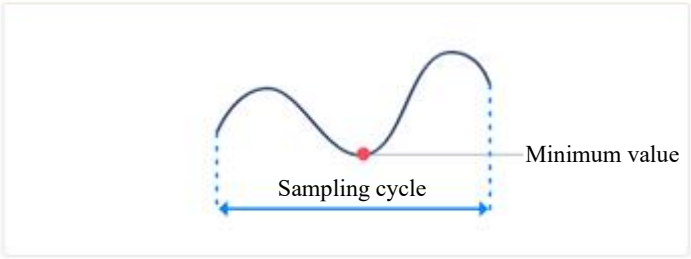
- Update condition: [External timing 2]



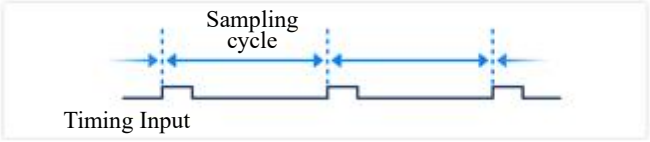
Valley Hold

Output the minimum value during the sampling period.

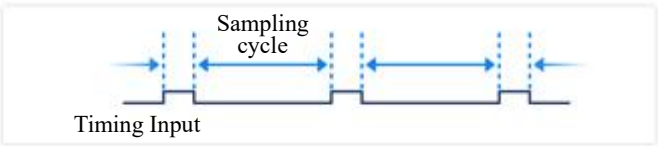
Valley Hold



- Update condition: [External timing 1]



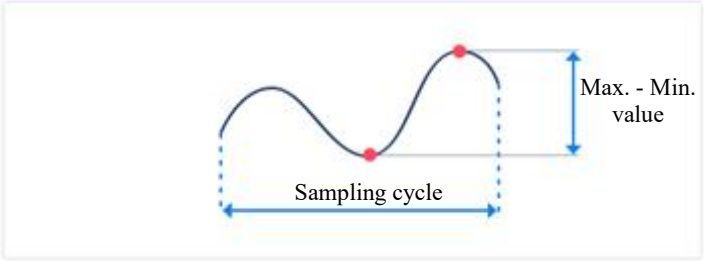
- Update condition: [External timing 2]



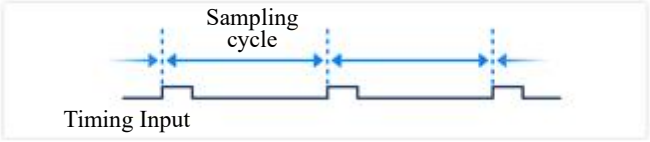
Peak to Peak Hold

Output the maximum value - minimum value during the sampling period.

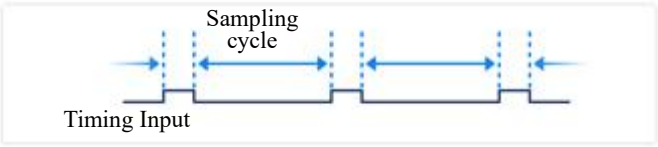
Peak to Peak Hold



- Update condition: [External timing 1]



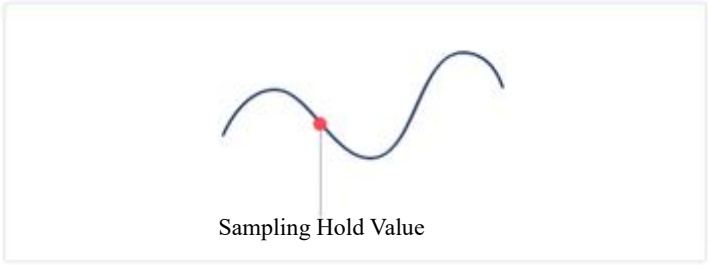
- Update condition: [External timing 2]



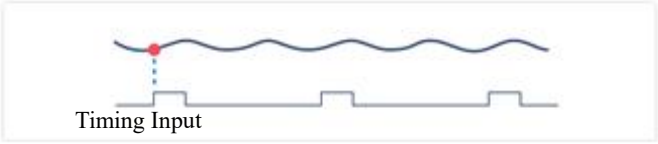
Sampling Hold

Output measurement values based on update time.

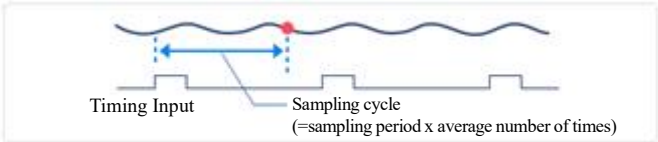
Sampling Hold



- Update condition: [External timing 1]



- Update condition: [External timing 2]



Minimum display unit

Select the minimum display unit for the measured value.

Analog output scaling

Set the analog range to represent the measured value, and you can choose to output analog voltage or analog current.

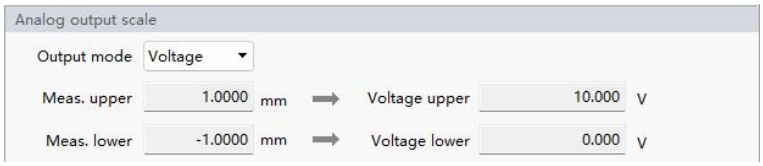
Analog voltage output can be set to the desired voltage range within the range of 0-10V; The analog current output can be set to the desired current range within the range of 4-20mA.

- **Output type selection**

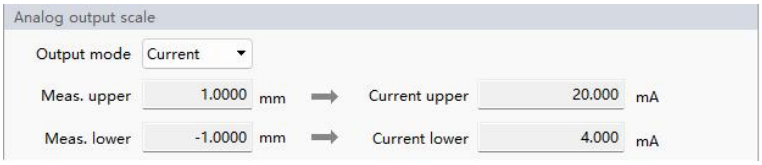
  You can choose to control the type of analog output from the following options:

  - OFF (Pictrure 3-1)
  - Voltage (Pictrure 3-2)
  - Current (Pictrure 3-3)

Pictrure 3-1 Turn off analog output



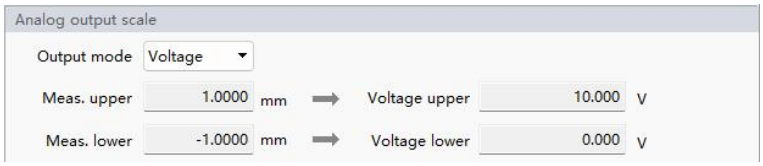
Pictrure 3-2 Analog voltage output



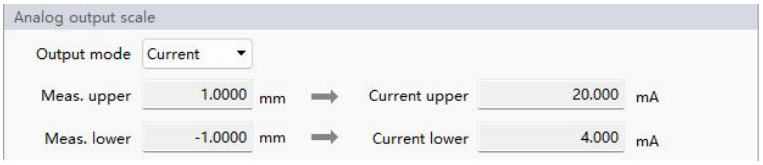
Pictrure 3-3 Analog current output

- **Set the corresponding relationship between analog output and measured values**

  1) Assuming that the scaling parameters for analog output are set as shown in Picture 3-4 or Picture 3-5:

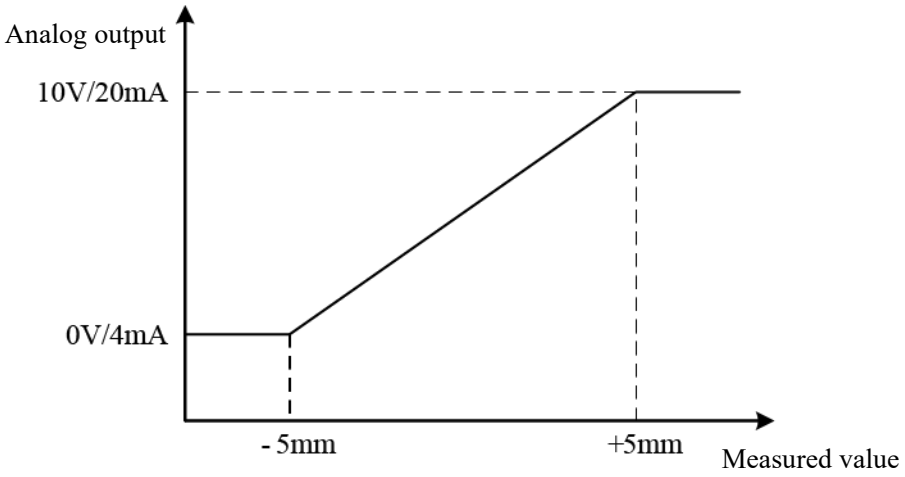


Picture 3-4



Picture 3-5

  1) The corresponding relationship between the analog output and the measured value is shown in Picture 3-6:



Picture 3- 6

- When the measured value is +5mm, the analog output is 10V or 20mA, and when it exceeds +5mm, it still outputs 10V or 20mA;
- When the measured value is -5mm, the analog voltage output is 0V or 4mA, and when it is lower than -5mm, it still outputs 0V or 4mA;
- Calculate the analog output based on the following formula for measured values between -5mm and +5mm:

$$\text{Output voltage(V)} = \frac{\text{Current measured value} - \text{Measured value lower limit}}{\text{Measured value upper limit} - \text{Measured value lower limit}} \times (\text{Output voltage upper limit} - \text{Output voltage lower limit}) + \text{Output voltage lower limit}$$

$$\text{Output current}(A) = \frac{\text{Current measured value} - \text{Measured value lower limit}}{\text{Measured value upper limit} - \text{Measured value lower limit}} \times (\text{Output current upper limit} - \text{Output current lower limit}) + \text{Output current lower limit}$$

2) When the measured value is the alarm value (± FFFFFF) or the standby value (XXXXXX/-------), the analog voltage output is 11V and the analog current output is 24mA.

Notes:

a) Measured value upper limit must be greater than the measured value lower limit.

b) Output voltage (current) upper limit must be greater than output voltage (current) lower limit.

4 Universal Settings and Functions

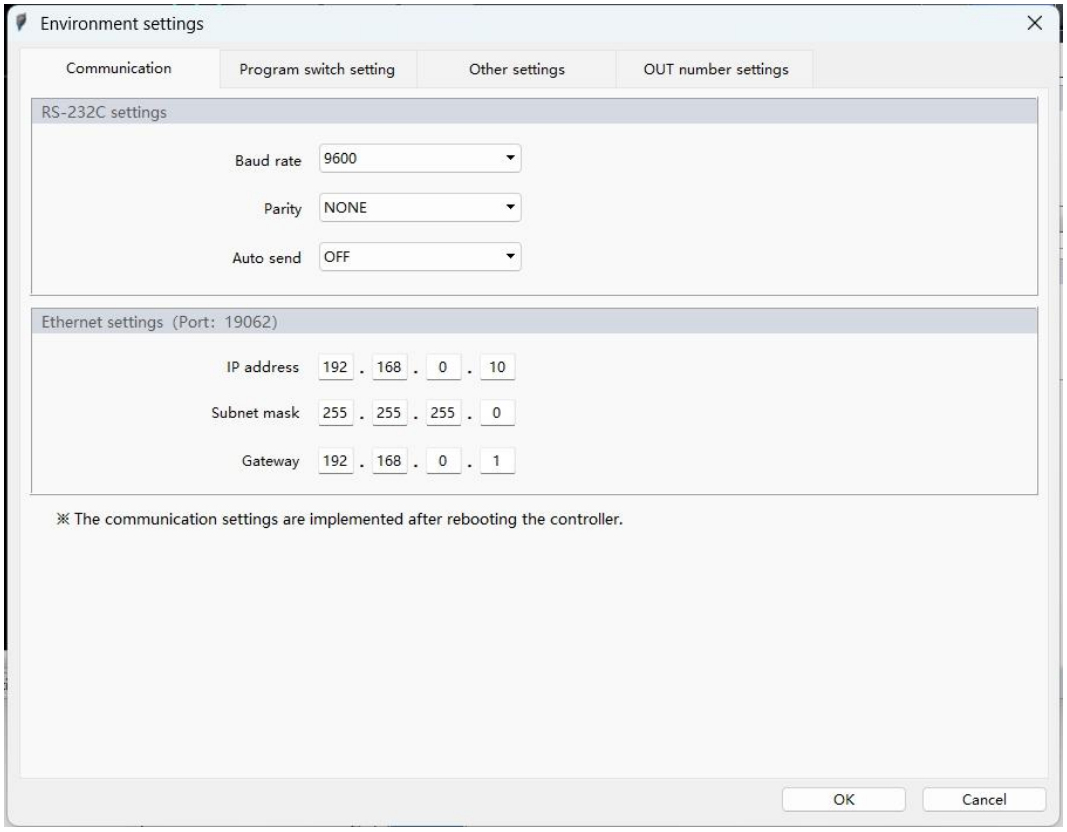
4.1 Environment Settings

Click the [Environment Settings] button on the master screen to display the [Environment Settings] screen.

If the program change setting is transmitted to the controller, it will be immediately applied.

1. Click on [Environment Settings] on the master screen.

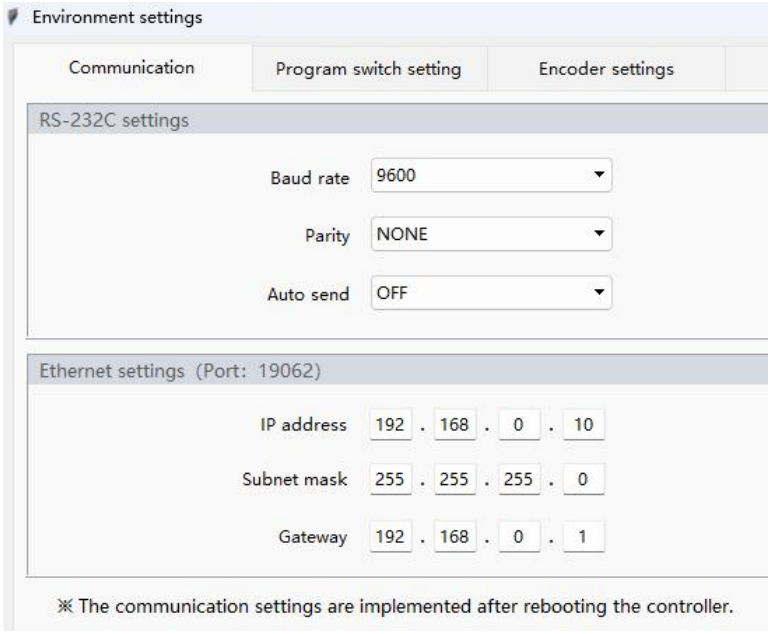
2. Perform [Environmental Settings].



📖 [Communication Settings] (Page 45)
📖 [Program Change Settings] (SGI series not supported) (Page 45)
📖 [Encoder Settings] (Page 46)
📖 [Input/Output Settings] (SGI series supported only) (Page 49)
📖 [Invalid Value Output Format Settings] (Page 50)
📖 [OUT Quantity Settings] (Page 50)

Communication Settings

Set the communication settings for the connected controller to RS-232C (RS485)/Ethernet.



RS-232C(RS485) Settings

When using RS-232C communication, make relevant settings.

Baud rate

Set the baud rate for RS-232C communication.

- Options (unit: bps): 9600 (default)/19200/38400/57600/115200

Parity check

Set the parity check for RS-232C communication.

- Options: Even/Odd/No Parity (default)

Automatic sending (not support SGI series laser displacement sensors)

Set automatic sending.

- Option: OFF (default)/ON.

Ethernet Settings

When using Ethernet communication, make relevant settings.

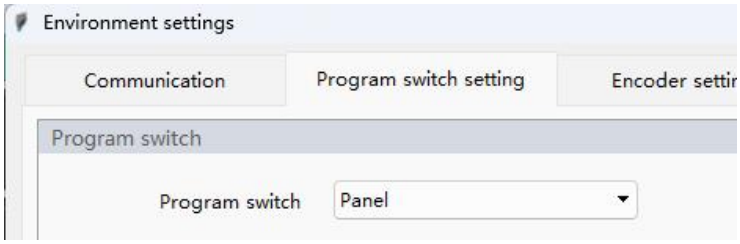
IP address/subnet mask/gateway

Set the IP address, subnet mask, and gateway of the controller.

Note: **The settings will only be applied the next time the controller is started.**

Program Change Settings (not support SGI series laser displacement sensors)

Perform program change settings.



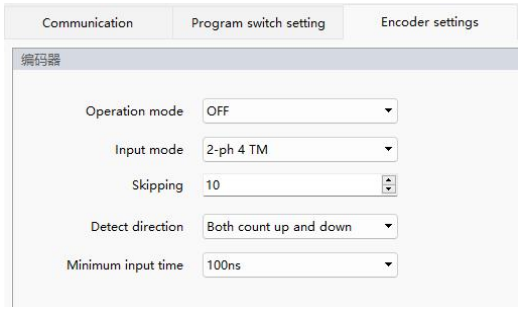
Program Change

This function is used to select whether to switch program numbers through SG-Imaging or external terminal input.

Option: Panel (default)/Terminal.

Encoder Settings

Set the function of the encoder signal and control the input method of the encoder signal.



Running Mode

Select the running mode of the encoder signal.

- Options:
  - OFF： Encoder input signal not working.
  - Timing: The encoder input signal is used as a synchronous timing signal, and the trigger frequency of the signal is ≤ 4kHz;
  - Trigger: The encoder input signal is used as the trigger signal of the sensing head to sample the measured value.

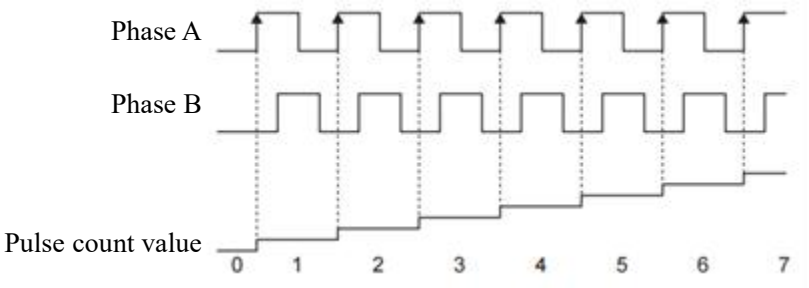
    The signal frequency should be less than the sampling frequency set in [Sampling Settings] (Page 24). For signals exceeding the sampling frequency, the measured value will output an alarm value.

Input Mode

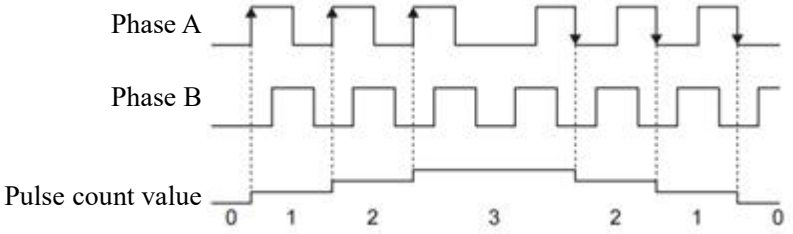
Select the input method for the encoder pulse signal.

- Options:
  - 1 phase 1 increment (no orientation)

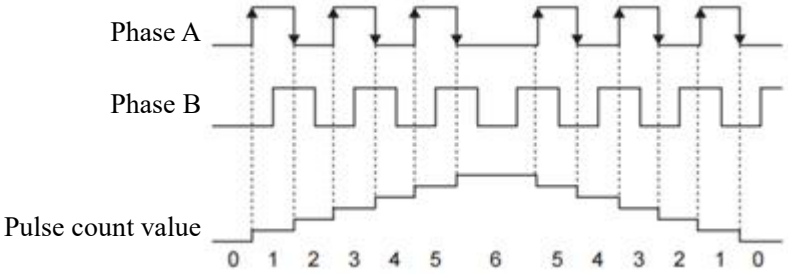
    It's not related to the input of phase B, the pulse count value increases on the rising edge of phase A.



- 2 phase 1 increment
  - When phase B is OFF
    - Identify the signal input at the rising edge of phase A and add a pulse count value.
    - Identify the signal input at the falling edge of phase A, subtract the pulse count value.
  - When phase B is ON
    - It does not identify signal inputs and not update pulse count values.



- 2 phase 2 increment
  - When phase B is OFF
    - Identify the signal input at the rising edge of phase A and add a pulse count value.
    - Identify the signal input at the falling edge of phase A, subtract the pulse count value.
  - When phase B is ON
    - Identify the signal input at the rising edge of phase A and subtract a pulse count value.
    - Identify the signal input at the falling edge of phase A, add the pulse count value.

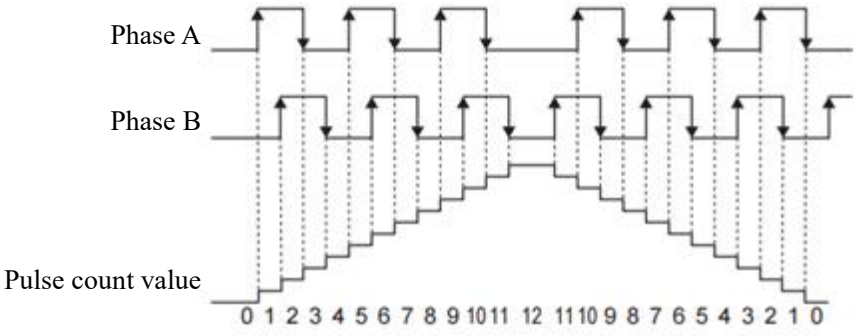


- 2 phase 4 increment

  The pulse count value is determined by the phase of phase A and phase B.

  When phase A is before phase B, add the pulse count value; when phase A is behind phase B, subtract the pulse count value.

  - When phase B is OFF
    - Identify the signal input at the rising edge of phase A and add a pulse count value.
    - Identify the signal input at the falling edge of phase A, subtract the pulse count value.
  - When phase B is ON
    - Identify the signal input at the rising edge of phase A and subtract a pulse count value.
    - Identify the signal input at the falling edge of phase A, add the pulse count value.
  - When phase A is OFF
    - Identify the signal input at the rising edge of phase B and subtract a pulse count value.
    - Identify the signal input at the falling edge of phase B, add the pulse count value.
  - When phase A is ON
    - Identify the signal input at the rising edge of phase B and add a pulse count value.
    - Identify the signal input at the falling edge of phase B, subtract the pulse count value.



Intervals

Set the interval between "trigger" or "timing" signals for the increase or decrease of pulse count values.

- Set value: 1-10000 (default: 200)

Orientation Detection

Choose whether to emit a "trigger" or "timer" signal when the pulse count increases or decreases.

- Options: Clockwise & Counterclockwise timing (default)/Clockwise timing/Counterclockwise timing

Minimum input time

Set the minimum pulse width time for A/B/Z phase pulse input.

- Option: 100ns (default)/200ns/500ns/1μs/2μs/5μs/10μs/20μs

Input/Output Settings (SGI series laser displacement sensors supported only)

Set the functions and corresponding electrical characteristics of input and output ports.

Input:

The functions of setting two input IO ports.

- Options:
  - OFF: Input ports 1 and 2 are not effective.
  - Timing/Zeroing: Input port 1 serves as the synchronous timing input port, and input port 2 serves as the synchronous zeroing input port.
  - Encoder: Input port 1 serves as the A-phase input port of the single-ended encoder, and input port 2 serves as the B-phase input port of the single-ended encoder (24V signal supported only).

Input/output electricals:

Set the electrical type of the digital input/output port.

- Options: NPN/PNP

Digital output:

Set the digital output ports (HI, GO, LOW, STORE) as comparators for which measured item (OUTx) to output.

- Options: OFF/OUT01/OUT02/OUT03/OUT04

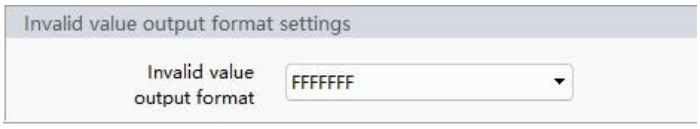
Analog output:

Set the analog output port as the measured result output for which measured item (OUTx).

- Options: OUT01/OUT02/OUT03/OUT04

Invalid Value Output Format Settings

Modifying the format definition of invalid values will affect the display of invalid values on the interface and the return value format of communication protocols.



Output format:

- FFFFFFF: Format 1
- 9999999: Format 2

Note:

FFFFFFF (Format 1)		9999999 (Format 2)		Description
Display value	Output value	Display value	Output value	
--------	XXXXXXXX	--------	-9999998	Standby data
±FFFFFFF	±FFFFFFF	±9999999	±9999999	Out of range
-FFFFFFF	-FFFFFFF	-9999999	-9999999	Invalid data

OUT Quantity Settings (firmware support required)

Switch the system to use 4 OUT calculation items or 8 OUT calculation items.

- **OUT Quantity:**

  4: Use four universal calculation items.

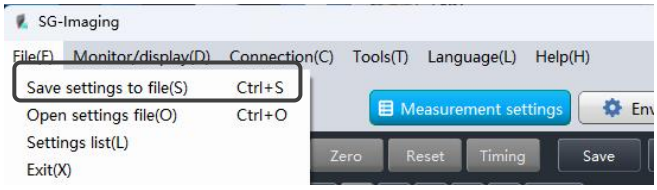
  8: Use 4 universal calculation items and 4 calculation items with only calculated functions.

4.2 Save and Read Settings

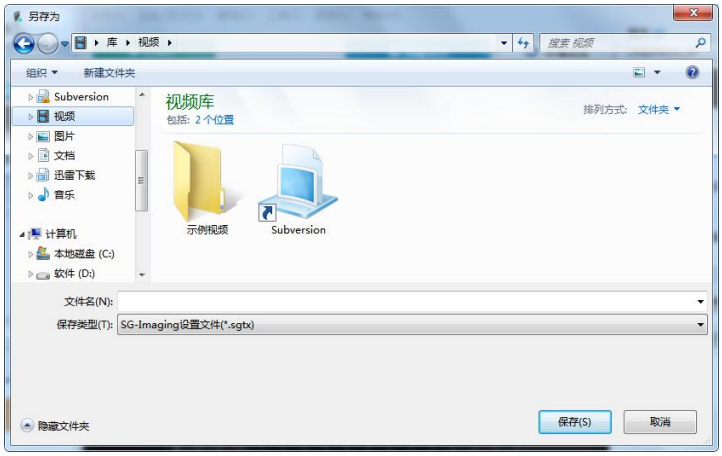
Save settings to a file

Save the current settings to a file.

1. Select the menu [File] -> [Save Settings to a File].



2. Set the saving location and file name, and then click [Save].

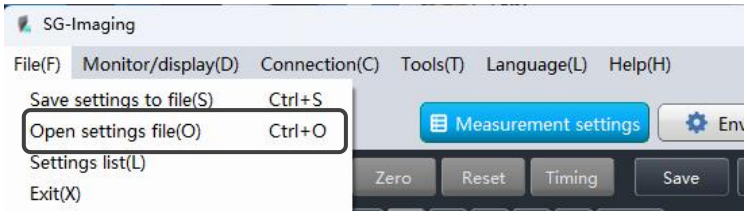


Read Setting Files

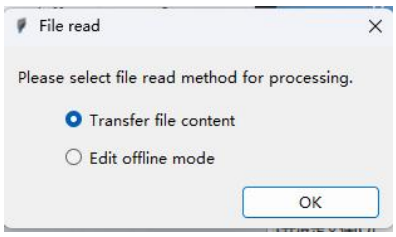
Read the settings file saved in the computer.

You can choose to transfer the read content to the controller or edit it in offline mode.

1. Select the menu [File] -> [Open Settings File].

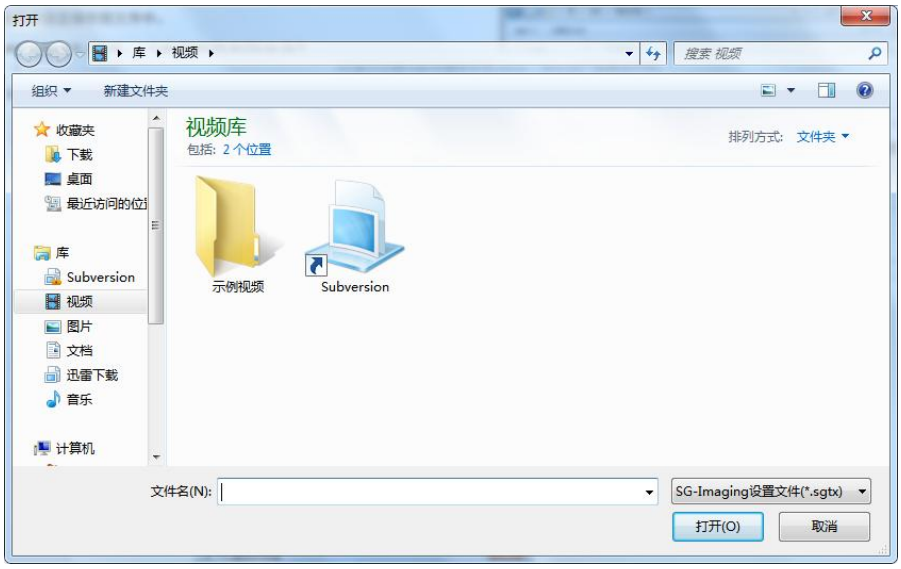


2. Select the reading method for the file, and then click [OK].



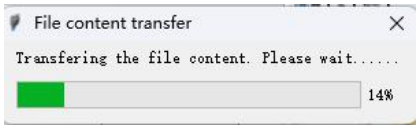
🕮 If you choose [Edit in Offline Mode], you can open any settings file for editing.

3. After selecting a file, click [Open].

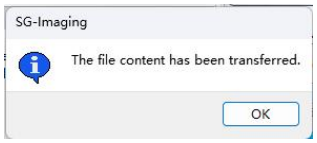


When selecting "Transfer File Content"

When transferring the read file content to the controller, a file transfer progress bar will be displayed.

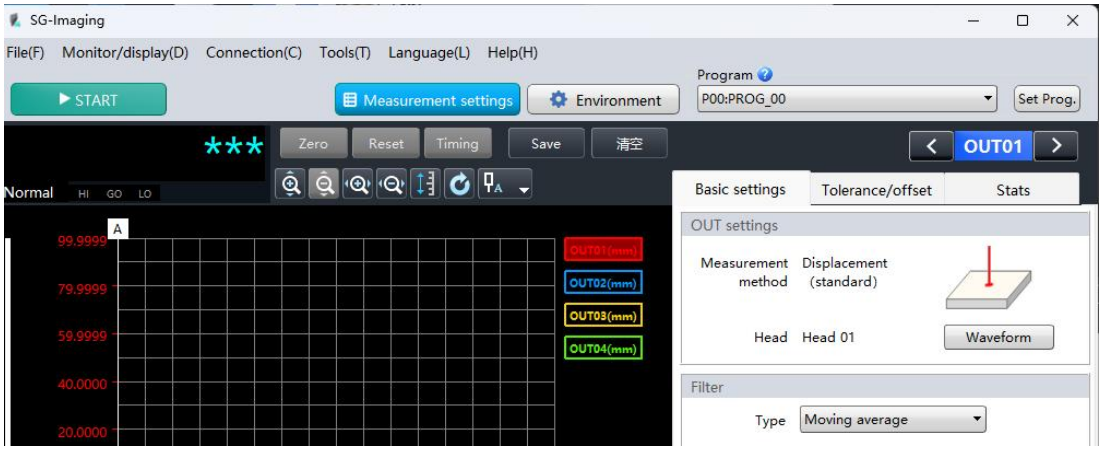


After the file transfer is completed, a prompt message screen will be displayed.



When selecting "Edit in Offline Mode"

Read the file content and start in offline mode.

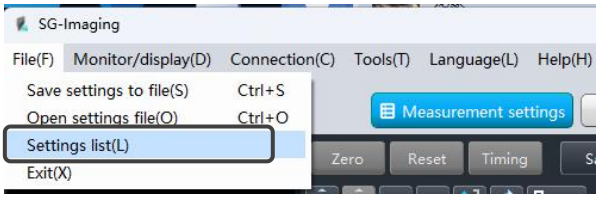


Display Settings Content

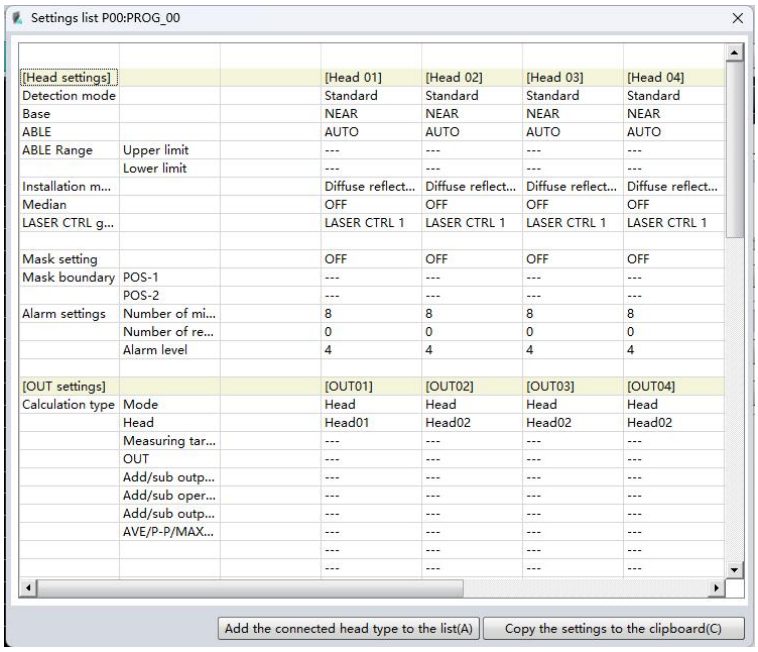
You can view the current Set Value List.

You can also paste the content copied to the clipboard into Excel for viewing.

1. Select the menu [File] -> [Set Value List].



Display [Set Value List] screen.



[Head settings]			[Head 01]	[Head 02]	[Head 03]	[Head 04]
Detection mode			Standard	Standard	Standard	Standard
Base			NEAR	NEAR	NEAR	NEAR
ABLE			AUTO	AUTO	AUTO	AUTO
ABLE Range	Upper limit		---	---	---	---
	Lower limit		---	---	---	---
Installation m...			Diffuse reflect...	Diffuse reflect...	Diffuse reflect...	Diffuse reflect...
Median			OFF	OFF	OFF	OFF
LASER CTRL g...			LASER CTRL 1	LASER CTRL 1	LASER CTRL 1	LASER CTRL 1
Mask setting			OFF	OFF	OFF	OFF
Mask boundary	POS-1		---	---	---	---
	POS-2		---	---	---	---
Alarm settings	Number of mi...		8	8	8	8
	Number of re...		0	0	0	0
	Alarm level		4	4	4	4
[OUT settings]			[OUT01]	[OUT02]	[OUT03]	[OUT04]
Calculation type	Mode		Head	Head	Head	Head
	Head		Head01	Head02	Head02	Head02
	Measuring tar...		---	---	---	---
	OUT		---	---	---	---
	Add/sub outp...		---	---	---	---
	Add/sub oper...		---	---	---	---
	Add/sub outp...		---	---	---	---
	AVE/P-P/MAX...		---	---	---	---
			---	---	---	---
			---	---	---	---

2. Click [Copy the Set Value List to the Clipboard].

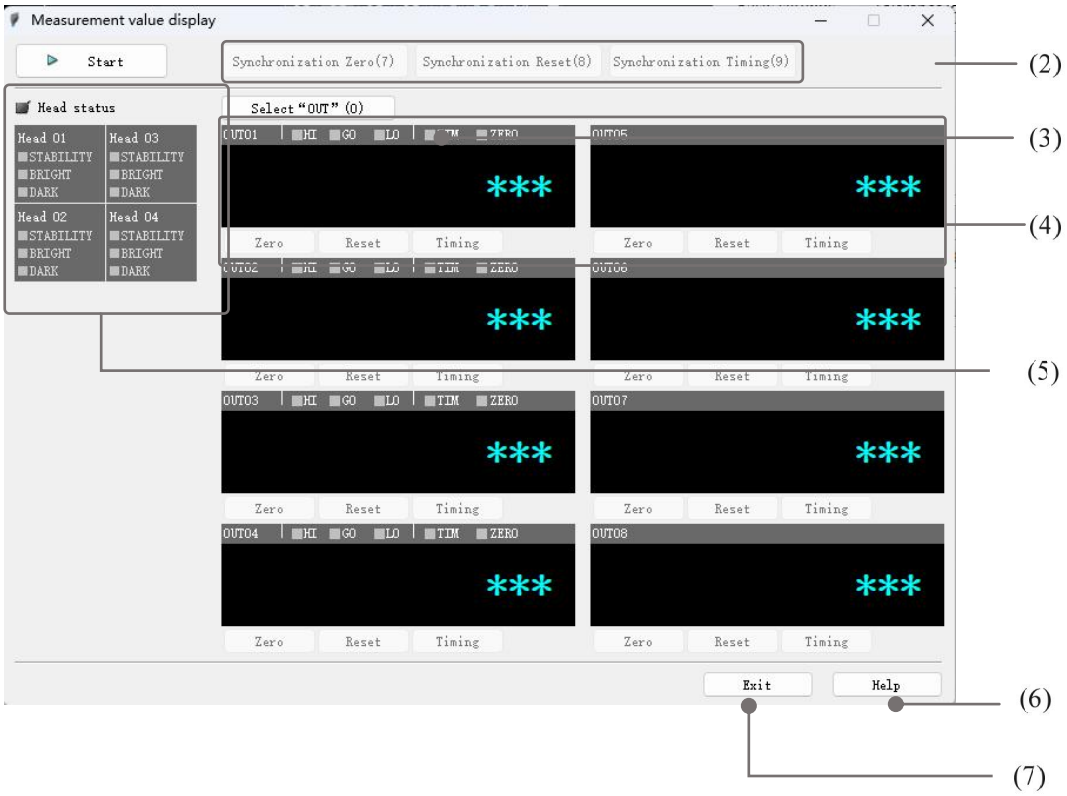
3. Paste into Excel and view the list.

[Sensing Head Setting Value]			[Sensing Head 01]	[Sensing Head 02]	[Sensing Head 03]	[Sensing Head 04]
Detection Mode			Standard	Standard	Standard	Standard
Datum Point			NEAR	NEAR	NEAR	NEAR
ABLE			AUTO	AUTO	AUTO	AUTO
ABLE Setting range	Upper Limit		---	---	---	---
	Lower Limit		---	---	---	---
Reflective Selection Mode			Diffuse Reflection	Diffuse Reflection	Diffuse Reflection	Diffuse Reflection
Median			OFF	OFF	OFF	OFF
LASER CTRL Groups			LASER CTRL 2	LASER CTRL 2	LASER CTRL 2	LASER CTRL 2
Shielding Settings			OFF	OFF	OFF	OFF
Shield Boundary	POS-1		---	---	---	---
	POS-2		---	---	---	---
Alarm Error	Number of Mistakes		8	8	8	8
	Recovery Times		0	0	0	0
	Alarm Level		4	4	4	4

4.3 Measured Value Monitoring

This section describes the "Measured Value Displaying" function for observing measured values on a PC.

1. Select the Menu [Monitor / Display] -> [Measured value monitoring]



(1) Start to obtain measured values

Start to obtain measured data from the controller.

After clicking "Start to obtain measured values", the button will change to "Stop to obtain measured values".

(2) Display measured data after applying "Synchronous Zero", "Synchronous Reset" or "Synchronous Timing".

Synchronous Zero

Apply simultaneous zeroing to the specified OUT.

Synchronous Reset

Apply simultaneous re-setting to the specified OUT.

Synchronous Timing

Apply simultaneous timing to the specified OUT.

(3) Select "OUT"

Check the OUTs to be displayed.

(4) Display measured data after applying "zero", "reset", or "timing".

Zero

The current measured data is set to the reference value (zero) and displayed.

For details, please refer to 🕮 [Automatic zeroing function] (Page 19)。

Reset

Display the measured values after resetting the operation of the measurement mode and the filter to default values.

Timing

Switch the timing function between ON and OFF.

Note: When the synchronous setting is checked for the selected OUT, the "Timing" button will be disabled.

Reference: The display status of the measured data is shown in the table below.

Status	Range	Display
HIGH	HI value < measured value	When “HI” highlights, measured value is displaying in red.
GO	LO value <= measured value <= HI value	When “GO” highlights, measured value is displaying in green.
LOW	Measured value < LO value	When “LO” highlights, measured value is displaying in red.
STANDBY		Measured value is displaying in “-------”.
ALARM		When “HI” and “LO” highlights, measured value is displaying in “-FFFFFF”.

(5) Sensing head status

Display the status of the sensing head.

(6) Help

Open the SG-Imaging Help file.

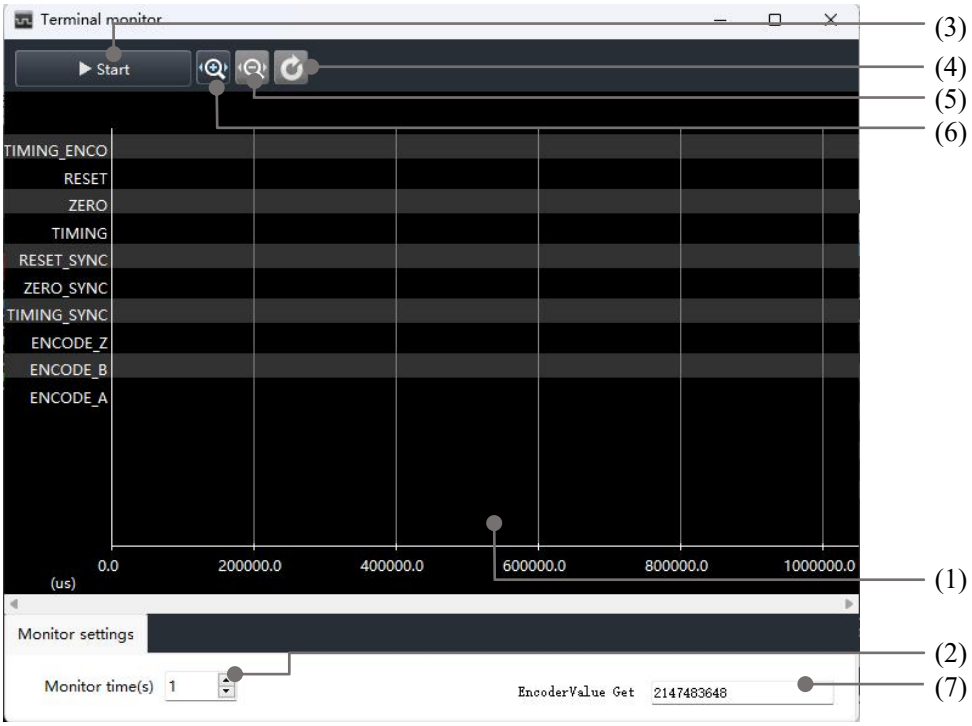
(7) Exit

Turn off "Measured Value Display".

4.4 Terminal Monitoring

This section describes the "Terminal Monitoring" function of observing signals from the input terminal on a PC.

1. Select the menu [Monitor / Display] -> [Terminal Monitoring].



(1) Input signal display area

The input signal will be displayed in a high or low logic level, with high level when there is no input and low level when there is input.

The entire monitoring process will collect the status of input ports for 1,000,000 times, and the collection interval is calculated based on the "monitoring time".

Description of each port definition:

Port	Description	Controller pins
TIMING_ENCO	Timing signals input to and converted by the Encoder	--
RESET	Reset input (binary selection)	8
ZERO	Automatic zeroing input (binary selection)	7
TIMING	Timing input (binary selection)	6
RESET_SYNC	Reset (sync.) input	5
ZERO_SYNC	Automatic zeroing (sync.) input	4

TIMEING_SYNC	Timing (sync.) input	3
ENCODE_Z	Encoder Z-phase input	41, 42
ENCODE_B	Encoder B-phase input	39, 40
ENCODE_A	Encoder A-phase input	37, 38

(2) Monitoring time

The total time for monitoring input signals, ranging from 1 to 60 seconds, corresponds to a signal-obtaining interval of 1 to 60μs.

(3) Start to obtain

Start to obtain input signal data from the controller.

After clicking "Start to obtain", the button will change to "Stop to obtain".

(4) Scaled down horizontally

Scaled down horizontally the input signal chart.

(5) Scaled up horizontally

Scaled up horizontally the input signal chart.

(6) Restore

Restore the default display scale of the input signal chart.

(7) Current encoders count value

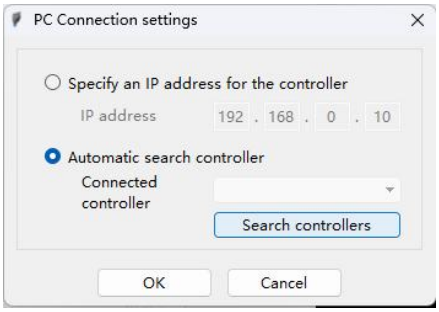
Display the current encoder count value, which is based on 2147483648 as the reference point, and then increase or decrease according to the input signal.

4.5 PC Communication Settings

Set the communication between the controller and SG-Imaging.

1. Select the menu [Communication] -> [PC Communication Settings].

The "PC Communication Settings" dialog box appears.



2. **Input the IP address of the controller.**

   Assign an IP address to the controller

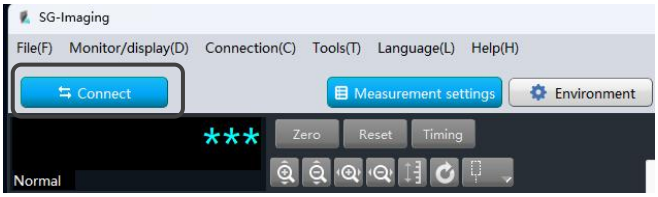
   Specify the actual IP address of the controller to be connected.

   Automatic search controller

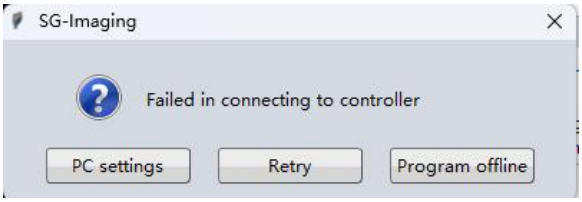
   Click "Search for Connected Controllers" to specify the controller to be connected.

3. **Click [OK].**

4. **Click [Connect] to establish communication with the controller.**



🕮 If Ethernet communication establishment fails, the following dialog box will be displayed.



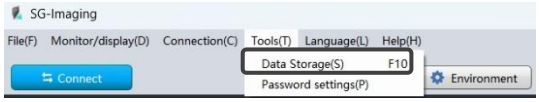
Please re-check the connection status of the Ethernet cable and whether the communication settings are correct.

4.6 Data Memory

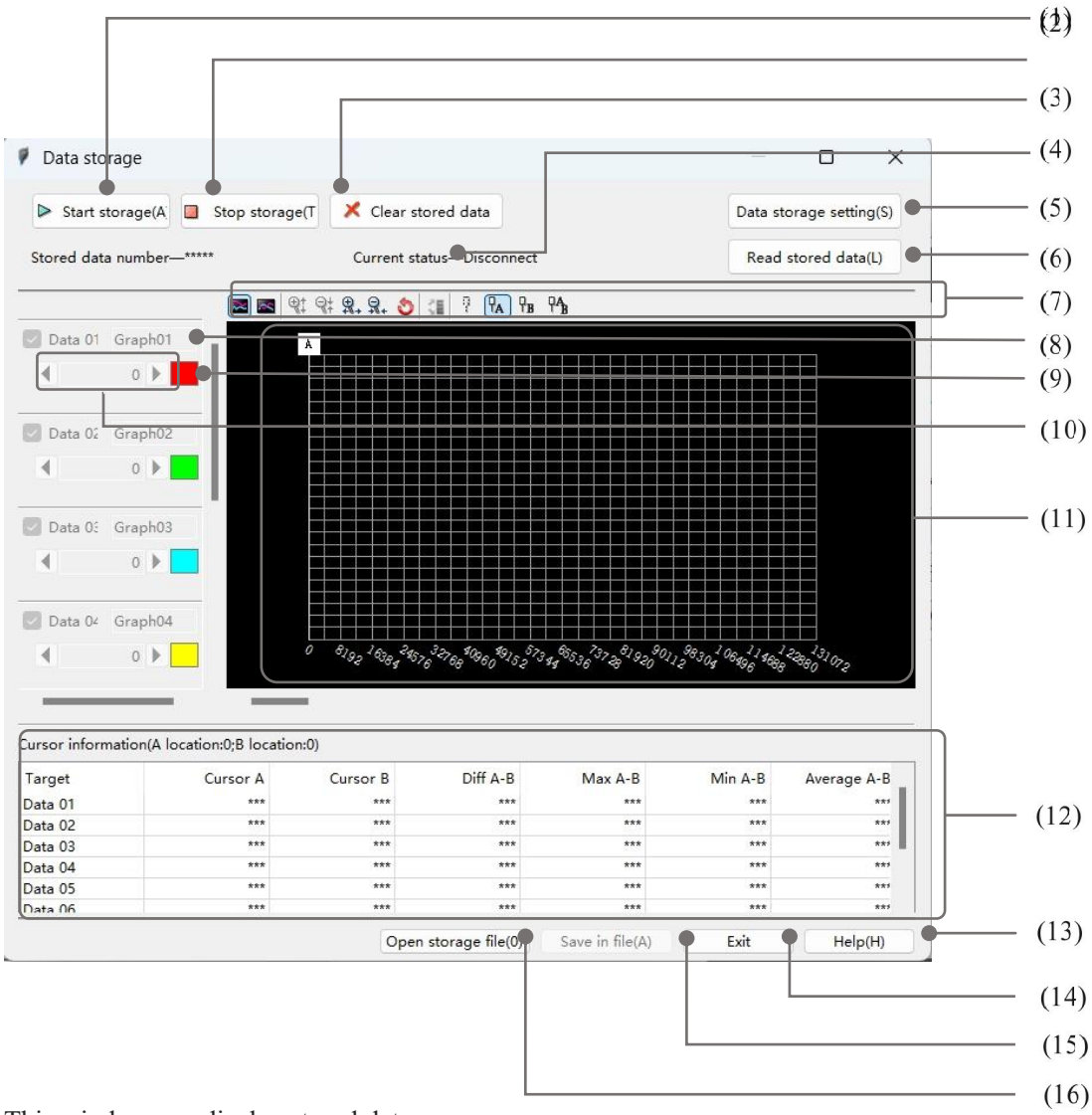
This section describes the method of changing data storage settings and information about the "data storage" function for displaying measured results.

The name and function of the data storage settings window

Select the menu [Tools] -> [Data Storage].



Reference: Up to 1.2 million measured values can be stored.



This window can display stored data:

- Storage data read from the controller.
- Storage data saved on the PC.

Reference:

- The size of the "Data Storage" window can be adjusted.
- It can only be enlarged based on the original window size.

(1) Start to store

Start to store data on the controller.

(2) Stop to store

Stop to store data on the controller.

(3) Clear stored data

Clear the data stored on the controller.

Note: The "Clear stored data" function will clear all data stored on the controller.

(4) Status display

Display the status of data stored on the controller.

Reference:

The following status will be displayed:

Status	Display	Displayed amount of stored data
Disconnected	Unconnected	*****
Standard mode: store	In storing	The current amount of stored data
Standard mode: stopped	Stopped	The current amount of stored data
Communication error	*****	*****
Other system error	System error	*****

(5) Data storage settings

Set the method for storing measured data. Please refer to "Data Storage Setting Process" (Page 62) for detailed information.

(6) Storage data readout

Load stored data from the controller. Please refer to "Loading Stored Data" (Page 65) for detailed information.

(7) Waveform display control toolbar

Tile/Cascade Display 

Set to display measured data waveforms in a stacked or cascading manner.

Zoom in/out 

Vertically and horizontally Zoom in/out the measured data waveform.

Return to default display 

Reset the display position that has been zoomed in/out or moved, and return to the default display.

Automatic adjustment 

Automatically adjust the vertical scale to fit the display area.

Cursor 

Hide cursor.

Cursor 

Select and display the cursor.

(8) Waveform Name

Set user-defined waveform names.

Notes:

- The waveform name can contain up to 8 alphanumeric characters, except for commas and periods, or 8 double-byte characters.
- The waveform name can only be set after the waveform is displayed.

(9) Waveform color

The color of the waveform display.

(10) Display location

Move the display position of the waveform.

Note: The display position can only be moved after the waveform is displayed.

(11) Waveform display of measured data

Display the loaded measurement data.

(12) Cursor information

Display cursor information in a table format.

(13) Help

Open the SG-Imaging Help file.

(14) Exit

Close the "Data Storage" window.

(15) Save to file

Save the stored data to a file (save as a CSV file).

(16) Reading files

Load storage data from a file.

Data Storage Setting Process

1. **Click on "Data Storage Settings".**

   Set the target OUT, data storage capacity, and storage period.

   Please refer to "Changing Data Storage Settings"(Page 64) for detailed information.

2. **Click "Start to store ".**

   The controller starts storing measured data.

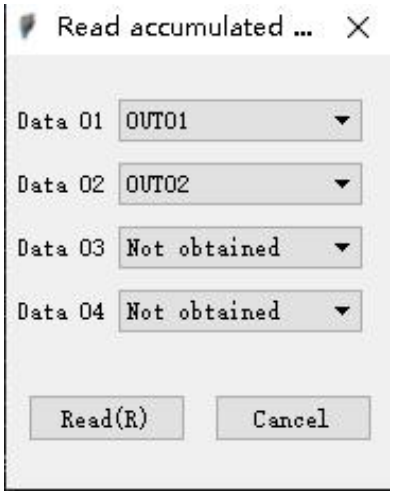
   When the amount of stored data reaches the value set in "Storage Data Volume", the storage automatically stops.

   Reference:

   - Click "Stop to store" to pause data storage.
   - After pausing, you can click "Start to store" again to continue storing data from the paused location.

3. **Click on "Stored Data Readout".**

   The "Read Accumulated Data" dialog box appears.



   Please refer to "Loading Stored Data" (Page 65) for detailed information on loading storage data.

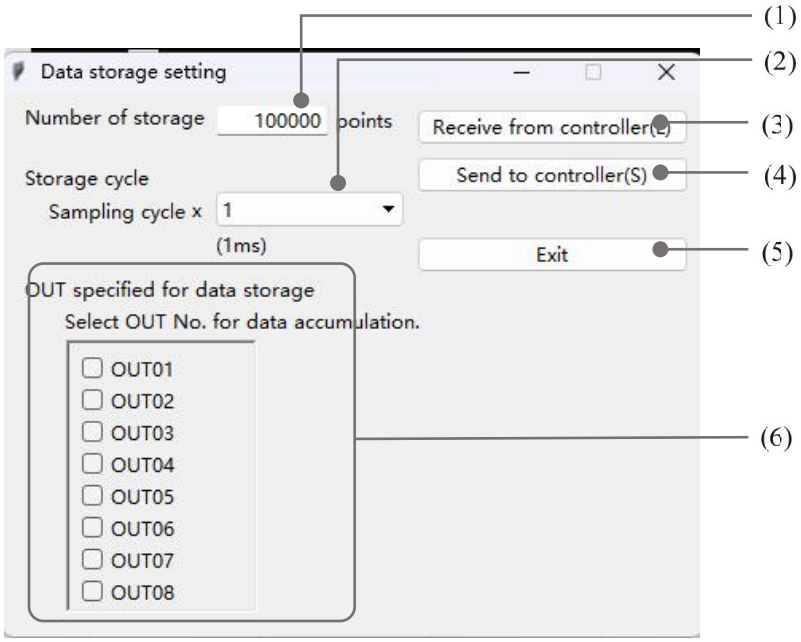
4. **Click "Readout".**

   The data stored in the controller is transmitted to the PC.

When the transmission progress bar reaches the right end, data transmission ends.

Changing Data Storage Settings

In the "Data Storage" window, click "Data Storage Settings" to display the "Data Storage Settings" dialog box.



(1) Data storage capacity

Set the number of data points to store.

(2) Storage cycle

Set the interval for data storage.

(3) Received from controller

Upload the set values from the controller.

(4) Send to controller

Download the set values to the controller.

Note: When uploading and downloading data, the controller will enter communication mode.

(5) Exit

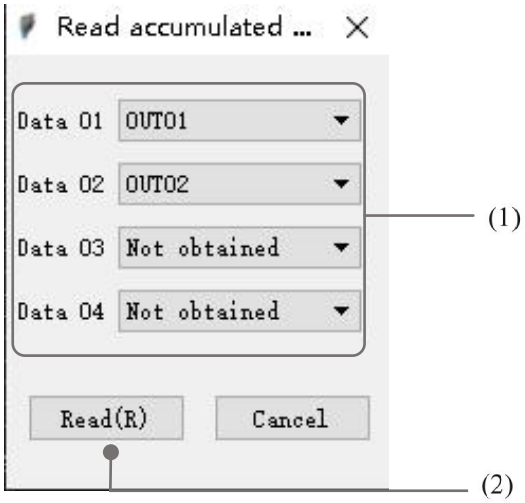
Close the "Data Storage Settings" window.

(6) Specify OUT for Data Storage

Check the OUT where you want to store data.

Loading Stored Data

In the "Data Storage" window, click "Stored Data Readout" to display the "Read Accumulated Data" dialog box.



(1) Data 01 to Data 04

Set the loading targets for each data from 01 to 04.

(2) Readout

Start loading stored data.

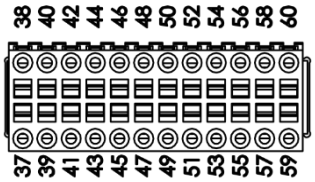
5 Communication Commands

This section describes the commands for communicating with the controller.

5.1 Specifications

- SG/SC series support RS232 interface communication with external devices.

RS232 Interface Description



Terminal number	Signal name	Description
55	RS232_TX	Sending signals to external devices
56	RS232_RX	Receive external device signals
57	RS232_GND	Ground wire

RS232 Communication Parameters

Sending method	Full duplex
Sending codes	ASCII
Data length	8 bits
Stop bit	1 bit
Parity check	None/Odd/Even
Baud rate	9600/19200/38400/57600/115200 bps
Data delimiter	\r\n

📖 Please refer to [Communication Settings] (Page 45).

➢ The SGI series supports RS485 interface communication with external devices.

RS485 Communication Parameters

Sending method	Half-duplex
Sending codes	ASCII
Data length	8 bits
Stop bit	1 bit
Parity check	None/Odd/Even
Baud rate	9600/19200/38400/57600/115200 bps
Data delimiter	\r\n

🕮 Please refer to [Communication Settings] (Page 45).

➢ SG/SC/SGI series support network interface communication with external devices.

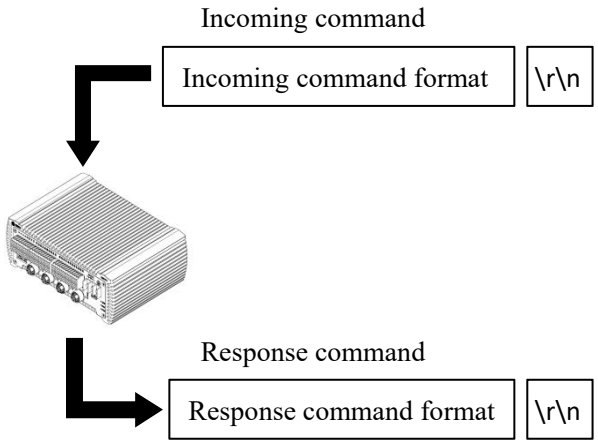
RJ45 (Ethernet port) communication parameters

Connection method	TCP Client
Communication port	19062
Sending codes	ASCII
Data delimiter	\r\n

🕮 Please refer to [Communication Settings] (Page 45) for network IP address modification.

5.2 Command Format Overview

Control operations based on commands passed in from external devices, and then send response commands to external devices. \r\n is used to separate each data in the incoming/response command format.



Note: When creating a control program, the program built should allow you to send the next command after confirming that you have received a response command from the sensor.

Reference:

Both uppercase and lowercase characters can be used in commands.

Whether the part enclosed in square brackets appears in the command format depends on the condition.

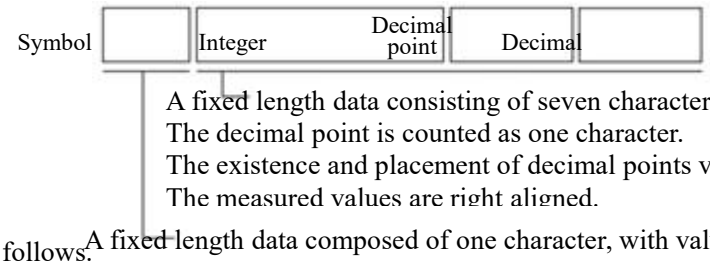
■ **Error response command format**

The following table lists the main error codes.

Response	ER, (Command sent), (Errors) \r\n
Error codes	• 50: Command error • 51: Status error • 60: Command length error • 61: Parameter count error • 62: Parameter range error

Measured Value Format

The output format of the measured values is as follows:



The following table provides some format examples.

Format 1※		Format 2※		Description
Display value	Output format	Display value	Output format	
1.2345	+01.2345	1.2345	+01.2345	Normal test value
-0.0120	-00.0120	-0.0120	-00.0120	
1234.56	+1234.56	1234.56	+1234.56	
-1.2	-00001.2	-1.2	-00001.2	
0.000	+000.000	0.000	+000.000	
--------	XXXXXXXX	--------	-9999998	Standby data
±FFFFFFF	±FFFFFFF	±9999999	±9999999	Out of range
-FFFFFFF	-FFFFFFF	-9999999	-9999999	Invalid data

※ Data format switching, please refer to [Invalid Value Output Format Settings] (Page 50)

Set value format (ffffff)

■ Set Change Format

This format has a fixed length and consists of one symbol and six-digit numerical values. Excluding decimal points.

■ Set to obtain format

This format has a fixed length and consists of one symbol, six-digit numerical value, and one decimal point.

5.3 Mode Change Command

This section describes the command format used to switch between "General Mode" and "Communication Mode".

Reference:

General Mode	During measurement	·Accept measurement control commands. ·Do not accept commands such as writing/reading set values.
	During tolerance / function setting period	·Do not accept communication. ·The measurement will stop.
Communication Mode		·When receiving the commands "Q", "0", "\r\n", the mode will change to communication mode and allow writing/reading of set values. ·When in communication mode, the measurement will stop.

■ Change to Communication Mode

Incoming command	Q0\r\n
Response commands	Q0\r\n
Parameter Description	-
Error code	·Err-51: Currently in communication mode.

■ Change to general mode

Change mode to normal mode

Incoming command	R0\r\n
Response commands	R0\r\n
Parameter Description	-
Error code	·Err-51: Currently in general mode. ·Err-63: The number of times the same OUT value is reused in the calculation exceeds the limit. ·Err-66: The calculation method parameters do not meet the requirements of the set list (no OUT is specified for AVE, MAX, MIN, or P-P calculations).

5.4 Measurement Control Commands

This section describes the command format used to control measurements. The incoming command is a command that the sensor can receive during measurement, and the response command is a command sent after correctly processing the incoming command.

The following sections contain detailed information about incoming commands and the response commands issued after correctly handling them.

For detailed information on error response commands, please refer to "Command Format Overview" (Page 68).

Note: These commands can only be received when the controller is in "General mode".

■ Measured value output (one)

Incoming command	MS,aa\r\n
Response commands	MS,aa,hhhhhhhh\r\n
Parameter Description	·Only output measured values with the specified OUT number. ·aa: OUT number (value 01 to 08, 01: OUT01, 02: OUT02... 08: OUT08). **Note:** When the OUT quantity is 4 (Page 50), the range of aa is 01~04. When the OUT quantity is 8, the range of aa is 01~08. ·hhhhhhhh: Measured value format.
Error code	-

■ Measured Value Output (multiple)

Incoming command	MM,iiii(iiiiiiii)\r\n
Response commands	MM,iiii(iiiiiiii),hhhhhhhh[,hhhhhhhh…,hhhhhhhh]\r\n
Parameter Description	·You can choose any numbered OUT from 4 or 8 to output measured values. ·iiii(iiiiiiii): When the number of OUT is 4 (Page 50), the number sequence format is iiii. When the number of OUT is 8, the number sequence format is iiiiiii. ·iiii: Specify a numerical sequence of 1 (output) or 0 (no output) for each OUT (Example: When specifying OUT02 and OUT04, the sequence is 0101). ·hhhhhhhh: Measured value format.
Error code	·Err-62: Specify all OUT as 0. ·Err-64: The specified OUT number exceeds the valid OUT range.

■ Measured Value Output (all)

Incoming command	MA\r\n
Response commands	MA,hhhhhhhh,[,hhhhhhhh…,hhhhhhhh]\r\n
Parameter Description	·All OUT measured values will be output. ·hhhhhhhh: Measured value format.
Error code	-

■ **Timing ON/OFF (one)**

Incoming command	TS,p,aa\r\n
Response commands	TS,p,aa\r\n
Parameter Description	·p: ON/OFF setting (0: OFF, 1: ON). ·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04)
Error code	·Err-62: The synchronized OUT was specified. ·Err-64: The specified OUT number exceeds the valid OUT range.

■ **Timing ON/OFF (multiple)**

Incoming command	TM,p,iiii\r\n
Response commands	TM,p,iiii\r\n
Parameter Description	·p: ON/OFF setting (0: OFF, 1: ON). ·iiii: Specify a numerical sequence of 1 (output) or 0 (no output) for each OUT (Example: When specifying OUT02 and OUT04, the sequence is 0101).
Error code	·Err-62: The synchronized OUT was specified. ·Err-64: The specified OUT number exceeds the valid OUT range.

■ **Timing ON/OFF (sync.)**

Incoming command	TP,p\r\n
Response commands	TP,p\r\n
Parameter Description	·This command applies to all synchronized OUT. ·p: ON/OFF setting (0: OFF, 1: ON).
Error code	Err-62: There is no synchronized OUT.

■ **Automatic Zeroing ON (one)**

Incoming command	VS,aa\r\n
Response commands	VS,aa\r\n
Parameter Description	aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04)
Error code	Err-64: The specified OUT number exceeds the valid OUT range.

■ **Automatic Zeroing ON (multiple)**

Incoming command	VM,iiii\r\n
Response commands	VM,iiii\r\n
Parameter Description	iiii : Specify a numerical sequence of 1 (output) or 0 (no output) for each OUT (Example: When specifying OUT02 and OUT04, the sequence is 0101).
Error code	Err-64: The specified OUT number exceeds the valid OUT range.

■ **Automatic Zeroing ON (sync.)**

Incoming command	VA\r\n
Response commands	VA\r\n
Parameter Description	This command applies to all synchronized OUT.
Error code	Err-62: There is no synchronized OUT.

■ **Automatic Zeroing OFF (one)**

Incoming command	WS,aa\r\n
Response commands	WS,aa\r\n
Parameter Description	aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04)
Error code	Err-64: The specified OUT number exceeds the valid OUT range.

■ **Automatic Zeroing OFF (multiple)**

Incoming command	WM,iiii\r\n
Response commands	WM,iiii\r\n
Parameter Description	iiii: Specify a numerical sequence of 1 (output) or 0 (no output) for each OUT (Example: When specifying OUT02 and OUT04, the sequence is 0101).
Error code	Err-64: The specified OUT number exceeds the valid OUT range.

■ **Automatic Zeroing OFF (sync.)**

Incoming command	WA\r\n
Response commands	WA\r\n
Parameter Description	This command applies to all synchronized OUT channels.
Error code	Err-62: There is no synchronized OUT.

■ **Reset (one)**

Incoming command	DS,aa\r\n
Response commands	DS\r\n
Parameter Description	aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04)
Error code	Err-64: The specified OUT number exceeds the valid OUT range.

■ **Reset (multiple)**

Incoming command	DM,iiii\r\n
Response	DM\r\n

commands	
Parameter Description	iiii: Specify a numerical sequence of 1 (output) or 0 (no output) for each OUT (Example: When specifying OUT02 and OUT04, the sequence is 0101)
Error code	Err-64: The specified OUT number exceeds the valid OUT range.

■ **Reset (sync.)**

Incoming command	DA\r\n
Response commands	DA\r\n
Parameter Description	This command applies to all synchronized OUT channels.
Error code	Err-62: There is no synchronized OUT.

■ **Switch Program Number**

Incoming command	PW,o\r\n
Response commands	PW\r\n
Parameter Description	o: Program number (0 to 7).
Error code	Err-62: The specified parameter exceeds the range defined by the parameter.

■ **Obtain the Current Program Number**

Incoming command	PR\r\n
Response commands	PR,o\r\n
Parameter Description	o: Program number (0 to 7).
Error code	Err-51: Status error.

■ **Data Storage Starts**

Incoming command	AS\r\n
Response commands	AS\r\n
Parameter Description	-
Error code	Err-51: The environment for executing commands is non-running mode.

■ **Data Storage Stopped**

Incoming command	AP\r\n
Response commands	AP\r\n
Parameter Description	-

Error code	Err-51: Status error.

■ Data Storage Initialization

Incoming command	AQ\r\n
Response commands	AQ\r\n
Parameter Description	-
Error code	Err-51: Status error.

■ Data Output of Data Storage

Incoming command	AO,aa\r\n
Response commands	AO,hhhhhhhh…,hhhhhhhh\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·hhhhhhhh: Measured value format
Error code	Err-71: The specified OUT is not the corresponding OUT for the stored data.

■ Status Output of Data Storage

Incoming command	AN\r\n
Response commands	AN,s,ddddddd[,ddddddd…ddddddd]\r\n
Parameter Description	·s: Storage status (0: Data storage stopped, 1: Storing data) ·ddddddd: The actual stored data number (maximum 1200000 based on the specified OUT number). The number of output values is the same as the number of OUT used, in order of OUT01, OUT02...
Error code	-

■ Light Intensity Output of Sensing Head

Incoming command	OT,aa\r\n
Response commands	OT,aa,dddd\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·dddd: Light intensity value (0000~1023). The output light intensity value is the maximum peak light intensity value of the sensing head.
Error code	Err-64: The specified OUT number exceeds the valid OUT range.

5.5 Setting Change Command

The following sections contain detailed information about incoming commands and the response commands issued after correctly handling them.

For detailed information on error response commands, please refer to "Command Format Overview" (Page 68).

Note: These commands are only accepted when the controller is in communication mode.

5.5.1 Sensing Head Settings

■ **Detection Mode**

Incoming command	SW,HB,M,qq,c\r\n
Response commands	SW,HB\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04) ·c: Function number (0: General, 1: Semi-transparent object, 2: Transparent object, 3: Transparent object, 2: Reflective resin)
Error code	·Err-62: “c” out of range. ·Err-64: The specified sensing head number exceeds the active sensing head count.

■ **Detection Mode**

Incoming command	SW,HB,B,qq,c\r\n
Response commands	SW,HB\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04) ·c: Function number (0: NEAR, 1: FAR)
Error code	·Err-62: “c” out of range. ·Err-64: The specified sensing head number exceeds the active sensing head count.

■ **ABLE**

Incoming command	SW,HA,M,qq,m\r\n
Response commands	SW,HA\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04) ·m: Mode (0: AUTO, 1: MANUAL)
Error code	·Err-64: The specified sensing head number exceeds the active sensing head count.

■ **ABLE Control Range**

Incoming command	SW,HA,R,qq,xx,xx\r\n

Response commands	SW,HA\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04) ·xx: Control range data (01 to 99). Values should be specified in the order of upper and lower limits.
Error code	·Err-62: Not meeting the conditions of "upper and lower limits". ·Err-64: The specified sensing head number exceeds the active sensing head count.

■ **ABLE Calibration Starts**

Incoming command	SW,HD,S,qq\r\n
Response commands	SW,HD\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04)
Error code	·Err-51: The sensing head specified for ABLE calibration is not yet connected or is performing calibration. ·Err-64: The specified sensing head number exceeds the active sensing head count.

■ **ABLE Calibration Completed**

Incoming command	SW,HD,P\r\n
Response commands	SW,HD\r\n
Parameter Description	-
Error code	Err-51: The command did not perform an ABLE calibration.

■ **ABLE Calibration Stopped**

Incoming command	SW,HD,C\r\n
Response commands	SW,HD\r\n
Parameter Description	The calibrated sensing head is automatically specified.
Error code	Err-51: The command did not perform an ABLE calibration.

■ **Reflective selection mode (installation mode)**

Incoming command	SW,HE,qq,c\r\n
Response commands	SW,HE\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04). ·c: Function number (0: Diffuse reflection, 1: Specular reflection).

Error code	·Err-62: “c” out of range. ·Err-64: The specified sensing head number exceeds the active sensing head count.

■ Median

Incoming command	SW,HG,qq,c\r\n
Response commands	SW,HG\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04) ·c: Function number (0: OFF, 1: 7, 2: 15, 3: 31)
Error code	·Err-62: “c” out of range. ·Err-64: The specified sensing head number exceeds the active sensing head count.

■ LASER CTRL GROUP

Incoming command	SW,HH,qq,c\r\n
Response commands	SW,HH,qq\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04) ·c: Function number (0: LASER_CTRL1, 1: LASER_CTRL2)
Error code	·Err-62: “c” out of range. ·Err-64: The specified sensing head number exceeds the active sensing head count.

■ Shielding settings

Incoming command	SW,HF,qq,c,fffffff,fffffff\r\n
Response commands	SW,HF\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04) ·c: Function number (0: OFF, 1: ON) ·fffffff: Set value format (valid digits: 6). The values should be specified in the order of point 1 and point 2.
Error code	·Err-62: “c” or “fffffff” out of range. ·Err-64: The specified sensing head number exceeds the active sensing head count.

■ Alarm Handling

Incoming command	SW,HC,N,qq,nnnn,nnnn\r\n
Response commands	SW,HC\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04) ·nnnn: Unsigned numerical value (0000 to 9999). Values should be specified in the order of error counting and restoring counting.

Error code	·Err-62: "nnnn" out of range. ·Err-64: The specified sensing head number exceeds the active sensing head count.

Alarm Level

Incoming command	SW,HC,L,qq,c\r\n
Response commands	SW,HC\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04). ·c: Alarm level (0 to 9).
Error code	·Err-62: “c” out of range. ·Err-64: The specified sensing head number exceeds the active sensing head count.

5.5.2 OUT Settings

■ Calculation Method

Incoming command	SW,OA,H,aa,ggg\r\n
Response commands	SW,OA,aa\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04) ·ggg: Sensing head number (H01 to H04) or OUT number (O01 to O04), calculation method (C01: ADD, C02: SUB, C03: AVE, C04: MAX, C05: MIN, C06: P-P)
Error code	·Err-64: The specified OUT number exceeds the valid OUT range. ·Err-66: "ggg" does not meet the specifications stated in the settings list.

■ Measured Target

Incoming command	SW,OA,T,aa,c\r\n
Response commands	SW,OA,aa\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04) ·c: Function number (0: 1, 1: 2, 2: 3, 3: 4, 4: 1-2, 5: 1-3, 6: 1-4, 7:2-3, 8: 2-4, 9: 3-4)
Error code	·Err-62: “c” out of range. ·Err-64: The specified OUT number exceeds the valid OUT range.

■ Calculation between OUTs (ADD, SUB)

Incoming command	SW,OA,C,aa,jj,jj\r\n
Response commands	SW,OA,aa\r\n
Parameter Description	·Even if the calculation method is changed, the specified value will be retained. ·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·jj: The OUT to be calculated (value 01 to 04), for example, when the calculation formula is “OUT01+OUT02”, these two “jj” values will be “01” and “02”.
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ OUT to be Calculated (AVE-P/P-MAX/MIN)

Incoming command	SW,OA,M,aa,iiii\r\n
Response commands	SW,OA,aa\r\n
Parameter Description	·When the selected calculation method is “AVE”, “MAX”, “MIN”, or “P-P”, use this command. ·Even if the calculation method is changed, the specified value will be retained.

	·iiii: This is a numerical sequence that specifies 1 (output) or 0 (no output) for each OUT (example: when specifying OUT02 and OUT04, the sequence is 0101). ·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04)
Error code	·Err-64: The specified OUT number exceeds the valid OUT range. ·Err-66: "iiiii" does not meet the specifications stated in the settings list.

■ **Detection Mode (measurement mode)**

Incoming command	SW,OD,aa,c\r\n
Response commands	SW,OD\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·c: Function number (0: General, 1: Peak hold, 2: Valley hold, 3: P to P hold, 4: Sample hold)
Error code	·Err-62: "c" out of range. ·Err-64: The specified OUT number exceeds the valid OUT range.

■ **Trigger Mode**

Incoming command	SW,OE,M,aa,c\r\n
Response commands	SW,OE\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·c: Function number (0: Trigger 1, 1: Trigger 2).
Error code	·Err-62: "c" out of range. ·Err-64: The specified OUT number exceeds the valid OUT range.

■ **Filter**

Incoming command	SW,OC,aa,c,c\r\n
Response commands	SW,OC\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·c: Function number The first c: Filter mode (0: Average) The second c: The function number of the filter mode selected by the first c (0: Take the average once, 1: Take the average four times, 2: Take the average 16 times, 3: Take the average 64 times, 4: Take the average 256 times, 5: Take the average 1024 times, 6: Take the average 4096 times, 7: Take the average 16384 times, 8: Take the average 65536 times, 9: Take the average 262144 times)
Error code	·Err-62: "c" out of range. ·Err-64: The specified OUT number exceeds the valid OUT range.

■ Tolerance Settings

Incoming command	SW,LM,aa,ffffff,ffffff,ffffff\r\n
Response commands	SW,LM\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·ffffff: Set value format (valid digits: 6). Values should be specified in the order of upper limit, lower limit, and delay. The first bit of delay is not the sign bit but 0.
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ Zoom

Incoming command	SW,OB,aa,ffffff,ffffff,ffffff,ffffff\r\n
Response commands	SW,OB\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·ffffff: Set value format (valid digits: 6). The values should be specified in order of the measured value (input value) of point 1, the displayed value of point 1, the measured value (input value) of point 2, and the displayed value of point 2.
Error code	·Err-64: The specified OUT number exceeds the valid OUT range. ·Err-68: “ffffff” does not meet the specifications in the set list.

■ Offset

Incoming command	SW,OF,aa,ffffff\r\n
Response commands	SW,OF\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·ffffff: Set value format (valid digits: 6).
Error code	·Err-62: “ffffff” out of range. ·Err-64: The specified OUT number exceeds the valid OUT range.

■ Minimum Display Unit

Incoming command	SW,OG,aa,c\r\n
Response commands	SW,OG\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·c: Function number (0: 0.01mm, 1: 0.001mm, 2: 0.0001mm, 3: 0.00001mm, 4: 0.1μm, 5: 0.01μm, 6: 0.001μm)
Error code	·Err-62: “c” out of range. ·Err-64: The specified OUT number exceeds the valid OUT range.

Analog output type switching

Incoming command	SW,VK,aa,yy\r\n
Response commands	SW,VK\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·yy: Function number (0: Analog output OFF, 1: Voltage output, 2: Current output)
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

Upper and lower limits of analog measured values

Incoming command	SW,VJ,aa,fffffff,fffffff\r\n
Response commands	SW,VJ\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·fffffff: Set value format (valid digits: 6). The values should be specified in the order of the upper and lower limits of the measured values.
Error code	·Err-64: The specified OUT number exceeds the valid OUT range. ·Err-68: “fffffff” does not meet the specifications in the set list.

Upper and lower limits of Analog output

Incoming command	SW,VI,aa,cccccc,cccccc\r\n
Response commands	SW,VI\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·cccccc: Set value format (valid digits: 6). The values should be specified in the order of the lower limit of the analog value and the upper limit of the analog output. When setting the voltage, the unit of this value is 1mV; When setting the current, the unit
Error code	·Err-64: The specified OUT number exceeds the valid OUT range. ·Err-68: “cccccc” does not meet the specifications in the set list.

5.5.3 Public Settings

■ **Sampling Frequency (SG5000 series)**

Incoming command	SW,CA,c\r\n
Response commands	SW,CA\r\n
Parameter Description	c: Function number (0: 590kHz, 1: 400kHz, 2: 200kHz, 3: 88kHz, 4: 50kHz, 5: 20kHz, 6: 10kHz, 7: 5kHz, 8: 2kHz, 9:1kHz)
Error code	Err-62: “c” out of range.

■ **Sampling Frequency (SG3000 series)**

Incoming command	SW,CA,c\r\n
Response commands	SW,CA\r\n
Parameter Description	c: Function number (0: 88kHz, 1: 50kHz, 2: 20kHz, 3: 10kHz, 4: 5kHz, 5: 2kHz, 6:1kHz)
Error code	Err-62: “c” out of range.

■ **Gating Time**

Incoming command	SW,CE,c\r\n
Response commands	SW,CE\r\n
Parameter Description	c: Function number (0: 2ms, 1: 5ms, 2: 10ms, 3: 20ms)
Error code	Err-62: “c” out of range.

■ **Synchronous Settings**

Incoming command	SW,OJ,aa,c\r\n
Response commands	SW,OJ\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·c: Function number (0: OFF, 1: ON)
Error code	Err-62: “c” out of range. Err-64: The specified OUT number exceeds the valid OUT range.

■ **Prevent mutual interference**

Incoming command	SW,CB,c\r\n
Response	SW,CB\r\n

commands	
Parameter Description	c: Function number (0: OFF, 1: AB-ON, 2: ABC-ON)
Error code	Err-62: “c” out of range.

■ **Prevent Mutual Interference Groups**

Incoming command	SW,HJ,qq,c\r\n
Response commands	SW,HJ\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04). ·c: Function number (0: A, 1: B, 2: C).
Error code	Err-62: “c” out of range. Err-64: The specified sensing head number exceeds the active sensing head count.

■ **Data Storage**

Incoming command	SW,CF,ddddddd,ll\r\n
Response commands	SW,CF\r\n
Parameter Description	·ddddddd: Number of data to be stored (0000000 to 1200000) ·ll: Storage cycle (00:1x, 01:2x, 02:5x, 03:10x, 04:20x, 05:50x, 06:100x, 07:200x, 08:500x, 09:1000x, 10: Synchronous input)
Error code	Err-62: "ddddddd" or "ll" is out of range.

■ **Specify OUT for Data Storage**

Incoming command	SW,OK,aa,c\r\n
Response commands	SW,OK\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04) ·c: Function number (0: OFF, 1: ON)
Error code	Err-62: “c” out of range. Err-64: The specified OUT number exceeds the valid OUT range.

5.5.4 Network Settings

■ **IP Address**

Incoming command	SW,EH,I,zzzzzzzzzzzz\r\n
Response commands	SW,EH\r\n
Parameter Description	zzzzzzzzzzz: IP address (Expressed as zzz. zzz. zzz. zzz) Example: When the IP address is 10.10.1.9, specify “010010001009”.
Error code	Err-62: “zzzzzzzzzzz” out of range.

■ **Subnet Mask**

Incoming command	SW,EH,M,zzzzzzzzzzzz\r\n
Response commands	SW,EH\r\n
Parameter Description	zzzzzzzzzzzz: Subnet mask (Expressed as zzz. zzz. zzz. zzz) Example: When the subnet mask is 255.255.0.0, specify “255255000000”.
Error code	Err-62: “zzzzzzzzzzzz” out of range.

■ **Default Gateway**

Incoming command	SW,EH,G,zzzzzzzzzzzz\r\n
Response commands	SW,EH\r\n
Parameter Description	zzzzzzzzzzzz: The IP address of the default gateway (Expressed as zzz. zzz. zzz. zzz) Example: When the IP address is 10.10.1.9, specify “010010001009”
Error code	Err-62: “zzzzzzzzzzzz” out of range.

5.5.5 Encoder Settings

■ **Operating Mode and Detection Direction**

Incoming command	SW,CJ,c,c\r\n
Response commands	SW,CJ\r\n
Parameter Description	The first c: operating mode (0: OFF, 1: timed, 2: triggered) The second c: detection direction (0: positive & negative timing, 1: positive timing, 2: negative timing)
Error code	Err-62: “c” out of range.

■ **Input mode, minimum input time, and interval**

Incoming command	SW,CI,c,ddddddddd,dddddd\r\n
Response commands	SW,CI\r\n
Parameter Description	·c: Input mode (0:1 phase 1 increment (no direction), 1:2 phase 1 increment, 2:2 phase 2 increment, 3:2 phase 4 increment) ·ddddddddd: Minimum input time (unit: ns) (0000000100/0000000200/0000000500/0000001000/0000002000/0000005000/0000010000/0000020000) ·dddddd: Trigger interval (000001 to 010000)
Error code	Err-62: “c”, “ddddddddd”, “dddddd” out of range.

5.6 Settings for Obtained Commands

This section describes the format of the command used to obtain the set value.

Note: These commands are only accepted when the controller is in communication mode.

- The set value format containing decimal points will be returned.
- For detailed information on each command, please refer to "Setting Change Command" (Page 76).

5.6.1 Sensing Head Settings

■ Detection Mode

Incoming command	SR,HB,M,qq\r\n
Response commands	SR,HB,M,qq,c\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04). ·c: Function number (0: General, 1: Semi-transparent object, 2: Transparent object, 3: Transparent object, 2: Reflective resin).
Error code	·Err-64: The specified sensing head number exceeds the active sensing head count.

■ Datum point

Incoming command	SR,HB,B,qq\r\n
Response commands	SR,HB,B,qq,c\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04). ·c: Function number (0: NEAR, 1: FAR).
Error code	·Err-64: The specified sensing head number exceeds the active sensing head count.

■ ABLE

Incoming command	SR,HA,M,qq\r\n
Response commands	SR,HA,M,qq,m\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04). ·m: Mode (0: AUTO, 1: MANUAL).
Error code	·Err-64: The specified sensing head number exceeds the active sensing head count.

■ ABLE Control Range

Incoming command	SR,HA,R,qq\r\n

Response commands	SR,HA,R,qq,xx,xx\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04). ·xx: Control range data (01 to 99). Return values in order of upper and lower limits.
Error code	·Err-64: The specified sensing head number exceeds the active sensing head count.

■ Reflective selection mode (installation mode)

Incoming command	SR,HE,qq\r\n
Response commands	SR,HE,qq,c\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04). ·c: Function number (0: Diffuse reflection, 1: Specular reflection).
Error code	·Err-64: The specified sensing head number exceeds the active sensing head count.

■ Median

Incoming command	SR,HG,qq\r\n
Response commands	SR,HG,qq,c\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04). ·c: Function number (0：OFF, 1：7, 2：15, 3：31)．
Error code	·Err-64: The specified sensing head number exceeds the active sensing head count.

■ LASER CTRL GROUP

Incoming command	SR,HH,qq\r\n
Response commands	SR,HH,qq,c\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04). ·c: Function number (0: LASER CTRL1, 1: LASER CTRL2).
Error code	·Err-64: The specified sensing head number exceeds the active sensing head count.

■ Shielding settings

Incoming command	SR,HF,qq,c\r\n
Response commands	SR,HF,qq,c,ffffffff,ffffffff\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04). ·c: Function number (0: OFF, 1: ON). ·ffffffff: Set value format (valid digits: 6). Return values in the order of point 1 and point 2.

Error code	·Err-62: “c” out of range. ·Err-64: The specified sensing head number exceeds the active sensing head count.

■ **Alarm Handling**

Incoming command	SR,HC,N,qq\r\n
Response commands	SR,HC,N,qq,nnnn,nnnn\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04). ·nnnn: Unsigned numerical value (0000 to 9999). Return values in the order of counting and restoring counting.
Error code	·Err-64: The specified sensing head number exceeds the active sensing head count.

■ **Alarm Level**

Incoming command	SR,HC,L,qq\r\n
Response commands	SR,HC,L,qq,c\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04). ·c: Function number (0 to 9)
Error code	·Err-64: The specified sensing head number exceeds the active sensing head count.

5.6.2 OUT Settings

■ **Calculation Method**

Incoming command	SR,OA,H,aa\r\n
Response commands	SR,OA,H,aa,ggg\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04). ·ggg: Sensing head number (H01 to H04) or OUT number (O01 to O04), calculation method (C01: ADD, C02: SUB, C03: AVE, C04: MAX, C05: MIN, C06: P-P).
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ **Measured Target**

Incoming command	SR,OA,T,aa\r\n
Response commands	SR,OA,T,aa,c\r\n

Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04). ·c: Function number (0:1, 1:2, 2:3, 3:4, 4:1-2, 5:1-3, 6:1-4, 7:2-3, 8:2-4, 9:3-4).
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ Calculation between OUTs (ADD, SUB)

Incoming command	SR,OA,C,aa\r\n
Response commands	SR,OA,C,aa,jj,jj\r\n
Parameter Description	·Even if the calculation method is changed, the specified value will be retained. ·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04). ·jj: OUT to be calculated (value 01 to 04). For example, when the calculation formula is "OUT01+OUT02", these two "jj" values will be "01" and "02".
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ OUT to be Calculated (AVE/P-P/MAX/MIN)

Incoming command	SR,OA,M,aa\r\n
Response commands	SR,OA,M,aa,iiii\r\n
Parameter Description	·Even if the calculation method is changed, the specified value will be retained. ·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04). ·iiii: Used to specify the format of multiple OUT or HEAD.
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ Detection Mode (measurement mode)

Incoming command	SR,OD,aa\r\n
Response commands	SR,OD,aa,c\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04). ·c: Function number (0: General, 1: Peak hold, 2: Valley hold, 3: P to P hold, 4: Sample hold).
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ Trigger Mode

Incoming command	SR,OE,M,aa\r\n
Response commands	SR,OE,M,aa,c\r\n

Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·c: Function number (0: Trigger 1, 1: Trigger 2)
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ Filter

Incoming command	SR,OC,aa\r\n
Response commands	SR,OC,aa,c,c\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04). ·c: Function number The first c: Filter mode (0: Average) The second c: The function number of the filter mode selected by the first c (0: Take the average once, 1: Take the average four times, 2: Take the average 16 times, 3: Take the average 64 times, 4: Take the average 256 times, 5: Take the average 1024 times, 6: Take the average 4096 times, 7: Take the average 16384 times, 8: Take the average 65536 times, 9: Take the average 262144 times)
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ Tolerance Settings

Incoming command	SR,LM,aa\r\n
Response commands	SR,LM,aa,ffffffff,ffffffff,ffffffff\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04). ·ffffffff: Set value format (valid digits: 6). Return values in order of upper limit, lower limit, and delay.
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ Zoom

Incoming command	SR,OB,aa\r\n
Response commands	SR,OB,aa,ffffffff,ffffffff,ffffffff,ffffffff\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04). ·ffffffff: Set value format (valid digits: 6). Return values in the order of the measured value (input value) of point 1, the displayed value of point 1, the measured value (input value) of point 2, and the displayed value of point 2.

Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ Offset

Incoming command	SR,OF,aa\r\n
Response commands	SR,OF,aa,ffffffff\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04). ·ffffffff: Set value format (valid digits: 6).
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ Minimum Display Unit

Incoming command	SR,OG,aa\r\n
Response commands	SR,OG,aa,c\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04). ·c: Function number When selecting the measured type as “displacement” (0: 0.01mm, 1: 0.001mm, 2: 0.0001mm, 3: 0.00001mm, 4: 0.1μm, 5: 0.01μm, 6: 0.001μm)
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ Analog output type switching

Incoming command	SR,VK,aa\r\n
Response commands	SR,VK,aa,yy \r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·yy: Function number (0: Analog output OFF, 1: Voltage output, 2: Current output)
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

■ Upper and lower limits of analog measured values

Incoming command	SR,VJ,aa\r\n
Response commands	SR,VJ,aa,ffffffff,ffffffff\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·ffffffff: Set value format (valid digits: 6). Return in the order of lower and upper measured values.
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

Upper and lower limits of Analog output

Incoming command	SW,VI,aa\r\n
Response commands	SW,VI,aa,cccccc,cccccc \r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT 01, 02: OUT 02... 04: OUT 04) ·cccccc: Set value format (valid digits: 6). Range in the order of lower limit and upper limit of analog output. When it is voltage, the unit of this value is 1mV; When it is current, the unit of this value is 1 μA.
Error code	·Err-64: The specified OUT number exceeds the valid OUT range.

5.6.3 Public Settings

■ Sampling frequency (SG5000 series)

Incoming command	SR,CA\r\n
Response commands	SR,CA,c\r\n
Parameter Description	c: Function number (0: 590kHz, 1: 400kHz, 2: 200kHz, 3: 88kHz, 4: 50kHz, 5: 20kHz, 6: 10kHz, 7: 5kHz, 8: 1kHz)
Error code	-

■ Sampling frequency (SG3000 series)

Incoming command	SR,CA\r\n
Response commands	SR,CA,c\r\n
Parameter Description	c: Function number (0: 88kHz, 1: 50kHz, 2: 20kHz, 3: 10kHz, 4: 5kHz, 5: 2kHz, 6:1kHz)
Error code	-

■ Gating time

Incoming command	SR,CE\r\n
Response commands	SR,CE,c\r\n
Parameter Description	C: Function number (0:2ms, 1:5ms, 2:10ms, 3:20ms)
Error code	-

■ Synchronous settings

Incoming command	SR,OJ,aa\r\n
Response commands	SR,OJ,aa,c\r\n
Parameter Description	·aa: OUT number (value 01 to 04, 01: OUT01, 02: OUT02... 04: OUT04). ·c: Function number (0: OFF, 1: ON）。
Error code	Err-64: The specified OUT number exceeds the valid OUT range.

■ Prevent mutual interference

Incoming command	SR,CB\r\n
Response commands	SR,CB,c\r\n

Parameter Description	c: Function number (0:OFF, 1:AB-ON, 2:ABC-ON）。
Error code	-

■ **Prevent Mutual Interference Groups**

Incoming command	SR,HJ,qq\r\n
Response commands	SR,HJ,qq,c\r\n
Parameter Description	·qq: Sensing head number (value 01 to 04) ·c: Function number (0:A, 1:B, 2:C）
Error code	Err-64: The specified sensing head number exceeds the active sensing head count.

■ **Data storage**

Incoming command	SR, CF\r\n
Response commands	SR,CF,ddddddd,ll\r\n
Parameter Description	·ddddddd: Number of data to be stored (0000000 to 1200000). ·ll: Storage cycle (0:1x, 1:2x, 2:5x, 3:10x, 4:20x, 5:50x, 6:100x, 7:200x, 8:500x, 9:1000x, 10: Synchronous input).
Error code	-

■ **Specify OUT for Data Storage**

Incoming command	SR,OK,aa\r\n
Response commands	SR,OK,aa,c\r\n
Parameter Description	·aa: OUT number (Values 01 to 04, 01: OUT01, 02: OUT02…04: OUT04). ·c: Function number (0: OFF, 1: ON).
Error code	Err-64: The specified OUT number exceeds the valid OUT range.

5.6.4 Network Settings

■ **IP Address**

Incoming command	SR,EH,I \r\n
Response commands	SR,EH,I,zzzzzzzzzzzz \r\n
Parameter Description	Zzzzzzzzzzzz: IP address (Expressed As zzz.zzz.zzz.zzz) Example: When the IP address is 10.10.1.9, specify "010010001009".
Error code	-

■ **Subnet Mask**

Incoming command	SR,EH,M\r\n

Response commands	SR,EH,M,zzzzzzzzzzzz\r\n
Parameter Description	Zzzzzzzzzzzz: subnet mask (Expressed As zzz.zzz.zzz.zzz) Example: When the subnet mask is 255.255.0.0, specify "255255000000".
Error code	-

■ **Default gateway**

Incoming command	SR,EH,G \r\n
Response commands	SR,EH,G,zzzzzzzzzzzz \r\n
Parameter Description	Zzzzzzzzzzzz: The IP address of the default gateway (Expressed As zzz.zzz.zzz.zzz) Example: When the IP address is 10.10.1.9, specify "010010001009".
Error code	-

5.6.5 Encoder Settings

■ **Operation mode and detection direction**

Incoming command	SR,CJ\r\n
Response commands	SR,CJ,c,c\r\n
Parameter Description	The first c: operating mode (0: OFF, 1: timed, 2: triggered) The second c: detection direction (0: positive & negative timing, 1: positive timing, 2: negative timing)
Error code	-

■ **Input mode, minimum input time, and interval**

Incoming command	SR,CI\r\n
Response commands	SR,CI,c,ddddddddddd,dddddd\r\n
Parameter Description	·c： Input mode (0:1 phase 1 increment (no orientation), 1: 2 phase 1 increment, 2: 2 phase 2 increment, 3: 2 phase 4 increment) ·ddddddddddd： Minimum input time (unit: ns) （0000000100/0000000200/0000000500/0000001000/0000002000/ 0000005000/0000010000/0000020000） ·dddddd： Trigger interval (00000 1 to 10000)
Error code	-

6 Appendix

6.1 Error Codes

Error Codes	Description	Remark
Err-50	Command error	The received command is not a command defined by this system.
Err-51	Status error	Unable to perform operation (e.g. received command does not match current communication mode).
Err-60	Command length error	The number of characters in the received command or parameter is too long or too short.
Err-61	Insufficient number of arguments	The number of parameters for the received command is insufficient.
Err-62	Argument out of range	The received setting value exceeds the allowed setting range.
Err-63	Argument out of range (OUT reference limit)	The number of times a certain OUT value is repeatedly referenced in the OUT calculation exceeds the limit.
Err-64	Argument out of range (OUT/Sensor head number)	The specified sensing head/OUT number exceeds the valid sensing head/OUT count.
Err-66	Argument out of range (OUT specification)	The calculation range of the specified OUT includes either the OUT itself or the target OUT has not been set for AVE/P-P/MIN/MAX calculation.
Err-68	Argument out of range (Zoom)	The specified scaling parameter does not meet the following conditions: • Input value 1 - Input value 2 ≠ 0 • (Display value 2 - Display value 1)/(Input value 2 - Input value 1) | ≤ 2
Err-71	Argument out of range (OUT specified for data storage)	The OUT number corresponding to the stored data exceeds the valid OUT count.