LASER WELD MONITOR

PC Application Software

MS-Viewer

OPERATION MANUAL

AMADA

OM1215390
MS-Viewer-E02-202307

Thank you for your purchase our product.
Please read this manual carefully to ensure correct use. Keep the manual handy after reading for future reference.

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- Read operation manuals of the devices (such as PC) to be used with the product.

Contents

1. Special Notes

(1) Safety Precautions

Before using the equipment, please read through the Safety Precautions carefully to ensure proper use.

- The precautions listed here are designed to ensure safe use and proactively prevent risks and damage to the user and other people. All precautions are critical for safety. Please read them all.
- The hazard signs have the following meanings:

⚠DANGER	Mishandling will cause imminent risk of death or serious injury.
⚠WARNING	Mishandling may cause risk of death or serious injury.
⚠ CAUTION	Mishandling may cause risk of injury and physical damage. It may also cause property damage.
	These signs represent “DONTs.” They warn of actions not covered by the product warranty. The concrete contents of prohibition are shown in illustrated form or in writing inside or near the symbol.
	These signs represent “DOs" which must be observed by the product user. The concrete contents of instructions are shown in illustrated form or in writing inside or near the symbol.
	A sign within a triangular border indicates that a hazard (danger, warning or caution) is present. The concrete contents of instructions are shown in illustrated form or in writing inside or near the symbol.

⚠ DANGER

DO NOT touch anything inside the equipment.
High voltage is present internally. Do not touch anything inside the equipment with the power on.

NEVER ATTEMPT to disassemble, repair or modify the equipment
Failure to observe this will result in an electric shock or fire.
Do not perform maintenance other than that detailed in the Operation Manual.

DO NOT look directly at the beam, and do not allow any part of the body to enter the beam.
Both direct and scattered beams are hazardous.
Direct eye exposure to a laser beam will cause blindness.

NEVER burn, destroy, cut, crush or chemically decompose the equipment.
This product incorporates parts containing arsenide (As).

⚠ WARNING

ALWAYS wear protective goggles.
Always wear protective goggles where the equipment is used.
Even if you wear them, you may lose your sight if the laser beam enters your eyes directly through protective goggles. Protective goggles attenuates the laser beam, but does not block it.

AVOID skin exposure to a processing or welding laser beam.
This product monitors the near-infrared light from the processing point.
Exposure to a laser beam will cause burns. Never expose any part of the body to a laser.

DO NOT touch the workpiece during or immediately after laser working.
The workpiece may be extremely hot.

USE the specified cables and connect them securely.
Using cables with an insufficient capacity or improper connection may result in a fire or electric shock.

KEEP the power and connection cables free of damage.
Do not walk on, twist, or tug the cables.
Damaged cable may result in an electric shock, short circuit, or fire
For repair or replacement, contact your dealer or us.

In the event of an anomaly, STOP the operation.
Continuing the operation with anomalies such as a generation of fumes, a burning odor, strange noise, or overheating unattended may result in an electric shock or fire. In the event of the above or other anomaly, immediately contact your dealer or us.

GROUND the equipment.
If not grounded, the equipment may cause an electric shock in the event of malfunction or ground fault.

STAY AWAY from the equipment if you have a pacemaker.
If you have a pacemaker, do not approach a welding machine in operation or the immediate area unless your doctor has given consent.
Welding machines generate a magnetic field which interferes with the operation of a pacemaker.

⚠ CAUTION

DO NOT splash water.
Electrical parts may cause an electric shock or short circuit if they become wet.

USE proper tools (e.g., wire stripper, pressure wire connectors) for termination of connection cables.
Failure to do so may damage the internal wires, leading to possibility of fire and electric shock.

PLACE the equipment on a firm surface.
Injury or equipment damage/malfunction may result if equipment topples over or falls from the installed location.

DO NOT place any drinks, etc. on the equipment.
Any liquid split onto the equipment may cause insulation failure, resulting in ground fault or fire.

DO NOT place flammable objects near the equipment.
Surface flash and expulsion (spatter) generated during welding may ignite flammable objects, resulting in a fire.
If work involves use of flammable items, place a non-flammable cover on such items.

DO NOT cover the equipment with a blanket or cloth.
During operation, do not cover the equipment with a blanket or cloth. This may lead to the equipment overheating and catching fire.

DO NOT use the equipment for applications other than metal working.
Using it otherwise may result in an electric shock or fire.

DO NOT use with the equipment other than the YAG or fiber laser equipment which oscillates a waveform of 1.0 µm band.
Using it otherwise may result in malfunction to the equipment.

ALWAYS wear appropriate work clothing.
Wear protective gear such as gloves, a long-sleeved top and leather apron.
Surface flash and expulsion (spatter) can cause burns if it contacts the skin.

PROVIDE fire extinguishers.
Provide fire extinguishers at the welding site as a precautionary measure.

PERFORM maintenance and inspection on a regular basis.
Perform maintenance and inspection regularly.
For repair or replacement, contact your dealer or us.

(2) Handling Precautions

- Designate a person with sufficient knowledge and experience in handling laser beams and laser equipment as a laser safety administrator.
- The laser safety administrator must take charge of the control keyswitch for the laser device. Further, the administrator must share safety knowledge with laser workers and take command of the work.
- Partition all areas that may be exposed to laser beams with a fence or other means. Further, the administrator must take charge of such areas, and post a sign in a clearly visible manner to keep them off limits for unauthorized personnel.
- Place the product on a firm surface, and keep it level with the ground when in use. Using it in a tilted position may result in malfunction.
- For the **MM-L400A**, install in a location with an ambient temperature range of 5 to 40ºC, ambient humidity of 85% RH or less and free from abrupt temperature changes. Further, avoid the following locations.
  - Dirty or dusty location or location with oil mist present
  - Location often exposed to vibration or shock
  - Location where chemical substances, etc. are handled
  - Location near a high noise generating source
  - Location where condensation occurs
- Perform warming-up operation for at least 10 minutes after turning on the power supply. When the ambient temperature is low, it is recommended that the time is increased.
- Keep the exterior clean with a soft cloth or cloth lightly dampened with water. For stains, clean them off using a diluted neutral detergent or alcohol. Do not use thinner or benzene as they may cause discoloration or deformation.
- To prevent malfunction, do not allow any foreign objects such as screws or coins to enter the equipment.
- Operate the switches and buttons with care. Rough operation or the use of a tool or pen tip may result in damage or malfunction.
- Subjecting cables to strong impact may damage it. Further, mount them securely until the connector is locked
- To prevent malfunction, be sure to turn off the power supply in advance when installing and removing cables that are connected on the rear side of the product.
- To prevent damage, do not bend the optical fiber beyond its minimum bending radius or apply any forms of shock to it.

Type	Minimum bending radius
Fiber unit	100 mm

- When an administrator or an operator enters an area containing a laser radiation hazard, safety measures to ensure compliance with MPE* limits are required.

  *MPE: Maximum Permissible Exposure of the laser radiation limit permissible for human eye and skin exposure.

* For more information about laser radiation regulations and MPE values, see the standard referenced below.

  Japanese Industrial Standard JIS C 6802 “Safety of laser products”

2. Features

The Laser Weld Monitor PC Application Software **MS-Viewer** connects to the **MM-L400A** Laser Weld Monitor, sets conditions for signal detection, and then displays the waveforms of the detected signals

MS-Viewer is equipped with the following features:

- Operations in the **Microsoft Windows** environment:

  Various functions are available using simple mouse operation. When using a tablet-type PC with Windows, finger-touch operations are also available.

- Large, easy-to-see graphic screen

  The display screens are Windows-compliant. Large and highly visible screens make various operations easy, such as setting conditions for signal detection, as well as acquisition, display, and analysis of waveforms.

- By setting tolerance limits for upper/lower excursions of the output waveforms, alarm signals can be set to trigger when the output waveforms are outside these tolerance limits. With the connection to the **MM-L400A,** the light generated from the processing point can be displayed as waveforms.

NOTE:
The **MM-L400A** and **MS-Viewer** are equipment to monitor the light from the processing point but not equipment to directly judge whether the laser welding status is good or bad.
The customer should optionally use a judging function considering the relation between the laser processing quality and the monitored output waveform.

3. Setup

This chapter explains how to set up the laser weld monitor PC application of the **MS-Viewer**.

(1) Setup

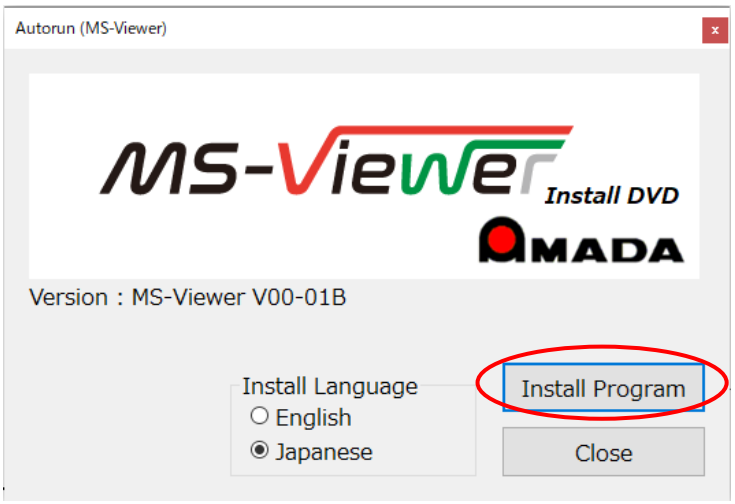
(1) Installation

The recommended PC specifications for the operation of the **MS-Viewer** are as follows:

CPU	Intel Core i5/1.6 GHz or more
Memory	16 GB or more
LAN	1 port (1000BASE-T compliant)
OS	Windows 10 Professional or later
Display	1920x1080 (Full HD)
Free HD capacity	10 GB or more

1) Insert the installation CD into the CD drive.
The installer stats automatically. If not, execute [AUtoRun.exe] in the CD.

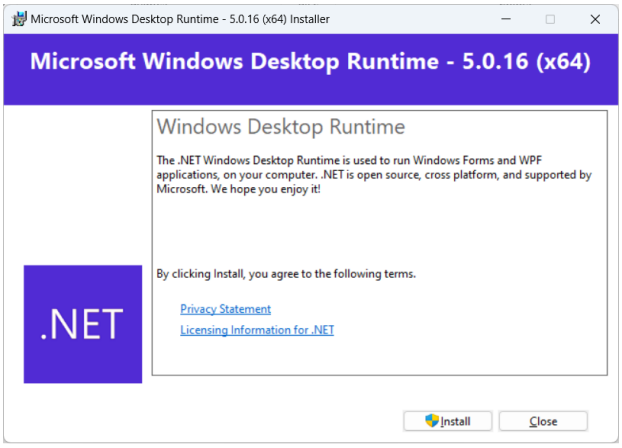
2) Select a language from [Install Language].



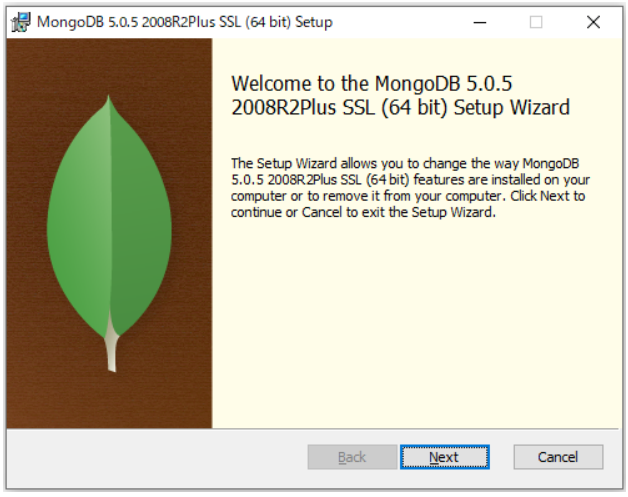
[Japanese] is selected by default for Japanese OS; [English] for OS with language other than Japanese. Select a language to install.

3) Click the [Install Program] button.

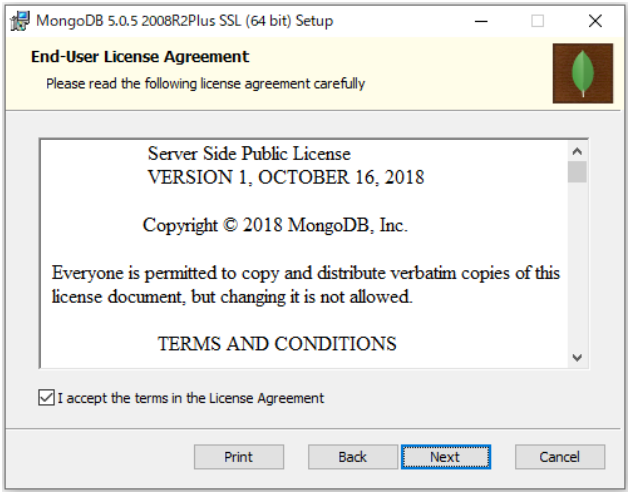
1. Once the installing operation starts, you are prompted to install Microsoft Windows Desktop-Runtime. Click the [Install] button to proceed.



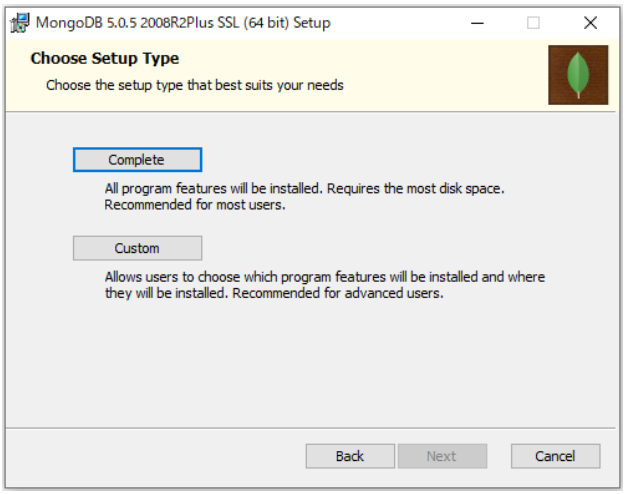
2. MongoDB 5.0.5 2008R2Plus SSL (64 bit) Setup is displayed. Click the [Next] button to set up. (The version No. in the figure below is for informative purpose only and may differ from what is displayed on the actual screen.)



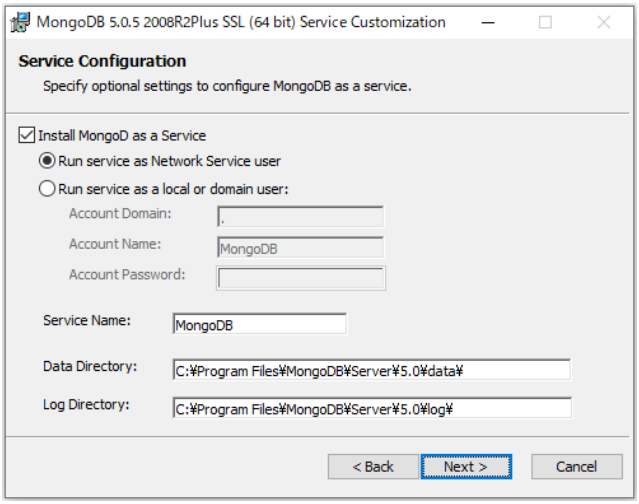
3. The End-User License Agreement is displayed. After confirming it, turn on the checkbox in [I accept the terms in the License Agreement], and click the [Next] button.



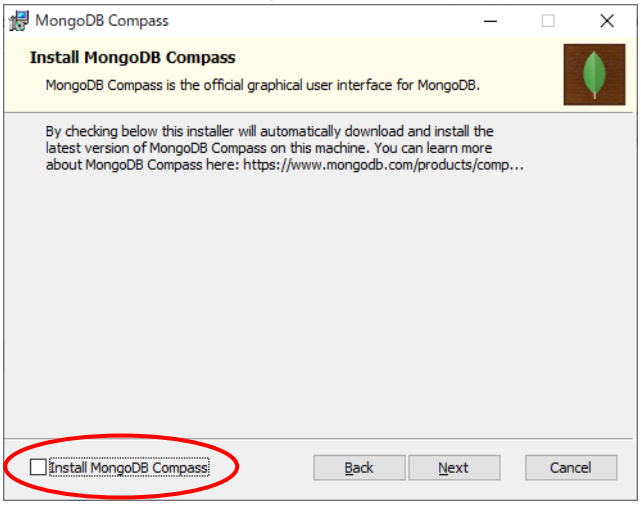
4. Choose Setup Type is displayed. Click [Complete].



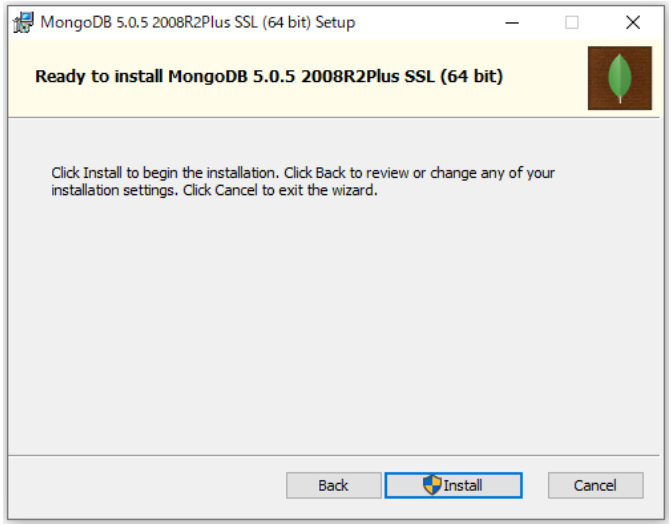
5. Service Configuration is displayed. Check that the [Install MongoD as a Service] option is selected, and click the [Next] button.



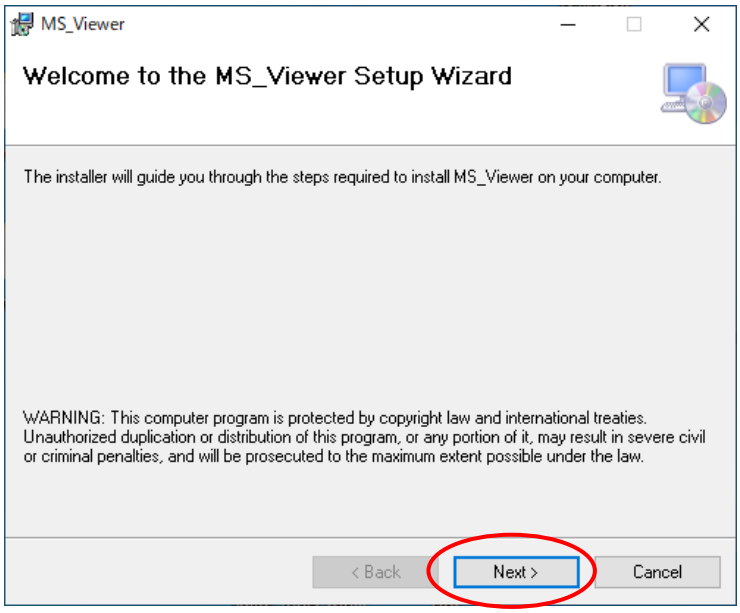
6. Install MongoDB Compass is displayed.
Turn off the checkbox [Install MongoDB Compass], and click the [Next] button.



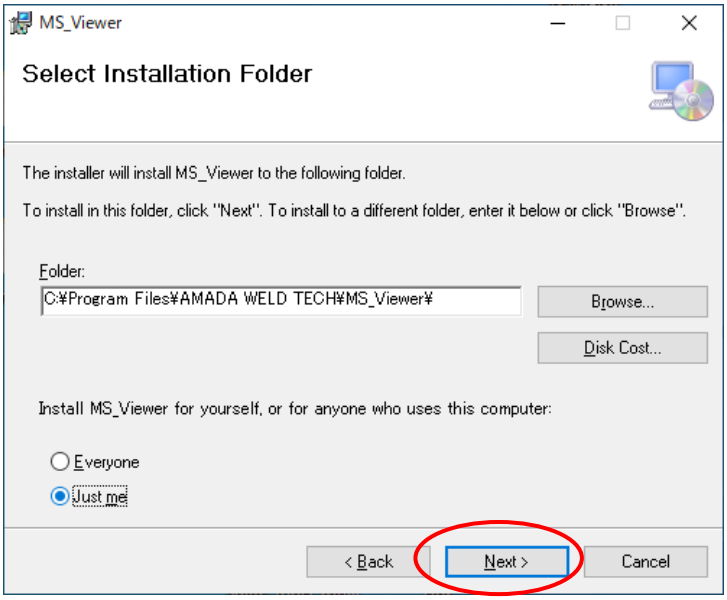
7. A confirmation screen for installation is displayed. Click the [Install] button to proceed the installation.



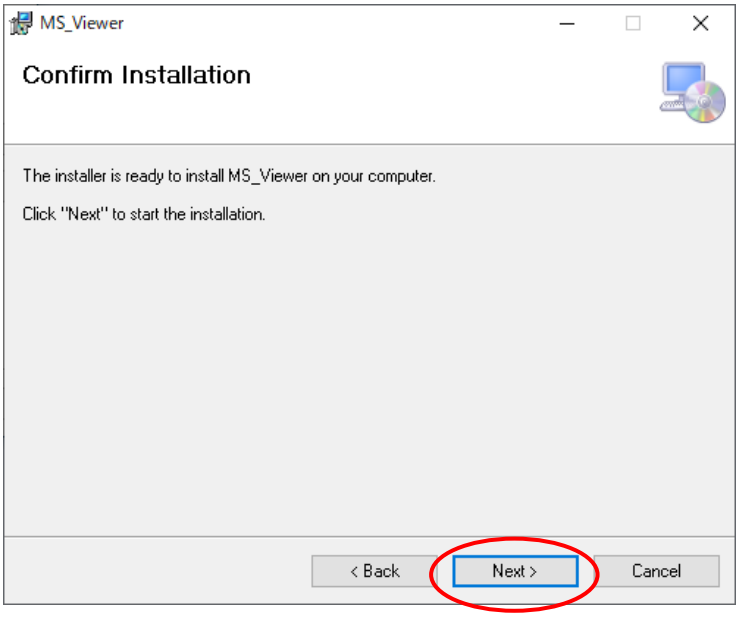
4) The Setup Wizard of MS-Viewer is displayed. Click the [Next] button.



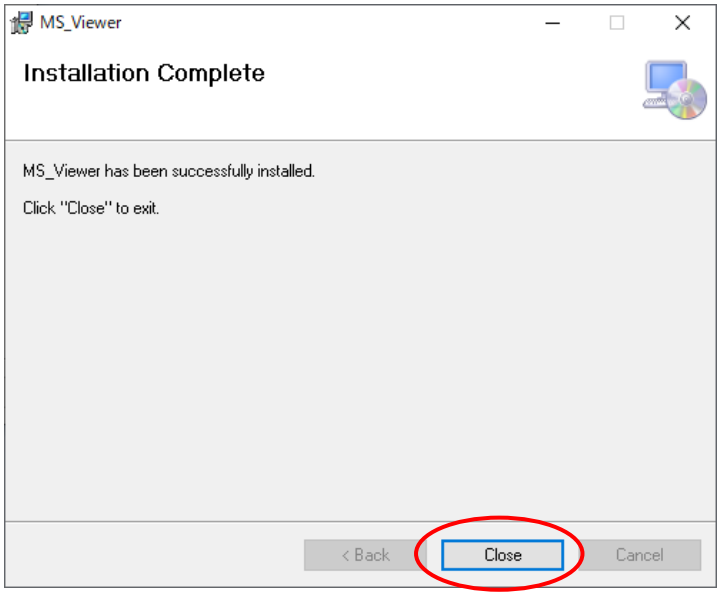
5) Set the destination folder and click the [Next] button.
The default is [C:¥Program Files¥AMADA WELD TECH¥MS-Viewer].



6) Click the [Next] button.



7) When the installation is completed, the following screen appears. Click the [Close] button to exit.



The following icon is created on desktop and registered in the program menu.

(2) IP address setting

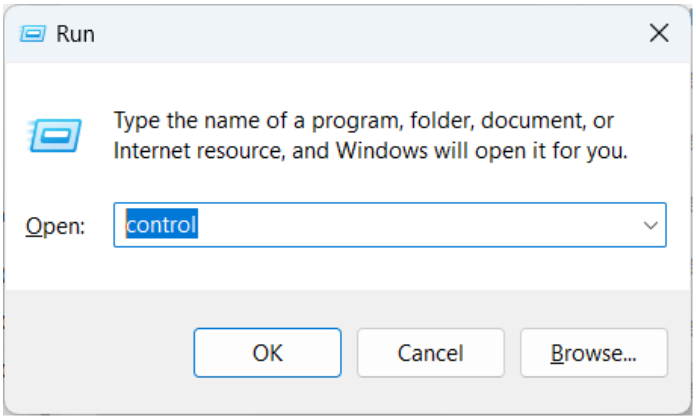
Set the IP address of the personal computer.

The IP address of the **MM-L400A** has been set to [192.168.1.40] at the factory. Use any address other than [192.168.1.40].

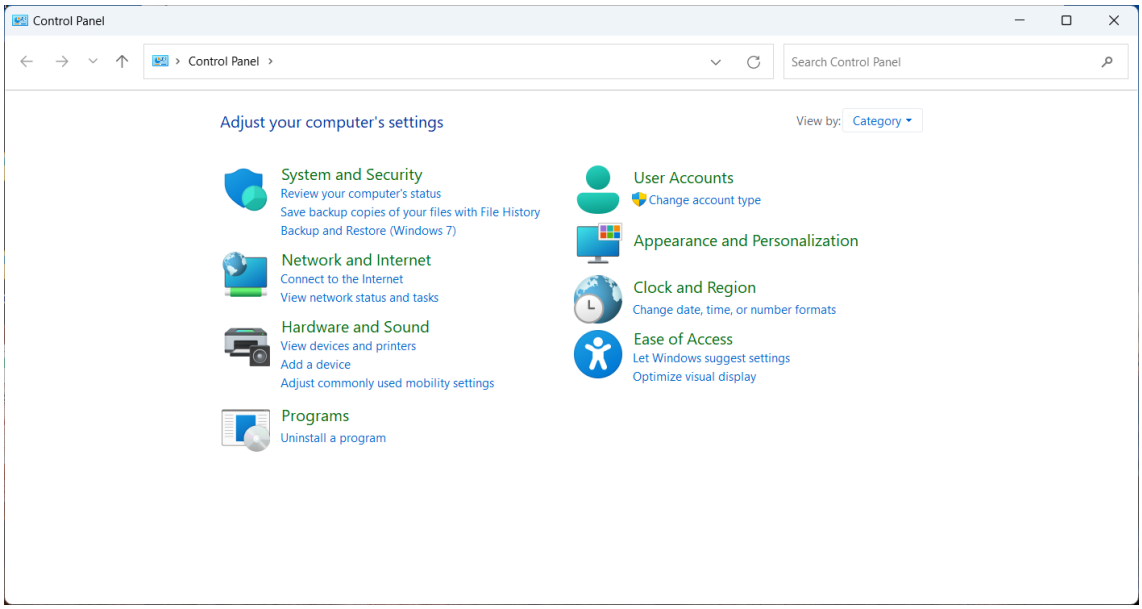
Setting procedure (for Windows 11)

1) Press the “Windows logo” key and the “R” key on the keyboard at the same time.

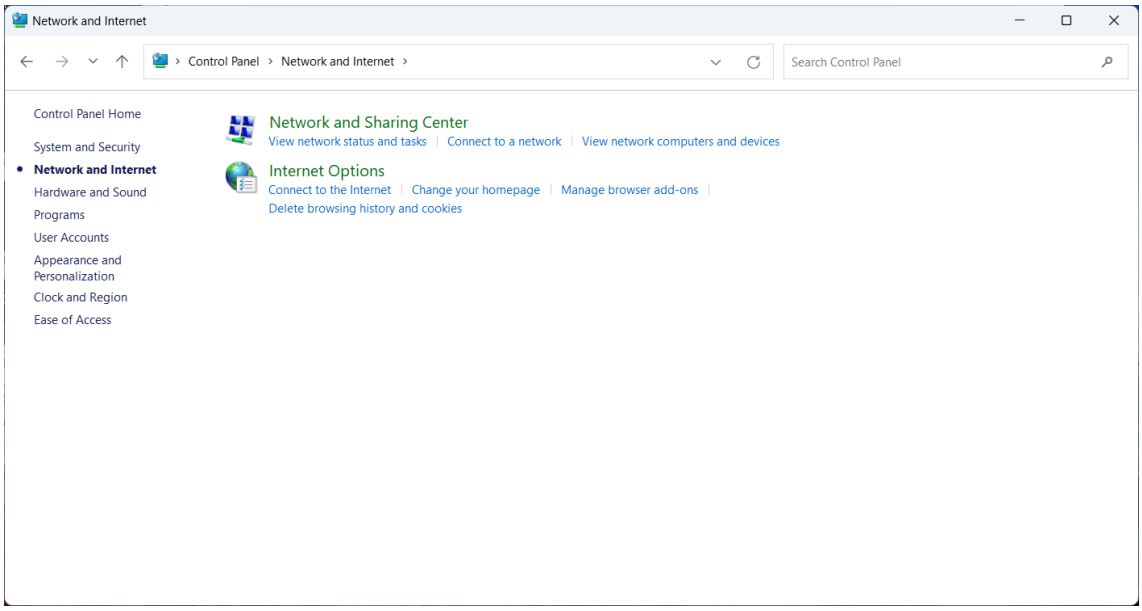
2) Select the displayed file name, input “control” as the name for the Run dialog, and click the [OK] button. The Control Panel screen appears.



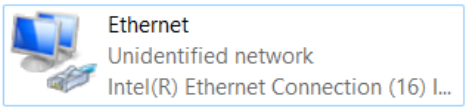
3) On the Control Panel, click the [Network and Internet] option.



4) On the [Network and Sharing Center] screen, select the [Change Adapter Setting] option.

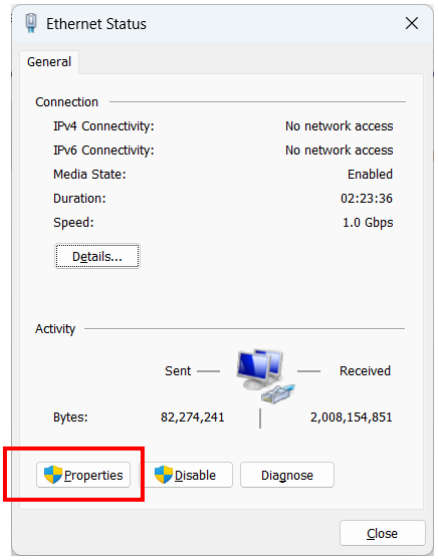


5) Select the network card to use.

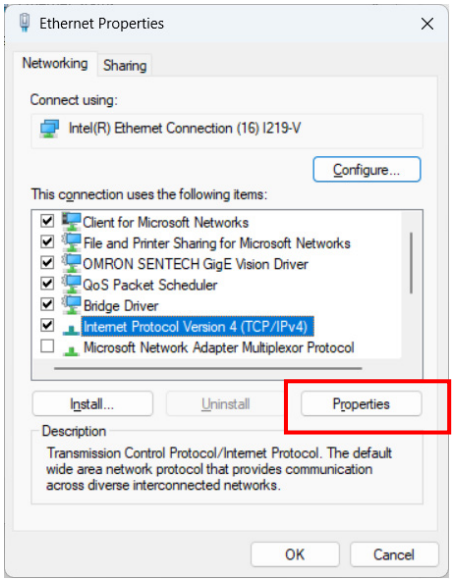


*The indication depends on the PC or the network card you use.

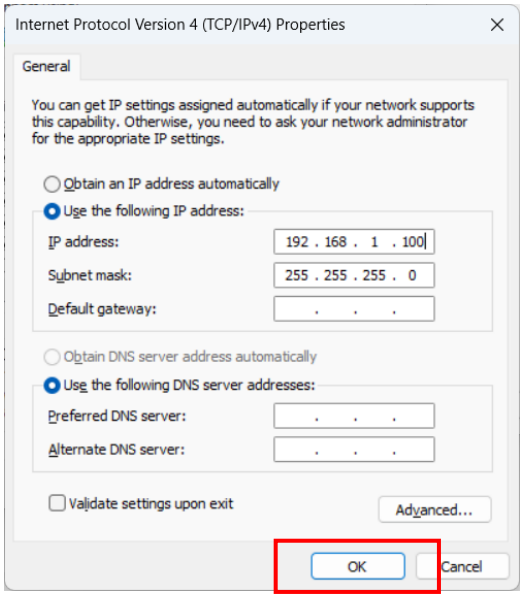
6) Click the [Properties] button.



7) Select [Internet Protocol Version 4(TCP/IPv4)], and click the [Properties] button.



8) Input the IP address. As in the following figure, set any value other than [192.168.1.40] for IP address, and set [255.255.255.0] for Subnet mask, and then click the [OK] button.



4. Startup and Shutdown of Application

This chapter describes how to start up and shut down the application software **MS-Viewer**.

(1) Startup and Shutdown of Application

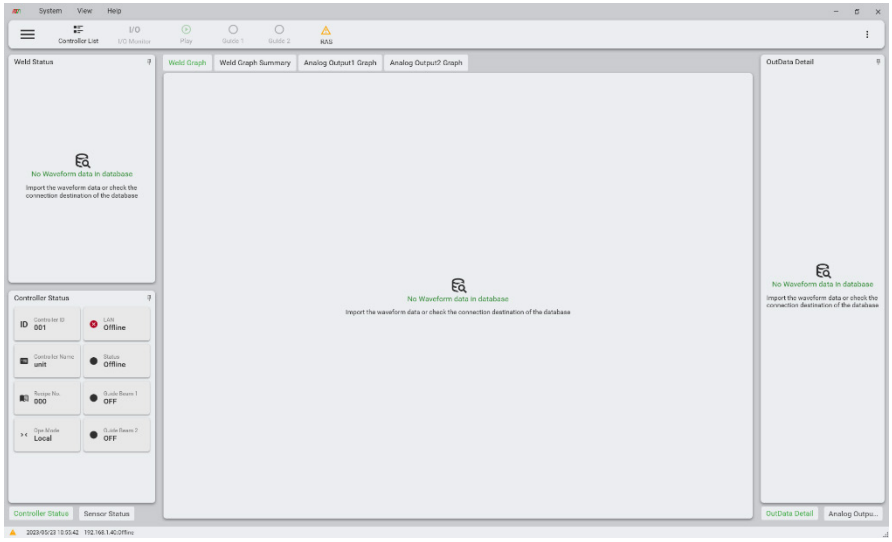
(1) Startup

Click **MS-Viewer** from the program menu of the personal computer or desktop icon .

* To obtain the waveform data with this application, 10 GB or more of the free capacity of the saving drive on the HDD is required.

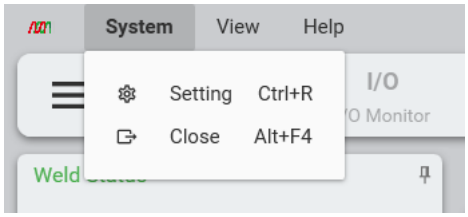
* It may take a little time until the application completes startup, as various data needs to be uploaded from the equipment.

* When connection with the equipment cannot be established, the application can be started using off-line status, as in the figure below.
With off-line status, some functions such as system configuration or condition settings are not operable.



(2) Shutdown

Select [System] and [Close] on the menu bar or click the close button (X) on the upper right of the application screen.

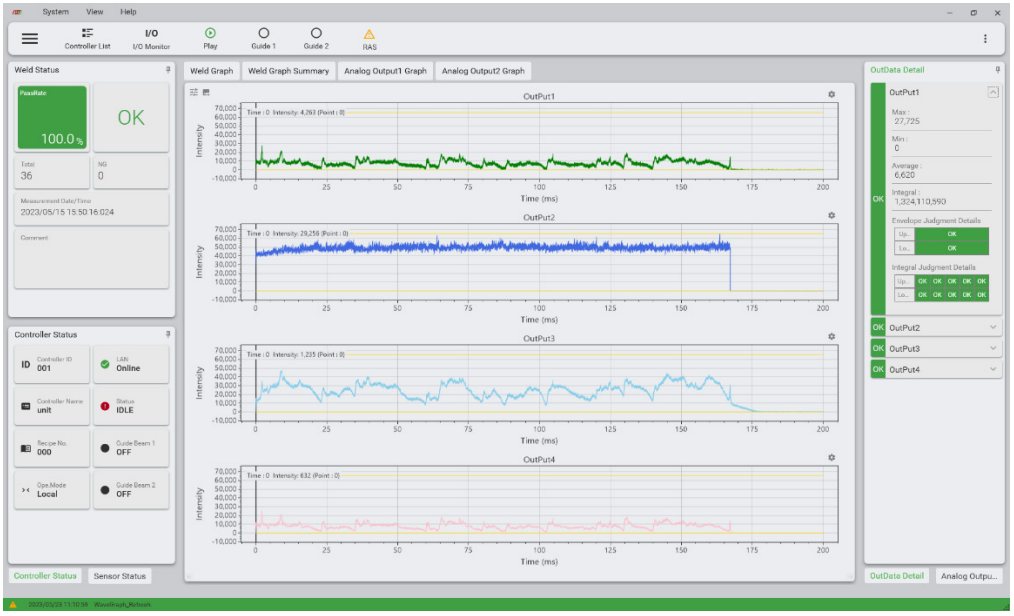


5. Displays and Functions

This chapter describes the displays and functions of the operation displays for the **MS-Viewer** application software.

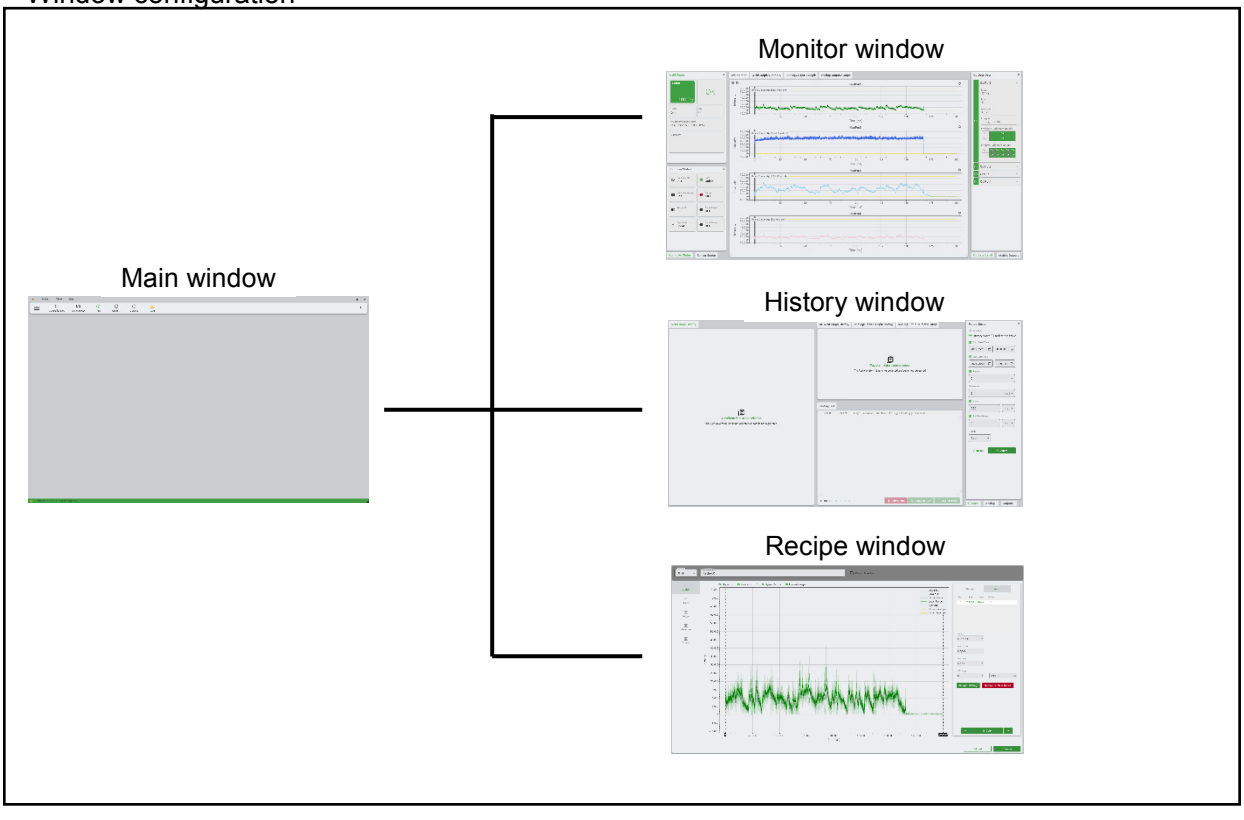
(1) Window Configuration of MS-Viewer

When starting up application, the Main window and the Monitor window appear in combination.



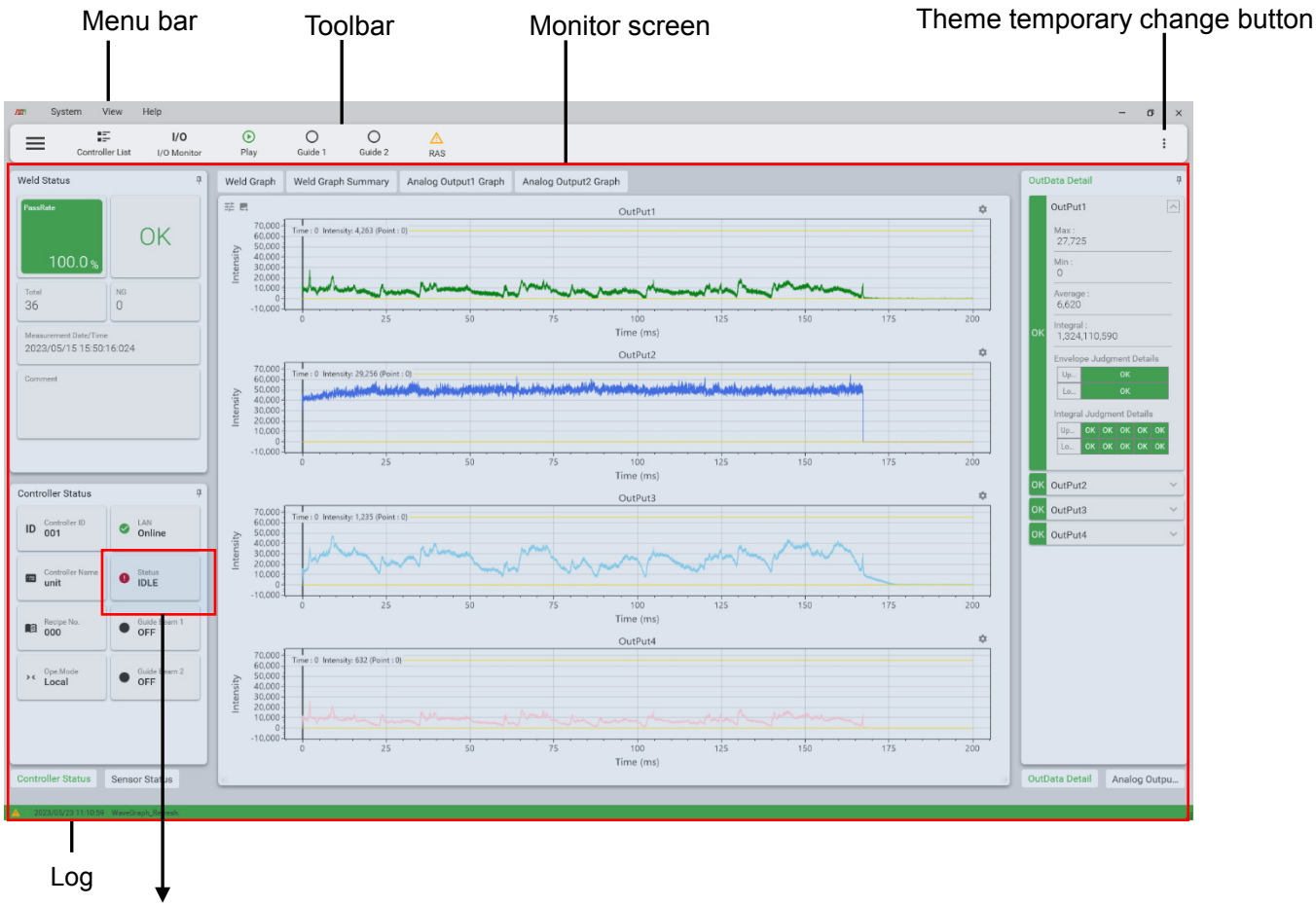
The **MS-Viewer** is usually used with the combined windows of Main and one of Monitor, History, or Recipe windows. To move to each window, use Page Transition in the toolbar.

Window configuration



(2) Function of Main Window

The Main window contains the Menu bar, Toolbar, and Log, enabling the equipment (controller) setting, guide beam switching on/off, and error reset.



[Individual parameter status description]

Indicates the controller status. The following shows the controller status list.

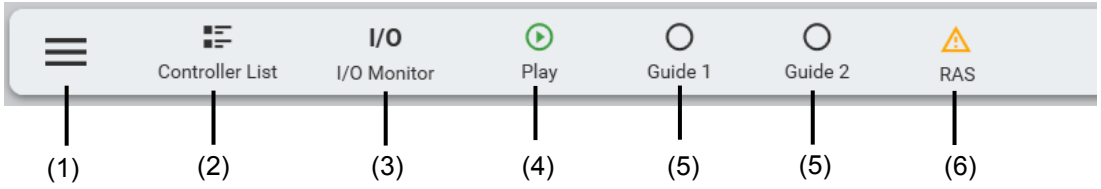
Status	Description
IDLE	Measurement preparation is completed
READY	Waiting for trigger detection
MEASURE	Measurement is in progress

Status	Description
Offline	Controller is not connected (connection is made when the controller initializes)
SHUTDOWN	Shutdown is being performed
ERROR	Abnormality has occurred

[Description of each element]

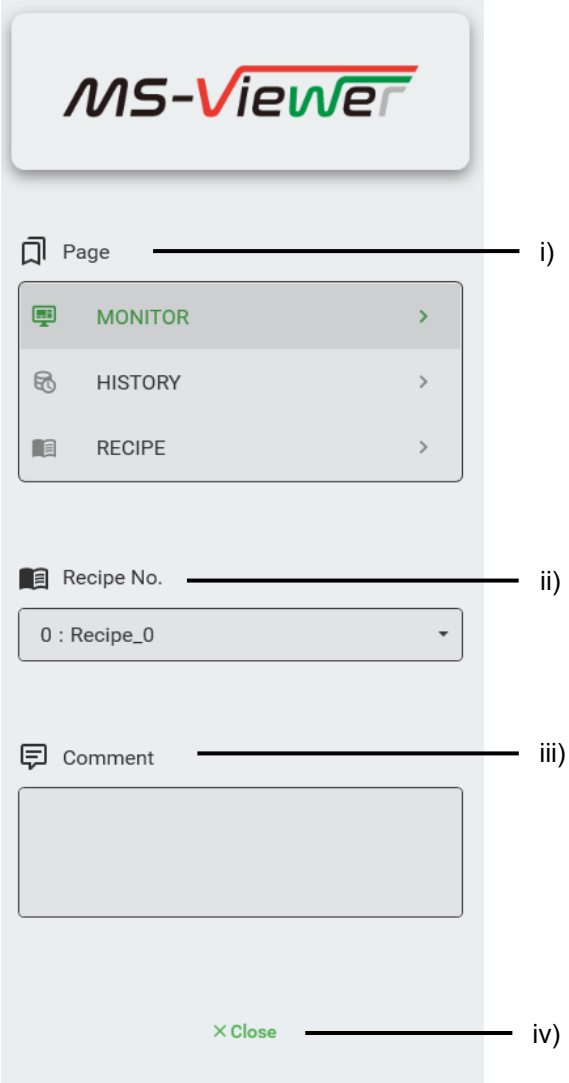
◆ Toolbar

The toolbar contains six buttons whose functions are described below.
Some functions of the toolbar are operable only in the Administrator mode.



(1) Page Transition

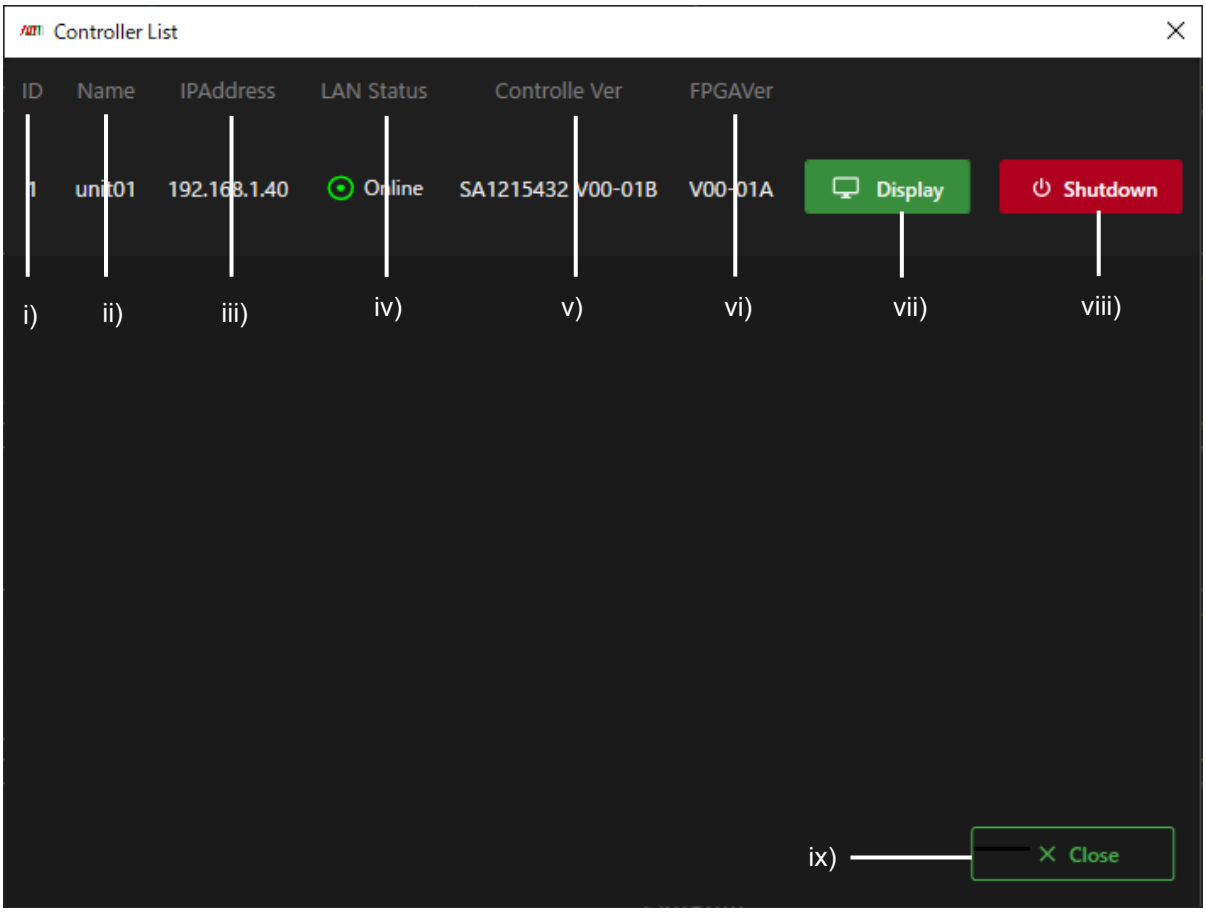
Windows of Monitor, History, and Recipe can be accessed via the Page Transition window. On the Page Transition window, the recipe No. can be selected and also comments can be input.



No.	Item	Description
i)	Page	Switches the display of Monitor/History/Recipe. The window in selection is highlighted.
ii)	Recipe No.	Displays the recipe No. currently in selection. Click ▼ to select another recipe No.
iii)	Comment	A comment can be added for each measurement.
iv)	Close	Clicking this button closes the page transition window.

(2) Controller List

Displays the list of currently connected controllers and their status.
“Shutdown” of the selected controller switches the status to offline.



No.	Item	Description
i)	ID	Displays the connection order of the controllers.
ii)	Name	Displays the controller name.
iii)	IPAddress	Displays the IP address of the controller.
iv)	LAN Status	Displays the LAN status of the controller. When offline, the display is as shown on the below: Offline
v)	Controlle Ver	Displays the version of the PCB and the software.
vi)	FPGAVer	Displays the FPGA version.
vii)	Display button	Displays the controller on the Monitor window.
viii)	Shutdown button	Shuts down the controller. During shutdown, the status changes to SHUTDOWN. When the shutdown completes, the status becomes Offline. *During shutdown, do not turn off the controller power. When starting up the controller after shutdown, the controller will establish the connection again.
ix)	Close	Clicking this button closes the Controller List.

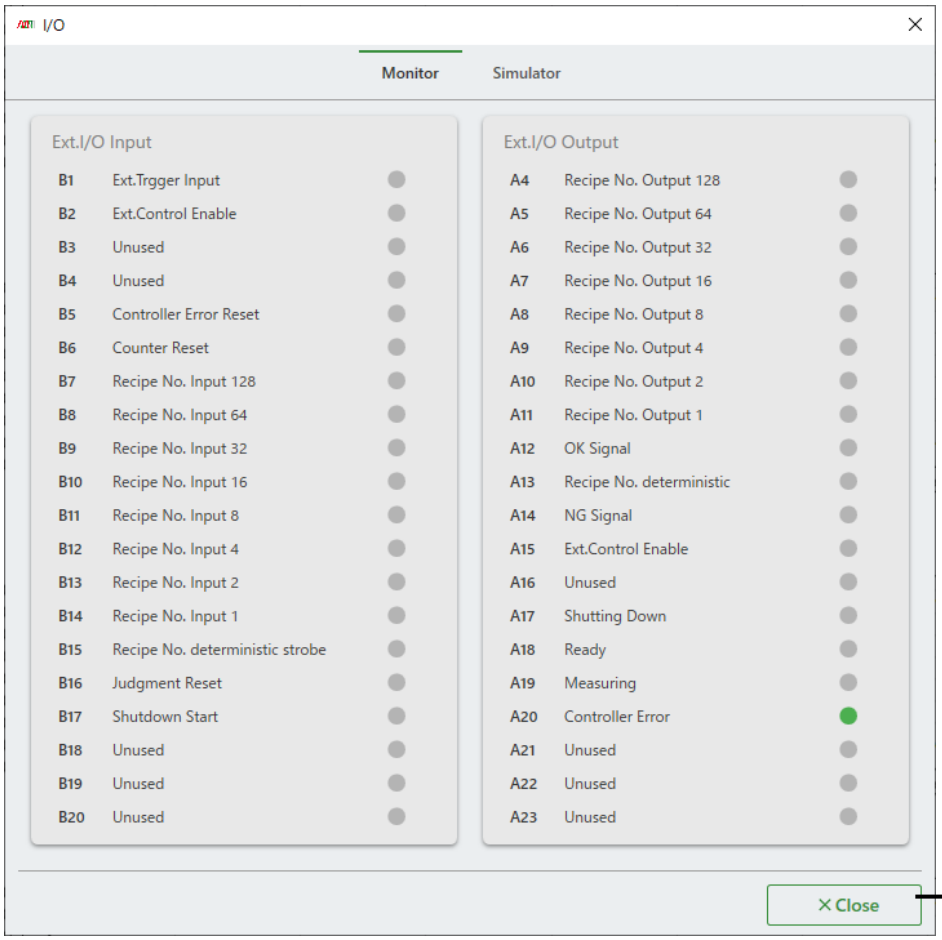
(3) I/O

Enables display of the on/off status of the external I/O signals and allows simulated outputs.

- Monitor

Displays the on/off status of the external I/O signals.

An on status is highlighted, and off status is grayed out.



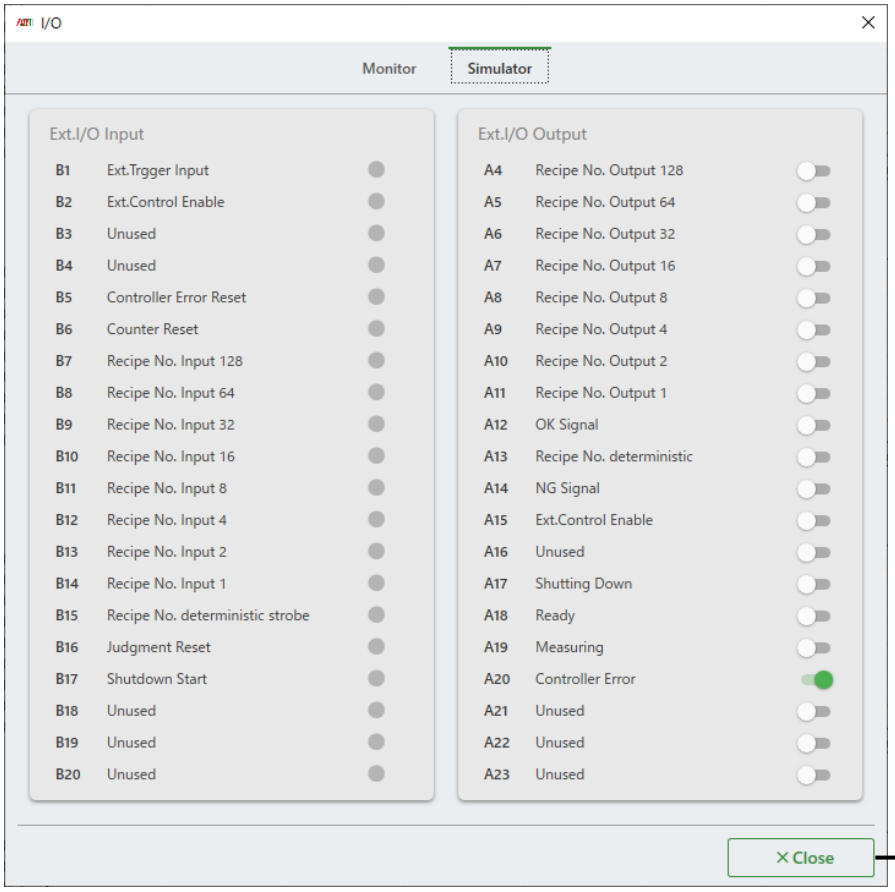
No.	Item	Description
i)	Close	Clicking this button closes the I/O.

● Simulator

Simulates the output of the external I/O signals. To simulate the on/off output, click the button to the right of each output parameter.

When turning the output on, the button slides to the right, and the parameter is highlighted.

The window below shows a simulation example in which the Recipe No. Output 3 (1+ 2) is output.



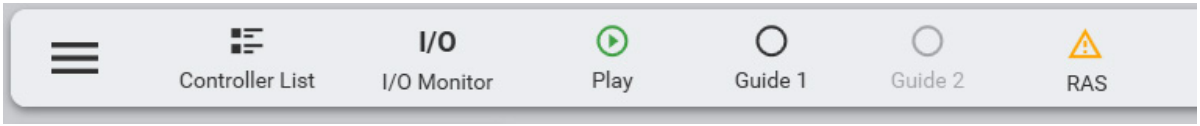
No.	Item	Description
i)	Close	Clicking this button closes I/O.

(4) Play/Pause button

Specifies start/stop of the measurement.

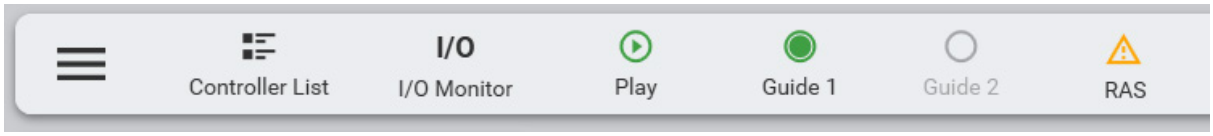
●Play (Measurement start)

Displayed when the measurement is paused. Clicking the button turns the controller status to READY. When the measurement starts, the guide beam is forced to turn off.



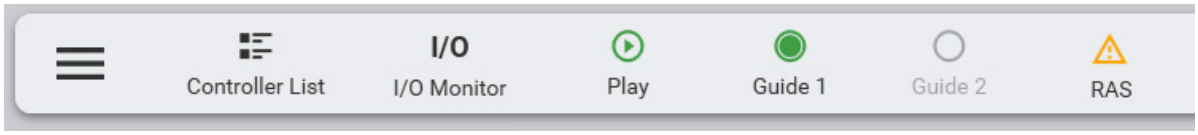
●Pause (Measurement stop)

Displayed when a measurement is being performed. Clicking the button switches to IDLE controller status.

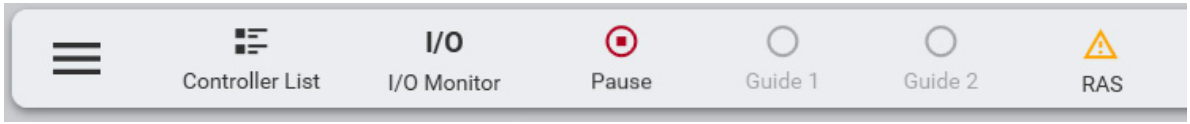


(5) Guide 1, Guide 2 (buttons)

The on/off status of the guide beam is toggled with each click of the button.



Turning on the guide beam switches the display to green.



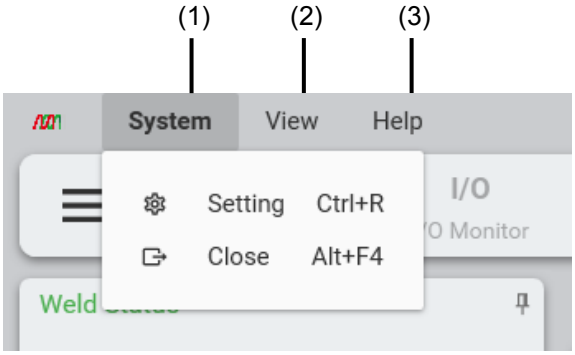
The number of the effective guide beam depends on the number of the sensor unit. Ineffective guide beam is grayed out, and so cannot be selected.

(6) RAS (button)

Clicking this button opens the error log. For details, see ◆Log display.

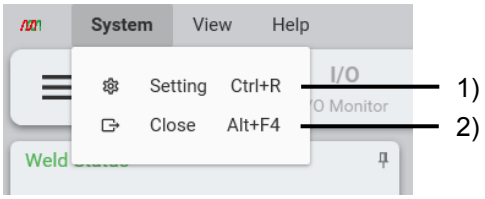
◆ Menu bar

The menu bar contains buttons of System, View, and Help.
Clicking each button displays deeper layers of parameters.



(1) System

System has two parameters: Setting and Close.



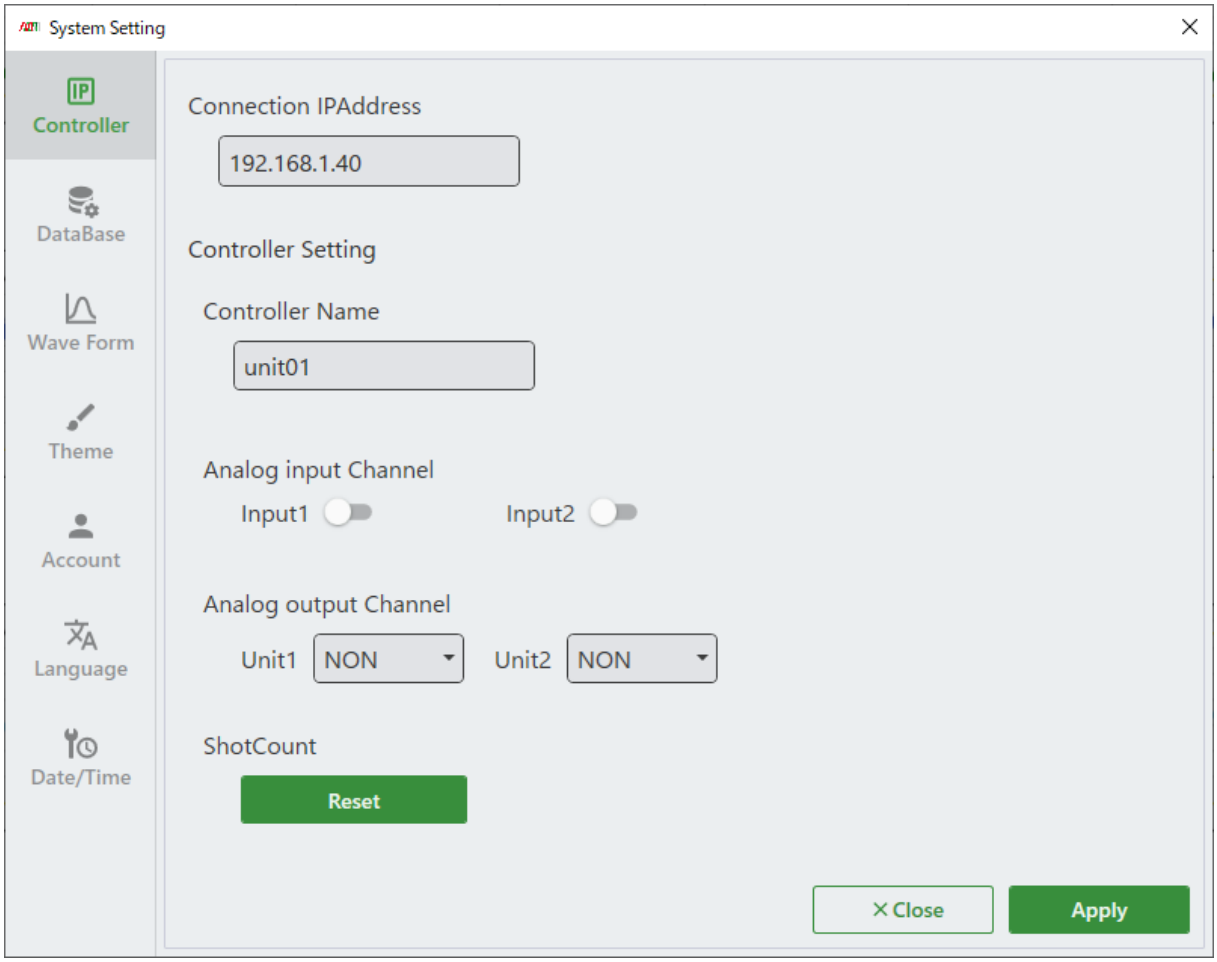
1) Setting

Clicking this icon opens the System Setting dialog.

The System Setting dialog enables setting of the controllers, the database to use, the theme, and accounts.

*Changing these settings requires restarting the application.

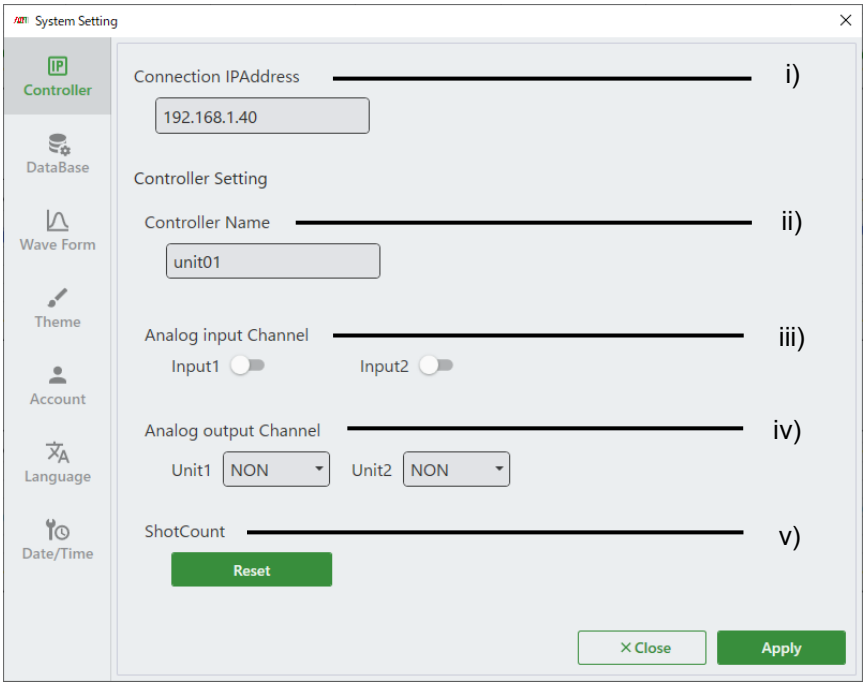
When editing is completed, click [Apply] at the lower right of the window, to send the setting to the MM-L400A. When all the editing is completed, click the [Close] button to close the editing window.

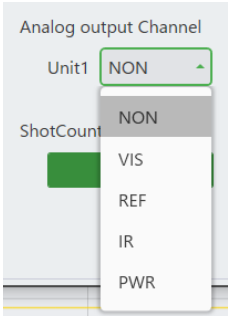


[System Setting dialog]

- Controller

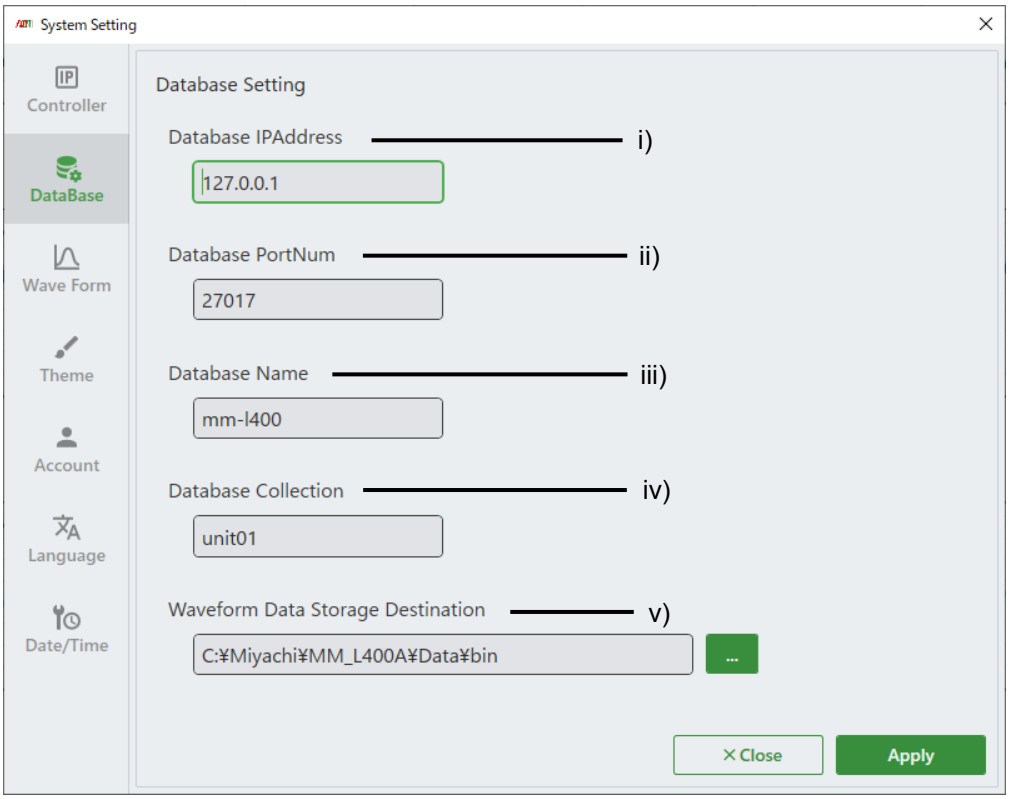
  Edits the name and the IP address of the controller connected.



No.	Item	Description
i)	Connection IPAddress	Enables editing of the IP address of the connection destination. The default IP address is set to: [192.168.1.40]
ii)	Controller Name	Enables editing of the controller name. The default name is set to: [unit01]
iii)	Analog input Channel	Enables setting whether to use the extension sensor. Click to switch the selection.
iv)	Analog output Channel	Enables specification of the input signal of the sensor output from AnalogOUT of the controller. 
v)	ShotCount	Clicking [Reset] resets the shot count and the NG count.

● Database

For displaying and editing the settings and the connected database.



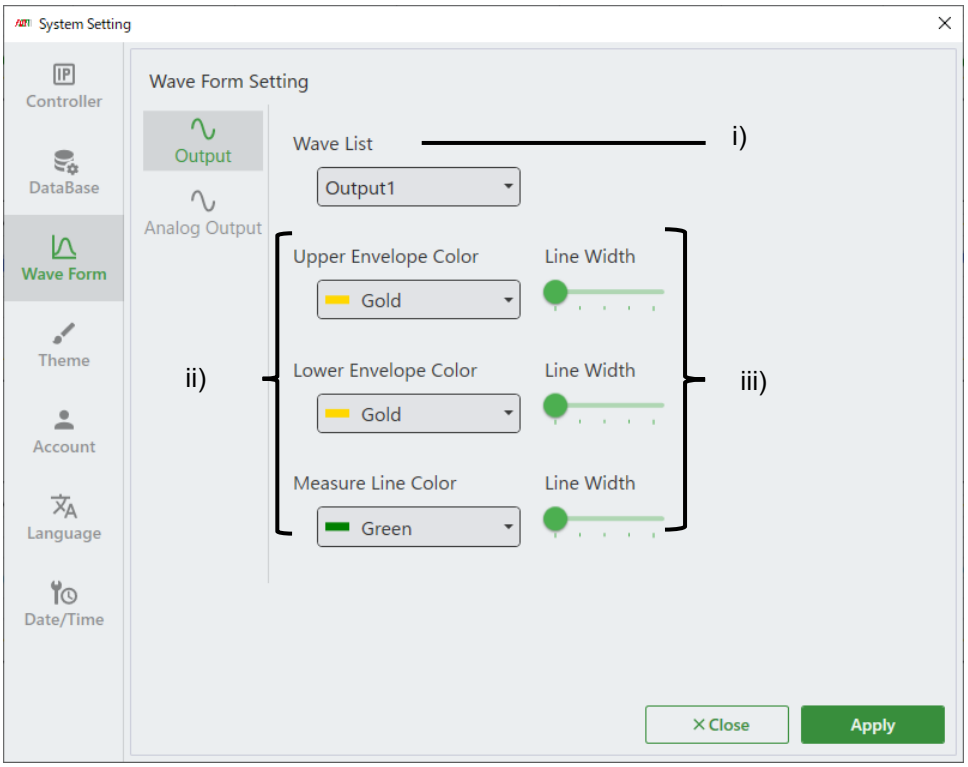
No.	Item	Description
i)	Database IPAdress	Enables editing of the IP address of the database.
ii)	Database PortNum	Enables changing of the port number of the database.
iii)	Database Name	Enables name change of the database.
iv)	Database Collection	Enables changes to the collection name.*1
v)	Waveform Data Storage Destination	Enables directory change to one where the waveform data is stored.

*1: Collection is a container to which the documents generated in the database are stored. Plural collections can be generated in a database.

● Wave Form Setting

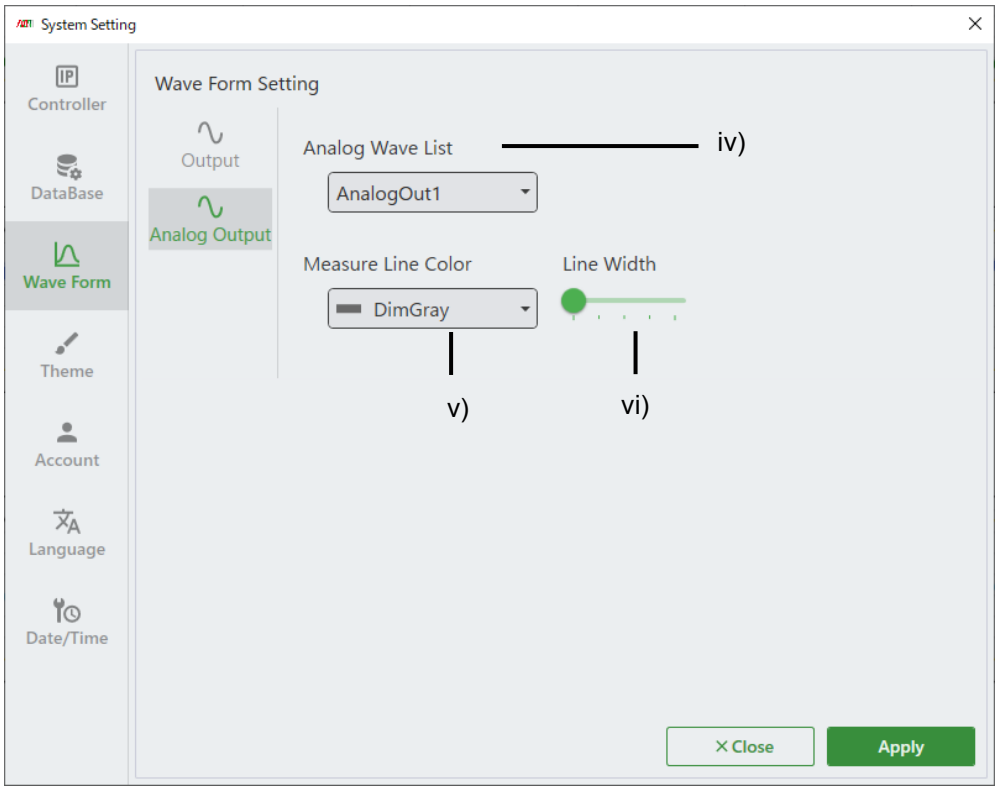
Wave Form Setting has two types of menus: Output and Analog Output.
For each output waveform, line color and line width of the waveform graph can be changed.

Output



No.	Item	Description
i)	Wave List	Displays the waveform name on the display. To display other waveforms, select from the combo box.
ii)	Upper/Lower Envelope Color and Measure Line Color	Changes the color of envelope or measurement line of the waveform listed in the waveform data list.
iii)	Line Width	Changes the width of the envelope and the line listed in the waveform data list.

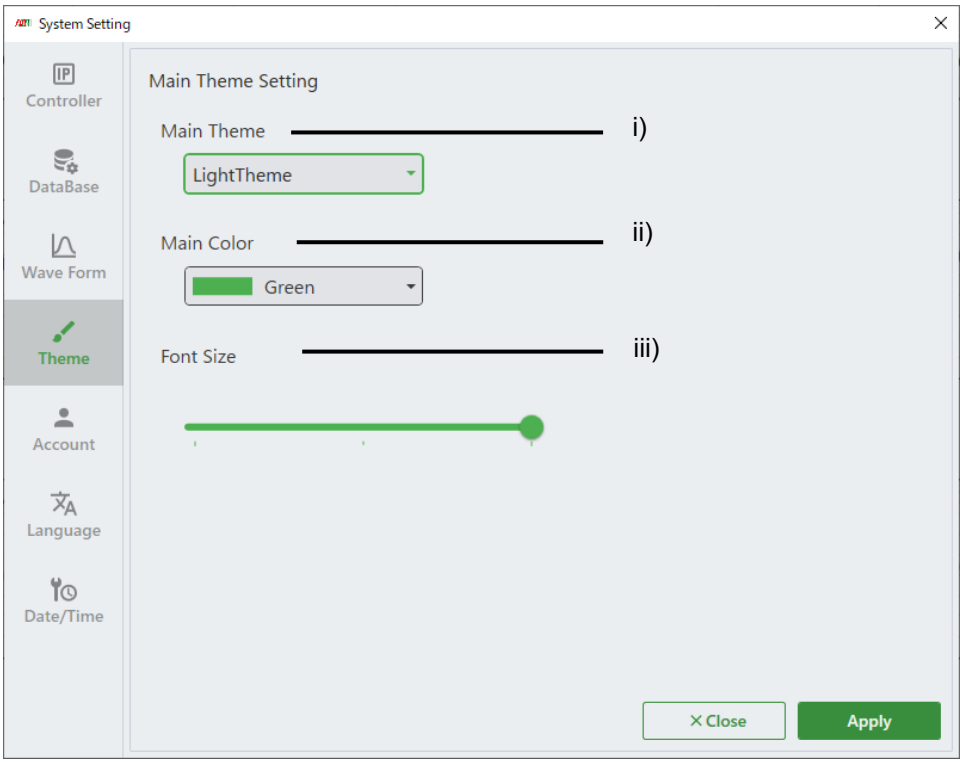
[Analog Output]



No.	Item	Description
iv)	Analog Wave List	Displays the analog waveform name. To display other waveforms, press ▼ and select from the list.
v)	Measure Line Color	Changes the line color of the displayed analog output waveform.
vi)	Line Width	Changes the line width of the displayed analog output waveform.

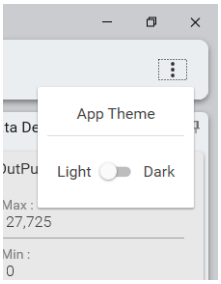
- Theme

  Enables main theme changes (background color: white or black), main color, and font size.



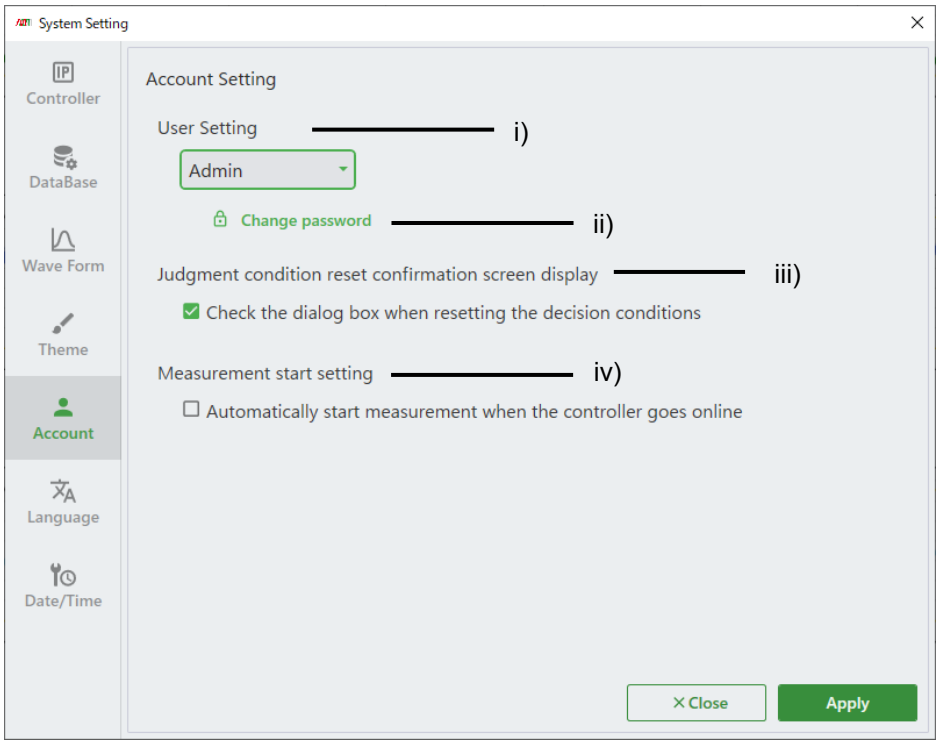
No.	Item	Description
i)	Main Theme	Enables application theme change.
ii)	Main Color	Enables changing the application main color to be changed.
iii)	Font Size	Enables font size change.

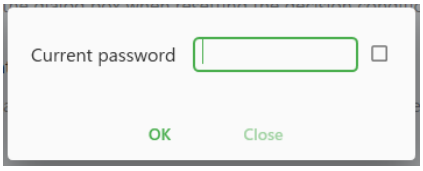
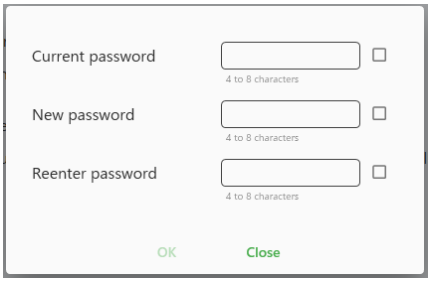
*To temporarily change the main theme, select [Light] or [Dark] from the Temporary Change button (the ⋮ mark) on the right end of Toolbar. This setting is valid until the application is closed.



● Account

Enables account setting.

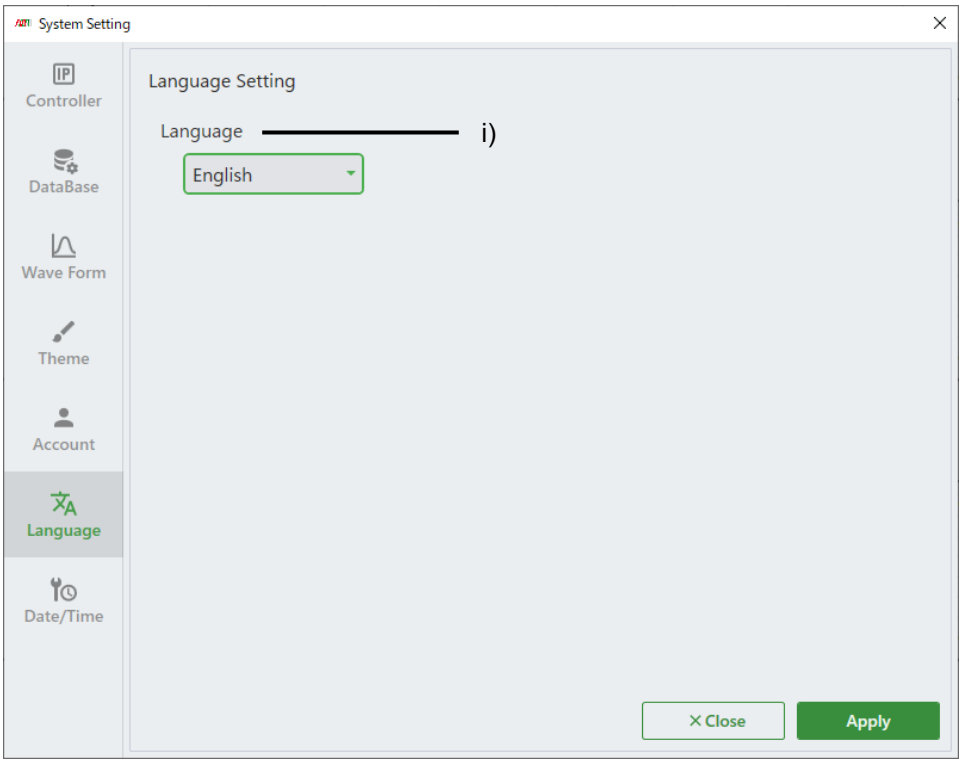


No.	Item	Description
i)	User Setting	Sets the user privileges. With Administrator privileges, all functions are available. With Operator privileges, some functions of the Recipe window and System Setting window are available. To select Administrator privileges, a password is required. The default password is set to an empty string. 
ii)	Change password	Allows the password to be changed (displayed only in Administrator level). Password of 4 to 8 alphanumeric characters can be set. 

No.	Item	Description
iii)	Judgment condition reset confirmation screen display	Specifies whether to display a confirmation window to reset a judgment condition. If this option is not selected (check mark not placed), when a judgment condition is edited which requires a reset, no confirmation window appears. *This option is recommended to be selected.
iv)	Measurement start setting	Specifies whether to automatically start measurement when the controller is online. Select this option with a checkmark to automatically start measurement when the controller is online.

- Language

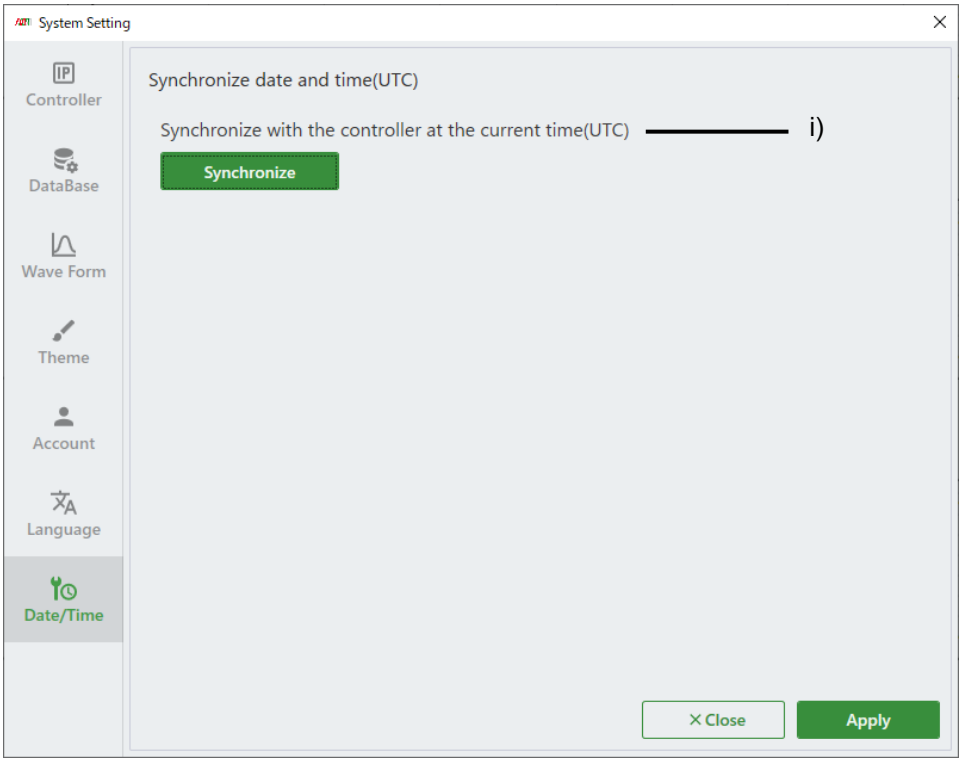
  Sets the language to use in the application.



No.	Item	Description
i)	Language	Select either [English] or [Japanese].

- Date/Time

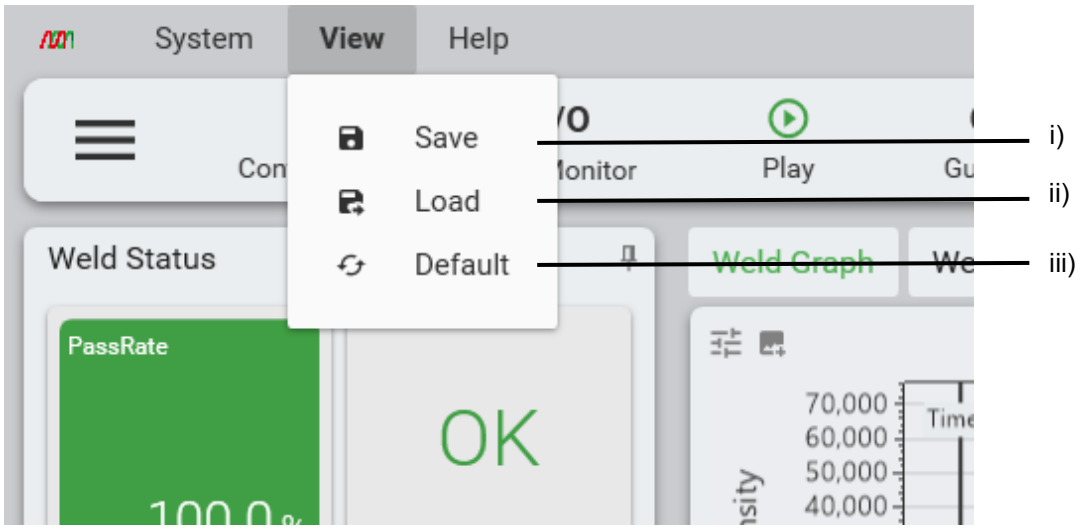
  Date and time setting is available.



No.	Item	Description
i)	Synchronize with the controller at the current time (UTC)	Synchronizes the controller date and time to that of the OS of the connected personal computer.

(2) View

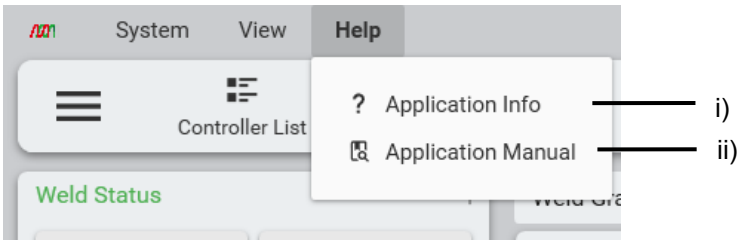
The [View] button contains the display layout setting parameters.



No.	Item	Description
i)	Save	Saves the current display layout file in an arbitrary folder.
ii)	Load	Reads the display layout file from an arbitrary folder to reproduce the layout when the layout is saved.
iii)	Default	Returns the display layout to the default location.

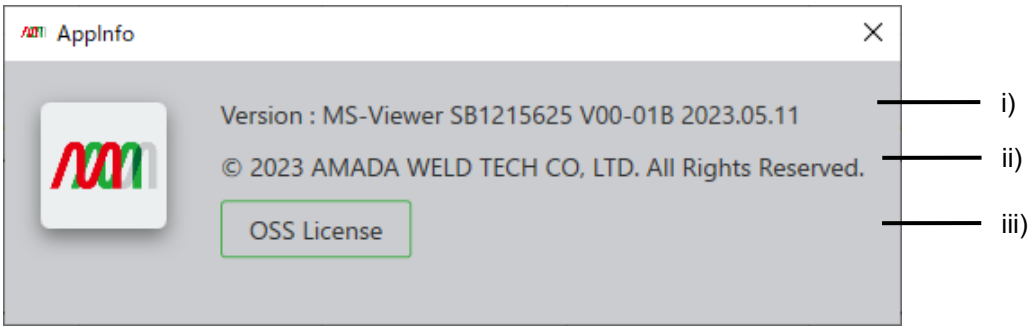
(3) Help

The [Help] button contains two parameters: Application Info and Application Manual.



No.	Item	Description
i)	Application Info	Displays a dialog of application information.
ii)	Application Manual	Displays a message to download the operation manual of the application. For the detailed download procedure, refer to the reference document contained in the product.

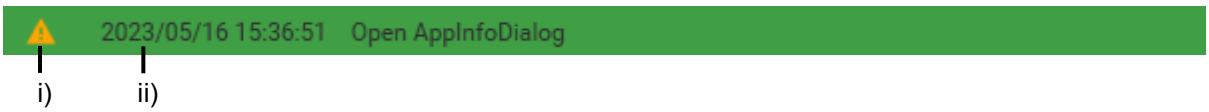
[System setting dialog]



No.	Item	Description
i)	Version	Displays the version of the MS-Viewer.
ii)	Copyright	Displays the copyright.
iii)	OSS License	Displays the dialog of the OSS license information.

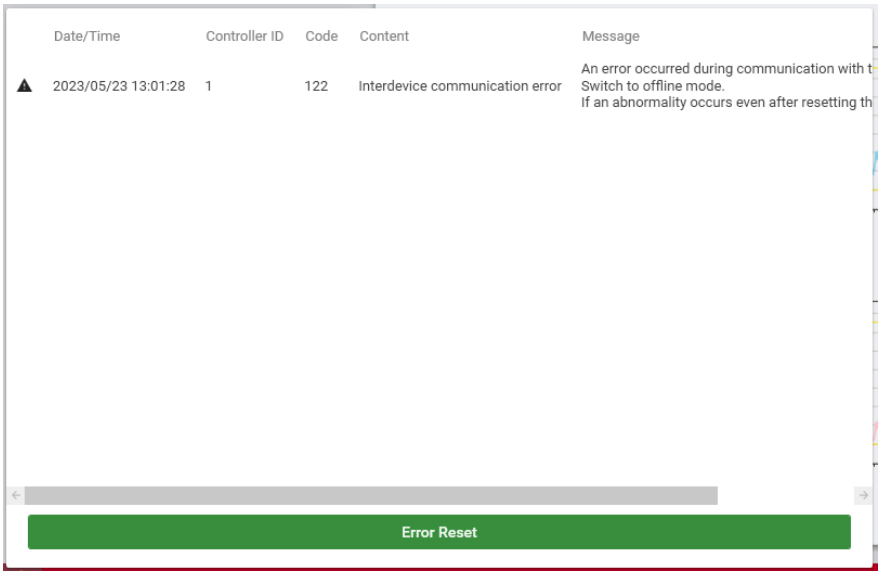
◆ Log display

There are two buttons: Error log that displays the error information, and Operation log that displays the operation information.

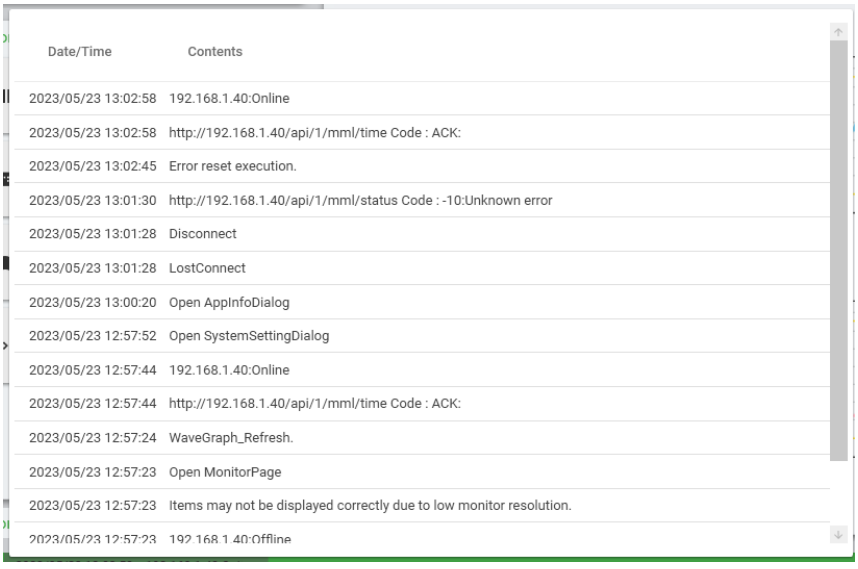


No.	Item	Description
i)	Error log	Clicking this button displays the recorded error log. After removing the error cause, click Error Reset to release the error.
ii)	Operation history	Clicking this button displays the operation history.

[Error Log]



[Operation Log]



(3) Function of Monitor Window

The Monitor window provides the controller information, graphical display of the acquired waveforms, and other detailed information.

Weld Status

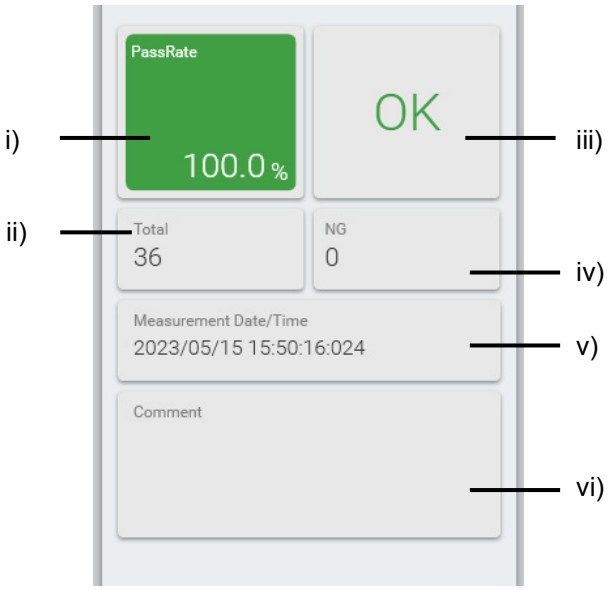
Waveform Graph Area

Controller Status

Detailed Waveform Data

(1) Weld Status display

The Weld Status display judges the OK/NG status of the welding from the acquired waveform graph data, and displays the total measurement number or the OK/NG result. Here describes each menu item of the Weld Status.

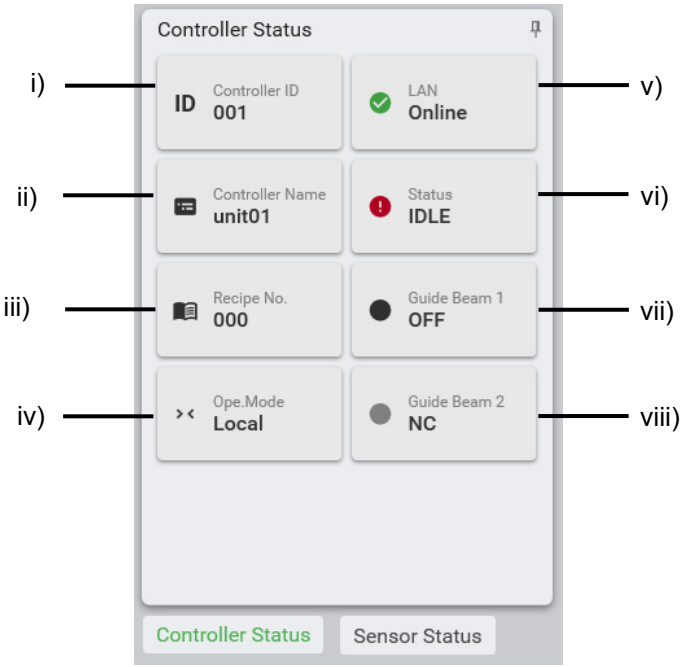


No.	Item	Description
i)	PassRate	Displays the OK rate judged from the total number and the OK number.
ii)	TOTAL	Displays the total measurement number.
iii)	OK/NG	Displays the measurement result.
iv)	NG	Displays the NG number.
v)	Measurement Date/Time	Displays the measurement date and time.
vi)	Comment	Displays the comment set in Page Transition on p. 5-3.

(2) Controller Status

Clicking the tabs on the Controller Status window enables switching of the display.

The Controller Status window displays connection status with the controller and detailed information on the selected recipe. The No. or the name of the recipe can be changed in the System Setting dialog.

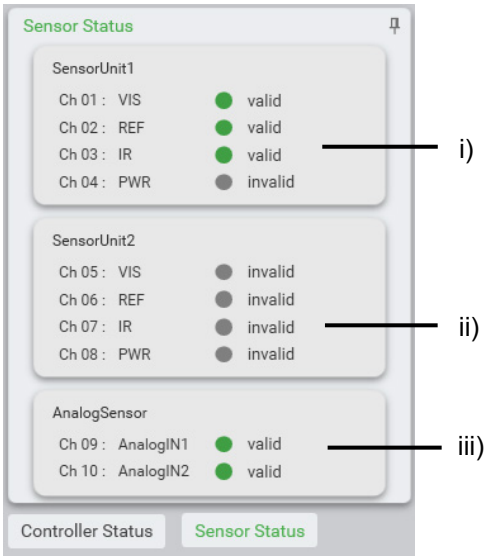


No.	Item	Description
i)	Controller ID	Displays the No. of the controller connected.
ii)	Controller Name	Displays the name of the controller connected.
iii)	Recipe No.	Displays the recipe No. selected.
iv)	Ope. Mode	Displays the operation mode of the controller. There are two types of the operation mode: Local and Remote. In offline status, the last controller status of the online status is displayed.
v)	LAN	Displays the connection status (online/offline) with the controller.
vi)	Status	Displays the current status of the controller.
vii)	Guide beam 1	Displays the lighting status of the guide beam of the controller connected. Clicking the Guide Beam button on Toolbar switches the guide beam on/off. When there is no corresponding guide beam available, “NC” is displayed. Guide beam is assigned as below: Sensor unit 1: Guide beam 1 Sensor unit 2: Guide beam 2
viii)	Guide beam 2	

(3) Sensor Status display

Clicking the tabs on the Sensor Status window enables switching of the display.

The Sensor Status window displays the status of each sensor.



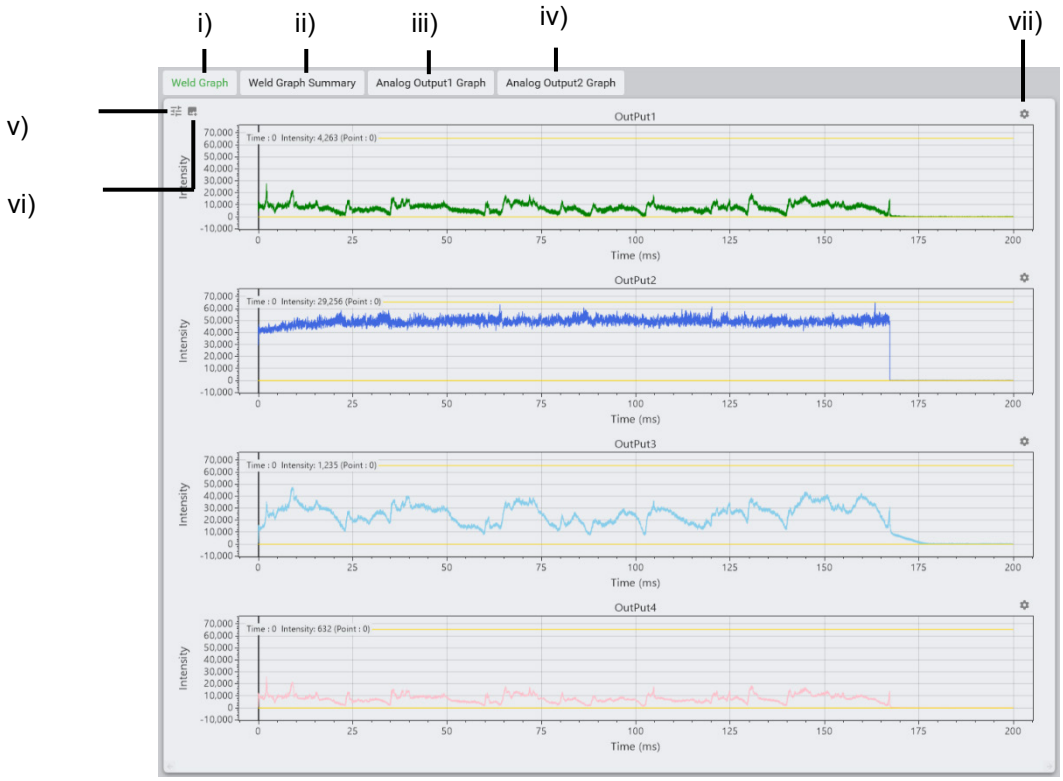
No.	Item	Description
i)	Sensor Unit 1	Displays the name and the status of sensor Ch1 to Ch4 of the Sensor Unit 1.
ii)	Sensor Unit 2	Displays the name and the status of sensor Ch5 to Ch8 of the Sensor Unit 2.
iii)	Analog Sensor	Displays the name and the status of sensor Ch9 to Ch10 of the Analog Sensor.

(4) Weld Graph display area

Displays waveform data of up to eight (8) sensors.
On a weld graph, the intensity is displayed on the vertical axis, and the measurement time is displayed on the horizontal axis.

The displayed waveform can be enlarged/reduced by mouse operation.

There are also other functions in which a scale or a size can be set on all the weld graphs on the display, while a specific envelope or a legend can be set for each weld graph.

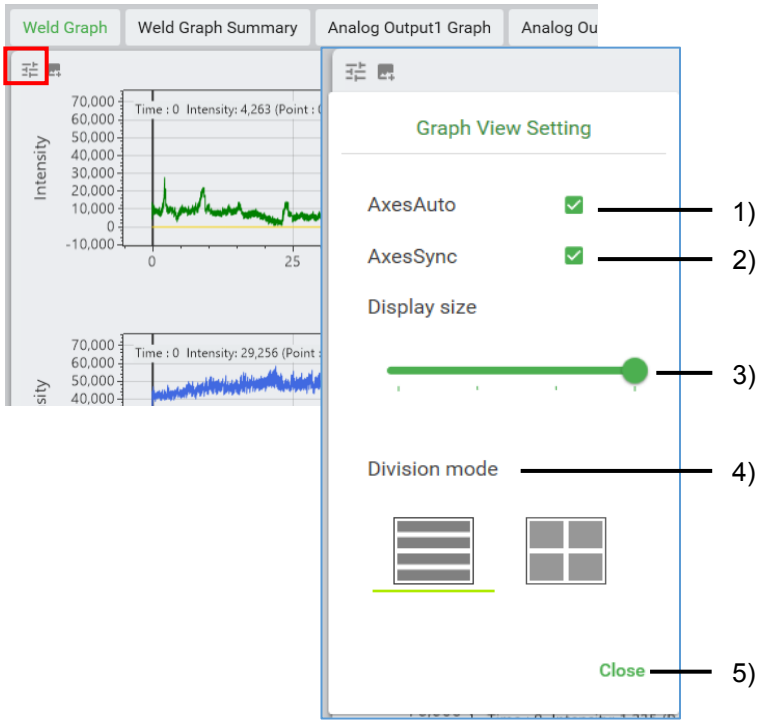


No.	Item	Description
i)	Weld Graph	Waveform data acquired by each sensor is divided into each weld graph for display.
ii)	Weld Graph Summary	Waveform data acquired by each sensor is summarized into a weld graph for display.
iii)	Analog Output1 Graph	Waveform data acquired by analog output is partitioned into each weld graph for display.
iv)	Analog Output2 Graph	
v)	Overall setting of weld graph display	Clicking this option displays a setting dialog. For details, see Description of “v) Overall setting of weld graph display.”
vi)	Image output of weld graph	Clicking this option saves a screenshot of the displayed waveform data to an arbitrary folder. For details, see Description of “vi) Image output of weld graph.
vii)	Individual setting of weld graph	Clicking this option displays a setting dialog. For details, see Description of “vii) Individual setting of weld graph.”

Description of “v) Overall setting of weld graph display”

Clicking this option displays a setting dialog.

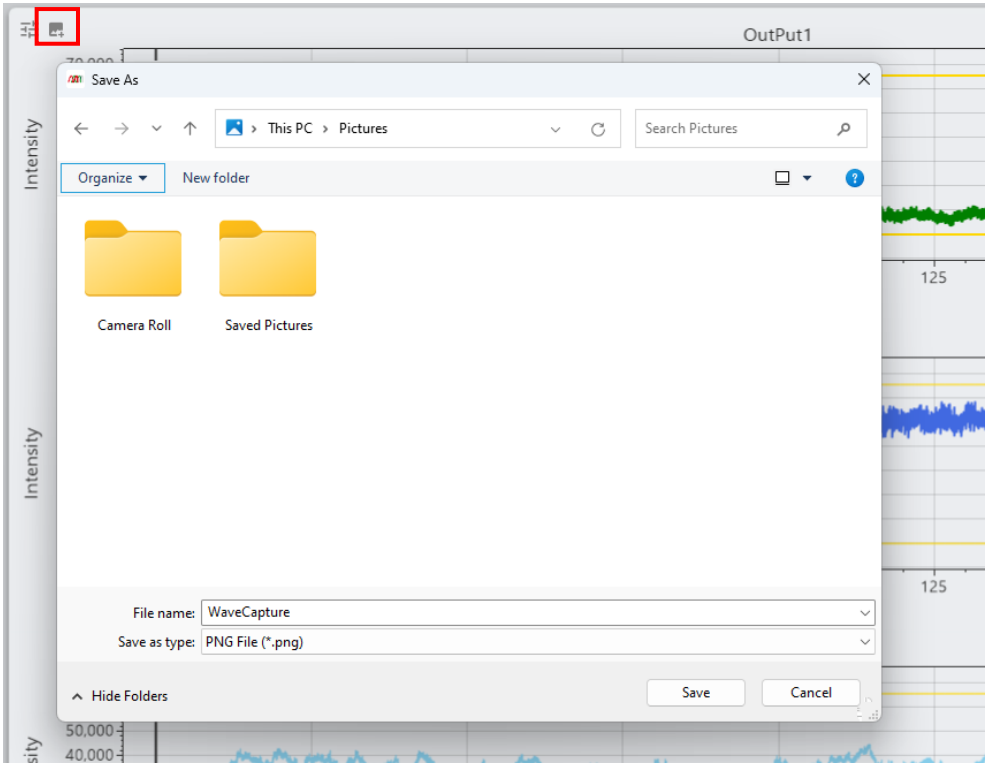
In this setting, all the weld graph data displayed is regarded as the setting target.



No.	Item	Description
1)	Axes Auto	Automatically adjusts the display scale of the weld graph.
2)	Axes Sync	Enables execution of each graph operation simultaneously.
3)	Display size	Specifies how many lines of weld data are displayed on a single window.
4)	Division mode	Specifies to display the weld data either in one row or two rows.
5)	Close	Clicking this option closes the setting dialog.

Description of “vi) Image output of weld graph”

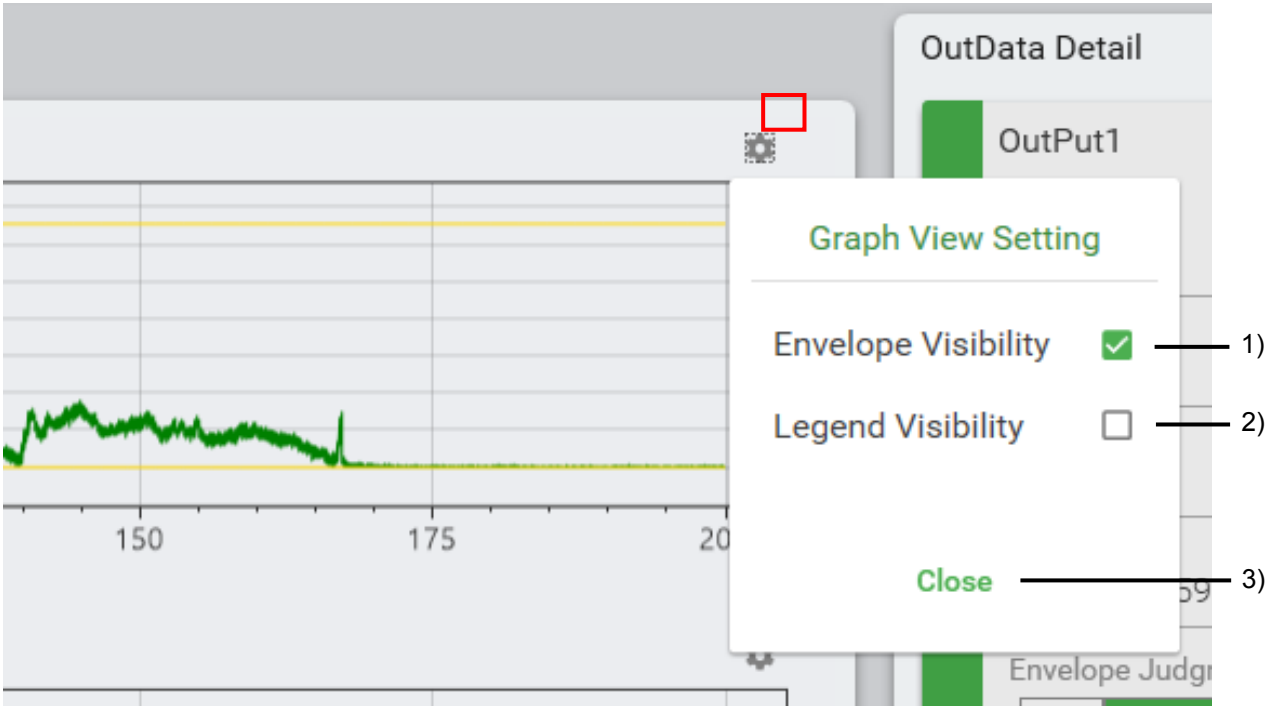
Clicking this option saves the screenshot of the displayed waveform data to an arbitrary folder.

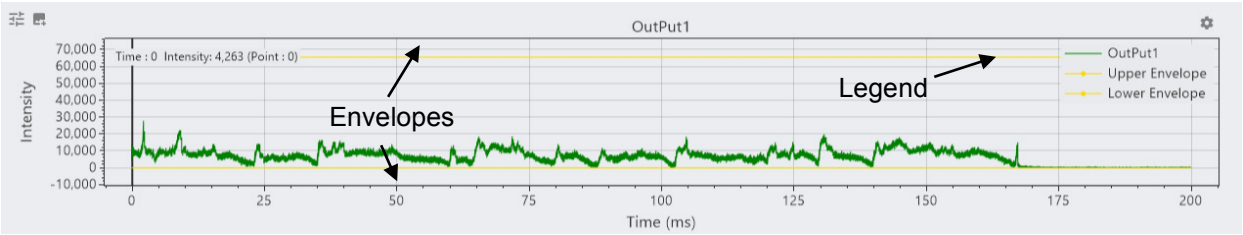


Description of “vii) Individual setting of weld graph”

Clicking this option displays a setting dialog.

This item needs to be set for each item of weld data.

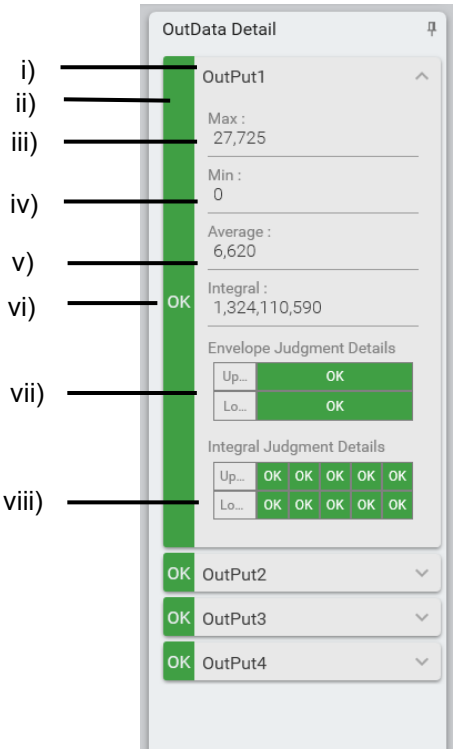




No.	Item	Description
1)	Envelope Visibility	Selecting this option with a checkmark displays an envelope.
2)	Legend Visibility	Selecting this option with a checkmark displays a legend.
6)	Close	Clicking this option closes the setting dialog.

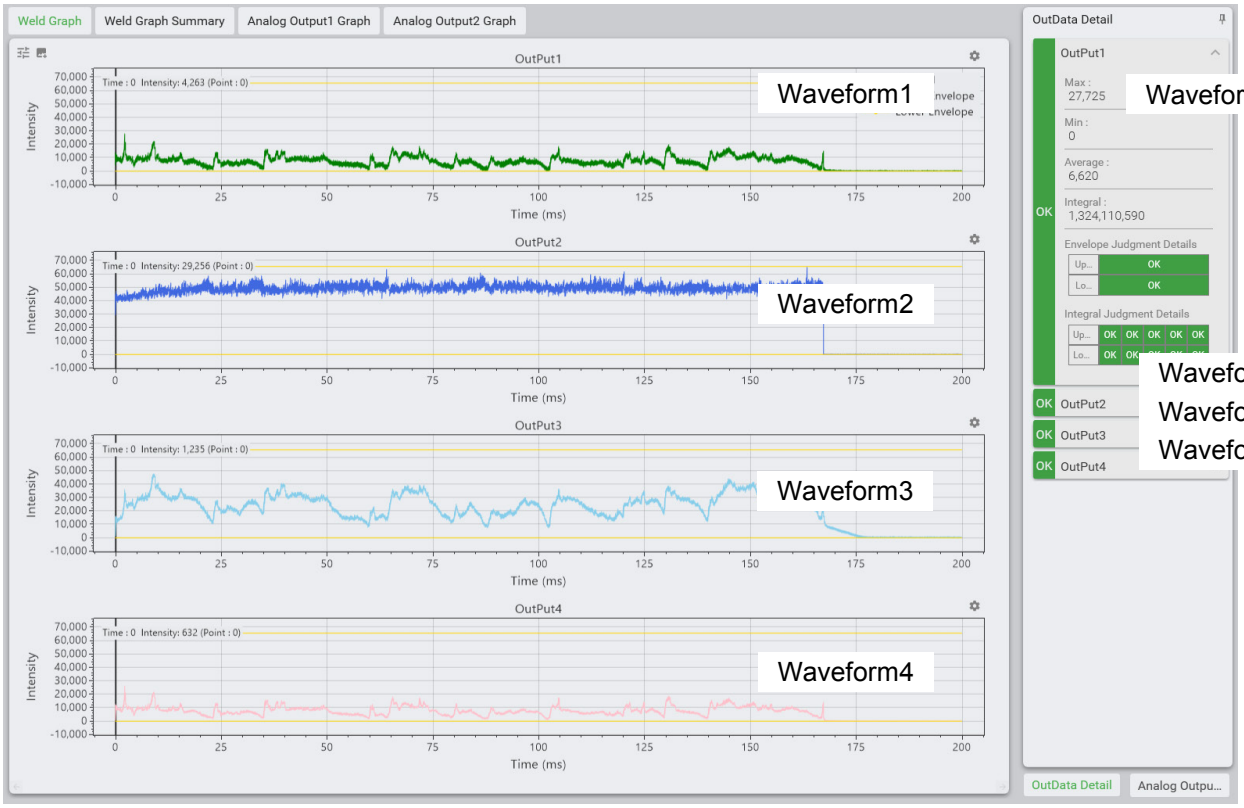
(5) OutData Detail window

This window is displayed by clicking the OutData Detail tab.
The OutData Detail window displays the maximum and the minimum values of the measurement data, as well as the judgment result of the envelopes, etc.



No.	Item	Description
i)	Output name	Displays the name of the output data of the latest measurement data. The name of the output can be set or edited in the Recipe window.
ii)	Total judgment result	Displays “OK” when the results of all the items set to be judged are OK, if there is any NG result, the row changes to red in color and “NG” is displayed.
iii)	Max.	Displays the maximum value of the latest measurement data.
iv)	Min.	Displays the minimum value of the latest measurement data.
v)	Average	Displays the average value of the latest measurement data.
vi)	Integral	Displays the integral value of the latest measurement data.
vii)	Envelope Judgment Details	When the acquired data value is within the envelope range, “OK” is displayed. If the data value is out of the range, “NG” is displayed.
viii)	Integral Judgment Details	When the acquired data value is within the range of integral judgment which specifies five data as maximum, “OK” is displayed. If the data value is outside the range, “NG” is displayed.

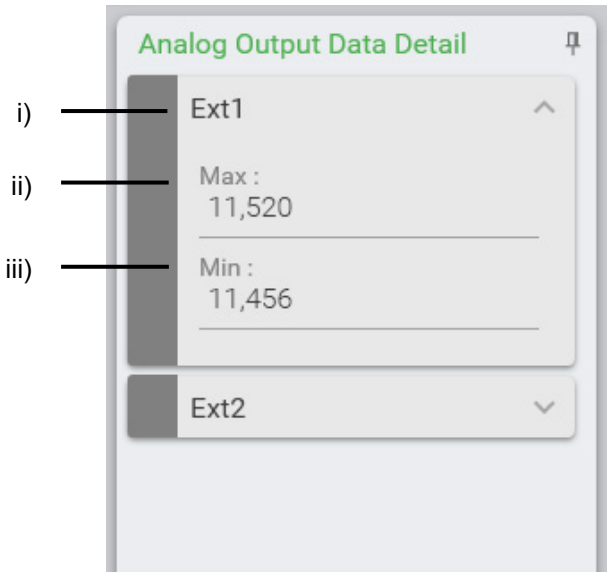
The detailed weld graph for the displayed waveform is displayed.



(6) Analog Output Data Detail

This window is displayed by clicking the Analog Output Data Detail tab.

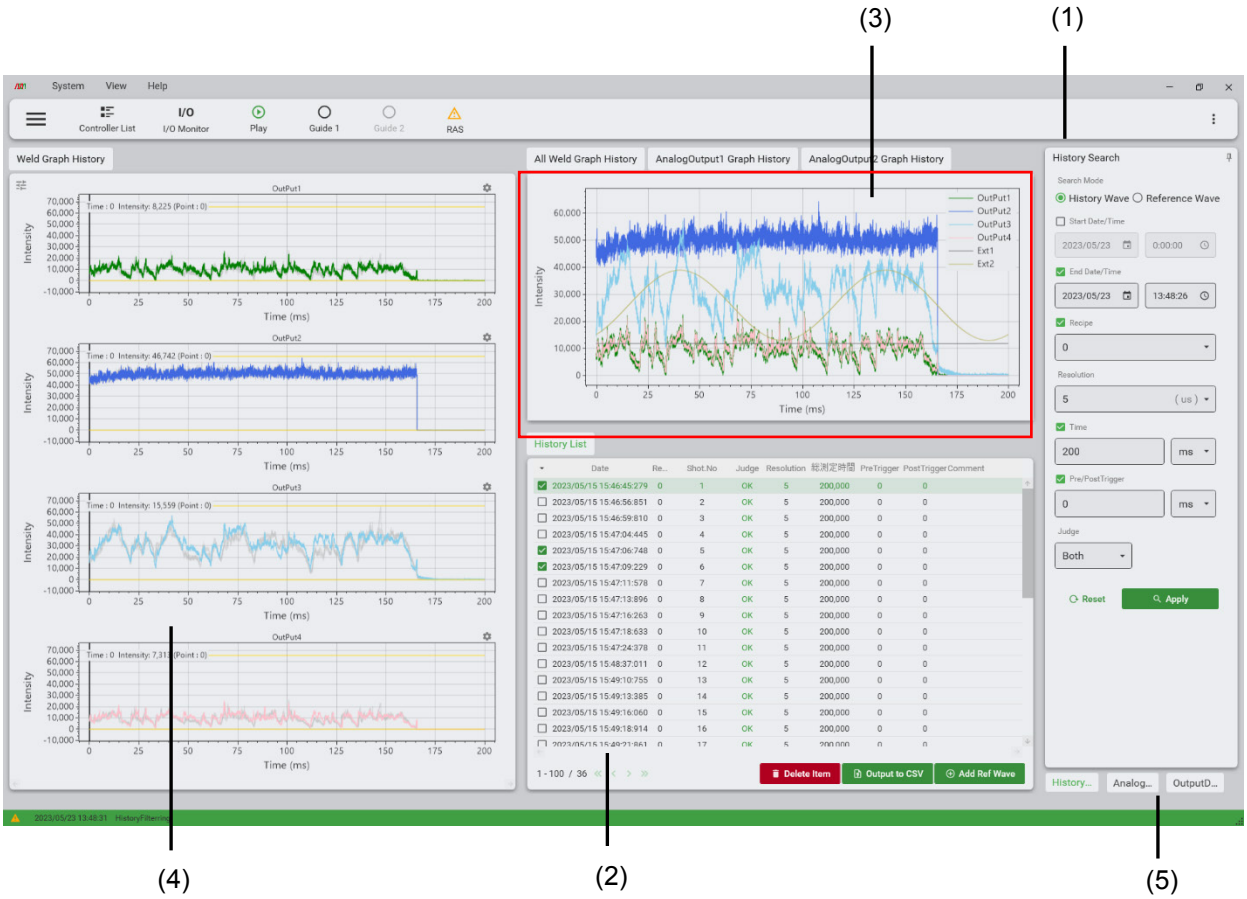
It displays maximum and minimum values of the analog data acquired by the externally connected devices.



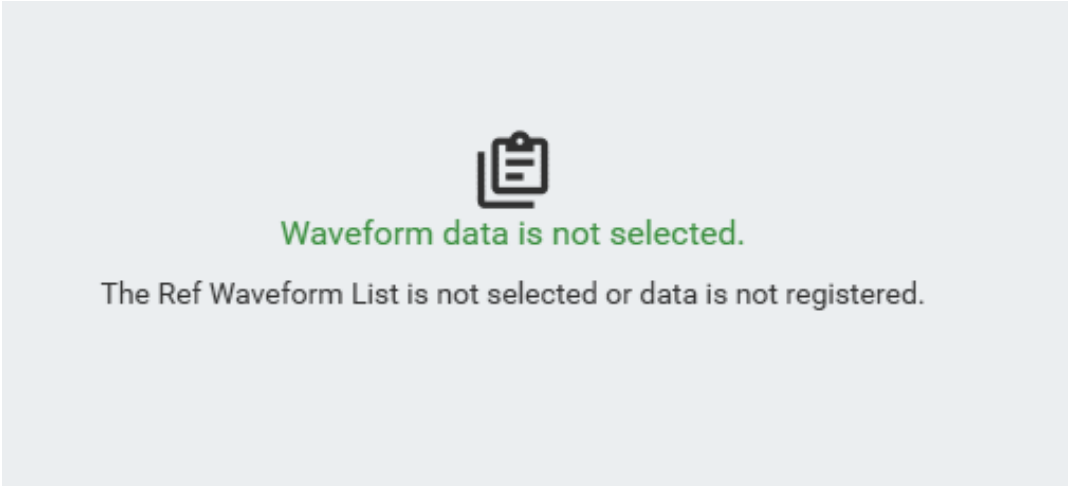
No.	Item	Description
i)	Name	Displays the name of the output data from the most recent measurement data.
ii)	Max	Displays the maximum value of the most recent measurement data.
iii)	Min	Displays the minimum value of the most recent measurement data.

(4) Function of History Search Window

The History Search window enables viewing/deleting the saved waveform data, registering/deleting the data to the reference waveform, and outputting the data to a CSV file.

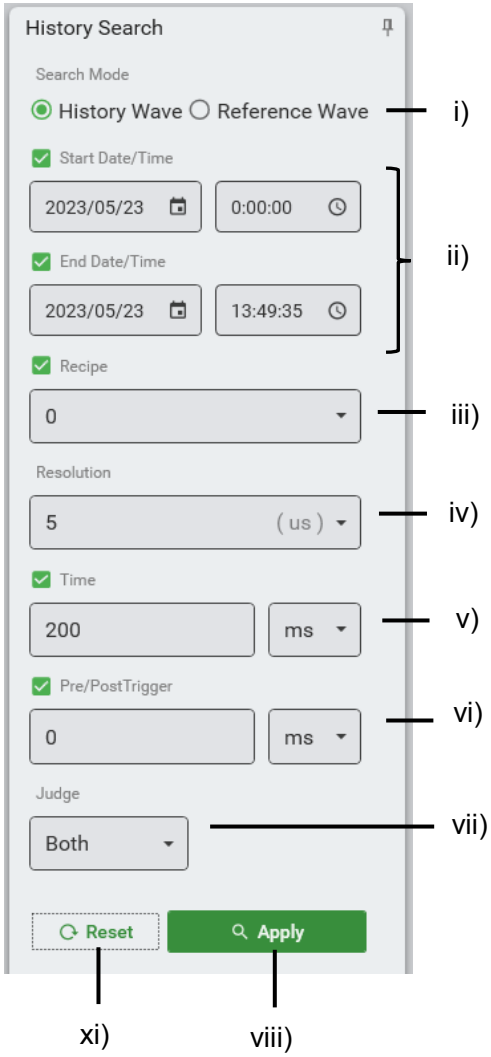


When no waveform data has been selected, the following message appears.



(1) History Search

Specify search conditions to search for the applicable waveform data.



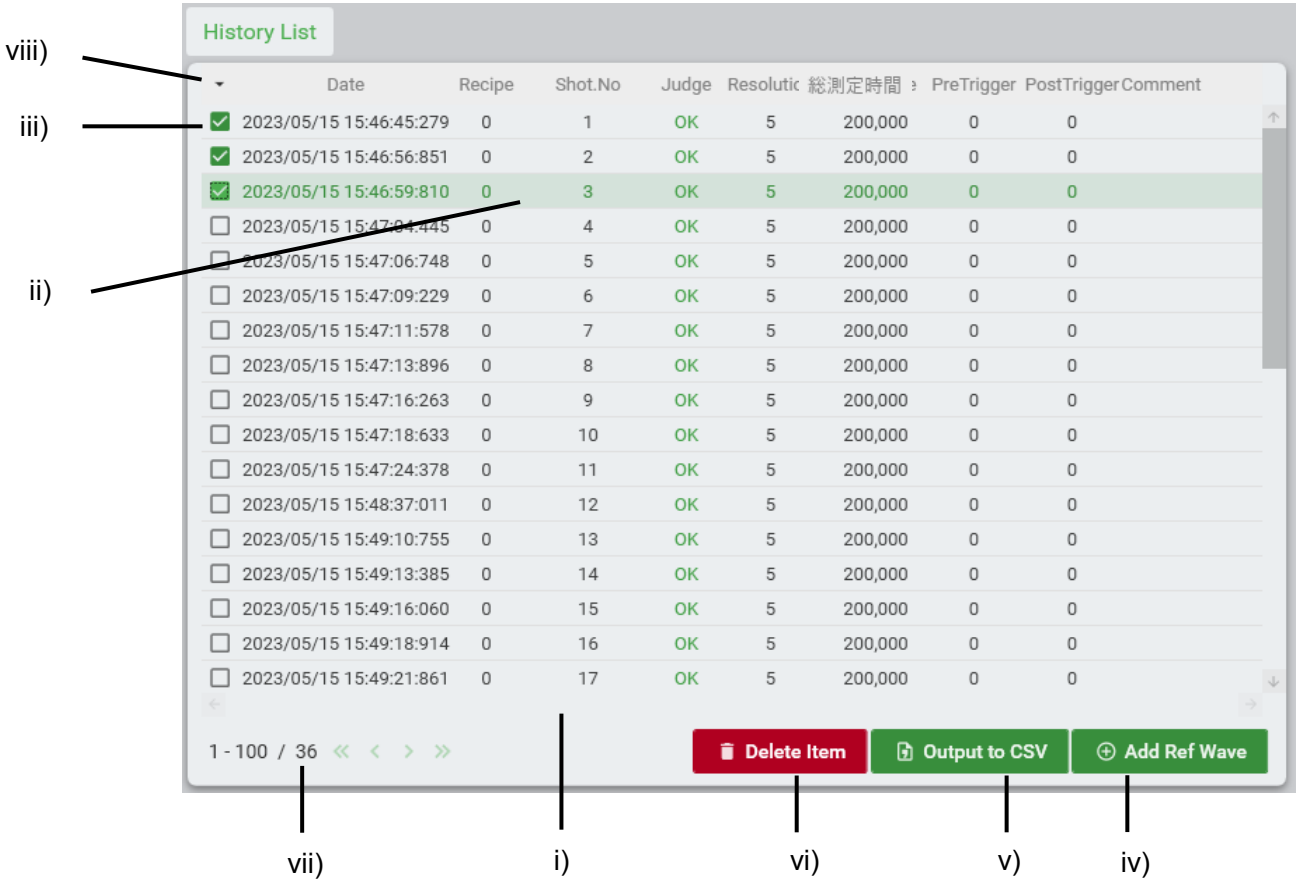
No.	Item	Description
i)	Search Mode	Specifies the search mode: History Wave: Mode to search for a past recorded waveform from the connected DB collection Reference Wave： Mode to search for a waveform registered to the reference waveform of the current Recipe No. *When Reference Wave is selected, the other search conditions are grayed out.
ii)	Start/End Date/Time	Specifies the term of the search target.
iii)	Recipe	Specifies the recipe No. of the search target.
iv)	Resolution	Specifies the resolution of the search target.
v)	Time	Specifies the measurement time of the search target.
vi)	Pre/Post Trigger	Specifies the pre/post trigger of the search target.
vii)	Judge	Specifies the judgment result of the search target. OK, NG, and Both are selectable. Both covers OK and NG as a search target.
viii)	Apply	Starts the search using the specified search condition.
ix)	Reset	Returns all search conditions to their default value. *The history list currently displayed is also deleted.

The items with a checkbox on the left side can be excluded from the search condition.
To exclude the item, click the checkbox to uncheck the check mark.

The default values of the items iii) to vi) are the values of the recipe No. currently specified.

(2) History List

Displays the search result.
The displayed data can be registered to the weld graph history, and output to a CSV file. The data can be specified to be added to the reference waveform.



No.	Item	Description
i)	Search result display	Displays the date, recipe, etc. of the waveform data satisfying the search condition.
ii)	Waveform selection	Displays a highlighted list. Clicking the list enables selection of its waveforms. The selected waveform is displayed highlighted in the corresponding waveform displays.
iii)	Checkbox	Click the checkbox to specify the waveform of the list as the operation target. Up to 100 waveforms can be specified, which are then displayed in the Weld Graph History window. To unselect a waveform from the operation target, click the checkbox again to uncheck it.
iv)	Add Ref Wave	Registers the specified waveform data to the reference waveform.
v)	Output to CSV	Stores the specified waveform in an arbitrary folder in a CSV file format.

No.	Item	Description
vi)	Delete Item	When searching by History Wave: Deletes the specified waveform data from the database. *Note that deleted waveform data cannot be recovered. When searching by Reference Wave: Deletes the specified waveform data from the Reference Wave database.
vii)	Number of displayed data	Displays the number of the waveform data satisfying the search condition. Up to 100 data items can be displayed on a page. Pages can be moved by clicking < or >. Clicking << or >> moves to the first/last page.
viii)	Batch process	Clicking this option displays a list of all as selected or all as deselected. All selected: Specifies all the lists currently displayed on the page. *When specified on other pages, up to 100 items in total are specified from the top of the page. All deselected: Unspecifies all the selected waveforms.

(3) All Weld Graph History/Analog Output Graph History window

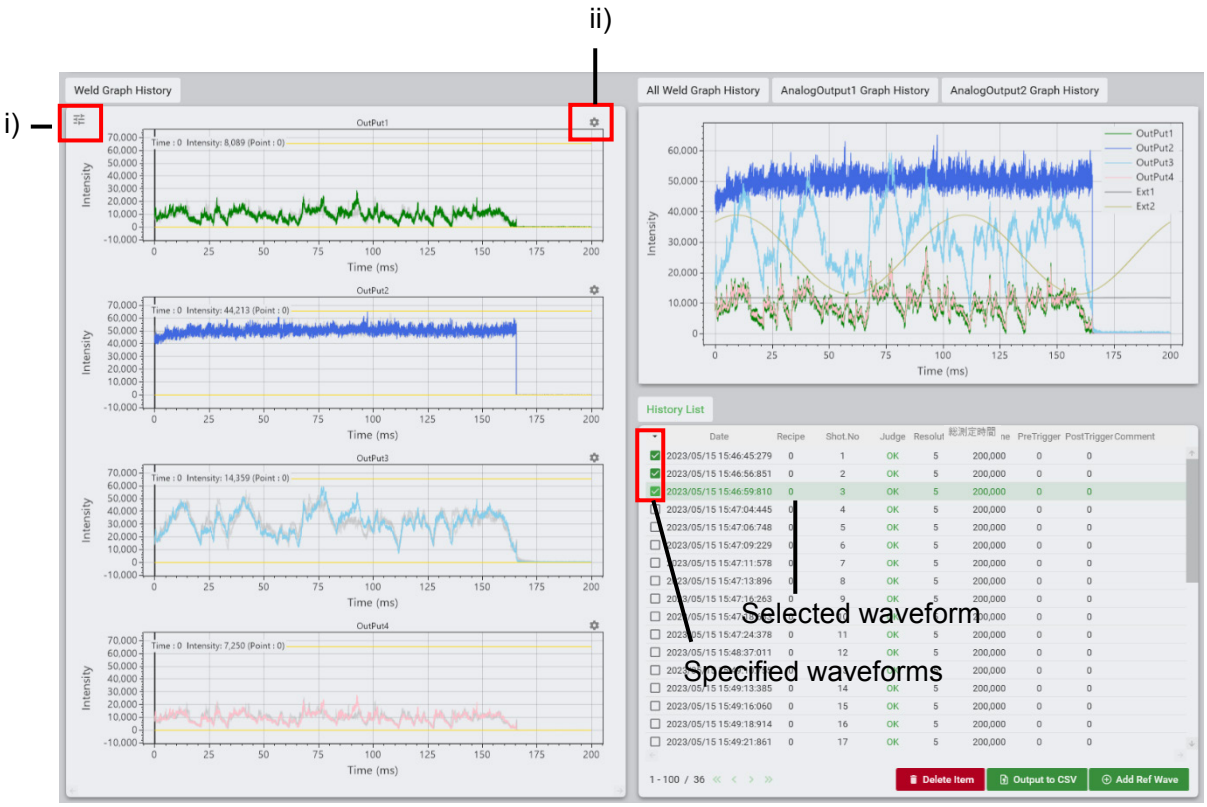
This window displays the waveform data currently selected in aggregation, as well as displaying the analog output waveforms.

No.	Item	Description
i)	All Weld Graph History	The selected waveform data is displayed overlapped.
ii)	Analog Output1 Graph History	Displays the analog output waveform for the selected waveform if it is available.
iii)	Analog Output2 Graph History	

(4) Weld Graph History

Waveform data specified in the History List is displayed on each channel.

The selected waveform is highlighted on the display, whereas the other waveforms are displayed in gray.

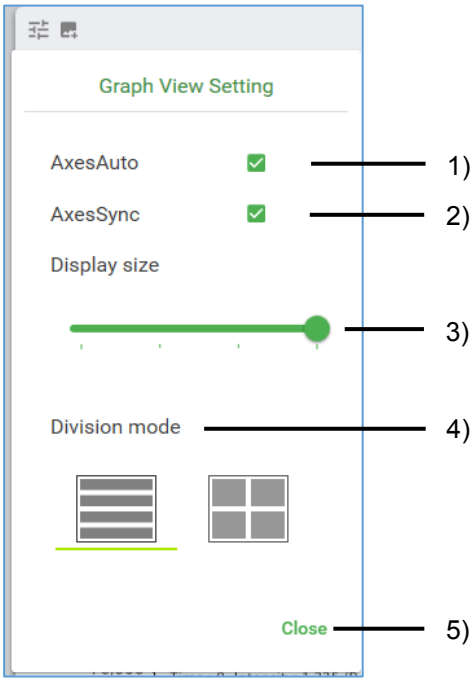


No.	Item	Description
i)	Batch setting for waveform display	Clicking this option displays a setting dialog. For details, see the description in “i) Batch setting for waveform display.”
ii)	Individual setting for waveform display	Clicking this option displays a setting dialog. For details, see the description in “ii) Individual setting for waveform display.”

Description of “i) Batch setting for waveform display”

Clicking this option displays a setting dialog.

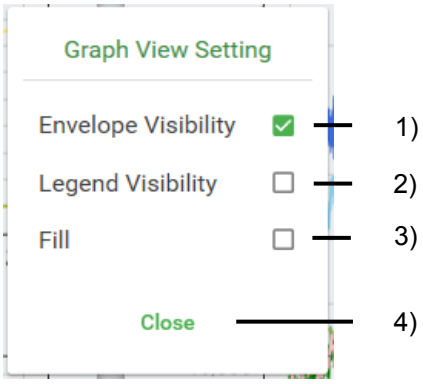
This item regards all the displayed waveform data as a setting target.

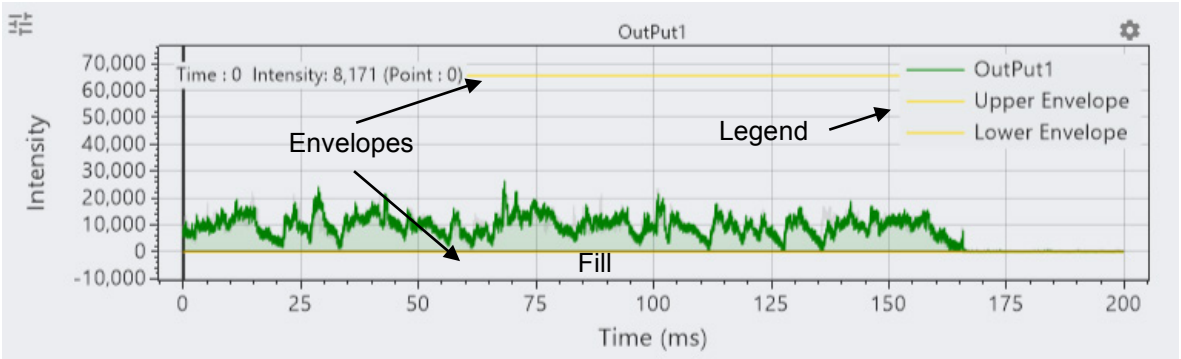


No.	Item	Description
1)	Axes Auto	Automatically adjusts the display scale of the weld graph.
2)	Axes Sync	Enables simultaneous execution of graph operation.
3)	Display size	Specifies how many lines of weld data are displayed in a single window.
4)	Division size	Specifies displaying of the weld data either in one row or two rows.
5)	Close	Clicking this option closes the setting dialog.

Description of “ii) Individual setting for waveform display”

Clicking this option displays a setting dialog.





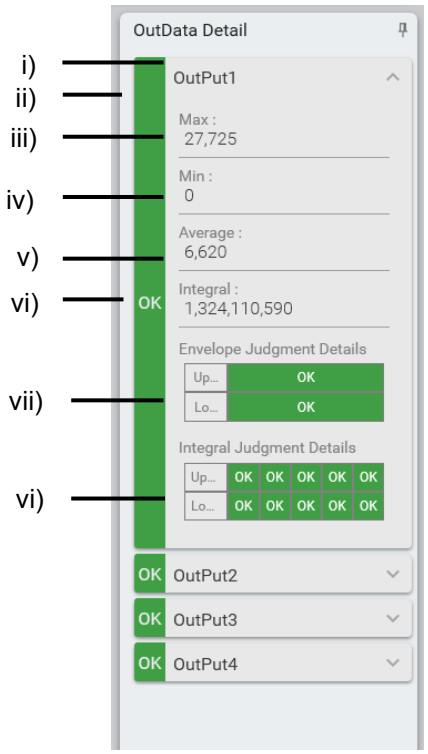
No.	Item	Description
1)	Envelope visibility	Selecting this option by using a checkmark displays an envelope.
2)	Legend visibility	Selecting this option by using a checkmark displays a legend.
3)	Fill	Clicking this option fills the lower part of the waveform.
4)	Close	Clicking this option closes the setting dialog.

(5) OutData Detail/Analog Output Data Detail

[OutData Detail]

This window is displayed by clicking the Outdata Detail tab.

The OutData Detail window displays the maximum and the minimum values of the selected waveform, as well as the judgment result of the envelopes, etc.

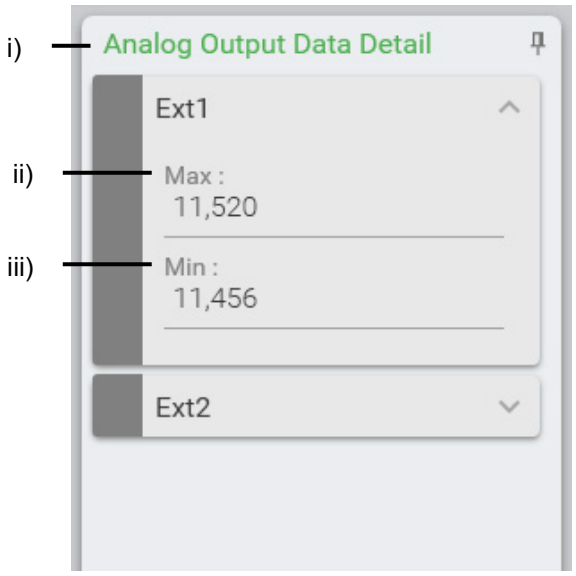


No.	Item	Description
i)	Output name	Displays the name of the output data of the selected data.
ii)	Total judgment result	Displays “OK” when the results of all the items set to be judged are OK, if there is any NG result, the row changes to red in color and “NG” is displayed.
iii)	Max.	Displays the maximum value of the selected data.
iv)	Min.	Displays the minimum value of the selected data.
v)	Average	Displays the average value of the selected data.
vi)	Integral	Displays the integral value of the selected data.
vii)	Envelope Judgment Details	When the value of the selected data is within the envelope range, “OK” is displayed. If the data value is outside the range, “NG” is displayed.
viii)	Integral Judgment Details	When the selected data value is within the range of integral judgment which specifies five data as maximum, “OK” is displayed. If the data value is outside the range, “NG” is displayed.

[Analog Output Data Detail]

This window is displayed by clicking the Analog Output Data Detail tab.

It displays maximum and minimum values of the analog data if the analog data is contained in the selected waveform.

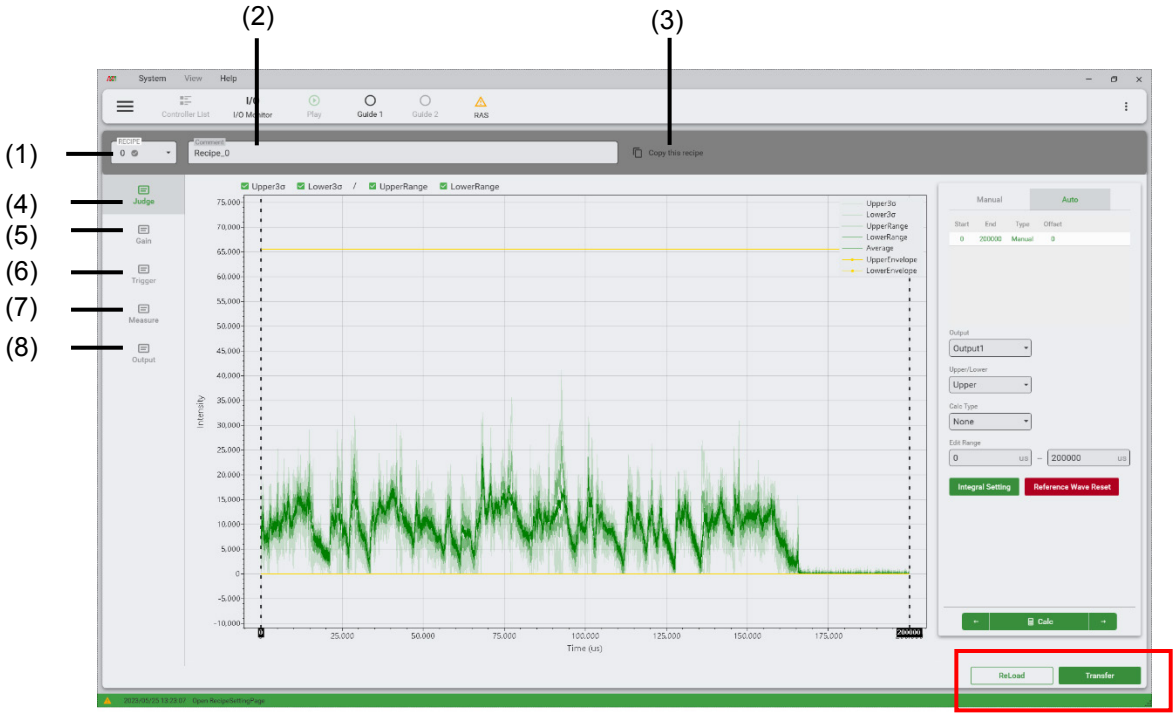


No.	Item	Description
i)	Name	Displays the name of the output data from the selected data.
ii)	Max:	Displays the maximum value of the selected data.
iii)	Min:	Displays the minimum value of the selected data.

(5) Function of Recipe Window

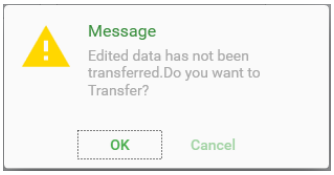
The Recipe window has five editing menus each of which requires setting: Judge, Gain, Trigger, Measure, and Output.

When the editing is complete, click [Transfer] on the lower right of the window to transfer the setting to the controller.
Clicking [Reload] deletes the edited contents and returns to the controller setting.



When all editing is complete, move to the next page using Page Transition in Toolbar.

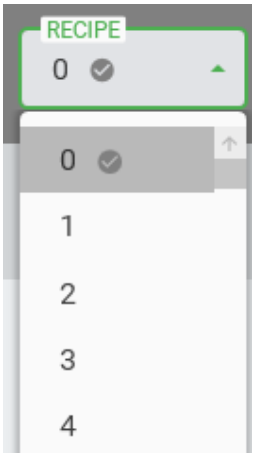
After editing, selecting Page Transition without pressing the [Transfer] button will display a confirmation message as below.



Clicking [OK] transfers the edited contents to the controller, and the page transitions.
Clicking [Cancel] deletes the edited contents, and the page transitions.

(1) Recipe No.

Specify the recipe to set or edit.
A recipe means with a checkmark it has already been transferred to the controller.

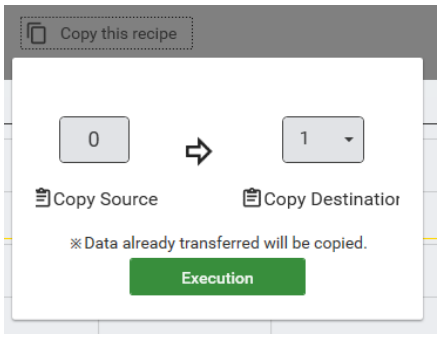


(2) Comment

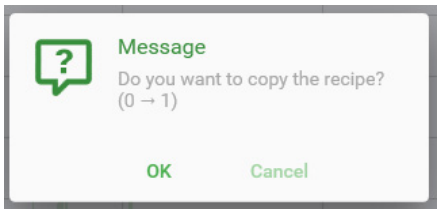
A comment can be attached to each recipe No.

(3) Copy this recipe

Clicking [Copy this recipe] opens the window as below.



Select the recipe No. of the copy destination and press [Execution].
The following message appears.



Clicking [OK] copies the recipe setting of the copy source (the recipe No.in selection）to the recipe No. of the copy destination.

Clicking [Cancel] closes this message without executing the copy operation.

(4) Judgment Setting

This window enables setting of the judgment conditions based on the reference waveform.

Available judgment settings are: automatic setting (AUTO) of the upper/lower limits of the waveform envelopes, manual setting (Manual), and integral calculation (Integral Setting).

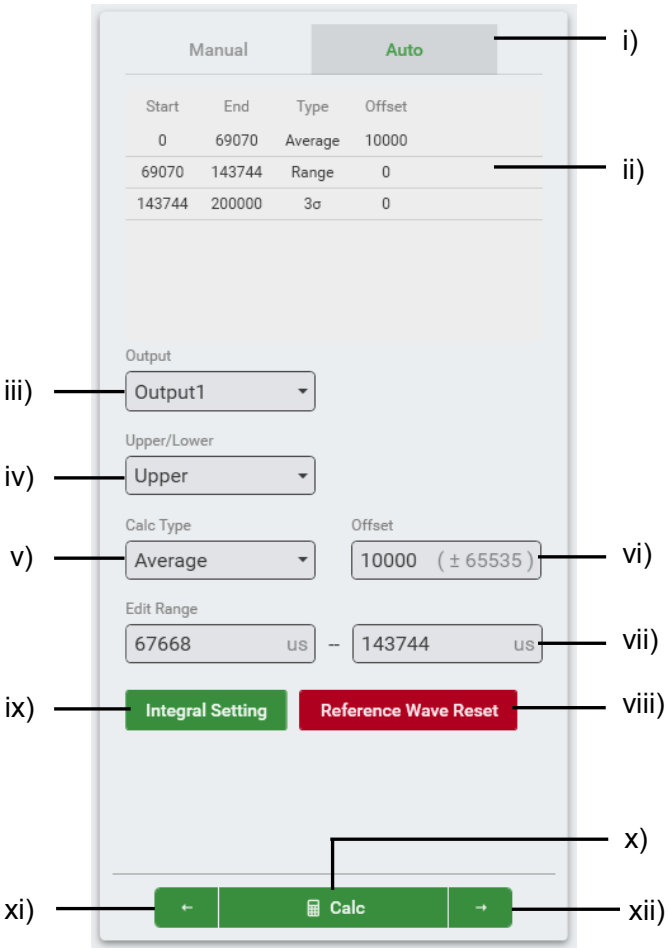
No.	Item	Description
i)	Waveform display setting	Switches show/hide status of the 3σwaveform calculated from the reference waveform and the range waveform. The waveform with a checkmark is displayed on the waveform display area.
ii)	Waveform display area	The upper/lower limits and the editing range set by average, 3σ, range waveform, and condition settings calculated by the reference waveform are displayed on the graph.
iii)	Condition setting	Displays or edits the setting values for judgment. Clicking Auto, Manual, and Integral Setting selects the setting to edit as follows: 1) AUTO: automatic setting of envelope judgment 2) MANUAL: manual setting of envelope judgment 3) Integral Setting: setting of integral judgment

1) Upper/lower limit setting of envelope (Auto)

The upper/lower limit waveforms of the envelope are set by automatically calculating it from the reference waveform.

To set the envelope, the reference waveform needs to be registered on the History window.

The condition set is displayed as follows:



No.	Item	Description
i)	Auto/Manual	Selects automatic calculation or manual calculation of the envelope.
ii)	Detailed display	Displays the detailed contents of the specified output as well as the upper/lower envelope waveform data. There are three tabs: Start/End: waveform setting range Type: calculation mode to use Offset: offset amount from the average value Click each tab to switch the editing range.
iii)	Output	Specifies the output for the envelope.
iv)	Upper/Lower	Specifies the envelope setting to either of: the upper limit or the lower limit.

No.	Item	Description
v)	Calc Type	Specifies the calculation method for the envelope. Average: The average of the multiple reference waveforms is used for the envelope. In this option, the upper/lower limits are determined by setting an offset. Range: From plural reference waveforms, a maximum waveform is calculated when the "Upper Limit" is selected, and a minimum waveform is calculated when the "Lower Limit" is selected. 3σ: From plural reference waveforms, waveform is calculated so that it is within the standard deviation ±3σ. "Upper limit" is the waveform including "+3σ," and "Lower limit" is the waveform including "-3σ." None: Select when no envelope is set.
vi)	Offset	Specifies the offset amount from the average. Displayed only when [Average] is selected for [Calc Type].
vii)	Edit Range	Specifies the calculation range (time) for the envelope. In the envelope calculation, the range between two dashed lines is calculated. Moving the dashed lines in the waveform display area can also specify the edit range.
viii)	Reference Wave Reset	Resets the reference waveform.
ix)	Integral Setting	Displays the setting of integral judgment.
x)	Calc	Performs envelope calculation using the set condition.
xi) xii)	← (Return) → (Go)	The MS-Viewer saves the most recent calculation result. Click either of these arrow marks to display the calculation result to refer. When changing the output or move to another page, the calculation results are deleted other than the most recent result.

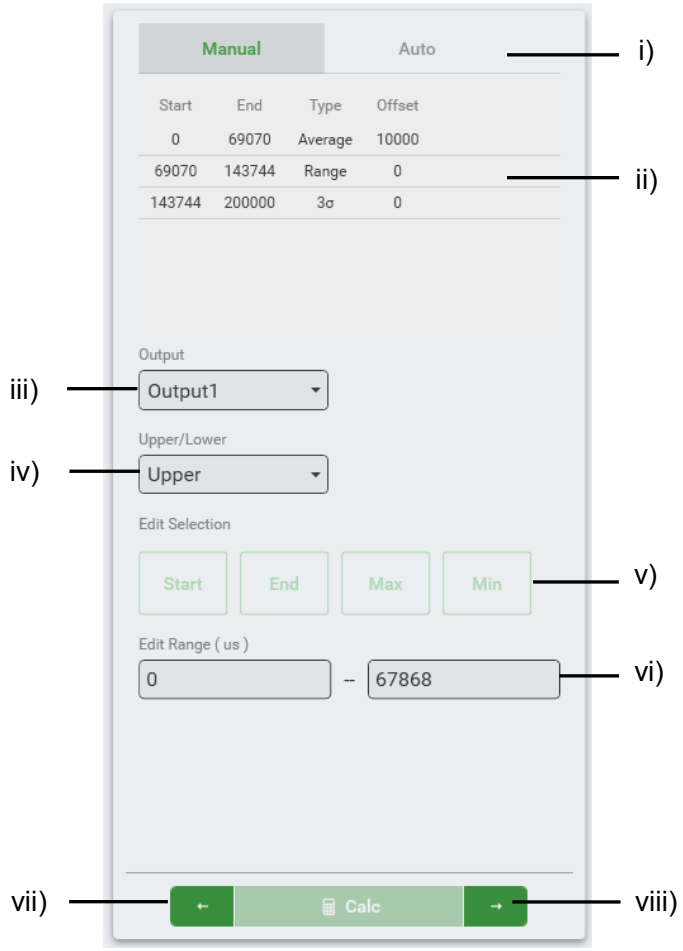
The following is an example of the waveform display area. The start/endpoints of the edit range are shown by dashed lines.


Upper3σ
Lower3σ
UpperRange
LowerRange
Edit range
Upper limit envelope
Lower limit envelope
Intensity
Time (us)
Average
LowerEnvelope
UpperEnvelope

2) Upper/lower limit setting of envelope (Manual)

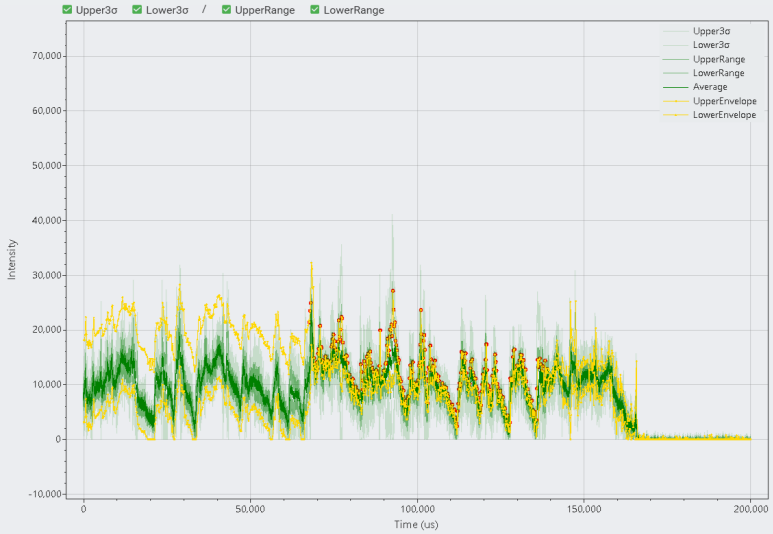
The upper/lower limit waveforms of the envelope are manually edited.

The condition set is displayed as follows:

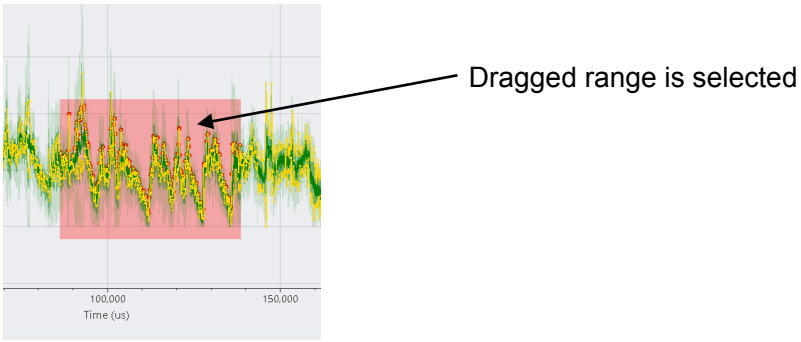


No.	Item	Description
i)	Auto/Manual	Selects automatic calculation or manual calculation of the envelope.
ii)	Detailed display	Displays the detailed contents of the specified output as well as the upper/lower envelope waveform data.
iii)	Output	Specifies the output setting for the envelope.
iv)	Upper/Lower	Specifies the envelope setting to either of: the upper limit or the lower limit.
v)	Edit Selection	Sets all the points of the selected waveform to either of the following: Start: the start point value of the selected point End: The end point value of the selected point Max: The maximum value of the selected point Min: The minimum value of the selected point
vi)	Edit Range	Displays the edit range (time).
vii) viii)	← (Return) → (Go)	The MS-Viewer saves the latest calculation result. Click either of these arrow marks to display the calculation result to refer. When changing the output or moving to another page, the calculation results are deleted other than the most recent result.

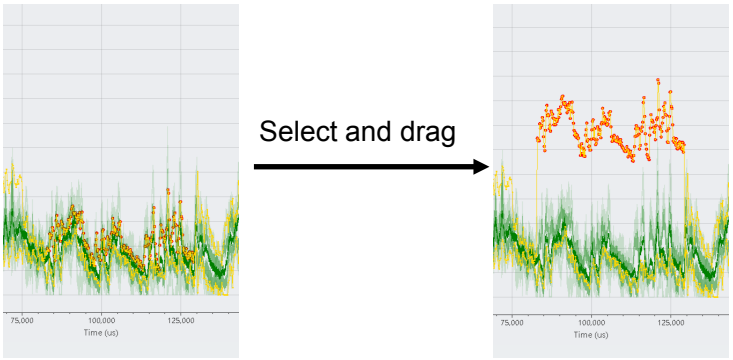
The following is an example of the waveform display area. The selected envelope points are displayed in red.



In manual setting, the envelope points within the range selected by dragging and right-clicking the mouse are edited in the waveform display area.



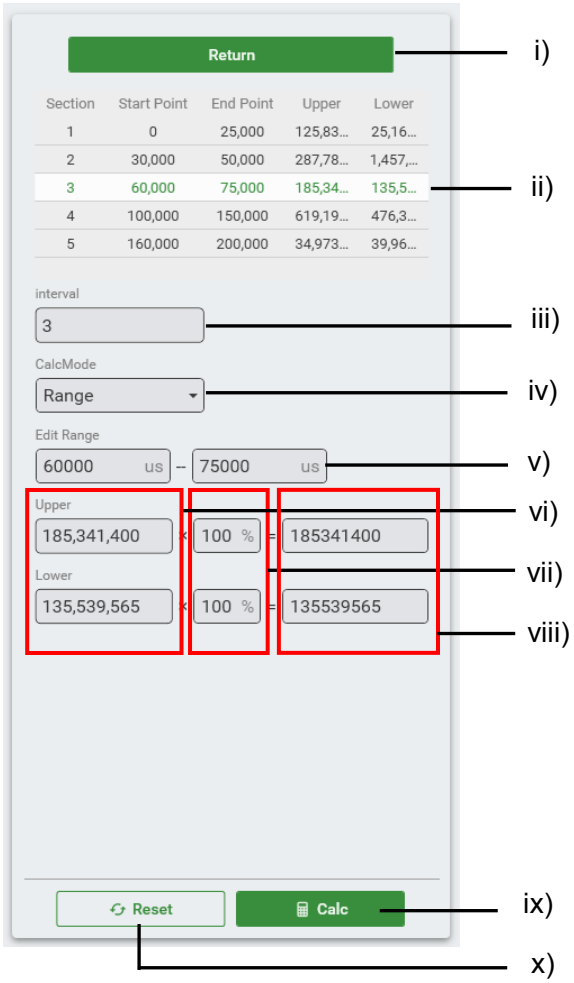
In the waveform display area, selecting the waveform of the edit range using a mouse can be used to change the upper/lower limit settings.



3)Integral Setting

The Integral Setting window sets the integral judgment condition. Clicking the Integral Setting tab on the envelope setting (Auto) displays this window.

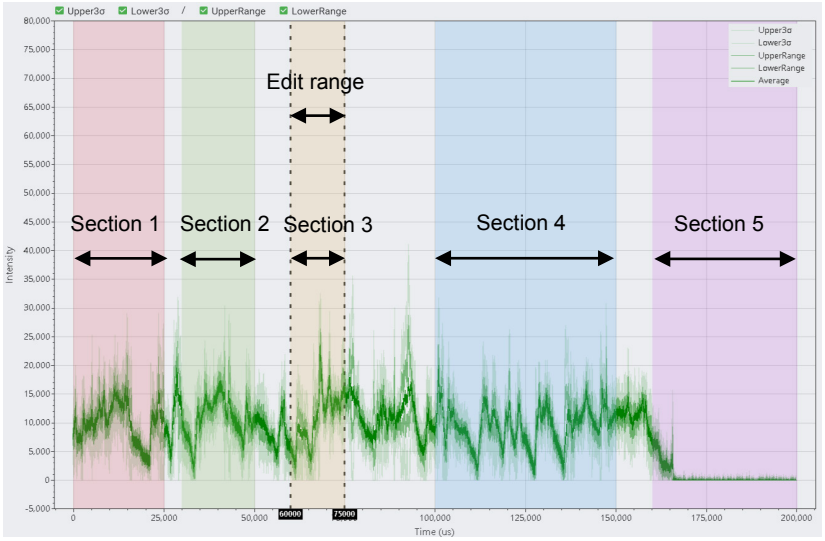
The condition set is displayed as follows:



No.	Item	Description
i)	Return	Selects the section to perform calculation, and displays the result. The setting display and edit is available for the section selected with this option.
ii)	Section selection	Selects the section on which to perform calculation, and displays the result. The setting display and edit is available for the section selected with this option.
iii)	Interval	Displays the section No. specified in Section selection.

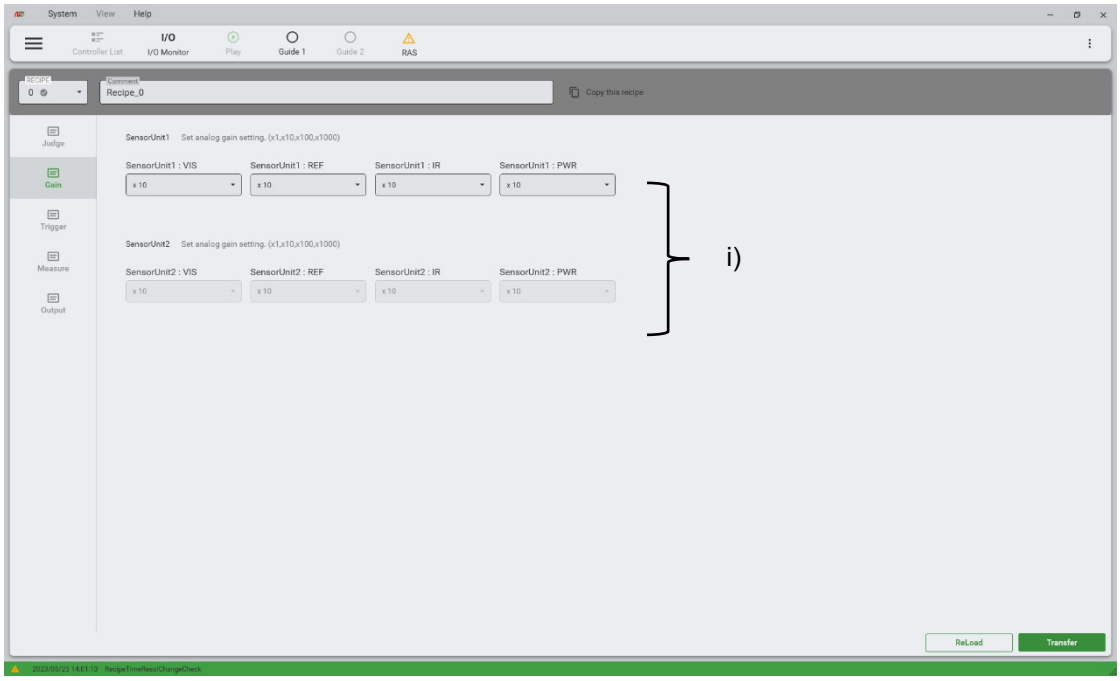
No.	Item	Description
iv)	Calc Mode	Specifies the calculation method. Calculates the integral value of the edit section of the following waveforms, and regard the result as the upper/lower limits. Average: average waveform of the multiple reference waveforms Range: waveform generated by the maximum/minimum values of the multiple reference waveforms 3σ: waveform of standard deviation±3σ of the multiple reference waveforms
v)	Edit Range	Specifies the calculation range (time) for the envelope. In the envelope calculation, the range between two dashed lines is calculated. Moving the dashed lines in the waveform display area can also be used to specify the edit range.
vi)	Upper/Lower	Displays the calculation result of “reference integral value” x “magnification”. The result can be directly input. At measurement, when the integral value of the specified edit section exceeds this range, the integral judgment is regarded as NG.
vii)	Magnification	Sets the magnification of Upper/Lower limits. When selecting [Average] for [CalcMode], the reference integral value can be the same for upper/lower limits. In this case, input different magnification values for Upper/Lower limits. If [Upper/Lower] values are directly input, this option is displayed as “-“.
viii)	Reference integral value	Displays the integral value calculated according to the calculation mode selected at [CalcMode].
ix)	Calc	Clicking this option executes the calculation.
x)	Reset	Returns the setting to the default status.

The following is an example of the waveform display area. The edit range of each section is displayed with a color filled. The start point and the end point of the section being edited are displayed with dashed lines.


Upper3σ
Lower3σ
UpperRange
LowerRange
Edit range
Section 1
Section 2
Section 3
Section 4
Section 5
Intensity
Time (us)
Average

(5) Gain setting window

Gain can be set for each sensor.

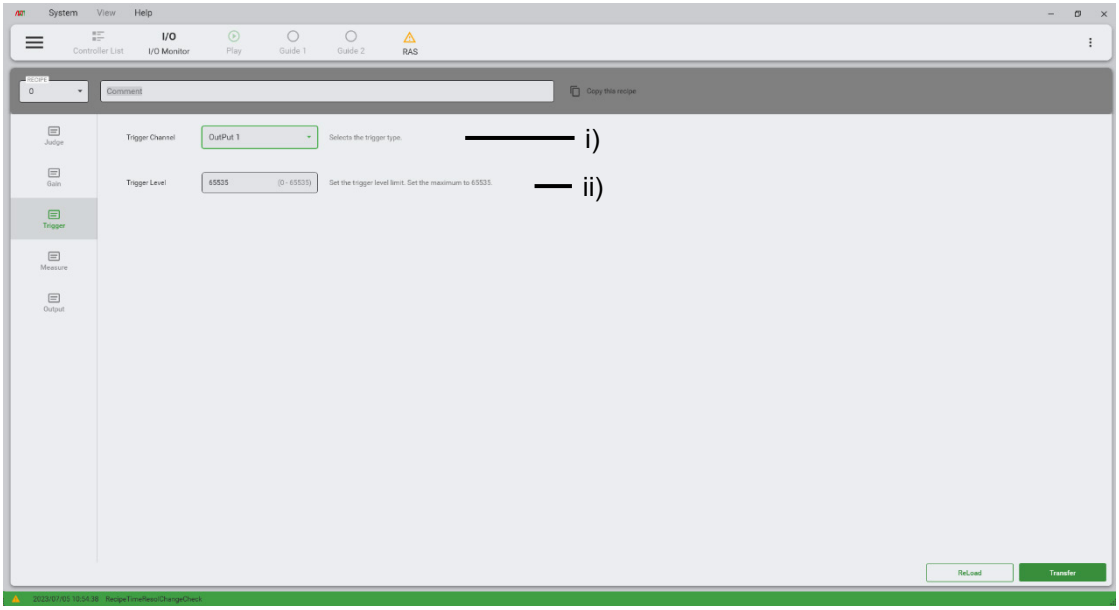


No.	Item	Description
i)	Gain	Select the gain value from x1, x10, x100, and x1000*1. This setting is valid only for the connected sensor.

*1: When setting the gain to x1000, the waveform will be changed significantly. To select this option, it is recommended to use moving average or a low/high-pass filter.

(6) Trigger setting window

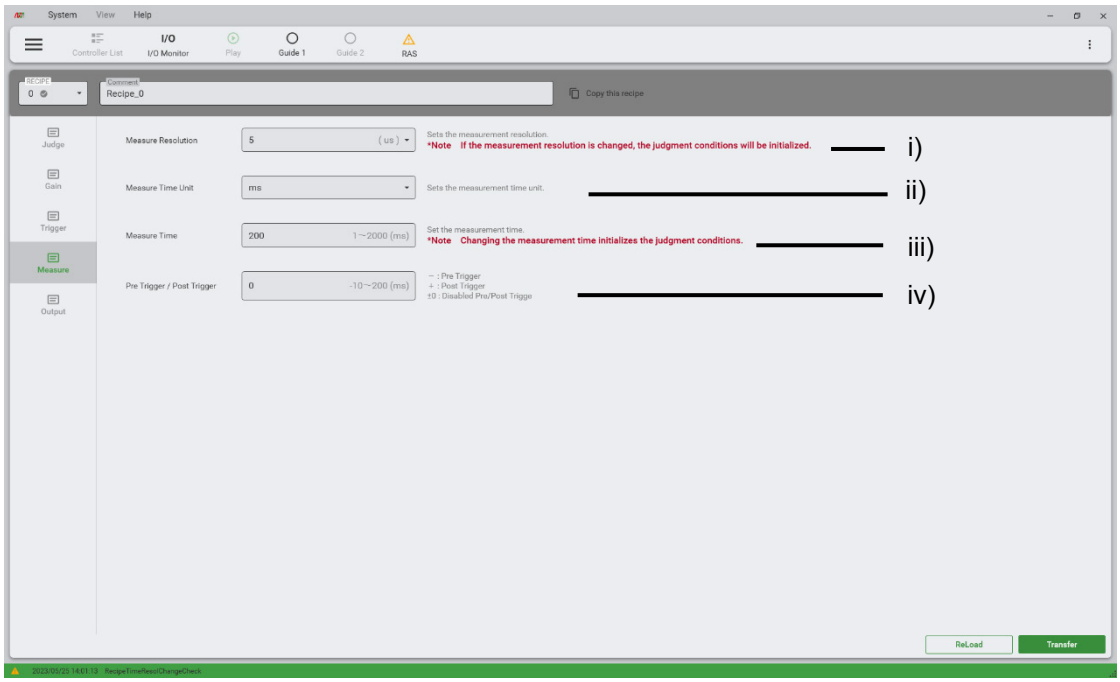
Trigger type can be selected.



No.	Item	Description
i)	Trigger Channel	Specifies a sensor (signal) for the trigger. When set to the external trigger, measurement starts with a trigger signal from the external trigger input (Ext. I/O).
ii)	Trigger Level	Input the upper limit value of the trigger level. The input frame is displayed when the trigger channel is specified. For an external trigger, the frame is not displayed. When the specified trigger channel value exceeds the trigger level, the measurement starts.

(7) Measurement setting window

Measurement resolution, unit, and measurement time can be set.
Input each item with the setting range.

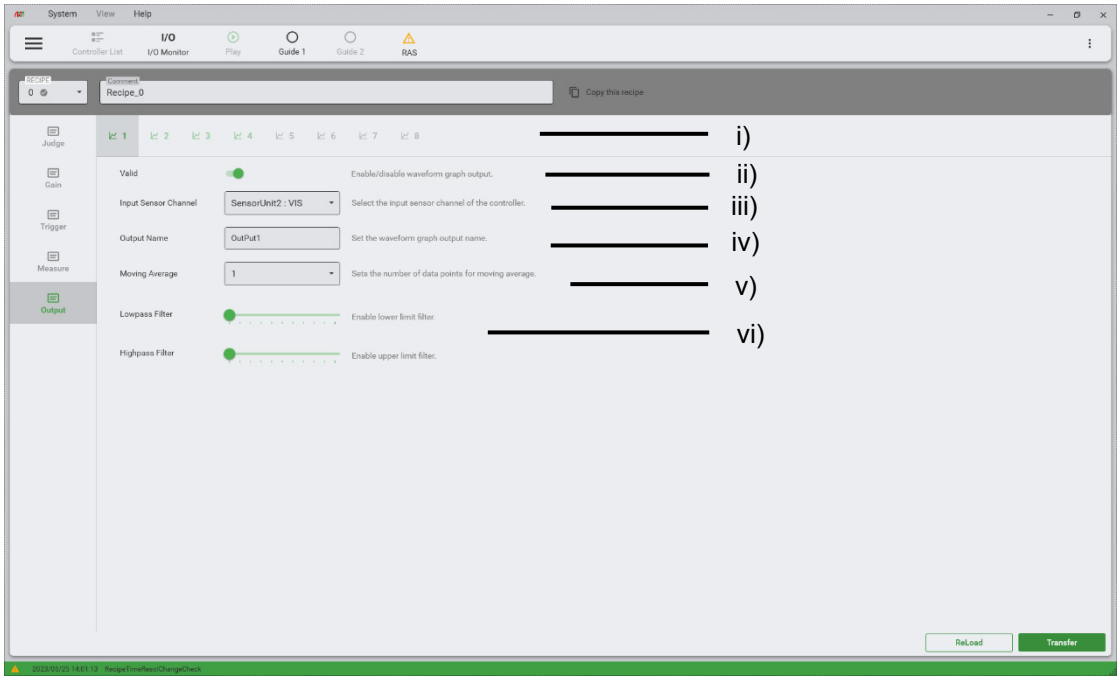


No.	Item	Description
i)	Measure Resolution*1	Set the resolution for the measurement.
ii)	Measure Time Unit	Select the measurement time unit from μs, ms, and s.
iii)	Measure Time*1	Set the measurement time.
iv)	Pre Trigger/ Post Trigger	Set to either Pre Trigger or Post Trigger according to the conditions of use. When neither of them is used, input “0”. Pre Trigger/Post Trigger operates as follows: Pre Trigger: To the waveform graph data, the data before the trigger point is added for the minus time. The judgment starts from the trigger point. Post Trigger: Envelope judgment is not performed from the measurement start until the set time passes, regardless of the judgment setting.

*1: When changing Measure Resolution and Measure Time, the judgment items also need to be edited.

(8) Output setting window

Sensor validity setting, assignment, and name of the sensor.



No.	Item	Description
i)	Weld graph No.	Displays the waveform graph No. to be displayed in the monitor window. Up to 8 waveform graphs can be displayed.
ii)	Valid/Invalid	With Valid status, the waveform data of the specified graph No. is displayed. With Invalid status, the waveform data is not displayed.
iii)	Input Sensor Channel	Assigns the sensor waveform data to the waveform graph No. The list shows the sensor connected to the controller.
iv)	Output Name	Input the output name of the waveform graph. The output name is displayed on the label of the waveform data.
v)	Moving Average	Sets the moving average time (μs).
vi)	Lowpass Filter	Sets the validity of the low-pass filter. Setting the slider to the left end (0) deactivates the low-pass filter.
	Highpass Filter	Sets the validity of the high-pass filter. Setting the slider to the left end (0) deactivates the high-pass filter.

6. Tutorial

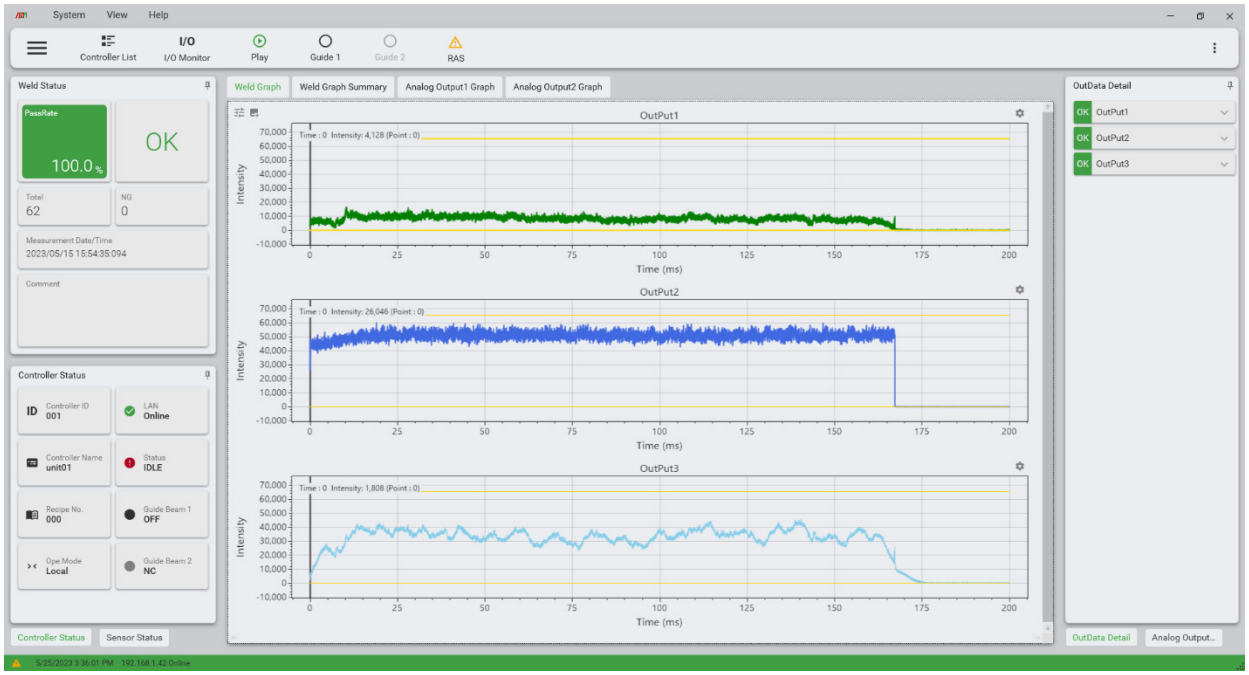
This chapter describes the basic operation procedure of the **MM-L400A**, including the preparation for waveform acquisition, measurement, and the settings for judgment (envelopes).

Configuration of the **MM-L400A** used for description is as follows:

	Unit		Implementation	Remarks
1	Base Unit		Implemented	
2	Sensor Unit 1			
	Ch1	SensorUnit1_VIS (Visible light unit)	Implemented	
	Ch2	SensorUnit1_REF (Reflective light unit)	Implemented	
	Ch3	SensorUnit1_IR (Near-infrared light unit)	Implemented	
	Ch4	SensorUnit1_PWR (Output light unit)	Not implemented	
3	Sensor Unit 2			
	Ch1	SensorUnit2_VIS (Visible light unit)	Not implemented	
	Ch2	SensorUnit2_REF (Reflective light unit)	Not implemented	
	Ch3	SensorUnit2_IR (Near-infrared light unit)	Not implemented	
	Ch4	SensorUnit2_PWR (Output light unit)	Not implemented	

*Analog input channels are not used.

Before starting each operation, turn on the power of the **MM-L400A** (including a warmup time of at least 10 min), and start the **MS-Viewer**.
To perform the measurement, turn on the power of the laser equipment.

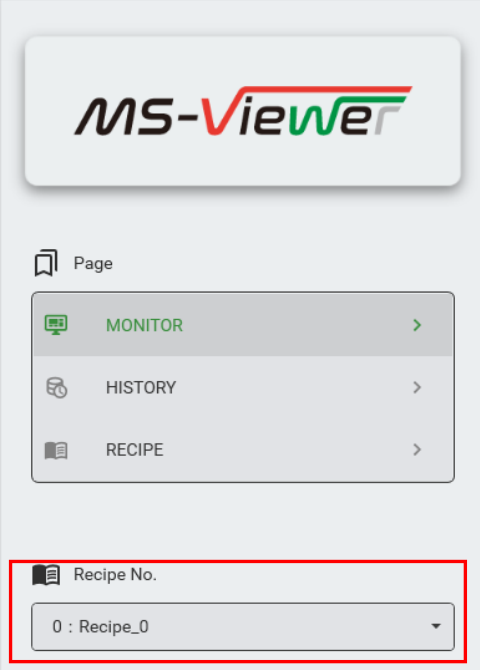

System
View
Help
Controller List
I/O Monitor
Play
Guide 1
Guide 2
RAS
Weld Status
PassRate
100.0 %
OK
Total
62
NG
0
Measurement Date/Time
2023/05/15 15:54:35:094
Comment
Controller Status
Controller ID
001
LAN
Online
Controller Name
unit01
Status
IDLE
Recipe No.
000
Guide Beam 1
OFF
Ope Mode
Local
Guide Beam 2
NC
Controller Status
Sensor Status
Weld Graph
Weld Graph Summary
Analog Output1 Graph
Analog Output2 Graph
OutPut1
Time : 0 Intensity: 4,128 (Point : 0)
Intensity
Time (ms)
OutPut2
Time : 0 Intensity: 26,046 (Point : 0)
Intensity
Time (ms)
OutPut3
Time : 0 Intensity: 1,808 (Point : 0)
Intensity
Time (ms)
OutData Detail
OK OutPut1
OK OutPut2
OK OutPut3
OutData Detail
Analog Output...

(1) Preparation for Waveform Data Acquisition

Recipe setting to acquire the waveform data is enabled.

1. Specify the Recipe No.

   Open the Page Transition window, and specify the Recipe No. with which the waveform data is acquired.
   Here, the Recipe No. 0 is used as an example.



2. Configure recipe setting (measurement conditions)

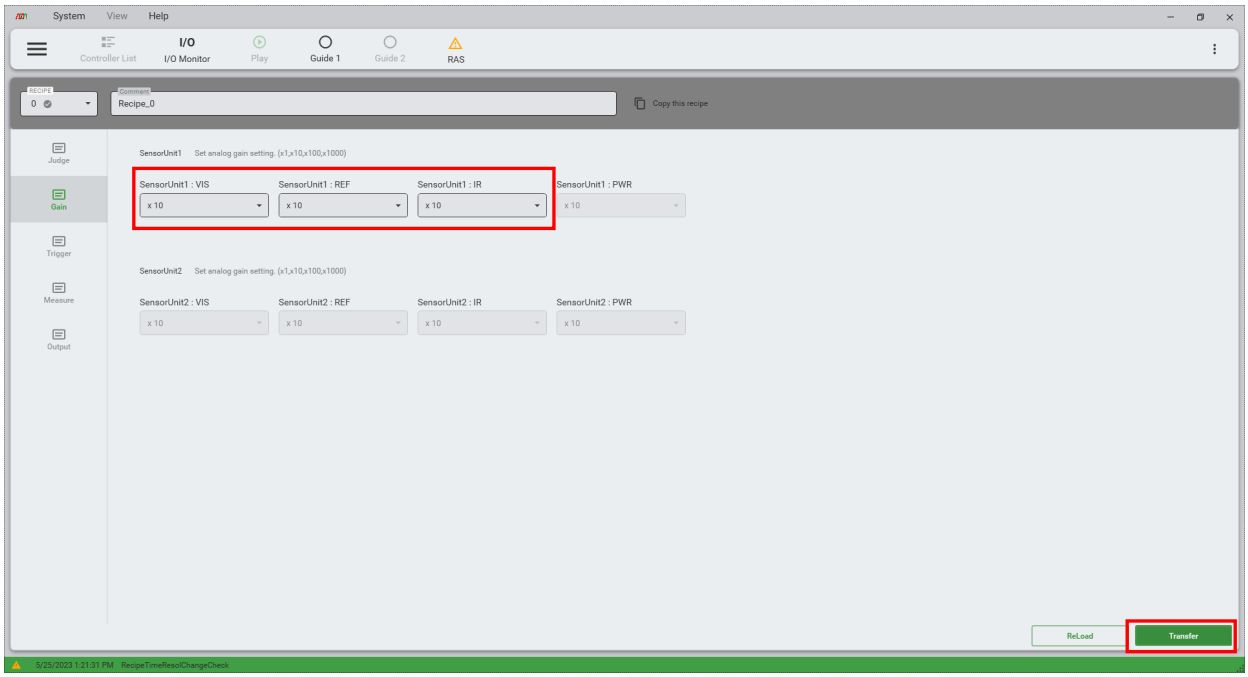
   After specifying the Recipe No., move to the Recipe window to configure the recipe settings (measurement conditions).

   1) Gain setting

      Click [Gain] in the left column of the Recipe window to open the Gain setting window. Set the gain value for each channel.

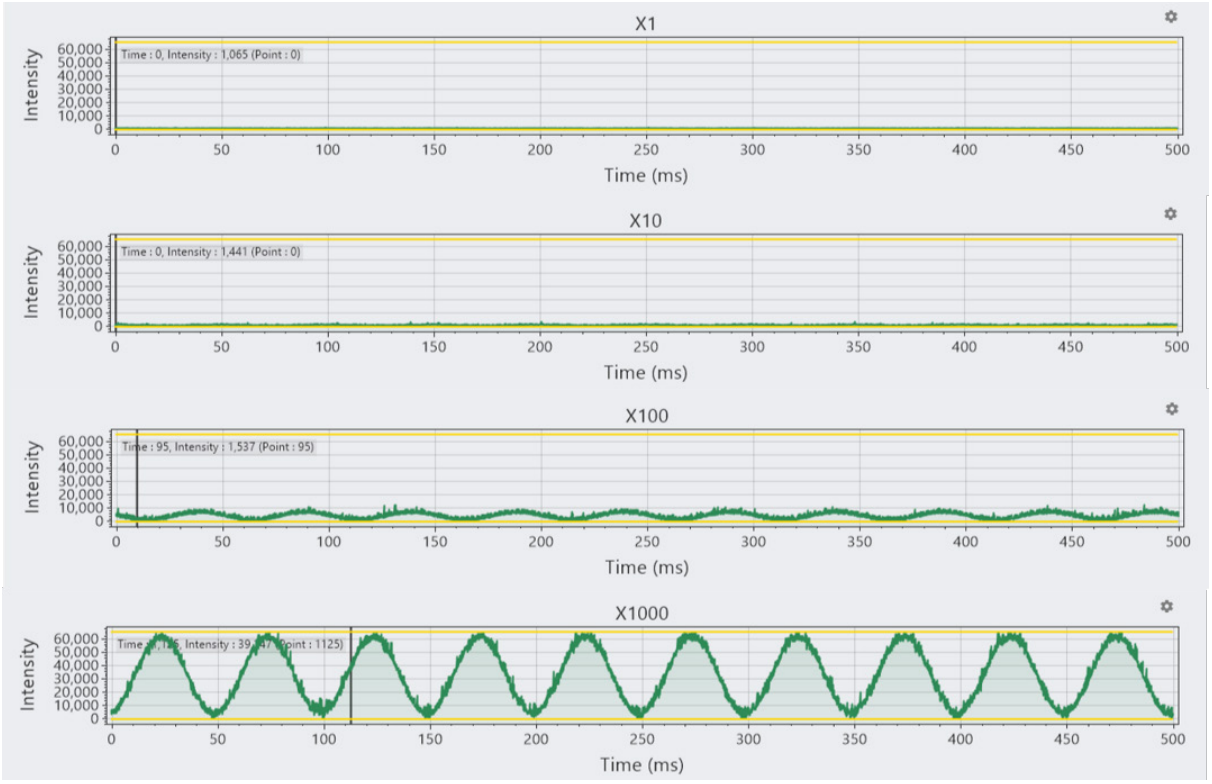
      For any unit that you do not wish to set the gain value, leave it at its default value.

      When setting is complete, click [Transfer]. To cancel the setting, click [ReLoad].



Change in the acquired wavelength according to the Gain value

Larger gain value enables expression of higher intensities (vertical axis) values. Also, the noise level will be higher.

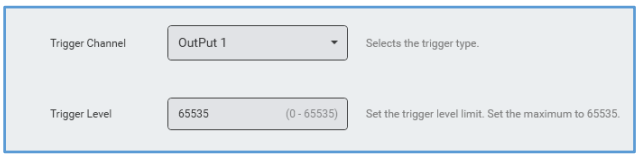


2) Trigger setting

Click [Output] in the left column of the Recipe window to open the Trigger setting window.

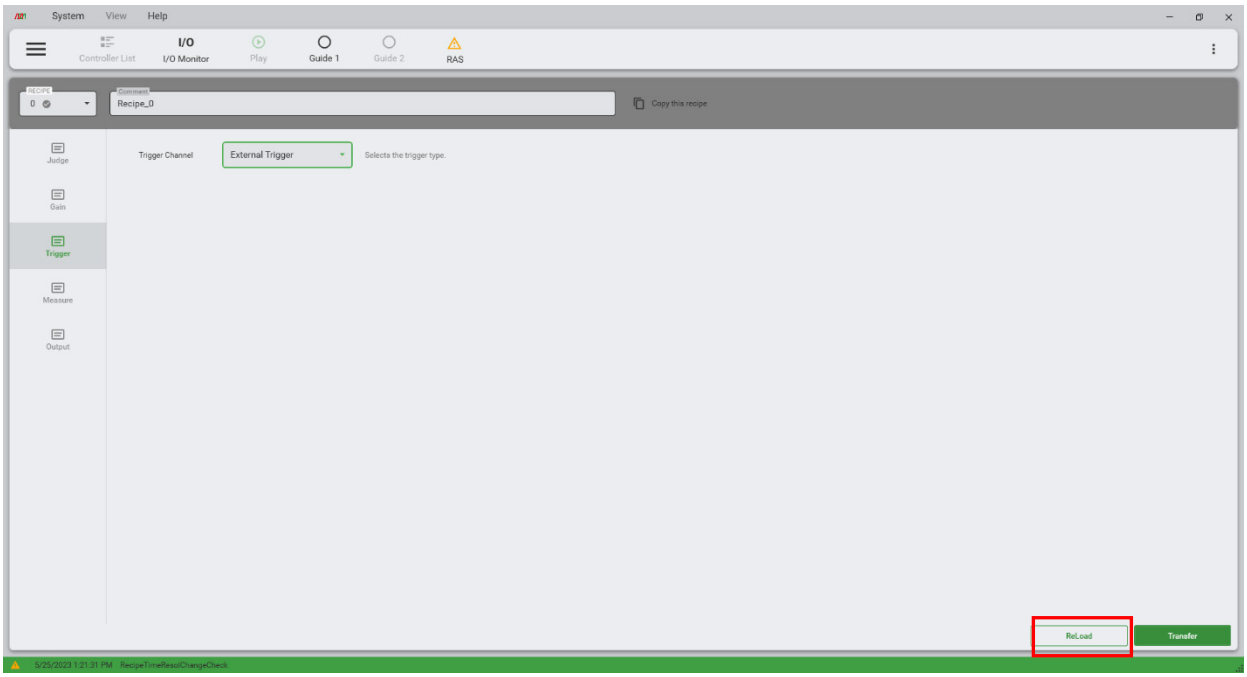
The Trigger Channel combo box displays available sensors.

Specifying the output or analog output displays an input field for Trigger Level.
Set any value within the range [0-65535] to Trigger level.



When External Trigger is specified, no input field for the Trigger level appears.
The trigger is applied via the external input of 0-10V.

When setting is complete, click [Transfer]. To cancel the setting, click [ReLoad].



3) Setting of measurement

Click [Measure] in the left column of the Measurement window to open the Trigger setting window.

When the conditions are already set for the judgment, setting the measurement items returns the judgment conditions to their default values. Check and set the judgment conditions again.

a) Measurement resolution

Each resolution setting has a specific measurement time to set. Specifying the resolution displays the maximum and the minimum measurement time in the input field of the measurement time.

Measurement resolution	Measurement time	
	Min	Max
1 µs	1 ms	400 ms
5 µs	1 ms	2,000 ms
10 µs	1 ms	4,000 ms
50 µs	1 ms	20,000 ms
100 µs	1 ms	40,000 ms
500 µs	1 ms	200,000 ms
1000 µs	1 ms	400,000 ms

b) Measurement time unit

Select the unit of the waveform data time from “µs”, “ms”, and “s”.

c) Measurement time

Set the measurement time within the range displayed in the input field.

d) Pre-trigger/Post-trigger

Set the timing from the point at which the input exceeds the trigger level to the point at which the measurement starts.

Pre Trigger

Waveform acquisition starts before the triggered timing.

Input value: -10ms to -1ms (Add the minus symbol “-“ before the value)

Post Trigger

Waveform acquisition starts after the triggered timing.

Input value: 1ms to 1000ms

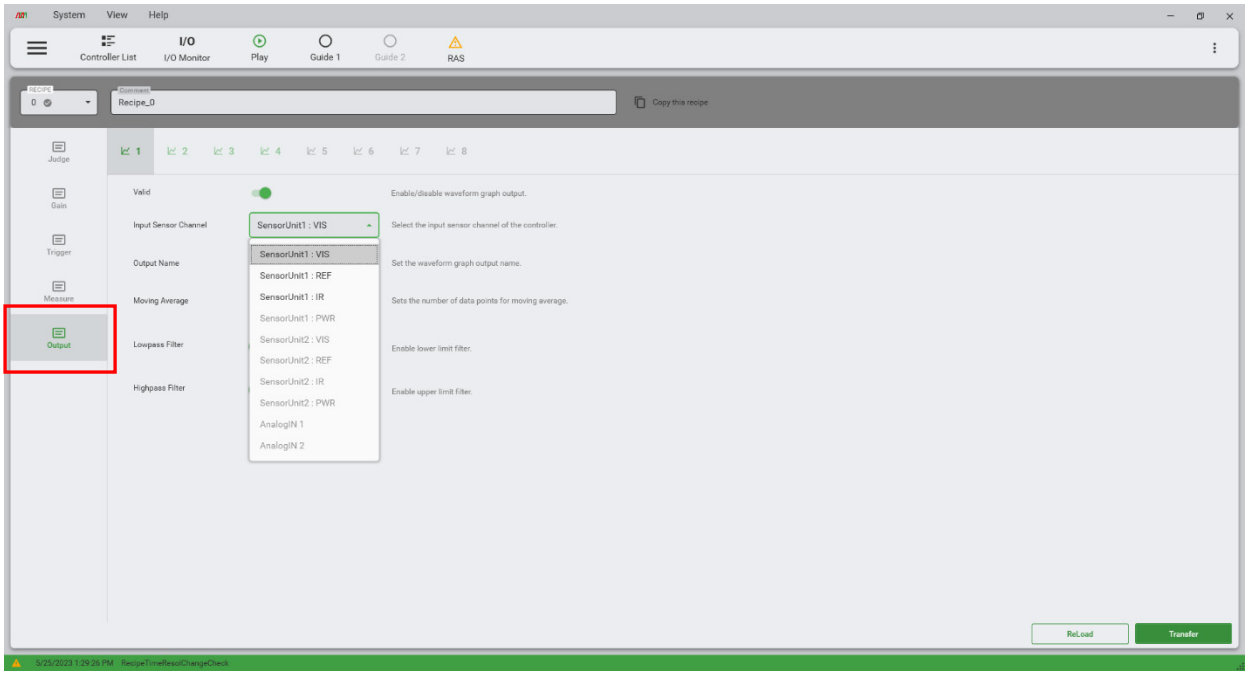
Disable Pre/Post-trigger

Input “0” (zero).

When setting is complete, click [Transfer]. To cancel the setting, click [ReLoad].

4) Setting of output

Click [Output] in the left column of the Measurement window to open the Output setting window.



a) Specify whether to display the waveform graph on the Monitor window.

Click 1 to switch the validity.

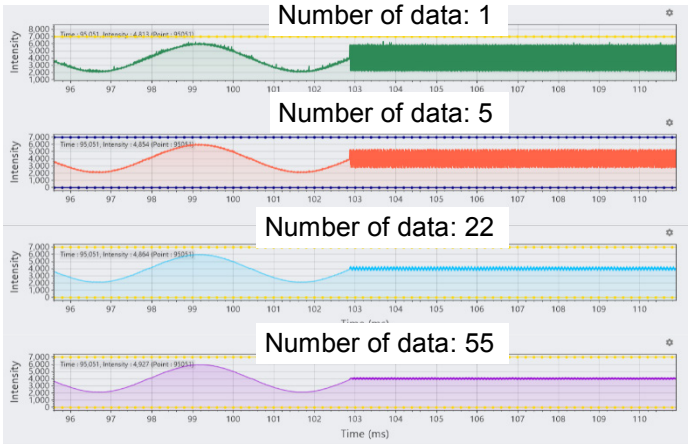
There are a maximum of eight channels available for this output setting.

b) From the combo box of the sensor channel, specify a sensor to display at 1.

c) Input the output name. This output name is displayed on the label of the waveform graph.

d) From the combo box, specify the moving average time.

Using moving averages, the average of the adjacent data is calculated, which minimizes the influence of high frequency noise components. When moving averages are not in use, select [1]. In the waveforms with a low frequency range as in the following examples, moving averages can effectively minimize noise in the waveforms.



e) Set low-pass filter or high-pass filter.

Adjust the slider to set the filter amount.

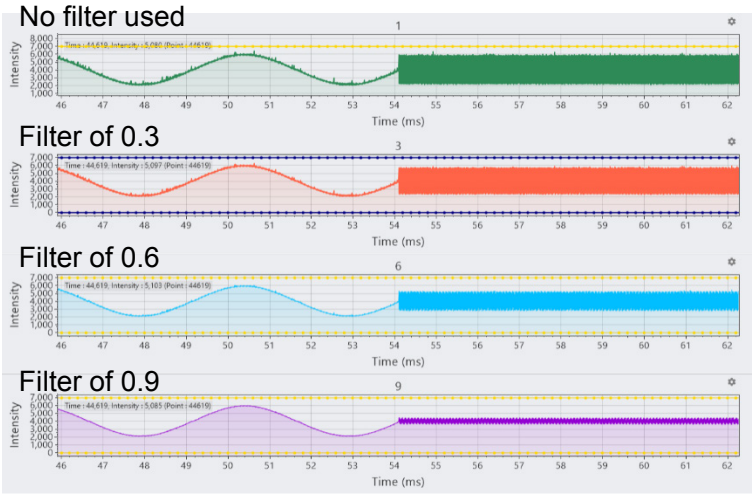
• Low-pass filter

This is a function to display the waveform with its high-frequency signal components subtracted. The filter amount can be set from 11 levels, from 0 to 1.0.

When the filter is not required, select [0] (the leftmost option).

Regardless of the filter amount level that is set, the low-pass filter attenuates the high frequency signal components only.

*Setting the filter to [1.0] makes all the waveform values zero.

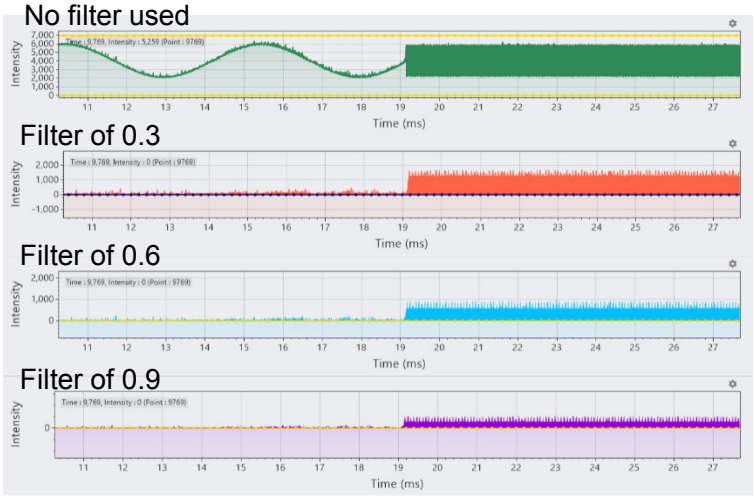


• High-pass filter

This is a function to display the waveform with its low-frequency signal components subtracted. The filter amount can be specified from 11 levels, from 0 to 1.0.
When the filter is not required, select [0] (the leftmost option).

For the high-pass filter, larger filter values attenuate the low-frequency signal components.

*Setting the filter to [1.0] makes all the waveform values to zero.



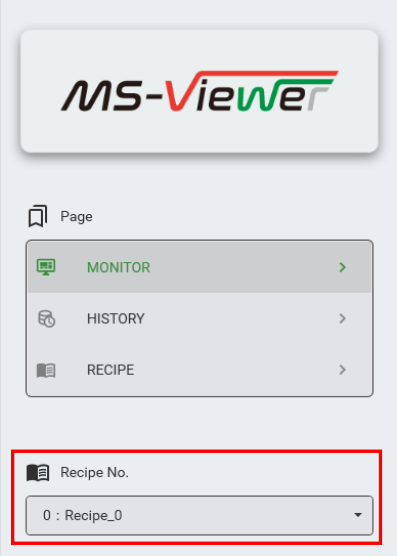
When the setting of 1 is completed, click [Transfer]. To cancel the setting, click [ReLoad]. For the other channels, set in the same way.

(2) Waveform Data Acquisition

Here describes how to acquire the waveform data.

(1) Specify the Recipe No.

Open the Page Transition window, and specify the Recipe No. with which the waveform data will be acquired.
Here, the Recipe No. 0 is used as an example.



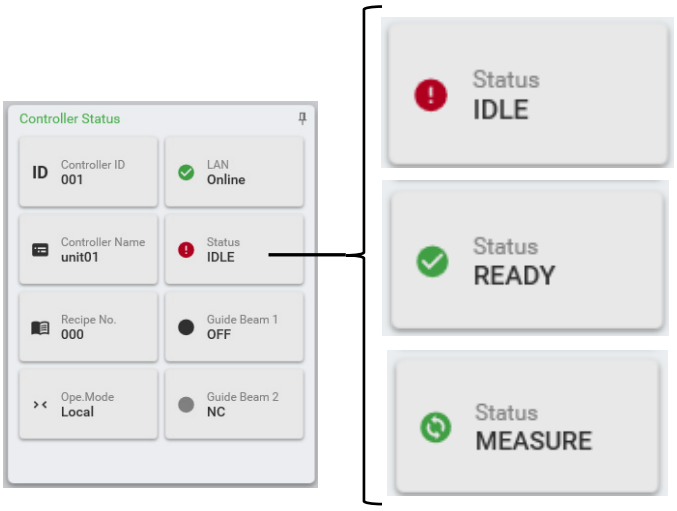
(2) Start measurement

After specifying the Recipe No., move to the Monitor window, and start measurement.

1) Check that the Recipe No. 000 is displayed in the Controller Status area, and click [Play] in the toolbar.

2) When [Play] is clicked, Controller Status changes from IDLE to READY.
When the trigger signal set on the Recipe window is detected, Controller Status changes to MEASURE, and measurement starts.

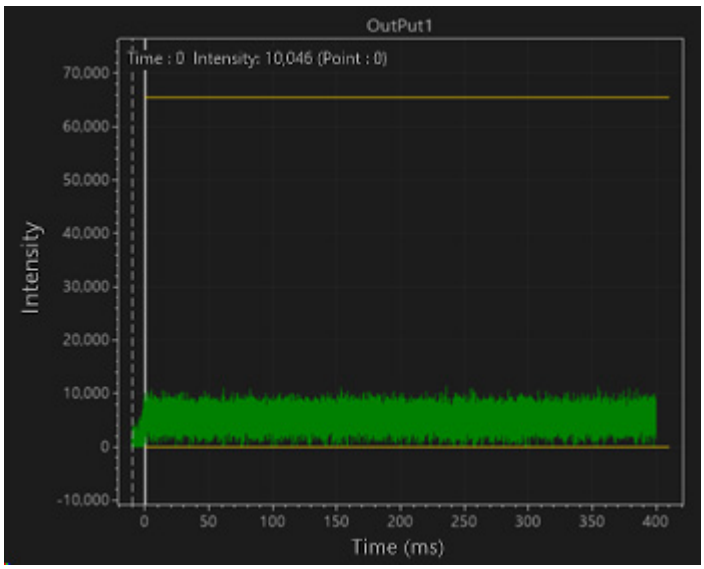
3) After sufficient waveforms have been acquired for making a judgment, click [Pause].
When measurement stops, the Controller Status changes to IDLE.



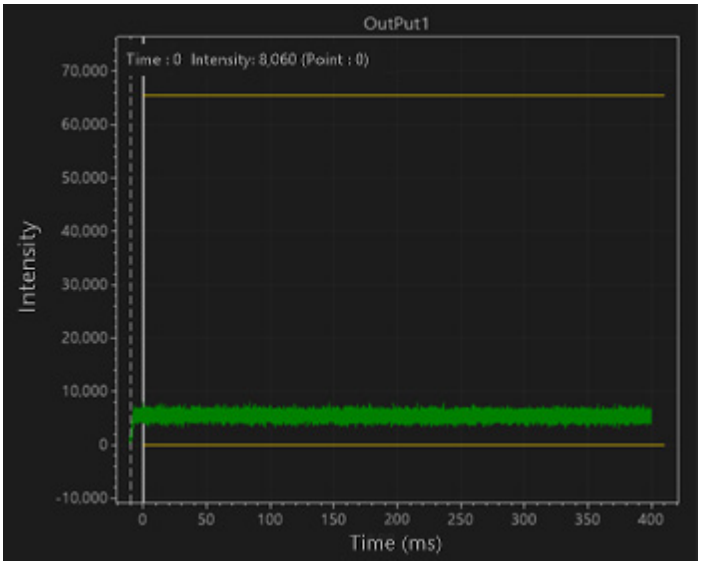
*When the laser output is low or if the equipment includes a product in which there is significant transmission loss, such as a scanner unit, sufficient intensity may not be obtained with x1 or x10 gain on each channel. In this case, increase the gain to x100 or x1000 and check again.

When the gain is set to x100 or x1000, noise components may also be significant, and sometimes noise components may appear to be the dominant signal in the measured output waveform.
In this case, set the low-pass filter, high-pass filter, and moving average to eliminate the noise components as far as possible.
Here describes an example of eliminating noise components with the gain set to x1000.

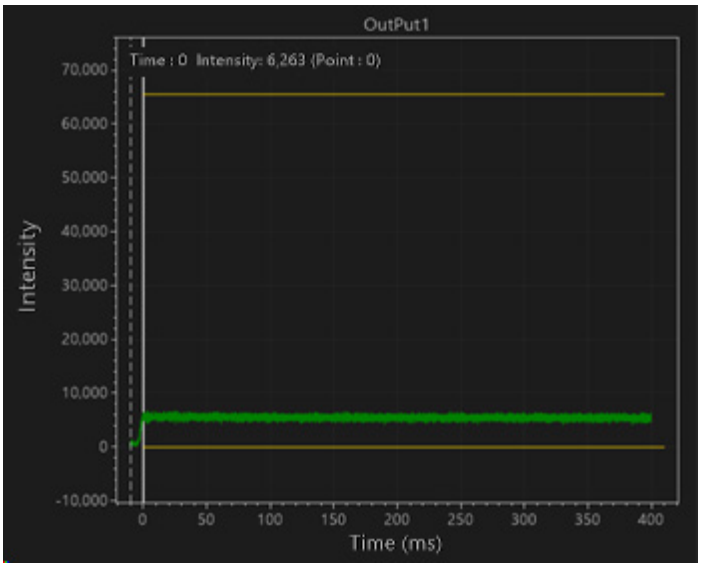
1) When the gain is set to x1000 and the amount is low, noise components may have significant influence.



2) Set the low-pass filter to 0.9. The noise components are reduced.

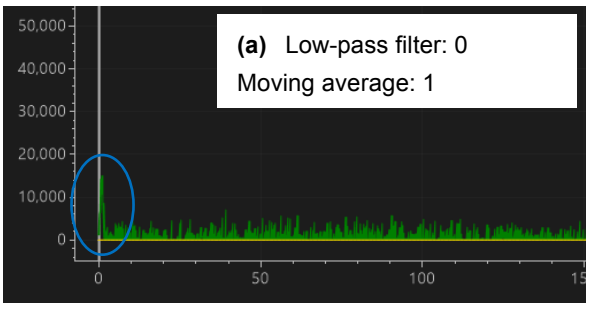


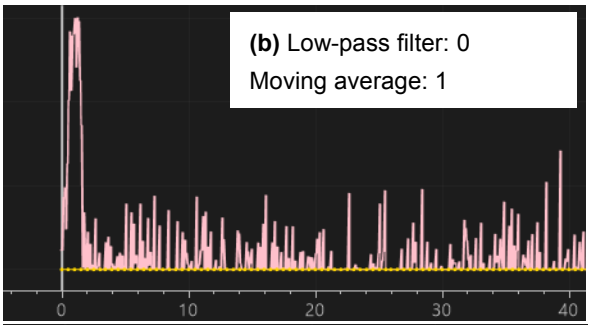
3) To further reduce the noise components, change the moving average to 40.

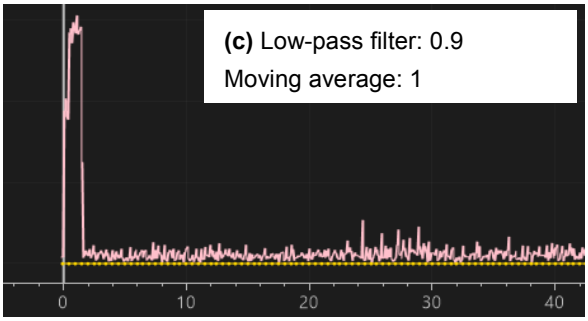


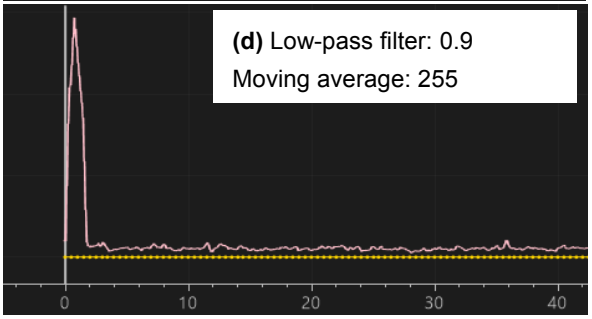
Increasing each setting value may also filter out minute transients which might be important to know. While changing the setting value, be sure to check and monitor the measured waveform.
Even when the measured waveform time is short, if there is sufficient amount to the noise components, measurement is possible with each setting value increased, without the drawbacks of filtering.

Below shows an example of the condition in which at laser processing of 1ms is measured with a gain of x1000, resulting in an amount of approx. 14000.
This shows how the noise components and how the measured waveform is influenced by changes in the settings of the low-pass filter and the moving average.
(a): Waveform measured with low-pass filter: 0, moving average: 1
(b): Magnified view of the waveform (a)
(c): Magnified waveform measured with low-pass filter: 0.9
(d): Magnified waveform measured with low-pass filter: 0.9, moving average: 255





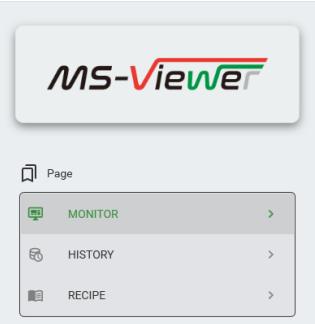




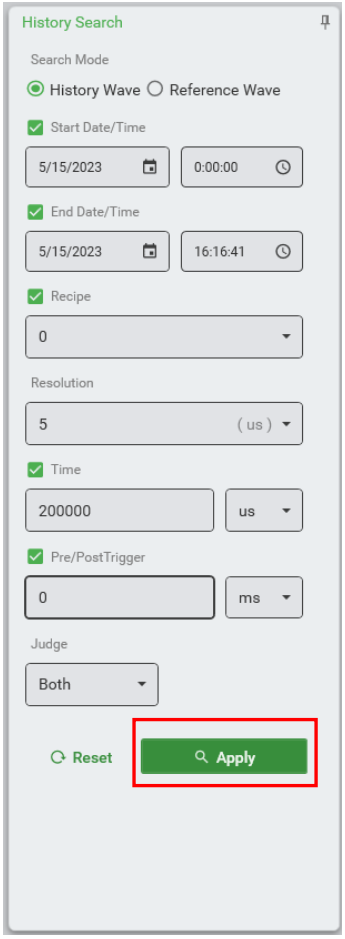
(3) Searching for Waveform Data

Here describes how to search for the saved waveform data.

(1) Open the Page Transition window, and go to the History window.



(2) Specify the search conditions, and click [Search].



◆Descriptions of Items◆

Search Mode: Selecting [History Wave] enables to search the waveform data satisfying the search condition from the DB collection currently connected.

Selecting [Reference Wave] enables to search the reference waveform of the currently selected Recipe No.

*The search condition is grayed out.

Start Date/Time:

Input the search period of the waveform data to display.

Click the calendar mark to specify the date.

Recipe: Specify the Recipe No. when the waveform data is acquired.

Resolution: Specify the resolution when the waveform data is acquired.

Time: Specify the measurement time when the waveform data is acquired.
Units can be selected from ”μs”, “ms”, and “s”.

Pre/Post Trigger:

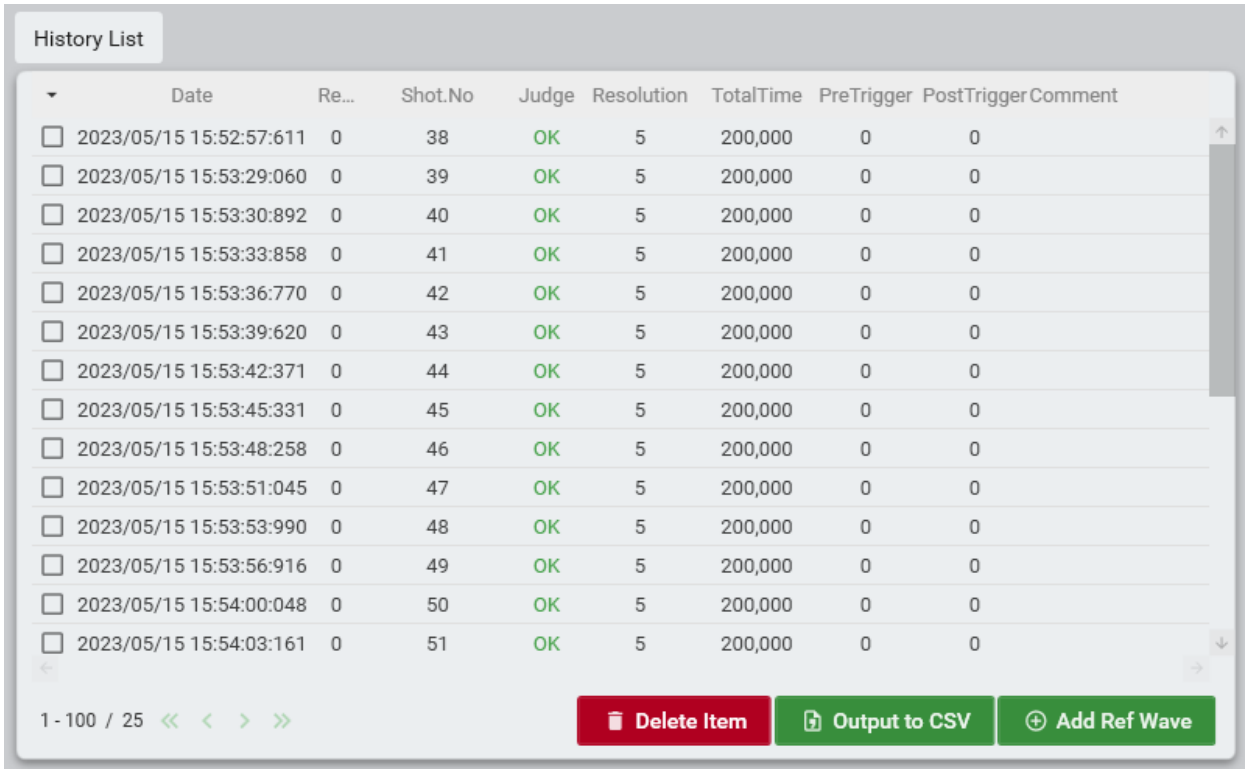
Specify the time for pre-/post-trigger when the waveform data is acquired.
Units can be selected from ”μs”, “ms”, and “s”.

Judge: Specifies the judgment result of waveform data.
“OK”, “NG”, or “Both” can be specified.

When selecting “Both”, both “OK” and “NG” are searched for.

Other than [Resolution] and [Judgment], a checkbox to enable/disable the condition is available for each item. To enable the condition, place a checkmark.
*Waveforms having different resolutions and measurement times from Resolution and Time cannot be added to a reference waveform.

(3) The waveform data satisfying the search conditions are displayed in the search list.



Selecting the waveform data in the History List displays the waveform on “All Weld Graph History”, “Analog Output 1 Graph History”*1, and “Analog Output 2 Graph History”*1.

Placing a checkmark in the checkbox of the waveform data in History List displays the waveform data in “Weld Graph History”.

On the Weld Graph History, all the waveforms selected with checkmarks are displayed. Only the active waveform is displayed in color, while the other waveforms are displayed in gray.

(*1: The waveform is not displayed when the analog output is disabled in the waveform data in selection.

(4) Envelope Setting with Reference Waveform Registered

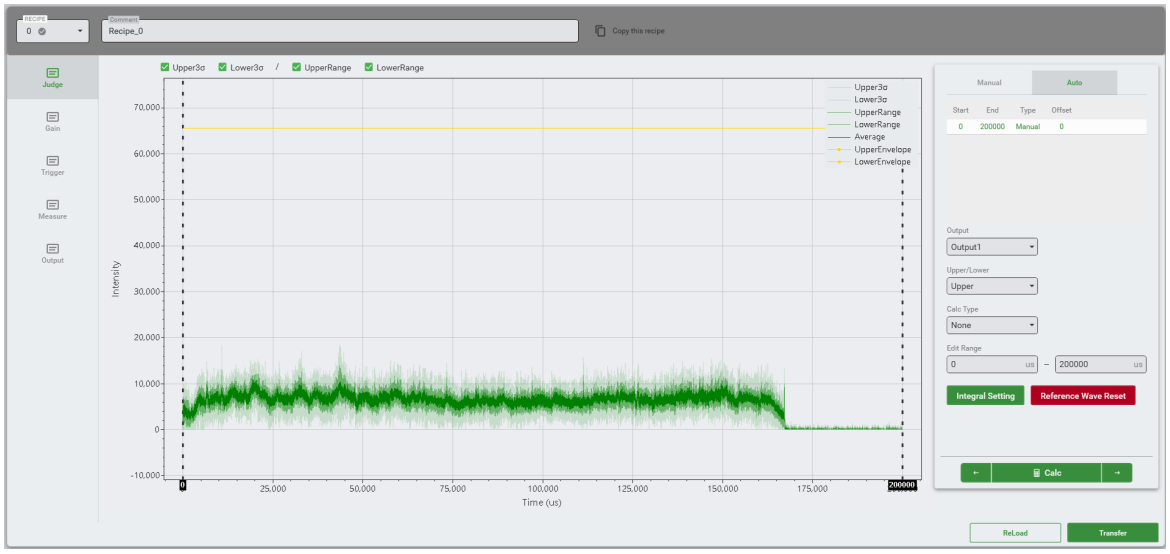
Here describes how to register the reference waveform for the judgment envelope.

(1) Select the waveform to register

Check that the waveform data to register as a reference waveform is displayed in the Weld Graph History, and click [Add Ref Wave].

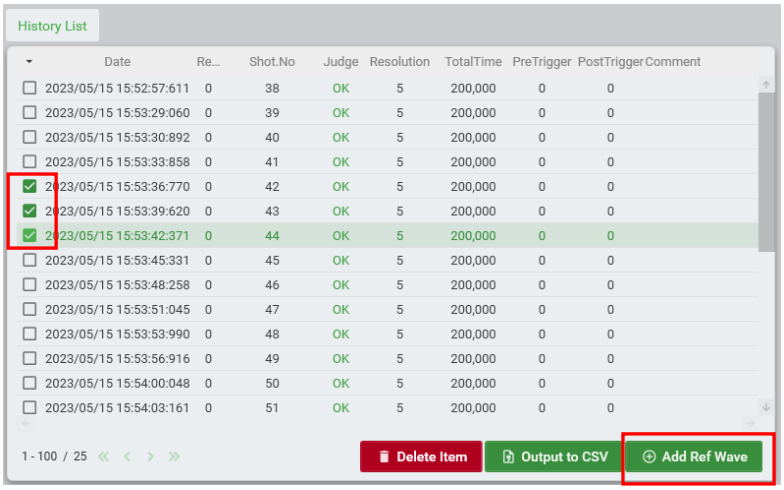
(2) Check the waveform graph

Select [Judge] in the Recipe window.
On the waveform display area, average, range (Max/Min), and 3σ of the reference waveform are displayed.

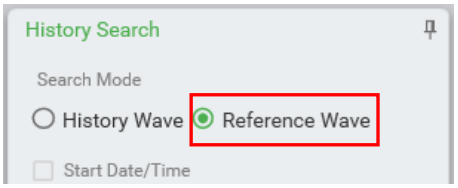


(3) Add or delete waveform graphs to the reference waveform

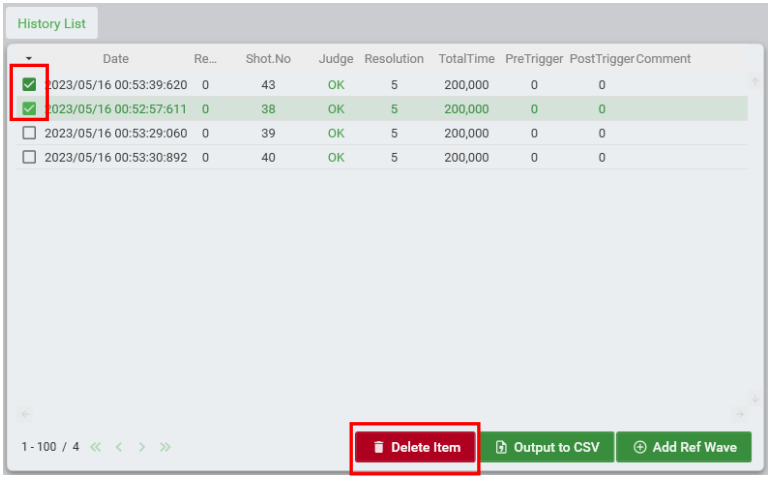
To add a waveform to the reference waveform, check the checkbox of the waveform data you wish to add, and click [Add Ref Wave].



To delete a waveform from the reference waveforms, select [Reference Wave] on History Search on the History window, and click [Apply].



On the History List that appears, select the checkbox(es) of the waveform data to delete, and click [Delete Item].



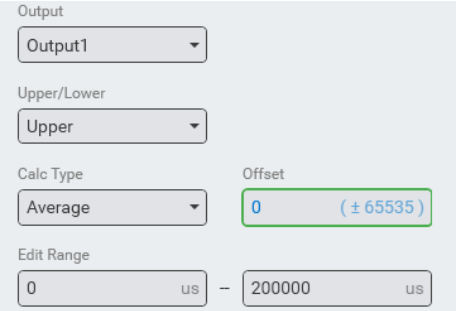
(4) Set [Judgment] conditions

Set envelope judgment (automatic/manual) and the upper/lower limit values used for the integral judgment.

1) Setting procedure of upper/lower limit values for the envelope judgment

[Automatic setting]

a) In the Output menu, select a channel for the envelope to set.

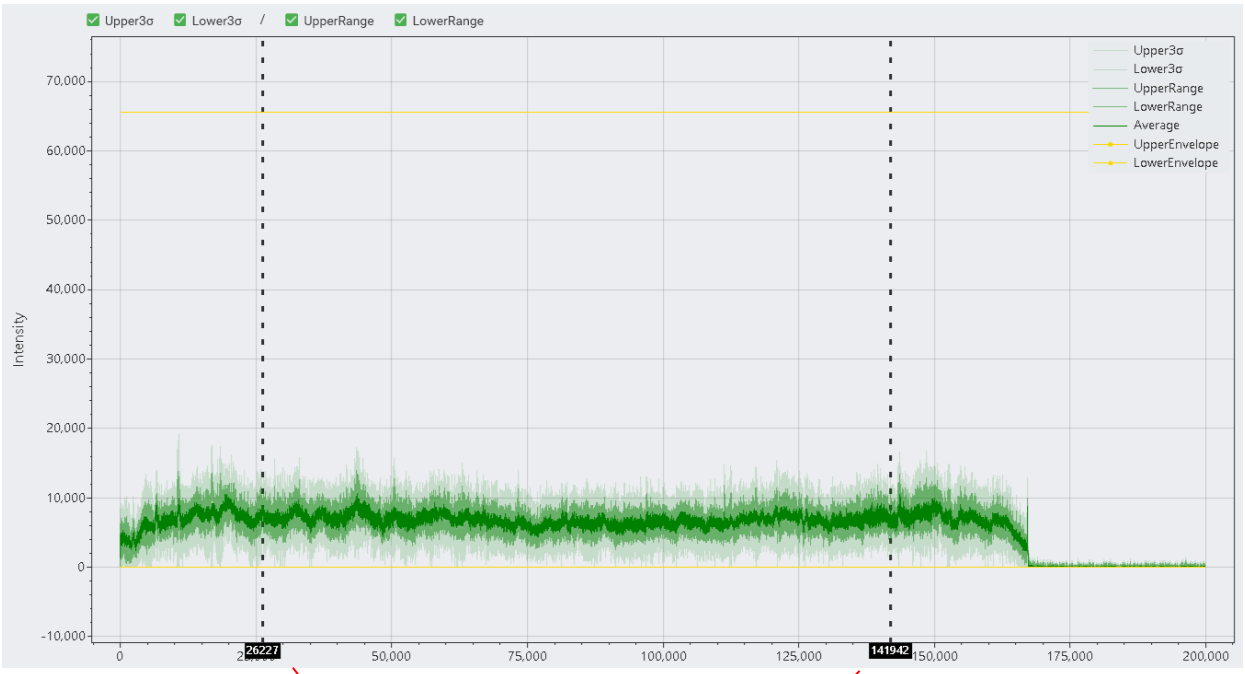


b) For [Upper/Lower], set the envelope either to the upper limit side or the lower.

In this example, the upper limit side is selected.

c) For [Edit Range], specify the range for calculation. You can drag the dashed lines on the displayed waveform to specify the range.

Dragging the dashed lines automatically inputs the data to [Edit Range].

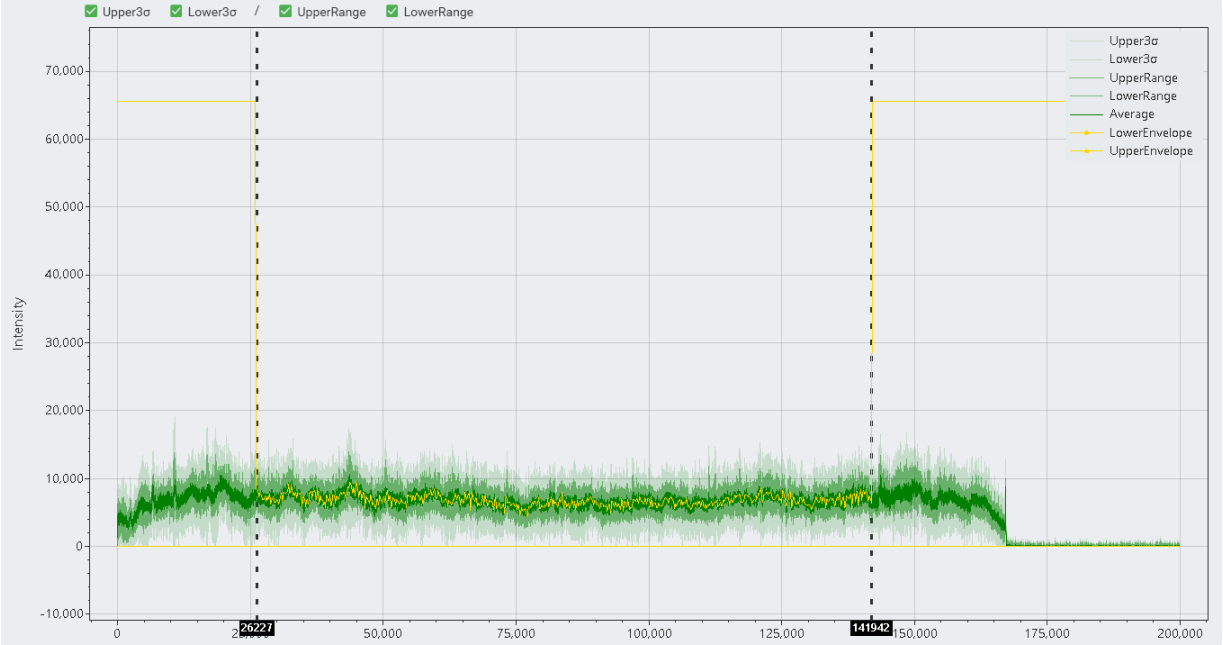


d) Specify [Calc Type].

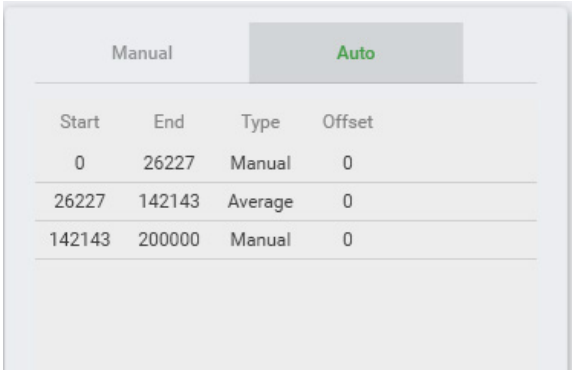
In this example, “Average” is selected.

e) Click [Calc] to perform the envelope calculation.

f) When the calculation is completed, the envelope waveform is displayed.



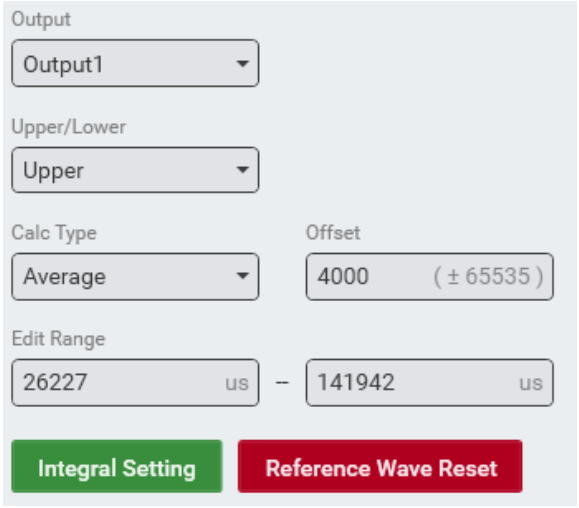
The range and the calculation type can be confirmed with the detailed menu.



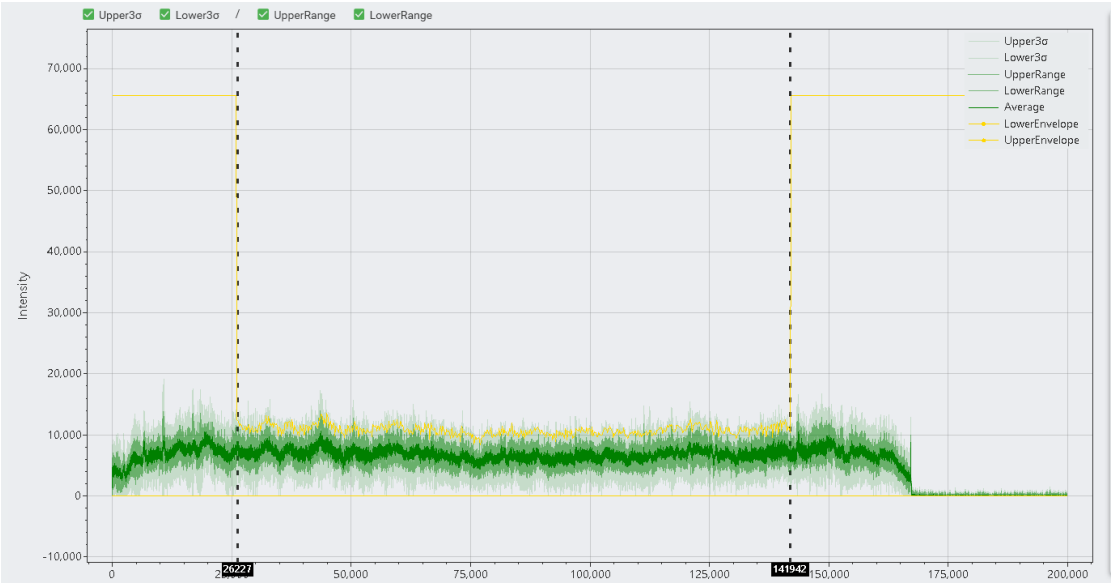
From the value calculated by the reference waveform, adjust the envelope by using the Offset value.

Especially when “Average” is selected for [Calc Type], the upper and the lower limits are the same, accordingly an offset setting is required.

In this example, “4000” is input as [Offset]. After input, click [Calc].



The envelope with the set offset value added is displayed.



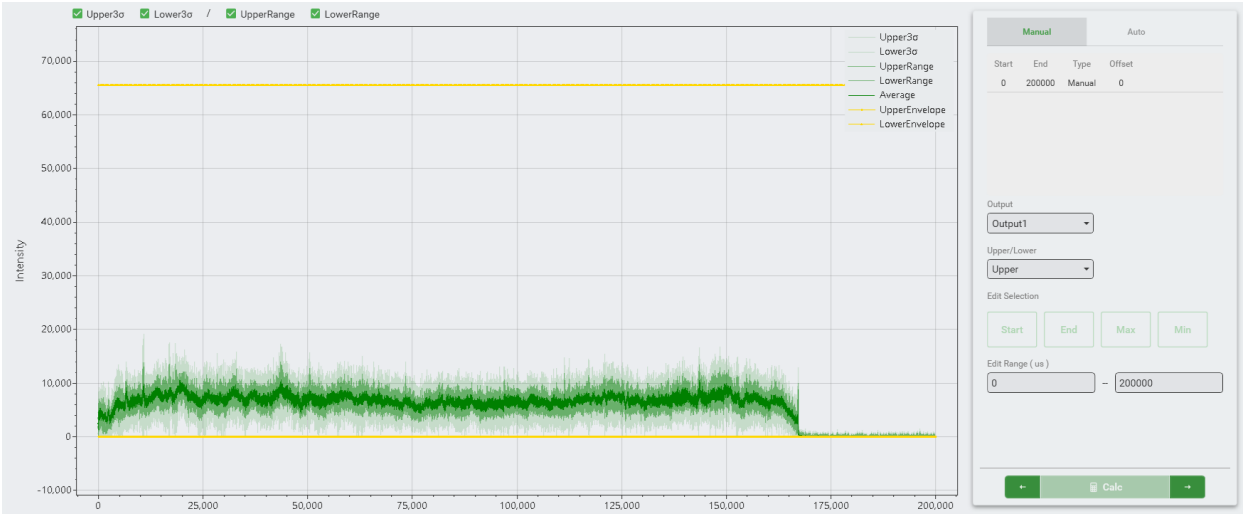
g) Click [Transfer] to transfer the envelope waveform to the Controller.

h) To set for other outputs, repeat the steps a) to g).

[Manual Setting]

By referring to the reference waveform added on the History window, envelopes can be manually edited.

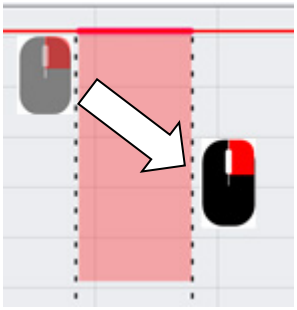
a) Display the reference waveform on the envelope editing window, and click [Manual].



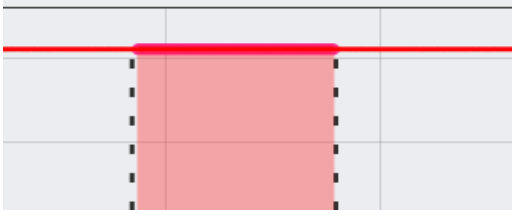
b) Specify the setting range

Specifying the range by right-clicking and holding the mouse sets the envelope range.

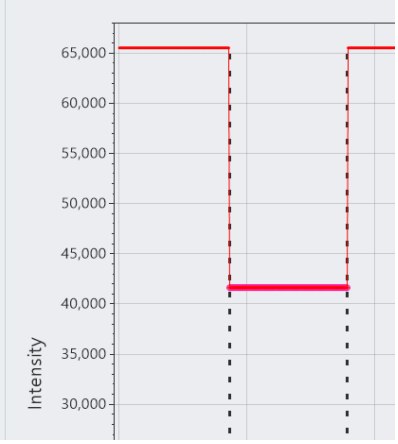
With the mouse right-clicked, drag it to select the range. The selected points are highlighted.



Releasing the right-clicking can release the selected range.



c) Right-clicking an arbitrary point within the selection range and dragging it can select and move the multiple points simultaneously in the selection range.



d) Click [Transfer] to transfer the calculated value to the Controller.

e) When the setting is completed, click ◄ (return).

2) Setting procedure of upper/lower limit values for integral setting

For [Integral Setting], set [Interval], [Calc Mode], [Edit Range], [Upper] and [Lower].

a) On the Automatic Setting window, open the Integral Setting menu.

b) Select the operation interval from the list. Five intervals at maximum can be set. For the selected intervals, the interval No. is assigned in the Interval field.

c) Select the calculation mode. As in the envelope setting, “Average”, “Range”, or ”3σ” can be selected. The calculation mode can be set for each interval.

d) Set the edit range ([Edit Range]). Dragging the dashed lines on the waveform can also set the range.

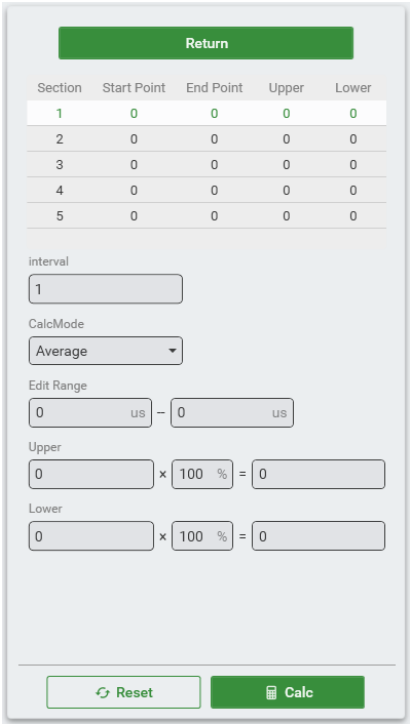
e) Set the magnification for [Upper] and [Lower]. Especially when “Average” is selected for [Calc Type], the upper and the lower limits are the same, accordingly a different magnification needs to be input.

The calculation result field can be directly input with values. When doing this, the magnification field will be displayed as “---“.

f) Click [Calc]. The setting value is displayed.

g) Click [Transfer] to transfer the calculated value to the Controller. To recalculate, repeat the setting and click [Calc]. To cancel the setting, click [Reset].

h) When the setting is complete, click ◄ (return).

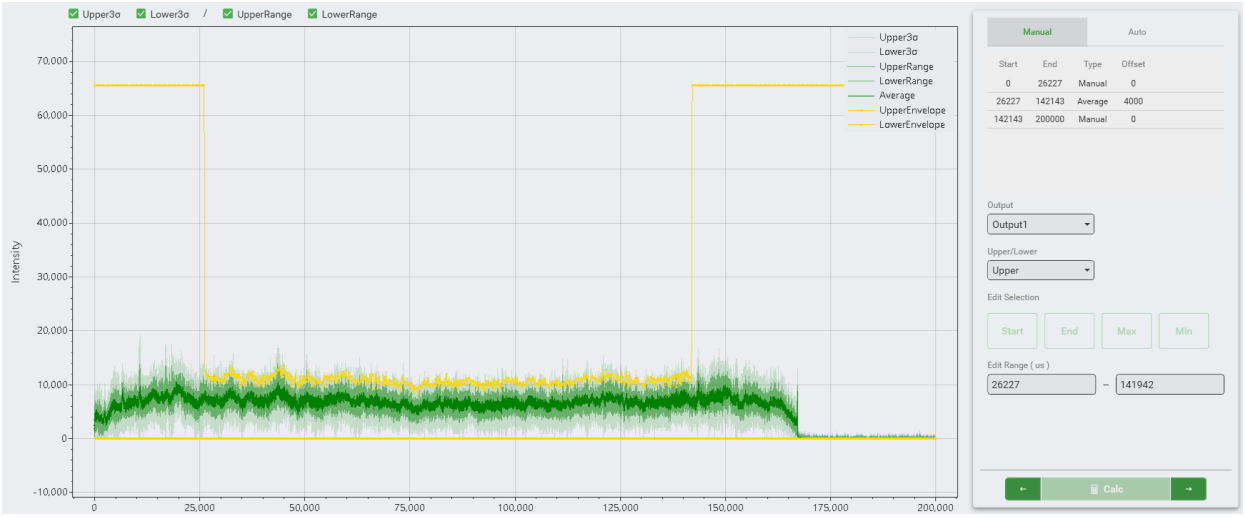


(5) Manual Editing of Automatically Set Envelope

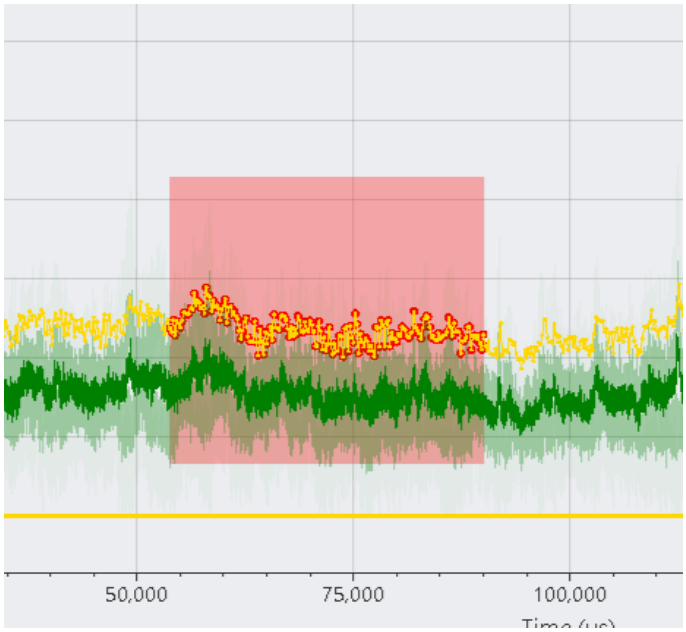
Even the envelope set with [Auto] can be manually set for the range to move.

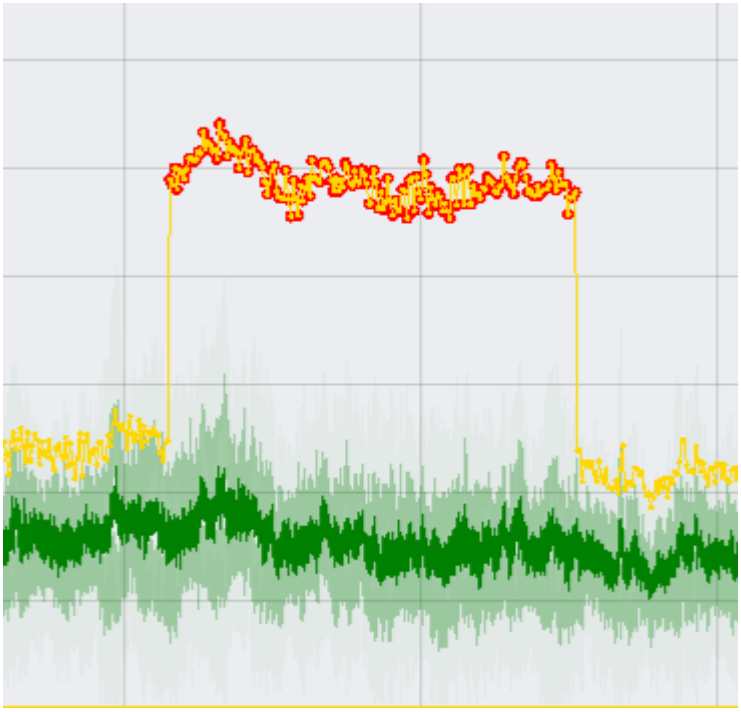
This function is useful to determine the offset for [Average] by checking the envelope waveform, or to add an offset value to the waveform in the [Range].

(1) Click [Manual].



(2) Specify/Select the range by using the mouse.



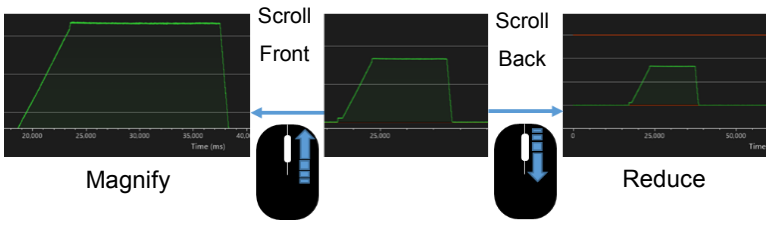
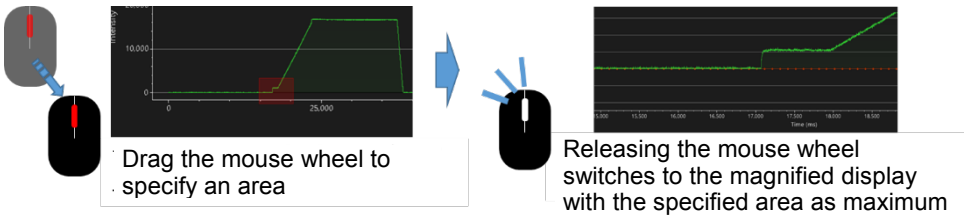
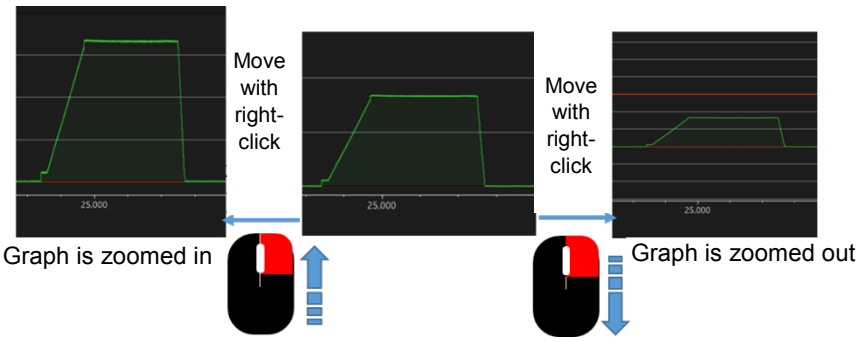
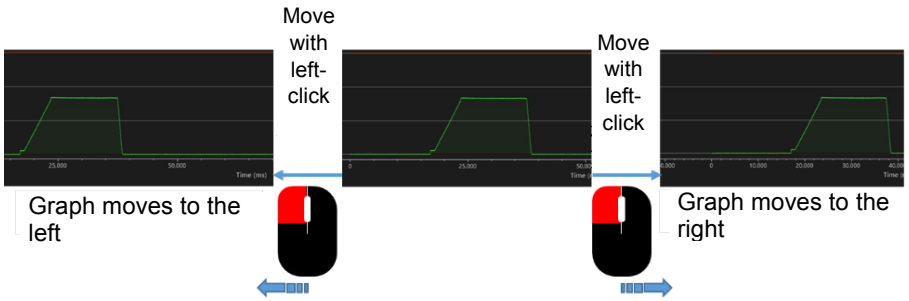


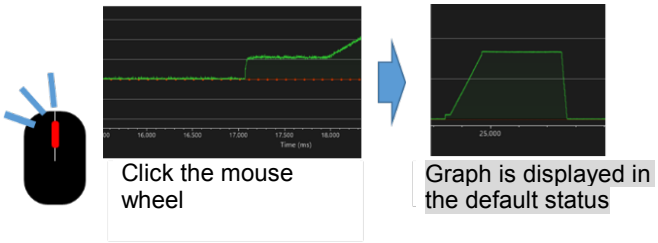
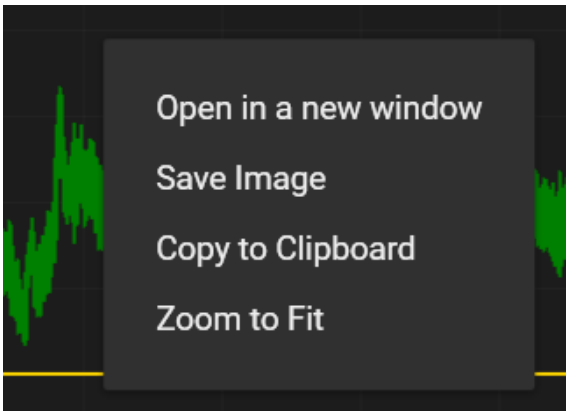
After specifying the range, selecting an arbitrary point and dragging it moves multiple points simultaneously.

(3) Click [Transfer] to transfer the calculated value to the Controller.

(6) Operation of Waveform Graph

Here describes how to magnify/reduce or move the waveforms.

Item	Operation
Magnification/ Reduction	Scrolling the mouse wheel enables magnification/reduction of a displayed waveform.  Dragging an area on a waveform with the mouse wheel clicked magnifies the selected area. 
Zoom In/Out	Dragging the mouse with right-click and hold zooms the waveform in/out. Vertically dragging the mouse with right-click and hold with the Shift key depressed zooms in/out in the vertical direction. Horizontally dragging the mouse with right-click and hold with the Ctrl key depressed zooms in/out in the horizontal direction. 
Moving	Dragging the mouse with left-click and hold moves the waveform freely. Dragging the mouse with the Shift key depressed moves the graph with the X-axis fixed. Dragging the mouse with the Ctrl key depressed moves the graph with the Y-axis fixed. 

Display reset	Clicking the mouse wheel resets the display.  Click the mouse wheel Graph is displayed in the default status
Pop-up window display	Right-clicking the mouse at an arbitrary point displays a pop-up window. 

(7) Exporting Waveform Data in a CSV Format

Here describes how to export the waveform data displayed in the History List in a CSV format.

(1) Open the History window and specify the waveform data to export.

(2) Click [Output to CSV].

(3) Save the file to an arbitrary folder.

Data Specifications

Name	Description
Selected Wave No.	Selected order
MongoDB Wave ID	ID in MongoDB
Output Name	Output name
Output No.	Output No.
Date Time	Date and time of measurement (Y/M/D, H:M:S.msec)
Comment	Comment describing the measurement
Controller ID	Unit ID
Schedule No.	Recipe No.
Schedule Name	Recipe name
Shot No.	Shot No.
NG Shot No.	Failed shot No.
Measurement Resolution(us)	Measurement resolution
Measurement Time(us)	Total measurement time
Measurement Point Num	Total number of measurement points
PreTrigger Time(us)	Pre-trigger time
PostTrigger Time(us)	Post-trigger time
Moving Average count	Moving average count
Filter	Filter setting
Max Value	Maximum measurement value
Min Value	Minimum measurement value
Average Value	Average measurement value
Integral Total Value	Total integral value
Integral Section X Value	Integral value in the section X

Total Judgment	Total judgment: OK/NG
Envelope Upperlimit Judgment	Envelope judgment (upper limit): OK/NG
Envelope Lowerlimit Judgment	Envelope judgment (lower limit): OK/NG
Integral Upperlimit SectionX Judgment	Integral judgment in the section X (upper limit): OK/NG
Integral Lowerlimit SectionX Judgment	Integral judgment in the section X (lower limit): OK/NG
Wave Data time(μs)	-
XXX: Measurement Time (μs)	Measurement value

7. Maintenance

The error contents are displayed on the Error Information Window (displayed by clicking the [Error Info (RAS)] button on the Maintenance Window.

(1) List of Error Codes

Error code	Error display	Contents of errors and corrective measure
1	Voltage of the backup battery is low.	The battery voltage of the Controller is low. When this error is output if the power is turned on again, consult us.
2	Connection error: Memory card	The memory card has a connection error. When this error is output if the power is turned on again, consult us.
3	Abnormal: Memory card	The memory card is abnormal. When this error is output if the power is turned on again, consult us.
4	Abnormal: EEPROM	The EEPROM part is abnormal. When this error is output if the power is turned on again, consult us.
5	Abnormal: Sensor temperature Ch1	The temperature of Ch1 sensor is abnormal. When this error is output if the power is turned on again, consult us.
6	Abnormal: Sensor temperature Ch2	The temperature of Ch2 sensor is abnormal. When this error is output if the power is turned on again, consult us.
7	Abnormal: Sensor temperature Ch3	The temperature of Ch3 sensor is abnormal. When this error is output if the power is turned on again, consult us.
8	Abnormal: Sensor temperature Ch4	The temperature of Ch4 sensor is abnormal. When this error is output if the power is turned on again, consult us.
9	Abnormal: Sensor temperature Ch5	The temperature of Ch5 sensor is abnormal. When this error is output if the power is turned on again, consult us.
10	Abnormal: Sensor temperature Ch6	The temperature of Ch6 sensor is abnormal. When this error is output if the power is turned on again, consult us.
11	Abnormal: Sensor temperature Ch7	The temperature of Ch7 sensor is abnormal. When this error is output if the power is turned on again, consult us.
12	Abnormal: Sensor temperature Ch8	The temperature of Ch8 sensor is abnormal. When this error is output if the power is turned on again, consult us.
13	Abnormal: Communication in the Controller	Communication in the Controller is abnormal. When this error is output if the power is turned on again, consult us.

14	Alarm: HDD capacity in short	Free space in HDD is decreasing. Delete unnecessary data, or provide with a new memory card.
15	Abnormal: HDD capacity in short	Free space in HDD is full. Delete unnecessary data, or provide with a new disk.
16	Abnormal: Controller (db)	The database in the Controller is abnormal. When this error is output if the power is turned on again, consult us.
17	Abnormal: Controller (others)	The Controller is abnormal. When this error is output if the power is turned on again, consult us.
18	Abnormal: Condition setting	The conditions which are not registrable have been set. Set the conditions again.
19	Power shutdown	The Controller has not been properly shut down. The setting conditions may not be correctly saved.
100	Configuration error	There is no setting file; the default setting file will be generated. Restart the application program.
101	Abnormal: Database connection	The database connection is abnormal. When this error is output if the power is turned on again, consult us.
102	Abnormal: Database writing	Abnormality has occurred during the measurement data writing. When this error is output if the power is turned on again, consult us.
103	Abnormal: Database reading	Abnormality has occurred during the measurement data reading. When this error is output if the power is turned on again, consult us.
120	Error: Database capacity	Free space in the database is full. Delete unnecessary data, or provide with a new storage.
121	Error: Storage capacity	Free space in the storage is full. Delete unnecessary data, or provide with a new storage.
122	Error: Communication between devices	Abnormality has occurred during the communication with the Controller. The communication will be switched to offline. When this error is output if the error is reset, consult us.
123	Error: Telegram between devices	Abnormality has occurred during the communication with the Controller. When this error is output if the error is reset, consult us.
150	Alarm: Database capacity	Free space in the database is decreasing. Delete unnecessary data, or provide with a new storage.
151	Alarm: Storage capacity	Free space in the storage is decreasing. Delete unnecessary data, or provide with a new storage
200	Abnormal: Data corruption	Measurement data is corrupted. When this error is output if the power is turned on again, consult us.

Close the window and take a proper measure by referring to the table above. If the problem cannot be settled by taking the proper measure, make contact with us for further information.

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