Original instructions

LASER WELD MONITOR

MM-L300A EU

OPERATION MANUAL

AMADA

AA04OM1193911-18

Thank you for your purchase of our **MM-L300A** Laser Weld Monitor.
Please read this manual carefully to ensure correct use. Keep the manual handy after reading for future reference.

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EU Declaration of Conformity

1. Special Notes

(1) Safety Precautions

Before using the instrument, 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.
	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 instrument.
High voltage is present internally. Do not touch anything inside the instrument with the power on.

NEVER ATTEMPT to disassemble, repair or modify the instrument.
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 instrument.
This product incorporates parts containing arsenide (As).

⚠ WARNING

ALWAYS wear protective goggles.
Always wear protective goggles where the instrument 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 instrument.
If not grounded, the instrument may cause an electric shock in the event of malfunction or ground fault.

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

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

DO NOT place flammable objects near the instrument.
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 instrument with a blanket or cloth.
During operation, do not cover the instrument with a blanket or cloth.
This may lead to the instrument overheating and catching fire.

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

DO NOT use with the instrument 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 instrument.

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-L300A, install in a location with an ambient temperature range of 0 to 40°C, ambient humidity of 85% RH or less and free from abrupt temperature changes. Further, avoid the following locations. (For the SU-N300A/SG-N300A, an ambient temperature range is 5 to 50°C and the protection class is IP64.):**
  - 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 instrument.**
- **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
SG-N300A sensor fiber	60 mm
Reflected light transmission fiber, φ400 μm	100 mm

* For more information about laser control, refer to the laser device operation manual.

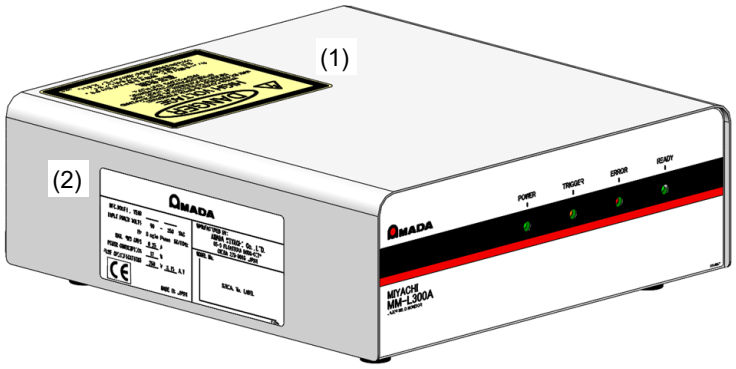
(3) Disposal

- The **SU-N300A/SG-N300A** and the external trigger unit incorporate parts containing arsenide (As). At the time of disposal, separate it from general industrial waste or domestic waste and carry out the disposal in accordance with applicable laws and regulations.
- Lithium batteries contain hazardous substances. At the time of disposal, observe the local laws and regulations.

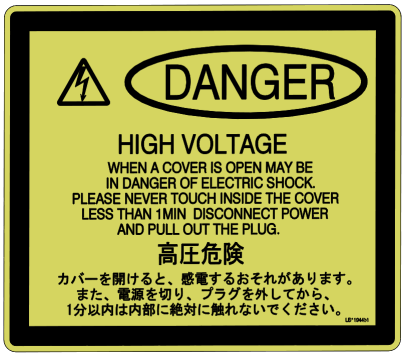
(4) Sticking Warning/Danger Labels

Warning/danger labels are struck on the product. Read the precautions provided on each label for correct use.

- **MM-L300A**

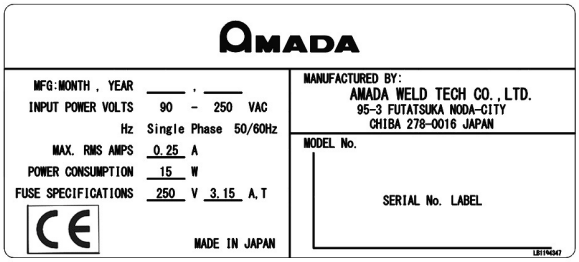


(1)

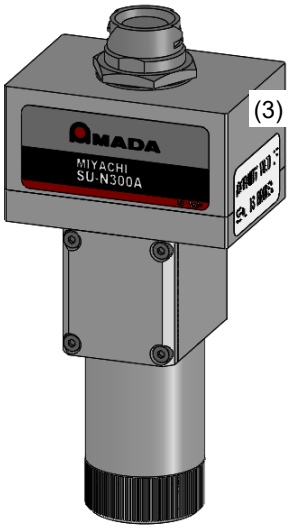


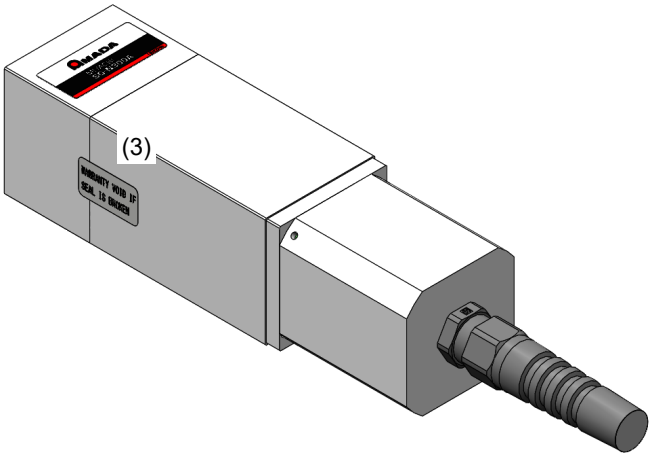
Do not open the cover except when replacing the battery.

(2)



- **SU-N300A/SG-N300A**





(3)

WARRANTY VOID IF
SEAL IS BROKEN

Tearing off the seal will void the warranty.

2. Features

The Laser Weld Monitor **MM-L300A** detects the near-infrared light generated from the processing point using a dedicated sensor unit **SU-N300A/SG-N300A**, thus monitoring the welding status. The **MM-L300A** offers the following features:

- At laser welding, the welding status can be monitored by detecting the near-infrared light generated from the processing point.
- Setting conditions and displaying waveforms can be easily done with the dedicated software.
- Produces an alarm signal output upon detection of an output waveform outside the tolerance range by setting upper and lower tolerance widths for the output waveform. Also, the output waveform which detects the near-infrared light can be displayed on the PC screen.
- The **SU-N300A** can be used by being mounted coaxially with the output unit (output unit series with the CCD camera) or externally.
- The **SG-N300A** can be used with the laser scanning optical system such as galvanometer scanner.
- A power supply in the range of 90 V AC to 250 V AC can be used.

NOTE:

The **MM-L300A** is equipment to monitor the near-infrared 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. Unpacking

(1) About Container

Dimension	Mass (including contents)	Remarks
Approx. 250 (H) x 525 (W) x 472 (D) mm	Approx. 8 kg	Common to the **SU-N300A/SG-N300A**
Approx. 360 (H) x 780 (W) x 560 (D) mm	Approx. 15 kg	Added when selecting the **SG-N300A** *1

*1 When the **SG-N300A** is selected, two containers are delivered.

(2) Checking the Contents of Container

Check the contents of container. If you find any defect, contact us.

(1) Products

Product name	Model	Qty
Laser weld monitor	MM-L300A-00-02	1

(2) Accessories

The model numbers of accessories are subject to change without notice. Depending on the part to be changed, the mounting screw shape may change and a necessary tool may be different. For the latest parts information, contact a nearest sales office.

Product name		Model	Qty
MM-L300A application software		AS1193660	1
Operation manual		AS1194324(OM1192626,OM1193911)	1
LAN cable category 7, 5 m		LD-TWST/BM50	1
Noise filter *1		ZCAT3035-1330	2
Connector for trigger cable		HR10A-7P-6P(73)	1
D-Sub 15 pins	Plug	HDAB-15P(05)	1
	Case	HDA-CTH(10)	1

(3) Selective required options

	Product name		Model	Qty
SU-N300A	Sensor unit	Standard specification	SU-N300A-00-02	1 *2
		High-sensitivity specification	SU-N300A-00-03	
SG-N300A	Sensor unit	Standard specification	SG-N300A-00-00	
		5% filter specification	SG-N300A-00-01	
		35% filter specification	SG-N300A-00-02	

	Product name		Model	Qty
Common	Sensor unit connecting cable	5 m	LP1203202	1 *2
		10 m	LP1203204	
	Power cord	250 V for use in Japan or China	KP244 VCTF3*1.25 KS16D 3m gray	1 *2
		250 V for use in Europe	CEE3P-W-1.8	
		125 V max.	KP-35 KS-16A SVT#18x3 B-TYPE	

(4) Options

	Product name		Model	Qty
SU-N300A	Coaxially mounting adapter *3		LP1192612 *4	1
	Filter for SU-N300A *5	5% 1 piece *6	LP1192609	1
		5% 2 pieces	LP1193718	1
		35% 1 piece *6	LP1201551	1
		35% 2 pieces	LP1201552	1
		5% 1 piece, 35% 1 piece	LP1201553	1
	Additional unit of filter for SU-N300A *6	5%	LP1192610	1
		35%	LP1201554	1
SG-N300A	External trigger unit *8		LP1208220	1
	External trigger input unit *8		AS1207732	1
	Reflected light transmission fiber *8		SIH-04CA□□m *9	1
	Filter for SG-N300A *5	5% 1 piece	LP1208971	1
		35% 1 piece	LP1209844	1
Common	Personal computer *10		PA1708952	1
	Analog output cable 2 m		AS1193108	1
	EtherNet/IP		AS1200799	1
	LAN cable category 7, 5 m		LD-TWST/BM50	1

*1 Used for AC cord and LAN cable. For mounting, refer to **5. (3) Mounting the Noise Filter**.

*2 Depends on the customer's selection.

*3 Used when installing the **SU-N300A** coaxially with the output unit with the CCD camera. Our engineer takes charge of mounting work.

*4 When the coaxially mounting adapter is shipped with being mounted on our output unit, the model number is changed into LP1203063. The shipping form is different, but there is no difference between LP1203063 and LP1192612 in performance.

*5 Mainly used against much emitted light when installing externally.

*6 Select an additional unit only when adding a filter to the filter for SU-N300A (1 piece).

*7 The AC inlet with switch contains a spare fuse. For details, refer to **12. (4) Replacing the Fuse**.

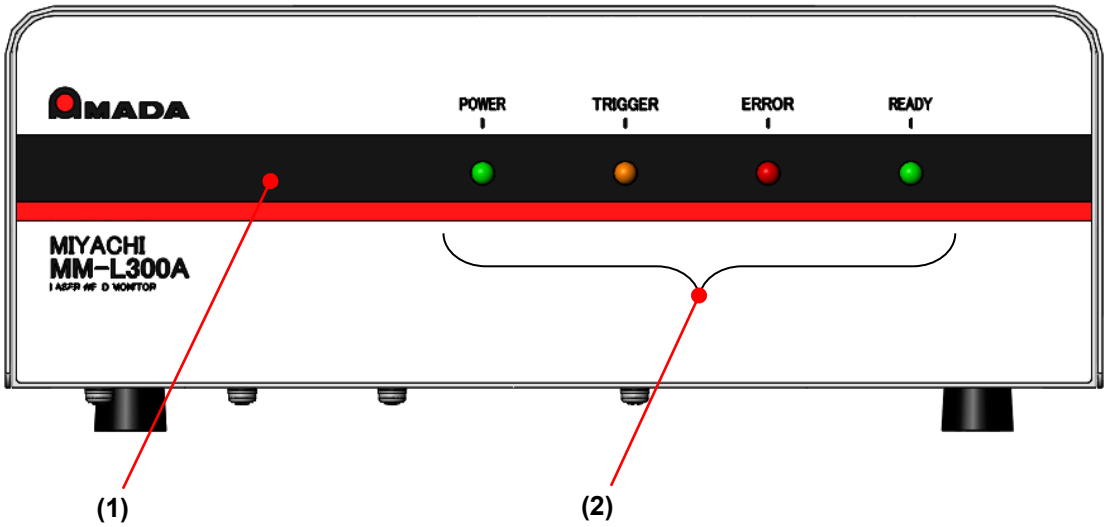
*8 Select it use the reflected light as a trigger to start measurement.

*9 Depends on the length to select.

*10 A personal computer is required to set conditions of the **MM-L300A**. It can be prepared by customers. For the PC specifications, refer to **6. (1) (1) Installation**.

4. Name and Function of Each Part

(1) Front



(1) Display panel:
Shows the status of the **MM-L300A**.

(2) Status indicating LED:
Indicates the current status of the **MM-L300A**.

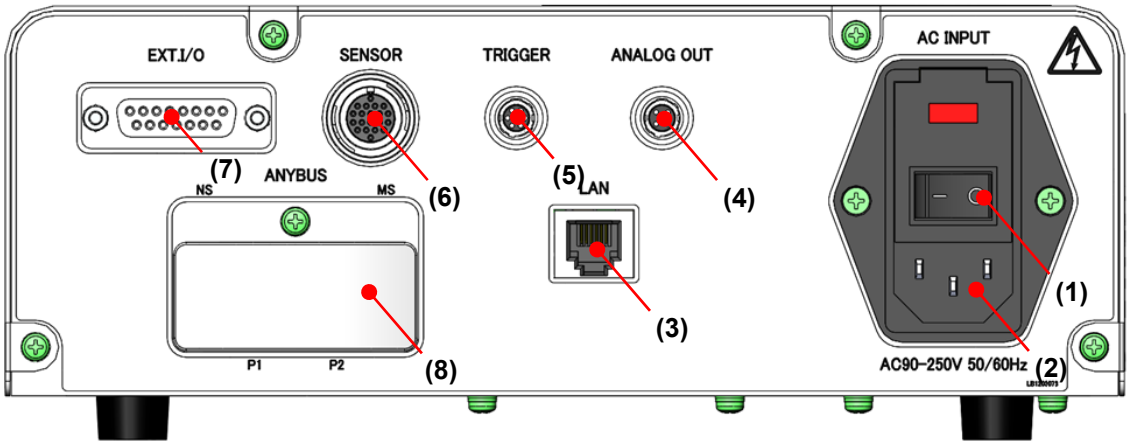
POWER: Lit in green when the power supply is turned on.

TRIGGER: Lit in orange from the measurement start to the end. There are two ways to start measurement, the internal trigger by monitor signal level and the external trigger of external input.

ERROR: Lit in red when a device error occurs.

READY: Lit in green when the preparation for measurement is completed and no device error occurs.

(2) Rear



(1) Power switch:
Turns the power ON/OFF.

(2) AC INPUT:
Used to connect the attached power cord to supply power.

(3) LAN:
Used to connect to the personal computer with the attached LAN cable.

(4) ANALOG OUT:
Outputs the **SU-N300A/SG-N300A** detection with the analog signal. It can be observed with an oscilloscope, etc. [Digital Gain] and [Offset] on the Maintenance Window are not reflected.

(5) TRIGGER:
Controls the measurement start by inputting the external trigger. Also, outputs the signal of MEASURE. This connector is also used when the optional external trigger unit is used.

(6) SENSOR:
Used to connect the **SU-N300A/SG-N300A** with the selected sensor unit connecting cable.

(7) EXT. I/O:
Connector for input and output with the external device.

(8) ANYBUS (option):
Terminal for external network. Used when the optional EtherNet/IP is used. (Refer to **11. EtherNet/IP**.)

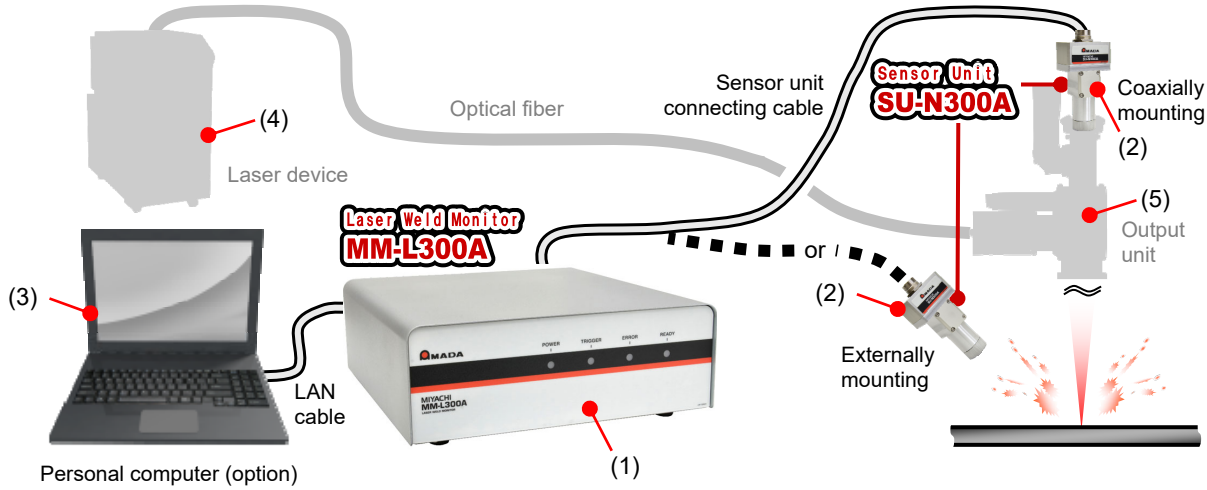
5. Connecting Equipment

(1) Configuration during Use

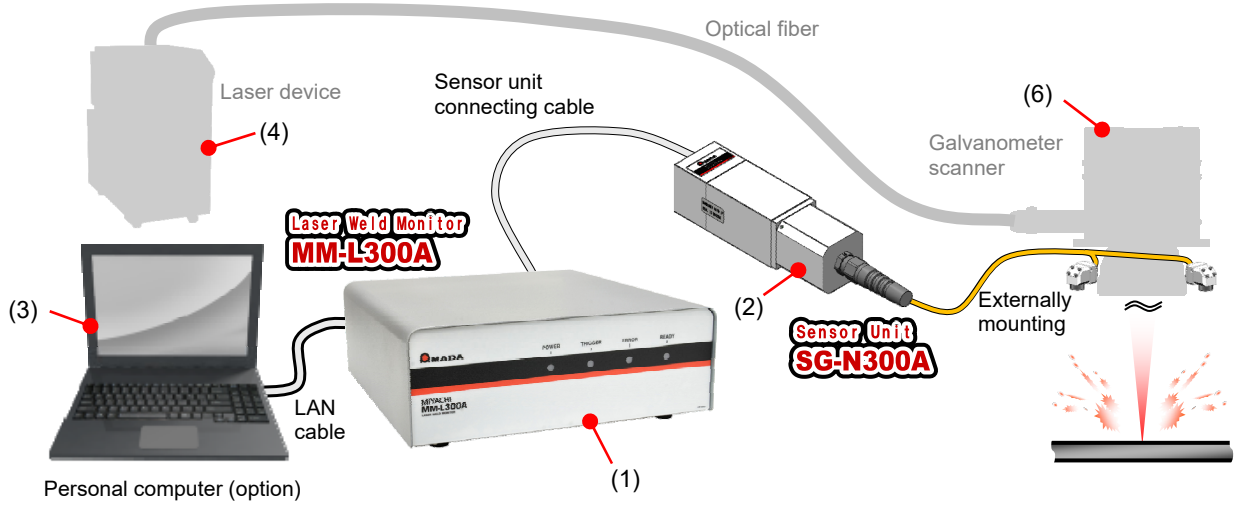
The use configurations of the **MM-L300A** is shown below.

The **MM-L300A** monitors the near-infrared light generated from the processing point by mounting the **SU-N300A** coaxially with the output unit or the **SU-N300A/SG-N300A** externally.

SU-N300A:



SG-N300A:



(1) MM-L300A:
Judges the upper/lower limit for obtaining waveforms, records measured data, etc.

(2) SU-N300A/SG-N300A:
Detects the near-infrared light from the processing point.

(3) Personal computer (option):
Sets conditions of the **MM-L300A**, displays waveforms, transfers and saves the waveform data, etc.

(4) Laser device (separately available):
Oscillates the laser light.
Be sure to read the operation manual for the laser device to be used.

(5) Output unit (separately available):
Condenses laser light and performs processing and welding.
Detects the near-infrared light from the processing point by mounting the **SU-N300A** coaxially with the output unit or externally.

(6) Galvanometer scanner (separately available):
Condenses laser light and performs processing and welding.
Detects the near-infrared light from the processing point by mounting the **SG-N300A** light-receiving unit around the fθ lens of the galvanometer scanner.

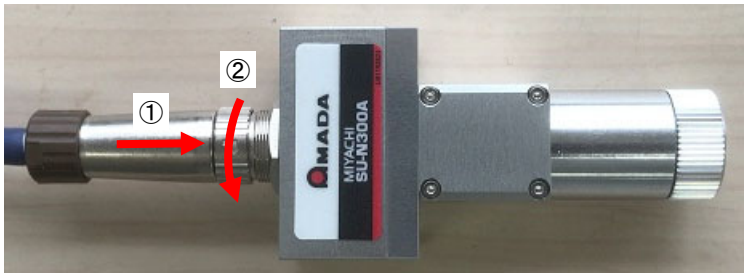
(2) Connecting the MM-L300A and the SU-N300A/SG-N300A

This section describes how to connect the **MM-L300A** to the **SU-N300A/SG-N300A**.

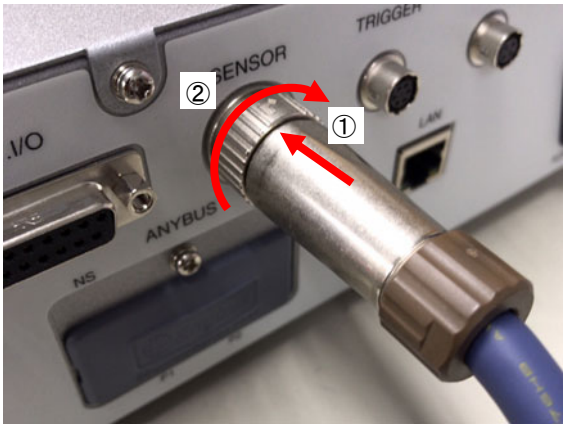
⚠ CAUTION

- If you connect or disconnect the **SU-N300A/SG-N300A** when the power supply of the **MM-L300A** is ON, a failure may occur. Accordingly, turn OFF the power supply.
- Do not bend the sensor unit connecting cable, impart a strong impact or make the end face dirty.
- Do not bend the sensor unit connecting cable over the minimum bending radius (70 mm) or less.

1) Connect the sensor unit connecting cable to the **SU-N300A/SG-N300A**.



2) Connect the opposite side of the sensor unit connecting cable used in Step 1 to the rear of the **MM-L300A**.



3) Connect the grounding of the power cord for the **MM-L300A** to the grounding terminal (class D grounding).

(3) Mounting the Noise Filter

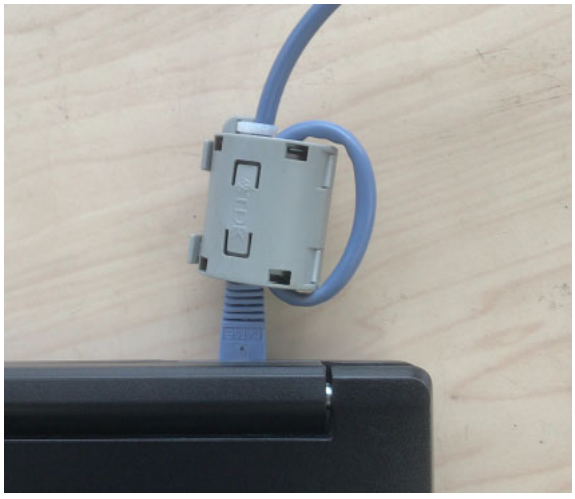
This section describes how to mount the attached noise filter to each cable.

⚠ CAUTION

- If you connect or disconnect the AC cord when the power supply of the **MM-L300A** is ON, a failure may occur. Accordingly, turn OFF the power supply of the **MM-L300A** when mounting the noise filter.
- If the noise filter is not mounted or is mounted at the place not specified, correct waveforms may not be obtained due to waveform including noise. Be sure to mount the noise filter as specified.

1) Mount the noise filter at the **MM-L300A** side of the AC cord with one turn. Then, fix the noise filter and the AC cord with the attached cable tie.

2) Mount the noise filter at the computer side of the LAN cable with two turns. Then, fix the noise filter and the LAN cable with the attached cable tie.

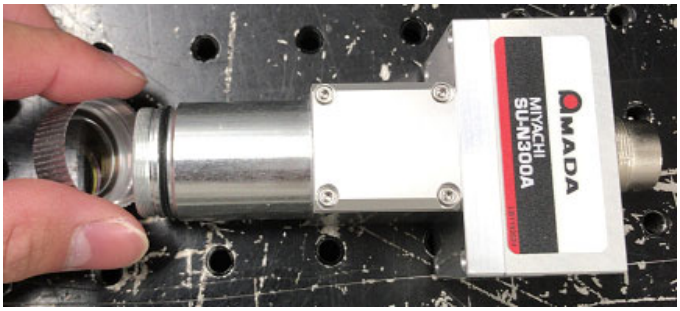


(4) Mounting the Filter for SU-N300A

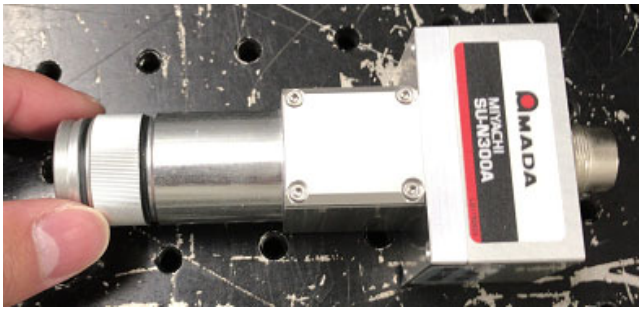
This section describes how to mount the optional filter for SU-N300A to the **SU-N300A**.

> **⚠ CAUTION**
>
> - Dust may enter the **SU-N300A** if the protective glass holder and the filter for SU-N300A are not properly tighten.
> - Do not touch the surface of the protective glass and the optical filter.
> - The protective glass may stick to the protective glass holder through the intermediary of the O-ring. In such case, gently press the protective glass with a finger from above the lens cleaning paper to remove it.

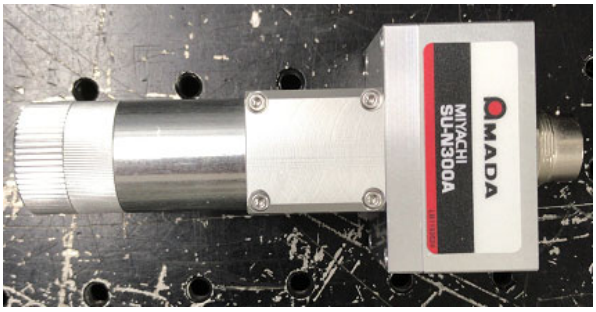
1) Remove the protective glass holder at the tip of the **SU-N300A** from the **SU-N300A**.



2) Mount the filter for SU-N300A with the male screw at the tip of the **SU-N300A**.



3) Mount the protective glass holder removed in Step 1 with the male screw at the tip of the filter for SU-N300A.
At this time, confirm that the protective glass in the protective glass holder and the O-ring are fitted at a proper position.



(5) Coaxially Mounting Adapter

This section describes the optional coaxially mounting adapter which allows to use the **SU-N300A** coaxially.

> **⚠ CAUTION**
>
> - Some output units with CCD camera do not support coaxial measurements. For details, contact us.
> - For the combination outline drawing of each output unit and the coaxially mounting adapter, contact us.

The **SU-N300A** can be fixed coaxially with the output unit by mounting the coaxially mounting adapter to our output unit with CCD camera.

Since measurements can be performed coaxially, the measurement position of the **SU-N300A** follows even when the output unit moves.

The coaxially mounting adapter is mounted at the position where the camera unit of the output unit with CCD camera is mounted.

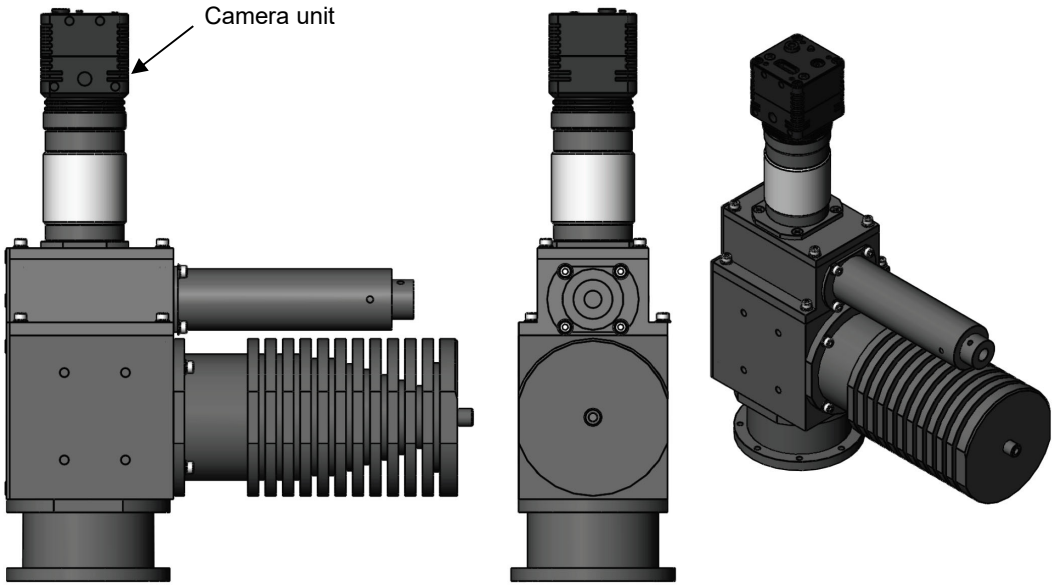
The camera unit assembled on the output unit is removed. Therefore, the appearance of the output unit changes and the camera image changes slightly.
Be very careful when using the camera image such as image processing because image may change. For the outline drawing of the coaxially mounting adapter and installation space, refer to **14. Outline Drawing**.

There are mainly two patterns for installation.

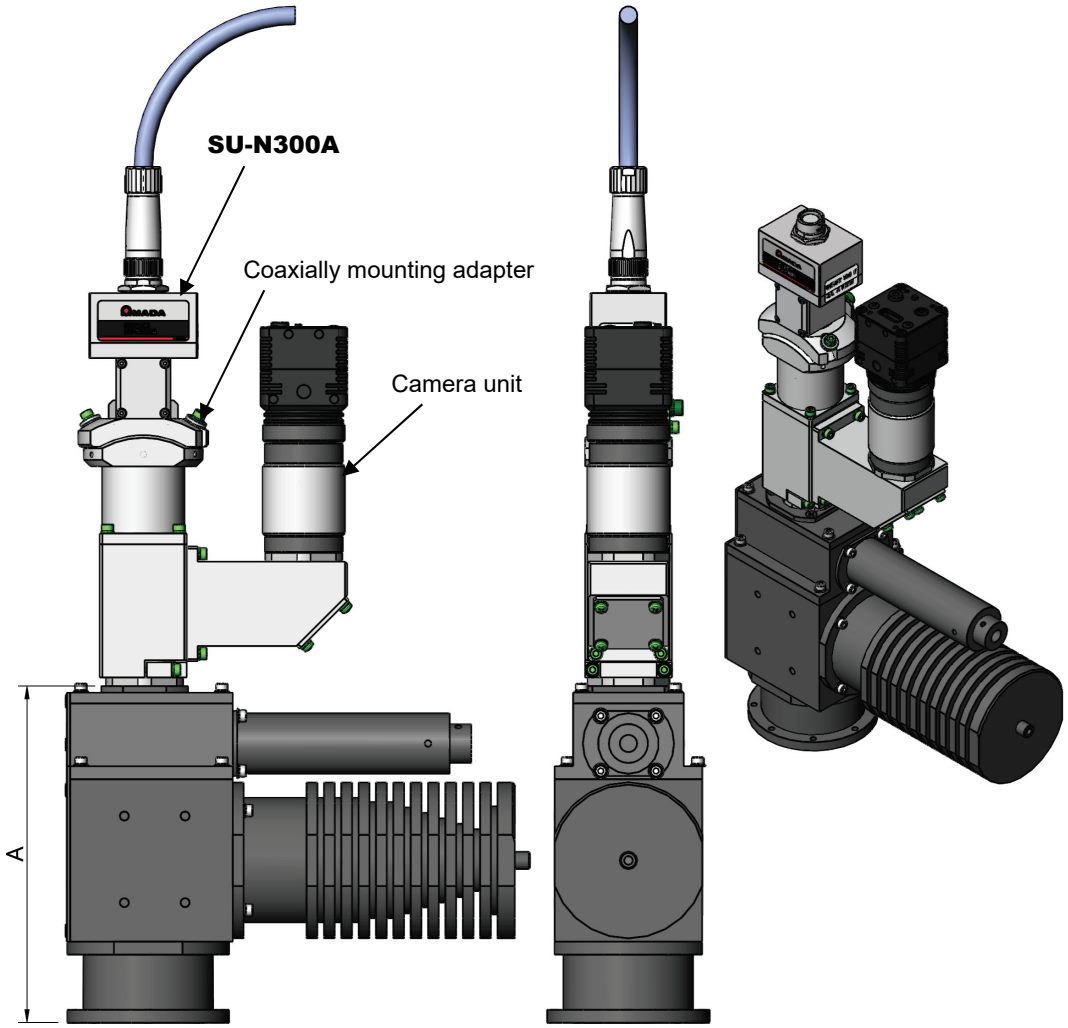
(1) Output unit which the laser light is turned

The coaxially mounting adapter is fixed at nearly right above the laser irradiation position.

Example) Before being mounted



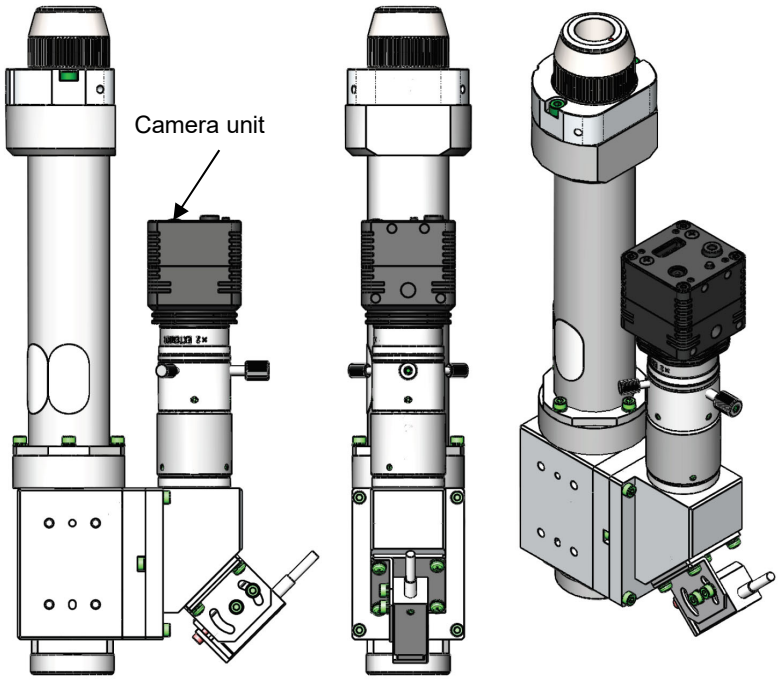
Example) After being mounted (The section above dimension A is rotatable by 360 degree as long as it interferes with something.)



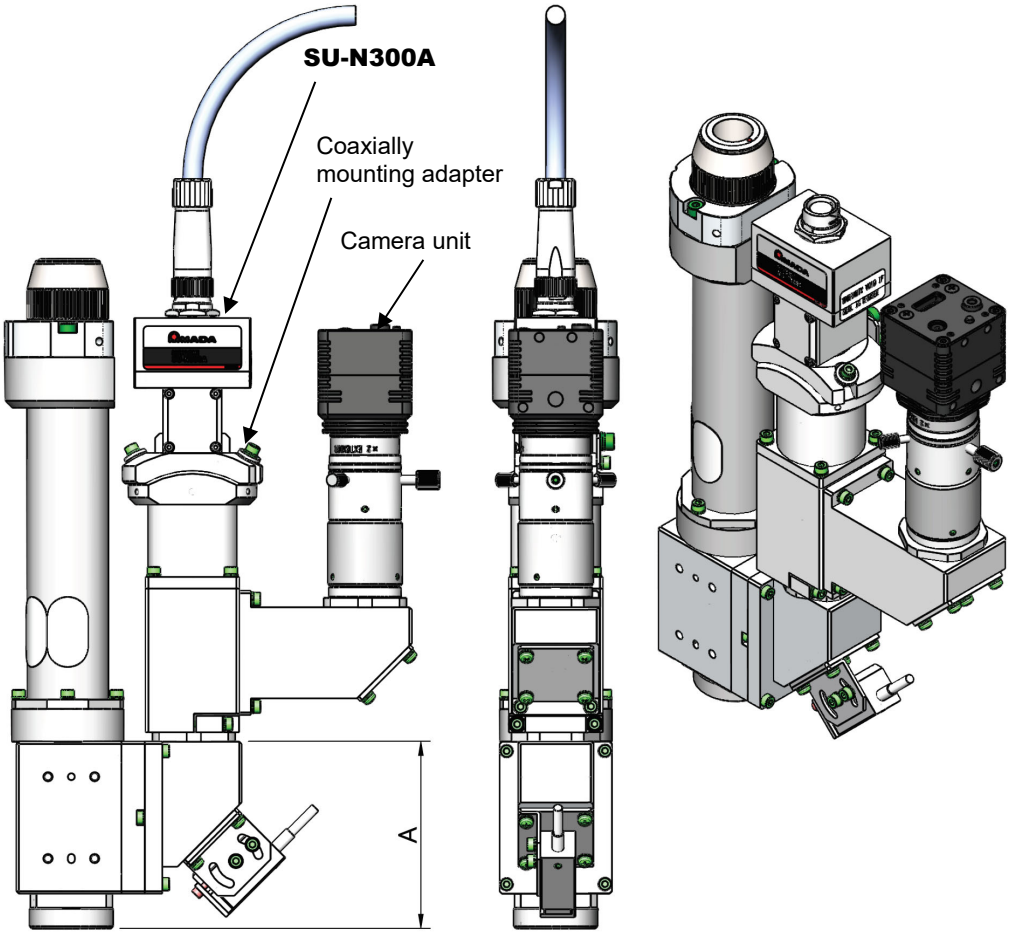
(2) Output unit which the laser light is not turned

The coaxially mounting adapter is fixed at the position where the laser light is turned by the output.

Example) Before being mounted



Example) After being mounted (The section above dimension A is rotatable by 360 degree as long as it interferes with something.)



(6) Externally Mounting the SU-N300A and Measures against the Reflected Light

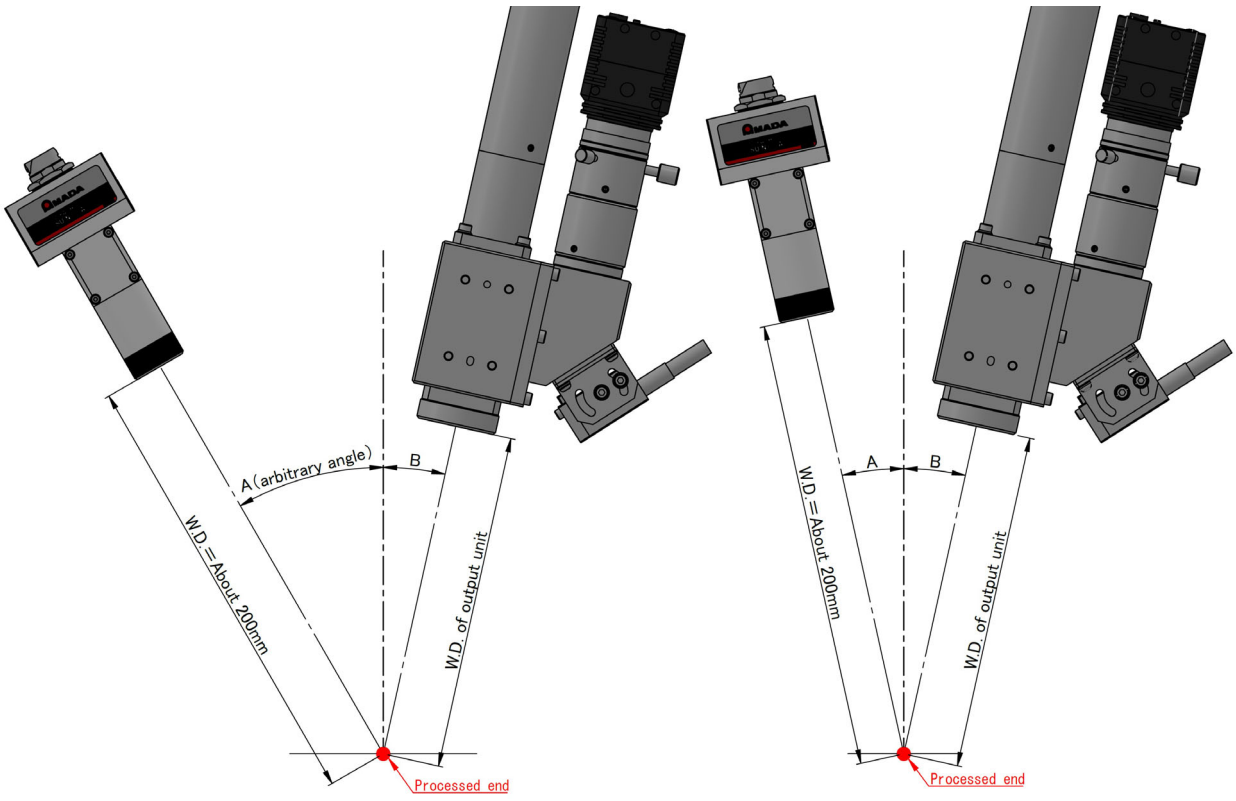
This section describes how to mount the **SU-N300A** externally and measures against the reflected light.

> **⚠ CAUTION**
>
> - Especially for processing and welding at high output for a long time, the **SU-N300A** may be overheated by reflected light or diffusion reflected light. In such case, you need to take cooling measures such as water-cooled jacket. Consult us.

1) Fix the **SU-N300A** in a place that is 200 mm (190 mm when the filter for SU-N300A is attached) away from the processing point. Angle A should be an arbitrary angle according to a purpose. However, do not install at a position where much reflected light is returned (refer to the figure below).

2) Insert the dedicated cable into the **SU-N300A** connector and tighten it by turning the plug fixing ring.

(Good example) **(Bad example)**



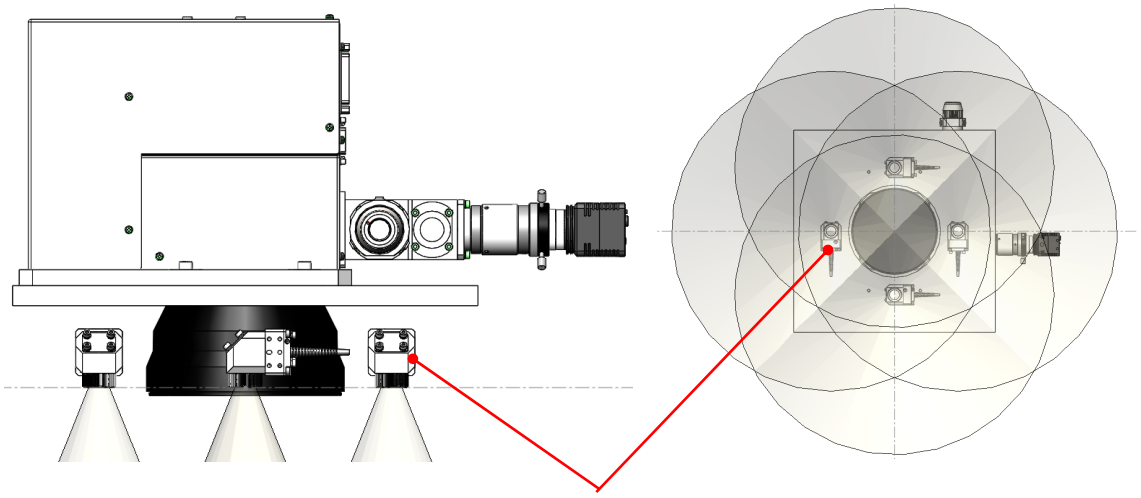
Angle A = arbitrary angle° (not A ≒ B)

(7) Externally Mounting the SG-N300A

This section describes how to use the **SG-N300A** by mounting to the fixture prepared by customer.

> **⚠ CAUTION**
>
> - Do not bend the sensor fiber, impart a strong impact or make the end face dirty.
> - Do not bend the sensor fiber over the minimum bending radius (60 mm) or less.
> - The angle of the light-receiving unit is adjusted by out engineer. For details, contact us.
> - Especially for processing and welding at high output for a long time, the **SG-N300A** may be overheated by reflected light or diffusion reflected light. In such case, you need to take cooling measures such as water-cooled jacket. Consult us.

1) As shown below, equally arrange four light-receiving units around the galvanometer scanner. At this time, consider mounting them by arranging length and bending radius of the sensor fiber and height of each light-receiving unit.



Light-receiving unit

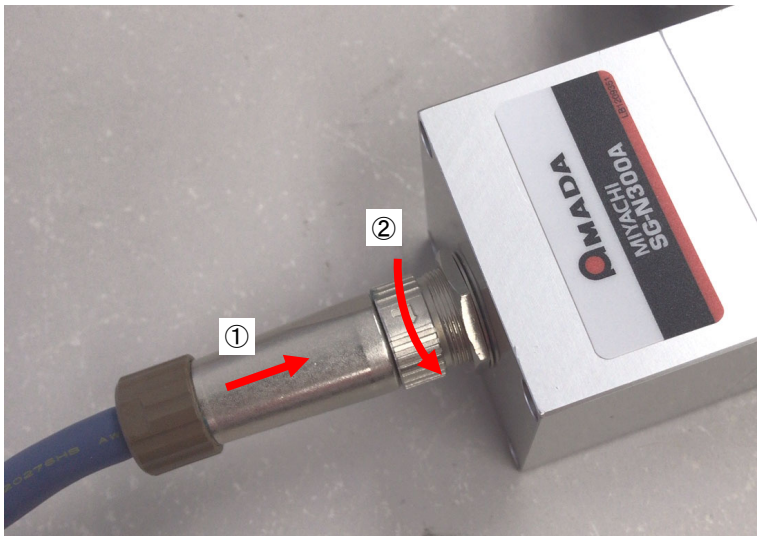
2) Before fixing them, confirm that the range to measure is covered By referring to “Measurement range of the light-receiving unit” in **14. (4) SG-N300A**. At this time, be careful of the arrangement of the sensor fiber. Also, as a tendency, the measurement intensity of the **MM-L300A** increases with the following conditions.

- The measurement intensity increases as the light-receiving unit comes closer to the processing point.
- The measurement intensity increases as the processing point comes closer to the center of the measurement area.

* The measurement area is a design value. Depending on the conditions, a measurement can be performed even outside the measurement area, but the measurement intensity drastically decreases.

* The distance to the processing point is arbitrary.

3) Insert the dedicated cable into the **SG-N300A** connector, and turn the ring for fixing the plug to tighten.



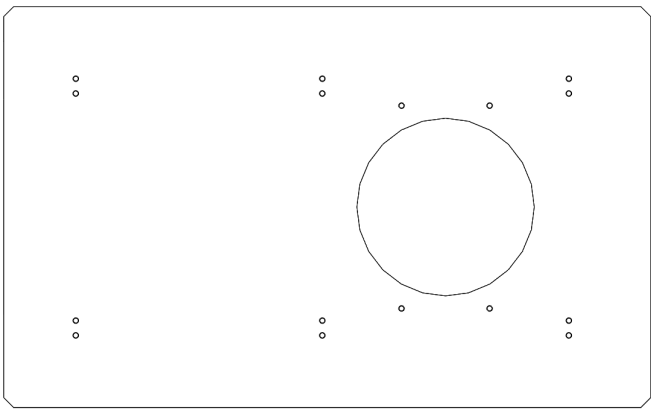
(8) Using by the Mounting Plate for SG-N300A

This section describes how to mount the **SG-N300A** with the mounting plate for SG-N300A (option).

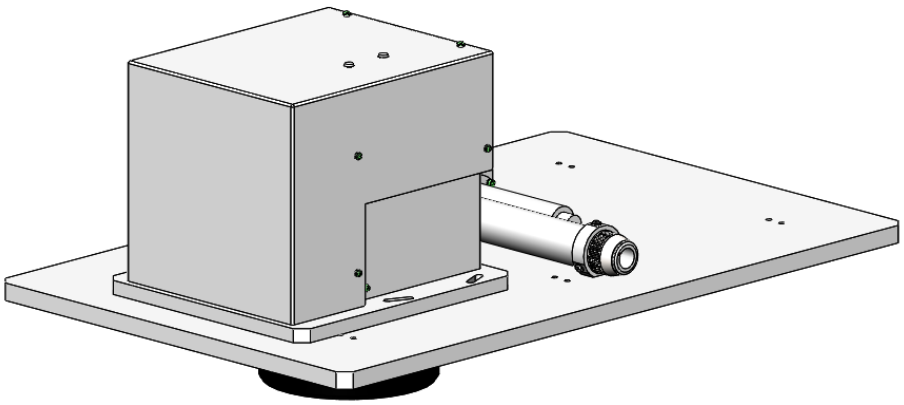
> **⚠ CAUTION**
>
> - Do not bend the sensor fiber, impart a strong impact or make the end face dirty.
> - Do not bend the sensor fiber over the minimum bending radius (60 mm) or less.
> - The angle of the mounting plate for SG-N300A and the light-receiving unit is adjusted by out engineer. For details, contact us.
> - Especially for processing and welding at high output for a long time, the **SG-N300A** may be overheated by reflected light or diffusion reflected light. In such case, you need to take cooling measures such as water-cooled jacket. Consult us.

(1) Preparation before mounting the mounting plate for SG-N300A

1) As described in “Recommended dimension of the mounting plate for SG-N300A” in outline drawings, prepare a base to fix the galvanometer scanner having twelve M6 screw holes.



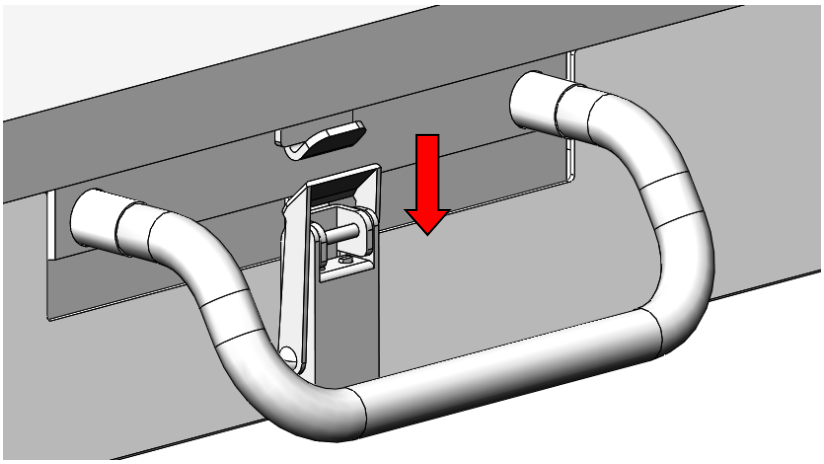
2) Fix the galvanometer scanner on the prepared base.



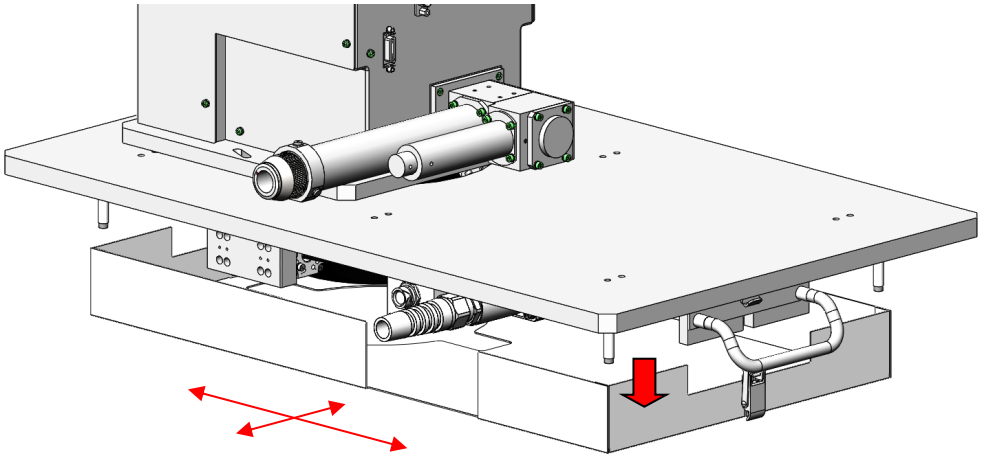
* The distance to the processing point is arbitrary.

(2) Removing the cover of the mounting plate for SG-N300A

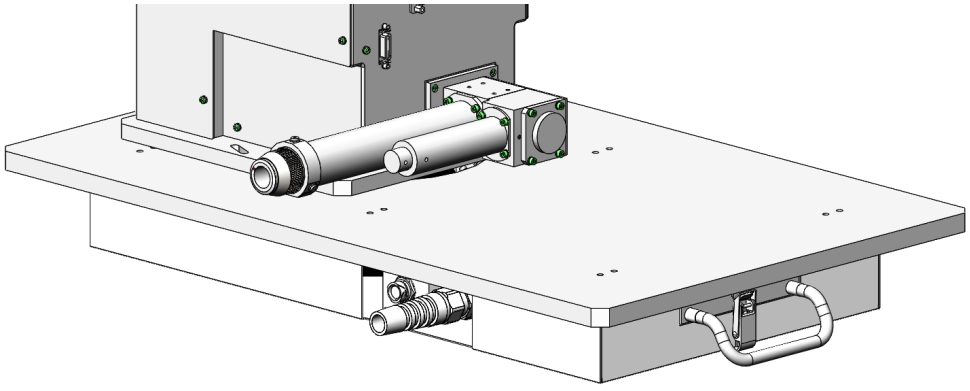
1) Remove two spring catches at the longitudinal side surface of the mounting plate for SG-N300A in the state that the cover is supported by both hands. The fixing of the cover is released by removing spring catches. Take care not to drop the cover.



2) When the cover is made approx. 50 mm lower than before removing the cover, the cover can be moved up and down, and to the right and left.



3) After cleaning the protective glass, fix the cover again with the above steps in reverse.



(9) Measures against the Reflected Light to the SG-N300A

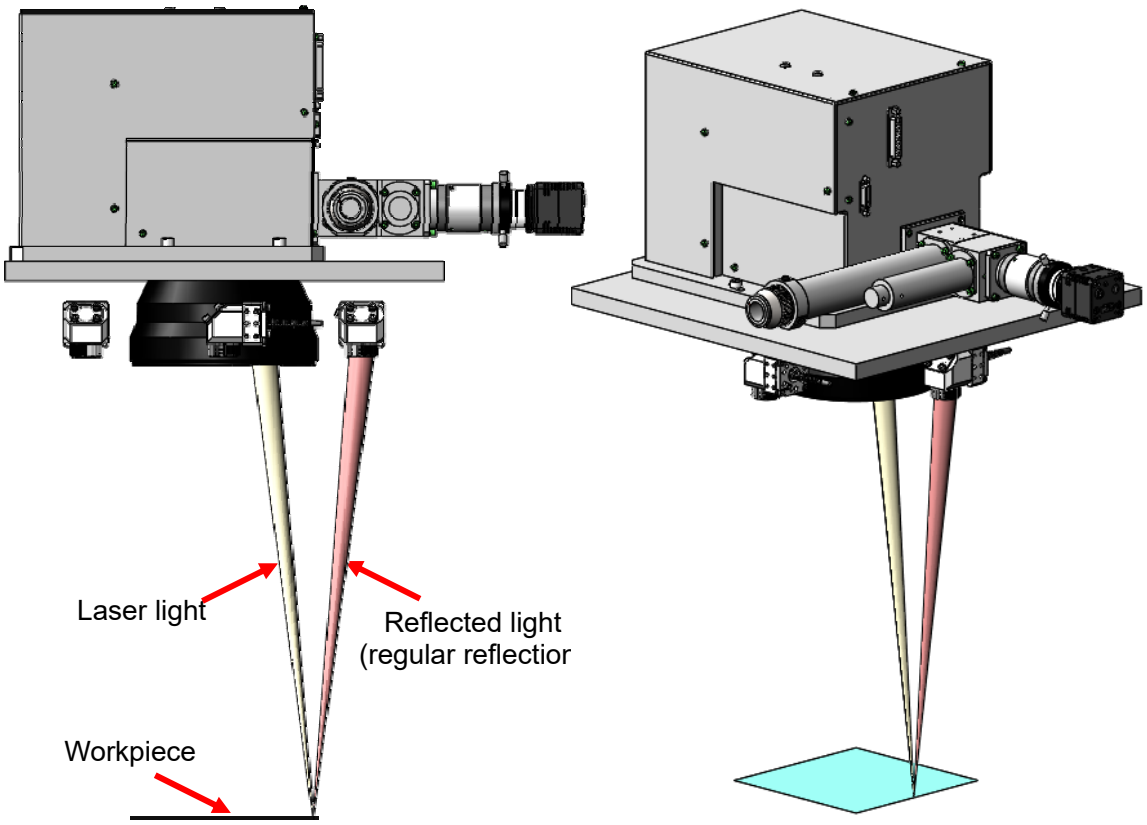
Measures against the reflected light to the **SG-N300A** are explained below.

> **⚠ CAUTION**
>
> Contact us each time:
>
> - when performing laser welding with laser conditions or layout files which operations have not been confirmed,
> - when there is a possibility of damage by heat storage or burning of parts due to the reflected light (regular reflection), or
> - when the **SG-N300A** and the mounting plate cover may be overheated by reflected light or diffusion reflected light. (You need to take cooling measures such as water-cooled jacket.)

Due to the **SG-N300A** specifications, the area where the laser reflected light by laser welding hits the light-receiving unit at a regular reflection position exists. When the light-receiving unit is installed on the X-axis or the Y-axis of the galvanometer scanner, the regular reflection position exists on the X-axis or the Y-axis.

The laser reflected light may cause damage by heat storage or burning of parts. Especially, a lot of light is reflected with the following laser welding device configurations.

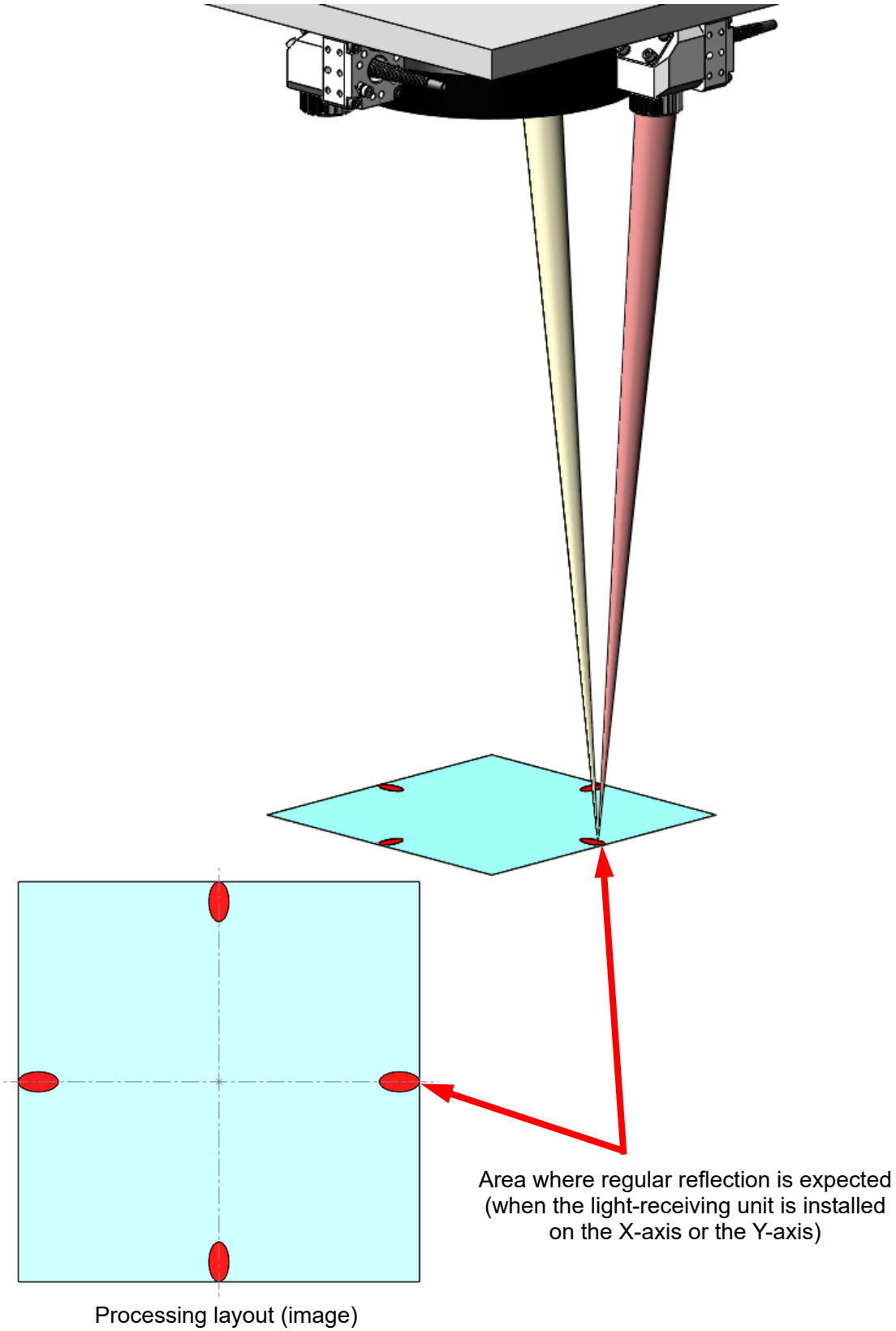
- Single mode laser welding configuration
- Short collimator lens f configuration



Beam path of laser light and reflected light (image)

Consider laser welding layout conditions so as not to generate situations below. For details, contact us.

- Continuous irradiation around the position where the laser at light-receiving unit receives a regular reflection
- Laser irradiation with conditions that workpiece is not melted due to the set up failure of workpiece



Processing layout (image)

(10) Using the External Trigger Unit

This section describes how to use the optional external trigger unit.

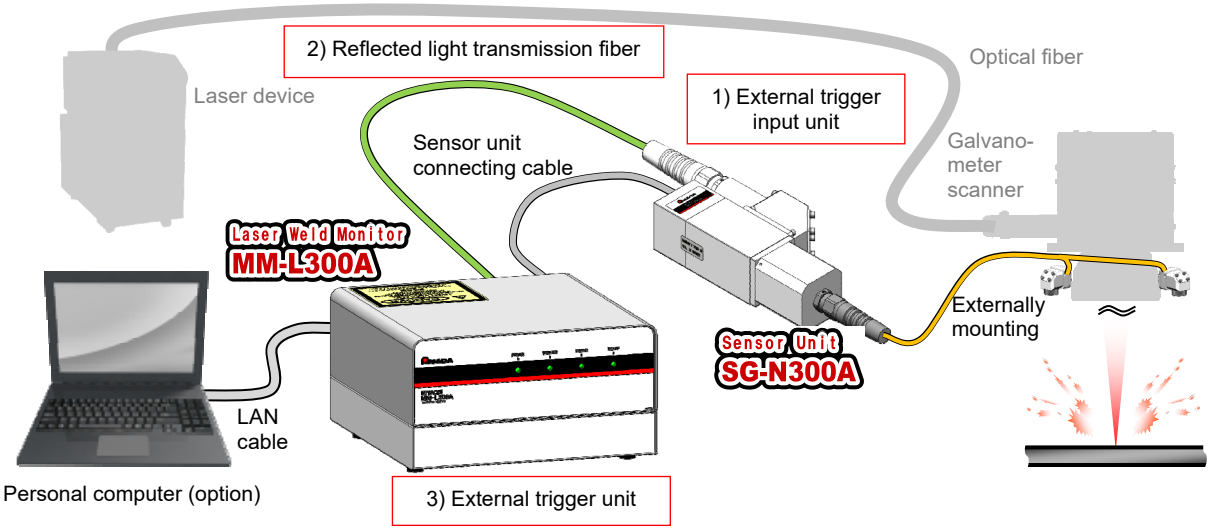
> **⚠ CAUTION**
>
> - If you connect or disconnect cables when the power supply of the **MM-L300A** is ON, a failure may occur. Accordingly, turn OFF the power supply of the **MM-L300A** before installing or uninstalling the **SG-N300A**.
> - Do not bend the sensor unit connecting cable over the minimum bending radius (70 mm) or less.
> - Do not bend the reflected light transmission fiber over the minimum bending radius (100 mm) or less.

(1) Use configurations of the external trigger unit

The use configurations of the external trigger unit is shown below.

Products in a red frame are added by adding the external trigger unit.

This is an effective trigger input when measurement is not started with the internal trigger at a stable timing or the external trigger signal cannot be input to the **MM-L300A**.



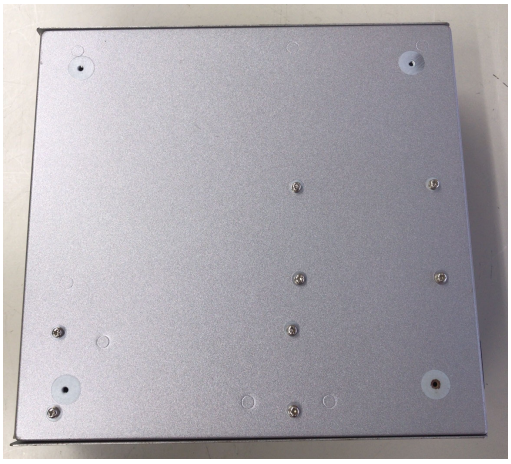
1) External trigger input unit (option):
For the **SG-N300A**, the reflected light for the external trigger unit can be coaxially obtained by mounting the external trigger input unit on the **SG-N300A**.

2) Reflected light transmission fiber (option):
Transmits the reflected light to the external trigger unit.

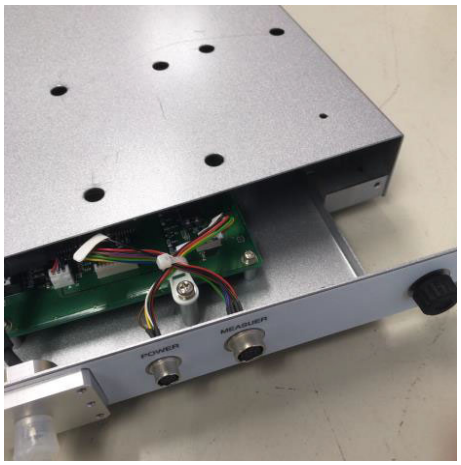
3) External trigger unit (option):
Outputs the external trigger signal which uses the reflected light as a trigger to the **MM-L300A**. The external trigger unit can be mounted at the bottom surface of the **MM-L300A**.

(2) Connecting the external trigger unit to the **MM-L300A**

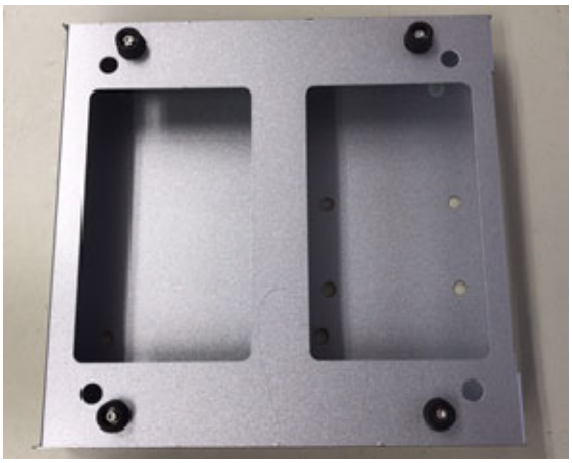
1) Reverse the **MM-L300A** and remove four rubber feet at the bottom surface. The removed rubber feet are no longer used. Store or discard them as needed.



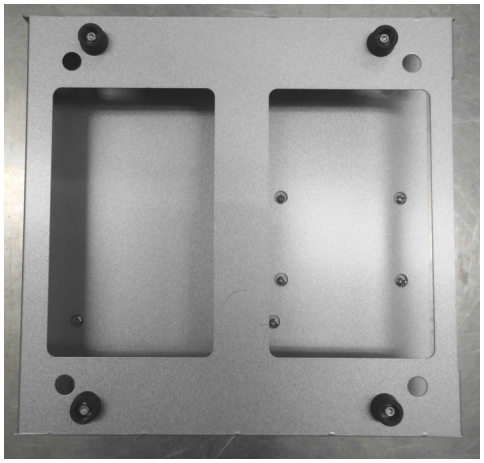
2) Loosen two screws at the rear panel of the external trigger unit to remove the internal metal plate.



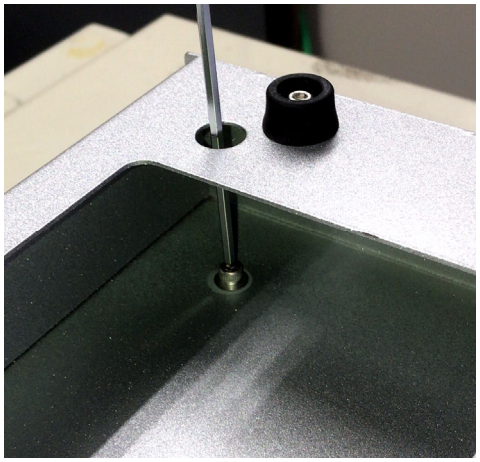
3) Remove four caps at the bottom surface of the external trigger unit.



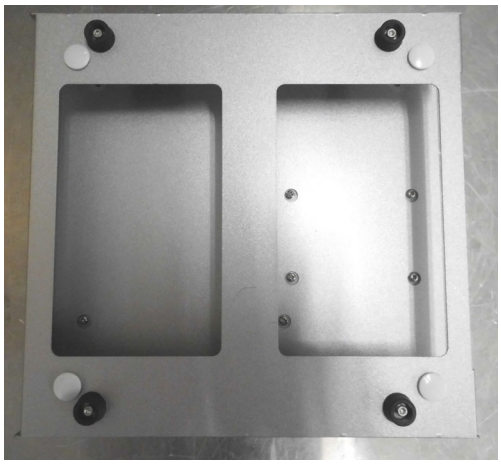
4) Arrange the upper surface of the external trigger unit so as to overlap at the bottom surface of the **MM-L300A**.



5) From screw hole of the rubber foot removed in Step 1, fix the **MM-L300A** and the external trigger unit with the screw attached to the external trigger unit.



6) Install caps removed in Step 3 to the original position.

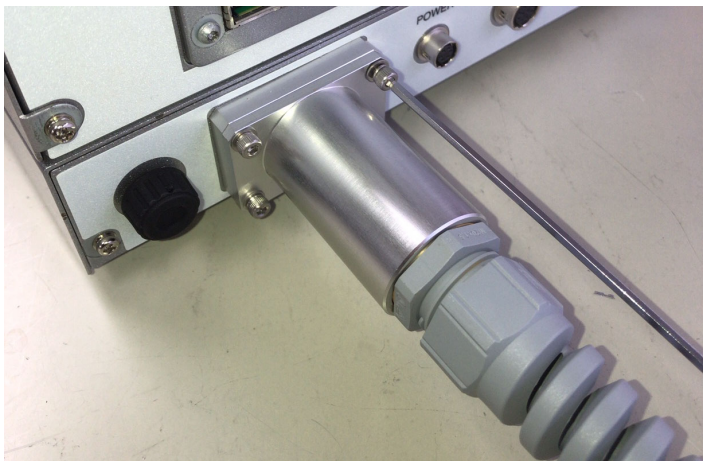


7) Insert the internal board removed in Step 2 into the original position and fix it with the screw removed earlier.

8) Connect the attached external trigger unit connecting harness to the TRIGGER connector of the **MM-L300A** and the POWER connector of the external trigger unit.

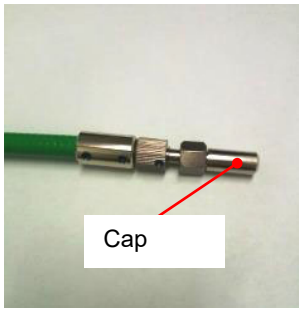
(3) Connecting the reflected light transmission fiber to the external trigger unit or the external trigger input unit
* Both cable gland and holder to remove are equivalent.

1) Remove four M3 screws fixed at the external trigger unit or external trigger input unit and remove the cable gland and holder.



2) Pass the removed cable gland and holder through the optical fiber. A spiral part is fixed in a screw shape, so it can be removed by turning it.

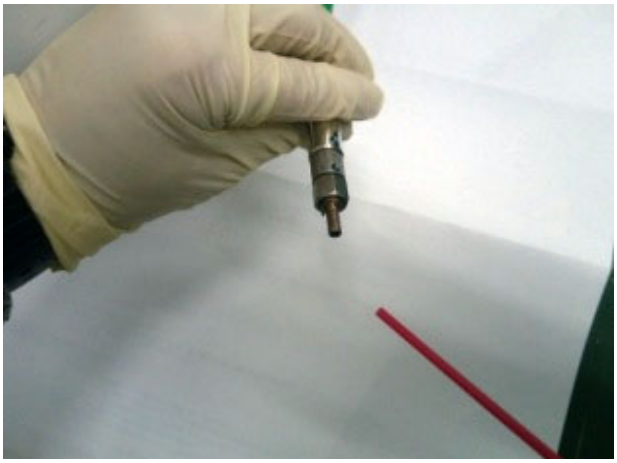
3) Remove the cap at the end of the optical fiber and the external trigger unit or external trigger input unit. Keep the recover cap in a clean place in custody. If a dirty cap is mounted again, this will stain the optical fiber.



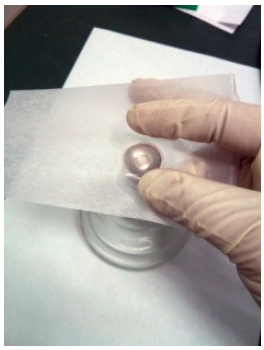
4) Align the groove on the output unit side and the key provided on the optical fiber side to mount the optical fiber on the end face checker, and then apply light from the oblique direction.

5) Check the end face of the optical fiber. If it is not stained or dust is not attached, proceed to Step 9.

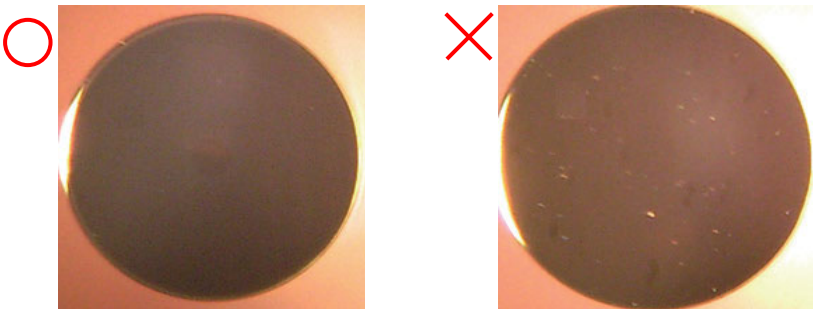
6) If it is stained or dust is attached, blow off dust by using the air blow and check the end face again.



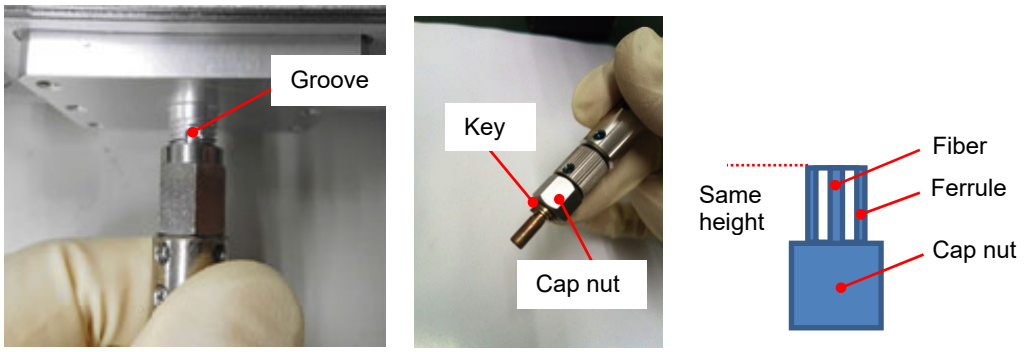
7) If the dirt cannot be removed by the air blow, apply HYPERCLEAN (EE-3310) on the cleaning paper. Place it on the optical fiber and wipe the optical fiber by pulling the cleaning paper across it.



8) Check the end face with the end face checker again. If there is stain, dust and streak, repeat above steps.

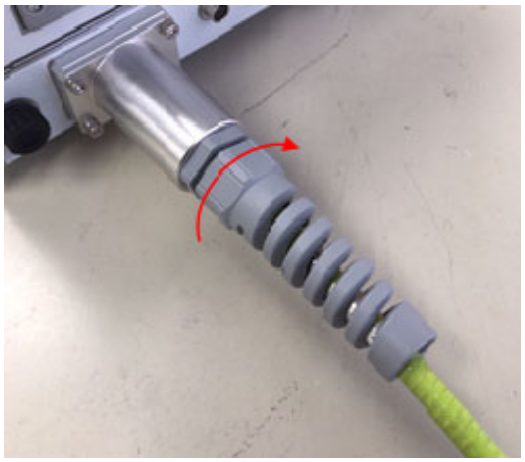


9) Check that there is no stain, dust and streak and mount it on the external trigger unit or external trigger input unit.
Insert the key provided on the optical fiber plug along the groove on the output unit side. At this time, take care that the end face of the optical fiber does not contact with the output unit. The end face of the optical fiber and the ferrule are the same height.



10) Turn the outer-side cap nut of the plug in the direction of the arrow to fix the optical fiber. At this time, strongly tighten the cap nut by hand without using a tool (recommended torque value: 2.0 N-m). Also, the connector section cannot be bent. Take care not to give excessive force to this section.

11) Fix the holder with the M3 screw first removed like the original. Finally, tighten the cable gland. (Recommended torque value: 4.0 N-m)



(11) Using the GWM External Trigger Input Cable

This section describes how to use the optional GWM external trigger input cable.

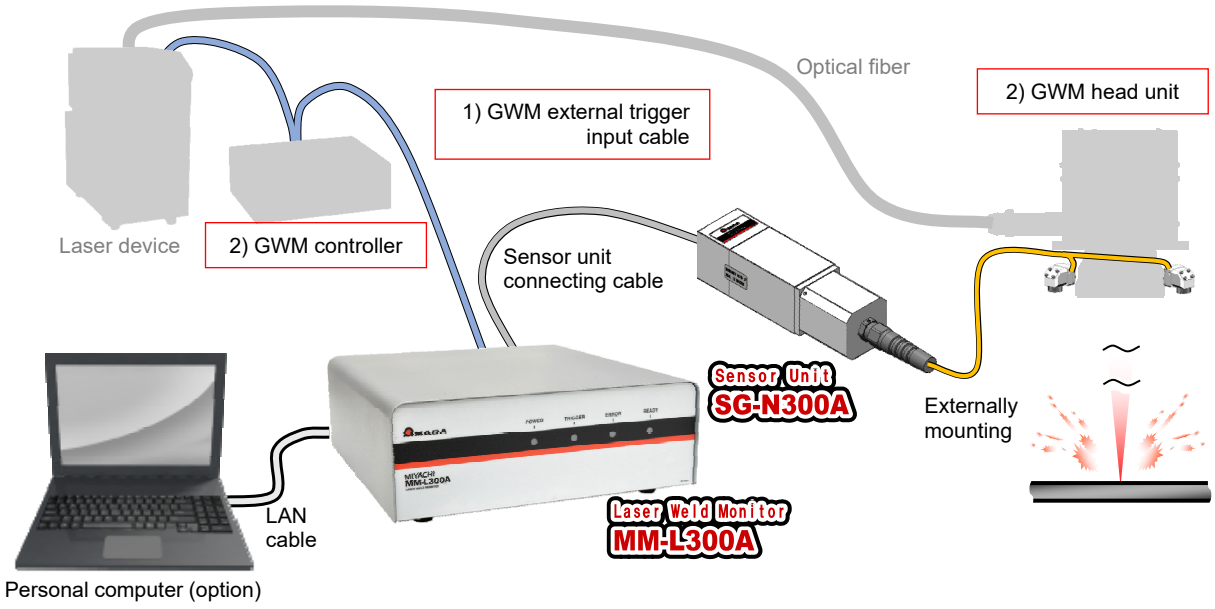
> **⚠ CAUTION**
>
> - If you connect or disconnect cables when the power supply of the **MM-L300A** is ON, a failure may occur. Accordingly, turn OFF all the power supply of the laser device, the GWM and the **MM-L300A** before installing or uninstalling the **SG-N300A**.

(1) Use configurations of the GWM external trigger input cable

The use configurations of the GWM external trigger input cable is shown below, and the I/O connection diagram is shown on the next page.

This is available when the GWM is used, and products in a red frame are added by adding the GWM external trigger input cable.

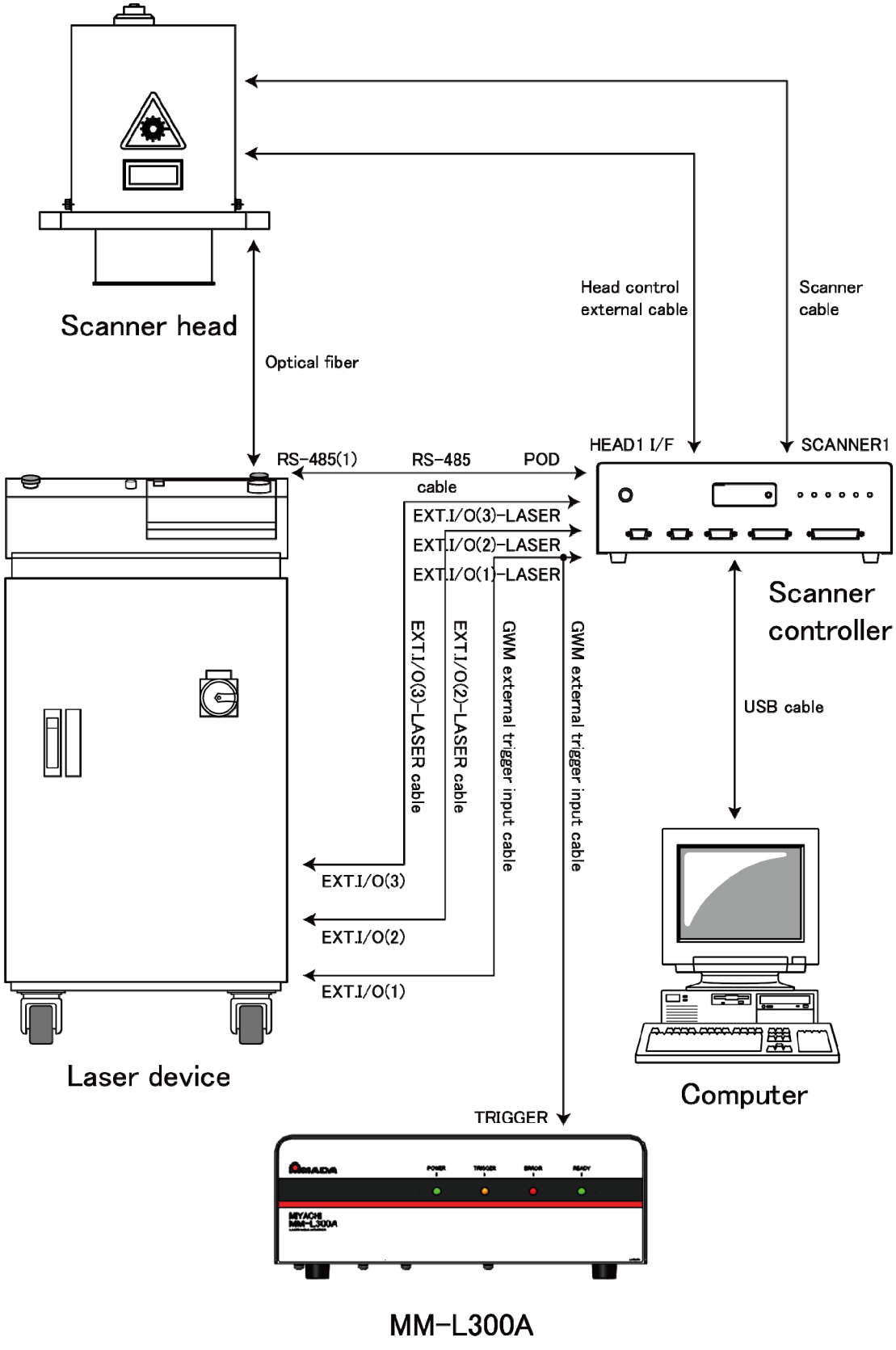
This allows to output the external trigger from the laser device to the **MM-L300A** and start measurement with the **MM-L300A** in accordance with the laser irradiation.



1) GWM external trigger input cable (option):
Connects to our laser device, GWM and the **MM-L300A**.
This allows to output the external trigger from the laser device to the **MM-L300A** and start measurement with the **MM-L300A** in accordance with the laser irradiation.

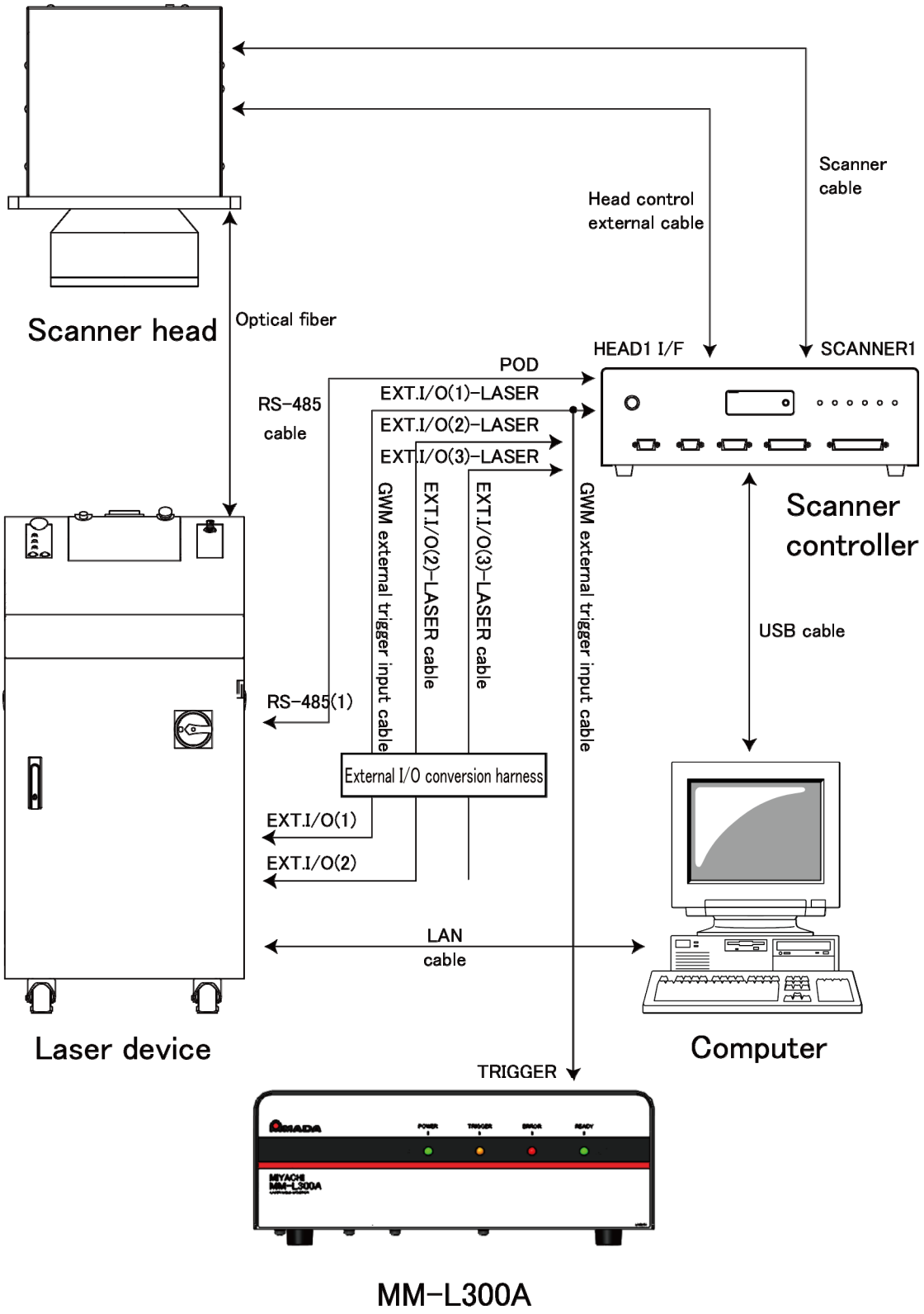
2) GWM (separately available):
Our laser scanning system for welding.
Freely scans the laser light in the XY direction.

Configurations when the FL-PL welder I/O conversion harness is not used



* Remove the EXT.I/O (1)-LASER cable and the GWM external trigger input cable instead. The removed cable is no longer used. Store or discard it as needed.

Configurations when the FL-PL welder I/O conversion harness is used



* Remove the EXT.I/O (1)-LASER cable and the GWM external trigger input cable instead. The removed cable is no longer used. Store or discard it as needed.

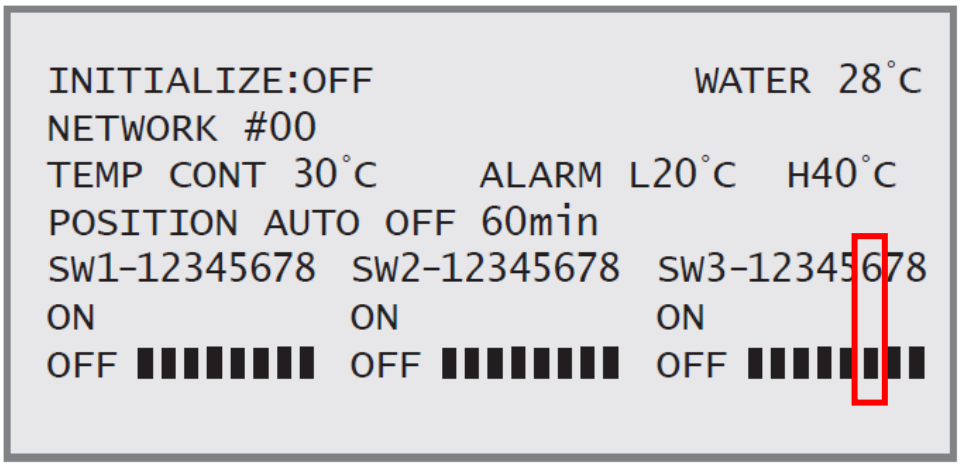
(2) How to set the trigger output from the YAG laser welder (ML-2xxx)

It is necessary to change the laser device setting to output the trigger from the laser device on the MEMORY SWITCH screen of the INITIALIZE screen.

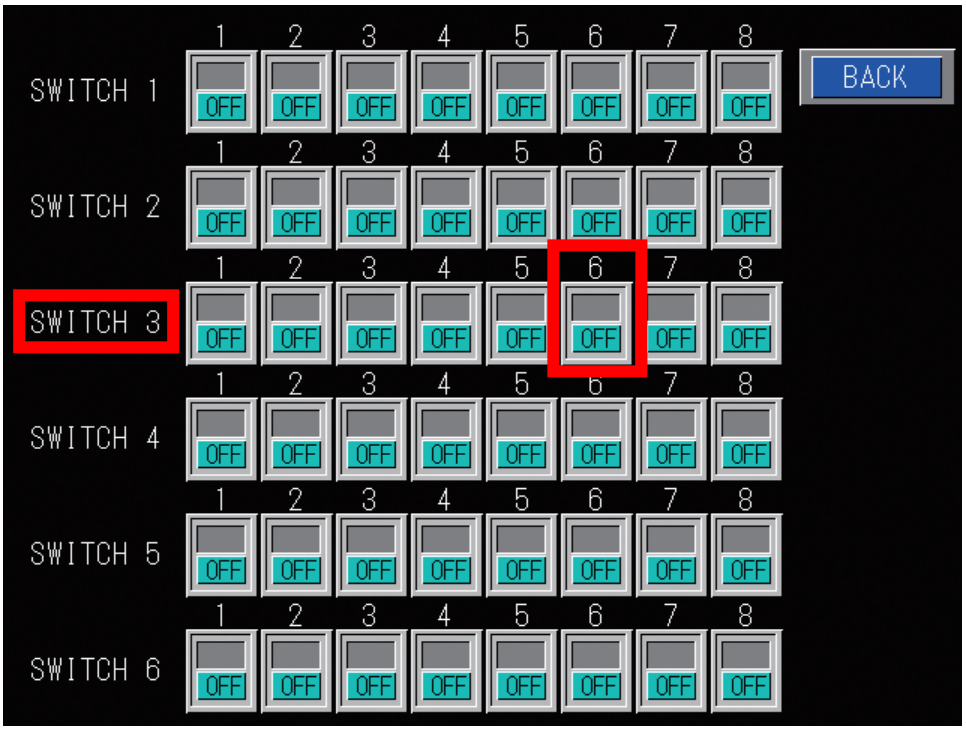
Refer to the operation manual for each YAG laser welder to set No.6 of SWITCH 3 to ON.

No.6 of SWITCH 3 is described as “Unused” on the operation manual for each YAG laser welder, but making this change allows the laser device to output the trigger.

Example: MEMORY SWITCH screen of ML-2050A/2051A/2150A



Example: MEMORY SWITCH screen of ML-2350A/2351A/2450A/2451A/2550A/2551A/2650B/2651B



6. How to Operate the PC Software

This chapter explains how to operate the PC software of the **MM-L300A**.

(1) Setup

(1) Installation

The PC specifications are as follows:

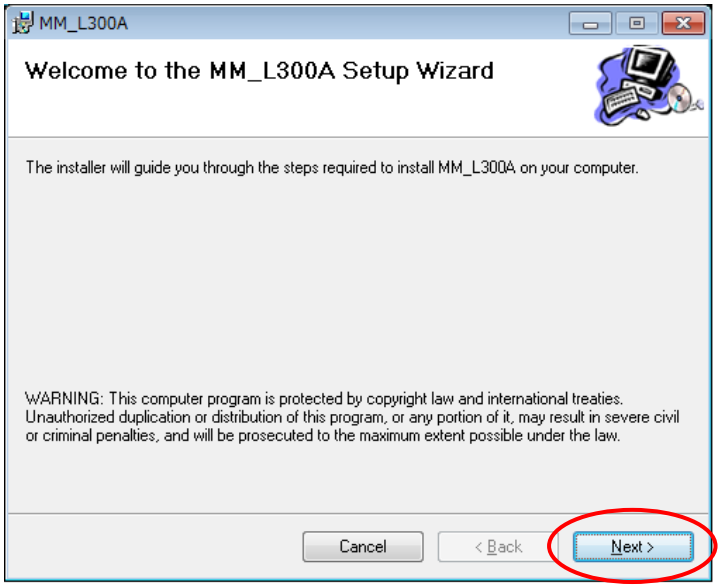
CPU	2 core / 1.6 GHz or more
Memory	2 GB or more
LAN	1 port (100BASE-T/100BASE-TX/10BASE-T compliant) [RJ-45]
OS	Windows 7/8.1/10, Professional 32 bit / 64 bit

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

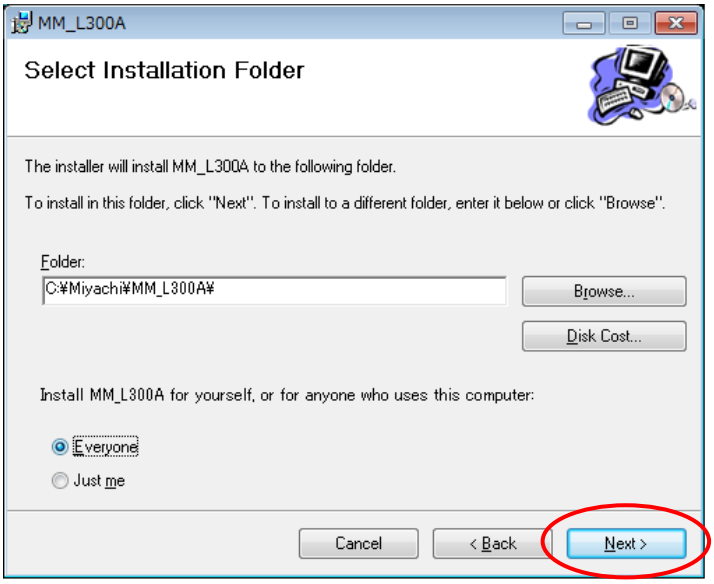
2) Select a language from [Install Language].
[Japanese] is selected by default for Japanese OS; [English] for OS with language other than Japanese. Select a language to install.

3) Click the [Install Program] button.

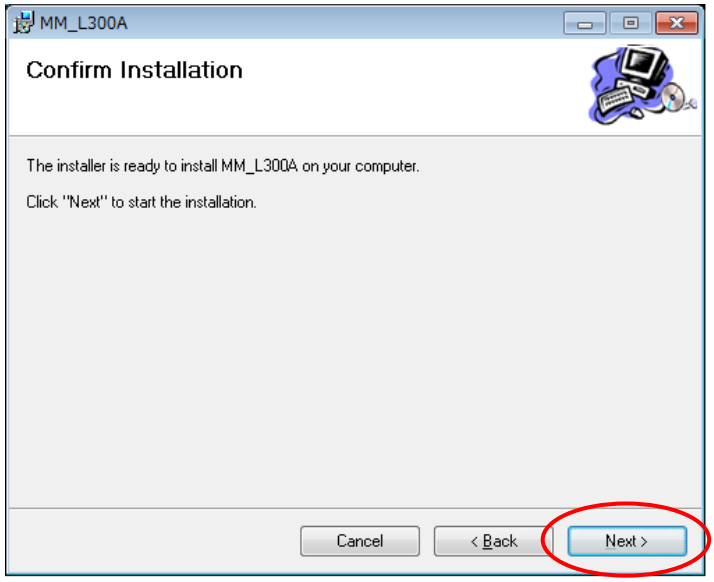
4) Click the [Next] button.



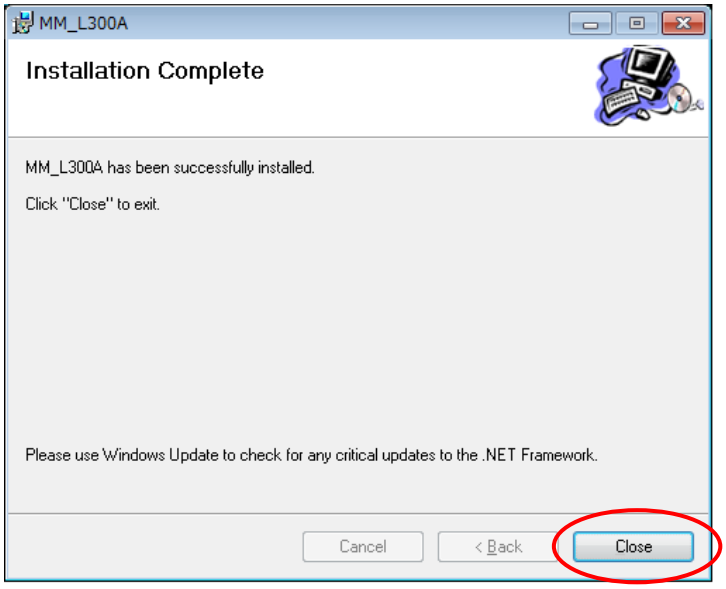
5) Set the destination folder and click the [Next] button.
The default is [C:¥Miyachi¥MM_L300A].



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.

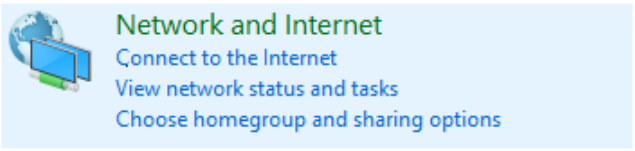
(2) IP address setting

Set the IP address of the personal computer.

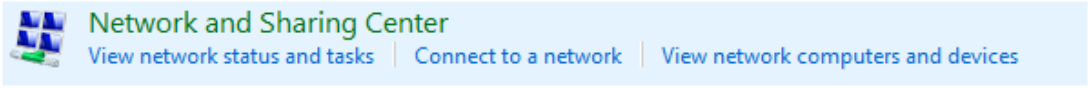
The IP address of the **MM-L300A** has been set to [192.168.1.10] at the factory. Use [192.168.1.100] or later for the IP address of the personal computer.

Setting procedure (for Windows 10)

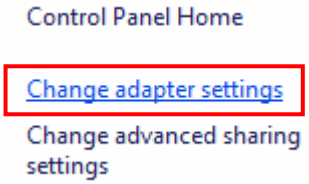
1) From the control panel, select [Network and Internet].



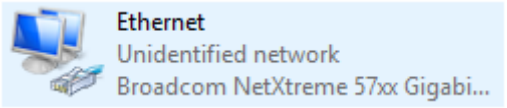
2) Select [Network and Sharing Center].



3) Select [Change adapter settings].

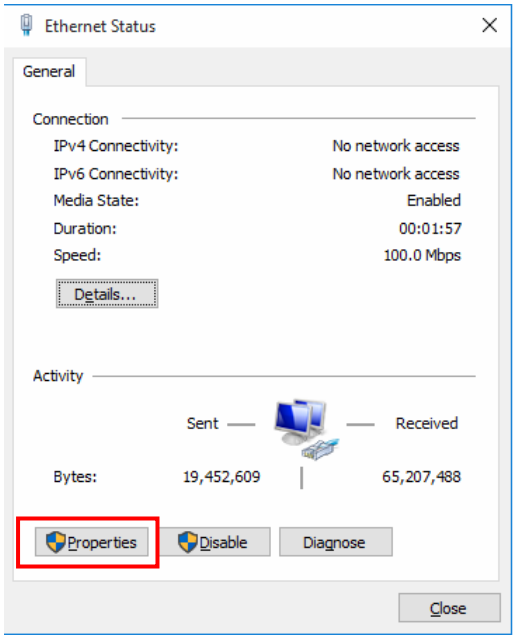


4) Select a network card to use.

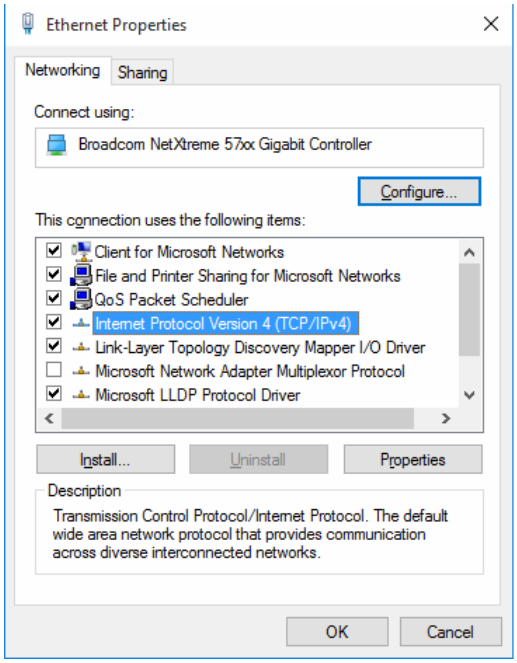


* Displays vary according to the personal computer or network card in use.

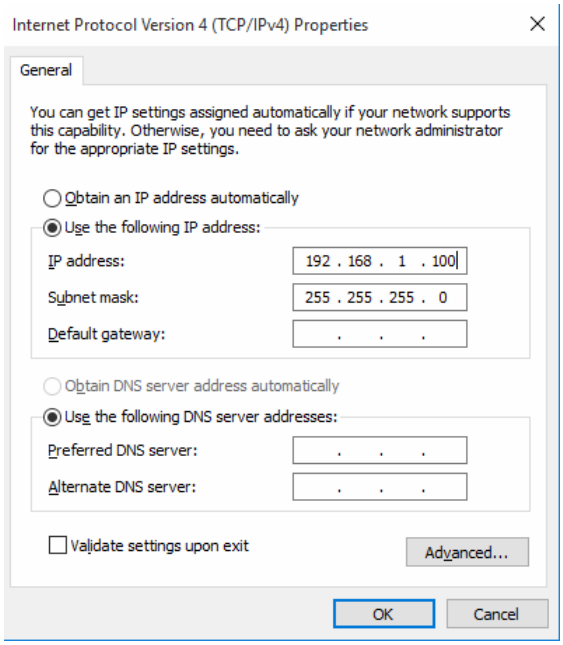
5) Click [Properties].



6) Select [Internet Protocol Version 4(TCP/IPv4)] and click [Properties].



7) Input the IP address. Set the IP address to [192.168.1.100] or later and the Subnet mask to [255.255.255.0] as shown below and click the [OK] button.



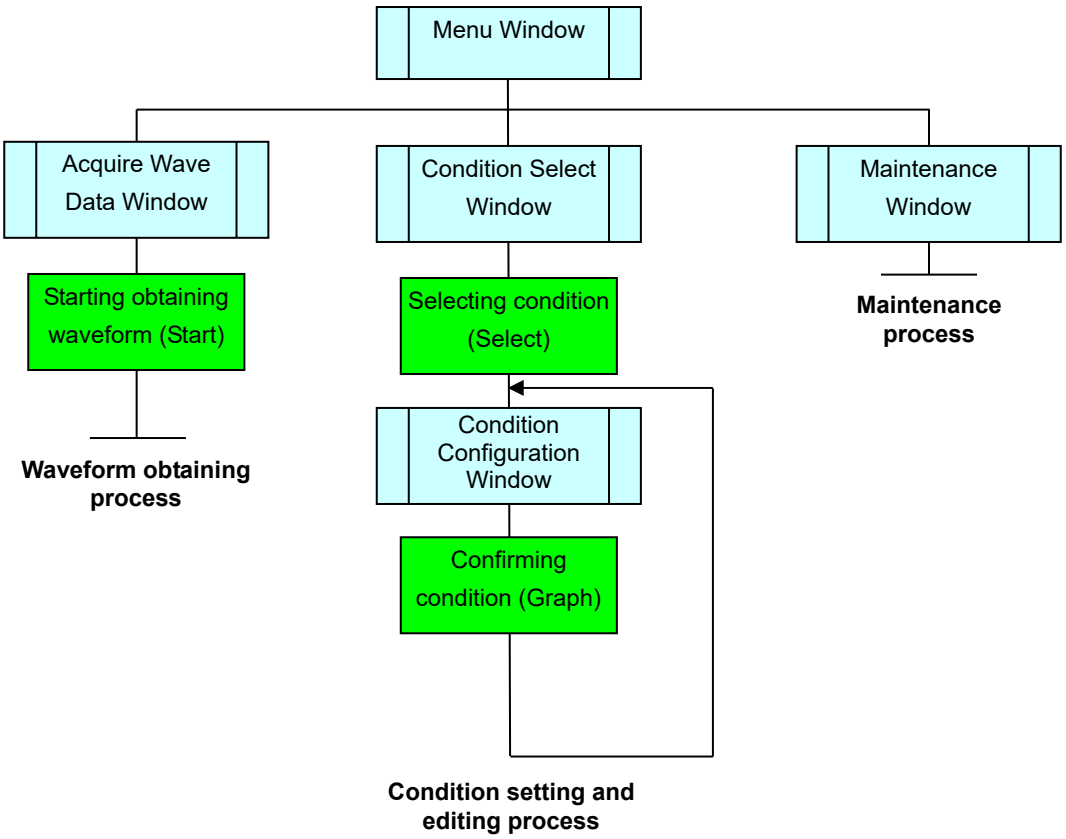
(2) Starting the Application

(1) Start procedure

Click **MM-L300A** from the program menu of the personal computer or desktop icon to start the Menu Window. (Refer to **(3)**.)

* To obtain the waveform data with this application, 5 GB or more of the free capacity of the saving drive on the HDD is required.

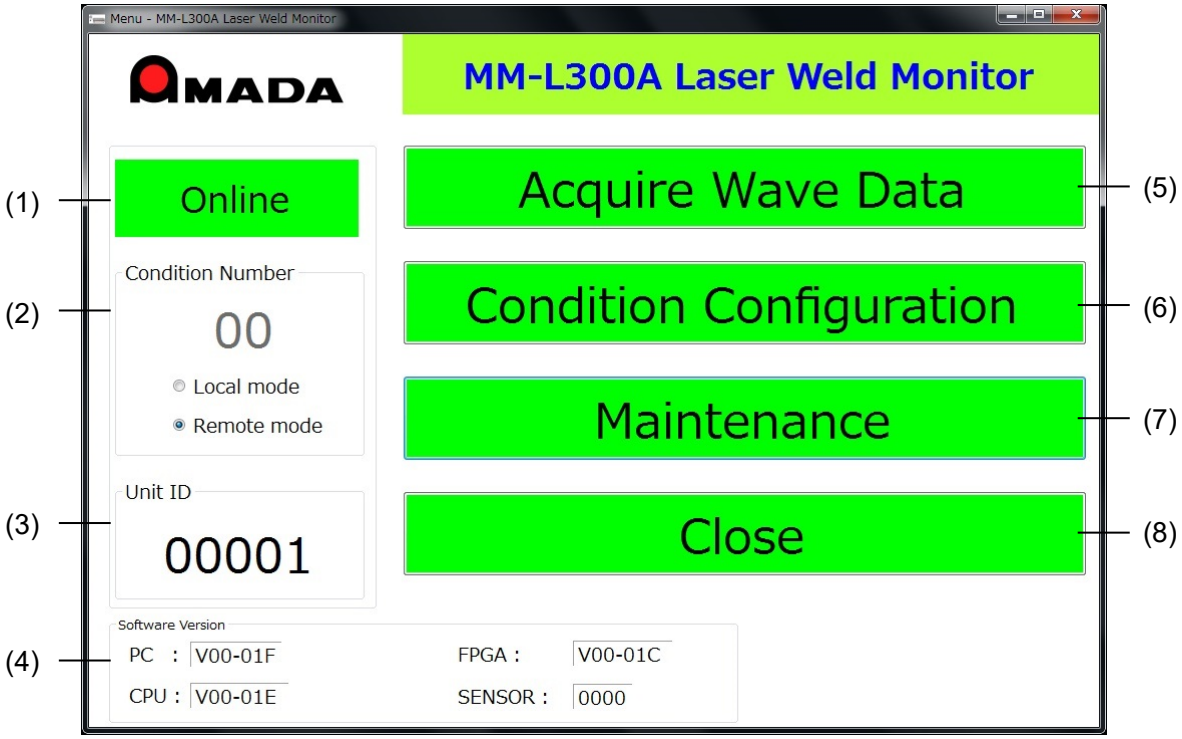
(2) Simple operation flow



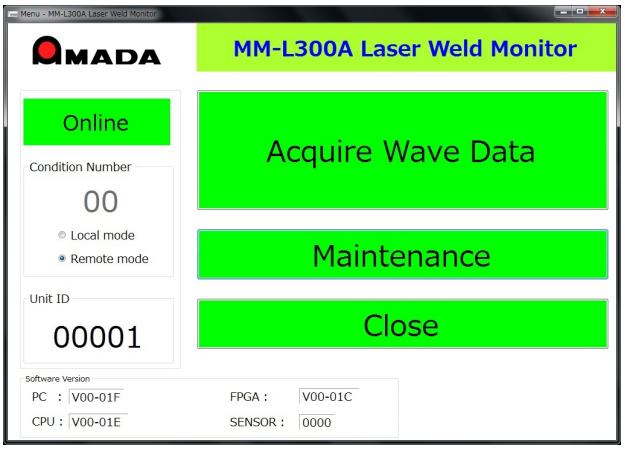
(3) Menu Window

When the application starts, this window is first displayed.

On this window, you can select to move to the Acquire Wave Data Window, the Condition Select Window, or the Maintenance Window.



No.	Item	Description
(1)	Status display	The connection state with the **MM-L300A** is displayed. Online: Indicates that connection between this application and the **MM-L300A** is established. Offline: Indicates that this application and the **MM-L300A** are not connected.
(2)	Condition Number	The condition number (00 to 63) set on the **MM-L300A** is displayed. The condition number can be set in either [Local mode] or [Remote mode]. During editing, the number is displayed in red. When determined by [Enter], it changes to black. The **MM-L300A** starts in [Remote mode] when turned on. Also, even if [Local mode] is selected, the mode is changed to [Remote mode] when this application is shut down. At the time of off-line, [Local mode] / [Remote mode] is not displayed. Local mode: Sets via this application. Remote mode: Sets via EXT. I/O.
(3)	Unit ID	The unit ID number set in the connected **MM-L300A** is displayed. It can be changed on the Maintenance Window.

No.	Item	Description
(4)	Software Version	The information on software version is displayed. PC: **MM-L300A**'s software version FPGA: **MM-L300A**'s FPGA version CPU: **MM-L300A**'s CPU version SENSOR: **SU-N300A/SG-N300A**'s CPU version
(5)	Acquire Wave Data	Moves to the Acquire Wave Data Window. (Refer to **(4)**.) Unavailable at the time of off-line. The button is displayed in gray and cannot be clicked.
(6)	Condition Configuration	Moves to the Condition Select Window. (Refer to **(5)**.) Unavailable when [Operator] is selected for [Mode] on the Maintenance Window. 
(7)	Maintenance	Moves to the Maintenance Window. (Refer to **(10)**.)
(8)	Close	The confirmation window is displayed. Click [OK] to shut down the application.

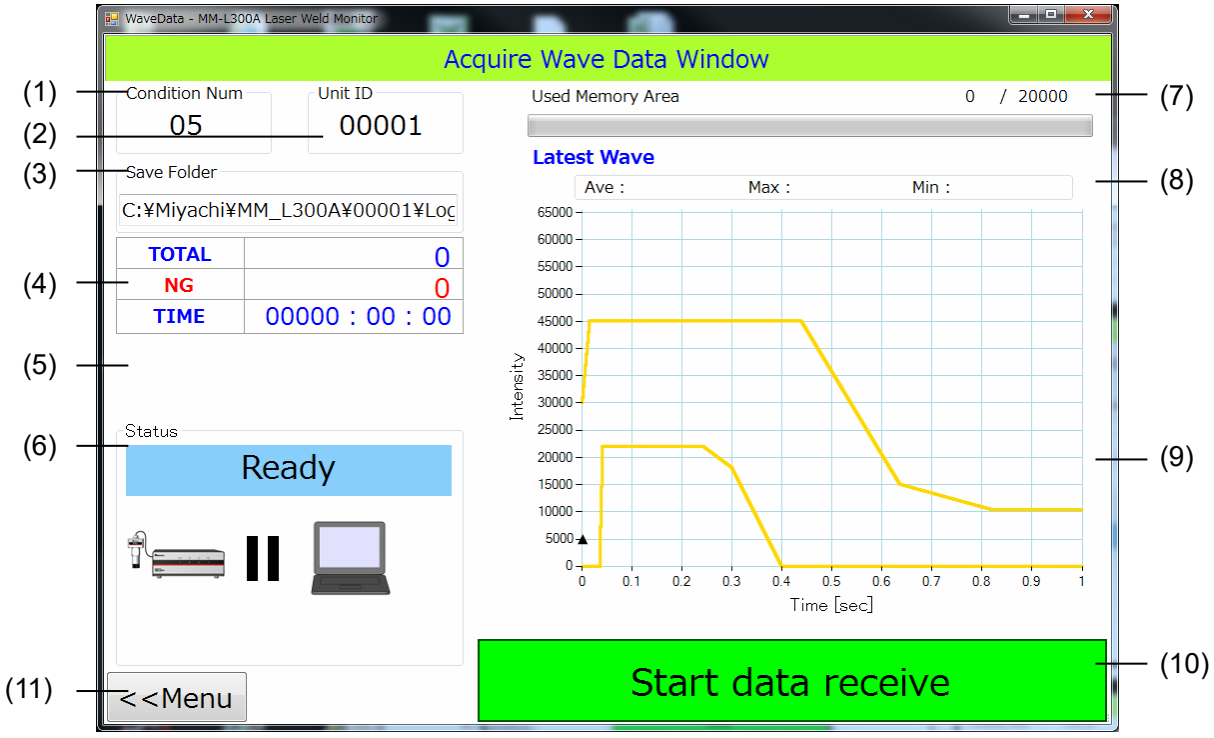
(4) Acquire Wave Data Window

This section explains how to display and save data obtained by the **MM-L300A**.

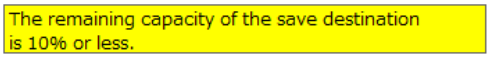
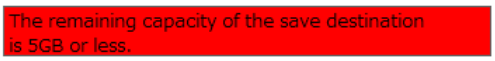
Click the [Acquire Wave Data] button on the Menu Window to display the Acquire Wave Data Window.

The filename of waveform data to be saved is the obtained time at the time. Be sure to transfer the system time of the personal computer to the **MM-L300A** in advance by the current time setting displayed at the bottom of the Maintenance Window. Also, set the current time in a similar way when replacing the personal computer.

(1) Reception standby of waveform data



No.	Item	Description
(1)	Condition Num	The measurement condition number of waveform received last is displayed.
(2)	Unit ID	The ID number of currently connected **MM-L300A** is displayed.
(3)	Save Folder	The storage destination of the transferred waveform data is displayed.
(4)	Transferred waveform information	The transferred waveform information is displayed. TOTAL: Total number of waveform data obtained after the **MM-L300A** is turned on (or the counter is reset) NG: Total number of abnormal waveforms in the waveform data after the **MM-L300A** is turned on (or the counter is reset) TIME: Elapsed time after the [Start data receive] button is clicked

No.	Item	Description
(5)		When a remaining capacity of the HDD saving data becomes small, the warning is displayed.  Displayed when the free capacity of the saving drive becomes less than 10%.  Displayed when the free capacity of the saving drive becomes less than 5 GB, and stops obtaining waveform for protection of HDD.
(6)	Status	The current status is displayed. Ready: State waiting for receiving waveform data to start. Busy: Receiving waveform data Offline: Disconnected Normal Wave: Normal waveform AbNormal Wave: Abnormal waveform (NG judgment)
(7)	Used Memory Area	The using state of **MM-L300A**'s waveform data internal memory is displayed.
(8)	Latest Wave	The time required for obtaining the currently displayed waveform is displayed. Average value (Ave), maximum value (Max) and minimum value (Min) of the displayed waveform are displayed.
(9)	Waveform display	The latest transferred waveform is displayed every 0.5 seconds. The Upper Limit and the Lower Limit set on the Condition Configuration Window is displayed by a graph (*1). Also, the trigger value set on the Maintenance Window is displayed by [▲]. When an abnormal waveform is detected, updating the display of waveforms stops.
(10)	Start data receive / Stop data receive	Controls the start or stop of transferring the waveform data into personal computer.
(11)	Menu	Moves to the Menu Window.

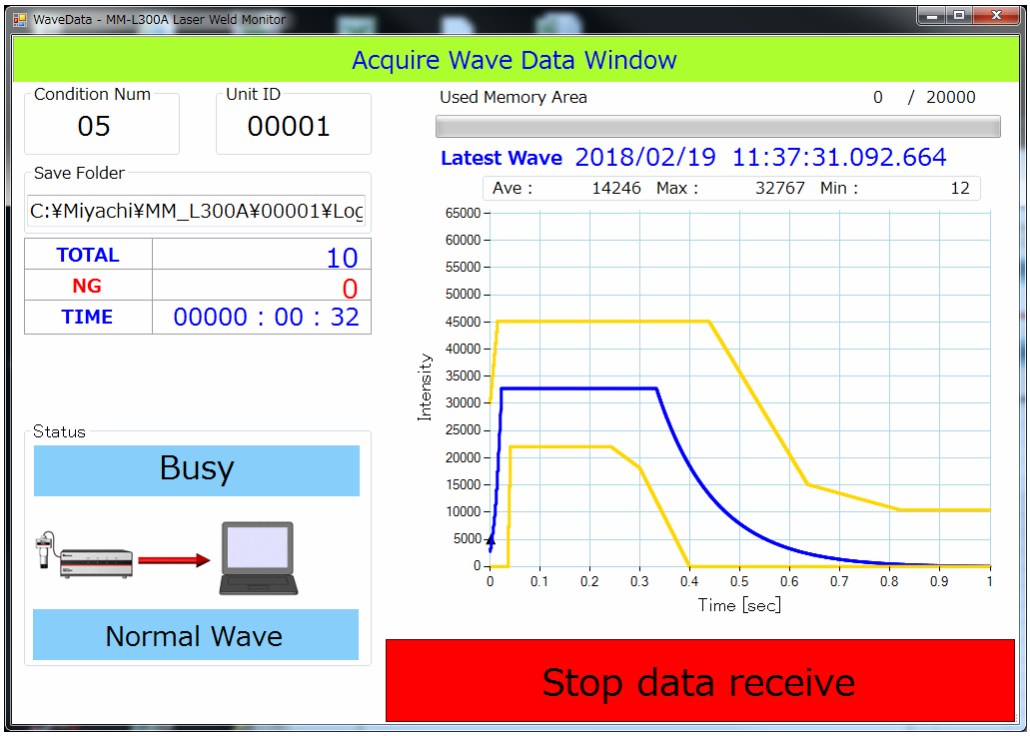
*1 The graph of Upper Limit and Lower Limit is the set value stored in the personal computer. After storing waveforms in the **MM-L300A**, by changing the measurement condition of the PC application and obtaining again waveforms stored in the **MM-L300A**, the waveform data itself is displayed with the measurement time of the previous condition, but [Upper Limit] / [Lower Limit] graph is displayed with the current condition.

(2) Reception start of waveform data

Clicking the [Start data receive] button saves and displays the waveform data transferred from the **MM-L300A**.

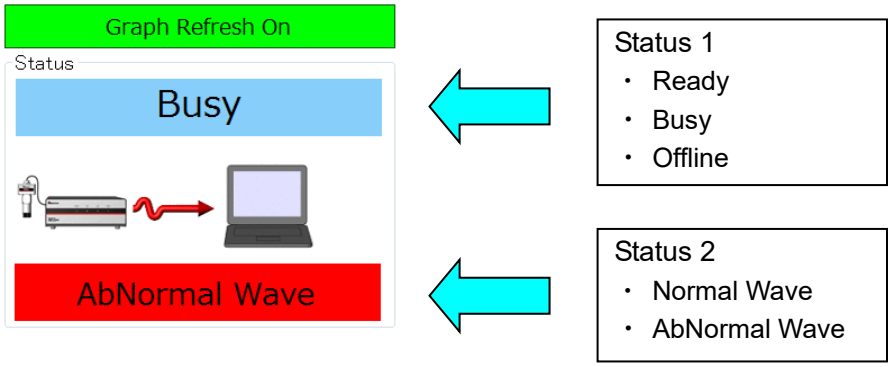
When the waveform data already exist in the internal memory of the **MM-L300A**, newly obtained waveforms are transferred after the data in the memory is transferred.

The window during obtaining waveforms is as shown in the next page:



If the transferred waveform is abnormal, updating the display of the waveform is stopped and the abnormal waveform is continuously displayed.

Also, the status display changes as shown below and the [Graph Refresh On] button is displayed. When the [Graph Refresh On] button is clicked, updating the display of waveforms is restarted.



Normally, [Busy] is displayed in Status 1 and [Normal Wave] is displayed in Status 2.

(3) Reception stop of waveform data

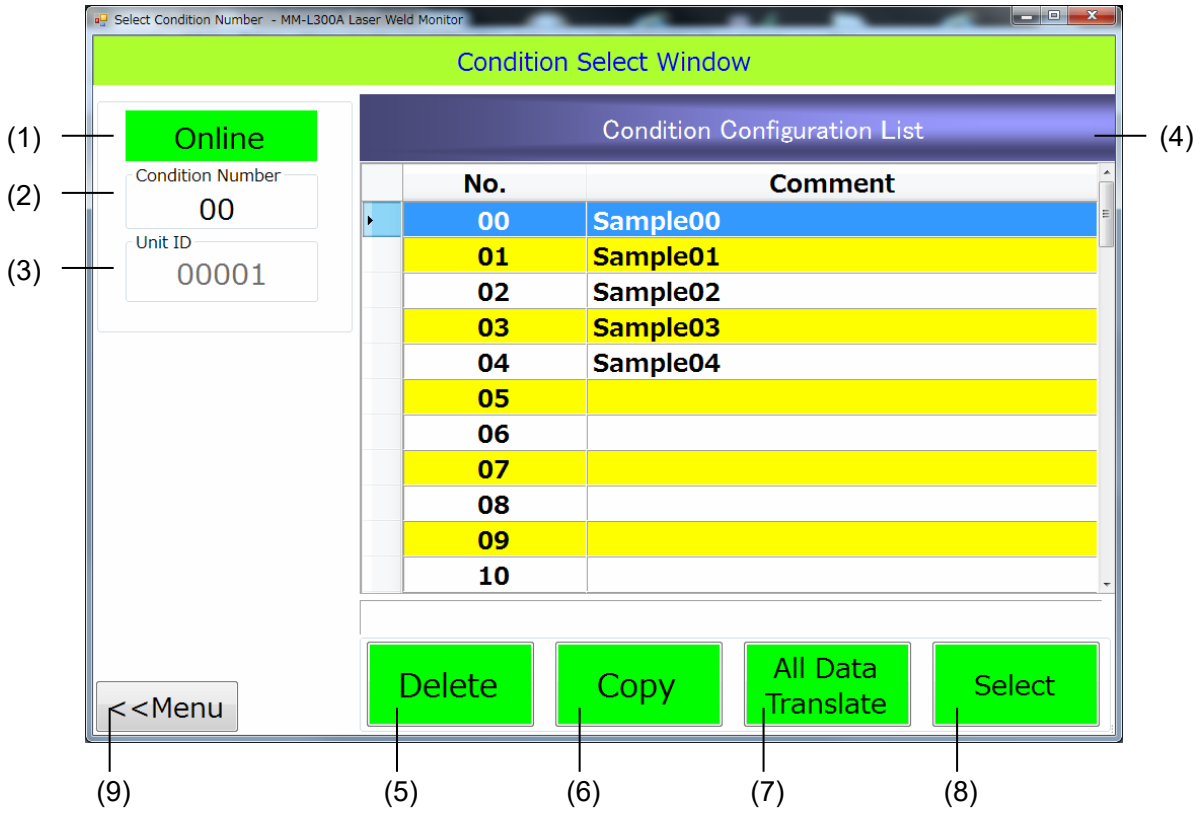
Clicking the [Stop data receive] button stops transferring the waveform data and return to the ready state.

* Even if the reception of waveform data is stopped, the **MM-L300A** itself obtains waveform. The **MM-L300A** can keep data for up to 20000 waveforms in the internal memory. When the number of waveforms exceeds 20000, the oldest waveform data is sequentially erased and overwritten. Click the [Start data receive] button again to transfer data held in the **MM-L300A** in the personal computer.

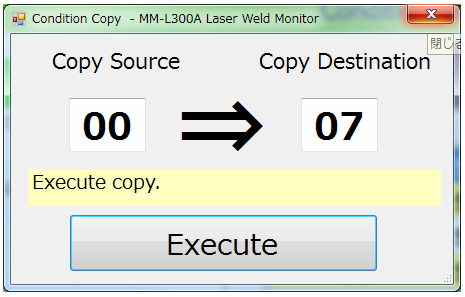
(5) Condition Select Window

This section explains how to set conditions.

Click the [Condition Configuration] button on the Menu Window to display the Condition Select Window.



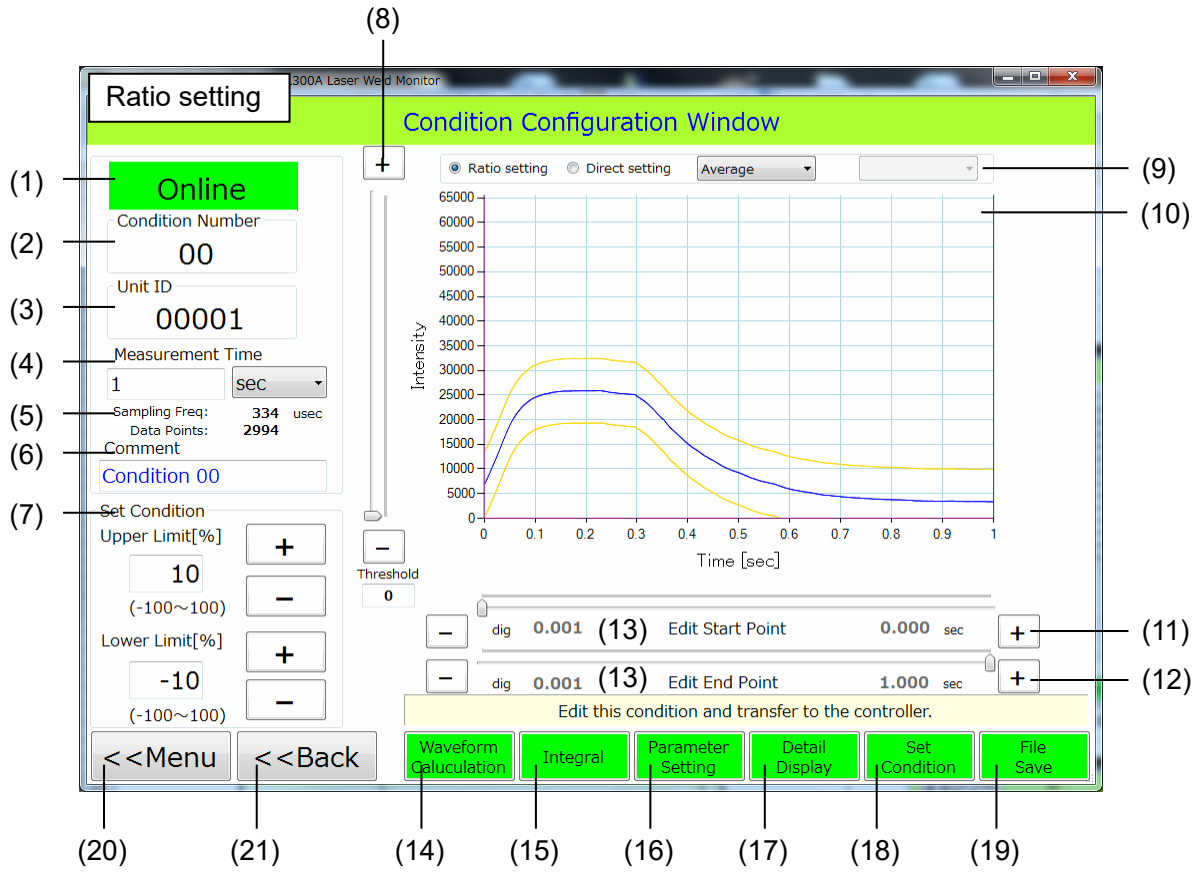
No.	Item	Description
(1)	Status display	The connection state with the **MM-L300A** is displayed. Online: Indicates that connection between this application and the **MM-L300A** is established. Offline: Indicates that this application and the **MM-L300A** are not connected.
(2)	Condition Number	The measurement condition number of the selected waveform is displayed. The default is 00.
(3)	Unit ID	The ID number of currently connected **MM-L300A** is displayed. At the time of off-line, the number can be changed by key input.
(4)	Condition Configuration List	The measurement condition number (00 to 63) and comment are displayed.
(5)	Delete	Deletes the measurement condition.

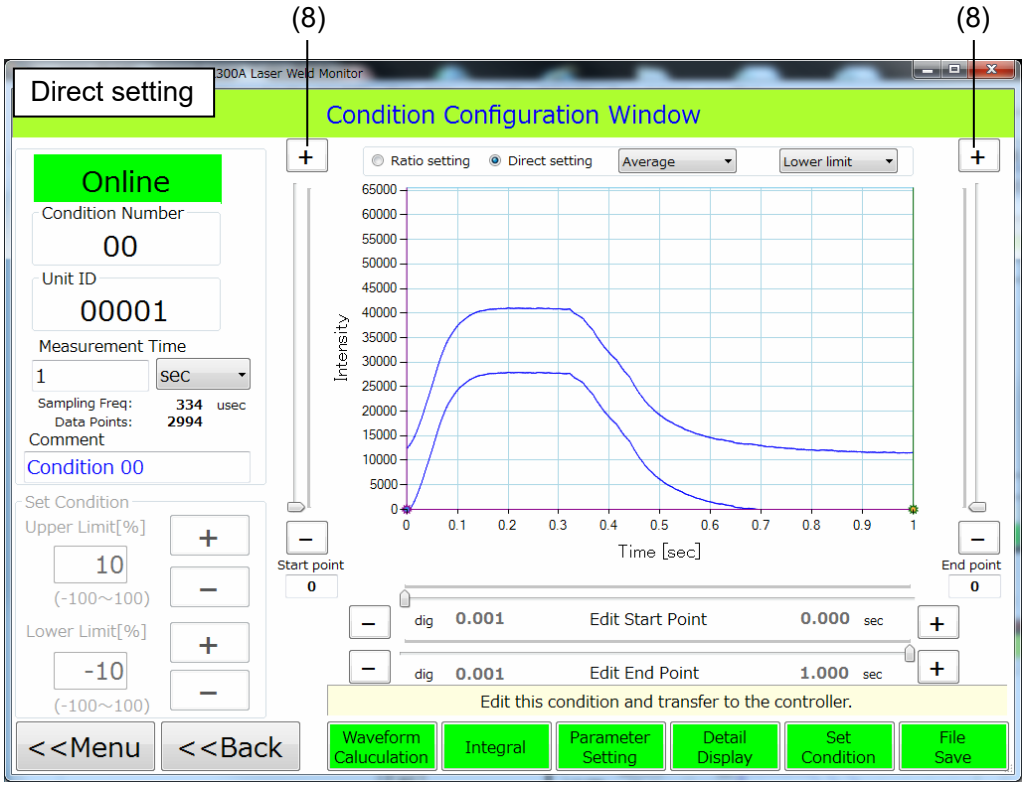
No.	Item	Description
(6)	Copy	Select the condition to copy to and then click this button. Input the condition number of the copy destination in the following dialog and click the [Execute] button to copy the condition. 
(7)	All Data Translate	Transfers all data of the measurement condition number (00 to 63) to the **MM-L300A**. Valid only at the time of on-line and displayed in gray at the time of off-line. When the [Menu] button is clicked without data transferred, the confirmation window appears.
(8)	Select	Determines the selected measurement condition number and moves to the Condition Configuration Window. Double-clicking the selected line also moves to the Condition Configuration Window.
(9)	Menu	Moves to the Menu Window.

(6) Condition Configuration Window

Select the condition number to edit the measurement condition from the Condition Select Window.

When the [Select] button on the Condition Select Window is clicked, the Condition Configuration Window is displayed.





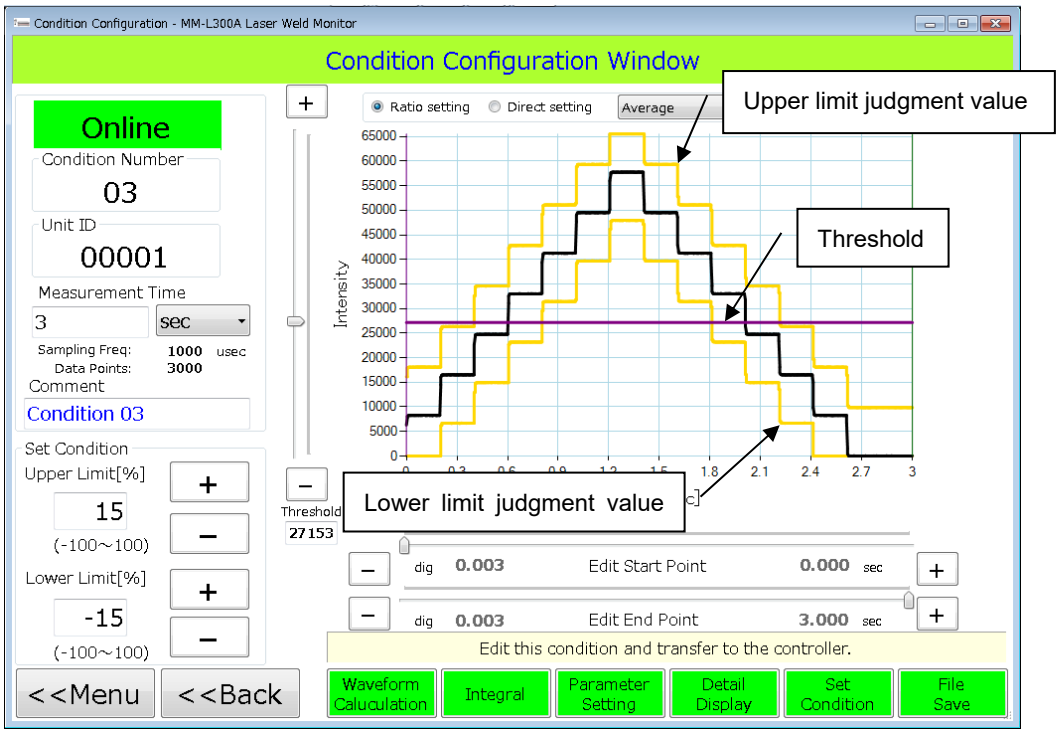
No.	Item	Description
(1)	Status display	The connection state with the **MM-L300A** is displayed. Online: Indicates that connection between this application and the **MM-L300A** is established. Offline: Indicates that this application and the **MM-L300A** are not connected.
(2)	Condition Number	The condition number (00 to 63) selected on the Condition Select Window is displayed.
(3)	Unit ID	The unit ID number set in the connected **MM-L300A** is displayed. It can be changed on the Maintenance Window.
(4)	Measurement Time	Sets the time required for obtaining a waveform of the **MM-L300A** (data sampling period after trigger-on) in the range of 1 to 999 (only integers). Also, set the unit of time (sec, msec, usec). Since the graph, integral settings and local parameters are initialized when the setting is changed, the confirmation window appears.
(5)	Sampling Freq Data Points	According to the measurement time set in [Measurement Time], data sampling cycle and the number of samplings (up to 3000 points can be set) are automatically displayed.
(6)	Comment	Displays and sets the comment of the condition. If nothing is input, [Condition XX (XX part is the condition number)] is input when saved. Also, "," (comma) cannot be used.
(7)	Set Condition	Specifies the Upper Limit and the Lower Limit of the range set in [Edit Start Point] and [Edit End Point] in the unit of %. (1% ≒ graph intensity scale × 1/100) Sets by key input or [+]/[-] button.
(8)	Ratio setting: Threshold	Sets the judgment threshold. The lower limit judgment value lower than this threshold becomes invalid. Sets by slide bar or [+]/[-] button. (Refer to **(1) Threshold**.)
	Direct setting: Start point / End point	Sets the intensity of Edit Start Point and Edit End Point. Sets by slide bar or [+]/[-] button.
(9)	Setting mode	Ratio setting: Sets the upper/lower limit judgment value of the judgment condition at a ratio. Direct setting: Sets the upper/lower limit judgment value of the judgment condition at an arbitrary value. Set upper limit and lower limit, respectively. Upper limit and Lower limit can be selected from the combo box. * From the reference waveform type selecting combo box, waveforms of Average, Range and 3σ can be switched and displayed. However, you need to select waveform and perform calculation on the Basis Waveform Calculation Window in advance.
(10)	Waveform display	The waveform calculated on the Basis Waveform Calculation Window and the upper/lower limit judgment value are displayed. Threshold is also displayed in the ratio setting.
(11)	Edit Start Point	Sets the point to start editing. Sets by slide bar or [+]/[-] button.
(12)	Edit End Point	Sets the point end editing. Sets by slide bar or [+]/[-] button.
(13)	dig	The resolution of the condition setting period of [Edit Start Point] and [Edit End Point] is displayed. When fractions are set in [Measurement Time], it shall be rounded off.

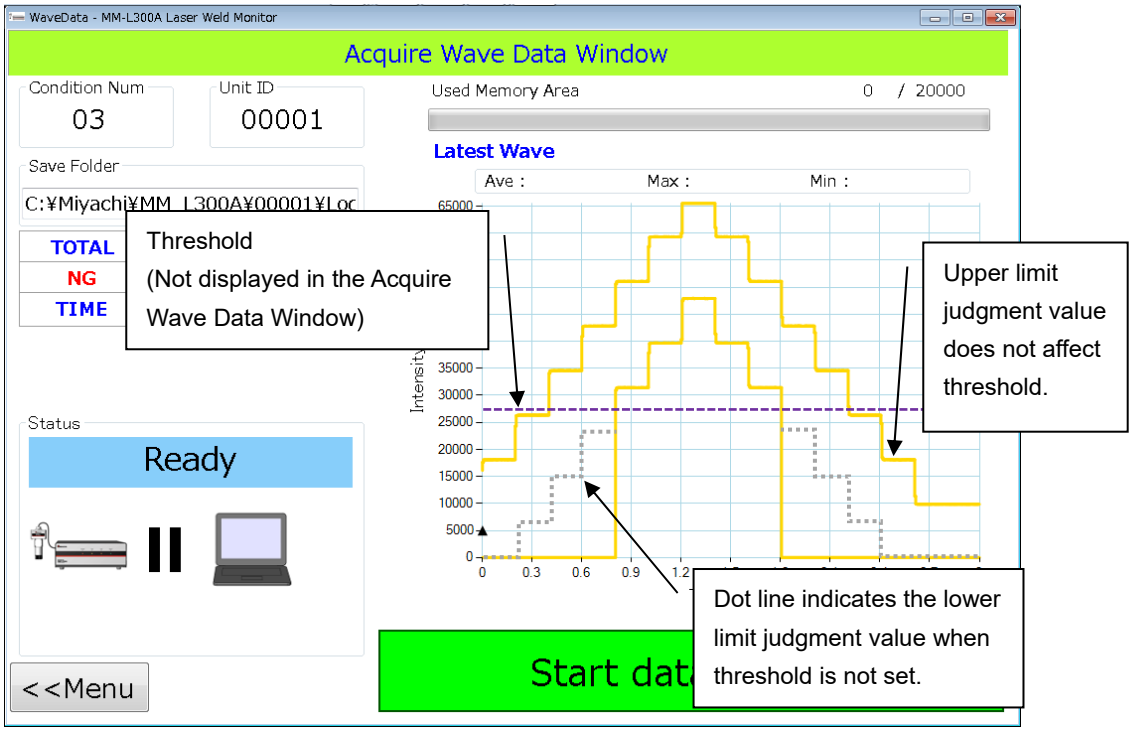
No.	Item	Description
(14)	Waveform Calculation	Moves to the Basis Waveform Calculation Window. Searches and calculates the obtained waveform data.
(15)	Integral	Moves to the Integral Configuration Window. Sets the judgment condition of integral sections 1 to 3.
(16)	Parameter Setting	Moves to the Parameter Setting Window. Sets the number of skips, the number of moving averages, the analog gain value, the intensity axis on graph, and thresholds of area judgment, amplitude judgment and times judgment.
(17)	Detail Display	Displays the Detail Condition Window to check and edit the detailed data of the setting contents.
(18)	Set Condition	Enables the setting condition, reflects in graph and displays the Detail Condition Window.
(19)	File Save	Saves the setting condition into the personal computer. Not transferred to the **MM-L300A**. The storage is completed, the confirmation window is displayed. When the setting condition is changed and the [Menu] or [Back] button is clicked without saved, the caution window notifying the operator of that the data is not saved appears.
(20)	Menu	Moves to the Menu Window after checking the presence or absence of data transfer.
(21)	Back	Moves to the previous window (Condition Select Window).

(1) Threshold

When the judgment threshold is set, the lower limit judgment value lower than the set threshold becomes invalid.

As shown below, when the threshold is set for the lower limit judgment value, the lower limit judgment value lower than the threshold becomes invalid and the lower limit judgment value within the range becomes 0.



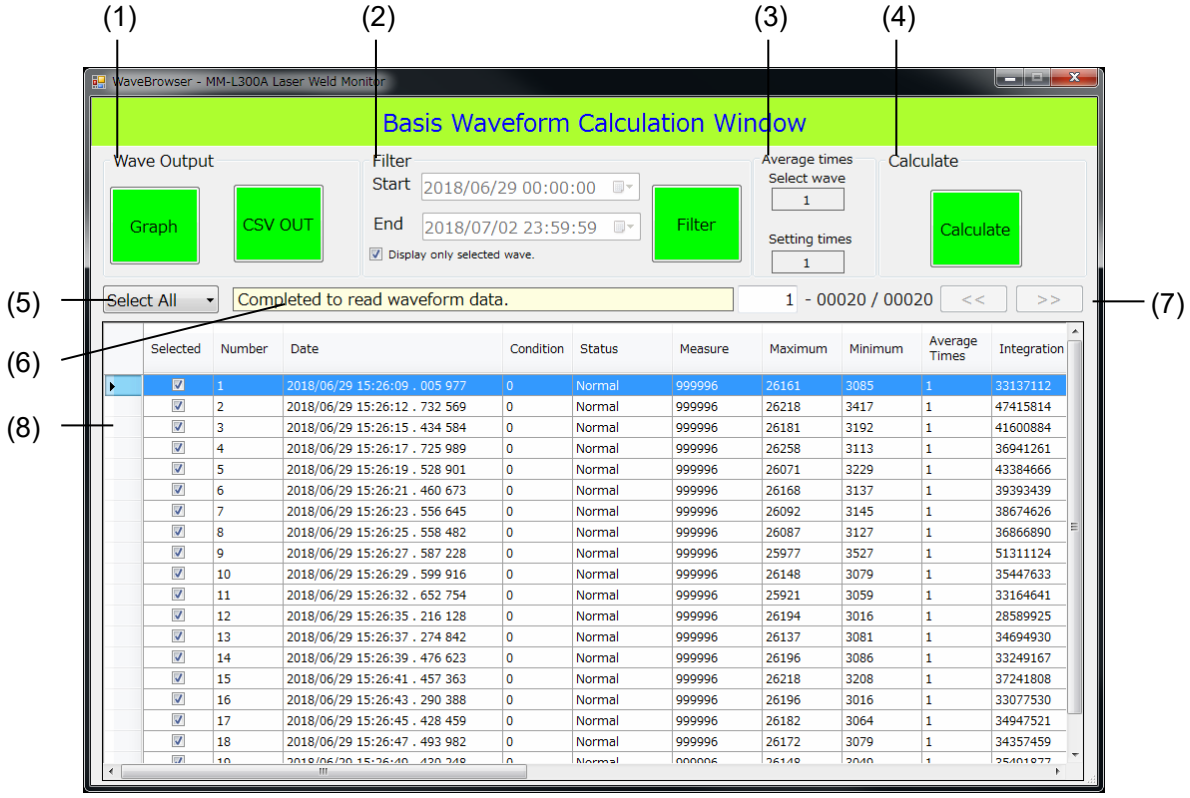

WaveData - MM-L300A Laser Weld Monitor
Acquire Wave Data Window
Condition Num
03
Unit ID
00001
Used Memory Area
0 / 20000
Latest Wave
Ave :
Max :
Min :
Save Folder
C:¥Miyachi¥MM_L300A¥00001¥Loc
TOTAL
NG
TIME
Threshold
(Not displayed in the Acquire Wave Data Window)
Upper limit judgment value does not affect threshold.
Intensity
65000
35000
30000
25000
20000
15000
10000
5000
0
0
0.3
0.6
0.9
Dot line indicates the lower limit judgment value when threshold is not set.
Status
Ready
<<Menu
Start dat

(7) Basis Waveform Calculation Window

Edit the reference waveform.

Click the [Waveform Calculation] button on the Condition Configuration Window to display the Basis Waveform Calculation Window.

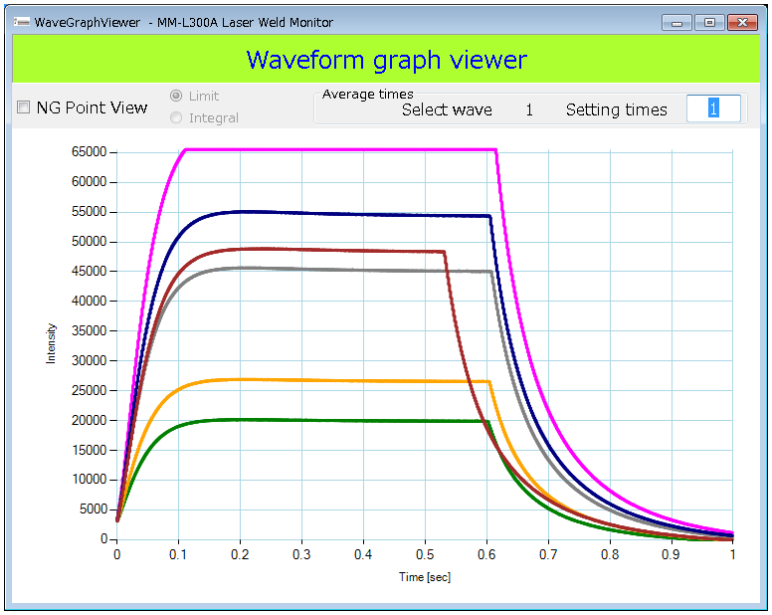
When the filter mode is set to [Basis waveform condition], the waveform data list used for creating the reference waveform is displayed. ([Display only selected wave.] is selected.) When the filter mode is set to [Specified condition], the waveform data list filtered with the specified condition is displayed.



No.	Item	Description
(1)	Wave Output	Selects the output method of the waveform of the selected condition and executes it. Graph: Displays in graph. (Refer to **(1) Waveform graph viewer**.) CSV OUT: Outputs the CSV file. Up to 1000 waveform data selected from the waveform data list can be output. (Refer to **(2) CSV file**.)
(2)	Filter	Sets the condition to filter and executes it. (Refer to **(3) Filter**.) When [Display only selected wave.] is selected, only waveforms selected in [Selected] out of waveform data extracted under the filtering condition (up to 65535) are displayed with starting at currently displayed page.

No.	Item	Description
(3)	Average times	Displays the number of moving average. Select wave: Displays the number of moving average when waveform selected in the waveform data list is obtained. When two or more waveforms are selected and they have different number of moving averages, nothing is displayed. Setting times: Displays [Setting times] specified in the Waveform graph viewer. When [Average Time] of the selected waveform is not 1, 1 is set in [Setting times]. The reference waveform obtained by the [Calculate] button becomes waveform data considered the value of [Setting times] as a moving average value. Also, the value of [Setting times] is automatically input in [Average times] on the Parameter Setting Window.
(4)	Calculate	Executes the calculation method (Average, Range, 3σ) of the selected waveform and moves to the Condition Configuration Window. The calculation result can be checked by switching the combo box on the Condition Configuration Window.
(5)	Selecting state display	Selects Select, Select All or Deselect All. Select: Puts the waveform data selected on the datagrid in a selecting state. When the selected waveform data already exists, the Select is displayed. Select All: Puts all the filtered waveform data (up to 65535) in a selecting state. Deselect All: Puts all the selected waveform data in an unselecting state.
(6)	Status display	The operation state is displayed. Reading wavedata..... Filtering..... Wavedata Over. Read up to Done filtering Calculating..... The number of selected wavedata Selected All Deselected All Finish to read wavedata.
(7)	Page feeding	The display start number/total number of waveforms of the waveform data is displayed. When the number of the waveform data is 101 or more, clicking [>>] displays next 100 waveforms and clicking [<<] returns to previous 100. Also, the display start number can be input in the text box.
(8)	Waveform data list	Selects the waveform data used to create the reference waveform from the obtained waveform data list. Turn on/off the checkbox in [Selected]. To select two or more waveforms, drag with a mouse and right-click. [Select], [Deselect] and [Reverse] are displayed and two or more waveforms can be selected. When the status of the waveform data is [NG], the cell is displayed in red.

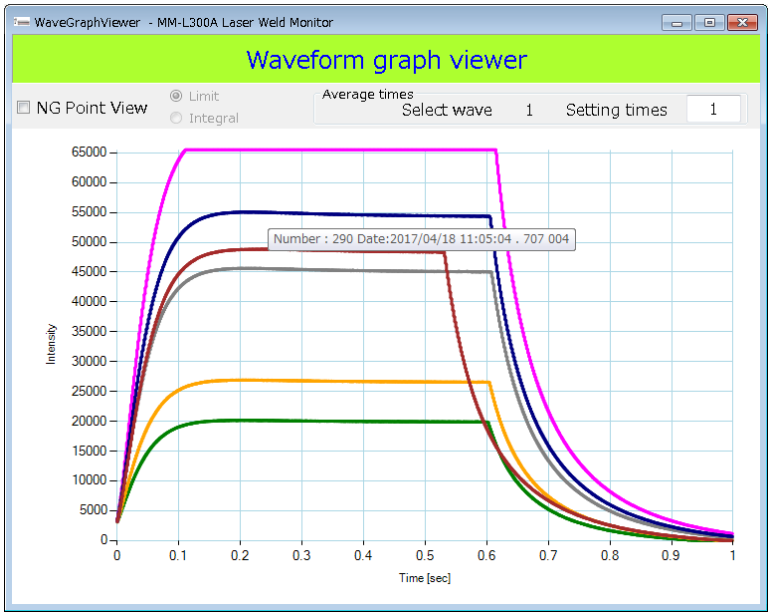
(1) Waveform graph viewer



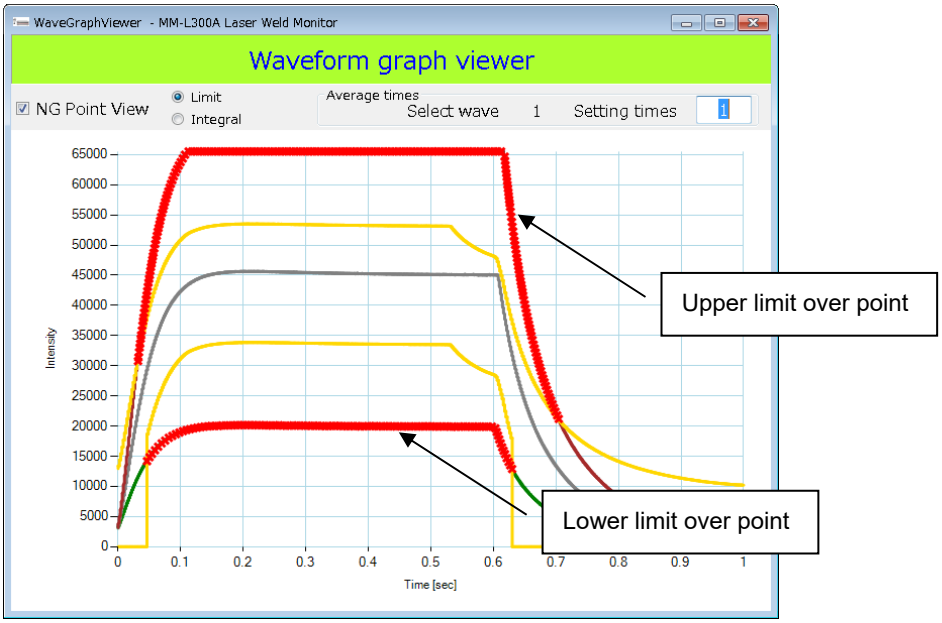
When the [Graph] button on the Basis Waveform Calculation Window is clicked, the graph of the waveform data selected in the waveform data list is displayed. Up to 100 waveform data can be displayed.

The graph is enlarged or reduced by turning a mouse wheel up and down (up: enlarged, down: reduced).

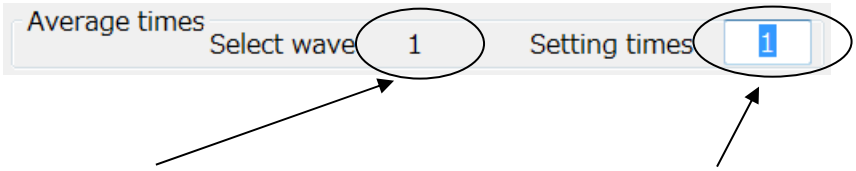
Also, putting a mouse pointer on the displayed waveform displays date and time in the selected information so that you can check which waveform information is displayed.



When [NG Point View] is selected, the graph above the range of [Upper Limit] or below the range of [Lower Limit] is displayed in NG (color selected in [NG Line] of [Line Color] on the Maintenance Window. [RED] in the example below).



Note) If the condition judged as abnormal has been changed thereafter, judgments are performed by the changed condition. When [NG Point View] is selected with old and new condition numbers mixed, an error occurs. For the changed condition, also change the condition number before saving it.



The number of moving average of the waveform when obtaining data selected in the waveform data list on the Basis Waveform Calculation Window is displayed.
When waveforms that have different number of moving averages are selected, nothing is displayed.

Specifies the number of moving average of the displayed waveform. The value cannot be exceeded 255. Redraws the graph with the set number of moving average. Valid only when the number of moving averages of the selected waveform is 1. (The waveform data which obtained data with 2 or more of the number of moving averages is invalid.)

(2) CSV file

The CSV file is output in the following format.

(Example of CSV data)

1st column: Data item	*2nd column: Waveform data*	
Date	2017/10/13_ 16:39:39.405.618	*Waveform obtained date and time*
Wave num	0	*Waveform data number (0 to 255)*
Result	1	*Judgment result (1:Normal 2:Abnormal)*
Data cnt	3000	*Number of valid data*
Skip times	0	*Number of skips*
Average times	1	*Number of moving averages*
Sampling	1	*Sampling cycle (μs)*
Integral	3882893	*Integrated value*
Integral Section1	3882893	*Integral section 1 integrated value *1*
Integral Section1 judgment	0	*Integral section 1 result (0:Normal 1:Upper limit error 2:Lower limit error *1*
Integral Section2	3882893	*Integral section 2 integrated value *1*
Integral Section2 judgment	0	*Integral section 2 result (0:Normal 1:Upper limit error 2:Lower limit error *1*
Integral Section3	3882893	*Integral section 3 integrated value *1*
Integral Section3 judgment	0	*Integral section 3 result (0:Normal 1:Upper limit error 2:Lower limit error *1*
Area judgment	0	*Area judgment (0:Normal 1:Upper limit error 2:Lower limit error 3:Upper/lower limit error) *1*
Amplitude judgment	0	*Amplitude judgment (0:Normal 1:Upper limit error 2:Lower limit error 3:Upper/lower limit error) *1*
Times judgment	0	*Times judgment (0:Normal 1:Upper limit error 2:Lower limit error 3:Upper/lower limit error) *1*
Limit judgment	0	*Upper/lower limit judgment (0:Normal 1:Upper limit error 2:Lower limit error 3:Upper/lower limit error) *2*
Min	937	*Minimum value*
Max	1694	*Maximum value*
Condition num	1	*Condition number*
Point1	1002	*Measured data of 1st point*
Point2	1006	*Measured data of 2nd point*
Point3	1010	*Measured data of 3rd point*
.	.	.
.	.	.
.	.	.
Point3000	1659	*Measured data of 3000th point*

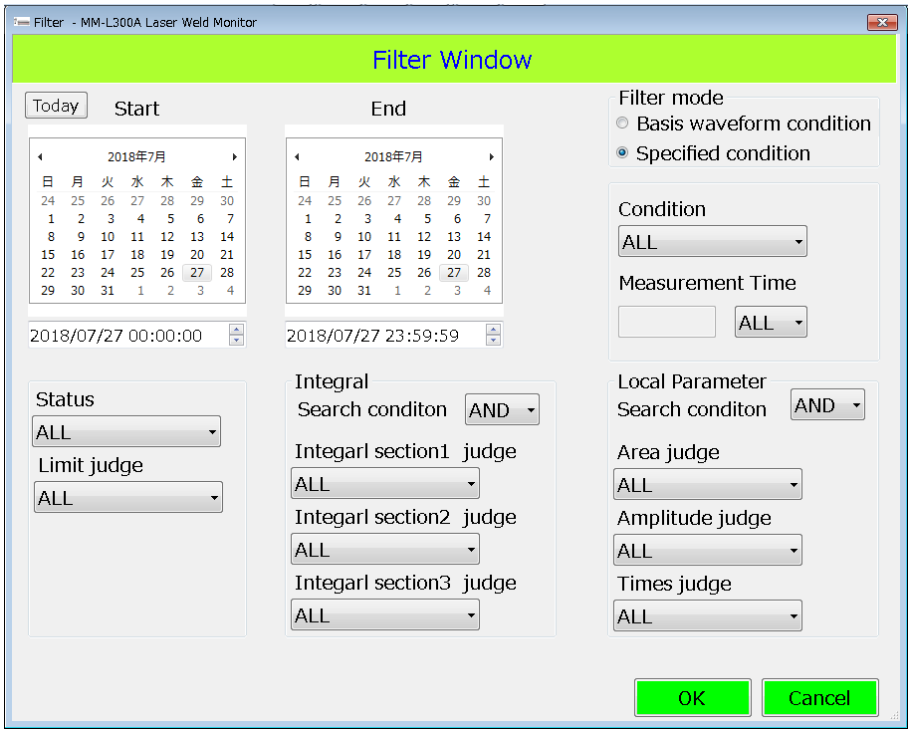
*1 Enabled when the CPU version is V00-01D or later and the FPGA version is V00-01B or later. In earlier versions, '---' is shown in the column of value.

*2 When the CPU version is V00-01D or later and the FPGA version is V00-01B or later, '---' is shown in the upper/lower limit judgment, since judgment conditions of area, amplitude and times are enabled. In earlier versions, the judgment result is shown.

(3) Filter

The reference waveform can be narrowed by setting the filtering condition when creating waveforms.

1) When the [Filter] button on the Basis Waveform Calculation Window is clicked, the Filter Window is displayed.



2) Default and contents for parameters to set are as follows.

	Default	Contents
Start	(Today)	2000/01/01 or later, earlier than the end day
	00:00:00	00:00:00 to 23:59:59
End	(Today)	2000/01/01 or later, later than the start day
	23:59:59	00:00:00 to 23:59:59
Filter mode		Basis waveform condition: This is a search condition to create a reference waveform. This condition is saved when a reference waveform is created and a file is saved. In this mode, only a waveform used for calculation is displayed by default the next time the Basis Waveform Calculation Window is opened. (When [Display only selected wave.] is deselected, unused waveforms matching the search condition are also displayed.) In this mode, filtering condition and search date cannot be changed. Specified condition: Waveform data can be searched by specifying an arbitrary search condition. Clicking the OK button saves the condition. In this mode, information on the selected waveform data is not held. Clicking the Today button sets the start date to 0:00:00 today and the end date to 23:59:59 today.
Condition	ALL	ALL, No.00 to No.63

	Default	Contents
Measurement Time	ALL	ALL, 1 us to 999 sec
Status	ALL	ALL, Normal, Abnormal
Limit judge	ALL	ALL, Abnormal, UpperOver, LowerOver, RangeOver (*1)
Integral		
Search condition	AND	AND, OR (*2)
Integral section1 judge	ALL	ALL, Not covered, Abnormal, UpperOver, LowerOver (*3)
Integral section2 judge	ALL	ALL, Not covered, Abnormal, UpperOver, LowerOver (*3)
Integral section3 judge	ALL	ALL, Not covered, Abnormal, UpperOver, LowerOver (*3)
Local Parameter		
Search condition	AND	AND, OR (*2)
Area judge	ALL	ALL, Not covered, Abnormal, UpperOver, LowerOver, RangeOver (*3)
Amplitude judge	ALL	ALL, Not covered, Abnormal, UpperOver, LowerOver, RangeOver (*3)
Times judge	ALL	ALL, Not covered, Abnormal, UpperOver, LowerOver, RangeOver (*3)

*1 When an option other than [ALL] is selected, Integral and Local Parameter cannot be selected.

*2 The Search condition only applies to the conditions surrounded by a frame. The AND condition is used between other items.

*3 When the Search condition is AND, [Not covered] cannot be selected. Also, when it is OR, [ALL] cannot be selected. When [Not covered] is selected, the result of the item is excluded from search items.

3) Set each value and click the [OK] button to start filtering. [Filtering.....] is displayed at the operation state on the Basis Waveform Calculation Window.

4) When the filtering is completed, [Done Filtering] is displayed.

(4) Selection of the waveform data

The obtained waveform data list is displayed on the Basis Waveform Calculation Window. Select the waveform data to use for creating the reference waveform.

To select it, turn on/off the checkbox in [Selected]. To select two or more waveforms, drag with a mouse and right-click. [Select], [Deselect] and [Reverse] are displayed and two or more waveforms can be selected.

- Select: Puts the selected waveform data in a selecting state.
- Deselect: Cancels the selection.
- Reverse: Deselects the selected waveform data and puts the unselected waveform data in a selecting state.

To check the selected waveform, click the [Graph] button on the Basis Waveform Calculation Window to display the Graph viewer. However, the number of waveforms which can be checked simultaneously is up to 100.

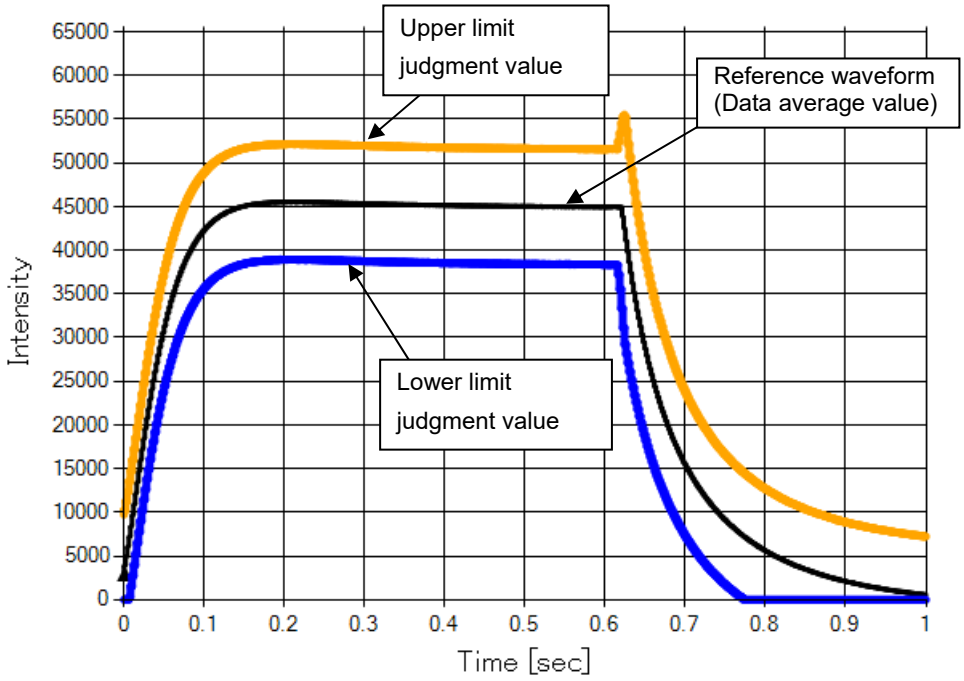
* Only selected waveforms in the page displayed in the Basis Waveform Calculation Window are displayed.

(5) Calculation of the selected waveform data

Select the waveform data and click the [Calculate] button.

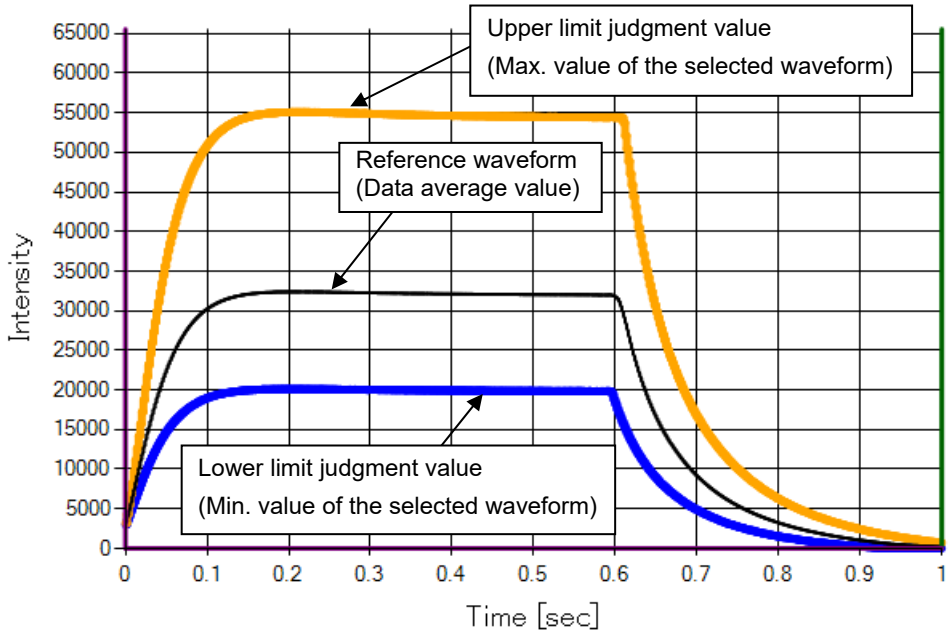
The Condition Configuration Window is displayed automatically. The condition of average is selected by default. According to the use, Average, Range or ±3σ can be selected from the combo box.

Average



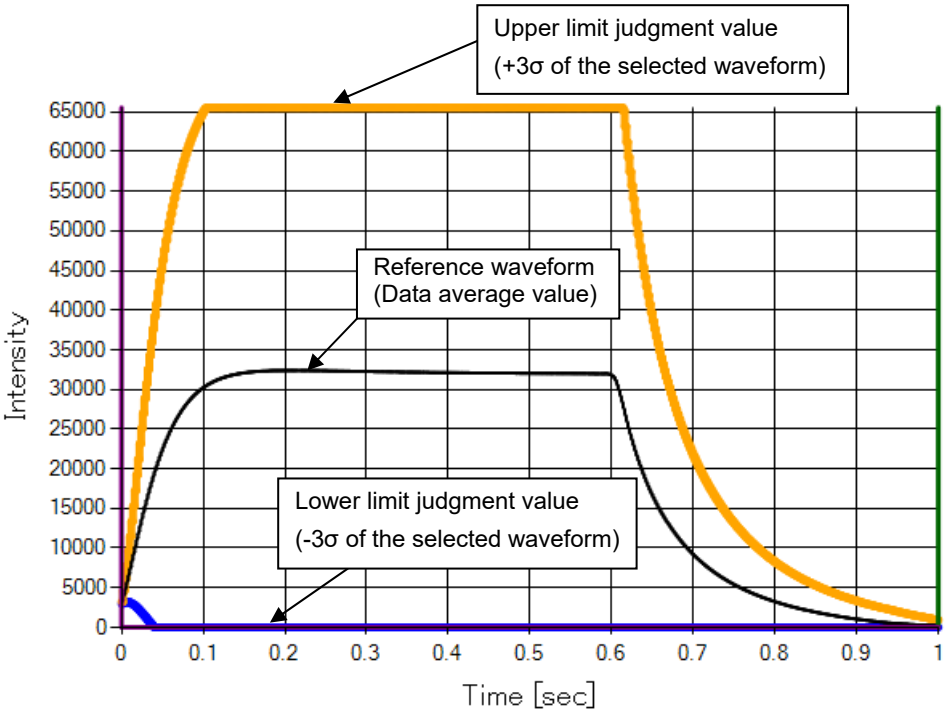
- Upper limit judgment value: data average value
- Lower limit judgment value: data average value

Range



- Upper limit judgment value: maximum value of the selected data
- Lower limit judgment value: minimum value of the selected data

±3σ



- Upper limit judgment value: +3σ value of the selected data
- Lower limit judgment value: -3σ value of the selected data

(6) Editing the upper/lower limit judgment value [Ratio setting]

Set the upper/lower limit judgment value for determining whether the obtained waveform is normal or abnormal.

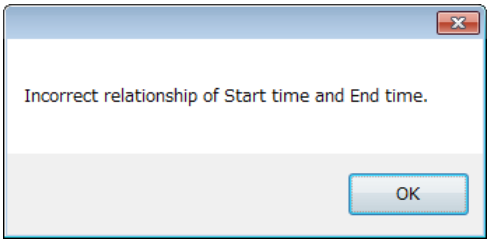
Adjust and edit the upper/lower limit of the reference waveform data created on the Basis Waveform Calculation Window.

* When the waveform data does not exist before the waveform data is obtained, default settings are as follows: average mode, average waveform intensity 32767, upper limit 50%, and lower limit -50%.

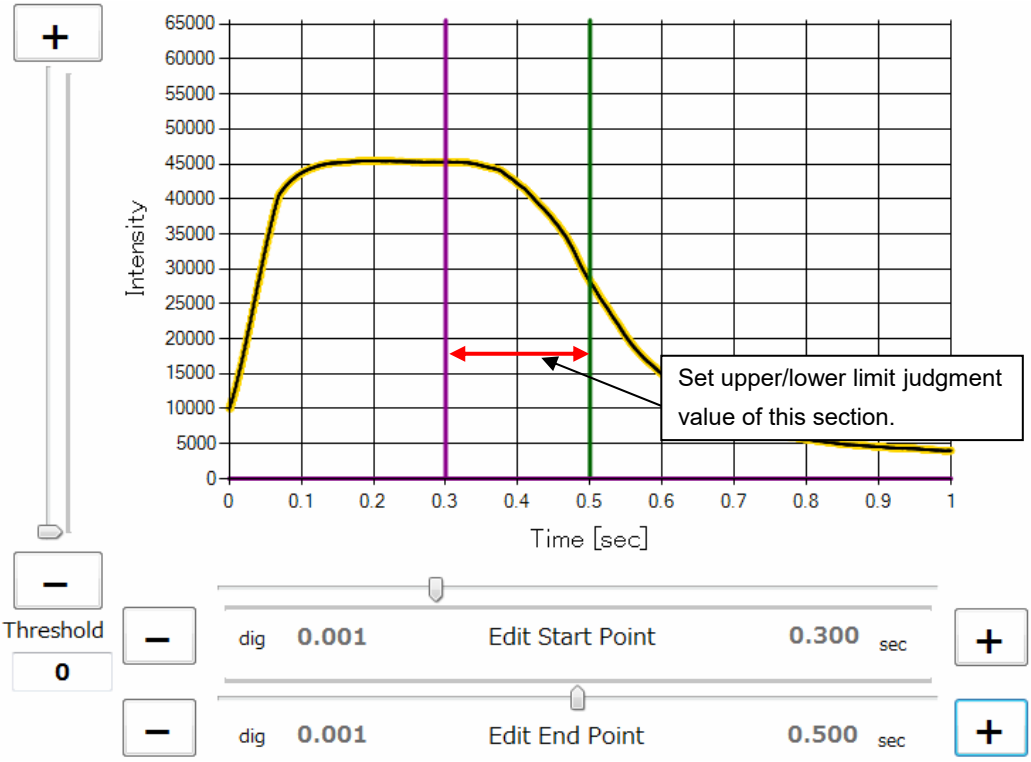
1) Set the setting mode to [Ratio setting].

2) Specify the data section to set the upper/lower limit judgment value by operating scroll bars of [Edit Start Point] and [Edit End Point], or [+]/[-] button.

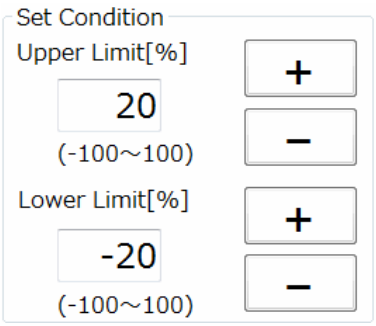
- For [Edit End Point], set the same value as that of [Edit Start Point] or larger.
- If the setting range conditions above is not satisfied, a message appears when a condition is changed or added.



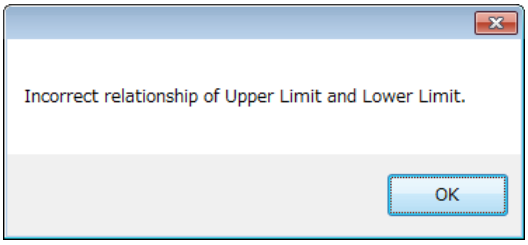
Click the [OK] button to return.



3) Set the upper/lower limit judgment value, and then set the position from Average, Range, or ±3σ in the unit of %. (1% ≒ graph intensity scale × 1/100)

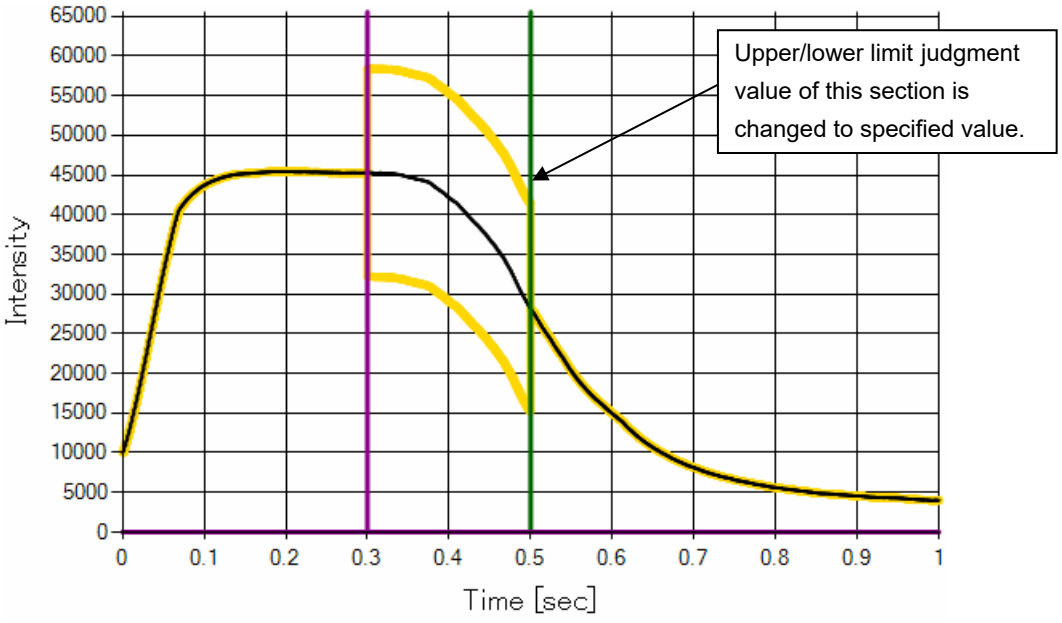


- If the setting range conditions above is not satisfied, a message appears when a condition is changed or added.

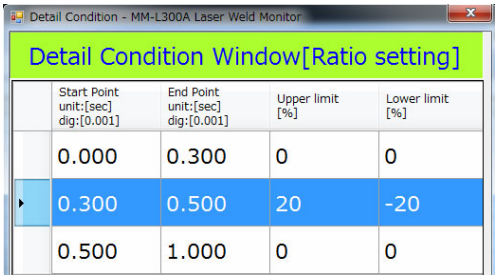


Click the [OK] button to return.

4) Click the [Set Condition] button to determine the setting.



Also, when the [Set Condition] button is clicked, the Detail Condition Window is displayed and setting contents can be checked. The Detail Condition Window can also be displayed by clicking the [Detail Display] button.

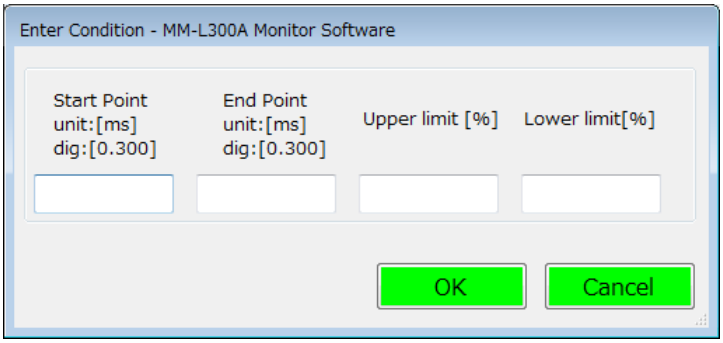


5) When the Detail Condition Window is opened by clicking the [Set Condition] button, the current setting condition is added. When the Detail Condition Window is opened by clicking the [Detail Display] button, the currently registered condition is displayed.

6) When you right-click on the datagrid, the menu for [Delete row], [Add a row] and [All clear] is displayed and the following operations can be made.

Delete row: Deletes the selected condition.
Add a row: Adds a condition. (input from the Enter Condition window)
All clear: Deletes all conditions.

When [Add a row] is selected, the following Enter Condition window is displayed.



A new condition can be added by inputting [Start Point], [End Point], [Upper limit], and [Lower limit] and clicking the [OK] button.

7) The minimum input unit for inputting [Start Point] and [End Point] by ten-key, is displayed in [dig]. When fractions are input, it shall be rounded off.

(7) Editing the upper/lower limit judgment value [Direct setting]

Set the upper/lower limit judgment value for determining whether the obtained waveform is normal or abnormal.

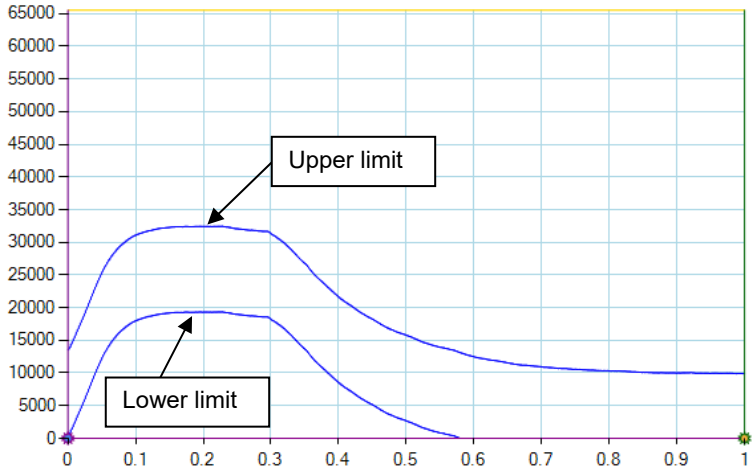
Adjust and edit the upper/lower limit judgment value of the reference waveform created on the Basis Waveform Calculation Window.

* When the waveform data does not exist before the waveform data is obtained, default settings are as follows: average mode, average waveform intensity 32767, upper limit 65535, and lower limit 0.

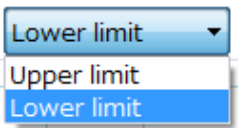
1) Set the setting mode to [Direct setting].

The graph display is as follows.

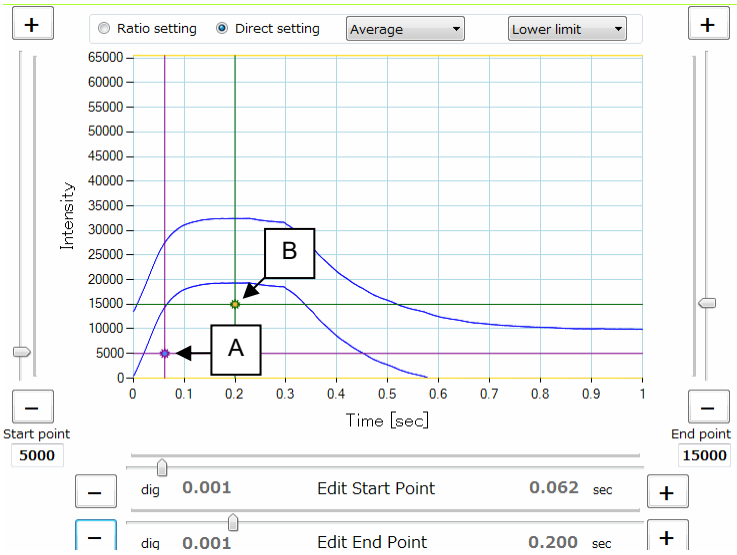
Displayed in the same color as the reference waveform, letting upper limit and lower limit set by the Ratio setting as a reference line. Average, Range or ±3σ can be switched by the combo box.



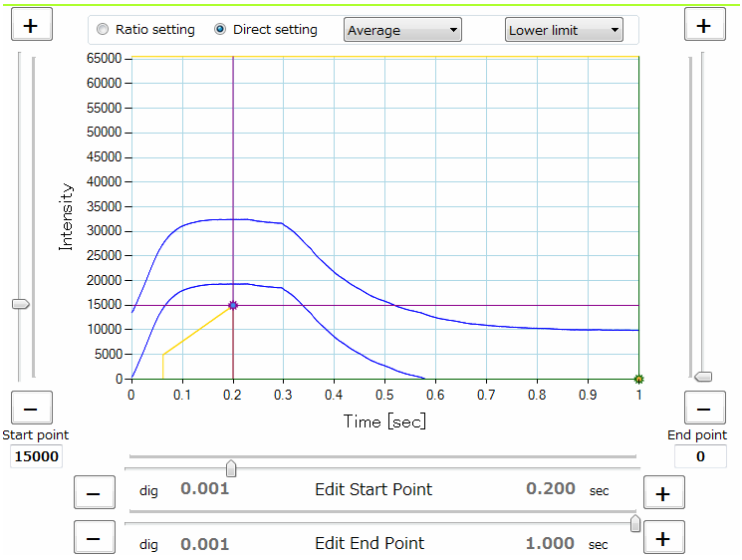
2) Select Upper limit or Lower limit from the combo box.



3) Specify the time section to set by operating scroll bars of [Edit Start Point] and [Edit End Point], or [+]/[-] button.
Set [Start point] (intensity at the edit start point) and [End point] (intensity at the edit end point) by operating scroll bars or [+]/[-] button. (Refer to A and B below.)



4) Click the [Set Condition] button and create the (upper or lower limit) judgment value of the specified section.

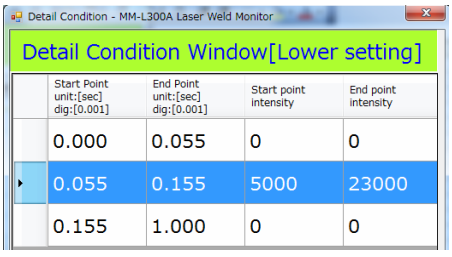


5) Repeat operations in Steps 3 to 4 and create an arbitrary (upper or lower limit) judgment value.

6) Create another judgment value (upper or lower limit).
Repeat operations in Steps 2 to 5 and create the (upper or lower limit) judgment value.

7) Just like the ratio setting, it can be edited in the Detail Condition Window.

Which judgment value is being set is displayed in brackets to the right of the window name. Operations are the same as the ratio setting. (Refer to Step 4 and later in (6).)

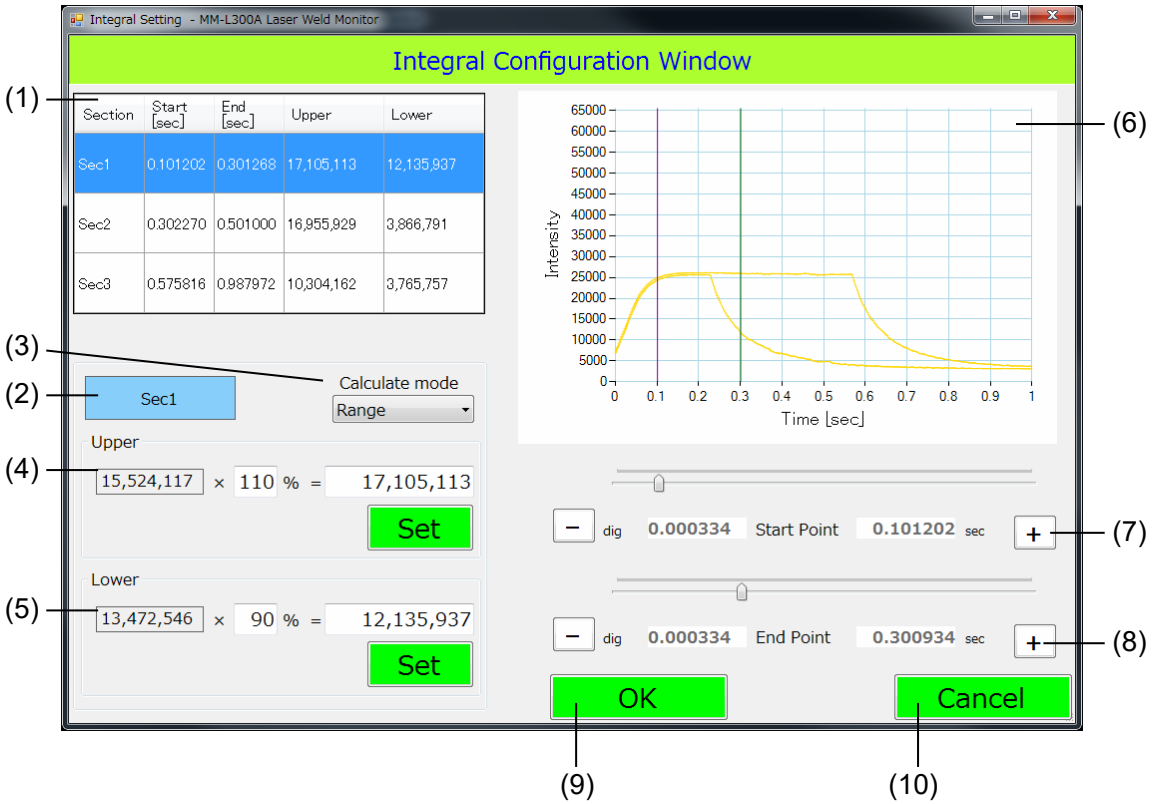


6. How to Operate the PC Software

(8) Integral Configuration Window

Click the [Integral] button on the Condition Configuration Window to display the Integral Configuration Window, and set conditions of integral judgment.

This function will be effective when the amplitude is large and it is difficult to perform a judgment only with the upper/lower limit judgment value.



No.	Item	Description
(1)	Section data list	The setting contents (start/end point, upper/lower limit setting value) of each setting section are displayed. Click the row of the section to set with a mouse to switch the setting section.
(2)	Setting section display	The currently effective setting section is displayed.
(3)	Calculate mode	Selects the upper/lower limit judgment value to display in the waveform display from Average, Range, and 3σ. The default is [Average].
(4)	Upper	On the left side, the integrated value of the upper limit judgment value of the mode selected for [Calculate mode] is displayed. When inputting a ratio of the setting value to the integrated value of the upper limit judgment value (0 to 999%), the judgment value is displayed on the right side. The judgment value can be input directly. When inputting directly, "---" is displayed in the column of ratio. When the [Set] button is clicked, the upper limit of the setting section in the section data list changes to the contents edited.

No.	Item	Description
(5)	Lower	On the left side, the integrated value of the lower limit judgment value of the mode selected for [Calculate mode] is displayed. When inputting a ratio of the setting value to the integrated value of the lower limit judgment value (0 to 999%), the judgment value is displayed on the right side. The judgment value can be input directly. When inputting directly, "---" is displayed in the column of ratio. When the [Set] button is clicked, the lower limit of the setting section in the section data list changes to the contents edited.
(6)	Waveform display	The integral reference waveform is displayed.
(7)	Start Point	Sets the point to start editing. Sets by slide bar or [+]/[-] button.
(8)	End Point	Sets the point end editing. Sets by slide bar or [+]/[-] button.
(9)	OK	Enables the contents edited in this window.
(10)	Cancel	Disables the contents edited in this window.

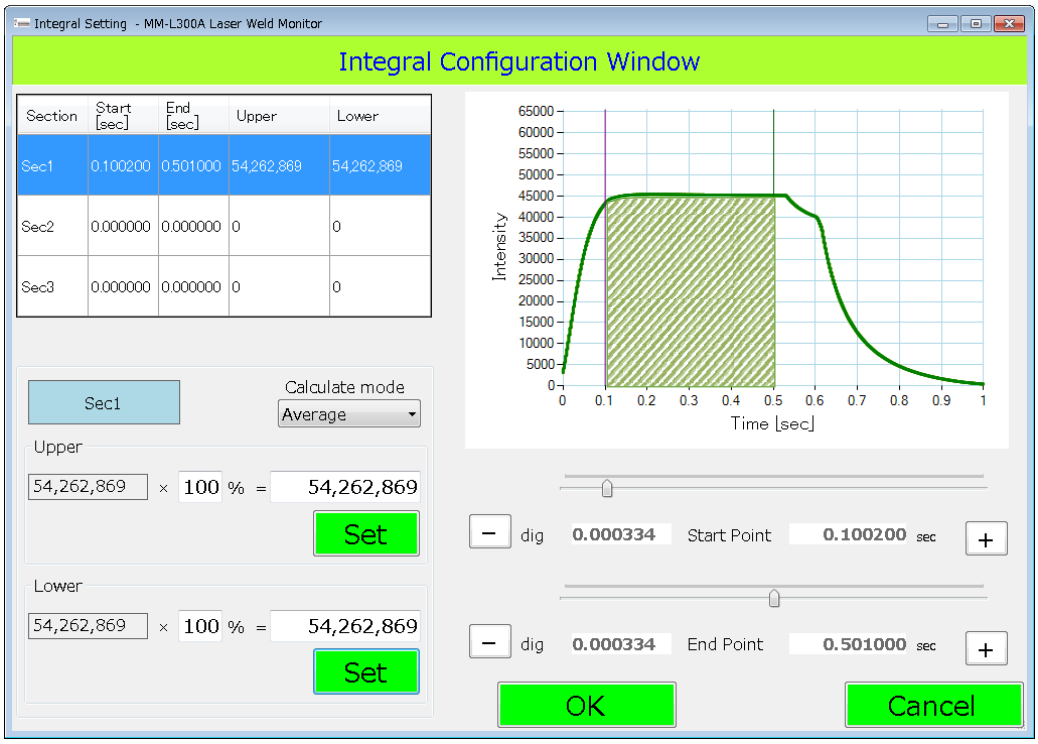
(1) Integral judgment

Set the section based on the reference waveform created on the Basis Waveform Calculation Window and perform the integral judgment. Even when the Skip times is set, it does not affect the integral judgment.

Calculate mode: Average

Since both upper and lower limit judgment values are reference waveform (data average value), values of upper limit and lower limit are equal.

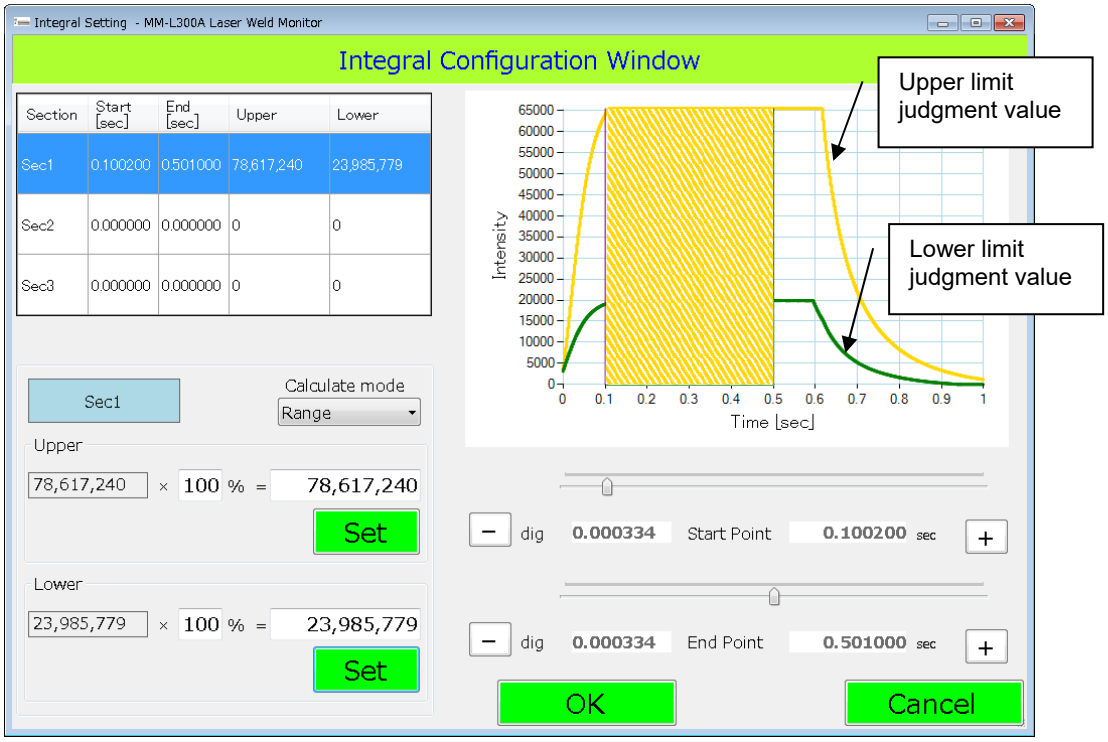
Example: The integrated value of upper/lower limits (green shaded area) in the section between 0.1002 s and 0.501 s is 54,262,869.



Calculate mode: Range

Since the upper limit judgment value is the maximum value of the selected data and the lower limit judgment value is the minimum value of the selected data, upper limit and lower limit are calculated in the set section respectively.

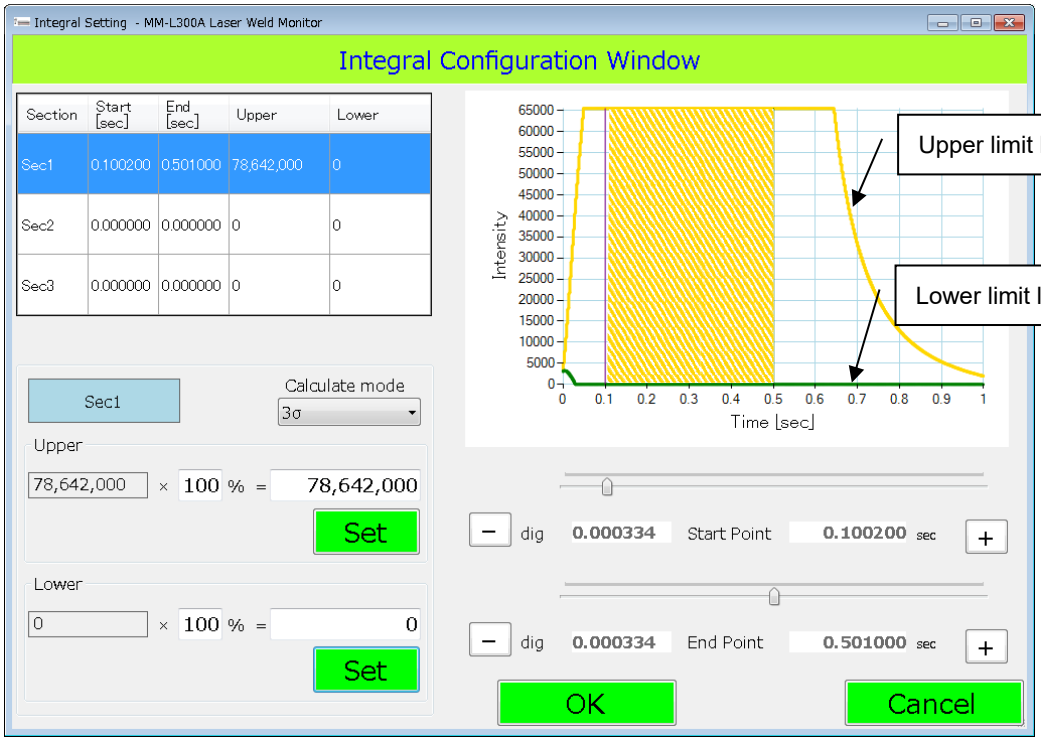
Example: The integrated value of upper limit (yellow shaded area) in the section between 0.1002 s and 0.501 s is 78,617,240, and the integrated value of lower limit (green shaded area) is 23,985,779.



Calculate mode: 3σ

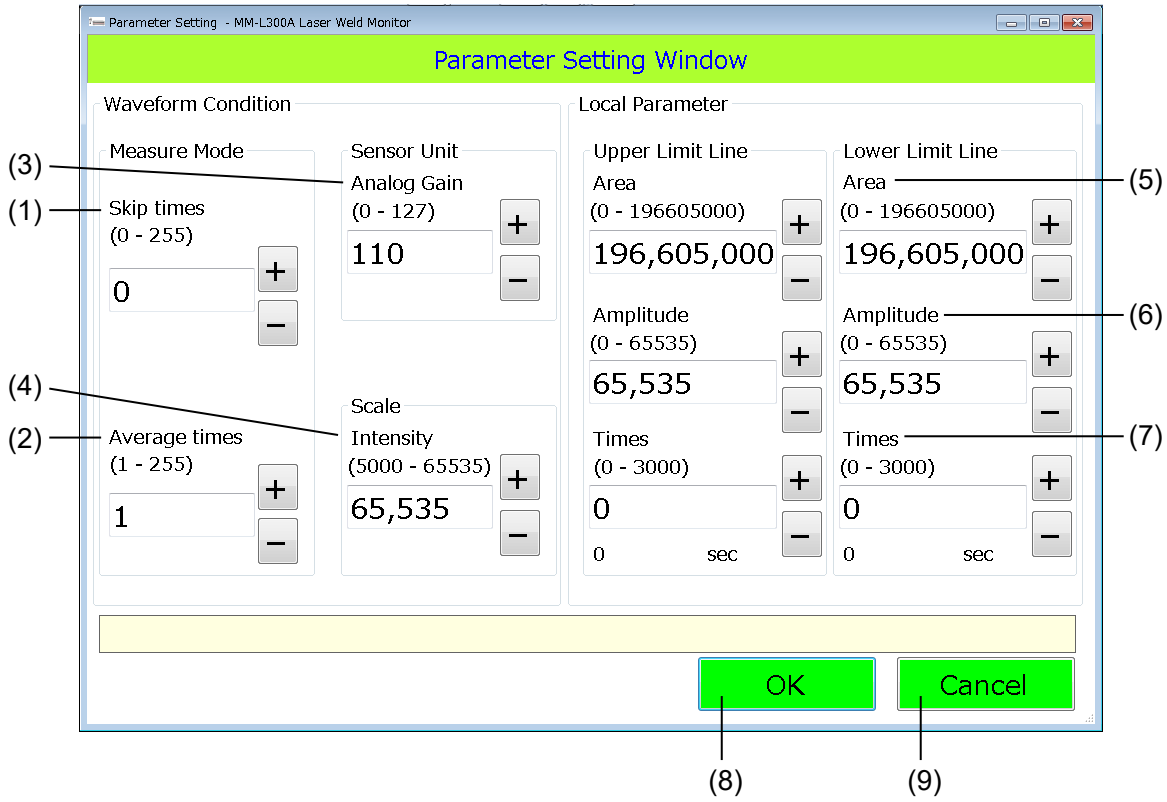
Since the upper limit judgment value is the +3σ value of the selected data and the lower limit judgment value is the -3σ value of the selected data, upper limit and lower limit are calculated in the set section respectively.

Example: The integrated value of upper limit (yellow shaded area) in the section between 0.1002 s and 0.501 s is 78,642,000, and the integrated value of lower limit (green shaded area) is 0.

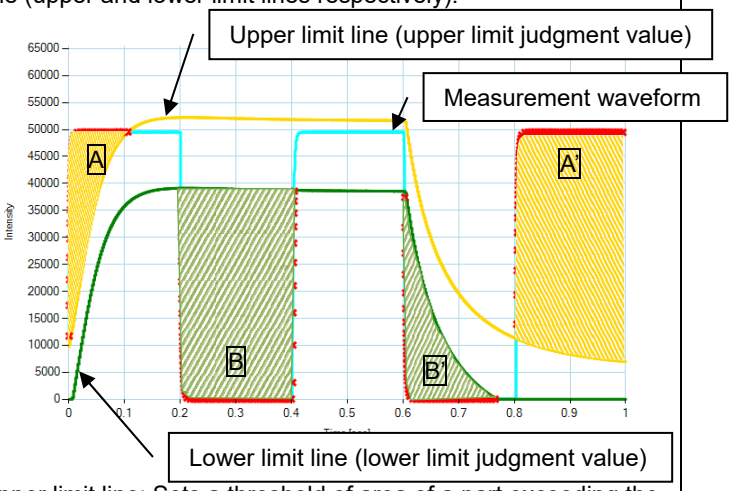

Integral Setting - MM-L300A Laser Weld Monitor
Integral Configuration Window
Section
Start [sec]
End [sec]
Upper
Lower
Sec1
0.100200
0.501000
78,642,000
0
Sec2
0.000000
0.000000
0
0
Sec3
0.000000
0.000000
0
0
Sec1
Calculate mode
3σ
Upper
78,642,000
× 100 % = 78,642,000
Set
Lower
0
× 100 % = 0
Set
Intensity
Time [sec]
Upper limit line
Lower limit line
dig 0.000334 Start Point 0.100200 sec
dig 0.000334 End Point 0.501000 sec
OK
Cancel

(9) Parameter Setting Window

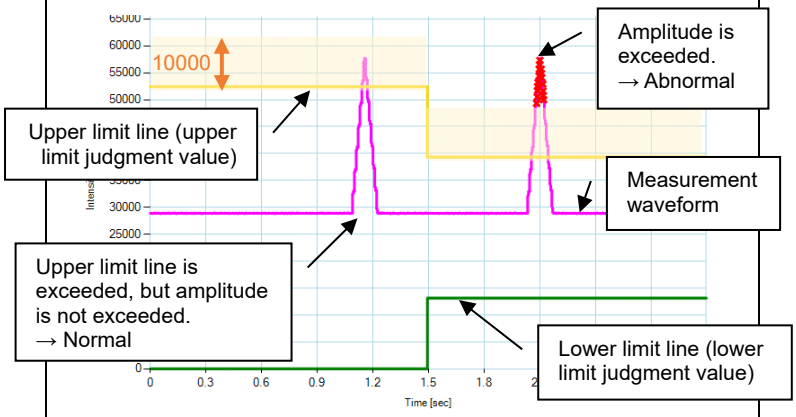
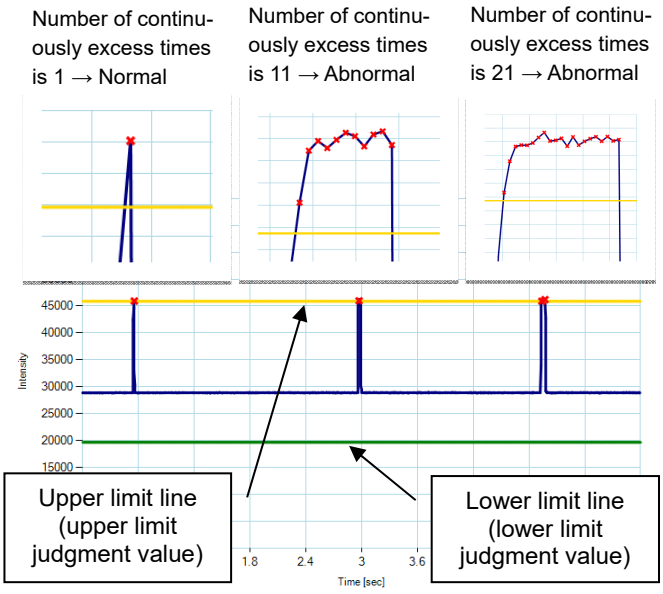
Click the [Parameter Setting] button on the Condition Configuration Window to display the Parameter Setting Window, and set the following parameters for each Condition Number.



No.	Item	Description
(1)	Skip times	Ignores comparison of waveforms during times specified here (0 to 255) x judgment cycle interval time*. Sets by ten-key input or [+]/[-] button. * The judgment cycle interval time is obtained by “time required for obtaining waveform ÷ 1000.” The minimum value of the judgment cycle interval time is 1 µsec, and when the calculation result above falls below 1 µsec, the judgment cycle interval time becomes 1 µsec.
(2)	Average times	Specifies the number of moving averages of the sampling data (1 to 255). Sets by ten-key input or [+]/[-] button. * The moving average is calculated after the trigger is applied internally or externally. Calculated as follows until the number of sampling times equals to the specified moving average or less: Specified number of moving average: N Intensity at each sampling point: p(1)p(2) ... p(N) Moving average data: a(1)a(2) ... a(N)a(N+1) a(1)=p(1)/N a(2)=(p(1)+p(2))/N a(N)=(p(1)+p(2)+ ... +p(N))/N a(N+1)=(p(2)+p(3)+ ... +p(N)+p(N+1))/N

<table>
<tr><th>No.</th><th>Item</th><th>Description</th></tr>
<tr><td></td><td>Average times
(continued from previous page)</td><td>Example) In case of 5 of moving average with p(1)=100, p(2)=200, p(3)=300, p(4)=400, and p(5)=500
<table>
<tr><th></th><th>a(1)</th><th>a(2)</th><th>a(3)</th><th>a(4)</th><th>a(5)</th></tr>
<tr><td>p(1)</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td></tr>
<tr><td>p(2)</td><td>-</td><td>200</td><td>200</td><td>200</td><td>200</td></tr>
<tr><td>p(3)</td><td>-</td><td>-</td><td>300</td><td>300</td><td>300</td></tr>
<tr><td>p(4)</td><td>-</td><td>-</td><td>-</td><td>400</td><td>400</td></tr>
<tr><td>p(5)</td><td>-</td><td>-</td><td>-</td><td>-</td><td>500</td></tr>
<tr><td>Each point value</td><td>20</td><td>60</td><td>120</td><td>200</td><td>300</td></tr>
</table></td></tr>
<tr><td>(3)</td><td>Analog Gain</td><td>Specifies gain value (0 to 127) of the SU-N300A/SG-N300A. Sets by ten-key input or [+]/[-] button.
For magnification conversion of gain value, refer to the gain characteristic table for the SU-N300A/SG-N300A.</td></tr>
<tr><td>(4)</td><td>Intensity</td><td>Sets the maximum value of the intensity axis of graph display (5000 to 65535). Sets by ten-key input or [+]/[-] button.</td></tr>
<tr><td>(5)</td><td>Area (*1)</td><td>Sets a threshold of the total area of a part where the measured value exceeds the upper limit line or falls below the lower limit line (upper and lower limit lines respectively).
 

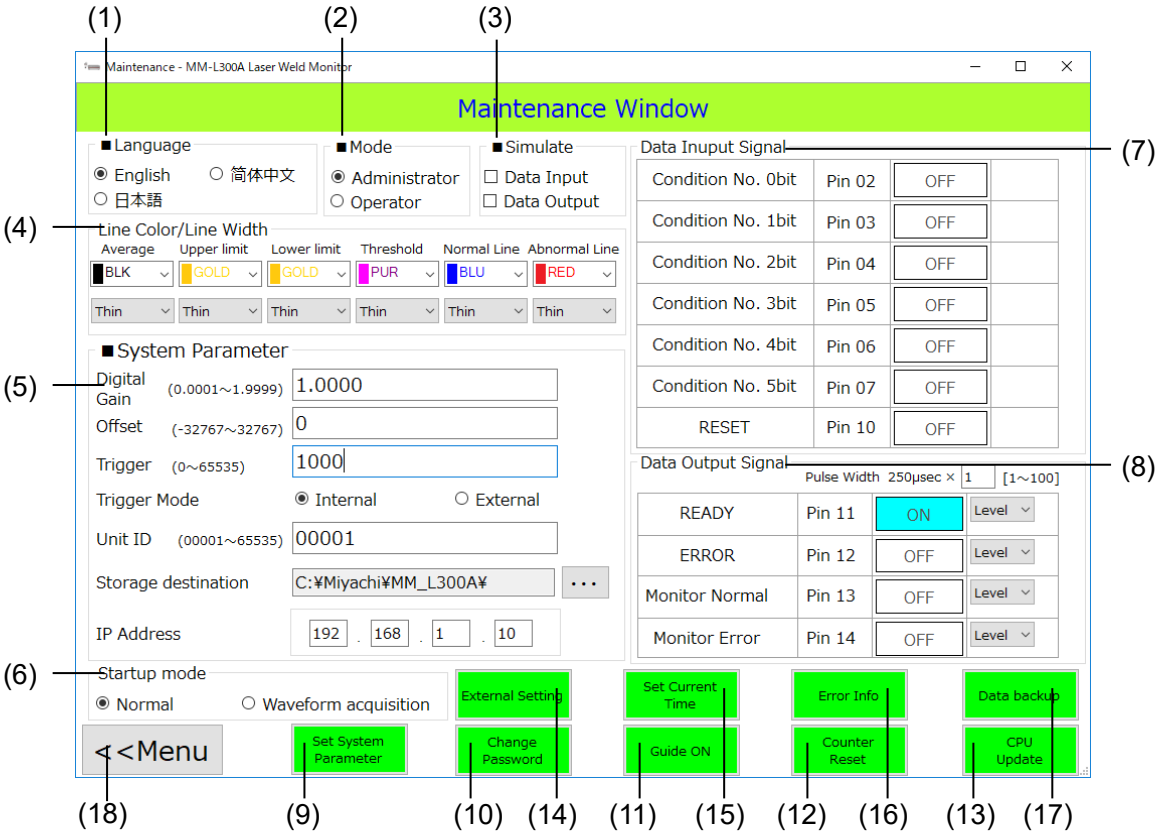
Upper limit line: Sets a threshold of area of a part exceeding the upper limit line (A+A'). When it is larger than the set value, the abnormality is judged.
Lower limit line: Sets a threshold of area of a part falling below the lower limit line (B+B'). When it is larger than the set value, the abnormality is judged.</td></tr>
</table>

No.	Item	Description
(6)	Amplitude (*1)	Sets a threshold of the intensity of a part where the measured value exceeds the upper limit line or falls below the lower limit line (upper and lower limit lines respectively). When 10000 is set for the upper limit line amplitude:  Upper limit line: Sets the width exceeding the upper limit line as a threshold. Unless this value is not exceeded, the abnormality is not judged even if the upper limit line is exceeded. When the upper limit line + the set value is exceeded, the abnormality is judged. Lower limit line: Sets the width falling below the lower limit line as a threshold. Unless this value is not fallen below, the abnormality is not judged even if the lower limit line is fallen below. When the lower limit line + the set value is fallen below, the abnormality is judged.
(7)	Times (*1)	Sets the threshold of the number of times that the measured value continuously exceeds the upper line or falls below the lower line (upper and lower limit lines respectively). When the upper line is continuously exceeded over or the lower limit line is continuously fallen below the set number of times, the abnormality is judged. When 10 is set for the upper limit line: 
(8)	OK	Enables the settings.
(9)	Cancel	Closes the Parameter Setting Window.

*1 Area, Amplitude and Times perform a judgment with the OR condition. Also, when the Skip times is set, they do not perform a judgment during the Skip times. Each judgment is performed when the Skip times is exceeded.

(10) Maintenance Window

To set conditions, click the [Maintenance] button on the Menu Window. The following Maintenance Window is displayed.



No.	Item	Description
(1)	Language	Selects language notation (Japanese, English, or Chinese). The selected language is reflected after restarting the PC software.
(2)	Mode	Selects the Administrator/Operator mode. When the Operator is selected, the [Condition Configuration] button on the Menu Window cannot be selected.
(3)	Simulate	Controls the input/output signal by this application.
(4)	Line Color / Line Width	Specifies the line color and width of each graph.

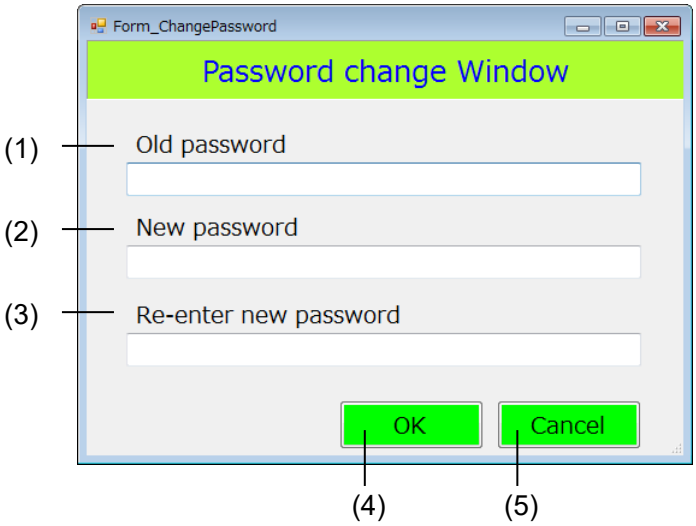
No.	Item	Description
(5)	System Parameter	Set followings: Digital Gain: Specifies the gain value of measurement waveform. Not reflected in the trigger and analog signals. Offset: Sets the offset value of measurement waveform. Not reflected in the trigger and analog signals. Trigger: Sets the measuring internal trigger value. When the near-infrared light exceeding the trigger value is detected at all times, waveforms are continuously obtained. Trigger Mode: Specifies the internal trigger (Internal) or external trigger (External). Unit ID: Sets the unit ID to measure with the **MM-L300A**. Storage destination: Specifies the measurement condition and the storage destination of the obtained waveform data. Click the [...] button to display the folder selection dialog and select the destination folder. IP Address: Sets the IP address of the **MM-L300A**.
(6)	Startup mode	Specify the application start mode. Normal: The Menu Window starts. Waveform acquisition: Moves to a state of obtaining waveforms when it is on-line at the time of startup.
(7)	Data Input Signal	The information on the EXT. I/O input is displayed.
(8)	Data Output Signal	The information on the EXT. I/O output is displayed. Sets the output system. The output system, which is level output (Level) or pulse output (Pulse), can be selected for every signal. When pulse output is selected, the pulse width can also be changed. The default is 250 μsec and can be specified at the integer multiple (up to 100 times).
(9)	Set System Parameter	Transfers the System Parameter data to the **MM-L300A**. When the transfer is completed, the confirmation message appears.
(10)	Change Password	Changes the password. (Refer to **(1) Password change**.) The password is requested when [Maintenance] on the Menu Window is clicked in the Operator mode.
(11)	Guide ON	Switches ON/OFF of the guide light when the **SU-N300A** is connected. The guide light is not turned on when the **SG-N300A** is connected.
(12)	Counter Reset	Resets the number of waveform data obtained after the **MM-L300A** is turned on. The number of waveform data is displayed on the Acquire Wave Data Window.
(13)	CPU Update	Updates the CPU software of the **MM-L300A**. (Refer to **(2) Updating of the CPU software**.)
(14)	External Setting	Displays the setting window to receive commands by connecting the personal computer which is running this application and the external control device with the LAN cable. (Refer to **(3) External device communication**.)
(15)	Set Current Time	Transfers the current time (system time of the personal computer) to the **MM-L300A**. When replacing the personal computer, be sure to transfer the current time to the **MM-L300A**.

No.	Item	Description
(16)	Error Info	The contents of error can be checked when an error occurs in the **MM-L300A**. (Refer to **(4) Error information**.)
(17)	Data backup	Performs backup and restoration of data saved in the memory of the **MM-L300A**. (Refer to **(5) Data backup**.)
(18)	Menu	Moves to the Menu Window.

Note) [Digital Gain], [Offset], [Trigger], [Trigger Mode], and [Unit ID] of System Parameter, and output system of output information can be set only at the time of on-line. Cannot be set at the time of off-line. At the time of off-line, [Set Current Time], [Guide ON], [Error Info], [Counter Reset], [Data backup], and [CPU Update] are not displayed.

(1) Password change

The password is requested when [Maintenance] on the Menu Window is clicked in Operator mode. The password can be changed on the following window. The password is displayed by [*]. (Default of password: None)

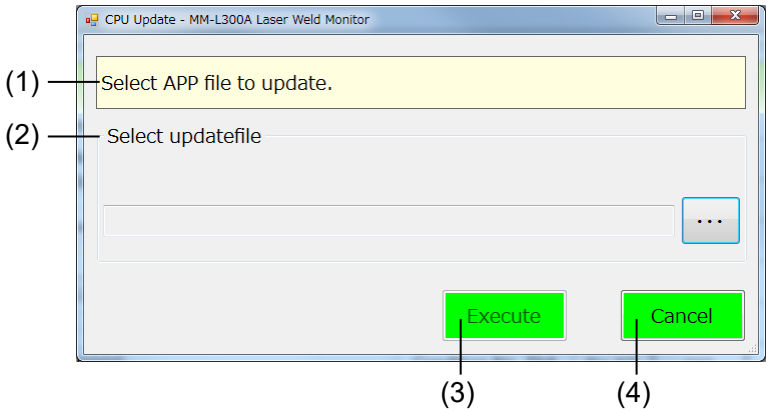


No.	Item	Description
(1)	Old password	Inputs the previous password. (1 to 16 half em alphanumeric characters)
(2)	New password	Inputs password to change. (1 to 16 half em alphanumeric characters)
(3)	Re-enter new password	Inputs password again to change. (1 to 16 half em alphanumeric characters)
(4)	OK	Makes a password change.
(5)	Cancel	Cancels the input.

(2) Updating of the CPU software

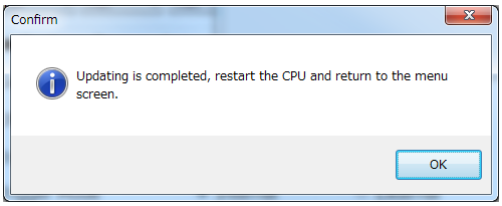
With this application, the CPU software of the **MM-L300A** can be updated. However, this function is valid only when the version of the CPU software is V00-01C to V00-01G. For updating, the APP file provided by us is required.

Click the [CPU Update] button on the Maintenance Window to display the CPU Update window.



No.	Item	Description
(1)	Navigate window	Operate in accordance with the message in this window.
(2)	Select update file	Click ··· button to select the APP file to update.
(3)	Execute	Updates the CPU.
(4)	Cancel	Closes the window without updating.

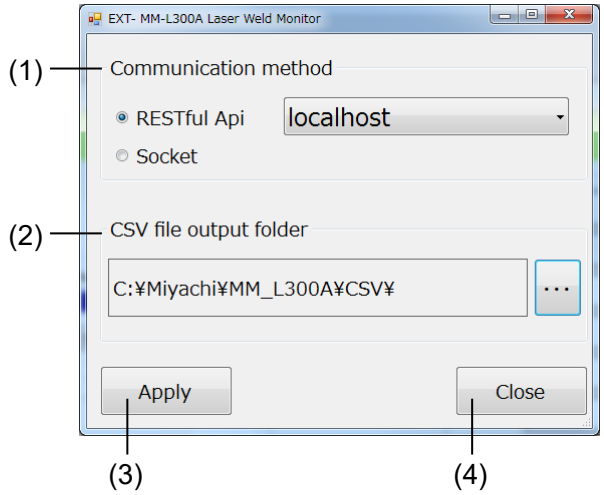
* When completing the updating of the CPU, the following message appears. When the [OK] button is clicked, the **MM-L300A** returns to the Menu Window to restart the CPU and enters off-line state. When it enters on-line again, the CPU version on the Menu Window changes to the updated version.



(3) External device communication

To use the external communication function, click the [External Setting] button on the Maintenance Window to open the setting window, and make communication settings.

For details of the external device communication, refer to **6. (11) External Device Communication**.

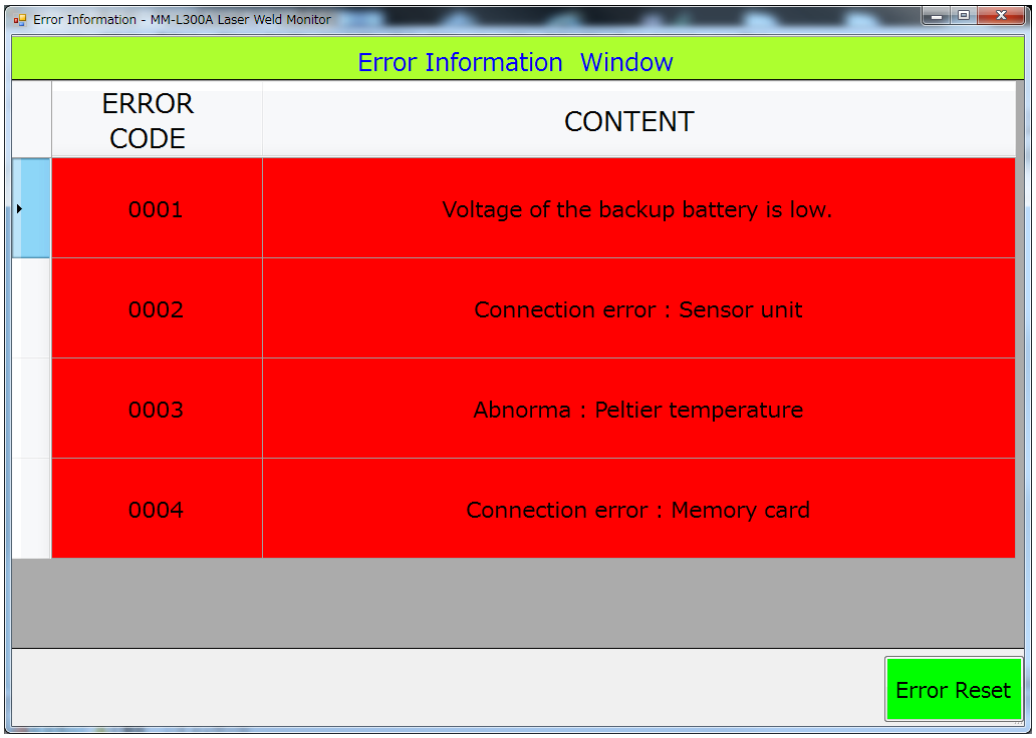


No.	Item	Description
(1)	Communication method	Select RESTful Api or socket communication. For RESTful Api, also select the IP address.
(2)	CSV file output folder	Specifies the folder to output the CSV file.
(3)	Apply	Saves the set contents and applies it. The **MM-L300A** starts with saved contents at the next start-up.
(4)	Close	Closes the window.

(4) Error information

When an error occurs in the **MM-L300A** (ERROR lamp lights up), click the [Error Info] button to display the error contents.

All errors occurring are displayed as shown below.

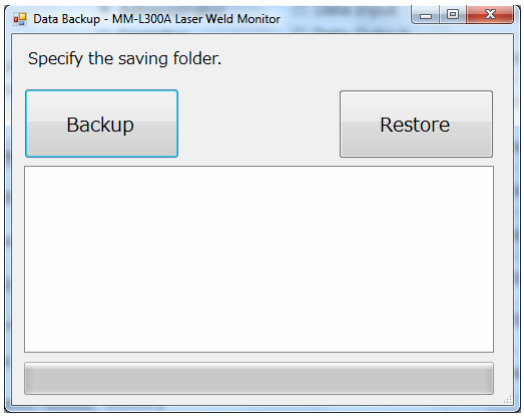


* Depending on the ambient operating temperature, the error code No. 0003 Peltier temperature error may occur immediately after the **MM-L300A** starts. When the **MM-L300A** is normal, it is released by clicking the [Error Reset] button after about 10 seconds.
Other error code Nos. are not released until the **MM-L300A** is turned off and the abnormal factor is eliminated.

(5) Data backup

Data saved in the memory card on the **MM-L300A** can be saved in any folder on your computer.

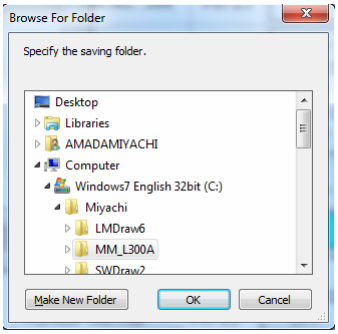
Click the [Data backup] button on the Maintenance Window. The Data Backup window is displayed.



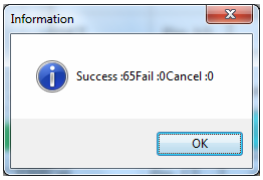
1) Data backup

Click the [Backup] button.

Specify the destination folder and click the [OK] button.



A folder of a name showing year, month, day, hour, minute, and second is created under the specified folder, and data is saved.
When backup is completed, the following message appears.

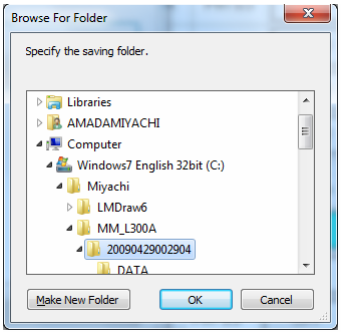


When the [OK] button is clicked, the Menu Window is displayed.

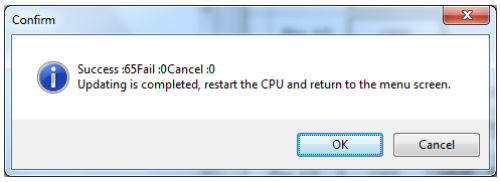
2) Data restoration

To restore the data saved in a folder on your computer to the **MM-L300A**, click the [Restore] button.

Specify the folder that data was saved.



When the [OK] button is clicked, data restoration is started.
When restoration is completed, the following message appears.



When the [OK] button is clicked, the Menu Window is displayed. The **MM-L300A** restarts automatically and the restored data is enabled.

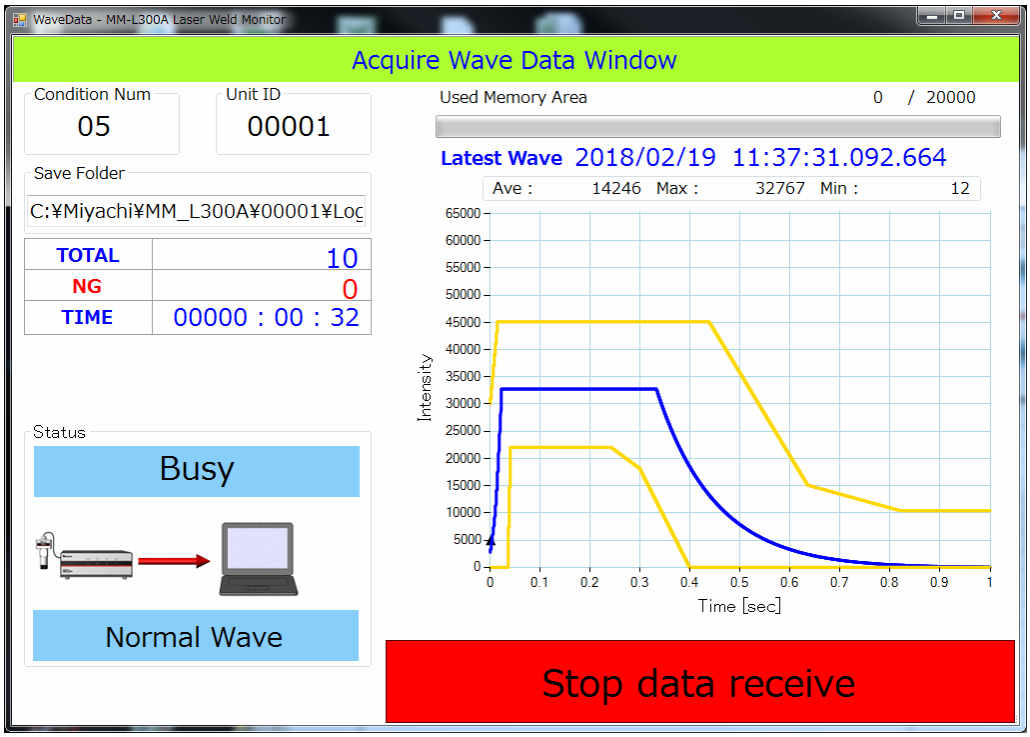
When the [Cancel] button is selected, turn off and on the power to the **MM-L300A** to enable the restored data.

(11) External Device Communication

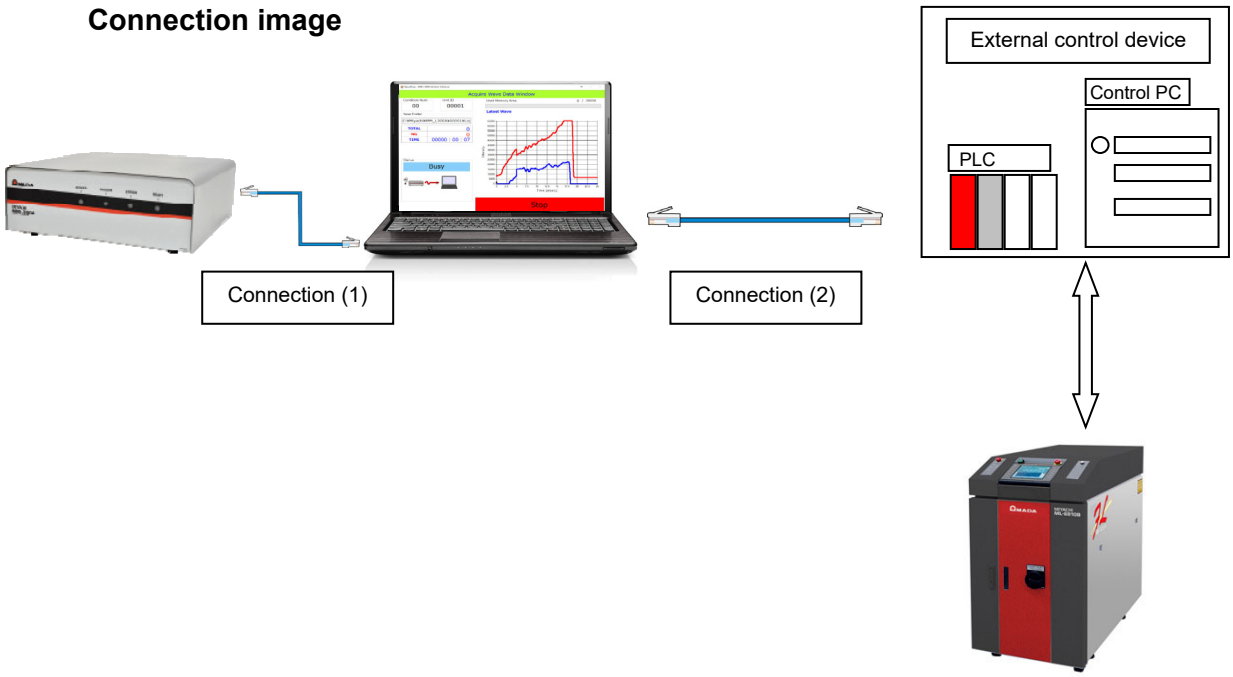
In the external device communication, by connecting the external device (personal computer, PLC) and the personal computer on which this application runs with a LAN cable, the waveform data in the period specified by the external control device can be saved in the specified CSV file and the average integrated value can be obtained.

* Up to 10,000 waveforms. When the number of waveforms exceeds 10,000, the oldest waveform data is sequentially overwritten.

* Only when waveform data is being received on the Acquire Wave Data Window, a command (request) can be received.

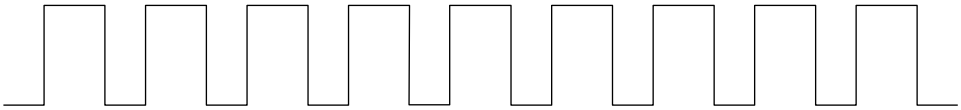


Connection image

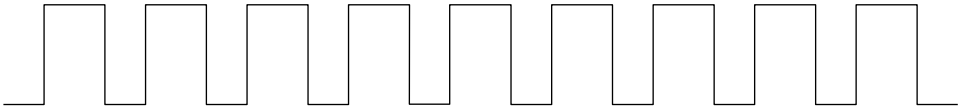


Waveform-obtaining image

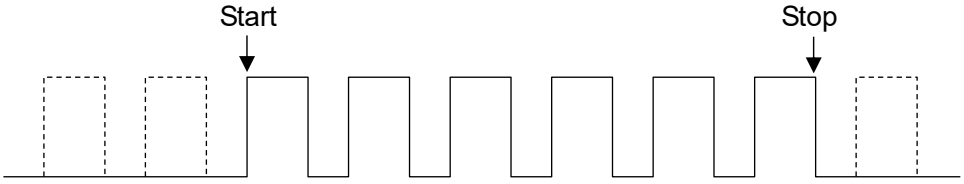
・Actual signal



・Obtaining by this application
All waveforms are transferred.



・Obtaining by the external device communication
The section for obtaining waveforms is specified. Waveforms obtained between start and stop can be output in CSV and the average integrated value can be obtained.



(1) RESTful Api communication specification

To transmit and receive commands by the RESTful Api communication, perform communication with the following specifications.

Port number: 80
Content-Type: application/json

1) Waveform-obtaining section start

Method: POST

Request URL: http://***.***.***.***/wave/ (***.***.***.***: IP address selected in the external device communication setting.)

BODY: "START"

Response: Successful: {"Return": "SUCCESS"}
Failed: {"Return": "FAIL"}

Processing contents: Instructs the start of waveform-obtaining section. When waveform data is not being received on the Acquire Wave Data Window, FAIL is returned.

2) Waveform-obtaining section stop

Method: POST

Request URL: http://***.***.***.***/wave/ (***.***.***.***: IP address selected in the external device communication setting.)

BODY: "STOP"

Response: Successful: {"Return": "SUCCESS"}
Failed: {"Return": "FAIL"}

Processing contents: Instructs the stop of waveform-obtaining section. When waveform data is not being received on the Acquire Wave Data Window and the waveform-obtaining section start command is invalid, FAIL is returned.

3) CSV file output

Method: POST

Request URL: http://***.***.***.***/wave/ (***.***.***.***: IP address selected in the external device communication setting.)

BODY: "CSV,xxxxxx" (xxxxxx: filename)

Response: Successful: {"Return": "SUCCESS"}
Failed: {"Return": "FAIL"}

Processing contents: Saves waveform data obtained between the start and stop of waveform-obtaining section in the CSV file.

By putting comma and filename after CSV in BODY, the filename of the CSV file to output can be specified. A filename is up to 16 characters. When the filename is not specified, year, month, date, hour, minute, and second when a command is received becomes filename. (yyyymmddhhmmss)

When waveform data is not being received on the Acquire Wave Data Window, FAIL is returned. When the specified filename already exists in the specified folder, it is overwritten. When the specified filename is under writing or opened in other editors, FAIL is returned.

4) Average output of integrated value

Method: GET

Request URL: http://***.***.***.***/wave/average.json (***.***.***.***: IP address selected in the external device communication setting.)

Response: Successful: {"Return": "xxxxx"} (xxxxx is an integer and an average value is returned.)
Failed: {"Return": "FAIL"}

Processing contents: Obtains the average integrated value of waveform data obtained between the start and stop of waveform-obtaining sections. When waveform data is not being received on the Acquire Wave Data Window, FAIL is returned.

(2) Socket communication specification

Responds to commands from the external devices using this application software as a socket server.

A transmission sentence consists of the following combinations.

Command sentence, parameter CR

A transmission sentence is represented in ASCII code and a comma (",") is used to separate command from parameter. A carriage return is added at the end of the sentence.

Port number: 5001

A reply sentence is represented in ASCII code and a carriage return is added at the end of the sentence.

1) Waveform-obtaining section start

Command: "START"

Parameter: None

Response: Successful: "SUCCESS"
Failed: "FAIL"

Processing contents: Instructs the start of waveform-obtaining section. When waveform data is not being received on the Acquire Wave Data Window, FAIL is returned.

2) Waveform-obtaining section stop

Command: "STOP"

Parameter: None

Response: Successful: "SUCCESS"
Failed: "FAIL"

Processing contents: Instructs the stop of waveform-obtaining section. When waveform data is not being received on the Acquire Wave Data Window and the waveform-obtaining section start command is invalid, FAIL is returned.

3) CSV file output

Command: "CSV"

Parameter: "xxxxxx" (xxxxxx: filename)

Response: Successful: "SUCCESS"
Failed: "FAIL"

Processing contents: Saves waveform data obtained between the start and stop of waveform-obtaining sections in the CSV file.

By putting comma and filename after CSV in BODY, the filename of the CSV file to output can be specified. A filename is up to 16 characters. When the filename is not specified, year, month, date, hour, minute, and second when a command is received becomes filename. (yyyymmddhhmmss)

When waveform data is not being received on the Acquire Wave Data Window, FAIL is returned. When the specified filename already exists in the specified folder, it is overwritten. When the specified filename is under writing or opened in other editors, FAIL is returned.

4) Average output of integrated value

Command: "AVERAGE"

Response: Successful: "xxxxx" (xxxxx is an integer and an average value is returned.)
Failed: "FAIL"

Processing contents: Obtains the average integrated value of waveform data obtained between the start and stop of waveform-obtaining section. When waveform data is not being received on the Acquire Wave Data Window, FAIL is returned.

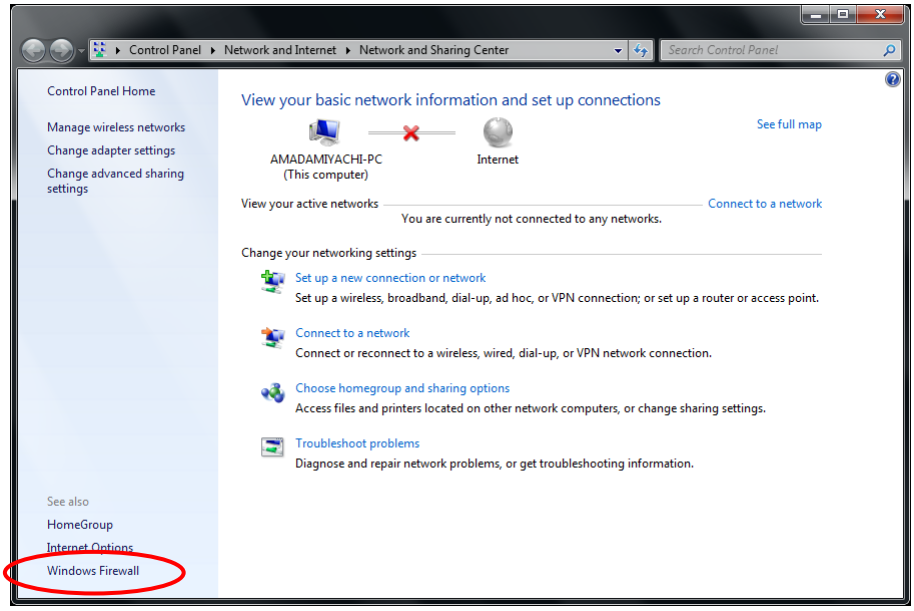
(3) Example of execution procedure

1) Start this application software.
2) Move to the Acquire Wave Data Window to start obtaining waveforms.
3) Issue the “START” command from the external control device.
4) Start laser welding.
5) End laser welding.
6) Issue the “STOP” command from the external control device.
7) Issue the “AVERAGE” command from the external control device.
8) Issue the “CSV” command from the external control device.

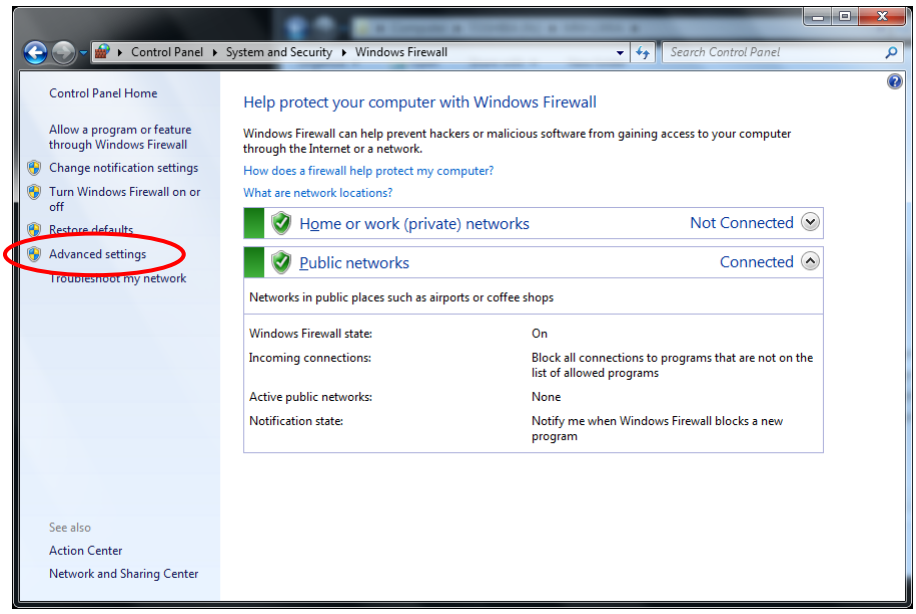
(4) Windows firewall setting

When the Windows firewall is enabled, make the following settings to allow this application.

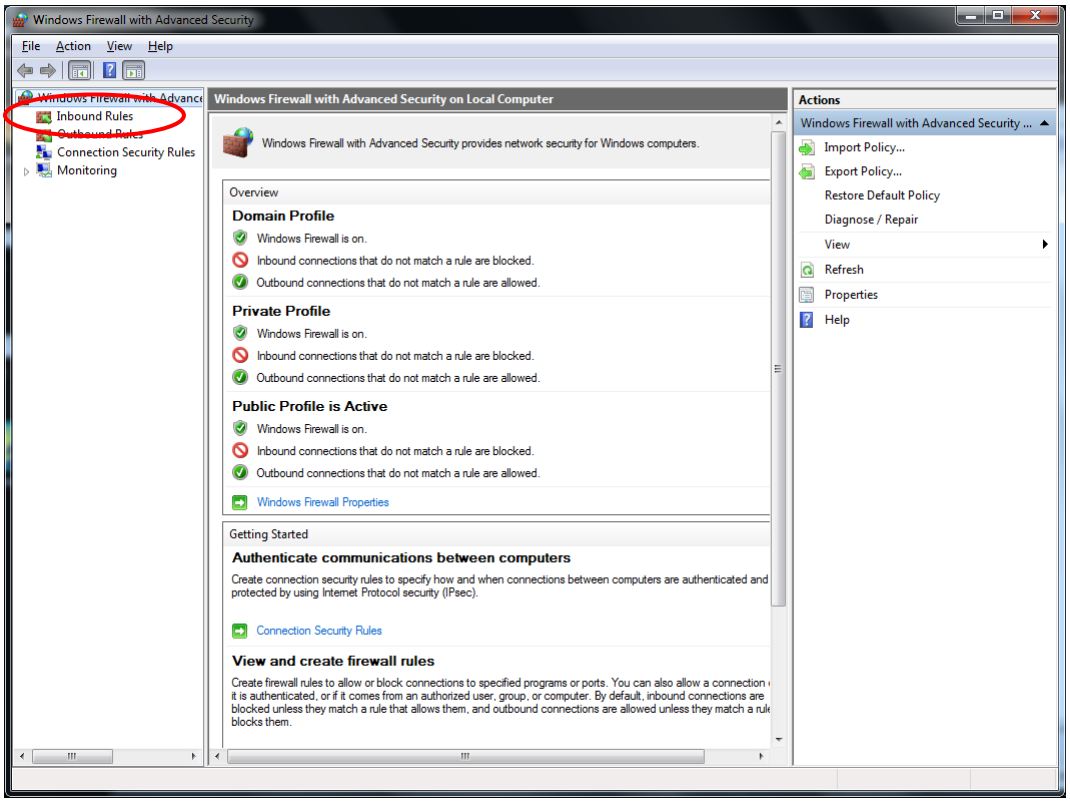
- Setting procedure of the RESTful Api communication
  1) From the Network and Sharing Center, click [Windows Firewall].



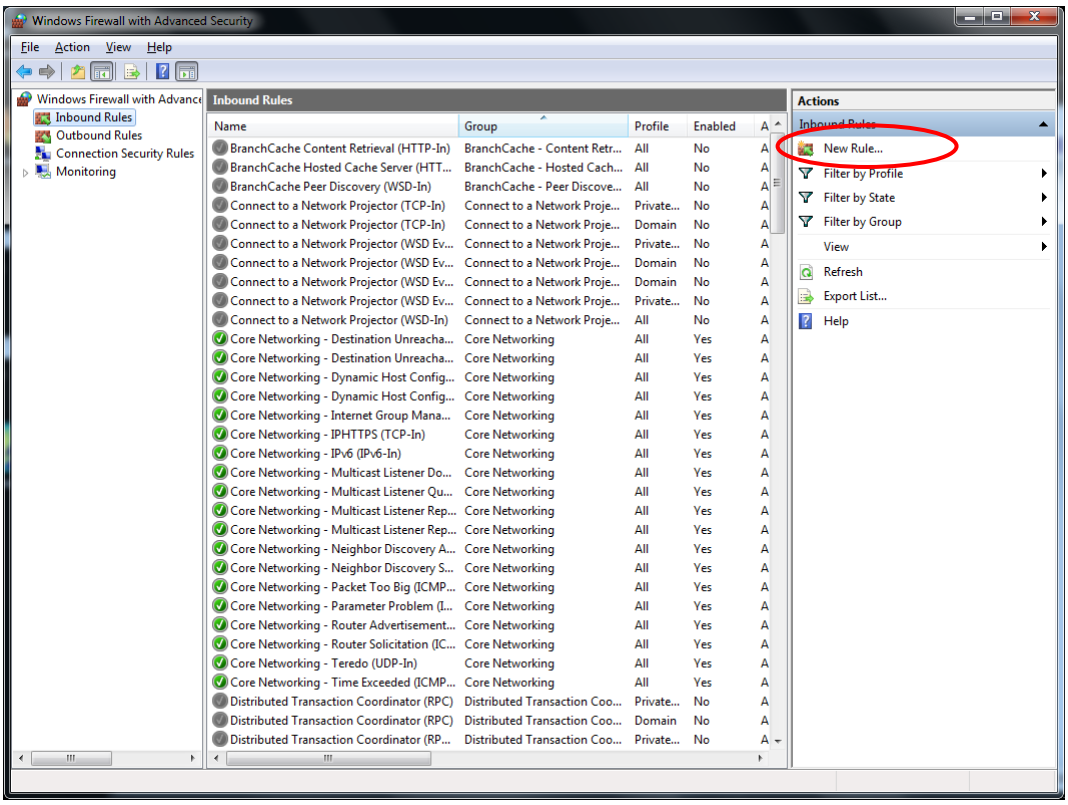
2) Click [Advanced settings].



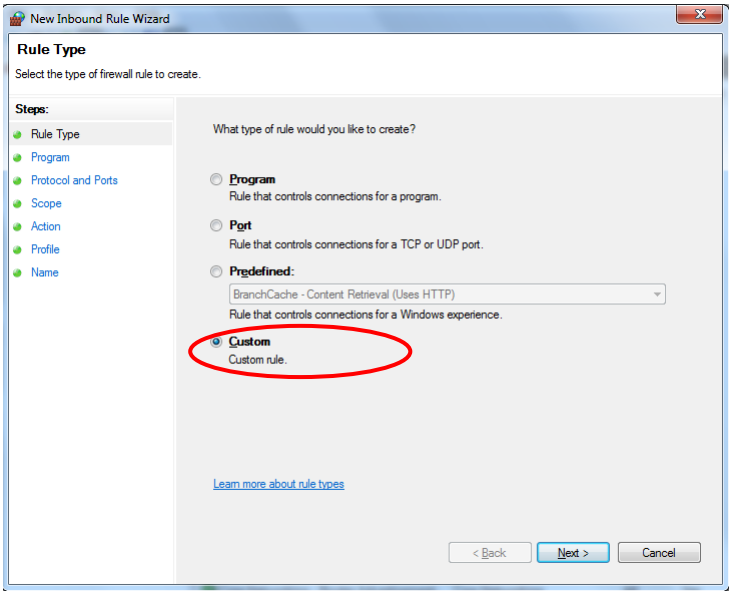
3) Click [Inbound Rules].



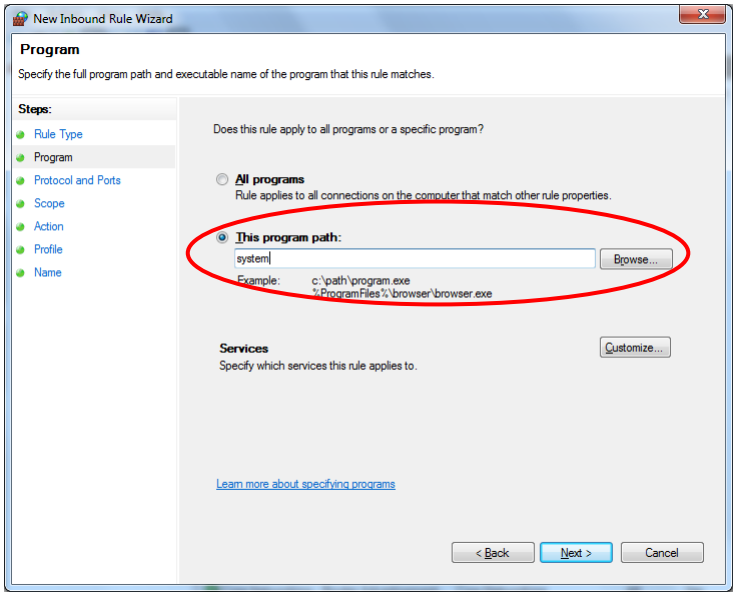
4) Click [New Rule].



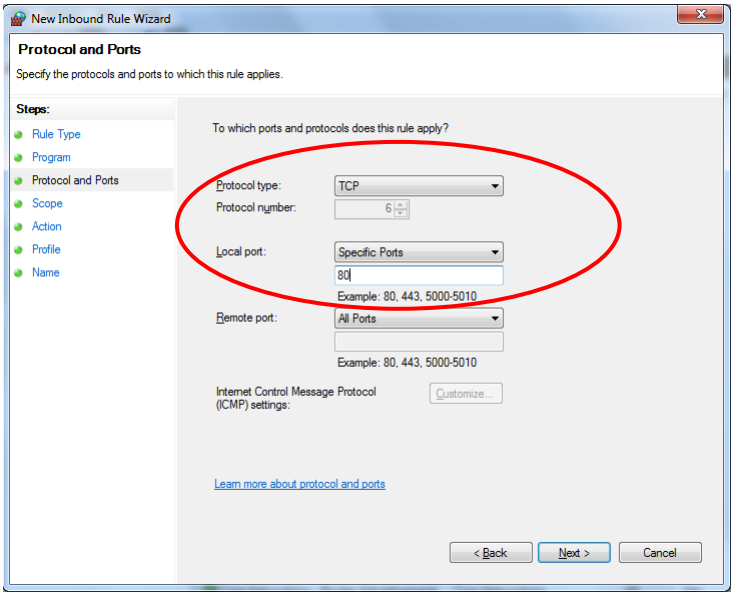
5) Select [Custom] and click the [Next >] button.



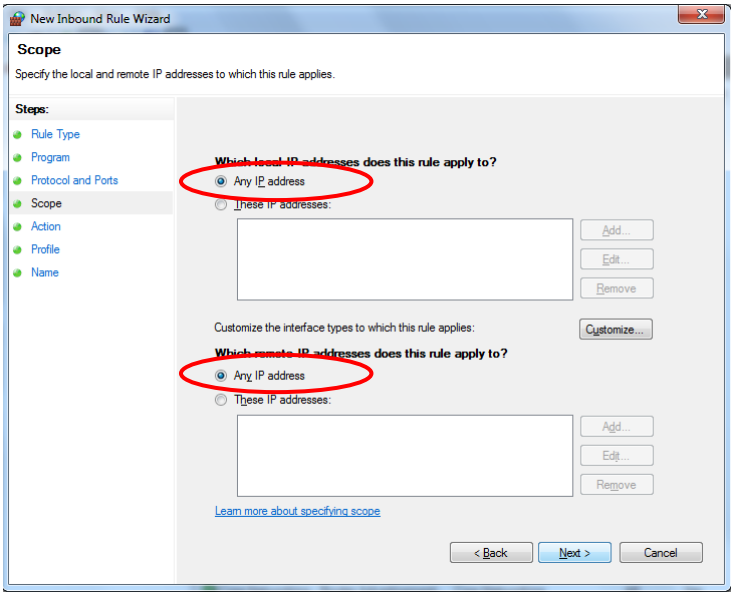
6) Input "system" in [This program path] and click the [Next >] button.



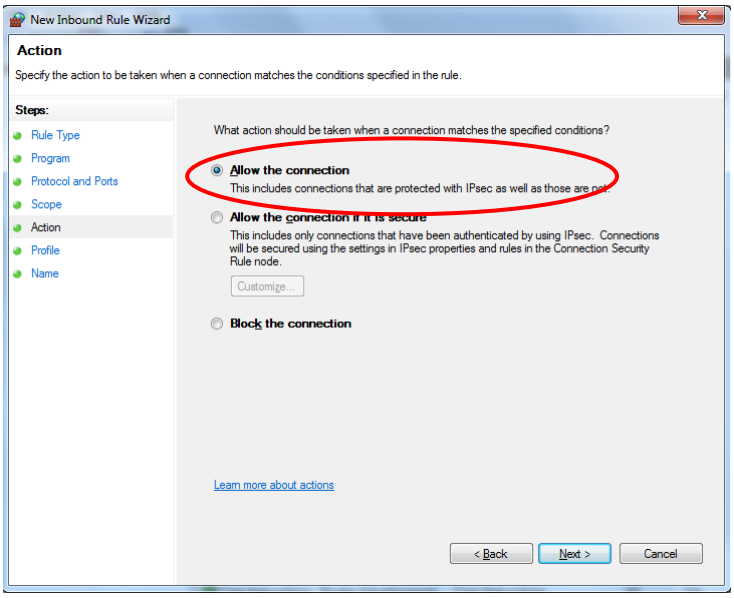
7) Select TCP in [Protocol type], select Specific Ports in [Local port], input “80”, and then click the [Next >] button.



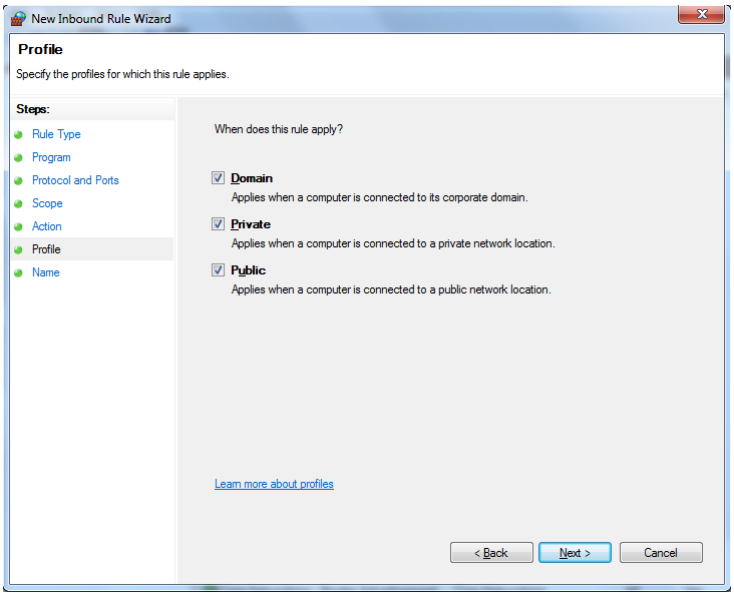
8) Select [Any IP address] and [Any IP address], and click the [Next >] button.



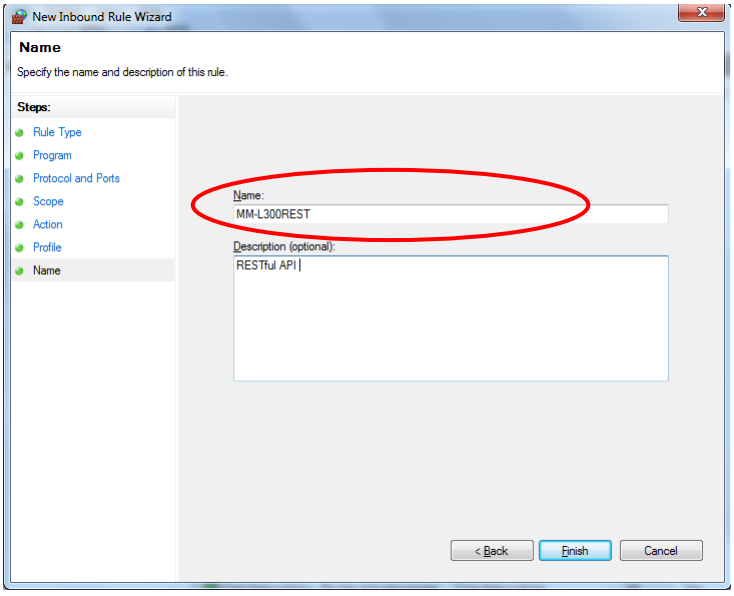
9) Select [Allow the connection] and click the [Next >] button.



10) Select [Domain], [Private] and [Public], and click the [Next >] button.

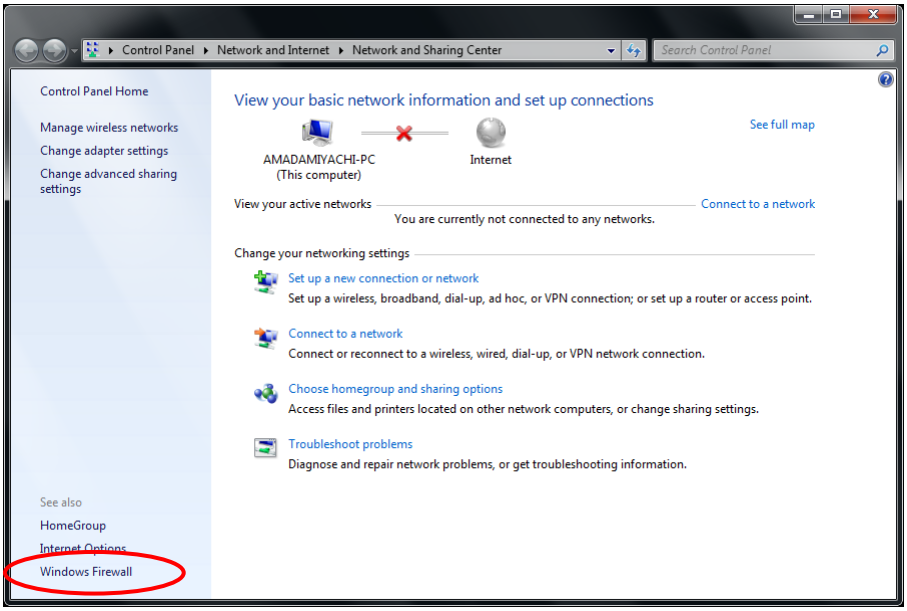


11) Enter an arbitrary name and click the [Finish] button.

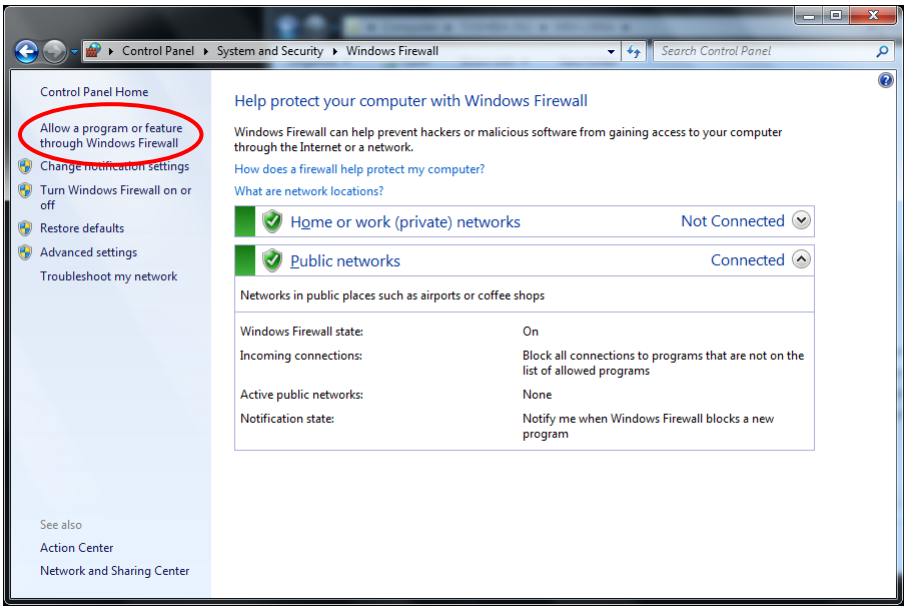


• Setting procedure of the socket communication

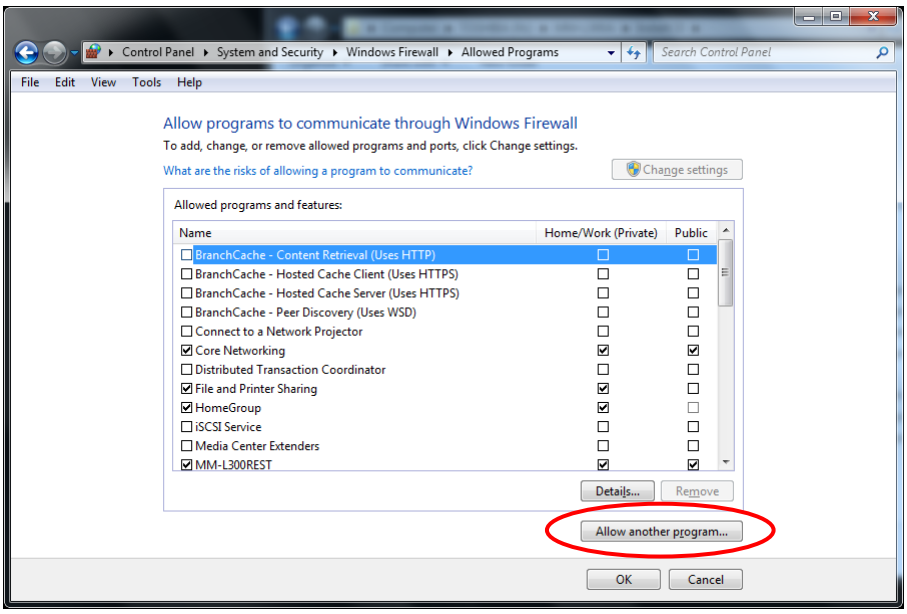
1) From the Network and Sharing Center, click [Windows Firewall].



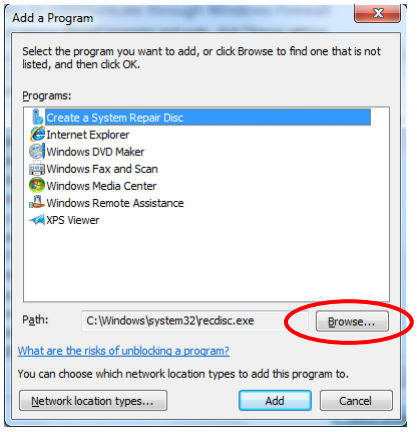
2) Click [Allow a program or feature through Windows Firewall].



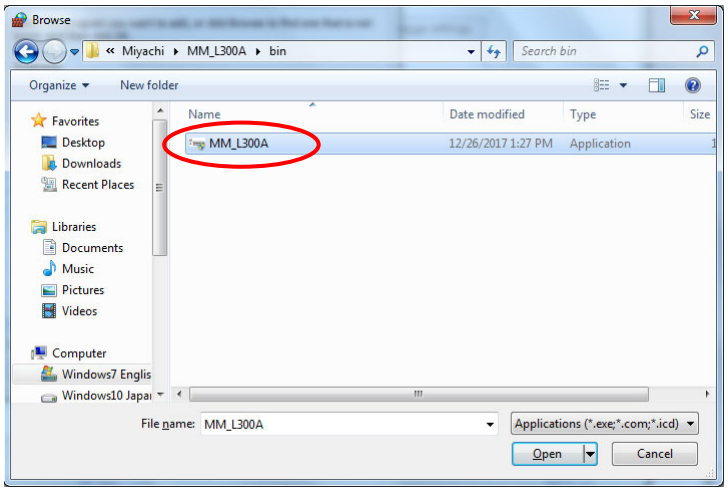
3) Click the [Allow another program] button.



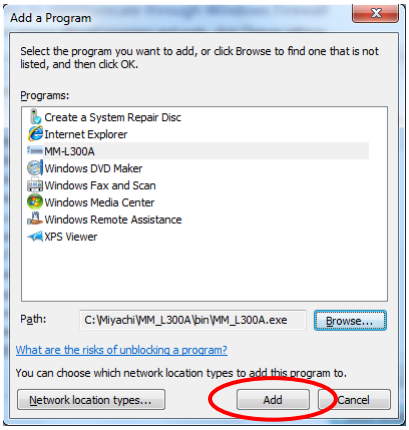
4) Click the [Browse] button.



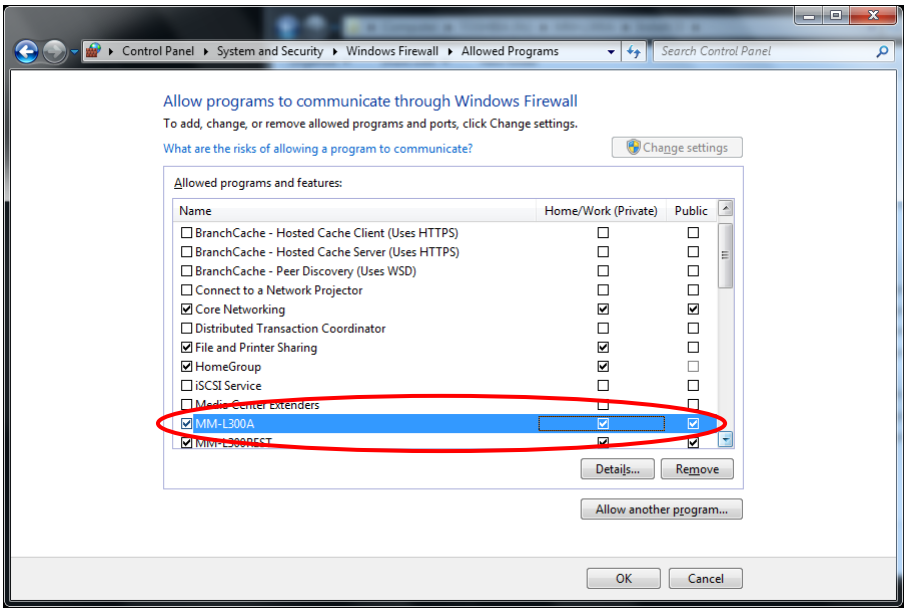
5) Select [MM_L300A.exe] from the installation destination of this application.



6) Click the [Add] button.



7) Enables [Home/Work (Private)] and [Public].



(12) Setting Parameters List

Shown below is parameters list set on each window.

- Menu Window

Item	Contents	Range (default)
Condition Number	Specifies the condition number.	00 to 63 (00)

- Acquire Wave Data Window

Item	Contents	Range (default)
-	-	-

- Condition Select Window

Item	Contents	Range (default)
Unit ID	Specifies the ID of the **MM-L300A**. (can be set at the time of off-line.)	00001 to 65535 (ID specified on the Maintenance Window)

- Condition Configuration Window

Item	Contents	Range (default)
Measurement Time	Specifies the time required for obtaining a waveform.	1 to 999 (300)
	Specifies the unit of the time required for obtaining a waveform.	usec, msec, sec (msec) *1
Comment	Specifies the name of condition.	-
Upper Limit	Specifies the upper limit of judgment.	-100 to 100 (50) *2
Lower Limit	Specifies the lower limit of judgment.	-100 to 100 (-50) *2
Threshold	Specifies the judgment threshold.	0 to 65535 (0)
Edit Start Point	Specifies the start point of judgment.	0 to 999
Edit End Point	Specifies the end point of judgment.	0 to 999

*1 Up to 999 sec.
*2 Default value in an unregistered state. Default in calculation is (0).

- Basis Waveform Calculation Window

Item	Contents	Range (default)
Waveform selection menu	Selects / selects all / deselects all measurement waveform(s).	Select, Select All *1, Deselect All (Deselect All)
Waveform display	The selected waveform is displayed by the [Graph] button.	1 to 100 *2 (0)
Display start number	Specifies the start number to display the measurement waveform.	1 to the number found by filtering conditional search *1 (1)

*1 The maximum number of measurement waveforms is 65535.
*2 The maximum number of waveforms to be graphically displayed is up to 100. Also, in [Select All], waveform of a page displayed is displayed by switching the page.

• Filter Window

Item	Contents	Range (default)
Start date	Specifies the start date to filter.	2000.1.1 to 2099.12.31 (current date)
Start time	Specifies the start time to filter.	00:00:00 to 23:59:59 (00:00:00)
End date	Specifies the end date to filter.	2000.1.1 to 2099.12.31 (current date)
End time	Specifies the end time to filter.	00:00:00 to 23:59:59 (23:59:59)
Condition	Specifies the condition number to filter.	ALL, No.00 to No.63 (ALL)
Measurement Time	Specifies the time required for obtaining waveform to filter.	1 to 999
	Specifies the unit of the time required for obtaining a waveform.	ALL, usec, msec, sec (ALL)
Status	Specifies the status of waveform to filter.	ALL, Normal, Abnormal (ALL)
Limit judge	Specifies the upper/lower limit judgment result of waveform to filter.	ALL, Abnormal, UpperOver, LowerOver, RangeOver (ALL)
Search condition	Specifies a search condition of waveform to filter.	AND, OR (AND)
Integral section1 judge	Specifies the integral section 1 judgment condition of waveform to filter.	ALL [Not covered] *1, Abnormal, UpperOver, LowerOver (ALL)
Integral section2 judge	Specifies the integral section 2 judgment condition of waveform to filter.	ALL [Not covered] *1, Abnormal, UpperOver, LowerOver (ALL)
Integral section3 judge	Specifies the integral section 3 judgment condition of waveform to filter.	ALL [Not covered] *1, Abnormal, UpperOver, LowerOver (ALL)
Area judge	Specifies the area judgment condition of waveform to filter.	ALL [Not covered] *1, Abnormal, UpperOver, LowerOver, RangeOver (ALL)
Amplitude judge	Specifies the amplitude judgment condition of waveform to filter.	ALL [Not covered] *1, Abnormal, UpperOver, LowerOver, RangeOver (ALL)
Times judge	Specifies the times judgment condition of waveform to filter.	ALL [Not covered] *1, Abnormal, UpperOver, LowerOver, RangeOver (ALL)

*1 ALL is selected when the Search condition is AND, and Not covered is selected when it is OR.

• Integral Configuration Window

Item	Contents	Range (default)
Calculate mode	Specifies the calculation mode of the reference waveform to set.	Average, Range, 3σ (Average)
Upper	Specifies the upper limit of the integral judgment threshold of the specified section.	0 to 4294967295
Lower	Specifies the lower limit of the integral judgment threshold of the specified section.	0 to 4294967295

• Parameter Setting Window

Item	Contents	Range (default)
Skip times	Specifies the judgment ignoring number of obtained waveforms.	0 to 255 (0)
Average times	Specifies the number of moving averages.	1 to 255 (1)
Analog Gain	Specifies the gain value of the **SU-N300A/SG-N300A**.	0 to 127 (110)
Scale	Sets the maximum value of the intensity axis of the graph display.	5000 to 65535 (65535)
Area (Upper Limit Line and Lower Limit Line)	Sets a threshold of the total area of a part where the measured value exceeds the upper line or falls below the lower limit line.	0 to number of valid data x 65535 (number of valid data x 65535)
Amplitude (Upper Limit Line and Lower Limit Line)	Sets a threshold of the intensity of a part where the measured value exceeds the upper line or falls below the lower limit line.	0 to 65535 (65535)
Times (Upper Limit Line and Lower Limit Line)	Sets a threshold of the number of times that the measured value continuously exceeds the upper line or falls below the lower limit line.	0 to number of valid data (0)

• Maintenance Window

Item	Contents	Range (default)
Digital Gain	Specifies the gain value of the measurement waveform	0.0001 to 1.9999 (1.0000)
Offset	Sets the offset value of the measurement waveform.	-32767 to 32767 (0)
Trigger	Sets the measuring internal trigger value.	0 to 65535 (65535)
Trigger Mode	Specifies the trigger to use.	Internal, External (Internal)
Unit ID	Sets the unit ID to measure with the **MM-L300A**.	00001 to 65535 (00001)
Storage Destination	Sets the data storage destination.	(destination of installation)
IP Address	Specifies the IP address of the **MM-L300A**.	Connection IP address (192.168.1.10)
Pulse Width	Sets the pulse width when the pulse output is selected for Data Output Signal. The default is 250 μsec and specified at the integer multiple.	1 to 100 (1)

- Password change Window

Item	Contents	Range (default)
Old password	Specifies the previous password.	1 to 16 half em alphanumeric characters (None)
New password	Specifies the password to change.	1 to 16 half em alphanumeric characters
Re-enter new password	Specifies the password to change.	1 to 16 half em alphanumeric characters

- Password input Window

Item	Contents	Range (default)
Please enter the password	Specifies the password.	1 to 16 half em alphanumeric characters

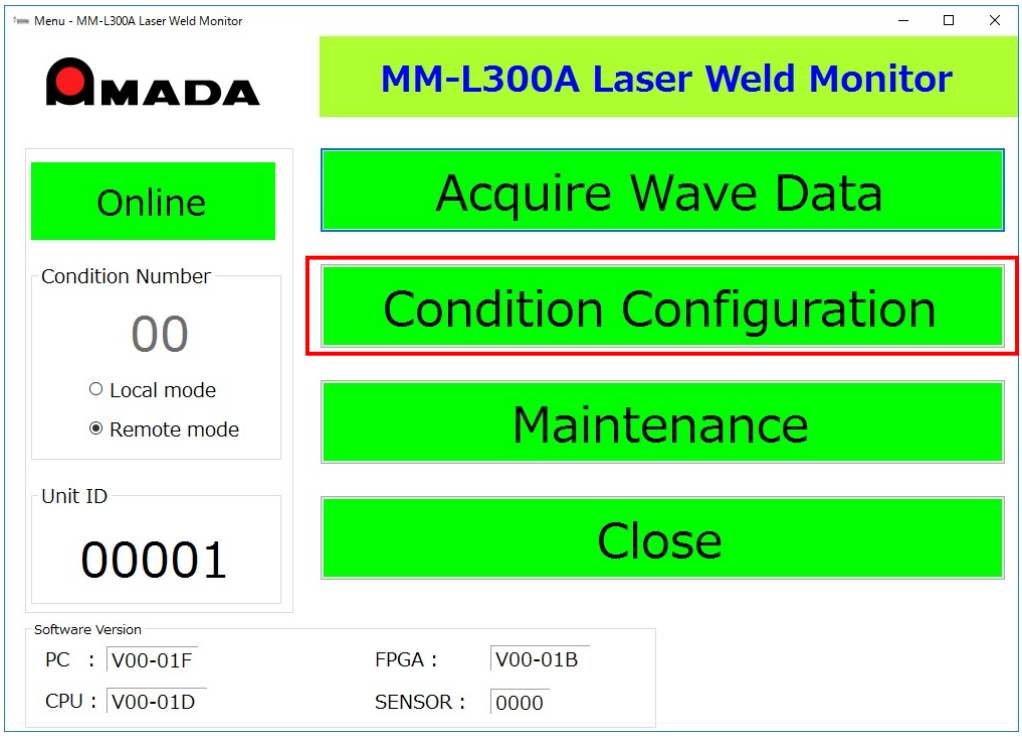
7. Basic Operation

(1) Setting Conditions

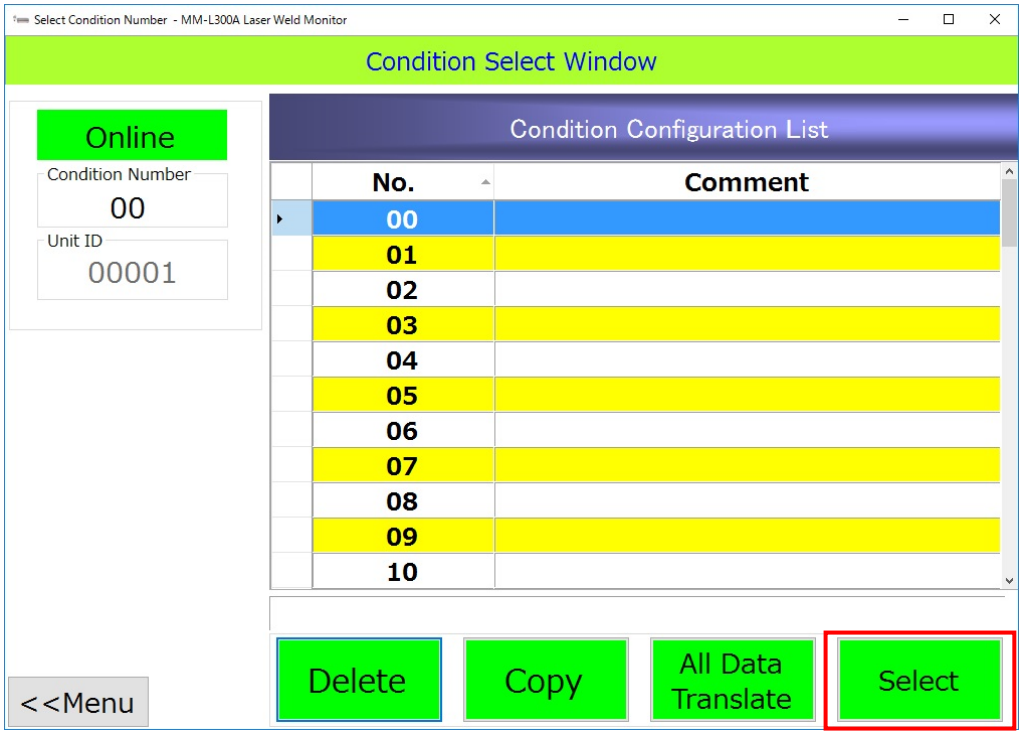
This section describes how to obtain waveforms with the **MM-L300A**.

> **⚠ CAUTION**
>
> - Read cautions for each item in the operation manual carefully to use the instrument properly.

1) Install the **MM-L300A** and peripheral equipment. (Refer to **5. Connecting Equipment**.)
2) Turn on the power switch provided on the rear of the **MM-L300A** and confirm that the POWER lamp of the display panel on the front lights up.
3) Turn on the personal computer in which the PC software of the **MM-L300A** is installed. Click **MM-L300A** from the program menu of the personal computer or desktop icon to start the Menu Window. (Refer to **6. (2) (1) Start procedure**.)
4) Click the [Condition Configuration] button on the Menu Window.



5) Select the condition number to set conditions by clicking from the Condition Configuration List and click the [Select] button or double-click the condition number to set.



6) Set the measurement time of waveform on the Condition Configuration Window.
For the measurement time, set a time longer than the desired laser irradiation time.
The waveform trends of each sensor unit are shown below.

- **SU-N300A**:
  When the time at least 100 times as long as the laser irradiation time is set, the sampling cycle becomes large and waveforms obtained from the **MM-L300A** become likely to be varied. (Refer to examples on the next page.)

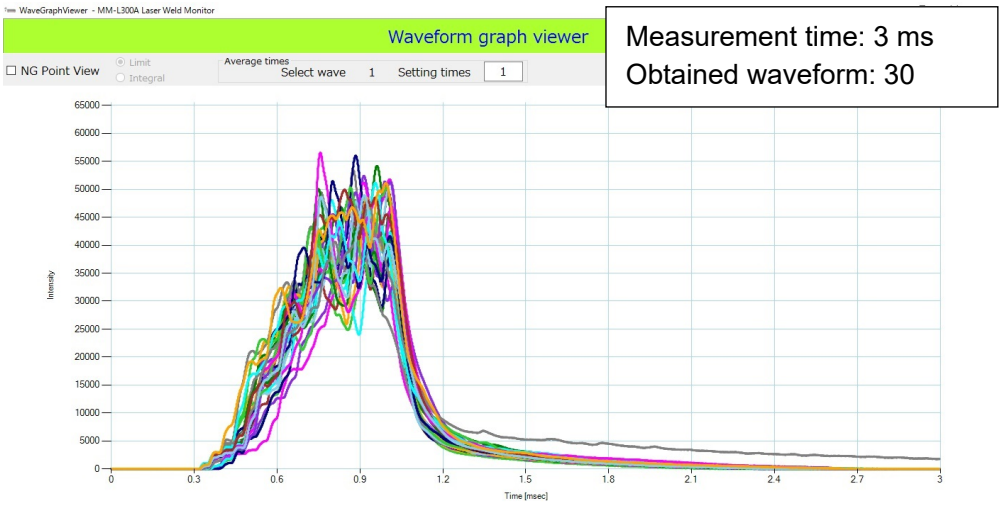
(Example) Waveform resolution when the measurement time is set to 100 times

Laser irradiation time	Measurement time	Sampling cycle *
0.1 ms	10 ms	4 µs
1 ms	100 ms	34 µs
10 ms	1 s	334 µs
100 ms	10 s	3.334 ms
1 s	100 s	33.334 ms

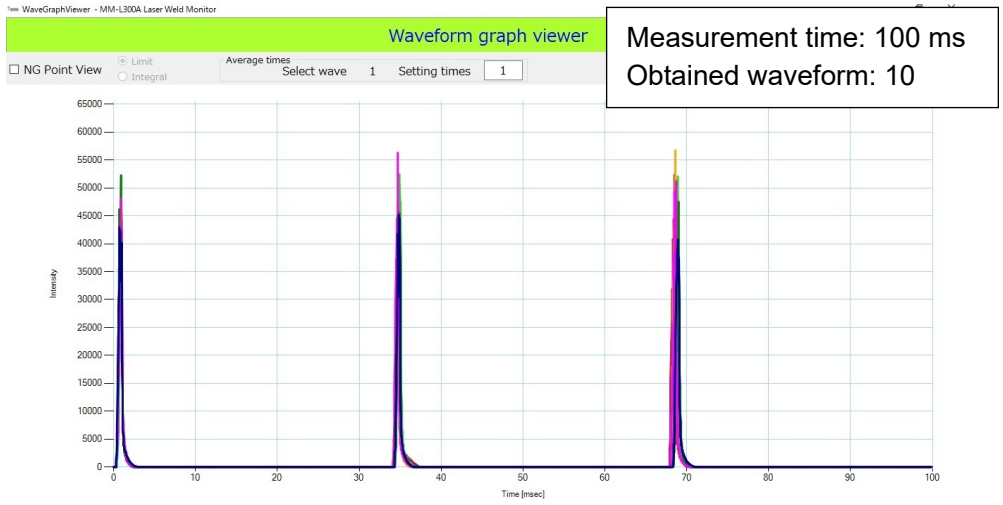
* When the measurement time is input, the sampling cycle is calculated automatically and displayed in the item of the sampling cycle under the measurement time.

(Example) When obtaining 30 shots of 1-ms laser irradiation with 3 ms, 100 ms, and 1 s of the measurement time

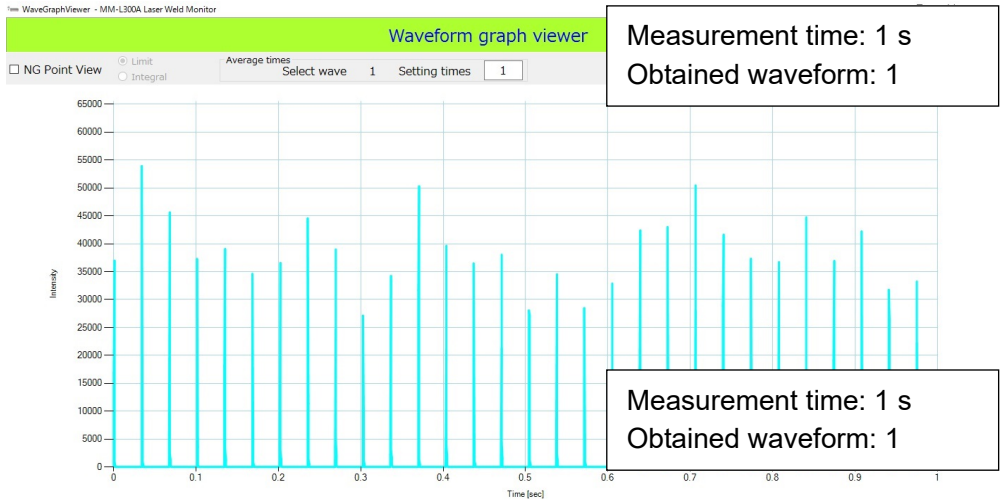
Comparison of the maximum values of each laser irradiation for 30 shots



Measurement time: 3 ms
Obtained waveform: 30



Measurement time: 100 ms
Obtained waveform: 10



Measurement time: 1 s
Obtained waveform: 1

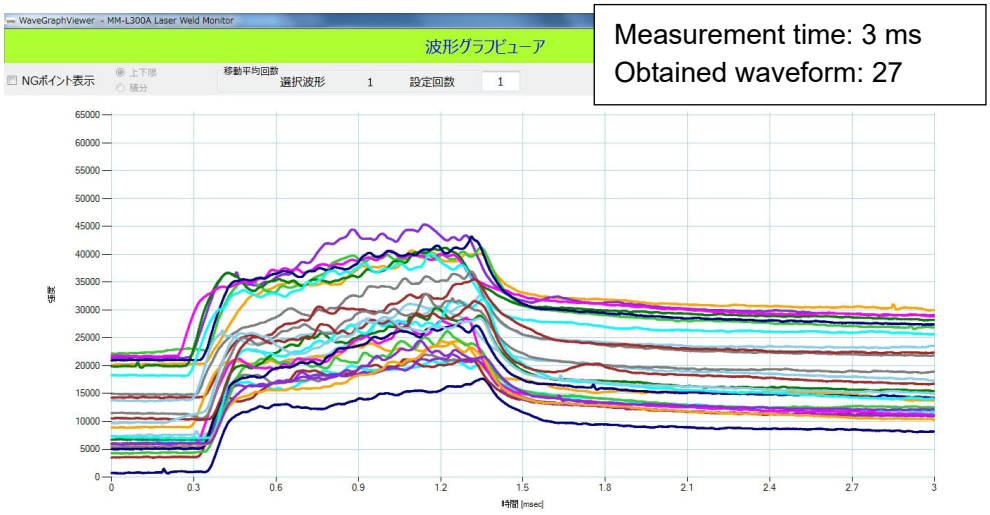
Measurement time: 1 s
Obtained waveform: 1

Measurement time (Waveform resolution)	Resolution	Max. value	Average value	Min. value	Standard deviation
3 ms (1 µs)	High	56569	49289.73	39603	3706.12
100 ms (334 µs)	↕	56736	46995.93	38241	4558.27
1 s (33.334 ms)	Low	53922	38591.43	27118	6375.41

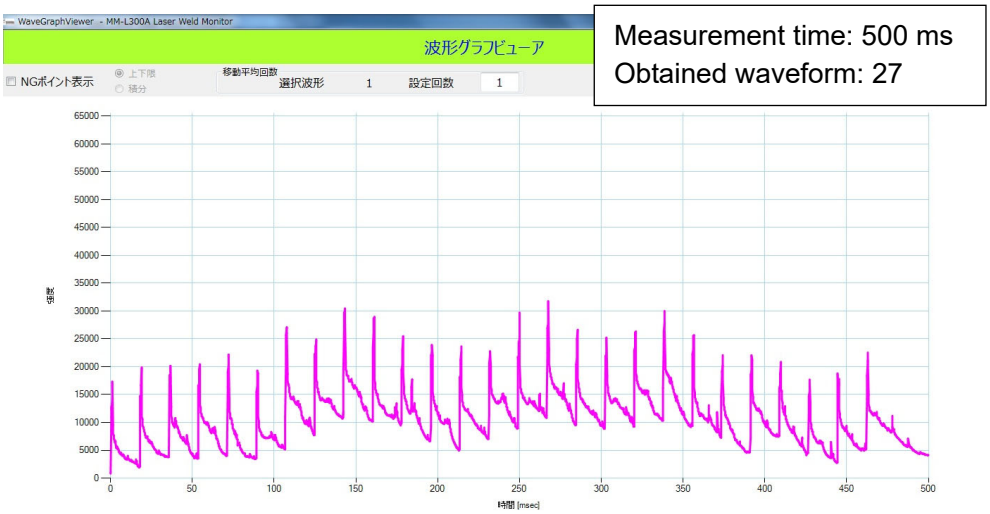
- **SG-N300A**:
  Same as the **SU-N300A**, when the time at least 100 times as long as the laser irradiation time is set, the sampling cycle becomes large and waveforms obtained from the **MM-L300A** become likely to be varied. However, is more affected by spatter than the **SU-N300A**. (Refer to examples below.)

(Example) When obtaining 27 shots of 1-ms laser irradiation with 3 ms and 500 ms of the measurement time

Comparison of the maximum values of each laser irradiation for 27 shots



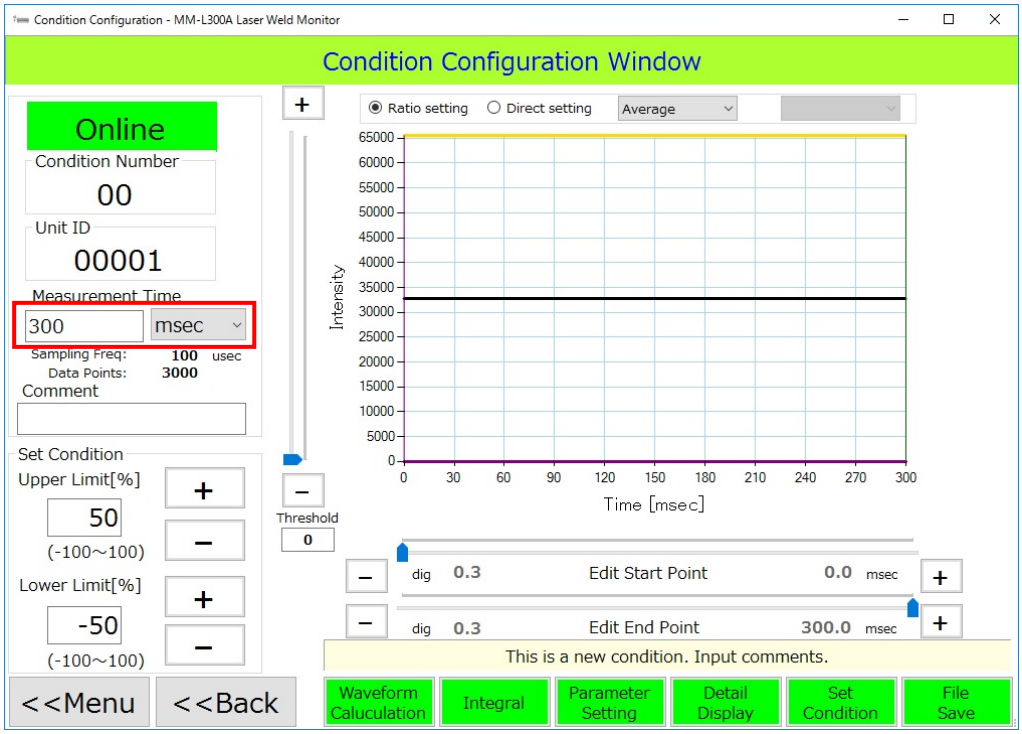
Measurement time: 3 ms
Obtained waveform: 27



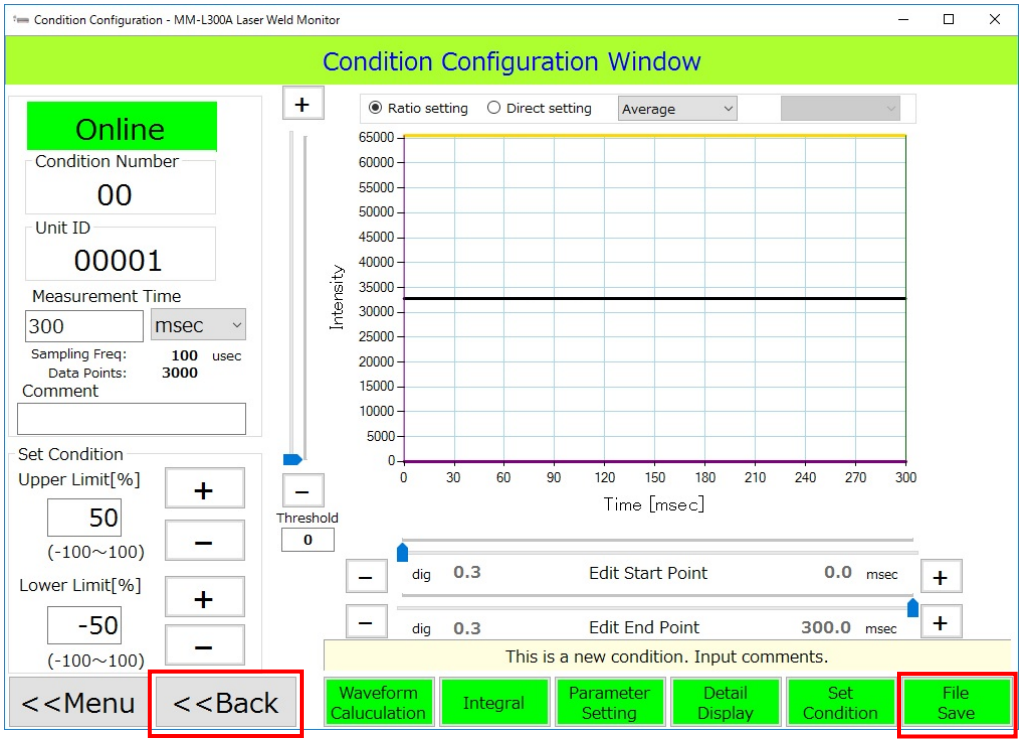
Measurement time: 500 ms
Obtained waveform: 27

When the measurement time is changed, a confirmation dialog “Clear the graph?” appears.
To clear the graph, click [OK]. The measurement time is changed. When [Cancel] is clicked, the dialog closes without changing the measurement time.

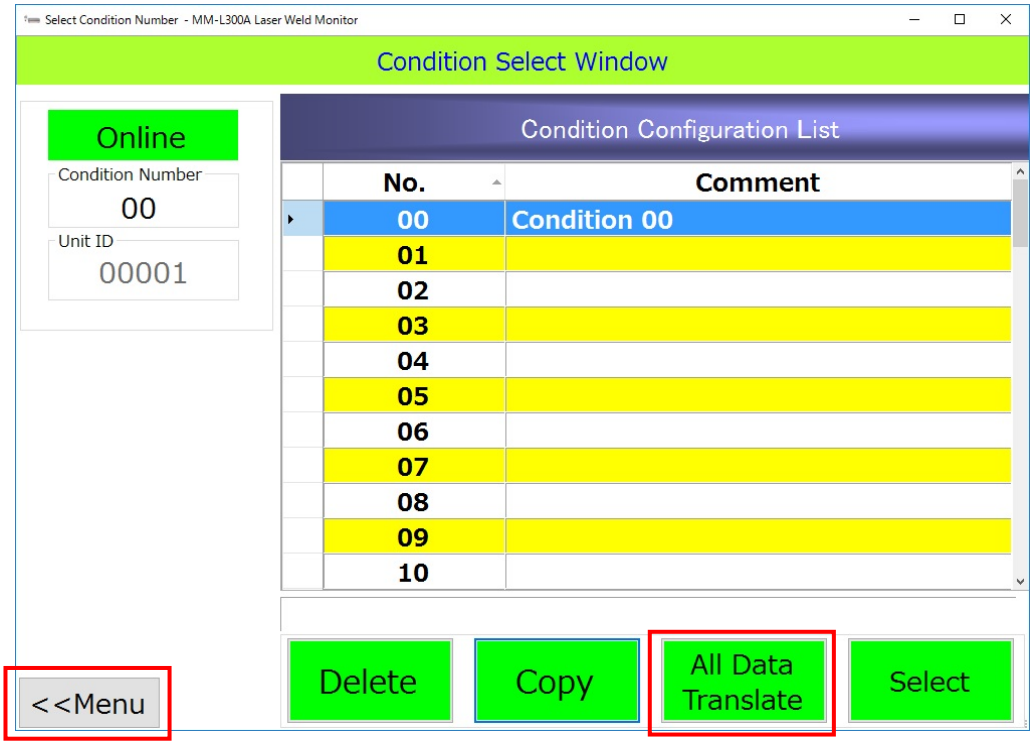
Set other items such as comments and parameters accordingly.
For how to set, refer to each item in **6. How to Operate the PC Software**.



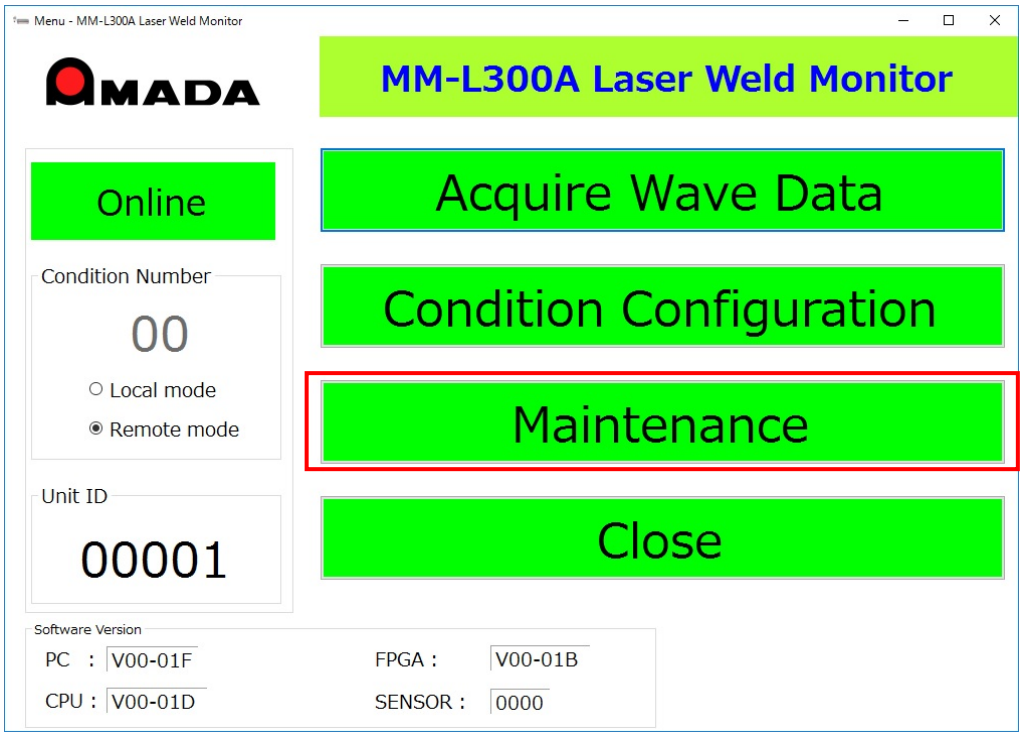
7) After completing setting, click the [File Save] button to save the setting condition in the personal computer.
After saving, click the [Back] button to return to the Condition Configuration List.



8) Click the [All Data Translate] button to transfer the setting condition to the **MM-L300A**.
After transferring, click the [Menu] button to return to the Menu Window.

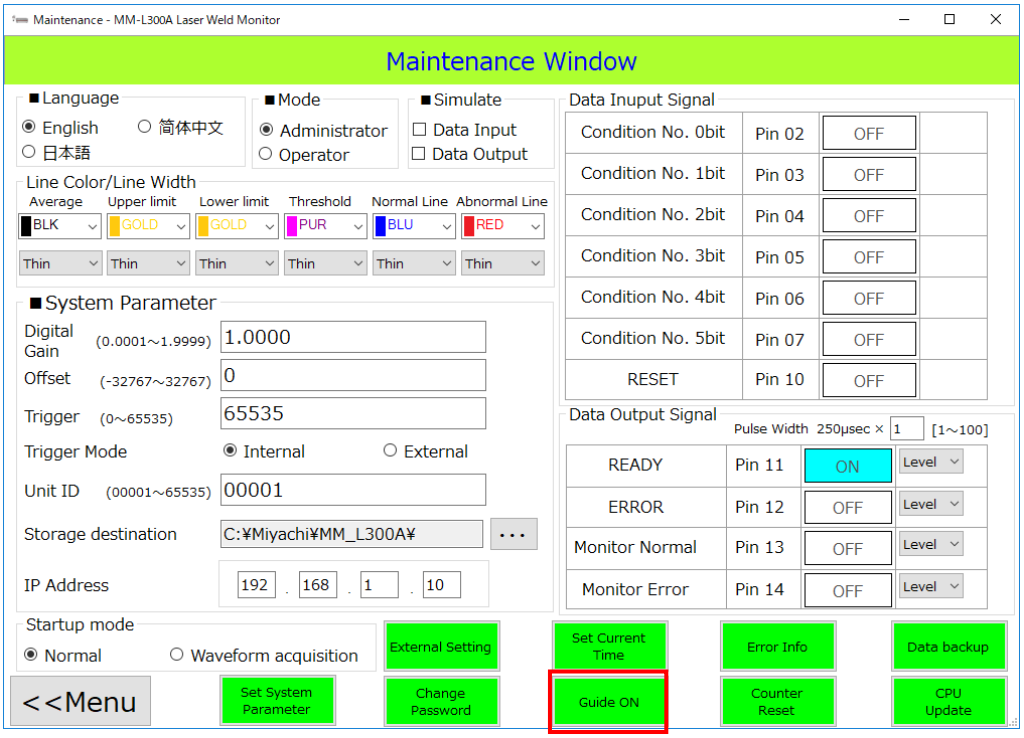


9) Click the [Maintenance] button on the Menu Window.



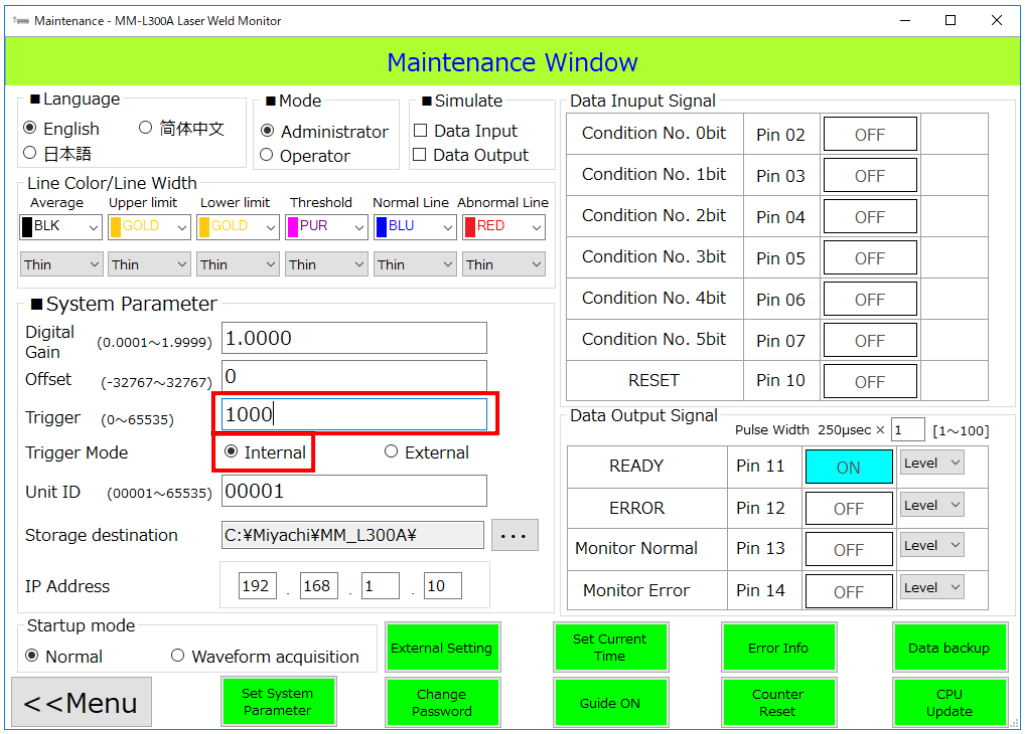
10) Click the [Guide ON] button on the Maintenance Window and check that the guide light (green light) is emitted from the **SU-N300A**.
Adjust the **SU-N300A** externally or coaxially so that the center of the guide light and the center of the measurement point align.
After adjustment, fix it so as not to be moved and click the [Guide OFF] button to turn off the guide light.

* For the **SG-N300A**, the guide light is not turned on. Calculate the irradiation range by referring to “Measurement range of the light-receiving unit” in the outline drawings.

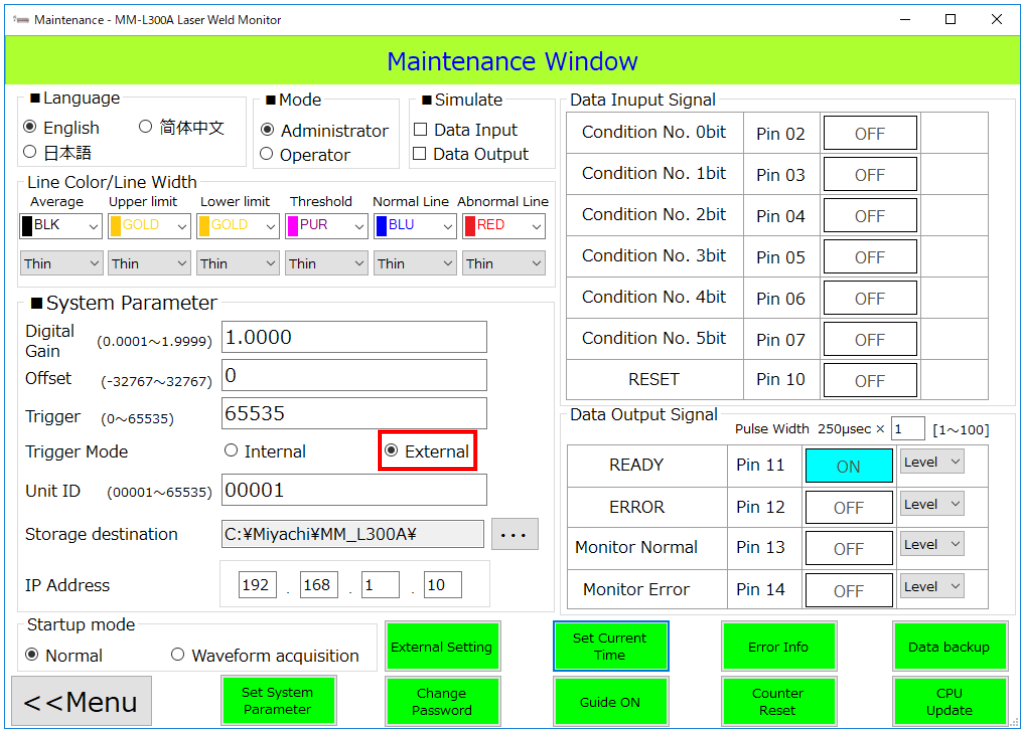


11) Set the Trigger Mode of the System Parameter either to [Internal] or [External].

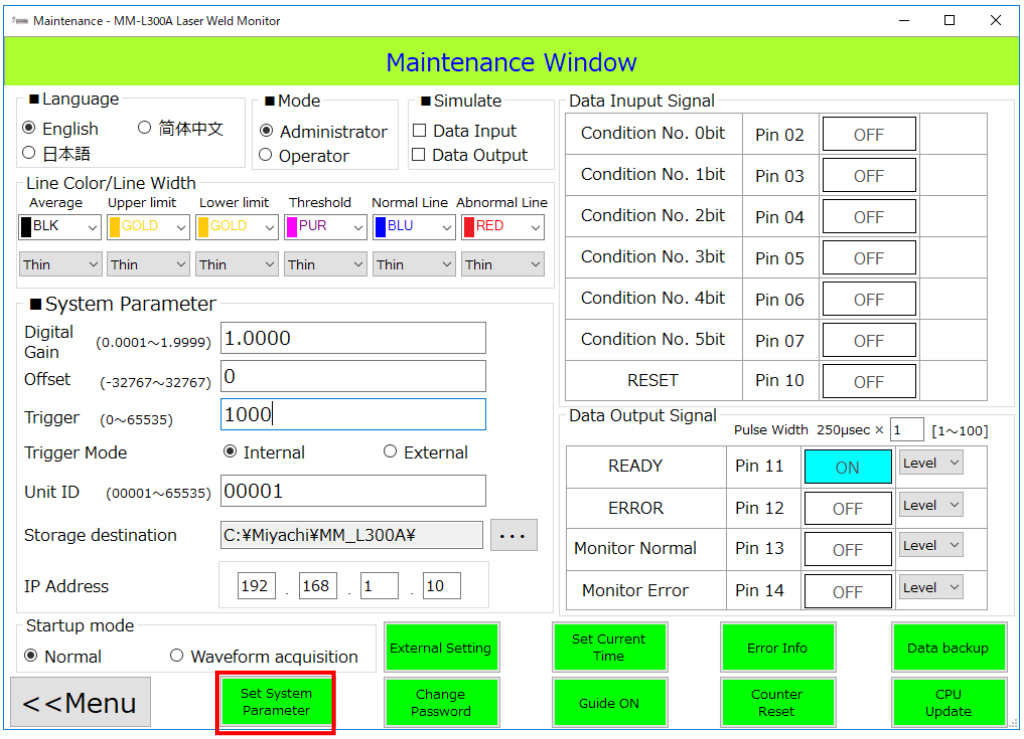
- Internal
  Set the Trigger of the System Parameter.
  Since the initial value is 65535, set a value as low as possible so that waveforms will not be continuously obtained due to external noise. (1000 or less is recommended.)
  When the TRIGGER lamp of the display panel on the front lights up even though the laser is not emitted, waveforms are obtained due to noise. Set the set value of the Trigger higher.



- External
  From the TRIGGER connector on the rear of the **MM-L300A**, connect the external trigger signal. (Refer to **9. Interface**.)
  It is not necessary to set the Trigger of the System Parameter.
  Also, when using the external trigger unit, select [External].



12) After completing setting, click the [Set System Parameter] button to transfer the set value to the **MM-L300A**.
At this time, keep the initial values; the Digital Gain is 1.0000 and the Offset is 0. (Refer to **12. (5) About the SU-N300A/SG-N300A**.)

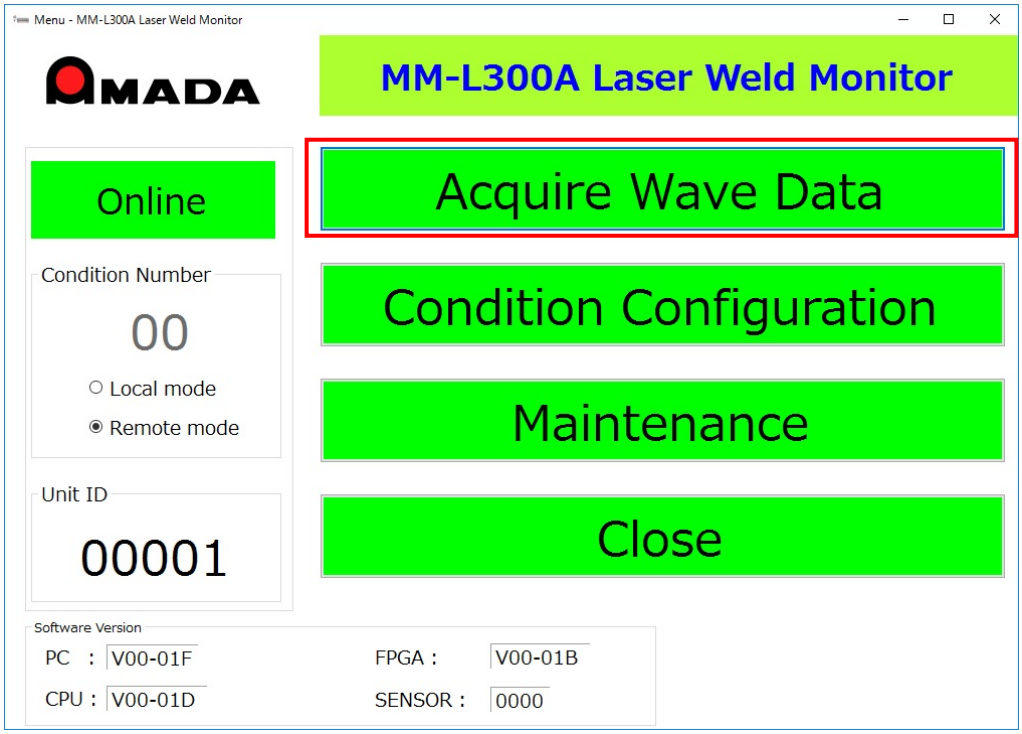


(2) Obtaining Waveforms

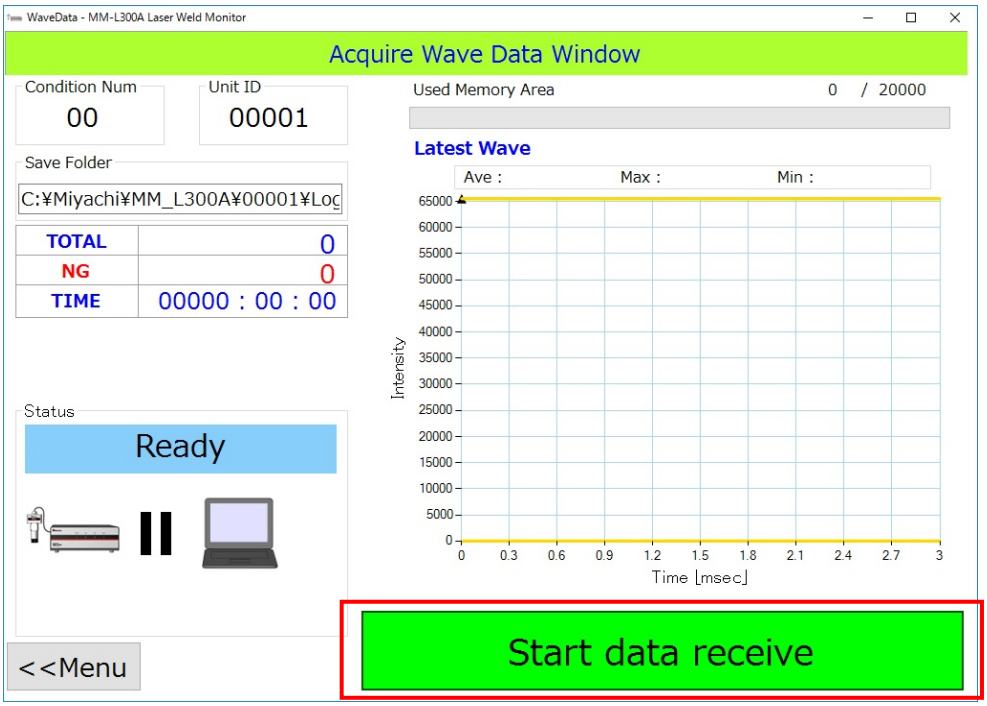
This section describes how to obtain waveforms with the **MM-L300A** whose conditions are set.

> **⚠ CAUTION**
>
> - Take care of laser when performing operation.
> - Read cautions for each item in the operation manual carefully to use the instrument properly.

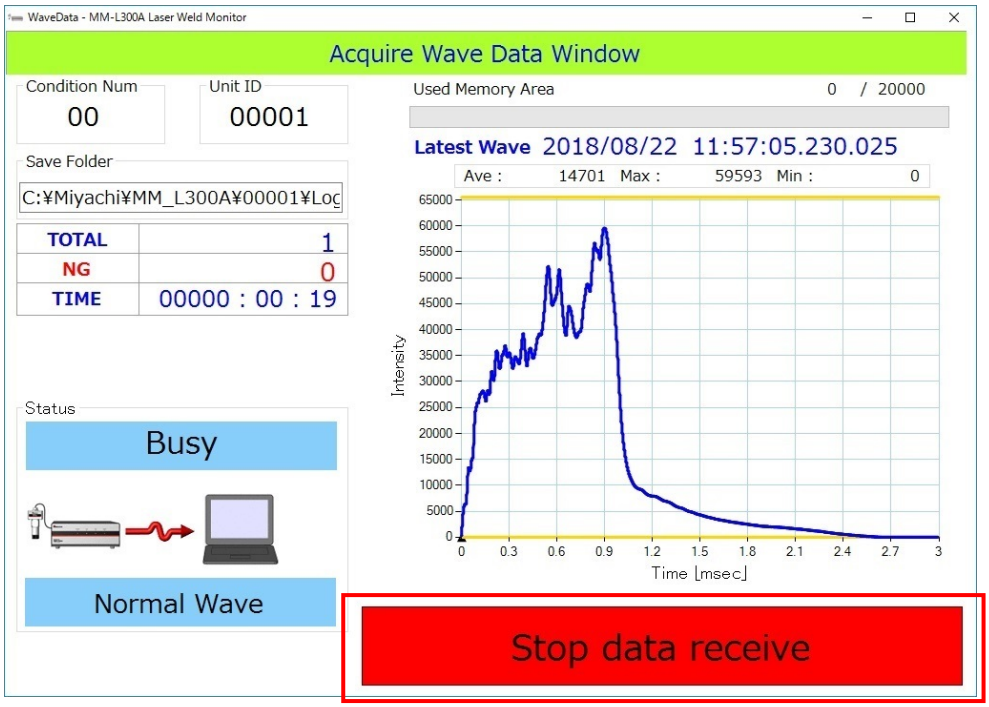
1) Click the [Acquire Wave Data] button on the Menu Window.



2) Click the [Start data receive] button on the Acquire Wave Data Window. When measurement waveforms are saved in the memory of the **MM-L300A**, they are transferred to the personal computer. (Refer to **6. (4) Acquire Wave Data Window**.)



3) Emit a laser with a data receiving state and perform measurement with the **MM-L300A**.
Since it is desirable that the waveform intensity is near the maximum value (around 50,000 is recommended), when the waveform cannot be obtained or the maximum value is significantly lower than 50,000, perform setting of the **MM-L300A** again referring to **12. (1) Troubleshooting**.
After obtaining data, click the [Stop data receive] button to finish the measurement of the **MM-L300A**.
Click the [Menu] button to return to the Menu Window.



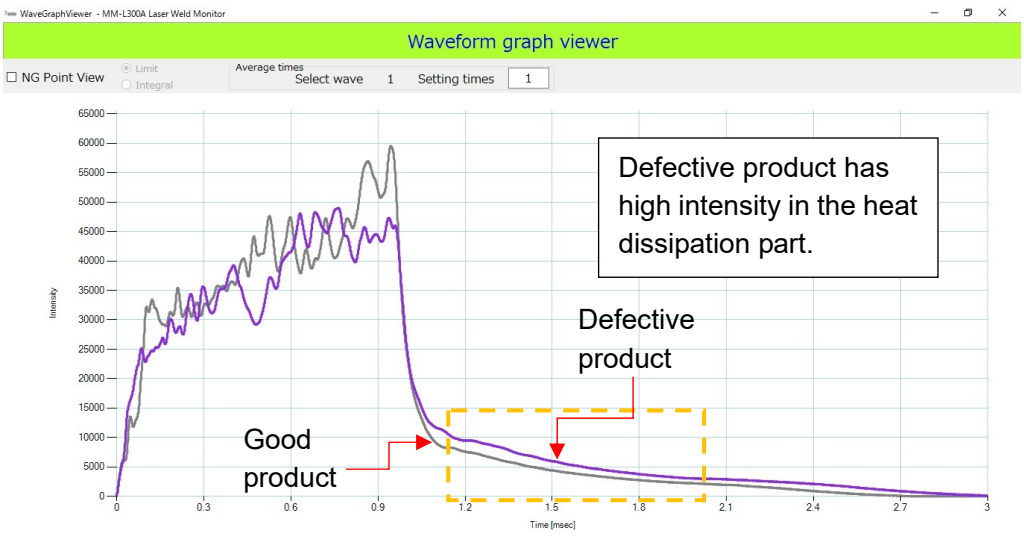
(3) Setting Quality Judgments

This section describes how to make quality judgments with the **MM-L300A**.

> **⚠ CAUTION**
>
> - Take care of laser when performing operation.
> - Read cautions for each item in the operation manual carefully to use the instrument properly.

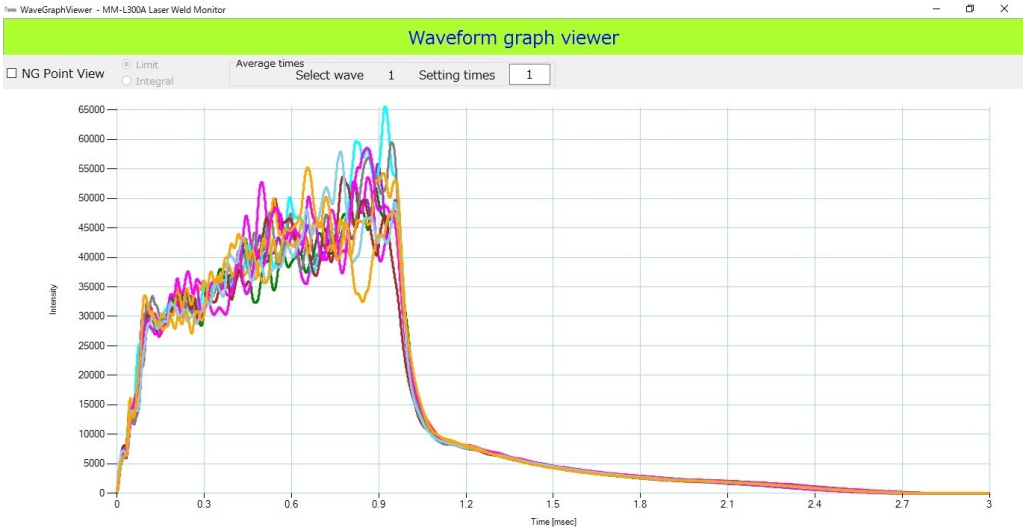
1) Measures a good product processing and a defective product processing with the **MM-L300A**.
   Compare normal waveforms and abnormal waveforms obtained with the **MM-L300A** and check a tendency of the differences between them. (The intensity is overall high or low, the intensity becomes high only when the spatter is generated, etc.)

(Example) Abnormal judgment by waveform measured with the same setting condition



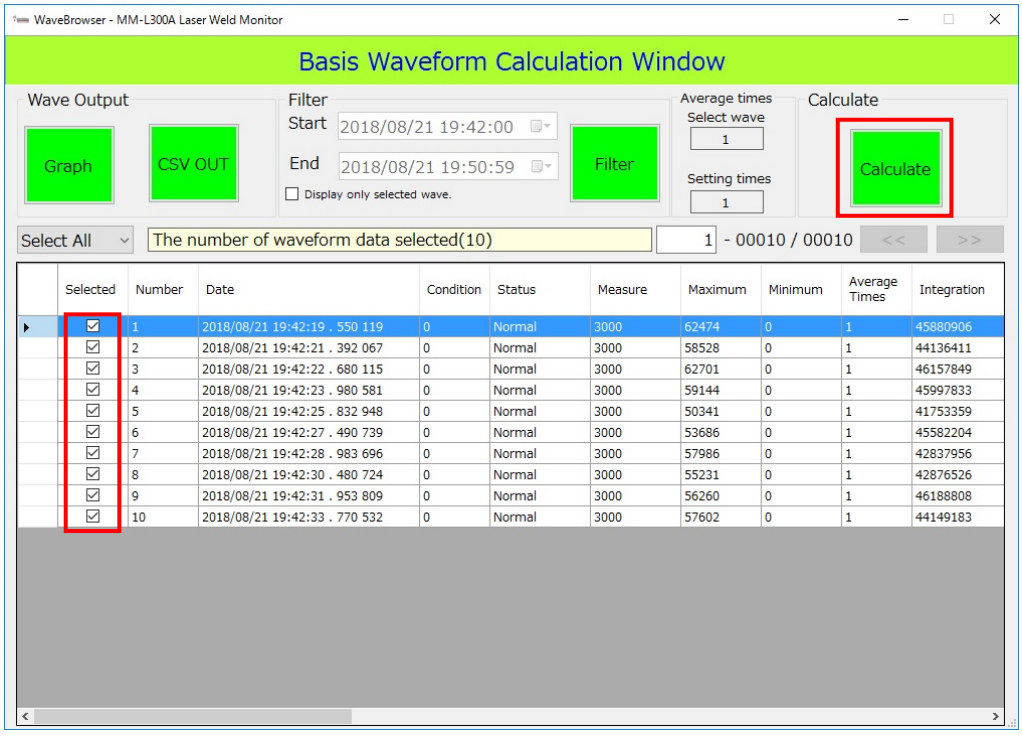
2) Obtain sample waveforms several times with the same processing conditions of a good product as Step 1 and setting conditions of the **MM-L300A**.
The larger the number of sample waveforms is, the more stable data is.

(Example) Measuring waveforms with processing conditions of a good product 10 times



3) Return to the Menu Window and select the condition number set when the sample waveform is obtained to display the Condition Configuration Window. (Refer to **7. (1) Setting Conditions**.)

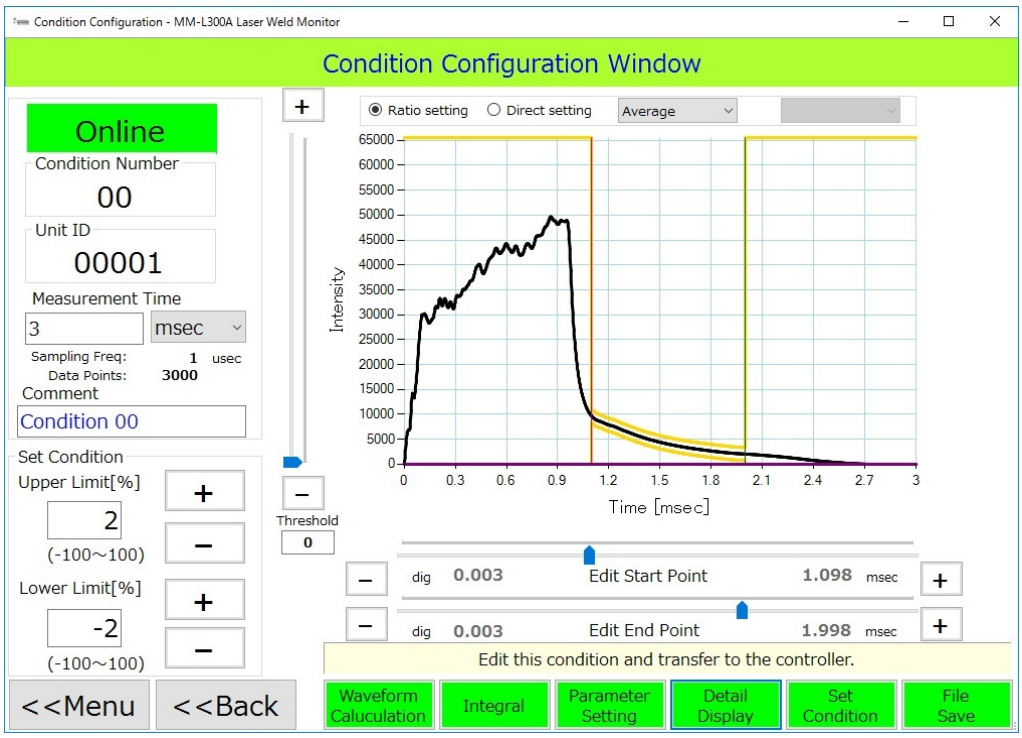
4) Click the [Waveform Calculation] button and select all sample waveforms of multiple times obtained in Step 2.
After selection, clicking the [Calculate] button displays the reference waveform of the selected sample waveform and at the same time returns to the Acquire Wave Data Window.
When the measurement waveform is not displayed, click the [Filter] button to check that the condition is proper. (Refer to **6. (7) ③ Filter**.)



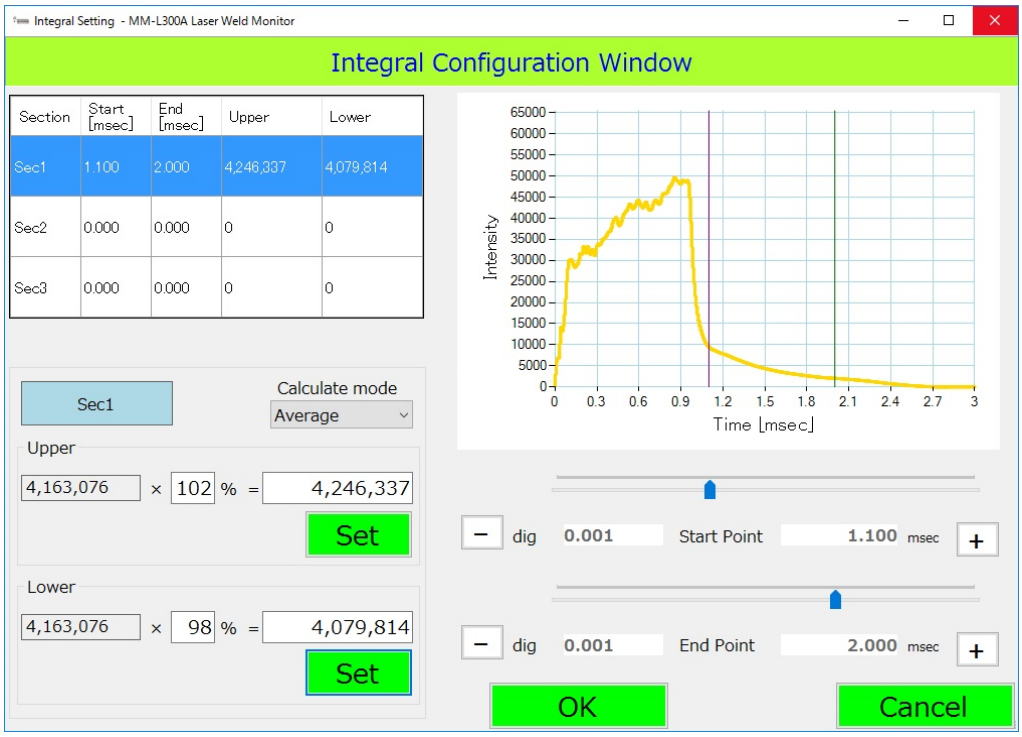
5) Referring to the reference waveform, create the waveform condition so that a tendency checked in Step 1 is judged as abnormal in the reference waveform setting of the **MM-L300A**. (Refer to **6. (6)** to **(9)**.)

(Example) When making judgment in the heat dissipation part after laser end (1.1 to 2.0 ms)

Ratio setting (±2% setting)

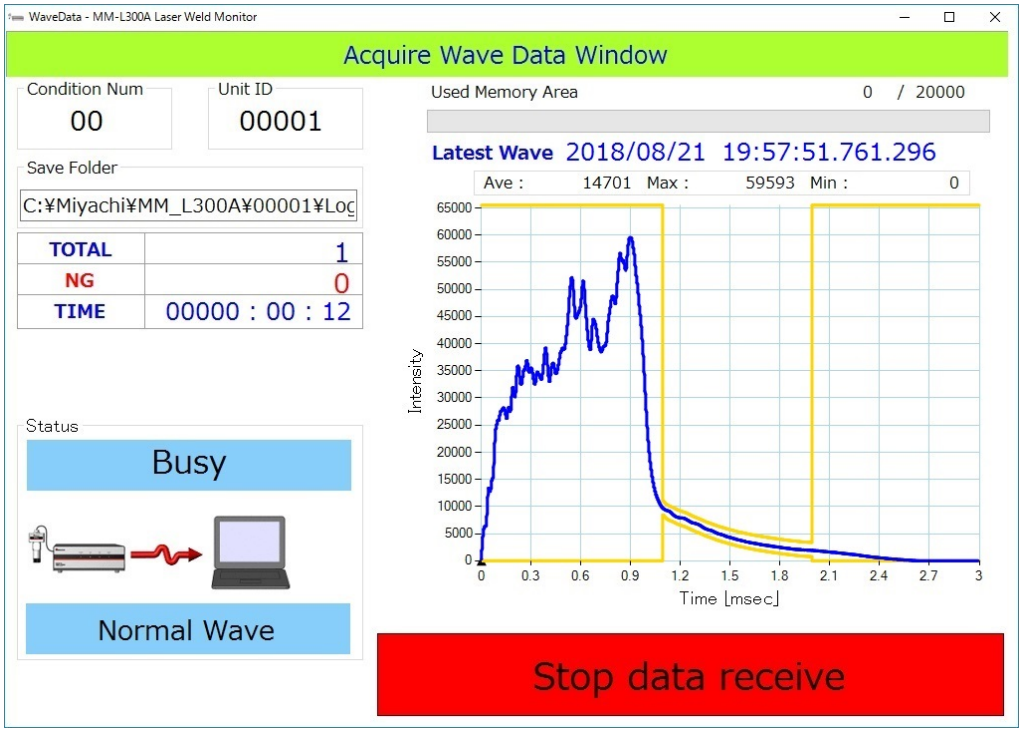


Integral setting (±2% setting for the average value)

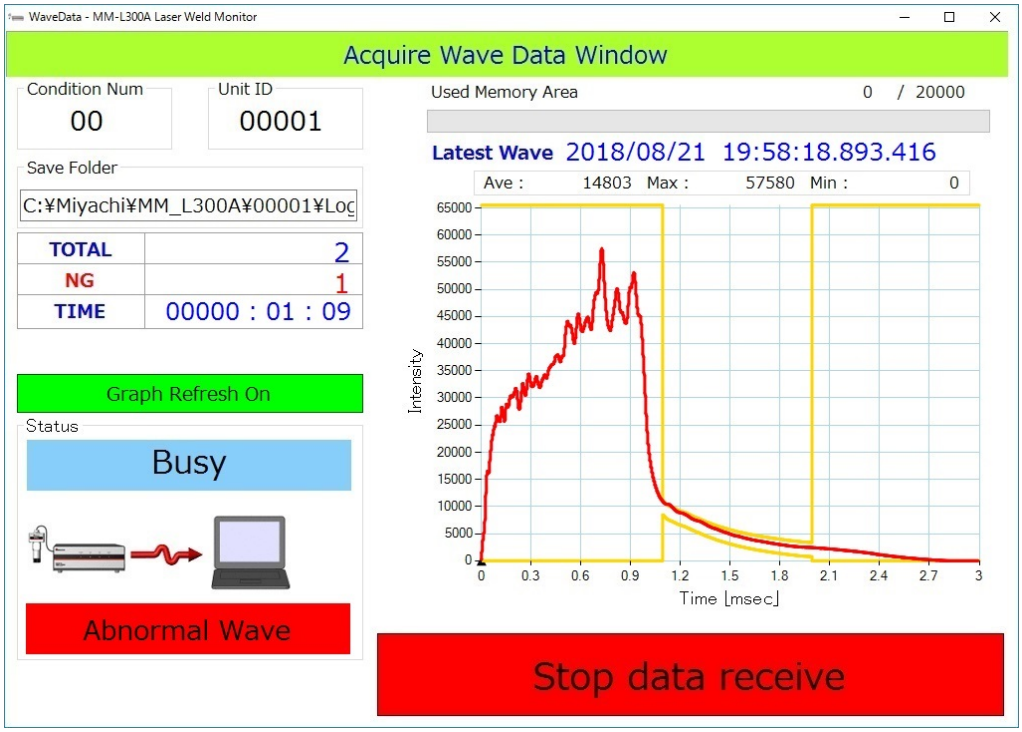


6) After creating conditions, save them in the personal computer and transfer them to the **MM-L300A**.
Just like Step 1, perform a good product processing and a defective product processing with the set condition number and check if a judgment is made as desired with the **MM-L300A**. If a judgment is not made as desired, perform adjustments in Steps 1 to 5 again.

Good product



Defective product



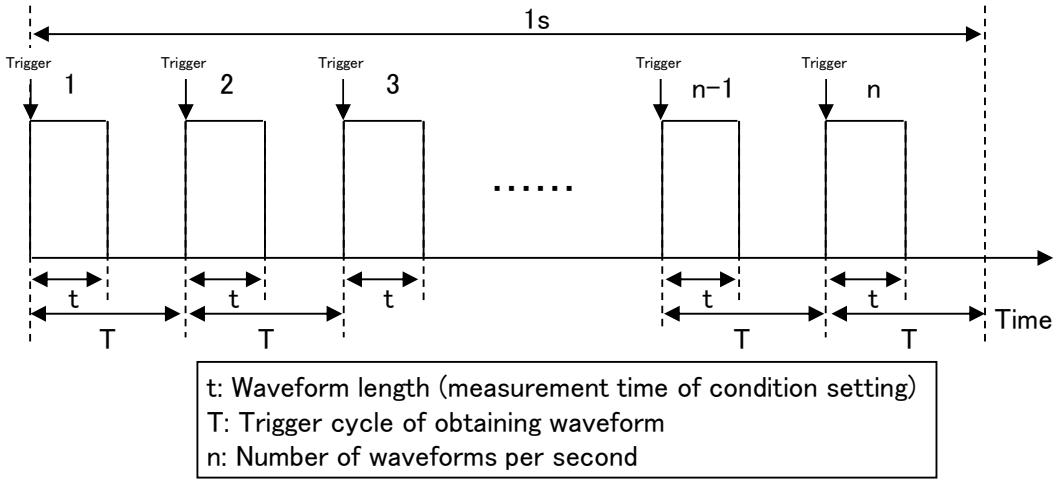
8. Measurement Data

(1) Storing Data

The following data (up to 20,000) is stored into the memory built in the **MM-L300A**.

Data that can be stored
Date, Time
Condition No.
Judgment result
Waveform data (divided into 3000 max.)

(2) Conditions for Obtaining Waveform



t: Waveform length (measurement time of condition setting)
T: Trigger cycle of obtaining waveform
n: Number of waveforms per second

(1) When conditions are not switched between laser weldings

t: Waveform length (measurement time of condition setting)
T: Trigger cycle of obtaining waveform
n: Number of waveforms per second

Quality judgment condition: T−t≧500 μs

● Relation between number of waveforms per second (trigger cycle of obtaining waveform: T) and waveform length (measurement time of condition setting: t)

Waveform length (measurement time of confition setting): t	Number of waveforms per second: n (Trigger cycle of obtaining waveform: T) 1 (1s)	250 (4ms)	333 (3ms)	500 (2ms)	1000 (1ms)
10 μs	○	○	○	○	○
〃	○	○	○	○	○
100 μs	○	○	○	○	○
〃	○	○	○	○	○
500 μs	○	○	○	○	○
〃	○	○	○	○	×
1ms	○	○	○	○	×
〃	○	○	○	○	×
1.5ms	○	○	○	○	×
〃	○	○	○	×	×
2.5ms	○	○	○	×	×
〃	○	○	×	×	×
3.5ms	○	○	×	×	×
〃	○	×	×	×	×
999.5ms	○	×	×	×	×
〃	×	×	×	×	×
1s	×	×	×	×	×

○: Can be judged
×: Cannot be judged

(2) When conditions are switched between laser weldings

t: Waveform length (measurement time of condition setting)
T: Trigger cycle of obtaining waveform
n: Number of waveforms per second

Quality judgment condition: T−t≧5.5ms

● Relation between number of waveforms per second (trigger cycle of obtaining waveform: T) and waveform length (measurement time of condition setting: t)

Waveform length (measurement time of confition setting): t	Number of waveforms per second: n (Trigger cycle of obtaining waveform: T)				
	1 (1s)	10 (100ms)	100 (10ms)	166 (6ms)	200 (5ms)
10 μ s	○	○	○	○	×
〃	○	○	○	○	×
100 μ s	○	○	○	○	×
〃	○	○	○	○	×
500 μ s	○	○	○	○	×
〃	○	○	○	×	×
1ms	○	○	○	×	×
〃	○	○	○	×	×
4.5ms	○	○	○	×	×
〃	○	○	×	×	×
10ms	○	○	×	×	×
〃	○	○	×	×	×
94.5ms	○	○	×	×	×
〃	○	×	×	×	×
994.5ms	○	×	×	×	×
〃	×	×	×	×	×
1s	×	×	×	×	×

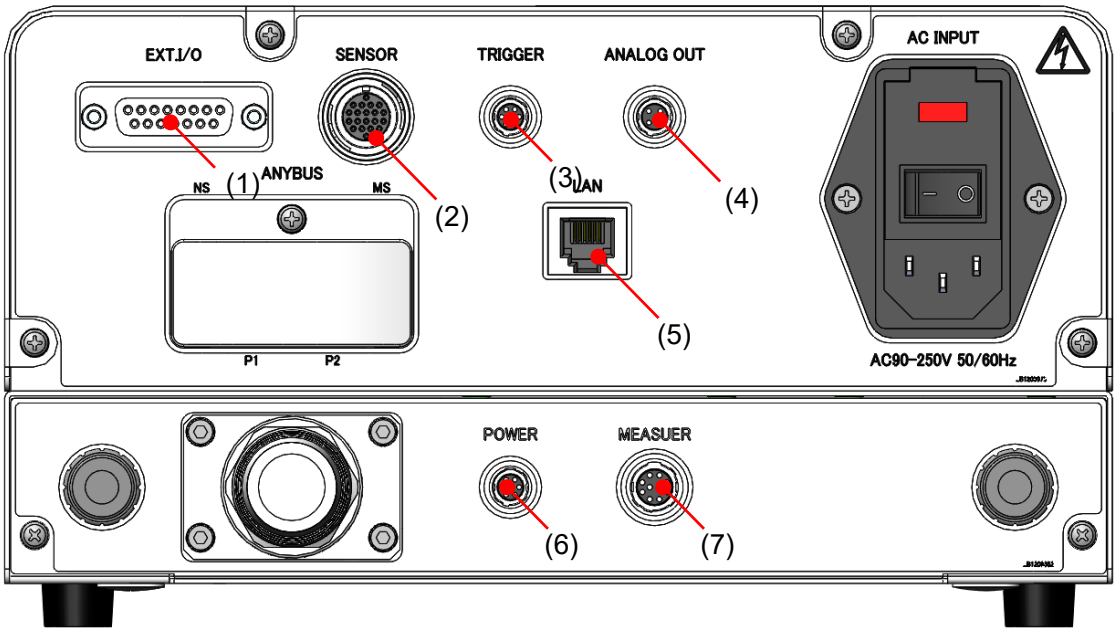
○: Can be judged
×: Cannot be judged

9. Interface

(1) Inputs/Outputs

Using the interface that is provided as standard allows you to select measurement condition of the **MM-L300A**, check quality judgment results, and collect measurement data, etc.

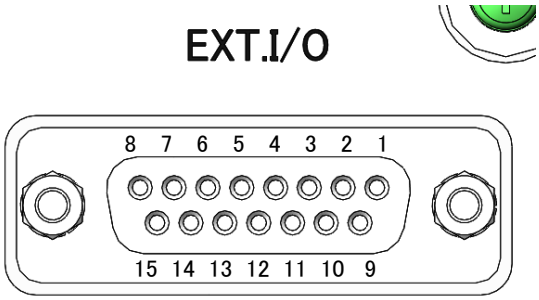
Connected device	Connector name in use	Remarks
Personal computer, etc.	LAN	Category 7 or more
External device (device to control the welding process)	EXT.I/O	D-Sub 15pin
External device (device to output trigger, etc.)	TRIGGER	
Oscilloscope, etc.	ANALOG OUT	
External network communication	ANYBUS	EtherNet/IP (option)
MM-L300A	POWER	External trigger unit (option)
Oscilloscope, external device, etc.	MEASURE	External trigger unit (option)



(2) Connectors

(1) EXT. I/O

This is an interface connector (D-Sub 15-pin, female) to make a connection with the external control unit.



Pin No.	Description	
1	+24V OUT (+24V (out)) Power supply for external input signals. This pin is exclusively used for the **MM-L300A**. Do not use it for any other purpose.	
2	Condition 0 (in)	Select a registered condition number by combining condition signal inputs 0, 1, 2, 3, 4, and 5. For how to select a condition number, refer to the table on the next page.
3	Condition 1 (in)	
4	Condition 2 (in)	
5	Condition 3 (in)	
6	Condition 4 (in)	
7	Condition 5 (in)	
8	0V OUT (GND) Power supply for external input signals. This pin is exclusively used for the **MM-L300A**. Do not use it for any other purpose.	
9	IN COM IN COM. This pin is exclusively used for the **MM-L300A**. Do not use it for any other purpose.	
10	RESET signal (RESET (in)) If trouble arises, an alarm is activated. When the cause of trouble has been eliminated and the circuit between RESET and IN COM is closed, the alarm will be canceled.	
11	READY signal (READY (out)) When the **MM-L300A** is ready to measure, the circuit between READY and OUT COM is closed internally.	
12	ERROR signal (ERROR (out)) When the **MM-L300A** is in an error state, the circuit between ERROR and OUT COM is closed internally.	
13	OK signal (OK (out)) When the measurement result is normal, the circuit between OK and OUT COM is closed internally.	
14	NG signal (NG (out)) When the measurement result is abnormal, the circuit between NG and OUT COM is closed internally.	
15	OUT COM OUT COM. This pin is exclusively used for the **MM-L300A**. Do not use it for any other purpose.	

Condition Number Selection

Set "Condition Number" by combining pin No.2 to pin No.7 (condition signals 0, 1, 2, 3, 4, and 5) inputs.

Condition Number	Signal					
	Condition5	Condition4	Condition3	Condition2	Condition1	Condition0
0						
1						●
2					●	
3					●	●
4				●		
5				●		●
6				●	●	
7				●	●	●
8			●			
9			●			●
10			●		●	
11			●		●	●
12			●	●		
13			●	●		●
14			●	●	●	
15			●	●	●	●
16		●				
17		●				●
18		●			●	
19		●			●	●
20		●		●		
21		●		●		●
22		●		●	●	
23		●		●	●	●
24		●	●			
25		●	●			●
26		●	●		●	
27		●	●		●	●
28		●	●	●		
29		●	●	●		●
30		●	●	●	●	
31		●	●	●	●	●
32	●					
33	●					●
34	●				●	
35	●				●	●
36	●			●		
37	●			●		●
38	●			●	●	
39	●			●	●	●
40	●		●			
41	●		●			●
42	●		●		●	
43	●		●		●	●
44	●		●	●		
45	●		●	●		●
46	●		●	●	●	
47	●		●	●	●	●
48	●	●				
49	●	●				●
50	●	●			●	
51	●	●			●	●
52	●	●		●		
53	●	●		●		●
54	●	●		●	●	
55	●	●		●	●	●
56	●	●	●			
57	●	●	●			●
58	●	●	●		●	
59	●	●	●		●	●
60	●	●	●	●		
61	●	●	●	●		●
62	●	●	●	●	●	
63	●	●	●	●	●	●

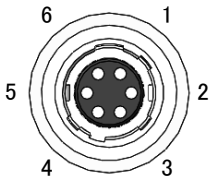
(2) SENSOR

This is a connector (20-pin) to make a connection with the **SU-N300A/SG-N300A**. This connector can send the signal detected by the **SU-N300A/SG-N300A** to the **MM-L300A**.
Do not connect a cable other than the dedicated cable.

(3) TRIGGER

By inputting the external trigger signal to the **MM-L300A**, can be measured in an arbitrary timing.
MEASURE is the signal during obtaining data. Refer to **(4) Timing Chart**.

TRIGGER

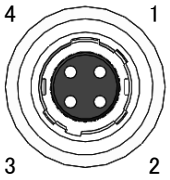


Pin No.	Description
1	+24V OUT (+24V (out)) Power supply for external input signals. This pin is exclusively used for the **MM-L300A**. Do not use it for any other purpose.
2	External trigger input signal (EXT TRG+ (in)) When the circuit between EXT TRGs is closed, the **MM-L300A** starts measurement. 24 V is input.
3	External trigger input signal (EXT TRG- (in)) When the circuit between EXT TRGs is closed, the **MM-L300A** starts measurement. 0 V is input.
4	0V OUT (GND) GND for external input signals. This pin is exclusively used for the **MM-L300A**. Do not use it for any other purpose.
5	Measuring signal (MEASURE OUT+ (out)) When the **MM-L300A** is measuring waveforms, the circuit between MEASURE OUTs is closed internally.
6	Measuring signal (MEASURE OUT- (out)) When the **MM-L300A** is measuring waveforms, the circuit between MEASURE OUTs is closed internally.

(4) ANALOG OUT

This connector can output an analog signal with 0 to 5 V.

ANALOG OUT



Pin No.	Description
1	0-5V OUT (ANALOG OUT+ (out)) The value which an incident light is converted into voltage is output.
2	Analog GND (ANALOG OUT- (out)) When measuring pin No.1, connect to the GND on the measuring side.
3	Unused Do not connect anything.
4	Unused Do not connect anything.

(5) LAN

This is a connector to make a connection with a personal computer.
This connector can output the data and waveform data measured by the **MM-L300A**.

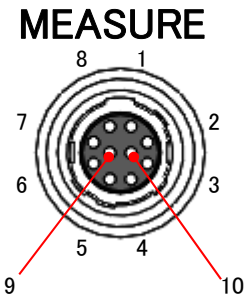
(6) POWER

This is a connector to make a connection with the **MM-L300A** (6-pin).
By connecting it to the TRIGGER connector of the **MM-L300A** with the attached external trigger unit connecting harness, the power can be supplied and the external trigger signal can be input.

* Since this unit uses the TRIGGER connector of the **MM-L300A**, pin Nos. 5 and 6 of the TRIGGER connector of the **MM-L300A** are disabled. When using the MEASURE signal, use pin Nos. 7 and 8 of the MEASURE connector (10-pin).

(7) MEASURE

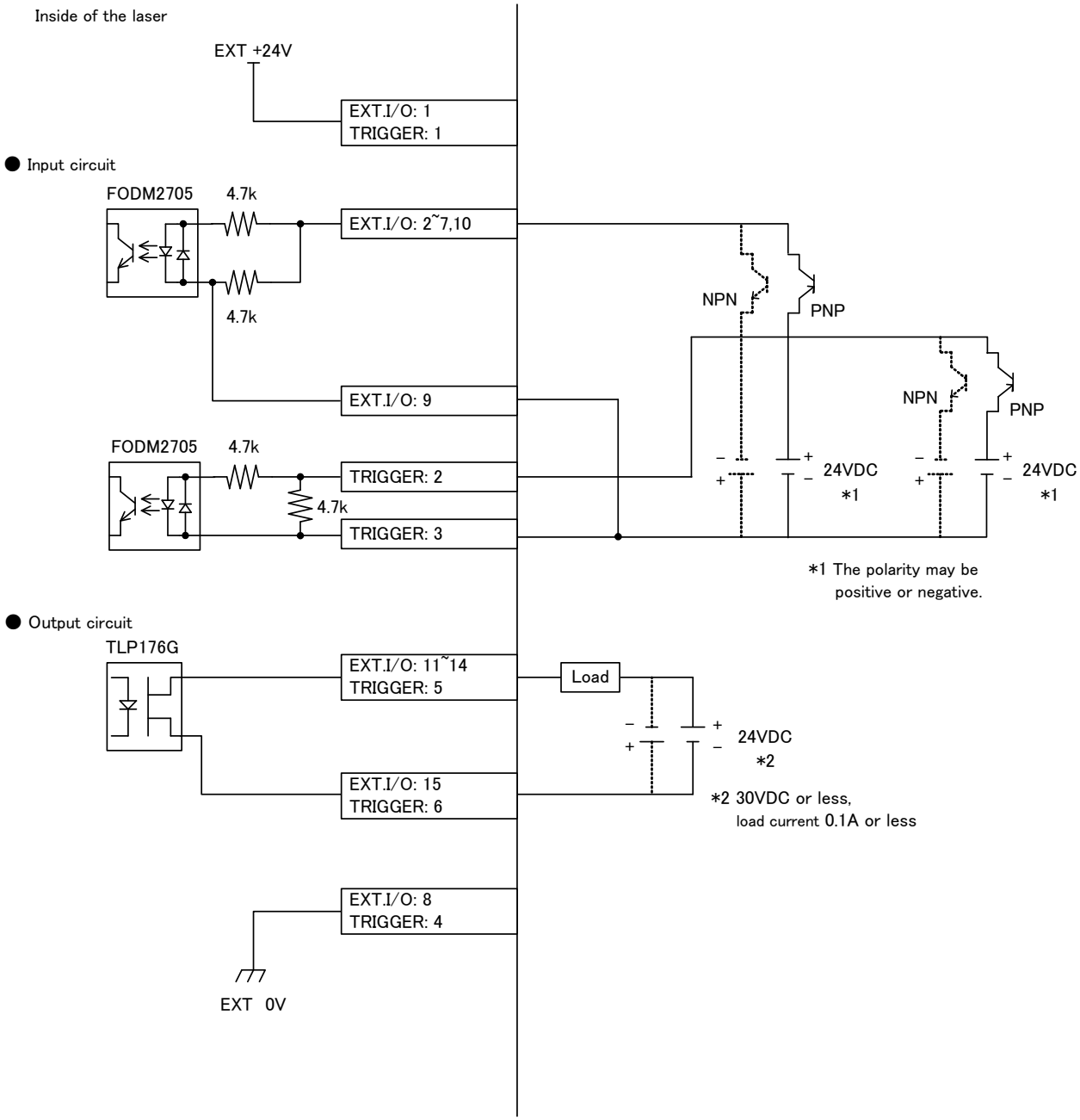
This is an interface connector with the external control device.



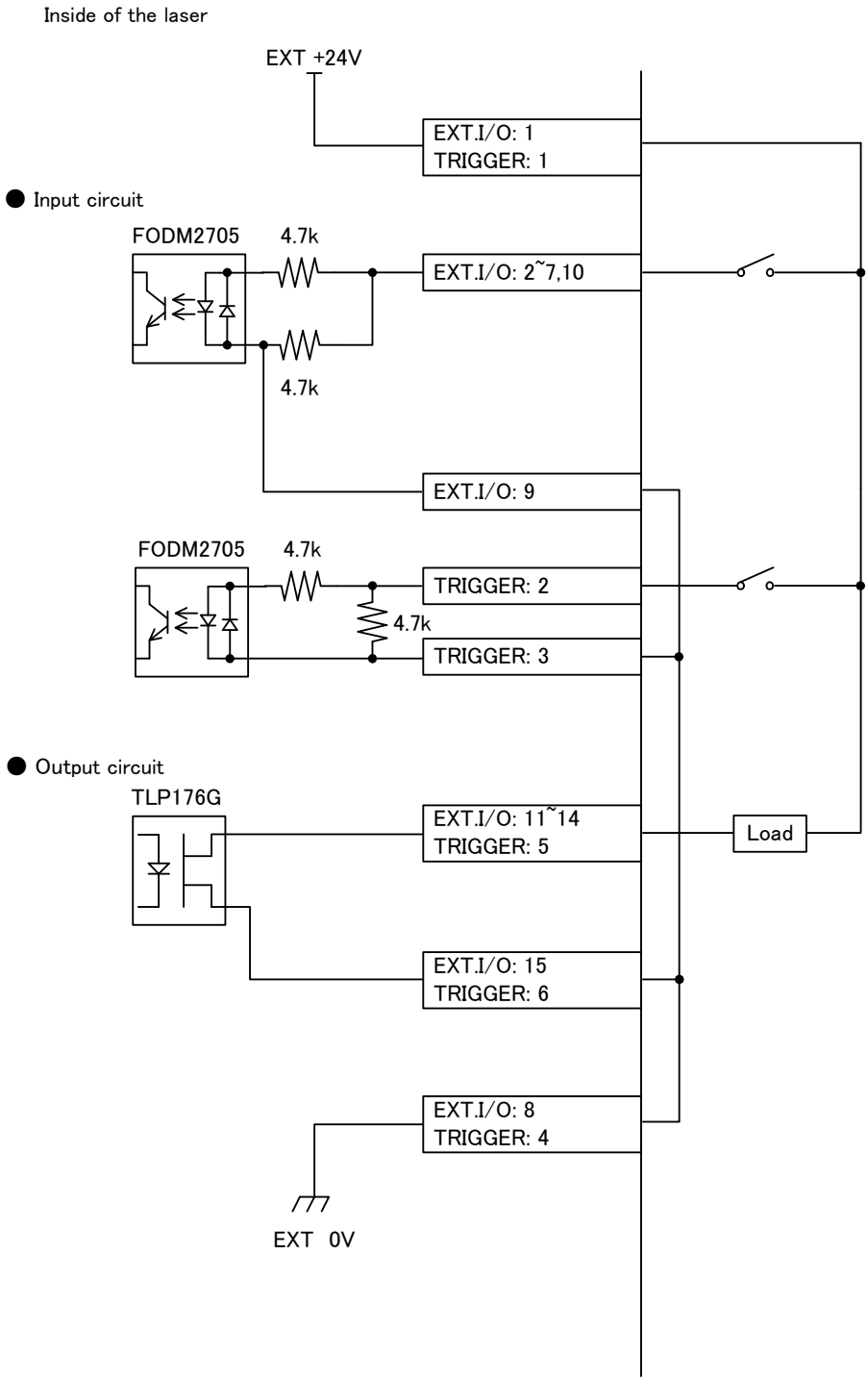
Pin No.	Description
1	0-5V OUT (ANALOG OUT+ (out)) The value which an incident light is converted into voltage is output.
2	Analog GND (ANALOG OUT- (out)) When measuring pin No.1, connect to the GND on the measuring side.
3	Unused Do not connect anything.
4	0-10V input (TRRIGER_IN+(in)) When 10 V is input, a measurement of the **MM-L300A** can be started at an arbitrary timing.
5	Analog GND (TRRIGER_IN-(in)) When inputting voltage to pin No.4, connect to the GND on the measuring side.
6	Unused Do not connect anything.
7	Measuring signal (MEASURE OUT+ (out)) When the **MM-L300A** is measuring waveforms, the circuit between MEASURE OUTs is closed internally. This is the same signal as pin No. 5 (MEASURE OUT+) of the TRIGGER connector on the **MM-L300A**.
8	Measuring signal (MEASURE OUT- (out)) When the **MM-L300A** is measuring waveforms, the circuit between MEASURE OUTs is closed internally. This is the same signal as pin No. 6 (MEASURE OUT-) of the TRIGGER connector on the **MM-L300A**.
9	Unused Do not connect anything.
10	Unused Do not connect anything.

(3) Example Connections of External Input/Output Signals

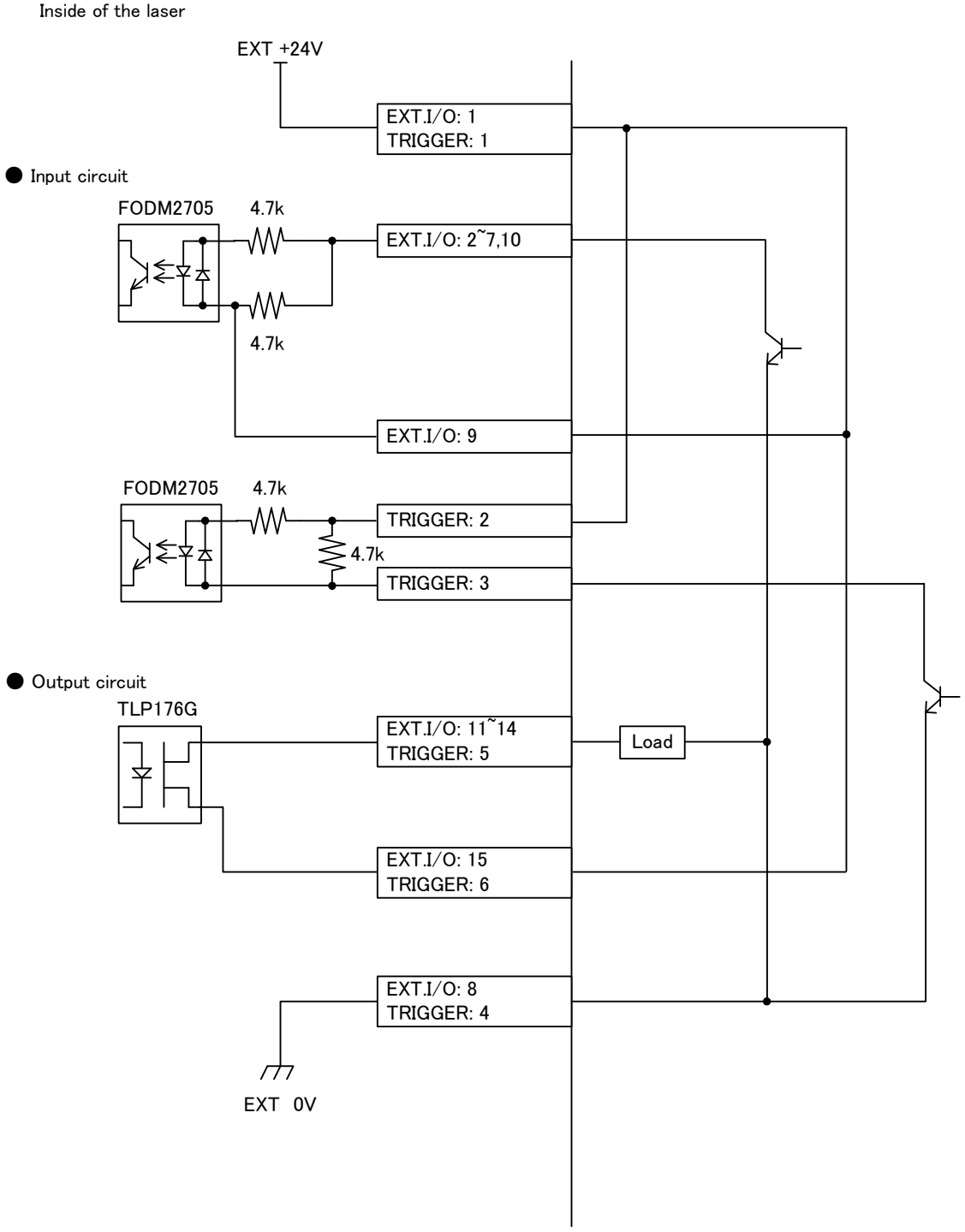
(1) When connected to an external power source



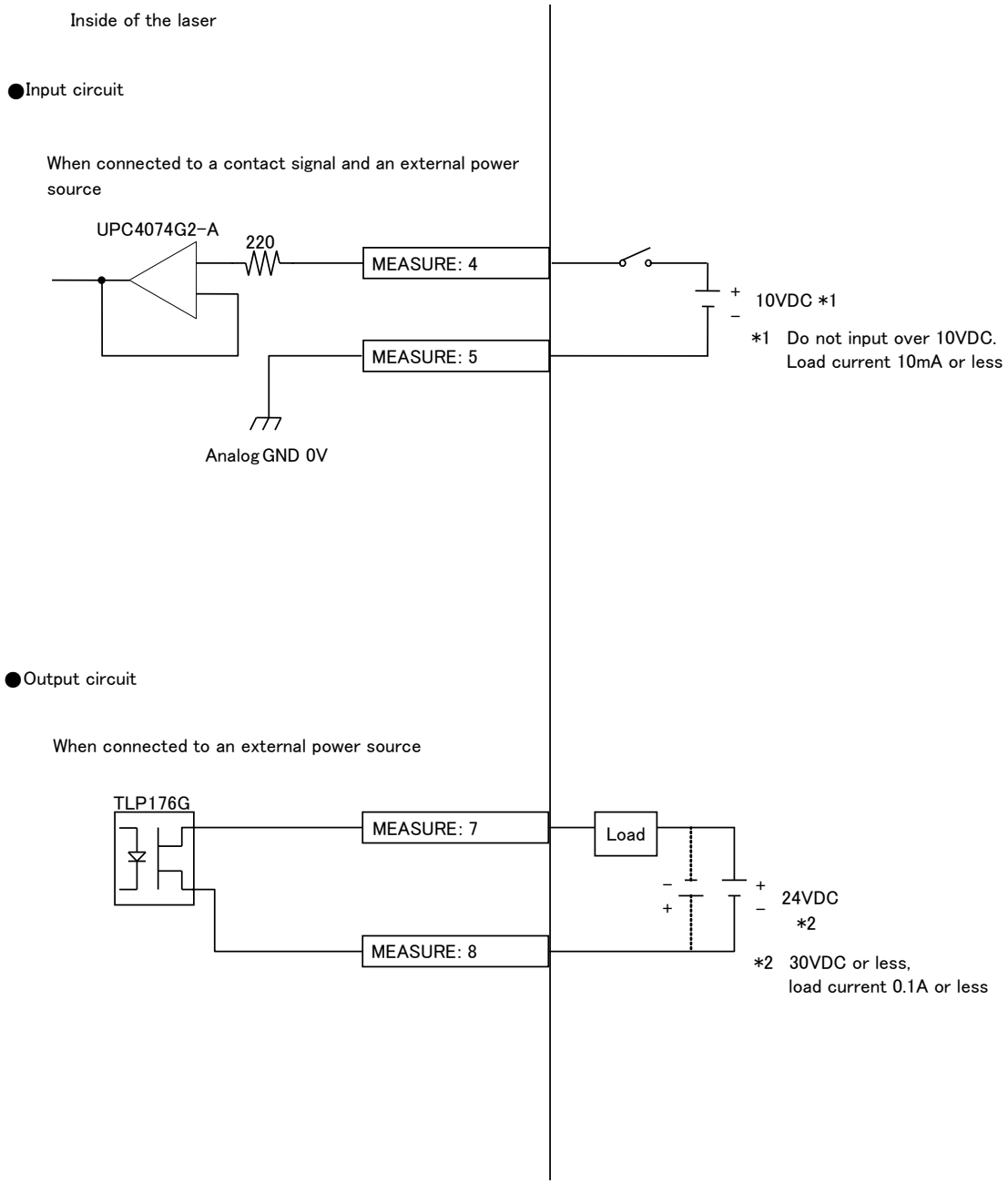
(2) When using a contact signal



(3) When connected to an internal power source and using an open-collector signal



(4) When connected to the external trigger unit (option)



(4) Timing Chart

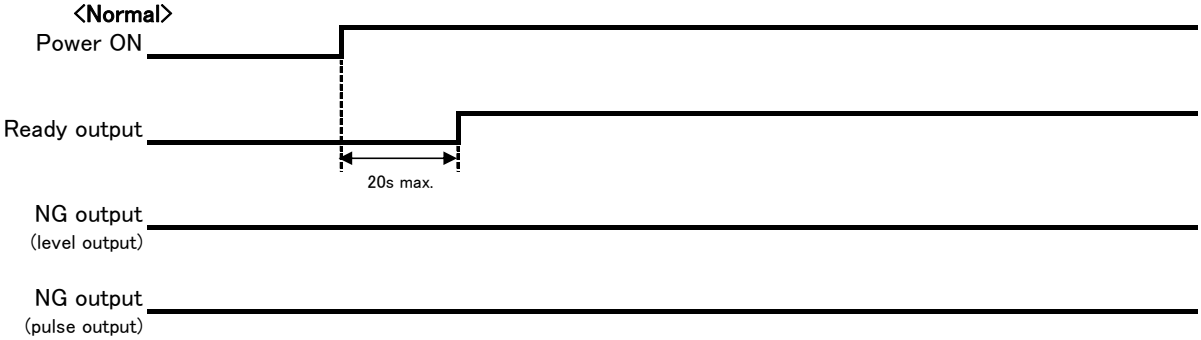
An example of timing chart for the case where the power supply of the **MM-L300A** is turned on, measurement by laser processing is performed and judgment is made is shown below.

In each timing chart, the equipment operation is represented on the axis of ordinates and the lapse of time is represented on the axis of abscissas to show the change status based on changes with the lapse of time at each operation and the time required for a certain operation.

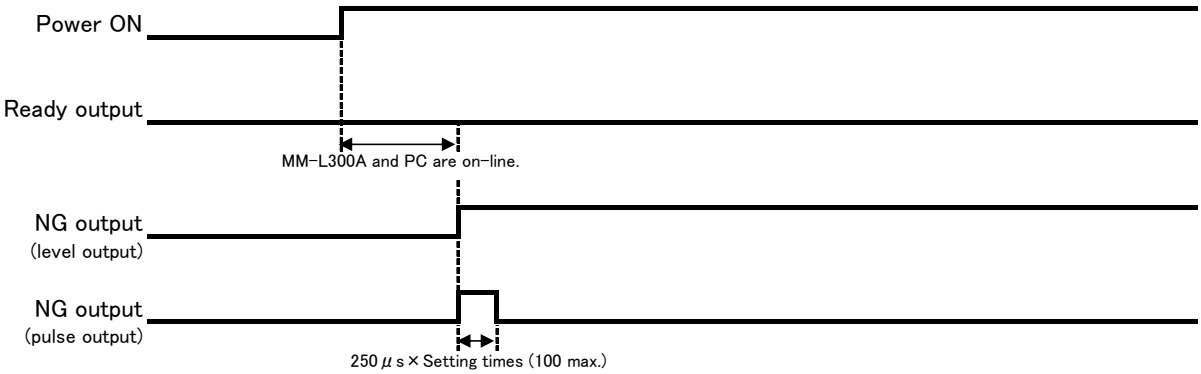
(1) From turning on the power supply to the ready status (common)

The following diagram shows the lapse of time in the case where the power supply of the **MM-L300A** is turned on and measurement becomes ready.

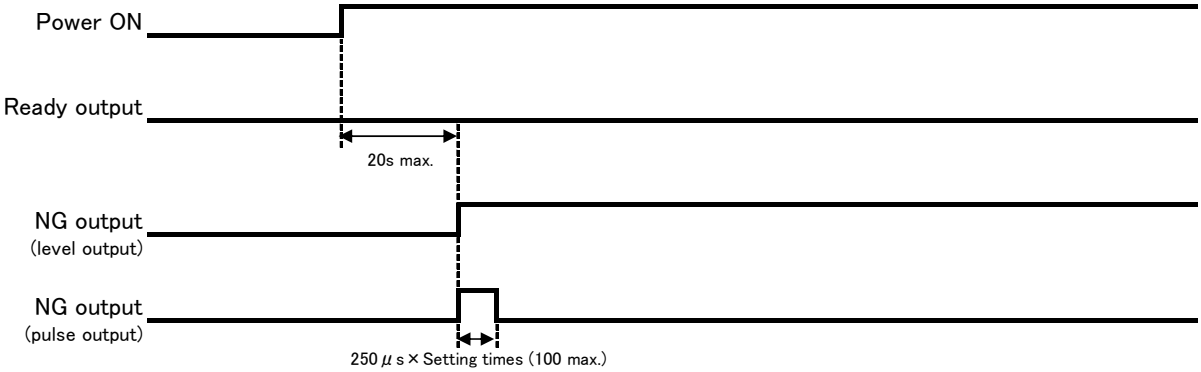
<Normal>



<When the SU-N300A/SG-N300A communication error occurs>

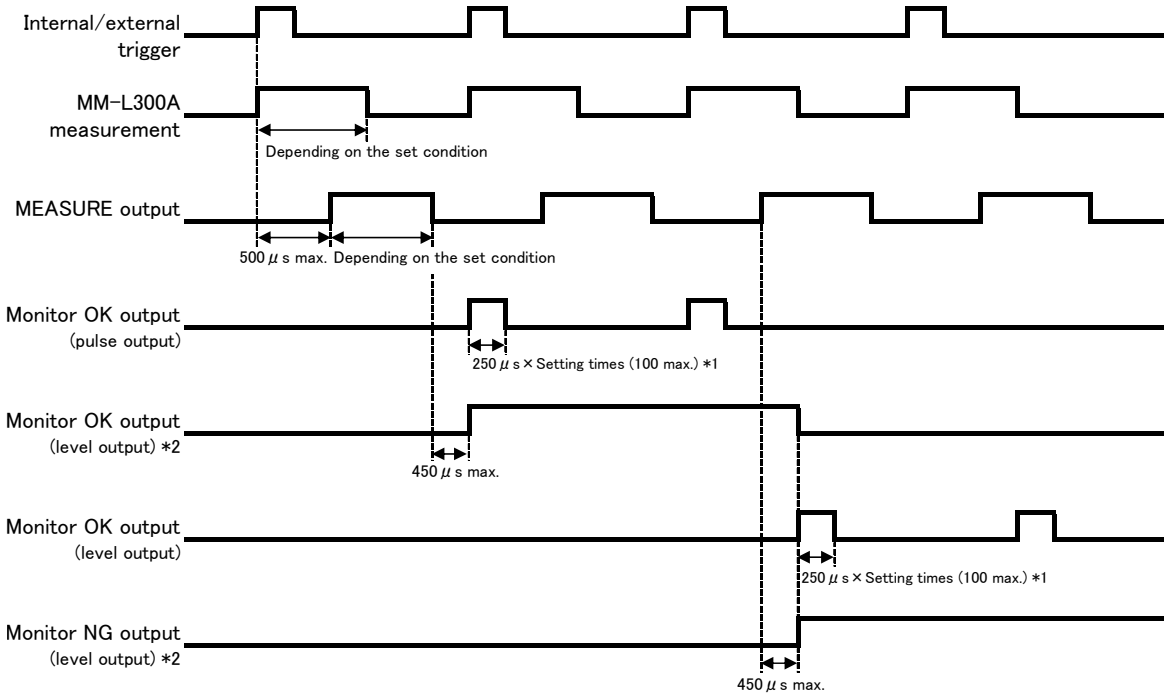


<When other errors occur>



(2) From the trigger input to the measurement judgment output (common)

The following diagram shows the lapse of time in the case where measurement by the **MM-L300A** is performed 4 times, and the first and second measurements are judged as OK and third and fourth measurements are judged as NG.



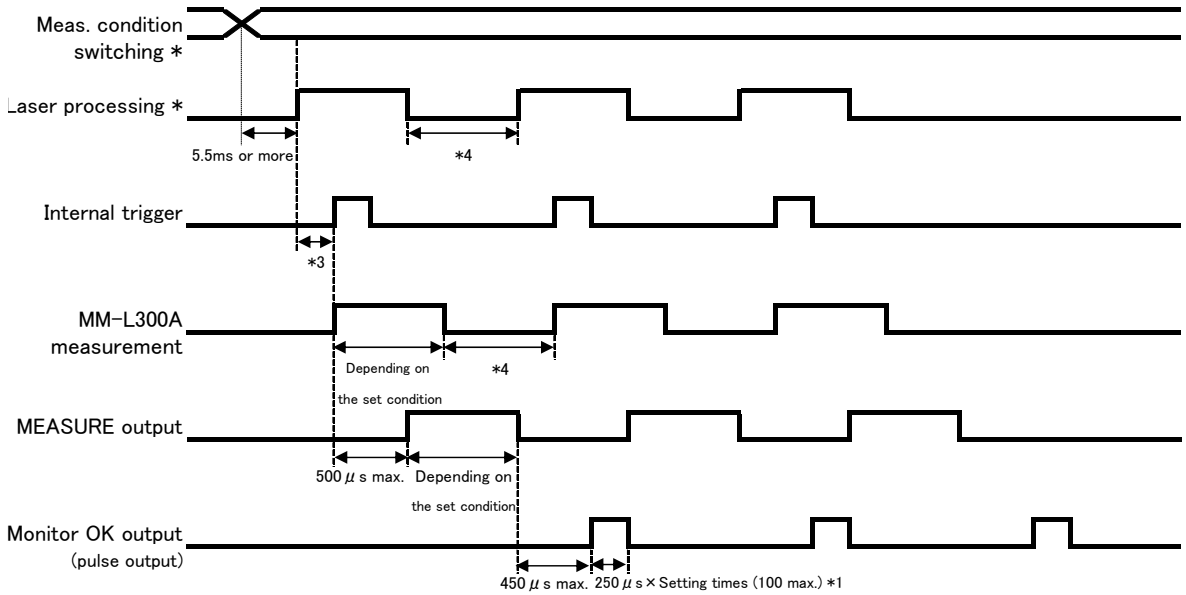
*1: When the next pulse signal is output before the time of “250 μs x setting times”, this signal becomes continuous without being turned off.

*2: For the level output setting, this signal is not turned off when the same signal remains.

(3) When conditions are manually switched in internal trigger mode and local mode

The following diagram shows the lapse of time in the case where measurement by laser processing is performed 3 times after the measurement condition number is manually switched, all 3 times are judged as OK, and pulse output is made.

(*: Operation on the user side)



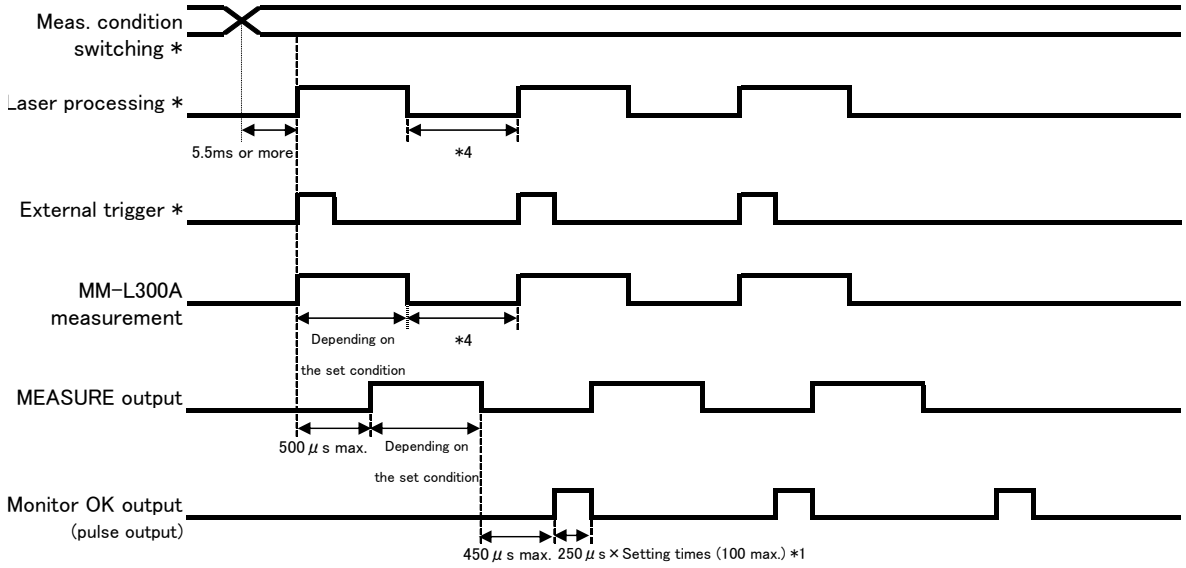
*3: The internal trigger is applied when the measured value obtained by emitted light from the processing end exceeds the trigger value set in the **MM-L300A**. Therefore, it varies depending on the laser condition and the workpiece material, or set trigger value, etc.
Also, the timing cannot be matched to the laser output start due to the specification above.
To match it, switch the mode to the external trigger mode and input the external trigger to the **MM-L300A** at the same timing as the laser oscillation signal.

*4: The minimum time from measurement end to start of the **MM-L300A** is 1 μs. However, at least 500 μs is required for check a correct measurement judgment output. (Refer to **8. (2) Conditions for Obtaining Waveform**.)
Specify the time from the laser end to the next laser output start considering above.

(4) When conditions are manually switched in external trigger mode and local mode

The following diagram shows the lapse of time in the case where the external trigger mode is switched from conditions in (3) and the external trigger is input at the same timing as laser oscillation

(*: Operation on the user side)

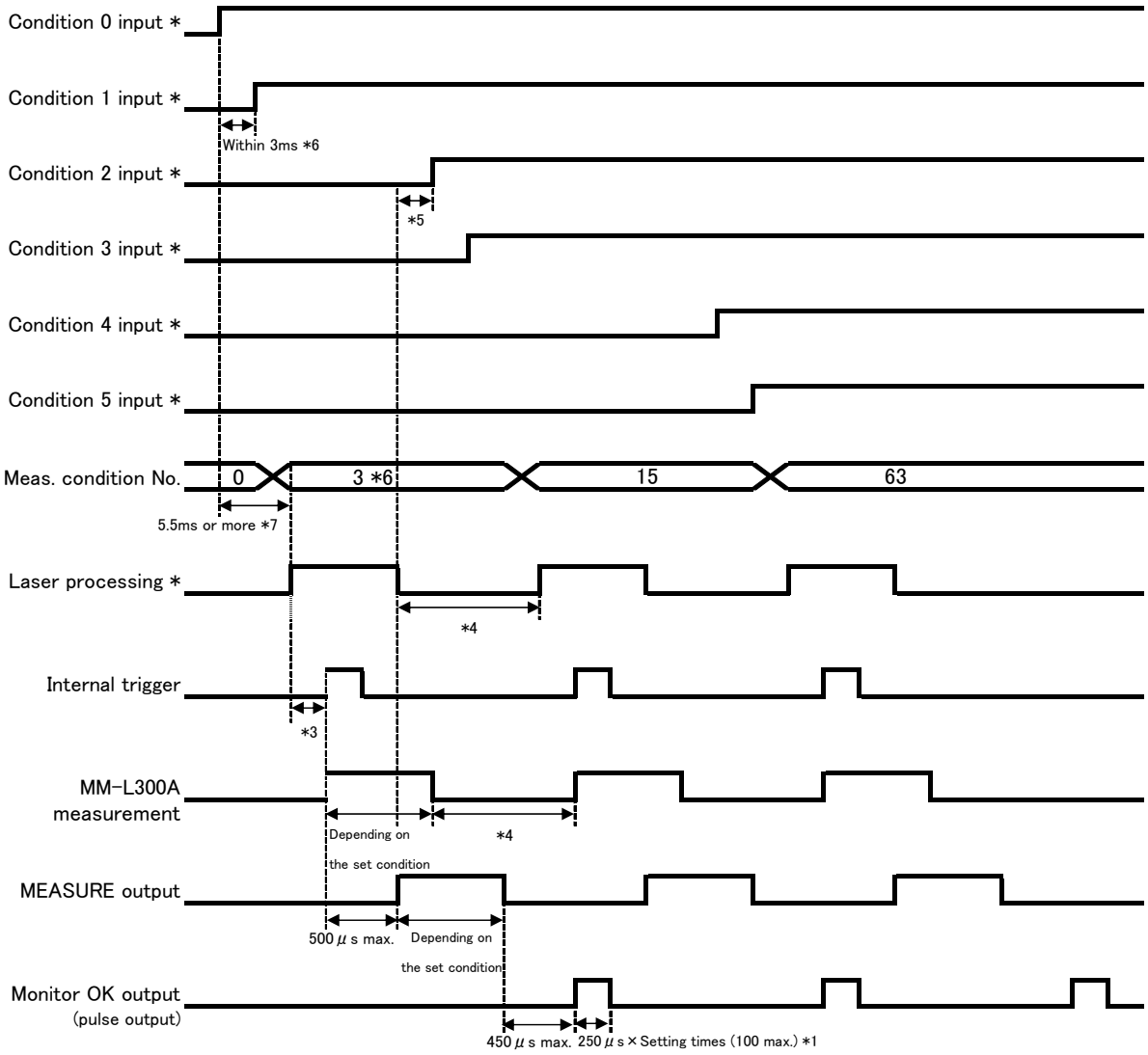


(5) When conditions are switched by external I/O in internal trigger mode and remote mode

Conditions are switched by external I/O before laser processing and condition number is changed in the order of 0 → 3 → 15 → 63.

The following diagram shows the lapse of time in the case where measurement by laser processing is performed 3 times, all 3 times are judged as OK, and pulse output is made.

(*: Operation on the user side)



*5: The measurement condition switching can be changed even while the **MM-L300A** performs measurement if it is later than the MEASURE output.

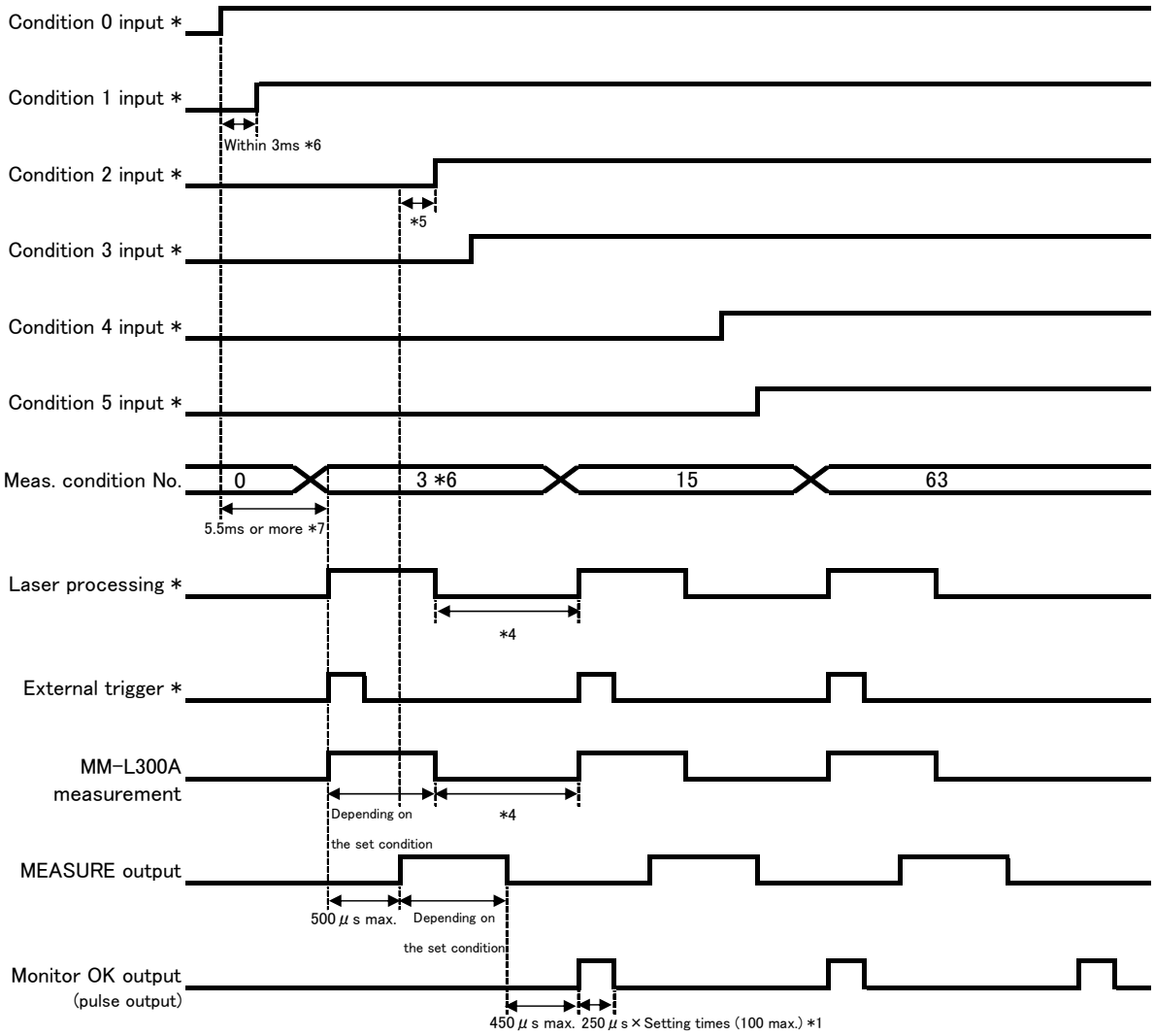
*6: When the interval between Condition 0 and Condition 1 is later than 3 ms, condition number is transmitted to the **MM-L300A** in the order of 0 → 1 → 3. To turn on and off multiple conditions, change all conditions within 3 ms after the condition switching start.

*7: The measurement condition switching is changed 5.5 ms after the condition switching start.

(6) When conditions are switched by external I/O in eternal trigger mode and remote mode

The following diagram shows the lapse of time in the case where the external trigger mode is switched from conditions in (5) and the external trigger is input at the same timing as laser oscillation.

(*: Operation on the user side)



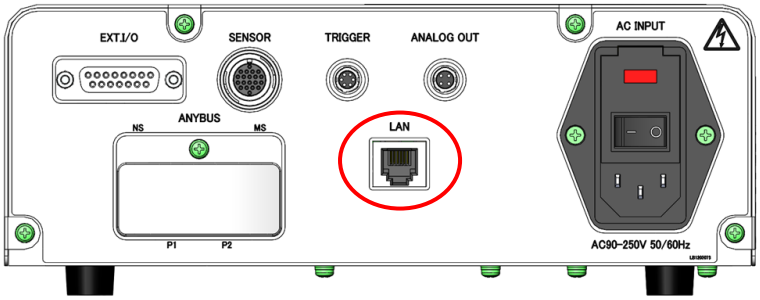
10. JSON

JSON (JavaScript Object Notation) is a data exchange format which can save and exchange data in an intuitive manner. It can create a web page dynamically by using JavaScript and represent data.

The **MM-L300A** can obtain the waveform data in the JSON format.

(1) Connection

JSON objects can be used when connecting to the LAN connector on the rear of the **MM-L300A**.



The communication settings such as IP address of the **MM-L300A** are set on the attached PC software. Refer to **6. (10) Maintenance Window**.

(2) JSON Object

(1) Returning the number of waveforms saved in the MM-L300A

Input and send GET:http://___.___._.__/api/1/waves/counts.json.
(IP address of MM-L300A)

Name	Data type	Note
count	Number	Number of saved waveforms (0 to 20000)

- Sample layout of JSON object
  {“count” : 20000 }

(2) Returning the waveform data of the specified number <num>

Input and send GET:http://___.___._.__/api/1/waves/data.json?num=<num>.
(IP address of MM-L300A)

When 1 is specified to <num>, the last waveform. 2 returns the second from last, 3 returns the third from last, ..., and n returns the n-th from last waveform. When a non-existent number is specified, blank list is returned.

Name	Data type	Note
wave-num	Number	Waveform serial number (0 to 255)

Name	Data type	Note
status	Number	Judgment result. Number is returned as follows: 1: Normal 2: Upper limit over * 4: Lower limit over * 6: Upper and lower limits over * 0: Integral judgment error (No upper and lower limits over. For details, refer to Integral-judge.) * Integral judgment error may occur simultaneously.
data-points	Number	Number of valid data, m (0 to 3056)
skip-times	Number	Number of skips (0 to 255)
average-times	Number	Number of moving averages (1 to 255)
sampling	Number	Sampling cycle (0 to 4294967295 µs)
date	Number	Waveform-recorded date and time (µs resolution in UNIX format)
integration	Number	Integrated value (0 to 4294967295)
min	Number	Minimum value (0 to 65535)
max	Number	Maximum value (0 to 65535)
condition	Number	Measured condition setting number (0 to 63)
wave-data	Number array	Waveform data (0 to 65535) Number of valid data, m (3056 max.)
Integral-num *1	Number	Number of partial integrated value, l (0 to 4)
Integral-judge *1	Number array	Judgment result of integral judgment Array of sixteen judgment error statuses (0: Absence of error, 1: Existence of error) in the following order: - Upper limit error (Area) - Lower limit error (Area) - Upper limit error (Amplitude) - Lower limit error (Amplitude) - Upper limit error (Times) - Lower limit error (Times) - Partial integration 1 Upper limit error - Partial integration 1 Lower limit error . . . - Partial integration 3 Upper limit error - Partial integration 3 Lower limit error After this, fixed to reserved 0
Integral-data *1	Number array	Partial integrated value (0 to 4294967295) Number of Partial integrated value, l

*1 Returned only when the integral judgment is valid.

- Sample layout of JSON object

```
{
  “wave-num” : 1,
  “status” : 1,
```

“data-points” : 3000,

“skip-times” : 0,

“average-times” : 1,

“sampling” : 1,

“date” : 1498529161000000,

“integration” : 805228545,

“min” : 0,

“max” : 65535,

“condition” : 63,

“wave-data” : [65535, 65535, ……, 65535]

Number of valid data (data-points), m

‘‘Integral-num” : 3,

‘‘Integral-judge” : [0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0],

‘‘Integral-data” : [12345, 23153, 0]

Number of partial integration (Integral-num), l

}

(3) Returning the total number of waveforms obtained from the start of the **MM-L300A**

Input and send GET:http://___.___._.__/api/1/waves/total.json.
(IP address of MM-L300A)

This value is not reset by [Counter Reset] on the PC software.

Name	Data type	Note
total-count	Number	Total number of waveforms from the start of the **MM-L300A** (0 to 18446744073709551615)

- Sample layout of JSON object
  {“total-count” : 20000 }

11. EtherNet/IP

(1) Function Overview

The **MM-L300A** optionally supports EtherNet/IP and can participate in the EtherNet/IP network as an adapter (server).

By connecting to a scanner (client) device such as PLC and EtherNet/IP network, you can obtain data from the **MM-L300A** and change settings.

Access the **MM-L300A**

The **MM-L300A** works as an adapter (server) device on the EtherNet/IP network. The **MM-L300A** cannot start the request. A scanner (client) device starts the request for the **MM-L300A**.

Regarding request, there are two types of message:

- Explicit message:
  Used for accessing the **MM-L300A** only when required and transmitting data.
- Implicit message:
  Periodically transmits the **MM-L300A**'s data specified in advance.

* For detail specifications of EtherNet/IP, refer to the information issued by ODVA, Inc.

* The **MM-L300A** supports EtherNet/IP by using Anybus CompactCom 40 EtherNet/IP of HMS Industrial Networks AB.

Trademark

- EtherNet/IP™ is a trademark of ODVA, Inc.
- Anybus® is a registered trademark of HMS Industrial Network AB.

(2) Network Connection

ANYBUS connector installation

1) Remove two screws at the front of the ANYBUS connector with the attached L-type wrench.
Then, remove the cover marked “EtherNet/IP.”
This cover is not used when ANYBUS is installed.

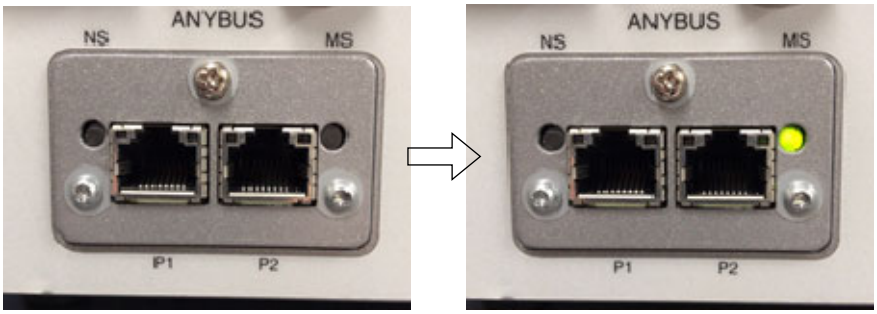

2) Insert the attached ANYBUS cover where the cover was present.
Then, temporarily tighten the screws with the screws removed in Step 1.


3) Turn OFF the **MM-L300A**.
Inserting the ANYBUS connector without turning OFF the **MM-L300A** may result in malfunction.

4) Remove the cover and the M3 screw attached at the ANYBUS on the rear of the **MM-L300A** with a screwdriver.

5) Insert the ANYBUS connector where the ANYBUS slot cover was present and lock the ANYBUS connector by tightening two screws with the L-type wrench attached to the ANYBUS connector.

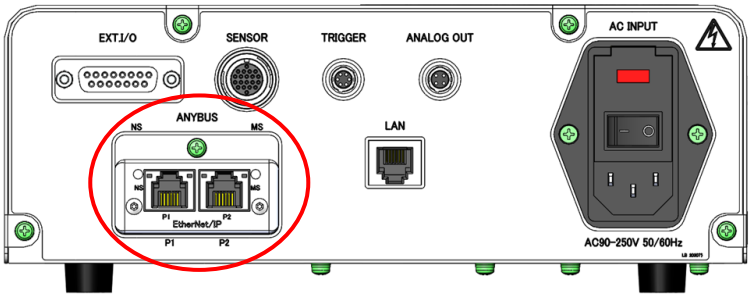
6) Turn ON the **MM-L300A**.
Confirm that the Module Status (MS) LED flashes in green after a while and the connector becomes in an idle state.
If the LED does not light up normally, perform Step 5. It may a contact failure of the connector.



Cable connection with the **MM-L300A**

Install the EtherNet port to connect to a network by EtherNet/IP (option). Connect the LAN cable (option) to the EtherNet port. For how to use EtherNet/IP, consult us.

* The LAN connector does not support EtherNet/IP.



MM-L300A setting

The default TCP/IP setting of the ANYBUS connector of the **MM-L300A** is DHCP (Dynamic Host Configuration Protocol). Automatically obtained from the DHCP server.

The DHCP setting can be disabled. The **MM-L300A** uses Anybus CompactCom 40 EtherNet/IP of HMS Industrial Network AB. Using Anybus IPconfig which can be downloaded free of charge from HMS's website www.anybus.com, the network setting such as IP address and validity/invalidity of DHCP can be changed.

The network setting can also be obtained through the TCP/IP interface object.

Preparation of scanner (client) device

To make the **MM-L300A** participate in network, you need to first install the device profile (EDS (Electronic Data Sheet) file) of the **MM-L300A** to a scanner (client) device. A scanner (client) device communicates with the **MM-L300A** based on the EDS file.

Install the attached EDS file to a scanner (client) device. For how to install, refer to the operation manual for a scanner (client) device.

How to get the EDS file

[MM-L300A_V1_1.eds] in the CD of the attached MM-L300A application software (AS1193660) is the EDS file of EtherNet/IP.

(3) Explicit Message

Explicit message is request response type communication.

The **MM-L300A** can read (Get) and write (Set) following data. The parameters of each data shown below are assigned to Parameter object. The number shown in the following table is the instance number of Parameter object.

- Data of the **MM-L300A**

#	Data name	Data type	Access	Data contents
1	CPU Version	SHORT_STRING	Get	CPU software version
2	FPGA Version	SHORT_STRING	Get	FPGA version
3	Sensor Version	SHORT_STRING	Get	SENSOR version
4	Status	USINT	Get	**MM-L300A** status 0: CPU Init. 1: FPGA Init. 2: Idle 3: Measuring 4: NG Wave 5: Change No. 6: Error
5	DIO Status	BYTE array [2]	Get	EXT. I/O status (1 = ON, 0 = OFF) Each bit shows the state of the following signal. [0]: Input signal bit0 to 5: Condition 0 to 5 (Pin 2 to 7) bit6: RESET (Pin 10) bit7: (Reserve) [1]: Output signal bit0: READY (Pin 11) bit1: ERROR (Pin 12) bit2: OK (Pin 13) bit3: NG (Pin 14) bit4 to bit7: (Reserve)
6	Error Info	BYTE	Get	Error status 0 = Normal Other than 0 = Occurrence of error whose error code is the number of bit “1”

#	Data name	Data type	Access	Data contents
7	Wave Data	UINT array [16]	Get	Waveform data last obtained (header part) [0]: Waveform attribute [1]: Number of data points [2]: Number of moving averages (high-order 8 bit), number of skips (low-order 8 bit) [3]: Sampling cycle μs (low-order 16 bit) [4]: Sampling cycle μs (high-order 16 bit) [5]: Value of Time 16 to 0 bit (UNIX time format, in the unit of μs) [6]: Value of Time 31 to 17 bit [7]: Value of Time 47 to 32 bit [8]: Value of Time 63 to 48 bit [9]: Integrated value (low-order 16 bit) [10]: Integrated value (high-order 16 bit) [11]: Minimum value [12]: Maximum value [13]: Measured condition setting number [14] to [15]: (Reserve)
8	Condition	UINT array [16]	Get	Settings of current condition (header part) [0]: Reserve [1]: Number of data points [2]: Resolution μs (low-order 16 bit) [3]: Resolution μs (high-order 16 bit) [4]: Sampling cycle μs (low-order 16 bit) [5]: Sampling cycle μs (high-order 16 bit) [6]: Sensor unit analog gain [7]: Number of moving averages (high-order 8 bit), number of skips (low-order 8 bit) [8] to [15]: (Reserve)
9	Condition No	USINT	Get/Set	Currently set condition number (For Set, the setting is reflected when the Condition Cntl is local.)
10	Condition Cntl	USINT	Get/Set	Change source of condition setting 0 = Remote (external DI switching) 1 = Local (other than external DI)
11	Trigger Mode	BOOL	Get/Set	Trigger mode 0 = External 1 = Internal
12	Wave Count	UDINT array [4]	Get/Set	Waveform count [0]: High-order 32 bit of TOTAL count [1]: Low-order 32 bit of TOTAL count [2]: High-order 32 bit of NG count [3]: Low-order 32 bit of NG count
13	Unit ID	UINT	Get	Unit ID
14	IP Address	USINT array [4]	Get	IP address setting of the **MM-L300A** (LAN connector)
15	Subnet Mask	USINT array [4]	Get	Subnet mask setting of the **MM-L300A** (LAN connector)
16	Gateway Address	USINT array [4]	Get	Default gateway setting of the **MM-L300A** (LAN connector)

#	Data name	Data type	Access	Data contents
17	Use memory Area	UINT	Get	Used memory area
18	Current Time	USINT array [5]	Get	Current time [0]: Year (last two digits) [1]: Month [2]: Day [3]: Hour [4]: Minute [5]: Second
19	Digital Gain	UINT	Get/Set	Digital gain Decimal-point omitted value (1.0000 setting of the PC software is 10000.)
20	Digital Offset	INT	Get/Set	Offset
21	Trigger Value	UINT	Get/Set	Trigger setting
22	DO Output Type	BYTE	Get/Set	Output setting of EXT. I/O (0 = Level, 1 = Pulse output) Each bit shows the following output setting. bit0: READY (Pin 11) bit1: ERROR (Pin 12) bit2: OK (Pin 13) bit3: NG (Pin 14) bit4 to bit7: (Reserve)
23	Guide	BOOL	Get/Set	ON/OFF of guide light 0 = Guide light OFF 1 = Guide light ON

(4) Implicit Message

Implicit message periodically transmits data specified in advance.

The implicit message of the **MM-L300A** supports the instance ID100 of Assembly object.

Data of the following order can be read periodically.

Data	Size (byte)
Status	1
DIO Status	2
Error Info	1
Wave Data	32
Condition	32
Condition No	1
Condition Ctrl	1
Trigger Mode	1
(Unused)	1
Wave Count	16
	88 in total

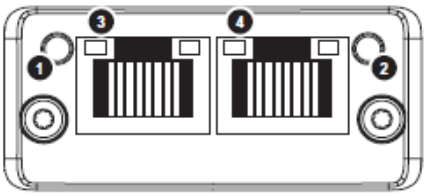
For details of data, refer to “Data of the **MM-L300A**” in **(3) Explicit Message**.

* The **MM-L300A** supports the implicit message, but read only. There is no writable data. (The instance ID150 of Assembly object is assigned to writing data, but the data size is 0.)

(5) LED Status Indication

Each LED on the ANYBUS connector indicates a network connection status.

#	Item
(1)	Network status (NS) LED
(2)	Module status (MS) LED
(3)	Link / Activity LED (Port 1)
(4)	Link / Activity LED (Port 2)



(1) Network status (NS) LED

LED status	Description
Off	No power or no connection
Green	On-line, 1 or more connections established (CIP class 1 or 3)
Green flashing	On-line, no established connection
Red	IP address overlapping, fatal error
Red flashing	1 or more connections timed out (CIP class 1, 3)

(2) Module status (MS) LED

LED status	Description
Off	No power
Green	Connector is in a RUN state.
Green flashing	Connector is in an idle state.
Red	Serious failure
Red flashing	Restorable failure. The setting is made, but the saved parameter is different from the parameter in use.

(3), (4) Link / Activity LED

LED status	Description
Off	No link, no activity
Green	Link (100 Mbit/s) established
Green flickering	Activity (100 Mbit/s)
Yellow	Link (10 Mbit/s) established
Yellow flickering	Activity (10 Mbit/s)

(6) Specifications

The basic specifications of EtherNet/IP server function of the **MM-L300A** are shown below.

For specifications other than EtherNet/IP of the **MM-L300A**, refer to **13. Specifications**.

Item	Specification
Maximum number of connections	6 (Explicit) + 4 (Implicit)
Use port	44818 (TCP), 2222 (UDP), 3250 (UDP) *1
Available message	Explicit (Class 3) + Implicit (Class 1)
Available object	Assembly, Parameter, Quality of Service *2
ACD function (Address Conflict Detection)	Available
QuickConnect function	Not available
DLR function (Device Level Ring)	Not available
EtherNet connector specifications	Dual port Ethernet (RJ-45 2 port)
	10/100 Mbit/s, full duplex or half duplex communication (Auto-negotiate supported)
	LED indication of module status and network status
Authentication	Already acquired by ODVA. File No. 11655.01 (August 3, 2017)

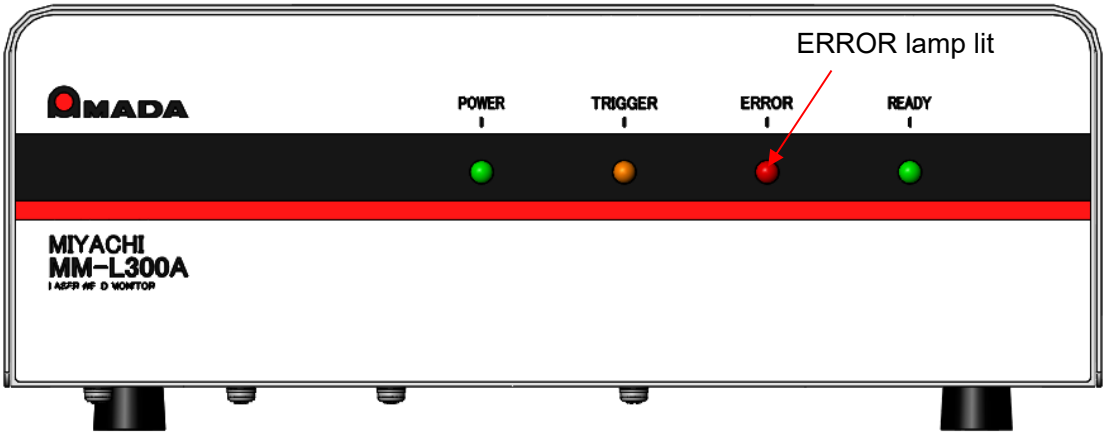
*1 Mainly, 44818 (TCP) port is used for Explicit message and 2222 (UDP) port for Implicit message. 3250 (UDP) port is used when the network setting is made by Anybus IPconfig.

*2 Description of the required object of EtherNet/IP is omitted.

12. Maintenance

(1) Troubleshooting

When an error occurs in the **MM-L300A**, the ERROR lamp on the display panel lights up in red.



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

The error codes list is shown in the following table:

Error code	Error display	Contents of error and corrective measure
0001	Voltage of the backup battery is low.	The voltage of the memory backup lithium battery is low. Replace the battery. (Refer to **12. (3) Replacing the Battery.**)
0002	Connection error : Sensor unit	Effective only when the personal computer is connected. The connection with the **SU-N300A/SG-N300A** is checked at the time of startup and start of obtaining waveform. When this error is output even if the **SU-N300A/SG-N300A** is connected, consult us.
0003	Abnormal : Peltier temperature	High temperature error of the **SU-N300A/SG-N300A**. Confirm that the equipment is used under the use environment condition.
0004	Connection error : Memory card	The memory card cannot be recognized. 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.

Symptoms that occur until a state changes to on-line

Symptom	Confirmation item	Measures
The power supply is not turned on.	Is the AC cable connected?	Connect the AC cable.
	Is a current applied to the switchboard (power supply)?	Turn on the circuit breaker in a switchboard.
	Is the power supply voltage normal?	Use with a voltage of 90 - 250 V AC.
	Are cables normal? (disconnection, etc.)	Use the normal cable.
	Is the fuse broken?	Replace the fuse. (Refer to **12. (4) Replacing the Fuse**.)
State does not change to on-line.	Is the IP address of the personal computer different from that of the **MM-L300A**?	Set a different IP. (**6. (1) (2) IP address setting**.)
	Is the IP address of the **MM-L300A** set to [192.168.1.10] when connecting it for the first time after purchase?	Change it on the Maintenance Window. (Refer to **6. (10) Maintenance Window**.)
	Is the LAN cable connected?	Connect the LAN cable.
	Is the power supply of the **MM-L300A** turned on?	Turn on the power supply.
The software cannot be installed.	Doesn't the installer start automatically?	Start it manually. (Refer to **6. (1) Setup**.)
	Is the .NET Framework installed?	Install it from Microsoft. For installation, the network connection is required.
The **MM-L300A** does not become READY.	Is the ERROR lamp at the front of the **MM-L300A** lit?	When the ERROR lamp is lit, check the Error Information. (Refer to **12. (1) Troubleshooting**.) When the ERROR lamp is not lit, consult us.
Transfer to the personal computer is not started.	Is the sensor unit connecting cable disconnected?	Surely connect the sensor unit connecting cable between the **MM-L300A** and the **SU-N300A/SG-N300A**.
	Is the sensor unit connecting cable damaged?	Use the normal sensor unit connecting cable.

Symptoms that occur until waveforms are obtained

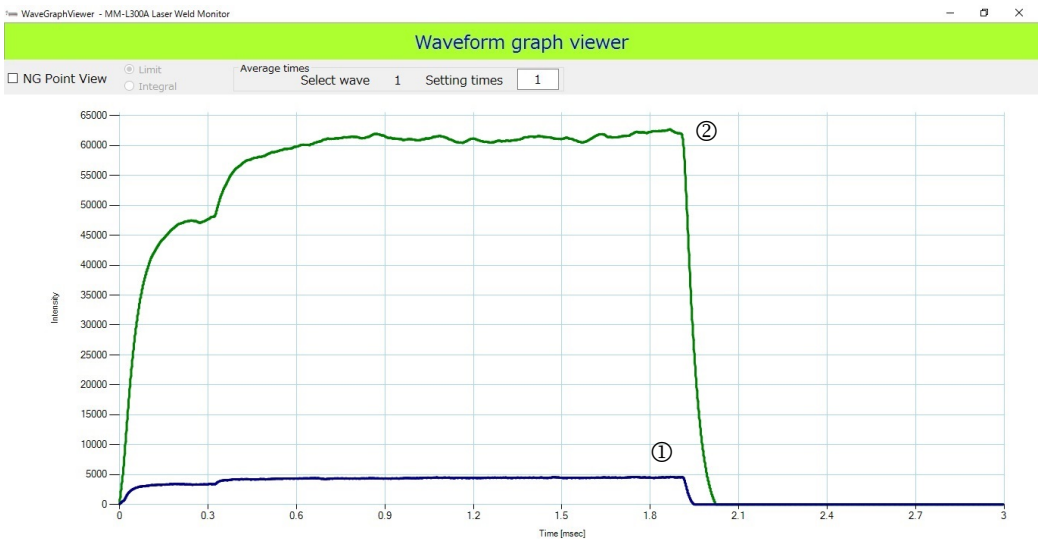
Symptom	Confirmation item	Measures
The guide light cannot be turned on.	Is the [Guide ON] button clicked on the Menu Window?	Click the [Guide ON] button. (For the **SG-N300A**, the guide light is not turned on.)
Waveforms cannot be obtained. / The intensity of waveform is low or high.	Is the monitoring point the **MM-L300A** aligned with the processing point?	Align the monitoring point of the **MM-L300A** with the processing point.
	Is the analog gain and digital gain adjustment proper?	Adjust the analog gain and digital gain so that waveforms can be obtained.
	Are the settings of external trigger and internal trigger proper?	Change them on the Maintenance Window.
	Is the trigger setting too high?	Lower the set value of the trigger.
	Is the external trigger input?	Check the TRIGGER. (Refer to 9. Interface.)
	Is the specification of the sensor proper?	Use a sensor with a proper specification. *1
	Is the specification of the filter for SU-N300A/SG-N300A proper?	Use a filter for SU-N300A/SG-N300A with a proper specification. *2
	Is the laser welding performed within the measurable range of the light-receiving unit?	Perform laser welding within the measurement range of the light-receiving unit.
The external trigger cannot be applied from the external trigger unit. (for the reflected light)	Are cables normal? (disconnection, etc.)	Use the normal cable.
	Is the trigger mode on the Maintenance Window on the MM-L300A software [External]?	Set the trigger mode to [External].
	Are laser conditions proper? (laser output, workpiece material, or laser irradiation angle, etc.)	Perform laser welding with proper laser conditions.
The external trigger cannot be applied from the external trigger unit. (for the 10 V input)	Is the 10 V input pulse input?	Input 10 V by the pulse signal. (Trigger is applied at the startup.)

Symptoms that occur after waveforms are obtained

Symptom	Confirmation item	Measures
Quality judgment cannot be performed.	Is the setting of the upper/lower limit judgment value proper?	Change the setting.
	Is the Threshold setting proper?	Check the setting.
	Is the Skip times setting proper?	Check the setting.
	Is the integral setting proper?	Check the setting.
	Are the Area, Amplitude, and Times settings proper?	Check the setting.
Disturbance of waveform * In proper installation, disturbance in waveform will be suppressed by the average function (moving average).	Is the installation method of the **SU-N300A**, the **SG-N300A** light-receiving unit, or the sensor fiber proper?	Install it so as not to receive vibration etc.
	Is the environment under high noise?	Take proper measures against noise.
EXT. I/O and TRIGGER signals cannot be input and output correctly.	Is the wiring proper?	Check the connection and disconnection of the connector.
	Is the timing chart proper?	Check the timing chart in the operation manual again to confirm the proper setting.

*1 The **SU-N300A** has standard specification and high-sensitivity specification (refer to **3. (2) (3) Selective required option**). When performing measurement with the same setting condition, the measurement intensity is different as shown below. (This tendency is a guide and changes slightly depending on measurement contents and individual difference.)

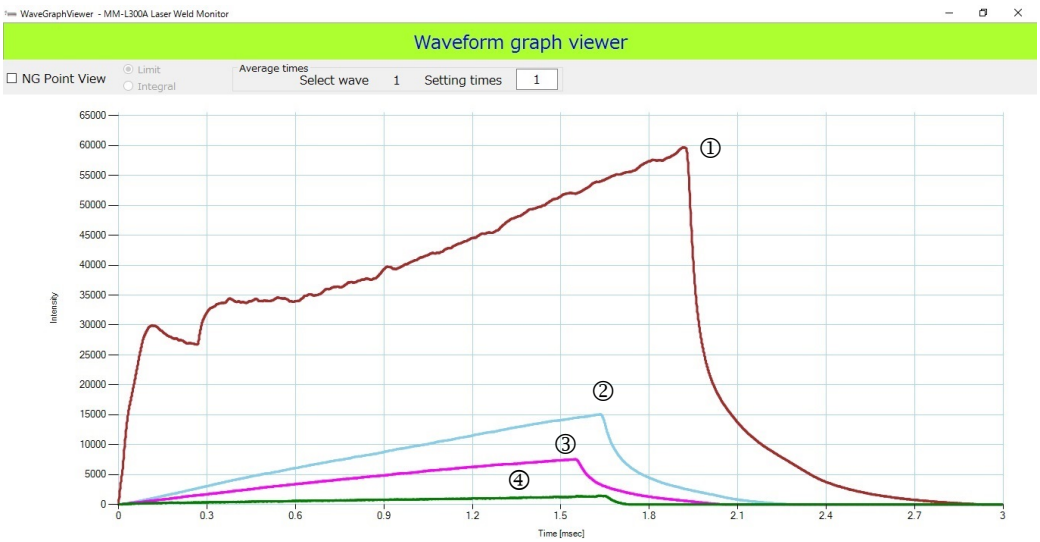
No.	Line color	Product specification
①	Blue	Standard specification
②	Green	High-sensitivity specification



*2 For lineup of the filter for SU-N300A/SG-N300A, refer to **3. (2) (4) Options**. When performing measurement with the same setting condition, the measurement intensity changes as shown below.

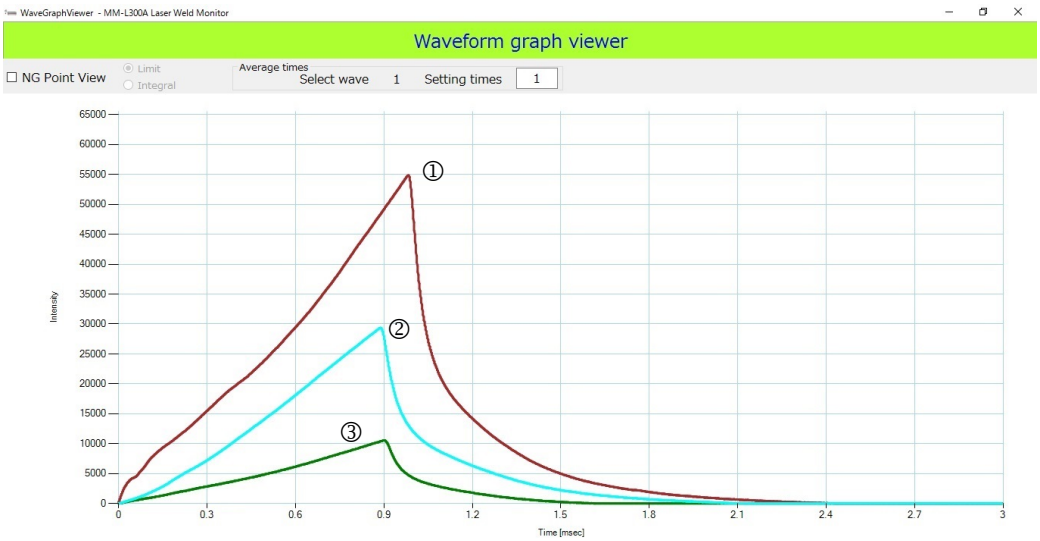
Condition 1

No.	Line color	Filter for SU-N300A	
①	Brown	No filter for SU-N300A	
②	Light blue	Filter for SU-N300A	35% 1 piece
③	Pink		35% 2 pieces
④	Green		5% 1 piece



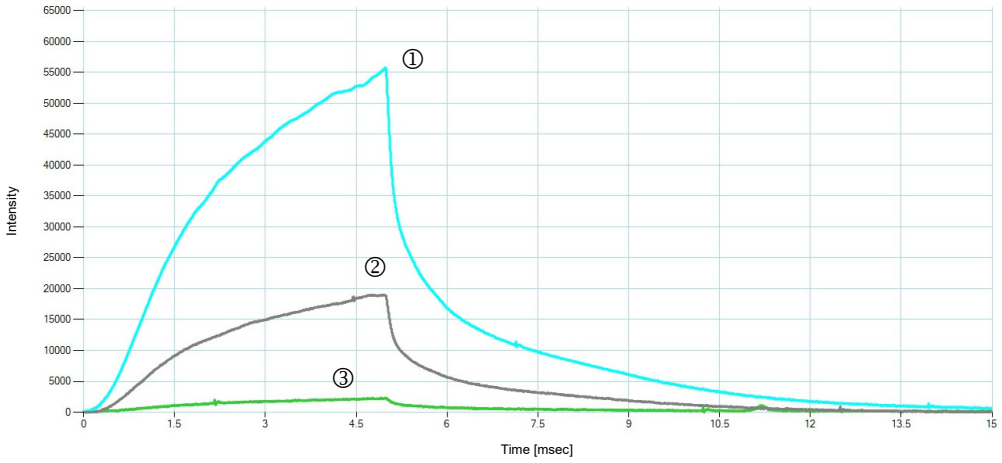
Condition 2

No.	Line color	Filter for SU-N300A	
①	Brown	Filter for SU-N300A	5% 1 piece
②	Light blue		5% 1 piece, 35% 1 piece
③	Green		5% 2 pieces



Condition 3

No.	Line color	Filter for SG-N300A	
①	Light blue	No filter for SG-N300A	
②	Grey	Filter for SG-N300A	35% 1 piece
③	Green		5% 1 piece



(2) Cleaning/Replacing the Protective Glass

The protective glass is designed to prevent the lens from atmospheric dust, spatter from the workpiece, and so on.

If dirty, this may lead to laser power loss. Therefore, regular cleaning and replacement is necessary.

⚠ CAUTION

- Dust may enter the **SU-N300A/SG-N300A** if the protective glass holder and the filter for SU-N300A are not properly tighten.
- Do not touch the surface of the protective glass and the optical filter.
- The protective glass may stick to the protective glass holder through the intermediary of the O-ring. In such case, gently press the protective glass with a finger from above the lens cleaning paper to remove it.

(1) Necessary items

- Lens cleaning paper
- Ethanol
- Air blow
- Gloves (made of latex for clean room)

(2) Maintenance parts

Item	Model No.	Item code
Protective glass *1	PO1192677	1192677
O-ring (for protective glass holder) *1	SS-185 Type 1 A	1192649
O-ring (for main unit) *1	SS-200 Type 1 A	1192650
O-ring (for protective glass) *2	OR VMQ-50 AS568-017 Clear	1209366

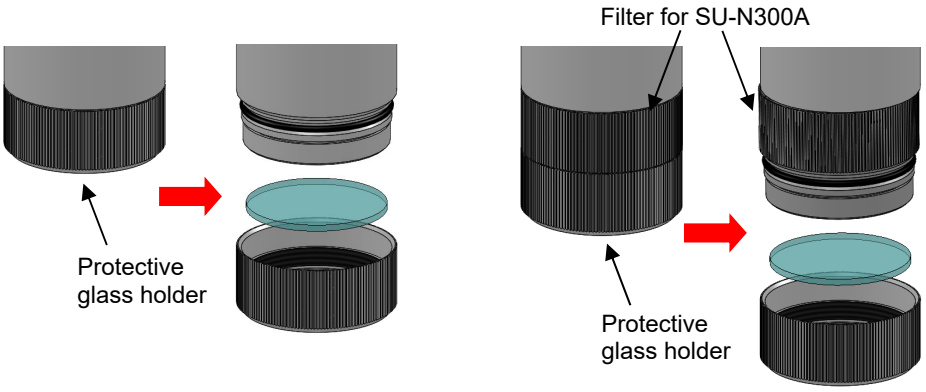
*1 For the **SU-N300A**, replace them together.
*2 For the **SG-N300A**, replace it when the O-ring is damaged.

(3) Cleaning/replacement procedure

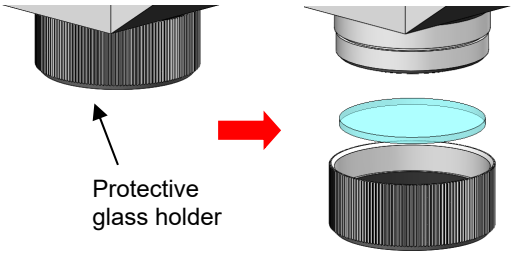
1) Turn OFF the power for the laser device.

2) Turn the protective glass holder at the tip of the **SU-N300A/SG-N300A** to detach from the **SU-N300A/SG-N300**. When the filter for SU-N300A is mounted, it is not necessary to remove the filter (as shown in the lower right figure).
Remove the protective glass in the protective glass holder.

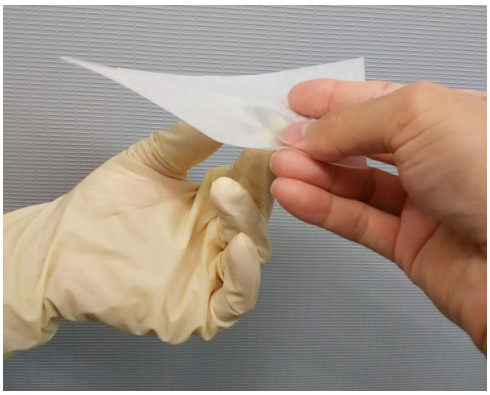
SU-N300A:



SG-N300A:



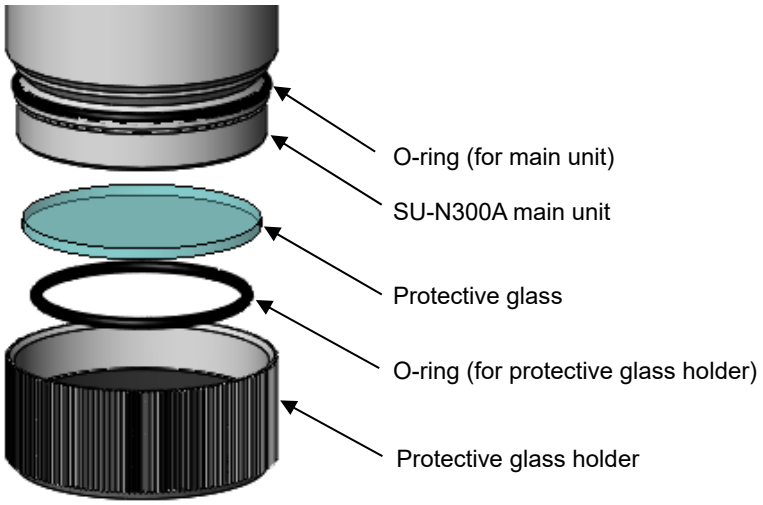
3) Place several drops of ethanol on the lens cleaning paper, make a wet part contact with the protective glass, and slowly pull it from left to right.
If the dirt cannot be cleaned off, replace the protective glass with a new one.



4) Fit the clean (or a new) protective glass into the stepped section of the protective glass holder. The glass orientation is not important.
Turn the protective glass holder until the protective glass is fixed.

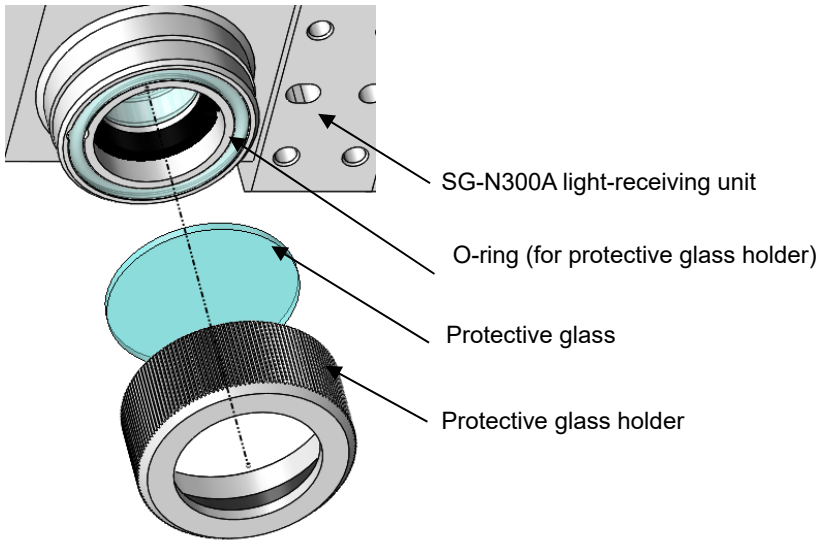
SU-N300A:

After confirming that the O-ring for main unit is attached to the **SU-N300A**, mount the protective glass holder.
At this time, mounting a wrong O-ring damages a dustproof function. Be sure to mount the same O-ring. (A smaller O-ring is used in the protective glass holder.)



SG-N300A:

After confirming that the O-ring for the **SG-N300A** light-receiving unit is not damaged, mount the protective glass holder.
Using a damaged O-ring damages a dustproof function. When the O-ring is damaged, replace it.



(3) Replacing the Battery

The **MM-L300A** incorporates a lithium battery for memory backup.

If the error message appears as a result of low battery voltage, replace the battery according to the following procedure.

> **ATTENTION**
>
> Lithium batteries contain hazardous substances. At the time of disposal, observe the local laws and regulations.

(1) Necessary items

- Phillips screwdriver
- Non-conductive gloves (made of latex, etc.)

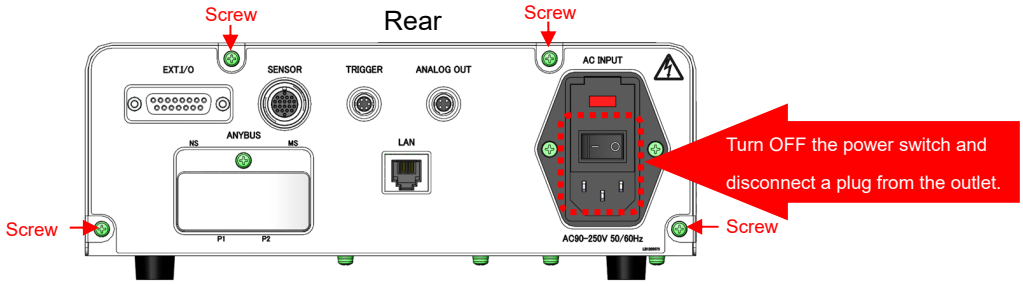
(2) Maintenance parts

Item	Model No.
Manganese lithium battery	CR2032 3V

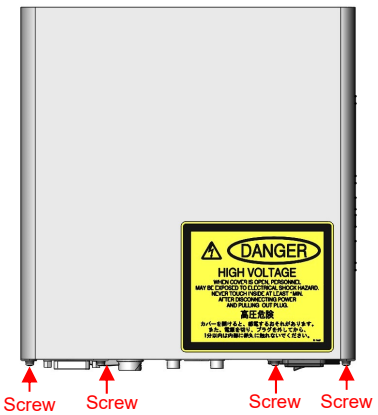
(3) Replacement procedure

1) Wear non-conductive gloves on both hands.

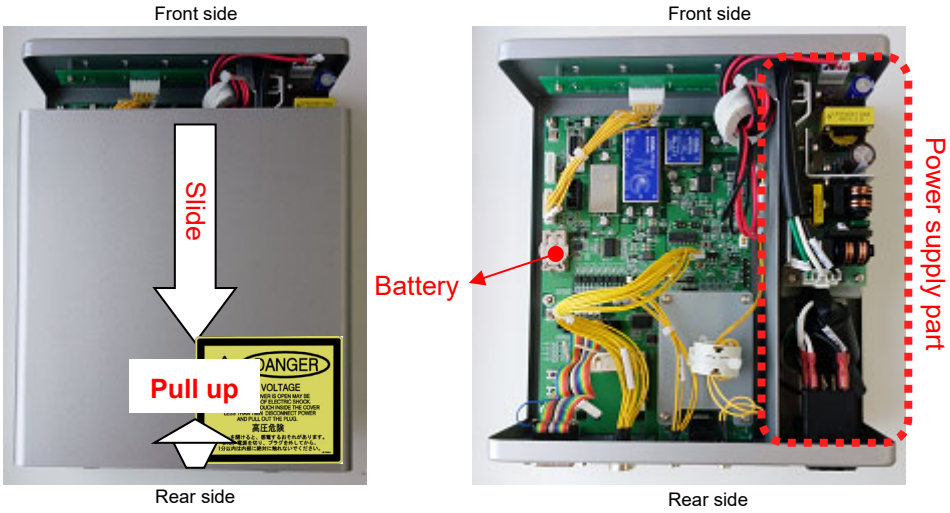
2) Turn OFF the power switch and be sure to disconnect a plug from the outlet.



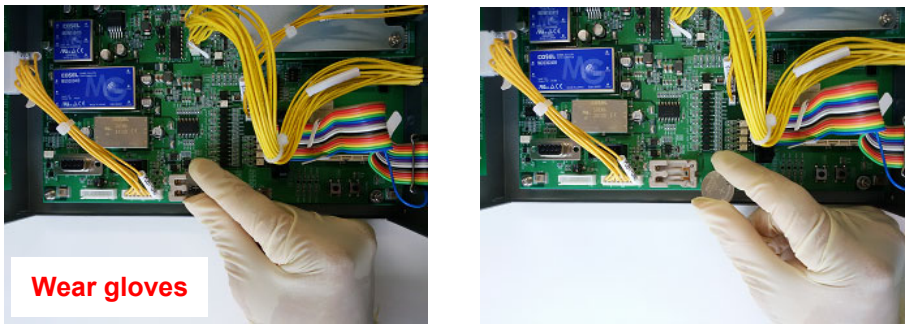
3) After one minute from turning OFF the power switch and disconnecting a plug from the outlet, remove four screws on the rear of the **MM-L300A** with a Phillips screwdriver.



4) Slide the sheet metal cover from the front side to the rear side and pull it upward to remove it.



5) Replace an old battery with a new one not to touch the power supply part.



6) Insert the cover from the rear side and mount it by sliding the front side.

7) Tighten four screws with 0.63 N·m of general torque.

8) Turn the power on.

9) Start the equipment and confirm that the battery error disappears.

10) Perform the Set Current Time. (Refer to **6. (10) Maintenance Window**.)

(4) Replacing the Fuse

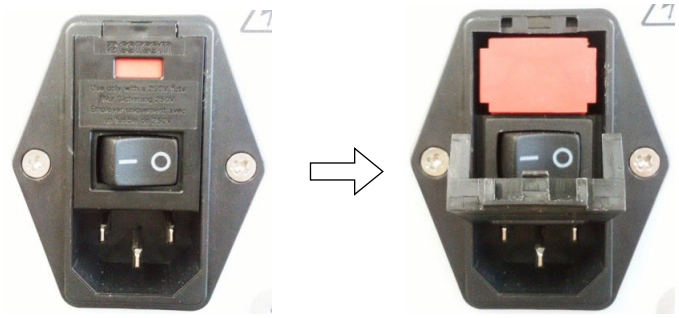
A fuse will be blown out in case of the occurrence of the exceeding the rated voltage (applying overvoltage). If a fuse is blown out, replace it according to the following procedure.

(1) Maintenance parts

Item	Model No.
Fuse	02153.15MXP

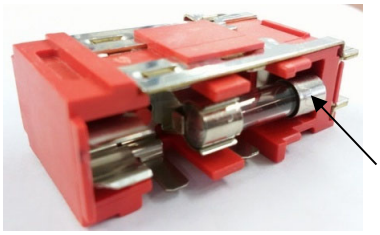
(2) Replacement procedure

1) Open the cover on the AC inlet.

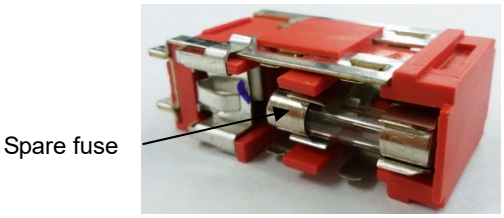


2) Pull out the red fuse box.

3) Remove the fuse on the right side.



4) The box contains a spare fuse on the left side.
Remove it and install it at the position on the right side shown in Step 3.



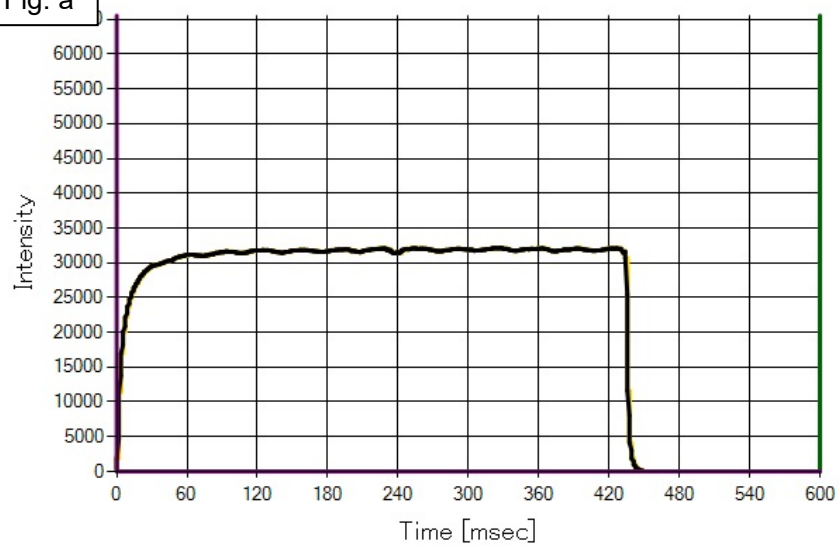
(5) About the SU-N300A/SG-N300A

The **SU-N300A/SG-N300A** does not guarantee the absolute value.
The output intensity of the **SU-N300A/SG-N300A** can be used for comparison to the relative value.

It assumes that waveform data can be always obtained with the same intensity under the determined conditions (laser output, profile, workpiece, and surface state are the same).

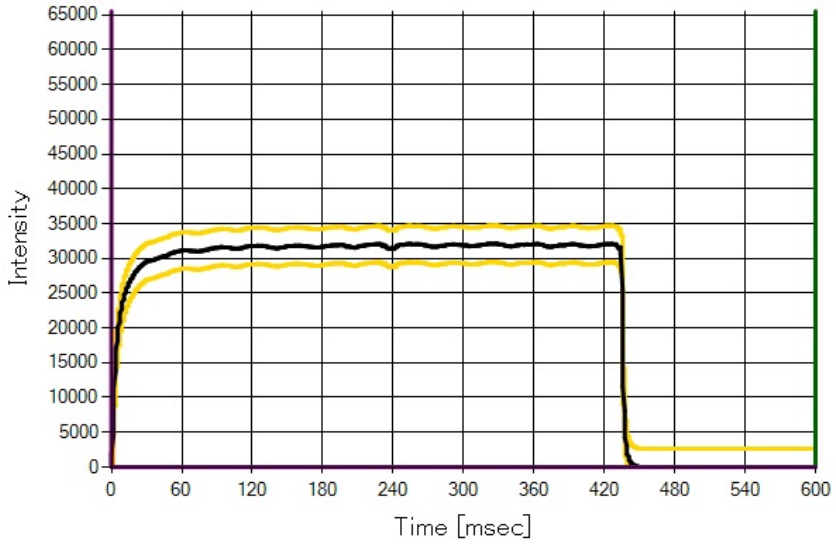
Since the detection intensity also changes when the setting state changes, in order to check that the **SU-N300A/SG-N300A** is normal, as shown in Fig. a, obtain waveforms at any determined conditions by welding on reference workpieces or inputting reference light source into the **SU-N300A/SG-N300A**. For reference light source, contact us.

Fig. a



For the obtained waveform, as shown in Fig. b, make the upper/lower limit setting in an extremely narrow range. On the basis of this condition, make adjustment by Digital Gain or Offset on the Maintenance Window so that the value always falls within a range.

Fig. b



13. Specifications

MM-L300A	Dimensions	230 (W) x 243 (D) x 89 (H) mm (excluding connector) 230 (W) x 391 (D) x 129 (H) mm (when connecting external trigger unit)
	Input supply voltage	Single-phase 90 - 250 V AC, 50/60 Hz
	Power consumption	18 W or less
	External control interface	Input/output: 15-pin, D-Sub (female)
	Input channel	1 channel
	Minimum measuring time resolution	1 µs
	Measuring time setting range	1 µs to 999 sec
	Judging function	Envelope (upper/lower limit setting)
	Maximum storage number of waveform data	20000
	Ambient operating temperature	0 to 40ºC (without condensation)
	Ambient operating humidity	85%RH or less (without condensation)
	Mass	Approx. 3.0 kg
	Grounding class	Class D grounding
	External network	Optionally available (Refer to **11. EtherNet/IP**.)
External trigger unit [*1] **(option)**	Dimensions	230 (W) x 391 (D) x 49 (H) mm
	Supply power voltage	Supplied from the **MM-L300A** main unit
	Detection wavelength	900 to 1,700 nm
	Ambient operating temperature	0 to 40ºC (without condensation)
	Ambient operating humidity	85%RH or less (without condensation)
	Mass	Approx.1.4 kg
SU-N300A	Dimensions	50 (W) x 35 (D) x 96 (H) mm (excluding connector) 50 (W) x 35 (D) x 106 (H) mm (when filter equipped, excluding connector)
	Measuring spot diameter	Approx. φ2 mm when W.D. is 200 mm
	Sight	Green LED (λ = approx. 525 nm)
	Detection wavelength	1,300 to 2,500 nm
	Ambient operating temperature [*2]	5 to 50ºC (without condensation)
	Ambient operating humidity	85%RH or less (without condensation)
	Protection class	IP64 (when connector and cable connected)
	Mass	Approx. 0.2 kg
	Cooling method	Air-cooled [*3]

SG-N300A	Dimensions of sensor part	50 (W) × 261 (D) × 50 (H) mm (excluding connector) 101.5 (W) × 345 (D) × 50 (H) mm (when connecting external trigger input unit)
	Dimensions of light-receiving part	55 (W) × 35 (D) × 44 (H) mm (excluding sensor fiber)
	Mounting method	Fixed (installation to excluding robot or moving stage)
	Measuring spot diameter	Refer to outline drawings.
	Laser welding layout condition	Use conditions avoiding damage risk by reflected light *4
	Sensor fiber allowable bending radius	Short: R30 mm Long: R60 mm
	Sight	Not equipped
	Detection wavelength	1,300 to 2,500 nm
	Ambient operating temperature *2 *5	5 to 50ºC (without condensation)
	Ambient operating humidity	85%RH or less (without condensation)
	Recommended ambient temperature	5 to 35ºC (without condensation)
	Protection class	IP64 (when connector and cable connected)
	Mass	Approx. 1.0 kg Approx. 1.3 kg (when assembling external trigger input unit)
	Cooling method	Air-cooled *3
Common	Vibration when in use	Continuous vibration test (test level: Class S) Frequency: 5 to 14 Hz amplitude control (1.25 mmp-p) 14 to 100 Hz acceleration control (0.5 G) or less Short-duration vibration test (test level: Class S) Frequency: 1 to 7 Hz amplitude control (10 mmp-p) 7 to 100 Hz acceleration control (1.0 G) or less
	Dust, oil mist	JEITA Class S: 8 mg/m^3 or less, 0.1 mg/m^3 or less
	Temperature during transport or storage	-10 to 60ºC (without condensation)
	Humidity during transport or storage	85%RH or less
	Vibration during transport	ASTM D 4728 Level2
	Impact during transport	ASTM D 4169-05 Level2
	Overvoltage category	II, only use of an outlet
	Altitude	2000 m max.
	CE marking	**MM-L300A** and **SU-N300A** are applicable.

*1: Use this product in the environment without conductive dust. If conductive dust enters in the product, this may result in a failure, electric shock, or fire. When using this product in this environment, make contact with us.

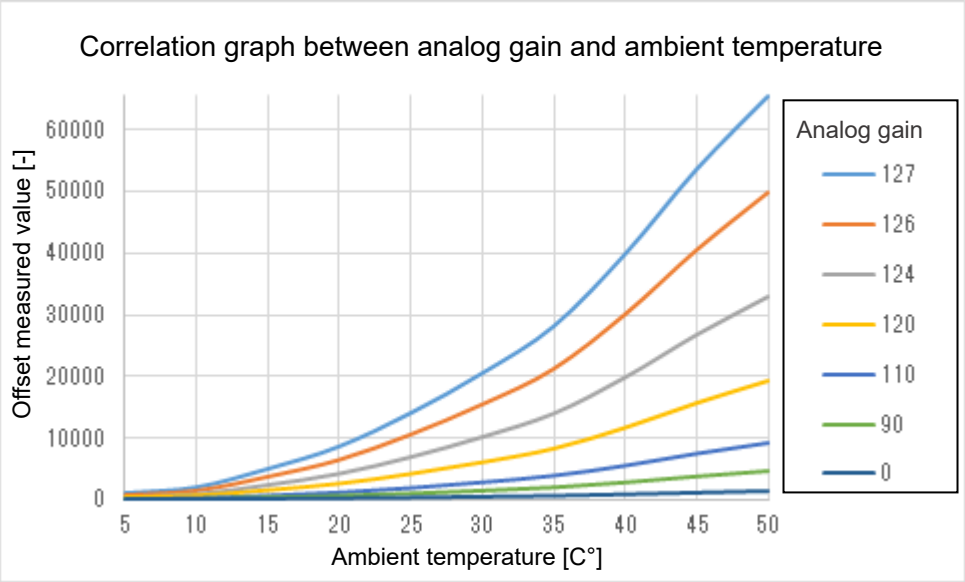
*2: It is recommended to use in the environment where the temperature change is small.

*3: When the **SU-N300A** stores heat by diffusion reflected light from workpiece, you need to take cooling measures such as water-cooled jacket or measures against reflected light. For details, refer to **5. (5)** to **(7)**.

*4: The laser reflected light may cause damage by heat storage or burning of parts. For details, refer to **5. (8) Measures against Reflected Light to the SG-N300A**.

*5: Environmental temperature dependency:
This device has environmental temperature dependency and the offset value (measured value when light is not received) changes depending on environmental temperature. The variation quantity depends on the setting value of the analog gain as shown in the graph below. To reduce

the influence of environmental temperature, it is recommended to set the analog gain to a small value.

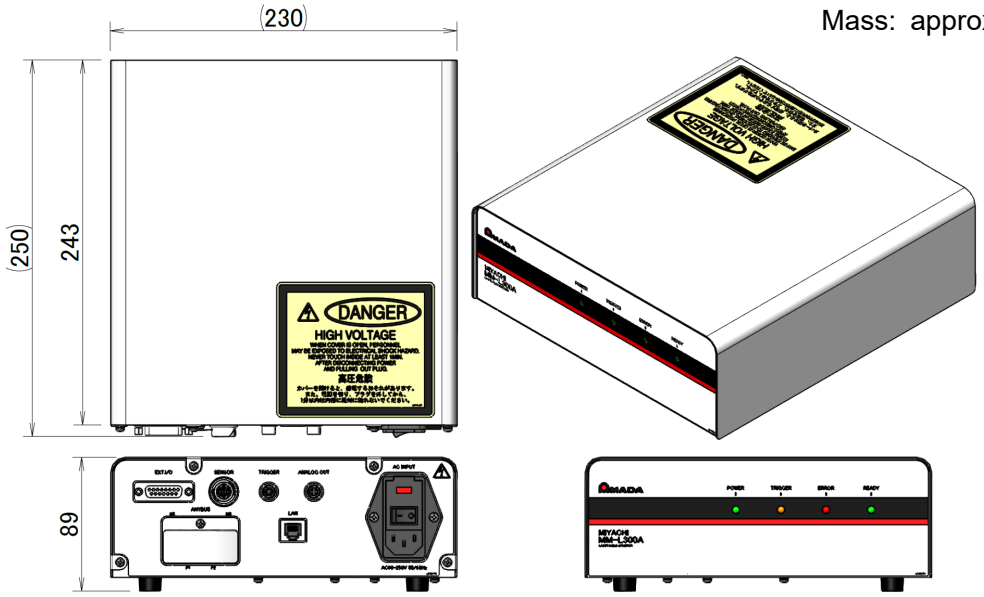


14. Outline Drawing

The unit is mm.

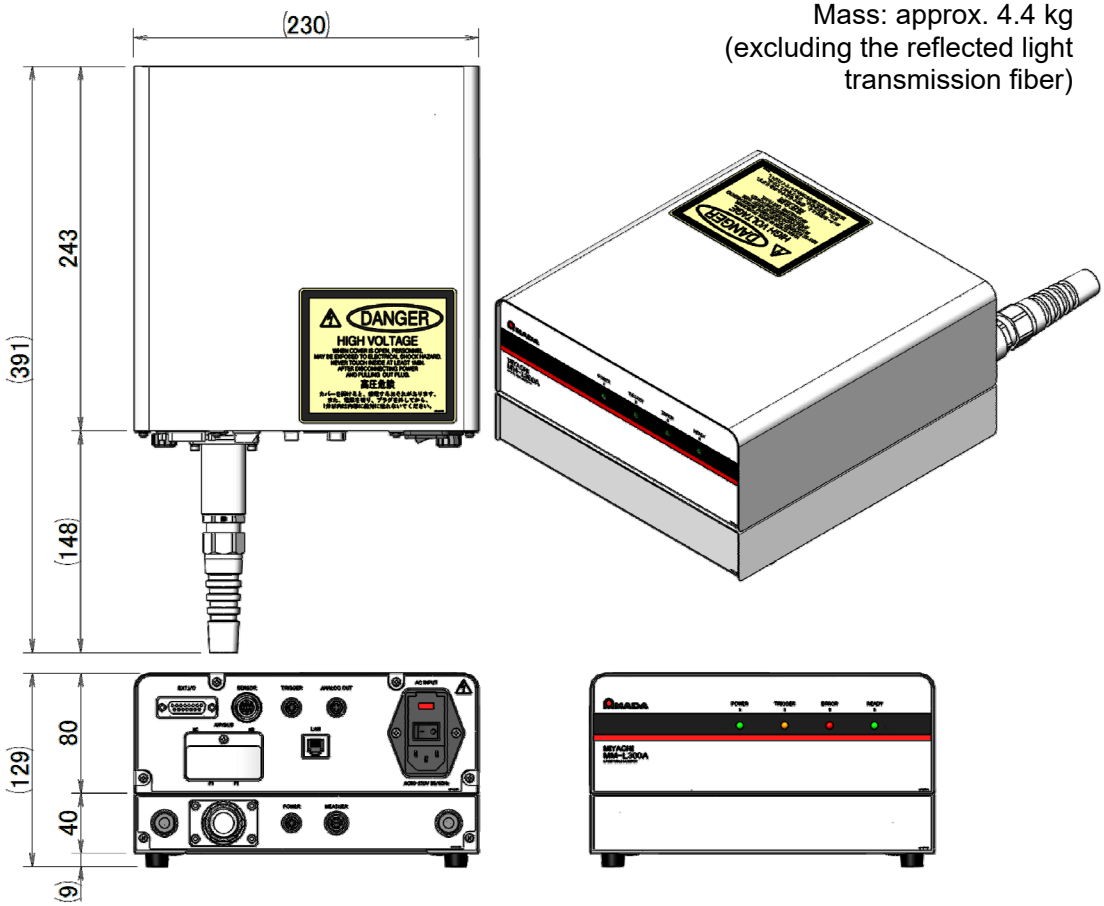
(1) MM-L300A

Mass: approx. 3.0 kg



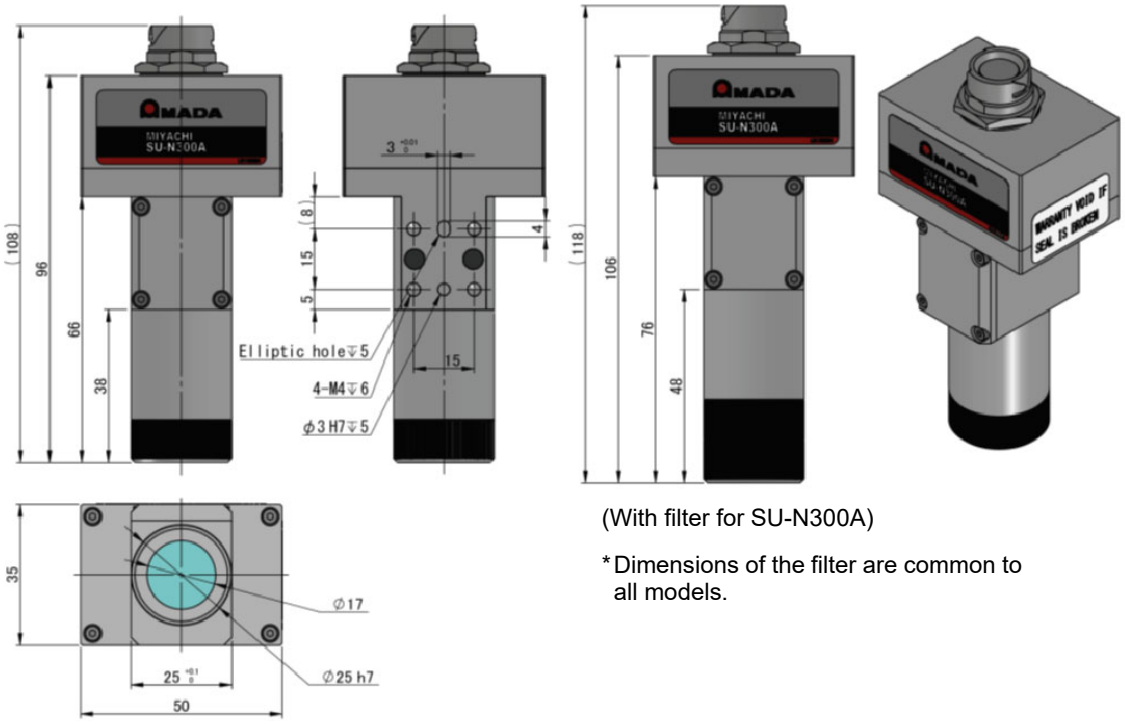
When assembling the external trigger unit

Mass: approx. 4.4 kg
(excluding the reflected light transmission fiber)



(2) SU-N300A

Mass: approx. 0.2 kg

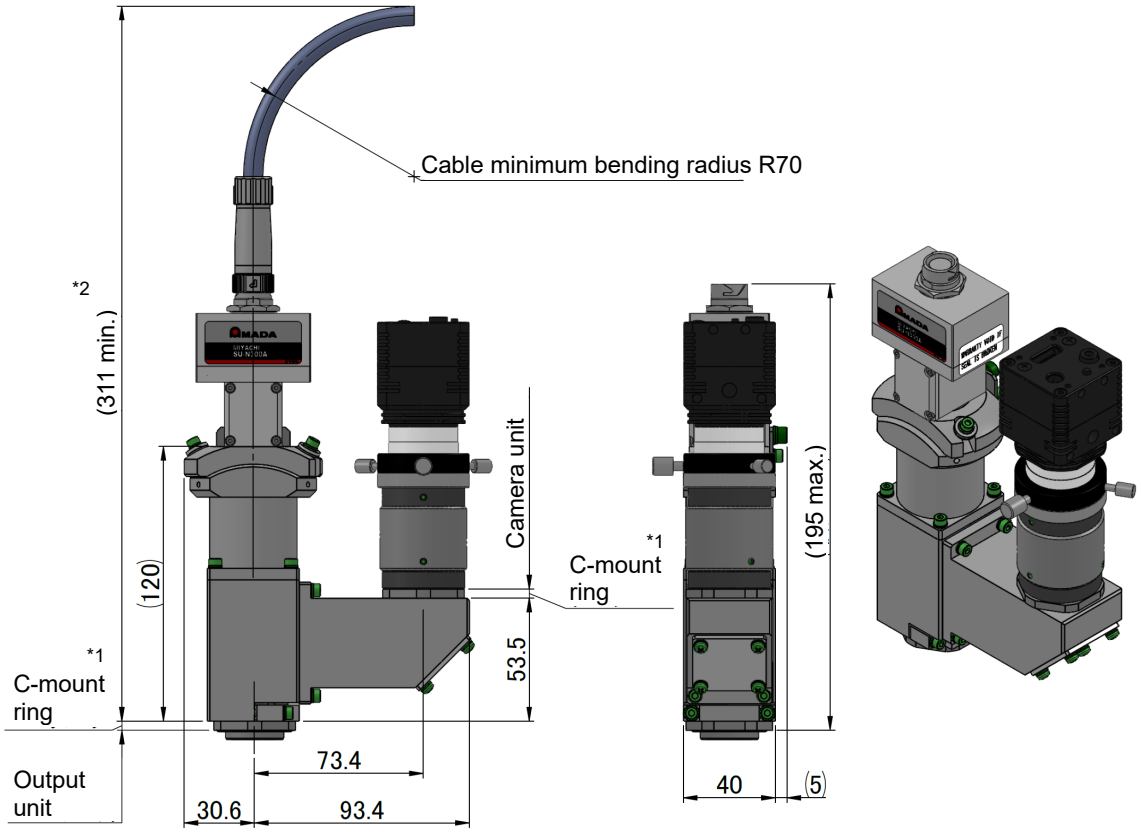


(With filter for SU-N300A)

* Dimensions of the filter are common to all models.

(3) Coaxially Mounting Adapter Incorporated with the SU-N300A (Option)

Mass: approx. 0.5 kg
(excluding the **SU-N300A** and camera unit, and including mounted accessories)

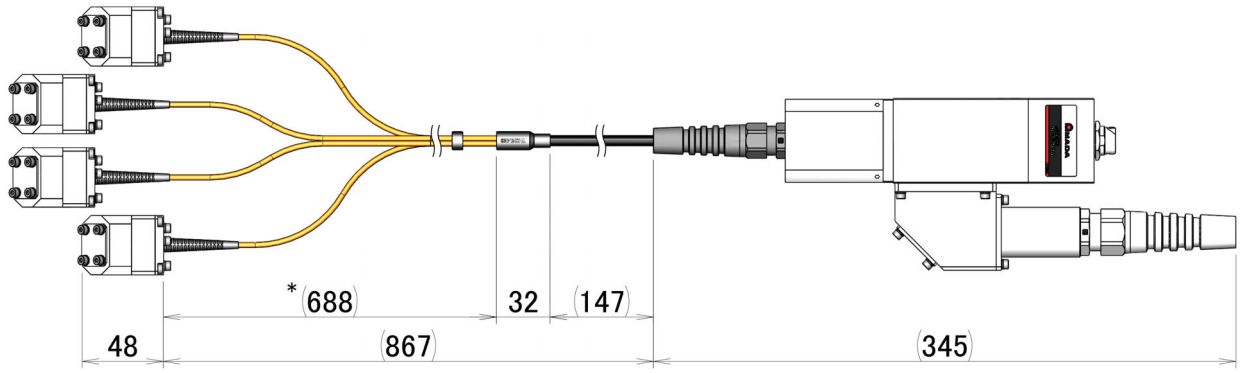


*1 The C-mount ring (4 mm in height) is used at either of two places.

*2 The required space for mounting the output unit is within this dimension.

(4) SG-N300A

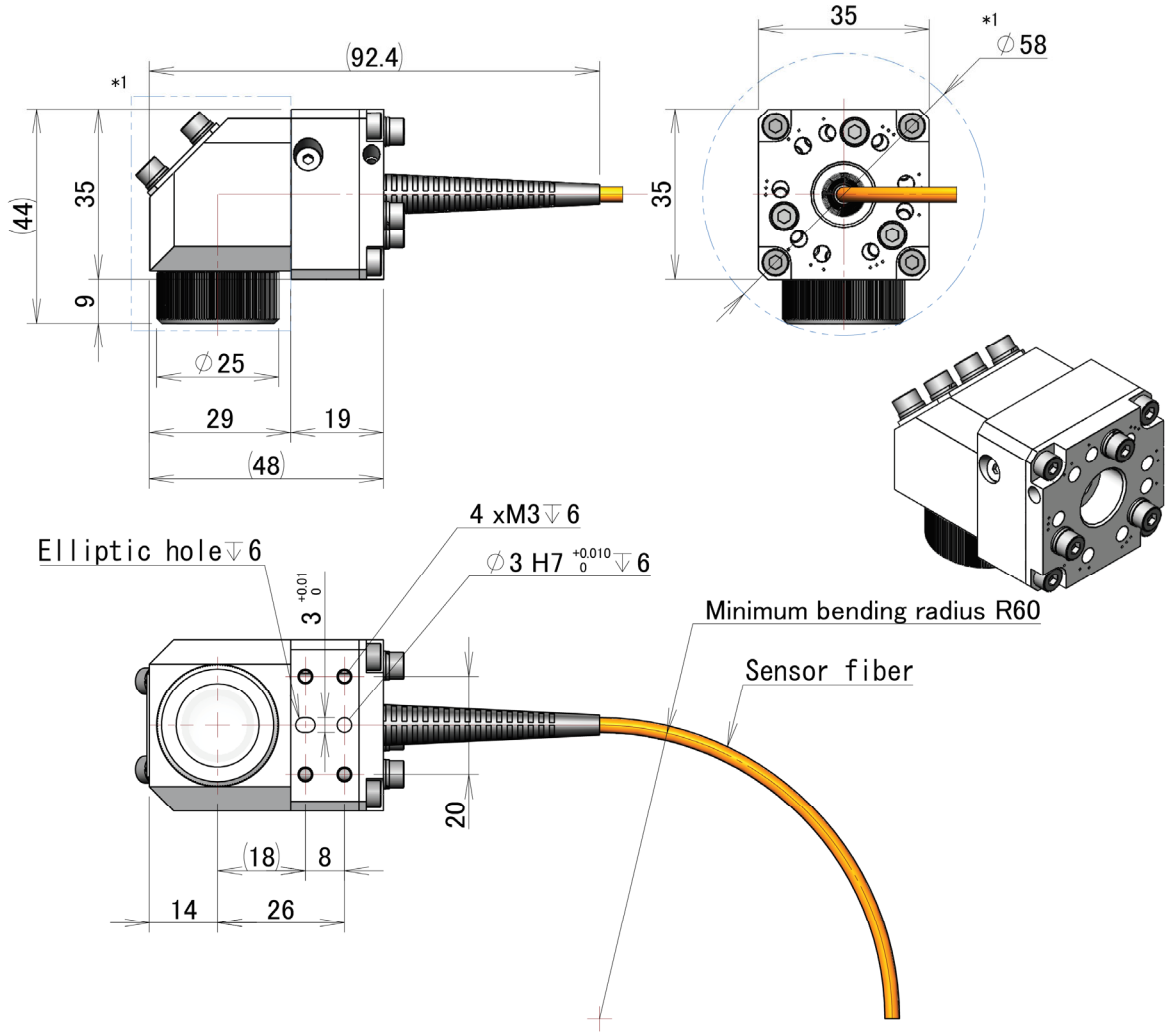
Mass: approx. 1.6 kg



* All four cables are the same length.

Light-receiving unit part

Mass: approx. 130 g

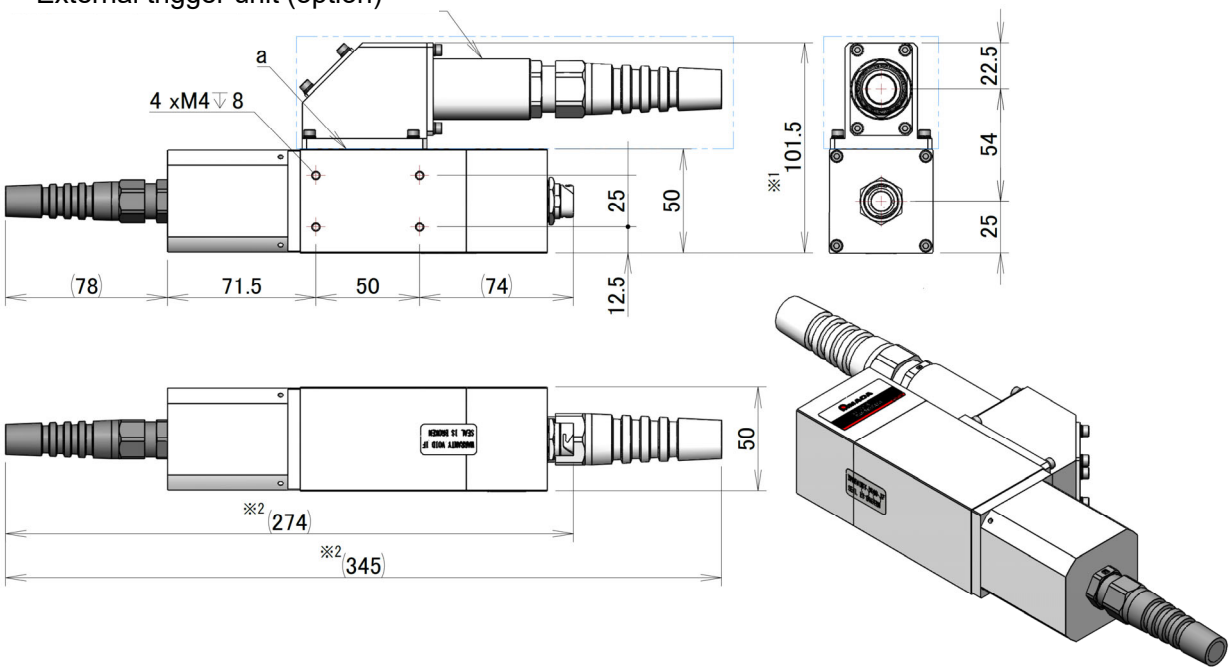


* The range of square part moves φ58 mm by adjusting the angle of the light-receiving unit.

Sensor part

Mass: approx. 1.0 kg
(including the external trigger input unit)

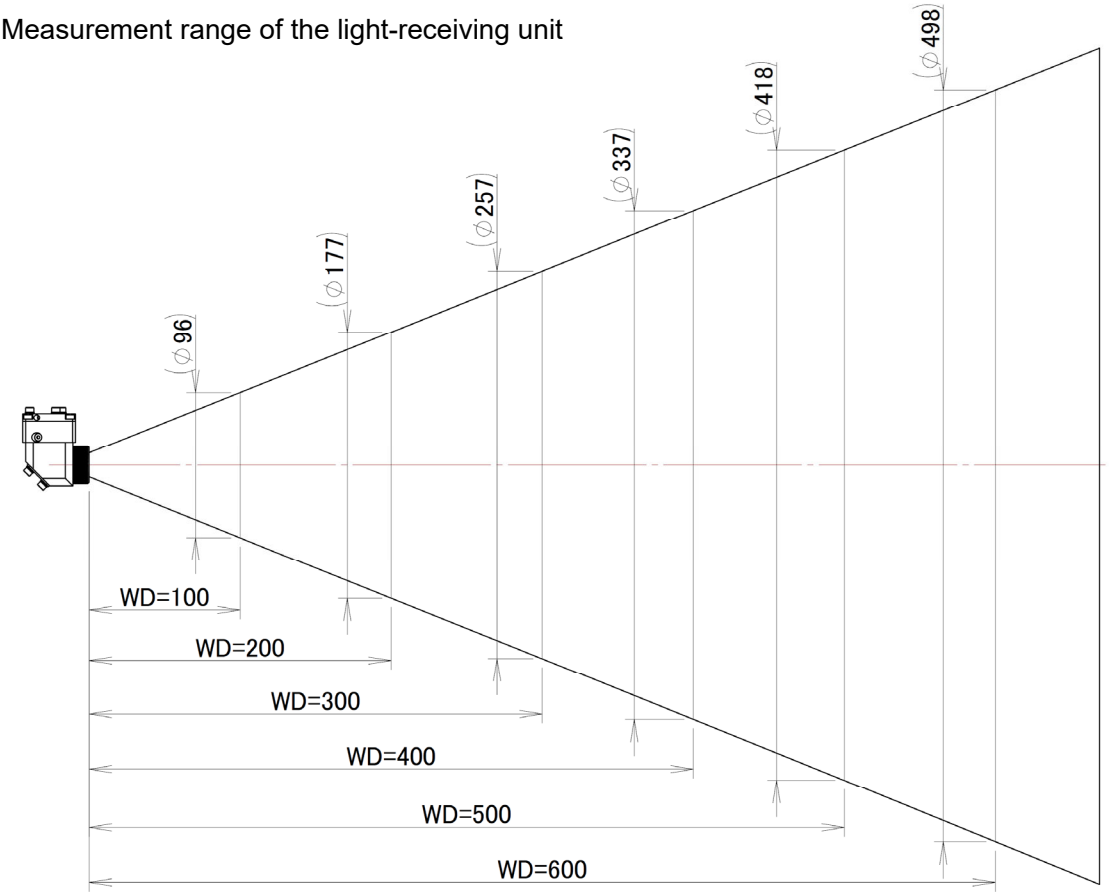
External trigger unit (option)



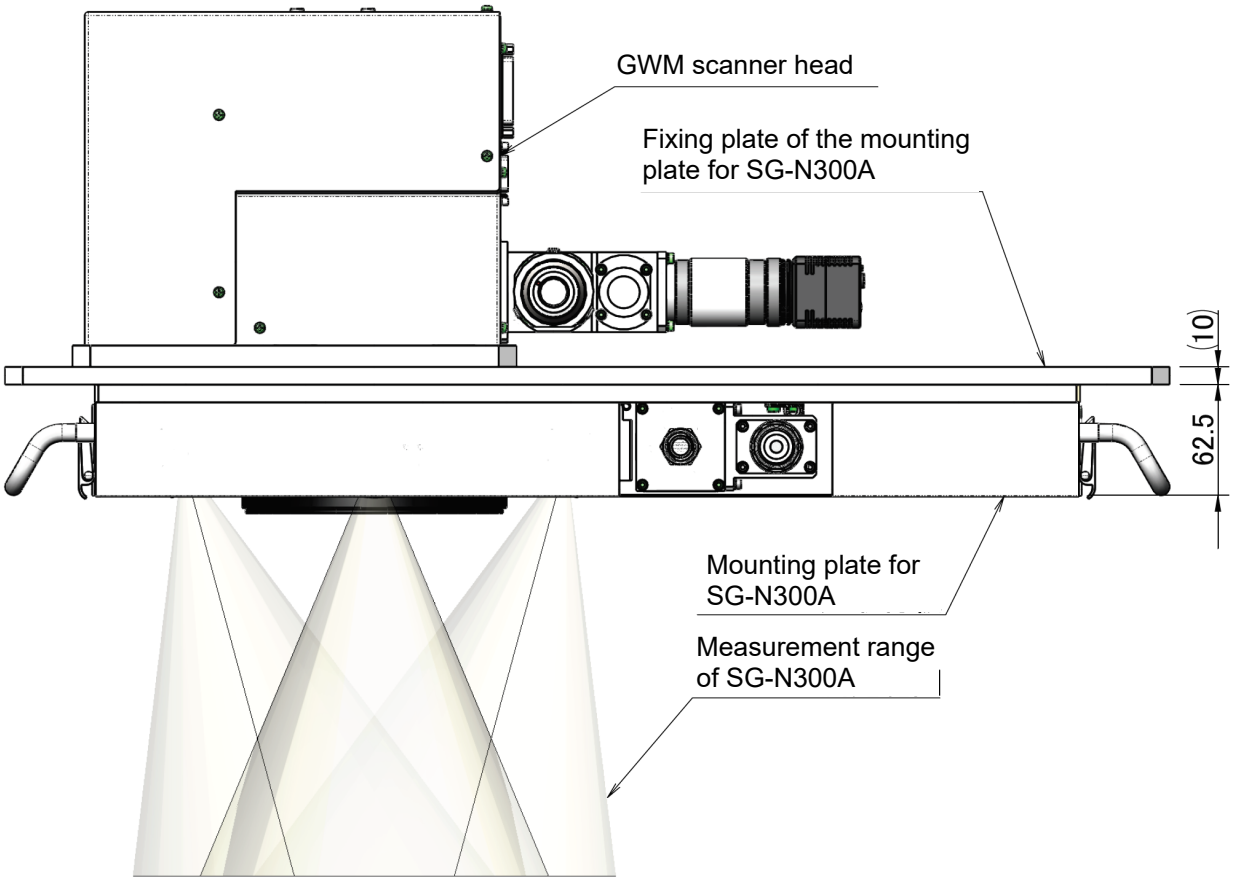
*1 When the external trigger input unit (option) is not mounted, a lid is added to the part “a” and the dimension changes from 101.5 mm to 56.2 mm.

*2 When the external trigger input unit (option) is not mounted, total length changes from 345 mm to 274 mm.

Measurement range of the light-receiving unit



Assembling example of GWM scanner head (fθ lens f163 mm)



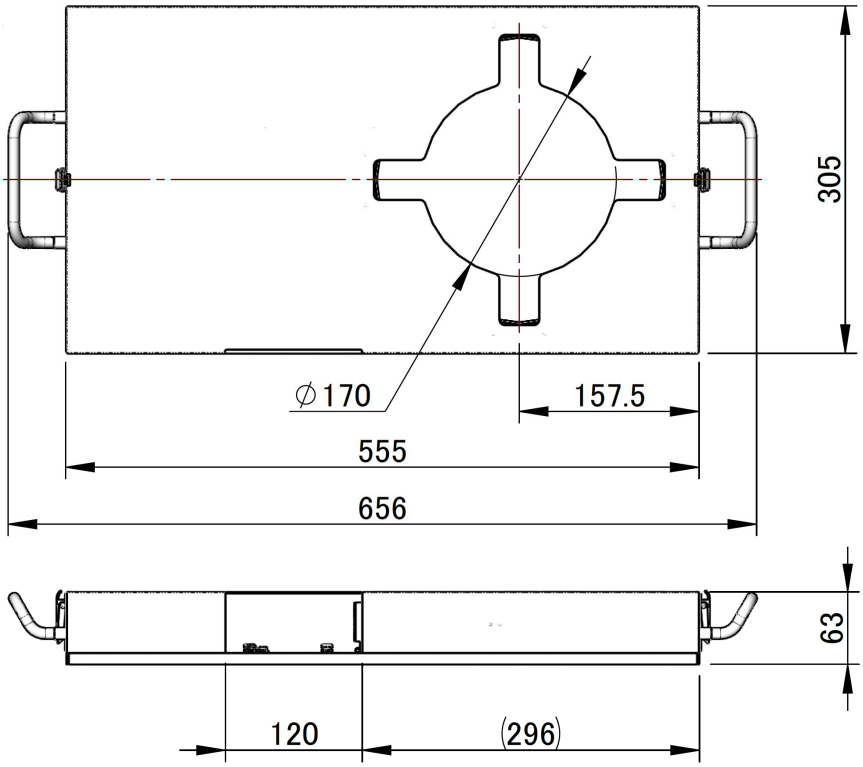
Measurement range of each fθ lens (design value)

fθ lens f (mm)	Processing area (mm)	Measurement range of SG-N300A (mm)
f80	φ35	φ35
f150	φ60	φ60
f165	φ100	φ72
f82	□20×20	φ20
f163	□78×78	φ78
f306	□150×150	φ150
f420	□220×220	φ171

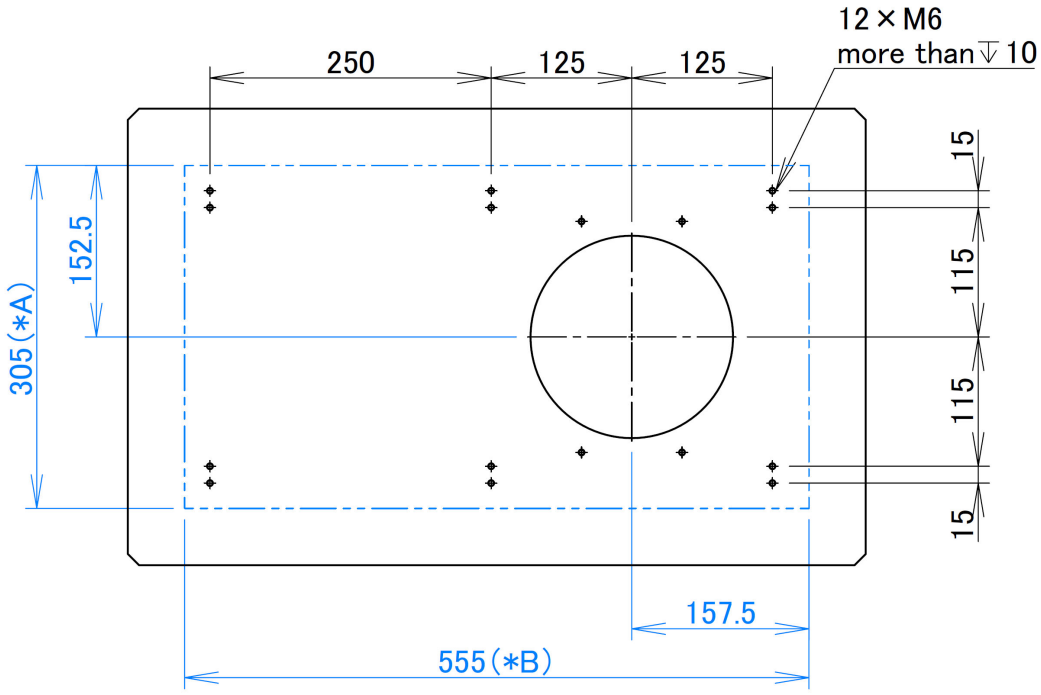
*1 The measurement range is designed with the fixing plate of the mounting plate for SG-N300A having a thickness of 10 mm. When the thickness of the fixing plate is changed, the measurement range changes and it affects the measured value.

(5) Mounting Plate for SG-N300A (Option)

Mass: approx. 4.0 kg
(excluding the **SG-N300A**)



Recommended dimension of the mounting plate for SG-N300A

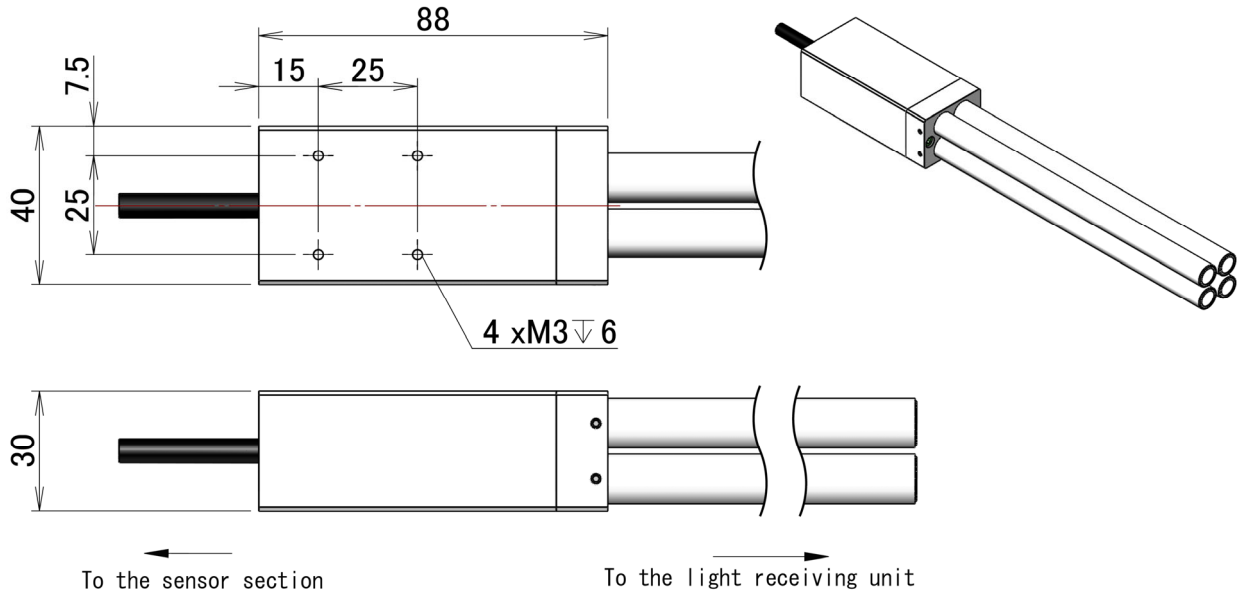


* A and B are depth and width of the mounting plate for SG-N300A.

* For dimensions to fix the galvanometer scanner, refer to the operation manual for each galvanometer scanner.

(6) SUS Pipe Fixing Unit (Option)

Mass: approx. 0.5 kg
(excluding the protective pipe and the sensor fiber)



CE

AMADA WELD TECH CO., LTD.

EU Declaration of Conformity

The company/manufacturer: **AMADA WELD TECH CO., LTD.**
95-3, Futatsuka, Noda-City, 278-0016 JAPAN

Herewith declares in his own sole responsibility conformity of the product

Designation:
i) **LASER WELD MONITOR**
ii) **SENSOR UNIT**
iii) **SENSOR CONNECTING CABLE 5m**
iv) **SENSOR CONNECTING CABLE 10m**

Types/Serial Number, etc.:
i) **MM-L300A-00-02**
ii) **SU-N300A-00-02**
iii) **LP1203202**
iv) **LP1203204**

With applicable regulations below

EU Directive:
Low Voltage Directive 2014/35/EU
EMC Directive 2014/30/EU
RoHS Directive 2011/65/EU , (EU)2015 / 863

Harmonized European/International Standards applied:
ISO12100 : 2010
BS / EN55011 : 2016 + A11:2020
EN61000-6-2 : 2019
EN61010-1:2010(3rd Edition)

Importer Distributor in EU:
(please place distributor/importer stamp here)

AMADA WELD TECH GmbH
Lindberghstrasse 1, D-82178 Puchheim, GERMANY
Tel: + 49 8983 9403 - 0

Division: **AMADA WELD TECH CO., LTD.**

2021.5.20
Noda-City/Japan 2021-05-20
Place and Date

T. Jingu
Toshiaki Jingu / Quality guarantee general manager
Name/Signature/Position

Note: This Declaration certifies conformity with the above mentioned Directive(s), but gives no assurances of properties within the meaning of the Law concerning product liability and ProdSG. It becomes invalid if any technical or other modification are carried out without manufacturers consent.

64G091-07-5