LASER WELD MONITOR

OPERATION MANUAL



OM1215388 MM-L400A-E02-202307 Thank you for your purchase our product.

Please read this manual carefully to ensure correct use. Keep the manual handy after reading for future reference.

Contents

1.	Special Notes	1-1
	(1) Safety Precautions	1-1
	(2) Handling Precautions	1-4
	(3) Disposal	1-5
	(4) Sticking Warning/Danger Labels	1-5
2.	Features	2-1
3.	Unpacking	3-1
	(1) Container	3-1
	(2) Checking the Contents of Container	3-1
	(1) Products	3-1
	(2) Accessories	3-1
	(3) Selective required options	3-2
	(4) Options	3-2
4.	Name and Function of Each Part	4-1
	(1) Front	4-1
	(2) Rear	4-2
	(3) Optical Fiber Unit	4-3
5.	Connecting Equipment	5-1
	(1) Typical Equipment Connection	5-1
	(2) Startup, Shutdown, and Power Off	5-2
	(3) Transportation and Installation	5-3
	(4) Mounting 19" Rack	5-4
	(5) Removing/Mounting Handles	5-7
	(6) Mounting Ferrite Clamp	5-9
	(7) Slicking Laser Aperture Laber	5-10
	(9) Mounting External Light-Receiving Unit and Measures against Reflected Light	
	(10) Removing/Mounting Light Attenuation Filter Unit	5-14
6.	Interface	6-1
•••	(1) Inputs/Outputs	6-1
	(2) Connectors	6-2
	(3) Example Connections of External Input/Output Signals	6-7
	(4) Timing Chart	6-10
7.	Maintenance	7-1
	(1) Troubleshooting	7-1
	(2) Cleaning/Replacing Protective Glass	7-5
	(3) Replacing Fuse	7-7
•	(4) About MM-L400A	/-8
8.	Sensitivity Check, Readjustment	8-1
9.	Specifications	9-1
10.	Outline Drawing	10-1
	(1) MM-L400A Laser Weld Monitor	10-1
	(2) Coaxially Mounting Adapter (MM-L400A) (Optional)	10-2
	(3) External Light-Receiving Unit (Optional)	10-3
11.	LICENSE	11-1

1. Special Notes

(1) Safety Precautions

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

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

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

DANGER



DO NOT touch anything inside the equipment.

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

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



DO NOT look directly at the beam, and do not allow any part of the body to enter the beam.

Both direct and scattered beams are hazardous. Direct eve exposure to a laser beam will cause blindness.



NEVER burn, destroy, cut, crush or chemically decompose the equipment.

This product incorporates parts containing arsenide (As).





ALWAYS wear protective goggles.

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

Exposure to a laser beam will cause burns. Never expose any part of the body



DO NOT touch the workpiece during or immediately after laser working.

AVOID skin exposure to a processing or welding laser beam. This product monitors the near-infrared light from the processing point.

The workpiece may be extremely hot.





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.





GROUND the equipment.

to a laser.

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



STAY AWAY from the equipment if you have a pacemaker.

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

1. Special Notes



DO NOT splash water.

Electrical parts may cause an electric shock or short circuit if they become wet.

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



PLACE the equipment on a firm surface.

Injury or equipment damage/malfunction may result if equipment topples over or falls from the installed location.



DO NOT place any drinks, etc. on the equipment.

Any liquid split onto the equipment may cause insulation failure, resulting in ground fault or fire.



DO NOT place flammable objects near the equipment.

Surface flash and expulsion (spatter) generated during welding may ignite flammable objects, resulting in a fire.

If work involves use of flammable items, place a non-flammable cover on such items.

DO NOT cover the equipment with a blanket or cloth.

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

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

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

ALWAYS wear appropriate work clothing.

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

PROVIDE fire extinguishers.

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

PERFORM maintenance and inspection on a regular basis. Perform maintenance and inspection regularly.

For repair or replacement, contact your dealer or us.

(2) Handling Precautions

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

Туре	Minimum bending radius
Fiber unit	100 mm

- When an administrator or an operator enters an area containing a laser radiation hazard, safety measures to ensure compliance with MPE^{*} limits are required.
 - *MPE: Maximum Permissible Exposure of the laser radiation limit permissible for human eye and skin exposure.
- * For more information about laser radiation regulations and MPE values, see the standard referenced below.
 - Japanese Industrial Standard JIS C 6802 "Safety of laser products"

Notification from Ministry of Health, Labor and Welfare No. 0325002 "Prevention measures plan concerning laser hazards"

1. Special Notes

(3) Disposal

The MM-L400A incorporate parts containing arsenide (As).

Dust or vapor of gallium arsenide (GaAs) is harmful; handle the product with care.

- \cdot At the time of disposal, the below process is recommended:
 - 1. The disposal work shall be subcontracted to a waste disposal specialist who is qualified for collection, transportation, and disposal of industrial waste that includes materials containing arsenic.
 - 2. This material shall be separated from general industrial waste or domestic waste, and controlled through to its final stage as specially-controlled industrial waste.
- No combustion, cutting, crushing of the product. Avoid chemical decomposition.

(4) Sticking Warning/Danger Labels

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

- MM-L400A (Front)
 - MM-L400A (Rear)





Tearing off the seal will void the warranty.

MM-L400A Accessories



The product has a Laser Aperture warning label included.

Attach this label to the product or place it near to where the Fiber Unit is connected. For details, see 5 (3) "Attaching the Laser Aperture Warning label."

• Co-axial mounting adapter (MM-L400A)



Tearing off the seal will void the warranty.

• External light-receiving unit



1. Special Notes

2. Features

The Laser Weld Monitor **MM-L400A** detects the light generated from the processing point and monitors the welding status. The **MM-L400A** offers the following features:

- At laser welding, the welding status can be monitored by detecting the light generated from the processing point.
- Transmits the light generated from the processing point to the incorporated sensor for measurement using optical fibers.
- Setting conditions and displaying waveforms can be easily done with MS-Viewer, 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 light generated from the processing point can be displayed on the PC screen.
- The MM-L400A allows external devices to be connected including an output unit and galvanometer scanner. Also, the output unit (output unit model series fitted with a CCD camera)^{*1} can be used by mounting coaxially with an optional adapter.
- A power supply in the range of 100 V AC to 240 V AC can be used.
- Turning on the guide light^{*2} enables confirmation of the measurement position.

NOTE:

The **MM-L400A** is equipment to monitor the light generated 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.

- *1: Coaxial mounting is available only for selected output unit products. For details, contact us.
- *2: The guide light of the **MM-L400A** is Class 3R of JIS C 6802 "Safety standards for laser products."

3. Unpacking

(1) Container

• At least two persons are required to remove the **MM-L400A** from its packing container.

Dimensions	Mass (including contents)	Remarks
Approx. 315 (H) x 1120 (W) x 621 (D) mm	Approx. 35 kg	Common to the MM-L400A

(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-L400A-00-00	1
	MM-L400A-00-01	

(2) Accessories

Product name	Model	Qty
PC software: MS-Viewer	AS1215744	1
LAN cable category 7, 5 m	LD-TWST/BM50	1
Ferrite clamp ^{*1}	NFT-8	2
Laser aperture warning label	LB1201367	1
D-Sub 9 pin plug	HDEB-9P(05)	1
D-Sub 15 pin plug	HDAB-15P(05)	1
D-Sub 25 pin plug	HDBB-25P(05)	1
D-Sub 50 pin plug	DF02P050F22A1	1
Circular push-pull connector	HR10A-7P-4P(73)	1

(3) Selective required options

	Pr	oduct name	Model	Qty
For external light receiving	External light-receiving unit		LP1214900	1* ²
For output unit	Coaxially mounting adapter (MM-L400A) ^{*3}		LP1214881	1* ²
	Coaxially mounting adapter (MM-L400A) (SET) ^{*3, 4}		LP1215369	
Transmission	Fiber unit	5m	LP1215333	1* ²
fiber		10m	LP1215334	
		20m	LP1215335	
Common	Power cord	250 V for use in Japan or China	KP244 VCTF3×1.25 KS16D 3m	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
Optical filter	Optical attenuation filter unit*5	AS1213648	1 ^{*2}

- *1 Used for LAN cable. For mounting, see **5. (6) Mounting the Ferrite Clamp.**
- *2 Depends on the customer's selection.
- *3 Used when installing the **MM-L400A** camera coaxially with the output unit with the CCD camera. Our engineer takes charge of mounting work.
- *4 When the coaxially mounting adapter **(MM-L400A)** is shipped with being mounted on our output unit, the model number is changed into LP1215369. The shipping form is different, but there is no difference between LP1214881 and LP1215369 in performance.
- *5 Mainly used to attenuate excessive light intensity emitted from the processing point.
- *6 PC is necessary to configure the settings of the **MM-L400A**. A PC can be also prepared by the customers. For the PC specifications, refer to the Application Manual of the **MS-Viewer.**

4. Name and Function of Each Part

(1) Display panel:

Shows the status of the MM-L400A.

(2) Status indicating LEDs:

Indicate the current status of the **MM-L400A**. All of the LEDs turn on soon after startup, and as the startup process continues, each LED flashes and turns off in sequence from the right. After startup completes, the LEDs operate as follows:

POWER:

Lit in green when the power supply is turned on. Flashes during the shutdown process.

MEASURE:

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. Flashes at the warning status.

READY:

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

CONNECT:

Lit in green during the measurement data transmission between the equipment and the PC.

SERVER CONNECT

Lit in green when the equipment and the PC (database server) are online.

IP RESET

Lit in green when the switch on the right is pressed to reset the IP address to the factory status (192.168.1.40). This resetting operation is invalid during measurement. To press the switch, use a sharp-pointed tool.

(3) Controller Power Switch

Used to turn on/off the power. To turn off the power, press the switch for 0.5 seconds or more.

4. Name and Function of Each Part

(2) Rear



(1) Power switch:

Turns on/off the power. When turning off the power switch, be sure to confirm that the controller power is off (POWER of the status indicating LEDs at the front).

- (2) AC INPUT Used to connect the attached power cord to supply power.
- (3) +24V OUT Outputs 24V to the external device.
- (4) EExt.I/O(2) Do not connect anything to this port.
- (5) USB Do not connect anything to this port.
- (6) Ext.I/O Connector for input and output with the external device.
- (7) LAN

Used to connect to the personal computer with the attached LAN cable.

- (8) EExt.I/O (1) Do not connect anything to this port.
- (9) ANALOG INPUT Connector for input from the external device.
- (10) ANALOG OUT

Outputs the **MM-L400A** detection with the analog signal. It can be observed with an oscilloscope, etc.

4. Name and Function of Each Part



End of corrugated tube



- (1) Corrugated tube: Used to protect the optical fibers.
- (2) Fiber unit ch1: The fiber unit connected from ch1 to ch3 of the sensor in the MM-L400A controller.
- (3) Fiber unit ch2:

The fiber unit connected from ch5 to ch7 of the sensor in the **MM-L400A** controller. When the unit is configured with only a single channel, this part is hollow.

(4) Empty conduits These conduits are empty.

4. Name and Function of Each Part

5. Connecting Equipment

(1) Typical Equipment Connection

The typical equipment connection of the **MM-L400A** is shown below.

The **MM-L400A** monitors the light generated from the processing point by mounting the coaxial mounting adapter (**MM-L400A**) coaxially with the output unit, or by mounting the external light-receiving unit.



Personal computer (option)

- (1) MM-L400A: Judges the upper/lower limit for obtaining waveforms, records measured data, etc.
- (2) Coaxial mounting adapter (MM-L400A)/External light-receiving unit Receives light necessary for the measurement from the processing point.
- (3) Personal computer (option):

With **MS-Viewer** installed, sets conditions of the **MM-L400A**, displays waveforms and saves the waveform data, etc. For installation, refer to the Application Manual of the **MS-Viewer**.

- (4) Laser device (separately available): Oscillates the laser light. Be sure to read the operation manual for the laser device.
- (5) Output unit (separately available):
 Condenses laser light and performs processing and welding. For the use with MM-L400A, mount either the external light-receiving unit (to be externally mounted) or the coaxial mounting adapter (MM-L400A) (to be coaxially mounted).

(2) Startup, Shutdown, and Power Off

This section describes the process from startup, shutdown, and power off of the **MM-L400A** and the equipment.



Startup

1) To start up the **MM-L400A**, turn on the AC power switch on the rear panel.



2) Push the controller power switch on the **MM-L400A** front panel. Startup operation starts, and the status indicating LEDs turn on in order. After the startup operation, the POWER LED turns on.



Shutdown, Power off

1) To shut down the **MM-L400A**, push the controller power switch for 0.5 seconds or more. During the shutdown operation, the POWER LED of the status indicating LEDs flashes. After the shutdown operation, the POWER LED turns off.



Push the switch for 0.5 seconds or more

During Shutdown: POWER LED flashes After Shutdown: POWER LED turns off

2) Confirm that the **MM-L400A** status indicator LEDs are off, and then turn off the AC power switch on the rear panel.



(3) Transportation and Installation

This section describes precautions for transportation and installation of the MM-L400A.



• Perform install or transport operations always by two or more persons.

To transport or install the **MM-L400A**, hold the parts at the both sides of the equipment as shown below.



(4) Mounting 19" Rack

This section describes how to mount the **MM-L400A** to a 19" rack.

- Before starting the operation, be sure to turn off the power of the MM-L400A.
- During the operation, avoid excessive force applied to the optical fibers.
- Be sure to use only the specified screws. Otherwise, it may damage the product.

To mount the **MM-L400A** to a commercially-available 19" rack, the parts on the bottom need to be removed. The required specifications for a 19" rack are as follows:

- · Size: 2U, Depth: 700 mm or more
- \cdot Equipped with a top panel supporting the **MM-L400A** (maximum weight of approx. 22 g)
- · Equipped with a screw hole securing the front
- 1) Place the lower pad in the package box of the **MM-L400A** on a stable base such as a table, and then place the **MM-L400A** on the lower pad.



2) Remove the target M4 screws (six positions) by using a tool. This enables to remove the part on the bottom from the **MM-L400A.**



3) Take out the **MM-L400A** from the lower pad. At this time, confirm that the bottom part is separated from the **MM-L400A** and remained on the lower pad.



4) Store the **MM-L400A** into the 19" rack by pushing from the front. At this time, pay attention not to apply forces to the optical fibers.



5) Secure the **MM-L400A** from the front. The slotted hole for the **MM-L400A** handle is large enough to accept up to M6 screws.



6) To return to the delivered status, perform the steps 1) to 3) in the reversed order, and secure the bottom part by using the removed M4 screws (six positions).
 (Recommended tightening torque: 1.27N ⋅ m)



(5) Removing/Mounting Handles

This section describes how to remove/mount the **MM-L400A** handles.



The handles on the both sides of the **MM-L400A** are removable.

1) Remove the M4 screws (2 positions) securing the handle by using a tool.



 The handle co-tightened with the M4 screws can be removed. After removing the handle, attach the M4 screws (two positions) to the original positions by using a tool. (Recommended tightening torque value: 1.27N · m)





Removed handle

3) Repeat the steps 1 and 2 to remove the handle in the opposite side.



4) To secure the handles back in the places, repeat the steps 1 and 2, and use the M4 screws to co-tighten with the handle. (Recommended tightening torque: 1.27N ⋅ m)



(6) Mounting Ferrite Clamp

٠

This section describes how to mount the attached ferrite clamp to the LAN cable.



• If the ferrite clamp is not mounted or is mounted at the place not specified, the waveform could contain noise, and correct waveforms may not be obtained. Be sure to mount the noise filter as specified.

Mount the attached ferrite clamp at the **MM-L400A** side of the LAN cable with one turn. Connect the other side of the LAN cable to the personal computer.





(7) Sticking Laser Aperture Label

This section describes how to stick the attached laser aperture label.



The **MM-L400A** is equipped with a guide light function to confirm the measurement position.

The guide light of the MM-L400A is Class 3R of JIS C 6802 "Safety of laser products".

Stick the laser aperture label near the laser aperture of the laser product as well as the product to which the fiber unit is mounted.

The external light-receiving unit which is an optional product is already sticked with the laser aperture label, and need no label to be sticked.

Laser aperture label (accessory)

レーザ開口 LASER APERTURE

External ligh-receiving unit (optional)

(8) Coaxially Mounting Adapter (MM-L400A)

This section describes the coaxially mounting optional adapter which allows to coaxially use the **MM-L400A** for measurement.

- Coaxial mounting is applicable to a part of our output units. For the details of applicable units, contact us.
- For the combination outline drawing of each output unit and the coaxially mounting adapter (**MM-L400A**), contact us.
- When a strong shock is applied to the coaxially mounting adapter (MM-L400A), the measurement light path is shifted, influencing the measurement values. Proper handling is required to use the adapter.

The **MM-L400A** can be fixed coaxially with the output unit by mounting the coaxially mounting adapter to our output unit with CCD camera.

Since measurement can be performed coaxially, the measurement position of the **MM-L400A** follows even when the output unit moves.

The mounting and the adjustment of the coaxially mounting adapter (**MM-L400A**) is only available by our qualified service personnel.

Since the coaxially mounting adapter (**MM-L400A**) is mounted to a position where the camera unit has been mounted, the mounting requires removal of the assembled camera unit.

This could influence the camera image of the output unit. When the image processing function is used, be sure to check the operation after mounting the output unit again.

For the appearance and mounting dimensions of the coaxially mounting adapter (**MM-L400A**), see 10. Outline Drawing.

For the appearance with the output unit, see "Typical Mounting Example" in p.5-11.

Typical Mounting Example

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 nothing)



(9) Mounting External Light-Receiving Unit and Measures against Reflected Light

This section describes how to use the light-receiving unit for external measurement and measures against the reflected light.



Angle A = arbitrary angle°(not A \Rightarrow B)

(10) Removing/Mounting Light Attenuation Filter Unit

This section describes how to remove/mount the light attenuation filter unit, which is an optional unit to optically attenuate the measured light volume of the **MM-L400A**.



- 1) Move the **MM-L400A** to a space for the operation. Replacing the optical attenuation filter unit requires a space of 120 mm or more from the top surface.
- 2) Loosen the M4 screws (two positions) on the **MM-L400A**. These screws are captive screws, which do not fall out even after being loosened.



3) Hold the loosened two M4 screws, and lift them up in approximately 12 mm. As necessary, lift them up while pulling them to the front side. This can easily remove the cover plate.



4) Pull the cover plate that has been lifted to the front to remove it.



5) Check the part for which the light volume is to attenuate. Loosen the M3 screws (two positions) and remove the lid (note that the M3 screws do not fall out). For MM-L300A-00-00, Ch5 to Ch7 have no sensor.



6) Loosen the M3 screws (two positions) of the target part, and remove the lid. Note that these M3 screws do not fall out.



 Insert the optical attenuation filter unit to the removed part, and secure it by using two M3 screws. (Recommended tightening torque: 0.69N ⋅ m)



 Perform the steps 2 to 4 in the reversed order, return the cover of the MM-L400A back in place, and secure it by using two M4 screws. (Recommended tightening torque: 1.27N · m)



5-16

6. Interface

(1) Inputs/Outputs

No	Connector name	Connected device	Remarks
(1)	EXT. I/O	Device to control the welding process	1.27mm pitch 50 pin Female
(2)	ANALOG INPUT	Sensor, etc.	D-Sub 9pin Female
(3)	ANALOG OUT	Oscilloscope, etc.	D-Sub 25pin Female
(4)	EExt. I/O (1)	Not used	-
(5)	EExt. I/O (2)	Not used	-
(6)	24V OUT	Trigger unit, etc.	3.81mm pitch 3 pin Female
(7)	LAN	Personal computer	Category 7 or higher
(8)	USB	Note used	-



(2) Connectors

(3) EXT. I/O

This is an interface connector (1.27 mm in pitch, 50-pin) to make connection with the external control unit. For pulse signal inputs, input should be continued for at least 1 ms.



Pin No.	Signal name	Description	
A1	+24V OUT	Power supply for external input/output (user I/O). Maximum output current is 0.1A.	
A2	+24V OUT		
A3	OUT COM	Common signal for output signals.	
A4	Recipe No. Select	Output of recipe No. in selection (binary code:128)	
A5		Output of recipe No. in selection (binary code:64)	
A6		Output of recipe No. in selection (binary code:32)	
A7		Output of recipe No. in selection (binary code:16)	
A8		Output of recipe No. in selection (binary code: 8)	
A9		Output of recipe No. in selection (binary code:4)	
A10		Output of recipe No. in selection (binary code:2)	
A11		Output of recipe No. in selection (binary code:1)	
A12	OK signal	When the judgment result is OK, the circuit is closed (on).	
A13	Recipe No. Determined	When the layout No. is determined, the circuit is closed (on).	
A14	NG signal	When the judgment result is NG, the circuit is closed (on).	
A15	External Control Enable	When the external control is enabled, the circuit is closed (on).	
A16	Not used	Do not connect anything.	
A17	In-Shutdown	The circuit is closed (on) during shutdown.	
A18	Ready	When the trigger is acceptable, the circuit is closed (on).	
A19	In-Measurement	The circuit is closed (on) during measurement.	
A20	Device Error	The circuit is open (B-contact) at error status.	
A21	Not used	Do not connect anything.	
A22	Not used		
A23	Not used		
A24	0V OUT	GND for external I/O. Do not use for any other purpose.	
A25	0V OUT	Same as above	

6. Interface

Pin No.	Signal name	Description
B1	External Trigger Input	With closed circuit input during READY, the measurement starts.
B2	External Control Enable	With closed circuit input, the mode is switched to the external control mode.
B3	Not used	Do not connect anything.
B4	Not used	
B5	Device Error Reset	With closed circuit input, the abnormal output is released.
		Functions when the external control is enabled.
B6	Counter Reset	With closed circuit input, the relative counter is reset.
		Functions when the external control is enabled.
B7		Input of recipe No. in selection (binary code:128)
B8		Input of recipe No. in selection (binary code:64)
B9	Recipe No. Select	Input of recipe No. in selection (binary code:32)
B10		Input of recipe No. in selection (binary code:16)
B11		Input of recipe No. in selection (binary code: 8)
B12		Input of recipe No. in selection (binary code:4)
B13		Input of recipe No. in selection (binary code:2)
B14		Input of recipe No. in selection (binary code:1)
DAG	Recipe No. Determined	Determines the recipe No.
ВІЭ	Strobe	Functions when the external control is enabled.
B16	Judgment Reset	With closed circuit input, the judgment result held is reset.
D47	S17 Shutdown Start	With closed input, the shutdown operation starts.
BI/		Functions when the external control is enabled.
B18	Not used	Do not connect anything.
B19	Not used	
B20	Not used	
B21	IN COM	Common terminal for input signals.
B22	Not used	Do not connect anything.
B23	Not used	
B24	Not used	
B25	Not used	1

(4) ANALOG INPUT

Transmits the signals detected by the external sensors or other devices to the $\ensuremath{\text{MM-L400A.}}$



Pin No.	Signal name	Description
1	Analog IN 1 (General-purpose)	General purpose analog input terminal. Voltage input: 0-10V(0-100%)
2	Analog GND	Common analog ground. Wire with the adjacent analog signals by using coaxial or twisted pair.
3	Analog IN 2 (General-purpose)	General purpose analog input terminal. Voltage input: 0-10V(0-100%)
4	Analog GND	Common analog ground. Wire with the adjacent analog signals by using coaxial or twisted pair.
5	Reserved	Do not connect anything.
6	Reserved	
7	Reserved	
8	Reserved	
9	Not used	

(3) ANALOG OUT

Transmits signals from the **MM-L400** to the external sensors or other devices.



25

14

Pin No.	Signal name	Description
1	Analog OUT 1	Used to output the analog signals set by the PC software. Voltage output: 0-10V(0-100%)
2	Analog GND	Common analog GND. Wire with the adjacent analog signals by using coaxial or twisted pair.
3	Analog OUT 2	Used to output the analog signals set by the PC software. Voltage output: 0-10V(0-100%)
4	Analog GND	Common analog GND. Wire with the adjacent analog signals by using coaxial or twisted pair.
5	Analog OUT 3	Used to output the analog signals set by the PC software. Voltage output: 0-10V(0-100%)
6	Analog GND	Common analog GND. Wire with the adjacent analog signals by using coaxial or twisted pair.
7	Analog OUT 4	Used to output the analog signals set by the PC software. Voltage output: 0-10V(0-100%)
8	Analog GND	Common analog GND. Wire with the adjacent analog signals by using coaxial or twisted pair.
9-16	Not used	Do not connect anything.
17	Analog IN 1 (General-purpose)	General purpose analog input 1 is then output.
18	Analog GND	Common analog GND. Wire with the adjacent analog signals by using coaxial or twisted pair.
19	Analog IN 2 (General-purpose)	General purpose analog input 2 is then output.
20	Analog GND	Common analog GND. Wire with the adjacent analog signals by using coaxial or twisted pair.
21-25	Reserved	Do not connect anything.

(6) 24V OUT

A connector for power output.



Pin No.	Signal name	Description
1	24V	Output terminal for 24V/1.5A
2	GND	Ground terminal
3	FG	Frame ground terminal with the same electrical potential with that of the housing.

(7) LAN

A connector to connect with a personal computer. Used for various settings and for transmission of measurement data.



(3) Example Connections of External Input/Output Signals

(1) When connected to an external power source



(2) When using a contact signal



6. Interface

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



6. Interface

(4) Timing Chart

Examples of timing chart are shown below for the case where the power supply of the **MM-L400A** is turned on, measurement by laser processing is performed and judgment is made.

Each timing chart, with the equipment operation represented on the vertical axis and the lapse of time represented on the horizontal axis, shows 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

The following diagram shows the lapse of time in the case where the power supply of the **MM-L400A** is turned on and measurement becomes ready.

<normal></normal>	
Front Power Switch on	
	Less than 5s
Power on	
Ready output	
	Until Trigger Acceptable*
NG output (Contact B)	
*Trigger Acceptable: ini (connection establishe	tial setting completed, sensor ready, and measurement data transmittable ad with save destination such as a personal computer)
<when error="" occurs=""></when>	
Front Power Switch on	
	Less than 5s
Power on	
Ready output	
	4 20s max.
NG output (Contact B)	

(2) To power off

The following diagram shows the lapse of time in the case where the internal power of the **MM-L400A** is turned off.



The internal power can be turned off either by using a personal computer, the front power switch of the equipment, or the EXT. I/O operation of the Shutdown Start input (B17).

During measurement, the internal power cannot be turned off. When using a personal computer, the internal power turns off after the measurement ends. When using the front power switch and EXT. I/O, input during measurement is invalid. The operation of Ext. I/O is enabled when External Control Enable is on.

During the internal power off operation, the In-Shutdown output (A17) is on. Turning off the AC power switch on the rear of the equipment during the shutdown operation can damage the setting data. Be sure to wait until the In-Shutdown output is off before turning off the AC power switch on the rear of the equipment

While the In-Shutdown output is on, the POWER lamp of the status indicator LEDs on the front of the equipment flashes.

(3) To switch conditions

An example of timing chart is shown below for the case where the condition No. is switched by using Ext. I/O.



When External Control Enable is on, the measurement condition No. can be switched by using Ext. I/O.

When External Control Enable is on, with the Recipe No. Determined Strobe input (B15) triggered (rising), the status changes to the condition of Recipe No. Select (B7 to B14). However, if the input is triggered during measurement, the status only changes after the measurement ends (the measurement continues with the condition that existed before the change until it ends).

The Recipe No. Determined output (A13) is on when it accepts the Recipe No. Determined Strobe input (B15). It is off when the Recipe No. Determined Strobe input (B15) is off. When changing the condition No., turn off the Recipe No. Determined Strobe input (B15) after the Recipe No. Determined output (A13) is on.

The Recipe No. Select outputs (A4 to A11) output the current condition No.

(4) From trigger input to measurement

An example of timing chart is shown below for the case where the measurement is performed by the **MM-L400A**.

TRIGGER	IN	
		Measurement does not start without
READY	OUT	Ready signal turned on
In-Measurement	OUT	
		Less than 1 ms
ок	OUT	
		✓ Less than 0.5 s
NG	OUT	
Judgment Reset	IN	

The following signal is triggered based on the setting of trigger conditions.

Trigger channel	Trigger
External trigger	Measurement starts with External trigger input of Ext. I/O (B1) and waveform rising
Other than External trigger	Triggered on when the selected output exceeds the set trigger level

When Ready is on and Trigger is on, the measurement starts. When the set measurement time is exceeded, the measurement ends. (When an error occurs during the measurement, the measurement ends at the point where error occurred).

If Ready is off, the measurement does not start even when Trigger is on.

When the waveform rising cannot be monitored due to the delay of the external trigger signals, perform pre-trigger setting.

Ready is on when all of the following conditions are satisfied:

- No error has occurred
- Shutdown is not in progress
- Database server is online
- Not during a condition change process
- Measurement has stopped

(5) From trigger input to measurement (Judgment Reset)

An example of timing chart is shown below for the time elapsed from the measurement start using the **MM-L400A** to the output of a judgment result (OK or NG signals), as well as the reset of the judgment result output.

TRIGGER	IN	
READY	OUT	
		 500 µs max. 500 µs max. 500 µs max.
In-Measurement	OUT	
		Less than 1 ms
ок	оит	without Judgment Reset signal input
		Less than 1 ms
NG	OUT	
¹ Judgment Reset	IN	

<When the Judgment Reset input(B16) is not used>

The OK signal of Ext. I/O (A12) is on when there is no NG in the judgment result at the measurement end.

The NG signal (A14) is on when there is NG in the judgment during measurement.

Both the OK signals and NG signals are off when the measurement starts. (Judgment results of the previous measurement are maintained until the next measurement starts.)

		Measurement starts w	hen TRIGGER is input in READY status	
TRIGGER	IN			
READY	OUT			
		→ 500 µs max.	500 μs	max.
in-Measurement	OUT			
			OK signal is output after measurement	NG is output even during measurement
ок	OUT			
			Less than 1 ms	▲ 10 ms max.
NG	OUT			
			Resets OK signal	Resets NG signal
Judgment Reset	IN			
			1 ms or more	1 ms or more

<When the Judgment Reset input(B16) is used>

When the measurement stops, if the Ext. I/O Judgment Reset input (B16) is triggered, OK signal (A12) and NG signal (A14) are off.

(6) Counter reset

An example of timing chart is shown below for the change in counter (the values of Total and NG in the PC software **MS-Viewer**) as well as the time elapsed from when the counter is reset by Ext. I/O.

		Less than 0.5 s
Counter Reset	IN	
		When Counter Reset signal is input during measurement,
		Less than 0.5 s the counter is reset after measurement ends.
Counter [0:8]	OUT	
		1 µs or less
In-Measurement	IN	

The counter increments when the measurement starts. (The NG value increments when the first NG is judged during a measurement.) In the **MS-Viewer**, however, the display is reset when each measurement ends (with the measurement data updated), the counter display changes when the measurement ends.

The Ext. I/O Counter Reset input (B6) is enabled when the External Control Enable is on.

The counter is reset to 0 when the External Control Enable is on and the Counter Reset input (B6) is triggered. However, when the input occurs during the measurement, the counter is reset to 0 when the measurement ends.

6. Interface	
6-15	

(7) Error Reset

An example of timing chart is shown below for the time elapsed from when the Ext. I/O is used to reset errors.

Timing Chart Name タイミングチャート名	INTEF ErrorF	RFACE_01 Reset_comment																					
		-																					
CLOCK	CIN		Ŀ	டா	ப	╶─					ப	<u> </u>				டா		Г		பு		Л	~
External Control Enable	IN																						
			•	→ L	ess t	han	0.5 s																
External Control Enable	OUT																						
								-	0.1	S O	r m	ore											
Error Reset	IN																						
								-	-	0.:	2 s	or le	ess										
Error Output	оит											-											
								Err	or o	utpu	ut is	s trig	gger	ed	with	Err	or	Res	set s	sigr	al		
Supplementary Explan	otion																						

Supplementary Explanation

Group Name

The Ext. I/O Error Reset input (B5) is enabled when the External Control Enable is on.

When an error has occurred and with External Control Enable on, the error is cleared by triggering the Error Reset input (B5).

6. Interface	
6-16	

7. Maintenance

(1) Troubleshooting

When an error occurs in the **MM-L400A**, the ERROR lamp on the display panel lights up in red.

	<u></u>				
1	POWER MEASURE	ERROR READY CONNECT CONNECT	RMADA	1	
	• •	• • • •			
:		Preser	MIXACHI MM-L400A	1	
	A			1	
	ERF	' ≀OR lamp			

Here describes the symptoms, confirmation item and measures to take.

Symptom	Confirmation item	Measures
The power	Is the AC cable connected?	Connect the AC cable.
supply is not turned on.	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 100 to 240 V AC.
	Are cables normal (free from disconnection, etc.)?	Use the normal cable.
	Is the fuse normal (free from malfunction or breakage)?	Replace the malfunctioned or the broken fuse. (See 7.(3) Replacing the Fuse)
State does not change to on- line.	Is the IP address of the personal computer different from that of the MM-L400A ?	Set a different IP. (See 3.(1)(2) IP address setting.)
	Is the IP address of the MM-	Press the IP address reset switch.
	L400A set to [192.168.1.40] when connecting it for the first time after purchase?	This sets the IP address to [192.168.1.40].
	Is the LAN cable connected?	Connect the LAN cable.
	Is the power supply of the MM- L400A turned on?	Turn on the power supply.

Phenomenon possibly occurring until online

Symptom	Confirmation item	Measures	
The software cannot be installed.	Doesn't the installer start automatically?	Start automatically. (Refer to the Application Manual of the MS-Viewer .)	
	Is the .NET Framework installed?	Install it from Microsoft. For installation, the network connection is required.	
The MM-L400A is not become READY.	Is the ERROR lamp at the front of the MM-L400A lit?	Check the ERROR information. (Refer to the Application Manual of the MS-Viewer .)	

Symptoms that occur until waveforms are obtained

Symptom	Confirmation item	Measures
The guide light cannot be turned on.	Is the [Guide] button clicked on the Main Window?	Click the [Guide] button.
Waveforms cannot be obtained. / The	aveformsIs the monitoring point of the MM-annot beL400A aligned with theotained. / Theprocessing point?	Align the monitoring point of the MM-L400A with the laser processing point.
intensity of waveform is low or high.	Is the analog gain adjustment proper?	Adjust the analog gain so that the waveforms can be obtained.
	Are the settings of external trigger and internal trigger proper?	Change them on the Recipe Window.
	Isn't the trigger setting too high?	Lower the set value of the trigger.
	Is the external trigger input?	Check Ext. I/O. (See 6. Interface.)
	Is the specification of the optical filter proper?	Use a filter for the MM-L400A with a proper specification.*1

7. Maintenance

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 setting proper?	Check the setting.
Disturbance of waveform	Is the installation method of the external light-receiving unit, coaxially mounting adapter, or the optical fiber proper?	Install it so as not to receive vibration etc.
	Is the environment under high noise?	Take proper measures against noise. As necessary, increase the setting value of the moving average.
EXT. I/O and TRIGGER signals cannot be input or 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.

Symptoms that occur after waveforms are obtained

*1: For the profiles of the optical filters for the **MM-L400A**, see (4) Options in 3.(2). When performing measurement with the same setting condition, the measurement intensity is different as shown below.

Visual lights

No.	Line color	Optical attenuation filter unit
(1)	Green	Without optical attenuation filter unit
(2)	Gray	With optical attenuation filter unit (AS1213648)



7. Maintenance

Reflective light

No.	Line color	Optical attenuation filter unit
(1)	Blue	Without optical attenuation filter unit
(2)	Gray	With optical attenuation filter unit (AS1213648)



Near-infrared light

No.	Line color	Optical attenuation filter unit
(1)	Light blue	Without optical attenuation filter unit
(2)	Gray	With optical attenuation filter unit (AS1213648)



(2) Cleaning/Replacing 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 external light-receiving unit if the protective glass holder is not properly tightened. 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 a case, gently press the protective glass with a finger from above the lens cleaning paper to remove it.

(3) Necessary items

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

(4) Maintenance parts

Item	Model No.
Protective glass *1	KU-0037
O-ring (for protective glass) *1	D9270 SG-26

- *1 Replace the protective glass and the O-ring together.
- (3) Cleaning/replacement procedure
 - 1) Turn off the power for the laser device and the power for the MM-L400A.

2) Turn the protective glass holder at the end of the external light-receiving unit to detach it from the unit. Remove the protective glass from the protective glass holder.



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.





4) Fit the Teflon ring in the protective glass holder, and then fit a clean (or new) protective glass. The glass orientation is not important. After that, fit the O-ring on the protective glass.

Turn the protective glass holder until the protective glass is securely tightened.



7. Maintenance

(3) Replacing Fuse

A fuse will be blown out if the rated voltage is exceeded (or overvoltage is applied). When this occurs, replace the fuse 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 fuse box.



Fuse box

3) Take out the fuse with the blown element, and replace it.



Fuse

7. Maintenance

(4) About MM-L400A

The **MM-L400A** does not guarantee the absolute value.

The output intensity of the **MM-L400A** can be used for comparison to the relative value.

It assumes that the 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 **MM-L400A** is normal, as shown in Fig. a, obtain waveforms at any determined conditions by welding on reference workpieces.



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, confirm that the value always falls within a range.



For the sensitivity check and readjustment, see 8. Sensitivity Check and Readjustment.

8. Sensitivity Check, Readjustment

To maintain the performance of the laser weld monitor **MM-L400A**, periodical sensitivity check is mandatory. Due to the product specifications, calibration is not possible for the equipment. Accordingly, sensitivity check is required to see if the equipment is in the same status with the default status at the shipment. When any gap is admitted, readjustment needs to be performed to readjust the measurement sensitivity to the default status.

The sensitivity check and readjustment can be performed at the customer site. The following environment is required for the readjustment:

- Provide a space for moving and working on the MM-L400A (500 mm x 700 mm or more). As necessary, the MM-L400A needs to be moved to the work space for internal adjustment.
- At readjustment, the MM-L400A can be under the influence of the customer environment. When in the readjustment works, it is recommended to stabilize the ambient temperature/humidity as well as to stop the surrounding devices (to avoid disturbance noises).
- The readjustment of the **MM-L400A** should be performed by using the PC of our service personnel.

Contact us for the details of the sensitivity check and readjustment.

8. Sensitivity Check, Readjustment

9. Specifications

Controller	Dimensions	486(W) x 597(D) x 109(H) mm (with handle and rubber feet mounted, excluding fiber bending radius)
	Maximum mass	Approx. 22 kg
	Input supply voltage	Single-phase 100 to 240 V AC (-10%, +4%), 50/60 Hz
	Power consumption	110 W or less
	Detection wavelength	Visible light: 400 to 800 nm Reflective light: 1060 to 1080 nm Near-infrared light: 1300 to 1700 nm
	Guide light wavelength	645 to 660 nm *Not measurable when the guide light is turned on.
	Guide light laser class	3R
	Input channel	Max. 8 channels + 2 channels from external analog input
	Repeatability	±4%*3
	Minimum measuring time resolution	1 µs
	Measuring time setting range	1 μs to 999 sec
	Judging function	Envelope (upper/lower limit judgment), integral judgment
	Grounding class	Class D grounding
Fiber unit	Minimum bending radius	R100 mm
	Mounting method	Fixed mounting *4, 5
Analog input	Input channel	2 channels
	Analog input voltage	0 to 10 V (resolution: 10 bits)
	Absolute maximum input	-0.3 to 11.2 V
	Input impedance	Approx. 1 MΩ
Analog output	Output channel	2 channels
(General-purpose	Output voltage	0 to 10 V
monitor)	Output impedance	Approx. 26 Ω
24V output	Output voltage	23 to 25 V
(3-pin connector)	Maximum output current	1.5 A
24V output	Output voltage	23.5 to 24.5 V
(IO connector)	Maximum output current	0.1 A
Use environment	Ambient operating temperature	5 to 40 °C (without condensation)

9. Specifications

Ambient operating humidity	85% RH or less (without condensation)
Cooling method	Natural air-cooled*6
Vibration when in use	JEITA IT-1004A Class S
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 60 °C (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	Not 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: The repeatability is effective when the following conditions are satisfied:
 - · Ambient temperature change: 1°C or less
 - Warm-up time: 10 minutes or more
 - · Analog gain x 1
 - · Intensity of 6000 or more
 - With a certain level of light volume entered (without the light accuracy)
- *4: When the fiber unit is mounted to the movable part such as a robot arm, the fiber damage is out of the warranty scope. Use the unit by taking the minimum bending radius or bending times into account.
- *5: When mounted to the movable part such as a robot arm, the fiber unit may influence the measurement value depending on the operation conditions. It is recommended to evaluate the operation beforehand. For details, contact us.
- *6: When the external light-receiving unit accumulates heat due to the diffuse reflection light from workpieces, a cooling measure or a measure against reflective light is required at the customer side. For details, see 5.(9) Measures against the Reflected Light to the External Light-receiving Unit.

10. Outline Drawing

(1) MM-L400A Laser Weld Monitor

Maximum mass: approx. 22 kg (Excluding the fiber unit)

(Unit: mm)



*1 When the bottom parts are removed, the product height is 88 mm.

10.Outline Drawing

(2) Coaxially Mounting Adapter (MM-L400A) (Optional)

Maximum mass: approx. 0.9 kg

(Excluding the fiber unit and the camera unit, including the accessories to mount)

(Unit: mm)



*1 Use the C-mount ring (height: 4 mm) to either of the two locations.

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

10.Outline Drawing

(3) External Light-Receiving Unit (Optional)

Mass: approx. 0.4 kg (Excluding the fiber unit)



10.Outline Drawing

11. License

Apche2 / MIT License

Copyright 2023 AMADA WELD TECH CO ,LTD. All Rights Reserved.

Apache License Version 2.0, January 2004 http://www.apache.org/licenses/

TERMS AND CONDITIONS FOR USE, REPRODUCTION, AND DISTRIBUTION

1. Definitions.

License shall mean the terms and conditions for use, reproduction, and distribution as defined by Sections 1 through 9 of this document.

Licensor shall mean the copyright owner or entity authorized by the copyright owner that is granting the License.

Legal Entity shall mean the union of the acting entity and all other entities that control, are controlled by, or are under common control with that entity. For the purposes of this definition, "control" means (i) the power, direct or indirect, to cause the direction or management of such entity, whether by contract or otherwise, or (ii) ownership of fifty percent (50%) or more of the outstanding shares, or (iii) beneficial ownership of such entity.

You (or "Your") shall mean an individual or Legal Entity exercising permissions granted by this License.

Source form shall mean the preferred form for making modifications, including but not limited to software source code, documentation source, and configuration files.

Object form shall mean any form resulting from mechanical transformation or translation of a Source form, including but not limited to compiled object code, generated documentation, and conversions to other media types.

Work shall mean the work of authorship, whether in Source or Object form, made available under the License, as indicated by a copyright notice that is included in or attached to the work (an example is provided in the Appendix below).

Derivative Works shall mean any work, whether in Source or Object form, that is based on (or derived from) the Work and for which the editorial revisions, annotations, elaborations, or other modifications represent, as a whole, an original work of authorship. For the purposes of this License, Derivative Works shall not include works that remain separable from, or merely link (or bind by name) to the interfaces of, the Work and Derivative Works thereof.

Contribution shall mean any work of authorship, including the original version of the Work and any modifications or additions to that Work or Derivative Works thereof, that is intentionally submitted to Licensor for inclusion in the Work by the copyright owner or by an individual or Legal Entity authorized to submit on behalf of the copyright owner. For the purposes of this definition, "submitted" means any form of electronic, verbal, or written communication sent to the Licensor or its representatives, including but not limited to communication on electronic mailing lists, source code control systems, and issue tracking systems that are managed by, or on behalf of, the Licensor for the purpose of discussing and improving the Work, but excluding communication that is conspicuously marked or otherwise designated in writing by the copyright owner as "Not a Contribution."

Contributor shall mean Licensor and any individual or Legal Entity on behalf of whom a Contribution has been received by Licensor and subsequently incorporated within the Work.

11. License	
11-1	

2. Grant of Copyright License. Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable copyright license to reproduce, prepare Derivative Works of, publicly display, publicly perform, sublicense, and distribute the Work and such Derivative Works in Source or Object form.

3. Grant of Patent License. Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable (except as stated in this section) patent license to make, have made, use, offer to sell, sell, import, and otherwise transfer the Work, where such license applies only to those patent claims licensable by such Contributor that are necessarily infringed by their Contribution(s) alone or by combination of their Contribution(s) with the Work to which such Contribution(s) was submitted. If You institute patent litigation against any entity (including a cross-claim or counterclaim in a lawsuit) alleging that the Work or a Contribution incorporated within the Work constitutes direct or contributory patent infringement, then any patent licenses granted to You under this License for that Work shall terminate as of the date such litigation is filed.

4. Redistribution. You may reproduce and distribute copies of the Work or Derivative Works thereof in any medium, with or without modifications, and in Source or Object form, provided that You meet the following conditions:

You must give any other recipients of the Work or Derivative Works a copy of this License; and You must cause any modified files to carry prominent notices stating that You changed the files; and You must retain, in the Source form of any Derivative Works that You distribute, all copyright, patent, trademark, and attribution notices from the Source form of the Work, excluding those notices that do not pertain to any part of the Derivative Works; and

If the Work includes a "NOTICE" text file as part of its distribution, then any Derivative Works that You distribute must include a readable copy of the attribution notices contained within such NOTICE file, excluding those notices that do not pertain to any part of the Derivative Works, in at least one of the following places: within a NOTICE text file distributed as part of the Derivative Works; within the Source form or documentation, if provided along with the Derivative Works; or, within a display generated by the Derivative Works, if and wherever such third-party notices normally appear. The contents of the NOTICE file are for informational purposes only and do not modify the License. You may add Your own attribution notices within Derivative Works that You distribute, alongside or as an addendum to the NOTICE text from the Work, provided that such additional attribution notices cannot be construed as modifying the License.

You may add Your own copyright statement to Your modifications and may provide additional or different license terms and conditions for use, reproduction, or distribution of Your modifications, or for any such Derivative Works as a whole, provided Your use, reproduction, and distribution of the Work otherwise complies with the conditions stated in this License. 5. Submission of Contributions. Unless You explicitly state otherwise, any Contribution intentionally submitted for inclusion in the Work by You to the Licensor shall be under the terms and conditions of this License, without any additional terms or conditions. Notwithstanding the above, nothing herein shall supersede or modify the terms of any separate license agreement you may have executed with Licensor regarding such Contributions.

6. Trademarks. This License does not grant permission to use the trade names, trademarks, service marks, or product names of the Licensor, except as required for reasonable and customary use in describing the origin of the Work and reproducing the content of the NOTICE file.

7. Disclaimer of Warranty. Unless required by applicable law or agreed to in writing, Licensor provides the Work (and each Contributor provides its Contributions) on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied, including, without limitation, any warranties or conditions of TITLE, NON-INFRINGEMENT, MERCHANTABILITY, or FITNESS FOR A PARTICULAR PURPOSE. You are solely responsible for determining the appropriateness of using or redistributing the Work and assume any risks associated with Your exercise of permissions under this License.

8. Limitation of Liability. In no event and under no legal theory, whether in tort (including negligence), contract, or otherwise, unless required by applicable law (such as deliberate and grossly negligent acts) or agreed to in writing, shall any Contributor be liable to You for damages, including any direct, indirect, special, incidental, or consequential damages of any character arising as a result of this License or out of the use or inability to use the Work (including but not limited to damages for loss of goodwill, work stoppage, computer failure or malfunction, or any and all other commercial damages or losses), even if such Contributor has been advised of the possibility of such damages.

9. Accepting Warranty or Additional Liability. While redistributing the Work or Derivative Works thereof, You may choose to offer, and charge a fee for, acceptance of support, warranty, indemnity, or other liability obligations and/or rights consistent with this License. However, in accepting such obligations, You may act only on Your own behalf and on Your sole responsibility, not on behalf of any other Contributor, and only if You agree to indemnify, defend, and hold each Contributor harmless for any liability incurred by, or claims asserted against, such Contributor by reason of your accepting any such warranty or additional liability.

END OF TERMS AND CONDITIONS

python / MIT License

- This LICENSE AGREEMENT is between the Python Software Foundation ("PSF"), and the Individual or Organization ("Licensee") accessing and otherwise using Python 3.10.5 software in source or binary form and its associated documentation.
- 2. Subject to the terms and conditions of this License Agreement, PSF hereby grants Licensee a nonexclusive, royalty-free, world-wide license to reproduce, analyze, test, perform and/or display publicly, prepare derivative works, distribute, and otherwise use Python 3.8.5 alone or in any derivative version, provided, however, that PSF's License Agreement and PSF's notice of copyright, i.e., "Copyright c 2001-2022 Python Software Foundation; All Rights Reserved" are retained in Python 3.8.5 alone or in any derivative version prepared by Licensee.
- 3. In the event Licensee prepares a derivative work that is based on or incorporates Python 3.8.5 or any part thereof, and wants to make the derivative work available to others as provided herein, then Licensee hereby agrees to include in any such work a brief summary of the changes made to Python 3.10.5.
- 4. PSF is making Python 3.8.5 available to Licensee on an "AS IS" basis. PSF MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED. BY WAY OF EXAMPLE, BUT NOT LIMITATION, PSF MAKES NO AND DISCLAIMS ANY REPRESENTATION OR WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OR THAT THE USE OF PYTHON 3.10.5 WILL NOT INFRINGE ANY THIRD PARTY RIGHTS.
- 5. PSF SHALL NOT BE LIABLE TO LICENSEE OR ANY OTHER USERS OF PYTHON 3.8.5 FOR ANY INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES OR LOSS AS A RESULT OF MODIFYING, DISTRIBUTING, OR OTHERWISE USING PYTHON 3.8.5, OR ANY DERIVATIVE THEREOF, EVEN IF ADVISED OF THE POSSIBILITY THEREOF.
- 6. This License Agreement will automatically terminate upon a material breach of its terms and conditions.

- 7. Nothing in this License Agreement shall be deemed to create any relationship of agency, partnership, or joint venture between PSF and Licensee. This License Agreement does not grant permission to use PSF trademarks or trade name in a trademark sense to endorse or promote products or services of Licensee, or any third party.
- 8. By copying, installing or otherwise using Python 3.8.5, Licensee agrees to be bound by the terms and conditions of this License Agreement.

SQLite3 / Public Domain

Flask / MIT License

Copyright 2023 AMADA WELD TECH CO ,LTD. All Rights Reserved.

Permission is hereby granted, free of charge,

to any person obtaining a copy of this software and associated documentation files (the "Software"),

to deal in the Software without restriction, including without limitation the rights to use,

copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software,

and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Werkzeug / MIT License

Copyright 2023 AMADA WELD TECH CO ,LTD. All Rights Reserved.

Permission is hereby granted, free of charge,

to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions: The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED,

INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT.

IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM,

DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

11. License	
11-5	