

RSD-SUNMAX-FL-PLC-200 Portable Laser Cleaner — User Manual

RSD-SUNMAX Series
SUNMAX LASER

About this document: This is an English translation of the Japanese original prepared by SUNMAX LASER for reference purposes. In case of any discrepancy, the Japanese original shall prevail. Specifications are subject to change without notice.

RSD-SUNMAX-FL-PLC-200

User Manual



Ver. 1.0 (English Edition)

RSD SUNMAX LASER
RINSYUNDOU Co., Ltd.

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Chapter 1 About This User Manual

This user manual describes the configuration, operation, and maintenance of the RSD-SUNMAX-FL-PLC-200 portable laser cleaner.

This user manual is provided as a PDF file.

Hyperlinks are included in the text where appropriate so that you can easily cross-reference related sections. Please note that these hyperlinks will not work if the manual is printed on paper.

Chapter 2 Precautions

2-1 For Safe Use

Warnings and Cautions

- To use this product safely, be sure to read this manual before operating the product.
- Keep this manual close at hand so that you can resolve any questions about the product at any time.
- To prevent harm to you and others and damage to property, this manual uses the following warning labels for operations and handling that involve danger.
- If the machine fails or a person is harmed as a result of actions contrary to the instructions in this manual, the warranty may not apply even within the warranty period.

Please read the text carefully and make sure you fully understand its contents.

Label	Meaning
Warning	Indicates actions that must never be performed. Improper handling is highly likely to result in fire, or in death or serious injury to the user.
Caution	Indicates actions that must never be performed. Improper handling may result in property damage or serious injury.

About the Pictograms

The instructions to be observed are classified and explained with the following pictograms. Please read the text carefully and make sure you fully understand its contents.



- This symbol indicates a prohibited action.
- This symbol indicates that the product must not get wet.
- This symbol indicates that disassembly is prohibited.
- This symbol indicates that touching the product with wet hands is prohibited.
- This symbol indicates a risk of bursting.
- This symbol indicates an action that must be performed.
- This symbol indicates that the power plug must be unplugged from the outlet.
- This symbol indicates a risk of ignition.

Safety Warnings



Warning: Do not continue using the laser machine or its accessories in an abnormal condition, for example if it emits smoke, an unusual odor, or an unusual noise. Doing so may cause a malfunction, electric shock, or fire. Stop using the machine immediately, turn off the power switch, unplug the power plug from the outlet, and contact your dealer.

Warning: Do not disassemble or modify the machine (except as instructed in this manual). Doing so may cause injury, electric shock, or fire. When performing the maintenance described in this manual,

or when carrying out checks or disassembly as instructed by your dealer, always unplug the power plug from the outlet before starting work.

Warning: Use the indicated power supply (AC 100 V). Using a power supply other than 100 V may damage the machine or cause fire or electric shock. Consult a professional electrical contractor.

Warning: Do not touch the machine or the power plug with wet hands. Doing so may cause electric shock.

Warning: Do not operate near open flames. Do not use the machine in places where open flames are present, such as near stoves or lit cigarettes.

Warning: Watch out for dust on the power cord. If dust accumulates on the power plug, it can generate heat and cause a fire.

Warning: Handle the power plug with care. Improper handling may cause a fire. When handling the power plug: do not insert the plug while dust or other foreign matter is on it, and insert the plug fully, all the way to its base.



Warning: If foreign objects or liquids such as water get inside the machine, do not continue using it. Doing so may cause electric shock, malfunction, or fire. Immediately turn off the power switch, unplug the power plug from the outlet, and contact your dealer.

Warning: Do not operate the machine while wearing metal objects such as watches or rings. Laser light striking the metal may be reflected and emitted in unintended directions.

Warning: Wear protective glasses (shield) and welding gloves during processing.

- Contact between the laser beam and the human body during processing will lead to injury or burns.
- Should the workpiece material catch fire, protective gear reduces the chance of the fire spreading.

- Reflections may cause laser light to be emitted outside the machine. In such cases, it may unintentionally strike a person or cause a fire.

Warning: Confirm that the supply gas is blowing. Performing processing while the assist gas is stopped greatly increases the risk of ignition.

Warning: Check that there are no cooling water leaks. Water leaks may cause electric shock, malfunction, or fire. Immediately turn off the power switch, unplug the power plug, and repair the leaking area.

Warning: Install a fire alarm and a fire extinguisher. For fire prevention and firefighting, always install a fire alarm and a fire extinguisher (or a bucket of water if no extinguisher is available) near the machine. Install the fire alarm at a height close to the ceiling.

Warning: Do not install the machine in a location where the temperature drops below freezing. The water inside the hoses will freeze, causing damage to or rupture of the laser oscillator. In winter, add antifreeze (coolant) to the water chiller.

Safety Precautions

Caution: Watch the water temperature during processing. Water circulates through the laser oscillator and the laser gun. If the cooling water temperature rises above the specified level, the laser oscillator and laser gun may be damaged. In that case, stop laser processing and either wait for the water temperature to drop or replace the water in the tank.

Caution: When transporting this product, carry it carefully and avoid vibration. It contains easily damaged components. Transport it with care, as vibration may affect the laser oscillator.

Caution: Clean this product regularly. To maintain stable performance, clean the protective lens and the focusing lens regularly.

Caution: Do not plug in or unplug the power plug while the power is on. Doing so may cause a malfunction.

Caution: Do not install the machine in an unstable location (such as on a wobbly stand or a tilted surface). It may fall or tip over, resulting in damage or injury.

Caution: Do not place the machine in humid or dusty locations. Not only may the machine's performance deteriorate, but there is also a risk of electric shock or fire.

Caution: Do not block the ventilation openings of this product. Blocking the ventilation openings traps heat inside, creating a risk of fire.

Caution: When the machine will not be used for a long period, turn off the power switch and unplug the power plug from the outlet for safety.

2-2 Installation Environment

The installation environment requirements for the machine are as follows.

Ambient temperature	-10°C to 40°C
Ambient humidity	80% or less

Installation in the following locations is prohibited, as it can cause malfunctions and shorten the service life of the machine.

- Locations subject to sudden changes in temperature or humidity (this can degrade or damage the optical lenses)
- Locations without clean air, where gas, dust, smoke, oil mist, or the like is generated; environments with high concentrations of CO₂, NO_x, or SO_x
- Locations subject to vibration or shock
- Locations near sources of high-frequency interference
- Locations where condensation forms (if the ambient temperature falls below freezing, the cooling water and other parts may freeze and damage the machine)
- Locations near flammable materials

Warning: Use the specified power cable. A power cable with insufficient capacity or an incorrect connection can cause fire or electric shock. Always ground the machine. If it is not grounded, a malfunction or current leakage may result in electric shock.

Caution: When replacing consumable parts, etc., turn off the power switch and unplug the power plug from the outlet beforehand for safety.

Warning: Never look directly at the laser emission during processing. Depending on the processing settings and the material, intense light may be produced, which can cause visual impairment or eye pain. In severe cases, retinal damage may result in blindness.

2-3 Safety Measures During Use

Because a laser cleaner is designed so that the operator controls the laser emission by hand, incorrect operation or handling can lead to serious accidents. Exercise the utmost care during operation.

Warning: Incorrect use or handling can damage the fiber laser cleaner and pose a risk of harm to the human body.



2-3-1 Operating Precautions

- Always wear laser safety glasses, highly fire-resistant protective gloves, and a dust mask when processing. People nearby must also wear them. If laser light enters the eyes, it can, in the worst case, cause blindness. If it strikes the skin, it can cause injuries involving burns.
- Do not look into the laser emission aperture or point it at people.
- While the laser is being emitted, do not look into the aperture from the front or put your hand in front of it.
- Designate an area for laser emission work and restrict entry by anyone other than operators and authorized personnel.
- Watch out for reflected light while working. Highly reflective materials (such as copper and aluminum) can reflect the laser strongly. The laser may also be reflected strongly if it is emitted at an incorrect focal distance.
- Do not bring flammable items into the laser emission area.
- Disassembly, repair, or modification by anyone other than a specialist is prohibited. Do not disassemble the machine beyond normal maintenance. Failures, electric shock, fire, or other problems arising from disassembly, repair, or modification are not covered by the warranty or repair service.
- Persons using a cardiac pacemaker or a similar device must not approach the machine. The machine generates a magnetic field that can interfere with the normal operation of pacemakers and similar devices.
- In areas that direct or indirect laser light may reach, install fences and signs to clearly separate them from other areas, and take measures to prevent anyone other than operators from approaching.
- Metal fumes may be generated during processing. Provide dust masks and ventilation equipment.

2-3-2 Preventing Laser Light Leakage

To prevent laser light leakage and process safely, observe the following when processing:

- Do not add or move workpieces or parts during processing.

- Close all of the machine's doors before processing.
- When emitting laser output during maintenance, never touch parts of the machine unrelated to the work. Also, use fire-resistant boards, heat-insulating materials, or the like to ensure that the laser is not emitted onto the surroundings.

2-3-3 Precautions During Work

- Do not damage electric wires, cables, or hoses. Do not step on, twist, or pull cables. A damaged cable can cause electric shock, a short circuit, or fire. A damaged hose may leak water or air.
- If the laser gun is overheating, stop processing immediately. A lens at the overheating point may be damaged. If you continue processing while it is overheating, in the worst case the laser oscillator may be damaged. If you damage the oscillator by continuing to use the machine without replacing the lens, this is not covered by warranty.
- If any abnormality occurs, such as a burning smell, unusual noise, abnormal heating, or smoke, turn off the power and contact us immediately. There is a risk of electric shock, fire, or other hazards.
- In the event of a short circuit or failure, confirm that there are no foreign objects inside the equipment, in particular metal or conductive objects.
- Do not use the machine when your clothing or body is wet, or in humid locations. Electrical components that come into contact with water can cause electric shock or short circuits.
- After finishing processing and turning off the machine's power, cut off the power supply to the machine, for example by unplugging the power plug or switching off the external circuit breaker.

2-3-4 Fire Prevention

- Do not place flammable or explosive materials or miscellaneous goods around the machine. When welding sparks scatter, flammable materials may ignite.
- Do not place flammable or explosive materials in the beam path or anywhere laser light may strike. If the laser beam hits flammable, explosive substances, it can cause a fire or explosion.
- Do not cover the equipment with blankets, cloth, or the like, as this can cause the equipment to overheat or catch fire.
- In the event of fire or explosion, turn off all power and use a carbon dioxide or dry powder fire extinguisher.

2-4 Points to Note During Use

2-4-1 Operating Notes

- Pay attention to the angle of the laser gun (torch) while processing. If the laser is emitted perpendicular to a light-reflecting material, the reflected laser can bounce back into the laser gun and damage internal components, or the reflected light may travel toward the operator.
- Before emitting the laser, check that nothing is adhering to the lens. Debris on the lens can cause lens damage.

2-4-2 Lens Replacement

- Do not replace lenses in a place where dust or dirt is suspended in the air.
- Do not replace lenses in a place exposed to wind or drafts.
- When removing a lens from the laser gun, cover the opening with masking tape or the top cap so that dust and debris cannot enter the interior.
- When installing a lens in the laser gun, check that no dust or particles are adhering to the lens before installing it.

2-4-3 Handling the Laser Gun and Cables

- Do not subject them to strong impacts such as dropping. The internal lenses and precision components may be damaged.
- The laser gun cable contains a fiber-optic cable. If the cable is damaged, the laser oscillator will be damaged. Do not twist, step on, or pull the cable.

2-4-4 Air and Gas

- When using compressed air, install a dryer and a filter, and always use clean air from which oil and moisture have been removed.
- Supply an appropriate air/gas pressure. Insufficient air/gas pressure can cause lens damage.

2-5 Laser Safety Standards and Classification

Safety standards have been established for laser products to prevent injury to users.

2-5-1 Laser Classes

In Japan, the JIS radiation safety standard for laser products, "C6802," is in force. It is the Japanese Industrial Standards translation of IEC 60825-1, so a product that complies with this standard can be considered to satisfy safety criteria common throughout the world. The standard specifies safety measures according to the wavelength and intensity of the laser, the required content of hazard warning labels, and so on.

レーザークラス	基準
クラス1	直接ビーム内観察を長時間行っても、またそのとき、観察用光学器具（ルーペ又は双眼鏡）を用いても安全であるレーザー製品。
クラス1M	裸眼（光学器具を用いない）で、直接ビーム内観察を長時間行っても安全であるレーザー製品。光学器具（ルーペ又は双眼鏡）を用いて観察すると、露光による目の障害が生じる可能性がある。クラス1Mレーザーの波長領域は、302.5nm～4000nmの間に限られている。
クラス2	400nm～700nmの波長範囲の可視光を放出するレーザー製品であって、瞬間的な被ばくの場合は安全であるが、意図的にビーム内を凝視すると危険なレーザー製品。光学器具を用いても目に障害が生じるリスクは増加しない。
クラス2M	可視のレーザービームを射出するレーザー製品であって、（光学器具を用いない）裸眼に対してだけ短時間の被ばくが安全なレーザー製品。光学器具（ルーペ又は双眼鏡）を用いて観察すると、露光による目の障害が生じる可能性がある。
クラス3R	直接のビーム内観察を行うと、目に障害が生じる可能性があるが、そのリスクが比較的小さいレーザー製品。目に障害が生じるリスクは露光時間とともに増大し、また意図的に目に露光することは危険である。
クラス3B	目へのビーム内露光が生じると、偶然による短時間の露光でも、通常危険なレーザー製品。拡散反射光の観察は通常安全である。
クラス4	ビーム内の観察及び皮膚への露光は危険であり、また拡散反射の観察も危険となる可能性があるレーザー製品。これらのレーザーには、しばしば火災の危険性が伴う。

2-5-2 Safety Standards

It is recommended that fiber laser cleaners be handled in accordance with the Japanese Industrial Standard "Safety of laser products (JIS C6802)." This standard was established to prevent injuries caused by laser equipment.

JIS C6802 classifies laser equipment according to its degree of hazard, and the CLC/PLC series falls under "Class 4," the highest hazard level. For the PLC-200, which is Class 4, we recommend implementing the following safety measures:

- Appointment of a safety supervisor: appoint a person with in-depth knowledge of laser equipment and laser beams as the supervisor, and rigorously enforce injury prevention and product management.
- Establishment of a controlled area: partition off the laser work area and mark it clearly with signs or similar means.
- Wearing of protective equipment: safety glasses suitable for fiber lasers, protective gloves, long-sleeved clothing, a leather apron, a dust mask, and so on.
- Inspection and maintenance: carry out pre-operation inspections as well as periodic inspections and adjustments.
- Safety and health education: provide education and training for operators.
- Keeping out hazardous materials: do not bring explosives or flammable substances into the laser work area.
- Hazardous gases, dust, etc.: take the measures prescribed by the Industrial Safety and Health Act.

In addition, the PLC-200 incorporates the following safety measures:

- Key control
- Warning labels affixed to alert users
- Warning indication by a lamp during laser emission
- Laser enable switch

2-6 Disclaimer

Please note in advance that we accept no liability whatsoever for damage, injury, accidents, or fire arising from the use of this product.

Furthermore, we accept no responsibility for any of the following damages:

- Incidental damage arising from the use of this product or from defective parts, etc.
- Damage caused by failure to observe the safety measures and precautions described in "Chapter 2: Precautions" of this manual
- Damage caused by modification of this product, or by combining it with equipment or software not provided by us

Chapter 3: Overview and Components

3-1 Overview of the Cleaner Main Unit

3-1-1 Main Unit Overview

Overall view



Rear View



3-2 Front of the Main Unit

The front of the unit contains the buttons and keys used to switch the power on and off.



3-2-1 Emergency Stop Button

Immediately stops the machine and brings it to a safe state.

3-2-2 Main Power Key

This key switches the main power on and off.

3-2-3 Indicator Lamp

The lamp changes color according to the machine's operating state. It lights yellow at startup and green during laser processing.



3-3 Top

The control panel is located on the top of the unit.

3-3-1 Control Panel

Used to control laser emission.

3-3 Rear

The rear of the unit contains external connection ports, such as the power cable inlet.



3-3-1 Assist Air Inlet

Assist air can be supplied here. Air pressure: 0.4–0.6 MPa

3-3-2 Power Supply

Supply 100 V / 10 A. Use a dedicated power source for this machine. If power is supplied through a multi-outlet power strip or similar shared wiring, insufficient power may prevent the laser from firing.

3-4 Laser Gun

The operator holds the laser gun in hand and uses it to perform processing.

Note: The shape of the laser head may differ depending on the production period.



3-4-1 Protective Lens

The protective lens is housed inside the laser gun and can be removed. For the lens replacement procedure, refer to "Protective Lens" in Chapter 7, Consumables.

3-4-2 Laser Emission Switch

When the laser is ready to fire, pressing this switch emits the laser from the emission aperture. Before pressing the switch, always confirm that the laser gun is pointed at the workpiece.

Warning: Careless pressing of the laser emission switch can directly lead to fire or accidents. Operate this button with the utmost care. The laser is emitted by a double-click-and-hold action (it fires while the switch is held down).

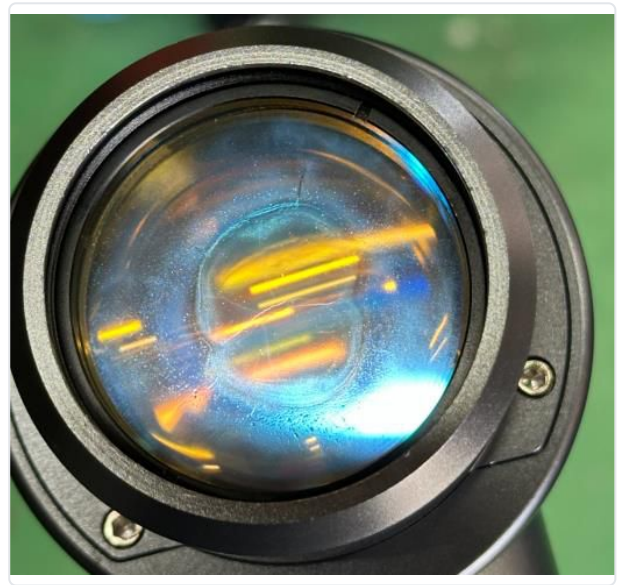
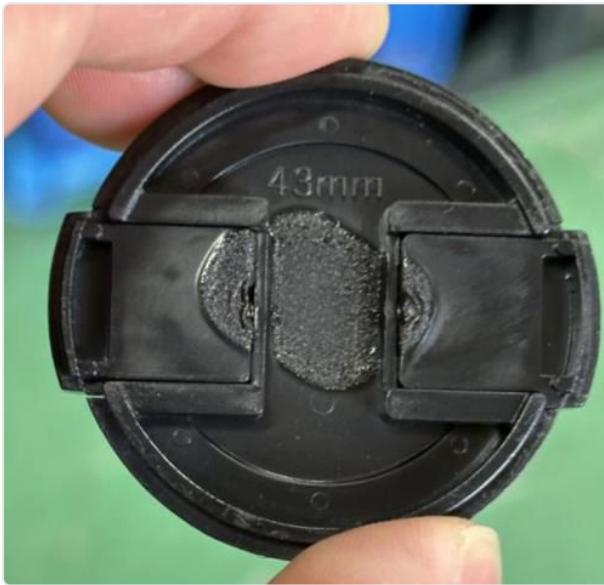


3-4-3 Laser Gun Power Button

Switches the laser gun's power on and off. The button lights green while the power is on.

3-4-4 Lens Cap

A lens cap is fitted to the emission aperture to protect it from dust.



Caution: Firing the laser with the lens cap still attached will burn the cap and damage the lens. Be sure to remove it first.

3-4-5 Assist Air

Using assist air prevents dirt and debris from adhering to the protective lens. In addition, by removing the hex screw on top of the laser gun and attaching the air nozzle, you can suppress (extinguish) flames that occur during laser emission.

Input air pressure: 0.4–0.6 MPa

Note: The use of assist air is not mandatory. In a work environment with adequate ventilation, the machine can be operated without assist air.



Precautions when using air

Caution: When using air, always pass it through a filter and dryer to thoroughly remove moisture, oil, and dust before use. In particular, if oil or moisture adheres to the protective lens, the laser may be reflected. If the reflected laser reaches the oscillator, it can damage the crystal inside the oscillator.

Chapter 4: Processing Procedure

4-1 Startup and Shutdown

Start up and shut down the PLC-200 using the following procedures.

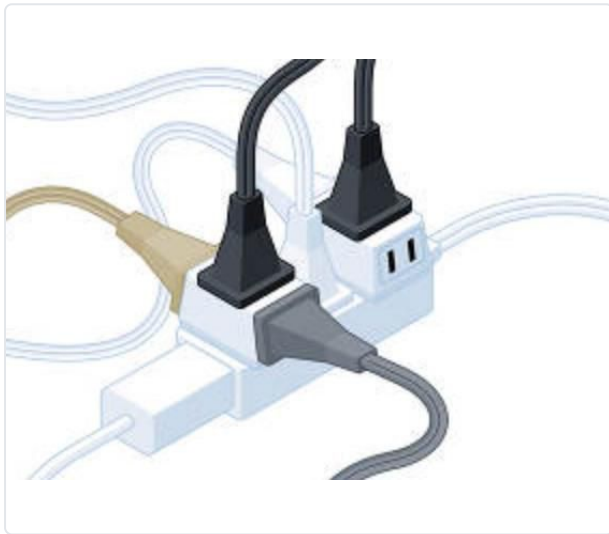
4-1-1 Startup

① Checks before startup

Before starting up, always confirm the following:

- Confirm that AC 100 V / 10 A power is correctly supplied to the laser machine's power cable.
- Always make sure the machine is properly grounded (earthed).
- Do not use multi-outlet power strips; always supply power from a dedicated circuit. Insufficient power may prevent the laser from firing.

② Switch the power on and off using the emergency stop button on the front of the unit.



Turning the button in the direction of the arrow releases the emergency stop button and turns the power on. Pressing the button turns the power off.

③ Make sure the oscillator key is turned to the left.

④ The operation panel starts up. A laser warning is displayed; touch the arrow (→) mark to proceed.

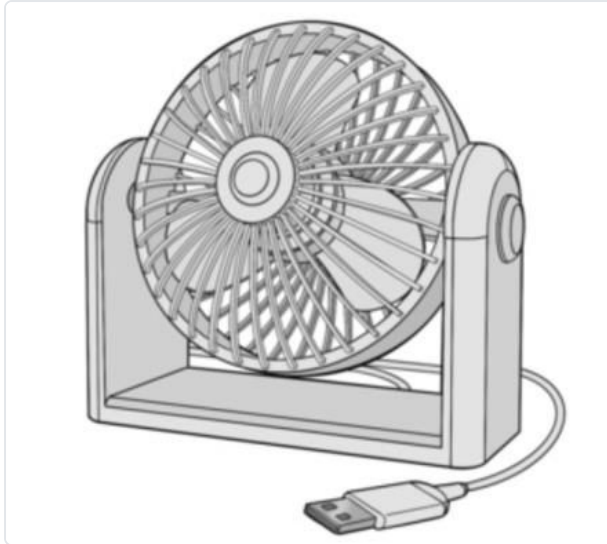


The screen is now up and running.

⑤ Smoke is generated during laser processing. If the generated smoke adheres to the lens, it will cause attenuation of the laser output and degradation or wear of the lens.

During processing, supply clean air or provide ventilation equipment (a fan, dust collector, etc.) so that smoke does not accumulate around the laser gun.

Note: The use of assist air is not mandatory. If the work environment has adequate ventilation (a fan or a dust-collection setup), the machine can be operated without assist air.



Use a fan or dust collector to carry the smoke away.
Clean air: supply at 0.4 MPa to 0.6 MPa.

Precautions when using air

Caution: When using air, always pass it through a filter and dryer to thoroughly remove moisture, oil, and dust before use. In particular, if oil or moisture adheres to the protective lens, the laser may be reflected. If the reflected laser reaches the oscillator, it can damage the crystal inside the oscillator.

4-1-2 Processing Procedure

Perform laser irradiation using the following procedure.

Processing procedure

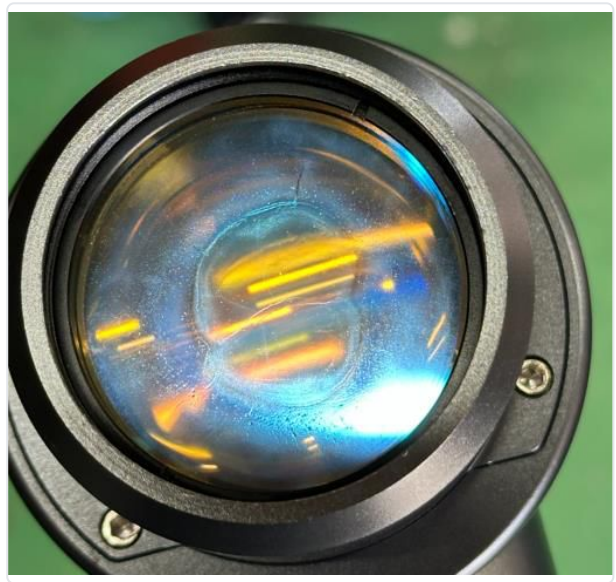
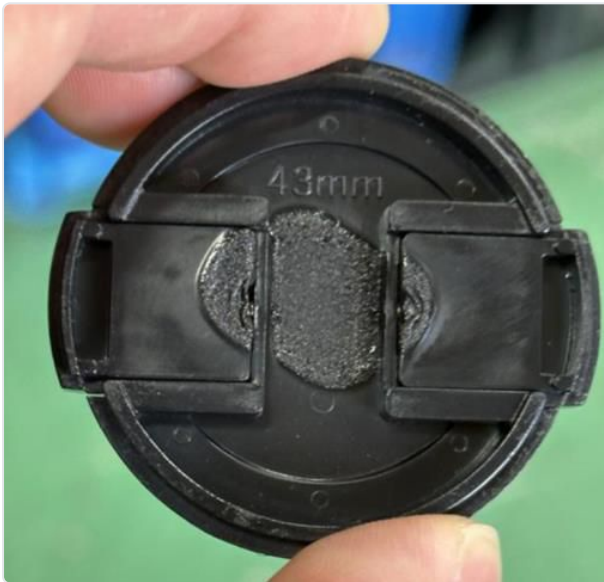
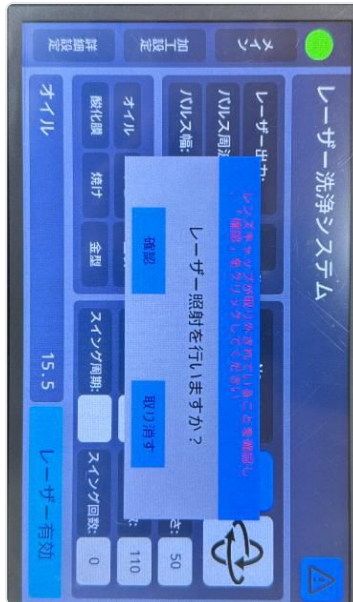
When the screen starts up, the "Main" screen is displayed. The Main screen is the central operation screen, where you perform laser irradiation and load or change processing settings.

① From "Processing Settings," adjust the laser and swing settings as desired, or select the material from "Workpiece" on the Main screen. For details on configuring your own settings in "Processing Settings," see Chapter 5, "Processing Settings."

- Configure the laser and swing settings manually
- Use a saved setting

Touch "Laser Enable" and confirm that the lens cap has been removed.

This is the button you touch to start laser irradiation.



Touch "Laser Enable." Confirm that the lens cap has been removed, then touch "Confirm."

Caution: If the laser is fired with the lens cap still attached, the cap will burn and the lens will be damaged or destroyed.

Warning: Before starting processing, put on protective goggles and a dust mask, and confirm that no one is near the emission port of the laser gun (no one standing in front of the gun).

Warning: Do not fire the laser near combustible materials or bring highly flammable materials close to the work area — doing so can cause a fire!

Point the laser gun at the object to be cleaned and double-click the trigger switch. The laser will fire.

Laser output varies greatly with the focal distance (the intensity of the sparks and the sound they produce serve as a guide). Move the gun back and forth and perform cleaning at the proper focal position.

A strong blue glow indicates that the bare metal surface (substrate) is exposed.

Warning: When the bare metal surface (substrate) is exposed, the laser reflectivity becomes high. If the laser is fired perpendicular to the base material, the reflected light may return toward the operator. During work, take great care that reflected light is not directed at the operator — for example, by firing the laser at an angle.

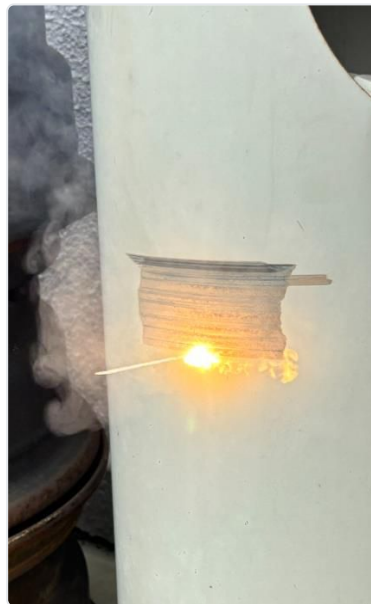
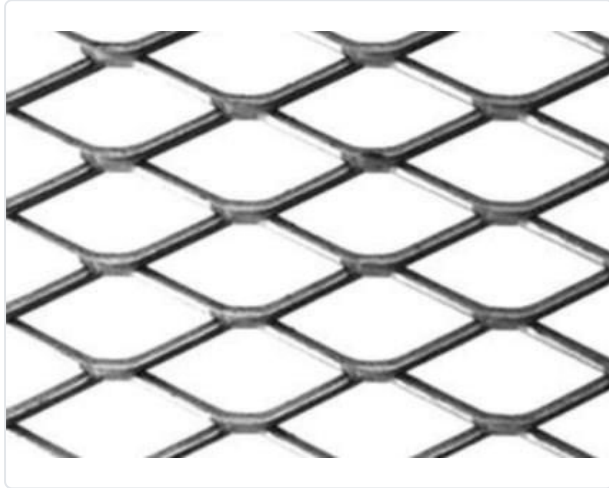


If a large amount of smoke is generated, use a large industrial fan or similar equipment to carry the smoke away from the laser gun. This helps prolong the life of the protective lens.

Precautions During Irradiation

Laser penetration

If the workpiece is expanded metal or has holes, the laser may pass through it. Even a laser that has passed through can cause damage depending on the distance. Place a steel plate or similar shielding behind the workpiece.



If the workpiece has holes, the laser can pass through — this is dangerous!

Reflected and scattered light

When the laser is fired at mirror-finished materials or highly reflective materials such as aluminum, the laser light may be reflected.

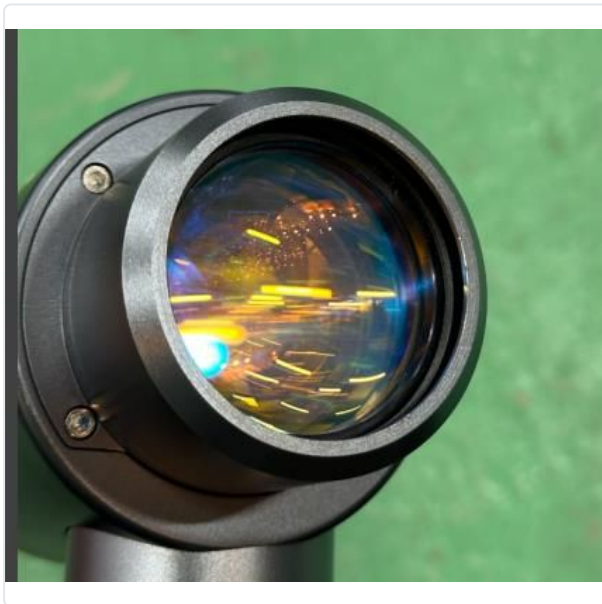
Warning: Always wear protective goggles during laser work. Before starting, thoroughly confirm that there are no people, combustibles, or other hazards in the surrounding area, and work only after safety has been secured.

Laser beam / Reflected light — it is dangerous if combustible materials are nearby!

4-1-3 Shutdown

Shut down the laser cleaner using the following procedure.

- ① When work is finished, release the Laser Enable button.



Touch here to release.

- ② Visually check that no dust or other contamination has adhered to the protective lens. If necessary, clean it using an air duster, alcohol, or the like.
- ③ Attach the lens cap to protect the lens from dust.
- ④ Press the emergency stop button to turn off the power.



- ⑤ If air is being supplied, stop the supply.

Chapter 5 Operation

5-1 Main Unit Operation Screen

Use the operation panel to configure settings and operate the machine according to the processing material and the work to be performed.



Selections are switched by touching the buttons on the touch panel.

Numeric values are entered using the numeric keypad that appears when you touch an input field.

Numeric keypad

5-1 Main

The Main screen is the screen used when performing laser irradiation.

5-1-1 Laser Irradiation Settings

The laser settings are displayed here.

On the Main screen, settings such as laser power cannot be changed. To change the settings, use the "Processing Settings" screen.

5-1-2 Workpiece Material

You can save and select the irradiation pattern best suited to the workpiece material.



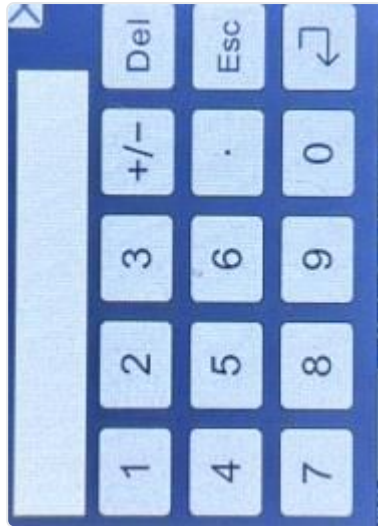
When you select a workpiece material, the optimal laser settings are applied automatically (settings such as laser power are fixed and cannot be adjusted by the user). The swing shape and its related settings, however, can be adjusted by the user.

5-1-3 Saving and Loading Settings

Up to 100 processing settings can be saved and loaded.

Select "No." to choose from the saved processing settings (including the laser and swing settings).

You can also touch the number to display a numeric keypad and directly load any setting from 1 to 100.



When one of the workpiece materials is selected, the number is not displayed. Touch "No." to make loading possible.

- Touch the number to display the numeric keypad. Saved settings can then be loaded: enter the number and touch Enter.
- Touch "No.".

5-1-4 Swing Mode

In Swing Mode, you can select the swing shape (the shape of the laser) to apply to the target object.

For a description of each swing shape, refer to the swing shape settings in the Processing Settings section.

5-1-5 Lens Temperature

The number displayed at the bottom of the screen is the temperature of the protective lens. When it reaches 50°C, an alarm is triggered and the laser stops.

5-1-6 Laser Enable

This is the button you touch to enable laser irradiation when starting processing.



1. Touch "Laser Enable".
2. Confirm that the lens cap has been removed, then touch "Confirm".
3. Laser irradiation is now possible. To stop, touch the red area.

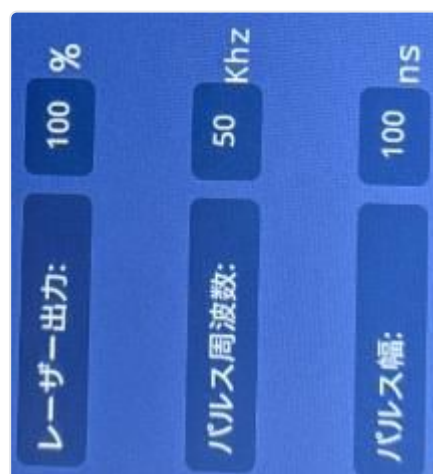
5-2 Processing Settings

In Processing Settings, you can adjust the laser processing conditions and the swing settings.

* The swing settings can also be adjusted from the Main screen.

5-2-1 Laser Settings

The laser settings consist of three elements — "Laser Power", "Pulse Frequency", and "Pulse Width" — and you can establish the optimal processing conditions by adjusting the balance between them.



Laser Power

Adjusts the laser output as a percentage. The higher the value, the greater the output. Because the output is unstable below 10%, set it to 10% or higher.

Pulse Frequency

The number of times the laser emits (fires a pulse) per second. It can be set in the range of 1–3000 kHz. Set the value with attention to "5-2-2 Cautions on Pulse Width and Pulse Frequency".

- **Low frequency (e.g., 20–90 kHz)**
 - Strong energy per pulse
 - High impact
 - Effective against stubborn rust and paint
- **High frequency (e.g., 100–200 kHz)**
 - Weak energy per pulse
 - Hits finely and evenly
 - Less likely to damage the base material

Pulse Width

This is how long each laser pulse is emitted (the duration of irradiation). Set the value with attention to "5-2-2 Cautions on Pulse Width and Pulse Frequency".

- **Small value (e.g., 50 ns)**
 - High instantaneous peak power
 - Small heat-affected zone
 - Suitable for precision cleaning
- **Large value (e.g., 300 ns)**
 - Energy acts over a wider area
 - Larger heat-affected zone
 - Powerful removal is possible

5-2-2 Cautions on Pulse Width and Frequency

The laser operates at maximum output above a certain frequency, but at values below the minimum frequency the output is automatically limited to protect the machine.

The frequency at which this output limiting begins (the threshold) varies depending on the set pulse width. For details, refer to the table below.

* The pulse width can be set in the range of 1–500 ns, but it is automatically rounded to a set of predetermined fixed values and reset to the nearest one.

* Setting the pulse width to "1 ns" puts the laser in continuous-wave (CW) mode; in this case, the frequency setting is disabled.

* The frequency can be set in the range of 1–3000 kHz, but operation may become unstable above 1000 kHz, so use at 1000 kHz or below is recommended.

Pulse width (ns)	Minimum frequency (kHz)	Maximum frequency (kHz)
1 (CW)	—	—
13	700	1000
20	460	
30	330	
45	210	
60	180	
80	140	
100	110	
150	75	
200	64	
250	55	900
350	45	600
500	40	500

5-2-2 Swing Shape Settings

The swing can be adjusted and configured here.

Changing the swing shape changes the laser irradiation pattern, which affects the removal result and the finish of the workpiece. Set the swing shape best suited to the application and the material to be removed.

Touch the area outlined in red to change the swing shape. The setting items differ depending on the selected shape. For details on each swing shape, refer to the descriptions below.



Line

Irradiates the laser in a straight line. Because the laser is concentrated along a line, it is absorbed deeply

into the base material. If the output is too strong, damage (scratches) may occur at the edges of the irradiation marks.

Swing Width

The swing width is the laser irradiation width in the X direction. The lower the value, the more the laser is concentrated and absorbed into the base material.

Swing Speed

The speed at which the laser sweeps from side to side. The higher the value, the faster the side-to-side oscillation and the more gently the laser strikes the base material. Conversely, at lower values the laser is absorbed more deeply; the removal marks become coarser, but the removal speed is faster.

There is an upper limit — for details, refer to the swing speed upper limit.

Rectangle 1

The straight-line laser moves up and down while irradiating, filling a rectangle with lines from one direction. If the output is too strong, damage (scratches) may occur at the edges of the irradiation marks.



Swing Width

The swing width is the laser irradiation width in the X direction. The lower the value, the more the laser is concentrated and absorbed into the base material.

Swing Height

The swing height is the laser irradiation width in the Y direction. The lower the value, the more the laser is concentrated and absorbed into the base material.

Swing Speed

The speed at which the laser sweeps from side to side. The higher the value, the faster the side-to-side oscillation and the more gently the laser strikes the base material. Conversely, at lower values the laser is absorbed more deeply; the removal marks become coarser, but the removal speed is faster.

There is an upper limit — for details, refer to the swing speed upper limit.

Swing Pitch

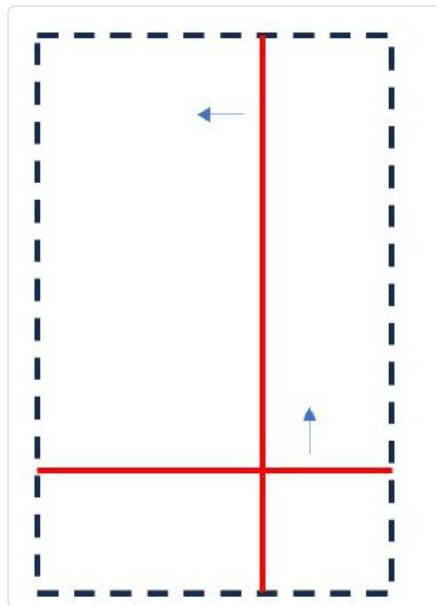
The swing pitch is the spacing between adjacent scan lines. The smaller the pitch, the denser the irradiation and the more the energy overlaps, resulting in greater removal power and a more uniform finish. Conversely, the larger the pitch, the wider the spacing between passes; processing speed improves, but uneven removal is more likely to occur.

Swing Count

The swing count is the number of times the laser irradiates the same spot back and forth (the laser fires the entered number of passes without your having to hold the button down). Increasing the swing count increases the number of passes over the same area, improving the removal volume and cleaning effect. However, too many passes may affect the base material or result in over-processing.

Rectangle 2

The straight-line laser moves up and down as well as left and right while irradiating, filling a rectangle with lines from two directions. It can efficiently remove deep rust and paint films, but if the output is too strong, damage (scratches) may occur at the edges of the irradiation marks.



Swing Width

The swing width is the laser irradiation width in the X direction. The lower the value, the more the laser is concentrated and absorbed into the base material.

Swing Height

The swing height is the laser irradiation width in the Y direction. The lower the value, the more the laser is concentrated and absorbed into the base material.

Swing Speed

The speed at which the laser sweeps from side to side. The higher the value, the faster the side-to-side oscillation and the more gently the laser strikes the base material. Conversely, at lower values the laser is absorbed more deeply; the removal marks become coarser, but the removal speed is faster.

There is an upper limit — for details, refer to the swing speed upper limit.

Swing Pitch

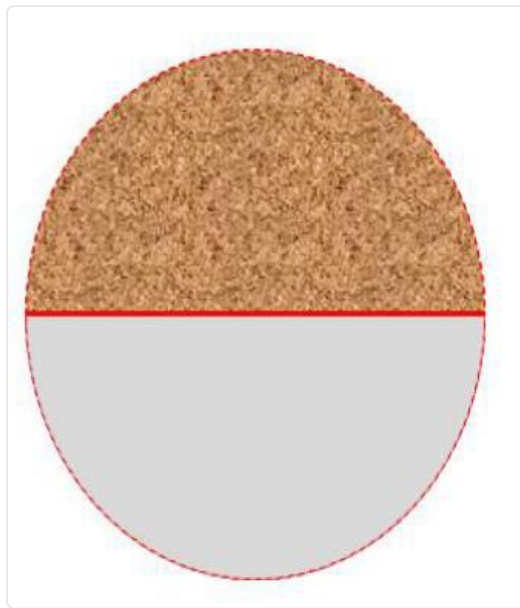
The swing pitch is the spacing between adjacent scan lines. The smaller the pitch, the denser the irradiation and the more the energy overlaps, resulting in greater removal power and a more uniform finish. Conversely, the larger the pitch, the wider the spacing between passes; processing speed improves, but uneven removal is more likely to occur.

Swing Count

The swing count is the number of times the laser irradiates the same spot back and forth (the laser fires the entered number of passes without your having to hold the button down). Increasing the swing count increases the number of passes over the same area, improving the removal volume and cleaning effect. However, too many passes may affect the base material or result in over-processing.

Circle 1

A linear laser beam is emitted while moving up and down, filling a circular area with straight lines from one direction. This pattern removes deep rust and paint films efficiently, but if the output is too strong, damage (scratches) may occur along the edges of the irradiated area.



Swing width

The swing width is the laser irradiation width in the X direction. The lower the value, the more concentrated the laser and the more it is absorbed into the base material.

Swing height

The swing height is the laser irradiation width in the Y direction. The lower the value, the more concentrated the laser and the more it is absorbed into the base material.

Swing speed

This is the speed at which the laser swings from side to side. The higher the value, the faster the laser oscillates left and right, irradiating the base material more gently. Conversely, at lower values the laser is absorbed more deeply; the removal marks become rougher, but the removal speed increases. An upper limit applies — see "Upper Limits of Swing Speed" for details.

Swing pitch

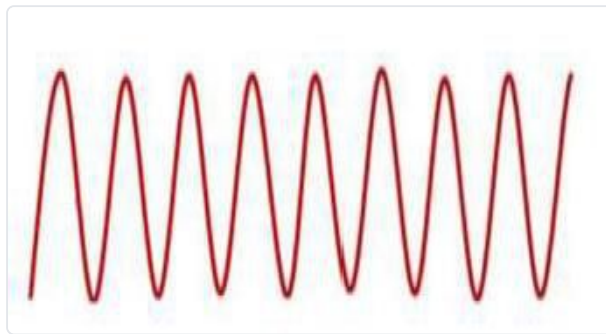
The swing pitch is the spacing between adjacent scan lines. The smaller the pitch, the denser the irradiation and the more the energy overlaps, resulting in greater removal power and a more uniform finish. Conversely, the larger the pitch, the wider the spacing between passes; processing speed improves, but uneven removal is more likely to occur. The default value is 0.1.

Swing count

The swing count is the number of times the laser makes back-and-forth passes over the same spot (the laser fires the entered number of times without your having to hold down the button). Increasing the swing count increases the number of passes over the same area, improving the amount of material removed and the cleaning effect. However, if the count is too high, it may affect the base material or result in overprocessing.

Wave 1

A wave-shaped laser beam is emitted while moving. It cuts relatively deeply into the base material. Use this pattern for heavily corroded rust or thick paint films.



Swing width

The swing width is the laser irradiation width in the X direction. The lower the value, the more concentrated the laser and the more it is absorbed into the base material.

Swing height

The swing height is the laser irradiation width in the Y direction. The lower the value, the more concentrated the laser and the more it is absorbed into the base material.

Swing speed

This is the speed at which the laser swings from side to side. The higher the value, the faster the laser oscillates left and right, irradiating the base material more gently. Conversely, at lower values the laser is absorbed more deeply; the removal marks become rougher, but the removal speed increases. An upper limit applies — see "Upper Limits of Swing Speed" for details.

Swing pitch

The swing pitch is the spacing between adjacent scan lines. The smaller the pitch, the denser the irradiation and the more the energy overlaps, resulting in greater removal power and a more uniform finish. Conversely, the larger the pitch, the wider the spacing between passes; processing speed improves, but uneven removal is more likely to occur. The default value is 0.1.

Swing cycle adjustment

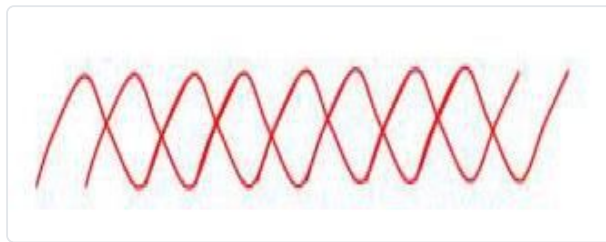
The swing cycle is the time it takes the laser to complete one back-and-forth swing motion, or the rate at which it repeats. The shorter (faster) the swing cycle, the more rapidly the irradiation repeats and the faster the processing speed. Conversely, with a longer (slower) swing cycle, the laser dwells longer on each spot, which tends to increase the removal effect.

Swing count

The swing count is the number of times the laser makes back-and-forth passes over the same spot (the laser fires the entered number of times without your having to hold down the button). Increasing the swing count increases the number of passes over the same area, improving the amount of material removed and the cleaning effect. However, if the count is too high, it may affect the base material or result in overprocessing.

Wave 2

A wave-shaped laser beam is emitted while moving. It cuts relatively deeply into the base material. Use this pattern for heavily corroded rust or thick paint films.



Swing width

The swing width is the laser irradiation width in the X direction. The lower the value, the more concentrated the laser and the more it is absorbed into the base material.

Swing height

The swing height is the laser irradiation width in the Y direction. The lower the value, the more concentrated the laser and the more it is absorbed into the base material.

Swing speed

This is the speed at which the laser swings from side to side. The higher the value, the faster the laser oscillates left and right, irradiating the base material more gently. Conversely, at lower values the laser is absorbed more deeply; the removal marks become rougher, but the removal speed increases. An upper limit applies — see "Upper Limits of Swing Speed" for details.

Swing pitch

The swing pitch is the spacing between adjacent scan lines. The smaller the pitch, the denser the irradiation and the more the energy overlaps, resulting in greater removal power and a more uniform finish. Conversely, the larger the pitch, the wider the spacing between passes; processing speed improves, but uneven removal is more likely to occur. The default value is 0.1.

Swing cycle adjustment

The swing cycle is the time it takes the laser to complete one back-and-forth swing motion, or the rate at which it repeats. The shorter (faster) the swing cycle, the more rapidly the irradiation repeats and the faster the processing speed. Conversely, with a longer (slower) swing cycle, the laser dwells longer on each spot, which tends to increase the removal effect.

Swing count

The swing count is the number of times the laser makes back-and-forth passes over the same spot (the laser fires the entered number of times without your having to hold down the button). Increasing the swing count increases the number of passes over the same area, improving the amount of material removed and the cleaning effect. However, if the count is too high, it may affect the base material or result in overprocessing.

Free-Form

In this mode, the swing trajectory and motion pattern can be set freely. Its key feature is that work can be performed with minimal damage to the base material. Use it for thin steel sheet or when you want to avoid heat effects on the base material.



Swing width

The swing width is the laser irradiation width in the X direction. The lower the value, the more concentrated the laser and the more it is absorbed into the base material.

Swing height

The swing height is the laser irradiation width in the Y direction. The lower the value, the more concentrated the laser and the more it is absorbed into the base material.

Swing speed

This is the speed at which the laser swings from side to side. The higher the value, the faster the laser oscillates left and right, irradiating the base material more gently. Conversely, at lower values the laser is absorbed more deeply; the removal marks become rougher, but the removal speed increases. An upper limit applies — see "Upper Limits of Swing Speed" for details.

X-axis frequency

The X-axis frequency is a value indicating the speed of the vibration (back-and-forth motion) in the X direction. The higher the frequency, the faster the swing speed and the greater the number of irradiation passes. The upper limit is 300 Hz. It cannot be set to the same value as the Y axis.

Y-axis frequency

The Y-axis frequency is a value indicating the speed of the vibration (back-and-forth motion) in the Y direction. The higher the frequency, the faster the swing speed and the greater the number of irradiation passes. The upper limit is 300 Hz. It cannot be set to the same value as the X axis.

Swing count

The swing count is the number of times the laser makes back-and-forth passes over the same spot (the laser fires the entered number of times without your having to hold down the button). Increasing the swing count increases the number of passes over the same area, improving the amount of material removed and the cleaning effect. However, if the count is too high, it may affect the base material or result in overprocessing.

Circle 2

A circular laser beam is emitted while moving outward from the center. This pattern removes deep rust and paint films efficiently, but if the output is strong, scratches may occur along the edges of the irradiated area.

Swing width

The swing width is the laser irradiation width in the X direction. The lower the value, the more concentrated the laser and the more it is absorbed into the base material.

Swing height

The swing height is the laser irradiation width in the Y direction. The lower the value, the more concentrated the laser and the more it is absorbed into the base material.

Swing speed

This is the speed at which the laser swings from side to side. The higher the value, the faster the laser oscillates left and right, irradiating the base material more gently. Conversely, at lower values the laser is absorbed more deeply; the removal marks become rougher, but the removal speed increases. An upper limit applies — see "Upper Limits of Swing Speed" for details.

Swing pitch

The swing pitch is the spacing between adjacent scan lines. The smaller the pitch, the denser the irradiation and the more the energy overlaps, resulting in greater removal power and a more uniform finish. Conversely, the larger the pitch, the wider the spacing between passes; processing speed improves, but uneven removal is more likely to occur. The default value is 0.1.

Swing count

The swing count is the number of times the laser makes back-and-forth passes over the same spot (the laser fires the entered number of times without your having to hold down the button). Increasing the swing count increases the number of passes over the same area, improving the amount of material removed and the cleaning effect. However, if the count is too high, it may affect the base material or result in overprocessing.

Flower

A chrysanthemum-patterned laser beam is emitted while rotating. This pattern concentrates the laser at the center, but damage (scratches) may occur at the center of the irradiated area.



Swing width

The swing width is the laser irradiation width in the X direction. The lower the value, the more concentrated the laser and the more it is absorbed into the base material.

Swing height

The swing height is the laser irradiation width in the Y direction. The lower the value, the more concentrated the laser and the more it is absorbed into the base material.

Swing speed

This is the speed at which the laser swings from side to side. The higher the value, the faster the laser oscillates left and right, irradiating the base material more gently. Conversely, at lower values the laser is absorbed more deeply; the removal marks become rougher, but the removal speed increases. An upper limit applies — see "Upper Limits of Swing Speed" for details.

Swing pitch

The swing pitch is the spacing between adjacent scan lines. The smaller the pitch, the denser the irradiation and the more the energy overlaps, resulting in greater removal power and a more uniform finish. Conversely, the larger the pitch, the wider the spacing between passes; processing speed improves, but uneven removal is more likely to occur. The default value is 0.1.

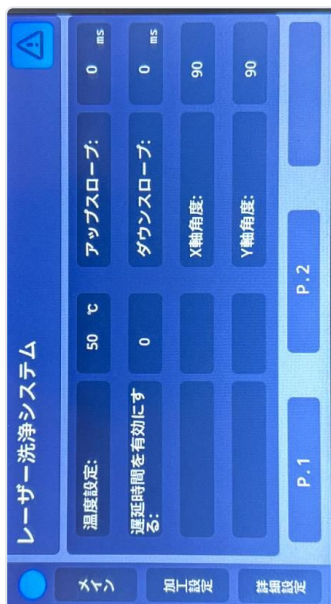
Swing count

The swing count is the number of times the laser makes back-and-forth passes over the same spot (the laser fires the entered number of times without your having to hold down the button). Increasing the swing count increases the number of passes over the same area, improving the amount of material removed and the cleaning effect. However, if the count is too high, it may affect the base material or result in overprocessing.

Upper Limits of Swing Speed

There is an upper limit on the maximum swing speed for each swing width. Refer to the table below when entering values.

スイング幅 (mm)	スイング速度 (mm/sec) 上限値
50 以上	30000
40-49	18000
30-39	14000
20-29	12000
10-19	6000
5-9	3000
3-5	2000
1-3	1000



5-2-3 Advanced Settings

In "Advanced Settings," you can change the machine's system configuration. The password is "123".

Distance sensor

Do not change this setting.

Japanese

Do not change this setting.

Y-axis correction

Allows correction relative to the actual swing width. Normally this is not used.

X-axis coefficient

Leave this at 110; do not change it.

Y-axis coefficient

Leave this at 110; do not change it.

Version

Displays the machine's version.

Edge coefficient

The edge coefficient is a setting value used to compensate the laser energy applied to the swing ends (edge areas) during swing scanning. In the swing motion, the irradiation time at the ends is shorter than at the center; left uncorrected, this can reduce the cleaning effect at the edges and cause uneven removal. This function compensates the laser output or irradiation time at the edge areas so that the entire processed surface is finished uniformly.

Laser delay

Sets the time by which laser emission is delayed.

Processing time

Displays the cumulative time the display has been powered on.

Irradiation time

Displays the cumulative laser emission time.

Temperature setting

Do not change this setting.

Enable delay time

Do not change this setting.

Up slope

Sets the time for the laser to reach the set laser output after the laser starts.

Down slope

Sets the time over which the laser gradually decays after the laser stops.

X-axis angle

Leave this at 90 degrees; do not change it.

Y-axis angle

Leave this at 90 degrees; do not change it.

Chapter 6: Maintenance

6-1 Protective Lens

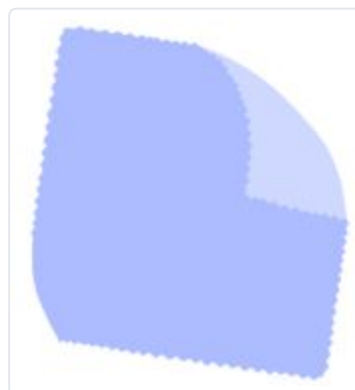
With repeated processing, deposits such as iron dust generated during operation accumulate on the surface of the protective lens.

If these deposits are not removed regularly, they can cause the protective lens to degrade or become damaged.

Therefore, clean the protective lens regularly and always keep it in a clean condition.

6-1-1 Cleaning Method

1. To prevent accidental laser emission, always perform this work with the power turned off.
2. Use an air blower (such as an air duster) to gently blow away dust and iron particles from the surface.
3. If deposits cannot be removed with an air blower, use high-concentration alcohol (IPA recommended) with a cotton swab or lens-cleaning cloth to remove them without scratching the lens.
 - * Do not rub the lens surface hard, as this may cause scratches.
4. Hold the lens up to a light source and check that no dust or deposits remain. If any remain, repeat step 3.



Chapter 7: Consumables

7-1 Protective Glasses and Protective Shields

Protective glasses and face shields can be purchased from our sales website. Laser safety glasses must be worn during any work involving laser emission. Wear protective glasses suited to the operator (e.g., preferred shading level or over-glasses type).

Sales website: https://www.e-inzai.com/shop/www/shop/sunmax/product_lcwparts-n1.html

Caution: The service life of protective glasses and protective shields is 3 years. Do not use them once 3 years have passed since opening.

7-2 Lenses

The laser gun contains multiple internal lenses.

Lenses are generally treated as consumables. The rate of wear varies depending on the material being processed and how the unit is used. With proper use, they can last a long time.

If a lens is damaged, it will generate heat. The laser gun is equipped with a temperature sensor and will trigger an alarm when the temperature becomes high. * In some cases, the alarm may not be triggered.



8-1 Support Contact

If you cannot resolve a problem or an abnormality has occurred and you need support from our staff, please contact us at the following. Sending photos or videos along with your inquiry helps us understand the situation in more detail.

Email	webmaster@laser-machine.com
Telephone	058-294-7333
LINE official account	
Support hours	9:00–17:00 (closed on weekends and national holidays)

