Quick Start Guide - FL-LCW-1500W/2000W-PRO (English Edition)

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.

Quick Start Guide

- Read this document only after you have understood the basic operations.
- Always read the full User Manual.
- For basic operating procedures, refer to the User Manual.

Contents

- Quick Start Guide
- Important Safety Information
  - Strictly enforce the laser-controlled area and the wearing of laser safety glasses and protective equipment
  - Fume control
  - Watch out for laser leakage during work
  - Watch out for reflected laser light during work
  - Replace lenses with great care
  - Cover the emission aperture after use
- Startup Procedure
  - 1. Switch on the main breaker
  - 2. Turn on the main power
  - 3. Before turning on the laser source, always confirm the water temperature is in the proper range
  - 4. Check the assist gas (shield gas)
- Welding Procedure
  - 1. Confirm that the screen shows "Laser Welding System"
  - 2. Confirm that the laser gun (torch) is in welding mode
  - 3. Select the welding conditions
  - 4. Install the nozzle and welding wire
  - 5. Check the focal length
  - 6. Pay attention to the angle and the sparks while welding
- Operation Panel Settings
- Using Fish-Scale Mode
- Problems During Welding

- Cutting Procedure
  - 1. Confirm that the screen shows "Laser Welding System"
  - 2. Confirm that the laser gun (torch) is in cutting mode
  - 3. Select the cutting conditions
  - 4. Check the laser beam path
  - 5. Supply gas or air
  - 6. Adjust the focal length
- Precautions During Cutting!
- Rust Removal (Cleaning) Procedure
  - 1. Confirm that the screen shows "Laser Cleaning System"
  - 2. Confirm that the laser gun (torch) is in cleaning mode
  - 3. Supply gas or air
  - 4. Set the cleaning (rust removal / paint stripping) conditions
- Precautions and Hazards When Using Cleaning Mode
- Protective Shielding (Backing) Methods

Important Safety Information

> Incorrect use of this machine can be hazardous to the human body. It can also damage the internal lenses (consumables).
>
> Before use, make sure you fully understand the following precautions before starting work!

Strictly enforce the laser-controlled area and the wearing of laser safety glasses and protective equipment

In any area where laser emission is performed, always wear laser safety glasses, highly heat-resistant gloves, and long sleeves.

This product emits a fiber laser (near-infrared) wavelength. If the laser beam strikes a person's skin or eyes, it can cause injuries such as burns or retinal damage. Establish a controlled area that people cannot casually enter, and install partitions so that the laser cannot escape outside the area. Every operator performing laser work must wear laser safety glasses.

The laser beam is invisible, and it is difficult to predict when reflected light will occur. Always wear laser safety glasses.

Fume control

When the laser is applied to metal, metal fume is generated. Fume is harmful to the human body. Provide ventilation equipment and wear a dust mask during work.

Watch out for laser leakage during work

The laser is emitted at the position illuminated by the red pointer (guide beam). If there is an extremely large gap at the joint you are welding, the laser may leak through to the back side. In laser cleaning (rust removal) mode, the laser will pass straight through if you irradiate objects with openings, such as expanded metal.

Watch out for reflected laser light during work

When welding aluminum or polished stainless steel, reflected laser light may occur. Reflection becomes strong when the focal length is far out of position or when the lens is clouded.

Example: when reflection is strong, the reflected laser shoots forward as shown in the figure below — in this photo, a glove is on fire.

Replace lenses with great care

Take the utmost care when replacing lenses. During replacement, dust can adhere to the lens, or dust can enter the inside of the laser gun and destroy the internal lenses.

Observe the following precautions:

- Replace lenses in a location with no airborne dust and no wind.
- As soon as you pull out the lens holder, cover the opening so that no dust can enter the inside of the gun.
- Before installing a lens, check that no dust has adhered to it.
- If dust adheres to the lens, remove it with an air duster or a cotton swab moistened with alcohol.
- Do not touch the lens surface; hold the lens by its edges.

Cover the emission aperture after use

Cover the emission aperture when you have finished using the machine. Otherwise, dust and dirt can contaminate the protection lens. The cleaning configuration is especially prone to dust entry.

Startup Procedure

1. Switch on the main breaker

The machine runs on 200 V single-phase power. With power supplied, switch on the breaker on the rear of the machine.

Note: When using a generator or similar power source, pay attention to the voltage. If the supply voltage falls below 200 V, problems such as the laser source failing to power on may occur. When using a generator, step the voltage up to 220 V before supplying power.

2. Turn on the main power

Turn the main power key clockwise to switch the power on. If the power does not come on when you turn the key, the emergency stop button may be pressed in, or 200 V power may not be supplied correctly.

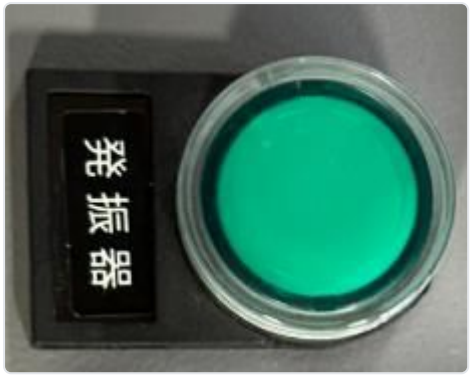
Power OFF / Power ON (see figure above)

Once the main power is on, the monitor and the water chiller start running. Next, check the water temperature of the water chiller.

3. Before turning on the laser source, always confirm the water temperature is in the proper range

Turn on the laser source only after the water temperature has reached the proper range. If the water temperature is not in the proper range, the laser source becomes unstable. The water chiller automatically regulates the temperature to 22–26°C. Operable temperature range: 20–30°C.

Check the value on the upper row of the display! In the photo shown, you must wait until the temperature reaches 20°C.



> Proper temperature: 20–30°C
>
> If the water temperature is below 20°C, let the machine warm up! If it is above 30°C, allow time for cooling. The temperature will reach the proper range automatically.

If the water temperature is too high, alarm "E02" or "E10" occurs. If this happens, wait until the water temperature drops.

If the water temperature is too low, alarm "E08" or "E11" occurs. If this happens, wait until the water temperature rises.

4. Check the assist gas (shield gas)

Check that the gas supply valve is open, and check the pressure gauge on the operation section to confirm that an adequate gas pressure is being supplied. If gas / clean air is not supplied in sufficient quantity, the protection lens will be damaged. For laser paint stripping that generates heavy fume

(smoke), and for welding galvanized steel, mill scale (black scale), or aluminum, set the gas pressure higher.

Operation	Gas pressure
Welding	0.15–0.3 MPa
Cutting	0.4–0.8 MPa
Cleaning	0.4–0.8 MPa

> Caution! When using air, remove all oil and moisture! If moisture or oil gets into the supply, the lens will be damaged. In the worst case, this can lead to failure of the laser source.

Welding Procedure

1. Confirm that the screen shows "Laser Welding System"

Confirm that the screen shows "Laser Welding System". If the screen shows "Laser Cleaning System", press the switch button at the top right of the home screen to change the screen.

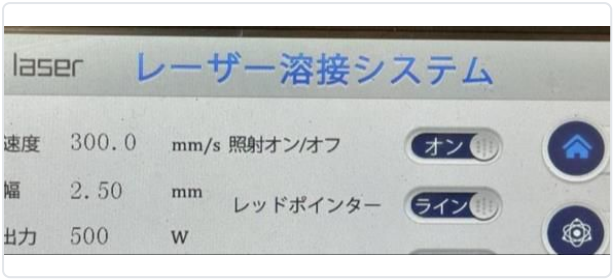
2. Confirm that the laser gun (torch) is in welding mode

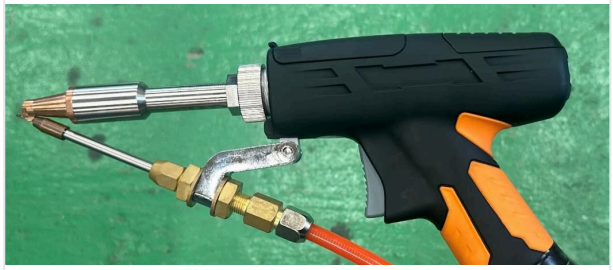
Confirm that the focusing lens installed is the welding focusing lens. If the cleaning focusing lens is installed, replace it.

Note: Replace the lens carefully so that no dust gets onto the lens or into the inside of the laser gun.

> When replacing the lens, any dust that has entered the inside of the cover can get into the gun. Remove it with an air duster before replacement! Replacing the lens while dust is present will destroy the lens. Always replace the lens so that no dust adheres to the inside of the laser gun or to the lens. Remove all dust inside the cover!

Confirm that the welding pipe and the wire tube are attached to the laser gun.





3. Select the welding conditions

From the "Settings" screen, open "Registered Settings". Select the "Material", then select the "Plate thickness" you want to weld.

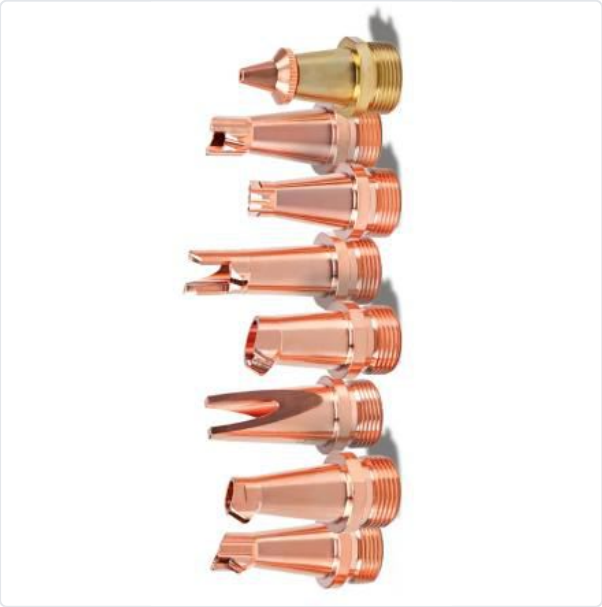
4. Install the nozzle and welding wire

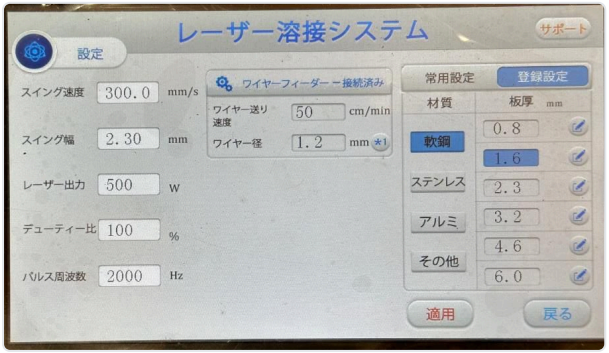
Based on the welding conditions in the settings table, select the optimal welding wire and load it into the wire feeder. Attach the wire nozzle and nozzle that match the wire diameter to the laser gun.

Example: when using 1.2 mm wire, install the AS-12 and a Φ1.2 wire nozzle.

Confirm that the nozzle and the wire nozzle are mounted perpendicular. If they are mounted at an angle, the wire will be offset and the bead may not be uniform.

Key point: eliminate the gap between the nozzle and the wire nozzle.




レーザー溶接システム
サポート
設定
スイング速度 300.0 mm/s
スイング幅 2.30 mm
レーザー出力 500 W
デューティー比 100 %
パルス周波数 2000 Hz
ワイヤーフィーダー 接続済み
ワイヤー送り速度 50 cm/min
ワイヤー径 1.2 mm
常用設定
登録設定
材質
板厚 mm
軟鋼
ステンレス
アルミ
その他
0.8
1.6
2.3
3.2
4.6
6.0
適用
戻る


1.6
1.2
1.0
0.8

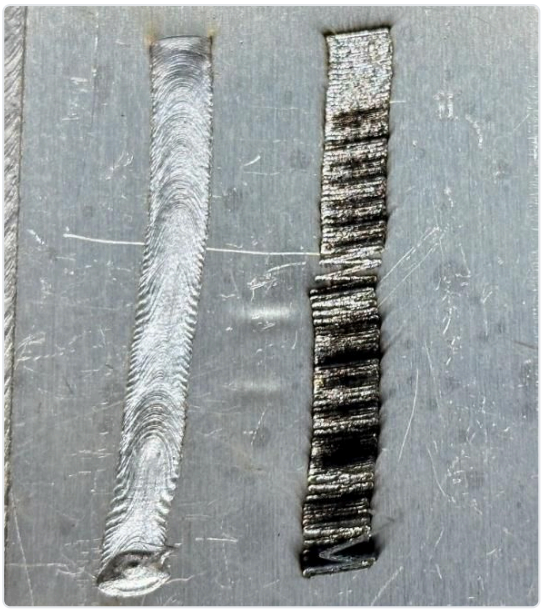
5. Check the focal length

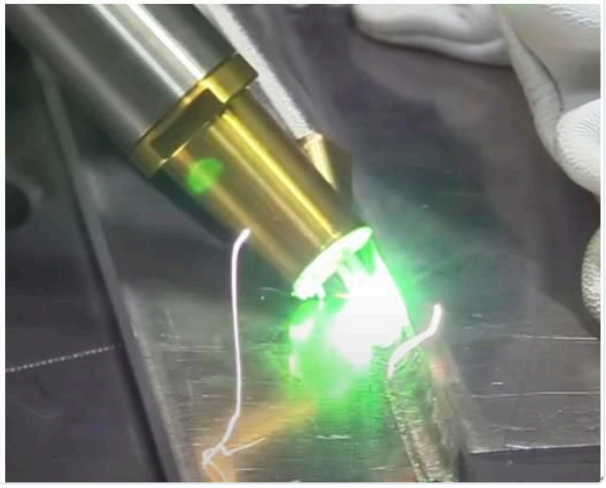
The focal length corresponds to how far the cylinder section of the laser gun extends (the distance from the focusing lens to the nozzle; a numbered scale is engraved on it). The focal length varies depending on the material being welded and on whether welding wire is used. If the focal length is not correct, the laser does not penetrate the material and is reflected instead. Reflected laser light scatters forward and is dangerous.

Reference values (with wire)	
Steel / stainless steel	0
Aluminum / copper	0 to −3

- The focal length may differ depending on whether wire is used or not.
- The focal length varies depending on the nozzle.

The figure below shows an example with aluminum welding. When the laser is in focus, the weld penetrates fully. When it is out of focus, oxidation is drawn into the weld and penetration becomes shallow. When the laser is in focus, the spark is green. (Depending on the material, it may not glow green.) With aluminum in particular, the correct focus may differ between fillet welding and butt welding.





> Danger! Never put your hand in front of the laser gun, never look into it from the front, and always confirm that no one is standing in front of it!

Example: when reflection is strong, the reflected laser shoots forward as shown in the figure below — in this photo, a glove is on fire.

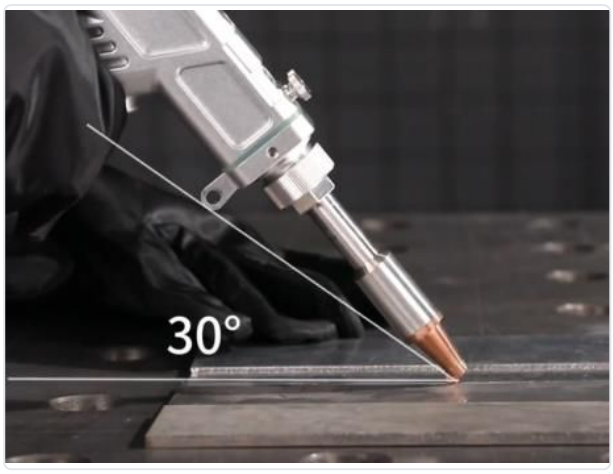
After adjusting the focus, always tighten it firmly with a spanner. If the tightening is loose, the pipe can move during processing, and you will end up working with a misaligned beam path.

6. Pay attention to the angle and the sparks while welding

Place the nozzle of the laser gun against the workpiece and press the laser emission button. The laser is emitted and welding becomes possible. If you weld highly reflective materials such as aluminum while holding the gun perpendicular (90 degrees), the reflected laser light can destroy the lenses inside the laser gun and, in the worst case, the laser source. The welding angle is approximately 30–40 degrees.

The direction of penetration changes with the angle of the torch (laser gun). For butt welding, point the gun perpendicular to the joint, but take care when performing fillet welding. Laser weld strength comes from penetration: aim at 30 degrees relative to the 90-degree corner.

Welded at a 30-degree tilt / Welded at a 45-degree tilt (see figure below)



- When you temporarily release the laser gun and set it down — for example, to change the workpiece — place it somewhere that has no electrical continuity with the laser emission clip. If you interrupt work for any reason and temporarily leave the work area, turn the laser key OFF (or shut the machine down).
- Do not perform work that carries electrical current, such as arc welding, at the same work site.

If the protection lens is damaged or the focus is off, no sparks are generated at all. If flame is visible near the nozzle, the protection lens may be broken or the focus may be off. The sound during welding also changes: when the lens and focus are normal, the spark sound is loud; when the lens is damaged or the focus is off, the sound becomes dull.

If welding contamination adheres to the lens, the laser is attenuated. In that case, remove it using IPA (99% alcohol) and a lens-cleaning swab. If the contamination cannot be removed, replace the lens.

Operation Panel Settings

These are the settings on the operation panel.

Within the operation screen, you normally adjust only the area outlined in red in the figure below.

Procedure: first enter the values from the settings table, then check the processing quality and fine-tune.

Note: the duty ratio is fixed at 100%.

Wire feed speed: wire feed speed = welding speed. A larger value feeds the wire faster, but if it is too fast the wire will not melt completely. Welding faster might seem to reduce distortion, but the degree of distortion actually changes with the balance against laser power. Recommended setting range: 30–70 cm/min.

Note: if the feed speed is too fast, the bead merely sits on top of the base material without sufficient penetration into the base material, which can lead to cracking.

Swing speed: this is the weaving travel speed. The higher the value, the faster the laser moves. If the swing speed is too fast, heat escapes and the wire may not melt completely. If the value is too low, the weld pool cannot keep up. For autogenous (fusion) welding without wire, we recommend a larger value. Recommended setting with wire: 200–350 mm/sec. Recommended setting without wire: 500–1000.

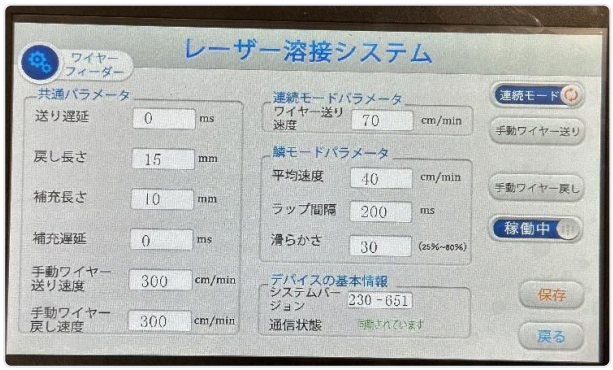
Swing width: this is the weaving width. The larger the swing width value, the wider the bead. Increasing the swing width inevitably reduces the amount of heat applied to any single point on the base material, so you must increase the heat input by reducing the wire feed speed, raising the laser power, or lowering the swing frequency.

Laser power: this is the laser output. Increasing the value increases penetration; decreasing it reduces penetration.

Using Fish-Scale Mode

Fish-scale mode, unlike pulse welding, is a mode that produces a fish-scale bead purely through wire control. In pulse welding, the laser is emitted intermittently; in fish-scale mode, the laser is emitted continuously (duty ratio fixed at 100%). As a result, compared with pulse welding, you can produce a fish-scale bead with deeper penetration.

Fish-scale mode can be set on the wire feeder or on the machine's operation panel.



Average speed

The average welding speed in fish-scale mode. Adjust it in balance with the scale overlap of the lap interval. If the lap interval is long, lower the average speed; if the lap interval is short, raise the average speed. Change it according to the bead appearance and the penetration depth.

Lap interval

Sets the spacing between individual scales. The larger the value, the lower the overlap ratio and the larger and more distinct each scale appears. Recommended setting range: 150–300 ms.

Smoothness

Adjusts the proportion of the wire's back-and-forth motion. A higher percentage brings the result closer to continuous mode; a lower percentage makes the fish-scale bead more distinct.

Problems During Welding

The nozzle or pipe overheats

Check whether the red pointer is touching the nozzle. If the red pointer is touching the nozzle, the laser beam path is misaligned and the laser is striking the nozzle or cylinder. This condition is abnormal. Stop processing immediately and adjust the beam path.

Attach masking tape to the nozzle and check the laser beam path.

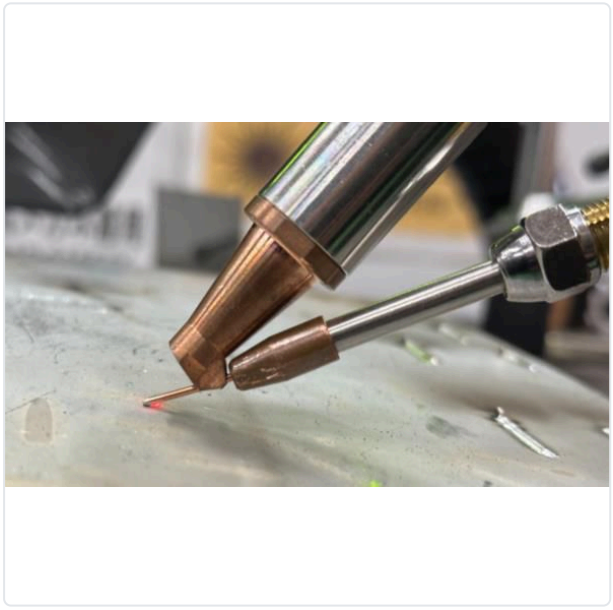
- If the beam path is offset left or right, adjust the value under "Advanced Settings" → "Beam Path Adjustment".
- If the beam path is offset up or down, refer to "Chapter 7 — Adjusting the Laser Gun" in the main User Manual and perform the adjustment.

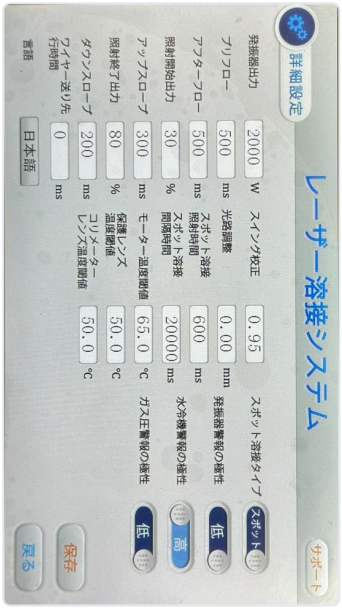
The figure below shows actual examples: correct beam path / misaligned beam path.

> In the misaligned example, the laser strikes the nozzle itself and the nozzle is deformed. If the nozzle glows red-hot, the beam path is misaligned. If you continue to use the machine with the beam path misaligned, the lens will be damaged — take care.

The Wire Does Not Detach Cleanly

1. Because the wire feed section is integrated with the hand torch, the laser must be hitting the wire when you detach it at the end of welding. As a guide, pull the torch toward yourself while lifting it gently — this makes the wire easier to detach. If you lift it sharply straight up, the angle of the wire tube holder changes and the wire may shift out of the wire guide of the welding nozzle.
2. Increase the "Emission End Power" value in the advanced settings. If the value is 100%, the laser does not attenuate below the set power at the end of welding, so the down-slope is disabled.
3. Set a wire feed delay value in the wire feeder settings. Delaying the wire feed at the end of welding makes it easier to separate the bead and the wire. Setting larger values for the retract length and the feed length also makes the wire easier to detach.





The Wire Feed Is Hard to Feel

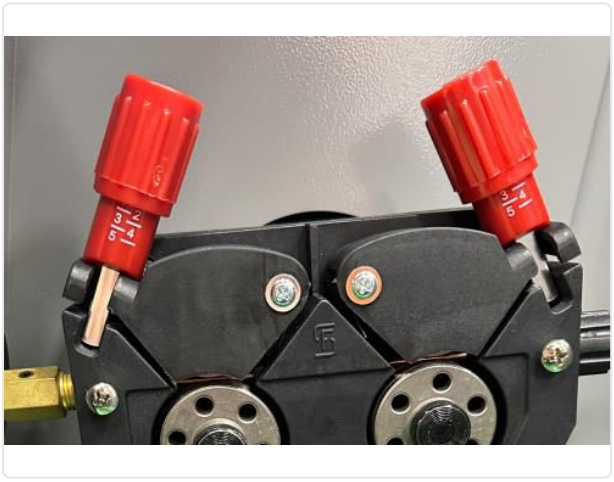
The wire may be slipping (turning without feeding). Adjust the wire clamping pressure. Tighten the red handle to secure the wire. When doing so, apply pressure according to the wire diameter so that the wire does not slip. The thinner the wire, the more tightening is required (a larger value).

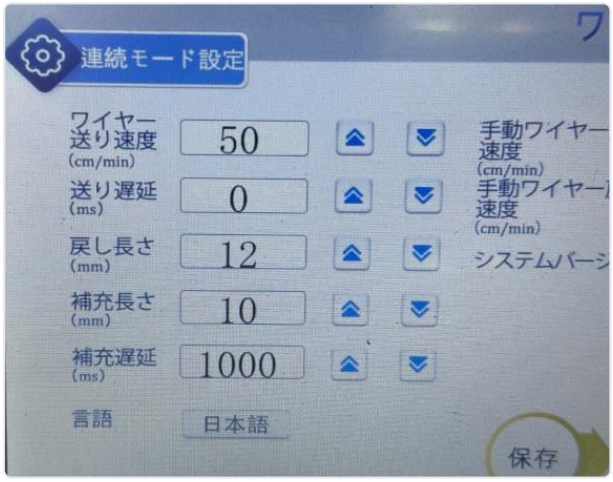
Wire diameter	Tightening amount (setting value)
1.0 mm or less	1–2 or less
1.0 mm / 1.2 mm	2–3
1.2 mm or more	3 or more

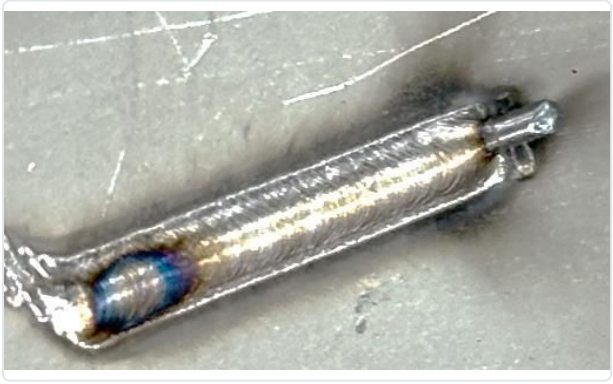
In addition, placing the wire feeder in a higher position can make the wire feed easier to feel, and feeding may become smoother and improve.

Preventing Wire Residue at the Weld Start Point

If the wire is ahead of the red pointer (the laser emission point) when welding starts, wire may be left behind at the weld start point. In that case, you can prevent this by adjusting the "retract" value in the wire feeder settings.



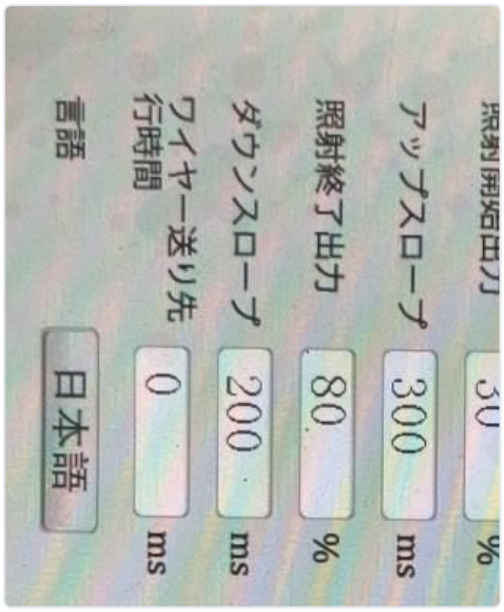




Preventing Oxidation at the Weld End

Set a wire feed delay value in the wire feeder settings. At the end of welding, the wire can block the shielding gas from reaching the weld. By setting a wire feed delay, the after-flow can be directed onto the

end of the weld.



Craters

If a crater forms at the end of laser welding, increase the down-slope value in the advanced settings. If you release the laser emission button at the end of laser welding while the circuit is still engaged, the laser can be stopped gradually.

Craters can be pronounced especially when welding aluminum, so we recommend setting a down-slope.

Setting value: minimum 200 ms

Oxidation Entrapment When Welding Aluminum

The focal length may be incorrect, the laser beam path may be misaligned, or the lens may be in poor condition.

Try focal lengths in the range 0 to −3 (without wire, adjust from 0 toward positive values). The position where the material sparks green and melts in is the correct focal length. If there is no improvement, the beam path may be misaligned or the protection lens may be damaged.

Note: Depending on the type and condition of the base material, the green glow may not appear. In that case, check that no oxide film adheres to the edges of the weld bead.

Excessive Spatter When Welding Zinc-Plated Material

This phenomenon occurs mainly when the heat input is excessive. Adjust the welding conditions according to the following procedure.

1. Use the setting values for mild steel listed in the settings table as the baseline.
2. Set the swing speed to +100, set the gas pressure higher, and weld.
3. If the molten metal still appears to boil under the above conditions, reduce the power and weld again.

Figure captions: With appropriate settings / With inappropriate settings

High Protection Lens Consumption

Protection lens wear can be relatively high, particularly when welding mill scale or zinc-plated materials, or when fillet welding continues for long periods. Adjust the welding conditions according to the following procedure.

1. Attach a nozzle with a built-in protective shield. Attaching a nozzle with a protective shield suppresses wear of the protection lens. (Nozzles with protective shields are sold separately.)

2. Increase the gas pressure / flow rate. Gas consumption will increase, but consumption of the protection lens can be reduced.

Cutting Procedure

1. Confirm That the Screen Shows "Laser Welding System"

Confirm that the screen shows "Laser Welding System". If the screen shows "Laser Cleaning System", press the switch button at the top right of the home screen to change screens.

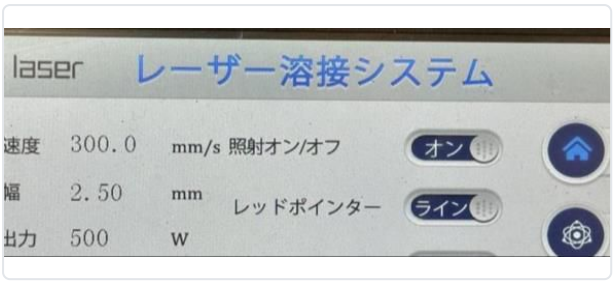
2. Confirm That the Laser Gun (Torch) Is in Cutting Mode

Confirm that the focusing lens is the "welding focusing lens". If the "cleaning focusing lens" is attached, replace it.

Note: Replace lenses carefully so that no dust gets onto the lens or into the inside of the laser gun.

> When replacing the lens, any dust that has entered inside the cover can contaminate the optics. Remove it with an air duster or similar first! Replacing the lens while dust is present will damage the lens.
>
> Always make sure that no dust adheres to the inside of the laser gun or to the lens when replacing. Remove the dust inside the cover!

For cutting, attach the cutting nozzle before you cut.



3. Selecting the Cutting Conditions

Open "Registered Settings" from the "Settings" screen. There is no item named "Cutting". Create a cutting setting under either "Other" or "Common Settings".

Open "Settings" and set the swing width value to 0. Set the laser power to a level sufficient for cutting.

- Note: The higher the power, the stronger the effect of the laser that penetrates through the back of the workpiece.
- Note: If a value greater than 0 is entered for the swing width, the laser may strike the nozzle and damage it.

4. Checking the Laser Beam Path

The emission opening of the cutting nozzle is extremely narrow; if the laser beam path is even slightly misaligned, the laser will strike the nozzle directly. Before emitting the laser, confirm that the laser beam path is centered.

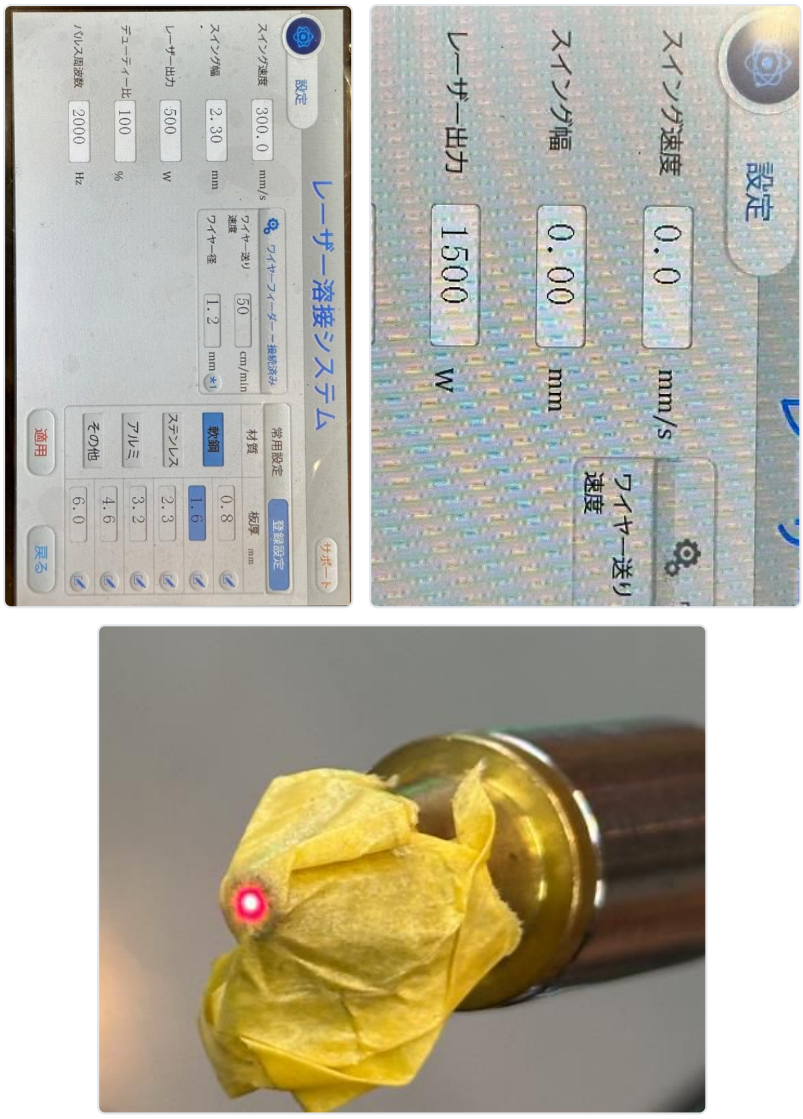


Figure captions: Beam path correctly aligned / Beam path misaligned

5. Supply Gas or Air

The gas type and gas pressure greatly affect cutting results.

- With nitrogen, cutting up to approximately 5 mm is possible.
- With air or oxygen, cutting up to approximately 8–10 mm is possible.

Recommended air/gas pressure: 0.4–0.8 MPa

Adjust the air/gas pressure according to the thickness of the base material. As the plate thickness increases, the air/gas pressure must be set higher. Note: When using oxygen, excessively high pressure may cause excessive melt-through.

6. Adjusting the Focal Length

Recommended focal length: 0 to +3

The focal length changes with the distance from the base material to the lens. It may also vary depending on the material and plate thickness. The thinner the plate, the more the value moves toward plus. For thicknesses up to about 3 mm, try cutting with the focus set to +3.

Note that the focal length also changes if the laser is emitted with the torch held off (not touching) the material.

> Caution! When using air, remove moisture, oil, dust, and other contaminants with a filter or dryer before use.

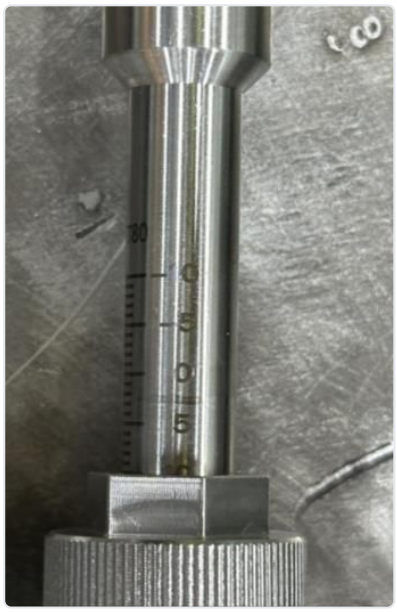



Figure captions: Photo of a fiber laser crystal section damaged by reflection / Photo of oil adhering to the protection lens

Cautions When Cutting!

In cutting, the laser is focused down to its minimum diameter for emission. A laser that has penetrated through a steel plate is extremely powerful. Place a steel plate or similar behind the workpiece as backing protection.

> Danger! The laser penetrates through the base material!
>
> Cutting three-dimensional objects is extremely dangerous! Always work in a location where no one is in the surrounding area.
>
> A penetrating laser is extremely dangerous. Check thoroughly that there are no highly flammable objects or people beyond the penetration point before working.
>
> The energy of the laser is extremely powerful. Use thick steel plates or similar for backing protection.

Rust Removal (Cleaning) Procedure

1. Confirm That the Screen Shows "Laser Cleaning System"

Confirm that the screen shows "Laser Cleaning System". If the screen shows "Laser Welding System", press the switch button at the top right of the home screen to change screens.

2. Confirm That the Laser Gun (Torch) Is in Cleaning Mode

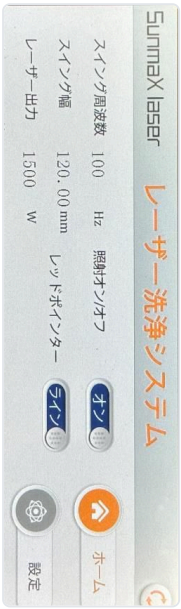
In this mode, the lens must be replaced. Replace it with the cleaning focusing lens carefully so that no dust gets in.

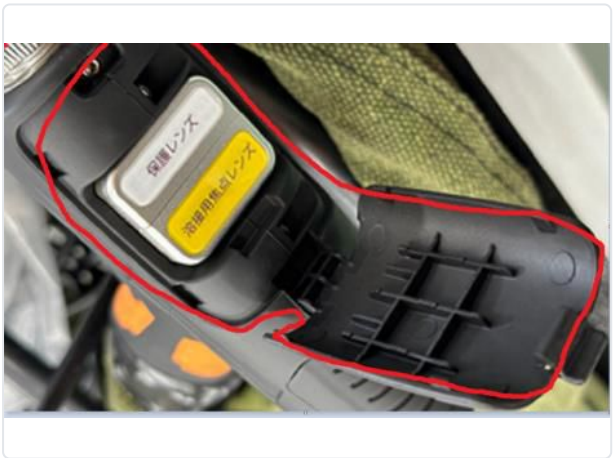
> When replacing the lens, any dust that has entered inside the cover can contaminate the optics. Remove it with an air duster or similar first! Replacing the lens while dust is present will damage the

> lens.
>
> Always make sure that no dust adheres to the inside of the laser gun or to the lens when replacing. Remove the dust inside the cover!

Set the laser head to the cleaning configuration.

Figure captions: Loosen the set screw / Remove the dust inside the cover!





3. Supply Gas or Air

During laser cleaning (rust removal), the purpose is not shielding; however, if gas/air is not sprayed while the laser is being emitted, airborne dust and smoke will enter the emission opening and damage the protection lens.

Recommended air/gas pressure: 0.4–0.8 MPa

Adjust the air/gas pressure according to the amount of smoke being generated.

Tip: Using a fan or similar to keep rust powder and smoke away from the laser gun allows you to save gas.

> Caution! When using air, remove moisture, oil, dust, and other contaminants with a filter or dryer before use.


AIR
AIRCOMPRESSER


ORION

Figure captions: Photo of a fiber laser crystal section damaged by reflection / Photo of oil adhering to the protection lens

4. Set the Cleaning (Rust Removal / Stripping) Conditions

Open the "Settings" screen and configure the laser power and other settings.

Rust removal settings are simple and not as difficult as welding. The parameters you operate are: focal length, laser power, swing frequency, swing width, and gas pressure.

Focal length is the distance from the laser gun to the surface being cleaned. If the distance is not appropriate, rust removal performance cannot be fully brought out. The distance that produces the largest sparks and the loudest sound is the optimum focal length. Also, emitting the laser while avoiding the vaporized smoke enables efficient removal.

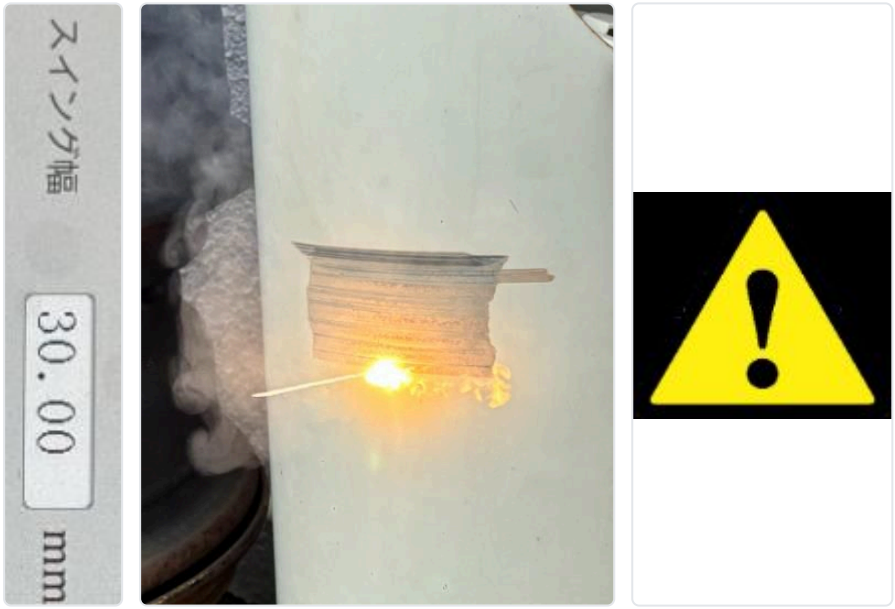
Emit the laser with the laser gun approximately 75 cm away from the base material. If it is too close or too far, the laser becomes weaker. Note: The focal length and swing width differ depending on the lens type.

Laser power: the larger the value, the stronger the laser applied — optimal for stubborn rust and mill scale. Applying high power to thin sheet metal may cause distortion.

Swing frequency is the traverse speed of the laser's lateral swing. With a high value it moves quickly, and zebra lines (rust removal marks) become less noticeable even when moving the laser gun fairly quickly. Decide the frequency value according to the condition of the rust to be removed.

- Light rust: set the frequency value higher (70–100 Hz)
- Thick rust or paint: set the frequency value lower (30–60 Hz)

Swing width is the laser emission width. Change it according to the area you want to clean. When the swing width is wide, the laser is spread over a larger area, and the heat input is lower than when the swing width is narrow.



Cautions and Hazards When Using Cleaning Mode

> Beware of laser reflection!
>
> When the laser is emitted onto metallic or mirror-like surfaces or aluminum materials, the laser may be reflected. For example, when paint stripping exposes a bare metal surface, depending on the surface texture, emitting the laser perpendicular to the surface can cause reflected light to escape toward the operator. Work with full attention to whether there are flammable materials or people near the surface being struck by the laser.

> Materials with mirror-like surfaces, especially aluminum and stainless steel, have high reflectivity and require particular caution.
>
> Wearing laser safety glasses is an absolute requirement for the laser operator. If there are people nearby, work with attention to reflections.

> Danger! Handle with care!
>
> During rust removal, never point the laser gun at people!
>
> Do not emit the laser at highly flammable objects such as gasoline tanks!
>
> Figure captions: Laser beam / Reflected light / Dangerous if flammable materials are nearby!

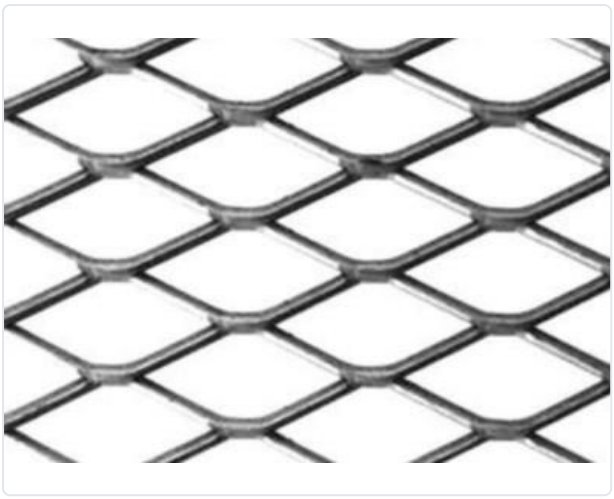
> Beware of the penetrating laser!
>
> With expanded metal, or when the emission target has holes, the laser may pass through. Even a laser that has passed through can cause damage depending on the distance. Place a steel plate or similar behind the target as backing protection.
>
> If the emission target has holes, the laser penetrates through — this is dangerous!

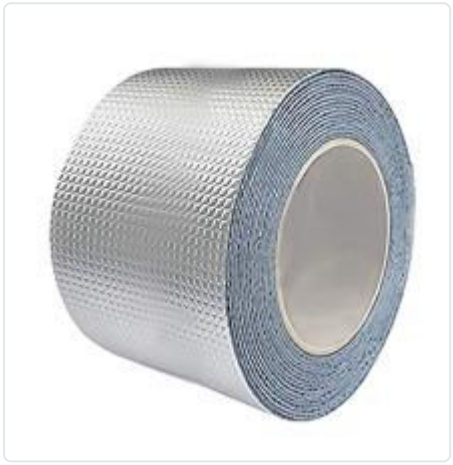
Protective Backing (Masking) Methods

1. Backing Material: Aluminum Tape

Reason for selection: Aluminum tape has the property of diffusing laser light and can effectively protect the areas of the workpiece outside the emission zone.

Managing reflection risk: Aluminum tape with an embossed (textured) surface disperses the energy of the laser light and reduces the burn risk to the operator. However, aluminum tape with a smooth or mirror-finished surface tends to concentrate the energy at a single point and must not be used, because of the risk of accidents caused by reflection.





2. Backing Material: Galvalume Steel Sheet

Reason for selection: Galvalume steel sheet is a composite sheet of zinc-plated steel and aluminum. It can effectively protect a wide area of the workpiece.

Managing reflection risk: Because the surface is treated with zinc plating and aluminum, it disperses the energy of the laser light and reduces the burn risk to the operator.

Note: Where the laser strikes strongly, the aluminum layer peels off and laser marks are left. At MAX power, it is best to respond by stacking three or more sheets.