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LRS1500-AC

REDSABRE 1500

# Compact, Air Cooled Fiber Laser
# Weld/Cut/Clean/De-rust
# 1500 Watt Output
# 1070 nm wavelength

## *Safety, Setup and General Use Guide for Hand Held Operation**

FDA Accession#: 2410134-000;
FDA Product Code: 95R—FF

**This is an early release safety and general use guide. It is considered to be a functional manual based off of engineering/factory supplied data that covers necessary and essential operation information. It also provides basic information for safe operation of the welder. A more detailed supplemental e- manual will be released in the future with more detailed setup and operation instructions along with more general data. This supplemental e-manual will be able to be downloaded as soon as it comes available.*

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Serial Number:_____

Manufacturing Date:_____ Purchase Date:_____
LSO Officer:_____ Employee Initials and Review Date:_____

**NOTICE:** This Laser Welder is classified as a CLASS 4 Laser.

***NOTICE:*** *The purchase or use of this product may require a trained Laser Safety Officer (LSO) to be present on premises and/or installation of a Class 1 laser safety enclosure. Annual reports and/or registration with local and state authorities may also be required.*

If you are using this product for the first time, please read this manual carefully before installation and use. Please carefully read the contents marked "Danger", "Warning" and "Caution" in this manual, and carefully identify the Safety signs and Warnings to ensure the safety of you and the people around you.

| Symobol | Signal Word | Meaning |
|---|---|---|
|  | **ELECTR0CUTION SHOCK DANGER!** | **DANGER!** Risk of electric shock or electrocution. Do not touch any area that bears this symbol. |
|  | **LASER PRESENT WARNING!** | **WARNING!** Watch out for lasers. Note the wavelength of laser radiation. There is a danger of laser radiation. Take appropriate protective measures. Don appropriate PPE while in this area. |
|  | **CAUTION!** | **CAUTION!** Be careful. Possible or emerging hazard. If you do not follow the instructions, it may cause damage and malfunction of the equipment or harm to yourself and others. |
|  | **FIRE WARNING!** | **WARNING!** Watch out for fires and combustible materials. The use of a laser creates sparks. The laser beam itself may create a fire if directed in the wrong area or carelessly handled. |

WARNING! Never point the laser gun/torch toward anyone. Always watch angles of reflection. Never allow the laser to reflect from shining or the mirrored surface or off of other highly reflective materials.

WARNING!

## California Proposition 65 Warning:

This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and in some cases, cancer. (California Health & Safety Code § 25249.5 et seq.)

Warning: Cancer and/or Reproductive Harm

**www.P65warnings.ca.gov**

## WARRANTY NOTICE:

Fiber lasers are reliable and can be of service for relatively long periods of time if proper care is taken. The warranty will cover against breakage and repair of the main components in general. However, It does not cover or protect against damage, breakage or wear of consumable items or damaged caused by misuse, neglect or failure to follow operation instructions and warnings. Consumable items are defined as items such as nozzles, wire feed tubes, protective cover lenses, focus lenses etc. that wear when used or have a service life based off of recognized patterns of use.

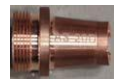
NOTICE: The fiber laser welder is built as strong and durable as technology allows. However, there are parts of the system that are vulnerable to damage. Proper maintenance and handling of the following items must be observed to keep warranty in effect. Damage occurring to the following as a result of the causes listed will not be covered in any circumstance unless it occurred during shipping.

- The gun (torch head). To prevent gun (torch head) damage:
    - Handle the gun gently. Do not bang or throw it around as is commonly done with a MIG gun or even a TIG torch. The gun contains sensitive adjustments and lenses which can become permanently damaged, broken or misaligned.
    - Do not drop the gun at any time. Make sure the gun cable arranged so that it is not a trip hazard. Tripping over the cable may jerk the gun off the table and damage the cable.
    - Store the gun properly. Keep it coiled lightly on the cable holder located on the side of the welder. Do not let it remain on the table or in the work area if the gun is left unattended or shift changes. Maintain a proper storage routine.
- The fiber cable. To help prevent damage to the fiber cable that carries the beam to the gun exercise care and caution in handling. *Be sure not allow the following to happen.*
    - **Do not drive over or step on the fiber (torch) cable. Do not roll the welder itself over the cable** This will damage the fibers in the cable or the cable coating/covering.
    - **Do not kink the cable.** Do not bend the fiber cable more than 60° angle. It should not have a sudden bend it in the cable, rather the cable should be radiused to form the 60° angle.
    - **Make sure the gun is not drug or pulled against a sharp edge, corner or table top which may kink the gun or cut the fiber cable.**

NOTICE*:* Failures of the gun and cable are rare, but when they do fail, the failure is almost always due to one of the above listed issues. The warranty does not guarantee against such damage.

- Protective Lens
    - The Protective lens is considered a consumable. Also the protective lens is relatively cheap and a generous supply should always be on hand. It is also important to regularly replace the protective lens of the laser mounted in the gun (torch head).
    - The unit should never be operated with a known defect, or burn in the lens.
    - Inspect these frequently until you understand the "wear" time of a protective lens. Smudging, smoke etc. all play a factor in this. If you notice any change or decline in laser quality or strength, stop and change the protective lens right away. Failure to do so may result in other cascade damage and failures of the focus lens, the reflective mirrors etc. *Damage occurring to the gun (torch head) assembly and its related components as a result of failure to change the protective lens is not covered under warranty. Make sure any employee is instructed on this and shown how to change the protective lens. Make sure to maintain an adequate stock of them.*

Quick Installation Operation Guide

| Process | Operating System | Nozzle Type |
|---|---|---|
| Welding | Laser Welding | Any Welding Nozzle Various |
| Cutting | Laser Welding | Cutting Nozzle  |
| Weld Cleaning | Laser Welding | AS-20D Nozzle  |
| Rust Removal/Descaling | Laser Cleaning | Use 800mm Focus Lens. Install Cleaning Nozzle. Cleaning focus lens is included in accessories.   |

Product Overview:

The REDSABRE 1500 is a fiber-type hand held laser system that is designed for welding and cutting related activities. The welder can also be used to clean welds in preparation for the next pass or for preparation for the passivation process. The de-scaling/de-rusting function can also be used to prep metal before welding and painting. The laser welder is comprised of several main components: an integrated cabinet, fiber laser cable, air cooling and circulation system (fans), LCD laser control system and hand- held welding gun (torch). In addition, the wire feeder and its programming are designed to work in tandem with the laser and does not provide welding power. Laser welding is suitable for welding many different types of metals.

Laser welding has been around for a while, but advancements in laser technology, in particular fiber laser technology, has made it compact and affordable thereby making widely appealing and accessible to the general welding industry. Laser welding is mainly utilized for welding of thin-walled materials and precision parts. The laser welding process uses invisible wavelength light energy to radiate and conduct heat to the workpiece surface. This process brings the metal quickly up to the melting point to join the two pieces of metal together. The welding heat needed to create fusion of the parent metals is controlled by the laser pulse width, energy, peak power and repetition rate parameters. These combine and work together to melt the workpiece and form a well-defined molten pool.

The laser joining process can be used for spot welding, butt welding, lap welding, seam welding and similar types of welding. It creates a high depth-to-width ratio (deep penetration) resulting in a small weld width along with a small heat affected zone. This results in low warping, fast welding speed. The high-quality welds are flat and aesthetically pleasing. The welds typically produce no porosity unless the base metal is highly contaminated. The laser welding process provides pin-point accurate control with a tight focus area, allowing high positioning accuracy and easy automation. '

It's important to understand and remember that this is a Class 4 laser. This is the strongest and most powerful class of lasers. The FDA controls distribution and operation of lasers in this country

regardless of application or industry in which it is to be used. Rules and governing bodies are different for the operation of laser welders than they are for traditional arc welders. Lasers should not be operated in open environments, especially where other people are present. A class 1 laser enclosure is typically required where other people cannot be excluded from the work place. At a bare minimum, a Laser Safety Officer should always be present during the operation of the laser. Training and certification to be a Laser Safety Officer is relatively inexpensive and is available from multiple sources including in-person seminars and online courses. Many Lase related OSHA regulations also are specific to lasers and different from conventional arc welders. Be aware of these differences and practice them.

The laser beam is invisible to the naked eye but it can create great harm to unprotected eyes and skin in an instant. Never point or aim a laser at anyone, even if the machine is turned off. **Never defeat any safety or interlock for the purpose of convenience**. If any part fails, remove the unit from service immediately. Secure the unit by unplugging the unit, removing the key and tagging out the unit as properly as regulations require. Seek immediate technical help and professional repair from Everlast. Repairs should not be made by unqualified people. Never allow any untrained person to use or demonstrate the welder. Always make safety priority.

Always observe and identify and generally look out for any reflective surfaces that may create a bounce-back (reflection) of the laser beam. Reflected laser light can also burn and damage eyes and skin. It can also start fires.
Keep a suitable fire extinguisher handy. Keep all chemicals and flammable items out of the effective range of the laser (laser hazard distance or LHD). Modification or misuse of this product is prohibited and can result in prosecution by authorities.

Be advised that this unit uses a visible red "Pilot" laser to represent where the invisible class 4 laser beam is actually is targeted before welding. This is a class 1 laser but it should not be misconstrued that this is the actual laser and actual location of the beam. These lasers can become misaligned with the Class 4 laser. The beams can become out of sync with each other over time and may need to be properly aligned for efficient and accurate use.

Use properly rated eye protection, rated for protection against 1070 nm wavelength lasers with a rating of 1500 watts with a 30,000 second protection. The eye protection device must remain undamaged by scratches or cracks to provide sufficient protection. They must fit properly. Do not rely on traditional welding helmets or welding shades, including Oxy-Fuel safety glasses to provide the protection needed. Look for the Optical Density Number (OD number). It is suggested to use eye protection with at least an OD of 6 as a minimum protection.

| Model | REDSABRE 1500 Air Cooled Fiber Laser Specifications |
|---|---|
| Welding Beam Laser Class | Class 4 |
| Pilot Laser Class | Class 1 |
| Gun/Torch Head Model | SUP21T |
| Input Power | 1~240V± 10%,50/60Hz |
| Laser Wave Length | 1070nm ± 5 (Ultraviolet, Invisible) |
| Laser Output Power | 1500W Maximum |
| Beam Operation | Continuous Wave or Modulated Scan |
| Laser Focus Lens Focal Length | Welding/Cutting/Weld Cleaning: 150mm; De-Rusting/Descaling: 800mm |
| Focus Lens Type | Quartz |
| Beam Quality | M2<1.2 |
| Output Variation | ± 2% |
| Input Power Wattage | ≤ 6KW |
| Fiber Cable Length | 5m (10m Optional) |
| Welding Thickness Range | Steel: ≤4mm (.157") Alum: ≤ 3.5mm (.138") Copper≤ 2mm (.079") |
| Maximum Seam Width | Welding: 6mm, Weld Cleaning: 8mm |
| Cutting thickness range | ≤5mm (.195") |
| Applicable materials | Carbon/Mild Steel, Stainless steel, Galvanized Sheet, Aluminum, Alloyed Aluminum, Titanium |
| Weld joint gap requirements | <1 mm (.40") without wire to <1.6mm (1/16") with wire feeder ;<2.0 mm with twin wire feeder |
| Pressure and flow rate of gas | Cut/Derust/Descale: 0.3Mpa-0.5Mpa @ 140lpm (44-73 psi @ 5cfm) on Air or N2<br>Welding/Weld Cleaning: 15L/min (31 CFH) 100% Ar |
| Fiber Optic Connector Type | QBH |
| Speed of welding travel | 0~120mm/S (0-4.75 in/S) |

# Main Technical Parameters:

## Working conditions and working environment:

- Working environment:
    - Operation temperature range 10 -40 ℃, (50-104° F).
    - Keep humidity levels under 70%. Maximum permissible use is <95% in limited conditions.
    - Keep operation climate stable. Do not allow dramatic swings in temperature if possible. Never store in open shelters or use in outdoors in exposed humid conditions.

### Avoid the following places:

- Dusty, oily, foggy or damp/wet areas, including areas prone to dew such as open structures.
- Vibration and areas subject to drops, shock loading and impacts.
- Areas subject to chemical sprays or mists
- Places near sources of High Frequency and EMF.
- In environments where high concentrations of certain gases exist such as CO2, NOX etc.

- If the temperature or environmental conditions change quickly, the YAG crystal, fiber end face and the optical lens will be exposed to moisture and damaged. Stains and cloudiness may form on them causing issues with operation. Be sure to keep the operation environment as stable as possible. If exposed to moisture, make sure all components are thoroughly dry before use.

## Need to Know Before Use:

Laser-In-Use Safety Warning Mark: Know this Symbol and Its Implications.

- The light that this laser generates is in the invisible wave length band. It cannot be seen with the naked eye. But yet it can do significant, instant and permanent damage to the eyes and skin. Do not watch or contact the laser beam without the proper safety equipment. Reflected beams can also do damage. Keep bystanders and non-essential personnel out of area.
- This is a Class 4 laser product, the most hazardous class. The beam from the laser welder can be reflected back to the eyes and skin. Retinal damage can occur when using this unit without the proper eye protection. If the skin is exposed to the beam directly or indirectly through reflection, the intense nature of the exposure may result in burns, pigmentation, ulcers, scars or subcutaneous tissue damage. Long term health risks are also posed such as skin cancer, cataracts and blindness.
- The laser warning symbol should be placed on both sides of the beam expanding mirror arm of the welding machine.
- Do not open the chassis of the welder. There are high-voltage components inside. Pay attention to safety procedures to prevent electric shock. The laser should only be repaired, maintenance or overhauled by trained professionals.
- Anywhere the laser is in use, these signs, or similar regulation-conforming versions must be posted to comply with safety regulations. This signals to bystanders and unauthorized personnel to avoid the area.



- Do not modify or adapt this laser welder in anyway that is not provided for or approved by the manufacturer. This welding system shall not be used with any cover, shield, lockout, safety or guard disabled or be used with otherwise nonfunctioning safety equipment.
- Do not use this equipment for any other purpose than general welding applications for which this unit is designed. Medical use or other uses not related directly to performing

welding, cutting or cleaning/derusting/descaling functions is prohibited.

- Do not watch the laser beam (visible and invisible beams, because both are present and occupying the same approximate area) without safety eyewear. Do not contact the laser beam or a laser generating component or this welder. Failure to comply will result in retinal damage, blindness or burns.
- If you or any worker has a pacemaker, do not approach the equipment operating area. The laser welding machine generates an electro- magnetic field, which may affect the operation of a pacemaker.
- In the area where there may be direct or indirect laser radiation, a class 1 laser enclosure should be set up. Laser Class 4 warning posters/plaques should be posted on the enclosure or in the operating area to distinguish it from other areas to warn and exclude bystanders and unauthorized personnel.
- During the routine maintenance and replacement of the torch or output components of the laser, do not touch the parts that are not related to the replacement of the lenses and serviceable components. Hold lenses carefully, making sure they are not touched with bare fingers on the focusing surface of the lens. Hold by the edges with laser lens paper.

## Laser Safety Notice:

**This laser welding machine uses a closed laser light path fiber(optic) design, which helps to prevent the leakage of laser radiation. Before, during and after the operation of the Red Sabre laser welding machine, please note the following important information:**

- Non-authorized and untrained personnel are not allowed to disassemble, repair and modify the equipment by themselves. Electric shock and fire can be caused by the above reasons. Conduct safety knowledge education and command production process for field operators. Do not perform operations other than maintenance as indicated in the instructions.
- Safety interlocks should be installed on the enclosure doors and connected to the machines to prevent accidental laser exposure.
- This power equipment must be wired correctly and grounded in compliance with code. Use only licensed electricians, otherwise the use of this machine may cause severe electric shock, or fire may as a result.
- Use the correct gauge wire, receptacle, and breaker/fuse for this unit.
- All covers and seals should remain in place while in use. Do not open the machine chassis while the unit is on. The cover should only be opened for cleaning and maintenance reasons.
- Even though the laser minimizes heat input, the work piece will be hot after welding and may continue to experience a rise in temperature after welding is completed as the heat diffuses through the metal.
- The laser should always be backed up approximately 1/8" to 3/16" behind the part being welded with a thick piece of metal or non-combustible, non-reflective item to prevent unwanted burning and damage to materials behind it. A stray beam that has penetrated through metal can still burn through to the legs and feet or any item in its path.

## Electrical Safety:

- Do not damage power lines and fiber cable. Regularly inspect for damage to the fiber cable. Inspect for signs of cuts, crushing or kinking of the cables. Replace any damaged fiber cable immediately. Replace cut or damaged power cords and plugs.
- Avoid twisting, jerking, or kinking the fiber cable. Cable damage can cause electric shock, short circuit or fire.
- Stop immediately and shut the machine town and remove the key if you detect a burning smell or see smoke or notice any signs or warnings of the equipment overheating. Fire or electrical shock may occur if these symptoms are ignored.
- Do not use the equipment in a wet or excessively humid or dew covered environment. Use only in a clean dry environment to help prevent electrical failure and electrical shock.
- You must shut off the equipment and unplug the welder anytime service replacing the diode pump or cleaning the unit.
- Do not allow the unit to continue to run when no work is being performed. Always shut the machine down rather than let it stand idle when pauses in work are greater than ten minutes. Always turn off the welder when taking breaks or going on lunch breaks. Do not leave the laser unattended.
- Remove the key and secure it in a safe place when the unit is not being use to prevent unwanted and unqualified personnel from operating the equipment.

## Material Safety Notice

- Keep the unit clean from dust and debris. Do not place any items on top or around the unit. Keep a free area space of 24 inches all around the machine cabinet/chassis. Dust and dry off the machine before use.
- Do not place any sort of beverages or beverage containers on the welder. This includes coffee cups, soda cans, and drink cups. Any spills can damage the unit and lead to shock or electrical fire. If anything is spilled onto the unit, dry immediately.

## Fire Safety

- Do not use near flammable and materials or potentially combustible materials. Remove all flammable liquids from the area. The beam can stray or reflect at considerable distance. Make sure your LSO has determined the laser hazard area and all combustible materials are nowhere near this zone. There is also a spark ignition risk created during the welding process which can lead to fire.
- Do not point the beam at any material not intended to be welded. Fuel, oil or grease that the beam contacts will quickly explode or ignite.
- Do not use covers blankets or non-fire-resistant materials to cover equipment in the welding area. The beam can ignite these instantly.
- Keep a dry chemical type ABC fire extinguisher present that is current on its inspection and testing date readily accessible. However, do not put the fire extinguisher directly in the area where the weld beam may contact it. Evaluate and consider an additional need for a “D” type extinguisher and/or a sand bucket to put out any metal fire that may occur.

## Installation, Setup and Maintenance

Upon receiving the welder, immediately open the box and evaluate the condition of the welder. Also check to make sure all parts and accessories are present and in working order. This should be done within 72 hours of receiving the unit. Also be sure to:

- Keep the original packing box for return if needed.
- Check the packing list for missing accessories. If anything is missing contact Everlast parts support immediately.
- Inspect the components for damage, including the chassis case and torch and fiber components.

### Confirm the following before use:

- Input power supply is rated as "clean powered: THD < 5%.
- 240V 1 phase input ±10%.
- The circuit is properly grounded and no other welders are being used or are running on the circuit.

### Assembly and Adjustment

- Install and attach all components. Do not force bend or modify any component.
- Turn on the main power supply, adjust the light path properly to start working.
- Assemble and adjust the casters so that they roll smoothly and the cabinet/chassis is level. Make sure all 4 are contacting the floor and roll freely. Use the step-down lock to lock the unit in place whenever the welder is not being purposefully moved.

### IMPORTANT! Note the following before use:

- Only allow trained personnel to work with and assemble the unit.
- Review laser safety guidelines.
- Appoint a Laser Safety Officer and make sure all registration requirements (some states require registration) and record keeping are carried out before use
- Any supply power and wiring is to be carried out by a licensed electrician.

### IMPORTANT! Note the following during use.

- Only operate the control panel with hands. Do not use a stylus, pen or pencil on the touch screen.
- Only operate one switch or panel button at a time. Operating multiple simultaneously may cause failure.
- After disassembly for cleaning or inspection, Make sure all panels are installed on the chassis

and the ground wire is connected from the control board to the connection on the chassis. Do not operate without it . Do not remove or cut ground wire.

- When connecting and using the laser torch/gun, do not drop the gun or damage any mating surfaces or connections. Make sure the optical faces of the connections are not damaged or dirty.

Optical System Care and Routine Maintenance

**The optical pump (Laser LED light generator) and fiber optic system, along with the laser gun, collimating lenses, focus mirror, protective lense and safety switches are key components of this system. Any damage to one or the other can result in poor function or damage to the unit. Always remember the following:**

- The coating layer of optical elements is easily damaged. Avoid damage and impact to the lenses. Do not drop gun or carelessly handle it. Always have a secure method of storing the gun when not in use.
- Avoid exposure of the lens to smoke and flame. This can happen if the laser accidentally drifts off target to painted metal surfaces or unprepared areas that are not intended for immediate welding. If smoke or flame is released from the accidental exposure, stop operation and remove gun from the area to help prevent the gun optics being exposed to the smoke.
- Do not touch or handle the surface of the optical lenses by hand or fingers. Use special tissues designed for laser optical use to handle during changes. These are inexpensive and economical.
- If the optical elements need to be wiped, use high concentration ethanol (99% or greater) and use laser/optical cleaning paper to handle the lens and clean.
- Handle the protective lens and optical lens only by the edges.
- Make note of the installation direction of the lens. This is important. Make sure the direction is noted before removal of the old lenses and before installation of the new lenses.
- Always wear eyewear approved for 1070 nm wavelength, rated for 1500 watt use @30k seconds duration. Use at least an OD6 rated for this wave length.
- Avoid allowing anyone to directly view the laser. If necessary, stop operation immediately.
- If a burning shape is observed or red-light position of phase paper during dimming, the light should be stopped and the light locking switch should be turned off.
- Before opening the welder chassis cover or servicing the diode pump, the power switch should be switched off and the unit unplugged.
    - Wait 5 minutes and measuring the voltage between the positive and negative electrodes of the power box with a multimeter, the voltage should be read below 5V before servicing.

## Basic Setup and Operation

- Confirm that the torch(gun) trigger switch is not engaged or otherwise stuck down.
- Check that the emergency stop switch is not engaged.
- Confirm that the key switch is turned on.
- Check to ensure the power light has come on and everything is lighting up properly.
- Turn on the laser and select the external control mode. (Some versions vary, consult Everlast tech support before the first start if you have a different version than what is listed below);
- After the laser program boots up and the automatic diagnostic completes (this may take up to 30 seconds) the touch screen will be functional.
- Set the first parameter on the touch screen to the welding selection.
- Touch/Select the "Start" option.
- Connect the safety clamp to the part being welded. The torch trigger is then used to weld.
- Keep the fiber optic cable and gun (torch) stored in the cable holder when not in use.

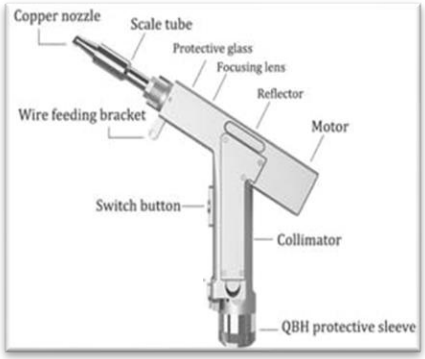
- The Safety/Ground clamp must be attached to work during welding. This is designed as a safety. It establishes continuity between the work piece and the contact nozzle (tip) and signals the safety system of the welder that the gun is in contact with the metal. This prevents accidental discharge of the laser and prevents accidental eye and skin exposure as well. If this is not connected the switch on the gun will not operate the laser.

**WARNING! Always make sure the shielding gas is turned on and flowing at the correct flow rate to prevent gun failure before use.**

- Wear safety glasses with an appropriate OD of 6.
- Do not point the gun (torch head) at anyone. Safety equipment can fail. Do not rely upon safety devices. Only the operator can ultimately control safety.
- Do not by pass the safety clamp by clamping directly to gun. Accidental firing of the laser can occur resulting in severe eye injury, burns or fire. The beam can bounce off of shiny or reflective surfaces, including metal surfaces. Watch out for reflected beams. Keep gun and torch at proper angles and distances to avoid this. If the surface is too reflective, denature the surface by sanding or using a stainless steel brush (for aluminum).

## Gun Information.

The SUP21 gun (torch head) is composed of several parts that will require attention and maintenance. Its design allows the focus lens, focus (scale) tube, protective lens and pilot laser adjustment to be easily accessed, adjusted or replaced. The standard SUP21T gun offered is the more advanced, compact and improved version of the all metal design shown on the left. But both guns have the same type of basic components in them. Please note that this gun on the right is an air cooled version supplied with the unit and is an updated version of the gun on the left. The gun on the right is shown with the wire feeder attachment installed. The wire feeder, when properly adjusted, should feed right into the laser path. The use of the wire feeder is optional. It is designed to help fill gaps and add filler metal to reinforce the weld on thicker materials.




### Gun Maintenance and Calibration.

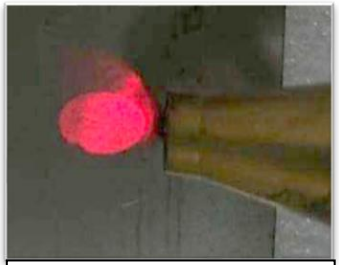
The SUP21 gun has several adjustable parts that must be maintained and or kept in adjustment for proper operation and longevity of its components. If not properly cared for, poor quality results will be achieved and the gun will fail prematurely (lack of maintenance voids warranty). The easily serviceable parts are the focus (scaled) tube, protective lens, focus lens, and Pilot (target) laser calibration. The collimating lens and focus mirror require more intensive work, but can be replaced by the user if clean conditions are kept and detailed instructions are followed. The user should contact Everlast for focus mirror and collimating lens removal and replacement instructions.

### Pilot (Target)Laser and Welding Laser Calibration and Adjustment

- Adjustment of the Pilot (Target) Laser Spot Location:
    - The Pilot laser is a visible class 1 laser used to represent the position of the ultraviolet welding laser beam which cannot be seen. It represents the “target point” of the welding laser. It should line up and be focused in the center of the nozzle before first use, or if the laser drifts out of alignment. This helps prevent the laser from burning the sides of the nozzle and helps the user to accurately preposition the gun in the center of the weld area before welding. The Pilot laser does no work in the welding process. It simply used as a visual cue for the user.
    - To begin adjustment, Install a small welding nozzle.
    - Remove the rear cover screw and cover.
    - The unit should be powered on for adjustment so only the Pilot (Target) laser is

enabled. Make sure the laser cannot come in direct contact of the table. Remove the safety clamp from any work surface.

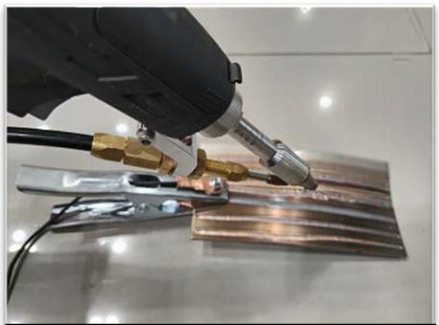
- Use a socket head key wrench to adjust the two screws ahead located on the top of the gun, which are side by side.
- The gun should be reclined slightly so the Pilot (Target) beam is seen at a short distance as it would be seen while welding.
- Using the two set screws that are side by side, adjust the red Pilot beam until it coincides with the center of the weld puddle area (the middle of the nozzle's aiming point). Adjust it until the Red Pilot Laser is pin-point focused and synchronized perfectly with the ultraviolet laser impact area on the metal. Do not try to weld or trigger the unit in the process of adjustment. Aiming for the center of the nozzle area will be sufficient to align the beams. However, if they are not aligned when welding, stop and repeat this process until they are.
- The unit should never be operated in the welding mode with any cover open or any gun component or safety measure missing.



Beam Out of Alignment

Pilot Laser Adjustment Screws

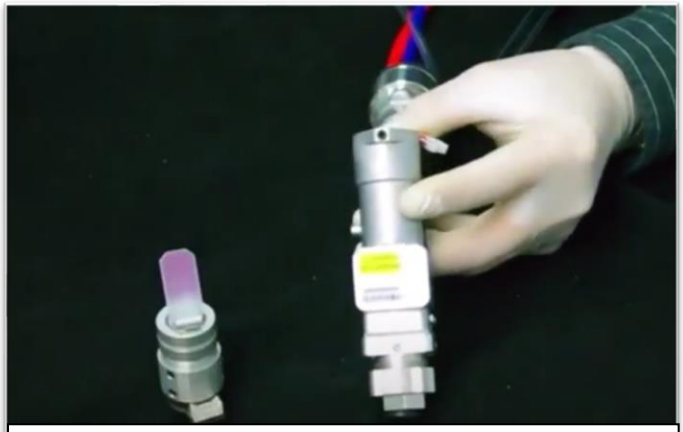
Beam Correctly Aligned



Retest Calibration

## Adjustment/Replacement of the Focusing Mirror

The focus mirror bends the light from the collimating lens mounted in the handle of the gun and redirects it to focus lens in the front section of the gun. This mirror has a fragile element to it. Though it is housed in a robust housing and in a shock absorbing gun housing, it can be damaged through gun dropping or banging around. The mirror can only really fail if the gun is dropped or banged around severely. Replacement of the mirror is not a warranty item for this reason, other than for a manufacturing defect noticeable at the outset of use.

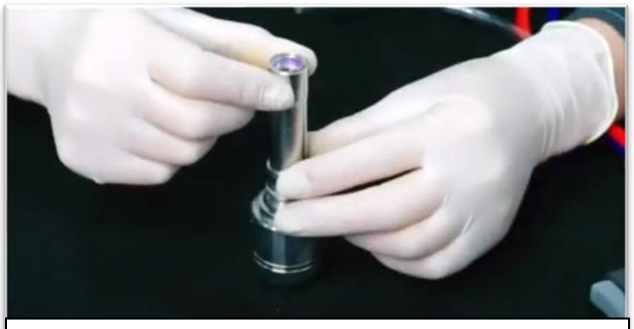


Gun Head Disassembled with Focus Mirror Removed

- Occasionally, the focusing mirror in the rear of the SUP21 gun may need to be replaced or readjusted due to dropping or breakage. This tends to be a major procedure, but can be accomplished in a few minutes with the correct tools and correct procedure.
- The SUP 21T gun must be disassembled to access the focus mirror. This includes removing the outer handle of the gun and removing all covers and doors. The rear section must be loosened at the set screws and the whole assembly must be removed to open and access the mirror.
- Contact Everlast Tech Support for the Red Sabre 1500 for detailed instructions **prior** to attempting this adjustment or replacement. All parts must be kept grease, lint and dust free and must be covered during the disassembly process to prevent dust from settling during the service process. You will need to prepare a soft, clean surface during this process. Any optic surface must not be touched or handled directly. Touching or handling the optical surfaces leaves behind oil and dirt, which can overheat and damage the laser system components. If any component is accidentally touched, it should be cleaned with 99% ethanol alcohol and lent free optical/laser paper.

## Replacement of the Collimating Lens

The collimating lens adjusts the laser light delivered to the gun from the fiber cable so the beam rays are running parallel to each other. This is not the focus lens which makes the final adjustments and convergence of the beam.



Collimating Lens Assembly Removed from Gun

- This is a relatively expensive item to replace. It is not a commonly required procedure however. It should be replaced periodically as laser efficiency declines. But in any event, this is still considered a consumable item and not generally covered under warranty except for manufacturing defect or aberration of the optics.
- The collimating lens is mounted in the handle section of the torch. The fiber cable must be removed from the gun handle and the end where the collimation assembly is removed must be covered to prevent dust settling on the components during the process.
- The area needs to be clean, dust/lint free and level so the collimating assembly can be stood on end for easy replacement.
- This repair/service can be done by the user with basic skills and an eye for cleanliness. The area must be clean and dust free. The components must be handled in a way to prevent direct contact with the optical surfaces and the exposed optical surfaces must be covered to prevent dust from settling during the service process.
- If the collimating lens needs to be replaced, contact Everlast technical support for a detailed procedure regarding replacement of the lens.

## Adjustment/Replacement of the Focus Lens and Protective Lens

There are two basic focus lenses used with this machine. One is for welding, weld cleaning and cutting. This is the 150mm focal length lens. The other lens is used for De-Rusting and Descaling metal. This is the 800mm focal length. Both are initially included with this machine. Other lens options exist, but these are the main two that are most useful. Cleaning can be done with the 150mm focus but it will result in a narrow path.

Lens Access Cover


Focus Lens Assembly


Protective and Focus Lens

Protective Lens Replacement

- The Focus lens redirects the beam into a convergence point in front of the gun, at the point of the weld. This allows the beam to be concentrated and all energy be focused in one spot. This also is considered a consumable, but is not frequently replaced unless other parts of the gun have been damaged or out of line. Overtime the lens may burn a loose efficiency and not properly focus the beam. It can also get dirt and smoke in it. This lens can be carefully cleaned with 99% ethanol alcohol and optic/laser lens paper. The lens is serviced by Everlast as a whole assembly, even though the lens itself may be replaced independently of the tray.
- The Protective lens seals and protects the focus beam from direct exposure to the outer environments. Though it is not fool proof, it helps to keep smoke, moisture dirt, dust and sparks away from the focus lens. This is the most commonly replaced item. When welding continuously, it may be necessary to replace several in a day.
- If the efficiency of the weld beam deteriorates or there is a lot of smoke and dust of in the air, the lens should be checked and replaced.
- To access and replace the Focus Lens and Protective Lens, remove the front access cover by squeezing on the end tabs and lift to remove.
- The Focus and Protective lens are installed in trays and can be removed one by one.

- Note the direction and position of the lens when it is removed. It is important that the lens is removed that it be installed in the same direction and location as when removed. Remove and replace only one lens at a time to prevent reversing installation and direction order. The protection lens is always installed in the front. The focus lens is always located in the rear slot.
- The complete replacement of the focus lens is recommended, which include the lens holder. The focus lens may be replaced individually, but it is not serviced or sold currently by Everlast. This is because it is usually best to replace all the parts since the sealing ring can be leaking or can get overheated. (Contact Parts Support for information and updates to stock status of individual focus lenses.)
- The protection lens can be removed and inspected for burns, cloudiness and damage to the surface. If any is seen, replace the lens. A damaged protection lens can also cause an unfocused, inefficient welding beam. It can also damage the focus lens by prevent the passage of light through.
- The protection lens can is removeable from the holder. There is a white sealing/keeper ring that can be unscrewed to allow access to the lens itself. Remove this sealing/keeper ring and gently remove the lens by turning it upside down into your other hand.
- Replace the lens (this is a flat lens, so direction does not matter), then replace the sealing/keeper ring.
- Install the lens assemblies so that both lenses are kept level with each other and they fully seat in the tray.
- Replace the cover. Never attempt to weld with the cover removed.

### Adjustment of Focus (Scale) Tube

The focus tube is used to adjust the pinpoint focus of the laser so that it is at its most effective distance point when the copper contact tip is on the metal. The graduated scaled lines on the side of the tube are for indexing the focus tube.

**WARNING!** This operation requires you to connect the safety/work clamp directly to the metal tube holder piece on the gun. This can be dangerous. Make sure no one else is near by. This is the only time the work clamp is connected directly to the gun. Never attempt to weld with the safety clamp attached to the gun. The laser can be accidentally activated this way. Wear all safety gear (PPE) while conducting this setup.

Focus Tube Adjustment

Focus Tube

- Make sure the red Pilot/Target laser is adjusted properly before starting this process.
- To adjust the welding laser focus, use a thin piece of scap piece of metal (18-14 gauge) at least 4"x4". Place the metal in the flat position so that it is spaced off the work table by at least one inch.
- Turn on shielding gas to the gun.
- Enable the laser through the control panel controls.
- Attach the safety/work clamp to the wire feed mounting tab on the gun.
- Hold the end of the gun about 4 to 5" away from the scrap plate.
- Enable the laser and pull the gun(torch) trigger to activate the laser.
- Notice how the laser is burning through the metal.
- Release the trigger and move 1" closer and repeat the process. Notice each time you pull the trigger how fast the laser burns through (if at all).
- Repeat these steps until the laser burns through quickly and effectively.
- Fine tune to the exact position that seems to be the best location.
- Notice this distance and record it.
- Loosen the collet nut that holds the focus tube.
- Slide the focus tube in or out until the edge of the copper contact tip touches the metal at the same point the laser was most efficiently burning through the metal. (The tip should be held against the plate at the normal welding angle during final adjustment.)
- Notice where the scale markings and location on the focus tube. These will indicate the focused distance and is a repeatable measurement unless something has been badly damaged or knocked out of calibration. Usually this measurement is between 0 and 5. However it could be more or less depending on the tip and the gun setup.
- Tighten the collet nut while holding the focus tube. Do not overtighten, but do not leave it loose enough to slide in and out with pressure on the contact tip.
- Immediately remove the safety/work clamp from the gun. Disable laser until ready to weld. Never leave the work clamp connected or accidental firing of the laser can occur.

## Control Panel and Operation

The operator's panel of the Red Sabre is mainly composed of a detachable touch screen and control box. The screen is magnetic and can be attached to any convenient location close to the user location to help reduce the amount of walk-back time needed for adjustment and setup.

### Power Controls

The unit has a basic power control panel that includes an Emergency Stop (E-Stop), Key Switch and an ON Indicator light. The E-Stop should be pressed in any emergency, but should not be used as a power down switch. The E Stop will deactivate the unit immediately. The E-Stop Knob must be rotated clockwise to reset. The key switch is a master safety switch, which is used to prevent access to unauthorized users. It should be removed and securely stored when the machine is not in use. **The main power switch is located on the rear of the machine and should be used to turn the unit on or off.** This is the only approved method of completely turning the machine on and off when not in use to ensure the unit has no power flowing through the machine. The key switch can be used for temporary stoppage and breaks. The E-Stop may not be used except in the event of an emergency. If the E-Stop fails, contact Everlast Technical support immediately and seek replacement options. Do not attempt to bypass the E-Stop.


Power Control Panel


Main Power Switch

### Startup

The unit must be connected to all control cables safety lockouts, communication lines before use. The items are clearly marked and distinct in shape and pinout sizes and numbers so that it is an intuitive setup. When the unit is first turned on, it will go through a boot up process before it reaches up full power. Allow time before using for this process to take place. The machine is usually fully booted within 30 seconds.

**CAUTION!** Make sure Argon is turned on for Laser welding. Connect air for cutting and de-rusting/de-scaling, otherwise damage will result to the gun and gun lenses. Always make sure they are turned on before use. Damage resulting in failure to operate with shielding or cutting/descaling gas/air flow is not covered under warranty.

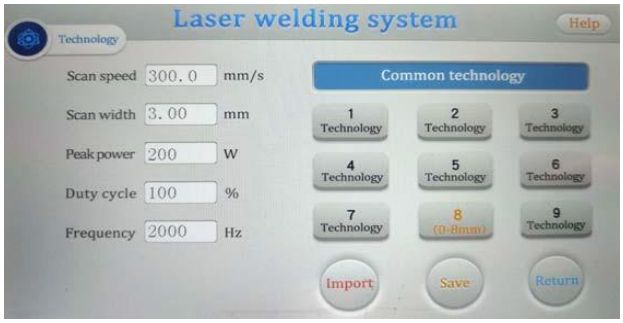
## Touch Screen Operation and Home/Main Screen

The touch screen has several pages to it, depending upon the process selected. The sliders indicate on and off or status conditions. In general, the left side of the screen data indicates the settings and values at which the machine is operating. The right side allows access to other settings and screens via touch of the icons.


- In this screen, the laser is enabled and the slider switch should appear to be slid to the right position. The laser is then enabled and the Pilot/Target laser is turned on automatically when the laser is enabled. The target laser is a class 1 laser and is not powerful enough to weld or do damage in normal conditions. However, do not leave the laser enabled unless you are ready to weld. Do not intentionally stare or look into the laser. Eye damage can still occur.
- The safety (Secure) lock icon on the screen is normally gray in color. However, when the gun(torch) head touches the workpiece with the safety clamp connected to the work piece, it senses continuity between the torch and work piece and will turn green. When the secure/safety lock turns green, the trigger is enabled and ready to fire the laser and weld.
- The welding mode slider is the defaults to the “Continuous” mode. The slider alternate setting for the Welding mode is “Spot” welding. This is a timed, intermittent pulse of the laser which helps to create precise pin-point welds without having to manually trigger and time a weld duration and release. When set properly the spot timer will allow the user to create consistent sized tack and spot welds.
- Notice the Pilot/Target Laser (Red Light) Indicator shape allows two different shapes to be selected. The default shape is “Line”. The alternate shape setting is a “Dot.” The dot is useful mainly in cutting.
- The “Recycle” arrows located at the top right allows you to access the derursting/descaling/paint removal program of the machine. When pressed the machine guides you through the steps required to change to cleaning. This includes a machine shut down at the key switch and reboot to make sure that the engagement of the derusting/descaling program is not accidentally engaged.

## Laser Welding Technology (Program) Process Screen

The technology/process screen allows the user to set up and save welding process parameters. This screen also allows you to save parameters in multiple programs. NOTICE: Touching any setting value on any screen with adjustable settings will bring up the number pad to enter the settings.




- To select a parameter for adjustment, touch parameter box related to the adjustment desired. Then use the pop-up number pad (not the ones labeled technology) to enter the desired value. Press "OK" on the number pad to finish and close the pop-up number pad.
- To save a parameter, press "Import," then press desired program number. Make adjustments to parameters. Press "Save" to finish adjustment. Press "Return" to go back to the home screen.
    - Process: Import>Number>Adjust>Save>Return
    - Program Number 8 should be reserved for weld cleaning functions only. This allows access to a wider cleaning (scan) width.

## Scanning/Wobble Settings Information

Scanning is a function of this laser which results in a wobbling/oscillating pattern of the laser beam. When combined with the output power (Wattage), it improves the wet in of the puddle and the grain structure of the post weld metal. It can also reduce any spatter crated during the melting process of the metal. The scan speed is how far the scan wobbles/oscillates in one second. The Scan width is how wide the beam wobbles in its scanning pattern. The scan frequency is how fast the scan completes one cycle, or in more precise terms it is how many times per second the scan cycle completes. This is expressed as Hertz. The Scanning speed is ultimately limited by scan width. The beam has a physical limit to how far it can travel in one second and ultimately limits how many scan cycles can be completed in one cycle based off the scan speed. In practical terms this creates a "wide" beam. Even though it is a single point laser, it acts a much wider or multiple lasers as it rapidly oscillates. As represented visually in the Target laser beam pattern, the scan width can be seen to change from narrow to wide as scan width is increased. The beam simply is moving so fast it appears a broad line. As the beam scan width widens, the weld puddle will widen. The weld will be wet in quickly and flatten as wire is added. The options for scan width, speed and peak power varies as follows:

- The scanning speed ranges from 2 to 6000mm/S
- The scanning width range is from 0 to 5mm, except for weld cleaning (Program 8).
    - The scanning speed is limited by the scanning width. There is a physical limit to the scanning speed. If the setting exceeds the limit, it will automatically default to the limit value.
- **When the scan width value is set to "0", this eliminates the scanning effect. The laser will**

essentially become a single point light source and will not weld very well.

- The most commonly used scan speed: 300mm/S, width 2.5mm.

- The peak power must be less than or equal to the laser power on the parameter page
  - Example: If the laser power is set to 1000W, then the value peak power should be set to less than 1000W.
- The Duty ratio range 0~100% .
  - The normal setting for most purposes is 100%
- The recommended scan pulse frequency range is 5-5000Hz
  - The default frequency is 2000Hz. Normally most operations can be performed at this setting.
- Press the HELP button on the upper right of the screen to get more parameter related info.
- To open saved or pre-programmed settings:
  - Touch "Common Technology" bar at the top.
  - Touch the program number desired on the key pad depicted on the side of the screen.
  - Touch "Import" to load the program.
  - Make any adjustments to program (Only touch "save" if changes are to be permanent)
  - Touch "Return" once the program has loaded to go back to the "Home" menu.

### Suggested Welding Settings

The welding settings in the chart below are approximate settings. This is not an exhaustive list, but are settings that are fairly common. They may not be correct or appropriate for every application. They are offered only as a starting point. In general, the small wire diameters will be fed faster than larger wire diameters as the thickness of plate goes up.

| Material | Thickness | Wire Feed Speed | Scan Speed | Scan Width | Output | Duty Cycle | Frequency | Wire Size |
|---|---|---|---|---|---|---|---|---|
| Steel | 1 mm | 100 mm/s | 300 mm/s | 2.5 mm | 400 W | 100% | 1000 Hz | .9 mm |
| Steel | 2 mm | 75 mm/s | 300 mm/s | 3.0 mm | 600 W | 100% | 1000 Hz | 1.2 mm |
| Steel | 3 mm | 60 mm/s | 300 mm/s | 3.5 mm | 900 W | 100% | 1000 Hz | 1.6 mm |
| Stainless | 1 mm | 100 mm/s | 300 mm/s | 2.5 mm | 400 W | 100% | 1000 Hz | .9 mm |
| Stainless | 2 mm | 110 mm/s | 300 mm/s | 3.0 mm | 700 W | 100% | 1000 Hz | .9 mm |
| Stainless | 3 mm | 100 mm/s | 300 mm/s | 3.5 mm | 900 W | 100% | 1000 Hz | .9 mm |
| Aluminum | 2 mm | 75 mm/s | 300 mm/s | 2.5 mm | 700 W | 100% | 1000 Hz | .9 mm |
| Aluminum | 3 mm | 60 mm/s | 300 mm/s | 3.0 mm | 900 W | 100% | 1000 Hz | 1.2 mm |

- These numbers are in metric value. Because of the industry and the favoring of laser related technology values being expressed in metric terms, the programming is in metric as well.
- To convert values from metric (in millimeters) to inches, divide the metric value by 25.4 to obtain the approximate decimal value in inches.
    - These are rounded, closest approximate or common thickness values:.9mm =.035", 1 mm=.040",1.2mm =.045"/.047"/3/64", 1.6mm= .062"/.062" 2.0mm=.078", 2.5mm= .098", 3 mm=.118", 3.5mm=.137", 4mm=.157mm
- If the exact plate millimeter thickness that corresponds to an equal Imperial unit or gauge is not listed, use the next closest setting or a midpoint setting between the closest two settings.
- The wire feed and scan width metric value settings are intrinsic to the machine and are relative to the power being used. They do not depend upon a conversion to be used properly. It is not important to convert these settings into Imperial values unless the user feels more comfortable with the magnitude of the value and units.

## Main Control Settings

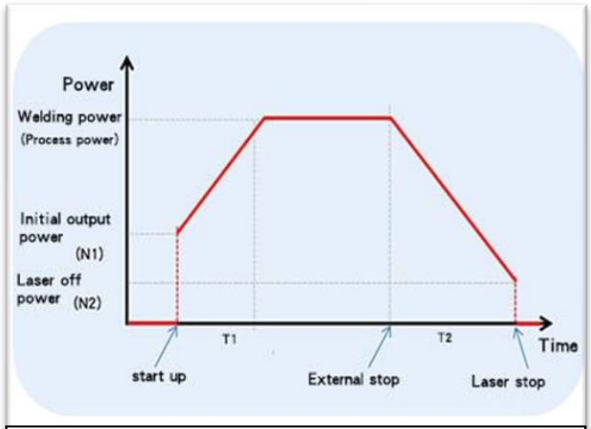
The unit allows full adjustment of all operational functions beyond the actual weld settings. To access the weld settings, touch the settings icon on the Home screen and the unit will bring up an access code/pass word screen before it allows changes to be made in the settings. This is designed so the welder base operation parameters cannot be changed arbitrarily except by an authorized administrator or supervisor. The settings page offers protective control over different temperature sensitive components. For nonnative English speakers and readers, this screen allows the user to choose from several different languages. See the overview of the settings below and the drawing on the next page for more explanation and illustrations of settings and functions.

NOTICE: This is a sample screen and programming designed for multiple units. Actual screen may not have all options functioning (i.e. water cooler functions).


- Default PIN/Password for setup: 123456. Press OK after entering the PIN.
- The laser power is the maximum output power (in watts) at which the welder is permitted to operate. This is designed so the machine does not exceed work parameters by the user. Typically, this would be set by an administrator or welding supervisor.
- The Pre-flow (Open Gas Delay) is important to set so that the shielding gas is flowing at the time the laser energizes and the weld metal is protected from oxidation. This will delay the actual start of the laser welding process by the amount of time set. Default Time: 200ms. Range: 200-3000ms.
- The Post-Flow (Off Gas Delay) is important to shield the weld after the laser beam has been shut off. It helps to prevent oxidation while the weld is hot. It also helps to cool the gun and extends the consumable life. Default Time: 200ms. Range 200-3000ms
- The laser programming has the ability to start at a lower power setting than the welding wattage setting. It then "up-slopes" the power setting from a beginning wattage (based on % of Maximum) setting to the Maximum wattage setting allowed. Both the start setting (Laser Starting Power) and the up-slope time (Laser On Progressive Time) can be adjusted. The up-slope time defines the amount of time it takes to ramp up from the start setting to the full wattage set on the machine.

- Starting Power Range: 1%-100%. Default: 30%
- Up Slope Time (Laser On Progressive Time) Range: 0-2000ms. Default 500ms.

- The laser programming has the ability to end the weld at a different power setting than the welding output setting. The wattage is gradually decreased, or "sloped" down to the final power setting (Laser off). This down slope time is called "Laser off Progressive time.
  - End (Laser off) Power Range: 1-100% of Welding Wattage. Default: 80%
  - Down Slope Time (Laser off Progressive Time): Range: 0-2000ms. Default 500ms.




Laser Starting, Welding and Ending Power Illustration

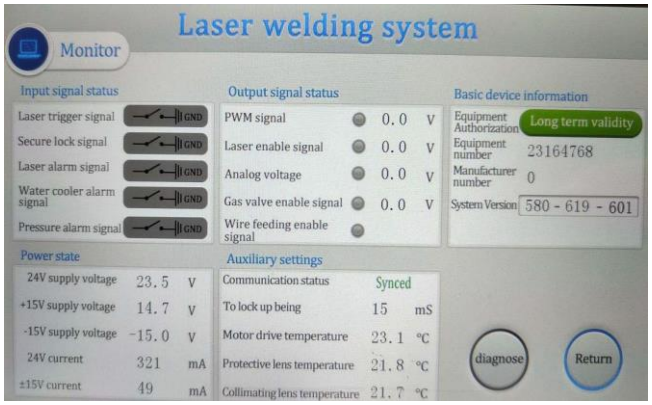
- When used with the wire feeder, the Wire Feeding Delay programs a slight pause in the wire feeding after the laser is fired (turned on). This gives the laser time to establish a welding puddle before feeding wire directly into the puddle area. This feature can be combined with the wire feeder retraction function to improve weld appearance and penetration before at the beginning of the weld.
  - Default time: 0 ms.
  - The Temperature Threshold parameters set the temperature at which the Alarm/Warning will be engaged when each gun component overheats. The maximum temperature alarm threshold is 70 ℃(158°F). It is recommended to set all values to 50°C. When the value is set to "0", the temperature alarm will be shut off. A setting of "0" could cause damage if the gun if it operates above the maximum rating. The exact operation threshold varies depending upon what temperature is being monitored and ambient temperature where the gun is used. Gun motor temperature may run higher than the other components so it may need to be set it slightly above the other temperatures. Avoid operating the alarm at the maximum threshold settings, if possible, to extend gun life to the maximum.
  - The Scan Correction parameter is used to calibrate the scan width of the red Pilo t(Target) laser so it can be reconciled to the actual scan width of the welding beam. This allows discrepancies to be eliminated between the two beams.
    - The scan correction coefficient range: .01 to 4

- Start with a 1.25 setting, then adjust from that point.
  NOTICE: Scan correction is accomplished through trial and error by experimenting with the visual scan width of the Pilot laser and the actual welded area.

- The Laser Center off set parameter calibrates the center of the Pilot Laser. The red Pilot Laser needs to be aligned with the actual target point of the welding beam. While the actual aim of the welding laser is accomplished through the rear adjustment screws under the guns cover, the red Pilot laser may become off centered and out of alignment with the target point of the welding beam.
  - The Laser center offset ranges: -3 to +3mm
  - -3mm = fully left adjustment; +3mm = fully right adjustment.
- The Alarm sound level can be adjusted through the alarm level settings for the unit. The low setting is the default. For noisy shops the high setting may be preferred.
- For rapid, quick welds or for welds requiring precise size and timing, the Spot Weld function offer several adjustable parameters. The Spot Weld function times how long the welding beam remains on while the gun trigger is held down. The beam will time out and turn off automatically, even if the trigger remains held down.
  - The Spot Weld Time Duration. This times how long the beam stays on while triggered. To deactivate Spot Function, set parameter to "0".
  - The Spot Weld Interval Time Duration. This times how long the beam will stay off if the gun trigger continues to be held down before another spot cycle occurs. This creates an alternating "on/off" cycle of the weld beam allowing long seams to be welded together with regular evenly spaced welds. This is often referred to as "Stitch" time. If the Stitch function is not desired, but the Spot function is desired, set to Weld Interval to "0". Set to "0" as a general default unless it is needed or the gun may flash on and off if this is forgotten. Keep in mind that the Stitch function will continue to cycle as long as the trigger is held down.
  - The weld shape may be altered as well. Default is "fish scale" which is a normal rounded shape.
- The Help mode can be pressed to access information on any unknown function.

### Monitoring Machine Status and Information

This unit has a self-monitoring mode available through the home screen which allows the user to access and view machine status. This is helpful in diagnoses and evaluating machine health and functions.




## Welding, Cutting and Weld Cleaning

The Red Sabre is a multi-function welder. This allows it to have a broad appeal to a wide range of customers in various industries. Each function is distinctly different from the other. But, at the same time, they are all related to each other through the fact one laser is accomplishing all tasks and it's only the setup or programming that distinguishes one from the other.

### Laser Welding.

Operation of the welding function is straight forward, once adjustments are made and the correct nozzle has been installed. In general, the weld width can be up to 6 mm depending upon the weld width desired. In most circumstances, the Pilot laser should be set to "Line" rather than dot so the width of the weld can be clearly seen. To Operate:

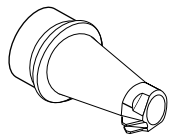
- The unit is turned on and the welding parameters selected and set.
- The Safety Clamp is attached to the work piece (Direct as possible)
- The gun's welding-type nozzle is placed in contact with the metal and the safety lock will be released.
- The Pilot Laser is aligned and centered to where the weld is desired.
- The trigger is pulled and the beam is turned on. The puddle quickly develops
- The gun is drug quickly and smoothly with the hand leading the welding puddle. The gun should never be pushed so that the gun trails the puddle. The gun should always lead the puddle. Work should be arranged so that a pull position can be maintained.

**NOTICE:** If the wire feeder is attached, the feeding of the wire will give a push effect. Initially this may startle or surprise the user. It may even feel somewhat disconcerting at first, but it is not a malfunction of the gun or the setting. It is a smooth and easy yet somewhat firm push. The push feeling should not be fought. While the gun should be securely gripped and supported, the user should not resist the push of

the wire. The push speed should not be impeded by applying counter pressure in any way. If the push is too fast or fusing of the metal is not complete, slow the feeder speed down rather than resist the push of the wire.

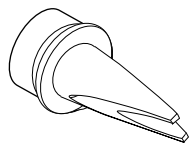
Make sure the correct desired welding nozzle is installed before turning on the machine. As a best practice always turn the machine off to make any nozzle changes or major adjustments to the gun setup, including installing the wire feeding bracket. Also make sure wire feeding attachment is correctly attached if the use of the wire feeder is to be employed. (See more later on wire attachment and use in the wire feeder section.) Select from one of the following nozzles. There are two basic types. However, some nozzles may be used for several different joint types or applications.

- Nozzles with wire feeding guide capability. The number and letter system represent the type of use and the wire size (in millimeters) the nozzle is designed for. However, these nozzles may have more than one suitable application other than the one specified. The stated uses are not absolute. The wire feed trace of the nozzle should be mounted so the nozzle risers are turned down and ride against the metal when drug. If they cannot be installed on the bottom when tightened, the focus tube must be loosened and readjusted so that the risers are flat in contact with the weld metal.



  - AS-12: Flat, bevel and inside corner joints. .8mm, .9mm, 1.0mm and 1.2mm wire sizes.
  - BS-16: Flat, bevel and inside corner joints. 1.6mm wire size
  - CS-12: Outside Corner, General Purpose. .8mm, .9mm, 1.0 and 1.2mm wire sizes.
  - ES-12: Flat and Outside Corner. .8mm, .9mm, 1.0mm, 1.2mm wires
  - FS-16: Flat and Outside Corner. 1.6mm
  - AS-20D: General Purpose (mainly used for weld cleaning and not welding) for Twin wire feeders only. .8, .9, 1.0, and 1.2mm wire sizes. (Twin Feeder not currently available for Red Sabre 1500.)

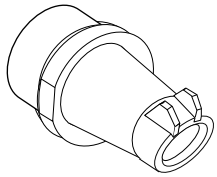
- Nozzles without wire feeding capability. These nozzles are used to make autogenous welds and are not typically used with any kind of filler metal. There is no provision for it. The nozzle should be adjusted so that both forks are flat and in contact with the weld metal.



Type C Nozzle. All Purpose. Currently only non-feeding type. *Some wire feeding nozzle types can be used without wire for some applications in lieu of the type C nozzl.*

## Weld Cleaning

The Weld Cleaning function is part of the welding function of the machine. It differs from the actual De-scaling and Rust removal programming. The standoff height is different, and a different scan program is used with relatively low wattage. The wattage should only vaporize the oxidation. It should not be set to melt the metal. It is mainly used to clean up welds and small seams and to prepare for passivation after the weld is completed. This will also help remove and descale any oxidation left over from the welding process. To setup the machine for weld cleaning, the correct nozzle must be installed and the wire feed system removed from the gun or the wire must be withdrawn from the cleaning area. (Use the feeder settings to retract the wire). Use the following steps to set the unit up for weld cleaning and oxidation removal:



- Install the AS-20D Nozzle. Make sure the wire feeding standoff is at the bottom. Rotate so that the risers are on the bottom.
- Select Laser Welding. Do not select cleaning function.
- Make sure the laser is “Enabled.”
- Select the Program button (Technology button).
- Import program 8. This allows a wider than normal scan width for a wider cleaning than the welding function. Maximum welding width is 6mm. Program 8 allows up to 8mm to be selected for this function. Program 8 should only be used for cleaning. Never try to weld this wide. The scan width sets the total width of the cleaning path. *If program 8 is not imported, the machine will only be limited to the welding parameters which can be used to clean at low power and low frequencies, and the scan width will be limited to 6mm maximum instead of the full 8mm range.*
- Weld cleaning requires relatively low wattage. 200-900W typically. Ultimatley it depends on metal thickness, weld width and cleaning power needed to get a thorough clean. Test before cleaning the weld. A small narrow band of cleaning should be seen on both sides of the weld. It should only need 1 pass for most welds. If two passes are needed, increase wattage by 50 to 100W and retest until the correct amount of cleaning is achieved. If too much wattage is used, the weld will begin to remelt.
- For high scan width (wide) weld cleaning (6-8mm), set the Scan Frequency to a higher setting (1000mm/s). This helps to prevent etching lines, unless they are desired for an artistic effect. A lower value like 300 mm/s will result in etched lines similar to a weld bead and may not clean as thoroughly or as smoothly. Also for wider/thicker welds, increased power may be required up to 900W. Do not use too many watts or the metal may begin to remelt.

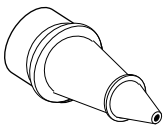
## Laser Cutting

Another function based on the Laser welding programming of the welder is laser cutting. This is designed to make clean and narrow kerf cuts in metals up to 3.5mm. The actual cut capacity is limited however to the metal type and may vary slightly. The cutting function does not use or require argon. The cutting function uses compressed air. The air must be dry and oil free. A dryer and an oil capture filter must be used in line. The cutting function may be used with $N_2$ gas and a high flow regulator. A standard regulator will not produce enough gas typically. Gas flow demand is at least 5 cfm @ 72 PSI. It is very important before the use of the laser cutting system that the laser beam is aligned properly and that the Pilot (target) laser is in alignment. Normally the laser will be in alignment, but check alignment with a regular welding nozzle before attempting to cut if it is suspected the laser may have gotten knocked out of alignment by a fall or impact to the torch head.

Proper Laser Cutting Technique

**WARNING!** The laser cutting process allows the beam to penetrate through the metal. Without a back stop material, the beam will hit other items beyond the cut. An errant beam can burn or cut into clothing, skin or any other target behind it at a considerable distance. Additionally, any reflective material behind the cut beam as it passes through the metal being cut can be reflected. Keep all body parts away from the back side of the metal during cutting. Place a thick metal plate or cut resistant material such as a ceramic block or fire brick behind the cutting area to absorb the beam as it cuts.

- Connect the air compressor to the Red Sabre. Be sure to preset Air pressure to 65 to 72 PSI before cutting. This air pressure not only keeps the torch cool while cutting, it also helps to remove the cut material from the kerf.
- Select the cutting nozzle and install it. The cutting nozzle is a specially made nozzle. It is only available in one size and is tapered to a point at the end. The opening is narrower than the welding nozzles. Make sure the end of the nozzle is free from defects and shows no signs of crushing or burn through on the sides.



- Select the Laser welding system function.
- Enable the Laser on the “Home” Screen.
- Under the “Technology” program screen, set the scan width to “0”. This is very important. Setting any scan width will damage the nozzle. The laser will be a pin point at this point. If the red Pilot laser isn’t centered in the nozzle, check and calibrate it so that it is and that the laser

cutting beam is centered in the hole of the cutting tip. Start with a welding tip first to correct and calibrate the aim of the Pilot laser.

- Set power to maximum 1500 Watts. If the settings do not allow it,go to the “Settings” program screen and reset maximum wattage value. the “Settings” program screen.
- The safety clamp must be attached to the material being cut.
- Raise or place the part being cut to at least three inches off of burn resistant backing materials such as thick plate metal or ceramic blocks/ fire bricks.
- Make sure all flammable material is cleared from behind the part being cut. Make sure no one is standing behind the part being cut while or in any angle in front of the cut. Keep all personnel behind the path of the cut/user.
- Place the gun on the material as shown in the picture above (previous page). Squeeze the trigger and drag the gun. Make sure the air is flowing.
- Pull the gun at a steady rate until the cut is complete and then release the trigger.

## Laser De-Rusting/De-Scaling/Paint Removal

The Red Sabre may be used to De-Rust and De-Scale metal. It can also to remove paint and coatings from metal. This special process allows rapid removal of rust, mill scale, paint and other coatings from metal items without overheating or deeply etching the metal. The clean width can be up to 60mm wide, depending upon the focal length of the focus lens. The standard focal length lens used is the 800mm focus lens. Cleaning may also be done with different shorter focal length lenses but the cleaning width will be smaller. This process can reduce the amount of environmental toxic waste and speed up restoration and preparation time required for painting or after weld cleanup

**WARNING!** The laser derusting/descaling cleaning process exposes the user directly to the laser beam. There is a greater risk of coming directly into contact with the beam. The beam scans wider and is held off a relatively great distance from the metal. There is a greater opportunity for accidental exposure. Do not place hands, feet or any body part in contact with the beam. Keep all body parts covered to prevent ultraviolet (UV) exposure. Keep all flammable substances out of direct contact with the beam. Make sure all combustible items such as fuel, plastic and paper are removed from the laser effective area. Additionally, use a respirator or provide approved ventilation due to potentially harmful particles being vaporized into the atmosphere. Be aware of possible inhalation hazards associated with vaporizing certain coatings, certain metals and other contaminants. There may be toxic fumes emitted. When exposed to the vaporized, air borne by-products of the laser cleaning process the user may experience respiratory distress, illness, death, or hidden long term health hazards. KNOW THE RISK! Make sure safety counter measures are in place. Keep respirators maintained and ventilation filters in good condition. Remember, the safety clamp is not used and no contact with the metal is made to operate the laser in the cleaning process. Accidental starting of the laser is possible. Always select the double trigger to ensure the beam cannot be energized with a single finger press. Remember to change over the gun during the changeover to the laser cleaning process while the machine is turned off at the switch.

Change Focus Lens

Remove Focus Tube

Select Cleaning Nozzle

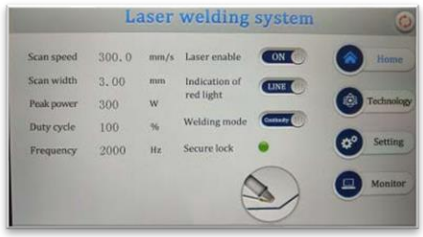
Install Cleaning Nozzle

### Accessing the Laser Cleaning Program

The cleaning program cannot be accessed directly. This is to improve safety and prevent accidental use of the program while welding and vice versa. It must be done consciously and the procedure followed to

access the program. Use the following steps to access the Laser Cleaning programming designed for De-rusting, De-Scaling and Paint removal:

- To access the program while in the Laser Welding Mode, press the recycle symbol located in the top right hand area of the screen



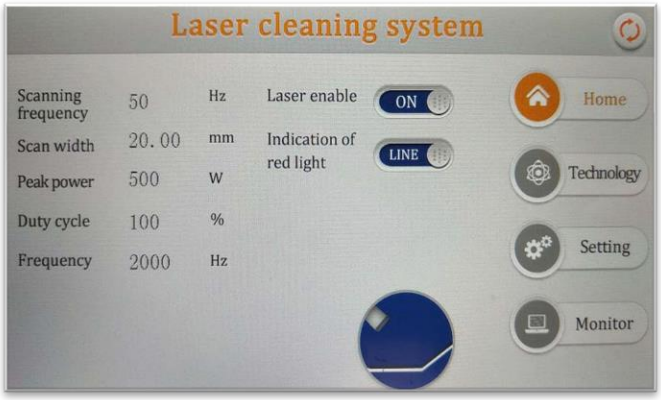

- The screen will display a confirmation screen to warn that the user is about to trigger the Laser Cleaning Programming. Press Confirm to begin the changeover. Press Return to re-enter the Laser Welding Mode.


- Once the change to the Laser Cleaning Program is confirmed. The program screen will ask for the unit to be powered off. Power the machine off at the key switch.


- Once the machine is powered down, Turn the key switch back on. The programming will reboot into the welcome screen. Once the program has rebooted, the screen depicted below should display. Once this displays the changeover process is complete. You have now accessed the Laser Cleaning Programming.

## Using the Laser Cleaning Program

The Laser cleaning home program is not completely different than the operation and function of the laser welding program, but there a few differences with range and control of settings.




- In this screen, the laser is enabled and the slider switch should appear to be slid to the right position. The laser is then enabled and the Pilot/Target laser is turned on automatically when the laser is enabled. The target laser is a class 1 laser and is not powerful enough to weld or do damage in normal conditions. However, do not leave the laser enabled unless you are ready to weld. Do not intentionally stare or look into the laser. Eye damage can still occur.
- The safety (Secure) lock icon does not exist on this screen. The gun does not touch the metal and can fire without the safety clamp attached. Be careful about handling or placing the gun in a way that the trigger could come into contact with an object that would fire the laser if the pressure or weight of the gun were to be placed upon it..
- Notice the Pilot/Target Laser (Red Light) Indicator shape allows two different shapes to be selected. The default shape is “Line.” For Cleaning use, the line shape is always recommended.
- The “Recycle” arrows located at the top right allows you to access the Laser Welding Programming. When pressed, the machine guides you through the steps required to change over to the Welding Programming functions. This includes a machine shut down at the key switch and reboot to make sure that the engagement of laser welding program is not accidentally engaged.
- To access any of the other functions/screens touch the right side buttons. These are important to use for making adjustments to settings.

**WARNING! Before using the laser for cleaning purposes, make sure the Argon has been disconnected and that compressed air or $N_2$ has been connected and turned on. Failure to have air or $N_2$ connected will damage the gun(torch) head.**

## The Laser Cleaning Technology (Program) Screen

The Laser Cleaning technology screen assists the user in making the basic adjustments in the cleaning settings. You will notice that the scanning speed has changed to scanning frequency. The other frequency refers to the laser operation itself. There are less programmable features. There are only two available.


- To select a parameter for adjustment, touch parameter box related to the adjustment desired. Then use the pop-up number pad to enter the desired value. Press "OK" on the number pad to finish and close the pop-up number pad.
- To save a parameter, press "Import," then press desired program number. Make adjustments to parameters. Press "Save" to finish adjustment. Press "Return" to go back to the home screen
    - Process: Import>Technology Number>Adjust>Save>Return
- The Scanning frequency range is determined by the width.
- The Scanning width allowed to be set is determined by the focus lens and gun type selected in the settings menu. Range is 0-20mm, 0-40mm or 0-120mm. If scan width is set to zero, the laser will be a pin point and will not clean properly.
- The Peak wattage cannot be set higher than the limit allowed on the settings page.
- The Laser frequency range is 5-5000Hz. The default is 2000Hz. The frequency will change the resolution of the scan. However, the frequency does not normally need to be changed.
- Press "Help" to get more explanations on the laser cleaning settings.
- Duty Cycle should remain at 100%.

## The Laser Cleaning Settings Screen.

The laser cleaning settings screen allows the full range of settings to be adjusted and gives master control over all the settings, ranges and functions. The use of the cleaning settings function is password protected to prevent unauthorized access.

- To access the settings screen, touch the settings icon on the right side of the home page
- When prompted, enter the password on the pop up key pad.
    - Password: 123456
- The Laser Settings Screen will appear.


- The first priority when entering the settings screen is to make sure the correct gun and focal length have been entered. <u>If the focal lens and focal length is ever changed, this must be the first thing that happens to protect the gun from damage. Selecting the correct focal length is critical.</u>
- Touch the top bar button with “Gun Head Model” to enter the gun head selection screen seen below:


    - Enter gun information and focal length of the focus lens. The gun is always the SUP21T. You will need to confirm the focal length of the focus lens. The one provided with the machine is 800mm. The standard lens or others may also be used but it will narrow your scan width. Entering return will exit and send you back to the settings screen.

- When the focal length and gun head have been entered, the machine will automatically go back to the settings page with the new parameter limits established in the programming.


- The settings and ranges below are important to how efficient the cleaning function performs.
    - The maximum power (wattage) sets the strength of the cleaning action. Usually cleaning takes place well below 1000W. Start with 300-400 Watts maximum allowed setting.
    - The Pre Flow (Open gas delay) sends air through the gun before the laser fires. For cleaning use only a short pre-flow is required. The default of 200ms is enough for most purposes.
        - Default: 200 ms
        - Range: 200-500ms
    - The Post Flow (Off gas delay) keeps air flowing and cooling the gun after the laser beam is turned off. This keeps the gun cool. The default of 200ms is enough for short or spot cleaning. Increase time as the gun begins to feel warm during heavy use.
        - Default 200ms
        - Range: 200-500ms
    - Scan correction aligns the Pilot laser light with the actual scanning of the laser beam.
        - Coefficient Range: .01 to 4
        - Typical is 1.25
    - Laser Center Offset adjusts the focus of the laser left or right to get the laser to line up with the center target area of the gun.
        - Range -75 to +75mm
        - -75= fully left; +75 =fully right

- The maximum operating temperatures of the gun components is 70°C (158° F). However, it is not recommended to set the maximum tolerance temperature that high. It can reduce service life of the gun and components.
    - Set mirror and collimator temperature to 50°C (122°F)
    - Set gun motor up to 65°C (149°F)
- Laser Starting Power (Starting Power) sets a low wattage start so the laser can ramp up to the maximum cleaning force. Expressed as a percent of Maximum set power.
    - Default: 30%
    - Recommended: 30-100%
- Laser Up Slope Time (Progressive time) is the set amount of time required for the laser to ramp up from the starting Wattage to the set maximum welding wattage
- Laser End Power (Laser off Power) is an ending power setting used for gently terminate the weld beam.
- Laser Down Slope Time (Laser off progressive end time) is the set amount of time required for the laser to ramp down from the welding Wattage to the laser end power setting.
- **Laser Trigger Setting is very important to operator safety.** The programming allows a choice for single or double presses of the trigger to fire the laser. The default setting is double press. It is highly recommended that this stays the default setting. This helps to prevent accidental triggering of the gun since the safety cable cannot be used with this type of operation. This adds a layer of safety. Setting to single trigger mode is not advised and can be a safety hazard, especially in the hands of an inexperienced user.

**Laser Cleaning Operation (De Rusting, Derusting and Paint Removal)**

Make sure all safety gear is worn, including respirators before using. In the main administrative "settings" menu, the gun should be set to double trigger press mode**. Never operate in single trigger mode.** To operate the Laser Cleaning function, observe the following procedure.

- Check the following:
    - Ensure the correct focal length and gun has been selected,
    - Ensure the correct lenses and nozzles have been installed.
    - Ensure that the Argon has been swapped for Compressed air or $N_2$
    - Ensure the air flow is on and the pressure is set between 65 and 72 PSI
    - Double Press Trigger mode is selected in the Settings Menu

  Laser is enabled (Laser is only enabled when the unit is immediately ready for use. Keep disabled otherwise.)

- Adjust the cleaning to 300W
- Set scan width to maximum setting if it is a large piece. Set to a low setting for small or narrow objects
- Holding the gun approximately 2 feet away from the metal, aim the gun toward the part being cleaned. (It's recommended that the first operation be performed on a test piece.)
- The gun should be held at a slight angle. Do not hold perpendicular in case the beam is accidentally reflected back to the user.
- Double press the trigger and hold it on the second press. The beam will energize and the cleaning process will begin.
- Adjust the gun distance to the preferred distance to get the best cleaning action and pattern width. Move the gun in and out while moving to see the pattern and width.
- Slowly move the gun up and down or back in forth over the part being cleaned. Move the gun steadily watching as the weld is cleaned. If the gun is traveling too fast, there will be a fine zig zag pattern. If the zig zag pattern persists after slowing, increase the Scan Frequency.
- If it takes multiple passes to clean an object or cleaning travel is too slow, increase wattage.

**CAUTION: Pay close attention to the beam scan width. If it is not carefully managed, the beam along the edges or the beam is too wide for the part being cleaned, the beam will strike the objects in the over-run path and they may become damaged. Keep hands, feet and all body parts out of the way of the beam.**

**NOTICE:** *To Re-enter the welding mode, use the same steps, (starting by pressing the recycle button in the upper right-hand corner) used to enter the cleaning mode and follow the prompts.*

## Wire Feeder Use and Installation

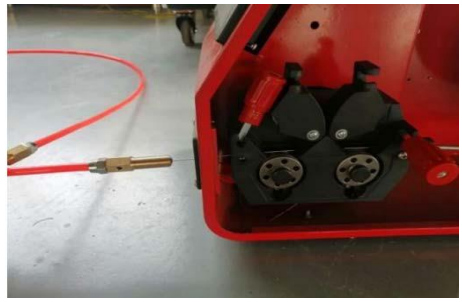
The wire feeder for the laser is similar to a MIG welder feeder. A user familiar with MIG welders will find the unit fairly straight forward and easy to setup and load. The main difference is that there is only a conduit instead of a gun attached to it and the feeder does not provide welding power. It is a pure "cold feed" system. It works in conjunction with the laser welder to feed wire into the puddle. This assists in developing weld strength and improving bead profile. It can also be used to help bridge small gaps where there are discontinuities in fit and where gaps are required for the root.

The feeder can be used with 8 and 12" spools of wire. Typically, it is best to use a full size roll if much welding is performed. *Even with thinner gauge materials .045" wire gives excellent performance. Of course larger or smaller wires may be used, but .045" is a good choice if multiple projects and thicknesses are involved.* The wire feed utilizes a dual drive system, which includes 4 total rolls. The unit includes several drive rolls so that the unit can be used with any common sized wire. The unit includes .8mm-1.0mm and 1.2-1.6mm kits (.030-.040 and .045-.062). The feeder can feed multiple wire types. Always make sure the correct wire is installed before use. Never use Flux-Cored wire types in this unit.

### Wire Installation.

- Select and ensure the correct sized drive rolls are properly installed.
    - Lower Tensioners and raise drive roll arms to change drive rolls
    - Loosen the thumb screws and remove each drive roll individually.
    - Only the bottom drive roll is removed. The top drive rolls are captive and should not be removed.
    - The drive roll size stamped on the side of the drive roll and is marked on the opposite side of the corresponding groove dimension.
    - Install the drive roll so when in use the drive roll size will be visible to the user.
    - Tighten thumb screws with only light pressure. Do not use tools or tighten very tight by hand.
- Install the wire with the wire trailing from the bottom edge as shown.
    - Be careful to prevent the wire from de-spooling during installation
    - Tighten the spool retainer hand nut gently only enough to prevent the wire spool from spinning with light twisting pressure applied.
    - Feed the wires over the drive roll grooves manually.
    - Feed the wire into the tube pickup at least 6" (See below on wire tube installation)
    - Lower Drive roll arms and adjust tension to a midway setting. If too tight the feeder may bind or the drive rolls may score the wire, which damages the tube liner. To light of tension will result in wire feed slippage.

- Install the wire tube into the feeder as shown below. Make sure the tube is fully inserted and tightened into the assembly. This part is brass. Be careful about overtightening
    - Match the copper wire tip up to the wire size installed.
    - Attach the tube to the Gun Head bracket
- Install both of the aviation-type connectors feeding from the laser power chassis.
    - Make sure power is off before making connections
    - Notice the two plugs cannot be confused. One has two pins, the other has 3 pins.
    - One line feeds the drive motor. The other line feeds the power to the display and processors. Do not touch live connections. These plugs are supplied with 24 V and 240V high voltage.



## Wire Feeder Use and Programming

The display has two pages: The home page and the Settings page. These pages are used to setup, calibrate and synchronize the wire feeder with the timing of the laser beam "turn-on".

The feeder should always be powered up while the laser is in use if wire is to be used. Always check control connections before use.

- To operate observe the following information
    - The Numerical display on the home page gives the feed rate in cm/min (2.54 cm per inch). The feed rate can be determined by using the chart found earlier in this manual concerning welding settings.
    - The unit has a wire jog function. Press and hold "Manual Wire Feeding" and the wire will spool out without the laser trigger being pressed. This is helpful for fast installation of wire, or to make fast adjustments. This feed rate is not the same as the set feed rate.
    - If the wire is over fed, the wire can be manually reversed (withdrawn) by pressing the "Manual Withdrawing" button and holding it until the wire is withdrawn enough.
    - The Home screen features a simple up or down control for wire speeding speed. The approximate feed is reflected in the display
    - Click on the Settings mode to access the settings. These settings allow you to fine tune the feeder and set boundaries for maximum rates


### Fine Tuning the Settings

The settings menu is accessed from the home screen. These settings help to define and fine tune the behavior of the feeder when the gun trigger is pulled and the laser beam starts. For some circumstances programming a slight delay in the wire feed is helpful so that a puddle can start and the beam does not hit cold wire before the weld puddle has had time to develop. The following settings are available for adjustment.

- Feeding Speed. This sets the maximum limit that the feeder can be set to. The feeder is capable of feeding at much higher rates than is needed. It is a good idea to program a lower maximum feed rate to prevent problems with welding. The feed rate of the wire also will give the user a “push” sensation. This may cause the user to move too fast before the puddle has fully melted.
- Start Up Delay. This sets a timed delay before the wire starts feeding. This delay allows the puddle to develop before wire is pushed into the puddle. This helps prevent poor fusion at the start. Adjust this through trial and error. It will depend on the joint type, gun angle and even the user.
- The wire can be programmed to withdraw before the weld is started to prevent feeding over wire that has run out after feeding has stopped. The will cause the wire feeder to reverse. Again, trial and error is required to determine the best setting as it will vary based on wire speed settings and user technique.
- The supplemental length is used to feed extra wire into the area as the puddle cools and the wire has melted back too far (especially during high wattage welds).
- The supplemental delay programs the amount of time the feeder waits before the supplemental wire is fed out from the spool to replace the over melted wire from the previous weld.

- Manual wire feed speed programs the wire jog “cold feed” speed. This feeds at a much faster rate than the welding speed feed out. Set the feed rate here in the settings menu. It’s recommended not to exceed three times the feed rate.
- Manual Wire retract feed. This is the rate at which the wire feeder retracts the wire after an “over feed” This setting should always be lower than the wire jog feed rate. Typically a 10% to 20% feed rate should be used than that of the wire jog (manual feed rate) setting.

IMPORTANT: After completing settings remember to click save to return to the home screen and ready the feeder for use.

## Maintenance:

| No | item | Method | Objective | Remarks |
|---|---|---|---|---|
| 1 | Cleaning housing and external equipment | Use clean cotton rag to wipe surface dust | cleaning | |
| 2 | Cleaning protective lenses | Remove lens and scrub with lint free cotton cloth dipped in 99.0% pure alcohol or use optic lens wipes | oil, dust removal | If there are cracks or spots Replace, Make sure that no coated surface is in the direction of flame spatter |

Weekly Maintenance Check

| No | item | method | objective | Remarks |
|---|---|---|---|---|
| 1 | Check temperature protection | Turn the temperature setting below the current temperature and the power supply should trip | Confirm machine protection is working properly | |

Monthly Maintenance Check

| No | Item | Method | Objective | Remarks |
|---|---|---|---|---|
| 1 | Clean Screens | Remove lens and scrub with lint free cotton cloth dipped in 99.5% pure alcohol or use optic lens wipes | Clean, transparent , oil-free lenses | |
| 2 | Clean all back lenses | | | Need to calibrate and synchronize Pilot laser and Welding Laser |
| 3 | Clean semi-reverse lenses | | | |
| 4 | Clean focus lens | | | |
| 5 | Clean 45° full mirror | | | |
| 6 | Confirm the working of limit switch | The worktable can return to the mechanical zero point and can move the worktable to the limit | Table does not jam, smooth movement | |

Annual Maintenance Check

Contact Everlast. This is an in depth maintenance and service check.

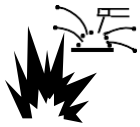
Fault analysis and troubleshooting methods

| fault phenomenon | analysis of causes | Exclusion methods | remarks |
|---|---|---|---|
| 1. power on no response | 1, power supply no power or lack of phase<br>2, emergency stop switch press<br>3, contactor failed | 1, restore power<br>2, Rotate emergency stop end 3, check contactor and its control line | |
| 2. no laser output | 1, laser power supply unstable<br>2, in lock mode<br>3, ground wire clamp not connected workpiece | 1, overhaul or replace power supply<br>2, turn on lock light switch<br>3, connect try again | |
| 3. laser output power low | 1, laser rod aging<br>2, optical lens aging<br>3, optical path deviation<br>4, lens dirty or damaged | 1, replace laser rod 2, replace optical lens<br>3, adjust all, half mirror<br>4, clean or replace all, half mirror | Contact Everlast |
| | | | |

Diagnosis.
This unit includes a diagnosis cable and USB designed for laptop use. Keep this stored securely. In the event of a failure, call Everlast Tech Support for a walk through of how to properly use the diagnosis feature/function. Do not attempt any repair your self until you have contacted Everlast technical support.

**PACKING LIST**

| No. | Name | Specifications | Quantity | Note |
|---|---|---|---|---|
| 1 | Laser Welding Machine | REDSABRE 1500 | 1 | |
| 2 | Laser gun+cable | -- | 1 | |
| 3 | Wire feeder | SUP-AMF-A | 1 | |
| 4 | Operation instructions | -- | 1 | |
| 5 | Certificate of quality | -- | 1 | |
| 6 | Laser gun nozzle | | | suitable for wire: |
| | | AS-12 | 1 | 0.8/1.0/1.2mm |
| | | BS-16 | 1 | 1.6mm |
| | | CS-12 | 1 | 0.8/1.0/1.2mm |
| | | ES-12 | 1 | 0.8/1.0/1.2mm |
| | | FS-16 | 1 | 1.6mm |
| | | C | 1 | no wire |
| | | cutting | 1 | thickness:<1.5mm |
| | | AS-20D | 1 | cleaning |
| 7 | tool box | -- | 1 | |
| 8 | Protective lens | D18T2 | 10 | |
| 9 | Wire feed wheel | V0.8/1.0,V1.2/1.6V U1.2/1.6V | 1set | |
| 10 | Protective goggles | -- | 1 | |
| 11 | Laser Diagnostic Data wire | -- | 1 | |
| 12 | inner hexagon spanner | -- | 1set | |
| 13 | Wire feed nozzle | -- | 1set | |
| 15 | Wire feeding hose for Al. | -- | 1 | |

|  |  |  |  |
|---|---|---|---|
| **WARNING** | - Do not touch electrically live parts or electrode with skin or wet clothing.<br>- Insulate yourself from work and ground. | - Keep flammable materials away. | - Wear eye, ear and body protection. |
| Spanish<br>**AVISO DE PRECAUCION** | - No toque las partes o los electrodos bajo carga con la piel o ropa moja- da.<br>- Aislese del trabajo y de la tierra. | - Mantenga el material combustible fuera del área de trabajo. | - Protéjase los ojos, los oídos y el cuerpo. |
| French<br>**ATTENTION** | - Ne laissez ni la peau ni des vête- ments mouillés entrer en contact avec des pièces sous tension.<br>- Isolez-vous du travail et de la terre. | - Gardez à l'écart de tout matériel inflammable. | - Protégez vos yeux, vos oreilles et votre corps. |
| German<br>**WARNUNG** | - Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung!<br>- Isolieren Sie sich von den Elektroden und dem Erdboden! | - Entfernen Sie brennbarres Material! | - Tragen Sie Augen-, Ohren- und Kör- perschutz! |
| Portuguese<br>**ATENÇÃO** | - Não toque partes elétricas e elec- trodos com a pele ou roupa molha- da.<br>- Isole-se da peça e terra. | - Mantenha inflamáveis bem guarda- dos. | - Use proteção para a vista, ouvido e corpo. |
| Japanese<br>**注意事項** | ● 通電中の電気部品、又は溶材にヒフやぬれた布で触れないこと。<br>● 施工物やアースから身体が絶縁されている様にして下さい。 | ● 燃えやすいものの側での溶接作業は絶対にしてはなりません。 | ● 目、耳及び身体に保護具をして下さい。 |
| Chinese<br>**警 告** | ● 皮肤或濕衣物切勿接觸帶電部件及銲條。<br>● 使你自己與地面和工件絕緣。 | ● 把一切易燃物品移離工作場所。 | ● 佩戴眼、耳及身體勞動保護用具。 |
| Korean<br>**위 험** | ● 전도체나 용접봉을 젖은 헝겁 또는 피부로 절대 접촉치 마십시요.<br>● 모재와 접지를 접촉치 마십시요. | ● 인화성 물질을 접근 시키지 마시요. | ● 눈, 귀와 몸에 보호장구를 착용하십시요. |
| Arabic<br>**تحذير** | ● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الالكترود بجلد الجسم أو بالملابس المبللة بالماء.<br>● ضع عازلا على جسمك خلال العمل. | ● ضع المواد القابلة للاشتعال في مكان بعيد. | ● ضع أدوات وملابس واقية على عينيك وأذنيك وجسمك. |

READ AND UNDERSTAND THE MANUFACTURER'S INSTRUCTION FOR THIS EQUIPMENT AND THE CONSUMABLES TO BE USED AND FOLLOW YOUR EMPLOYER'S SAFETY PRACTICES.

SE RECOMIENDA LEER Y ENTENDER LAS INSTRUCCIONES DEL FABRICANTE PARA EL USO DE ESTE EQUIPO Y LOS CONSUMIBLES QUE VA A UTILIZAR, SIGA LAS MEDIDAS DE SEGURIDAD DE SU SUPERVISOR.

LISEZ ET COMPRENEZ LES INSTRUCTIONS DU FABRICANT EN CE QUI REGARDE CET EQUIPMENT ET LES PRODUITS A ETRE EMPLOYES ET SUIVEZ LES PROCEDURES DE SECURITE DE VOTRE EMPLOYEUR.

LESEN SIE UND BEFOLGEN SIE DIE BETRIEBSANLEITUNG DER ANLAGE UND DEN ELEKTRODENEINSATZ DES HERSTELLERS. DIE UNFALLVERHÜTUNGSVORSCHRIFTEN DES ARBEITGEBERS SIND EBENFALLS ZU BEACHTEN.

|  |  |  |  |
|---|---|---|---|
| - Keep your head out of fumes.<br>- Use ventilation or exhaust to remove fumes from breathing zone. | - Turn power off before servicing. | - Do not operate with panel open or guards off. | **WARNING** |
| - Los humos fuera de la zona de res- piración.<br>- Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases. | - Desconectar el cable de ali- mentación de poder de la máquina antes de iniciar cualquier servicio. | - No operar con panel abierto o guardas quitadas. | Spanish<br>**AVISO DE PRECAUCION** |
| - Gardez la tête à l'écart des fumées.<br>- Utilisez un ventilateur ou un aspira- teur pour ôter les fumées des zones de travail. | - Débranchez le courant avant l'entre- tien. | - N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés. | French<br>**ATTENTION** |
| - Vermeiden Sie das Einatmen von Schweibrauch!<br>- Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes! | - Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öff- nen; Maschine anhalten!) | - Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen! | German<br>**WARNUNG** |
| - Mantenha seu rosto da fumaça.<br>- Use ventilação e exhaustão para remover fumo da zona respiratória. | - Não opere com as tampas removidas.<br>- Desligue a corrente antes de fazer serviço.<br>- Não toque as partes elétricas nuas. | - Mantenha-se afastado das partes moventes.<br>- Não opere com os paineis abertos ou guardas removidas. | Portuguese<br>**ATENÇÃO** |
| ● ヒュームから頭を離すようにして下さい。<br>● 換気や排煙に十分留意して下さい。 | ● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切って下さい。 | ● パネルやカバーを取り外したままで機械操作をしないで下さい。 | Japanese<br>**注意事項** |
| ●頭部遠離煙霧。<br>●在呼吸區使用通風或排風器除煙。 | ●維修前切斷電源。 | ●儀表板打開或沒有安全罩時不準作業。 | Chinese<br>**警 告** |
| ● 얼굴로부터 용접가스를 멀리하십시요.<br>● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시요. | ● 보수전에 전원을 차단하십시요. | ● 판넬이 열린 상태로 작동치 마십시요. | Korean<br>**위 험** |
| ● ابعد رأسك بعيداً عن الدخان.<br>● استعمل التهوية أو جهاز ضغط الدخان للخارج لكي تبعد الدخان عن المنطقة التي تتنفس فيها. | ● اقطع التيار الكهربائي قبل القيام بأية صيانة. | ● لا تشغل هذا الجهاز اذا كانت الاغطية الحديدية الواقية ليست عليه. | Arabic<br>**تحذير** |

**LEIA E COMPREENDA AS INSTRUÇÕES DO FABRICANTE PARA ESTE EQUIPAMENTO E AS PARTES DE USO, E SIGA AS PRÁTICAS DE SEGURANÇA DO EMPREGADOR.**

使う機械や溶材のメーカーの指示書をよく読み、まず理解して下さい。そして貴社の安全規定に従って下さい。

請詳細閱讀並理解製造廠提供的說明以及應該使用的銀捍材料，並請遵守貴方的有関勞動保護規定。

이 제품에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

اقرأ بتمعن وافهم تعليمات المصنع المنتج لهذه المعدات والمواد قبل استعمالها واتبع تعليمات الوقاية لصاحب العمل.