



# iWeld® Industrial 1902-MFX Series

## Operation & Maintenance Manual



HARNESSING THE POWER OF HOT LIGHT™

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# Declaration of Conformity

Manufacturer's Name: LaserStar Technologies Corporation®  
Manufacturer's Address: 2461 Orlando Central Parkway,  
Orlando, Florida 32809  
Phone / Fax: PH: (407) 248-1142 FX: (866) 708-5274  
Designation: iWeld® Industrial Welding Workstation (Nd:YAG)  
Model Number(s): 5xx-19xx-xx  
Year of Manufacture: 2024  
EC Directive(s): 2014/35/EU (Low Voltage Directive)  
2014/30/EU (EMC Directive)

## Standard(s) to which Conformity is Declared:

IEC 60825-1:2014 ED:3.0  
IEC 61000-6-2:2005 ED:2.0  
IEC 61000-6-4:2007 ED:2.1  
IEC 61010-1:2010 ED:3.0

This declaration is issued under sole responsibility of LaserStar Technologies Corporation®.  
The object of this declaration is in conformity with relevant Union harmonization legislation.

I, the undersigned, hereby declare that the equipment specified above conforms to the above identified standard(s) as described in the test record.

A handwritten signature in black ink, appearing to read 'James E. Gervais', is written over a horizontal line.

James E. Gervais  
**President and Chief Operating Officer**

Date: January 04, 2024



# Declaration of Compliance

United States and Canada

Manufacturer's Name: LaserStar Technologies Corporation®  
Manufacturer's Address: 2461 Orlando Central Parkway,  
Orlando, Florida 32809  
Phone / Fax: PH: (407) 248-1142 FX: (866) 708-5274  
Designation: iWeld® Industrial Welding Workstation (Nd:YAG)  
Model Number(s): 5xx-19xx-xx  
Year of Manufacture: 2024

## Standard(s) to which Compliance is Declared:

UL 61010-1:2010 ED:3 "Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use; Part 1: General Requirements"

CAN/CSA C22.2# 61010-1:2010 ED:3 "Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use; Part 1: General Requirements"

Code of Federal Regulations (CFR) Title 21; Part 1040.10, 1040.11 for Laser Products

FCC 47 CFR 15B c1A: 2011 Part 15: Subpart B  
Unintentional Radiators Class A Verification

Listing: ETL / cETL Mark-Control Number: 5009261

I, the undersigned, hereby declare that the equipment specified above conforms to the above identified standards, as described in the test record.

A handwritten signature in black ink, appearing to read 'James E. Gervais', is written over a horizontal line.

James E. Gervais  
**President and Chief Operating Officer**

Date: January 04, 2024

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# **LaserStar Technologies Corporation®**

## **Library Publication Data**

### **iWeld® Industrial 1902-MFX Series Welding Workstation**

### **Setup Guide, Operation & Maintenance Manual**

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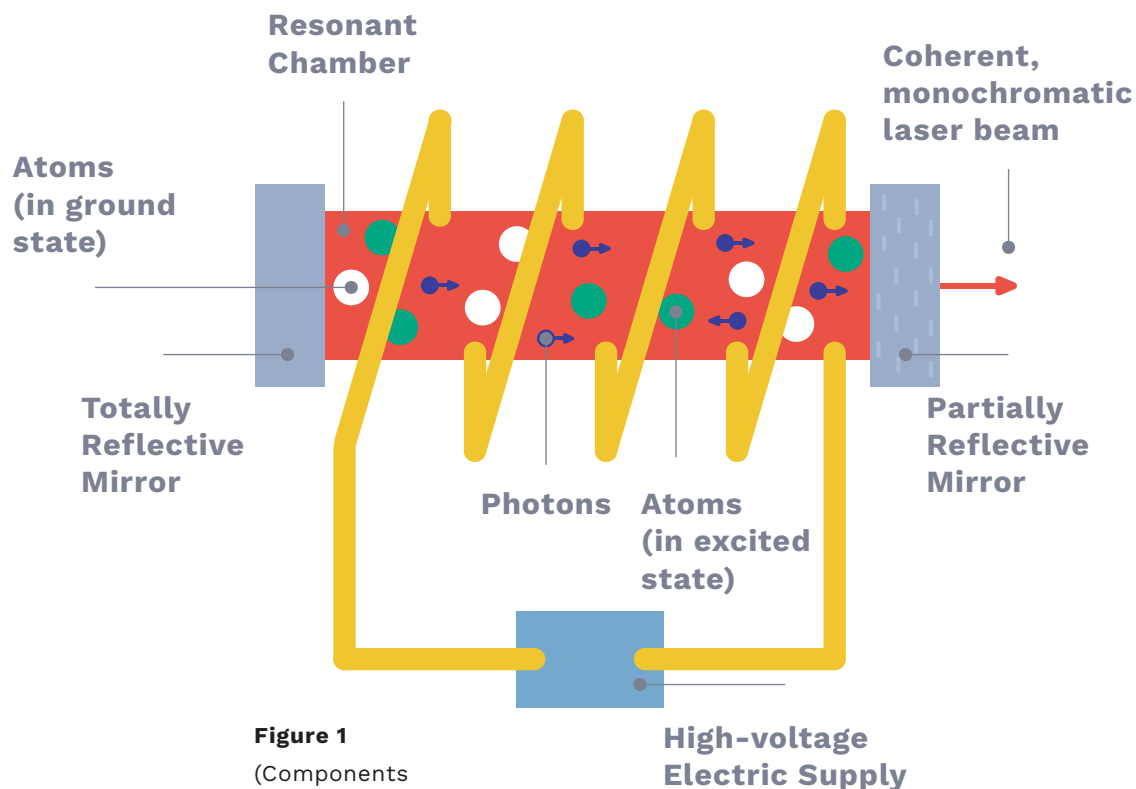
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## Background

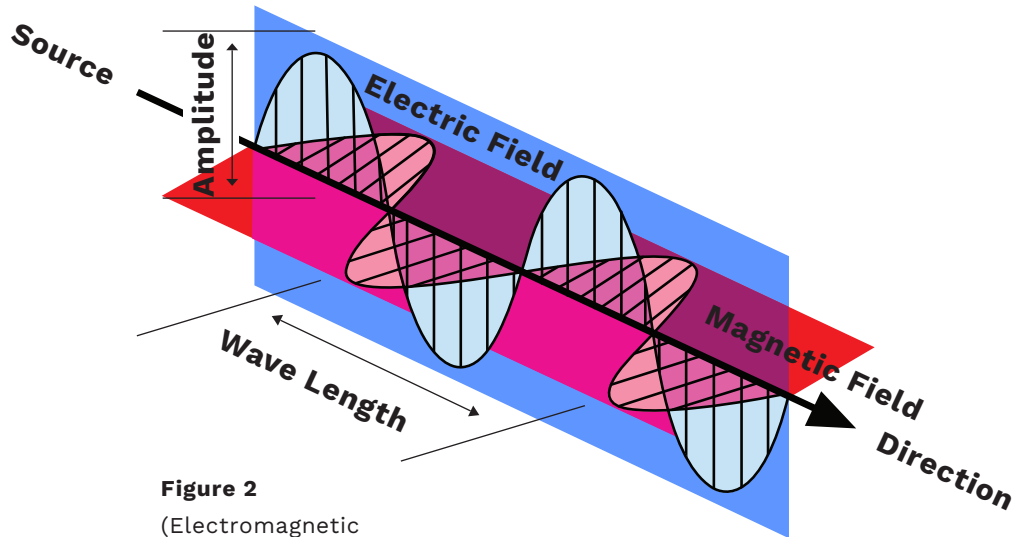
A laser is a device that emits a beam of coherent light through a process of optical amplification (based on the stimulated emission of electromagnetic radiation). The word *laser* is an acronym and stands for **light amplification by stimulated emission of radiation**.

Lasers exist and are made possible because of fundamental interactions between light and matter, or more specifically, electrons — negatively charged subatomic particles that orbit around the nucleus of an atom. These electrons and their associated photon energies exist at specific energy levels (energy levels uniquely dependent on an atom's structure).

Imagine these energy levels as orbits or rings around the sun — electrons within the outer rings produce more energy than those of inner rings. With the introduction of a new energy source (a flash of light), however, electrons can be stimulated or excited to a new energy state, transitioning from a lower-energy orbit to a higher-energy orbit. When they return to their normal or "ground" state, electrons emit particles of light called photons (**figure 1**).

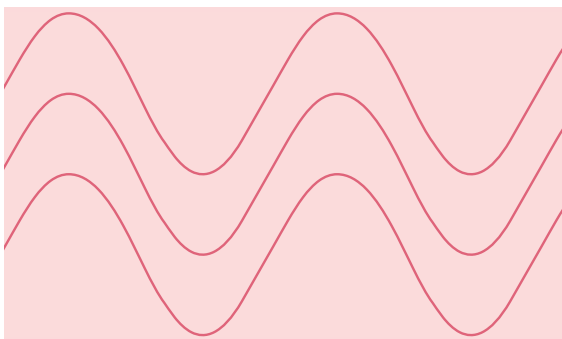


The propagation of light through space can be described as a traveling wave motion — an electromagnetic wave. The wave consists of two fields, each fluctuating — one electric and the other magnetic. The fields remain in-phase and at right angles (orthogonal) to one another — both perpendicular to the direction of travel (**figure 2**).

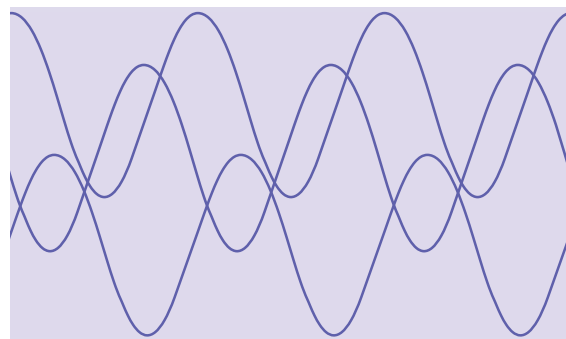


**Figure 2**  
(Electromagnetic wave)

The concept of laser light is better understood by defining and examining its inherent properties. The light outputted from a laser differs from ordinary light and has three (3) defining characteristics that make it unique and help it to stand apart: coherence, monochromaticity, and direction. When all emitted photons bear a constant relationship with one another in both time and phase, the light is said to be coherent. In addition, due to the specificity and purity of the medium, laser light is also monochromatic (one color). Lastly, light emitted from the laser is highly directional, traveling as a relatively narrow beam, in a single direction, and down a specific and predetermined path (**figures 3 & 4**).



**Figure 3**  
(Coherent,  
monochromatic,  
directional light)

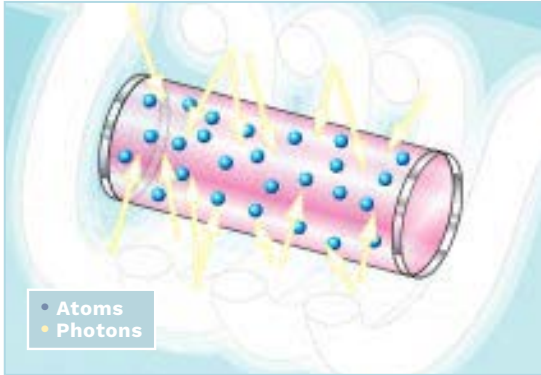


**Figure 4**  
(Incoherent,  
monochromatic  
directional light)

# I. Introduction

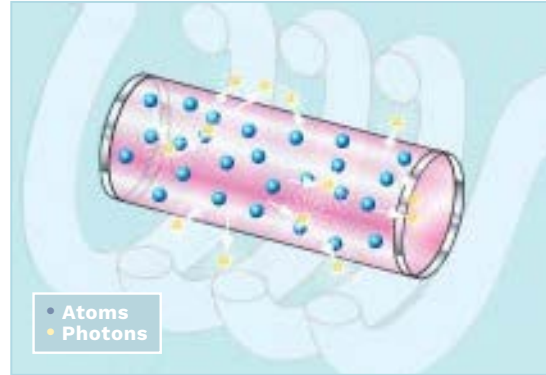
## Nd:Yag: About, Standards, and Technical Data

The iWeld® Industrial 1902-MFX Series Welding Workstation is a solid-state, high-intensity pulsed laser. The device utilizes a crystal compound (neodymium-doped yttrium aluminum garnet; Nd:Y3Al5O12) as the host material and laser medium. Most commonly, infrared light is emitted at 1064nm.



**Figure 1**

High-voltage electricity causes the flashlamp to emit an intense burst of light, exciting some atoms within the crystal, and causing them to shift to higher energy levels.



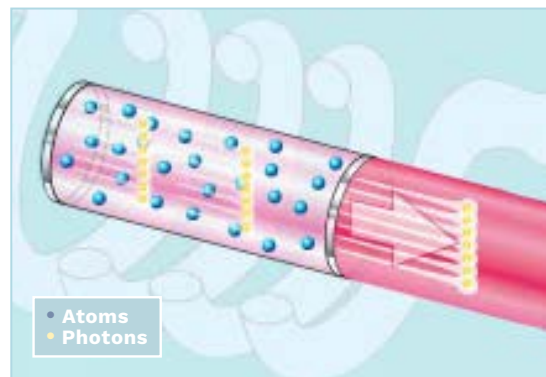
**Figure 2**

After reaching a specific energy level, some atoms emit particles of light called photons; initially the photons are emitted in all directions. As photons from one atom stimulate emissions from other nearby atoms, the light intensity is rapidly amplified.



**Figure 3**

Mirrors resting at the ends of the optical resonant cavity reflect photons back and forth, continuing the process of stimulated emissions and amplification.



**Figure 4**

Photons exit the chamber, through the end of a partially slivered mirror, and thus, we have laser light.

**Nd:Yag: About, Standards, and  
Technical Data Continued on Next Page**

## Nd:Yag: About, Standards, and Technical Data (continued)

**Figures 1–4** (diagrams on the previous page) show a typical resonator or optical resonant cavity. This is where the flashlamp and Nd:YAG crystal compound are located. When intensive light is applied to the crystal via a reflector, it initially produces non-directional light. For optimum utilization of the flashlamp light, both the laser crystal and the flashlamp are arranged just within the “focal point” of an ellipsoidal mirror. A semi-reflecting and a fully reflecting mirror are mounted outside the crystal. Only those parts of the laser light that hit these mirrors are reflected into the laser crystal can be amplified during the pulse of the flashlamp while passing through the crystal. The amplified laser light has the same properties as the original laser light; i.e. it has the same direction, the same wavelength, the same phase and the same polarization. The mirrors determine the highly directional propagation characteristics of the laser light.

Part of the laser light passes through the semi-reflecting mirror and is the laser light that performs the welding function. This process produces a very high energy density light beam, many times higher than is possible with normal light at the focal point of a lens. The energy “hot light” created at the focal point in a relatively short time (0.5 to 20mS) heats the workpiece beyond its melting point, and thus, enables a weld.

The area affected is in a limited range of only approximately 0.20 to 2mm, depending on the material. the laser light welds two (2) metals together, and thus permits safe, durable, precise and non-warp joining of parts in the form of a spot or seam. Because of the very short time of the laser pulse, the zone of heat influence is limited to the immediate vicinity of the welded spot or seam.

The characteristics of a laser pulse, and thus, the effect on the material, can be influenced by the operating parameters voltage and pulse length (width). The voltage has influence on the amplitude; the pulse length influences the width of the laser pulse.

**In practice, the effect of both parameters while welding metals is as follows:**

- The voltage first influences the welding depth.
- The pulse length predominantly influences the diameter of the welding point.
- The focus influences the welding depth, as well as the diameter of the welding spot. When increasing the diameter, the welding depth is reduced at the same time.

# iWeld® Industrial 1902-MFX Series Welding Workstation:

## Equipment Overview

The iWeld® Industrial 1902-MFX Series Welding Workstation is a highly specialized, portable, stand-alone, single-user operated laser welder designed for metalworking and fabrication. This versatile welding workstation, which is capable of quickly and precisely welding almost any metal or metal alloy, is well-suited for the industrial workspace and a wide variety of complex assembly applications, including spot and seam welding, mold repair, and micro-welding (applicable for industries including, aerospace engineering, computers and information technology, automotive, and medical device technologies).

With welding applications, the workpieces that are to be joined are manually arranged within the illuminated welding work chamber, and are then welded together by means of one or more high-intensity laser pulses.

The welding workstation is equipped with a stereo microscope with cross-hair, a specialized component within the welding chamber that allows for precise control and positioning of workpieces or parts for achieving consistently reliable welding applications results. The cross-hair marks the exact position of the laser pulse spot on the workpiece.

With any welding application, in order to achieve optimal finalized results, the workpiece must be properly positioned within the focusing area of the laser beam; positioning and workpiece height are determining factors that affect the results and outcome. The workpiece height is correct when the surface of the part is in focus while under the stereo microscope.

Laser pulse energy is another factor that can have a direct influence on the quality of the final weld; pulse energy output can be adjusted using the external touchscreen display. With these controls, the intensity of the laser pulse (voltage) is affected, as well as pulse length (mS). Settings for other materials can also be obtained by following the adjustment techniques described.

With certain materials, the quality of the weld can be improved using argon (inert) gas. **(Note: This machine is equipped with a separate argon (inert) gas valve.)**

The vapor produced during the welding process can be extracted from the lasing chamber and operator's work station using an external exhaust system.

The laser welding workstation is equipped with a foot pedal switch (with two [2] operating positions) that is capable of firing single or multiple laser pulses. The first position (pedal switch slightly depressed) enables the inert gas supply, and the second position (pedal switch fully depressed) releases the laser pulse. **(Note: A multi-functional foot pedal is also available.)**

(see section detailing motion, beginning on **page 70**)



# iWeld® Industrial 1902-MFX Series Welding Workstation: External Components and Body Configuration



**Figure 5**  
(iWeld® Industrial  
1902-MFX Series Welder)

**External Components and Body Configuration  
Continued on Next Page**

## External Components and Body Configuration

(for a visual reference of the individual components noted below, see the diagram on the previous page; **page 21**)

1. Stereo Microscope
  2. Main power switch and emergency shut-off switch (used to switch “on” or “off” the line voltage; not shown). In addition, the mains power switch functions as the device’s emergency shut-off and can be turned “off” or to the “O” position without use of the system key switch.
  3. System Key Switch
  4. Exhaust Outlet (rear of the device) and Chamber Filter (located inside the welding work chamber)
  5. Touchscreen Display
  6. Splash-protective Observation Window
  7. Hand Openings (×2)
  8. Welding Chamber Enclosure
  9. Illuminated Welding Chamber
  10. Welding Chamber Access Door
  11. Embedded Computer & Controls System (located inside the main body cabinet)
  12. Laser Source
  13. Wheel Locks and Risers (×2)
  14. Joystick
  15. Motion Control (touchscreen interface)
  16. MotionFX
- The **welding chamber (8)** is made accessible through the **hand openings (7)** or alternatively, the **welding chamber access door (10)**.
  - Workpieces or parts within the **illuminated welding chamber (9)** can be observed through the **splash-protective observation window (6)**. The observation window is made from a specialized material and allows for absorption of harmful laser radiation, as well as the ultraviolet (UV) component of plasma light.
  - The **stereo microscope (1)**, located at the top of the welding chamber, facilitates effortless positioning and adjustment of parts for welding applications.

## Technical Specifications

The modular construction of the iWeld® Industrial 1902-MFX Series Welding Workstation facilitates efficient, time-saving repairs by allowing for replacement of individual failed modules (non-functional units), as opposed to more intricate repairs that can require extensive downtime and dismantling of the entire machine.

**The welder consists of the following modules, which are configuration dependent:**

- Illuminated Welding Chamber (with stereo microscope)
- High-energy Pulse Laser
- Embedded Computer
- Power Supply Unit
- Inert (argon) Gas Supply and Blast Nozzle (for rapidly cooling workpieces; blast nozzle component is optional)
- Foot Pedal Switch (for triggering laser pulses and inert [argon] gas supply)
- Welding Chamber Exhaust System (with accompanying filter)

<b>iWeld® Industrial 1902-MFX Series Welding Workstation</b>	
<b>A typical system build includes a variety of standard and optional components</b>	
Laser Medium	Nd:YAG Crystal Compound
Laser Wavelength	1064 nm (infrared)
Beam Divergence (minimum; prior to beam-expanding and focusing optics)	~3 mRad
Pulse Energy (minimum)	Joules (model dependent)
Rated power	Watts (model dependent)
Pulse Power (maximum)	kW (per model)
Single or Continuous Pulse	Selectable Option
Pulse Length	0.1 to 50 mS
Laser Class	Class 4 (operator)
Ambient Conditions: Operating Temperature	5°C to 30°C (41°F to 86°F)
Ambient Conditions: Storage Temperature (water removed)	-10°C to 70°C (14°F to 158°F)
Ambient Conditions: Storage Temperature (with water [not recommended])	3°C (38°F) frost risk
Humidity (operating & storage)	10% to 95% (non-condensing)
Elevation (above sea level)	0 to 6,562 feet (0 to 2,000 meters)
Noise Level (dB)	Varies (model dependent)
Degree of Protection	IPX0
L × W × H	33 × 21 × 43 in (84 × 54 × 110 cm)
Weight	200 lbs (90 kg)
Electrical Requirements: Single-phase (reference machine ID label for specifications [rear of the welder])	15A, 208 – 240VAC, 50 / 60Hz (60W model) 25A, 208 – 240VAC, 50 / 60Hz (80W model)

## Technical Specifications (continued)

### Cooling:

- Internal Water and Air Heat Exchanger
- Particle Filter and Distilled Water Filter (located inside the internal cooling circuit)
- Cooling Water: 50°C (122°F) or 65°C (149°F; maximum temperature [model dependent])
- Ambient Temperature: 30°C (86°F; maximum)

Inert Gas: Pressure & Flow Regulation		
Operating Pressure (maximum)	Operating Pressure (minimum)	Flow Range (typical)
3.8 bar (59 psi; 0.38 MPa)	0 bar (0 psi; 0 MPa)	10 to 30 CFH

**(Note: To increase cost-savings and offset the expense for inert (argon) gas, the flow rate should be adjusted to the lowest setting possible for achieving the necessary surface finish.)**

### Noise Levels

The audible noise that is continuously produced by the welder can range in decibels (dB) and is model specific.

Power Supplies: Max Output		
Switching Supply	Power Supply	Lamp Simmer Supply
0 – 400VDC	24VDC	1000V / 150V @ 500mA

## Embedded Computer

The embedded computer is connected to the internal controls circuitry and is used for programming and setting welding parameters.

## Controls Circuits

The controls circuits ensure that the welder components are started and stopped in a safe manner (for both the equipment and operator).

### Various controls circuits exist for the following parts:

- Cooling Water (temperature, level, and flow rate)
- External Safety Contacts
- Laser Shutter
- View Shutter (located inside the Stereo Microscope)
- Supply Voltage

## Optical Viewing System

The welder is equipped with an advanced optical viewing system (stereo microscope) with cross-hair functionality. The stereo microscope is a specialized component within the laser welding chamber, and allows for precise positioning of parts for consistently reliable welding applications results. A variety of optical viewing systems and magnification strengths are available.

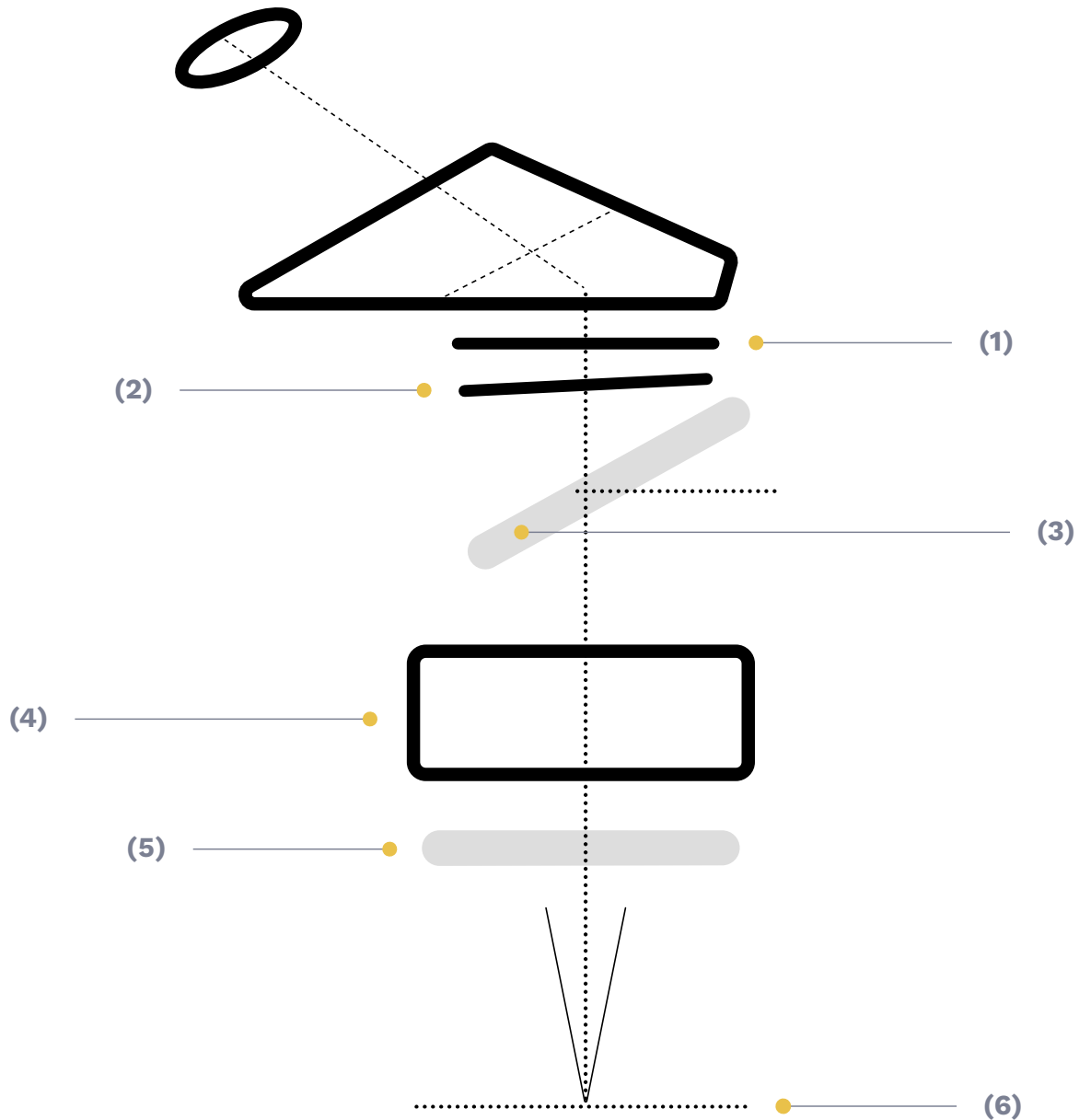
### Components and Function

- Observation Window (used for viewing and observation of applications processes within the welding working chamber)
- Cooling Water (temperature, level, and flow rate)
- Illuminated Welding Chamber with Adjustable Brightness (by means of the controls within the welding work chamber)
- View Shutter

**(Note: In an effort to shield and protect the operator's eyes, the view shutter will close automatically for a short duration with each laser pulse. Welding workstations with a flat-screen viewing system are not equipped with a view shutter.)**

## Fundamentals of Laser Light: View Path and Beam Path

To produce a beam of coherent, monochromatic light, the laser requires an active medium (in this case, optical fibers that have been doped with rare-earth elements), which is positioned between multiple reflectors (mirrors and lenses). These reflectors, which help to perpetuate and distribute the laser's light energy, also ensure the beam continues traveling along its pre-determined path.



**Figure 7**  
(View path and  
beam path)

**Fundamentals of Laser Light:**  
**View Path and Beam Path Continued on Next Page**

Fundamentals of Laser Light: View Path and Beam Path (continued)

- The laser beam is channeled through the optical path of the stereo microscope by means of a **highly reflective laser energy mirror (3)**.
- A specialized **focusing lens (4)** concentrates the laser beam and directs its focus onto the surface of the **workpiece (6)** that has been positioned within the laser’s focusing plane. Additionally, this lens also acts as the focusing lens for the stereo microscope.
- The **focusing lens (4)** is safeguarded from dust and metal splashing that is produced during the welding applications process with the aid of a **protective glass lens (5)**.
- The **view shutter (2)** shields and protects the operator’s eyes from harmful laser radiation, as well as the ultraviolet (UV) component of plasma light that results from a laser pulse during the welding applications process. With each laser pulse, the **view shutter (2)** will close automatically, obstructing the operator’s field of view for a short duration. If there is an interference and the **view shutter (2)** does not properly close, as a precautionary measure, the laser pulse will not be released. **(Note: Workstations with a flat-screen viewing system are not equipped with a view shutter.)**
- Like the **view shutter (2)**, both the **IR** and **UV absorbing filters (1)** protect the operator, blocking out harmful laser radiation and the ultraviolet (UV) component of plasma light to prevent contact with or damage to the eyes.

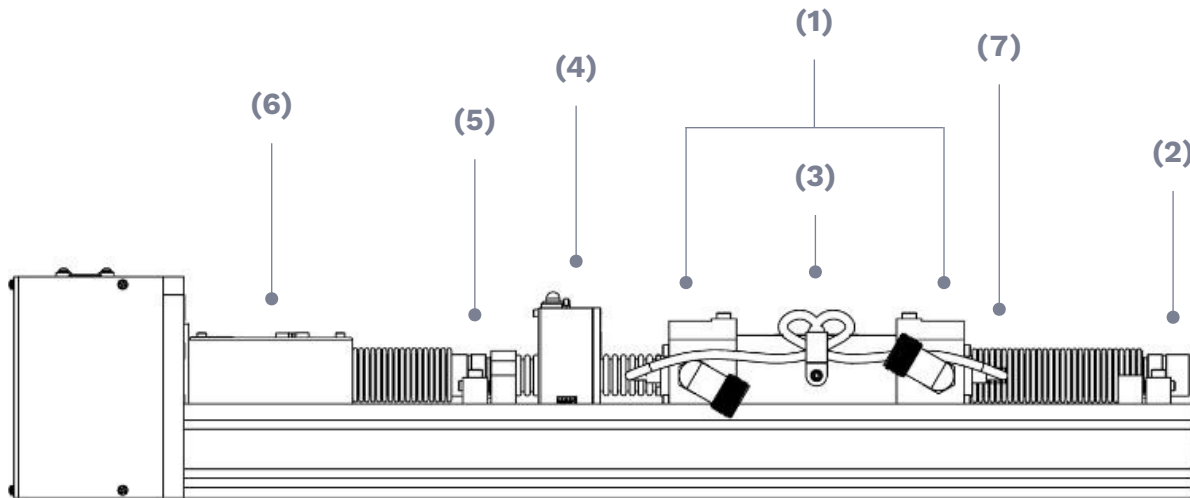
Components, Features & Additional Functionality

- + Storage of Operating Parameters
- + Beam-expander (motor-driven [for welding-point diameter])
- + Inert (argon) Gas Supply (with adjustable nozzle [nozzle is located inside the welding work chamber and positioned in close proximity to the workpiece])

Two-stage Laser Pulse Triggering	
The method below utilizes the foot pedal switch to initiate a laser pulse.	
Stage 1 (pedal partially depressed)	Stage 2 (pedal fully depressed)
Inert (argon) Gas Supply	Laser Pulse Triggering

## Laser Delivery System: Standard Optical Rail Components & Configuration

The components for this high-intensity pulse laser are mounted on an optical rail. Individual components are explained below with numbers ( ) that correspond to each module's position along the rail system.



**Figure 8**  
(Optical rail configuration)

### Optical Rail Components

- The **pump chamber (1)** contains the flashlamp and crystal compound (neodymium-doped yttrium aluminum garnet). The **ignition unit (3)** is located on the side and bottom of the **pump chamber (1)**.
- The **rear mirror (2)** reflects laser radiation entirely; the **semi-reflecting mirror (5)** transmits a portion of the laser light as useful radiation. With some high-powered systems, **pulse suppression (optional; not shown [7])** can be added between the **rear mirror (2)** and the **pump chamber (1)**.
- While in a closed state, the **laser shutter (4)** prevents the formation of harmful radiation. The **laser shutter (4)** remains closed when lowering the voltage or if there is a system fault.
- The diameter of the laser beam can be set by means of a **beam-expander (6)**, which is driven by a stepper motor. When making adjustments, both the diameter of the laser pulse spot and the energy density for the laser beam are affected.
- The laser beam is channeled through the optical path of the stereo microscope by means of a highly reflective mirror. The focusing lens then directs the beam onto the surface of the work-piece that has been positioned within the laser's focusing plane.

### Laser Delivery System: Standard Optical Rail Components & Configuration Continued on Next Page



## Computer Controls Unit

The computer controls unit is mounted beneath the laser's optical rail. If maintenance or service-related tasks are needed, the controls board is easily accessible from the side of the machine.

**The controls unit is used to control and operate the following components:**

- Flashlamp Power Supply (for laser pulse generation)
- Operating Elements
- Warning Indicators
- Safety Components (view shutter [within the optical viewing system] and laser shutter)
- Interlock Circuits Safety Checks

## Diagnostics and Self-Checks

To ensure the welder is functioning correctly, a series of diagnostics or self-tests are performed each time the machine is powered “on.”

**During start-up, the following self-checks are routinely performed by this device:**

- Cooling Water Flow Rate
- Cooling Water Temperature
- Distilled Water Tank (water-level check)
- Laser Shutter
- Welding Chamber Closed (model dependent)

While the testing sequence is being carried out, the electronic components, power supply, laser shutter, and view shutter are monitored to ensure they are properly functioning. If there is an error or malfunction, the flashlamp power supply will shut down and lasing functions will be deactivated.

When a malfunction occurs, an alert will appear on the controls panel display. When all faults have been eliminated, the flashlamp power supply can be switched “On” again.

## Flashlamp Power Supply, Capacitor Bank, and Simmer Supply

**The flashlamp power supply is comprised of the following components:**

- Capacitor Bank (forced discharge occurs while the machine is “off”)
- Simmer Supply (current power supply with ignition unit)
- Flashlamp (current control)

**(Note: The AC input voltage supplies the capacitor bank with DC voltage from a DC supply.)**

After switching on the flashlamp power supply, the flashlamp will be ignited via an ignition coil on top of the excitation unit. After ignition, a small sustaining current flows through the flashlamp (simmer current). The light flash that produces a laser pulse is generated by partially discharging the capacitors of the capacitor bank. For this, a transistor switch connects the charged capacitor bank to the laser flashlamp (triggered by fully pressing the pedal switch).

The “on” time is determined by the set value for the pulse length. During this time, a slight part of the energy stored in the capacitor bank is discharged via the flashlamp and the voltage of the capacitor bank drops. After the end of the lamp pulse, it is automatically recharged to the set reference input value for the voltage (recovery time). This recovery time depends on the set values for pulse length and voltage (pulse height) and needs about 0.1 and 3 seconds. After the power supply is switched off, high-power resistors automatically discharge the capacitor bank.

## Laser Delivery System: Standard Optical Rail Components & Configuration Continued on Next Page

## Heat Exchanger

With each flash of light, heat is generated in the flashlamp; the distilled water is used to effectively cool the flashlamp. A pump draws purified distilled water from a tank through a combination of a particle filter and distilled filter. The water then circulates past the lamp in the laser pump chamber. This water absorbs the dissipated heat and then expels it into the ambient air through a water/air heat exchanger.

The water is cooled by air circulation. A fan is turned on when the temperature of the cooling water reaches a preset temperature. A flow monitor, a level monitor, and an over temperature switch supervise the cooling water circuit and cut off the power supply of the laser lamp in the case of malfunction. **(Note: An alarm message will display on the touchscreen display; press the Reset button to clear the alert. If the cause of the error has not been corrected, the alert message will reappear.)**

## Foot Pedal Switch

There is a two-stage foot pedal switch for activating the inert gas and triggering laser pulses (see **page 35**).

## Exhaust Unit

The top of the welding chamber contains an opening through which the vapor produced by welding is exhausted.

If the filtered air is not to be exhausted into the work area, the exhausted air can be directed elsewhere by an adapter with a corresponding hose. The exhaust connector is located in the rear of the laser.



Caution!

**Use of controls or adjustments to performance or procedures other than those specified within this manual could result in hazardous radiation exposure; use caution when operating this device.**

## External Control Elements

Brightness  
Control



**Figure 9**  
(Welding Chamber  
Control Elements)

## Internal Control Elements



**Figure 10**  
(Welding chamber  
control elements)



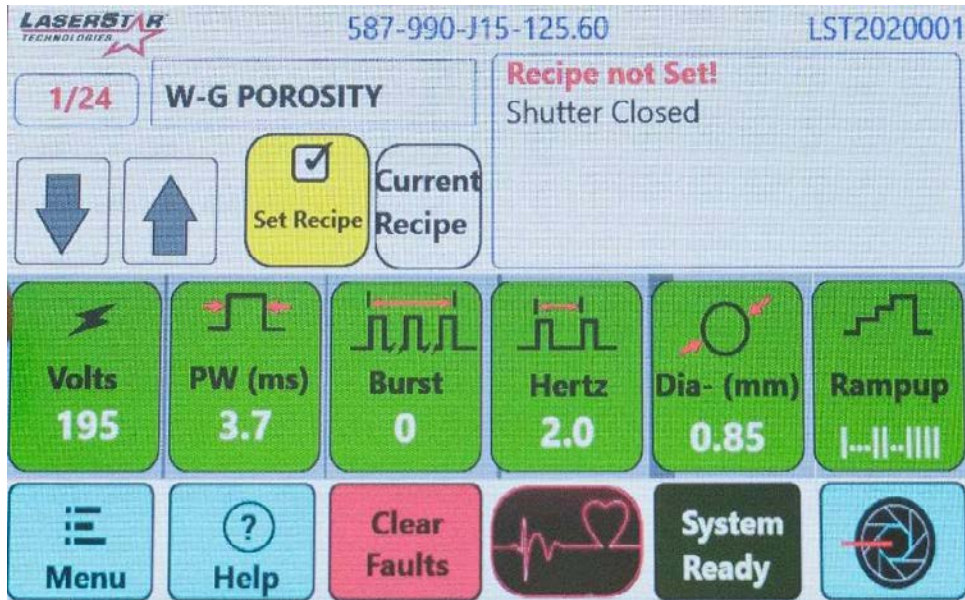
Caution!

**Use of controls or adjustments to performance or procedures other than those specified within this manual could result in hazardous radiation exposure; use caution when operating this device.**

## This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

## Touchscreen Display and Settings

The display layout is shown in **Figure 11** below. The first row shows recipe location, description of the recipe and messages; the second row displays operational / mode choices, Arrow Keys, Set Recipe, and current Recipe. The third row Green buttons display weld parameters-Voltage (V), Pulse Length (mS); Pulse Rate (Hz), Burst Mode or Pulse Suppression (optional / model specific); Beam Diameter; and Shape. The fourth row displays Laser Shutter status, System Ready, heartbeat indicator, Clear faults, help and Menu. **(Note: When the heartbeat button indicator is beating, the welder is ready to weld. The Safety Shutter button is used to open and close the safety shutter and displays the status.)**



**Figure 11**  
(Touchscreen  
display)

With exception of pulse width suppression, all parameters can be set using the touchscreen display (for additional details on the internal controls, be sure to reference **Internal Control Elements** and the corresponding diagram on the previous page).



**Attention:** To preserve the touchscreen display and extend the life of this digital device, you should refrain from using inappropriate items (i.e. pencils, pointers, pens, etc.) to press buttons or interact with the digital display. Using these and other unsuitable items can cause the touchscreen display to malfunction, resulting in erratic or faulty operation. This will reduce the lifetime of the touchscreen device and also void the machine's warranty.

Fingers (not finger nails) and the stylus pen that's been included with the machine are the only acceptable instruments that should be used when interacting with the touchscreen display.

## Electronic Beam Diameter Adjustment

The electronic beam diameter is controlled by the touchscreen display. The beam diameter is selected the same way as Voltage / V or other parameters in the display. The beam diameter range is model dependent.

## Foot Pedal Switch

The welder workstation is equipped with a foot pedal switch for triggering laser pulses and the inert gas. The foot pedal is connected to the machine via several flexible cables and can be moved or repositioned by the operator, as needed.

### The foot pedal switch has two (2) operating positions with the following functions:

#### Stage 1:

Depress the foot pedal, partially, until you notice initial resistance; this will trigger the inert (argon) gas supply to switch “on.”

#### Stage 2:

Depress the foot pedal, fully, until it reaches the floor; this will trigger a laser pulse. If the inert gas supply is connected to the welder, it will remain “on” until the foot pedal has been fully released.

### When releasing pulses consecutively, the following options are available:

- You can release the foot pedal slightly after each pulse and then push it right down again.
- If the pulse frequency is set for continuous-pulse mode (Hz), the laser can release a continuous series of pulses by depressing and holding down the foot pedal.
- If the Burst Mode (B) is set, the laser will release the number of pulses that the operator chooses by depressing and holding the foot pedal.

## Remote Interlock Connector

In addition to the foot pedal switch connector, there is a remote interlock connector available to readily connect the device to a secondary interlock circuit (such as an entry door) into a specific laser room. The remote interlock can be bypassed by using the remote interlock shorting cap, p/n 101-36-0036. Refer to **Installation, Section III** for instructions on connecting or bypassing this feature. For the location of the remote interlock connector, refer to Service, External Fuses & Rear Connections.

## Locking Brake

The front wheels of the welding workstation are equipped with a locking brake to secure the machine against unintentional movement at the installation site. Pressing the brake lever down will activate the brake.

## II. Safety

### Overview and Fundamentals

Radiation produced by laser light is capable of melting, burning or vaporizing almost any material. The composition of the workpiece also dictates the vapor or gases that are generated; therefore, appropriate safety precautions are essential and critically important.

The iWeld® Industrial 1902-MFX Series Welding Workstation is designed exclusively for welding applications, including both metals and metal alloys. To use the welder for any other purpose (or for anything beyond what has been outlined in this operation manual) is to use it improperly. LaserStar Technologies Corporation® will not accept liability for damages resulting from improper use or negligence.



**Indicates a potentially dangerous situation. Failure to heed this advisory can result in minor injury or property damage.**



**Indicates important guidelines for correct use of the welding workstation. Failure to heed this advisory can result in malfunctions or problems with the equipment and additionally, may cause damage to areas and property that is in close proximity to the machine.**

### Proper use of the welder includes:

- Following all instructions and procedures and heeding all precautions, warnings, and important safety guidelines provided throughout this manual.
- Ensuring inspections and routine maintenance intervals are scheduled and completed on time to maintain the welding workstation and preserve the equipment in its optimal condition.



**Indicates safe operating guidelines, tips and recommendations, and particularly useful details that will help you to better utilize all of the functions of your laser welder.**

In addition to general information and specified mandatory regulations that help to ensure safe operation of this device, this section also outlines information on potential risks and associated dangers when using the equipment, which cannot be eliminated (either because of design or structural means). These advisories are marked with varying safety symbols (examples follow) and are a mandatory requirement set forth by OSHA and CDRH.



**Indicates a potential threat or danger to health or life. Failure to heed this advisory can result in serious damage, critical injury, and death.**

### General Information

The iWeld® Industrial 1902-MFX Series Welding Workstation is a **class 4** laser (solid-state; Nd:YAG) with a high-powered optical output. **This device emits invisible radiation;** the invisible radiation that's generated during the welding applications process produces **a wavelength of 1064nm (near infrared range) and is not detectable by the human eye.** In addition, visible secondary radiation that's emitted from this device can cause dazzle effects when viewed for any length of time.





Warning!

**When working with direct access to the laser beam (for general use, maintenance or repair) appropriate laser protective eyewear must always be worn.** Intense radiation is capable of destroying the delicate tissues of the eye. When infrared light is transmitted from the cornea to the lens of the eye, it's multiplied (concentrated by up to 100,000 times). The light is then narrowly focused on the retina, causing burning and lesions. Because the tissue of the retina cannot be repaired, damage is permanent, resulting in a reduction or loss of eyesight (these effects may not be apparent for many years).

Always follow OSHA regulations, ANSI Z136.1-2014, Safe Use of Lasers or the equivalent national or international regulations (e.g. IEC / EN Standard 60825-1:2014) to ensure accident prevention and reduce your risk of exposure to radiation when working with laser equipment.



**If modifications are made to this device that affect performance, software or intended function (as described in ANSI Z136.1-2014, Safe Use of Lasers and outlined in official documentation for laser standards classification), the individual or organization responsible assumes the status of manufacturer and must obtain a new classification and appropriate device labeling.**

When operating laser equipment, appropriate protective eyewear — which protects against direct, reflected, and scattered radiation, is required; however, even while wearing protective eyewear, you should remain cautious, never looking directly into the laser beam, as it can. (Note: With class 4 operation, protective eyewear will normally shield against the hazards of collateral radiation (which includes ultraviolet, visible, and infrared radiation), however, if a concern exists that the accessible collateral radiation might be hazardous, the end-user is responsible for review and consideration of the MPE values required for the various materials being processed.)



Warning!

**While operating the equipment without the workspace protective housing or front door in place, all persons in the Nominal Ocular Hazard Area (NOHA) are required to wear appropriate laser protective eyewear (OD >6.5). This protective eyewear must meet applicable safety requirements (based on the laser's output power). The maximum radiant exposure (10cm from the laser's focus) is 32J/cm<sup>2</sup>. The maximum permissible exposure (MPE) @1s is 30uJ/cm<sup>2</sup>. The Nominal Ocular Hazard Distance (NOHA) is 150m from the laser's focus (120mm focus lens @1s exposure).**



Warning!

**Although the skin can withstand considerably higher radiation intensity than the tissue of the eye, burning destroys tissue. The severity and extent of damage depends on the period of exposure and the intensity of the irradiation. Appropriate protective clothing should be worn to protect the skin whenever necessary.**

**If a laser injury (or a suspected laser injury) occurs while using the laser welder, be sure to complete the following steps right away:**

- Turn “OFF” the machine’s **Main Power Switch**
- Notify your Safety Officer or Safety Specialist
- Consult a doctor or go to the hospital

## **Fire Hazard**

The intense power output from this **Class 4** laser can pose a fire hazard; a wide range of materials are susceptible and measures must be taken to prevent fires while the laser beam is active. Paper items (including diagrams, leaflets or even posters on the wall), curtains lacking fire retardant, wooden panels or other similar materials can be easily set on fire by direct or reflected laser radiation.

Containers holding flammable or explosive chemical agents (e.g. used for cleaning and maintenance tasks) should be kept away from the areas that are exposed to the laser beam. When using solvents or cleaning agents, be sure to heed relevant warnings. Significant explosions, fires, and other dangers can result if such containers are inadvertently exposed to or destroyed by the intense invisible laser beam.

## **Essential Safety Information**

**The guidelines below ensure the safe operation of the welder workstation:**

- This operation manual contains guidelines and important information for ensuring the safety of the operator and outlines procedures for proper use of the welding workstation.
- Anyone who works with or operates the laser welder must be informed on pertinent safety information and applicable safety regulations; this is a prerequisite for safe, trouble-free operation of this machine.
- Anyone who works with or operates the laser welder is expected to follow (and be knowledgeable of) the outlined operational procedures; especially the guidelines for safety.
- Mandatory regulations and requirements for ensuring safety and accident prevention (that are relevant for the current place of installation)

must be complied with. Additionally, regulations set forth by OSHA, ANSI Z136.1-2014, Safe Use of Lasers or equivalent national or international regulations (e.g. IEC / EN Standard 60825-1:2014) are especially critical. Lastly, be sure to stay informed and adhere to all required state, municipalities or local regulations and requirements.

## **Organizational Measures**

The employer must provide the necessary personal safety equipment (in this case, laser protective eyewear is required only for maintenance purposes) whenever there is direct access to the laser beam.

Regulations and requirements outlined in accordance with OSHA regulations, ANSI Z136.1-2014, Safe Use of Lasers or equivalent national or international regulations (e.g. IEC / EN Standard 60825-1:2014) must also be fulfilled.

The laser welder must always be maintained as instructed within this operation manual.

## **Employer Requirements**

**Only authorized personnel with adequate training are permitted to use and operate the laser welder. Employers are responsible for ensuring that authorized personnel:**

- Are familiar with important regulations concerning safety at work and accident prevention; employees must also have received instruction on the use of the laser system;
- Have read and understood the chapter in this manual concerning safety and be familiar with relevant warnings; employees should sign and acknowledge that these requirements have been met;
- Receive training and instruction on the dangerous effects of laser radiation in accordance with OSHA regulations, ANSI Z136.1-2014, Safe Use of Lasers or equivalent national or international regulations (e.g. IEC / EN Standard 60825-1:2014) to ensure accident prevention when working with laser equipment;
- Receive ongoing training at regular intervals on operation, safety measures, and best practices when using the laser welder.

## Personnel Requirements

**Personnel who are trained and authorized to work with the laser welder are expected to:**

- Comply with important regulations concerning safety at work and accident prevention for laser radiation, OSHA regulations, ANSI Z136.1-2014, Safe Use of Lasers or the equivalent national or international regulations (e.g. IEC/EN Standard 60825-1:2014).
- Have read and understood the chapter within this manual regarding safety and be familiar with the warnings noted throughout this manual; employees should sign and acknowledge that these requirements have been met.

## Potential Equipment Dangers

The iWeld Industrial 1902-MFX Series Welding Workstation is a state-of-the-art device, **meticulously designed and engineered to meet and exceed standards for safety and approved operation and safety regulations**. Nevertheless, use of this equipment can still endanger life and limb (both the operator and third parties) or damage products and other material assets.

**Keeping in mind these and other practical safety measures, it is vital that the welder be used only in the following ways and with these expectations:**



Warning!

**The welding workstation must only be used for its intended purpose as outlined in this manual (see details on proper use). In addition, the machine must also remain functionally sound (and in optimal condition) from the standpoint of safety.**

**If a malfunction occurs that creates an unsafe condition or negative consequence, it must be corrected right away.**

## Protective Devices

- Before each use, the safety mechanisms for the laser welder must all be checked to ensure they are correctly mounted and properly functioning.
- Safety mechanisms may only be removed when the laser welder has been switched “OFF” and appropriate measures have been taken to prevent the machine from being restarted. **(Note: The interlock switches can be bypassed by our service technicians and authorized specialists, if needed, but only when making adjustments or carrying out maintenance.)**

## Informal Safety Measures



Warning!

- The operating instructions for the welding workstation must remain at the installation site. In addition to the instructions, applicable regulations for ensuring safety when working with or operating laser equipment (including applicable local regulations for accident prevention and environmental protection) must be complied with. Regulations set forth by OSHA, ANSI Z136.1–2014, Safe Use of Lasers or the equivalent national or international regulations (e.g. IEC/EN Standard 60825–1:2014) are also critically important.
- All safety information and warning labels that are attached to the machine must remain intact, legible, and accessible (see the section entitled “Labeling”).

## Personnel Training



Warning!

- Only qualified personnel who receive adequate training and instruction on accident prevention and associated dangers when working with laser radiation (as required by OSHA, ANSI Z136.1–2014, Safe Use of Lasers or the equivalent national or international regulations [e.g. IEC/EN Standard 60825–1:2014]) are permitted to operate the laser welder.
- Trainees are only permitted to use the machine while under the supervision of an experienced user.

## Safety Measures for Normal Use

- Before using the machine, you must verify that all of the safety mechanisms (remote interlock, enclosure, front door safety interlock, laser protective eyewear, etc.) are properly functioning.
- Check the machine at least once a week for external damage and to ensure soundness of all safety mechanisms and other components are properly functioning (e.g. protective viewing windows, interlock circuits, welding chamber enclosure, chamber access door, protective flaps, and guards). The welder can only be used after routine safety checks are performed and the machine is deemed to be in safe and operable condition.

## Electric Shock Danger



- Only authorized personnel are permitted to carry out maintenance work on the power supply.
- The housing for the internal components must remain closed at all times. Only authorized personnel who are specially trained (and possess the appropriate tools) are permitted to open the housing and perform maintenance on the internal components.
- If work is to be carried out on voltage-carrying parts, a second person must be present who can switch the device “off” using the power switch, if necessary (see section entitled “Notes on Maintenance”).

## Particularly Dangerous Points



- Particularly dangerous points must be labeled as such. The various warning labels and their location on the machine are described in the section entitled “Labeling.”
- There is increased danger when the welding chamber is open and the interlock switches are simultaneously bridged (model dependent).
- Above all, never operate the laser while your hands, fingers or other body parts are positioned directly inside or beneath the cross-hair or path of the laser beam.

## Emission of Noxious Gases and Vapors



- Avoid inhalation of vapors produced during the welding applications process with correct use of the argon (inert) gas.
- Radiation produced by laser light is capable of melting, burning or vaporizing almost any material. The composition of the work piece also dictates the vapor or gases that are generated; therefore, appropriate safety precautions are essential and critically important. The operator should filter the air exhausted as required by OSHA regulations (for further details, reference the section on installation).
- Never use this machine on non-metallic materials, especially plastics.

## Equipment Modifications: Structural, System, and Software

- + **Never attempt to make additions or modifications to this equipment (structural or otherwise); any alteration requires mandatory written approval from LaserStar Technologies Corporation®.**
- + **It's important that this device be maintained as intended and kept in safe and operable condition. Be sure to immediately replace all parts that are not in optimal working condition. Never purchase or install components from other manufacturers; use only LaserStar Technologies Corporation® replacement and consumable parts.**

### **Important Advisory:**

Parts ordered from LaserStar Technologies Corporation® meet stipulated requirements for safety and performance; **there is no guarantee for parts purchased from companies other than LaserStar Technologies Corporation®.**

## Safety Officer

**When class 4 laser equipment is installed, the employer must appoint a competent Laser Safety Officer;** this action must be recorded in writing. In the case of **class 1** laser devices, the Laser Safety Officer need only be present while the service technician is carrying out service or maintenance on the equipment (and only when there's direct access to the laser beam). This assumes that the service technician bypasses the interlock switches or removes the protective covers from the machine.

With ongoing training and experience in the field of laser radiation, the Laser Safety Officer should be fully competent in operating the welding workstation. In addition, this person should **be knowledgeable and informed on all important safety protocols for the machine, as the Laser Safety Officer bears full responsibility for the safe operation of the laser equipment and correct implementation of mandatory safety measures.**

When completing training for proper use of the welding workstation, the Laser Safety Officer may elect to receive instruction from an approved body (e.g. an institution providing insurance against occupational accidents) or alternatively, can purchase and enroll in training provided by LaserStar Technologies Corporation®.



Caution!

**Authorized personnel with responsibilities for the operation, maintenance, or repair of this device must read and understand both the safety protocols and operating instructions for the equipment. Be sure to use this device only for its intended purpose; never aim the laser's beam in the direction of or directly at humans or animals.**

## **What To Do If You Receive A Burn**

If a laser pulse has burned your fingers or hand, you must be sure to have the wound treated. Depending on the severity of the burn, medical treatment may be necessary. Although a small burn is not particularly critical, it must still be monitored to be sure there is no resulting infection.

### **Scattered Radiation!**



**Scattered radiation can also cause minor burns on the skin of your hand. Depending on the material, its reflective properties, and the selected pulse energy, scattered radiation can also be dangerous. Only under very unfavorable circumstances will the scattered radiation reach intensities that can cause slight burns; this is because individual laser pulses are very short.**

Normal exposure of the skin to low levels of scattered radiation (at a wavelength of 1064nm) is regarded as physiologically safe; in this instance, infrared light is comparable with radiation from the sun.

### **Notes**

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## Important Safety & Informational Labels (Figures 1–7)

(9)  
[810-8001-10]  
Operator Must  
Read the Manual  
Prior to Use.

(2)  
[810-00-019]



**Figure 1**  
(Mains Power  
and Key Switch)

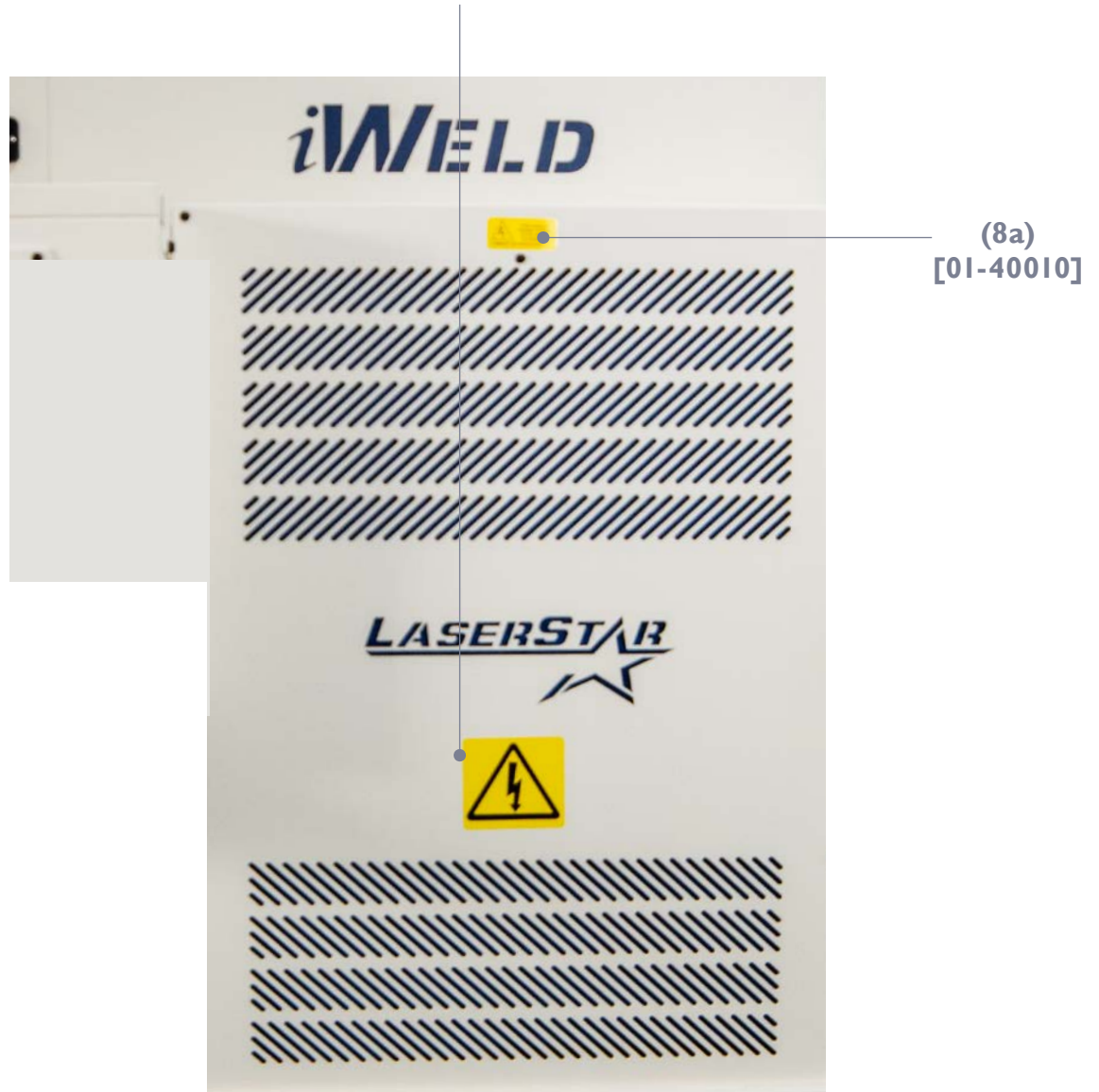
(6a)  
[71-40028]  
Required on All  
Welder Models.

**Important Safety & Informational Labels**  
**Continued on Next Page**



## Important Safety & Informational Labels (Figures 1–7 [continued])

(8b)  
[810-00-016]  
Label is Affixed to  
Both Side Panels.



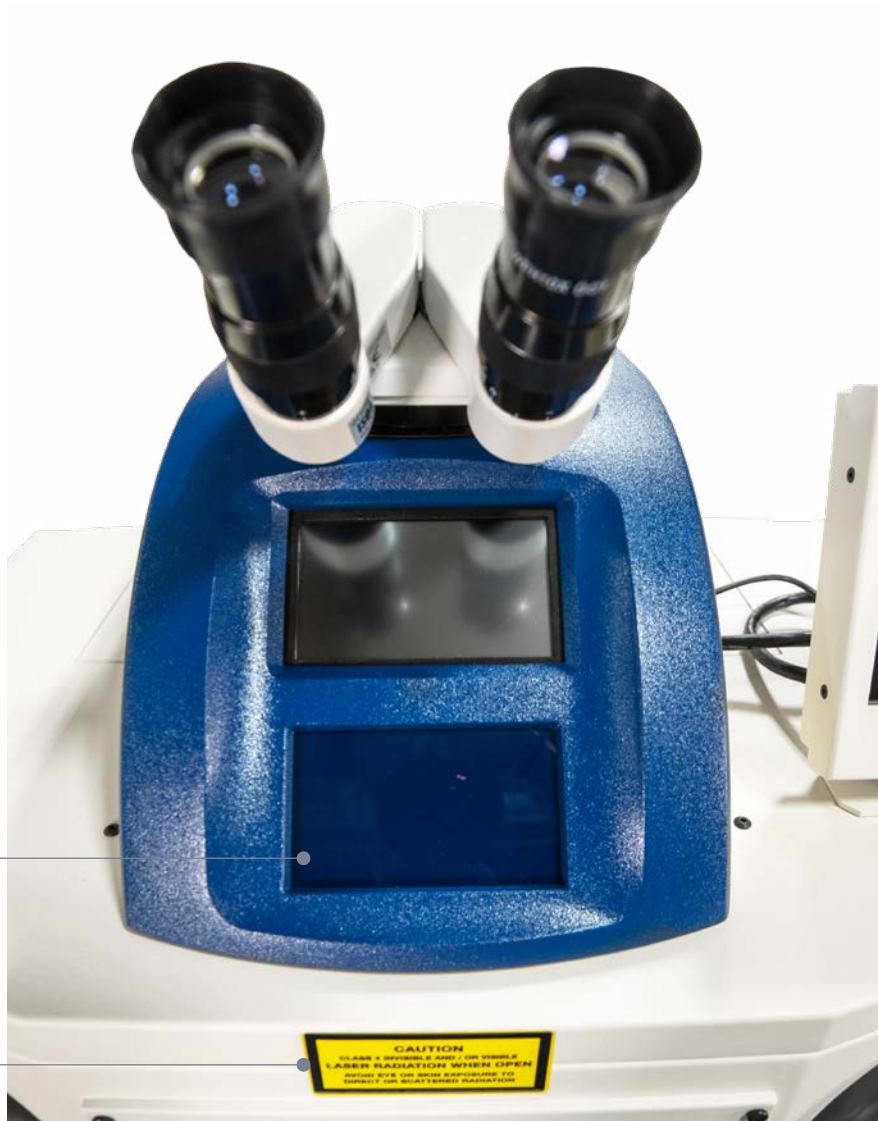
**Figure 2**  
(Right-side View)

**Important Safety & Informational Labels  
Continued on Next Page**

## Important Safety & Informational Labels (Figures 1–7 [continued])

(1a)  
[71-40026]

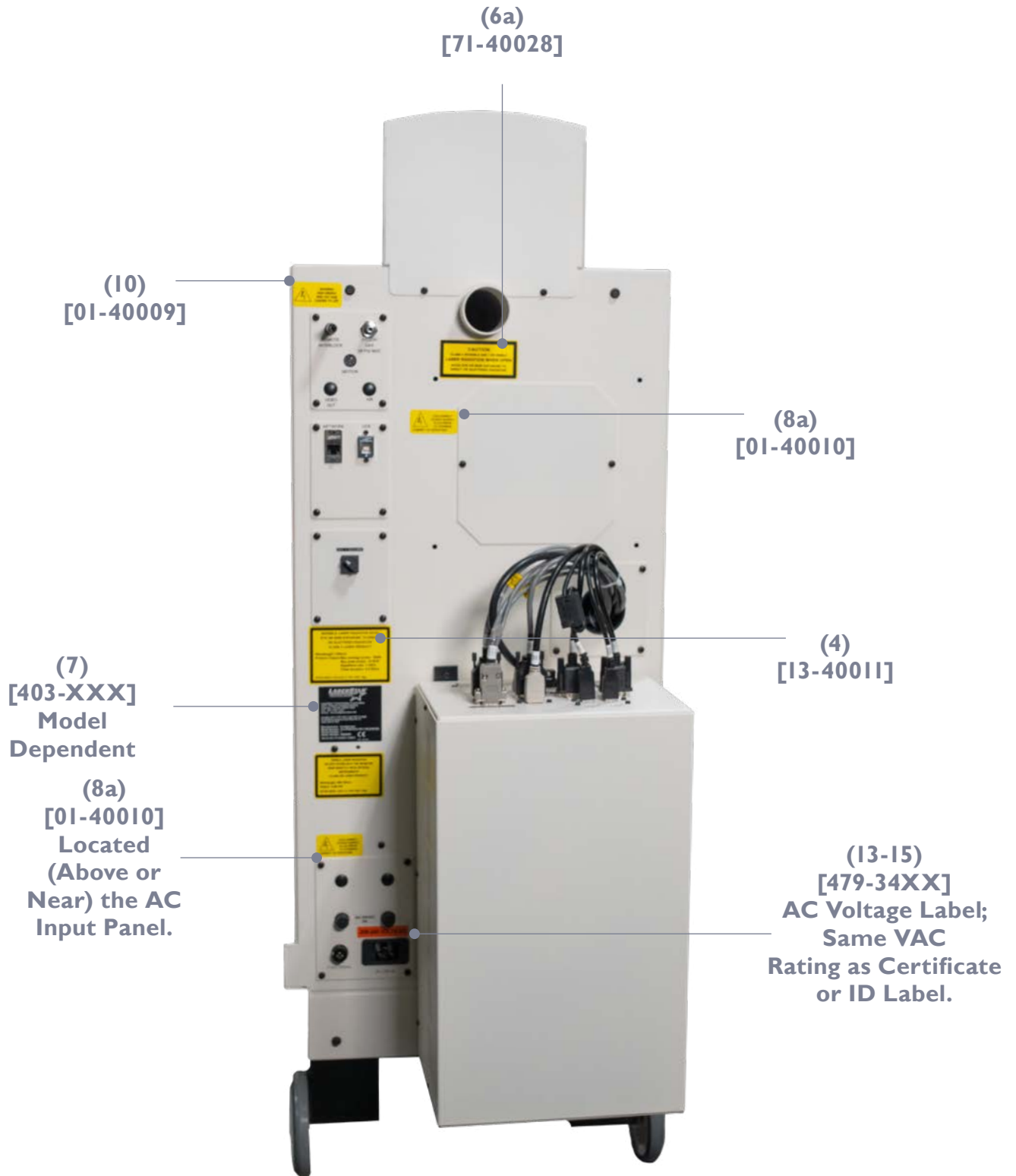
(6a)  
[71-40028]



**Figure 3**  
(View Window)

**Important Safety & Informational Labels  
Continued on Next Page**

## Important Safety & Informational Labels (Figures 1–7 [continued])

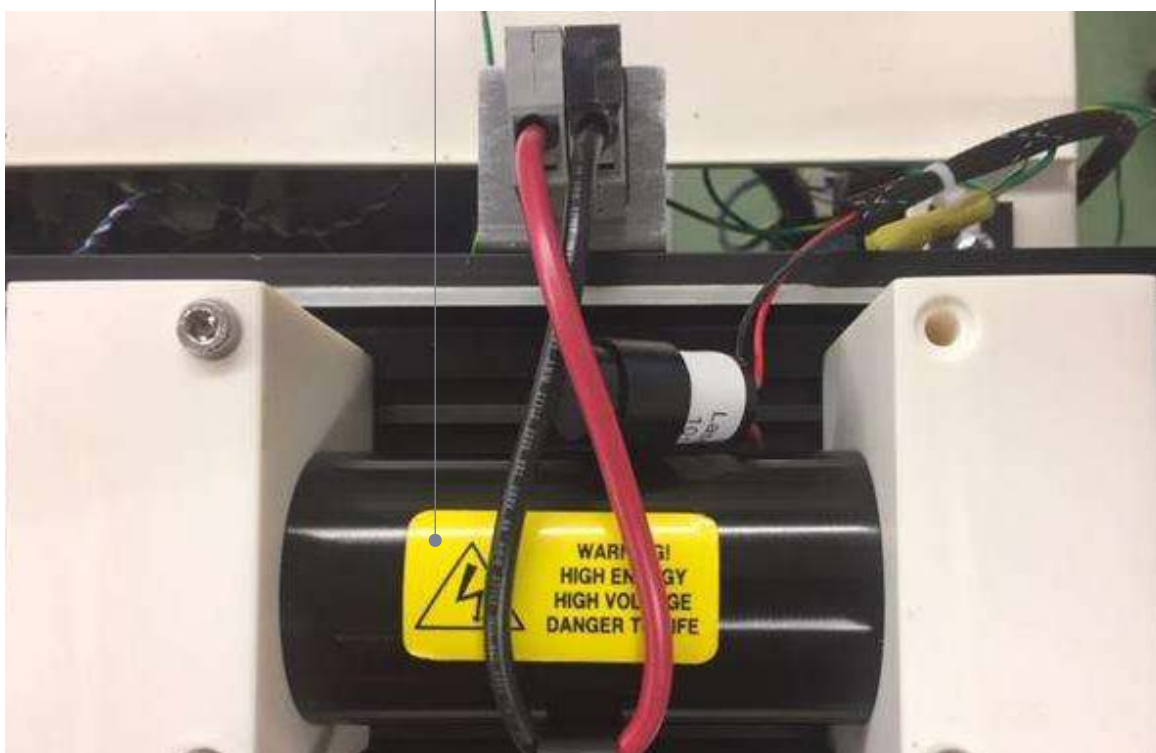


**Figure 4**  
(Rear View)

**Important Safety & Informational Labels**  
**Continued on Next Page**

## Important Safety & Informational Labels (Figures 1–7 [continued])

(10)  
[01-40009]



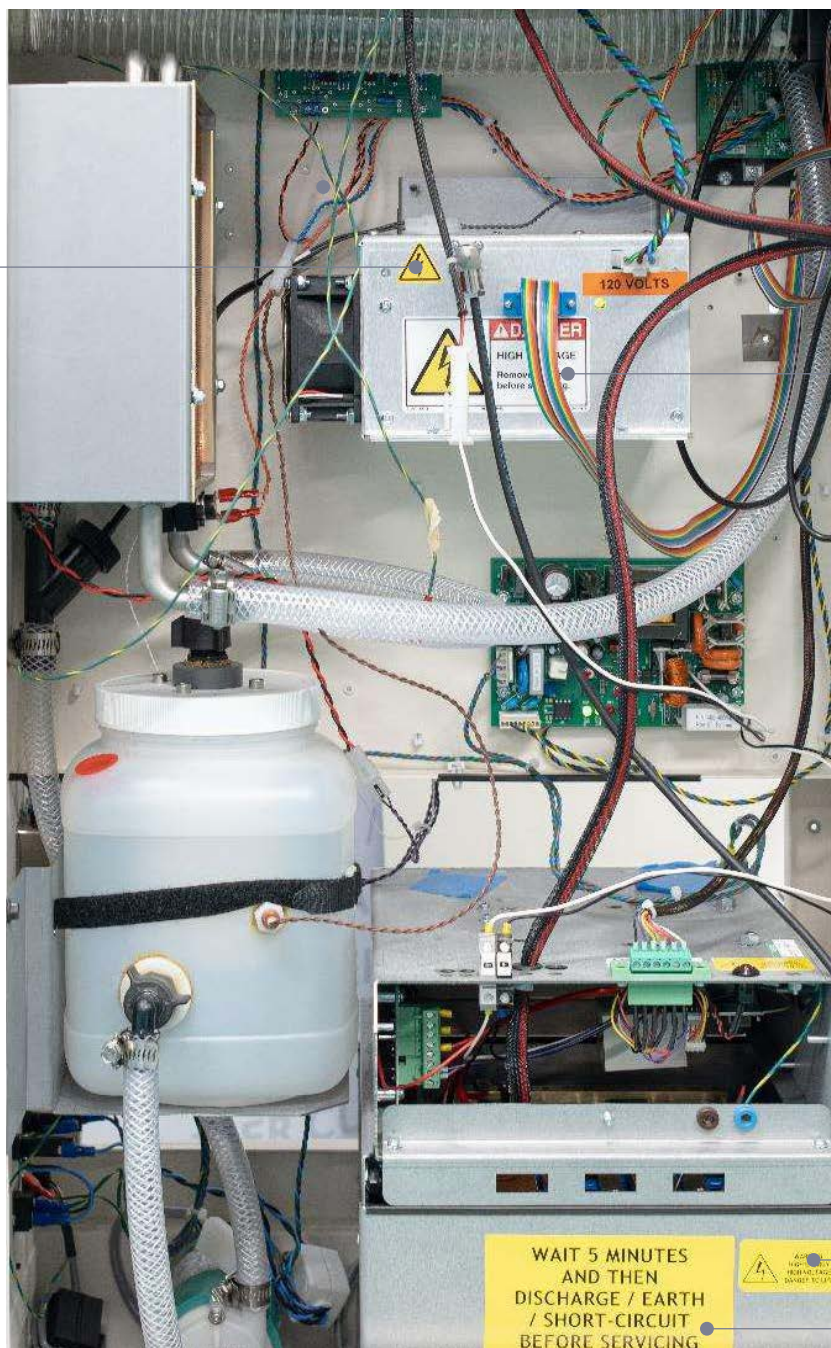
**Figure 5**  
(Pump Chamber)

**Important Safety & Informational Labels  
Continued on Next Page**



## Important Safety & Informational Labels (Figures 1–7 [continued])

(8b)  
[810-00-016]  
Equivalent



Danger: High  
Voltage; Remove  
Power Before  
Servicing Label.

(10)  
[01-40009]

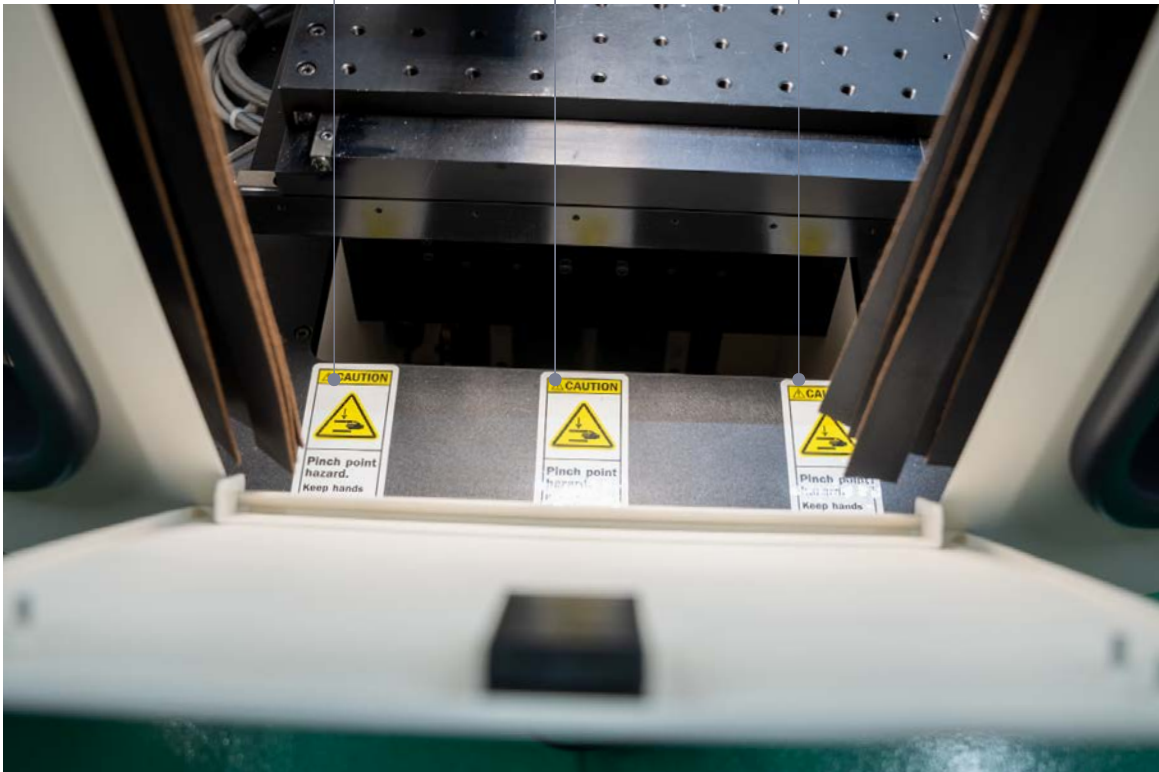
(12)  
(01-40012)

**Figure 6**  
(Flashlamp and  
Cap Charging Power  
Supplies)

**Important Safety & Informational Labels  
Continued on Next Page**

## Important Safety & Informational Labels (Figures 1–7 [continued])

(I5a)  
[810-8001-21]



**Figure 7**  
(Front Door, Opened)

**Important Safety & Informational Labels  
Continued on Next Page**

## Label Reproductions

Complies with **21 CFR 1040.10** and **1040.11**, except for deviations pursuant to [Laser Notice No. 50](#); dated July 26<sup>th</sup>, 2001.

### Aperture (1a or 1b; model dependent)



(1a)  
[71-40026]



(1b)  
[01-40026]

### General Warning



(2)  
[810-00-019]

### Visible and /or Invisible Radiation (3a or 3b; model dependent)



(3a)  
[71-40025]



(3b)  
[01-40025]

Label Reproductions Continued on Next Page

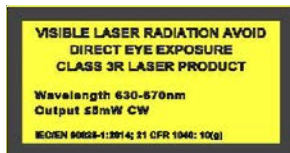
## Label Reproductions (continued)

### Invisible Radiation Output & Standards (model dependent)

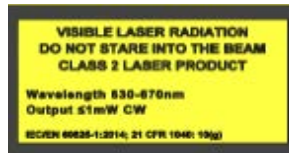


(4)  
[13-40011]

### Visible Radiation Output & Standards (5a or 5b; model dependent)



(5a)  
[48-40004]



(5b)  
[48-40007]

### Non-interlocked Protective Housing (6a or 6b; model dependent)



(6a)  
[71-40028]



(6b)  
[01-40028]

Label Reproductions Continued on Next Page



## Label Reproductions (continued)

### Device Certificate or Identification (model dependent)



(7)  
[403-003]

### Danger: High Voltage (be sure to disable power source before servicing)



(8a)  
[01-40010]



(8b)  
[810-00-016]

### Operator Must Read Manual Prior to Use



(9)  
[810-8001-10]

Label Reproductions Continued on Next Page

## Label Reproductions (continued)

### High Energy, High Voltage, Danger to Life



(10)  
[01-40009]

### ETL Certification (model dependent)



(11)  
[403-450]

### Wait 5 Minutes Before Discharging



(12)  
[01-40012]

Label Reproductions Continued on Next Page

## Label Reproductions (continued)

**208 – 240 Volts AC (model dependent)**



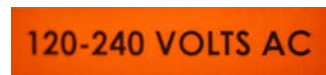
(13)  
[479-3414]

**120 Volts AC (model dependent)**



(13)  
[479-3413]

**120 – 240 Volts AC (model dependent)**



(13)  
[479-3415]

**Device Certificate or Identification  
(model dependent)**



(14)  
[48-40001]

**Caution: Pinch Point Hazard; Keep Hands  
Clear (16a or 16b; model dependent)**



(15a) (15b)  
[810-8001-21] [810-8001-22]

[illegible]

[illegible]

# III. Installation

## Overview and Requirements

This section describes the requirements that must be fulfilled to ensure faultless operation of the welding workstation. Details for installation, setup, and transport are also provided in this chapter.

## Safety Guidelines

**To ensure faultless operation of the laser welder, the installation site must adhere to the following specified safety requirements:**

- The welder should be installed in and remain in a location that is as dust-free as possible.
- Never expose the machine to direct sunlight.
- To ensure proper ventilation, the minimum clearance between the welder and any wall surface must be a minimum of at least 12" (300mm) from the back and sides.
- Never position the equipment in a way that makes it difficult to access or operate the machine's disconnecting device.
- The welder must be connected to an approved external filtration and fume exhaust system (either purchased separately or through LaserStar Technologies®). For details on setup and assembly, be sure to reference the included quick setup guide: External Fume & Heavy Particle Exhaust and Optional Cyclone – Quick Setup Guide in the back of this manual.



Caution!

**When choosing an installation site, you must take into account for maintenance, the ability to limit laser area is required (see regulations set forth by OSHA regarding accident prevention for laser radiation, ANSI Z136.1-2014, Safe Use of Lasers, or equivalent national or international regulations (e.g. IEC/EN Standard 60825-1:2014))**

## Ambient Conditions

Operating Temperature: (reference **Introduction > Technical Specifications; section I**)

Storage Temperature: (reference **Introduction > Technical Specifications; section I**)

**(Note: If the laser welder contains cooling water, do not store or transport when temperatures are below 3°C [frost risk]).**



Warning!

**Never add antifreeze solution to de-ionized cooling water.**

## Environmental Conditions

Elevation: (reference **Introduction > Technical Specifications; section I**)

Relative Humidity: (reference **Introduction > Technical Specifications; section I**)

## Unpacking



Warning!

**This equipment has been thoroughly inspected and tested prior to shipping; the welder has been delivered in faultless condition. Before opening the shipping container, be sure to thoroughly inspect the outside of the crate for indications of damage that may have occurred in transit.**

- If possible, transport the equipment to its final destination using the supplied skid.
- When unpacking the equipment, be sure to carefully remove the machine from the shipping container, packaging, and skid base.
- For helpful tips and step-by-step instructions on setup, be sure to reference the included quick setup guide: iWeld Industrial 1902-MFX Series Laser Welding System – Quick Setup Guide in the back of this manual.

Standard Shipping Container Contents

- iWeld® Industrial 1902-MFX Series Welding Workstation (stand-alone; without accessories)
- Viewing System
- Distilled Water
- Operation Manual (digitized version; included on flash drive)

(Note: Deliveries can include additional optional accessories. Following drop-off, be sure to reference your packing slip and compare with parts received.)

Notes

## Initial Power Connections and Distilled Water Filling



The activities described in this section should only be performed by trained service technicians who are affiliated with LaserStar Technologies Corporation® or other authorized personnel who are trained and qualified. Warranty claims for damage to persons or property that are the result of an improperly connected device will not be honored.



Check the VAC label and ID label on the rear of the machine and compare with the power conditions at the installation site.

### AC Voltage Input (AC disconnect)

The AC Voltage Input (AC disconnect) is used to supply AC power to the machine. (Note: Disconnecting this plug will disconnect AC power from the machine.) Each of the switches for the welding workstation (**main power switch** and **system key switch**) should be in the “off” position before applying AC voltage.

The machine’s model determines the AC requirements; check that the AC supply agrees with the specifications on the identification label (located on the rear of the welder). The identification label includes the machine’s model number, serial number, AC requirements, etc. (Note: Make sure the machine is grounded; the ground wire must be connected for safe and reliable operation.)

**(Note: When replacing the detachable “mains” supply cord, it’s important to purchase a cord that is appropriately rated. Be sure to check the rating for the replacement cord before purchase. Do not use or purchase cords that are inadequately rated.)**

### Securing the Welder with Brackets



Caution!

Brackets are supplied for applications that require the welder to be secured to the floor (horizontal surface) or wall (vertical surface) for increased stability. Brackets also prevent accidental tipping of the machine and should be used. For detailed instructions on attaching the brackets, reference **Service > Securing the Welder with Brackets; Section G.**

**(Note: The brackets and screws for securing the welder are fastened to the machine before transport. Be sure not to mistakenly discard them.)**



## Remote Interlock Connector

This machine is equipped with a remote interlock connector for connecting to a secondary interlock system; **the welder will not generate a laser pulse unless the remote interlock connector is closed.**

If you are not connecting the remote interlock to an additional interlock system, the shorting connector must be installed on the welder to enable operation of the laser.

- The shorting connector and keys for the key switch are included in the bag inside the welding work chamber.
- For the location of the remote interlock connector, reference **V. Maintenance: External Fuse Replacement, Rear System Overview, and External Connections.**
- To enable operation of the laser, you must insert the shorting connector into the remote interlock connector (located on the controls panel; rear of the machine).
- Manually tighten the connector locking ring clockwise until finger tight.

The remote interlock connector may be used to readily connect the system to a remote interlock circuit, such as an entry door into a specific laser room.

### **To connect the remote interlock to a secondary interlock circuit, the following requirements must be adhered to:**

- Before wiring, the shorting jumper (under the plastic cover of the connector) must be removed.
- The wiring should be routed away from all power cords and should not exceed thirty (30) feet or nine (9) meters in length.
- The interlock must be a voltage-free, form-a contact (normally open) that is held closed to enable operation of the laser.
- The shorting connection in the connector must be removed and wired to the secondary interlock circuit.
- A licensed professional in compliance and knowledgeable of applicable electrical codes must perform the wiring procedure.

## External Exhaust System

This laser system is equipped with an exhaust connection (2.0" or 50.8 mm) at the rear of the enclosure. We recommend the use of an external exhaust system with the appropriate air filtration (dependent on the type of material being marked, engraved or cut) and an enclosure extraction or vacuum (laser power and enclosure size are taken into account when determining the required "CFM" [200 to 400 CFM is the typical range; application dependent]).



Warning!

**Processing vapors with particulates can be an explosive or fire hazard (depending on the particulate material and concentration). Consult your organization's internal safety department for details on regulations and concentration levels of fumes with particulates (for your specific material processing) and for requirements set by your local authority for permissibility and safety limits to ensure the lasing equipment is adequate for your application. Lastly, be sure to change the machine's filters before the change filter indicator is red.**

Inert Gas: Pressure & Flow Regulation		
Operating Pressure (maximum)	Operating Pressure (minimum)	Flow Range (typical)
3.8 bar (59 psi; 0.38 MPa)	0 bar (0 psi; 0 MPa)	10 to 30 CFH

**(Note: To increase cost-savings and offset the expense for inert (argon) gas, the flow rate should be adjusted to the lowest setting possible for achieving the necessary surface finish.)**

## Distilled Water

Before the workstation is powered "on" for the first time, the water reservoir must first be filled with distilled water; use **only** distilled water. The procedure for filling is described in **Service > Section A: Initial Filling with Distilled Water**.

## Electromagnetic Compatibility

This device meets EMC standards listed in the **Declaration of Conformity** and **Declaration of Compliance**.

## Disassembly and Transport

To prepare the equipment for transport over short distances, you will only need to unplug the power supply and inert gas supply and loosen the locking brake(s) on the front wheels. The distilled water can remain in the water reservoir, but the tank must be removed from the enclosure.

Before storing the equipment or transporting over longer distances via freight truck, it is recommended that you empty the distilled water bottle. For this purpose, be sure to reference **Service > Replacing the Distilled Water and Changing the Water Reservoir Filter; section C.**

## Preparing for Storage

The equipment must be stored in a clean environment that meets specified storage temperature and humidity requirements. These details can be found in **Introduction > Technical Specifications; section I.**



Caution!

**Do not store or transport the device when temperatures are below 3°C (38°F) and while the cooling water remains in the tank or device's laser head, as there is a risk of damage from frost.**

If you anticipate storing or transporting the device at temperatures below 3°C (38°F) or if the equipment will remain unused for longer than a one-month period, the flashlamp chamber (located in the top optical rail) must be drained. Additionally, you must also drain the water from the machine's hoses and pumps.

**(Note: The procedures for draining the equipment should only be performed by trained service technicians who are affiliated with LaserStar Technologies Corporation® or other authorized personnel who are trained and qualified. Use of unsuitable materials (e.g. tissues and clothing) for drying out optical components can scratch surfaces and cause irrevocable damage.)**

## This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

## This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

## IV. Operation

### Overview and Fundamentals

This section describes system operations. The ( > ) symbol notes actions that must be carried out by the operator. In most cases, the actions performed by the operator (in any form) will result in reactions from the equipment; these reactions are marked with a (⊗) symbol. The welder can be operated from the touchscreen display. The buttons on the touchscreen are icons or pictograms used to initiate an action or function when pressed.



**Attention:** To ensure optimum performance, the laser source should be turned on and allowed time to warm up; this warm-up period is important, as it affects final power output. (Note: Some applications will not be sensitive to the output variation.) Details for the warm-up period applicable for this machine can be found in Section 1: Introduction > Technical Specifications.



Caution!

**Attention:** Use of controls or adjustments made to performance or procedures other than those specified herein may result in hazardous radiation exposure. If this machine is operated in a manner that has not been approved by the manufacturer, the equipment protections may fail or be compromised. Before operating, be sure that all users have read the information in the section for safety within this manual.



**Attention:** To preserve the touchscreen display and extend the life of this digital device, you should refrain from using inappropriate items (i.e. pencils, pointers, pens, etc.) to press buttons or interact with the digital display. Using these and other unsuitable items can cause the touchscreen display to malfunction, resulting in erratic or faulty operation. This will reduce the lifetime of the touchscreen device and also void the machine's warranty.

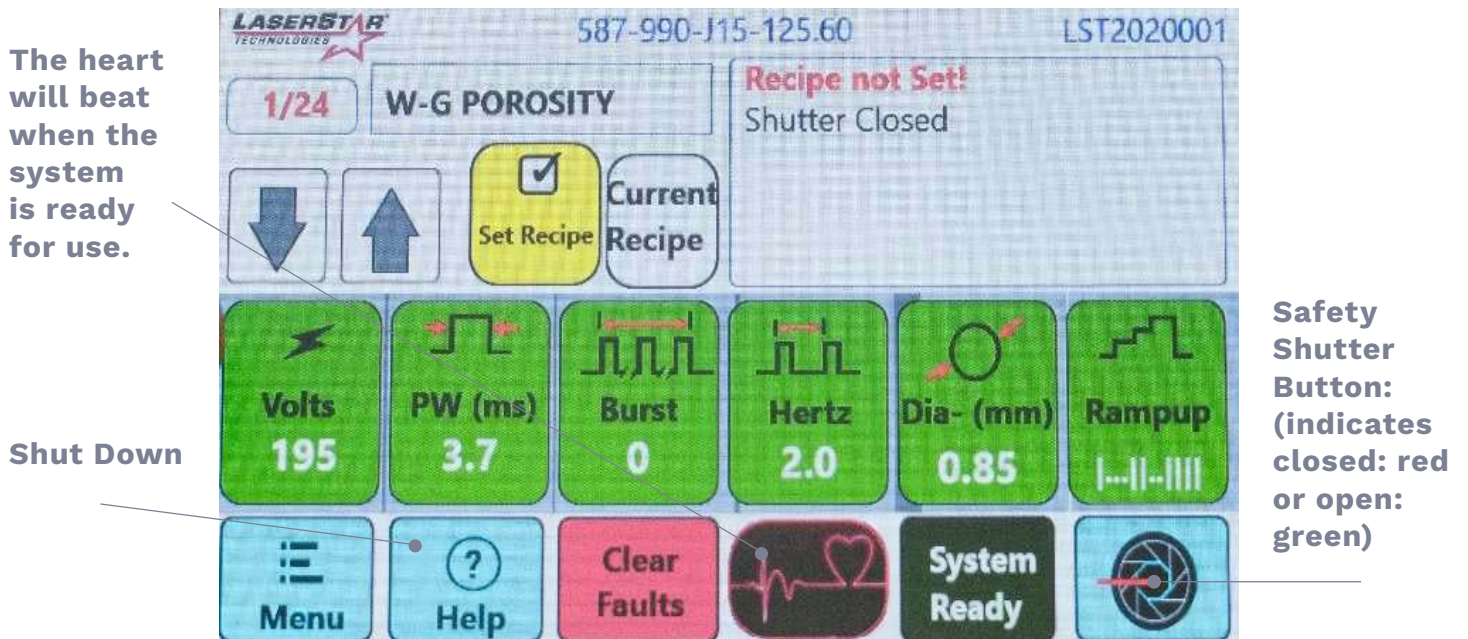
Fingers (not finger nails) and the stylus pen that's been included with the machine are the only acceptable instruments that should be used when interacting with the touchscreen display.

## Initial Operation (Figures 1 – 2c)

After having completed all steps described in the section, “Initial Power Connections and Distilled Water Filling,” the welder is ready for use. Instructions for switching “on” follow:




**Figure 1**  
(Switching “ON”)



**Figure 2**  
(Touchscreen  
Display)

## Switching “On” & Switching “Off” the Welder

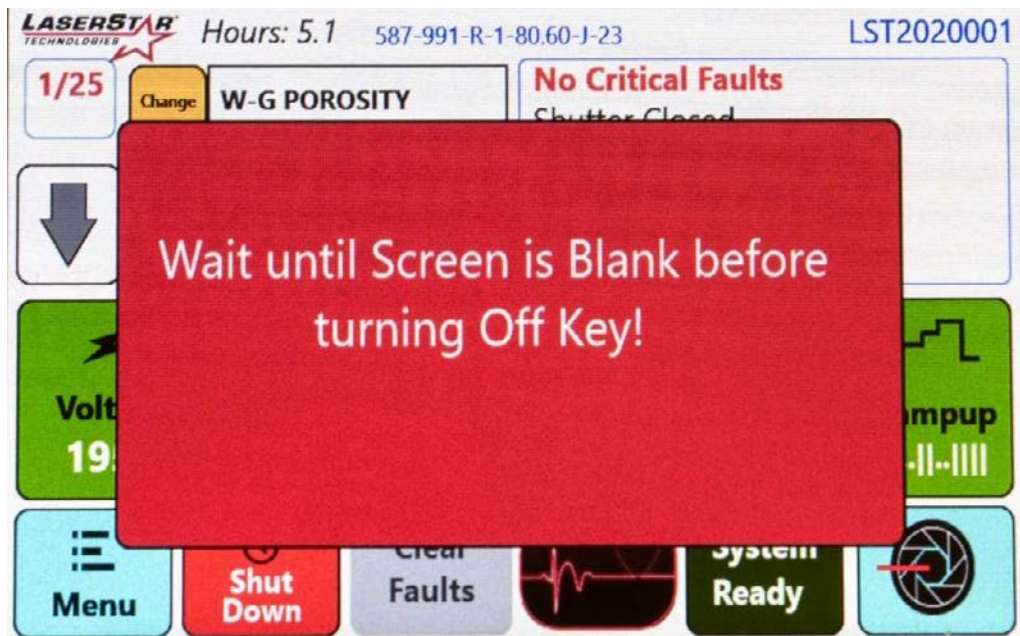
Operator Action	System Response
> Make sure the Key switch is in the “OFF” or “O” position ( <b>Figure 1</b> ).	(□) Verify.
> Turn the Mains Power Switch to the “ON” or “I” position) ( <b>Figure 1</b> ).	(□) The cooling pump will start. ( <b>Note: For optimal laser performance, wait approximately three minutes before turning on the key switch.</b> )
> Turn the key switch on (“I” position) ( <b>Figure 1</b> ).	(□) The touchscreen display will turn on. The device carries out a series of self-tests. If any failure occurs, an error message will be indicated in the display (see the section entitled “Status Indications”). The lighting in the welding chamber/area may come on (Note: Depends on dimmer setting.)
> Wait until the self-test (initializing) has been completed ( <b>Figure 2</b> ).	(□) The heartbeat display button on the touchscreen display will be beat when the system is ready for use.
> Press the Safety Shutter Button. (Note: Located on the touchscreen display.) ( <b>Figure 2</b> ).  	(□) The indicator located within the “safety shutter” button on the touchscreen display will change from closed to open when the shutter is pressed.
> Switching “Off” Power Down Procedure	Press the (Shut Down button) on the keypad ( <b>Figure 2</b> ). The Shutdown window will appear ( <b>Figure 2a</b> ) Press the (Shut Down) button on the Shut Down window. Wait for the screen to turn blank. ( <b>Figure 2b</b> ). When the screen is blank turn the Key switch to the off position. Now turn off the Main Power (Red Switch) ( <b>Figure 1</b> )



## Switching “On” & Switching “Off” the Welder



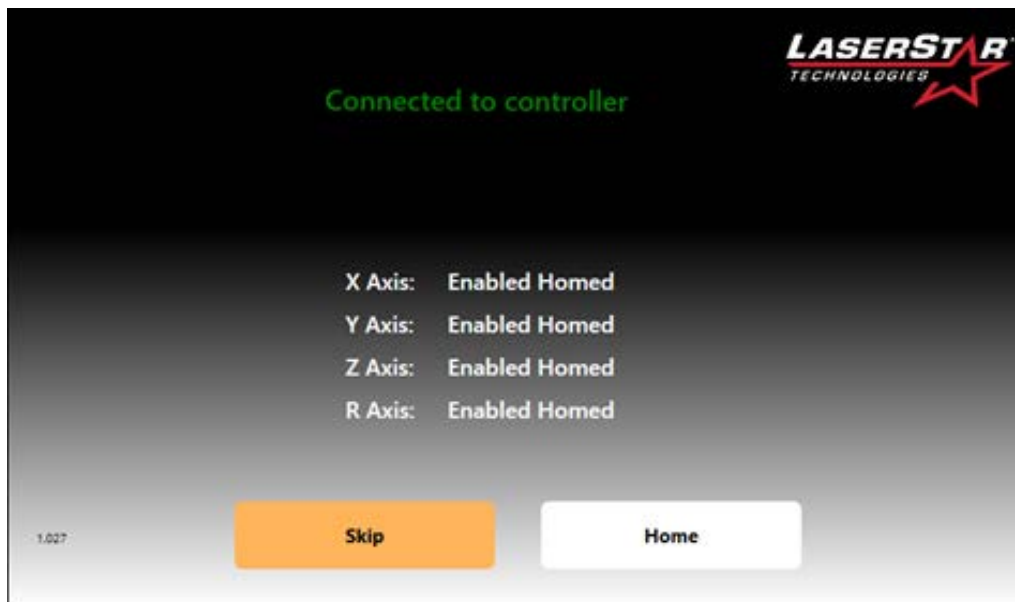
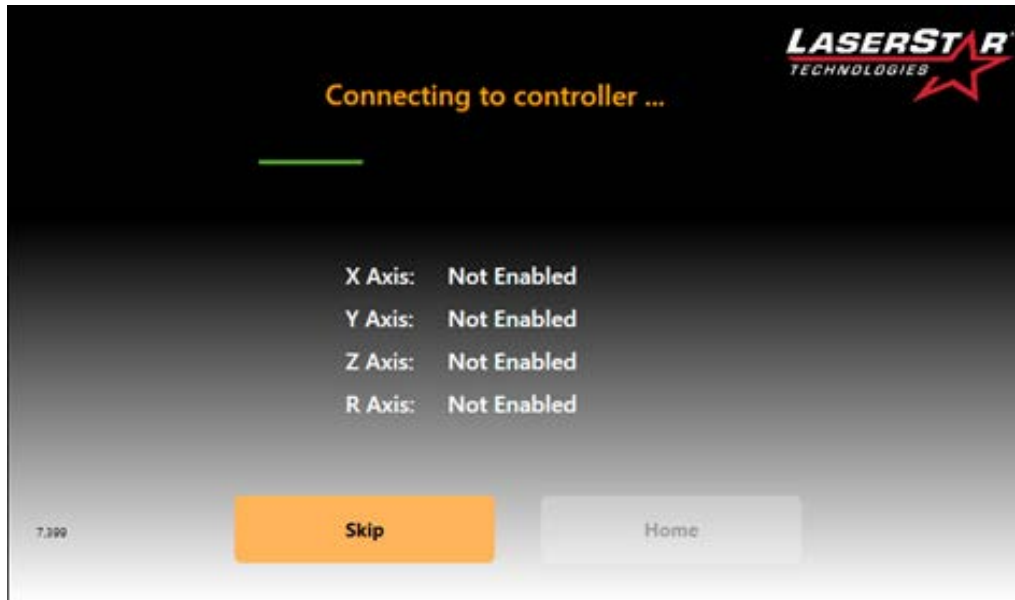
**Figure 2b**  
(Shut Down; message 1)



**Figure 2c**  
(Shut Down; message 2)

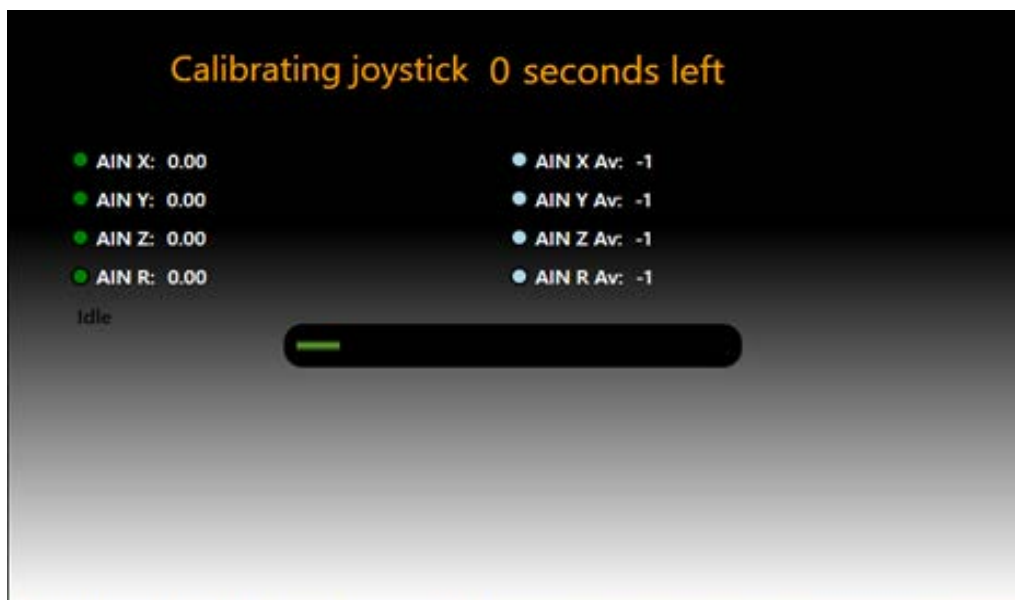
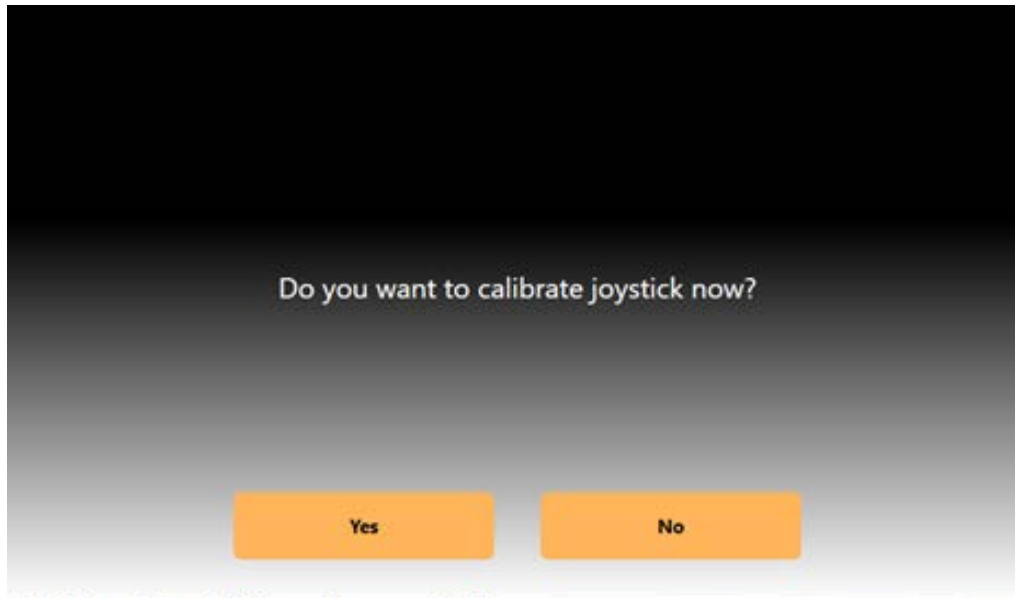
## Motion System Power-up Procedure

The “connecting to controller” screen will appear.



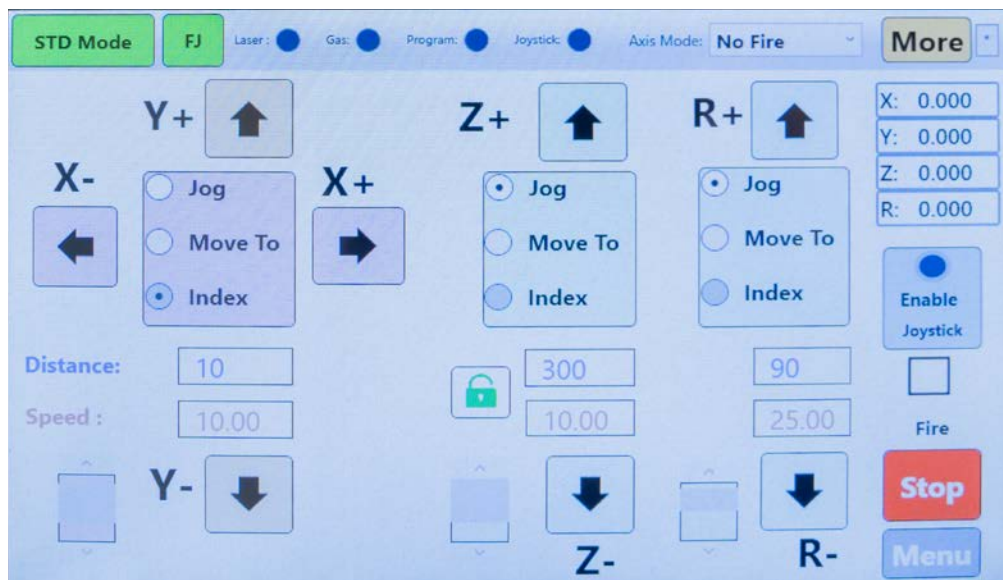
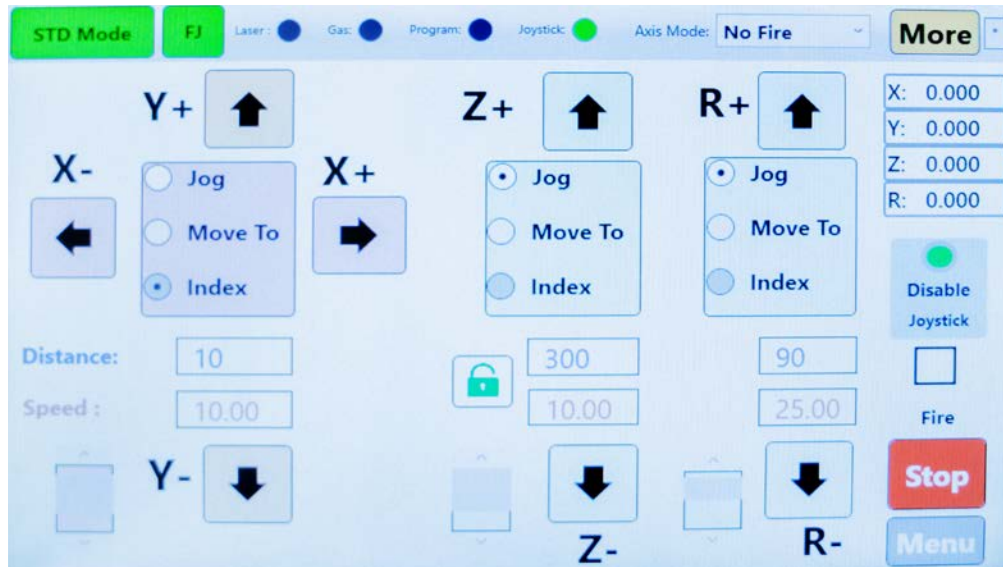
Press the **Home button** and the motion will home to 0-X, 0-Y and Max Z.

When the homing is completed, the joystick calibration screen will appear. Click “Yes.”



**(Note: Make sure not to touch Joystick during calibration as this will cause the joystick to calibrate incorrectly which can lead to axis moving when they shouldn't.)**

After calibration the “Jog Traditional” screen will appear.



Press the **Enable Joystick button**. This button will turn green when the joystick is enabled.

Test the joystick by moving the joystick forward and back, then left to right. This will move the X and Y axis.



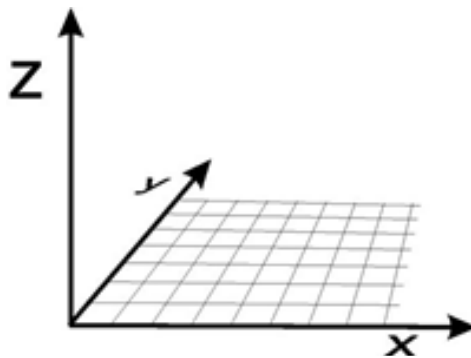
Twist the top of the joystick counterclockwise to move the motion platform down, clockwise for up. Test the rotation jog by pressing the buttons in the back of the joystick.



## Getting Started

Integrated MotionFX CNC Welding Workstations are configurable with up to four axes of motorized motion (XYZR).

- X axis allows linear movement “left” and “right”
- Y axis allows linear movement “forward” and “backward”
- Z axis allows linear movement “up” and “down”
- R axis allows 360° rotational movement



**Integrated MotionFX CNC Welding Workstations** can be operated in manual mode by using the joystick to control the movements of the motion platform, or the motion can be programmed using G-code logic to instruct the Motion platform where and how to move.

**G-code stands for Geometric Code and can be programmed in two modes:**

**Absolute:** Coordinates (**G90**) are measured from program zero, the program's origin. The value entered is the distance measured in millimeters from 0.

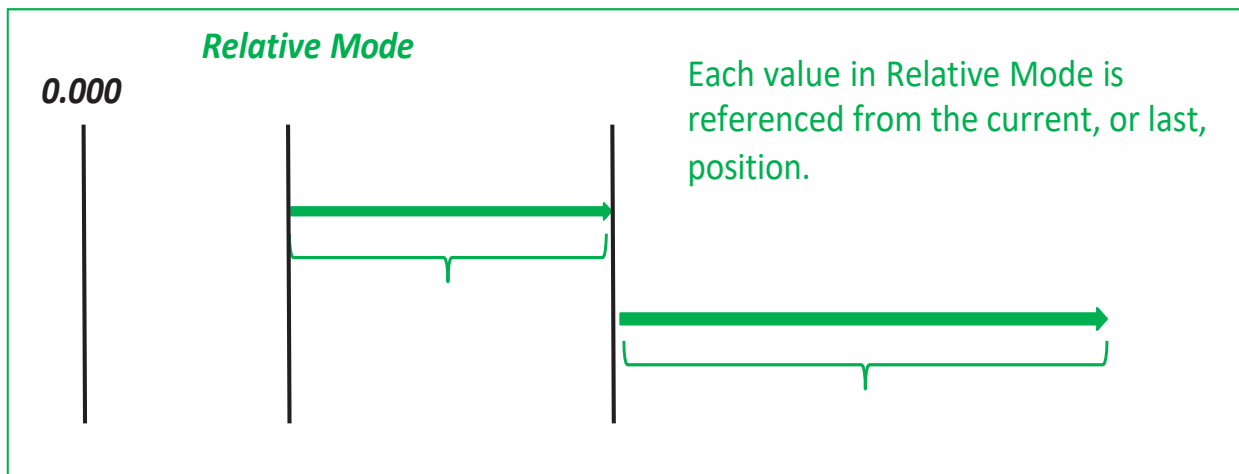
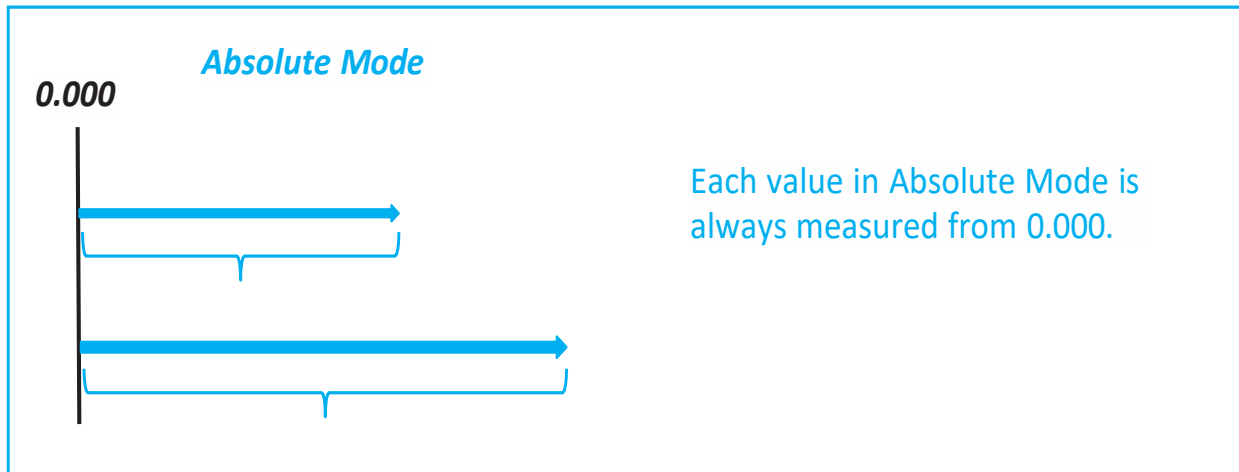
**Relative:** coordinates (**G91**) are measured from the current position. The value entered is the distance measured in millimeters from the current position.



**List of G-code Commands:**

- **G90:** Switch to absolute coordinates
- **G91:** Switch to relative coordinates
- **G0:** Move to coordinate with laser OFF
- **G1:** Move to coordinate with laser ON
- **G2:** Clockwise arc
- **G3:** Counter-clockwise arc
- **I:** Distance from arc start point to center point on X axis
- **J:** Distance from arc start point to center point on Y axis

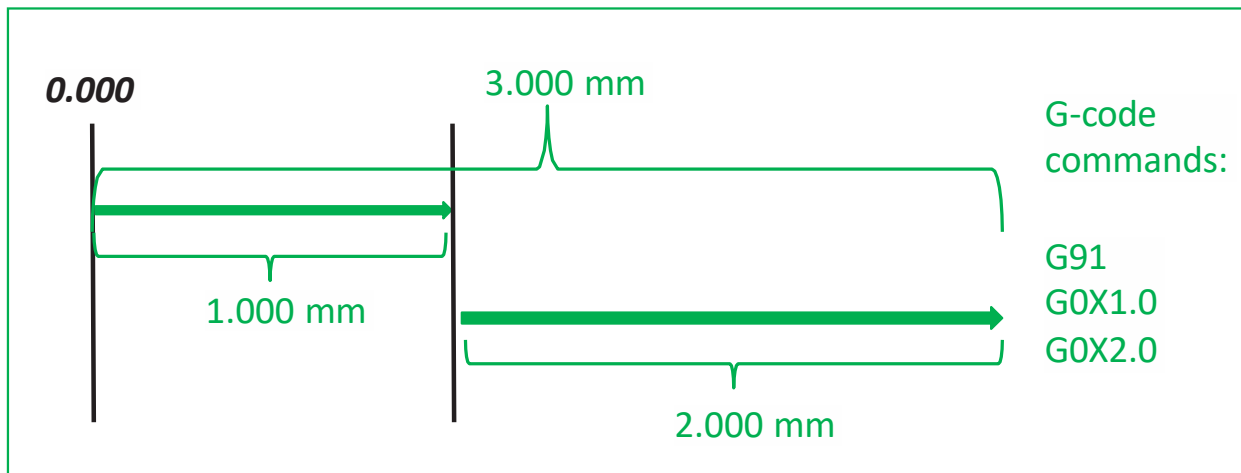
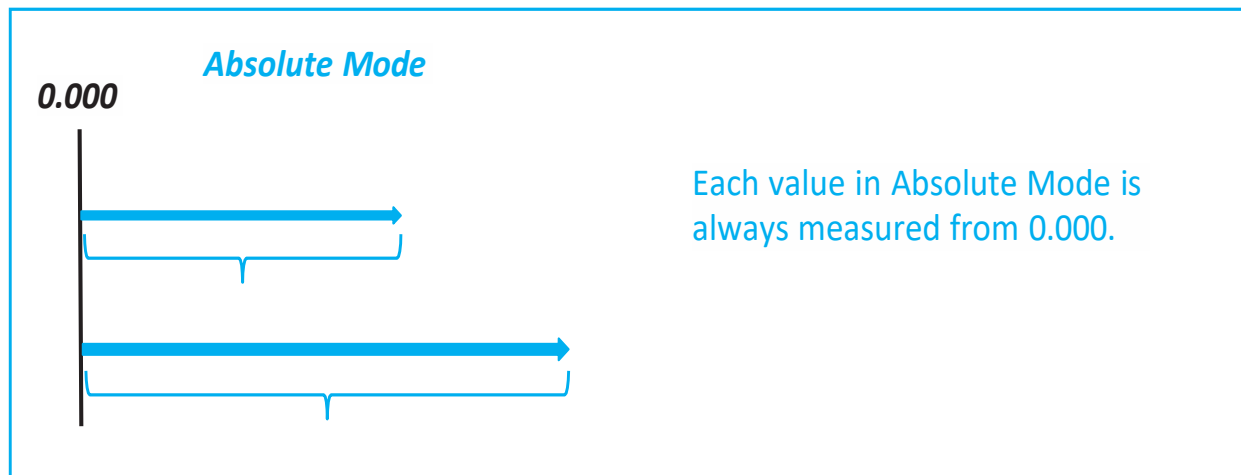
## Absolute versus Relative



**Absolute:** Coordinates (**G90**) are measured from program zero, the program's origin. The value entered is the distance measured in millimeters from 0.

**Relative:** Coordinates (**G91**) are measured from the current position. The value entered is the distance measured in millimeters from the current position.





In this example, the G-code is set to Absolute mode (**G90**):

G0X 1.0: The X axis is instructed to move to position 1.0

G0X 2.0: The X axis is instructed to move to position 2.0

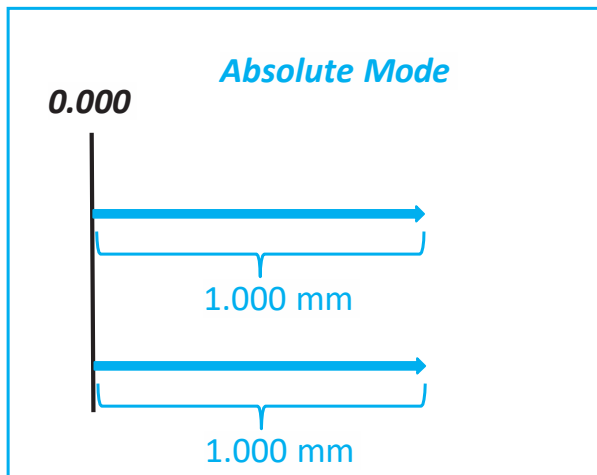
Result: The X-axis is at position 2.00

In this example, the G-code is set to Relative mode (**G91**):

G0X 1.0: The X-axis will move 1mm

G0X 2.0: The X-axis will move another 2mm Result: The X-axis is at position 3.00

Result: The X-axis is at position 3.00

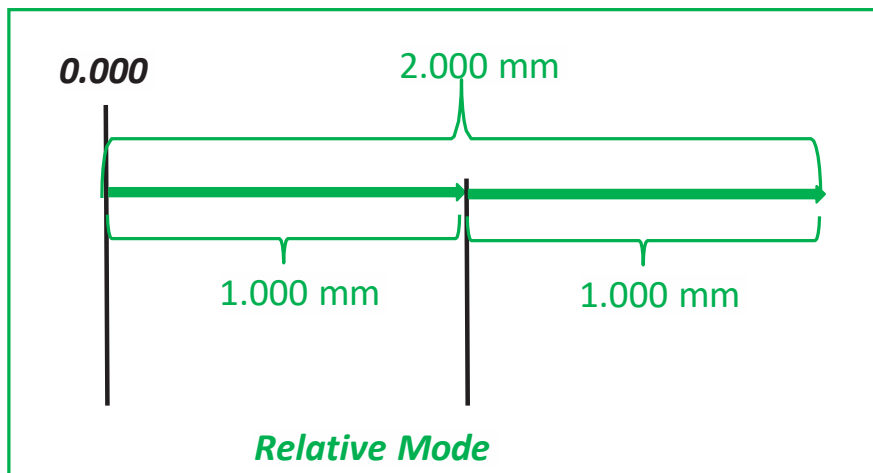


If we gave the same 1.000 mm move command (G0 X1.000Y0.000) twice in Absolute Mode we would still end up at 1.000 mm from 0.000.

G90 (absolute mode)

G0 X1.000Y0.000

G0 X1.000Y0.000



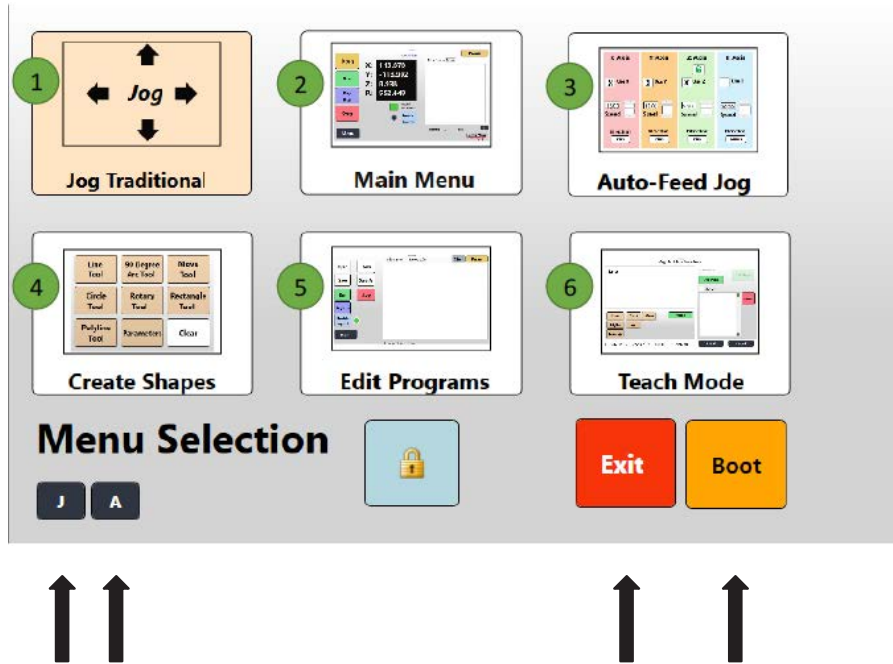
If we did the same thing in Relative Mode we would end up at 2.000 mm.

G91 (relative mode)

G0 X1.000Y0.000

G0 X1.000Y0.000

## Menu Selection Overview



This menu selection screen also contains a “Boot” button. The “Boot” button allows the user to select a menu that is open upon booting up of the program. To use it the user will press “Boot” then click on which menu they would like to be shown upon opening of the program and that menu will then be highlighted. For example, currently the “Jog Traditional” menu is highlighted meaning that when the program is opened this menu will be on the screen first. The “Exit” button beside the “Boot” button simply closes the program.

Buttons “J” and “A” technically allow you to calibrate the joystick beyond the autocalibration but are primarily for troubleshooting the system and will be used by service

The “Jog Traditional” screen is shown upon opening of the program by default. This is the screen used for much of the manual welding, jogging with the joystick/arrow buttons and/or index movement with arrow buttons.

The “Main Menu” screen is for loading pre-made programs for automated welding and running them.

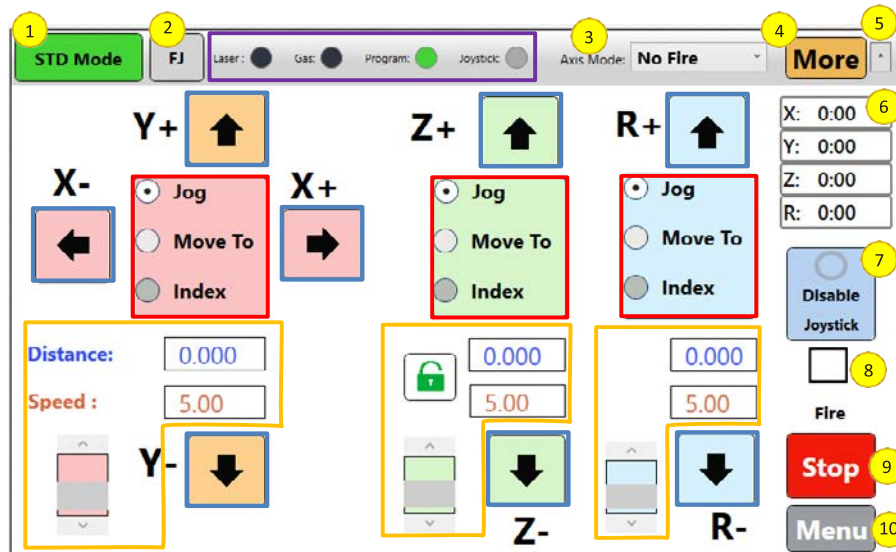
The “Auto-Feed Jog” screen is used for on- the-fly fixed speed welding with a foot pedal and/or joystick using axes of your choosing.

The “Create Shapes” screen is for creating a program, one shape at a time, for automated welding using specific input coordinates.

The “Edit Programs” screen is similar to the “Main Menu” screen with additional options to edit, save, and create new code.

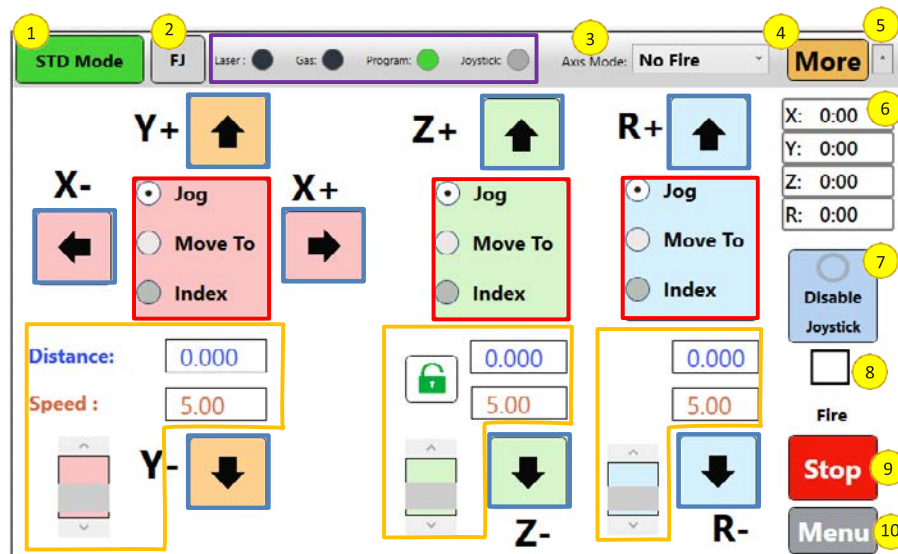
The “Teach Mode” screen is similar to the “Create Shapes” screen except that it allows the user to locate the points with the joystick instead of having to know exact coordinates.

## Jog Traditional



- 1 This box allows you to switch between standard and micro mode (Shown in Standard mode, only applicable to fiber lasers)
- 2 This box allows you to turn on and off “Fast Jog” mode. When this is enabled holding the joystick button will increase the speed of axis travel. When it is disabled (shown) the joystick button will fire the laser
- 3 The Axis Mode drop down allows you to change how the laser reacts to movement inputs on this screen
- 4 The “More” button unlocks this additional window. This window is for homing specific axes and for allowing/disallowing certain axes to move.
- 5 The “\*” button allows you to see the status of the limits of each axis.
- 6 This box shows the current position that the platform is currently at (in mm).
- 7 The joystick button is for enabling/disabling the joystick. When the dot is green and the box says “Disable Joystick” then the joystick is currently enabled. If the dot is gray and the box says “Enable Joystick” then the joystick is currently disabled.
- 8 The “Fire” box indicates whether or not the laser is enabled. If the box is unchecked the laser will not fire and if checked it will fire upon pressing the joystick button (if joystick is enabled) or fire upon pressing a movement arrow (depending on axis mode selected).
- 9 The “Stop” button stops all movement and lasing when pressed.
- 10 The “Menu” button returns back to the Menu Selection screen. Every screen on the “Menu Selection” screen will have this button in order to return back to select a different screen.

## Jog Traditional (continued)



In the red boxes is where you select the type of movement you will perform. “Jog” allows for movement using the on-screen arrows. “Move to” will move to an absolute coordinate location. “Index” will move a specified amount relative to the current location.



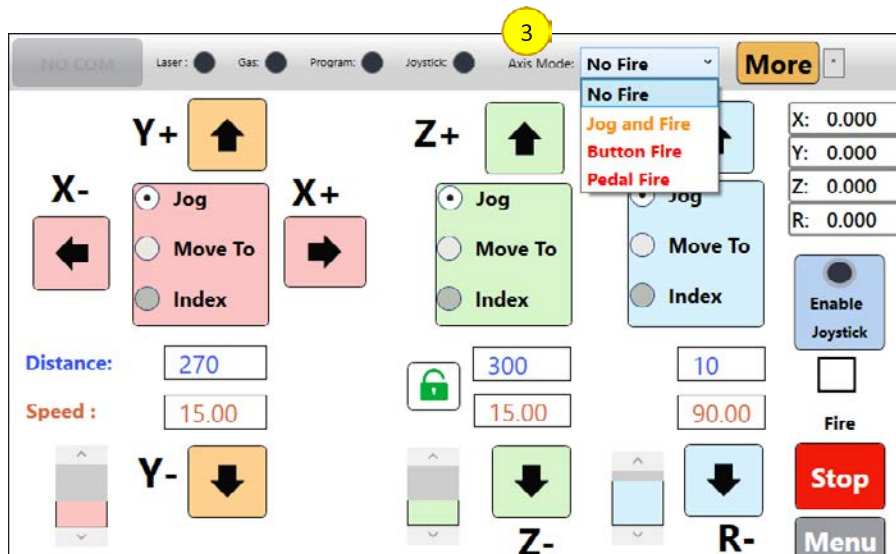
In the gold boxes the “Distance” box is the relative distance an index movement will go or the absolute location the move to movement will go to. The “Speed” box is the constant speed the laser will go for move to/index, and the maximum speed for the “Jog” option. There is a slider for adjusting the speed value. Note: units used are mm, mm/s, and degrees/s. The Z axis also has a lock button, this allows the axis to be prevented from moving when enabled.



In the blue boxes are the movement arrows. +Y moves away from the user, -Y towards the user, +X to the right, -X to the left, +Z up toward the ceiling, -Z down toward the floor, R+ rotary clockwise, R- counter-clockwise. For the “Jog” option these buttons are held down but for the “Move to/Index” they are pressed once.



In the purple box there are status indicators for the system. The indicators will light up if the action shown is happening. E.g., “Program:” turns green when a program is running. These indicators appear on other screens with the same function.



**The axis modes for the jog traditional screen do as follows:**

No Fire: Laser will not fire while using x / y / z / r buttons on screen to move motion platform

Jog and Fire: The laser will fire while using x / y / z / r buttons on screen to move motion platform

Button Fire: Laser will fire using the joystick button while using x / y / z / r buttons on screen to move motion platform

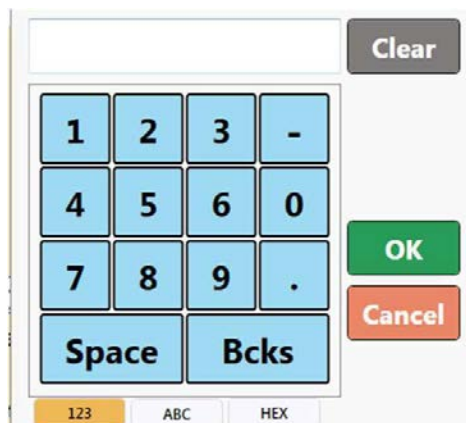
Pedal Fire: Laser will fire using the foot pedal while using x / y / z / r buttons on screen to move motion platform



The “More” screen also contains a “Motion Delay” option with a duration of delay (in ms) which allows to start the laser firing before the machine moves. The “Fire Duration” box is for setting how long the laser will be on for after hitting the fire button.

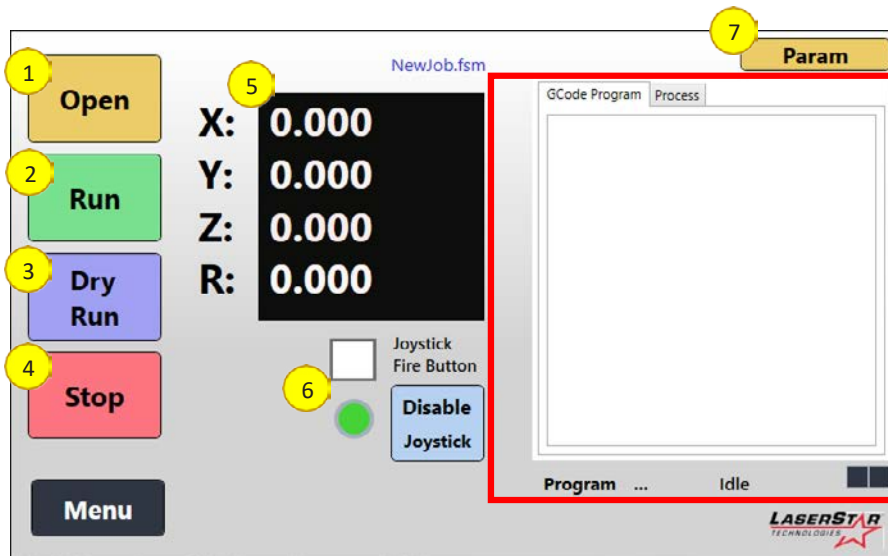
The “Home” button will bring the X, Y, and Z axes back to their original 0mm positions and will set the current rotary position as a new zero. The “Set Zero” button will set the current position to the new zero values in all 4 axes. The “Z Direction” button allows you to swap the positive and negative direction of the Z axis on the Joystick.

The “Fire” button will fire the laser and the “Stop” will stop all motion and firing until you provide additional input (e.g., pressing the foot pedal or clicking “Home”) The “Enable Motors” button shown will turn axis motors on and switch to read “Disable Motors



When the user clicks on any box with variable text in it the above window will popup, with number, text, and hexadecimal options. This allows the user to type in a desired value for speed or for parameters when applicable. This screen shows up in every menu except for the “Teach Mode” menu.

## Main Menu

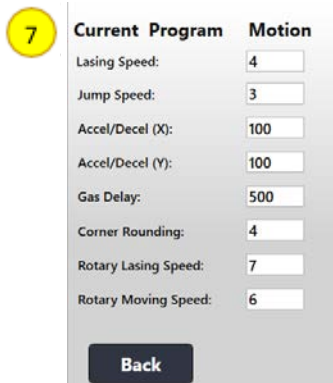


In the red box is the currently loaded program. Here you will find the code of the loaded program with the name above it. Below the code is a status that tells if the machine is currently running or if it is idle.

- 1 The "Open" button allows to open a saved program from a library of created programs.
- 2 The "Run" button will execute the program and start lasing/moving as commanded in the code block.
- 3 The "Dry Run" is the same as the "Run" without the laser firing. This is intended to confirm that the program is moving to the correct locations on the part without lasing on it yet.
- 4 The "Stop" button will halt the program thus stopping movement and lasing.
- 5 This is where you will see the current absolute location of the laser. Note: Moving the table up/down is not accounted for in this Z value.

Here you will find the joystick enable/disable as well as a checkbox for firing with the joystick.

- 6 A Green dot means the joystick is enabled and a gray dot means it is disabled. If the fire button box is unchecked then you will not be allowed to fire the laser with the joystick button, on the contrary if checked you can fire with the joystick button.



The "Param" button will open another window "Motion Parameters." In this window you are able to set some values for how the axes will move. Lasing speed and jump speed are how fast (in mm/s) the X & Y axes will move while lasing and while not lasing, respectively. The accel/decel values are how quickly the X & Y axes increase or decrease their speed (in mm/s<sup>2</sup>). Initial delay is the delay in movement(?) (in ms) upon running program and corner rounding makes sharp changes in direction smoother. Rotary lasing speed/moving speed are similar to the lasing/jump speed except for the rotary axis.



Clear

OK

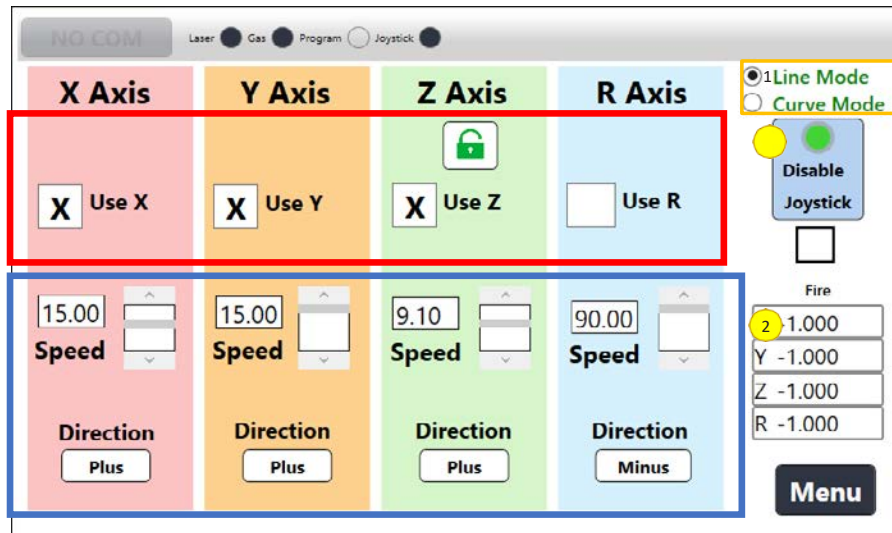
Cancel

1	2	3	4	5	6	7	8	9	0	Bcks
UP	(	.	)	;	X	Y	Z	R	Clear	Enter
Down	G1	G0	G90	G91	Space					

123
ABC
HEX
?

Within the main menu the user can click on the code block text box and this window will popup. This allows the user to edit the code that is currently open, although the user cannot save it on this screen. This keyboard is specifically designed for typing in G-code using relative and absolute modes to draw lines or make move commands in the X, Y, Z, and R axes. There are also options for the alphabet keyboard or a hexadecimal keyboard. This screen is applicable to the “Create Shapes” and “Edit Programs” menu options as well.

## Auto-feed Jog



The boxes outlined in red are for enabling or disabling specific axes; this is so that the user can stop an axis from moving that needs to be kept stationary. This applies to both foot pedal and joystick welding. The Z axis can also be locked.



Within the blue box is the speed value/sliders and the direction. The speed for the specific axes can be typed in or the slider can be used to set the speed (in mm/s or degrees/s for rotary). The direction buttons indicate which direction the specific axis will move, in the positive or negative direction.



The items outlined in this box allow you to switch between “Line” and “Curve” mode. Line Mode is faster moving and less responsive to small movements. Curve Mode moves slower and is more responsive to small movements

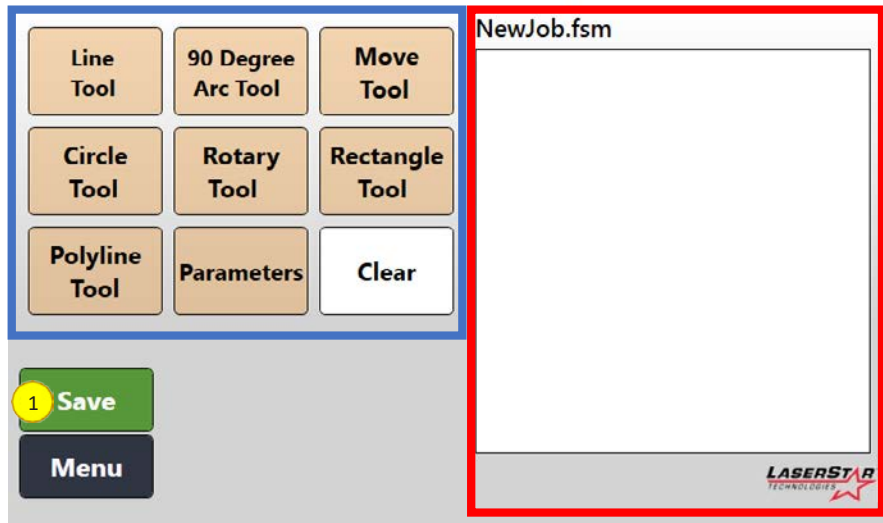


The disable/enable joystick button with the state of the joystick (green for enabled). When the “Fire Button” box is checked then the user is able to fire the laser with the joystick.



The position box tells the user what absolute coordinates the laser is currently at.

## Creating Shapes



In the blue box all the different shape creating tools are shown. These tools create the appropriate G-code with coordinate/point inputs, so the user does not have to type it out. There is also a “Clear” button which will erase any code added with the tools before a save.



The red box shows the job file name and the code block that is being created by the shape tools.



The save button adds in the code shown in the red box to the current job and saves it.

### Line Tool

☐ Absolute  
☒ Relative

**Angle:**

**Length:**

**Start Position:**

X:

Y:

**End Position:**

X:

Y:

Cancel
Add

The line tool creates the code for a line using 2 points specified (for absolute) or with an angle and length (for relative).

### 90 Degree Arc Tool

☐ Absolute  
☒ Relative

**Starting Position:**

X:

Y:

**Arc Dimensions:**

**Angle:**

**Radius:**

☒ Clockwise

Cancel
Add

The arc tool creates the code for an arc (a portion of a circle) with a starting point, and angle, and radius; either clockwise or counterclockwise.

### Move Tool

☐ Absolute  
☒ Relative

**Angle:**

**Length:**

**Start Position:**

X:

Y:

**End Position:**

X:

Y:

Cancel
Add

The move tool creates the code for a move to an absolute coordinate. For relative the user can either use angle + length or end position.

### Circle Tool

☐ Absolute  
☒ Relative

**Center Position:**

X:

Y:

**Circle Size:**

**Diameter:**

☒ Clockwise

Cancel
Add

The circle tool creates the code for a circle using a center position and diameter, either CW or CCW.

### Rotary Tool

☐ Absolute  
☒ Relative

**Start Angle:**

R:

☒ Relative

**Rotary Angle:**

R:

☒ Lase

Cancel
Add

The rotary tool is essentially a move to/lase to tool for the rotation axis.

### Rectangle Tool

☐ Absolute  
☒ Relative

**Start Position:**

X:

Y:

☐ Relative

**Rectangle Size:**

Height:

Length:

Cancel
Add

The rectangle tool uses a start position as one corner and the height and length as the change in Y and X coordinates, respectively.

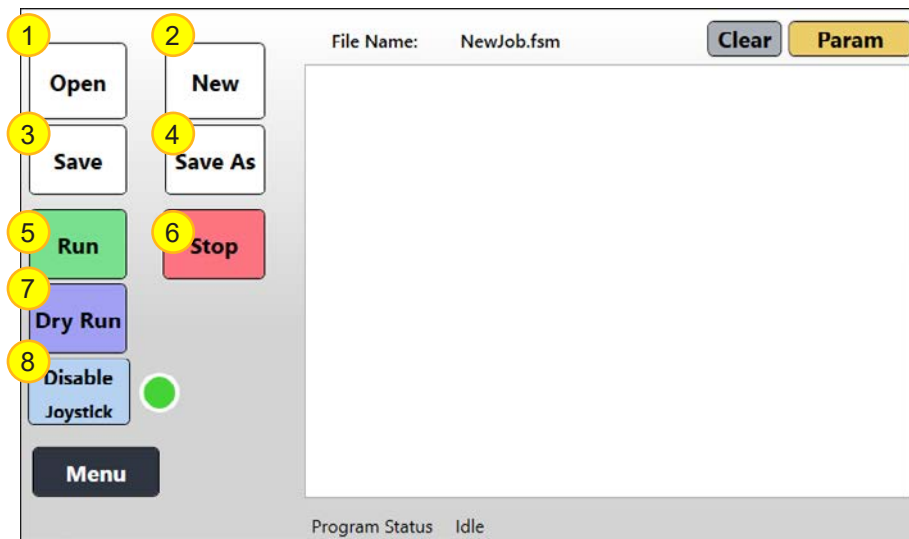
### Parameter Tool

Speed: <input type="text" value="0.000"/>	Init Delay: <input type="text" value="0.000"/>
Accel: <input type="text" value="0.000"/>	Volts: <input type="text" value="0.000"/>
Decel: <input type="text" value="0.000"/>	Frequency: <input type="text" value="0.000"/>
Corner Rnd: <input type="text" value="0.000"/>	Pulse Width: <input type="text" value="0.000"/>
Jump Speed: <input type="text" value="0.000"/>	

Cancel
Add

The parameter tool here has the same function as described in the “Main Menu.”

## Edit Programs



- 1 "Open" lets the user select a program from a file.
- 2 "New" creates a fresh job with no code.
- 3 "Save" lets the user save the program currently shown in the code window to the right.
- 4 "Save as" allows the user to save a program with a different name than it currently has.
- 5 "Run" will execute the code as shown in the code window.
- 6 "Stop" will halt all motion and lasing.
- 7 "Dry Run" executes the movements but not the lasing of the code.
- 8 The enable/disable joystick button allows/disallows the user to operate with the joystick; accompanied by green or grey dot indicating state.

## Teach Mode

*Circle Created*

**Circle**

1:	2:	3:
X: <input type="text" value="-1.0"/>	X: <input type="text" value="-1.0"/>	X: <input type="text" value="-1.0"/>
Y: <input type="text" value="-1.0"/>	Y: <input type="text" value="-1.0"/>	Y: <input type="text" value="-1.0"/>

Line

Circle

Move

Polyline

Arc

Rectangle

Restart

7
X: -1.000   Y: -1.000   Z: -1.000   R: -1.000

5

Add All

6

Cancel

1
☐ Connected

2

Add Point

3

Add Shape

8

● Line

● Circle

● Polyline

4

Delete

The “Connected” checkbox allows for a laser connecting the current shape to the previous command in the code.

The “Add Point” button adds the current location into the blue box as a point for creation of a shape.

The “Add Shape” puts the shape currently being specified into the list below when all the points have been input.

The “Delete” button allows the user to remove a selected shape from the list to the left before the code is added into the job.

The “Add All” button turns the list of shaped above into code and adds it into the job.

The “Cancel” button discards anything in the teach mode window and returns back to the menu selection.

The current position of the laser is shown here.

This is the list of shapes that have been added so far in the order that they will execute.

The blue box contains the points being used to create a specific shape selected

The red box contains the various shapes that can be created with teach mode. The restart button erases any points in the blue box for a fresh start on the current shape selected.

Energy Saver or Sleep Mode

This mode reduces the energy consumption of the machine. Press the “on” button to return to the main screen.

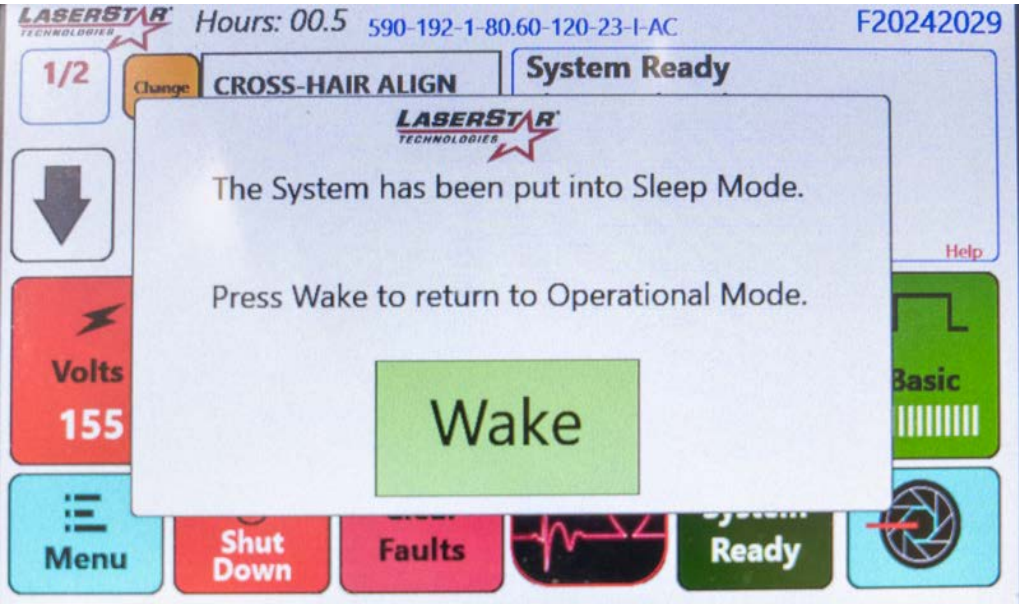


Figure 3  
(Energy saver  
or sleep mode)

Notes

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## Flexible Gas Lines



The flexible gas lines, located inside the welding work chamber, are made from plastic and are vulnerable to concentrated heat and prolonged extreme temperatures. Check to be sure the gas lines are not positioned near the chamber lights (most especially the halogen lights), as they are susceptible to melting and could catch fire or drip hot liquified plastic onto the operator's hands and arms or workpieces.

## Adjusting the Stereo Microscope

The stereo microscope is factory-adjusted for operators without vision impairments or abnormalities. Adjustments to the microscope, focus, and cross-hair will likely be necessary for operators who wear (and reliably depend on) glasses or contacts to see.

- Switch "on" the welding workstation, using only the **mains power switch**.
- Adjust the eyepieces, setting each to the zero (0) mark, and ensuring they're secured and fully inserted into their respective tubes.
- Place a sample workpiece in the visual field of the microscope. Check to be sure that the item appears crisp and in focus when viewed with the left eye open and the right eye closed.
- Look with the right eye through the right eyepiece, turning the right-side adjustment ring so that the cross-hair appears sharp and in focus through the right eyepiece.
- Using the lower portion of the eyepiece, rotate the component to orientate the cross-hair to the desired position. Check to be sure that the cross-hair is still in focus and adjust, if needed.
- Adjust the distance between both eyepieces so that the visual fields for both overlap (with eyes relaxed, observe the sample workpiece); a single rounded visual field should be present.

After finalizing all adjustments, the sample workpiece and cross-hair should appear sharply in focus while looking through each of the eyepieces simultaneously.

# Mounting the Stereo Microscope

When completing the steps below for microscope mounting and optical alignment, be sure to reference the optical alignment diagram on the next page.

- 1. Place the stereo microscope into the mounting bracket. **(Figure 4)**
- 2. Secure the microscope to the body of the welder by tightening the two (2) mounting screws. The mounting screws are located between the center, left, and right adjustment screws (see the diagram on the next page for details and a visual reference).
- 3. **Model Dependent:** Plug the microscope into the power input (located on the left-hand side of the welder; opposite the **mains power switch**).

# Optical Alignment

- 1. Using an adjustable lab jack (tabletop scissor-lift platform) or equivalent device, bring the steel plate into focus.
- 2. Adjust the parameters, as follows: 260V, 1.0mS, 0.0Hz, 0.5mm.
- 3. Fire a single laser pulse onto the steel plate; leave the plate in place and do not move.
- 4. Using the three (3) adjustment screws (refer to the diagram on the next page for placement), align the laser pulse position within the center of the cross-hair. **Caution: Be careful not to remove or overtighten the adjustment screws.**
- 5. Fire an additional single laser pulse onto the steel plate, testing to ensure that all adjustments for alignment are correct.

**(Note: Be sure to re-check the alignment periodically; adjustments may also need to be made for workpieces that differ in size or structure.)**

Notes

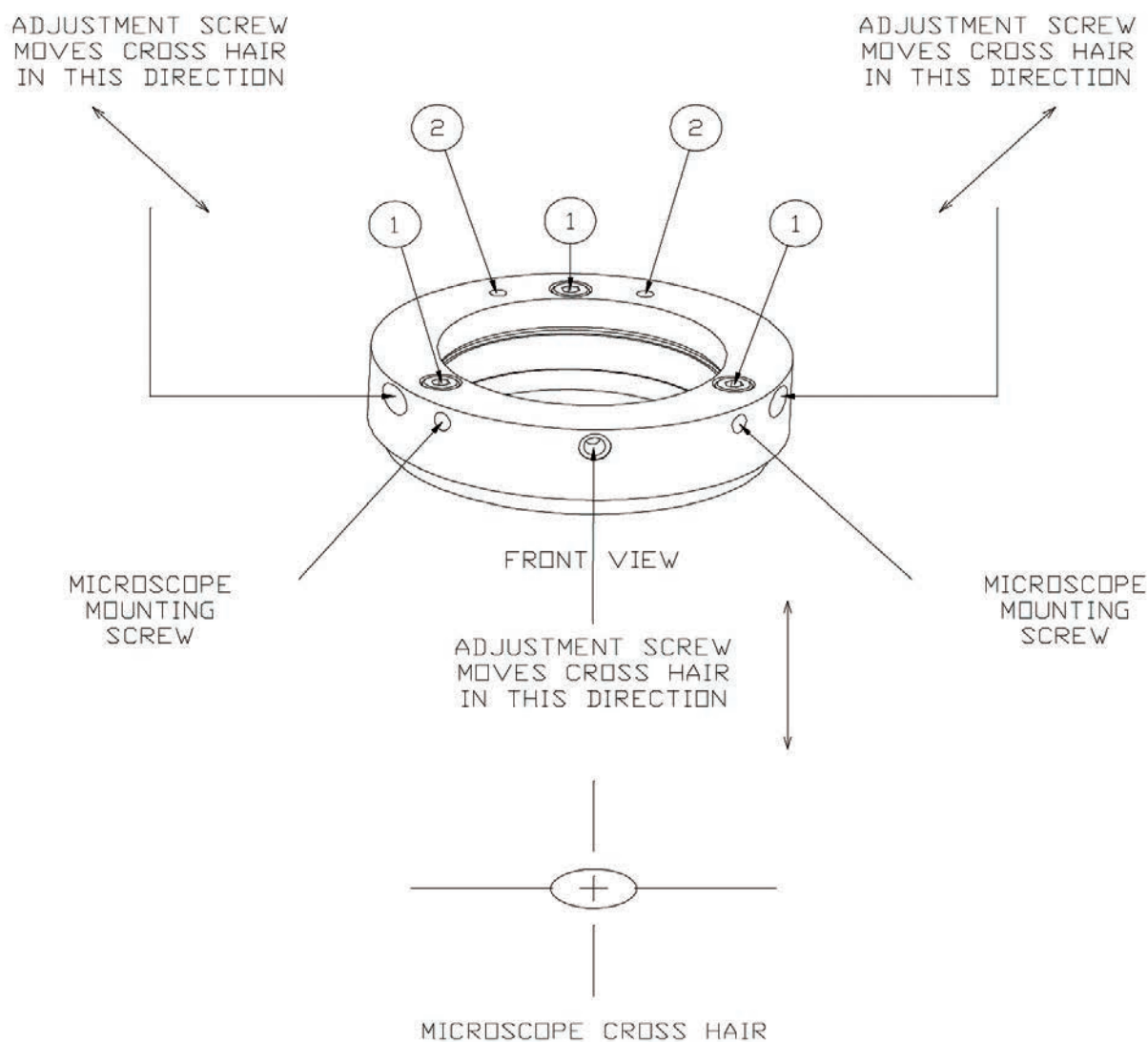
## Optical Alignment Diagram

### NOTES:

DO NOT REMOVE OR LOOSEN SCREWS LABELED ①

TO REMOVE MOUNTING BRACKET LOOSEN  
CAPTURED SCREWS IN HOLES LABELED ②

(SCREWS WILL LOOSEN BUT WILL NOT COME OUT).



**Figure 4**  
(Optical Alignment  
Diagram)

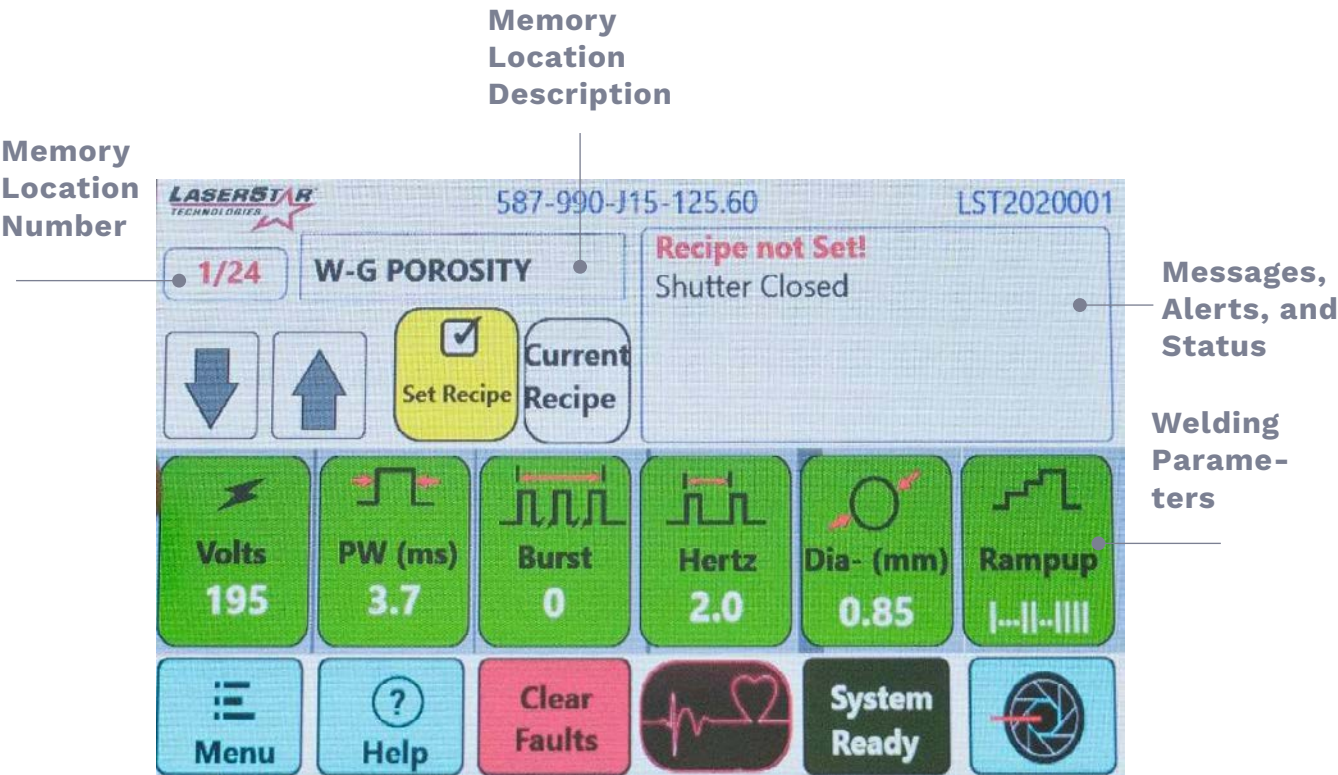
# Setting Operating Parameters

Selecting operating parameters can be achieved using the touchscreen display.

(Note: The safety shutter button, allow for specialized functions, which are defined in more detail later in this manual.)

## Touchscreen Display Operation

When pressing buttons on the touchscreen display, be sure to press directly in the center; off-center button pressing can result in unintended or undesirable actions.



**Figure 5**  
(Touchscreen  
Display)

## Messaging & Touchscreen Display Operation

Touchscreen Display Commands	
Buttons and Indicators	System Response
System Fault (red)	The system is <u>not</u> ready to operate; the safety shutter will not open.
System Ready (green)	The system is ready to operate; the safety shutter can be opened.
Safety Shutter (closed)	When the icon for the <b>Safety Shutter button</b> is closed, the shutter is closed. Press the <b>Safety Shutter button</b> to open.
Safety Shutter (open)	When the icon for the <b>Safety Shutter button</b> is open, the shutter is open. Press the <b>Safety Shutter button</b> to close.
Changing a Recipe Location Number (see <b>Figures 6 – 10</b> that follow)	<p>Press the <b>Recipe Location button</b> to change the recipe location number (<b>figure 5</b>).</p> <p>A number box will appear.</p> <p>Press the number and a numeric keypad will appear.</p> <p>Press Clear to clear the old location number.</p> <p>A number box will appear.</p> <p>Type in the desired memory location number; press OK and then press Done.</p> <p>Press the yellow (Set Recipe) button to load the values into the weld parameters.</p> <p>Loaded values will appear green.</p> <p><b>(Note: Memory recipe locations may be loaded with factory defaults.)</b></p>

**Messaging & Touchscreen  
Display Operation Continued on Next Page**

## Messaging & Touchscreen Display Operation (continued)

Touchscreen Display Commands	
Buttons and Indicators	System Response
<p>&gt; Recipe Location Description Set Recipe button Figure 9 &amp; 10</p>	<p><input type="checkbox"/> Weld Recipe Descriptions:</p> <p>Yellow (Set Recipe) button indicates the weld parameters are from this memory location; the parameters will be grey.</p> <p>Push button to Set Recipe. Green (Set Recipe) button indicates the recipe has been set into the parameters; the parameters will be green.</p>
<p>&gt; Welding Parameters:</p> <ul style="list-style-type: none"> <li>• Volts</li> <li>• PW (mS)</li> <li>• Hertz, Burst or Pulse Suppression (optional and model specific)</li> </ul> <p>Figures 11, 12, 13, 14</p>	<p><input type="checkbox"/> Current Welding Parameters:</p> <p>Volts- Press this button to change the value. A window will open with the current value, and up down arrow keys. Use the up / down arrows to change the value and then press Done. When the window with the current value is open, you may also press the number value, a numeric keypad will come up. You can then type in the desired value and press OK, then press Done.</p> <p>PW (mS)- Press this button to change the value. A window will open with the current value, and up down arrow keys. Use the up / down arrows to change the value and then press Done. When the window with the current value is open, you may also press the number value, a numeric keypad will come up. You can then type in the desired value and press OK, then press Done.</p> <p>Hertz- Press this button to change the value. A window will open with the current value, and up down arrow keys. Use the Up or Down arrows to change the value and then press Done. When the window with the current value is open, you may also press the number value, a numeric keypad will come up. You can then type in the desired value and press OK, then press Done.</p>

**Messaging & Touchscreen  
Display Operation Continued on Next Page**

## Messaging & Touchscreen Display Operation (continued)

Touchscreen Display Commands	
Buttons and Indicators	System Response
<p>&gt; Welding Parameters:</p> <ul style="list-style-type: none"> <li>• Hertz , Burst or Pulse Suppression (optional and model specific)</li> <li>• DIA (mm)</li> <li>• Shape (P<sup>3</sup>)</li> </ul> <p>Figures 11, 12, 13, 14</p>	<p>(□) Current Welding Parameters (continued):</p> <p>Burst- Press this button to change the value. A window will appear with the current value, and up down arrow keys. Use the Up and Down arrows to change the value and then press Done. When the window with the current value is open, you may also press the number value, a numeric keypad will come up. You can then type in the desired value and press OK, then press Done.</p> <p>DIA (mm)- Press this button to change the value. A window will appear with the current value, and up down arrow keys. Use the Up or Down arrows to change the value and then press Done. When the window with the current value is open, you may also press the number value, a numeric keypad will come up. You can then type in the desired value and press OK, then press Done.</p> <p>SHAPE-Press this button to change the P<sup>3</sup> shape. A window will open with the current Shape, and up down arrow keys. Use the Up or Down arrows to change the P<sup>3</sup> shape and then press OK.</p> <p><b>(Note: Once the value of each setting has been changed from the set recipe value, the button will turn from Green to Red (FIGURE 14). If the (Set Recipe) button is pressed again, all the settings will go back the that recipe's values and all buttons will turn green once again.)</b></p>

Messaging & Touchscreen  
Display Operation Continued on Next Page


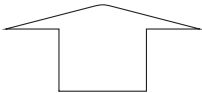
## Messaging & Touchscreen Display Operation (continued)

Touchscreen Display Commands	
Buttons and Indicators	System Response
> Messages FIGURE 5 Figure 15	<p>(□) Displays the laser status which includes-Critical Faults, shutter status and info, etc. A critical fault will appear in the message box and the heart will be broken indicating the laser cannot be used until the fault is cleared.</p>
> Saving & naming a Recipe Figure 16-21	<p>(□) Features:</p> <ul style="list-style-type: none"> <li>• Press the recipe description button, an alphanumeric keypad will appear.</li> <li>• Press the Clear button to clear the old recipe name; type in a name for the new recipe.</li> <li>• Press OK; this will store the new name.</li> <li>• Adjust the parameters to the desired setting; press the yellow (Save) button. A window will appear that asks: “Are you sure you want to save (with the name of your setting?) Button options: Save or Cancel. If you wish to save, press the Save button. The new setting will receive a new number location.</li> <li>• To delete a recipe first select the recipe you wish to delete. Press the Save button. Press the Delete button. (Figure 21)</li> </ul> <p><b>Attention: All information in this memory location will be lost.</b></p> <p><b>(Note: The parameters and description for factory default memory locations will also be cleared by this CLEAR button, but can be restored by going to the Main Screen / Menu / Restore Def Memory / LST.)</b></p>

Messaging & Touchscreen  
Display Operation Continued on Next Page



## Messaging & Touchscreen Display Operation (continued)

Touchscreen Display Commands	
Buttons and Indicators	System Response
> Menu	(□) Pressing this button opens a PIN Number screen. Press the PIN Number box and a numeric keypad will appear. Enter your PIN Number. Press OK, Press Done. (Figure 22)
> Menu Selection	(□) You are now in the Menu Selection screen. (Figure 23)
> (Down / DN) 	(□) Pressing this button will decrease the selected weld parameter values/shape; reduces memory location number; and selects Menu function (>).
> (Up) 	(□) Pressing this button will increase the selected weld parameter values/shape; increases memory location number; and selects Menu function (>).
Save	(□) Pressing this button will store the displayed weld parameters into memory location number displayed in the upper left corner.
> Menu Selection Screen: <ul style="list-style-type: none"> <li>• Create Custom Profile</li> <li>• Configuration</li> <li>• Register Status</li> <li>• Password</li> <li>• System Tests</li> <li>• Help</li> <li>• Factory Reset</li> <li>• Main Menu</li> </ul>	(□) Create Custom Profile: This screen allows the operator to create a custom profile. <ul style="list-style-type: none"> <li>• Press the (Create Profile) Figure 25.</li> <li>• The segment active on/off is divided into 12 segments. On the active row, you may change a segment by touching the active box either on (green) or off (red). (Figure 27)</li> <li>• When you are finished, press the done button, and then press Save; a Ramp Name box will display. (Figure 28)</li> <li>• If you wish to name your new profile, press the name in the box and an alphanumeric keypad will display. (Figure 29).</li> </ul>

**Messaging & Touchscreen  
Display Operation Continued on Next Page**

## Messaging & Touchscreen Display Operation (continued)

Touchscreen Display Commands	
Buttons and Indicators	System Response
<p>&gt; Menu Selection Screen (continued):</p> <ul style="list-style-type: none"> <li>• Create Custom Profile</li> <li>• Configuration</li> <li>• Register Status</li> <li>• Password</li> <li>• System Tests</li> <li>• Help</li> <li>• Factory Reset</li> <li>• Main Menu</li> </ul>	<p>(□) Type the new name and press Done. (Figure 30).</p> <p><b>Configuration:</b> For LST factory internal use only.</p> <p><b>Register Status:</b> For LST factory internal use only.</p> <p>Password:</p> <ul style="list-style-type: none"> <li>• To change your password, Press (Password) in the Menu screen. (Figure 25)</li> <li>• Screen to enter PIN Number will appear. (Figure 31)</li> <li>• Press the white box, the alphanumeric keypad will appear. (Figure 32) Enter your existing password and press OK. The Screen to enter PIN Number will appear again. (Figure 31) Press Done.</li> <li>• Password Setup appears. (Figure 33) Press Enter New PIN box. The alphanumeric keypad will appear again. (Figure 32) Type in the new password and press OK.</li> <li>• The screen to enter PIN Number will appear yet again, (Figure 31) Press Done, then press Return. The Password is now changed.</li> </ul>
	<p><b>System Tests:</b> For LST Service internal use only.</p> <p>Help: Press the Help Button; information appears for contacting LaserStar Technologies Corporation® Service Department (Figure 34)</p>

**Messaging & Touchscreen  
Display Operation Continued on Next Page**

## Messaging & Touchscreen Display Operation (continued)

Touchscreen Display Commands	
Buttons and Indicators	System Response
	<p><b>System Tests:</b> For LST Service internal use only.</p> <p>Help:</p> <ul style="list-style-type: none"> <li>• Press the Help Button, information for contacting LaserStar Technologies Corporation® Service Department appears . (Figure 34)</li> <li>• Press View, a Help Menu appears. (Figure 35) The sub-menu choices are, Startup, Message, Lamp Change, Laser Settings, Recipe Features and Menu Items. Pressing any one of these submenus will start a video presentation. (Figure 36) To enlarge the video, press the arrows in the lower right-hand corner. (Figure 37)</li> </ul> <p><b>Note: Video shown is Lamp Change.</b></p> <p>Factory Reset:</p> <p>Pressing this button will take you to two choices, Reset and Cancel. Figure 38</p> <ul style="list-style-type: none"> <li>• Pressing reset will set the laser back to factory settings.</li> <li>• Pressing Cancel will bring you back to the Menu screen.</li> </ul> <p><b>Note: Once the laser is Factory Reset, all programed settings will be lost.</b></p> <p>Main Menu:</p> <p>Takes you back to the main operating screen. (Figure 5)</p>

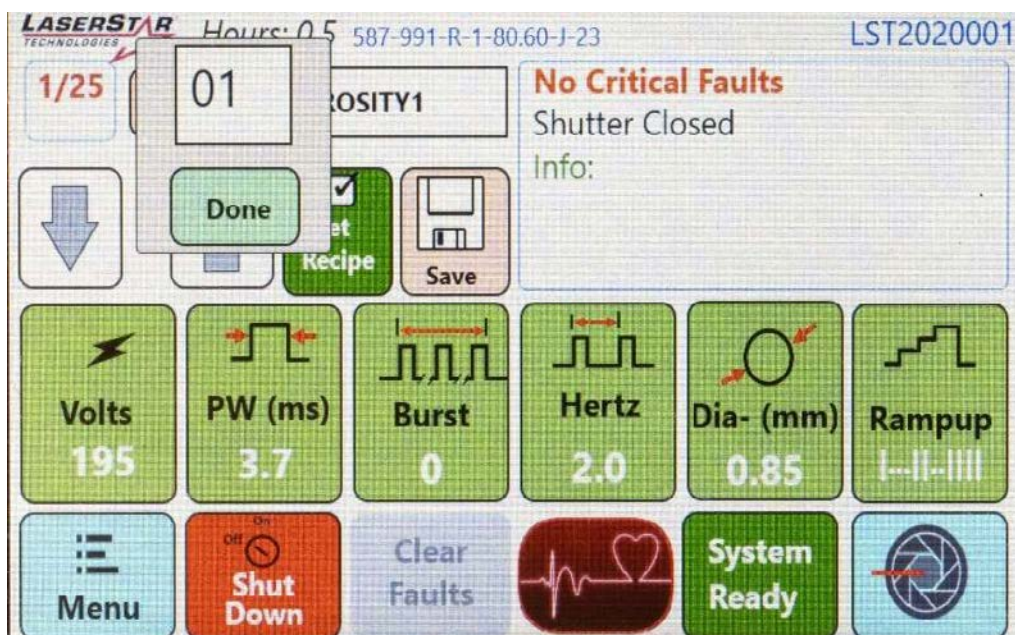
Messaging & Touchscreen  
Display Operation Continued on Next Page

# Messaging & Touchscreen Display Operation (continued)

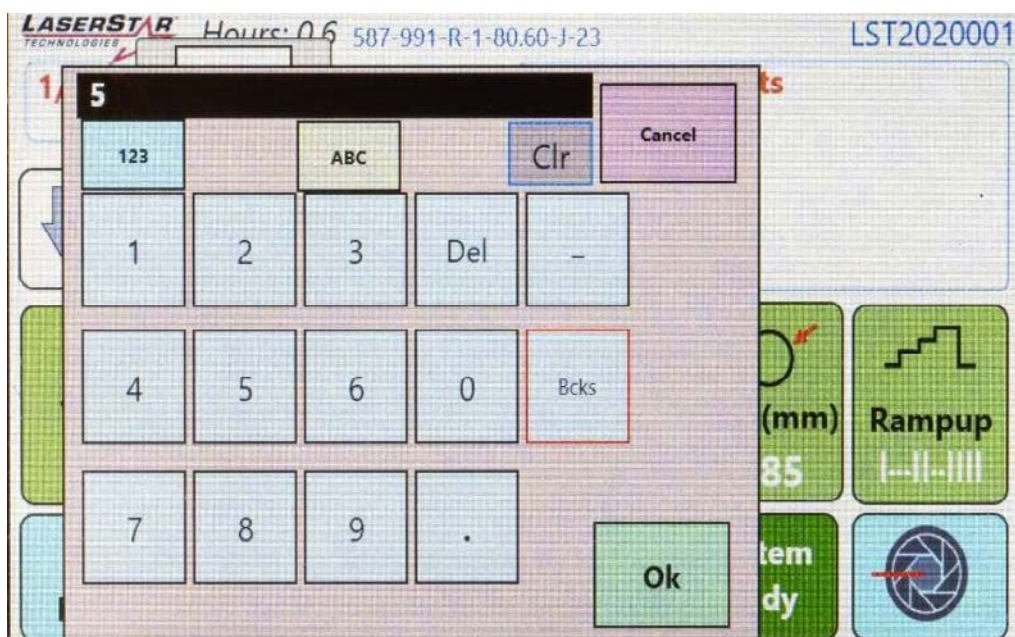
Touchscreen Display Commands	
Buttons and Indicators	System Response
	<p><b>System Tests (continued):</b> For LST Service internal use only.</p> <p>Phase 2 Features: Pre-weld Gas Post-weld Gas Pulse Count Hours On: Pulse Total: Fault Lists: Energy Usage: Volt Adj: Beam Ex Offset: Sleep:</p> <p>Figures 7 &amp; 16</p>
<p>Alphanumeric Keypad</p> <ul style="list-style-type: none"> <li>• I23</li> <li>• ABC</li> <li>• Cancel</li> <li>• Del</li> <li>• Clr</li> <li>• OK</li> <li>• Bcks</li> <li>• –</li> </ul>	<p>I23: Press this button to bring up the numeric keypad.</p> <p>ABC: Press this button to bring up the numeric keypad.</p> <p>Cancel: Pressing this button will return you to the main operating screen.</p> <p>Del: Press this button to delete the last chertier.</p> <p>Clr. Pressing this button will clear the memory location description entirely.</p> <p>OK: Press this button to save memory location description.</p> <p>Bcks: Press this button to delete the last character.</p> <p>– Press this to add a hyphen</p>

## Messaging & Touchscreen Display Operation Continued on Next Page

## Messaging & Touchscreen Display Operation (continued)



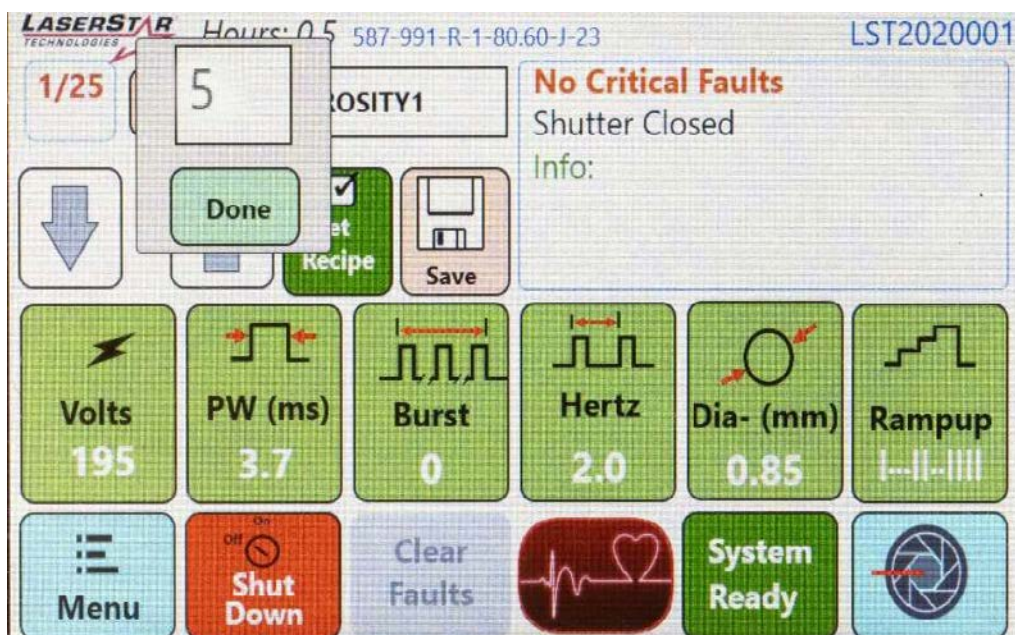
**Figure 6**  
(Recipe Location  
Number)



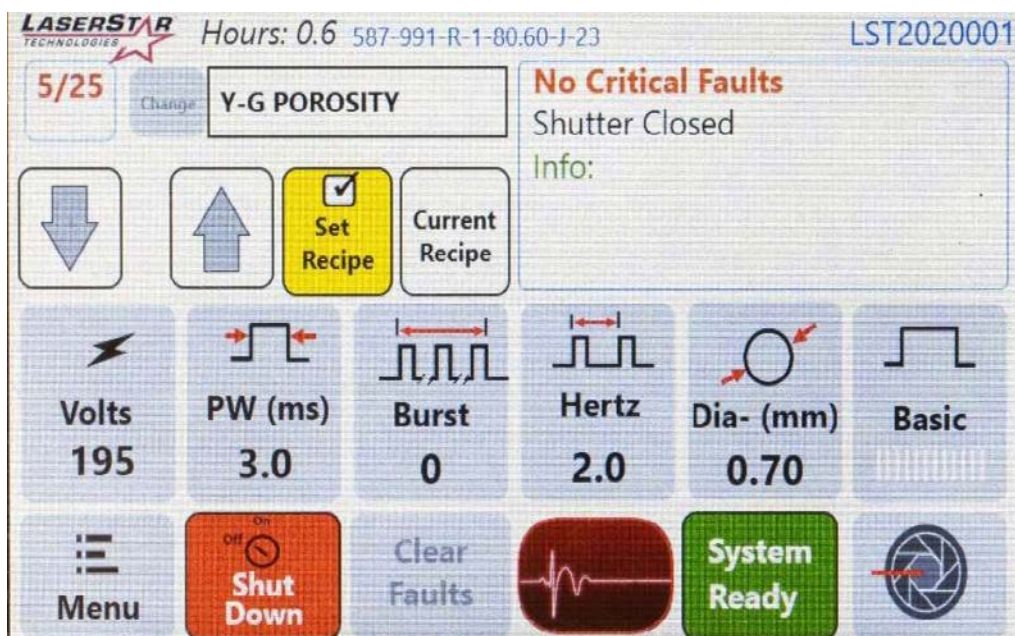
**Figure 7**  
(Numeric Keypad [Type  
Desired Recipe Number])



## Messaging & Touchscreen Display Operation (continued)



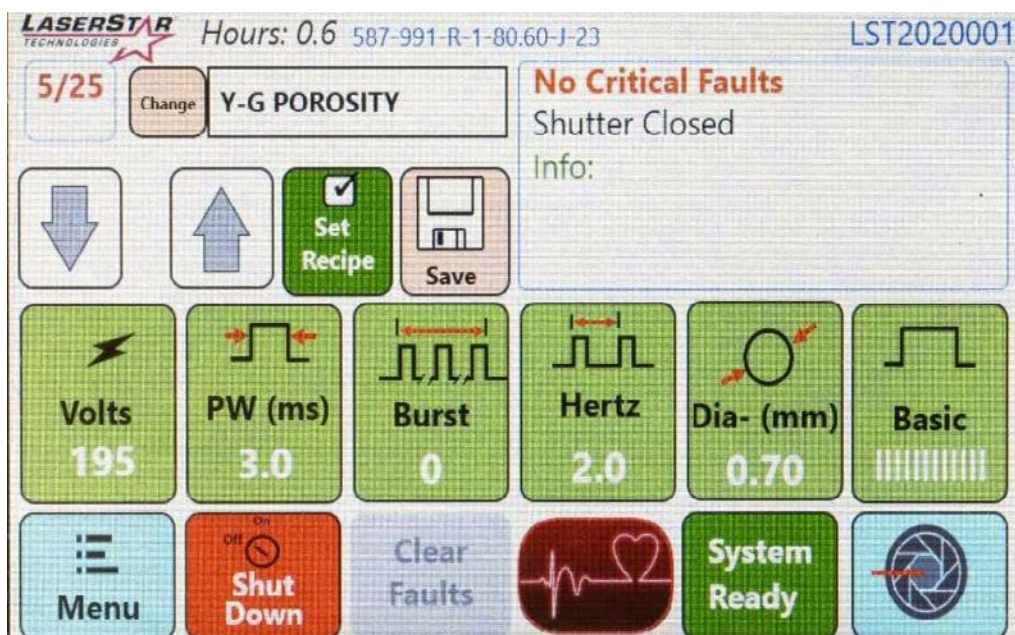
**Figure 8**  
(Done Button)



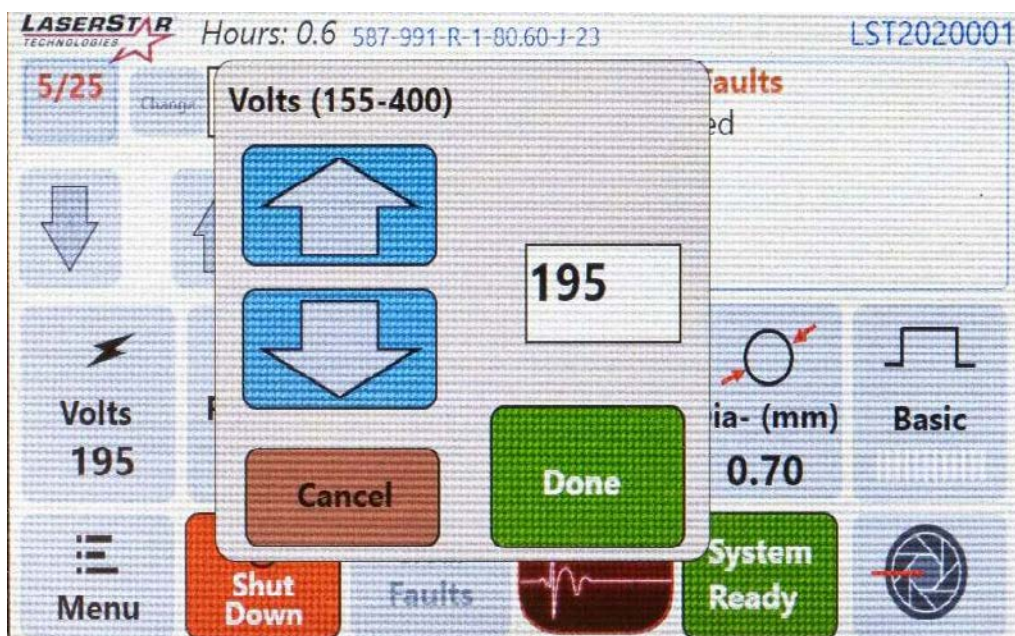
**Figure 9**  
(Set Recipe)



## Messaging & Touchscreen Display Operation (continued)



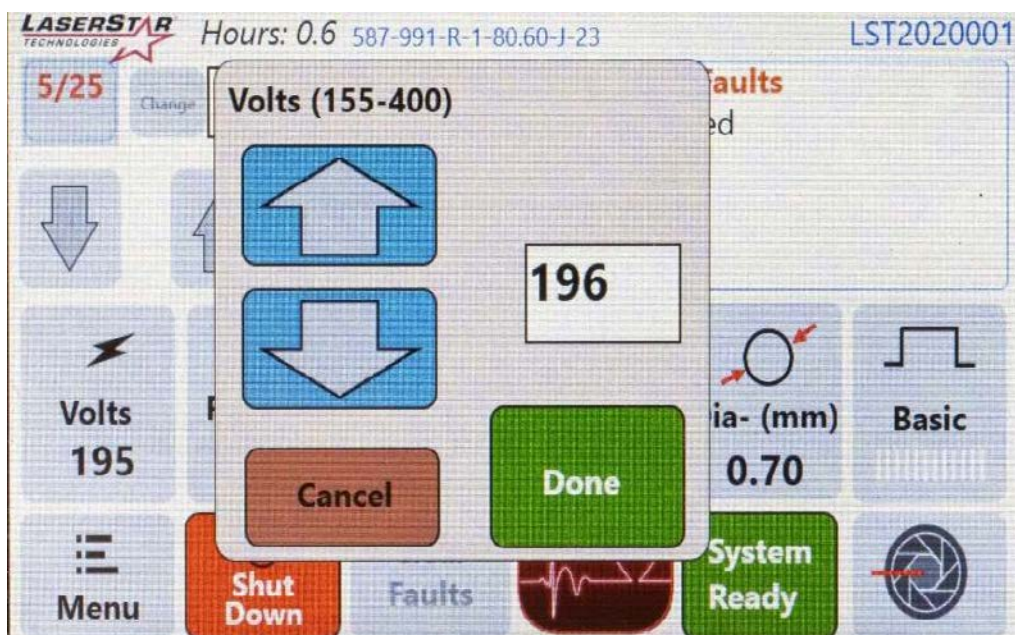
**Figure 10**  
(Recipe Set)



**Figure 11**  
(Arrow Keypad)

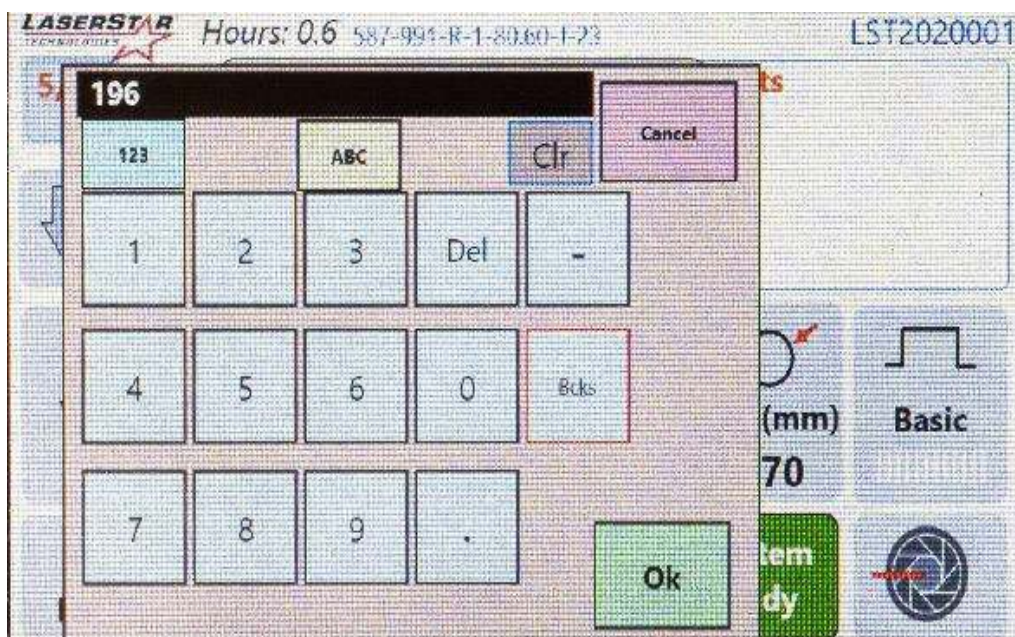


## Messaging & Touchscreen Display Operation (continued)



**Figure 12**

(Change Value [Enter Value  
Using Arrow Keypad; Press Done  
to Confirm])

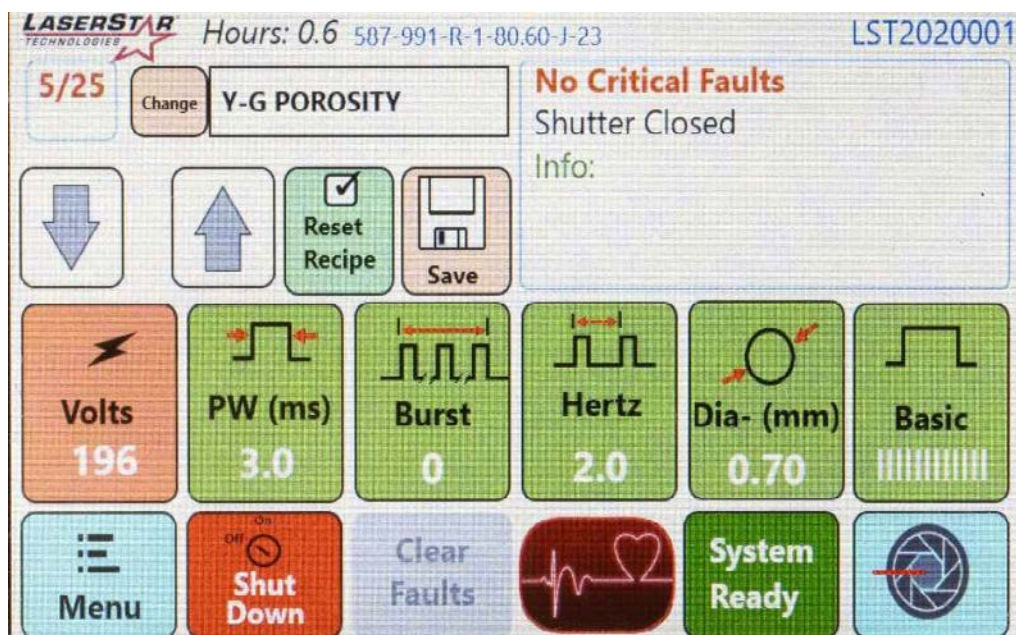


**Figure 13**

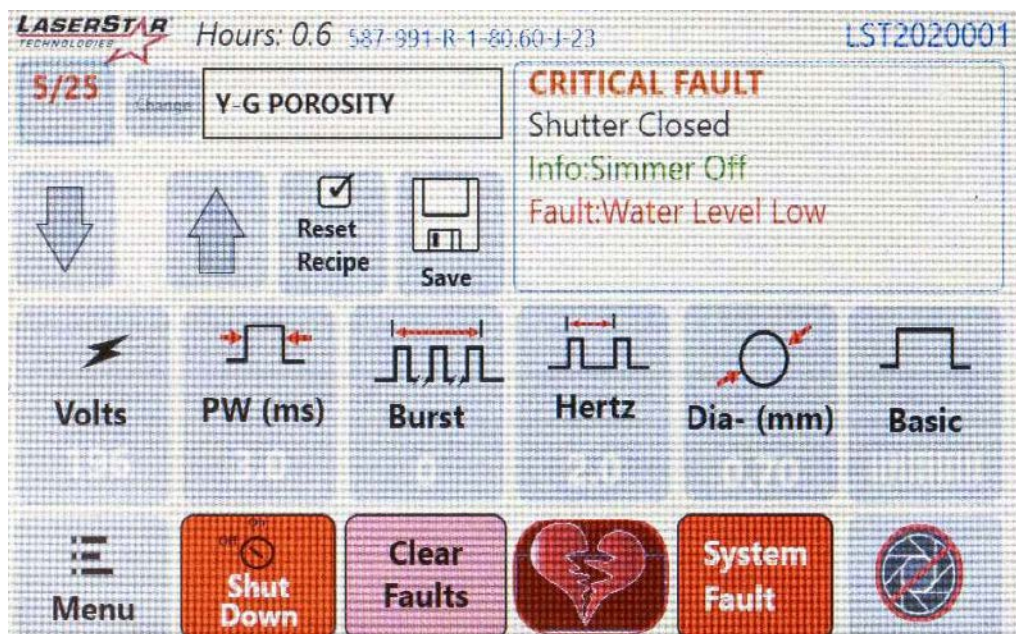
(Change Value [Enter Value  
Using Numeric Keypad; Press Ok  
to Confirm])



## Messaging & Touchscreen Display Operation (continued)



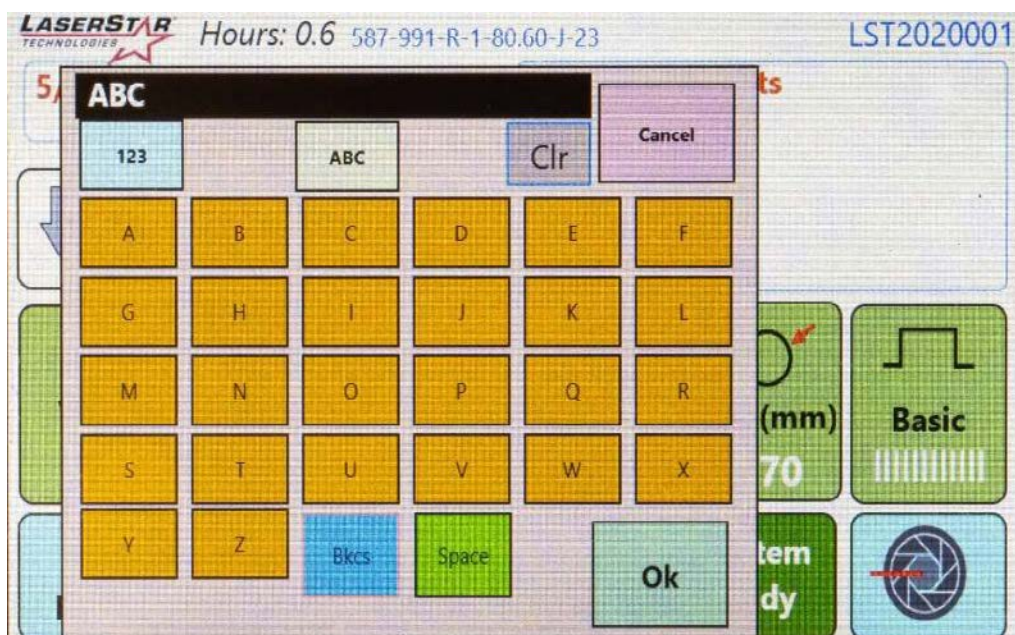
**Figure 14**  
(Changed Parameter)



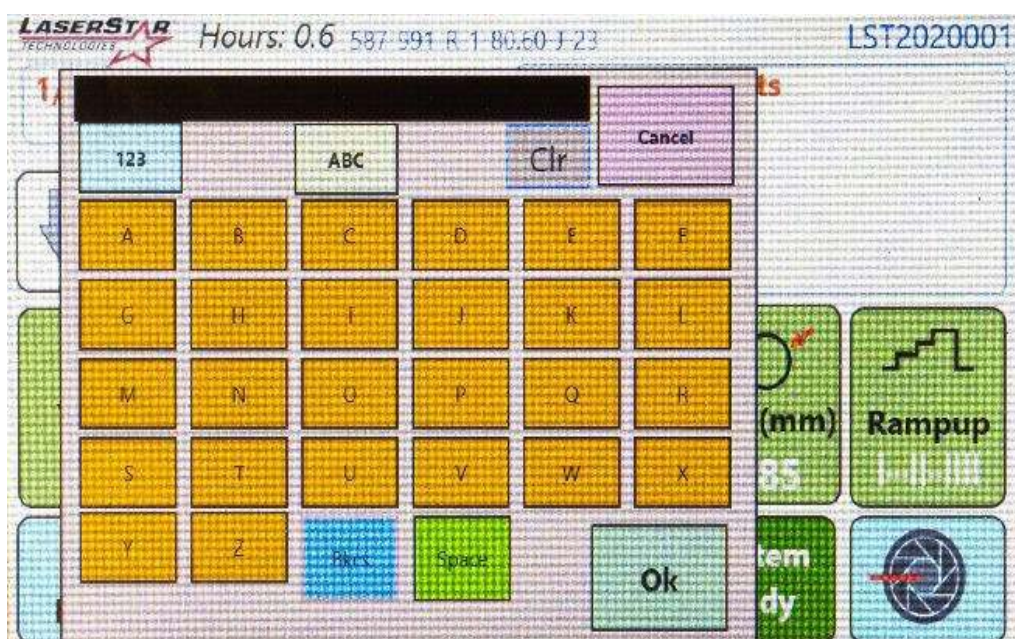
**Figure 15**  
(Critical Fault)



## Messaging & Touchscreen Display Operation (continued)



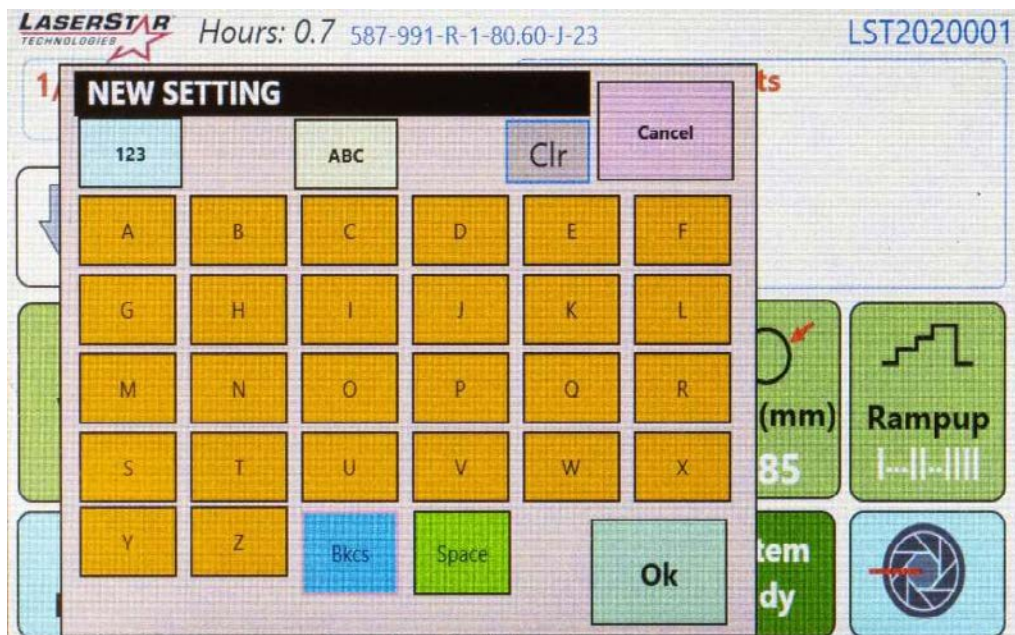
**Figure 16**  
(Alphanumeric Keypad)



**Figure 17**  
(Clear Name [Use Clr Button;  
Left of Cancel Button])

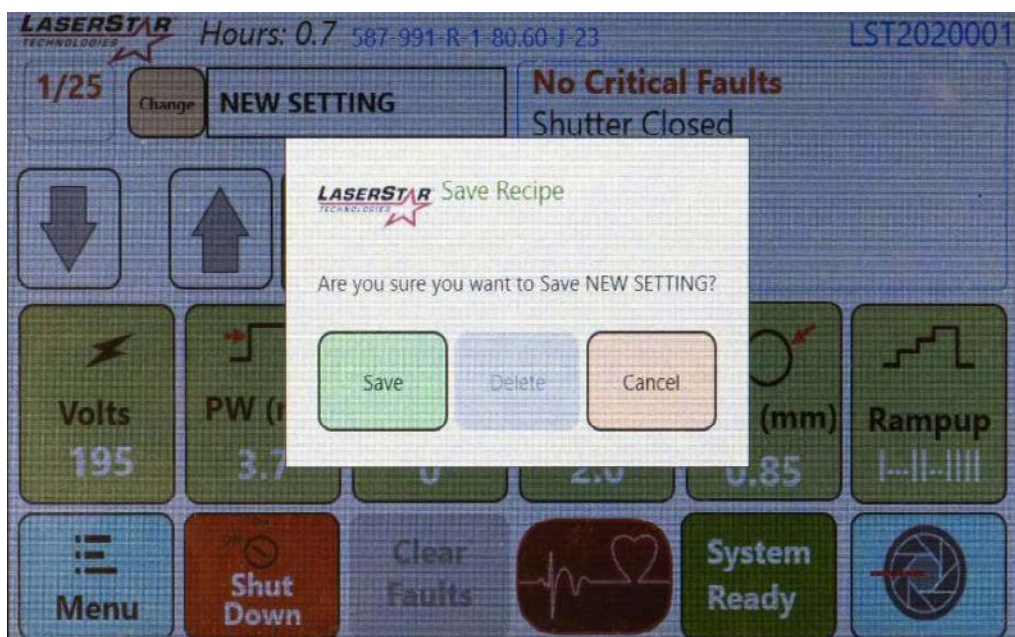


## Messaging & Touchscreen Display Operation (continued)



**Figure 18**

(Input New Name [Enter  
Value Using Alphanumeric  
Keypad; Press Ok to Confirm])

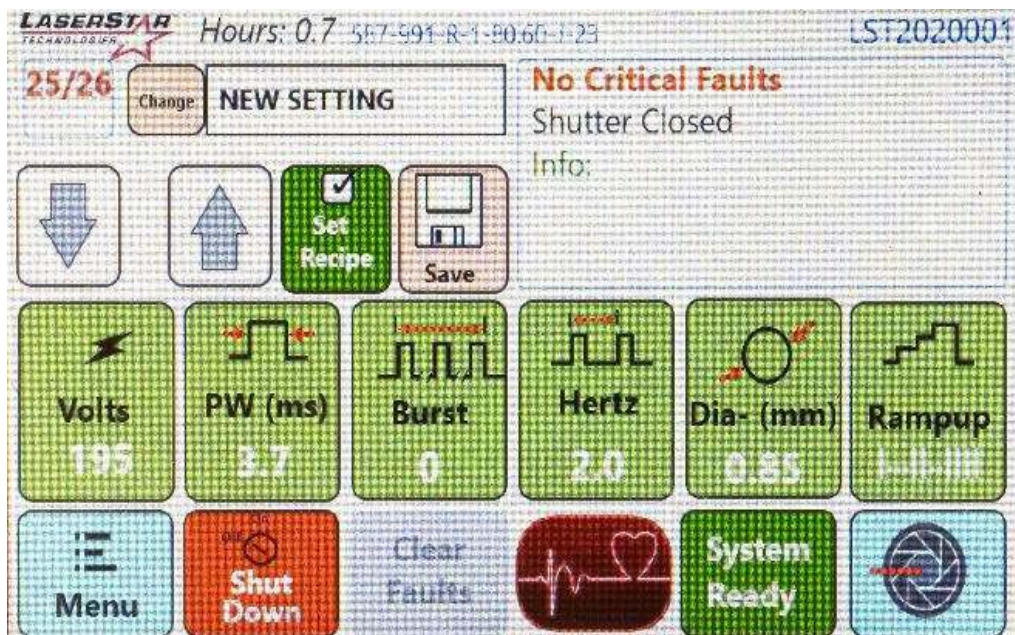


**Figure 19**

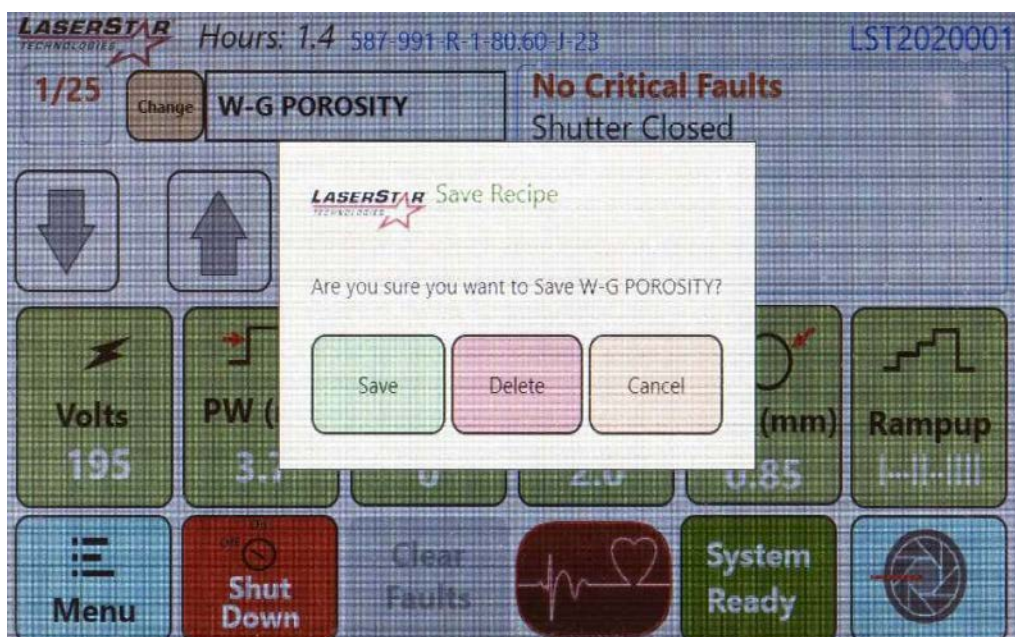
(Save New Recipe [Press  
Save to Confirm])



## Messaging & Touchscreen Display Operation (continued)



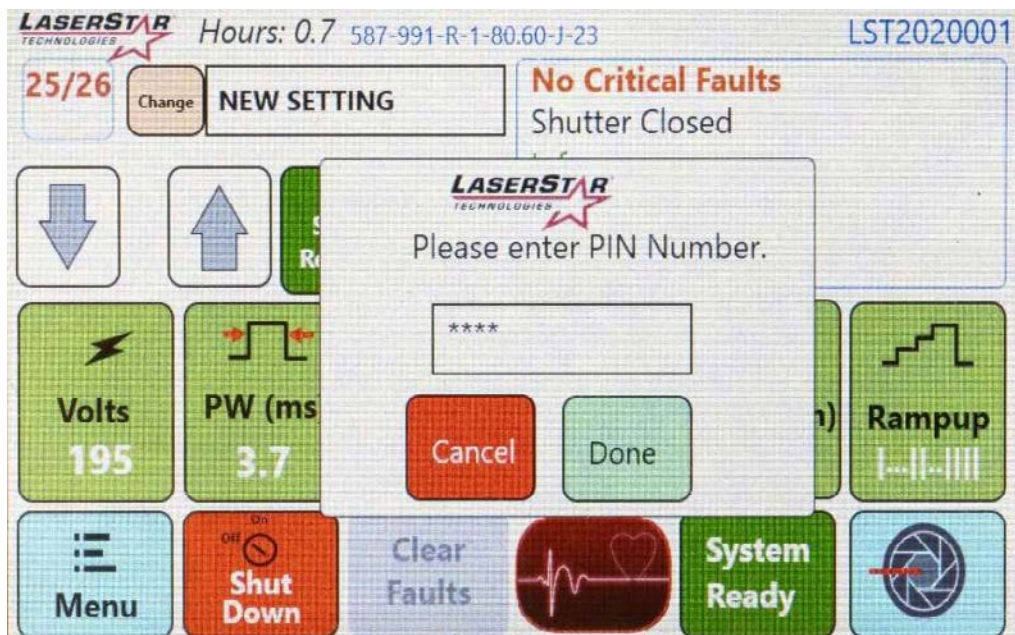
**Figure 20**  
(Set New Recipe [Saved  
Parameter Keys are Green])



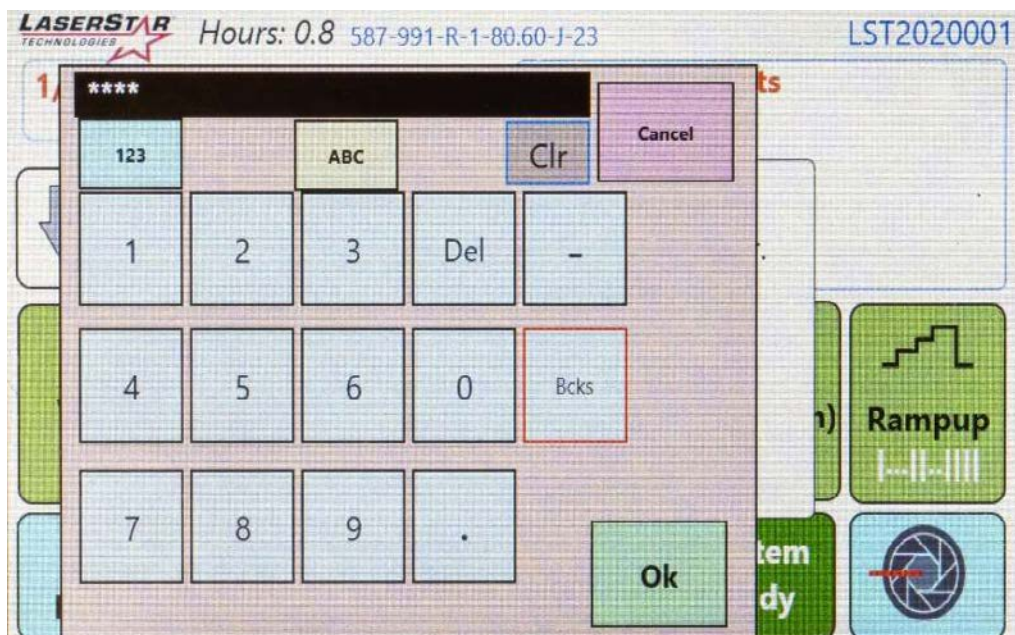
**Figure 21**  
(Press Delete [Clears  
Recipe Setting])



## Messaging & Touchscreen Display Operation (continued)

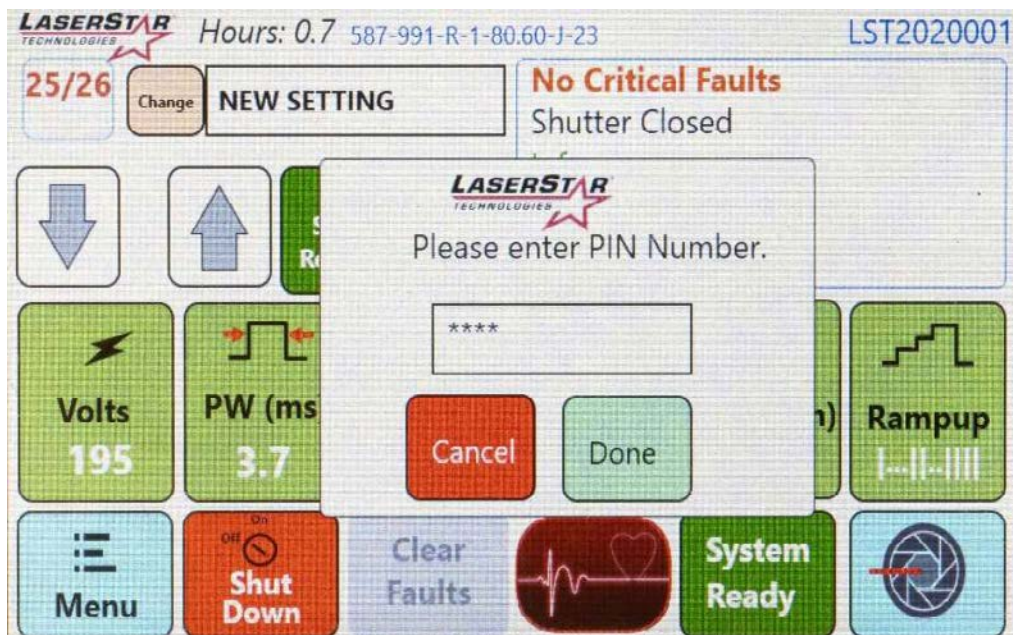


**Figure 22**  
(Input PIN Number [Press  
Done to Confirm])

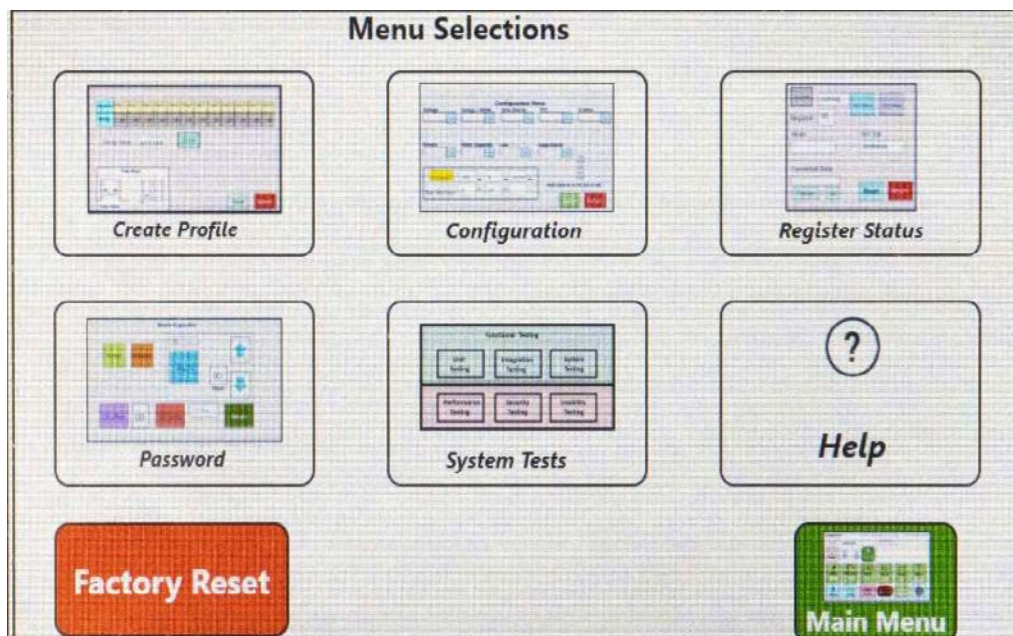


**Figure 23**  
(Input PIN Number [Enter  
Value Using Numeric Keypad;  
Press Ok to Confirm])

## Messaging & Touchscreen Display Operation (continued)



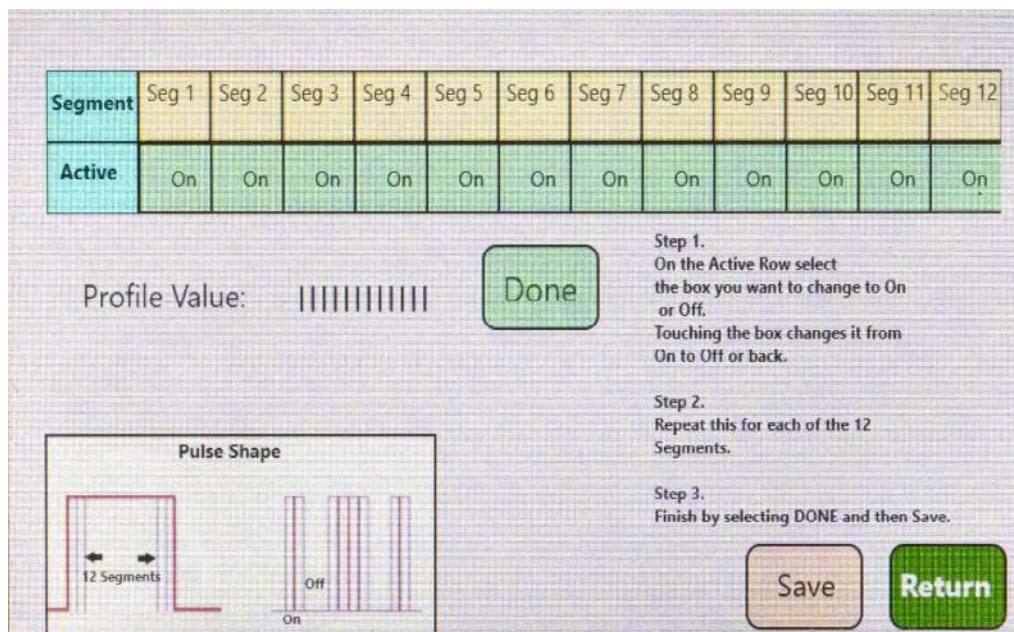
**Figure 24**  
(Input PIN Number [Press  
Done to Confirm])



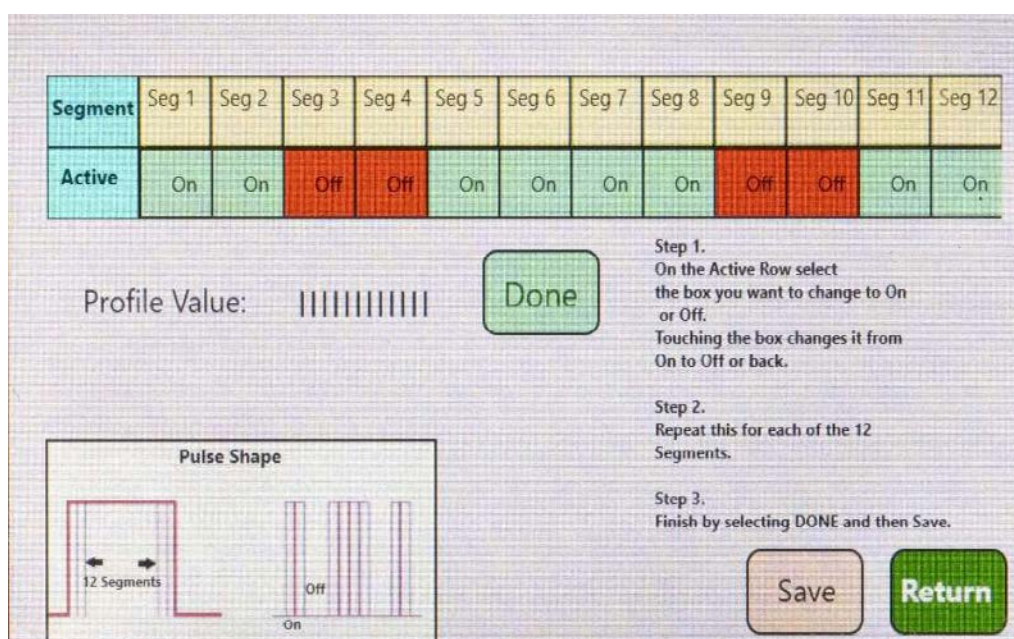
**Figure 25**  
(Menu Selection Screen)



## Messaging & Touchscreen Display Operation (continued)

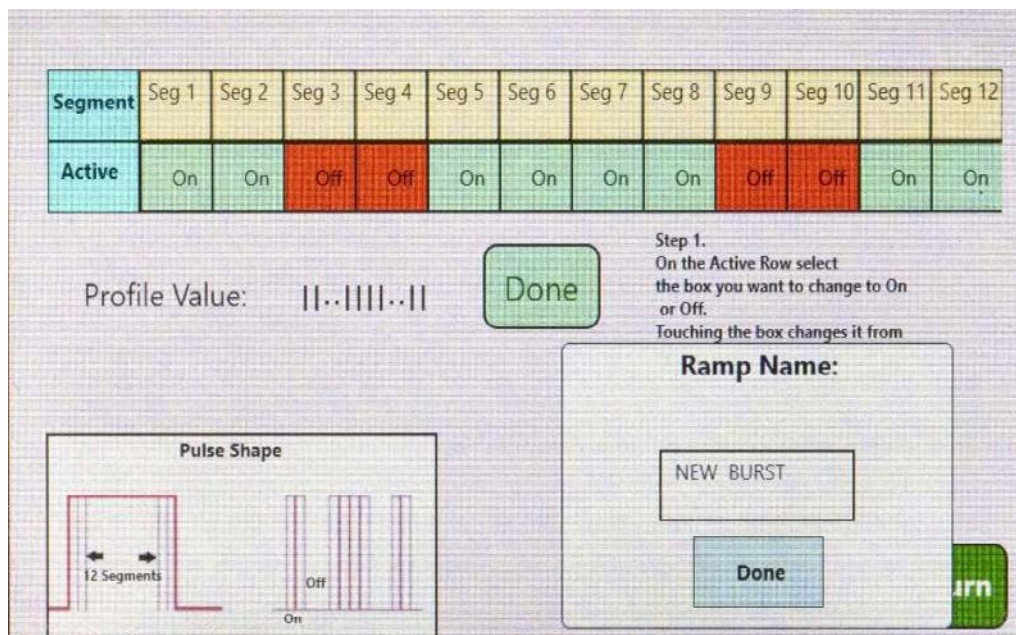


**Figure 26**  
(Create Profile [Press Done; Press Save to Confirm Settings])

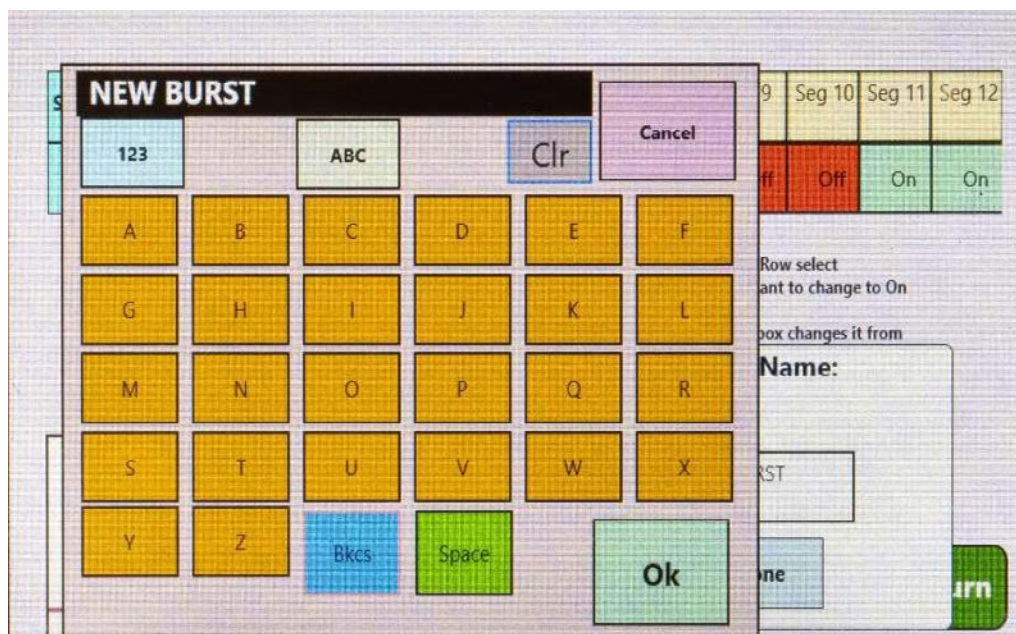


**Figure 27**  
(Select Active [Choose “On” or “Off”])

## Messaging & Touchscreen Display Operation (continued)



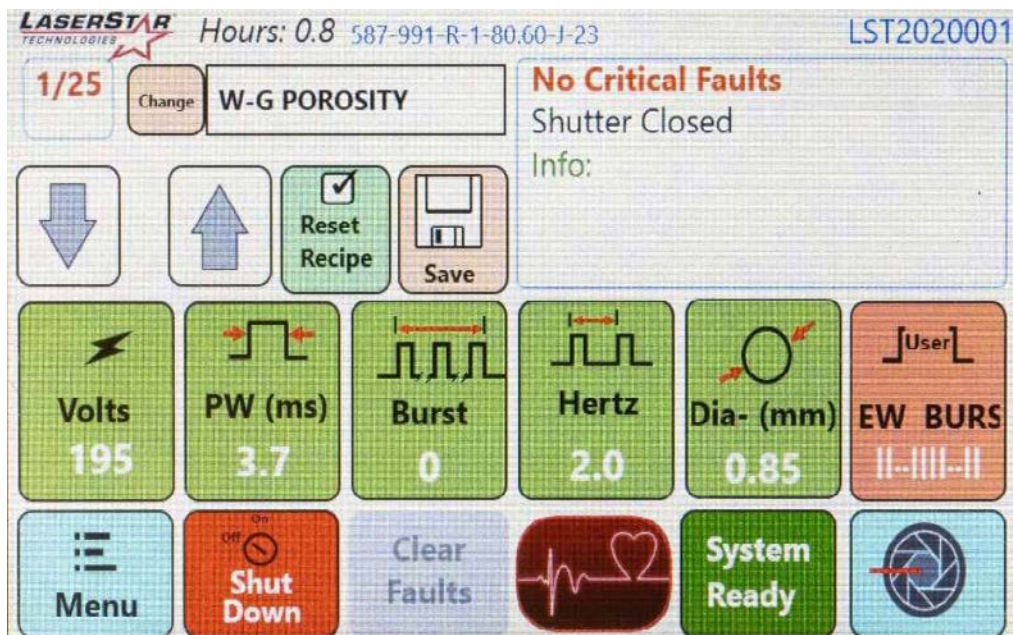
**Figure 28**  
(Ramp Name)



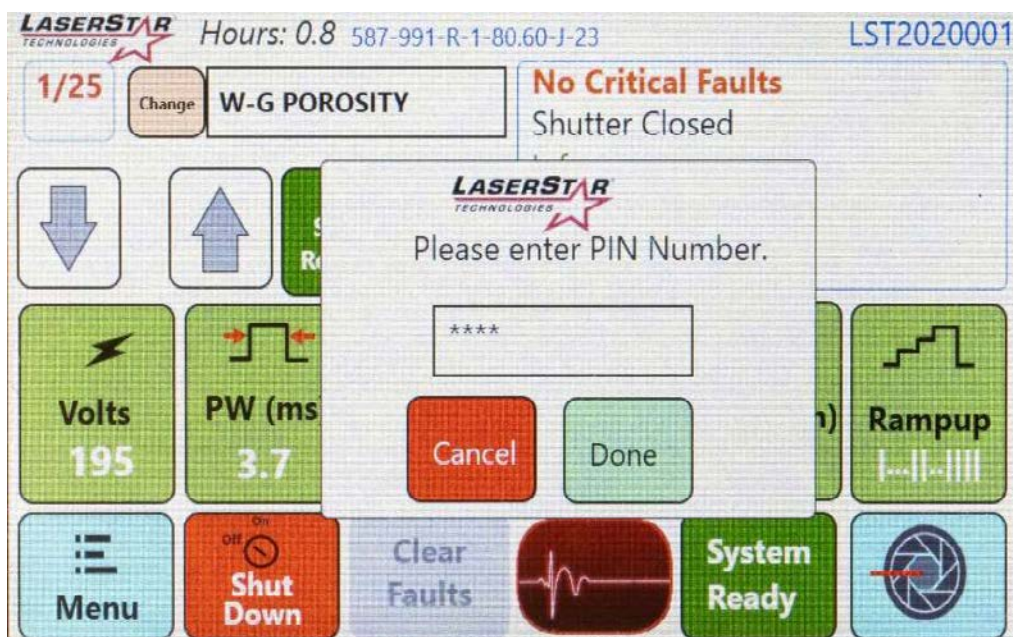
**Figure 29**  
(Alphanumeric Keypad)



## Messaging & Touchscreen Display Operation (continued)

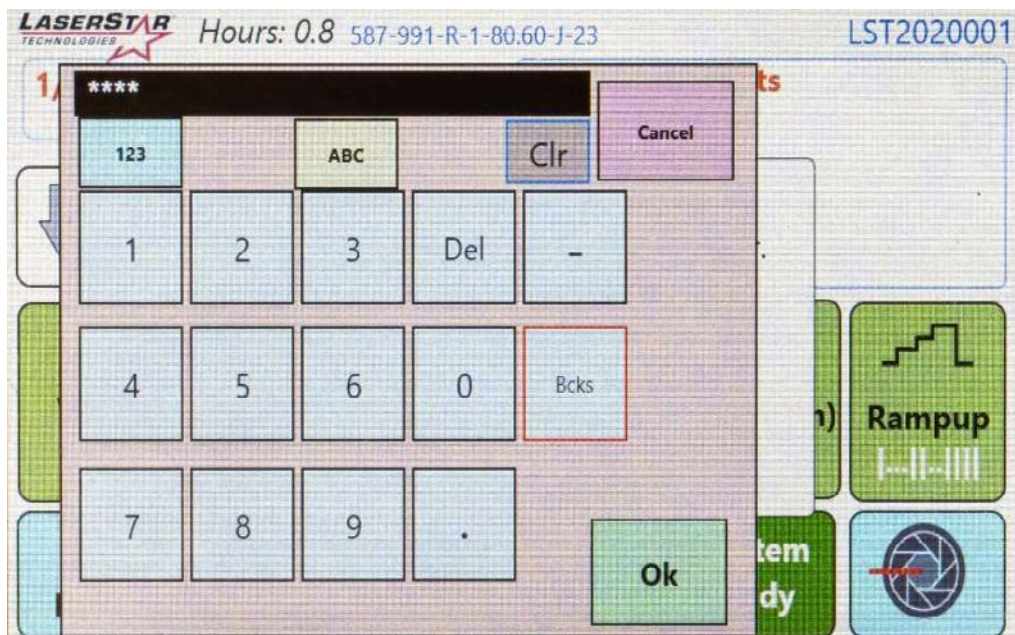


**Figure 30**  
(Custom Profile)



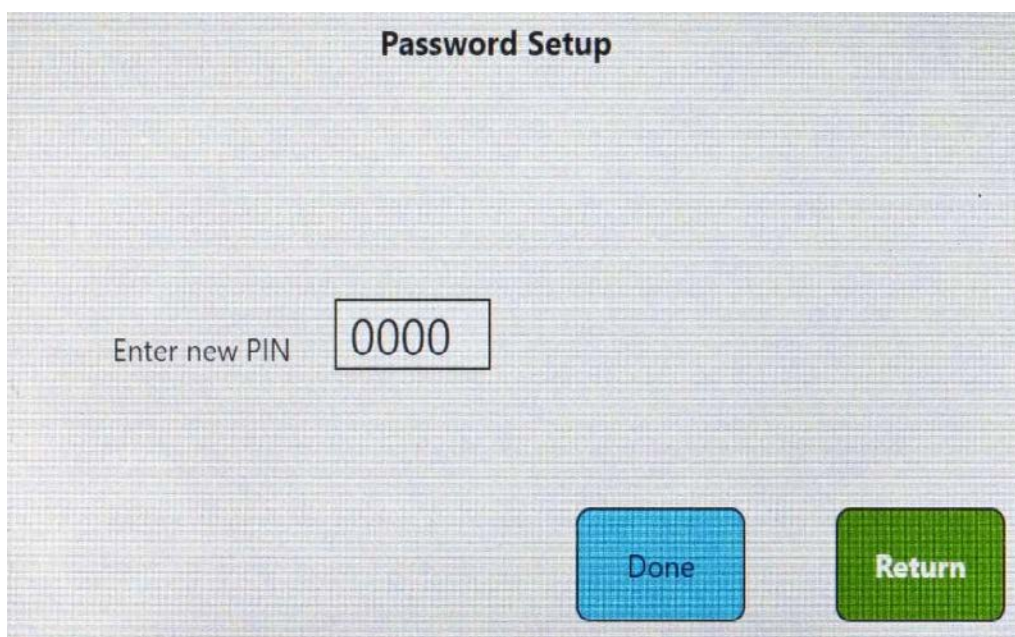
**Figure 31**  
(Input PIN Number [Press  
Done to Confirm])

## Messaging & Touchscreen Display Operation (continued)



**Figure 32**

(Input PIN Number [Enter  
Value Using Numeric Keypad;  
Press Ok to Confirm])

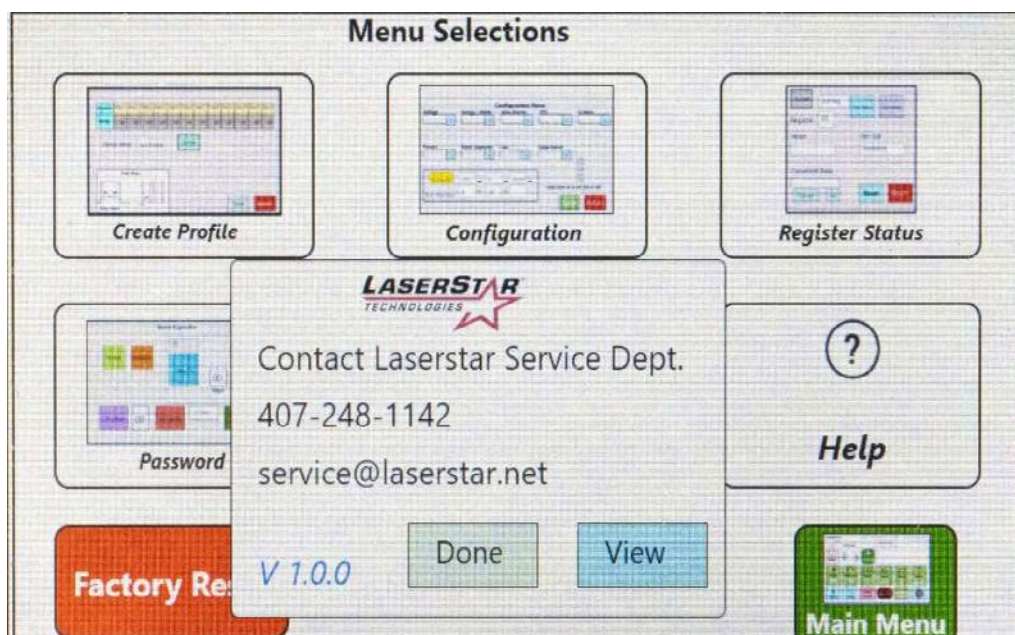


**Figure 33**

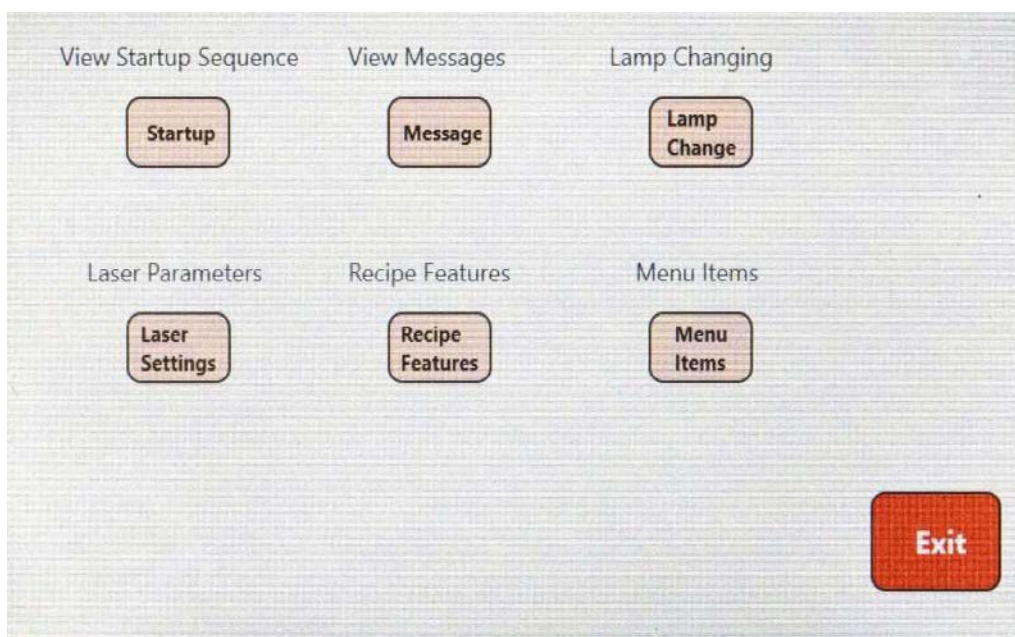
(New Password Setup [Press  
Done to Confirm])



## Messaging & Touchscreen Display Operation (continued)

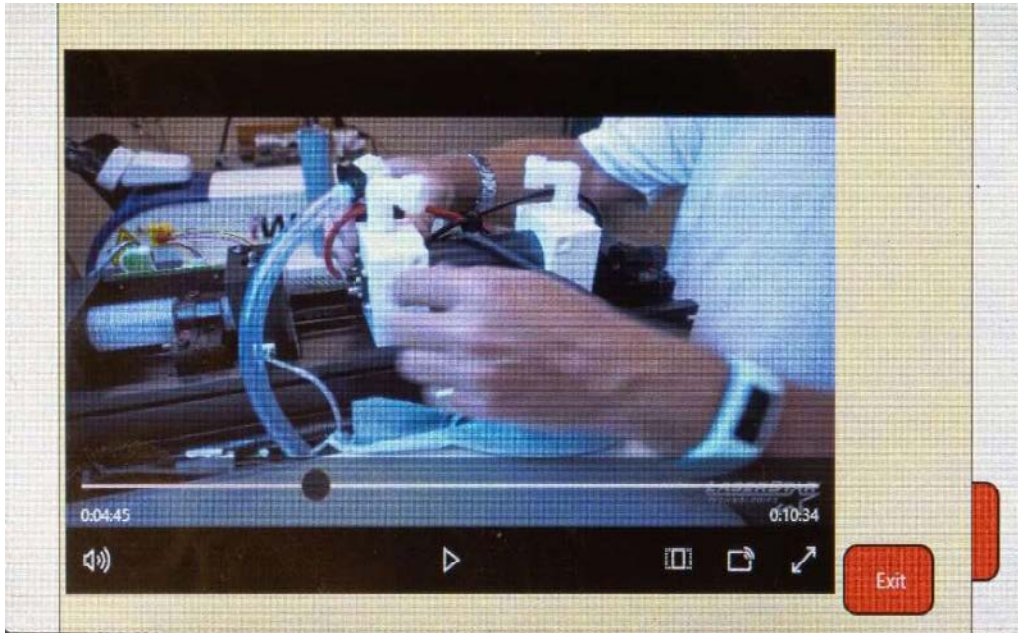


**Figure 34**  
(LaserStar Service  
Contacts)

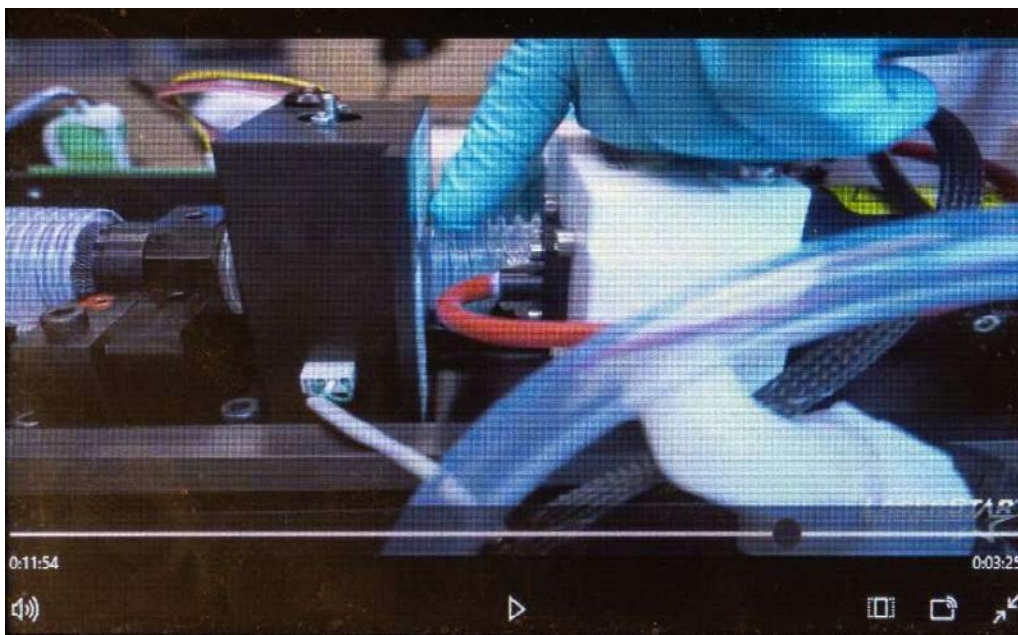


**Figure 35**  
(Help Topics  
[Secondary Menu])

## Messaging & Touchscreen Display Operation (continued)



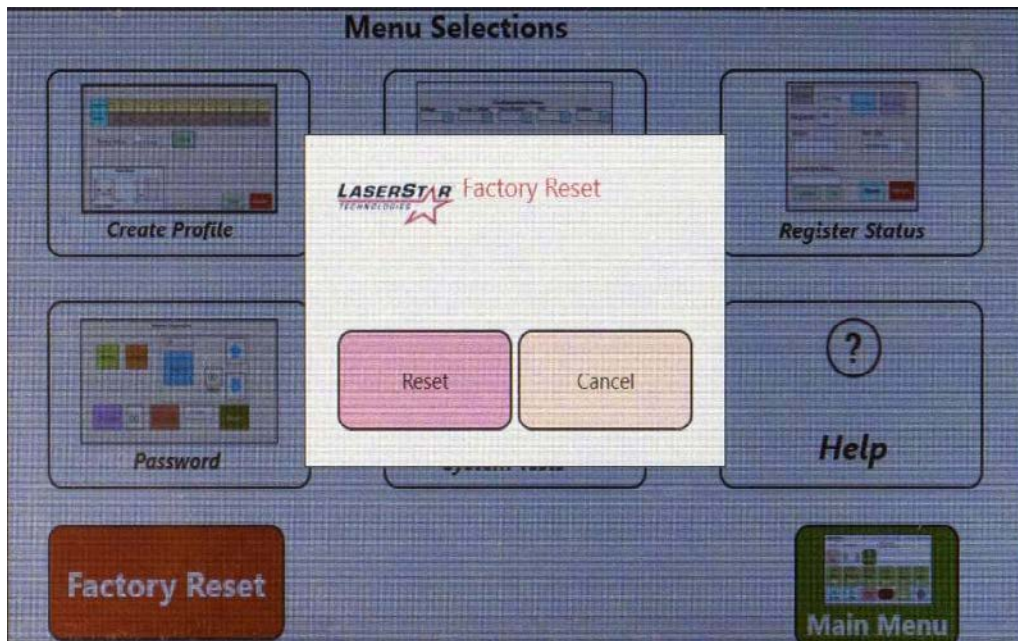
**Figure 36**  
(Video Support Topic  
[Press Play])



**Figure 37**  
(Video Support Topic  
[Fullscreen])



## Messaging & Touchscreen Display Operation (continued)



**Figure 38**

(Factory Reset [Call  
for Assistance])

## Storing Operating Parameters

The device's controller has stored memory locations with sets of pre-defined or pre-programmed operating parameters — each optimized for a specific application or material. Selecting from these pre-defined parameter settings allows the operator to utilize the same tried-and-tested operating data that was used previously to yield good results. **(Note: For additional details on pulse shape, be sure to reference the Appendix, as well as the section on Pulse Performance Technology.)**

In order to more readily identify the various memory locations, they can be assigned a unique name. Memory locations may already have default designations, but these can be changed, as needed.

### A stored set of parameters consists of the following:

(Note: The definitions for these parameter recipes are located in the section entitled **Operation > Setting Operating Parameters**.)

- Voltage

(Note: With some applications, adjustments to voltage are intended to compensate for flashlamp decay; this way the joule output is the same for the selected screen voltage. However, there are instances when the operator will need to maintain the same screen value for volts (while the actual voltage is the screen value  $\pm$  the offset value). For details, reference **Operation > Setting Operating Parameters**.)

- Pulse Width (PW [mS])
- Burst Mode
- Hertz (single pulse [0 Hz]; continuous pulse [ $\geq 1$  Hz])
- Pulse Suppression (PS; optional and model specific)
- Focus Setting (Dia [mm])
- Pulse Shape (see section on Pulse Performance Profile [P<sup>3</sup>] Technology)
- Beam Expander Offset

**(Note: The beam expander offset allows the user to maintain the same screen value for the focus setting (Dia [mm]), despite that the beam diameter is actually the screen value  $\pm$  the offset value.)**

**Storing Operating Parameters Continued on Next Page**

# Storing Operating Parameters (continued)

## Important Advisory:

- When selecting a specific memory location and opting to store parameters, the beam expander offset and voltage adjustment values displayed on the touchscreen menu (at that time) will be stored in this chosen memory location.
- If adjustments to the voltage are intended to compensate for flashlamp decay, it may be necessary to include this offset for all memory locations.
- If the operator has not chosen from a set of pre-defined parameters within a specified memory location, it's possible that the defined beam expander offset and voltage adjustment values displayed are from the last recalled memory value.
- Restoring factory defaults for the memory will erase modifications that were saved or altered by the user.  
**(Note: The operator should keep a back-up copy of all stored operating parameters.)**

Using the touchscreen display, the operator can save parameters into a specific memory location. Pressing the **Save button** will allow the operator to retain their applied settings, storing sets of parameters for future use with their applications.

Operator Action	System Response
See methods below for details on storing parameters.	
Press the <b>change button</b> ; type in the name of the new recipe setting.  Next, press <b>OK</b> . Then, <b>Save</b> .	The <b>alphanumeric keypad</b> will appear.  Two (2) options will appear on the screen — <b>Save</b> and <b>Cancel</b> .  The recipe name will be saved in the next available memory cell slot and will be assigned a recipe number.
Select the parameters you wish to save.	Using the touchscreen display, adjust the parameters to the desired settings.
> Press <b>Save</b> .	The values for <b>pulse shape</b> are stored with the welding parameters; these settings are viewable on the touchscreen display (main menu).

(Note: On the touchscreen display, when storing parameters with text, use the [ABC] or alternatively, switch to [123] on the alphanumeric keypad.)

# Resetting Stored Recipes

The touchscreen display can be used to recall operating parameters (recipes) that have been previously stored into a specific memory location (see the section entitled “**Storing Operating Parameters**” on pages 96 – 97).

Operator Action	System Response
There are multiple methods for setting a recipe; see below for details.	
Select the memory location to be used by pressing the <b>change button</b> (upper-left corner of the touchscreen display).  Next, use the <b>up</b> and <b>down arrows</b> to adjust the recipe location number.  Press the <b>set recipe button</b> to display and review the values for the parameter settings on the display.  When the recipe is set, the values will be green.	The selected recipe location’s welding parameters will be visible while the memory location number is changed.
Press the recipe cell number.  Press the <b>number box</b> ; enter the number for the desired recipe.  Next, press <b>OK</b> . Then, <b>Done</b> .  Next, press <b>Set Recipe</b> .	The <b>done button</b> will appear.  The <b>alphanumeric keypad</b> will appear ( <b>Figure 7</b> ).  All parameter settings will now turn green, indicating that the recipe has been set.



If there are no parameter values stored in the selected memory location number, the set values will remain unchanged. If the capacitor bank voltage is reduced as a result of the values selected, it is automatically reduced to the new value by pulse discharge.



Welding (touchscreen display)

Operator Action	System Response
Place the workpiece inside the welding work chamber.	
Set or adjust the weld parameters (recipe), optimizing for the selected material.	The <b>done button</b> will appear.  The <b>alphanumeric keypad</b> will appear <b>(Figure 7)</b>  The parameter settings will turn green; this indicates that the recipe has been set.
Press the <b>safety shutter button</b> .	The <b>safety shutter</b> will open.
Depress the <b>foot pedal switch</b> ; this action will enable and fire the laser.	A laser pulse is released.



**While the foot pedal is engaged, you should never place your hands or other body parts directly inside or beneath the path of the laser’s cross-hair; when a laser pulse is released (and with skin contact), there’s potential risk for serious injury, including severe burns.**

The dimmer control (located inside the welding work chamber) can be used to adjust the brightness level inside the work chamber and better illuminate a workpiece or part. Check the brightness using the stereo microscope; appropriate brightness is dependent on the material and properties of the workpiece.

**(Note: If the reference value for the voltage has been reduced, for safety reasons, the safety shutter will remain closed.)**

When welding (and while using inert gas), keep in mind that the outlet is located at the end of the gas tubing and should be positioned near the laser’s focal point. For most applications, adequate positioning is at the edge of the visual field (above the focal plane) for the stereo microscope.

# Optimizing Welding Results

With welding applications—in order to optimize results, workpieces must always be properly positioned within the focusing area of the laser beam; this is a determining factor that affects weld quality and the final outcome.

Operator Action	System Response
Proper positioning for workpieces — both horizontal and vertical, is important.	
Look through the <b>stereo microscope</b> and join the workpieces together — adjust the workpieces, as needed.	The cross-hair indicates the exact position of the laser's pulse spot.
When the welding point appears sharply in focus (and within the cross-hair), partially press down the <b>foot pedal switch</b> .	The inert gas supply will be enabled.
Depress the <b>foot pedal switch</b> down fully.	The <b>view shutter</b> will close automatically for a short duration; this occurs with each laser pulse.
To release consecutive laser pulses (with single-pulse mode), the <b>foot pedal switch</b> must be partially released, then fully (and repeatedly) depressed down. With continuous pulse mode, laser pulses are fired consecutively (for as long as the <b>foot pedal switch</b> remains fully depressed).	A laser pulse is released; this can be single or consecutive, depending on the operator's chosen action.
When you have finished with the welding application, be sure to place all workpieces down inside the work chamber to cool.	



**In some instances, and with specific materials, determining suitable parameters (voltage, pulse length, pulse frequency, beam diameter, and pulse shape), and additionally, the flow rate for the argon (inert) gas is based on a period of trial and error. In many cases, the quality of a weld point can also be vastly improved when the laser pulses are fired consecutively, and within a short span of time.**

Following adjustments to the voltage value, a pause in activity may occur; this happens while the device is charging or discharging energy. During this recovery period, the buttons on the display will switch to grey. The timing for recovery can range between 0.1 and eight (8) seconds, depending on the values that have been set for the voltage and laser pulse length. When the new settings are finalized, the set recipe settings will return to green.

## Setting Operating Parameters

The view shutter is controlled electronically and a laser pulse is only released if the view shutter is operating properly. Additionally, there is an optical filter in the viewing optic that blocks UV and laser light.

## Resetting Pulse Count

For information on resetting the pulse count, be sure to reference **Operating Parameters > Messaging and Touchscreen Display Operation**.

## Text Input Mode

For information on using text entry mode, be sure to reference **Operating Parameters > Messaging and Touchscreen Display Operation**.

## Switching “Off”

1. Turn the **key switch** to the **left**.
2. Turn the **main power switch** to the **left** (position “0”).
3. Close and turn “**off**” the inert gas valves (gas cylinder valve).

Remove the key from the **key switch** and be sure to store it securely; it should only be accessible to authorized personnel.



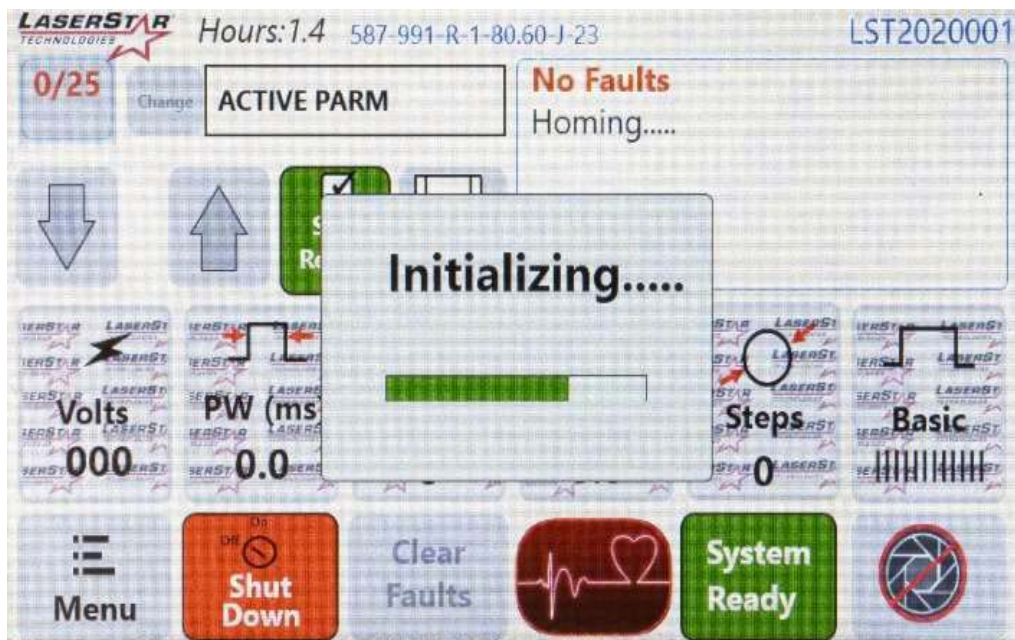
**Figure 39**  
(Switching “Off”)

## Status Monitoring and Indicators

During the self-test diagnostics, which begin immediately after the device has been switched "on," the LaserStar Technologies Corporation® logo is displayed, followed by the start of the software initialization. During operation, the current status of the laser is indicated by the beating heart on the touchscreen display. If the heart icon is broken, the system is not ready to weld.

**The micro-controller monitors the conditions for pulse release on the basis of the following criteria:**

- If the safety shutter is open, a laser pulse can only be released via the pedal switch.
- If the safety shutter is closed, a laser pulse cannot be released (the safety shutter helps to safeguard the operator, as well as others who are nearby — ensuring that unexpected or unplanned laser pulses are avoided.)
- In principle, the remote interlock prevents a laser pulse release.
- If there is a malfunction or failure with the remote interlock, the flashlamp power supply will automatically shut down.

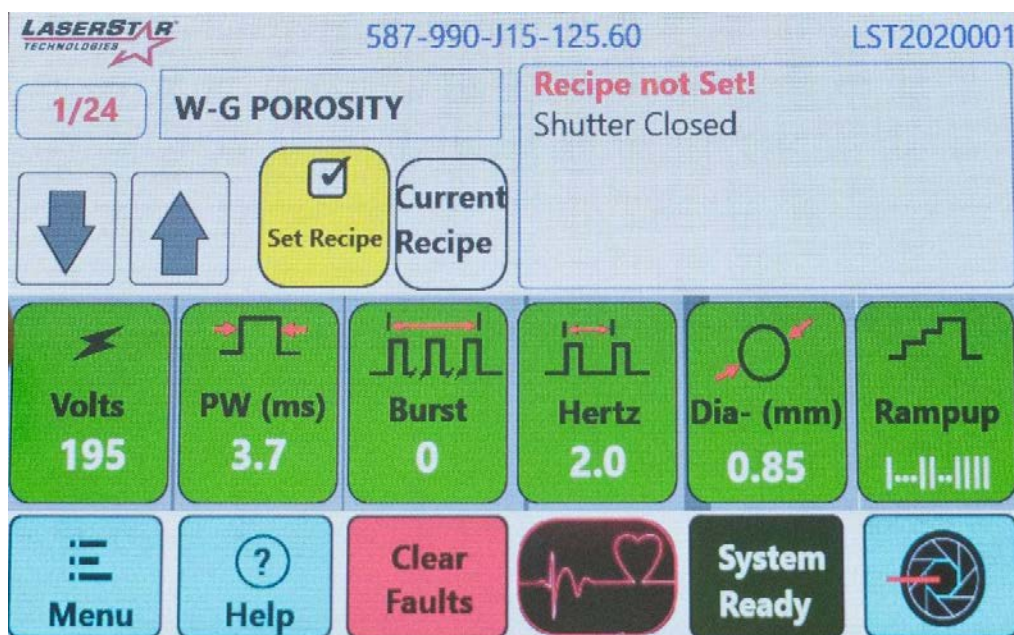


**Figure 40**  
(Initializing)

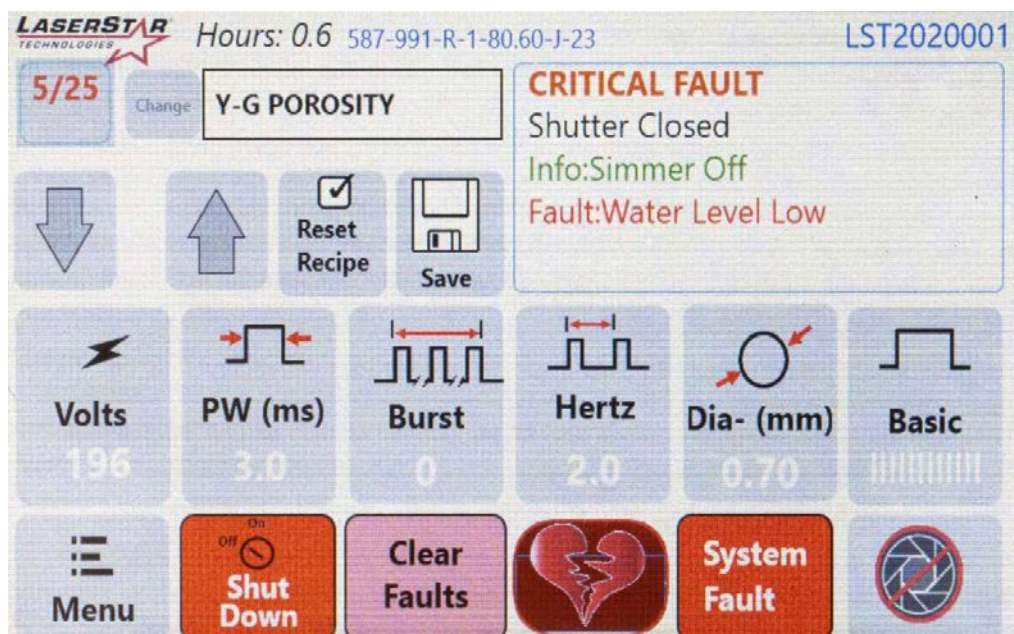
**Status Monitoring and Indicators Continued on Next Page**



## Status Monitoring & Indicators (continued)



**Figure 41**  
(Beating Heart  
Status)



**Figure 42**  
(Broken Heart  
Status)

(Note: The entire screen will be gray and the laser will not fire until the Critical Fault has been cleared.)

## **Passwords & Restricted Access (model and option dependent; factory installed — Reference Appendix, Section B)**

### **Important Advisory:**

The restricted access feature is intended to prevent unauthorized changes to the device's welding parameters; this feature is installed prior to shipping from LaserStar Technologies Corporation®. The operator can choose to enable or disable restricted access and password protection whenever they choose.

<b>LaserStar Technologies: Important Contacts</b>		
<b>Sales &amp; Training</b>	<b>Service &amp; Support</b>	<b>Corporate Office</b>
(407) 248-1142 <a href="mailto:sales@laserstar.net">sales@laserstar.net</a>	1-888-578-7782 <a href="mailto:service@laserstar.net">service@laserstar.net</a>	2461 Orlando Central Pkwy. Orlando, Florida 32809, USA

## This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[illegible]



## V. Maintenance

### Overview and Requirements

Routine maintenance is a requirement for ensuring the safe and optimal operation of the welder. Regular maintenance intervals must be scheduled in accordance with the manufacturer's recommendations and requirements.

#### **Before maintenance can be carried out, the following safety measures must be observed and followed:**

- Disable systems, subsystems, and auxiliary equipment by turning "OFF" and disconnecting from power sources or live components.
- Ensure that all the disconnected equipment has been secured against being switched "ON" again, whether automatically (e.g. vibration) or inadvertently (e.g. operator error). Secure the **Mains Power Switch** with a padlock (you may use the mechanical locking device provided) or alternatively, remove the fuses. Verify that all warning indicators are properly functioning and remain alert while maintenance is being carried out.
- Using a voltage meter or voltage tester, check whether the equipment is "live." Measure the conductors against one another and also against the protective ground conductor.
- When reconnecting the equipment, **remember, you should always ground first.** With low-voltage devices, short-circuit the capacitors, and for high-voltage devices, short circuit both the capacitors and high-voltage lines. When service has been concluded, be sure to remove the grounding and shorting jumpers.
- If there is a risk of touching "live" components while at the worksite, and it is not possible to disconnect these components from their voltage source, they must be covered with a reliable and sufficiently strong insulating material. If the components cannot be covered, another method must be used to prevent direct contact. Once precautions are in place, be sure also to cover the workspace with plastic sheeting, paneling, or a rubber mat.
- After maintenance is concluded, the service personnel must verify that the equipment is safe to operate.
- When replacing components, use only Laser Star Technologies Corporation® approved parts and accessories.



**When carrying out service or maintenance tasks, you should never work alone. A second person who is familiar with the risks posed by high-voltage electricity and laser radiation should always be present for these activities. This person will also provide support in the event of an emergency, turning off the equipment and administering first aid, if necessary.**



**This device complies with all generally recognized technical standards and regulations, including those set forth by OSHA, EC, EN, DIN, and VDE. The laser is ignited and operated using dangerous high voltage (>1 kV) and special care must be taken when working on the flash-lamp power supply. If you are recording measurements for the electrical or electronic components while the machine is "ON," it is critical to maintain required clearances (for details, refer to Installation, Section III. When working with electrical equipment of this kind, you must comply with relevant safety regulations (OSHA, or the equivalent national or international standards).**



**While working with an open device, you must comply with OSHA regulations for accident prevention with regard to laser radiation or equivalent national or international regulations (e.g. EC Directive 608 or IEC Publication 825). Remember also to wear the appropriate laser protective eyewear.**

## Maintenance Alerts



To optimize performance and minimize premature machine failure, maintenance routines should be carried out at the recommended intervals.

The welding workstation is programmed to alert the operator about upcoming or anticipated maintenance requirements. Maintenance reminders will appear on the touchscreen display, as indicated in the table below, which lists these tasks and their anticipated intervals.

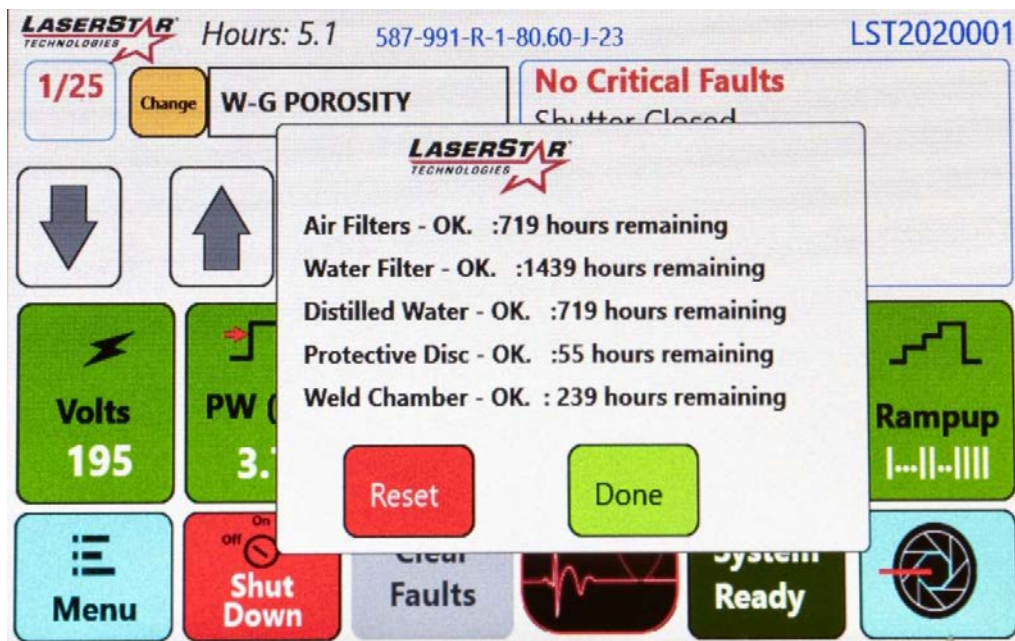
Maintenance Intervals: Alert Reminders			
Use <u>only</u> LaserStar Technologies Corporation® approved parts and accessories.			
Alert Notification	Interval	Hours (based on general usage within an 8-hour work day)	Reset Method
Protective Disk (cleaning)	7 days	56 hours	Press the <b>Reset button</b> to reset
Welding Chamber (cleaning)	30 days	240 hours	Press the <b>Reset button</b> to reset
Air Filter(s) (change)	90 days	720 hours	Press the <b>Reset button</b> to reset
Distilled Water (change)	90 days	720 hours	Press the <b>Reset button</b> to reset
Distilled Water Filter (change)	180 days	1440 hours	Press the <b>Reset button</b> to reset

Notes

## Maintenance Alerts (continued)



The laser will indicate with a beep when maintenance is due. Alerts appear on the touchscreen in red; pressing the Reset button will clear the alert (Figure 44 below). The Beating Heart button allows the user to view the hours remaining before maintenance is due for a specific component.



**Figure 44**  
(Maintenance Alerts)

## Maintenance Intervals



**The maintenance schedule is dependent on both the environment and general usage. The operator should determine the appropriate maintenance intervals.**

### Daily: (a)

1. The outside surface of the welder's body enclosure, the work chamber, and safety material (surrounds the outside of the splash-protective observation window) should be cleaned using a cloth that's been dampened with water or another non-abrasive cleaner. **If you choose to use 70% isopropyl alcohol, a flammable liquid, be sure there's no contact with the device's touch screen display; this will damage the display. Additionally, you should never use strong cleaning agents, such as powders or solvents to clean the equipment.**
2. The splash-protective observation window should be visually checked for cracks, voids or other damage. **If you discover damage, be sure to replace the splash-protective observation window before using the device.** (For additional details on this process, be sure to refer to the section entitled “**Replacing the Splash-Protective Observation Window and Laser Protective Window**” later in this chapter.)
3. The protective disk, which is located inside the work chamber, should be unscrewed from the **focus lens** and cleaned with a lens cleaning solution. We recommend LaserStar Technologies Corporation® Cleaning Solution (part number: 810-2353), which can be conveniently purchased from our [e-store](#). If you prefer to use cleaning wipes (part number: 810-2356 [quantity: 1]) or 810-2354 [quantity:90]), these are also available to purchase from our [e-store](#). **(Note: If opting for 70% isopropyl alcohol, be sure to use with a lint-free cleaning cloth. After cleaning, polish with a clean, lint-free wipe to remove any hazy residue.)**

Over time, and with continued use, you will notice metal splashes adhering to the surface of the **protective disk**; there is a danger of local heating at these splash points that can result in cracking or possible destruction of the **focus lens**. Eventually, the **protective disk** will need to be replaced. **Caution: When replacing the protective disk, always replace with a new component; never reinstall the protective disk with the side that has metal splashes facing upward.**

### Weekly: (b)

1. Check the alignment of the cross-hair with the device's pulse spot. (for additional details and step-by-step instructions on this process, see **Operation > Optical Alignment**.)
2. The splash-protective observation window (located behind the laser protective window) should be cleaned and checked for scratches, cracks, and holes.

**Maintenance Intervals Continued on Next Page**

## Maintenance Intervals (continued)

### Monthly: (c)

1. Inspect the welding chamber protective housing (i.e. arm cuffs and chamber door) for damage. **This device must not be used if any of the protective housing components are damaged.** If you discover damage, be sure to contact LaserStar Technologies Corporation® Service Department for support, by calling 1-888-578-7782.



Warning!

**Disconnect the AC Mains plug and wait five (5) minutes for the flashlamp power supply to discharge.**

2. Use a vacuum with an extension attachment to clean the heat exchanger fins. **Caution: The heat exchanger fins are both extremely sharp and delicate; when removing dust or debris from the fins, be careful not to cut yourself or damage this component.**
3. Check the water level inside the distilled water reservoir (for additional details, be sure to reference **Service > Section A: Refilling or Topping Off the Distilled Water Bottle**).
4. Check the exhaust system filter (located inside the welding chamber); if dirty, be sure to replace. (refer to **Maintenance > Filter Replacement and Chamber Exhaust** within this manual)
5. Check all enclosure air filters; if dirty, be sure to replace.
6. Adjust the device's power settings as follows: 250V, 1 mS, 0.0Hz, 0.20mm (beam diameter)
  - Position the supplied flash paper at the bottom of the welding chamber; fire a single laser pulse.
  - Compare the pulse spot with the samples that were shipped and included with purchase. If you notice differences in quality, be sure to contact LaserStar Technologies Corporation® Service Department for support.

### Quarterly: (d)

1. Change the distilled water every three (3) months.
2. Change the distilled water filter every six (6) months, depending on usage. (**Note: Reference Maintenance > Replacing the Distilled Water and Changing the Water Reservoir Filter.**)

### Annually: (d)

Perform routine maintenance at the scheduled intervals outlined above (or as needed, in accordance with individual usage).

## Protective Disk Replacement

1. Turn the **Main Power** switch “off” or to the “O” position. Wait **five (5) minutes** for the chamber lights to cool.
2. Insert both hands into the hand openings on the welder's body enclosure.
3. Remove the fixed gas nozzle by depressing the button on the left-hand side of the nozzle.
4. Remove the ring lamp by unscrewing the two (2) black thumb screws (located at 4 and 8 o'clock).  
**(Note: The lamp will also be plugged in at the top of the welding work chamber; be sure to unplug the component before attempting to remove.)**
5. Unscrew the knurled ring from the underside of the lens; turning counter-clockwise, remove the component from the welding chamber — ensuring that it remains horizontal, if possible.
6. Replace the previous **protective disk** with a new one.
7. Turning clockwise, secure the knurled ring together with the new protective disk; reaffix to the underside of the lens.

**(Note: The protective disk, which is constructed from glass, prevents the lens from being damaged by mechanical influences (i.e. metal splashes or dust). An anti-reflective coating is present on both sides of the disk and helps to minimize the chance of loss as a result of absorption.)**

8. Replace the ring lamp, setting in place around the **focus lens**. With the ring lamp in place, tighten the two (2) black thumb screws.
9. Replace the fixed gas nozzle by pushing the component into the receptacle; you will hear the nozzle snap into place.

## Refilling the Distilled Cooling Water, Bleeding the Pump, etc. (reference Service)



## The splash-protective observation window, a multi-layered protective component, consists of the following elements:

First, the splash-protective observation window, the inner-most layer — acts as a buffer, ensuring the laser protective window remains intact, and is shielded from dirt and debris. Second, the laser protective window, the outer-most layer — functions as a protective barrier, shielding the operator from dangerous emissions of radiation from laser light.

### Observation Window: Cleaning, Care, and Replacement

1. Loosen the two (2) hexagon socket screws that are positioned along the sidewalls inside the welding work chamber. While pressing your hand against the frame of the protective window, continue unscrewing the socket screws until the angle brackets can be rotated or removed.
2. Tilt the lower edges of each of the protective window components inward, pulling them downward simultaneously into the welding chamber.

Whether replacing or reinstalling the splash-protective observation window, be sure to first clean each of the components with an approved optical cleaning solution and soft, lint-free cloth. If you choose, you may purchase LaserStar Technologies Corporation® Optical Cleaning Solution (part number: 810-2353).

3. For newly installed components, be sure to first remove the protective foils from the splash-protective observation window; clean both sides with alcohol.



**Use care when handling and replacing the splash-protective observation window. Be careful not to scratch the window's surface. With rough handling, there is potential to damage the component.**

4. With the labels facing upward, place the laser protective window onto the splash-protective observation window; each component should be positioned into its respective slot.
5. Be sure to check that the laser protective window is located on the outside surface and fully seated inside its frame (harmful exposure to laser radiation can occur if the protective window is not properly installed.)
6. Apply light pressure to the two (2) angle brackets (resting over the hexagon socket screw head and washer) against the window. Tighten the hexagon socket screws, ensuring the windows fit snugly into the frame.

**(Note: If you hear clattering after installation is complete, the component has not been properly installed; be sure to reinstall the window if this is the case.)**

# Filter Replacement and Chamber Exhaust

1. Turn “off” the **key switch** and **main power** switch. Next, disconnect the main AC power source.
2. Wait five (5) minutes.
3. Remove the chamber exhaust filter cover on the rear of welding work chamber.
4. Remove the filter and replace.
5. Reinstall the filter cover.
6. Reconnect the main AC power source.
7. Check for the fan turning on and air being exhausted from the rear of the enclosure.



**You should never attempt to clean the machine's air filter; this component is intended for single-use and must be replaced periodically, as outlined in the section on maintenance. Never beat or blowout the filter with compressed air; this will compromise the integrity of the component and destroy the filter medium. In addition, risks are presented when pollutants that have adhered to the filter are cycled back into the air in the workspace.**

## Notes

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## Touchscreen Display

It's important to know, the touchscreen display is sensitive to chemicals, much as is a pair of glasses with plastic lenses (usually polycarbonate with a glare reduction coating). In fact, the cleaning kit often supplied with a pair of glasses is a great option for safely and effectively cleaning the touchscreen display; it typically includes a microfiber cloth and a gentle cleaning solution.

**When attempting to clean your machine's touchscreen display, be sure to keep the following guidelines in mind:**

- Use a soft lint-free cloth. The 3M Microfiber Lens Cleaning Cloth is especially recommended for cleaning touchscreen displays without requiring liquid cleaner.
- The cloth maybe used dry, or lightly dampened with a mild cleaner or Ethanol.
- Be sure the cloth is only lightly dampened, not wet. Never apply cleaner directly to touchscreen surface; if cleaner is spilled onto the display surface, soak it up immediately with an absorbent cloth.
- Cleaner must be neither acid nor alkali (neutral pH).
- When using cleaner, avoid contact with the edges of the film or glass.
- Wipe the surface gently; if there is a directional surface texture, wipe in the same direction as the texture.
- Never use acidic or alkaline cleaners, or organic chemicals such as: paint thinner, acetone, toluene, xylene, propyl or isopropyl alcohol, or kerosene.
- Suitable cleaning products are commercially available pre-packaged for use; one example of such a product is Klear Screen™ <<https://www.nushield.com/klear-screen-wiping-pads>> or commercially available off-the shelf retail brands such as Glass Plus® Glass and Surface Cleaner made by Reckitt-Benckiser <<http://www.glassplus.com/>>.
- Use of incorrect cleaners can result in optical impairment of touchscreen and/or damage to functionality.

**(Note: Most cleaning products contain between 1-3% isopropyl alcohol by volume, which is within acceptable limits for cleaning resistive touchscreen displays. Some products, however, contain ingredients like ammonia, phosphates or ethylene glycol, which are not acceptable. When making a decision to purchase products to clean the touchscreen display for your device, be sure to carefully review the list of ingredients on the label.)**

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## VI. Troubleshooting

(Note: Before troubleshooting is carried out on the machine, be sure to reference important safety protocols outlined in **Maintenance, Section V** within this manual.)

### General Information

All messages, alerts, and system faults are displayed in the upper right-hand corner of the touch-screen display. System faults are categorized with the following criteria: **critical**, **non-critical**, and **non-faults**. If there is a fault, it must be eliminated to successfully reset the machine and resume working. Once all faults have been eliminated, press the **Reset button** in the alarm box (or turn the system key switch “off” and then “on”) to reset the machine.



**While carrying out service-related activities with an open device, you must comply with regulations set forth by OSHA for accident prevention with regard to laser radiation or the equivalent national or international regulations (e.g. EC Directive 608 or IEC Publication 825). Be sure also to safeguard your eyes and wear appropriate laser protective eyewear.**

### Equipment Malfunction

If you experience a malfunction with your machine that cannot be eliminated through one of the actions outlined in the previous sections for Maintenance or Troubleshooting, be sure to document your results and immediately contact LaserStar Technologies Corporation® Service Department for support, by calling 1-888-578-7782.



**Service and maintenance tasks should only be performed by technicians who are affiliated with LaserStar Technologies Corporation® and who are appropriately trained; other properly trained personnel; personnel who are supervised by trained personnel (in-person or by phone); or by those who have read and understand the service-related protocols within the sections for Operation, Section IV and Maintenance, Section V within this manual.**

LaserStar Technologies: Important Contacts		
Sales & Training	Service & Support	Corporate Office
(407) 248-1142 <a href="mailto:sales@laserstar.net">sales@laserstar.net</a>	1-888-578-7782 <a href="mailto:service@laserstar.net">service@laserstar.net</a>	2461 Orlando Central Pkwy. Orlando, Florida 32809, USA

## Diagnosing & Troubleshooting Basics

System Messages		Possible Cause
Left Door Sensor*	DR INT	Left chamber door is open (Reference Service Section “E”)
Front Door Sensor*	DR INT	Front chamber door is open (Reference Service Section “E”)
Right Door Sensor*	DR INT	Right chamber door is open (Reference Service Section “E”)
Single Pulse Mode		Hertz (0.0) Depressing the foot pedal will only produce one laser pulse.
Multi Pulse Mode		Hertz activated. Depressing the foot pedal will produce multiple laser pulses.
Burst Pulse Mode		Burst activated. Depressing the foot pedal will produce the number of laser pulses that the operator has selected.
Storing Into Memory		Save key depressed. Parameters are being stored into a memory location.
Set Recipe		Set Recipe key depressed. A saved memory location is being activated.
Safety Shutter Closed		The Open Shutter (O) button has not been pressed to allow the safety shutter to open.
Safety Shutter Open		The Open Shutter (O) button has been pressed and the safety shutter is open.

**Diagnosing & Troubleshooting Basics**  
**Continued on Next Page**



## Diagnosing & Troubleshooting Basics (continued)

System Messages	Possible Cause
Cap Supply Not RDY	Displayed continually (third row on the touchscreen display. Intermittent: Power supply is not recharged to the specified voltage
Simmer Supply Off      Smr Off	Check and (or) change Flashlamp. (Reference Service Section / Simmer for details on lamp status)
Beam Expander Low Fault	Beam Expander “zero” signal not detected. Operation can continue, however, beam diameter is not changing.
Beam Expander Hi Fault	Beam Expander “Full Limit” signal not detected. Operation can continue, however, beam diameter is not changing.
<b>Error Reported (critical)</b>	
Water Flow Low      Flw Lw	Prime the water pump by opening the petcock or equivalent located near the water bottle. Are the inlet and outlet lines connected to the tank? Is the petcock closed after priming (model dependent)?
Water Level Low      Wtr Lw	Check the water level and be sure to refill the water reservoir, if needed.

**Diagnosing & Troubleshooting Basics**  
**Continued on Next Page**

## Diagnosing & Troubleshooting Basics (continued)

System Messages	Possible Cause
Water Temp High      Tmp Hi	The cooling water has exceeded its normal operating temperature; leave machine idle and leave “on” to cool.
CHG Supply Over Temp      Chg Tm	The cap-charging supply has exceeded its normal operating temperature; leave machine idle and leave “on” to cool.
CHG Supply Over Volt      Ovr V	The calibration for the charging supply and cap supply is “off”.
Cap Discharge Fault      Cap D	The power supply is not discharging.
IGBT Fault      IGBT F	Reset the fault and/or turn the key switch “off” and back “on”.
Safety Shutter Fault      Shtr Iv	A safety shutter error has been detected.
View Shutter Fault      Vs TmO	The view shutter is not tripping one (or both) of the “open” and “close” sensors.
External Interlock      R Int 1	Make sure remote interlock on door, etc. is okay. (Note: Or remote interlock shorting connector is fully installed.)
Release Foot Switch	The foot pedal is currently depressed or there’s a short in the foot pedal switch.

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## VII. Parts & Accessories

<b>LaserStar Technologies Corporation® Approved Components</b>	
<b>Description</b>	<b>Catalog Number</b>
Operation and Maintenance Manual (hardcopy)	13-99990-192MFX
Operation and Maintenance Manual (digital; USB flash drive)	90-99991-192MFX
Pump Chamber Repair Instructions (hardcopy)	87-99990-187
Pump Chamber Repair Instructions (digital; USB flash drive)	87-99991-187
Air Filter Kit (side panel)	87-64001
Air Filter Kit (chamber)	405-2601-080
Alignment Paper	00-10020
Beam Bending Mirror (2.0x & 3.0x)	05-19054
Beam Bending Mirror (5.0x)	05-19055
Cap Charging Supply (120 Volt)	405-4057-116
Cap Charging Supply (230 Volt / 60W)	405-4057-157
Cap Charging Supply (230 Volt / 80W)	127-30-3500
Hand Opening Protective Flap (right or left side)	05-66056-2

**Parts & Accessories Continued on Next Page**

## VII. Parts & Accessories (continued)

LaserStar Technologies Corporation® Approved Components	
Description	Catalog Number
Door Opening Protective Flap (rectangular)	05-66057-2
Control Board Assembly, P3	187-30-4017
Distilled Water (1 gallon)	100-75-0003
Distilled Water Pump (120VAC)	405-3500-210
Distilled Water Pump (220VAC)	405-3500-215
Fiber Wipes (quantity x1)	810-2356
Fiber Wipes (quantity x90)	810-2354
Flashlamp Supply (120 VAC)	190-30-12120
Flashlamp Supply (230 VAC)	190-30-1220
Flashlamp Supply (MD Model)	405-2460-412
Flashlamp Supply (Standard)	405-2460-410
Flow Plate	31-10047
Focus Lens Protective Disk	01-10112
Fuse: Exhaust Chamber and Dimmer Control (0.5A, 250VAC, SB 5 × 20mm)	405-4320-050

Parts & Accessories Continued on Next Page



## VII. Parts & Accessories (continued)

<b>LaserStar Technologies Corporation® Approved Components</b>	
<b>Description</b>	<b>Catalog Number</b>
Fuse: Welding Chamber and Dimmer Control (1A, 250VAC, SB 5 × 20mm)	405-4320-001
Fuse: Water Pump and Cooling Fan (2A, 250VAC, SB 5 × 20mm)	405-4320-002
Fuse (4A, 250VAC, SB 3AG)	405-4320-040
Fuse (5A, 250VAC SB 5 × 20mm; fast)	405-4320-500
Fuse (10A, 250VAC, SB 5 × 20mm)	405-4320-100
Fuse (15A, 250VAC, SB 3AB)	405-4320-015
Fuse (3.15A, Slo-blow/time lag/time delay)	405-4320-315
Light, LED, Ring	187-30-0650
Reflector: Ceramic	31-10045
Laser Rod Assembly	187-00-2015-11
LED Dimmer Assembly	161-30-8003
LED Lamp	405-2460-800
Spare Battery: Memory (CR2325 or BR2325)	405-3900-001
O-ring Flashlamp (x2 required)	466-011

**Parts & Accessories Continued on Next Page**

## VII. Parts & Accessories (continued)

<b>LaserStar Technologies Corporation® Approved Components</b>	
<b>Description</b>	<b>Catalog Number</b>
O-ring: YAG Rod (x2 required)	466-0915
Power Supply, 24VDC (all models with AC Simmer)	405-4000-2463
Power Supply, 48VDC (1DC fan systems)	405-4000-4857
Precision Optical Cleaning Liquid	810-2353
Protective Eyewear (diffused radiation)	444-001
Protective View Window	11-10071
RabbitCore® Module	405-2025-202
Regulator Kit (argon [inert] gas)	601-099
Remote Interlock Shorting Cap	101-36-0036
AC Simmer Supply	405-4086-01
Temperature Switch: 66C	405-5134-066
Troubleshooting Connector Kit	121-36-0006
Distilled Water Filter Kit	601-102

**Parts & Accessories Continued on Next Page**

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## VIII. Original Equipment Warranty - Flashlamp Welder Products

LaserStar Technologies Corporation® (“LaserStar”) warrants for a period of one (1) year, or two (2) years (depending on your purchase) from the date of invoice that this equipment will be free from defects in materials and workmanship as determined at the date of shipment. For details on your warranty period, please reference your purchase invoice.

### **(a). Limited Warranty:**

After reaching out and notifying the LaserStar Technologies Corporation® Service Department about a problem with your laser system, we will, at our option, elect to:

1. Immediately send a replacement part; or
2. Request defective part(s) or alternatively, the entire laser system be returned to LaserStar Technologies Corporation® Service Department for inspection and repair or replacement; or
3. Schedule a service technician to travel to the buyer’s facility to inspect, troubleshoot, repair, or replace defective components.

### **(b). Warranty Exclusions:**

1. This warranty does not provide coverage or protection against damage, misuse or abuse of the optical components (lenses, mirrors, glass, crystal, etc.) associated with the device;
2. This warranty does not provide coverage or protection against damage, misuse or abuse of the computer hardware;
3. It is required to connect an exhaust device to ensure ablated materials and/or harmful gases are removed from the system which can potentially cause damage to the laser system. Failure to connect an exhaust system can result in voiding the warranty.

4. This warranty does not provide coverage or protection for consumable parts (flashlamp [or flashlamp connectors], flow plate, resonator reflectors, protective disk, air filter, water filter, deionized water, cuffs, fuses, halogen lights, LED lamps, final focus lens, etc.).

This warranty is applicable for all equipment, when operated under normal conditions, and in an industrial environment. Any unauthorized use, misuse, neglect, or modification, including use of accessories that have not been previously approved or authorized by LaserStar Technologies Corporation® will void this warranty. Under no circumstance will LaserStar Technologies Corporation® accept liability for loss of use or for any indirect or consequential damage that is the result of customer negligence.

Satisfaction of this warranty, consistent with other provisions herein, is limited to replacement or repair, modification, at the sole discretion of LaserStar Technologies Corporation® and with LaserStar Technologies Corporation® to determine the availability of service personnel, and any absorption of associated service-related expenses.

**The warranty terms previously outlined are valid and will remain in effect only if and when the following obligations are met:**

- (a). Prompt written notification is provided to LaserStar Technologies Corporation® upon discovery of an alleged defect;
- (b). LaserStar Technologies Corporation® examines the equipment, and to its satisfaction, finds that any defect is not the result of misuse, neglect, improper installation, improper operation or improper maintenance, unauthorized repair, alteration or unusual deterioration or degradation of the equipment or parts thereof, due to the physical environment or an electrical or electromagnetic noise environment.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES WHETHER STATUTORY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND THEREFORE, EXCLUDES CERTIFICATIONS OR THE LIKE FOR EQUIPMENT PERFORMANCE, USE OR DESIGN WITH RESPECT TO ANY STANDARD, REGULATION OR THE LIKE (UNLESS, AND TO THE EXTENT, THIS HAS BEEN APPROVED INDEPENDENTLY, AND IN WRITING BY LASERSTAR TECHNOLOGIES CORPORATION®) AND EXTENDS ONLY TO THE BUYER OR CUSTOMER PURCHASING DIRECTLY FROM LASERSTAR TECHNOLOGIES CORPORATION® OR FROM ANOTHER AUTHORIZED RESELLER.

**Return Authorization:**

Whether your equipment is under warranty and in need of repair or otherwise, you must first contact LaserStar Technologies Corporation® to communicate your issue, schedule service, and obtain prior authorization; such authorization shall be granted for each reasonable request. Unless such authority has been granted, the shipment will be refused. Any and all transportation-related expenses associated with evaluation or repair of your equipment, including any refusal of delivery, are the sole expense of the buyer. When sending equipment to our facility, an RMA or CRA number will be assigned to accompany your laser system; this number should remain clearly marked and visible on the exterior of the shipping container.

**Governing Law:**

The sale and purchase of this equipment, including all terms and conditions thereof, shall be governed in accordance with the Uniform Commercial Code and the **laws of the State of Florida.**

**Limited Liability:**

LASERSTAR TECHNOLOGIES CORPORATION® DOES NOT ASSUME RESPONSIBILITY FOR, NOR WILL IT BE HELD LIABLE FOR (A) FINES OR PENALTIES RELATING TO PENALTY CLAUSES OF ANY VARIETY, OR (B) CERTIFICATIONS NOT OTHERWISE SPECIFICALLY PROVIDED HEREIN, (C) INDEMNIFICATION FROM THE BUYER OR OTHERS (RELATED OR NOT) FOR LIABILITY, CLAIMS, ACTION, DAMAGES, LOSS, FINES, COSTS OR EXPENSES, INCLUDING, WITHOUT LIMITATION, REASONABLE ATTORNEY’S FEES, OF EVERY KIND OR NATURE ASSERTED BY ANY PARTY, AND ARISING DIRECTLY OR INDIRECTLY FROM OR IN CONNECTION WITH EQUIPMENT OR REPAIRS RELATING TO THIS PURCHASE ORDER, OR (D) FOR INDIRECT OR CONSEQUENTIAL DAMAGE UNDER ANY CIRCUMSTANCE.

This warranty does provide coverage or protection against damage or defects resulting from accidents that occur while in transit, unauthorized repairs, alteration, misuse, neglect or failure to follow proper safety and operating instructions, fire, flood, freezing temperatures or acts of God.

Authorized Equipment Repairs		
Corporate Office	Rhode Island Office	California Office
<b>Sales, Training, Repairs &amp; Manufacturing</b>  2461 Orlando Central Pkwy. Orlando, Florida 32809 (407) 248-1142	<b>Sales, Training &amp; Repairs</b>  100 Jefferson Blvd., Ste. 315 Warwick, Rhode Island 02888 (407) 248-1142	<b>Sales, Training, Repairs &amp; Manufacturing</b>  20 East Foothill Blvd. Ste. 128 Arcadia, California 91006 (213) 612-0622

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# IX. Service

Before service is carried out on the machine, be sure to reference the important safety protocols outlined in **Maintenance; Section V** within this manual. Unplug the equipment or switch “off” the circuit breaker and wait five (5) minutes before servicing.



**Service and maintenance tasks should only be performed by technicians who are affiliated with LaserStar Technologies Corporation® and who are appropriately trained; other properly trained personnel; personnel who are supervised by trained personnel (in-person or by phone); or by those who have read and understand the service-related protocols within the sections for Operation; section IV and Maintenance, Section V within this manual.**



**While carrying out service-related activities with an open device, you must comply with regulations set forth by OSHA for accident prevention with regard to laser radiation or the equivalent national or international regulations (e.g. EC Directive 608 or IEC Publication 825). Be sure also to safeguard your eyes and wear appropriate laser protective eyewear.**



**Some service-related tasks and diagnostic procedures (i.e. simmer and flashlamp status, tri-door chamber, distilled water, etc.) will require the welder to be powered “on” for a part of the process. In these instances, extreme caution must be taken to avoid accidents or serious injury. Use caution when observing internal LED indicators, and when topping off the distilled water resevoir, or purging air from the cooling system. Never touch the electrical components or wiring when the machine is powered “on.”**

## Equipment Malfunction

If you experience a malfunction with your machine that cannot be eliminated through one of the actions outlined in the previous sections for Maintenance or Troubleshooting, please document your results and immediately contact LaserStar Technologies® Service Department for support; either by calling **1-888-578-7782** or emailing [service@laserstar.net](mailto:service@laserstar.net). When reaching out, be sure to include your machine’s model number and serial number with all correspondence. After emailing, be sure to follow-up with a phone call to our service department; this will ensure that we have received all of the details necessary to assist you.

LaserStar Technologies: Important Contacts		
Sales & Training	Service & Support	Corporate Office
(407) 248-1142 <a href="mailto:sales@laserstar.net">sales@laserstar.net</a>	1-888-578-7782 <a href="mailto:service@laserstar.net">service@laserstar.net</a>	2461 Orlando Central Pkwy. Orlando, Florida 32809, USA

## Section A: Distilled Water Cooling System

### Tools Needed (supplied or required):

- #2 Phillips Screwdriver
- 1.5 – 6mm Hex Key Wrench Set (metric)
- Adjustable Wrench (1 1/8" range) or 1" Open-end Wrench
- Siphon Hose, Basting Bulb (with 6" spout; McMaster-Carr-#7656K3) or Water Pump (manual or battery-powered)
- Clean Plastic Bucket or Container (≥6 liters or 1.5 gallons)
- Absorbent Paper Towels or Shop Towels (i.e. Scott Shop Original)
- Disposable Vinyl or PVC Gloves (powder-free and DEHP & DOP-free)
- Small Funnel
- Distilled Water
- Clean Room or Workspace

**Before powering "on" the welding workstation, you must first fill the water reservoir with distilled water. Use only distilled water; use of tap water or deionized water in this device will damage the equipment and void the machine's warranty. Be sure also that you're purchasing distilled water from a reputable supplier.**



**The water reservoir can be filled, water filter replaced, and bottle removed from the left side of the machine. The water bottle does not need to be removed for initial filling or topping off of the distilled water.**

### Initial Filling with Distilled Water

1. Turn the machine "off" by turning the **system key switch** to the "O" or "off" position. Next, turn the **mains power switch** to "O" or "off."
2. Turn the AC power "off" by unplugging the **mains power** cord or shutting "off" the wall disconnect switch; the device should remain "off" for **at least five (5) minutes** before servicing.

**Initial Filling with Distilled Water Continued on Next Page**

## Initial Filling with Distilled Water (continued)

3. Remove the seven (7) screws securing the left-side panel; lift the panel and disconnect the ground wire. **(Note: Be careful not to damage the ground wire.)**
4. Check that the bypass pinch valve is tightly closed; remove the bypass hose from the fill hole. **(figure 1)**
5. Using a clean funnel, fill the distilled water reservoir to the maximum-level line. **(Note: The maximum-level line is viewable while the distilled water bottle remains inside the base of the enclosure.)**
6. Prime the water cooling system by inserting the bypass hose back into the distilled water bottle; open the bypass pinch valve. **(figure 1)**
7. Plug in the AC mains plug and turn “on” the mains wall switch.
8. Turn “on” the welder’s **mains power** switch. **(Note: The key-switch should remain “off.”)**
  - a. **Attention:** The water should immediately start to flow; let the pump continue to run for 3 – 5 minutes. Next, tightly close the bypass pinch valve. **(figure 1)**
  - b. **Attention:** If the pump starts to squeal or make strange noises, immediately turn “off” the system. Leave the machine “off” for **five (5) minutes**; repeat this step, if needed.

**(Note: If you have trouble and need support, be sure to reach out to LaserStar Technologies Corporation® Service Department for assistance.)**

9. Run the pump until the air bubbles have ceased and are no longer visible in the hose lines. **(Note: Normally, this process can take around 10 to 15 minutes.)**
10. Turn “off” the **mains power** switch; wait for **five (5) minutes**.
11. Top off the distilled water reservoir; filling to the maximum-level line.
12. Replace the left-side panel and reinstall the seven (7) screws. **(Attention: Be sure to reconnect the ground wire.)** The welding workstation is ready for use.

## Refilling or Topping Off the Distilled Water Bottle

1. Turn the machine “off” by turning the **key switch** to the “O” or “off” position. Next, turn the **mains power switch** to “O” or “off.”
2. Turn “off” the AC power by unplugging the **mains power** cord or shutting “off” the wall disconnect switch; the device should remain “off” for **at least five (5) minutes** before servicing.
3. Remove the seven (7) screws securing the left-side panel; lift the panel and disconnect the ground wire. **(Note: Be careful not to damage the ground wire.)**
4. Remove the bypass hose from the fill hole. Next, using a clean funnel, fill the distilled water reservoir to the maximum-level line, and reinstall the bypass hose. **(figure 1)**
5. Replace the left-side panel and reinstall the seven (7) screws. **(Attention: Be sure to reconnect the ground wire).**
6. Plug in the AC mains plug and turn “on” the mains wall switch; the welding workstation is ready for use.

## Replacing the Distilled Water and Changing the Water Reservoir Filter

**(Attention: When completing the steps outlined below, be sure to have an empty bucket and paper towels available.)**

1. Turn the machine “off” by turning the **system key switch** to the “O” or “off” position. Next, turn the **mains power switch** to “O” or “off.”
2. Turn “off” the AC power by unplugging the **mains power** cord or shutting “off” the wall disconnect switch; the device should remain “off” **at least five (5) minutes** before servicing.
3. Remove the seven (7) screws securing the left-side panel; lift the panel and disconnect the ground wire being careful not to damage the wire.
4. Unscrew the distilled water reservoir cap and gently lift the filter assembly. Place the assembly together with the top hose over an empty bucket.

**Replacing the Distilled Water and Changing  
the Water Reservoir Filter Continued on Next Page**

## Replacing the Distilled Water and Changing the Water Reservoir Filter (continued)

5. Slowly disconnect the top hose disconnect fitting from the distilled water filter assembly. **(figure 2) (Attention: The hose will contain water; lower the hose and allow the water to drain into the bucket.)**
6. Place the filter assembly on a tabletop. Then, using a 4mm hex key wrench, remove the four (4) socket head cap screws. **(figure 4)**
7. Attach the new filter assembly to the water bottle cap. **(Attention: Be sure never to touch the water filter or filter medium without disposable vinyl or PVC gloves.)**
8. Install the new filter assembly into the water bottle; tighten the bottle cap and attach the top hose to the cap. **(figure 2) (Attention: Check to ensure that the top hose disconnect fitting is correctly threaded and secure.)**
9. Using a clean funnel, fill the distilled water reservoir to the maximum-level line and reinstall the bypass hose. **(figure 1)**
10. Verify that the top hose disconnect fitting on the water bottle cap is tight. (Figure 2)
11. Open the bypass pinch valve. **(figure 1)**
12. Plug in the AC mains plug and turn "on" the mains wall switch.
13. Turn "on" the welder's **mains power** switch. **(Note: The key-switch should remain "off".)**
  - a. **Attention:** The water should immediately start to flow; let the pump continue to run for 3 – 5 minutes. Next, tightly close the bypass pinch valve. **(figure 1)**
  - b. **Attention:** If the pump starts to squeal or make strange noises, immediately turn "off" the system. Leave the machine "off" for five (5) minutes; repeat this step, if needed.

**(Note: If you have trouble and need support, be sure to reach out to LaserStar Technologies Corporation® Service Department for assistance.)**

**Replacing the Distilled Water and Changing  
the Water Reservoir Filter Continued on Next Page**

## Replacing the Distilled Water and Changing the Water Reservoir Filter (continued)

14. Check for leaking near the water reservoir top hose disconnect fitting.
15. Run the pump until the air bubbles have ceased and are no longer visible in the hose lines.  
**(Note: Normally, this process can take around 10 to 15 minutes.)**
16. Turn "off" the **mains power switch**; wait for **five (5) minutes**.
17. Top off the distilled water reservoir; filling to the maximum-level line.
18. Replace the left-side panel and reinstall the seven (7) screws. **(Attention: Be sure to reconnect the ground wire.)** The welding workstation is ready for use.

## Removing the Distilled Water from the Machine (storage and transport)

1. Turn the machine "off" by turning the key switch to the "O" or "off" position. Next, turn the **mains power switch** to "O" or "off."
2. Turn "off" the AC power by unplugging the **mains power** cord or shutting "off" the wall disconnect switch; the device should remain "off" **at least five (5) minutes** before servicing.
3. Remove the seven (7) screws securing the left-side panel; lift the panel and disconnect the ground wire. **(Note: Be careful not to damage the ground wire.)**
4. Remove the red plug from the bottle. This will reveal a filling hole. (Figure 1) (Attention: Make sure you have paper towels available.)
5. Use a siphoning device, hand pump or squeeze pump to remove the water from the bottle through the filling hole. **(figure 1)**

**Removing the Distilled Water Bottle from the  
Machine (storage and transport) Continued on Next Page**



## Removing the Distilled Water from the Machine (storage and transport; continued)

6. Make up two air hose assemblies (~2 ft in length) for use with a manual air pump or clean shop air (no water or oil &  $\leq 30$  psi): One air hose assembly with a male garden hose fitting and a second air hose assembly with a female garden hose fitting. Both air hose assemblies will have fittings on the other end.
7. Slowly disconnect the front cooling hose female fitting / (2) from the pump chamber as shown in **figure 5**. **Attention: Before loosening the fitting, be sure to place paper towels below the this area to collect any water.**
8. Connect the female air garden hose assembly to the front pump chamber male cooling hose fitting / (1) on the pump chamber (**figure 5**). Blow the air through the cooling system until there is no water going into the water bottle. (Note: This will remove the water from the pump chamber and the heat exchanger.)
9. Connect the male air garden hose assembly fitting to the front cooling hose female fitting / (2) as shown in (**figure 5**) and blow the air through the cooling system until there is no water going into the water bottle.
10. Empty the water bottle and re-connect the front cooling hose female fitting to the front pump chamber male cooling hose fitting.
11. Replace the side panel and ground wire.

## Removing the Distilled Water Bottle from the Machine

1. Follow steps #1 – #13 under “Removing the Distilled Water from the Machine for Storage or Transport.” (Attention: Have paper towels available to wipe up any water.)
2. Unscrew the water bottle top and bottom disconnect fitting as shown in **figure 3**.
3. Disconnect the water bottle level sensor connector as shown in **figure 3**.

**Removing the Distilled Water Bottle  
from the Machine Continued on Next Page**

## Removing the Distilled Water Bottle from the Machine (continued)

4. Remove the water bottle strap as shown in **figure 3**.
5. Remove the water bottle.

## Notes

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## IX. Service: Figures & Parts Labeling



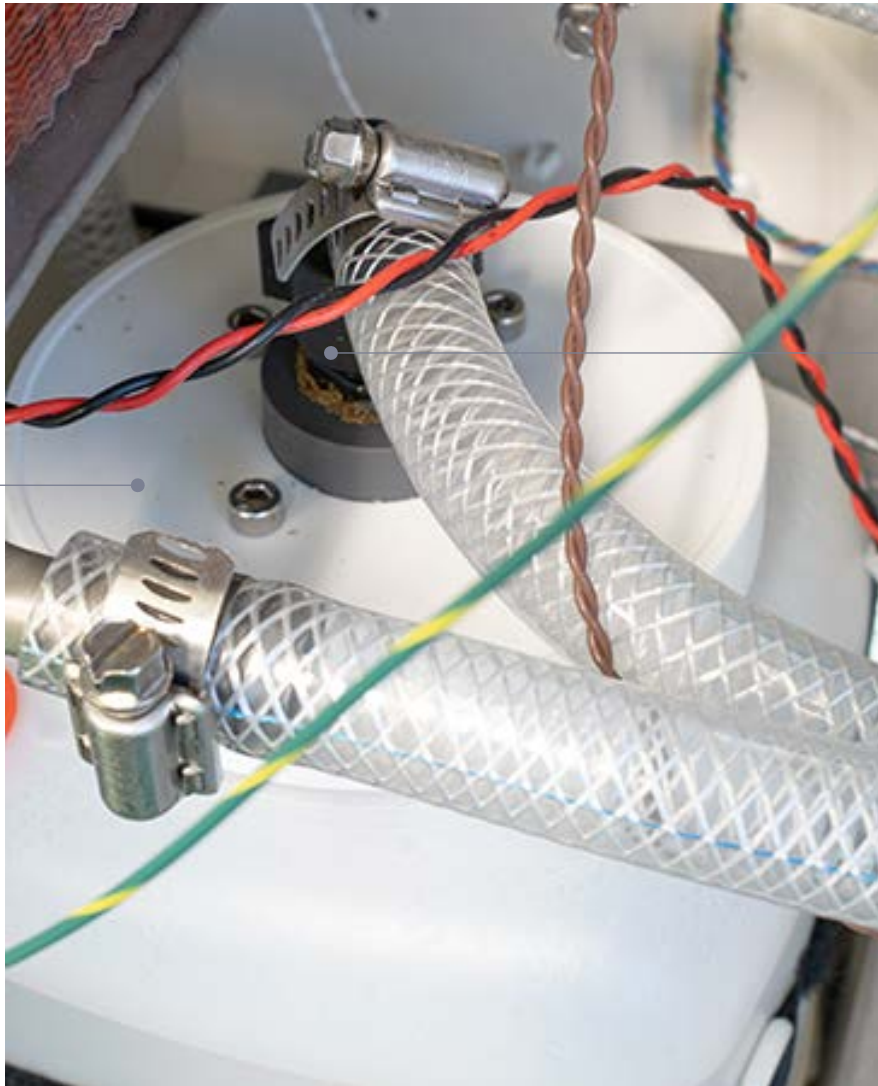
**Figure 45**  
(Distilled water  
bottle; left side)

**(Note: If you need to fill the distilled water bottle, it can be easily accessed from the left side of the machine. When filling the bottle, be sure to use the fill hole or bottle cap.)**

**IX. Service: Figures & Parts Labeling Continued on Next Page**

## IX. Service: Figures & Parts Labeling

**Water Bottle  
Cap and Filter  
Assembly**



**Top Disconnect  
Fitting**

**Figure 46**  
(Distilled water  
bottle [cap and  
filter assembly])

**IX. Servic: Figures & Parts Labeling  
Continued on Next Page**

## IX. Service: Figures & Parts Labeling

**Top Disconnect  
Fitting**



**Water Bottle  
Securing Strap**

**Water Level  
Sensor  
Connector**

**Figure 47**

(Distilled water bottle  
[bottom disconnect  
fitting and level-sensor  
connector])

**IX. Service: Figures & Parts Labeling  
Continued on Next Page**

## IX. Service: Figures & Parts Labeling

**Socket Head  
Cap Screws  
(x4 total)**

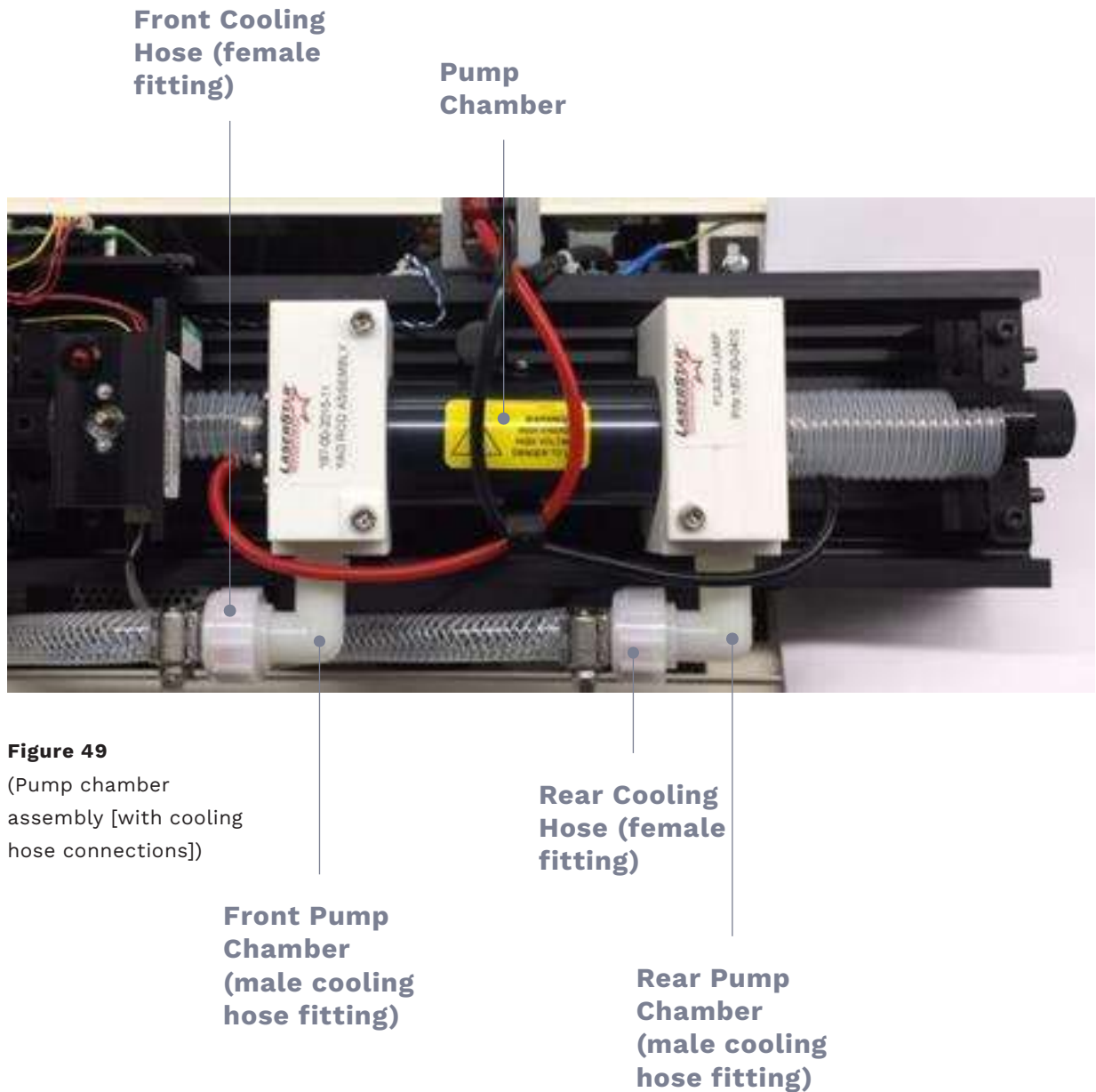


**Distilled  
Water Filter**

**Figure 48**  
(Distilled water  
filter replacement)

**IX. Service: Figures & Parts Labeling  
Continued on Next Page**

## IX. Service: Figures & Parts Labeling



**IX. Service: Figures & Parts Labeling**  
**Continued on Next Page**



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## Service B: Flashlamp Replacement

### Tools Needed (supplied or required):

- #2 Phillips Screwdriver and 3/16" Slotted Screwdriver
- 1.5 – 6mm Hex Key Wrench Set (metric)
- 70% Isopropyl Alcohol (flammable substance; be sure to use caution when applying), other approved optical cleaner or our recommended product, LaserStar Technologies Corporation® Optical Cleaning Solution (part number: 810-2353).
- Siphon Hose, Basting Bulb (with 6" spout; McMaster-Carr-#7656K3) or Water Pump (manual or battery-powered)
- Clean Plastic Bucket or Container (≥6 liters or 1.5 gallons)
- Lint-free cloth or our recommended solution, LaserStar Technologies Corporation® Cleaning Cloth (part number: 810-2356 [quantity: 1]) or 810-2354 [quantity: 90].
- Absorbent Paper Towels or Shop Towels (i.e. Scott Shop Original)
- Disposable Vinyl or PVC Gloves (powder-free and DEHP & DOP-free)
- Small Funnel
- Distilled Water
- Clean Room or Workspace

**(Note: The flashlamp replacement kit includes the flashlamp, O-rings, lab-quality gloves, protective tubing, and detailed steps and instructions for replacement. When replacing the flashlamp, be sure to reference the operation manual; this is a requirement.)**



Caution!

**When replacing the flashlamp, be sure to wear protective eyewear and gloves; do not handle the flashlamp unless you are wearing lab-quality gloves.**

1. Prior to removing the machine's top cover, turn "off" the **key switch** and **mains power switch**; unplug the AC power cord from both the machine and wall outlet.
2. Wait five (5) minutes. (This allows the flashlamp power supply to fully discharge.)
3. Remove machine top cover by removing the screws located on the rear of the cover as shown in (Figure 1). Carefully slide the cover back and remove the ground wire/green with a yellow stripe.
4. The machine will require the removal of the left-side cover. Carefully remove the ground wire (green with a yellow stripe). **(Note: When facing the front of the machine, the left-side cover is on your left.)**

## IX. Service, Section B: Flashlamp Replacement Continued on Next Page

## Service B: Flashlamp Replacement (continued)

The machine's cooling water must be at or below the "maximum line" on the large water bottle located in the bottom of the enclosure. Proceed to the start of the section for Service and choose the relevant section. (Note: Taking some water out of the bottle allows space for the water in the Pump Chamber to drain when the flashlamp o-ring seal is broken.)

5. Once the distilled water in the bottle is at the correct level, turn the machine so the right side is facing you. the laser rail orientation for flashlamp replacement is shown in **(figure 2)**. The technician replacing the flashlamp will be facing the laser rail from the side with the cooling water hoses / tubing. (Note: The microscope will be at your left. Place a clean cloth on the top of the right side panel to prevent scratching the paint & have a roll of paper towels available to wipe up any water that leaks out of the fittings.)
6. Proceed with flashlamp replacement steps (7-27) with applicable **Figures 1-21** to replace the flashlamp.

**Attention:** These replacement steps are applicable for a flashlamp that is not broken or shattered. If shattered or broken, proceed to next page "attention" for instructions.



**Attention:** Verify that the water bottle has been lowered to the minimum level line before starting the flashlamp replacement procedure.



**Attention:** If the flashlamp is broken / shattered, the "iWeld Laser Pump Chamber Repair Instructions" must be followed. The repair instructions are available on a USB Flash Drive / 987-99991-187, which is included in the O-ring Replacement Kit / (187-00-025). The O-ring replacement kit is required when disassembling and rebuilding a laser pump chamber. O-rings must not be reused. The "iWeld Laser Pump Chamber Repair Instructions" / (87-99990-187 are available at [laserstar.net](http://laserstar.net). (Note: Please contact LaserStar Technologies Corporation® Service Department for repair guidance on the pump chamber assembly / 187-00-1001 components. Components kits include flashlamps, laser rod assembly, flow plate, O-rings, etc. The service department will assist in ordering the correct replacement kits.)

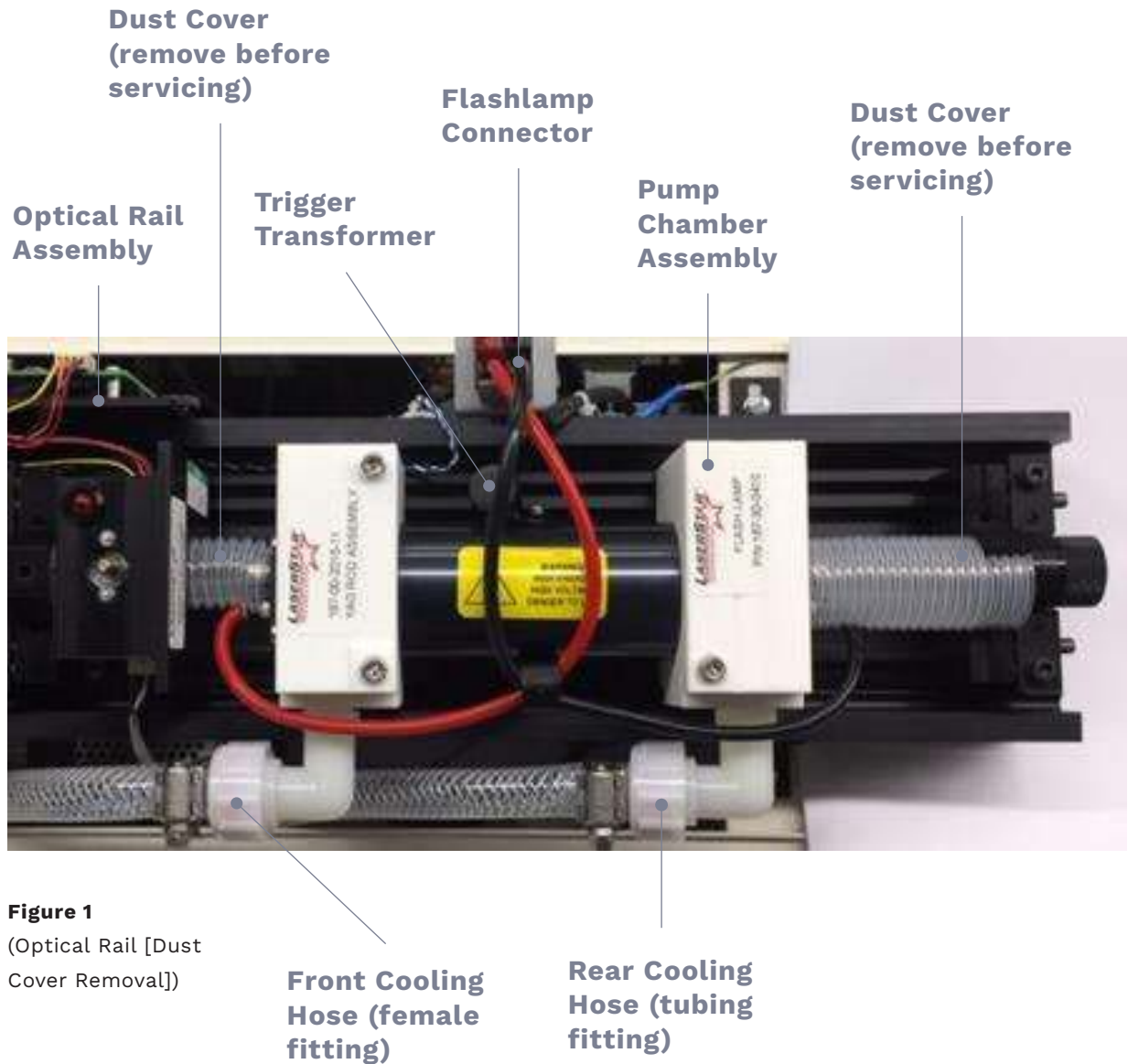


Caution!

Wear eye protection and protective gloves and be sure not to handle the flashlamp unless you are wearing lab quality gloves.

## IX. Service, Section B: Flashlamp Replacement Continued on Next Page

## IX. Service B: Flashlamp Replacement (continued)



**Figure 1**  
(Optical Rail [Dust  
Cover Removal])

IX. Service B: Flashlamp Replacement Continued on Next Page

## Service B: Flashlamp Replacement (continued)

7. Remove the dust protectors from the optical rail assembly **(figure 1)**.
8. Disconnect flashlamp wires and trigger transformer connector **(figure 2)**.
9. Place paper towels below the two (2) hose fittings **(figure 3)**. **(Attention: Be sure not to disconnect either of the hose fittings at this time.)**
10. Remove the three (3) screws securing the pump chamber assembly to the rail **(figure 4)**.
11. Carefully lift the rear of the chamber and slowly disconnect the rear hose fitting; **wait 10 seconds** to allow the remaining water in the pump chamber to drain; level the pump chamber and then disconnect the front hose fitting. Next, immediately rotate the chamber with the hose fittings facing upward **(figure 5)**. **(Attention: Keep a small bucket nearby to empty any remaining water from the pump chamber. Make sure also to have paper towels available to wipe spilled water.)**
12. Place the pump chamber on a clean benchtop or desk surface; remove the flashlamp wires from the cable clamp and straighten each **(figure 6)**.
13. Rotate pump chamber so that the black wire is facing outward and remove end cap screws and end cap using a M 2.5 Hex Key Wrench **(figure 7)**.
14. Rotate pump chamber; red wire facing outward; remove the end cap screws and end cap; and then gently pull on the red wire until the O-ring can be removed from the flashlamp and then discard the O-ring **(figure 8)**. **(Attention: Do not remove the flashlamp out at this time.)**
15. Rotate pump chamber so that the black wire end is on the right; remove the o-ring and discard the o-ring. Install the protective tube over the red wire end and make sure the metal connector is covered and not protruding. Carefully feed the protective tube covering the red flashlamp wire through the pump chamber while pulling on the black wire. (Note: The protective tube should remain in the chamber **(figure 9)**. **(Attention: If the flashlamp is broken or shattered, before continuing, be sure to reference “Attention” on page 107. Discard the flashlamp per applicable regulations.)**
16. Remove the new flashlamp assembly from the box and straighten the red and black wire. **(Attention: Make sure the protective tube is installed in the pump chamber as shown to protect the flow plate.)** Feed the red wire thru the right pump chamber end block as shown. Next, pull on the red wire and protective tube together until the flashlamp black plastic end is visible and extended approximately equal on both ends **(figure 10)**. **(Note: The protective tube can now be removed from the red wire end of the flashlamp assembly.)**

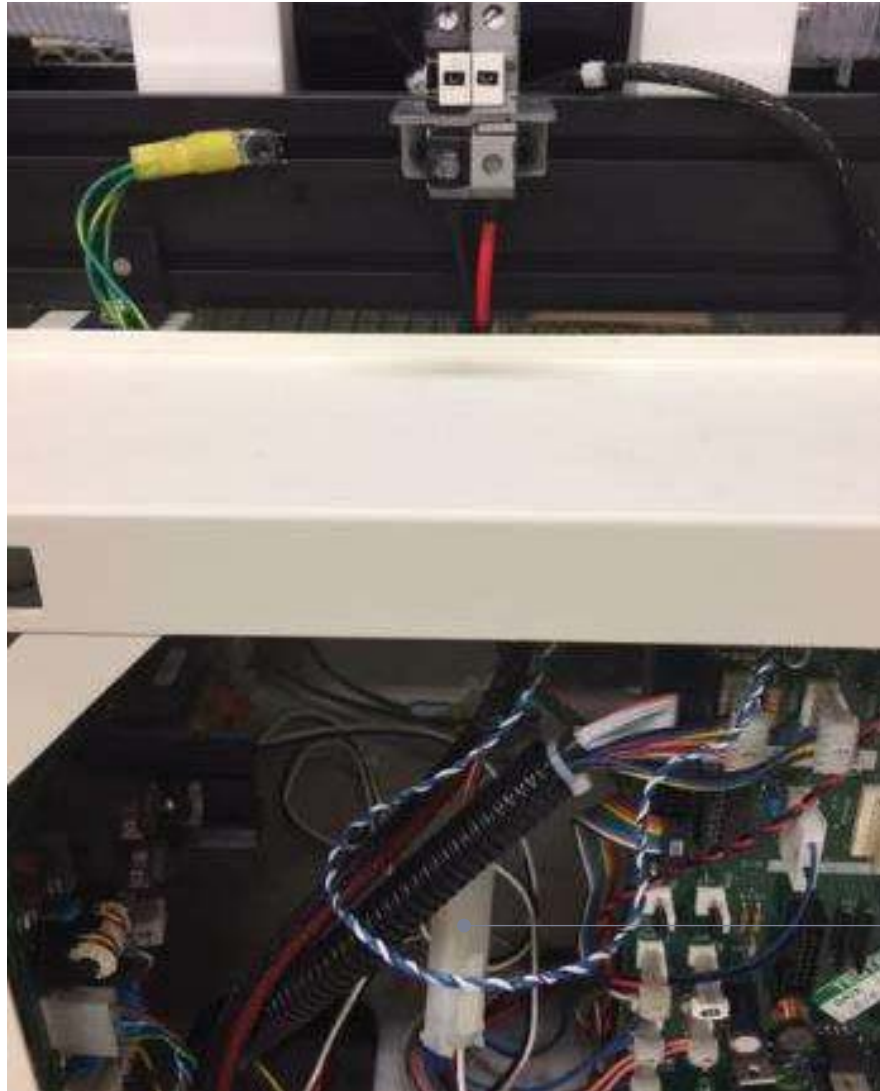
## IX. Service, Section B: Flashlamp Replacement Continued on Next Page

## Service B: Flashlamp Replacement (continued)

17. Install a new o-ring on both ends of the flashlamp assembly **(figure 11)**.
18. Install the end caps and screws onto both ends of the pump chamber assembly **(figure 12)**.  
**(Attention: Do not tighten screws at this time.)**
19. Position the flashlamp assembly such that each end of the flashlamp (plastic body/insulator) extends equally on both ends of the pump chamber **(figure 13)**.
20. Tighten the end cap screws on both ends of the pump chamber assembly and verify that each end of the flashlamp extends equally. (Note: Red wire end shown). Next, place the wires back through the cable clamp **(figure 14)**.
21. Carefully place the pump chamber back into the laser rail **(figure 15)**. **(Attention: Be careful not to bump the rear mirror assembly.)**
22. Position the pump chamber against the rail reference edge and then the end stop. Before tightening the pump chamber screws, move the pump chamber forward off the end stop by ~0.10" and then use an M4 hex key wrench to tighten the (2) front screws; the back screw should be snug and not overtightened **(figure 16)**.
23. Connect the red and black flashlamp wires to the flashlamp rail connector **(figure 17 & 18)**.
24. Connect the trigger transformer connector **(figure 19)**.
25. Install the dust covers centrally around the end of the laser rod on both ends of the pump chamber assembly **(figure 20)**. **(Attention: Make sure they do not block the laser beam path.)**
26. Connect the water cooling hoses to the pump chamber and tighten **(figure 21)**.
27. Fill the water bottle and prime the pump, per instructions at the start of this section.
28. Install the enclosure side cover and top cover. **(Attention: Make sure to connect the ground wire.)** The welder is ready for use.

## IX. Service, Section B: Flashlamp Replacement Continued on Next Page

## IX. Service B: Flashlamp Replacement (continued)



Trigger  
Transformer  
Connector

**Figure 2**  
(Trigger Transformer  
Connector)

**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**



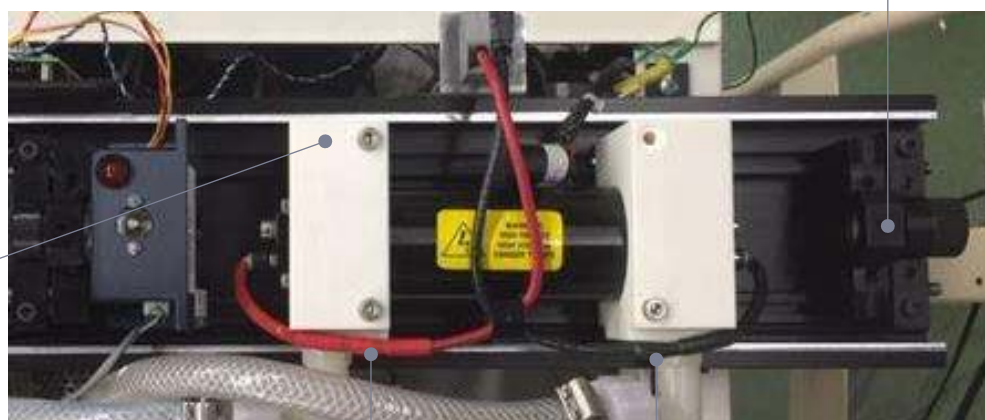
## IX. Service B: Flashlamp Replacement (continued)



**Figure 3**  
(Paper Towels [Placed  
Below the Hose Fittings])

Be careful  
not to bump  
the rear mirror  
assembly.

Remove the  
(3) screws  
from the rail  
retaining  
nuts (use an  
m4 hex key  
wrench).



**Figure 4**  
(Rail Retaining Nuts  
[Removing the Screws])

**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**

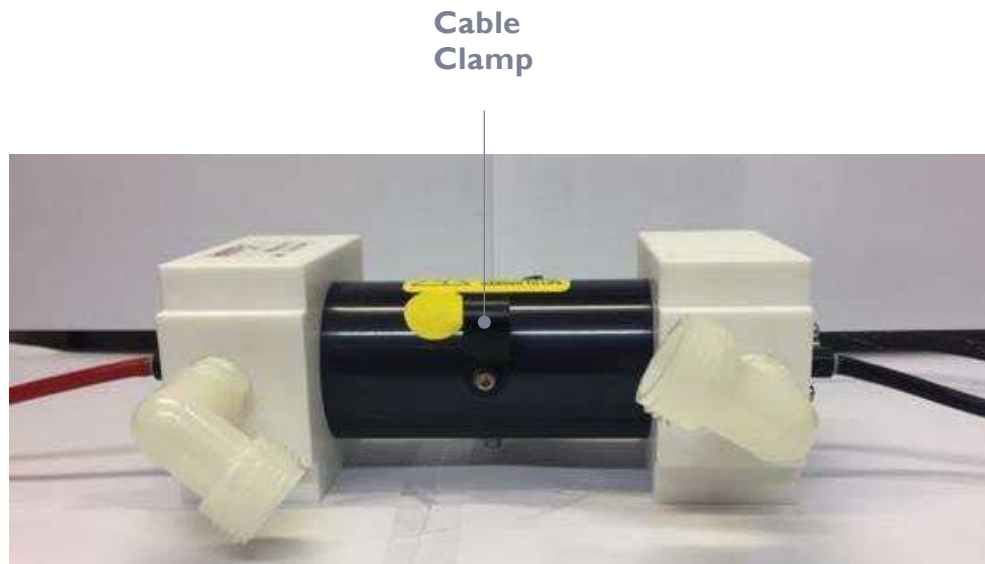
## IX. Service B: Flashlamp Replacement (continued)



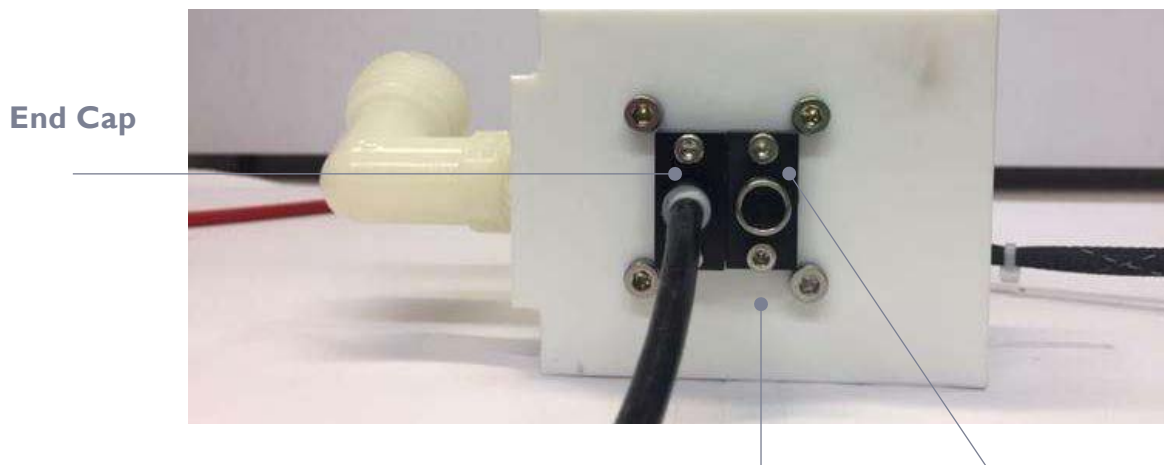
**Figure 5**  
(Pump Chamber  
[Tipping & Draining])

**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**

## IX. Service B: Flashlamp Replacement (continued)



**Figure 6**  
(Pump Chamber [with  
Flashlamp Wires Removed  
from the Cable Clamp &  
Straightened])



**Figure 7**  
(End Cap & End Cap  
Screws [removal])

**End Cap  
Screw (1)**  
[x4 total]

**End Cap  
Screw (2)**  
[x4 total]

**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**

## IX. Service B: Flashlamp Replacement (continued)



**Figure 8**  
(End Cap Removal  
[O-Ring Being Removed])

O-Ring

**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**

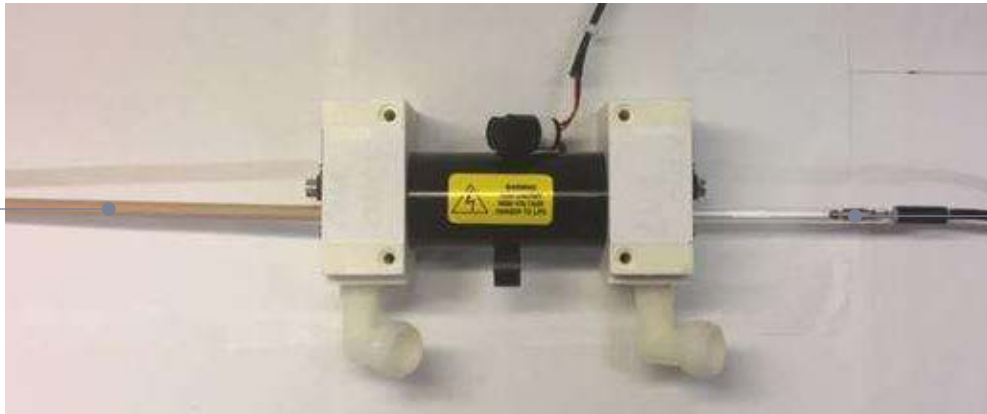
## IX. Service B: Flashlamp Replacement (continued)



Caution!

**Wear eye protection and protective gloves! Do not handle the flashlamp assembly or laser rod assembly unless you are wearing lab quality gloves.**

Install the protective tubing over the flashlamp (red-wired end), making sure the metal connector is covered and not protruding.



Flashlamp

**Figure 9**  
(Flashlamp [removal])

**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**

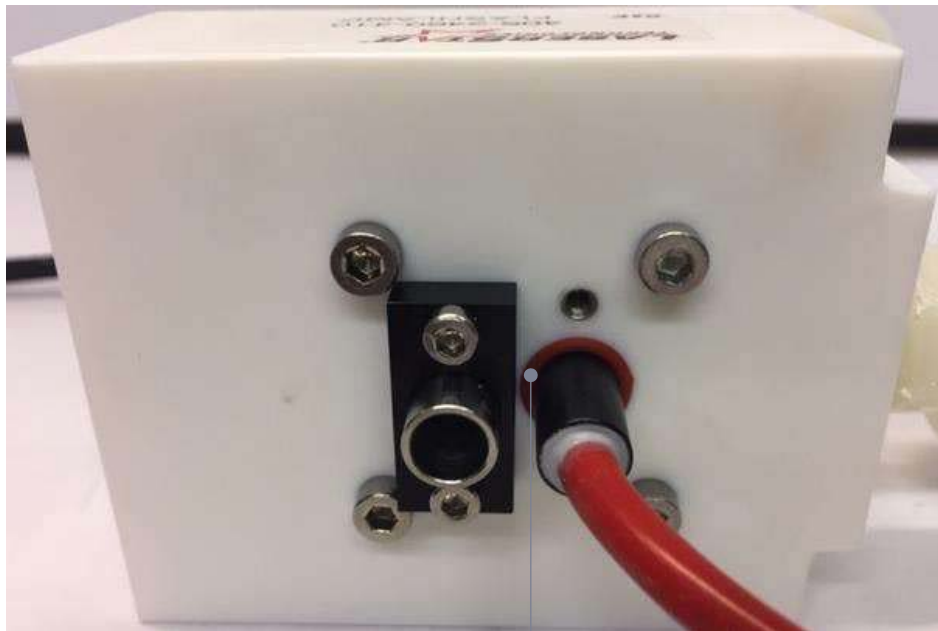
## IX. Service B: Flashlamp Replacement (continued)



**Figure 10**  
(Flashlamp Installation  
[with Protective Tubing  
& Plastic Ends Equally  
Extended])

**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**

## IX. Service B: Flashlamp Replacement (continued)



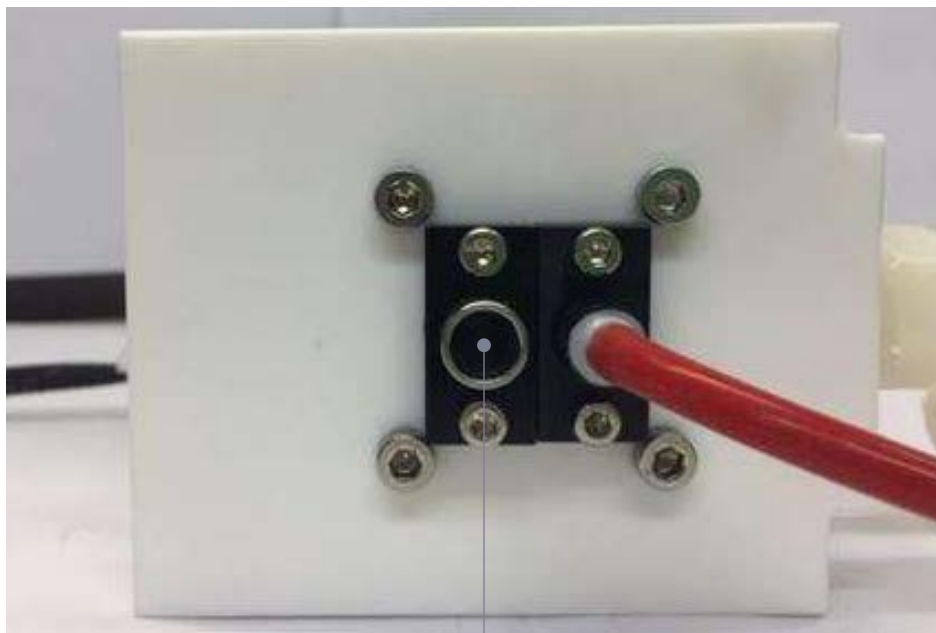
**Figure 11**  
(O-Ring [new  
installation])

O-Ring

**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**



## IX. Service B: Flashlamp Replacement (continued)



**Figure 12**  
(Red-wired End Cap  
Installation [Repeat for  
Black-wired End Cap])

**Installing  
End Caps**

**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**

## IX. Service B: Flashlamp Replacement (continued)

Flashlamp  
(extends out  
the same amount  
on each end)

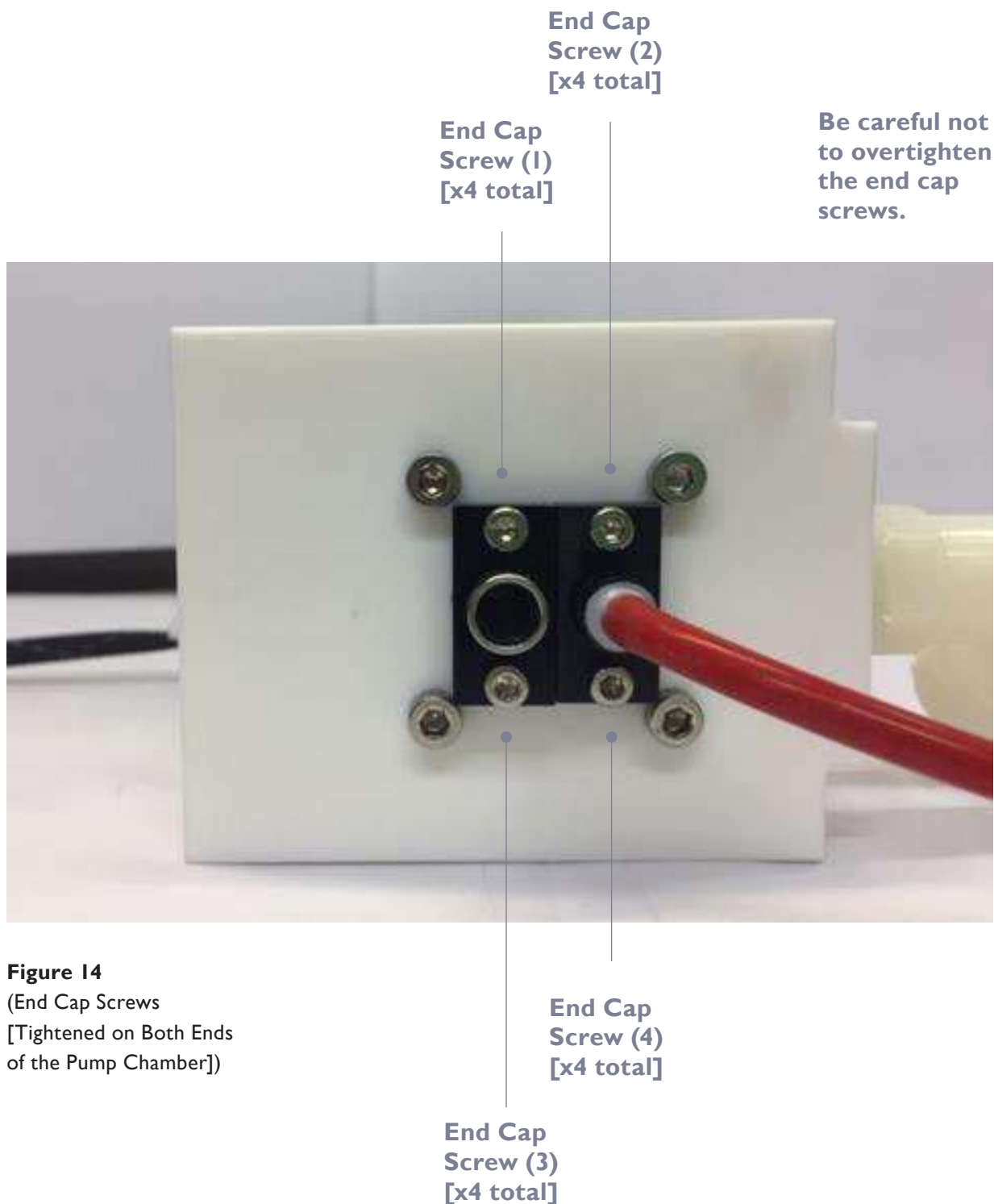
Flashlamp  
(extends out  
the same amount  
on each end)



**Figure 13**  
(Flashlamp [installed])

**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**

## IX. Service B: Flashlamp Replacement (continued)

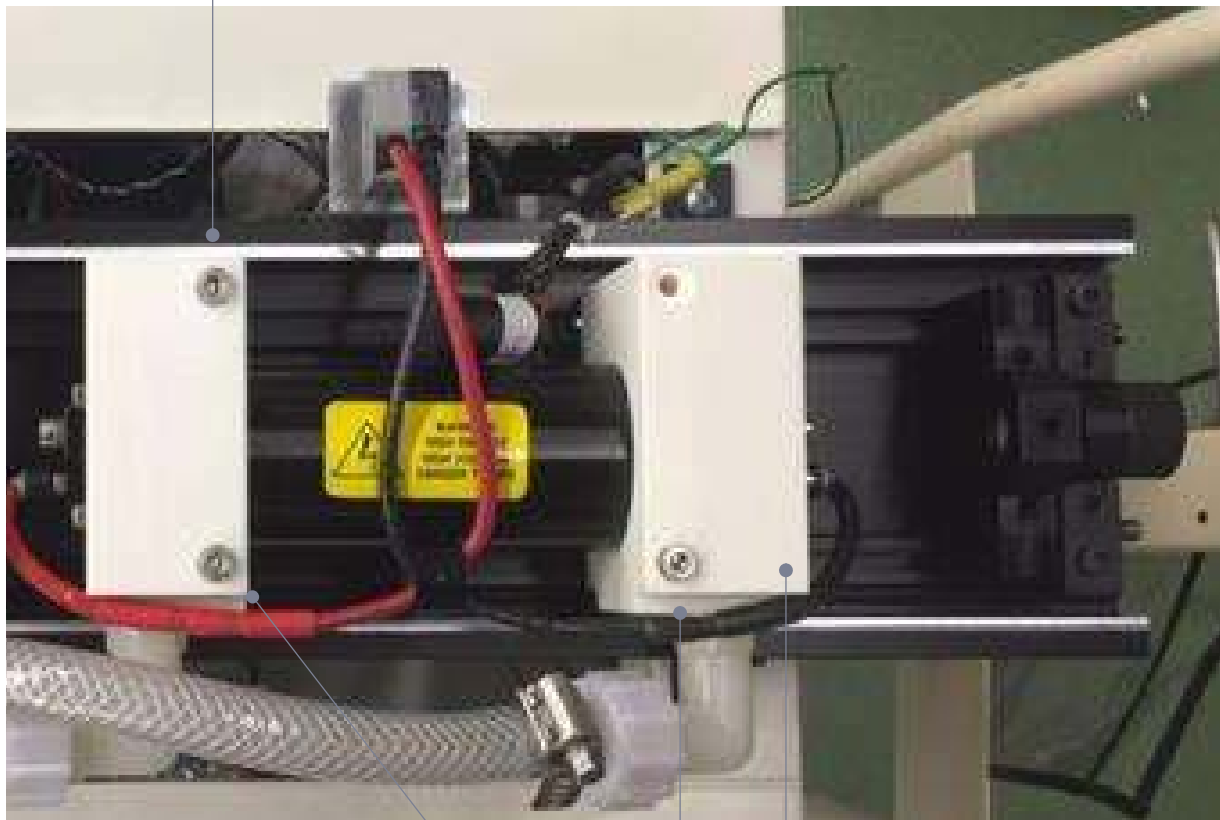


**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**

## IX. Service B: Flashlamp Replacement (continued)

Screw (1)  
[x3 total]

Be careful  
not to bump  
the rear mirror  
assembly.



**Figure 15**  
Pump Chamber [Installation]  
& Fastening the Screws to the  
Optical Rail)

Screw (2)  
[x3 total]

End Stop

Screw (3)  
[x3 total]

(Note: Carefully place the Pump Chamber Assembly back into the Optical Rail Assembly (the component should rest against the End Stop). When mounting the Pump Chamber to the Optical Rail, locate the retaining nut (on the rail) and replace each of the screws one at a time. This may take a few tries—be patient. Be sure not to fully tighten the screws at this point.)

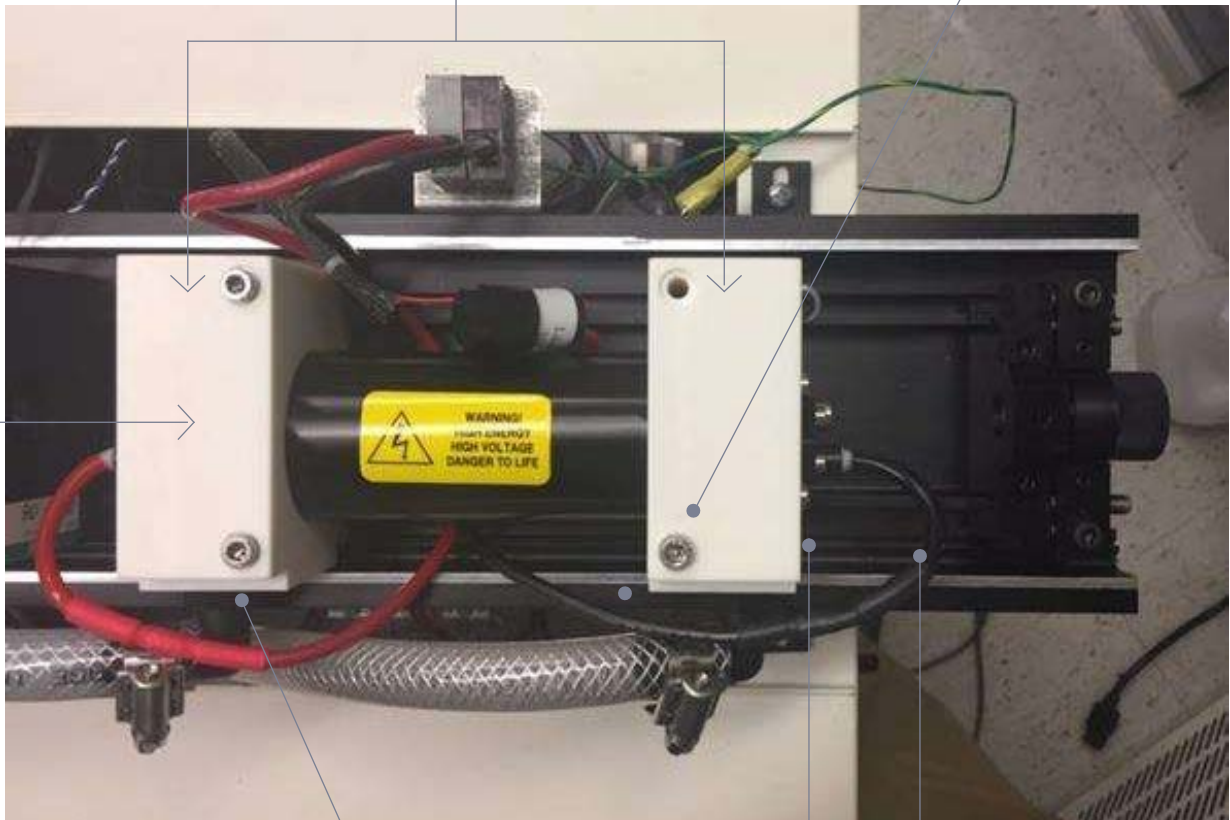
**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**

## IX. Service B: Flashlamp Replacement (continued)

1. Push the Pump Chamber against the Reference Edge of the Optical Rail (as shown by the two [2]) arrows).

2. Push the Pump Chamber back against the End Stop. Next, move off the End Stop [by ~.010"]].

4. This Pump Chamber screw should be snug and not too tight.



**Figure 16**  
(Pump Chamber [Positioning the Assembly Against the End Stop & Optical Rail Reference Edge])

End Stop

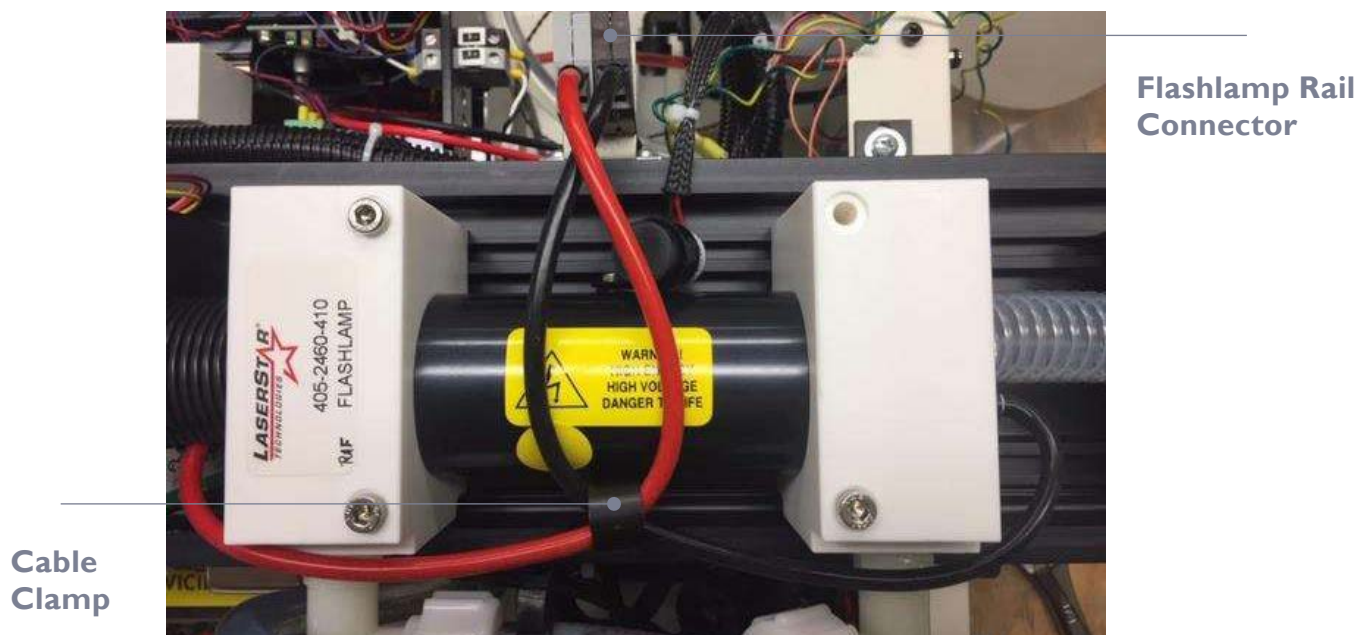
Make sure the Pump Chamber is resting flat on the rail surface.

3. Tighten the two (2) front Pump Chamber screws using an M4 hex key wrench.

Optical Rail Reference Edge

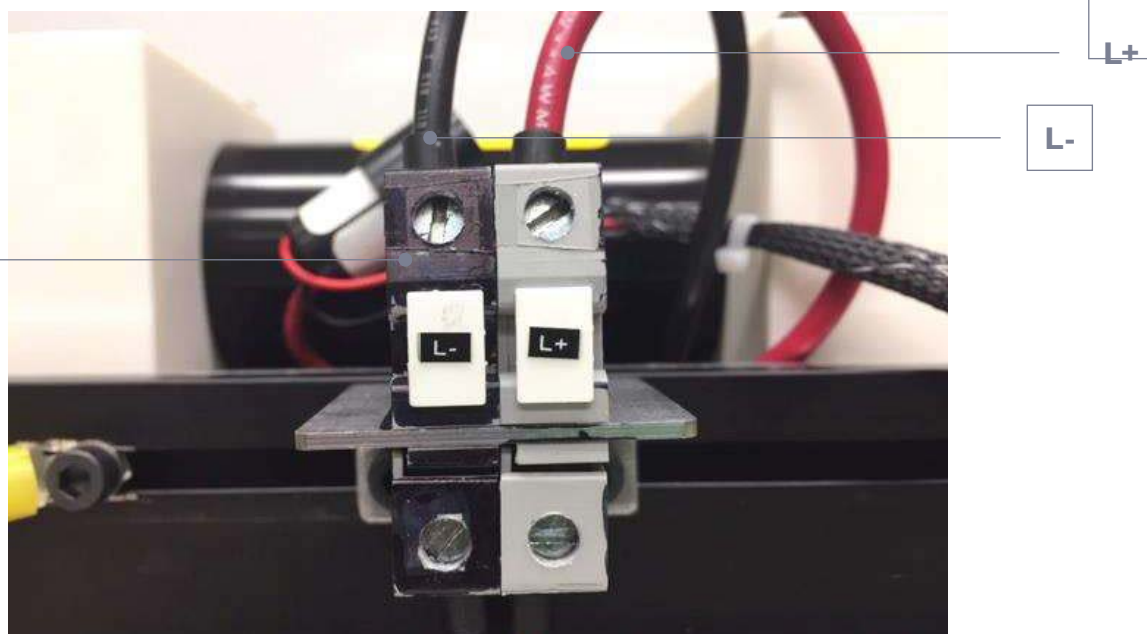
**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**

## IX. Service B: Flashlamp Replacement (continued)



**Figure 17**  
(Flashlamp [Wires  
Connected])

Using a 3/16" slotted screwdriver, connect the red (L+) and the black (L-) flashlamp wires, making sure each of the connector screws are securely fastened.



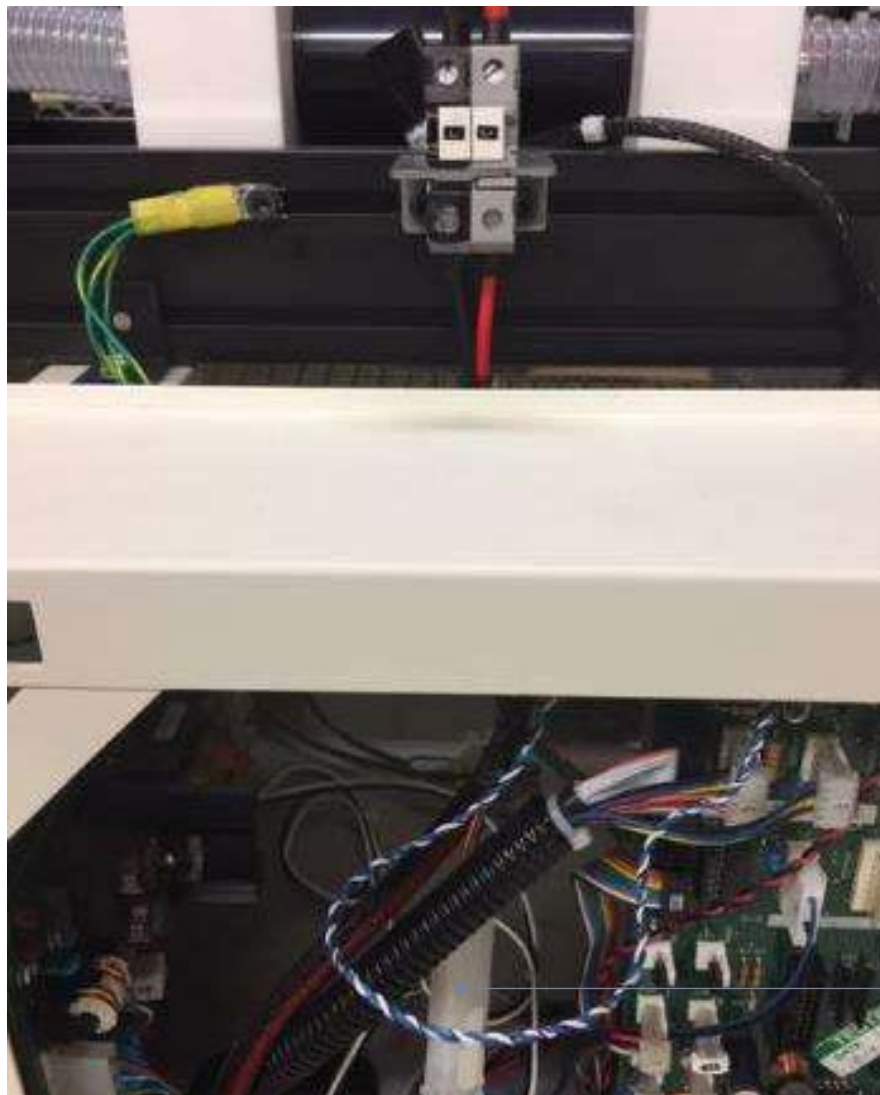
**Figure 18**  
(Flashlamp Wires; [Op-  
tical Rail; left-side])

**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**

## IX. Service B: Flashlamp Replacement (continued)



**Attention:** Verify the (L+) / RED wire and (L-) / BLACK wire are connected correctly. A lamp installed with reverse polarity will age after just a few pulses, causing rapid loss of laser power and any contamination on the lamp surface will dramatically shorten the lamp's life.



Trigger  
Transformer  
Connector

**Figure 19**  
(Trigger Transformer  
Connector)

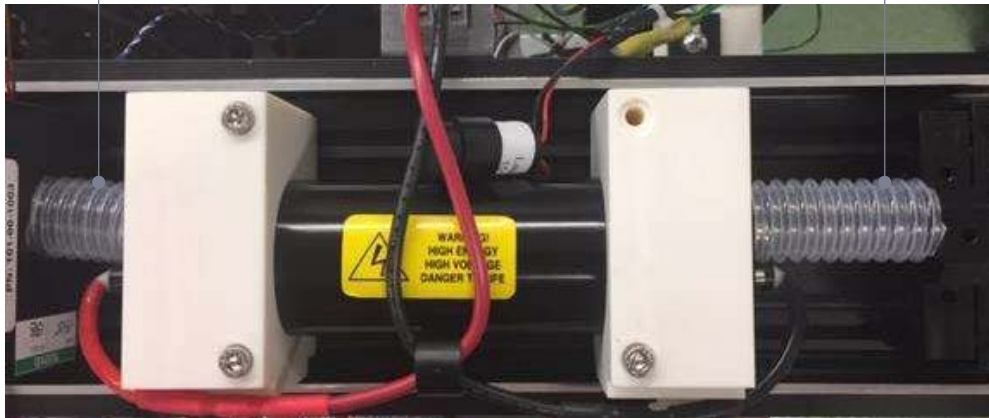
**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**



## IX. Service B: Flashlamp Replacement (continued)

Install the Dust  
Cover (shown  
crooked)

Install the Dust  
Cover (shown  
straight)



**Figure 20**  
(Optical Rail Assembly  
[Dust Cover Installation])

**IX. Service, Section B: Flashlamp Replacement Continued on Next Page**

## IX. Service B: Flashlamp Replacement (continued)



**Figure 21**  
(Connect & Tighten  
the Hose Fittings  
[x2 total])



Caution!

**Do not start the system if any water gets on the electronics. Let system dry for 24-hours. If not dry, call LaserStar Technologies Corporation® Service Department for instructions.**



**While bleeding the system, verify that there are no Pump Chamber leaks around the flashlamp O-ring seals and pump chamber hose connections.**

In the interest of safe and faultless operation of the product, it is strongly recommended that you keep a logbook for each laser. In this logbook all malfunctions and extraordinary events as well as all service and maintenance activities should be entered (e.g. replacement of the lamp or the filter).

## IX. Service C: Simmer Supply

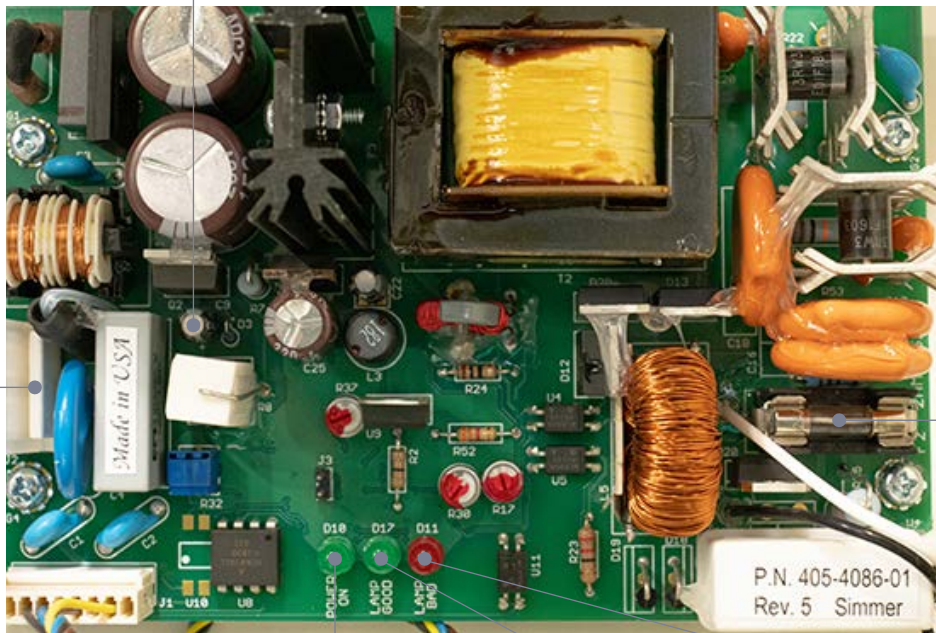
(Note: Reference Service section / Major System Components for the simmer location for the specific machine model / series location.)

**The following LED Indicators can be used to determine the status of the AC Simmer Board Assembly and Flashlamp:**

- Power On Led (top)- Green “on”-Simmer board powered up
- Lamp Good Led (middle)-Green “on”-Lamp okay
- Lamp Bad Led (bottom)-Red “on”-Lamp not okay

### AC Simmer Circuit Board Assembly

AC Input Fuse  
(not field  
replaceable)



DC Output  
Fuse (replace  
with 2A, 5x20,  
250VAC Slow  
Blow or LST  
p/n [405-4320  
-002])

**Figure 1**  
(Simmer Supply  
Assembly)

LED Power  
“ON”

LED Lamp  
“Good”

LED Lamp  
“Bad”

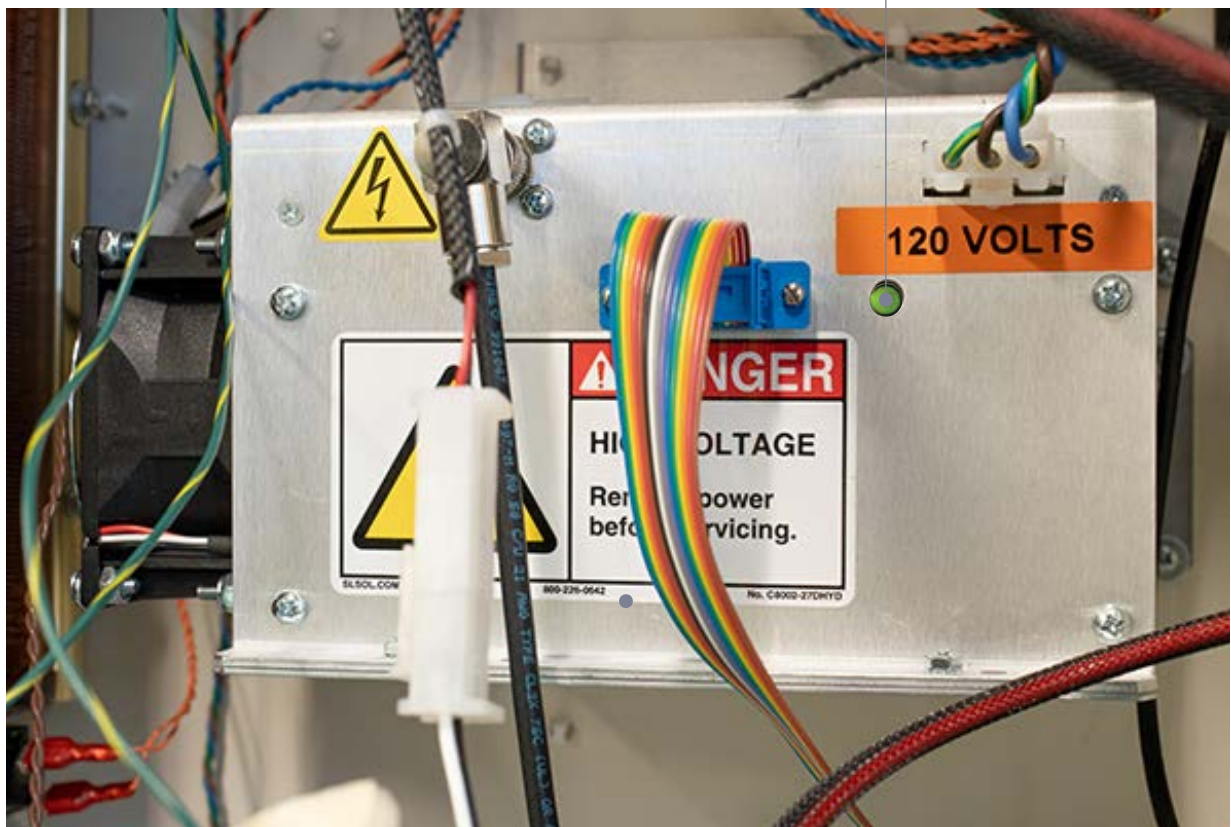
**(Note: All measurements taken across the flashlamp contacts with a voltmeter set to a range greater than 500 VDC.)**

**Lamp Good LED:** For output voltage between ~40V and ~300V the Lamp Good Indicator is ON and the Lamp Bad Indicator is OFF.

**Lamp Bad LED:** For output voltage above ~300V the Lamp Bad Indicator is ON and the Lamp Good Indicator is off. For an output voltage below ~40V the Lamp Bad Indicator is ON and the Lamp Good Indicator is OFF.

## IX. Service D: Cap Charging Supplies

Power Indicator  
(power “ON”  
[green light lit]  
power “OFF”  
[green light off])



**Figure 1**

(Cap Charger [single-supply:  
120VAC or 220 & 230VAC])

**(Note: There are four (4) basic configurations for the cap charging supplies. If the indicator light is not “ON” and green, the unit is not powered up or is not operating correctly.)**

## IX. Service E: External Fuse Replacement, Rear System Overview, and External Connections

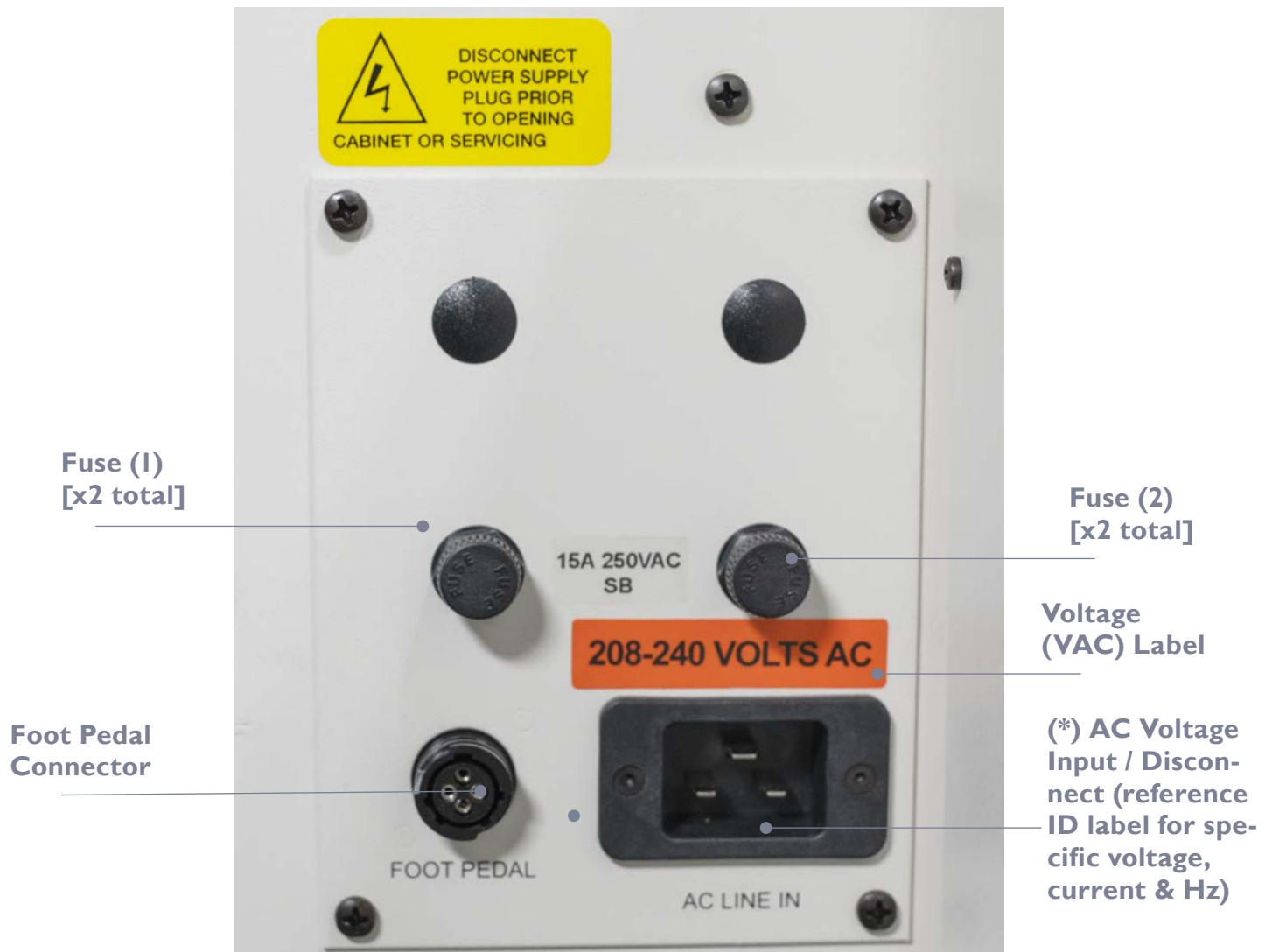


**Figure 73**  
(Rear System  
Overview)

## IX. Service E: External Fuse Replacement, Rear System Overview, and External Connections Continued on Next Page



## IX. Service E: External Fuse Replacement, Rear System Overview, and External Connections (continued)



**Figure 74**  
(Mains Power Panel)

# External Fuse Replacement

## Fuse Replacement

When completing the steps below, be sure to reference **Figure 74** on the previous page and **Data Table 1: Fuses** below.

1. When checking the status of or replacing any fuse, you must first turn “OFF” the machine using the **system key switch** and **mains power switch**.
2. Disconnect the AC power cord from the wall and from the equipment.
3. Remove foot pedal cable. Wait **at least five (5) minutes**.
4. Verify that the AC power has been disconnected; this step is **critically important**.
5. Move the machine to allow for access to its rear.
6. Remove all external fuses; be sure to check periodically and replace, as needed.
7. Reconnect the AC power and proceed with testing the system to ensure proper function.

**(Note: If you have trouble and need support, be sure to reach out to LaserStar Technologies Corporation® Service Department for assistance.)**

Data Table 1: Fuses			
Fuse(s)	Part Number (be sure to purchase <u>only</u> LaserStar Technologies Corporation® manufactured parts)	Amperage or Voltage Type: 120 – 230VAC	Usage
1 and 2	405 – 4320 –100	10A/250VAC /Time Lag /5x20mm Cartridge	Mains Power

**(Attention: Check the VAC label & ID label on the rear of the machine and compare with the power conditions at the installation site.)**



## Other External Connections

Remote Inter-  
lock Connector  
Receptacle  
(see note below)



Argon (inert  
gas) Input  
Connector

Motion Control  
Connector  
(optional)

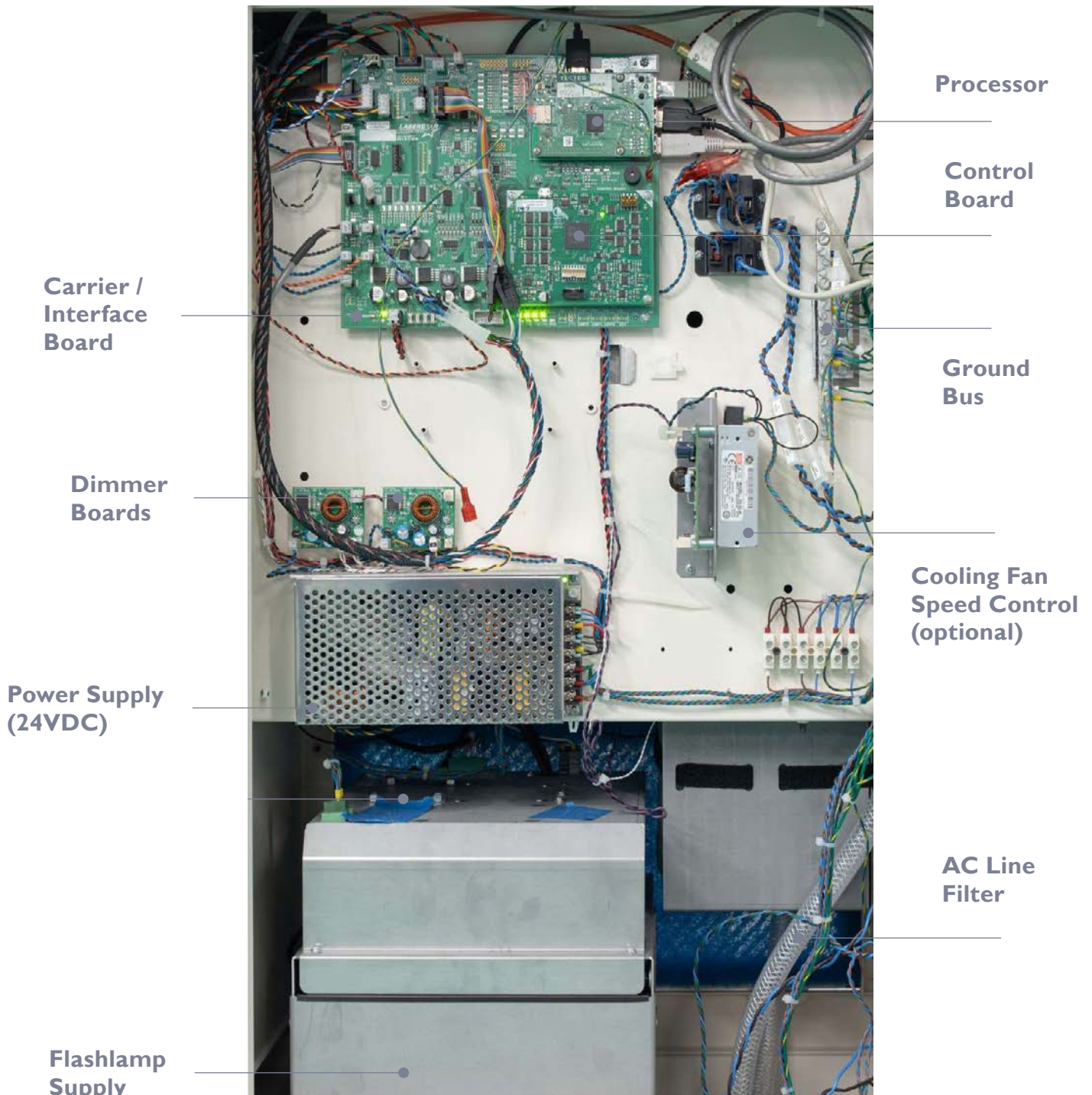
Video Out  
Connector  
(optional)

Air Input  
Connector  
(Optional)

**Figure 75**  
(Air, Argon Gas, Remote  
Interlock, Motion Control  
& Video Out Connector)

(Note: Image of the Remote Interlock Connector that is installed in the input.)

## IX. Service F: Major Internal System Components

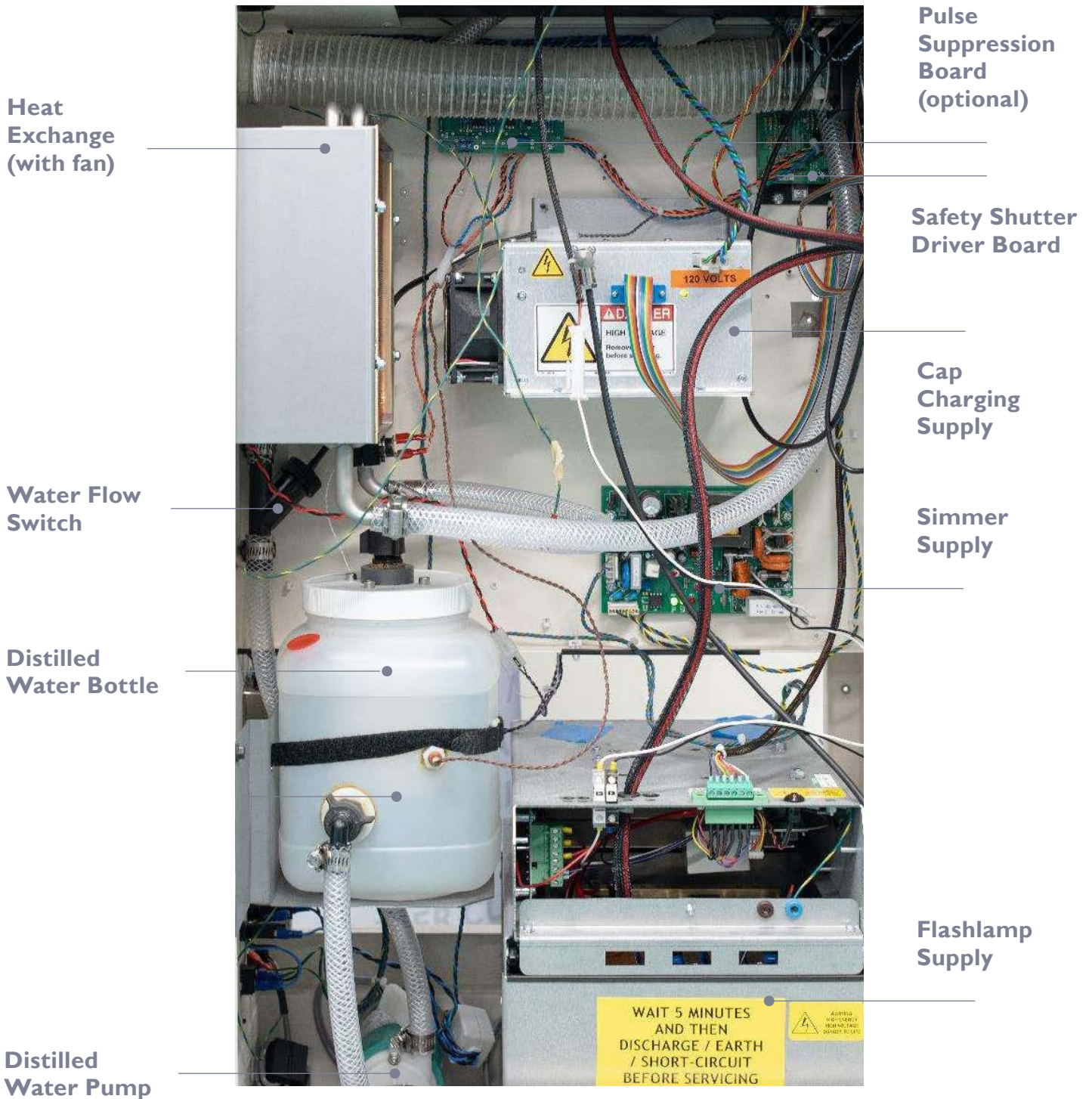


**Figure 76**  
(Power Controls  
[right-side])

## IX. Service F: Major Internal System Components Continued on Next Page



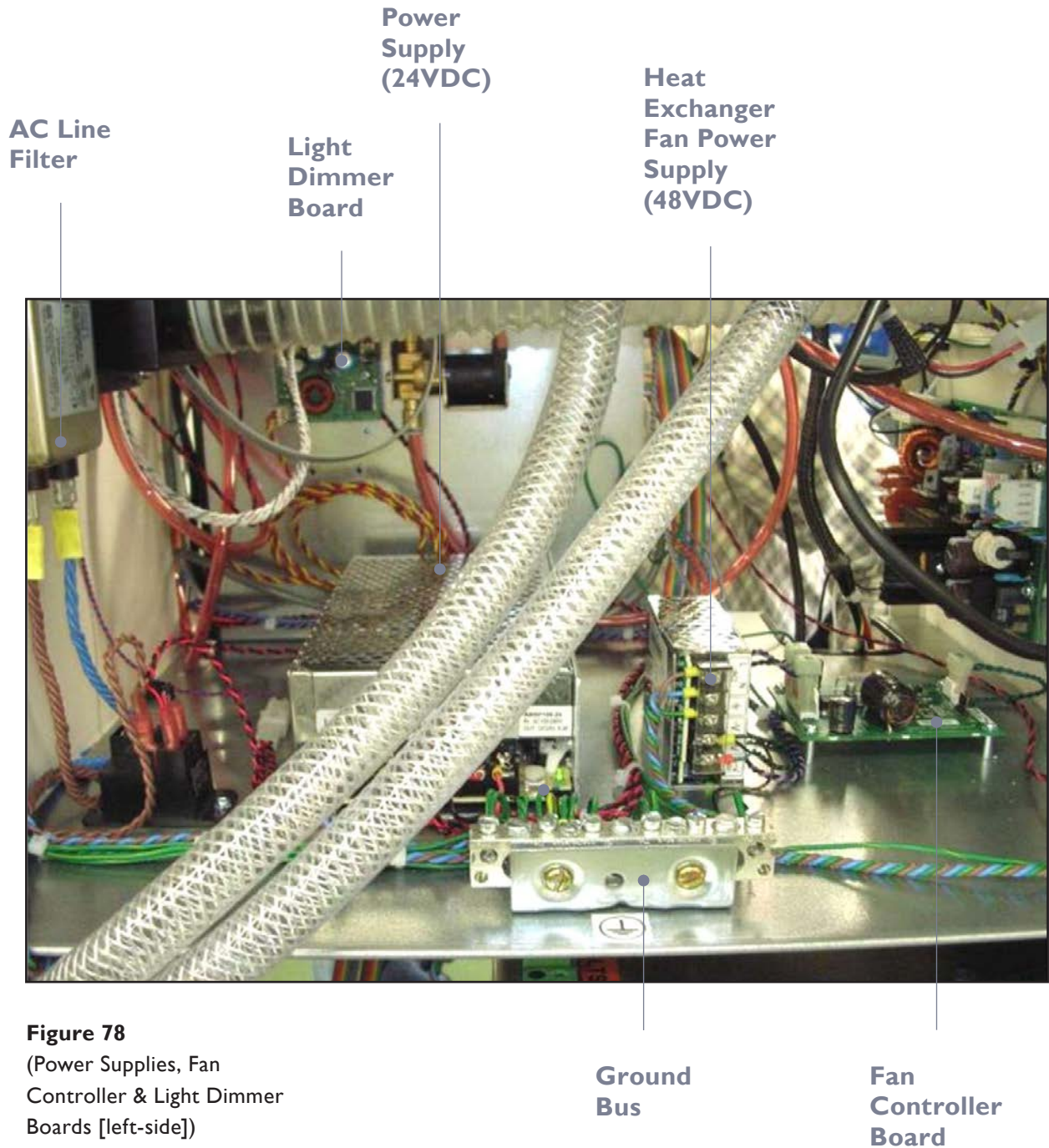
## IX. Service F: Major Internal System Components (continued)



**Figure 77**  
(Power Controls  
& Distilled Water  
[left-side])

**IX. Service F: Major Internal System  
Components Continued on Next Page**

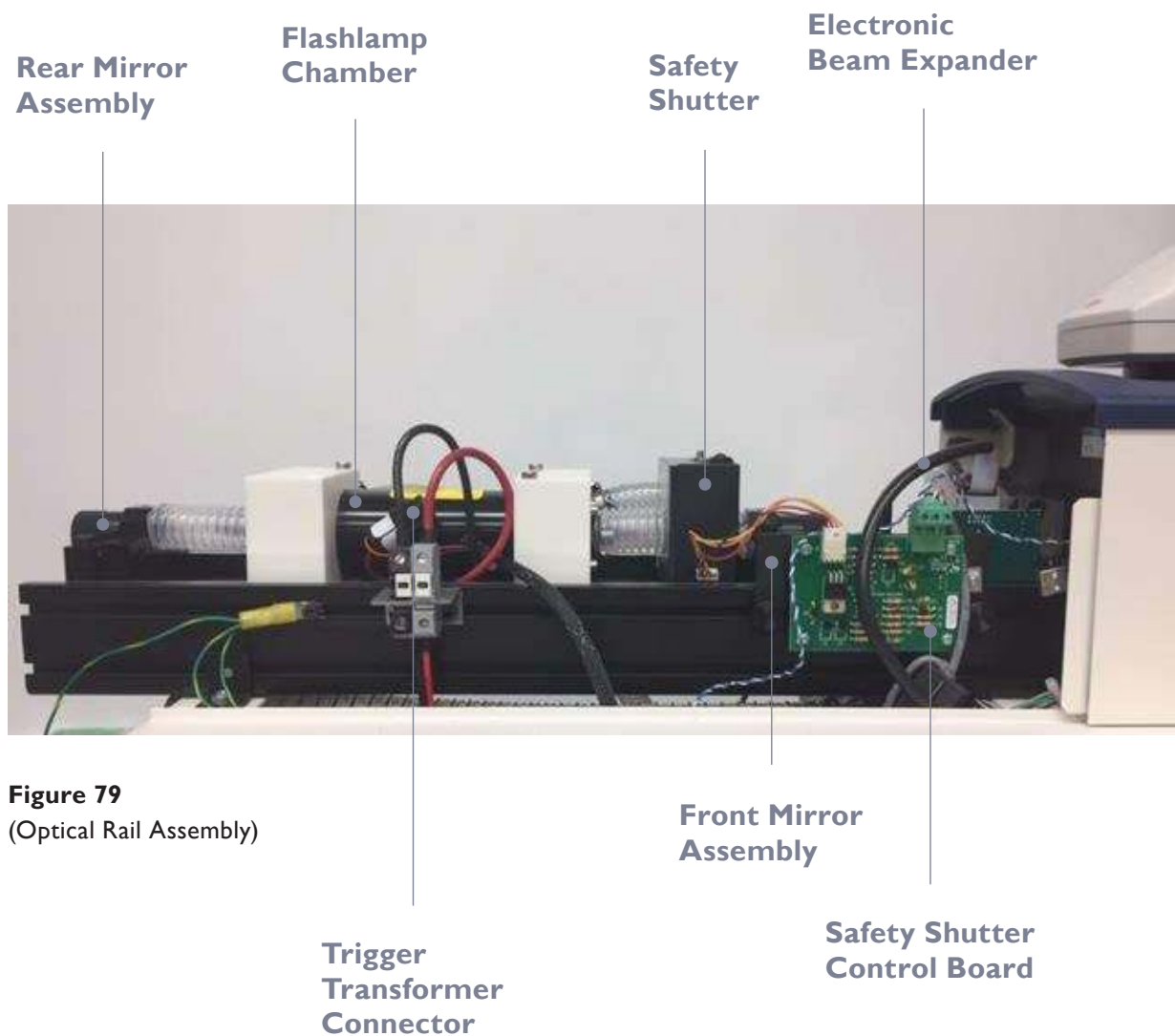
## IX. Service F: Major Internal System Components (continued)



**Figure 78**  
(Power Supplies, Fan  
Controller & Light Dimmer  
Boards [left-side])

IX. Service F: Major Internal System  
Components Continued on Next Page

## IX. Service F: Major Internal System Components (continued)



**Figure 79**  
(Optical Rail Assembly)



## IX. Service G: Securing the Welder with Brackets



**Figure 80**  
(Securing to the Wall  
[wall mounted] or  
Floor [floor mounted])

**(Note: Use an 8mm (or 5/16") socket wrench for the 5mm x 12mm screws (#10 32 x .375" screws may also be substituted for the 5mm screws).**

## X. Appendix, Section A: Configuration, Controls, and Operation

On the left side of the machine are the **rotary argon (inert) gas flow control (1)**, and **rotary brightness control (2)**; these control elements are used to adjust the laser pulse intensity, pulse length, and other similar factors.



**Figure 82**

(Welding chamber  
control elements)



## **X. Appendix, Section B: Restricted Access & Password (PIN) Protection**

**The Password feature is intended to prevent unauthorized modifications to system setups and configurations where multiple users can access the system and limits access to the Menu Screens.**

### **Changing the Password (PIN) Number:**

1. Press "MENU" on Main Screen (Figure 82)
2. Touch Password (Pin Number) (Figure 85)
3. Touch the number box (\*\*\*\*) (Figure 83)
4. This will bring up the numerical keypad (Figure 84)
5. Type in the default PIN number (2013) and press the OK button (Figure 84)
6. Now press (Done) (Figure 83)
7. Touch the number box (\*\*\*\*) (Figure 83)
13. Type in the new PIN number (Figure 87)
14. Press the OK button (Figure 86)
15. Uncheck No Password (Figure 86)
15. Now press (Done) (Figure 85)
15. Press Main Menu Button (Figure 85)
16. The new Password (PIN) is set.

**(Note: The operator can choose to enable or disable restricted access and password protection whenever they choose.)**

## **X. Appendix, Section B: Restricted Access & Password (PIN) Protection Continued on Next Page**

## **No Password Checkbox:**

Selecting this option (check mark in the box) will eliminate the need to enter a password for those users who don't require a password and do not want to take the time to enter a password to go into the Menu Options.

If the "No Password" checkbox is unchecked the last password used will become the required password for entry into the Menu Options.

## **Changing the Restricted Mode:**

The restricted access feature is intended to prevent unauthorized changes to the device's welding parameters. This feature is installed prior to shipping.

1. Press "MENU" on Main Screen (Figure 82)
2. Touch Password (Pin Number) (Figure 85)
3. Touch the number box (\*\*\*\*) (Figure 83)
4. This will bring up the numerical keypad (Figure 84)
5. Type in the default PIN number (2013) or the User PIN number and press the OK button (Figure 84)
6. Now press (Done) (Figure 83)
7. Press Restricted ON or Off to the desired mode (Figure 86)
8. Now press (Done) (Figure 86)
9. Press Main Menu Button (Figure 85)
10. The Restricted Mode has been set.

## X. Appendix, Section B: Restricted Access & Password (PIN) Protection

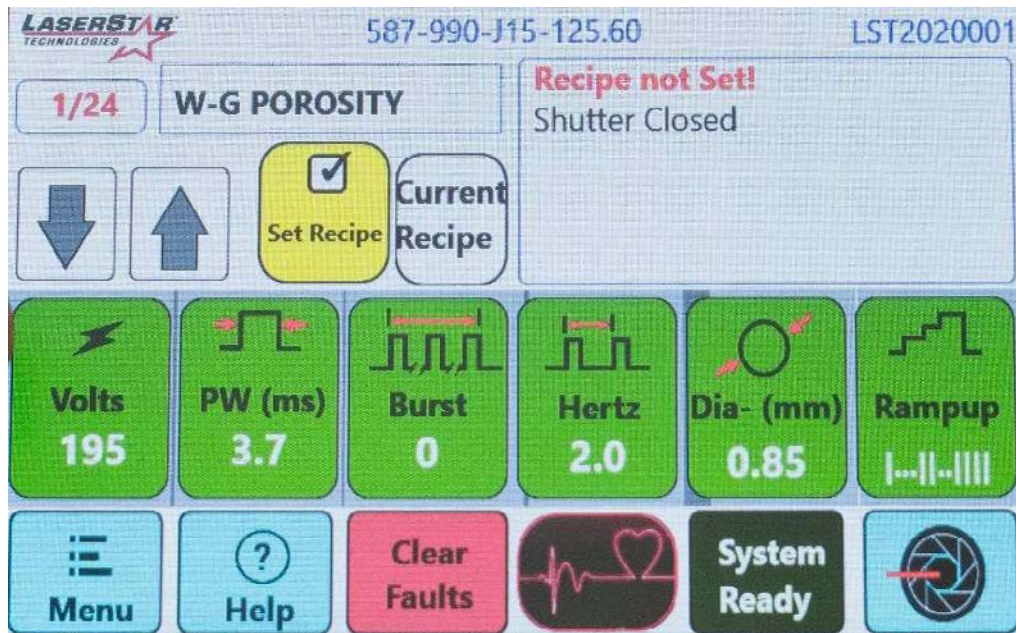


Figure 82  
(Main Menu [on-screen])

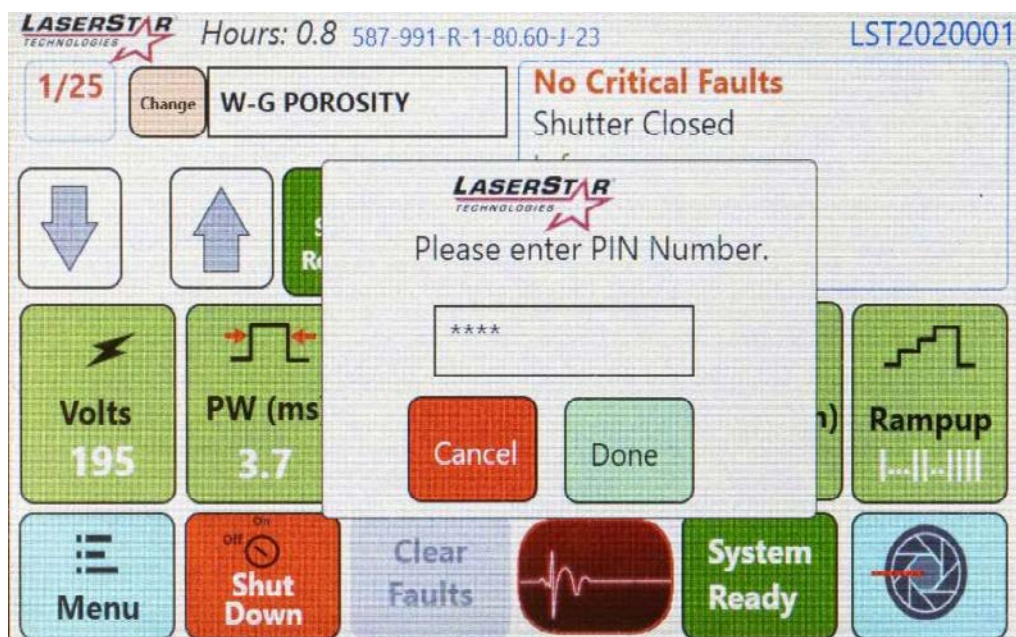
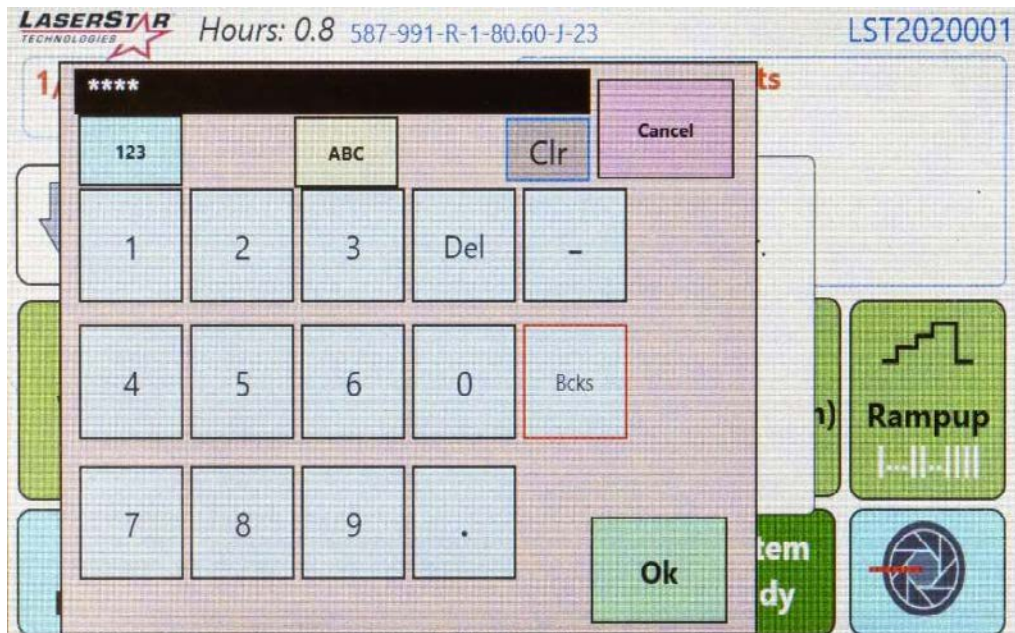


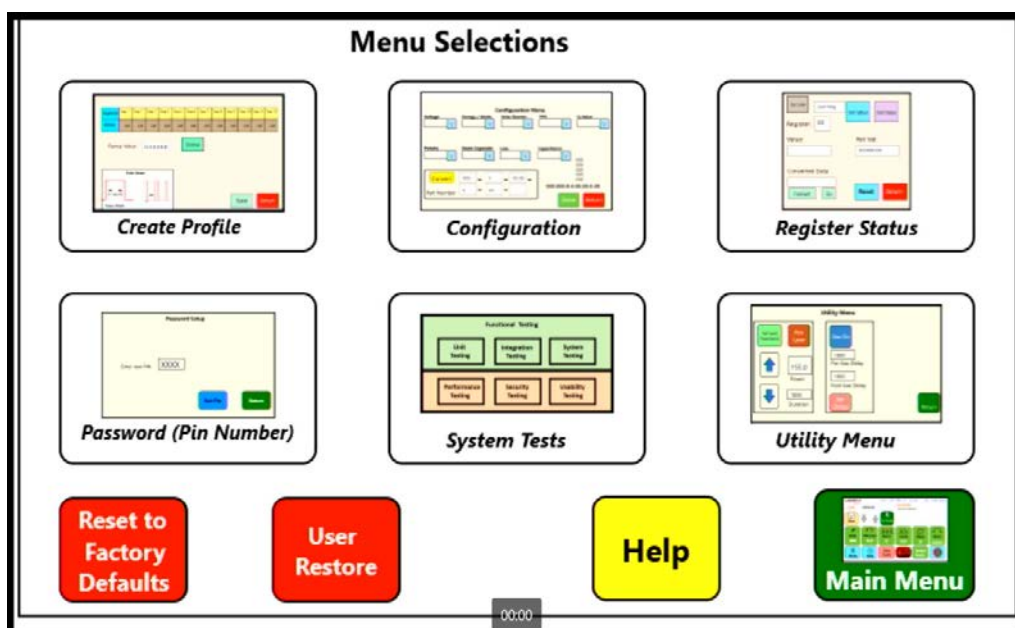
Figure 83  
(Input PIN Number [Press  
Done to Confirm])

## X. Appendix, Section B: Restricted Access & Password (PIN) Protection



**Figure 84**

(Input PIN Number [Enter  
Value Using Numeric Keypad;  
Press Ok to Confirm])



**Figure 85**

(LaserStar Service  
Contacts)



## X. Appendix, Section B: Restricted Access & Password (PIN) Protection

**Password Setup**

☐ Restricted On

☒ Restricted Off

Enter new PIN

☒ No Password

**Done** **Return**

**Figure 86**

(New Password Setup [Press Done to Confirm])

**Password Setup**

\*\*\*\*

123 ABC Clr Cancel

1 2 3 Del -

4 5 6 0 Bcks

7 8 9 .

**Ok** **Return**

**Figure 87**

(New PIN Number [Press Done to Confirm])

# X. Appendix, Section C: Cleaning, Service, and Maintenance Intervals Chart (with checklist)

The chart on the next page can be used as a resource for tracking cleaning tasks, routine maintenance intervals, and upcoming or anticipated service needs.

**Important Advisory:**

Routine maintenance is a requirement for ensuring the safe and optimal operation of the welder system. Regular maintenance intervals must be scheduled in accordance with the manufacturer’s recommendations and requirements. Use only LaserStar Technologies Corporation® approved parts and accessories. Service personnel must verify the equipment is safe to operate after maintenance is concluded.

LaserStar Technologies: Important Contacts		
Sales & Training	Service & Support	Corporate Office
(407) 248-1142 <a href="mailto:sales@laserstar.net">sales@laserstar.net</a>	1-888-578-7782 <a href="mailto:service@laserstar.net">service@laserstar.net</a>	2461 Orlando Central Pkwy. Orlando, Florida 32809, USA

Daily: Wipe Laser / Wipe chamber / Clean protective disc (w) = Water change (w&f) = Water & Filter change											
Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6	6	6
7 Weekly	7 Weekly	7 Weekly	7 Weekly	7 Weekly	7 Weekly	7 Weekly	7 Weekly	7 Weekly	7 Weekly	7 Weekly	7 Weekly
8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9
10	10	10	10	10	10	10	10	10	10	10	10
11	11	11	11	11	11	11	11	11	11	11	11
12	12	12	12	12	12	12	12	12	12	12	12
13	13	13	13	13	13	13	13	13	13	13	13
14 Weekly	14 Weekly	14 Weekly	14 Weekly	14 Weekly	14 Weekly	14 Weekly	14 Weekly	14 Weekly	14 Weekly	14 Weekly	14 Weekly
15	15	15	15	15	15	15	15	15	15	15	15
16	16	16	16	16	16	16	16	16	16	16	16
17	17	17	17	17	17	17	17	17	17	17	17
18	18	18	18	18	18	18	18	18	18	18	18
19	19	19	19	19	19	19	19	19	19	19	19
20	20	20	20	20	20	20	20	20	20	20	20
21 Weekly	21 Weekly	21 Weekly	21 Weekly	21 Weekly	21 Weekly	21 Weekly	21 Weekly	21 Weekly	21 Weekly	21 Weekly	21 Weekly
22	22	22	22	22	22	22	22	22	22	22	22
23	23	23	23	23	23	23	23	23	23	23	23
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25	25	25	25	25	25	25	25	25	25	25	25
26	26	26	26	26	26	26	26	26	26	26	26
27	27	27	27	27	27	27	27	27	27	27	27
28 Weekly	28 Weekly	28 Weekly	28 Weekly	28 Weekly	28 Weekly	28 Weekly	28 Weekly	28 Weekly	28 Weekly	28 Weekly	28 Weekly
29 Monthly	29 Monthly	29 Monthly	29 Monthly	29 Monthly	29 Monthly	29 Monthly	29 Monthly	29 Monthly	29 Monthly	29 Monthly	29 Monthly
30 Monthly	30 Monthly	30 Monthly	30 Monthly	30 Monthly	30 Monthly	30 Monthly	30 Monthly	30 Monthly	30 Monthly	30 Monthly	30 Monthly
31 Monthly	31 Monthly	31 Monthly	31 Monthly	31 Monthly	31 Monthly	31 Monthly	31 Monthly	31 Monthly	31 Monthly	31 Monthly	31 Monthly
		(w) Change water			(w & f) Change Water & Filter			(w) Change water		(w & f) Change Water & Filter	

**Weekly: Check cross-hair alignment / clean & inspect window splash protector**

week 1	week 6	week 11	week 16	week 21	week 26	week 31	week 36 (w)	week 41	week 46	week 51	
week 2	week 7	week 12 (w)	week 17	week 22	week 27	week 32	week 37	week 42	week 47	week 52	
week 3	week 8	week 13	week 18	week 23	week 28	week 33	week 38	week 43	week 48(w & f)		
week 4	week 9	week 14	week 19	week 24(w & f)	week 29	week 34	week 39	week 44	week 49		
week 5	week 10	week 15	week 20	week 25	week 30	week 35	week 40	week 45	week 50		

**Monthly: Clean cabinet, heat exchange / Check water level, replace air & exhaust filters, take Energy Test**

Month 1	Month 2		Month 4	Month 5		Month 7	Month 8		Month 10	Month 11	
Month 3 (w)			Month 6 (w & f)			Month 9 (w)			Month 12 (w & f)		

**(w) Quarterly: Change Water every 3 Months / Change Water & Filter every 6 Months.**

water only - 3rd month			water only - 9th month		
water & filter - 6th month			water & filter - 12th month		GTP 9-23-20



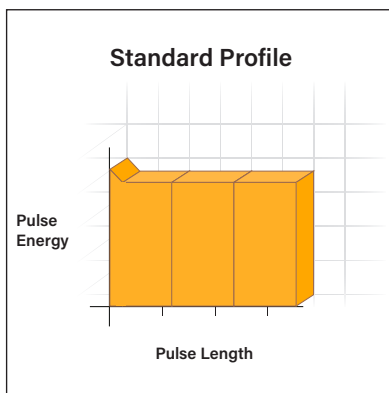
## X. Appendix, Section D: Pulse Performance Profile (P<sup>3</sup>) Technology

### Background

A pulse of energy from the laser welder consists of a number of characteristics or variables, two of which are pulse power and pulse duration.

The height of a laser pulse is the laser's peak power measured in kW. The pulse can be charted so that the pulse height is shown on the y-axis and the length or duration is shown along the x-axis. The area beneath the curve of the pulse height and pulse length is the pulse energy, which is measured in joules.

The standard pulse shape that is emitted from the laser is a rectangle with an initial spike for the first 1/2 millisecond (1/2 mS) or so. This initial spike (diagram below) helps to break down the reflectivity of the metal, resulting in significantly enhanced energy coupling. This spike can be accentuated or removed altogether, as you'll understand from reading this white paper.



A number of variables can affect the dimensions and quality of laser welds. Broadly speaking, welds can be categorized into two (2) "modes:" conduction and keyhole.

With conduction welds, the surface of the metal melts, and through heat conduction, a portion of the metal beneath the laser pulse spot also liquefies. With conduction welds, heat loss through conduction limits the maximum depth of the weld to approximately 1 mm (depending on the material).

Keyhole welds, unlike conduction welds, penetrate much deeper into the surface of the metal, but the process differs. With keyhole welds, in order to cut deeply into the metal material, a channel must be created and some of the material must be vaporized; through the process of either vaporization or splatter, metal material is lost.

### Variables that affect melt pool dimensions and the quality of spot welds include:

- Spatial energy distribution for the incident beam
- Pulse height (peak power)
- Pulse energy (application dependant)
- Pulse length (duration)
- Profile shape

### About Pulse Performance Profile (P<sup>3</sup>) Technology

The process for profiling a laser pulse requires specifying the percentage of pulse energy that is released for each 1 millisecond (1 mS) section. The individual sections are defined in intervals of: 25%, 50%, 75% or 100% of the total pulse energy output. To benefit from pulse profiling and achieve noticeable results, a minimum 3 millisecond (3 mS) pulse duration must be employed.

The energy required for pulsed laser welding can vary, depending upon the application and profile selected. For example, a pulse profile can be chosen for its slower cooling, surface cleaning, bulk heating or even vaporization of contaminants, and for each application, the energy requirement will differ. When this is the case, the energy required (both voltage and pulse length) will also increase to compensate, ensuring consistent weld penetration, despite the application of a custom profile preset.

### About Pulse Performance Profile (P<sup>3</sup>) Technology Continued on Next Page

## About Pulse Performance Profile (P<sup>3</sup>) Technology (continued)

These parameter adjustments have the potential to reduce lamp life, processing speed, and/or increase cycle times. However, this is a small price to pay and is almost always worth the noticeable improvement in the quality of the weld.

Conversely, if the initial spike is increased to improve energy coupling or duty cycle, **Burst** profiles are used, and the process can become much more efficient (less energy per pulse is used with pulse profiling for the same task).

When in doubt about which pulse profile may be most beneficial, you should first experiment with a **Basic** profile, taking note of the energy used (parameter selections) for a particular application. Next, select a recommended pulse profile and execute the application, again checking the energy used (parameter selections). Finally, compare the results of the two processes and choose a profile that meets your quality and processing speed requirements.

### Getting Started

Normally, a **Basic** profile is entirely appropriate when welding standard ferrous alloys without plating. However, pulse profiling may have a measurable effect on quality and consistency for welding applications with reflective, very dissimilar or contaminated material. For example, small, hairline cracks may be visible in particular alloys when using a **Basic** profile. However, when a **Ramp Down** profile is chosen, a solid, excellent weld is produced.

To determine if Pulse Performance Profile Technology will benefit your applications, it's important to become familiar with the parameter selections process for your machine. Second, you should understand pulse profiles and how adjustments can affect pulse energy output and impact welding materials. Lastly, work toward process improvements by employing a pulse profile. Try a profile based on its description and recommended use, measuring differences in the weld when compared with a **Basic** profile.

If, when you experiment with pulse profiles, you find that penetration is sacrificed, be sure to increase the energy (V) when actual processing is taking place. If the results are worse, try a different pulse profile configuration.

After experimenting with various pulse profiles, don't be concerned if you discover that the **Basic** profile is the best option for your application — at least you've committed to the process of experimentation for the sake of optimization.

### Using P<sup>3</sup> Technology

A variety of pulse profiles have been embedded into the laser's micro-welding software; seven (7) in total. Each profile has been programmed and stored in a specific memory location.

**The following pulse profiles are preloaded and available for use with the welder:**

- Basic
- Spike
- Ramp Down
- Ramp Up
- Pyramid
- Pre-pulse
- Burst

All pulse profiles are voltage proportional. For each profile, if the voltage increases, the energy per section also increases; the energy output percentage will, however, always remain the same.

The energy per section is proportional to the selected pulse length. To activate the pulse profile, a minimum pulse length of 3 milliseconds (3 mS) is required. As an example, when the pulse length is 3 milliseconds (3 mS), each section's pulse width will be 1 millisecond (1 mS). If the pulse length is 9 milliseconds (9 mS), each section's pulse width will be 9 milliseconds (9 mS) divided by 3, which equals 3 milliseconds (3 mS), and so on.

**Using P<sup>3</sup> Technology Continued on Next Page**

Using P<sup>3</sup> Technology (continued)

All pulse profiles (with exception of **Basic**) have a minimum pulse length of 3 milliseconds (3 mS). If a shorter pulse length is selected, the parameter will automatically reset to the default setting.

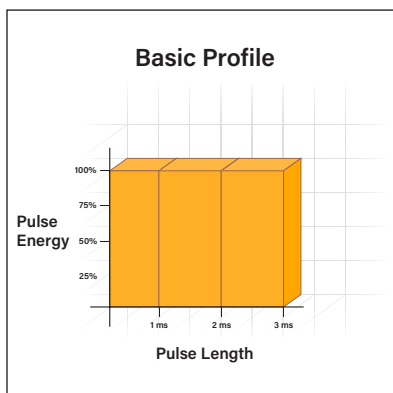
Pulse Profiles: Technical Specifications				
Imbedded Pulse Profiles (quantity)	Pulse Width	Energy Levels (per section)	Energy Sections (quantity)	Section Pulse Width (minimum value)
7	3-20 mS	5 (0%, 25%, 50%, 75%, 100%)	3	1 mS

Pre-programmed Pulse Performance Values	
Pulse Profile	Profile Settings
Basic	100%, 100%, 100%
Spike	100%, 25%, 25%
Ramp Down	100%, 50%, 25%
Ramp Up	25%, 50%, 100%
Pyramid	50%, 100%, 50%
Pre-pulse	50%, 100%, 75%
Burst	50%, 50%, 50%

## Basic Profile (yellow gold, platinum, and stainless steel)

For very low penetration welds that require excellent cosmetic presentation or when welding volatile materials, such as low melting point alloys, a **Basic** profile, which suppresses the initial higher peak power spike, can be beneficial.

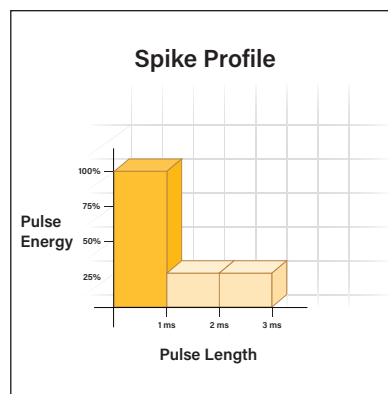
By eliminating the spike, the weld puddle will vibrate less during cooling. Ripples on the melt surface caused by vibration freeze within the puddle, producing a more rigid and less shiny surface. Materials with a low melting point or those with better absorption will not require an initial spike.



## Spike Profile (silver and copper; with silver [use tacking or single-pulse mode])

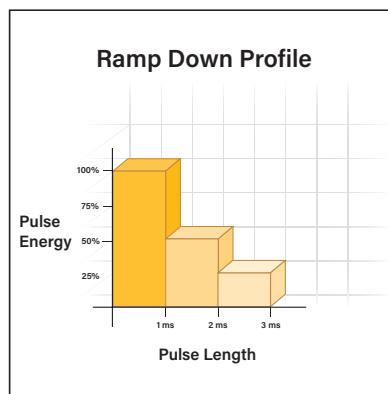
A **Spike** profile is helpful for highly reflective metals with higher conductivity, such as pure copper alloys, silver alloys, and some aluminum alloys or for applications in which the surface is highly reflective and the focused spot is larger.

With this profile, the initial spike in the first section is produced and initiates melting of the material surface. Next, absorption increases (by up to 20 times), ensuring that the remainder of energy from the laser pulse can be lowered. This can reduce the overall energy required, making coupling much more consistent and reducing weld spatter from the process (see diagram at top right).



## Ramp Down Profile (silver and aluminum)

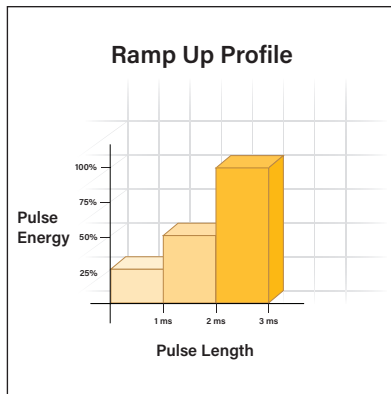
With higher carbon steels, alloys that are prone to cracks, casting alloys with voids or contaminants (or when the materials to be welded have very dissimilar melting points) a **Ramp Down** profile can be a huge benefit in the reduction of cracks and porosity (voids) in the weld.



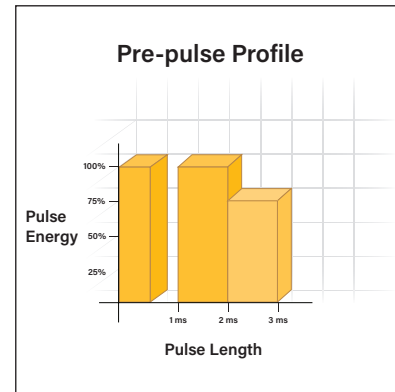
## Ramp Up Profile (white gold)

When welding materials with low melting points and with very low reflectivity or when welding materials with many volatile contaminants or with plating, the **Ramp Up** profile is helpful (see diagram on next page).

**Pulse Profile Applications and Usage Continued on Next Page**

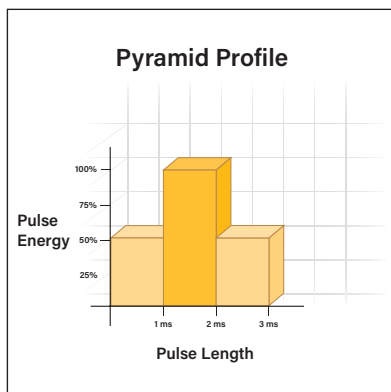


that it eliminates all contaminants. Usually, a delay of up to 1/2 millisecond (1 mS) follows to allow the material to get out of the weld zone. Then, the main weld process occurs, striking a consistent surface to ensure creation of a quality weld.



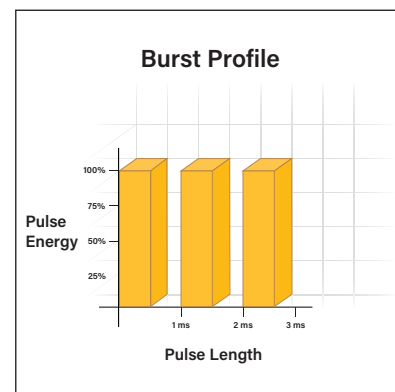
## Pyramid Profile (titanium)

Combines characteristics from both the **Ramp Up** and **Ramp Down** profiles and is suitable for welding dissimilar metals that are non-reactive to oxygen.



## Burst Profile (pewter, hollow [thin wall], and low-melting pot metal)






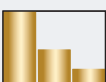
Essentially, the **Burst** profile delivers pulse energy output in repeated cycles with a consistent peak power. It has been shown to have value and a positive effect, increasing the overall weld depth.



## Pre-pulse Profile (eyeglasses)

When welding materials that have a low melting or boiling point, a plating or surface covering, or those that contain contaminants, such as pre-tinned electronic parts, anodized parts, painted parts or oil-contaminated parts, a **Pre-pulse** profile is helpful. Additionally, parts that have varying reflectivity, due to coating differences, oxidation or surface finish can benefit from a **Pre-pulse** profile.

This profile has an initial section with enough energy to vaporize and/or partially weld materials while also ensuring the heat penetrates the material enough

Recommended Pre-programmed Parameter Settings			
Metal Type	Parameter	Voltage	Pulse Profile
White Gold 	Porosity	195V 3.7ms 2.0Hz 0.85mm	Ramp Up
White Gold 	Re-tip	195V 3.5ms 2.0Hz 0.65mm	Ramp Up
White Gold 	Size Thin	208V 3.5ms 2.0Hz 0.70mm	Ramp Up
White Gold 	Size Thick	210V 7.0ms 2.0Hz 0.60mm	Ramp Up
Yellow Gold 	Porosity	195V 3.0ms 2.0Hz 0.70mm	Basic
Yellow Gold 	Re-tip	176V 3.0ms 2.0Hz 0.60mm	Basic
Yellow Gold 	Size Thin	203V 3.4ms 2.0HZ 0.60mm	Basic
Yellow Gold 	Size Thick	275V 4.0ms 2.0HZ 0.70mm	Basic
Silver 	Porosity	230V 3.5ms 2.0HZ 0.70mm	Ramp Down
Silver 	Re-Tip	235V 3.5ms 2.0HZ 0.75mm	Ramp Down
Silver 	Size Thin	255V 4.5ms 2.0HZ 0.75mm	Ramp Down

(Note: The parameter combinations above and in the table that follows are suggested starting points and are subject to change based on flashlamp age and alloy surface.)

Recommended Pre-programmed  
Parameter Settings Continued on Next Page

Recommended Pre-programmed Parameter Settings			
Metal Type	Parameter	Voltage	Pulse Profile
Silver 	Size Thick	290V 6.0ms 1.5Hz 0.65mm	Ramp Down
Platinum 	Porosity	220V 3.0ms 2.0Hz 0.70mm	Basic
Platinum 	Re-tip	220V 3.0ms 2.0Hz 0.80mm	Basic
Platinum 	Size Thin	225V 3.0ms 2.0Hz 0.60mm	Basic
Platinum 	Size Thick	250V 6.0ms 2.0Hz 0.75mm	Basic
Jump Rings 		213V 2.3ms 2.0Hz 0.75mm	Basic
Titanium 		211V 3.0ms 2.0Hz 0.65mm	Pyramid
Hollow 		194V 3.0ms 8.0Hz 0.45mm	Burst
Pewter 		180V 3.0ms 8.0Hz 0.60mm	Burst
Base Metal (white) 		195V 3.5ms 7.0Hz 0.80mm	Burst
Eyeglasses 		195V 3.5ms 2.0Hz 0.75mm	Pre-pulse
Stainless Steel 		200V 2.8ms 3.0Hz 0.70mm	Basic
Cross-hair Align 		200V 3.0ms 0.0Hz 0.70mm	Basic



## This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced, light blue horizontal lines running across the width of the page. The lines are thin and consistent in color and thickness throughout. There are no margins, text, or other markings present on the page.

[illegible]

## This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal blue or grey lines across its entire width. The lines are uniform in thickness and color, providing a clean template for writing or drawing. There are no margins, text, or other markings present on the page.

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applications results, please reach out — we'd love  
to hear from you!**

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