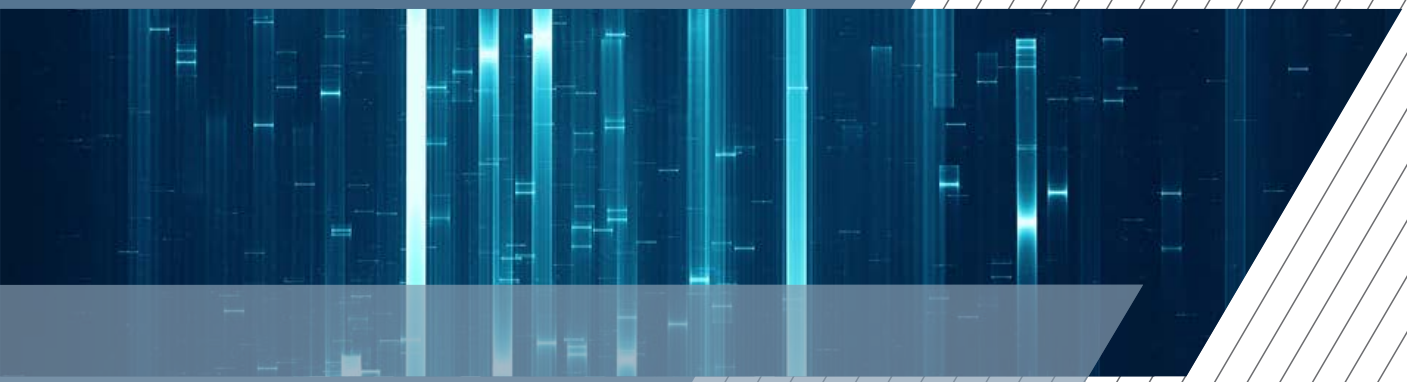
FIBERSTAR®

FiberStar® CNC Workstation 8801 Series

Operation & Maintenance Manual



LASERSTAR® TECHNOLOGIES

HARNESSING THE POWER OF HOT LIGHT™

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LASERSTAR
DO NOT LIFT HERE

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Declaration of Conformity

Manufacturer Name:	LaserStar Technologies Corporation®
Manufacturer Address:	2461 Orlando Central Parkway Orlando, Florida 32809
Phone / Fax:	PH: (407) 248-1142 FX: (866) 708-5274
Designation:	FiberStar® 8801 Series Workstation
Model Number(s):	5xx-88x with 5xx-87x LaserSystem
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 61010-1:2010, AMD1:2016

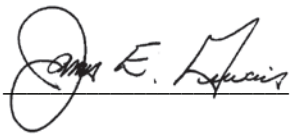
EN 61000-6-2:2019

EN 61000-6-4:2007 +A1:2010

EN 61000-6-4:2019

This declaration is issued under the 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 standards and fullfills the provisions of the EU directive(s).



James E. Gervais
President and Chief Operating Officer

Date: January 04, 2024

Declaration of Compliance

United States and Canada

Manufacturer Name:	LaserStar Technologies Corporation®
Manufacturer Address:	2461 Orlando Central Parkway Orlando, Florida 32809
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Standard(s) to which Compliance is Declared:

UL 61010-1:2012 Ed. 3+R:29 Jul2016 "Safety Requirements for Electrical Equipment for Laboratory Use; Part 1: General Requirements"

CSA C22.2 No. 61010-1-12:2012 Ed. 3+U2 "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 47CFR; Part 15, Subpart B (2017): Unintentional Radiators, Class A Verification

Listing: ETL Mark; Control Number: 4006074

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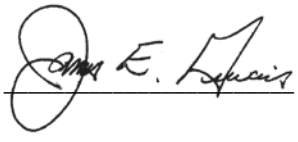

James E. Gervais
President and Chief Operating Officer

Date: January 04, 2024

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LaserStar Technologies Corporation®
Library Publication Data

FiberStar® 8801 Series Welding Workstation

Operation & Maintenance Manual

LaserStar Technologies: Important Contacts		
Sales & Training	**Service & Support**	**Corporate Office**
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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)**.

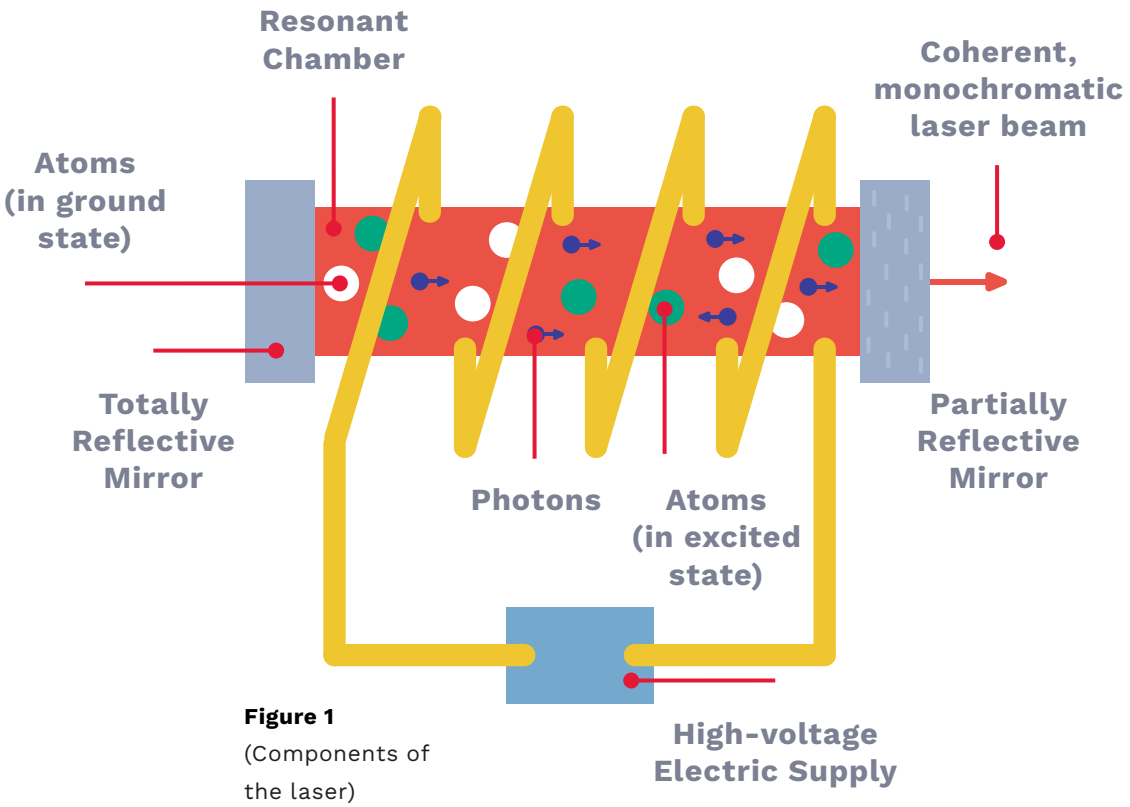


Figure 1
(Components of the laser)

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)**.

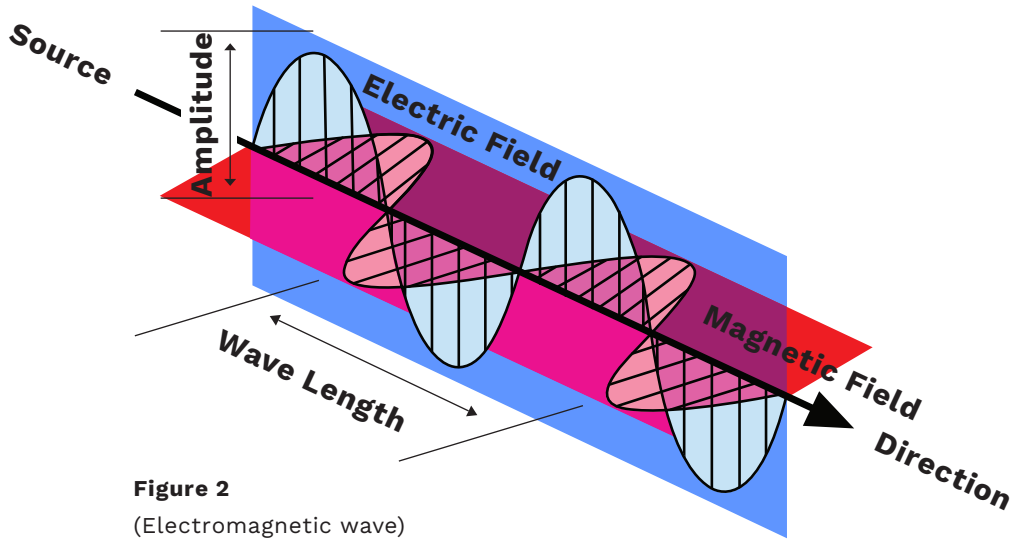


Figure 2
(Electromagnetic wave)

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).**

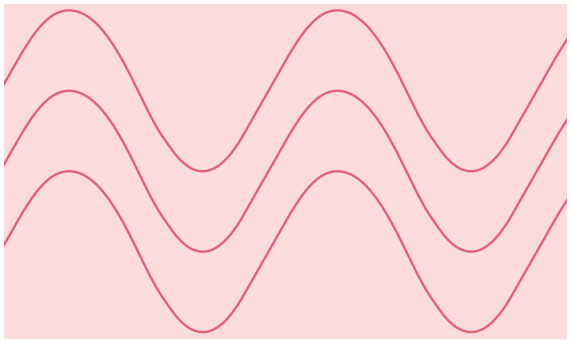


Figure 3
(Coherent, monochromatic directional light)

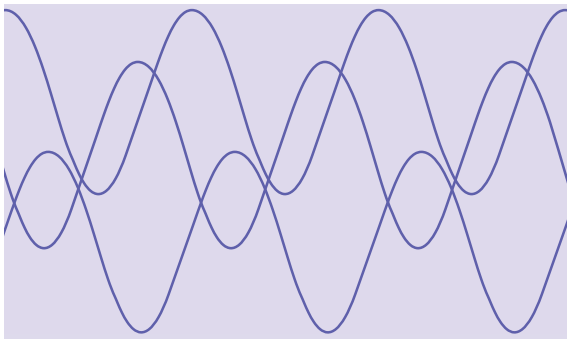


Figure 4
(Incoherent, monochromatic, directional light)

Notes

Notes

I. Introduction

Fiber Medium Laser: About, Standards, and Technical Data

A fiber laser is a device in which the active gain medium is an optical fiber doped with rare-earth elements, such as erbium, ytterbium, neodymium, etc. They are related to doped fiber amplifiers, which provide light amplification without lasing. Solid-state lasers or laser amplifiers where the light is guided due to the total internal reflection in a single mode optical fiber are instead called fiber lasers. The guiding of light allows extremely long gain regions providing good cooling conditions; fibers have high surface area to volume ration which allows efficient cooling. In addition, the fiber's wave guiding properties tend to reduce thermal distortion of the beam.

The fiber laser is often designed using a double-clad fiber, which consists of a fiber core, as well as an inner and an outer cladding. The index of the three concentric layers is chosen so that the fiber core acts as a single-mode fiber for laser emissions while the outer cladding acts as an efficient multi-mode core for the pump laser. This allows the pump to propagate a large amount of power into and through the active inner core region, while still having a high numerical aperture (NA) to permit effortless launching conditions.

The fiber laser 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 or "hot light" created at the focal point in a relatively short time (0.5 to 20 ms) heats the work piece beyond its melting point and thus enables a weld.

The affected area has a limited range — approximately 0.20 to 2 mm, depending on the material. The laser light welds two metals together and thus permits safe, durable, precise, and non-warped joining of metal materials 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 effects on the work material, can be influenced by the selected operating parameters (joules or energy), as well as the pulse length (width). The joules affects amplitude, while the pulse length influences the width of the laser pulse.

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

- Joules first influences the weld depth
- Pulse length predominantly influences the diameter of the welding point
- Focus influences weld depth, as well as the diameter of the weld spot. When the diameter of the weld spot is increased, weld depth is simultaneously reduced

Fiber Medium Laser: Advantages of Ownership

+ **Flexible Fiber**

  The inherent properties of light ensure that it can be easily delivered to a movable focusing element, which is important for laser cutting, welding, and folding of metals and polymers.

+ **Sustained Output Power**

  Fiber lasers can have active regions several kilometers long, and so can provide extraordinarily high optical gain. They can support kilowatt levels of continuous output power because of the fiber's high surface area to volume ratio, which allows efficient cooling.

+ **Superior Optical Quality**

  The fiber's wave guiding properties reduce or eliminate thermal distortion of the optical path, typically producing a diffraction-limited, high-quality optical beam.

+ **Conveniently Compact**

  Fiber lasers are compact compared to rod or gas lasers of comparable power, because the fiber can be bent and coiled to save space.

+ **Unwavering Reliability**

  Fiber lasers exhibit high vibrational stability, extended lifetime, and maintenance-free, turnkey operation.

  - High peak power and small pulses enable effective marking and engraving.
  - Additional power and improved beam quality provide cleaner cut edges and faster cutting speeds.
  - Lower cost of ownership.

FiberStar® 8801 Series Workstation:

Equipment Overview

The FiberStar® 8801 Series 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 welding work area, 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 with either of the internal welding chamber controls: joystick or keypad. With one control, the intensity of the laser pulse (voltage) is affected and with the other, the pulse length (mS) is altered. 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 by using argon (inert) gas. **Note: This laser system is equipped with an internal 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.

(For Motion FX operation, see Section IV. Operation.)

FiberStar® 8801 Series Workstation: External Components and Body Configuration

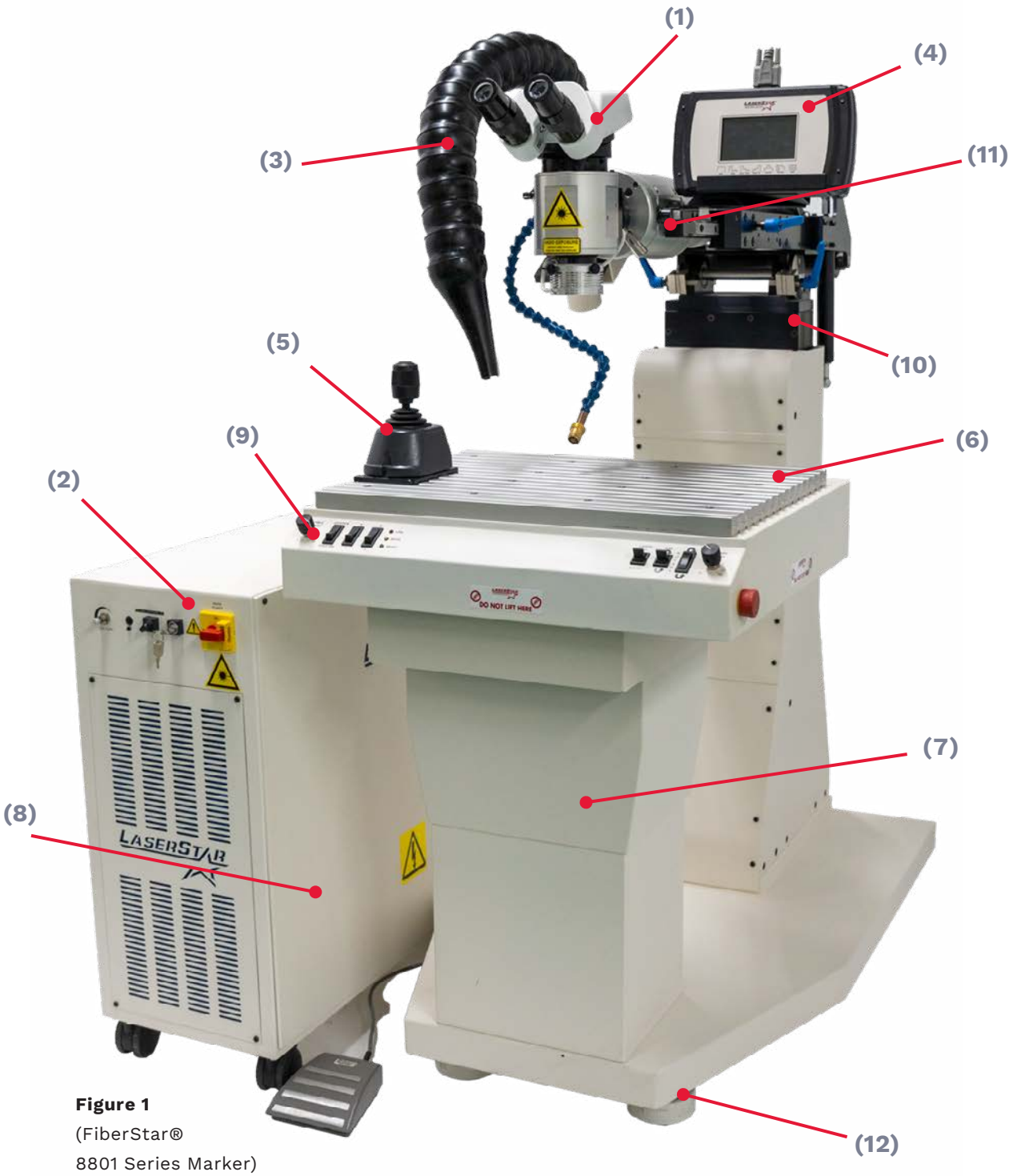


Figure 1
(FiberStar®
8801 Series Marker)

External Components and Body Configuration (continued)

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

1. Stereo Microscope
2. Main “On” and “Off” Switch, Emergency Switch, and System Key Switch
3. Flexible Exhaust Hose
4. Operator Interface Temrinal (OIT)
5. Motion Control Joystick
6. Motorized Work Table
7. Work Table Lifting Column
8. Power Supply Unit, Embedded Computer & Controls System (components are located inside the main body cabinet)
9. Table and Rotary Motion Control Switches
10. Delivery system lifting column
11. Remote delivery system
12. Wheel Locks (x6, x4 on the motion platform, x2 on the laser)

The **stereo microscope (1)**, mounted to the end of the remote delivery system, facilitates effortless positioning and adjustment of parts for welding applications.

Technical Specifications

The modular construction of the LaserStar® 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 laser system.

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

- High-energy Pulse Laser
- Embedded Computer
- Power Supply Unit
- Inert (argon) Gas Supply
- Foot Pedal Switch (for triggering laser pulses and inert [argon] gas supply)

LaserStar® Workstation - Laser Specifications				
A typical system build includes a variety of standard and optional components				
Laser Medium	Fiber-150W (PM)	Fiber-300W (PM)	Fiber-450W (PM)	Fiber-600W (PM)
Pulse Energy (maximum)	15 Joules	30 Joules	45 Joules	60 Joules
Maximum Avg. Radiant Power	150 Watts	300 Watts	450 Watts	600 Watts
Maximum Peak Power (Pulse Mode)	1500 Watts	3000 Watts	4500 Watts	6000 Watts
Rated Power (CW)	250 Watts	300 Watts	450 Watts	600 Watts

LaserStar® Workstation - Table Specifications	
A typical system build includes a variety of standard and optional components	
Laser Medium	Fiber 150, 300, 450, 600W (PM)
Laser Wavelength	1070 nm (infrared)
Beam Divergence (minimum; prior to beam-expanding and focusing optics)	≤1 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 (Standard)	0.2 to 50 mS
Pulse Length (Micro)	0.2 to 75 mS / CW
Laser Class	Class 4 (operator)
Ambient Conditions: Operating Temperature	5°C to 30°C (41°F to 86°F)
Ambient Conditions: Storage Temperature	–10°C to 70°C (14°F to 158°F)
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 (Laser)	30" x 24" x 27"
Weight (Laser)	250 lbs
L × W × H (Table)	42" x 24" x 46"*
Weight (Table)	340 lbs
Electrical Requirements: Single-phase (reference ID label for specifications [rear of the welder])	15A, 208 – 240VAC, 50 / 60Hz (60W model) 25A, 208 – 240VAC, 50 / 60Hz (80W model)

* Motion Table in lowest/center positions, actual size changes based on position of the axis.

Technical Specifications (continued)

Cooling

- Internal Air Heat Exchanger
- Ambient Temperature: 30°C (86°F; maximum)

Inert Gas: Pressure & Flow Regulation		
Operating Pressure (maximum)	**Operating Pressure (minimum)**	**Flow Range (typical)**
3.8 bar (55 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 (laser)	**Power Supply (logic)**
48VDC	24VDC

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:

- External Safety Contacts
- Laser Disable/Enable
- View Shutter (located inside the Stereo Microscope)
- Supply Voltage
- System Ready

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

- Welding Shield With Window (used for viewing and observation of application processes at the welding area
- Illuminated Welding area with Adjustable Brightness (by means of the controls on the remote delivery system
- View Shutter (shutter closes automatically for a short time with each laser

(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 sytem 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.

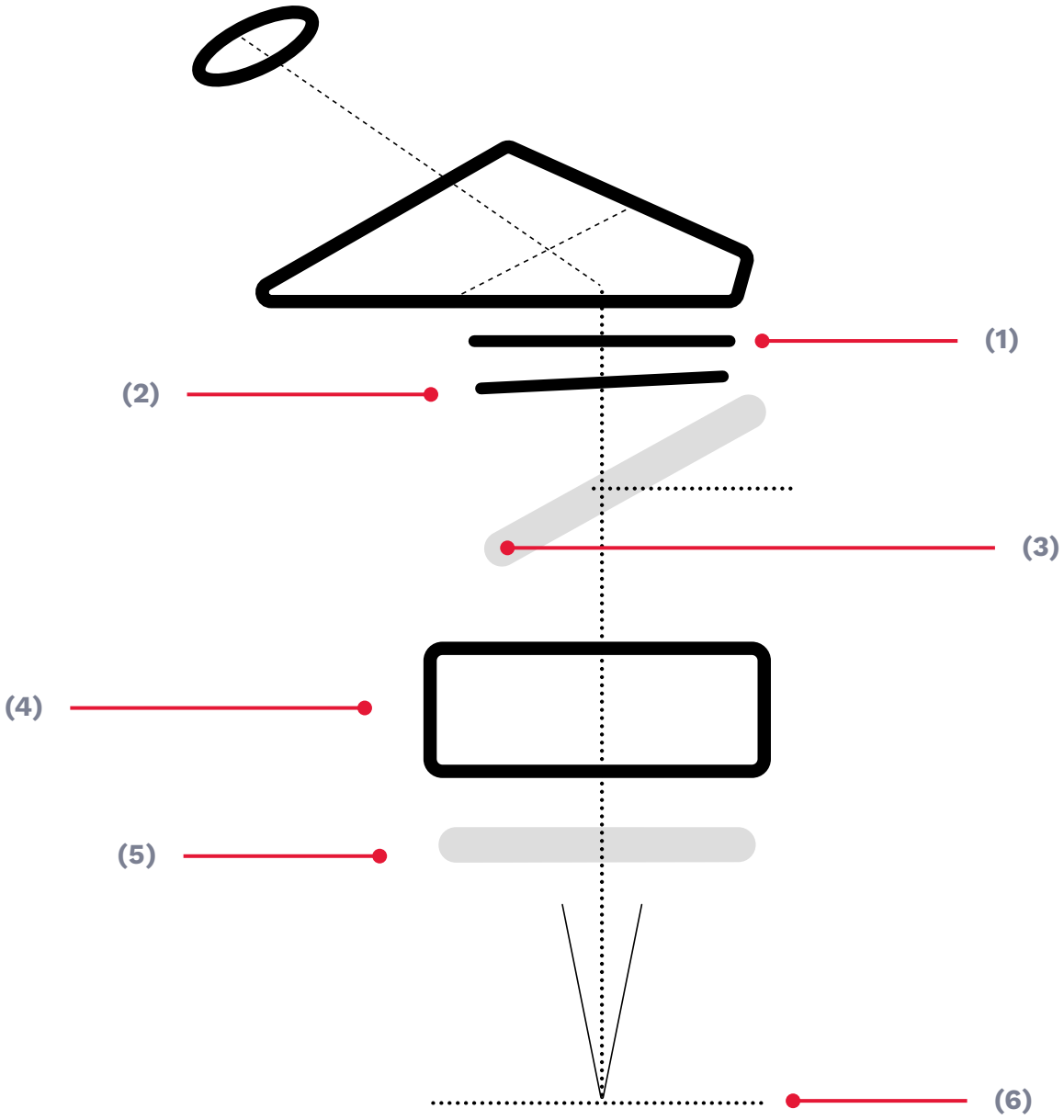


Figure 2
(View path and beam path)

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 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 durtion. 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),** the **IR 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])
+ Removable Steel Plate (used for securing and stabilizing larger workpieces)
+ Joystick Control (used to set or adjust recipes and welding parameters)
+ 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.

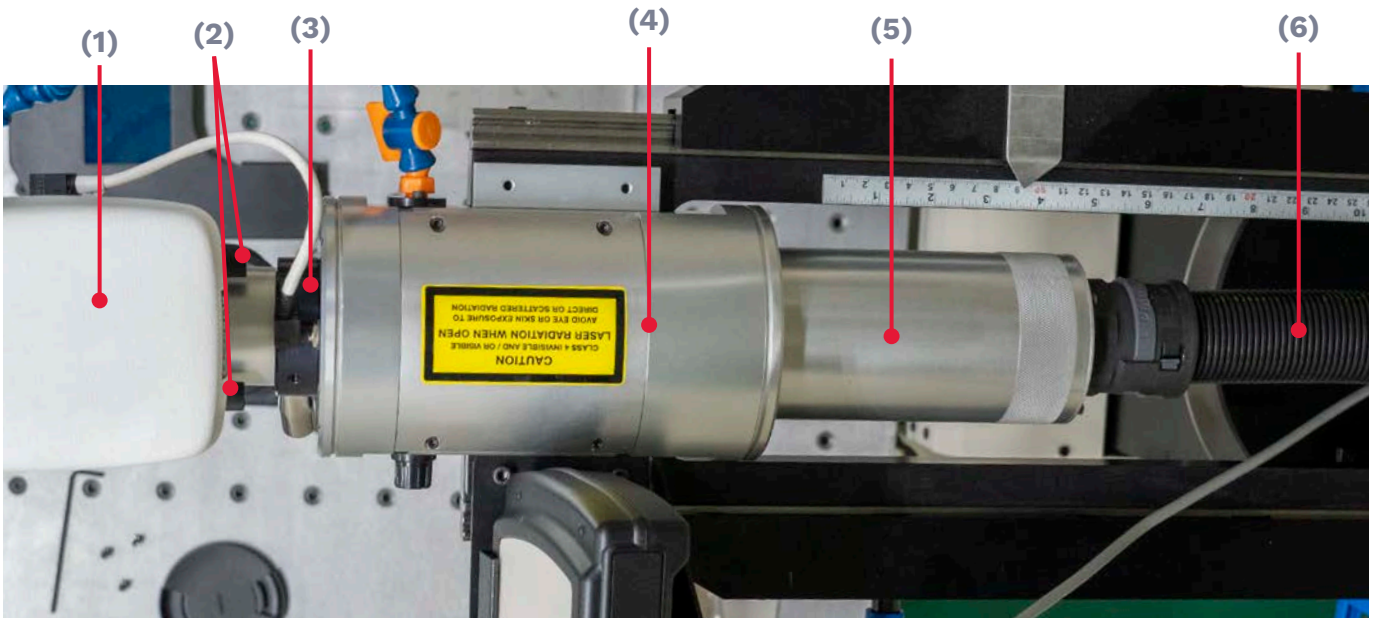


Figure 3
(Optical rail configuration)

Optical Rail Components

- The Laser Rail mounts a **Microscope (1)** onto the Beam Bender Assembly (Not shown) which contains a View Shutter Assembly (Mechanical or Bi-Stable) and Mirror. **Beam Bender Mirror Adjustment Screws (2)** are used for mirror alignment (set at factory, loosening screws may cause laser to go out of alignment).
- The **Locking Ring (3)** is used to rotate the Beam Bender Assembly so that the laser beam is perpendicular to the weld surface.
- The **Beam Expander (4)** is accessible under cover. (3X-Typical-Model / Option dependent)
- The **Beam Delivery Optic (BDO) (5)** is secured inside rail by a BDO clamp.
- The **Fiber Cable (6)** is inside a conduit for additional protection.

External Control Elements

Computer Controls Unit

The computer controls unit is mounted inside the power supply unit. If maintenance or service-related tasks are needed, the controls board is easily accessible from the front of the power supply unit.

The controls unit is used to control and op-erate the following components:

- Laser Power Supply (for laser pulse generation)
- Operating Elements
- Warning Indicators
- Safety Components
- 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 laser system is powered “on.”

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

- Air Filter
- Laser Status

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

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

Inert Gas and Compressed Air Supply (optional)

The device has a connecting socket for inert gas (argon, nitrogen, etc.). The remote delivery system has a flexible gas nozzle.

Exhaust Unit

The motion table has a flexible exhaust arm 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 near the rear of the motion table.

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

Figure 4
(Laser Control Elements)

Figure 5
(Laser Rail External Controls)

Touchscreen Display and Settings

The display layout is shown in the image 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 Enable/Disable 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 Laser Enable/Disable button is used to enable and disable the laser and displays the status.)**

Figure 5
(Touchscreen display)

With exception of pulse width suppression, all parameters can be set using the touchscreen display.

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 laser system's warranty.

Fingers (not finger nails) and the stylus pen that's been included with the laser system 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 or joystick. 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 laser system 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 laser system against unintentional movement at the installation site. Pressing the brake lever down will activate the brake. The motion table has 4 leveling wheels which can be set to level the table and lock its position. Twisting the knob at each wheel will set the position."

Notes

Notes

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 LaserStar® 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.

To use the system for any purpose 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.**

Proper use of this system includes:

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

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 marker, 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.

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

Indicates helpful tips or other important guidelines for correct use of the laser system. Failure to heed this advisory can result in malfunctions or problems with the device and additionally, can result in damage to areas or property in close proximity to the laser system.

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 system.

General Information

This laser system incorporates a **class 4 laser** (solid-state) with a high-powered optical output. **This device emits both visible and invisible radiation;** the invisible radiation generated during use produces **a wavelength of 1050–1090nm (near infrared range) and is not detectable by the human eye**. In addition, the visible secondary radiation that is emitted from this device can cause dazzle effects when viewed for any length of time.

<u>When working with direct access to the laser beam (for general use, maintenance or repair) appropriate laser protective eyewear must always be worn</u>. 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 labeling for the device.

<u>When operating laser equipment, appropriate protective eyewear - which protects against direct, reflected, and scattered radiation, is required</u>; however, even while wearing protective eyewear, you should remain cautious, never looking directly into the laser beam, as intense laser light is capable of destroying the delicate tissues of the eye. (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.)

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 8mJ/cm^2. The maximum permissible exposure (MPE) @10s is 185nJ/cm^2. The Nominal Ocular Hazard Distance (NOHA) is 24m from the laser's focus (163mm focus lens @10s exposure).

Although the skin can withstand considerably higher radiation intensity than the tissue of the eye, burning destroys tissue. The severityand 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 marker, be sure to complete the following steps right away:

- Turn “off” the device’s **mains 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 to catching fire and precautions 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.

Fundamental Safety Information

The guidelines below ensure safe operation when using the laser system:

- Read this manual; it contains guidelines and important information for ensuring the safety of the operator and outlines procedures for proper use of the system.
- Anyone who works with or operates the laser system must be informed of pertinent safety information and applicable safety regulations; this is a prerequisite for safe, trouble-free operation of this system.
- Anyone who works with or operates the system 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. In addition, all regulations set forth by OHSA, 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 and must be strictly adhered to. Lastly, be sure to stay informed on all required state, municipalities, and local regulations and requirements.

Organizational Measures

Specific guidelines and policies must be upheld to ensure the safety and wellbeing of personel who work with and operate the system. Organizational responsibilities and expectations are as follows:

- The employer must provide 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 system must be serviced at regular intervals and maintained as instructed within this manual.

Employer Requirements

Only authorized personnel who have received adequate training are permitted to work with and operate the system. Employers are responsible for ensuring that all operating personel:

- Have familiarity with important regulations regarding workplace safety 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 relevant topics, such as operation, safety, and best practices for using the laser system.

Personnel Requirements

Employees who are trained and authorized to work with the laser system are expected to:

- Comply with important regulations concerning workplace safety and accident prevention for laser radiation, OHSA 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 detailed throughout this manual; employees should sign and acknowledge that these requirements have been met.

Potential Equipment Dangers

This laser system 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.

The laser workstation must only be used for its intended purpose as outlined in this manual (see details on proper usage). In addition, the laser system 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 system must all be checked to ensure that they are functional and appropriately affixed to the device.
- Safety mechanisms may only be removed when the laser system has been switched “off” and appropriate measures have been taken to prevent the laser system from being restarted. **(Note: The interlock switches can be bypassed by our service technicians and authorized specialists, if needed, but only while making adjustments and carrying out maintenance and other service-related tasks.)**

Informal Safety Measures

The operating instructions for the 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 laser system must remain intact, legible, and accessible (see the section entitled “Labeling”).

Personnel Training

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 system.

Trainees are only permitted to use the laser system while under the supervision of an experienced user.

Safety Measures for Normal Use

- Before using the laser system, you must verify that all of the safety mechanisms (remote interlock, chamber enclosure, front door safety interlock, laser protective eyewear, etc.) are in proper order and functional.
- Be sure to check the laser system at least once a week for external damage and to ensure soundness of all safety mechanisms and other components are properly functioning (e.g. splash-protective observation window, laser protective window, interlock circuits, chamber enclosure, chamber access door). **The laser system must only be used after routine safety checks are performed and the laser system is deemed to be in safe and operable condition.**

Electric Shock Danger

- **Only authorized personnel are permitted to carry out maintenance 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; various warning labels and their location on the laser system are described in the section entitled, "Labeling."**
- **The system integrates a class 4 laser; therefore, appropriate safety eyewear is required and must be worn at all times.**

- **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 workpiece 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 device on non-metallic materials, especially plastics, without the use of an approved external fume and heavy particle exhaust filtration system.**

Equipment Modifications

+ **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 laser system 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® will meet stipulated requirements.**

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 laser system.

With ongoing training and experience in the field of laser radiation, the Laser Safety Officer should be fully competent in operating the workstation. In addition, this person should **be knowledgable and informed on all important safety protocols for the laser system, 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 laser system, 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®.

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.

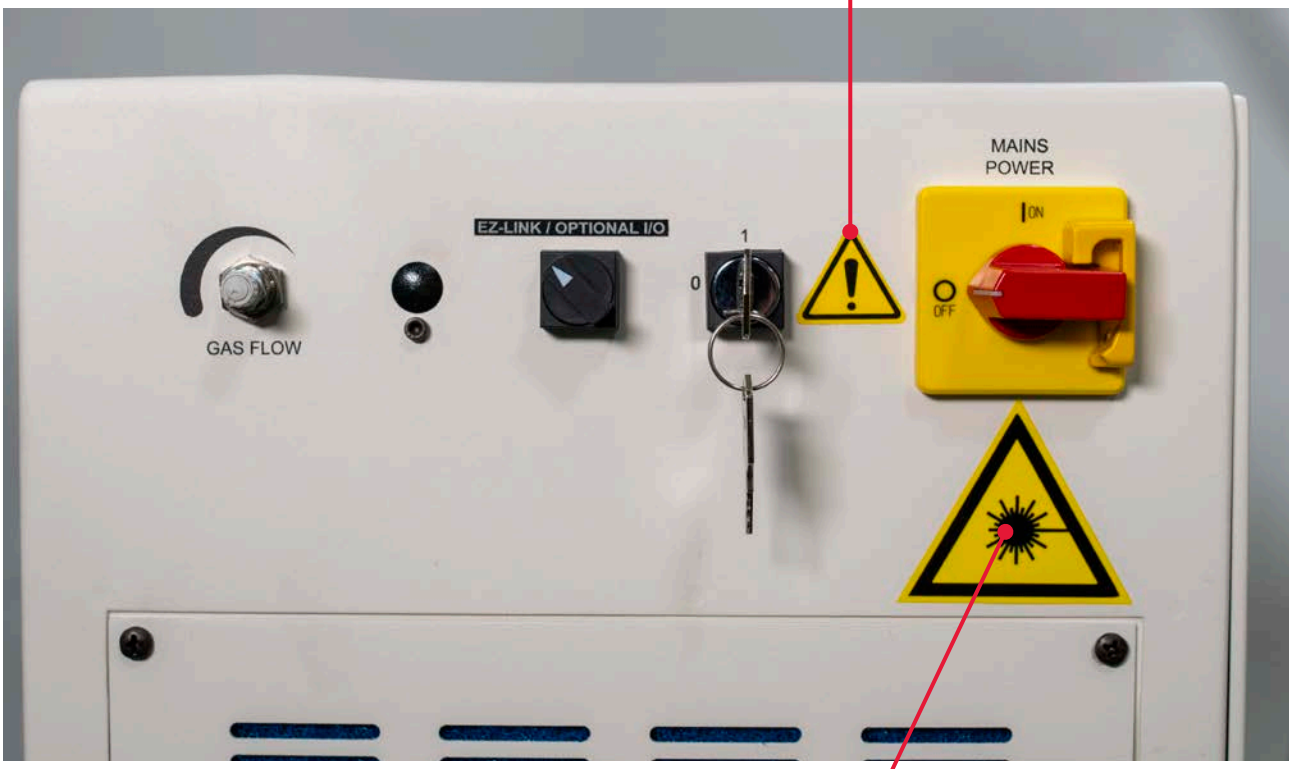
Scattered Radiation!

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 1070nm) is regarded as physiologically safe; in this instance, infrared light is comparable with radiation from the sun.

Notes

Important Safety & Informational Labels



[810-8001-10]
Operator Must Read the Manual <u>Prior</u> to Use.

[810-00-019]

Figure 1
(3803 Series; laser source front view)

Important Safety & Informational Labels (continued)

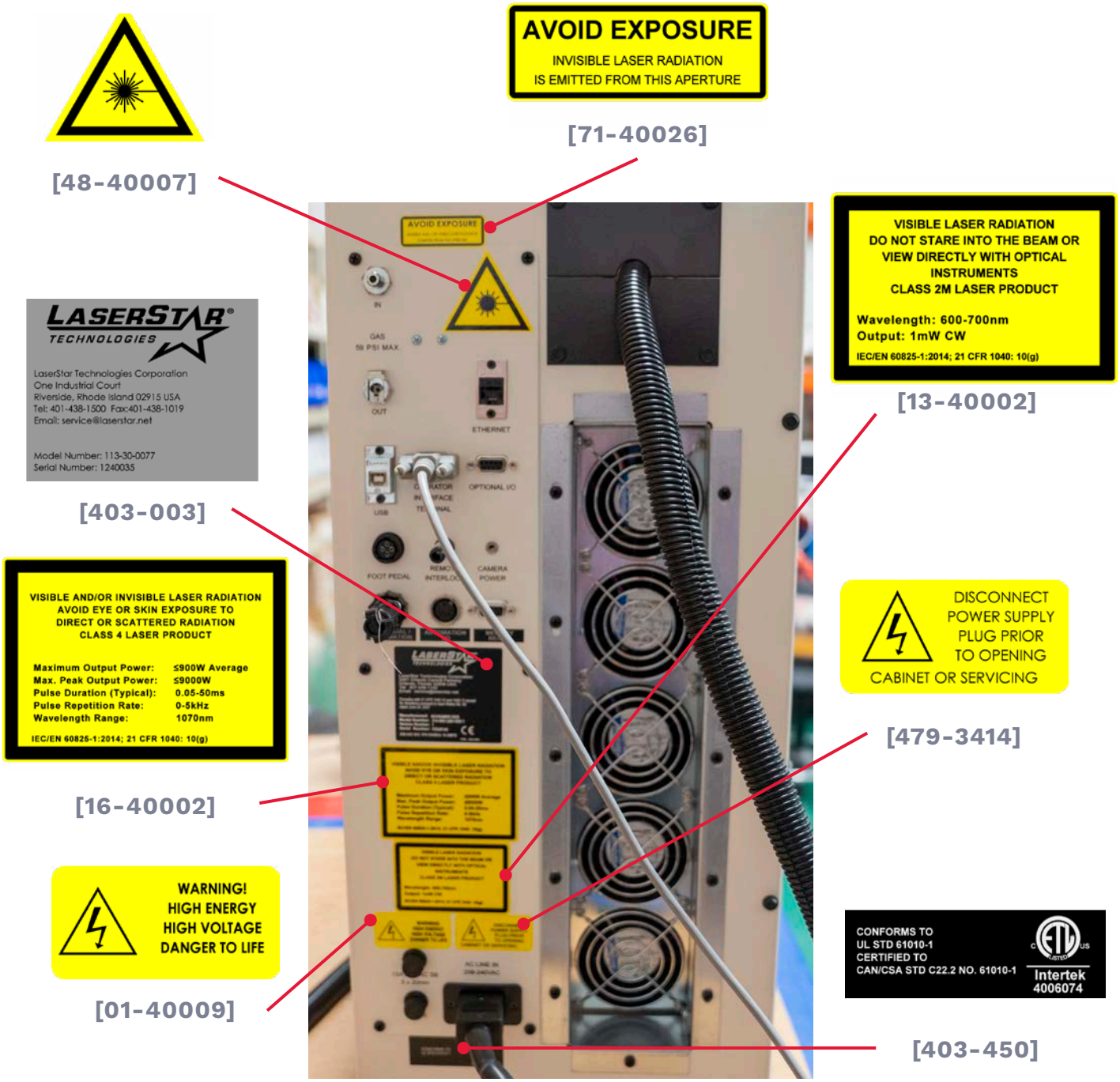


Figure 2
(3803 Series; laser source rear view)

Important Safety & Informational Labels (continued)

Figure 3
(3803 Series; laser source right view)

Figure 4
(8801 Series; table left view)

Important Safety & Informational Labels (continued)

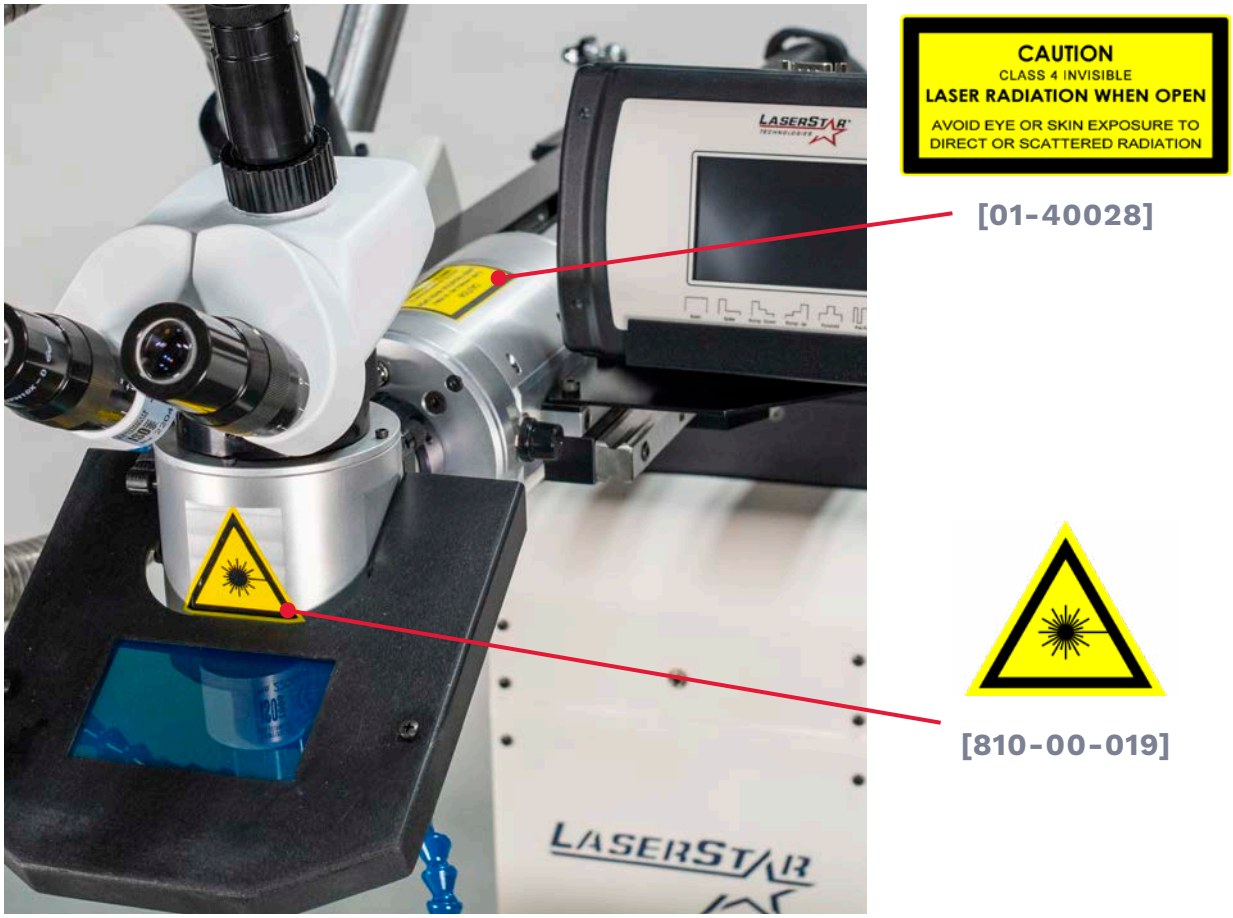


Figure 5
(8801 Series;
laser rail)

Figure 6
(8801 Series;
table back view)

Important Safety & Informational Labels (continued)

Figure 7
(8801 Series;
table front view)

[810-00-021]
(Also on the sides)

Notes

III. Installation

Overview & Requirements

This section describes the requirements that must be fulfilled to ensure faultless operation of the laser system. Details for installation, setup, and transport are detailed in this chapter.

Safety Guidelines

To ensure faultless operation of this system, specific measures must be implemented to promote safety and encourage sound operational practices. In an effort to safeguard against accidents, an installation site must meet and abide by the following rules and requirements:

- The system should be installed and remain in a location that is as dust-free as possible.
- Never expose this system to direct sunlight.
- To ensure proper ventilation, a **required clearance between this device 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 laser system's disconnecting device.
- **This device is required to be connected to an approved external filtration and fume exhaust system** (either purchased separately or sold through LaserStar Technologies Corporation®). For additional details about this requirement, be sure to reach out to your sales representative.

When choosing an installation site, be sure to 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**)

Environmental Conditions

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

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

Unpacking

Before shipping, this system underwent a thorough inspection process and rigorous software testing. This system has been delivered to the shipping carrier 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 occured in transit.

- If possible, use the supplied skid to transport the device to its final destination (the intended installation site).
- When unpacking the equipment and removing components from the shipping container, packaging, and skid base, be sure to use exceptional care.
- For helpful tips and step-by-step instructions on setup, be sure to reference the quick setup guide, which you can access by scanning the QR Code provided with your laser system.

Standard Shipping Container Contents

- LaserStar® Workstation (stand-alone; without accessories)
- Viewing System
- Basic Device Components and Hardware
- Motion Devices (optional)
- Operation Manual (digitized version; included on flash drive)

(Note: Orders can include additional accessories [add-ons that were purchased separately] Following delivery, be sure to reference the included packing slip and compare with parts received.)

Initial Power Connections

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 laser system and compare with the power conditions at the installation site.

AC Voltage Input (AC disconnect)

The AC voltage input is used to supply AC power to the workstation; removing this plug will disconnect the AC power from the equipment. Each of the laser system's switches (**mains power switch**, **system key switch**, and **setup key switch**) should be in the “off” position before applying AC voltage.

The laser system’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 system). This label includes important information for your laser system, including the device’s model number, serial number, and AC requirements. **Attention: Make sure the laser system is grounded; the ground wire must be connected for safe and reliable operation. When power requirements exceed 1kV on the AC line, surge suppression is required.**

When replacing the detachable mains supply cord, it’s important that the new cord be appropriately rated and suitable for the required or anticipated electrical load. Be sure to check the rating for the replacement cord before purchase; **never use or purchase cords that lack an appropriate rating**.

External Exhaust System

All **Class 1** devices are 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 used) 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]).

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 laser system’s filters before the change filter indicator is red.

Inert Gas: Pressure & Flow Regulation		
Operating Pressure (maximum)	**Operating Pressure (minimum)**	**Flow Range (typical)**
2 bar (29 psi; 0.2 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.)

Electromagnetic Compatibility

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

The limiting values for the generation of electromagnetic disturbance will be exceeded at both ends of the frequency spectrum whenever this device is operated within locations for residential, office, or trade and commerce districts

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.

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**.

Welding Shield Instructions

There are two threaded holes on each side of the laser head. The welding shield will attach there using the (4)-88-53801-410 (M410 Screw) and the (4)-88-20311-4 (Lock washer).

<u>Attention</u>: Do not use the shield to move the rail and do not lean on the shield.

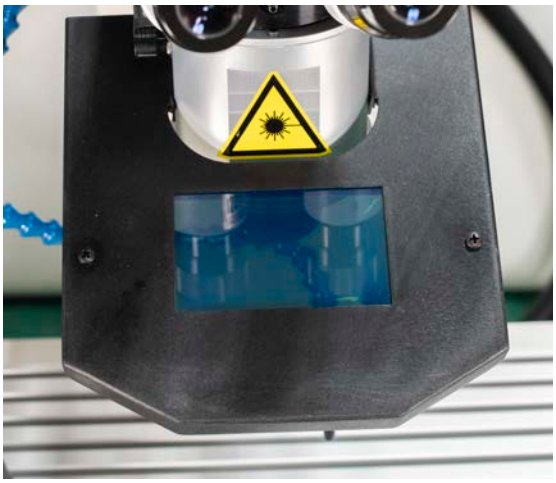


Figure 1
(Welding Shield)

Laser Engine Installation

1. Open the packaging. When unboxing the laser engine, be careful to not kink the fiber line.
2. Connect the laser engine power cable (230V).
3. The Operator Interface Terminal (OIT) connects to the Terminal port on the back of the laser engine.
4. Once the laser engine is turned on the OIT will display a start up screen. After a quick boot-up sequence the laser parameter screen will appear.

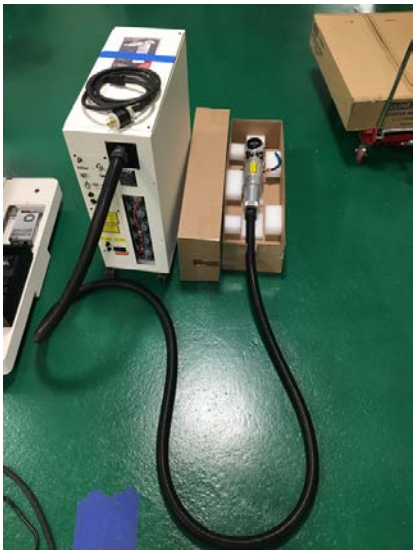


Figure 2
(8801 Series;
Laser Engine
Open Package)

Figure 3
(8801 Series;
Laser Engine
Power Cable)

Figure 4
(8801 Series;
OIT, Powered Down)

Figure 5
(8801 Series;
OIT, Powered On)

Laser Head Installation

When positioning the laser head for the mounting step be careful not to kink the laser fiber or else the laser may not function and need repairing.

Attach the mounting blocks to both sides of the laser head by screwing the socket head screws provided. Then line up the holes with the holes on the laser arm.

Secure the laser head to the arm with the socket head screws [M5x25 mm (88-53801-525) + m5 washer (88-20101-5)] on the underside of the laser arm as shown in the following images.

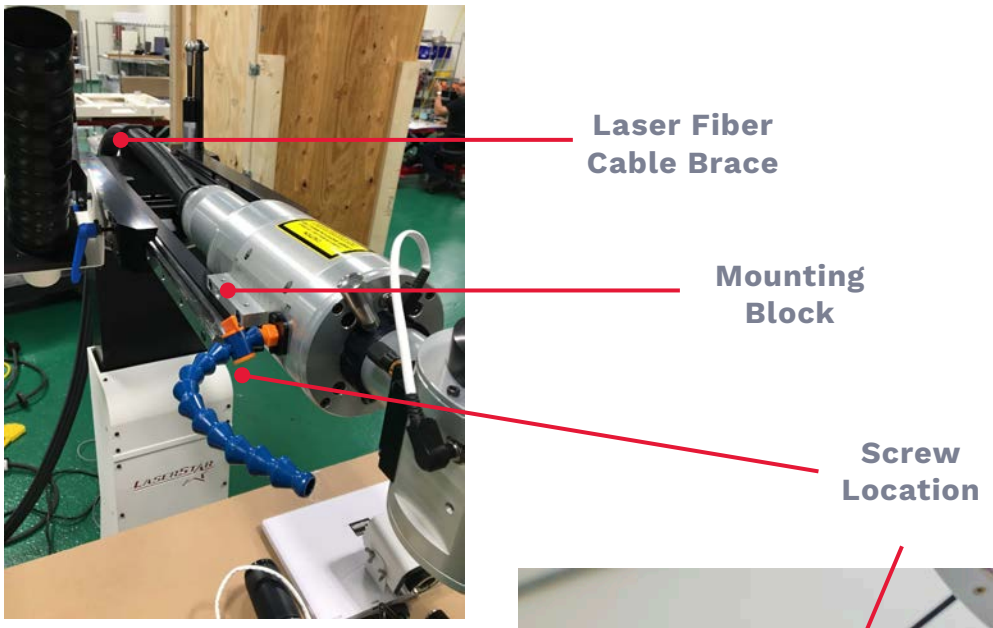


Figure 6
(Laser Rail Installation)

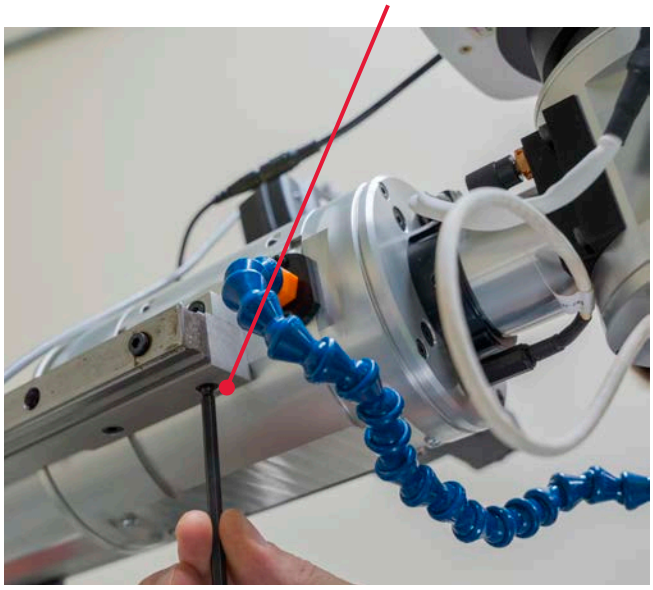


Figure 7
(Laser Rail Screws)

Laser Head Installation (continued)

Once the laser head is mounted tightly, clamp down the fiber cable in the bracket at the back of the laser arm.

Figure 8
(Fiber Cable Brace: Open)

Figure 9
(Fiber Cable Brace: Placed)

Locking Brakes

Caution!

The FiberStar Welding System should be installed vertically. Once the laser is wheeled to the final location, the brakes can then be set. To set the brakes push the brake tab in the downward position. To release the brakes, move the brake tabs in the upward position.

Motion table should be leveled to the world using adjustable leveling feet. Feet are adjusted by turning orange knob located at each wheel.

Caution!

All four brakes must be in the upward position prior to wheeling the laser. Pushing or moving the laser with the breaks down may cause damage to the brakes.

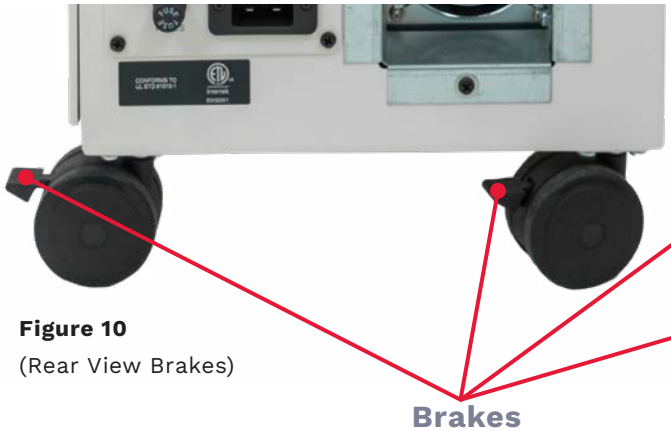


Figure 10
(Rear View Brakes)

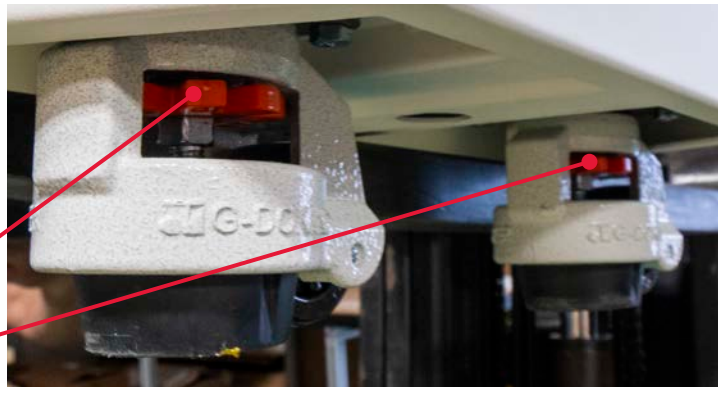


Figure 11
(Motion Table Brakes:
Model might not match)

Viewing System Installation

Model dependent. Actual equipment may not look as shown.

The lens can be screwed into the laser head. The microscope can be installed by placing it into the hole on top of the laser head and tighten the screws on either side of the mountaing ring.

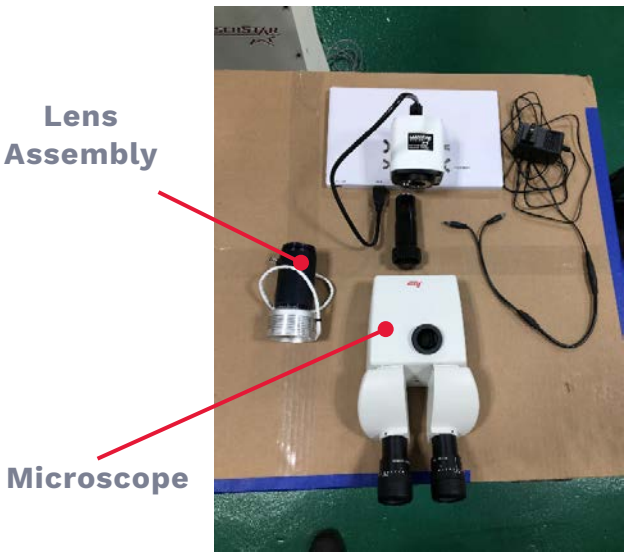


Figure 12
(Viewing System, separated)

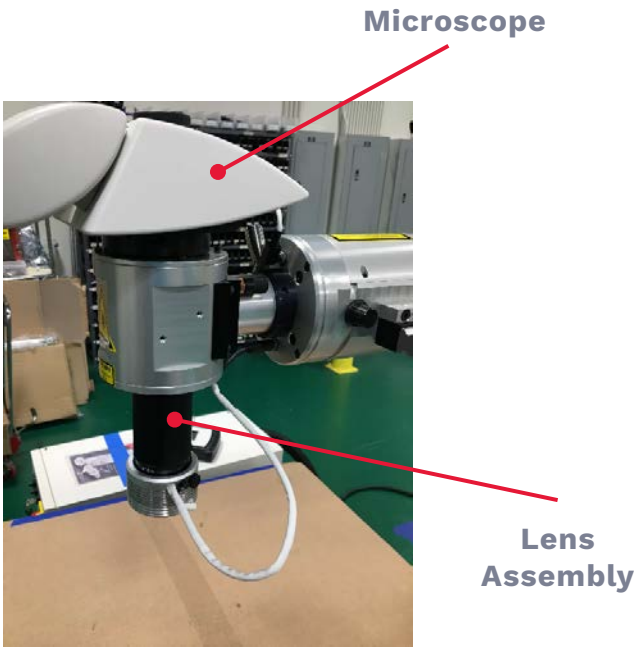


Figure 13
(Viewing System, installed)

Figure 14
(Microscope screen [optional])

Figure 15
(Microscope screen; installed)

Notes

Notes

IV. Operation

Overview and Reminders

This section describes systems operations. The (>) symbol notes actions that must be carried out by the operator. In most cases, these actions (in any form) will result in equipment responses or reactions ; these responses are noted with a (⊗) symbol. The welder can be operated using the touchscreen display or alternatively, the joystick control. The buttons on the touchscreen (each represented with an icon, pictogram or text) are used to initiate an action or function when pressed.

Whenever adjustments are made to this device that alter performance or use of the controls (adjustments which affect safety or interfere with standard operating protocols; other than those specified herein), this can result in hazardous radiation exposure. If this device is operated in a manner that has not been approved by the manufacturer, the equipment protections could fail, compromising the safety of the operator or others who are nearby. Before operating this device, all users must be sure to read the section within this manual on safety.

Attention: To ensure optimum performance, the laser source should be turned on and allowed time to warm up for at least 5 minutes; 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 laser system can be found in Section 1: Introduction > Technical Specifications.

In an effort to preserve the touchscreen display and extend the lifetime and functionality of the workstation, you should refrain from using inappropriate items (pencils, pens, pointer devices) to press buttons or interact with the digital display. Using these and other items not intended for use with digital devices can cause the touchscreen display to malfunction. This can result in erratic or faulty operation and will also void the laser system's warranty. When pressing buttons and interacting with the touchscreen display, be sure to use only your fingers (not finger nails) or the provided stylus pen that's been included with the workstation.

Operating Modes Continued on Next Page

Operating Modes (pulse and CW)

While operating the welding workstation, there are two (2) options for pulse mode that can be utilized—STD and Micro-pulse mode (CW).

When using STD pulse mode, maximum peak power is delivered while the laser is in use, however, maximum pulse duration and maximum duty-cycle are limited to specific values. Conversely, Micro-pulse mode (CW) uses a lower peak power, but this mode supports any available pulse profile shape (reference the section on Pulse Performance (P3) Technology.

(Note: When using Micro-pulse mode (CW), there's an option to enable Continuous Wave (CW) pulse mode. While enabled [and when the foot pedal is depressed], this device will generate continuous peak power output [shown in watts (W) on the touchscreen display]).

With STD pulse mode, there are four (4) pulse shapes available for use: Basic, Ramp Down, Spike, and Burst.

- STD pulse mode: With this mode, maximum peak power is considerably higher than with Micro-pulse or Continuous mode, however, maximum pulse duration and duty-cycle are both limited to specific values. With STD mode, output energy is measured in joules (J).
- Micro-pulse mode: In this CW mode, maximum peak power is reduced, while average power is increased.

While using micro-pulse mode, there are two (2) variations for the pulse mode that can be utilized:

- Micro-pulse (CW): All P^3 technology pulse shapes can be used in this mode. With Micro-pulse (CW), the output energy is measured in joules (J).
- Continuous (CW): With Continuous mode, the laser generates a continuous output while the foot pedal is depressed. The output power for Continuous (CW) is measured in watts (W).

Notes

Figure 1
(Software screen;
main menu)

Switching from Micro-pulse Mode to STD Pulse Mode

Press the **Menu button** > Press the **down arrow**; select **STD pulse mode** > Press the **Enter button** > Press the **up** or **down arrows**; scroll to “STD” > Press the **Enter button** > Press the **Exit button** twice (2) to return to the **main menu**.

Figure 2
(Micro-pulse
mode selected)

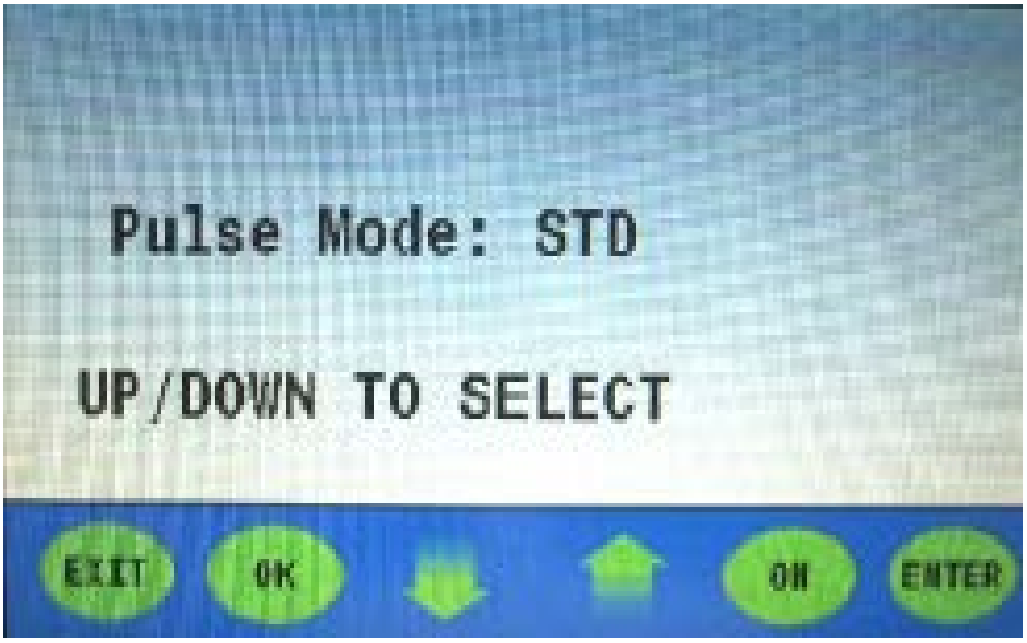


Figure 3
(Pulse mode changed;
micropulse mode to STD)

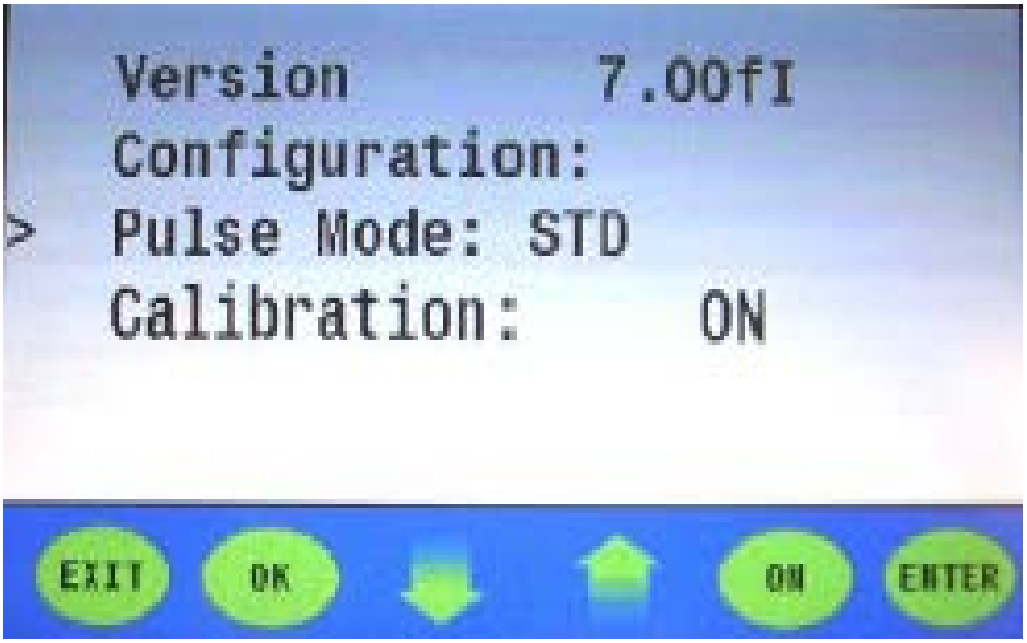


Figure 4
(STD pulse
mode selected)

With **STD (single-pulse) mode**, there are four (4) available pulse profiles to select from: **basic**, **ramp down**, **spike**, and **burst**; each of these profiles utilizes **Pulse Performance Profile (P³) Technology**.

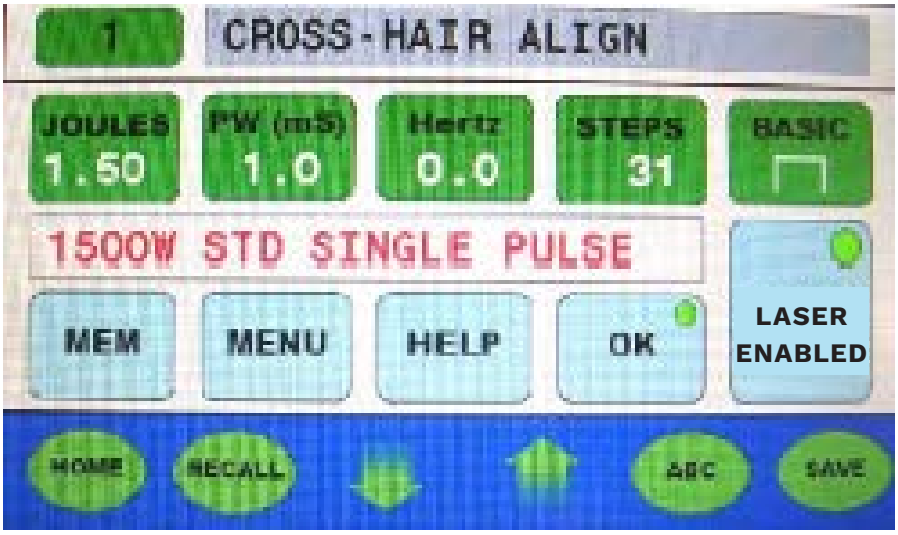


Figure 5
(STD [single-pulse]
mode)

With **STD (multi-pulse) mode**, there are four (4) available pulse profiles to choose from. Just like with **STD (single-pulse) mode**, available pulse profiles include: **basic**, **ramp down**, **spike**, and **burst**. Each of these options also make use of **Pulse Performance Profile (P³) Technology**.

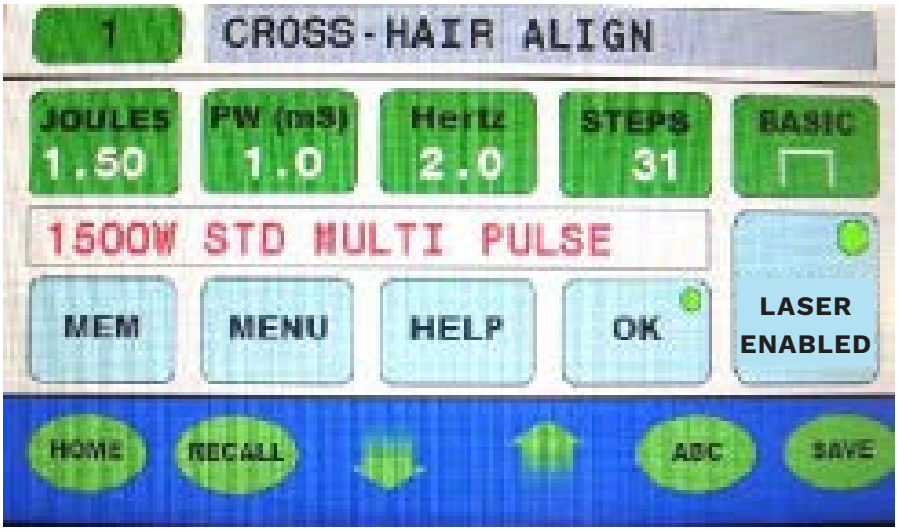


Figure 6
(STD [multi-pulse]
mode)

Enabling Micro-pulse Mode

Press the **Menu button** > Select **STD pulse mode** > Press the **Enter button** > Press the **up** or **down arrows**; scroll to “Micro” > Press the **Enter button** > Press the **Exit button** twice (2) to return to the **main menu**.

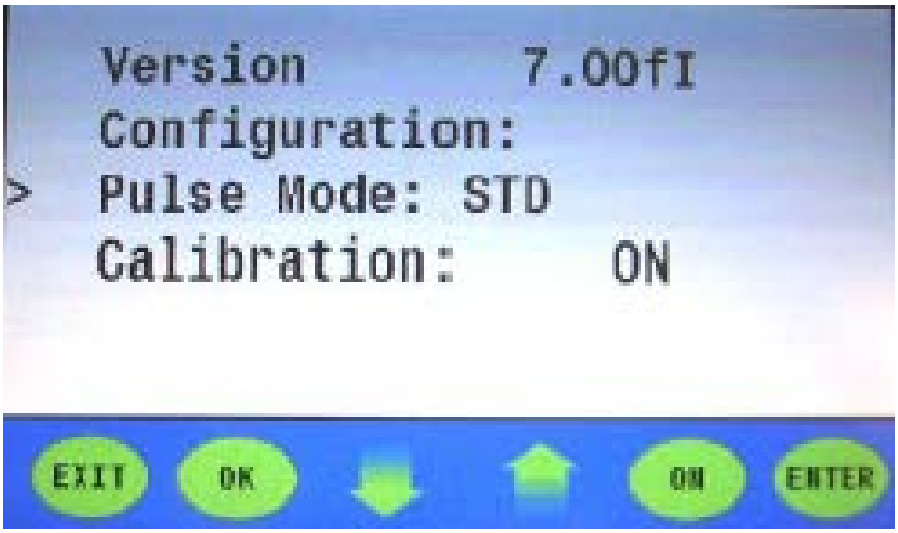


Figure 7
(STD pulse mode selected)

Figure 8
(Pulse mode changed; STD to Micro-pulse mode)

Figure 9
(Micro-pulse
mode selected)

Using Micro (single-pulse) Mode

With **Micro (single-pulse) mode**, all available pulse profiles (utilizing **Pulse Performance Profile [P³] Technology**) may be used. While in this mode, pulse width can range, however, once pulse width exceeds 50mS, only the **Basic** and **Burst profiles** are made accessible.

Figure 10
(Micro [single-pulse]
mode selected)

Using Micro (multi-pulse) Mode

Similar to **Micro (single-pulse) mode**, with **Micro (multi-pulse) mode**, all available pulse profiles (utilizing **Pulse Performance Profile [P³] Technology**) may be used. While in this mode, pulse width can range, however, once pulse width exceeds 50mS, only the **Basic** and **Burst profiles** are made accessible.

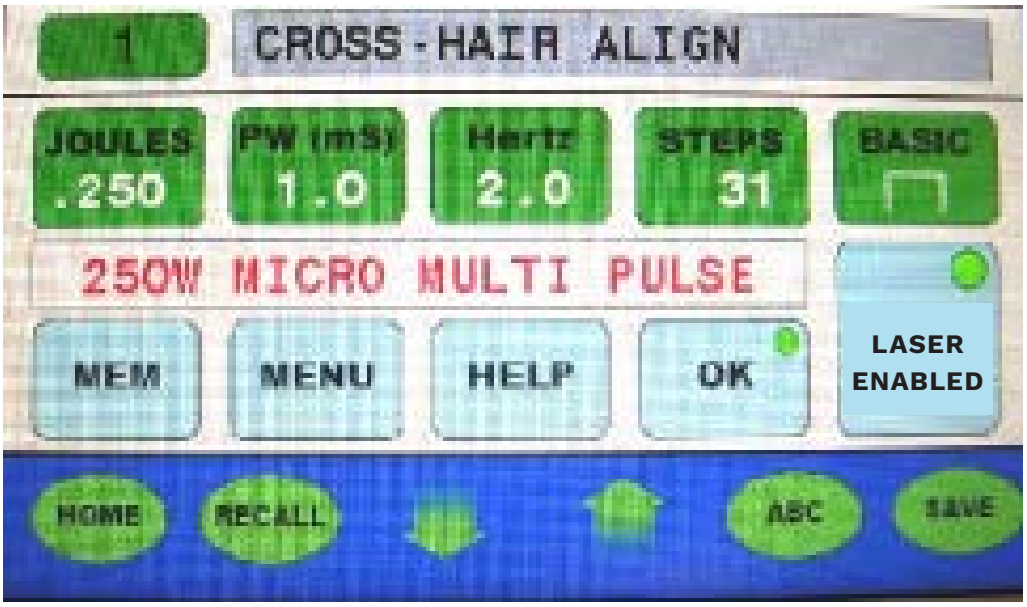


Figure 11
(Micro [multi-pulse]
mode selected)

Notes

Using Continuous Wave (CW) Mode

When accessing **Continuous Wave (CW) mode**, you must first select can **Micro-pulse mode**. Next, using the **up arrow**, scroll through the available options until “CW” is displayed on the PW (mS) button. (Note: The last number that displays on the **PW button** [before entering CW mode] is 75 mS.) The message area on the touchscreen display will show the current selection — **Continuous Wave (CW) mode**. While in this mode (and when the foot pedal is depressed), this device will generate continuous peak power output (shown in watts [W] on the touchscreen display).

Figure 12
(Continuous Wave
[CW] mode)

Notes

Calibration “On” or “Off”

Calibration is a configuration process and it's important for maintaining the workstation and the accuracy of the laser. Calibration can either be turned “on” or “off.” While “on” is displayed on the touchscreen, the STD and Micro-pulse modes are calibrated (each mode has a separate calibration file). When “CAL” is displayed, the workstation is in the correct mode to receive calibration, if needed. Keep in mind, “CAL” should only be selected when calibration is required (this is not a work mode). For additional details on calibration, including step-by-step instructions on this process, be sure to review the section in this manual titled: “**Gain and Calibration**.”

Enabling Calibration: Micro-pulse Mode

1. Press the **Menu button**.
2. Press the **down arrow**; select **Calibration**. Press the **Enter button**.
3. Press the **up** or **down arrows**; scroll to “ON.” Press the **Enter button**.
4. Press the **Exit button** twice (2) to return to the **main menu**.

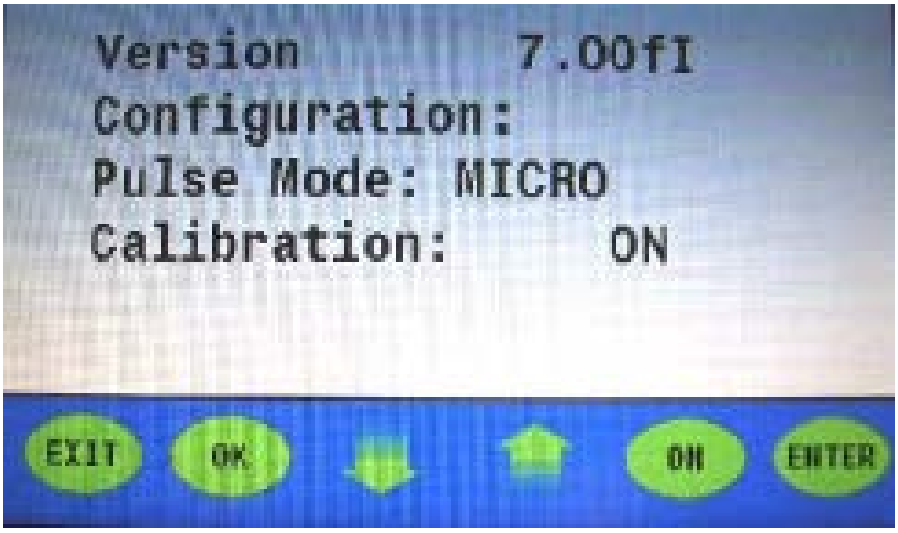


Figure 13
(Micro-pulse mode;
calibration “ON”)

Enabling Calibration: STD Pulse Mode

1. Press the **menu button**
2. Press the **down arrow**; select **calibration**. Press the **enter button**.
3. Press the **up** or **down arrows**; scroll to “on.” Press the **enter button**.
4. Press the **exit button** twice (x2) to return to the **main menu**.

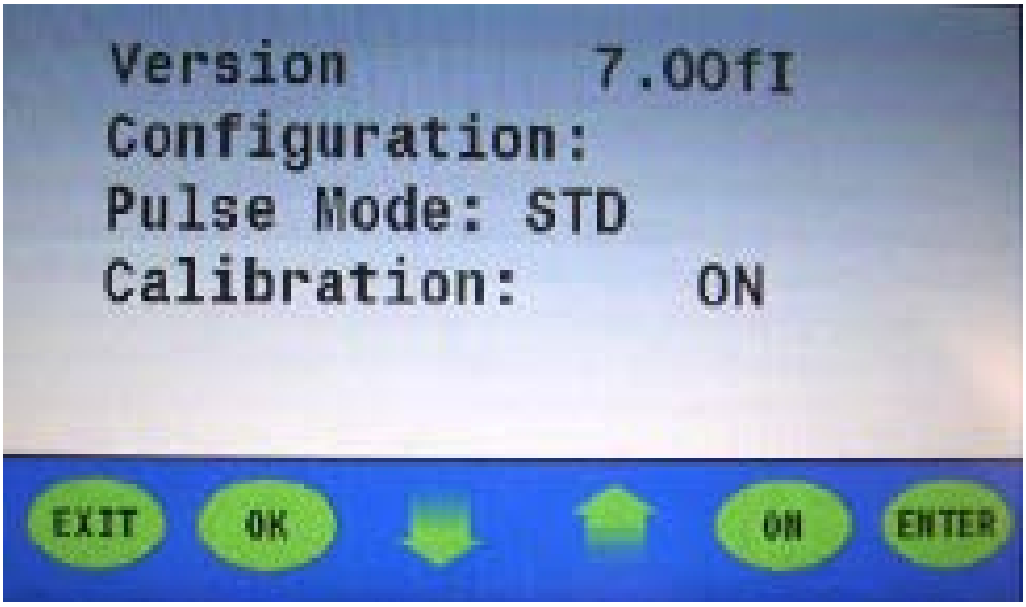


Figure 14
(STD pulse mode;
calibration “on”)

Initial Operation

After having read and understood this chapter and additionally, having completed all steps described in **Installation**, the welder is ready for use. For detailed instructions on enabling power to the workstation, reference the diagrams below and the table on the next page.

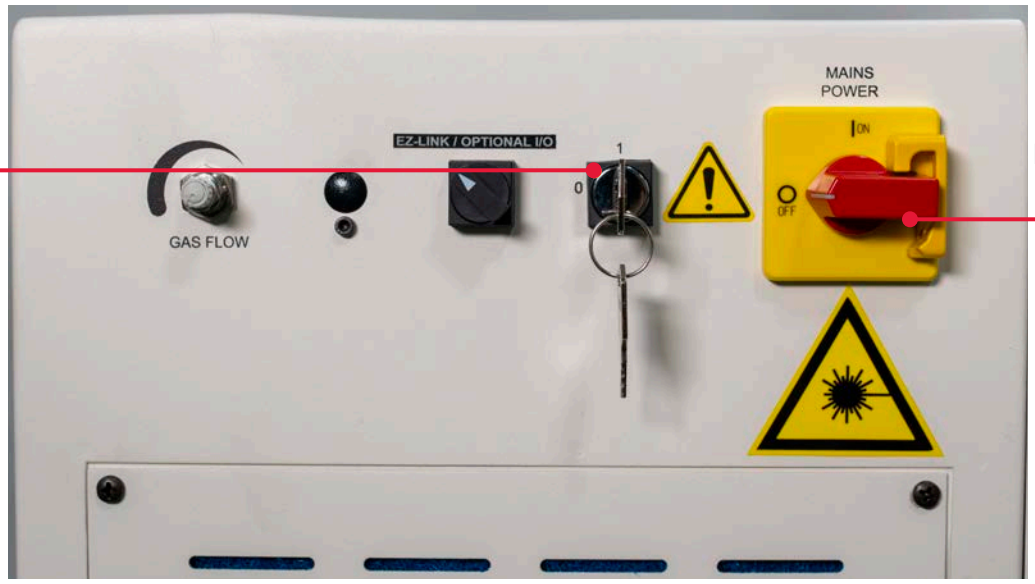


Figure 15
(Switching “ON”)

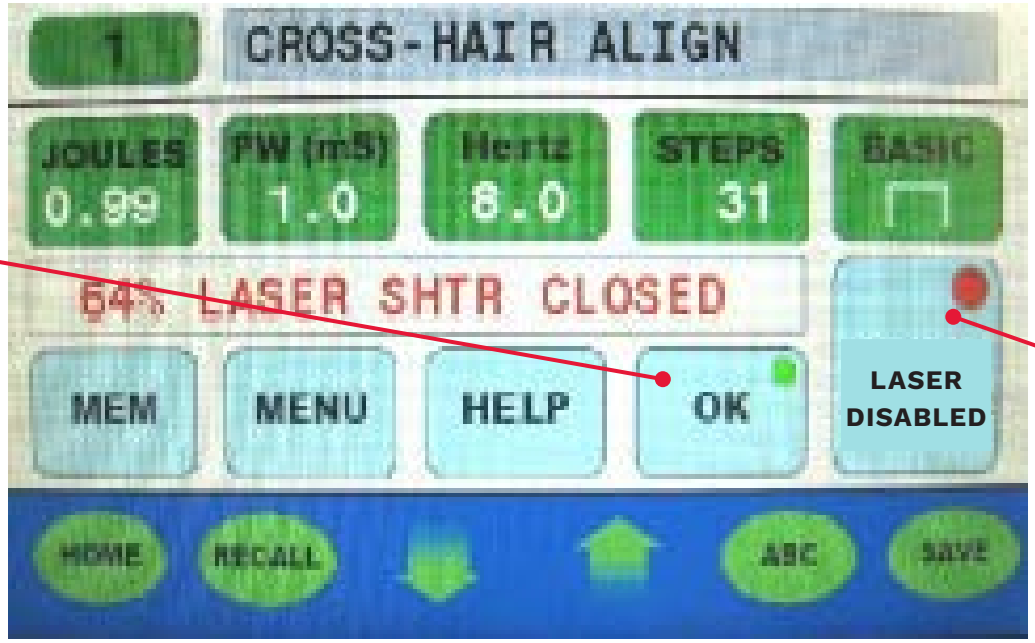


Figure 16
(Main menu;
touchscreen display)

Switching “On” the Welder

Operator Action	System Response
Make sure the **system key switch** is in the “off” or “O” position (see **figure 15** on the previous page).	
Turn the **mains power switch** “on” or to the “I” position (see **figure 15** on the previous page).	The touchscreen display will turn “on.” **(Note: If the system key switch is not immediately turned “on” after the mains power switch, an error will appear on the touchscreen display. To clear the error and resume powering “on” the device, turn the system key switch to the “on” or “I” position. Next, press the Home button.)**
Turn the **system key switch** “on” or to the “I” position (see **figure 15** on the previous page).	The welder is powered “on” and a series of self-tests are carried out — these self-tests check the device for malfunctions and ensure it's working properly. If a failure or system fault occurs during this process, an error message will appear on the touchscreen display (see the section entitled “**Status Indications**”). **(Note: Depending on the dimmer settings selected, you may notice the lights above the welding table turn "on")**
Wait for the self-test to complete before using the laser system (see **figure 16** on the previous page).	When the welder is ready for use, the indicator on the **OK button** will change from red to green.
Press the **laser enable/disable button** (located on the touchscreen display; see **figure 16** on the previous page).	When the laser is enabled, the indicator on the **laser enable/disable button** will change from red to green and say "laser enabled."
The welder remains idle for an extended period; the laser system enters energy-saver or sleep mode (see **figure 17** on the next page).	If the welder is left idle for an extended period of time (≥15 minutes), it will enter sleep mode; sleep mode helps to reduce the device's energy consumption.

Energy Saver or Sleep Mode

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

Figure 17
(Energy saver
or sleep mode)

Notes

Table Operation

Joystick Operation

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

Figure 18
(Joystick:
Forward Movement)

Figure 19
(Joystick:
Backward Movement)

Twist the top of the joystick counterclockwise to move the motion platform down, clockwise for up. Test the rotation jog by flipping the jog switch up and down on the table.

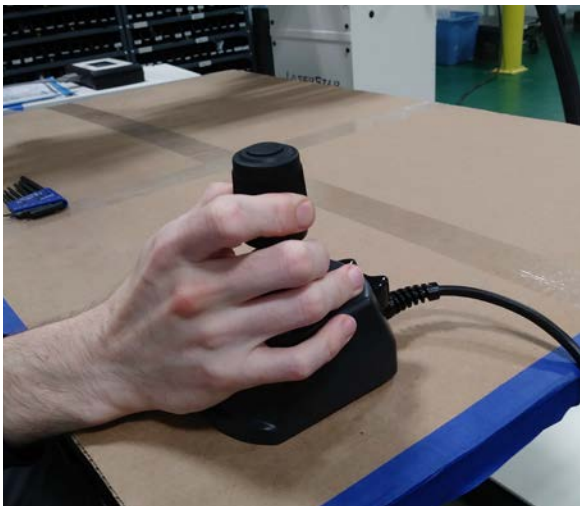


Figure 20
(Joystick: Twist to
Move Platform)

Figure 21
(Jog Rotation Switch)

Flexible Gas Lines

The flexible gas lines, 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 workstation 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, arms, and/or workpieces.

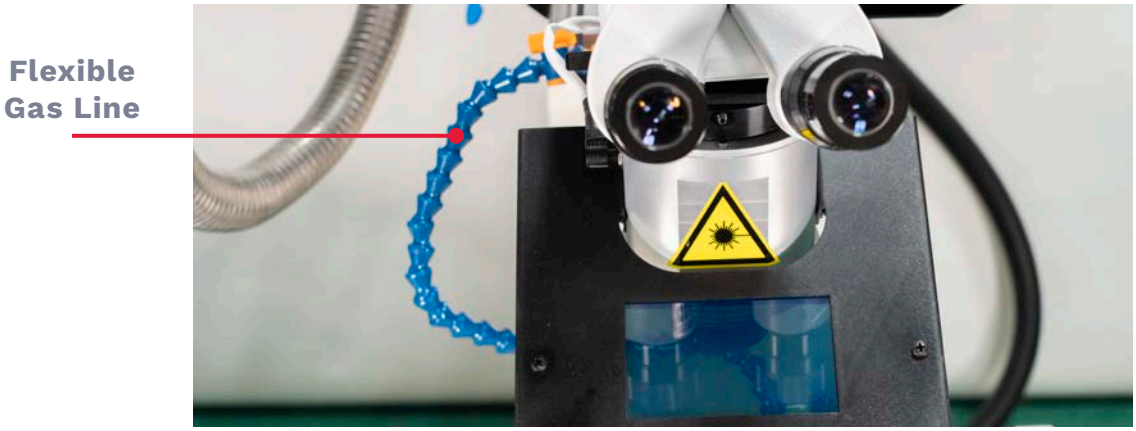


Figure 37
(8801 Laser Front)

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 any operator who wears (and reliably depends on) glasses or contacts to see and perform normal activities.

- Switch the welding workstation "on," using only the **mains power switch**; position "I".
- 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 into the visual field of the microscope. With the left eye open and the right eye closed, examine the workpiece through the left eyepiece. Check to be sure that the part appears sharp and in focus when viewed through the microscope.
- Look with the right eye through the right eyepiece. Turn the right-side adjustment ring so that the cross-hair appears in focus when viewed through the microscope's 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 the eyes in a relaxed state, observe the sample workpiece); a single rounded visual field should be present.

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

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.
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. Plug the microscope into the power input (located on the left-hand side of the welder; opposite the **mains power switch**).

Optical Alignment and Cross-hair Adjustment

1. Using an adjustable lab jack (tabletop scissor-lift platform) or equivalent device, bring the steel plate into focus.
2. Adjust the parameters to one of the following (the setting should be provided on recipe #79):
    - **0.230J 2.0ms 0 Hz 2.0 ms 20s Basic**
    - **0.090J 0.6ms 0 Hz 2.0 ms 20s Basic**
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.)

Optical Alignment Diagram

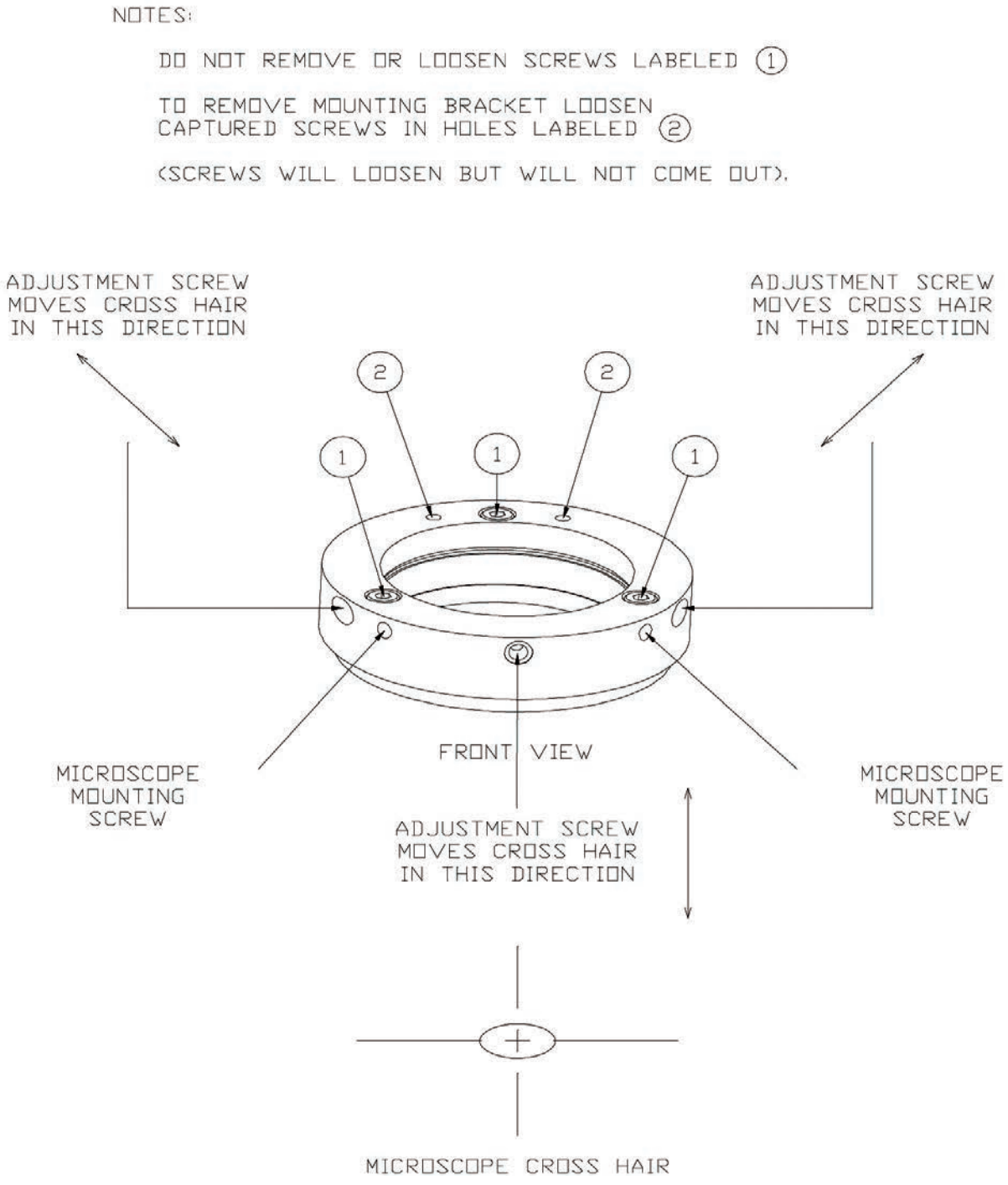


Figure 38
(Optical alignment diagram)

Setting Operating Parameters

Setting operating parameters can be achieved using either the touchscreen display or joystick control.

(Note: The laser enable/diable button, in conjunction with the joystick control, allows for specialized functions, which are defined in more detail later in this chapter.)

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.

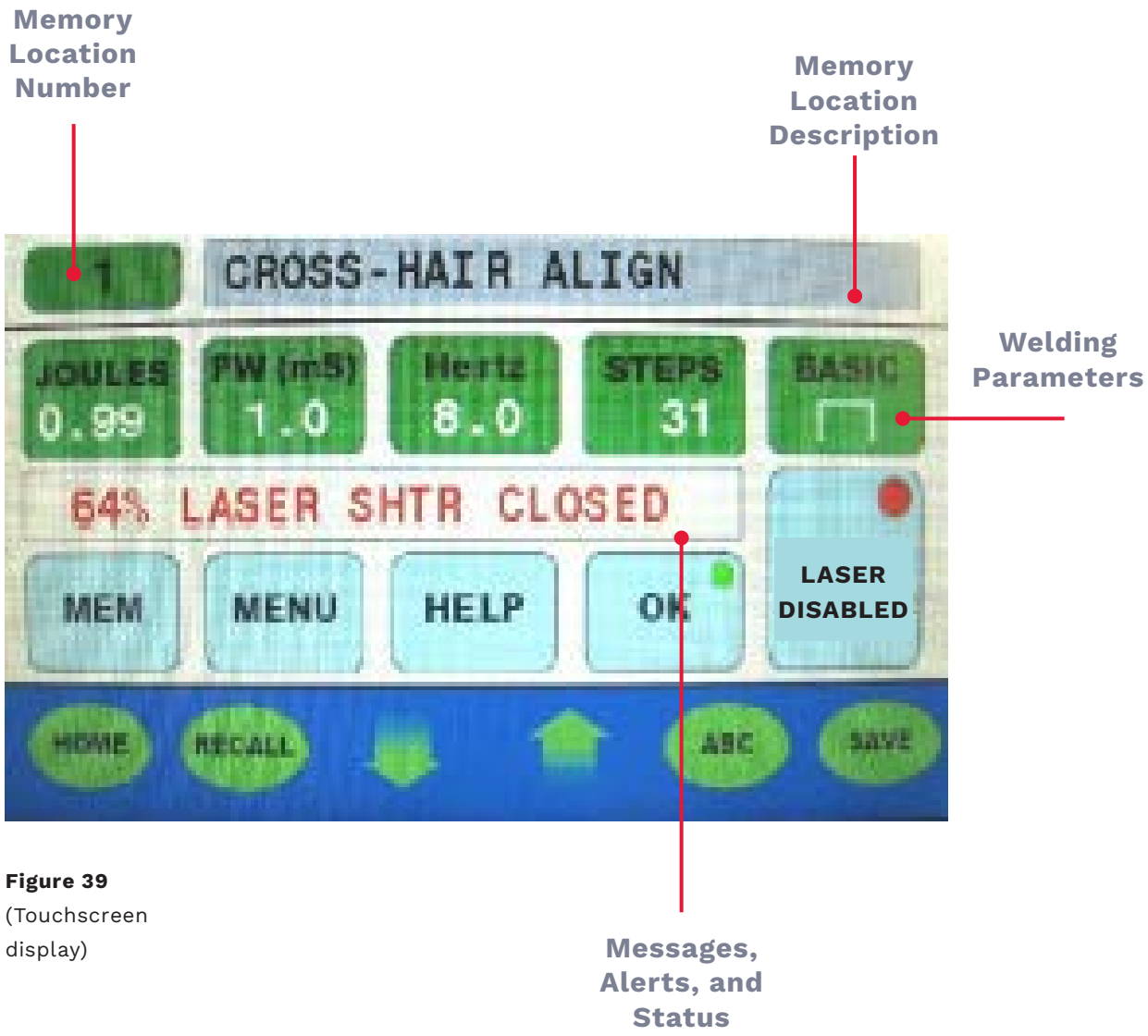


Figure 39
(Touchscreen display)

Messaging & Touchscreen Display Operation

Touchscreen Display Commands	
Buttons and Indicators	**System Response**
OK (see **figure 39** on the previous page)	Pressing the **OK button** confirms the current selection and parameters displayed; returns to the main screen.
OK (red)	The system is not ready to operate; the laser can not fire.
OK (green)	The system is ready to operate; the laser can fire.
Laser Disabled (red)	When the indicator for the **laser enable/disable button** is red, the laser is inactive. Press the **laser enable/disable button** so the laser is ready to fire.
Laser Enabled (green)	When the indicator for the **laser enable/disable button** is green, the laser is active. Press the **laser enable/disable button** so the laser does not fire.
Memory Location Number	Press the **memory location number button** to change the memory location number — the display will blink. Use the **up** or **down arrows** to change to the desired memory location number. Then, press **OK** (confirms selection; blinking stops). Press the **recall button** twice (×2) to load the stored values into the weld parameters. • yellow (indicates the weld parameters are from this memory location) • gray (indicates the weld parameters are not from this memory location) **(Note: Memory locations may be loaded with factory defaults.)**

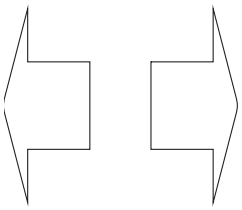
Messaging & Touchscreen Display Operation Continued on Next Page

Messaging & Touchscreen
Display Operation (continued)

Touchscreen Display Commands	
Buttons and Indicators	**System Response**
Menu	Press this button to navigate to the version or configuration display screen.
Menu Display Screen:	Use the **up** or **down arrows** to move the cursor (>) to the selected item. Press the **enter button** to enter the mode. Use the **up** or **down arrows** to change the mode (toggling “on” or “off”) or value (i.e. -0.50s). To store changes, press **Enter**. Press the **exit button** to return to the **main menu**. **Version**: ×××××× **Device Configuration**: **Version**: Alphanumeric **Pulse Mode**: STD or Micro **Calibration**: ON, CLR TABLE, GAIN & TABLE **Weld Gas**: “ON” or “OFF” (use the up or down arrows to adjust; press Enter) **Pre-weld Gas**: 0.00s (use the **up** or **down arrows** to adjust; press **Enter**) **Post-weld Gas**: 0.00s (use the **up** or **down arrows** to adjust; press **Enter**) **Sleep Mode**: Not applicable **Pulse Count**: 0 (use the **up** or **down arrows** to adjust) **Hours On**: 4.3 (no actions possible) **Pulse Total**: 0 (use the **up** or **down arrows** to adjust)

Messaging & Touchscreen
Display Operation Continued on Next Page

Touchscreen Display Commands

Buttons and Indicators	System Response
Version or configuration display screen (next page)	
OK	Pressing this button enters the selected item. Use the **up** or **down arrows** to change the mode. Then, press the **enter button** to store the results.
ON	Pressing this button will reset the pulse count, when the pulse count is selected.
Esc	Press this button to return to the device's **main menu**.
Clear	Pressing this button completely clears the memory location description.
	Pressing these arrows to select the alpha numeric characters.
Save	Press this button to save the memory location description.
BS	Press this button to delete the last character.
CAP	Press this button to change from upper or lowercase letters.
123	Press this button to change back and forth between letters and numbers.

Messaging & Touchscreen
Display Operation Continued on Next Page

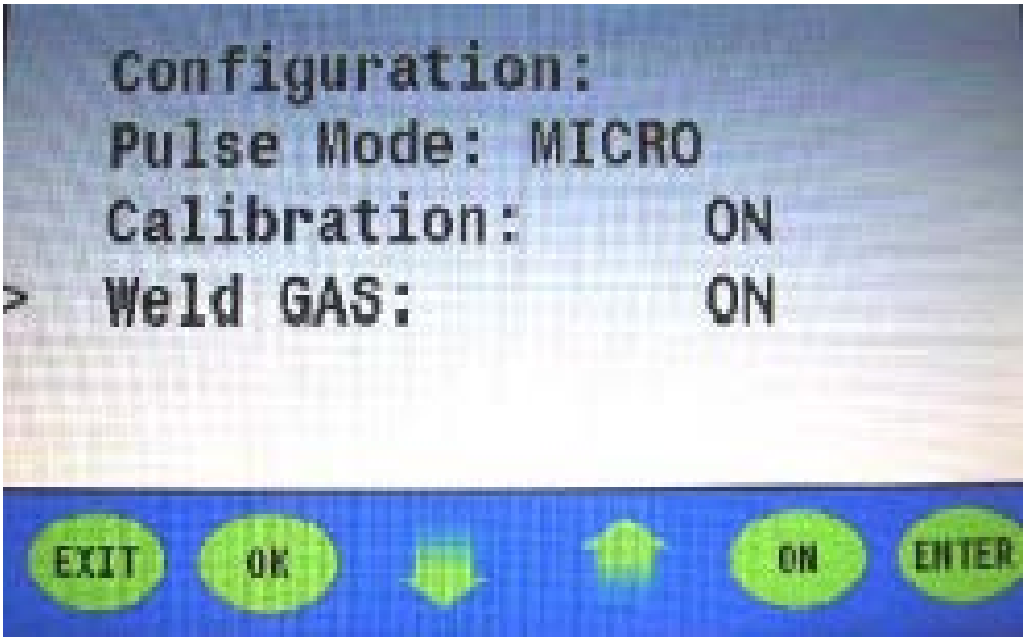


Figure 40
(Menu screen; scroll
to Weld GAS

Figure 41
(Main menu)

Messaging & Touchscreen Display Operation (continued)

Touchscreen Display Commands	
Buttons and Indicators	**System Response**
Memory Location Description	Displays the weld parameter description. + yellow (indicates the weld parameters are from this memory location) + gray (indicates the weld parameters are not from this memory location)
Welding Parameters • Joules (J) or Watts (W) • Pulse Width (PW [mS]) • Hertz , Burst or Pulse Suppression (optional and model specific)	Displays the current weld parameters: **Joules**: Press to change the value — the display will blink. Use the **up** or **down arrows** to adjust. Then, press **OK**. **(Note: Valid for all modes except CW Mode.)** **Watts**: Press to change the value — the display will blink. Use the **up** or **down arrows** to adjust. Then, press **OK**. **(Note: Valid only for CW Mode.)** **PW (mS)**: Press to change the value — the display will blink. Use the **up** or **down arrows** to adjust. Then, press **OK**. **Hertz, Burst or Pulse Suppression:** (Note: Use the **up** or **down arrows** to select Hertz, Burst or Pulse Suppression.) + Hertz: Press to change the value — the display will blink. Use the up or down arrows to adjust. Then, press OK. + Burst: Press to change the value—the display will blink. Use the up or down arrows to adjust. Then, press OK. + Pulse Suppression (optional and model specific): Press to change the value — the display will blink. Use the up or down arrows to adjust. Then, press OK.

Messaging & Touchscreen Display Operation Continued on Next Page

Touchscreen Display Commands	
Buttons and Indicators	**System Response**
Menu Display Screen (continued)	**Fault Lists**: (to view or clear, press the **"on" button**) **Restore Default Memory**: (use the **up** or **down arrows** to select an option) • **NO**: No change; press **enter**. • **ALL**: Reloads LST data with no change to user-defined memory locations; press the **enter button**. • **LST**: Reloads LST data and clears user-defined memory location; press the **enter button**. **Energy Usage**: 0 (use the **up** or **down arrows** to select an option) • **SHOW**: Press the **enter button**. • **SYS**: Press the **enter button**. • **CLEAR**: Press the **"on" button**. **Frequency Adjustment**: ×× (use the **up** or **down arrows** to select an option) **Beam Expander Offset**: ± 12 (use the **up** or **down arrows** to select an option; press the **Enter button**) **Password Summary**: **9** (use the **up** or **down arrows** to select an option; press the **Enter button**) **Diag**: Press the **On button**. **Back**: Press the **Enter button**.

Messaging & Touchscreen
Display Operation Continued on Next Page

Messaging & Touchscreen
Display Operation (continued)

Touchscreen Display Commands	
Buttons and Indicators	**System Response**
Menu Display Screen (continued)	(Note: If adjustments are not made within a reasonable timeframe, the device will return to the main screen.)
Enter	Pressing the enter button confirms a user selection. If necessary, changes can also be made using either the up or down arrows or by pressing "on." To store results, press enter.
Exit	Press this button once (×1) or twice (×2) to exit the version or configuration display screen and return to the main screen.
Welding Parameters • Pulse Spot Size (DIA [mm]) • Pulse Shape (see the section on **Pulse Performance Profile [P³] Technology**)	**DIA (mm)**: Press to change the value — the display will blink. Use the up or **down arrows** to adjust. Then, press **OK**. **Pulse Shape**: Press this button to change the value—the display will blink. Use the **up** or **down arrows** to adjust. Then, press **OK**. **(Note: If OK is not pressed, the selected operation will time out; the change will be stored.)**
Messages	Displays the laser system's status; lists details regarding error messages, memory parameters, laser status, etc.

Messaging & Touchscreen
Display Operation Continued on Next Page

Touchscreen Display Commands	
Buttons and Indicators	**System Response**
MEM (memory features) (see the **next page** that follow after these listed touchscreen display commands)	Displays stored parameters and a description for the memory location number, which can be found in the upper left-hand corner of the touchscreen display. Pressing the **clear button** allows the operator to clear the parameters and description for a selected memory location. **<u>Attention</u>: All information in this memory location, including factory defaults will be erased. To restore defaults, on the touchscreen, navigate to main menu > restore default memory > LST.** Displays a message to verify that the operator intends to clear the selected memory location. Pressing the **clear button** again will delete the memory. To return to the **main menu** without clearing the memory location, press the **home button**.

Messaging & Touchscreen
Display Operation Continued on Next Page

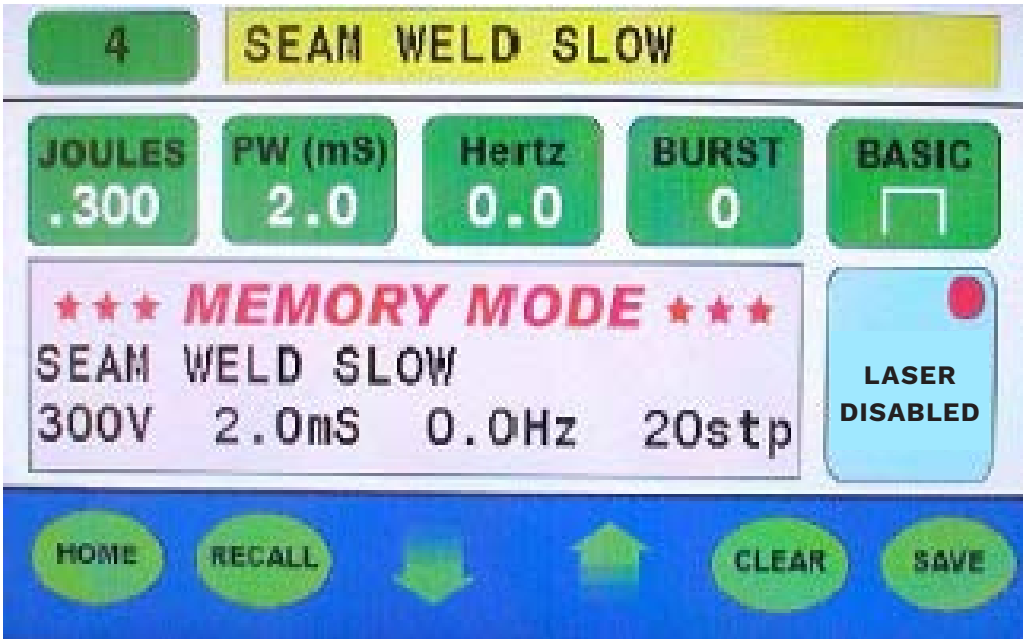


Figure 34a
(Memory mode)

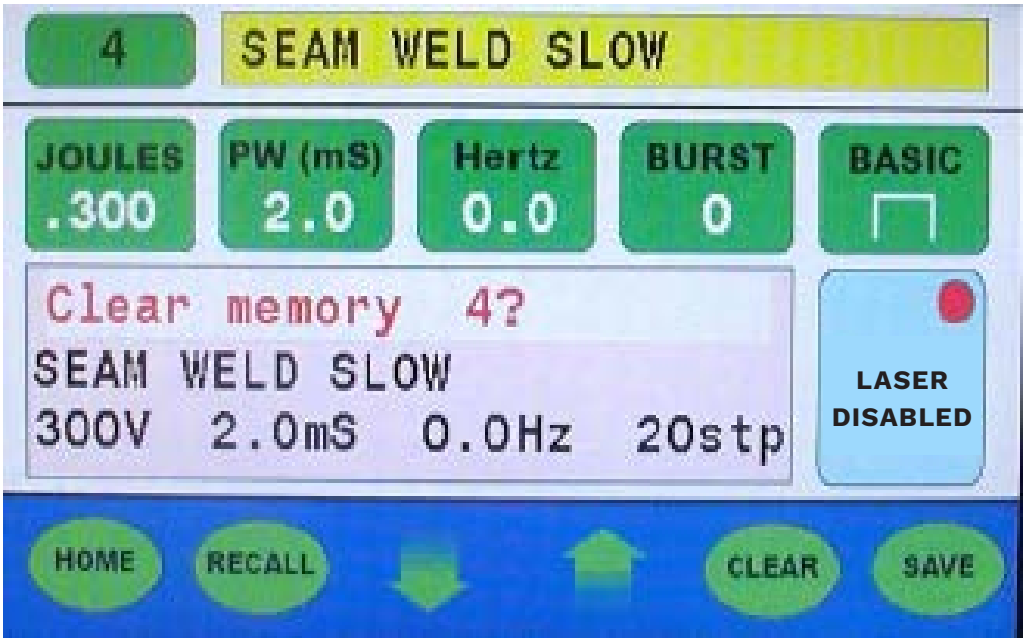


Figure 34b
(Clear memory;
press CLEAR)

Touchscreen Display Commands	
Buttons and Indicators	**System Response**
Help	Press this button to view the following: + LaserStar Technologies Corporation® Contact Details + Device Model Number + Device Serial Number + Tools & Helpful Information (to aid the operator)
Home	Pressing this button returns the system to the **main menu**.
Recall (see **the next page** that follow after these listed touchscreen display commands)	After selecting the memory location, press the **recall button** twice (x2). **(Note: The second button activation is in response to a question: "Recall memory ××?")** • gray (indicates the weld parameters are not from this memory location) • yellow (indicates the weld parameters are from this memory location)

Messaging & Touchscreen
Display Operation Continued on Next Page

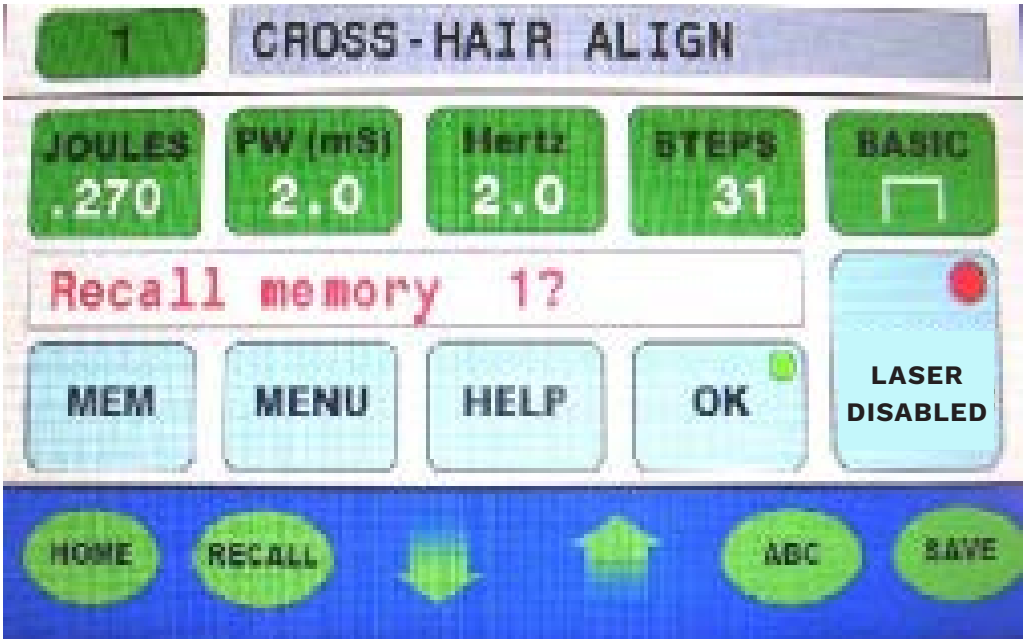
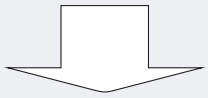
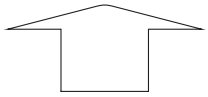


Figure 42
(Recall memory)

Figure 43
(Memory recalled)

Touchscreen Display Commands	
Buttons and Indicators	**System Response**
Down 	Press this button to decrease the selected parameter value or memory location number, and/or navigate to the **< (menu)** function.
Up 	Press this button to increase the selected parameter value or memory location number, and/or navigate to the **< (menu)** function.
ABC / 123 (see **figures 44 & 45** that follow after these listed touchscreen display commands)	Press this button to switch to the alphanumeric keypad; the alphanumeric keypad is used to name a weld parameter within a specific memory location.
Save (see **figures 46 & 47** that follow after these listed touchscreen display commands)	Pressing this button twice (x2) will store the welding parameters shown into the selected memory location number (located in the upper left-hand corner of the touchscreen display). **(Note: The second button activation is in response to a question: "Store in memory ××?".)**

Messaging & Touchscreen
Display Operation Continued on Next Page

Figure 44
(ABC keypad)

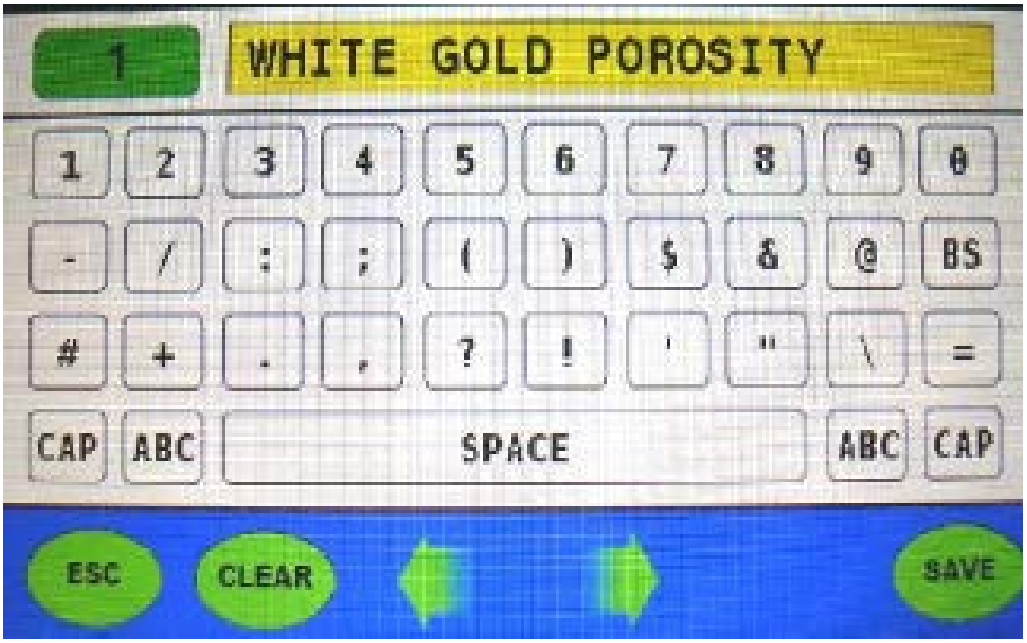


Figure 45
(123 keypad)

Figure 46
(Save process)

Figure 47
(Storing to memory)

Storing Parameters

The device's controller has stored memory locations with sets of predefined or pre-programmed operating parameters — each optimized for a specific application or material. Selecting from these predefined parameter settings allows the operator to utilize the same tried-and-tested operating data that previously yielded good results. These memory locations will already have default designations, but this can change, as needed. In order to better identify various memory locations, the operator can rename each, giving each a new text-based name or descriptor. If necessary, it's also possible to restore or recover the default memory names and locations in the future. When restoring defaults, it's important to note that all parameters that were added previously by the user will be erased.

A stored set of parameters consists of the following:

- Joules (J) or Watts (%)
- Pulse Width (PW [mS])
- Hertz (single pulse [0 Hz]; multi-pulse [≥0.5 Hz])
- Burst (At 0, it will match the frequency/pulse width. At 1 or higher the system will cease firing after the laser has fired [Burst] number of shots in a single fire signal.)
- Pulse Suppression (PS; optional and model specific)
- Focus Setting (Dia [mm] or Steps)
- Pulse Shape (see the section on **Pulse Performance Profile [P3] Technology**)
- Beam-expander Offset

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

Storing Operating Parameters Continued on Next Page

Storing Parameters (continued)

Important Advisory:

- When selecting a specific memory location and opting to store parameters, the beam-expander offset values displayed on the touchscreen menu (at that time) will be stored in this chosen memory location.
- If the operator has not chosen from a set of predefined parameters within a specified memory location, it's possible that the defined beam-expander offset 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 memory location settings and 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.	
Select the memory location to be utilized by pressing the **Memory Location Number button**—the display will blink. Use the **up** or **down arrows** to change to the desired memory location number.	The selected memory location number is displayed.
To store the values, press the **Save button** on the touchscreen display (or alternatively inside the welding work chamber) twice (×2).	The values for **pulse shape** 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.)

Recalling 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 detailing steps for **Storing Parameters**.

Operator Action	System Response
See methods below for details on recalling stored parameters.	
Select the memory location number to be utilized by pressing the **memory location number button** (located in the upper left-hand corner of the touchscreen display). Use the **up** or **down arrows** to change to the desired memory location number. Then, press the **recall button** twice (×2) to load the stored values into the welding parameters.	The welding parameters for the selected memory location are visible only while the memory location number is blinking (when the blinking stops, the parameters revert back to their previous values).
Press the **recall button** on the touchscreen display (or alternatively inside the welding work chamber) twice (×2).	The recalled welding parameters are displayed; the memory location description will change from gray to yellow.

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.

Notes

Welding Applications

Operator Action	System Response
Place the workpiece on the work area.	
Set or adjust the weld parameters (recipe), optimizing for the selected material. **(Note: Use the touchscreen display.)**	The **done button** will appear. The **alphanumeric keypad** will appear **(Figure 44)** The parameter settings will turn green this indicates that the recipe has been set
Press the **laser enable/disable button** on the touchscreen display (the indicator will change to green).	The **up** and **down arrows** will be highlighted. The **set recipe button** will be highlighted.
Depress the **foot pedal switch**; the will enable the laser and allow it to fire.	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, which is 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 joules has been reduced, for safety reasons, the laser will remain disabled.)

When welding (and while using inert gas), keep in mind that the gas outlet (located at the end of the gas tubing) 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. For inert gas welding, the gas outlet at the end of the gas tube is to be positioned near to the laser focal point. A position adequate for most applications is at the edge of the visual field of the stereomicroscope above the focal plane.

Operator Action	System Response
Proper positioning for workpieces—both horizontal and vertical, is important.	
Look through the **stereo microscope** 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 **foot pedal switch**.	The inert gas supply will be enabled.
Depress the **foot pedal switch** down fully.	The **view shutter** will close automatically for a short duration; this occurs with each laser pulse.
To release consecutive laser pulses (with single-pulse mode), the **foot pedal switch** must be partially released, then fully (and repeatedly) depressed down. With continuous pulse mode, laser pulses are fired consecutively (for as long as the **foot pedal switch** 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 (joules, 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 each laser pulse, and after adjustments are made to the joules value, the indicator on the **OK button** will switch to red. When the laser is ready to fire again, the indicator on the **OK button** will change to green. This recovery period can range between 0.1 and three (3) seconds, depending on the values that have been set for joules and laser pulse length.

Setting Operating Parameters

The view shutter is controlled electronically. A laser pulse will only be 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 pulse count, reference **Operating Parameters > Messaging and Touchscreen Display Operation > MEM**.

Text Input Mode

For information on using text input mode, see **Operating Parameters > Messaging and Touchscreen Display Operation > ABC / 123**.

Switching “Off”

Before the welding workstation can be powered down and switched “off,” the laser system must be allowed to cool for **ten (10) minutes**. During this period, the **system key switch** and **mains power switch** should remain “on.”

1. Turn the key in the **system key switch** to the **left**.
2. Turn the **mains power switch** to the **left** (position “O”).
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 personel.

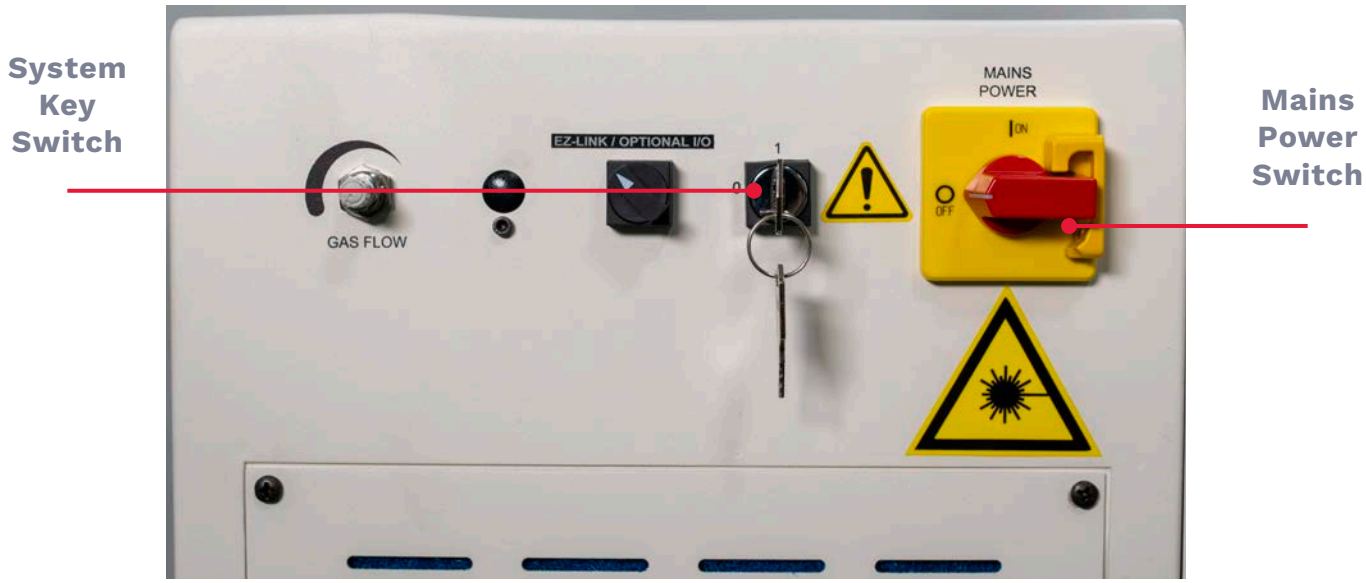


Figure 48
(Switching “Off”)

Status Monitoring and Indicators

During the self-test diagnostics, which begin immediately after the device has been switched “on,” and during operation, the current status of the laser is indicated by plain-text messages that are viewable on the touchscreen display. If the indicator on the **ok button** is green, the device is operable, and the laser is ready to weld.

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

- If the **laser is enabled**, a laser pulse can only be released via the foot pedal switch.
- If the **laser is diabled**, a laser pulse cannot be released (this helps to safeguard the operator, as well as others who are nearby — ensuring that unexpected or unplanned laser pulses are avoided.)

Notes

Passwords and Restricted Access (model & 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.

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

Notes

V. Maintenance

Overview & Requirements

Routine maintenance is a requirement for ensuring the safe and optimal operation of the marker. Regular maintenance intervals must be scheduled in accordance with the manufacturer's recommendations and requirements. **(Note: When working with an opened device, be sure always to wear appropriate laser protective eyewear.)**

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

- Disable all systems, subsystems, and auxiliary equipment by turning "OFF" and disconnecting from power sources or live components.
- Verify that all 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. Check all warning indicators to be sure they're functional 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. 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.

While working with an opened device, regulations set forth by OSHA regarding laser safety (or equivalent national or international regulations [e.g. EC Directive 608 or IEC Publication 825]) must be adhered to. Also remember to wear protective eyewear.

- If there's a risk of touching "live" components while at the worksite, and it's 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 has been concluded, the service personnel must verify that the equipment is safe to operate.
- When replacing components, use only LaserStar Technologies Corporation® approved parts and accessories.

While performing maintenance tasks, be sure never to work alone. A second person familiar with the risks posed by high-voltage electricity and laser radiation should be present. In the event of an emergency, this person will provide support, disabling power sources, 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 power supply. When recording measurements for electrical or electronic components (and while the laser system is "on,") it is critical to maintain required clearances (for details, see 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).

Maintenance Intervals

To optimize performance and minimize premature system 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 only LaserStar Technologies Corporation® approved parts and accessories.

Alert Notification	Interval	Hours (based on general usage within an 8-hour work day)	Reset Method (using the joystick control)
Protective Disk (cleaning)	7 days	56 hours	Press the **laser enable/disable button** to reset
Welding Table (cleaning)	30 days	240 hours	Press the **laser enable/disable button** to reset
Air Filter(s) (change)	90 days	720 hours	Press the **laser enable/disable button** twice (x2) to reset

Maintenance Alerts

See below for a visual representation of the maintenance intervals alert reminders (details for each are noted on the previous page). Alerts will appear on the touchscreen display whenever the system requires maintenance. Pressing the reset button, as the notifiction indicates, will clear the alert.

Notes

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 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 touchscreen 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 **Observation Window: Cleaning, Care, and Replacement** 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, chamber door, and arm flap inserts) 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.
2. Check the exhaust system filter (located inside the welding chamber); if dirty, be sure to replace (refer to **Maintenance > Chamber Exhaust Filter Replacement** within this manual)
3. Check all side panel air filters; if dirty, be sure to replace.
4. 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)

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

Protective Disk

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

Protective Disk Replacement

1. Turn the **mains 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 ring lamp will also be plugged into the rail; 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.
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).

The splash-protective observation window, which is 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 sides of the laser head. **(Note: Be sure to hold onto the frame with your free hand or have someone else hold it. Otherwise it will potentially fall and/or get damaged.)**
2. Remove the protective window.

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.

(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.)

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

Exhaust Filter Replacement

1. Turn “off” the **system key switch** and **mains power switch**. Next, disconnect the main AC power source; wait **five (5) minutes**.
2. Remove the exhaust filter cover (located on the side of the laser source) by unscrewing the two (2) screws.
3. Remove the filter and replace.
4. Reinstall the filter cover and screws.
5. Reconnect the main AC power source.
6. Check to be sure the fan turns “on” and that air is being exhausted from the exhaust port located at the rear of the enclosure.

Never attempt to clean the laser system'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 within the workspace.

Notes

Cleaning the 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 the device's touchscreen display, be sure to keep in mind the following guidelines:

- Use a soft, lint-free cloth to clean the surface of the display (can be dry or lightly dampened with a mild cleaner or ethanol; 3M's microfiber lens cleaning cloth is recommended and does not require the use of liquid cleaners).
- Never apply liquid cleaners directly to the surface of the touchscreen display; if solution is spilled onto the display's surface, be sure to using an absorbent cloth and immediately soak up excess liquid.
- When comparing cleaning solutions and considering a purchase, keep in mind: **the selected product should be neither acidic nor alkaline — it must be pH neutral**. In addition, make sure never to use organic chemicals, such as paint thinner, acetone, tolulene, xylene, propyl or isopropyl alcohol or kerosene. These and other similar products are not suitable for cleaning the touchscreen display and can result in optical impairment, which will damage the display and contribute to a reduction or loss of functionality.
- There are several pre-packaged and commercially available products that are suitable for cleaning the touchscreen display. Our recommendation, Klear Screen™ is alcohol and ammonia-free, non toxic, non-damaging, and non-flammable. The other, Glass Plus® Glass and Surface Cleaner (made by Reckitt-Benckiser), is another great off-the-shelf retail alternative.
- When using cleaning products on the workstation, be sure to avoid contact with the edges of the film or glass.
- Wipe the surface of the touchscreen gently; if you notice a directional surface texture, be sure to wipe in the direction of the texture, rather than against it.

Most cleaning products contain between 1–3% isopropyl alcohol by volume (this is within acceptable limits for cleaning resistive touchscreen displays). Some products, however, contain ingredients like ammonia, phosphates or ethylene glycol, which are not acceptable for use. When purchasing products to clean the touchscreen display, be sure to carefully review all listed ingredients.

Before removing and cleaning the device's components, make sure to identify the location of the laser source (see the section under service; major components). If the laser source is removed from the clamping block, the laser's alignment will be compromised. While realignment is achievable, this process will require support from our certified technicians. For assistance, be sure to contact LaserStar Technologies Corporation® Service Department.

Notes

VI. Troubleshooting

Before troubleshooting is carried out on the laser welder, be sure to reference the important safety protocols outlined in **Maintenance; section V** within this manual.

Overview and Reminders

All messages, alerts, and system faults are displayed on the touchscreen 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 sucessfully reset the laser system 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” again) to reset the laser system.

While working with an opened device, regulations set forth by OSHA regarding laser safety (or equivalent national or international regulations [e.g. EC Directive 608 or IEC Publication 825]) must be adhered to. Be sure also to safeguard your eyes and wear appropriate laser protective eyewear.

Equipment Malfunction

If you experience a malfunction with your laser system 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 maintenance and operation within this manual.

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

Diagnosing and Troubleshooting Basics

Alerts and System Messages	Possible Cause
STD Mode (single-pulse)	Depressing the **foot pedal switch** will produce **a single laser pulse**.
STD Mode (multi-pulse)	Depressing the **foot pedal switch** will produce **consecutive laser pulses** (hertz [Hz] is activated).
Micro Mode (single-pulse)	Depressing the **foot pedal switch** will produce **a single laser pulse**.
Micro Mode (multi-pulse)	Depressing the **foot pedal switch** will produce **consecutive laser pulses** (hertz [Hz] is activated).
Continuous Wave Mode (CW)	When enabled (and while the **foot pedal switch** is fully depressed), the laser will output **continuous peak power**.
Burst Mode (B)	Depressing the **foot pedal switch** will produce the number of laser pulses that the operator has specified (burst [B] is activated).
Storing to Memory (×)?	**Save button** is depressed; parameters are ready to be stored into memory location (×).
Storing to Memory	**Save button** is depressed; parameters are stored into a memory location.
Memory Recalled	**Recall button** is depressed; the last saved memory location is activated.
Clear Memory (×)	Depress the **Clear button**; the data in (×) memory location is **erased**.

Diagnosing & Troubleshooting Basics
Continued on Next Page

Diagnosing and Troubleshooting Basics (continued)

Alerts and System Messages	Possible Cause
Laser Disabled	**Laser enable/disable button** has not been pressed (pressing will allow the **laser to become enabled**).
Warning: Dead Battery	Control board memory battery back-up needs replacement (use either **CLT# 405–3900–001** or **3V DC Lithium 2325**).
5V DC Fault	5V DC power supply is out of range or has no output. **Contact LaserStar Technologies Corporation® Service Department for support**.
High Voltage: 24 Volts (V)	24V DC power supply output is above the operating limit. **Contact LaserStar Technologies Corporation® Service Department for support**.
Low Voltage: 24 Volts (V)	24V DC power supply output is below the operating limit. **Contact LaserStar Technologies Corporation® Service Department for support**.
Beam Expander Fault	Beam expander “zero” signal not detected. **Contact LaserStar Technologies Corporation® Service Department for support**. **(Note: In this instance, device operation can continue, however, the width of the beam diameter cannot be altered.)**

Diagnosing & Troubleshooting Basics
Continued on Next Page

Diagnosing and Troubleshooting Basics (continued)

Alerts and System Messages	Possible Cause
Beam Expander: High Fault	Beam expander “full limit” signal not detected. Device operation can continue, however, beam diameter width cannot be altered or adjusted. **Contact LaserStar Technologies Corporation® Service Department for support**.
Beam Expander: Low Fault	Beam expander “low limit” signal not detected. Operation can continue, however, beam diameter width cannot be altered or adjusted. **Contact LaserStar Technologies Corporation® Service Department for support**.
Laser Fault	A laser fault has been detected. If the fault remains active, perform a power cycle to clear. If the problem persists, **contact LaserStar Technologies Corporation® Service Department for support**.
Laser Fault	A laser enable/disable error has been detected.
Release Foot Pedal Switch	The foot pedal is currently depressed or there’s a short in the switch. Be sure to contact **LaserStar Technologies Corporation® Service Deparment for support**.
Joystick Stuck	Check to see whether the joystick control is in its central position. Push the joystick in any direction and allow it to return to its starting place. If the fault remains active, perform a power cycle to clear. If the problem persists, **contact LaserStar Technologies Corporation® Sevice Department for support**.

Diagnosing & Troubleshooting Basics
Continued on Next Page

Diagnosing and Troubleshooting Basics (continued)

Alerts and System Messages	Possible Cause
Aiming Beam Alarm	**Disable the laser** and press the **Home button at least two (×2) times** to reset. If the alarm remains active, cycle power. If the issue continues, **contact LaserStar Technologies Corporation® Service Department for support**.
Back Reflection: High	Press the **Home button at least two (×2) times** to reset. Reposition the workpiece; it should be slightly angled. If the problem persists, be sure to **contact LaserStar Technologies Corporation® Service Department for support**.
Command Buffer Overflow	Press the **Home button at least two (×2) times** to reset. If the alarm remains active, cycle power. If the problem persists, **contact LaserStar Technologies Corporation® Service Department for support**.
Critical Error	**Contact LaserStar Technologies Corporation® Service Department for diagnostics and troubleshooting support**.
Duty Cycle: High	Press the **Home button at least two (×2) times** to reset. Adjust the laser's power to a mid-range setting and fire the laser. If the alarm remains active, cycle power. If the issue continues, **contact LaserStar Technologies Corporation® Service Department for support**.
Fiber Interlock: Active	Check to be sure the laser engine's output fiber is properly seated and affixed within the collimator. Press the **Home button at least two (×2) times** to reset. If the alarm remains active, cycle power.

Diagnosing & Troubleshooting Basics
Continued on Next Page

Diagnosing and Troubleshooting Basics (continued)

Alerts and System Messages	Possible Cause
Fiber Interlock: Active (continued)	**Contact LaserStar Technologies Corporation® Service Department for support**.
Ground Leakage	Press the **Home button at least two (×2) times** to reset. If the alarm remains active, cycle power. If the problem persists, **contact LaserStar Technologies Corporation® Service Department for support**.
High Average Power	Press the **Home button at least two (×2) times** to reset. Reduce hertz (Hz) rate and re-test. If the alarm remains active, cycle power. If the problem persists, be sure to **contact LaserStar Technologies Corporation® Service Department for support**.
Power Supply: Failure	Verify that the **key switch** is "on." Press the **Home button at least two (×2) times** to reset. If the alarm remains active, cycle power. If the problem persists, be sure to **contact LaserStar Technologies Corporation® Service Department for support**.
Power Supply: Out of Range	Verify that the **key switch** is "on." Press the **Home button at least two (×2) times** to reset. If the alarm remains active, cycle power. If the problem persists, be sure to **contact LaserStar Technologies Corporation® Service Department for support**.
Pulse Energy: High	Press the **Home button at least two (×2) times** to reset. Reduce pulse energy and re-test. If the alarm remains active, cycle power. If the problem persists, **contact LaserStar Technologies Corporation® Service Department for support.**

Diagnosing & Troubleshooting Basics Continued on Next Page

Diagnosing and Troubleshooting Basics (continued)

Alerts and System Messages	Possible Cause
Pulse Energy: Too Long	Press the **Home button at least two (×2) times** to reset. Decrease the pulse width and re-test. Check the foot pedal and verify that it's functioning properly. For external activation, verify that the signal pulse length remains within the required specifications. If the alarm remains active, try cycling power. If the problem continues, **contact LaserStar Technologies Corporation® Service Department for support**.
Pulse Energy: Too Short	Press the **Home button at least two (×2) times** to reset. Decrease the pulse width and re-test. Check the foot pedal to ensure it's functioning properly. For external activation, verify that the signal pulse length remains within the required specifications. If the alarm remains active, cycle power. If the issue continues, **contact LaserStar Technologies Corporation® Service Department for support**.
Temperature: Low	The device's temperature is too low. Check the temperature of the space where the laser is housed and ensure it's appropriate. Press the **Home button at least two (×2) times** to reset. If the alarm remains active, cycle power. If the problem persists, **contact LaserStar Technologies Corporation® Service Department for support**.

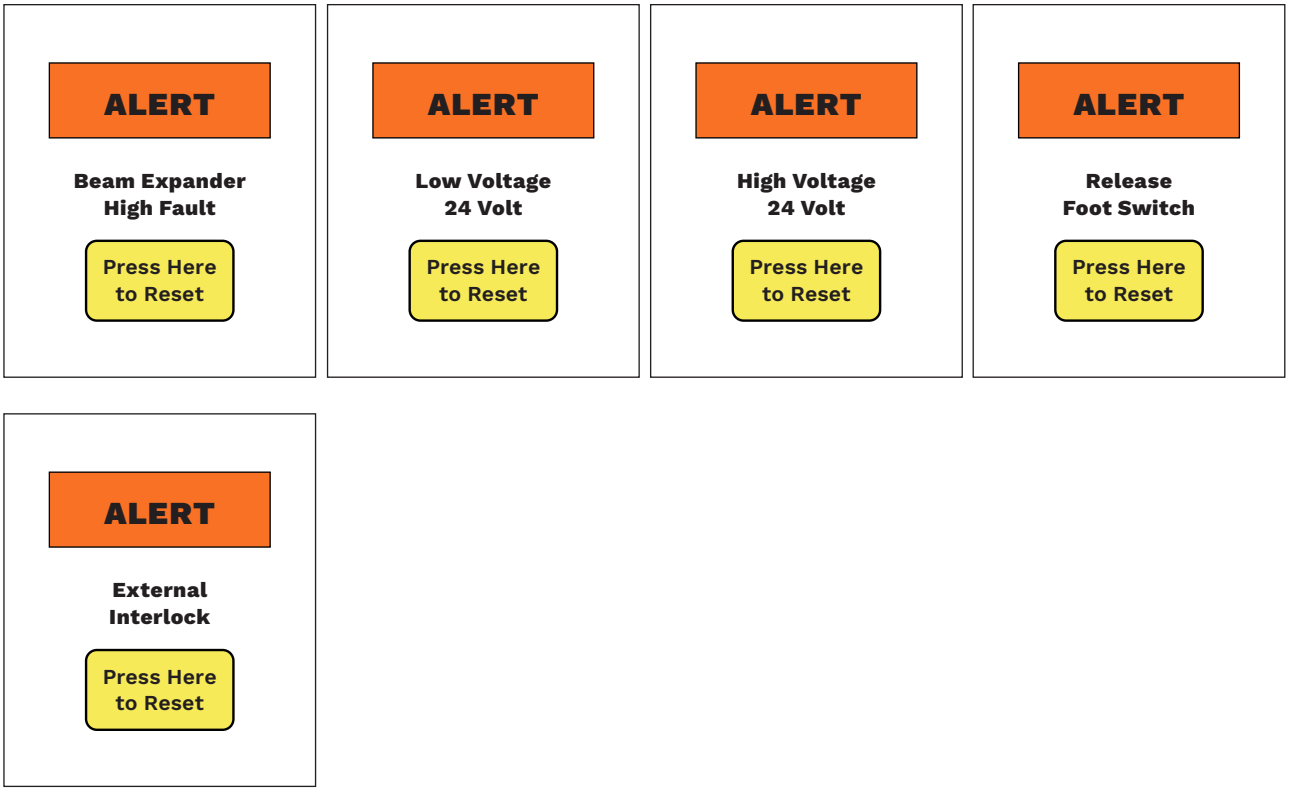
Diagnosing & Troubleshooting Basics
Continued on Next Page

Diagnosing and Troubleshooting Basics (continued)

Alerts and System Messages	Possible Cause
Workstation Overheating	The device's temerature is too high. Check the temperature of the space where the laser is housed and ensure it's appropriate. Press the **Home button at least two (×2) times** to reset. If the alarm remains active, cycle power. If the problem persists, **contact LaserStar Technologies Corporation® Service Department for support**.

Faults and Alarms

See below for a visual representation for the various cautionary alerts and alarms to be aware of (the causes for each are noted in the previous section — **Diagnosing and Troubleshooting Basics**. Alerts will appear on the touchscreen display whenever there is a critical fault or error reported. Pressing the reset button, as the notifiction indicates, will clear the alert.



Diagnosing & Troubleshooting Basics
Continued on Next Page

Fault Diagnostics Software

For support with troubleshooting and to obtain the fault diagnostics software, please contact LaserStar Technologies® Service Department.

Important Advisory:

The fault diagnostics software must only be used under guidance from support technicians affiliated with LaserStar Technologies Corporation®. If you are in need of support and require the use of the diagnostics software, please be sure to reach out to our service department for assistance.

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

Notes

VII. Parts & Accessories

LaserStar Technologies Corporation® Approved Components	
Description	**Catalog Number**
Operation and Maintenance Manual (hardcopy)	31-99990-881
Operation and Maintenance Manual (digital; USB flash drive)	31-99990-881
Air Filter Kit (side panel)	11-64004
Alignment Paper	00-10020
Beam Expander (3×)	121-00-1308
Laser Source (150 watt)	113-30-0151
Laser Source (300 watt)	113-30-0303
Laser Source (450 watt)	113-30-0452
Laser Source (600 watt)	113-30-0602
Control Board Assembly	121-30-2008
Fiber Wipe (quantity ×1)	810-2356
Fiber Wipes (quantity ×90)	810-2354
Focus Lens Protective Disk	01-10112
Foot Switch Assembly	111-30-0003

Parts & Accessories Continued on Next Page

LaserStar Technologies Corporation® Approved Components	
Description	**Catalog Number**
Fuse (15A, 250V AC 3AB fast ceramic)	405-4320-115
Fuse: Welding Chamber & Dimmer Control (1A, 250V AC, SB 5 × 20mm)	405-4320-001
Protective Eyewear	444-004
Protective Eyewear (diffused radiation)	444-001
LED Lamp	405-2460-800
Spare Battery (memory)	405-3900-001
Power Cord (250V AC 14/3 AWG)	116-36-6509
Power Supply Assembly (12V DC, 1.66A)	127-30-0166
Power Supply (24V DC, 6.3A)	405-4000-2463
Power Supply (48V DC, 32A)	405-4048-032
Protective View Window (plexiglass)	11-10071

Parts & Accessories Continued on Next Page

LaserStar Technologies Corporation® Approved Components	
Description	**Catalog Number**
Laser View Window (100 × 200)	01-10069
RabbitCore® Control Module	621-510
Regulator Kit (argon [inert] gas)	601-099
Remote Interlock Shorting Cap	101-36-0036
Troubleshooting Connector Kit	121-36-0006

Notes

Parts & Accessories Continued on Next Page

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VIII. Original Equipment Warranty - FiberStar 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 (damage to the resonator optical output fiber, 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 (protective disk, air filter, coolant filter (if required), coolant (if required), 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
Sales, Training, Repairs & Manufacturing	**Sales, Training & Repairs**	**Sales, Training, Repairs & Manufacturing**
2461 Orlando Central Pkwy. Orlando, Florida 32809 (407) 248-1142	100 Jefferson Blvd., Ste. 315 Warwick, Rhode Island 02888 (407) 248-1142	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 laser welder, 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 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 or purging air from the cooling system. While the device is “on,” be sure never to touch the electrical components or wiring.

Equipment Malfunction

If you experience a malfunction with your laser system 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. When reaching out, be sure to include your laser’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 sales@laserstar.net	1-888-578-7782 service@laserstar.net	2461 Orlando Central Pkwy. Orlando, Florida 32809, USA

Section A: Controls Board Memory Battery Replacement

The control board contains a battery; this battery provides power to the memory when the laser system is turned “off.” When the control board memory battery fails, the following alert displays on the touchscreen display: “Warning: Battery Dead.” When needed, a replacement battery (part number: 405-3900-001) can be purchased from LaserStar Technologies Corporation®.

(Note: If purchasing a replacement battery from another source, be sure to purchase from a reputable supplier and double check also that you're purchasing the correct battery for your device.)

1. Make sure the device is “off;” turn the **system key switch** and **mains power switch** to the “off” or “O” position.
2. Check to be sure that the AC power is “off;” remove the **mains power cord** or shut off the wall disconnect switch.
3. Remove the right-side panel and disconnect the ground wire from the panel. **(Note: When disconnecting the ground wire, detach using the clip and be sure to refrain from tugging at the wire to remove.)**
4. The location of the battery is shown in **figure 2**; be sure to read all associated notes and instructions for this section, as it contains important details for the battery removal process.
5. The process for battery removal and replacement is shown in **figure 2**; be sure to read all associated notes and instructions for this process; there are important pieces of information that must be reviewed and understood.
6. After installing the replacement battery, be sure to reconnect the device’s ground wire. Next, replace the right-side panel.
7. Enable power to the workstation; the previous alert message, “Warning: Battery Dead.” will appear on the touchscreen display. The next time the device is powered “on,” this message will not display.

IX. Service, Section A: Controls Board Memory Battery Replacement Continued on Next Page

Section A: Controls Board Memory Battery Replacement (continued)

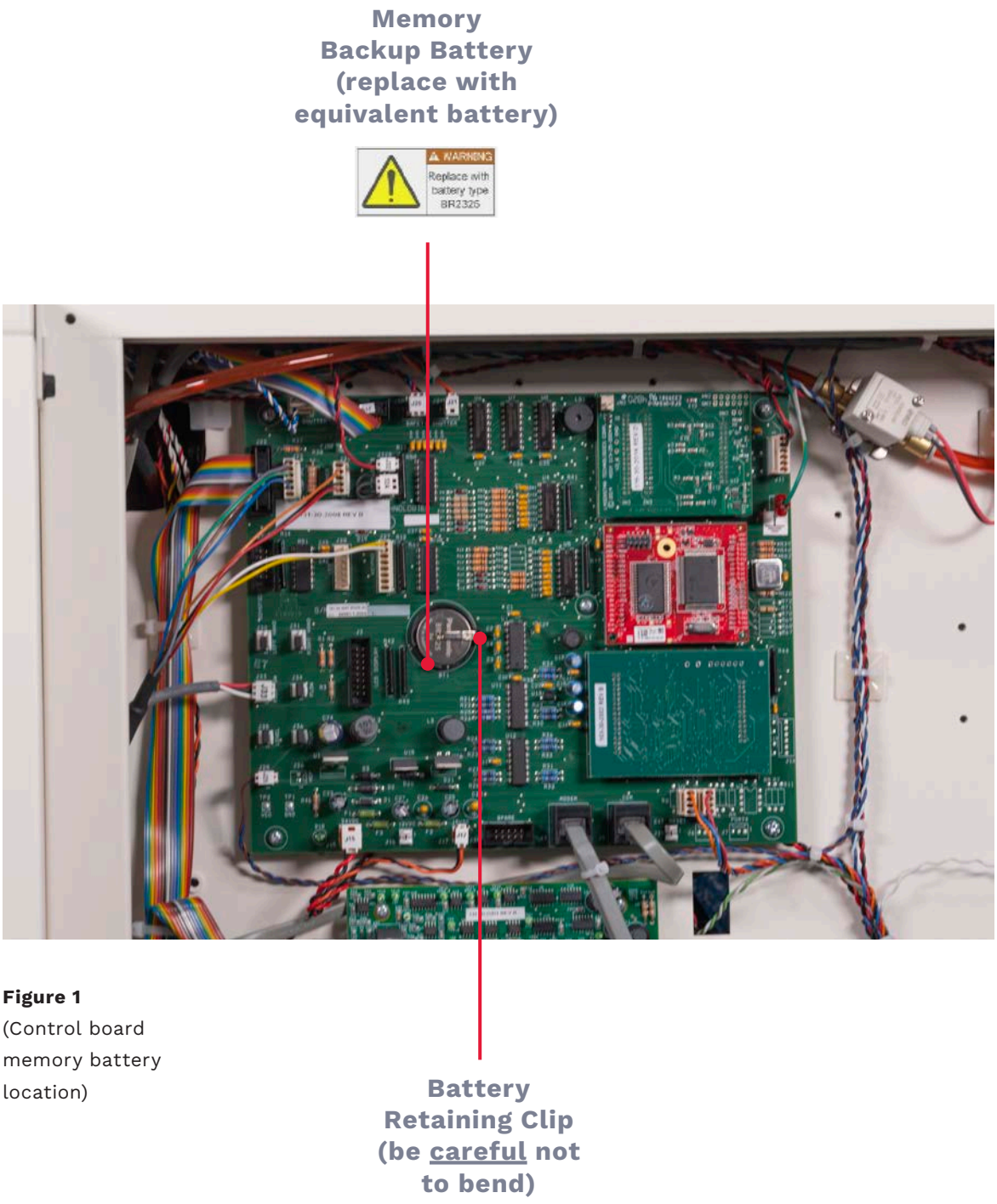


Figure 1
(Control board memory battery location)

Section A: Controls Board Memory Battery Replacement (continued)

Check to be sure the retaining clip has direct contact with the battery (circuit is complete; electrical current is flowing).

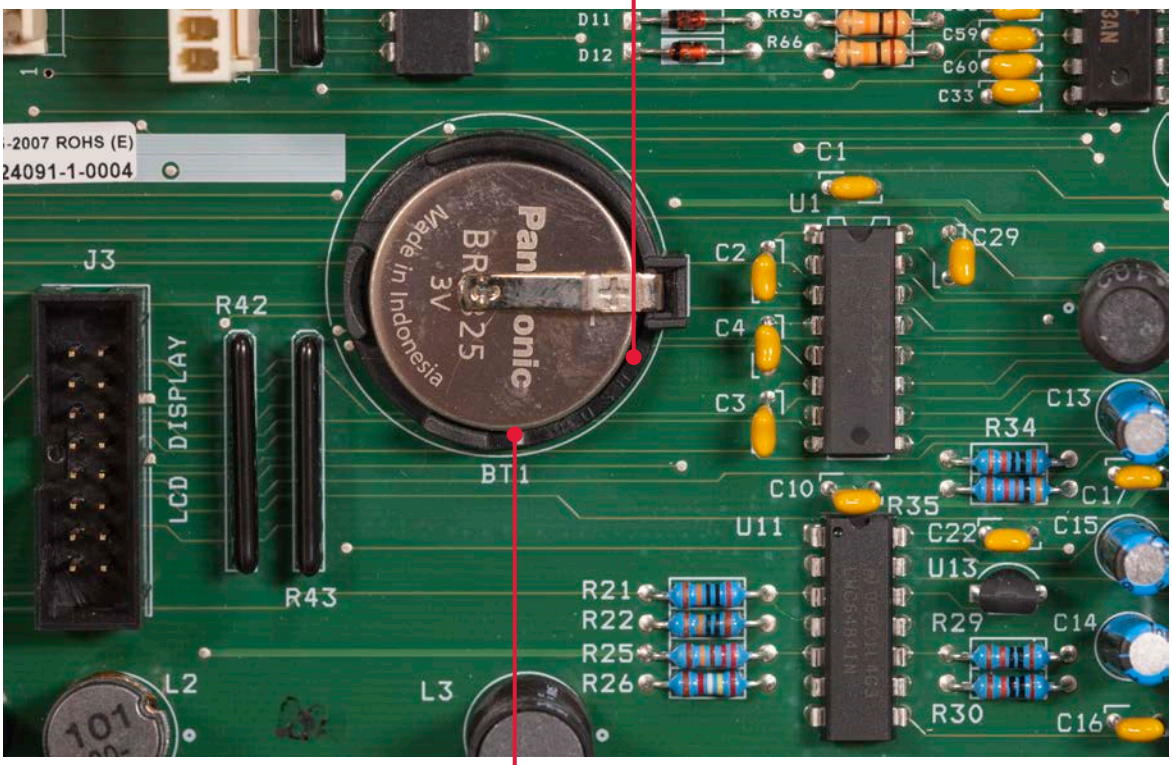


Figure 2
(Control board; battery replacement)

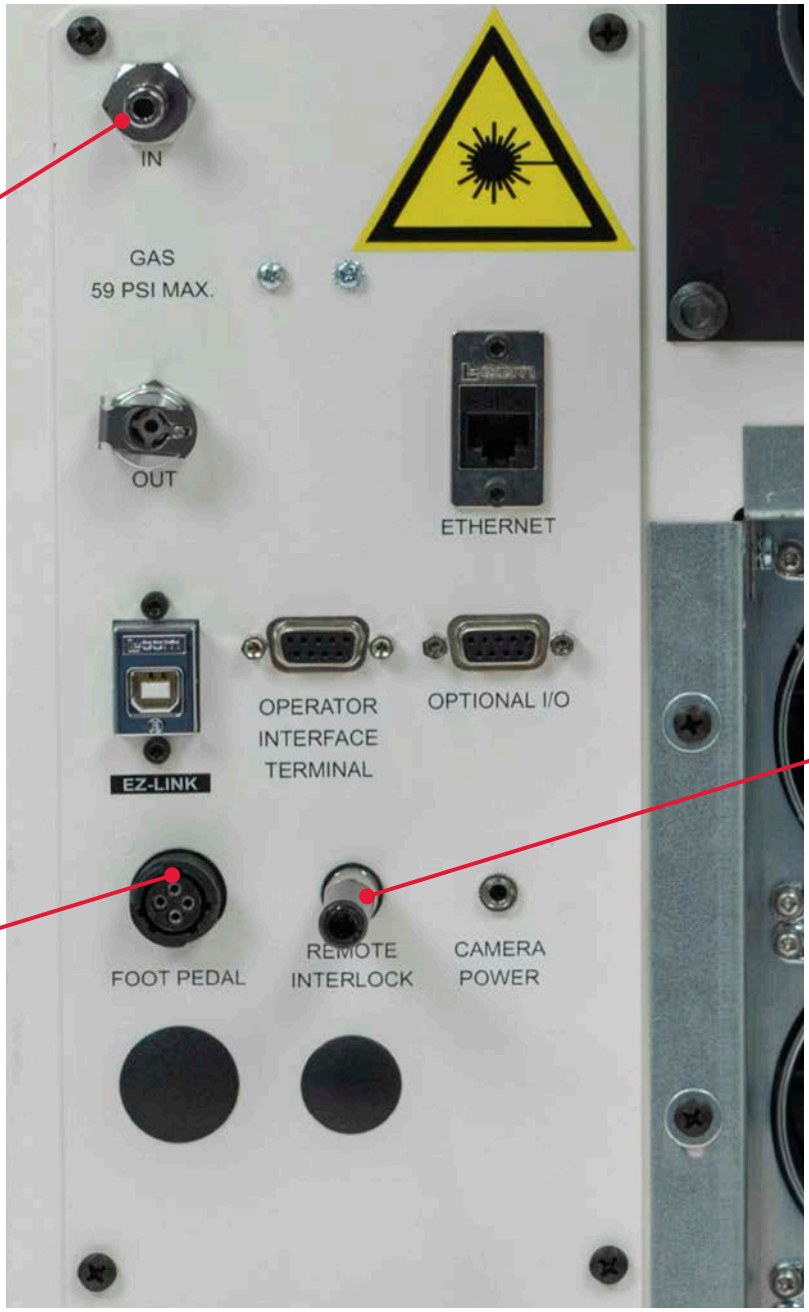
Insert battery into the terminal; should remain (+) side up.

Section B: Rear System Overview, External Connections, and External Fuse Replacement

Figure 1
(Rear view)

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

Section B: Rear System Overview, External Connections, and External Fuse Replacement (continued)



Argon (inert gas) Input Connector

Remote Interlock Connector Receptacle (installed into the input)

Foot Pedal Connector

Figure 2
(External connections)

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

Section B: Rear System Overview, External Connections, and External Fuse Replacement (continued)

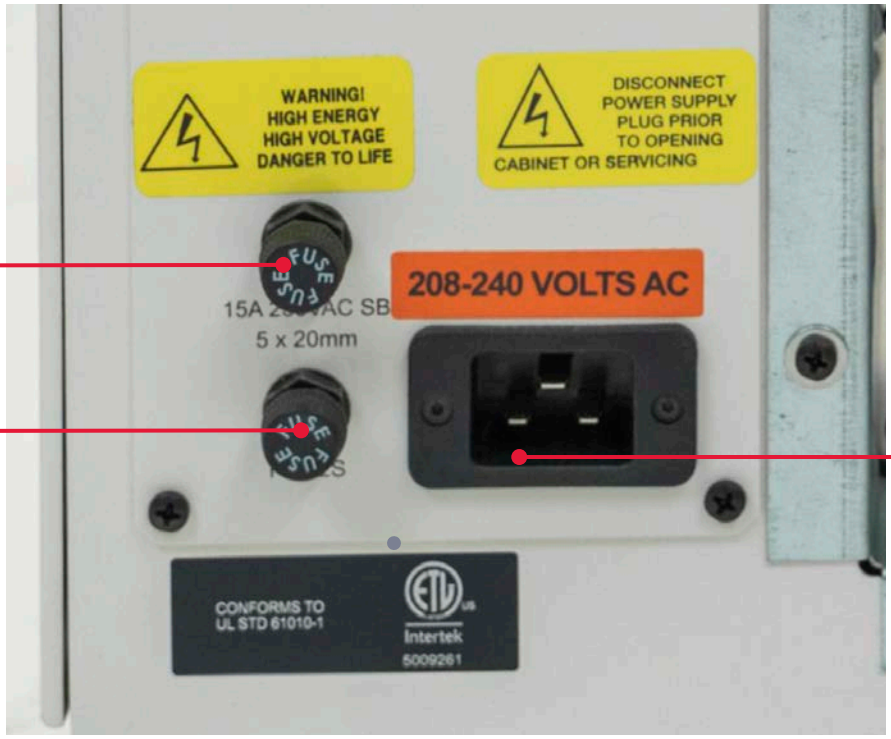


Figure 3
(Fuses and
mains power)

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

Section B: Rear System Overview, External Connections, and External Fuse Replacement (continued)

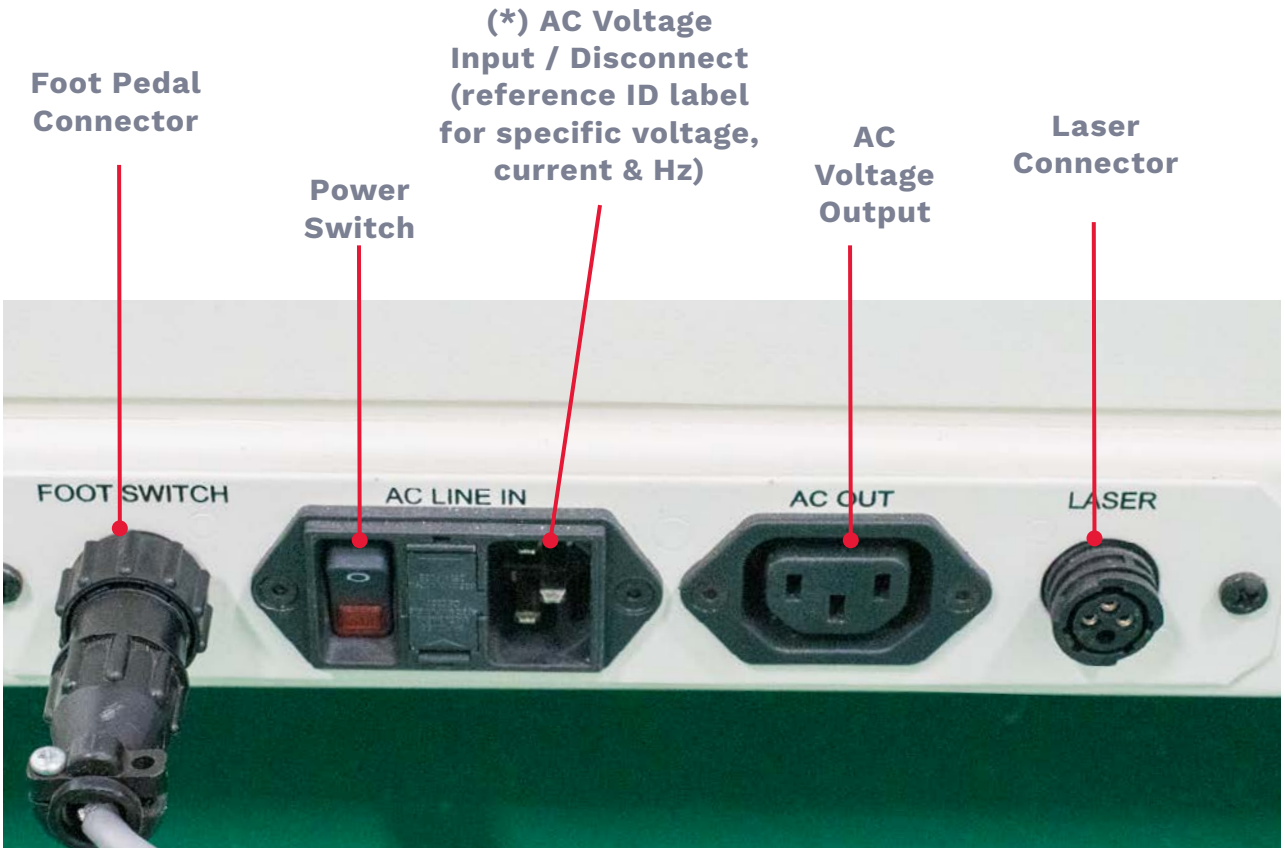


Figure 4
(Main Power Panel)

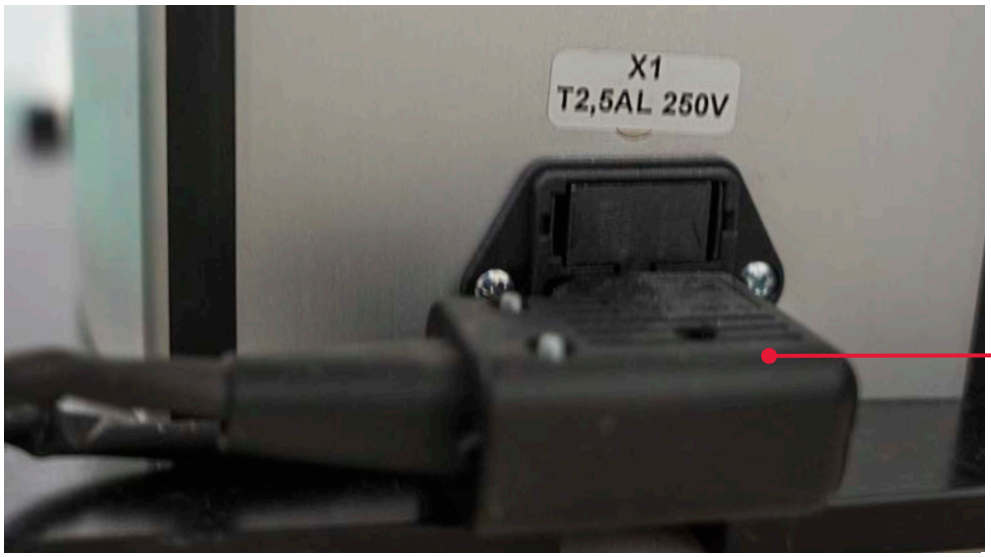


Figure 5
(Motion Table
Right side)

Section B: Rear System Overview, External Connections, and External Fuse Replacement (continued)

Fuse Replacement

When completing the steps below, be sure to reference the previous pages, as well as the data table below: **Fuses: Part Numbers and Amperage**.

1. When checking the status of or replacing any fuse, you must first turn “off” the device, using the **system key switch** and **mains power switch**.
2. Disconnect the AC power cord from the wall and from the equipment.
3. Remove the 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 laser system to allow for access to its rear.
6. Remove all external fuses; check and replace, as needed (be sure to check these periodically and replace fuses, as needed).
7. Reconnect the AC power and foot pedal; proceed with testing the device to ensure it's functioning properly.

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

Fuses: Part Numbers and Amperage

Fuses	Part Number (be sure to purchase only LaserStar Technologies Corporation® manufactured parts)	Amperage or Voltage Type: 120–230VAC	Usage
1 and 2	405–4320–115	15A/250VAC/3AB (fast; ceramic)	48VDC and 24VDC; power supplies
3 and 4	405–4320–001	1A/250VAC/ SB 5×20mm	Exhaust Fan

Attention: Check the VAC label & ID label on the rear of the laser system and compare with the power conditions at the installation site.

Notes

Section C: Major Internal System Components

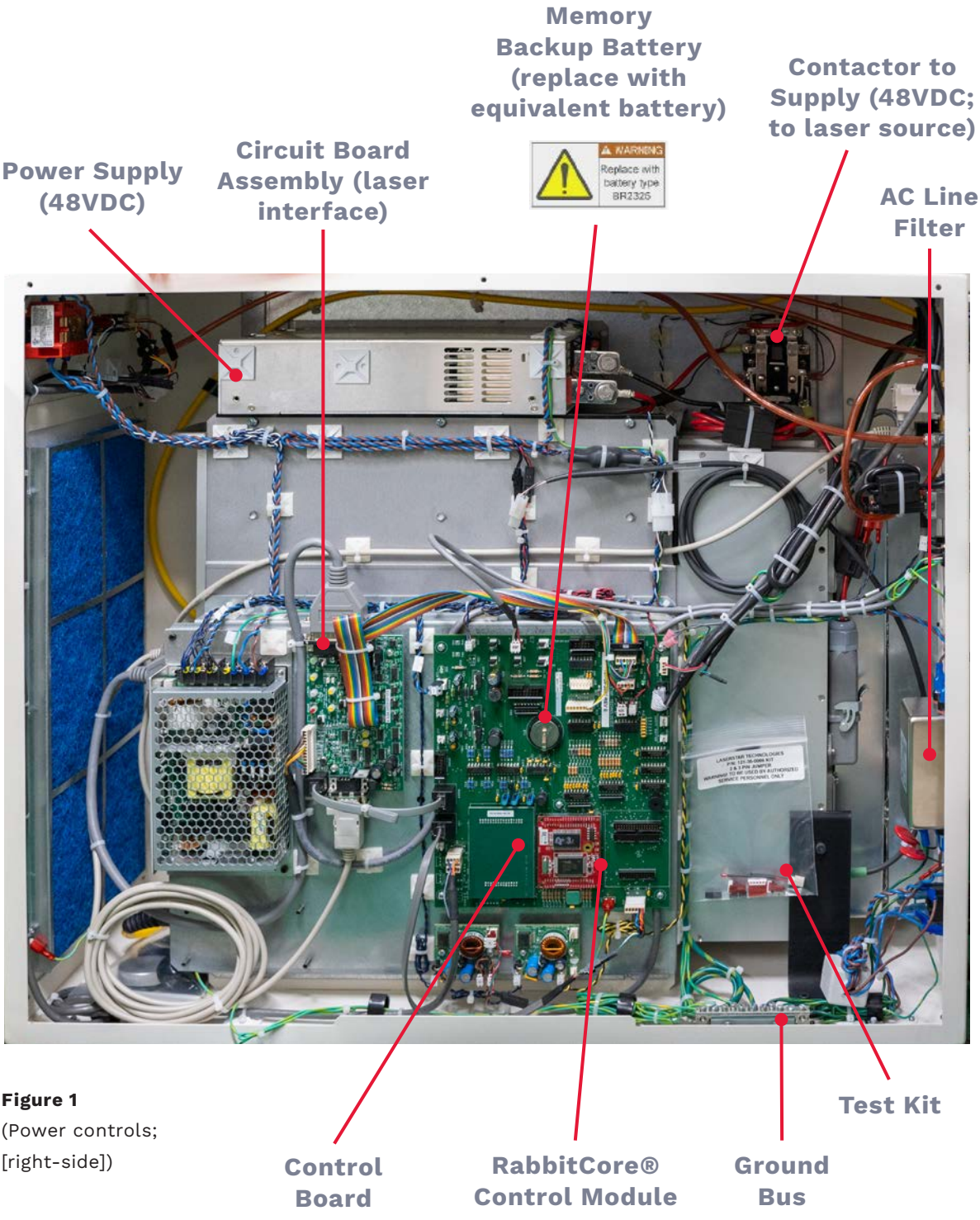


Figure 1
(Power controls; [right-side])

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

Section C: Major Internal System Components (continued)

Figure 2
(Laser source; left-side)

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

Notes

Notes

X. Appendix
Section A: Restricted Access and Password (PIN) Protection

The restricted access feature is intended to prevent unintentional or unauthorized changes to the device's welding parameters; installation of this feature occurs prior to shipping.

Enabling Restricted Access and Password (PIN) Protection

1. Press the **menu button** on the main screen **(figure 1)**.
2. Using the **down arrow**, scroll to **"restrict access" (figure 2)**.
3. Press the **enter button (figure 2);** the display will read **"no" (figure 3).**
4. Using the **up** or **down arrows**, switch to **"yes" (figure 4).**
5. Press **"on"** to enter **"yes" (figure 4)**.
6. Press the **exit button** twice (2) to return to main screen **(figure 4)**; password protection is enabled.

While password protection is enabled, the selectable options on the touchscreen display are restricted; the following buttons remain active (figure 1).

+ **memory location number** (upper left-hand corner of the display)
+ **up** or **down arrows** (select the desired memory location number; toggles between **hertz**, **burst**,and **PS**)
+ **recall** (press twice [×2] to load the weld parameters for the selected memory location)
+ **MEM** (displays the welding parameters and memory location description; **figure 5**)
+ **home** (returns the operator to the main screen)
+ **Laser enabled/disabled** (enables/disables the laser)
+ **help** (obtain support, including field service or guided technical support; holds information for the device's model number and serial number)

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

X. Appendix, Section A: Restricted Access and Password (PIN) Protection Continued on Next Page

Section A: Restricted Access and Password (PIN) Protection (continued)

Disabling Restricted Access and Password Protection (the default password for this device is: 438)

1. Press the menu button on the password screen; the first digit “4” will begin to blink (figure 6).
2. Using the **up arrow**, press to assign the first number in the password sequence (to decrease this number, use the **down arrow**).
3. Press the **menu button** on the password screen; a (*) is inputted into the field for the first digit. Next, press the **up arrow** to assign the second number; the “3” will blink **(figure 7)**.
4. Press the **menu button** on the password screen; a (*) is inputted into the field for the second number. Now, press the **up arrow** to assign the third digit; the last digit, “8,” will begin blinking **(figure 8)**.
5. Press the **menu button** on the password screen to enter the password and return to the main screen **(figure 1)**; password protection is disabled.

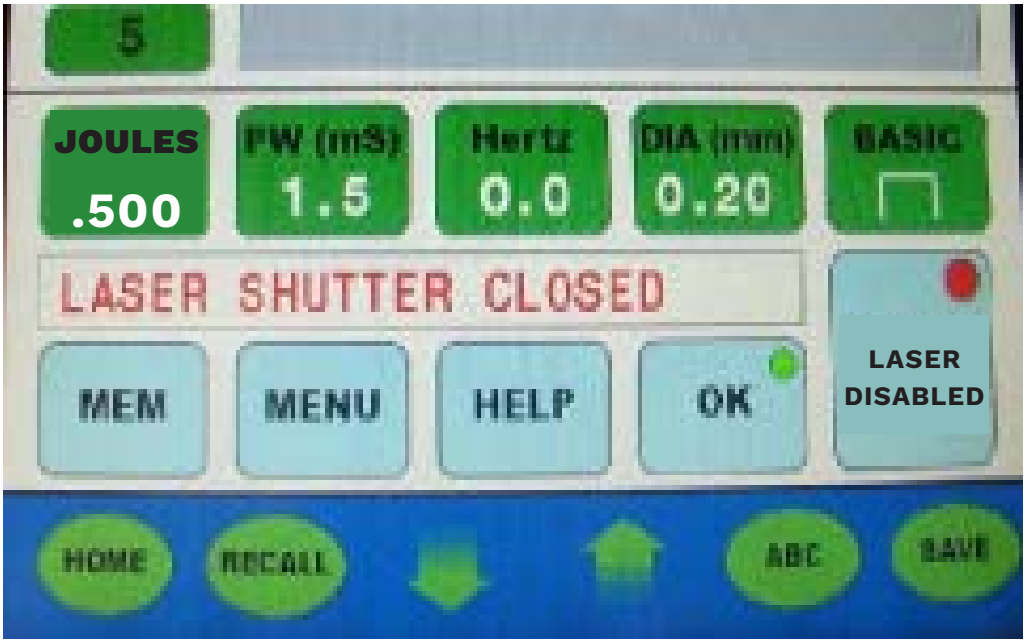


Figure 1
(Main menu)

X. Appendix, Section A: Restricted Access and Password (PIN) Protection Continued on Next Page

Section A: Restricted Access and Password (PIN) Protection (continued)

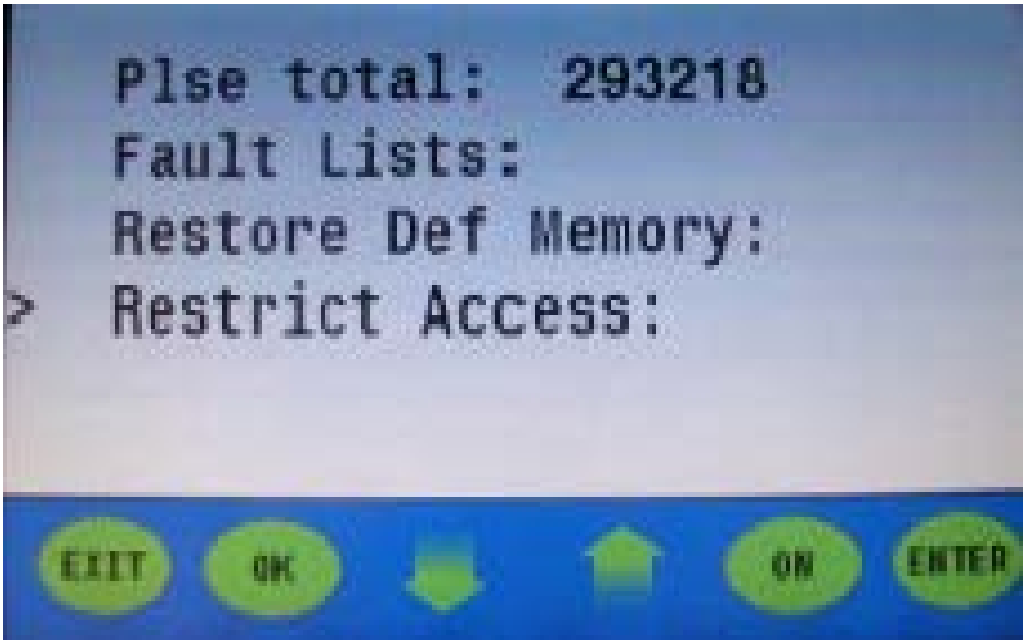


Figure 2
(Use down arrow;
Restrict Access > Enter)

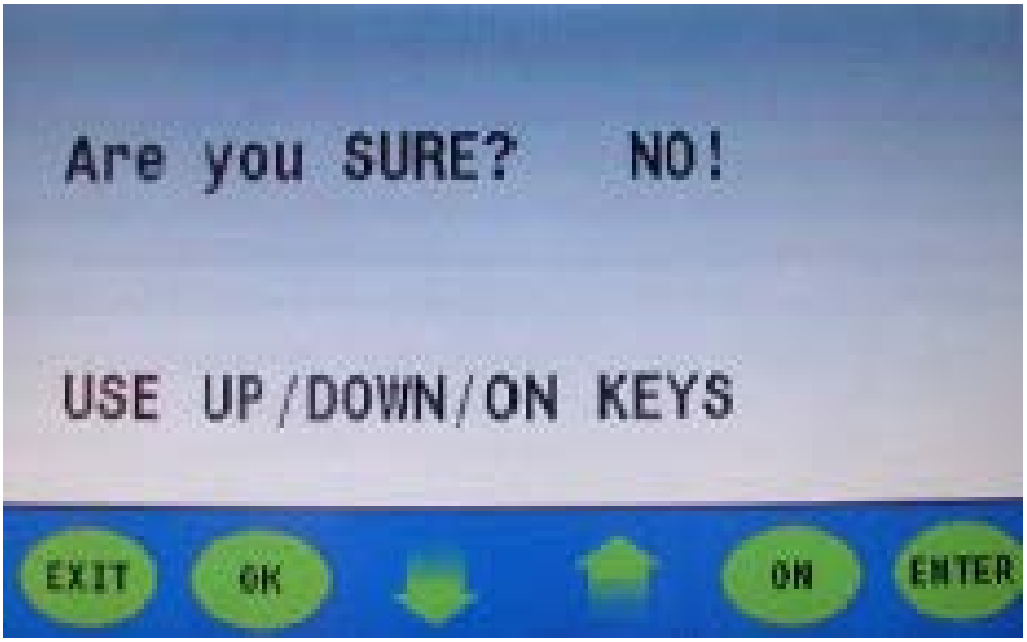


Figure 3
(Up or down arrows;
used to make selections)

X. Appendix, Section A: Restricted Access and Password (PIN) Protection Continued on Next Page

Section A: Restricted Access and Password (PIN) Protection (continued)

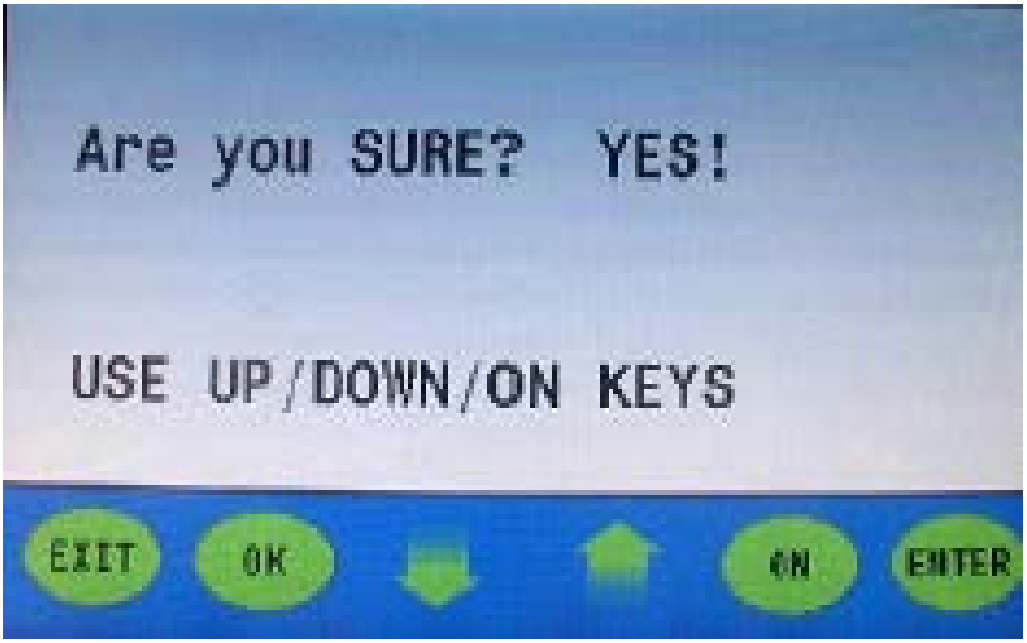


Figure 4
(YES > ON > EXIT > EXIT)

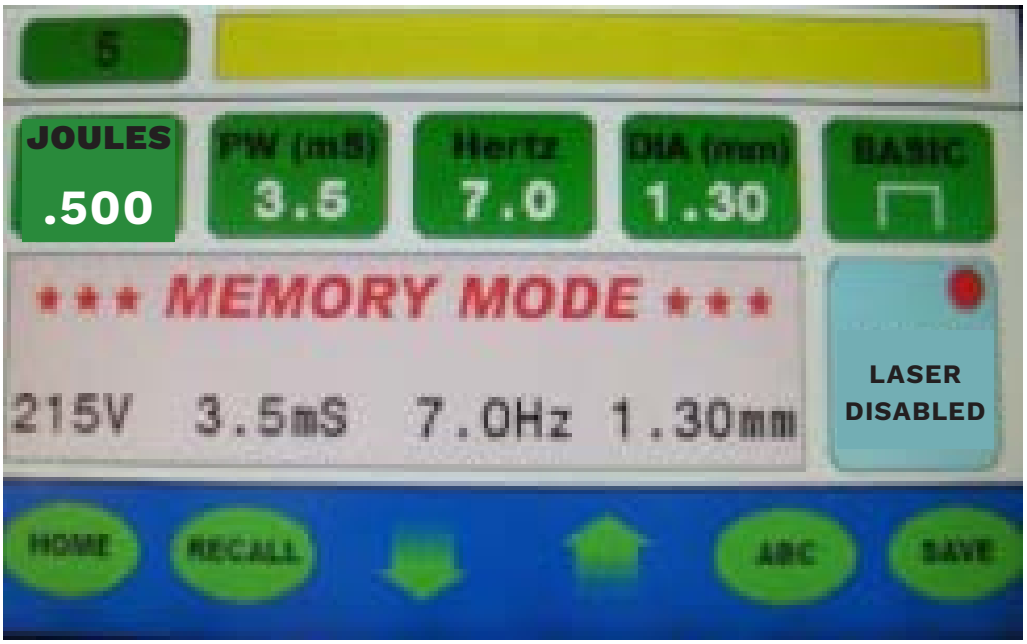


Figure 5
(Memory mode)

X. Appendix, Section A: Restricted Access and Password (PIN) Protection Continued on Next Page

Section A: Restricted Access and Password (PIN) Protection (continued)

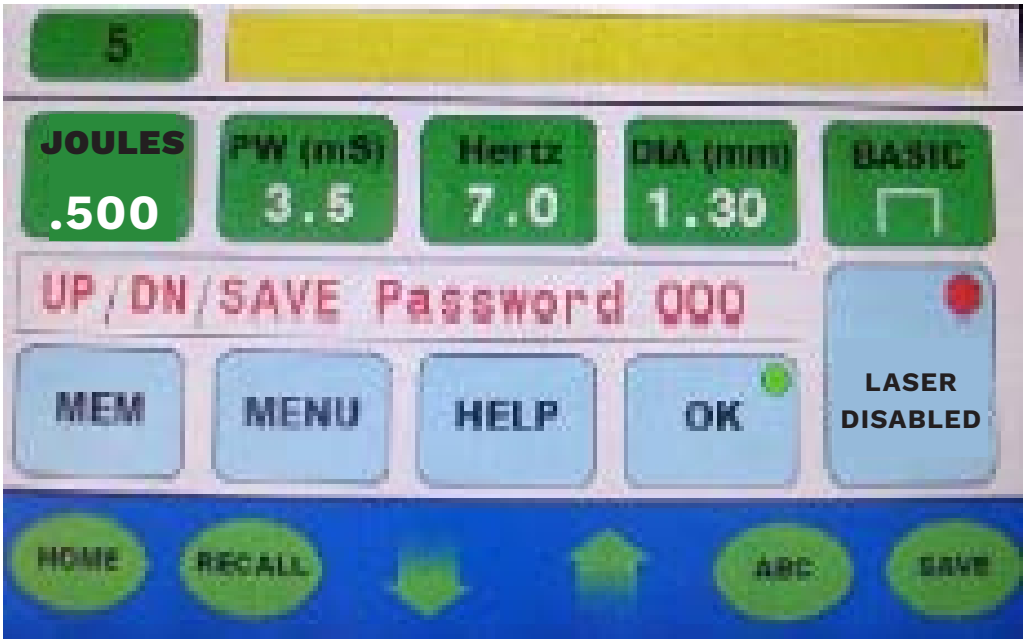


Figure 6
(Menu > up or down
arrow > “4”)

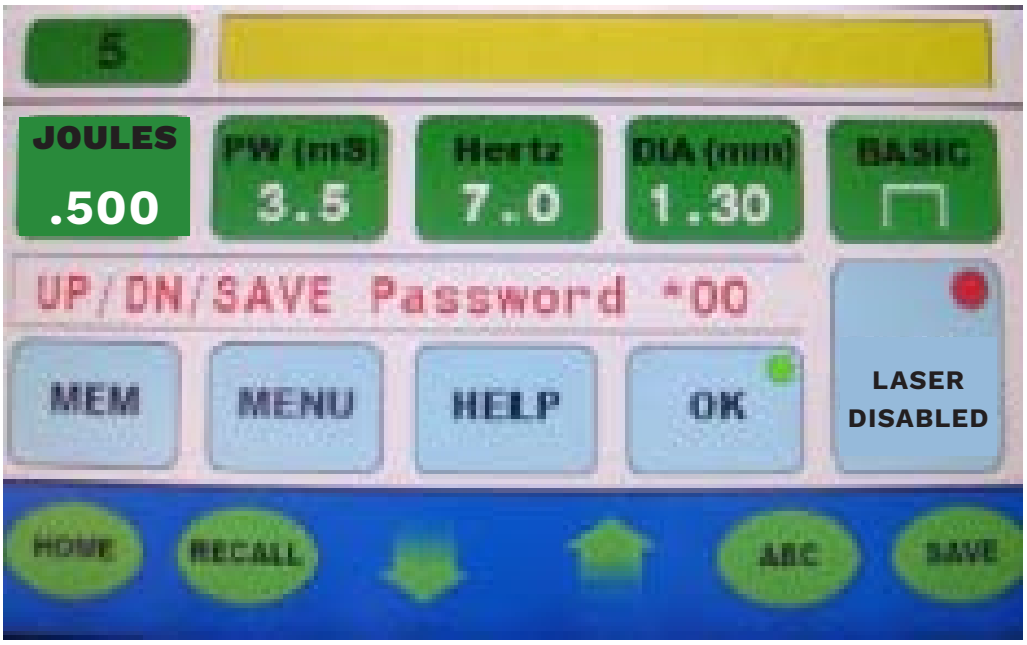


Figure 7
(Menu > up or down
arrow > “3”)

X. Appendix, Section A: Restricted Access and Password (PIN) Protection Continued on Next Page

Section A: Restricted Access and Password (PIN) Protection (continued)

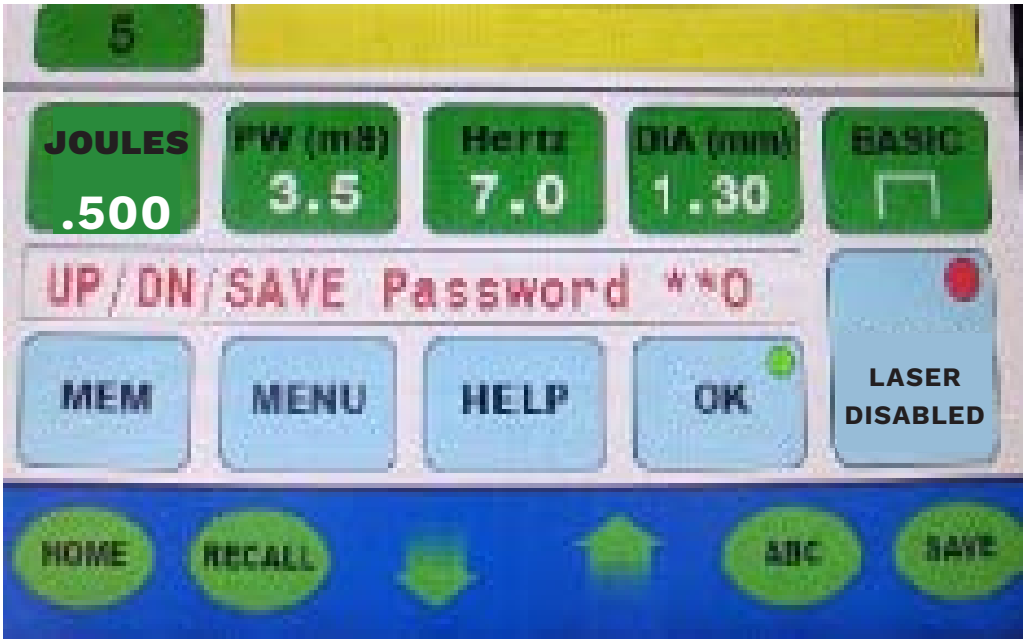


Figure 8
(Menu > up or down arrow > “8” > Menu)

Notes

X. Appendix, Section A: Restricted Access and Password (PIN) Protection Continued on Next Page

Section A: Restricted Access and Password (PIN) Protection (continued)

When changing the password for this device, be sure to record the new password and store this information in a safe location. If you need support with password recovery, reach out the LaserStar Technologies Service Department for assistance.

Changing the Password

1. Press the **menu button** on the main screen **(figure 9)**; scroll to **"User Password: Locked"** (the default password for this device is: **438**).
2. Using the **up arrow**, press to assign the first number in the password sequence (to decrease this number, use the **down arrow (figure 11)**.
3. Press the **enter button**; a (*) is inputted into the field for the first digit; the second number will begin to blink **(figure 12)**. Next, press the **up arrow** to assign the second number.
4. Press the **enter button**; a (*) is inputted into the field for the second number. Now, the third digit, the last digit in the password sequence, will begin to blink **(figure 13)**.
5. Press the **up arrow** to set the last digit for the password. Next, press the **enter button** to input the new password. Now, return to **"User Password: Unlocked"** on the main screen menu list **(figure 14)**.
6. To select or confirm **"User Password: Unlocked,"** press the **enter button**.
7. To set the first number in the new password sequence, press the **up arrow** (to decrease, use the **down arrow (figure 15)**.
8. Press the **enter button**; a (*) is inputted into the field for the first digit; the second number will begin to blink **(figure 16)**. Next, press the **up arrow** to assign the second number.
9. Press the **enter button**; a (*) is inputted into the field for the second number. Now, the third digit, the last digit in the password sequence, will begin to blink **(figure 17)**.
10. Using the **up arrow**, press to assign the third number in the new password sequence.
11. Press the **enter button** to input the new password and return to **"User Password: Unlocked"** on the menu list **(figure 18)**.
12. Press the **exit button** twice (2) to return to main screen **(figure 9)**; returns to the main menu screen and locks the parameters on the touchscreen display.

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

Section A: Restricted Access and Password (PIN) Protection (continued)

Figure 9
(Main menu)

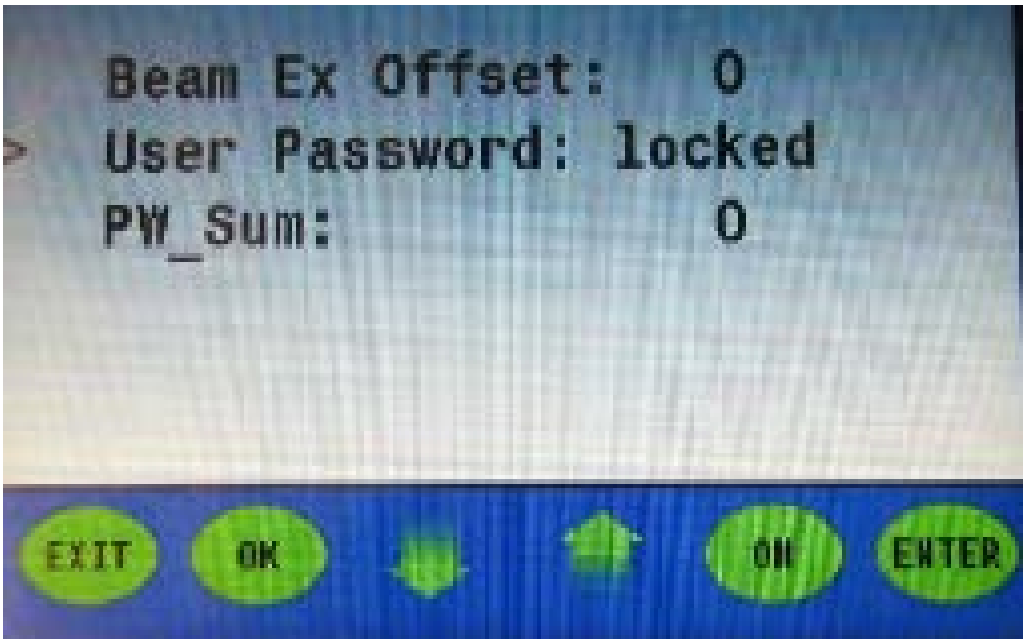


Figure 10
(User password: locked)

Section A: Restricted Access and Password (PIN) Protection (continued)

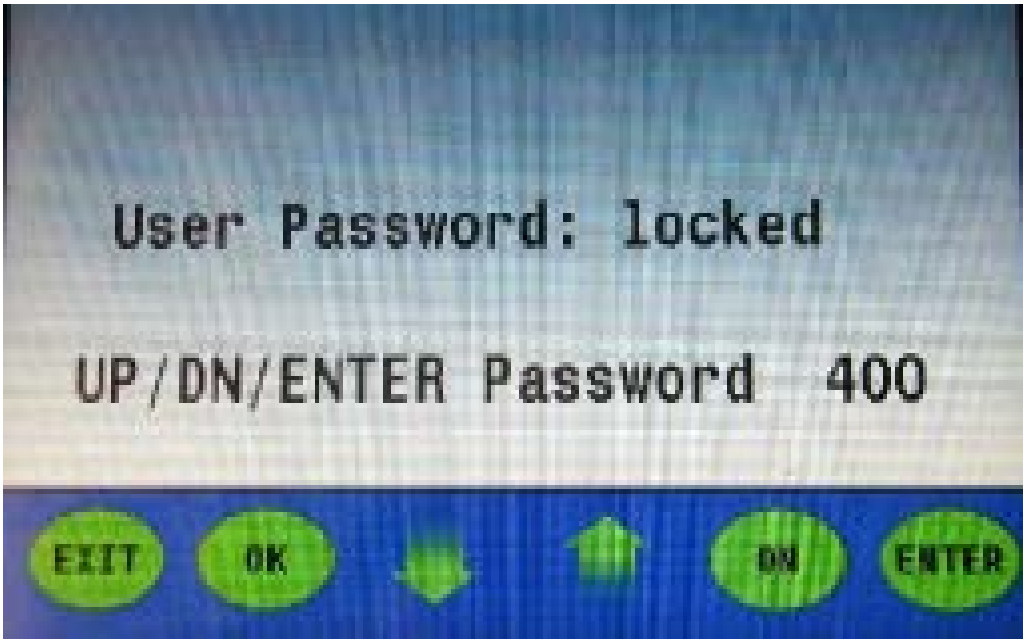


Figure 11
(Password change)

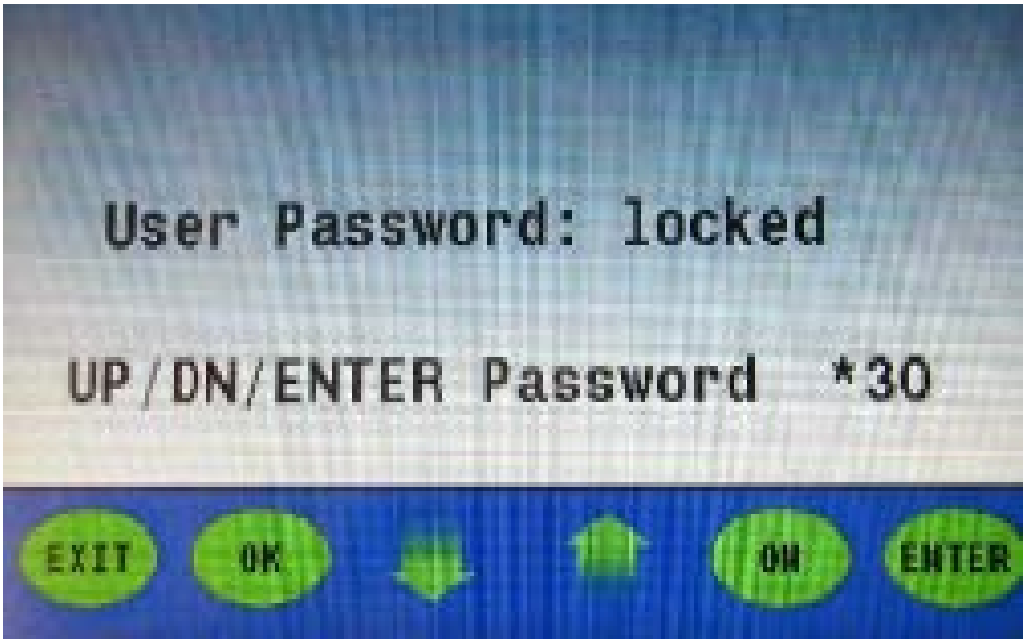


Figure 12
(Password change)

Figure 13
(Password change)

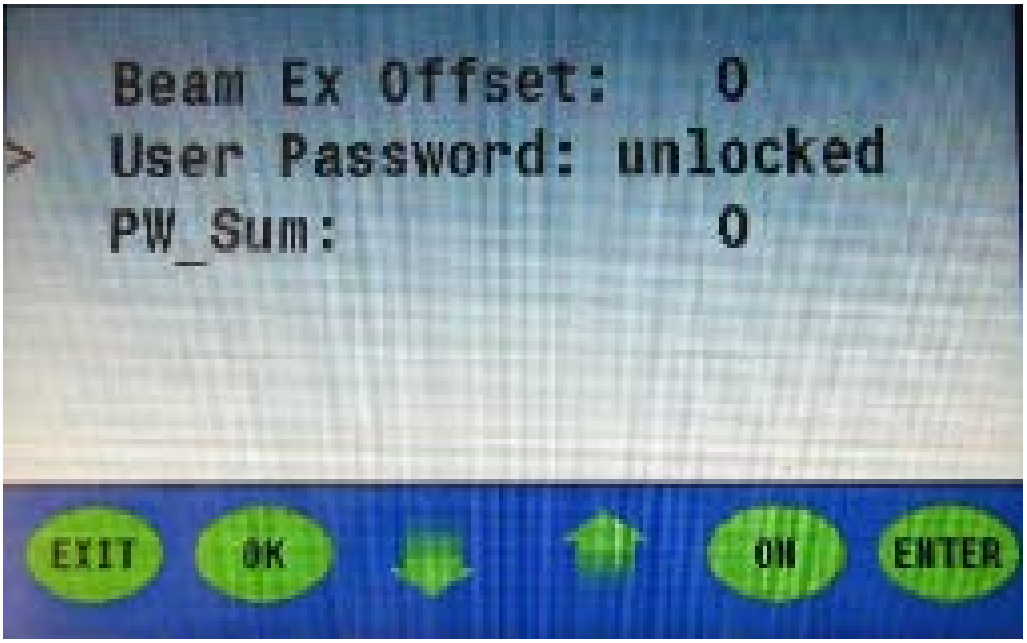


Figure 14
(User password: unlocked)

Section A: Restricted Access and Password (PIN) Protection (continued)

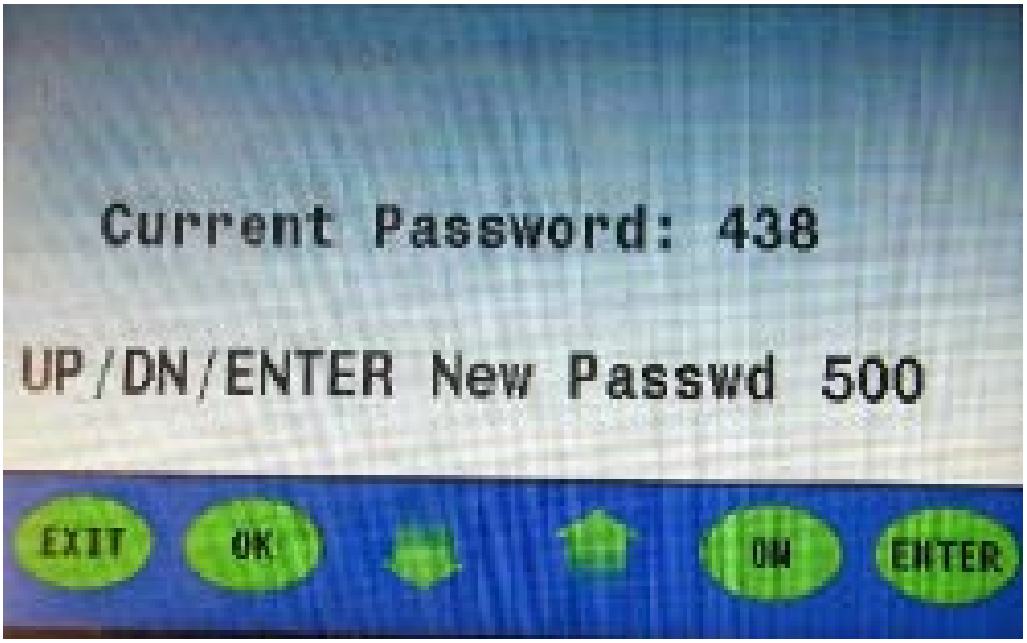


Figure 15
(New password)

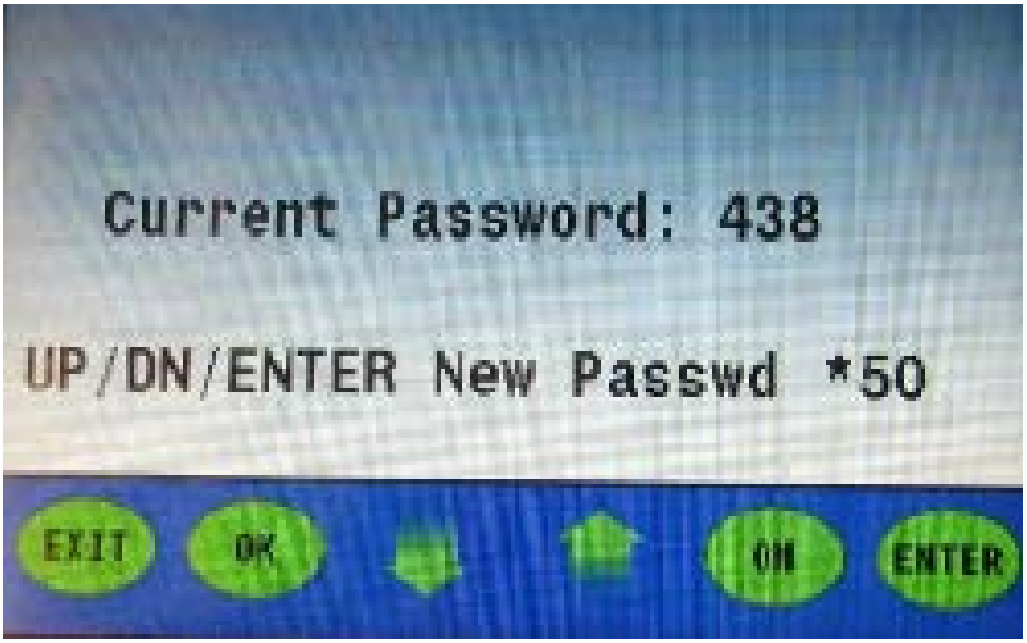


Figure 16
(New password)

Section A: Restricted Access and Password (PIN) Protection (continued)

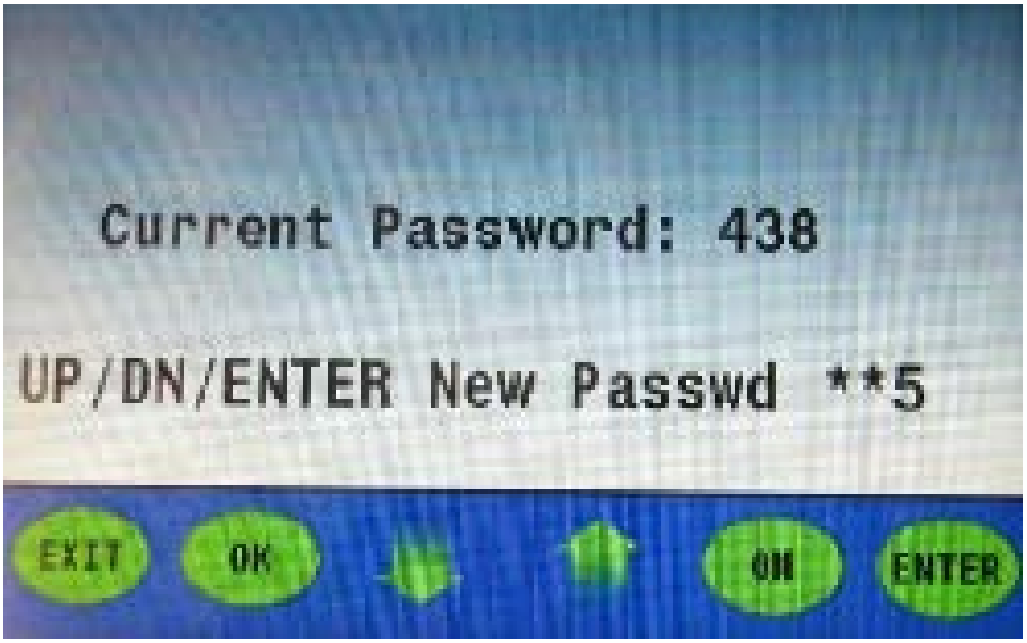


Figure 17
(New password)

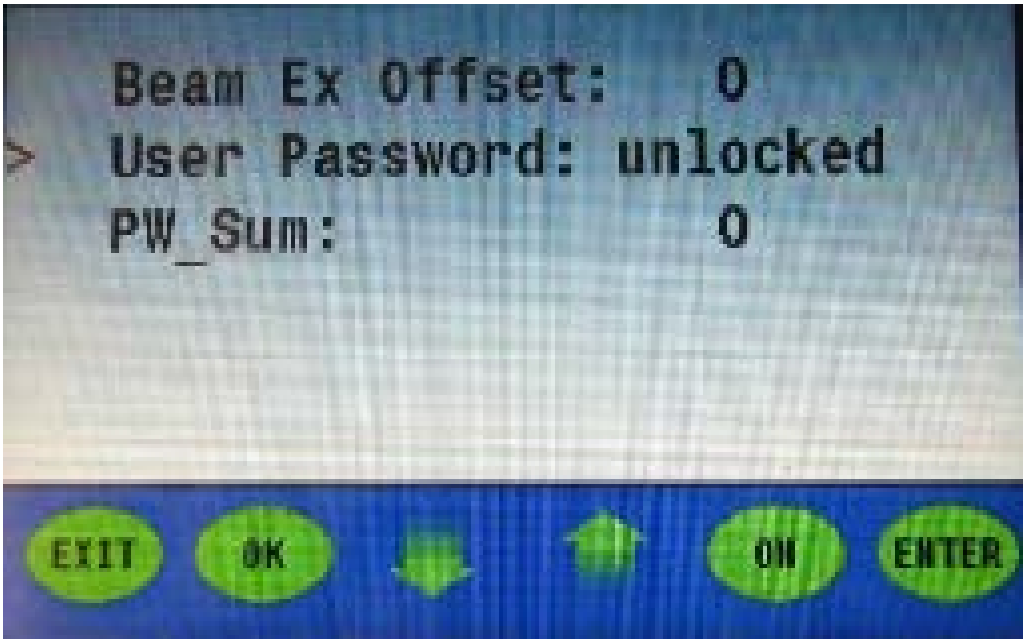


Figure 18
(User password: unlocked)

Section B: Gain and Table Calibration

Calibration

Tools Needed (supplied or required):

- Power Meter and Power Head (tools for measuring the laser's power and energy)
- Kentek's View-It® IR Infrared Detector (high-efficiency laser-sensitive material; provides convenient method for real-time viewing of beam shapes, mode structure, and beam alignment)
- Scale (metric; minimum 150mm)
- Laser Safety Glasses
- Vinyl or PVC Gloves (powder-free and DEHP & DOP-free; disposable)
- Clean Room or Workspace

(Note: Before starting the process of calibration, be sure to first secure the equipment and workspace, placing the welder into a secure room. The operator or technician calibrating this device must wear appropriate laser safety glasses; this is a requirement.)

Equipment Overview

The FiberStar® 8801 Series welding workstation is a highly specialized, stand-alone, single user operated laser welding device designed for metalworking and fabrication. This versatile welding workstation (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 assemblies applications, including spot and seam welding, mold repair, and micro-welding.

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

The welding workstation is equipped with a stereo microscope with cross-hair. This cross-hair (a specialized component inside the microscope lens) marks the exact position of the laser pulse spot onto the workpiece, ensuring that welding results remain consistent and accurate despite periods of prolonged or continuous use.

In addition to the stereomicroscope with cross-hair, the welding workstation is also equipped with a foot pedal switch with two (2) operating positions, capable of firing both single or continuous laser pulses. The first position (pedal switch slightly depressed) enables the inert gas supply, while the second position (pedal switch fully depressed) releases a laser pulse.

X. Appendix, Section B: Equipment Overview Continued on Next Page

Equipment Overview (continued)

With welding applications, to achieve optimal finalized results, the workpiece must be positioned within the focusing area of the laser beam. Positioning and workpiece height are the determining factors that affect the final results and outcome. **(Note: Workpiece height is correct when the surface of the part remains in focus while under the stereomicroscope.)**

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 either the joystick or keypad controls (located inside the welding work chamber). With one control, the intensity of the laser pulse (energy) is affected, and with the other, the pulse length (mS). Settings for additional materials can also be obtained by following the adjustment techniques described.

With certain materials, the quality and outcome of the weld can be improved using argon (inert) gas. This device is equipped with an argon [inert] gas valve.

Welding and cutting processes and applications have potential to generate gases that are hazardous to your health. The gases generated and their concentrations depend on the process used and the gas formation mechanisms. Gases, some of which may be hazardous, are inherent in some processes - either as a shielding gas (to protect the molten weld pool against atmospheric contamination) or for flame processes - as a consumable that is burnt.

During or after the welding applications process, following exposure to harmful fumes or irritants, the operator may experience the following symptoms:

- dizziness
- headache
- fatigue
- intense cough
- irritation of the eyes, nose or throat

Because vapors and gases produced during the welding process can be harmful, they must be filtered and extracted from the lasing chamber and operator's workstation with the use of an approved external fume and heavy particle exhaust system. The external exhaust system can either be purchased separately or through LaserStar Technologies Corporation®. If purchasing an exhaust from another manufacturing entity, be sure to seek approval from LaserStar Technologies Corporation®

Setup and Preparation (prior to beginning with device calibration)

- Make sure each of the tables for STD and Micro modes have been cleared.
- Check to be sure the final focus lens is clean. **(Note: The lens must be installed during gain calibration; verify the component is in place.)**
- Check to be sure that the work area lights (and all other ambient light sources) are “off.”
- Verify the laser beam has been defocused on the power head (reduce pulse spot size to 3/4” diameter); this will ensure power head damage is avoided and also improve accuracy.
- Check to be sure that the power meter is set to the lowest range, but still the highest resolution for optimizing accuracy.
- Before taking any measurements, check to be sure that the value for watts (displayed on the power meter) has stabilized. **(Note: The laser is stabilized [and fired] by holding down the foot pedal switch; hold down until you notice the value for watts shows little change.)**
- Select the new calibrated value that is closest to the nominal value. **(Note: The closest new calibrated value may be plus (+) or minus (-) the nominal value.)**

Notes

X. Appendix, Section B: Gain Calibration: STD Mode Continued on Next Page

Gain Calibration: STD Mode (figure 1 and data tables 1–2)

From the main screen, input the following parameters:

(a). Joules (per ××× watts model)

(b). Pulse Width: 3.0mS

(c). Frequency: 10Hz

(d). Burst (B): 0

(e). Basic

(f). Watts (per ××× watts model)

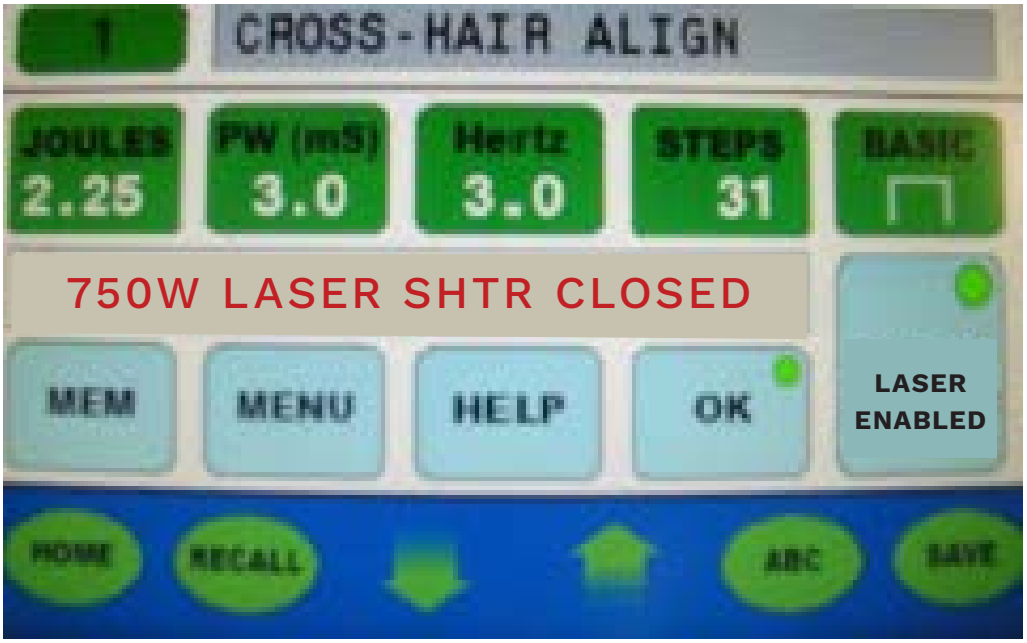


Figure 1
(Main screen;
laser enabled)

X. Appendix, Section B: Gain Calibration: STD Mode Continued on Next Page

Gain Calibration: STD Mode (150 watt models)

The settings below are typical and specific to STD (multi-pulse) mode

PW = 3.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
2.25	750	22.50	2.25	2.249

150 watt models: (*) These values are typical. The person or technician calibrating this device should match the joules value (watts ÷ 10) from the power / energy meter, remaining as close as possible to the joules value on the touchscreen display.

(**) The measured joules value should be the average of at least 3 (minimum) measurements.

Notes

X. Appendix, Section B: Gain Calibration: STD Mode Continued on Next Page

Gain Calibration: STD Mode (300 watt models)

The settings below are typical and specific to STD (multi-pulse) mode

PW = 3.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
4.50	1500	45.0	4.50	4.49

300 watt models: (*) These values are typical. The person or technician calibrating this device should match the joules value (watts ÷ 10) from the power / energy meter, remaining as close as possible to the joules value on the touchscreen display.

(**) The measured joules value should be the average of at least 3 (minimum) measurements.

Notes

Gain Calibration: STD Mode (450 watt models)

The settings below are typical and specific to STD (multi-pulse) mode

PW = 3.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
6.75	2250	67.51	6.751	6.802

450 watt models: (*) These values are typical. The person or technician calibrating this device should match the joules value (watts ÷ 10) from the power / energy meter, remaining as close as possible to the joules value on the touchscreen display.

(**) The measured joules value should be the average of at least 3 (minimum) measurements.

Notes

Gain Calibration: STD Mode (600 watt models)

The settings below are typical and specific to STD (multi-pulse) mode

PW = 3.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
9	3000	90.02	9.002	9.036

600 watt models: (*) These values are typical. The person or technician calibrating this device should match the joules value (watts ÷ 10) from the power / energy meter, remaining as close as possible to the joules value on the touchscreen display.

(**) The measured joules value should be the average of at least 3 (minimum) measurements.

Notes

Gain Calibration: Micro Mode (figures 2–10 & data tables 1–2)

From the main screen, input the following parameters:

(a). Joules (per ××× watts model)

(b). Pulse Width: -10.0mS

(c). Frequency: 10Hz

(d). Burst (B): 0

(e). Basic

(f). Watts per ××× watts model)

Figure 2
(Main menu;
laser disabled)

Gain Calibration: Micro Mode (150 watt models)

The settings below are typical and specific to Micro (multi-pulse) mode

PW = 10.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
1.25	125	12.49	1.249	1.251

150 watt models: (*) These values are typical. The person or technician calibrating this device should match the joules value (watts ÷ 10) from the power / energy meter, remaining as close as possible to the joules value shown on the touchscreen display.

(**) The measured joules value should be the average of at least 3 (minimum) measurements.

Notes

X. Appendix, Section B: Gain Calibration: Micro Mode Continued on Next Page

Gain Calibration: Micro Mode (300 watt models)

The settings below are typical and specific to Micro (multi-pulse) mode

PW = 10.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
1.50	150	14.98	1.498	1.497

300 watt models: (*) These values are typical. The person or technician calibrating this device should match the joules value (watts ÷ 10) from the power / energy meter, remaining as close as possible to the joules value shown on the touchscreen display.

(**) The measured joules value should be the average of at least 3 (minimum) measurements.

Notes

Gain Calibration: Micro Mode (450 watt models)

The settings below are typical and specific to Micro (multi-pulse) mode

PW = 10.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
2.25	225	22.48	2.248	2.253

450 watt models: (*) These values are typical. The person or technician calibrating this device should match the joules value (watts ÷ 10) from the power / energy meter, remaining as close as possible to the joules value shown on the touchscreen display.

(**) The measured joules value should be the average of at least 3 (minimum) measurements.

Notes

Gain Calibration: Micro Mode (600 watt models)

The settings below are typical and specific to Micro (multi-pulse) mode

PW = 10.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
3.00	300	30.04	3.004	2.995

600 watt models: (*) These values are typical. The person or technician calibrating this device should match the joules value (watts ÷ 10) from the power / energy meter, remaining as close as possible to the joules value shown on the touchscreen display.

(**) The measured joules value should be the average of at least 3 (minimum) measurements.

Notes

Calibration Procedure

1. Press the **up** or **down arrow** once; three [3] zeros [000] will appear on the right-hand side of “password” **(figure 14)**.

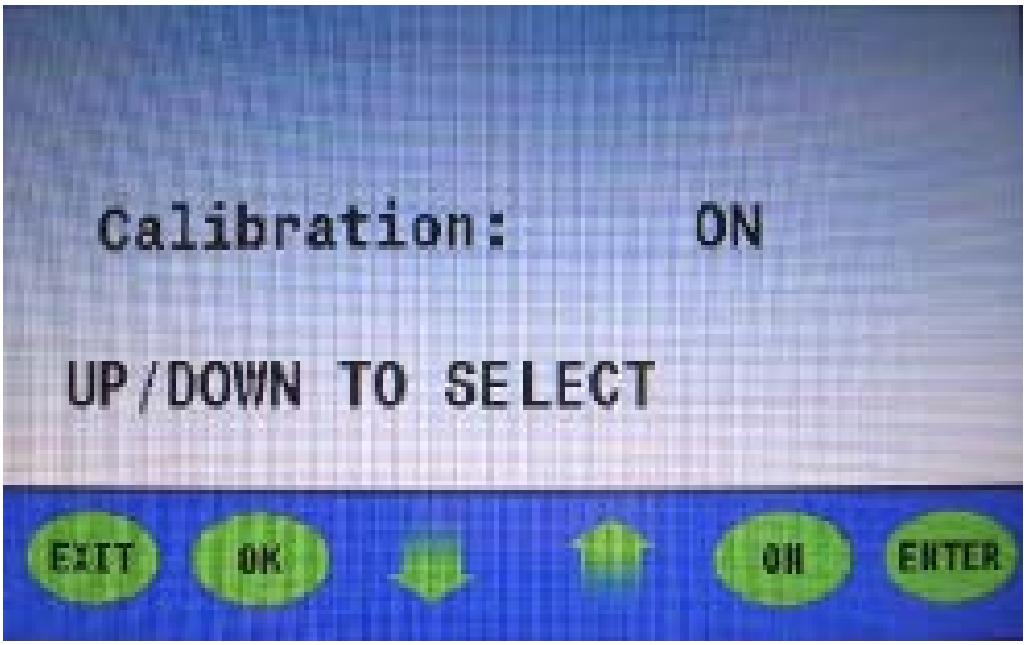


Figure 3
(Calibration “On”)

2. Press the **up** or **down arrow**; this allows you to set the value for the blinking “0” to “4”. Press the **enter button**.
3. Press the **up** or **down arrow** to set the second value in the number sequence, “0” to “3.” Next, press the **enter button**
4. Press the **up** or **down arrow** to set the last value in the number sequence, “0” to “8.” Press the **enter button**; the display will read: “Calibration: Table” **(figure 15)**.
5. Press the **enter button (figure 16).**
6. Press the **up** or **down arrow**; select “CLR Table.” Next, press the **enter button.**

X. Appendix, Section B: Gain Calibration Continued on Next Page

Calibration Procedure (continued)

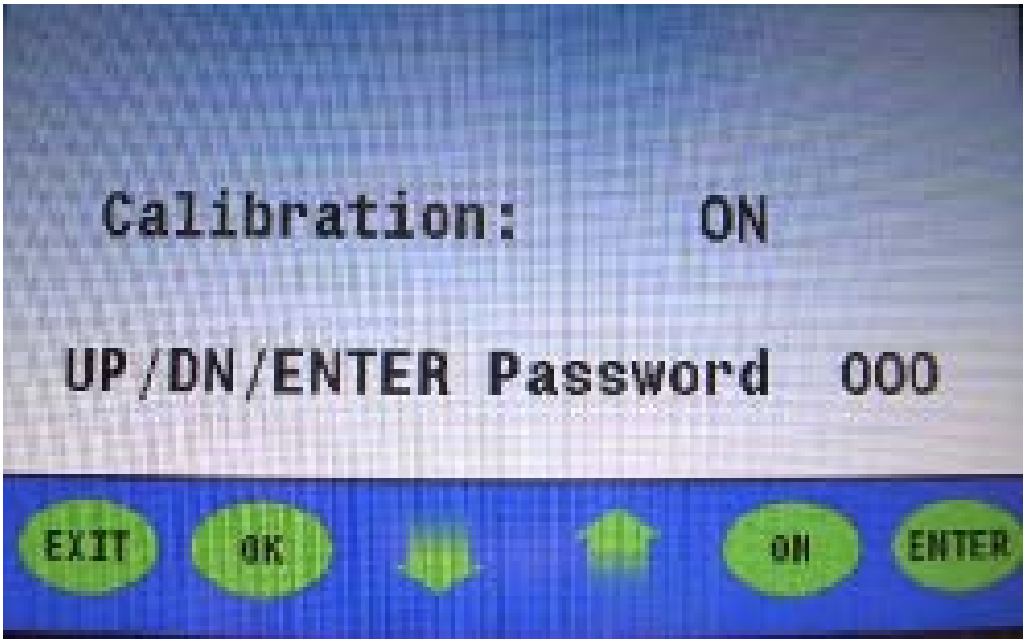


Figure 4
(Password)

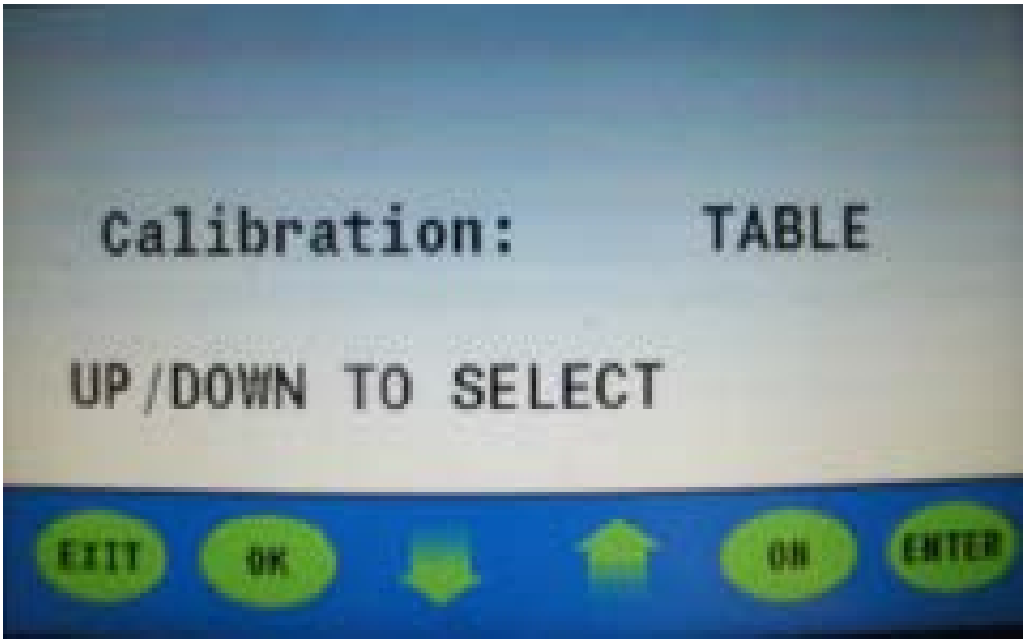


Figure 5
(Calibration: Table selected)

X. Appendix, Section B: Gain Calibration Continued on Next Page

Calibration Procedure (continued)

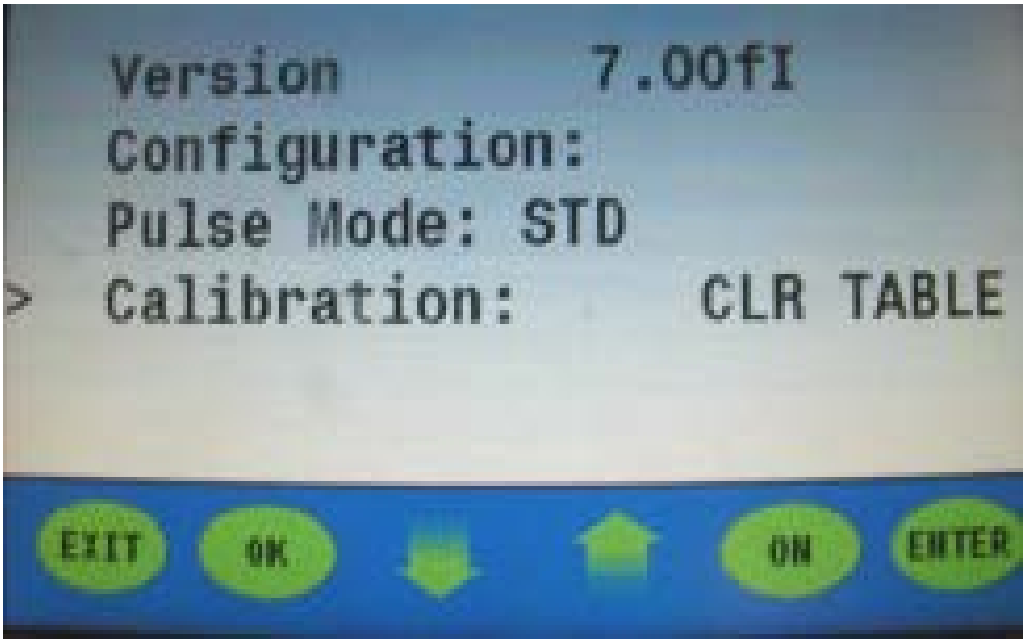


Figure 6
(Calibration; CLR table selected)

X. Appendix, Section B: Gain Calibration Continued on Next Page

Calibration Procedure (continued)

7. Press the **exit button** twice (×2) to return to the main menu **(figure 17).**

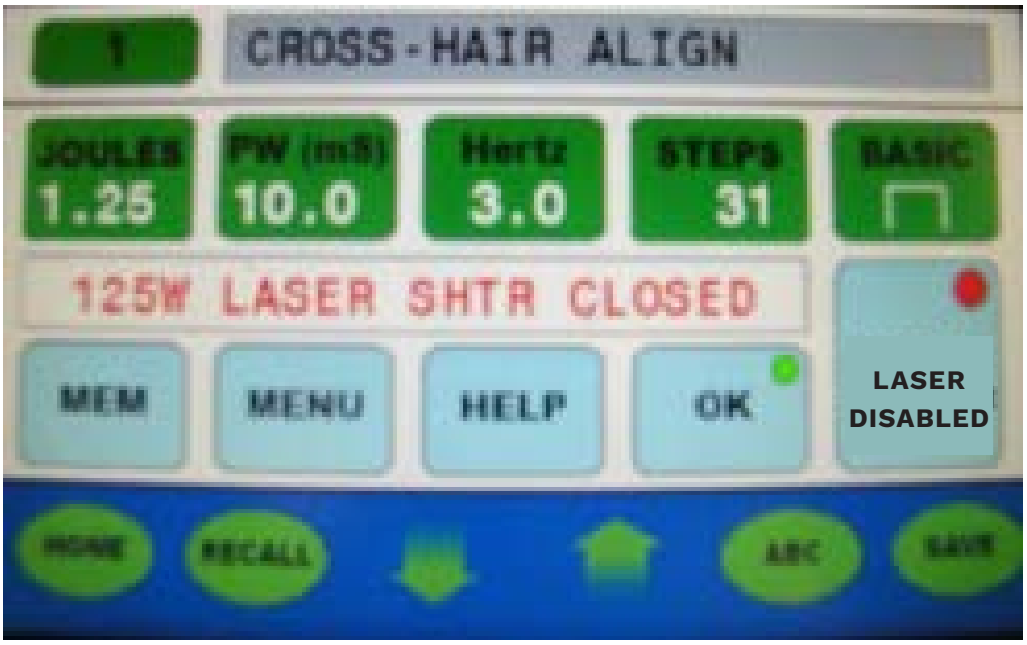


Figure 7
(Main menu; laser is disabled [150W models])

X. Appendix, Section B: Gain Calibration Continued on Next Page

Calibration Procedure (continued)

8. Press the **menu button** and scroll down to **calibration**. Press the **enter button**.
9. Press the **up** or **down arrow**; select "Gain." Next, press the enter button **(figure 8)**.

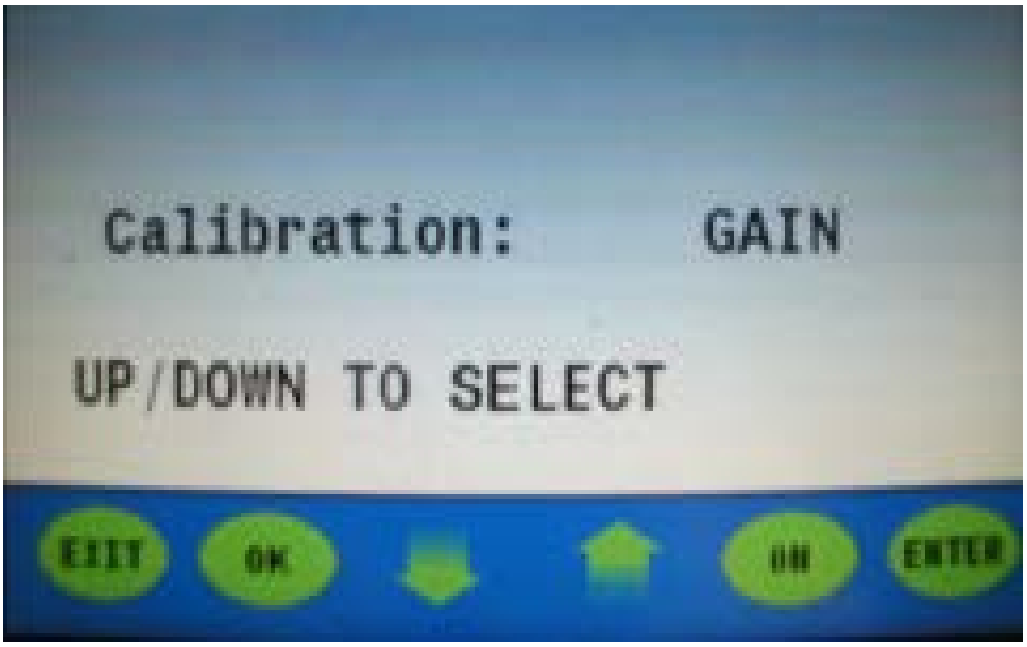


Figure 8
(Calibration; gain selected)

X. Appendix, Section B: Gain Calibration Continued on Next Page

Calibration Procedure (continued)

10. Press the **exit button** twice (×2) to return to the main menu.
11. The main menu will display: “125W LASER DISABLED” (the laser will be disabled).
12. Verify that the parameters on the main screen match those shown in step #1.
13. Setup the power meter and power head to measure watts. **(Note: Check to be sure that the laser beam is defocused. The beam diameter on the power head should be approximately [¾”] diameter.)**
14. Press the **laser enabled/disabled button** (this will enable the laser). The display will read: “125W gCAL MULTI PULSE” **(figure 19)**.

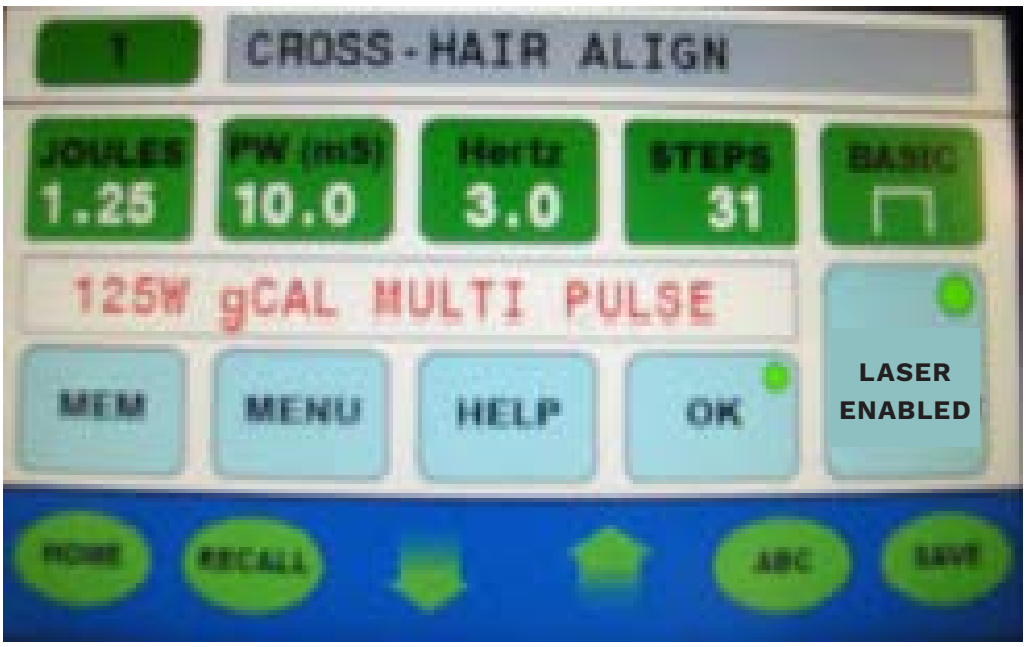


Figure 9
(Main menu; gain calibration [150W models])

X. Appendix, Section B: Gain Calibration Continued on Next Page

Calibration Procedure (continued)

15. Depress the **foot pedal switch** until the power meter value stabilizes (about 30 seconds).
16. Take a reading. **(Note: The goal is to have the power meter value (W ÷ 10 = J) equal to the joules parameter value shown in the touch screen display.)**
17. Release the **foot pedal switch**.
18. Press the **up** or **down arrow** twice (×2) to adjust the laser output.
19. Repeat **steps #24–#27** until the power meter value (W ÷ 10 = J) equals the joules parameter value shown on the touchscreen display.
20. Run for 60 seconds to verify that the power meter value (W ÷ 10 = J) equals the parameter value shown on the touchscreen display. If not, repeat **steps #24–#29**.
21. Select Laser Disabled.
22. Press the **menu button** and scroll down to **calibration**. Press the **enter button**.
23. Press the **up** or **down arrow** and change Gain to “ON” **(figure 20)**.
24. Press the **enter button**. Next, press the **exit button** twice (x2) to return to the main menu **(figure 11)**; calibration is complete.

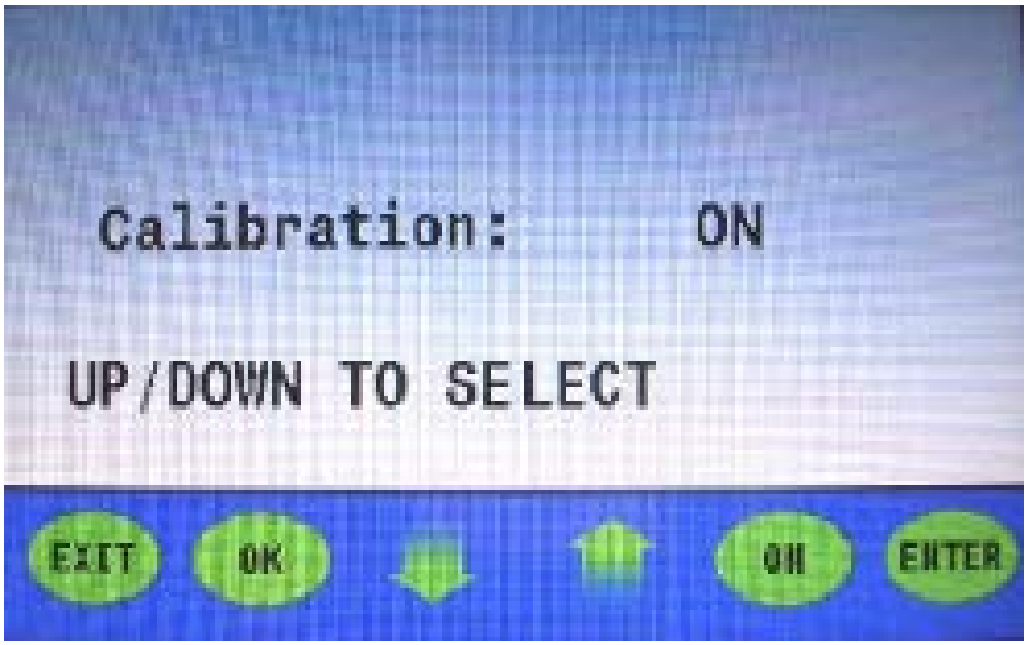


Figure 10
(Calibration “ON”)

X. Appendix, Section B: Gain Calibration Continued on Next Page

Gain Calibration Summary Guide

Analog Controls

1. **Select the Menu Icon (passcode: 438):**

    (a). Pulse Mode: “MICRO”

    (b). Calibration: “ON”

    (c). Enter passcode: 438

    (d). Calibration: “TABLE”

    (e). Select “CLR TABLE”

    (f). Press “ENTER”

    (g). Press “EXIT” twice

2. **Select the Menu Icon (passcode: 438):**

    (a). Pulse Mode: “STD”

    (b). Calibration: “ON”

    (c). Enter passcode: 438

    (d). Calibration: “TABLE”

    (e). Select “CLR TABLE”

    (f). Press “ENTER”

    (g). Press “EXIT” twice

3. **Input the following parameters on the touchscreen display (model and wattage dependent; all values are listed at 50% of the values noted on the corresponding test results sheet and data tables):**

    (a). Pulse Mode: “STD” (micro-pulse mode, if requested by customer)

    (b). Joules (pulse energy)

    (c). Milliseconds (pulse width)

    (d). Hertz

    (e). Watts (peak power)

Gain Calibration Summary Guide

4. **Setup the Power Meter:**

   (a). Check to be sure the final focus lens is clean. **(Note: The lens must be installed during gain calibration; verify the component is in place.)**

   (b). Check to be sure that the chamber lights (and all other ambient light sources) are “off.”

   (c). Verify the laser beam has been defocused on the power head (reduce pulse spot size to ¾” or 19mm diameter).

   (d). Select the lowest power range that measures equal the maximum average power noted on the test results sheet.

5. **Setup the Menu Icon:**

   (a). Pulse Mode: “STD” (micro-pulse mode, if requested by customer).

   (b). Set **calibration** to “GAIN.”

   (c). Exit to the main menu.

6. **Enable the laser:**

   (a). Depress the **foot pedal switch** until the power meter value stabilizes (about 30 seconds).

   (b). Take a reading from the device (W ÷ 10 = J).

   (c). Release the **foot pedal switch**.

   (d). Press the **up** or **down arrow** twice (×2) to adjust the laser's output.

   (e). Repeat steps (a–d) until the power meter value (W ÷ 10 = J) equals the joules (J) parameter value shown on the touchscreen display.

   (f). Run for 60 seconds to verify that the power meter value (W ÷ 10 = J) equals the parameter value shown in the touchscreen display.

   (g). Disable the laser by pressing the **laser enable/disable button**.

Attention: Be sure to refrain from using the **up** or **down arrows** again until completing the next step. Failure to follow this warning may result in corrupting the previous gain adjustment.

7. **Select Menu:**

   (a). Scroll down to calibration

   (b). Calibration: “on”

   (c). Press “enter”

   (d). Press “exit” twice (×2); Gain Calibration is complete.

VII. "STD" Mode Test Results (150W)

Machine Model Number: _____ **Machine Serial Number:** _____

Fiber Model Number: _____ **Fiber Serial Number:** _____

Date Tested: _____ **"GAIN" Calibration*:** **STD** or MICRO (Circle One)**

Test Person: _____ **Assembly Person:** _____

STD Mode: pulse width = 3ms, rate = 10Hz, [*] "GAIN" calibrated at linear / 50% values, [**] Preferred

STD MODE											
%	Energy	Pulse	Rate	Peak	Avg.	Avg.	Pulse	Avg. Power Tolerance			
Linear	Target	Width		Power	Power	Power	Energy	(±2%)			
%	J	mS	Hz	Calc. W	Calc. W	Actual W	Calc. J	Calc. %			
10.0%	0.450	3	10	150	4.50						
20.0%	0.900	3	10	300	9.00						
30.0%	1.350	3	10	450	13.50						
40.0%	1.800	3	10	600	18.00						
50.0%	2.250	3	10	750	22.50						
60.0%	2.700	3	10	900	27.00						
70.0%	3.150	3	10	1050	31.50						
80.0%	3.600	3	10	1200	36.00						
90.0%	4.050	3	10	1350	40.50						

“MICRO” Mode & “CW” Mode Test Results (150W)

Machine Model Number: _____ **Machine Serial Number:** _____

Fiber Model Number: _____ **Fiber Serial Number:** _____

Date Tested: _____ **"GAIN" Calibration*:** **STD** or MICRO (Circle One)**

Test Person: _____ **Assembly Person:** _____

MICRO Mode: pulse width = 10ms, rate = 10Hz, [*] "GAIN" calibrated at linear / 50% values, [**] Preferred

MICRO MODE										
%	Energy	Pulse	Rate	Peak	Avg.	Avg.	Pulse	Avg. Power Tolerance	Avg.	Avg.
Linear	Target	Width		Power	Power	Power	Energy	(±2%)	Power	Power
%	J	mS	Hz	Calc. W	Calc. W	Actual W	Calc. J	Calc. %	Target W	Actual W
20.0%	0.500	10	10	50	5.00				25	
30.0%	0.750	10	10	75	7.50				50	
40.0%	1.000	10	10	100	10.00				75	
50.0%	1.250	10	10	125	12.50				100	
60.0%	1.500	10	10	150	15.00					
70.0%	1.750	10	10	175	17.50					
80.0%	2.000	10	10	200	20.00					
90.0%	2.250	10	10	225	22.50					

VIII. "STD" Mode Test Results (300W)

Machine Model Number: _____ **Machine Serial Number:** _____

Fiber Model Number: _____ **Fiber Serial Number:** _____

Date Tested: _____ **"GAIN" Calibration*:** **STD** or MICRO (Circle One)**

Test Person: _____ **Assembly Person:** _____

STD Mode: pulse width = 3ms, rate = 10Hz, [*] "GAIN" calibrated at linear / 50% values, [**] Preferred

STD MODE											
%	Energy	Pulse	Rate	Peak	Avg.	Avg.	Pulse	Avg. Power Tolerance			
Linear	Target	Width		Power	Power	Power	Energy	(±2%)			
%	J	mS	Hz	Calc. W	Calc. W	Actual W	Calc. J	Calc. %			
10.0%	0.900	3	10	300	9.00						
20.0%	1.800	3	10	600	18.00						
30.0%	2.700	3	10	900	27.00						
40.0%	3.600	3	10	1200	36.00						
50.0%	4.500	3	10	1500	45.00						
60.0%	5.400	3	10	1800	54.00						
70.0%	6.300	3	10	2100	63.00						
80.0%	7.200	3	10	2400	72.00						
90.0%	8.100	3	10	2700	81.00						

“MICRO” Mode & “CW” Mode Test Results (300W)

Machine Model Number: _____ **Machine Serial Number:** _____

Fiber Model Number: _____ **Fiber Serial Number:** _____

Date Tested: _____ **"GAIN" Calibration*:** **STD** or MICRO (Circle One)**

Test Person: _____ **Assembly Person:** _____

MICRO Mode: pulse width = 10ms, rate = 10Hz, [*] "GAIN" calibrated at linear / 50% values, [**] Preferred

MICRO MODE									CW	
%	Energy	Pulse	Rate	Peak	Avg.	Avg.	Pulse	Avg. Power Tolerance	Avg.	Avg.
Linear	Target	Width		Power	Power	Power	Energy	(±2%)	Power	Power
%	J	mS	Hz	Calc. W	Calc. W	Actual W	Calc. J	Calc. %	Target W	Actual W
20.0%	0.600	10	10	60	6.00				30	
30.0%	0.900	10	10	90	9.00				100	
40.0%	1.200	10	10	120	12.00				150	
50.0%	1.500	10	10	150	15.00				200	
60.0%	1.800	10	10	180	18.00					
70.0%	2.100	10	10	210	21.00					
80.0%	2.400	10	10	240	24.00					
90.0%	2.700	10	10	270	27.00					

VIII. "STD" Mode Test Results (450W)

Machine Model Number: _____ **Machine Serial Number:** _____

Fiber Model Number: _____ **Fiber Serial Number:** _____

Date Tested: _____ **"GAIN" Calibration*:** **STD** or MICRO (Circle One)**

Test Person: _____ **Assembly Person:** _____

STD Mode: pulse width = 3ms, rate = 10Hz, [*] "GAIN" calibrated at linear / 50% values, [**] Preferred

STD MODE											
%	Energy	Pulse	Rate	Peak	Avg.	Avg.	Pulse	Avg. Power Tolerance			
Linear	Target	Width		Power	Power	Power	Energy	(±2%)			
%	J	mS	Hz	Calc. W	Calc. W	Actual W	Calc. J	Calc. %			
10.0%	1.350	3	10	450	13.50						
20.0%	2.700	3	10	900	27.00						
30.0%	4.050	3	10	1350	40.50						
40.0%	5.400	3	10	1800	54.00						
50.0%	6.750	3	10	2250	67.50						
60.0%	8.100	3	10	2700	81.00						
70.0%	9.450	3	10	3150	94.50						
80.0%	10.800	3	10	3600	108.00						
90.0%	12.150	3	10	4050	121.50						

“MICRO” Mode & “CW” Mode Test Results (450W)

Machine Model Number: _____ **Machine Serial Number:** _____

Fiber Model Number: _____ **Fiber Serial Number:** _____

Date Tested: _____ **"GAIN" Calibration*:** **STD** or MICRO (Circle One)**

Test Person: _____ **Assembly Person:** _____

MICRO Mode: pulse width = 10ms, rate = 10Hz, [*] "GAIN" calibrated at linear / 50% values, [**] Preferred

MICRO MODE									CW	
%	Energy	Pulse	Rate	Peak	Avg.	Avg.	Pulse	Avg. Power Tolerance	Avg.	Avg.
Watts	Target	Width		Power	Power	Power	Energy	(±2%)	Power	Power
%	J	mS	Hz	Calc. W	Calc. W	Actual W	Calc. J	Calc. %	Target W	Actual W
20.0%	0.900	10	10	90	9.00				45	
30.0%	1.350	10	10	135	13.50				150	
40.0%	1.800	10	10	180	18.00				225	
50.0%	2.250	10	10	225	22.50				300	
60.0%	2.700	10	10	270	27.00					
70.0%	3.150	10	10	315	31.50					
80.0%	3.600	10	10	360	36.00					
90.0%	4.050	10	10	405	40.50					

VIII. "STD" Mode Test Results (600W)

Machine Model Number: _____ **Machine Serial Number:** _____

Fiber Model Number: _____ **Fiber Serial Number:** _____

Date Tested: _____ **"GAIN" Calibration*:** **STD** or MICRO (Circle One)**

Test Person: _____ **Assembly Person:** _____

STD Mode: pulse width = 3ms, rate = 10Hz, [*] "GAIN" calibrated at linear / 50% values, [**] Preferred

STD MODE											
%	Energy	Pulse	Rate	Peak	Avg.	Avg.	Pulse	Avg. Power Tolerance			
Linear	Target	Width		Power	Power	Power	Energy	(±2%)			
%	J	mS	Hz	Calc. W	Calc. W	Actual W	Calc. J	Calc. %			
10.0%	1.800	3	10	600	18.00						
20.0%	3.600	3	10	1200	36.00						
30.0%	5.400	3	10	1800	54.00						
40.0%	7.200	3	10	2400	72.00						
50.0%	9.000	3	10	3000	90.00						
60.0%	10.800	3	10	3600	108.00						
70.0%	12.600	3	10	4200	126.00						
80.0%	14.400	3	10	4800	144.00						
90.0%	16.200	3	10	5400	162.00						

“MICRO” Mode & “CW” Mode Test Results (600W)

Machine Model Number: _____ **Machine Serial Number:** _____

Fiber Model Number: _____ **Fiber Serial Number:** _____

Date Tested: _____ **"GAIN" Calibration*:** **STD** or MICRO (Circle One)**

Test Person: _____ **Assembly Person:** _____

MICRO Mode: pulse width = 10ms, rate = 10Hz, [*] "GAIN" calibrated at linear / 50% values, [**] Preferred

MICRO MODE									CW	
%	Energy	Pulse	Rate	Peak	Avg.	Avg.	Pulse	Avg. Power Tolerance	Avg.	Avg.
Watts	Target	Width		Power	Power	Power	Energy	(±2%)	Power	Power
%	J	mS	Hz	Calc. W	Calc. W	Actual W	Calc. J	Calc. %	Target W	Actual W
20.0%	1.200	10	10	120	12.00				60	
30.0%	1.800	10	10	180	18.00				150	
40.0%	2.400	10	10	240	24.00				300	
50.0%	3.000	10	10	300	30.00				450	
60.0%	3.600	10	10	360	36.00					
70.0%	4.200	10	10	420	42.00					
80.0%	4.800	10	10	480	48.00					
90.0%	5.400	10	10	540	54.00					

Table Calibration: STD Mode & Micro Mode

Calibration: Overview and Tips

While at the factory, the FiberStar® 8801 Series welding workstation was calibrated using gain calibration; gain calibration is generally acceptable for most applications.

If table calibration is necessary, continue with the steps below. **(Note: Gain calibration is still a requirement and must be implemented prior to following the steps for table calibration.)** The values shown in **tables 1 & 2** that follow were recorded while the **final focus lens** was in place.

In order to enhance the welder's accuracy with specific applications, it is recommended that this device be calibrated using the pulse width and frequency (hertz) closest to the values that will be used for welding applications. When calibrating for a new pulse width and frequency, the operator may calibrate the system at all the joules values listed or only at selected values that are listed in **tables 1 or 2. (Note: When calibrating an individual value, all values between this new calibrated value and the nearest table value [on each side of this new calibrated value] will be recalculated. If the user is using both STD and Micro-pulse modes, then tables 1 and 2 should be recalibrated at the appropriate pulse width and frequency.)**

Proper calibration requires using the appropriate laser power or energy measuring equipment, which is available for order from our LaserStar Technologies Corporation® e-store. These measurements should be taken out of the **final focus lens**. The power meter should be placed at a distance from the **final focus lens** such that the beam size is defocused to approximately 3/4” diameter. **(Note: This calibration procedure creates an approximation of the energy (joules) over the watts range specified in tables 1 & 2.)**

There is a separate calibration procedure for both STD Mode and Micro Mode. The required password for both modes is “438.”

Setup and Preparation (prior to beginning with device calibration)

- The steps that follow should be performed prior to recalibrating (for either STD mode or Micro mode). The screenshots and figures in this section are for the FiberStar® 8801 Series (150 watt model). When calibrating, verify your device's model and refer to the correct watts table for applicable parameter settings or specifications.
- Check to be sure the final focus lens is clean. **(Note: The lens must be installed during gain calibration; verify the lens component is in place.)**
- Check to be sure that the chamber lights (and all other ambient light sources) are “off.”
- Verify that the laser beam has been defocused on the power head (reduce pulse spot size to 3/4” or 19mm diameter); this helps to improve accuracy and ensures that power head damage is avoided.

X. Appendix: Table Calibration: STD Mode & Micro Mode
Continued on Next Page

Setup and Preparation (prior to beginning with device calibration; continued)

- When recording measurements, and to further optimize welding results and ensure accuracy, set the power meter to the lowest power range (with the highest resolution). Check that the watts value displayed in the power meter is stabilized. **(Note: The laser is stabilized (and fired) by holding down the foot pedal until the watts value shows minimal fluctuation.)**
- Select the new calibrated value that is closest to the nominal value. **(Note: The closest new calibrated value may be plus (+) or minus (-) the nominal value.)**
- Check to be sure that the actual table values are documented; these values will be lost if the control board memory battery is removed.

Table Calibration: STD Mode (figures 1–9 & data tables)

From the main screen, input the following parameters:

(a). Joules (per ××× watts model)

(b). Pulse Width: 3.0mS

(c). Frequency: 10Hz

(d). Burst (B): 0

(e). Basic

(f). Watts (per ××× watts model)

Table Calibration: STD Mode & Micro Mode (Continued)

Figure 1
(Main screen;
laser disabled)

Notes

X. Appendix: Table Calibration: STD Mode Continued on Next Page

Table Calibration: STD Mode

Table Calibration: STD Mode (150 watt models)				
The settings below are typical and specific to STD (multi-pulse) mode				
PW = 3.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
.450	150	4.55	.455	.453
.900	300	8.78	.878	.880
1.35	450	13.55	1.355	1.345
1.80	600	18.04	1.804	1.810
2.25	750	22.49	2.249	2.247
2.70	900	26.95	2.695	2.690
3.15	1050	31.00	3.100	3.120
3.60	1200	35.7	3.57	3.56

X. Appendix: Table Calibration: STD Mode Continued on Next Page

Table Calibration: STD Mode

Table Calibration: STD Mode (150 watt models; continued)				
The settings below are typical and specific to STD (multi-pulse) mode				
PW = 3.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
4.05***	1350	40.3	4.03	4.04
4.50***	1500	44.8	4.48	4.51

150 watt models: (*) These values are typical. The person or technician calibrating this device should match the joules value (watts ÷ 10) from the power / energy meter, remaining as close as possible to the joules value shown on the touchscreen display.

(**) The measured joules value should be the average of at least 3 (minimum) measurements.

(***) Measurements taken out of the final focus lens (focus head) versus the BDO may not reach these values.

X. Appendix: Table Calibration: STD Mode Continued on Next Page

Table Calibration: STD Mode

Table Calibration: STD Mode (300 watt models)				
The settings below are typical and specific to STD (multi-pulse) mode				
PW = 3.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
.900	300	8.87	.887	.906
1.80	600	17.94	1.794	1.760
2.70	900	27.02	2.702	2.690
3.60	1200	35.9	3.59	3.620
4.50	1500	45.0	4.50	4.494
5.40	1800	54.1	5.41	5.38
6.30	2100	63.2	6.32	6.24
7.20	2400	72.2	7.22	7.12

X. Appendix: Table Calibration: STD Mode Continued on Next Page

Table Calibration: STD Mode

Table Calibration: STD Mode (300 watt models; continued)				
The settings below are typical and specific to STD (multi-pulse) mode				
PW = 3.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
8.10***	2700	81.2	8.12	8.08
9.00***	3000	89.5	8.95	9.02

300 watt models: (*) These values are typical. The person or technician calibrating this device should match the joules value (watts ÷ 10) from the power / energy meter, remaining as close as possible to the joules value shown on the touchscreen display.

(**) The measured joules value should be the average of at least 3 (minimum) measurements.

(***) Measurements taken out of the final focus lens (focus head) versus the BDO may not reach these values.

X. Appendix: Table Calibration: STD Mode Continued on Next Page

Table Calibration: STD (multi-pulse) Mode

Calibration Procedure

1. Press the **Menu button**. Next, scroll down to pulse mode and press **Enter (figure 2).**
2. Press the **up** or **down arrow** to scroll through the available options; select STD.
3. Press **Enter**. Then, press the **Exit button**.

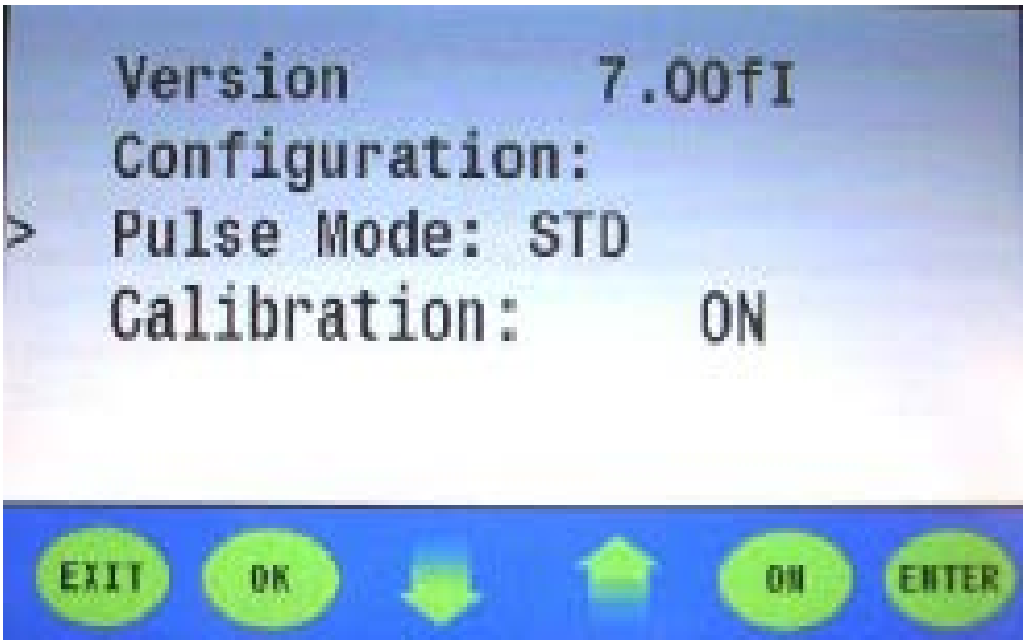


Figure 2
(Pulse mode:
STD selected)

X. Appendix: Table Calibration: STD (multi-pulse) Mode Continued on Next Page

Table Calibration: STD (multi-pulse) Mode

Calibration Procedure (continued)

4. Scroll down to “Calibration.” Next, press the **Enter button**. The display will read: “Calibration: ON” **(figure 3)**.

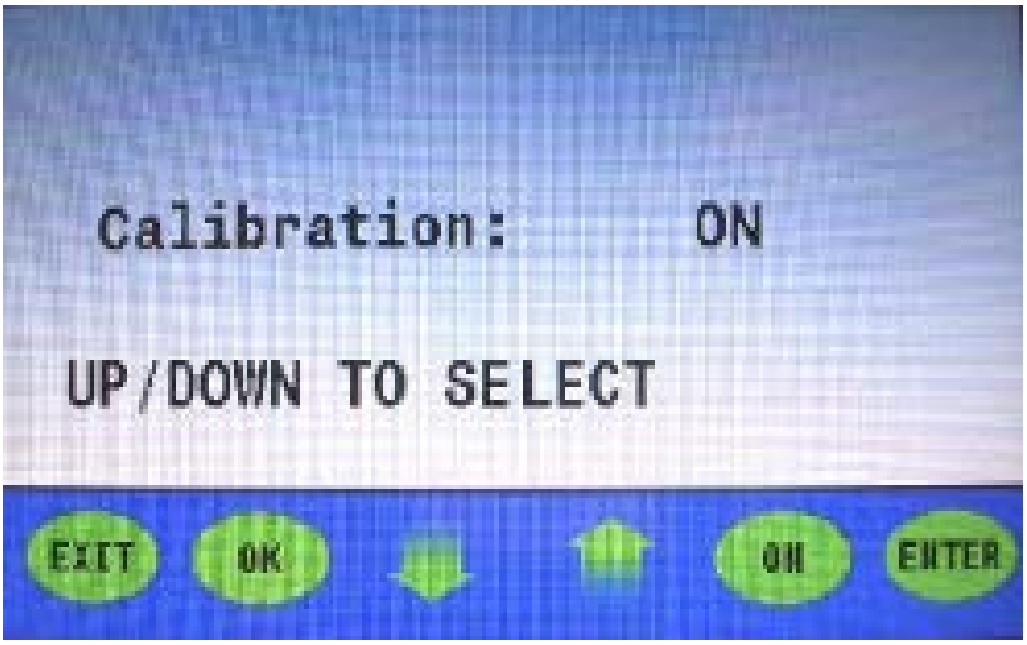


Figure 3
(Calibration: “on”)

5. Press the **up** or **down arrow** once; three [3] zeros [000] will appear on the right-hand side of “password” **(figure 4)**.

X. Appendix: Table Calibration: STD (multi-pulse) Mode Continued on Next Page

Table Calibration: STD (multi-pulse) Mode

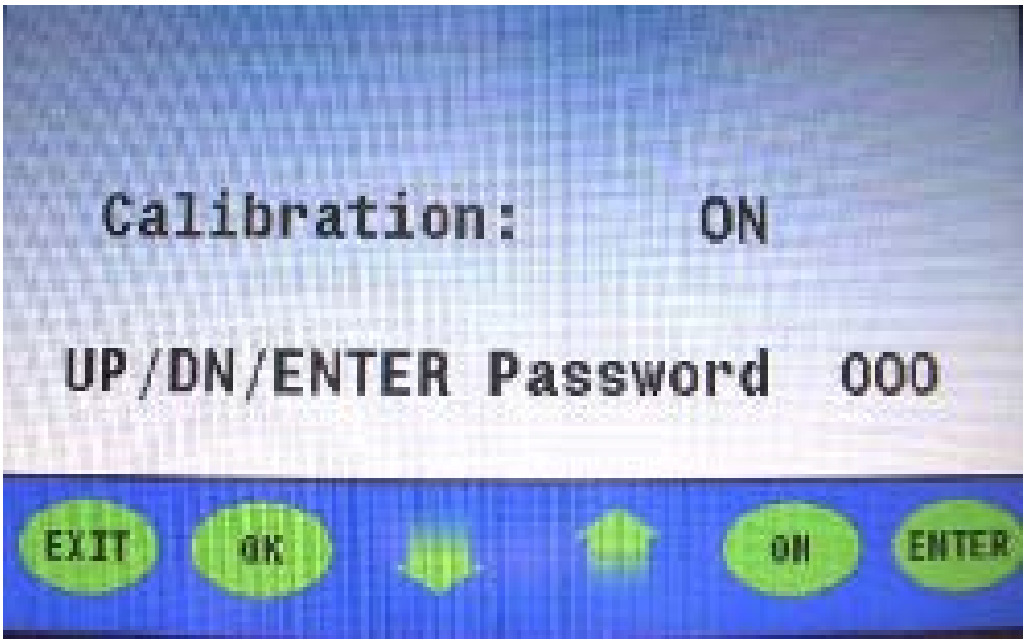


Figure 4
(Password screen)

Calibration Procedure (continued)

6. Press the **up** or **down arrow**; this allows you to set the value for the blinking “0” to “4”. Press the **Enter button**.
7. Press the **up** or **down arrow** to set the second value in the number sequence, “0” to “3.” Next, press the **Enter button**.
8. Press the **up** or **down arrow** to set the last value in the number sequence, “0” to “8.” Press the **Enter button**; the display will read: “Calibration: Table” **(figure 5)**.

X. Appendix: Table Calibration: STD (multi-pulse) Mode Continued on Next Page

Table Calibration: STD (multi-pulse) Mode

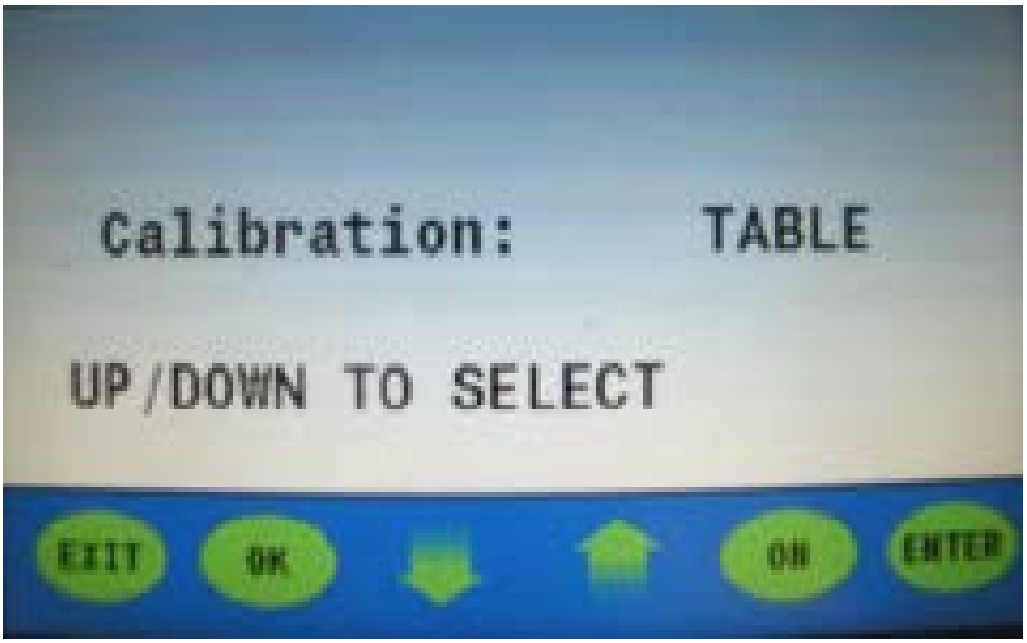


Figure 5
(Calibration:
Table selected)

Calibration Procedure (continued)

9. Press the **Enter button**.

10. Press the **up** or **down arrow**; select “CLR Table” **(figure 6)**.

11. Next, press the **Enter button**.

X. Appendix: Table Calibration: STD (multi-pulse) Mode Continued on Next Page

Table Calibration: STD (multi-pulse) Mode

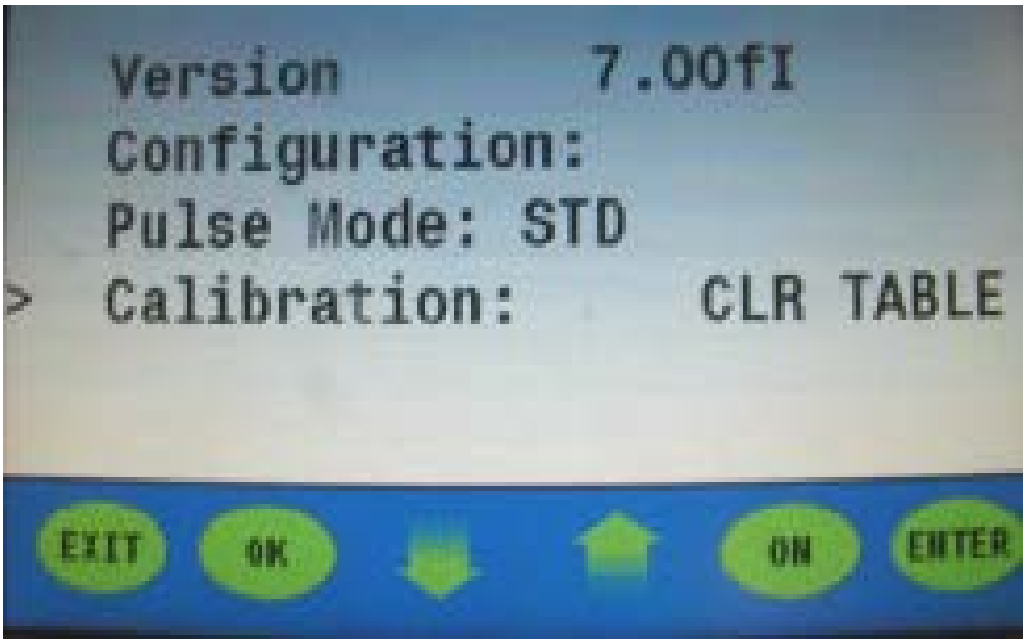


Figure 6
(Calibration: CLR
Table selected)

Calibration Procedure (continued)

12. Press the **Exit button** twice (×2) to return to the **main menu**.

13. The **laser will be disabled** and the touchscreen will display: “150W LASER DISABLED.”

14. Verify that the parameters on the touchscreen display match those shown in **step #1**.

15. Press the **Menu Button** and scroll down to **Calibration**. Press the **Enter Button**.

X. Appendix: Table Calibration: STD (multi-pulse) Mode Continued on Next Page

Table Calibration: STD (multi-pulse) Mode

16. Press the **up** or **down arrow**; select “Table.” Next, press the **Enter button (figure 7)**.

17. Press the **Exit button** twice (×2) to return to the **main menu**.

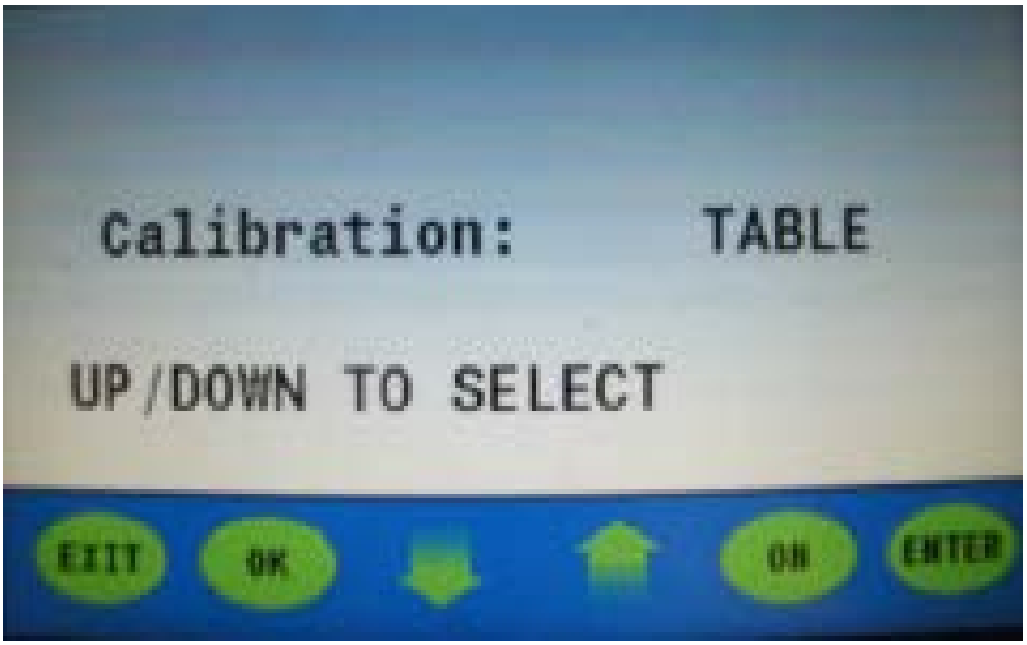


Figure 7
(Calibration:
Table selected)

18. Setup the power meter and power head to measure watts. **(Note: Check to be sure that the laser beam is defocused. The beam diameter on the power head should be approximately 3/4” in diameter.)** The laser will be disabled.

19. Select the **Joules button** from the **main menu**. Next, press the **up** or **down arrow** and enter either the first or second joules value (displayed in the table on **pages 206 or 208** (for correct values, be sure to reference your device’s unique certificate or ID label). The laser is enabled and the display will read “150W sCAL MULTI PULSE” **(figure 8)**.

X. Appendix: Table Calibration: STD (multi-pulse) Mode Continued on Next Page

Table Calibration: STD (multi-pulse) Mode

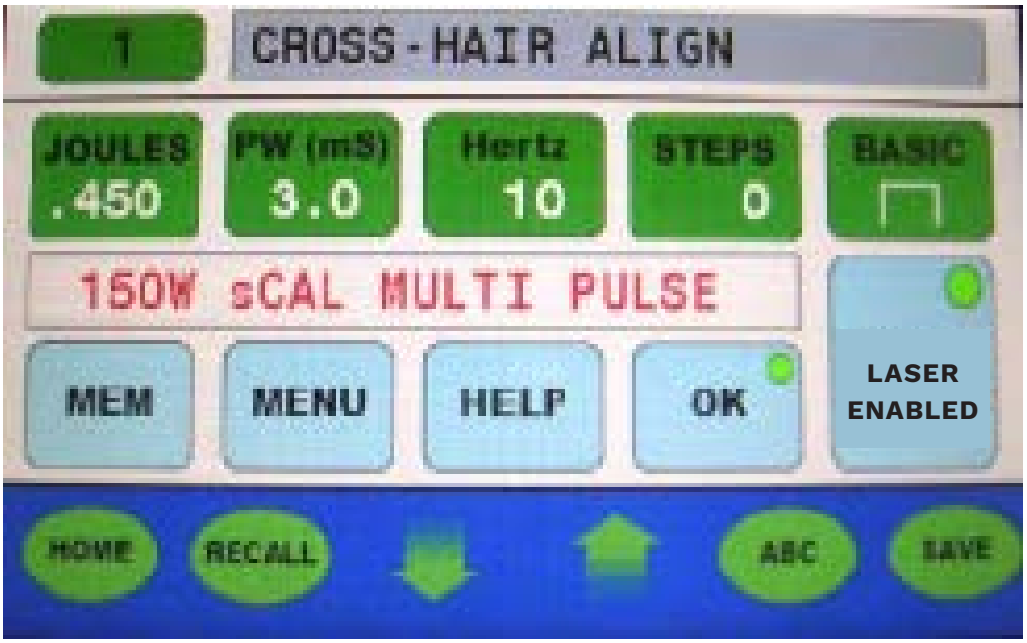


Figure 8
(Calibration: CLR
Table selected)

20. Depress the **foot pedal switch** until the power meter value stabilizes (about 30 seconds).

21. Take a reading. **(Note: The goal is to have the power meter value (W ÷ 10 = J) equal to the joules parameter value shown on the touchscreen display.)**

22. Release the **foot pedal switch**.

23. Press the **up** or **down arrow** twice (×2) to adjust the laser's output.

24. Repeat **steps #18–#22** until the power meter value (W ÷ 10 = J) equals the joules parameter

X. Appendix: Table Calibration: STD (multi-pulse) Mode Continued on Next Page

Calibration Procedure (continued)

25. Run for 60 seconds to verify that the power meter value (W ÷ 10 = J) equals the parameter value shown on the touchscreen display. If not, repeat **steps #18–#22**. The laser will be disabled.

26. Repeat **steps #25–#24** until all values listed in **table 2** (noted on **pages 208–209**) have been entered. The laser will still be disabled.

27. Press the **Menu button** and scroll through the available options; select **Calibration**. Next, press the **Enter button**.

28. Press the **up** or **down arrow**; change “Table” to “ON” **(figure 9)**. Press the **Enter button**.

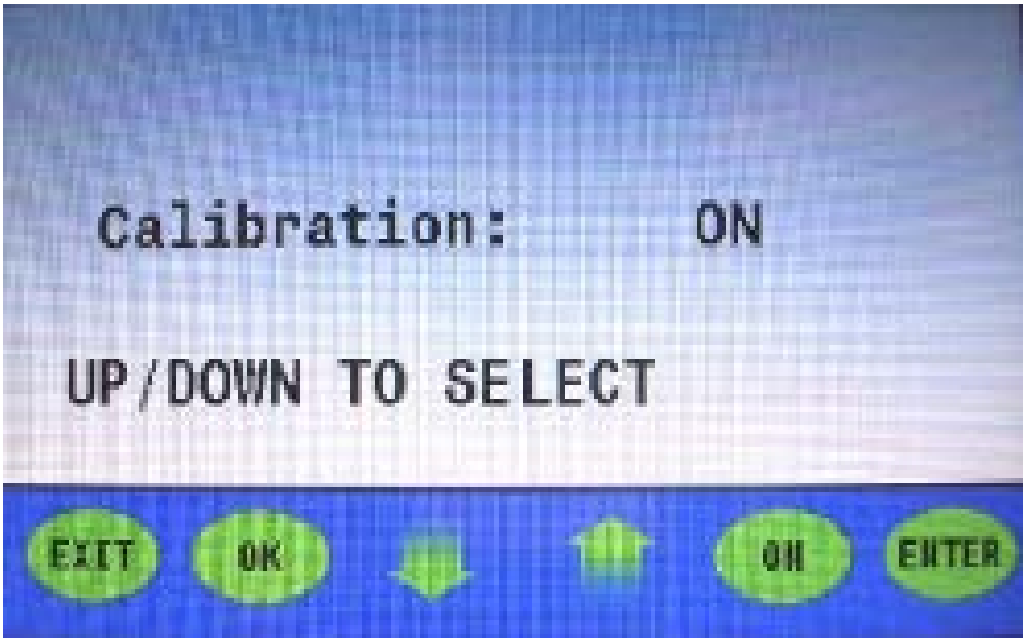


Figure 9
(Calibration:
“ON”)

29. Press the **Exit button** twice (×2) to return to the **main menu (figure 1)**. Table Calibration is complete.

X. Appendix: Table Calibration: STD (multi-pulse) Mode Continued on Next Page

Table Calibration: Micro Mode

Table Calibration: Micro Mode

From the main screen, and with the laser disable, input the following parameters:

(a). Joules (per ××× watts model)

(b). Pulse Width: 10.0mS

(c). Frequency: 10Hz

(d). Burst (B): 0

(e). Basic

(f). Watts (per ××× watts model)

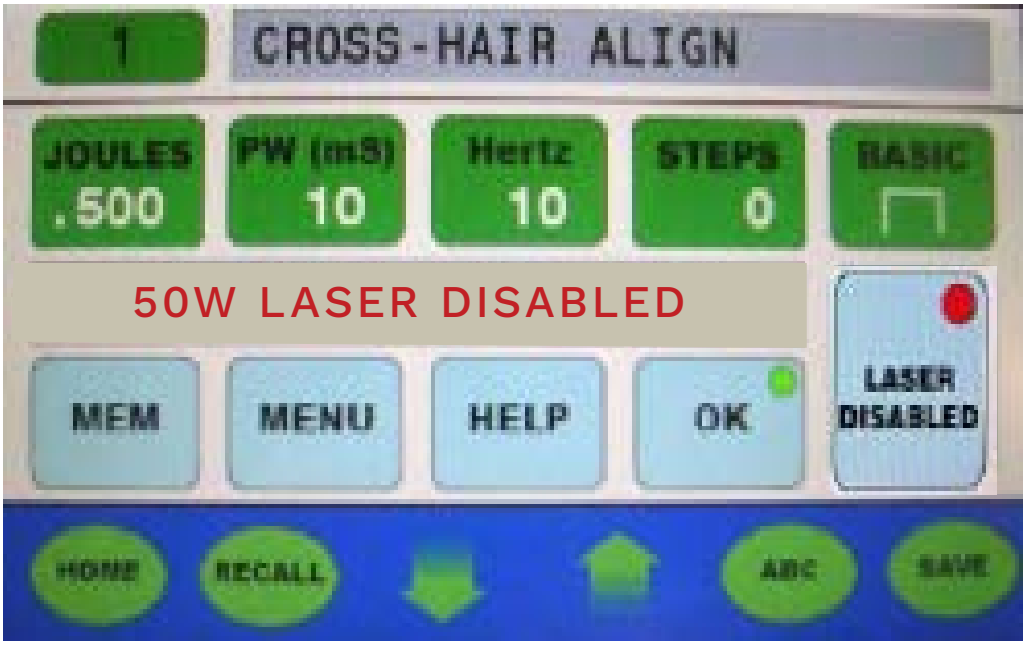


Figure 10
(Main menu;
laser disabled)

X. Appendix: Table Calibration: Micro Mode Continued on Next Page

Table Calibration: Micro Mode (continued)

Table Calibration: Micro Mode (150 watt models)				
The settings below are typical and specific to STD (multi-pulse) mode				
PW = 10.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
.500	50	5.20	.520	.505
.750	75	7.61	.761	.755
1.00	100	10.14	1.014	1.020
1.25	125	12.75	1.275	1.270
1.50	150	15.16	1.516	1.510
1.75	175	17.65	1.765	1.755
2.00	200	20.15	2.015	2.010
2.25***	225	22.54	2.254	2.251

X. Appendix: Table Calibration: Micro Mode Continued on Next Page

Table Calibration: Micro Mode (continued)

Table Calibration: Micro Mode (150 watt models; continued)				
The settings below are typical and specific to STD (multi-pulse) mode				
PW = 3.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
2.50***	250	24.90	2.490	2.485

150 watt models: (*) These values are typical. The person or technician calibrating this device should match the joules value (watts ÷ 10) from the power / energy meter, remaining as close as possible to the joules value shown on the touchscreen display.

(**) The measured joules value should be the average of at least 3 (minimum) measurements.

(***) Measurements taken out of the final focus lens (focus head) versus the BDO may not reach these values.

X. Appendix: Table Calibration: Micro Mode Continued on Next Page

Table Calibration: Micro Mode (continued)

Table Calibration: Micro Mode (300 watt models)				
The settings below are typical and specific to Calibration (multi-pulse) mode				
PW = 10.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
1.00	100	10.40	1.04	1.01
1.50	150	15.22	1.52	.755
2.00	200	20.28	2.03	1.51
2.50	250	25.50	2.55	2.54

300 watt models: (*) These values are typical. The person or technician calibrating this device should match the joules value (watts ÷ 10) from the power / energy meter, remaining as close as possible to the joules value shown on the touchscreen display.

(**) The measured joules value should be the average of at least 3 (minimum) measurements.

(***) Measurements taken out of the final focus lens (focus head) versus the BDO may not reach these values.

X. Appendix: Table Calibration: Micro Mode Continued on Next Page

Table Calibration: Micro Mode (continued)

Table Calibration: Micro Mode (300 watt models; continued)				
The settings below are typical and specific to Calibration (multi-pulse) mode				
PW = 10.0mS and Hertz = 10				**PW = 3.0mS and Hertz = 0**
Touchscreen Display (actual values shown on display)		**Power / Energy Meter (typical values)***		**Power / Energy Meter (typical values)****
Joules (J)	Watts (W; peak power)	Watts (W; average power measured)	Joules (J; W ÷ 10 calculated)	Joules (J; measured)**
3.00	300	30.32	3.03	3.02
3.50	350	35.30	3.53	3.51
4.00	400	40.30	4.03	4.02
4.50***	450	45.08	4.51	4.50
5.00***	500	49.80	4.98	4.97

300 watt models: (*) These values are typical. The person or technician calibrating this device should match the joules value (watts ÷ 10) from the power / energy meter, remaining as close as possible to the joules value shown on the touchscreen display.

(**) The measured joules value should be the average of at least 3 (minimum) measurements.

(***) Measurements taken out of the final focus lens (focus head) versus the BDO may not reach these values.

X. Appendix: Table Calibration: Micro Mode Continued on Next Page

Section C: Cleaning, Service, and Maintenance Intervals

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.

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Maintenance Intervals Schedule

Daily Tasks

- O Wipe laser and chamber.
- O Clean protective disc.

Weekly Tasks

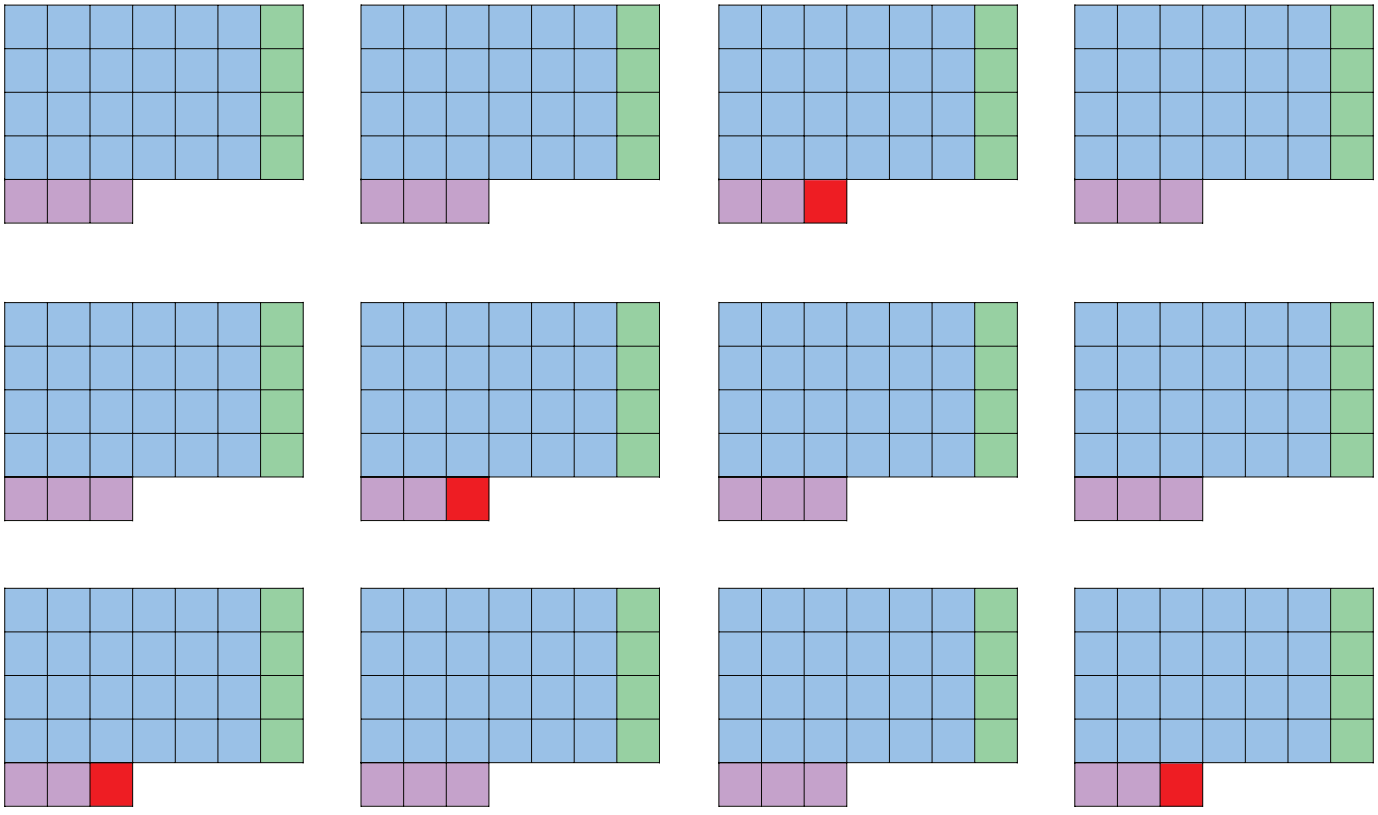
- O Check cross-hair alignment.
- O Clean and inspect window splash protector.

Monthly Tasks

- O Clean cabinet and heat exchange.
- O Inspect air and exhaust filters.
- O Run energy test.

Quarterly Tasks

- O Change filter as needed.



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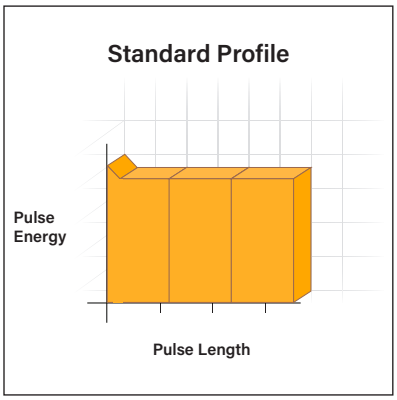
Appendix, Section D: Pulse Performance Profile (P3) Technology

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^3) 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^3) Technology Continued on Next Page

About Pulse Performance Profile (P3) 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, a **Burst** profile is used, and this process becomes 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 laser system. 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 P3 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 sections' pulse width will be 1 millisecond (1 mS). If the pulse length is 9 milliseconds (9 mS), each sections' pulse width will be 9 milliseconds (9 mS) divided by 3, which equals 3 milliseconds (3 mS), and so on.

Using P³ Technology Continued on Next Page

Using P3 Technology (continued)

All pulse profiles (with exception of the **Basic profile**) 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%, I00%)	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%

Switching Pulse Profiles

There are two (2) methods for changing the pulse profile; they are as follows:

1. **Keypad:**

   (a). Press the **enter button**; the pulse profile (located in the lower right-hand corner of the display) will blink.

   (b). Press the **up** or **down arrow** and scroll through the varying pulse profiles.

   (c). When the desired profile is displayed, wait for the profile to stop blinking.

2. **Welding Area:**

   (a). Press and hold the **Laser Enable/Disable button** to open (located on the back wall; right-hand side).

   (b). Using the **joystick control** (located on the far left), scroll **left** to **right**.

   (c). When the desired profile appears on the display, release the **Laser Enable/Disable button**.

Pulse Profiles: Power Level Adjustments (manual configuration)

Some applications may require a variation in the power level that is different than the predefined settings for a particular pulse profile. Using the software, you will have the ability to modify the power level (per tier) for any pre-programmed pulse profile.

To change the power level, do the following:

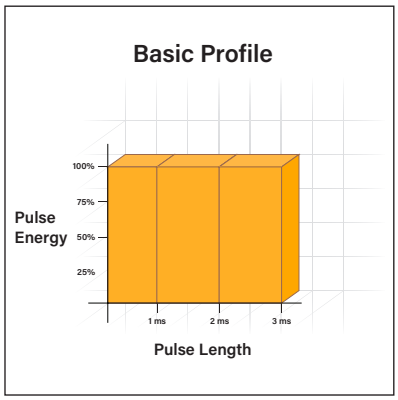
1. Press the **enter button** on the keypad; the Pulse Profile on the display will blink.
2. Press the “ABC” key on the key pad.
3. Press the **up** or **down arrow** and scroll to the desired pulse profile.
4. Press the **enter button** on the keypad—the pulse profile's power level setting will appear.
5. Using the **up** or **down arrows**, change the power level.
6. Press the **enter button** to confirm. After finalizing the power-level settings for the first tier, the second tier for the pulse profile can be adjusted. Settings for the pulse profile (second tier) will appear.
7. Repeat **steps #5** and **#6** for the second and third tier settings of the pulse profile.
8. Press the **enter button** twice (x2) to finalize these settings and exit to the **main menu**.

Pulse Profiles

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.

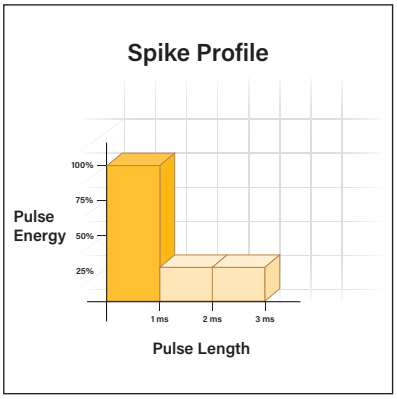
By eliminating the spike, the weld puddle will vibrate less during cooling. Ripples on the melt surface caused by vibration freeze within the puddle, producing a more rigid and less shiny surface. Materials with a low melting point or those with better absorption will not require an initial spike.



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

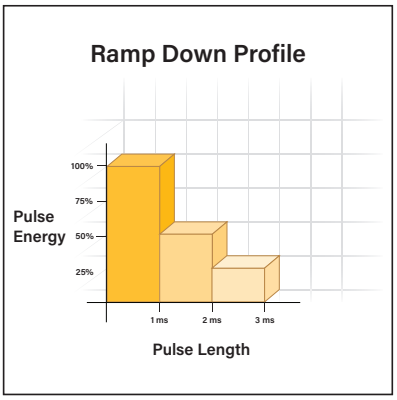
A **Spike profile** is helpful for highly reflective metals with higher conductivity, such as pure copper alloys, silver alloys, and some aluminum alloys or for applications in which the surface is highly reflective and the focused spot is larger.

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)

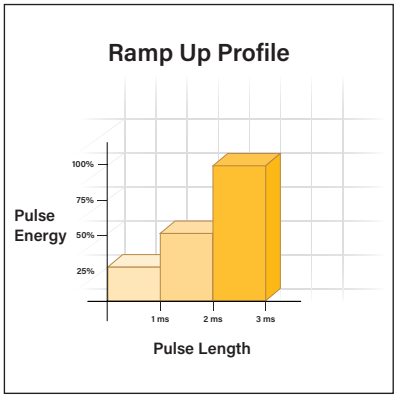
With higher carbon steels, alloys that are prone to cracks, casting alloys with voids or contaminants (or when the materials to be welded have very dissimilar melting points) a **Ramp Down profile** can be a huge benefit in the reduction of cracks and porosity (voids) in the weld.



Pulse Profile Applications and Usage Continued on Next Page

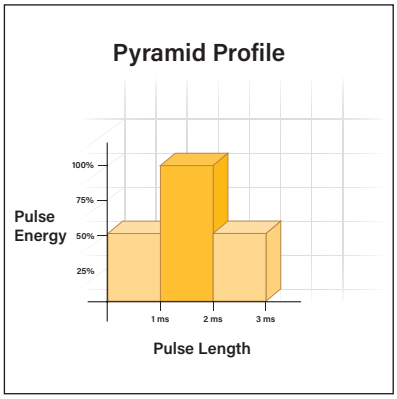
Ramp Up Profile (white gold)

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.



Pyramid Profile (titanium)

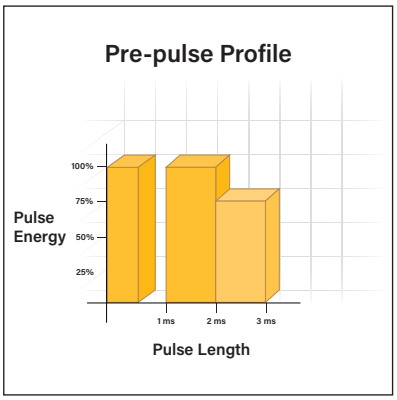
Combines characteristics from both the **Ramp Up** and **Ramp Down profiles** and is suitable for welding dissimilar metals that are non-reactive to oxygen.



Pre-pulse Profile (eyeglasses)

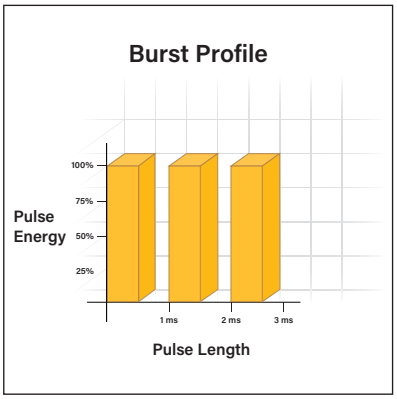
When welding materials that have a low melting or boiling point, a plating or surface covering, or those that contain contaminants, such as pre-tinned electronic parts, anodized parts, painted parts or oil-contaminated parts, a **Pre-pulse profile** is helpful. Additionally, parts that have varying reflectivity,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



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.



Notes

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If you have additional questions about your device or would like to provide feedback, a testimonial or present your applications results, please reach out — we'd love to hear from you!

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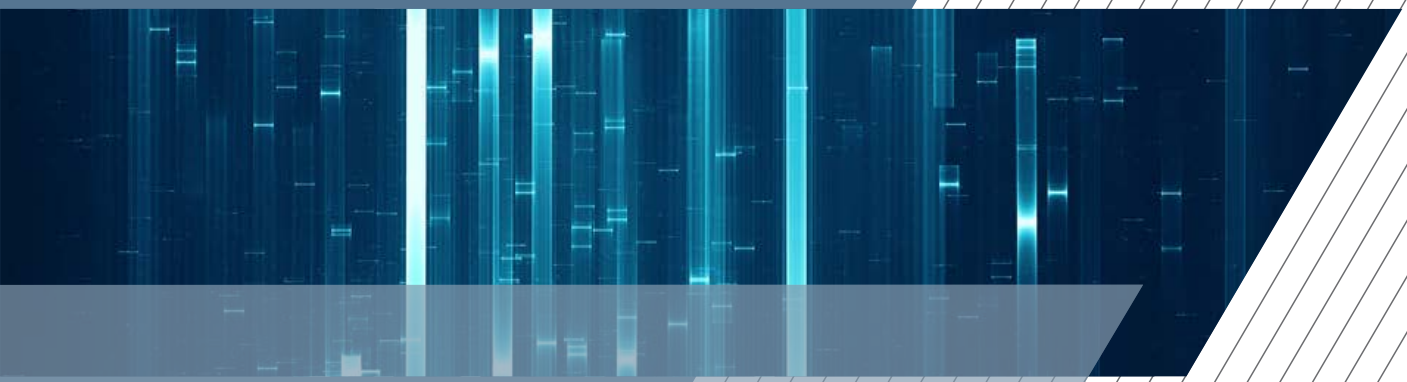

For additional resources, learning, and support, including our library of latest video how-tos, be sure to visit us online:

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