



Operators Manual for LS Series Introduction to RDWorks/LaserWORKS V8

608 Trestle Point
Sanford, FL 32771
Toll-Free: (888) 652-1555
Local: (407) 878-0880
Fax: (407) 878-0837

WWW.BOSSLASER.COM

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RD Works/LaserWORKS V8

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Introduction

Welcome to the Boss Laser Family!

We are very excited to have you as one of our valued customers. It is recommended that you print out this manual to save time in the future and be sure to keep it close to your machine or computer, so you can have easy access while you design files or operate the machine.

This manual will help walk you through basic set-up of the machine, how to use your LED panel and a basic walk-through of RD Works/LaserWORKS. These steps will help guide you through running your first file titled “Hello World”.

Please be sure to read the manual in its entirety prior to operating the machine, this will ensure a better understanding of the machine and how it works. We understand that there can be a learning curve like with any new piece of machinery but, with some effort and patience you will be running your new laser with confidence and speed in no time!

If you do have any questions while reading the manual or setting up your machine, feel free to give us a call at 1-888-652-1555 or email techsupport@bosslaser.com and a member of our technical support team would be happy to answer your questions.

Our Mission Statement:

“Boss Laser strives to honor God by positively impacting its clients, employees, and community by providing products and services with Integrity, Honesty, and Value.”

Warranty Disclaimer

This Limited Warranty applies to the laser machine itself and all parts purchased from Boss Laser, LLC.

This Limited Warranty covers any defects in material or workmanship while the machine is operating under normal use and for its intended purpose during the warranty period.

During this Warranty Period, Boss Laser, LLC will repair or replace any part or product that is proven defective while the machine is being used under normal conditions and for its intended purpose. This does NOT include labor and/or on-site tech support.

The Warranty Period for the Laser Equipment will begin on the day of arrival and will be covered for one year unless an extended warranty is purchased.

All parts purchased, and replacement parts are under warranty for one year from the day of arrival, the only exception to this warranty is the optical lens, which have a 30-day warranty from the date of arrival.

Any and all modifications that are made to the machine must have written consent from Technical Support or the warranty will be voided.

Lack of proper maintenance for the machine will also result in a voided warranty.

To obtain a warranty service or part you must first contact Technical Support via phone (1-888-652-1555) or email (techsupport@bosslaser.com) to determine any issues and the most appropriate solution for the machine

Fire & Hazardous Materials

⚠️WARNING: This machine uses high heat to engrave, etch, and cut material. At no point should the machine be left unsupervised while it is in use. Leaving the machine unattended while in use can result in a fire and substantial damage to the machine and the building it resides in. Any damage caused by fire that is not due to defects in workmanship or the machine itself will NOT be covered by the BOSS LASER, LLC Limited Warranty.

⚠️Hazardous Materials: Any and all materials considered hazardous to the health of the machine, the health of the individuals operating the machine and the individuals surrounding the machine while in use are NOT recommended to etch, cut or engrave. These materials can produce toxic fumes or cause the machine to not function properly and need replacement parts.

Materials that should NOT be cut, etched or engraved:

- ~~Metals~~- The LS Series is not capable of engraving or cutting metals. It only has the capability to etch metals with a coating (anodized, thermark, powder coating, etc.)
- ~~Polycarbonate~~- Fumes produced by polycarbonate can cause irritation to eyes, skin and the respiratory tract.
- ~~PVC Compounds~~- Fumes produced by Polyvinyl Chlorine can cause irritation to eyes, skin and the respiratory tract. This material should not be exposed to elevated temperatures.
- ~~Vinyl~~- Fumes produced by Vinyl that has Chlorine can cause irritation to eyes, skin and the respiratory tract. This material should not be exposed to elevated temperatures.

Helpful Hint:

Majority of materials have a “Material Safety Data Sheet” or MSDS, these can tell you whether materials are safe or not and whether they can be exposed to high heat. Any material containing chlorine is not safe to your laser or any individuals near the fumes. If you are still unsure about the material and its properties, give us a call and we would be happy to try and identify the safety of the material and whether it can be lasered or not.

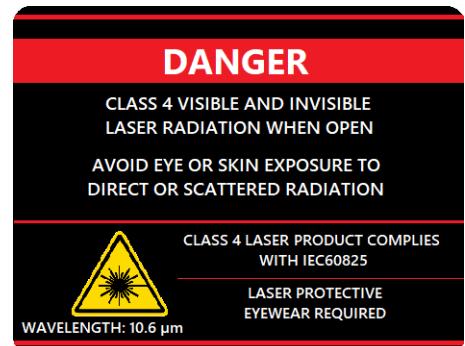
Important Warning Labels

These warning labels can be found all around your machine, it is important that you pay attention to these warning labels and adhere to them. These labels are put in place for the safety of the machine and the operator. If these warnings are not followed, it could cause serious damage to the machine and possible injuries to the operator.



The “DO NOT LIFT HERE” warning can be found on the tube extension for higher wattage LS Machines. Do not lift your machine by its tube extension under any circumstances, it can break the tube and cause damage to the machine. This part of the machine is fragile and should be handled with care.

The “DANGER: Visible & Invisible Radiation” warning label can be found on the front right side of the machine. Staring at the laser beam can cause damage to the eyes and touching the laser beam can cause serious injuries. Having the doors closed will protect your eyes and skin from injury.



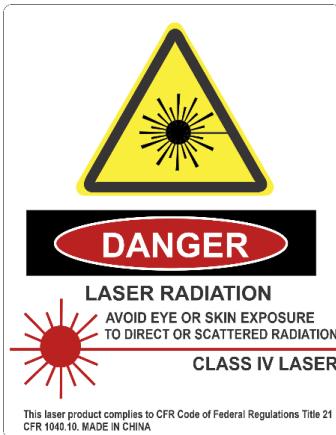
AVOID EXPOSURE
INVISIBLE LASER RADIATION
EMITTED FROM THIS APERTURE

The “AVOID EXPOSURE” warning label can be found inside of the working area, on the back left-hand side behind the gantry. The aperture next to this warning label is where your laser beam will bounce from mirror #1 to mirror #2. It is important to remember that the laser beam is invisible and can cause serious injury.

The “CAUTION” warning label will be located in multiple locations on the outside of your machine. This machine produces radiation and all doors to the machine should be closed when the laser is operating, unless the passthrough doors are needed. The laser beam itself is invisible and can cause serious injury when not handled properly

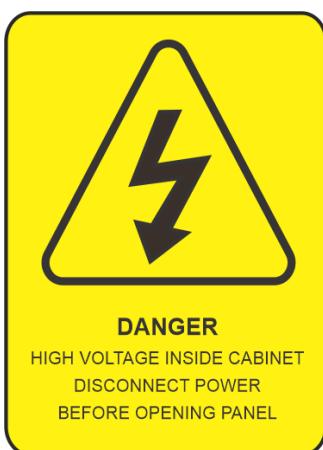
CAUTION-CLASS 4 VISIBLE
AND INVISIBLE LASER RADIATION
WHEN OPEN

AVOID EYE OR SKIN EXPOSURE TO
DIRECT OR SCATTERED RADIATION



The “DANGER: Laser Radiation” label can be found on the laser tube, which will be located on the back-side of the machine in the rear/top access panel. The laser beam will be initiated in the laser tube itself and it is important to have all panels and access doors closed prior to firing the laser. Also, make sure to disconnect your machine from any power source prior to handling the laser tube or its components. Protective eyewear and clothing must be worn if any access panels or doors are open while operating the machine.

The “DANGER FIRE HAZARD” warning label can be found on the top right-side of your machine above the LCD Screen and it is crucial to the health of your machine. The laser beam emitted from the machine is extremely hot and can cause any material to catch on fire. DO NOT leave the machine unattended while the machine is firing. Any fire that arises due to disregarding this warning is not covered by the warranty and any damages will be at the cost of the machine owner.



The “DANGER: High Voltage” sticker can be found on the inside of the right-hand bottom cabinet, on the power supply. This warning indicates that precautions should be taken when touching or handling any electrical components of the machine. Please make sure to disconnect the laser from all power sources prior to opening these cabinets or handling the internal electrical components.

⚠ Laser Safety & Policies ⚠

First and foremost, **BE CAREFUL**. Laser machines are a powerful tool and the proper precautions should be taken, just as if you were working with any other high-powered tool or machinery. These machines are designed to cut and engrave with highly focused heat energy and can be dangerous. You should never leave your machine unattended while it is in operation and do not let an inexperienced or unfamiliar person operate your machine at any time.

Always keep any access covers on and keep the top lid closed whenever the machine is in operation. Avoid any direct exposure and do not stare at the laser beam while the machine is operating. Notice and understand all of the warning labels located on your machine.

The following safety measures must be strictly enforced and be abided by to ensure the safety of the machine and the individual operating it. BossLaser, LLC shall not be held responsible for any damages or injuries resulting from improper use or dismantling of the laser machine.

- NEVER operate laser machinery unless you have been properly trained.
- ALWAYS use protective eyewear (preferably wraparound goggles); Or keep the lid closed.
- ALWAYS be sure to keep the exhaust fan running while the machine is in use.
- NEVER set anything on top of the laser and/or on the worktable while not in use.
- NEVER leave the laser unattended while it is running. This will ensure that you are able to see or hear any abnormalities / potential hazards.
- ALWAYS maintain the machine's environment free of heavy pollution, such as strong magnetic electrical interference.
- NEVER use unapproved or unsafe materials, such as Polyvinyl Chloride (PVC) or any materials that emit noxious gases. These gases can cause harm to your central nervous system.
- NEVER operate the laser near flammable or explosive substances. The UV light beam that is emitted is not visible and poses a fire hazard.
- NEVER lift the lid of the machine while it is running.
- NEVER engrave or try to cut reflective material, the laser beam can reflect and deviate (bounce around) which can cause blindness or serious injury, requiring medical attention.
- NEVER push or pull the laser head and its gantry while the laser is running.
- NEVER dismantle the laser machine, this can disrupt the laser and its high voltage/pressure parts. This can cause harm or injury.
- ALWAYS clean out the collection tray(s) to prevent accidental hazards.

⚠ In Case of a Fire:

1. Press the EMERGENCY STOP button located above the LED Panel
2. Lift the lid.
3. Quickly blow out the flame(s), a Co₂ fire extinguisher for serious flames

Laser Safe Materials

Lasers use heat to cut, engrave, and etch a given material. Some materials respond to this method beautifully and others will not do very well. It is important to know whether the material you are working with is safe or not, some materials like PVC are easy to cut but produce a Chlorine gas that is not healthy for the machine or the operator. To make this process a little bit easier, we have created a list of materials we know are safe for the machine.

MACHINE SERIES	LS	HP	LS	HP
LASER CUTTING	CO2		MARK/ENGRAVE	CO2
ACRYLIC	■	■	ACRYLIC	■ ■
WOOD	■	■	WOOD	■ ■
LEATHER	■	■	LEATHER	■ ■
PLASTICS	■	■	PLASTICS	■ ■
FABRIC	■	■	FABRIC	■ ■
MDF	■	■	RUBBER	■ ■
CARDBOARD	■	■	CORK	■ ■
PAPER	■	■	BRICK	■ ■
CORIAN	■	■	PHENOLIC	■ ■
FOAM	■	■	MELAMINE	■ ■
FIBERGLASS	■	■	GLASS	■ ■
RUBBER	■	■	GRANITE	■ ■
ALUMINUM			MARBLE	■ ■
COPPER			TILE	■ ■
SILVER			ALUMINUM*	■ ■
GOLD			SILVER	
STEEL	■		STEEL	■ ■
			BRASS	
			TITANIUM	■ ■

 **Note:** Some materials will engrave or cut better than others. On the back of this page, there is an in-depth list of materials we have tested with our Co2 LS Series Lasers.

Laser Safe Materials (Continued)

Plastics:

- ABS (Acrylonitrile Butadiene Styrene)
- Acrylic (Also known as Plexiglas, Lucite, PMMA)
- Delrin (POM, Acetal)
- High Density Polyethylene (HDPE) - Melts Badly 
- Kapton Tape (Polyimide)
- Mylar (Polyester)
- Nylon - Melts Badly 
- Polyethylene Terephthalate Glycol (PETG)
- Polyethylene - Melts Badly 
- Polypropylene - Melts somewhat 
- Styrene
- Two-Toned Acrylic - two-layer colored acrylic, top layer is a different color than the base color.
Used for signs, plaques, and instrumentation panels.

Foam:

- Depron – Often used for RC planes
- Ethylene Vinyl Acetate (EVA)
- Gator Foam – Hard shell of gator foam does well but, the foam core gets burned and eaten away.

Textiles & Others:

- Cloth - Leathers, suede, felt, hemp, cotton
- Paper - Cardstock, cardboard,
- Rubber - These can only be used if they do not contain chlorine Teflon (PTFE, Polytetrafluoroethylene)
- Woods - MDF, balsam, birch, poplar, red oak, cherry, holly, etc.

Accessing Our “How To” Videos and Manuals

We strive to provide support to our customers, that is why we have a large number of videos and manuals to assist our customers during the use or setup of their machine. In this manual, certain pages will contain an icon. This will indicate that there is a video located on our website that will be able to guide you through this process or give you a better idea of how something is done.

How to Access the Videos:

1. Go to BossLaser.com
2. There will be a banner of drop-down menus located towards the top of the page, select the menu labeled “Videos”.
3. Once the “Videos” option is selected, there will be two video categories to select from, for setup and instructional videos select “How To Laser Videos”.
4. These videos will allow you to get a visual of “Machine Setup”, “What’s In the Tool Box”, “Running Your First File” and much more!

How to Access the Manuals:

On the USB

1. Your LS Series Machine will come with a USB that contains the LaserWORKS software and a few of our manuals. The first step is to plug in the USB that accompanied the machine.
2. Next, there should be two folders within the USB, a “USB” folder and “USB (For LS Series GEN V)” folder. There will be manuals in each folder.
3. In the “USB” folder, there will be the manuals for “Hello World Walkthrough”, “RDWorks LaserWORKS v8 Installation” and “RDWorks LaserWORKS v8 User Manual”.
4. The “USB (For LS Series GEN V)” folder will contain the “LaserWORKS Rotary Set Up”, “Quick Start Guide for LS Series”, “RDWorks LaserWORKS v8 Controller Card Schematic”, “RDWorks LaserWORKS v8 Hardware”, and the file titled “READ ME” which will be a digital version of this manual.

On Our Website

1. Go to BossLaser.com
2. There will be a banner of drop-down menus located towards the top of the page, hover over the menu labeled “Support”.
3. After you hover over the menu labeled “Support” scale down the drop-down list until you reach “Downloads”. Now, hover over the “Downloads” option.
4. There should now be three subcategories labeled “Manuals”, “Software” and “Resources”. Select the “Manuals” option to view all manuals.
5. There will be manuals for almost all of our machines located on this page. Make sure you are downloading the proper manuals for the LS Series Machine.

Unpacking & Setting Up Your Machine

Your new laser will be delivered in a large wooden crate like the one pictured in **Figure 1**. Please be sure to have the necessary tools on hand when unpacking the crate, we recommend a hammer and a pry bar,

as well as some type of metal cutter or tin snips that will allow you to remove the bands from the crate. Our crates will have pallet feet, this allows for a forklift or pallet jack to be used so you can move the crate with ease.



Figure 1 Crated Laser Machine

While majority of our machines arrive safe and sound, we urge you to inspect the crate upon delivery to ensure that no damage has occurred while in transit. Damage can include pierced wood, smashed sides, or an open portion of the crate. If there seems to be any damage to the crate, take pictures prior to removing the bands. If no damage is visible on the outside, proceed to the opening of the crate. If there is damage to the crate, contact your

sales representative and send them pictures so we can report that damage to the carrier. The machine is insured for its full value while in transit and if it is damaged to the point of needing parts or replacement, the carriers are very good at covering those costs. But, the damage must be reported within 24 hours of delivery.

It is recommended that the bands be cut first then carefully use a crow bar to remove the lid of the crate. All of our crates are secured by 2" staples, so use caution when prying up the lid. Be careful not to use any part of the plywood interior as a focal point for the pry bar, stay on the outside framing to ensure that you will not pierce the plywood and damage the machine. Once you have the lid of the crate off, take out any smaller loose boxes that contain accessories (water pump, air pump, tool box, etc.) These boxes have a tendency to fall out if the crate walls were to be taken off first. After those smaller boxes have been removed, move onto the removal of the front panel, two side panels and then the back panel. Save these crate panels in the event that you ever need to move the machine to a different location.

Setting Up the Laser for the First Time

- Make sure to remove any foam or padding from inside or outside of the machine, this includes the inside of the cabinet. Remove any plastic ties used for securing the laser head from moving while in transit. Check for any nuts or bolts that may have come off or become loose during transit, these can usually be found in the bottom of the cabinet.
- Depending on what options you had purchased with your laser, the crate or pallet will have several boxes. Additionally, some units will have accessories taped to the working table, locate and identify any of these. If you think anything is missing from your machine or crate, please contact your sales representative. The loose boxes in the crate should contain the following things:
 - An air pump or compressor
 - A water pump or water chiller (CW-3000, CW-5000)
 - Exhaust Fan
 - A Toolbox that contains necessary software, accessories, or parts (extra lenses)
 - Additional accessories such as: rotary attachments, cleaning kits, etc

 **Note:** Some machine crates will come with a pallet, this pallet will contain the accessories that did not fit in the crate. If you received a crate with only the machine and no extra boxes and you did not receive a pallet, contact your sales representative to see if you are missing components.

Toolbox Contents



- 1. Exhaust Hose Clamps (3 count)
- 2. 6mm Nylon High Pressure Hosing
- 3. Resistor w/ Voltage & GND Wiring Clamps
- 4. Air Nozzle Regulator
- 5. High Precision Proximity Switch
- 6. Water Chiller Bypass Signal
- 7. 250V/20A Fuses (2 count)
- 8. Universal Machine Door Keys (3 sets of 2's)
- 9. Processing Test File Sample
- 10. Screwdriver
- 11. 500 MB Flashdrive
- 12. Ignition Keys (1 set of 2's)
- 13. A Set of Allen Keys
- 14. Focal Guide
- 15. 6-Pin Terminal w/ Wire Loop
- 16. Mirror Removal Tool
- 17. Lens Removal Tool
- 18. Power Cord
- 19. Nozzle Removal Tool

NOTE: The circled contents are used for testing purposes (assisted w/ Technical Support, if needed).

↗ A video on "What's In the Tool Box?" can be found on our website.

Exhaust Fan Set-Up

The exhaust of your machine requires the most effort and its importance cannot be overstated. The laser vaporizes material as it moves along the axis, this generates large amounts of smoke.

⚠ Some materials such as leather or wood generate larger amounts of smoke than other materials. The exhaust is necessary to remove harmful fumes and smoke. The exhaust must be ducted to the outside and away from any area where animals or humans congregate. When ducted correctly, a laser can be placed in an office or spare room. Larger in-line exhaust fans are available through Grainger.com or other industrial supply houses, these are recommended if your application requires constant cutting of material that gives off heavy smoke.

LS-1416's & LS-1420's will need a 4" exhaust fan with a minimum of 300CFM's.

While LS-1630's, LS-2436's, LS-2440's, & LS-3655's will need a 6" exhaust fan with a minimum of 500 CFM's.

Additionally, be certain to have the on/off switch within reach of the laser panel for easy access at all times. The exhaust fan must be turned on and used each time the laser is running and in use.

Figure 2a Illustrates the use of an exhaust system configuration with an exhaust blower while **Figure 2b** illustrates the use of a fume extractor.

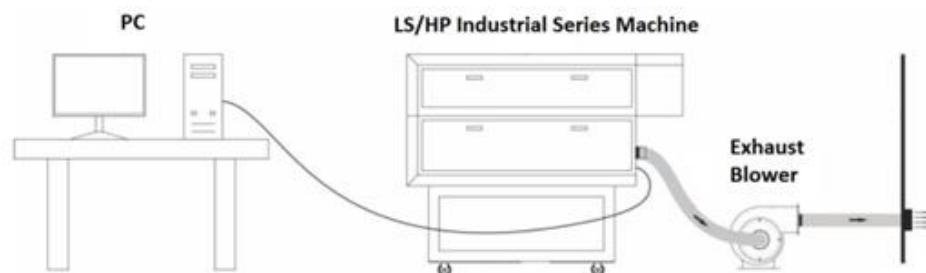


Figure 2a. Exhaust system configuration with an exhaust blower.

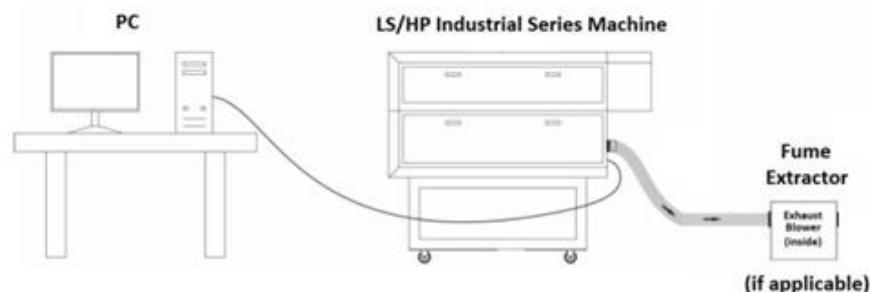


Figure 2b Exhaust System Configuration with a Fume Extractor

Water Pump/Water Chiller Set-Up

 **Note:** All BossLaser laser tubes are water cooled and the machine will not fire if the water is not going through the tube. Distilled water is highly recommended.

Water Pump:



Figure 3a Water Pump

The water pump in **Figure 3a** requires two lines, one to the water reservoir and one to the water out barbed fixture.

This water pump is designed to rest on the bottom of a container filled with at least 4 gallons of distilled water. A simple solution for this would be to use a 5 gallon bucket with three holes in the lid for 1/2" flexible hose lines and power cord. Make sure not to get the lines reversed

There will be a gold nozzle located in the water pump box, this will attach to the threaded opening located at the top of the water pump. Once the nozzle is attached, take the first line of tubing and place it over the nozzle (as shown in picture) and then place the other end of the tubing onto the fitting on the back of the machine that says "water in". Your second line of flexible tubing will be need to be put on the fitting that says "water out" and the other end of the tubing will need to flow back into the 5 gallon bucket. Finally, plug in your water pump and place it into the bucket of water.

Water Chiller:

The water chillers shown below are the CW-3000 (**Figure 3b**) and the CW-5000 (**Figure 3c**). These water chillers will come as shown with 3/8" flexible hose lines and power cord. The water chiller will have a reservoir with the capacity to hold a little under 3 gallons of distilled water.

You will need both flexible hoses to run the water from the chiller to the machine. On the machine and the chiller there will be nozzles labeled "out" and "in". One of these flexible hoses will go from the "out" from the chiller and "in" to the machine. The next hose will go "out" from the machine and "in" to the chiller. Then plug in your chiller to an electrical outlet.



Water Pump/Water Chiller Set-Up (Continued)

Chiller Signal Bypass: (Water Pump)

For those who did not purchase a chiller, you will receive a chiller signal bypass. (**Figure 3d**) This bypass will need to be plugged into the “chiller signal” outlet on the back of the machine in order for the laser to operate.



Figure 3d Chiller Signal Bypass



Figure 3e Chiller Signal Outlet & Ground Wire Outlet

Chiller Signal Cable: (Water Chiller)

The chiller will come with a chiller signal cable, this cable needs to be plugged into the “Chiller Signal” outlet located at the back of the machine. (**Figure 3e**) If this cable is not plugged in, the laser will not fire.

How to Ground Your Machine:

Located on the back of the machine, there will be a ground connector (**Figure 3e**). This is an external ground designed to help eliminate static electricity. Start by running the included ground wire from the connection on the machine to any grounded outlet or directly to earth. This step is not necessary but highly recommended if you live in an area with low humidity.

 **Note:** The water temperature should always be between 59-77 degrees Fahrenheit when running the machine. (15-25 Degrees Celsius)

 A short video of “Machine Setup” can be found on our website.

Air Pump/ Air Compressor Set-Up

The Air Pump (**Figure 4a**) and Air Compressor (**Figure 4b**) are used to blow air through the laser head. This will blow away debris and smoke from the laser beam while allowing for a cleaner cut and protecting the lens.

 **Note:** The air compressor on/off switch should be close by and preferably on the same circuit as the water chiller and exhaust fan to ensure it is in operation while running the laser machine.

Air Pump:



The air pump will come with 6mm nylon black tubing. This tubing will attach to the fitting located at the tip of the pump and to the back of the machine with the nozzle labeled "air in". Lastly, plug the air pump into the electrical outlet.

Figure 4a Air Pump

Air Compressor:



The air compressor will come with a fitting that will be located in the toolbox, it should look like **Figure 4c**. Start by using a 3/4" wrench to remove the gold air nozzle. Once you have removed the gold nozzle, use a 14mm wrench to attach the threaded air fitting to the opening where the gold nozzle once was. After attaching the fitting, the black nylon 6mm tubing located in the toolbox will need to be attached to that fitting and then attach the other end of the tubing to the "air in" outlet located at the back of the machine.



Figure 4b Air Compressor

Figure 4c Air Fitting

USB Ports and USB Cable

The laser machine will come with two USB connections, allowing you to import files in two different methods.

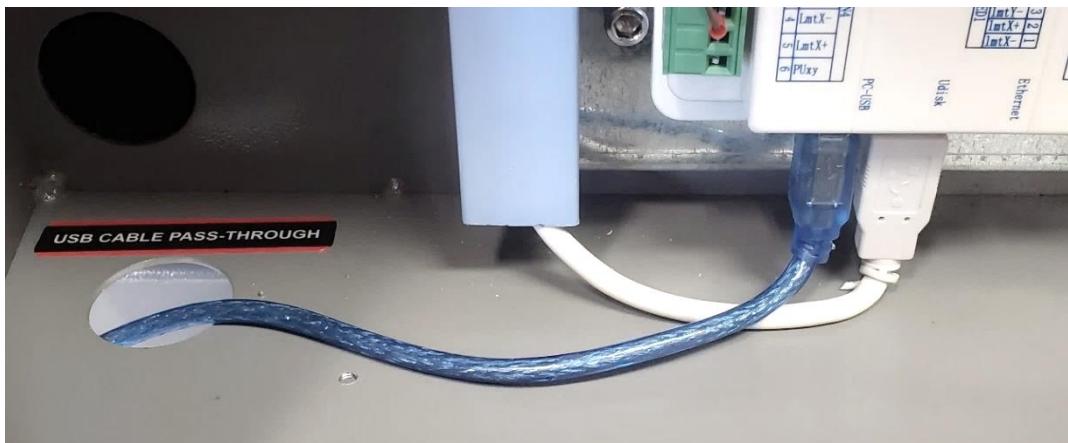


Figure 5a USB Port Passthrough

The first method allows the computer to communicate directly to the machine. In **Figure 5a** the USB port passthrough is shown, which can be found behind the latch door located on the back of the machine at the bottom. This type of cable is called either a “printer” cable or “A-Male to B-Male” cable. This blue cable will connect from the laser as shown in **Figure 5a** and go through the passthrough which will then allow your cable to be plugged in to your computers USB port while the latch door is closed, and your electrical components are protected.



Figure 5b USB Port and Light Switch

The second method will allow you to use a USB Memory Stick/ Flash Drive to transfer files to the machine. The USB port is located on the right-hand side of the machine, as pictured in **Figure 5b**. This USB port allows the machine to read an .rd file (RDWorks file) from the USB/Flash Drive. When using this port, press the “File” key then select “Udisk+” next, select “Read Mem File”, lastly, select the file and “Copy to memory”.

Both of these methods will be covered in greater detail later in this manual.

Important Switches

There are several switches installed on the laser cabinet. The first switch to identify is the main On/Off power switch, this can be shown in **Figure 6** above the large red button. The On/Off switches located on our machines are done by turn key. This ensures than no unauthorized person has the ability to use the machine. There should be two sets of keys within your tool box, we recommend keeping the second pair in a safe place.



Figure 6 LED Panel, Emergency Stop Button, Key On/Off Switch

The second switch to locate is the “Emergency Stop”, it is the large red circular push-down button with white arrows. This can be found directly below the turn key On/Off switch in **Figure 6**. The emergency stop push button is normally in the “up” position, but, if you push “down” this will cut off all of the power to the machine. To reset the emergency stop button, simply press the button down and turn it in a clockwise motion and the power will be restored.

Control Panel LED Keypad



Figure 7 LED Control Panel

Introduction to the Keys:

- **Reset:** This key will refresh the system and will stop all running applications and return to the main interface.
- **Origin:** This key will let you select the starting point of your file within the work table.
- **Pulse:** Pulses the laser beam
- **Frame:** This key will show you the framed area of which your file will run in
- **File:** The management of the memory and U disc files
- **Speed:** Setting the speed of the current running layer, or to set the direction keys' move speed
- **Max. Power:** Set the maximum laser power of the current running layer or set the power of the "Pulse" key
- **Min. Power:** Set the minimum laser power of the current running layer
- **Start/Pause:** To start or pause the current work on the laser
- **Left & Right Arrow:** To move the X axes of the left/right cursor
- **Up & Down Arrow:** To move the Y axes or the up/down cursor
- **Z/U Button:** The Z/U key can be pressed when the system is idle, or the work is finished. Pressing on this key will show some entries in the interface, each entry will include some functions, Z axes move, U axes move, each axes to go home, etc.
- **Esc:** Stops the current work that the machine is doing or to exit the current menu
- **Enter:** Validate the choice or change.

Main Interface Introduction

When the machine is powered on, the screen will show as illustrated in Figure 8.

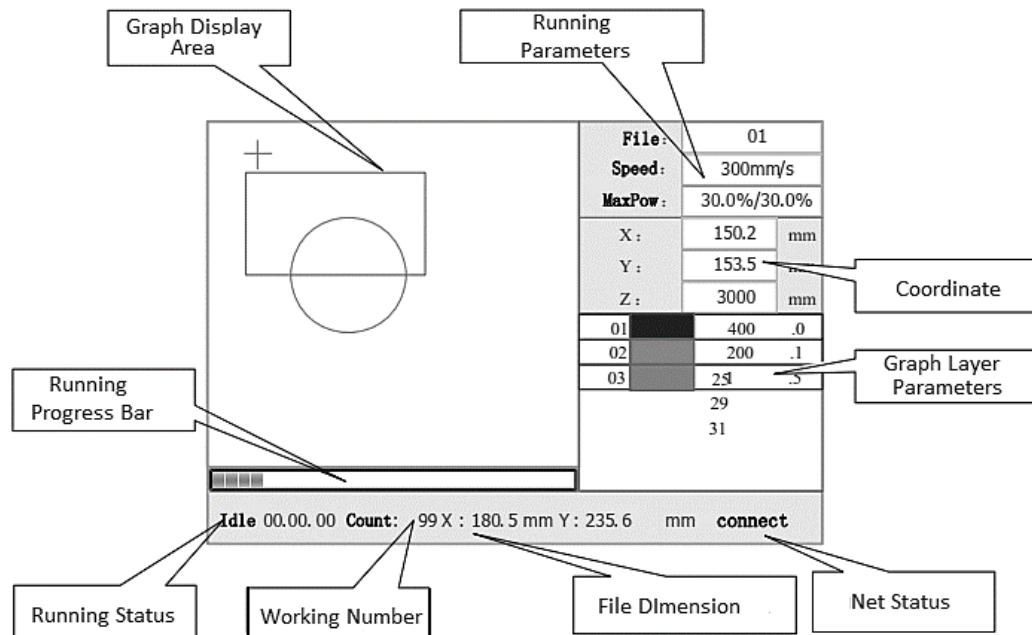


Figure 8 Main Interface Screen of Machine

- **Graph Display Area:** This area of the screen will give you a preview of your selected file
- **Running Parameters:** To display the running file's file number, speed, max power, etc.
- **Coordinate:** To display the current coordinate of X, Y and Z axes
- **Graph Layer Parameters:** To display the layers' information of the current file, such as maximum or minimum power, speed, etc. When the system is idle, double click the layer, then users can change the layer's parameters and the change would be saved
- **Running Status:** To display the current status of the machine such as idle, run, pause, finish, etc.
- **Running Progress Bar:** To display the progress bar of the current running file.
- **Working Number:** The total number of times this particular file has been run.
- **File Dimensions:** To display the dimension of the current file.
- **Net Status:** To display the connecting status of the Ethernet.

 **Note:** When work is idle or finished, all keys can be pushed. Users can select a file to run, set some parameters, preview to a select file, etc. But, when the machine is running a file or paused, some keys will not respond when they are pushed.

Speed Keys

Press the “Speed” key when the screen is on the main interface, as shown in **Figure 9**.

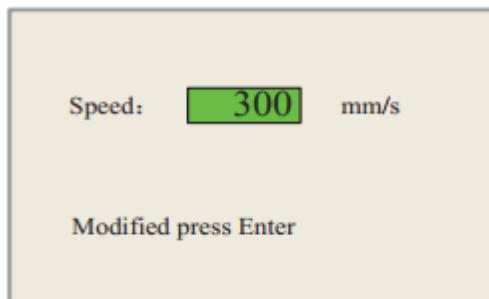


Figure 9 Display Screen for Speed Key

Press the “X +/-” (left & right arrow) keys to move the cursor in the numeral area and press the “Y +/-” (up & down arrow) keys to change the value, then press the “Enter” key to save the change, press the “Esc” key to invalidate the change.

Max/Min Power Keys

Press the “Max Power” or “Min Power” keys when the screen is on the main interface if you press the “Max Power” key Figure 10a will be shown and Figure 10b will be shown if the “Min Speed” key is pressed.

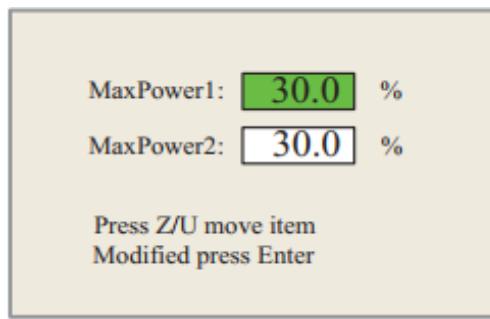


Figure 10a Max Power Display Screen

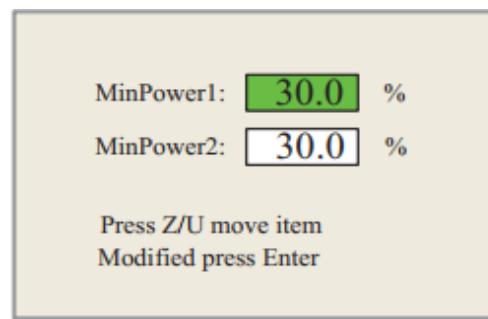


Figure 10b Min Power Display Screen

When the “Z/U” key is pressed, the highlighted block can move up and down to denote the changing item, then “Y +/-” (up & down arrow) keys and “X +/-” (left & right arrow) keys can be used to change the value.

Setting the Layer Parameters

After selecting a file to preview on the main interface, press the “Enter” key and the cursor will move to the first layer, then the “Y +/-” (up & down arrow) keys can be pressed to select the desired layer. After selecting the desired layer, the user can press the “Enter” key to check the selected layers parameters, illustrated in **Figure 11**.



Press “Z/U” key to move the highlighted block on the intended parameter, then change the parameter if needed. Press “OK” to validate the change or “Esc” to invalidate the change.

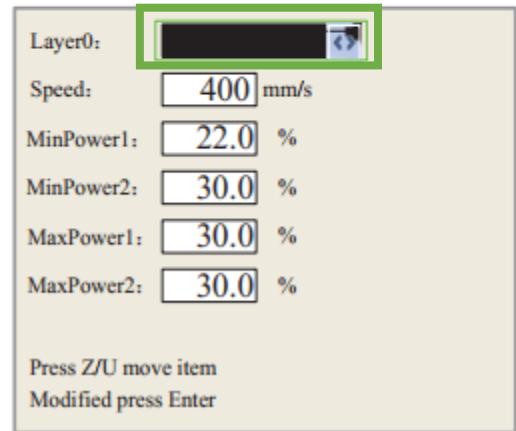


Figure 11 Layer Parameters as seen on the Main interface

Z/U Key

The “Z/U” key can be pressed when the system is idle, or the work is finished. When pressing this key, it will show the interface as shown in **Figure 12**.



Press the “Y +/-” (up & down arrow) keys to move the highlighted area onto the desired selection and then press “Enter” key to display the sub menu.

Z Move: When the menu is highlighted on “Z Move” the “X +/-” (left & right arrow) keys can be used to move the z axes.

U Move: When the menu is highlighted on “U Move” the “X +/-” (left & right arrow) keys can be used to move the u axes.

 **Note:** U-Axis is only used for feeder.

Figure 12 Z/U Interface Display

Axis Reset+



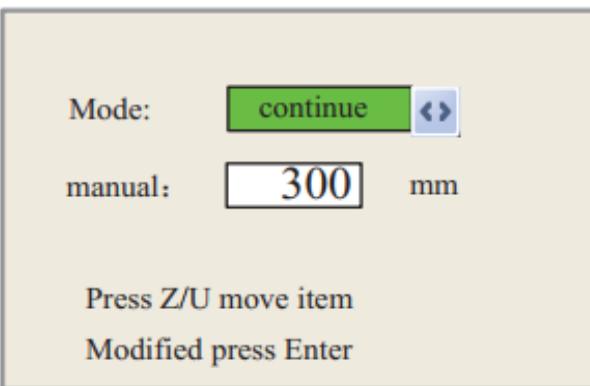
When the highlight is on “Axis reset+”, press the “Enter” key to show the screen as in **Figure 13**.

Press the “Y +/-” (up & down arrow) keys to move the cursor to one of the entry, then press “Enter” key to restart the elected axis.

Figure 13 Axis Reset Display

Manual Set+

When the highlight is on “Manual Set+”, press the “Enter” key to show the screen as in **Figure 14**.



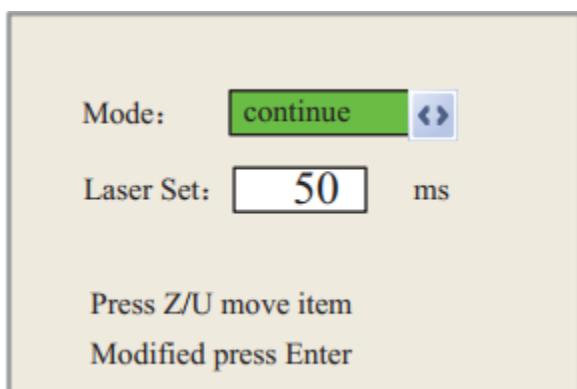
Press the “Z/U” key to move the highlight when the selection is on “Mode” press “X +/-” (left & right arrow) keys to select “Continue” or “Manual”.

When “Continue” is selected, press the direction keys to move the corresponding axes and when the direction keys are let go, the corresponding axes will stop moving. When “Manual” is selected, press the direction key one time, the corresponding axes will move a fixed length, unless the scope is overstepped.

Figure 14 Manual Set Display Screen

Laser Set+

When the highlight is on “Laser Set+”, push the “Enter” key to show the screen as in **Figure 15**.



Press the “Z/U” key to move the highlight when the selection is on “Mode” press “X +/-” (left & right arrow) keys to select “Continue” or “Manual”.

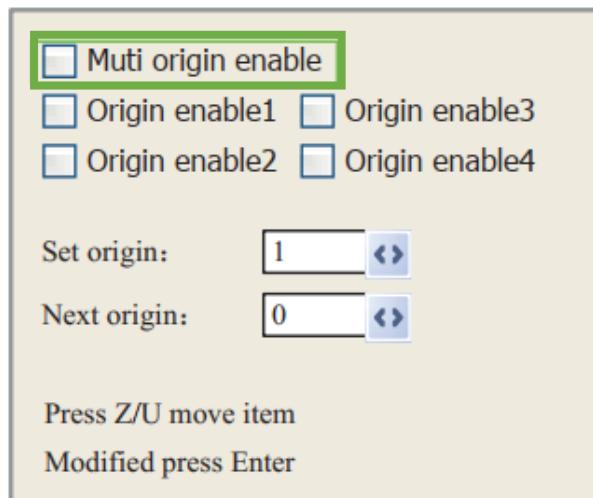
When “Continue” is selected, the “Laser Set” value is not valid, press the Laser key to pulse the laser tube. When the laser key is let go, the laser will finish pulsing. When “Manual” is selected, press the laser key one time and the laser tube will pulse for a fixed amount of time.

Figure 15 Laser Set Display Screen

Origin Set+

When the highlight is on “Origin Set+”, press the “Enter” key to show the screen as in **Figure 16**.

Press the “Z/U” key to move the highlight onto the desired “enable” item. Once you have highlighted the desired option, press the “Enter” key to enable or disable the selection.



If the origin is enabled, the small diamond is green, and when disabled the small diamond is grey. When the highlight is located on the “Set Origin” item or “Next Origin” item, press the “X +/-” (left & right arrow) keys to select the value.

Pay attention to when the highlight is on “Set Origin”. Use the “X +/-” (left & right arrow) keys to select a value then press “Enter” to validate the change or the change will not be saved and considered invalid.

Figure 16 Origin Set Display Screen

Each item is introduced below:

- **Multiple Origins Enabled:** This option can either be enabled by checking the box or disabled by leaving the box un-checked. If you select the multi-origin to be enabled, the system will use multiple-origin logic and the “Origin” key on the keyboard becomes invalid. In such a case, the parameter of each origin must be set in the menu as follows. If you choose for the multi-origin to be disabled, the system will use single-origin logic. You can press the “Origin” key and set the origin and only this origin can become valid.
- **Origin Enable 1/2/3/4:** After the multiple-origin logic is enabled, the four origins can independently be disabled and enabled.
- **Set Origin 1/2/3/4:** After the multiple-origin logic is enabled, you can stop the cursor at “Set as Origin 1/2/3/4”. Then press the “Enter” on the keyboard and the system will take the coordinated figures of the current X/Y axes as the corresponding ones to the origin.
- **Next Origin:** There are five digits from 0-4 to choose from, these are the origins to be used for the next figure. Origin 0 means that the origin set by the “Origin” key on the panel in the single-origin logic. 1-4 are the serial numbers of the origins in the multiple-origin logic. Origin can be modified to any one of the 1-4 origins, this can control the start location of the laser on the current file. The premise is that the origin is enabled but, it cannot be modified to origin 0.

Auto Focus

When the cursor stops at “Auto Focus”, press the “Enter” key to search for the focus. This is when a Z-axis is present, and the Z-axis reset function is enabled, the auto focusing is valid. Press the “Esc” key to return to the prior menu.

Setting the Machine Language

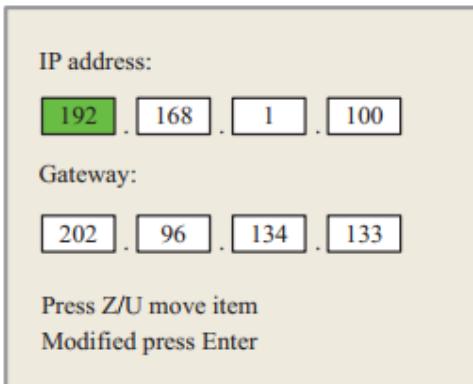


The item “Language” helps you to select an appropriate language which is displayed on the LED screen. Shown in **Figure 17**

Use the highlight to move between the language options and press “Enter” to select the desired language.

Figure 17 Language Options Display Screen

IP Address Set-Up

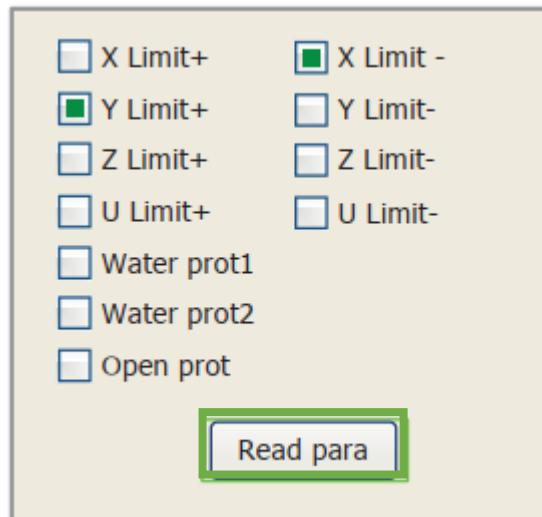


When the highlight is on IP setup, press the “Enter” key to show the screen shown in **Figure 18**.

Press the “Z/U” key to move the changing item, then push the “X +/-” (left & right arrow) keys and the “Y +/-” (up & down arrow) keys to change the value. When all of the IP & Gateway values are changed, press the “Enter” key to validate the change, or “Esc” key to cancel the change.

Figure 18 IP Set-Up Display Screen

Diagnoses



When the highlight is on the “Diagnoses” press the “Enter” key to see the screen in **Figure 19**.

This interface shows multiple selections for system input information such as, limiter status, the status of the water protect, the foot switch, etc. When the input is validated, the color frame will become filled, otherwise it will be grey.

Figure 19 Diagnoses Display Screen

Screen Origin

When the highlight is on “Screen Origin” press the “Enter” key to see the screen shown in **Figure 20**.

There will be 4 different entries to choose from: Top Left, Top Right, Bottom Left and Bottom Right. When one of these options are selected, the previewed graph on the screen would be a mirrored image, based on the X or Y direction.

NOTE: Make sure that the origin location is selected to “Top Right”



Figure 20 Screen Origin Display Screen

File Key

On the main interface, if the “File” key is pressed a screen will show, as in **Figure 21**

Opening Downloaded Files (Sent from the Computer or Stored on Machine):

After you have opened the “File” menu, the highlight should be located on “Read mem file”. Press the “Z/U” key on the control panel to show the list of downloaded files, this list should be located in the left column of the screen shown in **Figure 21**.

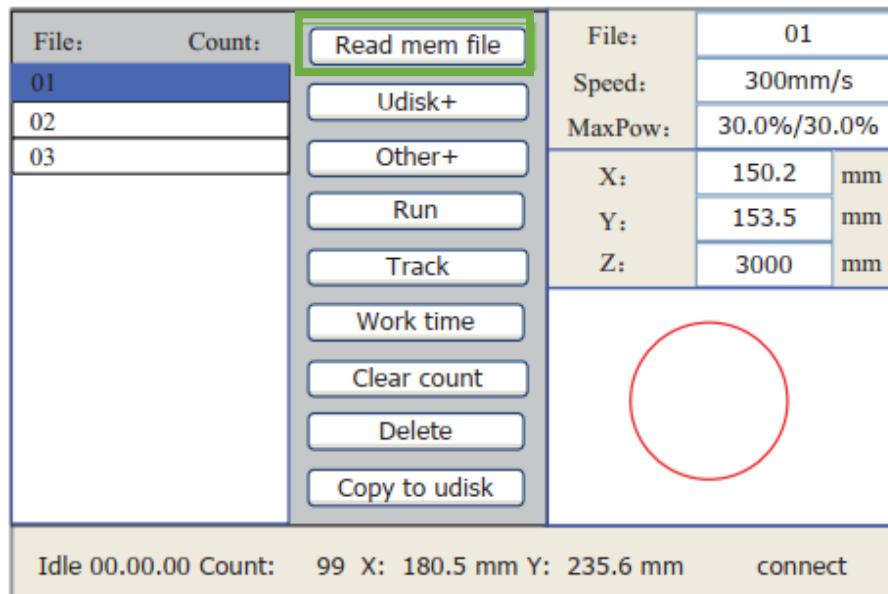


Figure 21 Memory File Display

Selecting a File:

Once you have selected the desired to move through the list and preview these files, press the left arrow key once to move to the downloaded files list. After you have navigated to the file list, use the up and down arrow keys to move throughout the list. Once you have highlighted the correct file press the “Enter” key to select it, a preview of the file will be located in the lower right area of the screen. If you wish to exit the preview, press the “Esc” key.

- **Read Mem File:** The machine will read the files that are downloaded on the machine
- **UDisk+:** The machine will read the files on the USB memory stick
- **Other:** A menu will pop-up for more options regarding the memory files (**Figure 23**)
- **Run:** The machine will run the selected file
- **Track:** The machine will illustrate an outline of the file by moving the laser head without firing.
- **Work Time:** Selecting this will show a forecasted run time of the selected file, the time is accurate to 1 millisecond.
- **Clear Count:** Selecting this will clear the run times of the selected file
- **Delete:** Selecting this will delete the selected file from the machine
- **Copy to Udisk:** Selecting this option will copy the selected file to the USB memory stick

File Key (Continued)

To Open USB Files:

After you have opened the “File” menu, the highlight should be located on “Read mem file”. Press the down arrow key once to move the highlight onto the “Udisk+” option. Then press the “Z/U” key on the control panel to show the list of files located on the USB, this list should be located in the left column of the screen shown in **Figure 22**.

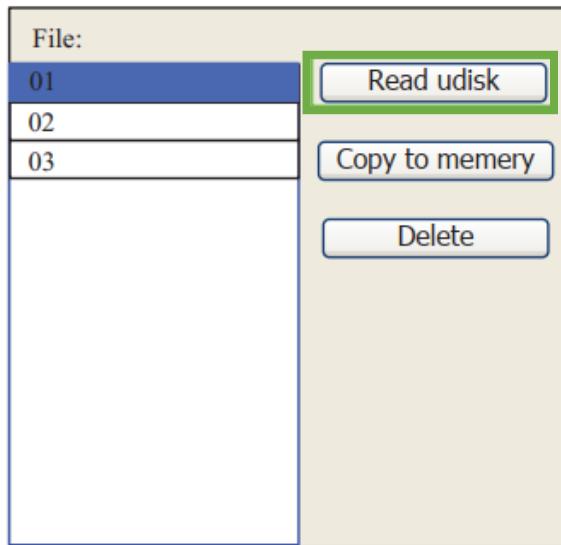


Figure 22 Udisk Display Screen

Selecting a File:

Once you have selected the desired to move through the list and preview these files, press the left arrow key once to move to the downloaded files list. After you have navigated to the file list, use the up and down arrow keys to move throughout the list. Once you have highlighted the correct file press the “Enter” key to select it, a preview of the file will be located in the lower right area of the screen. If you wish to exit the preview, press the “Esc” key.

- **Read Udisk:** Selecting this allows the machine to read the file you have selected from the USB
- **Copy to memory:** Selecting this allows the machine to copy the file from the USB to the machine memory
- **Delete:** Selecting this option will DELETE the file from your USB memory stick.

File Key (Continued)

The “Other” Menu:

When the “Other” option from the “File” menu is selected, the menu shown in **Figure 23** will appear on the screen.

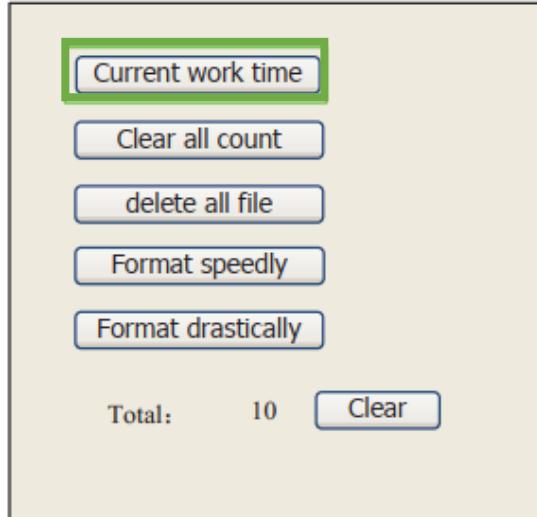


Figure 23 The “Other” Function Display

- **Current Work Time:** Selecting this will show a forecasted run time of the selected file, the time is accurate to 1 millisecond.
- **Clear All Count:** This function will clear the run times for all of the files on the memory of the machine.
- **Delete All File:** This function will delete all of the files on the memory of the machine.
- **Format Speedily:** Selecting this function will format the memory in a rapid manner and then delete all of the files stored in the machines memory.
- **Format Drastically:** Selecting this function will format the memory in a drastic manner and then delete all of the files stored in the machines memory.
- **Total:** This will show the total amount of minutes it will take to run all of the files within the machines memory.
- **Clear:** Selecting the clear function will allow you to clear all run times of the files stored in the machines memory.

 **Note:** We do NOT recommend that a large number of files be stored on the memory of the machine. It has the capability to slow down the control card of the LED screen. We recommend only keeping a minimum number of files stored on the machines memory.

How to Focus the Lens

Manual Focus:

Focusing the lens is a very important part of running this laser machine. The machine lens must be focused each time a material with a different thickness is placed on the working table. The laser uses highly focused light energy to do its job and the focusing of the lens is necessary, thankfully it is quite easy.

The first step is placing your material on the work table, next is locating the *focal guide*, this should be located in your toolbox and will look like **Figure 24b**. The focal guide will need to be placed on the ledge of the nozzle as shown in **Figure 24a**. While the focal guide sits on the ledge of the nozzle, use the up and down arrow keys on the control panel to move the Z-axis (the table) up or down. (It is best to hold your focal guide in place while you move the table). Once the material comes in contact with the focal guide, your lens is now focused!

 **Note:** Always be careful when focusing your lens with thick material, do not allow the material to collide with the lens housing. This can cause SERIOUS DAMAGE to the laser machine.

Auto-Focus:

First, place the material on the working table and press the "Z/U" key on the LED control panel. Be sure that the nozzle as shown in **Figure 24a** is positioned above the material you wish to cut or engrave, not above the bare table.

When your laser head nozzle is above the material, press the "Z/U" key once and then use your up/down arrow keys to navigate the options until the highlight is on "Auto Focus". Use the "Enter" key to select it and the Z-axis will automatically travel upwards until your material touches the nozzle of the laser head., it will then lower to the perfect focal point. Your lens is now focused, and your machine is ready to cut or engrave!

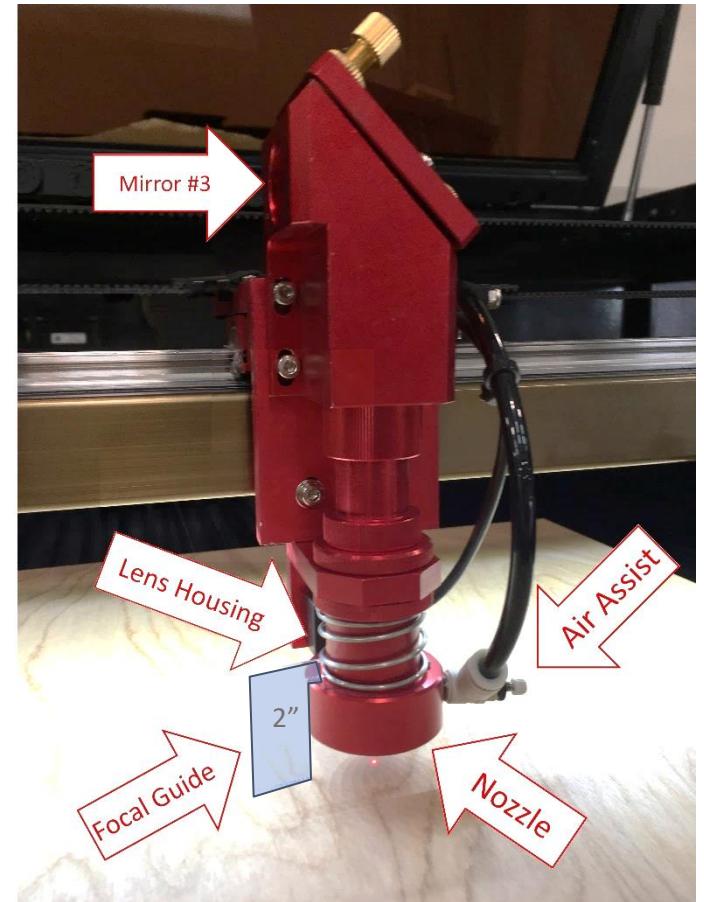


Figure 24a Laser Head Assembly



Figure 24b 2" Focal Guide

Adjusting the Focal Depth

When using auto-focus, the distance between the nozzle and material can be adjusted, this is called “Adjusting the Focal Depth” and this can be done in LaserWORKS V8. The focal depth may need to be adjusted for different material, different sized lenses, or to create a different quality of cut or engraving. And it can be done in 4 simple steps.

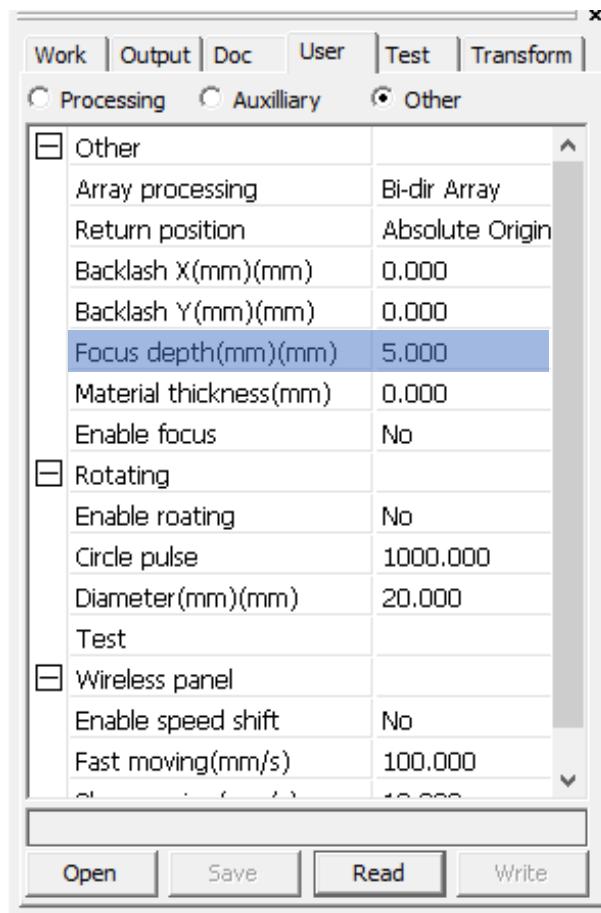


Figure 24c LaserWORKS Control Panel, User Tab

1. Open LaserWORKS and locate the control panel window on the right side of the screen, it will look like **Figure 24c**.
2. Once you locate find the control panel window, find the “User” tab shown in **Figure 24c**
3. After the “User” tab is selected, there will be a sub-category named “Other”. A few rows down you will find an option called “Focus Depth (mm)”.
4. Finally, select the “Focus Depth (mm)” option and change your focal depth.

Note: The focal depth is set in millimeters, it is best to keep this in mind when adjusting your distance between the nozzle and the material

Installing LaserWORKS

Your machine will come with a LaserWORKS USB drive (**Figure 25b**) within a booklet(**Figure 25a**), this USB will contain the LaserWORKS software. The following steps will guide you on how to install LaserWORKS.

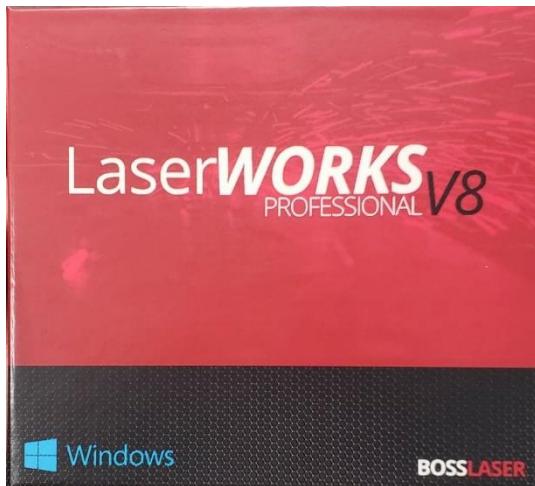


Figure 25a LaserWORKS USB Booklet

First, remove the USB from the booklet and plug into the desired windows computer. Once the USB has been plugged in, the USB files should pop up, as shown in **Figure 25c**.

Note: In order for LaserWORKS to be operable on your computer, it must have Windows XP or newer, with a minimum of 4GB RAM, and a minimum of an i3 Intel core processor.



Figure 25b LaserWORKS USB Drive

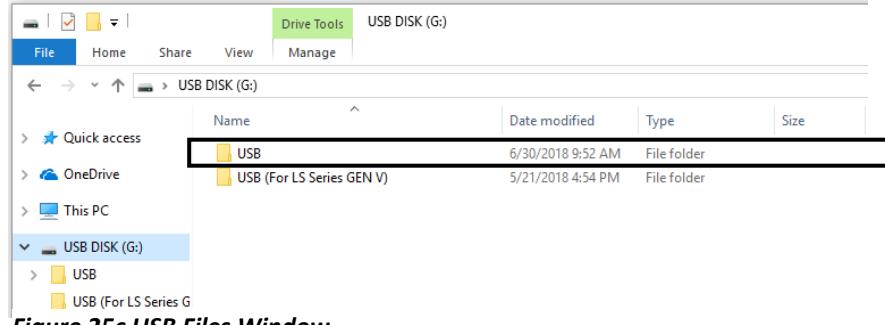


Figure 25c USB Files Window

After Figure 25c is shown, click on the file labeled “USB” and find the file titled “LaserWORKS v8.01.28” As shown in **Figure 25d**.

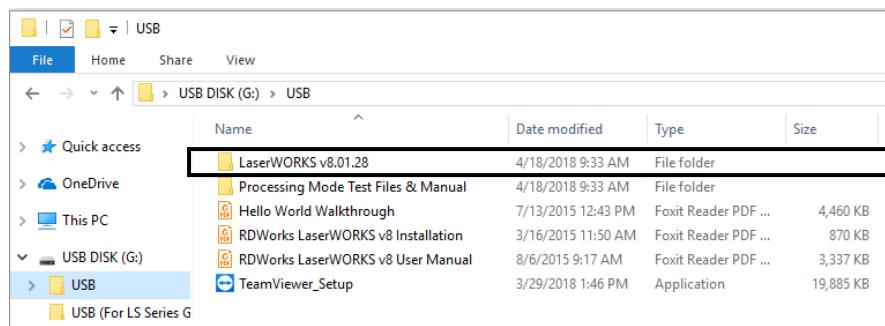


Figure 25d USB Files “USB” Folder

Installing LaserWORKS (Continued)

Now that the “LaserWORKS v8.01.28” file has been located, double-click on the file to show the screen in **Figure 25e**.

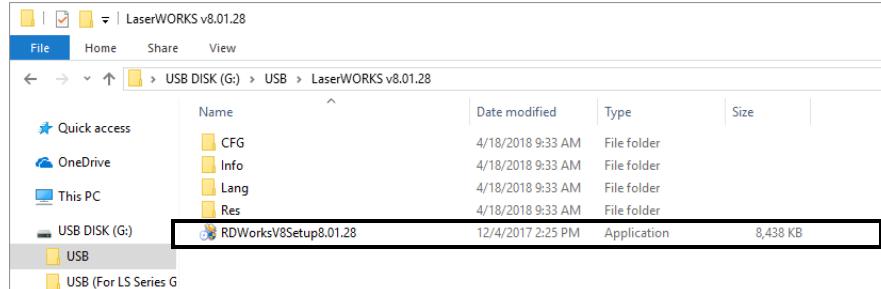


Figure 25e LaserWORKS v8.01.28 Folder

In this folder, there will be an application named “RDWorksV8setup8.01.28”, double-click this application to initiate the install process. A new screen will now pop-up and will look like **Figure 25f**.

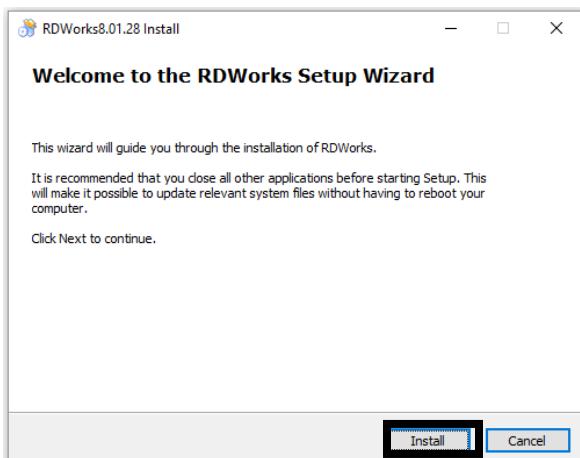


Figure 25f RDWorks Setup Wizard

Now that the RDWorks Setup Wizard screen has popped-up, press the “Install” button in the bottom right corner.

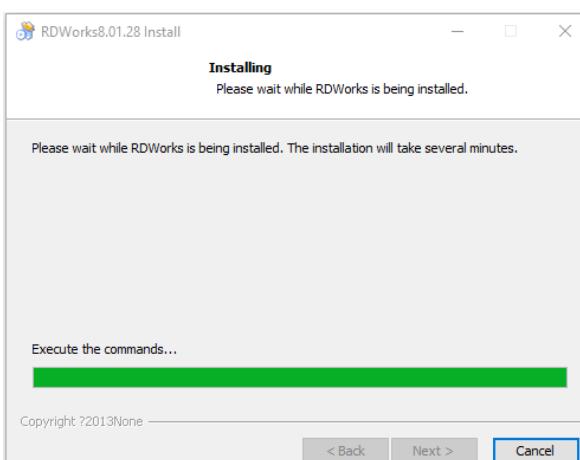


Figure 25g RDWorks Setup Wizard Installation Progress Screen

After the “Install” button has been pressed, an “Install Progression Screen” will be shown, as in **Figure 25g**.

Installing LaserWORKS (Continued)

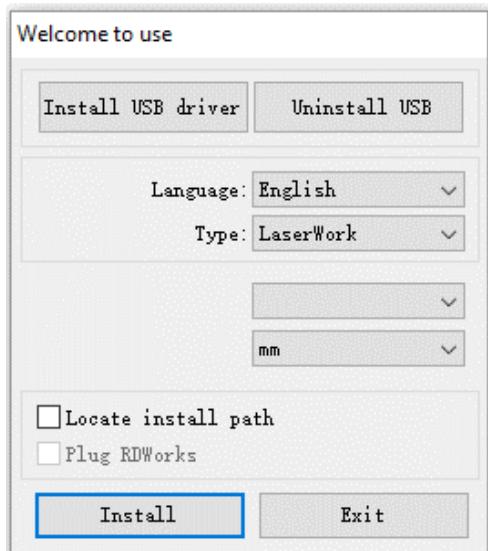


Figure 25h Install Options Screen

Once the Install has been completed, a new window will come onto the screen, as shown in **Figure 25h**. This is the RDWorks Installation Options Screen. This will give you the option to Install or Uninstall RDWorks from your computer properly, choose your language, and what type of software you wish to install.

Language: The Language can be set to “Simplify Chinese”, “Traditional Chinese”, “English” or “Other”.

Type: **Note:** For this tutorial, we will only be installing the stand-alone version of LaserWORKS. The plug-ins for Corel Draw, AutoCAD, Engravelab, and Adobe Illustrator can be found in the “RDWorks/LaserWORKS v8 Installation” file in the “USB” folder as shown in **Figure 25d**.

Units of Measurement: The drop-down menu that shows “mm” will give you two options for units of measurement to choose from when using RDWorks. The first will be millimeters “mm”, or there is an option for inches. The machine will always use millimeters. If you choose to use inches in RDWorks and send a file to the machine, it will automatically convert the unit of measurement to millimeters. Using inches or millimeters while designing or editing a file is at the preference of the machine operator.

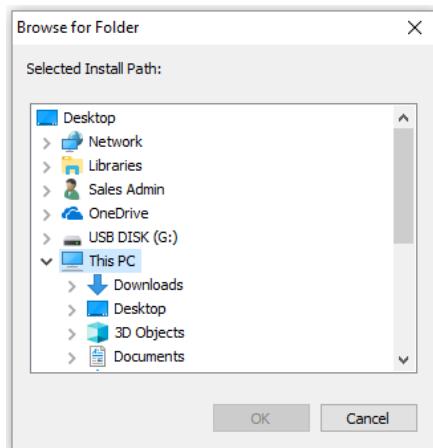


Figure 25i Locate Install Path Selection Window

Locate Install Path: When installing LaserWORKS/RDWorks, the default install path is “C:\\”, if you wish to change this install path, check this option box. After you click “Install” a window will pop-up and you can select the destination of the install path, as shown in **Figure 25i**. If you want to leave the install path at “C:\\”, leave the option unchecked.

Plug RDWorks: This option is not applicable for the “LaserWork” stand-alone version. If Corel Draw, AutoCAD, Engravelab, or Adobe Illustrator is used, it will be applicable. If using these plug-ins, please refer to the “RDWorks/LaserWORKS v8 Installation” guide for further instruction.

After the options for RDWorks/LaserWORKS has been chosen, click “Install” at the bottom of the window, you will now see the window shown in **Figure 25j**.
RDWorks/LaserWORKS is now installed!

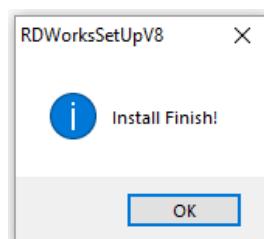


Figure 25j RDWorks Install Finished Window

Introduction to Laser WORKS

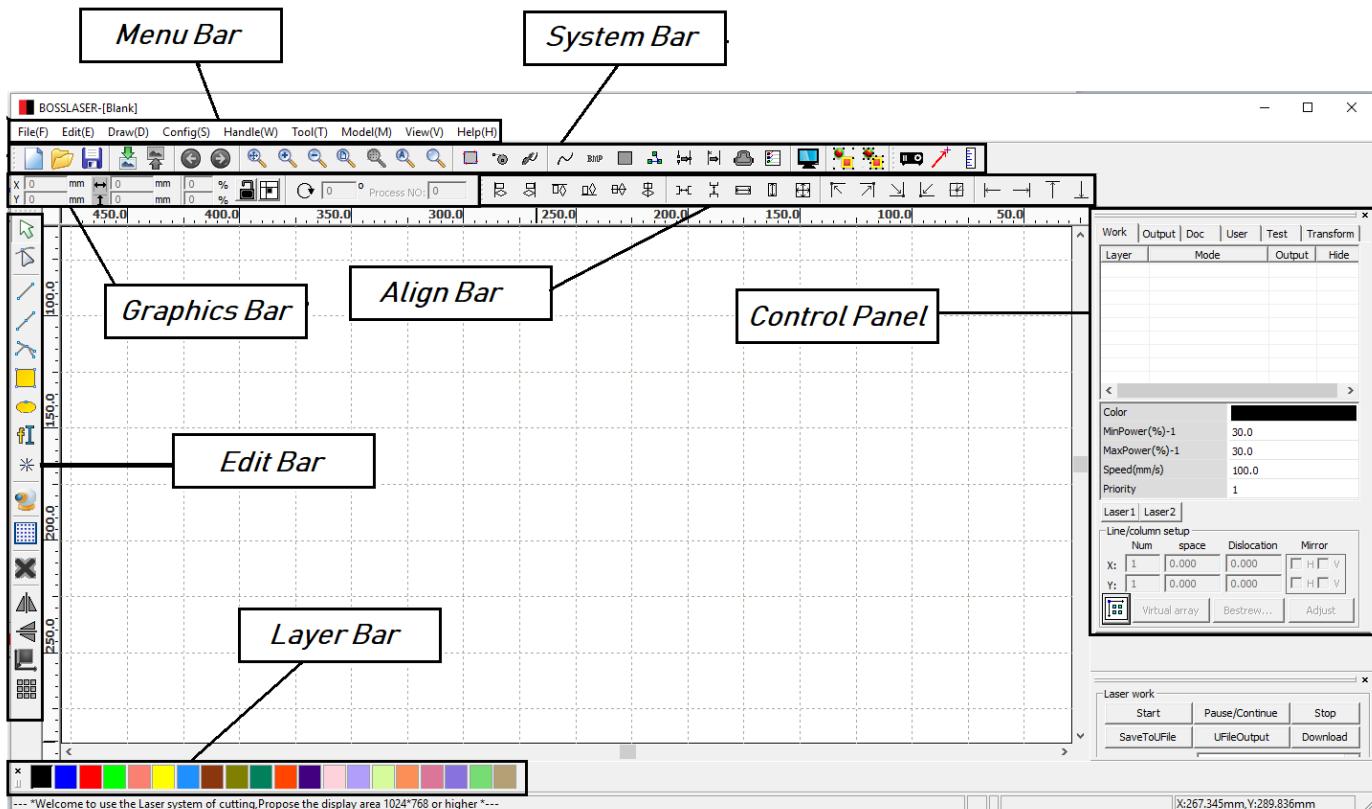


Figure 26 LaserWORKS V8 Main Interface

- **MenuBar:** The main functions of the software are implemented through the Menu Bar. Basic functions such as Document, Edit, Draw, Setting, Processing, View and Help can be located here.
- **System Bar:** Some of the most commonly used functions such as Open, Save, Import, Preview, Export, and New can be found here.
- **Graphics Bar:** This bar will allow you to change basic graphic attributes such as location, size, and scale.
- **Edit Bar:** Located to the left of the work area and has functions that will allow you to edit or create graphics or files.
- **Align Bar:** This bar is located to the left of the Graphics Bar and will allow you to align selected files or graphics by using multiple options.
- **Layer Bar:** Located at the bottom of the work area, these different colors will allow you to create different layered files or graphics.
- **Control Panel:** This panel is used to complete laser processing of multiple tasks, including the setting of layer parameters, axis control, and processing.

Creating Layers in LaserWORKS

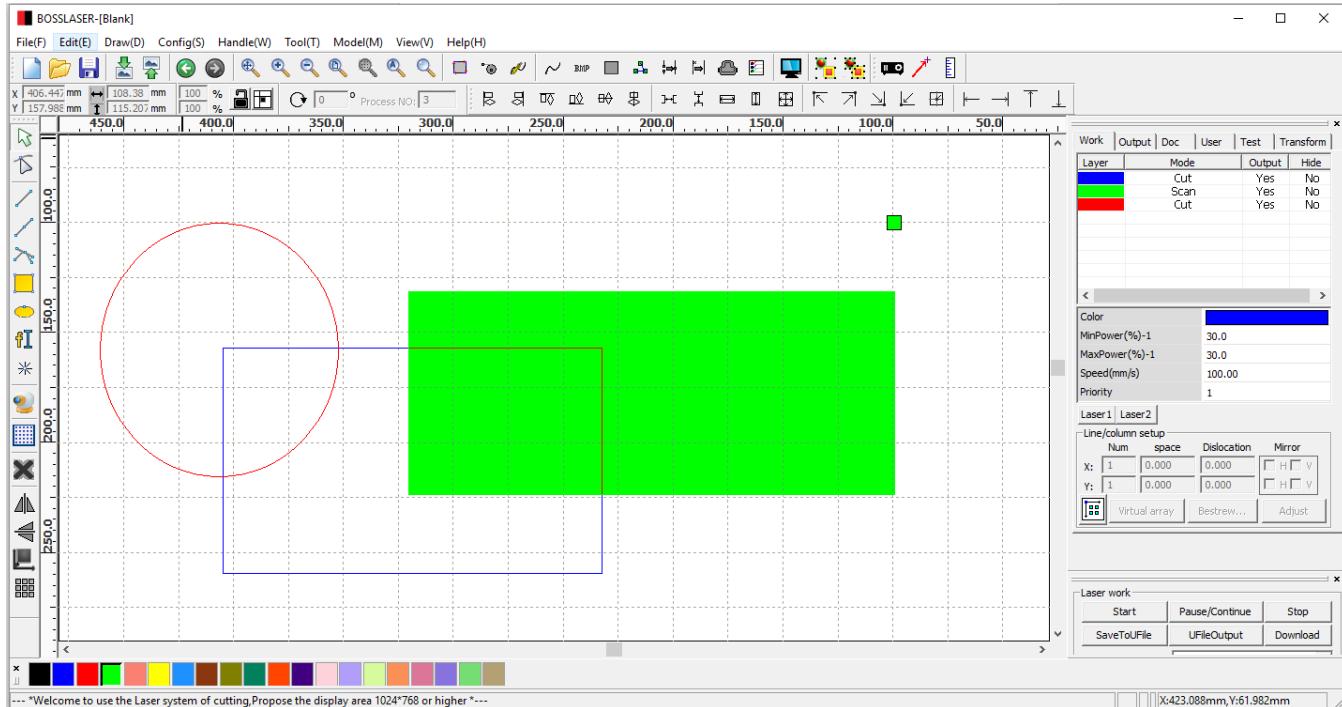


Figure 27 LaserWORKS Main Interface with Layers

In Figure 27 we have created a random selection of shapes in LaserWORKS and assigned them different layers(colors)

In order to create different layers, you must select a color from the "Layer Bar" and then select a shape or text option on the "Edit Bar"

After you have selected a color from the "Layer Bar" and created text or a shape in the work area, you have now created a layer.

When you create layers, these layers will be shown in the "Control Panel" window under the "Work" tab, shown in Figure 28.

 **Note:** When you create a layer in LaserWORKS, it will be either a "cut" layer or "scan" (etch) layer. If your layer is filled in, it will scan. If your layer is an outline, it will cut. If you are using the "Dot" processing mode, it will also be an outline.

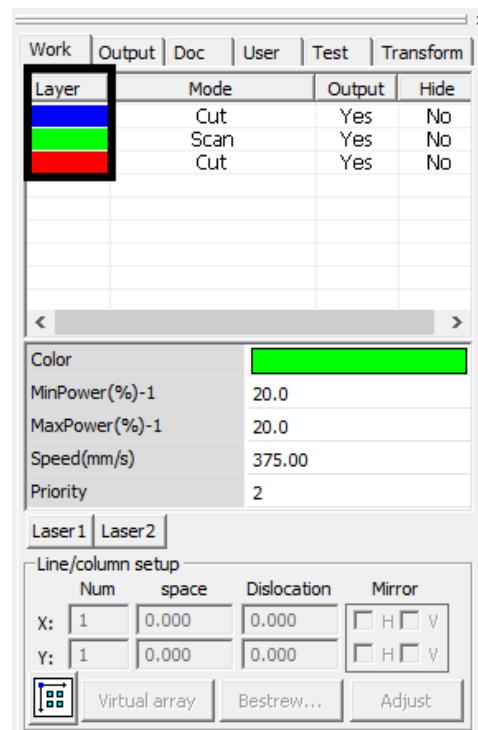


Figure 28 Control Panel with Layers

Setting the Laser Scan Parameters

The input panel for setting the laser scanning parameters can be seen in **Figure 29**. You can bring up this panel by double-clicking one of the layers in the “Work” tab in the control panel, as seen in **Figure 28** on the previous page.

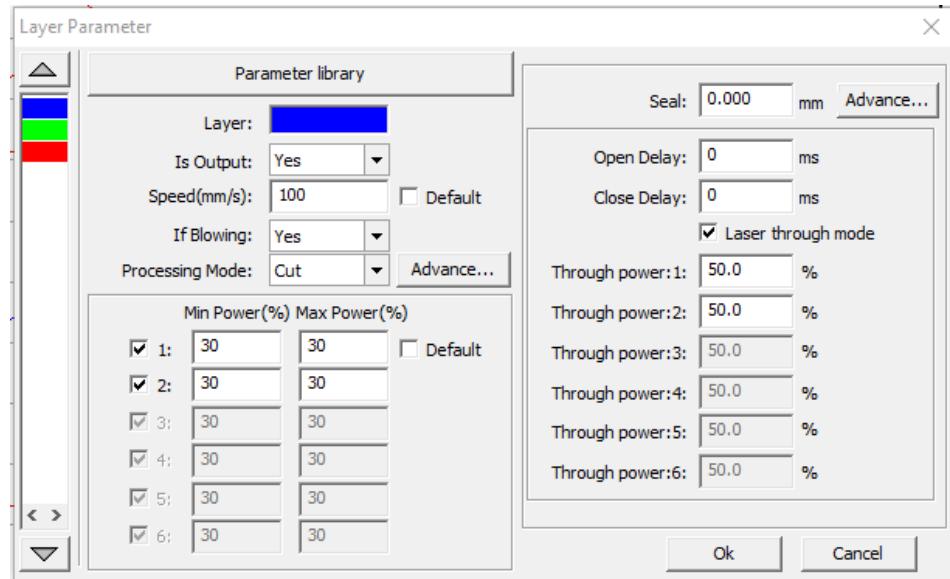


Figure 29 Layer Parameters Panel

Layer: The software has the ability to distinguish between different layers and the processing of their parameters. If you wish to select a different layer while on the “Layer Parameter” menu, click the color of the layer on the far-right side of the pop-up menu.

Is Output: This parameter will have two options, “Yes or “No”. If “Yes” is selected, the corresponding layer will be output. If “No” is selected, then the layer will not be processed by the laser.

Speed(mm/s): This will dictate how slow or fast your laser will engrave or cut the file. Note that when a smoother edge cut is trying to be achieved it is best to use a slower speed. If the speed is set to a fast rate when cutting material, the cutting will be erratic and create jagged edges. If the “Default” box is checked, the speed that is set on your “Control Panel” of your machine will be the speed in which the file is ran.

Recommended Maximum “Scan” Engraving Speed:

LS-1416 & LS1420 = 375mm/s

LS-1630 = 400mm/s

LS-2436 & LS2440 = 500mm/s

LS-3655 = 500mm/s

 **Note:** “Cut” speeds will vary depending on whether the material is going to be cut all of the way through or lightly marked on. These speeds can also vary with density of the material.

Setting the Laser Scan Parameters (Continued)

If Blowing: This setting will take note of whether the external fan is operating. This option should set to “Yes” at all times. This will ensure the air assist is functioning.

Processing Mode: This option will allow you to choose how the layer is processed. If the layer is a vector layer (i.e., color layer), the options are “Cut”, “Scan” (Engrave) & “Dot” (Dotting). If the layer is a BMP layer (bitmap image), only the “Scan” mode is available.

Minimum Power & Maximum Power: The power of these values range from 0 to 100, the lowest power being 0 and the highest being 100. The minimum and maximum power should be set to the same values for consistency throughout the layer while the machine is running the file. If the “Default” box is checked, the minimum and maximum power set on the control panel of the machine will be the power used while running the file.

Laser 1, Laser 2: These fields can be shown in **Figure 29**, they are labeled as “1:” & “2:” and correlate with minimum and maximum speed.

Seal: Closed cutting graphics do not require the use of sealing compensation, but enclosed graphics can be closed by means of it. However, if the sealing is misplaced, there is no compensation. Either clearance optimization or backlash compensation can be used, depending on user preferences.

Open Delay: This is the delay from when the “Start” key is pressed on the control panel on the machine to when the laser actually fires and starts running a file.

Close Delay: This is the delay in which the laser is turned off after completing the running of the file.

Laser Through Mode: If this option is checked, the laser will have an initial power that is inputted into the “Through Power” field located in **Figure 29**

Through Power: This is the field where a power percentage is input, this will be the initial power in which the laser will fire.

Setting the Laser Scan Parameters (Continued)

In Figure 29 there will be an “Advance” option in the top right corner. If selected, the Other Cutting Parameter menu in Figure 30 will pop-up.

Enable Sew Compensation: This is caused by the laser cutting the seam size of the graphics and the deviation of the actual cut out. Seam width only applied to closed graphics.

Sew Direction: This will allow you to choose the direction of the laser compensation, for this example, we will use a circle. If you want to keep the circle from being cutoff, you would set the direction of the compensation outward. If you want to keep the integrity of the internal part of the circle, the direction of the compensation should be set to inward.

Sew Width: This sets the laser cutting seam width

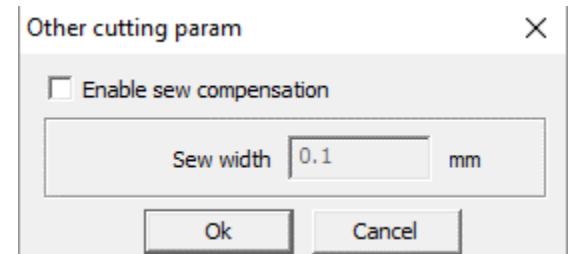


Figure 30 Other Cutting Parameters

“Dot” Parameter Settings:

Dot Time: This will be the amount of time the laser will emit a beam on one dot. The higher the value, the darker the dot will be.

Dot Interval: The amount of space between the dots

Dot Length: This is the length of the dot for cutting a dash line.

Center Dot: This will only make a dot at the center of the file

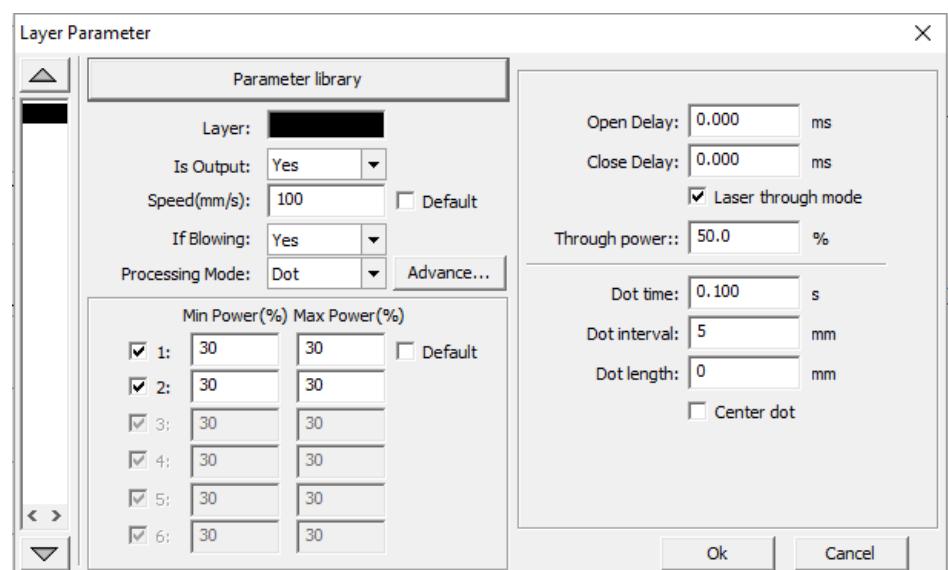


Figure 31 Layer Parameter Input Screen for “Dot” Mode

Setting the Laser Scan Parameters (Continued)

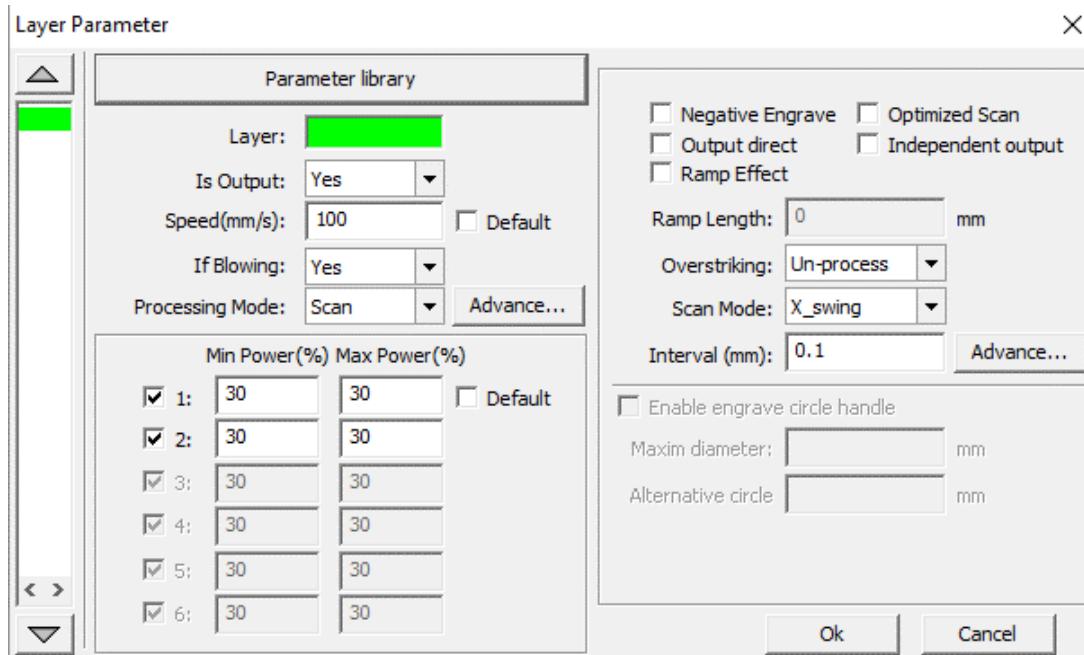


Figure 32a Bitmap Scanning Parameters Input Screen

Figure 32a contains settings for scanned bitmap parameters while in **Figure 32b** are the parameters for vector scanning. Vector files do not support scanning the color carving, optimization scanning or direct output.

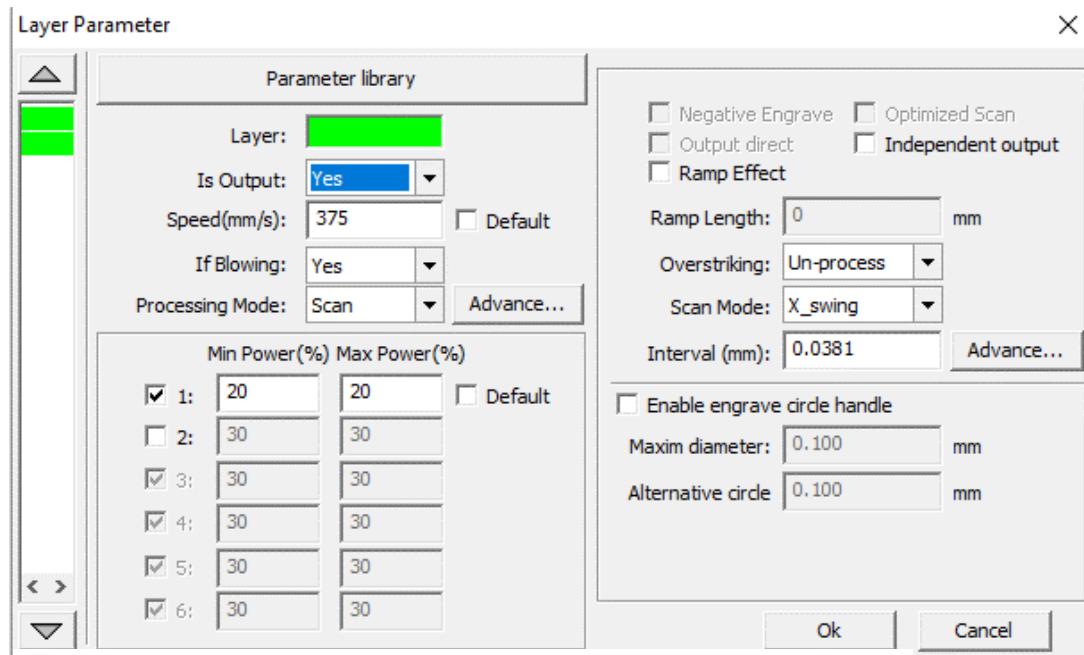


Figure 32b Vector Scanning Parameters Input Screen

Setting the Laser Scan Parameters (Continued)

Optimal Scanning: Choose optimal scanning to automatically adjust the scan, this will change the scanning interval to achieve the best effect. If this is left un-checked, the user settings of the scanning interval scan pattern are applied. It is advised that “optimal scanning” is selected.

Output Direct: If your file has a grayscale effect, ie. Light and dark colors or shading, choosing output direct is advised. When choosing output direct a higher power will be associated with deep or dark colors and for shallow or light colors there will be lower power outputs.

Scan Mode: There are four different scanning modes: X_unilaterism, X_swing, Y_unilaterism, and Y_swing.

X_unilaterism: The scanning pattern in which the laser head will use a back and forth motion in a horizontal direction while pulsing or firing. This will either be left to right or right to left, (uni-directional).

X_swing: This pattern refers to the motion of the laser head moving in a horizontal direction, back and forth. The laser will fire or pulse from left to right AND right to left, (bi-directional).

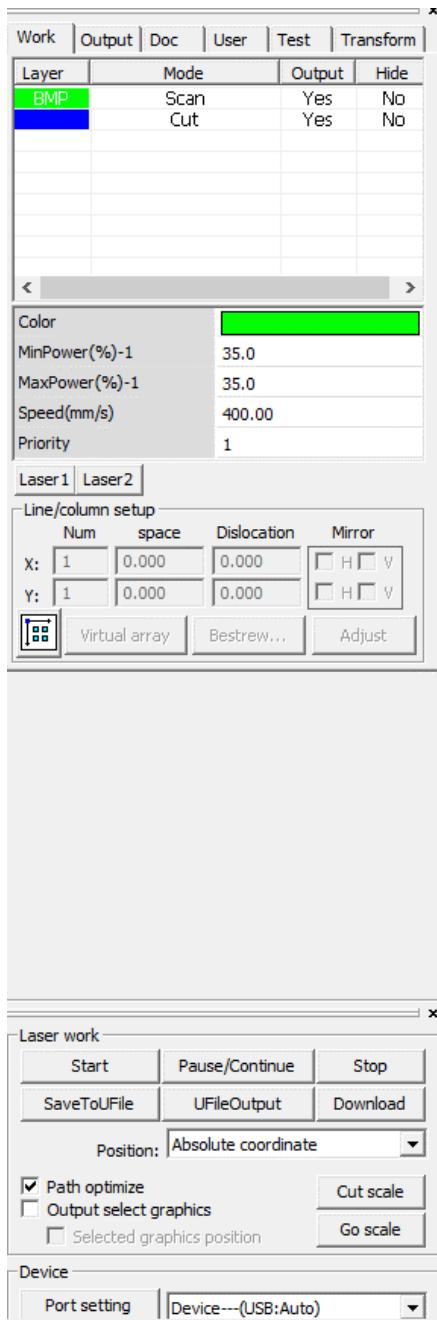
Y_unilaterism: The scanning pattern in which the laser head will move back and forth in a vertical direction. The laser will fire or pulse in an up and down OR down and up, (uni-directional).

Y_swing: This pattern refers to the motion of the laser head moving in a vertical direction, back and forth. The laser will fire or pulse up and down AND down and up, (bi-directional).

Interval (mm): This refers to the optical scan and its distance under a line. The smaller the interval, the more depth the graphics are scanned, and vice versa.

 **Note:** For vector layers (i.e. color layers), the scanning interval should be set to 0.065-.1mm. For Bitmap or BMP layer, the scanning interval should be set to 0.065-.1mm as well.

Sending Files to the Laser using LaserWORKS



Save to UFile: Clicking this button will save the current file as an RD file which can be used for offline processing. The file can be copied to another memory board for full offline operation. **Use this option to export your file(s) to a USB flash drive, then to import into your machine.**

Download: Clicking this button will download the file(s) to the memory of the controller, where the user can start it through the machine panel. Use this option to send your file(s) directly to your machine. Your computer must be connected to your machine via the USB cable connection located on page (page number).

Output Select Graphics:

If “Output Select Graphics” is checked, only the selected graphics will be outputted to the machine. If “Selected Graphics Position” is checked, the selected graphics will be outputted in position of your machines worktable to the position set in the software.

Now that you have sent your file(s) to the machine, go to the LED control panel and press the “File” key. Once you have pressed the “File” key, locate the file you had imported. While the file is highlighted, you should see a preview of your image that reflects that file. Once you have that, press the “Enter” key and you are ready to go!

Figure 33 Input Screen for Sending Files to the Machine using LaserWORKS

 **Note:** A more in-depth LaserWORKS manual can be found on the USB or BossLaser.com

Running Your First File, “Hello World”

Before proceeding through this tutorial, make sure you have the latest version of LaserWORKS (8.01.18 & up)*. To prolong the life of the laser tube, we do NOT recommend going over 85% power for long periods of time when firing the laser tube, doing so will reduce the life of the laser tube and impact performance.

Getting Started:

First, open LaserWORKS and ensure that the graph hatch is selected. You can do this by opening the “Config(s)” Menu as shown in Figure 34a. If it is not checked, press the graph hatch option and it should now be checked. Enabling this feature will help you determine how your text/image is processed. If it is filled by a color, it will scan or engrave. If it is an outline, it will cut.

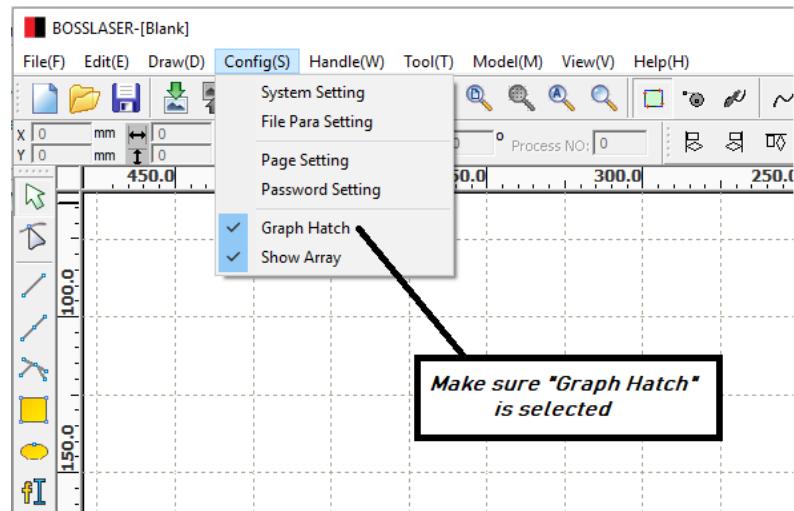


Figure 34a Graph Hatch Option

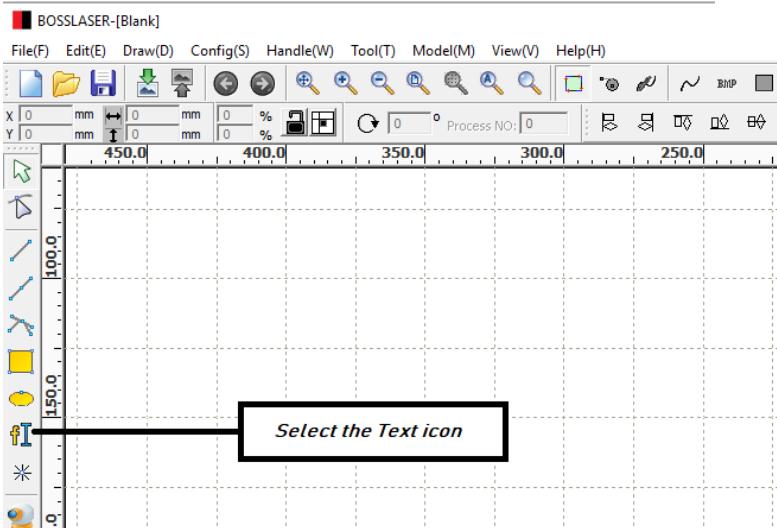


Figure 34b Selecting the “Text” Option

Now, locate the “Text” icon in Figure 34b and select it.

Note: Find the latest version of the LaserWORKS software on our website under “Manual Downloads”

A video of “Running Your First File” can be found on our website.

Running Your First File, “Hello World”(Continued)

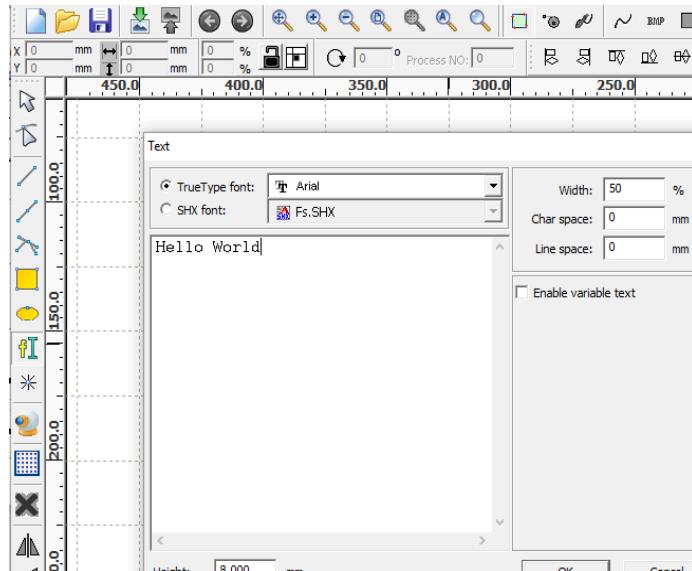


Figure 34c “Hello World” Input Text Screen

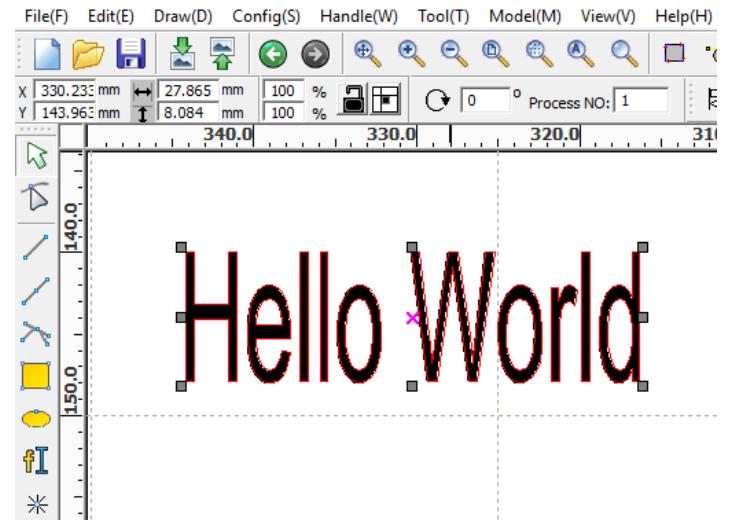


Figure 34d “Hello World” Text

After the “Text” icon has been selected, a window will pop up as in **Figure 34c**. When this window has popped up, type in the text “Hello World” into the text box. Make sure to select the “Arial” font in the top drop down bar of the window. Next, be sure that the width percentage is set to 50% and the height is set to 8mm. When this step has been completed select the “OK” button. Now, your screen should resemble **Figure 34d**.

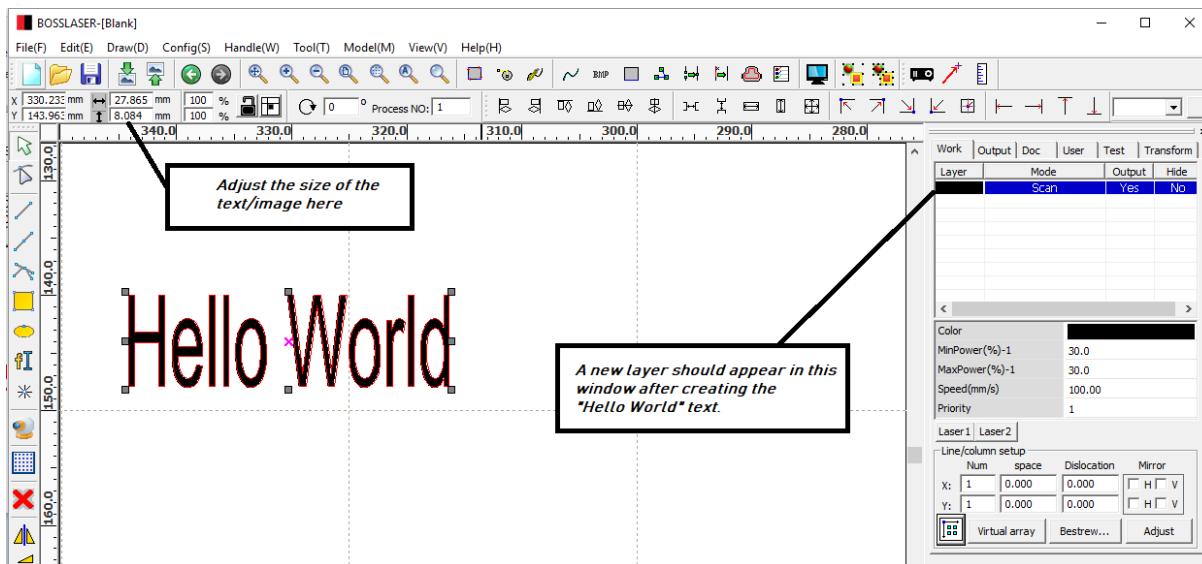


Figure 34e “Hello World” New Layer, Adjustable Sizing

Running Your First File, “Hello World”(Continued)

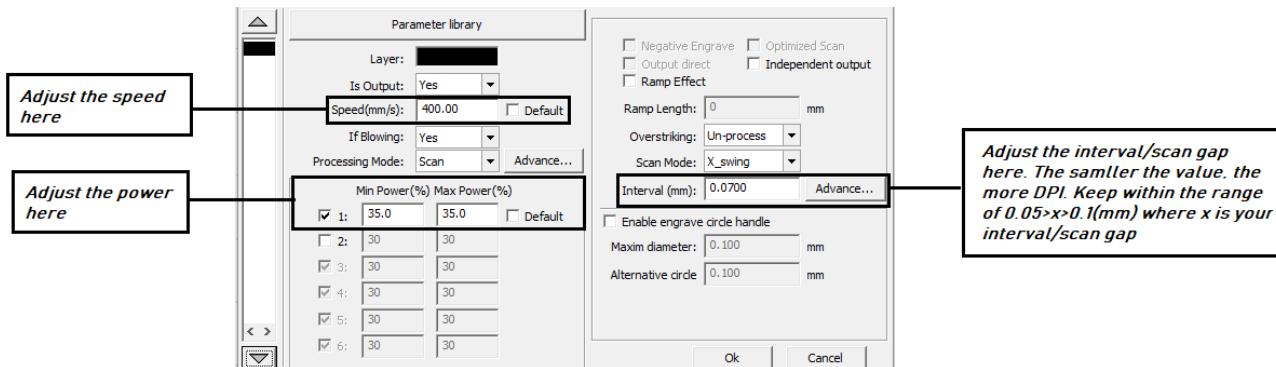


Figure 34f “Hello World” Layer Parameter Window

Now that a new layer has been formed, we can adjust the settings. To do this, double click the layer located in the control panel. Once the layer has been double clicked, you will see the screen in Figure 34f. The “Layer Parameter” window is where you will adjust the speed to 400mm/s, the power to 35% for min & max power, and an interval of 0.07mm. Then select “Ok”

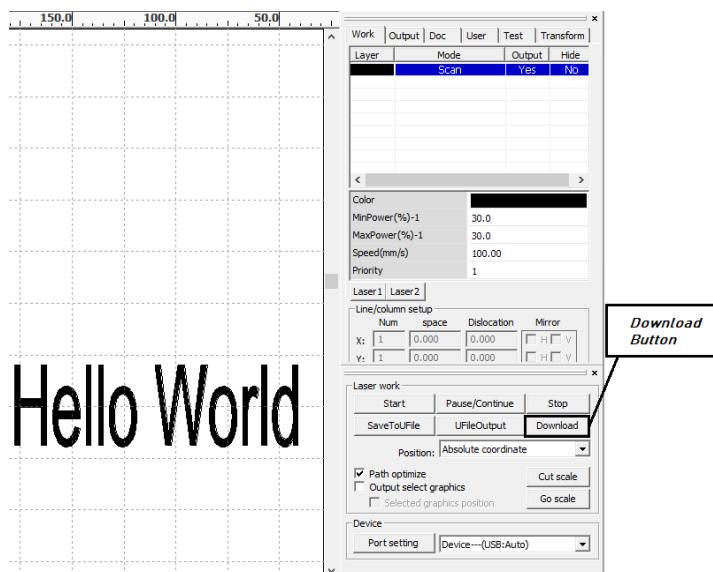
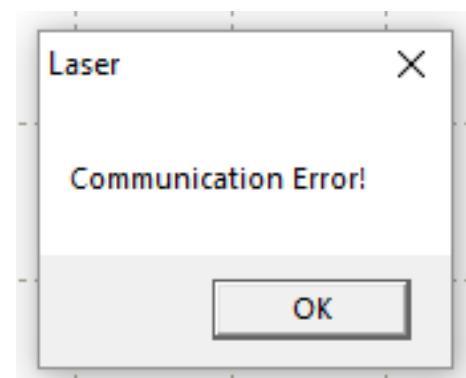


Figure 34g LaserWORKS Control Panel Download Button

After the parameters of the “Hello World” text has been changed, the file is now ready to be downloaded to the machine. The first step is to make sure the machine is turned on and the **BLUE USB** cable is plugged into the machine and the PC Computer. In LaserWORKS, locate the “Download” button as shown in Figure 34g. Select and click on the “Download” button.



Note: If there is an issue communicating or the machine is not on the “Communication Error” shown in Figure 34h will pop-up.

Running Your First File, “Hello World”(Continued)



Figure 34h Name Document File Window

After clicking the “Download” button, the “Name Document” window will appear.

All files will have the “DEFAULT” file name, as shown in **Figure 34h**

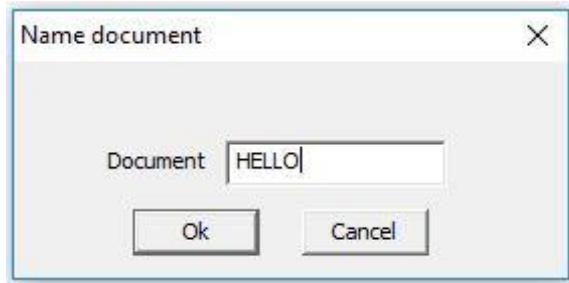


Figure 34i Rename the file “HELLO”

For this tutorial, rename the file “HELLO” as shown in **Figure 34i**.

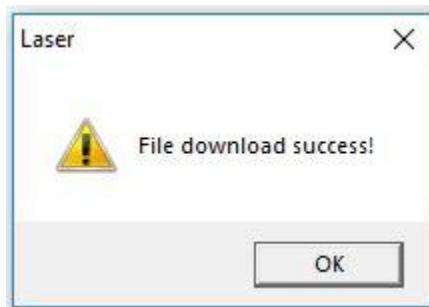


Figure 34j File downloaded successfully to the machine

When the file has been successfully downloaded to the machine,

the window in **Figure 34j** should appear on the computer screen.

Running Your First File, “Hello World”(Continued)

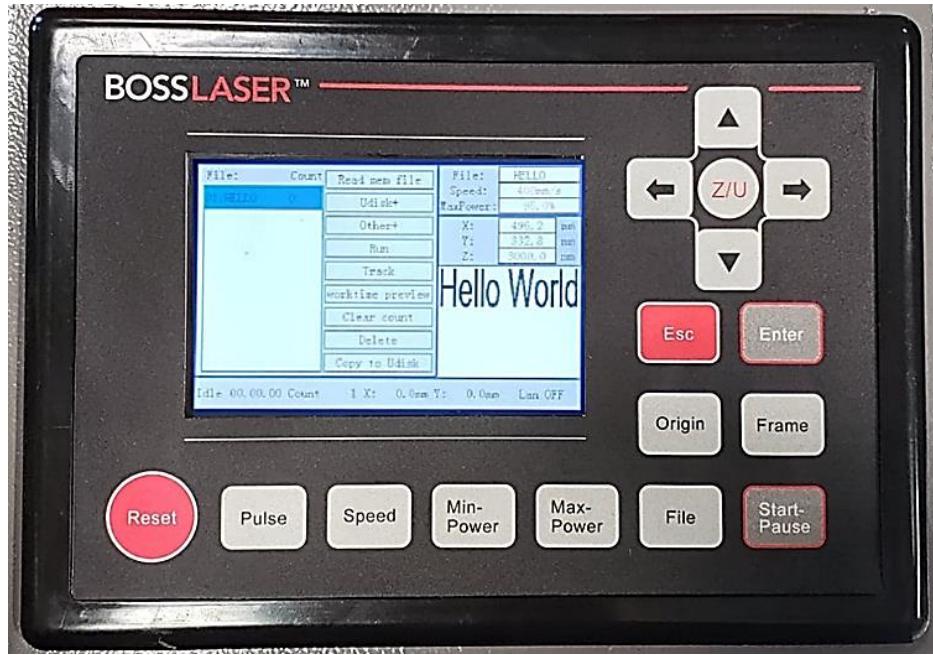


Figure 35a LED Control Panel with “HELLO WORLD” file

After the “HELLO” file has been downloaded to the machine, press the “File” key located on the LED Control Panel. Once the file key has been pressed, the screen in **Figure 35a** will be shown; the “HELLO” file name will be located in the left column of the screen and a preview of the file will be shown in the bottom right-hand corner of the screen. With the “HELLO” file still selected, press the “Enter” key and you will be brought to the main screen with “Hello World” file as shown in **Figure 35b**.



Figure 35b Main Interface “HELLO WORLD” Preview with laser settings

Running Your First File, “Hello World”(Continued)

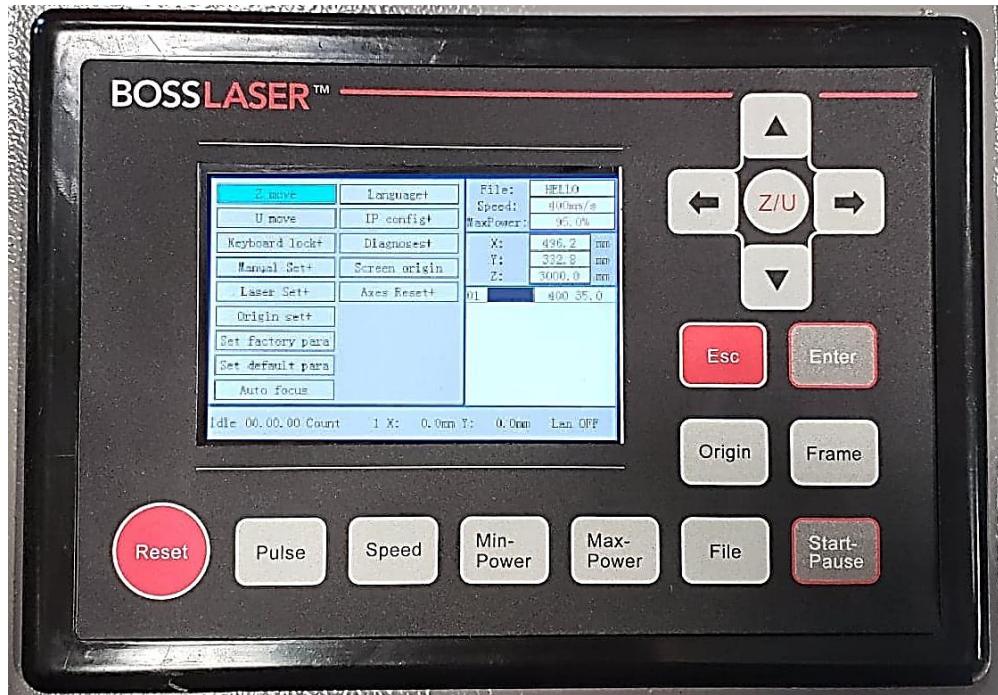


Figure 35c List of Functions for the File



Figure 36 Laser head with Focal Guide

Now, place your material on the work table (we used a piece of wood). On the LED Screen, press the “Z/U” key, a list of functions should now appear as seen in **Figure 35c**. Using the down arrow key, until the highlight is on the “Auto Focus” function.

⚠ Make sure your material is directly underneath the nozzle of the laser head prior to proceeding to the next step!

Now press the “Enter” key, the worktable will now move up towards the nozzle and auto-focus the lens. You can double check the auto-focus by using the focal guide as illustrated in **Figure 36**.

Running Your First File, “Hello World”(Continued)

After the lens is focused, we can proceed to running the file. The first step in this is to close the lid of the machine which will trigger the interlock switch so the machine knows it is ready to fire. The machine will not fire without the lid being closed. Before you run the file, ensure that your water pump/water chiller, air pump/air compressor, and exhaust blower are all turned on and functioning properly.

Next, using the arrow keys, move your laser head on top of your material where you want the job to start then, press the origin button located on the LED Control Panel. (Remember that the default origin of the laser is the top right corner of the work table.) By setting the origin it is telling the machine to always start the job there. Now press the “Frame” key on the LED Control Panel to preview a box, this will be the size of the image/file perimeter. (This should match the dimensions of your image)

Then press the “Start- Pause” key to start the job. To ensure that the laser is indeed firing, the miliamp (mA) reader should provide a reading of the amount of miliamps being used. The higher the power percentage, the high the output of miliamps.

Finally, after the job has been completed by the laser carefully open the lid and see the text “HELLO WORLD” engraved on the material as seen in **Figure 37**.



Figure 37 “HELLO WORLD” Engraved on Wood

This concludes the tutorial of “HELLO WORLD”.

Now that all of the steps have been provided to run this job correctly, we encourage you to use these steps in different applications to help run your machine effectively and master different techniques and materials. Practice makes perfect!

Tuning the Optics

 **Note:** Before any machine leaves our facility, it is put through a quality assurance process and these optics are already aligned and ready for use. Therefore, there is no need for adjustment to the mirrors, tube, or bracket. There is a possibility that the optics may have shifted in transit but, we recommend calling technical support prior to making ANY adjustments.

The laser tube and optics are the heart of the machine, it is important to understand the basics which will allow you to get the most out of your machine. Once tuned, the laser machine should stay aligned for months of work. Check the alignment of the optics once a month to insure no bumping or mechanical failure has occurred.

By studying the diagram in **Figure 38** you can see the simplicity of the system. There is one long glass tube, three small mirrors, and the laser head. The laser beam travels in a straight line, the laser tube in the rear will need to be adjusted to hit the mirror (#1) in the dead center, then adjust mirror (#1) to hit mirror (#2) in the dead center. Finally, adjust mirror (#2) to hit the dead center of the mirror in the laser head.

 **Be careful with this procedure!** Never have the machine on while working around the laser tube. Make an adjustment, then turn on the laser and fire a test shot by pressing the "Pulse" key located on the LED Control Panel

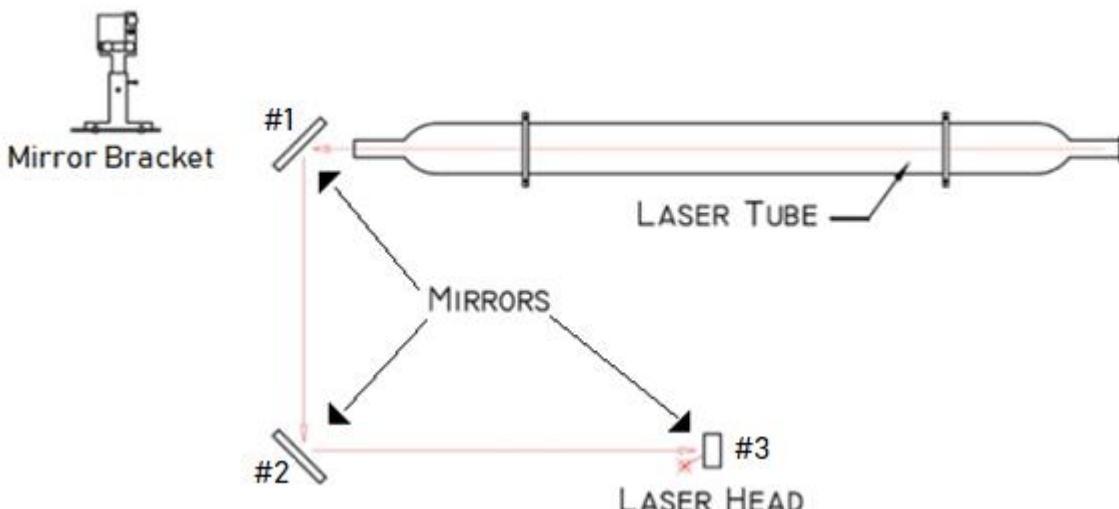


Figure 38 Laser Tube and Mirrors

 A video for "Laser Alignment" can be found on our website.

Tuning the Optics (Continued)

Tube Bracket:

The Tuba Bracket, which is illustrated in Figure 39 holds the glass tube safely and securely. The bracket has two adjustment parameters for the tube, which is vertically or horizontally in the cabinet. All adjustments are accomplished using the **Height Adjustment Wheel** (vertical adjustment) and **un-screwing/re-screwing the four allen screws** at the base of the tube bracket (horizontal adjustment).

The **horizontal adjustment** screws are under the bracket and through the cabinet metal. Once the allen screws are loose, you will have about .5 inch travel front to back. Both brackets have slotted holes in the cabinet for this purpose.

The **vertical adjustment** is quite simple. First, use an allen key to loosen the vertical adjustment allen screws and then lower or raise the upper bracket using the height adjustment wheel. With these two adjustment parameters, the process of aligning the tube to hit the first mirror will be much easier!

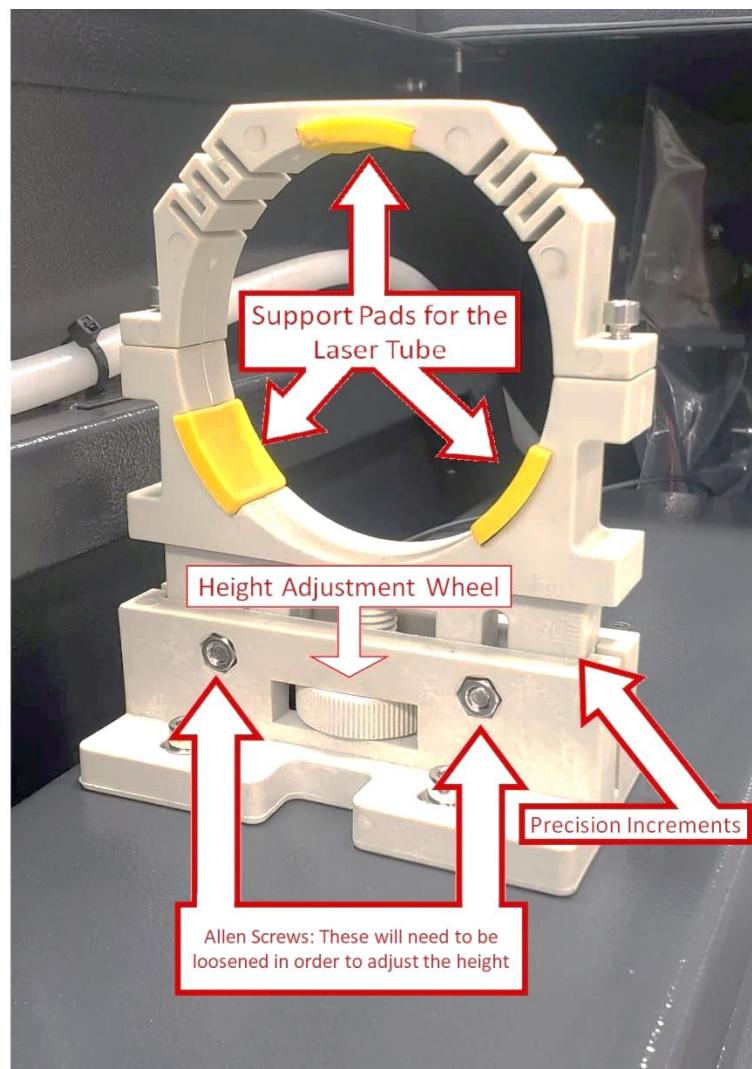


Figure 39 Tube Bracket

Tuning the Optics (Continued)

Adjusting the Mirrors:

An easy method for identifying exactly where the laser beam hits the mirror is to place a piece of masking tape over the mirror, as shown in **Figure 40a**. Use the least adhesive tape you can find (painters tape or masking tape, something that will not leave residue). Next, use the "Pulse" button located on the LED Control Panel to quickly emit a laser beam. The laser beam will quickly burn through the tape leaving its mark as shown in **Figure 40b**.

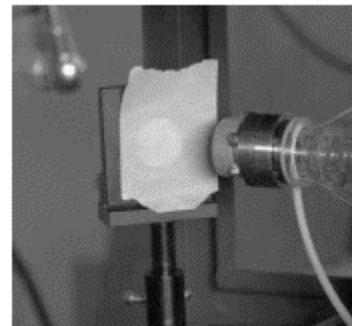


Figure 40a Mirror Bracket with Tape

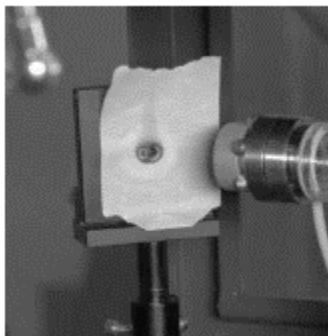


Figure 40b Mirror Bracket with "Pulse" Test Tape

⚠ Please use caution, this is EXTREMELY DANGEROUS if done incorrectly. If the laser is off-target of the mirror, the laser beam will shoot into the room and hit someone or something. Pay very close attention when doing this test! The laser beam has no color and cannot be seen, the red color you see is from the red dot pointer, this is used as a guide for the naked eye of the direction the laser beam is traveling.

Mirror Brackets:

The mirror bracket works as much like the tube bracket with additional fine screws for micro adjustments. You will most-likely not need to use the macro-adjustments for vertical or horizontal corrections, just the micro screws for fine tuning.

An illustration of the mirror bracket in **Figure 40c** shows the fine adjustment screws. Again, use caution and only adjust when the machine is off. If you find that there is no burn mark on the tape after a pulse test, make a large target with a piece of cardboard to see where the laser beam is pointing. Then, use the micro adjustment screws on the mirror bracket to bring the beam to the center of the mirror. One, two or all three mirrors may have to be adjusted.

For Example: If after firing a test shot no burn hole shows up on the tape, make a large target with a piece of cardboard to see where laser mirror #1 is pointed. Using just the fine adjustment screws, you should be able to bring the beam right to the center of mirror #2. After tuning mirror #1 to hit mirror #2 perfectly, adjust mirror #2 to hit the laser head dead center. Use the same masking tape technique to adjust all the mirrors, and the tune-up will be done in little time.

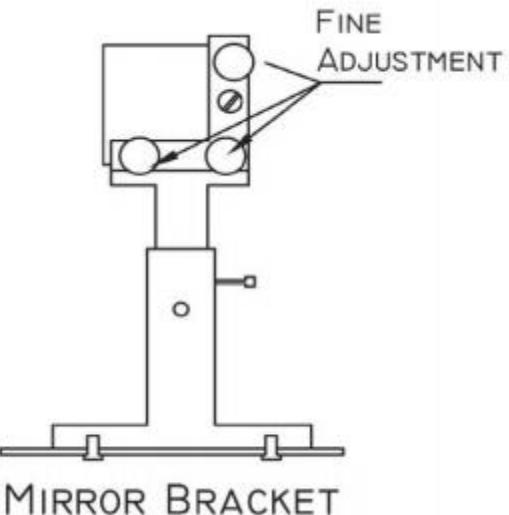


Figure 40c Mirror Bracket with Fine Adjustment/Micro adjustments

Replacing the Lens

Lenses are one of the few parts of the laser that will need regular maintenance and cleaning. Cleaning the lens is simple when done often, but can become difficult or not possible when rarely done.

 **Note:** The cleanliness of your lens can greatly impact the cuts and engravings that you are trying to accomplish with your laser. If the lens is obstructed with scratches or a film of char, it will not produce a good quality engraving or cut.

The lens is small, about 20mm in diameter and two distinct sides, one concave and one convex. When re-installing the lens the convex side (curved/rounded side) should always face up in the laser head. (towards the sky, not towards the work table)

As shown in **Figure 41**, the lens assembly consists of two main parts, the lens housing and the nozzle. There are also three components of the lens housing which are the lens, washer and slotted ring nut.

To remove the lens or replacement of cleaning, loosen the friction set screw on the main lens housing while holding the lens tube to ensure that it does not fall and get damaged. After loosening the screw set, remove the lens tube from the housing as shown in **Figure 41**.

Your machine came with a "Lens Removal Tool" which should be located in the toolbox, this will remove the slotted ring nut. The tool will look like a scraper rather than a screw driver, its width is designed to fit inside the lens tube and fill the slots. Be careful not to let the tip of the removal tool slip and scratch the lens.

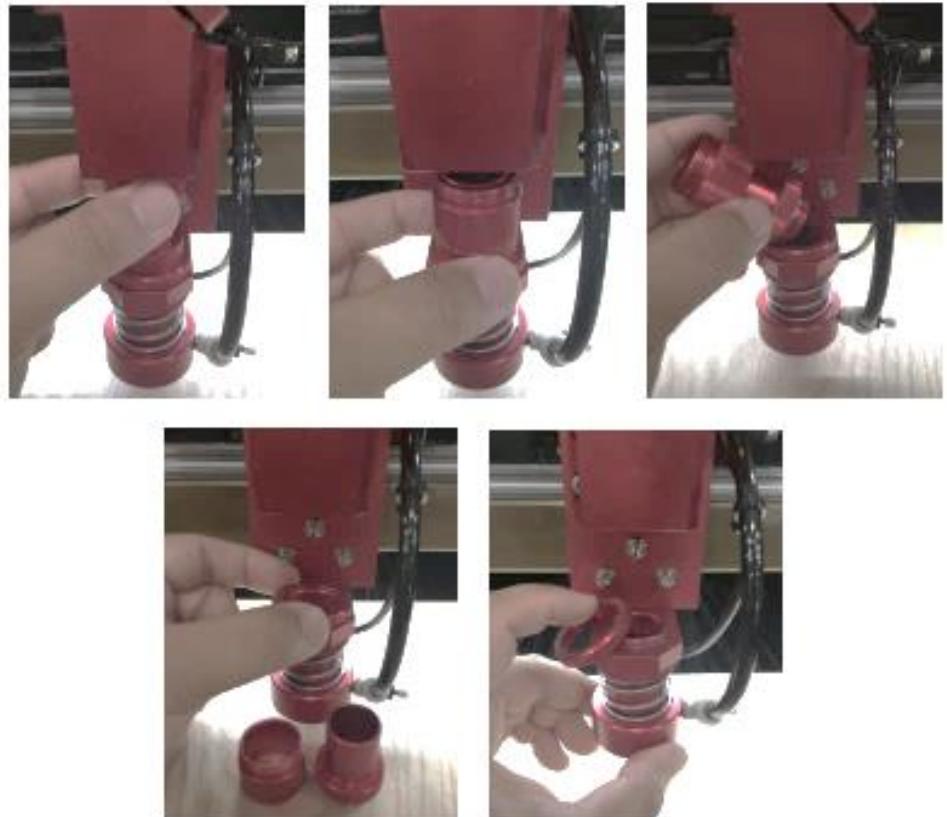


Figure 41 Lens Assembly

Replacing the Lens (Continued)

At this point the lens can be replaced or cleaned. Different size lens can be inserted as well, just be aware that a 4" lens has a different focus point than a 2" lens. The beam width increases with focal length and may require a nozzle with a larger opening.

Handle the lens carefully, using a lens cleaner/wipes to clean both sides of the lens. Lens paper works well and should show a brown residue after cleaning. Make sure to place the concave side down towards the working platform when reassembling, convex side always faces the laser beam. *Rubber O-ring first, then the lens and ring nut.* Don't over tighten ring nut, just snug it up against the washer, and then a quarter turn more.

Burned lenses are a common problem for new users of any laser machine. Make sure to clean it often, especially if cutting on a regular basis. Keeping the lens clean will make it last a longer & more efficient.

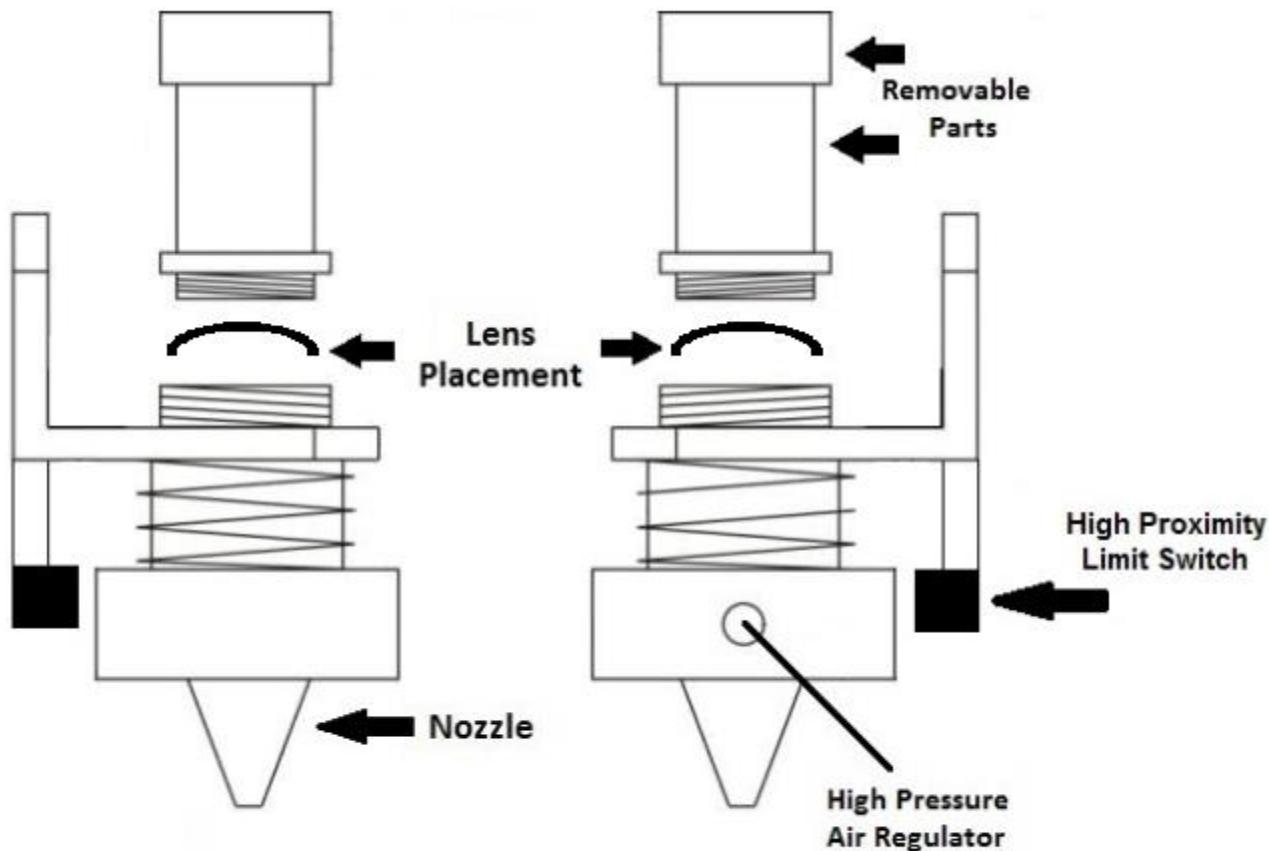


Figure 42 Lens Housing

Laser Maintenance Schedule

Focal Lens:

This is the lens that is used to focus the laser beam and it should be cleaned at least once per week. It is NOT possible to clean the lens while it is mounted in the focal lens tube. The laser beam alignment should be checked after the cleaning of the lens has been completed. If there is any type of fire or large issue with smoke or fumes, it is advised to check the lens and clean it.

When cleaning the lens, use denatured alcohol as the cleaning solvent, use a lens tissue or cotton swabs to apply the solvent. Lens cleanings alcohol free wipes will also do the trick but, we recommend having a BossLaser Lens Cleaning Kit, which can be purchased on our website. DO NOT scrape the lens, only use soft fabrics and approved solvents when cleaning the lens. Only use a soft swirling motion when applying the solvent then use a dry swab in a soft swirling motion to evaporate the solvent completely.

The lens surface is somewhat difficult to see in normal lighting. In order to see any dirt on the lens, look at the reflection in the lens. (Think of this like when you take glasses off of your face to see any smudges or scratches in the lenses, you usually can't see them until you've held them away from your face and in a different angle of light.)

Make sure not to leave any dirt, smudges or water on your focal lens. The focal lens should be replaced if it is cracked, chipped, the coating is scratched, the core of the lens is darkened, the coating is wearing off or any other significant damage is found that could impact the laser beam passing through the focal lens. Some minor blemishes are acceptable, but these problems waste power and will result in reduced laser power at the target material. Any dirt, contaminate, or damage to the lens will cause the lens to deteriorate more quickly.

Mirror #3:

This mirror is located in the laser head and located directly above the focal lens and needs to be cleaned at least once a month. If there is any incident of fire or any large amounts of smoke or fumes, it is advised to check the mirror and clean it. It is possible for this mirror to be cleaned in the mounting bracket but, it is highly advised that the mirror be removed from the bracket and cleaned thoroughly.

When cleaning the mirror, use denatured alcohol as the cleaning solvent, use a lens tissue or cotton swabs to apply the solvent. Lens cleanings alcohol free wipes will also do the trick but, we recommend having a BossLaser Lens Cleaning Kit, which can be purchased on our website. DO NOT scrape the mirror, only use soft fabrics and approved solvents when cleaning the mirror. Only use a soft swirling motion when applying the solvent then use a dry swab in a soft swirling motion to evaporate the solvent completely.

Make sure not to leave any dirt, smudges or water on your focal mirror. The mirror should be replaced if it is pitted/scratched, rusted, discolored from heat damage, or any other significant damage is found. Some minor blemishes are acceptable, but these problems waste power and will result in reduced laser power at the target material. Any dirt, contaminate, or damage to the mirror will cause the lens to deteriorate more quickly.

↗ A video on "Laser Machine Routine Maintenance" can be found on our website.

Laser Maintenance Schedule (Continued)

Mirror #2:

This mirror is located directly at the end of the gantry rail on the left-hand side and should be cleaned at least every two months. Use the same directions for cleaning as you would Mirror #3

Mirror #1:

This mirror is located directly at the end of the laser tube on the left-hand side, this mirror should be cleaned at-least every three months. Use the same directions for cleaning as you would Mirror #3

Laser Tube Output Coupler Lens:

This lens is located inside the output end of the laser tube, located closest to Mirror #3 and should be cleaned at least every 3 months. **You must be very careful when cleaning this lens**, it CANNOT be removed from the laser tube or replaced. As with other lenses and mirrors, use cotton swabs and isopropyl alcohol or lens wipes with an alcohol-free solution to clean this lens. The goal when cleaning this lens is to remove dust, film contamination from humidity, smoke or fumes. **Be very careful, do not scratch the lens, it is non-replaceable unless the whole tube is replaced.**

Gantry Rails and Worm Rods:

The gantry rails and worm rods should be checked at least every 3-6 months. The time between the cleaning and re-greasing of the gantry will depend on environment, usage of machine, cleanliness of area, etc. Your gantry and worm rods should be re-greased with **White Lithium Grease**, as needed. If the grease on your gantry or worm rods is discolored, clumping or filled with debris, it must be cleaned.

Linear Rails:

The linear rails are the guiding rails along the left and right sides and across the gantry. These rails should be kept clean and without rust and have a light coating of white lithium grease. The linear rails should be cleaned and examined once a month to prevent the laser head from seizing up. The surface of the rails should always have white lithium grease on them and should be “wet” to the touch but not saturated or dripping.

The best way to see if you need to do some cleaning of the rails is to check the end of the rail where the home switch is located. If you see a dirty line, then clean the rails off and apply a fresh coat of white lithium grease.

Linear Bearings:

The linear bearings are found under the gantry (to mount the gantry to the side rails) and under the focal head (to mount the focal head to the gantry). We recommend using white lithium grease and applying that onto the linear rails and inside the linear bearings.

Incline Portion of Table & Collection Tray(s):

It is HIGHLY RECCOMENDED that these areas be cleaned of debris before, between and after operating the machine. Doing so will help prevent any accidental hazards that may cause a fire or excessive smoke.

Laser Maintenance Schedule (Continued)

Nuts/Bolts:

If you are concerned about these items rusting, then you should apply a thin coating of silicone base grease. One application per year should suffice.

Rubber Belts:

The rubber belts should be checked for appropriate tension at least every 6 months. You should expect the two side belts to be the same tension and should be adjusted and tensioned on the same maintenance schedule. These side belts work together to move the gantry from front to back. If one belt is tensioned more often than the other, that belt could become stretched out more than the other. It is difficult to describe the appropriate tension of the belt but, there should be no slack, sagging or flapping. If the belt appears to be worn on one side it would be best to check the bearing alignment and assure that there is no damage. There are many laser machine designs but, the method of changing the belt tension should not be too complex. It is normally a method of tightening a screw and then applying a lock nut to keep the screw in place.

Air Filters:

If a fume extractor was purchased with the machine, there will be filters installed within that fume extractor. These air filters work best when air is able to move freely from one side to the other while catch dust, fumes and other debris within the air. If the air filter is dirty the air pressure will be greatly reduced. The main application of a fume extractor is to clean the air and absorb the dangerous smells and fumes that some material can produce. Some of these gases can be caustic, nauseating, volatile, corrosive, or even deadly. It is best to use multiple stages of filters to catch the particles of different sizes. New filters can be ordered from BossLaser by contacting sales.

Chiller & Coolant:

First, automotive antifreeze should NEVER be used as a laser coolant, only deionized water. In the absence of deionized water, distilled water can be used (tap water being a last resort). The coolant should always be clean and clear. It is a common problem for the coolant to become infested with mold, this often will look like a murky green water with algae build up on the inner walls of the hoses. This issue can be solved in just a few steps.

1. Flush out the bad water from the chiller or the water pump reservoir.
2. Create a solution of water and 20% bleach. Cycle the bleach-water solution for about 30 minutes then flush out this water.
3. Switch the inlet and outlet hoses and flush them with more cleaned distilled water. This should dislodge mold from inside the laser tube.
4. The safety flow sensor could also be full of mold, the best solution is to take it apart and clean it with soft brush or pipe cleaners. Make sure to re-assemble the sensor correctly and without leaks. It is possible that harsh cleaners could creep into the sensor electronics and cause permanent damage.



Note: The chiller water should be changed ATLEAST once every two months.

Laser Maintenance Schedule (Continued)

Storage of the Laser:

Keep the laser machine in a clean, dry and warm location with no vibration. Make sure there are NO MATERIAL(S) left on the worktable when the machine is not in use.

Use a Dehumidifier:

Humidity can cause the metal parts of the laser machine to rust, all metal at some point can rust. One unexpected metal surface is the laser mirrors. It is best to try and control the humidity level in the laser work area. Clean the mirrors and check for oxidation as a possible problem. Replace the mirrors that do not meet your expectation of performance.

Make a Maintenance Schedule:

The easiest way to follow a cleaning schedule is to use a calendar and keep it close to your machine, write the dates that you want to do maintenance on. Some maintenance is needed on a regular basis while other cleaning could be an immediate requirement after a fire or large amount of smoke or fumes. A laser machine that has lack of maintenance could result in a laser that is not working properly or at all and remember that lack of maintenance can void your warranty.

Use a Heater:

If your laser is expected to be exposed to temperatures lower than 50 degrees Fahrenheit, a heater is going to be needed. The laser machine is a significant investment and should be kept warm. It is quite easy to put a ceramic space heater inside of the laser machine with the temperature set to a moderate temperature. The heat will move throughout the inside of the laser and keep the glass laser tube warm enough not to freeze, crack or break. A sudden shock of icy cold water rushing into the warm glass can break the glass laser tube. But, what to do about the water pump, bucket or chiller?

There are a few options:

1. Use an aquarium heater to warm the water and set the temperature to a moderate level. Remember that the water in the hoses can still freeze, use a timer to switch the water pump on/off every fifteen minutes.
2. If you are worried about wasting the life of your pump, drain the laser coolant from the entire system. Disconnect the hoses from the laser machine and use an air compressor to blow as much water out as you can. Blow air into the water hose connected to the laser from the "water out" port. Take the chiller to a place where it will not freeze and put a heater inside of the machine.
3. Move the laser machine and all components in a temperature-controlled environment with no risk of freezing.

Machine Memory:

There should always be little to no files stored on your machine's memory. A large number of files can cause the controller card to have a slower reaction time when using the LED Control Panel and screen. If the machine's memory is pushed to its limits, it has the possibility to crash the controller card and/or lock up the entire machine. This machine is just like a computer, if you acquire a large number of files over time, it will cause the operating system to slow down.

Troubleshooting

Laser Not Turning On:

First, make sure that the electrical outlet is working, plug in a lamp or phone charger to ensure that it is the machine and not the outlet.

Check the simple stuff first

- Is the emergency stop button pressed?
- Is the key in the machine and turned into the on position?
- Is the cord plugged into the machine and electrical outlet?

Machine is Turning on but Not Firing:

The laser has multiple protection modes built in to prevent possible injuries or damage to the machine.

Problems with any of these modes can prevent the machine from firing but, the laser head will still move around as if the machine is working correctly.

- Check to see if the chiller or water pump is working and flowing water throughout the tube. If no water flow is detected by the machine, it will not fire. If you are using a water pump, make sure your chiller bypass cable is plugged in.
- Ensure that all of the cabinet doors and machine hood is closed, our machines come with interlocks to prevent the machine operating when the doors or hood are open.
- Check to see if the exhaust fan is on and working, the machine will not fire without it.

X or Y Slop Over Error/ Frame Over Error:

When running the “Frame” and/or “Start-Pause button, the slop/frame error message will appear only if the object(s)/image(s) being executed on the worktable is overextending (too big or not enough space on the worktable for the file to be done).

The File Is Starting at the Same Spot Every Time:

In most cases, this happens when the “Origin” was accidentally selected. To cancel the origin, press the “Z/U” key and cycle through the options until you see “Axis Reset+” is highlighted. Select it and then highlight over the “XY Axis Reset”. Once that is selected, the laser head will go to its home position and now the origin has been cancelled. To change the origin position, just move the laser head to your desired location, then press the “Origin” key again to set the origin.

Hardware Troubleshooting

Water Chiller (CW-3000/CW-5000)

If the water chiller alarm is going off (a beeping noise), it can be one of two reasons. #1) The water line hoses are pinched so that the water cannot freely flow. #2) The water chiller does not have enough water #3) The temperature is either below or above the alarm levels.

Air Compressor

Use the regulator that is attached to the air compressor to adjust the amount of pressure being applied onto your material.