

# BOSSLASER™

## Operators Manual for LS Series A Class IV CO2 Laser Machine

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# Introduction

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## 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 and how to use your touchscreen panel.

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 407-878-0880 or email [techsupport@bosslaser.com](mailto: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.*”

# Definitions of Procedures

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The BOSSLASER LS Series laser system is a machine that uses a carbon dioxide laser for cutting or engraving absorptive sheet materials. Within the protective housing, the laser beam traverses three mirrors on a two-axis moving frame and is again reflected into the focusing optics for irradiation of the workpiece.

## Operation

Operational procedures include programming the controller for the pattern to be cut or engraved, opening the housing to place the panel or material workpiece, closing the housing if possible, initiating the cutting process, opening the housing and removal of the finished workpiece. Because the machine can be used to cut panels that can exceed the dimension of the machine, the housing includes removable panels (pass-throughs).

## Maintenance

Maintenance includes routine cleaning and emptying of the scrap tray. These procedures are performed with the machine off.

## Service

Service includes initial installation and alignment, as well as repair when needed. Procedures during service may require the machine to be turned on. BOSSLASER recommends that only trained service personnel complete service or repair.

# Warranty Disclaimer

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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.

This Limited Warranty does not cover any problem that is caused by: Conditions, malfunctions or damage not resulting from defects in material or workmanship (ex. modifications done to the machine)

**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 (407-878-0880) or email (techsupport@bosslaser.com) to determine any issues and the most appropriate solution for the machine.



# Safety Precautions

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The BOSSLASER LS Series Laser Systems are a Class 4 laser product, as defined in International Standard IEC 60825-1.

The BOSSLASER LS Series model family complies with 21 CFR 1040.10 and 1040.11, the Federal Performance Standards for Light-Emitting Products, except for deviations pursuant to Laser Notice No. 50, dated May 8, 2019. The Center for Devices and Radiological Health, of the US FDA, issued Laser Notice No. 50 to permit manufacturers to classify and manufacture their products in accordance with the International Standard.

During normal operation, the output of the embedded laser is contained. The laser cabinet has a main access door with a safety interlock that turns the laser off if it is opened during operation, as well as non-interlocked doors that can be opened during operation. If any non-interlocked doors are opened during operation, proper personal protective equipment (PPE) is required.

The visible output beam of the Laser Diode Pointer (Red Dot Pointer) is accessible to the operator. While this device employs the same technology as the familiar laser pen-pointers, like them it is potentially hazardous if its beam is directed into the eye.

We have made every effort to make the Laser Diode Pointer (Red Dot Pointer) as safe as possible. Its beam path is located well inside the cabinet, and under normal operation, no hazardous levels of laser radiation can escape.

The standard reference for laser safety is the American Standard for the Safe Use of Lasers, Z136.1-2000, developed by the American National Standards Institute (ANSI). This reference is the basis for many of the federal regulations for laser and laser system manufacturers, and for the Occupational Safety and Health Administration (OSHA) laser safety guidelines. It contains detailed information concerning proper installation and use of laser systems.

While the ANSI standard itself does not have the force of law, its recommendations, including warning signage, training, and the designation of a laser safety officer, may be compulsory under local workplace regulations when operating laser systems above Class I. It is the operator's responsibility to ensure that the installation and operation of the Boss Laser LS Series Laser System is performed in accordance with all applicable laws.

Copies of ANSI Standard Z136.1-2000 are available from:



Laser Institute of America  
12424 Research Parkway, Suite 125  
Orlando, FL 32826  
(407) 380-1553

# Safety Precautions

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- Before using the machine, any and all operators are required to read this manual carefully and adhere to the operating requirements & specifications. Anyone who has not read this manual should abstain from using the laser machinery, as it can cause harm to the machinery, the operator, and any bystanders.
- This laser machine is a Class IV laser machine, laser radiation is a possibility. Failing to follow the proper safety precautions has the potential to cause the following:
  - Materials within the machine and the surrounding areas to catch on fire.
  - When certain materials are processed by a laser machine, those materials can generate or produce toxic or hazardous gas when processed by a laser machine (see Laser Safe Materials section).
  - Direct exposure to laser radiation, causing harm to the human body.
- To ensure you are prepared for any possible accidents or emergencies, it is recommended to adhere to the following safety measures:
  - Have a CO2/ABC fire extinguisher on hand and nearby to minimize damage to the machine and the surrounding environment in case of a fire.
  - Avoid stacking flammable or explosive objects on or near the machine.
  - Ensure good ventilation within the area while running the laser machine.
  - Only allow qualified personnel to operate the laser machine at all times, each person who enters the area should have general safety laser knowledge and any person who operates the machine should read this manual first.
- This laser machine uses electricity, having the potential increase the risk of electrical shock. Do not disassemble the machine without prior approval from Technical Support, otherwise warranty may be voided. Ensure all sources of power are removed for Service and Maintenance.
- Prior to the operation of the laser machine, all covers, doors, hoods, and safety mechanisms should be in place.
- During machine operation, the operator must be present to observe the working status of the machine, the machine cannot be left unattended. In case of an abnormality or an emergency it is important for the operator to react quickly and safely. In case of an emergency, utilize the emergency stop button, disconnect the machine from power immediately and take precautionary measures to inspect the machine prior to returning to normal use.
- To minimize the chance of accidents and emergencies, turn off the laser machine and disconnect any power cords prior to leaving the machine unattended.
- Do not place any reflective materials or objects in the machine, reflective material can cause the laser beam to deflect, causing damage to the machine.
- The ideal environment for your machine is a dry environment, free of interference from pollution, vibration, high voltage, or strong magnets. The laser machine should be in an ambient temperature of 39° - 104° Fahrenheit (5° - 40° Celsius) with humidity ranges of 5%-95% with no dew.
- The operating voltage of this machine should be AC 110V 60Hz.

# Fire & Hazardous Materials

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⚠ **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:**

- ⊘ 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.

# Laser Safety & Policies

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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 CO<sub>2</sub> fire extinguisher for serious flames

# Laser Safe Materials

Lasers use heat to cut and etch a given material. Some materials respond to this method beautifully, other materials can have less than a desirable effect. It is important to know the material you are working with, some materials like PVC are easy to cut, but give off a chlorine gas that's not healthy for the machine or the operator. Below is a list to use as a guide. New materials come out daily, if you are not sure about its laser ability, contact us and we'll try and identify its properties and determine if it's both safe and possible.

To make this process a little bit easier, we have created a list of materials we know are safe for the machine. It is important to review the information below and on the next page to ensure you are not attempting to cut or engrave a material that is not meant for your machine.

MACHINE SERIES	LS	HP		LS	HP
<b>LASER CUTTING</b>	<b>CO2</b>		<b>MARK/ENGRAVE</b>	<b>CO2</b>	
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/HP Series Lasers

## Laser Safe Materials (Continued)

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### 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.

### Materials that can't or should not be cut:

- Metals (exceptions of etching = Using TherMark. Cutting = HP models "Oxygen/Air assist")
- Polycarbonate (PC, Lexan) due to the fumes.
- Any material containing chlorine
  - PVC (Cintra) - contains chlorine
  - Vinyl - contains chlorine

# Safety Features & Regulatory Compliance

BOSS LASER has incorporated specific safety features into the LS Series Laser System in order to meet the requirements of 21 CFR 1040. These safety features include:

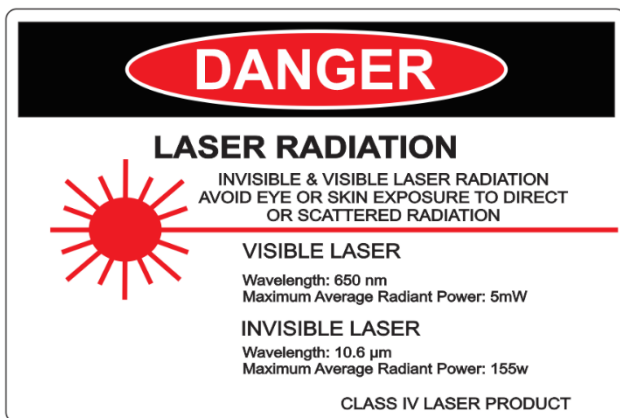
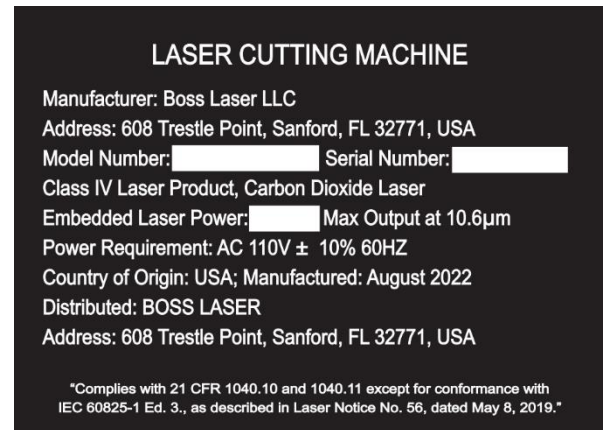
- A safety enclosure (cabinet), which fully encloses the engraving laser and its beam path.
- Dual redundant interlock systems that turn off the engraving laser when the main access door is opened.
- A visible emission indicator illuminates when the Laser is operating. There is an emission indicator is near the machine control panel.
- A manual reset enables resumption of laser radiation emission after interruption of emission caused by the use of a remote interlock or after an interruption of emission in excess of 5 seconds duration due to the unexpected loss of main electrical power.
- An emergency stop is used to immediately cease emission of laser radiation.
- A viewing optics window is incorporated with the safety enclosure (cabinet) to limit the levels of laser radiation to the human eye. Additionally, Laser safety glasses are also provided for operation when pass-through doors are in use.
- A remote interlock functions, when the terminals of the connector are not electrically joined, human access to all laser radiation from the laser product in excess of the accessible emission limits of Class I and table VI shall be prevented.

21 CFR 1040 require that certification, identification, and warning labels be placed on laser products. Reproductions of labels on the BOSS LASER LS Series Laser System follow, with their locations specified.

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.

## Certification/Identification

The “Certification” and “Identification” labels are combined into one label. The label can be found on the back right side of the machine.



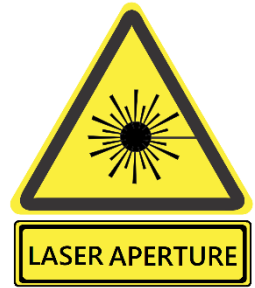
## Warning Logotype

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.

# Safety Features & Regulatory Compliance

## Laser Aperture

The “LASER APERTURE” warning label can be found inside of the working area, on the back left-hand side behind the gantry and on the laser head. The first aperture warning label is where your laser beam will bounce from mirror #1 to mirror #2. The second aperture warning label is where your laser beam will exit the laser head.



## Non-Interlocked Protective Housing

### **DANGER**

VISIBLE and/or INVISIBLE LASER RADIATION  
WHEN OPEN. AVOID EYE OR SKIN EXPOSURE  
TO DIRECT OR SCATTERED RADIATION.

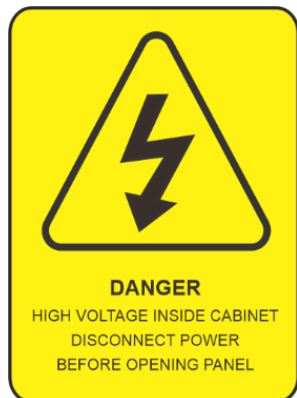
The “DANGER” labels for non-interlocked doors are located on the machine body next to the doors that are accessible/removable. This machine produces laser radiation & all doors to the machine should be closed when the laser is operating unless the pass-through doors are needed.

## Interlocked Protective Housing

The “DANGER” labels for interlocked protective housings are located on the machine body next to every door that are accessible when interlock is defeated.

### **DANGER**

VISIBLE and/or INVISIBLE LASER RADIATION  
WHEN OPEN AND INTERLOCK DEFEATED.  
AVOID EYE OR SKIN EXPOSURE  
TO DIRECT OR SCATTERED RADIATION.



## Electrical Safety

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.

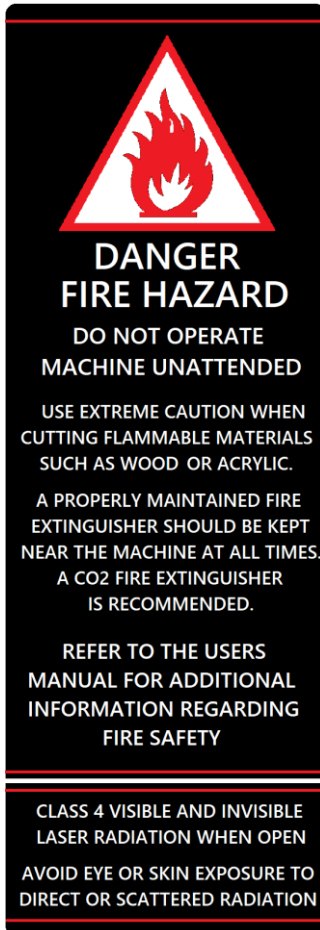
## Do Not Lift

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.





# Safety Features & Regulatory Compliance



## Danger Fire Hazard

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.

## Laser Tube Handling

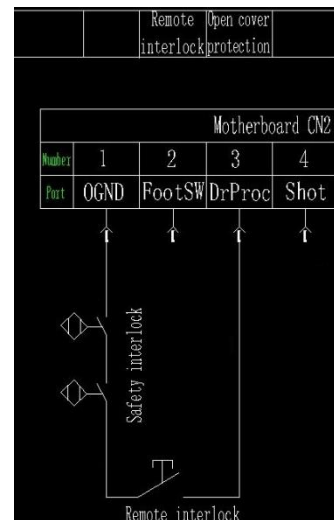
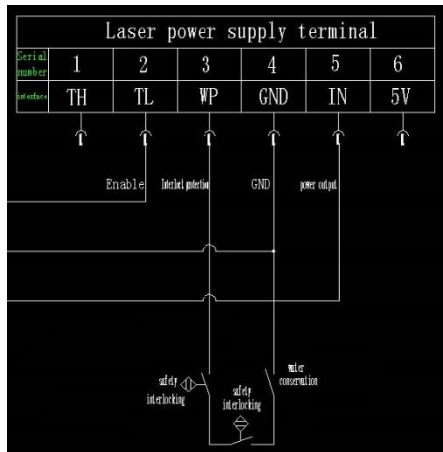
The “DANGER: Laser Radiation” label and the “Laser Aperture” label can be found on the laser tube, which will be located on the backside of the machine in the rear/top access panel. The laser beam will be initiated in the laser tube itself and it is important to have all panels and access doors closed 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 eye wear and clothing must be worn if any access panels or doors are open while operating the machine.



## Safety Design Features

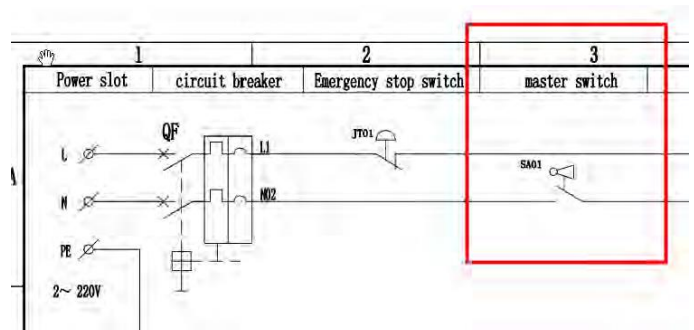
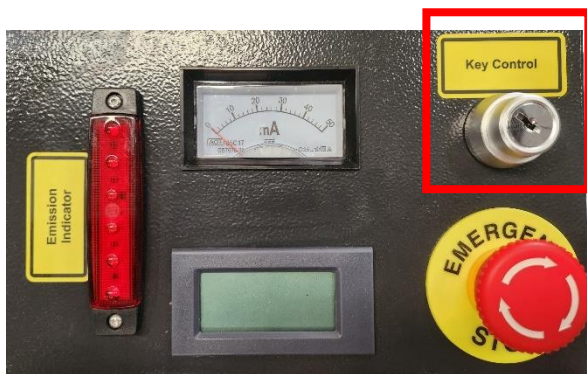
### Safety Interlocks

There are two safety interlocks on your Boss Laser LS machine, both of these interlocks are installed under the hood of the machine. When the hood is closed, the interlock switch will be pushed down, closing the circuit, and enabling the machine to work normally. When the hood is open, the safety interlock switch will be disengaged, opening the circuit, making the machine inoperable and will not allow the machine to output the laser beam. Examples of these circuits can be seen below.



### Key Control (Master Switch)

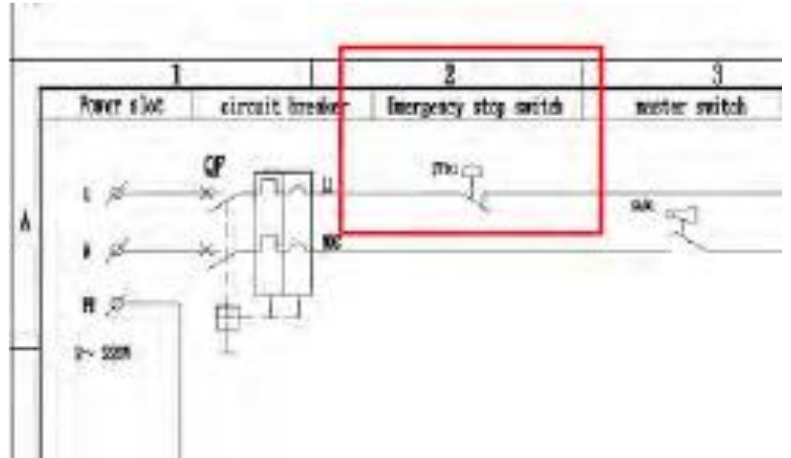
The master switch is installed as part of the control panel. The master switch controls the neutral line of the main circuit. When this switch is turned off, the machine is powered down.



# Safety Design Features

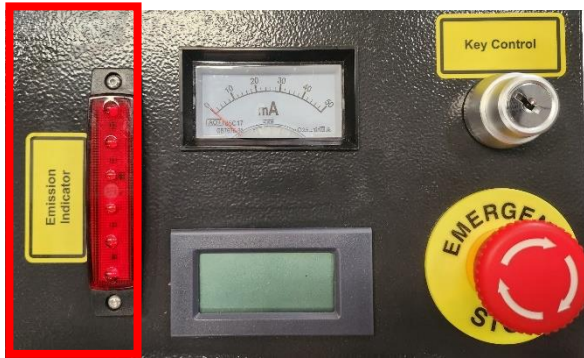
## Emergency Stop Switch

The emergency stop switch is installed as part of the control panel. The emergency stop switch controls the live wire of the main circuit, and when the main control switch is turned off, the machine will power down.



## Emission Indicator

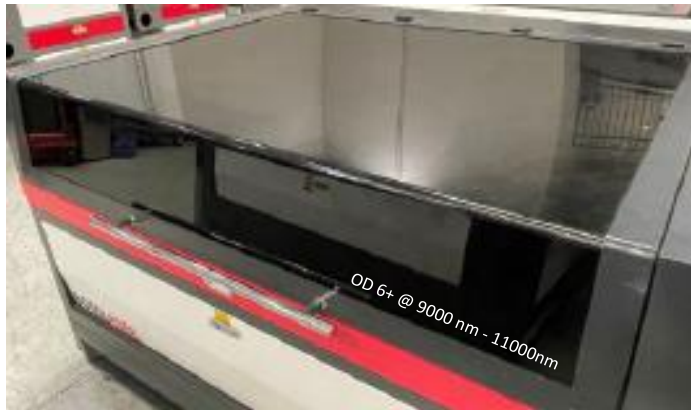
The emission indicator is installed as part of the control panel. The two terminals of emission indicator are wires to the Status and +24V of the control board. When the tube output laser, the board generates out a signal to make the emission indicator light up.



# Safety Design Features

## Protective Housing & Optic Viewing

The protective housing incorporates a viewing window for the end user to safely observe the laser when in operation. The viewing optic has a 6+ Optical Density.



## Personal Protective Equipment (PPE)

Laser Safety Glasses are included with the machine, they can be found inside the toolbox. All eyewear provided meet or exceed ANSI Standards for the BOSSLASER LS Series Safety Systems. The Laser Safety Glasses should be worn when the pass-throughs are being utilized.



## Remote Interlock

The machine incorporates a remote interlock connector for the end user to have the option of implementing a remote interlock with the included In-Use Connector. The included Remote Interlock Not In-Use Jumper will be used if the end user does not desire to use a remote interlock. An optional Remote E-Stop is also included with the machine to be used as a remote interlock, if desired.



Remote Interlock  
In-Use Connector



Remote Interlock Not  
In-Use Connector  
(Jumper Plug)



Optional Remote E-Stop

# Accessing Our "How To" Videos & Manuals

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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 a QR code. 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:

Scan this QR code to access our Instructional Videos.



## How to Access the Manuals Online

Scan this QR Code to access our Manuals Online



## How to Access the Manuals on the USB:

1. Your LS Series Machine will come with a USB that contains the LightBurn 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 (LightBurn)" folder and "USB (For LS Series GEN V)" folder. There will be manuals in each folder.
3. In the "USB (LightBurn)" folder, there will be the manuals for the LightBurn software and a "READ ME" (for installing LightBurn).
4. The "USB (For LS Series GEN V)" folder will contain the "BossMod Manual", "LS Manual", "Controller Card Schematic" and a "User's Manual of RDC644XG Control System."

# Unpacking Your Laser Machine

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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.

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 crowbar 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, toolbox, etc.) These boxes tend 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 Your Laser Machine

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- 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 Compressor
  - Water chiller (CW-5200 or CW-6000)
  - 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

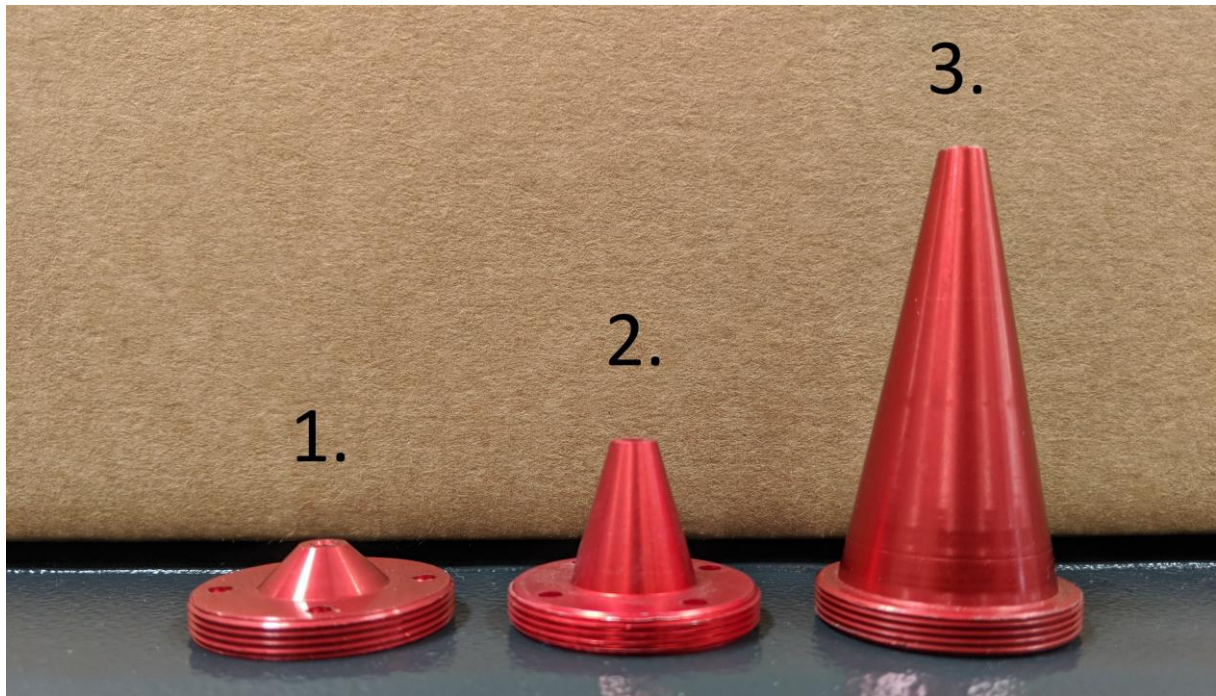


- |     |  |     |                                 |
|-----|--|-----|---------------------------------|
| 1.  | Exhaust Hose Clamps (3 count)                | 15. | Ignition Keys                   |
| 2.  | 2.5mm, 3mm, 4mm, & 5mm Allen Wrenches        | 16. | Nozzle Removal Tool             |
| 3.  | Power Cable                                  | 17. | Ethernet Cable                  |
| 4.  | Lens Removal Tool                            | 18. | USB Communication Cable         |
| 5.  | Mirror Removal Tool                          | 19. | Boss Laser Test File            |
| 6.  | Resistor w/ Voltage & GND Wiring Clamps      | 20. | High Precision Proximity Switch |
| 7.  | Universal Machine Door Keys                  | 21. | Air Nozzle Regulator            |
| 8.  | Flathead Screwdriver                         | 22. | Remote Emergency Stop Switch    |
| 9.  | 6-Pin Terminal w/ Wire Loop                  | 23. | 6mm Nylon High Pressure Hosing  |
| 10. | 250V/20A Fuses (2 count)                     | 24. | Water Chiller Bypass Signal     |
| 11. | Air Pump Fitting (Fitting Dependent on Pump) | 25. | 8mm Hosing to 8mm/6mm Fitting   |
| 12. | Air Compressor Fitting                       | 26. | CO2 Laser Safety Glasses        |
| 13. | Silicone Tubing for Water Pump/Chiller       | 27. | Remote Interlock Connector      |
| 14. | 500 MB Flash drive                           | 28. | Remote Interlock Jumper         |

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

# Laser Head Nozzles

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In addition to the items found on the previous page, there will also be two extra nozzles within your toolbox.

These nozzles will allow you to use different lens sizes to achieve different results.

1. For 2" lens
  - a. Recommended lens for engraving & cutting
2. For 2.5" lens
  - a. Leaning more towards cutting capacity than engraving
3. For 4" lens
  - a. Ideally for cutting than engraving material



# Exhaust Fan/Fume Extractor

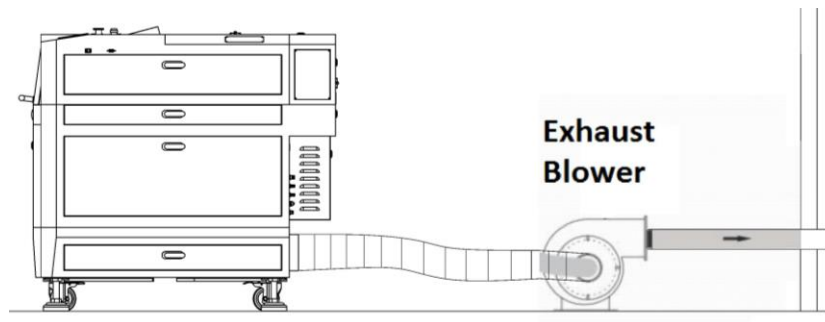
The laser vaporizes material as it moves along the axis, this generates large amounts of smoke. The exhaust of your machine and its importance cannot be overstated as it is necessary to remove harmful fumes and smoke produced by the laser machine. Some materials such as leather or wood generate larger amounts of smoke than other materials.

If you did not purchase a fume extractor, 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, garage, or spare room.

If you will be cutting or engraving materials that will produce large amounts of smoke or fumes, industrial size in-line fans can be purchased from websites like Grainger and other industrial supply warehouses. All Series LS machines 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.

## Setting Up an Exhaust Fan



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

First, ensure your machine is placed in an appropriate area that has an option for venting, this can include a door, window, duct, etc. You will need to exhaust your machine outside if you are using an exhaust fan.

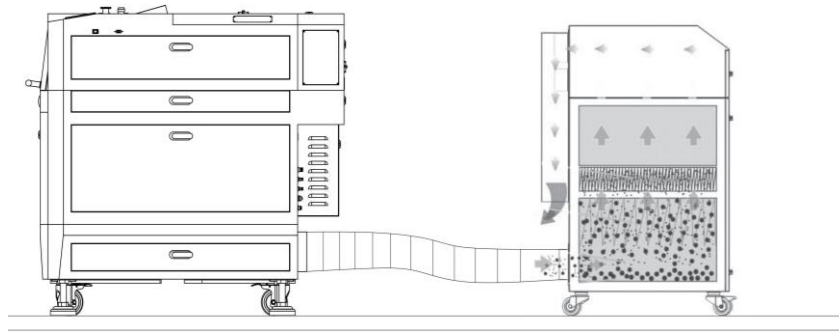
Remove the exhaust blower box and exhaust tubing from the crate, as well as your exhaust hose clamps from the toolbox. You will take one (1) exhaust tubing from the crate and place it on the exhaust port, located on the back side of the machine on the bottom (this will be a 6" metal circle). Once the tubing is placed on the exhaust port, take one (1) exhaust hose clamp, and place it over the tubing and the exhaust port. Now that the exhaust hose clamp is properly placed, tighten it down so there is a snug fit with minimal room for fumes to escape.

After the first end of the exhaust hose has been placed and secured, take the second exhaust hose clamp, and place it on the other end of the exhaust tubing. Next, place the exhaust tubing and clamp on the intake port of the exhaust fan, as shown above, after it is correctly positioned tighten down the exhaust clamp as you did the first time.

Finally, take your second piece of exhaust tubing and third exhaust hose clamp and attach them to the exhaust out port of the exhaust fan, tighten down the exhaust clamp as you did the previous clamps.

Now that your exhaust fan has been properly set-up. Take the other end of your exhaust tubing and place it where you will be able to exhaust smoke and fumes. If you are going to be exhausting your machine through a duct or other fabricated output, you may need another exhaust hose clamp to ensure that it stays secure.

## Setting Up a Fume Extractor



**Figure 2b.** Exhaust system configuration with a Fume Extractor.

Remove the exhaust blower box and exhaust tubing from the crate, as well as your exhaust hose clamps from the toolbox. You will take one (1) exhaust tubing from the crate and place it on the exhaust port, located on the back side of the machine on the bottom (this will be a 6" metal circle). Once the tubing is placed on the exhaust port, take one (1) exhaust hose clamp, and place it over the tubing and the exhaust port. Now that the exhaust hose clamp is properly placed, tighten it down so there is a snug fit with minimal room for fumes to escape.

After the first end of the exhaust hose has been placed and secured, take the second exhaust hose clamp, and place it on the other end of the exhaust tubing. Next, place the exhaust tubing and clamp on the intake port of the fume extractor, as shown on the previous page, after it is correctly positioned tighten down the exhaust clamp as you did the first time. Please remember that your fume extractor may look different than the photo on the previous page, some fume extractors have intake ports located on the top, others located on the back.

If you would like to purchase a fume extractor or replacement filters for your current fume extractor, scan this QR code.



To view the appropriate operator's manual for your fume extractor, scan the QR code for your fume extractor below.



**FILTRABOX MICRO  
OPERATORS' MANUAL**



**FILTRABOX COMPACT X  
OPERATORS' MANUAL**



**FILTRABOX EXPAND X-2  
OPERATORS' MANUAL**



**FILTRABOX EXPAND X-3  
OPERATORS' MANUAL**



# Water Pump

All Boss Laser 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.

The water pump 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 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 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

## Setting up Your Water Chiller

Remove the water chiller from the box and remove all packaging materials. Your LS machine will come with two (2) pieces of silicone tubing, a water chiller signal cable, and a power cord. This tubing & cord should be located in the box your water chiller came in. You also will need a minimum of 3 gallons of distilled water.



To attach your water chiller to your machine, place the water chiller next to the machine, preferably on the right-hand side of the machine, next to your "Water In" & "Water Out" ports located on the backside of the machine.



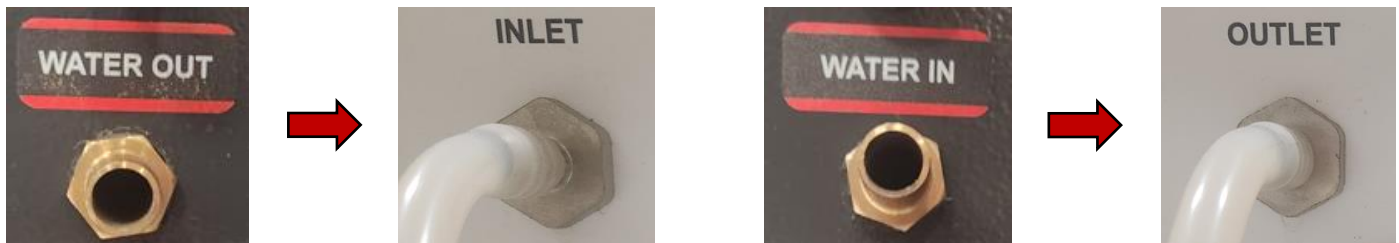
## Setting up Your Water Chiller (Continued)

Prior to attaching your water chiller to the machine, it will need to be filled with water. It is important to fill the water chiller after it is placed next to the machine, this way it will not be as heavy to maneuver. Your water chiller needs to be filled with **distilled water**. To start, you will need about 3 gallons of distilled water to fill your water chiller.

On the CW-5200, you will unscrew the cap located on the top of the water chiller and use a funnel to pour in the distilled water. On the CW-6000 water chiller, the spout in which you pour the distilled water into will be located on the backside of the water chiller. When pouring your distilled water into the water chiller, watch the water level indicator located on the back of the machine to be sure you do not under or overfill your water chiller. The water level indicator is shown to the right of this page the water level should fall towards the upper end of the “Normal” green range.



After your water chiller has been placed and filled with distilled water, it is time to connect your water chiller to the machine. Take the 1<sup>st</sup> piece of silicone tubing and connect it to the “Water Out” port on the backside of the machine. Take the other end of that same silicone tubing and place it on the “Inlet” port of the water chiller. Next, take the 2<sup>nd</sup> piece of silicone tubing and place it on the “Water In” port of the machine, take the other end of that same silicone tubing and place it onto the “Outlet” port of the water chiller.



This will keep a constant flow of water going out from the chiller, into the machine to cool the laser tube, then back out from the machine into the water chiller. Doing this will keep your laser tube at the appropriate temperature to ensure the longevity of your tube.

Once your silicone tubing has been attached to the proper ports and your water chiller has been filled to the appropriate level of water, it is time to plug in the power cord. Take the female end of the power cord and plug it into the power port located on the backside of the chiller. Then, take the male end of the power cord and plug it into a 110V outlet.

After your water chiller has been plugged in, take the water chiller signal cable, and plug it into the back of the chiller that says “Alarm Output”, the other end of the cable should plug into the back of the machine labeled “Chiller Signal”



After your water chiller has been properly connected and filled with water, press the power-on rocker switch (CW-5200) or the Power Switch (CW-6000) located on the front of your chiller into the “On” position.

## Setting the Water Chiller Temperature

To ensure optimal performance of your Boss Laser LS machine, it is important to keep your water temperature between 68°- 77° Fahrenheit (20°- 25° Celsius).

If you live in a region that tends to be hotter, we recommend setting your water chiller to the lower end of the range for water temperature. If you live in a region that tends to be on the cooler side, or you are operating your machine in a temperature-controlled environment, we recommend staying towards the middle range for water temperature. You may need to adjust your temperature of your water chiller based on your environment and operating conditions.

Follow these steps to set a water temperature that is appropriate for your environment, changing your chiller from “Intelligent Mode” to “Constant Mode”:

1. Locate the four (4) buttons on the front of your chiller, next to the LCD screen, these buttons are as follows:
  - a. Reset (RST)
  - b. SET
  - c. ▲ (Up)
  - d. ▼ (Down)
2. Press the ▲ button and the “SET” button simultaneously, hold down those buttons until the LCD shows “0”.
3. Now, press the ▲ button until you get to a value of “8”, then press the “SET” button. “F0” should now be shown on your LCD screen.
4. Use your ▲ button again, until your screen displays “F3”. Then press “SET”.
5. Now, your screen will show a number to let you know what mode you’re in, the number associated with each mode can be shown below:
  - a. 1 – Intelligent
  - b. 0 – Constant
6. Press the ▼ button to put your water chiller in Constant mode.
7. Press the “RST” button to confirm the change.
8. Now, your water chiller will display the temperature your water chiller is currently set to (in Celsius).
9. Press the “SET” button to change the temperature, then press the ▲ or ▼ buttons to change the temperature.
10. Once you’ve adjusted the water chiller to your desired temperature, press the “RST” button to confirm the change.

If you’d like to watch a video on how to set your water chiller temperature, scan the QR on your smart phone!



**Note:** If you live in a region that can get temperatures below freezing and your machine is not in a temperature-controlled environment, we recommend have a space heater near the machine to keep the laser tube from freezing. If a space heater is not available, we recommend you empty all of the water from the laser tube and place the laser tube in a temperature-controlled area if possible. If the laser tube is filled with water and the temperature gets at or below freezing, the water will expand and cause the laser tube to break. If a laser tube breaks due to freezing, it is not covered by your warranty.

## Air Pump

The air pump will come with 6mm black nylon 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.



## Air Compressor

The purpose of the **air compressor** (shown in **Figure 4a**) is to blow air through the laser head therefore blowing debris and smoke away from the beam, while allowing for cleaner cuts and protecting the lens. The air compressor on/off switch should also be close by and preferably on the same circuit as the water chiller and exhaust fan to ensure its operation when running the laser machine. The air compressor will come with a fitting that will be located in the toolbox; it should look like the picture below (these fittings can be a variation of colors):



**Note:** To prevent water build up in the hosing to the air nozzle, we recommend either draining the water of the air compressor after every use and/or purchasing a water/air separator.

## Setting Up Your Air Compressor

Remove your Air Compressor from the crate and remove all contents from the box. After removing your air compressor and any components within the box, take an adjustable wrench and use it to take off the gold quick disconnect on the air compressor, as shown to the right.

Now, take the 6mm air compressor fitting located in your toolbox and attach it to the same port that you remove the gold quick disconnect from. You may need to wrap Teflon tape around the threads of the air compressor fitting prior to screwing it into the air compressor. Use your adjustable wrench to ensure the fitting is secure and snug, be careful not to overtighten.



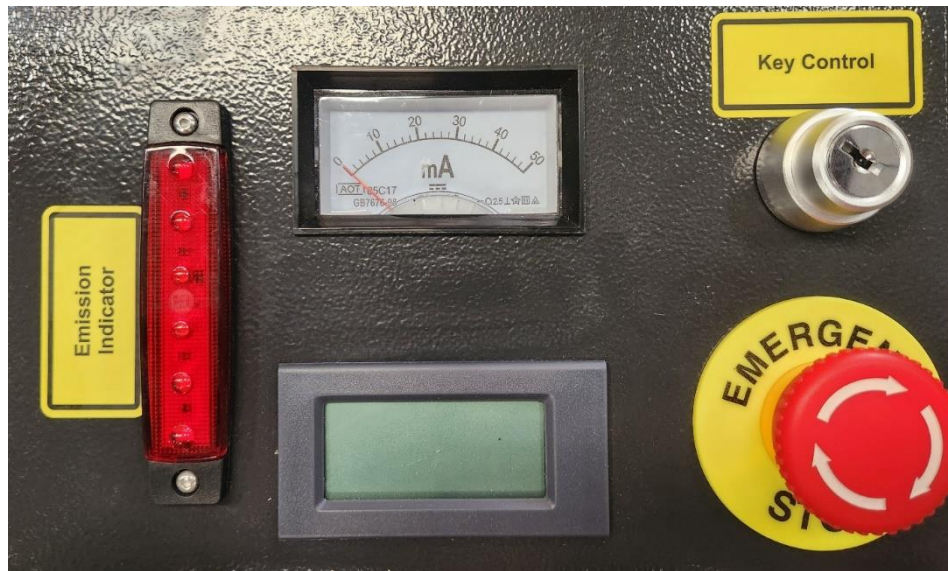
After you have changed the fitting, remove the 6mm nylon tubing from the toolbox and plug it into the air compressor fitting we just installed. Once that is complete, take the other end of the 6mm nylon tubing and plug it into the “Air In” port located on the back side of the machine.



To ensure the longevity of your air compressor, it is recommended that you empty the air out of the compressor after each use. The air sitting in the tank can create moisture, causing rust within the air compressor, shortening its lifespan.

# Main Switches & Controls

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## Emission Indicator

The emission indicator can be seen in the image above to the far left. The emission indicator is a safety feature and will glow red when the machine is emitting a laser beam.

## Milliamp Gauge

The milliamp gauge can be seen in the top middle in the picture located above. This gauge will show the output of the laser beam in milliamps. Technical Support may ask you to reference this gauge for troubleshooting purposes.

## Temperature Gauge

The temperature gauge can be seen in the bottom middle of the picture shown above. This temperature gauge will read the temperature of the water going through the tube. It is important to pay attention to this gauge as the temperature of your water should be between 68°- 77° Fahrenheit (20°- 25° Celsius).

## Key Control

The Key Control can be seen in the top right of the image above. The key ignition is where you will insert your ignition key and turn the key, turning on the machine. If the machine is not in use, the key should be removed and put in a safe and secure location to prevent any unauthorized use.

## Emergency Stop

The Emergency Stop button can be seen in the bottom right of the image above. The Emergency Stop is a safety feature and should be used in case of an emergency. If the button is engaged, it will be pushed down. If the emergency stop is in the up position, it is disengaged. For your machine to turn on, the Emergency Stop must be disengaged.

# Main Switches & Controls

## USB-B Data Cable & USB Ports

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



The first method allows the computer to communicate directly to the machine. In the image above, the USB port passthrough is shown, which can be found behind the latch door located on the back hand side 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 and go through the passthrough which will then allow your cable to be plugged in to your computer’s USB port while the latch door is closed, and your electrical components are protected.

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 above. This USB port allows the machine to read an .rdfile (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”.



## Light Switch

The Light Switch can be found on the right-hand side of your machine. This rocker switch is to turn on and turn off the lights located within your laser machine.

## Main Control Panel

The control panel of your machine is where you have the capability to make changes to the parameters and settings of your machine and your files. A USB port is located at the top right-hand side of the Control Panel, this is where you will insert your USB dongle to send files to the machine instead of a cable connection. If you want to use a dongle USB and plug it into the control panel, the files must be saved as .ud5 in order for the machine to read the files.

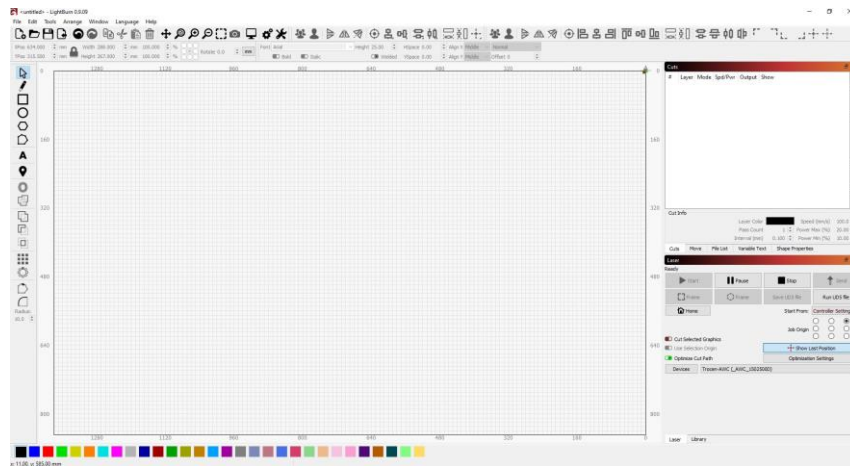




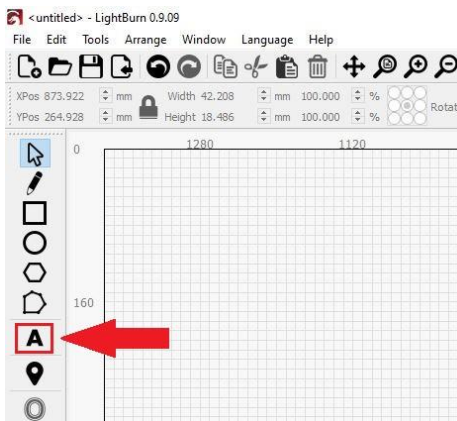
# Running Your First File

After Installing the Lightburn Software on your computer and inputting your activation code, you can run your first file.

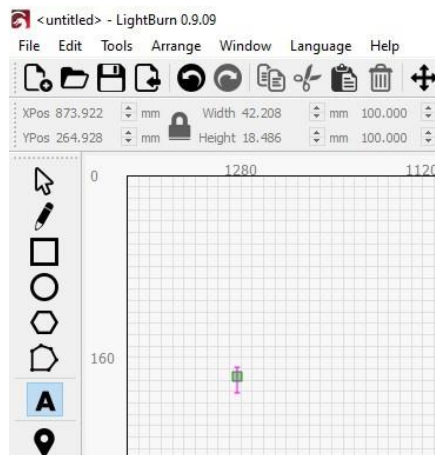
First you will need to launch Lightburn, your screen should appear similar to the screen below.



Click on the Text icon indicated by the red arrow w/ the red square around it:

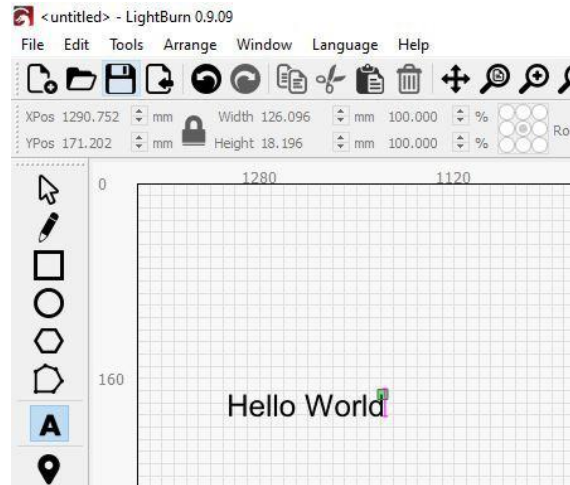


Once you have selected Text, click anywhere on the grid space and a text cursor will appear (as shown below):

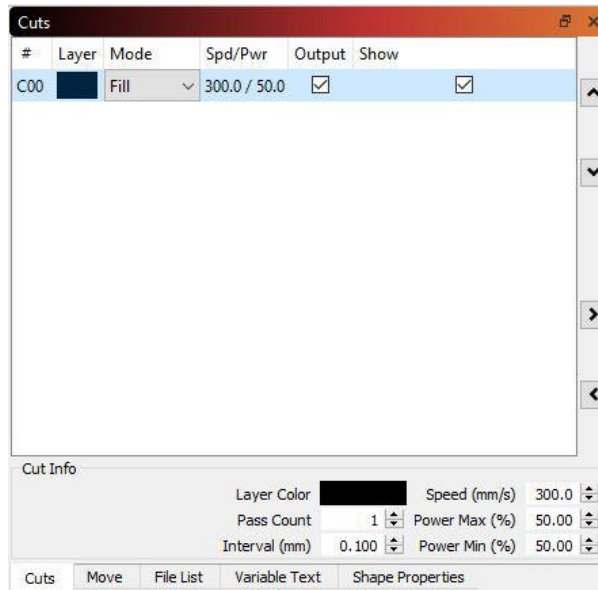


# Running Your First File (Continued)

For this exercise, type "Hello World" in the text box (as shown below):



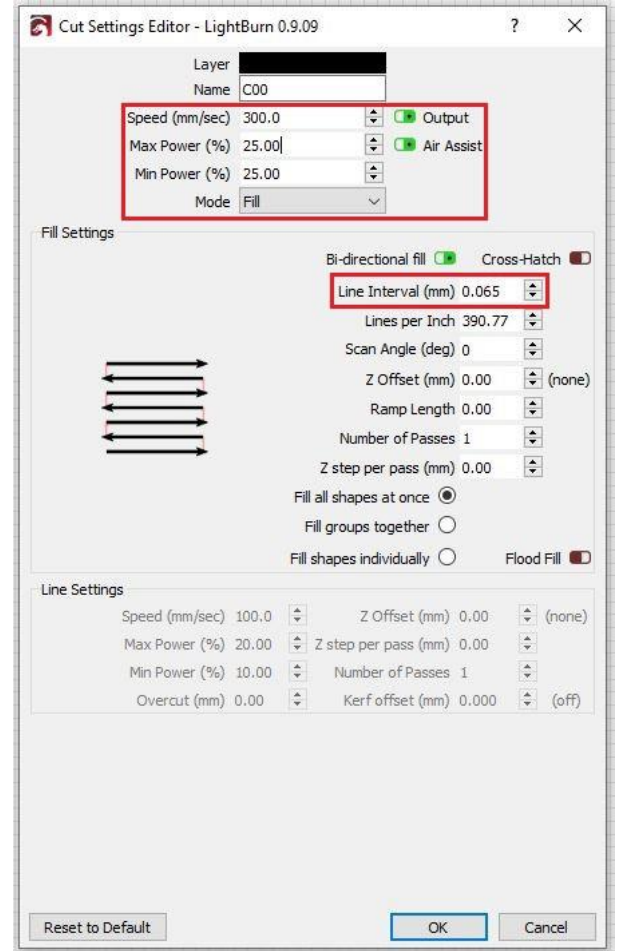
The next step is to set the Speed and Power for the image. Located on the top right side of the LightBurn software, you'll find the Layer Options (as shown below):



# Running Your First File (Continued)

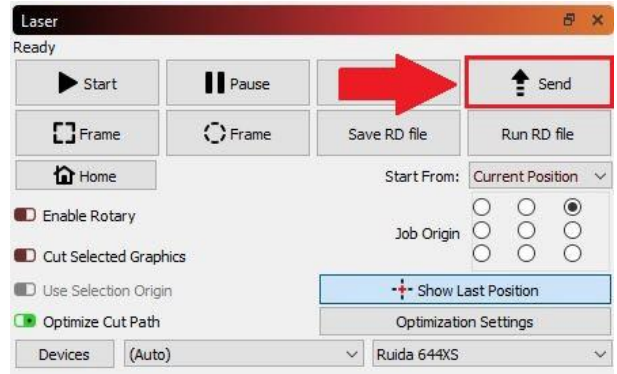
Double click on the Layer Color. The Layer Parameter window, shown below, should appear.

- **Mode:** Make sure this is set to **Fill**
- **Power (%):** For this exercise, we are going to use **25% (for Min. & Max.)**
- **Speed (mm/sec):** Set this to **300**. Maximum Speed is limited to 500.
- **Line Interval (mm):** Set this to **0.065**. Recommended range = 0.065 - 0.1

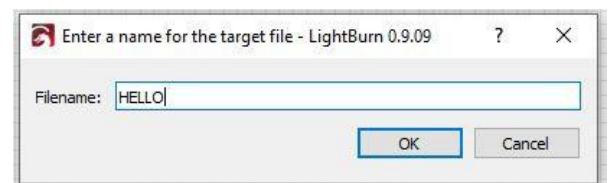


The next step is to now send this file to the machine. Make sure you have the Black USB Cable connected to the PC from the machine and that the machine is ON.

Now locate the Send button which is below the Cuts Window (on the right side of the software):

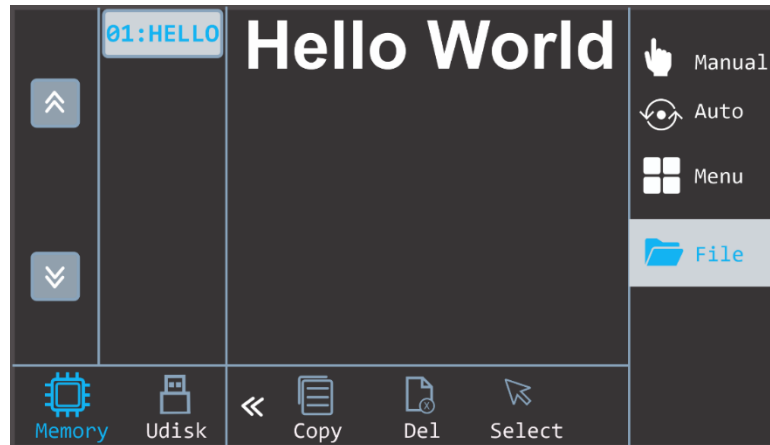


Once you clicked on the Send button, the window shown below will appear. You can add a name to your file (for this exercise, we named it HELLO). Then click OK to send this file to the machine.



# Running Your First File (Continued)

After sending the file to your machine, we must now select the file to run on the machine. Follow the steps below to run the “Hello World” file on your machine.



Pressing the **File** button illustrates as shown.

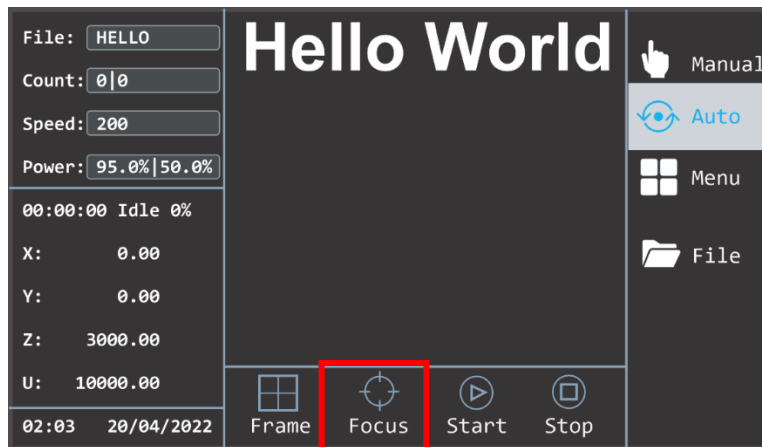
After pressing the **File** button on your touch screen, locate the “Hello” file as shown on the right-hand side of the touch screen, as shown above.

Once you’ve selected the “Hello” file a preview of your file can be seen in the middle of the screen. Once you see the file preview on the screen, press the “**Select**” button located on the bottom of the screen. Doing so will return you to the main interface with the “Hello World” text, as shown below.

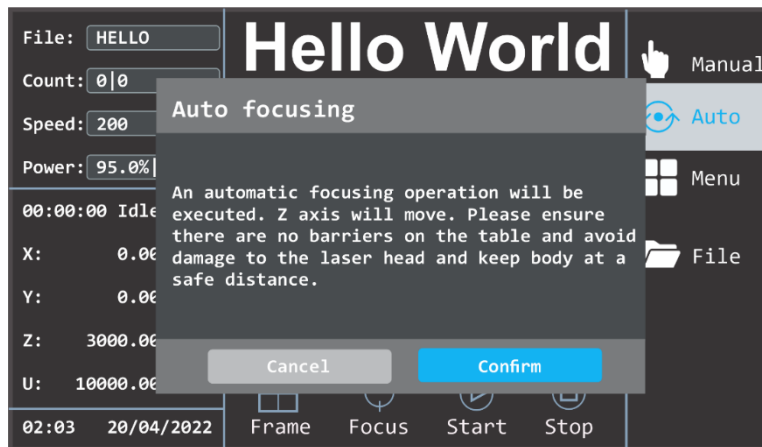


Now place your material on the worktable (in our case, a piece of wood). Make sure your material is set directly under the nozzle of the laser head before proceeding to the auto focus function.

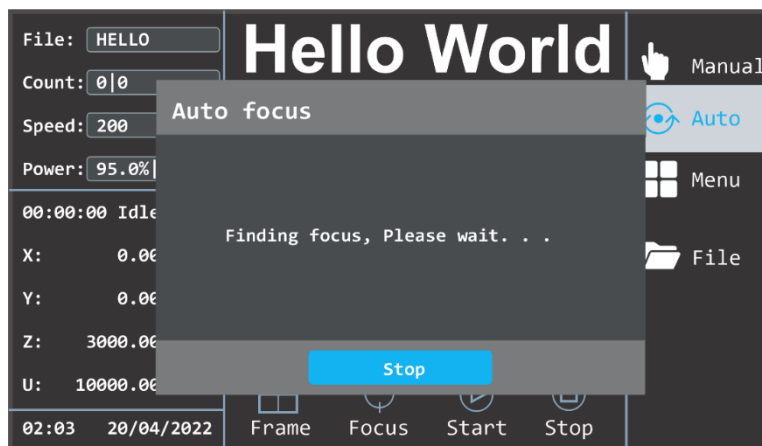
# Running Your First File (Continued)



On the touch screen, locate the **Focus** button at the bottom of the screen. Press the Focus button, a separate dialogue window will pop-up, as shown below.




Press the Confirm button to start the autofocus process on the machine. A new dialogue window will appear when the autofocus is in progress, as shown below. The worktable will move up towards the nozzle and focus on your material.



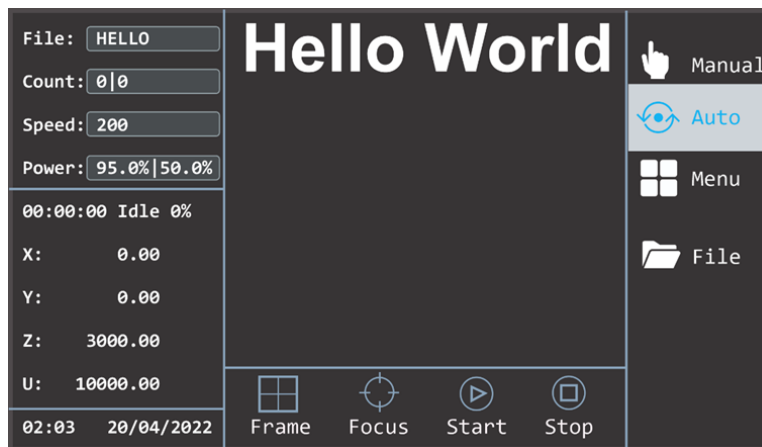
# Running Your First File (Continued)

Now close the front lid of the machine to trigger the interlock switch so that machine knows it's ready to fire. Make sure all of your components are turned on: **Water chiller, Air Compressor, and the Exhaust Blower.**

Using the arrow keys under the **Manual button** of the main interface, move your laser head on top of your material

where you want the job to start (Default Laser Origin = Top-right corner) then press the **Origin button** (). By setting the origin is telling the machine to always start the job here. Now press the **Frame button** located at the bottom of the main interface (as shown below) to preview a box which will be the size of the image's perimeter. This should match the dimensions of your image.

Then press **Start** button to start the job. To see if the laser is indeed firing, the milliamp reader should provide a reading of the number of mAs being used (higher the power percentage, the higher the mAs).



Finally, after the job is finished, open the lid, and see that the "HELLO WORLD" has been engraved according to the settings applied, as shown below.



This concludes the exercise and now that all the steps have been provided to you to run this job correctly, you'll be able to apply these steps to different applications to help you run your machine efficiently and effectively (ex. running a Cut instead of an Engraving and/or both)

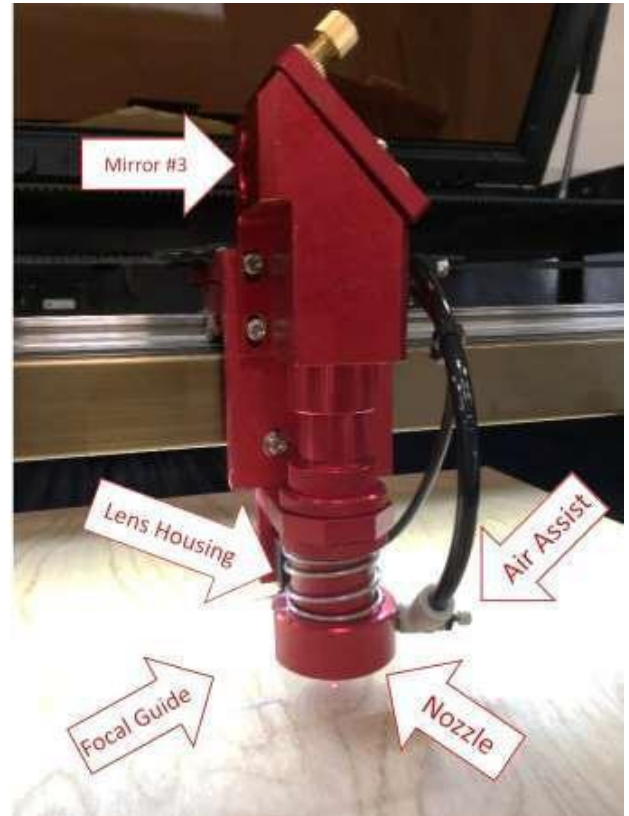
# How to Focus the Lens

## 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 worktable, next is locating the focal guide, this should be 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 meets 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!



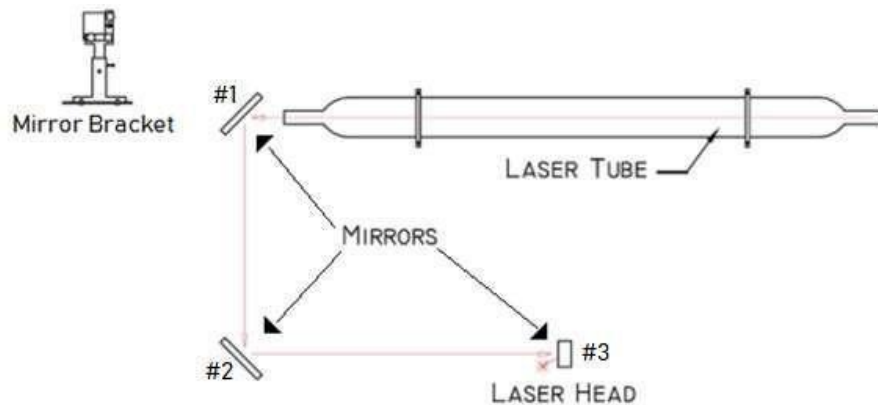
# Tuning the Optics

🔧 **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 25 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 press the “Pulse” key located on the LED



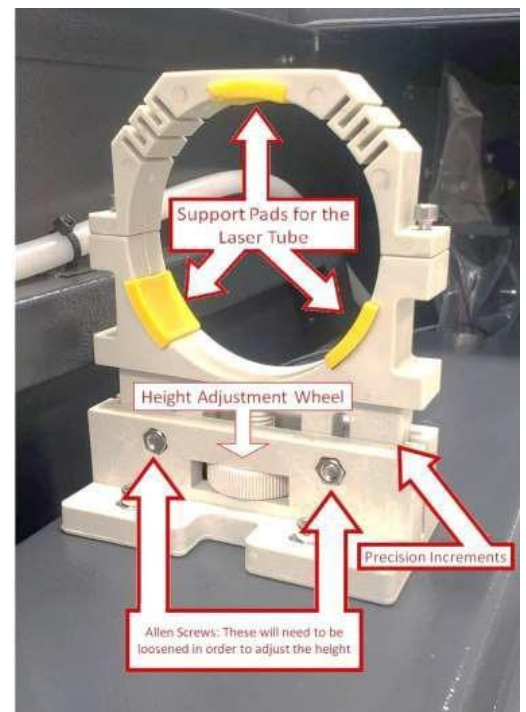
turn on the laser and pressing the “Pulse” key Control Panel

## Tube Bracket:

The Tube Bracket, which is illustrated in Figure 26 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!



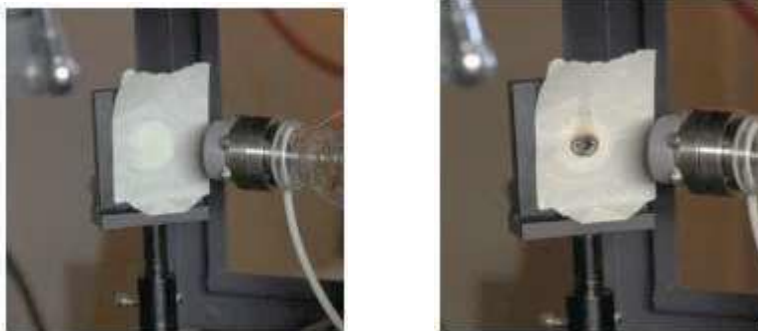


# Tuning the Optics (Continued)

## 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 27a. 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 27b.

⚠ 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 27c 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.

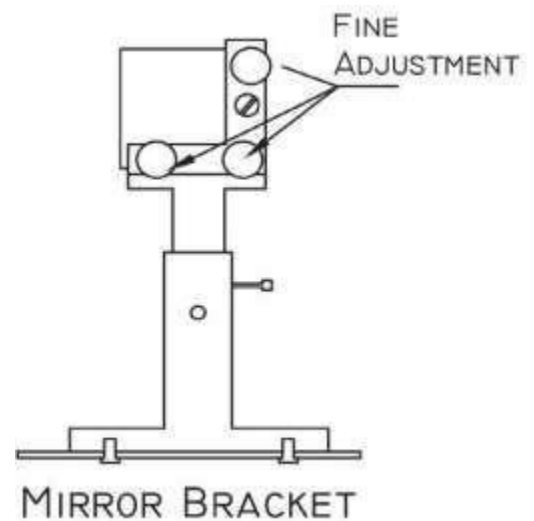


Figure 27c Mirror Bracket with Fine Adjustment/  
Micro adjustments

# 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 worktable)

As shown in Figure 28, 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 28.

Your machine came with a “Lens Removal Tool” which should be in the toolbox, this will remove the slotted ring nut. The tool will look like scraper rather than a screwdriver, 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.

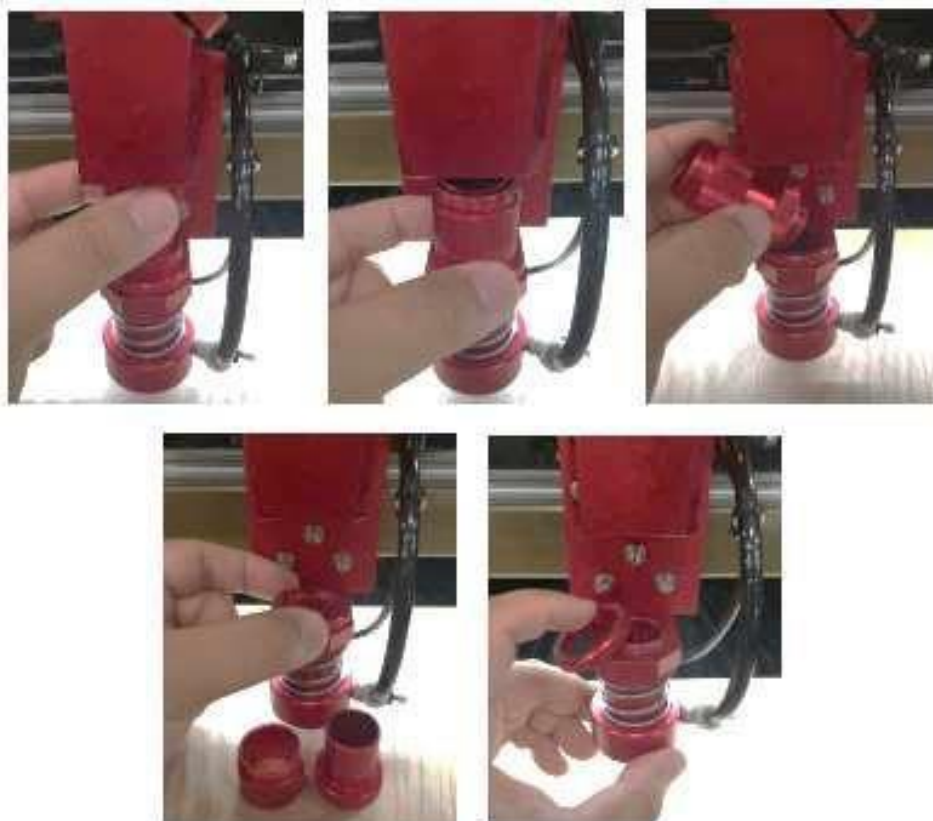


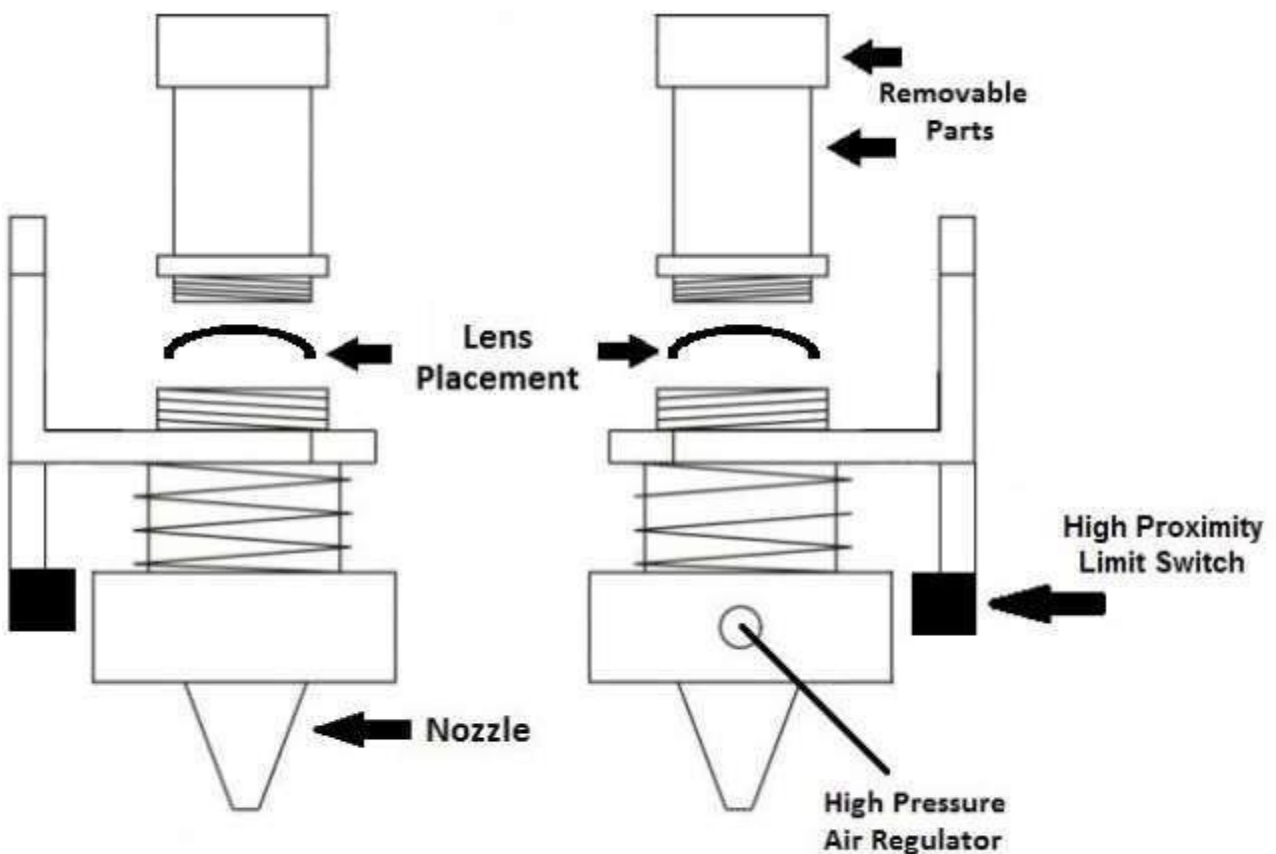
Figure 28 Lens Assembly

## 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 29 Lens Housing*

# Laser Maintenance Schedule

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## 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 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 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.

# Laser Maintenance Schedule (Continued)

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## 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 can 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 AT LEAST once every two months.

# Laser Maintenance Schedule (Continued)

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## 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

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## 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 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

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## 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 waterline 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.