Operators Manual for HP Series

A Class IV CO2 Laser Machine

Table of Contents

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 the 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 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

The BOSSLASER HP 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. At the end of this manual, you will find the recommended maintenance items and the frequency in which they should be performed, if you have any questions about maintenance, reach out to technical support for via phone or email.

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 repairs.

Warnings

- In Normal Mode, do NOT launch the Auto-Focus (or Auto Up&Down) function if the Metal Head is mounted.
- Do NOT try to Auto-Focus if the laser head is not at its proper location (all the way down; close to the Z+ Limit Switch)
- Do NOT use FOLLOW MODE on Non-Metal material.
- Do NOT use oxygen when cutting organic material (non- metal)
- Do NOT use compressed air to process metal.

If any of these events occur, you will be financially responsible for any damages that occur to your laser machine.

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 the length of time stated on your original Boss Laser sales order, if an extended warranty is purchased, it will be noted on the sales order.

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

This Limited Warranty does not cover any problem that is caused by: Environmental 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 of 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

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

The BOSSLASER HP 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 Epilog Model 16000 & 17000 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

- 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 CO_2/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 to increase the risk of electrical shock. Do not disassemble the machine without prior approval from Technical Support, otherwise the 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 65◦ - 95◦ Fahrenheit (18◦ - 35◦ Celsius) with humidity ranges of 5%-95% with no dew.

- The operating voltage of this machine should be AC 110V 60Hz.

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:

🚫 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:
The 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

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 damage 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_2 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. Just because it can cut or engrave, does not mean it should. 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
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/HP Series Lasers

Laser Safe Materials

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.

HP (High Pressure) materials include all the above guidelines and as listed:
- Stainless steel up to 18 gauge
- Mild steel up to 20 gauge
- Thicker and denser woods

Safety Features & Regulatory Compliance

BOSS LASER has incorporated specific safety features into the HP 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 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 requires that certification, identification, and warning labels be placed on laser products. Reproductions of labels on the BOSS LASER HP 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.

LASER CUTTING MACHINE
Manufacturer: Boss Laser LLC
Address: 608 Trestle Point, Sanford, FL 32771, USA
Model Number: _____   Serial Number: _____
Class IV Laser Product, Carbon Dioxide Laser
Embedded Laser Power: _____ Max Output at 10.6μm
Power Requirement: AC 110V ± 10% 60HZ
Country of Origin: USA; Manufactured: August 2022
Distributed: BOSS LASER
Address: 608 Trestle Point, Sanford, FL 32771, USA

"Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019."

DANGER

LASER RADIATION
INVISIBLE & VISIBLE LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO DIRECT
OR SCATTERED RADIATION

VISIBLE LASER
Wavelength: 650 nm
Maximum Average Radiant Power: 5mW

INVISIBLE LASER
Wavelength: 10.6 μm
Maximum Average Radiant Power: 155w

CLASS IV LASER PRODUCT

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.
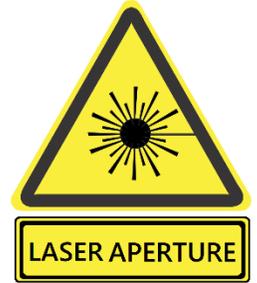
Non-Interlocked Protective Housing

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

DANGER

HIGH VOLTAGE INSIDE CABINET DISCONNECT POWER BEFORE OPENING PANEL
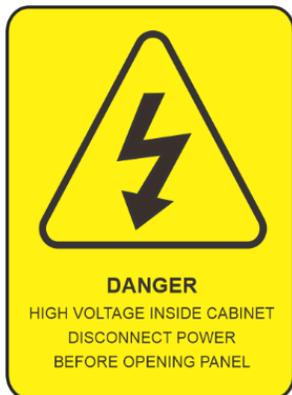
The "DANGER: High Voltage" sticker can be found on the inside of the right- hand bottom cabinet, on the power supply. This warning indicates that precautions should be taken when touching or handling any electrical components of the machine. Please make sure to disconnect the laser from all power sources 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.

DO NOT LIFT HERE

Safety Features & Regulatory Compliance
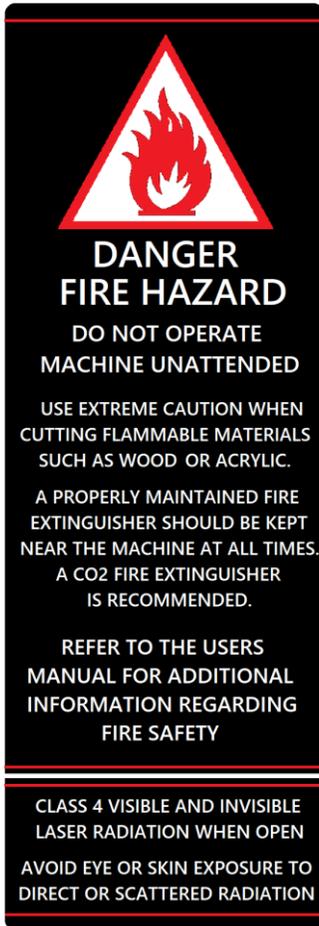
Danger Fire Hazard

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.
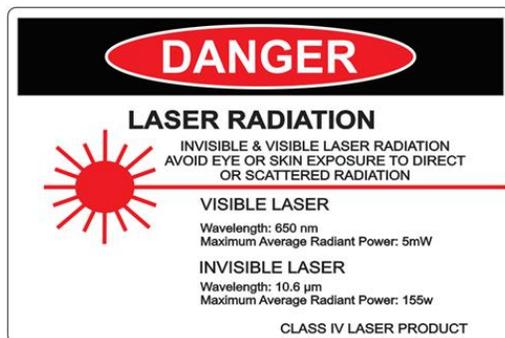
Safety Design Features

Safety Interlocks

There are two safety interlocks on your Boss Laser HP machine, both 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.
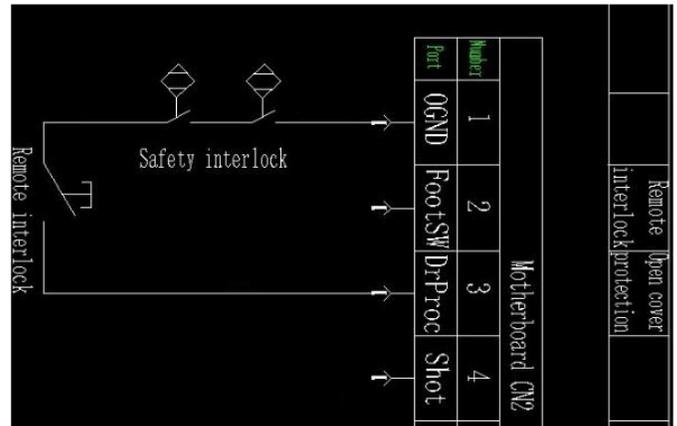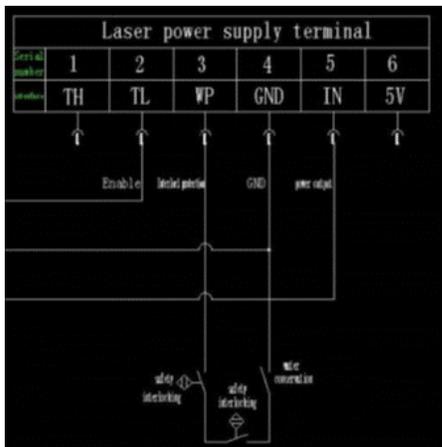
Key Control (Master Switch)

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.
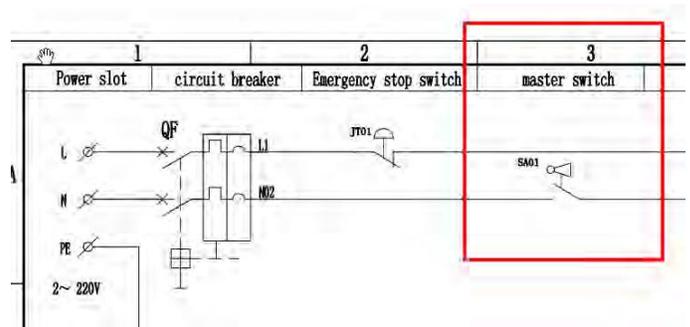
Safety Design Features

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.
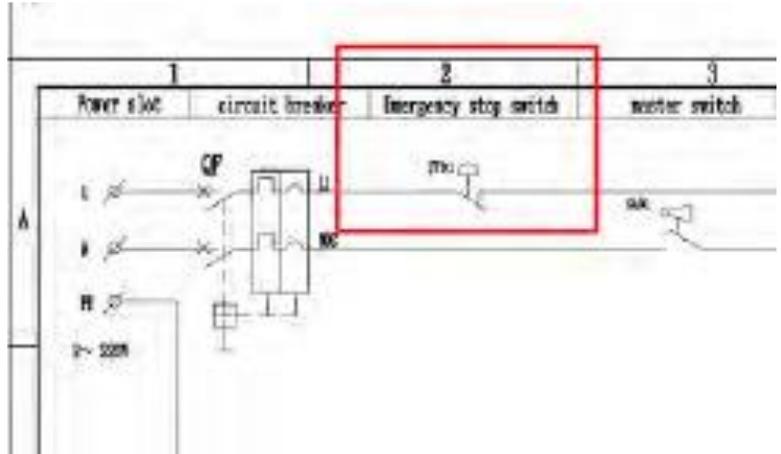
Emission Indicator

The emission indicator is installed as part of the control panel. The two terminals of emission indicator are wires to OUT6 and GND of the control board. When the file is being run on the machine, the board generates a signal to make the emissions indicator light up.
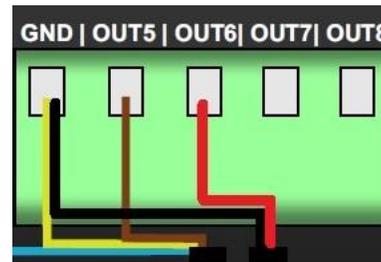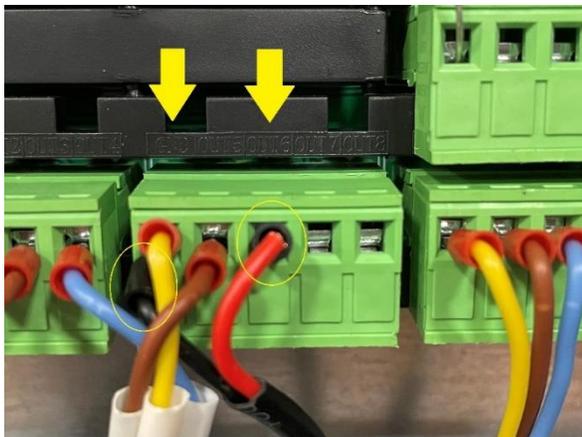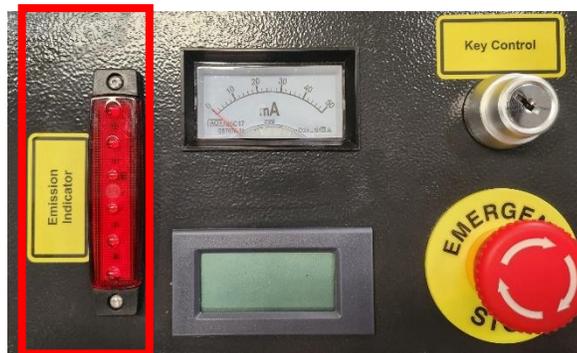
Safety Design Features

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.

OD 6+ @ 9000 nm - 11000nm

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 HP 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

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 HP 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 HP 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 HP Series GEN V)" folder will contain the "PiBurn Manual", "HP Manual", "Controller Card Schematic" and a "User's Manual of AWC7824 Control System."

Upacking Your Laser Machine

Your new laser will be delivered in a large wooden crate like the one pictured. 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 the 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

- 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)	**16.** Nozzle Removal Tool
2. 2.5mm, 3mm, 4mm, & 5mm Allen Wrenches	**17.** Ethernet Cable
3. Power Cable	**18.** USB Communication Cable
4. Lens Removal Tool	**19.** Boss Laser Test File
5. Mirror Removal Tool	**20.** High Precision Proximity Switch
6. Resistor w/ Voltage & GND Wiring Clamps	**21.** Air Nozzle Regulator
7. Universal Machine Door Keys	**22.** Metal Lens Housing Assembly
8. Flathead Screwdriver	**23.** 6mm Nylon High Pressure Hosing
9. 6-Pin Terminal w/ Wire Loop	**24.** Water Chiller Bypass Signal
10. 250V/20A Fuses (2 count)	**25.** 8mm Hosing to 8mm/6mm Fitting
11. Air Pump Fitting (Fitting Dependent on Pump)	**26.** CO2 Laser Safety Glasses
12. Air Compressor Fitting	**27.** Remote Interlock Connector
13. Silicone Tubing for Water Pump/Chiller	**28.** Remote Interlock Jumper
14. 500 MB Flash drive	**29.** Remote Emergency Stop Switch
15. Ignition Keys	**30.** 2-Pin with Wire Bypass Connector (2 count)

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

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. Both HP-2440's & 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.

Setting Up an Exhaust Fan
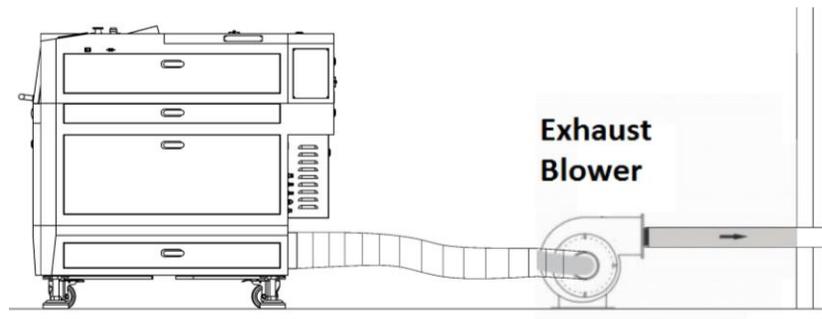
Exhaust system configuration with an exhaust blower.

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
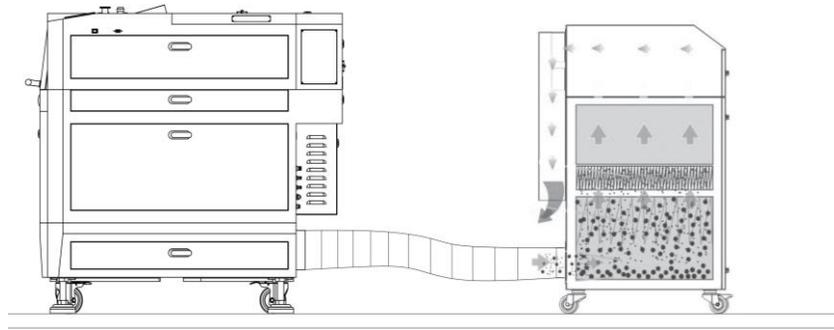
Exhaust system configuration with a Fume Extractor.

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 cave 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 Chiller

All Boss Laser tubes are water cooled and the laser machine will not fire if water is not going through tube. The Boss Laser HP machines will be accompanied by a water chiller (CW-5200 or CW-6000).

Setting up Your Water Chiller

Remove the water chiller from the box and remove all packaging materials. Your HP machine will come with two (2) pieces of silicone tubing, a water chiller signal cable, and a power cord. This tubing & cord should be 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.

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.** The amount of distilled water you need will depend on the model of water chiller you purchased; a CW-5200 will require about 2 gallons, while a CW-6000 will require about 4 gallons of distilled water.

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.

Setting up Your Water Chiller (Continued)

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 1st 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 2nd 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.
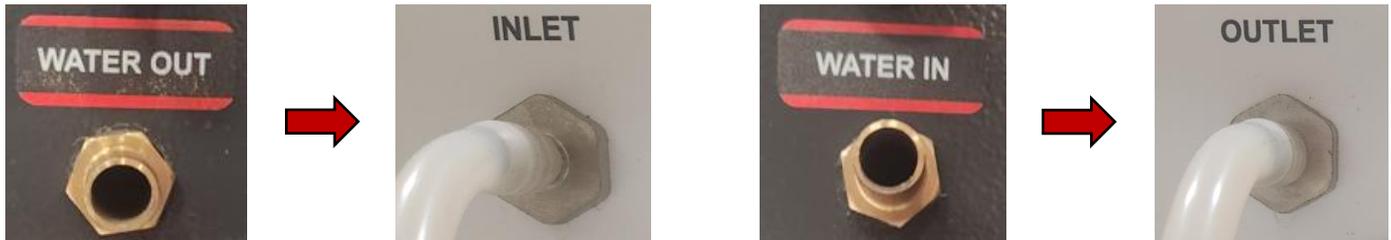
This will keep a constant flow of water going out from the chiller, into the machine to cool the laser tube, then back out from the machine into the water chiller. Doing this will keep your laser tube at the appropriate temperature to ensure the longevity of your tube.

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" then, the other end of the cable should plug into the back of the machine labeled "Chiller Signal".
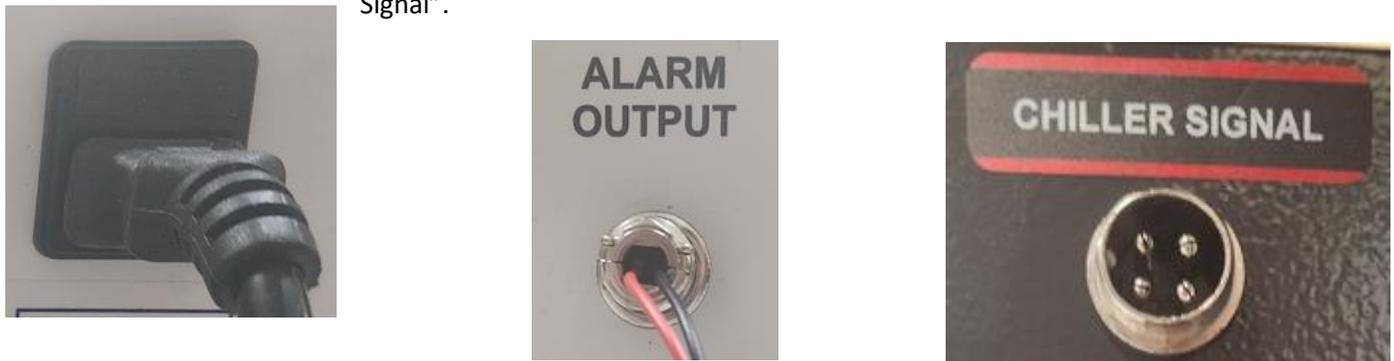
After your water chiller has been properly connected and filled with water, press the power-on rocker switch (CW-5200) or the Power Switch (CW-6000) located on the front of your chiller into the "On" position.

Setting the Water Chiller Temperature

To ensure optimal performance of your Boss Laser HP 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 the 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 with 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 having 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 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 to 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 Compressor

The purpose of the air compressor 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 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, leading to rust within the air compressor, shortening its lifespan.

Main Switches & Controls

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 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

FTC Control Panel

The FTC Control Panel is used to adjust the settings and calibrate the metal laser head when using the HP machine for metal cutting. We will go into how to use your FTC Control panel a little bit later in the manual.
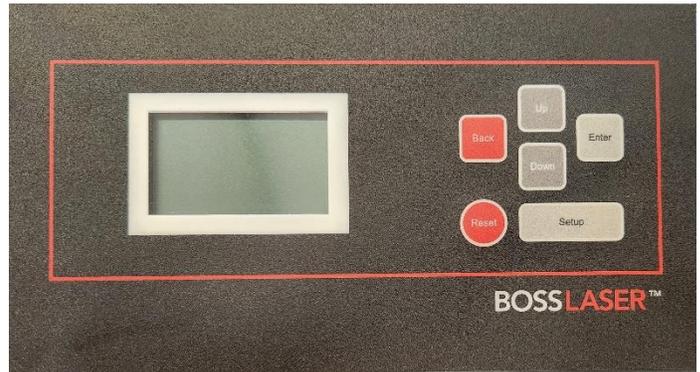
USB-B Data Cable & Ethernet Cable

The USB-B & Ethernet cable can be found on the right-hand side of your laser machine.
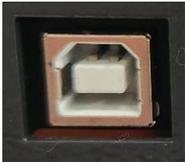
USB-B Data Cable – The USB-B Data Cable can be seen in the image below on the left-hand side. This port is used to connect your computer to the laser machine, allowing you to send files from the computer to the laser machine.

Ethernet Cable – The Ethernet Cable can be seen in the image below on the right-hand side and is used for network connection and Wi-Fi networking when applicable**.**

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 a ".ud5" file in order for the machine to read the files.

Main Interface Introduction
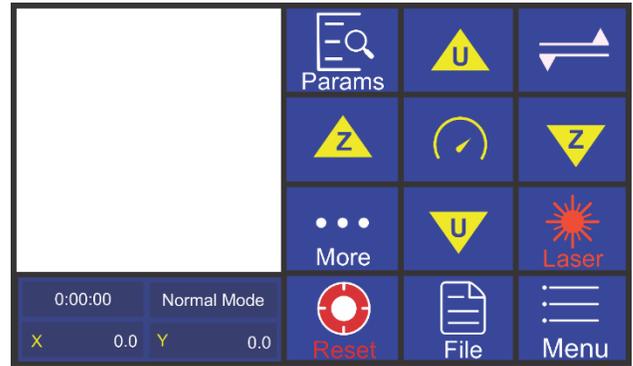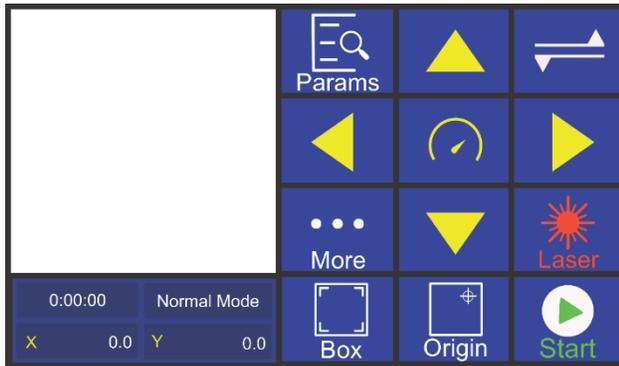
When turning on your HP Machine, your screen will resemble the screen shown above to the left. You will have a second screen that can be accessed by pressing the button that resembles two flags laying down in the top right corner of the touch panel. After touching that button, your screen will now resemble the screen shown above to the right.

It is important that you understand the buttons and functions on the touch panel and how they change the parameters of your laser machine. On the following pages, we will go over what each function of the control panel is for.

Control Panel Functions

	This window will be empty when you initially turn on your machine. After you have sent a file to the laser machine and selected a file to run, a preview of your file will appear on this screen.
0:00:00	This portion of the screen will
Normal Mode / Follow Mode	This area of the screen will tell you whether your HP machine is currently in "Follow Mode" or "Normal Mode". "Normal Mode" will be processing organic materials. "Follow Mode" will be for use with your metal cutting laser head. We will review how to change this setting later in the manual.
X 0.0	This area of the screen will tell you the X coordinate of your laser head.
Y 0.0	This area of the screen will tell you the Y coordinate of your laser head.
Params	Selecting this button will show the parameters of the file you are previewing and/or running on the machine. Including Speed, Min Power, Max Power, the name of the file, how many times the file has been run on the machine, and how many times the file has been run in its lifetime.
◀	Selecting this option will move your laser head to the left, along the x-axis.
More	Selecting the "More" option will allow you to adjust the Ins, Outs, Cut Box, Reset, Move and Other options within the machine. We will review these options in-depth later in the manual.
Box	Selecting this option will cause the laser head to start at the origin point and then frame the area in which the file will be engraved or cut.
▲	Selecting this option will move your laser head to the toward the back of the machine table, along the y-axis.
▼	Selecting this option will move your laser head to the toward the front of the machine table, along the y-axis.

Control Panel Functions

	Selecting this button will adjust the speed at which your laser head moves when pressing the Up Arrow, Down Arrow, Left Arrow, Right Arrow, Z-Axis Up Arrow, Z-Axis Down Arrow, U-Axis Up Arrow, and U-Axis Down Arrow.
Origin	This option will set the origin of your laser head in its current position when selected.
	This button will allow you to switch between the primary screen and secondary screen on your machine.
	Selecting this option will move your laser head to the right, along the x-axis.
Laser	Selecting this option will pulse the laser beam.
Start	Selecting this option will cause your file to start. Once the file has been started, a "Pause: and "Stop" button will appear on the screen. This will allow you to pause or stop the file from running.
Z	Selecting this option will move your laser head in the upward direction (toward the ceiling), along the Z-axis.
Reset	Selecting this option will cause the laser head to reset its origin and send the laser head back to the zero X and Y coordinates.
U	Selecting this option will move your table upward (toward the ceiling), along the U-axis.
U	Selecting this option will move your table in the downward (toward the ground), along the U-axis.
File	Selecting the "File" option will allow you to see what files are available on your machine after the file has been sent. We will review this option in-depth later in this manual.
Z	Selecting this option will move your laser head in the downward direction (toward the ground), along the Z-axis.
Menu	Selecting this option will take you to the Main menu, where you can access the UDisk Files, Manage the Origin, Change the Motion Parameter Settings, Change the Common Parameter Settings, and the Manufacturer Parameter Settings. We will review these options in-depth later in this manual.
Pause	After a file has been selected and the "Start" button has been pressed, a "Pause" button will appear. Allowing you to pause your laser machine from running the file, if needed.
Stop	After a file has been selected and the "Start" button has been pressed, a "Stop" button will appear. Allowing you to Stop your laser machine from firing and canceling the file, if needed.

Control Panel Functions

Control Panel Quick Reference Guide

We will go into depth about the functions and settings available on the control panel later in the manual. This reference guide is to be used as a table of contents for your control panel, so you can quickly and easily find the parameter you're trying to change or view.

"More" Button
- ▶ "Ins" Menu
  - ▷ X-, Y-, X+, Y+, Z-, U-, Z+, U+, V-, W-, V+, W+, IN1, IN2, IN3, IN4, IN5, IN6, WP1, WP2, WP3, WP4 Options.
- ▶ "Outs" Menu
  - ▷ Outs, Out1, Out2, Out3, Out4, Out5, Out6, Out7, Out8 Options.
- ▶ "Cut Box" Menu
  - ▷ Blank Distance (mm) Option
- ▶ "Reset" Menu
  - ▷ U Reset
  - ▷ V Reset
  - ▷ W Reset
  - ▷ X&Y Reset
  - ▷ Z Reset
- ▶ "Move" Menu
  - ▷ Jog Distance
  - ▷ U-Axis Up
  - ▷ U-Axis Down
  - ▷ Z-Axis Up
  - ▷ Z-Axis Down
  - ▷ Speed of Laser Head Adjustment
  - ▷ Menu Change
  - ▷ X-Axis Left
  - ▷ X-Axis Right
  - ▷ Y-Axis Up
  - ▷ Y-Axis Down
- ▶ "Other" Menu
  - ▷ Z AutoFocus
  - ▷ X&Y to Origin
  - ▷ Continue to Previous Work

"Menu" Button
- ▶ UDisk Files
- ▶ Origin Manage
  - ▷ Origin 1, 2, 3, 4
    - → The origin'PX(mm)
    - → The origin'PY(mm)
    - → Set Current Position as the origin
    - → Move head to the origin
- ▶ **Motion Parameter Settings**
  - ▷ Space Speed
  - ▷ Cut Jerk
  - ▷ Space Jerk
  - ▷ Min Acc
  - ▷ Engrave Acc
- ▶ **Common Parameter Settings**
  - ▷ Work Mode
    - → Go Origin After Reset
    - → Origin Mode
    - → GoBack Position
    - → Count Mode
    - → Feeding Mode
  - ▷ Common Parameters
    - → AutoFocus Distance (mm)
    - → KeyMove'Speed
    - → RunBox'Speed
    - → CutBox'Speed
    - → Blow Open Delay(s)
  - ▷ Axis Speed Parameters
    - → Z Work Speed
    - → U Work Speed
    - → XY Home Speed
    - → Z Home Speed
    - → U Home Speed
  - ▷ Rotate Engraving&Cutting
    - → Rotary Disable/Enable
    - → Rotary Axis
    - → Type of Rotary
    - → Pulse Count Per Rotate
    - → Current Diameter (mm)
  - ▷ Cutting Follow
    - → Cutting Follow Enable/Disable
    - → Down Delay(s)
    - → Up Delay(s)
    - → Drilling Power(%)
    - → Drilling Total Time(s)
- ▶ Manufacturer Parameter Settings

Control Panel Functions

"Params" Button

The "Params" option can be seen on your main interface and once selected will tell you Speed, Min Power, Max Power, Name, the number of times the machine has run the file consecutively and the number of times the file has been run in its lifetime.
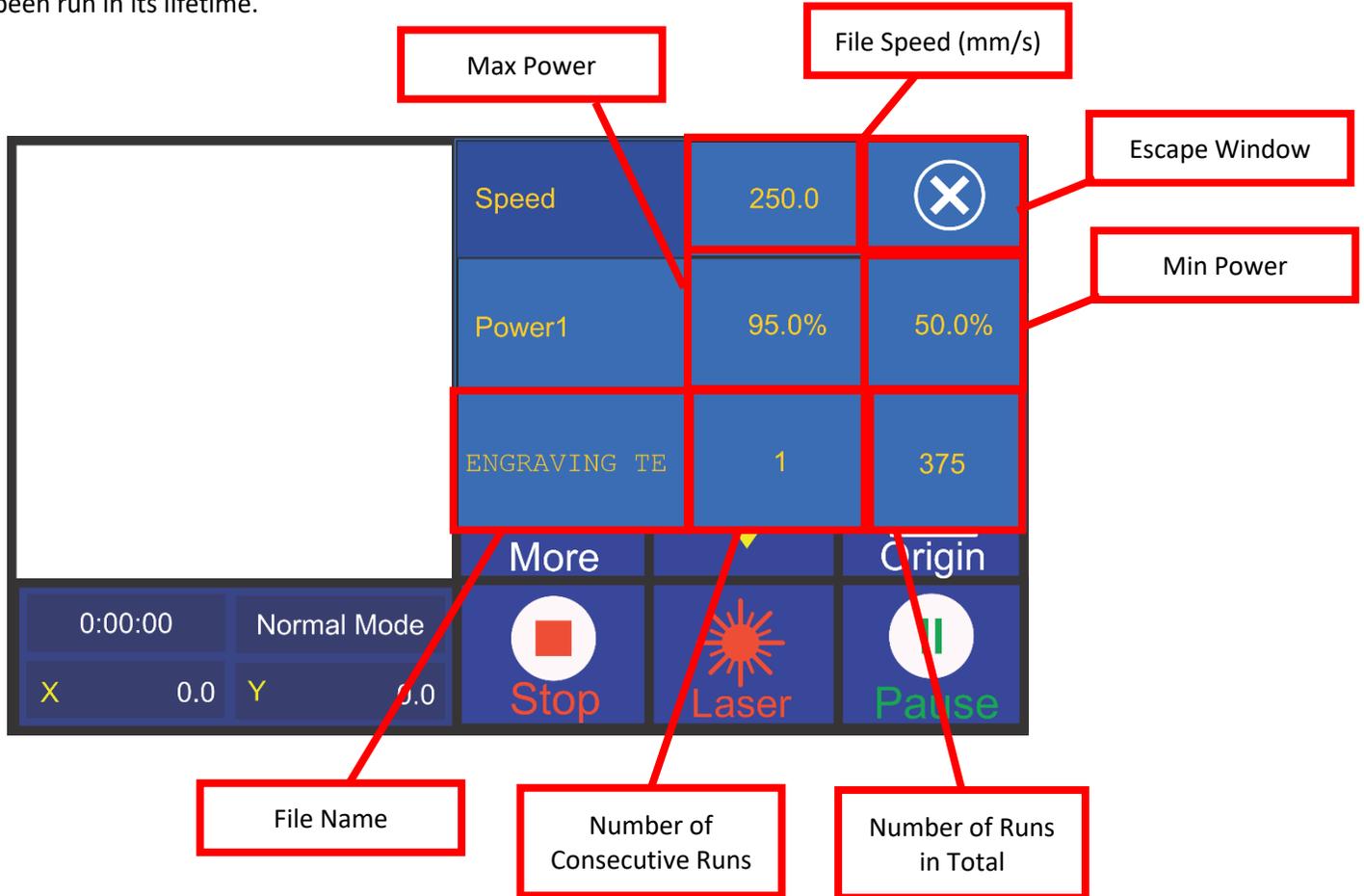
- **File Speed (mm/s) –** This box will tell you the speed your file is set to run, in millimeters per second.
- **Escape Window –** To exit the Params window, click the Escape Window "X" option.
- **Max Power –** Also known as the "Maximum Power", is the highest power in which the laser machine will output while the file is running.
  - We recommend not setting your machine's maximum power above 95%, doing so can shorten the life of your laser tube.
- **Min Power –** Also known as the "Minimum Power", is the lowest power in which the laser machine will output while the file is running.
  - The minimum power your machine should be set at is 5%, if the machine is set any lower it will not fire.
- **File Name –** This field will show the name or partial name of the file that the machine is previewing running.
- **Number of Consecutive Runs –** This field will show the number of times the file has been run consecutively on the machine.
- **Number of Runs in Total –** This field will show the number of times the file has been run on the machine in total.

Control Panel Functions

"More" Button

Ins Menu

The "Ins" Menu is for testing the input signals for the machine. The input signals will allow technical support to troubleshoot your machine to see if anything is out of the ordinary and needs to be adjusted. This can consist of the limit switches, amongst other input signals.

Outs Menu

The "Outs" Menu is for testing the output signals for the machine. The output signals will allow technical support to troubleshoot your machine to see if anything is out of the ordinary and needs to be adjusted. This can consist of the emission light, air solenoid operation, and metal laser head functions.
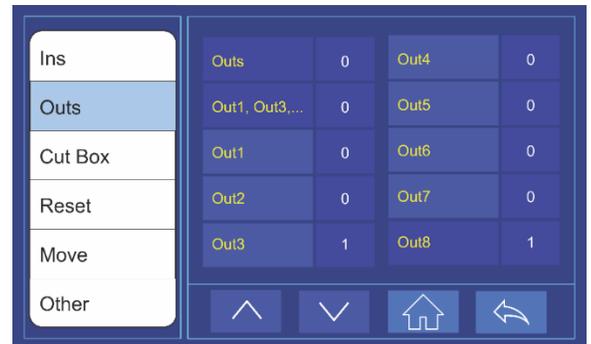
Cut Box Menu

The "Cut Box" Menu is for cutting the outer frame of the file. This will allow you to score the outer perimeter of your file. The "Blank Distance" is the distance between the file and the outline of the box, somewhat of a frame to the file.
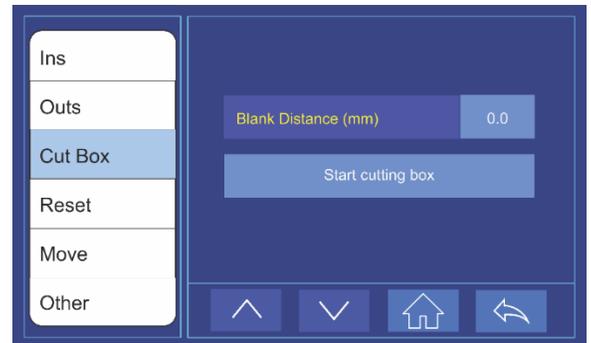
Reset Menu

The Reset Menu can also be used for troubleshooting and resetting a certain axis of the laser machine. This can ensure that the laser head returns to the X, Y, & Z limit switch positions.

Control Panel Functions

Move Menu

The Move Menu will allow you to manually move your laser head or worktable. Refer to the Control Panel Functions Menu breakdown on page 34 & 35.
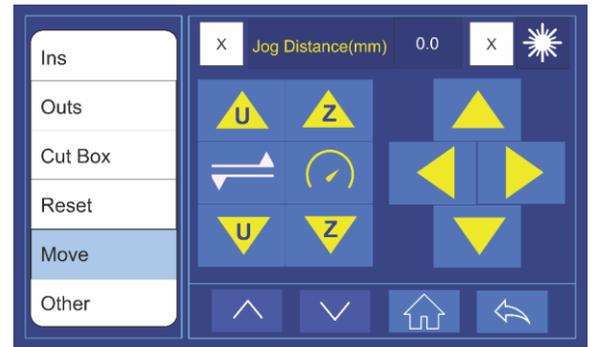
Other Menu

The Other Menu has three options for you to use. The first being the Z AutoFocus, allowing you to focus your laser head based on the height of your material.

The X&Y to Origin option will allow you to bring the laser head back to the origin point that was previously set.

The Continue to Previous Work option will give you the opportunity to return your laser head and machine back to the coordinate in which your machine left off prior to a shut down. This could be useful in an emergency or power outage.
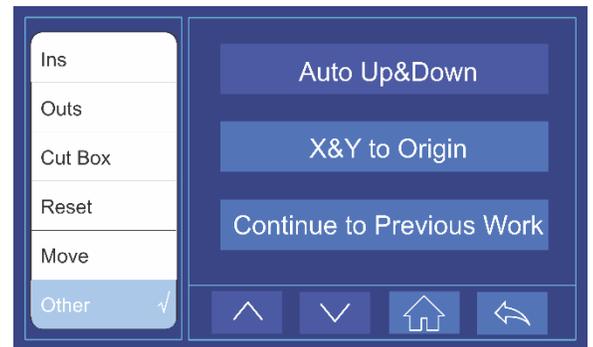
"Menu" Button

After selecting the "Menu" button on the main interface, a menu resembling the image to the right will be shown. In the top left, the title "Main Menu" will be shown. To the top right, the date and time will be shown. On the right-hand side, you will see four options.

The arrow pointing up option will allow you to move up while navigating the menu, you can also press any option on the menu you wish to select.

The arrow pointing down option will allow you to move down while navigating the menu, you can also press any option on the menu you wish to select.

The "Home" button will allow you to return to the main interface at any point in time.

The return arrow button can be selected at any time while in the main menu to return to the previous screen.

Control Panel Functions

UDisk Files Menu

By Selecting the "UDisk Files" on the "Main Menu" you will be brought to the "UDisk" Screen. If you do not have a USB connected to the laser machine, an error will appear on the screen, as shown below to the left. If a USB is plugged into the machine, a screen that resembles the screen below and to the right.
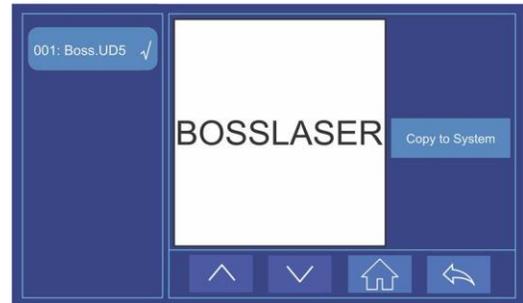
Origin Manage Menu

The Origin Manage Menu will allow you to switch between different laser head coordinates. You have the capability to set up to four different origin points for the laser head.

The Set Current Position as the Origin option will set the current coordinates of the laser head as the origin. Be sure to select the origin you wish to change on the left-hand side of the menu prior to pressing this option.

The Move Head to Origin option will move the laser head to the coordinates in which that origin was set to previously. You can select the origins from the left-hand side, then click this option to see where all your current origins are set.
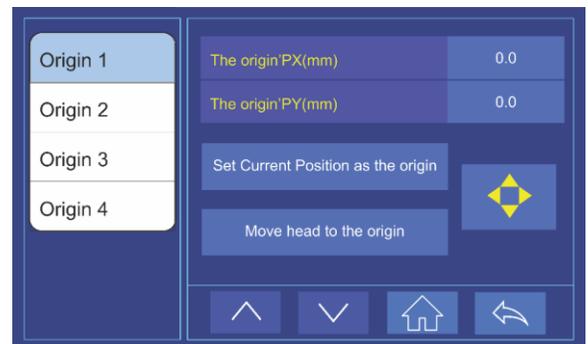
Motion Parameter Settings

- **Space Speed** – The Space Speed will allow you to set the speed in which the laser head will move when the laser is not firing.

- **Cut Jerk** - The Cut Jerk is the acceleration in which the laser head moves while cutting.

- **Space Jerk** - The Space Jerk is the acceleration in which the laser head moves while not firing or in idle.

- **Min Acc** - The Minimum Acceleration in the minimum acceleration in which the laser head will move while cutting.

- **Engrave Acc** - The Minimum Acceleration in the minimum acceleration in which the laser head will move while engraving.

While selecting any of the options noted above, a screen will appear that will give you the capability to input your preferred numerical value to adjust your parameters, as shown to the right.
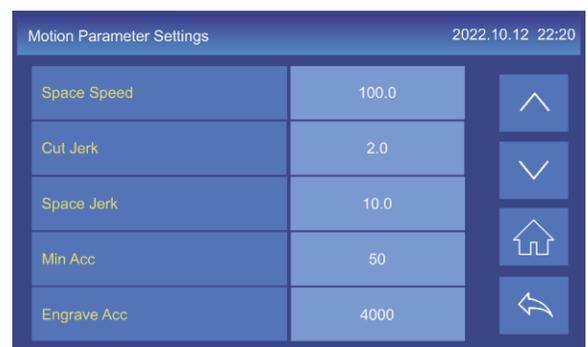
Control Panel Functions

Common Parameter Settings

- **Work Mode** – The Work Mode Menu consists of the parameters that can be adjusted to change the working mode of your laser machine. This will consist of Origin Settings, the Count Mode, and the Feeding Mode.

- **Common Parameters** – The Common Parameters Menu will consist of the parameters that can be adjusted in order to change the working mode of your laser machine. Including AutoFocus Distance, Different Speed Settings, and the Blow Open Delays.

- **Axis Speed Parameters** – The Axis Speed Parameter Menu will consist of the adjustments that can be made to the speed parameters for the Z Axis, U Axis, and XY Axis.

- **Rotate Engraving&Cutting** – The Rotary Engraving&Cutting Menu will consist of the parameters that can be adjusted to control your rotary when turned on and paired with the machine.

- **Cutting Follow** – The Cutting Follow Menu will consist of the parameters that can be adjusted for the Follow Mode of the machine, otherwise known as the Metal Cutting Mode. These parameters have been set by the manufacturer; no adjustments are needed.

Work Mode

Go Origin After Reset
If you choose to enable this function, the laser head will stop at the origin after the laser head has been reset. If this option is disabled, the laser head will return to "home" which is the back right corner of the machine bed.

Origin Mode
- **Key Origin** – The Key Origin, the origin that the machine is set to.

- **Soft Origin** – The Soft Origin is the origin of the file currently being run. This origin is set in the software. If you select this option, it will use the origin that was set in the software.

- **Machine Zero as Origin** – Selecting this option will cause the origin to be set at the "home" position, the back right-hand side of the table, otherwise known at the zero coordinates (0,0).

- **Current Position** – Selecting this option will set the laser head origin as the current position of the laser head.
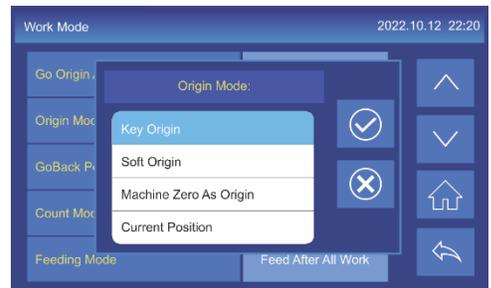
GoBack Position
- **Current Position** – Selecting this option will cause the laser head to stay in its final position where the file had finished, it will not return to home or the origin.

- **Zero Coord** – The laser head will return to "home" after the file has completed, otherwise known as the back right corner or the zero coordinates (0,0)

- **Current Origin** – The laser head will return to the origin point that was set after the file has finished running.
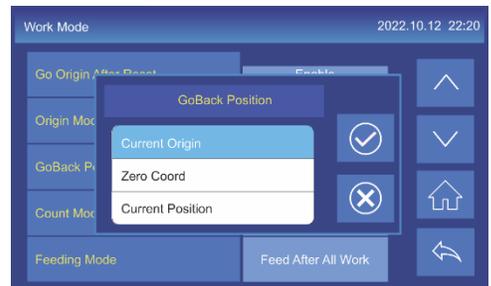
Control Panel Functions

Count Mode

- **Count Per Work** – Count plus one after processing all graphics in one format.

- **Count Per Light** – When the laser beam is emitted, it counts plus one.

- **Single of Array** – The count of a solid line figure in the array is increased by one after processing.

Feeding Mode

- Feeding Mode is available on the control panel, but not available on the HP series machines in its current state.

Common Parameters

- **AutoFocus Distance(mm)** – This is the set distance as to what you would like your laser head to be from the material when you autofocus. For example, if you'd like your laser head nozzle to be 5mm away from the material after autofocusing, you will put "5mm" into this field.

- **KeyMove'Speed** – Changing this parameter will adjust the speed at which the laser head will move when you use the arrow keys on the touch panel to adjust the position of your laser head. In the image to the right, it is set to 250mm/s per second.

- **RunBox'Speed** – Changing this parameter will adjust the speed at which the laser head will move when you select the "Box" option on the touch panel. In the image to the right, it is set to 200mm/s per second.

- **CutBox'Speed** – Changing this parameter will adjust the speed in which the laser head will move when you select the "Cut Box" option on the touch panel. In the image to the right, it is set to 50mm/s per second.

- **Blow Open Delay(s)** – Changing this parameter will adjust the time interval from when the machine starts emitting a laser beam to when air will blow out of the air assist nozzle. In the image above, ours is set to 0.0 seconds.

Control Panel Functions

Axis Speed Parameters

- **Z Work Speed** – Adjusting this parameter will change the speed of the laser head when it moves along the Z-axis.

- **U Work Speed** – Adjusting this parameter will change the speed of the laser head when it moves along the U-axis.

- **XY Home Speed** – Adjusting this parameter will change the speed of the laser head when it moves along the X & Y-axis while resetting the laser head to return to its "home" coordinates.

- **Z Home Speed** – Adjusting this parameter will change the speed of the laser head when it moves along the Z-axis while resetting the laser head to return to its "home" coordinates.

- **U Home Speed** – Adjusting this parameter will change the speed of the laser head when it moves along the U-axis while resetting the laser head to return to its "home" coordinates.
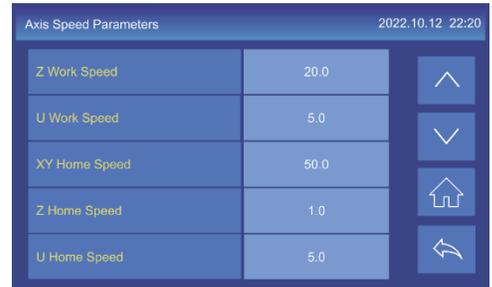
Rotate Engraving&Cutting

The Rotate Engraving&Cutting parameters will allow you to adjust the parameters of your rotary based on which rotary you are using, your material, the rotary axis, and the pulse rate.

✎ Note: It is important to remember that after you've made a change to any of the rotary parameters that the machine must be turned off and turned back on for them to take effect.

Rotary
Changing this parameter will either "Enable" or "Disable" your rotary tool. Your machine must have the rotary setting "Enabled" for your rotary to rotate while running a file.
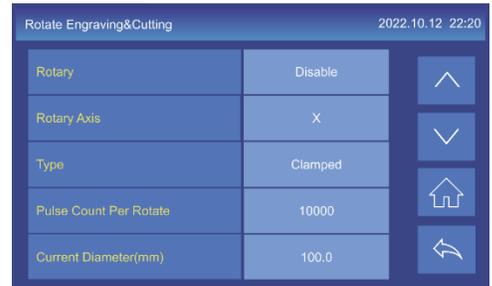
Rotary Axis
This parameter will allow you to adjust the axis in which your rotary is running. Your rotary material should always be along the Y-Axis (left to right), therefore when using your rotary, this option should always be set to the "Y-Axis".

Type
This parameter will allow you to adjust the type of rotary you are using with the machine.

You will only use the "Clamped" option.

Control Panel Functions

Pulse Count Per Rotate

The Pulse Count Per Rotate will allow you to adjust the number of pulses for the motor to make the rotary axis make one full rotation.

- Piburn – 12,500
- BossMod (Both Chuck & Roller)– 10,000
- Long Roller – 6,800
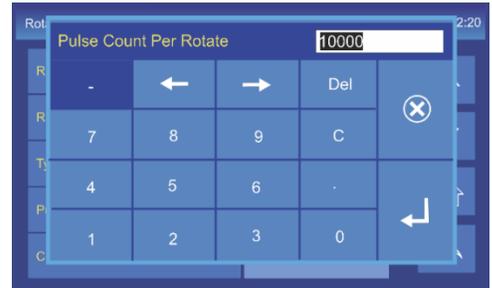
Current Diameter

The Current Diameter is the diameter of the material you plan to engrave while using the rotary.

- PiBurn – 62mm or 63mm
- BossMod – 66mm
- Long Roller – 35mm

Cutting Follow

The Cutting Follow Menu has the parameters set for the metal head to process metal with your HP Series Machine. These parameters are set by the manufacturer and should not be adjusted without prior approval from the Boss Laser Technical Support staff.
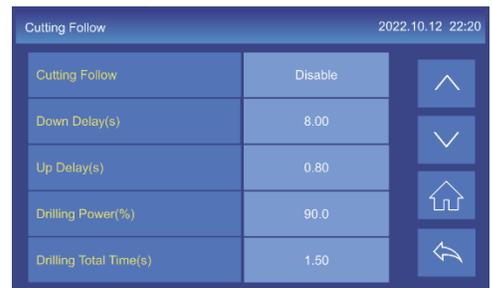
Cutting Follow

The Cutting Follow parameter will allow you to enable or disable your Follow Mode. It is best to remember that if your HP machine is in Follow Mode, it is set to cut metal material. If your HP machine is set to Normal Mode, it is set to work on organic materials like wood and plastic.

Down Delay(s)

The Down Delay is the interval in which the metal head will move downward while cutting metal material is Follow Mode. This parameter is set by the manufacturer and should not be adjusted without prior approval from the Boss Laser Technical Support staff.
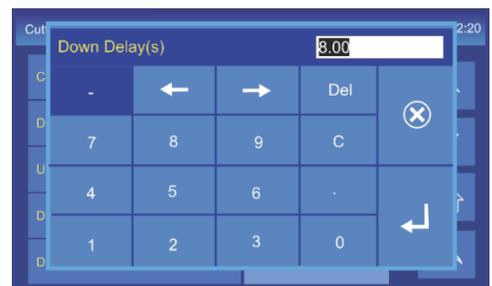
Control Panel Functions

Up Delay(s)

The Up Delay is the interval in which the metal head will move upward while cutting metal material is Follow Mode. This parameter is set by the manufacturer and should not be adjusted without prior approval from the Boss Laser Technical Support staff.

Drilling Power(%)

The Drilling Power is the percentage of power that the laser tube will emit when the laser machine starts running a file in Follow Mode to process metal materials.

Your drilling power should sit somewhere between 85% - 95%.
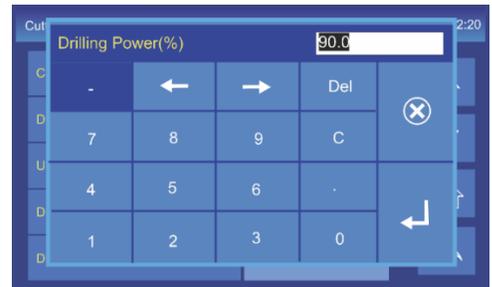
Drilling Total Time(s)

The Drilling Time is the amount of time in seconds that the Drilling Power will be run at the start of the file. For example, if you set your Drilling Power to 90% and your Drilling Total Time to 2 seconds. Your laser tube will emit at a power of 95% for 2 seconds after you press "Start" to run a file.

The ideal drilling time is 3 seconds, but this is preference.
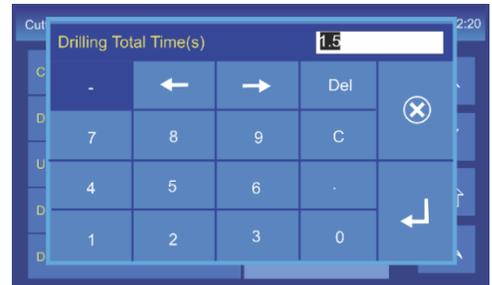
Manufacturer Settings

The Manufacturer Settings are password protected. This is to ensure that your laser machine is functioning properly, and no parameters are changed that will affect the functionality of the machine. If technical support needs to adjust a setting that is password protected, they will provide the password at that time.

Software

Types of Software for Your HP Laser

Your Boss Laser HP machine has the option of two different types of software, both will do the job of sending your files to the laser machine. However, there are differences between the two software's.

LaserCAD is a basic controller software that is a first party solution for the machine's controller, has some in-program design capabilities, and it is mostly used as a conduit to send files to your HP machine.

In contrast, Lightburn is a controller software that is known for being more user friendly with more effect design capabilities, as well as an active support team who is constantly working to ensure the software is functioning appropriately and up to Boss Laser's quality standards.

Your machine will come with LaserCAD, but you can always upgrade to Lightburn. Lightburn also offers a trial period so you can test it out prior to buying it. You can use the QR code in the "Downloading the LightBurn Software" section of this manual if you are interested in the trial.

LaserCAD - Connecting Your Laser Machine to Your Computer

First and foremost, it is extremely important that your computer is plugged in to the laser machine via the USB Connection Cable from your toolbox prior to installing your LaserCAD software and the machine is turned on. If you do not have your laser machine plugged into your computer and the machine on prior to downloading the LaserCAD Software, the drivers will not be downloaded, and your laser machine will not connect to LaserCAD to send files.

To do this, take the USB connection cable from your toolbox and plug the USB-B end of the cable into the USB-B plug on the right-hand side of the machine, as shown earlier in this manual. Take the other end of the USB cable and plug it into the USB port on your laptop.

Downloading the LaserCAD Software

There are two ways to download the LaserCAD software. The first way is through the Boss Laser website. If you wish to download LaserCAD through our website, scan the QR code to the right. After being taken to the website, click the "LaserCAD Software" download link on the right-hand side. If you choose to download LaserCAD from our website, skip to the "Installing the LaserCAD Software" section on this page.

The second way to download LightBurn is via the USB that was provided with your machine and can be found in your toolbox. In that USB, there will be multiple folders and files to help you run your machine. Double-click the "LightBurn" Folder. Inside of that folder, double-click the "BOSSLASER LaserCAD V7.95.5", the name of this might change depending on the version of LaserCAD currently available. Then, double-click the "Setup" file to start the download and installation of LaserCAD.

Software

Installing the LaserCAD Software

After double-clicking the "Setup" file a new window will be launched to start the setup of the LaserCAD software.

Remember your machine & computer MUST be connected via the USB cable for this software to communicate with your laser. After ensuring you are connected, click the "Install USB Driver" button on the top of the pop-up window.

Once you have installed the USB Driver, we can now move along and install the LaserCAD software. Make sure the Type is **BOSSLASER LaserCAD V7.95.5** and Language is set to **English**. Then click Install.
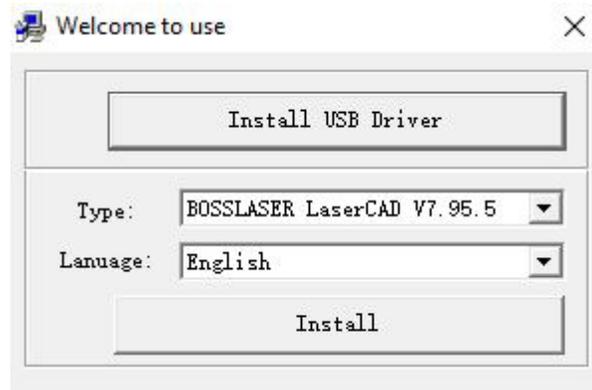
After clicking "Install" a new window will appear that looks similar to the image below. This pop-up window will ask you to select the install path. By default, this is set to your C: Drive on your PC. Once selected, click on the OK button to finalize the installation of LaserCAD.

Now that you have selected the path for your installation of LaserCAD and clicked "OK", your computer will now start the download and installation process, after it has completed, you will have a new window pop-up and say, "Install OK!". This means your LaserCAD software has downloaded and installed successfully.
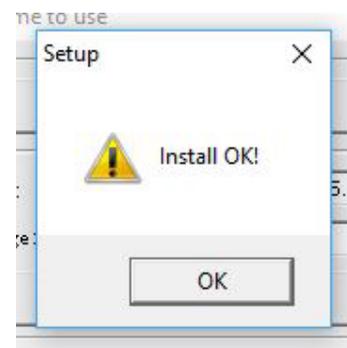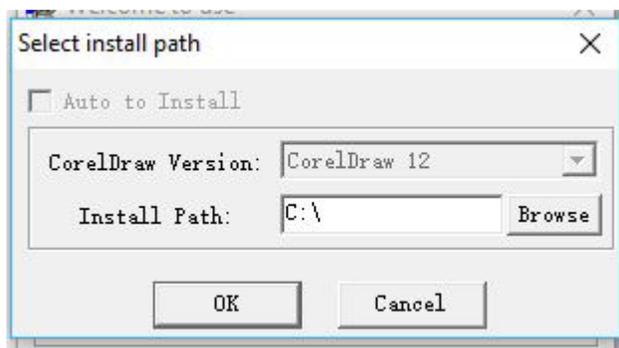
Software

LightBurn - Connecting Your Laser Machine to Your Computer

First and foremost, it is extremely important that your computer is plugged in to the laser machine via the USB Connection Cable from your toolbox prior to installing your LightBurn software and the machine is turned on. If you do not have your laser machine plugged into your computer and the machine on prior to downloading the LightBurn Software, the drivers will not be downloaded, and your laser machine will not connect to LightBurn to send files.

To do this, take the USB connection cable from your toolbox and plug the USB-B end of the cable into the USB-B plug on the right-hand side of the machine, as shown earlier in this manual. Take the other end of the USB cable and plug it into the USB port on your laptop.

Downloading the LightBurn Software

There are two ways to download the LightBurn software. The first way is through the download link on the LightBurn website. If you wish to download LightBurn through their website, scan the QR code to the right. After being taken to the website, click the version that best fits your operating system on your computer. If you choose to download it from the LightBurn website, skip to the "Installing the LightBurn Software" section on this page.

The second way to download LightBurn is via the USB that was provided with your machine and can be found in your toolbox. In that USB, there will be multiple folders and files to help you run your machine. Double-click the "LightBurn" Folder. Inside of that folder, double-click the "LightBurn-v1.400" folder, the name of this might change depending on the version of LightBurn currently available.

Installing the LightBurn Software

After you have selected to download the LightBurn software from either the website or the USB, a new window will appear that resembles the one below.
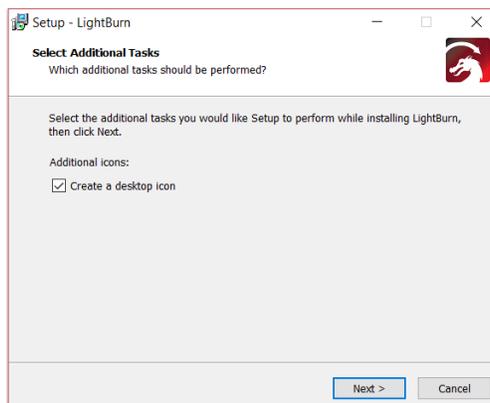
You can choose whether to create a desktop icon or not. If you'd like a desktop icon for LightBurn, leave the check box checked. If you do not wish to have a desktop icon for the LightBurn software, uncheck the box. Your next screen will depend on whether you chose to create a desktop icon or not, see the next page for an example.

Software

Desktop Icon	No Desktop Icon
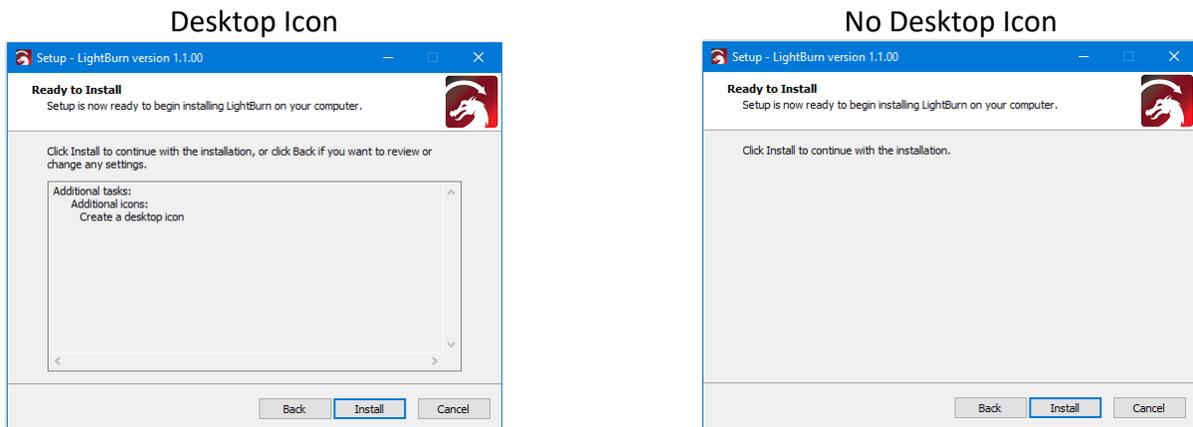
After you have decided whether to create a desktop icon or not, click the "Install" button to install the LightBurn software.

Completing the LightBurn Software Installation

While your LightBurn software is in the process of being installed, your screen will resemble the screen below to the left. After your LightBurn has finished installing, the screen titled "Completing the LightBurn Setup Wizard", as shown below and to the right.
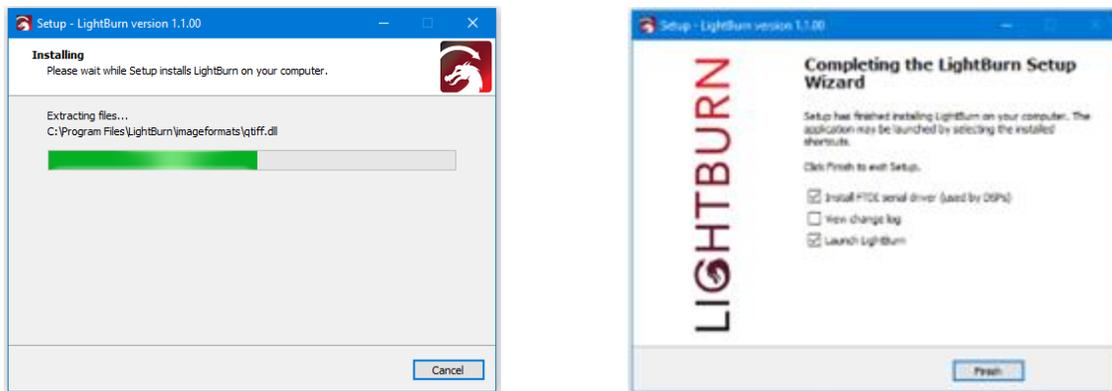
There are three check boxes on this screen, we will review them below.

- Install FTDI Serial Driver (used by DSPs) – By checking this box you will install the drivers to the machine. This is extremely important if it is your first time setting up the machine or installing an updated version of LightBurn. For an HP Machine, this box needs to be checked.

- View Change Log – By checking this box, you will be shown the "patch notes" or changes from the previous versions of LightBurn to the current version you are downloading.

- Launch LightBurn – By checking this box, LightBurn will automatically open after you click the "Finish" button.

After you have checked or unchecked the boxes, click the "Finish" button to complete the installation of LightBurn.

Software

Adding a Device in LightBurn

In order for your laser to communicate with the LightBurn software, a device must be added to the software. On the lower right-hand side of the LightBurn software, there will be a button labeled "Devices", click that button.
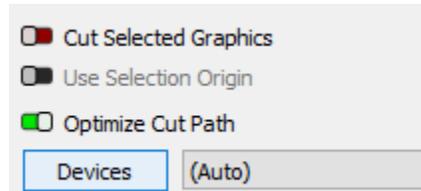
After you click the "Devices" button, a new window will appear. With your laser machine still plugged into the computer, click the "Find My Laser" button in the new window.
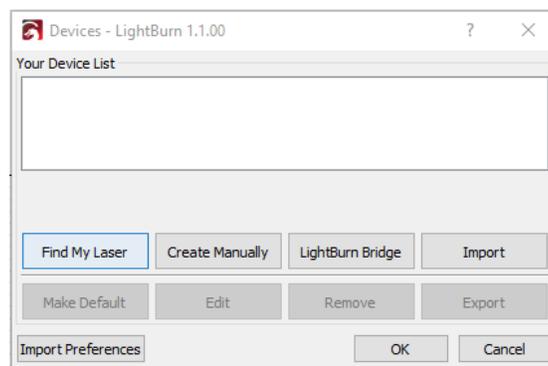
Another new window will appear and will resemble the window shown below. After ensuring your computer is plugged into the laser machine, click "Next".
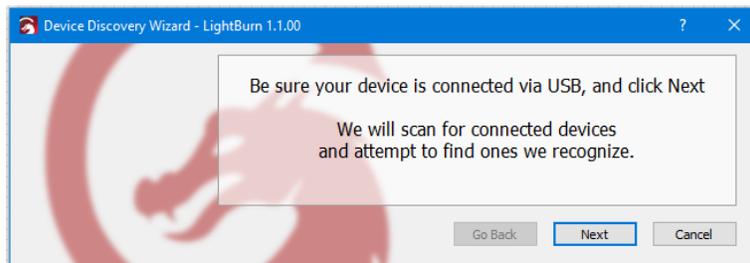
After clicking "Next", a screen similar to the one below will appear where your laser machine controller card name should appear. Click the device listed under "Device Info" and click "Add Device".
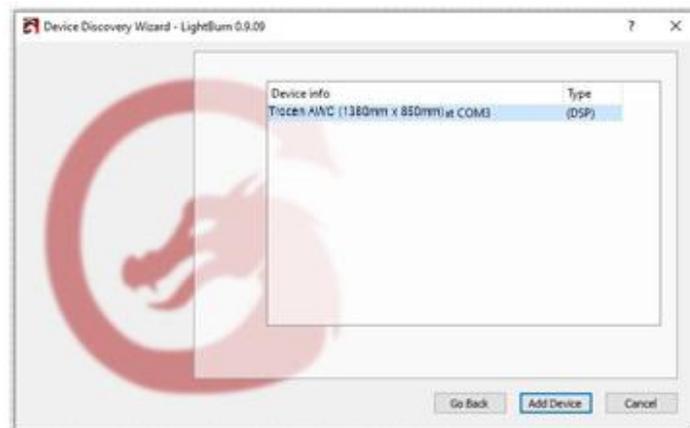
Software

Adding a Device in LightBurn (Continued)

On the next screen you will be prompted to select the origin of your laser. You should select "Rear Right" if it not already selected for you, the Rear Right is the machine's DATUM point.
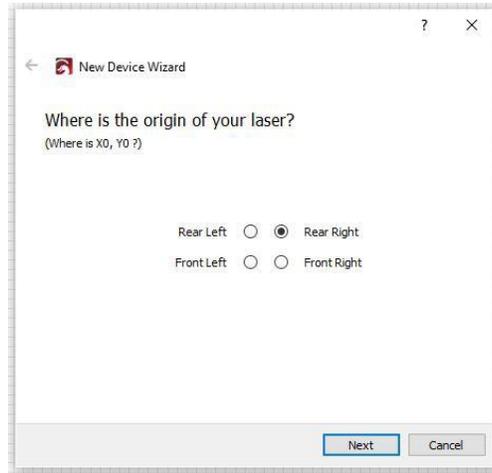
After you have selected the origin point of the laser, you will be provided a summary of the new device you are adding, as shown in the picture below. As a reminder, your screen will not show the exact information in the image below, the information may be different based on your machine bed size and controller card.
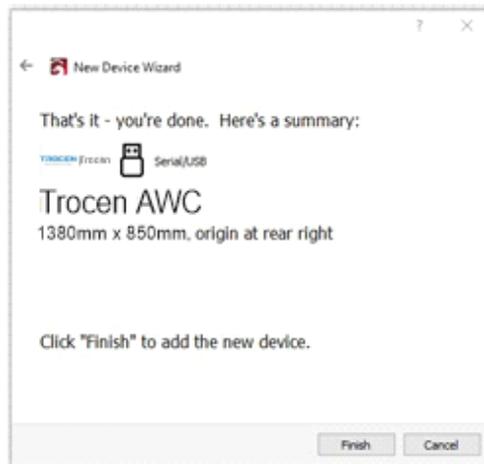
After your laser machine has been added as a device in LightBurn, your Devices window should now look something like the picture below.
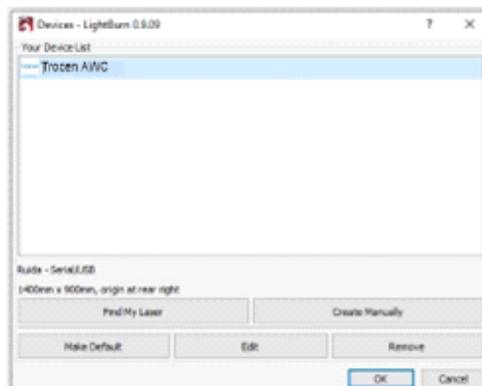
Software

Manually Adding Your Machine to LightBurn

In the event that your HP machine was not automatically recognized by the machine, there is a way to manually add the machine Lightburn. Follow these steps to manually add your machine to your LightBurn Software. If you have any questions while completing these steps, reach out to Technical Support via email or phone for assistance.

After the LightBurn software has been installed, launch the Lightburn software.

In order for your laser to communicate with the LightBurn software, a device must be added to the software. On the lower right-hand side of the LightBurn software, there will be a button labeled "Devices", click that button.

After you click the "Devices" button, a new window will appear. With your laser machine still plugged into the computer, click the "Create Manually" button in the new window, then click "OK" in the bottom right-hand corner.

Now, a list of controllers will appear, select "Trocen-AWC" from the list, as shown below, then click "Next".

Now, you will be asked how you would like to connect the laser to the controller. Select the "Serial/USB" option from the list and click "Next". Be Sure your USB cable from your machine is plugged into the computer in which you are operating LightBurn with.

Manually Adding Your Machine to LightBurn (Continued)

Lightburn will now ask you to name your new device, this is to ensure you can tell your machines apart if you have multiple, making it easier to switch back and forth between them when necessary. You could name it "HP2440" or "HP3655" if you'd like.

You will also be required to enter the dimensions of the work area; we have referenced these dimensions below.

HP 2440 = X – 980mm, Y – 540mm / HP 3655 = X – 1380 mm, Y – 850 mm

Now that the device has been named and the dimensions have been entered, click the "Next" button on the bottom right-hand side of the window.

The next step is to select the origin of your laser head, this is where the machine will consider "home" or it's "starting point" for the laser head when the machine is turned on. We will select the "Rear Right" option.
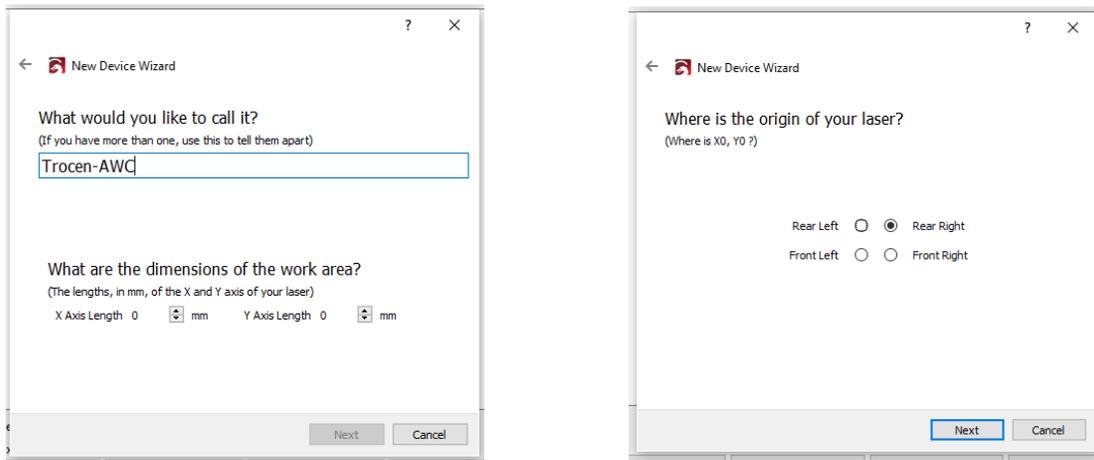
After you have selected your origin, click the "Next" button on the bottom right-hand side of the window. You will then be brought to the summary screen of adding your device, review the information to ensure accuracy and click "Finish".

Now that you have finished adding your device, it will be shown in your "Devices" window of LightBurn on the right-hand side of the screen.
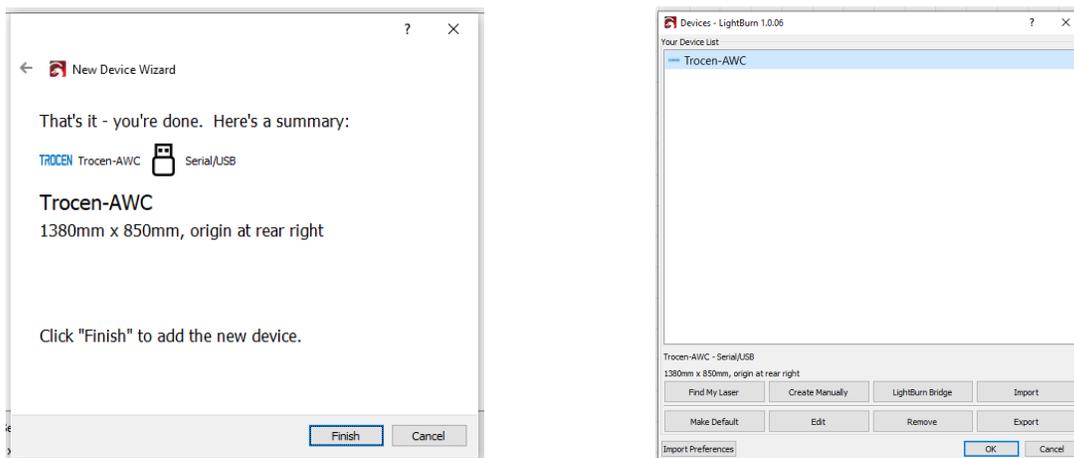
Nozzles & Lenses

Your HP Laser Machine can use 4 different lenses, some of these lenses and nozzle will be used in Normal Mode, and others will be used in Follow Mode. Let's start by reviewing which nozzles and lenses are for Normal Mode when you are cutting, and engraving organize non-metal materials.

Nozzles for Normal Mode

In the image to the right, there are three nozzles that can be used in Normal Mode, we will go over them below.

1. **2.5" Lens Nozzle** – The 2.5" Lens Nozzle will be used for 2.5" lenses (the organic 2.5" lens for cutting non-metal materials such as will woods and plastics will be a diameter of 20.4mm, the metal cutting 2.5" lens will have a different diameter.)
2. **4" Lens Nozzle** – The 4" lens Nozzle will be used with a 4" lens.

Lenses for Normal Mode

1. **2.5" Lens** - The 2.5" Organic Lens can be used for engraving and also cutting softer materials of medium thickness. The organic 2.5" lens for cutting non-metal materials such as will woods and plastics will be a diameter of 20.4mm, the metal cutting 2.5" lens will have a different diameter.
2. **4" Lens** – The 4" lens is used for cutting thicker and more dense materials than the 2" and 2.5" lens'.

Nozzles for Follow Mode

Your HP Series Laser machine will come with the 2.5" metal cutting nozzle for your HP laser, it should already be installed on the metal lens housing assembly, as shown to the right.

Lenses for Follow Mode

The HP Series Machine will only use a 25.4mm diameter 2.5" lens while in follow mode and using the metal lens housing assembly.

If you'd like to purchase any extra lenses

to have on hand, scan this QR code!

How to AutoFocus Your Laser Head (Non-Metal)

Set Screw

Dust Cover

Allen Key Hole

Air Regulator

Nozzle
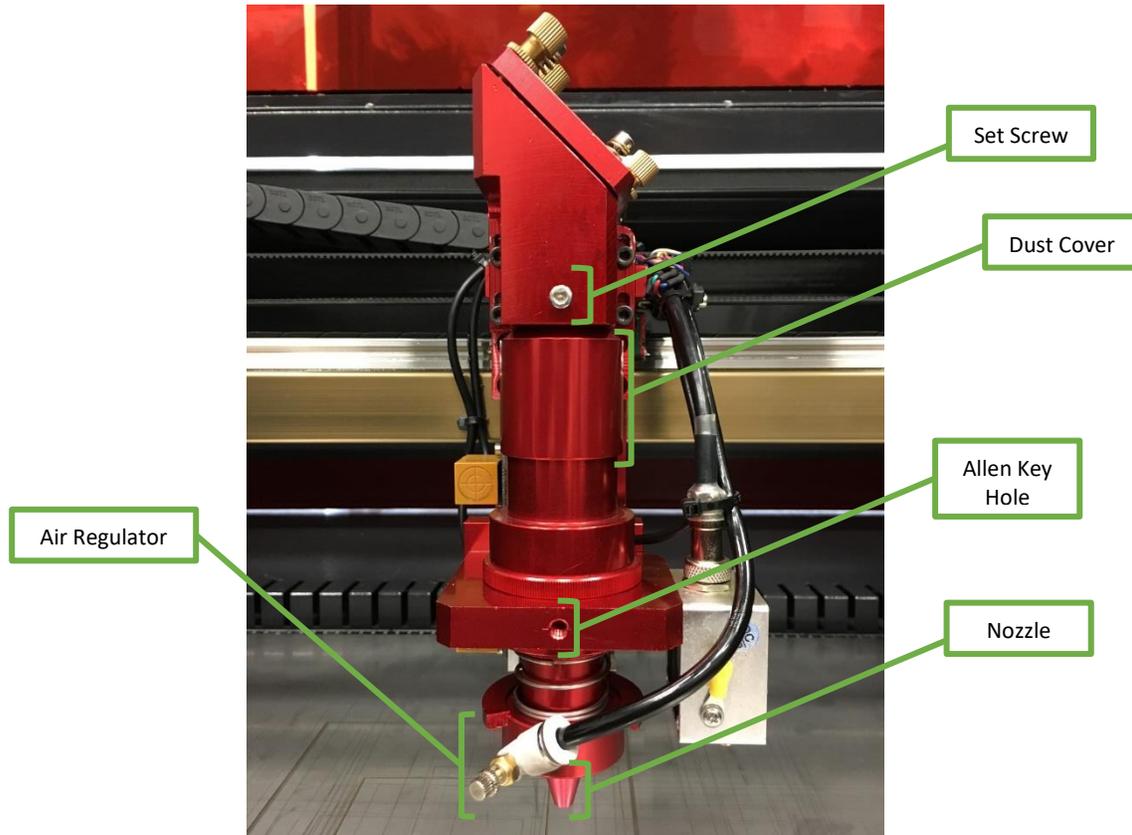
The lens must be refocused every time a new material is placed on the working platform to be processed. The laser uses high focused energy to process the material you are engraving or cutting, meaning the focusing of the laser becomes very important and fortunately, very easy.

As shown in the picture above, you can see the components associated with focusing the laser head. As you get more comfortable with the use of your laser and its components, the variables for focusing your laser head can be adjusted to create a variety of results.

Always be careful when focusing thicker pieces of material, it is important that lens housing not collide with the material. This can cause serious damage to the laser head and its components.

Autofocusing Your Laser Head (Non-Metal)

Prior to attempting to AutoFocus your Non-Metal laser head; your machine MUST be in NORMAL MODE. If your machine is in Follow Mode, it must be changed to Normal Mode. To switch from Follow Mode to Normal Mode, press the section of the screen showing "Normal Mode" or "Follow Mode", as shown to the right. By pressing this section of the screen, it will allow you to switch between the two modes easily.
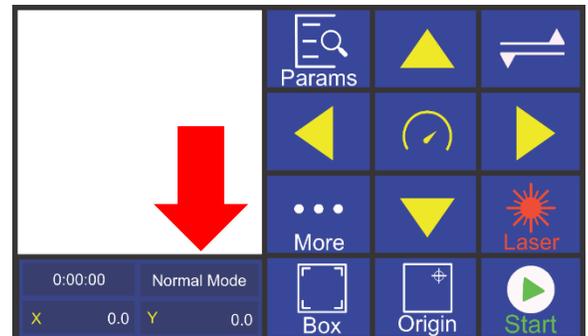
How to AutoFocus Your Laser Head (Non-Metal)

Next, we need to ensure your laser head is almost all the way down. To do this, move to the secondary screen by pressing the button in the top right-hand side of the touch panel that resembles two flags. You should now be taken to a screen that resembles the one to the right.
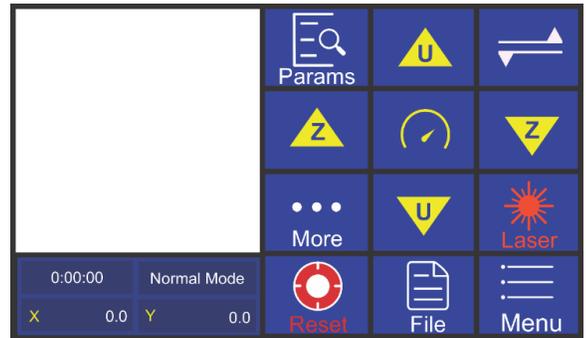
Now we need to press the arrow button pointing down with a "Z" inside of the arrow. This will make your laser head go down, hold the button down until your laser head will not go any farther down.

Next, we need to locate the Z+ Limit Switch, this switch can be seen on the back side of the laser head, as seen in the photo below. The Z+ Limit Switch is a small yellow box and there will be a red-light indicator on that box, as shown below. Now that the laser head is as low as it can go, we must slightly bring the laser head back up to turn that red indicator light off. To do this, use the arrow pointing upwards with the "Z" and only tap it until the red light turns off, do not hold it down.
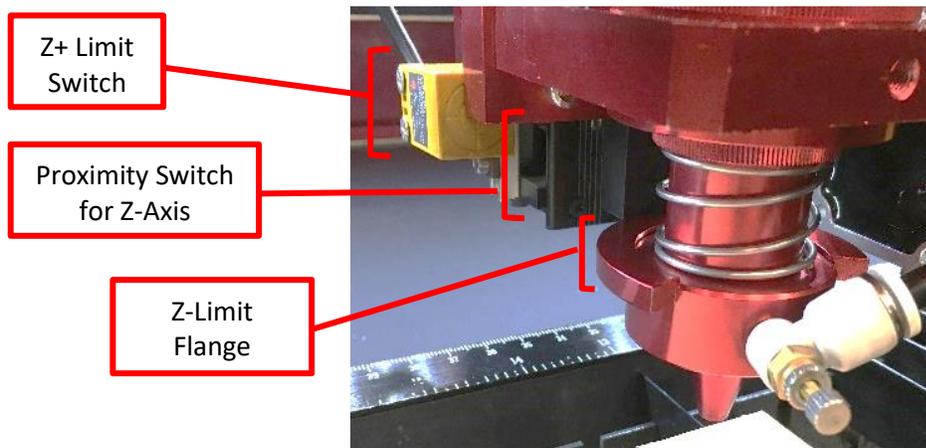
After your laser head is in optimal place to AutoFocus, place your non-metal material on the worktable below the laser head. It is extremely important that the material is under the laser head when you attempt to AutoFocus, if you do not have a piece of material there, it can cause the laser head to crash and cause damage to the machine.

After placing your material, go back to the primary touch panel screen where you will find the "More" button. Press the "More" button and then go to the sub-menu named "Other". Then, press the "Z AutoFocus" option on the "Other" menu.

Doing this will cause the worktable to bring the material upwards towards the nozzle of the laser head. The Z Limit Flange will then start to get closer to the proximity switch for the Z-Axis. Once the flange reaches the switch, it will then cause the worktable to go back down and set the focal depth, otherwise known as the AutoFocus distance.
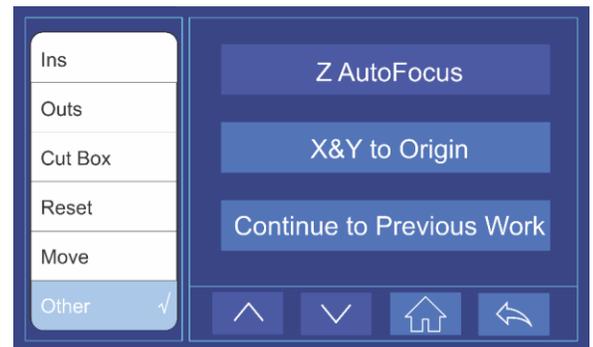
Running Your First Non-Metal File – Hello World

Now that your HP Series machine has been set-up, your Lightburn Software has been installed and your laser head is focused, it is time to run your first file, how exciting!

For this exercise, we will be using a piece of ¼" birch wood. Since we will be engraving this material, the thickness of the material does not matter but, our settings will be based on birch wood and a 150W laser tube that comes standard in an HP 2440 & HP 3655.

Creating the File

First start by opening LightBurn if you do not already have it open. Now, we will select the Letter "A" tool on the left-hand side of the LightBurn software window. This tool is also known as the "Create / Edit Text" tool. You can also select this tool by pressing CTRL + T on your keyboard simultaneously.
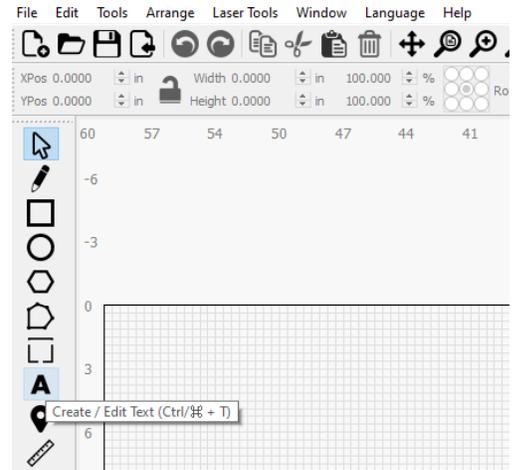
After you select the tool, the "A" will turn red, so you know it's selected. Once the Create & Edit Text tool has been selected, use your mouse to click on the work area in LightBurn, this work area will mimic your worktable of your machine in relation to size.
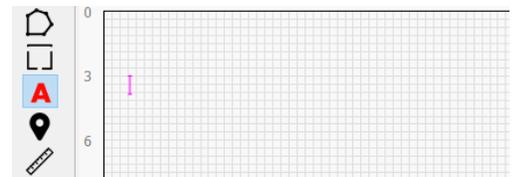
After you have selected your place on the work area in LightBurn, you should see a pink Caret to let you know where the text will start, as shown to the right.

Next, type "Hello World" on your keyboard into the LightBurn software. Your text should resemble the text in the picture below.

If your text is not filled in like the image above and is an outline of the text like the image below, not to worry, that is an easy fix, continue to the next section to learn how to fix it. If your "Hello World" is filled in and looks like the image above, skip to the "Adjusting Speed & Power of Your Layer" section.

Changing the Layers from "Line" to "Fill"

If your text of "Hello World" looks like an outline as shown in the image below, we need to change the layer from a "Line" to a "Fill". A "Line" means the layer is set to cut the material or simply score it, it will not fill in the file, just like on the screen, it will only engrave/cut the outline of "Hello World", it will not fill the spaces between the outlines. If your layer is set to "Fill" it means that it will engrave the filled in portions of that layer, as shown above.

Running Your First Non-Metal File – Hello World

In Lightburn you can have multiple layers that will differentiate if it engraves or cuts, the speed of which you run the laser, and the power that is emitted from the laser beam. We will review those layer options shortly but let's change that "Hello World" from a "Line" layer to a "Fill" Layer.

In the top right-hand side of Lightburn, there is a section called "Cuts / Layers". In that section should be one layer, this is your "Hello World" layer, as shown below.
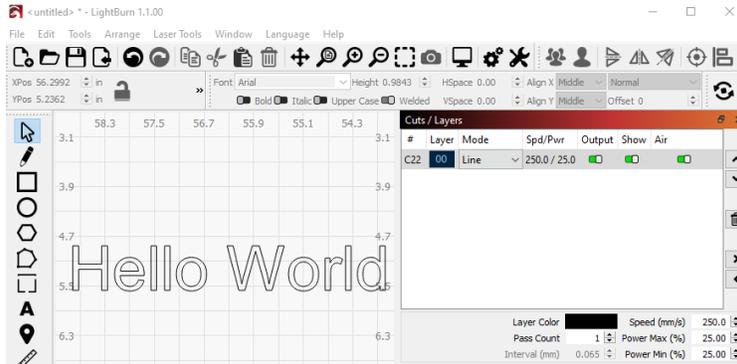
Since your "Hello World" text is only an outline, we need to change the "Mode" from "Line" to "Fill". In the dropdown menu under "Mode" change your selection from "Line" to "Fill". After you do this, your "Hello World" text should now be filled in.
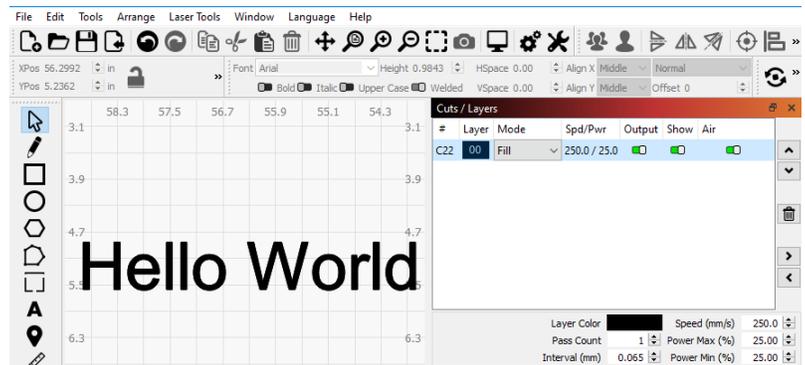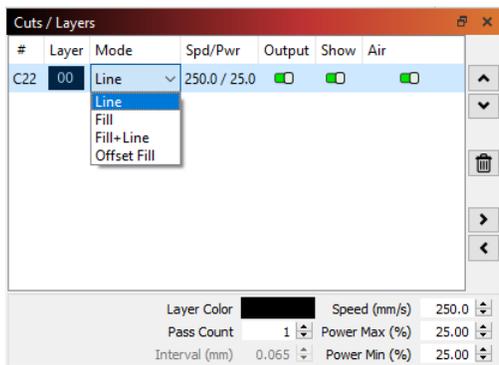
Adjusting Speed & Power of Your Layer

Now that our "Hello World" text layer is set to "Fill", we need to change the speed and power to ensure we get good results on our engraving.

As a reminder, every material is different, it may take some trial and error to produce the desired result if you are unfamiliar with the material or have never worked with a material before, adjusting the speed power can be a learning curve. We have provided a sample file on your USB to help try and narrow down the best parameters for your specific machine, we will go into that later in this manual.

On the upper right-hand side of LightBurn, locate the "Cuts / Layers" section of the software where you "Hello World" layer can be found. This area should resemble the image to the right.
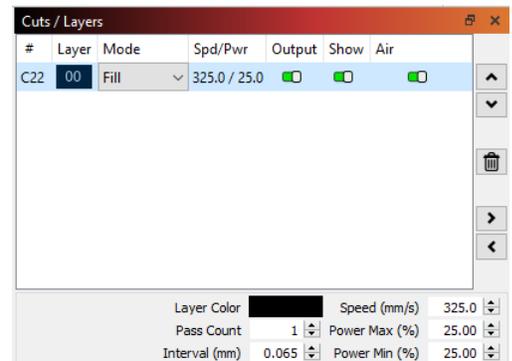
Running Your First Non-Metal File – Hello World

Adjusting Speed & Power of Your Layer (Continued)

After locating the "Cuts / Layers" section of LightBurn, double click on your "Hello World" layer. Doing this will result in the "Cut Settings Editor" window to open. In this window you can rename the file, change the speed, maximum power, and minimum power, amongst other parameters. For this activity, we will just be adjusting the File Name, Power, Speed, and Line Interval. You can also change your "Mode" from this window as well. Here are the parameters we changed, and what we changed them to:

- **Name:** C22 ➔ Hello World
- **Speed (mm/sec):** 325.0 ➔ 300
- **Max Power (%):** 25 ➔ 25
- **Min Power (%):** 25 ➔ 25
- **Line Interval (mm):** 0.065 ➔ 0.065

Some of our parameters did not change but, it is always best to double check them before sending the file to the laser machine. Once you have confirmed the changes to your parameters, click "OK".

Before Parameter Changes	After Parameter Changes
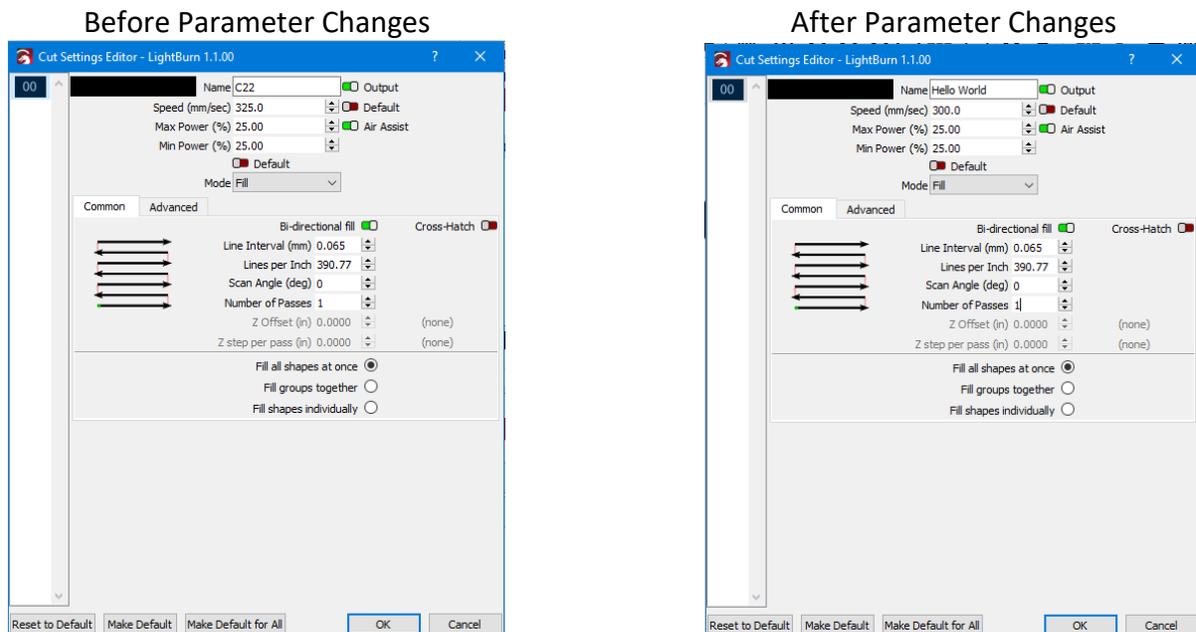
Sending the File to the Laser Machine

The next step is to send the file to the laser machine, be sure your Black USB Cable is plugged into both your computer and your laser machine, and the laser machine is on prior to sending the file.

Now, locate the "Laser" section in LightBurn, as shown to the right. Click the "Send" button on the top right-hand side of the "Laser" window.
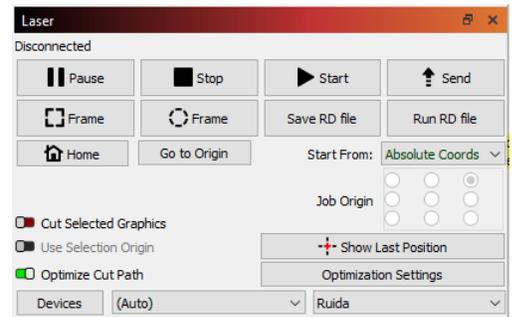
A new window will appear where you will name your file prior to sending it to the laser, we will name this one "HELLO". After naming the file, click "OK".
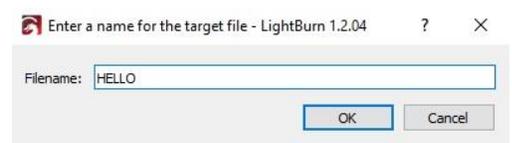
Running Your First Non-Metal File – Hello World

Running the "Hello World" File on Your Machine

After sending your "Hello World" file to the machine, it should automatically load to the white window preview screen, as shown to the right.

Next, you will want to place your piece of material on the worktable. Your piece of material can be placed on any area of the worktable, it just has to be inside the worktable to be engraved and/or cut.

After the material has been placed on the worktable, use the directional arrows on your primary touch panel screen to move your laser head over the material you've placed on the worktable.
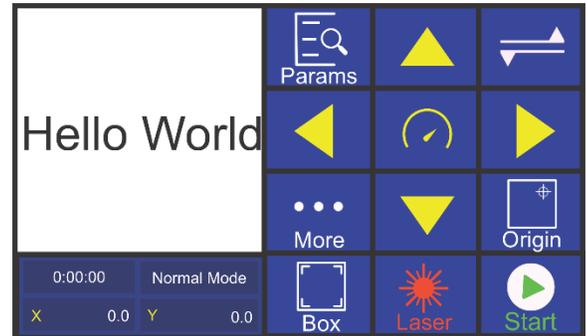
Remember that your origin is the Rear Right, meaning your file/laser head will start the file on the rear right of where you place it. After you are happy with your laser head placement over your material, press the "Origin" button on the touch panel, this will set the location in which your laser head will call "home" or the rear right/top right corner for running the file.

Now, press the "Box" button on your primary touch panel screen. This will create a box shape with the laser head, letting line up your file with the material, also letting you know how big your file is and if your file will fall outside of the material. It is important that your material is big enough to cover the "Box" area because if it doesn't, your file will only be partially engraved or cut on the material and the remainder of the file outside of the "Box" will be engraved on the metal knife blades that hold the material and the bottom tray of the machine.

After you have made sure the material is big enough and in the right place, it is time to AutoFocus the laser head. Follow the directions in the "How to AutoFocus Your Laser Head (Non-Metal)" section a few pages back.

Next, ensure your water chiller, air compressor, and exhaust fan are all on and functioning appropriately.

Finally, we are able to run the file on your HP Series machine. Close the hood and press the "Start" button to run your file. After your file has completed and the laser machine is done firing, open the hood and look at what you made! Our "Hello World" file can be seen below engraved on birch wood.

In the future when running a file, it should always be the following prior to firing the laser machine.

1. Place the material on the worktable
2. Move your laser head to the right position over your material on the worktable
3. Press the "Origin" button to give your laser head a temporary home of where the file should start.
4. Press the "Box" button to ensure your material is big enough and in the right spot.
5. Ensure your water chiller, air compressor, and exhaust fan are all on and functioning properly.
6. Then press "Start".

Running The Engraving Test File

We know that you will engrave and cut a wide variety of materials on your HP Series Laser machine. But let's start with using the provided test file to see what engraving settings might be best for your material and desired result.

On the USB Flash Drive that came with the machine and can be found in the toolbox, there will be a folder called "Test Files", as shown in the image below. Double-click on the "Test Files" folder. Inside you will find a few test files for you to use but let's stick with the "Engraving Test File" for now.
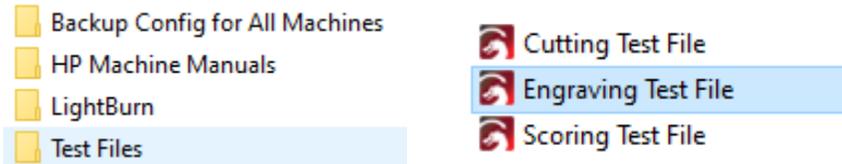
Since the LightBurn software should already be installed, you should be able to double-click the "Engraving Test File" and it should open in LightBurn as shown below.
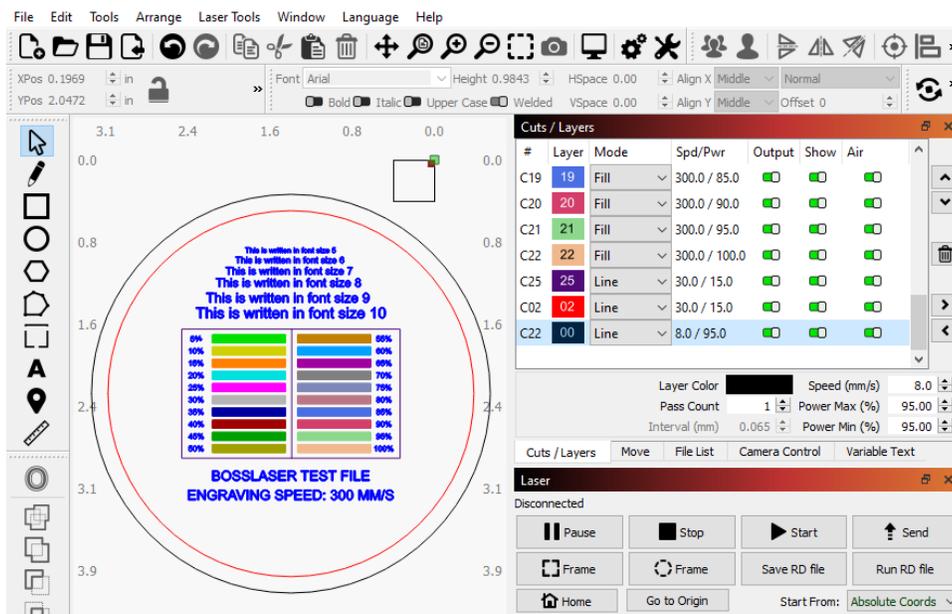
Do not change any of the layers or their parameters at first, these have been set to test a variety of laser powers at a speed of 300mm/s to give you an idea of the different results you can get. You can adjust the speeds of the file later to see if a slower or faster speed will give you the type of result you want.

This file is also set to cut out a circle of the test file at the end, if you wish for the test file not to be cut out, select the 00 Layer, and toggle the "Output" to the red/off position, as shown to the right. This will cause the layer not to be sent to the laser machine for processing.

You will send this file to the laser machine the same way you sent the "Hello World" file and follow the same directions for running the file.

You will also have a piece of birch wood engraving test file in your toolbox that was run on your machine prior to leaving Boss Laser.
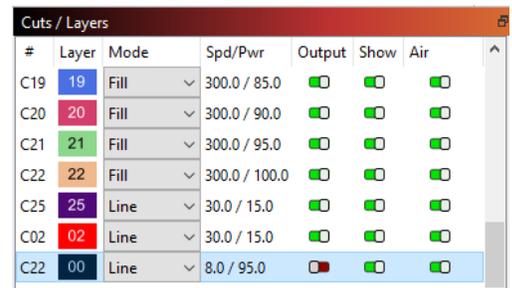
Running The Cutting Test File

After you are comfortable engraving different files and types of materials, we also encourage you to get comfortable with cutting organic materials prior to attempting to cut metal with your HP metal cutting laser head.

Therefore, we have also included a cutting test file on your USB Flash Drive that can be found in the toolbox that accompanied your machine. First, navigate to the "Test Files" Folder and then open your "Cutting Test File" the same way you opened up your "Engraving Test File".
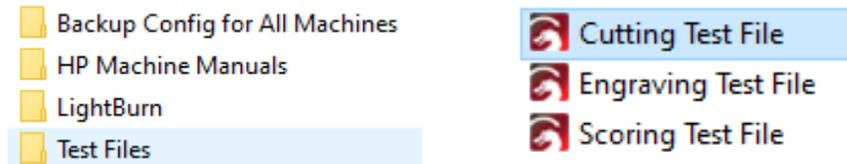
After you have successfully opened your "Cutting Test File", your LightBurn screen should resemble the image below.
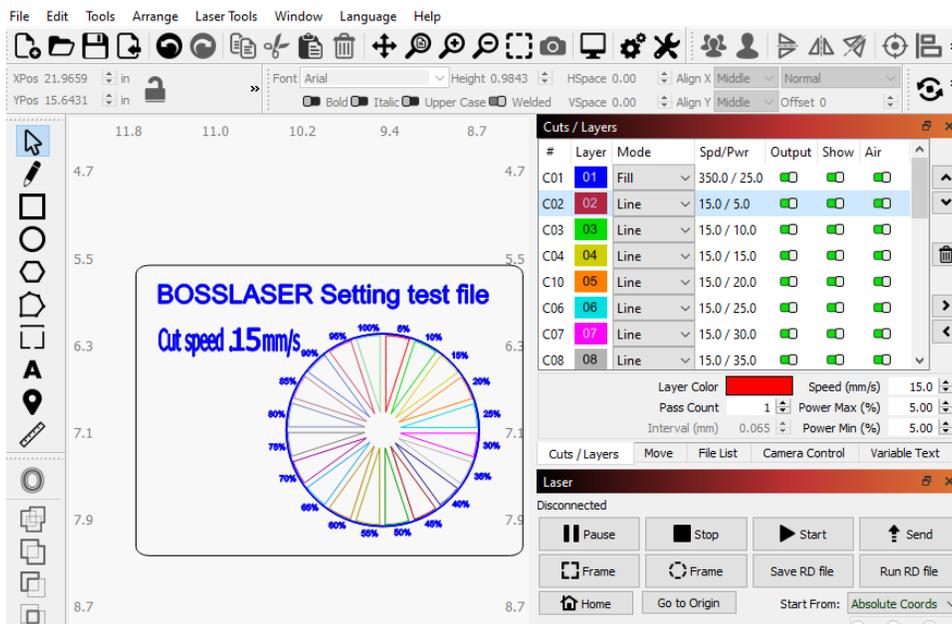
Again, we do not recommend that you change any parameters at first. These parameters have been set for you to cut at 15mm/s at various laser powers to see what the minimum requirement is to get a clean cut through the material you are attempting to cut. Both the speed and power parameters can be changed to adjust based on the type of material and the thickness of the material.

After the Cutting Test File has been opened and you are ready to run the file, you can follow the same directions from when you ran the "Hello World" file. The sending of the file and running on the laser is the same process for a cut as it is an engraving.

Running The Scoring Test File

We have reviewed both the engraving and cutting test files, but what is scoring? Scoring is a like a deep engraving; however, it will run at a higher power and a slower speed than engraving, but not at a high enough power or low enough speed to cut through the material. This test file can help you decide what result you are trying to achieve based on the material and its thickness.

When we engrave a file, we set the layer in LightBurn to "Fill". But, for a scoring a material, we will set the layer to "Line" if you just want to a deep outline of the file. If you want the laser machine to engrave the internal space and score the outline, you will set the layer to "Fill+Line".

Right now, we will just be scoring the test file, but feel free to try the "Fill+Line" in some of your files to see how it effects your results.

First, you will need to locate the "Test Files" folder on the USB Flash Drive, then double-click the "Test Files" folder. Once inside of the folder, double-click on the "Scoring Test File" file and it should automatically open in LightBurn.
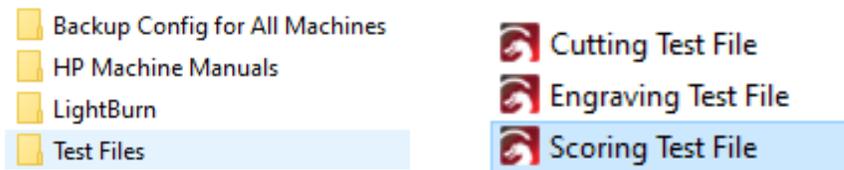
After you have opened the "Scoring Test File" it will resemble the image shown below.
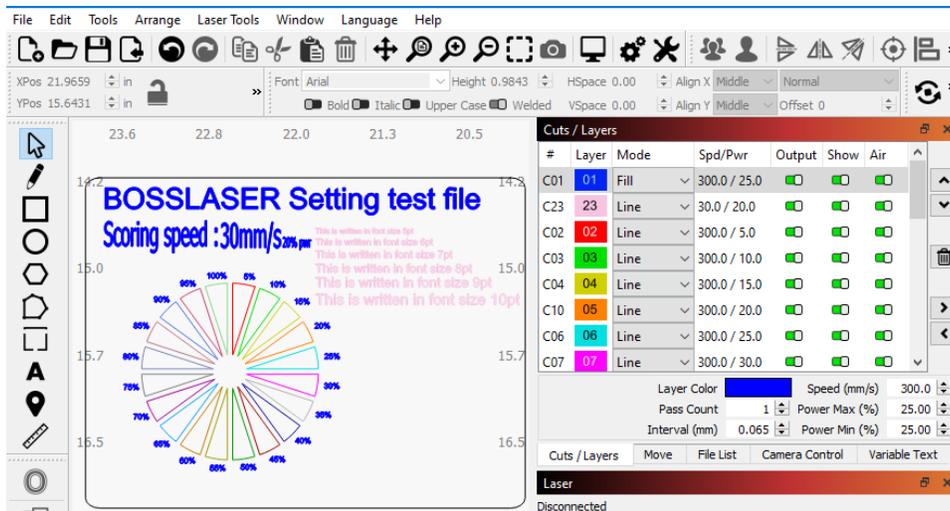
Again, we do not recommend that you change any parameters at first. These parameters have been set for you to score at 300mm/s at various laser powers to display a variety of outcomes when attempting to score your material. Both the speed and power parameters can be changed to adjust based on the type of material and the thickness of the material to achieve different results.

After the Scoring Test File has been opened and you are ready to run the file, you can follow the same directions from when you ran the "Hello World" file. The sending of the file and running on the laser is the same process for a score as it is an engraving or cut file.

Changing Your Non-Metal Head to a Metal Head

We encourage you to get comfortable with engraving, cutting, and scoring a variety of organic materials prior to attempting to cut any stainless or mild steel metals. Over the next few pages, we will show you how to change out your non-metal laser head assembly to a metal laser head assembly. It is extremely important that you remove the non-metal laser head assembly, install the metal laser head assembly, and hook up your oxygen assist prior to attempting to cut any mild or stainless steel with your HP Series machine.

Removing the Non-Metal Laser Head Assembly

Before we remove any pieces from the non-metal laser head, make sure your laser head assembly is all the way down, this is to ensure that you have enough room to remove the dust cover from the laser head assembly. You can do this by navigating to your secondary screen on your touch panel and pressing the down arrow button labeled with a "Z". Hold down this button until your laser head will no longer move downwards.
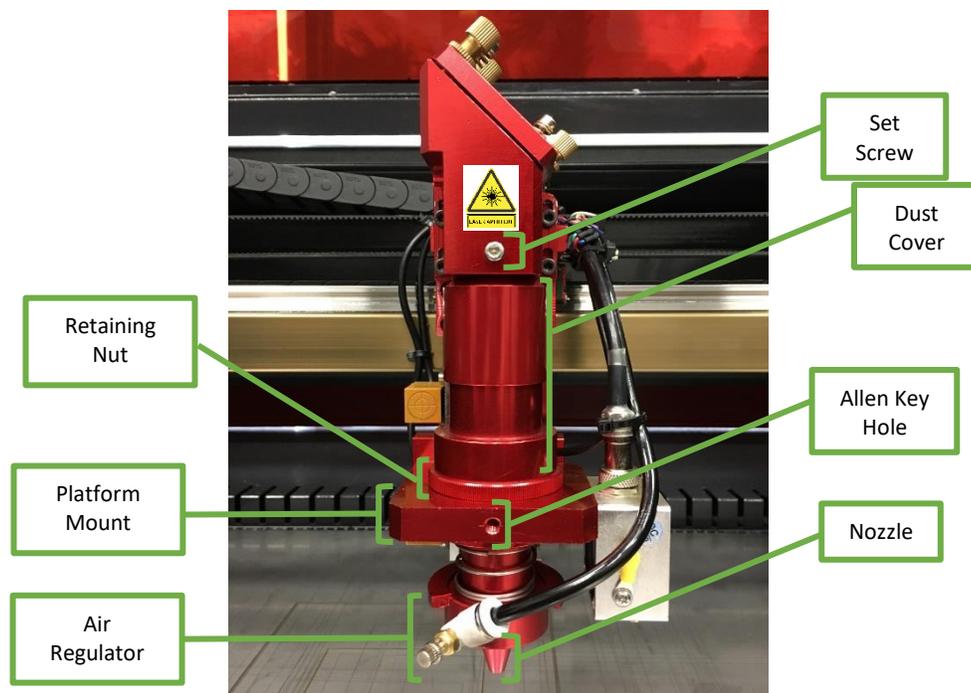
Now, rotate the set screw located on the top of portion of the non-metal laser head assembly, as shown in the picture to the right.

Once your set screw has loosed the dust cover, the dust cover will drop down. Remove the dust cover as shown in the image to the far right. Put the dust cover to the side, you will reinstall it shortly.
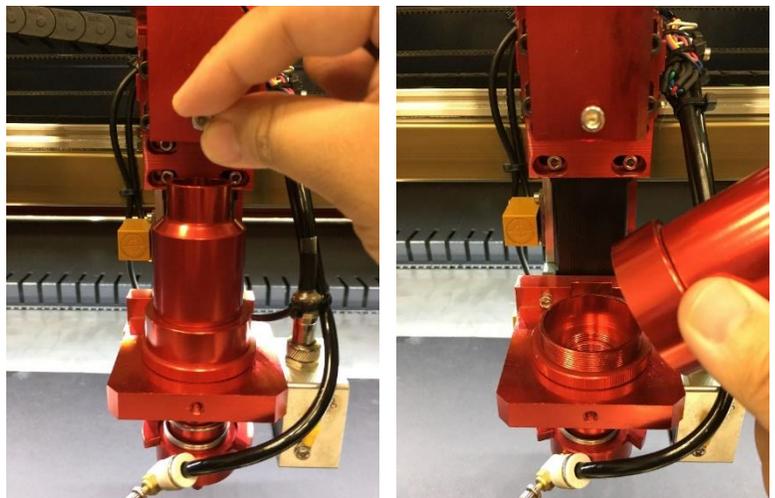
Changing Your Non-Metal Head to a Metal Head

After the dust cover has been removed, you will need to unscrew the retaining nut that is holding the non-metal lens housing and nozzle in place. It is important that you hold the nozzle portion of the non-metal laser head, as it will fall once the retaining nut is removed. Once the retaining nut and non-metal laser head is free, place the retaining nut back onto the non-metal laser head and place the assembly into the toolbox for safe keeping.

Now remove the black nylon tubing attached to the air regulator, this can be a little bit difficult since it is in a tight space but push down on the ring of the air regulator where the black nylon tubing plugs in, this should release the black nylon tubing from the air regulator.

Once you have released the non-metal lens housing and the black nylon tubing has been separated from the air regulator, place your non-metal lens housing in your toolbox for safe keeping until you need it again.
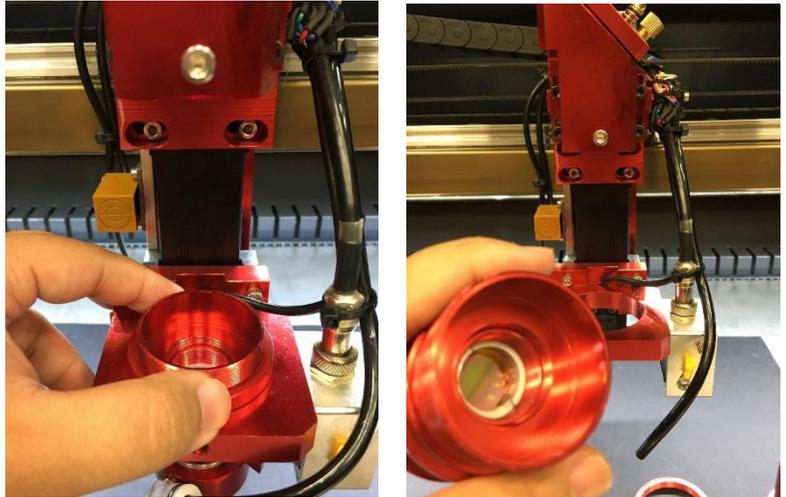
Installing the Metal Laser Head Assembly

After the non-metal laser head assembly has been completely removed, grab your dust cover and your metal laser head assembly from your toolbox. Your metal laser head assembly will resemble the metal laser head assembly shown in the image below.

Lens Housing

Retaining Nut

Air Regulator

Signal Cable Port

Nozzle
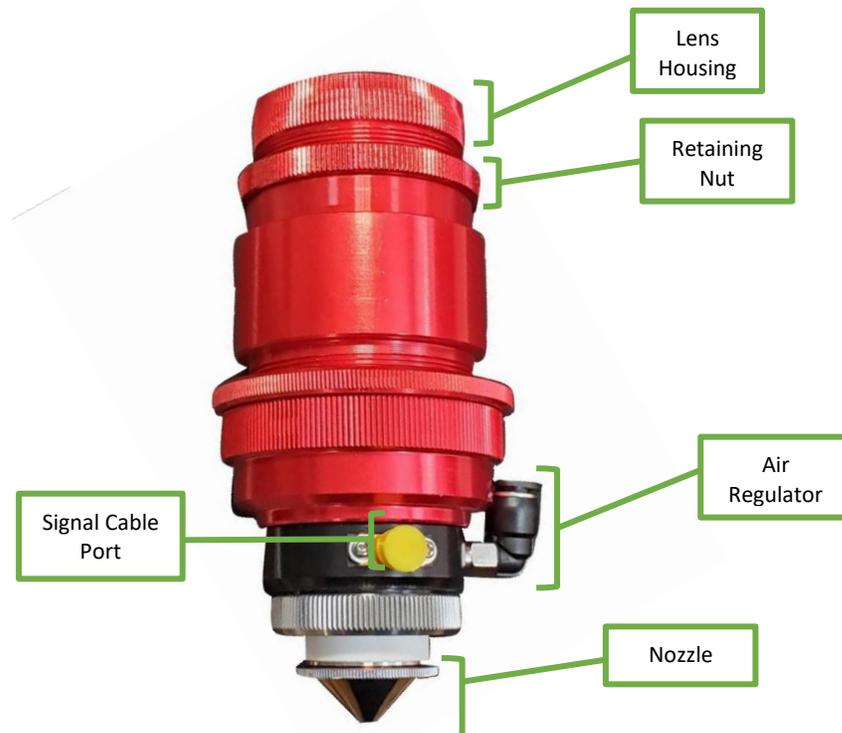
*IMPORTANT:** You can use your metal head to cut non-metal materials. However, you CANNOT autofocus your laser head when using the metal laser head. You would need to find the focal point manually, which we will review later in this manual*

Changing Your Non-Metal Head to a Metal Head

With your metal laser head assembly in hand, unscrew the lens housing from the assembly and put it in a safe place. After the lens housing has been removed, unscrew the retaining nut from the assembly. Take the remaining bottom half of the metal laser head assembly and place it underneath the platform of the laser head mount, be sure that your air regulator on the metal laser head is on the front or right-hand side and can attach to the black nylon tubing with ease. Then use the retaining nut and rotate it clockwise on the thread of the metal laser head assembly until snug to secure the bottom half of the metal head laser assembly to the platform mount, do not over rotate the retaining nut.

Once the bottom half of the metal laser head assembly is attached and secured, attach the black nylon tubing to the air regulator quick disconnect as it was attached to the non-metal laser head. Next, there should be a small blue cable attached to the signal cable port, take that cable, and attach it to the Amplifier (silver box).
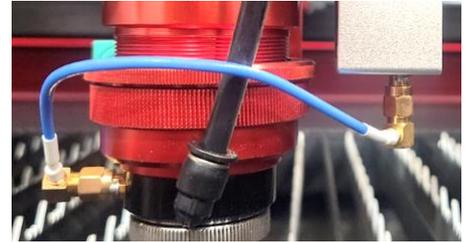
After you have attached the black nylon tubing to the air regulator and the blue signal cable to the amplifier, your lens housing can be inserted into the metal laser head assembly, as shown below. Once inserted, screw the lens housing clockwise into the metal laser head assembly until snug, do not over rotate the lens housing.

After the lens housing is secure, take the dust cover and place it over the lens housing, the edge of the dust cover should sit on the retaining nut. One the dust cover is in place, bring the top portion of the dust cover up and tighten the set screw to secure the dust cover.

Oxygen For Cutting Metal

With your new HP Boss Laser machine, you have the capability to cut up to 20 gauge mild & 18 gauge stainless steel. To cut metal with your HP machine, you will need the assistance of oxygen, preferably welders grade oxygen. You will also need an oxygen regulator.

Setting Up Your Oxygen Tank & Oxygen Regulator

Gauge for Oxygen going to the machine

Gauge for Oxygen coming out of the cylinder

Outlet Connector

Inlet Connector

Knob to adjust ougoing Oxygen PSI
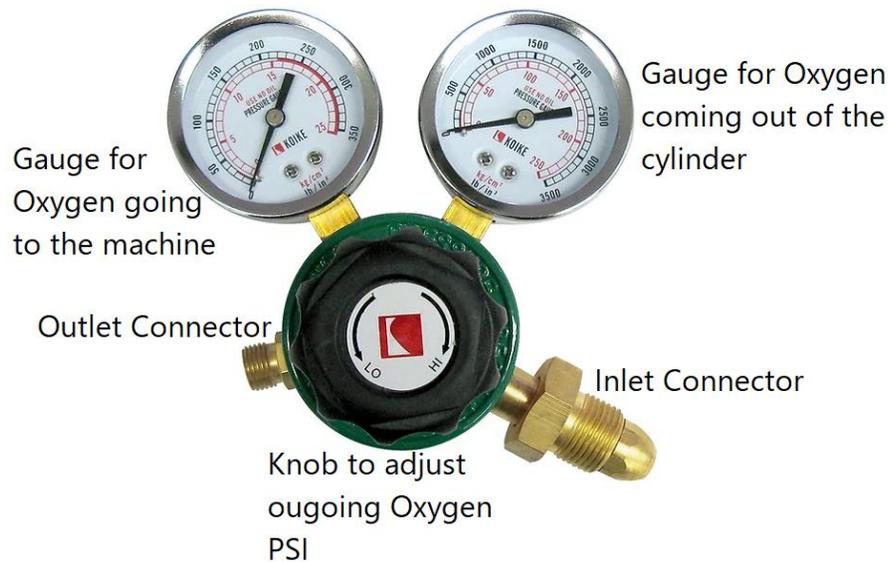
To purchase an Oxygen Regulator, scan this QR code.

First, you will need to set up your oxygen tank near or next to your HP laser machine. If you are only keeping one (1) cylinder on hand, be sure to have a cylinder holder, rack, or barricade to prevent any injury to the laser machine or bystanders. If you are keeping multiple cylinders of oxygen on hand, a cradle is recommended.

After your cylinder of oxygen has been placed and is secure, take the oxygen regulator and mount the brass/gold colored inlet connector and screw it onto the oxygen tank outlet connection. This is the longer brass fixture as shown in the picture to the right. There are other attachments located in the oxygen regulator kit to ensure a proper fit for your needs.

Now that your oxygen regulator has been mounted to your oxygen tank, take the black nylon tubing, and place it onto the outlet connector, this will be the shorter brass connector on the left-hand side.

After your oxygen regulator has been placed on the oxygen cylinder and the nylon tubing has been attached, take the other end of the nylon tubing, and plug it into the "Oxygen In" port located on the back of your machine. This will be in the same area that your water chiller and other major components are plugged in to.

Setting up to Cut Metal on Your HP Series Machine

Setting up the Laser Head

Now that the metal laser head and oxygen are installed, we need to make a few more adjustments prior to cutting any thin mild and stainless steel with your HP Series machine.

First, make sure your laser is in "Follow Mode". To do this, press the "Mode" box on your touch panel until it reads "Follow Mode", as shown in the image to the right.
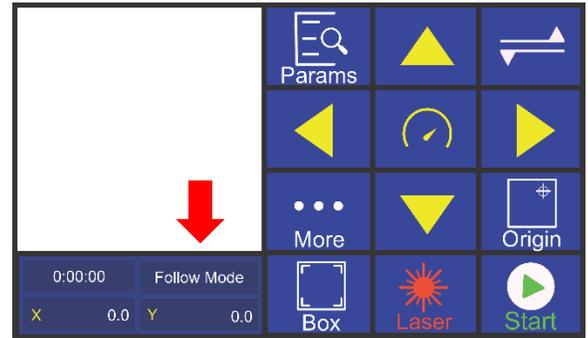
After putting the laser in follow mode, you will need to switch to the FTC 61 Series Control Panel to adjust the position of the laser head. To move the laser head up and down, use the "Up" and "Down button on the FTC 61 Series Control Panel, as shown below.
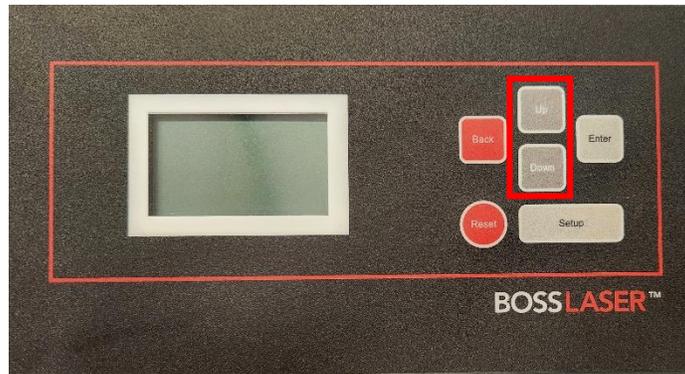
You will need to adjust the height of the laser head until the red metal bracket on the back side of the laser head is right under the Z-Limit Switch, as shown below.
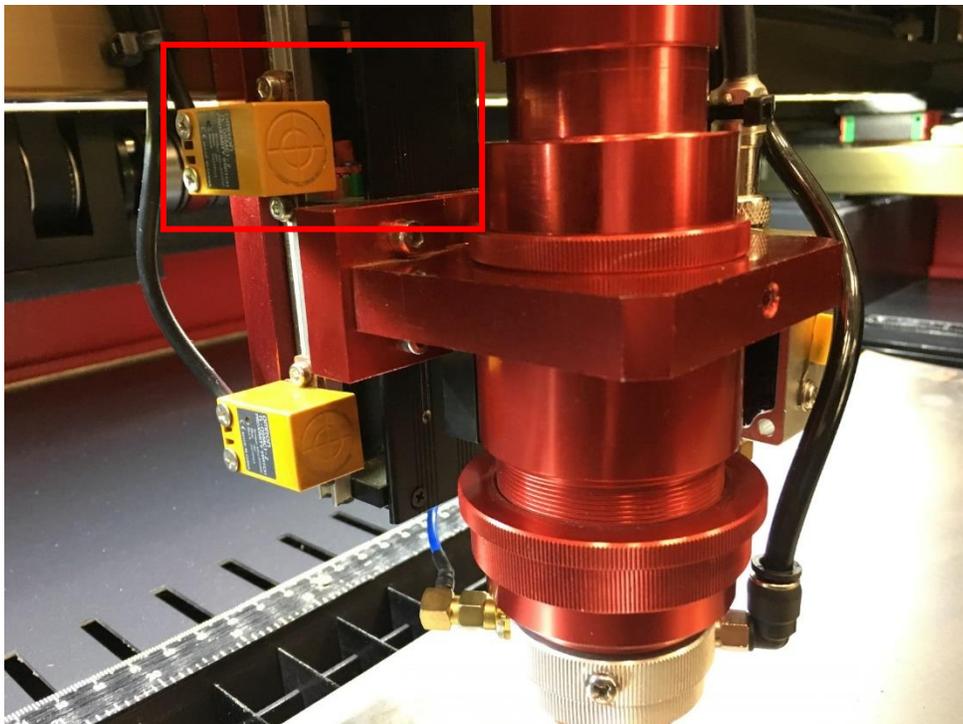
Setting up to Cut Metal on Your HP Series Machine

Calibrating the Metal Head

Calibrating the metal head is extremely important and should be done prior to cutting any new metal material. First, put your piece of thin stainless or mild steel on the worktable and make sure your worktable is about ¼ to ¾ inches from the nozzle of the laser head. To do this, go to your secondary control panel screen where you can find the U-Axis Up and Down arrows, press these arrows to move your worktable up and down to the desired position.
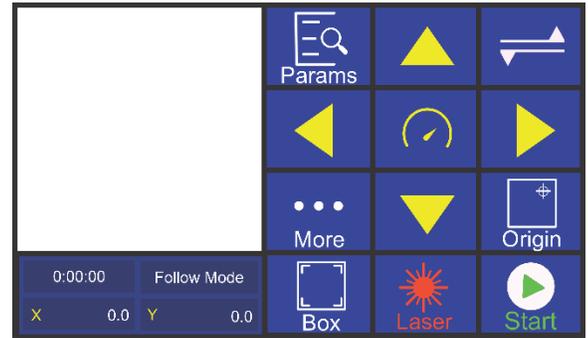
Now, use the "Up" and "Down" buttons on the FTC 61 Series Control Panel to move the laser head about 5mm away from the material, as shown in the picture below.
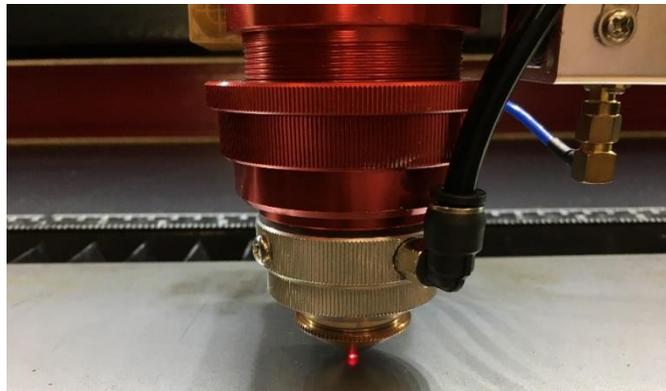
To start the calibration, press the "Setup" button on the FTC 61 Control panel, as shown below.
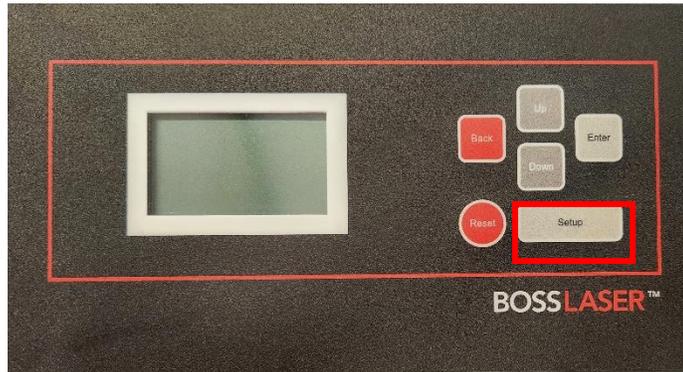
Now, your FTC Series 61 Control Panel screen will resemble the screen below to the left, use the "Up" and "Down" keys on the control panel to move the selection arrow to the "Calibration" option. When ready click the "Enter" button to start the calibration process, this will cause the laser head to move on its own. After the calibration has finished, the machine will "grade" the calibration, press the "Enter" button to save the calibration.
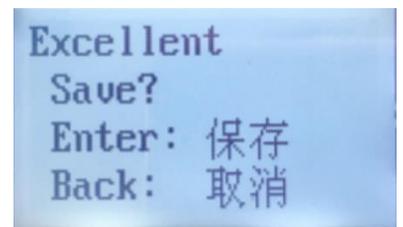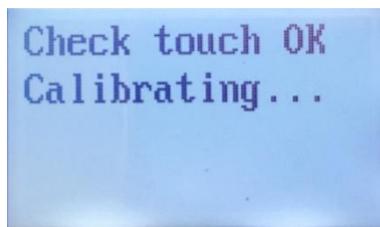
Running Your First Metal Cutting File

Creating the File in LightBurn

For this exercise, we will cut out a circle through 20-gauge mild steel. First, we will open the LightBurn Software to create our file.
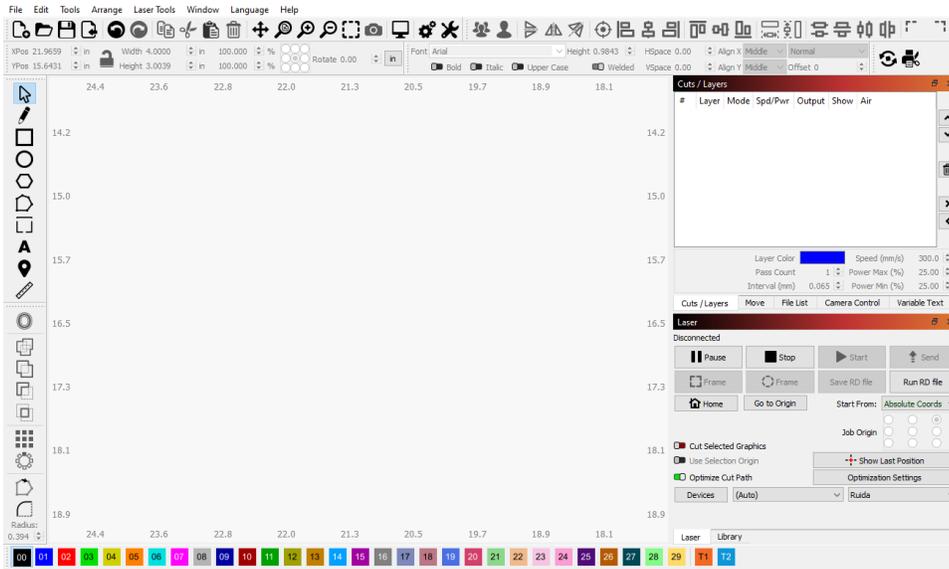
Next, click on the "○" icon on the left-hand side of the window. After you have clicked the "○" option, the icon will turn red, letting you know it has been selected for us. After selecting the "○" icon, click your worktable space in LightBurn, click on the worktable, hold down the mouse button and drag it across the worktable to make a circle, the size doesn't matter, we will fix the size. After you have completed that step, your screen will resemble the one below.
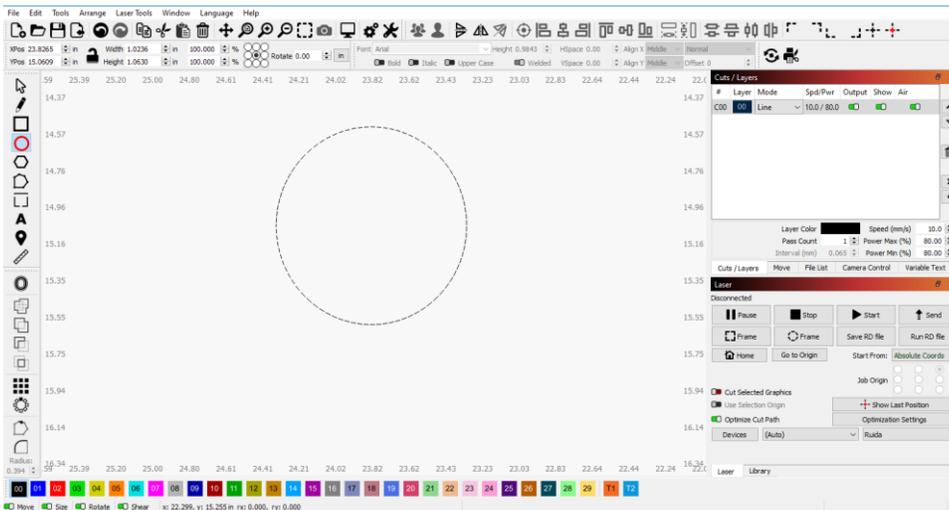
Next, select the cursor "select" option on the top left. We will select the circle we just made. For this, we need to make sure our measurements are in millimeters and not in inches. So do this, navigate to the numeric edit's toolbar, as shown below. If your measurements are showing "in", click it to change it to "mm".
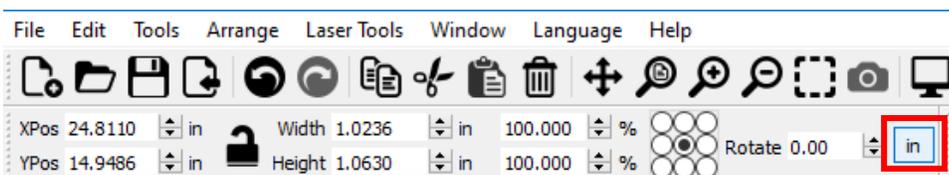
Running Your First Metal Cutting File

Once you have changed your measurement to millimeters, we need to change the size of our circle. In the numerical edit's toolbar, you will see a parameter for "Height" and "Width", set those both to a value of 55. Be sure your padlock on the left of the "Height" and "Width" is unlocked so you can change the dimensions accordingly.
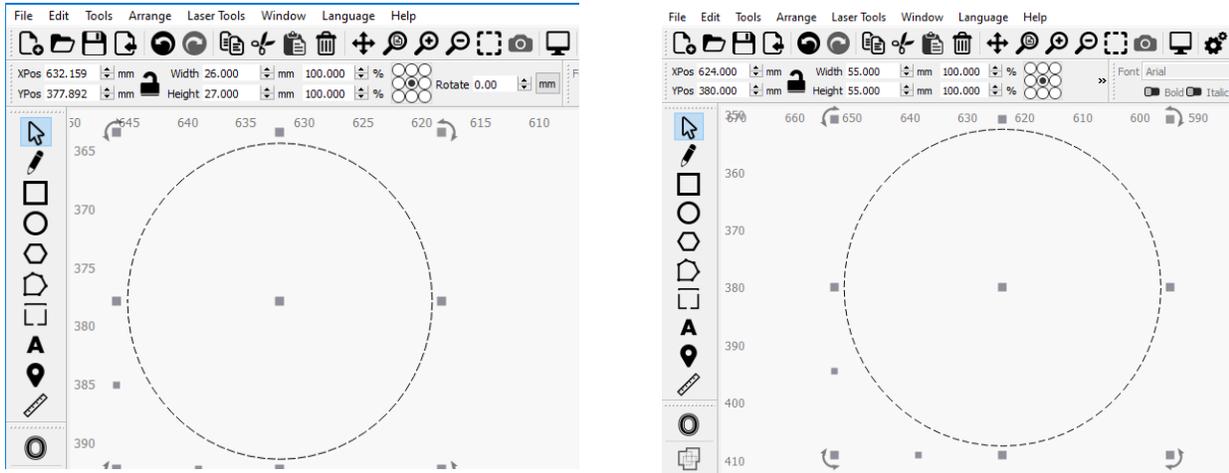
After your circle is 55mm in both height and width, we can change the speed and power parameters. Locate your "Cuts / Layers" window in LightBurn, as shown below.
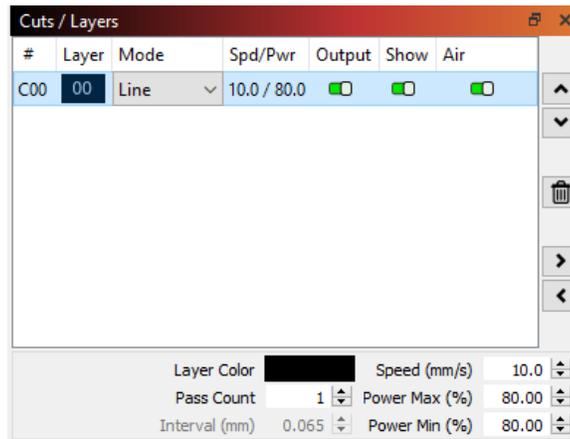
Double-click on the layer for your 55mm circle, doing so will open your "Cut Settings Editor" window. For cutting metal, we need to adjust a few more parameters. Your window will open in the "Common" parameters tab, we need to click on the "Advanced" tab to get to the parameters we need to adjust.
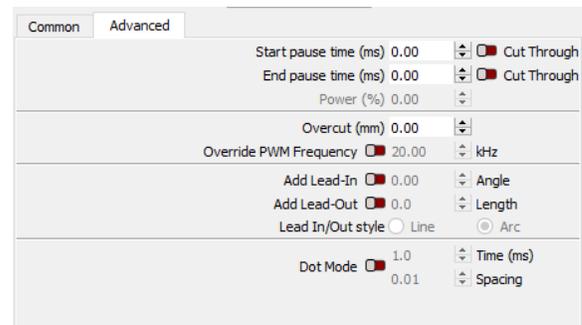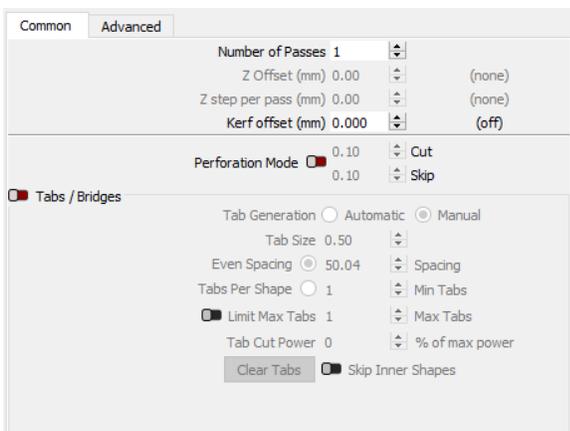
Running Your First Metal Cutting File

In the "Advanced" settings tab, we adjust the following parameters to the following:

- **Name:** Circle Cut

- **Speed (mm/sec):** 15.00

- **Max Power (%):** 85.00

- **Min Power (%):** 85.00

- **Mode**: Line

- **Add Lead-In:** Toggle to the right (green), leave numerical field at 0.0

- **Add Lead Out:** 25.4

- **Lead In/Out Style:** Line

<table>
<tr><td style="text-align:center">Before Parameter Changes</td><td style="text-align:center">After Parameter Changes</td></tr>
</table>
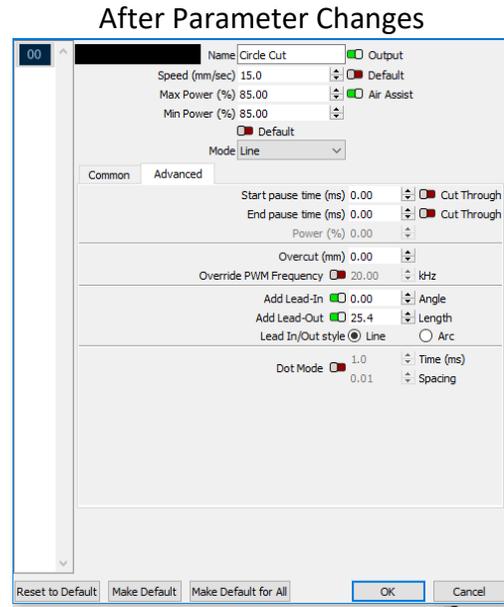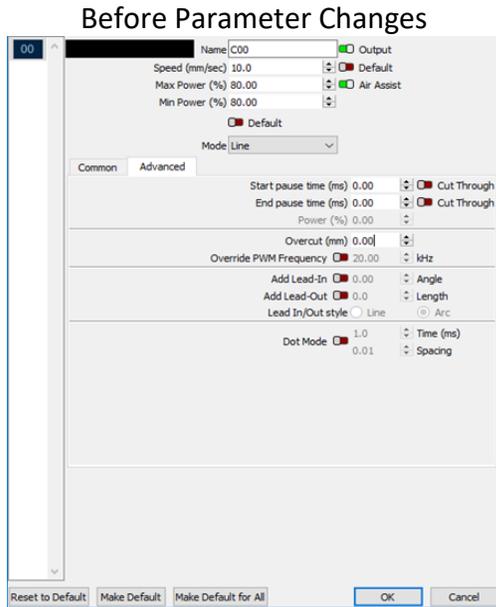
After the parameters have been changed, click "OK" to confirm the changes. Now, we have to send the file to the machine. Be sure your machine is turned on and plugged in via the black USB cable that was provided in your toolbox. Then, press the "Send" button under the "Laser" section of LightBurn.
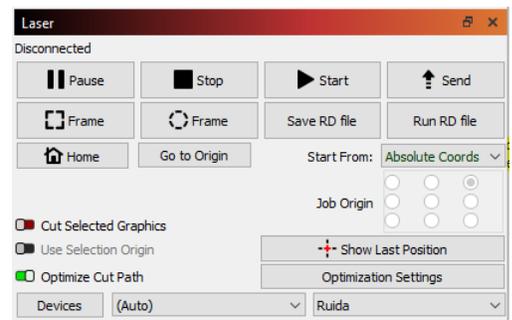
A new window will appear where you can name your file prior to sending it to the laser machine, we will name this one "CIRCLE".
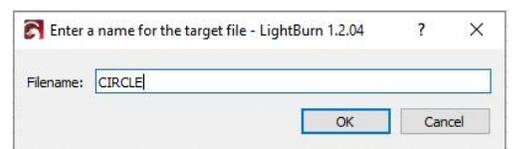
Running Your First Metal Cutting File

Running the Circle Metal Cutting File on Your Machine

After sending the file to the laser machine, you can look over to your touch panel and you should see a preview of your circle file on the screen in the preview window, an example of this can be seen to the right.

If not already there, place your piece of 20-guage mild steel on the worktable and use the arrow keys to move your laser head over the piece of mild steel. You can calibrate your laser head again just to be safe if you want to.
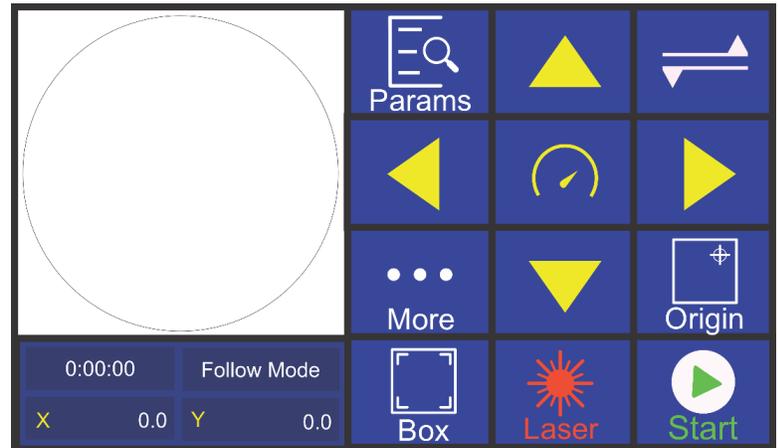
After positioning your laser head, press the "Origin" button on the touch panel to set the laser heads "home" for this file run. Setting the origin will give the laser head an origin point to start at when you press "Start".

Next you will press the "Box" button on the touch panel, this will cause the laser head to make a perimeter box of the circle file on the screen. Make sure your box is within your metal material, if the box perimeter goes outside of the metal material, move your material, or adjust your origin.

Before running your file, be sure your compressor air source is disconnected from the laser machine "Air In" port on the back of the machine. You will need welders grade oxygen connected to the "Oxygen In" port located on the back of the machine and turned on. Do not use compressed air to cut metal or leave the compressed air connected to the machine while running oxygen. To review the complete steps for setting up your oxygen and oxygen regulator, see the "Setting Up Your Oxygen Tank & Oxygen Regulator" section of this manual.

Once you have an oxygen tank with an oxygen regulator, you'll need to make sure you get the correct fitting for the regulator that will match the tubing that goes into the back of the machine of the oxygen fitting. The fitting needed will be a Push-to-Connect R-Thread Pneumatic fitting for an 8mm tube. If you have any questions about obtaining the proper fitting, please reach out to Technical Support via phone or email.

Prior to running any file, we want to make sure that the water chiller and exhaust fan are on and functioning properly, as well as the oxygen tank connected, and the tank valve is open. Once you have confirmed that all of your major components are on and functioning properly, we can run our file.

Close the machine hood as well as any side doors and press the "Start" button on the touch panel. After your job has completed, your result will look similar to the images below.

Running Your First Metal Cutting File

Adjusting Your Metal Cutting Parameters

If you notice any burring on the bottom of your metal material after running the file and you have already tested different PSI levels for your oxygen, you may need to change your "Follow Height". The follow height is basically the same as finding the focal appropriate focal point to help reduce the amount of burring. To change the focal height, follow the steps below.

Your follow height will range from 1.0mm – 4.0mm. To change the follow height, press the "Setup" button on the FTC Series 61 Control Panel.
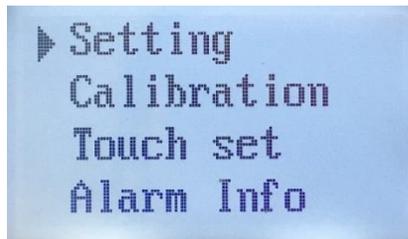
Next, press the "Down" button until the "Flw higt" option is selected. Press the "Enter" button to select the "Flw higt". Once the "Flw higt" is selected, use the "Up" & "Down" buttons to adjust the follow height. Once the number has been adjusted to your liking, press the "Enter" button and then the "Back" button.
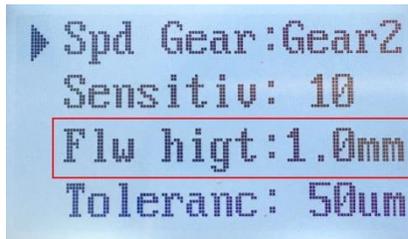
You will now be asked whether you'd like to save your changes or not. Press "Enter" to confirm the change, press "Back" to not save the change.
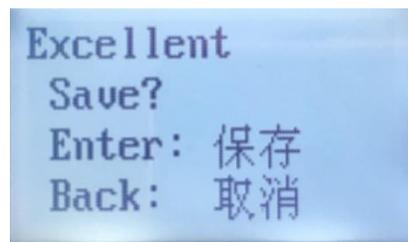
This concludes the steps on running your first metal cutting file on your HP Series Machine. If you have any questions about cutting metal or engraving/cutting organic materials, please do not hesitate to contact Technical Support via email or phone call for assistance.

Finding the Focal Point Without AutoFocus

Finding the focal depth of your laser machine without using the AutoFocus function can take a little bit of trial and error but can create a variety of results. This application can only be used in Normal Mode and with organic material, for metal materials you would need to follow the instructions for "Adjusting Your Metal Cutting Parameters" on the previous page to find the best focal depth for your metal laser head and metal cutting applications. Before starting this section, please make sure the non-metal laser head is installed, that you've read through the "How to AutoFocus Your Laser Head (Non-Metal)" section of this manual, and that you are in "Normal Mode." We want to make sure that the laser head assembly is at the correct position (at the lowest position, right above the Z+ limit switch) to prevent any serious damage to the laser head and its components.

To find the best focal depth, you are going to put a piece of wood down on the worktable and run the AutoFocus function (More button > Z AutoFocus). Once the machine has finished focusing, you are going to pulse onto the wood at 95% max power by using the Laser button. Once the pulse has been burnt into the wood, you can write down the coordinate for the Z-Axis next to that pulse mark (press where it's showing the X & Y coordinates on the Touch Panel to switch to the Z & U coordinates of the machine).

After you have the pulse marked onto your material, you will then raise or lower the worktable and pulse at different heights. You will be marking each Z-Axis coordinate for the corresponding pulse long the way. What you are looking for is the smallest dot possible burnt onto your material. This will be your new focal depth. An example is shown below, the pulse mark we started at was 7.3.
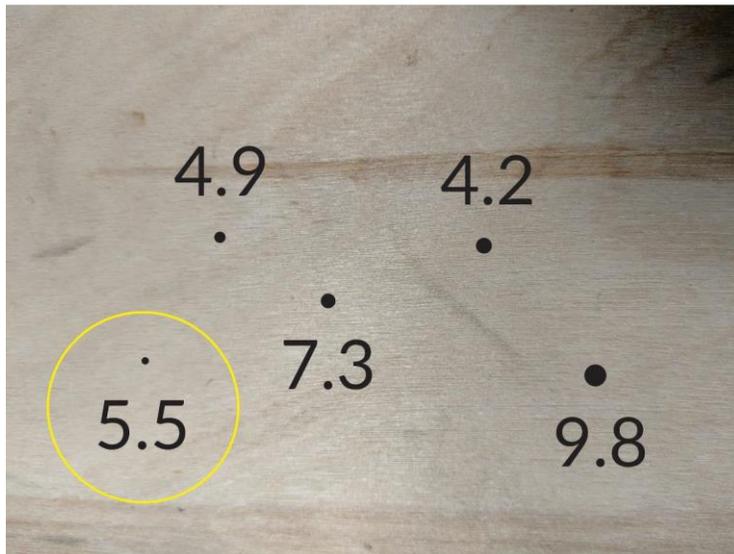
Examples of pulses, each at different heights

After you have your desired focal depth, you will need to update your AutoFocus Distance on the touch panel. To change your AutoFocus Distance, press the Menu button > Common Parameter Settings > Common Parameters > AutoFocus Distance (mm). You will input the number that you found works the best, which in our case is 5.5.

After doing these steps you can AutoFocus your laser again and it will go to the number you have set in the common parameter settings.

Note: The numbers that are shown above were used as examples and your machine may not produce the same results at the same focal depths that are shown above.

Aligning the Optics

Your HP Series Machine left our facility after being aligned and quality assessed prior to being shipped to you. Therefore, when you receive your machine, you should not need to do any tuning of the optics or aligning of the mirrors. However, LTL freight trucks can produce quite a bit of vibration to your laser machine or hit obstructions such as potholes or speed bumps along their journey, which can cause the optics to shift slightly.

Majority of the time, you should not have to tune the optics when first running your machine. But you will need to adjust your optics down the line as you replace the consumables within the laser machine, this includes but is not limited to lenses, tubes, and mirrors.

We have created a video to help you while aligning the mirrors or tuning the optics of your machine. You can scan the QR code to the right to open the video.

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

By studying the diagram shown below, you can see the simplicity of the system: One long glass tube, three small mirrors and a laser head, that's it. The light/laser travels in a straight line, adjusting the laser tube in the rear to hit first mirror (A dead center first, then adjust mirror (A to hit mirror (B dead center. And finally adjust mirror (B to hit laser head dead center.

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 LASER button on the LED panel.
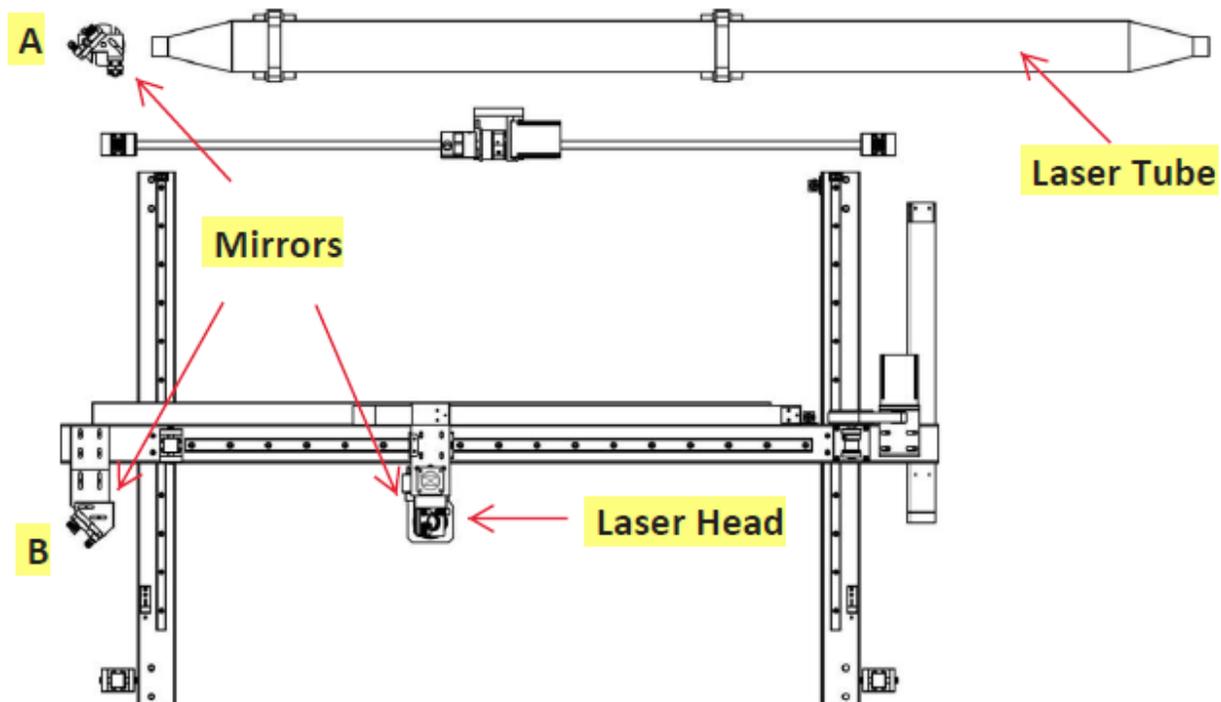
Aligning the Optics

Adjusting the Tube Brackets

Please use caution as the laser beam itself is invisible and can cause serious injury. Any time the laser beam is being fired to align the tube or mirrors with the doors open, your CO2 laser safety glasses should be worn by the operator and any other bystander in the area.

The laser machine should be turned **OFF** while making any adjustments to the optics and only be turned back on to do pulse tests after adjustments have been made.

The tube bracket secures the long glass laser tube to the cabinet. The bracket has two adjustment parameters. You basically can move it vertically up and down, and horizontally front and back. All adjustments are accomplished using the Height Adjustment Wheel (vertical adjustment and unscrewing/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 loose, you have about .5-inch travel from front back. Both brackets have the slotted holes machined in the cabinet for this purpose.

The vertical adjustment is simple, just loosen the two vertical adjustment Allen screws and lower or raise the upper bracket using the Height Adjustment Wheel. With these two adjustment parameters aligning the tube to hit the first mirror requires little effort.

After adjusting the laser tube and brackets, use the "Pulse" button on the touch panel to see where the laser beam has marked the tape on the mirror A, located at the back left corner of the machine, closest to the end of the laser tube.

An easy method of identifying exactly where the laser beam hits the mirror is to place a piece of masking tape over the mirror as shown below, use the least adhesive tape you can find like painters' tape or masking tape. The laser will quickly burn through the tape leaving its mark. Using to strong an adhesive just leaves a mess to clean up afterwards. Remember to use caution, if the laser is way off target it could shoot into the room, missing the mirror, the cabinet and hitting someone or something. This has the potential to injure bystanders, the operator, and possibly the room the laser sits in.

The laser beam should hit dead center of the mirror, if this is not the case, adjust your tube until you achieve the desired result.
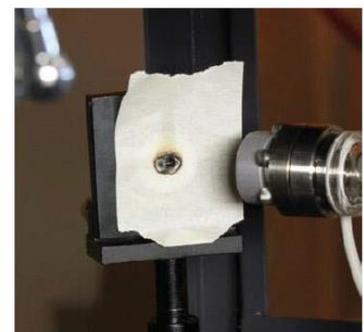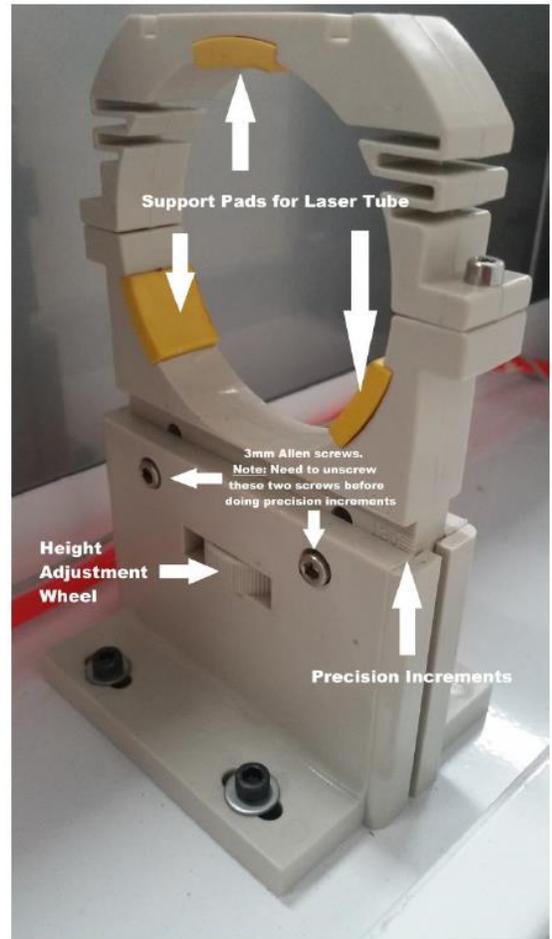
Aligning the Optics

Adjusting the Mirror Brackets

After the laser tube has been adjusted to hit Mirror A dead center, we must now adjust the Mirror B until the laser beam hits directly into the center of Mirror B from Mirror A. You may need to adjust Mirror A and Mirror B to get the perfect alignment.

Adjust the mirror brackets is much like adjust the tube brackets, there are macro and micro adjustment options. It is unlikely that you will need to adjust the macro adjustments for your mirrors. The micro adjustments as micro adjustments, otherwise known as the fine adjustments, should be able to adjust your mirrors as needed.

An illustration of the mirror bracket is shown to the right, showcasing the fine/micro adjustment screws. The machine should be off while making any adjustments to the optics hardware. After the adjustments have been made, turn the machine back on and press the "Pulse" button to see where the laser beam hits the tape on the mirror.
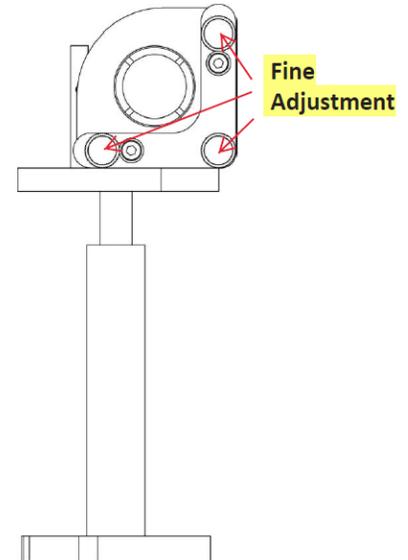
If you pulse the laser beam and see no burn mark, take a piece of cardboard to make a larger target and see where the laser beam may be pointing to.

After you see where the laser beam is going, turn the laser machine off and use the fine/micro adjustment screws on the bracket to adjust the positioning of the mirror. Once the adjustments are made, turn the machine back on and press the "Pulse" button on the touch panel again. Continue this process until the laser beam hits from the tube to the center or Mirror A, and then the center of the laser beam on Mirror B from Mirror A.

After the laser beam is aligned from the laser tube to Mirror A, to Mirror B, we now need to adjust Mirror B, so the laser beam hits the center of the mirror located on the laser head.

We know that the alignment of the laser beam from the tubes to the mirrors can be cumbersome, time consuming, and sometimes frustrating. But, in order to achieve great results with your laser machine, the alignment of the laser beam is extremely important and plays a huge role in your overall result.

With that being said, we have created a tool that can make laser alignment a little easier and user friendly, a laser alignment tool. If you wish to purchase the laser alignment tool, scan the QR code on the right side of this page. This QR code will also give you more information on the alignment tool and an instructional video on how it works.

Also, if you ever have any questions on aligning your laser machine, please reach out to Technical Support via email or phone.

Replacing the Lens

Your laser lenses are considered a consumable but, if you take care of them, they can last you for quite some time. Your lens will need regular maintenance which we will review in the "Maintenance" section of this manual towards the end. It is extremely important that you keep your lens clean and dry to extend the life of the lens. It is recommended that you purchase a water separator for your air compressor to minimize the amount of liquid that can get into your air lines. Water on your lens can cause your lens to become spotty or damaged. Also, if you live in a humid climate or your laser resides in a humid area, it is recommended that you purchase a dehumidifier as humidity can also cause for moisture in your lens housing and machine.

Also, an important thing to remember is that your lens should always be curved side up when installed, as shown in the illustration to the right.
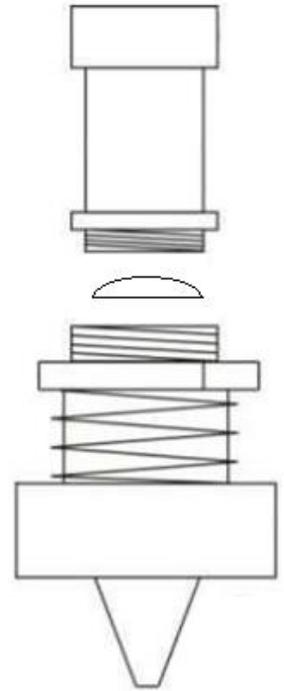
Non-Metal Laser Head Lens Replacement

This process will be similar to how we started the process of removing the Non-Metal Laser Head to a Metal Laser Head.

First, you will want to make sure your laser head is as far down as it can go, this is to ensure your dust cover can be removed. To move the laser head down, go to the secondary touch panel screen and use the down facing arrow button labeled with a "Z". Hold this button down until the laser head will not go any farther down.

Remove the dust cover from your non-metal laser head and put it off to the side. Next, you will detach your air regulator hosing from the air regulator port on your laser head. Then unscrew the retaining nut from the laser head assembly, remember to keep your other hand under the laser head nozzle, as it will fall once the retaining nut is loose. Take the retaining nut and put it off to the side with the dust cover.
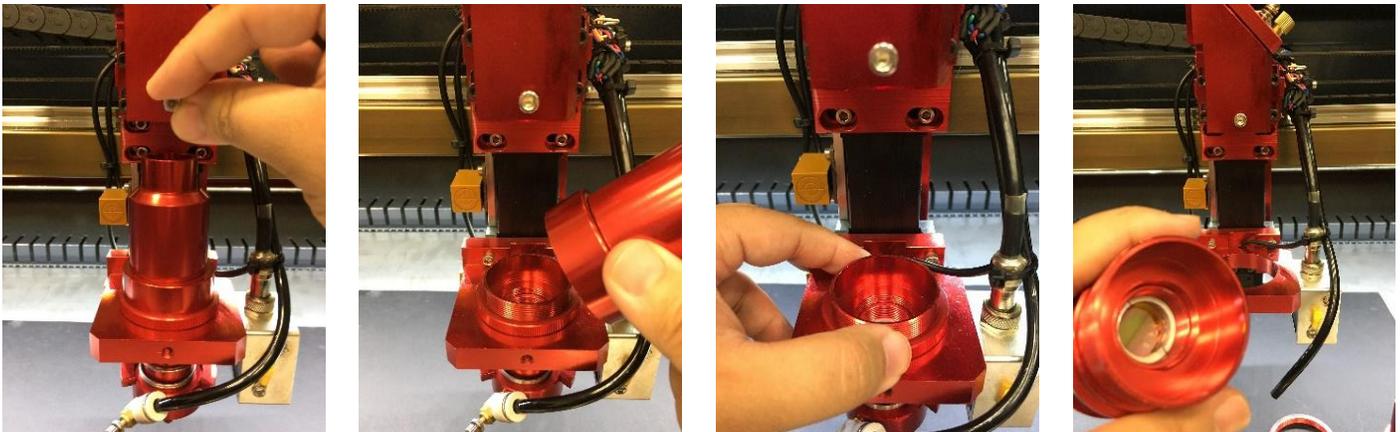
After the laser head is free from the machine look inside the top of the laser head that was removed from the base, you will see what resembles the image on the right-hand side. Notice the little grooves on both sides of the retaining ring, this is where you will use your lens removal tool to remove the lens from the housing.

Replacing the Lens

Non-Metal Laser Head Lens Replacement (Continued)

Remove the "Lens Removal Tool" from your toolbox, shown in the image to the right as number 4. This will be the smaller of the two removal tools.

Gently place the lens removal tool into the grooves and rotate counterclockwise until the retaining ring is free from the housing. It is extremely important you are careful while using the lens removal tool, as it can scratch the lens. Once the retaining ring is loose, your lens can fall out, it is recommended you do this over a soft, clean surface to prevent the lens from scratching, cracking, or breaking in case it falls out.

Once the retaining ring is free, remove the rubber O-ring, and gently pop out the lens. Again, we recommend you do this over a clean, soft surface to prevent the lens from getting damaged.

If you are just cleaning the lens and re-installing it, reference the section "How to Clean Your Laser Lens" section in the "Maintenance" section of this manual.

If you are installing a new lens, take the new lens out of its packaging, we recommend using finger gloves to minimize getting dirt, oil, and fingerprints on the lens. Place the lens with the curved side up and place a new O-ring around the top perimeter of the lens. Once the lens and O-ring are placed inside of the lens housing. Gently put your retaining ring back onto the O-ring and use your lens removal tool to gently screw in the retaining ring to the lens housing. Be very careful with the lens removal tool, it can scratch and damage your lens if used with incorrectly. It is extremely important that the retaining ring is snug but not overly tight, the lens is fragile and can crack is the retaining nut is too tight.

After your lens is replaced back into the lens housing, place the laser head assembly with the nozzle and lens housing back into the mount on the laser head, use the retaining nut and screw it back on to secure the laser head to the mount. Place the dust cover back onto the retaining nut and take the top portion of the dust cover and place it into the top of the assembly and secure it into place by tightening the set screw. You have now changed your laser lens in the non-metal head.
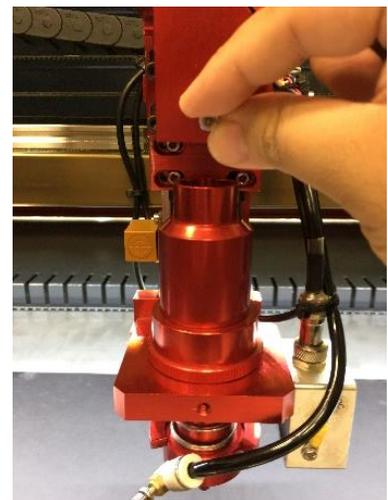
Replacing the Lens

Metal Laser Head Lens Replacement

Make sure your laser head is as far down as it can go; this is to ensure your dust cover can be removed. To move the laser head down, go to the secondary touch panel screen and use the down facing arrow button labeled with a "Z". Hold this button down until the laser head will not go any farther down.

Remove the dust cover from your metal laser head and put it off to the side. Unlike the non-metal laser head lens placement, the metal laser head has its own lens housing. Remove the lens housing by rotating counterclockwise using the ridges for grip. Once the lens housing is removed, the lens is at the bottom of the housing.

Remove the "Lens Removal Tool" from your toolbox, shown in the image to the right as number 4. This will be the smaller of the two removal tools.

Gently place the lens removal tool into the grooves and rotate counterclockwise until the retaining ring is free from the housing. It is extremely important you are careful while using the lens removal tool, as it can scratch the lens. Once the retaining ring is loose, your lens can fall out, it is recommended you do this over a soft, clean surface to prevent the lens from scratching, cracking, or breaking in case it falls out.

Once the retaining ring is free, remove the rubber O-ring, and gently pop out the lens. Again, we recommend you do this over a clean, soft surface to prevent the lens from getting damaged. If you are just cleaning the lens and re-installing it, reference the section "How to Clean Your Laser Lens" section in the "Maintenance" section of this manual.

If you are installing a new lens, take the new lens out of its packaging, we recommend using finger gloves to minimize getting dirt, oil, and fingerprints on the lens. Place the lens with the convex side (curved side up, facing towards Mirror #3 when the lens housing is installed back on the metal laser head assembly) and place the rubber O-ring on the concave side (bowl-shaped) of the lens. Once the lens and O-ring are placed inside of the lens housing. Gently put your retaining ring back onto the O-ring and use your lens removal tool to gently screw in the retaining ring to the lens housing. Be very careful with the lens removal tool, it can scratch and damage your lens if used with incorrectly. It is extremely important that the retaining ring is snug but not overly tight, the lens is fragile and can crack is the retaining nut is too tight.

After your lens is replaced back into the lens housing, screw back on the lens housing into the metal laser head assembly. Place the dust cover back onto the metal laser head assembly and secure it into place by tightening the set screw. You have now changed your laser lens in the metal head.

Maintenance Schedule

Making a Maintenance Schedule

The easiest way to follow a cleaning schedule is to buy a calendar and write on the dates that you want to do the maintenance. Some maintenance is needed on a regular basis while other cleaning could be an immediate requirement after a disaster. Just know that avoiding the maintenance of your laser could result in the fact that the laser doesn't work right ...or doesn't work at all.

Optics Maintenance Schedule

Focal Lens

This lens is used to focus the laser beam, how often you clean your lens will vary based on the environment, the material you are processing, the power you're running your machine, if you have a water separator, etc. It is extremely important to clean your lens frequently to achieve the optimal results with your machine.

It is not possible to clean the lens while it is mounted in the focal tube. The laser beam alignment should be checked after cleaning is completed. If there is any incident of fire or large issue of smoke/fumes, then it is advised to check the lens and clean it. Use denatured alcohol and/or acetone as the cleaning solvent. Use a lens tissue or cotton tipped swabs (Q-Tips to apply the solvent. Len wipes with alcohol-free solution will also do the trick. Do not scrape the lens. Use the solvent to dissolve the dirt from the lens surface. Only use a soft swirling motion when applying the solvent. Use a dry swab in soft swirling motion while evaporating the solvent. Use as many swabs as needed to result in a clean lens surface. The lens surface should be somewhat difficult to see. Look at a reflection in the lens to help see dirt on the surface. Make sure to clean the lens and not leave water marks or dirt smears.

To ensure machine operators have the proper solvents and materials to clean their optics, we have created an Optics Cleaning Kit, Scan the QR code to purchase from our website.

The focal lens should be replaced if it is cracked, the coating is scratched/pitted, the core material is darkened, the coating is delaminating, 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 lens will cause the lens to become damaged faster.

Mirror #3/C

This mirror is located directly above the focal lens. This mirror should be cleaned at least once a month. If there is any incident of fire or large issue of smoke/fumes, then it is advised to check the mirror and clean it. It is possible to clean the mirror in its mounting bracket, but highly advised to remove the mirror from position and thoroughly clean it. The laser beam alignment should be checked after cleaning is completed. Use denatured alcohol as the cleaning solvent. Use a lens tissue or cotton tipped swabs (Q-Tips to apply the solvent. Len wipes with alcohol-free solution will also do the trick. Do not scrape the lens. Use the solvent to dissolve the dirt from the lens surface. Only use a soft swirling motion when applying the solvent.

Use a dry swab in soft swirling motion while evaporating the solvent. Use as many swabs as needed to result in a clean surface. The mirror surface should be difficult to see. Look at a reflection in the mirror to help see dirt on the surface. Make sure to clean the lens and not leave water marks or dirt smears. 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 laser power and will result in reduced laser power at the target material. Any dirt, contamination, or damage on the mirror will cause the mirror to become damaged faster.

Maintenance Schedule

Mirror #2/B & 1/A

Mirror 2/B is located directly at the end of the gantry rail, while mirror 1/A mirror is located directly in front of the laser tube. These mirrors should be cleaned at least every two months. Use the method of cleaning you used for Mirror #3.

Laser Tube Coupler Lens

This lens is located inside the output end of the laser tube. It should be cleaned at least once every three months. **You must be very careful when cleaning this lens. It cannot be removed from the laser tube.** As with the other lenses and mirrors, Q-tips and denatured alcohol or lens wipes with alcohol-free solution can be used. Be gentle. Ideally, it will only be necessary to remove dust or film contamination from humidity, smoke, or fumes. **Do not scratch this lens; it is not replaceable, purchasing a new laser tube will be the only resolution.**

Mechanical Maintenance Schedule

Linear Rails & Bearings

Linear rails are the guiding rails along the left and right sides, and across the gantry. These rails should be clean, without rust, and have a slight glaze coating of white lithium grease. The linear rails should be cleaned and examined once a month in order to prevent the laser head from seizing to move. The surface of the metal should always have white lithium grease on it such that it is "wet" to the touch.

The best way to see that you need to do some cleaning 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 fresh white lithium grease.
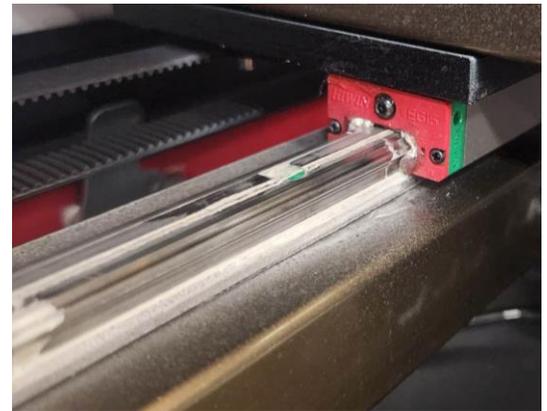
Your bearings should automatically be lubricated by running over the lubricated rails. However, it doesn't hurt to spray into your bearings with white lithium grease.

Rubber Belts

The rubber belts should be checked for appropriate tension at least every six months. You should expect the two side belts to be the same tension and should be tensioned at the same maintenance schedule. These side belts work together to move the gantry from front to rear. If one belt is tensioned more often than another, then that belt could become stretched more than the other. It is difficult to describe how tight the belts should be, but there should not be a slack, sagging, or flapping. If the belt appears to be worn on one side, check the bearing alignment or damage to the matching bearings. 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. If you have questions regarding what your specific belt tension should be for your machine, please contact technical support via phone call or email.

Table & Collection Tray

It is HIGHLY recommended that these areas must be clean of debris before, between and after usage of the machine. Doing so will help prevent any accidental hazards that may cause (ex. fire/excessive smoke the machine to be damaged.

Nuts & Bolts

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

Maintenance Schedule

Accessory Maintenance Schedule

Air Filters

Please consult your user appropriate user manuals for cleaning or replacing the air filters. Air filters work best when air can move through them and catch the specs of dust, fumes, and other debris in the air. If a filter is too dirty, then the air pressure will be adversely reduced. It can be very important to get the bad smells out of the room. Some gases from the laser cutting process can be caustic, nauseating, volatile, corrosive, or even deadly. It is best to use multiple stages of filters to catch particles of different sizes.

Coolant

Firstly, automotive antifreeze should not be used as a laser coolant. The best coolant is deionized water. In the absence of deionized water, distilled water can be used. Tap water should be a last resort, and a temporary solution, if necessary, as it can cause bacteria and mold to produce in the water lines and cause corrosion of metal over time. If tap water must be used, you will need to drain the water lines and the tube of all tap water and then flush it out with deionized or distilled water before running the machine with deionized or distilled water again. The coolant should always be clean and clear. It is a common problem for the coolant to become infested with mold. This often looks like murky green water with algae build up on the inner walls of the hoses. The solution is a multi-step process.

1. Flush out the bad water.
2. Add fresh water with 20 percent bleach. Cycle the bleach-water for 30 minutes. Flush this water out also.
3. Switch the inlet and outlet hoses and flush with more water. This should dislodge mold from inside the laser tube.
4. The flow safety sensor could also be full of mold. The best solution is to take it apart and clean with a 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.

Storage of the Laser

Clean, dry, warm location with no vibration. Make sure there are NO MATERIAL(S) LEFT on the worktable when the machine is not in use.

Dehumidifer

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

Heaters

If your laser is expected to be exposed to temperatures below 50 degrees Fahrenheit, then use a heater. The laser machine is a significant investment and should be kept warm. It is easy to put a ceramic space heater inside the laser machine with the temperature set to something moderate. The heat will move throughout the inside of the laser and keep the glass laser tube warm enough to not freeze or crack. A sudden shock of icy cold water rushing into the warm glass can break the glass laser tube.

Troubleshooting

Machine Not Turning On/Firing

First make sure the power receptacle the laser is plugged into has working power. Plug in some other device, like a lamp or power drill and check for power.

Check the simple stuff first.
- Is the emergency kill button pressed?
- Is the key turned to the on position?
- Has the breaker for that electrical outlet been tripped?
- Is the machine plugged in?
- Do you have a blown fuse?
- Is the chiller on and is the water flowing?

Machine is Turning on But Not Firing

The laser has several protection modes built in to prevent possible injury or machine damage. Problems with any of these systems will prevent the laser from firing, although the head will still move around like the machine is working fine.

- Check the water supply. If the laser does not detect water flowing through the tube the laser will not fire, so make sure either your CW-5000/6000 water chiller is on.
- Make sure all doors are closed. All our machines come with interlocks to prevent operation in the advent lid or doors are open.

Beyond Size! Error!

When running the Box and/or START-PAUSE button, the Beyond Size error message will appear only if the object(s)/image(s) being executed on the worktable is overextending (too big and/or not enough space on the worktable to be done)

The File/Job Starts In the Same Spot Every Time

In most cases, this happens when the "ORIGIN" was accidentally selected. To change the origin position, just move the laser head to your desired location, then press the ORIGIN button again to set the origin.

Hardware

Water Chiller (for CW-5000/6000 Models)

If the water chiller's alarm is going off (beeping noise), it's either (1) the water hoses are pinched so the water flow is being stopped. (2) The water chiller is low in water and (3) The temperature is either below or above the alarm levels (refer to the CW-5000/6000 manual for default temp. levels)

Air Compressor (California Air Tools 8010)

Hold 8.0 gal. Produces up to 120 psi. The air compressor needs to be on at all times when operating your machine. Use the regulator that is attached to the air compressor to adjust the amount of pressure being applied onto your material.