BOSSLASER™

Operators Manual for HP Series

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CAUTION!

- **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 event(s) occur, you will be financially responsible for any damages received to your laser machine.

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Introduction

Welcome to the Boss Laser Family!

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

This manual will help walk you through basic set-up of the machine and how to use your LED 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 1-888-652-1555 or email techsupport@bosslaser.com and a member of our technical support team would be happy to answer your questions.

Our Mission Statement:

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

Warranty Disclaimer

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

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

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

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

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

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

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

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

Fire & Hazardous Materials

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

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

Materials that should **NOT** be cut, etched or engraved:

- 🚫 Polycarbonate- Fumes produced by polycarbonate can cause irritation to eyes, skin and the respiratory tract,

- 🚫 PVC Compounds- Fumes produced by Polyvinyl Chlorine can cause irritation to eyes, skin and the respiratory tract. This material should not be exposed to elevated temperatures.

- 🚫 Vinyl- Fumes produced by Vinyl that has Chlorine can cause irritation to eyes, skin and the respiratory tract. This material should not be exposed to elevated temperatures.

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

Important Warning Labels

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

This machine produces radiation and all doors to the machine should be closed when the laser is operating, unless the passthrough doors are needed. 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.

The "DANGER FIRE HAZARD" warning is crucial to the health of your machine. The laser beam emitted from the machine is extremely hot and can cause any material to catch on fire. DO NOT leave the machine unattended while the machine is firing. Any fire that arises due to disregarding this warning is not covered by the warranty and any damages will be at the cost of the machine owner.

The "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.

⚠️ <u>Laser Safety & Policies</u> ⚠️

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

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

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

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

⚠️ In Case of a Fire:

1. Press the EMERGENCY STOP button located above the LED Panel

2. Lift the lid.

3. Quickly blow out the flame(s), a CO_2 fire extinguisher for serious flames

Laser Safe Materials

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

MACHINE SERIES	LS	HP	MARK/ENGRAVE	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 (Continued)

Plastics:

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

Foam:

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

Textiles & Others:

- <u>Cloth</u>- Leathers, suede, felt, hemp, cotton
- <u>Paper</u> – Cardstock, cardboard,
- <u>Rubber</u> – These can only be used if they do not contain chlorine Teflon (PTFE, Polytetrafluoroethylene)
- <u>Woods</u> – 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

Unpacking & Setting Up Your Machine

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

Figure 1 Crated Laser Machine

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

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

bands. If no damage is visible on the outside, proceed to the opening of the crate. If there is damage to the crate, contact your sales representative and send them pictures so we can report that damage to the carrier. The machine is insured for its full value while in transit and if it is damaged to the point of needing parts or replacement, the carriers are very good at covering those costs. But, the damage must be reported within 24 hours of delivery.

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

Setting Up the Laser for the First Time

- o 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.
- o 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-5000 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
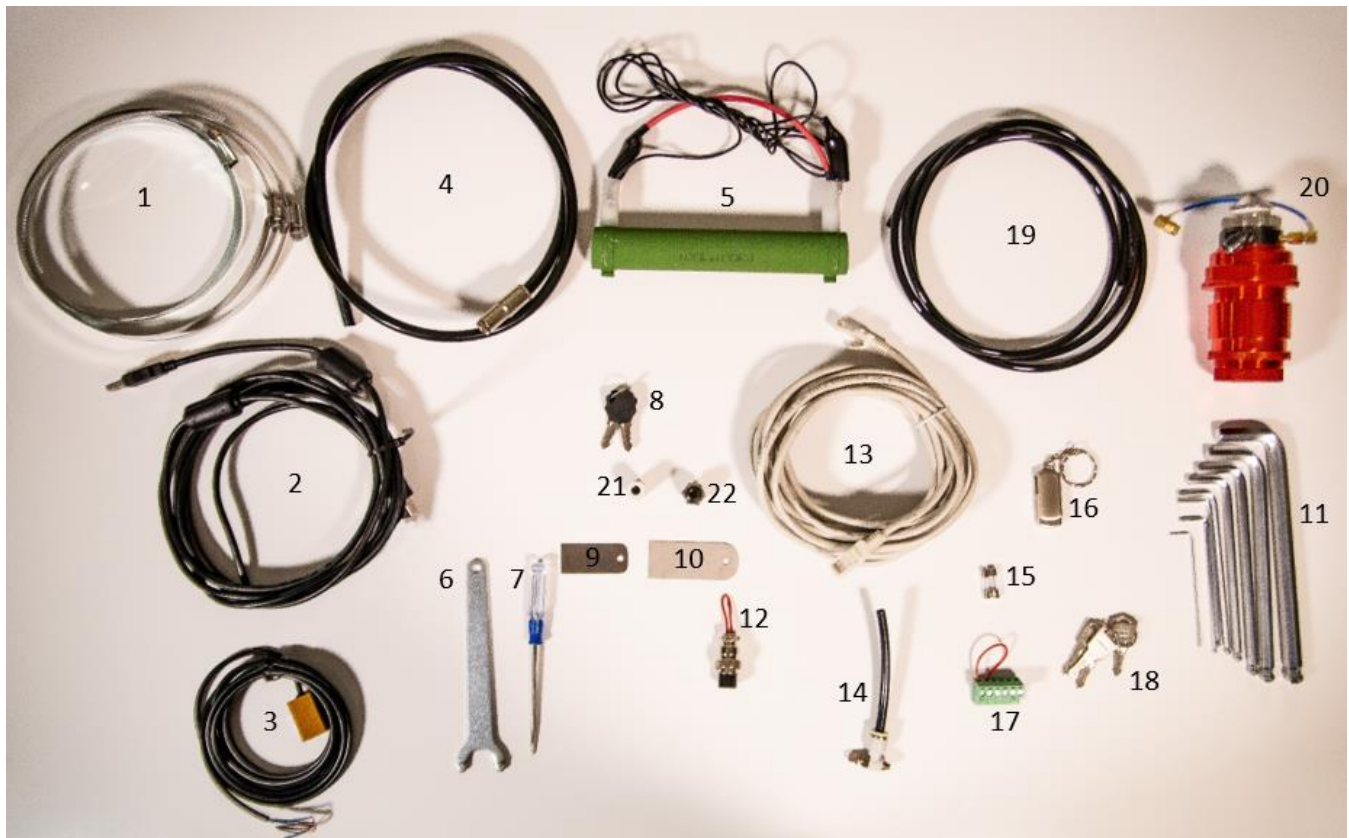
1. Exhaust Hose Clamps (3 count)
2. USB Communication Cable
3. High Precision Proximity Switch
4. 8mm Hosing to 8mm/6mm Fitting
5. Resistor w/ Voltage & GND Wiring Clamps
6. Nozzle Removal Tool
7. Flat Head Screwdriver
8. Ignition Keys (1 set of 2 keys)
9. Lens Removal Tool
10. Mirror Removal Tool
11. A Set of Allen Keys
12. Water Chiller Bypass Signal
13. Ethernet Cable
14. Air Nozzle Regulator
15. 250V/20A Fuses (2 count)
16. 500 MB Flash drive
17. 6-Pin Terminal w/ Wire Loop
18. Universal Machine Door Keys (3 Sets of 2's)
19. 6mm Nylon High Pressure Hosing
20. Metal Lens Housing Assembly
21. Air Pump Fitting
22. Air Compressor Fitting

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

Exhaust Fan Set-Up

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

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

Both HP-2436'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. **Figure 2a** Illustrates the use of an exhaust system configuration with an exhaust blower while **Figure 2b** illustrates the use of a fume extractor.

Figure 2a. Exhaust system configuration with an exhaust blower.
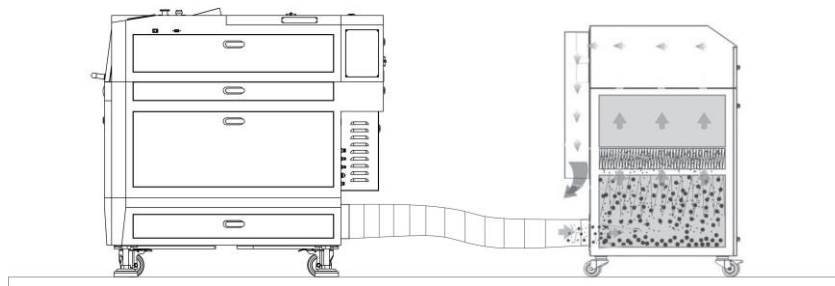
Figure 2b. Exhaust system configuration with a Fume Extractor.

All BossLaser tubes are water cooled and the laser machine will not fire if water is not going through tube. The HP machines come with a **water chiller (5000 or 6000)** shown in **Figure 3**.

Figure 3. A CW-5000 (left) and CW-6000 (right) water chiller.

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

Air Fitting

Figure 4a. An air compressor w/ regulator included with your machine (8 gal, 120 psi)

<u>Note:</u> 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 an water/air separator.

Figure 4b

Notice the ground connector located on the back of the machine (show in **Figure 4b**). This is an external ground designed to help eliminate static electricity. Just run the included ground wire from the connection to any grounded outlet or direct to earth. **This step is not always necessary**, but if you live in an area with low humidity, it's a good idea.

The image in **Figure 4d** shows a loop for those who did not receive a chiller with their laser machine. This would apply to most LS-1416s since the water chiller is an option.

Figure 4c

Figure 4d. Chiller Signal Bypass

If you only have a **Water Pump**, plug this into the *Chiller Signal* outlet as shown in **Figure 4c**. Without this plugged in, the laser will not fire. **Figure 4c** also illustrates the **8mm to 6mm reducer** to hook up the 6mm hosing from the compressor to the machine. Once the above is attached and ready to operate, your new laser machine is ready to go!

If you have received a **Water Chiller (5000, or 6000 series)**, you'll need to plug in the *Water Chiller Cable* (supplied with your Chiller Unit) into the *Chiller Signal* outlet for your laser to fire.

Switches and LED Control Panel

Several switches are installed on the laser cabinet. Depending on model, the first switch to identify is the main On/Off power switch. The picture in **Figure 5** shows a common on/off main switch and the **Emergency Stop** button. The emergency stop push button is normally in the up position, by pressing down all power to the machine will be cut off. To re-set simply twist button, it will pop back up and power will be restored. The keyed on/off switch located at the bottom of the red emergency off button is turned so the bottom of the key points to either the on or off position. This is a security measure to insure no unauthorized use. Store the second key in a safe place.

USB port and USB cable

The laser machine comes with two ways to communicate with your computer. A direct method is the simplest only requiring the data USB cable coming out of the **right side of the machine by the control panel** to be plugged directly into the designated computer USB port. The picture in **Figure 6** shows the black USB cable connection of the machine.

The second communication option is using the USB port on the LED Control Panel to directly read a .ud5 file from the USB memory stick plugged into it. When using this port, the laser machine will read the file and store it into memory. The LED panel will light up and display a message telling you file has been successfully uploaded and to remove the USB memory stick. Both of these options will be covered in more detail later in this manual.

Figure 5. LED Control Panel & Switches

Figure 6. Black USB Hookup

Safe Materials for you and your laser

Lasers use heat to cut and etch a given material. Some materials respond to this method beautifully, others not so much. It is important to know the material you are working with, since some, like **PVC** are easy to cut, but give off a **chlorine gas** that's not healthy for you or your machine. 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.

The LED Keypad

Introduction to the Keys

【**Reset**】：No matter what the state of the machine is in, pressing this button will make it enter the resetting state.

【**File**】: Browse the files stored in the controller main board.

【**Pulse** 】: For optical testing. Once pressed, the CO2 laser will fire.

【**Box**】: Frames the working area from the origin point of the current file.

【**Origin**】: Setting machine's starting point of the current file.

【**Menu**】: To show the main menu.

【**Stop**】: Once pressed, the machine will stop its current function and move back to its origin.

【**Shift**】: The second function switching button (for example, exchanging the Max & Min Power of the four laser sources in the main menu).

【**Start/Pause**】: Pause the machine and keep it stay at location. Press again to resume.

【**Z↑** 】【**Z↓** 】: Directly control the upward, downward, left and right movement in the main menu. When not highlighted by the cursor, it can be used for changing the parameters. When highlighted, use the 【↑】【↓】【←】【→】 for navigating the menus.

【↑】【↓】【←】【→】：For moving the X & Y Axis. Also used to navigate the menus.

【**Z/U**】：Z axis with auto focus. And Z, U, V, W axis movement functions.

【**ESC**】：Exit edit mode (Exit cursor). Return to previous menu.

【**Enter**】：Enter edit mode（Start cursor). Confirm the current operation.

【**Numbers 1-9**】 ：Quickly modify the parameters, as well as quick access to digital corresponding menu item.

【**C**】：For backspace when you are modifying the parameters.

Main Menu Function Introduction

- **Top bar**: Displays the control system software version, date and time.

- **File**: Displays the file name currently being processed.

- **Count**: This number accounts for the amount of times the file currently being processed has finished.

- **Speed**: Displays the default speed of this current file.

- **MaxPower 1 MinPower1 / MaxPower2 MinPower2**: Displays the Max & Min power of laser 1 and 2. Max power means working power. Min power means turning power.

- **Time**: Displays the amount of time worked with this task.

- **Status**: Displays the machine state. Includes working state, idle state, pause state. There will be a percentage to show the working process of the current file under working state.

- **PX PY**: Displays the X & Y coordinate in the working state.

Main Menu Function Settings

Document parameters settings

In the Main Menu area press【Enter】to make the file name highlighted as shown below.
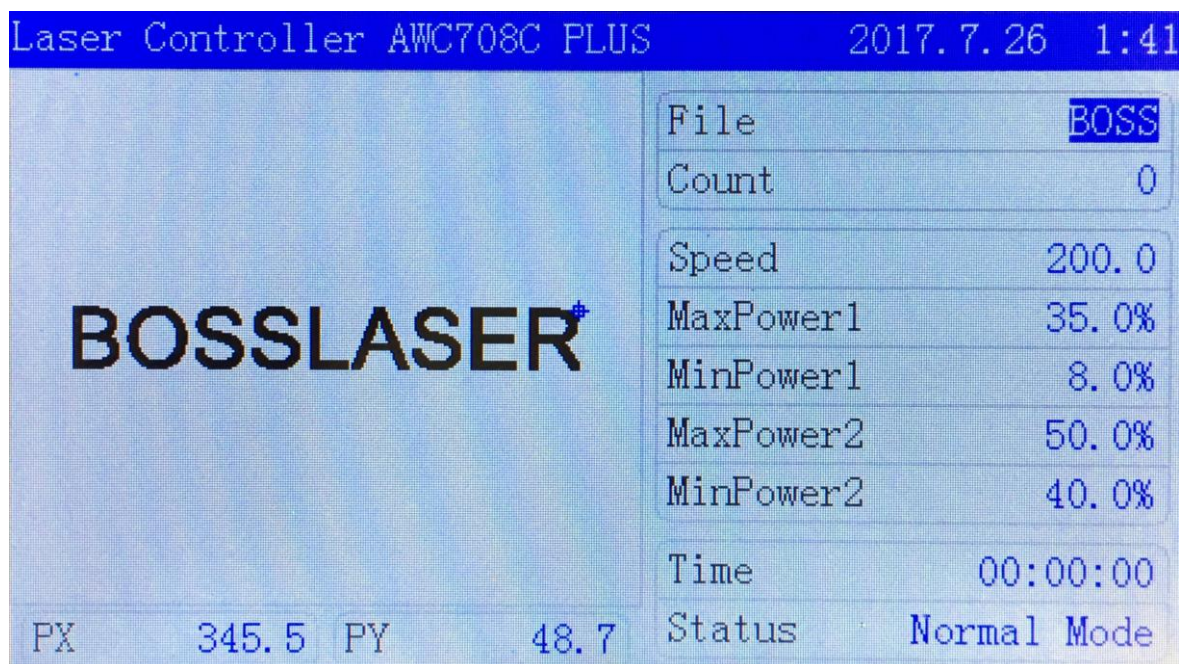
Pressing【Enter 】a second time to enter the file parameter settings. Move the cursor to【Document Params Settings】，Press【Enter】to enter the document parameters settings as shown below.
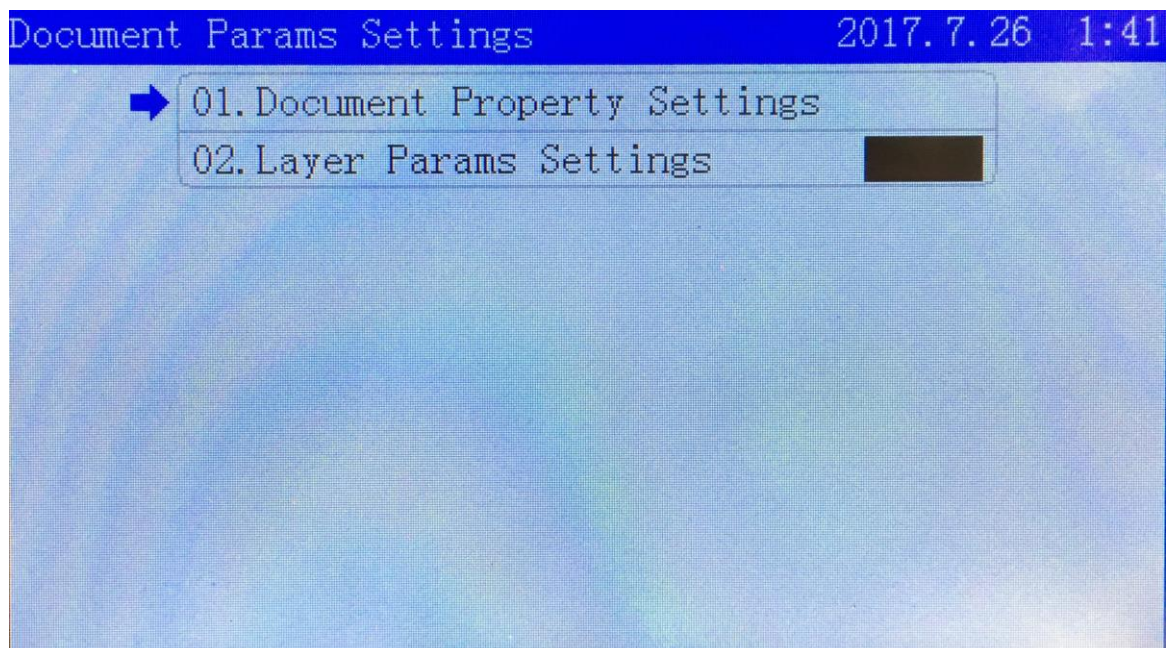
Move the cursor to the options you want to change, input numbers, then press【Enter】to finish it.

- **Repeat Count**: Machine repeat working times.

- **Repeat Delay(s)**: The interval between the initial file being finished and the next one of the same file.

- **Feed Distance(mm)**: Distance of each movement of the feeding axis .

- **X Size(mm)**: The size in the X direction of the file

- **Y Size(mm)**: The size in the Y direction of the file

Layer Parameters Settings

In the file parameter settings, press 【↓】to move the cursor to 【Layer Params Settings】, Press【Enter】 to enter Layer Parameter Settings.

- **Work Mode**: Choose the working state of the processed file.

- **Speed(mm/s)**: Set the speed of the processed file.

- Max Power : Max power of the laser head. Also known as the working power of laser.

- Min Power : Min power of the laser head. Also known as the turning power of laser.

In the layer parameters, move the cursor to the options you want to change, press【Z↑】 【Z↓】 or input numbers 0-9 to change the numbers. Then press【Enter】to accept the changes.

Clearing Total Count

In the main menu, press【Enter 】to make the highlighted cursor to be displayed. Then move it to 【Count】, then press【Enter】to move it to【To Clear Total Count】and press【Enter】as shown below.
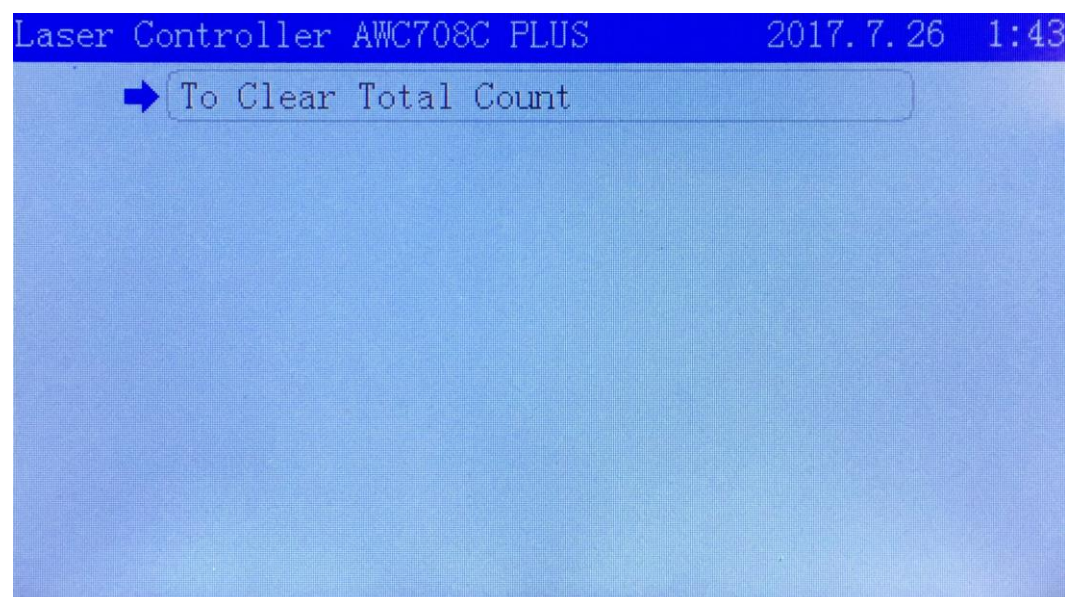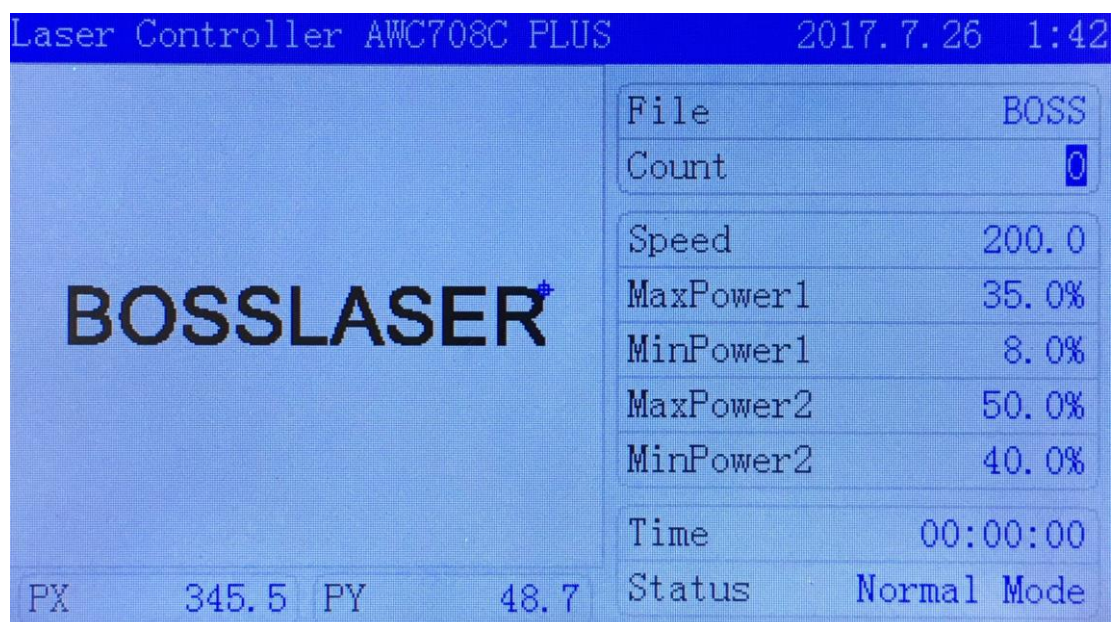
Set Work Property

In the main menu, press 【 Enter 】 to make the highlighted cursor to be displayed. Move it to 【Speed】, press 【Enter】, then find 【Set Work Property】 as shown below.
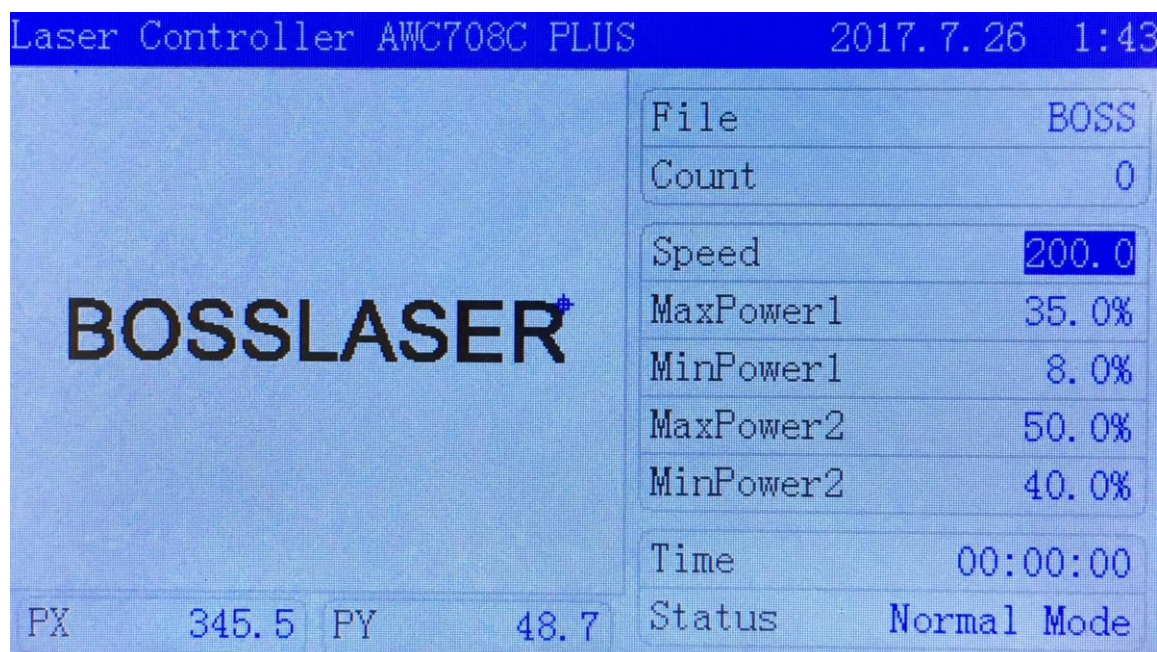
Move the cursor to the options you want to change，Press 【Z↑】【Z↓】or input numbers 0-9 to change the numbers, then press 【Enter】to accept the changes.
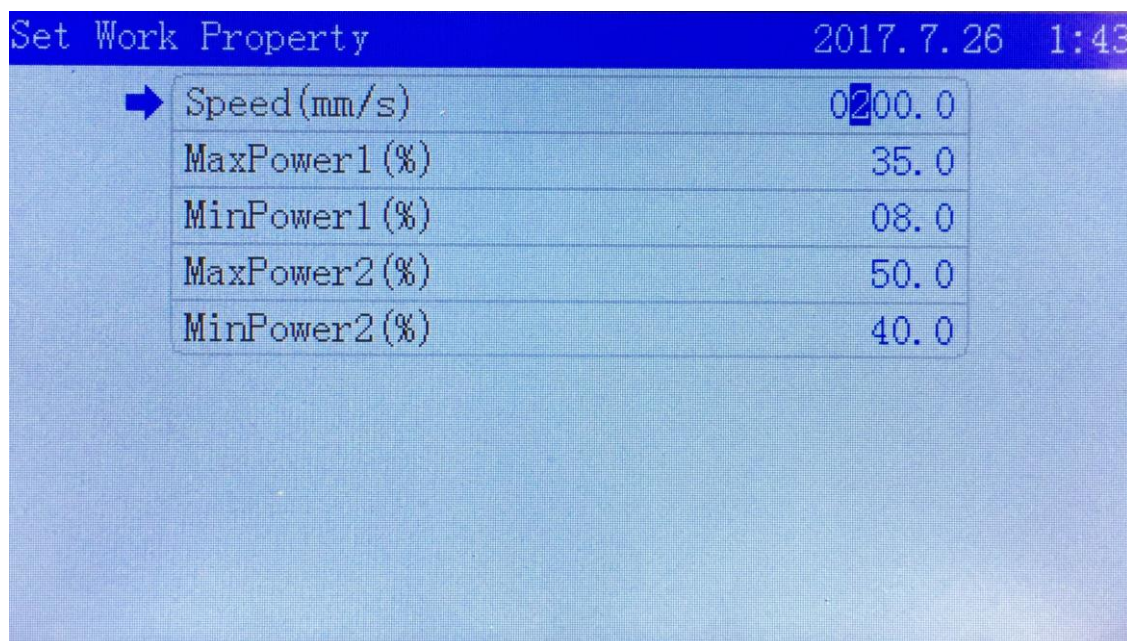
Main Menu Function Settings
U Disk Files

Insert U disk to USB port. If your U disk has a "light indicator" (shows connectivity) and shows that it's connected, press【Menu】to enter the main menu, move the cursor to【U Disk Files】 then press【Enter】to enter U disk files management.
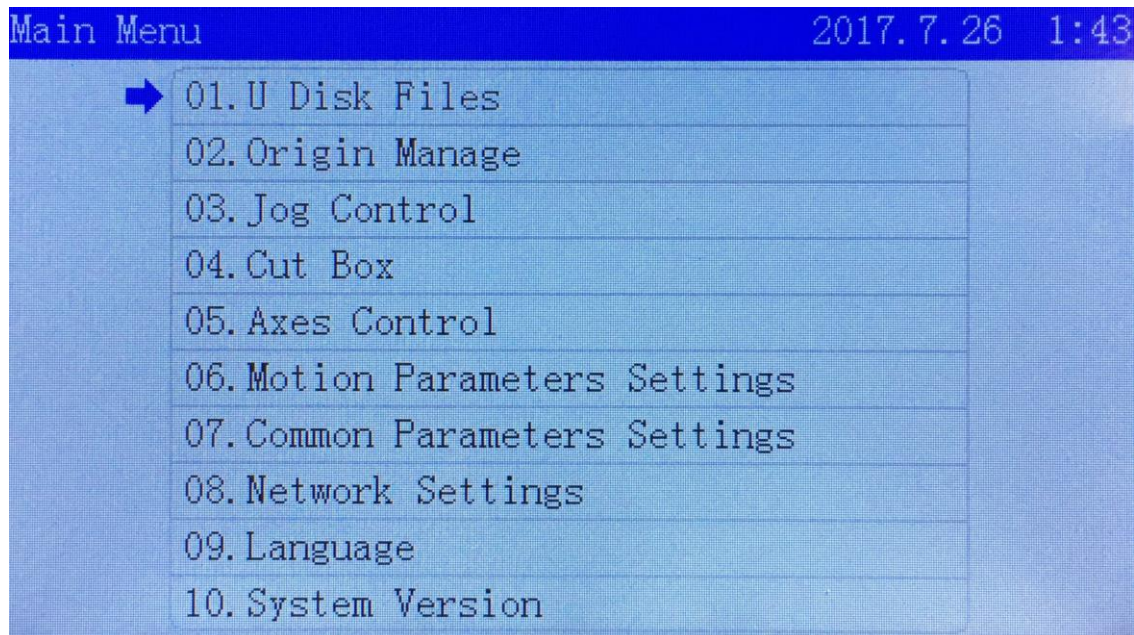
	① U disk should be formatted to FAT 32 File system. Quick Format is forbidden. Any other files formations are not supported. ② Recommend using a U disk with a "light indicator" to ensure if the U disk is connected successfully with the main board ③ When the U disk has never been able to read , try using a different U disk.

U Disk Work Files

Move the cursor to【Work' Files】then press【Enter】
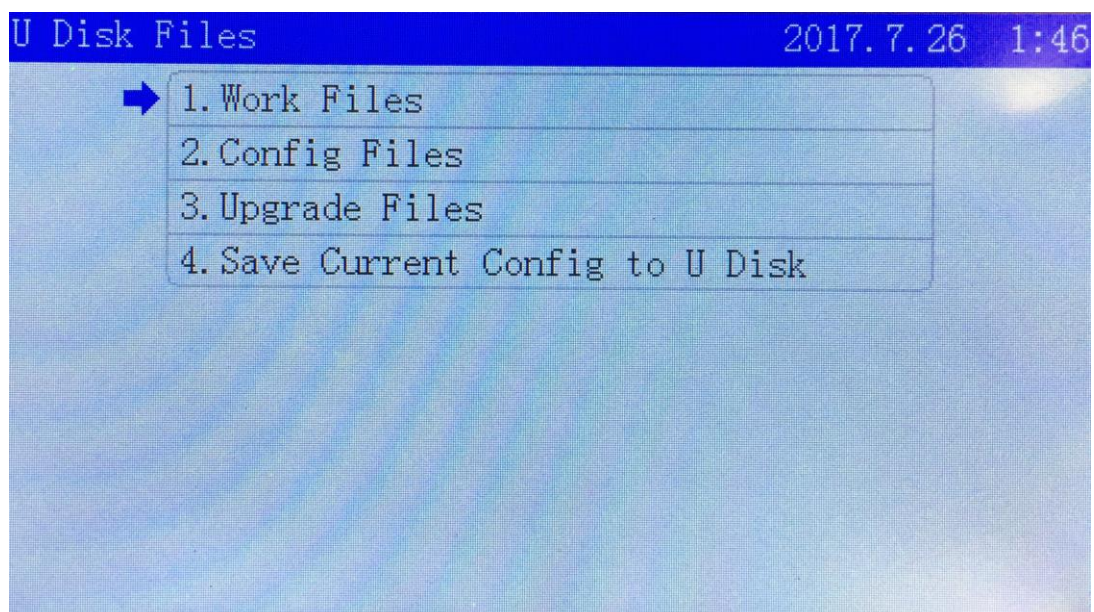
On the panel, the working file in the U disk will be presented. The right side shows the working file previewing. Press【Enter】to copy the working file from U disk to main board storage.
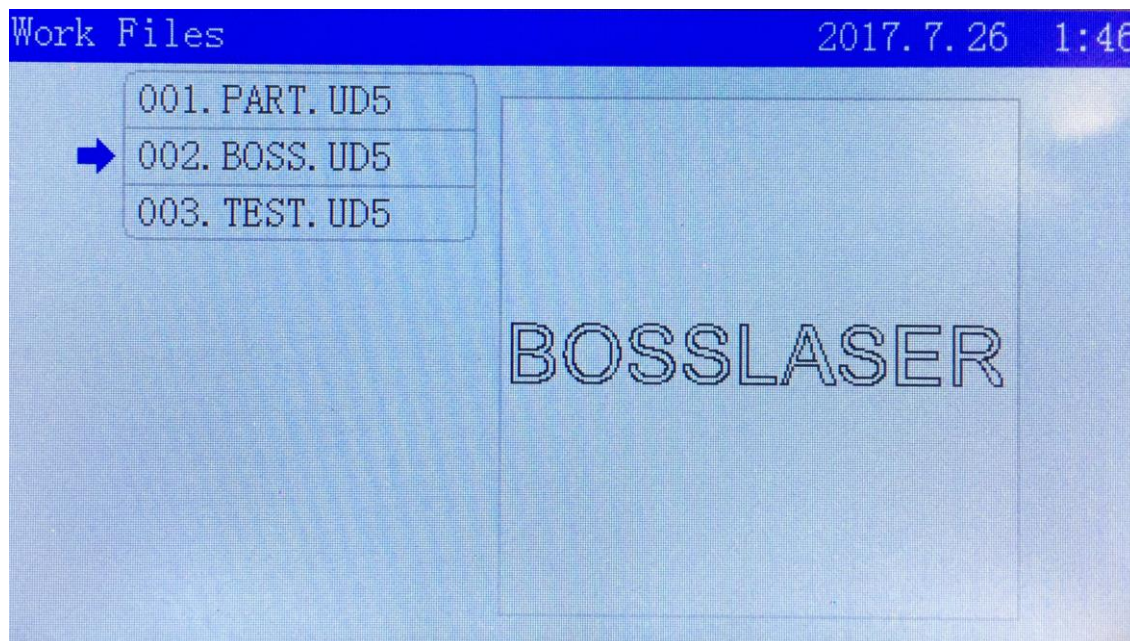
💡	The working file in the U disk is saved with a suffix of UD5. Files other than the .UD5 file extension will not readable.

Config Files.

Move the cursor to 【Config' Files】, press【Enter】to enter it. Move the cursor to the file which you need to copy to main board. Press 【 Enter 】 to accept the changes.
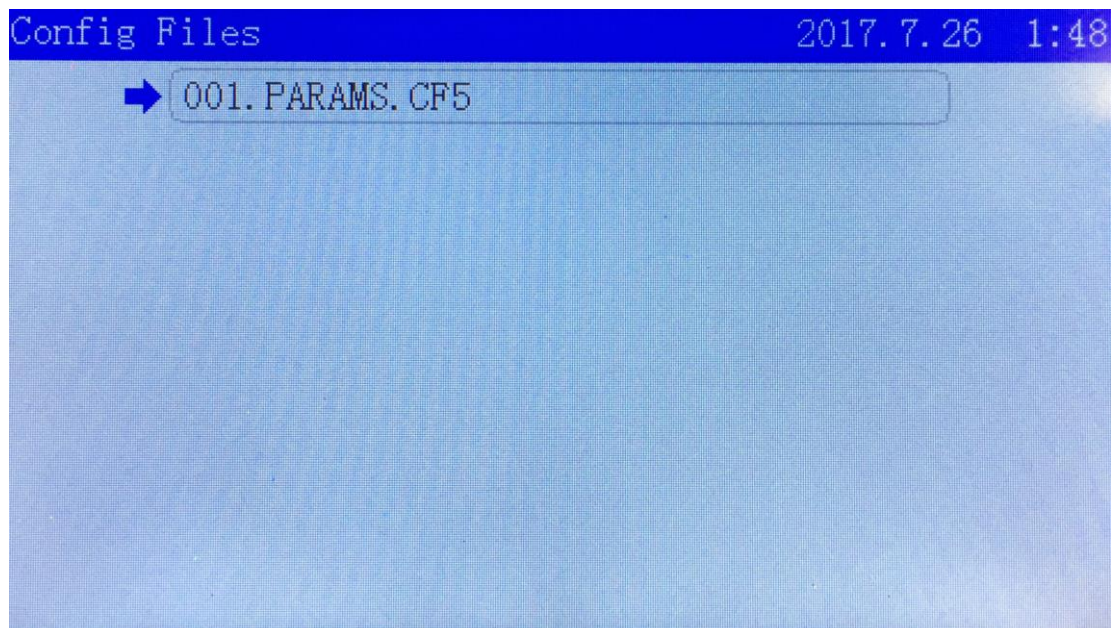
Upgrade Files

Move the cursor to 【Upgrade' Files】and press【Enter】to enter Upgrade Files screen. Move the cursor to the file you need, press 【 Enter 】 then it will start the upgrading process. *PLUS version upgrade files are listed as* **AWC708P…**
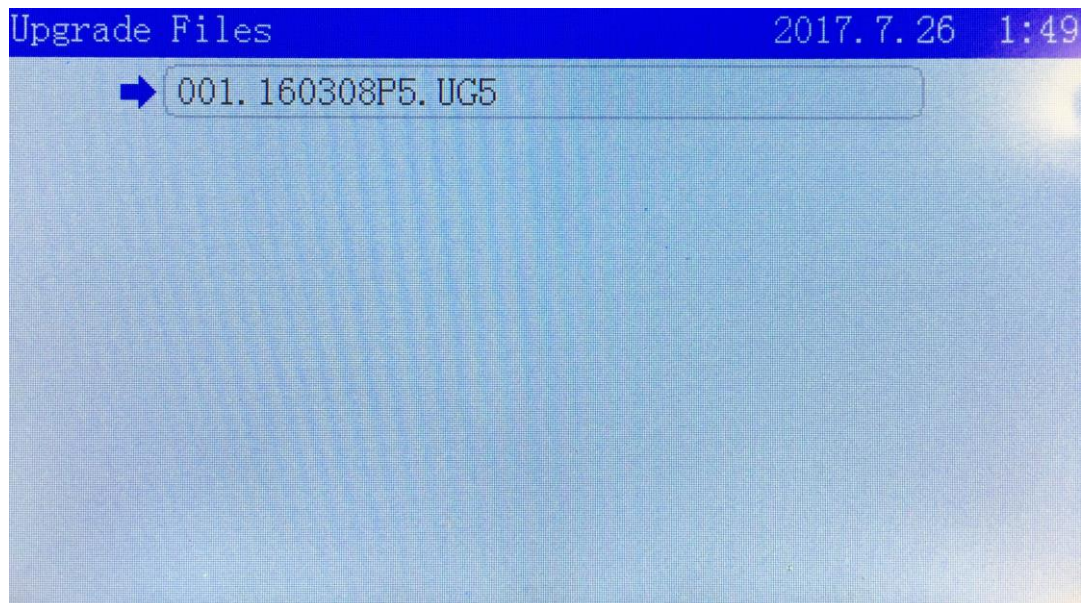
	Do NOT cut off electricity before the upgrade has finished. Otherwise it may lead to a burn out. The upgrade period lasts for 30 seconds. After that, the main board will reset.

Save Current Config to U Disk

Move the cursor to【Save current config to Udisk】then press【Enter】to save onto the U disk. The file will be saved as a "Params.CF5" name.
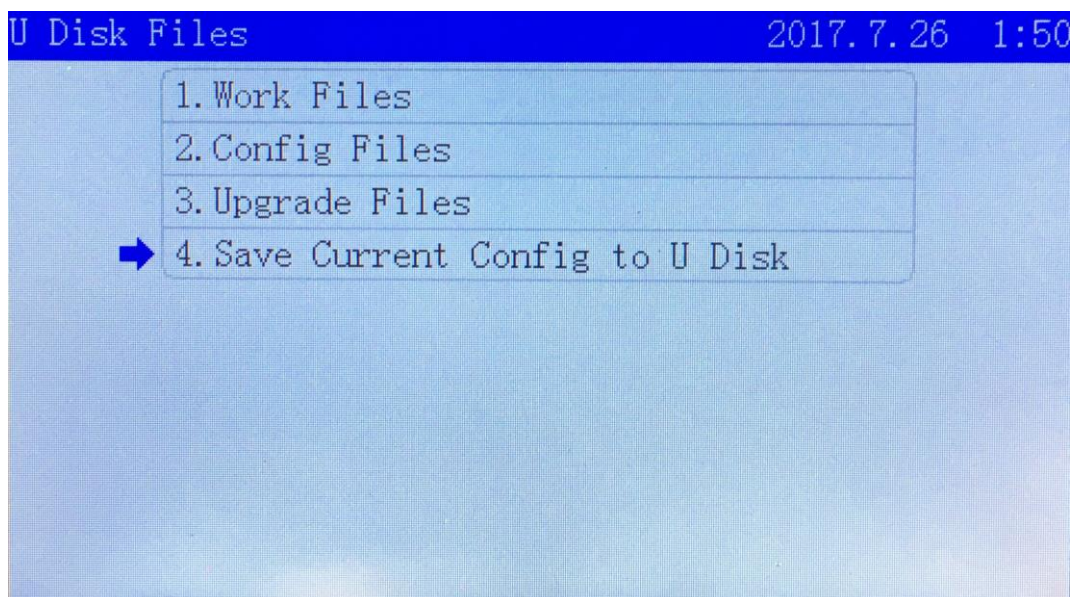
Origin Manage

In main menu, press【Menu】then move the cursor to【Origin Manage】as shown below.
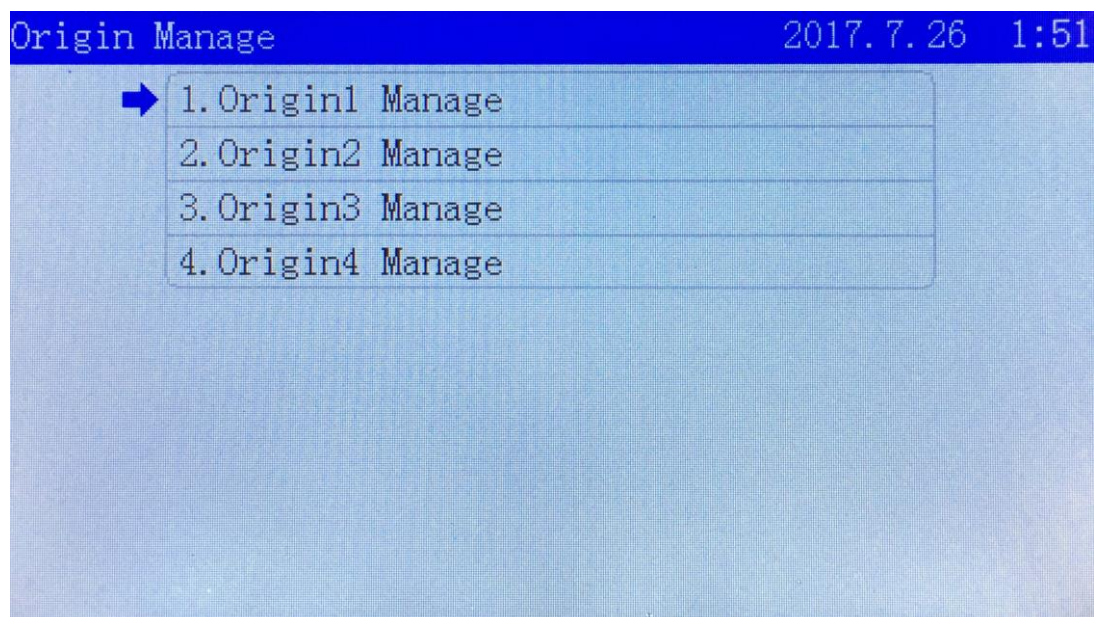
Move the cursor to【Origin1 Manage】, press【Enter】to enter the Origin 1 management interface. Move the cursor to【Set current position as the origin】, press【Enter】to set the current laser head position as origin point.

Move the cursor to "The origin'PX(mm)"and "The origin'PY(mm)". Press【Z↑】【Z↓】or input numbers 0-9 to change the numbers and the location. Press【Enter】to confirm the changes.

```
Origin1 Manage                          2017.7.26  1:51
   ➡ Move Head to the Origin
     Set Current Postion as the Origin
     The Origin' PX(mm)                        0000.0
     The Origin' PY(mm)                        0000.0
```
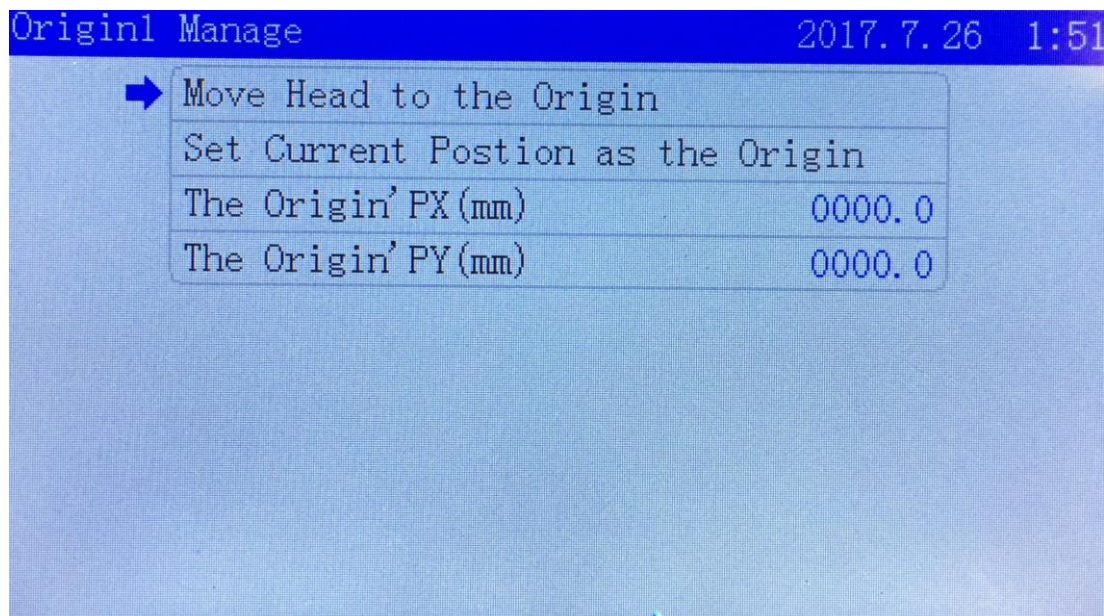
Jog Control

In main menu, press【Menu】.Move the cursor to 【Jog Control】,press【Enter】.
Press【Z↑】【Z↓】or input numbers 0-9 to change the jog distance.
Press【Enter】to accept the changes. In Jog control screen, press【Z↑】
【Z↓】move cursor to a relative joy axis.
Press【↑】【↓】【←】【→】can control their movement.

```
Jog Control                             2017.7.26  1:51
   ➡ Jog Distance(mm)                       00000.0
     XY Jog
     Z Jog
     U Jog
     V Jog
     W Jog
```
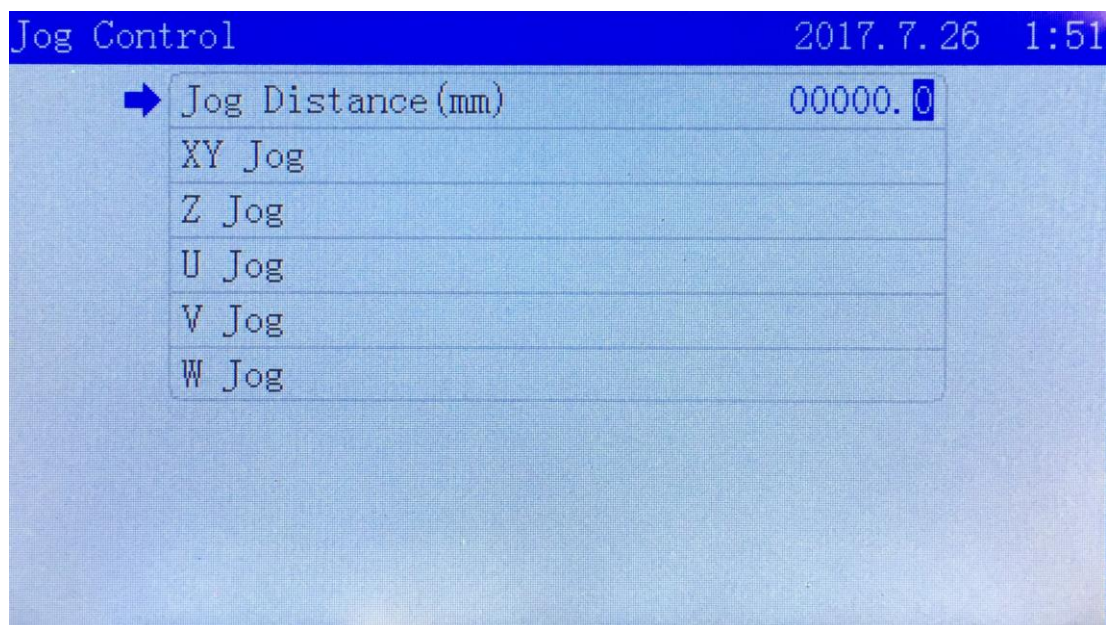
Cut Box

In main menu screen, press【Menu】 and move the cursor to【Cut Box】.

Press【Enter】to enter "Cut box". Move the cursor to "Blank Distance(mm)". Press【Z↑】【Z↓】or input numbers 0-9 to edit the blank distance. After that you can choose 【Start cutting box】and press【Enter】to start cutting box.
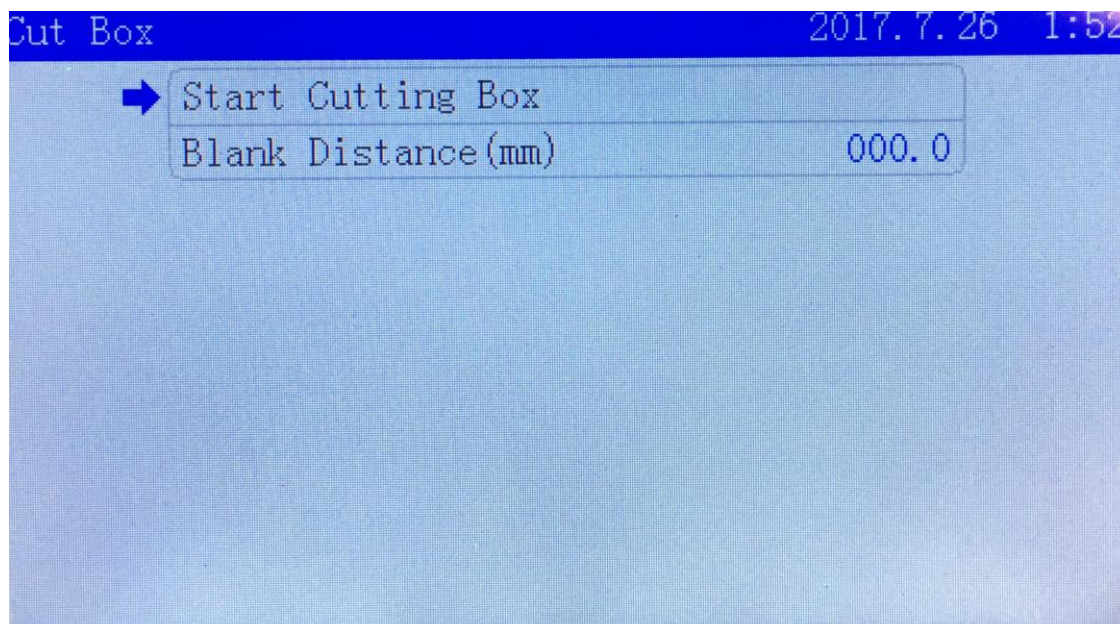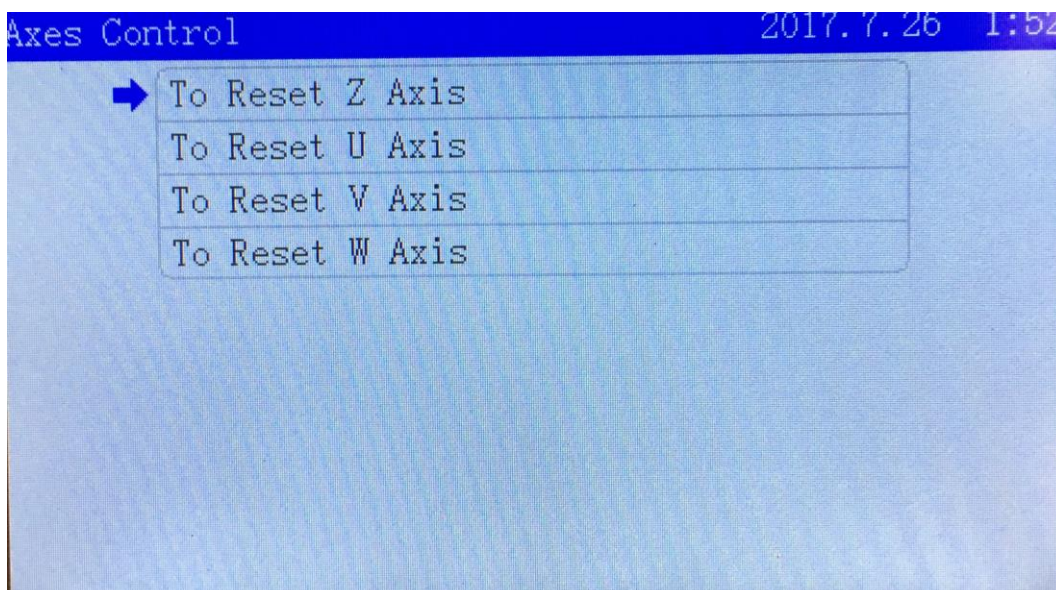

- **Blank Distance(mm)**: The distance from File Box position to the actual cutting box position.

Axes Control

In main menu screen, press【Menu】 and move the cursor to【Axes Control】.

Press【Enter】to enter "Axes Control " screen. Move the cursor to the axes option you need to do the reset on. Press【Enter】to start it.

Motion Parameters Settings

In main menu interface press 【Menu】.Move cursor to 【Motion Parameters Settings 】 press 【Enter】.Press【Z↑】【Z↓】or input numbers 0-9 to change the numbers.Press【Enter】to finish it.

Motion Parameters Settings	2017.7.26 1:52
➡ Space Speed(mm/s)	0200.0
Cut Jerk(mm/s3)	040000
Space Jerk(mm/s3)	060000
Min Acc(mm/s2)	00100
Cut Acc(mm/s2)	01500
Space Acc(mm/s2)	03000
Engrave Acc(mm/s2)	10000
Start Speed(mm/s)	10.0
Speed Factor	1.0

- **Space Speed(mm/s)**: The movement speed of laser head when there is no laser output.

- **Cut Jerk(mm/s3)**: Cutting speed jerk of axes.

- **Space Jerk(mm/s3)**: The Jerk speed of axes when there is no laser output.

- **Min Acc(mm/s2)**: Min acceleration when axes are sped up and down during motion cutting.

- **Cut Acc(mm/s2)**: Cutting acceleration when axes are sped up and down during motion cutting.

- **Space Acc(mm/s2)**: The Acceleration speed of axes when there is no laser output.

- **Engrave Acc(mm/s2)**: Engraving acceleration when axes are sped up and down during motion cutting.

- **Start Speed(mm/s)**: Speed of axes from no movement to startup.

Common Parameters Settings

In main menu screen, press 【Menu】. Move cursor to 【Common Parameters Settings】press 【Enter】.

Work Mode
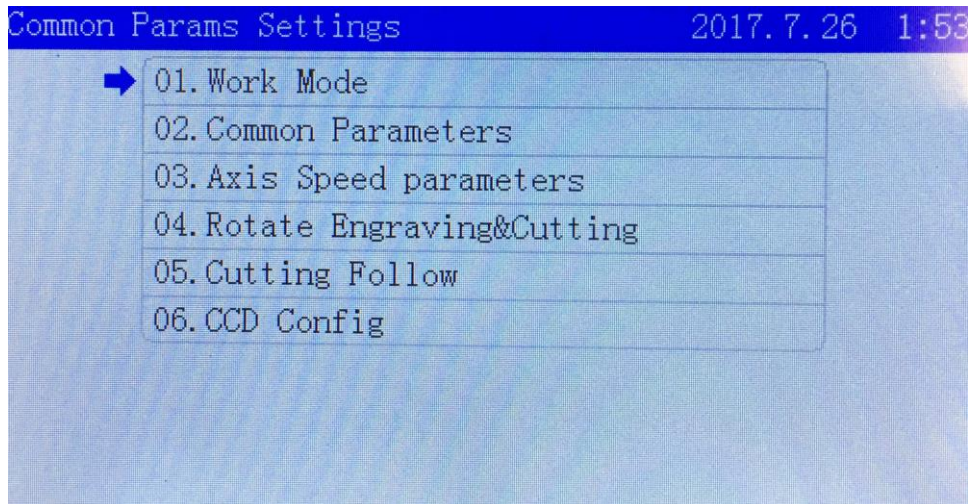
Move the cursor to 【Work Mode】press【Enter】.
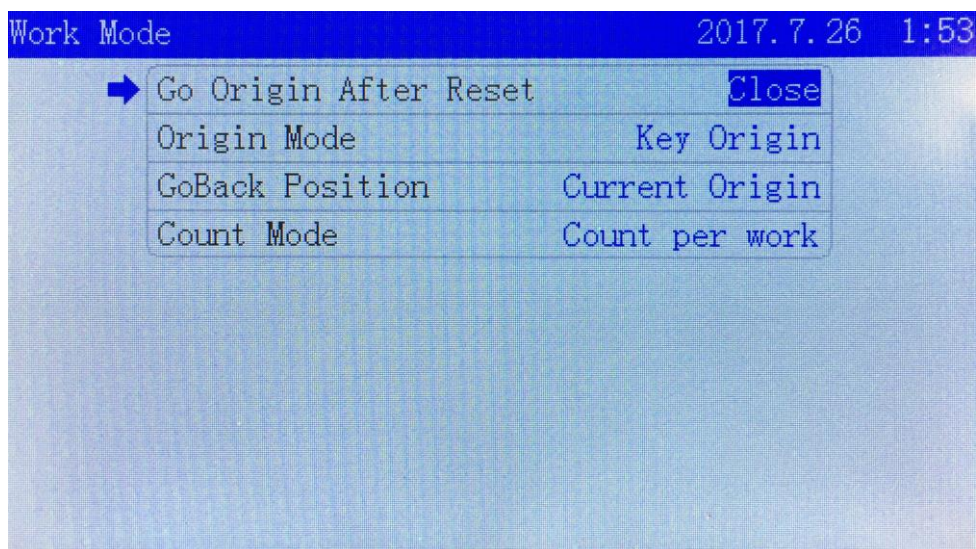
Move the cursor to 【Go Origin After Rest】and press 【←】【→】. You can choose "back to origin point after a reset" as on or off.

Move the cursor to 【Origin Mode】and press 【←】【→】. You can switch origin mode

as 【Software Origin】【Machine Zero As Origin】【Current Position】【Key Origin】.Press 【Enter】to accept the changes.

Move the cursor to 【GoBack Position】 and Press 【←】【→】. You can switch back position mode as 【Goback Machine Zero】【Current Position】【Current Origin】. Press【Enter】to accept the changes. Move the cursor to【Count Mode】and press 【←】【→】to switch the count mode as 【Count Per Work】【Count Per Light】【Single of Array】and press 【Enter】to accept the changes.

Go Origin After Reset: When it's opened, laser head will be back to Origin after resetting. Or It will stay at machine origin point.

Origin Mode: *Current Origin*, or keep the current origin point of machine; *Key Origin*, or press panel "Origin" button after laser head moved to the chosen position; *Software Origin* means the origin point when drawing a file; *Machine Zero As Origin* means set a appointed position as machine's origin point.

GoBack Position: *Current Position* means laser head stay at where task finished; *Current Origin* means go back to Origin point after that; *Goback Machine Zero* means back to machine zero point since all finished.

Count Mode: *Count Per Work* means it will be counted as once after all files cut; *Count Per Light* means it will be counted as once after laser optical output one time; *Single of Array* means it will be counted as once after one of all files in this task is cut.

Common Parameters

In main menu screen, press【Menu】. Move the cursor to 【Common Parameters】
press【Enter】. Press 【Z↑】 【Z↓】 or input numbers 0-9 to change the numbers and finish it.
Then press
【Enter】.

- **AutoFocus Distance(mm)**: The distance from laser head lens focus point to the origin point of Z axis.

- **KeyMove'Speed(mm/s)**: The speed of axis movement when using the control panel keys.

- **RunBox' Speed(mm/s)**: The speed of laser head running in space state, or running box without the laser output.

- **CutBox's Speed(mm/s)**: The speed of laser head optical output and cutting box.

- **Blow Open Delay(s)**: The period between laser head optical output and air blowing started.

- **Blow Close Delay(s)**: The period between laser head optical output stopped and air blowing stopped.
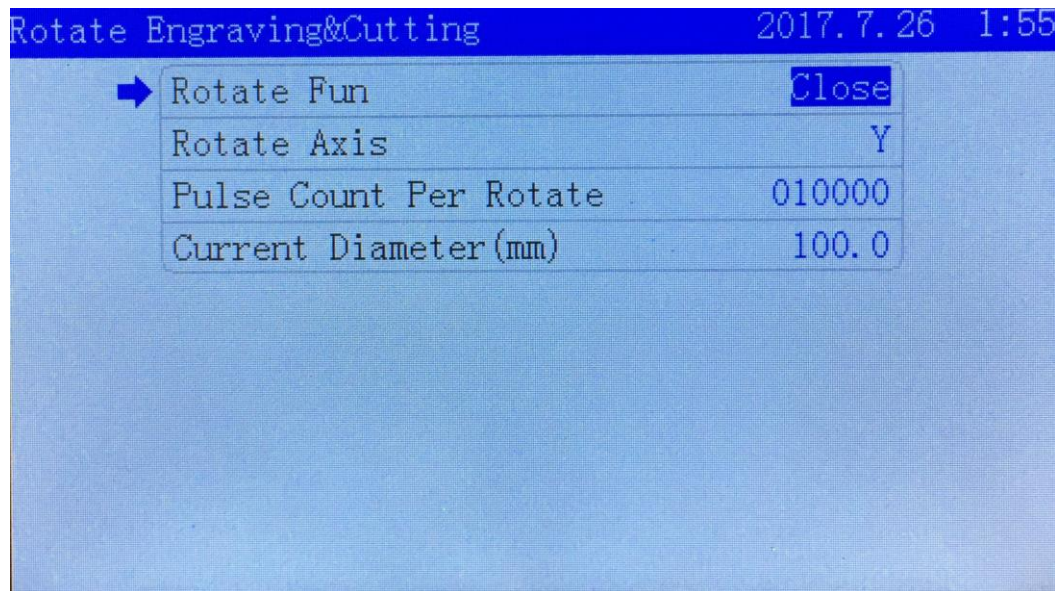
Axis Speed Parameters

In main menu screen, press 【 Menu 】 . Move the cursor to 【 Axis Speed Parameters 】 press 【Enter】. Press 【Z↑】【Z↓】 or input numbers 0-9 to change the numbers and accept changes.

- **Z/U/V/W Work Speed**：Z/U/V/W axes working speed.

- **XY/Z/U/V/W Home Speed**：XY/Z/U/V/W axes resetting speed.

Rotate Engraving & Cutting

In main menu screen, press【Menu】. Move the cursor to 【Rotate Engraving & Cutting】and press 【Enter】，Press【←】【→】to switch each item. Press【Z↑】【Z↓】or input numbers 0-9 to make any changes. Then Press【Enter】to accept changes.

- **Rotate Function**: To enable or disable the rotate engraving function.

- **Rotate Axis**: The chosen axis when rotate engraving function be used with.

- **Pulse Count Per Rotate**: The pulse parameters for the motor to make the rotary axis rotate one circle.

- **Current Diameter(mm)**: The diameter of the material being processed.

Network Settings

In main menu screen, press【Menu】. Move the cursor to 【Network Settings】and press【Enter】. Then press 【↑】【↓】to move the cursor. Press【Z↑】【Z↓】or input numbers 0-9 to change the numbers and accept changes.
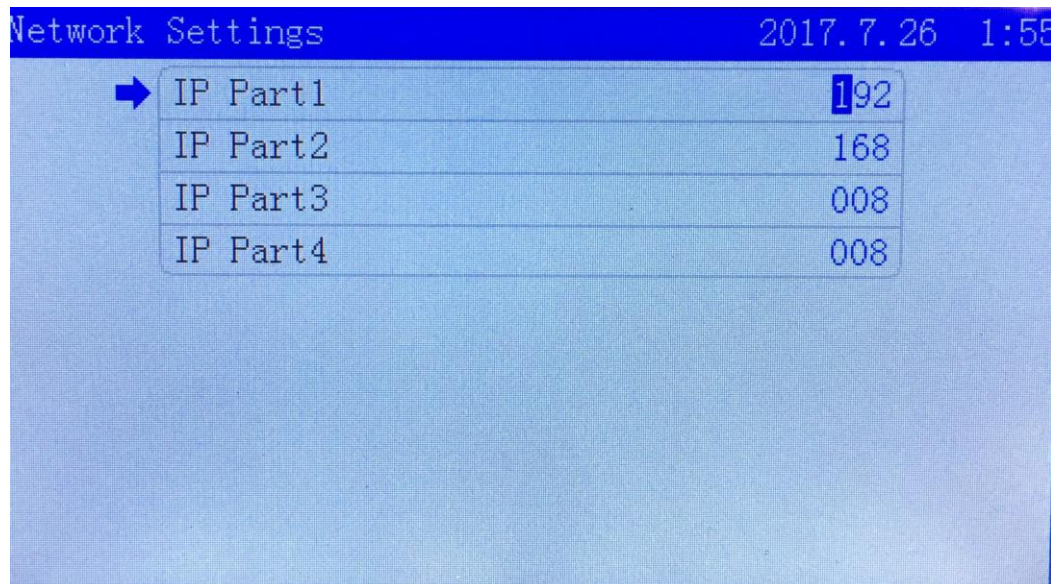
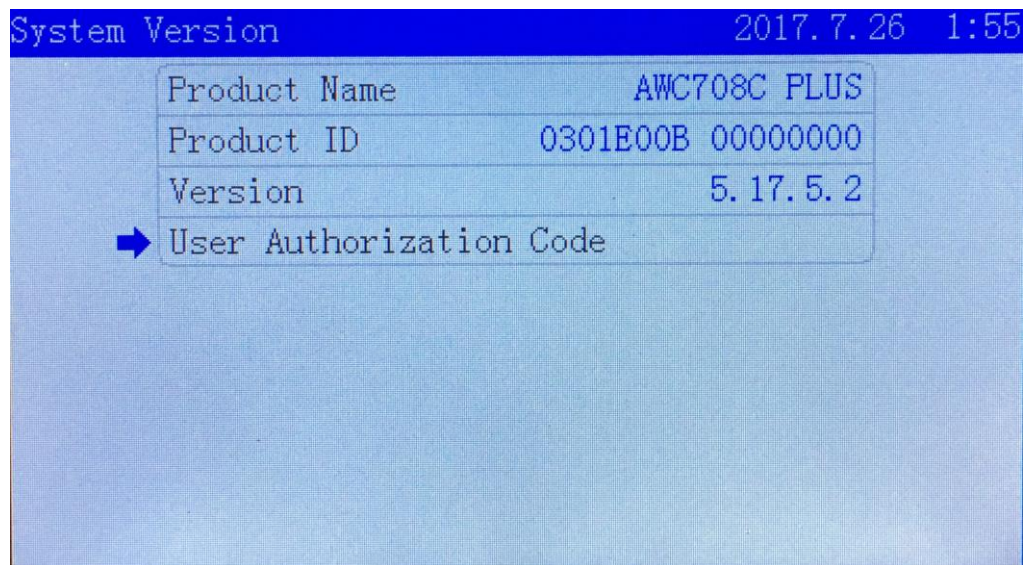**Language**

In main menu screen, press 【Menu】. Move the cursor to 【Language】and press【Enter】. Then press 【←】【→】to switch languages and press【Enter】to accept changes.
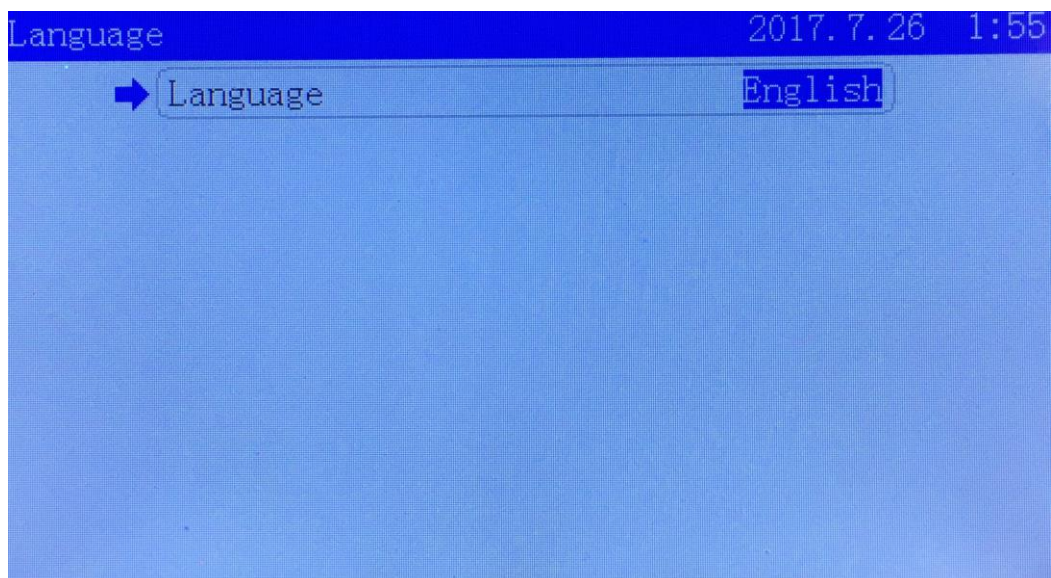
System Version

In main menu screen, press【Menu】. Move the cursor to 【System Version】and press【Enter】to check the controller's system version information.

How to Focus the Lens (Non-Metal / Normal Mode)
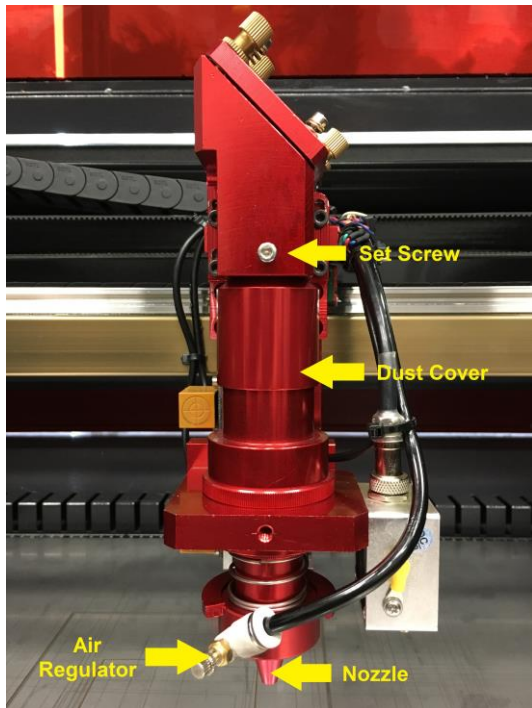
Figure 7. Components of the laser head assembly.

Focusing the lens must be re-done every time a new material thickness is placed on the working platform. The laser used highly focused energy to do its job, focusing becomes very important, and fortunately, very easy. In **Figure 7** you can see the components associated with correctly focusing the laser head. As you get comfortable in the use of your laser these variables can be experimented with for all kinds of interesting results.

Imtpor ant! Always be careful when focusing thick material not to allow material to collide with the lens housing. This can cause serious damage to the laser machine.

Using the Auto-Focus Option for **Non-Metal ONLY**

Before continuing this part, make sure you are in Normal Mode. If you are, by any chance, on Follow Mode, you'll need to switch to Normal Mode. To switch to Normal Mode, hold the STOP button and press the "C" button on the Control Panel. Doing this will allow you to switch between the modes.

Using the Auto-Focus Option for **Non-Metal ONLY** (cont.)

Make sure to have the laser head all the way down, right before triggering the Z+ Limit Switch (red light indicator if touching; if light is on, jog back up slightly till it turns off) before continuing... (Use Z Down button on the LCD Control Panel to move it down)


Now place your "Non-Metal" material (for this example, we'll use birch wood) below the laser head as shown on the picture.

Next, press the **Z/U Button** on the Control Panel to have the menu show that's illustrated on the picture. If you need to bring the worktable up closer to the nozzle before AutoFocusing, use the **Z Up & Z Down Buttons** to move the arrow to select **U Move** on the Control Panel. Once set here, you can use the **Right & Left Arrow Buttons** to move the worktable up and down.


Once you press the Enter button when the AutoFocus (or Auto Up&Down) option is highlighted, the worktable will 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 Z Axis. Once the flange reaches the switch, it will then bounce the worktable back downward at the set Focal Depth.

Note: The Focal Depth is set by the size of the lens already installed upon receiving the machine.
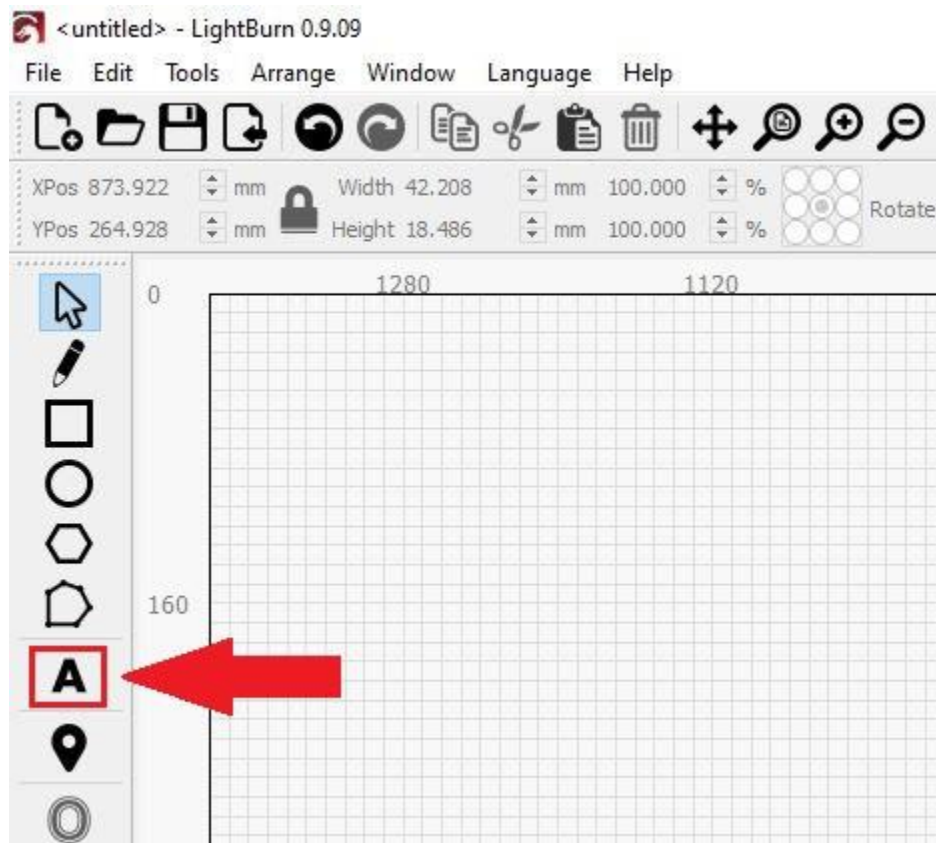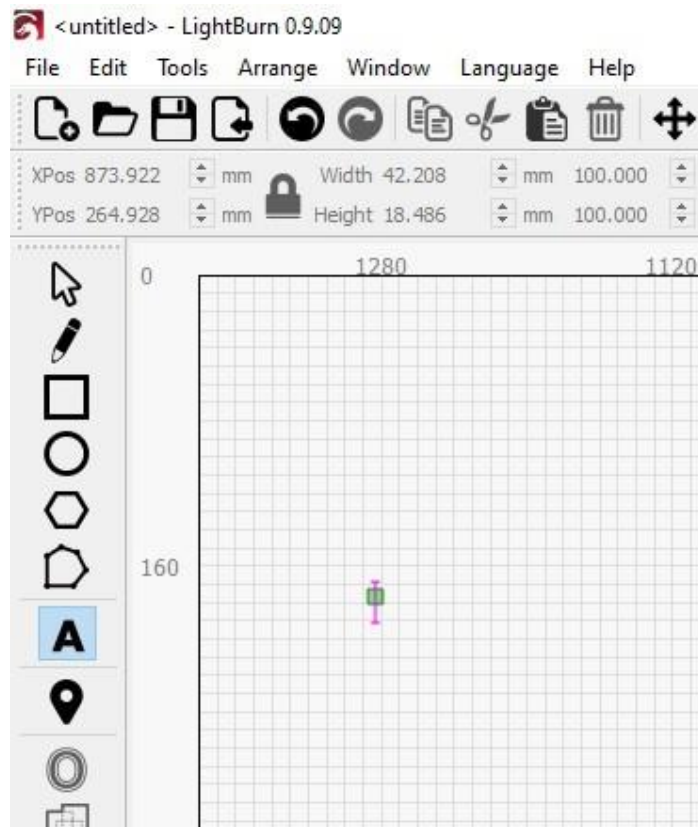

Now you are focused on your material.
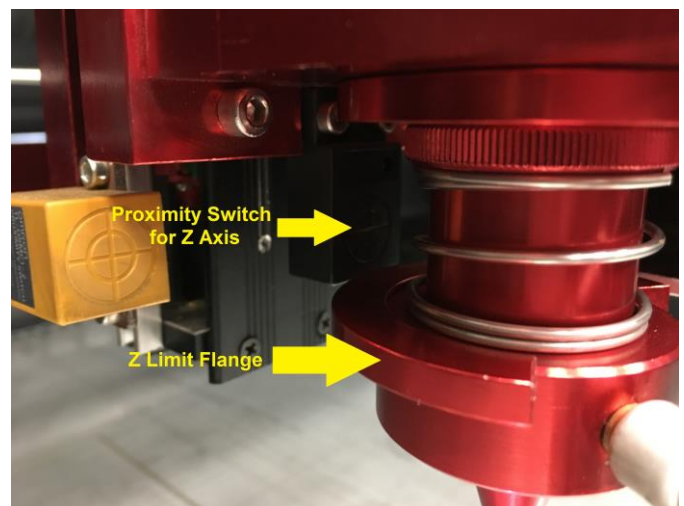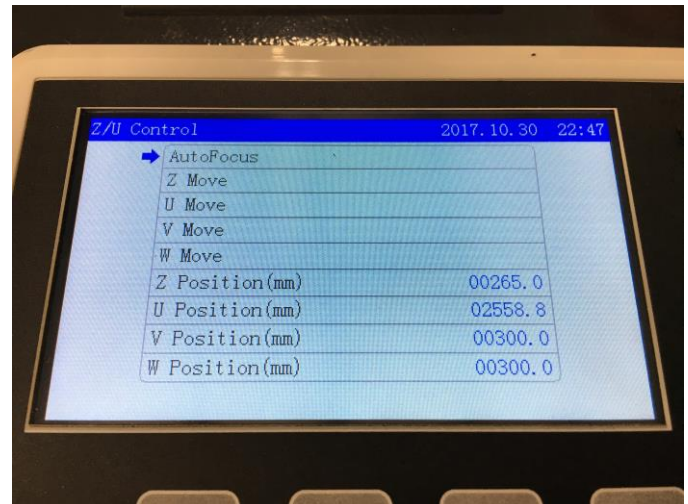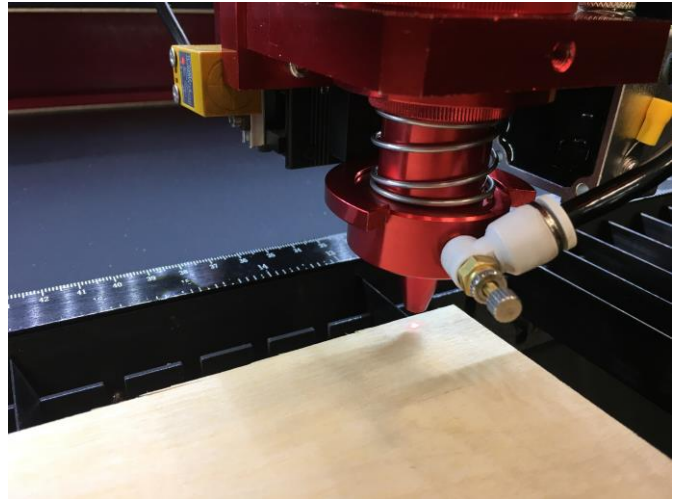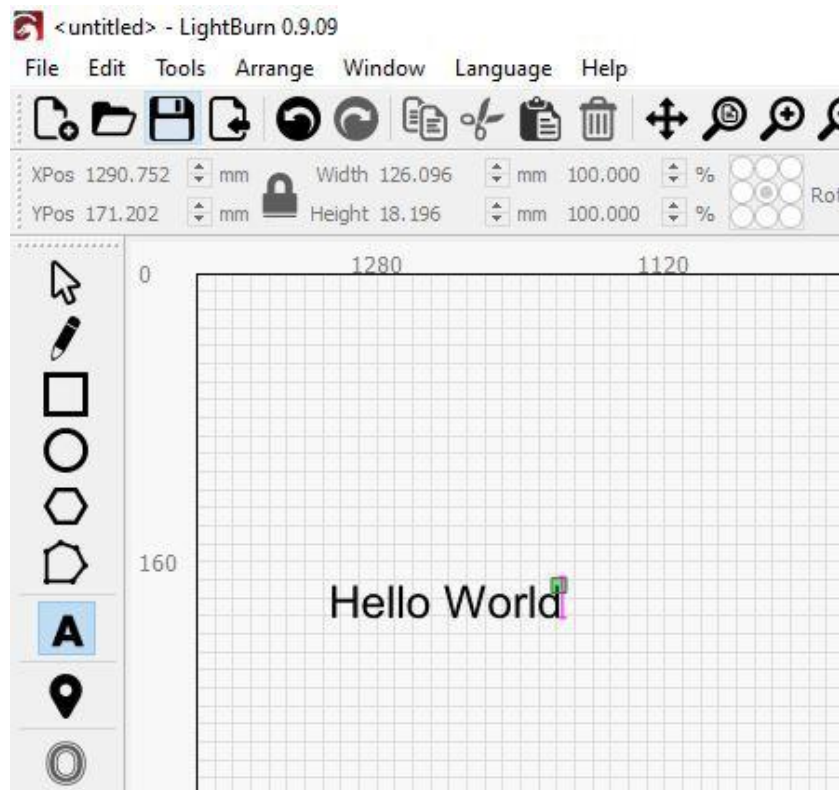
Now launch the LightBurn software:
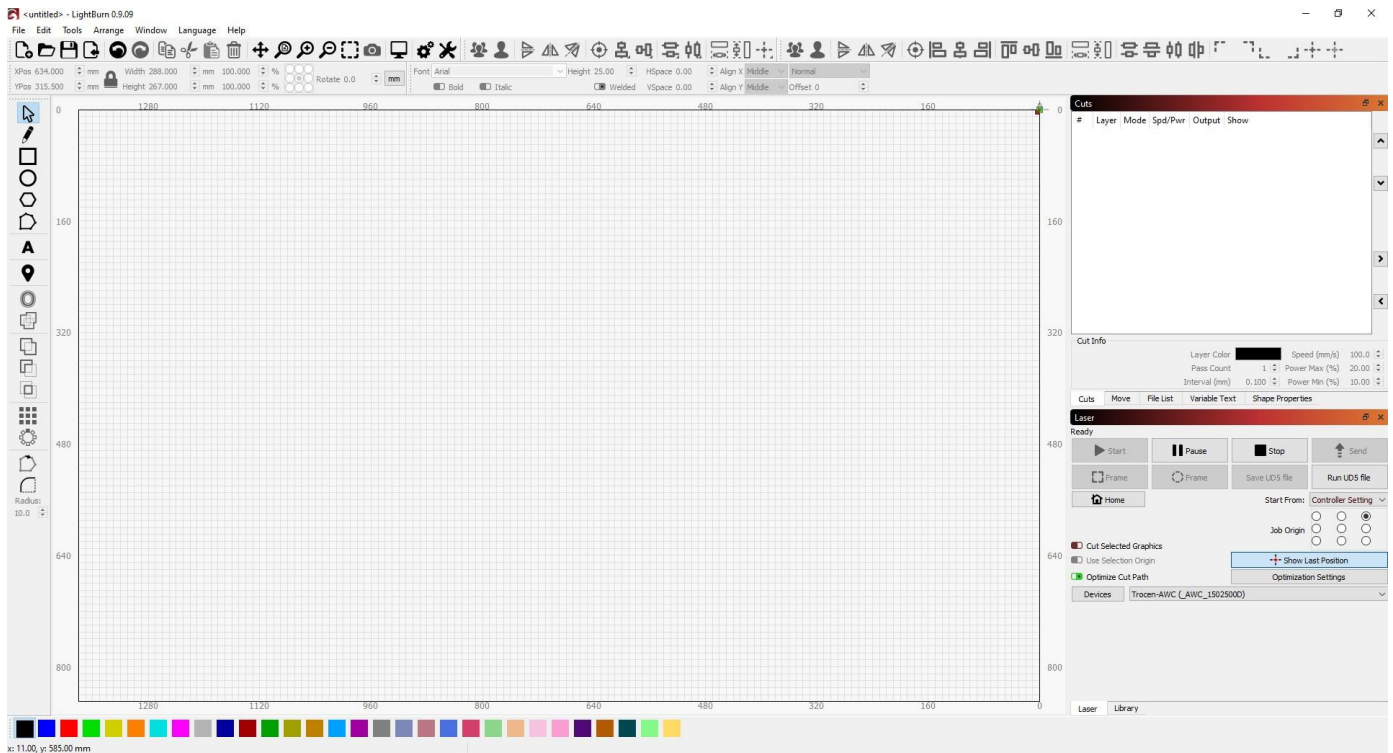
Click on the **Text** icon indicated by the red arrow w/ the red square around it:
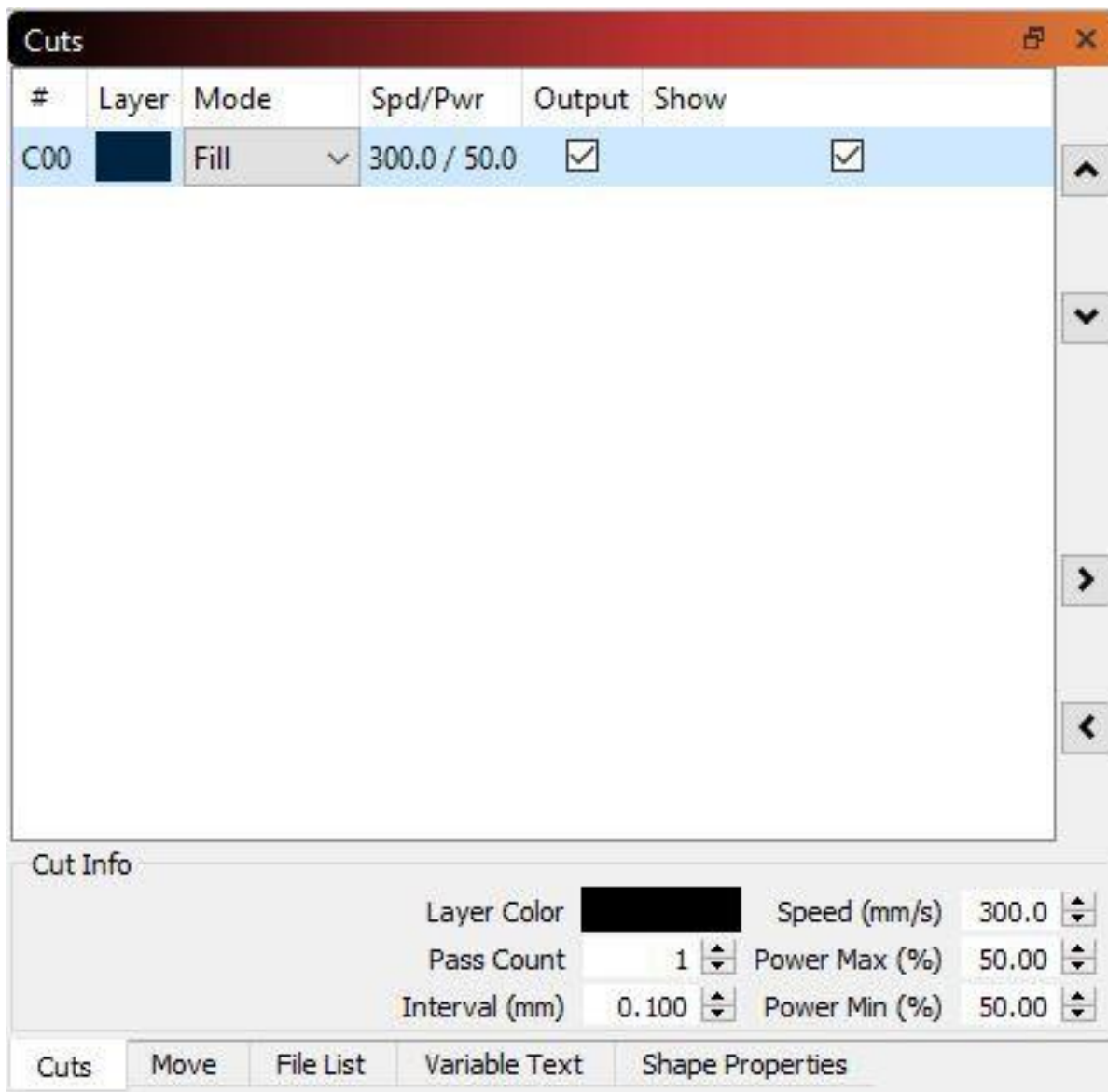
Once you have selected **Text**, click anywhere on the grid space and a text cursor will appear (as shown below):
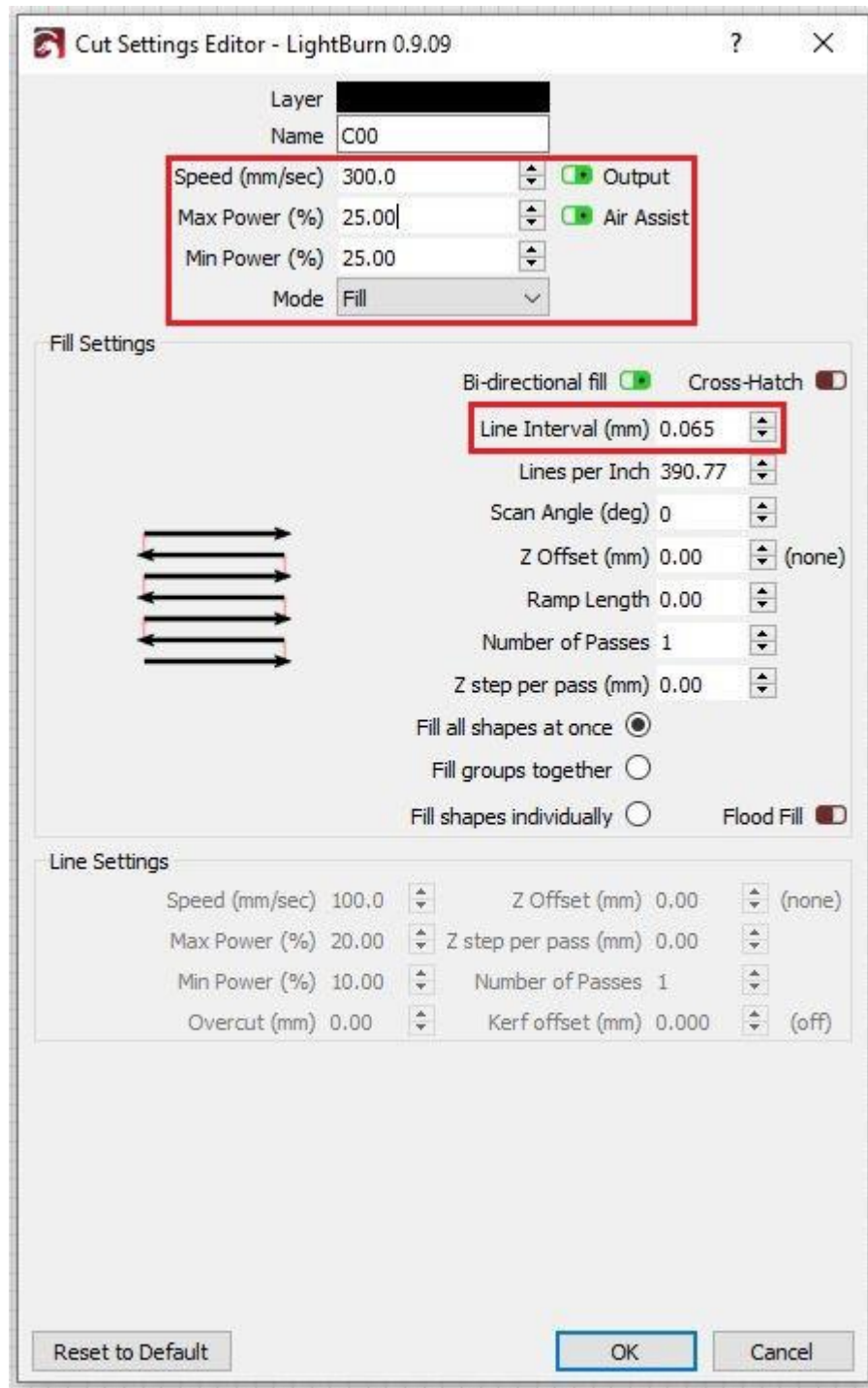

For this exercise, type "**Hello World**" in the text box (as shown below):

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

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


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

After those changes have been made, click on the **OK** button.

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

Now locate the **Send button** which is below the Cuts Window (on the right side of the software):
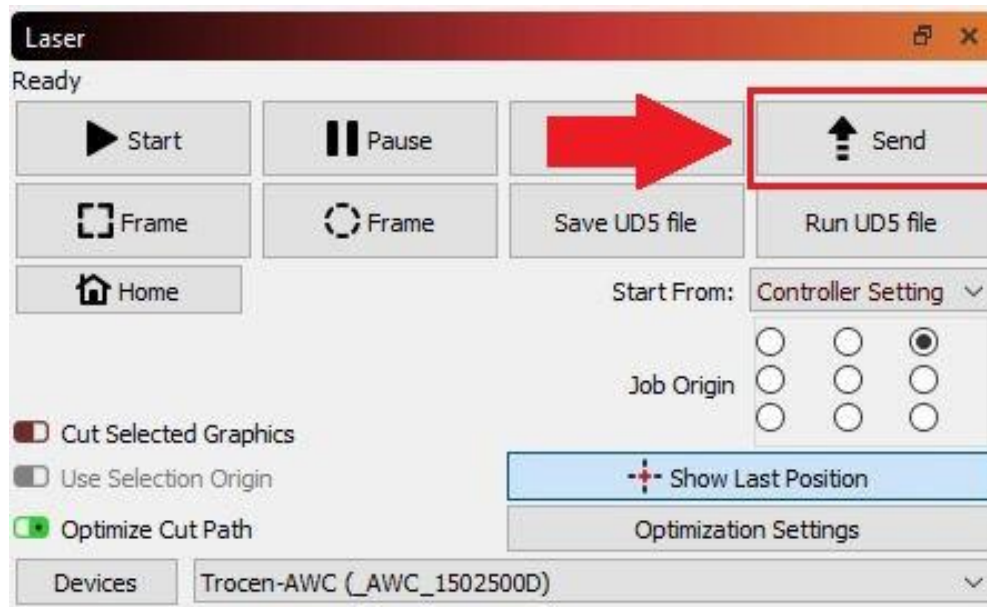
Once you clicked on the **Send button**, the window shown below will appear. You can add a name to your file (for this exercise, we named it **HELLO**). Then click **OK** to send this file to the machine.
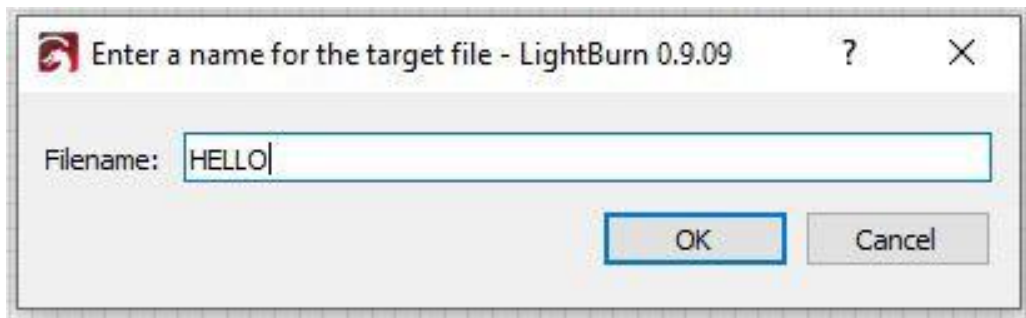
Now if you go to your LCD Control Panel on your machine, you'll see that the file **HELLO** has been sent to the machine (as shown below):
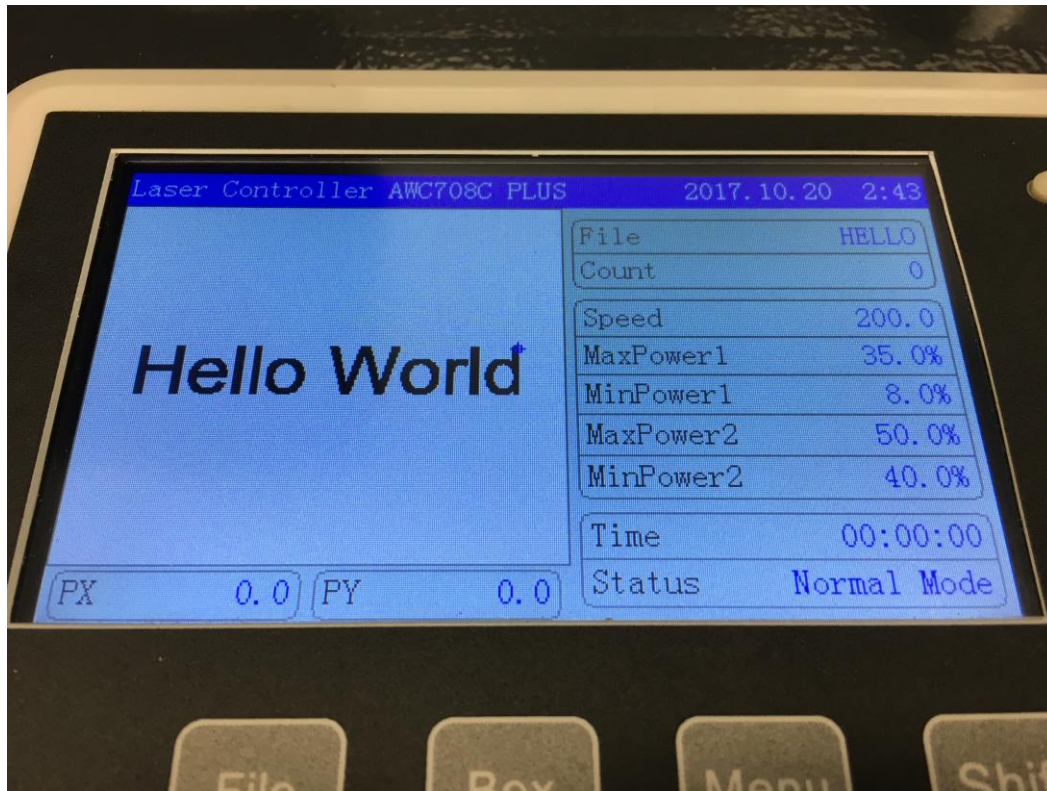
Using the **Directional Arrow buttons** (shown below), move the laser head above your material, for this exercise, a piece of wood (birch wood).

Before you start this job, **make sure you Auto-Focus the laser head to your material** (refer back to the Auto-Focus Section on how to do this).

Now that you have the laser head Auto-Focused and above your material, position the laser head to be on the top-right of your work area (this area is where you want your image to be). The reason behind being at the top-right is because, by default, the origin point is set to the top right of the image.

Once you have positioned the laser head at the top right, now press the **Origin button** (shown below) on the LCD Control Panel. This will set the origin here so when you start your job, it will start from here.

To outline the size of the job (perimeter), press the **Box button** (shown below). This will move the laser head in a square-like pattern to show you the size of your image. This is a good tool for anyone that needs to re-position their material to match their placement needs.
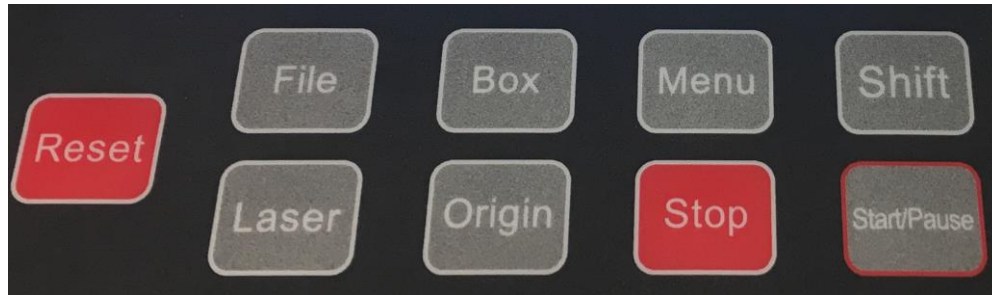
Now make sure your **water chiller, exhaust blower, and air compressor is on** with the machine's lid closed, you can now press the **Start/Pause button** to run the job.

Once the job is finished running, it should look like the picture shown below:

We HIGHLY recommend you do multiple sessions of using the Non-Metal head until you feel comfortable of the software and the procedures of creating the file and sending it to the machine BEFORE moving into cutting metal using the Metal head.
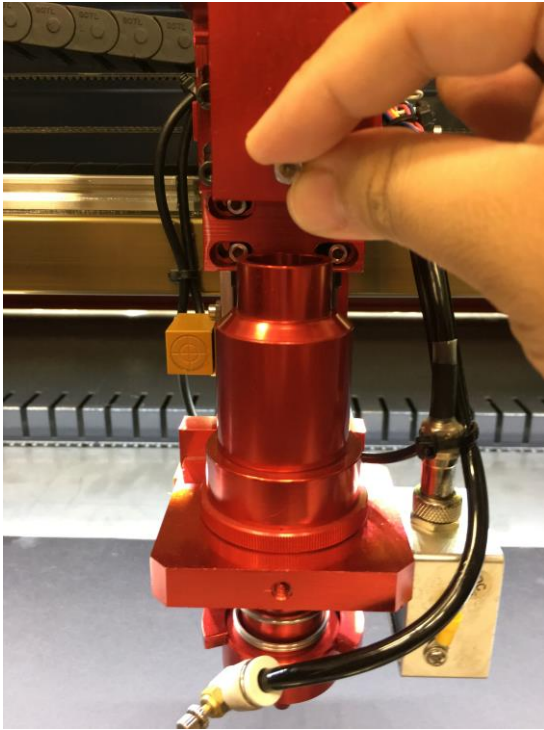
Changing Non-Metal Head to Metal Head

Now before we move into cutting metal with the Metal head, **we need to change out the Non-Metal Lens housing & nozzle assembly** to the **Metal lens housing & nozzle assembly.**

First, make sure the Non-Metal laser head assembly is all the way down so we can have enough room to remove the dust cover from the laser head assembly. To move the laser head assembly down, use the **Z-Down button** on the LCD Control Panel. The position of the laser head assembly is shown below:
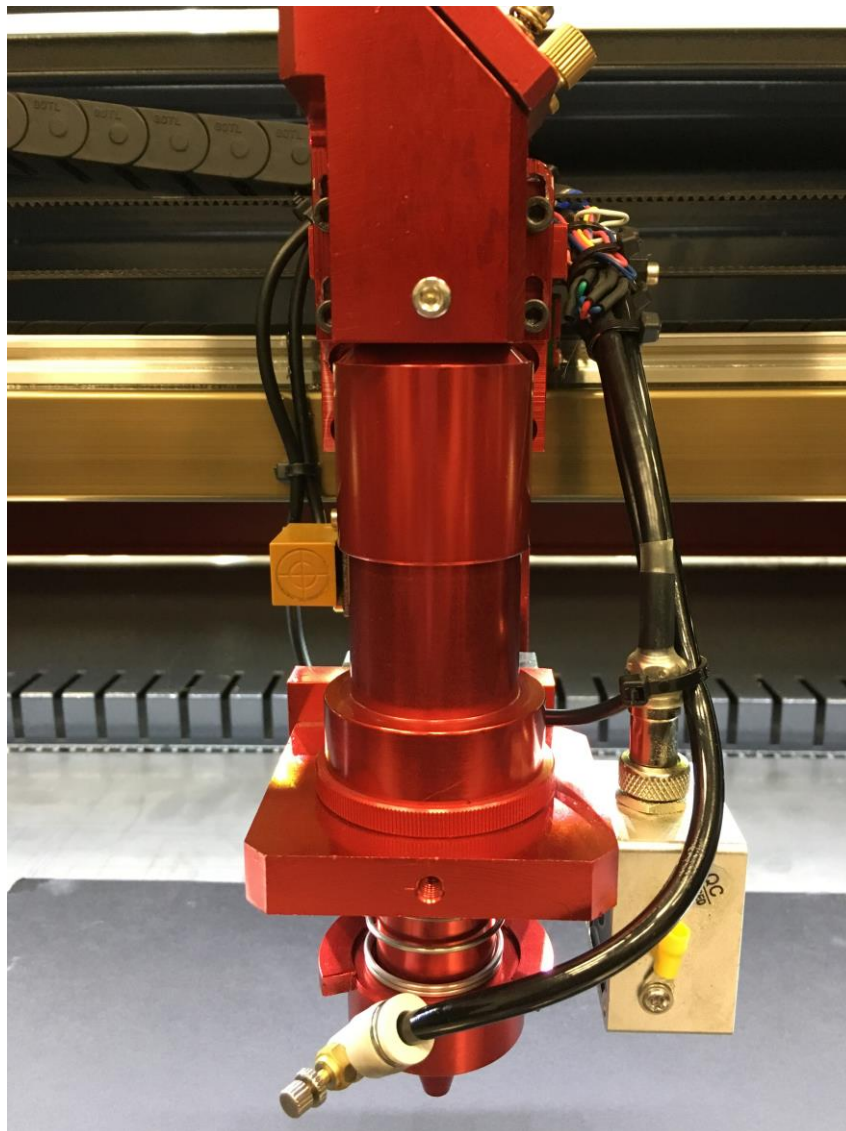
Now rotate the set screw to unlock and drop the dust cover out from the laser head assembly (as illustrated below):

As shown below, loosen the retaining nut that is holding the **Non-Metal lens housing** and remove it from the laser head assembly. You'll need to unhook the 6mm hosing from the nozzle to complete remove the lens housing.

Now installing the Metal head is the same way you would install the Non-Metal head (held by a retaining nut), but you'll need to make sure you install the **Blue Signal Cable** to the **Amplifier (Silver Box)**. Also, make sure you have installed back the 6mm hosing to the nozzle (as shown below):
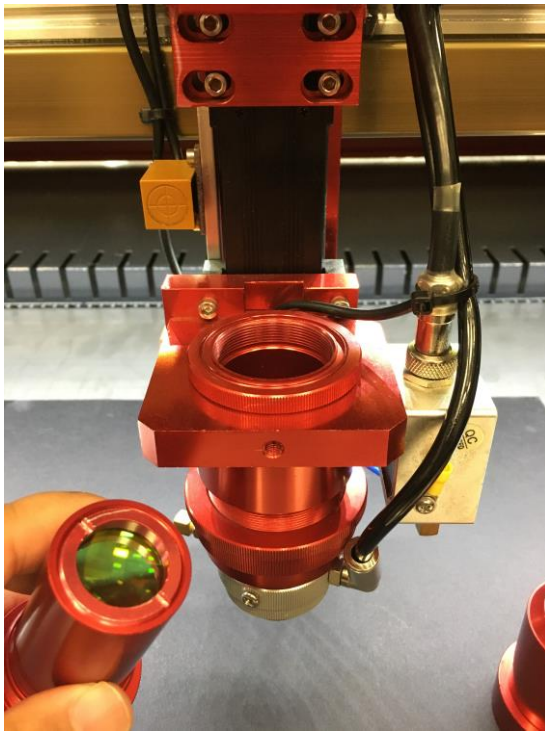

For the Metal Head, there is a separate piece for the lens housing (shown above; being held by the hand in the picture)

Finally, install the dust cover and tighten it with the set screw shown below:
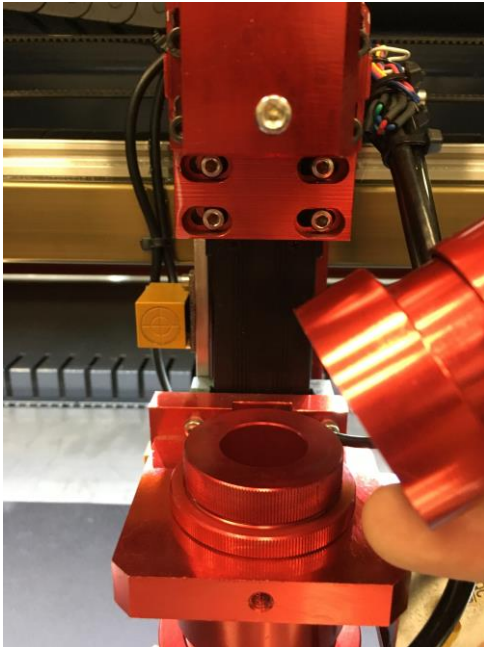
Technically, you can still use the Metal head to cut Non-Metal material. The main drawback from this is that you do NOT have the Auto-Focus Function available now. So, again, you CAN NOT Auto-Focus when you have the Metal head equipped!

So for cutting Non-metal material with the Metal head, you will need to manually find the focal point (finding the smallest spot size by pulsing the laser onto your material)**. Because the nozzle hole of the Metal head is smaller than the Non-metal head, you'll increase your cutting performance because of the "more concentrated" air flow** (as a result shown below, a simple half inch circle cut out):
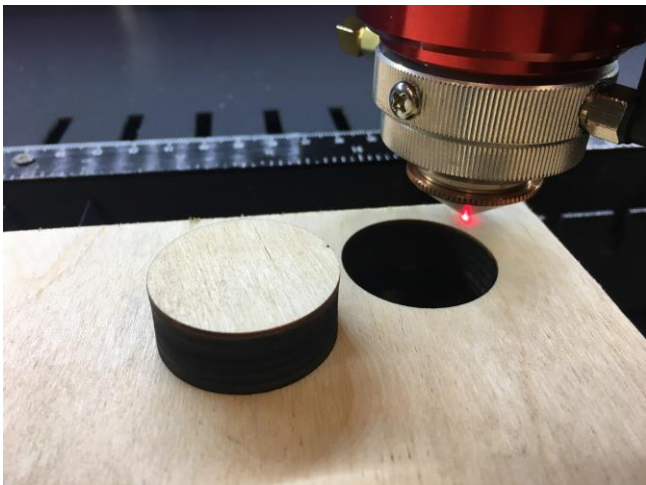
Cutting Metal using the Metal Head

Now that we have the Metal head installed, **there are some preparations and settings to configure before doing your first metal cut out.**
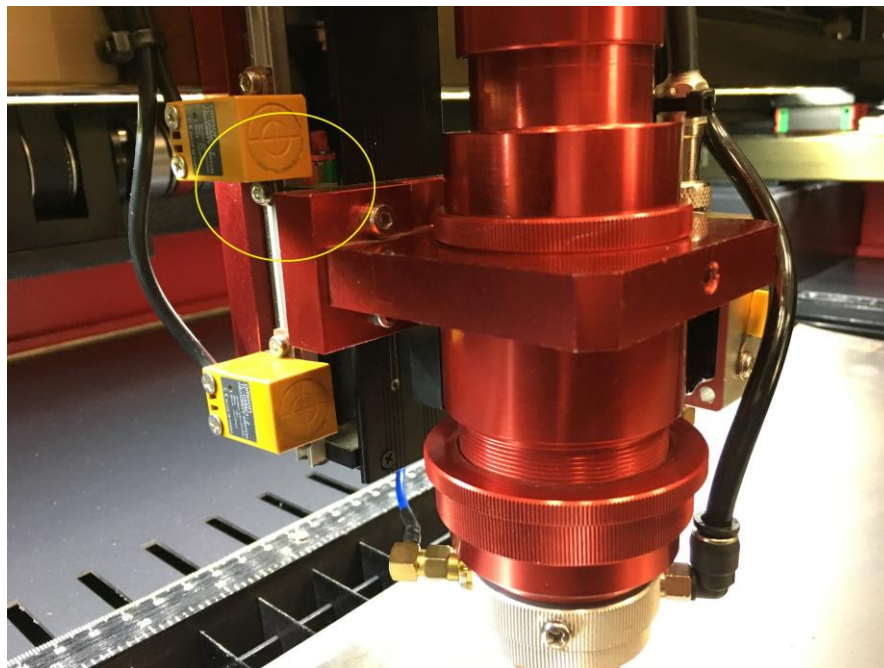
Before continuing this part, make sure you are in <u>Follow Mode</u>. If you are in Normal Mode from the previous exercise, you'll need to switch to Follow Mode. To switch to Follow Mode, hold the STOP button and press the "C" button on the Control Panel. Doing this will allow you to switch between the modes (as shown below):

Since you are now in FOLLOW MODE, to move the laser head up or down will be done on the FTC 61 Series Control Panel (as shown below in the yellow box):

You will need to adjust the height of the laser head where top of the red block is right under the Z-Limit Switch (as shown below in the yellow circle):

Metal Head Calibration

Before continuing, make sure your worktable is about 0.5 - 0.75 inches from the laser head nozzle. To do this, press the Z/U button on the Control Panel, highlight U Axis using the Z Up & Z Down buttons. Once selected, press the right & left arrow keys to move the worktable up or down.

To start the calibration, press the **Setup button** on the FTC 61 Series Control Panel (as shown below in the yellow box):

Now move the laser head's nozzle by using the **Up and Down buttons from the FTC 61 Series Control Panel** very close to the material, but not touching (about 5mm gap), as illustrated in the picture showing the metal head w/ the metal sheet.
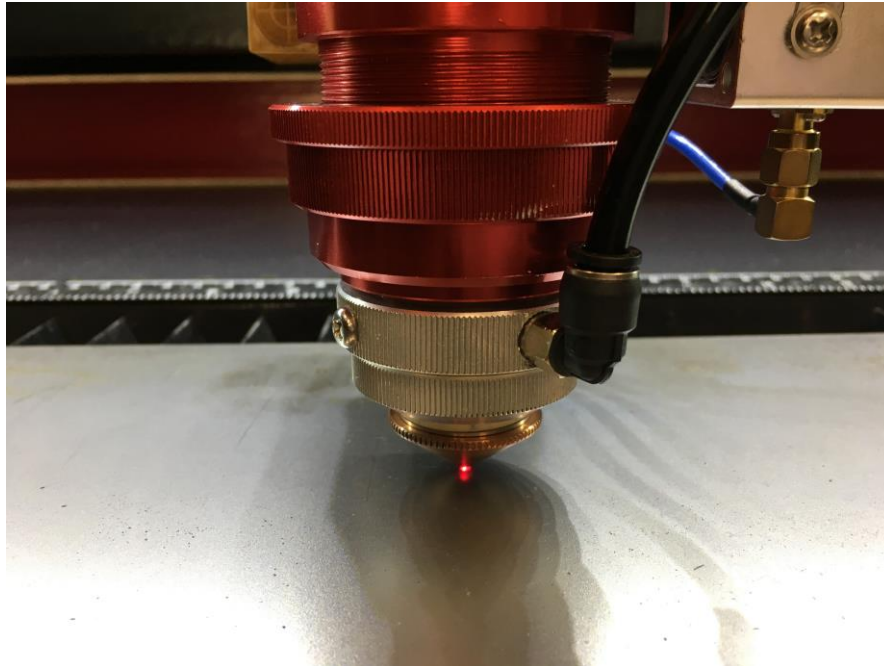
While still in the Settings menu, highlight over the **Calibration** option, then press the **Enter button**. This will initiate the Calibration process and you'll notice that the Metal head will move on its own.
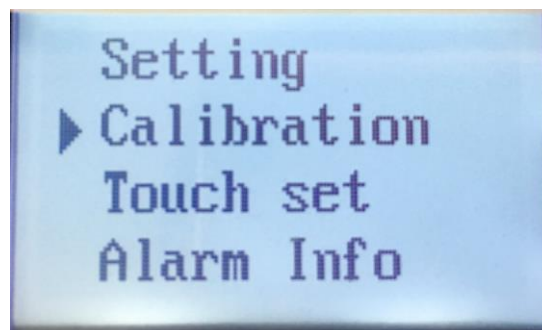
After it has finished, it will "grade" the overall calibration. Then press the **Enter button** to save the calibration.
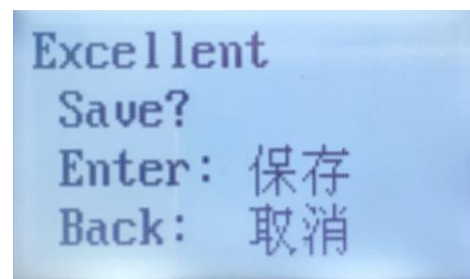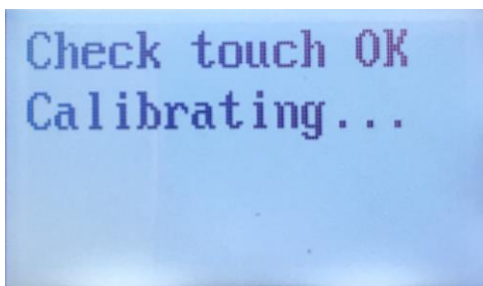
For this exercise, we will <mark>cut out a circle through 20 gauge mild steel.</mark> So open **LightBurn** so we can create a circle with some speed/power settings.
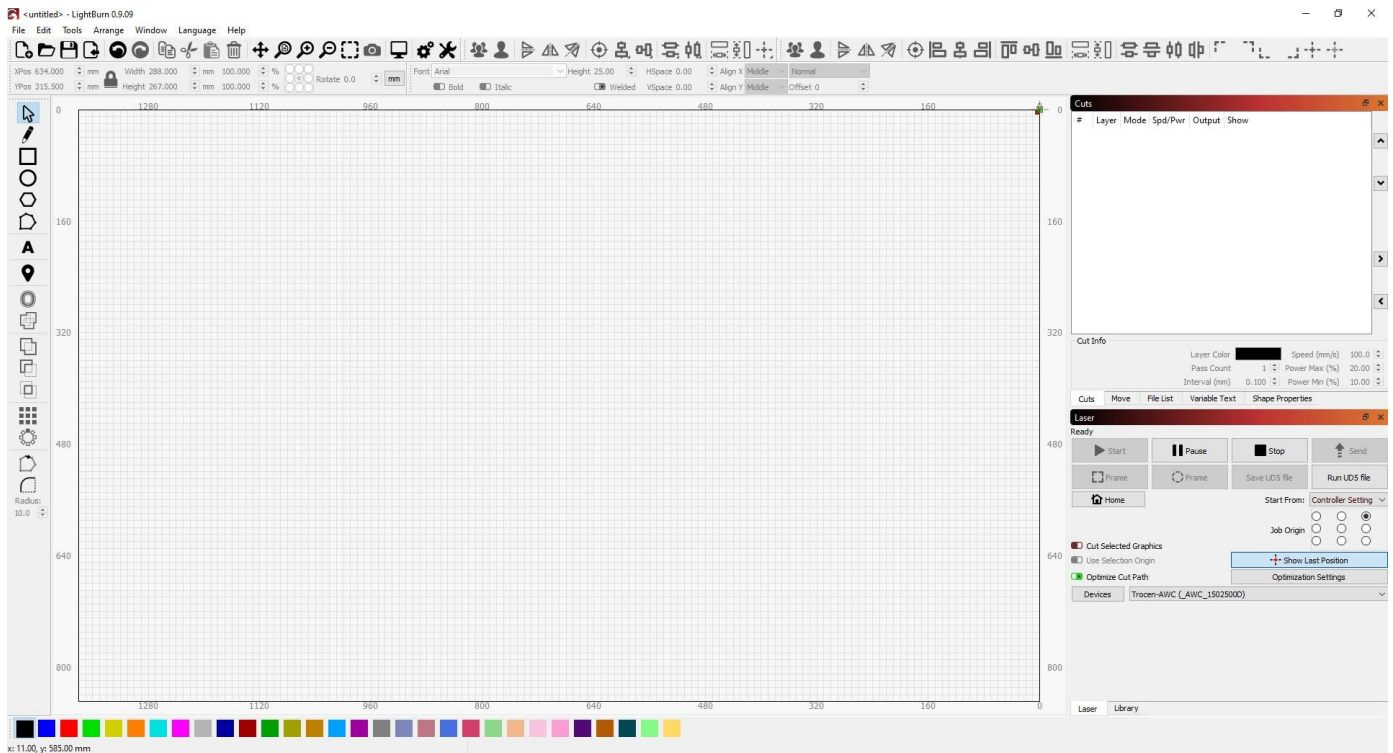
Click on the **Circle** icon indicated by the red arrow w/ the red square around it:
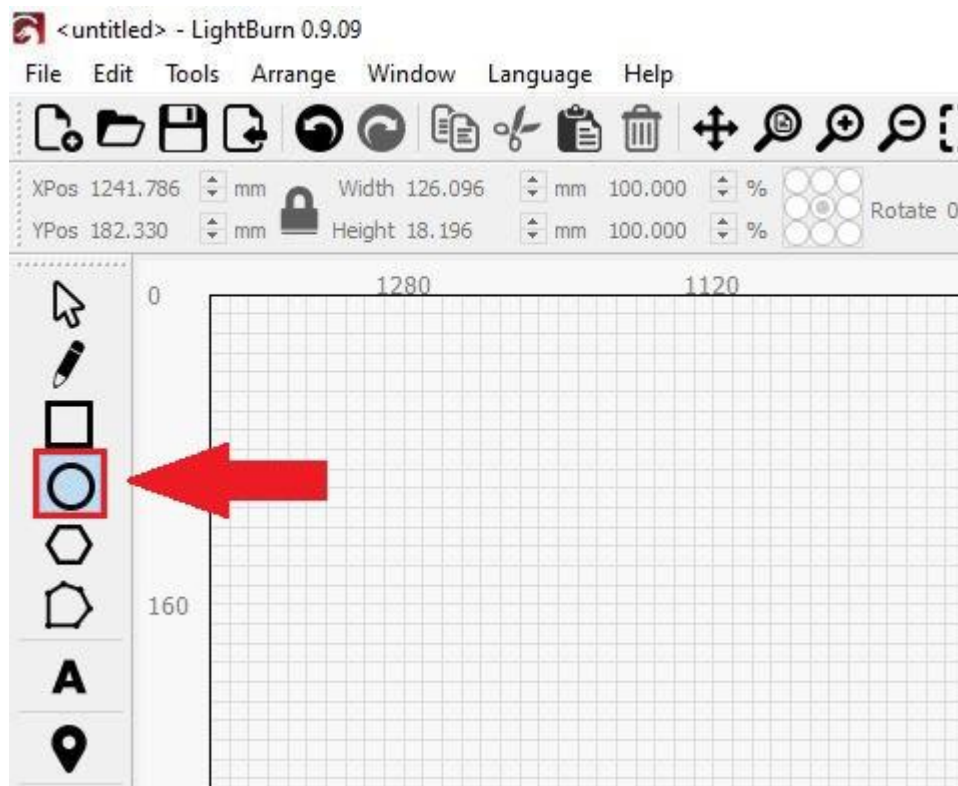
So for this exercise, a 50 mm in diameter circle was created (50 mm x 50 mm) as shown below:
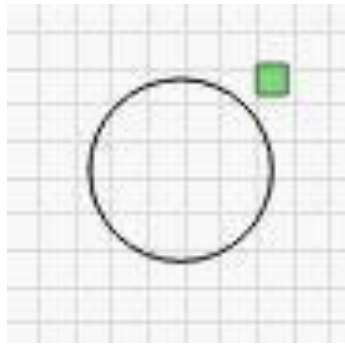
The next step is to set the **Speed and Power** for the cut of the circle. Located on the top right side of the LightBurn software, you'll find the Cuts Window (as shown below):
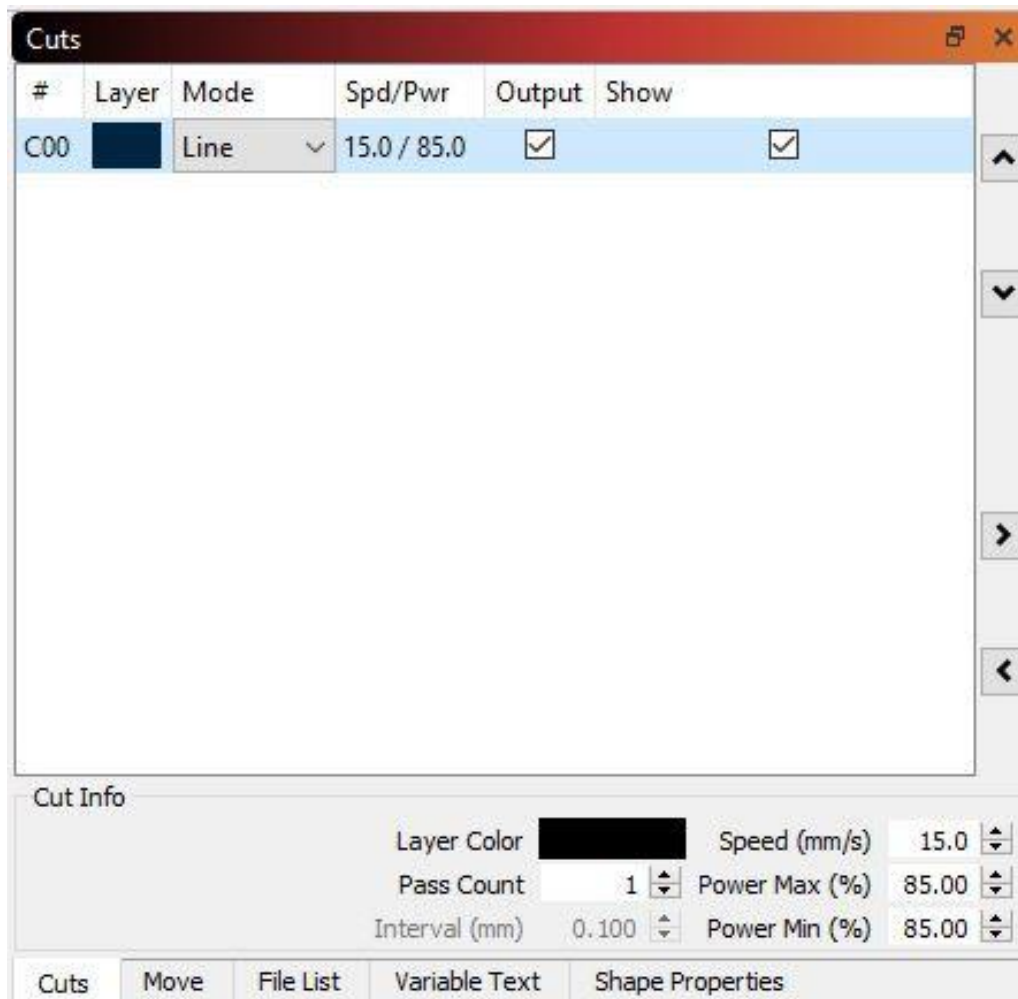
Double click on the **Layer Color**. The Layer Parameter window, shown below, should appear:

- **Work Mode:** Make sure this is set to **Cut**
- **Power (%):** For this exercise, we are going to use **85% (Min & Max)**
- **Speed (mm/s):** Set this to **15.**
- **Add Lead-In: Enabled** (green = on)
- **Length: 25.4 mm**
- **Lead In/Out Style: Line or Arc** (for this exercise, select Line)

After those changes have been made, click on the **OK** button.

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

Now locate the **Send button** which is below the Cuts Window (on the right side of the software):
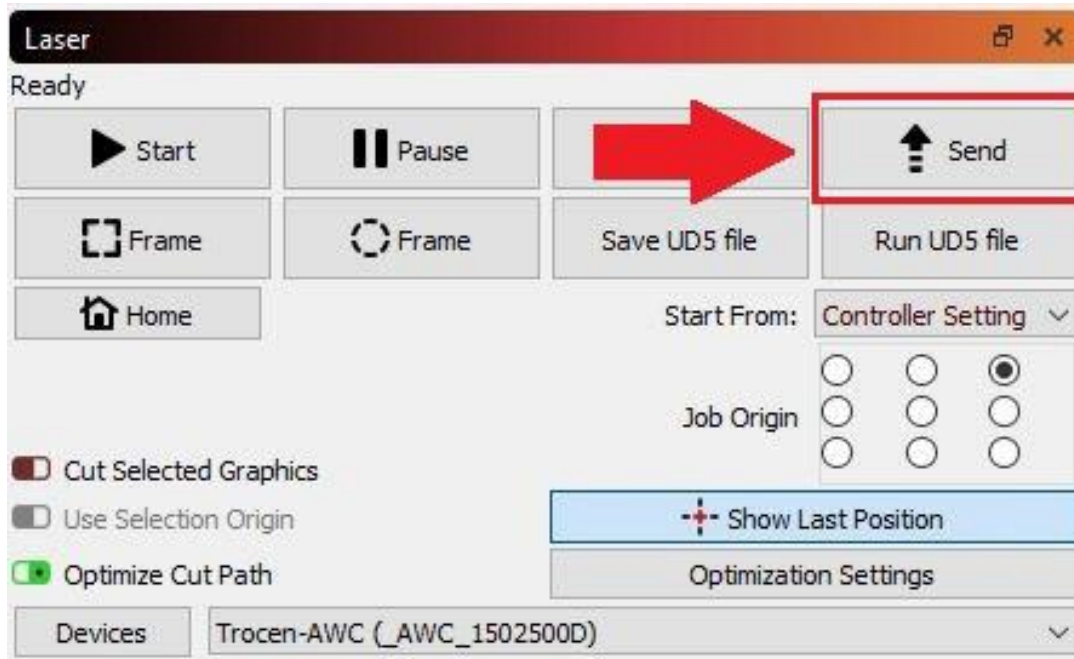
Once you clicked on the **Send button**, the window shown below will appear. You can add a name to your file (for this exercise, we named it **CIRCLE**). Then click **OK** to send this file to the machine.
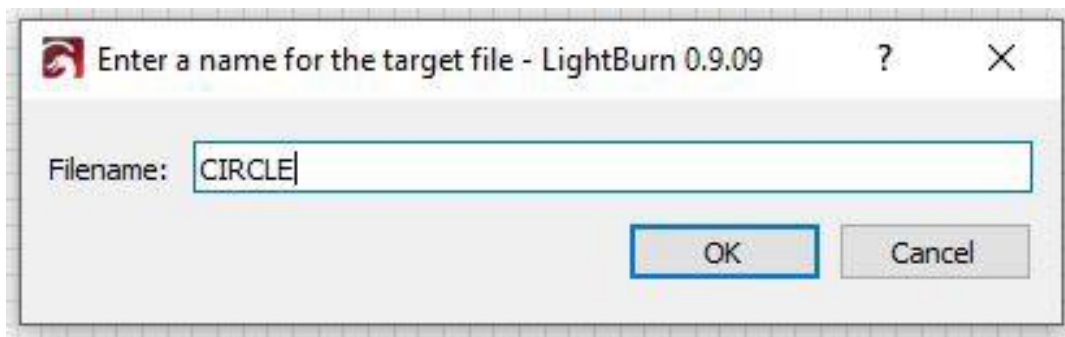
Now if you go to your LCD Control Panel on your machine, you'll see that the file **CIRCLE** has been sent to the machine (as shown below):
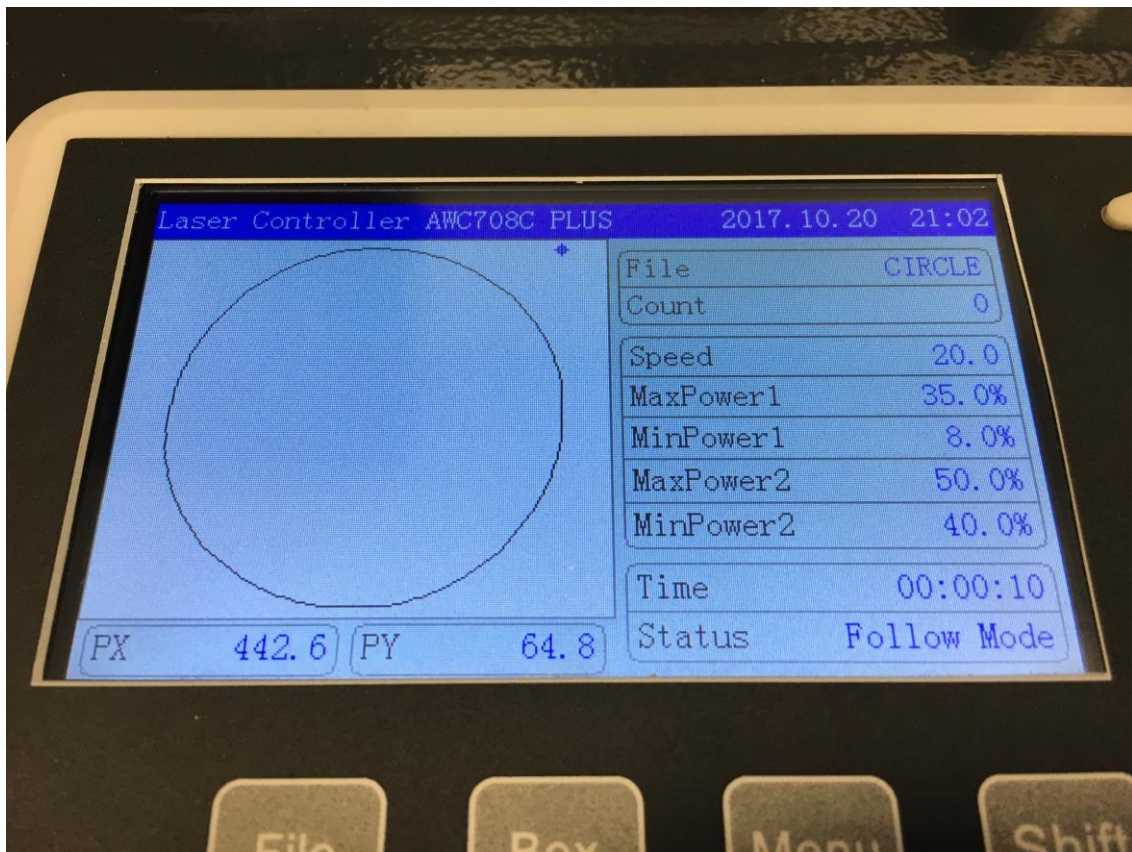
Using the **Directional Arrow buttons** (shown below), move the laser head above your material, for this exercise, a 20 gauge mild steel sheet.

Now that you have the Metal head calibrated and above your material, position the laser head to be on the top-right of your work area (this area is where you want your cut out to be). The reason behind being at the top-right is because, by default, the origin point is set to the top right of the cut out.

Once you have position the laser head at the top right, now press the Origin button (shown below) on the LCD Control Panel. This will set the origin here so when you start your job, it will start from here.

To outline the size of the job (perimeter), press the Box button (shown below). This will move the laser head in a square-like pattern to show you the size of your image. This is a good tool for anyone that needs to re-position their material to match their placement needs.

Before running your first metal cut, you'll need to make sure you have Oxygen available (standard tank; higher the purity, the better) to help aid your metal cuts. DO NOT USE COMPRESSED AIR TO CUT METAL!!!

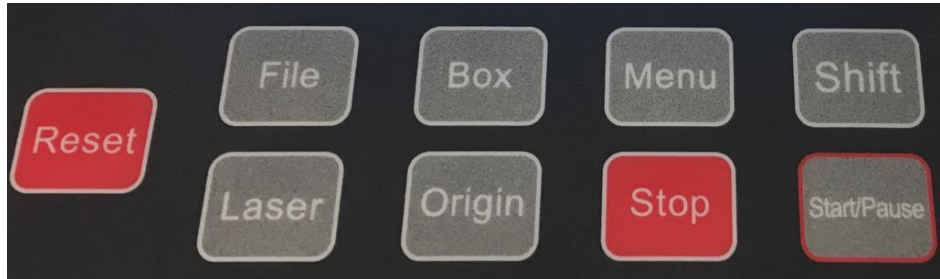Once you have an oxygen tank with an oxygen regulator, you'll need to make sure you get the correct fitting for the regulator that will match the tubing that goes into the back of the machine of the oxygen fitting. The fitting needed will be a **Push-to-Connect R-Thread Pneumatic fitting for a 8mm tube**. You can call or email Tech. Support at 888.652.1555 or techsupport@bosslaser.com, respectively, to get more information about the fittings themselves.

Now make sure your **water chiller and exhaust blower is on, the oxygen tank valve open**, and with the machine's lid closed, you can now press the **Start/Pause button** to run the job.

Once the job is finished running, it should look like the picture shown below:

Now if you notice any burring at the bottom of your metal piece and you've already tested different PSI levels of oxygen, you may need to change your **Follow Height** (moving the focal point) to help reduce the amount of burring.

The Follow Height ranges from 1.0mm - 4.0mm. To change the Follow Height, press the **Setup button on the FTC 61 Series Control Panel**.
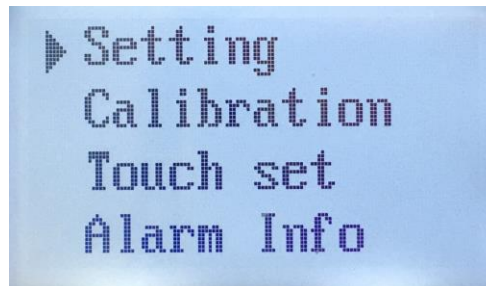
Now press the **Down button** twice to highlight the **Flow Height option** (indicated by the red box). Press the **Enter button** here and using the **Up & Down buttons**, you can change the value of your Follow Height.
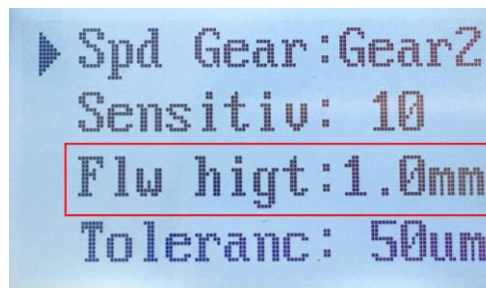
After making the changes, Press the **Enter button**, then the **Back button**. You be prompted to save the new settings. Press the **Enter button for YES** or the **Back button for NO**.
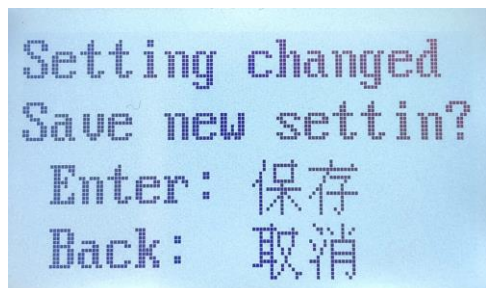
This now concludes the procedures of running your first file with the Non-Metal & Metal laser head. If there's any further questions/concerns, please contact Tech. Support via phone/email (888.652.1555 / techsupport@bosslaser.com).

Tuning the Optics

NOTE: *Upon receiving your machine, all machines go through a QA (Quality Assurance) process AND are already aligned, ready for use. So there1s no need for any adjustments with the mirrors/ tube/bracket. This section is only for providing prior knowledge on how to adjust/tune the laser.*

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 in **Figure 8a**, you can see the simplicity of the system: One long glass tube, two 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.
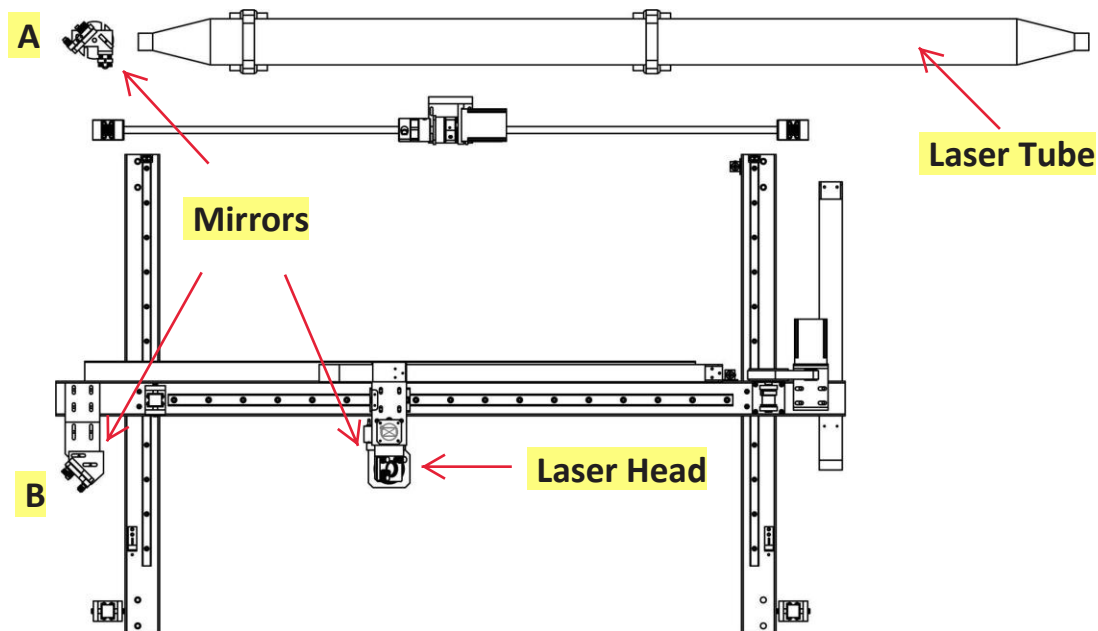
Figure 8a. Laser tube and associated mirrors.

Tube Bracket

The tube bracket, illustrated in **Figure 8b**, does just what it says, it 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.
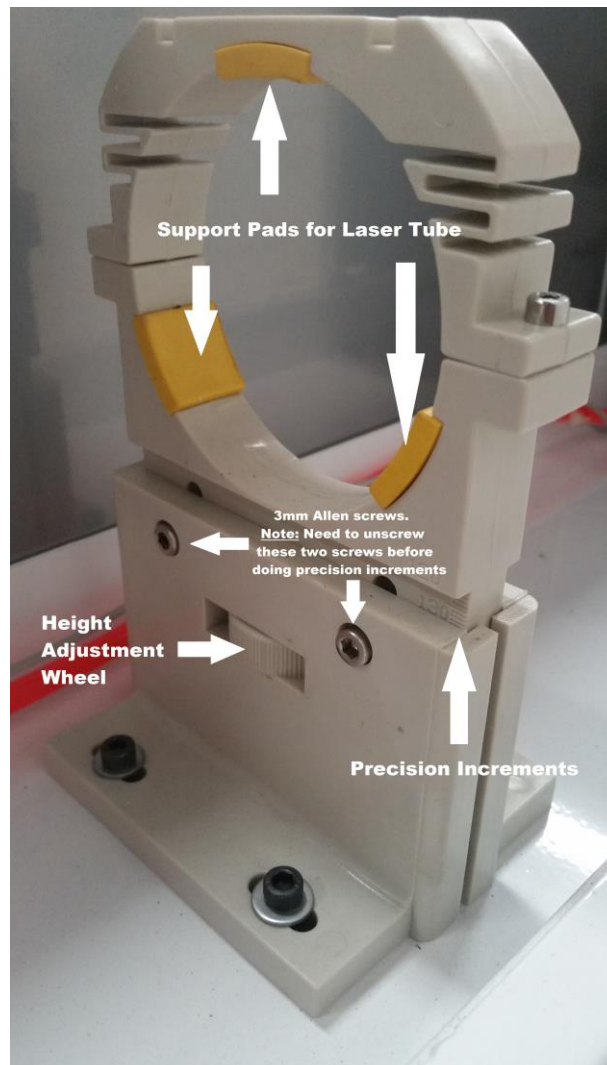
Figure 8b. Tube Bracket for LS/HP Industrial Series Machines.

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.

Figure 9a. Using masking tape to determine where the laser hits the mirror.

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 in **Figure 9a**. Use the least adhesive tape you can find. The laser will quickly burn through the tape leaving its mark as shown in **Figure 9b**. 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 l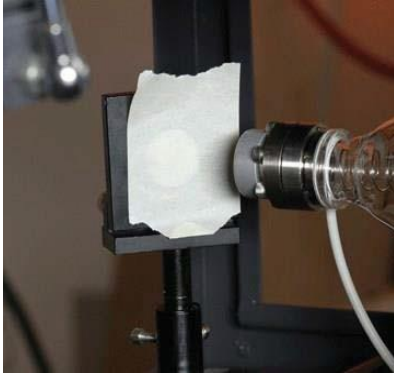iterally shoot into the room, missing the mirror, the cabinet and hitting someone or something. This could be dangerous.*

Use extra caution on his procedure. The laser beam has no color and can't be seen. Once finished make sure mirrors are clean and continue on to the next step

Mirror Bracket

The mirror bracket works much like the tube bracket with additional fine screws for micro adjustments. Chances are you will not have to use either of the Macro adjustments for vertical or horizontal corrections, just the micro screws for fine tuning.

An illustration of the mirror bracket showing the fine-adjustment screws is shown in **Figure 9c**. Again, use caution and only adjust when the machine is off. If after firing a test shot no burn hole shows up on the tape, make a large target with a piece of cardboard to see where laser mirror A is pointed. Using just the fine adjustment screws, you should be able to bring the beam right to the center of mirror B.

After tuning mirror A to hit mirror B perfectly, adjust mirror B to hit the laser head dead center. Use the same masking tape technique to adjust all the mirrors, and the tune-up will be done in little time.
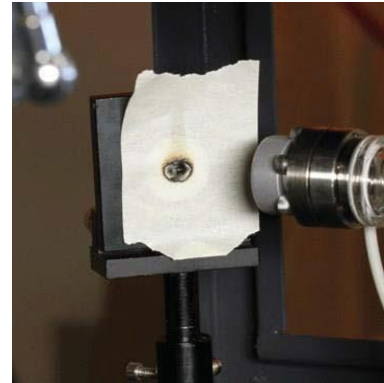

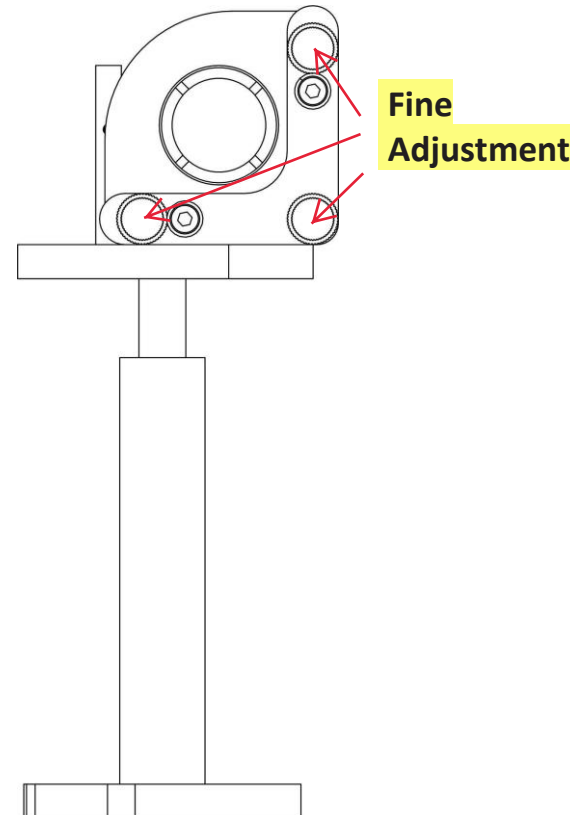**Figure 9b.** Hole on tape shows location of the laser beam.

Figure 9c. Mirror bracket

Lens Replacement

Lenses are one of the few parts of a laser machine that need regular maintenance, primarily regular cleaning. Lens cleaning is simple if done often, difficult or not possible if rarely done.

There are two types of lens that come with your HP Machine. The Non-Metal head's lens is small, about 20 mm across, with 2 distinct sides, one flat and one convex or curved out. ***When reinstalling, the curved side always faces the laser path, away from the working platform***. On the other hand, the Metal Head's lens is larger, about 25.4 mm (1 inch) across with 2 distinct sides. The same rule applies when re-installing the lens. As illustrated in **Figure 10**, the lens assembly consist of 2 main parts, the lens tube (also known as the lens housing and nozzle. Then there 3 parts inside the lens tube - the lens, O-ring and retaining nut.

For Non-Metal Head Configuration
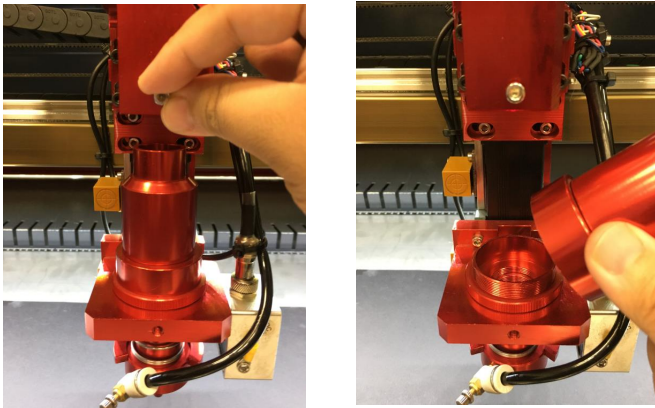
Taking off the dust cover.

Figure 10. Lens assembly.
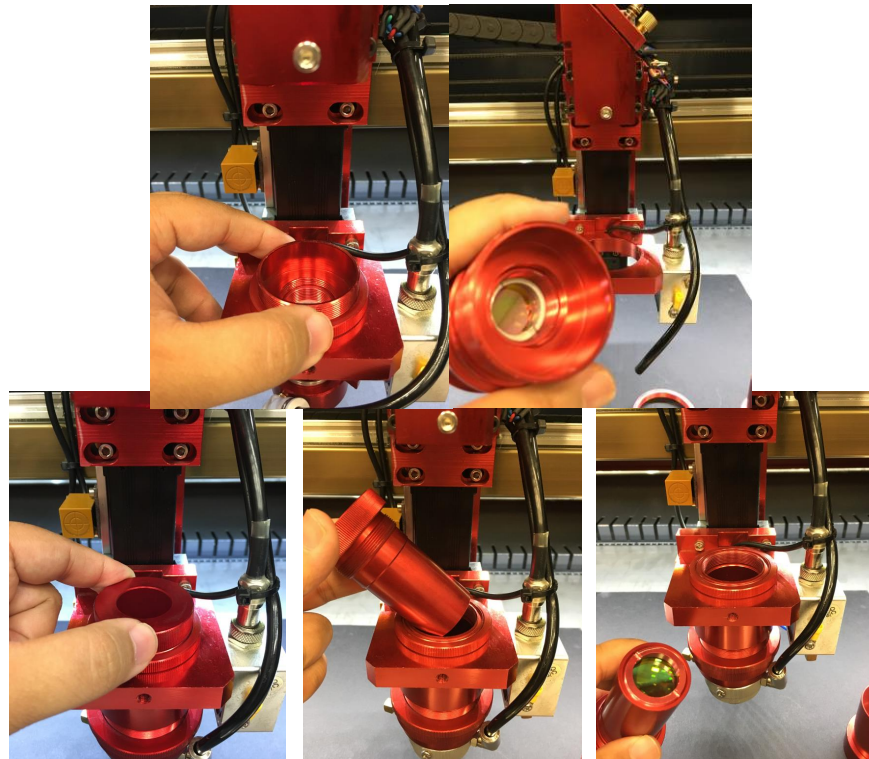
For Metal Head Configuration

To remove lens for replacement or cleaning, loosen the retaining nut on the main lens housing holding the lens tube in place. After loosening the set screw the lens tube should slide out of the housing. Separate the lens tube from the nozzle like the illustration shown in **Figure 10**.

Your laser tool box came with a tool for removing the retaining nut. The tool looks more like a scraper than a screw driver. Its width is designed to fit inside the lens tube and fill the slots. Be careful not to let the blade tip slip and scratch the lens.

Once the slotted ring is out, the rubber washer will keep the lens pressed against the laser tube. Using a pencil with eraser, insert the eraser end into the laser tube and push out the lens. Both lens and washer will fall out the large end.

**Non-Metal
(Normal Mode)**

**Metal
(Follow Mode)**

**Lens
Placement**
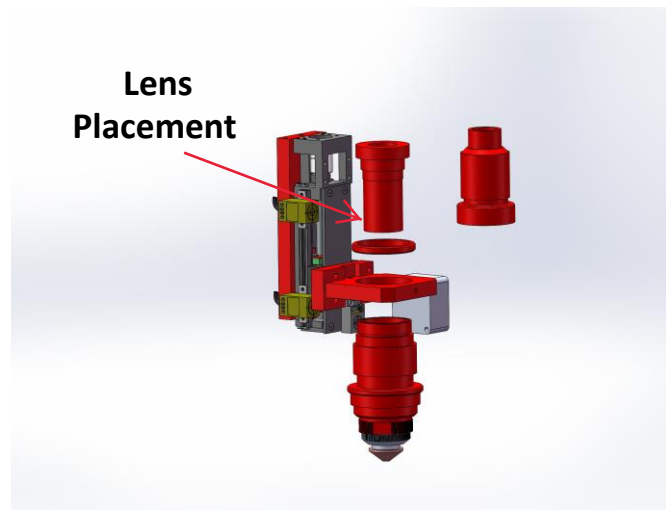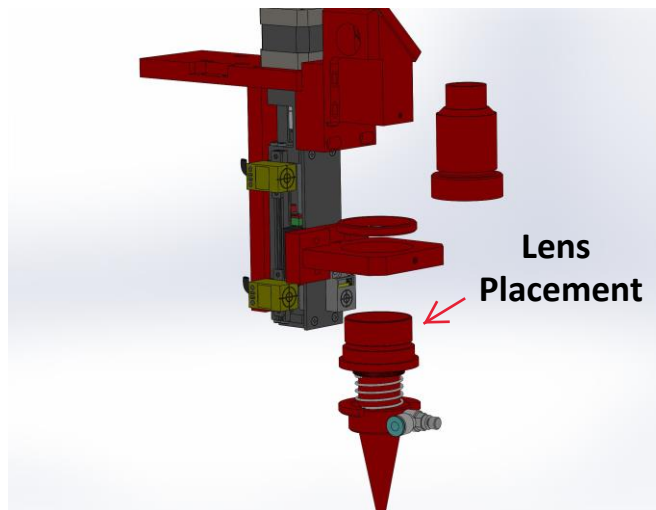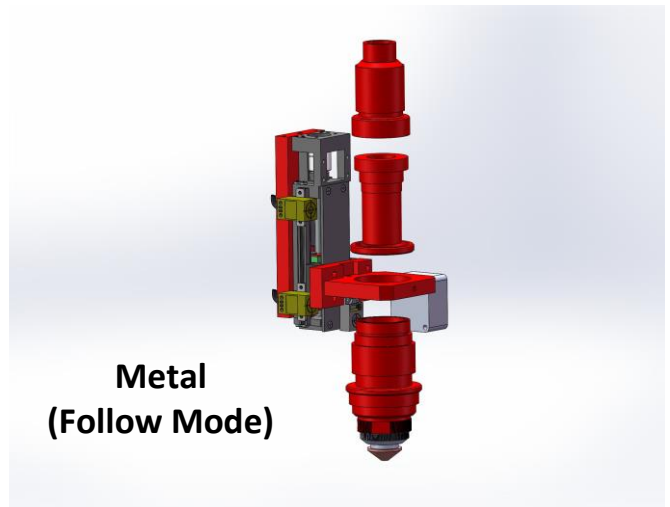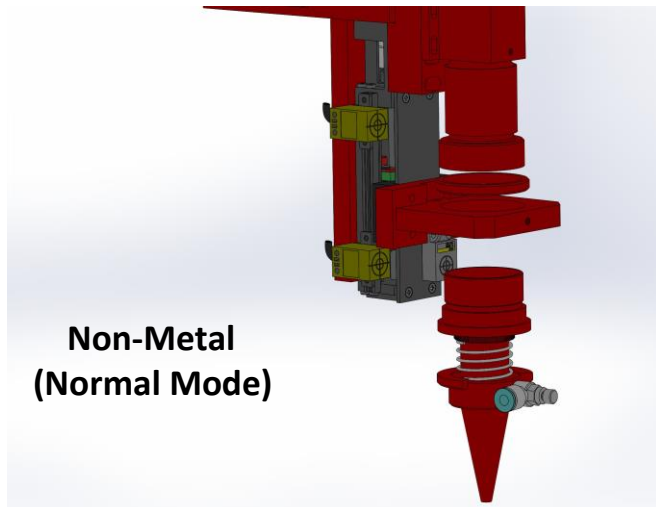
**Lens
Placement**

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

Handle the lens carefully, using isopropyl alcohol or lens cleaner/wipes to clean the flat side. Lens paper works well and should show a brown residue after cleaning.

Make sure to place the flat side down towards the working platform when reassembling, curved side always faces the laser beam. _**Rubber O-ring first, Lens, and then the ring nut**_ (**from bottom to top**). Don't over tighten ring nut, just snug it up against the washer, and then a quarter turn more.

Burned lenses are a common problem for new users of any laser machine. Make sure to clean it often, especially if cutting on a regular basis. Kept clean a lens will last a long time.

Maintenance Schedule

Focal lens:

This is the lens that is used to focus the laser beam. This lens should be cleaned at least once per week. 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.

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 (in the laser head**:**

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 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 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, contaminate, or damage on the mirror will cause the mirror to become damaged faster.

Mirror #2:

This mirror is located directly at the end of the gantry rail. This mirror should be cleaned at least every *two* months. Use the same directions as found for Mirror #3

Mirror #1:

This mirror is located directly in front of the laser tube. This mirror should be cleaned at least every *three* months. Use the same directions as found for Mirror #3.

Laser tube output 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 acetone 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.**

Linear rails:

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 to prevent the laser head not 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.

Linear bearings:

The linear bearings are found under the gantry (to mount the gantry to the side rails and under the focal head (to mount the focal head to the gantry. These bearings have grease fittings for pushing lubricant into the ball bearing areas. You might not have a special grease pump to lubricate the bearings. Try the cheap and easy approach. 1 Remove the grease fitting, 2 Apply the grease to your finger, 3 Push the grease into the little hole, 4 push more grease into the little hole, 5) go to step #2 ...... 6) Put the grease fitting back on.

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.

Air filters:

Please consult your user appropriate user manual(s for cleaning or replacing the air filters. Air filters work best when air is able to 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 off-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 the particles of different size.

Incline Portion of Table & Collection Tray(s):

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.

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 much later resort. The coolant should always be clean and clear. It is a common problem for the coolant to becom infested with mold. This often looks like a 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.

Use a dehumidifier:

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.

Make 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 such that the laser doesn't work right ...or doesn't work at all.

Use a heater:

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

Laser not coming on

First make sure 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?

Machine coming 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 actually 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 keeps starting at 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. **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.