



Techno CNC Laser Manual with RDWorks v8



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Disclaimer: Techno CNC Systems, LLC, is not responsible for any loss due to improper operation or violation against the items contained in this manual herein.

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IN CASE OF FIRE:

1. Press the **EMERGENCY STOP** button located on the side of the machine next to LED Panel
2. Lift the lid
3. Quickly blow out the flame (or use a CO2 fire extinguisher for serious flames)



This machine is a Class 4 Laser Device. This is the MOST Hazardous Laser Classification.

Permanent eye damage will result from direct, diffuse or indirect viewing of the laser beam with the potential for fire hazard and skin hazard (serious burns)

Use great caution to control the path of the beam as these dangers are present even from apparent matte surfaces; although they appear non-shiny, may reflect the laserbeam.



WARNING: DO NOT OPERATE THIS MACHINE WITHOUT PROPER TRAINING!

Improper or unsafe operation of the machine will result in personal injury and/or damage to the equipment. It is the user's responsibility for proper operation of the laser machine and must not violate the following instructions.

General Guidelines

- Before operating, ensure proper ventilation.
- Before servicing, disconnect all power sources.
- Before using, check for damaged parts. An authorized technician should perform all repairs. Only identical or authorized replacement parts should be used.
- DO NOT operate this machine without proper training.
- DO NOT attempt to exceed the limits of machine.
- DO NOT attempt to use machine for purposes other than what is intended.
- DO NOT operate unattended.
- DO NOT wear jewelry or loose clothing when operating machine.
- DO NOT loosen, remove, or adjust machine parts or cables while power is on.
- Wear proper laser eye protection.
- Wear proper protective clothing.
- Stay alert at all times when operating the machine.
- Maintain proper balance and footing when working around the machine.
- Make sure voltage supplied is appropriate to the specifications of the components
- Keep fingers, hands, and all other objects away from machine while power is on.
- Use proper fixtures and clamps to secure work. Never use your hands to secure work.
- Use machine only in clean, well-lit areas free from excessive moisture.
- Keep all areas around the equipment free of flammable materials, including but not limited to wood, material scraps, clothing, cleaning solvents, plastic and more.

In case of emergency, have fire extinguishing equipment available.

SAFETY INFORMATION! **DANGER: CLASS 4 LASER PRODUCT**



Read these instructions thoroughly before operating machine. **DO NOT** operate machine if you are unfamiliar with these safe operating instructions. **DO NOT** operate machine without knowing where the Emergency Stop switch is located.



- DANGER: Visible and / or invisible laser radiation.
- Avoid eye or skin exposure.
- Avoid direct or reflected exposure to the beam from glass and shiny surfaces.
- DO NOT STARE INTO BEAM or view directly with optical instruments.
- Laser protective eyewear is required.
- Laser radiation may cause the following:
 - 1) MATERIALS DAMAGE AND BURNING: Keep the beam moving to avoid burning materials at close range. Dark materials which absorb heat, and lightweight materials such as paper and fabric, are most easily burned by visible laser beams.
 - 2) SKIN INJURY (BURN) HAZARD: Avoid skin exposure, especially at close range. The burning can be severe and cause permanent scars.
 - (3) TOXIC, HARMFUL GASES MAY APPEAR: Fire extinguishing equipment must be available by the machine. It is strictly forbidden to put flammable, explosive articles around the table and equipment and proper ventilation be maintained at all times.
- Manufacturing objects and emissions should be in accordance with local laws and regulations. In addition to federal laws, some states and jurisdictions also regulate laser equipment and/or usage.
- Laser processing may cause risks. Users should carefully consider whether processed object is suitable for laser operation.
- POWER OFF THE EQUIPMENT BEFORE YOU LEAVE: DO NOT operate unattended.
- When equipment is processing, it's strictly forbidden to open any end covers.
- It is strictly prohibited to place any irrelevant total reflection or diffuse reflection object near the equipment to prevent the laser reflection from doing harm to the body or flammable items.
- When the operation is in process, the operator must watch the status of the equipment at all times. If an abnormal condition occurs, the power supply of the machine should be cut off immediately and corresponding measures should be taken to correct the problem.
- This equipment may produce electromagnetic interference and should be positioned far away from electrical-sensitive equipment.
- Vibration and strong magnetic interference will affect the laser operation and must not be present.
- Working temperature must not exceed 5-40 °C, humidity 5-95% (No condensation must be present).
- Working voltage: AC220V, 50HZ. When the voltage is not stable or does not match the machine, it is strictly prohibited to run the equipment.
- Machine must be plugged into a four-pronged grounded outlet. Do not remove the grounding plug or connect into an ungrounded extension cord.
- High voltage or other potential dangers may be inside the laser equipment. We insist you assemble it under the guidance of factory trained professionals.
- WARNING: Ensure that all electrical connections are carried out by a qualified electrician. Improper electrical connections can result in damage to the equipment, fire and death.

Setting up the Laser for first time

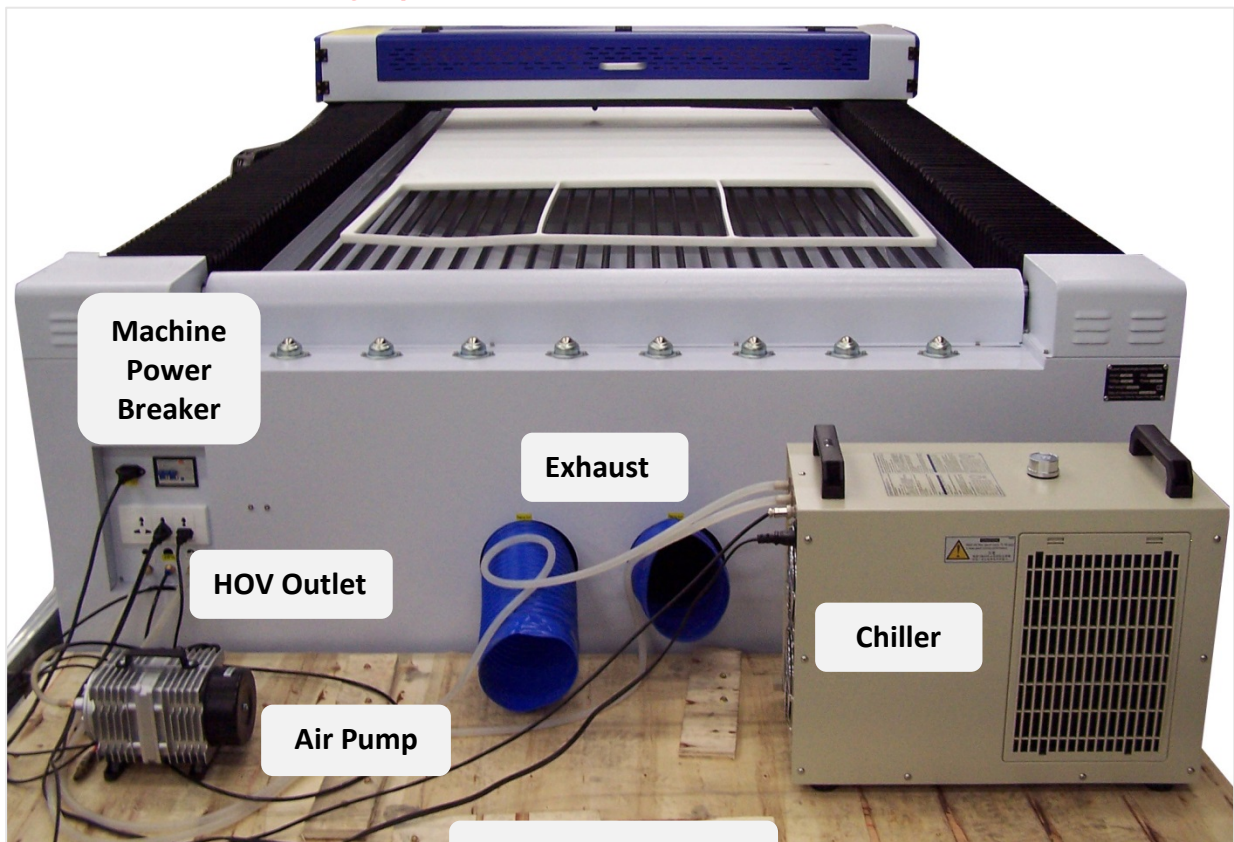


Figure 1

Make sure to remove any foam material from inside of cabinet. Remove any plastic ties used for securing laser head from moving on x or y axis during shipping. Check for any loose nuts or bolts that may have come off during shipping in the bottom of cabinet.

Depending on what options purchased with your laser, there will be boxes outside of the laser cabinet. Additionally, some units will have accessories taped to the working table inside the cabinet. Locate and identify each of these. You should see the common items listed below and possibly some additional accessories:

- Vacuum Blower with 6 inch duct flanges
- Water Chiller for tube cooling
- Air pump with tubing
- Tool box containing necessary software and hardware components.
- Additional accessories such as rotary attachment, cutting table, custom jig, etc.
(According to purchasing order).

The exhaust (Labeled in Figure 1) requires the most effort and its importance can't be overstated. The laser vaporizes material as it moves along its axis, generating large amounts of smoke. Some materials like leather or wood generate much more. The exhaust is necessary to remove this byproduct to the outside, away from any area where coworkers may congregate. Correctly ducted, a laser can easily be placed in an office or spare room.



Figure 2

Larger machines have two exhaust ports. Figure 1 and Figure 2 show the typical exhaust outlets on all of the larger Techno Lasers. Both ports are designed to remove air from above the material, during engraving/etching for example.

The water chiller (Figure 1 and Figure 3) requires two lines; one to the water inlet and one to the water outlet barbed fixture. All Techno Laser tubes are water cooled and the laser machine will not fire if water is not moving through tube. The chiller is capable of holding 4-5 gallons of deionized water. A simple method to add/remove water is to use a 5 gallon bucket and a funnel.



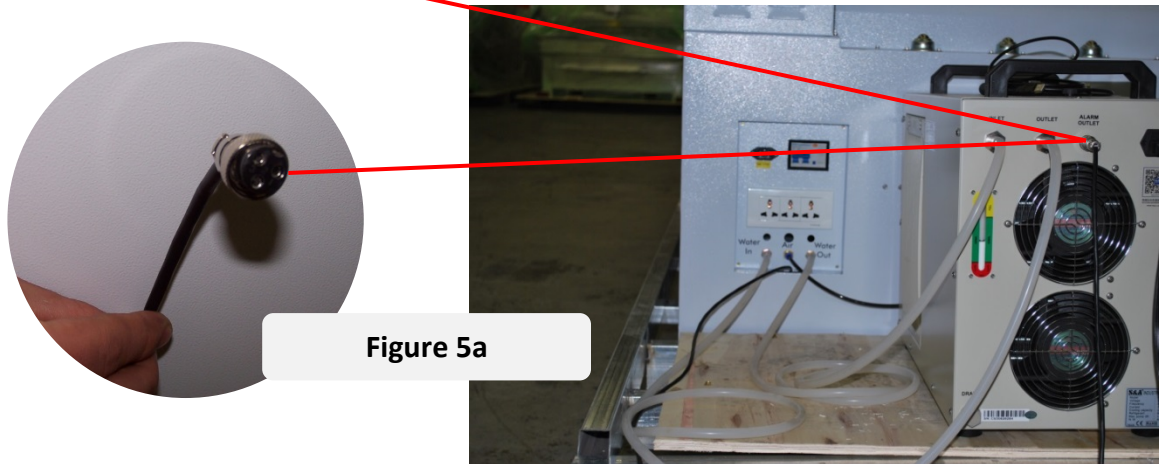
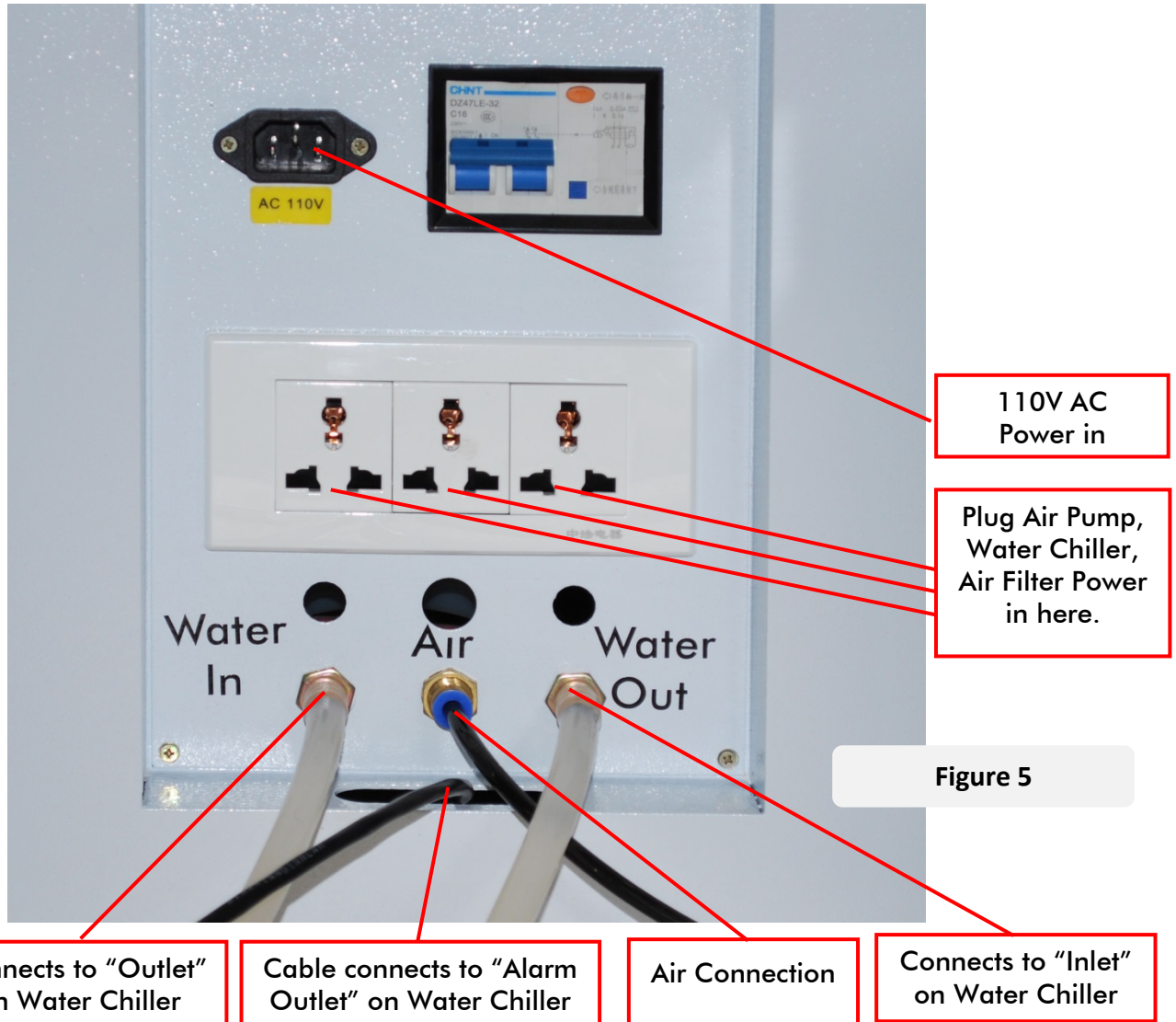
Figure 3

The air pump (Figure 1 and Figure 4) needs to be attached to the air inlet fixture on the machine. The purpose of the air pump 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 pump will turn on and off with the laser.



Figure 4

Machine Connections



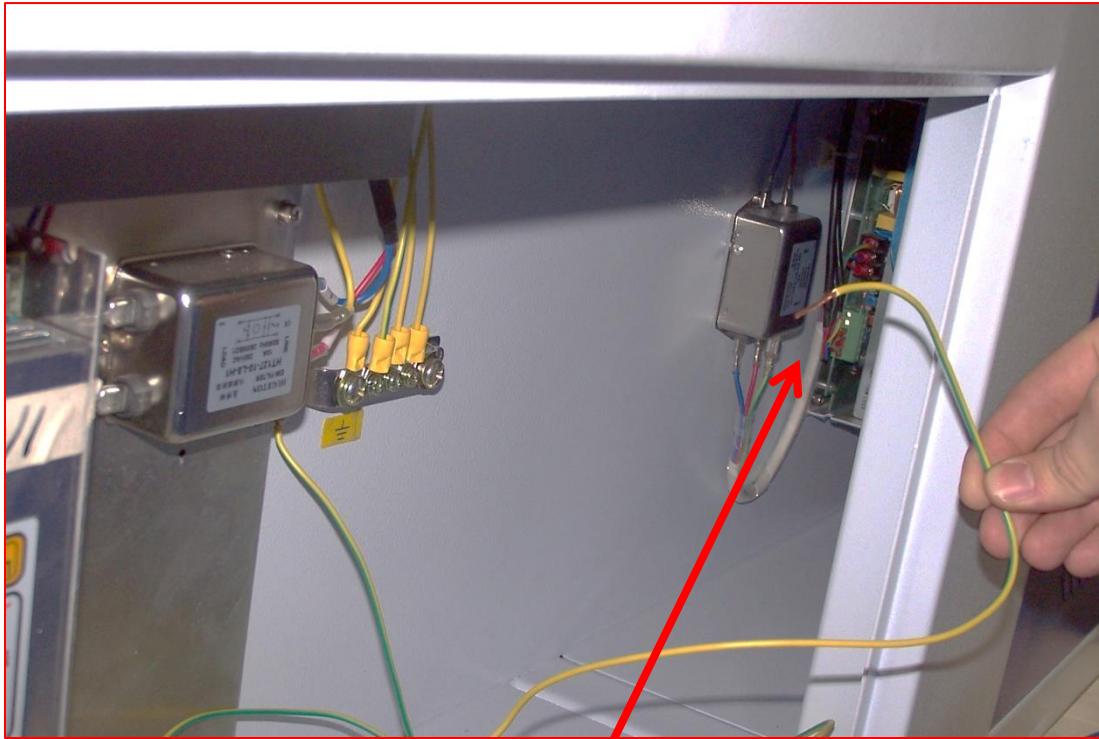
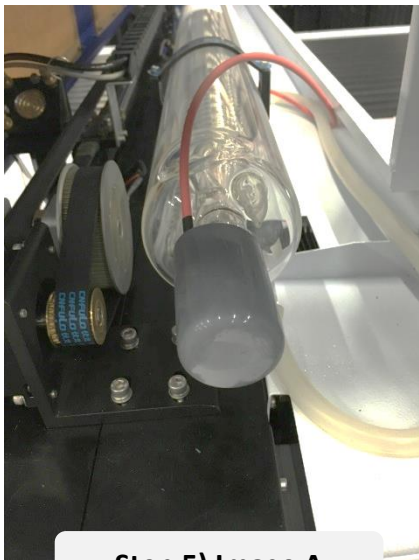


Figure 5b

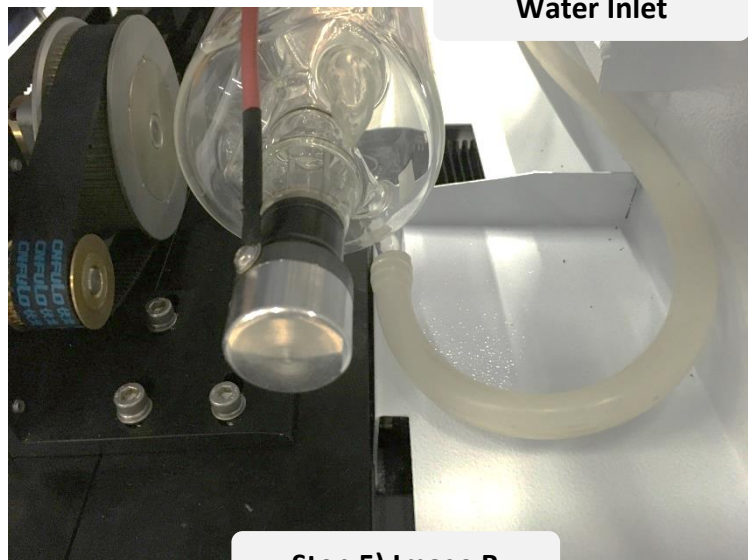
Notice the ground connector wire located on the left side of the machine inside the cabinet. Use the black keys to open and retrieve the ground wire. This is an external ground designed to help eliminate static electricity. Just run the included ground wire from the connection to any grounded outlet 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. **(Figure 5b)**

Installation of the CO2 Laser tube.

- 1) Push the gantry to the rear of the machine and open the rear access door. Make sure the tube clamps are loose, the two wires (one black and one red) are free and the two water hoses are out of the way for installation of the CO2 Laser tube.
- 2) CAREFULLY unpack the Laser tube.
- 3) Ensure that the laser tube brackets are secure to the gantry and are tight. If the brackets are loose from shipping, tighten them down before installing the laser tube.
- 4) Using two people, carefully place the laser tube into the laser tube clamps. One person should hold the tube steady as the other person guides it into position. Make sure the end with the rubber cap is on the left side and the end with the crystal lens is pointing toward mirror A. You will need to move the laser tube at an angle in order to fit it inside the gantry.
- 5) Once in position, tighten the tube clamps snug so the tube cannot move and the water inlet and outlet ports can be easily accessed.
- 6) Remove the rubber cap and connect the red wire to the cathode terminal. Make sure the wire points toward the middle of the tube as the rubber cap **MUST** be put back onto the terminal.
(See Image A and Image B below.) Without the cap, electricity is able to arc, causing damage to the machine and can lead to possible injury.
- 7) Connect the water inlet hose (comes from same location as the red wire) to the water inlet nipple on the end of the tube. **(See Image B below.)**

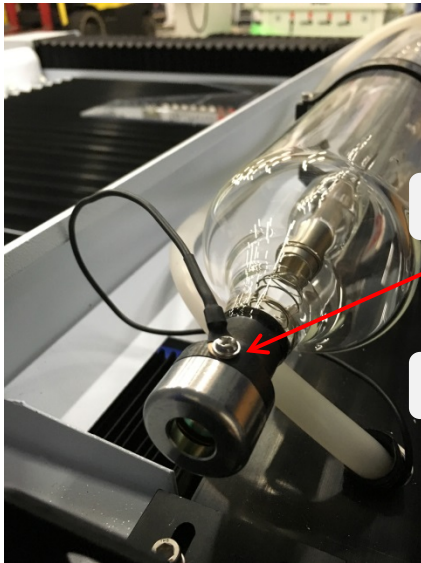


Step 5) Image A



Step 5) Image B

- 8) Moving to the other side of the laser tube, connect the black wire to the screw point on the anode of the tube. (See Image 7C below.)



Black wire connects here.

Step 7) Image 7C

- 9) Connect the water outlet hose (comes from same location as the black wire) to the water outlet nipple located toward the middle of the tube. (See Image 8D below.)



Water Outlet

Step 8) Image 7d

- 10) Make sure all screws are tight (clamps and wires) and that the tube **CANNOT** move.

Switches and Panel

LED Control

LED Keypad,
Display and
Functions



Figure 6

EMERGENCY
STOP Switch

UDisk (USB key)
Port

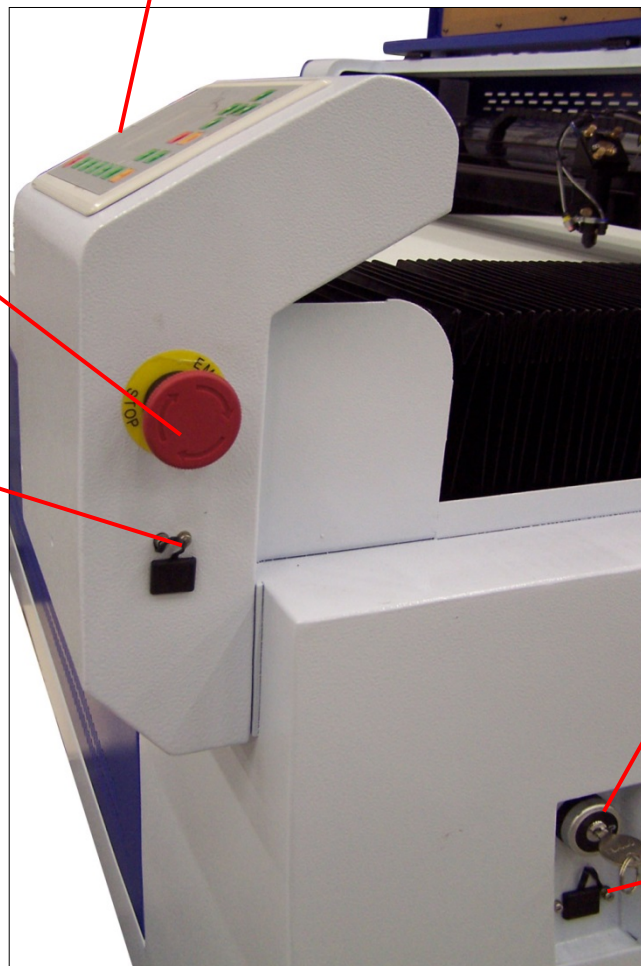


Figure 7

Machine's Power
Switch

USB interface
Port

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.

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
- PETG (polyethylene terephthalate glycol)
- Polyethylene (PE) – melts badly
- Polypropylene (PP) – melts somewhat
- Styrene
- Two-tone acrylic – top color different than core material, usually for custom instrumentation panels, signs, and plaques.

Foam:

- Depron foam – often used for RC planes.
- EPM
- Gator foam – foam core gets burned and eaten away compared to the top and bottom hard shell.

Other:

- Cloths (leather, suede, felt, hemp, cotton)
- Papers
- Rubbers (only if they do not contain chlorine Teflon (PTFE, Polytetrafluoroethylene))
- Woods (MDF, balsa, birch, poplar, red oak, cherry, holly, etc.)

HP (High Pressure) materials include all the above guidelines and as listed:

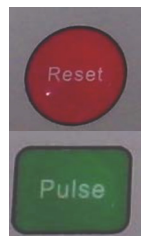
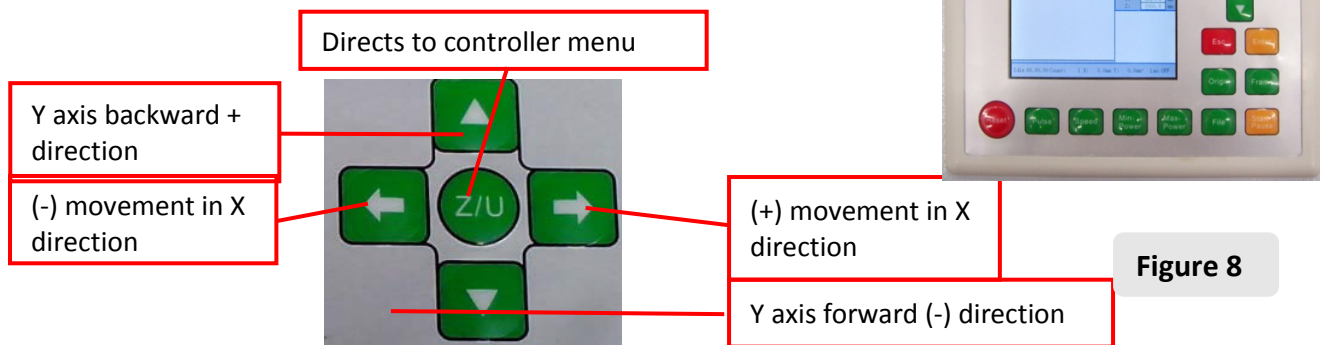
- Stainless steel up to 18 gauge (only 260 W Laser)
- Mild steel up to 18 gauge (only 260 W Laser)
- Thicker and denser woods (only 260 W Laser)
- Engrave steels by removing material to common depths (only 260 W Laser)

Materials that can't or should not be cut:

- Non ferrous metals
- Polycarbonate (PC, Lexan) due to the fumes.
- Any material containing chlorine
- PVC (Cintra) – contains chlorine
- Vinyl – contains chlorine

- Phenolic

The LED Keypad Functions



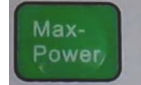
Reset: After pressing the reset button, the machine will go through its homing process and then return back to its last saved origin.



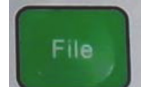
Pulse: By pressing pulse, the machine will generate a laser for as long as you hold the button. This is used for calibrating the laser. See instructions on how to calibrate the laser to learn how to use this function properly and safely. Enclosed lasers must have cover closed in order to operate pulse function.



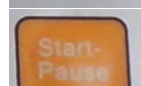
Speed: Used to change the jogging speed of the machine. This function can also be used to change the processing speed in the middle of a program, or while a program is paused.



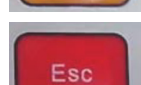
Min - power/minimum power: Can be used to change the min processing power of a project. This function can be used while machine is running a file.



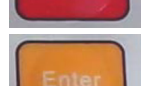
Max power/maximum power: Used to change max processing power of a project. This function can be used while machine is running a file.



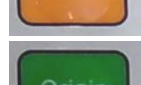
File: Click to view/delete memory file. USB memory can be copied to machine and programs are automatically saved once processed.



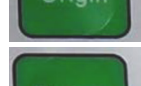
Start / Pause: Used to start a program and pause the program while processing.



Esc/return: Will exit out of various settings, unload program files and return operator to main screen. Also is used to find the last saved origin from the main screen.



Enter/sure: Used to confirm changes to parameters and settings. Used as the select key while navigating through menus.



Origin/location: Used to set the origin of the laser at the operators desired location. The origin is the start point of the program.



Frame/walk the borders: The machine will start from its origin and jog around the processing area that the laser will be cutting/engraving. This essentially “frames out” the working area of the program.

Introduction to the Main Interface

When the system is powered on, the screen will show as illustrated in Figure 9

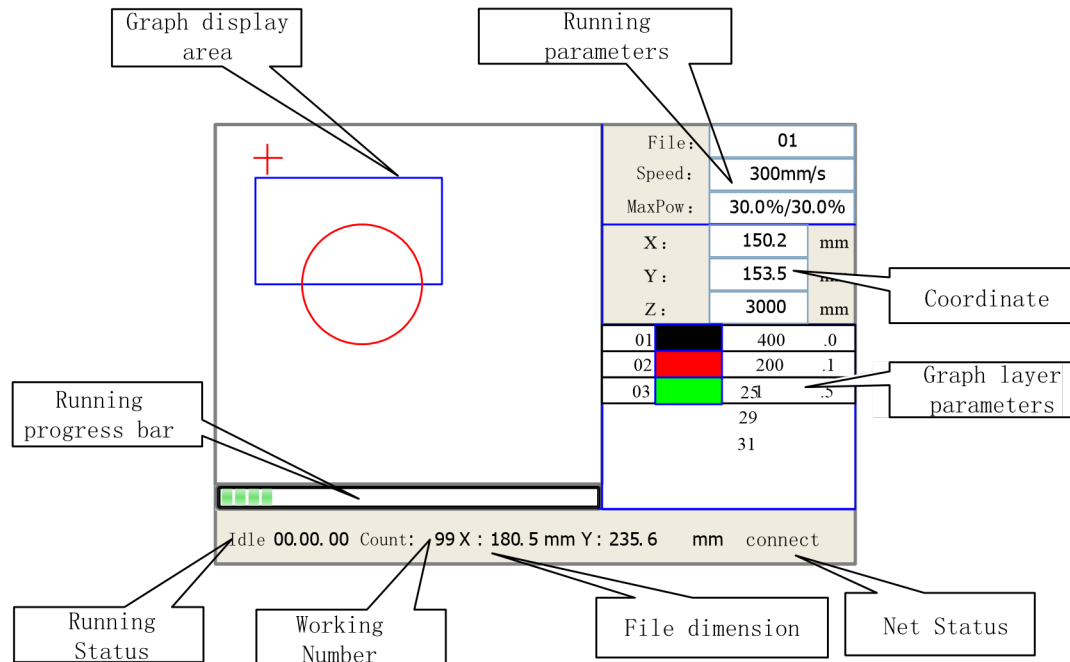


Figure 9

- **Graph Display Area:** Displays the current file's toolpath and current location during file execution.
- **Running parameters:** Displays the running file's file name, speed, and power.
- **Coordinate:** Displays the current coordinate of X,Y and Z axes
- **Graph layer parameters:** Displays the layers' information of the current file, such as max or min power, speed, etc. Displays cutting/etching parameters for the selected file. These parameters include; min and max power percentage, and speed. You are able to adjust these parameters at the machine or by using the RD Works V8 software.
- **Running Status:** Displays the current status of the machine, such as Idle, Run, Pause, Finish, etc.
- **Running Progress Bar:** Displays progression of a running file.
- **Working Number:** Shows the number of times the current file has run.
- **File Dimension:** Displays the dimension of the current file in metric units.
- **Net status:** Displays the network status.

When work is Idle or finished, all keys can be pushed, users can select a file to run, set some parameters, preview to a select file etc. But, when work is running or paused, some keys don't respond when they are pushed.

Speed key

Push the “Speed” key when the screen is on the main interface, as shown in Figure 10

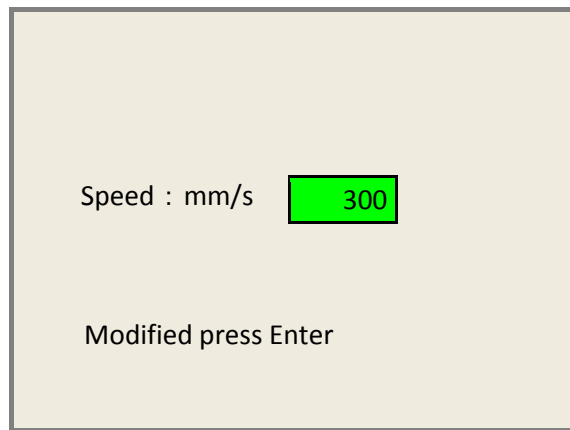
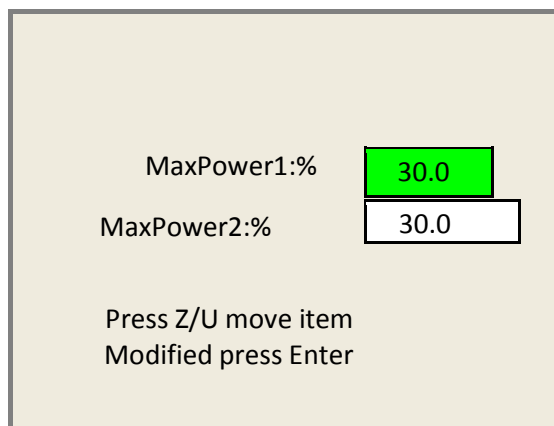


Figure 10

Push the “X+/-” Keys to move the cursor in the numeral area, and push the “Y +/-” keys to change the value, then push the “Enter” key to save the change, push the “Esc” key to invalidate the change.

Max/Min power keys

Push the “Max Power” or the “Min Power” keys when the screen is on the main interface, shown in Figure 11a-b (See the following page)

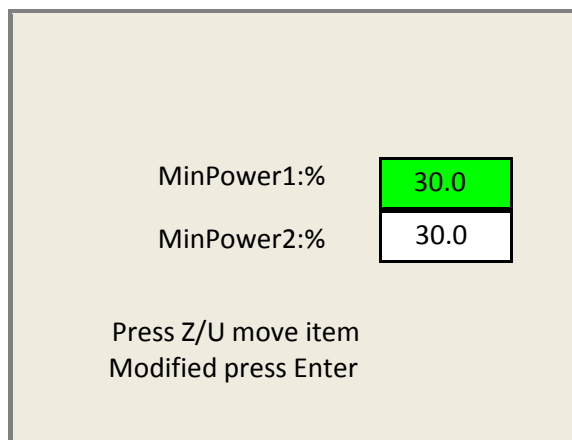


The screenshot shows a CNC control interface with a light beige background. It displays two power settings: 'MaxPower1:%' and 'MaxPower2:%'. Each setting has a corresponding input field containing the value '30.0'. The 'MaxPower1' field is highlighted with a green background, while the 'MaxPower2' field has a white background with a black border. Below the input fields, the text 'Press Z/U move item' and 'Modified press Enter' is displayed.

MaxPower1:%	30.0
MaxPower2:%	30.0

Press Z/U move item
Modified press Enter

Figure 11a



The screenshot shows a CNC control interface with a light beige background. It displays two power settings: 'MinPower1:%' and 'MinPower2:%'. Each setting has a corresponding input field containing the value '30.0'. The 'MinPower1' field is highlighted with a green background, while the 'MinPower2' field has a white background with a black border. Below the input fields, the text 'Press Z/U move item' and 'Modified press Enter' is displayed.

MinPower1:%	30.0
MinPower2:%	30.0

Press Z/U move item
Modified press Enter

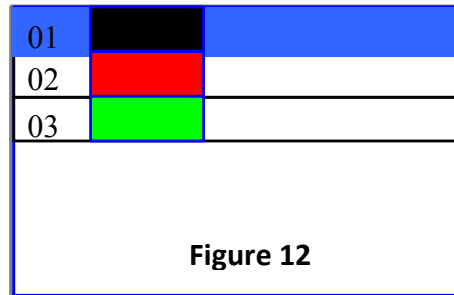
Figure 11b


When “Z/U” key is pushed, the green block can move up and down to denote the changing item, then “Y+/-” keys and “X+/-” keys can be used to change the value.

These changes can be made while a file is running on the machine or after it is loaded.

Set the layer parameters

After selecting a file to preview on the main interface, the user can push the “Enter” key to move the cursor to select a layer. The “Y+/-” keys can be pushed to highlight a layer. The “Enter” key can be used again to select and edit the layer’s parameters, illustrated in Figure 12.



Layer0 : 

Speed : mm/s

MinPower1 : %

MinPower2 : %

MaxPower1 : %

MaxPower2 : %

Press Z/U move item

Modified press Enter

Figure 13

The user can push “Z/U” Keys to move the green block to any parameter, so that it can be changed as needed. Press “ENTER” to validate the change, and “Esc” to invalidate the change.

Z/U Key

The Z/U key can be pressed when the system is idle or the work is finished. When pressed, it will show the following menu.

If your machine is equipped with a z-axis, highlight "z move" and use the X +/- keys to move the axis.

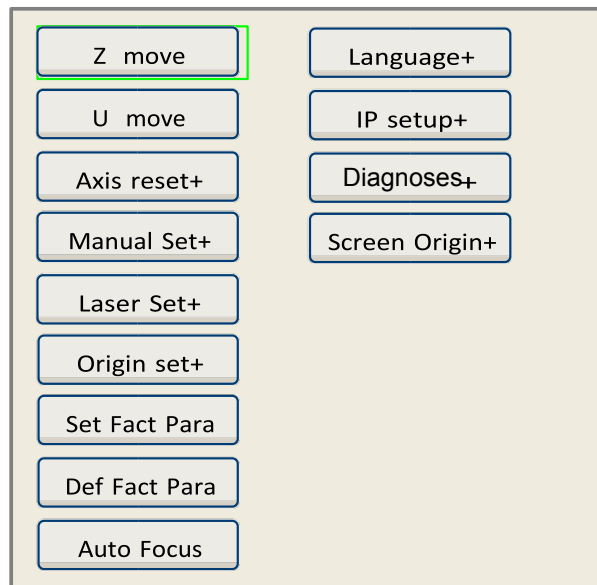


Figure 14

File Key → Memory File

On the main interface, if "File" key is pressed, it will appear as below in Figure 15:

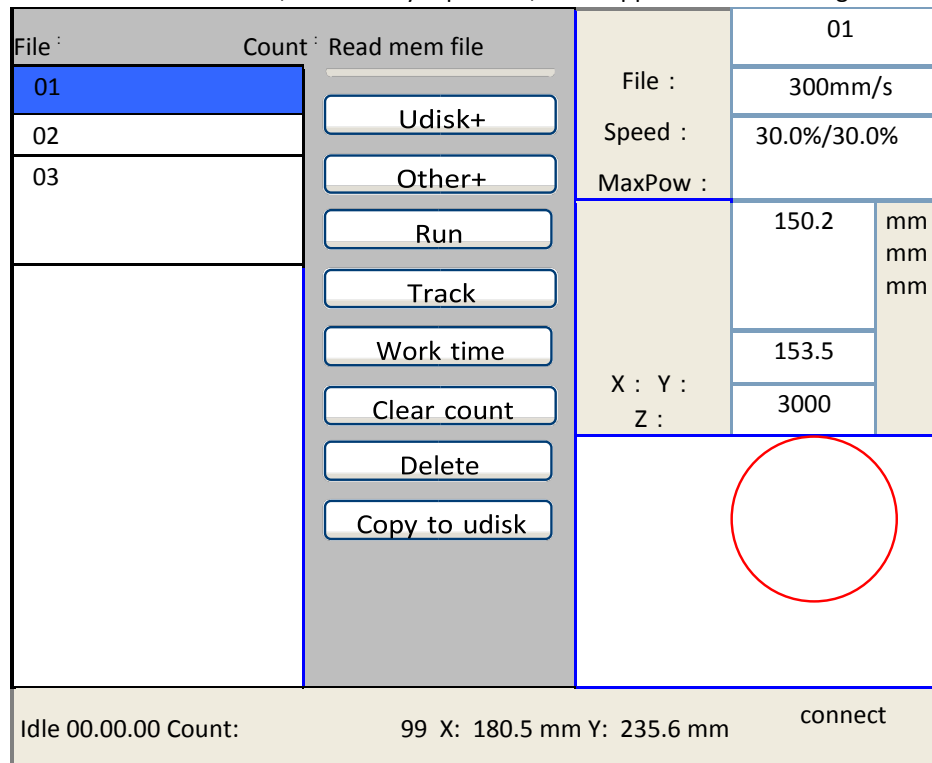


Figure 15

When showing this menu, the system would read the memory file first. The file name and the work times would be listed, and the selected file is previewed in the bottom right area. “Y+/-” keys could be used to move the cursor on the file name list. When the cursor is on a target file name, press the “Enter” key, the selected file will be loaded and previewed on the main screen. Pushing the “esc” key will cancel the file selection.

“X+/-” keys could be used to move the cursor left and right. All the item show as below:

- **Read mem file:** read the memory file list.
- **Udisk:** read the USB file list.
- **Run:** Runs the selected file.
- **Track:** Tracks the selected file (track mode is optional).
- **Work time:** Estimates the running time of the selected file. The time is accurate to 1ms.
- **Clear count:** Clears the running count of the selected file.
- **Delete:** Deletes the selected file in the memory.
- **Copy to Udisk:** Copies the selected file to the USB disk
- If the “Other” entry is pressed, the system will show as below in Figure 16

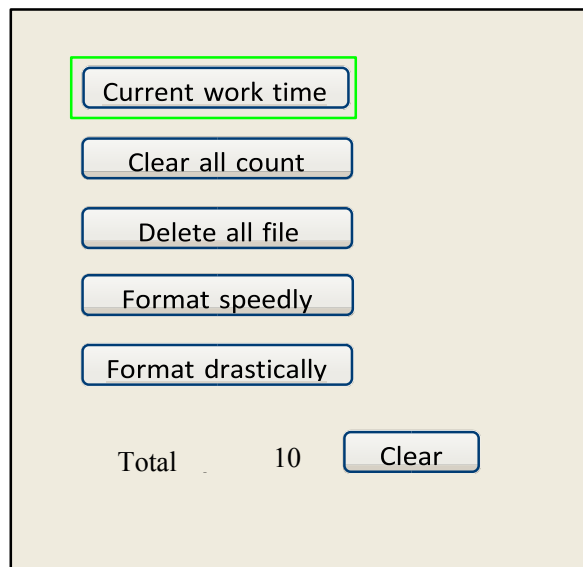


Figure 16

- **Current work time:** Estimates the running time of the current file (the current file No. is showed on the main interface), and the time is accurate to 1ms.
- **Clear all count:** Clears the running times of every file in the memory
- **Delete all file:** Deletes all memory files
- **Total:** Shows total of the running times for all files. “Clear” resets.

U Disk File

If the “Udisk” entry in Figure 17 is pressed, the system will show as Figure 17, and the operation method is all the same as Figure 16.

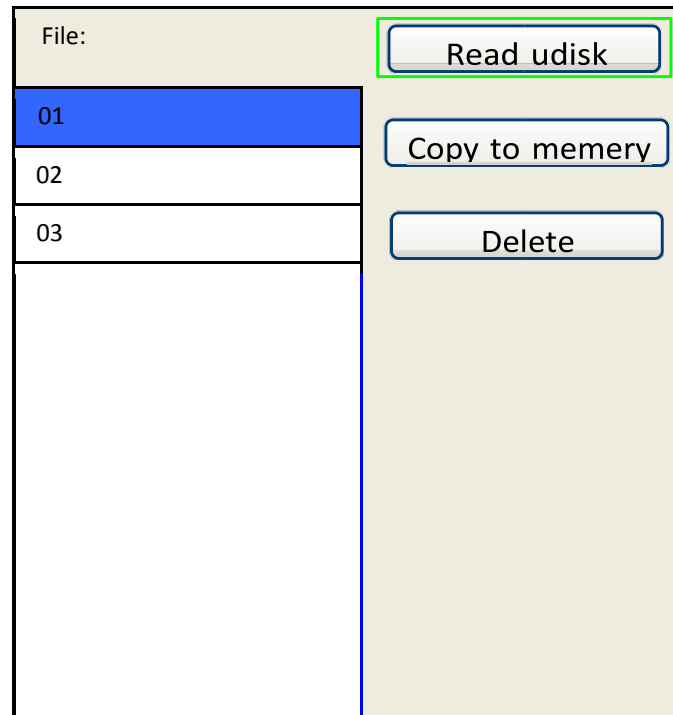


Figure 17

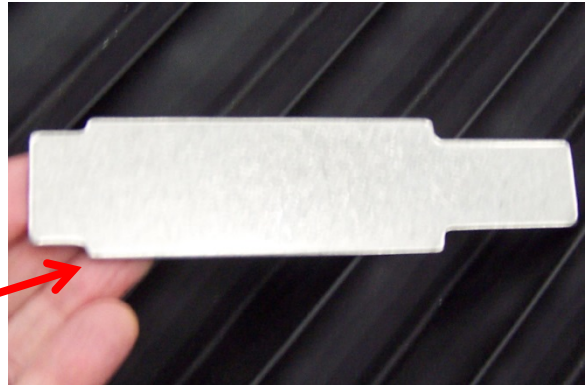
- Read Udisk: Reads the file list on the USB key.
- Copy to memory: Copy the selected USB key file to the memory.
- Delete: Delete the selected USB key file

Lens Replacement

Lenses are one of the few parts of a laser machine that need regular maintenance, primarily regular cleaning.

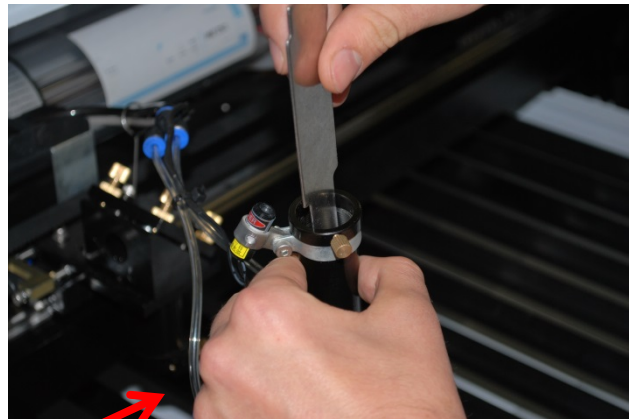
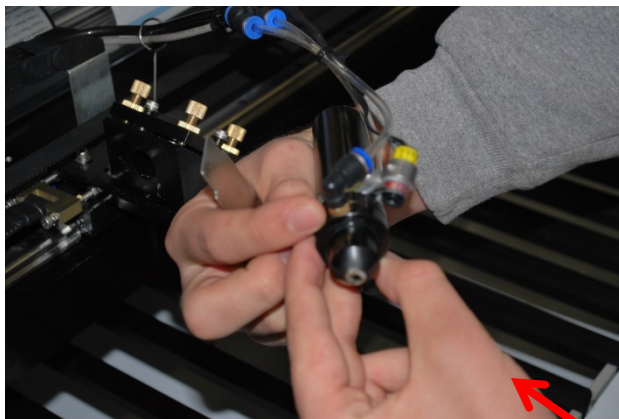
The laser tool box contains a tool for removing the slotted ring nut and is shown on the right. The tool looks more like a scraper than a screw driver. Its width is designed to fit inside the lens tube and fill the slots. The other end of the slotted ring tool removes the mirrors from their holders. **Be careful not to let the blade tip slip and scratch the lens.**

Laser Tool



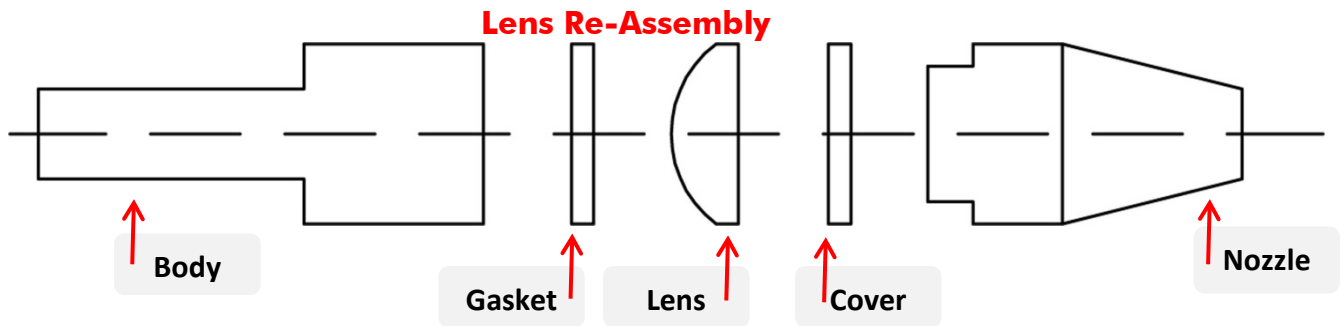
The lens is small, about 0.787 inches (20 mm) across, with 2 distinct sides, one flat and one convex. **When reinstalling, the curved side always faces the laser path, away from the working platform.** As illustrated in Figure 6, the lens assembly consists of 2 main parts, the lens tube (also known as the lens housing) and nozzle. Always remember, “Bubble Up”

The 3 parts inside the lens tube are the lens, D-ring and slotted ring nut.



To remove lens for replacement or for cleaning, loosen the friction set screw on the main lens housing holding the lens tube in place as shown above left. After loosening set screw, the lens tube should slide out of the housing. Separate the lens tube from the nozzle like the illustration shown above right.

Lens Replacement and/or Cleaning



Handle the lens carefully, using acetone or lens cleaner/wipes to clean both sides.

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

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

Lense should be inspected daily.

Tuning the Optics

The laser tube, mirrors and lenses are the most crucial part of your Techno CNC Systems laser machine and as so, it is important to develop an understanding of the system and its tuning process. Once tuned, the laser machine should stay aligned for months. Check it once every month to insure no bumping or mechanical failure has occurred causing the laser to misalign.

By studying the diagram below (Figure 1), you can see the simplicity of the system: One long glass laser tube, two small mirrors and a laser head with a focusing lens. Because every laser tube is unique, we must adjust the mirrors and lenses to accommodate the new laser path, ensuring the beam finds the laser head and thus having an ideal cut.

The basic idea behind tuning the optics is to adjust the mirrors and laser tube so that the laser's beam path is as centered as possible going into the laser head. To do this we must adjust 2 mirrors, A and B. Once mirrors A and B have been adjusted so that the beam reaches the center of the laser head, we can adjust one last mirror, C, inside the laser head, which reflects the beam straight down at the material, ensuring a plum and straight cut.

Be careful with this procedure. Make an adjustment, then turn on the laser and fire a test shot by pressing the PULSE button on the LED panel.

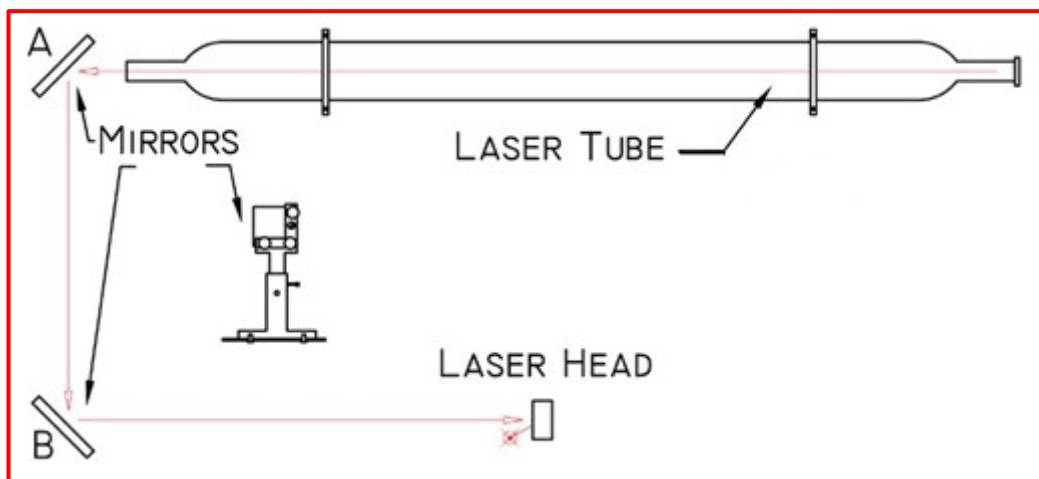
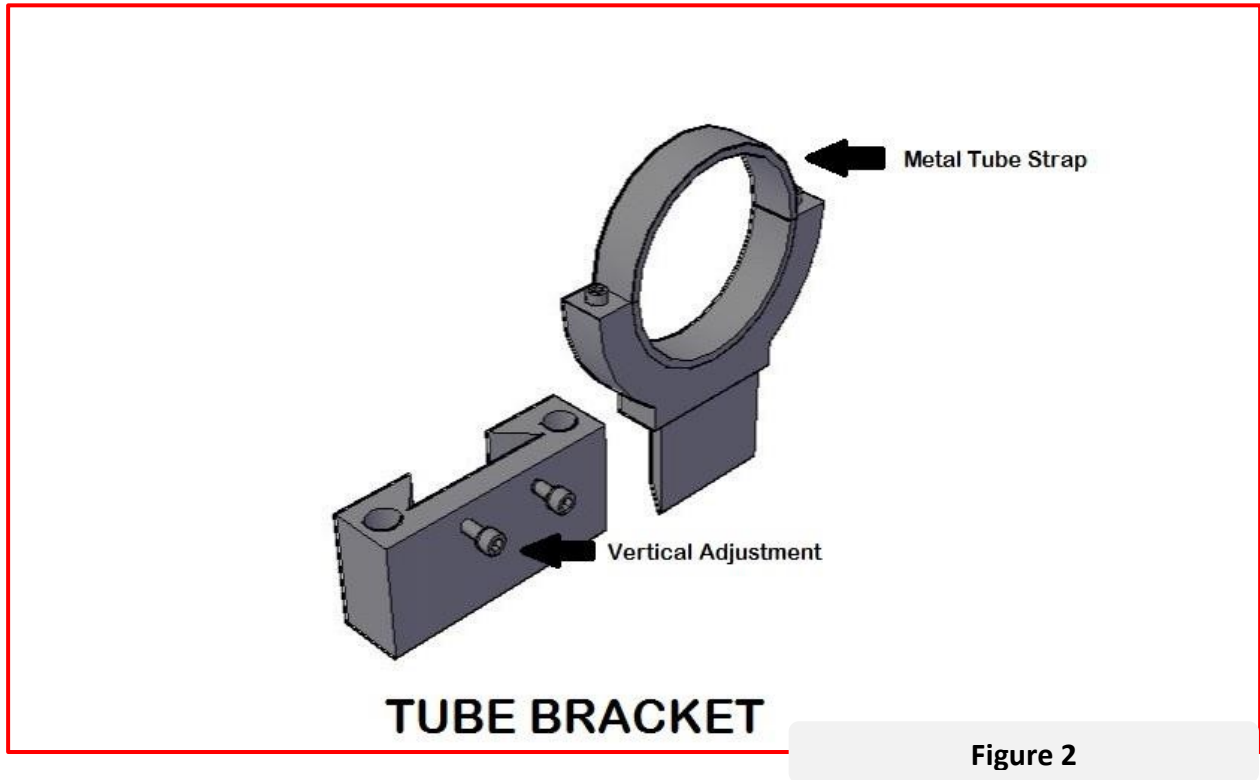


Figure 1

Tube Bracket

One of the two tube brackets, illustrated in Figure 2, secures the long glass laser tube in a stable position. The bracket can also be adjusted up and down, so we can ensure the beam travels to the center of mirror A. The two bolts on top of the bracket are not to be used for adjustment. Their sole purpose is to hold the tube in place. All adjustments are accomplished using the vertical bolts.



The vertical adjustment is simple, just loosen the two vertical adjustment screws and lower or raise the upper bracket. With these adjustment screws, aligning the tube to hit the first mirror is simple and easy.

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 2a and firing the laser using the PULSE button. The laser will quickly burn through the tape leaving its mark as shown in Figure 2b.



Figure 2a

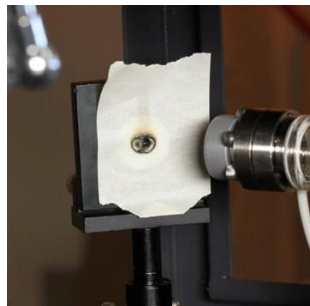


Figure 2b

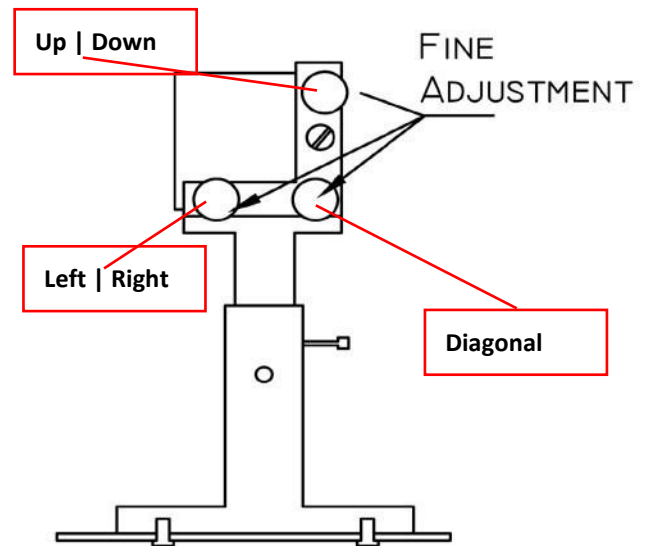
Remember to use caution, if the laser is way off target, it could literally shoot into the room, missing the mirror, the cabinet and hitting someone or something. This could be dangerous. Use extra caution on this procedure. The laser beam has no color and can't be seen. Once finished make sure mirrors are clean and continue on to the next step.

Mirror Bracket

The mirror bracket works much like the tube bracket, except with fine tune adjustments.

An illustration of the mirror bracket showing the fine-adjustment screws is shown on Figure 3. 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. First jog the head all the way across from mirror B. Using the same masking tape technique, adjust mirror B so the laser hits the middle of the laser head. Once the laser is centered on the laser head, we can adjust mirror C, on the laser head. To direct the laser straight down this time, put the tape on the tip of the nozzle and adjust accordingly.



MIRROR BRACKET

Figure 3

Maintenance Schedule

Focal lens:

This is the lens that is used to focus the laser beam. This lens should be inspected and cleaned regularly. 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 C (in the laser head):

This mirror is located directly above the focal lens. This mirror should be cleaned regularly. 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 B:

This mirror is located directly at the end of the gantry rail. This mirror should be inspected and cleaned regularly. Use the same directions as found for Mirror C.

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 C.

Laser tube output coupler lens:

This lens is located inside the output end of the laser tube. This lens should be cleaned, inspected, and cleaned regularly. You must be very careful when cleaning this lens. This lens cannot be removed from the laser tube. You can use a Q-tip for applying the acetone. Lens wipes with alcohol-free solution will also do the trick. Be gentle. The ideal situation is that you are only removing dust, film contamination from humidity, or smoke fumes. Do not scratch this lens. It is not replaceable.

Linear rails: The 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 some oil. The linear rails should be given some attention about every month. The surfaces of the metal should always have oil 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 near where the home switch is located. If you see a dirt line, then clean the rails off and apply fresh oil.

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. Some 4x8 units will have an oiler system installed. Sewing machine oil is used in this oiler system. The oil reservoir is located under the machine next to the power supply. Pump once, every week in order to lubricate linear bearings.

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. 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 particulates 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-gasses 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 different sizes of particles.

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. 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 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.

Use a dehumidifier:

Humidity can cause the metal parts of the laser machine to rust. While 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 turning 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?
- Check the 120v 5amp fuse located in the receptacle used to power up the laser. The fuse is a pull out type at the bottom of the receptacle. Not all units will have the fuse receptacle.
- Check the re-settable fuse box (breaker), make sure the lever is in the on position. Not all units will have this fuse.

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 water pump or water chiller is on.
- Make sure all doors are closed. All our machines come with interlocks to prevent operation in the event lid or doors are open. These interlocks are installed on smaller model machines that are enclosed.

X or Y Slop Over Error / Frame Over Error

When running the Frame and/or START-PAUSE button, the Slop/Frame error message will appear only if the object(s)/image(s) being executed on the worktable is overextending (too big 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 cancel the origin, press the Z/U button and cycle through the options until you see Axis Reset+. Select it and then highlight over the XY axis reset. Once that is selected, the laser head will go to it's home position and now the origin has been cancelled. To change the origin position, just move the laser head to your desired location, then press the ORIGIN button again to set the origin.

Hardware:

- Water Pump OR Water Chiller – 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.
- Down draft blower OR Down draft air filter.
- Air Pump – Produces around 20 lbs. of pressure and NEEDS to be on at all times when the unit is operational.

Introduction to RDWorks

Main Interface:

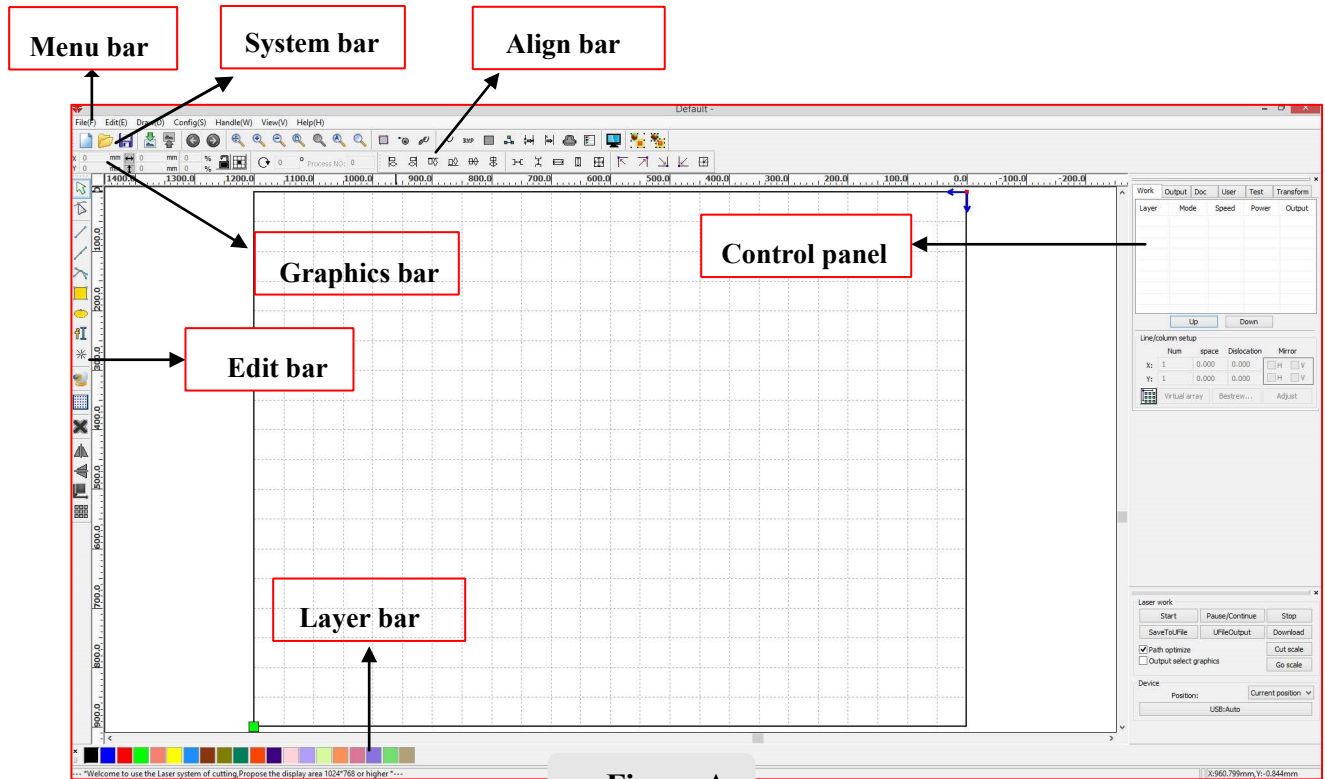


Figure A

The functions of the various components of the interface are as follows. (See Figure A.)

Menu Bar: The main functions of the software are implemented through the Menu Bar. Commands executed through the Menu Bar include some of the most basic functions, including Document, Edit, Draw, Setting, Processing, View, and Help.

System Bar: Some of the most commonly used command buttons chosen from the menu are placed on the System bar.

Graphics Bar: Basic graphic attributes as graphic location, size, scale, and number processing as accessed through the graphics bar.

Edit Bar: The default location of the edit bar is on the left of the work area. Tools that the user uses frequently can be placed in the edit bar to increase ease and flexibility of operation.

Align Bar: Used to align selected objects.

Layer Bar: Used to change the layering of selected objects.

Control Panel: Used to complete laser processing of multiple tasks, including the setting of layer parameters, axis control, processing, and so on.

Setting Laser Scan Parameters:

The input panel for setting laser scanning parameters (in **Figure 1**) is brought up by double clicking on the colored layer in the Work tab in the layer settings. (Also see **Figures 1a & 1b.**)

Layer: The software can distinguish between different layers of processing and their parameters

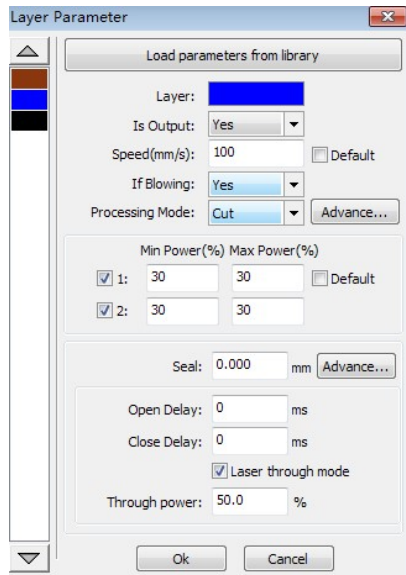


Figure 1

Is Output: This parameter has two settings, yes and no. If set to Yes, the corresponding layer will be output, whereas a No setting will result in the layer not being processed

Speed: The corresponding processing method of processing speed. Note that when a smooth cut is paramount, slower processing should be used; faster processing causes the trajectory of the cut to be more erratic. If Default box is checked, the speed set on the Control Panel on your machine will be the speed at which the file is ran.

"Cut" Speeds will vary depending on whether the material is going to be cut all the way through or lightly marked on.

If Blowing: This setting takes note of whether the external fan is operating. If it is enabled, by clicking it, then this layer will open the fan if the user has created a "can" for the fan (if no can has been created, clicking this function has no effect). **This should be always set to YES at all times.**

Processing Mode: This setting controls how the corresponding layer is processed. If the current layer is a vector layer (i.e., is a color layer), it includes three choices:

Scan = Engraving, **Cut** = Cutting, and **Dot** = Dotting.

If the current layer is a BMP layer (bitmap image), the Scan mode is only available.

Laser 1, Laser 2: These settings corresponding to the motherboard laser signals 1 and 2. Note that laser 2 is meaningless if your machine only has one laser tube.

Minimum power and maximum power: The power of the values range from 0 to 100, with 100 being maximum laser power and 0 being minimum.

The minimum and maximum power should be set to the same values for a synchronous adjustment (consistent). If **Default** box is checked, the Min. & Max. power set on the **Control Panel** on your machine will be the power at which the file is ran.

Figure 1a

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

Open Delay: The delay at which the laser is turned on. This is a button for a time / medallion latency

Close Delay: The delay at which the laser is turned off. Light off through wear / light off delay time

Laser through mode: If checked, follows the % at which the Through power is set in respect to the power set in the layer parameters or control panel.

Through power: The percentage of the power used to initially pierce material. Through power settings will vary depending on the material being cut.

[Enable sew compensation]: Caused by laser cutting seam size of the graphics and graphic deviation of actual cutting out. Seam width compensation only applies to closed graphics.

[Sew Direction]: According to the actual need to set up, such as cutting a circle. If you want to keep the circle from being cut off, you should set the direction of compensation outward, if want to keep the hole, should set the direction of compensation inward.

[Sew width]: This sets the laser cutting seam width.

Figure 1b

Laser Scanning Parameters Setting

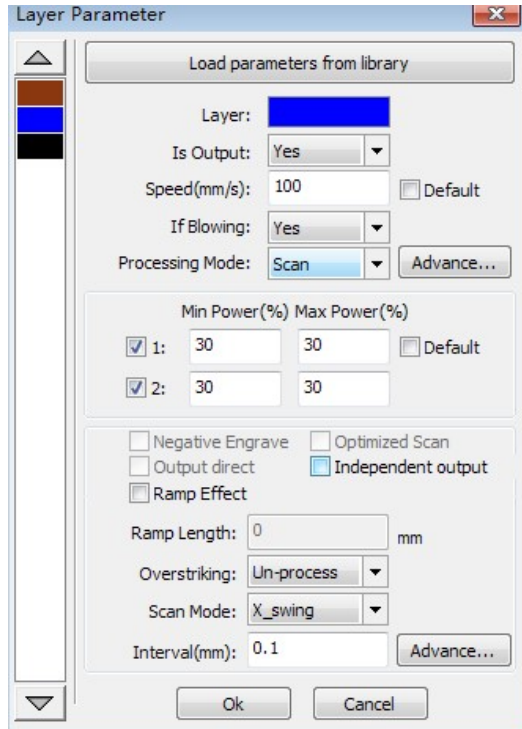


Figure 1c

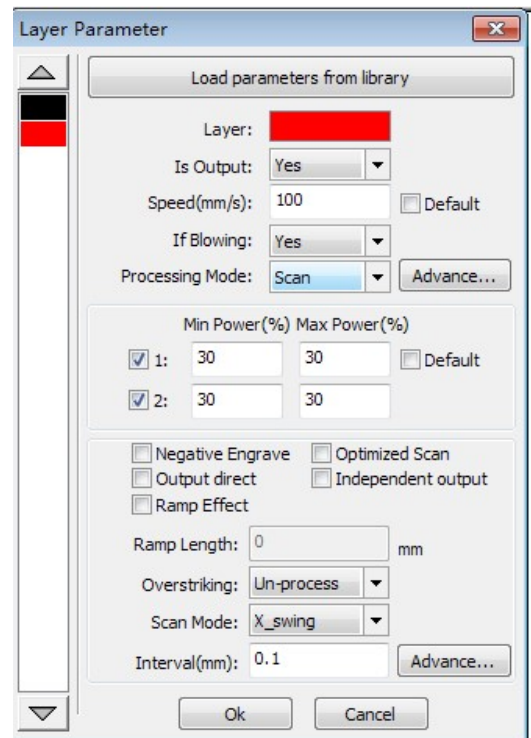


Figure 1d

In **Figure 1c** shows vector scanning parameters, while **Figure 1d** contains settings for scanned bitmap parameters. Vector data do not support scanning the color carving, optimization scanning, or direct output.

Optimal scanning: Choose optimal scanning to automatically adjust the scan to the scanning interval for best effect. Otherwise, the user settings of the scanning interval scan pattern are applied. It is generally advisable to choose "optimal scanning."

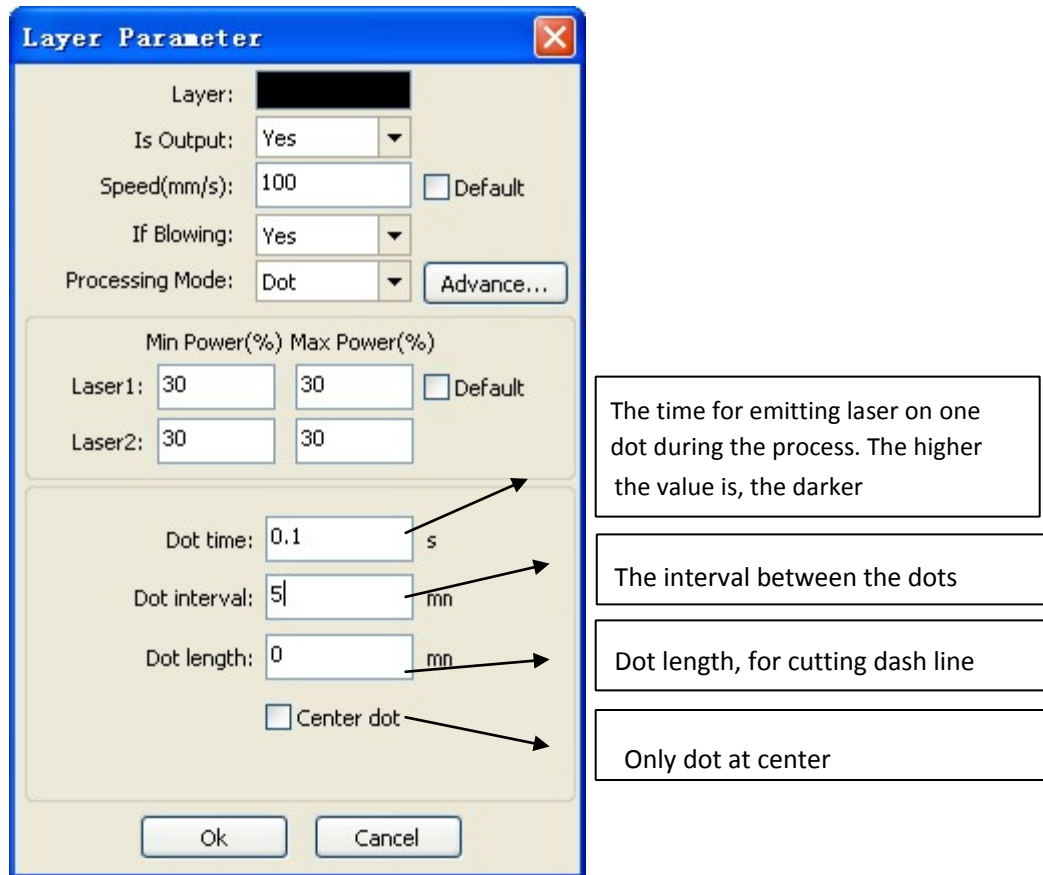
Output direct: As referred to the image (Grayscale Bitmap), higher power will be associated with deep/dark colors, on the other hand, for shallow/light colors will have lower power outputs.

Scan mode: There was four different scanning modes: **X_unilateralism**, **X_swing**, **Y_unilateralism** and **Y_swing**

- **X_unilateralism:** The scanning pattern of a back and forth motion in a horizontal direction, in which the laser is pulsing/shooting from left to right OR right to left (uni-directional).
- **X_swing:** Refers to the optical horizontal direction in the back and forth scanning of graphics, in which the laser is pulsing/shooting from left to right AND right to left (bi-directional).
- **Y_unilateralism:** The scanning pattern of a back and forth motion in a vertical direction, in which the laser is pulsing/shooting from up and down OR down and up (uni-directional).
- **Y_swing:** Refers to the optical vertical direction in the back and forth scanning of graphics, in which the laser is pulsing/shooting from up and down AND down and up (bi-directional).

Interval (mm): Refers to the optical scan and its distance under a line. The smaller the interval, the more deeply the graphics are scanned, and vice versa. Suggestions: For vector layers (i.e. color layers), the scanning interval should be set to 0.1 mm or less. For a bitmap layer (i.e., a BMP layer), the scanning interval should be set to 0.1 mm or above. Then change the maximum power to make the minimum power after scanning the graphics depth to achieve the ideal effect.

Laser Dot Parameters Setting



The screenshot shows the 'Layer Parameter' dialog box. It contains several input fields and checkboxes. Annotations with arrows point from text boxes on the right to specific fields in the dialog:

- Layer:** A text field containing a black square.
- Is Output:** A dropdown menu set to 'Yes'.
- Speed(mm/s):** A text field set to '100' with a 'Default' checkbox.
- If Blowing:** A dropdown menu set to 'Yes'.
- Processing Mode:** A dropdown menu set to 'Dot' with an 'Advance...' button.
- Min Power(%) Max Power(%)** section:
 - Laser1:** Two text fields, both set to '30', with a 'Default' checkbox.
 - Laser2:** Two text fields, both set to '30'.
- Dot time:** A text field set to '0.1' with a unit 's'.
- Dot interval:** A text field set to '5' with a unit 'mn'.
- Dot length:** A text field set to '0' with a unit 'mn'.
- Center dot:** An unchecked checkbox.

Annotations on the right side of the dialog box:

- Points to 'Dot time': The time for emitting laser on one dot during the process. The higher the value is, the darker
- Points to 'Dot interval': The interval between the dots
- Points to 'Dot length': Dot length, for cutting dash line
- Points to 'Center dot': Only dot at center

At the bottom of the dialog box are 'Ok' and 'Cancel' buttons.

Figure 1e

CNC Laser Tutorial

Before Running the Machine:

- X and Y-axis belts have tie wraps which bind them together. Make sure they are removed or the y-axis will not be mobile.
- Make sure machine has air, water and power (120 V Single phase) going to it. Also make sure ventilation system is hooked up properly.
- Confirm the proper software is installed (RDWorksV8) and being used while using the machine. The software/machine is compatible with DXF, PLT, and AI files.

Start-up:

- Make sure key is in its correct ignition slot located on the right side of the machine beside a USB port (silver key with no plastic cover). The USB port next to the key slot is used to hook up any portable PC devices.
- Make sure E-stop is not engaged (If E-stop is engaged, twist the button clockwise and the button will release). E-stop is located on the right side of the machine perpendicular to the main screen.
- Start machine by turning the key clockwise one click. The machine will produce several loud beeping sounds then automatically home. Once in its home position, the machine will then move to its origin point (based on the most recent program that was run). This all happens in sequence without any operator prompts or assistance.

Using software to save a file to cut/engrave:

- Import any DXF, PLT, and AI file into the RDWorksV8 software. If the drawing/image being imported is in standard measurements go to 'configuration' then 'File Param' and change the import settings from mm to inches.
- Once the drawing is imported select the appropriate vectors which you want to cut and double click on power and speed options located at the top right of the screen. The options on display are layer, mode, speed, power, output.
- A window will pop up in the middle of the screen giving you an array of variables that can be changed. You will be focusing on min power, max power, speed, and processing mode.
- Check with technician/charts (if available) for speed and power inputs.
- If you are cutting material the processing mode should be on 'cut'. If you are engraving the processing mode should be on 'scan'.
- Click OK when you are done entering these parameters.
- At the bottom right of the screen, underneath the title 'Laser Work' there are a number of buttons. Click on 'SaveToFile' and save the drawing to a memory stick.
- Once the file is saved, bring it over to the machine and insert it into the USB port beside the E-stop button. Now we will be working with the buttons located around the main screen of the machine.

Running a program:

- Press the button labeled 'file'




- Scroll to the option labeled 'Udisk', press Enter.



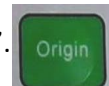
When selecting any options on the screen, you will be using the Enter button.


- Select the 'read file' option on the next screen. This will bring up a window which contains the files that are saved on the memory stick being used as well as images of the drawings.

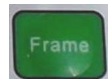
- Select the appropriate file and click Enter.  Once the file is selected, click on 'copy to memory'. This saves the selected file to the machine's memory storage.

- There is a small plastic focal guide with a width of 11mm which is used to focus the lens inside the laser housing. Using this "tool" and the clamp from the laser housing, set the laser the correct distance from the material and tighten the clamp. When setting the height of the laser you want to use the side that is 11 mm. Failing to do so will result in imperfect cuts and possibly combusting stock. Make sure this clamp is tight or the laser height may change while running a program resulting in imperfections and/or damage to the machine.

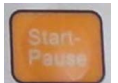
- Once the file is selected and the laser is set 11 mm above the material using the plastic focal guide, you can jog the machine to the corresponding area in which you want to set your origin. Once you have the laser over the appropriate spot you can select the button labeled 'origin'.

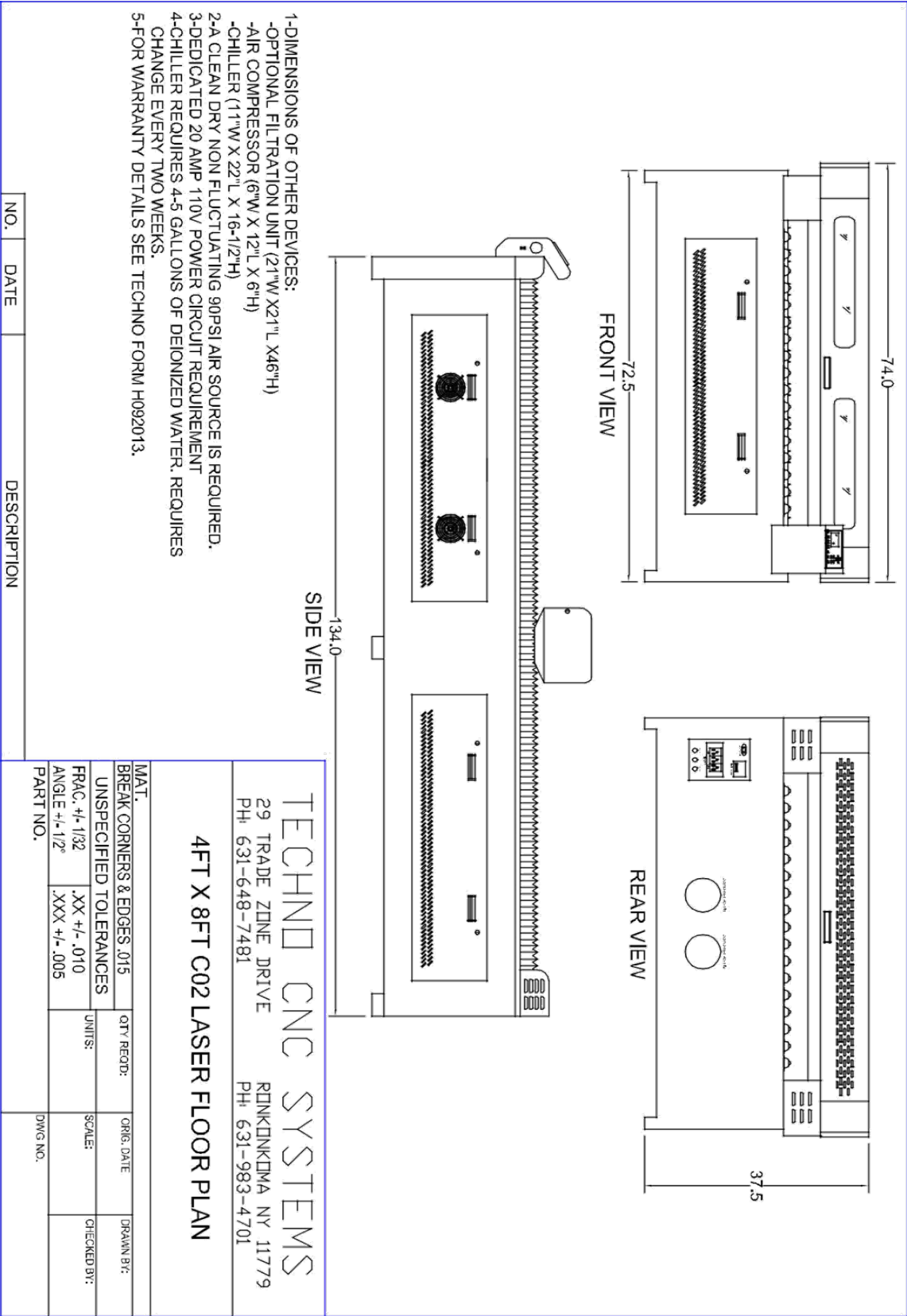


- After selecting 'origin' press the button labeled 'frame'.  The machine will then jog itself around the area in which it will be cutting.



- Once the machine has returned to its origin and is no longer mobile you can press the 'start/pause' button and watch the machine perform.





Laser Cutting Reference Chart

Cutting speed and material details may vary. This form is for reference only.

Materials	Laser Power 80W	Laser power 100W	Laser Power 150W
Acrylic 1/8"	10-15 Fine finish 50%-80% 50-55 rough cut	10-15 fine finish 40%-80% 55-60 rough cut	10-15 fine finish 30%-80% 60-70 rough cut
Acrylic 3/16"	8-15 Fine finish 60%-90% 15-20 Rough cut	8-15 Fine finish 70%-90% 6-9 Rough cut	8-15 Fine finish 60%-90% 25-30 Rough cut
Acrylic 3/8"	3-5 Fine finish 60%-85% 6-8 Rough cut	4-6 Fine finish 70%-90% 6-9 rough cut	5-8 Fine finish 70%-90% 10 Rough cut
Acrylic 1.0"	0.4-0.6 Fine finish 80%-95% .7-.9 Rough cut	.4-.8 Fine finish 80%-95%	.6-1 Fine finish 80%-95% 0.8-1.2 Rough cut
Plywood 3/16"	40-60 60%-85%	50-70 65%-85%	50-80 50%-90%
Plywood 1/2"	NO	5-8 70%-95%	8-12 30%-90%
Medium low MDF 1/4"	6-10 60%-85%	8-15 50%-95%	15-20 50%-90%
Medium/low 1/2"	NO	2-3 80%-90%	80%-90%
Foam 7/8"	50-60 75%-85%	60-80 75%-85%	80-100 70%-90%
Leather	400-600 20%-90%	400-600 20%-90%	400-600 20%-90%
Textile	400-600 20%-90%	400-600 20%-90%	400-600 20%-90%
Sponge cloth	400-600 20%-90%	400-600 20%-90%	400-600 20%-90%

Techno CNC Systems, LLC., Terms and Conditions For Limited Warranty and Repairs Warranty

WARRANTY

All Techno CNC Systems, LLC., mechanical components are warranted against manufacturer's defects in material and workmanship for a period of one (1) year from the time of shipment from Techno CNC Systems, LLC., facilities. All Techno CNC Systems, LLC., electrical components are similarly warranted for a period of one (1) year from the time of shipment from Techno CNC Systems, LLC., facilities. Techno CNC Systems, LLC.,'s sole obligation under this warranty is limited to repairing the product or, at its option, replacing the product without additional charge, provided the item is properly returned to Techno CNC Systems, LLC., for repair as described below. The provisions of this warranty shall not apply to any product that has been subjected to tampering, abuse, improper setup or operating conditions, misuse, lack of proper maintenance, or unauthorized user adjustment. Techno CNC Systems, LLC., makes no warranty that its products are fit for any use or purpose to which they may be put by the customer, whether or not such use or purpose has been disclosed to Techno CNC Systems, LLC., in specifications or drawings previously or subsequently provided, and whether or not Techno CNC Systems, LLC.,'s products are specifically designed and/or manufactured for such a purpose. NOTE: Drive motors (servo or stepper) are considered "mechanical components".

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED. ALL OTHER WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHETHER EXPRESSED, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING, ARE HEREBY DISCLAIMED. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.

LIMITATION OF REMEDY

In no event shall Techno CNC Systems, LLC., be liable for any incidental, consequential, or special damages of any kind or nature whatsoever. Techno CNC Systems, LLC., is in no way liable for any lost profits arising from or connected to this agreement or items sold under this agreement, whether alleged to arise from breach of contract, expressed or implied warranty, or in tort, including, without limitation, negligence, failure to warn, or strict liability.

RETURN PROCEDURE

Before returning any equipment in or out of warranty, the customer must first obtain a return authorization number and packing instructions from Techno CNC Systems, LLC.,. No claim will be allowed nor credit given for products returned without such authorization. Proper packaging and insurance for transportation is solely the customer's responsibility. After approval from Techno CNC Systems, LLC., the product should be returned with a statement of the problem and transportation prepaid. If, upon examination, warranted defects exist, the product will be repaired or replaced at no charge, and shipped prepaid back to the customer. Return shipment will be by common carrier (i.e., UPS). If rapid delivery is requested by customer, then such transport is at the customer's expense. If an out-of-warranty situation exists, the customer will be notified of the repair costs immediately. At such time, the customer must issue a purchase order to cover the cost of the repair or authorize the product to be shipped back as is, at the customer's expense. In any case, a restocking charge of 20% will be charged on all items returned to stock.

FIELD SERVICE

Repairs are ordinarily done at Techno CNC Systems, LLC.,'s Ronkonkoma, New York facility, where all necessary instrumentation is available. This instrumentation is difficult to transport, so field service is severely limited, and will only be supplied at Techno CNC Systems, LLC.,'s discretion. If field service is required and is performed at Techno CNC Systems, LLC.,'s sole discretion, all relevant expenses, including transportation, travel time, subsistence costs, and the prevailing cost per hour (eight hour minimum) are the responsibility of the customer.

UNFORESEEN CIRCUMSTANCES

Techno CNC Systems, LLC., is not liable for delay or failure to perform any obligations hereunder by reason of circumstances beyond its reasonable control. These circumstances include, but are not limited to, accidents, acts of God, strikes or labor disputes, laws, rules, or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials, and any other event beyond Techno CNC Systems, LLC.,'s control.

ENTIRE AGREEMENT/GOVERNING LAW

The terms and conditions contained herein shall constitute the entire agreement concerning the terms and conditions for the limited warranty described hereunder. No oral or other representations are in effect. This Agreement shall be governed in all respects by the laws of New York State. No legal action may be taken by any party more than one (1) year after the date of purchase.

TECHNO CNC SYSTEMS, LLC., RESERVES THE RIGHT TO CHANGE DESIGNS, SPECIFICATIONS, PRICES, AND ANY APPLICABLE DOCUMENTATION WITHOUT PRIOR NOTICE.

