



LASER MACHINE

Operation Manual

Model: Ranger3

Address: 21 Blue Sky Court, Sacramento CA 95828

Phone: (916) 383- 8166

Email: contactus@lightobject.com



Read and understand the operation manual before using this machine.

Failure to follow operating instructions could result in death or serious injury.

Contents

CO ₂ Laser Safety & Policies	4
Accessories	6
First Time Machine Setup.....	7
Installing Other Accessories	12
Connecting Laser Machine to Computer	14
Sending Files to Laser Machine.....	17
Control Panel Keypad	18
Laser Current Control	19
Rotary Usage.....	19
Z-table Usage	20
Focusing/replacing the Lens	21
Engraving Adjustment:	21
Maintenance	22
Troubleshooting	23

CO₂ Laser Safety & Policies

WARNING: The safety precautions below are mandatory guidelines that must be followed. LightObject will not be held responsible for damages or injuries resulting from improper use of the laser machine.

DO NOT operate the laser machine until you have been properly trained.

DO NOT make contact with any exposed wires on the machine.

DO NOT use any unapproved or unsafe materials such as Polyvinyl Chloride (PVC) which emits noxious gases that can harm your central nervous system.

DO NOT operate the laser near flammable/explosive substances.

DO NOT let water freeze inside the laser tube, it can crack the glass.

DO NOT engrave on shiny metal or mirror as the laser beam can be reflected and deviate that may result in blindness or burn.

NEVER look directly at the laser while in operation and avoid exposure to laser.

NEVER set anything on top of the laser and/or on the worktable when not in use.

NEVER leave the laser machine running while unattended. Monitor the machine when it is running at all times to be able to hear and observe abnormalities and potential hazards.

NEVER push or pull on the laser head housing or gantry while the laser is running.

NEVER dismantle the laser machine as there are laser and high voltage parts that could harm or result in injury.

NEVER open the upper cover of the laser machine while it is running.

ALWAYS wear proper goggles during machine operation.

ALWAYS unplug the machine before making any further adjustments.

ALWAYS keep hands away from machine while operating and stand clear from laser tube area.

In Case of an Emergency:

TURN OFF the POWER SWITCH of the machine OR
Press the EMERGENCYSTOP button

Fire & Hazardous Materials

WARNING: 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 LightObject warranty.

Hazardous Materials: Any materials considered hazardous are NOT recommended to etch, cut or engrave. These materials can produce toxic fumes or cause the machine to not function properly.

Materials that should NOT be used on the machine:

Polycarbonate PVC Compounds Vinyl

Fumes produced by above materials can cause irritation to eyes, skin and the respiratory tract. This material should not be exposed to elevated temperatures.

Laser Safe Materials:

Acrylic, Wood, Leather, Plastics (ABS, POM, Polyimide, PP, Styrene), Fabric, MDF, Cardboard, Paper, Foam, Fiberglass, rubber

Accessories

Air Exhaust Fan
(optional)



Air Pump
(optional)



Air Exhaust Hose



Exhaust Hose
Clamps



Tubing for Water
Chiller



Laser Tube



Water Chiller
(sold separately)



Air pressure
regulator, gauge
(optional)



Other accessories

- 1) Spare tubing
- 2) USB cable
- 3) Other tools for adjustment
- 4) CD (software)

NOTE: Optional software LightBurn is sold separately

First Time Machine Setup

The following components are required for operating the laser machine:

Air Assist: to blow smoke away from the beam, preventing damage to the lens and preventing burning the material.

Water Chiller: to circulate cool water into the laser tube to prevent the tube from overheating. The laser tube needs to be at a cool temperature of 15°C - 25°C or else the laser tube may overheat and potentially crack.

Silicone Tubing for Water Chiller and Air Pump: 2 hoses to transfer water for cooling of the laser tube and 1 hose to blow air around the laser head.

Air Exhaust Hose and Air Exhaust Fan: to provide ventilation removing fumes from laser machine.

Unpacking and Setting Up the Machine

- 1) Uncrate/unwrap a laser machine



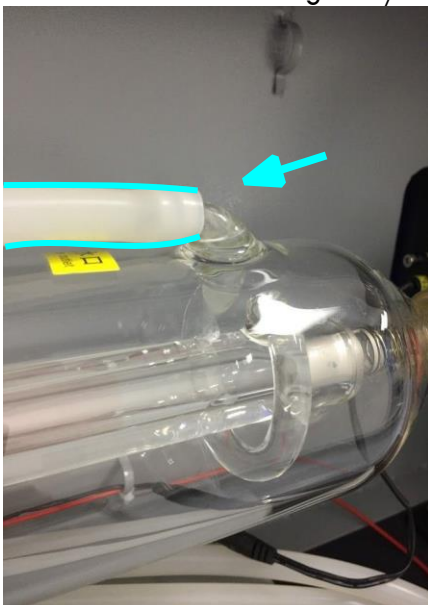
- 2) Open up the laser machine and retrieve all accessories that may be inside the machine when shipped.
- 3) Once all of the accessories have been removed, you are now ready to begin setting up the machine.
- 4) Depending on the size of your laser tube, you may need to remove the side panel and install the laser tube extension case.
! For default short laser tube, it can be pre-installed in the machine, so the laser tube installation steps can be skipped.



- 5) Place in the laser tube carefully.



- 6) Connect the water tubing inlet/outlet, high voltage wire and ground wire to the laser tube.



- 7) Be sure to connect the silicone tubing on both sides of the laser tube. Connect water tubing between chiller and machine. Chiller's outlet goes to machine's inlet. Machine's outlet goes to Chiller's inlet. The correct direction of water flow is from high voltage side (red wire) of the laser tube to the low voltage side.

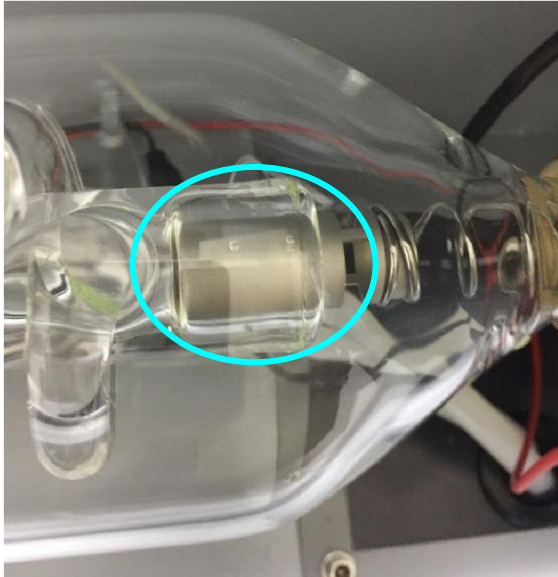


(Chiller's back side for reference only)



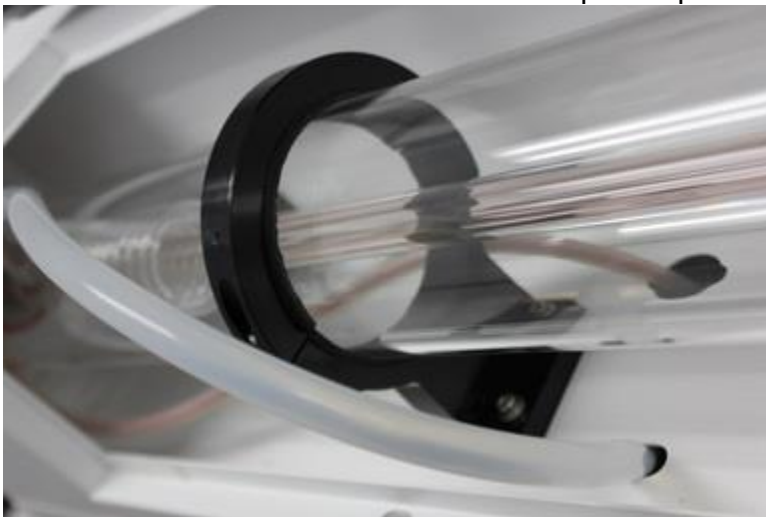
Note: The water temperature is recommended to be between 59-77 degrees Fahrenheit when running the machine. (15-25 Degrees Celsius).

- 8) Fill up the water chiller with distilled water and power up, observe the water flow direction. Switch the inlet/outlet if it is wrong.
- 9) Check air bubble trapped in the laser tube. **Squeeze the water tubing or tilt the laser tube carefully to get rid of the big bubble.** Small bubbles are acceptable.

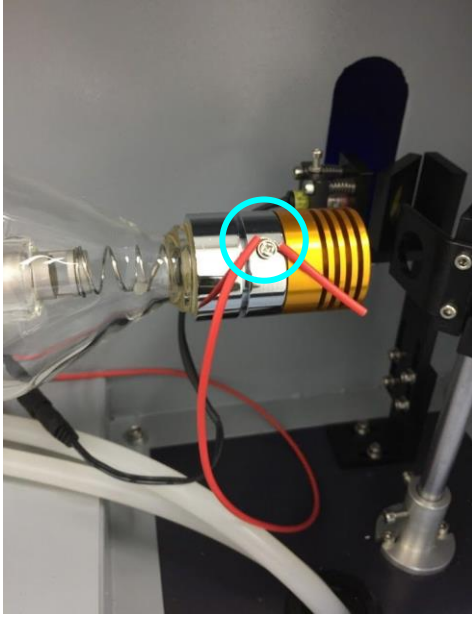


IMPORTANT: if large bubbles are present when the laser is firing, the tube can crack. Check for bubble every time the water chiller is turned on. Ranger III water protection feature is on the 7813 controller. Please make sure it is enabled under Menu>>Manufacturer Parameter(password 7813)>>Laser Parameters>>Laser Water Protection. Laser should not be fired when water chiller is not running.

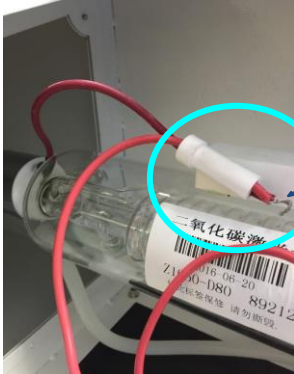
- 10) Secure the laser tube on the laser tube mounts. For laser beam alignment, shim can be placed between the tube mount and laser tube to adjust the position.



- 11) For screw type connection laser tube, put the rubber cap back on the tube's high voltage side to prevent arcing:



For wire type connection, make a secure twist. Then shield it with a piece of silicone tubing to prevent arcing. Make sure there is no moving parts around which could loosen the twist.



Twist

For pin type connection: Wrap the wire around the tube's metal pin. Fix the connection by proper soldering OR applying silicon glue. Make sure to shield it with a piece of silicone tubing to prevent arcing.



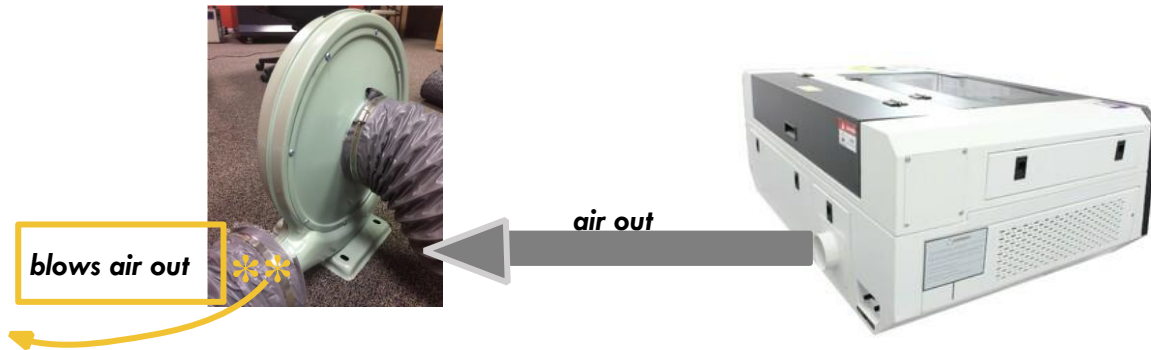
- 12) Hookup the power cord of the machine and power up the machine. Turn on the control power before turning on the laser power.

Installing Other Accessories

Exhaust Fan Installation

Some materials such as leather or wood generate larger amounts of smoke than other materials. An 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.

Connect the air exhaust hose by using the hose ring clamps provided, connecting the exhaust hose is done in the rear or underneath (varies based on machine). See picture below.



Turn the exhaust fan on when doing any cutting and engraving to remove the smoke and fumes.

Note: Avoid excessive length, kinks and turns when installing the exhaust duct/hose.

Air Assist

Connect the air pump to the laser machine air input. Turn on the air before doing any cutting or engraving to prevent any clouding on the lens and to prevent the material from burning.

Some CO2 cutter models come with high pressure tubing to enable easy upgrades for larger air compressor. An air pressure regulator is used along with an air compressor to adjust the air flow from your compressor to the laser machine.

Pull up the knob then rotate clockwise to increase the pressure.





Some machine model has a two-inlet air solenoid. The lower inlet is open when job is not running; the top inlet is open when job is running. If compressed air is used, the air will keep blowing. You may connect A directly to B in the picture so the air only blows when job is running. If you want to use the layer air on/off setting, you may move the 7813 controller's wiring pinout from out1 to out6. Please refer to the controller manual.

Air Pump / Air Compressor

The Air Compressor (sold separately) are used to blow air through the laser head. This will blow away debris and smoke from the laser beam while allowing for a cleaner cut and protecting the lens. If your air pump only has soft tubing connector, you may insert a short piece of thin hard tubing into the soft tubing to make connection to the machine inlet.

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

Connecting Laser Machine to Computer

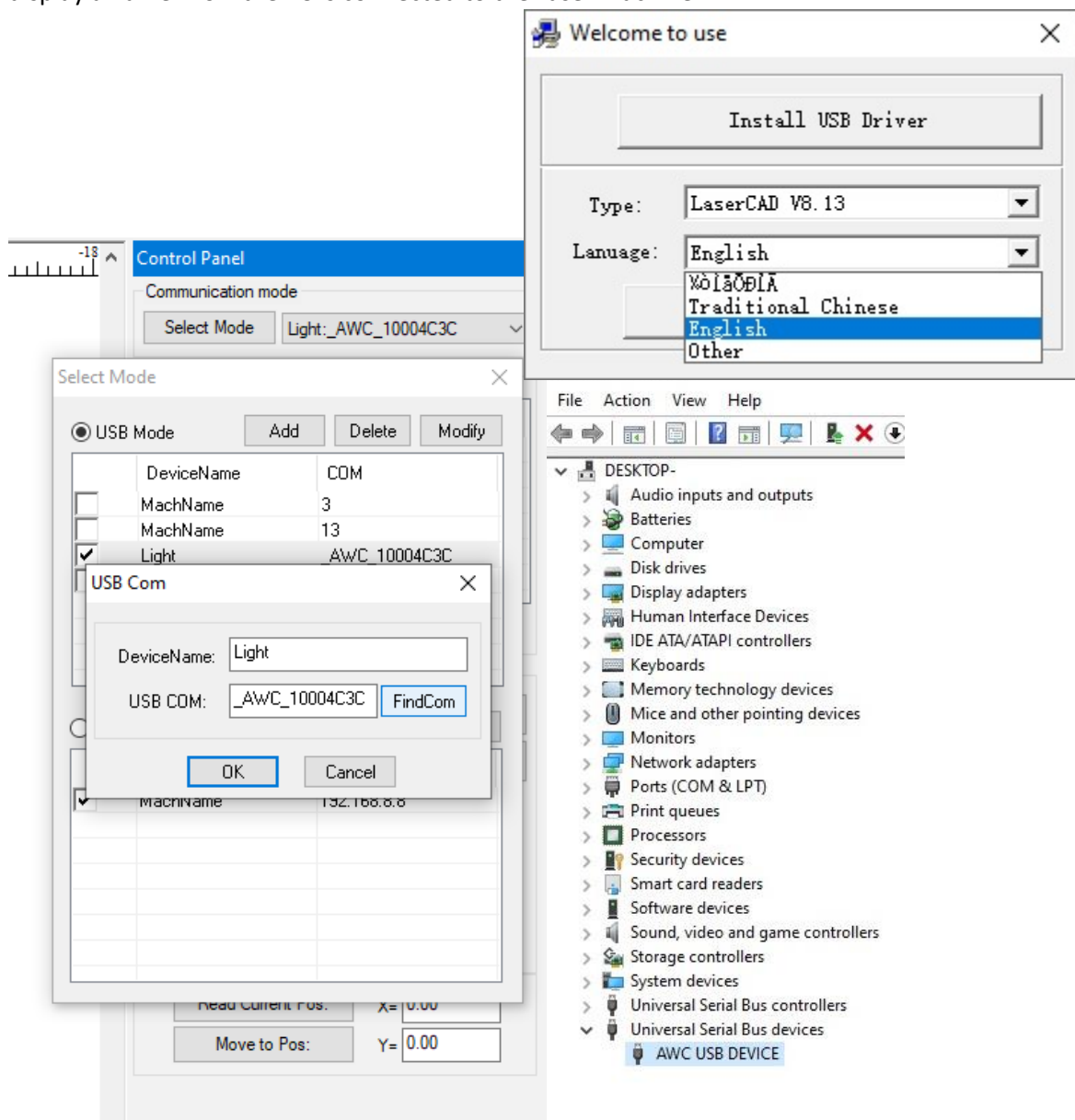
The laser machine controller works with these software

- AutoLaser for Topwisdom, LaserCAD for Trocen, RDWorks for Ruida (for Windows only)
- LightBurn (for Mac and Windows)

Example: LaserCAD installation

If the USB driver is successfully installed, under Windows device manager, the USB device should not have yellow! icon.

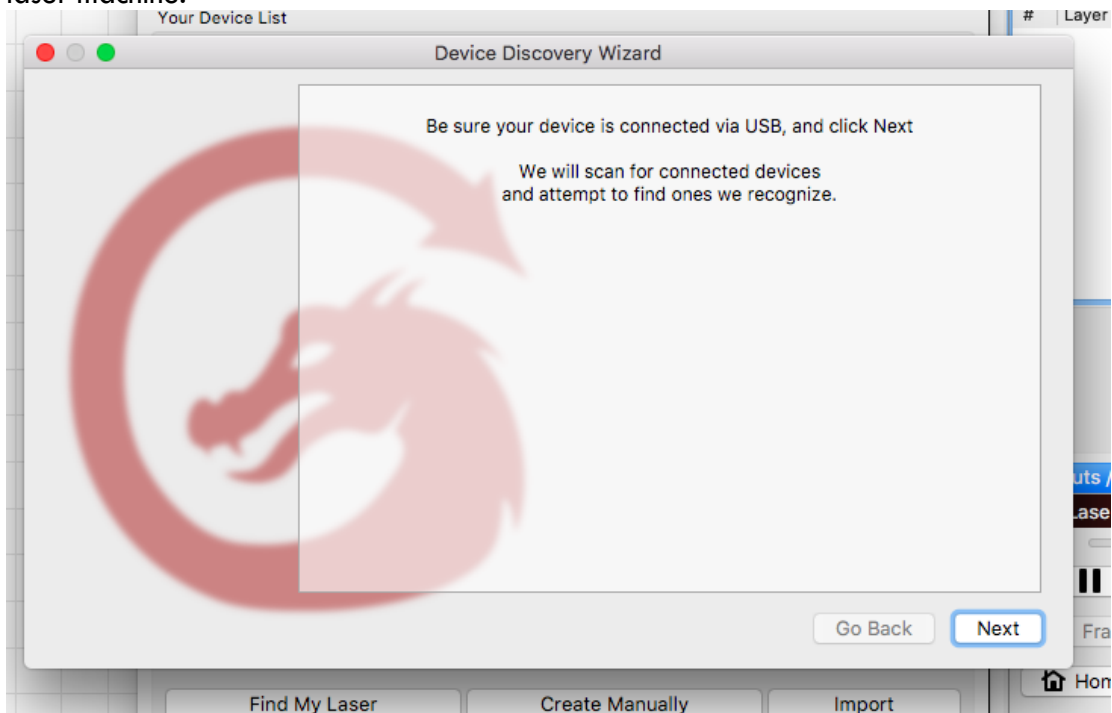
In LaserCAD, click select mode, Add, FindCom. If the driver is properly installed, USB COM will display a name. Now the PC is connected to the Laser machine.

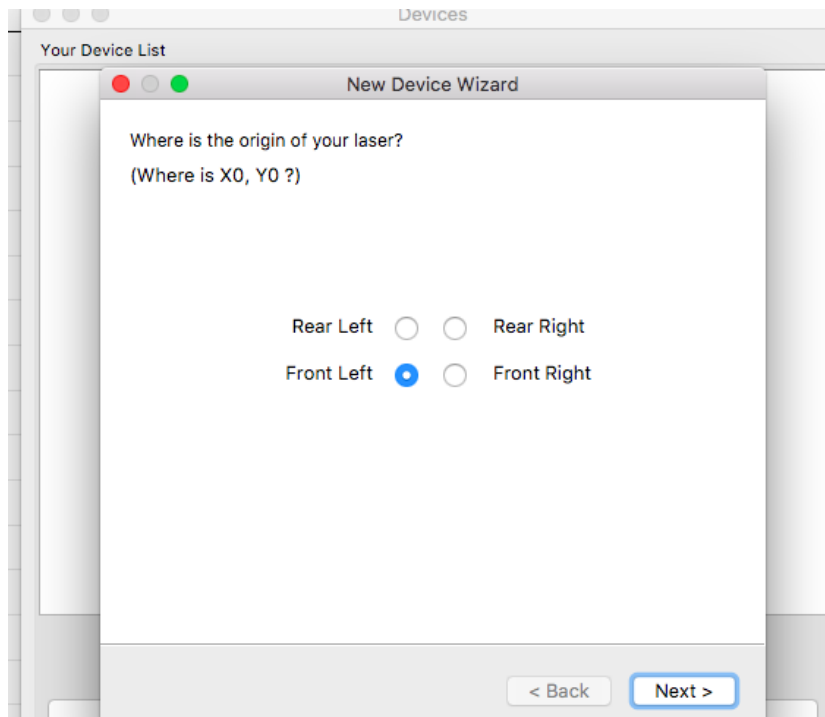


Ethernet connection does not need usb driver. First is to find out the IP address of you computer.
For Windows: You may check under "Network." ->"Properties." ->"View Status"->"Local Area Connection." Click "detail" and look for the IPV4 address.
For Mac: Under "Network" in the System Preferences panel->"Show"->lan->TCP/IP
Add 1 to the fourth number. For example, if the computer ip is 192.168.1.45, we can put 192.168.1.46 in both PC software and the laser controller.

Set up with LightBurn (For WINDOWS USB cable, Install USB driver using LaserCAD first)

- 1) Download and install the software LightBurn from <https://lightburnsoftware.com/>
- 2) Connect the USB cable.
- 3) Follow the instruction from the screen, and it will guide you connecting the computer to the laser machine.





If machine origin is not set correctly, the job file sent to the controller could be mirrored.
Ranger uses rear right.

NOTE: Please refer LightBurn instruction manual and tutorials in their site for configuration and usage. Some controllers need to be set to USB instead of Serial/USB.

If you are using LAN connection, input the same IP address set on the laser controller.

NOTE: Please make sure LAN cable is connected between computer and laser machine.

- 4) Press Menu on the controller panel
- 5) Select "System config"
- 6) Select "Read"
- 7) IP address should be shown e.g. 169.254.164.041 (depends your network)
- 8) Click "Devices"
- 9) Click "Create Manually"
- 10) Select "Trocen" in New Device Wizard, click "Next"
- 11) Choose "Ethernet/UDP"
- 12) Input the IP address you have seen in the DSP control panel e.g. 169.254.169.041
- 13) Input the Name you would like to call it
- 14) Input the dimensions of the work area e.g. 600mm for the width, 380mm for the height
- 15) Select the origin, then click "Next"
- 16) It will show the setting, then click "Finish"

Sending Files to Laser Machine

Once you have established the connection between the computer and the laser machine, job files can be transferred.

To do this, click on the “Send” button(LightBurn) OR “Download” button (LaserCAD) located on the right side of the laser software.

Alternatively, save the file as UFile and put in a USB stick. Then download the file from the USB stick on the laser control panel.

Control Panel Keypad

Note: Since the laser cutter can be connected to different controllers (e.g. Ruida RDC644XG), please always refer to the controller manuals for details.

Functions of typical keypad:

Reset: Reset the gantry;

Origin: Set the relative origin;

Laser: Fire the Laser temporary;

Box/Frame: To track by the current job working area;

File: The management of the memory and U disc files;

Speed: Set the speed of the current running layer, or set the direction keys' move speed;

Max. Power: Set the laser power of the current running layer, or set the "Laser" Key power.

Min. Power: Set the min laser power of the current running layer;

Start/Pause: To start or pause the work;

Left and right arrow: To move the X axis or the left/right cursor;

Up and down arrow: To move the Y axis or the up/down cursor;

Z/U: The Z/U key can be pressed when the system is idle or the work is finished. On pressing this key, it will show some entries in the interface, each entry includes some functions, Z axis move, U axis move, each axis to go home

Esc: To stop work, or to exit menu;

Enter: Validate the change;

Laser Current Control

It is important that the laser tube does not run with over current as it could damage the laser tube. Normally, we will limit the maximum current output by using software or laser power supply's potentiometer before it is shipped.

Running the laser tube at low mA can make it last longer. Here is a general guideline of the max mA allowed:

35~45W: 16mA

50W: 18mA

60W: 20mA

80W: 26mA

100~130W: 28mA

150W: 30mA



Rotary Usage

To wire up a two phase stepper motor for rotary, check the connection and pair up the wiring to EFGH in the picture. After connecting the rotary plug to the Ranger, turn on the rotary button to disable y axis motor and enable the output for rotary. Under common parameter of the 7813 controller menu, enable the rotary. Press Reset on the 7813 controller. After x axis is homed, you will need to press Stop during homing because there is no limit switch for the rotary homing.



To change back to Y axis mode, turn off the rotary button on machine and unplug the rotary. Disable rotary under touchscreen menu, then reset.



Z-table Usage

Ranger3 has dual motors sharing one driver for z axis. Do not put anything heavy on the work bed when machine power is off, otherwise the bed may move down by itself.

To level the z bed left and right sides, turn off the machine. If left side is lower than right side, rotate the left side screw drive to move up the left table.

During startup z homing, please make sure the laser head or gantry will not hit anything when the z table moves up. Do not lower the laser head barrel too much during z homing; it may crash the work bed.

The z startup homing can be disabled under parameter>>AutoReset by user, but the z absolute position will not be correct. User may perform a manual homing under more>>Reset.

User may press Stop during the z homing. Be careful when lowering z table, as it may hit the bottom and stall the z motor. Do not put any object on the work table when homing z axis; the z limit sensor shown in picture needs to detect the table to set the z=0 for homing.



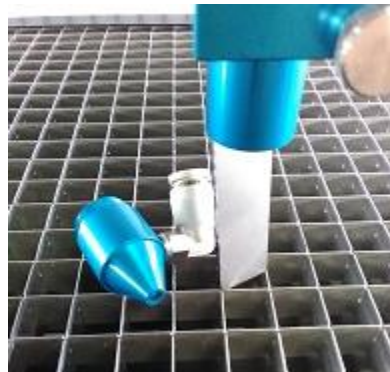
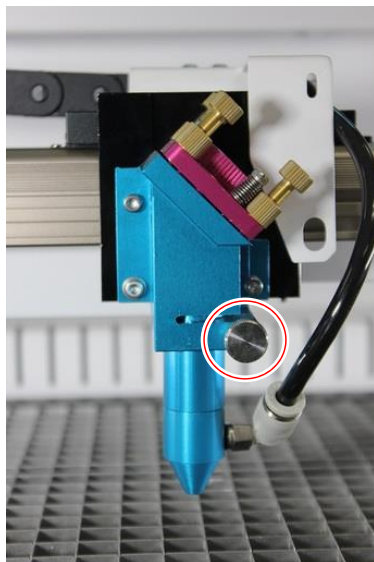
Focusing/replacing the Lens

The lens should be adjusted and focused according to the thickness and type of material. The distance between the lens and the work piece should be kept equal to the focal length. When using the default 15by50.8mm lens, the gap between the nozzle tip and material should be kept at about 6mm. In other words, the distance between the lens and material needs to be about 50.8mm.

To adjust the focus, adjust the z table to accommodate the thickness of the material. When it is focused, the burn's diameter on the top surface of the material will be the smallest.

OR

You may do a ramp test. Put a piece of wood at an angle like a ramp. Laser cut a line across it. Move the laser head over the narrowest section of burn mark. The gap is the focus height.



To change the lens, loosen the screw shown in picture. Press on the air connector's top to pull out the air tube. Slide down the laser head barrel. Unscrew the bottom nozzle from the barrel. You may use the rectangle steel piece in the accessory or other tools to loosen the lens retention ring inside barrel.



Note: Make sure optics are clean.

Engraving Adjustment:

The timing between laser firing and motors movement can be finetuned. Draw a 20mm by 5mm rectangle, and set the scan gap to be 1mm. Enable the offset adjustment, then send the job to the laser machine. It will mark five lines on the material. Keep adjusting the “offset” value until the lines line up. It needs one value for each speed the machine engraves at.

Engrave Reverse offset

Speed	Reverse Offset
200.00	1.00
300.00	-0.10

☒ Enable

Add

Delete

Modify

Maintenance

Cooling:

Automotive antifreeze should not be used as a laser coolant. Distilled water should be used. The water needs to be changed before it gets dirty.

Focal lens:

This is the lens that is used to focus the laser beam. This lens should be cleaned before it gets dirty. Use denatured alcohol and/or acetone as the cleaning solvent. Use a lens tissue or cotton tipped swabs.

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.

Mirrors:

Mirrors should be cleaned at least every three months. The first mirror (next to the laser tube) usually does not get dirty easily.

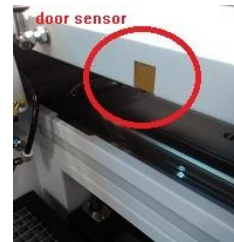
A little bit of laser power is lost by laser going through the beam combiner after the first mirror. To get higher laser power, you may take out the beam combiner by removing its 3 mounting screws.

Laser Alignment

WARNING: DO NOT obstruct the path of the laser, beam is invisible!

Put a piece of metal close to the door sensor to bypass door protection.

NOTE: Due to transportation, the alignment may be off.



- 1) To make sure that the laser is properly aligned, place an adhesive note around the alignment housing next to the mirror.
- 2) Set the laser power low to avoid burning the paper.
- 3) Start with the first mirror; press the laser button once. If that mirror is aligned correctly, the burned marks should be at the same spot when the y gantry is at max and min travel(x gantry for second mirror). When the third mirror is aligned, the burn marks on the material should be concentric after moving the laser barrel up/down.
If it is not aligned, the adjustment screws for each mirror must be adjusted. Please check our social media video online for detail.
- 4) Once the first mirror is done, repeat the steps to align the 2nd mirror.
- 5) When mirrors are aligned correctly, the mark will be in the center regardless of the x and y position (wherever the laser head moves).

For mirror mount shown in picture, #1 is for locking #2 thumb screw, #2 is for adjusting, #3 hex screw is for adding tension to secure all three thumb screws. One of the thumb screws move laser beam left/right, one of them move beam up/down, one of them move laser beam diagonally. To remove mirror, unscrew #4.



Troubleshooting

The machine does not turn on:

Make sure to check below

1. Does the DC power supply function properly?
2. Check the fuse under the machine power socket.
3. Is the power switch turned to the on position?

Laser does not fire:

Make sure to check below

1. Check if the water chiller functions properly. The laser machine has a water flow sensor connecting to the laser controller. The laser will not fire if there is no water flowing through the sensor.
2. All covers are closed. There is one sensor for the front cover.

Controller gives message “Engraving out of range”:

Make sure drawing size is smaller than the max working area. The laser head needs a small buffering area to accelerate on left and right sides. Do not set the job origin close to the ends. Increase the engraving acceleration to about 9000 under user parameter.