



Laser Cutting Guidebook

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Laser Cutting Guidebook

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Introduction to Laser Cutting!

Welcome to our 2022 Laser Cutting Guidebook! This guidebook is meant to be an introduction to laser cutting/engraving and a basic operating and maintenance guide to the laser manufactured by G.Weike: 600mm x 400mm, CO2, 100w laser cutter/engravers and sold by 1st Maker Space.

Please take a moment now to review the Safe Operating Rules included in this manual!

In the following pages, you will find instructions on using the laser cutter as well as fundamentals of the Lightburn Laser Cutter Control Software which you can download from <https://lightburnsoftware.com/>

Whether you are just a beginner to laser cutting or using this as a reference tool for advanced projects our hope is that all educators, students and makers can benefit from these guides.

1st Maker Space has also developed a series of video tutorials which describe setup and operation of our laser cutters. The tutorials can be found at <https://1stmakerspace.com/laser-cutter-resources>.

Thank you for allowing 1st Maker Space be a part of your making Making Journey!



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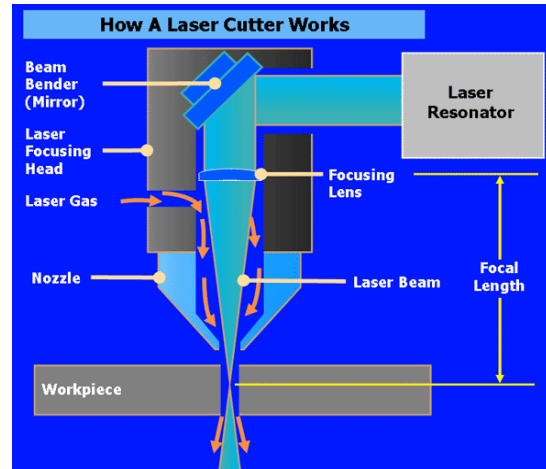
The Basics of Laser Cutting

What is Laser cutting?

Laser cutting uses a focused high-powered light beam to cut or engrave a material with high accuracy. Laser stands for “light amplification by stimulated emission of radiation.”

How does a laser cutter work?

A laser beam is emitted from a laser tube filled with a CO₂ mixture, when a current is passed through it. This beam is then reflected off 3 mirrors to “bend” the beam through a focal lens in the laser head. When focused, this beam melts, evaporates, or burns the materials at the point where the beam is focused. The beam produced by the laser cutter is in the infrared range of the electromagnetic spectrum, making it invisible to the human eye.



The laser cutter is directed by a combination of software and hardware called a “computer numerically controlled” machine. Your design gives this machine directions about where to move the laser head, how intense to make the laser beam and how fast to move the head. RDWorks and LightBurn software can create a design, but you may also use and Computer Aided Design (CAD) software that can create a Drawing eXchange Format (DXF) file and then import the file into the laser cutter software.

The design software creates a digital drawing which can be scaled, i.e. made smaller or larger without altering the proportions of the design and without losing resolution. This is a characteristic of ‘vector’ design which create shapes by using lines defined by direction and length rather than length alone.

A laser cutter has three methods that can be used to make a limitless number of projects:

- Vector cutting (makes a full cut through the material by tracing the vector path)
- Vector engraving (created a surface level cut on the top of the material by tracing the vector path)
- Raster engraving (uses a series of engraved lines to fill in a polygon)

What can a laser cutter do?

A laser cutter can cut through and/or etch (engrave) a variety of materials. A list of recommended materials can be found in our Laser Materials Guide in Appendix A.

You must use caution in the selection of materials you use with the laser cutter. Some are prone to start a fire. Others produce dangerous particulates when cut or engraved. If you are unsure about a material, JUST DON'T USE IT!

A laser cutter/engraver is a versatile machine that can create a variety of projects. Listed below are only a few examples of projects sorted by their relevance to coursework in schools.

You can browse many social media sites for more ideas. And don't forget to browse the 1st Maker Space Blog posts for ideas!

We like:

- <https://www.instagram.com/explore/tags/lasercutter/?hl=en>
- <https://all3dp.com/2/best-laser-cutter-projects-laser-cut-ideas/>
- <https://www.ponoko.com/blog/design-ideas/laser-cutter-projects-ideas/>
- <https://www.instructables.com/workshop/laser-cutting/projects/>
- <https://www.epiloglaser.com/how-it-works/applications/start-a-laser-business.htm>
- <https://www.pinterest.com/> Search for 'Laser Cutter Projects'

<ul style="list-style-type: none"> • Engineering: Eco Smart Houses Bridges Architectural models • Science: LED Name tag LifeCycle Puzzles Clocks • Arts Stencils Sculptures Guides • Math Unit Circle Sine/Cosine Manipulatives Law of Sines Manipulative • Language Arts Identity Box Symbols or Motifs from readings (such as the eyes of Doctor T.J. Eckleburg) • Foreign Language Alphabet Blocks Family Trees 	<ul style="list-style-type: none"> • History Hieroglyphics Artifacts Strategy tables Family trees • Geography Cutting outlines of States/Countries with major cities/rivers engraved Topography maps • Social Studies Flags Timelines Famous seals / documents • Family and Consumer Science Fabric Design Hot pads Lid Lifters • School-wide Trophies for competitions Signs for teachers' rooms Hall passes Birthday Calendars Holiday Ornaments Fund-raising trinkets
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Information

A laser cutter is a cutting device which focuses a high energy laser beam onto a material resulting in a high quality and dimensionally accurate cut. These devices can be used to cut, etch, engrave, or drill a variety of materials. They are often easily affordable and easy to use causing the use of laser cutters by schools, hobbyists, small businesses, makerspaces and universities to expanded significantly.

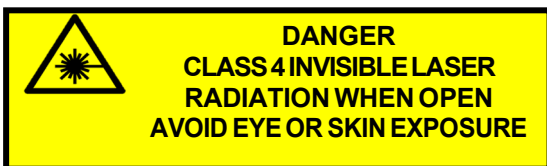
Laser cutters are normally fully enclosed systems that prevent laser operation unless the safety interlocked doors are fully closed. They typically contain a carbon dioxide (CO₂) laser that produces *invisible laser radiation* at a wavelength of 10600 nm in the infrared spectrum.



CAUTION: The Laser Cutters we sell include a CLASS IV Laser Tube!


Classification

Our lasers MAY ONLY BE USED WITH THE SUPERVISION OF A TRAINED TEACHER in accordance with *ANSI Z136.1 Safe Use of Lasers*. These devices are safe when used as designed, without manipulating the safety features. YOU MUST HAVE SPECIAL TRAINING TO PERFORM ANY MAINTENANCE INCLUDING ALIGNMENT OF MIRRORS.



HOWEVER, the lasers embedded inside the enclosed system are often Class 3B or Class 4 lasers, which emit high energy laser beams capable of causing serious eye and skin injury if the beam is not contained within the device. Therefore, safety interlocks should never be bypassed.

Training & Personal Protective Equipment

- ◆ All users must be properly trained on the potential hazards, control measures, lab and manufacturer's operating procedures, use of personal protective equipment (PPE), emergency procedures, and safety precautions for operating the laser cutter.
- ◆ Other required training includes use of Fire Extinguisher or sand flame retardant 
- ◆ Required PPE: Safety glasses to protect eyes from particles, debris, etc., proper skin protection to reduce burns, and hearing protection (if necessary).



Safety glasses



Hearing protection



Gloves



Hazards and Precautions

Laser light



- ◆ The invisible high energy laser beam can cause severe eye damage, including blindness and serious skin burns. The doors are interlocked such that the laser beam will be disabled when the doors are opened. This will completely contain the laser beam under normal use.
- ◆ Improper use of the controls and modification of the safety features may cause serious eye injury and burns.

- ◆ **DO NOT** modify or disable any safety features of the laser system.
- ◆ **DO NOT** operate the laser unless all covers are in place and interlocks are working properly.
- ◆ **DO NOT** look directly into the laser beam.

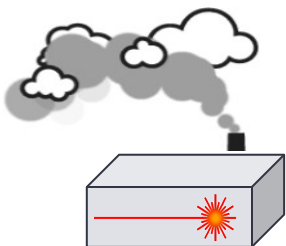
Fire



- ◆ The high intensity laser beam can produce extremely high temperatures and significant amounts of heat as the substrate material is burned away while cutting.
- ◆ Some materials can catch fire during cutting operations creating fumes and smoke inside the device.
- ◆ Dirt and debris may cause fire and a poor quality cut or mechanical component failure.
- ◆ It is important that users remain with the laser during operation to ensure that any flare-ups/ flame are properly contained and extinguished.
- ◆ Obtain the Material Safety Data Sheet (MSDS) from the material's manufacturer when handling or processing the materials.

- ◆ **DO NOT** use materials that are highly flammable, explosive or produce toxic byproducts.
- ◆ **DO NOT** remove material from the cutting bed before it has cooled.
- ◆ **DO NOT** leave a laser cutter operating unattended.
- ◆ **ALWAYS** clean up clutter, debris and flammable materials in the laser cutter after use.
- ◆ **ALWAYS** keep a properly maintained fire extinguisher nearby. A Bucket of Sand + Scoop is recommended.

Air contaminants



- ◆ Laser cutters will generate fumes, vapors, particulates, and metal fumes from substrate that can be highly toxic (plastics and other combustible materials).
- ◆ All laser cutter systems must be equipped with a fume exhaust system and filtration system that meets manufacturer specifications.
- ◆ These fumes or air contaminants can damage the machine and harm your health. If the air filter or exhaust system is malfunctioning, immediately stop operating the laser cutter and notify your 1st Maker Space @ 317-399-5001.

- ◆ **DO NOT** cut a material that has not been approved by the manufacturer.
- ◆ **DO NOT** use a laser cutter with a malfunctioning exhaust system or clogged air filter

MAKERSPACE Laser Engraver



Pre-Installation Checklist

Congratulations on your purchase of a 1st Maker Space Laser Engraver. There are a few things that need to happen to prepare your space to receive and operate your new machine.

Prior to machine delivery, please:

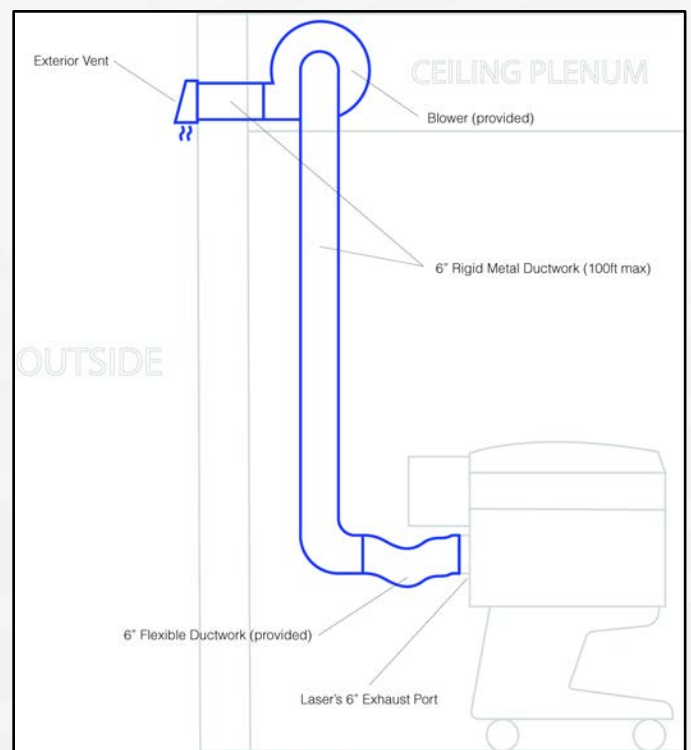
- Locate a space in your facility. Some considerations include:
 - Near or on an outside wall for venting outside
 - Close access to exterior ventilation system
 - Close to power receptacle; switched quad outlet with 20A service recommended.
 - Minimum 6' x 4' floor space for machine footprint (machine is approx. 60" wide by 36" deep by 43" tall)
- Provide 6" rigid metal exhaust port within 3 feet of the center rear of the machine leading to exterior exhaust location (max 100ft total distance from machine to blower). Machine will be connected to port via flexible tubing provided with laser.
- Prepare for installation of exhaust blower as close to the outside as possible to maintain negative pressure throughout the entire exhaust run.
- Provide power switch for blower at or near machine
- Dedicated PC or Laptop for machine operation

What's included:

1. Laser Machine with Honeycomb Tray
2. CW-3000 Water Chiller
3. Mini Air Compressor
4. Machine setup and calibration

What's NOT included:

5. Rigid exhaust ductwork or installation
6. Exterior vent or installation
7. Installation or modification of electrical outlets



Typical installation setup. Ceiling plenum mounted blower is not necessary but will cut down on noise.

Laser Cutter Software

You should have a PC or Mac available to run the Lightburn software and which will connect to the laser cutter/engraver using the USB cable provided.



You can download the free Lightburn Software trial from

<https://lightburnsoftware.com/pages/trial-version-try-before-you-buy>

1st Maker Space will provide you with the activation key when you purchase a laser cutter bundle. Otherwise you may purchase your own key.

There are a multitude of excellent LightBurn tutorials including videos, forums and examples available on the LightBurn website:

- <https://lightburnsoftware.com/pages/tutorials>

The main LightBurn documentation is constantly updated and available on GitHub here

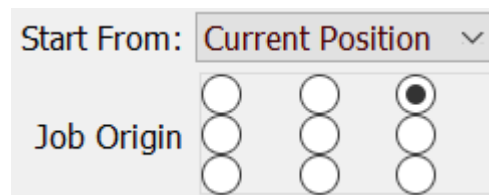
- <https://github.com/LightBurnSoftware/Documentation/blob/master/README.md>

Connecting your PC or Mac to the Laser Cutter/Engraver

After you download LightBurn, be sure the USB cable coming out of the Laser Cutter/Engraver is attached to the PC or Mac and the laser is turned on. When you begin to install the software it will offer to install a Serial to USB port driver which you should accept. This process will also include identifying the type of controller used in the Laser Cutter. (It should discover a RUIDA RDC644XG controller or one that is compatible with that model.)

NOTE: Some school IT environments have policies that may prohibit installation of non-approved software or hardware. Be sure to ask your IT department about their rules before you begin.

We recommend that you select the right-rear point for where operation begins:



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The Ruida controller setting will in the lower right hand of the software display when the installation is complete.

Ruida 644XG

The main Ruida Controller document may be found here. (See further along for basic operating information.

- <https://variometrum.hu/pdf/rdc6442g.pdf>

Design Software

Many software design tools may be used to create the 2D designs compatible with laser cutters. For beginners we recommend a free 'web-based' TinkerCAD account available here: <https://www.tinkercad.com/> Since TinkerCAD is web based it is compatible with Chromebooks.

You may create a Tinkercad account and watch 1-2 tutorials on Tinkercad modeling – this will be useful to create 2D designs and export as SVG files.

NOTE: the files you create for laser cutting must be exported to an SVG file and stored in a location (or on a flash drive) which may be imported on the PC or Mac where you installed Lightburn.

Make sure the software you use can produce file types compatible with LightBurn

- vg, ai, pdf, dxf, hpgl, plt, png, jpg, bmp.

Laser technology and method of operation

There are essentially only two parameters which you can control to achieve all the effects the laser cutter can produce: Speed & Power. Pairs of speed and power may be applied independently to each element of a design. For example, you may wish to engrave a section of a design, then cut the shape surrounding your design out of a larger piece of material like a sheet of acrylic. The exact speeds and power you use will depend on the effect you intend to create and the properties of the materials you are using.

Lower Power @ Higher Speeds	Etch
Higher Power @ Lower Speeds	Cut

This is made simple by identifying the pairs of speed and power using a unique color. Later, each color becomes a layer in a stack of layers signifying a sequence of operations that the laser cutter performs to complete the job.

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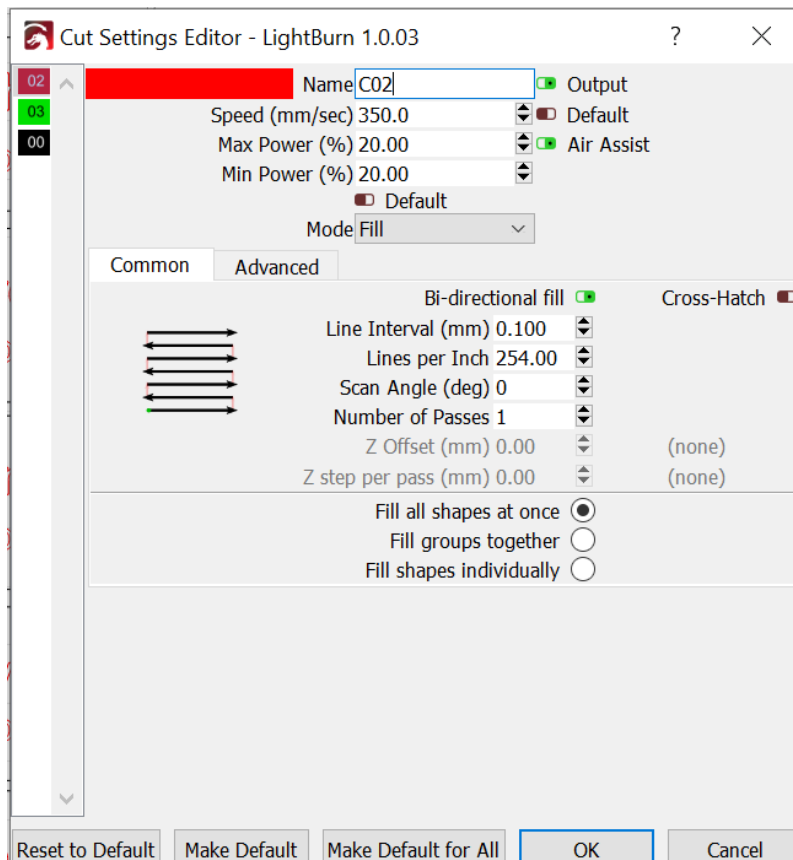
The color selection palate is located at the bottom of the software page:



Which produce a stack that looks like this when elements from the design are selected and a color is chosen.

#	Layer	Mode	Spd/Pwr	Output	Show	Air
C02	02	Fill	350.0 / 20.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
C03	03	Line	15.0 / 80.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
C00	00	Line	15.0 / 80.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

When a row is accessed by double clicking, a panel of parameters is exposed which allows adjustment of each.



As you will notice below, the colors associated with each element of your design make it simple to identify the parameters that will be used to produce that element. In this case Red is used to engrave the name and organization on this acrylic pendant. Green is used to cut the place where the LED, coin cell battery and fob attachment will go. And Black is used to cut the pendant from the sheet of acrylic.



Learning to design for and operate a laser cutter is a fun and challenging endeavor. The training videos available on the LightBurn website together with those you will find from creators elsewhere – particularly on maker websites with YouTube channels – will inspire you to be more creative and attempt more artistic, useful and/or functional designs as your experience grows.

Maintenance needs

Since the operation of a laser cutter produces products of combustion, smoke, debris and possibly small pieces of material that become loose and fall away, there is a constant need for maintenance. Mostly this can be taken care of by a designated user who has been trained during the laser cutter installation, but periodic maintenance performed by experts will be required to keep the laser in good working order – and more importantly – assure the safe operation of the machine, accessories and related systems.

Typical 'light' maintenance should be performed **weekly** and include:

TURN OFF LASER WHILE PERFORMING THESE TASKS!

- Vacuuming debris from inside the cabinet and under the honeycomb work surface
- Lightly cleaning mirrors using isopropyl alcohol & lint free swab
- Clean around the auto-focus probe
- Clean along the slides and lightly re-grease if necessary
- Remove exhaust tube at the rear of the machine and vacuum any debris caught in the exhaust host.
- Check to see that there are no obstructions inside the machine preventing the flow of exhaust to the exhaust port
- Check to see that there are no obstructions between the exhaust port, exhaust fan and where the exhaust leaves the building.
- Check that the chiller is full of distilled water
- Check for leaks in the hoses between the chiller, compressor and the laser machine cabinet

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- Double check that all cabinet doors are locked and the safety interlock system is operational.
- Check that the sufficient sand, sand bucket & scoop (or other fire extinguisher system) is in place and operational.
- **Observe that NO UNAUTHORIZED MATERIALS ARE BEING USED**

We recommend these maintenance items be attended to ***at least twice a year under normal use*** – more frequently if the machine is used heavily. This maintenance cycle may also be required if the laser machine is moved outside the room in which it was originally installed.

Only an experienced technician should undertake these maintenance tasks.

- Align, and if needed, replace mirrors (Every 6-12 months depending on use)
- Test, and if needed, replace the laser tube
- Clean and re-grease slides

BASIC Power-On/Off Sequence

During normal operation the laser cutter & engraver requires that all four devices be on and functional

1. The laser cutter must be turned on. The Ruida Control panel will be illuminated.
2. The CW3000 Chiller must be on and water flowing through the coolant lines connected to the in and out 'Water' ports of the laser cabinet
3. The Air Compressor must be on, connected to the 'Air' port of the laser cabinet, and air flowing around the lens assembly. You should be able to feel a low pressure (20 psi) stream of air below the lens.
4. The Exhaust fan must be on. You should be able to feel a flow of air at the rear of the cabinet exiting the exhaust plenum which is positioned just above the honeycomb bed resting on the adjustable height Z table.

We recommend that all these devices be powered on and off at a single switch.

Also: If you have a PC attached to the USB cable that comes from the laser cabinet, you should turn the laser and accessories on *before* the PC so the USB driver detects the Ruida controller when it reboots and loads the appropriate software to control the laser cutter.

The RUIDA Control Panel

Your laser cutter engraver includes a Ruida controller which interfaces with a PC running laser control software like LightBurn. The Ruida controller can also execute many of the functions of the laser cutter from its operating panel.

For example:

- Move the laser lens assembly and carriage along X or Y axis
- Set the origin point for the coordinate system – Forward/Back, Left/Right
- Set the default laser power & carriage/lens assembly speed
- Auto-focus the distance between the laser lens assembly and the material you are cutting or engraving.
- Test fire (pulse) the laser – this is useful for assuring the laser tube is firing, the mirrors are adjusted and the laser beam is focused.
- Select/run/delete stored jobs

There are many other functions, including safety and operational functions, managed by the Ruida controller. Please take a minute to review these Special Notes:

Here is a link to the manufacturer's manual for the Ruida controller used with the G Weike Laser cutter Engraver we resell: <https://www.ruidacontroller.com/wp-content/uploads/2021/10/RDC6442GU-DFM-RD-Control-System-V1.3-Manual.pdf>

In addition, the laser controller system disables the laser firing system if the safety interlock detects that the cover is open or the chiller is in an alarm state: no water flow or over temperature coolant.



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Typical Operations Performed at the Ruida Control Panel

1st Maker Space has produced a training video available on YouTube here: <https://youtu.be/BOWK49b9an0> which presents the typical operations you will be regularly perform using the Ruida Control Panel.

These operations are also covered during on-site training for the laser cutter/engraver.

If you have any questions about these operations please contact our technical services department: 317-399-5001.

1. Insert a sheet of approved material
 - a. Move the laser lens assembly to the extreme rear of the cabinet to avoid disturbing the lens while inserting the material using the Arrow keys.



2. Set the Z offset of the laser lens assembly using the Auto Focus feature
 - a. Be careful to only use this feature with ***rigid materials*** on the work surface. Using very thin materials or positioning the Z Height Probe over an empty area can cause damage to the probe and the lens assembly.
 - b. Position the laser lens assembly over the material
 - c. Press A/U
 - d. Select the Autofocus option using the Down Arrow then press Enter
3. Test fire the laser by pressing the Pulse button

4. Set the Origin using the arrow keys
 - a. Press Esc
 - b. Position the laser lens assembly using the arrow keys
 - c. Press Origin



5. Open a File after it has been sent by Lightburn
 - a. Press Esc
 - b. Press File
 - c. Use the arrow keys to select the file
 - d. Press Enter



6. Confirm the 'bounds' and position of the job
 - a. Open the file
 - b. Set the Origin
 - c. Press the Frame button



7. Start a job

- a. With the file open and after setting the origin press the Start/Pause button
- b. Press the Start/Pause button again to toggle running on or off
- c. Press the Reset button to cancel the job



8. You can Pause and Restart a Job

- a. Press the Start/Pause button on the laser cutter controls
- b. Press the escape button to cancel the Job



9. Managing Files stored on the Ruida Controller

- a. The laser cutter control system can only store 100 designs. To delete files previously downloaded to the laser cutter, press the File button to access the File browser and navigate to the file to be deleted. Hit the right arrow to browse the File options and use the down arrow to highlight the delete button and hit Enter twice.
- b. You can delete all files on the Ruido Controller too. Press the File button to access the File browser and navigate to option for Other. Select 'Clear All Files' and press Enter.

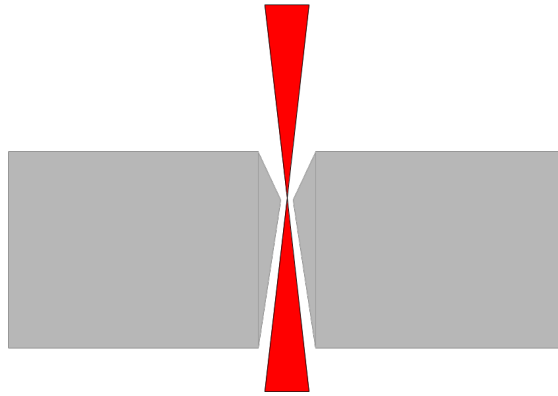
NOTE: Many of the operations supported by the Ruida Controller can also be performed directly from the LightBurn software. Review their manual for details.

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REMEMBER

**YOU CAN PRESS THE EMERGENCY STOP BUTTON AT ANYTIME TO
IMMEDIATELY STOP THE LASER OPERATION
NEVER OPERATE THE LASER UNATTENDED**



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Suitable Materials, typical speeds & power settings for the laser cutting/engraving

<p>SEE APPENDIX A for Laser Cutter Materials NOT SUITABLE FOR CUTTING/ENGRAVING.</p> <p>Paper</p> <ul style="list-style-type: none"> • Speed: 600 • Min Power: 30 • Max Power: 30 <p>Wood</p> <ul style="list-style-type: none"> • Cut <ul style="list-style-type: none"> ○ Speed: 40 ○ Min Power: 40 ○ Max Power: 40 • Engrave <ul style="list-style-type: none"> ○ Speed: 1000 ○ Min Power: 30 ○ Max Power: 30 <p>MDF</p> <ul style="list-style-type: none"> • Cut <ul style="list-style-type: none"> ○ Speed: 10 ○ Min/Max: 40/40 • Engraving <ul style="list-style-type: none"> ○ Speed: 1000 ○ Min/Max: 30/30 	<p>Thin Cardboard (cereal boxes, Soda cases, etc.)</p> <ul style="list-style-type: none"> • Speed: 500 • Min Power: 30 • Max Power: 30 <p>Single Corrugated cardboard (NEVER CUT 2+ Layer!)</p> <ul style="list-style-type: none"> • Cut <ul style="list-style-type: none"> ○ Speed: 40 ○ Min Power: 40 ○ Max Power: 40 • Engrave <ul style="list-style-type: none"> ○ Speed: 1000 ○ Min Power: 30 ○ Max Power: 30 <p>Acrylic <i>Note: Avoid extruded acrylic. Use cast acrylic.</i></p> <ul style="list-style-type: none"> • Cut <ul style="list-style-type: none"> ○ Speed: 10 ○ Min Power: 70 ○ Max Power: 70 • Engrave <ul style="list-style-type: none"> ○ Speed: 1000 ○ Min Power: 30 ○ Max Power: 30
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Materials unsuitable for Laser cutting - and why!

Any material that contains halogens will release toxic and/or corrosive gases – DO NOT USE!

- | | | |
|----------------|------------------|----------------|
| ○ PVC | ○ Teflon | ○ Polyester |
| ○ Some rubbers | ○ ABS | ○ Carbon Fiber |
| ○ Vinyl | ○ Nylon | |
| ○ Neoprene | ○ Epoxy Matrices | |

<p>Non-anodized metals</p> <ul style="list-style-type: none"> • Reflects the laser (potentially onto a person) <p>Moist porous, hard materials</p> <ul style="list-style-type: none"> • Absorbs moisture or chemicals that get trapped in the material which will be released by the laser cutter. • Steam builds up in these materials which could create a steam explosion. Be sure to let the material dry completely before using in the laser cutter. 	<p>HDPE (Milk bottle plastic)</p> <ul style="list-style-type: none"> • Catches fire and melts <p>Food</p> <ul style="list-style-type: none"> • Food cut from the laser cutter will not be food safe. It can be done, but other materials that are cut in the laser cutter (such as acrylic) aren't safe to consume. <p>Glass</p> <ul style="list-style-type: none"> • Creates microshards that will go into the air (and potentially your lungs)
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CW-3000 INDUSTRIAL CHILLER USER MANUAL



<1> INTRODUCTION

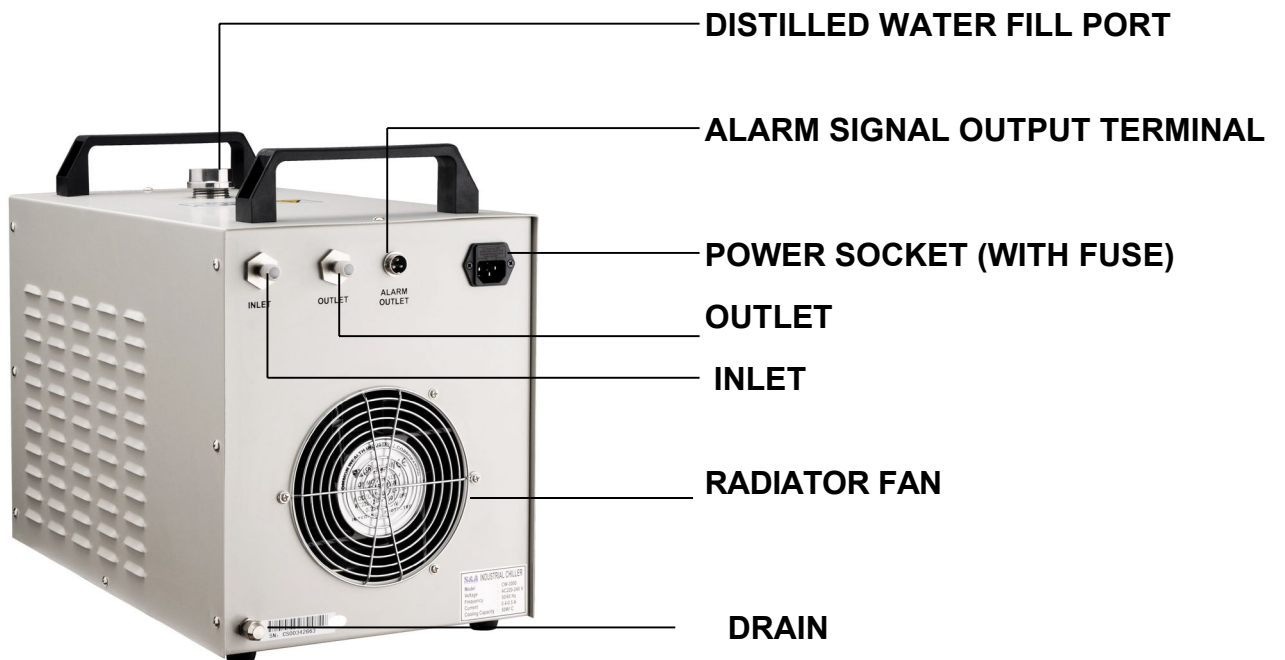
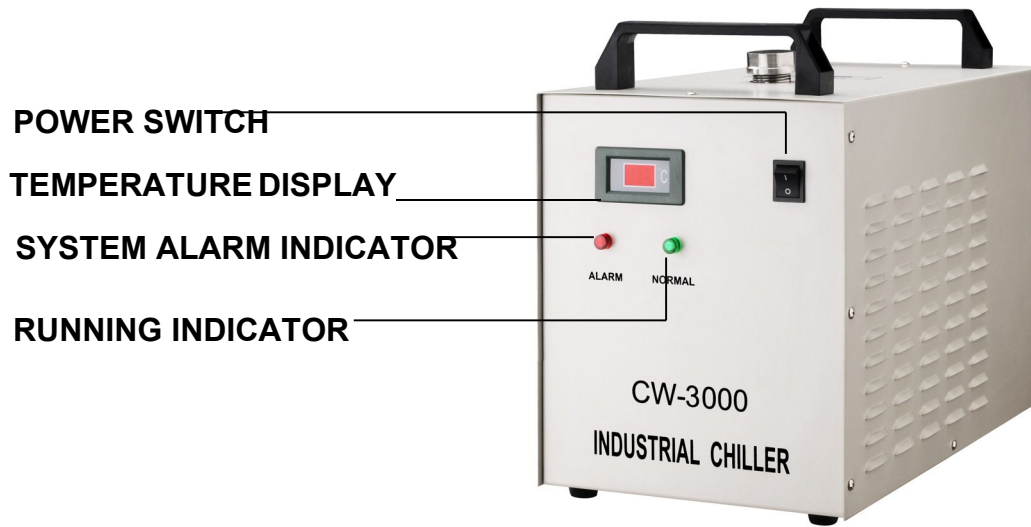
The CW-3000 Chiller keeps the laser tube cool and extends its life and increases performance.

1. Real-time temperature monitoring – an alarm will sound if the flow of water is not detected.
2. The air-cooled radiator dissipates heat efficiently.

<2> CAUTION

1. **MAKE SURE** to fill the water reservoir with **DISTILLED WATER ONLY**.
2. Cooler should be placed in a well-ventilated, dry environment away from heat sources. Please keep at least 30cm from obstructions to the air outlet which is in the back of the cooler, and should leave at least 10cm between obstructions and air inlets of both sides.
3. The cooling water must be drained if the cooler is out of use for a long time or before being transported.
4. To protect laser tubes, the chiller will stop working when the water temperature is lower than 10°C, and it will restart to run when water temperature rises above 20 °C.

<3> Details



1. To begin operation

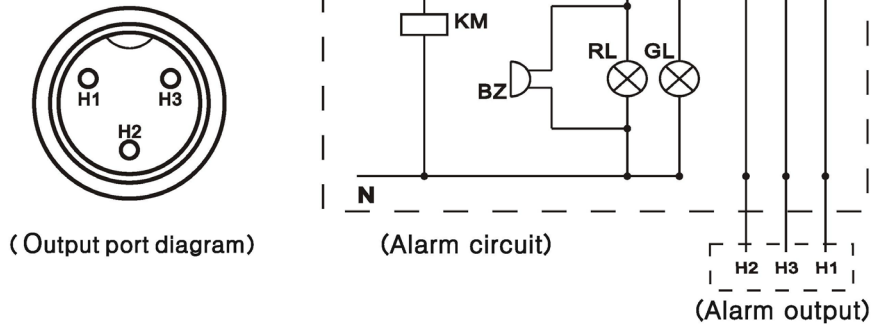
1. Open the package to check if the machine is intact and all the necessary accessories are completed.
2. Open the distilled water fill port, then add 2 gal of distilled water.
3. Connect the water inlet and outlet pipe to laser
4. Plug in power, turn on the power switch.
5. Check the water level of the water tank again.

2. Alarm description

Causes of the cooling water circulation loop alarm and the working condition table.

Display Condition	Green light	Red light	Buzzer	out H1、 H2	out H1、 H3
Normal	On	Off	No Alert	Off	On
Water stops up	Off	On	Alert	On	Off
Surpasses 60°C	Off	On	Alert	On	Off
Pump breakdown	Off	On	Alert	On	Off
Water alarm	Off	On	Alert	On	Off
Faulted circuit	/	/	/	On	Off
Power outage	/	/	/	On	Off

Note: The flow alarm port connects to the normally open relay and normally closed relay contacts, requiring operating current to be less than 5A, working voltage less than 115V.



3. Maintenance

To ensure good heat dissipation, remove the cover and clear any obstructions or dirt which may have accumulated on the heat exchange coils after the Chiller has been used for 1000+ hrs.

<4> SPECIFICATIONS

Model	CW-3000AG	CW-3000DG	CW-3000AF	CW-3000DF	CW-3000AK	CW-3000DK
Voltages	AC220~240V	AC100~120V	AC220~240V	AC100~120V	AC220~240V	AC100~120V
Frequency	50/60Hz					
Current	0.45A	0.9A	0.45A	0.9A	0.5A	1.0A
Cooling capacity	50W/ ° C				60W/ ° C	
Inlet and outlet hold	Outside dimensions 10mm brass connector		Inside dimensions 8mm speedy connector		Inside dimensions 6mm speedy connector	
Max. pumping lift	10 M				70 M	
N.W	9.5Kg				12Kg	
G.W	12Kg				14.5Kg	
Dimensions	47X27X37cm(LxWxH)					
Packing dimensions	59X39X48cm(LxWxH)					

<5> SIMPLE TROUBLESHOOTING

Failure	Fault	Repair
Machine turned on but unelectrified	Power cord is not plugged in place	Plug the power cord in place
	fuse blown	Replace the fuse inside the power interface which is in the back of machine
Flow alarm (panel red light) with water pipe directly connect to the outlet, inlet, there is no water flow	Water level in water tank is too low	Feed water and check the pipe leakage
When used with the device, flow alarm (panel red light), but a direct connection with the pipe outlet and inlet, there is water flowing but not alarming	Blockage in circulating water pipeline	Check circulating water pipeline
High water temperature	Chiller of poor ventilation	Clean Heat Exchange tubing
	Excessive heat load	Reduce the heat load or to use other models
Fan does not work	Water temperature below 20 degrees Celsius	This is normal
Switch on with alarm after adding water or changing water	Water spilled into electric circuit	Allow to dry or Dry off cap
	Damaged pumps	Replace or repair water pump. DO NOT OPERATE WITHOUT WATER!
Slow drainage	The water fill port is not open	Open the water fill port

<6> PACKING LIST

1. User manual
2. Power cord
3. Two connection hoses
4. Signal cable

CAUTION: The CW3000 is not to be used by children or persons with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they are supervised or have been trained!

LG6040N

Laser Engraving Machine



Technical Parameters

Laser - Type	Sealed CO2 laser tube
Laser Power	40W 60W 80W (optional)
Engraving Area	600mm x 400mm
Worktable	Motorized up down table
Whole Machine Size	1360*850*950mm
Engraving Speed	0-36,000mm/min
Resetting Positioning Accuracy	±0.05mm
Working Voltage	AC 110-220V±10%,50-60Hz
Gross Power	<1000W
Operating Temperature	0-45°C
Operating Humidity	5-95%
Minimum Shaping Character	English 1x1mm
Graphic Format Supported	BMP, PLT, DST, DXP, and AI
Driving System	stepper

Cooling Mode	Water-cooling and protection system
Auxiliary Equipments	Exhaust-fans, air-exhaust pipe
Controlling Software	DSP control system
Compatible Software	CorelDraw AutoCAD Photoshop

Application Industry

Wood, organic glass, plastic, garments, paper, leather, rubber, and other nonmetal materials.



FG 6XL Centrifugal Inline Fan

Item #: 40407

Variante : 120V 1~ 60Hz



Description

A multi-purpose inline duct fan for exhaust or supply air; ideal for commercial and residential ventilation applications. Customers benefit from the seamless, leak-free design, low noise operation, easy installation and reduce maintenance requirements, ensuring project cost and timelines are optimized. The fan is suitable for indoor applications and can be mounted at any angle in any point along the ductwork.

- Airflow 460 cfm at 0.2" Ps
- Mounting bracket and hardware included
- Suitable with indoor installations
- Speed controlled with solid-state speed controller WC15 or ON/OFF push-button 60 min timer FD60EM
- 5-year factory warranty

The housing is...

[Find more details in our online catalogue](#)

Technical parameters

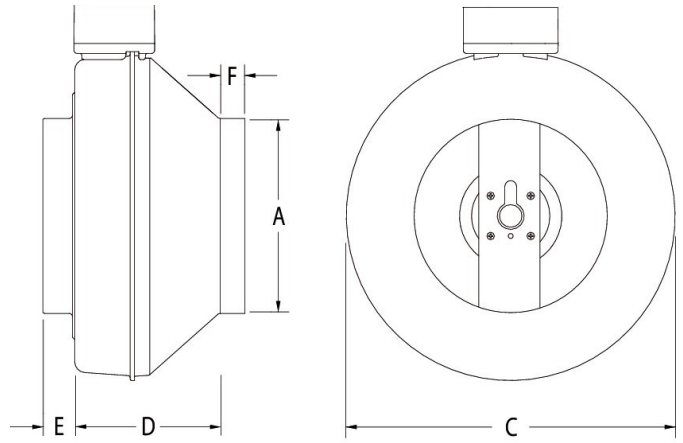
Nominal data	
Voltage (nominal)	120 V
Frequency	60 Hz
Phase(s)	1~
Input power	150 W
Input current	1.31 A
Impeller speed	2,703 r.p.m.
Air flow	max 494 cfm
Temperature of transported air	max 140 °F
Max temperature of transported air, when speed controlled	140 °F
Protection/Classification	
Enclosure class, motor	IP44
Insulation class	B
Dimensions and weights	
Duct dimension; Circular, inlet	6 in.
Duct dimension; Circular, outlet	6 in.
Weight	9.1 lb
Optional	
Duct connection type	Circular

Performances

Dimensions

CFM Table

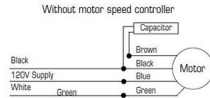
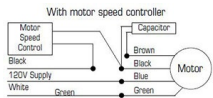
Model	0" Ps	0.2" Ps	0.4" Ps	0.6" Ps	0.8" Ps	1.0" Ps	1.5" Ps	2.0" Ps
FG 4	135	110	83	55	25	-	-	-
FG 4XL	170	150	134	119	103	86	40	-
FG 5XL	220	190	160	135	112	91	41	-
FG 6	303	270	232	196	164	134	58	-
FG 6M	418	370	317	268	224	186	101	16
FG 6XL	483	450	409	369	329	289	201	-
FG 8	461	410	351	295	243	191	97	14
FG 8XL	502	470	428	388	351	313	218	100
FG 10	513	480	444	407	366	324	216	90
FG 10XL	589	560	531	503	472	441	355	260
FG 12	741	680	601	515	434	363	236	141
FG 12XL	940	880	819	746	670	596	425	400



Model	A	C	D	E	F
4	4 (101)	8 1/2 (216)	6 1/2 (165)	1 (25)	1 (25)
4XL	4 (101)	9 3/4 (248)	6 15/16	1 (25)	1 (25)
5	5 (127)	8 5/8 (219)	6 1/2 (165)	1 (25)	1 (25)
5XL	5 (127)	9 3/4 (248)	6 (152)	1 1/8 (29)	1 1/8 (29)
6	6 (152)	11 3/8 (289)	6 1/4 (159)	1 (25)	7/8 (22)
6XL	6 (152)	13 1/8 (333)	7 (178)	1 (25)	1 (25)
6M	6 (152)	13 1/8 (333)	7 (178)	1 (25)	1 (25)
8, 8XL	8 (203)	13 1/4 (337)	6 (152)	1 1/8 (29)	1 (25)
10	10 (254)	13 1/4 (337)	4 3/4 (121)	1 1/8 (29)	1 (25)
10XL	10 (254)	13 1/4 (337)	4 13/16 (122)	1 1/4 (32)	1 (25)
12, 12XL	12 (305)	16 (406)	6 11/16 (170)	1 1/2 (38)	1 (25)

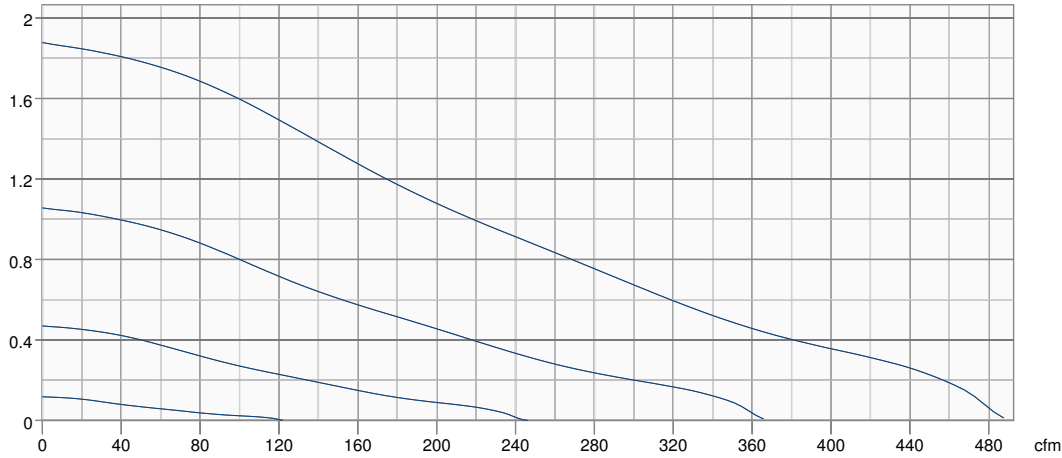
Dimensions are in inches (mm).

Wiring



Performance curve

in. wg.



Hydraulic data	
Required air flow	-
Required static pressure	-
Working air flow	-
Working static pressure	-
Air density	0.075 lb/ft³
Power	-
Fan control - RPM	-
Current	-
SFP	-
Control voltage	-
Supply voltage	-

Accessories

FD60EM Electronic Timer Switch (411386)
 WC 15 Speed Control (5A) (411102)
 RSK 6 Backdraft Damper (411114)
 IG 6 Inlet Guard (411109)
 LD 6 Silencer (411284)
 MGS 6 Metal Supply Grill (411242)

VT20M Pgrm Fan Main Ctrl (45386)
 FIDT 6 Insulated Flex Duct (411064)
 FC 6 Mounting Clamps (2 pcs) (411120)
 IR 6 Iris Damper (411236)
 MGE 6 Metal Exhaust Grill (411371)
 PBV6 Bath Fan Grill (412261)

Documents

450369 FG Submittal Sheet EN.pdf
 400017 FG OIPM EN FR ES.PDF
 40407.dxf



Hailea ACO-009e Air Compressor

Product Specification

Brand	Hailea
Maximum Flow Rate (CFM)	140 L/min
Discharge Pressure	0.035 Mpa
Power Source	120 VAC
Compressor Noise Level (Db)	<60dB
Weight	5.1 kg
Voltage	135 W
Minimum Order Quantity	1 Piece

ROTARY GUIDE



GENERAL LASER SAFETY:

1. Ensure proper equipment is turned on.
 - a. Power on exhaust.
 - b. Power on and Connect air compressor.
 - c. Power on chiller and verify water temp.
2. Locate bucket of sand.
3. **Turn off laser cutter before swapping the Rotary and Y-axis cables.**

SECURING WORKPIECE IN CHUCK:

1. Locate chuck Key.
2. Place metal teeth inside chuck – NOTE: there are 'inside' and 'outside' chuck parts. Also: each chuck is numbered and should be assembled in sequential order.
3. Insert chuck key into chuck.
 - a. Rotate clockwise to bring teeth in towards the center.
 - b. Rotate counterclockwise to loosen teeth.
4. Prepare material to be engraved/cut.
 - a. Loosen chuck to fit teeth around (or inside) the object.
 - b. Clamp material in chuck teeth. Pay close attention to centering the material to reduce 'run-out' by using the centering pin on the centering assembly on the opposite end of the rotary rails.
 - c. Tighten chuck.
 - d. Loosen clamp on centering assembly.
 - e. Bring forward the clamp to the object's center.
 - f. Re-tighten clamp.

LOWERING BED/INSTALLING ROTARY PARALLEL WITH LASER LENS CARRIAGE:

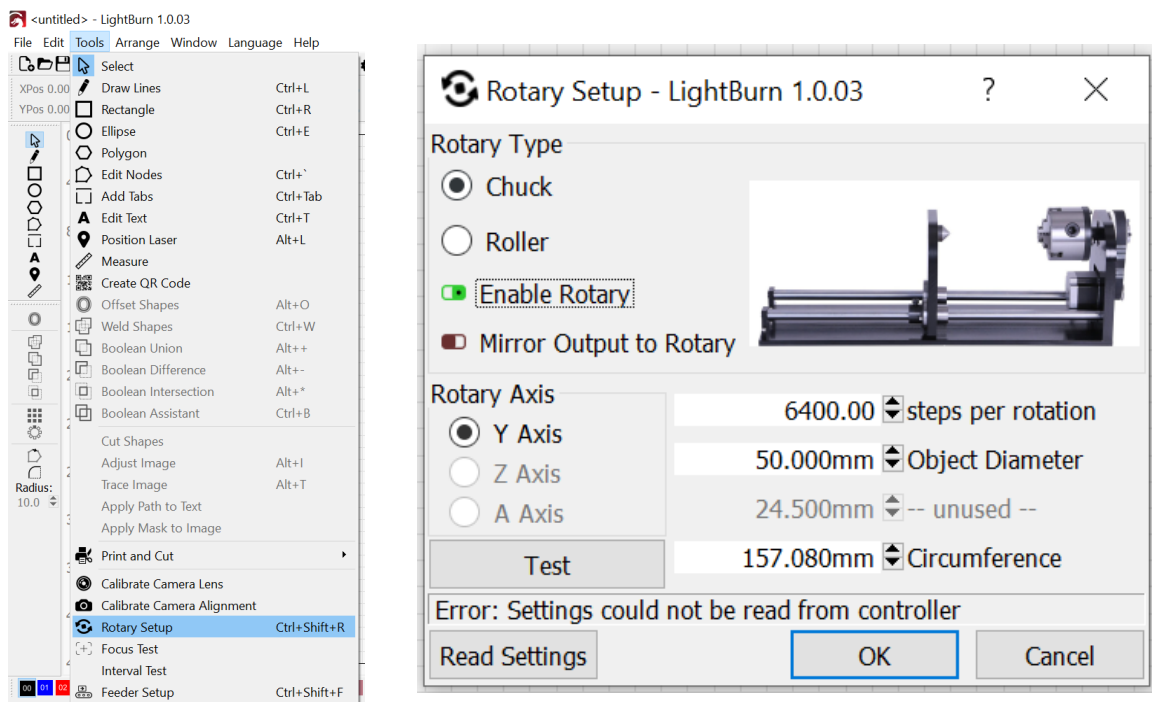
1. Move laser lens carriage to rear of cabinet and remove Honeycomb bed.
2. Lower Z-axis.
 - a. Press "Z/U" on keypad.
 - b. Hover over "Z move" option.
 - c. Press and hold the right arrow – bed should move down.
 - d. Release when the bed reaches the bottom of the cabinet.
3. Place the Rotary attachment on the bare bed parallel to the Y-axis.
 - a. Observe inscribed parallel lines on bare bed for reference.
 - b. Line up one side of the rotary to be parallel to one of these lines.

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REPLACING Y-AXIS CABLE WITH ROTARY CABLE; RESETING LASER TO 'DISCOVER' ROTARY ATTACHMENT:

1. Replace Y-axis cable with the cable from the rotary attachment.
 - a. Ensure laser head is in the top right corner.
 - b. Turn off power to the laser.
 - c. Unplug the laser.
 - d. Locate the Y-axis cable connection (front right of the bay under the keypad).
 - e. Unscrew Y-axis connection.
 - f. Replace with cable from Rotary attachment.
 - g. Manually move laser head to the very top right position.
 - h. Plug laser back in.
 - i. Turn laser on – NOTE: reset with Rotary attached may take up to 2 minutes.
2. Enable rotary attachment in LightBurn.
 - a. Open LightBurn software.
 - b. Click "Tools" in the top menu bar.
 - c. Click "Rotary Setup" (near the bottom).
 - d. Select the following settings:
 - i. "Chuck"
 - ii. "Enable Rotary"
 - iii. "Y Axis"
 - iv. If the laser is engraving/cutting mirrored, enable "Mirror output to rotary".
3. Enter correct steps per rotation, object diameter, and circumference.
 - a. The correct steps per rotation is 6400.



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TESTING ROTARY SETTINGS:

1. Ensure the chuck is set up correctly.
 - a. Refer to the "Setting up chuck" section.
2. Observe that the Y-axis has been transferred to the rotary.
3. Wait for laser to discover the rotary or press Esc.
 - a. The laser will have discovered the rotary when the rotary stops spinning after power up.
4. Manually move the laser head above material.
 - a. Use the Z move function of the controller to lower the bed with the Rotary attachment BELOW the lens assembly.
 - b. Be careful to not allow the laser lens assembly to interfere with the Rotary Chuck!**
5. Press the "Origin" button on the keypad once the laser head is in its proper place.
 - a. "Origin" is where the laser head will go after the job is finished or when reset.
 - b. If an Origin location has not been selected the laser head will ram into the rotary chuck when the job is finished. **This will damage the laser head and rotary chuck!**
6. Autofocus laser head on your material.
 - a. Ensure that the laser's Z-axis probe is over the top of the workpiece.
 - b. Click "Z/U" on the keypad.
 - c. Scroll down to "Auto focus".
 - d. Press "Enter" (Gold button).
7. Ensure correct operation of the rotary attachment using Frame & Pulse.
 - a. Mark wherever the laser head location is on the workpiece with a pen. Press the green "Pulse" button. The pulse feature is only active when the lid is closed and the chiller is on.
 - b. Press "Test" in rotary settings.
 - c. Observe that the chuck makes one full rotation (In-line with the mark previously made). If the rotation does not meet the mark, check that you have accurately entered the workpiece diameter.
 - d. You may need to adjust your design to match the height (circumference) of the workpiece. You may also need to adjust the mirroring of the design. We recommend that you practice on scrap material until you are sure that the result will match your needs.

REMOVING ROTARY ATTACHMENT:

1. Turn Laser Off.
2. Unplug laser.
3. Manually move laser head and carriage to the rearmost right corner of the cabinet.
4. Unscrew rotary cable from Y-axis connector.
5. Remove rotary from laser.
6. Connect the original Y-axis cable to Y-axis connector.
7. Replace the honeycomb tray back into laser.
8. Plug laser in.

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9. Turn laser on.
10. Raise Z-axis to normal level.
 - a. Press "Z/U" on keypad.
 - b. Hover over "Z move" option.
 - c. Press and hold Left arrow until the honeycomb is in a normal engraving/cutting position.
11. Open the rotary settings in Lightburn
 - a. Click "Tools" in the menu bar.
 - b. Click "Rotary Setup" (near the bottom).
 - c. Turn off "Enable Rotary".

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