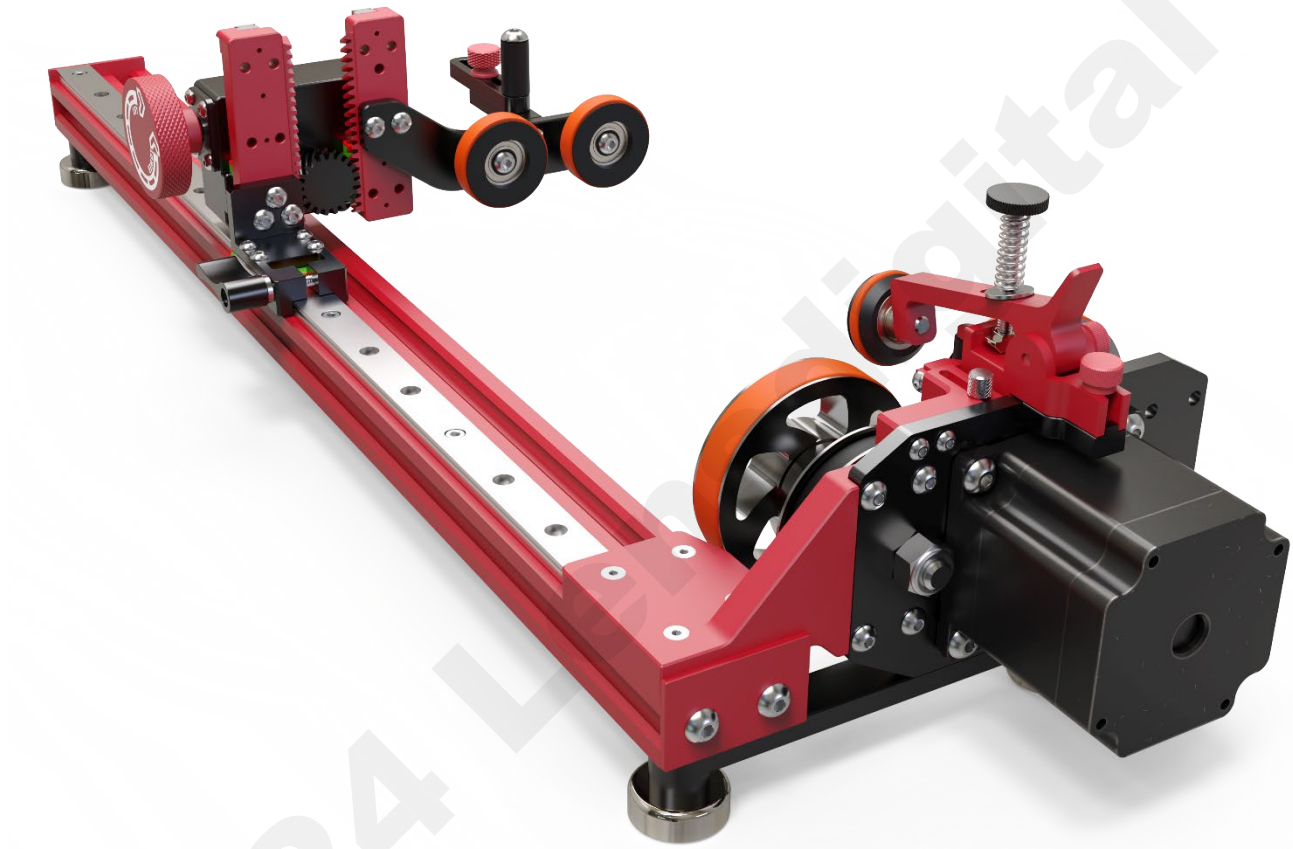
PIBURN LASER ROTARY ATTACHMENT V

User Manual



Updated: October 15, 2024 (get the latest version at: http://piburn.info/manual)

Note: PiBurn is a rotary attachment for laser cutters engravers that allows you to engrave cylindrical objects.

It's meant to temporary replace your Y-Axis and will work with most Ruida type controllers.

Note: Due to constant improvements to the design your PiBurn might look slightly different from the one pictured in this guide.

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What's new in V

In its 5th iteration, the PiBurn underwent some significant changes. PiBurn 4 improved over the previous version, and it's still an amazing and versatile rotary. It wasn't easy, but we managed to make some improvements and released this new version, "V"

- Low profile self-locking telescoping back wheel support with an even greater range of movement. In the medium to low position, the tower is now even lower than the clamp, thus eliminating any possible laser gantry collision
- The new footboard with back wheels can be further repositioned using extra mounting holes, further extending the range of movement of the telescoping tower
- A linear back-support rail guide allows smoother, more precise movement. It eliminates front-to-back alignment issues and never gets loose or wobbly like V-wheels
- Integrated linear rail guide brake/stopper makes securing the carriage with back support quick and easy at a flick of a lever
- O-rings on the back wheels were replaced with wide tires that won't slip off. Never lose them again
- New one-piece silicone tires replace O-rings on front wheels, increasing friction and preventing losing O-rings. They will stay put no matter what
- A smaller platform means you can now move back support much further than before, increasing travel even on shorter-length PiBurn
- The completely redesigned head unit is now much more compact. The motor is centered between wheels, and an improved belt drive system eliminates any belt slippage.
- Increased 4.5x (3.6x for Thunder motor) gear reduction system increases engraving resolution, finer movement, and higher torque
- The much-improved wheel design not only has a new, sleek look but also has integrated bearings and will stay perfectly parallel to the headboard
- Pulley is also integrated into the wheels, so it will never get loose or start slipping
- Improved clamp
    - more ergonomic design
    - The new clamp platform makes removing and reinstalling the clamp much easier and eliminates any side-to-side movement
- The headboard can be easily swapped without the need for alignment

Main Diagram

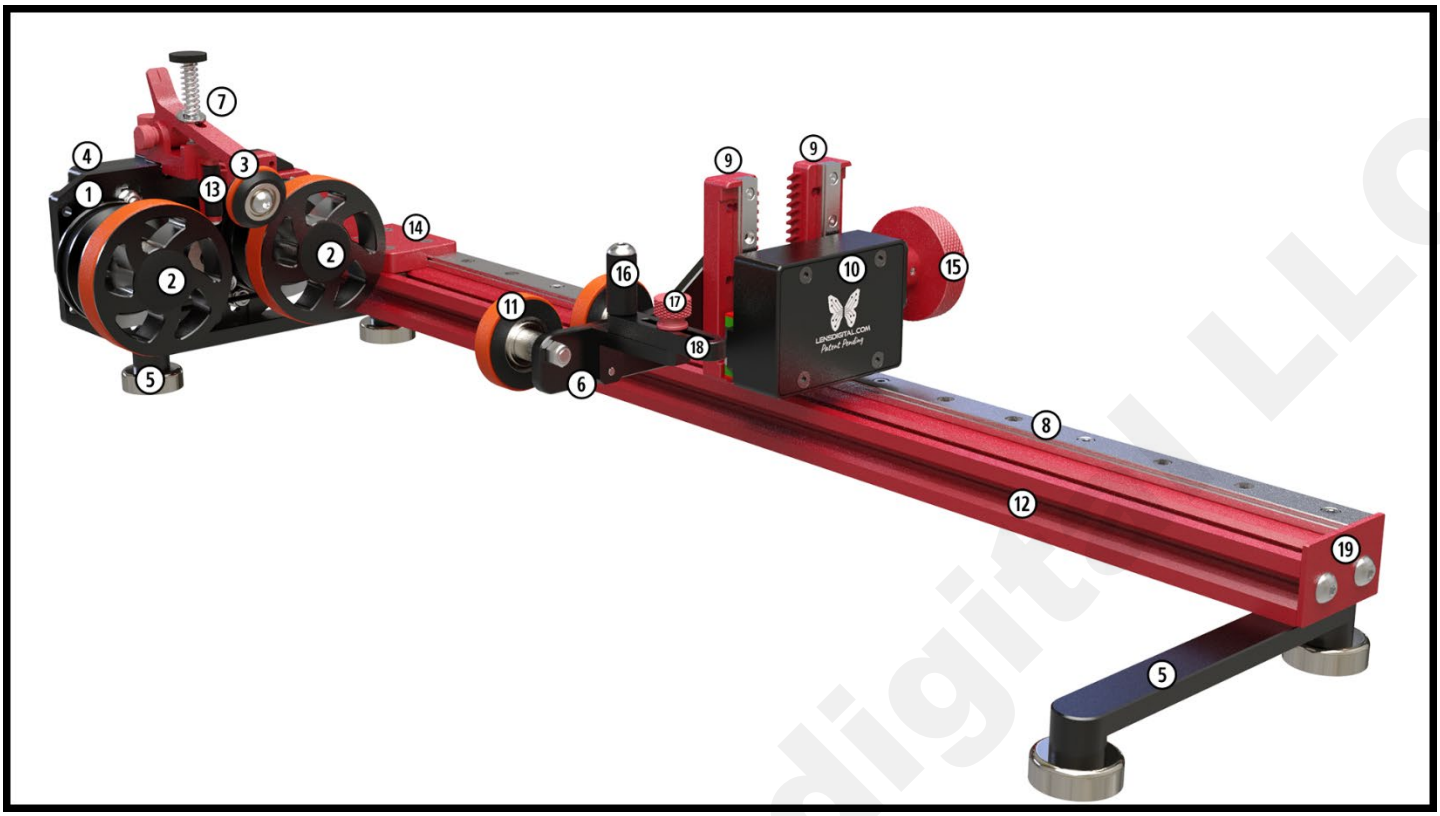


Figure 1. Front View

1. Headboard
2. Front Rollers/Wheels
3. Clamp
4. Motor (behind headboard)
5. Fixed Magnetic Feet
6. Footboard
7. Clamp Lock Screw
8. Main Linear Guide Rail
9. Telescoping Lift Rack Gears
10. Gearbox
11. Back Support Wheels
12. Main Support Rail
13.Front End Stopper
14. Headboard Mount Bracket
15. Vertical Adjustment Hand Wheel
16. Back End-stop Roller
17. Back End-Stop Lock thumb screw
18. Back End-Stop platform
19. Rail cap

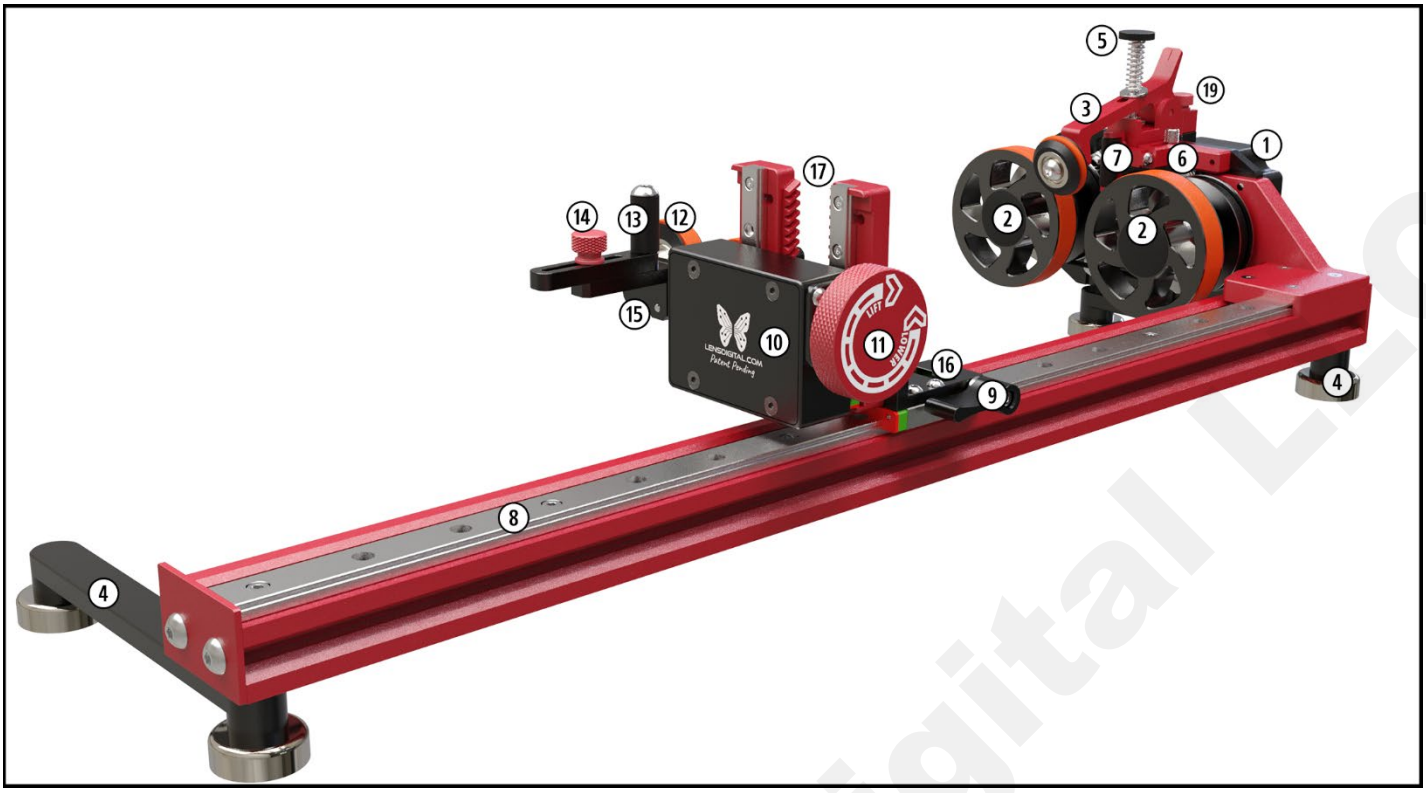


Figure 2. Back View

1. Motor (on Headboard)
2. Front Rollers/Wheels
3. Clamp
4. Fixed Magnetic Feet
5. Clamp Tension Screw
6. Front end-stop lock screw
7. Front end-stop
8. Main Linear Guide Rail
9. Horizontal Adjustment lock thumb screw
10. Gearbox
11. Vertical Adjustment Hand Wheel
12. Back Rollers/Wheels
13. Back End-stop Roller
14. Back End-Stop Lock thumb screw
15. Footboard
16. Carriage
17. Telescoping Lift Rack Gears

19. Clamp Attachment Thumb Screw

Dimensions

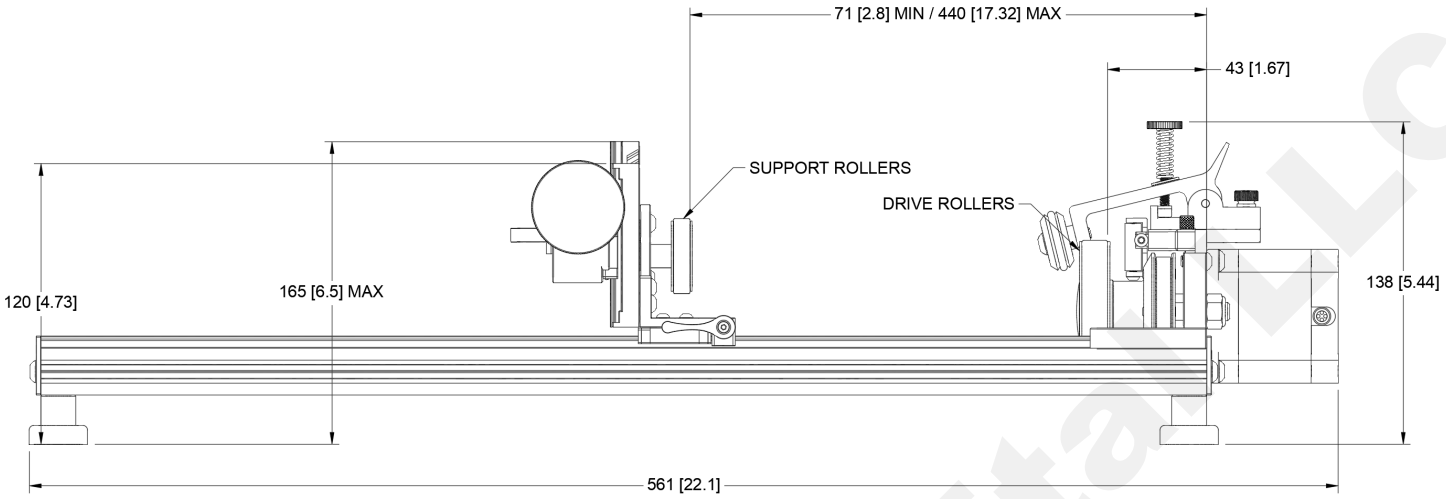


Figure 3 Standard Version Length Dimensions (side view)

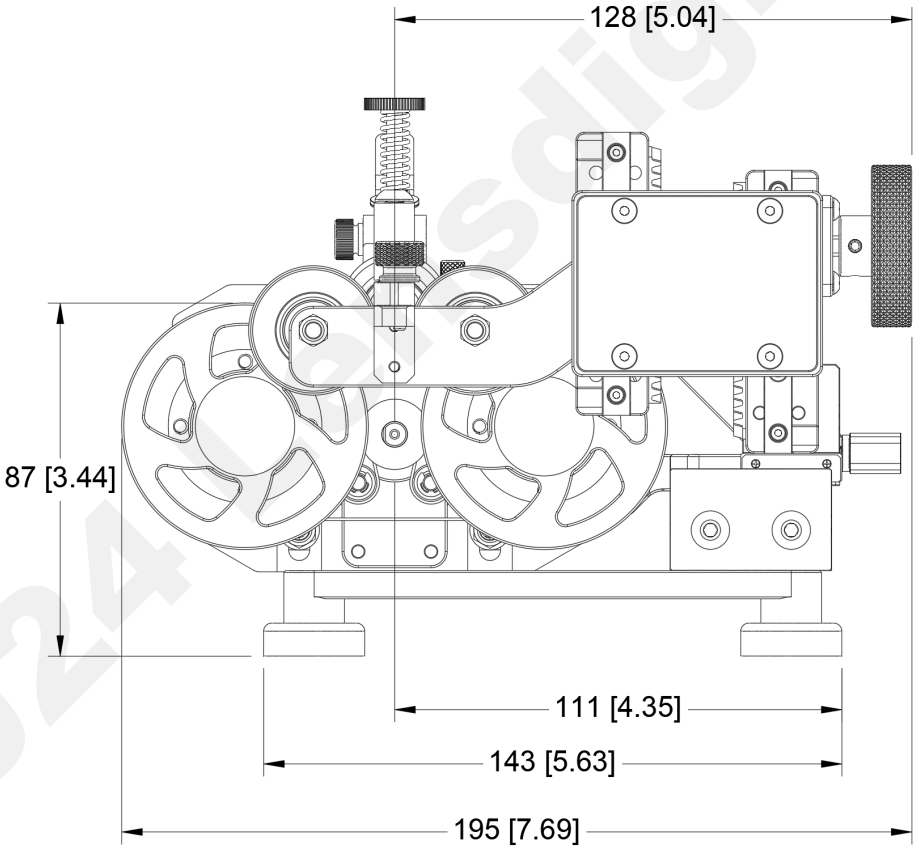


Figure 4 Back view dimensions

PiBurn comes in three lengths to accommodate different laser bed sizes.

The total length of Standard PiBurn is 563 mm (22.1 in), and a “MINI” (i.e., for Boss LS-1416) is 397 mm (15.61 in).

The maximum height of Piburn is 165 mm (6.5 inches), with back support fully extended (120mm when lowered). The distance from the bottom of the floor to the top of the front wheels is 87mm (3.44 in).

Chapter I: Installation

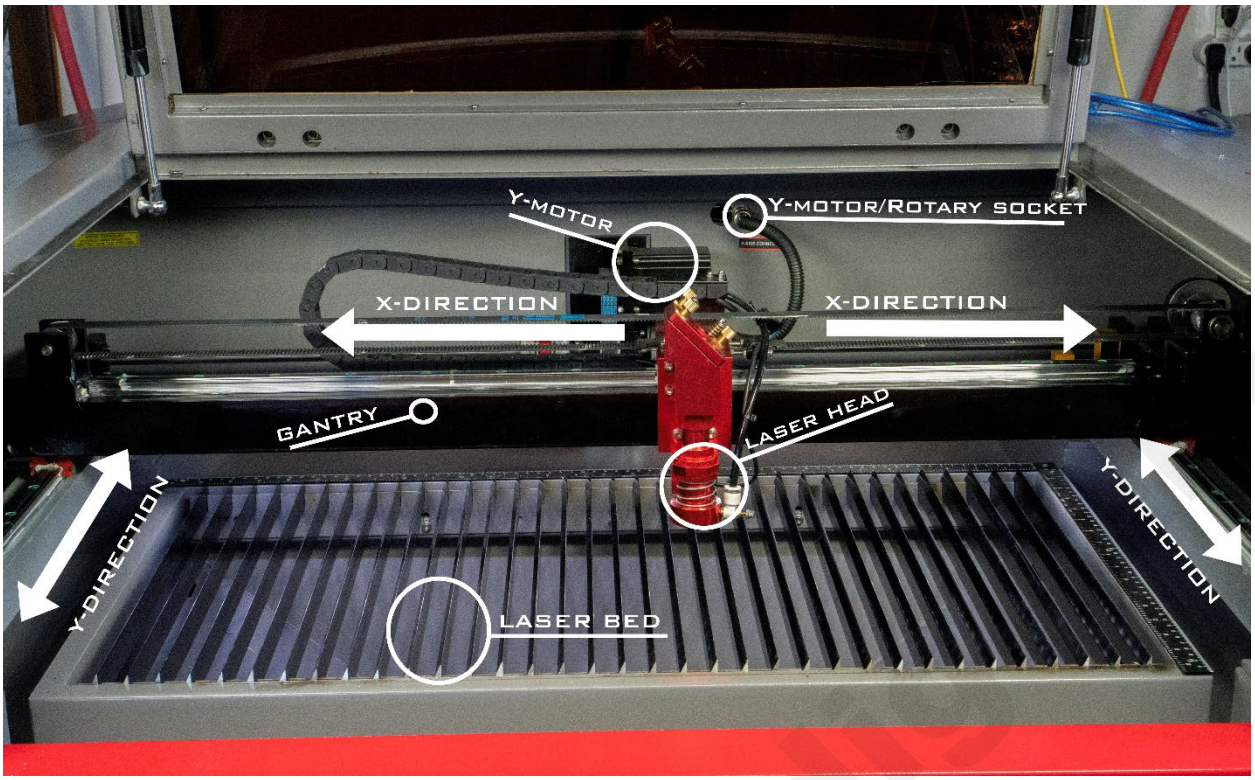


Figure 5. Laser Overview (Boss Laser)

Plug in PiBurn to your machine

NOTE: Different laser machines have different ways of connecting rotary attachments. Some (i.e., Boss Lasers made after 2020, Aeon Mira/Nova, Thunder laser) have dedicated rotary port and either manual switch or automatic relay to enable it. In machines that don't have a dedicated rotary port (i.e., Boss Laser made before 2020, OMTech, and other generic), usually, you will unplug your Y-axis motor and plug in the rotary instead.

For Machines without dedicated Rotary Port:

1. Locate the Y-Axis plug. This is where your Y-motor is plugged in. Usually, it's located in the "work chamber" and easily accessible once you lift the main machine cover. On older Boss Laser machines, the plug is located toward the back

Figure 6. Y-Axis Connector

2. Lower your bed so PiBurn can easily fit under the laser nozzle
3. We also recommend that you move your laser head to the top right corner (or whenever your normal homing position is) via control panel arrows and save position (i.e., the "**Origin**" button on the control panel) before turning the machine off. It's safer this way because the laser head tends to move very fast to the position it was in last before the machine was powered down. It can injure or surprise you when it does that.
4. Finally, power down the machine.

For Machines with Dedicated Rotary Port:

1. Power on your laser and let it auto home.
2. Locate the Rotary port (note on some machines (i.e., Aeon Mira) you might have to lower the z table to gain access to this port and plug in the Rotary). On Boss laser, you might need to open the top right access door to see the rotary port and switch.
3. If your laser machine has a Rotary switch, switch it to the rotary position. Note: This will disable your gantry movement! On some machines, the gantry stays powered on and can't be moved by hand (i.e., Boss Laser). If that's the case, you will need to position your gantry above the middle of the PiBurn first before turning on the Rotary switch.

Install PiBurn

(see note for Thunder Laser)

1. When physically placing the PiBurn insider laser, you have three options:
   a. Place it on top of the Honeycomb Table
   b. Place it on the "knife blades."
   c. Place it directly on the laser floor
   You can place PiBurn directly on the honeycomb table if you have enough headroom space. PiBurn has Magnetic Feet, so using a honeycomb made from ferrous metal (i.e., NOT aluminum) is best. If you desire to place PiBurn directly on top of your knife blades, we recommend placing it on something large and flat (like an acrylic or plywood sheet) so feet don't slide off the blades.
2. When engraving larger objects, and if your laser machine allows, you can remove knife blades and place the rotary directly on the laser bed. This is the recommended setup for Aeon Laser machines.
3. If your laser bed has sloping walls (i.e., Boss Laser or some OMTech machines), you can attach optional magnetic slope adapter brackets (sold separately) to those walls. Then, you can place rotary on those adapters like on any flat surface.
4. Plug in your rotary as described above.
5. Carefully arrange wire, PiBurn, and supporting platform so it doesn't interfere with the laser bed going up or down. We don't want the wire to get pinched between moving parts.
6. Turn on your machine (if it wasn't already).

Homing Machine with Rotary Attachment

When you turn on your laser, it must perform a "homing" sequence to know its start position. This usually involves moving the gantry and laser head into the top right (or left on some machines) corner until it reaches the end-stop limit switch. Then, the laser will move a little away from the limit switch and then back. Upon completion of the homing sequence, the laser head and gantry will want to move rapidly to the last known position where it was when you turned off the laser.

In many laser machines, when you plug in the rotary, you are disabling the Y gantry motor, so it won't be able to reach the limit switch on its own. In cases like that, you will need to move the gantry by hand to simulate a normal homing sequence. But sometimes you can't move the gantry because its motor is still under power (i.e., Boss Laser). In that case, you

should only plug in the rotary after the machine has finished homing sequence and you position the gantry over PiBurn's center

To home gantry by hand, push the whole gantry all the way back to trigger the Y-axis limit switch.

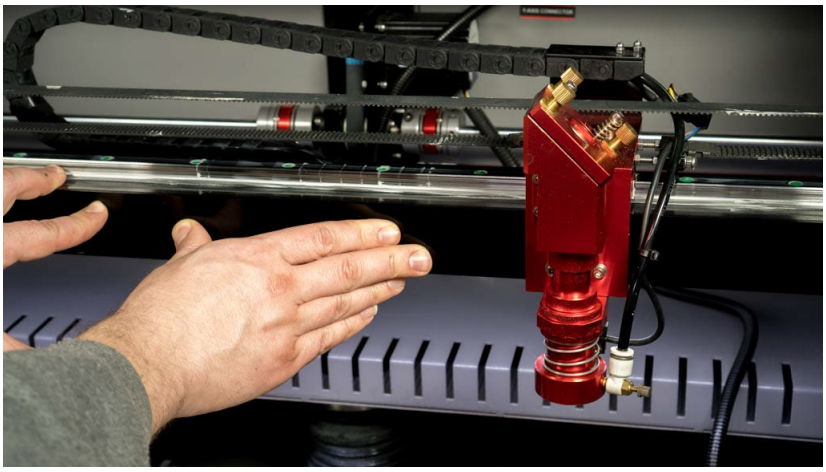


Figure 7. Pushing Gantry

- You'll notice that rollers on the Piburn will start rotating in the opposite direction after you reach the limit switch. That's because the laser wants to move the gantry forward a little.
- Pull the gantry towards yourself just a bit so it disengages the limit switch, and finally push it all the way back again.

At this point, you manually finished performing the initialization process that the machine usually does automatically when the Y-axis is plugged in. It should all be set to continue with the software setup part.

Note for Thunder Laser Owners:

Because the rotary is connected to a separate "U-axis," you don't need to worry about manually homing the machine. Just plug it into a dedicated rotary port. Watch out for laser head clearance to ensure it won't hit any part of your PiBurn when it's homing.

Chapter II: Main Software Settings

To correctly configure your PiBurn with a laser machine, you will need to determine two settings.

The first setting is "**Diameter (mm)**". This one is easy; it's always going to be around **63-64 mm,** no matter what object you engrave. Diameter refers to the diameter of the front rollers of the PiBurn.

The second setting, "**Steps Per Rotation"** (a.k.a. SPR), is slightly trickier. This number tells your laser machine how many pulses/steps it needs to send to the rotary's motor for a full 360-degree rotation. Or, in practical terms, it controls how far your engraving object is rotated. If you incorrectly set this number, your engravings will be squished or elongated. This number depends on how your laser engraver was set up at the factory.

Known "Steps Per Rotation" Values:

Laser Machine/Model	Steps per Rotation
Boss Laser LS1420/1416	10,800 or 14,400
Boss Laser LS1630 and above	22,500
AEON Laser (before June 2023) **AEON Laser (after June 2023)**	45,000 57,600
Thunder	36,000
OMTech	9,000 or 22,500
AP Laser	22,500

For all others, it must be determined by looking at Stepper Driver DIP switches, as described below. **DO NOT CHANGE THE DIP SWITCH POSITION**! Only note them.

WARNING!

Your machine must be completely powered off, unplugged, and discharged because you must go inside the electronics compartment to inspect some switch settings visually.

1. Open the door that leads you to the internal electronics compartment. On the Boss 1630 series, it's located in the back of the machine.

Figure 8. Door to electronics

2. Locate the Stepper Motor Driver that controls your Y motor. Stepper Driver looks similar to the one in the picture below.

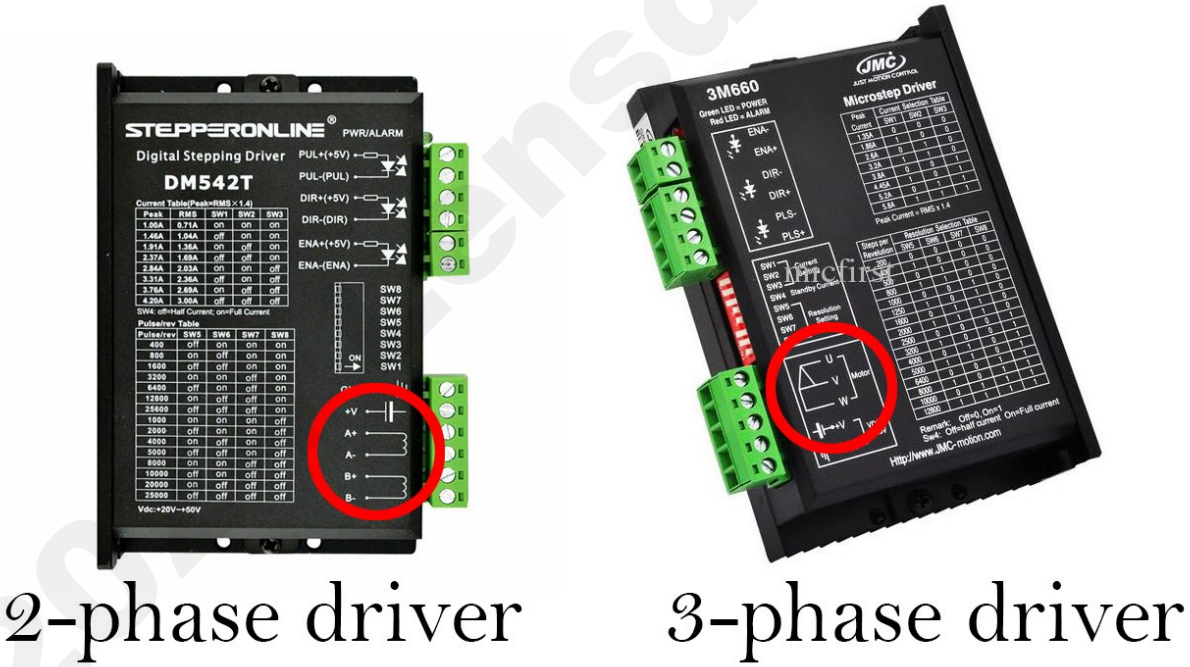


Figure 9

3. There will be 2 or 3 of them inside your machine. One for the X motor, one for the Y motor, and one for the Z axis (if your machine is equipped with a motorized table). Y and X drivers should be identical to each other.

Here's what it looks like inside Boss Laser LS-1630 machine (notice drivers are labeled):

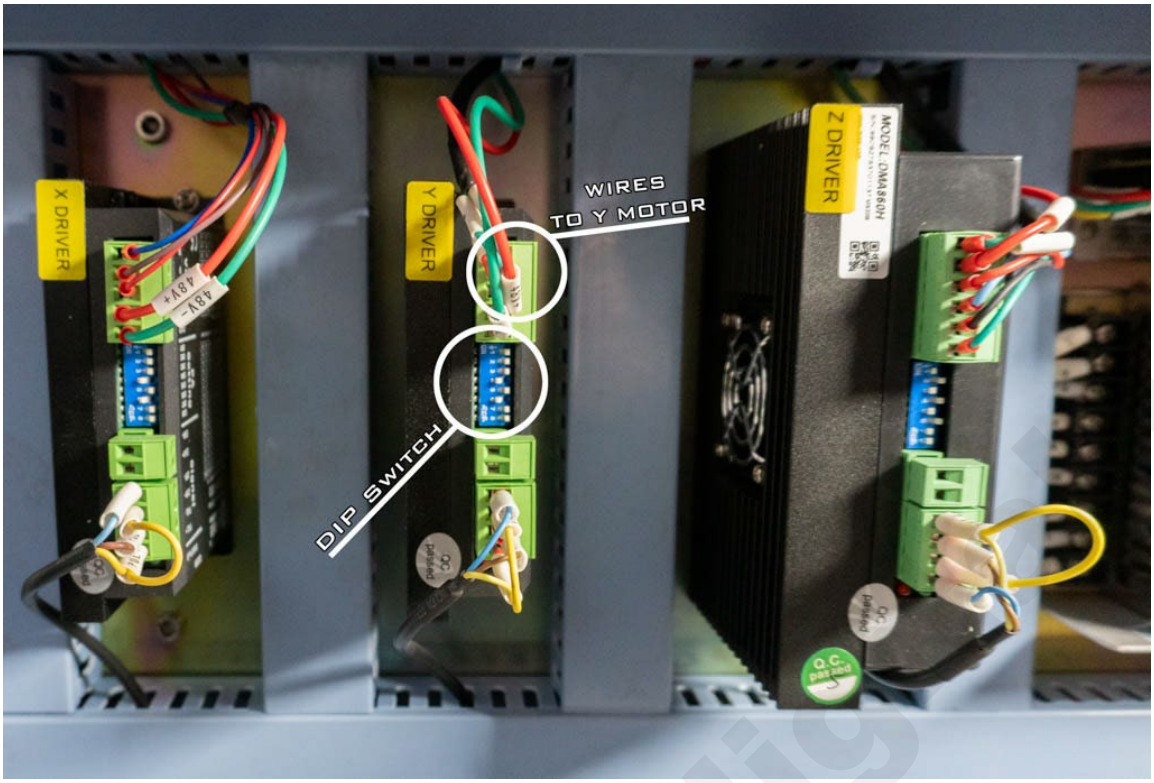


Figure 10. Stepper Drivers inside Boss Laser

4. If yours are not labeled, try tracing wires from the plug where your motor was plugged in (and where we now connected the PiBurn rotary).
5. Write down (or take a photo) of:
    a. **Make** and **Model Number** of the **Stepper Driver**
    b. Position of **"DIP" switches**. These are tiny switches on the back of the motor driver that can be flipped up or down. There's about 6-8 of them. Please refer to *F*igure 8. Stepper Drivers inside Boss Laser
6. Find out how many "**Pulse/Rev**" (Pulses per Revolution) your Y driver is set to.
   The position of **DIP switches** determines the "**Pulse/Rev**" setting.
   Many stepper drivers will have a "**Pulse/Rev**" table printed on them (see *Figure 9. Close* look at stepper driver). If yours doesn't have it, search online and download the manual for your stepper driver model. In the manual, find the "**Pulse/Rev**" table.

Let's look at example below:

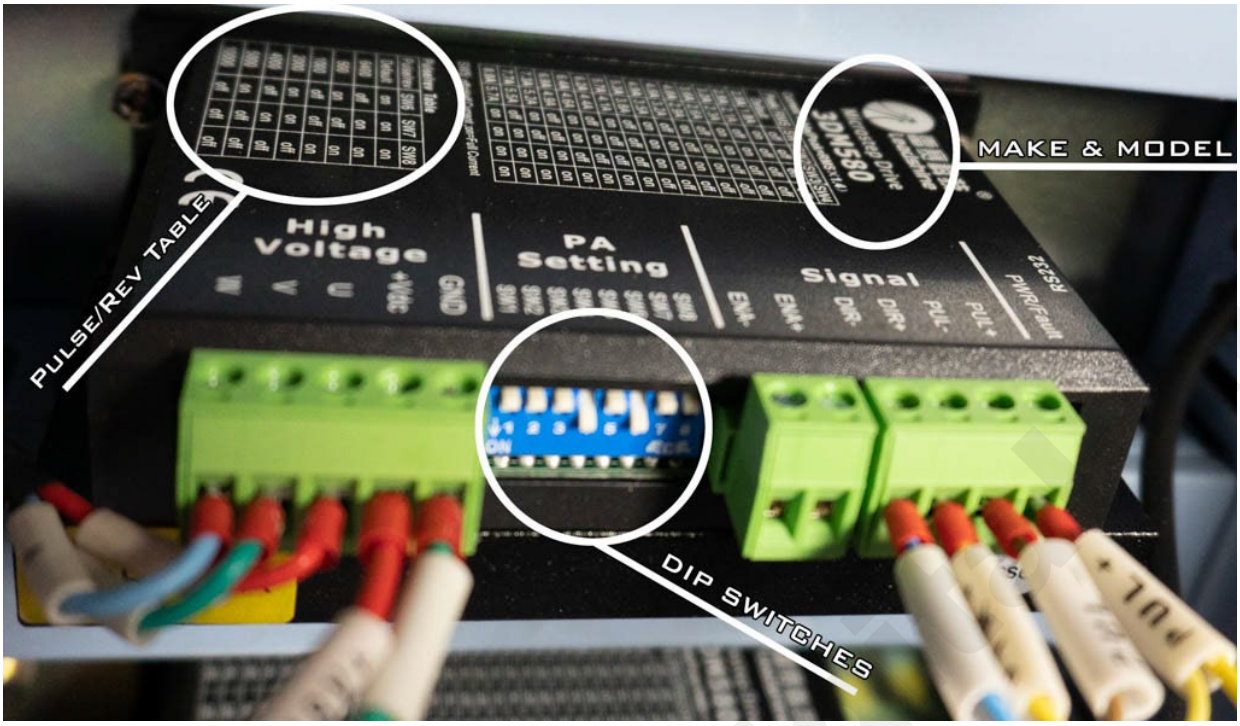


Figure 11. A close look at the stepper driver

There are 8 **DIP switches** on this driver, SW1 - SW8. Switches 4 (SW4) and 6 (SW6) are turned on (flipped down), while the rest are off (flipped up).

This driver has **Pulse/Rev** Table printed on it, so we don't need to know its manufacturer and model (there is no need to look at the manual).

The table refers only to the positions of SW6, SW7, and SW8. In our case, **SW6** is **ON**, and **SW7** and **SW8** are **OFF**.

This combination shows that our **Pulse/rev** value is **5000**. That's the one you need to know for the next step.

7. To find the "**Steps Per Rotation**" setting, take the "**Pulse/Rev**" value (from the previous step) and **multiply by 4.5x** (that's the gear ratio of PiBurn if you are curious). Note that for Thunder Lasers, the gear ratio is **3.6x**
   For example, if your **Pulse/Rev** = **5000**, your **Steps Per Rotation** will be: 5000*4.5=**22,500**

Chapter III: Configuring Software

Now that we know the Diameter and Steps Per Rotation values let's use RDWorks or LightBurn to configure your laser to use PiBurn.

1. Ensure your PiBurn is installed and plugged inside your laser engraver.
2. Turn on the Laser machine and manually home-in Y-axis
3. Connect your machine to the computer running RDWorks or Lightburn. Use either a USB cable or a network connection.
4. If you are using RDWorks (or LaserWorks, which is the same software)
    a. Navigate to the **User** tab and press the "**Read**" button. If you don't see Read/Write buttons, resize the window (drag the border) down until it appears

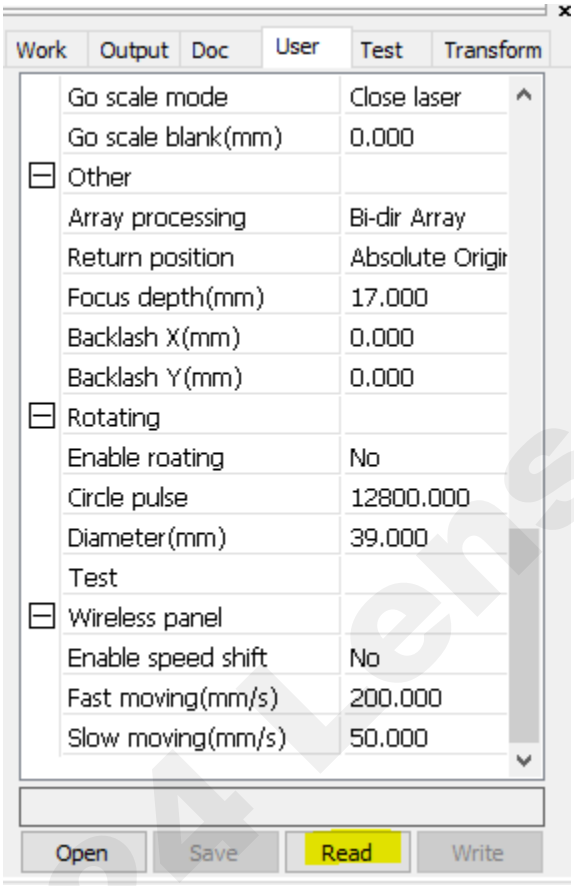


Figure 12

    b. Scroll down until you see the "**Rotating**" section (*note in newer versions of RDWorks, **User** tab is separated into three sections. If you don't see the "**Rotating**" option, click on the "**Other**" radio button on top*).
    c. Change "**Enable Rotating**" to "**Yes.**"
    d. Enter the "**Circle Pulse**" (a.k.a. **Steps Per Rotation**) value you determined from the previous chapter.
    e. Enter "**Diameter(mm)**" to be **63**
    f. Click the "**Write**" button

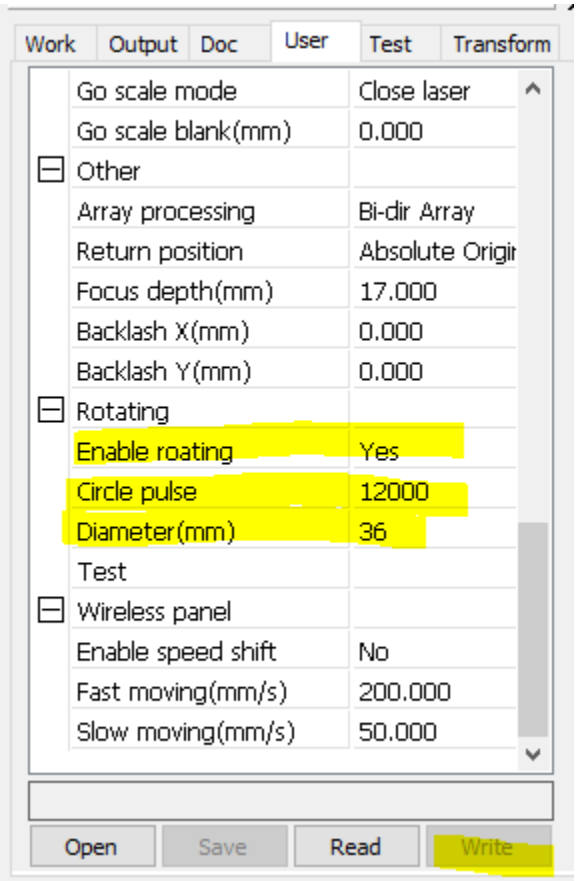


Figure 13

5. If you are using Lightburn, start it go to the “Tools” menu, and select “Rotary Setup.” (or click Rotary Icon on top toolbar)
    a. Change Rotary Type to “Roller”
    b. Click on the “Enable Rotary” switch to make it green.
    c. Rotary Axes should be set to “Y-axis” (for Thunder, it will be “A Axis”)
    d. Change “Steps Per Rotation” to a value you determined from the previous chapter
    e. Set “Roller Diameter” to 63 or 64 mm (due to slight variations in rubber tires, this value might be different for your specific rotary by about a millimeter).
    f. Disregard “Object Diameter” and “Circumference” values; they do not affect anything

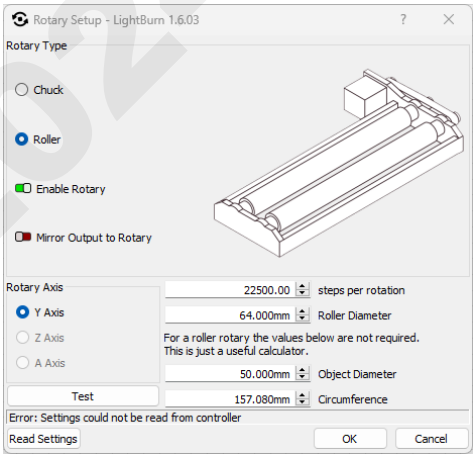


Figure 14 Lightburn Rotary Setup

6. **Lower idle and acceleration speed**.

   While this is not required, we strongly suggest your lower acceleration speeds when using a rotary attachment. That's the speed at which the head moves between cut movements. When cutting or engraving flat materials, you might have noticed that the laser moves at the speed that you entered when it's firing, but when it's done with cutting/engraving, it will move very fast to the starting position. Rotary attachment is not meant to be rotated this fast and might cause the object that you are engraving to fly off it after engraving is done or when doing a "frame" operation.

   To access parameters in Lightroom, Open "Machine Settings "from the "Edit" menu. In RDWorks, these can be found under the "User" Tab.

   That's why it's highly recommended that this value be lowered when using rotary. Please write down default values first so you can change them when you are not using the rotary. You can back up all the default settings by hitting the Read button and then **Save** Button and store this file on your computer. In fact, it's a great idea to save settings for both rotary and "flatwork" and just load each one as needed. Note: Some machines will come with these settings on a USB flash drive; however, they might be outdated.

   Change the following values:

   a. Set "**Idle Speed(mm/s)**" to 30
   b. Set "**Idle Acc(mm/s2)**" to 30
   c. Set "**Min Acc(mm/s2)**" to 20
   d. Set "**Max Acc(mm/s2)**" to 30.

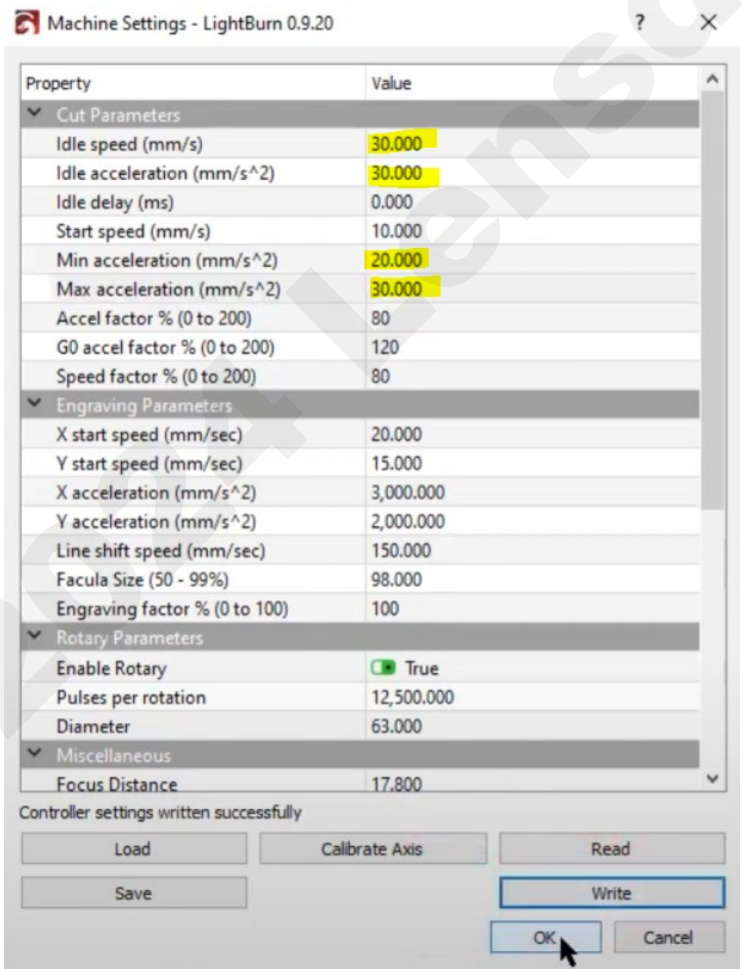
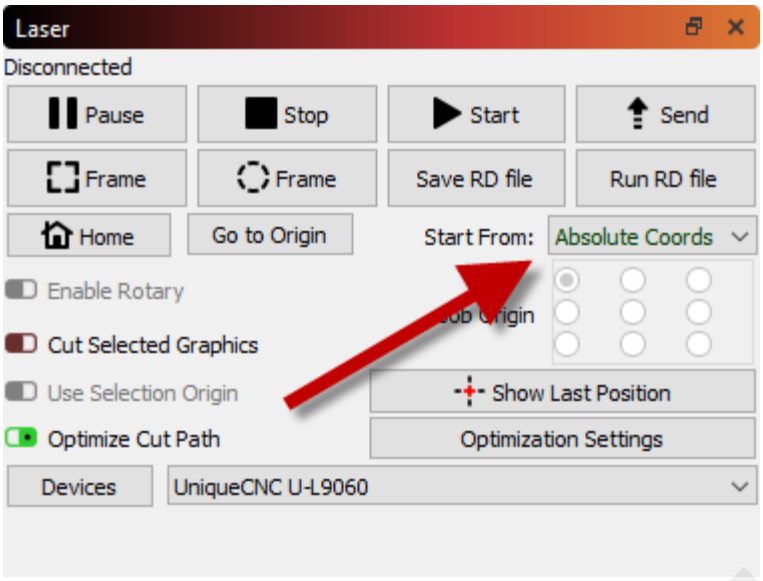


Figure 15. Speed Settings

These are just suggested values, and you might have to adjust them according to your machine.

7. Special Note about Thunder laser. Thunder Lasers uses custom firmware for its controller. For the PiBurn rotary to work with these machines, you must change Origin in Lightburn to anything OTHER THAN "**Absolute Coordinates**." This is very important! With Absolute Coordinates selected, the Y gantry will move instead of turning the rotary.



Boss HP machine setup

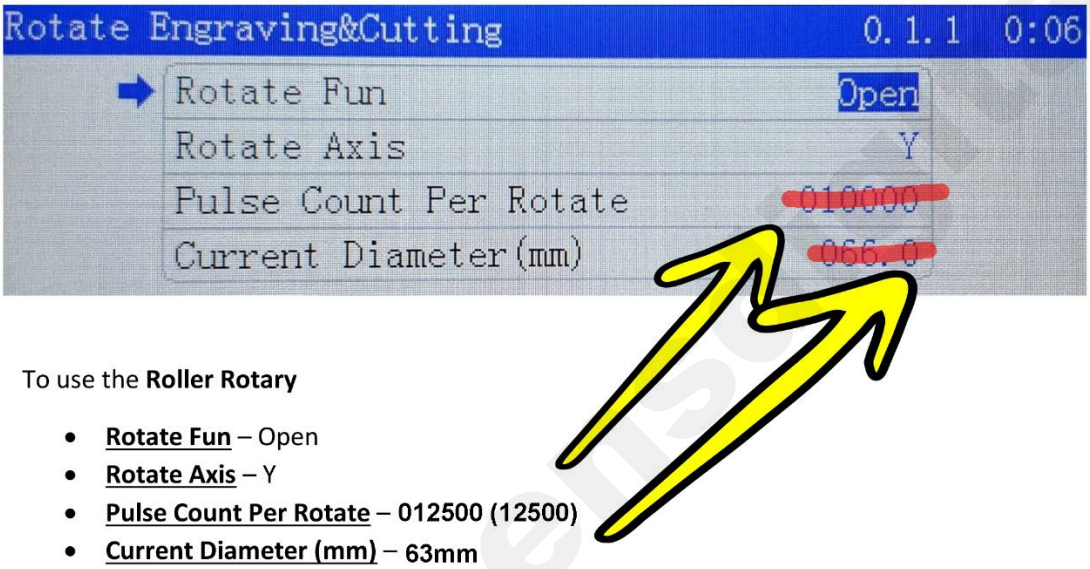
These lasers use a different controller. Lightburn is unable to change rotary settings on it, so it has to be done from the laser's control panel:

Setting up in LaserCAD (HP Machines)

On the AWC Control Panel, press the **Menu button**, then go to:

7. Common Parameter Settings > Press Enter > 4. Rotate Engraving&Cutting > Press Enter

The following picture shows that **four parameters** that need to be adjusted



To use the **Roller Rotary**

- **Rotate Fun** – Open
- **Rotate Axis** – Y
- **Pulse Count Per Rotate** – 012500 (12500)
- **Current Diameter (mm)** – 63mm

✎ **NOTE: You will need to RESET the machine (Turning off/on the machine or pressing the RESET button) after you've made changes!**

To go back to the worktable, change the **Rotate Fun to "Close,"** then press the **Enter button**. Then RESET the machine to save changes to the machine.

Chapter IV: Fine Tuning and Testing

Now, we can finally start some testing! If your laser has a built-in beam combiner (i.e., red pointer laser dot), you don't even need to fire the actual laser until you tune in to the correct setting!

Find a cylindrical object you want to test. We now carry a calibration tumbler in our Shop at lensdigital.com!

We have a video showing this process in detail: https://youtu.be/uY54OtFF6Lk?si=Oj_yNtIyWOcEAy39

An actual tumbler (preferably a simple shape without a bottle-like neck) would be a good choice. Cut a piece of masking tape and place it on the table. Using a ruler, draw a 100 mm long line (or if you prefer imperial units, make it 4 inches) with start/end marks as shown on the picture and then wrap it around your tumbler.

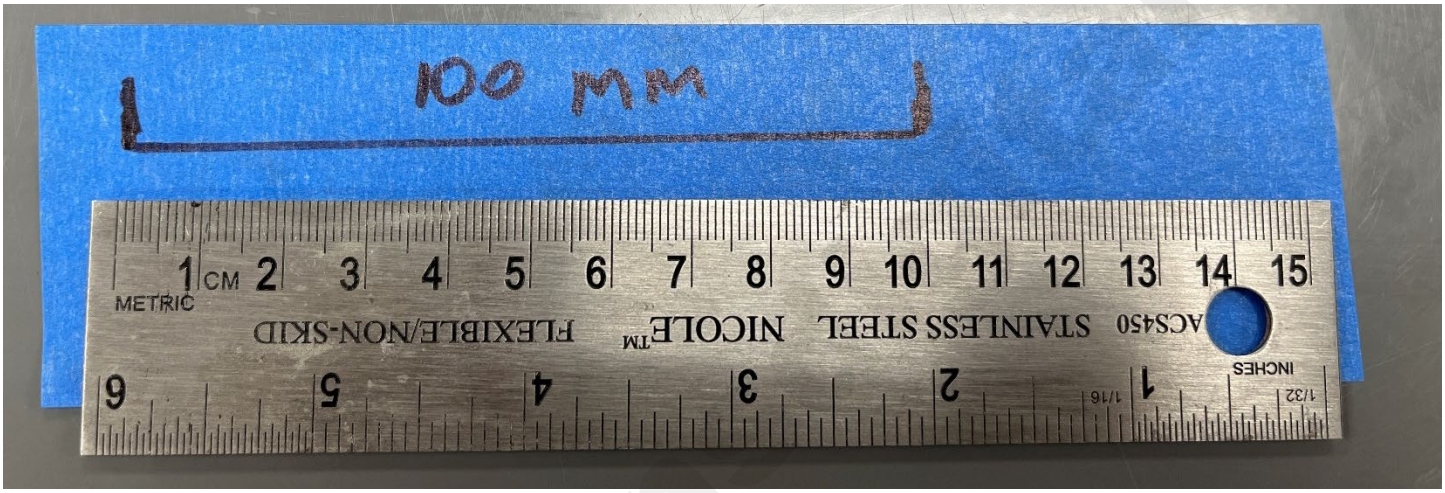


Figure 16. Mark distance on tape

Figure 17: Apply tape to the tumbler

Open **RDWorks** or LightBurn and create a square shape or just a vertical line.

Make sure that the little “padlock” icon is “unlocked”.

Change the square’s width to about 10 mm and length to 100 mm (exactly). Or if using imperial units, make it 4 inches long. It doesn’t matter as long as you use the **SAME** “vertical” length as the line you drew on the masking tape!

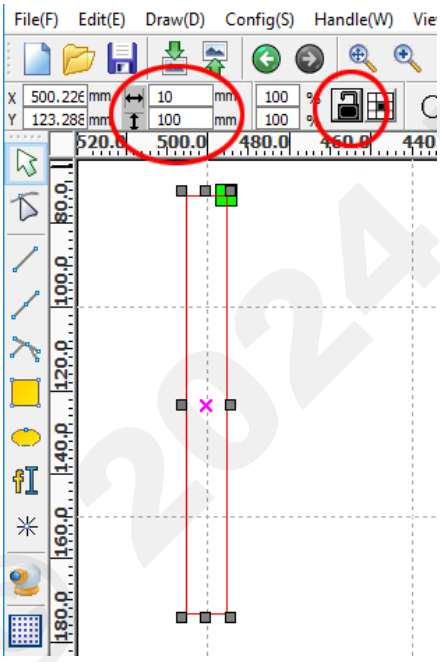


Figure 18. Shape in RDWorks

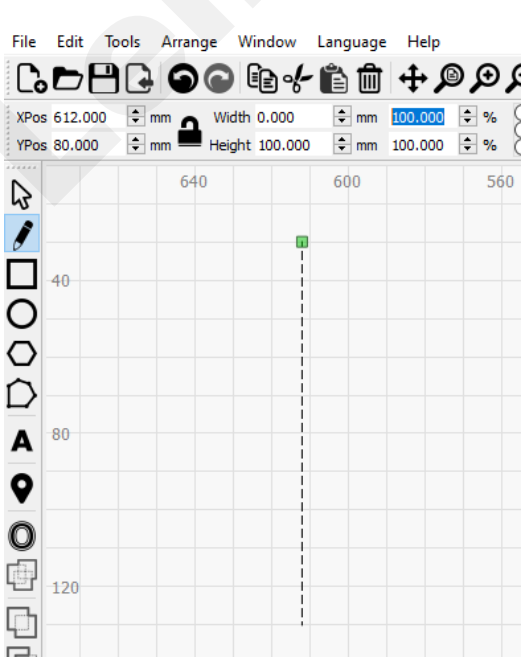


Figure 19. Create shape in Lightburn

In layer settings, change power to 1% (we don’t want the laser to fire), and speed to 20mm/sec. Upload this file to your laser machine; let’s name it “square”.

At the laser machine's control panel, change the default speed to 20mm/sec (press the "Speed" button).

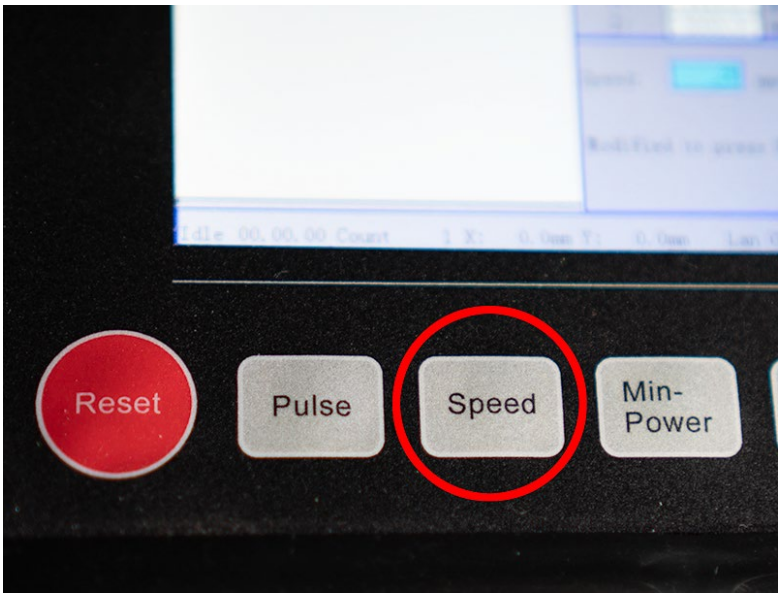


Figure 20. Speed Button

Insert your test object into PiBurn, adjust rollers for the correct length and height, and use the clamp.
See Chapter V: Basic Operation if you are unsure how to do this.

Move Y gantry until it's directly above PiBurn. Move the laser head in the X direction using the left/right arrows on the control panel to position it above the first mark.

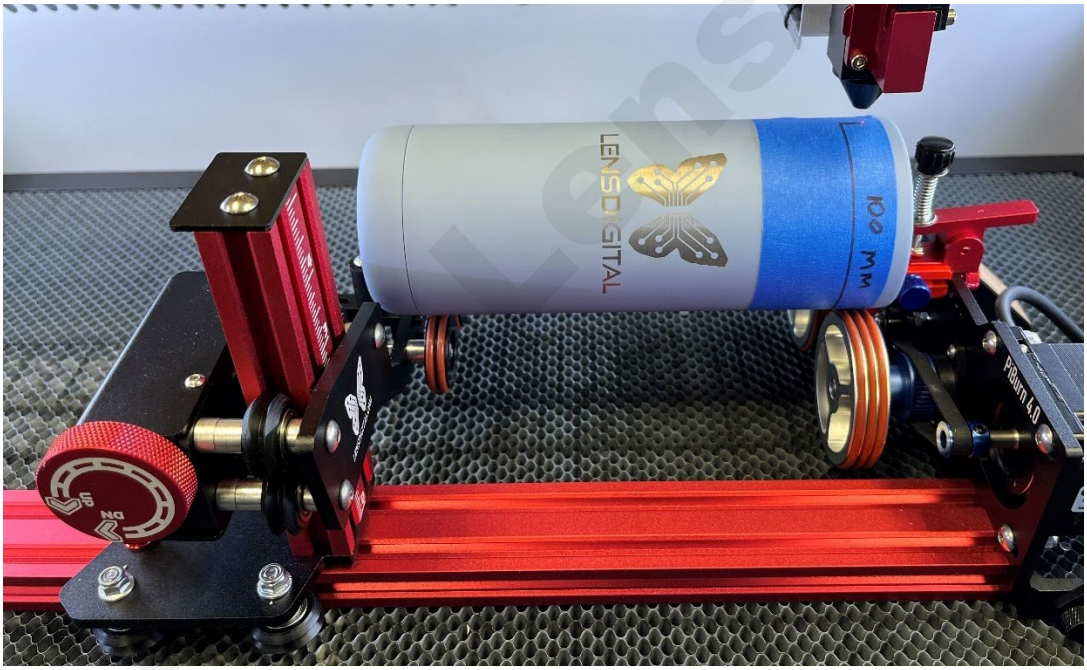


Figure 21: Position laser over start of the line.

You might need to rotate the object using the up/down arrows on the control panel. Hit the "Origin" button.

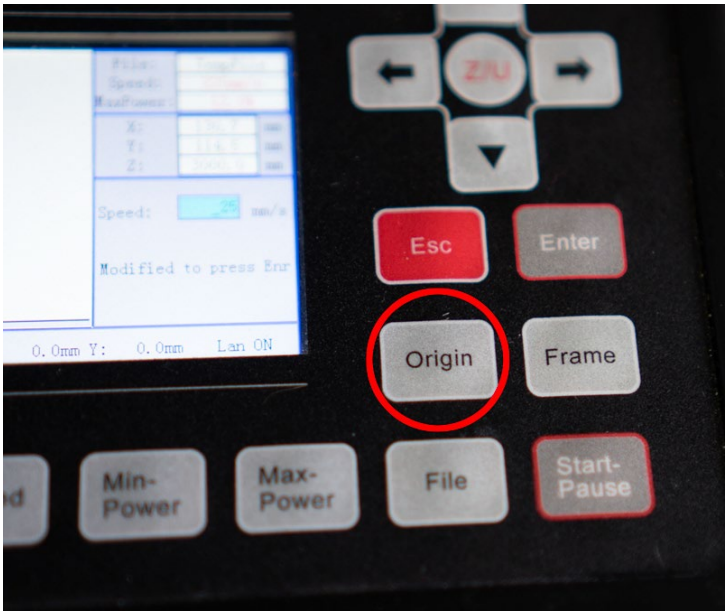


Figure 22. Origin Button

Move the laser bed up or down to approximate focal distance. It doesn't really matter as long as you can see a laser dot on the object clearly.

Load the "**square**" file and press the "**Frame**" button.

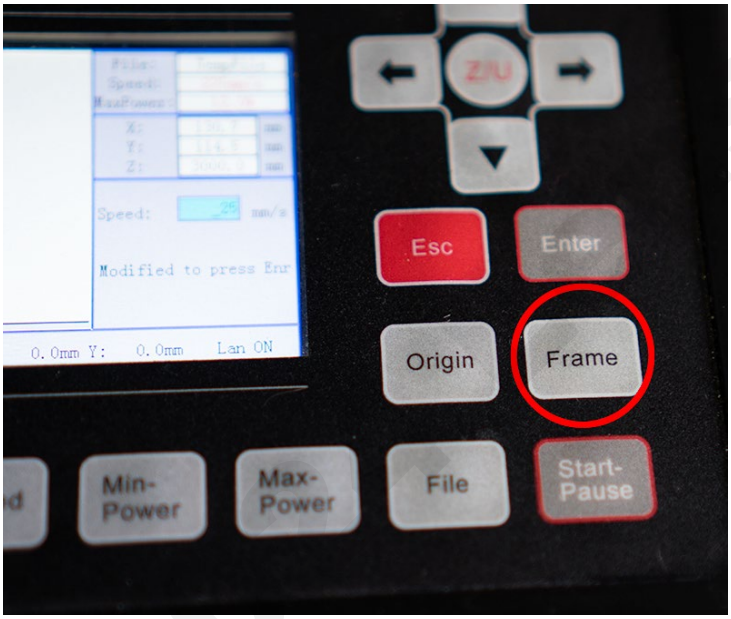


Figure 23. Frame Button

PiBurn will rotate the object in one direction and then back. Note up to which point it stopped before returning to its original position. You are all set if it goes right up to the second mark! Otherwise, follow these steps:

1. If the laser didn't reach the end mark, you will need to decrease the "**diameter (mm)**" number. Increase it depending on how short it stopped to the mark. Follow the guide in "Chapter III: Configuring Software" to adjust this value. Turning off or restart the machine between these changes is unnecessary.
2. If the laser went past the end mark, you'll need to increase the "**diameter (mm)**" number.
3. Finally, save the new setting and try "**Frame**" again.
4. Adjust again as needed until it stops right at the end mark.

*TIP: You can also adjust the "**Steps Per Rotation**" value instead of **diameter**, which might give you finer adjustment*

What if your machine doesn't have a red "pointer" laser (beam combiner)? In this case you will need actually to burn in the line on the object. Adjust the power of the line layer to the minimum at which your laser will fire. You only want to see where it ends up…

Note: If you get a "SLOP Y Over" error, you position too close to the laser's maximum or minimum coordinates on the Y axis. Laser can't move below 0 or above max coordinate. You'll need to rotate rotary wheels (using arrow keys on the control panel) until your Y reads somewhere between your max and min coordinates (for example, 150 mm might be a good number), then reposition the tumbler (with your hands) until the start of the line is under red laser dot and don't forget to press the Origin button too.

See a video about "Y SLOP Error": https://www.youtube.com/watch?v=spi-B7qGKMw

Chapter V: Basic Operations

Assuming you have already set up your machine to work with PiBurn and connected the rotary attachment, here are basic operation guides.

Note: Due to constant improvements to the design, your PiBurn might look slightly different from the one pictured below.

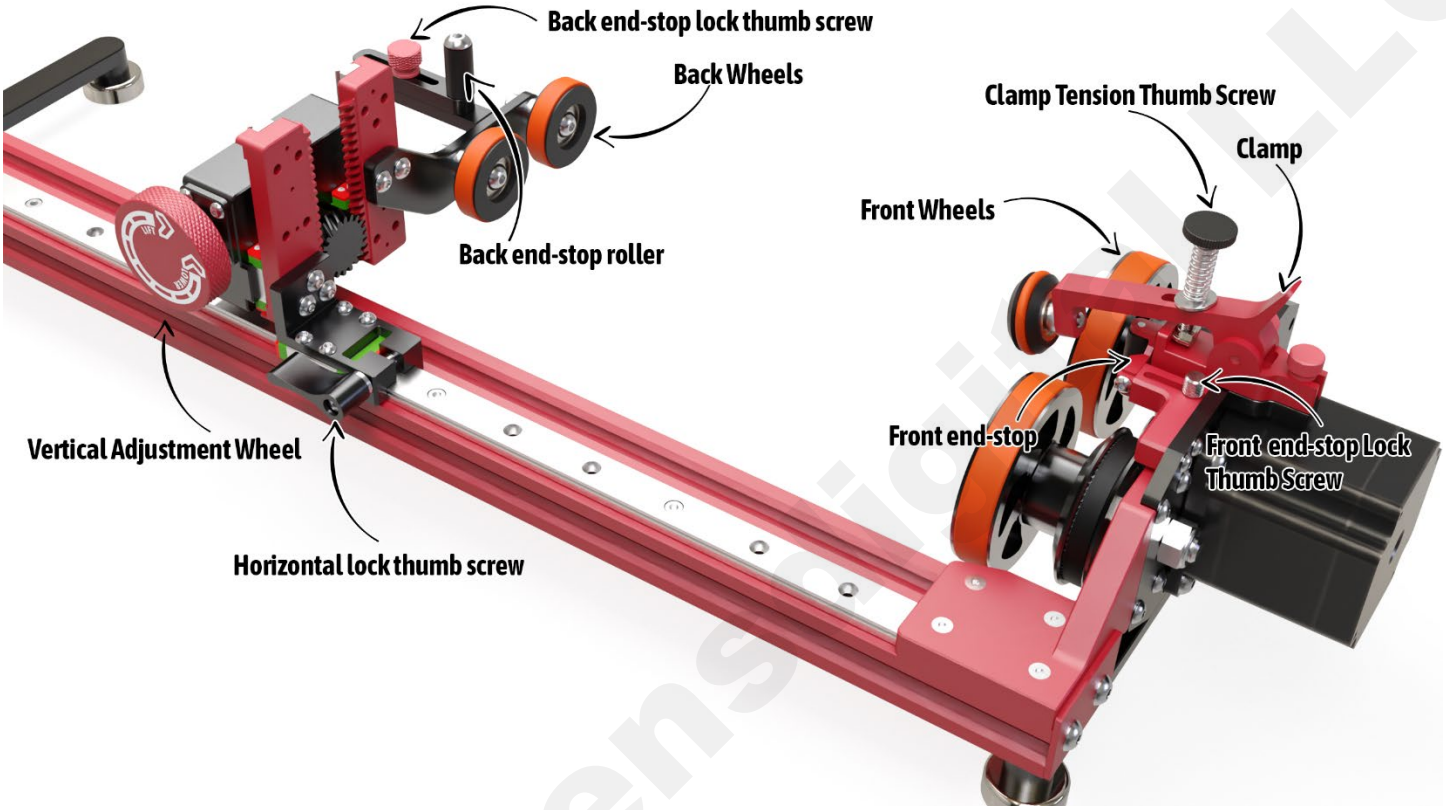


Figure 24. Rotary Overview

Loading/Unloading object

1. Remove the lid from the object to fit the clamp inside it. If it's impossible to use the clamp, remove the clamp arm and set it aside (*see Clamp Operation*)
2. Loosen up the horizontal lock thumb screw so the back wheels carriage can slide back and forth freely.
3. Loosen up the Back end-stop lock screw and move the back end-stop wheel out of the way.

4. Put the largest/heaviest part of the object on the front wheels (clamp it if possible) and hold the back side of it in the air slide carriage until it's positioned correctly. The front of the cup/glass should slightly touch the front-end stop.

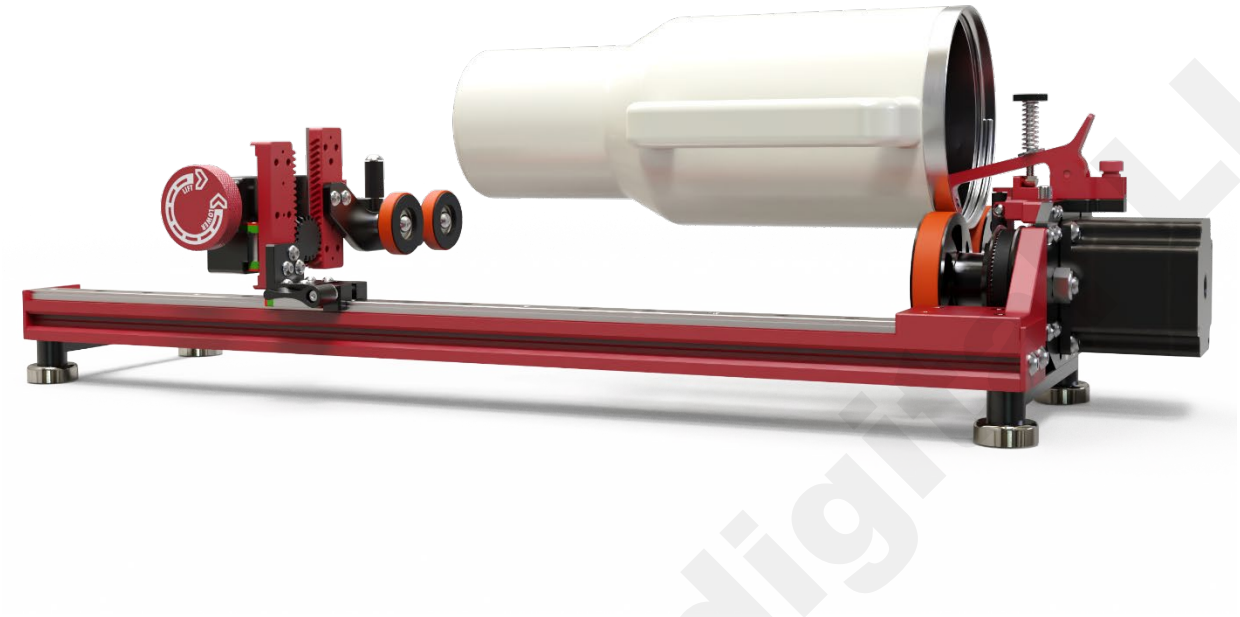


Figure 25. Tumbler Setup

5. Slide the Back Support Carriage until it's under the back of the tumbler and pace the back side of the tumbler on the back wheels

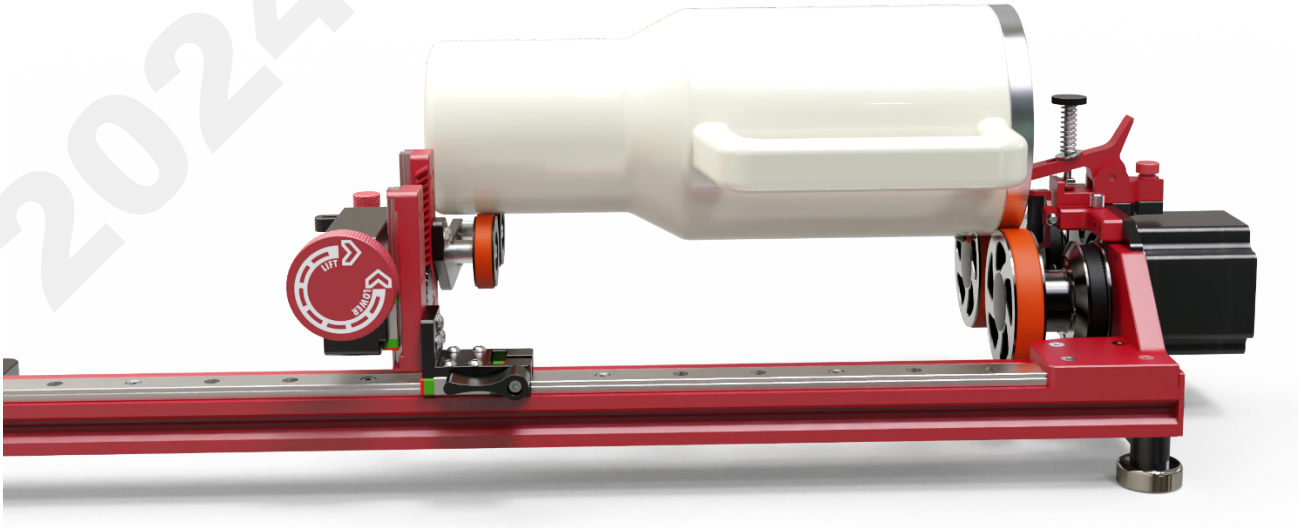


Figure 26. Back wheels

6. Start turning the lift mechanism's hand wheel until most of the object's surface is parallel to the rail. Use bubble level for this step. Place it on top of the tumbler.

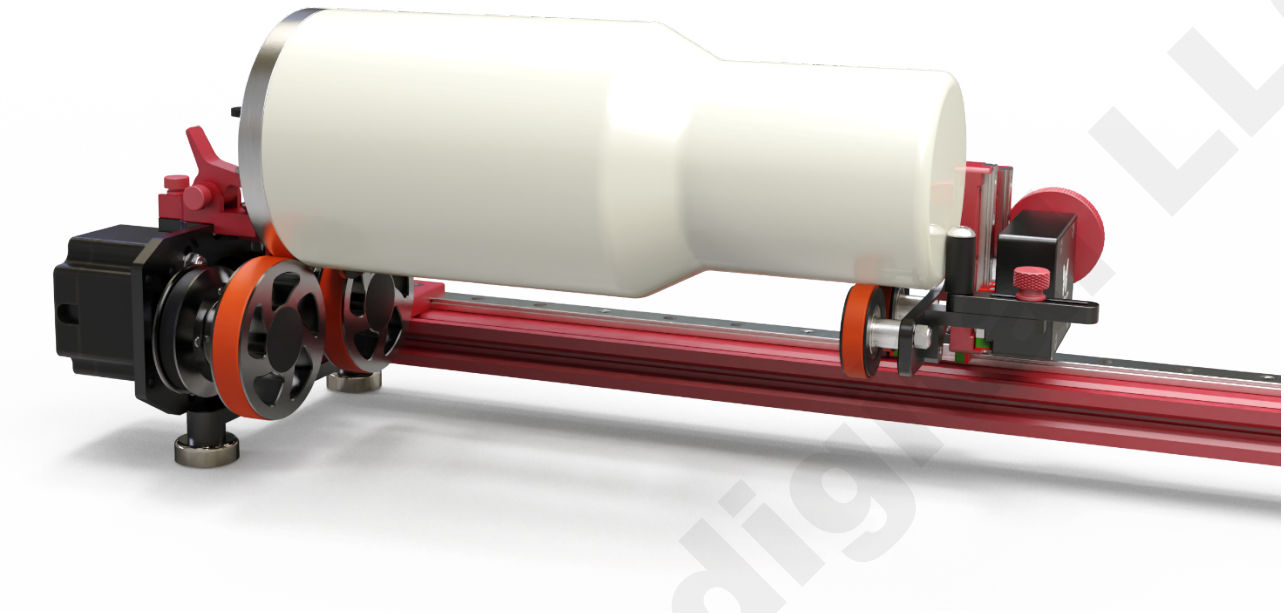


Figure 27. View from the back

7. Move the backstopper so it touches the bottom of the tumbler. Make it as straight as possible, and move the carriage away from the tumbler if needed. Secure the backstopper with a red thumbscrew.

Figure 28. Back stopper (wheel version)

8. Tighten the Horizontal Lock Thumbscrew so the carriage doesn't move.
9. Change the machine's "framing" speed to 10-25mm/s

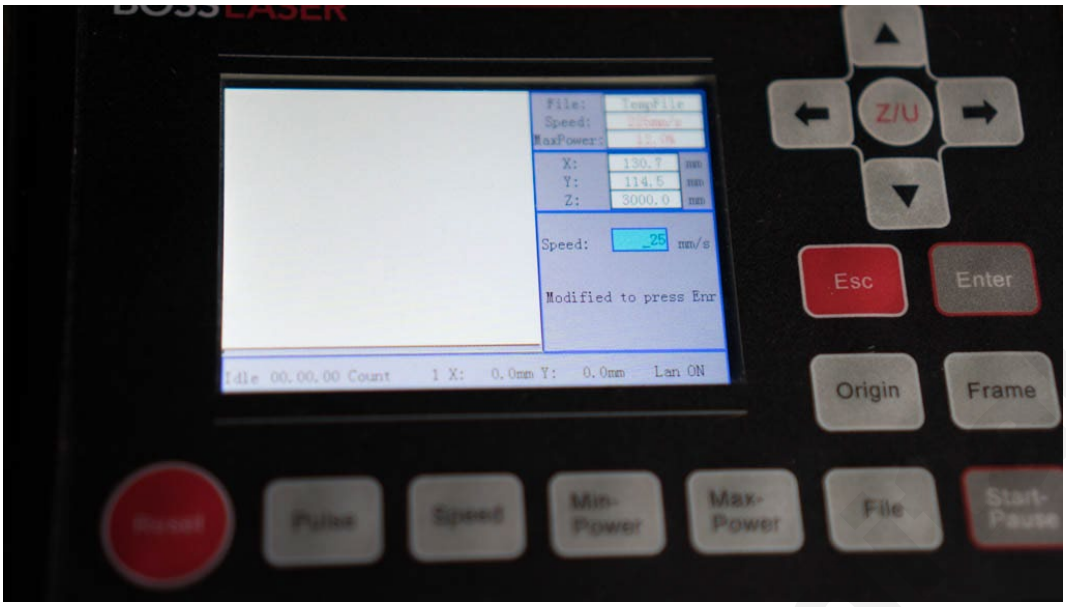


Figure 29. Speed

10. Using up/down arrows on the control panel, rotate the object slightly to ensure its sitting correctly.
11. Load the graphics file, frame, and start engraving.

Clamp Operation

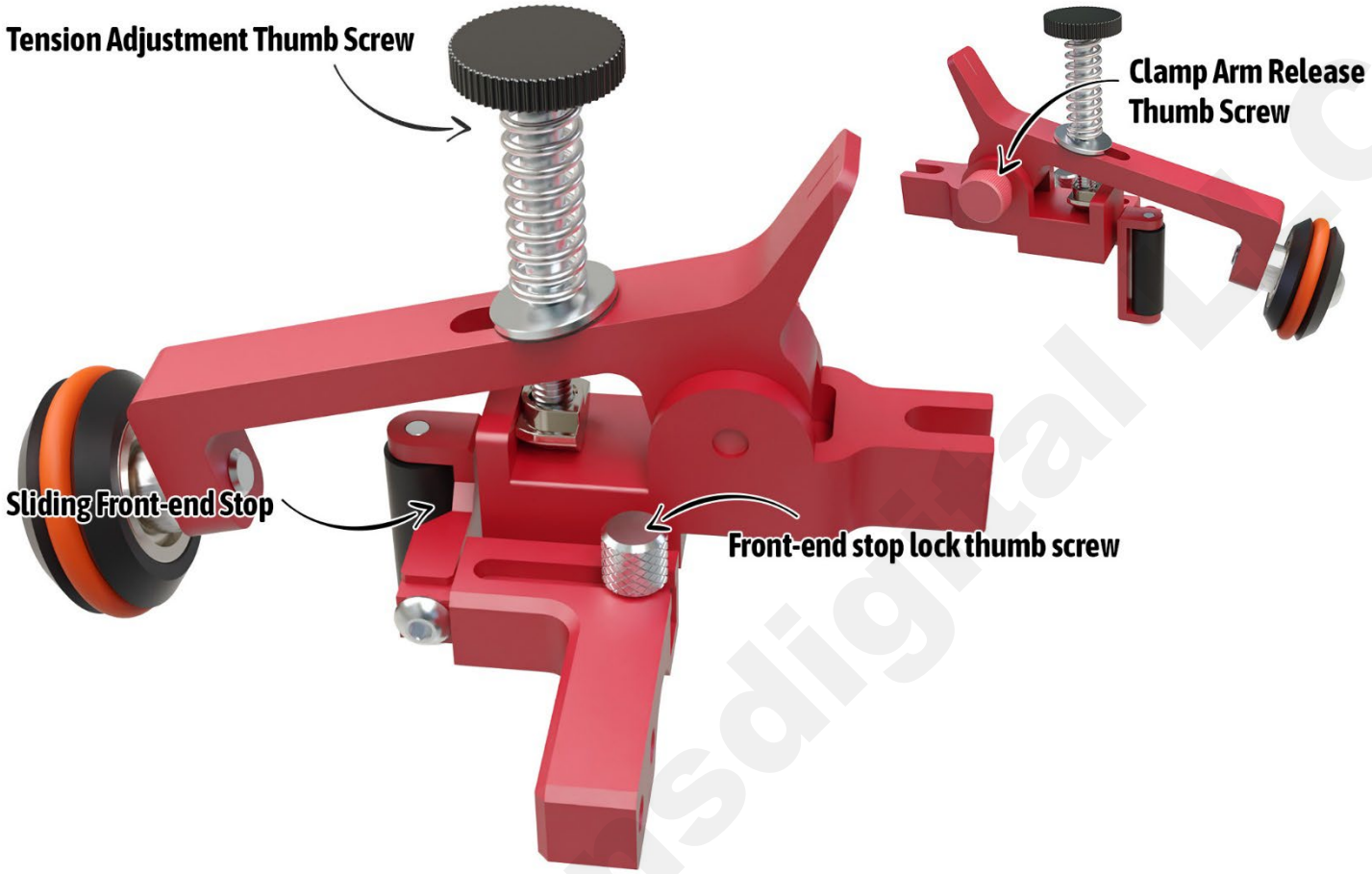


Figure 30. Clamp

The clamp spring provides sufficient pressure for most objects; however, when more clamping power is needed, please use Tensions Adjustment Thumb Screw (Locking Screw on old plastic clamp) to increase clamping force on the object.

The sliding roller front-end stop is attached separately to the headboard (it's not attached to the clamp). It works together with a back-end stop and serves two tasks. One is to prevent the object from "walking" or moving forward or back when rotating. The second task is spacing mugs with handles by keeping the mug at the correct distance so its handle doesn't hit the front wheels. In most cases, you'll want to keep your front end-stopper retracted all the way back, but when spacing mugs with handles, you need to extend it until it pushes the mug far away so its handle doesn't hit the front wheels. To extend or retract the front-end stop, loosen up its lock screw and move the end-stop to the desired location. When done, tighten the thumb screw to lock it in place.

The clamp will usually be placed inside an engravable object such as a tumbler or glass. However, in some cases, like when engraving bottles, you will want the widest part of the bottle to be on the front rollers, and the clamp won't open wide

enough to accommodate these. In this case, you need to remove the whole clamp using a single thumb screw.

Figure 31. Bottle placement

If you find that the front stopper interferes with a bottle, it can also be removed (two M3x8mm screws hold it). To remove the clamp arm, first unscrew the black tension thumb screw on top until it is no longer inside the clamp base (leave a small t-nut on the screw as it prevents the spring and other parts of the clamp from flying away). Now just unscrew the M4 thumb screw on the side that holds the arm to the base. The arm will easily come off.

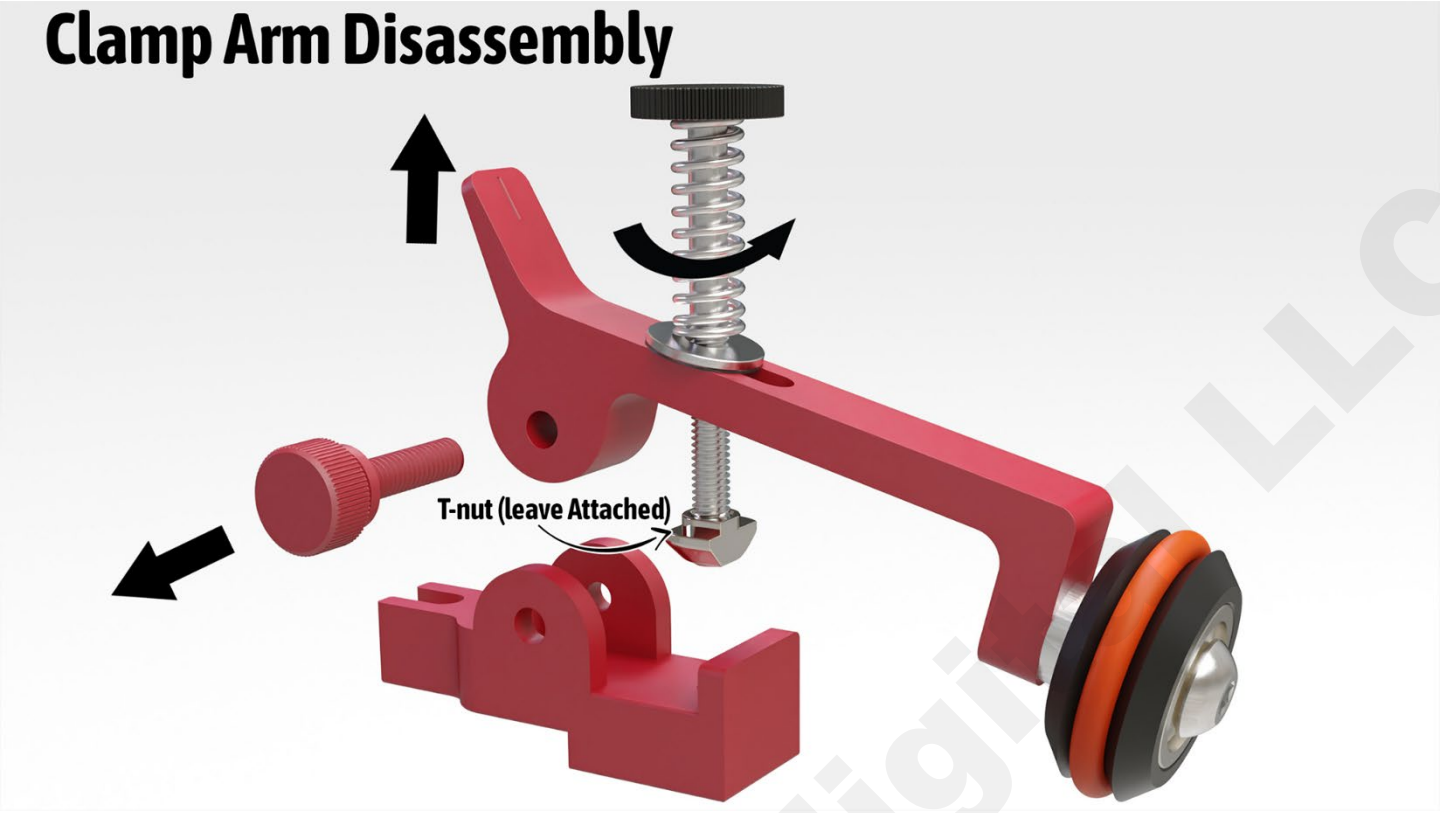


Figure 32. Clamp Disassembly

Re-assemble the clamp in reverse order. Be careful with T-nut, don't move it too high up the long thumb screw. You should have just a little bit of thumb screw exposed under the t-nut so it will thread into the clamp base. T-nut will remain in the same spot when you screwing-in black long thumb screw.

Front Stopper Removal

If Front Stopper is in a way and you want to remove it, you can either remove its arm with the roller, which is easier and doesn't require any tools, or you can remove the whole stopper by unscrewing two M3 screws using a 2mm hex wrench/key

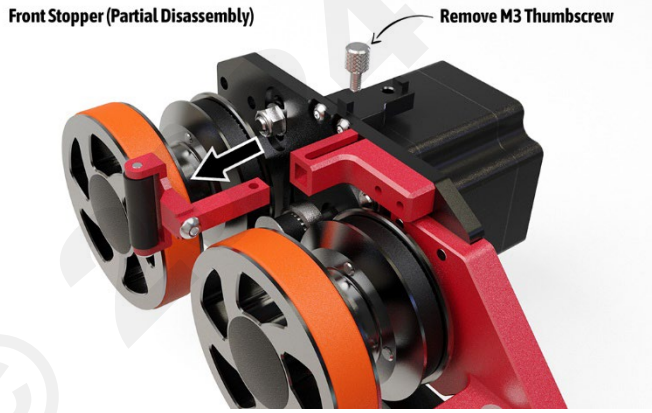


Figure 33. Partial Front Stopper Removal

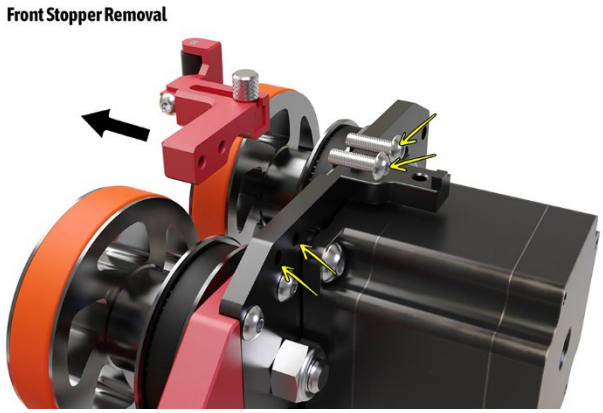


Figure 34. Front Stopper Removal

Focusing and Beam Alignment

You'll always want to align your Y axis to be in the middle of the PiBurn. The easiest way to do this is to position Y gantry by hand above PiBurn and move the laser head from the control panel left or right until it's above the middle line of the clamp (your clamp will have a triangular alignment mark).

Figure 35. Alignment Points

Then move the laser head until it's directly over the middle of the red thumb screw holding back the stopper

Move/Rotate one of the rotary until your laser's gantry path is parallel to the rotary's rail. In other words, your PiBurn is aligned when your red laser dot hits both alignment points of the rotary (mark on the clamp and center of the thumb screw on the backstopper).

Focusing

If your laser has auto-focus, you can use it as normal; just try focusing over the **front** area of the object closest to the motor. Make sure you are ready to hit the emergency stop button, too.
Some users reported malfunctioning autofocus bending stainless steel tumblers, which could break PiBurn. We never had this happen in our tests, but it is better if you are aware.

Chapter VI: Usage Guides and Suggestions

Always remember the #1 Rule: BE SAFE!

Do not operate your laser machine with the cover opened, but if you must always wear protective goggles and never place your hand in the path of the laser beam. Infrared Laser is invisible, and it hurts a lot when it touches you.

Rule #2 is: Rotate SLOW!

Laser engraver/cutter machines are meant to move fast when not firing to save operator time. This includes movements to the cutting position, framing, or moving back to the start position at the end of engraving.

The rotary attachment is not designed to move this quickly! If it spins rapidly, any object on it will fly off and break (i.e. glass) in the worst case or shift and slip in the best.

So, before you start, set your machine's default movement speed to about **30 mm/s** or lower. This can be done via the control panel's "**Speed**" button. This setting doesn't affect lasering operations, only manual movements and the "**Framing**" function (when you hit the "**Frame**" button).
Lower your idle speed and acceleration as well. This function is performed via machine Settings in Lightburn and is described in detail in Chapter III.

Y coordinates position

The Rotary replaces the Y axis of the laser machine, and it doesn't have a limit as it rotates forever. Unfortunately, the machine doesn't know that. It will not let you rotate past a specific point because it will think you hit the physical limit of your machine's bed. This can cause the machine to refuse to engrave and give a "Slope" Error.

Let's say that your machine's maximum cutting area in the Y direction is 400 mm. You have an engraving that's 100 mm wide. While positioning and rotating your tumbler, you get to the Y=350 mm mark (this can be seen on the control panel's LCD screen). When you try engraving from this point, you will get a "Slope" error because the machine can't engrave at a position above 400 mm (350+100=450).

That's easy to fix.

1. Hold the UP arrow key on the control panel until the machine shows Y close to 0 mm.
2. Disengage the clamp and rotate your tumbler by hand until it's at roughly the starting position that you want
3. You can fine-tune its position now using the UP/Down arrow keys as long as you don't go too far (i.e., above the 300 mm limit as in our example).
4. Hit the "Origin" Button to save this as the start position.

Slipping/Jumping Off

Some very light objects might not have enough weight to stay on rollers despite the front clamp. If you see an object slipping from back rollers, add some weight. Place a small bag of rice or sand inside the object to add weight.

Sizing and Aligning Your Artwork

Aligning

The cool thing about the PiBurn rotary is that its stepper motor is installed on the outside of the headboard. This means you don't have to invert your image or rotate PiBurn in an "unnatural" position.

Your artwork will be engraved just like you see it on the screen. In most cases, you'll just want to rotate it by -90 degrees because your bottle or tumbler is laying on its side inside the rotary. Of course, if you want it to be engraved sideways, you don't need to rotate artwork.

Here's an example:

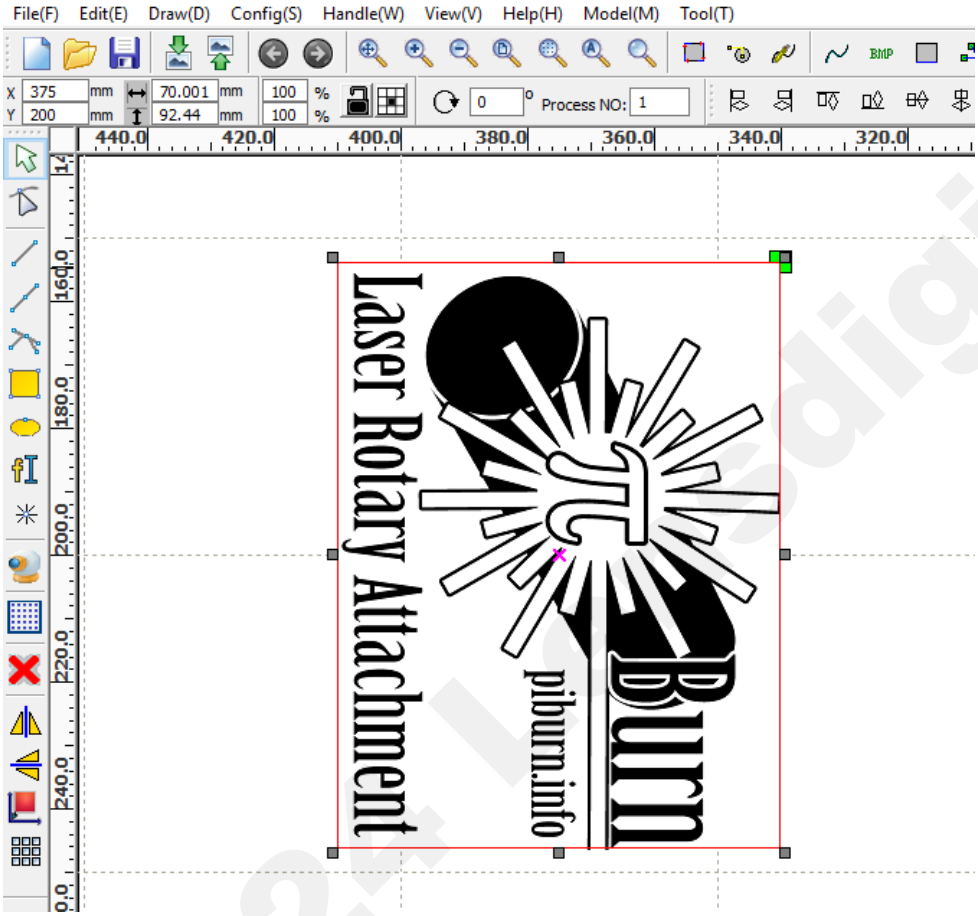


Figure 36. Image Alignment

And Resulting Engraving:

Figure 37. Result of Engraving

Sizing Artwork

Measure the object you are trying to engrave. You'll need to know the length of the area you want to engrave (X direction) and the width (Y direction). Length is easy, but to find out the width you'll need to calculate the circumference of the service. The easiest way is to measure the object's diameter and multiply it by the number Pi (3.14). Do you see why we named our rotary PiBurn? 😊

For example, you have a tumbler that has a diameter of 6 inches (152 mm) at its widest point. And its length is 10 inches (254 mm). The maximum size of the artwork you'll be able to engrave is 152x254mm. But do leave some room for margins.

Uneven Surfaces

For best-quality engraving, the distance from the laser's head to the object must be the same throughout the whole area. This is because the laser beam is the smallest and has the highest power at the lens' focal distance.
Unfortunately, that's not always possible with curved glasses, cups, etc. Try averaging focal distance by focusing on the area between the highest and lower points. Engraving should still come out great!
If the height difference is too much, design your artwork to be engraved in sections if possible, or simply size it so it doesn't cover too large of the area lengthwise.

Bottle Objects or Help, my image is getting stretched!

The most common issue we are seeing people reporting is their engraving is being stretched on the bottle-like objects (i.e. large diameter body and smaller diameter neck). This happens because the smaller diameter part of the object rotates less compared to the rest of the object. So, if the neck of the bottle turned ½ of the way, the rest of the bottle might have turned ¾ of the way at the same time. When you set your steps per rotation and roller diameter, these settings ONLY affect the part that's directly on the big drive wheels! So, if you want to engrave the neck of the bottle, it will come out correctly. However, now you have to take into account the difference in the diameters. There are three choices you can take to address this problem:

1. Remove the clamp arm and simply flip the bottle around! There is no need to mess with settings, and usually, uniform objects like that engrave fine without the clamp.
2. Temporarily adjust steps per rotation or roller diameter settings. You will have to find the correct settings experimentally (we recommend doing a 100mm test as described in this manual). Just don't forget to change settings back when you want to engrave normally shaped object.
3. Finally, you can just resize your artwork, "squishing" its height until it comes out ok in the engraving.

It's important to keep in mind that some bottle tumblers have threads on the neck. These will force the bottle to move back or forward on the rotary, pushing it against the front or back stopper so hard that it will prevent it from rotating correctly and skipping. For this, you can laser cut an adapter that will go on your threaded neck and make it smooth. As a bonus, if you make an adapter the same diameter as the main body of the bottle, then you won't have to worry about diameter differences!

Switching to regular laser operations

After you are done with the PiBurn rotary, don't forget to disable the rotary function, or you will not be able to engrave/cut materials! In LightBurn, you can go to Rotary setup and switch off to enable Rotary. But you'll also want to change the acceleration values. The best way to do this is to have two configuration files saved somewhere—one for Rotary and one for Flat work. Just load the one you want via machine settings and write it to the controller memory.

Chapter VII: Maintenance and Alignment

This maintenance is needed to keep PiBurn in top shape.

Silicone Tires

If you are using metal marking sprays like Laserbond 100 or Cermark, some of the compound will be transferred to the tires. You can wipe off Tires with a paper towel and alcohol to make sure they are providing good traction to the engraving objects.

Linear Guide Rail

Please clean your linear guide rail and lubricate it often to prevent rust and ensure smooth motion. You can use a variety of lubricants, and it's a good idea to stick with the same kind (i.e., don't mix and match). You can use machine oil or white lithium grease.

Appendix A: Note on Thunder Laser Motor (Servo) Switches

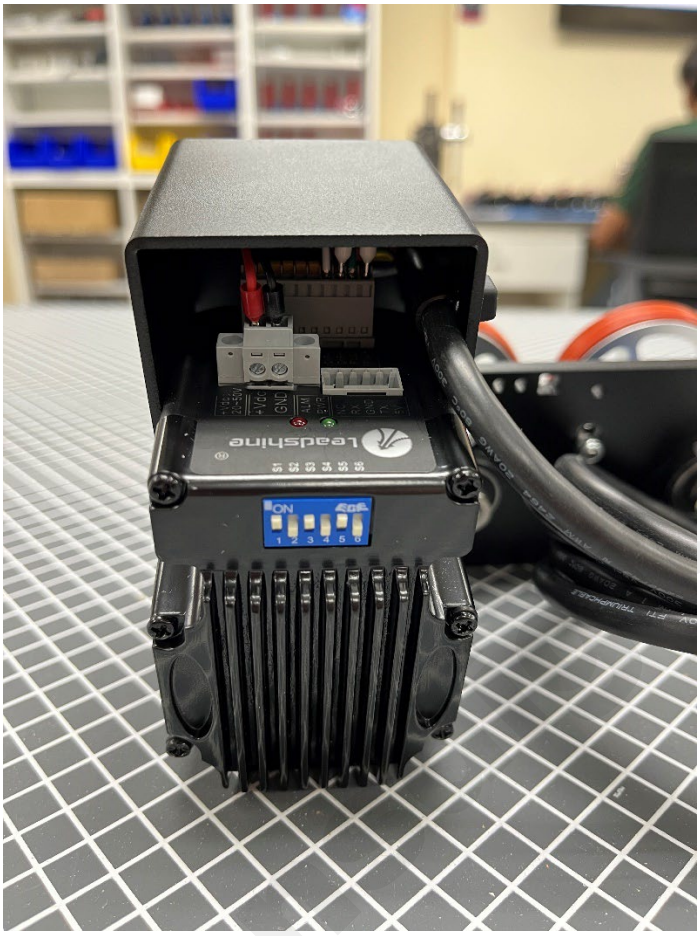


Figure 38. Servo Motor Switches

PiBurn for Thunder Lasers uses a special “closed-loop hybrid stepper motor.” We will refer to it as a servo motor (even though it’s not a true servo) in the manual. These motors have 6 DIP switches on the back. We shipped these with Switch #1,#3, and #5 in the Up (ON) position. Switches 1-4 control default steps per rotation; please don’t change them, or you will have to figure out new settings for your laser controller.

However, Switch #5 controls motor rotation direction. It’s up to the end user how he wants to place the rotary inside the laser. Most place it with the motor facing the left side of the laser, and for this placement, we recommend Switch 5 to be ON. However, if you decide to rotate your rotary 180 degrees, you’ll want to flip this switch to on, or your engraving might come out “mirrored.”

So simply said, if your engraving is mirrored, just flip switch Number 5 (i.e., UP if it’s down, or Down if it was UP).

Never turn on switch #6, as it will place the motor into test mode, and it will just spin on its own until the switch is turned off.

Repair and Warranty

Due to its modular design, PiBurn is very easy to repair if any of its parts break. There are no rivets or hidden latches; almost everything can be taken apart in a few minutes with an Allen hex key and pliers. If you need a part replaced, please contact us via **the Contact Us** page on our website.

PiBurn is covered by a 1-year limited warranty. If anything breaks during regular use, we'll fix or replace it.