Laser Cutter Guide

This guide is limited to the basics of the library's **Epilog Mini 12"x18" laser engraver.** After you are trained, we encourage you to read the full laser manual starting with section 7 and then seek out tutorials and projects that interest you to further develop your skills. Email us at makerspace@estesvalleylibrary.org if you need advice on whether a project is possible on our laser cutter.

Laser Basics

People refer to these machines as either "laser cutters" or "laser engravers", but they can do both! These two modes are called **raster engrave** and **vector cut**

raster engrave - engrave photographs, shapes, and text into the top layer of a material

Speed and power settings determine the depth and color of the engraving. Some materials darken when engraved (sometimes dramatically) and some do not. Image resolution also affects color and depth- an image engraved at 600 DPI has twice as many dots as one engraved at 300, and will look sharper, build up more heat and remove more material.

vector cut - cut a thin line all the way through a material

Generally, our laser can cut materials up to ¼" thick. Speed and power settings determine the depth of the cut, while frequency affects how much heat builds up on the material. Low frequency is desirable for materials like wood and paper that can char, while high is best for materials like acrylic where melting creates a clean edge.

Combined Mode

In combined mode the laser will raster engrave first and vector cut second.

Bad Laser Materials

Adapted from ATXhs.org | *Always* positively identify your materials before cutting

PVC (polyvinyl chloride), including vinyl and pleather/artificial leather	Emits noxious chlorine gas when cut!	**Don't *ever* cut materials containing chloride** as they release chlorine gas that will corrode the inside of the laser, damaging the optics and motion control system. It's bad for people too! If you aren't sure your material doesn't contain chlorides, don't cut it!
Polycarbonate/Lexan	Cuts poorly, discolors, damages laser optics	Although it might *look* just like acrylic, polycarbonate absorbs the laser's light frequency, causing discoloration and poor cutting performance. The inefficient cutting process creates stringy soot that can coat and damage the laser optics.
ABS	Cuts poorly, melts, catches fire, emits fumes	ABS cuts and engraves poorly on a CO2 laser. It tends to melt rather than vaporizing, creating ugly cut edges and risking fire. It also emits noxious fumes.
Polystyrene Foam	Catches fire	Catches fire quickly and burns rapidly. Polystyrene foam is the #1 cause of laser fires!
Polypropylene Foam	Catches fire	Like polystyrene, it melts, catches fire, and the melted drops continue to burn and turn into rock-hard drips and pebbles.
Epoxy	Emits noxious fumes	CO2 lasers can't cut through it, and attempting to cut it releases toxic fumes. Items coated in epoxy or cast epoxy resins should not be used in the laser cutter.
Fiberglass	Can't be cut, emits noxious fumes	It's a mix of two materials that can't be cut. The laser can't cut the glass fibers, and the epoxy resin can't be cut AND releases fumes
Coated Carbon Fiber	Emits noxious fumes	Thin carbon fiber mat can be cut, but not when coated with epoxy
Material with "PSA" glue backing	Damages laser optics	Otherwise suitable materials like wood veneer create sticky soot that can damage the laser optics if they have a "PSA" glue backing. Please do not cut sheets of material that have a PSA backing.
Polyethylene (HDPE & LDPE)	Cuts poorly, melts	Plastics commonly found in packaging materials (milk bottles, butter tubs, etc). It melts and becomes gooey and waxy, with messy edges

Good & OK Laser Materials

- *Always* positively identify your materials before cutting
- Bring extra materials and plan to test your settings before working on your project
- Check the laser binder for recommended settings
- Our laser cannot cut metal, no matter how thin! See the next page for ways to engrave on metal

Cut & Engrave

Acrylic/Plexiglass	Cuts beautifully! One of the best materials for laser cutting. We buy our acrylic from estreetplastics.com. *Cast* acrylic engraves better than *extruded* acrylic, so look for "cast" in the product description if you're buying for an engraving project.
Specialty laser plastics & sheet materials	Check the "Laser" section of online engraving suppliers like jpplus.com for plastics and other sheet materials specially selected for laser use, including two-layer plastics for high-contrast engraving
Wood	**Baltic birch plywood, alder, and cherry** give especially nice results and white pine, oak, and balsa are also recommended. Woods with a tighter grain make for clearer engravings, but wood with a bold grain can give an interesting artistic result. Plywood is more difficult to cut than solid wood and our low-power tube will struggle with plywood sheets thicker than about ⅝". Test on different woods before pursuing a large project to make sure you like the results. Wood specially selected for laser cutting can be purchased from engraving suppliers like jpplus.com.
Eucaboard brand hardboard	**Eucaboard by Eucatex** is a common brand of high-density fiberboard that cuts and engraves beautifully in the laser and contains no glues (it's made entirely of eucalyptus fiber), so no worries about releasing fumes. Check the back of HDF sheets at Home Depot, Lowes etc for this brand to guarantee an excellent laser experience.
Paper & Cardboard	Cardboard is a great material for the beginner laser cutter enthusiast since it's cheap or free! It cuts better than it engraves. The laser cuts even delicate paper beautifully at low power levels- use the solid vacuum table and magnets or tape to hold the paper down.
Fabric	The laser can cut both synthetic and natural fabrics on low power levels. Use the solid vacuum table with magnets or tape to hold it down.
Taskboard	Taskboard is a dense, solid paper product about halfway between cardstock and balsa wood. It engraves and cuts beautifully. Highly recommended for craft projects. Commonly used for architectural models. Available from taskboard.com

Leather	Leather engraves and cuts nicely, but it doesn't smell very good.
Cork	Cork cuts easily and is also very rewarding to engrave, creating a clear and crisp black mark even on low power settings. Avoid cork with a PSA (pressure sensitive adhesive) backing which can create sticky smoke that is hard on the laser optics.

Engraving Only

Painted & coated metal	**The laser cannot cut or mark metal (not even foil!),** but it CAN mark or remove surface coatings from painted or coated metal. Painted steel water bottles and other drinkware give nice results, especially on the rotary, as does anodized aluminum. Several passes may be required to remove the coating completely- bring a spare item to test on! Metal sheets pretreated with a "Ceramark" coating work great for engraving- check engraving suppliers like jpplus.com for Alumamark/Ceramark or "laserable metal".
Promotional items	Promotional items like keychains, coasters, wallets, jewelry boxes, etc are sometimes engraveable. Browse an engraving supplier like jpplus.com and follow their recommendations for best results. **Never engrave unknown materials, especially plastics!** You *must* be able to positively identify the specific material before engraving it (for example, alder, acrylic, anodized aluminum, painted steel- not just "wood" or "plastic"!)
Glass	Glass can be engraved with good results. Colored glass tiles are a great place to start. Rounded objects (bottles, wine glasses, Christmas ornaments) can be engraved either by propping them on the flat table, or on the optional rotary attachment. The rotary is best for intermediate to advanced laser users who are ready for a challenge.
Ceramic Tile	Works great, especially darker tiles with a lighter center. The laser will remove the top layer and expose the interior ceramic color.
Stone	Stone can be marked with high power settings and several passes. Slate gives especially good results and smooth river stones can be interesting, if unpredictable.

Have a project idea? Wondering if your material can be cut or engraved?

Please email makerspace@estesvalleylibrary and we will help you evaluate your material

⚠️ Laser Safety, part 1

- **Never leave the laser unattended.**
  Do not leave the room during a cutting job, no matter how long. Remain within arm's reach of the laser and fire extinguisher during any job, and monitor the laser beam during vector cutting, which is much more likely to start a fire.
- **Use proper ventilation**
  The laser has two ventilation systems- a large exhaust fan to the outside, and a small air assist pump that blows debris away from the cut area with a strong stream of air. The laser also has its own fan that works with the exhaust.
  - **The exhaust is on during all jobs.** The Laser/Exhaust switch powers both the laser and the exhaust fan.
  - **Use the Air Assist when vector cutting.**
    The air assist pump blows a directed stream of air that keeps the cut area cool and free of flammable debris and makes your cut cleaner. Air assist is not necessary for raster engraving-only jobs, but it doesn't hurt, either.
  - **When using the laser, close all windows in the Makerspace and close the doors**
    - Don't "air out the room" by opening windows when cutting- prevailing winds will blow the exhaust back inside.
    - Closing the Makerspace doors will help the exhaust fans work efficiently by pressurizing the room and will keep Computer Commons users from being disturbed
    - If your material has a strong smell, take occasional breaks while leaving Laser/Exhaust **on** so the fans can work to clear the room
- **Know your material. Never cut unknown materials.**
  Materials containing chlorides (like PVC plastic sheets and vinyl/faux leather) ***release poison gases*** that can permanently damage the laser and even injure people. Several other materials are poor choices for laser cutting. Review the Bad and Good lists of laser materials when planning your project.
- **Use care when moving items from the laser**.
  Laser cut objects usually cool quickly, but there is always a chance of heat or flame on cut edges.
- **Eye safety**
  The high-power cutting laser beam is contained in the cabinet and cannot hurt you. Although it is very tempting to watch the beam during cutting, it can cause non-permanent afterimages much like a camera flash, so stare sparingly.
- **Laser safety interlock**
  Raising the lid during a job will turn off the laser beam, **but the X/Y motors will continue running.** Plan to pause jobs before raising the lid.

🔥 Laser Safety, part 2: In Case of Fire

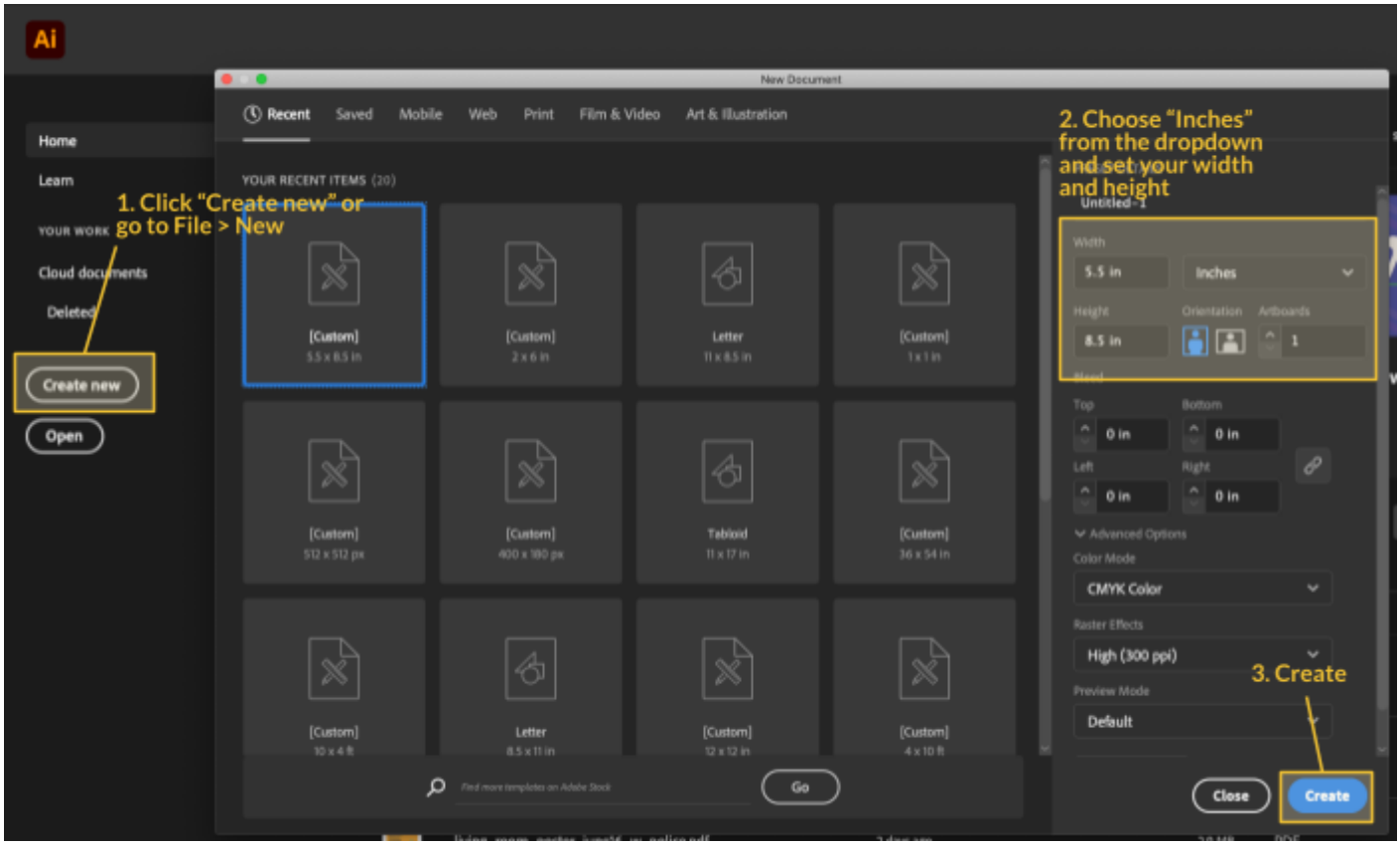
- Lasers can and will start fires! Vector cutting is much more likely than raster engraving to start a fire. **Always monitor vector cuts,** and stay within arm's reach of the laser control panel and the fire extinguisher even during raster engraving. See the list of Bad materials and avoid materials that are more prone to burning.
    - **Sparks or brief flame:** Monitor the job carefully and note if the flame goes out when the laser moves away from the area. Brief flames may mean a poor quality cutting job. If your job seems to be creating frequent flame, try restarting the job at a lower power level or higher speed.
    - **Small sustained flame (think birthday candle):** Pause the job, open the lid and either blow out the flame or douse it with a damp cloth. Stop the job with Reset and restart with a lower power level/higher speed.
    - **Large flames contained within laser enclosure:** Pause the job or turn off the laser, then follow instructions on the Makerspace fire extinguisher. The fire extinguisher in the makerspace is a special formula that will not damage the laser
    - **Flames outside laser enclosure:** Notify staff immediately. More fire extinguishers and fire alarm pull boxes are located in the hallway next to the elevator and by the 2nd floor emergency exit (southwest corner of the second floor, opposite and to the right of the makerspace doors)

Setting up your artwork in Illustrator

Creating laser artwork in Illustrator is a big topic! Below are the steps for a basic job.

Creating a new document

- Open Adobe Illustrator Ai
- Use the **Create New** button or go to **File > New**
    - If you are using a sheet of material (like a piece of cardboard or acrylic), you will want to make a document **the same size as your *entire material piece*** and place your designs exactly where you want them to appear on the material sheet.
    - If you are using a small or irregularly sized item like a coaster, you can instead make a document **the same size as your *design***. In a later step, you will manually position the design on your item
- In this **New Document** window, set the units to Inches and the height and width to your material or design and click **Create**



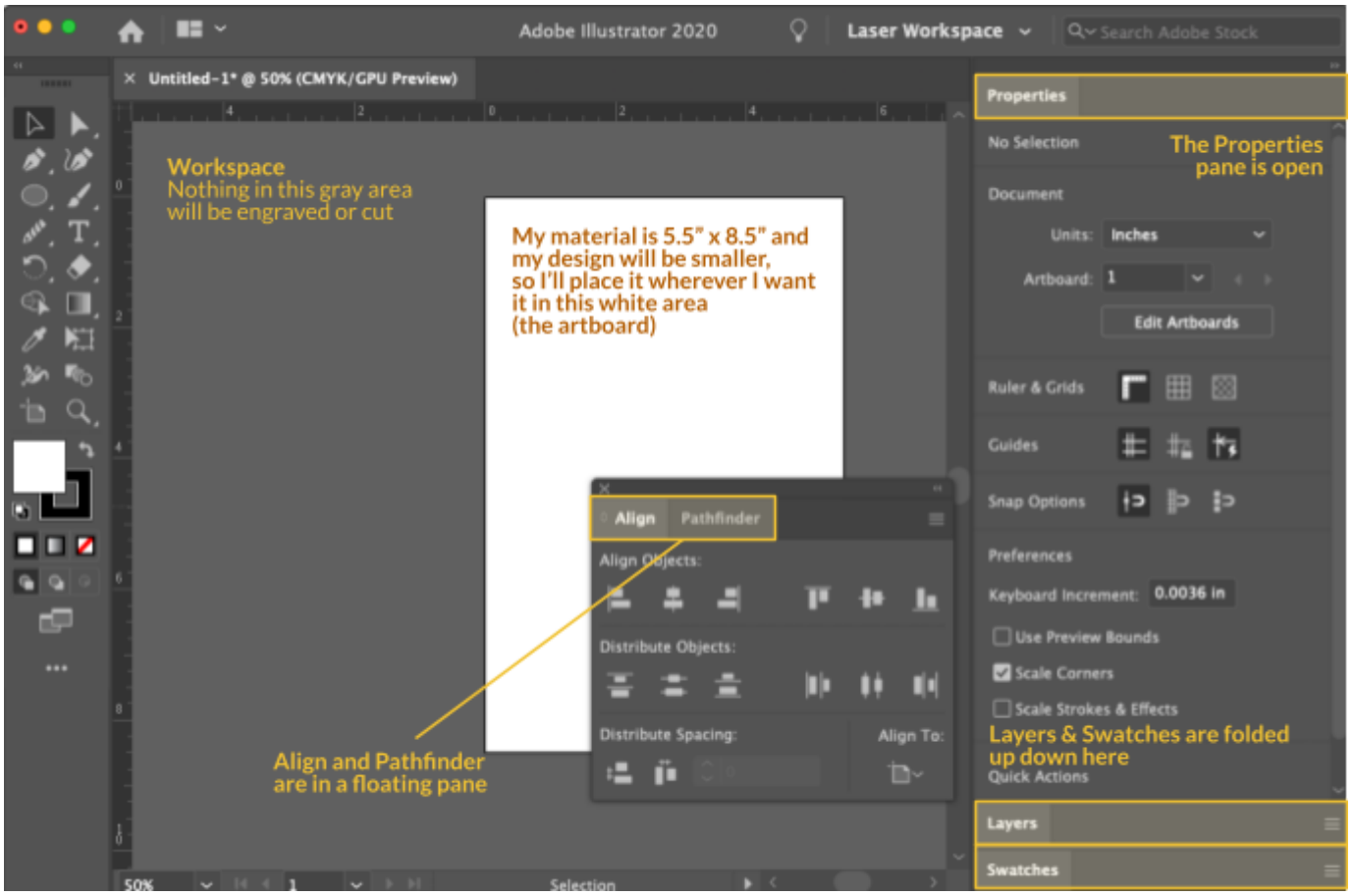
Setting up your artwork in Illustrator, *continued*

Example project

For my example project, I will engrave some text and then cut it out as a round tag shape

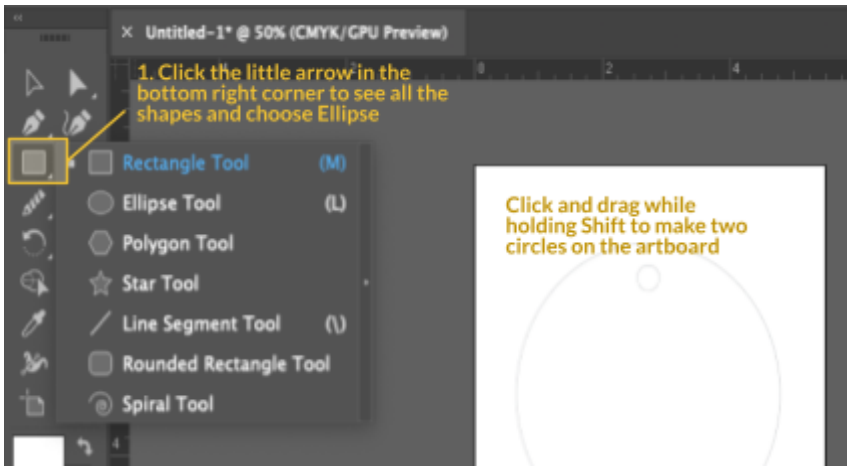
1. The Illustrator workspace

First, I'll make sure I have all my useful Illustrator panes open by going to Window > Workspace > Reset Laser Workspace *(The Makerspace laser computer has a custom "Laser Workspace" already set up)*. This will open the Properties, Layers, Swatches, Align, and Pathfinder panes.



2. Making shapes

- Choose the **Ellipse tool** (click the little arrow in the bottom right corner of the **Rectangle tool** to see all the shapes)
- Click and drag while holding Shift to make two circles, one small and one large. (Holding Shift keeps your circle circular, rather than making an oval)

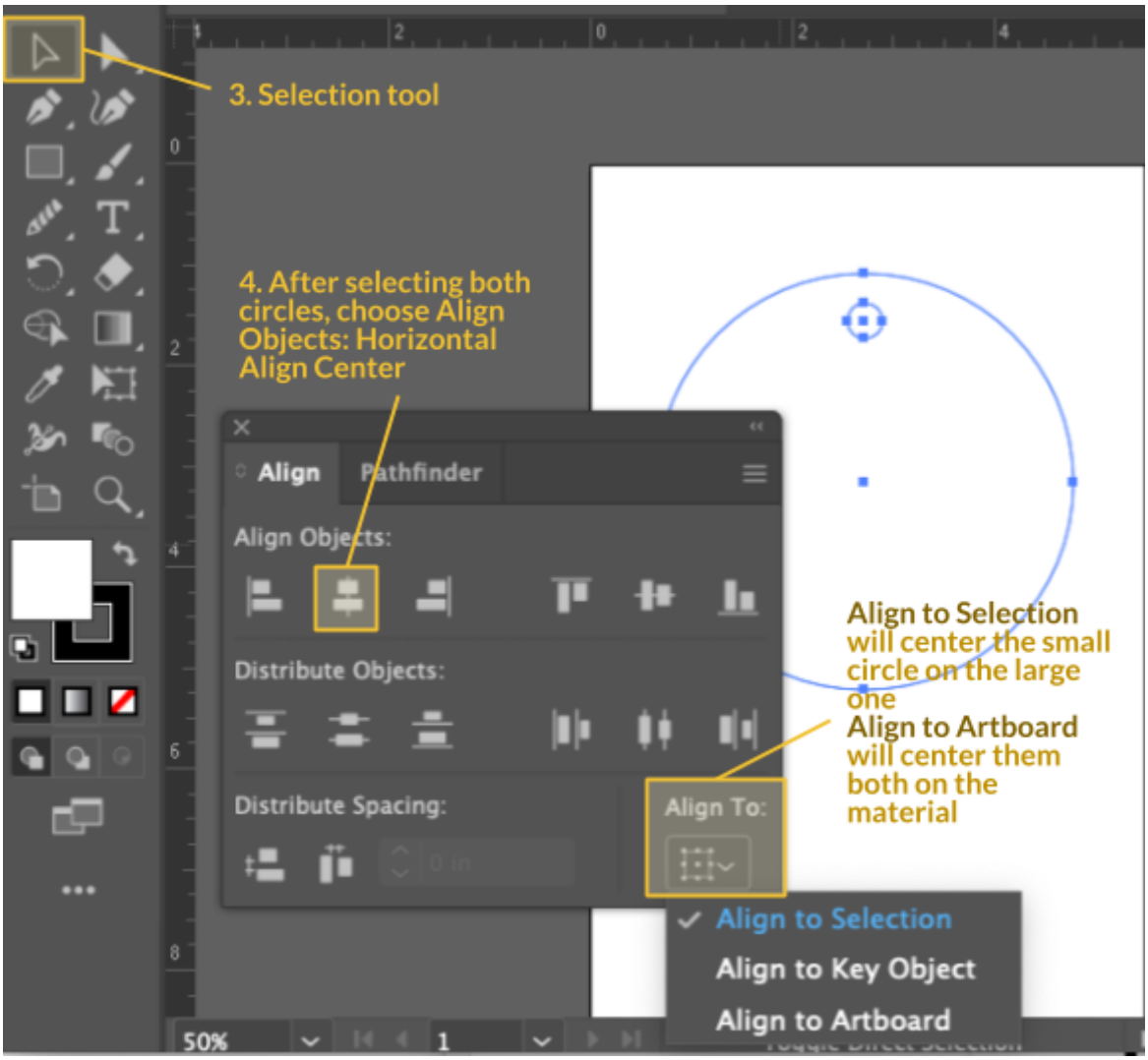


3. Selecting and nudging

- Now I choose the **Selection tool** (black arrow). There are a few ways to select objects:
  - Click on each circle to choose them one at a time
  - Hold Shift and click on one circle and then the other to select both
  - Click and drag over both circles to Box Select both at once
- Once I have a shape selected, I can either drag it to move it, or nudge it with the keyboard for more precision
  - Use the arrow keys for a tiny nudge
  - Hold shift and use the arrow keys for a bigger nudge.
- Select the small circle and nudge it near the top of the big circle

4. Aligning

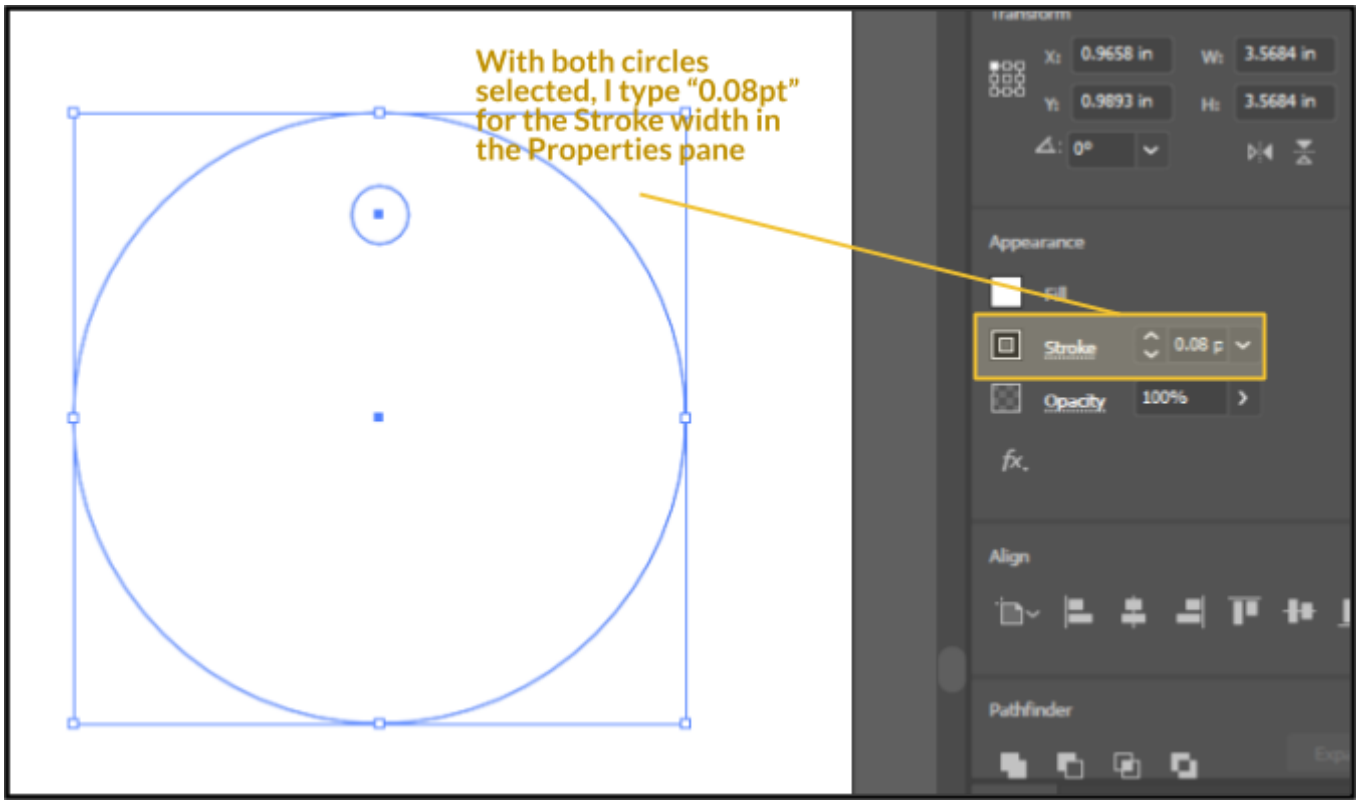
- Now we can use the **Align pane** to line up the small circle and the big circle so we know it's perfectly centered.
  - Use the **Selection tool** to select both circles (either click and drag to Box Select, or hold shift and click each of the circles)
  - In the **Align pane**, in the "Align to:" dropdown, you can leave **Align to Selection** selected, or change it to **Align to Artboard** so the circles are aligned to both each other and your piece of material
  - Choose the **Horizontal Align Center** button.



5. Stroke width

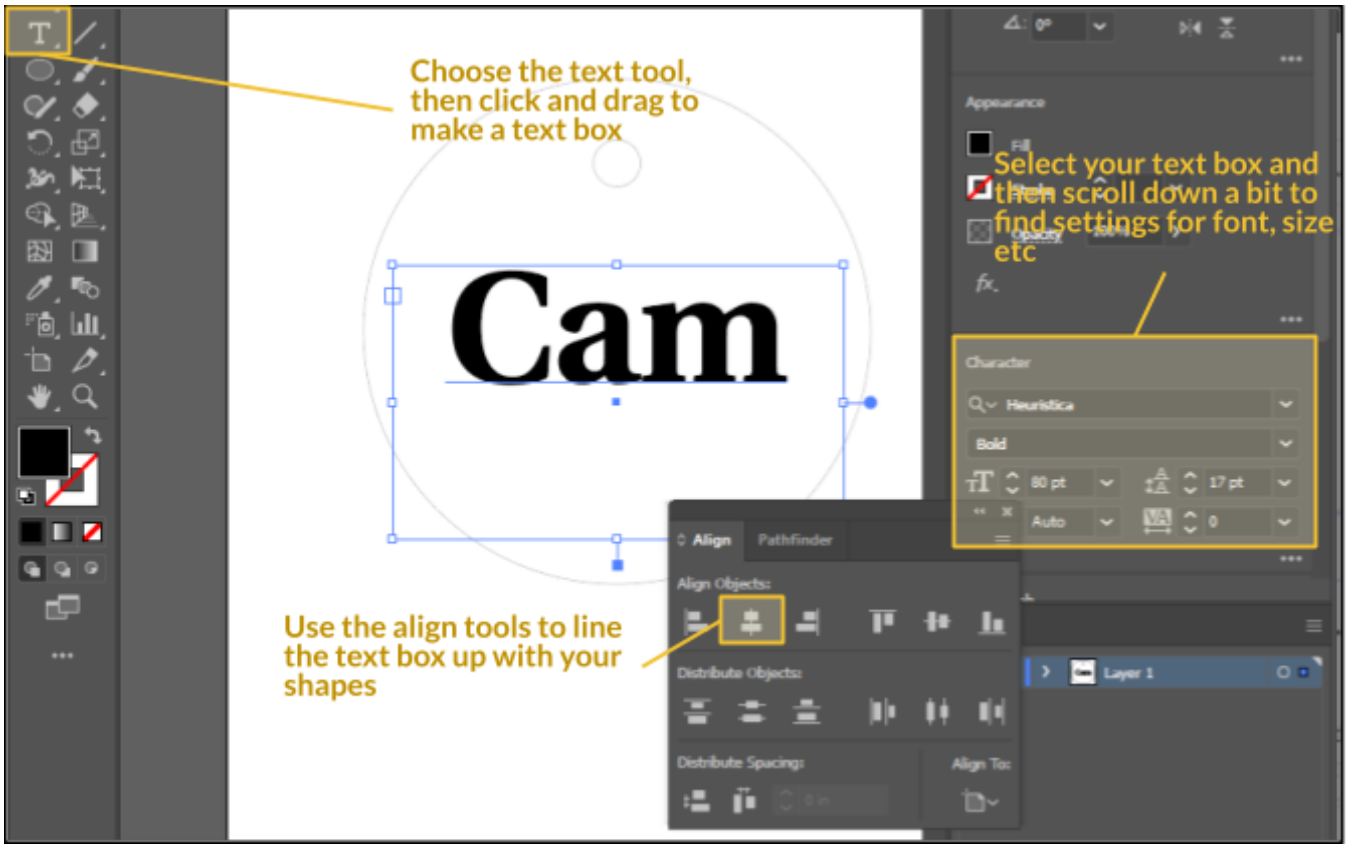
With both circles selected, in the Properties pane, set the line width to 0.08 pt (you will type it in rather than finding it in the dropdown)

0.08 pt (or 0.001 inches, or 0.025 mm, if you're using those units) is a very special line width. The laser will interpret any line this width as an instruction to vector cut a smooth line through the material. Any line or area thicker than 0.08 pt/0.001 in/0.025 mm will be raster engraved.



6. Text tool

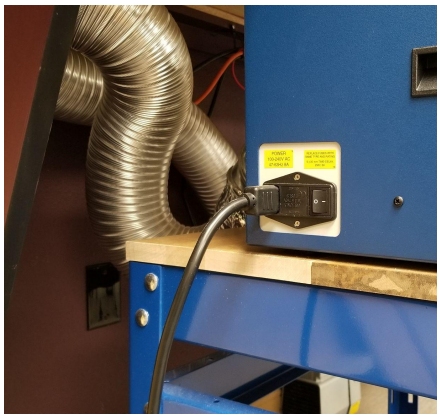
Find the Text tool. Click and drag to make a text box. Type your text and change the font and size if needed in the Properties pane. Drag the edges of the text box with the Selection tool to line it up where you want it on your tag. Because this text is solid black, not outlined with a 0.08 pt stroke, it will be engraved rather than cutting through.



Now you're ready to engrave and cut this design!

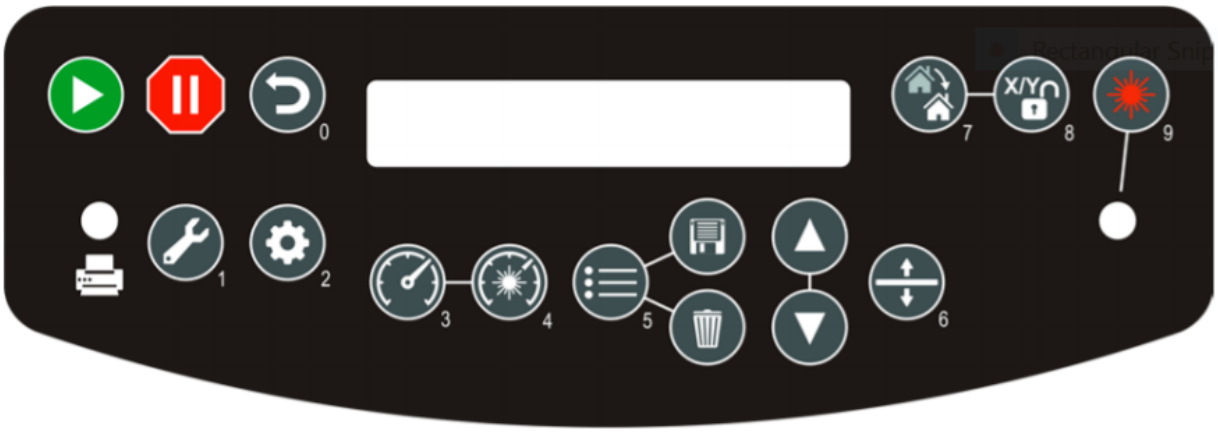
Getting the laser ready

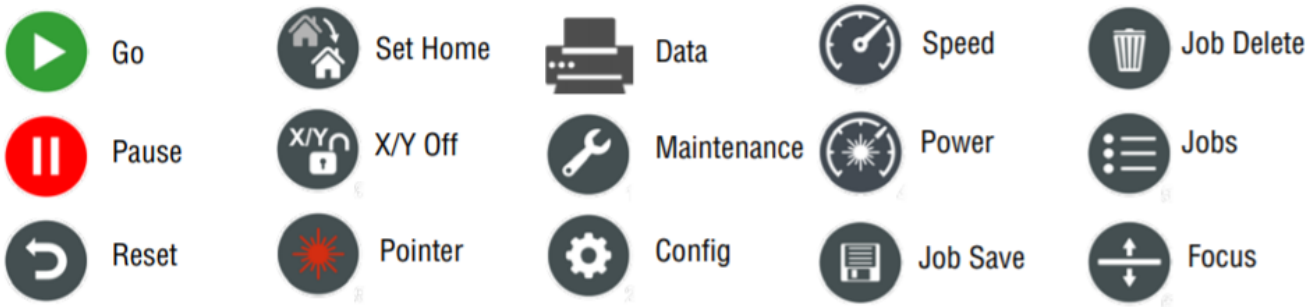
Power On

		
Turn on the **Laser/Exhaust** switch under the counter. You can also turn **Air Assist** on now if you like.	If the laser doesn't come on, check that the large switch near the plug on the lower rear part of the right side is flipped to | (on)	The laser will boot up and you will hear the X and Y axis motors checking their home position

Control panel

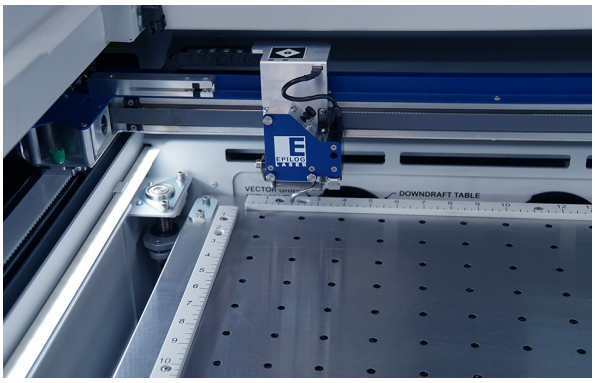
The buttons you'll usually use on the front panel of the Epilog Mini are **Go**, **Pause**, **Reset**, **Set Home**, **X/Y Off, Red Dot Pointer**, **Maintenance**, **Focus**, and the **Up/Down arrows**





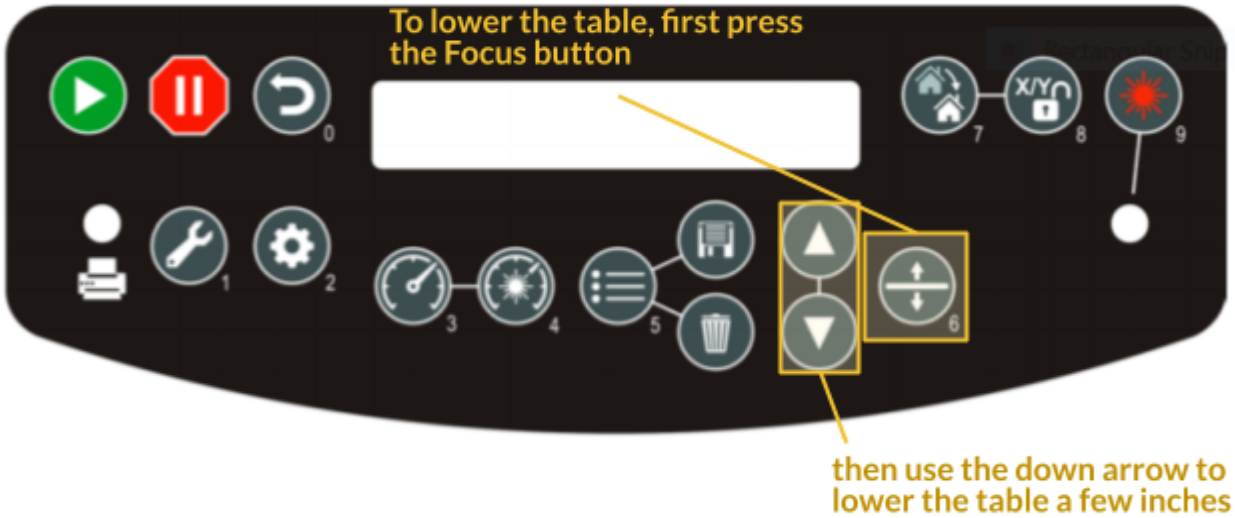
Vector grid and vacuum hold-down table

Change tables if needed. Generally, you can use the vector grid, which looks like a honeycomb. Tables are kept in cabinet 10.

	Use the **vector grid** for vector cutting *or* raster engraving on materials that are heavy enough that they won't blow around. The open grid minimizes scorch marks on the back of your material caused by the laser beam bouncing off the metal.
	Use the **vacuum table** (solid with small holes) for engraving/cutting on light materials/objects that need suction, magnets, and/or tape to stay in place. The more holes in the table are covered, the more the light material will be held in place. You can cover any exposed holes with scrap material or use the magnets on the whiteboard and/or blue tape to hold your light material in place if needed

To change the table

- Press the **Focus button** and use the **up/down buttons** to lower the table a few inches.
- Flip up the spring-loaded rulers on the left, top, and right sides of the enclosure
- Load the table (vector grid with its metal rim down, vacuum table shiny side up), and flip the rulers down



Where to place your material

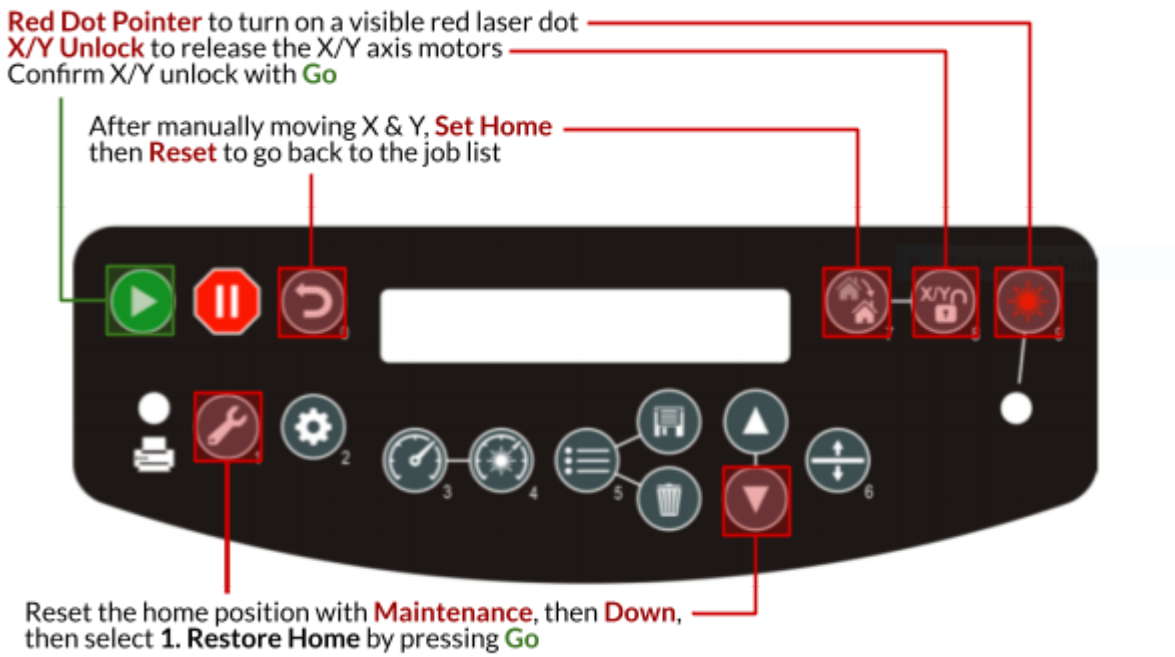
Option 1: Starting from the top left corner (easiest, good for sheet materials)

1. When making your design, set your document (artboard) size to the same size as your entire piece of sheet material, and place the design where you would like it to appear on the sheet.
2. When loading your material, slide it snugly against the rulers at the top left corner of the table. **That's it!**

Option 2: Starting from the center-center position (good for small or irregularly shaped objects/materials)**:**

Center-center engraving
Unlocking the X/Y axis, lining up X and Y on a pencil mark using the Red Dot Pointer, and setting the new home position. Now the laser will center my design on the pencil mark instead of starting from the top left corner of the bed.

1. When making your design, set your document (artboard) size to be around the same size as your design. For example, you might make a 3" wide, 2" high design to go in the middle of 4" diameter round coaster
2. Use a ruler to identify the center of your item and mark it with a pencil dot (or guess!)
3. Place your item anywhere on the bed
   On the control panel, press **4. Red Dot Pointer**, then **5. X/Y Off**, then **6. Go** to confirm
4. Move the X-Y carriage with your hand (the X axis is a small silver head, and the Y is a large blue bar that spans the laser chassis) until the red dot pointer is in the center of your object.
   On the control panel, press **8. Set Home**, then **9. Reset** to go back to the job list.



Using the center-center position: When finished

When finished with your Center-Center engraving job, reset the home position for the next user: On the control panel, press **Maintenance** and then the **down arrow**, then choose **1. Restore Home** and press **Go.**

Focus

Autofocus

A good choice for most flat materials. A plunger on the laser carriage will tap your material surface to measure distance before starting the job. You won't have to change anything on the laser control panel if you choose autofocus- you'll just select Auto Focus in the Laser Dashboard during printing.

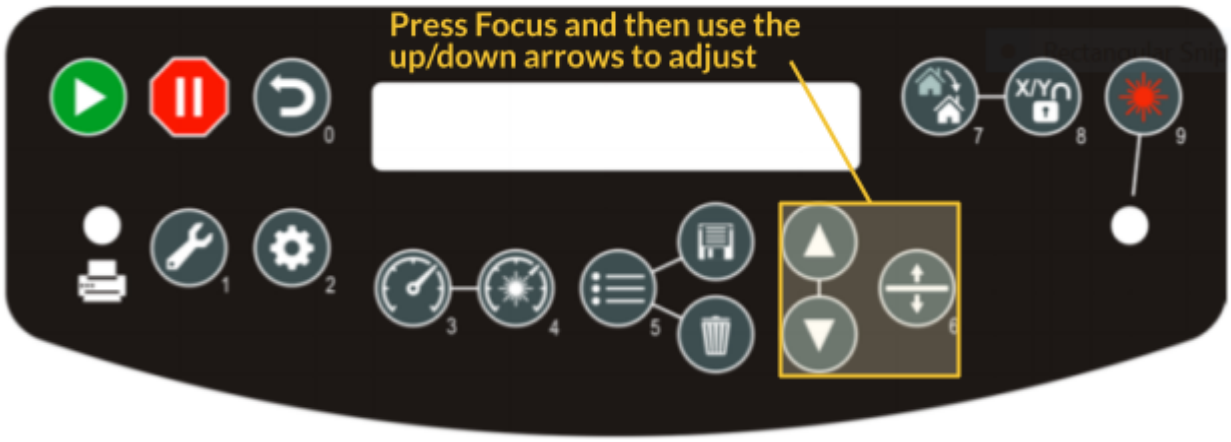
If you are running many jobs on the same material, you can leave Auto Focus unchecked after the first job has run Auto Focus. The laser table will not move out of place until it's focused again.

Do not use autofocus on bumpy objects or sheet materials that already have holes cut out- hitting the edge of a hole or lump can fold the autofocus plunger over and jam the x-axis.

Manual focus

Good for small or unusually shaped items or soft surfaces, situations where you want a little extra certainty, or would prefer the autofocus plunger not touch your material (which could move it)

1. Place the **focus gauge** onto the laser carriage. A magnet on the carriage holds it in place.
2. Press **Focus** on the control panel, then use the control panel's **up/down arrows** to raise/lower the table until the material surface just barely touches the focus gauge. It doesn't have to be perfect. If you lower the focus gauge into the material, it will move up without hurting anything and eventually pop off the magnet.
    - If your material is curved, select a medium distance between the high and low points.
    - If there is more than 3mm of variation in your surface, parts of your engraving may look fuzzy and the beam might not cut all the way through during vector cutting (the more out of focus the beam is, the weaker it is)
3. You will *uncheck* Auto Focus in the Laser Dashboard during the printing step.
4. Press the back arrow (button 0) on the laser panel to exit focus mode.



About warming up the laser tube and testing

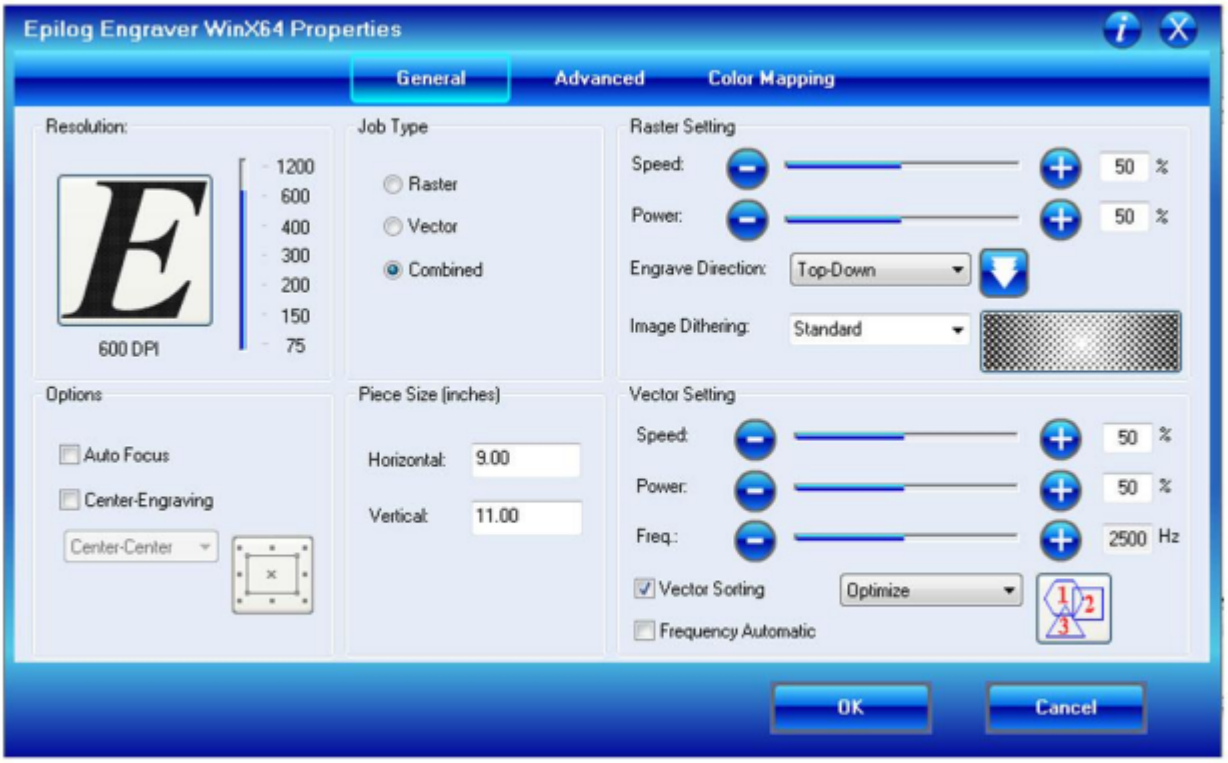
For every new laser project, plan to test first with a piece of scrap material or run a small job on one corner of a material sheet.

- After sitting for a few hours, the laser tube needs a chance to warm up to full power. About 45 seconds of engraving or 5 seconds of cutting is enough to bring the tube up to full power. You will know it's ready when you see a visible beam.
- If you have a valuable material or a limited number of pieces, you will want to dial in your settings with several tests. The tables of material settings in the binder and the laser manual are just starting points
- **Test on your real material if you can.** If you have no extra material, use a bit of cardboard. Cutting on cardboard won't give you much information about your power settings, but it will warm the laser tube up.

Running your job

Setting up your job in the Laser Dashboard

- Go to **File > Print** and click **Setup** in the lower left corner. This will pull up a list of printers.
- Select **Epilog Engraver X64 Ethernet**, then **Preferences** to open the Laser Dashboard



- **Set Piece Size first and exit the dashboard to apply the setting (Illustrator glitch)**
  - Set the Piece Size to the same size as your Illustrator document, then click OK, then Print.
  - Click **Setup** again and then **Print** again and you should see the **Media size** in the lower left hand corner of the Illustrator print window change
  - Now you can do **Setup > Epilog Engraver X64 Ethernet > Preferences** once more and set the rest of your preferences.
- **Resolution**
  - Between 600 and 300 DPI is good for photos. Refer to the materials tables for example settings. Epilog manual page 63 has other tips for choosing DPI. You can leave this setting wherever it happens to be if you are doing a vector-only job.

- **Job Type**
  - Make a habit of selecting either Raster or Vector unless you're doing a job that requires both- then choose Combined.
- **Raster Setting (if you're raster engraving)**
  - **Speed/Power:** Refer to the materials tables and page 143 of the laser manual for your raster speed and power settings. You can either type a value or use the -/+ buttons and/or slider to adjust.
  - **Engrave Direction:** Choosing bottom-up engraving can prevent soot from being drawn into the nooks and crannies of your raster design, which is especially noticeable on light materials like paper.
  - **Image Dithering:** Refer to page 77 of the laser manual for advice on which dithering settings are best for which application. When in doubt, choose Standard.
- **Vector Setting (if you're vector cutting)**
  - **Speed/Power/Frequency:** Refer to the materials table on page x for your vector speed, power, and frequency settings. You can either type a value or use the -/+ buttons and/or slider to adjust. (Adjust frequency using the buttons or slider.)
  - **Vector sort:** Optimize works for most cutting jobs, while inside-out is preferred for jobs where small interior details need to be cut first.
  - **Frequency automatic**: Leave unchecked
- **Options:**
  - **Auto Focus:** If you used the manual focus gauge when loading your material, *uncheck* Auto Focus. If not, check it.
  - **Center-Engraving:** If you loaded your material in the center-center position and set a new home, check Center-Engraving and choose Center-Center from the dropdown.
  - **Send to Laser/Send to Manager:** Keep both of these checked.

Ready to go

When ready, click **OK**, then **Print**, then **Print** again. This will queue the job on the laser, but it won't start until you press the **Go button** on the control panel.

Quick check before starting the job

- Is the exhaust fan on?
- Is the air assist pump on if needed?
- Did you warm up the laser tube?
- Is your material loaded?

The LCD screen on the laser will display your job name. (The job sent from the computer most recently will be the one displayed)

- Press the green **Go** button on the laser to start the job.

During the job

- Stay within arms reach of the laser during engraving, and watch the job during cutting.
- Follow the **Laser Safety: In case of fire** instructions if you see flames
- To pause the job, use the red **Pause button**. Resume with the green **Go button**.
- To end the job, use the red **Pause button** and then the black **Reset button**.

When done

- Remove any debris from the bed
- Pull very hard on one front access door handle to open it, then flip out the two latches on the crumb tray, slide it out, dump it, and replace it.
- Turn off the laser, the Laser/Exhaust switch, and the Air Assist pump switch.

Material Settings

These are initial power settings for common materials. Bring extra materials for testing and plan to adjust your settings further.

			Engrave/Raster	*Cut/Vector*
Material	*Speed*	*Power*	*DPI*	*Frequency*
Wood				
Engrave photos*	40	100	600 DPI	
*Note: Plan to experiment with the dither settings to get the most appealing results on your material				
Engrave text/clipart (high resolution)	30	100	600 DPI	
Engrave text/clipart	25	100	300 DPI	
Cut veneer	30	22		Freq. 500
Cut ⅛" (3mm)	25	100		Freq. 500
Cut ¼" (6mm)	8	100		Freq. 500
Acrylic				
Engrave photos	90	60	300 DPI	
Engrave text/clipart (high resolution)	90	80	600 DPI	
Engrave text/clipart	90	75	300 DPI	
Cut ⅛" (3mm)	9	100		Freq. 5000
Cut ¼" (6mm)	5	100		Freq. 5000
Other plastic				
Engrave general plastic	90	40	300 DPI	
Engrave two-layer plastic (high resolution)	90	70	600 DPI	
Engrave two-layer plastic	90	80	300 DPI	
Cardboard				
Cut single layer	50	50		Freq. 500
Cut double layer	30	70		Freq. 500
Engrave (light mark)	100	15	300 DPI	

Copy paper				
Cut	100	15		Freq. 1000

Material	*Speed*	*Power*	*DPI*	*Frequency*
Eucaboard brand hardboard				
Cut	12	100		Freq. 500
Engrave	30	100	600 DPI	
JPPlus Laserable Alderwood				
Cut (⅛”)	25	100		Freq. 500
Engrave	30	100	600 DPI	
Taskboard				
Cut (1/16”)	50	50		Freq. 500
Engrave	100	60	300 DPI	
Slate Coasters				
text	90	65	600 DPI	
photo	90	55	300 DPI	
Cork coaster				
Engrave	90	50	600 DPI	
Other materials				
Painted steel water bottle* (engrave only) **Our bottles had thin paint- bottles with a Yeti-like textured coating may need more power*	60	50	600 DPI	
Leather ⅛”				
Engrave text	70	60	600 DPI	
Cut (⅛”)	20	80		Freq. 600

Intermediate Tutorial: Image to Vector with Image Trace

Just about any image can be *raster engraved* on the laser, but to cut all the way through a material, you will need to give the laser **vectors**, also known as **paths**. During a vector cut, instead of making rows of dots as it does during raster, the laser will smoothly follow the path, creating a cut line that's only as wide as the laser beam.

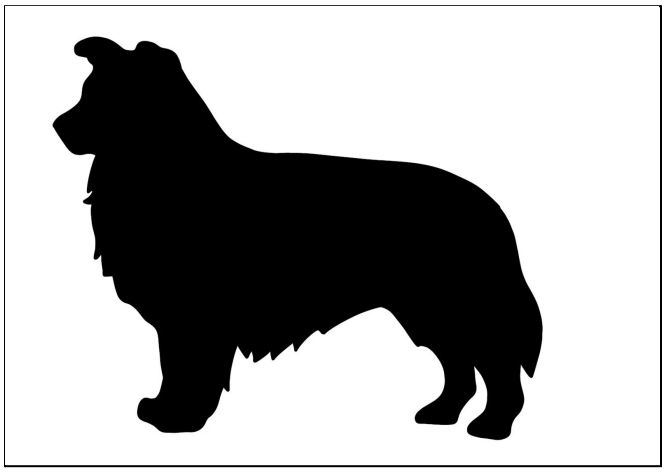
Option 1: Start with a vector file

You can skip the tracing step by starting with a vector file. Vector files are a bit harder to find online than other kinds of clip art and sites often charge a few dollars to download a package of vector images. Vector files typically have an .ai, .eps, or .svg extension. Even if it seems like you're downloading a vector file, you're sometimes only getting the raster preview image, which will not be cuttable without tracing. Vecteezy.com is a stock vector site. Designs without the "pro" label are free to download. The Noun Project is also a fun place to look for free, simple vector files thenounproject.com When you open the file in Illustrator, you should be able to click on parts of the illustration with the Direct Select tool and see blue paths outlining the shapes.

Option 2: Select a traceable image:

The image to trace should have few colors (black and white is best) and simple forms. A photograph can be successfully traced, but it won't be cuttable. Try googling for "border collie silhouette" or "border collie clip art" rather than just "border collie", and when selecting an image, choose the one with the highest contrast and the fewest colors. You can also Desaturate and adjust the levels on your image in Photoshop first. (Also- psst! You are responsible for following copyright law!). Copy the image or save it to the computer.

This clip art will make an excellent cut path- it has a pure white background and solid filled shape



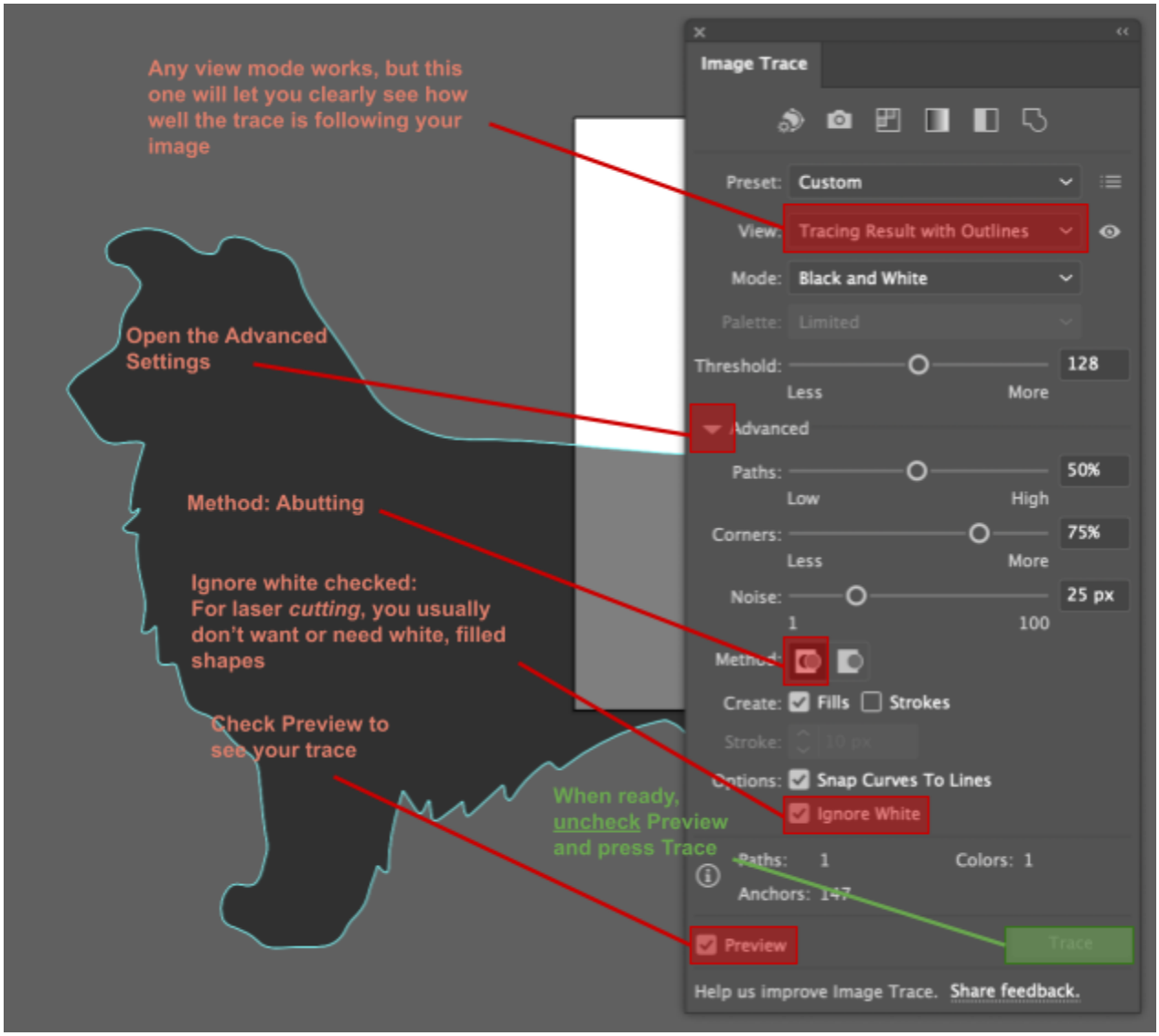


Image Trace

1. **File > Place** or paste an image onto the artboard.
    - The higher resolution the image, the more accurate the trace.
    - It's OK if the image hangs off the sides of the artboard during the trace
2. Click the image to select it, then open the **Window > Image Trace** pane.
   Use the following settings:
    - **Preset:** Default
    - **View:** Outlines with Source Image
    - **Mode:** Black and White
        - *If you are going to **raster engrave** your trace rather than cutting it, you can try the other two modes too*
3. **Zoom in** so you can see the relationship between the image and the outlines.

Image Trace, *continued*

4. **Open the Advanced settings:**
    - Tweak the Threshold, Paths, Corners, and Noise sliders until you like the way the outlines follow the image.
        - **Noise and Threshold** affect where the line falls relative to the pixels
        - **Paths and Corners** increase the number of points in the trace, which will make your design cut more slowly, but it will be more accurate (which can also look overly jagged, so slide it until it looks the way you like)
5. **Choose the Method.**
    - **For most cases, Abutting with Ignore White checked is the best choice.**
6. When ready, uncheck Preview and press Trace or go to the **Object menu > Image Trace > Expand**

Finishing touches

1. **Ungroup.** All the shapes in your trace will be one group. Right-click and choose Ungroup. You may have to Ungroup a few times to free all the shapes.
2. **Delete unwanted shapes**. Select shapes you don't need (using either Direct Select (black arrow) or Select (white)) and use the Delete key.
3. **Regroup.** Box-select and Right-click > Group shapes that need to stay together.
4. **To make your trace cuttable,** box-select all the wanted shapes and set them to **Fill: None** and **Stroke: 0.08pt Solid Black** in the Properties pane.

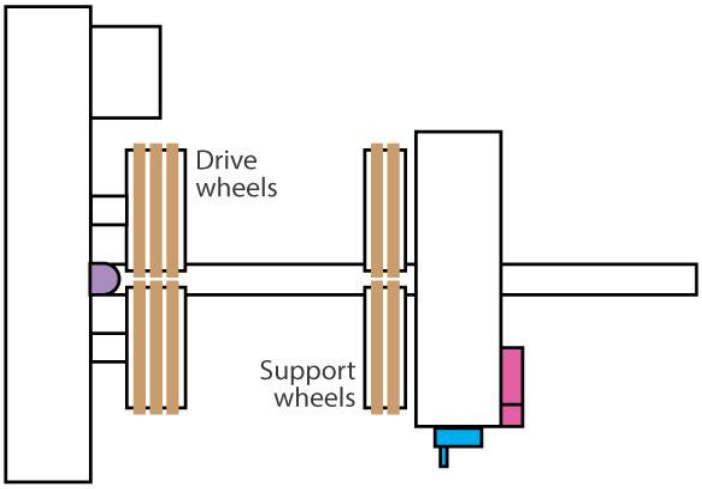
Advanced Laser Training: Using the Rotary Attachment

Step 1: Remove the vector grid and crumb tray and install the rotary

1. **Lower the table slightly.** Power the laser on. Using focus mode, lower the table a few inches so you have room to flip the rulers up.
2. **Remove the vector grid.** Flip up the spring-loaded left, top, and right rulers and lift the vector grid up and out. Set aside.
3. **Remove the crumb tray.** Open the front door (pull very, very hard on just one of the handles). Flip the crumb tray latches outward and slide the crumb tray out. Set aside.
4. **Lower the table completely.** Using focus mode, lower the table all the way down.
5. **POWER OFF. Never plug in the rotary when the power is on.**
6. **Position the rotary.** With the wheels on the left side, align the 3 pins of the rotary with the 3 holes on the bottom of the laser (the right hand pin is out of sight under a little cutout on the frame)
    - When handling the rotary, try not to touch the rubber tires
7. **Plug the rotary in.** Leave the power off for now.

Parts of the rotary

- The **drive wheels** on the right side are motorized and spin your object
- The **support wheels** on the left side roll with the object and can be raised up and down to make the surface of your object level. If your object has a narrow side, place it on these wheels.
- Push the left side of your object against the **bumper.** The bumper is the start point of the engraving.
- Flip the **release lever** toward the front of the laser to slide the support wheels right. Flip it back to lock.
- Use this **knob** to raise and lower the support wheels to level your object



Step 2: Place your object on the wheels and level it

1. **Examine your object and decide how to place it on the wheels.**
    - The rotary attachment has a scissor jack that can lift the right side of your object, so you'll want to place the side that needs lifting, usually the smaller side, to the right.
    - You can also place both sets of wheels under a straight/flat section of your object rather than under the far end.
2. **Adjust the spacing between the tires.**
    - Flip the silver release lever toward the front of the laser and slide the support wheels to the right until the space between the wheels is the right width for your object. Flip it back to lock.
3. **Place the object on the tires.**
    - Push the object against the black tab/bumper on the left side of the rotary. This bumper is the start point for the engraving.
4. **Level the object.**
    - Use a level from the pegboard and compare the frame of the laser to the top edge of your object, then rotate the scissor jack knob to raise/lower the right side if needed.
5. **Turn the laser on.**
    - With the rotary plugged in, the laser will automatically set the home position to the black bumper (X 0, Y at the centerline of the rotary)

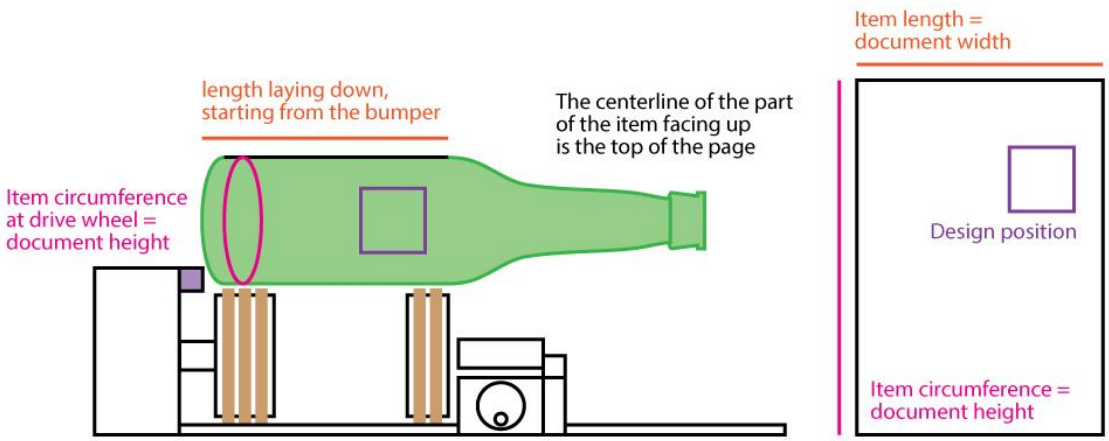
Step 3: Manual focus

1. **Put the focus gauge on the pegs on the X-axis and choose Focus Mode.**
    a. In focus mode, the X and Y axes are released, so you can move the x-carriage side to side to find a good spot to focus on if needed.
2. **Use the arrow keys to raise the z-axis/table until the gauge touches your item.**
3. **Exit focus mode with the Back/Reset button**

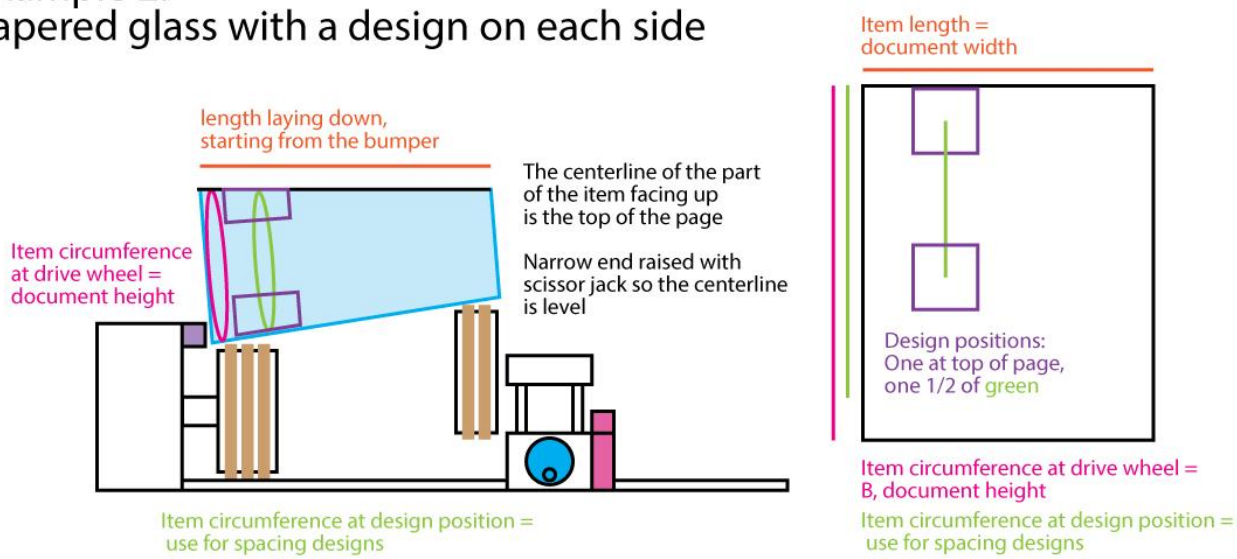
Step 4: Create a document and position your design

1. **In Adobe Illustrator, use Create New to make a document the same size as your object.**
    - **Document width:** length (right to left) of the object when it's horizontal, starting from the left side
    - **Document height:** Distance from your starting point to the end of your design
2. Refer to the examples on the next page for tips on how to position your design on the document.

Example 1:
Bottle with a straight section



Example 2:
Tapered glass with a design on each side



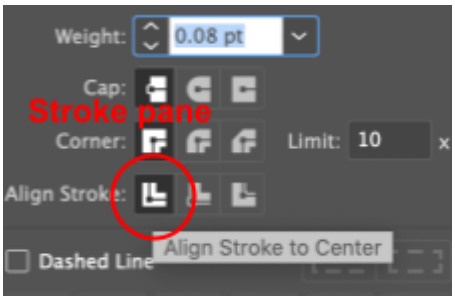
Step 5: Print

- Refer to the Laser Cutter training for full printing instructions, with these special considerations:
    - **Resolution:** Use 300 DPI for glass- higher DPI settings get flaky/melty
    - **Job Type:** Will be **Raster** in most cases
    - **Raster Setting:**
        - **Image Dithering: Jarvis** is recommended for glass
    - **Options:**
        - **Auto focus** should be *unchecked*
        - **Center-Engraving** should be *unchecked*
    - **Page Size:** Same as your document- width is the object length, height is the object circumference
- The laser automatically detects the rotary and knows to spin the object rather than moving the Y axis.
- **Remember to warm up the laser tube** on scrap material (use your own test object, or use a scrap bottle from Cabinet 10). You don't need to relevel or change focus, just look for a visible beam.
- Use the material settings from the material tables.
- Especially when using the rotary, **run the job with the lid up** and the red dot pointer on to confirm that the object is stable on the wheels and that the laser is traveling to the area you want to engrave. Then run again with the lid down.

Glass Tips

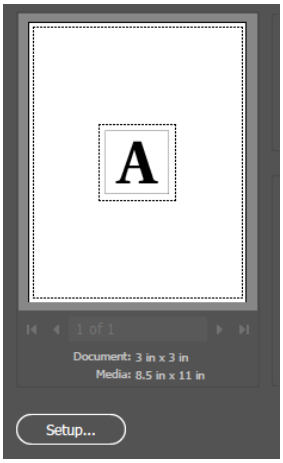
- When removing glass, **do not touch the engraved area** when removing the item. Rinse the engraving under water with a scrub pad to remove the glass powder.
- Try changing the fill color of your design to 80% gray (that's the third gray from the left in the Illustrator Swatches panel. Hover over the swatches to see the K percentage) rather than using pure black
- Use the Jarvis rather than the Standard dither for a frosty appearance

Troubleshooting

My job is showing up on the front panel of the laser but when I press Go, it just beeps and then says Done without cutting/engraving
 
 	
	• Check that your job type is right for your job (vector for cutting, raster for engraving, combined for both)
	  ○ If your job is Combined, try running it first as vector only and then as engraving only to help diagnose the problem
	• For vector cutting jobs, check that your line:
	  ○ is a vector line (click with the white Direct Select tool and make sure you can you can see a path, points, and handles)
	  ○ Is the right width (0.08 pt/0.001 in)
	  ○ Is the right color (#000000, solid black)
	  ○ Is aligned to the center of the path. In the Properties pane, click the word Stroke and check that Align to Center is selected rather than Inside or Outside, and that Dashed Line is **unchecked**

I'm running a vector job and the laser is cutting, but not all the way through	• Check focus • Check line width and color (0.08 pt, solid black) • Let makerspace@estesvalleylibrary.org that the laser optics may need to be inspected and cleaned
I'm engraving a photo or complex illustration and it doesn't look very good	• For a really nice photo engraving, plan to dedicate a generous piece of scrap material (same as your intended final material) and run 4 or more test jobs to get your settings just right ○ Try different dithering modes during your test jobs. Refer to Chapter 13 of the full laser manual for advice. • Open your image in Photoshop first, Desaturate it, and then use Levels and/or Curves to make your whites whiter and your darks darker • A DPI of higher than 300 can cause a stripey, uneven appearance on glass and acrylic due to the densely placed dots melting the material unpredictably. If you want a very high-resolution look on acrylic or glass, plan to run it at a lower than recommended power and try running it more than once.

Oh no! The autofocus plunger folded over and it looks broken, and the laser says it is jammed!	First, don't panic, the autofocus plunger is spring loaded and it can fold over without damage. You will need to manually lower the table so the laser can check its x and y axis during startup without getting caught: 1. Turn **off** the laser 2. Pull very, very hard on ONE of the handles on the front door of the laser 3. Grab the first belt you see running along the bottom of the laser's case and pull it to the right to slowly lower the table. You'll probably have to pull on the belt a few times to get the bed low enough that the autofocus plunger is no longer folded over. 4. Close the door and turn the laser on. It should be able to run through its normal setup process. In the future, **avoid using Auto Focus with bumpy, uneven, or oddly sized materials,** or material sheets with holes in them. If the autofocus plunger touches down at an angle, it can fold over. 

I'm trying to start a job but the laser seems like it's starting somewhere in the middle of the bed.	Check that someone didn't accidentally set a new home location during center-center engraving and then forget to reset it: On the control panel, press **Maintenance** and then the **down arrow**, then choose **1. Restore Home** and press **Go.**
The laser starts in the top corner of the bed, but it's putting my design in the wrong place	Make sure your Piece Size in the Laser Dashboard is the same size as your Illustrator document. If not, set the Piece Size in the dashboard, click Print, **then open Setup again and click Print again** (this is a glitch in Illustrator). You should see your Document and Media size (bottom left corner of the Illustrator print pane) are the same.  *On the right, my Document (Illustrator artboard) and my Media (called Piece Size in the Laser Dashboard) aren't the same. I might have forgotten to set Piece Size, or I might need to click Setup again and then Print to get past the Illustrator glitch.* If your piece size and document size are the same, check that your design wasn't auto rotated in illustrator. *Below, my Document size and Media size are both right, but under Orientation my design is rotated 90 degrees. I should click the first button under Orientation to get my design going the right direction.*