MakeIt Labs

1. What is laser / how it works
   a. Laser Tube – (Do not open/touch)
   b. 2 axis gantry
   c. mirrors (Do not touch – do not clean – do not align)
   d. Z Axis
   e. Positioning laser
   f. Cooling system
   g. Ventilation system
      i. Use "porous" backing materials for airflow
   h. Blower system
   i. Control Pad
      i. Home
      ii. XY movement
      iii. Z
      iv. Auto-Z
      v. Stop button
      vi. "Emergency" stop button
         1. When to use
            a. Whenever in doubt!
            2. TWIST to reset
   j. RFID box
   k. "Large piece" doorway (Mention, but use only with "special permission")
   l. DO NOT SLAM DOOR!
2. Safety
   a. YOU are responsibly for safety of others/surroundings
   b. You MUST BE PRESENT and ATTENTIVE in area during operation – Watch for fires!
   c. CO2 & Hallotron fire extinguishers
      i. Only use It – keep on-hand
      ii. Report all usage
   d. Interlock switches – DO NOT override
   e. Eye Protection
      i. Wear at all times
      1. Always "Two layers"
      ii. You and OTHERS in the area
      iii. Do not look directly toward laser
      iv. Laser beam is INVISIBLE (different than positioning laser)
   f. Smoke, Vapors and Gasses
      i. Use only proper materials! (See Material section below)
         ii. Allow materials to "sit" on bed with exhaust on and door closed "as long as possible" (This is my own practice – it's a bit "fuzzy")
      g. Warn about "gaps" in housing
      h. Warn about placing potentially hot materials in trash
         i. "Cool down" time
      i. Violations will revoke laser privileges
3. Materials
   a. What you CAN cut
      i. Wood (Up to 3/8") – Thicker – maybe – multipass – carbonization? (Fire Risk)
      ii. Acrylic – (Multipass for thick pieces)
      iii. Leather
      iv. Fabrics
      v. Most Plastics
      vi. Cardboard/Paper (Be careful for fires)
      vii. Food
         1. Chocolate
         2. Others
   b. What you can ENGRAVE
      i. Glass
      ii. Metals (With CerMark)
      iii. Stone
      iv. Tile
   c. What you CANNOT cut
      i. Chlorine=BAD
         1. Testing materials for chlorine (burns Green)
      ii. Why?

1. Poisonous Gasses
2. Corrosive Gasses

iii. Which Materials

1. PVC
2. Vinyl
3. Anything Highly Reflective
4. Fiberglass
5. Polycarbonate/Lexan
6. Polystyrene Foam
7. Polypropylene Foam
8. HDPE
9. Coated Carbon Fiber
10. Pressure Treated Wood

d. Materials Book

i. Online wiki materials DB

e. Rabbit web site reference
f. Materials Shelf

4. Material s Storage
   a. New 48-hour temp policy
   b. Must fill out form
   c. Longer storage needs approval
5. Software
   a. Basic Drawing
   b. Assigning of colors/layers to geometry
   c. Setting speeds/feeds (and “output”) of layers
      i. (See “Materials”)
   d. Raster/Engrave (vs. Cut)
   e. “Lines”
      i. Hairlines
   f. Print to Laser
   g. Bounding-box check
6. Cutting
   a. Keep work away from sides of machine
   b. Positioning of work – adjustment with keypad/arrows
   c. Auto Z-Axis calibration
   d. Check travel of machine
      i. Head crash into weights
      ii. Head crash into sides
      iii. Visible laser vs. Cutting laser vs. Food
   e. Positioning of
   f. Test Cuts
      i. Different speeds/feeds
   g. Make sure air and exhaust all work
   h. WATCH machine during all cuts!
   i. Allow for cool-off after use & before discarding materials
   j. Two Lenses – Lens Switching
   k. Honeycomb vs Engraving Plate
7. Processes
   a. Engraving
      i. Paper backing
   a. Badly warped pieces – weights or silly putty
   b. Backing materials
      ii. Save Honeycomb
      iii. Reduce reflections/burning
8. Troubleshooting
   a. Cutting Issues
      i. May need cleaning/adjustment
      ii. Bad Material!
      iii. Z axis/focus
      iv. Power/Speed
   b. Runs but doesn’t cut anything
      i. RFID may need periodic re-checking-in
   c. Geometry problems
      i. Y-Rotation set incorrectly
   d. Insufficient Depth
      i. Two-Pass – manual Z-Adjust on second pass
      ii. Hard to do on wood – carbonization
   e. Horrible noise on Z-Axis
      i. “Stop”
      ii. Manually move Z – try again
   f. Gantry/head/laser crash into stuff
      i. Emergency “Stop”
      ii. Fix physical issues
   g. Gantry/head crashes into limit/perimeter on cut or on test box

i. Check for weird artifact – far edges of drawing
ii. "immediate" mode

h. Uneven cutting
i. Larger/warped piece uneven on bed
1. Silly Putty
2. Tape
3. Use weights
4. **MAKE SURE** head will not crash into weights!!!!

i. Keypad working oddly – beeping – or gantry moving
i. Stuck key – find and press again

j. Keypad beeps instead of doing something
i. Wrong mode - Press "ESC"

k. Nothing powers on at all!
i. Check Emergency stop button

9. Vectors don't show
a. Line too thick?
b. Line too thin?
c. Not 100% Opacity?

10. Contact for:
a. Calibration
b. Lens cleaning
c. Problems/Questions
d. If there's a problem – let someone know – don't let the next person discover it down the road!

11. Software
a. Free
i. Inskcape – Vector Drawing – artwork
ii. Onshape – Freemium
iii. Fusion 360
iv. Draftsight – Engineering/CAD
v. GIMP – Image Manipulation – Engraving

b. Commercial
i. Vector Art – Adobe Illustrator, Corel Draw
ii. CAD – AutoCAD, Draftsight
iii. Images/Engraving – Photoshop

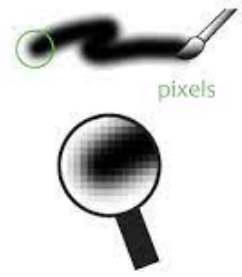
12. Contacts
a. Problems/Questions/Classes: laser@makeitlabs.com
b. brad.goodman.makeitlabs@gmail.com
c.
d. Slack!

13. References
a. wiki.makeitlabs.com
b. https://wiki.makeitlabs.com/resource-areas/laser-cutters/epilog

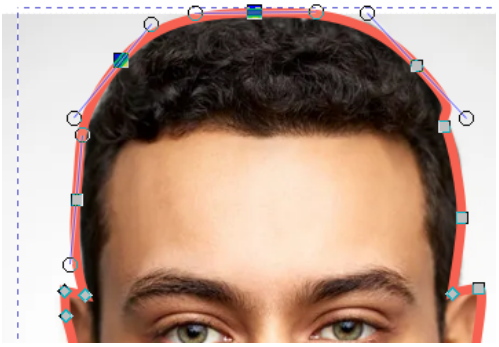
Cheat Sheet

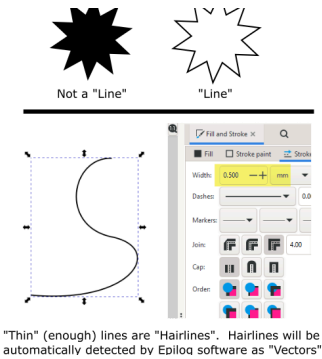
Vectors and Bitmaps

Programs generally work in either BITMAPS or VECTORS. Bitmaps are grids of pixels of different colors, each of which may be set to a different color to create an image. Vectors are the representation of a line or curve. Epilog can engrave either bitmaps or vectors but can only use vectors as cut lines. Thus if you are engraving a







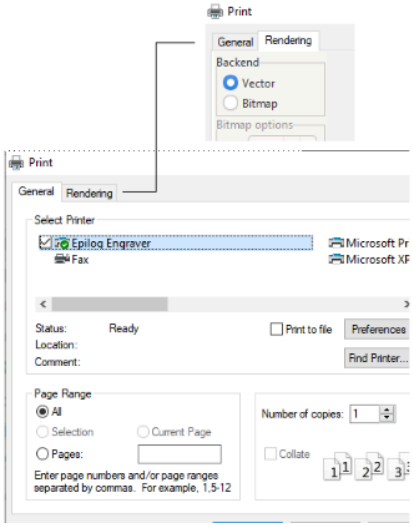


"Thin" (enough) lines are "Hairlines". Hairlines will be automatically detected by Epilog software as "Vectors" for

bitmap image and which to subsequently cut the image out, you need to pull the bitmap into a vector program such as Inkscape

Sending art from Software to Dashboard

Whether Vectors or Bitmaps – once you have your art, “Print” it to “Epilog Engraver” to send it to dashboard.



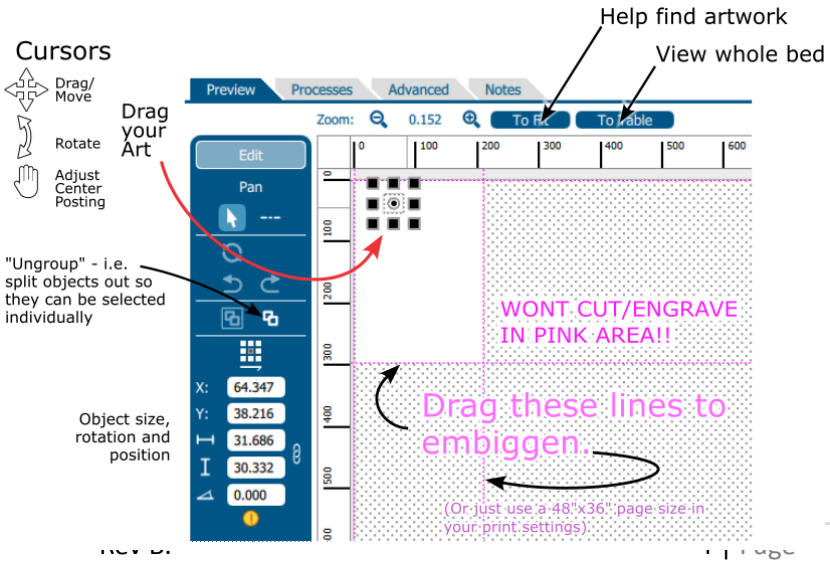
- "Print" to send to laser.
- Make sure you have "Epilog Engraver" set as device
- (Should be sent to backend as "Vector")

Epilog Dashboard

Epilog dashboard is the software that will prepare your artwork for sending to the laser. It’s primary job is to

1. Position your artwork on the laser bed. (Or set it up for positioning on the laser itself via “Center Point Mode”)
2. Telling it what to “cut” and what to “engrave”
3. Assigning Speed, Power and other parameters to your artwork (or various pieces thereof)

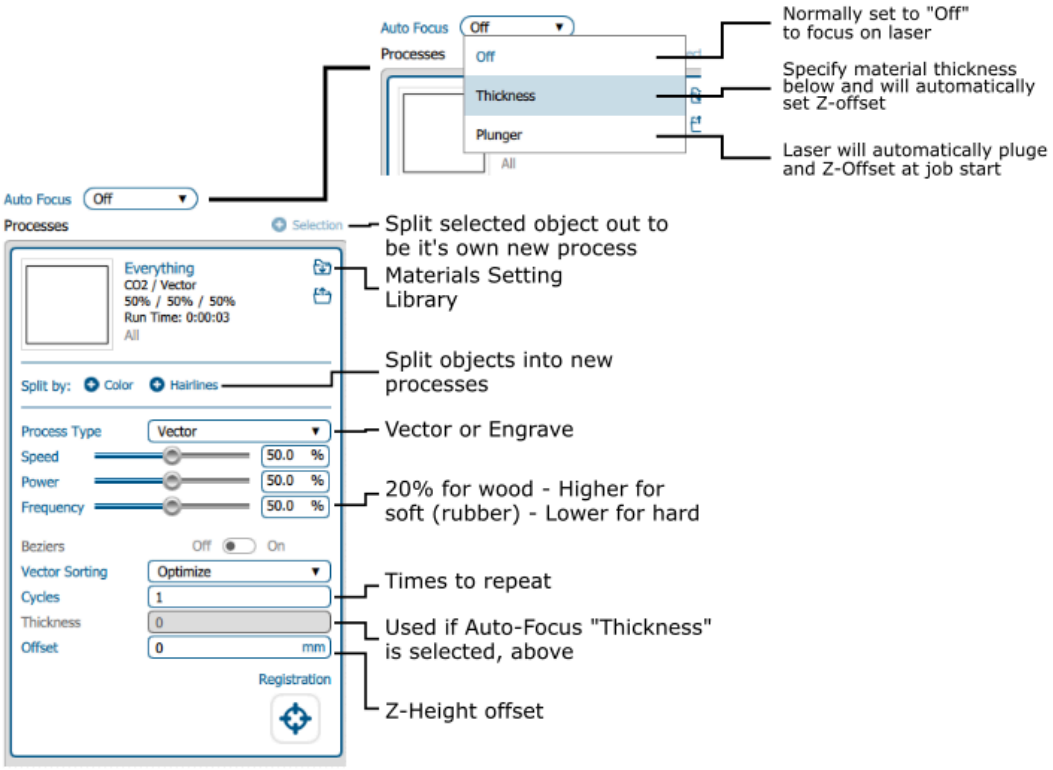
Positioning and Placement



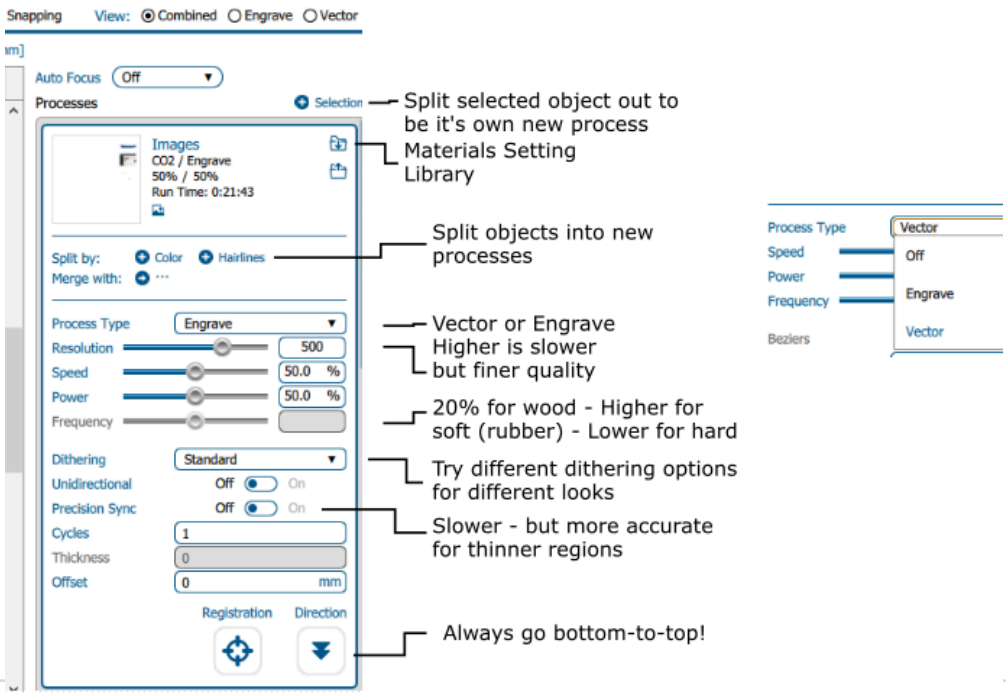
When printing, your artwork will be sent to the Epilog Dashboard. The "Preview" tab will show your artwork with some basic manipulation options. If you are connected to laser, it will show the camera bed for you to place your artwork directly on. Remember to

only place artwork in the "pink" area - and increase this area if need-be!

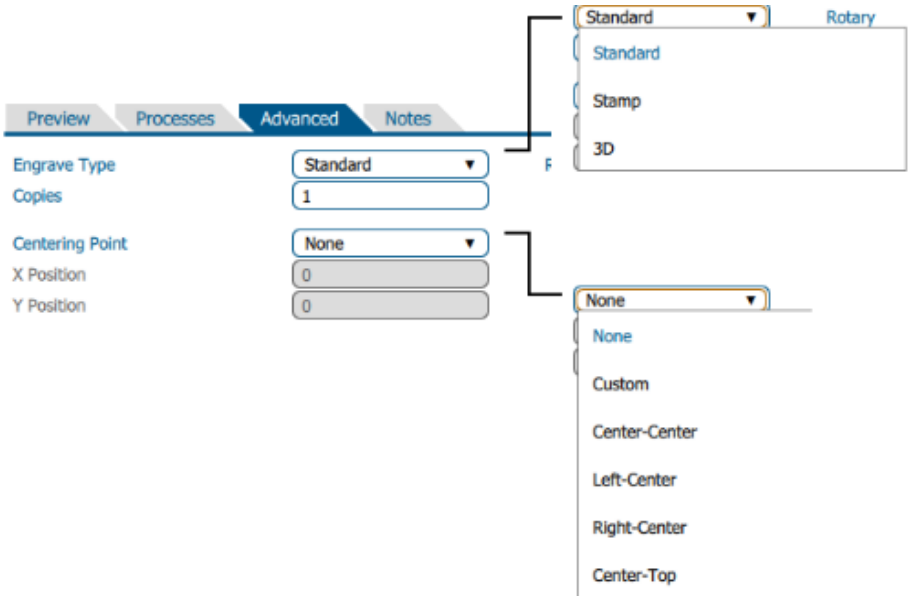
Vector Cutting Options



Engraving Options



Advanced Options



"3D" Engraving options allows you to use a 3D greyscale depth map as an indication of height.

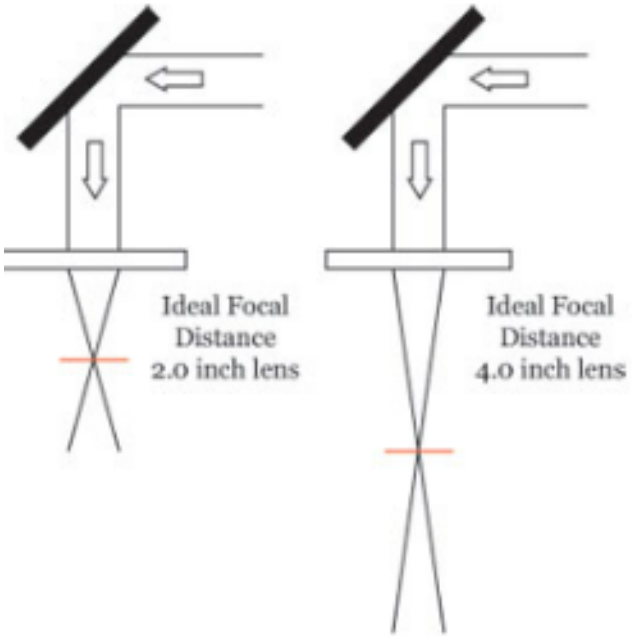
"Stamp" engraving allows engaving with beveled edges for better creation of stamps.

"Center Point" mode allows positioning relative to a specified "center point" on the laser, instead of absolute positioning on the bed (with camera alignment).

Lenses

4" Cutting Lens (Standard)

- Produces focused beam over longer vertical distance
- Specialty lens typically used for engraving within recessed area (bowl or plate).
- Used for deeper cuts - cutting thick materials.
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2" Engraving Lens

- Standard lens on most laser systems.
- Multipurpose for both engraving and cutting applications.
- Recommended for raster engraving from 300 DPI to 600 DPI resolutions.
- Produces spot size of 0.004 to 0.007 inches in diameter.