Dremel Digilab LC40
Laser Engraver/Cutter
Requirements

Be Certified
You must complete Laser Certification Training before using the Laser. By using the Entrepreneurship Garage Laser you certify that you have been trained by Garage Staff and agree to abide by all rules set forth by the Entrepreneurship Garage. **UNAUTHORIZED USE WILL RESULT IN A GARAGE BAN.** Duration of ban will be determined by Garage Staff.

Be Present During Operation
You must always be present when using the Laser, to monitor for fires and other potential hazards! If you walk away, staff or other member are authorized to stop the machine due to the fire risk.

Materials must be Verified to be Laser Safe
If you bring in your own material, you will be required to provide the Material Safety Data Sheet (MSDS). If you cannot provide proof that your material is approved for laser processing, you will not be allowed to use it.

Buying Materials
Materials can be bought at the Hill Library, Home Depot, Lowes, Hobby Lobby, Amazon or other online sites like Inventables.com. Look for laser certified materials.
Guidelines

Certain items are not allowed to be cut or engraved with this device due to catching fire or emitting carcinogens and lethal fumes.

See the list of acceptable materials in this document. Before using any material you must make sure that you know what it is and from where it was sourced.

If you are unsure of the material you have, you are not allowed to use it on the Laser. If you would like to use a material not listed, you must provide the material MSDS sheet and get approval from Garage Staff prior to use.

We use CO2 laser machines. This involves firing a laser which cuts by melting, burning or vaporizing your material. You can achieve a really fine level of cutting detail with a wide variety of materials.

Material Processing Information:

Laser Material Processing Area: 
(W x H) 20 x 12 in

Maximum Part Size: 
(W x H x D) 20 x 12 x 1.25 in

Maximum Engraving Material Dimensions: 
18.4 x 12 x 1.25 in

Maximum Cut Material Thickness: 
.25 in

Do Not Attempt to Cut through material thicker than .25"
Safety

EXPOSURE TO THE LASER BEAM MAY CAUSE PHYSICAL BURNS AND CAN CAUSE SEVERE EYE DAMAGE.

*SAFETY GLASSES ARE REQUIRED WHEN OPERATING THE LASER

(Black Laser Safe Safety Glasses)

NEVER OPERATE THE LASER SYSTEM WITHOUT CONSTANT SUPERVISION OF THE CUTTING AND ENGRAVING PROCESS.

You must remain at the laser for the duration of your cut.

NEVER LEAVE MATERIALS IN THE LASER SYSTEM AFTER LASER PROCESSING HAS FINISHED.

Materials left in the laser cutter are a fire hazard.

ENSURE THE VENTILATION SYSTEM IS OPERATING PROPERLY.

Listen and ensure ventilation system is activated.

SOME MATERIALS, WHEN ENGRAVED OR CUT WITH A LASER, CAN PRODUCE TOXIC AND CORROSIVE FUMES.

These fumes pose a high health risk and can cause death.
Materials

Category | Materials
--- | ---
Woods | Untreated Plywoods, Untreated Hardwoods, Basswood, Balsa Wood, Masonite or Hardboard (etch only)
Plastics | Acrylic (Cast, Extruded, non-reflective), Mylar (non-reflective)
Paper/Cardboard | Construction paper, Corrugated Cardboard
Other | Soda lime glass (will only etch, cannot be mirrored), Kapton, Carbon Fiber Mat (untreated, no resin)

If your material is not listed, DO NOT USE on Garage Lasers. Consult with Staff if you have questions.

### Banned Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Danger</th>
<th>Cause/Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>Carcinogens</td>
<td>Residues in the laser cutter can be carcinogenic. It's disgusting, dangerous, and you don't want to eat it.</td>
</tr>
<tr>
<td>Acrylonitrile butadiene styrene (ABS)</td>
<td>Emits cyanide gas, melts, bursts into flame</td>
<td>Tends to melt rather than vaporize, leaving behind gooey deposits on the honeycomb bed. Easily bursts into flame. Also engraves poorly (again, it melts rather than etches).</td>
</tr>
<tr>
<td>Coated carbon fiber</td>
<td>Emits dangerous fumes</td>
<td>The coating emits dangerous fumes. Thin, uncoated carbon fiber mat can be cut, but will fray along the cut edges</td>
</tr>
<tr>
<td>Chlorinated plastics (PVC, vinyl, pleather/artificial leather, Sintra, Kydex)</td>
<td>Emits chlorine gas when cut</td>
<td>Destroys the focus lens and mirrors, corrodes metal parts and motion control system.</td>
</tr>
<tr>
<td>Polyoxymethylene (POM) or Delrin</td>
<td>Emits dangerous fumes</td>
<td>Formaldehyde cause skin, eye, and respiratory irritation and allergic reactions and cancer in rat studies.</td>
</tr>
<tr>
<td>Dureflex</td>
<td>Emits dangerous fumes</td>
<td>Produces hydrogen cyanide; it will kill you.</td>
</tr>
<tr>
<td>Fiberglass</td>
<td>Emits dangerous fumes</td>
<td>Glass can't be cut, and the resin emits dangerous fumes.</td>
</tr>
<tr>
<td>Galvanized metal</td>
<td>Emits dangerous fumes</td>
<td>Zinc fumes are poisonous. Galvanized metal should never be super-heated (so don't weld on it either).</td>
</tr>
<tr>
<td>High-density polyethylene (HDPE)</td>
<td>Catches fire and melts</td>
<td>Do we need to say more? Don't use it!</td>
</tr>
<tr>
<td>Medium-density fiberboard (MDF), light-density fiberboard (LDF) or other particle board</td>
<td>Generates high amounts of smoke</td>
<td>Detrimental to lenses and mirrors.</td>
</tr>
<tr>
<td>Mirrored surfaces</td>
<td>Will not cut, reflects laser beam</td>
<td>Mirror surfaces can reflect the laser beam, damaging the cutter's interior components. Some mirrored materials can be placed reflective-side down and cut.</td>
</tr>
<tr>
<td>Polyetherimide (PEI), EVA foam, or any other plastic/foam</td>
<td>Emits chlorine gas</td>
<td>Laser cutting these materials produces smoke and toxic gases that corrode the interior of the laser cutter.</td>
</tr>
<tr>
<td>Polycarbonate Lexan</td>
<td>Cuts poorly, discolors, catches fire</td>
<td>Polycarbonate absorbs infrared energy, and thus cuts very poorly—tends to melt or burn instead. Surfaces near cut edges discolor badly.</td>
</tr>
<tr>
<td>Polystyrene foam</td>
<td>Catches fire</td>
<td>This is the #1 cause of laser fires!</td>
</tr>
<tr>
<td>Polypropylene foam</td>
<td>Catches fire</td>
<td>Just as bad as polystyrene, with the added feature of leaving behind rock-hard deposits.</td>
</tr>
<tr>
<td>Pressure treated wood</td>
<td>Emits dangerous fumes</td>
<td>Should never be burned—not in your fireplace, and definitely not in our laser.</td>
</tr>
</tbody>
</table>
The following process assumes that the reader intends to both Cut/Etch and Rast in the same session, if this is not the case you can simply omit the steps as needed.

1. Locate and open the ‘Digilab Template.ai’ located on the computer’s desktop. Your view should be similar to below:

2. Save a new version of the template under the name of your choice. This ensures anyone using the laser after you will have access to the same unaltered template.
3. Confirm that you are developing in the new .ai file. You should see the name of the document in Adobe Illustrator change as below:

![Before and After Images]

4. Add images and shapes you intend to Rast to the ‘Rast (.jpg)’ layer in the Illustrator file. Include white space as needed.

   a. Ensure you are in the right layer by double clicking on the ‘Rast’ layer in the 'Layers' section, as shown below (The outline of anything added to the layer should mimic the color of the Rast layer):

   ![Layer Selection](image)

   If a shape or image is not located in the proper layer you can simply drag the box located to the right of the layer the shape is currently in and move it to the appropriate layer, as shown below:
b. Place images and shapes as needed. Once finished click the eye icon located to the left of the ‘Rast’ layer. This should lead to a blank screen, which confirms that all of the pieces are currently located in the ‘Rast’ Layer.

5. Add images and shapes you intend to Cut or Etch to the ‘Cut/Etch (.svg)’ layer in the illustrator file. Repeat steps 4(a) and 4(b) for this layer.  
   **Note:** The Color used to define Etch and Cut doesn’t matter, however in order to ensure the Cut and Etch operation are interpreted properly, the colors chosen should be different (i.e. purple and green). Any shape created in this layer should have **NO FILL**, to avoid additional cut paths being added to the file, which will lead to an improper cut.

An example of a completed file shown below:
6. Now that the document has been set up properly it is time to export each layer to the appropriate file type. In order to export only a single layer make sure the eye icon is turned off for all other layers.

- Both Layers Visible
- Rast Layer Only

   a. Export the **Rast layer** as a "*.jpg" file type. Digilab software only allows JPEG filetypes for Rast operations.

   **File > Export > Export As...**
b. Set ‘Save as type’ to JPEG and set JPEG options as needed (Recommended to leave JPEG options as-is)

Output for Rast Layer

![Image of NC State University logo]

File > Export > Export As...

c. Export the Etch/Cut layer as an ".svg" file type. SVG filetypes only contain information pertaining to cut and etch operations.
d. Set ‘Save as type’ to SVG and set SVG options as needed (For text cutting/etching ensure ‘Font:’ is set to ‘Convert to Outlines’)

The resulting .jpg and .svg files are what will be used in the Dremel Digilab software to perform laser cutting.
Engraving/Cutting - Digilab Software

Once your file is prepared in Adobe Illustrator you can begin the engraving/cutting process.

1. Check to ensure that there are no materials or debris in the laser processing area.

2. Ensure that your material is safe to use in the laser and adheres to the material processing guidelines set forth in this document.

3. Log into the connected desktop with the proper user/pass.

4. Turn on Dremel Digilab via the power switch located on the back right corner of the device. You should hear a fan kick on and the touch screen on the Digilab will light up.

5. Open up an instance of Microsoft Edge, go to favorites and select ‘Dremel Digilab’

Your screen should look like the image below:
6. Place the material you intend to cut or etch into the Digilab material processing area.

7. Focus the Laser

a. Find the focusing puck in the puck holder attached to the Dremel Laser machine.
b. Ensure the laser is over your material. You may need to use the movement controls to move it into position.
c. Place the puck between your material and the laser.
d. Locate the thumb screw above the laser. You're going to loosen and tighten this screw on the laser head to move the laser head up and down to focus.
e. Once you've got the laser head resting gently on top of the puck, tighten the screw because now you're focused.
f. Put the puck back in the holder.
8. Hover over the import icon and then click on the dropdown labeled ‘capture’ and then click next again on the following popup.

The resulting workspace will now have the location of your material as the background image:
9. Import your cut/etch and rasts layers into the program. You can only upload one file at a time so you need upload each layer separately. This will likely cause the placement of the layers to be off.

10. Adjust the location and scale of each layer as needed, using the background image of your material as a guide to ensure the cut and rast won’t go off the material.

   ![Good Location](image1)
   ![Bad Location](image2)

   a. As an added check you can click the ‘Run Perimeter’ button. This will cause the laser to circle the active cut area, and can be used as an added visual confirmation that you are cutting in a good area. (the laser will not active during this process)
11. Set correct settings for the **Rast layer**. If the file is formatted correctly, clicking on the Rast layer will pull up the engrave box.

   a. Most settings in this panel are straightforward. If you intend to rast an image with multiple intensities (multiple shades of gray like a black and white image) as opposed to simply black and white, enable the 'Grayscale' option.

12. Set correct settings for the **Etch/Cut layer**. If the file is formatted correctly, clicking on the Etch/Cut layer will pull up the Cut/Score box.
a. Set each of the colors to indicate either a cut or score (etch) function and their respective speed, heats, and depths.

13. Set Material type and thickness from the icon menu.

14. Using the Dremel Digilab touch screen (on the machine), confirm the Laser head is adjusted, your material is laserable, and that you will remain by the laser by clicking the three appropriate green bubbles.

15. Double press the blue button below the touch pad and your cut will begin!

Stay Next to the Laser for the Entire Duration of your Cut! DO NOT OPEN the Lid while the Machine is Operating!
Addressing Errors and Problems

1. If your laser operation produces a **large flare up** while operating, immediately stop your job. This is an indication that your Power setting is too high for the intended operation/material. This is also a sign that you may be using the wrong or incompatible material.

2. If you are unable to cut through your material cleanly after a few attempts, this is an indication you are using a material that is not laser compatible.

3. If your **Material Catches Fire**.

   - **Stop the operation Immediately** and **Unplug** the device.
   - **Alert Staff**. If Staff is unavailable and the fire hasn't died down, **Use the Fire Extinguisher** to extinguish the fire.
   - If the Fire has become **Uncontrollable - Pull the Red Emergency Pull Station** to alert the Fire Department.

For all other issues alert Staff or send an email to ncstate-ent-garage@ncsu.edu
Post Cut Process - Clean-Up & Shutdown

Follow the steps outlined below before removing your completed parts.

1. Once cutting is complete allow the laser cutter to sit for a minute or two as the vent clears any smoke and other particulate matter.

2. Use the Digilab touchscreen to home the laser. This gets it out of the way so the material is safe to remove.

3. Gently lift your material without moving it to ensure that all cuts went all the way through the material. You may need to run your cuts again if the laser didn't cut all the way through the material.

4. Remove all material from the laser processing area.

5. Clean up the area around the laser.

4. Turn Off the Dremel Digilab.

5. Log Out of the computer.

5. Marvel at your finished creation!