

InnovationStudio



Gloucester County Library System

Universal Laser Systems VLS3.50 Laser Cutter/Engraver

Safety and Operation Guide

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WARNING

The laser cutter is a potentially dangerous machine. The most common safety risk while using the laser cutter comes from fire. The laser cutter can also produce dangerous fumes (e.g., chlorine), if used with improper materials.

Operators must receive training prior to use of the laser cutter.

The cutter must remain under constant supervision while in use.



System Specifications

Laser power:	30W
Work area:	24 x 12 in (610 x 305 mm)
Maximum part size:	26.75 x 14.6 x 4 in (679 x 370 x 102mm)
Motorized Z axis lifting capacity:	20 lbs (9 kg).
Available Lenses:	2.0 in (51 mm).

For more detailed specifications please see [Universal Laser Systems](#).

General Capability

Our Universal Laser Systems Laser can be used to either etch designs into materials or completely cut through them. It does so by concentrating a laser beam and burning through the material. The burning process sometimes creates smoke, however the laser cutter uses a vacuum to ensure the internal environment does not remain smoky.

The machine utilizes a 30 watt, air cooled, sealed CO₂ laser to cut up to ¼” acrylic, wood, and paper, among other materials. It can also etch vector (line/arc) and perform raster (image) engravings into these materials. Varied cutting speeds, power levels, and pulses per inch (PPI) allow some modulation of etching, making some limited forms of three dimensional relief possible. However, the laser cutter is primarily a 2D cutting and etching tool, with the third dimension achievable through stacking or assembly of multiple laser-cut elements or layers.

All users must undergo a certification/training session to learn how to operate the laser cutter/engraver before they can use it on their own.

Laser Cutter Safety

The most common safety risk while using the laser cutter comes from fire. Anyone using the cutter must sit in front of it and watch their entire job until it is finished. Failure to do so may result in damage to the machine and possible bodily harm to the user and other makerspace users.

NOTE: If at any time during cutting you notice anything unusual, shut off the machine immediately! This includes fire, loose parts, warped materials, or anything that looks or sounds strange to you

WHEN IN DOUBT, SHUT IT OFF!

General Safety

- All materials used on the laser cutter must be approved by GCLS Makerspace staff prior to cutting (see details below).
- Eye protection in the form of laser-rated safety goggles is required by all users. Safety goggles are available for loan from GCLS staff. Please note regular glasses (even safety glasses) are not adequate.
- Cell phones/texting, and laptop or desktop use are not allowed while monitoring a cut.

- After your job finishes cutting, the enclosure lid must be left shut for at least 60 seconds to allow for smoke and fumes to be exhausted.

Fire Protocol

Any fire lasting more than half a second must be controlled. This list of steps begins with the simplest and escalates. Follow as many steps as necessary to extinguish any fire:

1. Lift the top door. This often stops small flames.
2. Turn off the exhaust system.
3. Remove the material if it is safe to grab a corner.
4. If your job begins to produce large flames and/or excessive smoke, immediately notify the nearest GCLS staff member.

Notify GCLS staff immediately, even if a fire is small and easily extinguished. It's important to know why it occurred, assess any damage, and prevent it from repeating. Discontinue using the laser until GCLS Makerspace staff have assessed that it is okay to resume.

Circumstances that can cause fire:

- Files with lots of dense geometry very close together. This can cause the laser to repeatedly cut the same area, build up heat in one area and ignite it
- Similarly, power settings too high for the material being cut and/or speed settings too slow
- The laser is not focused properly (focus carriage is too close or too far from material). The laser must be focused manually, and material thickness must be entered by the user. Ask GCLS Makerspace staff to assist with this.
- Attempting to cut materials on top of each other
- Always remove all material including scrap material from the machine after use. It is required to remove the cutting table and clean out the interior. Scrap material left in the laser system including materials that collect in the removable cutting table can be a fire hazard.
- Exposure to the laser beam may cause physical burns and can cause severe eye damage. Proper use and care of this system are essential to safe operation.
- Properly using the installed fume exhaust system is mandatory when operating the laser system. Fumes and smoke from the engraving process must be extracted from the laser system and filtered.

Laser Work Space Etiquette

- If a laser system breaks or is damaged while you are using it, inform GCLS Makerspace staff immediately. Equipment damage is a normal part of the shop environment; for safety reasons it is important to inform a staff member immediately.
- Always clean up fully after yourself. No material scraps should remain in the makerspace or in the machine.
- If a laser system is not cutting material, the lens may need to be cleaned. Do not increase the intensity as this can cause the lens to burst. Notify a GCLS Makerspace staff member, so the lens can be cleaned if needed.

Costs

Operators must pay a \$5.00 minimum usage charge for the first hour, and \$2.50 for each additional half hour rounded up. **See below for materials costs.**

Laser Cutter Materials

All materials used on the laser cutter must be approved by GCLS Makerspace staff prior to cutting. Some materials can be extremely toxic and/or damaging to the machine. Reflective materials should never be cut, as they can cause the laser beam to reflect and bounce out of the enclosure. **Do not attempt to cut any unapproved materials;** doing so will result in your being banned from use of the system. GCLS Makerspace staff are available to answer questions about materials.

Laser Safe Materials

Remember that all materials create fumes when laser cut. "Safe" materials are judged as such by not being overly combustible or releasing corrosive, mutagenic, or poisonous gases when laser cut.

GCLS offers the following **materials for purchase** in the makerspace:

- **1/8" Baltic Birch plywood** - use settings for Medium Wood > Birch in the the ULS database. - \$0.01 per square inch, rounded up.
- **1/8" Cast Acrylic** (clear, white, black) - \$0.05 per square inch, rounded up.

Materials costs in square inches, rounded up, will be calculated by GCLS staff, and include waste material created by the cut design within a rectangular area.

Other Acceptable Materials

When provided by the the user, the following materials must be approved by GCLS Makerspace staff prior to cutting. A receipt showing the type and source of the material, and a Safety Data Sheet (SDS) must be presented to staff as part of the approval process. **GCLS reserves the right to refuse use of any material in the laser cutter/engraver for any reason.**

- **Paper / Cardstock** - can be both etched and cut
- **Wood** - can be both etched and cut
- **Interior Grade Plywood**
- **Cast Acrylic** can be cut or rastered (has a frosted, translucent appearance)
- **Extruded Acrylic** - can be cut (does not frost when etched)
- **Delrin** - hard plastic, good for mechanical parts like gears (available in different hardnesses)
- **Cotton / Felt / Hemp** - cuts well, engraves well
- **Polyester fabric** - cuts okay, edges melt a bit, doesn't engrave well
- **Leather** - natural leather only, not synthetic "pleather"
- **Anodized Aluminum** - can be etched (Black anodized aluminum provides best contrast out of all anodized aluminum)
- **Ceramic / Stone** - Engraving is possible on porcelain, ceramic, terracotta slate, marble and stone
- **Brass** - Uncoated brass can not be etched with a laser, it needs to have some kind of coating (such as paint).
- **Glass** - Can be etched only. Must be flat. Etching colored glass has best visual results.
- **Rubber** - Buna-N Rubber, Polyurethane rubber, natural rubber (no nitrile rubber or any chlorine-containing rubber)

BANNED Materials

For your health safety and others in the shop, processing any material that is not laser-safe is against GCLS Makerspace policy.

- **PVC** (aka Polyvinyl chloride, vinyl, pleather) is not laser safe. Chlorinated materials (are corrosive to the machine and toxic)
- **Chlorinated rubbers** also release chlorine. Some paints contain chlorinated rubber.
- **Nitrile rubber** releases hydrogen cyanide when combusted
- **Polystyrene foam (aka Styrofoam)** - Melts and catches fire. Very dangerous.
- **Almost any foam** - Including Foam core, polypropylene foam, etc. Very dangerous.

- **Construction grade plywood** - Most plywood sold in hardware stores is not bonded with modified adhesives making it prone to smoking, flaming, charring at the edges and producing toxic fumes.
- **ABS** off-gases hydrogen cyanide in fumes, a chemical known to be very toxic and has been used as a chemical warfare agent.
- **Polycarbonate** (aka **Lexan**) - absorbs infrared radiation, causing it to melt and warp. Looks very similar to acrylic sheets.

Design & File Setup

See our **Design & File Setup guides** for Adobe Illustrator and Inkscape for instructions.

System Operation

Clean off the honeycomb cutting bed. Debris can be a fire hazard.

GCLS Makerspace staff will check, and if necessary, clean the mirrors and lenses.

Load and Position Material

- Place material in the upper left corner being careful not to dent the bed.

Focus

- Place the base of the focusing tool flat on your material, and line it up slightly in front of the laser head.
- Use the up and down arrows on the laser system control panel to adjust the height of the bed. Use caution when moving the bed as it can crash into the laser carriage.
- Focus is set when the lip of the focusing tool is aligned with the bottom edge of the laser carriage. The flat part should be flush with the face of the lens carriage, with the focusing tool sitting flat.

Remember to set the focus anytime you start using the machine, as well as when you switch to a material with a different thickness/depth.

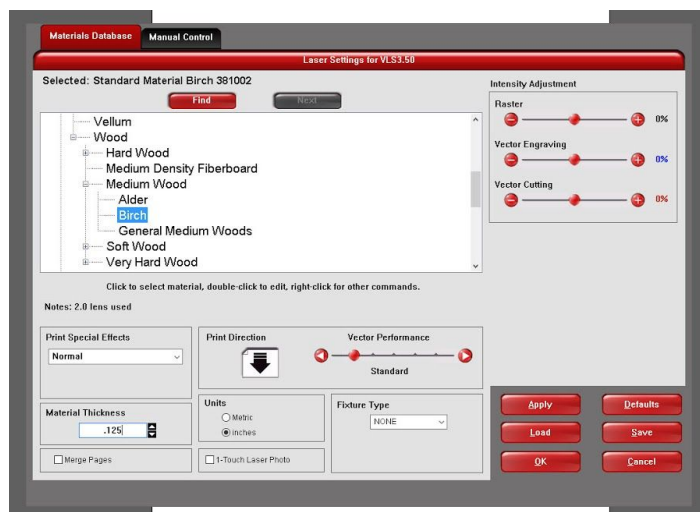
Send the Design to Universal Control Panel

1. While still in Illustrator, click Print to open the printing options.
2. Click "set up" in the bottom, right corner
3. Open the preferences dialog. This will load the laser cutter's material settings database.

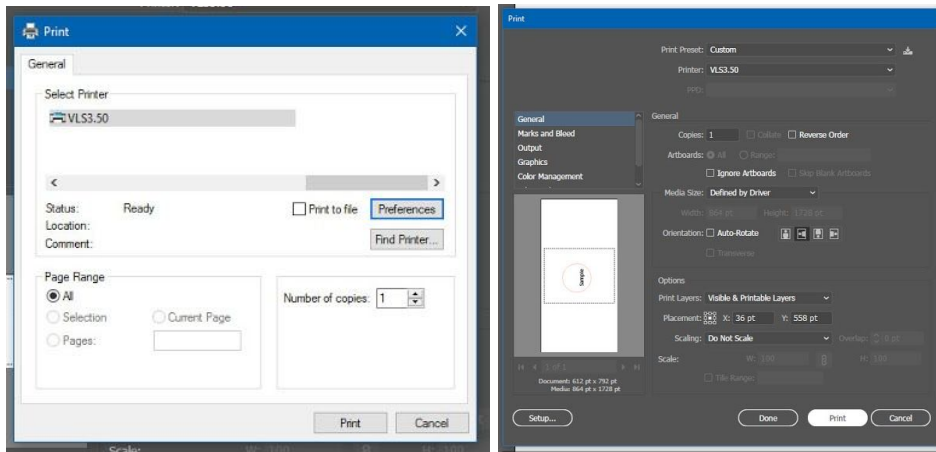
Laser Cutter Interface

Vector cutting depth and raster engraving depth (or marking intensity if you are surface marking only) are controlled by specifying the speed of processing and the laser power level for raster engraving and by specifying the speed of processing, laser power level and number of pulses per inch (PPI) for vector cutting and marking.

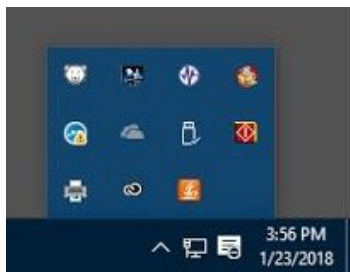
These parameters are specified in the laser cutter preferences interface by one of two methods. The two methods are laid out in tabs in the laser cutter interface. The first method is a materials database method which simplifies setup for beginners and casual users, the second method is a manual method with allows much more control for advanced users. Each method treats assignment of laser job settings to colors in the graphic being printed and interpretation of raster and vector elements in the graphic being printed in slightly different ways.



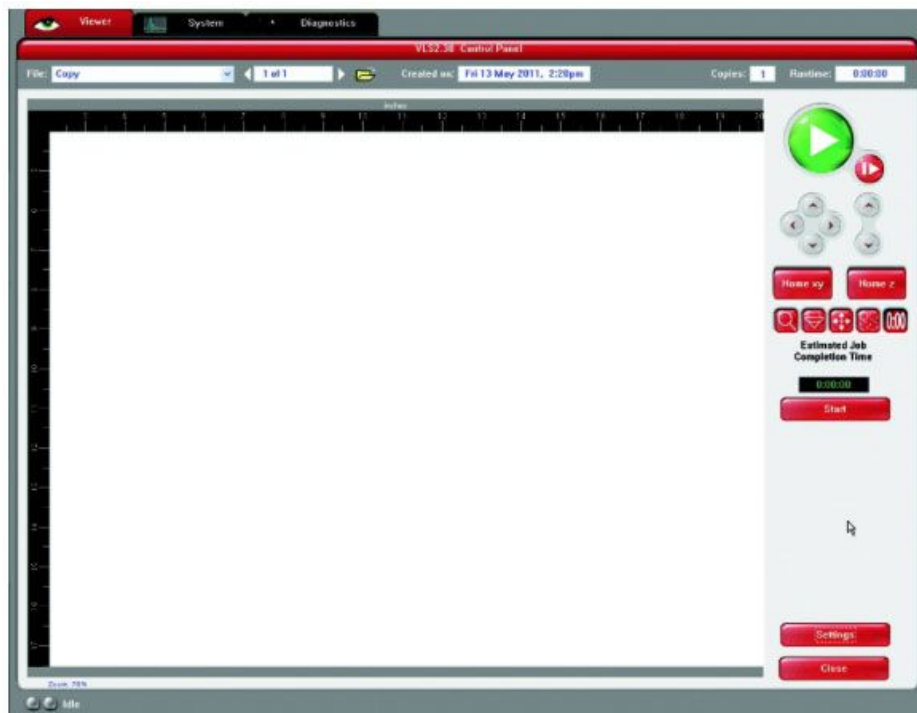
1. Materials are listed under various categories. Under the appropriate category or sub-category, select the material you are processing.
2. Enter the **material thickness**. Use calipers to measure the thickness accurately.
3. Click **Defaults** to reset the **Intensity Adjustment** sliders to 0%. Only adjust vector cutting intensity if needed.
4. Click **OK**, then click **Print** through both of these dialog boxes:








5. At the bottom right of the screen, click the Universal Control Panel icon.



It will load the geometry into this screen.



Basic View (default mode)

	<ul style="list-style-type: none"> • The Basic View shows a preview window of the job currently selected. • The cursor becomes a magnifying glass (Zoom Tool) if you pass it over the preview window. Left-clicking the mouse zooms in and right-clicking zooms out. (Mouse scroll wheel can be used in any mode to zoom in and out.) • Selecting the Settings button takes you back to the printer driver interface to allow you to change most of the settings for the job selected. Keep in mind that some settings cannot be changed after printing from your graphics program, such as print density and vector quality. If a setting is not adjustable after printing from your graphics program, it will be grayed out or not appear at all when you press the settings button in the UCP.
	<p>The Focus View feature allows you to quickly manually move the focus carriage to a desired position in the material processing field. This is useful for focusing, as well as testing whether the geometry falls within the material.</p>
	<p>The Relocate feature gives you the ability to move the image in the selected job to another area of the engraving field. This feature does not permanently modify the original image location.</p>
	<p>The Duplicate feature gives you the ability duplicate an image in a grid pattern. You can select how many rows and columns of the image as well as the spacing between the rows and columns.</p>
	<p>The estimate feature approximately calculates the amount of time it will take the laser system to process the selected job. For more complex jobs, the estimate feature can take awhile to estimate the job completion time. A job can be estimated while a machine is disconnected or turned off.</p>

Before Starting The Laser Cutter

1. Always ask a GCLS Makerspace staff member, if you have any issues setting up your cut file or preparing the laser cutter.
2. Make sure the material is positioned correctly within the engraving area, and the geometry is positioned correctly in the Control Panel.
3. Close the top door.
4. Start the **BOFA fume exhaust system** using the power switch on the rear of the unit.

Making Your Cut

1. Press the green START button on the UCP to begin laser processing.
2. The cutter must remain under constant supervision while in use.

After Your Job Finishes Cutting

1. Keep enclosure lid shut for at least 60 seconds to allow for smoke and fumes to be exhausted.
2. Shut down the BOFA fume exhaust system.
3. Ensure that the area is cleaned up. Please pick up knockouts and other scrap from your work and remember to remove your scrap when finished.
4. Any files you copied to the computer will be deleted when the computer restarts, so make sure you back the files up to a USB drive.