

WPI Laser Cutter User Guide

The laser cutter is capable of cutting and engraving two-dimensional drawings in various materials including wood and plastic. The laser cutter owned by the WPI Department of Mechanical Engineering is a Versalaser VLS-4.60 by Universal Laser Systems. It has a 60-watt laser and a 24" x 18" cutting platform. It can cut materials up to ½" thick.

The laser cutter is connected to a PC and is interfaced much like a printer or plotter. Although just about any software package may be used for sending a 2D drawing to the laser, the recommended applications are AutoCAD and Visio.

Materials that can be cut on this laser include: plastic (acrylic and delrin), wood, rubber, and cardboard/foamboard. Other materials may also be cut or engraved, but be sure to consult the manual first. The machine is **NOT capable of cutting any metal** and requires a special procedure for engraving/marketing certain metals. Be 100% sure that a material may be cut before attempting, the laser cutter is a valuable tool and certain materials may damage its optics. Also, note that certain materials may look similar, but are not equivalent – Acrylic sheets cut incredibly well and **polycarbonate (Lexan) may not be cut** on this machine (it will flare up and melt).

All users must undergo a training session to learn how to operate the machine before they can use it on their own. Once you have completed the training and have been approved to use the machine, follow the steps below to make your part.



Please note that this guide is intended to supplement, not replace, the user guide provided by ULS.

Prepare a Drawing

Any 2D drawing may be sent to the laser cutter from just about any software application. However, the recommended and supported application is AutoCAD. Microsoft Visio also works well for simple drawings and developing parts or test objects on the fly. Please prepare your part drawings BEFORE coming to the laser cutter. If the parts were generated in a 3D modeling software such as Pro/E or Solidworks, you will need to generate a 2D drawing of the parts. Keep in mind that only planar parts may be manufactured. Make a drawing from within the CAD software including only the appropriate view with no hidden lines, dimension or notes, or border. If making multiple parts at once, they may be combined at this step. Save the drawing as either a DWG or DXF file for import into AutoCAD.

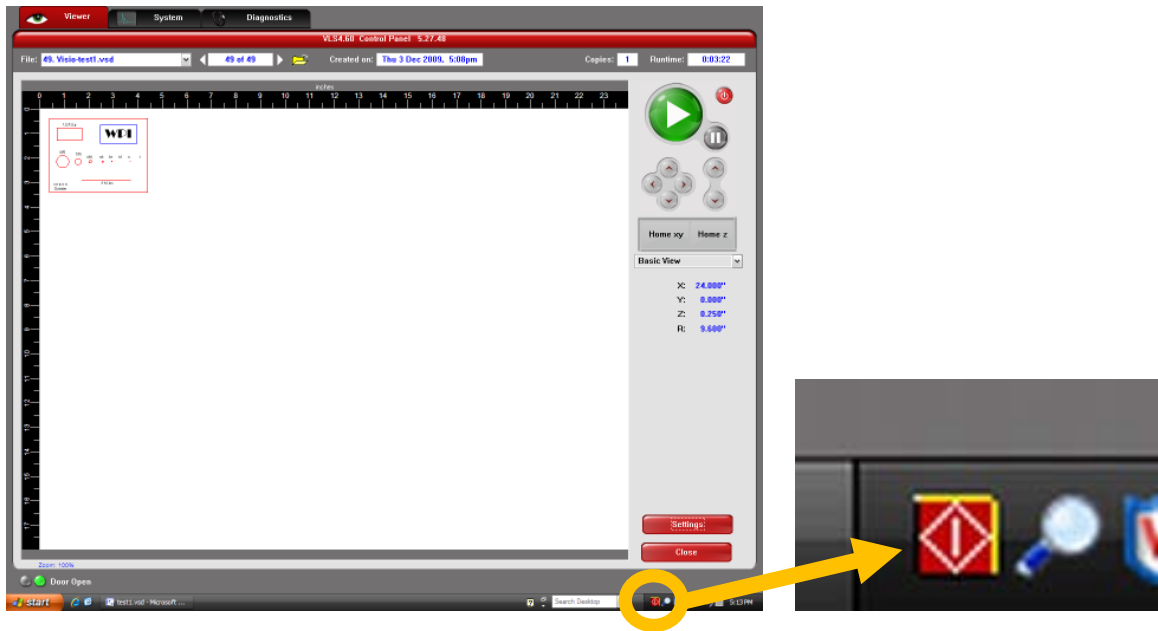
Specific drawing requirements:

- Import drawing into AutoCAD
- Ensure that the scaling is correct. Either inches or mm may be used.
- Make sure that the parts will fit in 24" wide by 18" high.
- Set the appropriate line colors corresponding to cutting power. Although other settings may be used, it is recommended to use the default settings:
 - RED – Vector cutting (typical cutting)
 - BLUE – Vector engraving/scoring (engraving of lines and block letter text)
 - BLACK – Raster engraving (engraving of images and most text fonts)
- Set the line width:
 - 0.001" (1 mil) works well in standard units
 - 0.05mm (50um) works well in metric units
- Combine parts within AutoCAD if multiple parts are to be manufactured at once.

Note that you may save files and configurations on the laser cutter PC. Please use a temporary directory under your name within "My Documents." However, this computer has many users and may be subject to periodic cleaning. ALWAYS KEEP YOUR OWN BACKUP COPY OF FILES AND CONFIGURATIONS. We can not be responsible for items left on this computer.

Preparing the Laser Cutter

1. Enter your name, contact info, project, and date/time into the log sheet.
2. Log in to the computer
3. Ensure that the software driver is active. The red icon, shown below, opens the driver. The driver is connected to the laser cutter when the buttons are active.



4. Turn on the laser cutter by pressing the power button below. Note that the laser **will only turn on with an active USB connection** to the PC – please be sure that the computer is on and logged in. If it will not turn on, first check the power cord. If required unplug and replug the USB wire – if asked to approve a new hardware install just click OK.



5. Turn on the exhaust blower. The blower must **always be operating** and venting properly while the laser cutter is on.

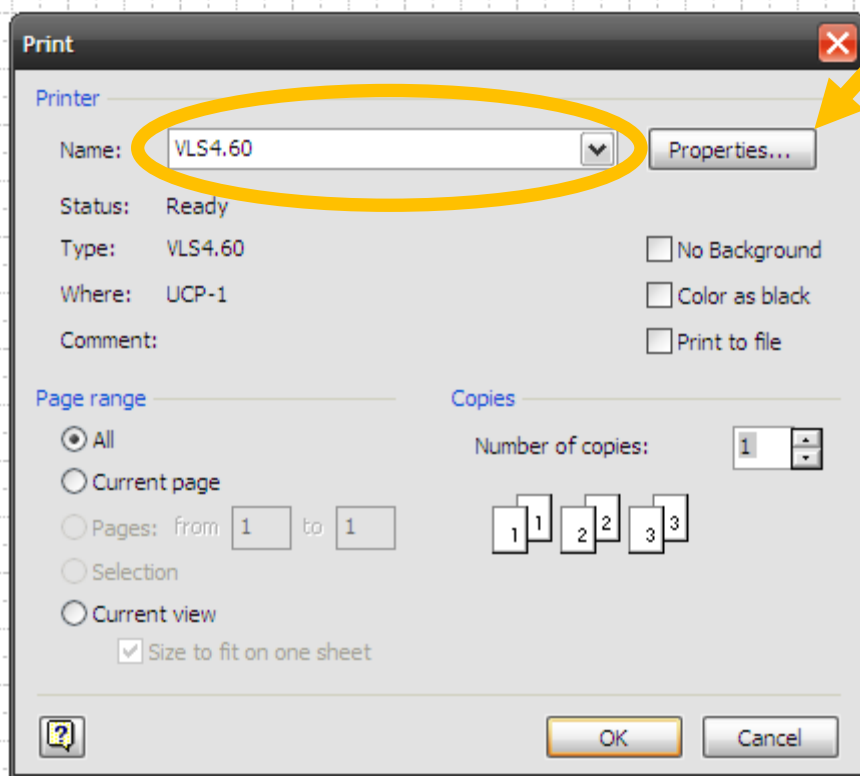


6. Open the cover to the cutting platform. This enables the interlock to prevent cutting until ready.

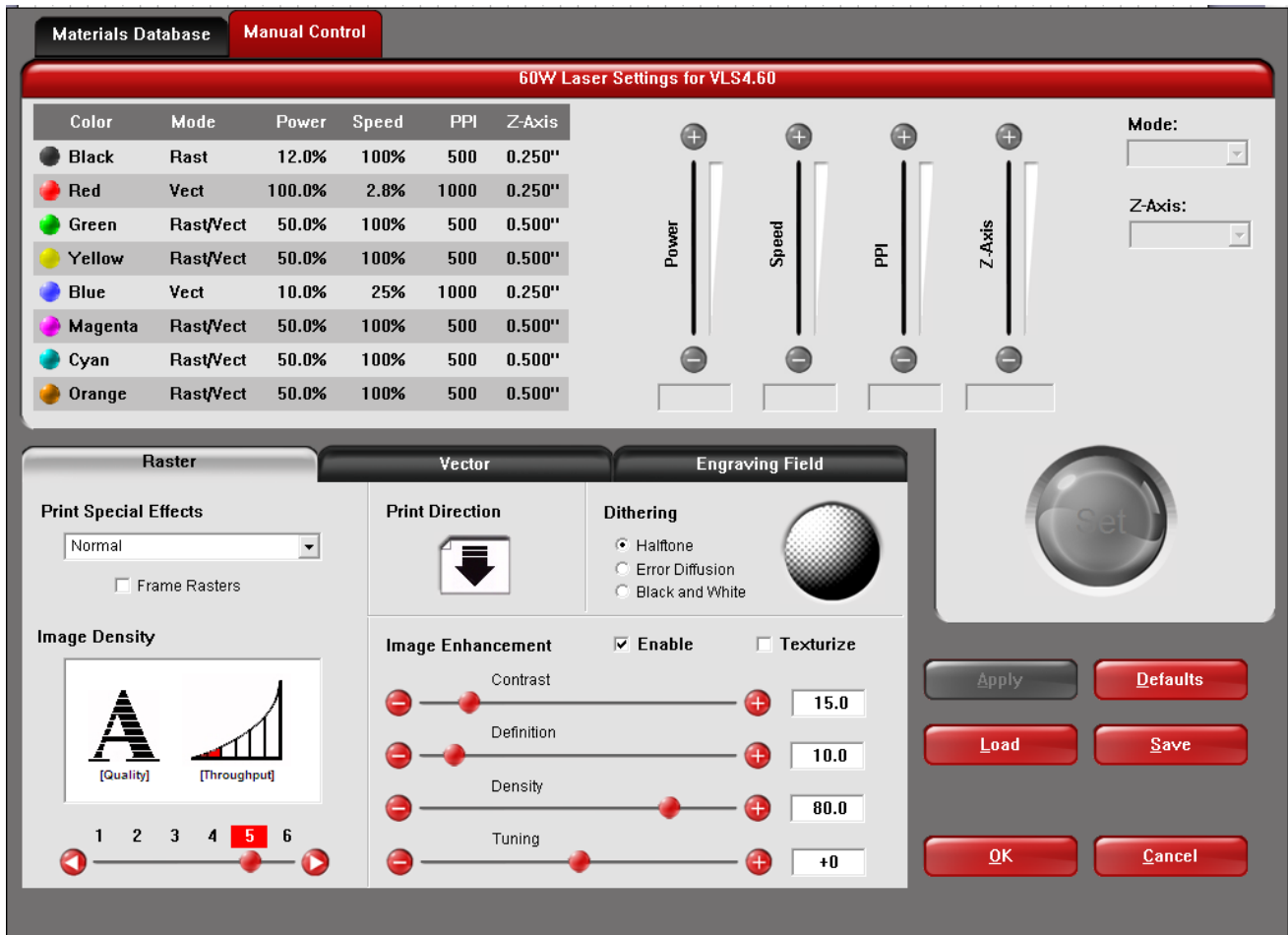


Preparing to Cut

1. Load the drawing generated before into AutoCAD (or other software package).
2. Ensure proper colors and line widths. Use the default color settings if possible.
3. Confirm that only the desired parts are displayed with no borders, hidden lines, or other marks.
4. Combine multiple parts and/or duplicate parts in the CAD software as required prior to sending to the laser cutter.
5. Select “Print” or “Plot” in the selected application.
6. In the Print dialog, select the “VLS4.60” printer. The laser cutter is controlled like a print driver.



- To configure the laser cutter settings, click the “Properties” button shown in the previous figure. In AutoCAD you will next to take the additional step of selecting “Custom Properties.” This will bring up the laser configuration screen shown below.



The default colors are:

- RED – Vector cutting (typical cutting)
- BLUE – Vector engraving/scoring (engraving of lines and block letter text)
- BLACK – Raster engraving (engraving of images and most text fonts)

For each color, set the “Power”, “Speed”, and “Pulses per Inch (PPI)”. Also set “Mode” to VECTOR (line) or RASTER (image) as necessary. The Material Database and other user’s setting can be used as a starting point. Change the settings by selecting the color, adjusting the values, and clicking “Set”.

The “Material Database” tab allows you to select your material type and thickness. If you select a material and thickness in the “Materials Database” tab, it will automatically show up and overwrite the existing settings. Although these often provide a good starting point, do not blindly trust the setting generated from the materials database without testing first. Note that it will use the default color scheme listed above.

The Z-Axis setting is used for focusing the laser by offsetting the cutting table height. If “Z-Axis” is ENABLED, the laser will Auto focus. In this case, be sure to set the appropriate material thickness for each line color. In most cases, “Z-Axis” should be ENABLED to use auto focusing.

Alternatively, “Z-Axis” may be DISABLED and you will have to set the focus manually as described later.

THE ABOVE SETTING SHOULD BE SET BASED ON CUTTING A SIMPLE TEST PART. SETTINGS AND PERFORMANCE WILL VARY BASED ON THE MATERIAL TYPE AND THICKNESS USED.

8. Save your settings to your own directory if you plan to reuse them. If cutting the same material and thickness as a previous part, you may also load a previously used setting.
9. Click OK to set the laser cutter settings.

Note that the settings may not remain the same if you select “Print” again. **Always confirm the laser cutter settings.**

10. In the software Print dialog, confirm that the part is in the appropriate location and is scaled correctly. The ideal location is the upper-left corner of the sheet to ensure that it is not clipped when imported into the laser cutter software.

In AutoCAD: the “Plot Area” should be set to EXTENTS to plot the whole part (assuming it’s set up correctly with no border).

Scale should be set to 1:1 unless the units are incorrect or it was not appropriately scaled in the CAD software

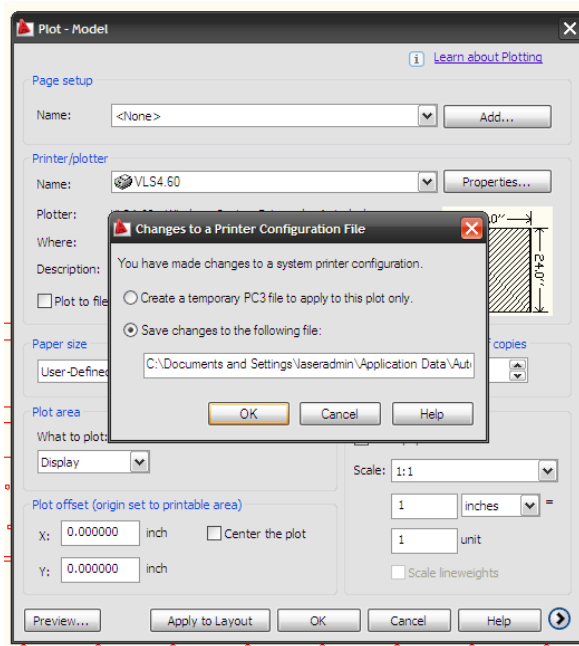
Set the Plot Offset to either CENTER for small parts or [0,0] for large parts. This ensures the part drawing is not clipped later.

If prompted, the page size should be set to a user defined value of 24” x 18”. If not set correctly, large parts may be clipped when sent to the laser cutter software.

Check the “Preview” to ensure the part is scaled and located correctly. Adjust the coordinates if the part is not fully visible when imported into the laser software.

11. Select “Print” or “OK” to send the job to the laser cutter.

In AutoCAD, you may be prompted with a question to save the changes. Select the 2nd option and click OK. You may also save a custom print setting in “Page Setup” before clicking “OK”.

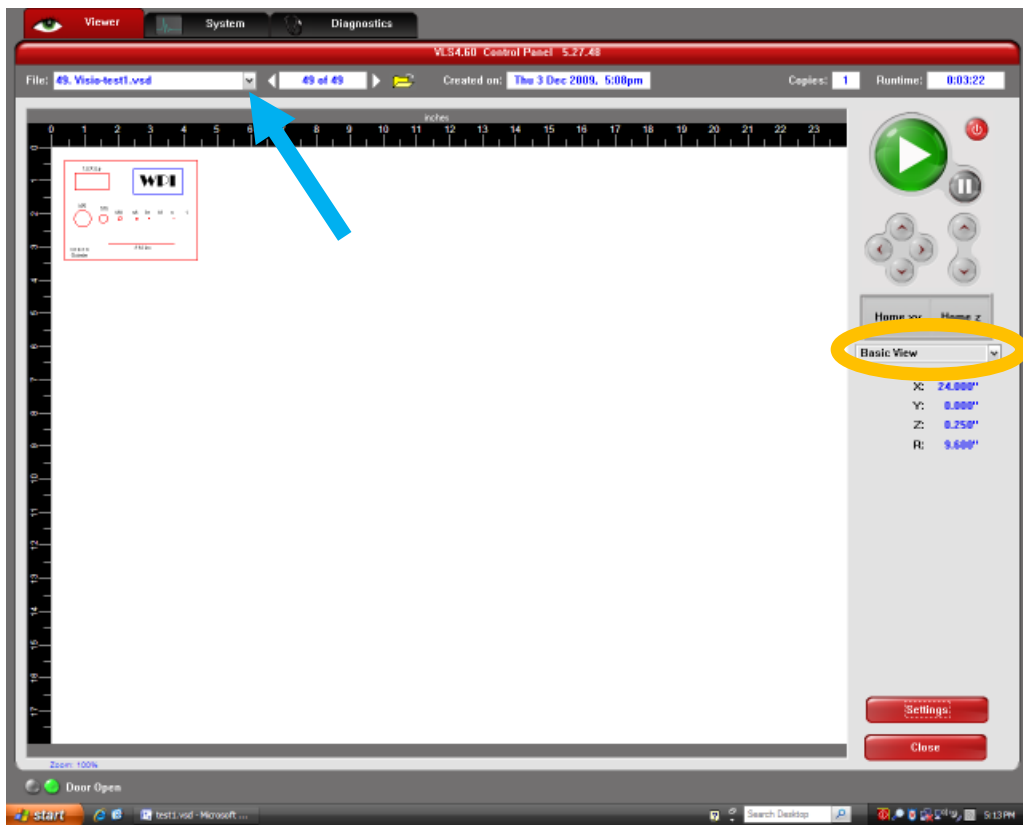


Cutting Parts

1. Click the icon in the lower right corner displayed below in orange. This will bring up the laser cutter software in the default “Basic View”.

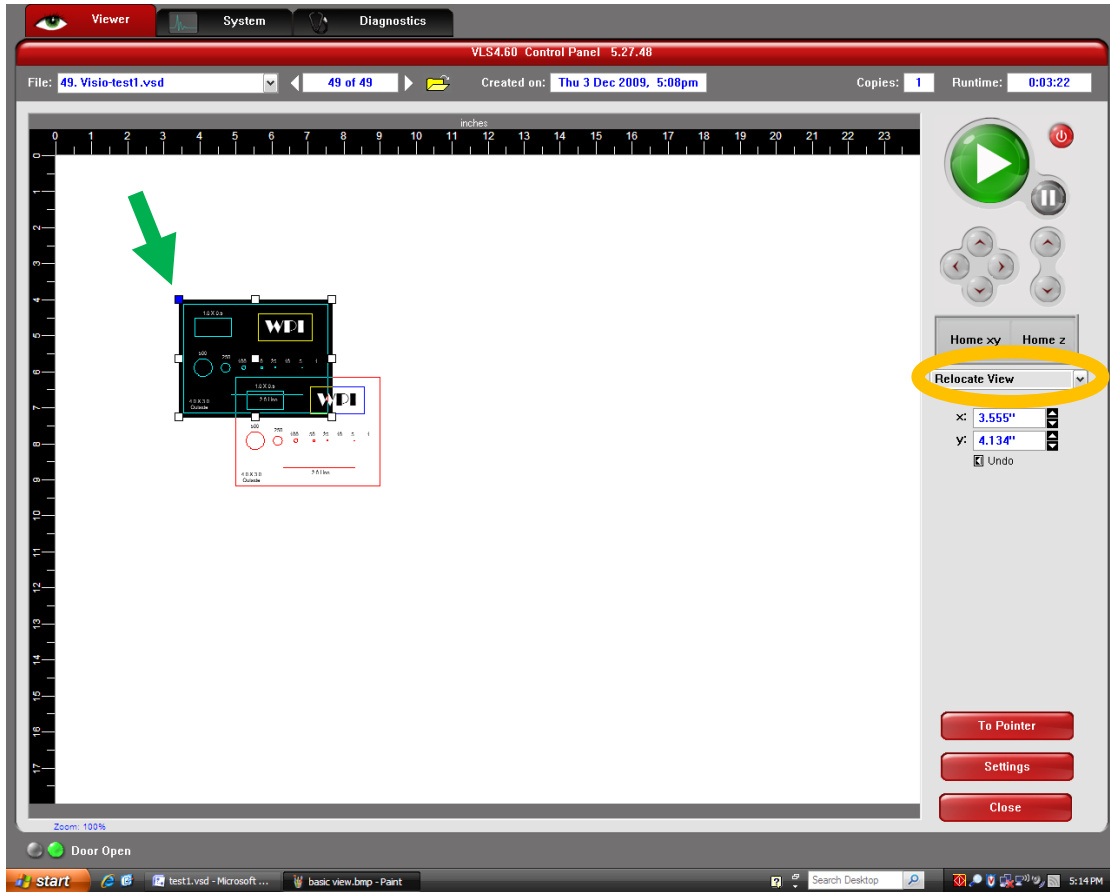


The view mode can be changed in the drop down box shown with the orange ellipse below. Your part should show up on the screen. If it does not, select the last item in the “File” list shown with the blue arrow below. Note that if you send a file while it is actively cutting, it will show up at the end of this list.



2. Check your part. Ensure that all lines are there and in the same color as your CAD drawing. If your part does not display or is incomplete, repeat the steps in the previous section. Potential causes for blank or missing lines are mismatched color or line thickness. If a feature shows up in the wrong color, it may be the wrong line thickness or color and defaulted to Raster mode.

- Adjust the part location. Select “Relocate View” to bring up this mode as shown in orange.



In relocate mode, handles will appear on the part’s corners and edges. Click on and it will turn blue as shown with the green arrow above. Drag the part from that handle to the desired location on the workspace. The displayed workspace and rulers match those of the 24” x 18” honeycomb cutting table. This mode can be convenient for placing the part in an open location on your material.

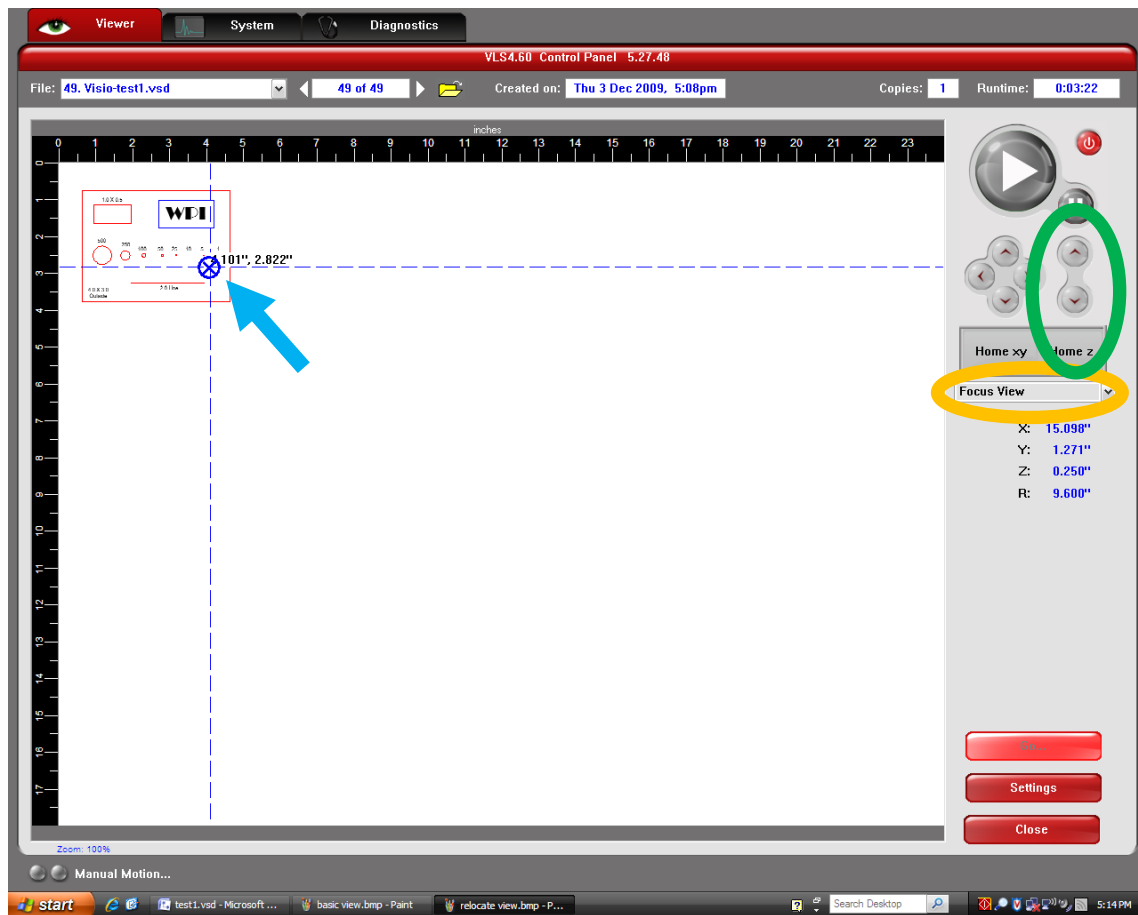
- Load the material into the laser cutter. You may use sheets up to **24” wide by 18” high**. Ensure that the cutting table is clear below the sheet with no debris. Ensure that the edges of the sheet are flush against the honeycomb surface; do not cut parts with the sheet overlapping the edges.

If cutting acrylic sheet, REMOVE THE TOP PAPER LAYER. You may keep the paper on the bottom to help keep the surface clean from any charred debris or remove it.

5. Focus the laser only if necessary.

If you selected **ENABLED** for “Z Axis” and appropriately set the material thickness, skip this step. Any settings that you make will be overridden by the laser cutter software when it starts cutting.

If “Z Axis” is **DISABLED**, then you must manually focus the laser. Select “Focus View,” shown in orange below, to set the correct mode.



Click somewhere near the center of your part as shown with the blue arrow above, and the laser will move to that position.

NOTE: This functionality can also be used to locate a part on the material by clicking on the corners or other features of your part and seeing where they will end up on the material to be cut.

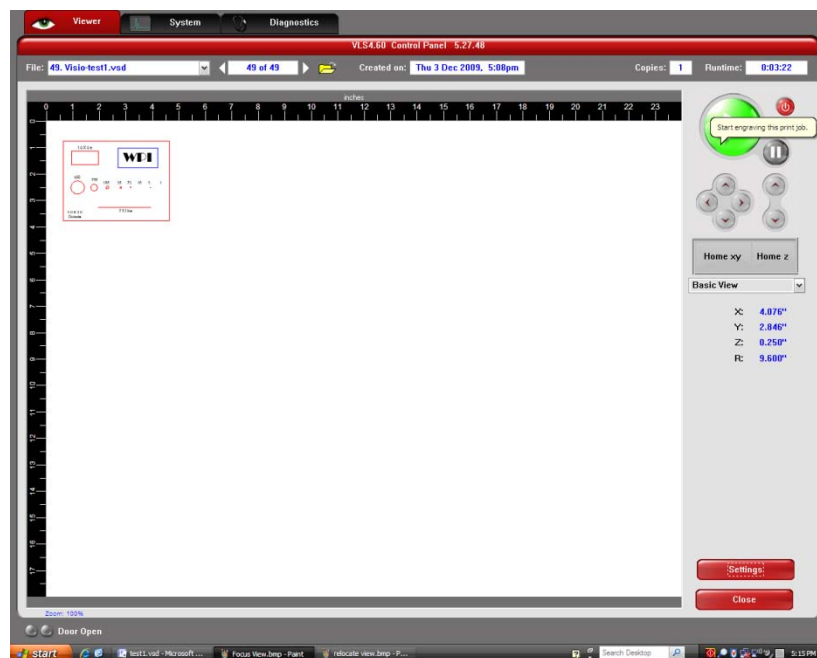
Lower the cutting table using the “Home Z” arrows in the software (green ellipse shown above) or on the cutter interface panel (blue ellipse shown below) to allow clearance for the focusing tool. Place the focusing tool on the part surface with its flat edge against the laser head and the beveled edge just below.



Slowly raise the table height using the “Home Z” arrows in the software or on the cutter interface panel until the focus tool first deflects outwards as the beveled edge makes contact with the laser head. This sets the focal length of the laser.

ENSURE THAT THE LASER COVER IS OPEN BEFORE PROCEEDING!!!

6. Send the part to the laser cutter in visible laser preview mode. Go back to the “Basic View” and click the large green “Play” button.



7. Confirm the cut pattern. With the lid open, the laser cutter will operate with a visible red laser pointer instead of a cutting laser. Run the part once with the visible laser to ensure that all features are cut as expected and that the location is correct.

ENSURE THAT THE EXHAUST BLOWER IS ON BEFORE PROCEEDING

8. Cut the Part. Close the lid and press the “Play” button again. It can be pressed either in the software or on the laser cutter interface panel.



To pause, press the Red “Pause” button. To resume, press the “Pause” button again. To restart, press the Green “Play” button.

When done, inspect your part.

IN AN EMERGENCY, PRESS THE RED PAUSE BUTTON TO STOP THE LASER AND TABLE MOTION.

If cutting materials where there is/was a lot of debris, smoke, or flare up, please notify one of the shop staff. The lens unit may need to be cleaned before further use. Failure to notify may result in damage to the laser optics.

9. When done:
 - a. Remove the material and ensure that the laser cutter surface is clear.
 - b. Shut down the laser cutter holding the “Power” button on laser cutter interface for several seconds, or click the corresponding button in the software.
 - c. Shut down the exhaust blower.
 - d. Backup files and log off the computer.
 - e. Ensure that the area is cleaned up.
 - f. Complete the log sheet.

Revision History:

Original document generated 12/8/2009 by Prof. Gregory Fischer, gfischer@wpi.edu