# Laser Cutter Tutorial

## Digital Design Lab

## Materials and Settings

### Basswood

<table>
<thead>
<tr>
<th>Material</th>
<th>Power</th>
<th>Speed</th>
<th>PPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/32&quot;</td>
<td>55</td>
<td>30</td>
<td>300</td>
</tr>
<tr>
<td>1/16&quot;</td>
<td>55</td>
<td>30</td>
<td>300</td>
</tr>
</tbody>
</table>

### Plywood

<table>
<thead>
<tr>
<th>Material</th>
<th>Power</th>
<th>Speed</th>
<th>PPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/32&quot;</td>
<td>55</td>
<td>30</td>
<td>300</td>
</tr>
<tr>
<td>1/16&quot;</td>
<td>55</td>
<td>30</td>
<td>300</td>
</tr>
</tbody>
</table>

### Chipboard

<table>
<thead>
<tr>
<th>Material</th>
<th>Power</th>
<th>Speed</th>
<th>PPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>70</td>
<td>30</td>
<td>300</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>70</td>
<td>30</td>
<td>300</td>
</tr>
</tbody>
</table>

### Styrene

<table>
<thead>
<tr>
<th>Material</th>
<th>Power</th>
<th>Speed</th>
<th>PPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/32&quot;</td>
<td>55</td>
<td>35</td>
<td>500</td>
</tr>
<tr>
<td>1/16&quot;</td>
<td>55</td>
<td>35</td>
<td>500</td>
</tr>
</tbody>
</table>

### Cardboard

<table>
<thead>
<tr>
<th>Material</th>
<th>Power</th>
<th>Speed</th>
<th>PPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>50</td>
<td>30</td>
<td>300</td>
</tr>
</tbody>
</table>

### Matboard

<table>
<thead>
<tr>
<th>Material</th>
<th>Power</th>
<th>Speed</th>
<th>PPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>45</td>
<td>30</td>
<td>300</td>
</tr>
</tbody>
</table>

### Arylic

<table>
<thead>
<tr>
<th>Material</th>
<th>Power</th>
<th>Speed</th>
<th>PPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 PLY</td>
<td>60</td>
<td>30</td>
<td>300</td>
</tr>
<tr>
<td>2 PLY</td>
<td>60</td>
<td>30</td>
<td>300</td>
</tr>
<tr>
<td>3 PLY</td>
<td>60</td>
<td>30</td>
<td>300</td>
</tr>
</tbody>
</table>

*Note: Power: 45 30, Speed: 8 20, PPI: 300 300 (for 3x2 run twice)*

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*ASU Herberger Institute for Design and the Arts*
LASER CUTTER POLICIES

Students should come to their laser cutting session ready to cut. The laser cutter workstation is not a place to make extensive changes to their files before cutting.

Students MUST be actively watching the laser cutter at ALL times, due to the fact that the material may catch on fire.

Fires
Small flames are to be expected
If your material catches fire and remains on fire, immediately stop the laser cutter using the main power switch and notify a Lab Assistant.

After the part is completed, keep the lid of the laser cutter closed for 10 seconds to allow smoke or vapors to be vented.

Clean up your workstation when you are finished. Do not leave materials of any kind in or around the laser cutter. Please place all recyclable materials in the recycling bins in the Digital Lab.
**TERMINOLOGY**

**VECTOR**
- Laser follows line paths
- **USES:** cut or etch
- **PROS:**
  - speedy
- **CONS:**
  - unable to create solid fills

**RASTER**
- Laser creates a series of horizontal scan lines
- **USES:** etch only
- **PROS:**
  - etch entire image with fill
- **CONS:**
  - slow process
  - begins from the top of the image and etches one line of pixels at a time
TERMINOLOGY

PPI (PULSES PER INCH)

the laser is never ‘on’ continuously although it may appear to be. The laser beam pulses and the PPI setting indicates how many laser pulses per linear inch the laser will emit. The higher the PPI the hotter the material will get (it will not cut deeper).

STANDARD SETTING
PPI: 300

SHARPEN EDGES
PPI: 100 – 150

CHAR OR BURN EDGES (CAUTION: ONLY FOR WOOD)
PPI: 450 – 500
Students are authorized to only cut APPROVED materials, students will be denied access to the laser cutters if a BANNED material is brought down to cut.

### APPROVED
- **Natural Wood**
  - Basswood
  - Avoid oily / resinous woods
- **Plywood**
  - Birch plywood recommended
- **Paper / Cardstock**
  - Matboard
  - Cardboard
  - Butter board
  - Chipboard
- **Extruded Polystyrene**
- **Acrylic**
- **Mylar**

### BANNED
- **Any Painted Materials**
- **PVC (Poly Vinyl Chloride)**
- **MDF**
- **Masonite**
- **Polycarbonate**
- **Plastics (ABS, HDPE, PLA, etc.)**
- **Fiberglass**
- **Foam**
  - Foam core
24" X 18"

LASER CUTTER OPERATION

STEP 1: POWER
The power switch is located near the ventilation ducts.
The power switch turns on and off both laser cutters.
The laser cutters must be turned on before a file can be sent.

STEP 2: MATERIAL PLACEMENT
The material should be placed in the upper left-hand corner.
You may use tape to secure materials to the side rulers.
STEP 3:

FOCUS THE LASER

Press the ‘Z’ button

Place the focus tool on top of your material and against the front left or right side of the laser head (you may need to move your material so that it is under the laser head).

Use the up and down arrows to raise or lower the base platform

Raise or lower the base platform so that the bottom of the laser head is level with the beveled edge of the focus tool

Once focused, Remove the focus tool and press the ‘Z’ button again to send the head back
STEP 4: BEGIN LASER

From the ‘FILE’ menu, ensure that your file name is displayed with the settings that you set.

Test the file. With the lid open press the ‘play’ button and watch the outline of where the laser will cut.

Begin laser cutting. Close the lid to the laser cutter and press the ‘START’ button.
The laser cutter software is compatible with the following design programs and extensions:

**ADOBE**

- **ILLUSTRATOR CS6**
  - File: *ai*
  - Functions: Cut/Etch Vector Lines, Etch Images

- **PHOTOSHOP CS6**
  - File: *psd*
  - Functions: Etch Images

- **INDESIGN CS6**
  - File: *indd*
  - Functions: Etch Images

**AUTODESK**

- **AUTOCAD 2013**
  - File: *dwg*
  - Functions: Cut/Etch Vector Lines

**CORELDRAW**

- **CORELDRAW X5**
  - File: *cdr*
  - Functions: Etch Images
DOCUMENT SETUP:
ADOBE ILLUSTRATOR

PAGE SIZE
Create an artboard with the same dimensions as the laser cutter that you will be cutting on.

SMALL LASER CUTTER: 24” x 18”

LARGE LASER CUTTER: 32” x 18”

LINE WEIGHTS
Set the line weights for everything that will be cut or etched to 0.001

CREATE LAYERS
If your image needs to be cut on certain lines and etched on others then you will need to prepare your file with separate layers.

Example: Hide the cut layer and send the file to the laser cutter to etch the visible layer. Then hide the etch layer and make the cut layer visible, send the file to the laser cutter to cut the visible layer. (do not move your material)
Tip: There are 1/8" margins, be sure to take this into account when setting up your file.
PRINT SETUP: ADOBE ILLUSTRATOR

BEFORE YOU PRINT:
- Hide any layers that require different laser cutter setting (Ex: Cut vs Etch)
- Ensure the images are placed so they fall on the material in the laser cutter

File > Print
Select Printer
Large Laser Cutter: PLS6.75
Small Laser Cutter: V-460
Click on Setup
PRINT SETUP:
ADOBE ILLUSTRATOR  V-460: 24"x18"

Click on Custom Properties

Set Pen Mode
- VECT - Vector
- RAST - Raster
- RAST/VECT - Do NOT Use

Select Black

Adjust Settings
- Input Power
- Input Speed
- Input PPI

Click Set

Click OK
PRINT SETUP:
ADOBE ILLUSTRATOR

Click Print
Media Size: User Defined LANDSCAPE
Click Print

Ensure the laser cutter is on before sending your file.

Move to the laser cutter and follow the laser cutter instructions.
Your image must be sized to fit on the material it will be etched on. You will be able to place where the image will fall on the laser cutter platform in the ‘print’ menu.

**SMALL LASER CUTTER: 24” x 18”**

**LARGE LASER CUTTER: 32” x 18”**

The darker the color, the deeper the laser will engrave. Black will always etch at the settings selected.

If your image needs to be etched with a specific setting in some areas and etched at a different setting in others then you will need to prepare your file with separate layers.

*See the following example...*
Students can use multiple layers for setting changes. Only keep one layer visible at a time, adjust the etch settings for that layer and send it to the laser cutter. Repeat these steps for the other layers.
DOCUMENT SETUP:
ADOBE PHOTOSHOP

BEFORE YOU PRINT:
- Hide any layers that require different laser cutter setting
- Ensure the images are placed so they fall on the material in the laser cutter

File > Print
Select Printer
Large Laser Cutter: PLS6.75
Small Laser Cutter: V-460
Click Print Settings
DOCUMENT SETUP:
ADOBE PHOTOSHOP

V-460: 24"x18"

Select Black
Black is the only option

Adjust Settings
Input Power
Input Speed
Input PPI

Click Set

Click OK
DOCUMENT SETUP:
ADOBE PHOTOSHOP

Adjust Image Location
Move the image to where the material is placed on the lasercut platform

Click Print
Ensure the laser cutter is on before sending your file.

Move to the laser cutter and follow the laser cutter instructions
# DOCUMENT SETUP: AUTODESK AUTOCAD

<table>
<thead>
<tr>
<th>Category</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SET UNITS</strong></td>
<td>Set your units to Architectural (inches/feet)</td>
</tr>
<tr>
<td><strong>EXPLODE</strong></td>
<td>Explode all blocks and groups the laser cutter will not recognize any blocks</td>
</tr>
<tr>
<td><strong>CREATE LAYERS</strong></td>
<td>Create a CUT layer and an ETCH layer (if also etching). Place all the lines to be cut on the CUT layer and all the lines to be etched on the ETCH layer.</td>
</tr>
<tr>
<td><strong>ADJUST LAYER PROPERTIES</strong></td>
<td>Within the layer properties set the CUT and ETCH layer properties with the following: LINE WEIGHTS – 0.00mm, BASIC COLOR – red, blue, yellow, green, cyan, white, orange. <em>Note: the laser cutter will not recognize any other colors.</em></td>
</tr>
<tr>
<td><strong>WE RECOMMEND USING A PAPERSPACE LAYOUT</strong></td>
<td>Click on the layout tab at the bottom of the window</td>
</tr>
</tbody>
</table>
From Paperspace
Print > Page Setup

Select the appropriate Layout
Click Modify

Select Printer
24"x18": V-460

Select the Default Paper Size
LANDSCAPE or PORTRAIT (whichever is the default)

Click OK
Note: the paper size defaults to 24"x24", yet the laser cutter is only 24"x18".

In order to cut properly we need to keep the 24"x24" paper size.

To work around this error we will need to only use the top 18" of the 24"x24" square.
Create a 24" x 18" viewport and place it at the top of the page.

Tip: There are 1/8" margins, be sure to take this into account when setting up your file.

Set the Viewport Scale

Scale the viewport according to the desired scale (ex. 1:1, 1/16"=1', etc.)
DOCUMENT SETUP:
AUTODESK AUTOCAD

File > Print/Plot
Select the Laser Cutter
Click on Properties
Click on Custom Properties
Set Pen Mode
Set according to each color
VECT - Vector
RAST - Raster
RAST/VECT - Do NOT Use

Select Color (Cut)

Adjust Settings
Input Power
Input Speed
Input PPI

Click Set

Repeat Steps for other Colors (Etch)

Click OK
DOCUMENT SETUP: PAPER SPACE

AUTODESK AUTOCAD

Plot Style: None

Verify Print Scale
Should be 1:1 Scale

Select Layout

Check Portrait
always use portrait even if your paper size is in landscape

Click OK

Move to the laser cutter and follow the laser cutter instructions
STEP 1:
CREATE A BOX EQUIVALENT TO A 24"x24" ACCORDING TO YOUR DESIRED SCALE.

STEP 2:
WITHIN THE SQUARE BOX, DRAW ANOTHER BOX THAT IS EQUIVALENT TO A 24"x18" BOX IN THE UPPER LEFT HAND CORNER.

STEP 3:
ARRANGE THE PARTS SO THEY SIT APPROPRIATELY IN THE 24"x18" BOX.

REMEMBER TO TAKE INTO ACCOUNT THE SIZE AND SHAPE OF YOUR MATERIAL.

FOR EXAMPLE:
If your image is 30'x50' then it will obviously not fit within a 24"x24" box. You will have to create a box that is equivalent to the scale you need to cut at.
DOCUMENT SETUP: MODEL SPACE

AUTODESK AUTOCAD

Select Printer
24"x18" V-460

Select the Default Paper Size
LANDSCAPE or PORTRAIT (whichever is the default)

Click on Properties

Click on Custom Properties
DOCUMENT SETUP: MODEL SPACE

AUTODESK AUTOCAD

Set Pen Mode
Set according to each color
VECT - Vector
RAST - Raster
RAST/VECT - Do NOT Use

Select Color (Cut)

Adjust Settings
Input Power
Input Speed
Input PPI

Click Set

Repeat Steps for other Colors (Etch)

Click OK
DOCUMENT SETUP: MODEL SPACE

AUTODESK AUTOCAD

- Plot Style: None
- Verify Print Scale depending on your selection
- Select Window select the entire 24"x24" box
- Check Portrait always use portrait even if your paper size is in landscape
- Click OK

Move to the laser cutter and follow the laser cutter instructions.
## TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Issue</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOT CUTTING AT GIVEN SETTINGS</td>
<td>- Focus the lens</td>
</tr>
<tr>
<td></td>
<td>- Decrease speed settings</td>
</tr>
<tr>
<td>THICK CUT/ETCH LINES</td>
<td>- Focus the lens</td>
</tr>
<tr>
<td></td>
<td>- Notify staff to clean the lens</td>
</tr>
<tr>
<td></td>
<td>- Increase speed or decrease power settings</td>
</tr>
<tr>
<td>THE LASER CUTTER SETTINGS DISPLAY '0's</td>
<td>- Check line weights on file (0.00, 0.001)</td>
</tr>
<tr>
<td></td>
<td>- Incorrect Color Settings (AutoCAD)</td>
</tr>
<tr>
<td>EXCESSIVE CHARRING OR FLARE UPS</td>
<td>- Power setting too high</td>
</tr>
<tr>
<td></td>
<td>- Speed setting too low</td>
</tr>
<tr>
<td></td>
<td>- Notify staff to clean the lens</td>
</tr>
<tr>
<td>ONLY HIGH POWER SETTINGS CUT MATERIAL</td>
<td>- Focus the lens</td>
</tr>
<tr>
<td></td>
<td>- Notify staff to clean the lens</td>
</tr>
</tbody>
</table>