HOW TO PREPARE FILES FOR THE LASER PRO C180.

The Laser Pro C180 is a 40 watt CO2 laser with a bed size of 18” x 12”. It can easily cut and/or engrave materials such as wood, cardboard, and acrylic up to 1/8” thick. It can be run by a number of programs: this packet will show how to run it through Adobe Illustrator. The primary purpose of this packets is to demonstrate the basic principles of the laser’s print driver as well as show the proper preparation of files for the laser prior to their arrival to the fabrication lab.

SETTING UP FILES FOR THE LASER:

One of the more important factors in using any laser cutter is file preparation. There are a few basic principles when using any laser cutter that you will want to keep in mind while setting up your files.

The laser will recognize two types of files: RASTER and VECTOR.

- RASTER / BITMAP images are comprised of pixels usually appearing in a jpeg, pdf, tif, or png format.

- VECTOR images are comprised of paths, defined by mathematical equations, allowing for proportional scaling. These files usually appear as ai, eps, cdr, or dxf files.

You can use vector images to both cut and engrave using the laser driver. If a vector line is .001 this will be read by the driver as a cut line. Any stroke width above .001 will be read as an engraving. Raster images on the other hand can only be engraved, they can never be used to cut objects out.

VECTOR: stroke width of .001= CUT LINE  above .001= ENGRAVING
RASTER: no stroke lines, RASTER IMAGES WILL ONLY ENGRAVE

Another factor to keep in mind is that the print driver can also recognize certain colors as commands which dictate certain functions of the laser. The laser driver will only recognize RGB colors, making it very important to set your files up as RGB to avoid aggravation and confusion. With this information in mind, we will begin by setting up a file.
FILE SETUP:

It is best practice to set up your file to match the size of the laser bed: 18” x 12”. Again, it is also important to bear in mind that the laser cutter will ONLY read RGB color.

To begin:
Open Adobe Illustrator
Go to: FILE > NEW
NAME YOUR FILE, then proceed to PROFILE > RGB BASIC. From there change the settings to match what is seen below.

18” W x 12” H: correlates to the bed size.
NAME YOUR FILES!

RGB PROFILE:
this changes to a custom setup once you begin making alterations to the file settings, it is still in RGB mode.

LANDSCAPE ORIENTATION:
correlates to the bed’s orientation

RGB COLOR MODE: under ADVANCED is where you will find RGB color mode.

NOTE:
All objects must lie within the boundaries of the artboard for the laser to recognize them

Once you have completed these steps, click OK.
LAYERS:

Before we go any further, I would like to stress the importance of LAYERS. When one starts developing files that have multiple operations occurring, say a bitmap engraving, a vector engraving, and a cut line, it is very helpful to separate each of these different operations onto separate layers. The ability to run separate portions of a file from a layer designated to a specific operation allows much greater control over the process as a whole.

You can see here the ideal situation where you have your three different operations properly labeled and separated into different layers. This is how all files should come to the lab.

With your file now setup we will begin to go over the types of images you will be sending to the laser and the proper ways to identify them for the driver.

LINE WEIGHT & STROKE / FILL COLOR:

If you have a file with both raster images and vector cut lines, you will need to differentiate between the two. The way to do that is with STROKE WIDTH. As stated earlier, cut lines need to be identified using a STROKE WIDTH of .001.

That is not to say that you cannot use a vector line as an engraving, you definitely will do that with some of your files, but if you want to use a particular vector as a CUT LINE it MUST have a stroke width of .001, anything above that will register in the driver as an engraving.

You can seen here, we have two vector lines. One of them is 1 pt. one is .001 pt. While both are vectors the 1 pt. line will be engraved at one power setting while the .001 pt center circle, will be cut out due to its line weight.
With line weights in mind, you will also want to start identifying stroke/ fill colors. The colors of the lines and fills in your file will dictate the intensity and speed at which your image is either cut or engraved.

If you have your file set up properly the drop down arrows on either stroke or fill will give you RBG color options.

You can see here how the use of different colors to define power settings within portions of your file will appear within the driver.

Another thing to bear in mind is that the C180 driver reads color information sequentially. It will execute the operations for black, then red, then green and so on.

This images shows the first 7 color options in the driver. These will be good to keep in mind when assigning colors to different portions of your files.

You may say: “I thought the stroke weight identified vector cuts?” It does, but the color of that vector line, be it a cut line or an engraving is what identifies where in the sequence and with what intensity it is cut. The same goes for all other lines.
Another way to change the RGB settings of a line or fill is in the lower corner of the left hand tool bar. Here you will see two color swatches for fill and stroke. By double clicking on either one it will bring up a menu in which you can change the RGB value of each color.

When it comes to adjusting your color settings it is valuable to know that the **ABSOLUTE RGB COLOR SETTING IS 255**. When adjusting RED for example, the R value must be set to 255, G and B must be set to zero. This method applies for all three of those colors: R, G, and B. Note the color settings below as a good reference guide.

RGB ABSOLUTE: 255  
BLACK: R:0 G:0 B:0  
WHITE: R:255 G: 255 B: 255

So that covers vector lines as well as color settings for identifying different operations within the driver. The next step is to understand how to bring an outside raster image into illustrator for engraving.

**BITMAP / RASTER ENGRAVING:**

Before you try to engrave a bitmap image, it is recommended that you **RUN IT THROUGH PHOTOSHOP FIRST**. When the laser engraves a raster image it uses the bitmap data of that image to adjust power intensity in accordance with the gradients of the image. Black will read as full power, white will read as no power and so on. The more defined the contrast is between the gradients, the better the engraving will be. Photoshop helps immensely with this process.

Another aspect of bitmap engraving to keep in mind is the fact that the resolution of your original image will have a direct effect on your final engraving. There are options in the driver to adjust the DPI of your engraving, but when choosing an image it is ideal to find one of at least 300 DPI to ensure that you get a good final result.
To start:
Open Adobe Photoshop
FILE > NEW > MODE: GRAYSCALE

Once you have your new file, CREATE A NEW LAYER and PLACE your image within it. With your gray scale image there, you can use the tools from the IMAGE menu shown below to make contrast adjustments to your photo for engraving.

Use any number of these tools to experiment with the contrast levels of your image.

When it comes to the alteration of photos for engraving it is best to err on the side of HIGH CONTRAST. The laser does not deal well with mid-tone grays. EXPOSURE and OFFSET as well as BRIGHTNESS / CONTRAST make very useful tools for this task.

As can be seen here, PHOTO 2 has been altered to eliminate a lot of the mid-tone grays that would not translate well to the laser cutter. Again, with bitmap engraving, the higher the contrast, while still retaining image clarity, the better.

From here CROP down your file to fit the boundaries of your image. This will make the file more manageable when placing it in illustrator. Then: FILE > SAVE AS > PNG (with no compression.) From here you will be able to place your image corrected PNG file directly into your Illustrator file.
We have now covered the three types of information that you may send to the laser as well as the correct methods of doing so. The image below shows an example of all of the information covered the packet thus far. It has color coded cut and engraving lines as well as a color corrected raster engraving placed from Photoshop into Illustrator.

When running a combined file such as this, it is recommended, as stated earlier, that you separate each element onto a different layer. While the laser can run vector and raster settings at the same time, for the sake of control it is best practice to separate your file into different layers and run them individually.

From here we will move on to a tool for isolating and masking portions of bitmap and vector images in Illustrator called a **CLIPPING MASK**.

**CLIPPING MASKS:**

Clipping masks in Illustrator are a way of isolating portions of an image using vector paths. The portions which are “removed” are still there, they are just not visible. This technique can be used with the laser to mask portions of images for engraving purposes.

**TO START**, one should already have an Illustrator file created per the instructions on page 2 of this packet.

**Within your Illustrator file:**

Create a **NEW LAYER** and label it as your engraving image. From there go to **FILE > PLACE**. Choose a file which has been run through Photoshop and **PLACE** it on this new layer. With your image placed in your Illustrator file, you have two options for preparing your image for the clipping mask.
1: IMAGE TRACE:
This will create vector paths from the bitmap data of your image applying to them both a fill and a stroke. While having your image in vector format can be helpful, you may also loose some of your image clarity.

You will find IMAGE TRACE under the OBJECT menu.
Once you have traced your image, alterations can be made to your trace settings in the top tool bar

2: RASTERIZE:
When you place images into illustrator, they will most likely already be in a rasterized format. Rasterizing an image within Illustrator simply embeds it into your file as an editable object.

You will find rasterize under the OBJECT menu.

For best results when rasterizing images in Illustrator reference the settings shown here.

- COLOR: RGB
- PPI: 300
- BACKGROUND: Transparent
- CLIPPING MASK: Nope, not yet
- PRESERVE SPOT COLORS: yes

For engraving purposes, the choice between raster and vector is aesthetic. A clipping mask can be made with both so experiment with the two and see which one suits you better. Once you have made alterations to your image you are then ready to create your clipping mask.
MAKING THE MASK:

Using the **SHAPE BUILDER** or **PEN** tool in the left tool bar, create the outline of your clipping mask. Make sure that this vector path is created on a layer separate from the image you are masking. **NOTE:** only CLOSED vector paths can be used to create the boundaries of a clipping mask.

It is very helpful to arrange the image layer below the layer with the vector path you are using to clip it.

With your images in place and your layers in order, you are ready to go. **DIRECT SELECT** both your **IMAGE** and **CLIPPING LAYER**.

From there got to: **OBJECT > CLIPPING MASK > MAKE**. The results of a proper clipping mask can be seen here.

Now you understand the basics of a clipping mask. If you are using an **IMAGE TRACED** image (a vector image) simply make the create the mask as directed on the previous pages and you will be ready to engrave. If you have created a clipping mask with a **RASTER** image, there is an additional step in order for it to work with our laser cutter.

Once you have successfully created your clipping mask with a **RASTER** image you must select both the image and the clipping mask and **RASTERIZE** the whole selection in order for it work with the laser.
Use: **OBJECT > RASTERIZE**  
The same menu as before will pop up, this time you will select: **CREATE CLIPPING MASK > OK.**  

This message will pop up: click **OK.**  

From here your whole clipping mask will be rasterized and ready for engraving.  

**MAJOR NOTE:** If you are working in any lab but the Digital Fabrication Lab you are running on Adobe Illustrator CS7. Here in the lab we are on **CS6.** When saving files you **MUST SAVE IN A LEGACY FORMAT FOR CS6.** In addition to this you will need to **LINK ANY IMAGES** that you have placed into your file.  

**VERSION** will appear at the top of your save options. This is where you will find **CS6.**  

**OTHER LABS**  
**DFL (CS6)**  

make sure to link any files that you may have embedded into your file or they will be left on the computer you were working on.  

With your file saved in the proper format, you are ready to bring it to the lab and begin the cutting process with one of our technicians.  

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So those are the basics of how to use Illustrator to create the best possible files for the laser cutter. We here in the Digital Fabrication Lab are always here to help troubleshoot issues with files. That being said, it is strongly recommended that if you are new to Illustrator, and you plan on using it during your course of study or for personal projects that you **PRACTICE, PRACTICE, and PRACTICE.** Lynda.com and even YouTube have an impressive number of step-by-step tutorials which can guide and enhance your learning process. Illustrator is a powerful program with a diverse number of applications not only here in the Fabrication Lab but elsewhere. The better you understand it, the broader the scope of your projects can become.
VECTOR GRAPHICS: Why are they so cool?

Vector graphics are digital images that are based on paths (vectors). These paths travel through control points (nodes). How the paths behave between these points are described by mathematical expressions.

When you scale a vector graphic up or down, you are changing the distance between the control points. The behavior of the paths remains uniform in relation to the scale. This is because the rendering software recalculates the expression/function representing the path with the new scale input you have given it.

The image to the left shows a resized vector. The small squares are the control points. These points are farther apart in the larger version, but the paths retain their shape in proportion to the new scale, rather than being stretched.

Vector graphics are ideal for 2D designs because they can be rescaled so easily without any loss of quality. A vector graphic, like a business logo can be scaled down to the size of a business card or scaled up to the size of a billboard, without losing any image quality. If you were to try to do the same with a jpeg file, you would have a pixelated mess.