RETINA ENGRAVE

USER MANUAL

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WELCOME TO RETINAENGRAVE v3.0

RetinaEngrave v3.0 software allows the operator complete mastery over their laser cutter. All projects are first created or imported into the software and then operators have a variety of options for settings, adding features and other alterations before activating the laser to run the job. This manual will present an overview of each window and button function as well as walk users through a typical project from start to finish. Note that RetinaEngrave software is exclusive to Full Spectrum Laser hardware and is not compatible with other lasers. For complete instructions on your Full Spectrum Laser System, refer to your user manual.

Connect to Software

RetinaEngrave v3.0 is a combination of a print driver and control software that communicates with, downloads jobs to, and controls the laser system. There is no download required for RetinaEngrave v3.0. With a local connection (achievable with Wi-Fi or an Ethernet cable) your Muse software will be available for use within your web browser

1. **Turn On Laser Cutter:** Turning on your laser will automatically boot up the Touch Screen interface. Allow 30 seconds or so for the machine and touch screen to boot up.
2. **Access the Application:** If your network supports "Bonjour" technology (DNS-SD) simply navigate to the following address to access the application: **"fsl.local/".** **-OR-**
3. **Note the Device Address:** This will be visible on lower left corner of LCD and will vary depending on connection type (ethernet/WIFI).
4. **Type IP Into Browser:** Type this IP number into your favorite browser (Google Chrome is recommended) and press the enter key. This will link you to the RetinaEngrave v3.0 interface. You now have full access to the software. There is no need to install or download anything. You must, however, keep a local connection to the device while operating the software, either through Wi-Fi or the Ethernet cable.

Connection Methods

1. **Ethernet (Preferred):** Connect your Muse unit to your local router or switch using an ethernet cable. The device IP address may be assigned automatically in most cases as supported by your local network. In cases where no DHCP server exists, you may statically assign an IP address from the LCD or the web application options menu.
2. **WIFI:** Connect you Muse to a local wireless network via the LCD or web application.
3. **HotSpot:** Connect your PC, laptop, or tablet directly to the wireless network hosted by the unit.
4. **Direct (Link-Local) Ethernet Connection:** Connect an ethernet cable directly from your PC or laptop to the device.

RetinaEngrave v3.0 Print Drivers

RE3 users can download the RE3 print drivers from the Full Spectrum Laser website in order to send device-specific print files to the laser cutter. Go to https://fslaser.com/RetinaEngrave and choose either the Windows print driver or the MAC/OS print driver.

RETINAENGRAVE v3.0 INTERFACE
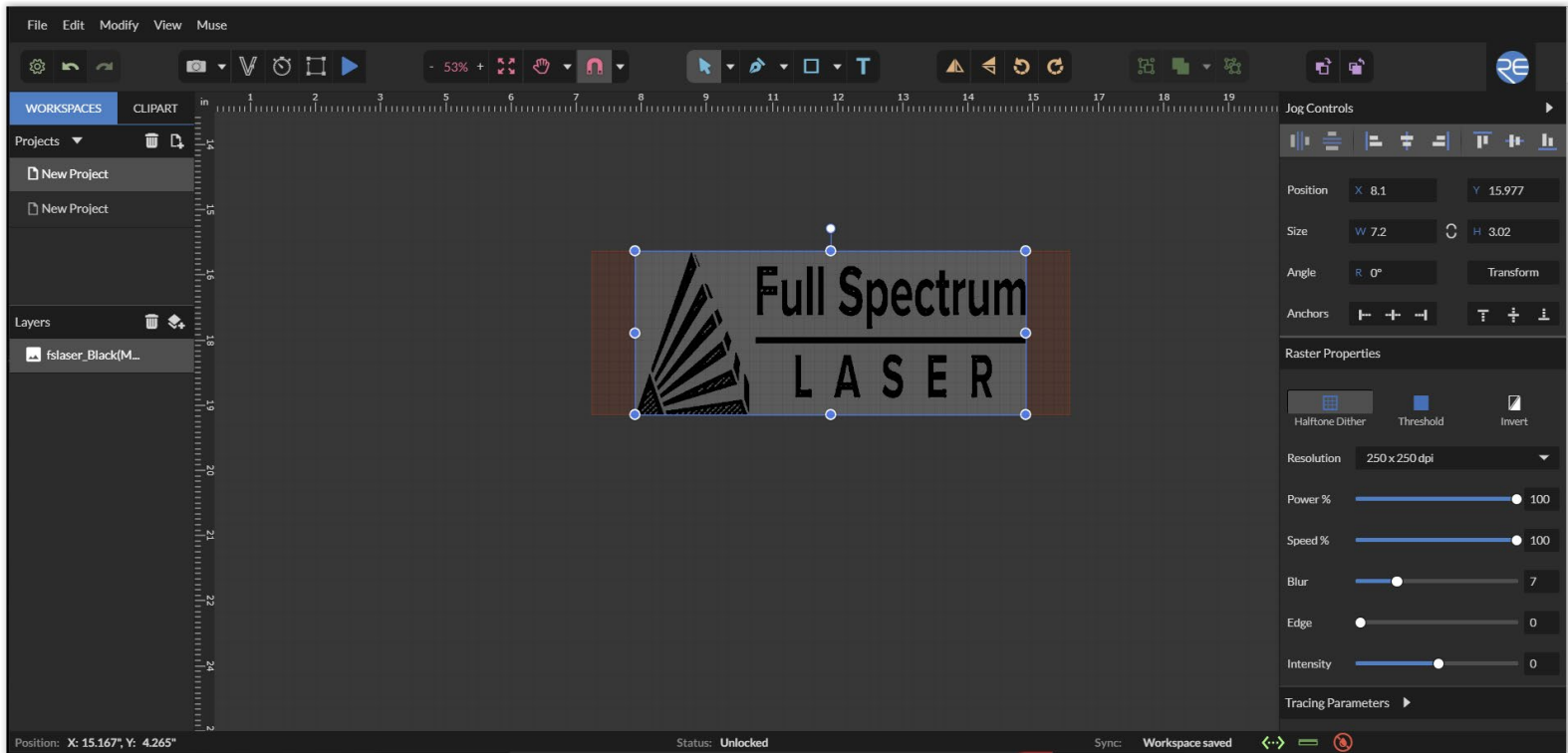
Workspace Window

The workspace window shows a preview of your current job and its position in the laser bed.

Top Menu

File   Edit   Modify   View   Muse

File Menus

New Project (Alt+N): Start a new project.
New From Clipboard (Shift+Ctrl+Alt+N): Start a new project from the clipboard.
Load Project from File (Ctrl+O): Load a project from a saved file.
Place/Import: Import and place a file.
Import fonts: Add fonts from outside source.
Export Project to File (Shift+Ctrl+E): Export to a file.
Submit Support Ticket: Auto send a support request ticket.

Edit Menus

Undo Delete Layer or Item (Ctrl+Z): Reverse previous project command.
Redo (Shift+Ctrl+Z): Reverse your last undo.
Cut (Ctrl+X): Selected object or item is removed.
Copy (Ctrl+C): Copy some portion of an object or item.
Paste (Ctrl+V): Paste a copied or cut portion of an object or item.
Delete (Del): Delete selected object or item.
Paste In Place (Shift+Ctrl+V): Paste a copied object or item in same location.
Paste Inside Selection: Paste a copied object or item inside selected area.
Paste Style (F4): Paste and match style.
Duplicate (Ctrl+D): Create a copy of a selected object.
Clone (Shift+Ctrl+D): Create an exact copy or 'clone' of an object.
Select All (Ctrl+A): Select all items in work screen.
Deselect All (Shift+Ctrl+D): All items in work screen are deselected.
Invert Selection (Ctrl+I): Items previously selected are now unselected and items unselected are selected.
Select by Font Type: Select item by font type.
Settings: Displays settings menu.

Modify Menus

Arrange

Send to Front (Shift+Ctrl+Up): Send an object to the front layer.
Bring Forward (Ctrl+Up): Send an object one layer forward.
Send Backward (Ctrl+Down): Send an object one layer backwards.
Send to Back (Shift+Ctrl+Down): Send an object to the back layer.

Align

Align Left: Align object to the left.
Align Center: Align object to center.
Align Right: Align object to right.
Align Top: Align object to top.
Align Middle: Align object to middle.
Align Bottom: Align object to bottom.
Same Width: All selected objects convert to same width.
Same Height: All selected objects convert to the same height.
Distribute Horizontally: Evenly arrange selected objects horizontally.
Distribute Vertically: Evenly arrange selected objects vertically.
Snap to Full Units: Snap to grid as full units.
Snap to Half Units: Snap to grid as half units.

Transform

Rotate 45° Left: Rotate selected object left 45°.
Rotate 90° Left: Rotate selected object left 90°.
Rotate 180° Left: Rotate selected object left 180°.
Rotate 45° Right: Rotate selected object right 45°.
Rotate 90° Right: Rotate selected object right 90°.
Rotate 180° Right: Rotate selected object right 180°.
Flip Vertical: Reverse selected object's orientation along vertical axis.
Flip Horizontal: Reverse selected object's orientation along horizontal axis.
Group Selection (Ctrl+G): Select a group of objects.
Merge Selection (Ctrl+M): Merge a selected group of objects.
Split Selection (Shift+Ctrl+M): Split up a compound shape or object.

Create Compound Shape

Union: Combine layers into a single compound layer.
Intersection: Combine overlapping layers into a single compound layer.
Subtract: Remove and combine non-overlapping layers into a single compound layer.
Difference: Combine non-overlapping layers into a single compound layer.
Create Nested Compound: Combine compound shapes into a single compound shape.

Path

Join Paths (Ctrl+J): Combine 2 or more selected paths into one compound path.

Split Paths (Shift+Ctrl+J): Split a compound path into its original separate paths.

Convert to Path (Shift+Ctrl+P): Convert a non-path to a layer path.

Convert to Raw Path: Convert a path or non-path layer to a new path.

Convert to Outline: Create an outline path of a specified size around an object.

Expand/Shrink: Scale an object up or down by a specified amount.

Vectorize Border: Create a vector path of the border of an object.

Rasterize - Convert object to raster

Vectorize Image: Create vector paths of each separate element in an image.

Attach Text to Path: Attach and conform text to a path.

Detach Text from Path: Detach text that is attached to a path.

Simplify Path (Ctrl+Alt+S): Simplify (and smooth) a path to varying degrees of tolerance.

Connect Path Lines: Connect together the ends of 2 or more paths.

Break Curve: Break apart a path at a specified node.

Reverse Order: Reverse the order of nodes in a path.

View Menus

Original View (Ctrl+0): Return the workspace back to the original view state prior to zooming or panning.

Fit Selection: Fit the current selection to the viewable page area.

Fit Layer: Fit the currently selected layer to the viewable page area.

Fit All (Alt+Ctrl+0): Fit all layers, whether or not selected, to the viewable page area.

Magnification:

+6% - +25600% Magnification: Increase or decrease magnification.

Zoom In (Ctrl++): Enlarges workspace screen detail and size.

Zoom Out (Ctrl+-): Reduces workspace screen detail and size.

View Mode:

Full View: Set to full view mode.

Fast View: Set to fast view mode.

Outline View: Set to outline view mode.

Output View: Set to output view mode.

Show Rulers (Ctrl+Alt+R): Toggle rulers on and off.

Show GuideLines (Ctrl+,): Toggle guidelines on and off.

Show Grid (Ctrl+Alt+G): Toggle grid on and off.

Show Tooltips (Ctrl+]): Toggle tooltips on and off.

Show Effects (Ctrl+E): Toggle effects on and off.

Snap To:

Use Snapping (Shift+F10): Enable or disable the snapping feature.

Use Snap Zones: Enable or disable the snap zone feature.

Snap to Grid: Enable or disable the Snap to Grid feature.

Snap to GuideLines: Enable or disable the Snap to GuideLines feature.

Snap to Full Pixels: Enable or disable the Snap to Full Pixels feature.

Snap to Anchor Points: Enable or disable the Snap to Anchor Points feature.

Snap to Shapes: Enable or disable the Snap to Shapes feature.

Snap to Pages: Enable or disable the Snap to Pages feature.

Show Inspector Panel: Toggle inspector panel on and off.

Show Outline Panel: Toggle outline panel on and off.

Toggle Fullscreen (F): Toggle full screen view on and off.

Muse Menus

Capture Workspace: Initiates camera functions.

Clear Last Visual: Remove last camera image.

Trace Background: Used with camera functions to apply vectors to selected area of image.

Estimate Job Time: Give approximate time for job to complete.

Run Perimeter: Laser continuously outlines the border of the current project. Press again to stop running perimeter.

Run Job: Run your project. When running, "Play" button is replaced with "Pause" and "Cancel".

Pause Job: Pause the laser from continuing with current project.

Cancel Job: Stop the laser and cancel current operation.
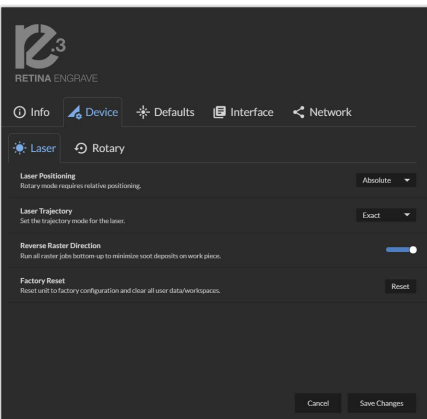
Setting Options

Info
Displays information regarding your machine.

Version: Version information.
WiFi MAC Address: As reported by device.
Raster Statistics: Total time in raster mode and raster lines completed.
Vector Statistics: Total time firing while in vector mode.

Device
Displays information regarding device options.

Laser Positioning: Toggles between "Absolute" and "Relative" positioning.
Laser Trajectory: Toggle trajectory (Exact, Fast and Mixed).
Reverse Raster Direction: Run raster jobs "Bottom-Up".
Factory Reset: Reset to factory configuration and clear all user data.
Rotary Mode: Informs machine a rotary device is being used.
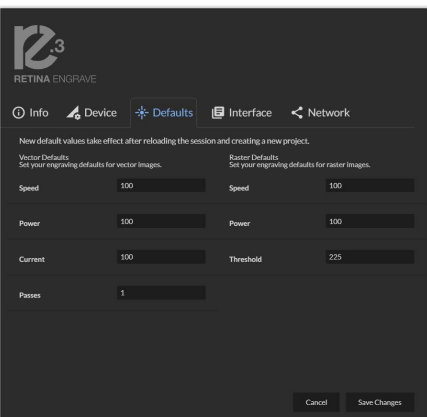
Defaults
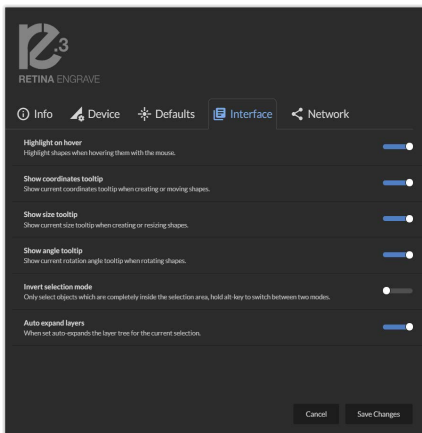Set you engraving defaults for vector and raster images.

Speed: Set speed default from 1 to 100.
Power: Set power default from 1 to 100.
Current: Set current default from 1 to 100.
Passes: Set the number of passes default.
Threshold: Set threshold default value from 0 to 255.

Interface

Show or hide tooltips and other modes.

Highlight On Hover: Highlight shapes when hovering with mouse.
Show Coordinates Tooltip: Show current coordinates tooltip when creating or moving shapes.
Show Size Tooltip: Show current size tooltip when creating or resizing shapes.
Show Angle Tooltip: Show current rotation angle tooltip when rotating shapes.
Invert Selection Mode: Toggle inverted selection mode on and off.
Auto Expand Layers: When set, auto expands the layer tree for the current selection.
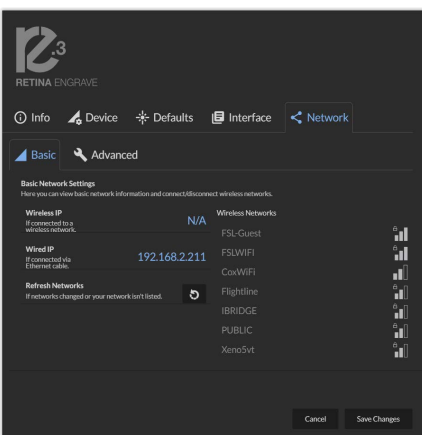
Network

View network information and connect / disconnect wireless network.

Basic Settings: View basic network information and connect/disconnect wireless network.
Wireless IP: Wireless IP information displayed.
Wired IP: Ethernet connection information displayed.
Refresh Network: Click button to refresh network.
Advanced Settings: Set static IPs and change DNS settings.

Setting Controls

Access settings options and undo / redo actions.

Settings: Go to setting options.
Undo: Reverse your last action.
Redo: Reverse your last undo.

Muse Controls

Capture Workspace: Initiates camera functions (see using camera functions).
Clear Last Visual: Remove last camera image.
Vectorize: Used with camera functions to apply vector/engraving to selected area of image.
Estimate Job Time: Give approximate time for job to complete.
Run Perimeter: Laser continuously outlines the border of the current project.
Press again to stop running perimeter.
Run Job: Run your project. When running, "Play" button is replaced with "Pause" and "Cancel".
Pause Job: Pause the laser from continuing with current project.
Cancel Job: Stop the laser and cancel current operation.

View / Snap Controls

View options or position items on workspace grid.

Zoom (-/+): Enlarges/Reduces workspace screen detail and size.

Fit All View

    Pan (H): Manually pan project window using mouse.
    Zoom (Z): Zoom project window using mouse.

Snap
    Use Snapping (Shift+F10): Enable or disable the snapping feature.
    Use Snap Zones: Enable or disable the snap zone feature.
    Snap to Grid: Enable or disable the Snap to Grid feature.
    Snap to Guide Lines: Enable or disable the Snap to Guide Lines feature.
    Snap to Full Pixels: Enable or disable the Snap to Full Pixels feature.
    Snap to Anchor Points: Enable or disable the Snap to Anchor Points feature.
    Snap to Shapes: Enable or disable the Snap to Shapes feature.
    Snap to Pages: Enable or disable the Snap to Pages feature.
    Show Grid: Toggle grid on and off.
    Show Guidelines: Toggle guidelines on and off.

Draw Controls

Select (Pointer): Instantly initiate mouse pointer.

Subselect
> **Pointer (V):** Initiates mouse pointer.
> **Subselect (D):** Initiates "subselect" mouse pointer.
> **Lasso (O):** Initiates "lasso" mouse pointer.
> **Layer (M):** Initiates "layer" mouse pointer.

Path
> **Pen (P):** Initiates "pen" mouse pointer for creating custom paths.
> **Bezigon (B):** Initiates "bezigon" mouse pointer for creating custom path points.
> **Freehand:** Initiates "freehand" mouse pointer for creating freehand paths.
> **Magic Hand:** Initiates "magic" mouse pointer for creating paths.
> **Knife (K)**

Shape
> **Line (L):** Create a line with the drawing tool.
> **Rectangle:** Create a rectangle with the drawing tool.
> **Ellipse (E):** Create an ellipse with the drawing tool.
> **Polygon:** Create a polygon with the drawing tool.
> **Triangle:** Create a triangle with the drawing tool.
> **Star:** Create a star with the drawing tool.

Text: Create an object made of text.

Position Menu

Flip Horizontally: Flip object along horizontal axis.
Flip Vertically: Flip object along vertical axis.
Rotate 90° Left: Rotate object 90° left.
Rotate 90° Right: Rotate object 90° right.

Group Menu

Group: Group objects

Merge
> **Union:** Combine layers into a single compound layer.
> **Difference:** Combine non-overlapping layers into a single compound layer.
> **Intersection:** Combine overlapping layers into a single compound layer.
> **Subtract:** Remove and combine non-overlapping layers into a single compound layer.
> **Split:** Split up a compound shape or object.
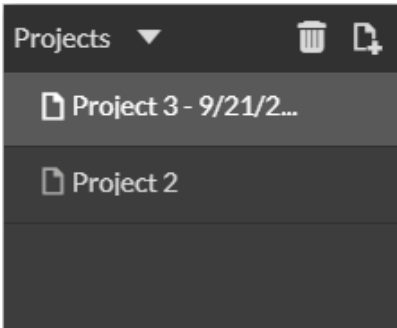
Arrange Menu

Bring Forward: Send an object one layer forward.
Send Backward: Send an object one layer backward.

Projects Menu

Displays information about projects.

Reduce Window: Reduce or expand projects window.
Delete: Delete selected project.

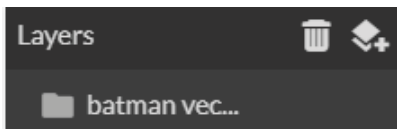**Create New Project:** Begin a new project.
      Project Name: Displays project's name.
      Toggle Lock: Lock or unlock project in current order.
      Toggle Visibility: Turn visibility of project on or off.

Layers Menu

Displays information on layers.

Delete: Delete selected layer.
New Layer: Add a new layer.
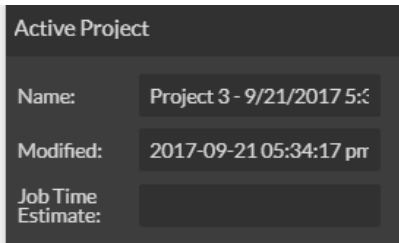   **Layer Name:** Displays name of project.
      Toggle Lock: Lock or unlock layer in current order.
      Toggle Visibility: Turn visibility of layer on or off.
      Toggle Outline: Turn displayed outline of layer on or off.

Active Window Info

This window displays information regarding the active project.
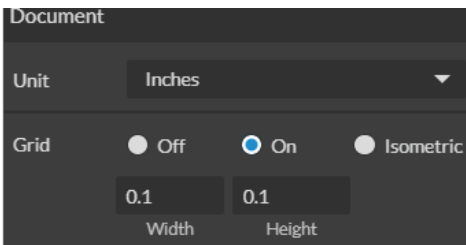
Active Project Name: Displays name of active project.
Modified: Displays last date project was modified.
Job Time Estimate: Displays estimated time until job is complete.

Document Window

Unit: Choose unit of measurement from the following -
    Pixels: Sets unit of measurement to pixels.
    Centimeters: Sets unit of measurement to centimeters.
    Millimeters: Sets unit of measurement to millimeters.
    Inches: Sets unit of measurement to inches.
    Picas: Sets unit of measurement to picas.
    Points: Sets unit of measurement to points.

Grid: Toggles grid on/off/isometric.
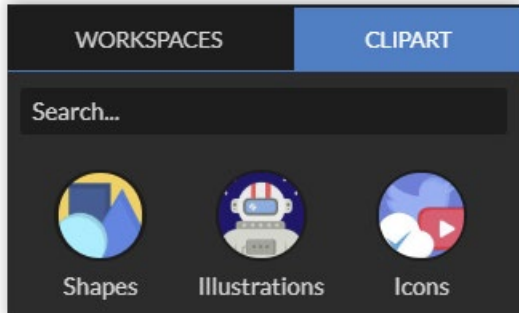   **On:** When "on" grid displays in workspace.
    Off: When off, grid does not display in workspace.
    Isometric: Toggles grid from squares to isometric grid.

Width: Displays width of item according to chosen unit of measurement.
Height: Displays height of item according to chosen unit of measurement.

Clip Art Window

Access pre-made clip art samples of shapes, illustrations and icons.

Vector Engraving Parameters Window

Window appears when vector file is detected and is used to input vector settings.

Hide Window: Click to hide vector engraving parameters window.
Show All Parameters: Toggle to show or hide all parameters.
Change Position: Drag with mouse to reorder any color.
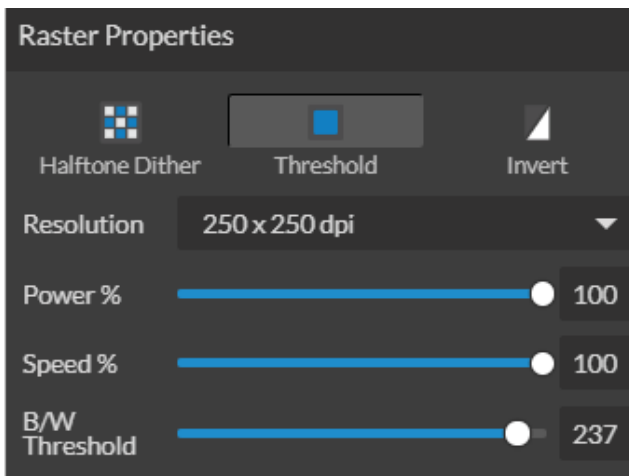**Color Indicator:** Separates vector cuts with color indicators.
Speed: Input speed settings.
Power: Input power settings.
Current: Input current settings.
Passes: Input the number of passes for the laser.

Raster Properties Window

Halftone Dither: Apply Halftone Dither.

Threshold: Apply Threshold.
     Blur: Adjust blur filter radius from 0 to 30.
     Edge: Adjust edge enhancement threshold from 0 to 30.
     Intensity: Adjust intensity from -255 to 255.
Invert: Reverse Black and White elements.
Resolution: Set resolution (250, 500, 1000 dpi).
Poser %: Select power percentage from 1 to 100.
Speed%: Select speed percentage from 1 to 100.
B/W Threshold: Select black and white threshold from 0 to 255.

Indicators (Bottom Row)

Position Indicator: Displays current position of the laser on the grid.

Time Remaining Indicator: Displays the time remaining to complete the current job.

Status Indicator: Displays whether laser is ready to initiate a job or is currently executing a job.

Sync Indicator:

Machine Indicators: Displays information on connected devices.

Device Connection Available:
Lid Indicator: Tells operator if lid is open or closed. The laser will not fire if lid is open.
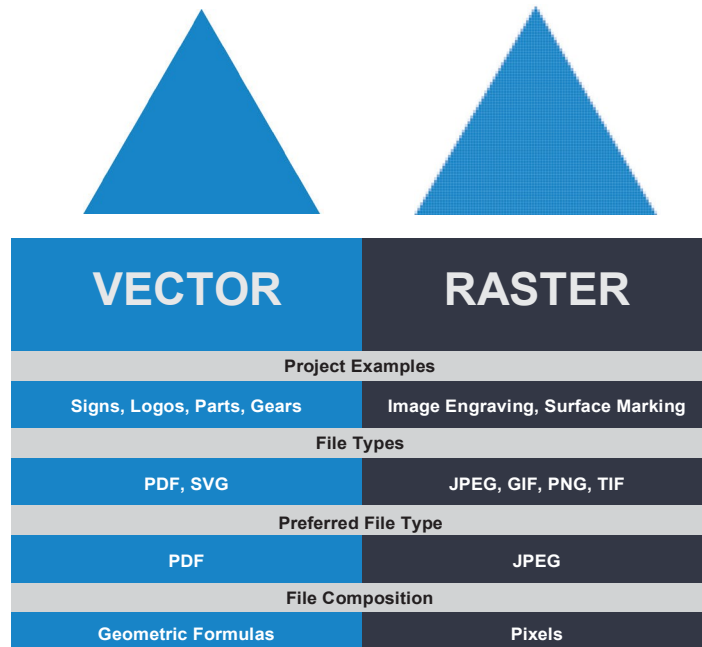**Water Flow Indicator:** Tells operator if water is flowing through the laser tube or not. The laser will not fire if water is not running through the laser tube.
Air Assist Indicator: Tells operator if air assist is on or off. Air assist should always be on when running a job.
Exhaust Indicator: Tells operator if exhaust is on or off. Exhaust should always be on when running a job.

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USER OPERATIONS

This section will guide you through using your Muse laser cutter. To get started, it is important to understand the meanings of "Vector Cutting" and "Raster Engraving" and their associated file types.

VECTOR	RASTER
Project Examples	
Signs, Logos, Parts, Gears	Image Engraving, Surface Marking
File Types	
PDF, SVG	JPEG, GIF, PNG, TIF
Preferred File Type	
PDF	JPEG
File Composition	
Geometric Formulas	Pixels

What is Vector Cutting?

Vector cutting is the most common feature of a laser cutter. Vector cutting with a laser means "to cut a line or shape". When vector cutting, the laser follows the "vector lines" embedding in the vector image to cut out the design. The laser starts at a designated location and follows the vector lines until the shape is cut out. This process is highly accurate and requires no resolution adjustments because of the properties of a vector image.

Vector Images

In Vector Cut mode, the software receives information from the print stream and interprets it as a series of paths for the laser head to follow. For the print stream to have vector information, the file being printed must be a vector image. Vector images are more flexible than raster images. These images are created using mathematical equations rather than pixel blocks. PDF's work great as vector files and are easy to resize without losing resolution. Company logos and branded graphics are usually vector images.

What is Engraving?

Engraving is the process by which complex designs are etched into a workpiece. Engraving can range from a simple surface mark all the way through deep material removal. Engraving is differentiated from cutting in that cutting is the process of burning a closed contour completely through a workpiece. Engraving is also known as "Raster Engraving" or "Rastering". For engraving, a laser has two states: on and off. Every black pixel or "laser dot" is the result of the laser turning on and firing at that location. This location is controlled by the input image, which can be thought of as a "map" of on and off pixels. The laser fires individual pulses corresponding to pixels in an image. When the laser is operating in raster mode the head moves rapidly from left to right and slowly from top to bottom, engraving your image pixel by pixel and line by line.

Images and Engraving

Engravable images use multiple colored pixels to form an image. JPEGs and PNGs are common engraving image types. Most of the photos found on the Internet and photo prints are raster images. Raster images are created using a fixed number of colored pixels, so they can't be dramatically resized without distorting their resolution. When sized to ft a space they weren't designed to, the pixels become visibly grainy and the image becomes distorted. When this happens, altered photos may appear pixelated or low resolution compared to the original source. Because of this, it is important that you save raster files at precisely the dimensions needed to eliminate possible resolution issues.

PDF Files

Engraving works with both vector and pixel-based source files, allowing you to engrave anything from a simple block logo all the way to high-resolution photographs. A PDF file type is generally treated as vector file, however, RetinaEngrave v3.0 can read PDF files as either a vector or an engraving file when you import the image. This allows operator great freedom in converting any image file to a PDF.

Direct Printing PDF Files

The easiest way to import any file type to RetinaEngrave v3.0 is to "drag 'n drop" it directly into the workspace window. If there are ever any problems importing files in this manner, direct printing a converted PDF file is the next method to try. Most design software has a simple method for converting files to PDF and then directly printing them to the RetinaEngrave v3.0 software.

Design Tools for RetinaEngrave v3.0

RetinaEngrave v3.0 includes a robust set of design tools, allowing users to design in the software without needing outside design software. Third party design software, however, is still an option for RetinaEngrave v3.0 users. Just about any design software will work (You can choose the software you are most comfortable with, as long as you can convert files to PDF (which most can). You can also "direct print" to the software. Each operating system does this in a slightly different way, so check the instructions for your particular program.

If you use third party design software and run into a problem with the print interface, we recommend printing to the XPS Document Image Writer or saving as a PDF. PDF files save vector information and are the best way to carry artwork from a non-compatible operating system (Mac or Linux) onto your Windows PC.

Compatible design packages include: CorelDraw, Adobe Illustrator, Inkscape and Google's free online vector drawing application. Additionally, most CAD packages are able to output drawings in a vector format for printing; Autodesk 123D is particularly interesting for its cost (free) and built-in 3D slicing capabilities.

USING YOUR LASER CUTTER

Project Workflow

The RetinaEngrave v3.0 software works with your FSL Laser Cutter to create a simple and intuitive set of operations that is easy to learn and use. With experience, you will find your machine achieving amazing results following this procedure. Use this Project Workflow List for the "best practice" sequence for any project and follow the step-by-step instructions from start to finish.

Project Workflow Checklist

0. Safety First

Before starting any project, be sure you are aware of all safety issues. Be sure you read and understand all safety warnings presented in Section I: Safety First and that all safety requirements are being upheld. This is a good time to check your machine's power connections and that the accessories are properly attached and are operating normally.

1. Create Design

Typically, projects are created in design software and then imported to RetinaEngrave v3.0. Generally, a PDF file is optimal for most vector cuts, as PDF files are easy to convert to and most design software has "convert to PDF" as a standard feature. For rastering (engraving), a JPEG file is best as these are bitmap files perfect for pixel-based images. It is important to know, at this stage, if you intend to do a vector cut or an engraving and choose the most appropriate file type (PDF or JPEG). This will greatly aid the software to run the job smoothly and quickly. RetinaEngrave v3.0 includes a robust set of design tools, allowing users to design in the software without needing outside design software. Third party design software, however, is still an option for RetinaEngrave v3.0 users. Just about any design software will work (You can choose the software you are most comfortable with, as long as you can convert files to PDF (which most can). You can also "direct print" to the software. Each operating system does this in a slightly different way, so check the instructions for your particular computer.

Raster Image (bitmap)
**Pixel based image.**
Example: JPEG
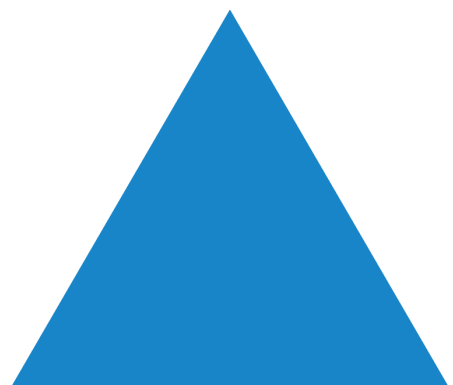
Vector File
Geometric based
image. Example: PDF

2. Connect to RetinaEngrave v3.0

Follow the instructions presented in Section III: Installation & Assembly. As a recap, you will turn on your computer and your Muse laser cutter and wait for both to finish their boot cycle. Then, observe the connected network address on the lower left corner of the Muse LCD. Copy this IP address into your computer's browser navigation bar and the program will appear, ready to use. For best results, we recommend using Google Chrome as this is the most compatible with RetinaEngrave v3.0 technology. Note that your PC and your Muse unit must be connected to the same network at all times during normal operation.
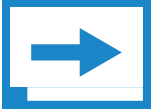
3. Import Design

Import your designs by selecting the "Open File" icon, or by dragging and dropping your file into the workspace. This software detects a wide variety of file types, however, for vector cuts PDF files work best and are simple to convert on most design software. For raster engraving, the JPEG file format is widely used and can easily be taken from a cell phone photo or an image found online. It is important to know what files work best with vector or raster images. A raster image is a pixel-based image (bitmap) and works well as a JPEG file. When you import a JPEG file, the software will automatically detect it as a raster file and will setup the project accordingly by presented raster options in the properties tab menu.

4. Place Material

At this stage you will place your material into the laser bed workspace. The material can be placed anywhere within the workbed; however, we recommend placing material close to center. Once the material is placed, close the lid. Your material is what you will be cutting or engraving. Typical materials include wood, acrylic, cardboard, fabric, etc. Note that is the user's responsibility to know the components of any material used and the limitations of utilizing that material (thickness, chemical residues, etc.) with a 45W laser tube. Always check with the material manufacturer, or MSDSonline.com, if there are any questions to its usage. We recommend using a Materials Log to keep track of the different materials you use.

5. Focus

Follow the focusing instructions given in your machine's user manual. Note that if your machine has an auto-focus feature, focusing will be done automatically when the job is run.
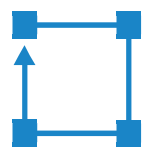
6. Align Laser to Material

Alignment of the material ensures the design to be cut is contained within the material in the workspace. This process also makes sure the design is aligned to the material so the cut is positioned straight. Typically, this can be done with a simple vision check while "jogging the perimeter". By using the directional arrows on the touchscreen or the arrow keys on your computer, move the laser dot to the top left corner of your material. When placing an engraving image, leave at least ½" inch of space on the left and right side. When creating engravings, you must compensate for the left and right overshooting of the laser head. Once the material looks aligned, click the "Jog Perimeter" button. The laser head will automatically outline the material with the red beam diode. You can then adjust the material as needed.

Note the laser head will continue to outline the material until stopped manually by clicking the "Run Perimeter" button a second time. See Positioning below for more options.

7. Adjust Object Properties
It is again important to know if you intend to raster, vector cut or both. Once the file is imported, and the image is clicked with your mouse, you will have access to the Properties Tab. Click this tab and select the parameters for your cuts and/or engravings. For details on setting these parameters, see below.

8. Run Job
Clicking the "Start Job/Play" button begins the laser cutting process. Before doing so, double check your safety protocol and that your system accessories are connected properly. Be sure to monitor the job while the laser is firing.

Engraving

Engraving, also called Rastering, is the process of creating a surface image on material without cutting through the material entirely.

Setting Engraving Properties

Clicking an object (design image) in the workspace will allow you to access that object properties tab. The software will identify if the object is a vector or an engravable object and present the appropriate properties window. To show the properties of an engravable object, click the object.
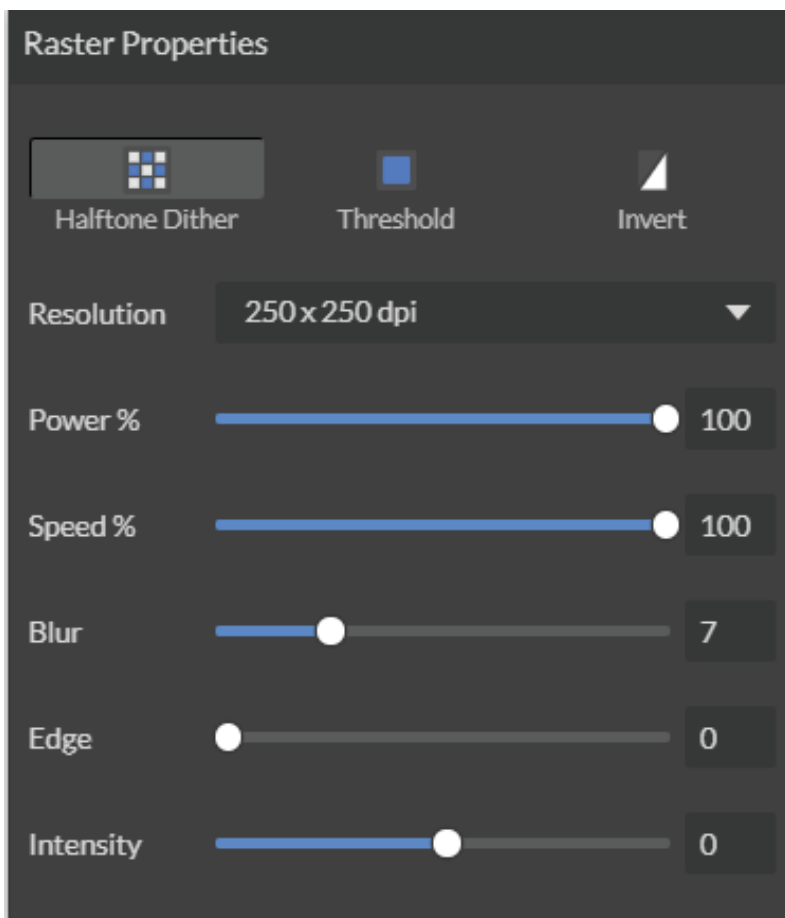
Setting Resolution

The resolution of your engravings can be controlled by the DPI (Dots Per Inch). DPI options include 250, 500, and 1000. The more dots per inch, the higher precision and quality of your images, while a lower DPI will process and engrave faster.

Remember that with a higher DPI (1000), the laser is in contact with the material for a longer period of time and may result in deeper engravings than with a lower DPI (250). Speed and power should be compensated for different DPI settings. The software's default resolution is set to 250 DPI.

Setting Raster Power

The power settings determine the output of the laser tube. A 100% power setting will create a deeper engraving while lower settings will create more surface level engravings.

Setting Raster Speed

Speed settings determine how quickly the laser head will move. For faster engravings, 100% is ideal. Lowering the speed will allow you to create deeper engravings, as it allows the laser beam to be in contact with the material for a longer period of time.

Applying B/W Threshold

At this moment, the image is still displayed in black and white. The black and white raster feature is great for tracing logos, text, or simple high contrast images that only appear in a single color. You can adjust the threshold of what's considered black, and what's considered white by selecting your image and clicking "Threshold". This will bring up a B/W Threshold slide bar, from which you can adjust B/W threshold to your liking.
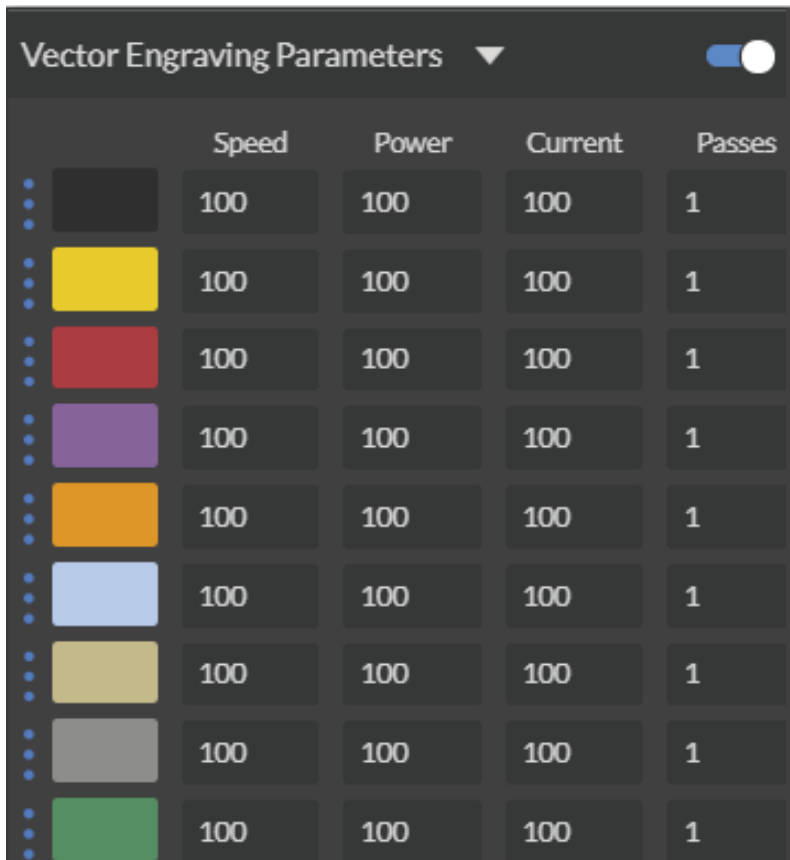
3D Engraving Options

For images that have shadows and depth, it's ideal to use 3D engraving "also called dithering". Dithering creates a series of dots similar to newsprint. This effectively creates a grayscale that is ideal for photorealistic engravings. To dither an object, click the dithering button. You can then adjust the dither with the Blur, Edge and Intensity slide bars.

# Vector Cutting

Setting Vector Properties

When a PDF file is imported into RetinaEngrave v3.0, the program automatically detects it as both a vector file and a raster file.

Vector Color

Tags allow you to create separate vector layers and keep track of them with a unique color. Each color will match an object in the workscreen. You can set the order of operations by clicking on the "three dots" and then dragging the layer up or down. Objects are then processed from top to bottom.
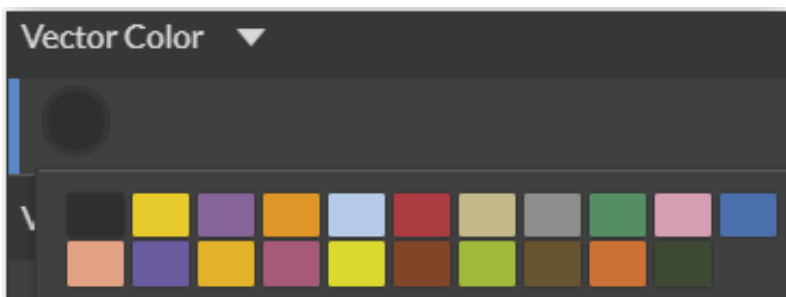
Vector Engraving Parameters Window

Window appears when vector file is detected and is used to input vector settings.

Hide Window: Click to hide vector engraving parameters window.
Show All Parameters: Toggle to show or hide all parameters.
Change Position: Drag with mouse to reorder any color.
Color Indicator: Separates vector cuts with color indicators.
Speed: Input speed settings.
Power: Input power settings.
Current: Input current settings.
Passes: Input the number of passes for the laser.

Setting Vector Speed

The optimal speed setting varies, depending on the power of the laser tube and properties of the material itself. Like raster engraving, speed will determine how quickly the laser head moves. You will need to experiment with material testing to find the right speed for your vector cuts.

Setting Vector Power

Power will determine how much power the laser tube delivers. As with speed, power will vary depending on the wattage of the laser tube and the material itself. You will need to experiment with material testing to find the right speed for your vector cuts.

Setting Vector Current

Vector current is a control unique to vector files. Vector current controls the pulse of the laser. 100% will create constant power for smooth cutting, while lower percentages will add increasingly more off time between pulses. As always, settings will vary with your tube wattage and type of material. It's best to test on an inconspicuous part of your material before creating your final piece. Once optimal results are discovered for speed, power and current, through material testing, record the settings for each in a materials log.

Passes

This allows the operator to assign how many times the laser will complete a full cycle. Adding passes creates deeper cuts. Note that if you delete a vector line (by clicking "-"), set passes to "0" first.

Show All Parameters

This toggle switch displays or hides all possible vector tag as a series of color options. Often when performing both vector cuts and raster engraving, it is a good idea to change the color of the vector cut to something other than black. This will avoid the laser detecting the vector cut as part of the raster.

Basic Vector Cutting Example

In the software, the red lines tell the laser what to cut. All red lines will be cut through the material creating the empty space in the final project.
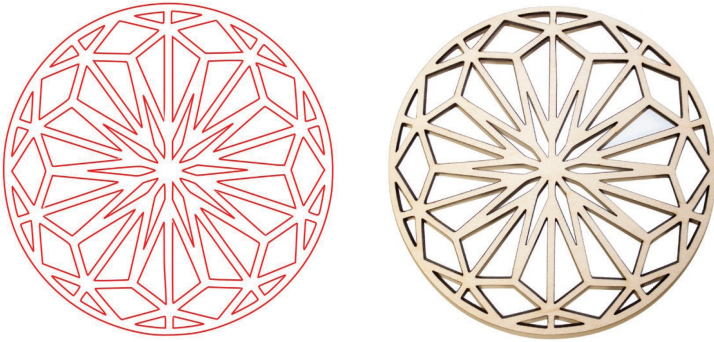

Vector Cutting Example

We can outline (as opposed to fill) parts of the pattern for a second design option. Again, we will instruct the laser using our vector properties In this design, the blue lines will not be cut through on our material, but instead will be marked, as the red outline still cuts.
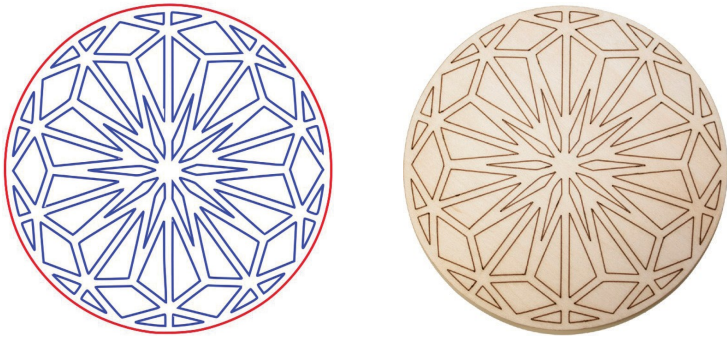
Combining Vector and Raster

Engravings can be combined with vector cuts to create a variety of outcomes. A simple example is to engrave an image, and then cut the image out with a vector outline. In this case the laser will raster in the black fill and cut the red line.
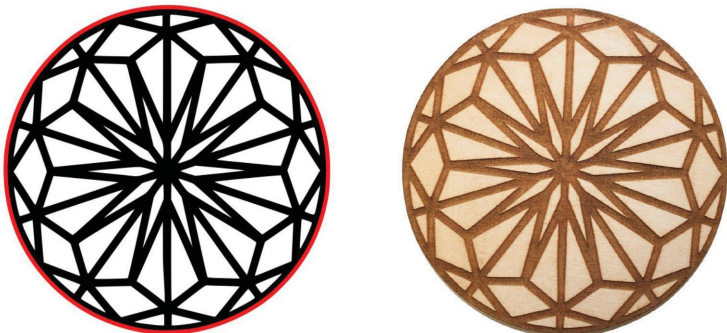
DESIGNING WITH RETINAENGRAVE v3.0

RetinaEngrave v3.0 contains design tools to allow for custom designs within the software itself. Here you can design and create objects without accessing third-party design software.

Adding Text

Click the "T" icon and then click anywhere in the view window. You can now write your text. To customize your text, click on the text object you created and a new window will appear with options to adjust the positioning, size and font of your text.

Full Text Options Window
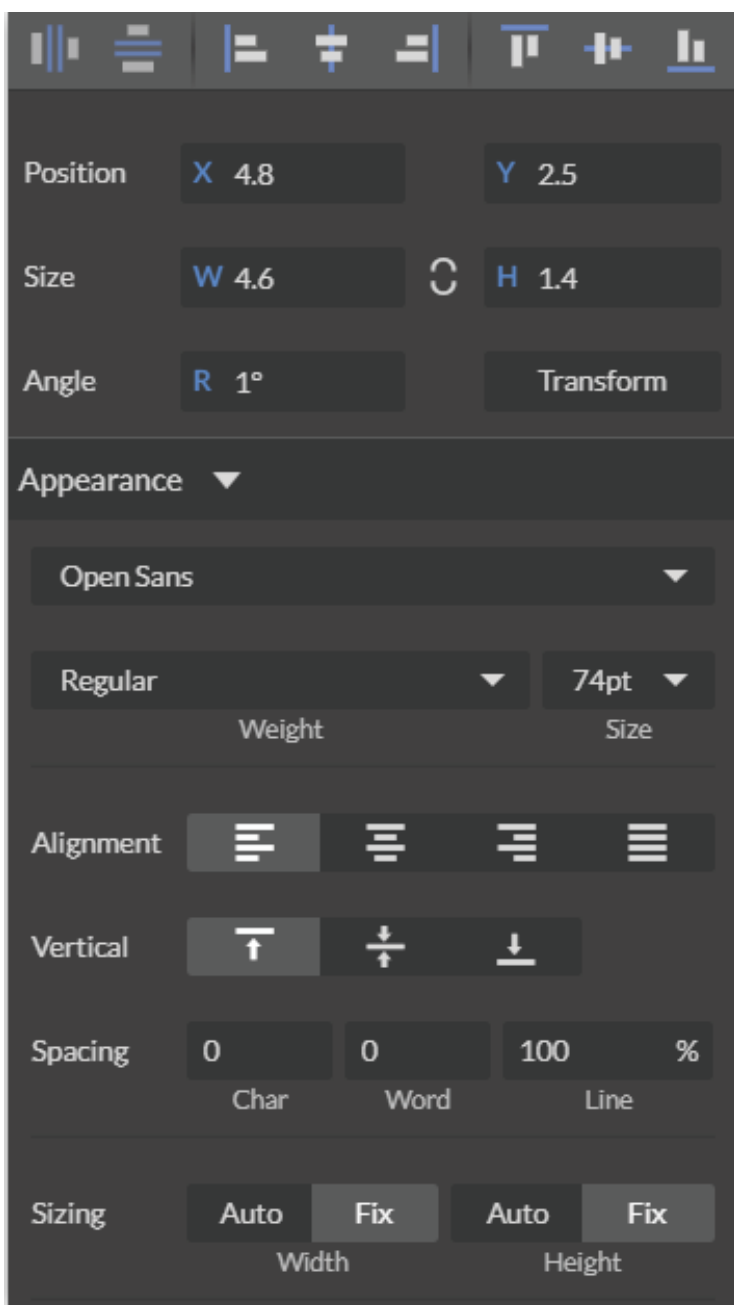
Text Positioning

Text position can be quickly adjusted by clicking on one of the following options.

Distribute Horizontally: Evenly arrange selected Text horizontally.
Distribute Vertically: Evenly arrange selected text vertically.
Align Left: Align text to the left.
Align Center: Align text to center.
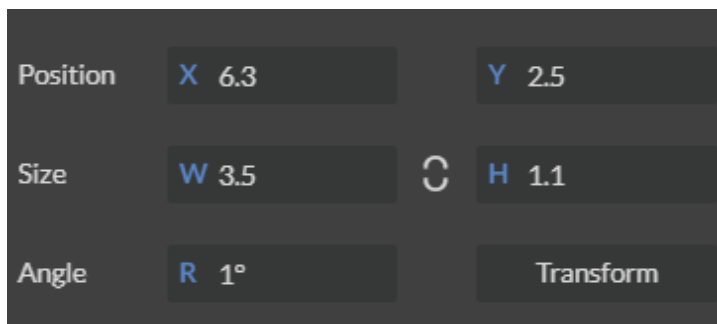**Align Right:** Align text to right.
Align Top: Align text to top.
Align Middle: Align text to middle.
Align Bottom: Align text to bottom

Text Positioning Coordinates

This window displays the coordinates and other specs of the selected text. Coordinates can be changed manually by entering the desired specifics directly into the software.

Position: Displays position of text in X/Y coordinates in the workspace. Click box to directly input X/Y coordinates.
**Size:** Displays size of text according to width and height. Click box to directly input desired width and height of text.
Angle: Displays angle of text as a degree. Click box to directly input angle degree of text.
Transform: Clicking the transform button brings up the Transform Window options.

Text Transform Options

Transform options allow the operator to alter the shape and skew of text.
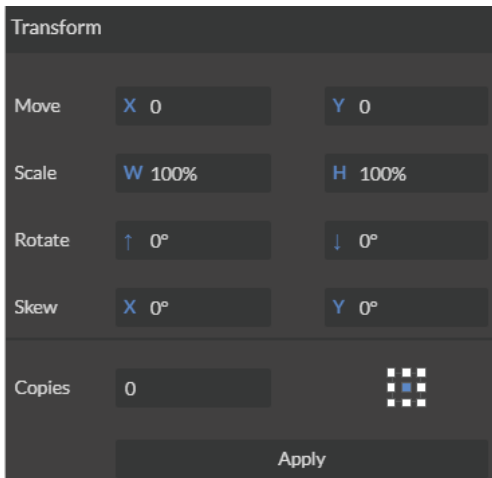
Move: Set X/Y coordinates.
Scale: Manipulate the scale of text, separately, in width and height.
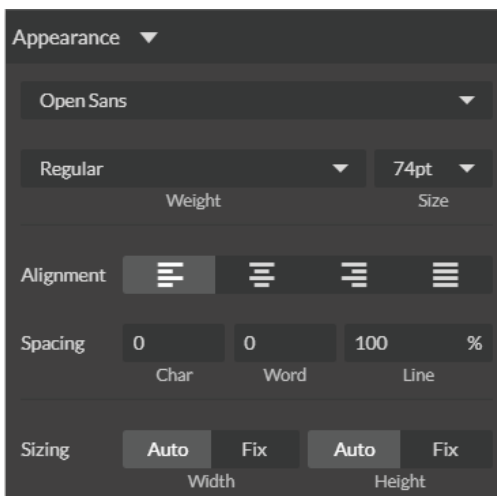**Rotate:** Rotate text a set number of degrees, up or down.
Skew: Skew the angle of text by a set number of degrees on the X and Y axis.
Copies: Create duplicates of the selected text.
Apply: Click to apply all transform changes.

Text Appearance

Select Font: Choose or change selected text font.
Weight: Choose bold and italic options for selected text.
Font Size: Choose font size for selected text.
Alignment: Align or justify selected text left, right or center.
Spacing: Set pacing or characters, word blocks and line spacing.
Sizing: Lock all sizing options (Fixed) or allow custom alterations (Auto).
When set to auto, click on text and use mouse to manipulate corner nods to change size.

Text Path Options

Attach Text to Path

This function allows the user to attach text to a shape and contour the text to that shape. As an example, user creates an ellipse design and a text element separately. With the mouse, drag a square over both. By clicking Attach Text to Path, the text is merged with the ellipse and the text conforms to the contour of the shape. The user can then drag the text element to the desired position, using the mouse.

Detach Text from Path

This function reverses the Attach Text to Path option. Select the object and text with the mouse by dragging a square to highlight both. Then, click Detach Text from Path. The shape and the text will now be separated.

Convert to Path (Shift+Ctrl+P)

Convert a non-path to a layer path. If a layer is composed of elements that are treated like paths, internally, or the layer is a Text object, the existing paths that make up the object are simply extracted from the object as they are already defined. The result is a compound path containing all of the separate paths. Any transform information from the original layer is not retained in the individual paths. For all other types of layers, a new path is created, preserving any transforms. The user creates a text layer then converts to a path. Because the text was comprised of more than one distinct element a compound path is created. The compound path can then be split into separate paths for each distinct element in the text.

Convert to Raw Path

Convert a path or non-path layer to a new path. This is similar to Convert to Path with some important differences. With Convert to Raw Path new path objects are always created regardless of the type of the original layer and transforms are preserved. The user creates a text layer then attaches it to an ellipse path so that it follows the curvature of the ellipse, then converts the text to a raw path. The text retains its curvature because the transforms of the separate text paths are preserved.

Creating Objects in RetinaEngrave v3.0

The easiest way to create an object is to select a shape from the tools menu. For example, you want to make a circle. Select the circle tool, then click and drag to create a circular shape. By holding shift while dragging, you can constrain the proportions so that the circle is perfectly round. Design view has hundreds of shapes that can be selected and manipulated to endless choices. Click the "Shape" icon to access shape library.

Creating Shapes

Click the Square Icon and then click and hold anywhere in the view window. By moving the mouse, you can expand and manipulate the square you want to create. By clicking the drop-down arrow next to the Square Icon, you can choose other base shapes and expand them just like with a square. The basic shape library includes **line, rectangle, ellipse, polygon, triangle** and **star**. You can modify any shape by clicking on it and then adjusting the interface data appearing on the right side of the screen. Each shape will have slightly different options as follows:
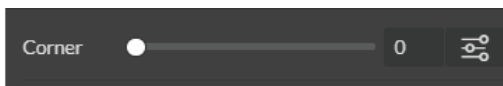
Line (L)
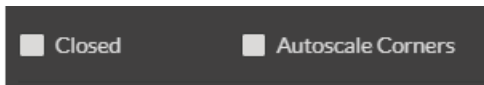
Closed:
Autoscale Corners:

Rectangle (R)

Corner: Slide bar contorts and manipulates corner styles.
Advanced Settings: Open a window for additional corner options.
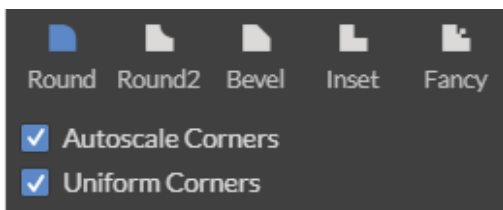
Round: Create rounded corners.
Round2: Create inverted rounded corners.
Bevel: Create beveled corners.
Inset: Create inset corners.
Fancy: Create fancy corners
Autoscale Corners: Toggle autoscale corners on and off.
Uniform Corners: Click to ensure all corners have the same parameters.

Ellipse (E)

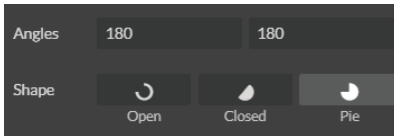| Angles	180	180
Shape	Open	Closed	Pie

Angles: Input custom angles
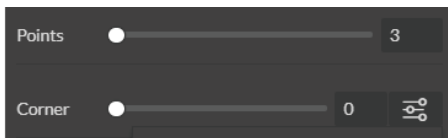
Shape
> **Open:** Click for open ellipse.
> **Closed:** Click for closed ellipse.
> **Pie:** Click for pie shaped ellipse.

Triangle, Polygon & Star

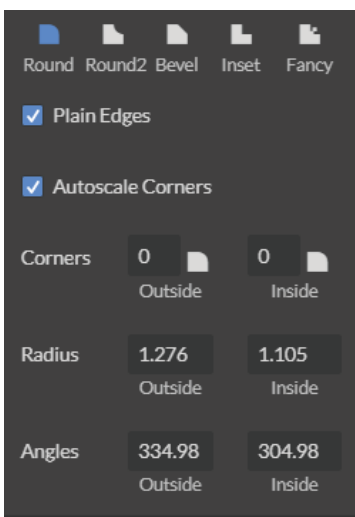| Points	●	3
Corner	●	0

Points: Slide bar to create polygons with multipoints (3 to 25).
Corner: Slide bar to curve corners
Advanced Settings: Clicking the icon opens a new popup window.

Advanced Settings

Round Round2 Bevel Inset Fancy

☑ Plain Edges

☑ Autoscale Corners

Corners	0	0
	Outside	Inside
Radius	1.276	1.105
	Outside	Inside
Angles	334.98	304.98
	Outside	Inside

Round: Create rounded corners.
Round2: Create inverted rounded corners.
Bevel: Create beveled corners.
Inset: Create inset corners.
Fancy: Create fancy corners
Autoscale Corners: Toggle autoscale corners on and off.
Uniform Corners: Click to ensure all corners have the same parameters.
Plain Edges: Toggle plain edges on and off.
Corners: Input outside and inside corner curvature.
Radius: Input outside and inside corner radius.
Angles: Input outside and inside corner angles.

Creating and Manipulating Compound Shapes & Objects

Operators can combine and modify shapes and objects to create unique compound shapes and objects with these functions (see also Modify):

Split Selection (Shift+Ctrl+G)

Split up a previously created compound shape or object that has been Unioned with other shapes. Select the compound shape and choose Split Selection. The different objects are split back up into individual layers that can be moved independently.

Create Compound Shape->Union

Combine multiple layers into a single compound layer. Union will create a compound shape containing all of the selected layers, retaining their relative positions. Union together several different object and create a compound shape so they can all be moved and manipulated as one. To reverse, select the compound shape and choose Split Selection. The different objects are split back up into individual layers so you can move one of them independently.

Create Compound Shape->Intersection

Combine overlapping layers into a single compound layer. Intersection will create a compound shape containing the areas where the selected layers overlap. Intersect together part of an ellipse and part of a rectangle to create a new compound shape with curved and straight lines.

Create Compound Shape->Subtract

Remove and combine non-overlapping layers into a single compound layer. Subtract will create a compound shape containing only the areas of the last selected layer where the other selected layers do not overlap. For example, users can create an ellipse and subtract a rectangular area so the ellipse can be placed over another layer and not obstruct part of it. Or use to make a design that is made up of standard shapes by subtracting certain areas.

Create Compound Shape->Difference

Combine non-overlapping layers into a single compound layer. Difference is the opposite of Intersection. It will create a compound shape containing only the areas where the layers do not overlap. For example, the user can create a large circle ellipse, then create a smaller circle ellipse. Place the smaller circle ellipse over the large circle ellipse and center it. Select both layers and choose Difference. A hole is created in the large circle ellipse and a donut design is formed.

Create Nested Compound

Combine compound shapes into a single compound shape. All of the selected compound shapes will be nested within the compound shape that was selected last. For example, if user has created compound shapes and created the layout with the desired spacing but would like to move them all while retaining the existing layout, creating a nested compound shape that includes them all works best.

Convert to Outline

Create an outline path of a specified size around an object. If the original object is not continuous, such as a line, an outline is created around the line and the original line is replaced. If the original object is continuous, such as a rectangle, an outline is created around the rectangle and the original rectangle is preserved, resulting in a compound path with two rectangles. The user creates a curved line then converts it to an outline of size 10. The result is a continuous curved polygon that looks like a wet noodle.

Expand/Shrink

Scale an object up or down by a specified amount. The user creates an object and wants to grow it a few pixels but trying to scale it with a selection box is too difficult. He can expand the object by specifying the exact amount.

Creating & Converting Vector Paths

A vector path indicates the line the laser moves along while cutting. For a simple line, the path is a clear route from Point A to Point B. More complicated paths, and shapes, can be created using the following options in the Modify drop-down window:

Vectorize Border

Use to create a vector path of the border of an object. For example, the user creates an object, such as a rectangle, and wants to have a vector path of just the border of the triangle.

Vectorize Image

Use to create vector paths of each separate element in an image. For example, the user first imports an image. User then wants certain parts of the image to be vectors so they can be cut. User vectorizes the image and then moves some of the resulting vectors out of the image object. The vectors can then be edited.

Join Paths (Ctrl+J)

Combine 2 or more selected paths into one compound path. The result is a single layer titled 'Compound Path'. It does not connect them into one continuous path but rather a single object with breaks between the individual paths that were joined. The user joins together multiple path objects so that they can be transformed more easily and change their properties as a single object.

Split Paths (Shift+Ctrl+J)

Split a compound path into its original separate paths. The result is a path layer for each separate path in the Compound path.

Simplify Path (Ctrl+Alt+S)

Simplify (and smooth) a path to varying degrees of tolerance. The user creates a freehand line or compound curve but the resulting curve has some sharp turns and jagged edges. Next, select the path and simplifies it with a tolerance (start with 20%). The resulting path has fewer vertices and smoother turns.

Connect Path Lines

Connect together the ends of 2 or more paths. The user vectorizes an image containing text. Due to the low quality of the image some, of the text characters have breaks in their paths, so the user selects the lonely paths and uses the "Connect Paths Lines" feature to connect the paths.

Break Curve

Break apart a path at a specified node. The user creates a path but would like to separate it and add space at certain vertices to add another artistic element in between. Or maybe to specify different engraving parameters for different parts of the path. To do so, the user selects a node and chooses "Break Curve". The path is separated into two separate paths.

Reverse Order

Reverse the order of nodes in a path. When the user creates several paths and uses the "Connect Paths Lines" feature, they are connected but not at the desired ends. This is because the paths are connected from the last node of one path to the first node of the next. Undo the previous action and chooses "Reverse Order" on one of the paths. Then connects the paths and they are connected perfectly.

OTHER OPERATIONS

Positioning the Laser Head (Jog)

Operators will want to become accustomed to moving the laser head, in order to position the laser. This can be done in one of two methods: manual and jog control. Manually moving the laser head requires that the laser head be in the "Unlocked" position. To unlock the laser head, push the "Lock" icon, on the touch screen, so that the icon has an open lock icon. The laser head can now be freely moved to any position in the workspace by hand.

Jogging is when the operator uses the touch screen "jog" buttons, or Ctrl + Left Mouse Button within the web application workspace, to move the laser head. To use the jog feature, the laser head must be in the "Locked" position. To lock the laser head, push the "Lock" icon so that the icon has a closed lock icon.

Positioning Material

Relative positioning is relative to the laser head. The red dot from the laser will be considered the top left corner of an image. This makes positioning easier without the use of the Muse camera system.

Absolute positioning is the default mode and will directly translate the object's location on the computer workspace to the respective location on the laser bed. Absolute positioning is ideal when using the camera system.

You can switch from Relative Positioning to Absolute Positioning by going to Settings, within the Edit drop-down options. Click Settings>Device. Next, choose Absolute Positioning or Relative Positioning on the slide bar across from Laser Positioning. Click "Save Changes" when you are done.

Mouse Controls

A. Drag 'n Drop
Click and hold a design file and then drag it into the workspace. You will be invited to "Drop anywhere!". Once uploaded, click and hold the left mouse button and drag the mouse to move the object in the workspace.

B. Resize / Rotate
Clicking on the object with your mouse will highlight the square adjusters for size and orientation. Use the mouse to manipulate the object's size by expanding or constricting the square adjusters or turning the rotation node to rotate object.

C. Alt + Left Click to Rotate
Hold the Alt button on your keyboard, then left click and hold your mouse over the rotation node. By moving the mouse, you can resize the object from center rather than the corner.

D. Alt + Left Click to Resize
Hold the Alt button on your keyboard, then left click and hold your mouse over one of the four corner "resizing" nodes. By moving the mouse, you can to rotate the object from the opposing node.
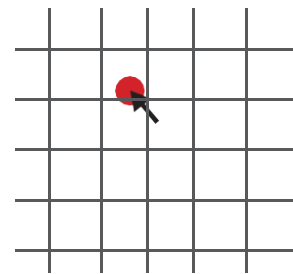
E. Home to Location
Instantly home the laser to any location in the work bed by simultaneously holding the Ctrl key and left-clicking the mouse. This allows you to choose where the laser starts the job.
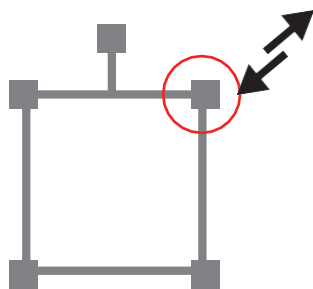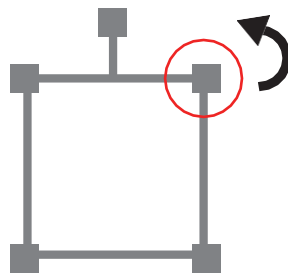
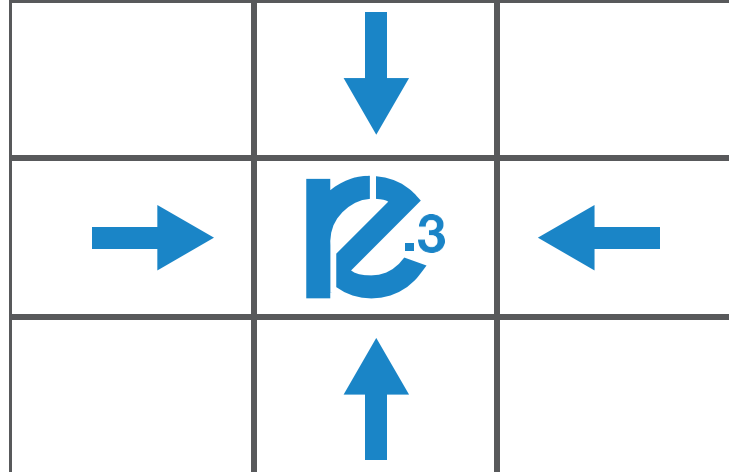**Resize**   **Rotate**   **Home to Location**

Camera: Capture Workspace

Use the onboard camera to capture your workspace to align your design.

1. Place material in center of laser bed.

2. Position the laser head above the material and use the focus billet to focus the cone above the material surface. Ensure your material does not impede the movement of the laser head.

3. Initiate Camera Sequence - Press the Camera Icon on your RE2 software, or on the LCD touch screen (for touch screen controls, see user manual) - Note that you 1) use the camera button, 2) position the head, and 3) press the camera button again (this initiates sequence with no indication on software). Follow the steps on the screen. Click "New Height Measurement". The laser head will shift back and measure the height of your material using the secondary red beam laser. You can repeat this step several times for more accurate results. If results don't improve, it may be that your material is an uneven surface. Click Continue when focused.

4. After 9 photos are taken and stitched, your workspace should now represent your laser bed. Position your design as needed (for help importing, see the Work-Flow Section), and adjust setting.

5. You are now ready to run your job! To double check a position on your workspace, CTRL-Click anywhere on the work space to position the laser head there.

Camera: Vector Trace

Use the onboard camera to capture your workspace to align your design.
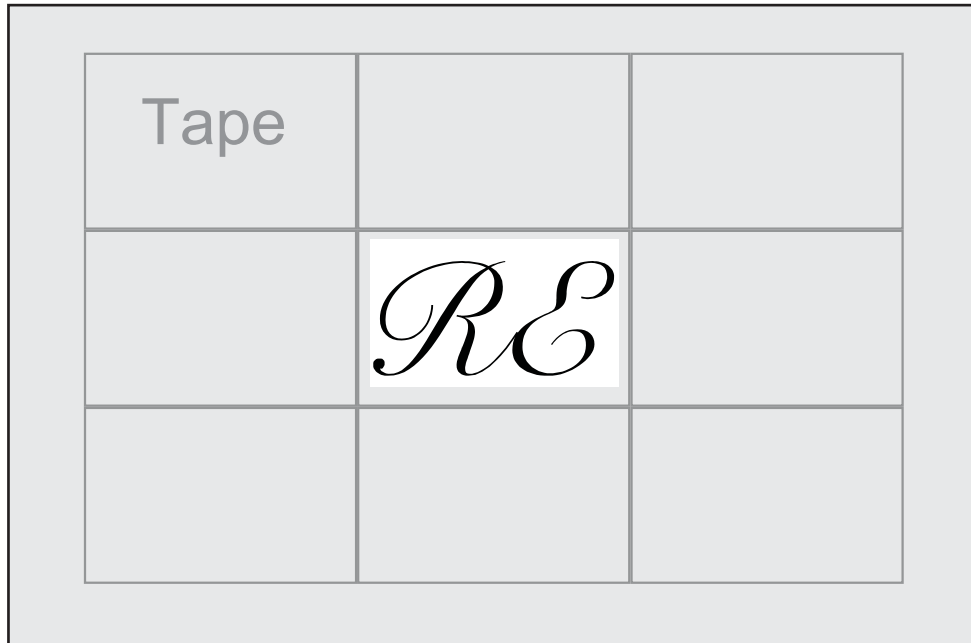
MASKING TAPE OVER WORK AREA

1. Choose your material, and prep. Flat objects work best, and we suggest you place masking tape (paper tape) on the surface before marking with a pen (sharpie). Don't allow the masking to tape to overlay on the material when applying more than one strip.

2. Using a thick black marker or pen, draw on your material. Thick solid lines will be read the best. If coloring in a space, ensure completely filled in.

3. Capture the workspace as shown in steps 3 & 4 in the "Capture Workspace" instructions.

4. Click on the "Vectorize" icon in the top menu bar (show with label). This will bring up a sub-menu. Using your mouse, select the section you want to vectorize and press ok. You can repeat this step as many times as you like. Place a white piece of paper behind your self-drawn design to help aid if having trouble capturing the area you want to vectorize.

5. You now have Bitmap and Vector data for your object available.
They should appear in the Object Manager box. Delete data not needed. If just engraving, delete vector data, if just cutting or marking, delete bitmap data.

6. You are now ready to run your job!