GALVO

muse

Full Spectrum
L A S E R

Full Spectrum
L A S E R

Muse Galvo

Operations Manual
version 1.0

Table of Contents

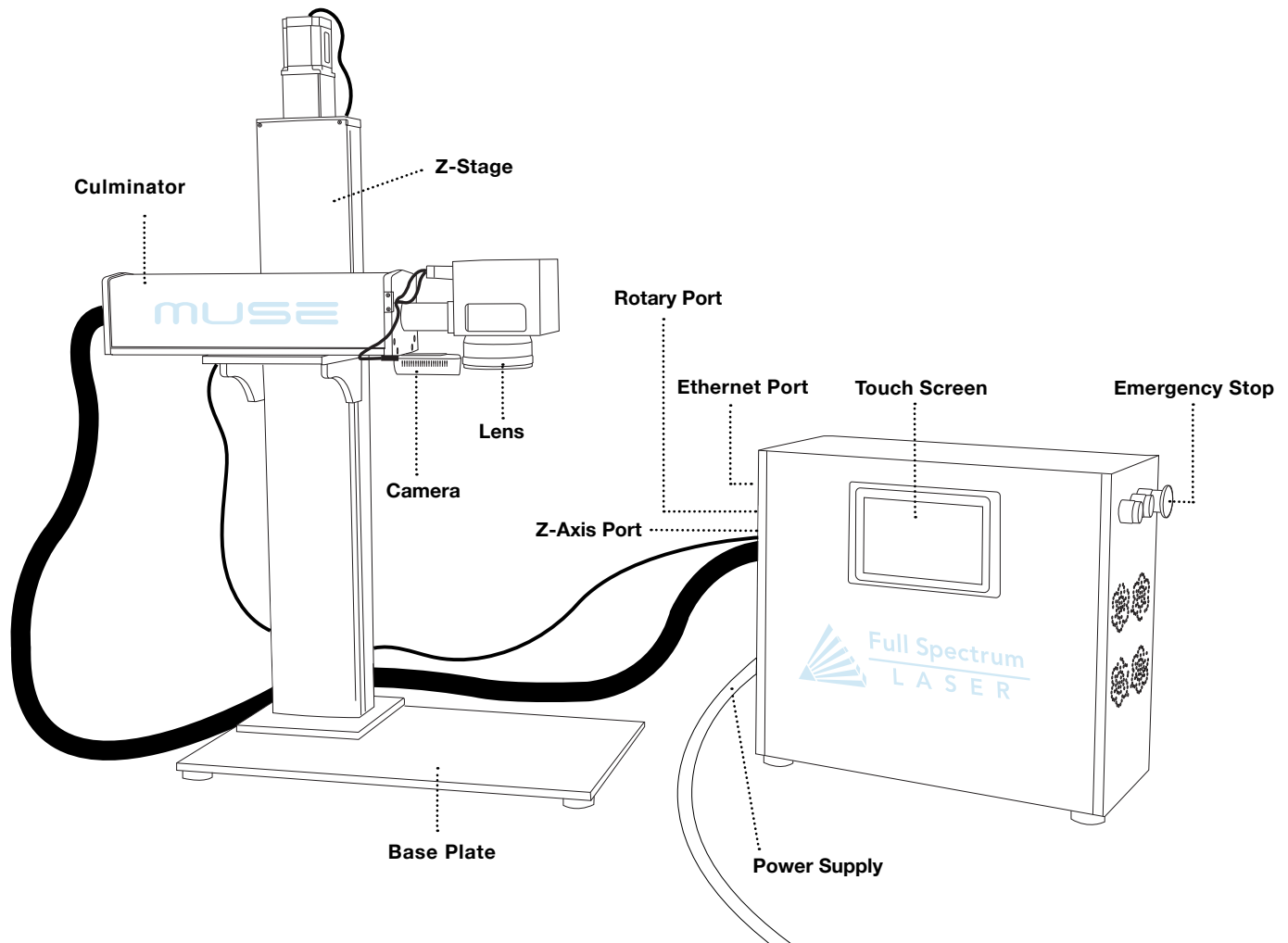# The Muse Galvo by Full Spectrum Laser

Congratulations on your purchase of a Full Spectrum Laser Muse Galvo. With proper usage and upkeep, your laser cutter should provide years of productive output. This user manual will guide you through the safety guidelines and operation of your machine. It is recommended that you familiarize yourself with this manual before using your laser cutter.

For more information and product selection, please visit www.fslaser.com

Compliance Statement The Full Spectrum Laser Muse Galvo Laser System is a Class 4 laser product, as defined in International Standard IEC 608251. The Full Spectrum Muse Galvo complies with 21 CFR 1040.10 and 1040.11, the Federal Performance Standards for Light Emitting Products, except for deviations pursuant to Laser Notice No. 50, dated July 16, 2001. The Center for Devices and Radiological Health of the US FDA issued Laser Notice No. 50 to permit manufacturers to classify and manufacture their products in accordance with the International Standard. 21 CFR 1040 and IEC 608251 require that certification, identification, and warning labels be placed on laser products. Reproductions of the labels found on the Full Spectrum Hobby Advanced Laser System follow, with locations specified:

⚠CAUTION

Class IV laser visible and invisible laser radiation avoid eye and skin exposure. Wear protective eyewear

This product complies with the 21 CFR 140.10 and CFR 140.11 except for the deviations pursuant to Laser Notice No. 50, dated July 26, 2001

FSLASER.COM

Full Spectrum Laser LLC
6216 S Sandhill Road
Las Vegas, NV 89120 USA

Eyewear needs to protect 1064 nm wavelength sources.

Symbols and Definitions

Red icons indicate dangerous situations that could result in death or serious injury.

Indicates a hazardous situation.

Indicates a risk of fire.
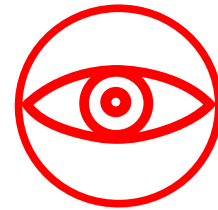
Warns of potential risk to eye-safety.

Indicates a respiratory hazard.
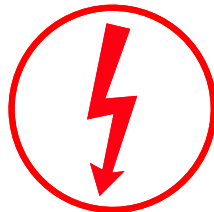
Indicates an electrical hazard.

Indicates sharp edges that could cause injury via laceration.

Black icons indicate practices not related to personal injury.

NOTICE

Calls attention to important information.

Warns of fragile parts or materials.

Calls attention to important details.
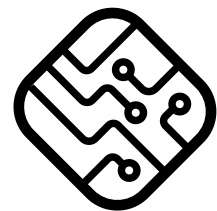
Indicates issues regarding software or network.

Setup Precautions

Follow all safety protocols and procedures before operating any machinery. It is the responsibility of the operator to ensure all safety precautions are correctly followed and the machine is properly assembled and in working order.

CAUTION

⚠

· Always inspect the laser cutter for damage or breakage before each use. Do not operate machinery that is damaged or defective in any way.

· Always have a clean, level, and open work space to unbox and place your laser cutter.

· Never modify, disassemble, or in any way alter the construction of the laser and never start up a system that has been modified or disassembled.

· Keep your laser system clean and organized

· Do not disassemble the machine or remove any of its protective covers.

· Always have on hand a first-aid kit designed for the initial treatment of burns and smoke inhalation. Be sure to store this kit in an area that is outside risk areas.

· Never operate the machine with any of the panels removed. Be aware that removal of any portion of the cabinet will expose the laser system and greatly increase the risk of injury and/or fire.

Safety During Operation

The Muse Galvo laser has an overall rating of Class 4. Class 4 lasers have the capabiblity to damage eyes, burn skin and start fires.

Follow these Safety Guidelines at all times:

DANGER

- **Always use provided safety glasses. Unshielded laser light is harmful to the eyes.**

- **It is recommend that when the laser is running, the user is at least 5 ft from the laser.**

- **Never aim any laser towards an aircraft or vehicle that is in motion.** The bright light can flash, blind, cause glare, or distract the pilot or driver.

DANGER

- **Only operate Muse Galvo in a ventilated area larger than 10ft x 10ft.** Excessive inhalation of fumes can be detrimental to health or fatal.

- **Never engrave or cut any material containing PVC or vinyl under any circumstance. These materials (along with other materials that contain chlorine / chloride) produce a highly toxic, corrosive vapor that is lethal to humans and will destroy your machine**. Your warranty will be void if your machine is damaged by corrosion from engraving or cutting PVC or vinyl.

- **Never engrave or cut any unknown material.** The vaporization / melting of many materials, including but not limited to PVC and polycarbonates, can give off hazardous fumes. Please refer to the MSDS sheet from the material manufacturer to determine the response of any work material to extreme heat (burning/fire hazard).

Electrical Safety

CAUTION
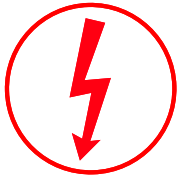
· **Do not open the machine while the unit is plugged in. Opening the machine may expose the operator to the unit's AC input power which is potentially lethal.**

· **Never make or break any electrical connections to the system while the unit is turned on.**

· **Never access the electronics area with hands or tools unless the unit is disconnected from power for at least fifteen minutes.**

· **Emergency shutoff is controlled by the red button on the front of the Muse Galvo.**

The standard reference for laser safety is the American Standard for the Safe Use of Lasers, Z136.12000, developed by the American National Standards Institute (ANSI). This reference is the basis for many of the federal regulations for laser and laser system manufacturers, and for the Occupational Safety and Health Administration (OSHA) laser safety guidelines. It contains detailed information concerning proper installation and use of laser systems. While the ANSI standard itself does not have the force of law, its recommendations, including warning signage, training, and the designation of a laser safety officer, may be compulsory under local workplace regulations when operating laser systems above Class I. It is the operator's responsibility to ensure that the installation and operation of the Full Spectrum Laser Hobby Laser System is performed in accordance with all applicable laws. Copies of ANSI Standard Z136.12000 are available from: LASER INSTITUTE OF AMERICA 12424 RESEARCH PARKWAY, SUITE 125 ORLANDO, FL 32826 (407) 3801553.

Fire Safety

Laser cutting and engraving systems can present a significant fire hazard due to the extremely high temperatures generated by the laser beam. While the objective of most cutting and engraving operations is to vaporize material without burning, most materials capable of being cut or engraved are inherently combustible and can ignite. Usually this is a small flame of burning material issuing from the cut zone which self-extinguishes due to the air assist or depowering of the beam. However, it is possible for the flame to propagate and set fire to the machine and its surroundings.

CAUTION

• **Always keep a properly maintained and inspected 5lbs. or larger fire extinguisher on hand.** Full Spectrum Laser recommends a Halogen fire extinguisher or a multipurpose dry chemical fire extinguisher. Halogen extinguishers are more expensive than a dry chemical, but offer certain advantages should you ever need to use an extinguisher. The Halogen extinguisher discharges a clean, easily removable substance that is not harmful to the mechanics or wiring of the laser system. The dry chemical extinguisher discharges a sticky, corrosive powder that is very difficult to clean up.

• **Stacking materials (especially organic materials such as paper) can lead to increased risk of flame propagation or work piece ignition.**

• **Never operate your machine unattended.** There is a significant risk of fire if the machine is set improperly, or if the machine should experience a mechanical or electrical failure while operating.

• **Always keep the area around the machine clean and free of clutter,** combustible materials, explosives, or volatile solvents such as acetone, alcohol, or gasoline.

• **Be cautious when vector cutting.** Many materials have the potential to burst suddenly into flames – even materials that may be very familiar to the user. Always monitor the machine when it is operating

• **Vector cutting with the laser has the most potential to create an open flame.** Acrylic in all its different forms has been shown to be especially flammable when vector cutting with a laser.

• **Never cut PVC (polyvinyl chloride) under any circumstances:** fumes are highly toxic and potentially lethal.

• **Never store any flammable materials in the immediate vicinity of the device.** Debris and left over produced materials within the machine must be removed to prevent fire hazard.

Cable Connections

In order to operate your Muse Galvo, you must connect the Z-Axis cable and the Power cable.

Z-Axis Output Cable

Optics Cable

Ethernet

Rotary Connect

Z-Axis Port
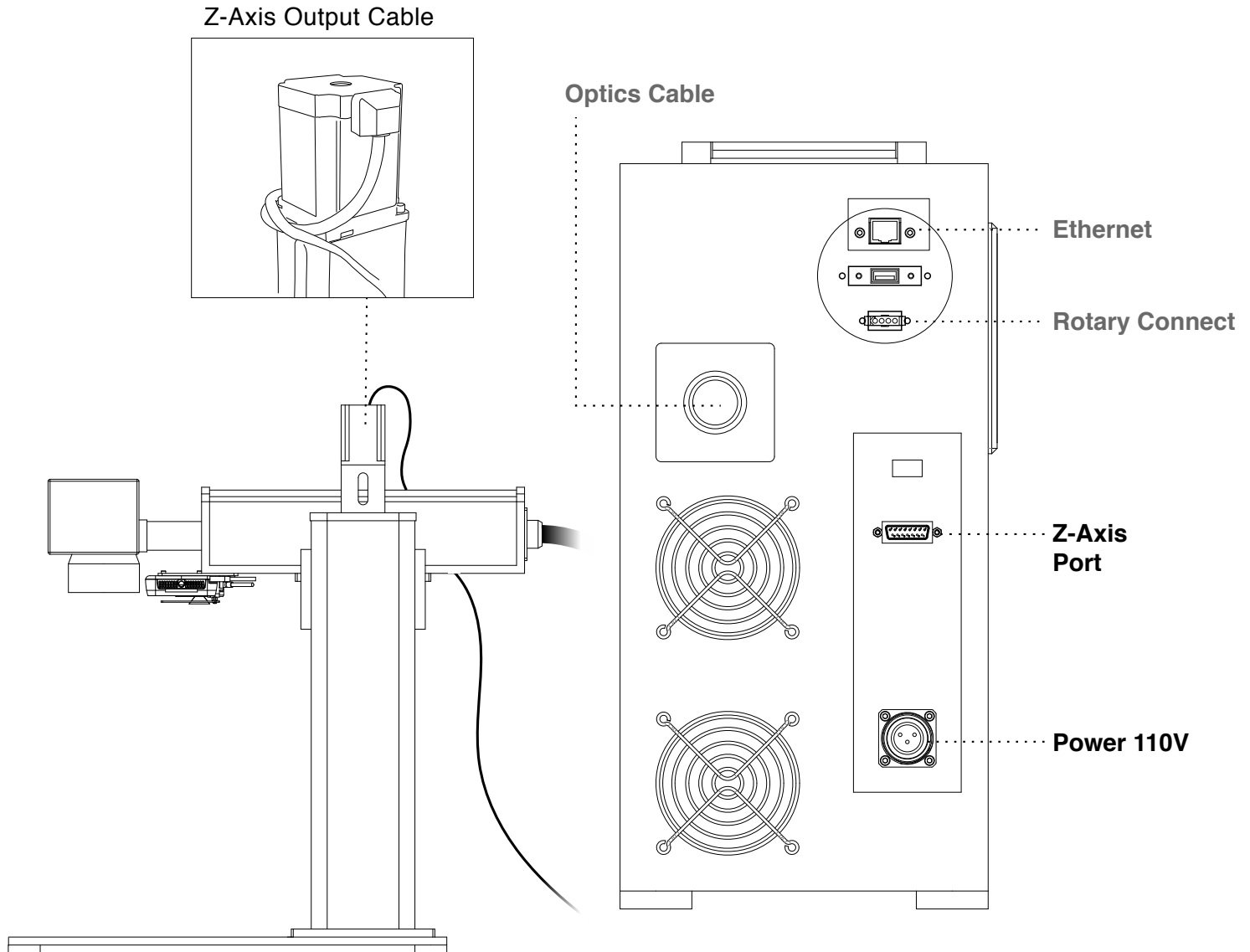
Power 110V

NOTICE

• Connect Z-Axis Output Cable and Power 110V cable after assembling Z-Stage **(pg 10)**

• Optics cable can be easily be damaged do no bend excessively.
(Bending radius of optics cable must not exceed 15cm)

The three buttons on the side of the Muse Galvo Tower are intended for security precautions. They control the power going to the internal boards and the laser.

**On / Off Control for Internal Boards
(Circuits, Galvo Power)**

**On / Off Control
for Laser**

LASER   BOARD/GALVO   EMSTOP
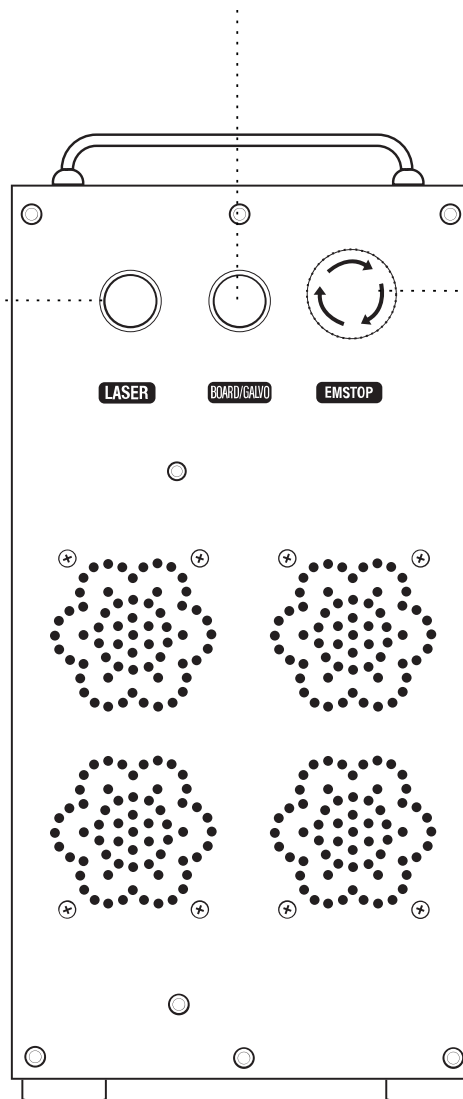
Emergency Stop

If an emergency occurs then push the button down to shut down the machine instantly. To restart the machine, turn the Emergency Stop button clockwise until it resets back into it's normal un-pressed position and then hit the green power button adjacent to it.

Z-Stage and Platform Assembly

1. Unpack all the items from the box.

2. Set the Base Plate on a flat surface.

3. Place Z-Stage on the Base Plate. Mount the Z-Stage using M6 Screws and Washers.
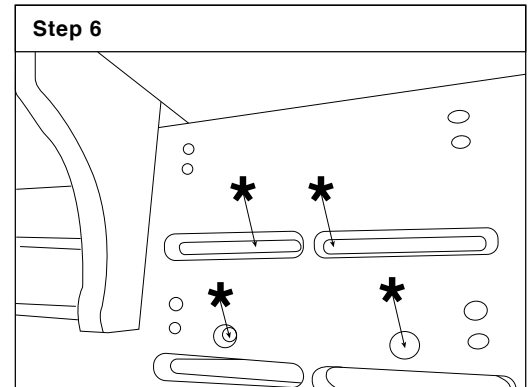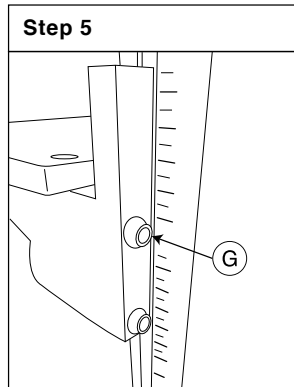
4. Insert Dowel Pins into the center hole on the Z-Stage.

5. Mount the Platform onto the Z-Stage using M5 Screws.

6. Mount the culminator onto the platform, ensure lens is centered over work area.

7. Line up the T-Nuts within the culminator with the slots and largest hole on the Platform.
Use 4 M5 Screws.

Step 3	Step 4	Step 5	Step 6
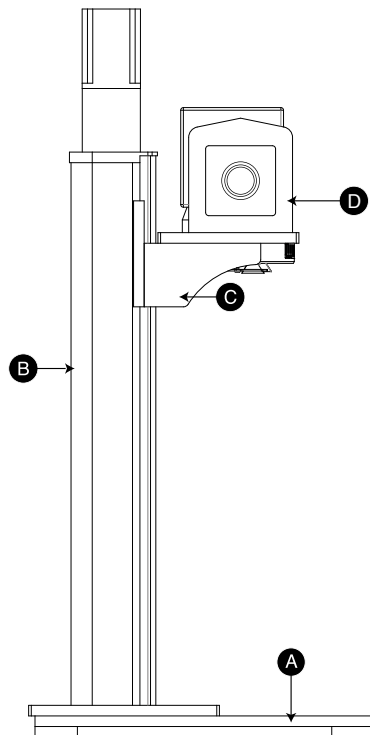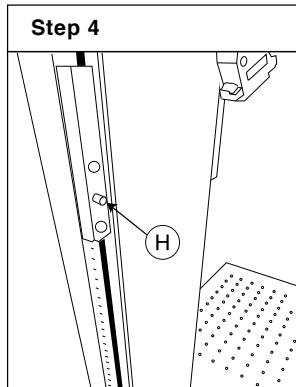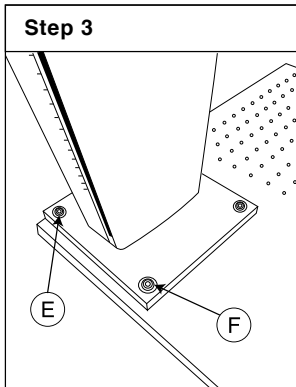
NOTICE

Make sure the T-nuts are lined up ✱

Ensure culminator is parallel to the front edge of the platform.

Parts		
Label	**Description**	**Quantity**
A	Base Plate	1
B	Z-Stage	1
C	Platform	1
D	Culminator	1
E	M6 Screws	4
F	M6 Washers	4
G	M5 Screws	8
H	Dowel Pins	2

The Muse Galvo offers a multitude of Setup Options, depicted below are some ways you can set up your laser system.

Option 1
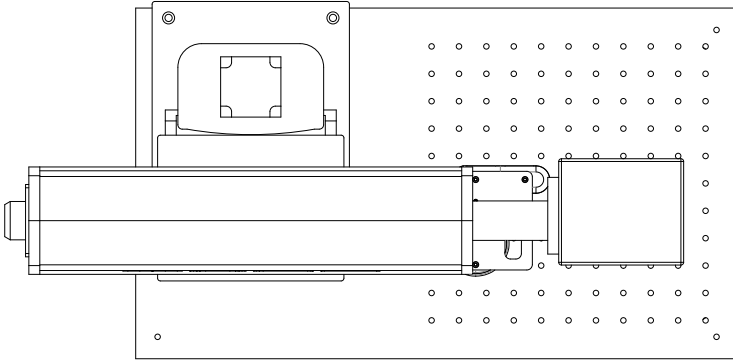
Option 3
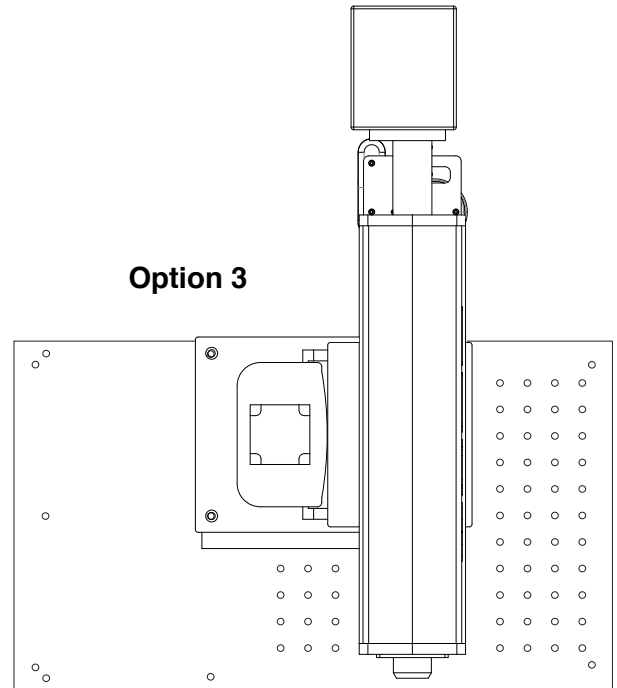
Option 2
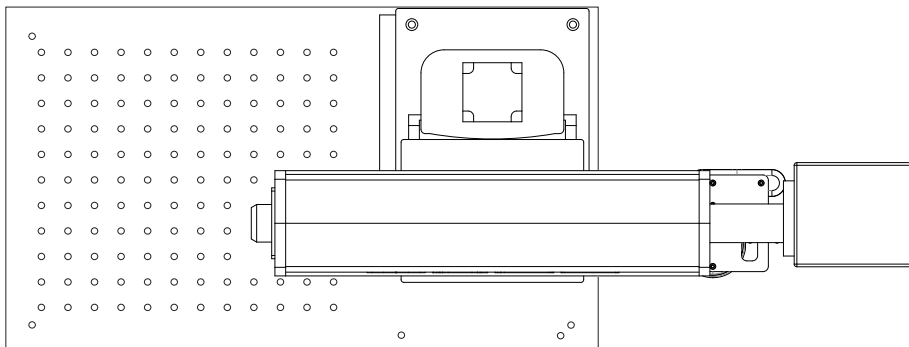
* This option is only suported by two mounting screws

Full Spectrum
L A S E R
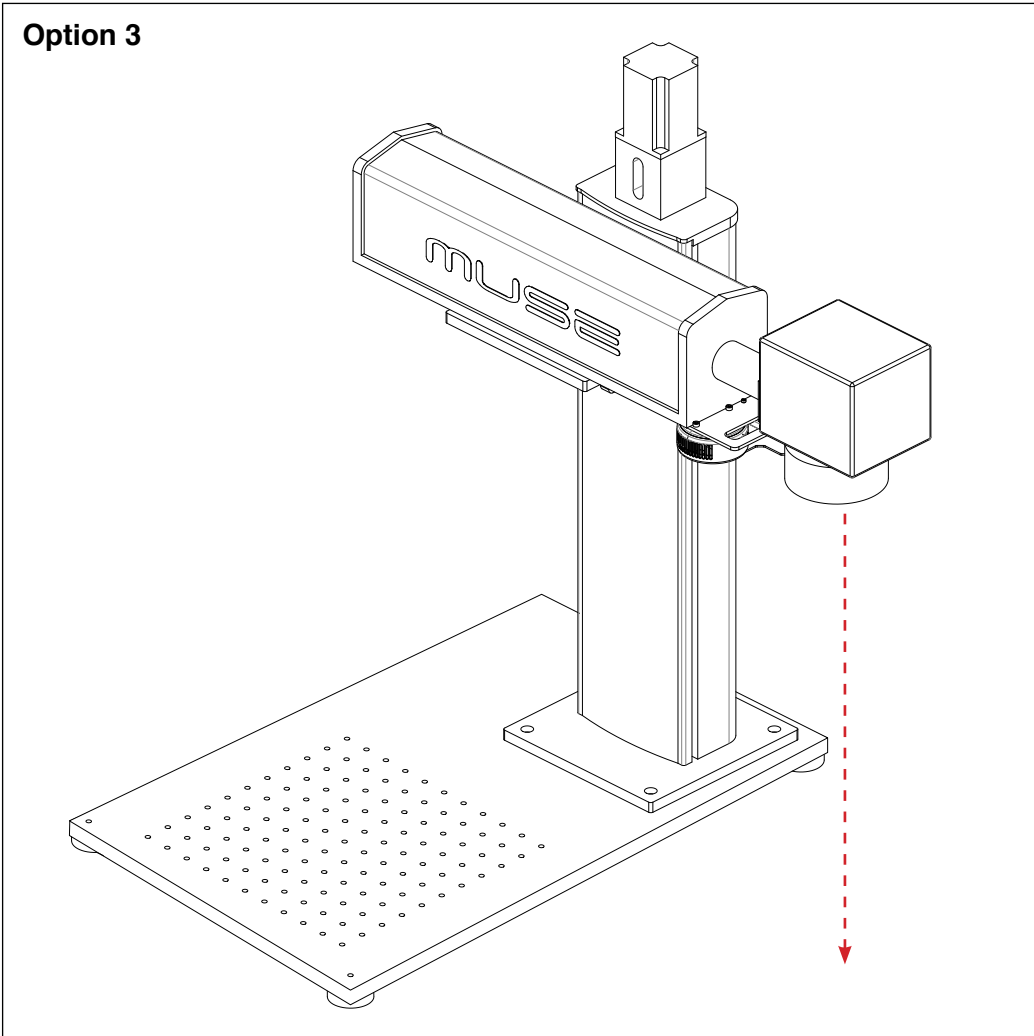
Option 3

This option is the ideal setup when using the rotary. It's practical for engraving tall objects and/or using lenses with high focal lengths because it allows you more vertical freedom in placing objects since it doesn't have to be placed on the Base Plate.

Prepare Software Connection

The Muse Galvo utilizes RetinaEngrave v3.0, a browser-based software which doesn't require any downloads. Only two items are required in order to access RetinaEngrave v3.0: a computer with access to an internet browser (Google Chrome recommended) and a connection between the Muse Galvo and the internet or said computer.

Connect Via Router (Recommended):
Connecting to the Muse Galvo via the router is the most reliable way to establish a link to RE3.

1. Locate and remove the included Ethernet cable from its packaging.

2. Plug the Ethernet cable into the Ethernet slot on the Muse Galvo.

3. Plug the other end of the Ethernet cable into your router's Ethernet slot.

Connect to Wi-Fi
Connecting to the Muse Galvo via Wi-Fi is the secondary way to establish a link to RE3.

1. Tap Network on the Muse Galvo Screen.

2. Click Wi-Fi and the machine will automatically search for networks.

3. Select the preferred connection from the list and enter the proper password in order to connect to Wi-Fi.The machine will now have internet connection and is ready to connect to RetinaEngrave v3.0

Connect Directly to Computer

A direct connection between the Muse Galvo and the computer should only be done if the previous two options are not possible.

1. Locate and remove the included Ethernet cable from its packaging.

2. Plug the Ethernet cable into the Ethernet slot on the Muse Galvo.

3. Plug the other end of the Ethernet cable into your computer's Ethernet slot.

Assembly Stage 7: 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 the included Ethernet cable) your Muse Galvo will link with the software's IP address.

1. Turning on Muse Galvo will automatically boot up your Muse Touch Screen interface. Allow 30 seconds or so for the machine and touch screen to boot up.

2. Locate the IP Address at the bottom right of the Home screen. Alternatively, you can find the IP Address of the machine by tapping Tools -> About. The address will be listed there. This IP Address is of the network you connected the machine to. Wireless and Wired connections will have different IP Addresses.

3. Type IP Into Browser: On the Network Screen you will see a "Wired IP" number. Using your computer, type this IP number into your favorite browser (Google Chrome is recommended). 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, either through Wi-Fi or the Ethernet cable.

• Occasionally, RetinaEngrave v3.0 software will run an update. This is an automatic process that can happen when you first boot up the machine. Typically, updates are quick, however, there may be some occasions where updates can take longer. Allow the update time to complete before running the Muse Galvo.

• The machine must be powered on when operating the software or when connecting the machine via the Ethernet cable. You will need uninterrupted Internet access for this process.

Section III. Lens Calibration

NOTICE	Avoid glare, direct sunshine, and bright lighting while operating machine. Bright light can impair the sensors.

WARNING	
	Wear protective eye wear.

Calibration cannot be done in Rotary Mode. Calibration should be performed specifically for these conditions:

• If any setup other than Option 1 is used.

• The cameras are changed or manipulated.

• The lens are removed, replaced, or changed.

• If the base plate is changed or removed.

Replacing the Lens

If you wish to change the lens for a different one, the machine must be calibrated again.

Then select Galvo Fiber -> Diagnostics -> Galvo Calibration. This will walk you through the calibration process. These steps are listed below as well.

File   Edit   Modify   View   Galvo Fiber   Help

Camera ▶
Estimate Job Time
Run Job   G
Diagnostics ▶   Galvo Calibration

Full Spectrum
L A S E R
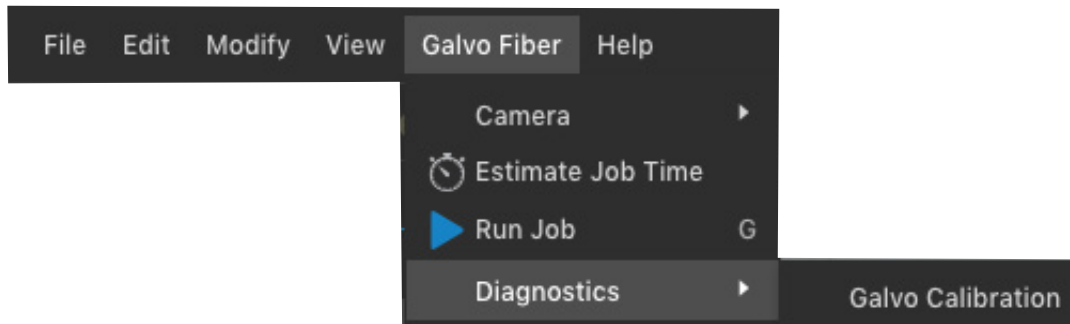
1. Click the home button to move the laser to it's home position. Input the number that appears on the ruler into the box and click next.

2. Test the open and closed position of the camera shutter. The position can be adjusted. The shutter should cover the cameras properly. Default value for lens open and closed positions: 0.5 and 2.5.

3. Raise the Z-Stage until the distance from the lens to the work space is as listed in the table. If the focal length of the lens does not match that of those in the table then use this formula to find the height you should set: Initial Height = Lens Focal Length + 40mm Place an anodized aluminum card in portrait orientation, in the center of the workspace under the red laser, then click next.

254mm Lens

284mm"

Target

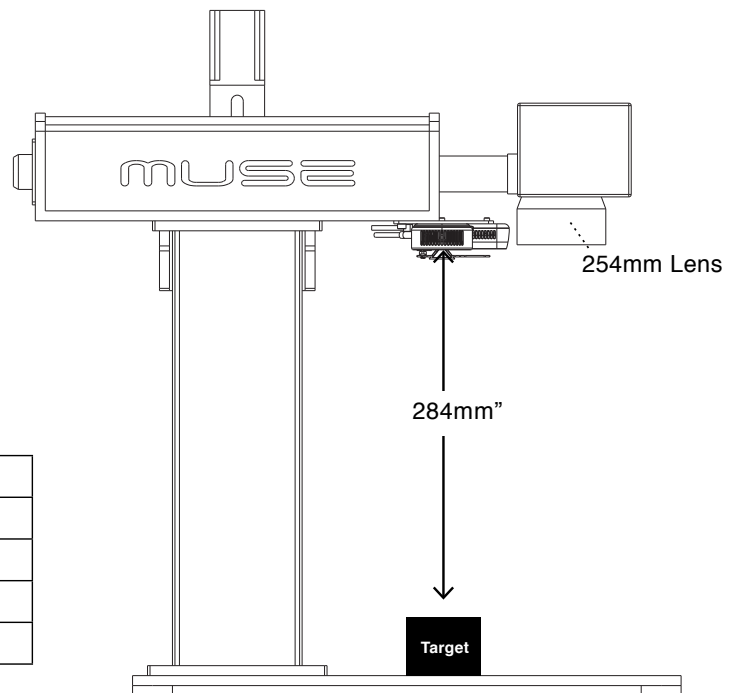| Lens Focal Length	Approximate Distance
163mm Lens	203mm
254mm Lens	294mm
330mm Lens	370mm
420mm Lens	460mm

4. With the anodized aluminum card placed, enter a speed and power value the click the start button to begin marking test patterns. This step can take up to 5 minutes to complete. Do not close or reload the application during this process. When the test patterns are done click next.

5. Check the resulting patterns and input the number (1-50) which shows the best defined pattern with the clearest lines and spacing between lines, then click next. This will require a microscope.

6. This next step is for distance calibrating the camera. Lay out about 2 to 4 white sheets of letter size paper in with the red dot at the center of the sheets. Click the start button. The red dot will move around in order to calibrate the distance from the sensor. This step may take up to 2 minutes to complete. Do not close or reload the application during this process.

NOTICE

After calibration, the machine will auto-focus to the material before engraving. Keep in mind the height of the object being engraved. If the object is too tall then the laser cannot auto focus to the material and the cut quality will be worse. If you wish to engrave tall objects then try a different setup option to allow the laser to go to the proper focus height.

CAUTION

While operating the laser, it is important that the shutter is covering the camera. **Reflected light from the laser will destroy the camera if not covered**
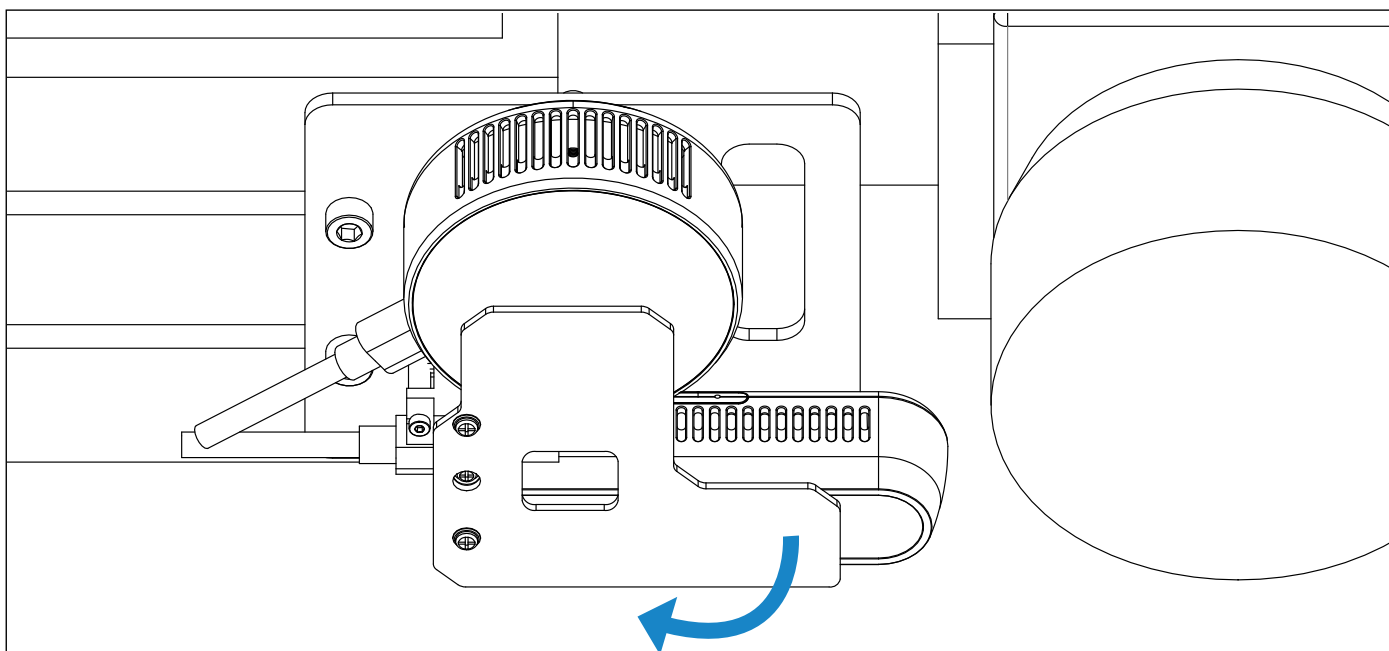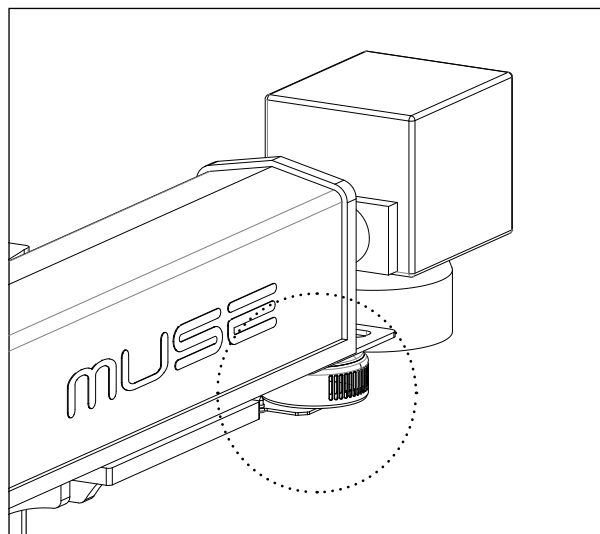
Depicted is the covered position, The camera will be in this position anytime the laser is being used. It will return to the open position after the job finishes.

Muse Galvo touch panel allows you to control the basic functions of your laser without needing to connect to a computer. To actually run jobs, you will need to access the RetinaEngrave v3.0 software (see Installations and Assembly Section.)
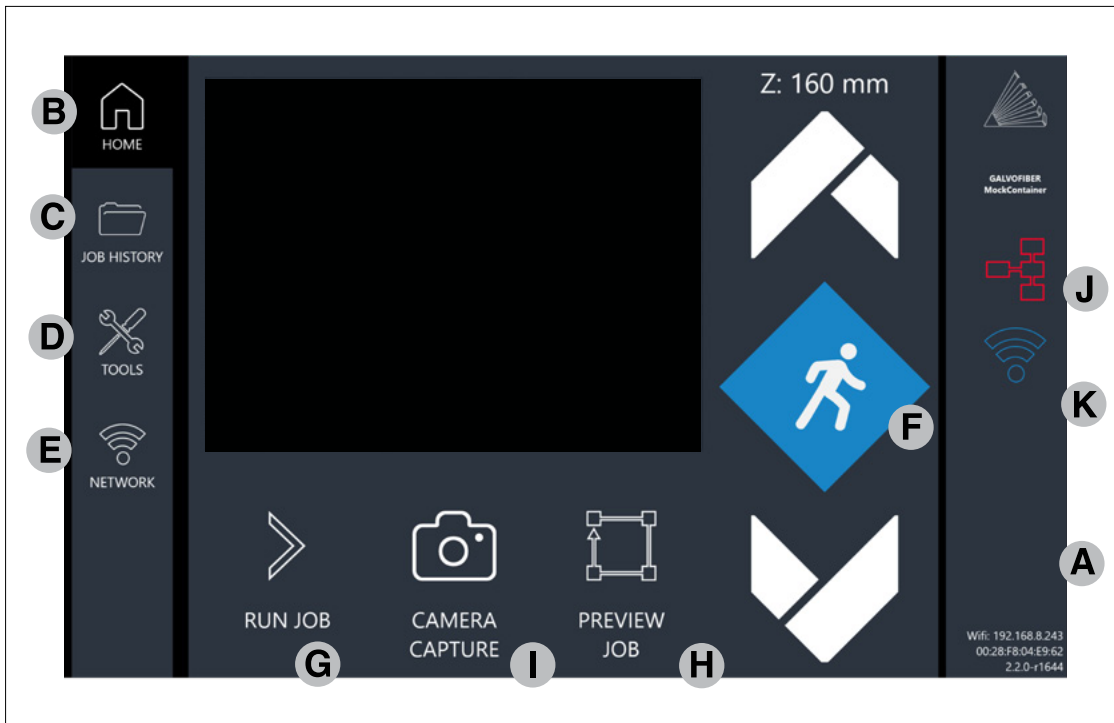
Retina Engrave 3 has a rotary mode you can switch to. The rotary should be connected to the Muse Galvo before it is powered on. Once you engage rotary mode in RE3. The "Directional Jog" button will change to a "Z-Axis" symbol. Tapping on the "Z-Axis" symbol will change to the "Rotary" symbol. The arrows will now control the rotary.

A **IP Address**
Muse's IP Address. Type this into address bar of web browser

B **Home**
Returns to the main Home Screen from any sub-screen

C **Job History**
Accesses Job History sub-screen

D **Tools**
Accesses About, Update Status, Factory Reset, and Home Laser

E **Network**
Wi-Fi settings, Static IP settings

F **Jog Speed Toggle**
Change Toggle Speed
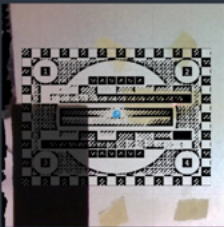
G **Run Job**
Start current job in workspace

H **Preview Job**
Shows the outline of the shape being engraved (vectoring) or a box showing the space the job will use (rastering).

I **Camera Capture**
Captures the workspace.

J **Wired Connection**
Indicates connection status from the machine to wired network.

K **Wi-Fi Connection**
Indicates connection from the machine to wireless network.

Job History

Job History allows the user to browse previous jobs

Clicking on the File Row allows the user to run and view previous job details.
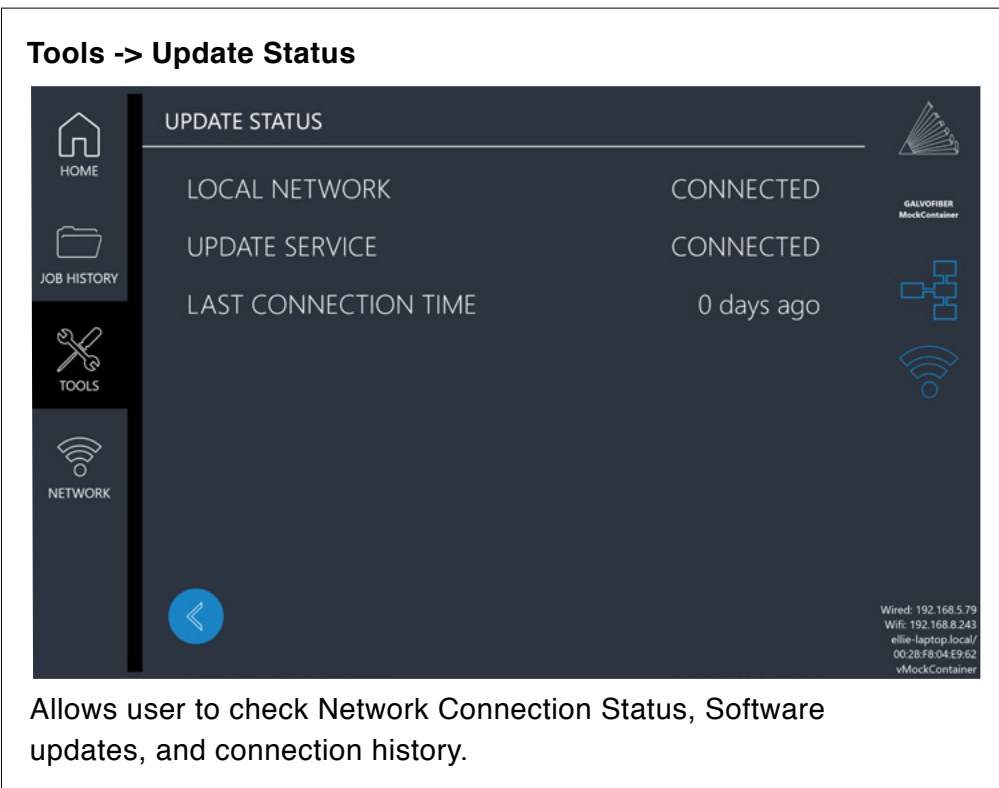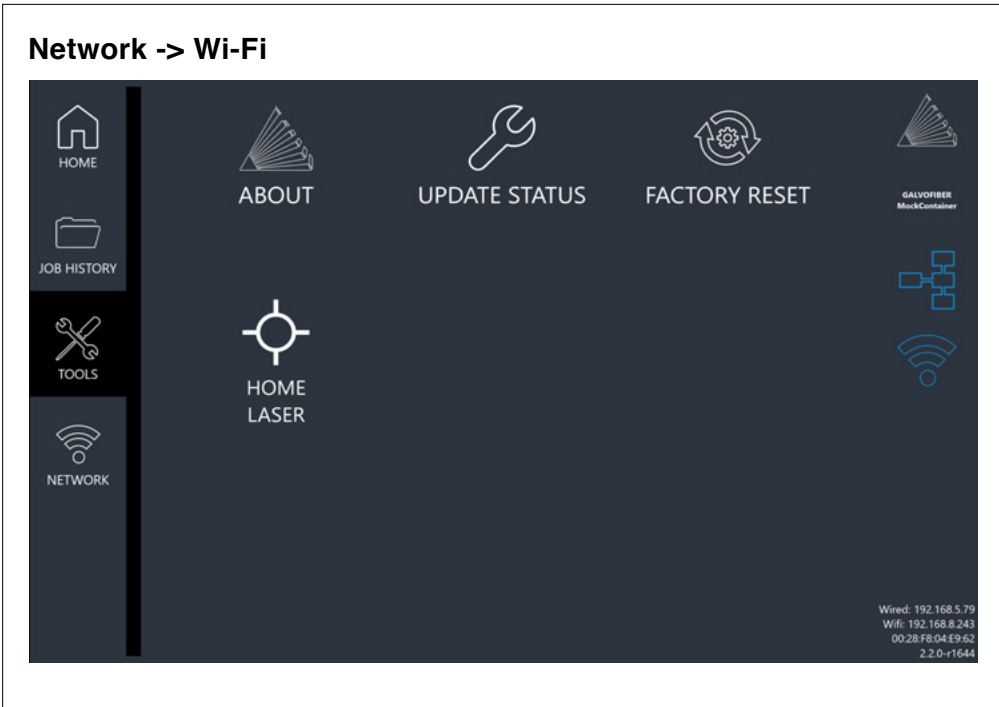
Network

Network -> IP Configuration
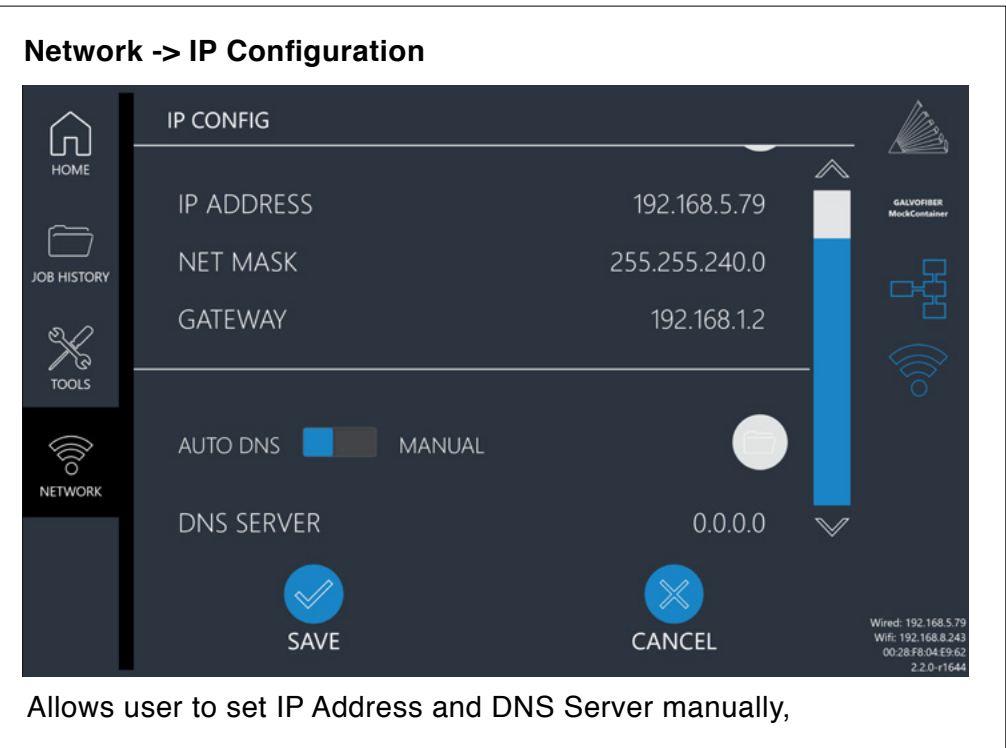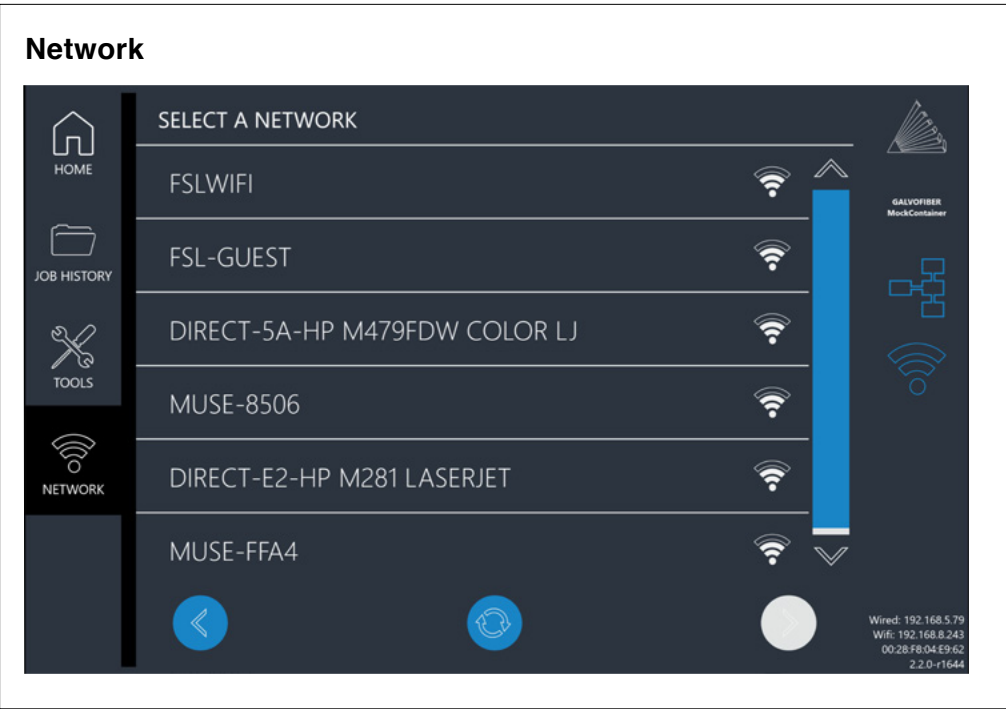
Allows user to set IP Address and DNS Server manually,

In this section you will be introduced to the major interface features of RetinaEngrave v3.0

Muse Control (q)

View / Snap Menu (p)

Draw Menu (o)

Group Menu (m)

Arrange Menu (l)

Position Menu (n)

Convert to Path (k)

Main Menu (A)

Settings (B)

Projects (C)

Layers & Objects (D)

Indicator (E)

Jog Controls (J)

Video Feed (I)

Project Info (H)

Vector / Raster Engraving Parameters (G)

Sync Indicator (F)

Menu Menu (A)

File   Edit   Modify   View   Galvo Fiber   Help
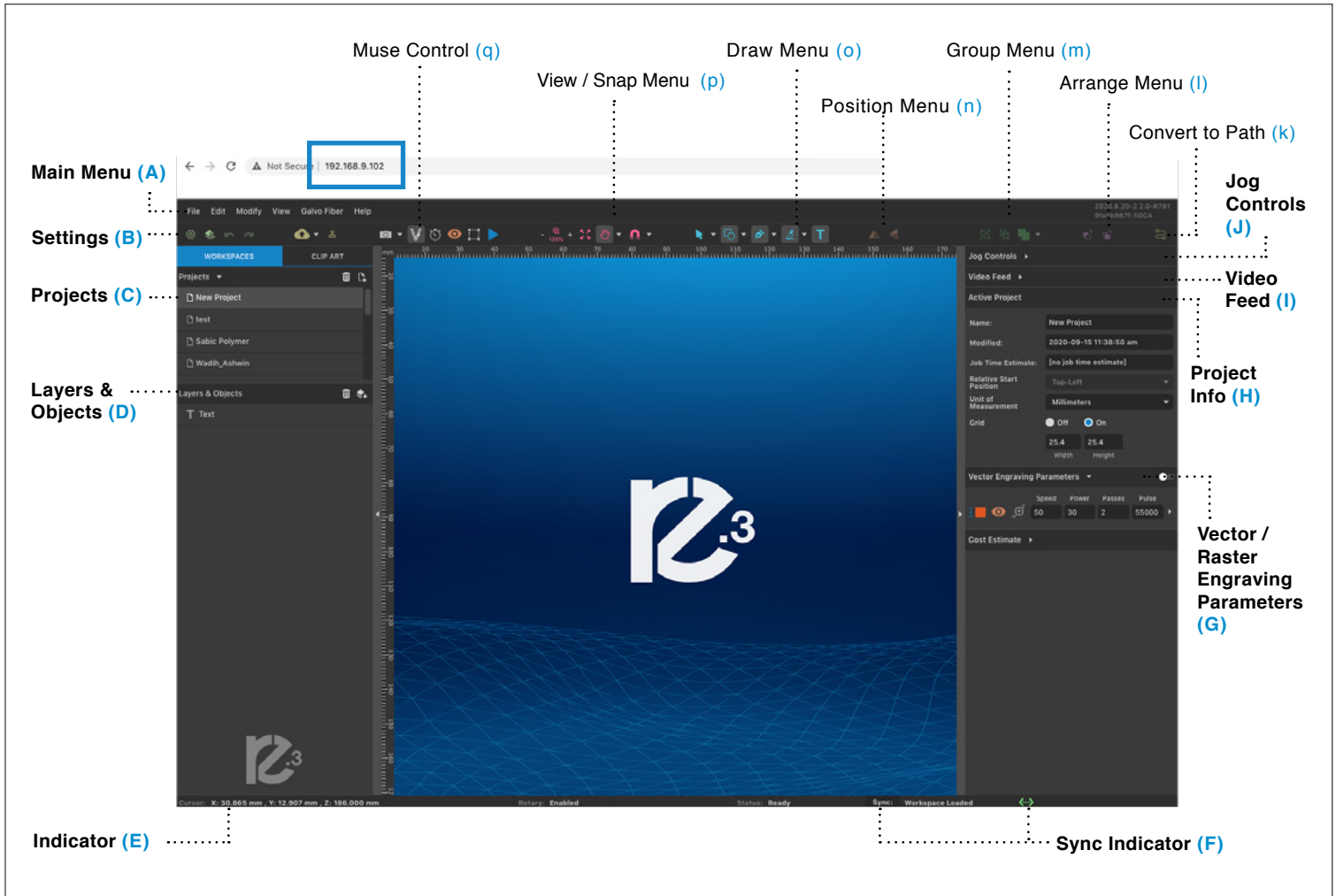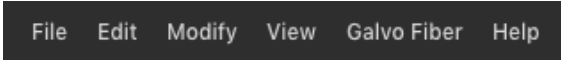
File

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

Undo Delete Layer or Item (Ctrl+Z): Reverse previous project command.

Redo (Shift+Ctrl+Z): Reverse your last undo.

Edit (Continued)

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.

Materials...

Activate user profiles

Modify

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°.

(Continued)

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.

Pack Objects

Generate Barcode

View

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: Increase or decrease magnification.

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

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

Outline View: Set to outline view mode.

Canvas

Show Rulers: Toggle guidelines on and off.

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

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

Toggle fullscreen...

3D Viewer

Mobile Version

Video Feed

Galvo Fiber

Camera

Capture Workspace: Initiates camera functions.

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

Diagnostics

Galvo Calibration

Help

User guide

Support

Contact us

Submit Support Ticket

Tutorials

Importing PDF

Vector Colors

Settings (B)

Info: Information regarding your machine.
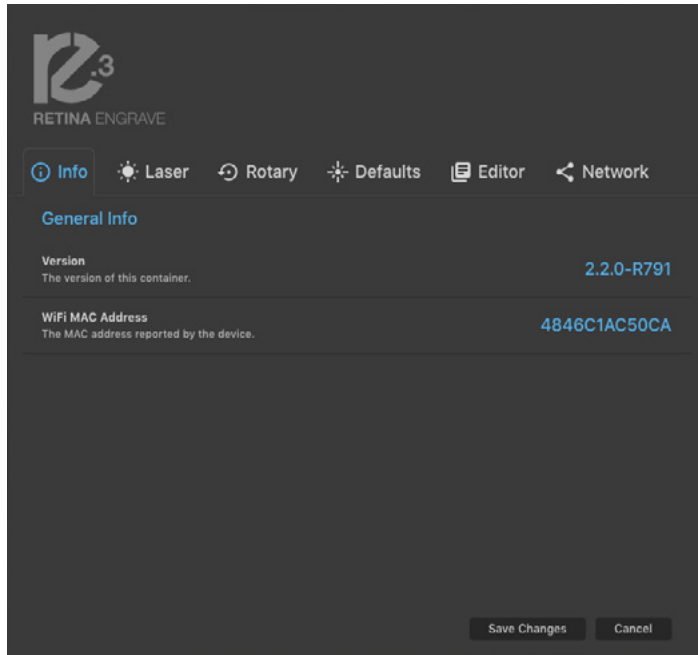
Laser: Information regarding device options.
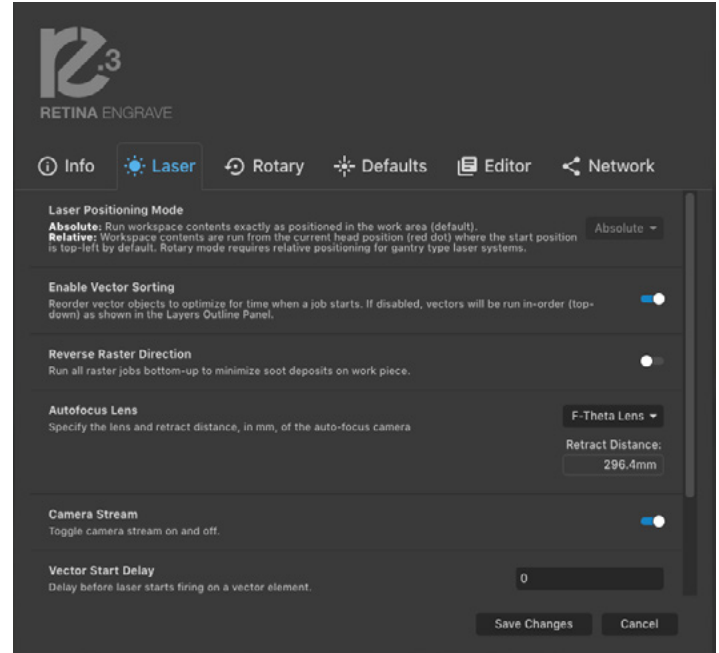
Interface

Show or hide tooltips and other modes.
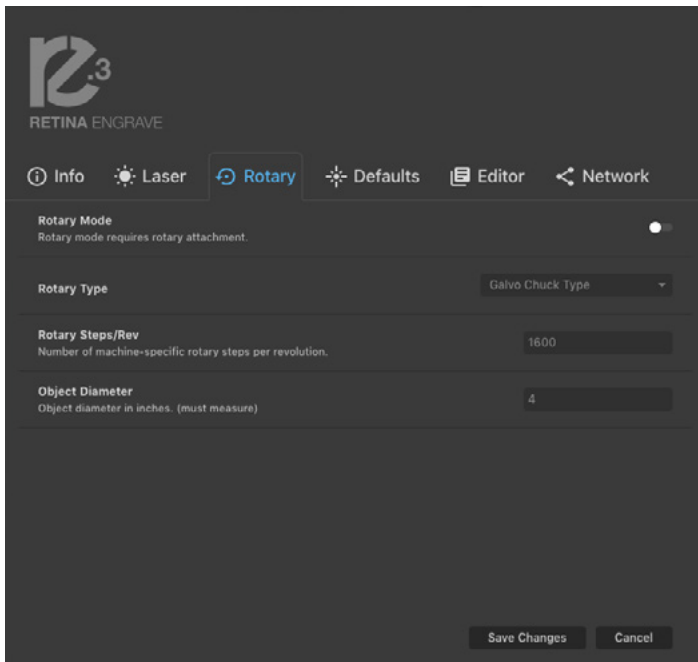
Defaults

Set image defaults with dither options.

RetinaEngrave v3.0 Software
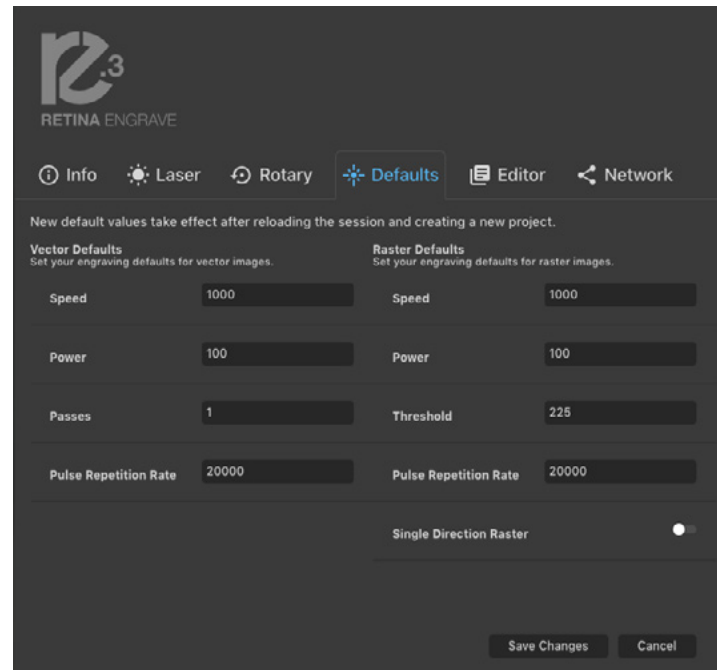
Editor
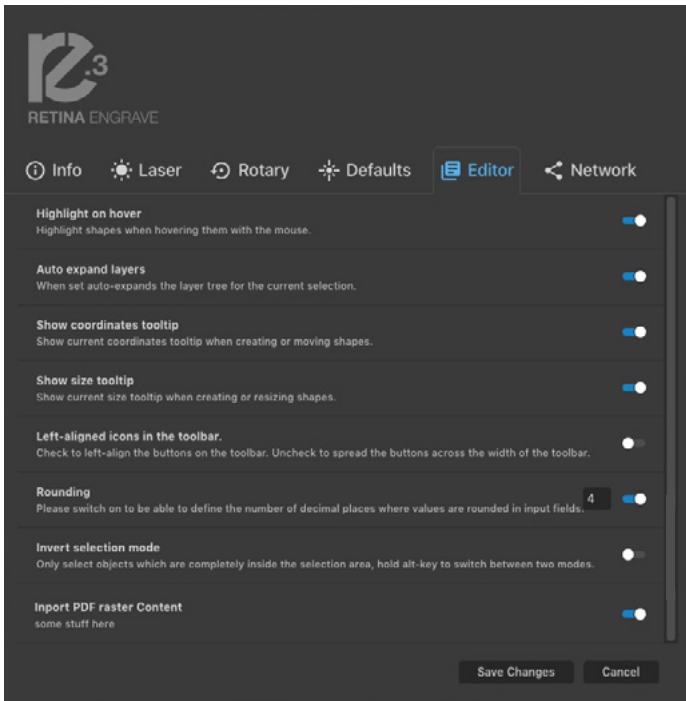
Network
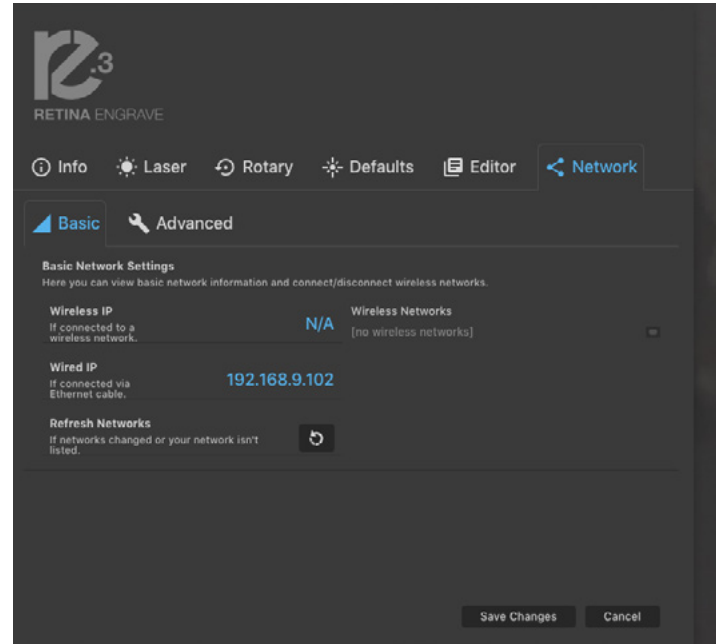
Settings (B)
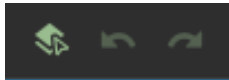
Save: Save project.

Undo: Reverse your last action.

Redo: Reverse your last undo.

Muse Control (q)

Capture Workspace: Takes images of workspace

Clear Last Workspace Capture: Clears previous workspace image.

Estimate Job Time: Amount of time the job will take.

Preview Contour of All Objects: Shows laser tracing of job.

Show Bounding Perimeter of all Objects: Shows the space the job will occupy.

Run Job: Start Engraving

View Snap Controls (p)

`-  302%  +`
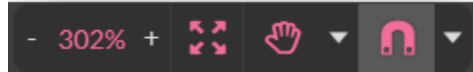
View options or position items on workspace grid.

Zoom (-/+): Enlarges/Reduces workspace screen detail and size.
Fit All: Fits entire captured image on screen.
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 Menu (o)
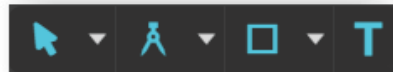
Select (Pointer): Instantly initiate mouse pointer.
    Subselect
        Pointer (V): Initiates mouse pointer.
        Subselect (D): Initiates "subselect" mouse pointer.
        Lasso (O): Initiates "lasso" mouse pointer.
        Layer (M): Initiates "layer" mouse pointer.
    Path
        Pen (P): 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): Initiates "knife" for cutting out objects
    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 (n)

Flip Horizontally: Flip object along horizontal axis.

Flip Vertically: Flip object along vertical axis.

Bring Forward: Moves object to an upper layer.

Send Backward: Moves object to a lower layer.

Group Menu (m)

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 (l)
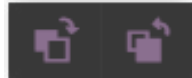
Bring Forward: Send an object one layer forward.

Send Backward: Send an object one layer backward.

Convert to Path (k)

Convert objects to paths.

Projects Menu (C)

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.
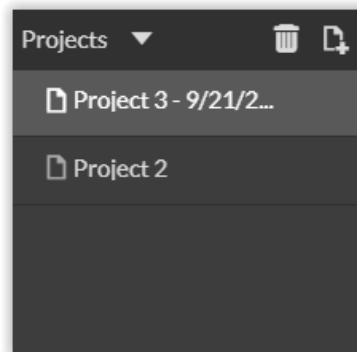
Layers & Objects Menu (D)

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.
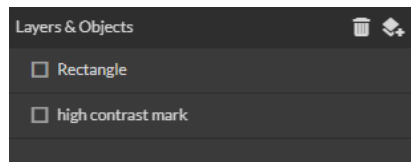
Toggle Visibility: Turn visibility of layer on or off.

Toggle Outline: Turn displayed outline of layer on or off.

Project Info (H)

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.

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
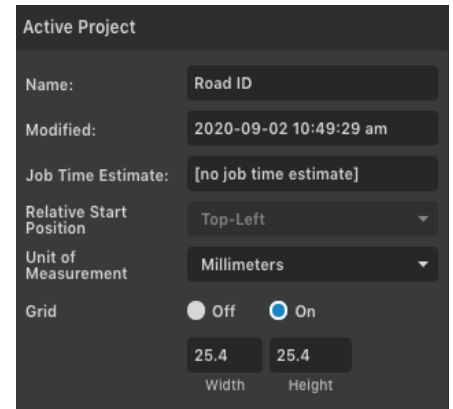
Vector Engraving & Parameters (G)

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.
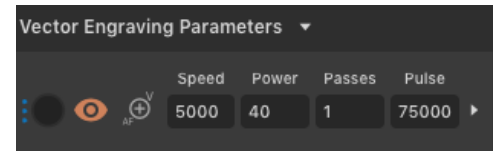
Raster Properties Window (G)

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.

Power%: Select power percentage from 1 to 100.

Speed: Select speed from 1 to 2000.

B/W Threshold: Select black and white threshold from 0 to 255.
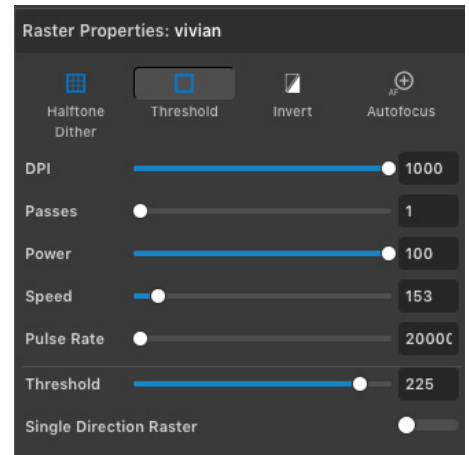
Object Packing (Appears when an object is selected)

Allows the user to arrange multiple designs relative to the top-left corner with customized spacing.

Padding: Spacing between objects.

Size: Determine packing space.
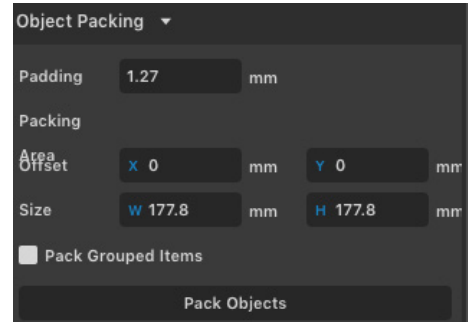
Vector Fill & Rasterize (G)

Use the this Window to set an infill for shapes and designs.

Infill: Set the pattern of your fill.

Generation: Generates raster lines based off all objects or for each.

Rasterize: Clicking icon opens raster menu.
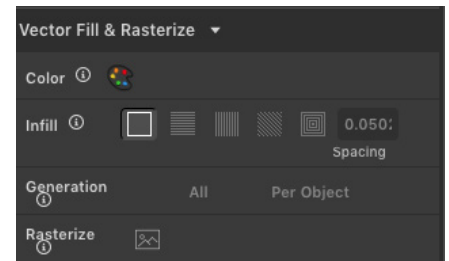
Video Feed (I)

Use this window to view realtime display.
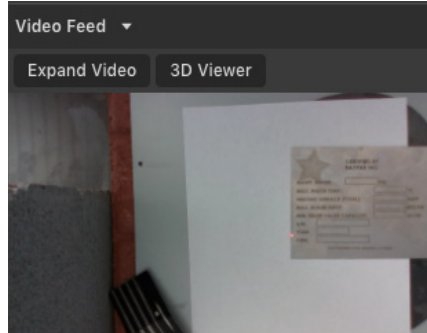
Jog Controls (J)

This tool is for moving the culminator and camera along the Z-Axis (up and down)
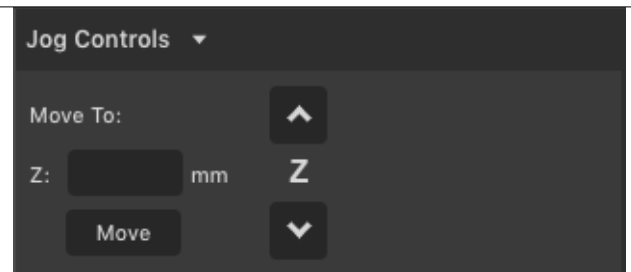
Indicators (Bottom Row) (E)

Position: X: 6.890", Y: 3.937"

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

Remaining: 3 Min, 36 Sec   41%

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

Status: Ready   Status: Executing job

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

Sync: Workspace saved

Sync Indicator: Notifies you of the last workspace update operation results. "Press Sync" to sync immediately. The workspace will update automatically, periodically.

Machine Indicators: Displays information on connected devices.

Device Connection Available: Indicates connection to machine is successful.

Engraving / Rastering

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 Raster Properties will automatically open. For vector objects (basic shapes), it will open up the Vector Fill & Rasterize tap. Select the icon next to Rasterize to open the Raster Properties.

Setting DPI
DPI can be adjusted using the slider or entering a number into the adjacent box. It ranges from 1 to 1000. A higher DPI means better precision and quality of your images, while a lower DPI will proved faster processing and engraving speeds.

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.
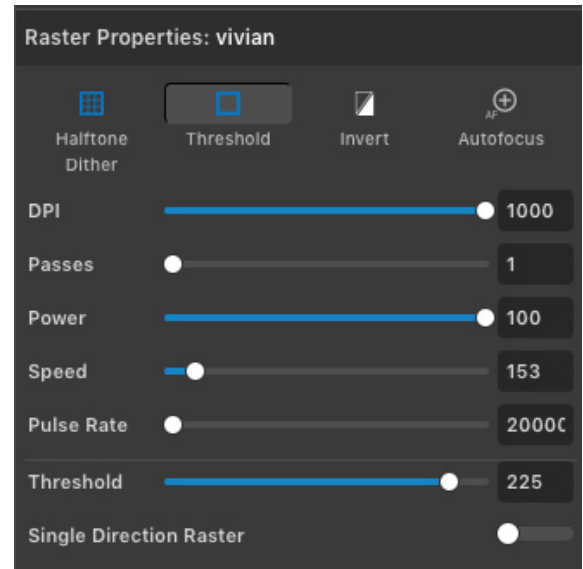
Setting Passes
The passes setting dictates the amount of times the selected shape is engraved. The passes range from 1 to 999. Increasing the number of passes will increase the amount of times the shape is rastered.

Setting Raster Speed
Speed settings determine how quickly the object will be engraved. Lowering speed allows you to create deeper engravings, as it allows the laser beam to be in contact with the material for a longer period of time.

Setting Pulse Rate
This allows you to set the pulse rate of the laser which is the number of emitted pulses per second. The pulse rate ranges from 20000 to 80000. Lower pulse rates result in deeper engravings while higher pulse rates result in shallower marks.

Applying B/W Threshold
At this moment, the image is still displayed in threshold. 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.

Applying Single Direction Raster
Toggling this on will cause the machine to raster in one direction for the entire object.

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

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.When a vector object (basic shapes) is selected the Vector Fill & Rasterize property tab will open on the right side. For vector engravings, this tab will allow you to set the infill for the object.

Infill
This section fills in the selected object. The way the fill will appear is based on which option is selected. You can enter the spacing between each infill line.

Generation
This feature decides how the infill is generated. Per Object generates the infill pattern for each individual drawing object at a time. All generates the infill pattern based on the location of all of the objects. Using All is usually preferred since it leads to all of the lines of the infill being even across all the patterns whereas Per Object would cause the infill lines of each object to not match up.

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.

Setting Vector Power
Power will determine how much power the laser 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.
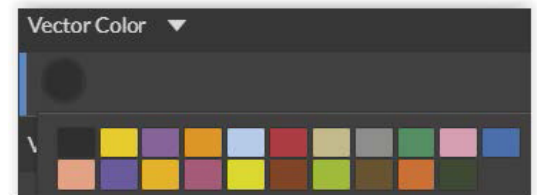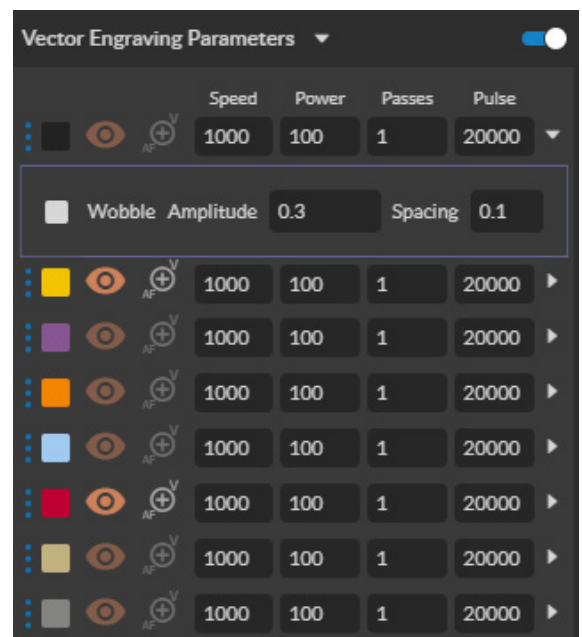
Setting Vector Speed

Speed settings determine how quickly the object will be engraved. Lowering speed allows you to create deeper engravings, as it allows the laser beam to be in contact with the material for a longer period of time.

Passes

This allows the operator to assign how many times the laser will complete a full cycle. Adding passes creates deeper cuts. Setting passes to "0" will disable the respective color layer.

Setting Pulse Rate

This allows you to set the pulse rate of the laser which is the number of emitted pulses per second. The pulse rate ranges from 20000 to 80000. Lower pulse rates result in deeper engravings while higher pulse rates result in shallower marks.

Wobble

Widens the beam path by running vectors along concentric circles.

Amplitude

Affects the diameter of the wobble. Bigger amplitude means a larger diameter wobble.

Spacing

Affects the spacing of the wobble. Higher values means the wobbles are spaced further apart.

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.

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.

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.

Adding Text T

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.

Text Positioning
Text position can be quickly adjusted by clicking on one of the following options:
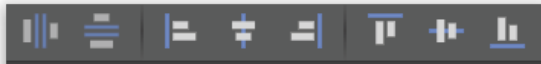
Distribute Horizontally: Evenly arrange selected Text horizontally.
Distribute Vertically: Evenly arrange selected text vertically.
Align Left: Align text to the left. Align Center: Align text to center. Align Right: Align text to right.
Align Top: Align text to top.
Align Middle: Align text to middle.
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	X 6.3	Y 2.5
Size	W 3.5	H 1.1
Angle	R 1°	Transform
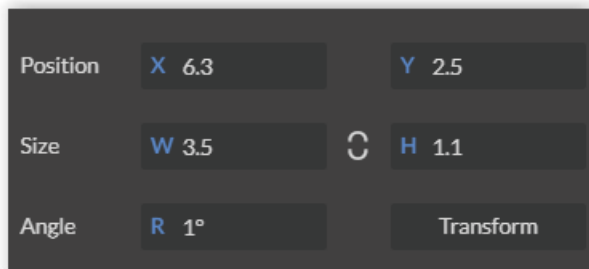
Position: Displays position of text in X/Y coordinates in the workspace. Click box to directly input X/Y coordinates.
Size: Displays size of text according to width and height. Click box to directly input desired width and height of text.
Angle: Displays angle of text as a degree. Click box to directly 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.
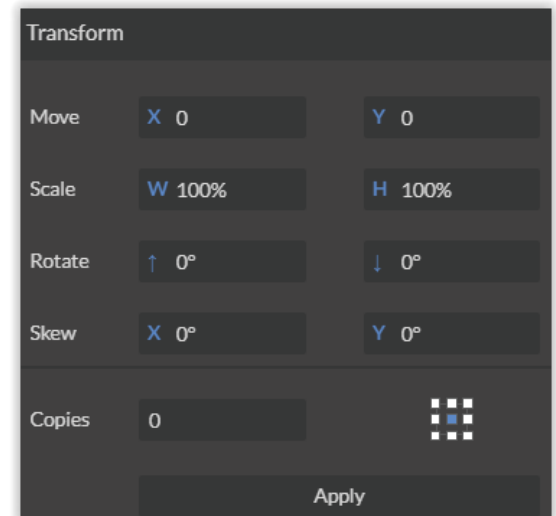
Text Appearance

Transform options allow the operator to alter the shape and skew of text.

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.
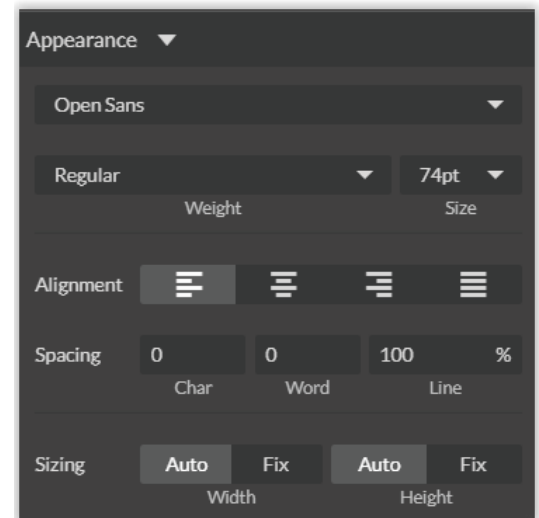
Text Path Options

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.

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 "Star" 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)
Creates Lines

Rectangle (R)
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.
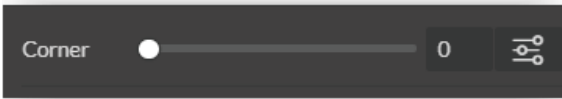
Ellipse (E)
Angles: Input custom angles
Shape:
>**Open:** Click for open ellipse.
>**Closed:** Click for closed ellipse.
>**Pie:** Click for pie shaped ellipse.

Triangle, Polygon & Star
Points: Slide bar to create polygons with multiple points (3 to 25).
Corner: Slide bar to curve corners
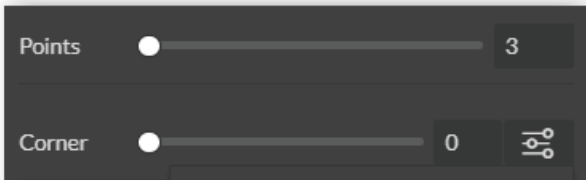
Advanced Settings
Round: Create rounded corners.
Round2: Create inverted rounded corners.
Bevel: Create beveled corners.
Inset: Create inset corners.
Fancy: Create fancy corners
Autoscale Corners: Toggle autoscale corners on and off.
Uniform Corners: Click to ensure all corners have the same parameters.
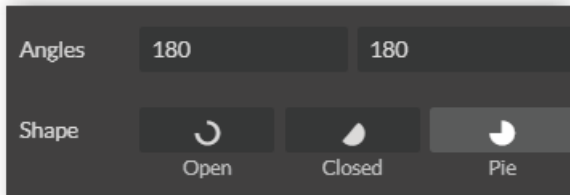**Plain Edges:** Toggle plain edges on and off.
Corners: Input outside and inside corner curvature.
Radius: Input outside and inside corner radius.
Angles: Input outside and inside corner angles.
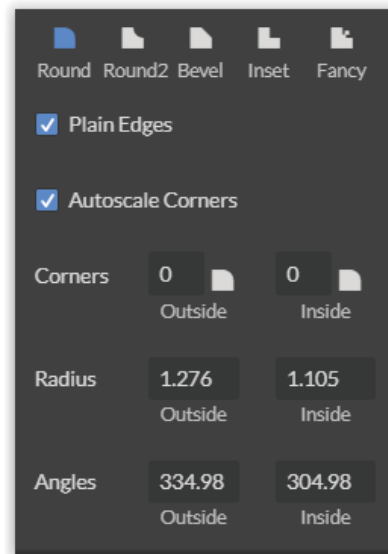
Creating, Manipulating Compound Shapes & Objects

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 Inter- section. 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. The user 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.

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 'Com- pound 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.

Mouse Controls

1. 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.

2. 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.

3. 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.

4. 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.

5.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.

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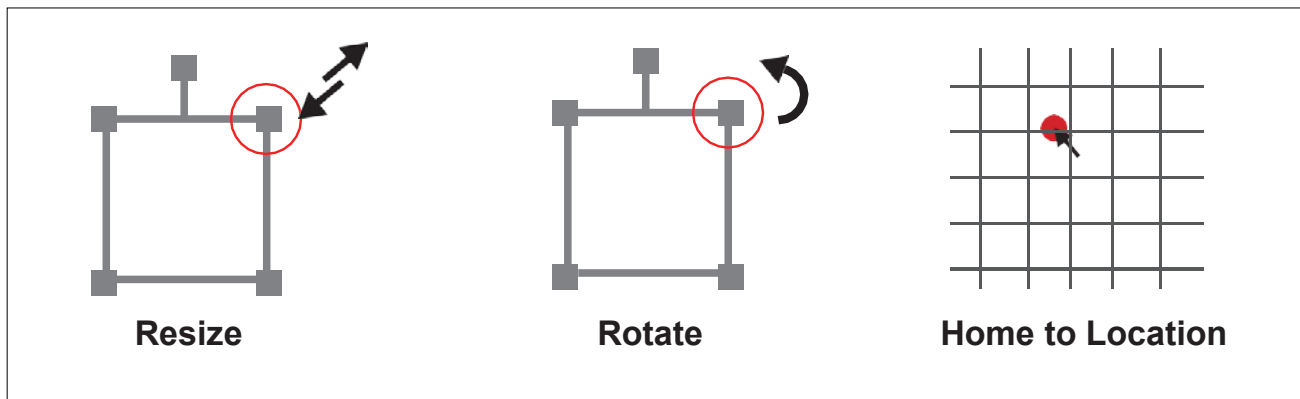
This section will guide you through using your Muse Galvo laser cutter. To get started, it is important to understand the meanings of "Vector Cutting" and "Raster Engraving" and their associated file types.

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

General Functions

Vector cutting
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.

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 a 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 have a simple method for converting files to PDF and then directly printing them to the RetinaEngrave v3.0 software.

Designing in 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.

From Concept to Design

The RetinaEngrave v3.0 software works with your Muse Galvo to create a simple and intuitive set of operations that is easy to learn and use. With experience, you will find your Muse Galvo 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.

1. Create Design

Create your design in the program of your choice.
Note: Files should be created with laser cutting considered.

2. Connect to Software

Link your Muse Galvo to the software by typing the IP address found on the Touch Screen (Tools>About) into your browser (Google Chrome Suggested).

3. Import Design

Create your design in the program of your choice.
Note: Files should be created with laser cutting considered.

4. Place Material

Place your material on the workspace.

5. Align Laser to Material

Using either the perimeter tool, or camera function (see camera features), align your design on the appropriate area of your material.

6. Adjust Object Properties

Using the Properties Manager Window, adjust your Vector or Raster settings for your cut, mark, or engraving.

7. Run Job

Double check your safety precautions and accessories, and press the "play" button to start the job.

> ⚠️ 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 3.0. 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.
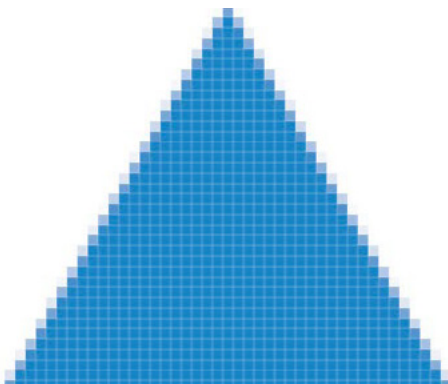
Raster Image (bitmap)

Pixel based image.

Examples: JPEG, PNG
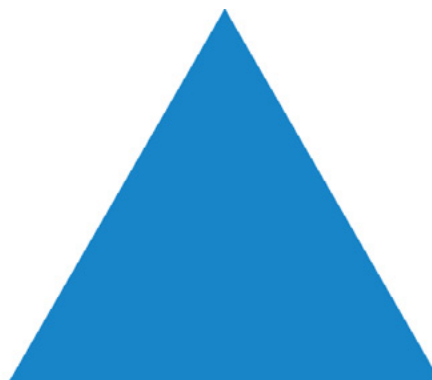
Vector Image (bitmap)

Vector File Geometric based image.

Example: SVG, AI, PDF

Appendix A. **Rotary Attachment**

The Full Spectrum Laser Hobby Advanced Rotary Attachment is an accessory to the Muse Galvo Laser System and is not included with the base purchase. The rotary attachment is capable of engraving on objects from 0.25in diameter. You can order the rotary attachment from the Full Spectrum Laser website at:

https://fslaser.com/laser-accessories/

Aligning Your Rotary Attachment

The rotary attachment is a chuck type. For the chuck rotary - the cylindrical object is locked into place by the jaw and the chuck and rotated to engrave an image onto the surface. The rotary attachment works by translating Y motion along a cylindrical surface.

1. Power off and unplug your unit. Then plug in the rotary to the corresponding connector and power on the machine. Make sure the laser is on so you can see the red dot.

2. Connect to the software and switch to Rotary Mode in the software. Click Settings and select Rotary. Toggle Rotary Mode and select Galvo Chuck Type. The Rotary Steps/Rev is set for the provided rotary. The diameter of the object you wish to engrave should be measured and entered into the Object Diameter box. Next select Laser and under Laser Position Mode select Relative Positioning. This is required for the rotary. It can be changed to Absolute Positioning the same way. Select Save Changes when finished.
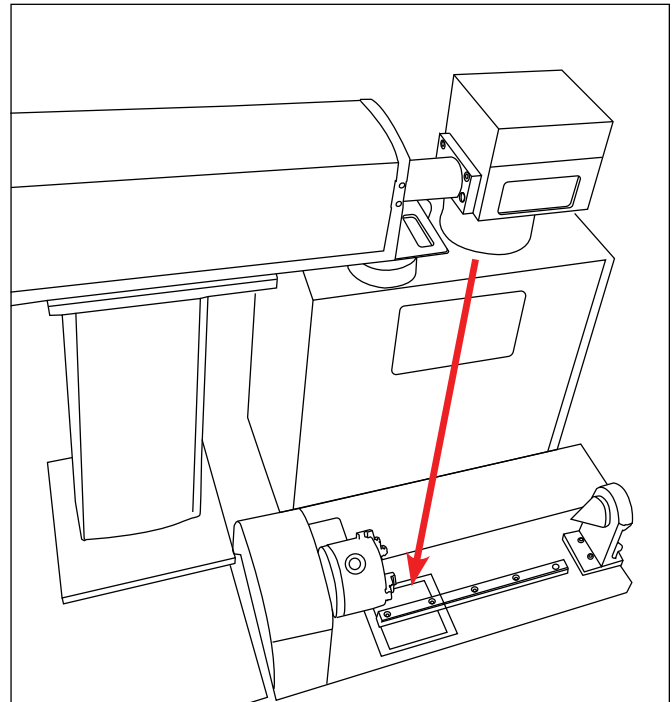
NOTICE

• **Do not connect / disconnect rotary when machine is powered on. Will cause damage to machine.**

• Rotary engraving is best performed along the topmost area of the project.

• It is crucial that the rotary be level. Use a small carpenter's level to be sure your rotary is flat within the interior of the laser cutter.

3. Lay the rotary parallel to the culminator in the work area. Click Camera Capture in RE3 to obtain a picture of the rotary. Make sure the sticker is visible in the image capture. Ctrl + Left Click the sticker in RE3 to autofocus to it.

4. Select Run Perimeter in RE3 and a red light traced square will appear on the sticker. Line up the square on the sticker with the red light trace. Now the rotary is ready for use.

# Using the Rotary Attachment with RetinaEngrave
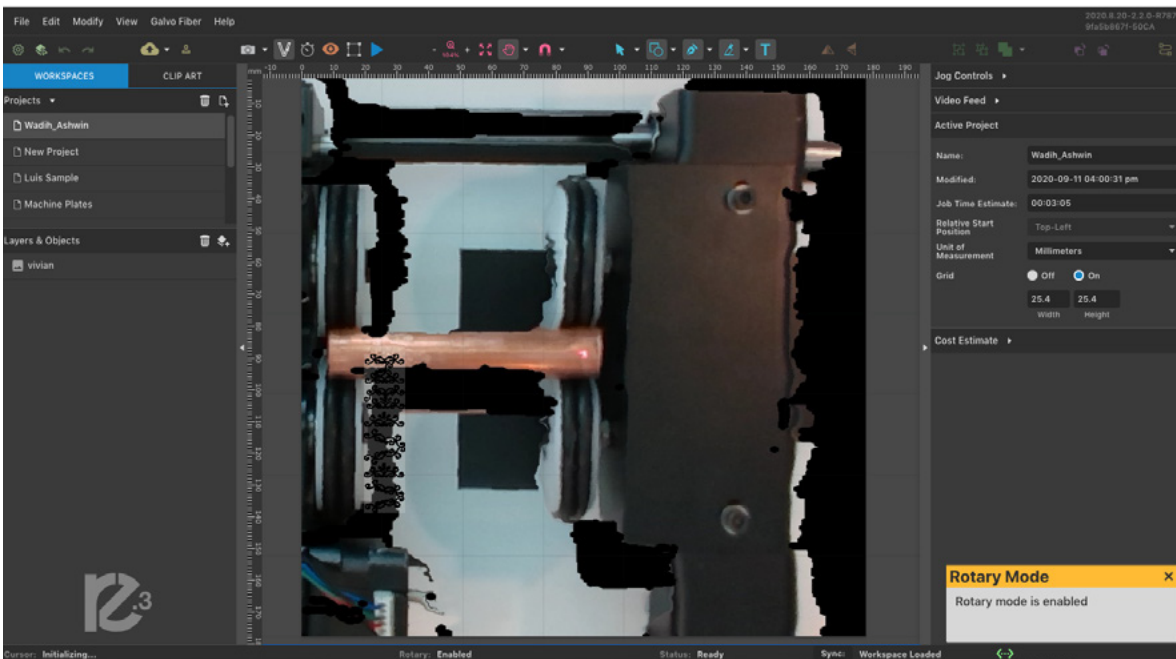
| **NOTICE** | The only positioning that matters in rotary mode is the X location. The Y position does not matter. Click the eye and the rotary will turn and show the rastering. To engrave a pattern evenly around a part, make sure the height of the drawing is equal to the circumference of the part. |

Appendix A. **Rotary Attachment**
Using the Rotary

After Rotary mode is enabled the icon on the Muse Galvo will change from the walk icon to the Z-Axis icon. Tapping on the icon switches the controls from Z-Axis to Rotary control. Hitting the arrows now will turn the rotary. You can return to Z-Axis controls anytime by clicking the Rotary icon.
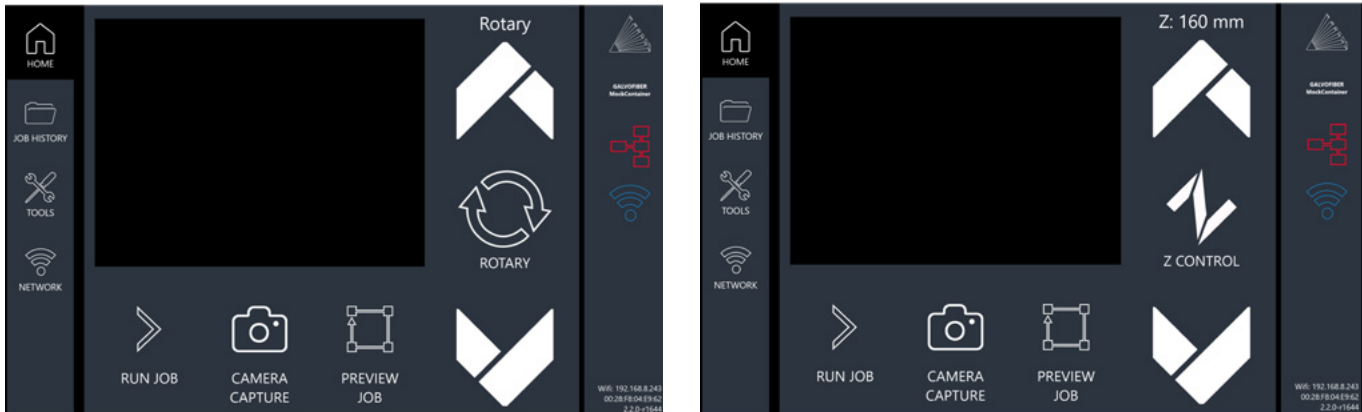
Make sure the diameter of the cylindrical object you wish to engrave is measured and entered into the Diameter section when toggling rotary mode.The jaws of the chuck can be opened and shut using the chuck key. How the cylindrical object should be held by the chuck will change based on the features of the object. Objects that are smaller in size can be held by pinching the jaw shut on the outer diameter. Objects with large holes (such as mugs) are more stable when the jaws are pushing out into the inner diameter of the object. Make sure that the object is rotating along its centerline or else the Muse Galvo will not properly engrave the object.

For objects that are difficult to keep centered with the chuck alone the live center should be used to stabilize it. In order to use the live center, a small hole should be made at the center of the object on the end which will be facing the live center. The live center will then be slid into the hole which will keep the cylindrical object centered. If you do not wish to create a hole in the object you are engraving then use a buffer piece with a hole in it. Attach it to the point of the live center and move the live center forward until the buffer supports the cylindrical object.

In rotary mode, engravings can only be made through rastering. In RE3 the rastering speed is what determines how quickly the rotary turns. The distance that the rotary will engrave is dependent on the height of the image that is being engraved. To engrave the entire circumference of the object then the height of the image should be equal to the circumference of the cylindrical object.

Appendix B. **Warranty**

Within the first 30 days, Full Spectrum Laser will replace or repair any defective parts free of charge and pay for ground shipping of parts. Overnight shipping is available at extra charge.

Outside the first 30 days, Full Spectrum Laser will replace or repair any defective part within the warranty period free of charge but shipping charges are the responsibility of the customer. The warranty includes parts and labor only. Shipping of defective and replacement components is excluded by the warranty. The customer may arrange their own shipping or drop parts off to exchange parts at our warehouse free of charge. Typically, Full Spectrum Laser has most replacement parts on hand for immediate shipment of under warranty parts.

All defective parts must be returned to Full Spectrum Laser postage paid for evaluation before replacements are issued unless otherwise authorized. The warranty is valid for normal use only and excludes Acts of God, user error and use outside of normal parameters. Parts damaged by fires are considered user error if the machine is left unattended. Just like operating a household gas stove, always stand next to the machine with a fire extinguisher and be ready to turn it off in case of a fire and never operate the machine unattended.

Prior to 8/7/2012, the extended warranty was charged separately and the Hobby Lasers had a 60-day base warranty on all items excluding shipping unless an extended warranty was purchased.

After 8/7/2012, the Hobby lasers have a 60-day warranty on all items and a free extended limited 1- year warranty which excludes consumable items/shipping included in their price. The limited warranty excludes shipping and consumables and other normal wear and tear items. All electronic items (control cards, power supplies, motors) and most mechanical items are covered under the extended warranty unless damaged by abuse/fires. Consumables not covered include, but are not limited to, rubber parts such as tubing, belts, plastic wheels, lenses, mirrors, other optics, and laser tubes. Within the first 30 days the original purchaser may transfer the balance of your warranty to anyone else free of charge provided you notify us in writing. Outside of the first 30 days, we will only provide warranty and tech support services to the original purchaser unless a warranty transfer fee is paid as there is a cost involved with initial tech support of new users and accounting fees. If you sell your machine, the warranty remains valid but the buyer must arrange with the original purchaser to request RMAs and send in the machine for repairs unless a warranty transfer fee is paid.

Please Note: Full Spectrum Laser DOES NOT offer warranties or customer support for 3rd Party replacement parts, including replacement laser tubes. Use of such parts may not be compatible with Full Spectrum Laser machines and can cause damage to your laser system.

Visit https://laser101.fslaser.com/support for most currently warranty postings.

Join the Full Spectrum Laser Community

Full Spectrum Laser invites you to join our community of hobby makers and professional manufacturers through our social media channels (Facebook, Instagram, Twitter, YouTube). We always have something positive to say about hobby maker culture or the industry we work in. You can follow us as we cross the country going to conventions and maker events or just check out all the awesome stuff we make. Best of all, we offer all those designs for all those projects we make with our laser cutters and 3D printers for FREE. Join our community and see what all the excitement is about.

- www.facebook.com/fslaser
- https://www.instagram.com/fullspectrumlaser
- https://twitter.com/FullSpecLaser
- https://www.youtube.com/user/FullSpectrumLasers

Full Spectrum
L A S E R