MUSE MOPA

USER MANUAL

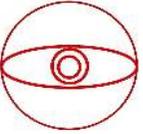Full Spectrum
L A S E R

Safety Warning:

Do not leave your machine unattended.

Avoid using materials made of carbon or that contain carbon components.

Always keep a fire extinguisher and first aid kit nearby.

Do not attempt to access any electrical areas while the machine is on. Unplug the machine and wait for an hour before accessing panels.

Never stare directly into the laser when running a project. Always wear the provided safety goggles.

Inspect your machine before each use. Do not use if the machine or its accessories are damaged in any way.

Always maintain a clean work area.

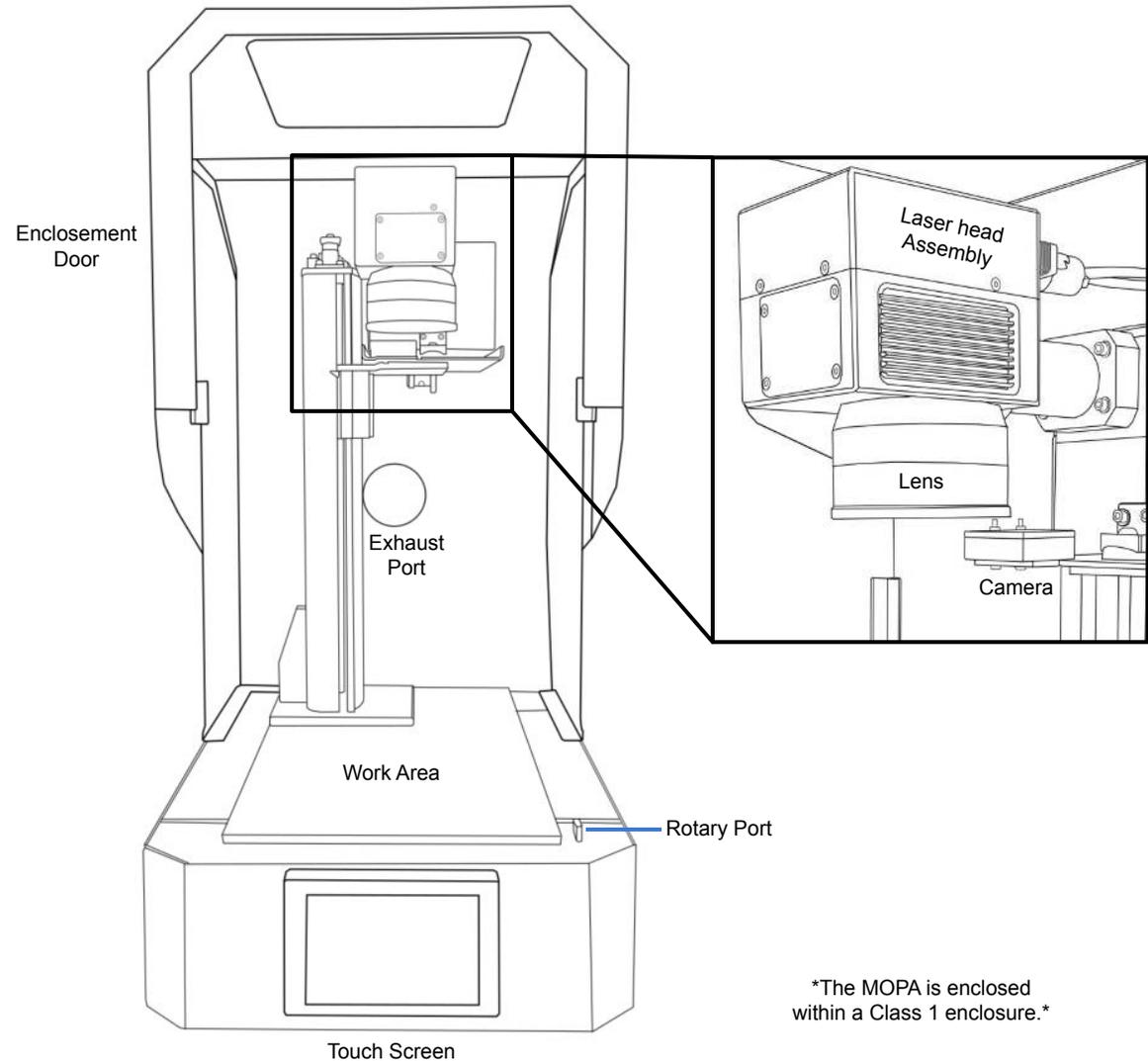**Looking for financing or eager to buy, contact Sales:**

M-F 8AM-5PM PST
sales@fslaser.com
702-802-3101

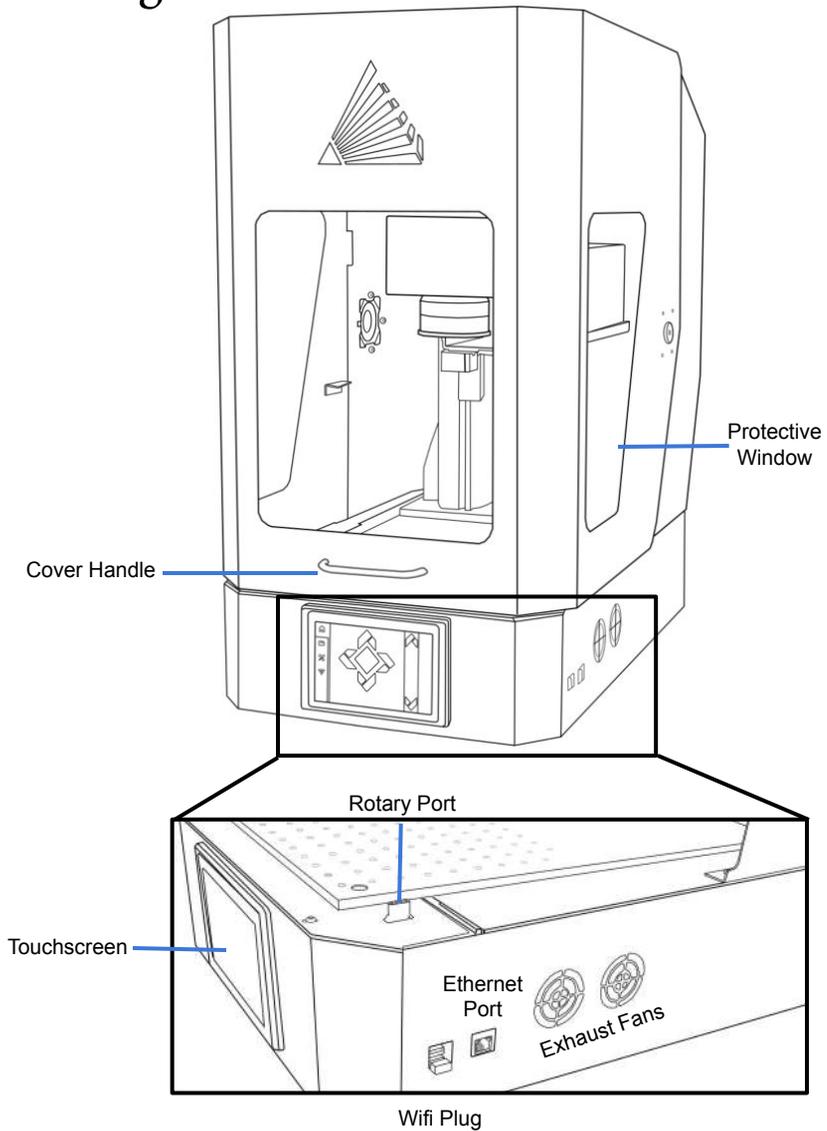**Need help, visit us at our Help Center or contact Support:**

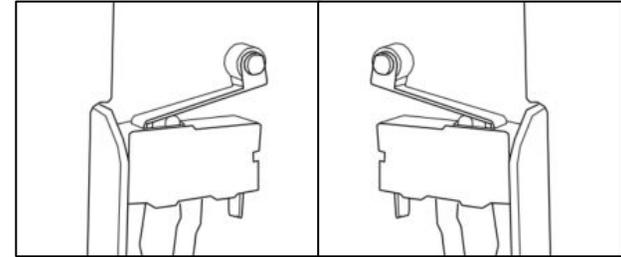M-F 8AM-5PM PST
support@fslaser.com
702-802-3103

Diagram:

Enclosement Door

Laser head Assembly

Lens

Camera

Exhaust Port

Work Area

Rotary Port

Touch Screen

The MOPA is enclosed within a Class 1 enclosure.

Diagrams:

Protective Window

Cover Handle

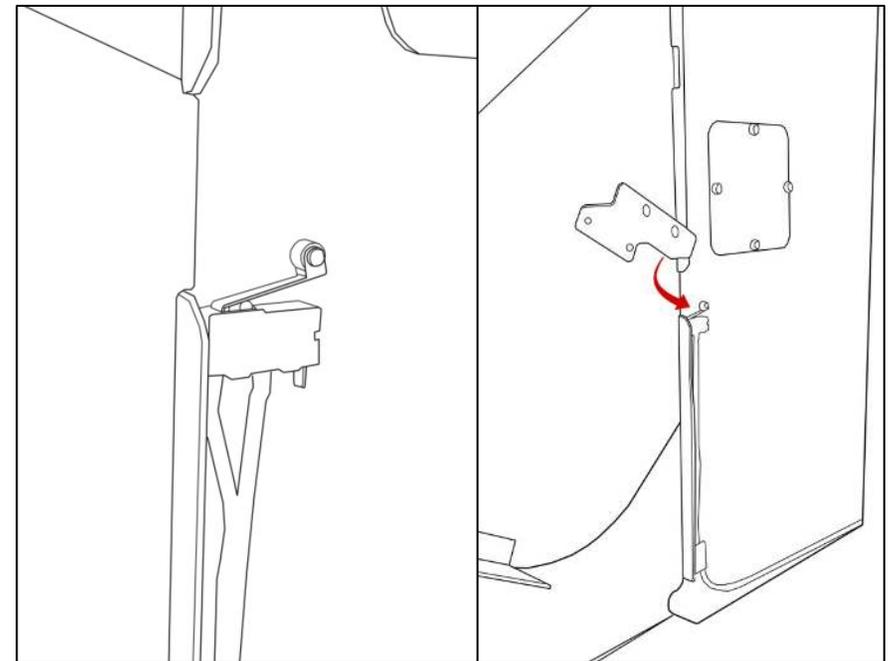Rotary Port

Touchscreen

Ethernet Port
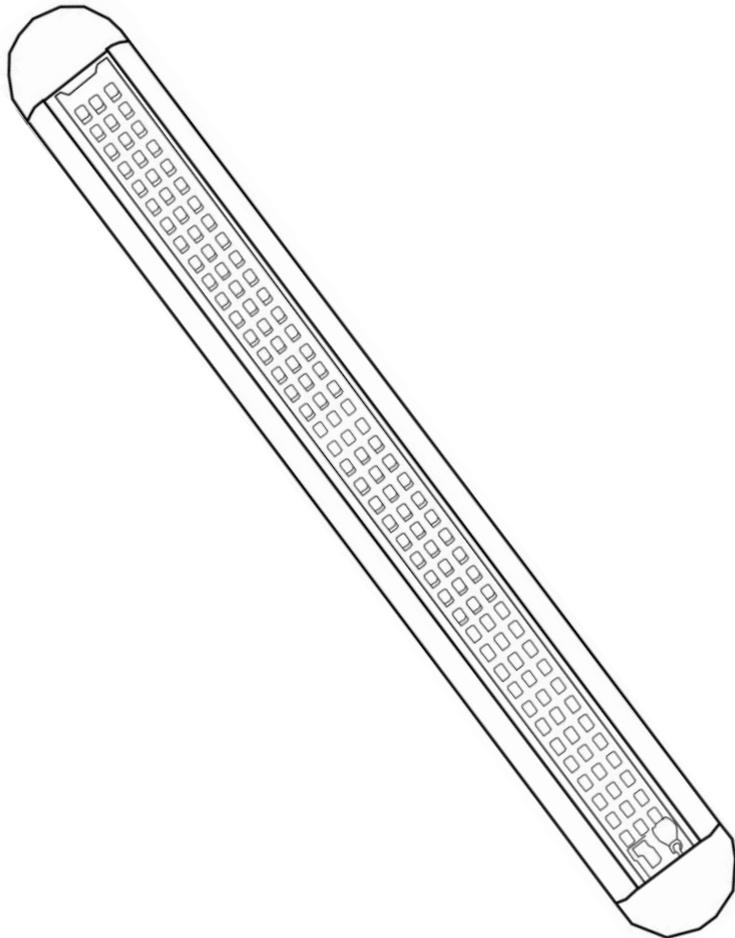
Exhaust Fans

Wifi Plug

Safety Switches:

The MOPA laser engraver is equipped with two safety switches on the case to ensure that the laser does not fire when the lid is open. A clicking sound will offer when the safety switch is activated to let the user know the machine is now ready to fire.

Diagrams:

Internal Light:

Connecting to Internet:

Connect Via Router (Recommended):

To establish a reliable link to RE3, it is recommended to connect the MOPA to the router. The MOPA is equipped with an ethernet cable that should be plugged into the ethernet ports of both devices
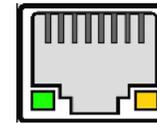
Note: Ethernet port looks the same on all devices

Fig. 18

Connect to Wi-Fi:

Make sure that the dongle, a device attached to the USB port of your machine, is present and connected as it enables your machine to connect to the WiFi network.
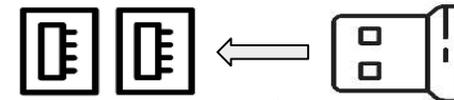
Fig. 19

1. To connect to the WiFi network, select the Network button located on the top right of the Touchscreen.

2. Then, choose the WiFi option and search for your network. Once you have located your network, select it and enter your password.

Connecting Directly Using Computer:

This option is only advisable when the other two methods are not possible. The MOPA Galvo can connect to the computer through Ethernet, but an adapter might be required for your computer.

Touchscreen Interface:

Movement Controls:
The movement icon allows the user to adjust the stage's vertical movement through three adjustable speed settings. The speed settings can be modified by selecting the prism icon.

Home
The Home screen displays important information such as the device's IP address, the QR Code for RE3, and controls for the laser head.

Job History
The Job History icon provides easy access to previous projects. Users can select the file and view its contents, or choose to re-run the job. Note that an internet connection is not required to use files saved in this section.
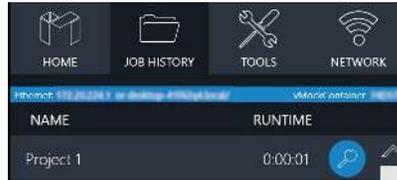
Machine Indicators:
Wired IP Indicator:
The IP indicator shows if the machine is connected to an ethernet cable.

Connected   Not Connected

Wi-Fi Indicator:
The Wi-Fi indicator will indicate if the machine is connected to the Wi-Fi.

Connected   Not Connected

Run Job Icon:
Selecting the icon will run the job.

Network ➯ Wi-Fi
Enables users to connect to a Wi-Fi network.

Mobile Version
A mobile version of the device is accessible by either scanning the QR Code or entering the device's IP address into the web browser of a mobile device.

Tools
The Tools icon enables the user to verify and modify the machine settings, activate rotary attachments, home the laser, and retrieve relevant information regarding the device.

AutoFocus Icon:
The Autofocus icon automatically moves your machines Z-stage to the height needed to perform an engraving. (Needs QR card to work.)

Camera Capture Icon:
The Camera Capture icon takes images of the workspace.
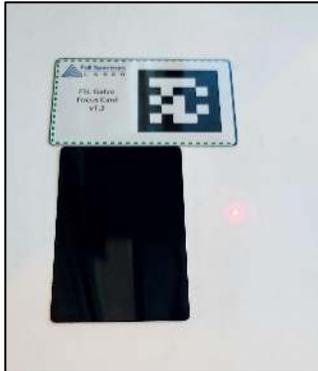

Preview Job Icon:
Selecting the icon will make the machine outline the area of your project on your workspace.

Focusing:

Autofocus

To autofocus your machine, you need to retrieve your April tag card first. Ensure that the side of the card which says "Focus Card V1.2" is facing up, and position it under the camera.

There are two methods to autofocus your machine.

1. The first method involves navigating to the touch screen and selecting the Autofocus icon located on the Home page.

2. The second method requires you to enter RE3 by typing the IP address in the web browser. Then, go to the Jog Controls, select the Autofocus Icon.
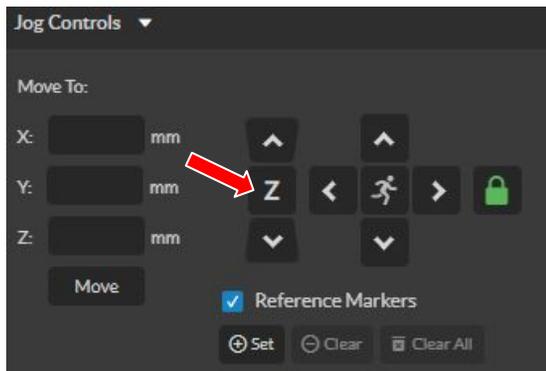
Note: If your machine does not move when the autofocus button is hit, then lower the gantry and try again.

Manual Focus

The focal length of the lens determines the distance between your laser head and the material. Refer to the chart below for the required distance for each of our lenses.

Lens Focal Length	Distance from Material
163mm	203mm
254mm	294mm
330mm	370mm
420mm	460mm

Note that the numbers in the chart refer to the distance from the lens to the object and not from the lens to the workspace. If you switch to a larger object, adjust the stage accordingly.

During manual adjustments, keep an eye on the red diode. When the laser turns on and begins to home, the red diode will appear large and fuzzy. As the laser head moves down the stage, the red diode becomes smaller and more focused. Once the diode appears clearest, you can run the focusing test to ensure that it falls within the desired range.

Focus Test

After you have focused your machine, locate the Focus Test Icon and click on it.

This will bring up a focus test window. Ensure that you have selected the appropriate lens size and click on the "Generate Test Pattern" button to produce a grid.


From the grid, choose the two markings that appear most similar to one another. Enter these markings into the pattern selection and save the results. For instance, you may choose 3F and 4D as they appear to be similar.

Focusing:

Dual Diode:

A diode is affixed to the rear of the machine and positioned according to the focal length of the lens. The laser can be focused by lowering the Z-stage until the machine diode aligns with it.
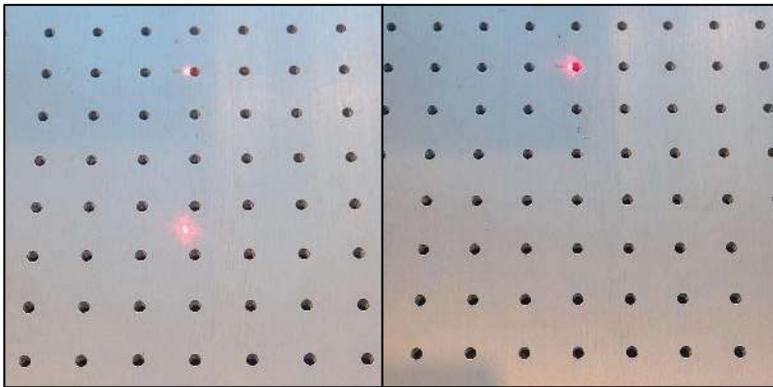

When switching lenses, the rear diode will need to be readjusted to accommodate the new focal length. This can be achieved by autofocusing your machine and then adjusting the position of the back diode until it aligns with the laser. Once the adjustment is made, perform a focus test to ensure optimal results.

Lens Replacement:

Lens Collar
Camera
Lens
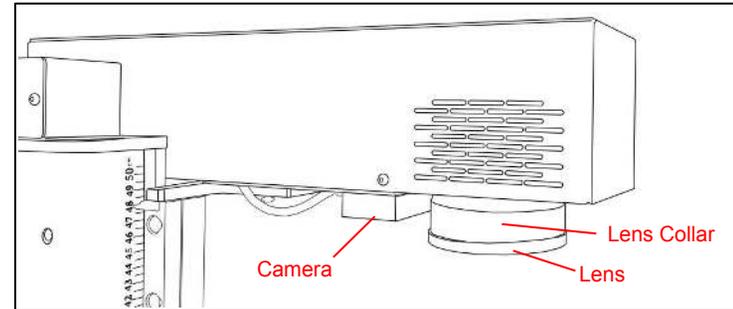
1. Remove any objects or work pieces from underneath the lens work area. Ensure laser head is in a reachable position to remove lens.

3. Place the lens cap onto your lens to protect the lens from potential damage.

4. Carefully twist counter-clockwise to loosen the lens.

Try not to damage the camera or camera shutter located on the side of the scanhead.
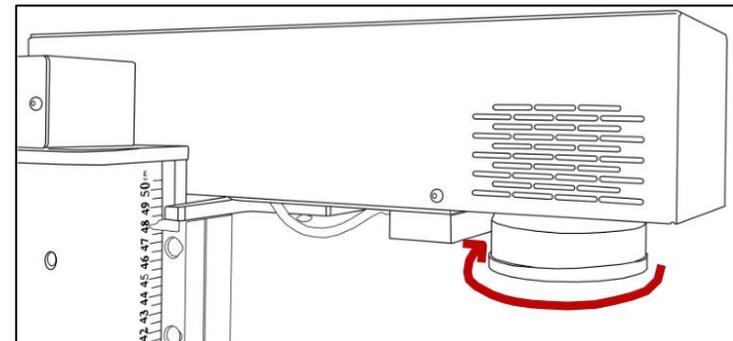
Avoid touching the glass surface of the lens to prevent scratches. The lens collar may come loose with the lens,if that occurs remove both together and separate once dismounted.

5. Replace the collar to the scanhead before inserting a new lens.

Full Spectrum
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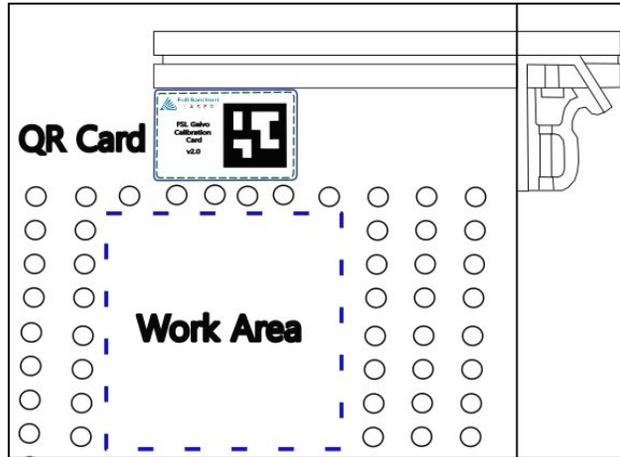
Lens Calibration:

Preparation:

To perform a lens calibration, ensure that the QR card is positioned within the camera's view, with the Calibration April Tag facing upwards. The card should be placed outside the work area and parallel to it for accurate calibration. The size of the work area is determined by the lens in use (refer to the chart below).

Lens Size(mm)	Working Area Approx. (mm)
163	110X110
210	140X140
254	175X175
330	220X220
420	300X300

Access the "Laser Tools" page by navigating to the Machine name, locate Diagnostics, and then select Galvo Calibration Alternatively, you can type the IP Address/setup in your web browser to access the same page.

1. Once the Laser Tools page is loaded, locate the Laser Focus and Lens Calibration section.

Ensure that the correct lens size is saved in the lens section. If the wrong lens setting is saved, then all subsequent calibrations will need to be redone.

2. Select Run Lens Calibration.

The red diode will disappear, and the camera will slowly turn off. The diode will start scanning the work area. After the calibration is finished, you will be given a pass or fail result.

If your test fails, it could be due to lighting in your work area. If it is too bright, close any open blinds or turn off lights before retrying. If it is too dark, try placing a white piece of paper under the laser diode to improve visibility.

After the machine passes the calibration test, we recommend performing a camera capture to ensure the QR card was positioned correctly. If the QR card was not placed parallel to the work area, the camera may be calibrated improperly.
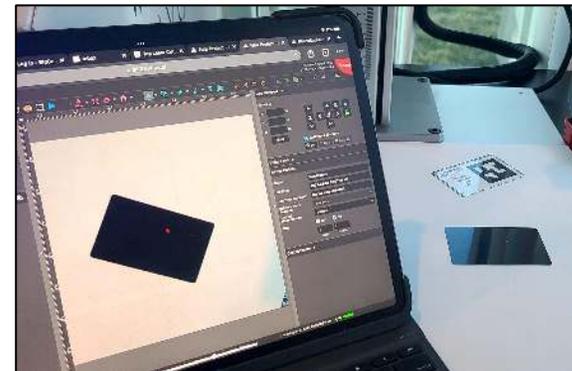
An example of a wrongly calibrated camera is when the workspace is shifted by the angle of the QR card. If this happens, you should re-run the calibration.

Once the machine is successfully calibrated to the lens, we need to perform mark and preview adjustments to ensure the laser properly engraves in its new work area.

Mark Adjustment:

To verify the success of the lens calibration process, run the mark adjustment. Ensure that the speed and power settings remain unchanged, but adjust the size parameter. The size refers to the dimensions of the square that will be marked, and its value depends on the lens size being used.

1. Place a flat piece of test material under the laser for marking.

2. Preview the square before proceeding to ensure that only the test material will be marked.

3. Select "Mark Square".

Measure the marked square. It should match the size chosen earlier. If the lens calibration was not done correctly, the marked square may be off by approximately 2mm. In that case, re-run the lens calibration and redo the lens adjustment.

Please note that the intentional cut-off of the top left corner of the square.

4. Select "Save Mark Adjustment".

Preview Adjustment:

After confirming that the mark adjustment is accurate, proceed to mark a new square by selecting the "Mark Square" button.

1. Without moving the previously engraved material, press the "Preview Square" button.

2. Make use of the adjustment buttons to align the tracing made by the red dot precisely with the marked square.

3. Finally, select "Save Preview Adjustment" to save the adjustments made.

Parameter Test:

If your not sure what types of settings you want to use for your materials, then try using the **Laser Parameter Test**. It can be found directly under the Laser Tools tab on the Setup page. The Parameters Test will generate a graph to test the two parameters chosen at their minimum and maximum values, with the spaces in between determined by the grid size. This means that a larger grid size makes it easier to narrow down your selection.

The parameters you can test are: Power, Speed, Frequency, DPI, and Pulse Width. Pulse Width is a parameter only used in MOPA machines. To access the Setup page, go to the Machine name, then go to Diagnostics and select Galvo Calibration. Next, select the Parameters tab.

Focus Tag Calibration:

Ensure that your machine is properly focused before starting the calibration process. Take note of the Z-stage coordinates displayed on the Main Unit screen to ensure accurate calibration.

Navigate to the Laser Tools page and locate the Galvo Autofocus Calibration section. Select the Autofocus Mode.

AprilTag:

Choose the **AprilTag option** to calibrate the **Focus card**. Place the Focus tag in the center of the work space.

Click on the **Take Snapshot** button to capture an image with the camera. The Focus Tag should appear on the screen with a red box above it. If the box does not appear, it may indicate a damaged Tag.

Ensure that the tag size is saved as **19.44**.

Set the lower offset for your stage. It is recommended to start with a value of 120 and adjust from there.

Saving the focus will cause the machine to move to the lower offset position. If the lower offset is set too low, it may hit zero and return to the previous location. Set the lower offset as close to the bottom as possible for optimal accuracy.

After saving the focus, move the stage from its position and test the autofocus. If done correctly, the stage will return to its previous focus location.

Note: The mode that is not selected will be inaccessible.

Red Diode:

To adjust the red diode, select the **TwoDots** option.

Position the back diode to the desired location.

Select **Update Ref. Position**.

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RetinaEngraveV3 (RE3):

RE3 can be accessed by entering your machines IP address into your web browser. When loaded RE3 will appear like so.

Main Toolbar   Workspace Tools   Viewing Tools   Drawing Tools   Orientation Tools   Grouping Tools

Project List

Project Information

Gantry Coordinates   Cursor Coordinates   Rotary Switch   Status Indicators

Main Toolbar
File: Create new projects,import and export existing projects, import image or drawing, and sync the workspace.
Edit: Select object, delete or duplicated objects, undo and redo changes, access setting and materials Library.
Modify: Arrange layers, move and modify images, and create compound objects and paths
View: Adjust magnification, canvas settings, and view other display settings
Machine Name: Use the camera functions, run a job and access the laser tools page from diagnostics.
Help: Access the user guide, support, tutorials, and the list of keyboard shortcuts.

Workspace Tools
Focusing Test: Verify that your laser it in focus
Capture Workspace: Takes images of workspace
   Clear Last Workspace Capture: Clears previous workspace image.
Trace Background Image
Estimate Job Time: Amount of time the job will take.
Show Bounding Perimeter of all Objects: Shows the space the job will occupy.
Run Job: Start Engraving

**Viewing Tools**
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.

Drawing Tools:
1. Select: Pointer
    - Subselect
    - Lasso
    - Layer
2. Shape: Line.
    - Rectangle
    - Ellipse
    - Polygon
    - Triangle
    - Star
3. Path:Pen
    - Bezigon
    - Freehand
4. Knife: Cuts out objects
    - Freehand Shaping: Initiates "freehand" mouse pointer for creating paths.
5. Text
6. Monogram
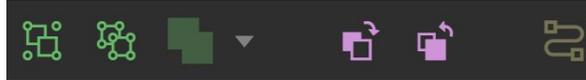
Grouping Tools:
Group: Group objects
Merge: Union: Combine layers into a single compound layer.
Difference: Combine non-overlapping layers into a single compound layer.
Intersection: Combine overlapping layers into a single compound layer.
Subtract: Remove and combine non-overlapping layers into a single compound layer.
Split: Split up a compound shape or object.

Orientation Tools:
Flip Horizontally: Flip object along horizontal axis.
Flip Vertically: Flip object along vertical axis.
Rotate CCW: Rotates 90 degrees counterclockwise.
Rotate CW: Rotates 90 degrees clockwise.
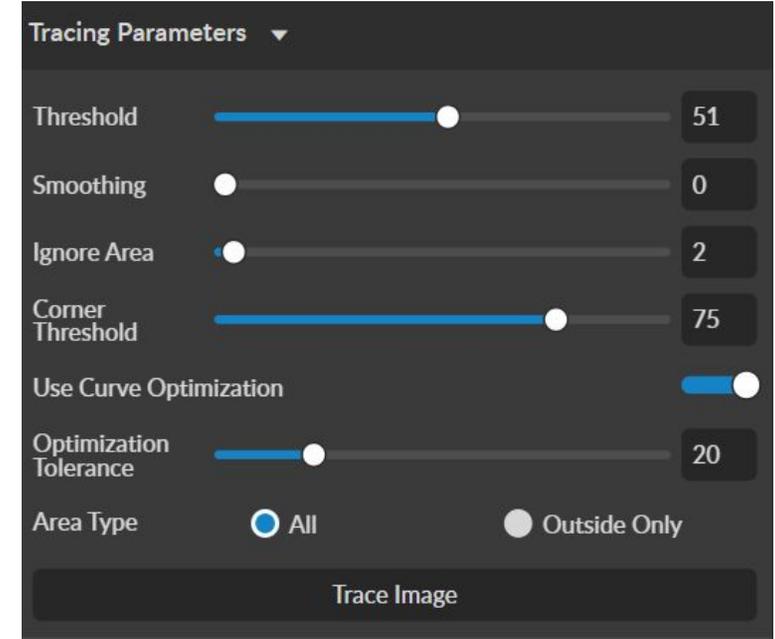
Positioning Tools:

Center Left | Center Middle | Center Right | Center Top | Center Middle | Center Bottom

Position Coordinates

Object Size

Object Transformation

Scaling Button

Tracing Parameters:
Tracing is used on rastered images to be made into vector lines for cutting.
Threshold- Pixels to include

Smoothing- smoothens the corners of the selected object

Ignore Area- how much speckling will be removed

Corner Threshold- how sharp corners will look

Optimization Tolerance- determines how many lines are in each curve.

Ex. The greater the tolerance, the fewer lines but it affects accuracy.

Area Type- All- The entire picture is trace.

Outside Only- The border of the picture is traced.

Full Spectrum AI:

Full Spectrum Lasers has just unveiled its newest innovation - an advanced AI system that is set to revolutionize the laser cutting industry. This cutting-edge technology is designed to enhance the precision and accuracy of Full Spectrum Lasers' machines, providing customers with even greater control over their cutting and engraving projects.

Entering RE3:

In order to use the AI, the machine must be connected to the internet.

1. Go to the web browser and enter the following format: **IPAddress/re3**.

The software will have and additional toolbar next to the Help icon.

AI Toolbar:

The **Find Objects** icon is used to detect multiple objects within the workspace. In order to use this function a screenshot of the workspace needs to be taken.
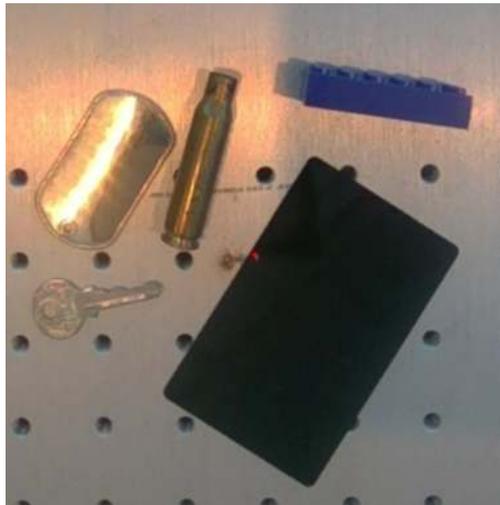
After taking the Screenshot, hold the **Shift** key and select a few spots on the present objects, then hold the **Shift** and **Alt** keys to select background spots. Once completed, select the **Find Objects** icon.
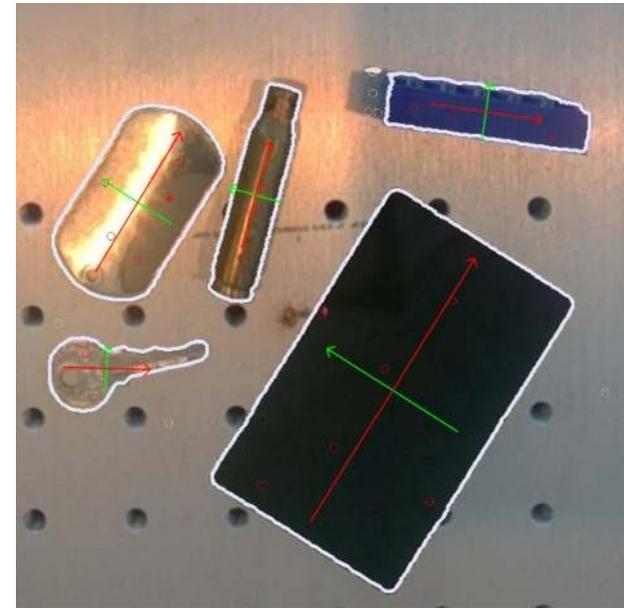
The AI will then identify the objects, highlight the perimeter and calculate the center of each object. The width is displayed in red, while the height will be displayed in green.

If a part of the background was added to the perimeter it can be removed by using the **Shift** and **Alt** keys to identify it as background then select the **Find Object** icon again.

The screenshot can be cleared of any selects using the following icon.

Full Spectrum AI:

Aligning objects:

Vector and Raster objects can be selected and placed onto the center of each perimeter using the align option. Keep in mind that the AI will not resize the selected objects, it will only place the object at the center. Therefore you will need to resize the object yourself.
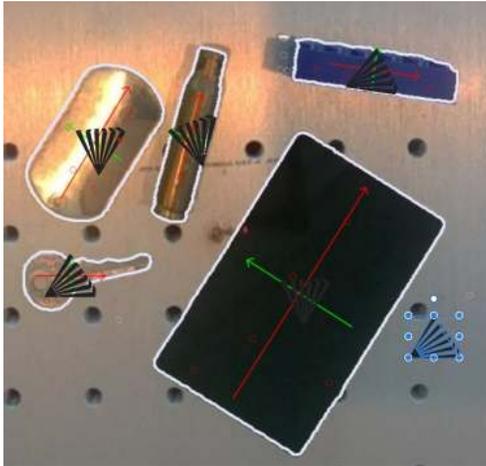
Aligning Text:

There are two methods to align text.

1. The Textbox Options:

Selecting the written text. Then select the **Align** option. The text will be placed at the center of the perimeters. If the object needs to be numbered select the Auto Increment option from the Text window.
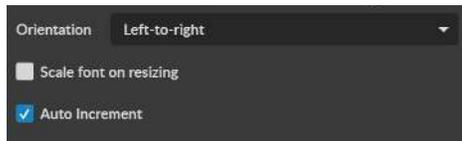
2. The Advance Settings:(Sidebar)
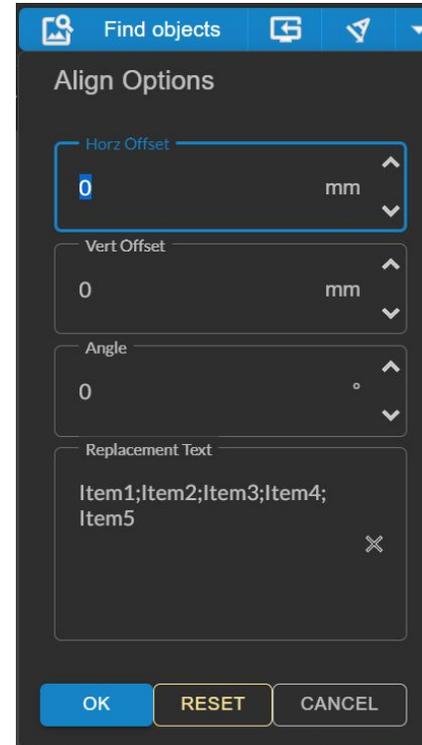
By selecting the down arrow, a side bar will appear showing the settings for all the identified objects.

The horizontal and vertical offset can be set here as well as the angle from which the object is rotated clockwise.

The text of the objects can be placed here under the replacement text window. The text for each object can be written down and separated from each other using the **;** key, as shown in the picture.

Use the ok button to save the settings. Then select the **Align** option.
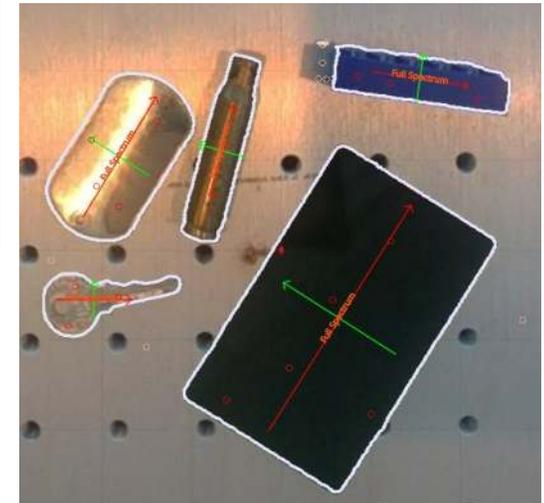
Full Spectrum AI:

Text to Art Generation:

Our AI can generate raster images using a text prompt. Select the downward arrow to open the prompt window.

Write your prompt and then select the **OK** icon. The window will close automatically. Then select the **Generate image from text** option. Your image will be generated.
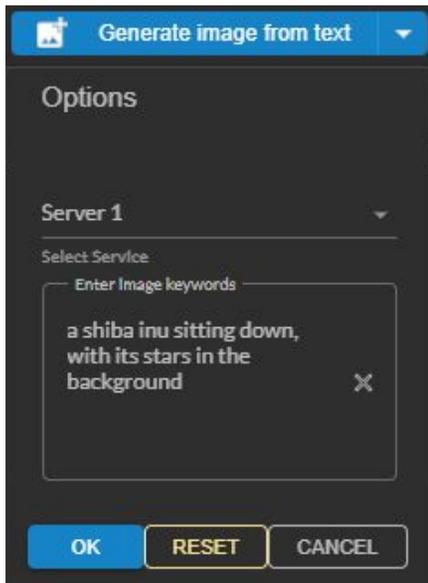
Background Removal:

Our AI can identify the subject of the image and remove any unwanted background.
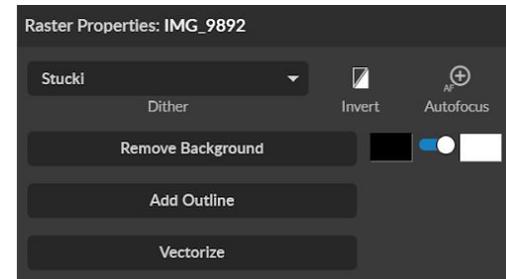
Removing the background can be done from the Raster Properties section. The background will be replaced with the background color of your choice. The white background is selected for normal engravings while the black background is used for images that are going to be inverted.

Starting Parameters:

The following parameters are for starting your engravings, these setting will have to be fine tuned for each machine.

Material	Model	Power %	Speed	Pulse Width	Frequency	Passes	Line Spacing	Notes
Acrylic	20 Watt							
Aluminum	20 Watt	80	1000		45		0.01	
Glass	20 Watt	20	400		40			
Painted Aluminum Business Card	20 Watt							
Plastic	20 Watt	30	800		40			
Stainless Steel	20 Watt	80	1000		60		0.03	
Acrylic	60 Watt							
Aluminum	60 Watt							
Glass		35	600					
Painted Aluminum Business Card	60 Watt							
Plastic								
Stainless Steel	60 Watt							
Hyrdro flasks and tumbers	60 Watt	100	1000	2 (Low)	1950 (High Freq)	2 Pref	1000DPI (.04)	210 (Lens) most bottles might need a polish pass
Black Anealment mark	60 Watt	20	800	80	150	1	25400 (.001)	very slow (210 Lens) Focus must be exact.
holographic on stainless steel	60 Wattq	11	1800	80	150	1	25400 (.001)	210 Lens, sensitive to changes in power
Acrylic	100 Watt							
Aluminum	100 Watt							
Glass								
Painted Aluminum Business Card								
Plastic								
Stainless Steel	100 Watt							
Holographic on stainless steel	100 watt	40	1000	100	300	1	0.0508	Holo effect is drastically noticeable when a light is shined on the image
Anealment mark	100w	40	1000	12	200	1		
Anealment mark	100 Watt	20	800	80	150	1	0.001	

Full Spectrum
L A S E R

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Project Procedure:

```
┌─────────────────────────────┐
│    Connect to Software      │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│    Create or Import Design   │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│   Adjust Object Properties   │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│       Place Material         │
└─────────────────────────────┘
              ↓
┌─────────────────────────────┐
│        Focus Lens            │
└─────────────────────────────┘
              ↓
┌──────────────────────────────────┐
│ Align Material to Engraving Areas │
└──────────────────────────────────┘
              ↓
┌─────────────────────────────┐
│         Run Job              │
└─────────────────────────────┘
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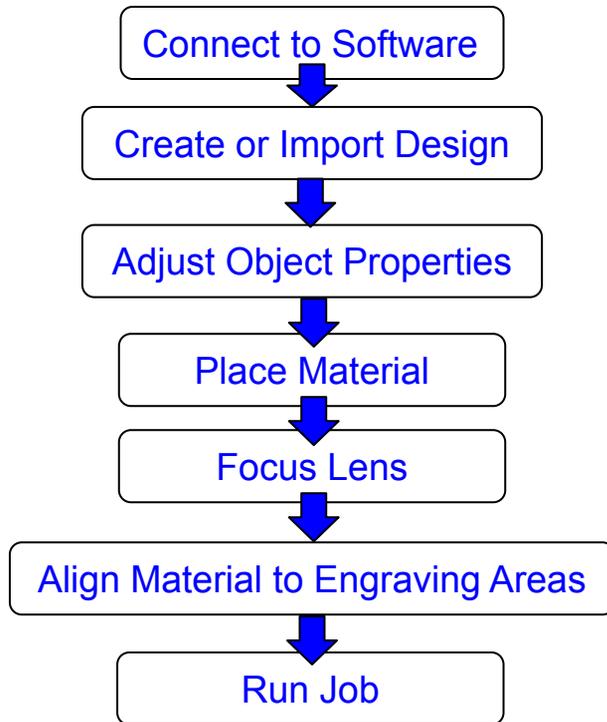
For more information on your machine refer to your user manual. For information on RE3, refer to the RE3 Guide found in our website.

Troubleshooting:

Q: What should I do if my laser isn't marking?

A: Check if the laser is properly focused. If the machine is not at the right height, it won't engrave. Refocus the laser head after changing to a new material. Still having difficulties, make sure that your material is compatible with your laser engraver.

Q: Why are my marks turning out incorrect?

A: Experiment with different settings to find the ones that work best for your requirements. Here are some initial guidelines to get started:

- To get darker/lighter engravings, adjust the power or speed.
- To get deeper engravings, decrease the speed or increase passes.
- For clearer engravings, use a picture with a high resolution.

Q: What should I do if my engravings are too shallow?

A: You may need to increase the power and/or decrease the speed. Multiple passes can also add more depth. You can also use a smaller lens to engrave in more detail. For precise engravings, ensure that the laser is fully focused by performing a laser focus test every time you switch to a new material.

Q: How can I solve issues with focusing my laser?

A: If using auto-focusing with the QR tag, ensure that the QR tag is visible in the camera during the entire process. If the tag goes off-screen, the machine won't focus. If it doesn't work, try manual focusing.

Q: What should I do if my engravings look wobbly and uneven?

A: If you've recently calibrated your camera, check that you did it on a flat, smooth, and level surface. Otherwise, recalibrate on a different surface. Another reason could be that your material is not flat while engraving, it can come out uneven. Flatten and/or weigh down your material before engraving to avoid this issue.

If your having an issue not listed here, visit our Help Center. We provides comprehensive videos, and useful resources for troubleshooting to helping you get the most out of your investment in our products.
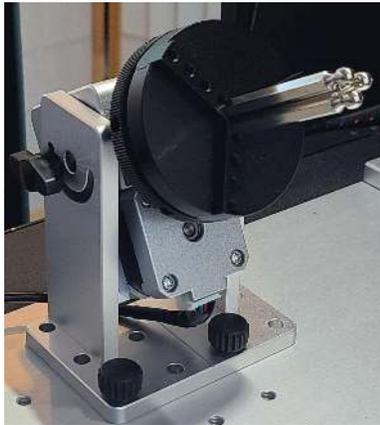
Full Spectrum
L A S E R

Galvo Accessories (Sold Seperately):
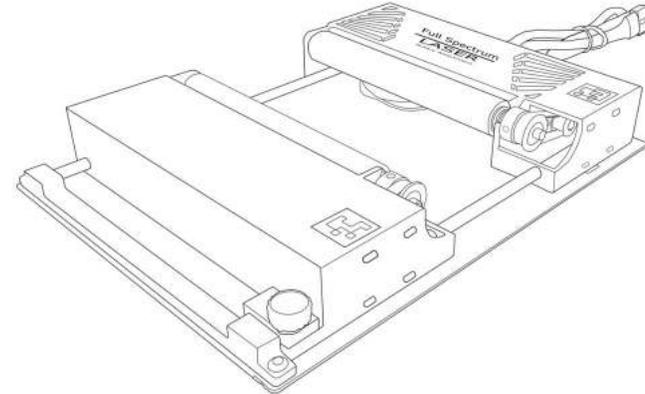
Chuck Rotary:
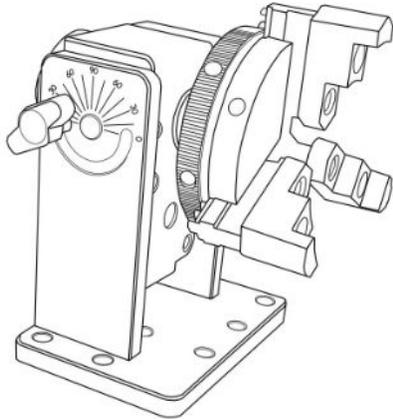
The Chuck Rotary is a compact rotary that is designed to help object of any size with ease.

The jaws can be swapped out by removing the screws. The rod attachment can be used for engraving smaller objects such as rings.

For more information visit the product page here or check out or Zendesk article here.

Low Profile Rotary:

The Low Profile Rotary is a compact rotary that is designed to be used with any Muse machine. Its adjustable mount makes the Low Profile rotary capable of engraving cylindrical objects ease.

Linear Rail:
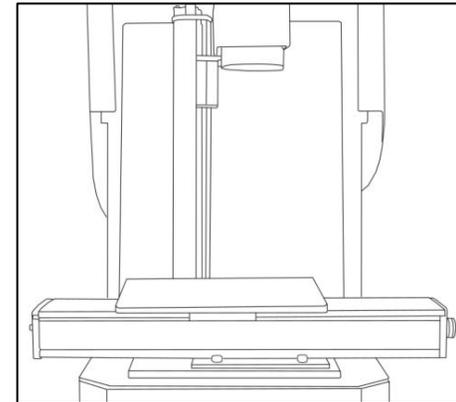
The Linear Stage uses a motorized rail to engrave long pieces of material with ease.

For more information visit the product page here or check out or contact us here.

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