BETTER SOFTWARE FOR LASER CUTTERS

LightBurn Software

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1. Home

Welcome to the LightBurn Docs!

Please use the search bar at the top of the page or click the closest match below to find information on the tool or topic you'd like to learn about.

You can make LightBurn feature requests on our suggestion site.

Disclaimer and Safety

Troubleshooting

- Connection Problems
- Job Quality
- LightBurn Editor FAQ
- GRBL Errors

Beginner Pathway

- Installing LightBurn
- Adding Your Laser to LightBurn
- How to Use LightBurn
- Zooming, Panning, and Selection
- Getting Started: Making a Simple Project
- Coordinates, Device Origin, and Job Origin - Placing your work

Primary Documentation

- Instructions on Commonly Used LightBurn Features
- Cool Tricks and Usability Tips
- Working With Fusion 360
- LightBurn Bridge Docs
- Using a Rotary
- Galvo Docs

If you need to read our documentation in a different language, you can use Google Translate to translate this website into your preferred language.

For your convenience, we have shortcuts to Google translate for Spanish (Español), German (Deutsch), Italian (Italiano), Chinese ( ), and French (Français).

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2. Disclaimer and Safety

Danger

Lasers use intense beams of light to create heat and fire as a normal part of their operation, and depending on the laser, the light might not be visible to you. When used safely, a laser cutter is an incredibly useful tool. However if the proper safety measures are ignored, you could burn or blind yourself or someone else, or start a fire that could damage or destroy your home, or in the worst case, kill someone. CO_2 lasers use high voltages, and if wired incorrectly could kill you.

Do not leave a running laser unattended.

By using this software, the user accepts complete responsibility for each and every aspect of safety associated with the use of the laser machine, laser system and LightBurn Software.

You agree that:

1. You will always follow the manufacturer guidelines when operating your machines.
2. You will not hold the author or contributors of LightBurn liable for any damage to equipment or persons from the use of LightBurn.
3. You understand the potential hazards in using high power lasers and high voltages.
4. You will wear proper eye protection rated for your laser when operating it.
5. You will use the LightBurn software in a legal and safe manner.
6. You relieve the author and contributors from any liability arising from the use or distribution of the LightBurn software.
7. You are entirely operating at your own risk. Lasers can be lethally dangerous.

Troubleshooting

3. Troubleshooting

If you're having trouble using LightBurn, our troubleshooting resources are a great place to start looking for help with common problems and frequenly asked questions. You can also email support, and talk with LightBurn staff and users on our forum.

Over time, we will be adding more troubleshooting resources. We'll try to keep links consistent, but if a link to a specific troubleshooting resource changes, you'll always be able to find it from this page. If you can't find what you're looking for, you can contact our documentation team by clicking the envelope icon next to any header and let us know.

3.1 What's Wrong?

Choose a category below for more help.

Connection Problems

Get help connecting your laser to a computer and sending jobs to it.

Job Quality

Resources to help you figure out why your laser's output doesn't look how you expect.

LightBurn Editor FAQ

Frequently asked questions about creating and editing designs in LightBurn.

GRBL Errors

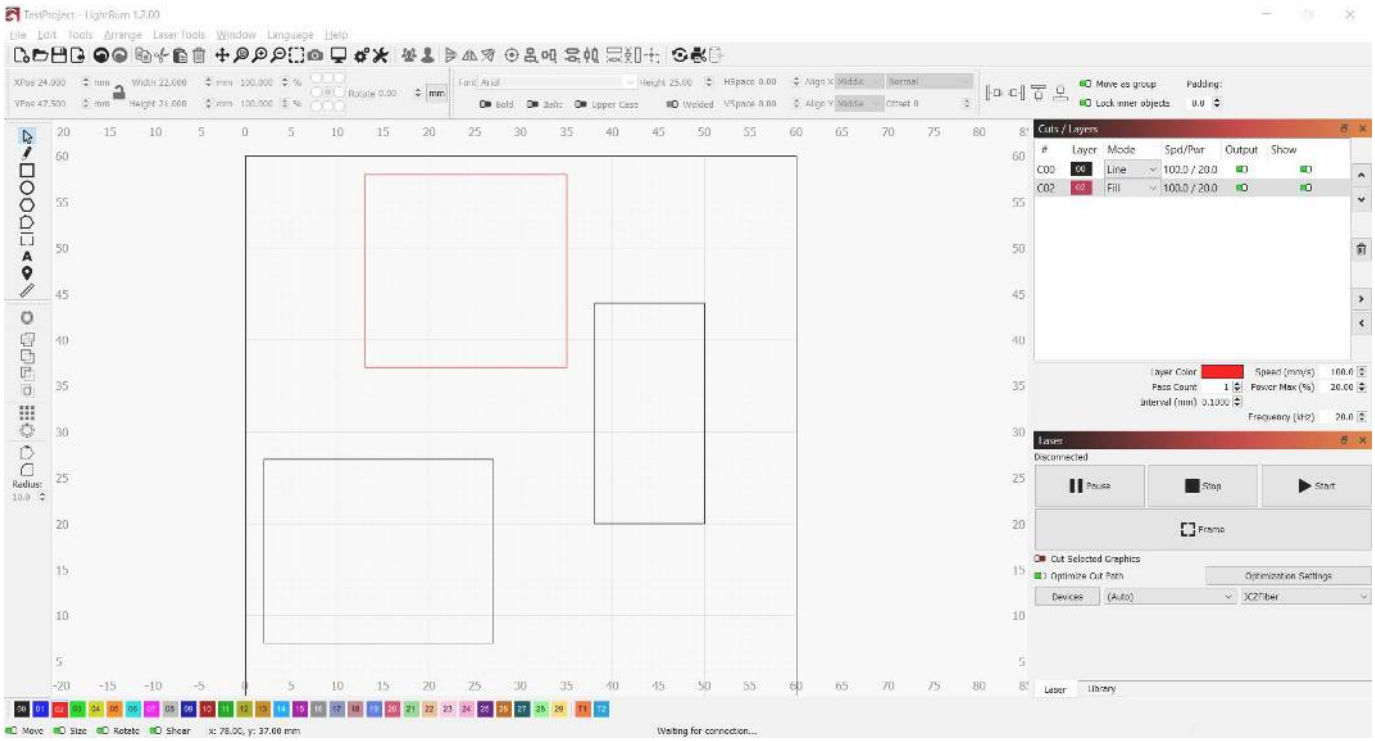
Resources to help you understand GRBL-specific errors.

4. Beginner Docs

Beginner Docs **First Steps**

4.1 What Is LightBurn?

LightBurn is a layout, editing, and control software for your laser cutter. LightBurn talks directly to your laser without the use of additional software.



With LightBurn you can:

- Import artwork in a variety of common vector graphic and image formats (including AI, PDF, SVG, DXF, PLT, PNG, JPG, GIF, and BMP)
- Arrange, edit, and even create new vector shapes within the editor, with powerful features like offsetting, boolean operations, welding, and node editing
- Apply settings like power, speed, number of passes, cut order, brightness & contrast, dithering mode, and much more
- Send the result directly to your laser cutter

LightBurn is a native application written for Windows, macOS, and Linux.

4.2 Beginner Walkthrough

Beginner Docs **First Steps**

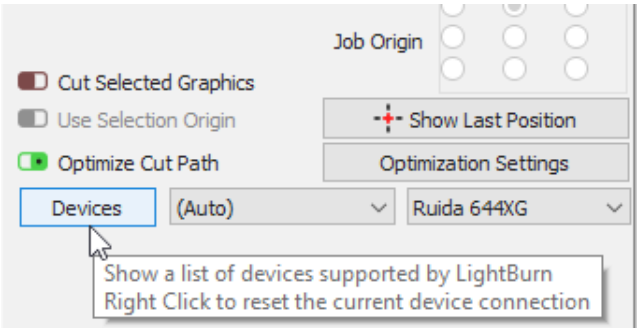
4.2.1 Adding & Configuring for Beginners

LightBurn can't control every laser, but it can talk to a number of different types of laser controllers, all of which use different ways of communicating, and have different abilities and settings.

This step tells LightBurn what type of laser you have.

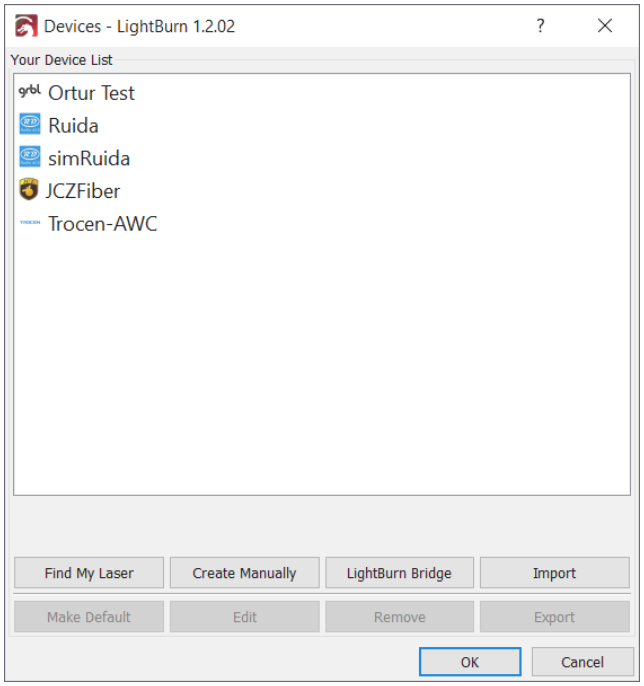
If you've never configured a device in LightBurn, you'll be brought here automatically when you run the software. It is important that you pick *something* because the interface in LightBurn will change depending on the capabilities of the laser you choose. If you don't have a laser to connect to yet, you can create a placeholder device.

If you've done this before but want to change your laser or add a new one, click the **Devices** button in the Laser Window to bring up the devices list.



LightBurn can also be configured to control more than one laser, and there are settings stored for each device. If you don't pick one, we have nowhere to put these settings, and a number of features within LightBurn will not work until this is set up.

The Devices Window



This is the Devices window in LightBurn. Here you will see a list of all the laser devices you've added to LightBurn, or an empty list when you're first starting.

The simplest way to proceed is to click Find My Laser and let LightBurn locate and identify your laser. If that doesn't work, your laser may connect with Ethernet, or if you have a Marlin device, you'll need to use Create Manually. If you're using a LightBurn Bridge device, you can use the LightBurn Bridge setup.

- Find My Laser
- Create Manually
- LightBurn Bridge

You can also import and export laser configurations to move them between computers using the **Export** button on this page from the source computer and then import it to the new install using the **Import** button. Exporting will create a `.lbdev` (LightBurn device) file which contains all of the device specific information LightBurn needs to import that machine's profile into the new computer.

> **Tip**
>
> You can import a LightBurn Device profile by dragging and dropping it into the LightBurn window.

What if I don't have a laser yet?

You don't ever need to connect a laser to LightBurn to use it, but LightBurn will not run without a device profile configured, because it needs a place to store some settings, and wants to know what options to show you in the interface. If you use a laser that accepts files on a USB drive for example, LightBurn needs to know which controller it uses so it can produce the correct output files.

To start using LightBurn without a laser, use Create Manually and configure the things you can, and guess at whatever you don't know. When you finally do get your laser, you can come back to this screen, select the 'dummy' profile you set up, and click `Remove`. Then you can follow the setup steps here for real this time and use your laser!

Configuring

If you have a GCode controller—particularly if you also use your system as a CNC or 3D printer—there may be additional configuration required.

- Common GRBL setups

If you have a Ruida DSP controller and are configuring from scratch, read here:

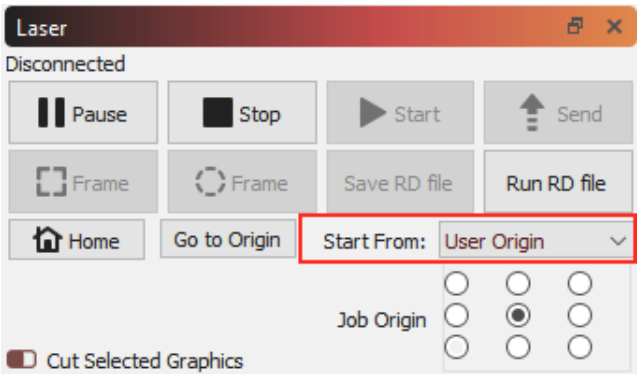
- Configuring a Ruida

If you're using a galvo laser, start here:

- Configuring A Galvo

4.2.2 Coordinates and Job Origin

There are a few ways to tell LightBurn where to ouput your project within the work area of your machine, each available in the **Start From** menu in the **Laser** window.

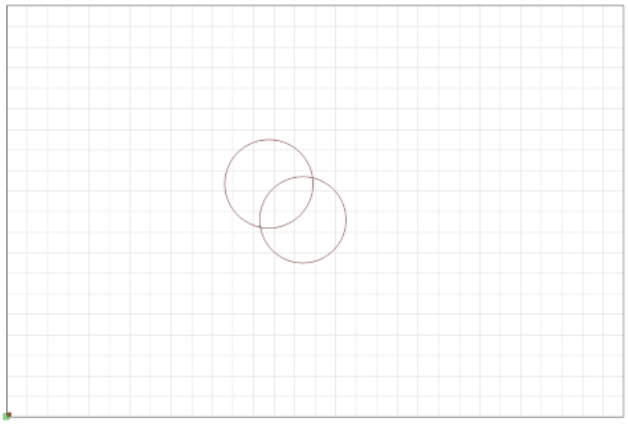


Absolute Coordinates

Absolute Coordinates is the simplest option. The grid you see in the main editing window of LightBurn represents your machine's physical work area. Anything you place in the LightBurn grid will be output in the corresponding location in your machine's work area.

> **Note**
>
> Using absolute positioning requires a laser with homing switches and a fixed origin. If you have a small diode laser that does not have homing switches, you will need to manually home the machine. See: Machines without homing sensors / limit switches.

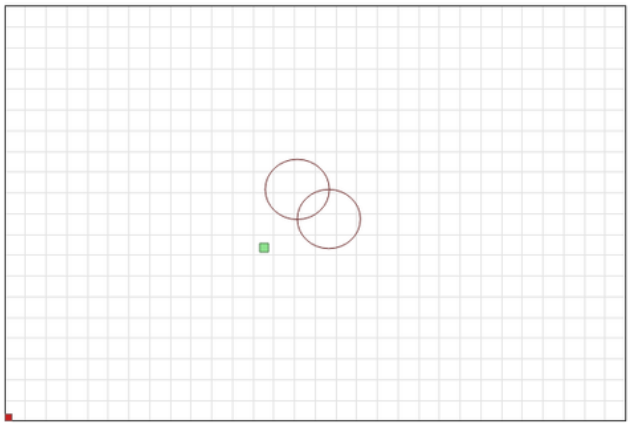
In the image below, the two circles placed in the middle of the LightBurn grid will be cut in the middle of the machine work area. The green square in the lower left of the image represents the **Job Origin**, and the red square in the same place shows the **Machine Origin**. When using Absolute Coordinates these are always in the same place.



Current Position

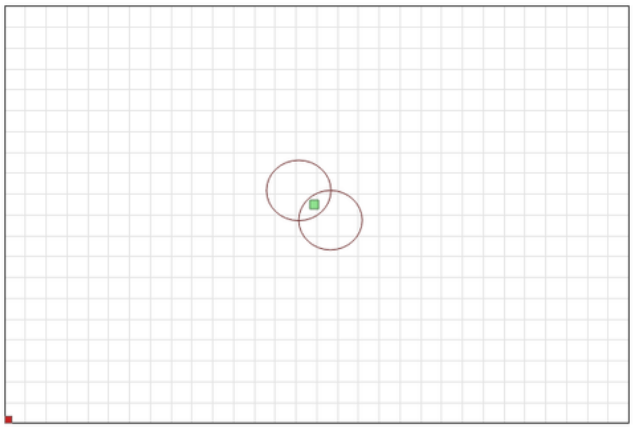
With **Current Position** selected, your job outputs relative to the current position of the laser head when you hit the **Start** button. The **Job Origin** control in the **Laser** window tells LightBurn how to orient output relative to the laser head.

In this image, we're starting from the Current Position, with the Job Origin set to the *lower left*:



Notice that the green Job Origin indicator has moved. This represents the position of the laser when you start the job, so the laser is going to move slightly up and to the right from wherever it is, cut the two circles, and go back to where it started.

Now imagine that you want to etch this two-circle pattern onto a coaster or a phone case. Lining it up from the *lower left* is not easy. If you change the Job Origin setting to *center*, you get this instead:



The job will be centered around the current position of the laser head. If you position the laser head directly over the center of the item you want to etch, the output will be centered on the item.

User Origin

User Origin works almost exactly the same as **Current Position**, except that the starting location is *programmable*. To set a User Origin, you must first jog your laser to the location you want your job to start from, then set the origin.

Some lasers with digital displays, such as those with Ruida controllers, have an `Origin` button which you press to set the origin. GCode-based systems use the **Set Origin** button in the **Move** window in LightBurn to do the same thing.

After setting the origin, you are free to move your laser around the workspace. With User Origin selected as the **Start From** mode, the laser will move back to that programmed location and start the project from there.

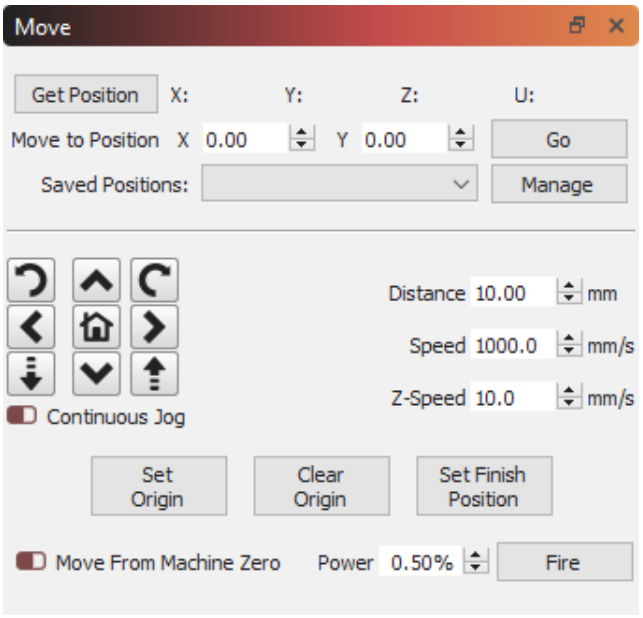
As with Current Position, the **Job Origin** setting determines how output will be oriented relative the user-defined origin.

Finish Position

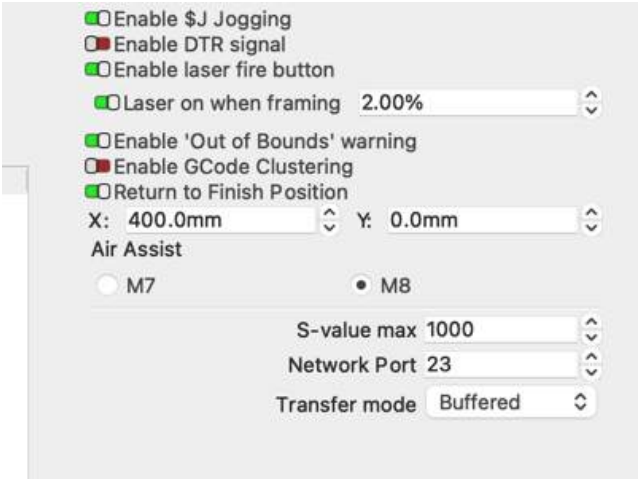
> **Note**
>
> The **Finish Position** option is only available for GCode-based controllers. DSP controllers manage this internally.

LightBurn allows you to control where you want the head of the laser to return after a job is finished. By default, it will return to 0,0, but this is not always optimal for all machines.

To change your laser's Finish Position, go to the **Move** window and use the arrows to position your laser head wherever you would like it to return to after the job is finished, then click the **Set Finish Position** button. Your machine will now remember that spot for future jobs. Finish Position can be adjusted at any time by repeating the above steps for a new location.



Users with GCode-based lasers can also adjust or disable the Finish Position in the **Device Settings** window.



4.2.3 Basic Usage: The Essentials

So far we've done a brief introduction to the UI and covered zooming, panning, and selecting.

The next things we'll cover are:

- Creating Shapes
- Importing Artwork
- Moving and Sizing Artwork
- Grouping
- Cut Layer Settings
- Controlling the Laser

Creating Shapes

LightBurn's shape creation tools let you create simple shapes. Choose a tool from the left toolbar, like the ellipse, rectangle, or polygon tools. With a tool selected, left-click in the workspace and drag the mouse to adjust the size of the shape you're creating. While dragging, the Shift key will force the shape to have the same width and height, so you get circles and squares instead of ellipses and rectangles. The Ctrl key causes the shape to be centered on the starting point, instead of dragging it out from corner to corner. Release the mouse button to finalize the shape.

For text, select the text tool, then click in the edit window to place the cursor. Type your text, and press the Esc key when finished.

Importing Artwork

The shape creation tools let you make simple shapes in LightBurn, like circles, rectangles, text, and polygons, and also give you the ability to edit and adjust them, but LightBurn isn't intended to be a complete artist package or dimensioned modeling tool. For that, you would use external software like CorelDraw, Adobe Illustrator, Inkscape, or AutoCAD. Photo or image manipulation software such as Photoshop or GIMP can be used to create or manipulate image files.

When you have artwork ready in one of these programs, the next step is to import it into LightBurn to adjust the settings. LightBurn can import the following file types:

Vector / mixed formats:

- .ai - Adobe Illustrator
- .svg - Scalable Vector Graphics
- .dxf - AutoCAD Drawing Exchange Format
- .pdf - Adobe Portable Document Format
- .plt / .hpgl - Plotter / Hewlett-Packard Graphics Language

Image formats:

- .png - Portable Network Graphics
- .jpg / .jpeg - Joint Photographic Experts Group format
- .bmp - Windows Bitmap
- .gif - Graphics Interchange Format
- .tif / .tiff - Tagged Image File Format

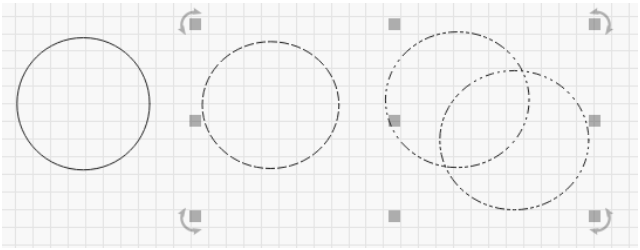
Note that not all features of every format will be supported. Vector graphics formats in particular are incredibly complex, and using more advanced features, like pattern fills, masking, gradients, and so on will not necessarily translate well when importing. LightBurn cares about shape outlines - if you want artwork to include the advanced features, the best option is usually exporting as a high-DPI image.

You can import files into LightBurn in several different ways:

- Clicking the Import button on the main toolbar ()
- Using the File > Import option from the main menu
- Pressing the Import keyboard shortcut (Ctrl + I)
- Dragging a file from the Windows Explorer or MacOS Finder into LightBurn
- Copying and Pasting an image from a browser window into LightBurn

Moving and Sizing Artwork

Once you have your artwork in LightBurn, the next step is usually placing or sizing it. When one or more items are selected, you'll see various "tool handles" appear around the outside of the selection, like this:



In the image above, you can see 9 gray squares, and four arrows. If you hover your mouse over any of them, the cursor will change to indicate the kind of operation that tool performs - resizing, moving, or rotating.

Grabbing any of the four corners will let you resize the artwork from that corner, and defaults to uniform resizing with the opposite corner as the anchor point. Holding the Ctrl key (or Command on Mac) switches the anchor point to the center, so the object center remains in place when resizing. Holding the Shift key allows you to resize the width and height independently, instead of locking them together.

Grabbing any of the four side handles will let you adjust the width or height of the selection, and the Ctrl (or Command) key switches to center anchor just as it does with corner sizing. When moving, the status bar shows both the absolute position of the selection being moved, and the relative distance it has moved.

The center handle is for moving the selection, though you can also click and drag any edge of any shape to do this as well. When moving a selection, holding the Shift key constrains the movement to be horizontal, vertical, or diagonal.

The four rotate handles allow you to rotate the object freely using the mouse. While rotating, the relative rotation is

displayed in the status bar. Holding the Ctrl key (Command on Mac) snaps the rotation to the nearest 5 degrees, holding Shift will snap to 15 degrees, and holding Ctrl+Shift snaps to 45 degrees.

You can also move, rotate, and resize artwork using the Numeric Edits Toolbar.

Grouping

When you create shapes in LightBurn, they're independent of other shapes you create. Sometimes it's handy to be able to treat a collection of things as a single unit, to make sure they keep their relative position and size when you're moving them around. In LightBurn, this is called a Group. If you select two or more shapes and click the 'Group' button (), or press ^ Ctrl + G, you'll create a new object that contains the original shapes. To un-group the objects so you can edit the individual parts, select a group of shapes and click the un-group button (), or ^ Ctrl + U.

You can tell if a shape is in a group or not based on how it looks when selected.

Ungrouped objects are displayed with a simple dash pattern when selected, like the single circle above on the left. A grouped shape shows a repeating dot-dot-dash pattern when selected, shown on the three smaller circles above on the right.

Cut Layer Settings

Artwork imported from vector files assigns shapes to layers in LightBurn based on the colors of the vectors in the original file. If you create your files with this in mind, it can save you time.

Layers in LightBurn are used to assign different settings to the shapes in your design. For example:

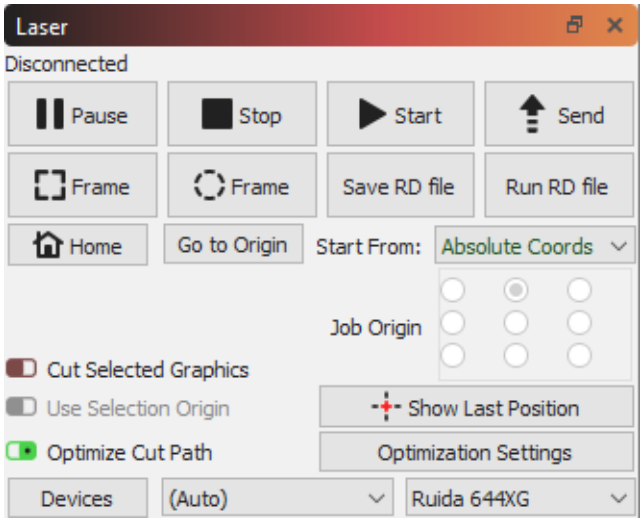
In the above design, black could be used for a solid, dark engraving, blue could be a very light engraving with an outline to add definition to the text, and red would be a slow, high-power cutting layer. The final output to the laser might look like this:

The information shown in the Cuts / Layers window is just the basics. You can see the full set of options for a layer by double-clicking the entry in the layer list to bring up the Cut Settings window.

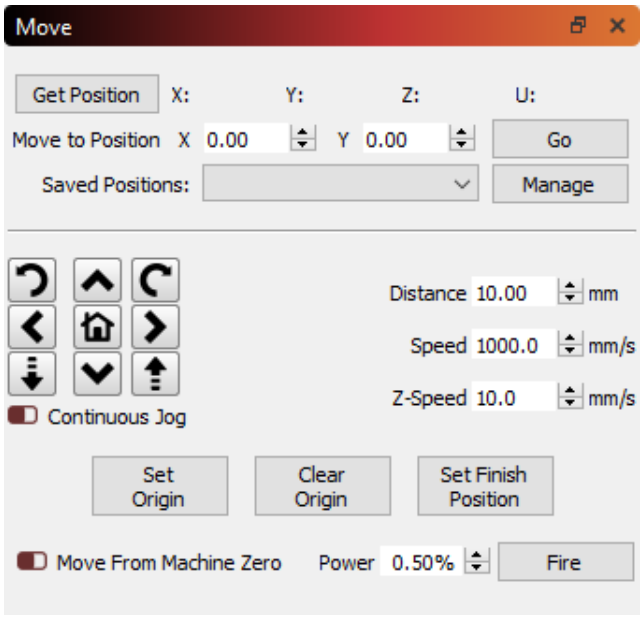
Controlling the Laser

There are two windows primarily used to control the laser:

The Laser Window, shown in the lower right of the display by default, lets you select your laser, start, stop, or pause a job, frame the design (move the laser head around the boundary of your design to test alignment), and more. These options can vary based on the type of laser you're using.

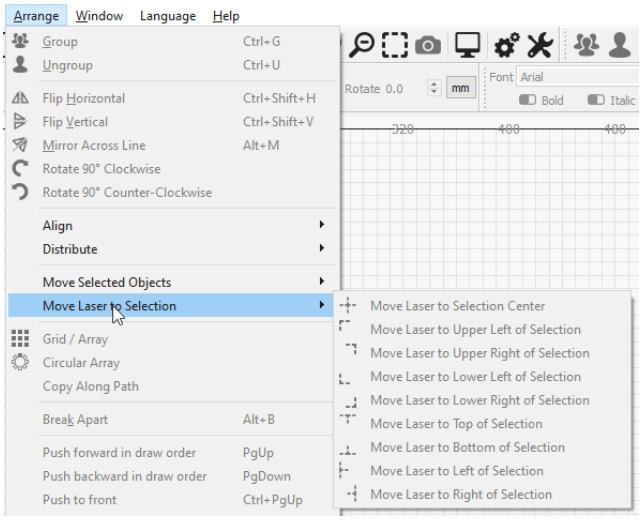


The Move Window, docked behind the Cuts / Layers window by default, gives you jog buttons and positioning control, and the 'Speed' value there is used when framing or jogging the laser in LightBurn.



There are a couple other methods for moving the laser that are noteworthy:

- The Click-to-Position tool ( ) on the Creation Tools toolbar lets you click anywhere in the workspace and LightBurn will jog the laser to that point.
- Note that this assumes that your laser has been properly homed - Some DIY-style machines do not have homing switches, so using any form of absolute positioning in LightBurn requires extra steps.
- The number pad arrow keys can be used to jog the laser after clicking in the edit window (workspace).
- The Arrange menu and arrangement tools can be used to move the laser relative to artwork in the workspace.



Beginner Docs **First Steps**

4.2.4 Making a Simple Project

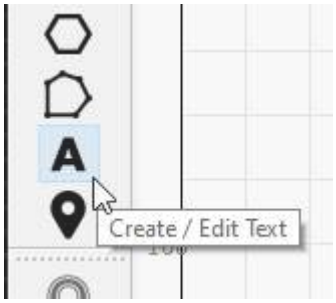
We're going to go step-by-step through creating a small, simple project in LightBurn, from start to finish, to show you how to use a few of the basic editing tools, and give you a feel for how things work.

Before you start, make sure you have a laser set up in LightBurn (see Adding your Laser).

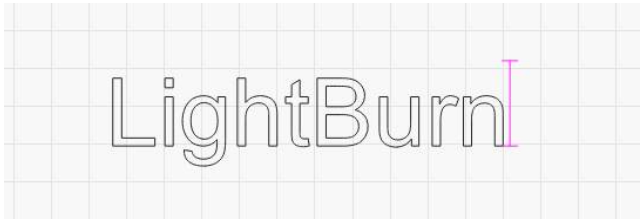
This project will be a simple name tag, cut out around the letters, ideally made from thin wood or acrylic, but a piece of cardboard will do.

Creating the text

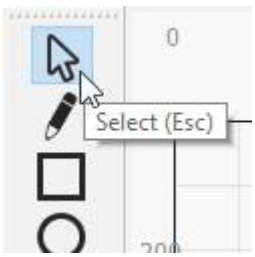
With LightBurn running, and an empty project, click the Create Text button shown below. It normally lives along the left side of the main window:



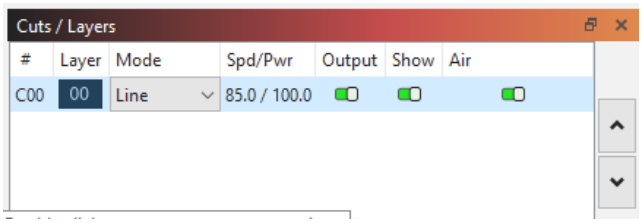
Next, click the mouse somewhere in the middle of the Edit window (the workspace) to get a cursor, then type your name:



Click the 'Select' tool button on the top left of the edit window, or press Esc twice (once to finish entering text, and again to exit text entry and go back to selection mode).



When you finish the text, you'll see an entry appear in the Cuts / Layers list on the upper right of the display. This is the "layer" that your text is on, and it holds the settings that will be sent to the laser for all the objects on this layer:

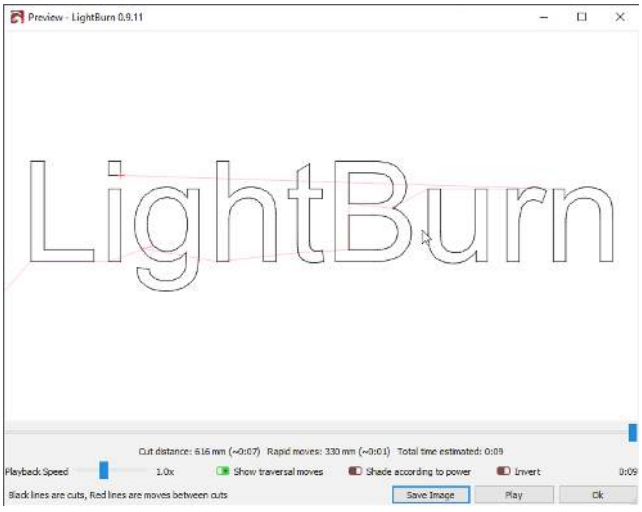


This tells us that the shapes on this layer will be drawn as lines, with 100 mm/sec speed, and 20% power. Depending on your settings, the '100.0' might be different - Diode lasers are less powerful than CO2 lasers, and run slower, so they tend to use mm/minute as units, so the same default value would display as 6000 mm/min. If you have your units set to Inches, you might see 3.9 in/sec, or 236 in/min.

Previewing

To see how the laser will run your project, click the Preview button in the middle of the main toolbar:

The preview window will pop up, showing the completed job, like this:

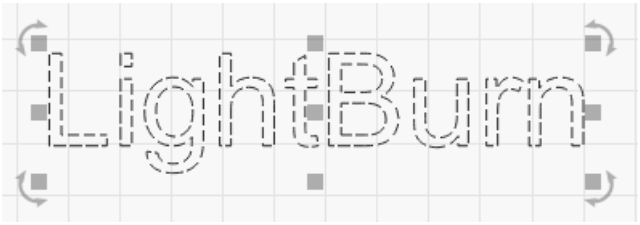


The lighter red lines are showing the laser moving between the shapes (traversal moves), and the black lines are where the laser will burn. Click the 'Play' button and you can watch a simulation of how the laser will run the job. You can also grab the slider and drag it around to see the cut at different points in time. Spot checking the output like this is a good habit to get into, because you'll likely spot mistakes before you burn the project for real, saving time and material. Click the 'Ok' button to close the preview.

For more information on the preview window see its page here Preview Window

Changing text properties

Make sure you're still in Selection mode - the 'Select' tool should be highlighted. Click the name, or click and drag a rectangle around it to select it. When it's selected, it will be drawn as animated dashes instead of solid lines, and handles will appear around the selection to let you change the size, position, or orientation.



The options in the Text Toolbar at the top will activate, like this:

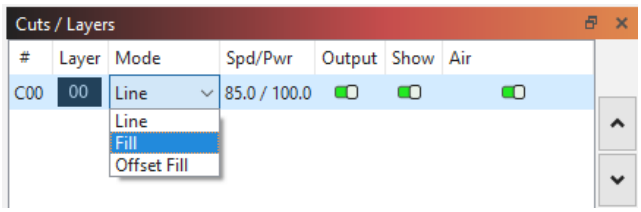
Click the drop down for the font, and change it to anything you like. While you are choosing, the changes will be displayed in real time in the edit window. You can change the height, make it bold or italic, and adjust spacing here too.

Undo / Redo

If you make a change you don't like, you can undo it by clicking the Undo button on the toolbar (or pressing `^ Ctrl` + `Z`, or Edit > Undo in the menu). If you decide you liked it after all, you can also Redo (`^ Ctrl` + `⇧ Shift` + `Z` / `⌘ Cmd` + `⇧ Shift` + `Z`). Undo and Redo in LightBurn are unlimited - the undo system doesn't reset unless you create a new file or close the program.

Changing the Layer settings

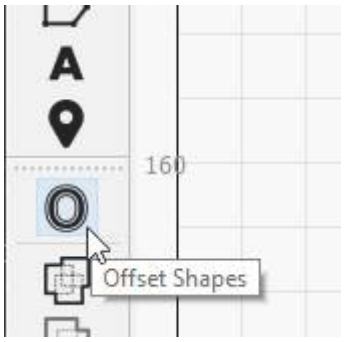
Rather than outline the text, we're going to change it to be solid filled. In the Cuts / Layers window, click where it says 'Line' and change it to 'Fill', like this:



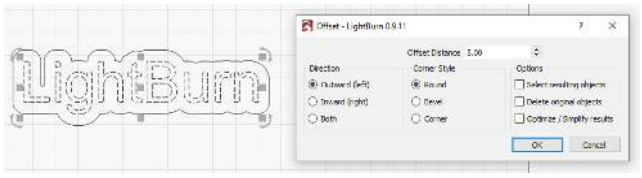
You'll notice that the display in the edit window hasn't changed, but if you run the preview again, it looks quite different. By default, the view in LightBurn shows outlines only, not fills, because it's much faster, and it prevents things from being hidden behind solid shapes that might still be run on the laser.

Adding an outline: The Offset tool

With the text selected, click the 'Offset' button on the left toolbar, shown here:

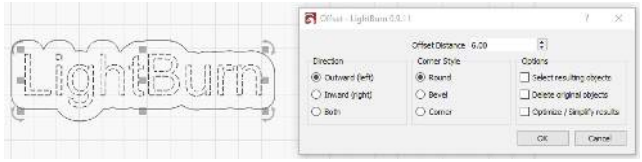


The Offset options window will appear, and you should see something like this:



The offset tool creates a new shape by outlining the shapes in your selection at a given distance, either inward, outward, or both, and merging the result. If you point the mouse at the 'Offset Distance' value, you can scroll the mouse wheel to change the number and watch the result change on the fly. You can also click the box and just enter a number as well.

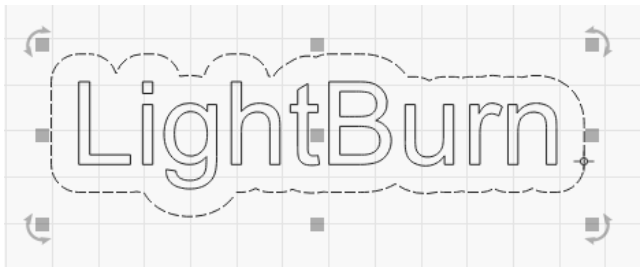
Make the Offset Distance value large enough that there are no internal gaps in the outline - Notice the gap above between the L and the next letter is gone in the version below:



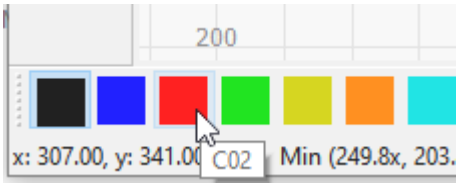
When you're happy with the result, click 'OK'.

Changing Layers

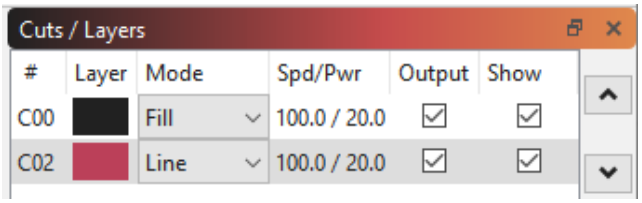
Now, use the left mouse button to click the new outline you just made, so it is the only thing selected, like this:



Then, click the Red button in the color palette at the bottom of the display:



The outline will turn red, and you should see two entries in your Cuts / Layers list, like this:

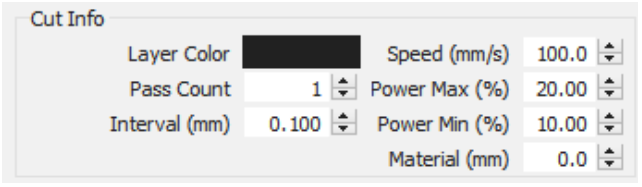


The first, the black layer, is the fill for your text, and the second red layer is for the outline cut.

Speed and Power

This is where things get a little tricky in terms of you being able to follow along. Speed and power settings vary quite a bit between lasers, and LightBurn supports a lot of different types of machines. It also depends on the kind of material you're using - cutting through ⅛" basswood uses much less power than cutting through ¼" plywood or acrylic. For right now we'll assume ⅛" (3 mm) plywood and give some guesses for settings, but you'll probably have to change them.

To start with, click the black color entry in the Cuts / Layers window. Below the list of layers you'll see the Cut Info window, containing something like this:



For the text, you want enough power to engrave into the material you're using, but not too deep.

- If you have a CO_2 laser, use 200 mm/sec, 15% power (both Power Min and Power Max - more on this later) and leave everything else.
- If you have a diode laser, use 50 mm/sec (or 3000 mm/min), and 50% power.

Understand that this is a rough starting point, and you will probably need to change this later.

Now, click the red entry in the Cuts / Layers window. This is going to be what cuts through the material to cut out the shape. Cutting requires more power and much less speed.

- For a CO_2 laser, set 15 mm/sec, 75% power (again for both min and max power)
- For a diode laser, use 2 mm/sec (120 mm/min), and 100% power. Depending on the strength of the diode you have, you might need to go slower than this, or use more passes by setting the Pass Count value higher.

Again, these are guesses, but they're a starting point.

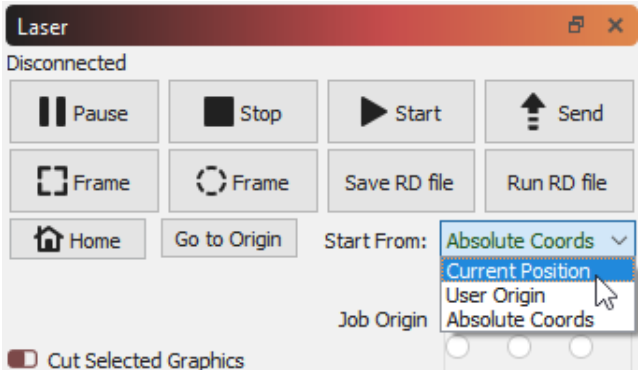
Open the Preview window again (Alt+P, or click the Preview button), then drag the progress slider from left to right to watch how the job will run. You'll see the text engrave first, followed by the outline cut. If you don't see those things, check the settings again, and verify that you have the first layer (black) set to Fill, and the second layer (red) set to Line.

Positioning the Job on the Laser

When sending this to the laser, there are a couple of different ways that it can be positioned, and the one you choose may depend on the kind of hardware you have. If you have a small diode laser that does not having homing switches, you will likely want to run the job using the 'Current Position' mode. For now, that's what we'll recommend for everyone, since it's easy.

If you have an Ortur Laser Master, or other small laser that *does* have homing switches enabled, you will likely find 'Absolute Coords' to be the simpler setting to use - this means that wherever you place your work in LightBurn is exactly where it will go on the laser.

In the Laser window, which is in the lower-right of the main window by default, look for the 'Start From' drop down box, and choose 'Current Position' or 'Absolute Coords'. If you see 'Controller Setting' in this window, it means you have a Trocen Controller, and the start position is set from the controller menus, not from software. Don't sweat it for now.



If you used 'Current Position' mode, you'll see the 9-dot "Job Origin" control under it activate, and you should see a green square on your design in the same spot indicated by Job Origin control, like this:

In the above image, the Job Origin is set to the lower-left, and that's where the green origin square is on the design. That green square represents the position of the laser before

you start the job, so the design is going to end up above and to the right of wherever the laser is when we press Start.

Put a piece of material in the bed of the laser, and use the arrow keys on the laser controller (if you have that) to move the head of the laser to the lower-left corner of the material. If your laser controller doesn't have arrows, click an empty spot in the edit window, then use the arrows on the Number Pad of your keyboard to jog the laser around instead.

When you think it's lined up, press the button labeled 'Frame'. The head of the laser will move in a rectangle around where the job will go. If you need to adjust anything, do so, then Frame again.

If you only have the option for 'Controller Setting' in the above window, when you position the laser in the lower corner of the material, press the button labeled 'Origin' on the controller panel to tell the controller this is where you'd like the job to start.

When everything is lined up, close the lid on the laser (or if you don't have one, put on your safety glasses), then press the Start button.

If anything goes wrong, hit the Stop button to abort the job, but if not, let it finish. When it completes, have a look at how things ended up - if the engraving of the name is too deep or too dark, you can increase the speed or reduce the power (or both). If the cut didn't go all the way through, reduce the speed or increase the power (or both). If you don't move your part, you can run the cut again (possibly with new settings) without having to use a new piece of material..

Results and Next Steps

When it's done, hopefully it looks like something like this:

That's it for this quick tutorial - It's only meant to be a starting point, but hopefully it was enough to give you a little foundation, and a taste of how things work.

Next Steps:

We recommend going through some of our "LightBurn Basics" tutorials on YouTube, and we have a great project tutorial that's a little more in depth called the "WIFI QR Code tutorial" that covers more ground, including importing.

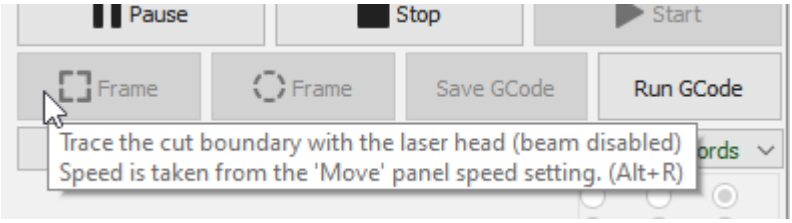
- LightBurn YouTube channel

Beginner Docs **First Steps**

4.3 LightBurn UI Tour

If you've never used LightBurn before, the main window might seem a little intimidating. Try not to let it scare you - we'll break out the important sections to start with. LightBurn also has some features to make it easier to learn:

- Tool tips: If you hover the mouse over a control, you'll see a small bit of text pop up that describes that button or feature, like this:

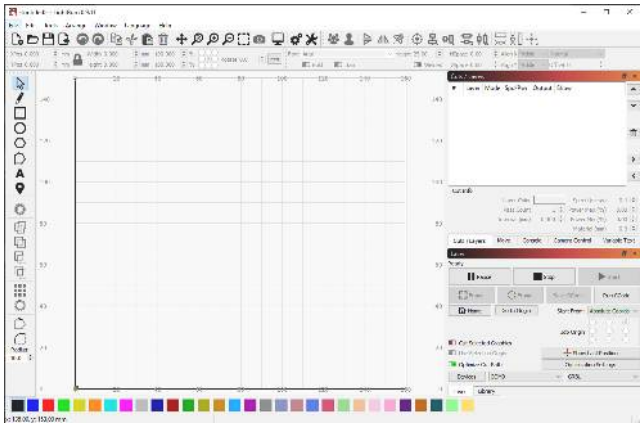


Help

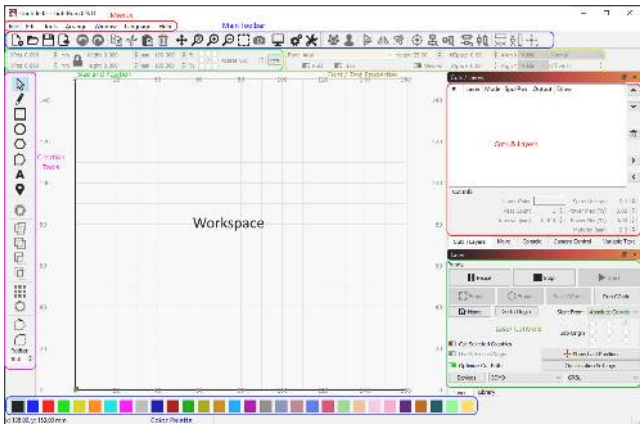
If you hover the mouse over something and press the F1 key (help), LightBurn will launch the help page for that feature in your browser. Most of the panels and buttons on the main window of LightBurn will do this.

4.3.1 The Main Window

This is the default layout for the main LightBurn window:



Here it is again, with the sections labeled:



Open Image

It's worth noting that along the very bottom of the main display is a status bar that will occasionally show information like an automatic backup in progress, position of the cursor, laser connecting, and so on.

The main sections of the user interface are all linked as chapters, so you can skip around as needed. It's a big application but you don't need to know all of it to use it well!

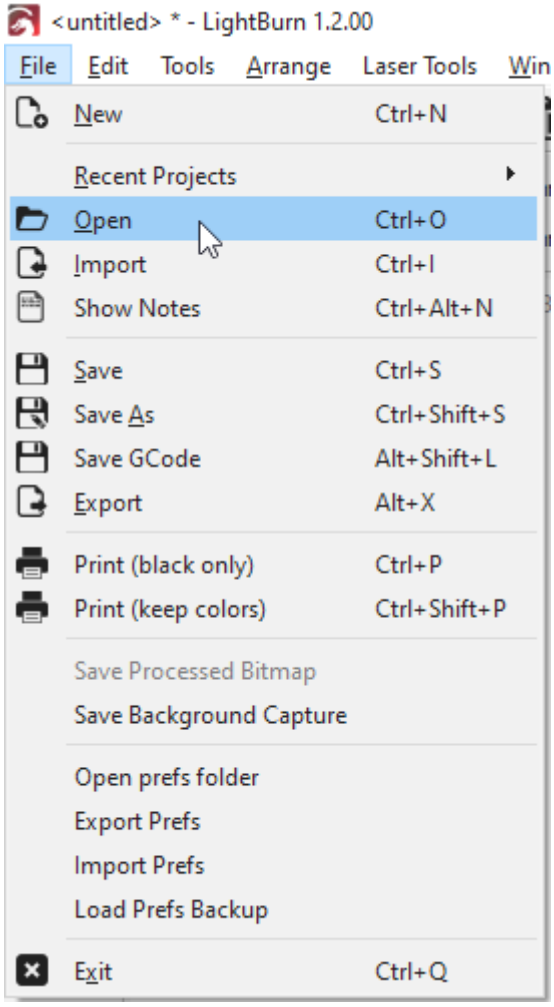
The Main Window
Menus
Main Toolbar
Creation & Modifier Tools
Color Palette
Tool Layers
Cuts & Layers
Size, Position, Numeric Edits
Font & Text
Laser Window
Workspace / Edit Window

For a full list of the windows and dockables in LightBurn, see the section on the user interface.

These are the windows you will use most commonly, though there are others. If you ever close one accidentally and want it back, go to the menu bar, click the `Window` menu, or just right-click an empty space on the toolbar, and re-enable the window you want back.

4.3.2 Menus

Almost all desktop software uses menus in some form. The menu bar at the top of the main window gives you access to almost every feature available in LightBurn.



Depending on the operating system you're using the menus might appear a little differently, and some features may be removed if your laser doesn't support them.

If a feature has a shortcut, it will be shown next to it in the menu, as shown above. Learning the shortcuts for the features you use most often will make using LightBurn much faster, and sometimes there are even 'shorter' shortcuts - you can find these in the help menu under Help > Quick Help and Notes.

See Menus for detailed information.

4.3.3 Main Toolbar

The main toolbar in LightBurn gives you quick access to commonly used functions for opening or importing files, saving, using the clipboard (copy & paste), moving or zooming the view. Right beside it is the Arrangement toolbar, containing some commonly used arrangement tools for arranging and aligning shapes.

If you aren't sure what a button is for, hover the mouse over it and it will tell you:

See Main Toolbar and Arrangement Toolbar for detailed information.

4.3.4 Creation & Modifier Tools

The shape creation tools are normally arranged vertically, but we're showing them sideways here. By default, these are docked along the left side of the work space for quick access.

The first tool, 'Select' is probably the one you'll use most, and is the default tool chosen when LightBurn starts. The others are used to create basic shapes like circles and rectangles, text, and lines, and there are few for modifying shapes in more complicated ways, like merging shapes, or creating lots of copies of shapes.

See Creation Tool and Modifier Tool for detailed information.

4.3.5 Color Palette

The color palette lives along the bottom of the main window by default, though a common alternative is docking it next to the creation tools along the left.

Lasers don't print in color, so these colors are used to assign different kinds of operations to the shapes in your design. A common convention is to use bright red for cuts, though how you use the colors is up to you.

With nothing selected in the workspace, click a color entry and subsequent new shapes will be created in that color. If you have something selected, clicking a color entry will apply that color to the shapes in your selection. The colors currently in use in your design will also appear as entries in the **Cuts / Layers** window, where you can choose the operations that each color will represent.

See Layer Colors for detailed information.

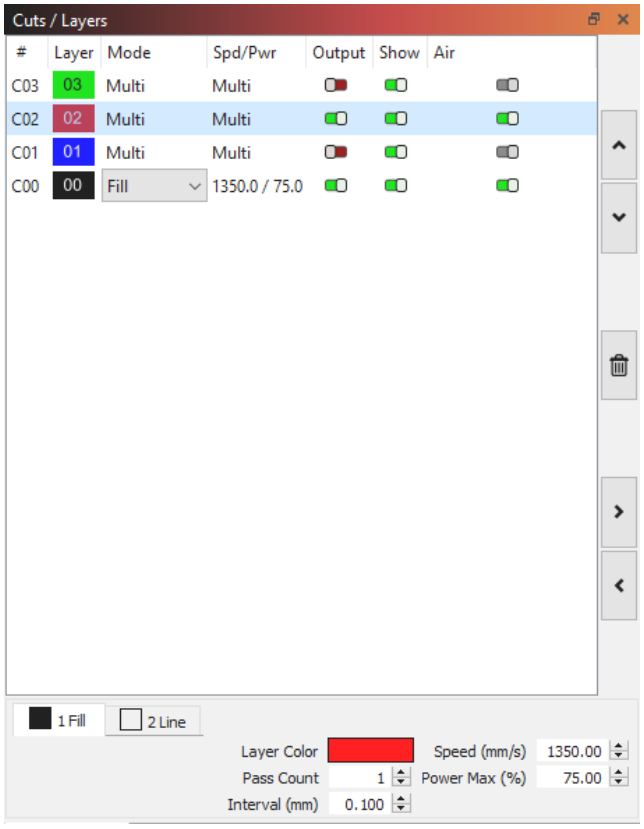
Tool Layers

There are two special layers at the end of the cut palette, labeled **T1** and **T2**. These are **Tool Layers** and are used for creating non-output shapes in your designs. These layers have no cut parameters and will never be output to the laser. For example you could use them for:

- Indicating pre-determined material size and position on your machine
- Guide-lines for aligning shapes
- Apply Path to Text (without the path being output)
- Image Masking

4.3.6 Cuts / Layers

The **Cuts / Layers** window shows the colors currently in use in your design, and lets you quickly access the settings assigned to each color.



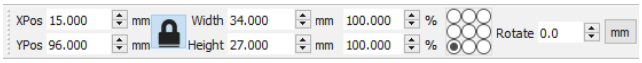
The first column shows the name you've assigned to this layer, followed by the color, then the Mode (Line, Fill, both, or Image). Then the speed and power are displayed, followed by the options to enable or disable sending this layer to the laser, or displaying it in the workspace.

Underneath the layer list you can see and change the basic settings for the currently selected layer. **Double-clicking** an entry in the layer list, it will bring up a larger **Cut Settings Editor** with a more complete set of options.

See Cuts / Layers Window for detailed information.

4.3.7 Size and Position / Numeric Edits

The **Numeric Edits** toolbar lets you resize, position, and rotate shapes, and change the unit of measure.

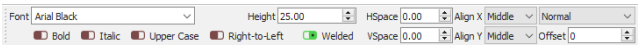


The **Lock** button can be used to maintain the aspect ratio of your objects when changing the size, and the 9-dot control lets you choose the positioning and sizing origin point. The number entry boxes accept equations and units as well--e.g. entering 5 mm, 5in, 5", or 5 * 3 mm will be processed into the correct result.

See Numeric Edits Toolbar for detailed information.

4.3.8 Fonts and Text Controls

The font and text toolbar will activate when the **Create Text** tool is used or when text objects are selected.

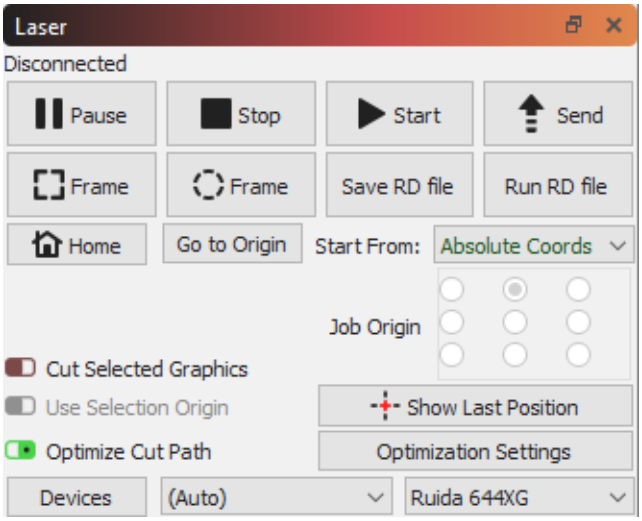


This toolbar lets you change the font, size, spacing, alignment, and automatic character welding settings. The **Fonts and Text** toolbar also includes settings for variable text, e.g. serial numbers, dates, and data tables read from CSV files.

See Fonts and Text for detailed information.

4.3.9 Laser Window

The **Laser** Window is used to select the active machine, test the framing (the artwork's outer bounds), run and stop the machine, and choose the file processing, order, and artwork positioning within the workspace.



Note that this window may look different for you depending on the type of laser chosen and the options it supports, and some options will be hidden if you are in 'Beginner Mode'.

See Laser Window for detailed information.

4.3.10 Workspace / Edit Window

The **workspace**, or edit window, is the drawing area where your design is laid out. The size of the border and grid within the workspace represents the available work area on your machine. The artwork arranged and displayed within the workspace will be processed and sent to your machine for production.

Next Step: Zooming, Panning, and Selection

4.4 Feature Comparison

Feature	LightBurn	RDWorks	LaserCAD	AutoLaser	LaserWeb
Windows 7, 8, 10	*	*	*	*	*
Mac OSX	*				*
Linux	*				*
64-bit native application	*				
Drag & Drop	*				
Copy & Paste with system clipboard	*				
Undo / Redo	Unlimited	20 steps	Unlimited	30 steps	no
User support forum	*				
CorelDraw macro	*	*	*	*	
Rectangular array tool	*	*	*	*	
Circular array tool	*				
Illustrator import (AI)	*	*	*	*	
PDF import	*			*	
SVG Import	*			*	*
DXF import	*	*	*	*	*
Support for DXF instances	*				
Specify cut start point & direction	*	*	*	*	
Mixed manual / automatic cut order	*				
Automatic Inside / outside cut order	*	*	*	*	
Ruida controller support	*	*			
Trocen controller support	*		*		
TopWisdom controller support	*			*	
GCode controller support	*				*
Integrated webcam support for job placement	*				
Print & Cut registration mark support	*	* (requires RDV controller)			
Image operations					
Image dither modes	7	2	0	2	0
Halftone image generation	*	*		*	
Transparent bitmap support	*				
Brightness / Contrast image controls	*	*	*	*	
Image edge enhancement	*				

Feature	LightBurn	RDWorks	LaserCAD	AutoLaser	LaserWeb
Vectorize image (trace)	*	*		*	
Crop / Mask images	*				
Vector Operations					
Create and edit vector graphics in-app	*	*	*	*	
Vector shape node-level editing	*	*	*	*	
Automatic text welding	*				
Boolean operations (union, subtract, weld)	*				
Shape offsetting	*	* (poor)	* (poor)	* (poor)	
Welded offsets	*				
Multiple offset corner types (round / sharp / beveled)	*				
Use objects as guides	*				
Create rectangles with rounded corners	*				
Fillet shape corners	*				
Multiple object selection modes (crossing, enclosing)	*				
Fully simulated preview	*	*			
Text / Font Operations					
TrueType font support	*	*	*	*	
SHX font support	*	*	*	*	
Apply text to curved path	*				
Bend text	*				
Engraving operations					
Ramp generation (for stamp making)	*	*	*	*	
Material Settings Library	*	*			
Rotary engraving support	*	*	*	*	*
Tool path preview	*	*	*	*	*
Move laser to graphic position	*				
Move graphic to laser position	*				
Jog laser by clicking in page	*				
Jog laser with numeric keypad	*				*

5. Primary Docs

5.1 Tips and Tricks

LightBurn has a decent number of user interface tricks that aren't always obvious, so we're listing many of them here. We also have a LightBurn HotKey reference guide here.

5.1.1 Tool Tips

Nearly everything in LightBurn has pop-up text that will tell you what the control is for and sometimes gives additional help, like this:

5.1.2 Topic-Aware Help

If you point the mouse cursor at a button or window and press F1 (help), LightBurn will launch your browser and open the documentation on the relevant help page for that control. This works for nearly all controls on the main window.

5.1.3 Reset the Window Layout

Sometimes a window gets moved off the screen or positioned in a way that makes it hard to find or move. You can reset the window layout in LightBurn in two different ways:

- In the Window menu, choose "Reset to default layout". This will undock all windows, and re-dock them in the default order.
- If that doesn't do it, restart LightBurn while holding ⇧ Shift - this skips restoring the saved window layout, and always works.

5.1.4 Reset to Default Settings

To completely reset LightBurn's settings:

1. Open LightBurn
2. Go to **File → Open Prefs Folder**
3. Close LightBurn
4. Delete the contents of the prefs folder, which should contain a pair of files called `prefs.ini` and `prefs.old`
5. Re-open LightBurn. All settings should be reset to default, and all devices will be removed.

5.1.5 Edit Window Shortcuts

The edit window has a number of single-key shortcuts that are only active when you have clicked in the edit window. They are:

- H — flip selection horizontally
- V — flip selection vertically
- L, R, T, B — Align the selected objects by Left, Right, Top, or Bottom edges
- C — Align the selected objects along their vertical centerlines
- E — Align the selected objects along their horizontal centerlines
- P — Move the selection to the center of the page
- Arrow keys — Move the selection (⇧ Shift and ^ Ctrl adjust the size of the move)
- , (comma) and . (decimal), usually under < and 1, are rotated 90° counterclockwise and clockwise
- Holding Shift while pressing , (comma) and . (period/decimal) will rotate 45°
- Tab ⇥ — Select the next shape in the shape list
- Number pad arrows — Jog the laser

5.1.6 Framing Mode Nudging

While framing, the arrow keys can be used to nudge the position of your graphics by 1 mm. Holding ⇧ Shift will increase the movement distance to 5 mm, and holding ^ Ctrl will decrease it to 0.2 mm.

5.1.7 Equation Support in Number Boxes

The position, width, and height boxes in LightBurn will accept not just numbers, but also measurements and equations. All of these are valid:

- 50 mm, 5 cm
- 10 in, 10"
- 2 ft, 2'
- 10.25 / 2
- (10+2) * 4 + 1 in

You can also use the constants e and pi, and functions like sin, cos, tan, sqrt, abs, atan, log, pow, and more.

5.1.8 Copy & Paste from Other Applications

LightBurn can paste data in known formats from other applications.

- An image copied from a browser can be pasted into LightBurn
- Text copied from anywhere can be pasted into LightBurn
- Shapes copied from Inkscape can be pasted into LightBurn

5.1.9 Drag & Drop from the File Browser

Files in any format supported by LightBurn can be dragged into LightBurn from your file browser (Windows file explorer, or Finder on macOS).

5.1.10 Automatic File Backups

LightBurn by default will save backups of whatever file you are working on. If you have previously saved the file as a LightBurn project, the backup will be stored in the same folder, with the same name, but with "_backup" appended to it.

If you haven't saved the file with a name yet, LightBurn will store the backups for it in you Documents folder with the name "AutoSave_xxxx" where the x's are a random string of characters. If LightBurn crashes, you can usually open the most recent of these files to recover your work.

5.1.11 Auto-Start a Job on Send

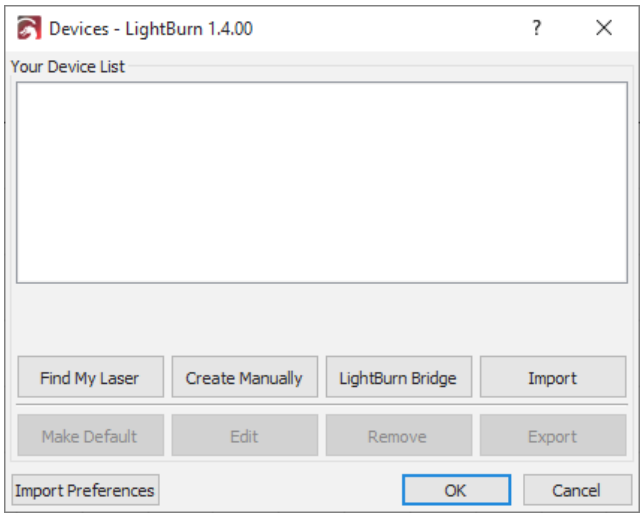
Hold the ⇧ Shift key when you click the **Send** button in LightBurn, and LightBurn will automatically run the file on the laser when the transfer is completed. This is useful if you are sending very complex or large files, and want to be certain that the transfer completes before the job starts running, but saves you from having to press **Start** on the controller.

5.1.12 Pause and Stop from the Keyboard

While your laser is running, you can use your keyboard's Pause key to pause the laser and ^ Ctrl + Break to stop it. Break is typically on the same key as Pause, but more compact keyboards may not have this key.

5.1.13 Setting up a New Computer

Setting up a new computer can be a pain—especially if you've put a lot of time and effort into adding machines and configuring your LightBurn installation exactly how you like it. To avoid repeating all that work, you can export your preferences on your old computer using **File → Export Prefs**, and then import them on your new computer using **File → Import Prefs**. Starting in version 1.3, there is also an **Import Prefs** button in the **Devices** window if no lasers have been added—this lets you import preference files when you first open a fresh installation of LightBurn.

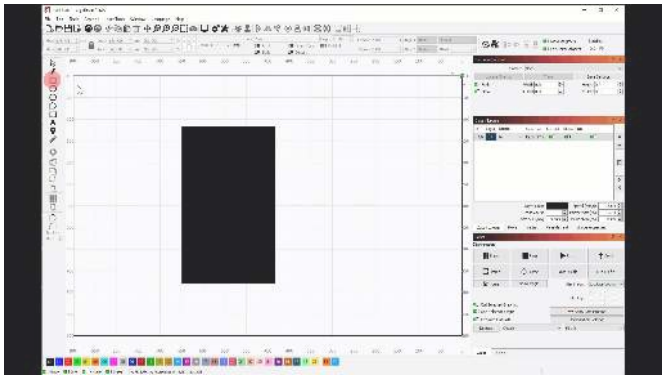


5.1.14 Alignment Guides

LightBurn 1.5 and higher

Click here for a video overview

While dragging to draw, move, or scale objects, holding ⎇ Alt will produce alignment guides for edges and midpoints of existing objects.



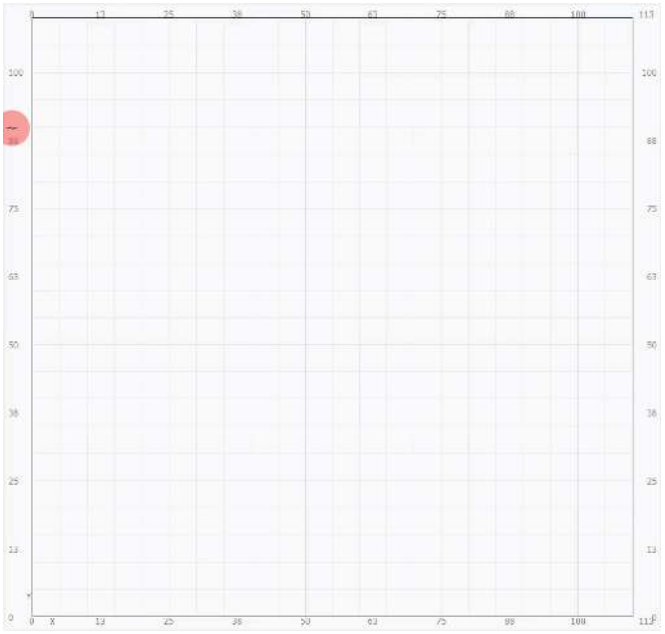
Using Alignment Guides by holding down ⎇ Alt while drawing

5.1.15 Draggable Guidelines

LightBurn 1.5 and higher

Click here for a video overview

Horizontal and vertical guidelines can now be created by dragging from the ruler area of the LightBurn workspace. Guidelines can be treated like any other line. Guidelines can be locked to avoid accidentally moving them.



You can also make guidelines of any shape by drawing objects and adding them to one of the Tool Layers

5.2 Installation & Licensing

Beginner Docs

5.2.1 Downloading & Installing LightBurn

Downloading LightBurn

The first step is to go to lightburnsoftware.com

At the top, click "Download and Trial" (or click here)

You'll see links for the current release of LightBurn. Download the version that matches your computer.

- Windows 64-bit - nearly all modern computers are 64-bit
- Windows 32-bit - some older systems might need this
- Mac OSX
- Linux 64-bit

When you've completed the download, you should see the file in your "Downloads" folder or the manually selected folder. On Windows and Mac you can just double-click the downloaded file.

MINIMUM COMPUTER SYSTEM REQUIREMENTS

LightBurn will run on Windows 7.0 or later (32 or 64-bit), macOS 10.11 or later, and certain 64-bit Linux versions. Linux users should see Linux Installation for more details.

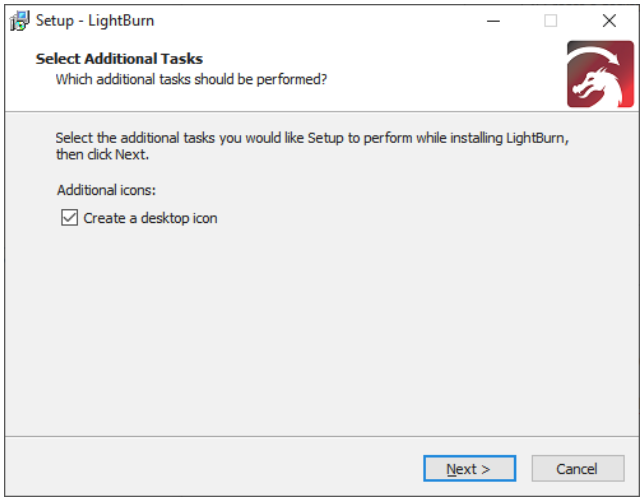
LightBurn does not require a powerful computer for most work, though if your designs contain a lot of images, more memory is helpful. As with most things, a faster computer will make it easier to work with large images or complex vector graphics.

Choose your operating system:

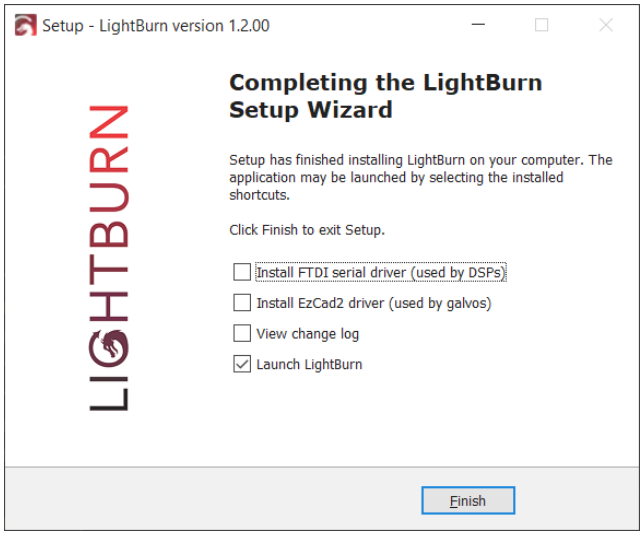
- Windows
- macOS
- Linux

Windows Installation

Launch the installer by double-clicking it. Windows may ask if you trust us first.



Click Next, then click 'Install'. The installation will proceed. When it completes, you'll see this:



If you have never installed LightBurn before, you might need to check the 'Install FTDI driver' button - this is mostly used by DSP controllers, like Ruida and TopWisdom, and it only needs to be done once. If you update the software later, you do not need to repeat this step.

That's it! Locate the LightBurn icon to launch the program

MacOS Installation

Installing LightBurn on Mac is accomplished the same way as most macOS software. After downloading the DMG file, open the file (typically by double-clicking) and drag LightBurn into your Applications folder. As long as you have version 1.2.00 or later, LightBurn should be ready to use. If

you're using an older version, please see the information below for an additional step you'll need to take.

Versions before 1.2.00 were not notarized to be recognized by your computer as coming from a trusted developer. If you installed an older version, you'll need to follow the steps below to allow your computer to run the software:

macOS Notarization Bypass Guide (fixing the 'unable to check it for malicious software' warning)

To Install the LightBurn application:

1. Double-click the LightBurn.dmg file to mount the disk image
2. Drag the LightBurn application into your applications folder
3. Eject the LightBurn disk image, or drag it to the trash bin

When launching LightBurn for the first time:

1. Open a Finder window
2. Browse to the 'Applications' folder
3. Hold the Control key and click the LightBurn icon, or right-click or two-finger tap the icon
4. Choose 'Open' from the menu
5. When macOS asks if it should open the program, say yes, and it will be listed as an exception in your launcher. From then on you can just launch the application normally.

VIDEO WALKTHROUGH

Linux Installation

LINUX COMPATIBILITY

LightBurn is tested on Ubuntu Linux, and current releases are officially supported on Ubuntu 20.04 and 22.04.

Ubuntu

- Ubuntu 18.04 users unable to upgrade to a more recent version should download LightBurn 1.2.01, the last release compatible with their operating system.
- Ubuntu 20.04 users can use any of the installation methods described below.
- Ubuntu 22.04 users will need to use LightBurn's new AppImage installer.

USING APPIMAGE

LightBurn is now available as an AppImage for easier setup and increased compatibility. To use the LightBurn AppImage:

1. Download the AppImage file
2. Add the user to the dialout and tty groups
3. Make sure libfuse is installed
4. Make the file executable
5. Double-click the AppImage file to run it.

Add User to Dialout and TTY

Info

In the command below, `$USER` doesn't need to be replaced with your username. It's a standard system variable, and if entered exactly as shown below will automaticlaly refer to the logged-in user's username.

Open a terminal and run the following command. When complete, be sure to log out and log back in to refresh permissions:

```
sudo adduser $USER dialout && sudo adduser $USER tty
```

Install libfuse

Ubuntu 22.04 does not have the FUSE library, which prevents AppImage from working as expected. To install the library, use the following command in the terminal:

```
sudo apt install libfuse2
```

Graphical method to make the AppImage file executable:

1. Right-click on the `.appimage` file
2. Select **Properties**
3. Go to the **Permissions Tab**
4. Check the **Allow executing file as program** box

Command line method:

Replace `<AppImage File>` with the actual `.appimage` file and run the following:

```
chmod u+x <AppImage File>
```

AppImage Troubleshooting

- Make sure you've logged out and back in after adding the current user to the dialout and tty groups.
- If you're having trouble with the AppImage, you may find this guide from itsfoss.com useful: itsfoss.com/cant-run-appimage-ubuntu/.
- Our support team is also available to help. When reaching out to support, please include in your message that you're using AppImage on Linux, and which Linux version you're using.

USING `.RUN` OR `.7Z` INSTALLER

In step 1 below, `$USER` doesn't need to be replaced with your username. It's a standard system variable, and if entered exactly as shown below will automatically refer to the logged-in user's username.

1. Open a terminal and run the following command:
2. `sudo adduser $USER dialout && sudo adduser $USER tty`
3. **IMPORTANT!** Log out and log back in (this refreshes the permissions we just added)
4. Download the Linux 64-bit version, either the `.run` file or the `.7z` file and follow the appropriate steps below:

`.run` installer

1. Open your terminal and `cd` to the directory you downloaded the file to.
2. Run `bash ./LightBurn-Linux64-v*.run`
3. It will now automatically install and create a program listing in your desktop environment.

`.7z` installer

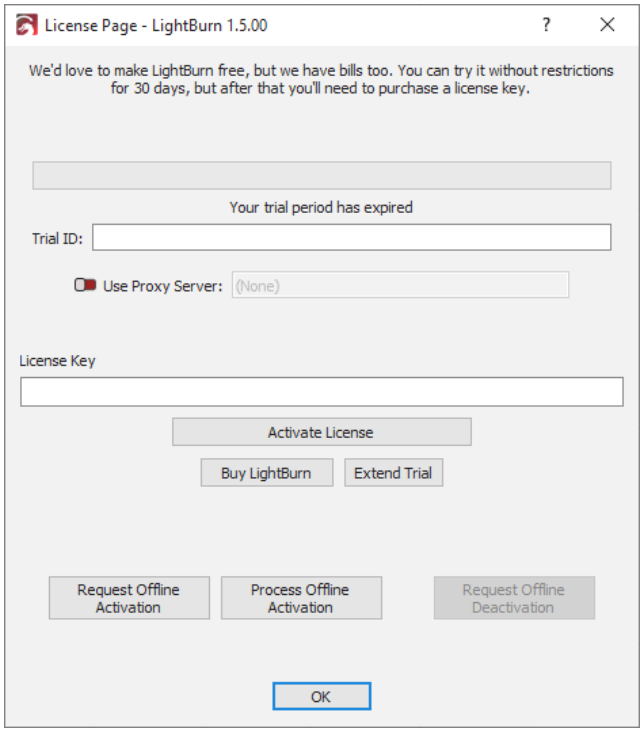
1. Extract the folder wherever you want LightBurn to exist
2. Right click `AppRun` → Properties → Permissions → 'Allow executing file as program'
3. Double click `AppRun` inside your LightBurn folder

Primary Docs

5.2.2 Trial or License Activation

If you've never activated LightBurn on a particular computer before, you'll immediately see the **License and Trial** page. From this page, you can:

- Enter and activate a license key you've already purchased
- Start a free 30 day trial
- Purchase a license key from our website
- Extend your free trial
- Deactivate a license to free up an installation for a different computer



You can get back to this screen in LightBurn at any time by going to **Help → License Management**. For more information on License Management, including offline activation and deactivating a computer, please see License Management.

Trial Extensions

Starting in LightBurn 1.5, trial extensions happen automatically when you click **Extend Trial**. In earlier versions of LightBurn, the button will open an email to support to request an extension.

Activating a Trial

Click the **Activate Trial** button to activate a free 30 day trial of LightBurn.

Activating a License Key

If you already have a license key, enter it into the **License Key** box and click **Activate License**. Be sure to enter your license key *exactly* as provided, including the dashes. We recommend copying the license key directly from your original order email and pasting it into the License Key box.

If you will be using LightBurn on a computer without an internet connection, please follow the Offline Activation instructions.

Next Steps

Once you have activated your license or the trial, click **OK** to close the window.

The next thing you'll see is the **General Usage Notes** page - this is a brief help page to get you started. Click **OK** to close this window. You can get back to it any time in the Help menu under **Help → Quick Help and Notes**.

You're almost done!

Next Step: Adding your Laser to LightBurn

Primary Docs

5.2.3 License Management

The license system used by LightBurn has a web portal that you can use to view the computers on their license, and do some basic tasks like remove a computer that has failed and process an offline activation.

If you purchased your key from LightBurn directly, you will have access to this portal. If you purchased from a 3rd party vendor, we would need to assign your license key to your email address for you to use this. Contact us via email (support@lightburnsoftware.com) **with your full name and license key** to have us do this.

To access the license portal, go to http://lightburn.cryptlex.app

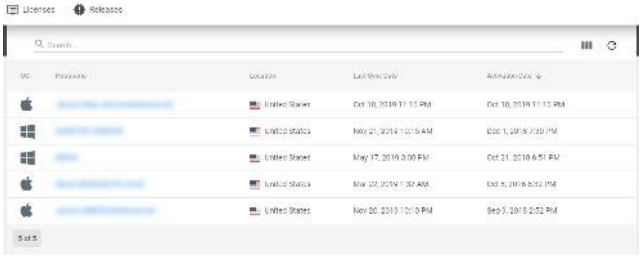
The first time you use the portal you will need to request a password reset. Click 'Forgot Password', enter the email address where you received your license key, and click 'Recover Password'. You will receive an email from Cryptlex with a password reset link. Follow the link, choose your new password, then log in.

If you do not see it, please check your Promotions or Spam folders as the password reset email sometimes ends up there. If you still cannot find it, then your email provider might be blocking the email from ever reaching you to begin with - some email providers do this. We know Gmail works well, and if you provide a Gmail account, we can put your key under that instead so that you can access the portal. In this case, contact us via email with your full name and license key.

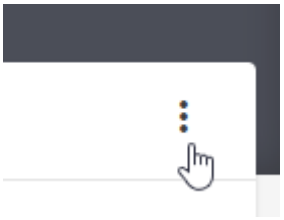
REMOVING AN OLD COMPUTER FROM YOUR KEY:

On the main screen you will see any licenses associated with your email address, like this:

Clicking on "#/# Activations" next to a license will show which computers are assigned to your license key, when they were activated and last used, etc, like this:



Clicking one of the computers will show additional details, and displays this icon in the upper-right:



Click that, and you have the option to delete an activation, removing the license from that computer, and freeing up the license seat for use on another machine.

OFFLINE ACTIVATION

If you have would like to license a computer without a network connection, enter the license key, then click “Request Offline Activation”. It will ask you to save a file that contains the machine fingerprint as an offline request. Copy that to a USB flash drive and bring it to a machine with a network connection.

To do offline activation from the portal, open the .ofr file in a text editor (Sublime Text or Notepad++ work nicely) and copy the entire string. With your license being viewed, click 'Activations', then 'Offline Activation', and paste the copied OFR content into the request box in the Cryptlex portal. This will produce the .dat response file which is what you will put back into the offline LightBurn system.

If you're not comfortable doing this yourself, you can email the .ofr file **and your license key** to us, and we will process and return the .dat response file that you use to complete the activation.

If you’re trying to run the trial, there isn’t currently a way to register the trial without an internet connection. It only needs to be connected long enough to verify that the machine hasn’t run the trial before, and doesn’t require the connection after that.

5.3 Adding A Laser

Beginner Docs **First Steps**

5.3.1 Laser Types

There are many types of laser cutters and engravers that are compatible with LightBurn, let's talk about a few of them.

Diode Lasers

These devices typically share a lot of design with 3D printers, and are equipped with a small, fairly low-power diode laser module. These devices can usually cut thin pieces of wood or plastics, but are far more often used to engrave wood or plastic surfaces with a design.

Machine Guides

- **Sculpfun S9 Limit Switch Guide**
- **Sculpfun S9 Flashing GRBL Guide**

CO_2 Lasers

These devices use a CO_2 beam to cut through thicker pieces of wood, plastics, or other organic materials. While there are "galvo" style CO_2 laser cutters, most of these are gantry style, where the beam is "moved" about the cutting area with a gantry system. Many of these lasers use a glass tube filled with gas to produce the beam, hence the name.

Machine Guides

- **3018/"CNC" Guide**
- **Ruida Ethernet Guide**
- **Trocen Ethernet Guide**

Galvo Lasers

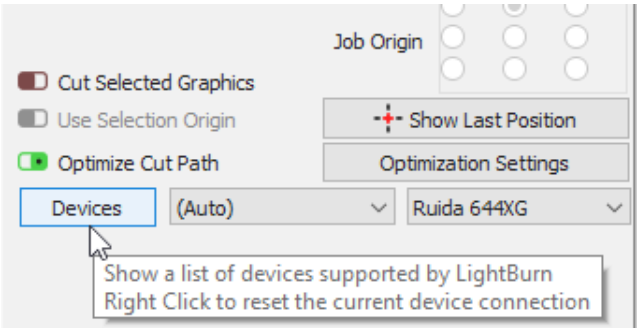
These devices have a fixed galvo head responsible for actuating mirrors to move the beam, and usually have an external box responsible for generating a beam. This beam is produced by a CO_2 or Fiber source to engrave, color, or occasionally cut pieces of metal or glass.

Machine Guides

- **JCZ/Galvo Guide**

5.3.2 Find My Laser

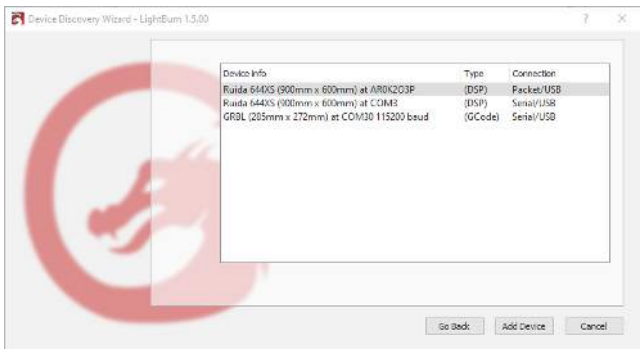
Start by clicking the **Devices** button in the **Laser** window to open the **Devices** window.



In the Devices window, click the 'Find My Laser' button, and you'll see this screen:

Make sure your laser is powered on, connected to your computer with a USB cable, and has completed any startup sequence it needs to, like homing. Click next when the laser is ready.

LightBurn will list the devices it was able to recognize after a short scan:



In this example, I have two lasers connected to my computer — a Ruida DSP controller on COM3 and a GRBL controller on COM30. Select your laser and click `Add Device`.

If your laser wasn't found automatically, or if you don't have a laser available to connect, you'll need to manually create a laser. Otherwise, continue on for additional information on setting up your GCode, DSP, or Galvo device.

GCode devices

If you have a GCode controller, you may be asked whether your machine is an X-Carve or Shapeoko because there are some specific settings that need to be configured for those machines. Click the appropriate button. If not, click `Other`. You will be asked where the origin of your machine is and if you want to home on startup. Nearly all GCode systems use the front left corner as the origin.

Enable homing on startup if your machine has homing or limit switches, otherwise leave it off. If you see `Error: 9` in the console later, it means you've enabled this feature, but your machine isn't configured for homing. Homing and origin settings are among the settings you can change in Device Settings.

Some GCode devices will require additional configuration of either LightBurn or the controller.

Next: Connecting to the Laser

DSP devices

If you have a DSP controller, you'll select the machine's origin and whether to home on startup on the next screen. This is the corner the machine moves to when homing after power up. Most DSP controllers use the rear left corner as the origin, so select that if you're not sure. If you get it wrong, your laser's movement may be flipped, but you'll be able to change this setting in Device Settings later.

Click 'OK' on the Devices window to exit after your laser has been added.

Next: Software walk-through for beginners

Galvo devices

When adding a galvo device, LightBurn will attempt to import the `markcfg7` configuration file from your EZCAD2 setup or installation drive. You will need to select the file and then enter your workspace size. See the Galvo Setup page for more information, including what to do if you don't have a configuration file, as well as our video on setting up a galvo laser.

Next: Software walk-through for beginners

What if my laser isn't found?

If LightBurn can't find your laser, it could be for a number of reasons:

- **Missing drivers**: Install your laser-specific drivers and software. Even if you don't plan to use it, they can include the necessary drivers that are not included with LightBurn.
- In the case of galvo devices, they have a LightBurn specific driver that needs to be used. See here for more information.

- **Can't connect**: Only one application can talk to your laser at a time. If you run other software, like RDWorks, Easel, Carbide Create, AutoLaser, LaserCAD, etc., make sure that software is not running when you run LightBurn.
- **Networked device**: LightBurn can't automatically configure a network-connected laser. For this, you'll have to click Create Manually and follow the outlined steps.
- **Marlin controller** - If you are using a Marlin controller, they have a variety of baud rates and configuration options. They take significantly longer to reset than most other controllers making auto-search impractical. Click Create Manually and follow the listed steps.

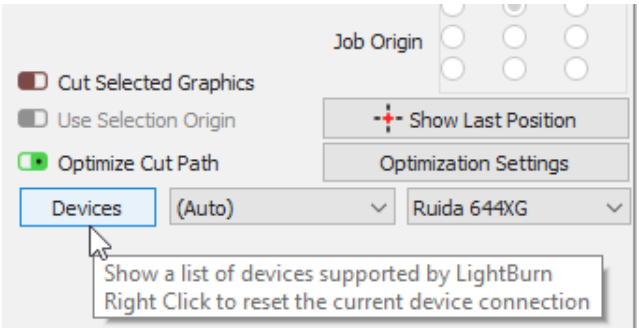
5.3.3 Manually adding a Laser

If you need to add a laser that isn't connected to your computer or is connected over a network, you can add it manually.

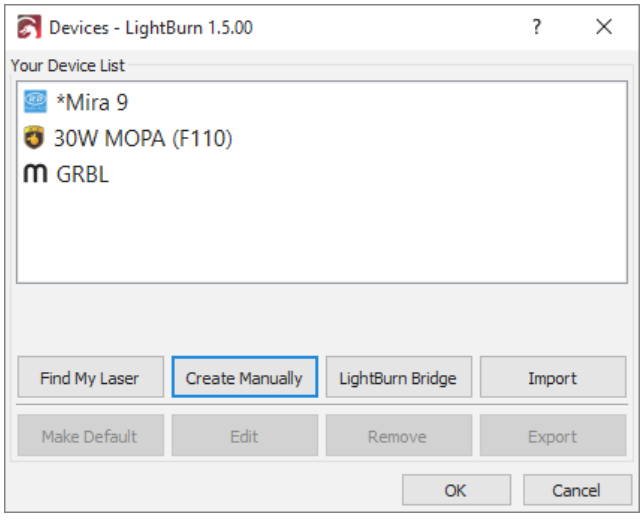
I don't have a laser yet!

If you don't have a laser, the **No Machine** device type added in LightBurn 1.5 can be used to create a simple placeholder device of any size you want.

Start by clicking the **Devices** button in the **Laser** window to open the **Devices** window.

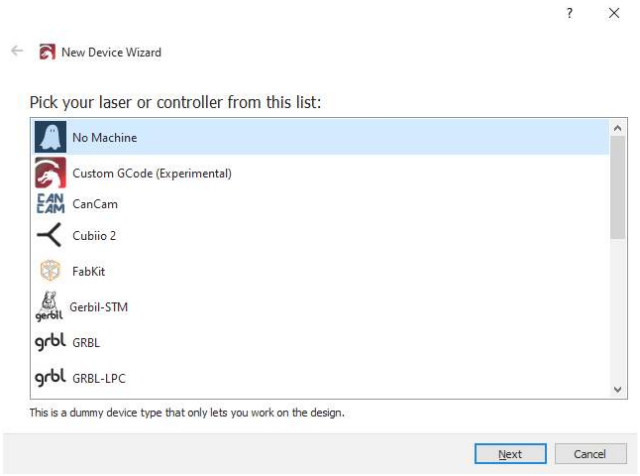


Click the **Create Manually** button on the Devices window.



Device Type

LightBurn will open the New Device Wizard, and the first thing you'll see is a list of the controllers supported by your version of LightBurn:

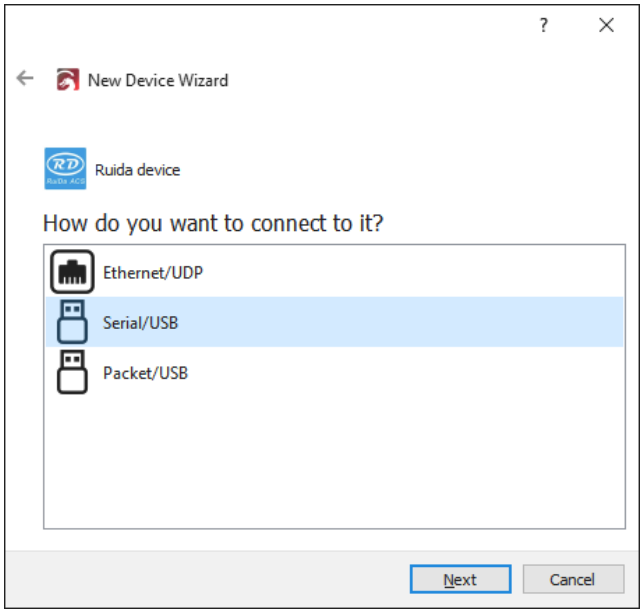


Choose the entry that matches the type of controller or firmware in your laser and click **Next**. If you don't have a device to connect yet, you can choose the **No Machine** type to move ahead with using the software.

The Custom GCode device type added in LightBurn 1.5 allows you to create custom templates for generating GCode. This won't be necessary for most users, but if you have a custom machine or purchased a machine from a vendor using non-standard GCode, go to Custom GCode to learn more.

Connection Type

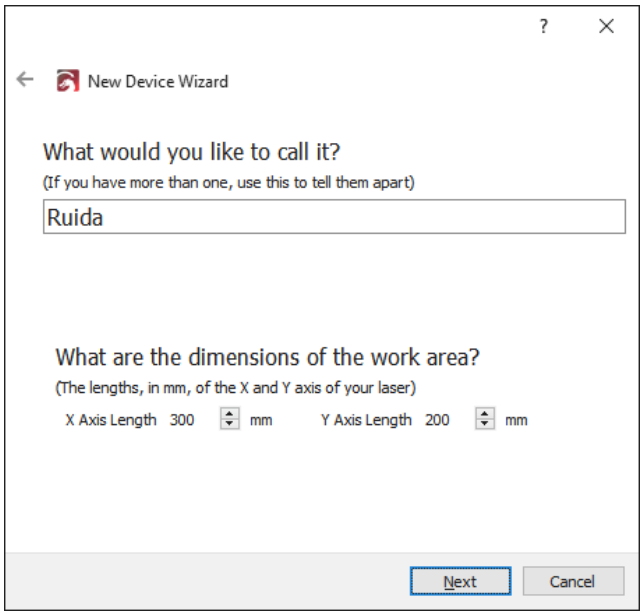
The next step is choosing how you connect to your laser. The choices you see will depend on the type of connection methods supported by your controller and LightBurn. Serial/USB is the most common. Some controllers allow connection by Ethernet (note that this includes both Wi-Fi and wired).



Choose how you wish to connect, and click **Next**.

Name And Work Area Size

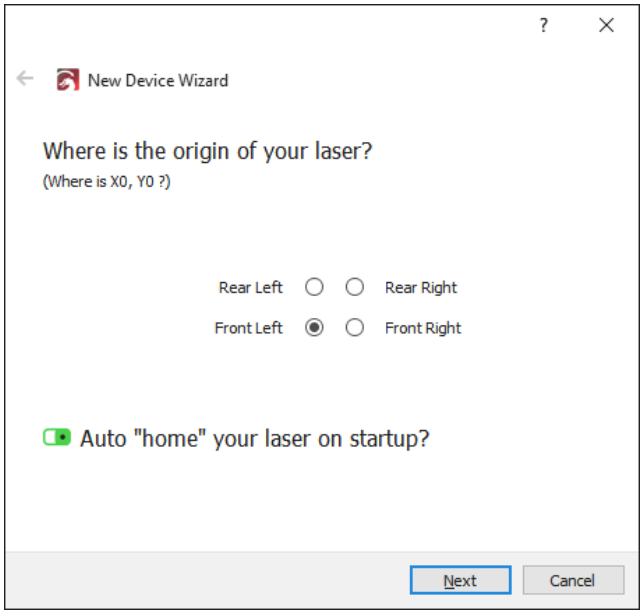
You can name the laser, which is very useful if you have more than one or just leave it as is.



You *must* set the size of the work area for your laser so that LightBurn can make try to prevent things from going out of bounds. If you don't know the exact size, you can easily change this later in the Device Settings page.

Laser Origin And Homing

The origin setting is where the 'zero' point of your X & Y axis meet. If you get this wrong, you can change it later in Device Settings. This setting also controls the orientation of the output — if it's wrong, the output from your laser may be mirrored or upside down.

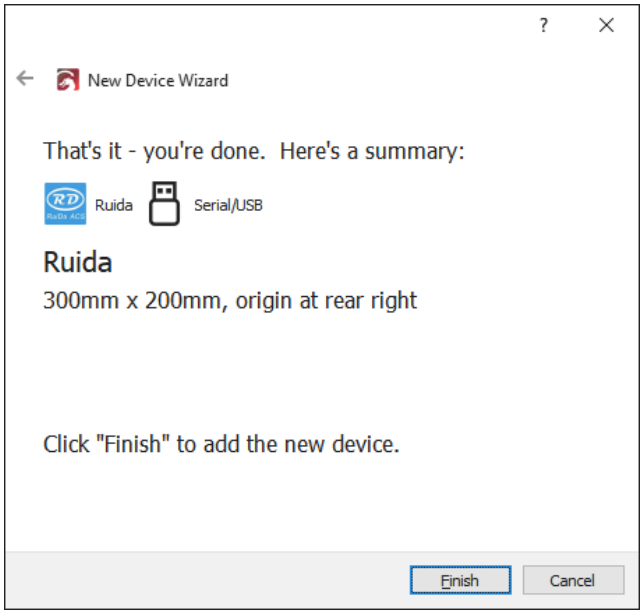


If you have a GCode based controller, like GRBL, Smoothieware, or Marlin, commonly used with diode lasers or smaller hobby systems, in almost all cases the origin will be in the front-left. With GCode based systems, you are given the option to send the homing command when LightBurn first connects. If your laser does not have homing switches, leave this off.

If you have a DSP controller, like Ruida, Trocen, or TopWisdom, common in larger CO_2 lasers with metal cabinets and LCD panels, the origin corner will be the corner that the laser head seeks out when you power it up. With DSP controllers, the controller will automatically home itself when powered up, so you will not see the option for homing on startup.

Review Settings

The final page will show you a summary of your choices. You can go back and fix anything if necessary, or click **Finish** to create the new device entry.



Next Step: Connecting to the Laser

LightBurn Bridge **Primary Docs**

5.3.4 LightBurn Bridge

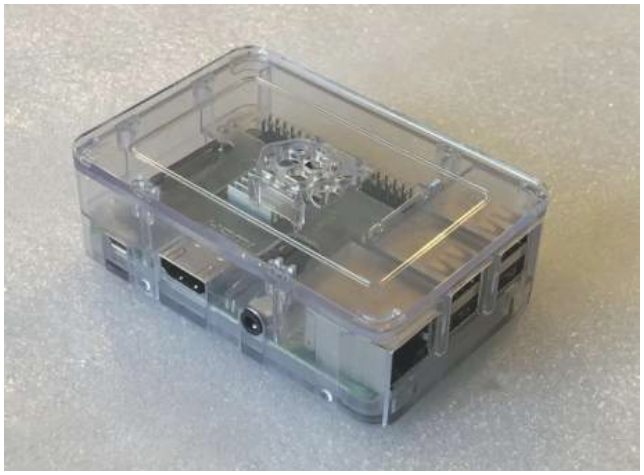
Warning

The LightBurn Bridge is **only** for use with lasers using Ruida controllers.

The LightBurn Bridge was created by LightBurn to get around some of the limitations of Ruida controllers. Ruida uses the UDP network protocol, which does not guarantee data transmission, and is therefore not reliable enough to use over WIFI. Many computers no longer have a network port, and running a network cable is often impractical or cumbersome. In addition, Apple's device driver for the USB connection to the Ruida has issues that often cause data loss.

The LightBurn Bridge overcomes all of this. It's a Raspberry Pi running software created by LightBurn to act as a relay between your PC and laser. You connect to it using TCP, so the commands are reliably sent even over WIFI. The Bridge forwards the commands to the controller using a short network cable, and relays responses back to your computer.

The LightBurn Bridge is simple to configure, requires no drivers, and typically sends data 50% to 100% faster than a USB connection. It looks like this:



If you purchased a kit with everything included, continue below. But if you want to setup your own with a Raspberry Pi you already have, follow the SD card flashing instructions first.

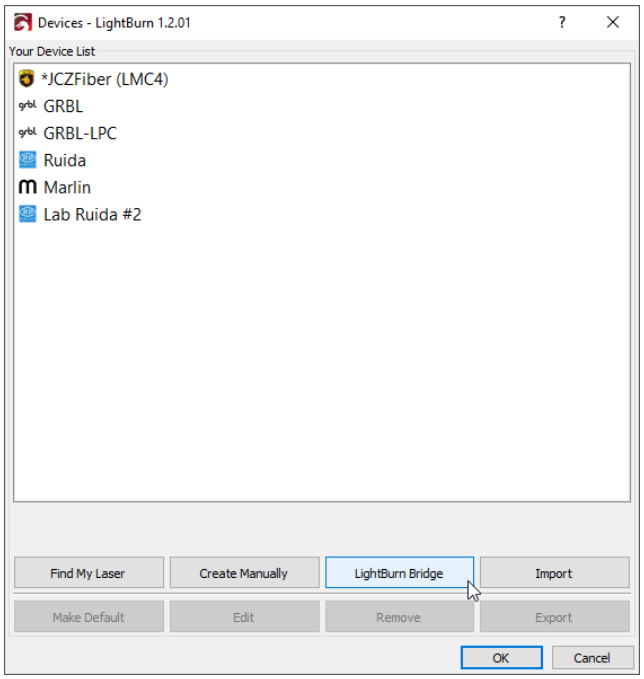
Danger

The bridge is intended to be an appliance. We have tested the software extensively, but we do not support modifications to the hardware or firmware - if you alter the system to add functionality beyond what is covered here, or in the Advanced Guide, you're on your own.

LightBurn Bridge Setup

The LightBurn Bridge is pre-configured to connect to a laser configured with an IP address of **10.0.3.3**. In the Ruida control panel, set the IP of your laser to this value, then connect a network cable from the controller to the Raspberry Pi, and plug in the Pi with its power adapter. If you need to change the IP address, please check out the Configuration Options, and please note the caveats to doing this, listed there.

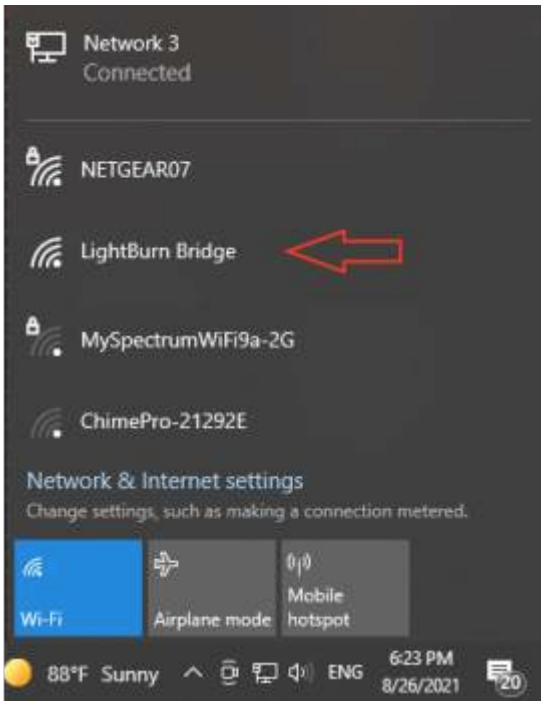
In LightBurn, in the Devices screen, click 'LightBurn Bridge' to set it up:

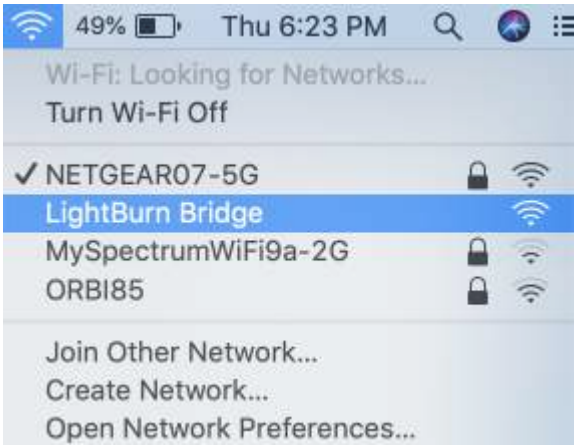


CONNECTING THE LIGHTBURN BRIDGE TO YOUR NETWORK

LightBurn will open the LightBurn Bridge discovery wizard to guide you through the setup.

On your computer or a mobile device, use the WiFi settings to find the LightBurn Bridge device, and connect to it:





Note: The access point name you find will typically have a four-character random string at the end of the name, such as `LightBurn Bridge E4B7`. This is to prevent conflicts if you have multiple LightBurn Bridge devices in the same location.

When you've selected the LightBurn Bridge access point, click Next.

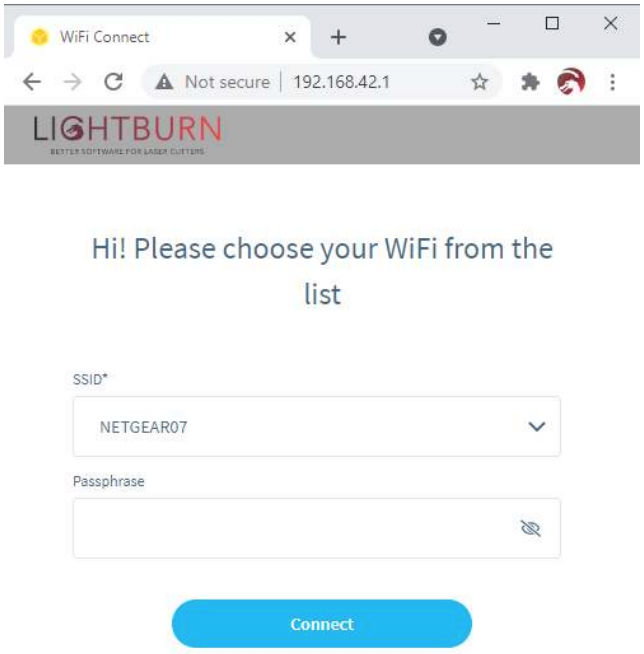
Note: You may also configure the WiFi manually, as shown on the Advanced Usage page.

CONFIGURING THE BRIDGE IN LIGHTBURN

Now you need to tell the LightBurn Bridge which WiFi network to connect to, and give it the network password. In most cases, the configuration page on the Bridge will open automatically. If it does not, browse to http://192.168.42.1 as shown in the wizard page below. If you want to use your PC to configure the Bridge, click the button shown to open your browser to the correct page:

SETTING THE WIFI NAME AND PASSWORD

In the browser window, you'll see a page like this:

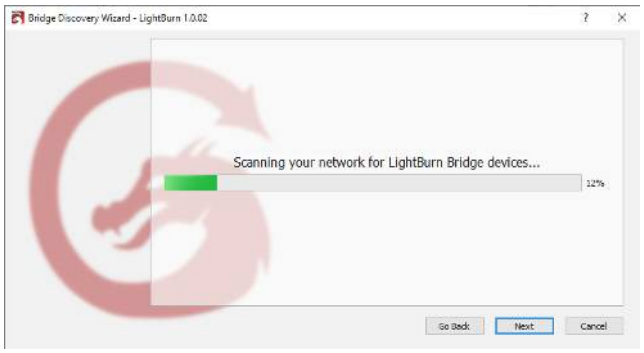


Select your WiFi network from the list of options, enter your password, then click the 'Connect' button at the bottom. You'll see a message appear near the top, telling you that the bridge is connecting to your WiFi network. You can now close the browser window and go back to the LightBurn wizard.

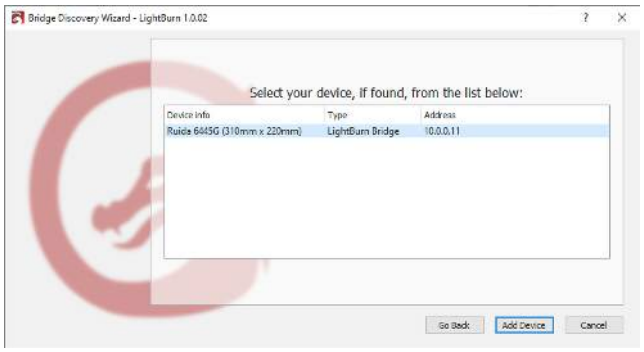
If you were using your PC to configure the LightBurn Bridge, re-connect the PC to your WiFi network if you need to.

FINDING THE LIGHTBURN BRIDGE FROM YOUR PC

LightBurn will now scan your network, looking for connected devices, to find the new LightBurn Bridge. You'll see a progress bar appear as it does this:



If LightBurn is able to connect to the Bridge device, and the Bridge was able to talk to your laser, you should see something like this:

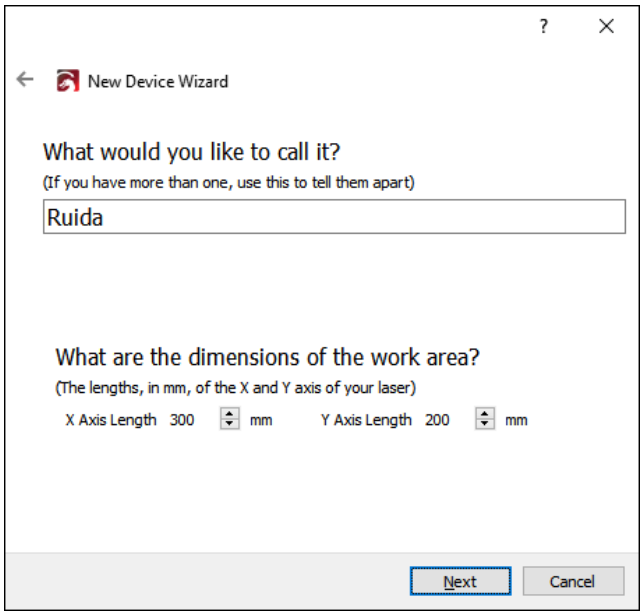


If everything looks good, click 'Add Device' and you'll be taken to the setup screen for the device, asking you to enter the name, check the size, and so on. Click here to skip to the next section.

If the either the Bridge or the laser are not found, you may need to change the IP address on your laser to 10.0.3.3 (the default for the LightBurn Bridge), or optionally, you can configure the bridge to use a different address for your laser.

NAME AND WORK AREA SIZE

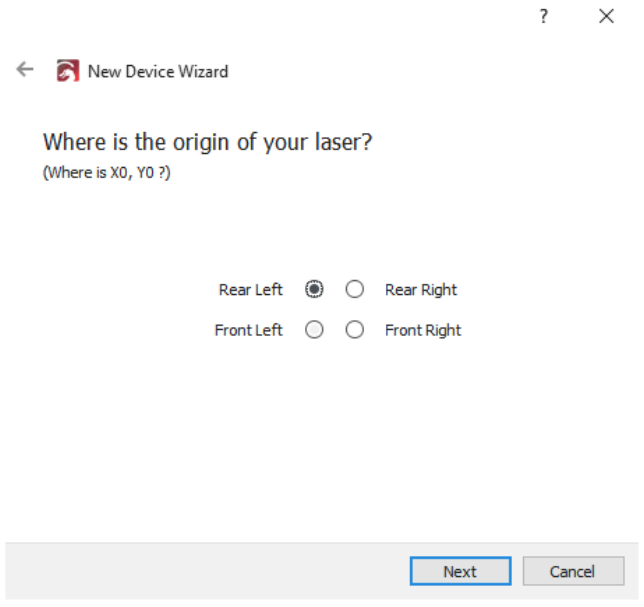
You can name the laser, which is very useful if you have more than one, or just leave it as is.



You *must* set the size of the work area for your laser so that LightBurn can try to prevent things from going out of bounds. If you don't know the exact size, you can easily change this later in the Device Settings page.

LASER ORIGIN

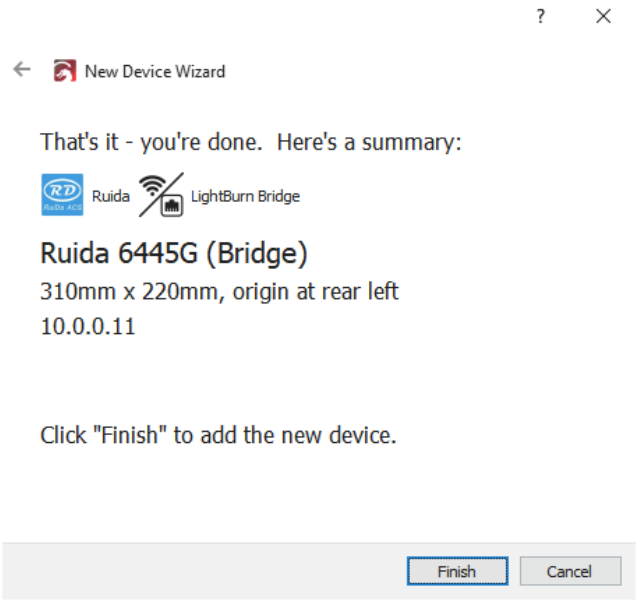
The origin setting is where the 'zero' point of your X & Y axis meet. If you get this wrong, you can change it later in the Device Settings page. This setting also controls the orientation of the output - if it's wrong, the output from your laser may be mirrored or upside down.



With a DSP controller, like Ruida, Trocen, or TopWisdom, the origin corner will be the corner that the laser head seeks out when you power it up.

ALL DONE!

That's it - The final page will show you a summary of your choices. You can go back and fix anything if necessary, or click Finish to create the new device entry.



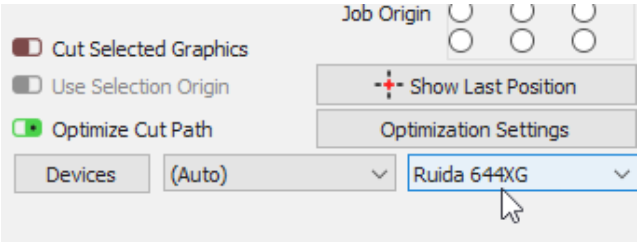
NEXT STEPS

If your use of LightBurn Bridge is more complex than indicated here, you may need to take a look at our Advanced Guide for LightBurn Bridge.

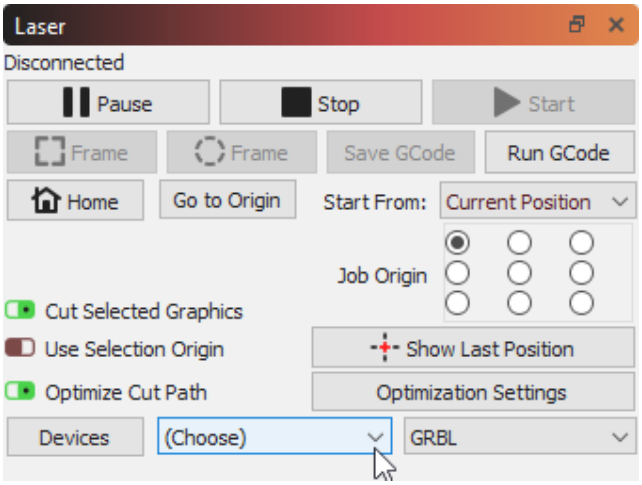
5.3.5 Connecting to the Laser

Once you have added your laser to LightBurn, it should appear in the list of devices to the right of the 'Devices' button in the Laser Window. If you only have a single laser, it will be automatically chosen for you.

If you have more than one laser set up, you might need to select the one to connect to by clicking here:



Depending on the type of controller you have, you might have to manually choose the port that the laser is connected to, by clicking where you see '(Choose)' in the Laser Window:



As long as your laser is connected to the same communication port, LightBurn will reconnect when you re-start. If you reboot your computer, or plug the controller into a different USB port, you might need to re-select it.

If you see the '(Choose)' as shown above, you need to select the port. If no ports are listed in the drop-down, it means that no devices were found, which could mean that it is not plugged in correctly, isn't powered, or you're missing a driver.

If your laser disconnects for some reason, or enters an alarm state and needs to be reset, you can quickly re-connect by right-clicking the 'Devices' button in the Laser Window.

Troubleshooting

Some Linux users have reported issues connecting to lasers that had previously worked after upgrading to Ubuntu 22.04 due to a conflict with the Braille display driver `BRLTTY`.

To check if `BRLTTY` is running, open a terminal window and run `ps -fe | grep brltty`. You can remove the process from the system using `sudo apt-get purge --auto-remove brltty`

5.4 Configuring A Laser

GRBL **Primary Docs**

5.4.1 Common GRBL/GCode Setups

Most GCode-based lasers are pre-configured to work with LightBurn, but if you have a less common machine like a Shapeoko, EleksMaker, X-Carve, or Acro system, you might need to make some simple changes to get the most from LightBurn.

Quick Reference

- You might need to adjust your spindle max RPM value (`$30`) to match the LightBurn default (1000) or vice versa. The value in LightBurn is called "S-Value Max" in Device Settings.
- You might need to enable "Laser Mode" if you have GRBL 1.1f or later (`$32=1`)
- If you have an older version of GRBL (prior to 1.1f) upgrading the firmware is highly recommended, as Laser Mode also prevents the machine from pausing with every power change. The pause, which happens on older versions, or when not using Laser Mode, will cause excessive burn spots when engraving images.
- If your machine uses negative workspace coordinates you'll need to apply a workspace offset (`G10 L2 P1 xx yy`).
- Set your machine status reporting to be relative to the workspace origin, not the machine origin (`$10=0`).
- Make sure the controller is reporting positions in mm, as expected by LightBurn (`$13=0`)
- If your machine does not have homing switches (also called limit switches) you will need to home it manually if you want to use Absolute Coords or User Origin modes

GRBL Flavors

GRBL firmware was originally designed for CNC machines and 3D printers, with laser support added more recently. It is highly configurable, and this is both a blessing and a curse. The "standard" way a CNC machine is configured is somewhat different from the way laser machines often are. Luckily this is easy to change, and easy to switch from one to the other.

More recent versions of GRBL (1.1f and up) support two laser-oriented features. The first is Laser Mode, enabled by setting $32=1 in the firmware settings. Laser mode eliminates the pauses that happen when changing power output, because GRBL knows it's controlling a laser which reacts instantly, instead of waiting for a spindle to change RPM.

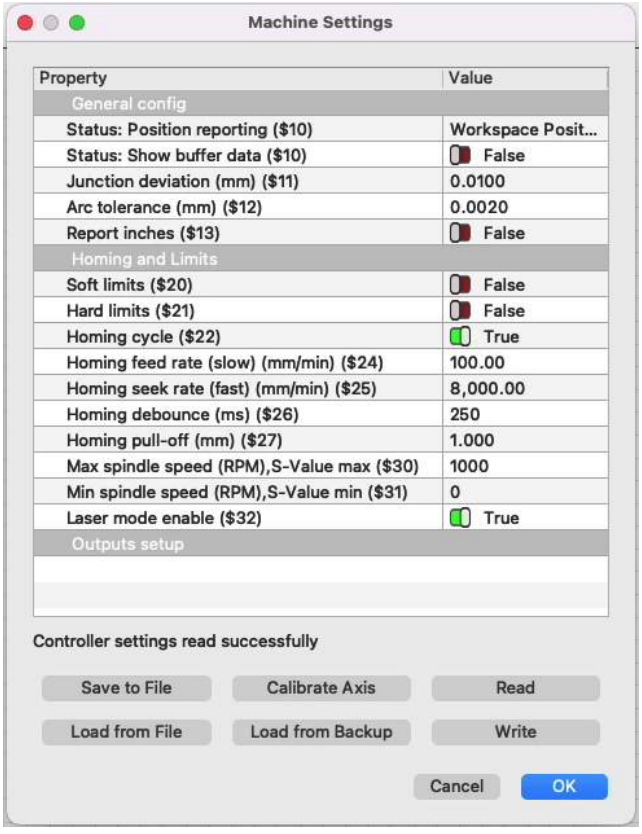
The second is a feature called variable power mode, or the M4 command. In this mode, GRBL adjusts the laser power as the machine speeds up and slows down, making for very consistent cutting and marking. Older versions of GRBL do not have this feature, and simply run the laser at a constant power output for the duration of a cut. Since the machine needs to slow down to take sharp corners, this means corners get over-burnt, while long straight lines end up lighter. This also has the benefit that when the laser comes to a complete stop, the beam turns off (zero speed equals zero power), meaning that pausing a job automatically turns off the laser. This is not always true with other versions of GRBL.

If you aren't already running GRBL 1.1f (or later) on your controller, we highly recommend it for laser use. If this isn't an option, that's ok, but your results won't be as good, and pausing the laser runs the risk of leaving the beam on and ruining the job.

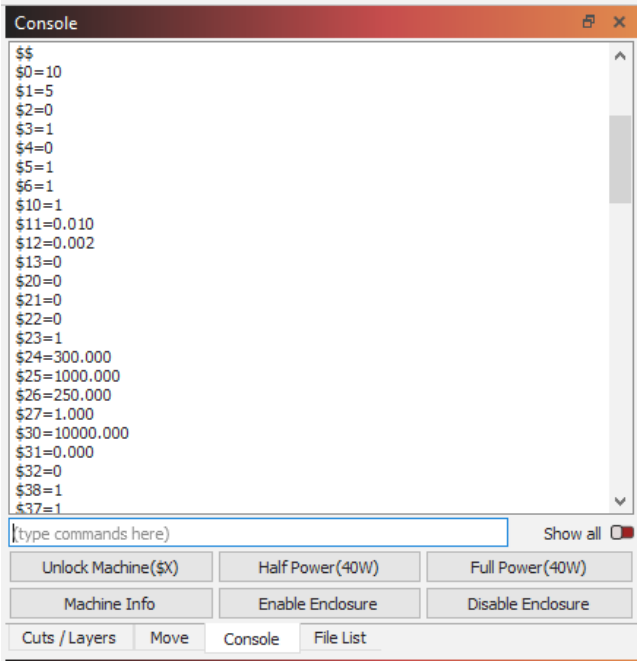
Getting Machine Settings

Many GRBL based machines allow the settings of the machine to be easily exported or viewed. For advanced configuration like adding limit switches, updating firmware, or setting up a new controller, you'll need to interact with these values. You can do this in LightBurn by using the **Console** window or the **Machine Settings** window to copy, update, or reset your machine settings.

The Machine Settings window provides you with a formatted table with the parameters labeled. You can also export these settings to a file for later restoration, like we did in our GRBL flashing guide.



In the Console, enter `$$` to have the controller return the machine's configuration. This will show the settings in plain text, requiring more familiarity with what each command means but allowing you to view the configuration directly, without any chance of mislabeling based on custom vendor configurations.



Shapeoko

Shapeoko machines typically use GRBL 1.1f, as do newer X-Carve and some other systems, but as they are designed as CNC machines, they are typically configured for negative workspace coordinates. LightBurn doesn't directly support negative workspace coordinates, but you can use a Shapeoko in LightBurn with a workspace offset. Please see the directions in Negative Coordinate Machines for directions to set a workspace offset, clear the offset to use the machine in CNC mode, and create macros to switch modes quickly.

You can set these commands up as macro buttons in the LightBurn console window. Enter the first command into a macro and call it "Use Laser", and enter the second command into a different macro and call it "Use CNC". When you want to use your laser, click the "Use Laser" macro button, and when you're done and want to switch back to CNC, click the "Use CNC" button.

After setting this, you will also need to make sure your machine is reporting coordinates relative to this workspace origin, instead of the absolute machine zero. Do this by entering $10=0 in the console.

X-Carve

X-Carve machines sold prior to January 2018 generally run an older flavor of GRBL (1.0c) which does not support the variable power (`M4`) command, meaning you'll need to use the GRBL-M3 device in LightBurn. Machines sold after that date use GRBL 1.1f, and will work with the standard GRBL device in LightBurn if the following settings commands are entered in the console:

```
$30=1000
$32=1
```

These two lines:

- Set the spindle max value ($30) to match LightBurn and GRBL's default setting (1000)
- Enable laser mode ($32=1)

Other Machines

If you aren't sure how to configure your machine, the following steps will help you figure it out.

Figure out which firmware you're running

In LightBurn, when you first connect to the machine the console will typically show a 'hello' message from the controller. For Smoothieware boards it is just "Smoothie". For GRBL, it will be "GRBL 1.1f [$ for help]" or similar - this tells you it's GRBL, and which version. Machines using GRBL 1.1f or later will support the M4 variable power command, and just use the "GRBL" driver in LightBurn. GRBL 1.1e or older (GRBL 1.0, GRBL 0.9, etc) must use the GRBL-M3 device in LightBurn.

Find the machine origin and coordinate direction

1. Home the machine by pressing the Home button ( ) in the **Move** window.
2. In the console window, type `G0 X0 Y0` and press `Enter ⏎`. This will command your machine to head toward its origin position - the location represented by (0, 0) in the machine's coordinate system. This is not always the same as the home position. The origin is usually either the front left corner or the rear right corner of the machine, but can be a different corner or the center of the work area. If your machine moved to the center, skip to Center Origin Machines for more information.
3. After the machine has stopped moving from the previous command, type `G0 X10 Y10` and press `Enter ⏎`. If your machine moves 10 mm into the work area on both axes, your machine uses positive workspace coordinates. You can set the origin in LightBurn to match the machine origin you found in step 2. If your machine bumped the rails, it uses negative coordinates. Please see Negative Coordinate Machines for more information.

Negative Coordinate Machines

LightBurn expects positive workspace coordinates. If your machine is configured to use negative workspace coordinates, you can set a workspace offset to enable compatibility with LightBurn. If you are switching between LightBurn and CNC software that expects a negative coordinate system, you can clear the workspace offset. You can also set macros to toggle between the two modes.

SET A WORKSPACE OFFSET

In the console, enter `G10 L2 P1 X-WIDTH Y-HEIGHT` and hit `Enter ⏎`. Replace `WIDTH` and `HEIGHT` with the actual X and Y

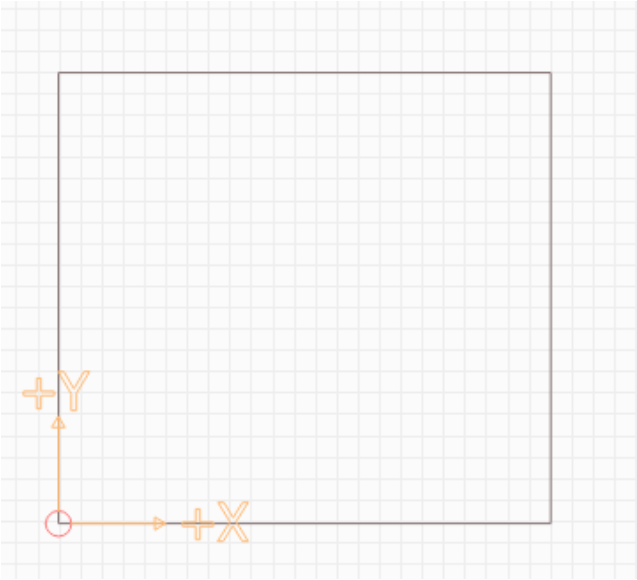
travel distances of your machine. Set your machine to use workspace coordinates with the `$10=0` command.

Example: `G10 L2 P1 X-310 Y-180` Enter ⏎

CLEAR A WORKSPACE OFFSET

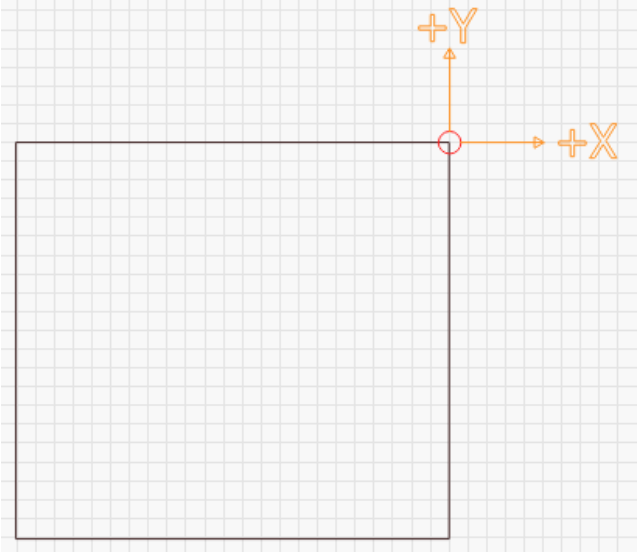
In the console, enter `G10 L2 P1 X0 Y0`. This is generally only required if switching between using your machine as a laser (with an offset) and as a CNC machine in software that expects negative coordinates.

DETAILED EXPLANATION.



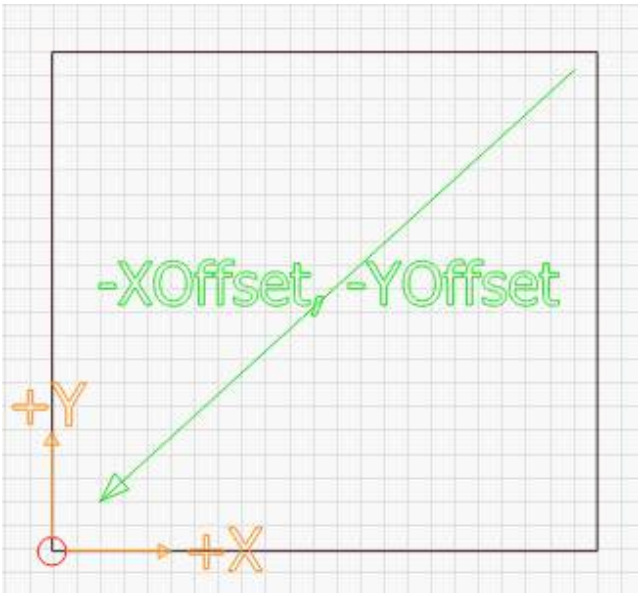
This image shows the origin at the front left, with positive X values moving to the right, and positive Y values heading to the rear of the machine.

A negative workspace system looks like this:



In this image, the origin is at the rear right of the machine. The X and Y directions are the same as before, but now you would need to use negative numbers to move into the work area.

You'll need to know the total distance your machine can travel in both axis. For a Shapeoko XXL, for example, it's 812 mm in X and Y. For a 1000 mm 2nd Generation X-Carve, it's 750 mm in X and Y - note the difference between overall size and travel distance. By applying a workspace offset that is the size of your machine area, you can shift the offset to the opposite corner, like this:



Entering `G10 L2 P1 X-812 Y-812` means set an offset (`G10 L2`) in the first coordinate system (`P1`) with a distance of -812 mm in each direction (`X-812 Y-812`).

If you enable a workspace offset, you will also need to make GRBL report its location relative to this shifted origin, instead of in "machine space", by setting $10=0. Some systems, like Easel or Carbide Motion, may need a different value, so it's a good idea to make a note of the existing setting.

SET MACROS

For a one click way to set or clear workspace coordinates, you can store these commands in the macro buttons in the console window.

1. Right click one of the buttons at the bottom of the console window
2. Enter the command you want to save in the text box that pops up
3. Set the button label to something easily recognizable, such as "Use Laser" or "Use CNC"
4. Press **OK** to save the settings

Once the macro is saved, you can use the command by pressing the appropriate button.

CENTER ORIGIN MACHINES

Some systems have their origin in the center of the workspace. To confirm that this is the case, after homing your machine enter `G0 X0 Y0` in the console and press Enter ⏎. This command says "rapid move to coordinate 0,0". If your machine travels to the center of the workspace, it's configured for a center origin.

A center origin machine requires a workspace offset similar to what's described in Negative Coordinate Machines, but the offset should be half the travel distance. For instance, a machine with a travel distance of 500 mm x 500 mm and a center origin would require `G10 L2 P1 X-250 Y-250`.

Machines without homing sensors / limit switches

If your machine does not have homing switches (also called limit switches) you will need to home it manually if you want to use Absolute Coords or User Origin modes. There are two ways to do this:

- With the machine off, manually move the laser head to the origin position (usually front-left), then power up the machine. Until you tell it otherwise, the power-on location of the controller is treated as the zero position.
- With the machine powered, jog the laser head to the origin position. In the console window, type: `G92 X0 Y0` and press `Enter ⏎`. The `G92` command tells GRBL to set the current location as the specified coordinate, so you're telling the machine "this is zero". You will also need to set `$10=0` for this to work correctly.

If you use the second option frequently, you may want to save the command as a macro.

XTOOL WI-FI UPLOAD

We do not currently (as of LightBurn 1.5) support uploading GCode to the xTool family of lasers via Wi-Fi. The upload mechanism is significantly different from the currently supported methods, and that development hasn't yet been completed. Thank you for understanding.

5.4.2 Configuring a Ruida

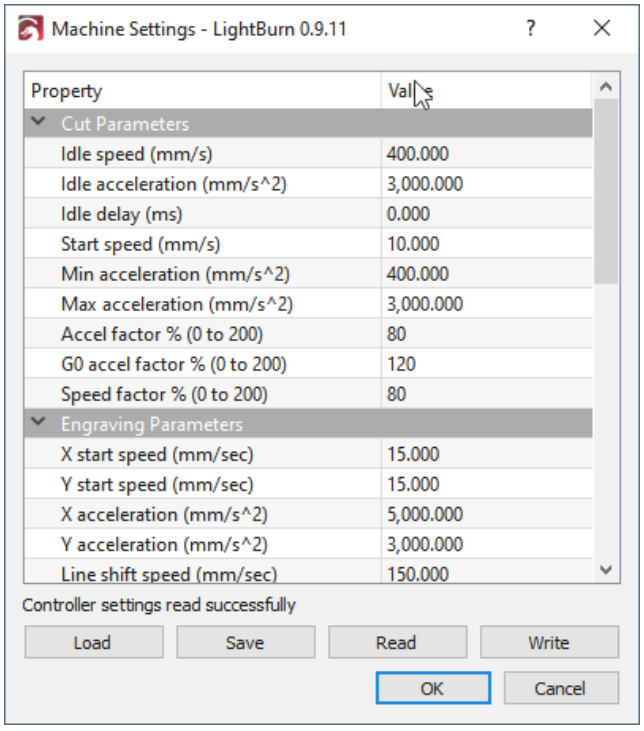
When purchasing a laser with a DSP controller installed, the factory making the machine configures the laser controller for you to tell the controller how fast and in what directions to move, where the homing switches are, and so on.

If you are installing a new controller into a machine, you will need to perform the configuration that is normally done for you by the factory.

A somewhat common mistake for new users is doing a 'factory reset' of their controller - this resets it to the stock configuration supplied by Ruida, not the configuration applied by the company that set up your laser, so it's not recommended to do this. Chances are you already have, which is why you're here.

Ruida Machine Settings in LightBurn

With the laser connected to your computer, go to the bottom of the Edit menu and click Machine Settings. LightBurn will open the Machine Settings window and read the configuration from your controller. You should see this screen:

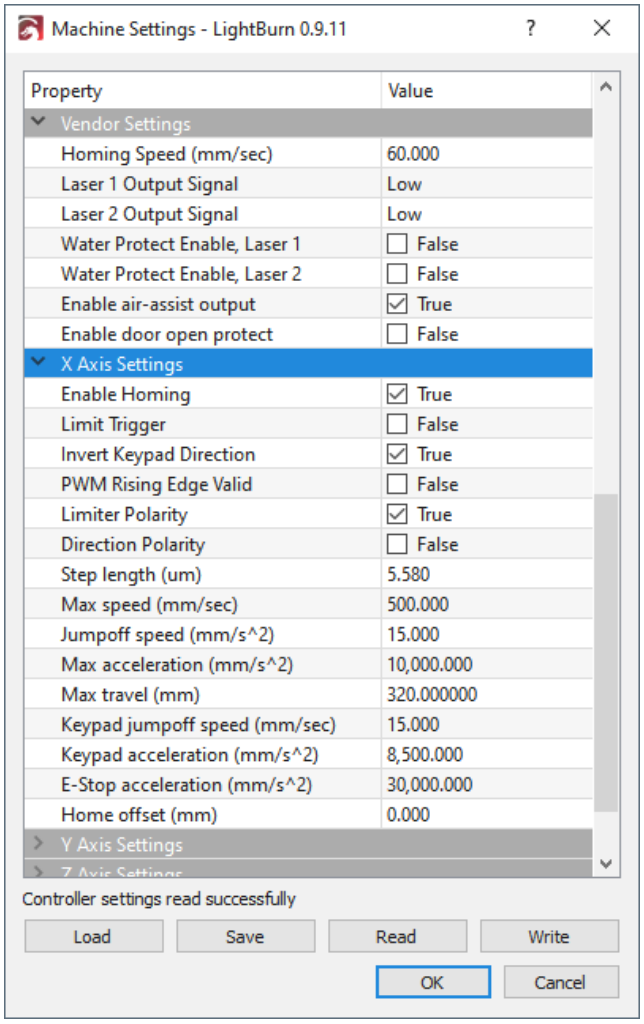


The top section of the list is referred to as user settings - these are settings that are intended to be tunable by the user if necessary. The lower section, under 'Vendor Settings' are things usually configured for you by the factory and should only be changed if you have a good reason for doing so.

It's also a good idea to back up the initial settings before you change them, so you can go back to what you had if you make a mistake and can't remember what you did.

The 'Read' button tells LightBurn to read the settings from the controller (this happens automatically when you open the Machine Settings window). The 'Save' button will write all settings to a file. 'Load' will read settings from a file back into memory. 'Write' commits the settings in LightBurn back to your controller.

In the bottom of the Machine Settings window is a heading called Vendor Settings. Click it to 'unroll it' and you'll see something like this:



The first section is general configuration, and then there are settings that are specific to each axis, followed by a Laser section, for configuration specific to the laser type.

Homing, Directions, and Travel

A DSP laser will have homing switches - one on each axis. They might be physical lever-type micro switches, optical beam-break switches, or inductive proximity sensors. Locate the switch at the end of the X axis, and the one for the Y

axis. Note that the Ruida homes using the X- and Y- limit switches.

When you power up the laser, the first thing it will do is move toward the corner it thinks those switches are at to home itself. If it's moving in in the wrong direction, you'll have to hit the ESC button on the controller itself to stop it.

Bring up Machine Settings in LightBurn, and go to the Vendor settings section at the bottom, and open the X axis and Y axis Settings. Near the top of each will be three check boxes:

- Invert Keypad Direction
- Limiter Polarity
- Direction Polarity

The first (keypad direction) controls which way the arrow buttons move the laser. The second (limiter polarity) tells the controller whether the limit switch triggers high (normally open) or low (normally closed) when contacted, and the 3rd (direction polarity) controls which way the motor moves in general.

There are only 4 possible combinations of "limiter polarity" and "direction polarity" for each axis. I can't tell you which is the correct combination, but change those settings for the X axis until it moves properly when you power the machine, then do the Y axis. Once these are set, the next steps are easier.

When the limiter and direction settings are correct, check that the keypad arrows on the machine are moving the laser in the correct direction. If not, toggle the 'Invert Keypad Direction' button for whichever axis is wrong.

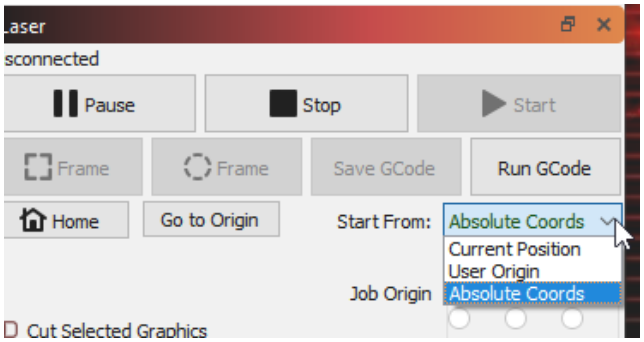
You will also need to set the 'Max Travel' value for the X and Y axis - these numbers dictate the length of each axis, and together define the size of the work area of the machine.

Step Length Calibration

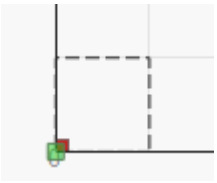
The next part is figuring out how far the laser moves when you tell it to, and how far off it is. The controller needs to know how far a single step moves when it sends a step pulse to the motors so it can translate real measurements into the proper number of steps.

Rough Calibration

In LightBurn, set the 'Start From' setting in the Laser window to Absolute Coords, like this:



Then draw a small rectangle at the origin. Start with 10 x 10 or 20 x 20 mm, like this:



Note that your origin corner might be in a different spot than mine - you should set it in the device settings to match the origin corner of the machine.

Now, use the 'Frame" button (shown above, near the 'Start From' setting) and see how big it frames. If it's barely moving, your step size is too big (the controller thinks it is moving more than it is). If it moves way too far, the step size is too small (the controller thinks it has to take lots more steps than necessary).

This part is just doing rough adjustment - it's not accurate at all, but you need to get into the right ballpark before doing the next part.

In the Machine Settings again, in the settings for the X and Y axis, are values called 'Step Length' Adjust those according to what I said above - If the controller doesn't move enough by half, cut the step length in half. If it moves twice as far as it should, double the step length. Frame again, and iterate until the size of what you've drawn and the size the laser frames is reasonably close.

Final Calibration

Now, draw a box similar to the original, but make it 100 x 100, or 200 x 200 (mm), set the Min and Max power low to start, but high enough to make a mark, and run the job it on a piece of scrap material. Measure the result as accurately as you can.

This time, actually do the real math with the step size:

- New Step Size = (Current Step Size * Measured Length) / Requested Length

If the controller complains about 'water protect', you can disable the water protect setting in the machine settings. Ditto for the door protect (it's the lid open switch). If you have a flow meter, you should have it hooked up so you know you have water running through the tube, and have the water protect enabled.

As you are dialing in the above settings, if the steppers skip or make buzzing sounds, you might need to reduce the Idle Acceleration or Idle Speed settings near the top. Those things will require tuning with some trial and error.

FIXING SKEWED ENGRAVING

An occasional problem with new setups, and sometimes even existing machines, is lines cutting correctly, but engravings coming out slanted or skewed, like this:

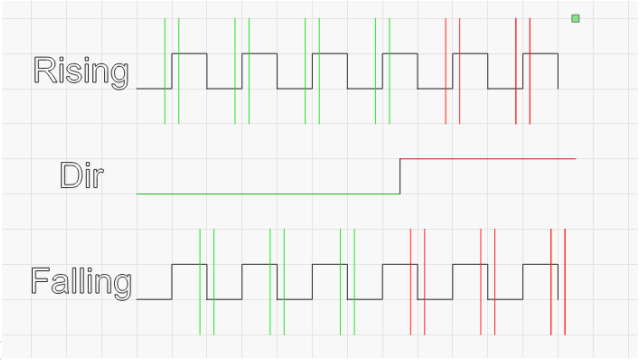
If your output looks like this, you likely have your motor pulse step polarity set incorrectly. On Ruida controllers, there's a setting called 'PWM Rising Edge Valid' that you can change for each axis that tells the controller whether the rising edge or falling edge of a step pulse is what the motor driver is looking for. Toggling this may fix skewed engraving.

The fix is relatively simple. In Edit > Machine Settings, look in the X & Y axis motor settings section at the bottom, and look for the value of 'PWM Rising Edge Valid' on the X axis. Change that - if's it's checked, un-check it, or vice versa. Then, copy the new setting over to the Y axis as well.

What is this setting and why does it matter?

A step pulse is a transition from low to high, or high to low. The controller will hold the line low, and pulse it high, or hold the line high, and pulse it low. The transition itself is what matters, and motor drivers will either look for a transition from low to high (rising edge) or high to low (falling edge) to accept as a 'Step'.

If the laser controller believes that the motor driver is looking for the leading edge signal (when it transitions from low to high), it will pulse the line, and could change the direction line immediately after that. If the motor driver is waiting for the falling edge, it will see the direction change BEFORE the falling edge of the pulse, meaning that it will change direction one step too soon.



[

In the image above, the upper line of steps is interpreted as 4 steps in one direction, then two in the other. The lower line is interpreted as 3 and 3, and the only difference is which side of the step signal the driver is looking for.

Start & End Delay

This features adds in a start/stop delay to allow the laser to enable any systems it enables itself when starting a job. This gives, for example, fans time to get to speed or evacuate the air in the laser before stopping when done.

5.5 User Interface & Features

5.5.1 Menus

The various features in LightBurn are accessed through the menus. The various features in each menu are listed and explained here.

- File Menu
- Edit Menu
- Tools Menu
- Arrange Menu
- Laser Tools Menu
- Window Menu
- Language Menu
- Help Menu

File Menu

NEW

Clicking "New" in the File Menu will clear any current project and create a new one. You can also press ^ Ctrl + N / ⌘ Cmd + N.

NEW WINDOW

Clicking "New Window" will open a new instance of LightBurn. This can be used to run jobs on multiple lasers at the same time or quickly jump between projects.

Please note that if you change LightBurn's settings while you have multiple windows open, the settings in whichever window is closed last will be saved to the preferences file and will overwrite any changes you made previously in other windows.

RECENT PROJECTS

This will open a list of the most recently opened files to choose from.

OPEN

To open an existing or saved file, click on “Open” in the File menu or press ^ Ctrl + O / ⌘ Cmd + O.

IMPORT

You can import any supported LightBurn files into the file you are currently working on. Click on “Import” in the File menu or press ^ Ctrl + I / ⌘ Cmd + I LightBurn supports importing the following file types: svg, ai, pdf, dxf, hpgl, plt, png, jpg, bmp, tiff, gif, webp.

SHOW NOTES

Add or view project comments through this menu. (^ Ctrl + ⎇ Alt + N)

SAVE

To save a project click on “Save” in the File menu or press ^ Ctrl + S / ⌘ Cmd + S. Type the name you want the file saved as in the dialog box that opens up.

SAVE AS

To save a file with changes, but still keep the original file intact, click on the “Save As” icon in the File menu.

SAVE GCODE

Generates and saves the GCode (the code that gets would normally be sent to the laser cutter) for the project as it currently stands. (⎇ Alt + ⇧ Shift + L)

> **Note**
>
> This option will only be enabled for devices that communicate via GCode.

EXPORT

To export a file to a different file format, click on “Export” in the File menu (^ Ctrl + X / ⌘ Cmd + X). LightBurn can export to SVG, AI, and DXF formats. Bitmaps are only exported in SVG files, and text is automatically converted to simple shapes in all export formats. (⎇ Alt + X)

If you have objects selected, only those will be exported, otherwise it will export the entire content of your project. If you have exactly one bitmap selected, you will also be given the option to export as PNG or JPG.

PRINT (BLACK ONLY)

This menu item (^ Ctrl + P) outputs a black and white document to be sent to a printer or built-in "Print to PDF" tools. This document is saved exclusively in black/white.

PRINT (KEEP COLOR)

Similarly to above, you can use Print (keep color) to send to a physical printer, or to a file, your design for review, markup, etc. The export is sent with the same colors as selected in the Color Palette. This can also be triggered by ^ Ctrl + ⇧ Shift + P.

SAVE PROCESSED BITMAP

Exports a copy of a bitmap that you have edited in LightBurn with the edits.

SAVE BACKGROUND CAPTURE

If you have a camera connected, this function saves a screenshot of the camera feed.

OPEN PREFS FOLDER

Opens the folder containing your LightBurn preferences in your file browser.

EXPORT PREFS

Allows you to export your preferences as they currently stand.

IMPORT PREFS

Allows you to import preferences from an exported copy.

LOAD PREFS BACKUP

Allows you to import preferences from a list of (automatically saved) versions.

EXIT

To exit LightBurn, click on the “Exit" in the File menu or press ^ Ctrl + Q / ⌘ Cmd + Q. You will be prompted to save your file if you have unsaved changes.

Return to top

Edit Menu

UNDO

To undo the last editing action done on the current file, click on "Undo" in the Edit menu or press ^ Ctrl + Z / ⌘ Cmd + Z

REDO

To Redo the last editing action done on the current file, click on "Redo" in the Edit menu or press ⇧ Shift + ^ Ctrl + Z / ⇧ Shift + ⌘ Cmd + Z

SELECT ALL

To select all objects in the current file click on "Select all" in the Edit menu or press ^ Ctrl + A / ⌘ Cmd + A.

INVERT SELECTION

Selects the opposite of what you have currently selected. E.g. if you have one object selected, it will select every object except that one. (^ Ctrl + ⇧ Shift + I)

CUT

To one or more objects from the current file, select them and click on "Cut" in the Edit menu or press ^ Ctrl + X This will put the object on the clipboard, and remove it from the current file.

COPY

To copy one or more objects, select them and click "Copy" in the Edit menu or press ^ Ctrl + C / ⌘ Cmd + C This will put the objects on the clipboard, but leave the original object alone.

DUPLICATE

To duplicate a selection in place, select one or more objects and click "Duplicate" in the Edit menu or press Ctrl+D. This is an "in-place" copy and paste operation all in one, bypassing the clipboard. This means if you already have something on the clipboard, it'll still be there after using Duplicate. The duplicate is placed directly on top of the original.

PASTE

To paste an object from the clipboard click "Paste" in the Edit menu or press ^ Ctrl + V. This will place a copy of the clipboard contents in the current file. Note that LightBurn can paste text or images copied to the clipboard from other software.

PASTE IN PLACE

To paste an object from the clipboard click "Paste in place" in the Edit menu or press ⎇ Alt + V. This will place a copy of the clipboard contents in the current file in the same spot that it was in the original file.

DELETE

To delete an object select it and click "Delete" in the Edit menu, or hit ⌦ Del. This will remove the object from the current file.

CONVERT TO PATH

This converts a built-in shape object, like a rectangle, ellipse, or text, into lines and curves that can be edited. Click on "Convert to path" in the Edit menu or the right-click context menu, or enter ^ Ctrl + ⇧ Shift + C. The original shape information is lost, so you won't be able to change text with the text tool after using this.

CONVERT TO BITMAP

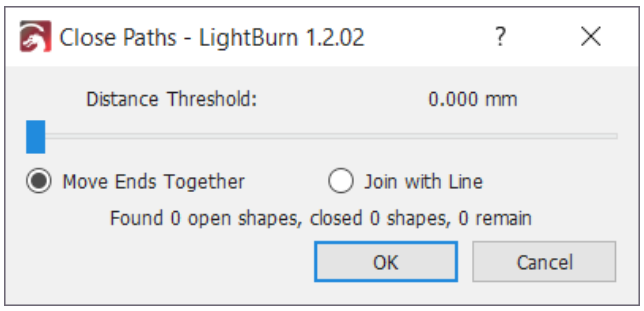
This converts selected vectors into bitmaps (rasters/pixels). (^ Ctrl + ⇧ Shift + B)

CLOSE PATH

In order to Fill a shape with your laser, the shape must be a closed loop, where the starting and ending point are the same. If the start and end points are very close, but not quite connected, "Close Path" will move them together. Click on "Close path" in the Edit menu or press Alt+C.

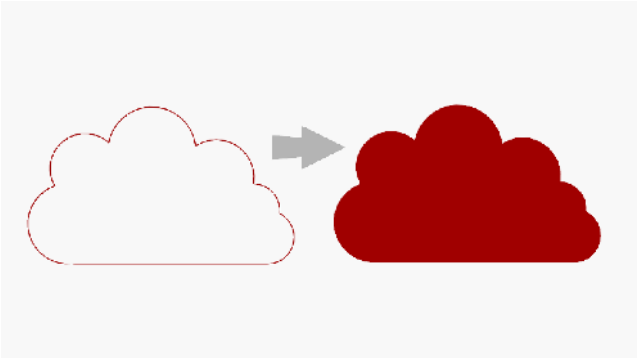
CLOSE PATHS WITH TOLERANCE

Works similarly to close paths, but allows you to set a tolerance for "close" points, so that it doesn't join parts that are far from each other.



AUTO-JOIN SELECTED SHAPES

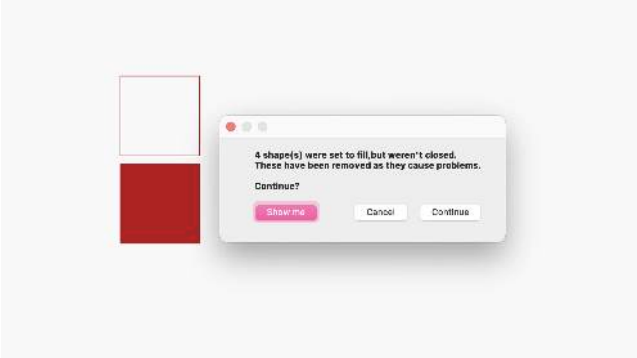
This tool is great for repairing designs (like imported DXF files) that are made of many disconnected lines when they should really be a closed ‘watertight’ shape.



Auto-Join searches the (ungrouped) selected objects and connects any open end points that are within 0.05 mm of each other.

Click on "Auto-Join Selected Shapes" in the Edit menu or press Alt + J.

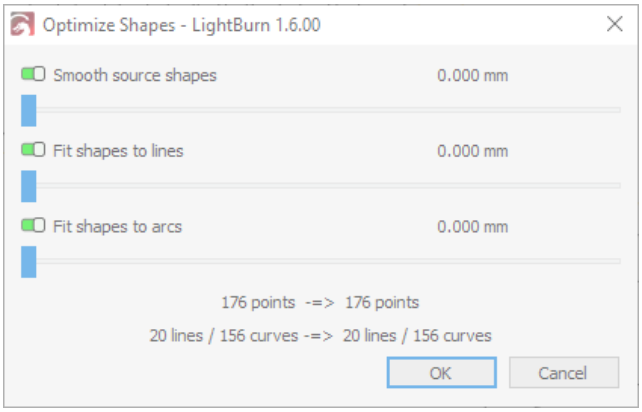
If you Preview, run, or start a job that contains open shapes on a fill layer you will get an error asking if you want to ignore these.



Auto-join is a great way to close these shapes. Anything it isn't able to fix can be fixed manually by dragging the upen points together using Node Editing.

OPTIMIZE SELECTED SHAPES

Hotkey: Alt + Shift + O



The **Optimize Shapes** tool smooths selected shapes or fits them to arcs or lines within a specified *error tolerance*.

Error tolerance defines the maximum amount the new optimized shapes can deviate from the source shapes, and is controlled by the sliders beneath each optimization option.

Switches next to each optimization option control whether they are enabled or disabled.

- **Smooth source shapes** flattens wavy or jagged lines in selected shapes — useful for cleaning up vectors from traced images.
- **Fit shapes to lines** simplifies existing lines or converts curves to line segments — useful for reducing node count, or cleaning up graphics with unwanted overlapping lines.
- **Fit shapes to arcs** converts lines to curves — useful for reducing node count, or recovering arcs from software that exports them as many small line segmnets.

The readout at the bottom of the Optimize Shapes window displays the number of **Points** (nodes), **Lines**, and **Curves** (arcs) in the original shapes and in the resultant optimized shapes.

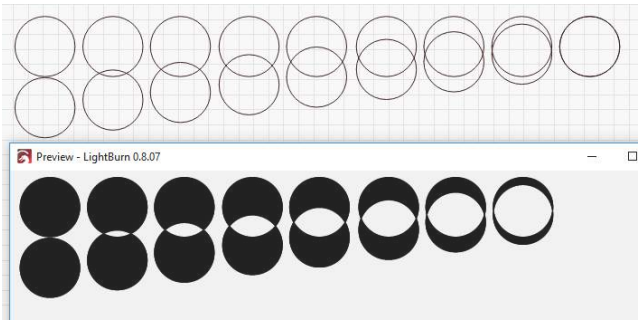
Optimizations are visible in your workspace as you make changes — adjust the tolerance sliders or enable and disable optimizations to see the result of different combinations of tolerances and optimizations.

Clicking **OK** confirms changes and optimizes the source shapes, while **Cancel** discards changes and leaves the shapes as they are.

DELETE DUPLICATES

Hotkey: Alt + D

This tool is great for finding and removing duplicate shapes which might otherwise cause erroneous moves and double-cuts. It will delete (ungrouped) duplicate items within the whole design. For example, if two squares of the same size and same rotation are sitting on top of each other, **Delete Duplicates** will remove the extra square.



If you have filled objects that are appearing as lines in the workspace but disappearing in the Preview, it's likely a duplicated shape.

If the tool didn't appear to work, ungroup the objects in your design and try again.

SELECT OPEN SHAPES

This will select all open shapes in the document.

SELECT OPEN SHAPES SET TO FILL

This will select all the open shapes that are set to fill in the document.

SELECT ALL SHAPES IN CURRENT LAYER

This will select all the shapes that are set to cut in the current layer of the document. Note that if some of these shapes are grouped, the system may have to un-group them in order to select them.

SELECT CONTAINED SHAPES

Will select all the shapes that fall entirely within the shape you have selected.

IMAGE OPTIONS

Offers you various ways to refresh or replace bitmap images in your project. Handy if you have made some edits to a bitmap in a different editing software, and you want to replace the old version you have open in LightBurn.

Refresh Image

Reload Image

Replace Image To Fit

SETTINGS

Clicking on "Settings" in the Edit menu will open the Settings window, where you can change general user settings and preferences.

DEVICE SETTINGS

Opens the Device Settings window, for editing LightBurn preferences specific to the chosen laser.

MACHINE SETTINGS

Opens an editor that allows reading and writing firmware settings from supported controllers.

DEBUG DRAWING

This is mostly an internal tool for LightBurn developers that shows the bounds of shapes being drawn.

CONVERT TO CUT (DEBUG)

Also an internal tool for LightBurn developers - It converts the selected shapes into the cuts that would be sent to the laser, and makes a new shape from the result. This is not how you produce gcode / cuts for your machine, it's just a debugging tool for the LightBurn developers.

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Tools Menu

Many of the tools in this menu are also available as icons in the tool toolbar that by default, is on the left side of the workspace. See Creation Tools for more information.

SELECT

Click on "Select" to select objects in the workspace, or to access menus and toolbars.

DRAW LINES

Click on "Draw Lines" or press ^ Ctrl + L to draw straight or curved lines in the workspace. Click + Drag to make curved lines.

RECTANGLE

Click on "Rectangle" or press ^ Ctrl + R to draw rectangles in the workspace.

ELLIPSE

Click on "Ellipse" or press ^ Ctrl + E to draw ellipses in the workspace.

POLYGON

Create a regular polygon with a variable number of sides (triangle, hexagon, octagon, etc). (⇧ Shift & drag)

EDIT NODES

Click on "Edit Nodes" or press ^ Ctrl + ` to edit nodes of objects in the workspace.

EDIT TEXT

Click on "Edit Text" or press ^ Ctrl + T to create or edit text in the workspace.

POSITION LASER

Allows you to click on a place in your project, and have your laser move to that point in real life (works best with absolute coordinates/end-stops).

MEASURE

Opens up a window that provides you with various information about objects as you hover over them in your scene. Things like line length, start and end point, etc.

CREATE QR CODE

Allows you to create a QR code containing various information such as: Wifi details, contact info, links, text, raw content, etc.

OFFSET SHAPES

Used to create new shapes that are offset from the current selection, inward or outward.

WELD SHAPES

Fuses multiple shapes together into a single outline.

BOOLEAN UNION

Adds two closed paths together into one mass so that all their intersecting lines disappear.

BOOLEAN DIFFERENCE

Select an closed path you want cut, and then also select another that you want to cut out of the first and then click Boolean Difference to do so.

BOOLEAN INTERSECTION

Select two closed paths and click Boolean Intersection to remove all the areas that don't overlap.

BOOLEAN ASSISTANT

Gives you a preview of the Boolean functions described above, to help you choose the correct one.

CUT SHAPES

Select the shape you want cut and also select another shape, then select Cut Shape. The outcome will both what you would get from a boolean difference and a boolean intersection. This also works on open paths (unlike the boolean operations).

ADJUST IMAGE

Allows you to edit a bitmap image in various ways, such as brightness, contrast, image processing mode, negative, etc.

TRACE IMAGE

Opens the image tracing tool where you can trace the content of a bitmap image into vector graphics.

APPLY PATH TO TEXT

If you select a shape and a line of text, this command will attach the text to the shape, so the text follows the path. This allows you to make curved text. (Read more here)

APPLY MASK TO IMAGE

Select a closed shape and a bitmap, and this function will cut the bitmap to fit the shape. See how to use this tool effectively here.

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ARRANGE MENU

Group

Click on "Group" or press "Ctrl + G" to group the selected objects in the workspace.

Ungroup

Click on "Ungroup" or press "Ctrl + U" to ungroup the selected objects in the workspace.

Auto-Group

Automatically groups shapes within other shapes that contain them.

Flip Horizontal

Click on "Flip Horizontal" or press "Ctrl + Shift + H" to flip the selected objects in the workspace horizontaly.

Flip Vertical

Click on "Flip Vertical" or press "Ctrl + Shift + V" to flip the selected objects in the workspace vertically.

Mirror Across Line

Select objects and the shift select line to mirror them about, and then click "Mirror Across line" or press "Alt+M".

Rotate 90° Clockwise

Select objects and click "Rotate 90° Clockwise" or press ".".

Rotate 90° Counter-Clockwise

Select objects and click "Rotate 90° COunter-Clockwise" or press ",".

Two-Point Rotate / Scale

Select object and click "Two-Rotate / Scale " or press "Ctrl/CMD + 2". Click the point you will rotate about, then to only rotate, move the mouse to the second point. To scale hold shift while rotating. For more information see Two-Point Rotate / Scale

Align Centers

Click on "Align Centers" to place the center points of the selected objects directly on top of each other.

Align Left

Click on "Align Left" or press "Ctrl + Shift + Left arrow" to align the selected objects in the workspace to the left.

Align Right

Click on "Align Right" or press "Ctrl + Shift + Right arrow" to align the selected objects in the workspace to the right.

Align Top

Click on "Align Top" or press "Ctrl + Shift + Up arrow" to align the selected objects in the workspace to the top.

Align Bottom

Click on "Align Bottom" or press "Ctrl + Shift + Down arrow" to align the selected objects in the workspace to the bottom.

Align H-Center

Click on "Align H-Center" to align the selected objects in the workspace to the center of the horizontal plane.

Align V-Center

Click on "Align V-Center" to align the selected objects in the workspace to the center of the vertical plane.

Distribute

Provides various methods of evenly spacing objects across various axes.

Move H-together

Click on "H-together to move shapes like distribute, but keeps shapes together

Move V-together

Click on "V-together to move shapes like distribute, but keeps shapes together

Nest Selected

Exports selected objects to a file, copies that file path, and opens SVGnest.com so you can upload the file and nest your objects.

Dock

A little like simple nesting. Select some shapes and click one of the directional docking buttons, and LightBurn will "dock" all your shapes together in that direction, moving them together until they touch. See Docking for more information.

Move Selected Objects

Offers various places to move the selected objects to, such as page centre, laser position, upper left, etc.

Move to Page Center

Click on this to move selected objects to center of page

Move to Upper Left

Click on this to move selected objects to Upper Left of page.

Move to Upper Right

Click on this to move selected objects to Upper Right of page.

Move to Lower Left

Click on this to move selected objects to Lower Left of page.

Move to Lower Right

Click on this to move selected objects to Lower Right of page.

Move Laser to Selection

Offers various ways for you to move the laser to parts of the object you have selected, like the top left or centre of it.

Grid / Array

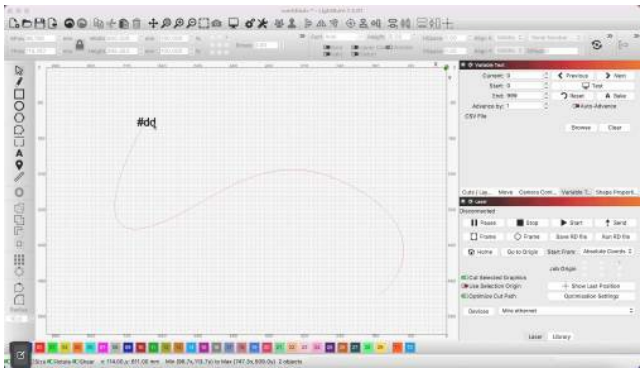
Click on "Grid / Array" to create an array or grid of objects in the workspace. A window will open allowing you to enter the parameters for the array or grid. For more details, see here.

Circular Array

Click on "Circular Array" to create an array or grid of objects in a circle in the workspace. A window will open allowing you to enter the parameters for the array. For more details, see here.

Copy Along Path

Click on "Copy Along Path" to make copies of your selected shape(s) along a path. First, select the object(s) you want to copy, then select the path to copy along. Then select "Copy Along Path". You can create a certain number of copies or set the space between copies. By default, the orientation of your copies will stay the same, but the "Rotate" option will cause the shape to rotate along the path.



Create Rubber-Band outline from selection

Creates an outline on the current layer encompassing all selected parts.

Break apart

Click on "Break apart" to break selected object into individual parts.

Push forward in draw order

Click on "Push forward in draw order" or use "Page up" key to move the selected object up one level in the draw order. Usefull when trying to see objects on the screen.

Push backward in draw order

Click on "Push backward in draw order" or use "Page down" key to move the selected object down one level in the draw order. Usefull when trying to see objects on the screen. "Ctrl-PgDn" or "Ctrl-PgUp" will send an object to the very bottom, or very top of the objects on the screen.

Push to Front

Moves the selected object to the top of the drawer order.

Push to Back

Moves the selected object to the bottom of the drawer order.

Note: Drawing order changes *only* work in wireframe (outline) rendering mode, not filled. In filled rendering mode, the display order will always match the layer order.

Lock Selected Shapes

Locks selected shapes from being edited in any way.

Unlock Selected Shapes

Unlocks selected shapes to allow them to be edited again.

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LASER TOOLS MENU

The Laser Tools menu is the new home for utilities that interact with the laser.

Print and Cut

This sub-menu lets you run the Print and Cut wizard, set the targets, enable the different Print and Cut modes, or reset it.

Calibrate Camera Lens

Open the camera lens calibration wizard. For more information on setting up the camera, see here.

Calibrate Camera Alignment

Open the camera alignment calibration wizard. For more information on setting up the camera, see here.

Rotary Setup

This will open the rotary setup dialog box. Use this to set up your rotary attachment.

Feeder Setup

This will open the auto-feed setup dialog. Use this to set up the auto-feed table controls for Ruida controllers with an auto-feeding table.

Focus Test

Opens the Focus Test generator tool. Requires a machine with a controlled Z-axis.

Interval Test

Opens the Interval Test generator tool, though this has been largely replaced by the Material Test generator below.

Material Test

Opens the Material Test generator tool, which lets you generate and run test grids with varying settings.

Center Finder

Opens the Center Finder tool, used to locate the center of a circular object in a few simple steps. see Center Finder

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WINDOW MENU

Reset to Default Layout

To arrange the windows and menus back to the original default layout, click on "Reset to Default Layout" You can use the Window menu to toggle windows and menus on or off.

Preview

Click on "Preview" or press "Alt + P" to open the preview window. It will show the current laser project and includes information on cut distance, rapid moves, and total time estimate. Cut lines are in black and traversal moves are red. You can toggle the display of traversal moves on or off, as well as shading by power level.

Zoom to Page

Zooms so that the full workspace is in view.

Zoom In

Click on "Zoom In" or press "Ctrl + =" to zoom in the workspace.

Zoom Out

Click on "Zoom In" or press "Ctrl + -" to zoom out in the workspace.

Frame Selection

Zoom the view to completely contain the current selection. (Ctrl + Shift + A)

View Style

Allows you to change the appearance of objects in your scene from wireframe or filled modes.

Return to top

LANGUAGE MENU

Choose the language you would like to have LightBurn use in this menu.

Return to top

HELP MENU

About LightBurn

Shows your LightBurn Version, copyright and attribution information.

LightBurn Support Forum

Links to our online forum where you can get help from our support staff and the community.

Quick Help and Notes

Click on "Quick Help and Notes" or press F1 to access hotkey list, general usage notes and version information.

Online Documentation

Click on "Online Documentation to access the documentation for LightBurn.

PDF Documentation

Links to a PDF copy of our documentation, if you prefer reading pages over online text.

Online Video Tutorials

Click on "Online Video Tutorials" to access the tutorial videos.

CorelDraw macro setup help

Links to documentation about installing the LightBurn macro for CorelDraw

Generate Support Data

Generates encoded data that is handy to provide to our support staff when you are seeking help with a problem.

Camera Selection Help

Helps you select an apropriate camera for your laser cutter.

Check for Updates

Click on "Check for Updates" to make sure you are on the most recent version.

License Management

Launch the license dialog, where you can enter your license key, or see the status of your trial period or license.

Enable Debug Log

This is for the developers, turn on the log by clicking on "Enable Debug Log". The log file will be written to your "My Documents" folder on Windows, or Documents on Mac, and is cumulative - each time you enable the debug log it will append to any existing log, so it's a good idea to delete it after you're finished.

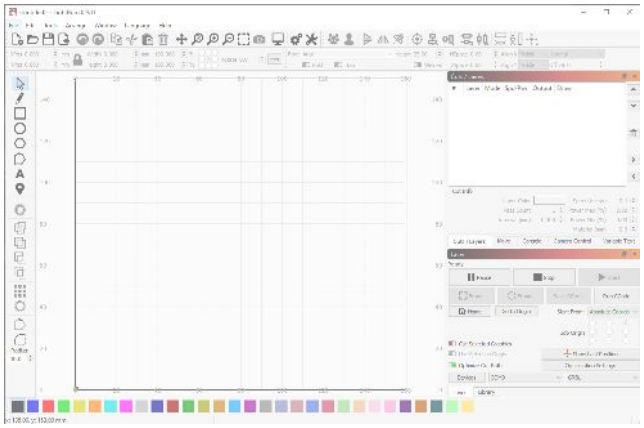
- Device Settings (settings specific to each laser)

5.5.2 Windows & Buttons

LightBurn Windows

This is a list of all the standard windows (and toolbars) available in LightBurn, and how to use them.

USER INTERFACE



Main Elements

- Main window, menus, and status bar
- Main Toolbar (file, clipboard, view, settings)
- Move window (jogging and positioning)
- Laser Control (status and control)

Editing

- Arrangement Toolbar (grouping, mirroring, alignment, distribution)
- Zooming, Panning, and Selecting Items (traversing the workspace)
- Creation tools (selection, shapes, text, node editing)
- Modifier tools (offsetting, Boolean operations, grids)
- Numeric Edits (size, position, units)
- Fonts and Text (choice, configuration)
- Variable Text (dynamic text content)
- Shape Properties (configuration, power, cut order)

Cut Settings

- Cuts & Layers (how the laser treats your graphics)
- Color palette

Libraries

- Art Library (store assets that get reused)
- Material Library (store materials that get reused)

Machine Specific

- File List (files on DSP controllers)
- Console (textual control interface for GRBL/GCode)
- Camera Control (adjust and calibrate cameras)

Setup

- LightBurn Settings (global LightBurn settings)
- Machine Settings (on-machine settings)

Main Toolbar

Hover over an icon to see the name, click for more information.

NEW

Create a new file.

OPEN

Open a file. By default, the dialog box filters for LightBurn (`.lbrn` and `.lbrn2`) files, but you can use the dropdown to show all supported file types, supported image file types, or supported vector file types.

Open will open the file as a LightBurn project. If you want to bring a file into an existing project, please use Import instead.

IMPORT

Import a file into your currently open project. By default, the dialog box shows all supported file types, but you can use the dropdown to filter for support image file types or supported vector file types.

UNDO & REDO

Undo and redo your actions in LightBurn.

COPY, CUT, PASTE, DELETE

Copy will save a copy of your selected object(s) to the computer's clipboard. Cut will do the same, in addition to removing the existing object(s) from the page. Paste will insert the contents of your computer's clipboard into LightBurn. Delete will remove the selected object(s) from the page.

PAN / DRAG VIEW

Allows you to click to drag the page around. If using a mouse, you can accomplish the same thing by clicking the mouse wheel and dragging.

ZOOM TO PAGE

Zoom to show the page as large as possible, centered within your LightBurn window.

ZOOM IN & ZOOM OUT

Zooms your page in to get a closer view, or out to see more of the page at once.

ZOOM TO FRAME SELECTION

Zoom to show the selected objects as large as possible, centered within your LightBurn window. If no objects are selected, it will instead zoom to show all objects on the page. Unlike Zoom to Page, it will ignore empty space on your page.

UPDATE THE BACKGROUND FROM THE CAMERA

Update the camera overlay, if you're using a camera. Grayed out and unselectable when the camera is not in use.

PREVIEW

Open the Preview Window.

SETTINGS

Open the general LightBurn Settings window.

DEVICE SETTINGS

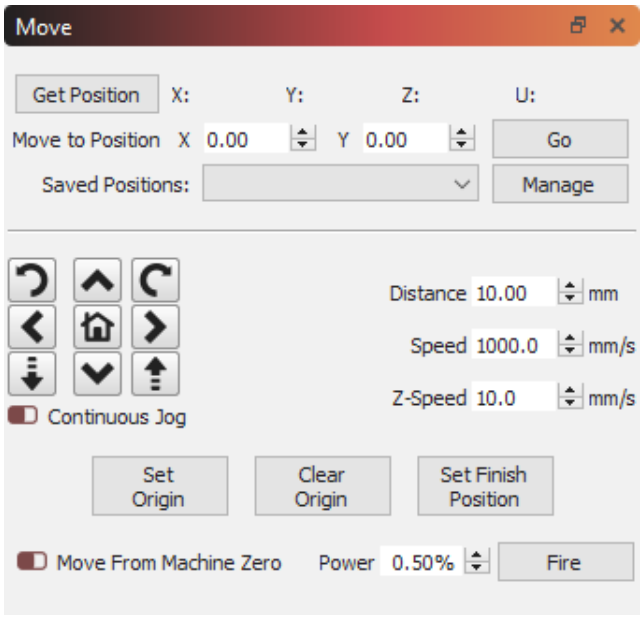
Open the Device Settings window.

GRBL **Primary Docs** **Ruida** **UI**

Move Window

The Move window is used primarily for jogging and positioning, as well as homing functions.

> **Info**
>
> This window will not show up for Galvo devices. Their mirror configuration means "static movement in the workspace" doesn't behave as expected.



Get Position, when pressed, will query the controller for its current location, and display it in the X,Y,Z,U fields to the right.

The **Go** button on the right side will send the laser to the entered coordinates in the *Move to Position* entry boxes.

The **Saved Positions** drop-down displays a list of previously stored positions. This can be useful for jogging to known locations on the work area, like a specific corner, the location of your rotary tool, commonly used jigs, and so on. You can manage the contents of this list by clicking the **Manage** button on the right.

To jog your laser, click one of the arrow buttons around the home button. This will move your head by the set *distance*, and *speed* entered in the window.

The **Speed** setting in this window also controls the movement speed used when use the Frame buttons, or using the 'Click to Move' tool.

If your laser supports it, enabling the '*Continuous Jog*' switch changes the behavior - In this mode, press and hold one of the buttons to move the laser at the desired speed, then release the button to stop.

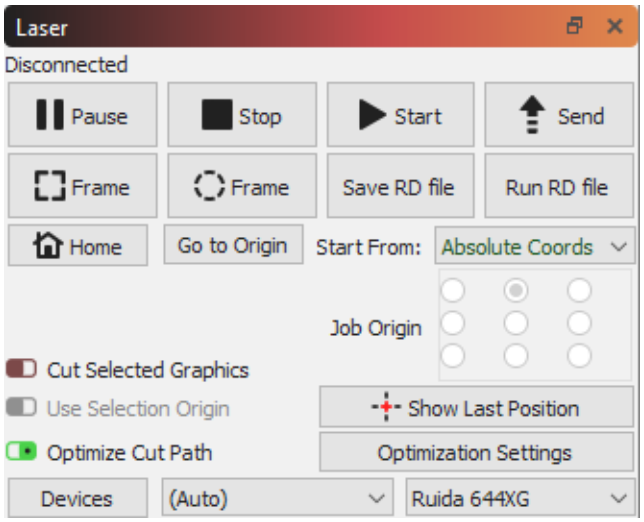
You can also get the current position, set or clear a custom origin or set the 'Finish Position' - IE, where the laser head is sent when a job finishes.

Note: If you have a Ruida controller, you will not see Set Origin, Clear Origin, or Set Finish Position, as these are handled by the controller itself. LightBurn will generally show only controls you can use.

Primary Docs **UI**

Laser Window

The Laser Window lets you select the laser you're using, see it's connection status, send jobs to the laser, and control a few different things about how jobs are run on the laser, including how the job is positioned, and the order things are cut.



The type of laser you have active will affect how this window looks, and Beginner Mode will change it too, so don't panic if yours looks different than what is shown here.

START / STOP / PAUSE

The Start, Stop, and Pause buttons will likely get a lot of use:

- **Start**: run the current file on the laser
- **Pause**: pause a running job, allowing it to be resumed when you click the pause button again
- **Stop**: immediately abort the running job

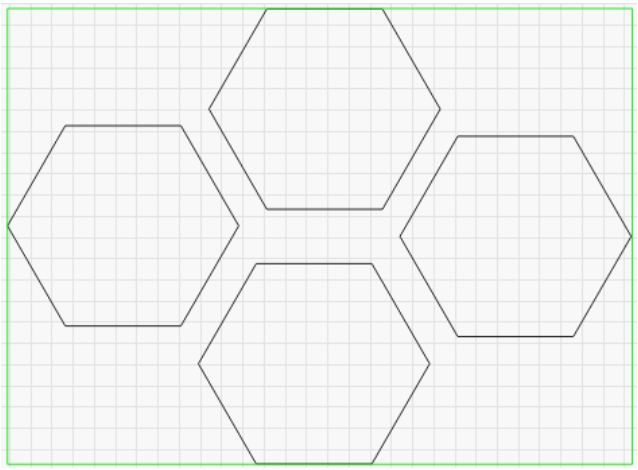
The **Send** button, if your laser supports it, will let you send the current job to the laser as a named file, so you can run from the laser itself.

FRAMING

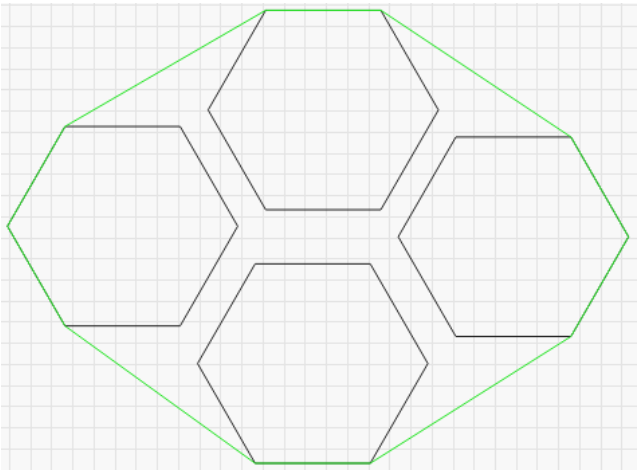
The two **Frame** buttons are used to preview the position of the job on the laser.

The first is a standard rectangular frame, also called a 'Bounding Box'. This is the smallest rectangle that will fully contain the shapes you're sending to the laser.

If my current file was these four hexagons, the green rectangle around them is the path the rectangular frame would follow:



The **O-Frame** button, called the 'Rubber Band Frame', traces a path around your design that is the shape of a rubber band stretched around it. For the hexagons file, it would look like this:



This is useful for lining up jobs with irregular shapes where a simple box outline doesn't fit well. For example, a long, thin diagonal shape, or a triangle.

SAVE / RUN MACHINE FILES

The next two buttons will change depending on the type of laser you're using, but they always do the same things. The first will save the current design as a 'Machine Ready' file, in the file format used by your laser. The second will load and run a previously saved file. If you have a Ruida, these will save and run RD files. If you have a GCode based laser, these buttons will save and run GCode files.

HOME

The **Home** button will tell your laser to execute a homing cycle, where it moves toward the home position looking for the switches that activate when it hits the boundary. Homing is how your laser figures out where it is.

GO TO ORIGIN

The **Go to Origin** button tells the laser to jog to the position currently set as the user origin. Most DSP controllers have an

'Origin' button on the panel that you press to set the current position as the user origin. If you want to send the laser to that spot, press the 'Go to Origin' button.

START FROM / JOB ORIGIN

These two controls affect where the job is placed on the bed of your laser. Please read the Coordinates and Job Origin page for details on the different modes, and how they affect the placement of your job.

CUT SELECTED GRAPHICS

This toggle switch tells LightBurn to only send the portion of your design that is currently selected. If you run a file on your machine and part of the design doesn't cut all the way through, select that piece, enable this switch, and click **Start** to re-send just the selected part of the job. The placement of the part will not change.

USE SELECTION ORIGIN

When used in combination with **Cut Selected Graphics**, the **Use Selection Origin** button tells LightBurn that you want the origin of the job to be calculated from only the parts that are selected, not the whole design. This is useful if you have many different shapes in a file, like a large selection of frames, but only want to send the one you've chosen, and want the origin calculated from just that selected item.

SHOW LAST POSITION

When enabled, the Show Last Position button places a cross-hair cursor in the edit window at the location of the laser head. If you jog the laser within LightBurn using any of the positioning tools, the position will be updated. The position *does not update live* - for example, it will not update while a job is running, because that would encourage you to watch the screen instead of your laser. A laser should never be left unattended while running.

OPTIMIZE CUT PATH

This toggle will enable / disable the path optimizer that plans the cutting path the laser will take. With it disabled, the order will simply be the order that the shapes in your file were drawn in.

OPTIMIZATION SETTINGS

This button opens the Optimization Settings window, allowing you to change the various options that control the cut planner.

DEVICES

Opens the Devices window, allowing you to add, remove, or edit device profiles for the lasers you want to use with LightBurn. Right-clicking the Devices button closes and re-opens the connection to the currently selected device.

Preview Window

The preview window allows you to preview the path the laser will take and verify your order of operations while getting a rough idea of your final result, while giving an estimated time of how long the program will take.

You can bring up the preview in a few ways:

- Press Alt + P
- Click the preview button on the toolbar - it looks like a TV
- In the menu, go to **Window > Preview**
- Right click and choose **Preview** in the context menu

The previewed path is handled exactly like it will be sent to the laser control so the path is affected by things like

- Cut settings (multiple passes, tabs, kerf, etc)
- Layer order
- Optimization settings
- Cut Selected Graphics
- Origin

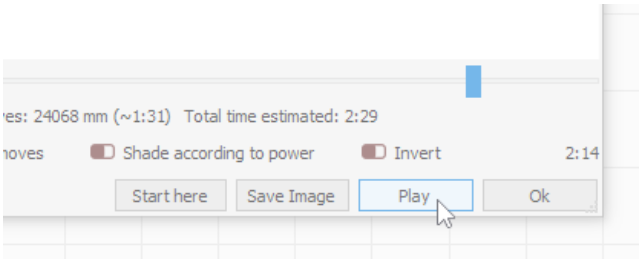
PATH PREVIEW

There are a few ways you can see how the job will run.

Time Slider

The Time Slider allows you to quickly slide through the project and understand the cut order and path.

Play Button



Play allows you to play the project in real time or sped up or slowed down based on the "Playback Speed" slider.

Job Information

Below the Time Slider there is information about your project:

- Cut distance - The distance the laser travels while on
- Rapid Moves - The traverse move distance (laser not on)
- Total time estimated - This is the total time estimated for the job based on the cut speeds and traversal move speeds defined in "Additional Settings" in Device Settings. If you've changed your acceleration or speed settings, or you find that your preview times are not accurate, you can use the **Read From Controller** button in this window to update the settings for the preview.

New in v1.3: The preview will automatically simulate the overscan moves used by DSP controllers, giving a more accurate time.

PREVIEW OUTPUT

Start Here

The *Start Here* button will you allow you to start a program on the laser part way through, from wherever the preview time slider is currently set.

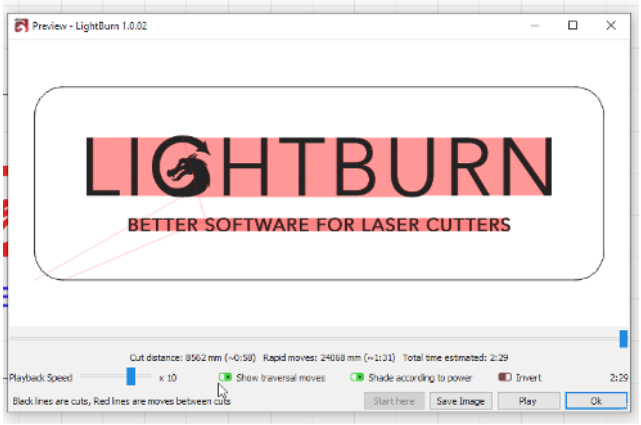
Save Image

Save Image saves out an image file of the current state of the preview window.

OPTIONS

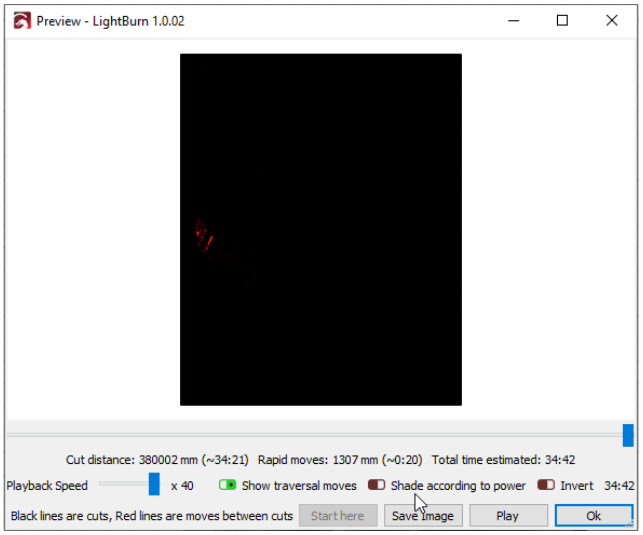
Show Traversal Moves

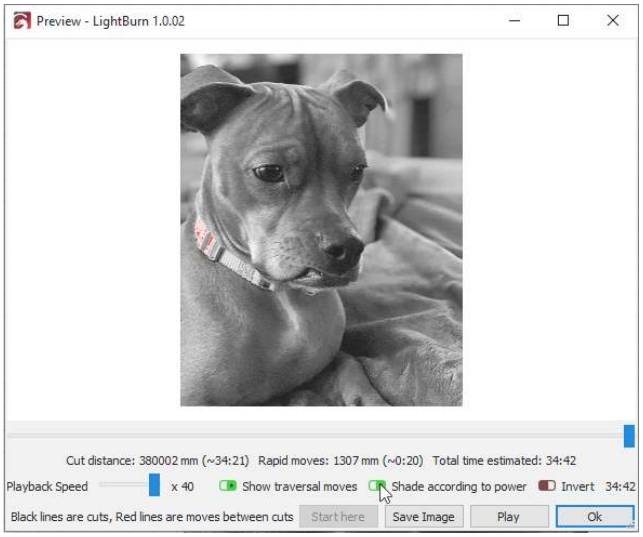
Show traversal moves shows travel (non-laser moves) with red lines when enabled.



Shade According to power

The shade according to power option only works with Grayscale with Image Mode or Power Scaling with Fill Mode





Invert

The *Invert* button is used to change the preview to make the lasered areas light, and the background dark, so you can see what your output might look like on slate, wood that's been painted black, or any other material where the burned area will be lighter than the original material.

TROUBLESHOOTING

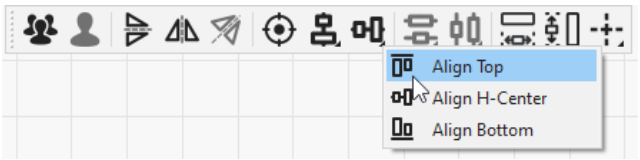
If the preview window's estimated time is inaccurate, you may need to update the Simulation Settings as part of your Device Settings.

Primary Docs **UI**

Arrangement Toolbar

The Arrangement Toolbar comes in two flavors–long, shown at the top, and shorter, shown just below it. Both offer the same functions, but the shorter version of it is available for those with smaller displays, to save space.

If you are using the shorter version of the Arrangement toolbar, buttons with a small triangular mark in the lower-right corner of the button will open a sub-menu with more choices, like this:



The Arrangement toolbar mostly functions to control the placement and alignment of shapes in your design.

 **GROUP AND**  **UNGROUP**

The Group button and the related Ungroup button (below) are used to place shapes into a container (a group) so they can be treated as a single entity when moving, resizing, assigning layer color, and so on. The relative position and size of the grouped objects is maintained. You can also make groups of grouped objects, creating a hierarchy of grouped shapes.

Use the hotkeys ^ Ctrl + G or ⌘ Cmd + G to group, and ^ Ctrl + U or ⌘ Cmd + U to Ungroup.

Grouping shapes is often used to tell LightBurn to treat the group as a single entity for an operation, like aligning shapes, using the Boolean tools, and even for cutting, if the proper optimization options are chosen, but the most common reason is simply to make it easier to move and size a collection of related shapes, like different parts of an imported file or image trace.

Note: grouped shapes are not "connected"–if you draw four distinct lines, and make their ends touch so it looks like a square and then group them, they are still four distinct lines, not a continuous connected path. To join the shapes together, you would use the Auto Join tool.

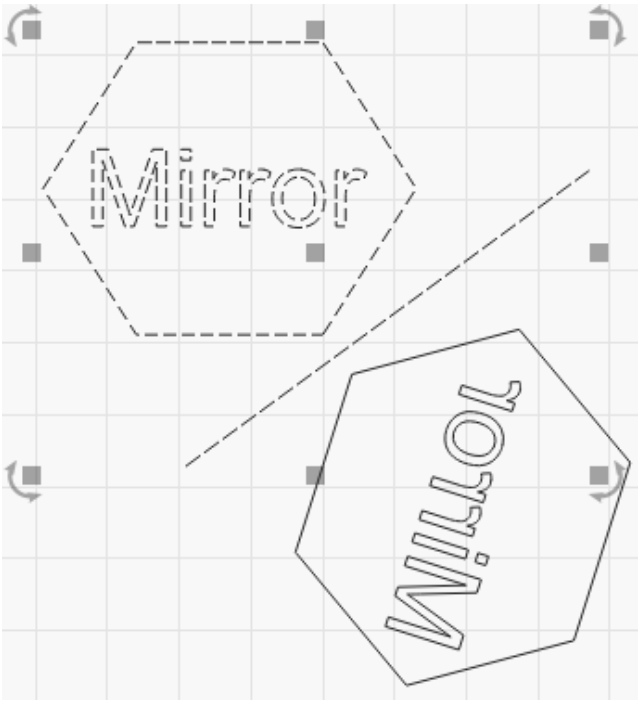
The Ungroup button does the opposite of what the Group button does–it takes a set of grouped objects, removes them from the group, and discards the container. The individual shapes that made up the group are now distinct shapes again.

VERTICAL MIRROR AND HORIZONTAL MIRROR

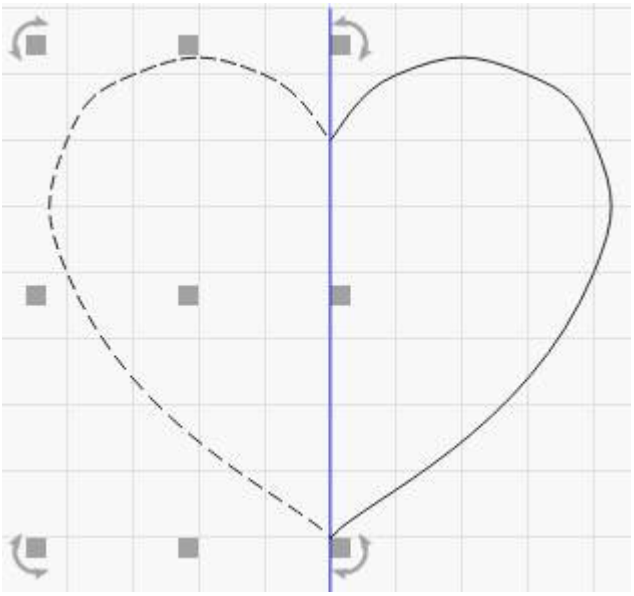
The mirror buttons take the current selection and flip it horizontally or vertically. You can use the hotkeys ^ Ctrl + ⇧ Shift + H or ⌘ Cmd + ⇧ Shift + H to mirror horizontally and ^ Ctrl + ⇧ Shift + V or ⌘ Cmd + ⇧ Shift + V to mirror vertically. If the Edit window has the keyboard focus, you can also press H or V to mirror horizontally or vertically.

MIRROR ACROSS A LINE

This tool behaves slightly differently to the other two mirror tools in that it creates a copy of the selected object or objects, and mirrors it (or them) across a line. The line must have only two points, and be the last item selected. The default hotkey for Mirror Across Line is ^ Ctrl + ⇧ Shift + M or ⌘ Cmd + ⇧ Shift + M.



This tool can be used if you want to create a symmetrical shape, like a bottle or heart. You draw half the original shape, then mirror it to create the other half, like this:



ALIGN CENTERS

Select two or more shapes, then click the Align Centers tool to move all shapes in the selection to be centered over the last selected item.

ALIGN VERTICALLY ALONG LEFT, CENTER, OR RIGHT

These buttons will move all shapes in the current selection to align the left, right, or vertical centers of the selected shapes to the last item in the selection.

ALIGN HORIZONTALLY ALONG TOP, CENTER, OR BOTTOM

These buttons will move all shapes in the current selection to align the top, bottom, or horizontal centers of the selected shapes to the last item in the selection.

DISTRIBUTE VERTICALLY

These two buttons will vertically move the items in the current selection to space them evenly, either setting the same distance between the centers of each object, or setting the same distance between edges of the objects.

DISTRIBUTE HORIZONTALLY

These two buttons will horizontally move the items in the current selection to space them evenly, either setting the same distance between the centers of each object, or setting the same distance between edges of the objects.

MAKE SAME WIDTH / MAKE SAME HEIGHT

These buttons will set all objects in the selection to the same width or height as the last selected item. Objects will resize

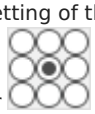
from their centers. Holding ⇧ Shift while clicking one of these buttons will preserve the aspect ratio of the selected items while resizing.

MOVE SELECTION TO CORNER OR PAGE CENTER

These buttons move the current selection to the indicated corner of the workspace, or the center of it. You can quickly move the selection to the page center by hitting P after selecting. These functions can also be found in the Arrange menu, under 'Move Selected Objects'.

Holding the ^ Ctrl or ⌘ Cmd key while pressing one of these buttons will move the laser to the indicated corner of the selection, instead of moving the selected objects. These functions can also be found in the Arrange menu, under 'Move Laser to Selection'.

MOVE SELECTION TO LASER POSITION

This button will move the current selection to the current position of the laser head. The selection is placed relative to the laser head based on the setting of the 9-dot corner control on the Numeric Toolbar 

Zooming, Panning, and Selection

While working on a design in the **Edit Window**, you can focus on different parts of your design with the **Zoom** and **Pan** functions. You can also use the **Selection** tool to select portions of your design to modify. The video below covers useful selection tips to help you work with your designs more effectively.

ZOOMING

Scrolling the mouse wheel will zoom in or out from the location of the mouse, allowing you to quickly zoom in on whatever your mouse is pointing at. Zooming can also be done on most touchpads with a two-finger swipe up or down.

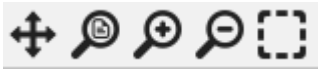
The + and - keys on the keyboard also zoom in and out.

PANNING

To pan the view, sliding the window around, press and hold the middle mouse button and move the mouse. If you don't have a middle mouse button, you can hold the Space bar on your keyboard down instead - you'll see the mouse cursor change to a hand  , and then you can grab and drag the view with the left mouse button.

TOOLBAR

These tools can also be accessed from the **Main Toolbar**.



The first button, the four arrows, is the **Pan** control. Click that to enter Pan mode, to drag the view. You'll see the mouse cursor change to a hand, like this:  When the hand cursor is visible, you can drag the view around by pressing the left mouse button and moving the mouse. The Space bar acts as a shortcut for the Pan control.

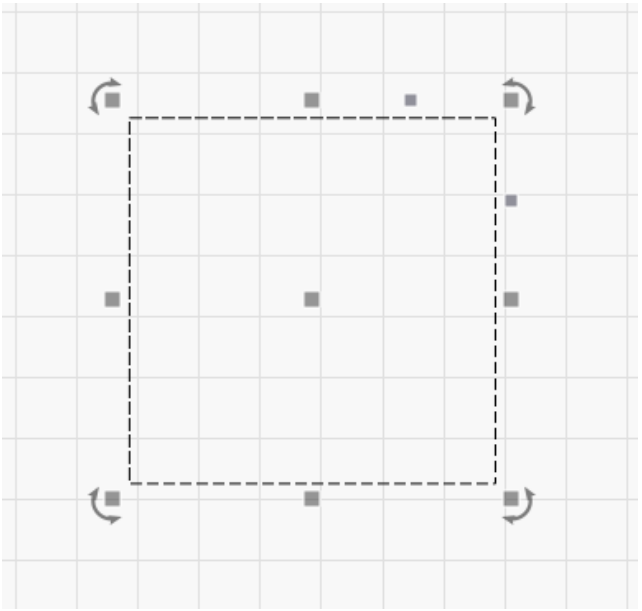
The second button is **Zoom to Page** - clicking this will reset the view in the workspace to frame the entire work area, which is the view that LightBurn starts with.

The next two buttons are **Zoom In** and **Zoom Out**. Clicking them will zoom in or out of the center of the view.

The fourth button is **Frame Selection** - Clicking this will zoom the view to focus on whatever is currently selected. If nothing is selected, it will zoom to fit all of the objects in your project.

SELECTION

Objects in LightBurn must be selected before they can be modified. The primary way to select objects is to click on them while the **Selection** tool is active. Please see the video at the top of this page for more tips on selecting objects, or read below for a summary.

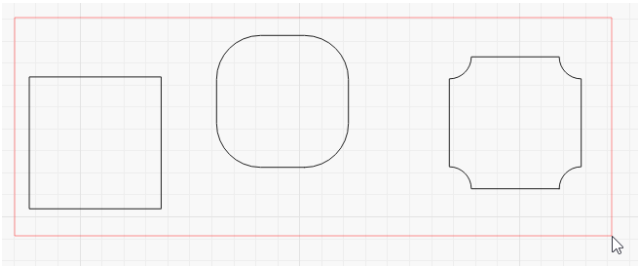


A few things happen when a shape is selected:

1. The selected shape is drawn with an animated pattern instead of solid lines.
2. The edit handles for resizing, positioning, skewing, or rotating the selection appear.
3. The size and position of your selection is shown in the **Numeric Edits** toolbar.
4. Other controls in LightBurn may activate, if relevant to the selection.

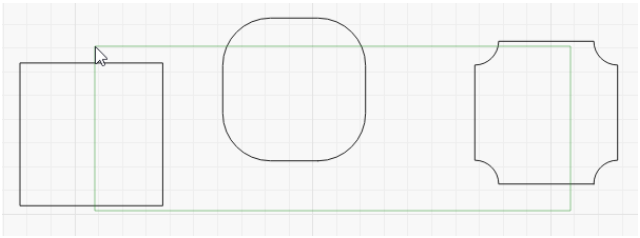
To clear the current selection, left click an empty space in the view or press the ⎋ Esc key.

You can select a collection of shapes by pressing and holding the left mouse button and dragging a rectangle around the things to select, from left to right, like this:



The red rectangle will disappear when you release the mouse button, and all the shapes *fully* enclosed within it will be selected. This is called an enclosing selection - only things fully contained in the red enclosing rectangle will be selected.

You can drag from right to left instead, and this will create a green rectangle, which will select anything that it crosses:



In this case, all three items will be selected even though they are not fully contained by the selection rectangle.

Experiment with these two selection methods - understanding how they work, and when to use them, makes working on larger projects much faster.

Selection Modifiers

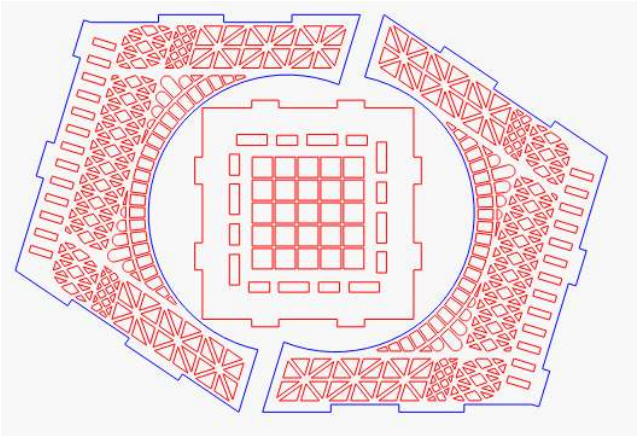
To supplement click-select and rectangle selection, LightBurn supports these modifier keys:

- ⇧ Shift : Holding Shift while selecting will add the new selection to the current one.
- (^ Ctrl / ⌘ Cmd) + ⇧ Shift: Holding both ^ Ctrl and ⇧ Shift will remove the new selection from the current one.
- ^ Ctrl / ⌘ Cmd: Holding ^ Ctrl by itself will toggle the selection state of the new selection.

Additional Selection Tools

There are also a few items in the Edit menu for special types of selection:

- **Select All**: selects everything in the project
- **Invert Selection**: Anything selected becomes unselected, and anything unselected is now selected
- **Select open shapes**: Selects anything in the design that is an open shape (IE, is not a closed path that forms a continuous loop)
- **Select open shapes set to Fill**: Similar to Select open shapes, but only selects open shapes that are set to 'Fill' - This is useful, because LightBurn is unable to fill shapes that aren't closed, so this can help you find them.
- **Select all shapes in current layer**: If you choose a layer setting and click this option, it will select everything assigned to that layer. You can also do this by holding the ⇧ Shift key and clicking the layer in the Cuts/Layers window.
- **Select contained shapes**: this is one you won't use often, but it's incredibly powerful when you need it. Select a single shape in LightBurn, then click 'Select Contained Shapes' to add everything that is 'inside' the item currently selected. For example, if you wanted to select everything inside one of the two blue outlines below, click-select or drag-select would be difficult and time consuming, but 'Select contained shapes' does it in just two clicks:



Troubleshooting

Normally, selecting an object in LightBurn will give a nice even "crawling ants" animation. If you find that you're getting odd flashing or patterns, the most likely problem is overlapping geometry. This is often the result of importing the same file twice, or other design software exporting paths improperly.

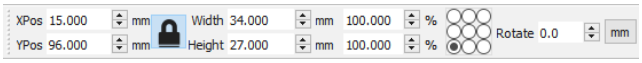
To solve this problem quickly, try deleting duplicate shapes using **Edit → Delete Duplicates** or ⎇ Alt + D.

You can also try ungrouping (^ Ctrl/⌘ Cmd + U) and deleting individual shapes if you want more manual control.

Next Step: Basic Usage - The Essentials

Primary Docs **UI**

Numeric Edits Toolbar



The Numeric Edits toolbar in LightBurn is used for adjusting the size, position, and orientation of shapes or groups of shapes in your project.

XPos and YPos

The X and Y (horizontal and vertical) positions of your selection, relative to the point in your selection indicated by the 9-dot control toward the right side of the toolbar. In the above image, the 9-dot control is showing the lower-left corner, so the XPos and YPos values are showing the current location of that corner of the selection.

Width and Height

The width and height of the current selection. When the lock control is enabled, the aspect ratio (relationship between width and height) of your selection is maintained - this means that if you have a shape that is currently 50 mm wide and 25 mm tall, it is twice as wide as it is tall, or it has a 2:1 aspect ratio. If you change the width to 80 while the lock is enabled, the height will automatically change to 40, preserving the 2:1 ratio. If you unlock the lock control, the width and height can be changed independently.

The width and height controls are followed by percentage controls which can be used to quickly change the relative size of your selection. Enter 50 in one of the boxes, and the size will become 50% of whatever it was before.

Rotate

The rotate box is used to rotate the current selection by the number of degrees entered.

mm / in control

Used to quickly toggle between metric and imperial. Default state will depend on your current unit of measurement.

Equation support

Note that the XPos, YPos, Width, Height, and Rotate fields can all accept equations, and the XPos, YPos, Width, and Height controls accept units as well. This means that if you are working in mm, but you want to create a shape that is 5 inches wide, just enter 5in or 5" into the width field and LightBurn will convert it for you. More information about the equation support in LightBurn can be found on the Tips and Tricks page.

Primary Docs **Text & Fonts** **UI**

Fonts and Text

Creating text in LightBurn is simple - click the Create Text tool ( ) on the Creation Toolbar, click somewhere on the page to get a cursor, and type.

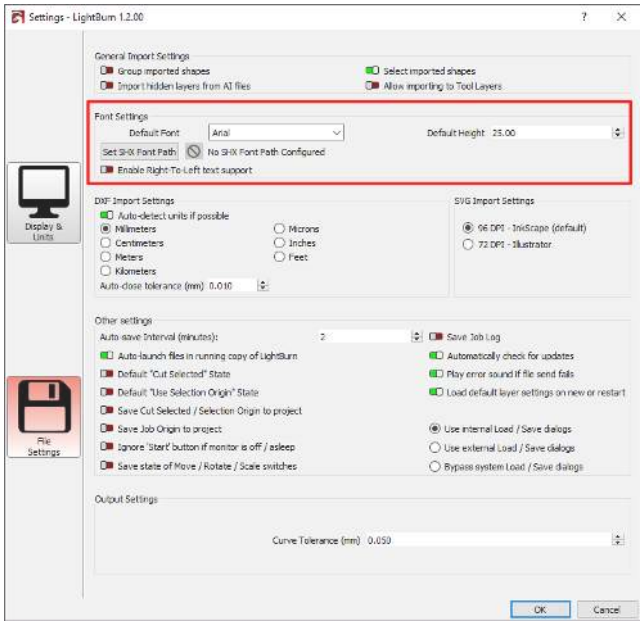
When you enable the Create Text tool, the Text Options toolbar will activate as well.

With the Text tool in LightBurn you can:

- Create text on the screen, or edit existing text by clicking within it.
- Change font and size, alignment, and spacing
- Enable / disable automatic welding
- Create Variable Text objects

FONT SETTINGS

There are a number of global font settings that can be found in the settings dialog on the **File Settings** page:



- **Default Font** - Default selected font for new documents
- **Default Height** - Default font height for new documents
- **Enable Right-to-Left text support** - This will automatically be enabled on first run if a Right-to-Left language is the current system input language. But it can be forced on here later if needed. It will allow you to turn on Right-to-Left font rendering for any text.
- **Set SHX Font Path** - Click to set directory containing SHX font files. Shift+Click to clear. See SHX Fonts section below for more.

TEXT OPTIONS TOOLBAR

The Text Toolbar, located on the upper toolbar in LightBurn by default, is where you set properties on text shapes, like which font to use, as well as size, spacing, and more.

The Text Toolbar looks like this:

The list of fonts in LightBurn is taken from your computer system. If you want to use a new font in LightBurn, use the facility provided by your operating system to install the font, then re-start LightBurn.

> **Favorites and filtering fonts**
>
> Right-click the font dropdown for additional options. You can add the currently selected font to your favorites. Favorites will appear at the top of the font list. You can also choose to filter for SHX fonts or system fonts.

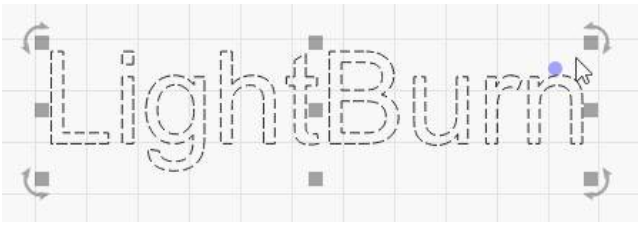
- **Font** - Select the font.
- **Height** - Sets the overall font height. The Height property of fonts is not exact - It is generally the height of a capital letter X in the font, but every font has an internal size that is scaled by this height, and the dimensions aren't required to be accurate.
- **HSpace** - adjusts the horizontal character spacing as a percentage of the font size. Positive numbers space the characters out more, negative numbers move them closer together.
- **VSpace** - adjusts the vertical line spacing as a percentage of the font height. Positive numbers increase the distance between lines, negative numbers reduce it.
- **Align X** - chooses the horizontal anchor position of the text - Left, Right, or Middle
- **Align Y** - chooses the vertical anchor position of the text - Bottom, Top, or Middle. Top aligns text to the top of capital letters, and Middle aligns to roughly the middle of the capital letters. This is most useful when applying text to a path.

- **Bold** - Displays the font in bold typeface, if available
- **Italic** - Displays the font in italics, if available
- **Upper Case** - Forces all text to be upper case
- **Right-to-Left** - Force Right-to-Left text rendering. Must be enabled in settings. This will automatically be set if enabled and current input language is Right-to-Left.
- **Welded** - Enables automatic welding of characters. When characters touch or overlap, as is common with script fonts, enabling this option will automatically weld the overlaps together.

The remaining two options are for Variable Text, like serial numbers, dates, and so on. More information about Variable Text can be found here.

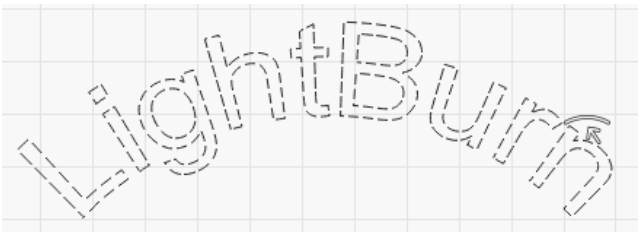
CURVED TEXT

After creating a piece of text, if you return to Selection mode by clicking the Select tool or pressing Esc, you will see a blue dot near the text you've created, like this:



If you hover over the dot, your cursor will change to the bend cursor.

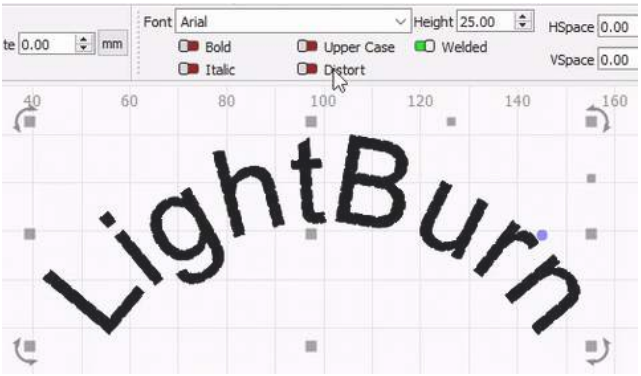
If you click and drag the dot, your text will bend around an invisible circle, like this:



Double-click the dot to clear the bend and restore the text.

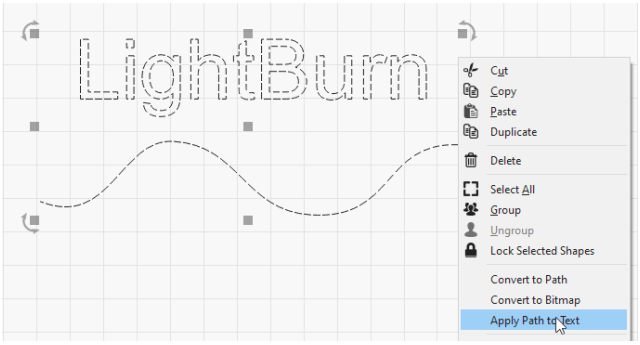
New in v1.3

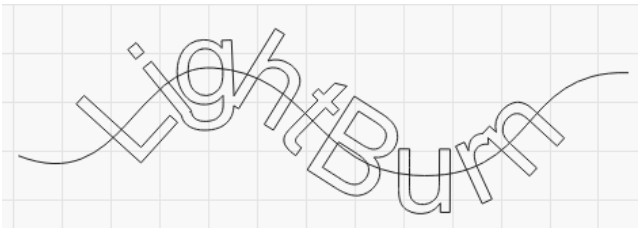
When bending text, you can use the "Distort" toggle to choose whether to distort the text as part of the bend, or leave the individual characters unchanged.



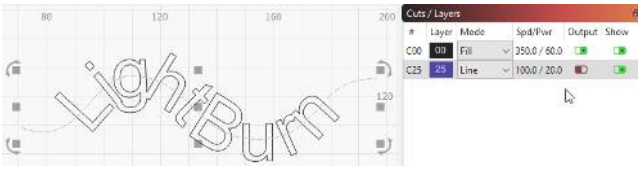
APPLY PATH TO TEXT

If you want the text to follow a more complicated curve, you can use the 'Apply Path to Text' function in LightBurn to attach text to any shape in LightBurn. Draw your shape and your text, then select both and go to Tools > Apply Path to Text, or right-click and choose it from the pop-up menu:





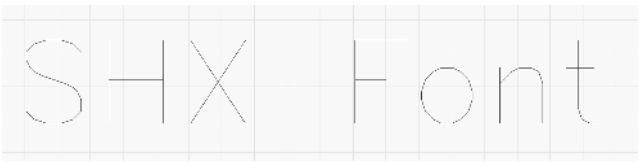
Note that for text to remain editable you cannot delete the path, so if it is not something you want engraved along with your design, put the path on its own layer and set that layer not to output, like this:



Curved text and text on a path will still automatically weld, and can be used with the Variable Text feature as well.

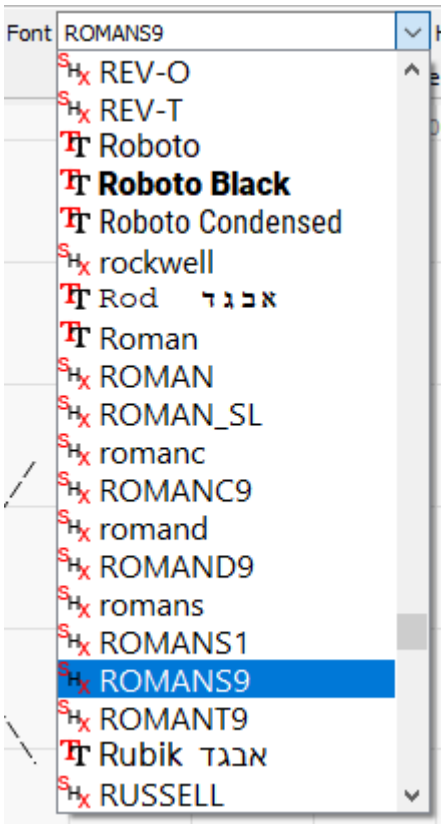
SHX FONTS

LightBurn also supports the use of SHX font files which are an old AutoDesk font format, mainly intended for use with CNC machines. Most importantly, SHX fonts lack many of limitations of standard system fonts and have the ability to define "single line" fonts, such as this:



LightBurn does not ship with any included SHX fonts, but there are many to be found online for free with a quick search. Once you have SHX files downloaded, LightBurn must be told where they are. In the Font Settings dialog, click on "Set SHX Font Path" and choose the directory where your SHX files are located. It will not show the files as it is merely a directory chooser.

Once LightBurn knows where to load the SHX fonts from they should automatically show up in the Text Options Toolbar font dropdown.



SHX fonts are differentiated from normal fonts by the icon next to each entry:

- SHX denotes an SHX font
- TT denotes a standard operating system font

MOVING LIGHTBURN FILES WITH FONTS

When you save a copy of a file that contains text, LightBurn automatically includes a copy of the text as a path and embeds it into the file. If you open the file on another computer that has the same font, you will be able to edit the text as usual. However, if you open the design on a computer *without* the font, LightBurn will warn you about the missing font(s) and load the path embedded in the file. This way your file won't break when you move to another computer, although you won't be able to edit the text without the correct font.

If you want to move designs containing text between computers, be sure to install all necessary fonts on all computers you're using.

IMPORTING OTHER FILES WITH TEXT

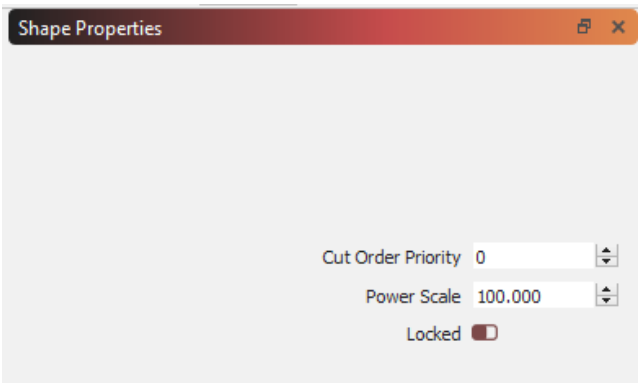
If you are opening files not made in LightBurn that contain text, please make sure that any fonts used in the file are installed on your computer *or* that the text has been converted to paths using whatever tools are available in the other program. Different programs will use different terms for this process, but terms such as 'welding', 'convert to outline', and 'convert to path' are commonly used.

Primary Docs UI

Shape Properties

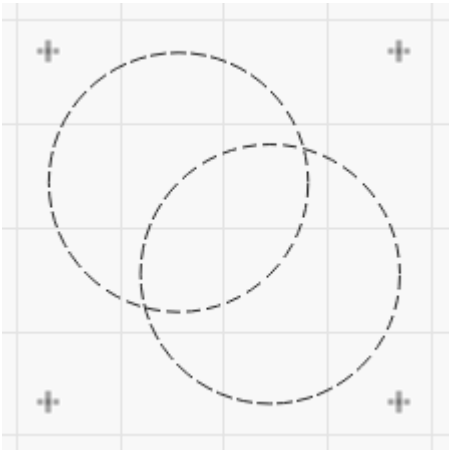
In the `Window` menu, you can enable the `Shape Properties` panel, which will contextually display properties of any selected shape. The contents of this panel will depend entirely on the shape or shapes that are currently selected.

At the simplest, such as when only a Path shape, QR Code or when multiple shapes are selected, the panel will only display 3 properties:



- **Cut Order Priority**: Sets the priority of this shape when used with 'Order by Priority' in the Cut Optimization settings. Lower values are cut first.
- **Power Scale**: Scales the power used to cut this shape by this percentage between Min Power and Max Power
- **Locked**: Prevents movement or other changes to this shape.

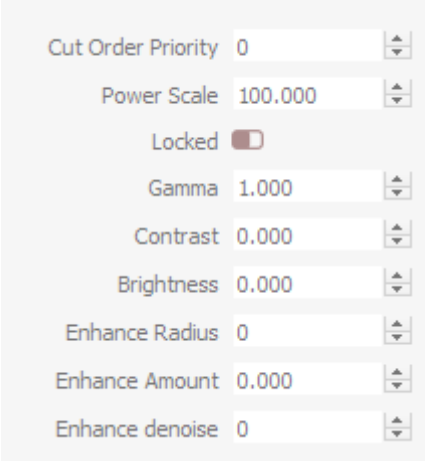
Note that locked shapes are shown without the usual selection controls since they cannot be moved while locked:



When multiple shapes are selected, changing these values acts on all selected shapes at once.

Other shape types include a wide variety of other properties that can be set but will always also include the properties listed above.

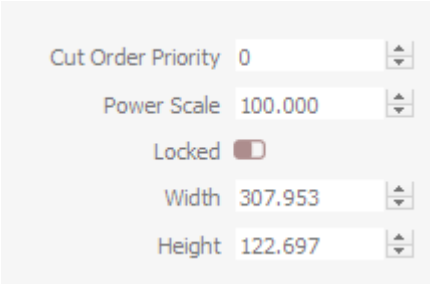
IMAGE



- **Gamma**: Adjusts the mid-tone curve for images. 1.0 is normal. Lower values brightnen the mid tones, and higher values will darken them.
- **Contrast**: Increases or decreases image contrast.
- **Brightness**: Increases or decreases image brightness.
- **Enhance Radius**: Radius of edge enhancement - 0 is none.
- **Enhance Amount**: Increases or decreases edge enhancement.
- **Enhance denoise**: Use to reduce noise in smooth areas.

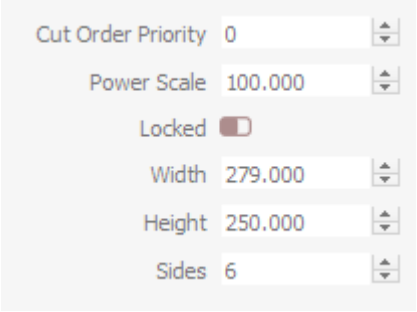
Note: Enhance is also often referred to as "Unsharp masking", and will increase the contrast of edges in the image. A larger radius spreads the effect across a wider area near the edge being enhanced.

ELLIPSE



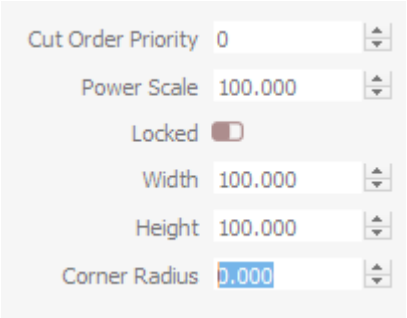
- **Width**: X axis size component.
- **Height**: Y axis size component.

POLYGON



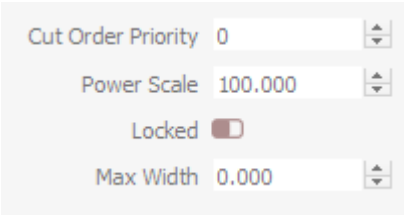
- **Width**: X axis size component.
- **Height**: Y axis size component.
- **Sides**: Number of sides.

RECTANGLE



- **Width**: X axis size component.
- **Height**: Y axis size component.
- **Corner Radius**: Sets the radius for curved corners on the rectangle.

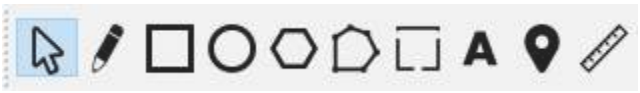
TEXT



- **Max Width**: Text will begin scaling if the length exceeds this, use zero for no limit..

Primary Docs **Tools** **UI**

Creation Tools



The shape creation tools are the basic ways you build stuff from scratch in LightBurn, along with the Selection tool, and the 'Click to Position' tool.

The tools are:

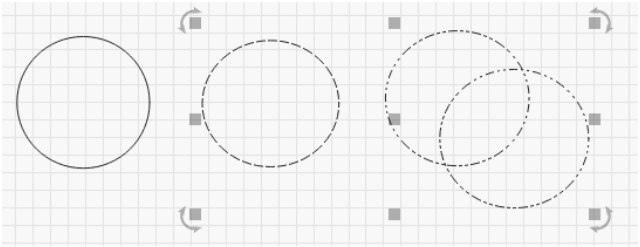
- Creation Tools
- Selection tool
- Click Selection
- Drag Selection
- Enclosing Selection
- Crossing Selection
- Selection Modifiers
- Moving, Resizing, Shearing, and Rotating
- Snapping
- Draw Lines tool
- Measuring
- Rectangle tool
- Ellipse tool
- Polygon tool
- Click to Move tool

SELECTION TOOL 

You'll likely use this more than any other tool in LightBurn. The selection arrow is used to choose which things in your workspace you want to change, and there are a number of different ways that selection happens in LightBurn.

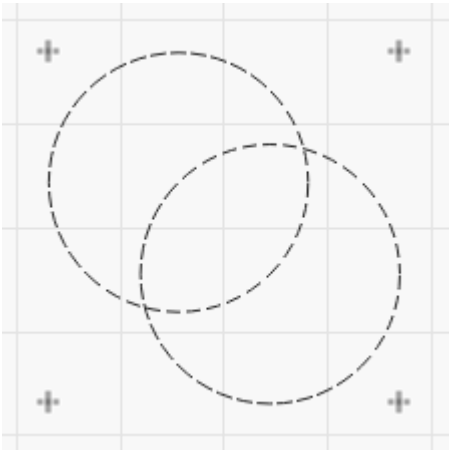
Click Selection

Point at the outline of a shape and click with the left mouse button to select it. The shape will change from solid to an animated pattern of dashes. There are several things you can tell from this pattern:



The circle on the left is not selected. The circle in the middle is selected, and it is a simple shape, because the pattern is just simple dashes. The two circles on the right are grouped - visible because the pattern is a combination of dots and dashes.

The selection shown above is also comprised of unlocked shapes, as denoted by the fact that the move, resize, and rotate controls are shown. Locked shapes, however, do not show any of these selection controls, as shown below.



The direction that the pattern animates shows the direction that the shape will be cut in (unless you tell LightBurn that it's ok to choose a different direction).

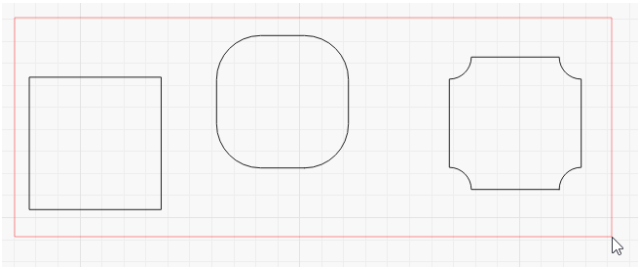
To clear the current selection, left-click an empty space in the view, or press the Esc key.

Drag Selection

If you click an empty space in the edit window and drag the cursor, a selection rectangle appears. Drag the rectangle out over a number of shapes and let go to select them. There are two types of drag selection:

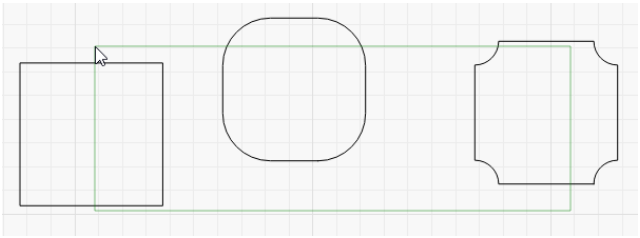
Enclosing Selection

If you drag from left to right, you'll see a red rectangle. Selecting a shape with an enclosing selection means the shape must be completely contained by the rectangle in order to select it.



Crossing Selection

If you drag from right to left, you'll see a green rectangle. Selecting a shape with a crossing selection means that if the rectangle crosses the shape at all, the shape will be selected:



Selection Modifiers

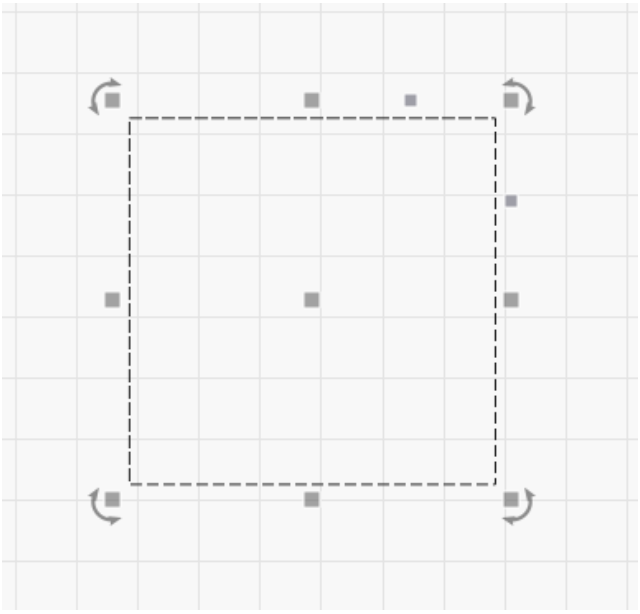
To supplement click-select and rectangle selection, LightBurn supports these modifier keys:

- ⇧ Shift: Holding ⇧ Shift while selecting will add the new selection to the current one
- ^ Ctrl + ⇧ Shift or ⌘ Cmd + ⇧ Shift: Holding both ^ Ctrl and ⇧ Shift will remove the new selection from the current one
- ^ Ctrl or ⌘ Cmd: Holding ^ Ctrl by itself will toggle the selection state of the new selection

Note that on macOS, the Command key is used instead of the ^ Ctrl key.

Moving, Resizing, Shearing, and Rotating

When one or more shapes are selected, several controls appear around them, like this:



The small squares around the outside of the selection can be clicked and dragged to resize the selection from that side or corner. If you move the mouse over one, the cursor will change to show that the action is available.

When dragging one of the four corners, the shape will maintain its relative width to height (aspect ratio) so it doesn't 'stretch'. You can override that by holding the ⇧ Shift key while dragging a corner.

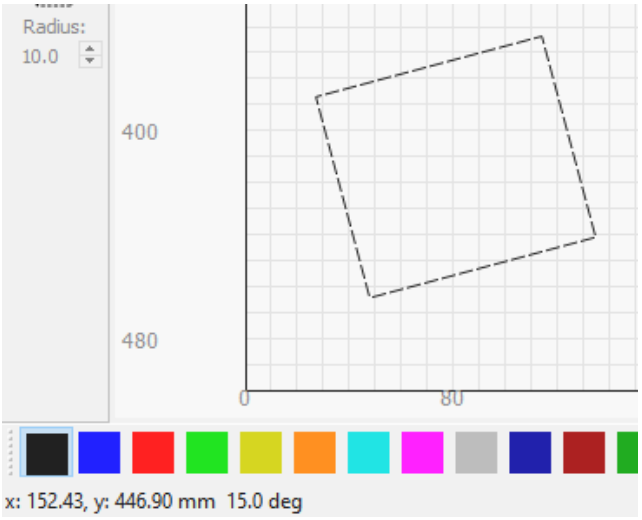
When dragging any of the sizing adjustments, the behavior is asymmetric - the other side of the object acts like an anchor and stays in place. Holding the ^ Ctrl or ⌘ Cmd key makes the action symmetrical, using the center of the object as the anchor instead of the other side.

When dragging the non-symmetrical adjustments, you can "shear" the entire design in the X or Y axis. This allows for "corner-pinching" of your design, and maintains the same center as you had before.

The center square that appears is a movement handle - you can click and drag it to reposition the shape, however you can also click anywhere on the boundary of the shape to do this, and you don't even have to select it first - Simply click the boundary, and while continuing to hold the left button, drag the shape.

The circular arrows shown at the four corners are used to rotate the shape. By default the rotation is "free", however holding the ^ Ctrl key will snap it to 5 degree increments.

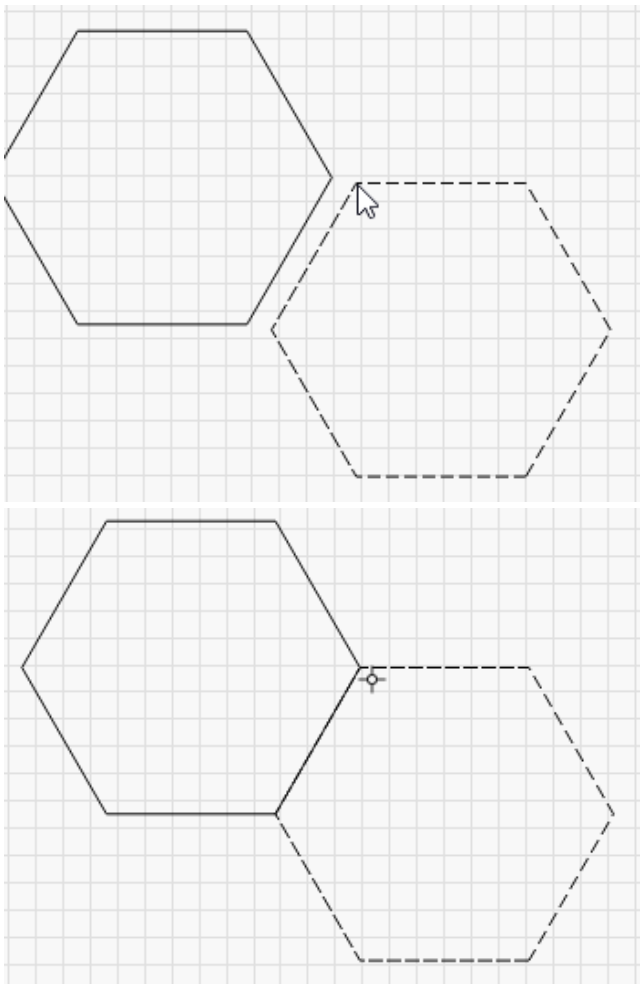
When dragging, scaling, or rotating shapes, the bottom status bar in the main window will often show feedback, like this:



Here I can see the position of my mouse, and the angle I have rotated the shape to while I'm rotating it.

Snapping

When you move the mouse over a shape to select it, you will occasionally see the cursor change to a small crosshair. This shows that you are over a snap point, like a corner, node, the center of a line, or the center of a shape. If you click at this moment, the point you drag the object from will be that snap point. When dragging an object to move it, as you get near other objects, those objects may also snap the cursor location, allowing you to position shapes perfectly with each other. If you are close to a grid point, the selection will snap to the grid as well.



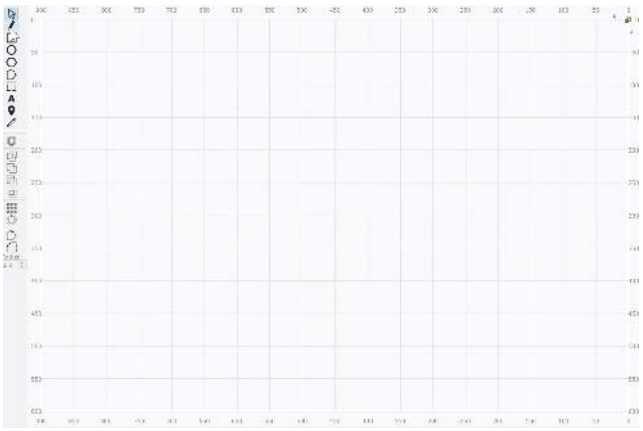
If you do not want shapes to snap when dragging, hold the ^ Ctrl key to temporarily turn off the snapping behavior.

DRAW LINES TOOL

Hotkey = ^ Ctrl + L or ⌘ Cmd + L

Click the pencil to use the Line tool. Click anywhere on the page to start a line, then click in a different location to place the endpoint of the line. The Line tool will continue adding segments until you either click back at the starting point to close it, click the right mouse button to stop, or press the ⎋ Esc key.

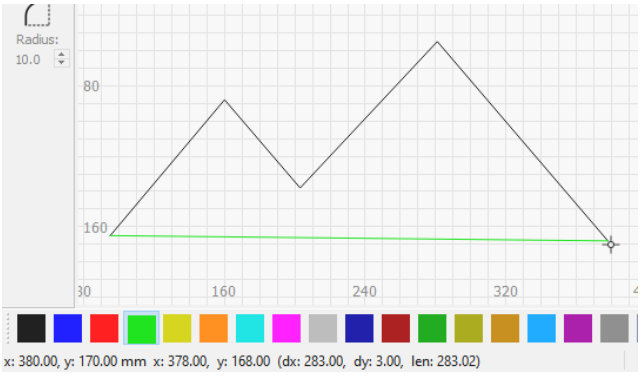
To create curved lines, click and drag when placing a point. You can combine curved and straight segments when using the Line tool.



Measuring

A little known feature of the Line tool is that it is also intended to be used for measuring distances. The status display at the bottom of the main window shows the length of the line being drawn, even before you've completed it.

If you want to measure the distance between two points in your design, start a line at one point, then move the mouse to the other point, but *don't click yet*. Look at the status window to see the length of the line in progress. When you have noted your measurement, right-click or press ⎋ Esc to cancel the line.



The status window shows:

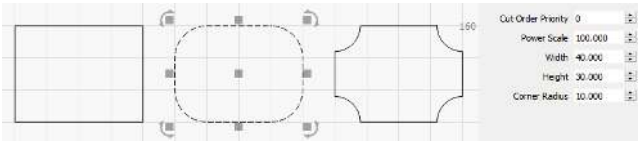
- dx: the distance along the X axis only
- dy: the distance along the Y axis only
- len: the length of the current line segment
- It will also show the angle between successive line segments as you create them

RECTANGLE TOOL

Hotkey = (^ Ctrl / ⌘ Cmd) R

The rectangle tool is used to draw squares and rectangles. Holding Shift while dragging will lock the width and height, producing a perfect square. Holding Ctrl will drag the rectangle or square from the center, instead of the corner.

With a rectangle selected, if you look in the Shape Properties Window you can adjust the 'Corner Radius' property to produce rounded rectangles, or frames with inward corners:



ELLIPSE TOOL

Hotkey = ^ Ctrl + E or ⌘ Cmd + E

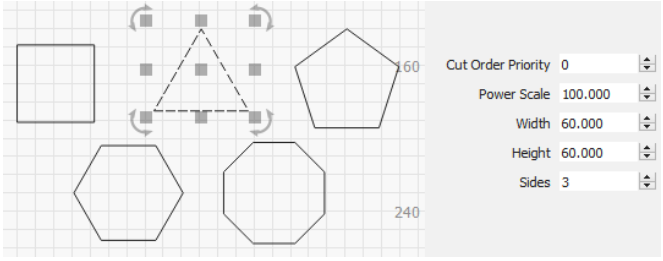
The ellipse tool is used to draw ellipses and circles. Similar to the Rectangle tool, holding ++shif++ while dragging will lock the width and height, producing a perfect circle. Holding ^ Ctrl will drag the ellipse or circle from the center, instead of the corner.

POLYGON TOOL

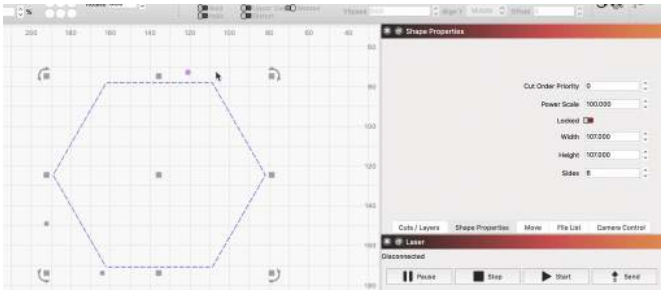
The polygon tool is used to draw regular polygons, like hexagons. Holding ⇧ Shift while dragging will lock the width and height. Holding ^ Ctrl will drag the polygon from the center, instead of the corner.

There are two methods to change the number of sides. Start by selecting the polygon and then do one of the following:

1. Open the Shape Properties Window and adjust the **Sides** property.



2. In LightBurn 1.5 or higher, drag the purple handle to change the number of sides as shown below:



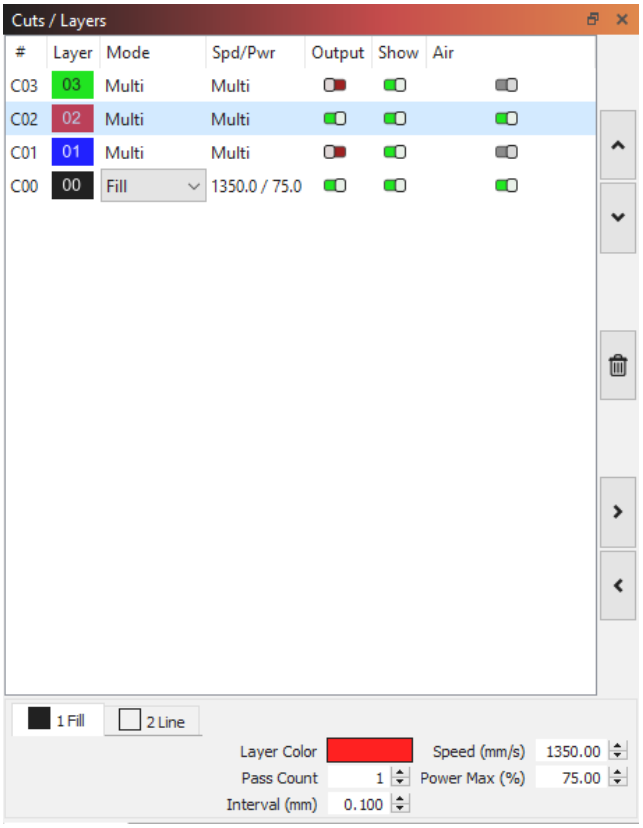
CLICK TO MOVE TOOL

Hotkey = ⎇ Alt + L

The Click-to-Move tool is a quick way to jog your laser to a location somewhere in the workspace. Select this tool, then click anywhere on the page and LightBurn will issue a command to send your laser there. This tool automatically turns itself off after about 10 seconds, in case you accidentally leave it on. Trying to select a shape and having the laser move away from where you want it can be confusing.

Primary Docs UI

Cuts / Layers



The Cuts / Layers window in LightBurn shows the list of operations you have in your design. The layers will usually be cut in this order, but you can change that if you want.

This view gives:

- A summary of all operations in the design
- The type of operation (Line, Fill, Multi, or Image)
- The main speed and power settings
- Toggles to show whether the layer is output (sent to the laser) or shown in the editor window.

If you select an entry in this list of operations, the values at the bottom of the list will let you edit speed, power, number of passes, and interval.

The buttons to the side allow you to manipulate the list of layers:

Move

The first two buttons, "Move up / Move down", let you re-order the entries in the list.

Delete

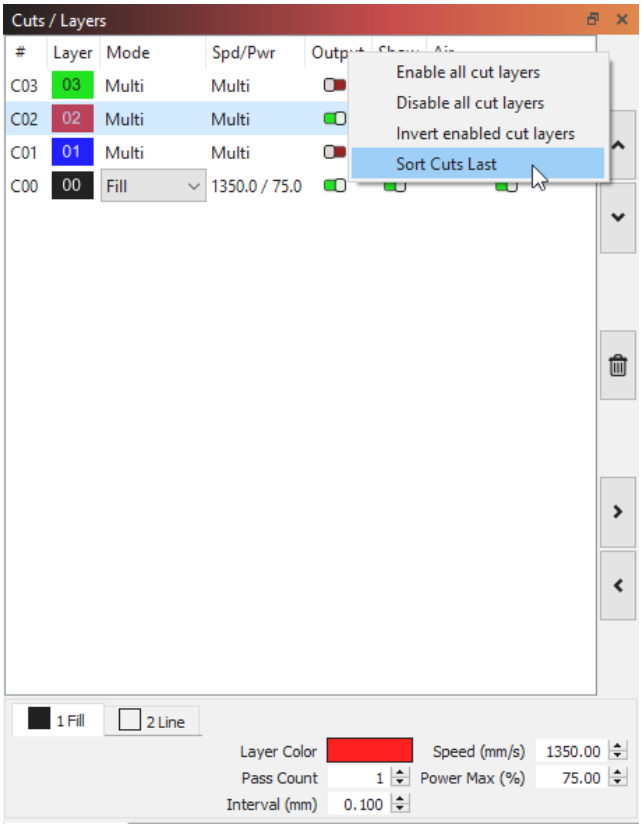
This button will delete all the content on the selected layer.

Cache

These two buttons let you copy a layer's settings (right arrow) into a cache and paste the settings onto a selected layer. This can be very useful if you want the same settings on multiple layers, or want to use one layer's settings as the starting point for further modifications on another layer.

ADDITIONAL TIPS

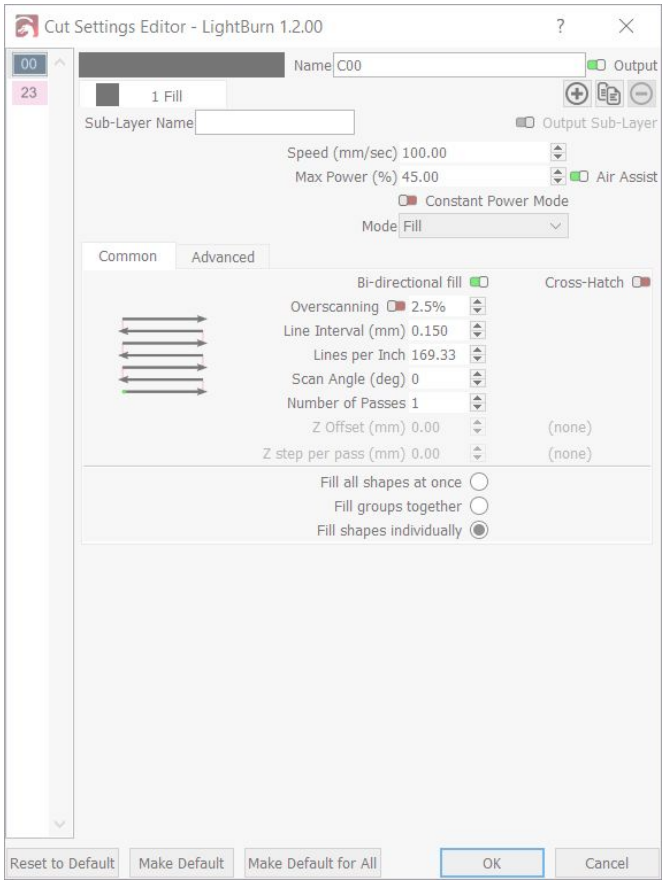
- If you right-click the 'Output' or 'Show' headers at the top of the list, you can quickly turn on, off, or toggle that setting for all layers:



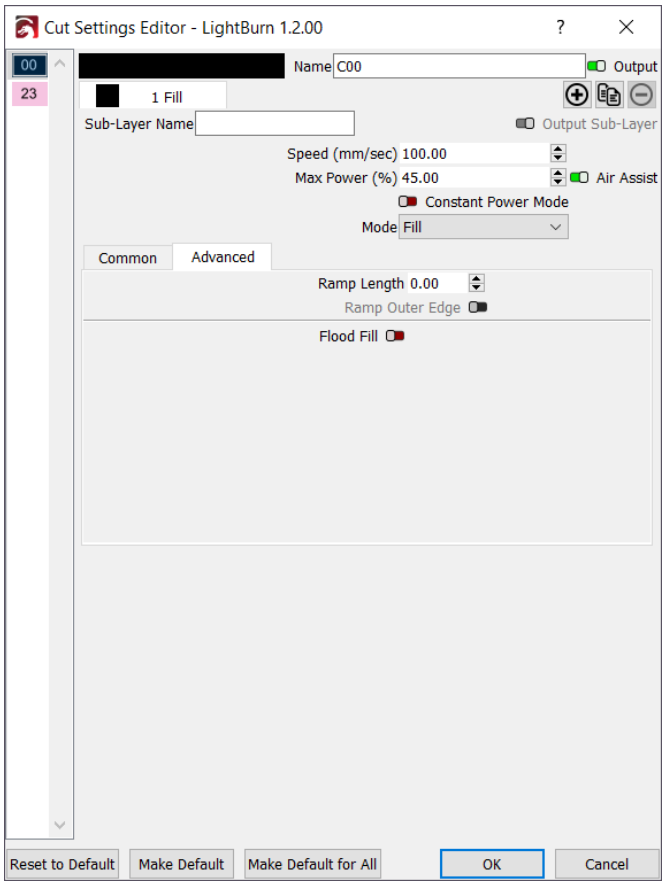
- Right-clicking an entry in the layer list will flash all the shapes using that color in the edit window, allowing you to quickly see what's using this layer setting.
- Holding the Shift key and clicking a layer entry will select all shapes using that layer color. Note that if you have shapes using this layer grouped with other shapes from other layers, the shapes from the selected layer will be removed from the group in order to select them, so this operation *can* alter your file.
- Double-clicking an entry in the layer list will bring up the full Cut Settings Window, allowing you to edit to all the cut settings, including many not shown here.

Cut Settings Editor

CUT SETTINGS - FILL MODE



Common Settings



Advanced Settings

Fill mode permits you to instruct the laser to scan line by line and fill in the shape you want, similar to how a paper printer works. Fill mode will fill in closed shapes but not open shapes.

Note for long-term users

In older versions of LightBurn the 'Fill' mode was referred to as 'Scan'. We've updated the terminology to make it easier for new users.

Bi-directional Fill

When enabled, the laser will engrave in a side-to-side sweeping motion with the laser on and engraving in both directions. When disabled, the laser will engrave traveling one way, then return to the start of the next line without engraving the return pass. Depending on the type of laser, enabling this can save significant time on long engraving jobs.

Cross-Hatch

When enabled, runs a second engraving pass 90 degrees rotated from the first to ensure a consistent and thorough fill.

Overscanning

When enabled, adds extra moves to the beginning and end of each line to give the laser time to speed up before firing, and slow down afterward.

When **Overscanning** is not used or not set correctly, engraved jobs appear more burned at the edges and lighter in the middle.

This is caused by the laser slowing down to change scanning direction.

Thankfully LightBurn can compensate for this by running the tool head outside the boundaries of the engraving, but with the laser off. This maintains an even speed on the engraving itself to provide a consistent engrave. You need a little more space either side of the engraving to accommodate this overscanning.

This setting will not be available for DSP controllers or Galvo lasers. See the DSP or Galvo tabs for more information.

GCode DSP Controllers Galvo Lasers

On GCode devices, enable Overscanning in your Fill or Image layer.

If you already have this enabled and you are still seeing issues, you might need a larger value for the Overscan setting, particularly if your acceleration is low.

If Overscanning is enabled on a GCode laser and there isn't enough room at the edge of the job to accommodate the extra travel distance, you may encounter LightBurn's **Cut May Be Out Of Bounds** error.

DSP controllers handle Overscanning in hardware. If a job on a DSP laser requires Overscanning and there isn't enough room at the edge of the job to accommodate it, your DSP controller may return the Not Enough Extend Space error.

Galvo lasers don't use Overscanning. Correcting for excessive burning at edges is handled by the Delay settings in **Device Settings**.

Line Interval

Controls the spacing between scanned rows, and indirectly controls **Lines per Inch**.

Lines per Inch

A different, often more intuitive way of controlling the line interval, or spacing between rows.

Scan Angle

Normally 0, meaning the laser will scan back and forth horizontally across the image, progressing from the bottom of the image to the top. If you set this to 180, the laser will scan the image from top to bottom. Setting this to 90 will scan the laser vertically over the image, progressing from left to right.

Note

If you have a DSP controller, we do not advise using angles that aren't a multiple of 90 degrees. Horizontal and Vertical scanning is supported natively by the hardware, and it will automatically handle over-scanning beyond the sides of the image to get the head to full speed before engraving starts. Scanning at non-90 degree angles is "emulated" using normal cutting moves. It works, but it's mostly useful as a style option, and not recommended for general use.

Number of Passes

Sets how many times the laser will run this filled shape.

Angle Increment

This feature allows subsequent passes of the layer or sub-layer to increment the scan angle automatically.

Z Offset

If you have Z moves enabled, and your controller supports it, the Z Offset setting can be used to move the laser head closer to the material (inward) or farther away from it (outward). Focusing deeper into the material can sometimes help to cut thicker material, and lifting the laser away from the material can produce a thicker line.

Z step per pass

When doing more than a single pass over a shape, the Z step per pass setting allows you to tell LightBurn to raise or lower the laser with each pass by some amount. This is most often used for thick cutting or deep engraving, allowing you to shift the focus point deeper with each pass to help maintain efficient cutting.

Warning for Z moves

If your system uses auto-focus, you may not be able to push the focus point lower, because most systems treat the auto-focus height as the lowest possible height (Z limit) to avoid crashing the laser head. Be careful using Z moves, as they do have the potential to physically damage your laser by crashing the head into the material.

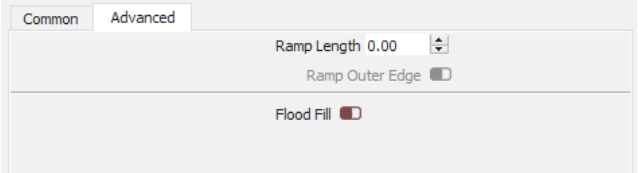
Fill Grouping

These options control which shapes are filled at the same time on the laser. If you run your laser fast, OR your laser accelerates slowly, it is often most efficient to scan things all at once, so the laser spends most of its time moving at the speed you've chosen, and less time changing direction. If you are engraving slowly, your laser accelerates fast, or the design contains a lot of blank space, it can be more efficient to fill clusters of close shapes, or just fill the shapes one by one. If you aren't sure, try different options and use Preview to estimate the time.

- **Fill all shapes at once**: The default, this setting means that everything on this layer will be filled at the same time, sweeping back and forth across the whole job. If you are running the laser fast (300 mm/sec or more) this is usually the most efficient option, with some exceptions.
- **Fill groups together**: This setting will fill all shapes in a group at the same time.
- **Fill shapes individually**: This setting fills all shapes one by one.

Advanced settings

Under the **Advanced** tab you'll find a few useful, but less frequently used options.



Ramp Length

This setting can be used to slope the sides of an engraving by varying the laser power, and is useful if you create rubber stamps, particularly if the designs have thin regions that need extra support. The ramp length controls how far from the design the slope will extend.

Note: On a DSP controller, the ramp varies the laser power from Min Power to Max Power, so you must set these differently to get a ramped side. Typically you would set Min Power to be just above the firing threshold of your laser.

Flood Fill

Flood fill tries to eliminate travel moves across blank space, so it's perfect for engraving something like a large, empty rectangle, where the blank area in the middle would consume most of the time spent.

Warning

This option is incredibly useful when you need it, but is *very* sensitive to machine tuning and backlash, and can end up leaving gaps in your engraving if the design is complex and/or your machine is not set up optimally.

If used on complex designs, Flood Fill can produce engraving paths that jump around a lot, and return later to fill in missed spots, which is why it can leave gaps if the machine isn't well tuned. Use it sparingly, and use the Preview tool to see how the option will engrave your design so you aren't surprised by the path it takes.

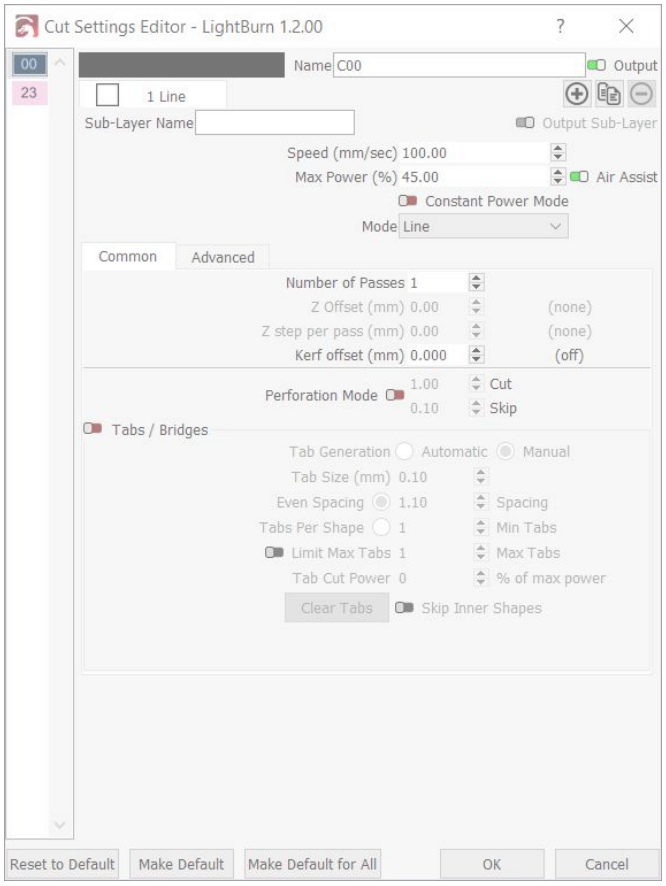
Fill + Line Behavior

In older versions of LightBurn, Fill+Line mode allowed primitive Sublayer use to draw an outline around an engraved shape. This has since been superseded. The legacy behavior can be approximated with Sub-Layers, one for Fill and a second one for Line with the same base motion settings.

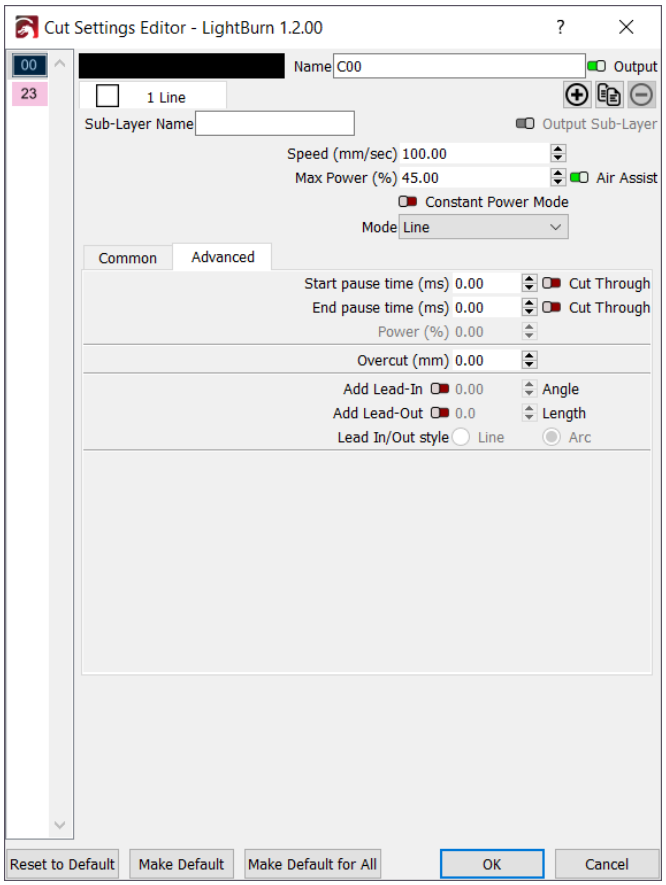
Danger

LightBurn will automatically convert pre-1.2 project files with Fill+Line settings to Sub-Layers in 1.2, including Fill+Line behavior. This produces two layers, one with your legacy "Fill" settings, and a subsequent layer with "Line" settings, to be run afterwards. Going backwards from current project files to pre-1.2 LightBurn is likely to result in breakages involving Sub-Layers due to how complex the changes are.

CUT SETTINGS - LINE MODE



Common Settings



Advanced Settings

The image above shows the settings for **Line** mode. In this mode, the laser follows the exact path of your design, tracing the lines with the beam enabled at the power you've chosen. If you move quickly, or with low power, you will likely just etch the surface (sometimes called vector marking). If you move slowly and with high power, especially with a CO_2 laser, you will cut deeper, possibly through the material. The only difference between surface marking and cutting is the power and speed.

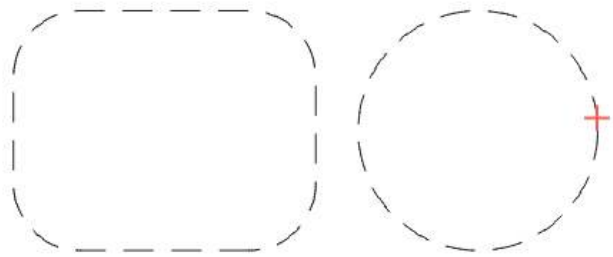
Number of Passes

How many times the laser will repeat the shapes on this layer. Sometimes, when cutting thick material, trying to engrave very deep, or using a lower power laser, more than one pass may be necessary.

Perforation Mode

If you are trying to cut fold lines in card stock, stitch holes in leather, or just make dashed lines, **Perforation Mode** allows you to choose the distance to cut, followed by the distance to skip.

This can also help when using delicate materials with a powerful laser. With very low cut and skip values, the beam is rapidly switched on and off, reducing the effective power output. Try starting with cut and skip values of 0.1 mm each, and adjust the ratio between cut and skip to tune it further.



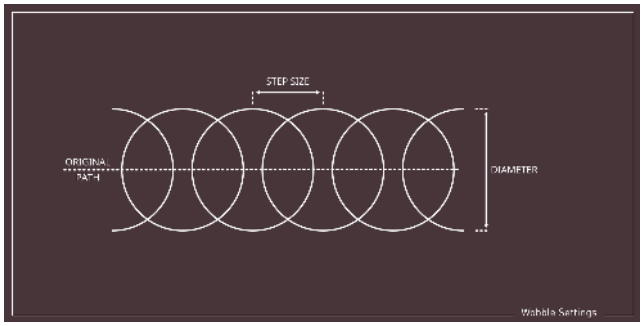
Tabs / Bridges

Adding **Tabs / Bridges** to your design commands your laser to skip small sections of a cut, so objects do not fall out immediately but can be removed later. For an in-depth walk through on this features, see the Tabs / Bridges page.

Galvo-Specific Settings

Wobble (Galvo-only)

This option is only available if you are using a galvo laser. Because galvo lasers are not optimized for cutting, it can be hard to apply enoug power to a given area while in **Line** mode to cut through material. Wobble can be used to trace small circles along the path of the line, creating a thicker line and forcing the galvo to spend longer in each section of the line. The **Step** value refers to how far apart the circles are, and the **Size** value refers to the diameter of the circles (in millimeters).



Gantry-Specific Settings

These settings will only be available if you are using a gantry laser.

Z Offset

If you have Z moves enabled, and your controller supports it, the Z Offset setting can be used to move the laser head closer to the material (inward) or farther away from it (outward). Focusing deeper into the material can sometimes help to cut thicker material, and lifting the laser away from the material can produce a thicker line.

Z step per pass

When doing more than a single pass over a shape, the Z step per pass setting allows you to tell LightBurn to raise or lower the laser with each pass by some amount. This is most often used for thick cutting or deep engraving, allowing you to shift the focus point deeper with each pass to help maintain efficient cutting.

Warning for Z moves

If your system uses auto-focus, you may not be able to push the focus point lower, because most systems treat the auto-focus height as the lowest possible height (Z limit) to avoid crashing the laser head. Be careful using Z moves, as they do have the potential to physically damage your laser by crashing the head into the material.

Kerf Offset

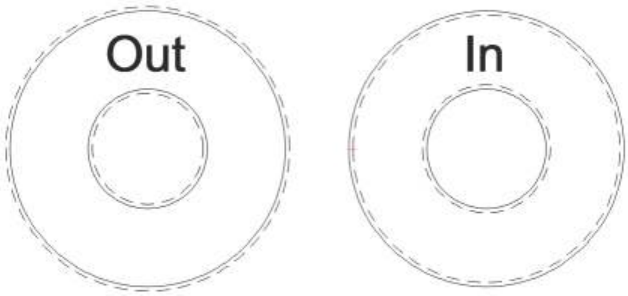
Closed Shapes Only

Because LightBurn must determine the inside and outside of a shape in order to apply a Kerf Offset, this setting will only work with closed shapes.

Kerf refers to the thickness or width of a cut made by a cutting tool. The kerf of a laser is much narrower than that of a saw blade, but the extra material removed can interfere with close-fitting parts such as tabbed boxes or inlays.

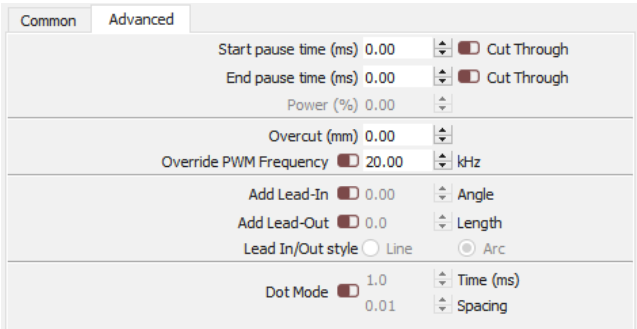
Kerf Offset compensates for the extra material removed by offsetting the path of the laser to the outside of closed shapes (for positive values) or the inside (for negative values). This doesn't modify the underlying shape, so your design can be used on lasers with different kerfs by adjusting the Kerf Offset value.

The image below shows how Kerf Offset (dashed lines) relates to the original shape (solid lines).



Advanced Settings

Under the **Advanced** tab you'll find useful, but less frequently used, options, many of which can be used to compensate for lasers that don't fire at the start or end of cuts. This tab will not be available if you are using a galvo laser.



Start / End pause time

These options can be used to add a delay at the beginning of a cut, the end, or both. If you also enable the **Cut Through** option, the beam will be turned on during this pause, which can be used to **prime** the cut, for example when cutting very thick material. The **Power %** value sets the power of the laser during this pause.

If used without the **Cut Through** toggle enabled, it can be used to add a delay to let the gantry settle down after a rapid move, or allow time for an air assist solenoid to engage.

Cut Through

Cut Through will dwell (pause) with the laser on at the start or end of a cut to help pierce the material there.

Overcut

Overcut will extend a cut, to burn an extra bit at the end.

Override PWM Frequency

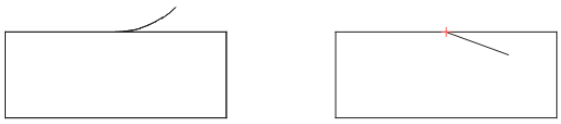
If you have an RF Excited tube, this setting allows you to control the PWM frequency of the pulses sent to the laser, and can change the edge finish on certain materials.

Override PPI

Only available on Trocen controllers, the **PPI** setting (Pulses Per Inch) lets you tell the laser to send an exact number of pulses per inch of travel, instead of varying the beam power directly. This is useful for delicate materials like paper, and is similar to using **Perforation Mode**, but is handled by the hardware itself.

Lead In / Lead Out

Lead-in and Lead-out are optional lines or curves added to the start or end of a cut. When cutting thick material, particularly if using 'Cut Through' delays, or cutting metal, there is often a mark left at the start of the cut that is slightly thicker than the rest, and can leave an indent on an otherwise smooth edge. With this setting, you can add a small line to the start or end of a cut, so that mark happens off the cut line itself. The 'Angle' value controls the placement of the lead line - a positive number tells LightBurn to put the lead line outside the shape, and a negative number means to put it inside. You can choose to make the lead a straight line, or a short arc.



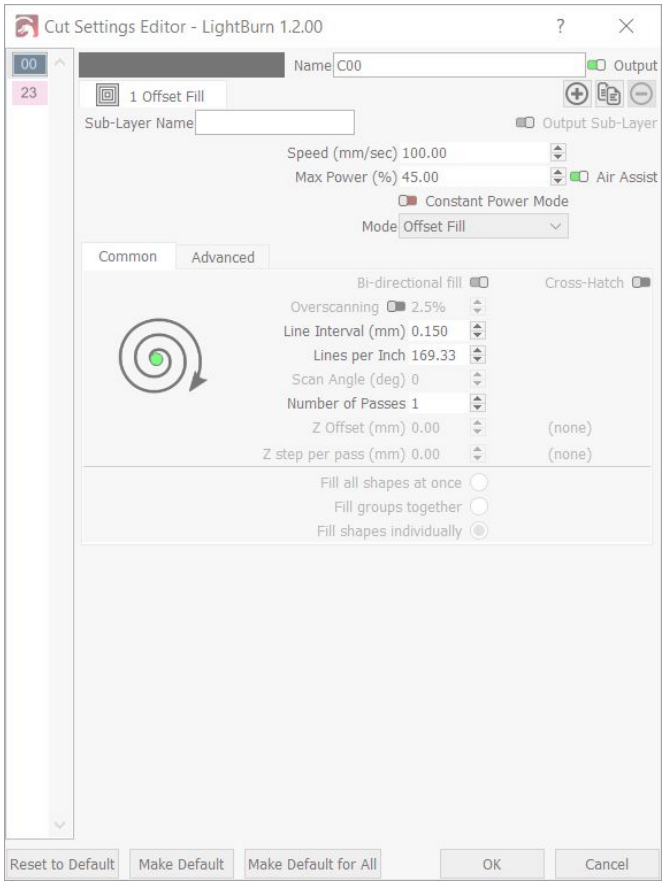
The shape above on the left is using an arc set to +45 degrees, so it starts outside the shape. The one on the right is a line set to -20 degrees, so it appears inside the shape.

Dot Mode

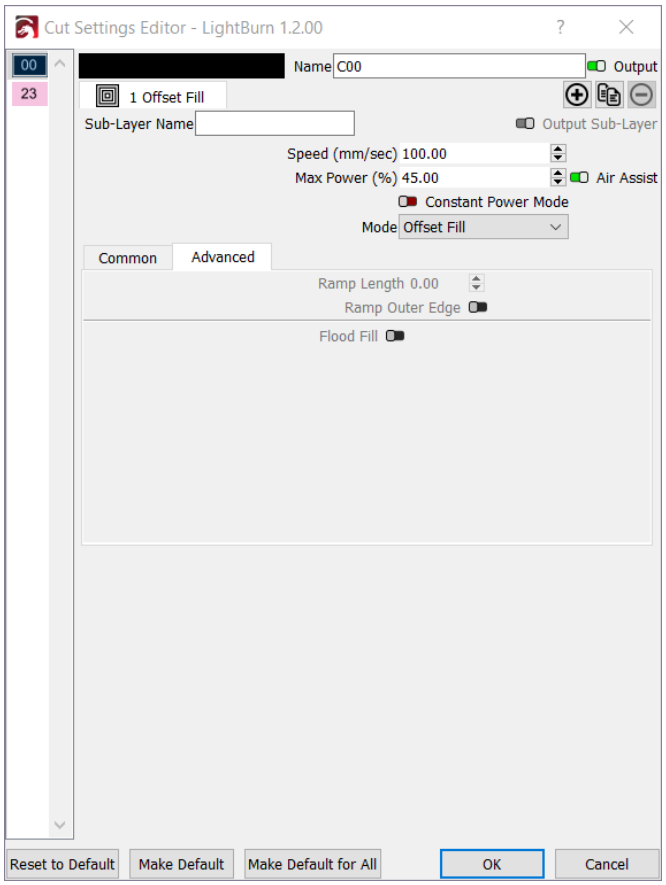
When enabled, the laser will pause and pulse at regular intervals along the path, instead of cutting continuously. The 'Time' value specifies the pause delay in milliseconds, and

the spacing parameter sets how far apart the pulses are. This can be an effective way to do stitching holes, or cut very thin or delicate materials, but the constant pausing can shake the machine - using Perforation Mode is often preferable for this reason. This setting is not available on all lasers.

CUT SETTINGS - OFFSET FILL MODE



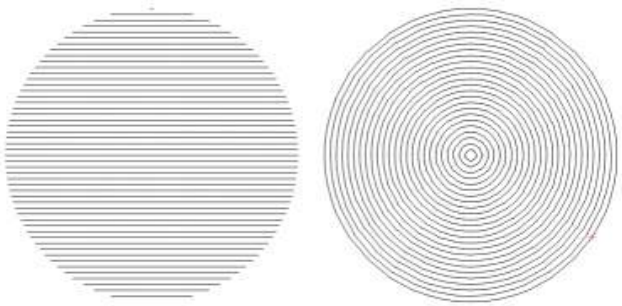
Common Settings



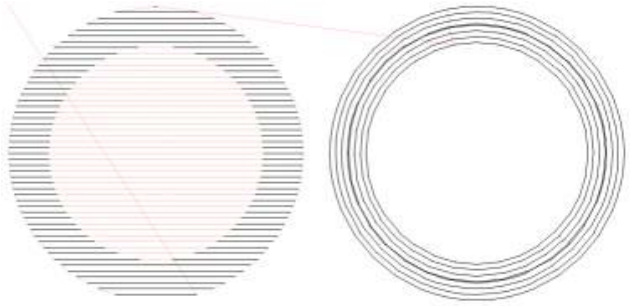
Advanced Settings

This mode will fill an outline with lines that follow the shape of the object. If you have ever worked with a CNC router, it would be called an "offset pocket" operation.

For comparison, a traditional Fill is on the left, and an Offset Fill on right.



Raster fill is preferred for general use, however offset fill can save time in certain cases if you have a slower machine, or the shape you are filling is hollow, like this:

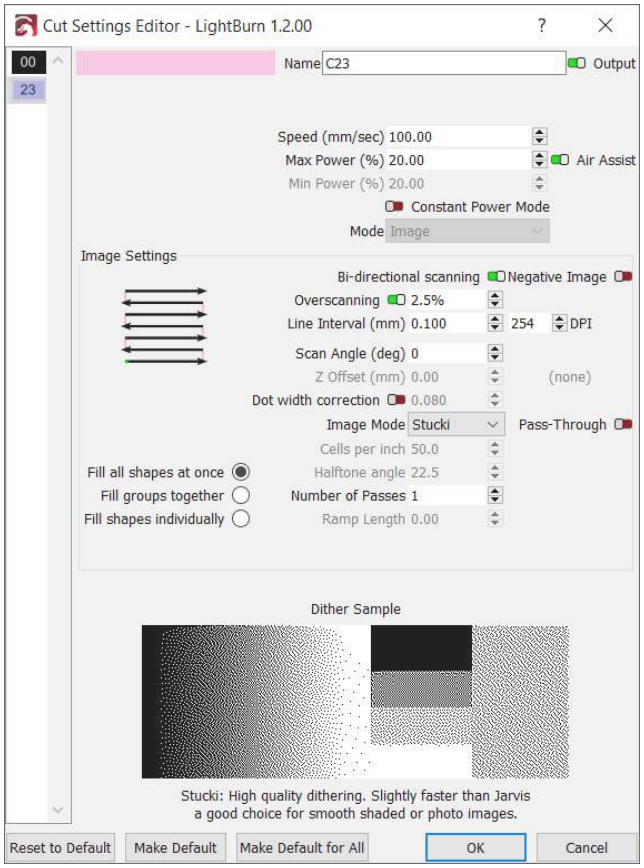


In this case, you can see that the left image has many more traversal moves (non-cutting movement of the laser, shown in red), where the right side does not. Offset fills take considerably longer to generate because the computations to generate the path are much more complex.

Aside from the differences in path generation, settings here are similar to the regular fill mode.

CUT SETTINGS - IMAGE MODE

This mode is only available for images, and lets you choose options to control how LightBurn renders the image data on the laser.



The image above shows the settings available for images. Many of these settings are also available in Fill Mode.

> **Tip**
>
> For image engravings, CO2 lasers are typically run at low power, decreasing speed if needed to make a darker engraving. Diode lasers are often run at high or even full power, depending on material and laser output wattage.

These settings do not allow you to control things like image brightness or contrast. Instead, those are set on a per-image basis and can be accessed via the Adjust Image tool or Shape Properties panel.

Bi-directional Fill

When enabled, the laser will engrave in a side-to-side sweeping motion with the laser on and engraving in both directions. When disabled, the laser will engrave traveling one way, then return to the start of the next line without engraving the return pass. Depending on the type of laser, enabling this can save significant time on long engraving jobs.

Negative Image

This will invert your image during engraving. Light becomes dark, dark becomes light. This is useful for engraving slate or glass, where burned areas become lighter.

Overscanning

When enabled, adds extra moves to the beginning and end of each line to give the laser time to speed up before firing, and slow down afterward.

When **Overscanning** is not used or not set correctly, engraved jobs appear more burned at the edges and lighter in the middle.

This is caused by the laser slowing down to change scanning direction.

Thankfully LightBurn can compensate for this by running the tool head outside the boundaries of the engraving, but with the laser off. This maintains an even speed on the engraving itself to provide a consistent engrave. You need a little more space either side of the engraving to accommodate this overscanning.

This setting will not be available for DSP controllers or Galvo lasers. See the DSP or Galvo tabs for more information.

GCode DSP Controllers Galvo Lasers

On GCode devices, enable Overscanning in your Fill or Image layer.

If you already have this enabled and you are still seeing issues, you might need a larger value for the Overscan setting, particularly if your acceleration is low.

If Overscanning is enabled on a GCode laser and there isn't enough room at the edge of the job to accommodate the extra travel distance, you may encounter LightBurn's **Cut May Be Out Of Bounds** error.

DSP controllers handle Overscanning in hardware. If a job on a DSP laser requires Overscanning and there isn't enough room at the edge of the job to accommodate it, your DSP controller may return the Not Enough Extend Space error.

Galvo lasers don't use Overscanning. Correcting for excessive burning at edges is handled by the Delay settings in **Device Settings**.

Line Interval

Controls the spacing between scanned rows, and indirectly controls **DPI**.

DPI (Dots Per Inch)

Controls the pixel density of the output - this is another way of representing **Line Interval**. DPI is 25.4 / Line Interval.

Scan Angle

Defaults to 0, meaning the laser will scan back and forth horizontally across the image, progressing from the bottom of the image to the top. If you set this to 180, the laser will

scan the image from top to bottom. Setting this to 90 will scan the laser vertically over the image, progressing from left to right.

NOTE: If you have a DSP controller, we do not advise using angles that aren't a multiple of 90 degrees. Horizontal and Vertical scanning is supported natively by the hardware, and it will automatically handle over-scanning beyond the sides of the image to get the head to full speed before engraving starts. Scanning at non-90 degree angles is emulated using normal cutting moves. It works, but it's mostly useful as a style option, and not recommended for general use.

Z Offset

If Z moves are enabled, this setting controls how much to raise or lower the Z axis when executing this fill. Lifting the laser a few mm, for example, can make the beam wider, allowing the use of larger interval values, which can make filling a large area faster.

Cells per inch

Number of Halftone shading dots to compute per inch. Only enabled when the Halftone Image Mode is selected.

Halftone angle

Angle of the Halftone shading patern. Only enabled when the Halftone Image Mode is selected.

Number of Passes

How many times to repeat the entire engraving process.

Ramp Length

Length to ramp in and out of the sides of engraved features. Typically used for rubber stamps.

Pass-Through

When working with images that have been pre-processed for laser engraving, enable this setting to engrave the image as is, rather than resampling using the image modes described below. **Line Interval/DPI** will be directly tied to the size of the image.

Image Mode

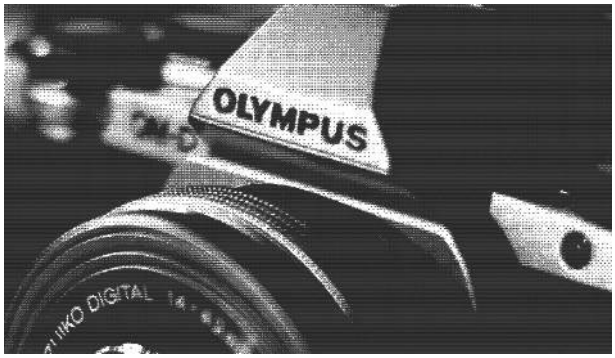
The Image Mode setting controls how LightBurn processes your image. Below you can see a description of each Image Mode in LightBurn, along with an example of how that mode changes the look of the example image. Click on the image previews to see a larger version.

Example Image

Threshold

A simple on / off switch if the image is dark / bright at a given location. This should only be used for images that are two-color black/white to begin with, such as an image you dithered outside of LightBurn. Don't use this mode for grayscale or color images.

Ordered



Also called ordered dithering, this is a step above threshold for grayscale images, and uses densely packed on/off dots to approximate shading, using an ordered/ regular grid pattern. This is ok for general use, but works best for images with large areas of solid fill, where diffusion dithering can cause unwanted artifacts (see below).

Atkinson

A good "in between" mode for solid color or smooth shaded images. It resembles Jarvis but preserves detail better, though very light or dark areas may be blown out.

Dither

Also called error diffusion dithering, this is the best choice for smoothly shaded images, like photos. This also approximates shading with simple dots, but does so without evident patterning, and tends to produce more subtle shading.

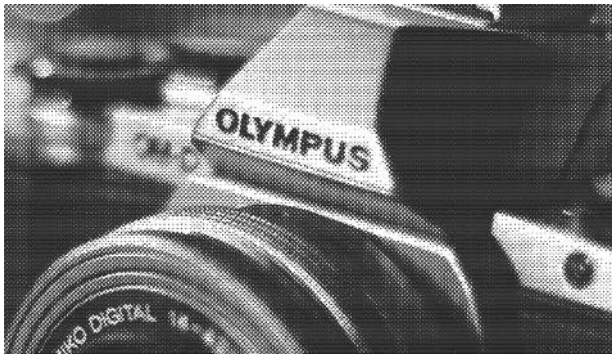
Stucki

High quality dithering. Slightly faster than Jarvis and a good choice for smooth shaded or photo images.

Jarvis

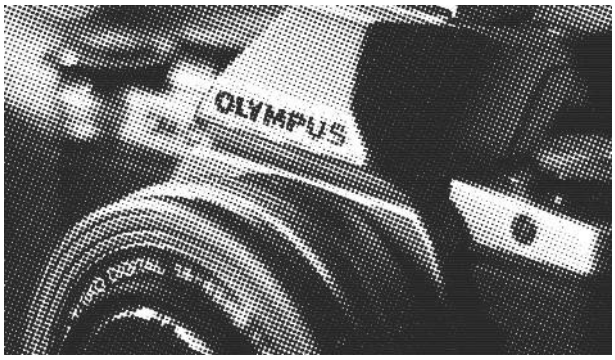
High quality dithering. Usually the best choice for smooth shaded or photo images.

Newsprint



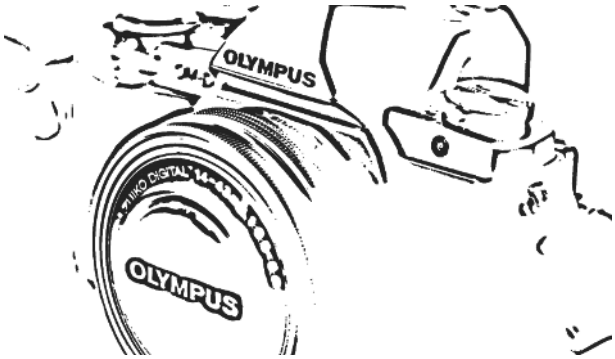
Emulates newspaper halftone. It has good shading, but is visibly patterned. Good for higher DPI settings, or Smoothieware controllers.

Halftone



Good quality shading for high DPI images. It is similar to newsprint but can have variable cell size and pattern angle.

Sketch



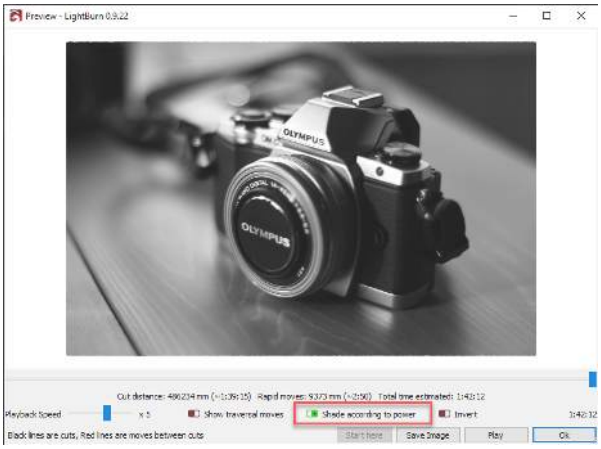
Useful for line drawings or handwriting as it tries to detect hard edges.

Grayscale

Varies power output as a percentage between Min and Max power, using Min power for the lightest shades and Max power for the darkest. With a diode laser this can provide great shading but is harder to get right than plain dithering. With a CO2 laser, grayscale mode can achieve variable depth (3D) engraving rather than shading. Images typically need to be specifically created for this use.

Note

When previewing a Grayscale engraving, be sure to check `Shade according to power` otherwise you will see a completely black preview since, unlike other modes, Grayscale scans every portion of the image, just at varying levels of laser power.



Fill Grouping

These options control which shapes are filled at the same time on the laser. If you run your laser fast, OR your laser accelerates slowly, it is often most efficient to scan things all at once, so the laser spends most of its time moving at the speed you've chosen, and less time changing direction. If you are engraving slowly, your laser accelerates fast, or the design contains a lot of blank space, it can be more efficient to fill clusters of close shapes, or just fill the shapes one by one. If you aren't sure, try different options and use Preview to estimate the time.

- **Fill all shapes at once**: The default, this setting means that everything on this layer will be filled at the same time, sweeping back and forth across the whole job. If you are running the laser fast (300 mm/sec or more) this is usually the most efficient option, with some exceptions.
- **Fill groups together**: This setting will fill all shapes in a group at the same time.
- **Fill shapes individually**: This setting fills all shapes one by one.

TABS / BRIDGES

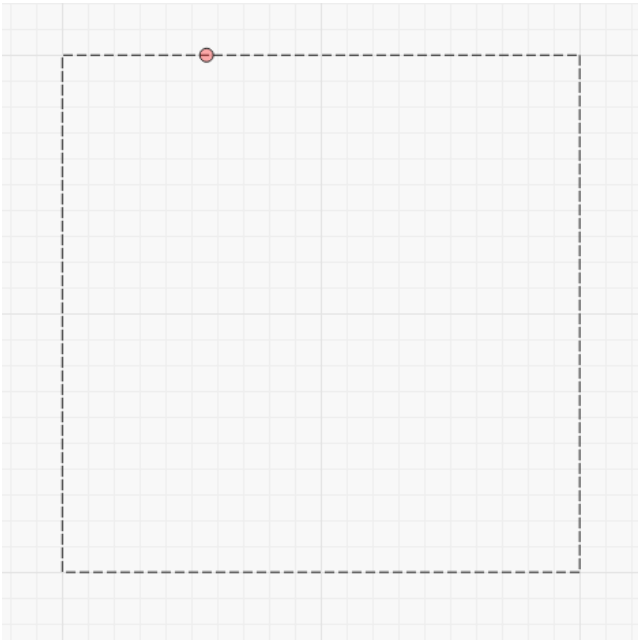
Sometimes it is helpful to include tabs (sometimes called bridges) in objects that you are cutting out so that they do not fall out immediately but can be removed later. The concept comes from the CNC world but is much simpler in the context of a Laser. Simply put, it's where you skip a very small section of a cut, often less than 1 mm in length. In the example below, the left square has no tabs applied, while the right has a single 1 mm wide tab on each side.

Basic Usage

First, note that you will need to disable **Beginner Mode** in the LightBurn Settings otherwise the tabs functionality will not be available. Once that is done, you will see the "Add Tabs" tool is available:

You can only add tabs to shapes that are in **Line** mode. Once the **Add Tabs** tool is selected you will see the **Insert Tab** cursor () when hovering over a shape which you can add a tab to.

Simply click where you would like a tab, and a red circle will apear where you clicked, denoting that a tab will be placed there.



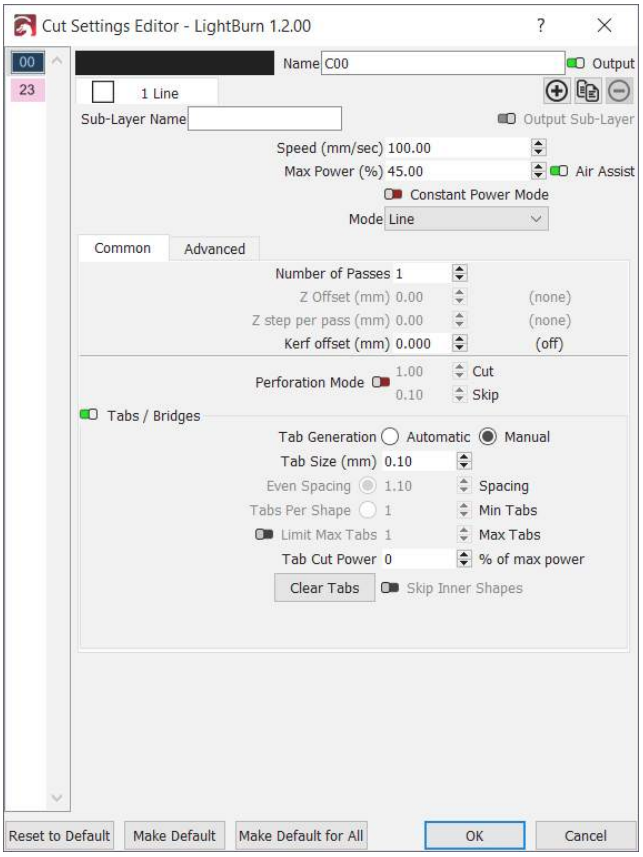
Tabs default to 0.5 mm in width and you can place many tabs on any shape. The system will, however, limit how close any two tabs can be based on the currently set tab size.

If a tab needs to be moved, simply click on it again and drag it to a new location, even on another shape.

Finally, you can delete a tab by double-clicking or shift+clicking the tab.

Advanced Usage

In a **Line** mode cut setting's option dialog you will now see a **Tabs / Bridges** section which allows more control.



Global Enable / Disable

The **Tabs / Bridges** group has a checkbox in the top-left. Flipping this to off will supress any tabs on that cut layer without losing any previously configured tabs or tab settings.

Tab Generation

- **Manual** - Any tabs must be manually placed using the methods described above.
- **Automatic** - Tabs will be placed on all cut layer shapes, based on the values of **Even Spacing**, **Tabs Per Shape**, and **Skip Inner Shapes**.

Tab Size

Defines the total length of any tabs in whatever the currently configured system unit type is (mm or inch). The system will skip cutting for this distance, if possible.

Even Spacing

When automatically generating tabs, each contiguous path section will have at least one tab applied at the very start of the path and then again at this distance interval (mm or inch depending on unit settings).

Tabs Per Shape

When automatically generating tabs, using this option will place this number of evenly spaced tabs on each contiguous path section for each shape on the cut layer.

Limit Max Tabs

This option allows you to set an upper bound on how many tabs each object can have automatically generated.

Tab Cut Power

If set to anything other than 0%, tabs will have pulsed cuts across the distance of the tab instead of just skipping it completely. In the example below, the top tab is set to 25% whereas the bottom tab is set to 75%.

Not all laser controllers can reliably vary the power mid-cut so this was a way to implement "partially cut" tabs in a consistent way. By increasing the amount it pulses on during the tab you can further weaken the tab overall.

Skip Inner Shapes

When enabled any shapes that are completely contained by another shape in the same cut layer will not have automatic tabs applied. This does not effect manual tab placement.

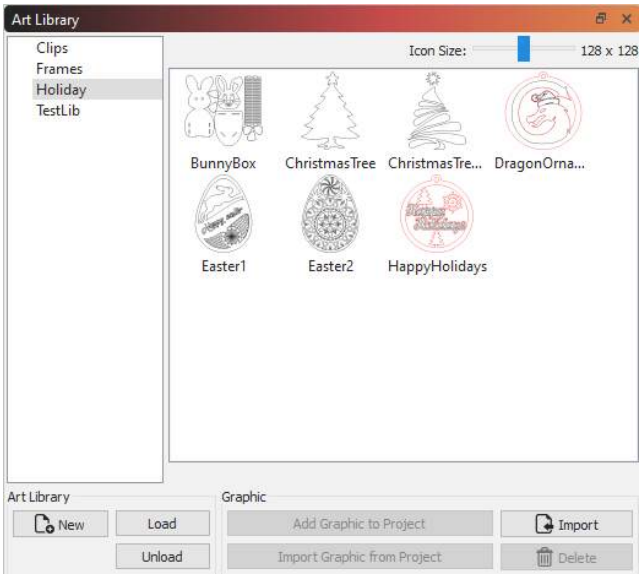
Clear Tabs

Delete all tabs (manual or automatic) from every shape on this cut layer.

Libraries **Primary Docs** **UI**

Art Library

The Art Library is a way to quickly store and recall artwork that you use on a regular basis and want quick access to when designing.



On the left side of the window it shows the libraries that are currently loaded, and the right side shows the artwork in the currently selected library. Artwork can be easily imported into the library from files on your hard drive, or from a selection in your current project. When you want to use something from the library, just grab the thumbnail from the right view and drag it into your project.

Note: The library *only* stores artwork, much like the contents of your AI, SVG, DXF, or image files. It does not store the cut or fill settings applied to the artwork.

Library Files

Each library you create is a file on your hard drive containing all the graphics inside it in a compact form. You can copy library files between computers to share the contents. LightBurn remembers which libraries you have loaded. Unloading a library file just removes it from your list of loaded libraries, but doesn't delete the file or its contents, which makes it easy to bring in seasonal or holiday specific libraries when you need them, then unload them to reduce clutter when you don't.

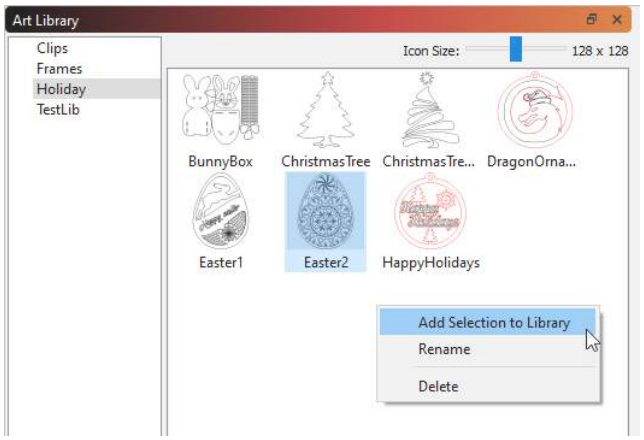
To create a new (empty) library, click the 'New' button and choose a location and a name to store the library file. Once created and selected, you can immediately start adding content to it.

Adding artwork to a Library

If you have files on your hard drive that you want to add you can click the Import button. This will let you import multiple files at once if you want to, and each one will become an entry in the current library. You can also select something in

your current project and click 'Import Graphic from Project' to add the selected artwork to the current library.

You can also right-click in the library view, like this:



From the pop-up menu, you can add the current selection to the library, rename the selected library graphic, or delete it.

Adding artwork from the Library to your project

When you want to use an item from the library, locate it in the thumbnail view on the right, then simply drag it into your project wherever you would like it to appear, and drop it. You can also click 'Add Graphic to Project' in the buttons along the bottom.

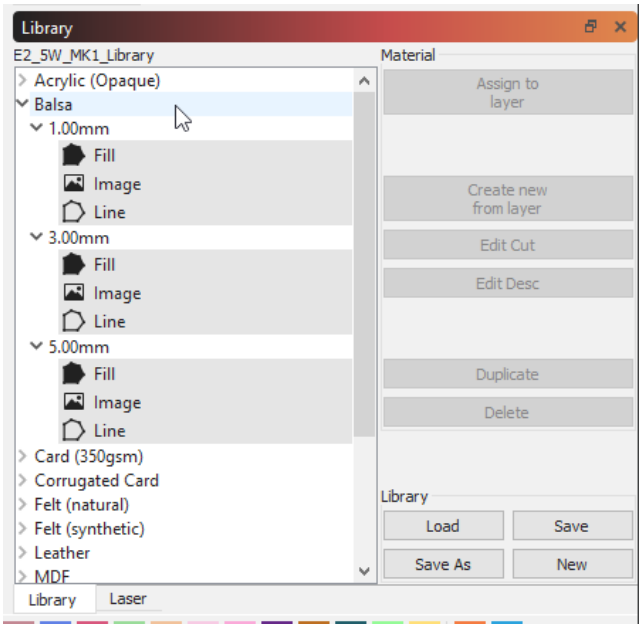
Loading and Unloading Libraries

If you have libraries that you use rarely, or are seasonal (like Halloween, Christmas, Easter, Spring, Fall, etc) you can unload them when you are no longer using them by selecting the library on the left, and clicking the 'Unload' button. This just removes it from the view, but does not delete the file from your hard drive. When you need it again, click the Load button, and locate the file on your hard drive. It will be added back to the list and usable until you unload it again.

Libraries **Primary Docs** **UI**

Material Library

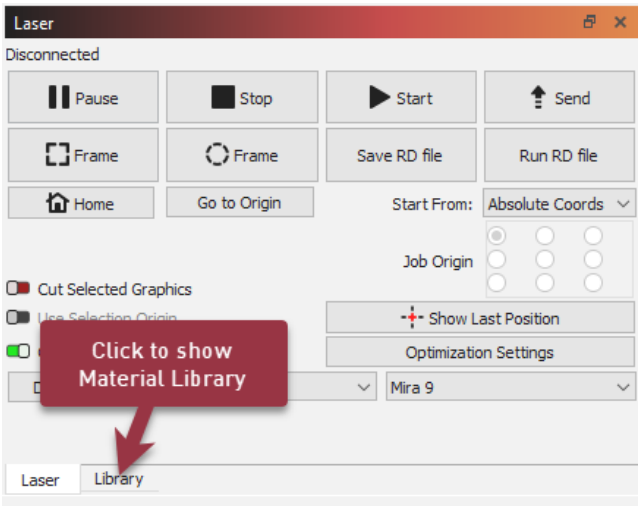
LightBurn's Material Library provides a way to store and organize presets for different operations on different materials, and have a way to quickly apply them. To add presets to the material library, you set up a cut layer however you like and save it to a library. You set a material type, thickness (if appropriate), and a short description. Libraries can be saved to shared drives to access your settings conveniently from multiple computers.



Presets can be applied to a layer by selecting the library entry and assigning or linking it to the layer.

ACCESSING THE MATERIAL LIBARY

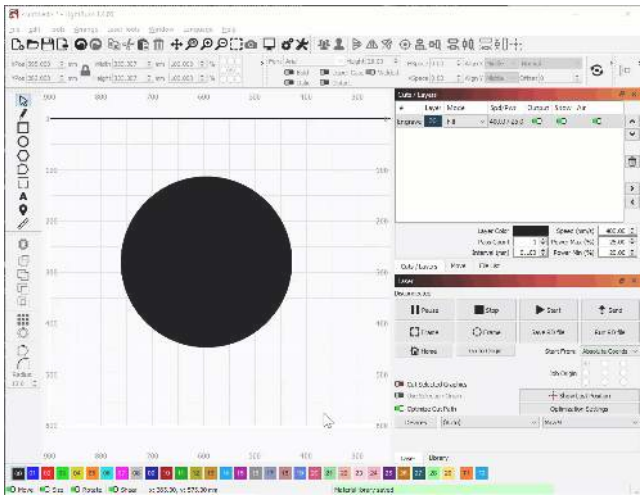
To get started, make sure you can see the **Library Window**. In the default layout, it's behind the Laser Window, so you may have to click to show it. If you don't see it there, make sure the Library Window is turned on by going to **Window > Library**.



CREATE NEW MATERIAL LIBRARY PRESETS

Material library presets are created by copying settings from existing cut layers.

1. Select one of your cut layers, then click the **Create new from Layer** button in the **Library window**.
2. Fill out the detail sheet with the **Material Name**, **Thickness** (if relevant), **Title** (if relevant), and **Description**
3. Now you can use the new entry anytime in the future by assigning it to a new cut layer.



Material Library Details

Name	Description
Material Name	The name of the material this applies to. Presets are grouped by material.
Thickness	The thickness of the material. Use *No Thickness* for surface operations like engraving or scoring that don't depend on the material thickness.
Title	Only available when *No Thickness* is selected. Used to describe the general category of preset, such as "engrave" or "score" and group presets in a similar way to grouping by thickness.
Description	Describe the preset.

USE MATERIAL LIBRARY PRESETS

Presets are used by assigning or linking them to a cut layer in your project. To assign or link a preset to a cut layer:

1. Select a layer you want to assign the preset to, or an object on that layer.
2. In the material library, select to preset you want to apply to the cut layer.
3. Click either **Assign** or **Link**

> **Note**
>
> If your current selected layer has Sub-Layers in any capacity, using "Create new from layer" will assign all Sublayer details to that object, and render with "Multi" in the Cut Settings Editor.

Assign

Assigning a material library preset to a layer is equivalent to manually copying cut settings written in a notebook into the layer settings. You can modify the layer's cut settings without affecting the saved preset, and you can modify the saved preset without affecting the layer. This is often useful as a starting point for creating new presets, or using an existing preset with minor modifications.

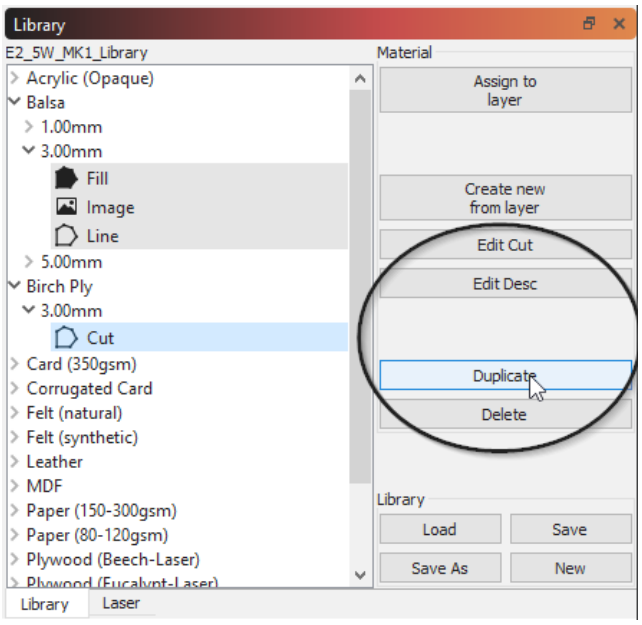
Link

Linking a material library preset to a layer will make a connection between the library and the layer. Modifying a preset will also update the layer's cut settings, and you will be unable to modify the layer's cut settings in the Cut Settings Editor unless you unlink the layer. This is often useful for files that you will be running again in the future, so that future improvements to your custom presets will be automatically applied in your project.

MANAGING MATERIAL LIBRARIES

Modify Existing Presets

Existing Material Library presets can be managed by selecting the preset's description and using the buttons on the right side of the Library window.



Edit Cut

Click **Edit Cut** to open the **Cut Settings Editor**. This allows you to change any of the cut settings as you would normally and saves them back to the library.

Edit Description

Click **Edit Description** to modify the Name, Thickness and Description for the highlighted entry.

Duplicate

Click **Duplicate** to create a copy of the highlighted entry. This can be helpful in quickly adding to your library.

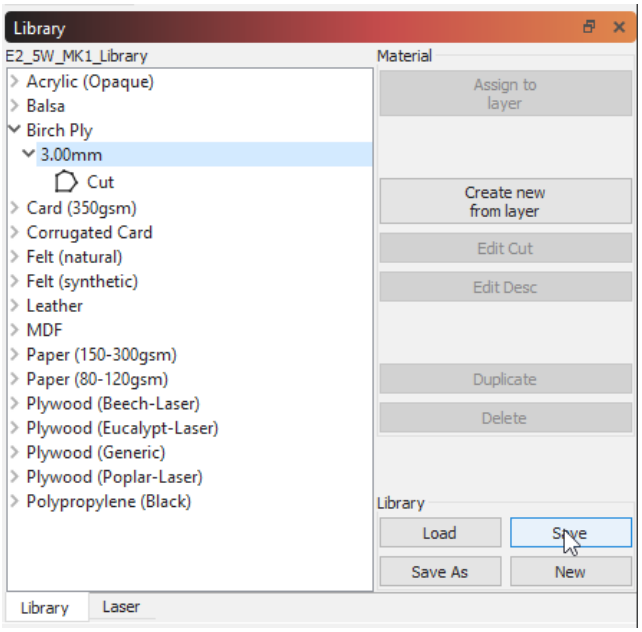
Hint: Combined with **Edit Description** and **Edit Cut** you can keep the same "Material Name" and "Thickness" to create 'nested' entries (e.g. 3 mm cut, scan and image). Keeping just the "Name" while changing the "Thickness" allows nesting of different thicknesses of the same material.

Delete

Click **Delete** to remove a single cut setting entry from the library.

Save a Library

As you fill out the Library with your favorite materials, it is always a good idea to periodically save your additions. To do this, click the **Save** button.

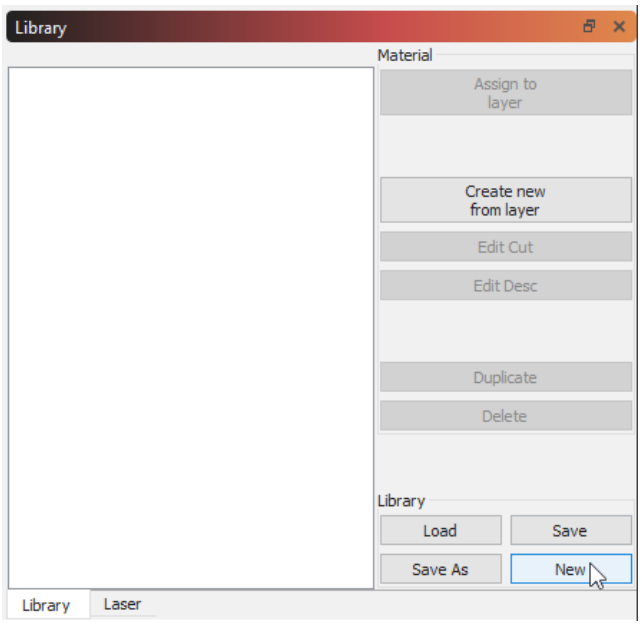


Duplicate a Library

Click **Save As** to create a complete copy of your active library and saves it under a new name of your choice.

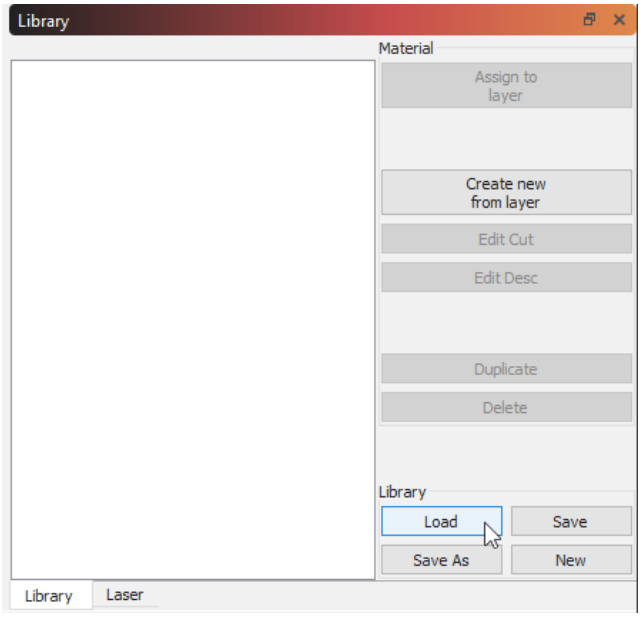
New Library

Depending on your workflow, you may want to have multiple libraries to work from. You can start a new Material Library any time by clicking the **New** button in the lower-right corner of the **Library** window. This will open a new, blank library ready to fill out and save.



Load a Library

Selecting **Load** provides access to your previously saved Material Libraries. Clicking on it will open a dialog allowing you to select and open a saved Material Library. Your chosen file will then become the active library for use.



Merge Libraries (LightBurn 1.5+)

Starting with LightBurn 1.5, the **Merge** button allows you to select a Material Library file saved on your computer to merge with your currently active library.

ADVANCED USAGE

Multiple Lasers

If you have multiple lasers, it's typically best to create a material library for each laser. When you save a library, it is linked to the currently active device. In the future, when you select that device, the library associated with it will load automatically. When you change material libraries, LightBurn

will check any linked layers against the newly loaded material library. If there's a matching preset in the new library, LightBurn will automatically transfer the link over to the new library and update the layer's cut settings.

Multiple Computers

Multiple computers can access a single Material Library file hosted on a network drive or from cloud service storage (e.g. Dropbox, Google Drive, iCloud, OneDrive, etc.). To open up a shared Material Library on a different computer, use the **Load** button in the **Library** window.

Please note that if you have multiple computers pointing to the same Material Library file, updates made from one computer won't show on the other computer(s) until LightBurn is restarted or the library is reloaded with the **Load** button.

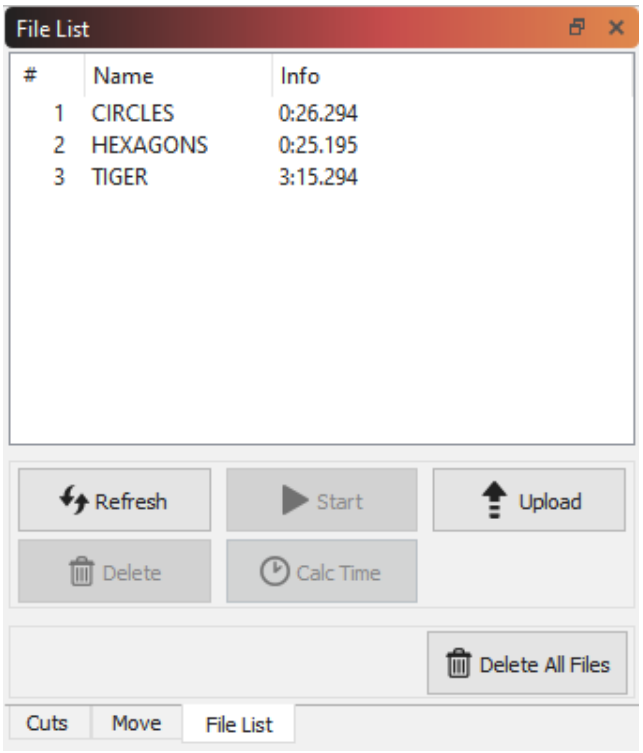
Primary Docs **Ruida** **UI**

File List Window

This window is only supported on DSP controllers that allow hosting files on the controller, and allows you to see and manage the files hosted there.

Info

If not working with DSP controllers, this menu will not present itself or be usable. This is intended behavior.



Hit the Refresh button to query your controller for the list of hosted files. You can select a file and press Start to run it, Delete to remove it from the controller, or Download to save it locally. Pressing Upload will let you choose a local cut file to send to the controller (this is not the same as the current job, which you can upload with the "Send" button in the Laser window.

It is worth noting that some controllers, particularly Ruida, can take significant time to delete a file from the beginning of the list if there are many files (or large files) following it. We suspect that the controller is compacting the internal storage when you do this, so if you are planning to delete multiple files, it is faster to delete from the end of the list first.

The 'Delete All Files' button is generally much faster than deleting files one by one.

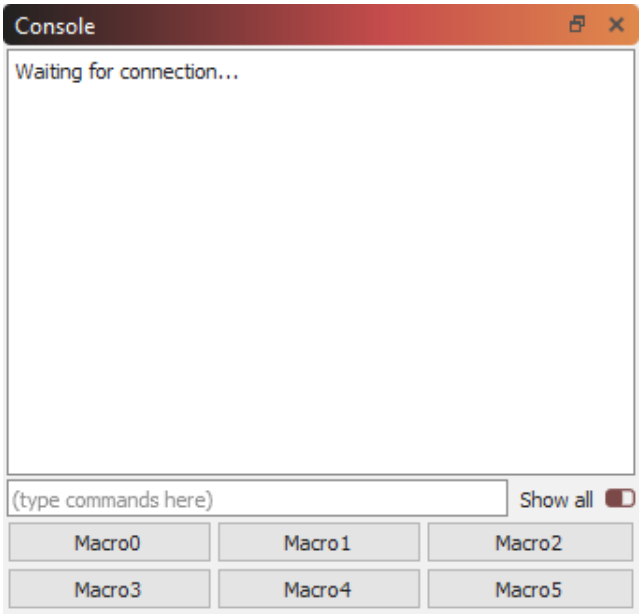
The 'Calc Time' button is available only on supported controllers (Ruida) and will compute the time taken to run the job on the controller itself. With engraving jobs this can

take a considerable amount of time to do, as the controller is basically simulating the job internally, and the math is complex. When it completes, the duration to run the file will be shown in the 'Info' column.

GRBL **Primary Docs** **UI**

Console Window

On GCode machines, the console window allows you to directly input commands and see messages from the controller itself.



You can type a command in the text box and the console will output the results. Examples would be manual GCode commands or retrieving configuration details from your connected device.

If the controller encounters an error during execution, it will be shown here as well.

If you have commands that you use frequently, you can store them in one of the macro buttons. Right-click a button to bring up the options to change the macro contents. Give the button a meaningful name, and enter one or more commands to send to the controller when the macro button is clicked.

Enable the '*Show All*' toggle switch to display all commands sent between LightBurn and your controller.

Note, the console window functions are not available on DSP controllers, like Ruida, Trocen, or TopWisdom as these are not GCode based, and do not accept GCode commands.

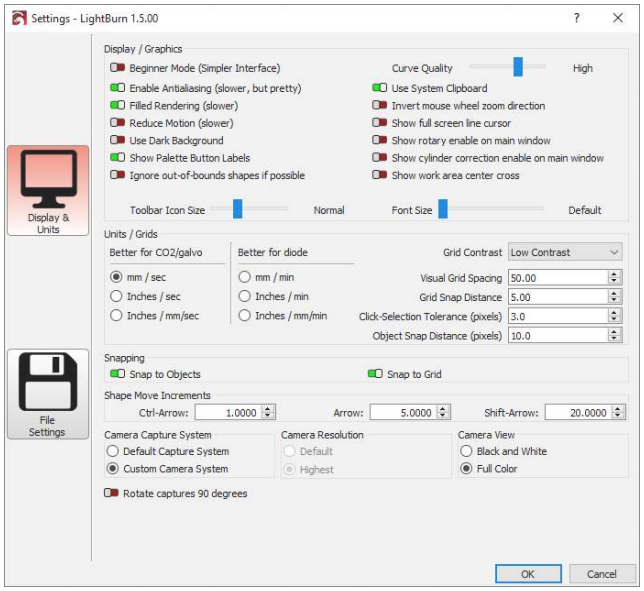
Primary Docs **Settings** **UI**

Settings

The Settings window in LightBurn controls global user preferences for LightBurn - these are the settings that apply regardless of what laser(s) you set up. These are split into two pages - Display / Units settings and File settings.

DISPLAY & UNITS SETTINGS

The first page is the display and units settings, shown below:

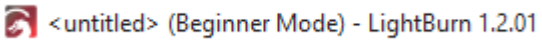


Display / Graphics

Settings in this section control the display and presentation of LightBurn.

Beginner Mode

Beginner Mode simplifies the interface by removing options new users are unlikely to use. It can be turned on and off at any time from this screen. When Beginner Mode is active, you'll see the message below in the title bar.



Beginner Mode removes the following controls from the Main Window:

- Toggles for Move, Rotate, Shear and Scale at the bottom of the window
- Optimization Settings button
- Show Laser Position
- Cut Selected and Use Selection Origin
- Many of the Align Tools from the Arrangement Toolbar are replaced with the Align Helper

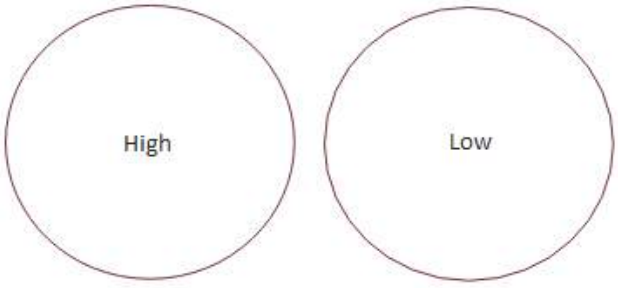
More Info

Although Beginner Mode can make it easier to get started, it also mean that your interface will look a little different than most video tutorials or screenshots you'll see.

If you're searching for a button or features and you don't see it, it might be because of Beginner Mode, but it could *also* be because you're using a machine that doesn't support the feature you're looking for. LightBurn's interface adapts to only show you the features that are compatible with your machine type.

Curve Quality

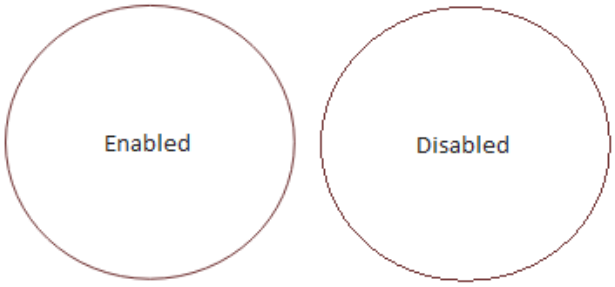
This controls the precision LightBurn uses in displaying curves on the screen. All curves are displayed as a series of short lines, but the higher this value is, the shorter those lines will be. You can see the difference below.



If you're working with files containing thousands of curves and your computer is lagging you may want to try reducing this value. If you need your curves to be very precise, you may want to increase it.

Enable Anti-aliasing

Anti-aliasing smooths the appearance of lines on your screen. Enabling anti-aliasing will make your design previews look much nicer, but does increase demand on your machine. If you notice your computer lagging, especially on older computers or when working with very complex designs, you may want to try disabling this setting.



Filled Rendering

When enabled, LightBurn will display filled shapes directly in the edit window. This takes longer than rendering the wire outlines, and it can hide things from you behind those filled shapes that may still be sent to the laser, so we recommend

using this only for spot-checking your work, and not for general editing.

Use Dark Background

Shows the main edit window using a dark color scheme which may be easier on people with light sensitivity.

Show Palette Button Labels

This setting, enabled by default, shows numbered labels on the color palette swatches, making it easier to tell the more similar entries apart. This is also useful for users with color blindness or other vision impairments.

Use System Clipboard

Enabling this makes copy and paste operations slightly slower, but allows LightBurn to:

- Copy and paste across different runs of LightBurn, or between two running copies of the app
- Paste images copied from other software or web browsers
- Paste text directly into the edit window, auto-creating a text object for you

Invert mouse wheel zoom direction

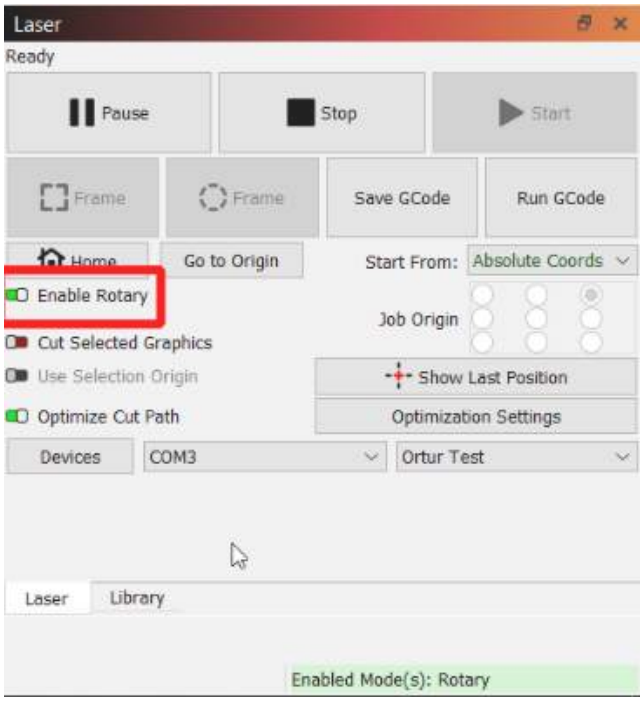
This toggle allows users to override the scrolling behavior within LightBurn to better match their preferences for macOS or Windows.

Show full-screen line cursor

When enabled, this feature draws a cross-hair that spans the entire edit screen, which can make it easier to line up graphics.

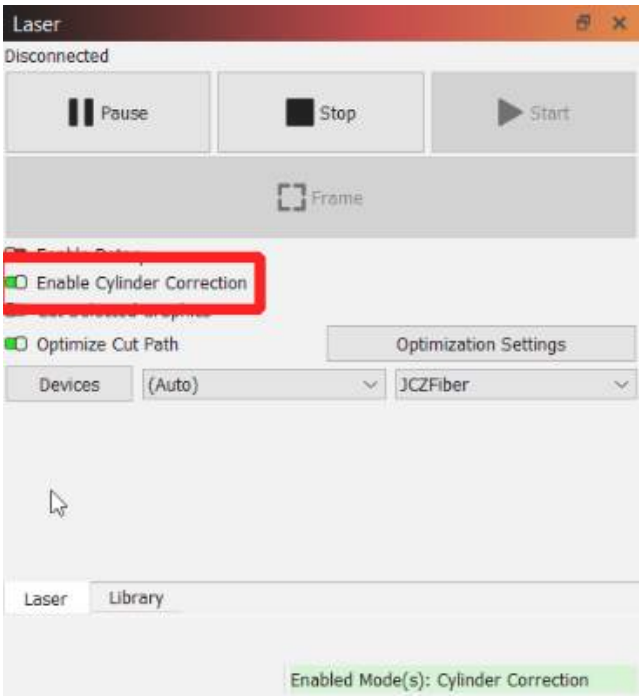
Show Rotary Enable on Main Window

This adds a toggle to the main window in the Laser pane to easily confirm whether rotary is enabled or not at a glance.



Show Cylinder Correction Enable on Main Window

This adds a toggle to the main window in the Laser pane to easily confirm whether cylinder correction (for engraving of cylindrical objects without a rotary) is enabled or not.

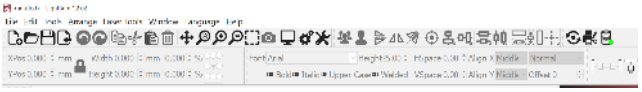


Toolbar Icon Size

This slider allows you to manually change the scaling of icon elements in the LightBurn UI. This allows for manual overrides for HiDPI screens, UI scaling, and visually impaired users. Not all UI elements may fit on screen if increased too high.

Font Size

This slider allows the end user to decrease or increase the font size for LightBurn window text anywhere in the program. This allows for manual overrides for HiDPI screens, UI scaling, and visually impaired users. Not all UI elements may fit on screen if increased too high.



Info

Setting either of these sliders to be too high may result in clipping of UI elements, due to being an assumed size. If you scale them up or down such that you cannot reach the menu items to open the menu and shrink them, please use the methods listed here to reset LightBurn to the default layout.

Units & Grids

Inches / mm

LightBurn internally operates in millimeters, but can display in either millimeters or inches. Speeds can be represented as either units per second or units per minute. Users with diode lasers will likely prefer the units per minute setting, whereas CO_2 lasers generally express speeds using units per second.

Grid Contrast

This allows you to adjust the brightness of the grid in LightBurn's main window relative to the background.

Visual Grid Spacing

The visual grid is set to 10 mm by default. Note that this is independent of the Grid Snap setting below.

Grid Snap Distance

Positioning of lines and other primitives will snap to the Grid Snap distance unless overridden using the Ctrl key. The default for this is 1 mm.

Click Selection Tolerance

This is how close you have to be to a line or vertex, in screen pixels, to click it. Increase this number if you have trouble selecting things, decrease it if you find yourself selecting things you didn't mean to.

Object Snap Distance

Controls how close, in screen pixels, your cursor has to be to an object vertex or center to engage the object snapping behavior.

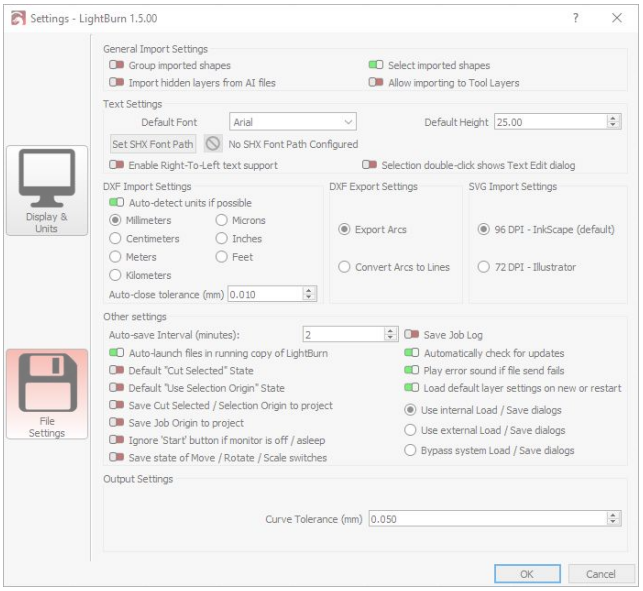
Snap to Objects / Snap to Grid

LightBurn has two snapping behaviors which can be enabled and disabled here. Snap to Objects will snap your pointer location to the nearest object center or vertex when creating new objects, or drawing lines, making it easier to connect and align shapes. Snap to Grid will snap your cursor position to the nearest grid location, as specified by the Grid Snap value. Note that the Grid Snap and the Visual Grid do not have to be the same.

Shape Move Increments

When moving objects with the cursor keys in the edit window, these values control the distance to move the selection, when using the arrow keys by themselves or with the Control or Shift modifiers.

FILE SETTINGS



General Import Settings

Group Imported Shapes

This toggle groups shapes imported from a single file together automatically, so they don't get scattered in a complex design.

Select Imported Shapes

This permits LightBurn to automatically select the shapes imported from a file in your editor to adjust and edit them as needed without needing to manually select them.

Import Hidden Layers from AI Files

When importing AI (Adobe Illustrator) files, you may want to import layers hidden in the source file for construction, design, etc. for lasering.

Allow Importing to Tool Layers

Enable files to be imported directly to LightBurn's tool layers.

Font Settings

Default Font

This is the font LightBurn will attempt to use for all blocks of text made with the Create Text Tool.

Default Height

This is the default height (in millimeters) of text LightBurn will attempt to make when using the Create Text Tool.

Set SHX Font Path

LightBurn allows the use of SHX fonts for single-line & quick text to laser. LightBurn will attempt to load them from the folder specified in this dialogue.

> **Info**
>
> It's suggested that this folder is placed in a location you can easily access, your Documents folder, where you store your LightBurn projects, etc. It is *not* suggested this is stored within the LightBurn application folder installed by default at `C:\Program Files\LightBurn\`.

Enable Right-to-Left Text Support

This allows LightBurn to render and utilize fonts for languages that are intended to be used right-to-left, such as Urdu.

Selection double-click shows Text Edit dialog

If enabled, double clicking on a text object *with the selection tool active* will open the text edit dialog. If disabled, or if the text tool is active, double clicking will allow you to edit the text directly in the main window.

DXF Import Settings

Units

DXF files do not store the measurement system that was used to create them. If you create an object that is 5 inches wide, it might import as 5 mm wide, because LightBurn can only see the '5'. Similarly, if your object was created in microns, it might import huge. Set this value as appropriate before importing DXF files to ensure correct scaling.

Auto Close Tolerance

DXF files are often saved as a collection of discrete pieces, instead of continuous paths. The Auto-Close Tolerance value tells LightBurn to connect any lines or curves that are on the same layer and closer together than this value.

Other Settings

Auto Save Interval

You can set the frequency of your auto-save by adjusting the value in minutes here. Setting the auto-save interval to 0 disables the automatic backups.

Auto-launch files in running copy of LightBurn

This toggle attempts to open any LightBurn project files opened on your computer within a running copy of LightBurn, rather than opening an additional copy of the program.

Save Cut Selected / Selection Origin to Project

This saves the cut selected and selection origin items to the file you're currently editing in, for any number of files.

Save Job Origin to project

This saves specific information about the origin of your job to the project. One example of a potential use is a "custom origin" when using a jig or fixture for your laser.

Ignore 'Start' button if monitor is off / asleep

This toggle prevents you from accidentally starting the laser by presing the wrong key when waking the computer. This is particularly useful on lasers that don't have enclosures with safety interlocks, such as most diode and galvo lasers.

Save state of Move / Scale / Rotate switches

This stores the state of the Move, Scale and Rotate switches to persist across multiple uses.

Save Job Log

This instructs LightBurn to save which project file was run, on what laser profile, and at what time.

Automatically check for updates

This permits (or denies) LightBurn the ability to automatically check for updates to itself, and inform you of them. This may be useful if your license is out of date and you want to hide the update notification.

Ignore out-of-bounds shapes if possible

This instructs LightBurn to not send shapes outside your work area to your laser, permitting use as a construction area.

Play error sound if file send fails

This produces an audible chime in the event uploading a file to a DSP controller fails.

Load default layer settings on new or restart

Colors normally start with their last used settings. If this option is enabled, a new drawing will have a clean slate with default color settings for all layers. Default settings can be updated using the "Make Default" Button in the Cut Settings Editor. If this option is enabled, it may make sense to also use Material Libraries to store layer settings and make them easy to reuse.

Use Internal Load / External Load / Bypass Load

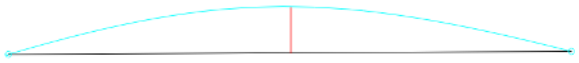
These settings permit you to use non-native system dialogues to perform file/save/open operations with LightBurn. This can be useful to avoid crashing or hanging on certain programs modifying or using native dialogs.

Output Settings

Curve Tolerance

This setting is similar to the Curve Quality setting above, except that it controls the quality of output to the laser. Because it specifies the maximum amount of error allowed, the *lower* the value, the more accurate the curve will be. A value of 0 would be "perfect", but would create very dense data, as some lasers can only process line segments. Most users will be fine leaving this at the default value of 0.05 mm.

Technical Details



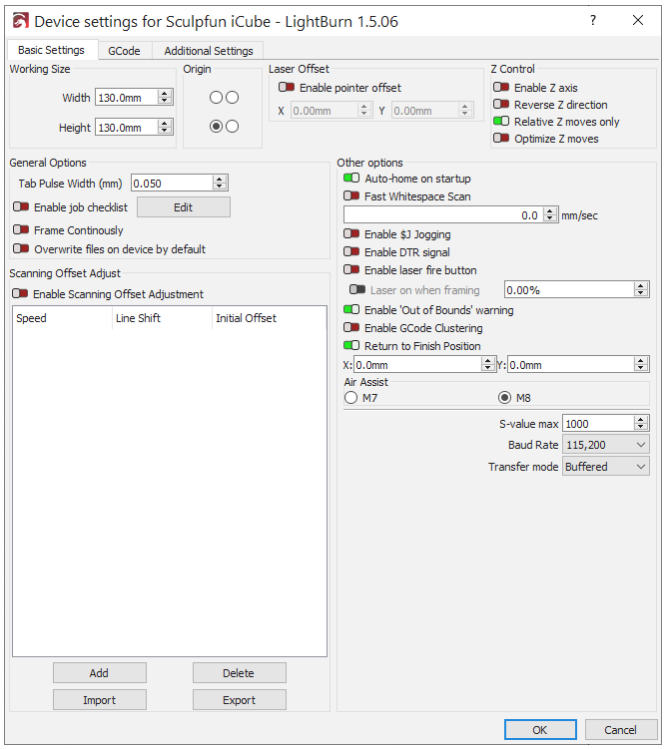
In the above image, the blue curve between the two points is the ideal shape. The black line is a straight line between them, and the red line shows the error (how far the line is from the curve). LightBurn measures this error, and if it's equal to or lower than the Curve Tolerance value, it outputs the straight line. If not, the curve is subdivided into two linear segments and the process repeats with each new segment. Those segments are shown below in violet, along with their new error values. You can see that the two new lines do a much better job of approximating the original curve.

Most people will probably never need to change this - the default is 0.05 mm, which is about ½ the width of a typical beam. Note that this is the *maximum* error value allowed, typical output will be better than this, and this only affects curves, not straight lines or vertices — which are exact.

Primary Docs **Settings** **UI**

Device Settings

The **Device Settings** window controls device-specific settings for your laser. To change these settings, select the appropriate device in the **Laser** window and go to **Edit → Device Settings**. The settings for GCode and DSP devices are described below. For Galvo devices, please see Galvo Settings.



The Device Settings window as seen with a GCode device.

The Device Settings window is split into several tabs, not all of which will be available for all machines.

- **Basic Settings** contains the most commonly used settings.
- **GCode** allows for modification of the GCode output for GCode devices.
- **Additional Settings** controls the settings used for simulating a preview and estimating time.
- **Custom GCode** allows for advanced GCode customization when using the **Custom GCode** device type.

Basic Settings GCode Additional Settings Custom GCode

BASIC SETTINGS

This tab is available for all devices, and contains the most commonly used settings.

Working Size

The maximum X (**Width**) and Y (**Height**) travel for your laser. This affects the work area in LightBurn, but does not affect the laser itself.

Origin

The location of your laser's **Origin**, or home. If this is set incorrectly, the orientation of your laser's output will be mirrored or inverted.

For help with troubleshooting your laser's Origin, please see Troubleshooting: Wrong Orientation.

Laser Offset

If your laser has a red-dot pointer for framing, this setting allows you to compensate for misalignment between the pointer and the actual cutting location.

This setting defaults to disabled, but you can enable it to shift the laser's output relative to the red dot. Expand the box below for tips to calculate the offset.

Adjusting Laser Offset

1. Mark a location on a piece of material to use as a reference.
2. Make sure **Start From** in the **Laser** window is set to **Current Position**, and line up the red dot with the location you marked.
3. Burn a small dot or intersecting lines at this location. Make sure you have an easily identified point at the **Job Origin**. You may need to change the Job Origin setting in the Laser window.
4. Measure the distance between the reference point you originally marked and the actual point you engraved with the laser to determine what offset you need, and enter those values for X (horizontal offset) and Y (vertical offset).
5. Check that your adjustment is correct by repeating the process.

Enable U Axis

Enable this setting to apply per-layer U Axis offsets. This is not supported by all controllers.

Z Control

This section contains settings for your laser's Z axis, which controls the distance between the laser and the workpiece. The options available will vary depending on what laser you're using.

Enable Z Axis

Enable this to allow LightBurn to control the Z axis of your machine.

Warning

Enabling this setting means that LightBurn will *always* emit Z values for a running job. If using this setting, you *must* either enable **Relative Z moves only** or set a **Material** height value in the **Cuts / Layers** window.

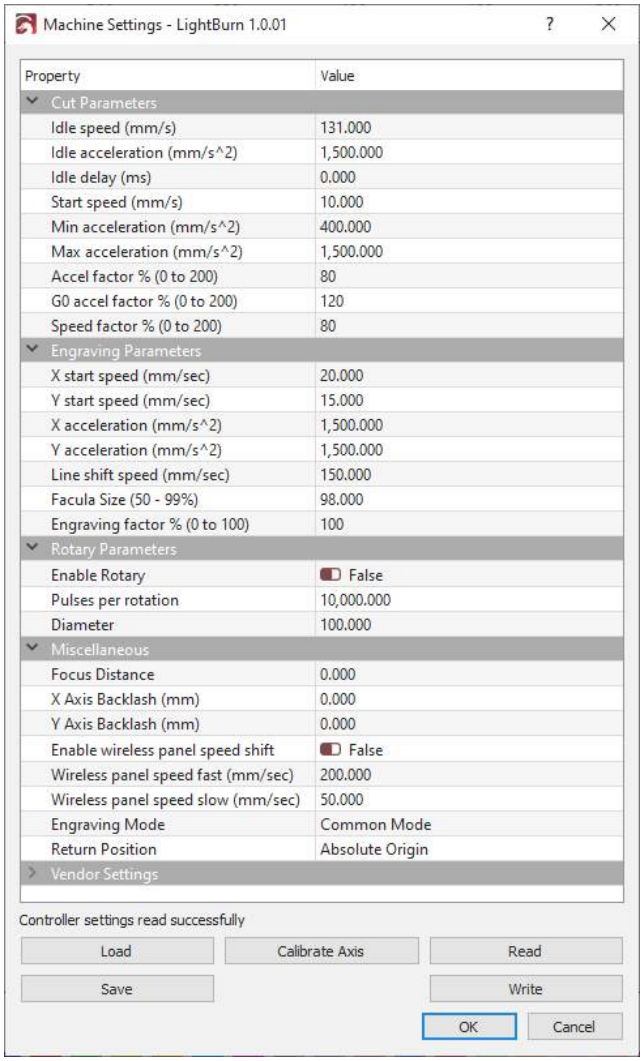
If you do not take either of these steps, the default Material height of 0 may result in your laser head

Primary Docs **Settings** **UI**

Machine Settings

Many of the controllers supported by LightBurn have user configurable device parameters and, in many cases, you can edit those parameters directly from the `Machine Settings` dialog in LightBurn. Notable exceptions are Smoothieware and Marlin, which do not currently allow use of the `Machine Settings` dialog.

While connected to your machine you can go to `Edit > Machine Settings` and will be presented with the following dialog (sometimes after a brief delay while the parameters are read from the controller):



The content of this dialog will be different for every controller type so we won't go through every option and value here. The parameter names are intended to be relatively self-explainatory but if you do not understand what something does, definitely do not just go about changing it. Look in the documentation for your controller or search on the LightBurn Forums for more info.

We would like to specifically call out the `Vendor Settings` section that will appear for Ruida controllers. These settings are typically set at the factory where your laser was manufacturered or configured and it's best not to touch any of these unless you **really** know what you are doing.

Beyond the parameters that you can change there are five operations that can be taken with the buttons at the bottom of the dialog:

WRITE

Write all currently modified parameters back to the controller. This **must** be clicked before you close the dialog as the parameters are not sent to the controller as you change them, only after clicking the `Write` button.

READ

This will reload the settings from the controller. Note that any changes you made will be lost if you have not written them to the controller first.

SAVE

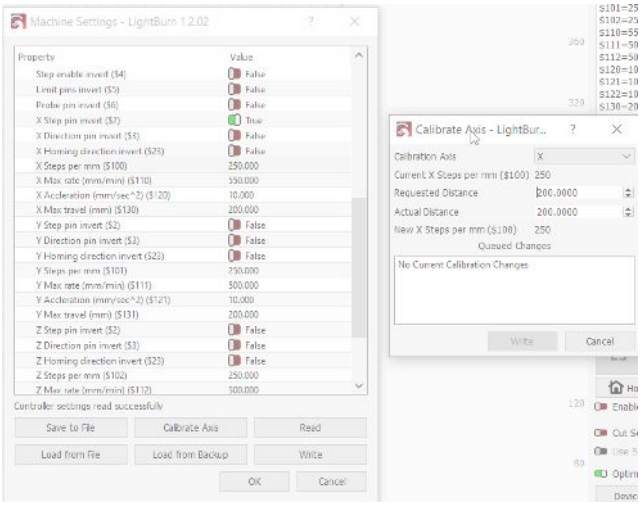
Save the controller parameters to a `.lbset` file. This allows you to backup your controller parameters so they can be reloaded later in case of accidental change or loaded on another machine which you would like to be configured in the same way.

LOAD

Load a `.lbset` file and overwrite the current controller parameters with its contents. **Warning:** this will overwrite **all** parameters! Be sure to back up what you had first with the `Save` option and **only** load parameters from a known and trusted source!

In some cases your laser manufacturer will actually provide this file for you, as a backup.

CALIBRATE AXIS



The `Calibrate Axis` tool is provided as a shortcut to getting your machine axis movement distances dialed in and setting the `steps/mm` parameter on your controller. Please note that this is no replacement for knowing the true `steps/mm` value for *your specific machine*. You can read more on our steps/mm page.

To use this tool, you will need to follow these steps:

- Choose an axis to calibrate with the `Calibration Axis` option. This will display the current `steps/mm` setting directly below.
- Choose a distance you want to move that axis as a test. 200 mm, for example. Then enter that in the `Requested Distance` field.
- Instruct your laser to move that distance. If you cannot do that from a built in control screen, you may have to back out of `Calibrate Axis` and use the jogging functions on the Move Window to move the selected distance.
- Measure the actual distance moved in whatever way is easiest for your particular machine, with the most accurate measurement tool you have. Calipers or a ruller with fine degredations would be best.
- Back in the `Calibrate Axis` dialog, enter the measured value into the `Actual Distance` field. This will show you the newly calculated `steps/mm` value below.
- Finally, click on the `Write` button to persist this value to the controller.

Note: It may require multiple iterations of these steps to dial everything in to an acceptable level of accuracy, especially with less accurate measuring tools. Though, the larger the `Requested Distance` value, the easier it is to measure the difference. Simply repeat the same steps, using the same requested distance each time. The new `steps/mm` value should continue to become more accurate the more times you repeat this process.

5.5.3 Tools & Wizards

Primary Docs **Tools**

LightBurn Tools & Wizards

This is a list of all the standard tools offered in LightBurn to make your projects easier and to edit your designs more directly.

IMAGES

- Image Adjustment
- Image Tracing
- Image Masking

ALIGNMENT & FIXTURING

- Center Finder
- Snapping Tool
- Docking Tool
- Cut Shapes

EDITING & MEASURING

- Edit Nodes Tool
- Measure Tool / Ruler
- Modifier Tools
- Two-Point Rotate
- Tab/Slot Resizer

GENERATORS & VARIABLES

- Material Test Generator
- QR Code Creator
- Variable Text
- Formatting

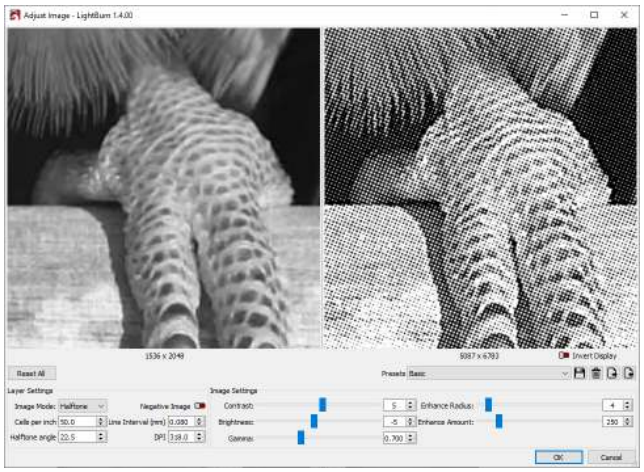
Primary Docs **Tools**

Adjust Image Tool

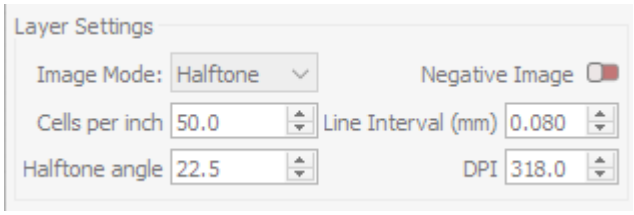
The Adjust Image tool is designed to greatly simplify the process of tweaking image properties such as contrast, brightness, and gamma while also changing the engrave settings. Best of all it allows you to instantly see the results of these changes with both the image properties and engrave settings applied.

The Adjust Image tool can be accessed by selecting any single image, right clicking, and choosing the `Adjust Image` option.

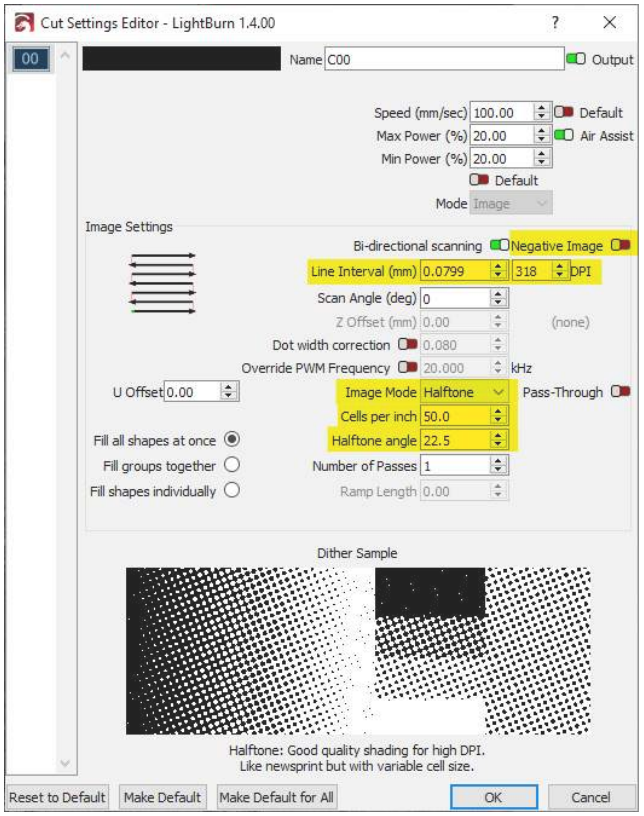
On the top left the original grayscale source image is displayed. On the top right is the processed result of the chosen settings. Just like in the main edit window, you can use the mouse scroll wheel to zoom in and out on the image and clicking and dragging to move the image around. The source image and output image are kept in sync while zooming and moving around.



LAYER SETTINGS



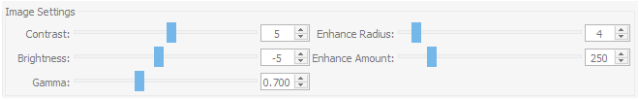
The Layer Settings group on the left contains settings that correspond directly to those found in the Cut Settings Editor, as highlighted below:



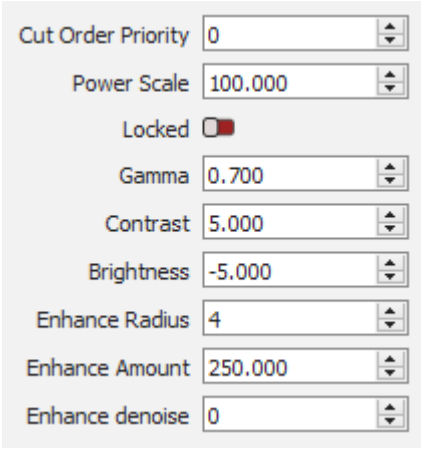
When adjusting an image and changing these settings, it will update those values on the cut layer currently used by the image selected when you click the OK button. If you click Cancel, nothing will be changed. It should be noted that these settings will affect **any** image on the same layer.

The most important setting here is the "Image Mode" dropdown as it will allow you to choose from the various image processing modes we have. Unlike changing this setting from the Cut Settings Editor, you get to see what that image mode looks like immediately, side-by-side with the source image.

IMAGE SETTINGS



The Image Settings group on the right contains settings that correspond directly to those found in the Image Shape Properties panel. In the Adjust Image window, they're provided as easy to use sliders, so that you can very quickly tweak these values to get the desired result.



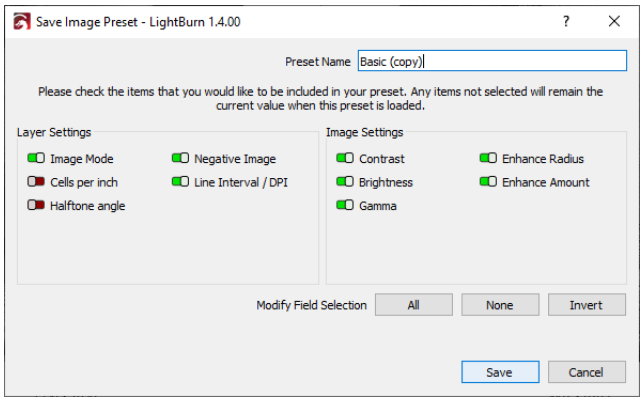
PRESETS

LightBurn offers two image presets within the **Adjust Image** window, as well as the option to save your own frequently used image settings as custom presets.

The **Basic** preset is a good starting point for your own engravings or custom presets. The **Black Paint on White** is similar, but inverted for engraving light marks onto dark surfaces.

Save Image Preset

The first button next to the **Presets** dropdown allows you to save your current settings as an image preset. You can choose which layer and image settings are included in the preset. Any settings not included won't be changed when the preset is loaded.



Delete Image Preset

The second button allows you to delete presets. Make sure the preset you want to delete is selected in the dropdown first.

Export/Import Image Preset

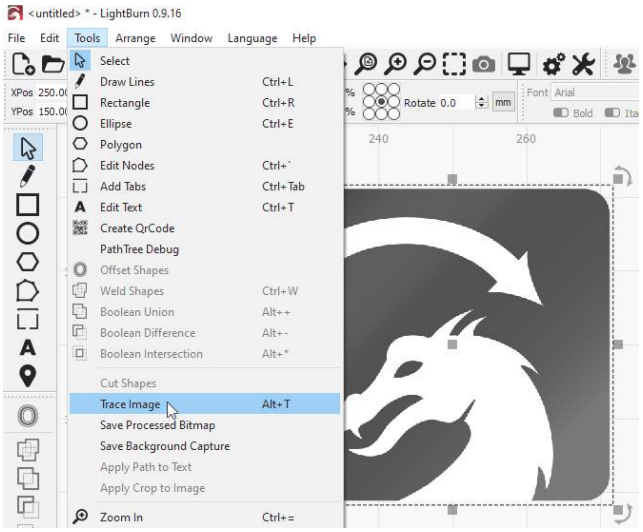
The third and fourth buttons allow you to export and import image presets, which is useful for backing up your presets and for moving them between computers.

Tracing Images

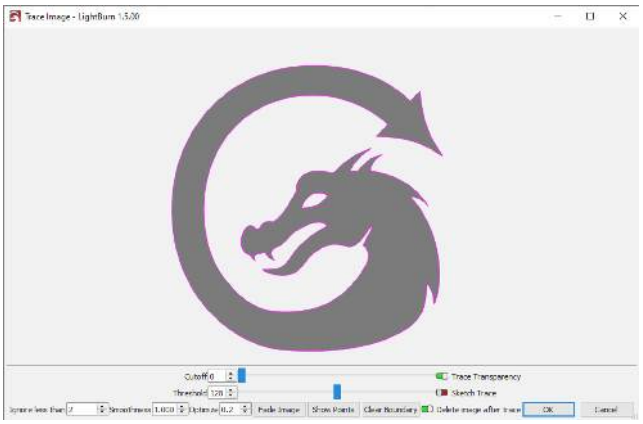
LightBurn has a feature that will trace the outline of a bitmap image and convert it to a vector graphic. This works best for content that has very clear edges, like a silhouette or a cartoon. It does not work very well for photographs, though with some cleanup those may be usable as well.

We have an excellent tutorial video for this feature on our YouTube channel here: Image Tracing Tutorial

To start, import an image object into LightBurn, select it, then choose **Tools -> Trace Image** from the menu or press Alt + T. You can also select an image, then right-click and choose Trace Image from the pop-up menu.



You'll be presented with the Trace Image dialog, with your image showing in the window, like this:



In the image above, the purple lines are the vectors that LightBurn has produced from the image being traced. If you want to be able to see them more clearly, click the "Fade Image" button, and the image will dim. You can also zoom and pan using the same controls as the preview window (mouse wheel to zoom, and click-drag the view with either left or middle mouse).

CONTROLS

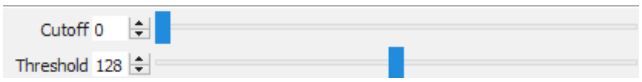
The preview window can be panned and zoomed just like the edit window, using the middle mouse button to pan and the

mouse wheel to zoom. Double-clicking the middle mouse button resets the view.

Cutoff and Threshold

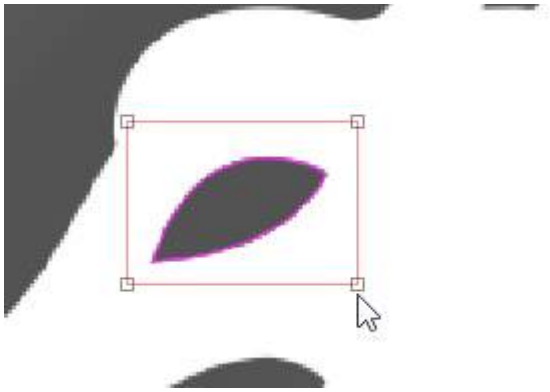
The **Cutoff** slider controls the lower end of the range of values that LightBurn will outline with vectors, and the **Threshold** slider sets the upper end. The default is 0 to 128, which traces around all values in the range of 0 to 128 brightness, excluding lighter values in the range of 129 to 255 brightness.

By adjusting these two controls, it is possible to trace around a narrow range of the image.



Selection Area

By clicking and dragging within the trace window you can specify a portion of the image you would like to trace. Once the area is defined, you can grab and drag a corner of it to adjust, or just single-click to reset it.

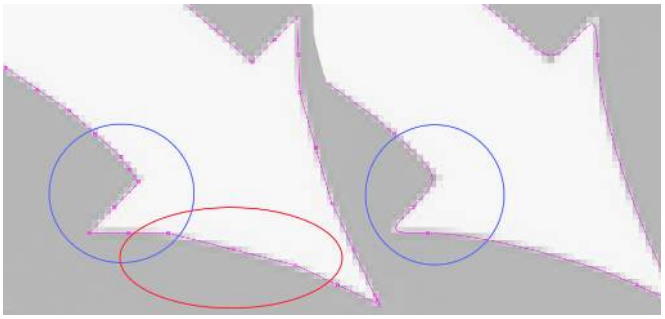


Ignore less than

This setting tells the tracing tool to ignore anything smaller than this many pixels in area. If you are trying to trace a noisy image, increasing this may help.

Smoothness

Image tracing determines how aggressively the trace tool smooths out the shapes it generates. A value of 0.0 will produce entirely straight lines, while the maximum value of 1.333 will make almost everything into curves.



*The shape on the left was traced with a **Smoothness** of 0, and produced a jagged result. The shape on the right was traced with a **Smoothness** of 1.333, and produced overly soft corners.*

The default **Smoothness** value of 1.0 is generally a good starting point to produce smooth curves without losing sharp corners.

Optimize

After generating lines and curves, the image trace feature will attempt to merge similar lines and curves together to reduce the node count of the result. The Optimize parameter controls how aggressive this is. 0 means no merging. The default of 0.2 is a nice balance between accuracy of the result and node count.

Fade Image

Dims the image to make it easier to see the resulting vector shapes

Show Points

Enables the display of the points (nodes) of the resulting vector trace. Enabling this is useful when you are tuning the Optimize parameter to see the resulting points.

SKETCH TRACE

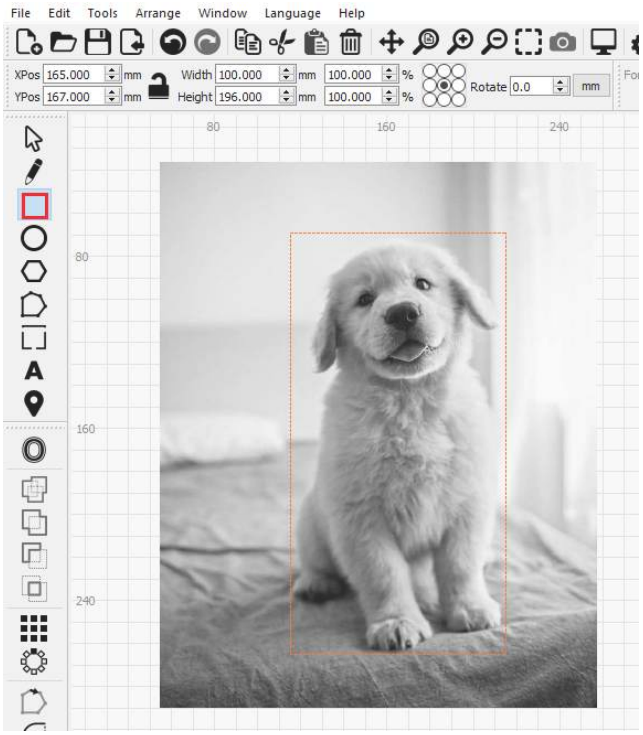
Sketch trace is intended to help with tracing handwriting or hand-drawn images, for instance tracing a recipe to engrave onto a cutting board. Without this setting, the threshold used to determine whether a pixel is filled or empty is consistent across the entire image. With this setting activated, LightBurn will consider its pixels neighbors more heavily to compensate for inconsistencies in both lighting and the darkness of the image you're tracing. You can see more at this timestamp of our tracing video.

Image Masking / Cropping

If you have an image for which you would like to only engrave a portion of that image, you can use the **Image Mask** feature to mask off the area of the image to be engraved. At the simplest this is the same as doing a basic crop to the image, but you can go so much further than that with masking.

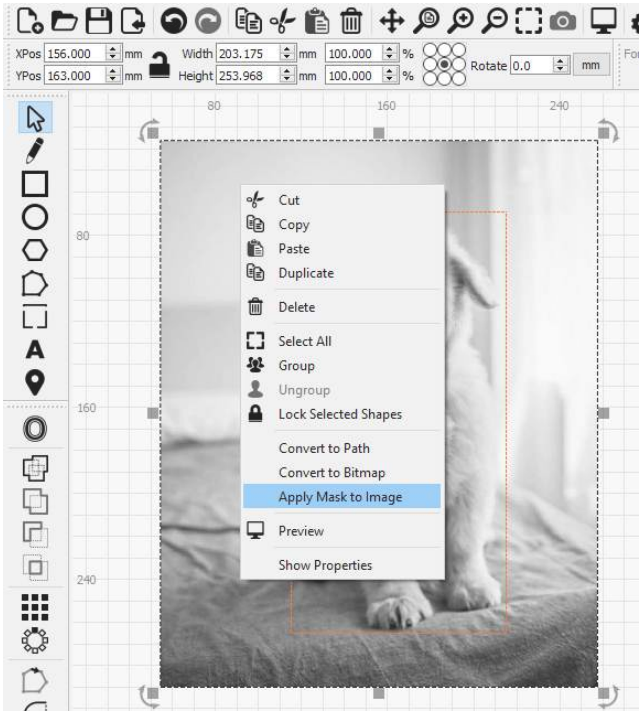
BASIC USAGE

At the simplest this process consists of an image and single, simple shape:



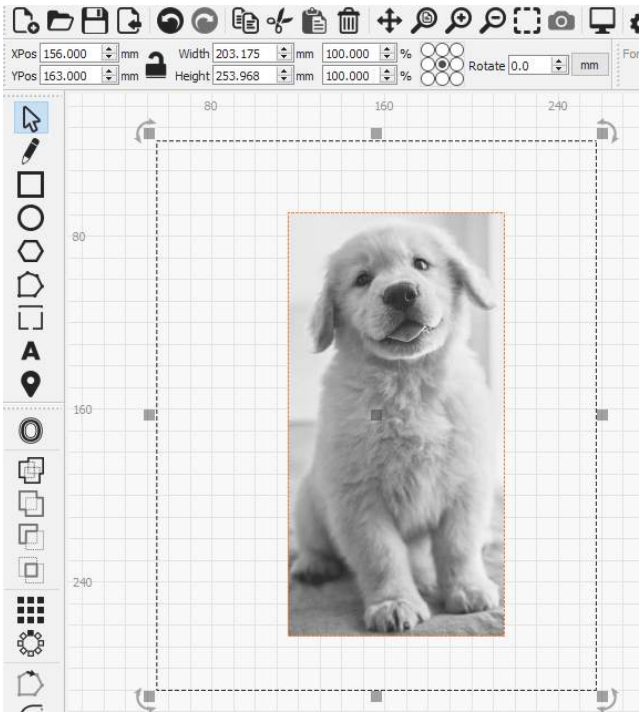
As shown here, the shape is using a Tool Layer which can be useful for this process as the masking shape will not also be output. If you also need to cut along the mask then simply use any of the normal tool layers for this process.

Now select both shapes. You can then apply a mask by either selecting **Tools > Apply Mask to Image** or right clicking on the selection and choosing **Apply Mask to Image**.



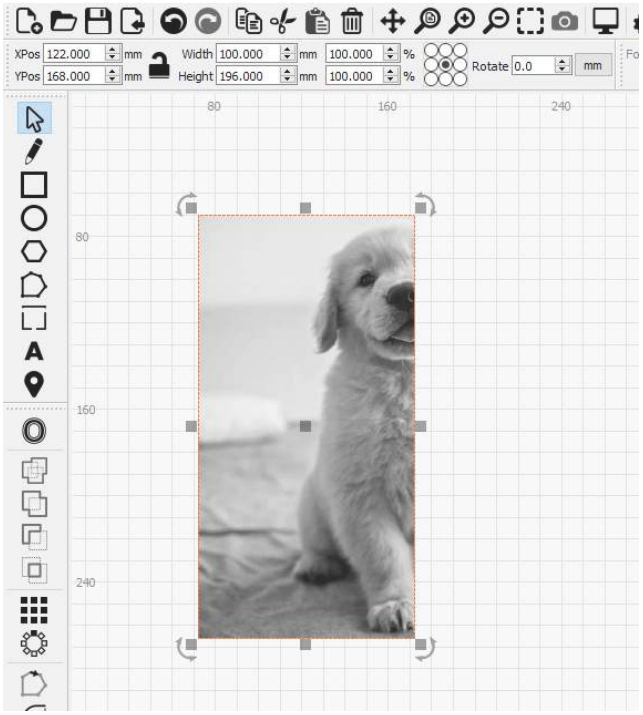
Note: You cannot mask using a layer set to Fill, as the filled output would cover the visible image. Any shape you wish to use as a mask must be either a Tool layer, or set to Line mode.

The mask will now be applied to the image as you can see below:

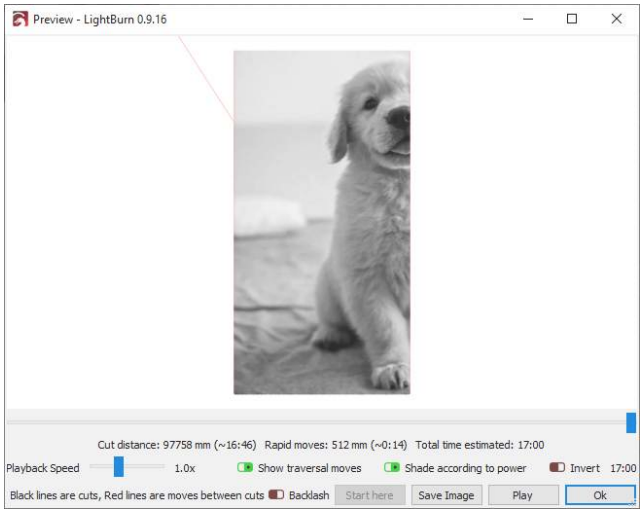


As you can see in the above screenshot, the selection box is still the same size as it was before. This is because the entire image still exists, but the mask is providing a windowed view into that image. If you select just the

masking shape or the image, you can move it to reposition the mask.



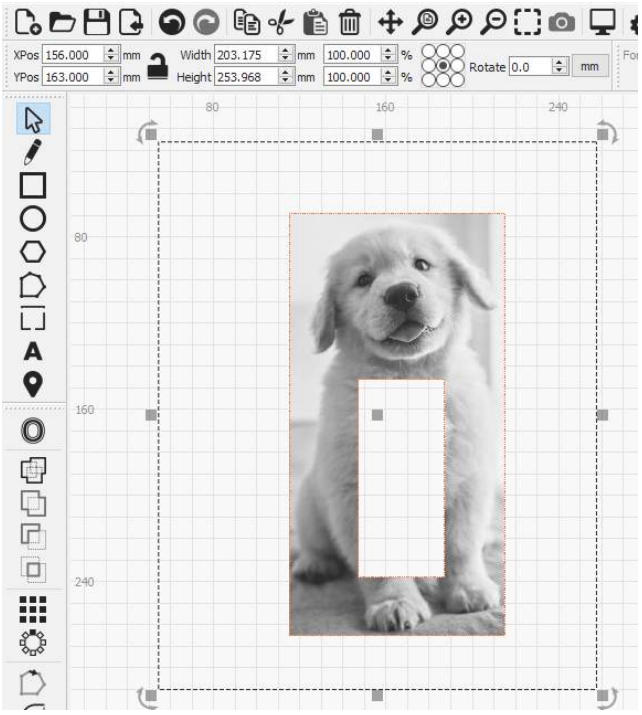
No image data is lost during this process and you can still reposition the image or mask even after saving and reopening a project at a later time. However, as you can see in the preview below, only that part of the image that was masked off will be output:



ADVANCED USAGE

What we've shown above amounts to merely an advance crop feature but image masking can go much further. For example, you can mask an image using multiple shapes.

> **Note**
>
> When using multiple shapes to mask an image, all shapes **must** be on the same cut/tool layer and those shapes **must** be grouped together. Otherwise the **Apply Mask to Image** option will not be available._

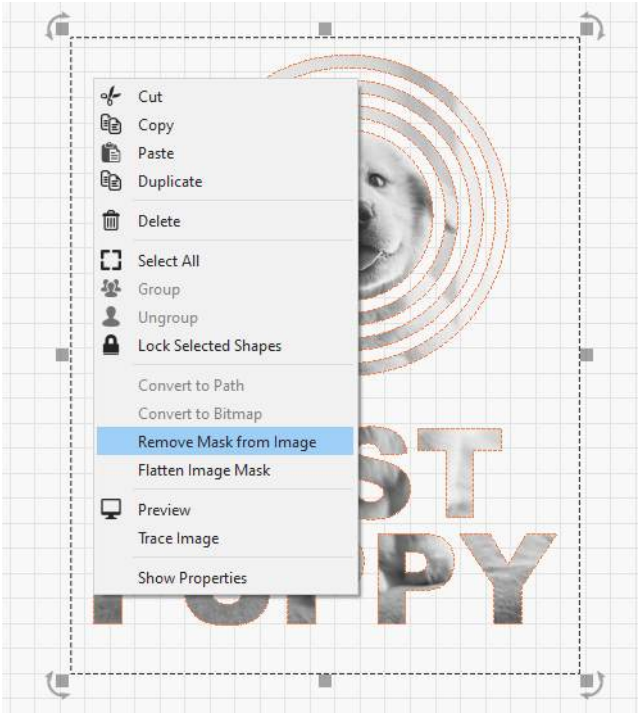


But you can, of course, go far beyond that. Any closed shape can be used as a mask and the easiest way to think about how that mask is applied, is that anywhere LightBurn would normally fill that closed shape in **Fill Mode** will now be "filled" with the image instead. For example:

Just remember that you must group together all shapes to be used as a mask first.

Removing a Mask

If you would like to remove the masking you can either simply select, then delete the mask shape or shape group, or you can select the image, right click, and choose **Remove Mask from Image**:



Using the **Remove Mask from Image** option will preserve the mask shape (or shape group) for later use.

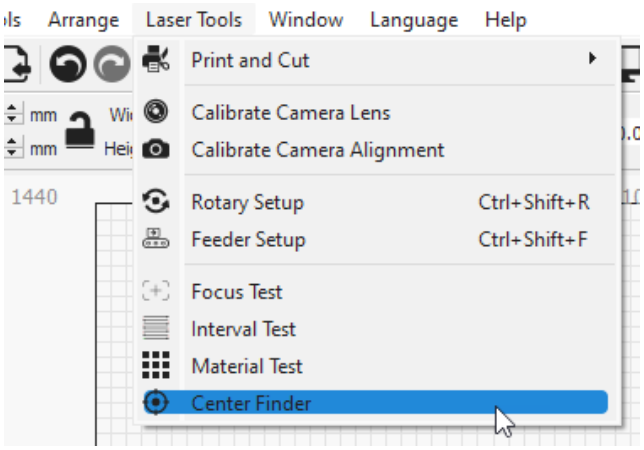
Flattening a Mask

Finally, if you would like to "bake in" an image mask, you can select the image, right click and choose **Flatten Image Mask**. This will make the mask permanent, actually removing the now unused image data as well as deleting the image mask shape. As you can see below, the selection box is now smaller and the mask shape is now gone:

Primary Docs **Tools**

Center Finder

The **Center Finder** is available in the **Laser Tools** menu. It is useful for finding the center of circular stock, as well as defining that stock in your LightBurn workspace.



First Steps

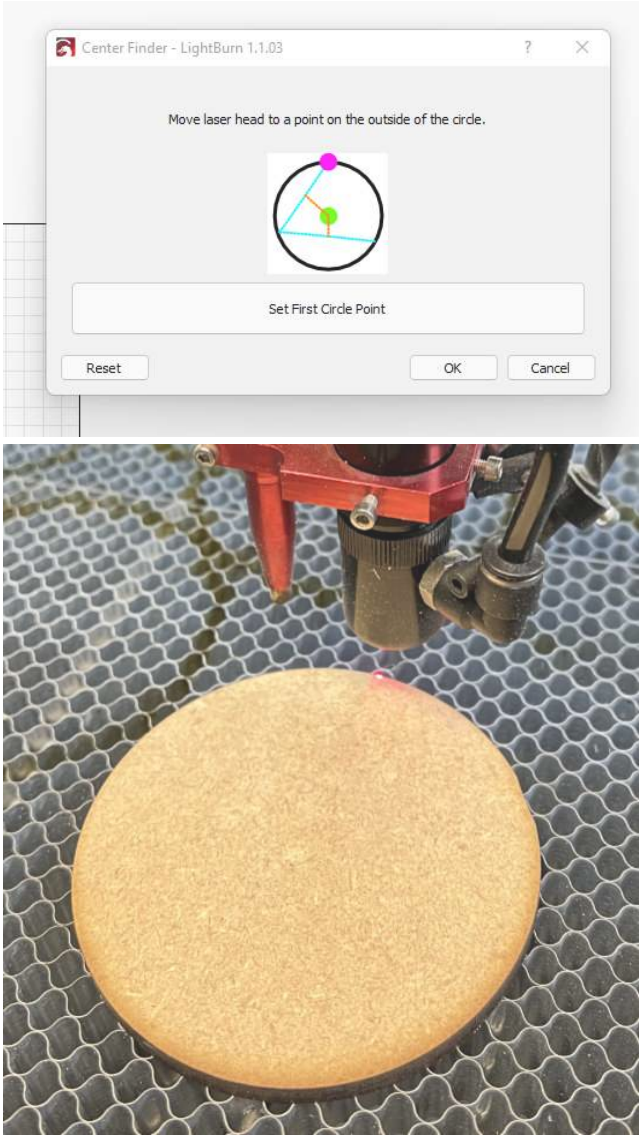
- Home your machine.
- If your machine does not have homing switches, make sure to start the machine with the laser head at the 0,0 point of your work space — that is typically the lower left corner for GCode-based devices.
- If the stock you are referencing is light or can be moved easily, make sure to secure it so it does not get bumped during the operations.

Set the Points

Point 1

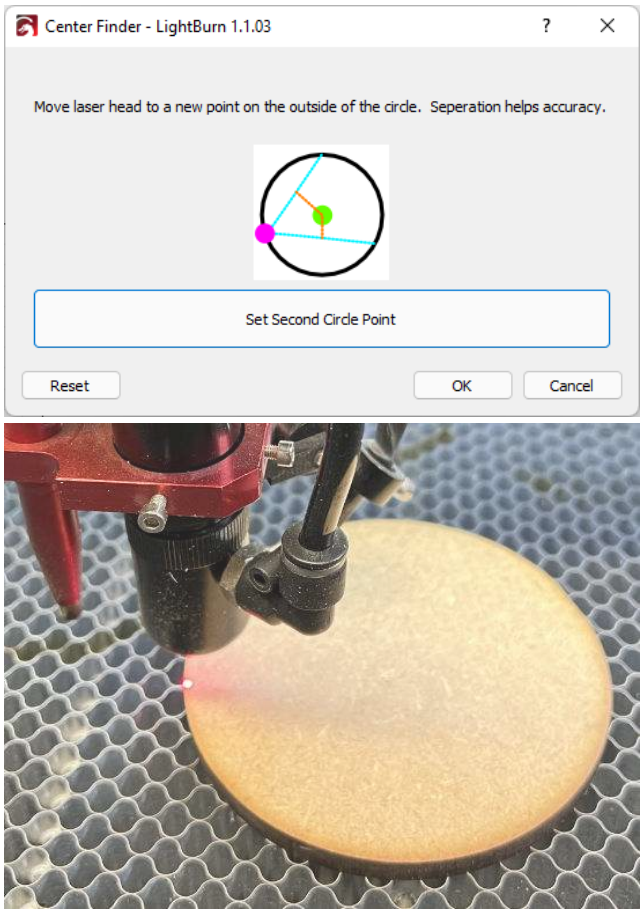
Jog the laser head to the first position on the edge of your circle, as shown in the wizard.

*Note: you must jog the laser head with the laser control panel or from the **Move** window. Center Finder will not work if you move the laser head by hand.*



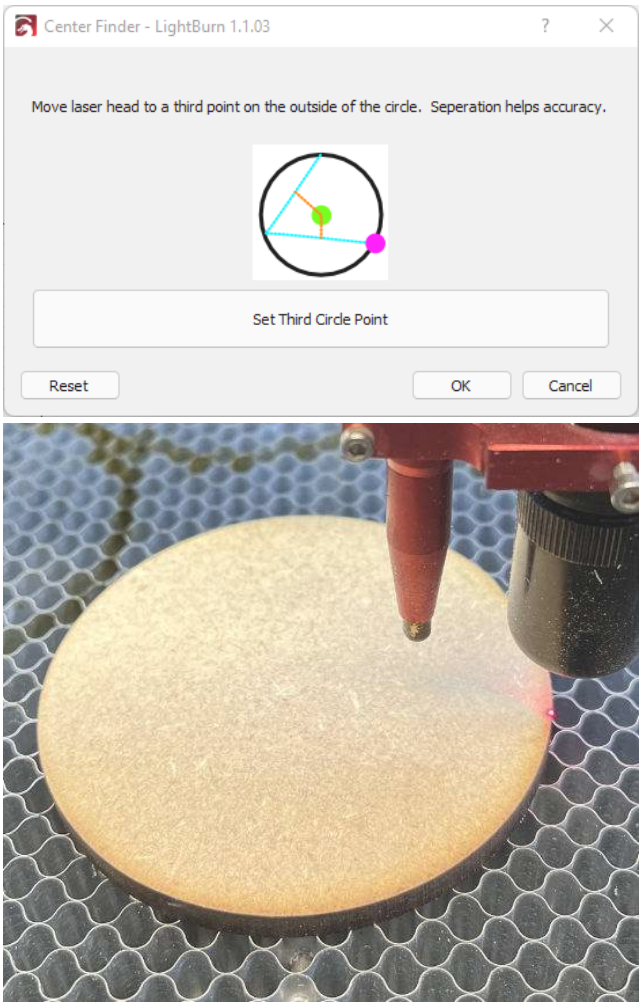
Point 2

Jog the laser head to the next position on the edge of your circle, as shown in the wizard.



Point 3

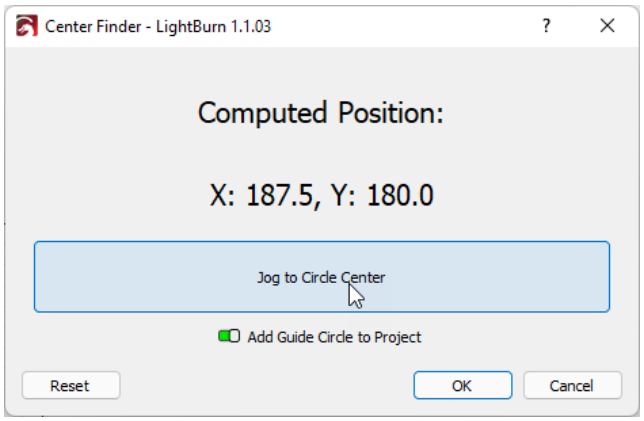
Jog the laser head to the last position on the edge of your circle, as shown in the wizard.



Align to Center

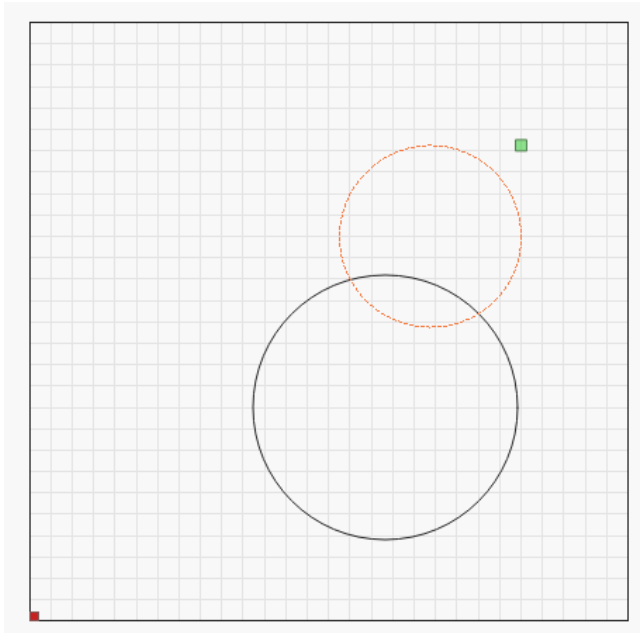
Move to Center

The last step will show you the calculated center of your circle and allow you to jog to that point.



Create Guide Circle

Toggle on **Add Guide Circle to Project** to create a circle on the **T1** **Tool Layer** that will provide a representation of your stock in your LightBurn workspace.



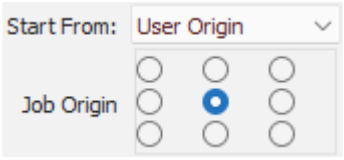
Set Origin

Absolute Coordinates

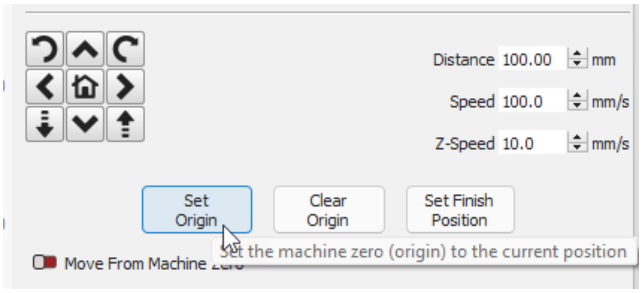
If you use **Absolute Coordinates** for your workflow, move your design to the guide circle, and make sure your **Start From** mode is set to **Absolute Coords**.

User Origin — Center

If you use **User Origin** make sure the center radio button is selected as **Job Origin**.



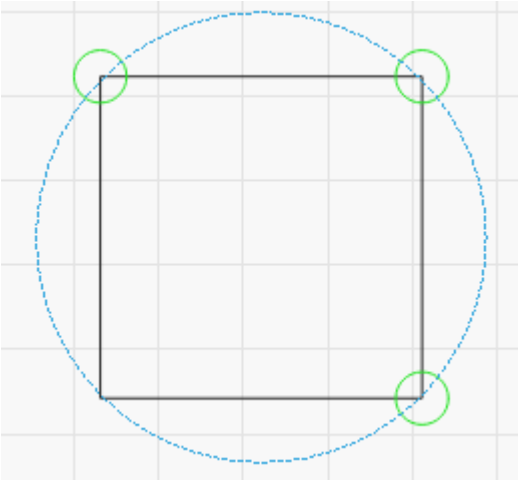
After you move the laser to the center of your stock, press the **Origin** button on your DSP control panel or the **Set Origin** Button in the **Move** window.



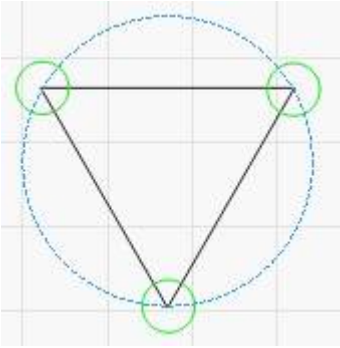
Notes

- The accuracy of the **Center Finder** depends on the accuracy of your point placement. If you have a red dot laser that is accurate, one trick is to try to split the dot on the edges of your stock.
- You can set the points in any order, and they do not need to be positioned exactly as shown in the reference photos — they need only be far enough apart from one another along the perimeter of the shape that they are valid for calculating the center. The reference photos are meant as guidelines for acceptable distance.
- This tool can find the center of any shape that can be *described* with a circle diameter:

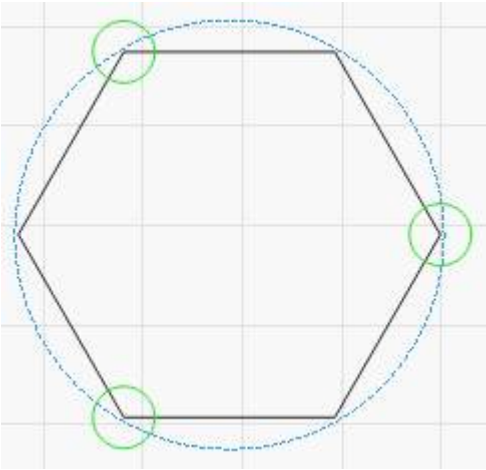
- Squares (pick 3 corners)



- Equilateral Triangles



- Hexagons



Troubleshooting

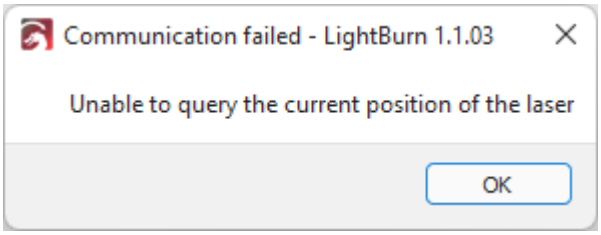
Set a Point Incorrectly

Hit the **Reset** Button. This will clear *all* points saved. After, restart from the current point. You can set the points in any order.

Unable to query the current position of the laser

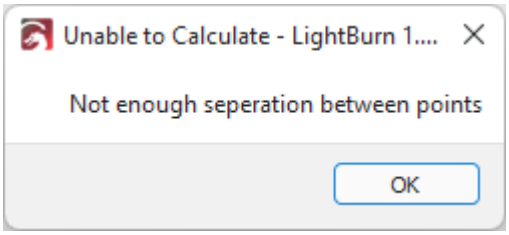
This happens when LightBurn is unable to get the position of the laser from the controller. Often, the laser is still moving, or another command is still in process. Click **OK**, and try again after waiting a few seconds.

If the warning persists, make sure the controller is still connected and is showing **Ready** at the top of the **Laser** window. If you are unable to connect, see Troubleshooting: Connection Problems.



Not enough separation between points

You have not moved the laser away from the last point or have not moved it far enough to make an acceptable calculation. Try moving farther away and setting the point again. You must jog the laser using its control panel or the **Move** window, and not by hand.

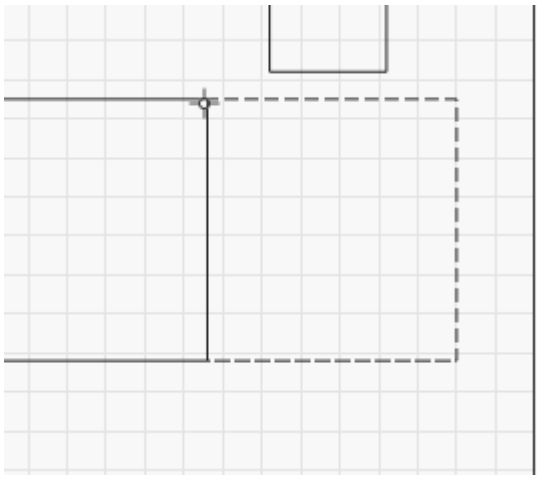


Unable to Calculate Center

LightBurn can't calculate center, or it would be outside your workspace. This typically happens on machines without homing switches that were not manually homed properly. Restart your machine with the head at your machine origin and try to run the wizard again.

Snapping Tool

When moving objects around the work area, you may notice that on certain points your cursor changes to a different icon. This allows you to use that point to snap a moving shape to another.



SNAPPING BEHAVIORS

LightBurn will automatically align your selection to snapping points if you see the cursor change to a snap cursor before you click:

- The selection will snap to a point

- The selection will snap to a line

- The selection will snap to the midpoint of a line

- The selection will snap to the center of an object

Hold `^ Ctrl` or `⌘ Cmd` to toggle object snapping (Disable by default, may be enable if Settings were changed).

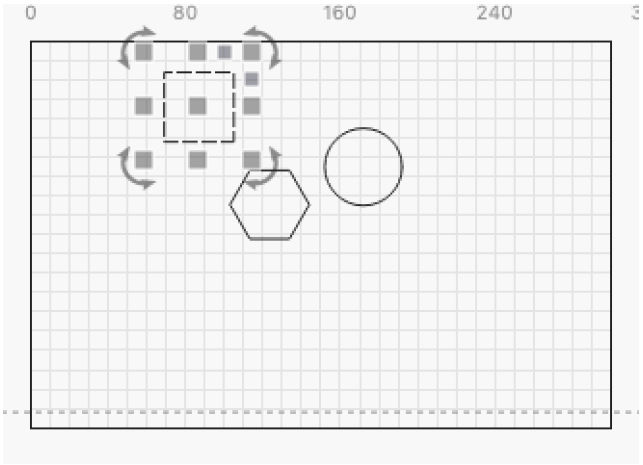
Hold Alt to make snapping 'stickier' - you can snap to things from farther away.

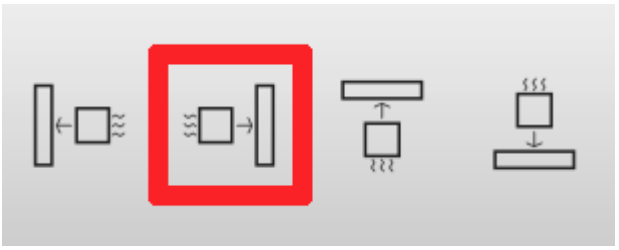
Primary Docs **Tools**

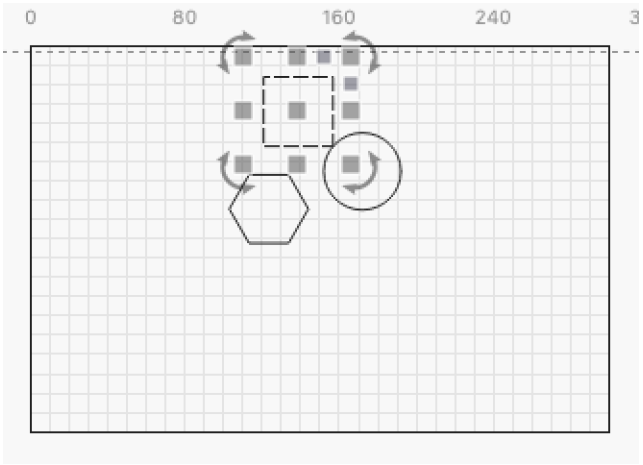
Docking Tool

The Docking tool can be used to bring your objects closer together in your workspace, to allow for more efficient use of your space.

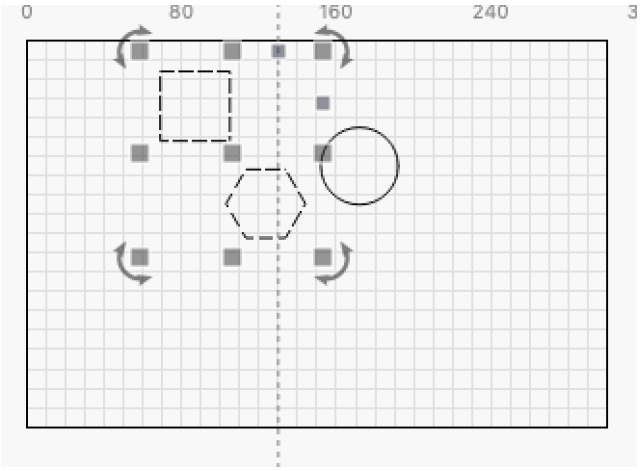
Each of the Docking buttons will tell your selected objects to move in that direction, until they hit something.

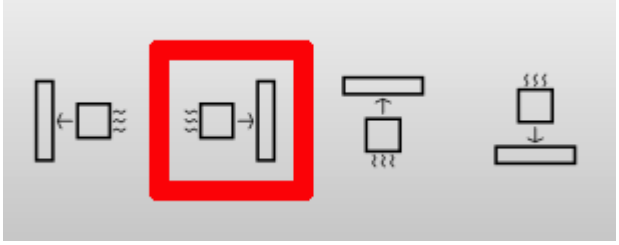


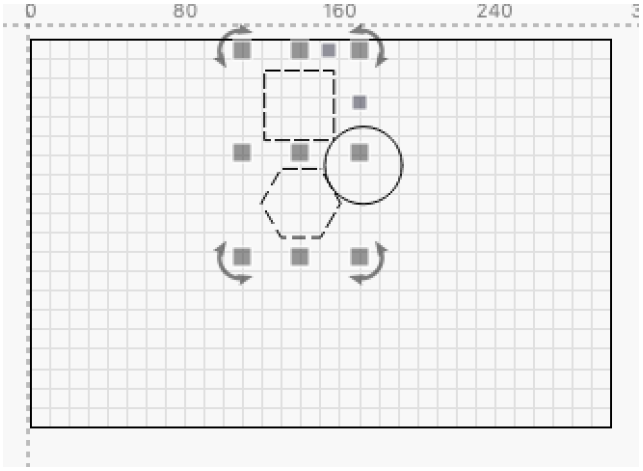




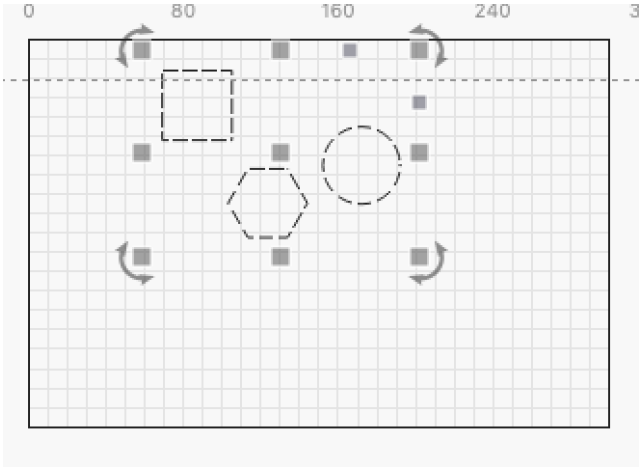
By default, the Docking tool will move all selected objects, as far as they will go.

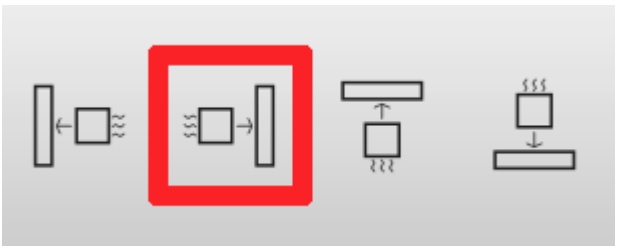




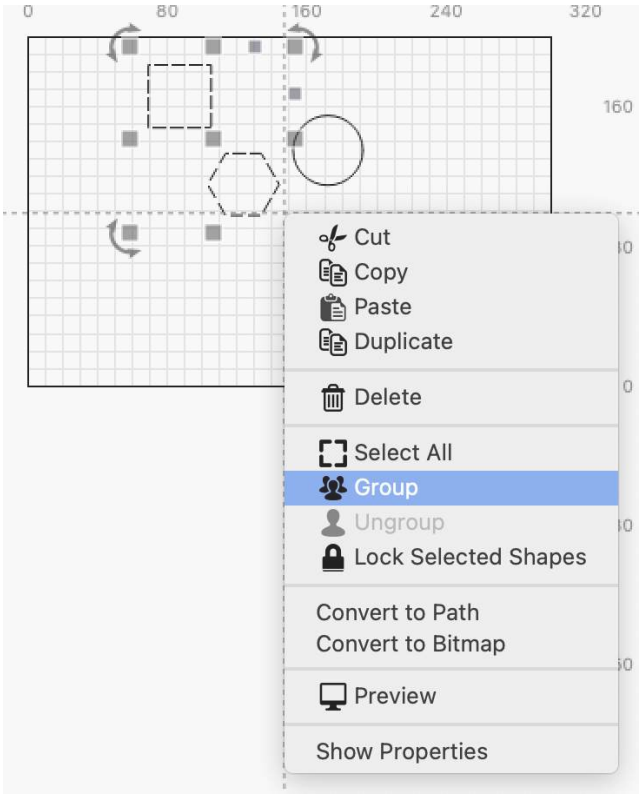


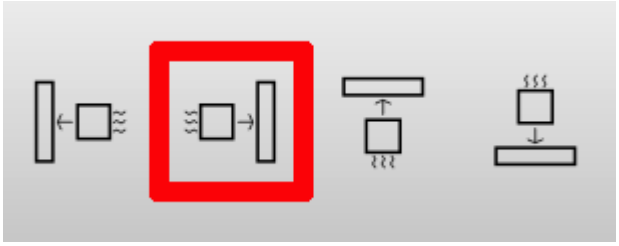
If no other objects are hit, the edge of the workspace will be used.

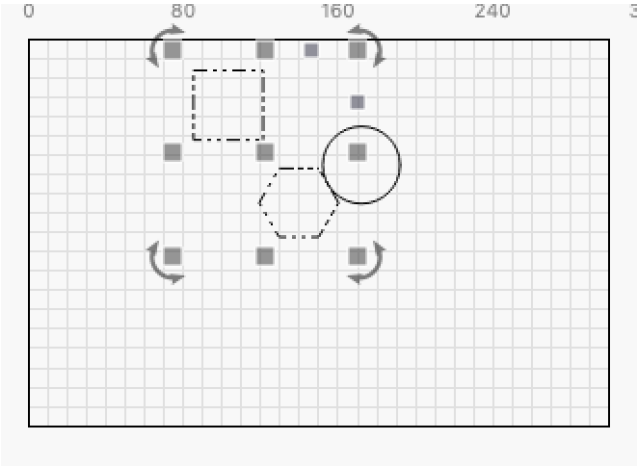




Grouped objects will move together, so if any of them stop, the whole group will stop.

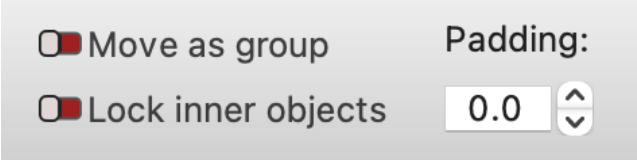






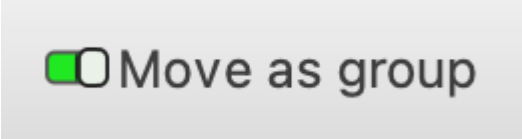
ADDITIONAL OPTIONS

The Docking tool comes with a few extra features to change how it works. These options can be found next to the Docking buttons:

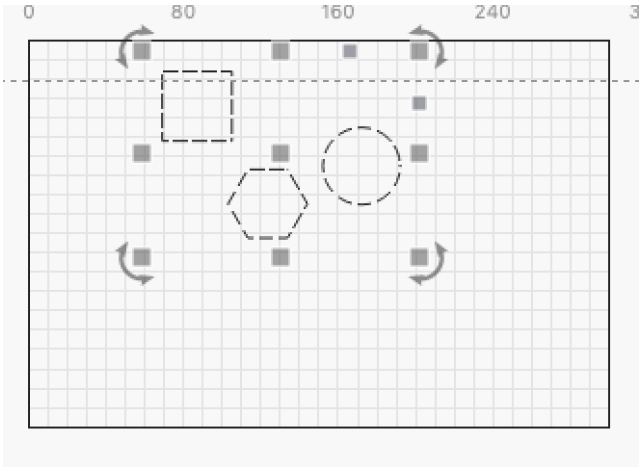


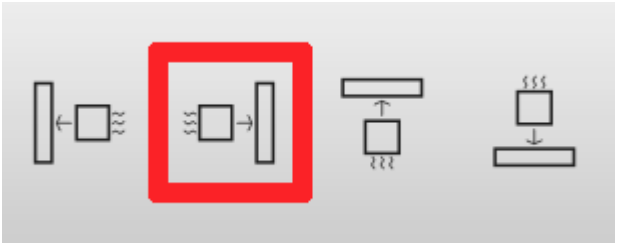
Move as group

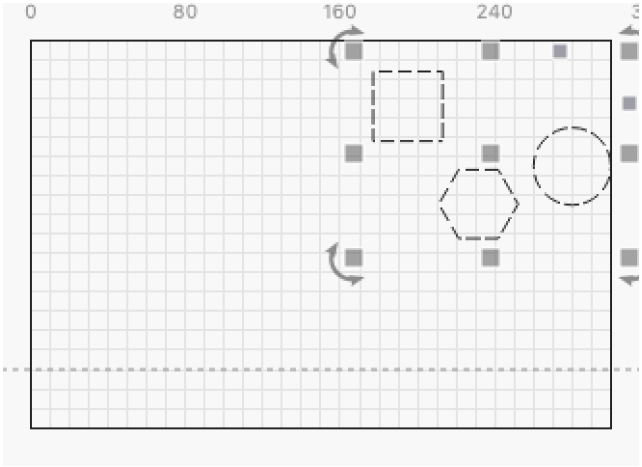
The `Move as group` setting treats separate objects as if they were grouped.



This means that they will only move until one of the objects stops, and the rest of the selected objects will also stop.



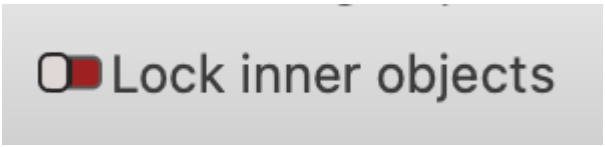


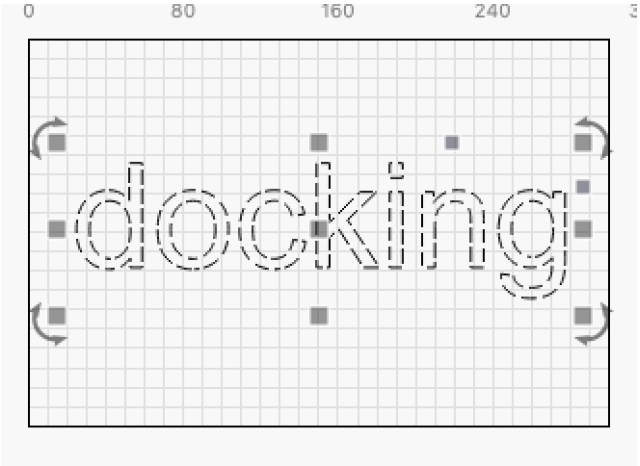


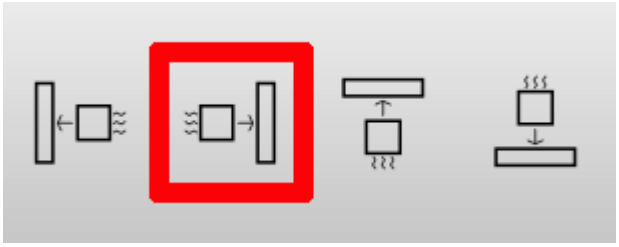
Lock inner objects

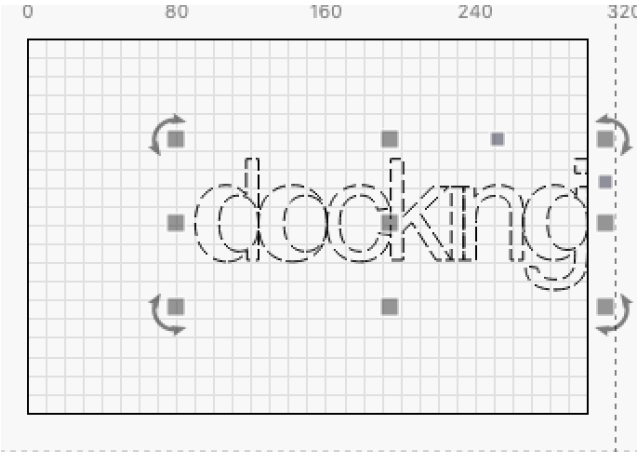
The `Lock inner objects` setting keeps objects inside other objects together.

When this setting is Off, the inner objects will continue to move, even when the outer object has stopped.

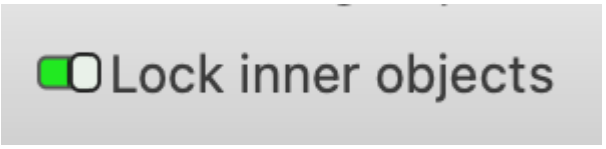


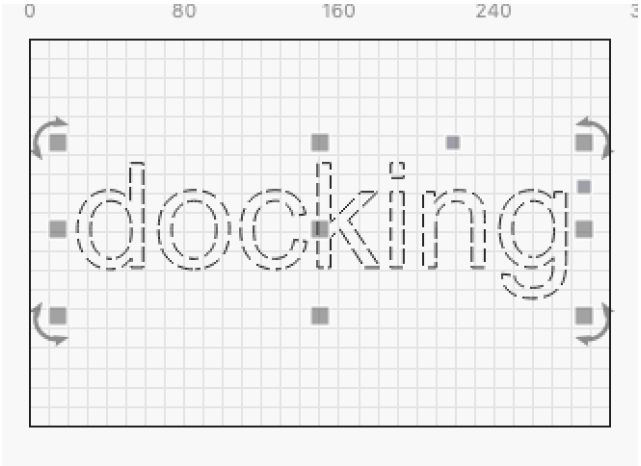


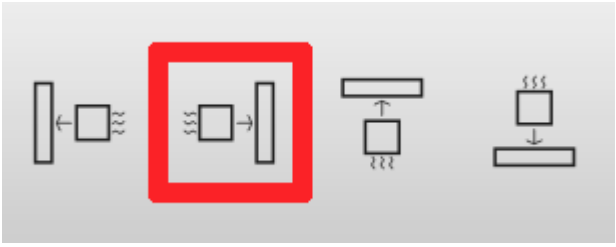


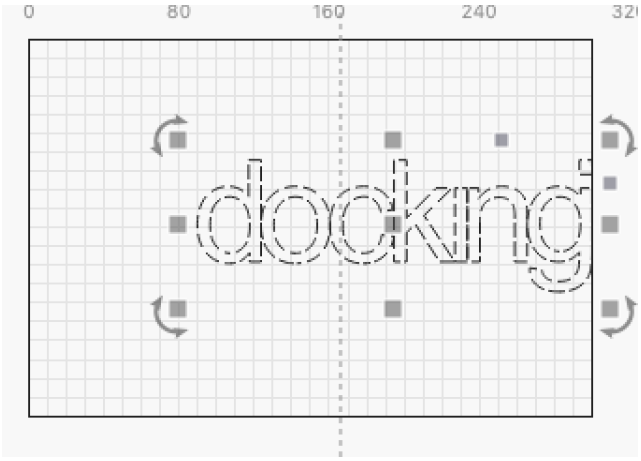


When turned on, the setting will keep the inner objects with the surrounding object.







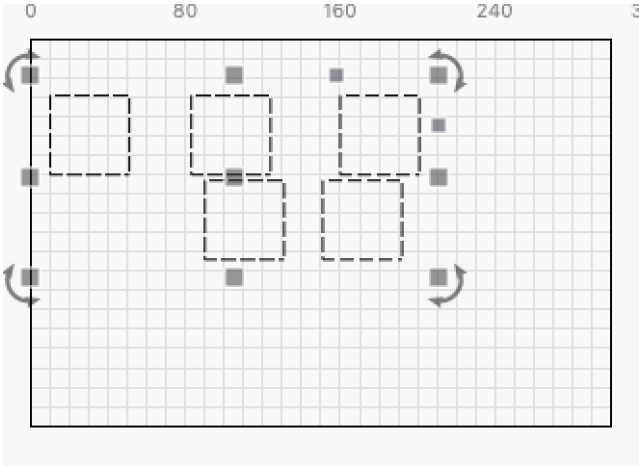


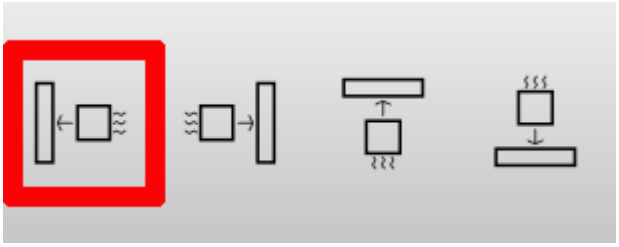
Note that this does not affect objects *that are overlapping*; in this case, the objects will each move independently, finding their own object to dock against (unless you use the `Move as Group` option above).

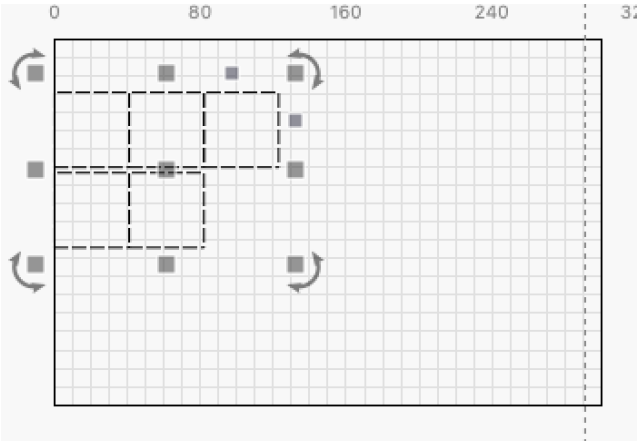
Padding

The `Padding` setting allows you to specify a distance that will be maintained between objects that are docked.

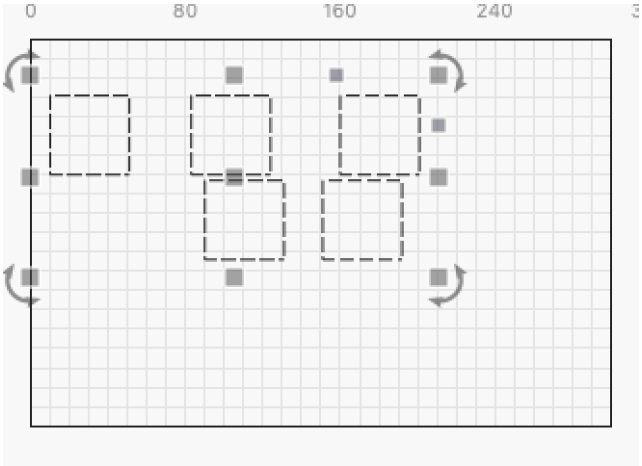
By default, this value is 0.0, which means that objects will dock right against each other.

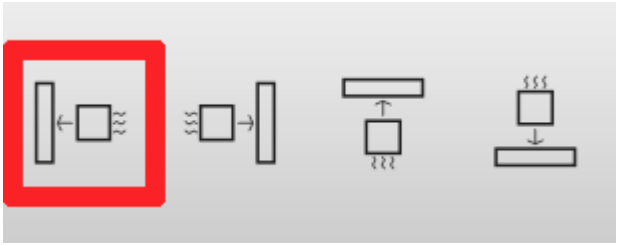


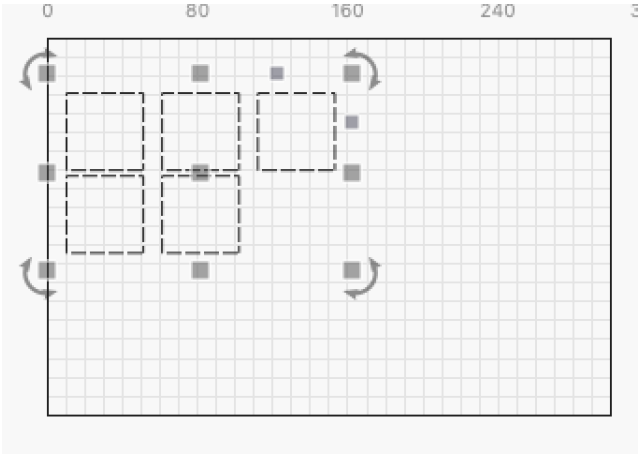




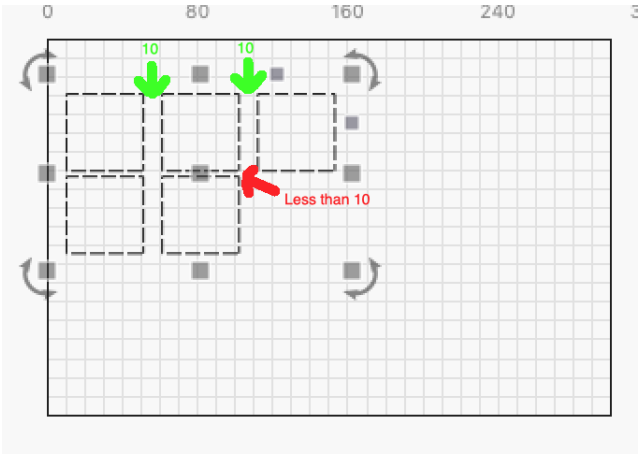
By increasing this value, you can have objects leave some space when they meet.



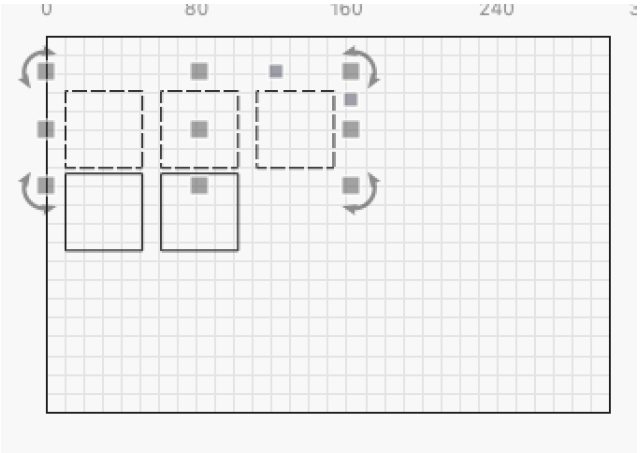


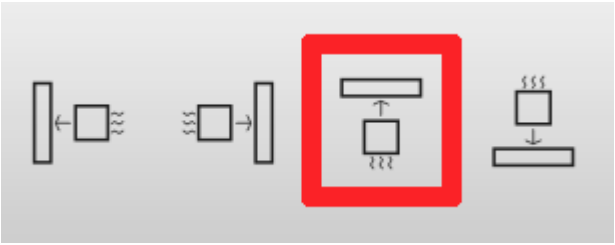


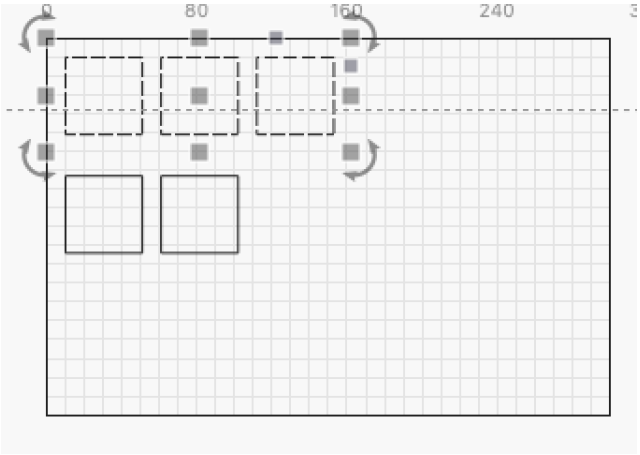
Note that the Padding is only applied in the direction the objects are docking - it won't be enforced in the other directions.

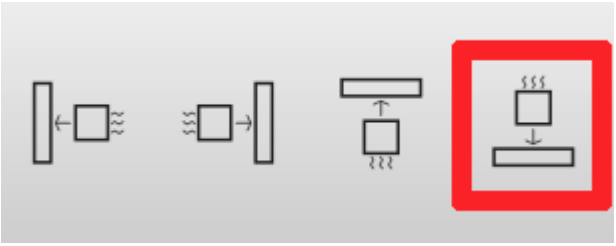


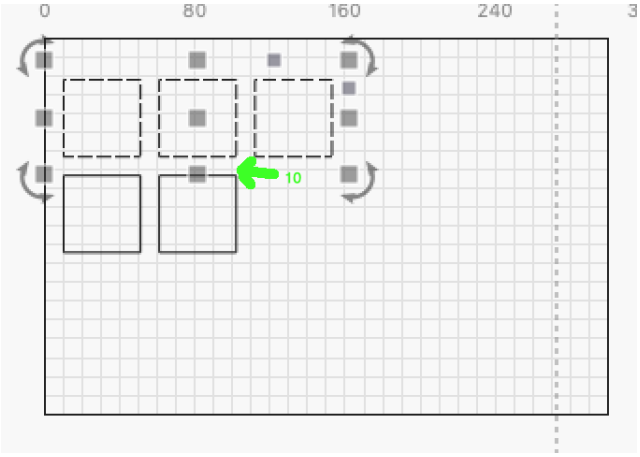
You can fix that extra padding by moving the objects away, then back:



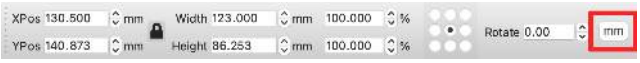








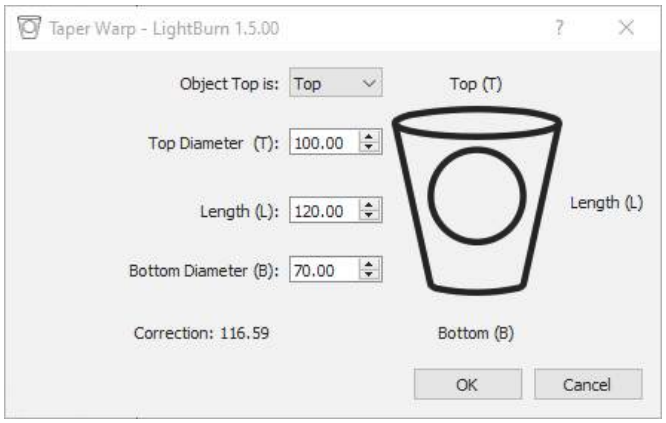
The units for the Padding tool (in / mm) are the same as other tools, such as the Numeric Edits tool.



Taper Warp

Available in LightBurn 1.5 and higher

The **Taper Warp Tool** assists in rotary engravings on tapered objects by compensating for the difference in diameter between the top and the bottom.



The Taper Warp dialog box

USING TAPER WARP

1. Select which side of the artwork is at the top of the object
2. Measure the diameter of the top of the object
3. Measure the diameter of the bottom of the object
4. Measure the distance between top and bottom
5. Enter measurements into the dialog box and press **OK**

RESULTS

The orange tool layers represent the text and its boundaries before being altered by Taper Warp

Edit Nodes Tool 

The Edit Nodes tool allows you to edit the nodes, lines, and curves that make up a shape in LightBurn. Note that built-in primitives in LightBurn, like Text, Ellipses and Rectangles, cannot be edited without converting them to a generic path object first using Convert to Path.

NODE EDIT

Action	Windows / Linux	macOS	Notes
Smooth corner node	S	S	while hovering over a node
Convert line to smooth curve	S	S	while hovering over a line
Convert curve to line	L	L	while hovering over a curve
Convert smooth node to corner	C	C	while hovering over a node
Delete node	D	D	while hovering over a node
Delete line	D	D	while hovering over a line
Insert node point	I	I	while hovering over a line or curve
Insert node at midpoint	M	M	while hovering over a line or curve
Break shape at point	B	B	while hovering over a point
Trim line	T	T	while hovering over a line, trim line under mouse at next intersection
	E	E	while hovering

Action	Windows / Linux	macOS	Notes
Extend line			over a point, extend line from point under mouse to intersection with another shape
Align to angle	A	A	while hovering over a line, press 'A' to align it to the nearest horizontal, vertical, or 45° angle (new in v1.3)

Video Tutorial: Trim and Extend

SNAPPING

Note that in all of the above tools, when creating a new shape, you will occasionally see the cursor change if you hover over a point on an existing shape. This means LightBurn is going to snap what you're about to make to that point. You can bypass this behavior by pressing the Ctrl key (Command on MacOS). LightBurn will snap to object centers, end points of lines or curves, or center point of lines or curves, in addition to just snapping to the grid.

PATHS AND SHAPES - CONVERT TO PATH

In LightBurn, all vector objects are stored as paths - a series of points connected by lines or curves. If you use the Draw Lines tool, you are directly creating what LightBurn calls a Path shape. Path shapes are the "lowest level" thing you can make in LightBurn.

Rectangles, Circles, Polygons, and Text shapes are different - They store the information used to build the path, and if any of that information changes, the path is discarded an re-built from scratch.

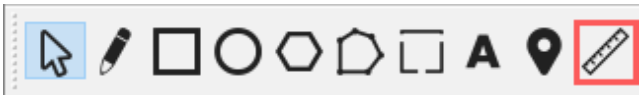
For example, Rectangle shapes know their Width, Height, and whether the corners have a radius. If you edit the 'Corner Radius' property on a rectangle shape, the path that LightBurn has built is thrown away, and a new one with the new radius is created. Similarly, if you change the font applied to a text shape, the old version of it is discarded and a new one is built using the new font.

If you want to node edit a shape, it has to be a path shape - using the Convert to Path function in LightBurn on a built-in shape type tells LightBurn to turn it into an editable thing that is just points and curves, and that it's ok to throw away the information about the original type of thing it was.

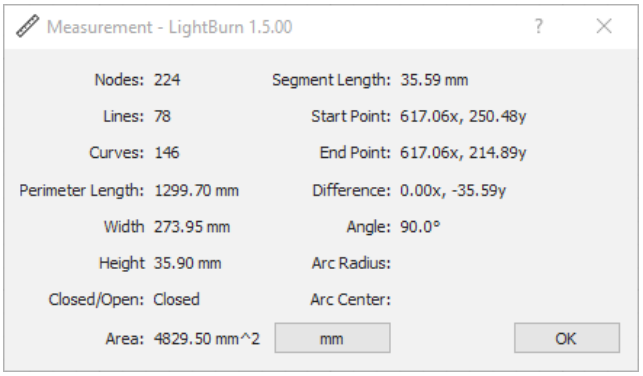
Primary Docs **Tools**

Measure Tool 

With the measurement tool you can view a wide array of useful information about any shape object. To use this tool, click on the ruler icon in the Creation Tools toolbar. (Alt + M)



It will display the following dialog:



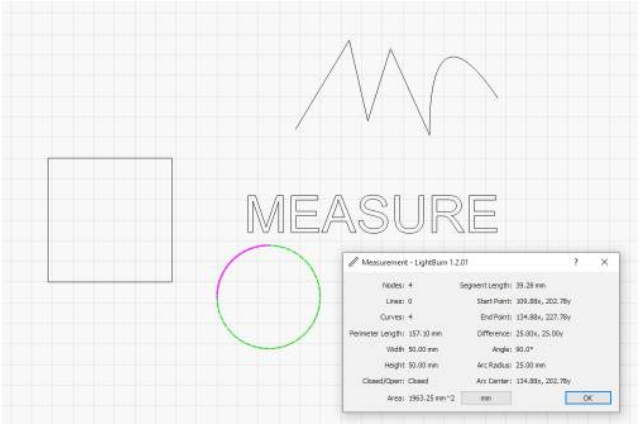
As you hover the cursor over shapes, individual shapes are highlighted in green and the line or curve segment the cursor is currently hovering over is highlighted in purple, as shown on the right edge of the first **M** below:

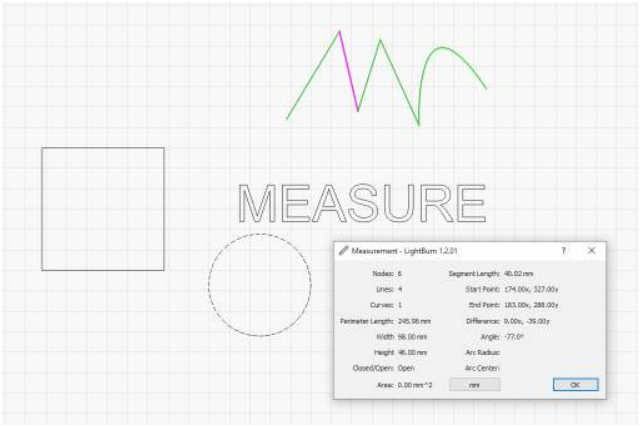
The measurement dialog describes the highlighted shape. A brief explanation of the values included:

Value	Explanation
Nodes	Number of nodes (end points of line segments and curves)
Lines	Number of straight lines
Curves	Number of arcs or Bézier curves
Perimeter Length	Total length of all line/curve segments
Closed/Open	Whether or not the shape is closed

Value	Explanation
Area	The total area of the shape. Empty for open shapes
Segment Length	Length of the highlighted line/curve segment
Start Point	X, Y coordinate of the start node of the highlighted segment
End Point	X, Y coordinate of the end node of the highlighted segment
Difference	Difference in X and Y between the start and end nodes
Angle	Angle of the line between the start and end points
Arc Radius	Radius of the arc, if the curve is a true circular arc. Empty otherwise
Arc Center	Center point of the arc, if the curve is a true circular arc. Empty otherwise

Below you can see further examples of the state of the measurement tool dialog, based on the type of segment being measured.

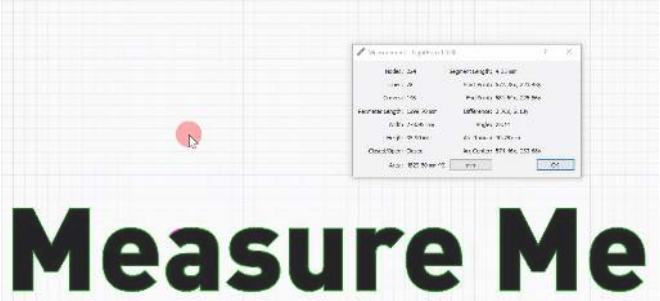




DRAG MEASURE

If you need to measure the distance between two points, you can click and drag between any two points and get the above information. You can select an existing node, but this works for any two points, regardless of whether any shapes exist.

LightBurn 1.5+: Starting in LightBurn 1.5, holding down ⇧ Shift and dragging with the **Measure Tool** locks the measurement to horizontal, vertical, and 45 degree angles.



Dragging with axis snapping

Primary Docs Tools UI

Modifier Tools

The modifier tools, as the name suggests, are primarily used to modify existing shapes.

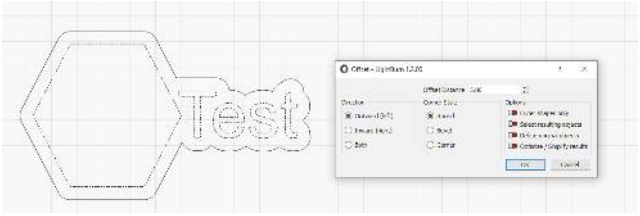
The tools are:

- Modifier Tools
- Offset
- Weld
- Boolean
- Boolean Assistant
- Boolean Union
- Boolean Subtract
- Boolean Intersection
- Video Walkthrough of the Boolean Operations
- Arrays
- Grid Array
- Circular Array Tool
- Virtual Arrays
- Start Point Editor
- Radius Tool
- Add a Radius
- Remove or Change a Radius
- Troubleshooting Radii
- Warp and Deform (version 1.4+)
- Warp Selection
- Deform Selection

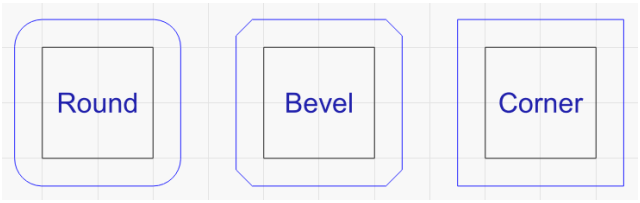
OFFSET

Hotkey = Alt + O

The offset tool is used to create outlines around existing shapes, either inward or outward, offset from the original by a given amount. We use the offset tool in the 'Making a Simple Project' topic, so that's a great introduction.



The corner style option chooses how outward corners are offset:



The offset tool remembers the last set of options you used, and if you hold the Ctrl key when you click the offset button, it will perform the offset operation using the previous settings, without bringing up the dialog.

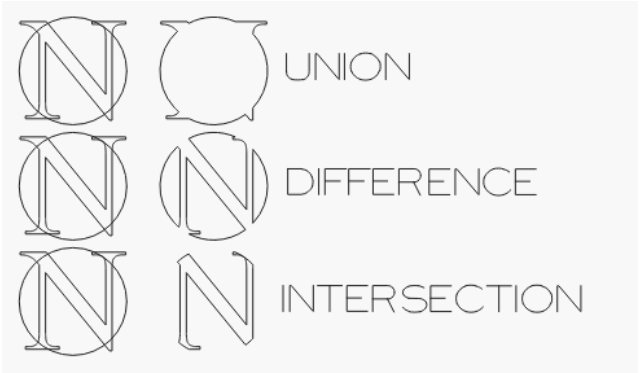
WELD

Hotkey = Ctrl/⌘ + W

Clicking on the Weld icon will join all the selected shapes into a single entity that is the outline of all the selected shapes. Note that Weld requires closed shapes, but will accept any number of inputs. If you weld something and the middle content disappears, try Boolean Union instead.

BOOLEAN

The Boolean tools are used to combine shapes into more complex shapes. The three different Boolean operations are shown here:



- Union keeps the area covered by either shape - it merges them.
- Difference is the 2nd shape removed from the first.
- Intersection keeps the area covered by both shapes.

Boolean tools require exactly two shapes or two groups of shapes. **Weld** can be used on any number of shapes, and can often be used as an alternative to repeated Boolean Union operations. Otherwise, you'll need to perform multiple Boolean operations to combine more than two shapes.

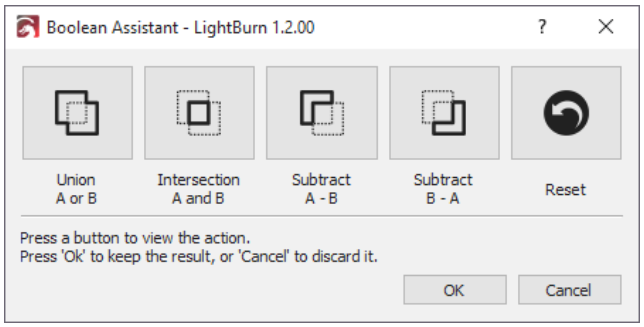
All shapes used with the Boolean tools must be closed shapes, meaning continuous loops whose starting and ending points are the same.

Boolean Assistant

Hotkey = Ctrl/⌘ + B

Because it can be hard to remember which operation (or which order) is going to do the thing you want, we've added

a new Boolean Helper that will let you preview each of the Boolean operations before deciding on one.



Click any of the first 4 buttons to see what that operation will look like, or click the 'Reset' button to see the original shapes. If your design is not complex, hovering over the buttons will also work. When you see the result you want, click the 'Ok' button to keep it, or click 'Cancel' to revert.

Boolean Union

Boolean Union is similar to weld, but works with 2 selected objects only. However these selected objects can actually be grouped items, not just a single vector shape.

Boolean Subtract

Hotkey = Alt + -

Boolean Subtract (also called Boolean Difference) will remove the area that the second selected shape overlaps the first shape by. The order in which you select shapes will determine the outcome. This tool also works with grouped items. If you end up subtracting the items in the wrong order, Undo, then perform the operation again — the undo switches the order of the items, so a simple Undo and click-again of of the Subtract button is a quick fix.

Boolean Intersection

Hotkey = Alt + *

Boolean Intersection creates a new shape from the overlapping areas of two selected shapes.

Video Walkthrough of the Boolean Operations

Click for a Boolean demonstration video

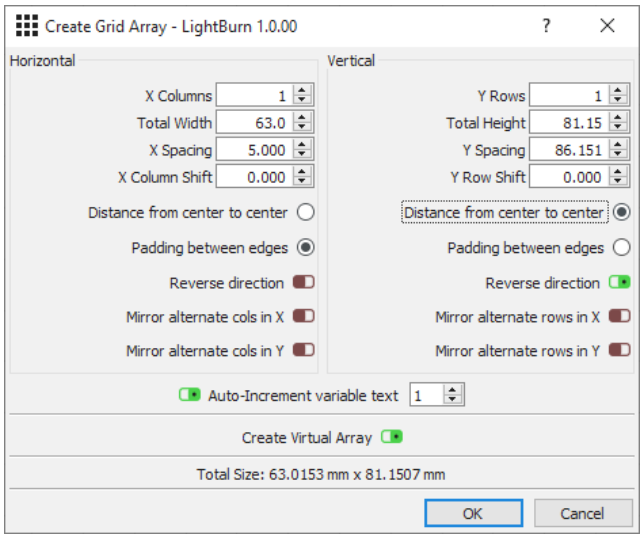
The above video describes in more detail how the various Boolean operations differ, and why welding text to a circle should be done with a Boolean Union instead.

ARRAYS

Arrays allow you to make regularly spaced copies of a shape. LightBurn offers both grid and circular arrays.

Grid Array

The Grid Array tool allows you to copy a shape (or shapes) with regular spacing horizontally, vertically, or both, and includes options to adjust spacing, to shift odd rows, mirror the shapes, and more.

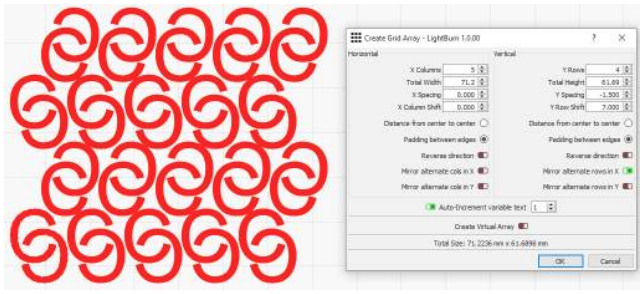


The X and Y columns settings let you specify how many copies of your shape to make in each direction.

Total Width and Total Height are convenience options that allow you to tell it the maximum size to occupy/ It will set the X Columns and Y Rows values to whatever is necessary to fill the specified size without going over, based on the other provided settings.

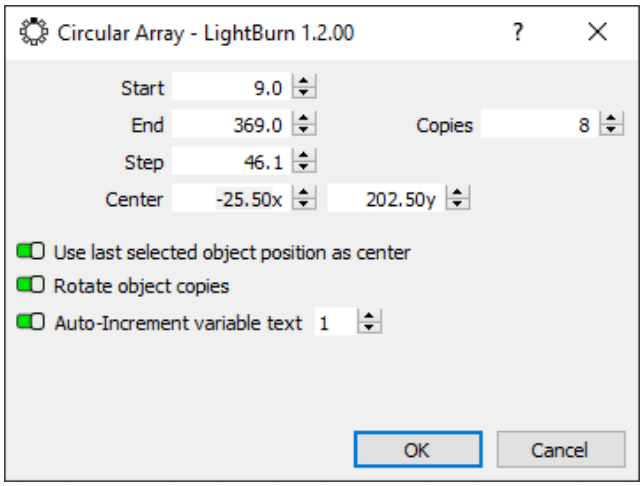
Spacing can be specified between edges (how much padding between shapes) or between centers (absolute object spacing).

Column and Row Shift values let you offset alternate columns or rows, and you can mirror them as well, allowing you to more efficiently pack oddly shaped items together, like this:

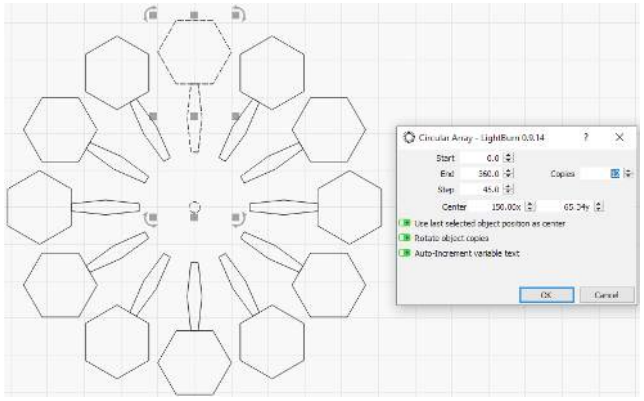


Circular Array Tool

The Radial Array (or circular array) tool lets you create copies of a shape (or shapes) around a central point. This is useful for creating ornamental patterns, clock faces, and more.



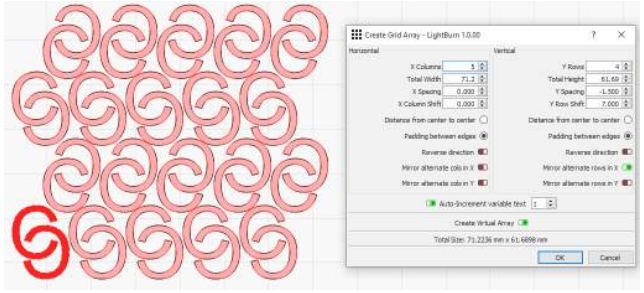
You can manually enter the point of rotation, but it's much simpler to create a shape to use as the center point, and select that shape last. The created copies can be rotated or not - Numbers on a clock, for example, are often left upright for readability, but roman numerals are usually rotated.



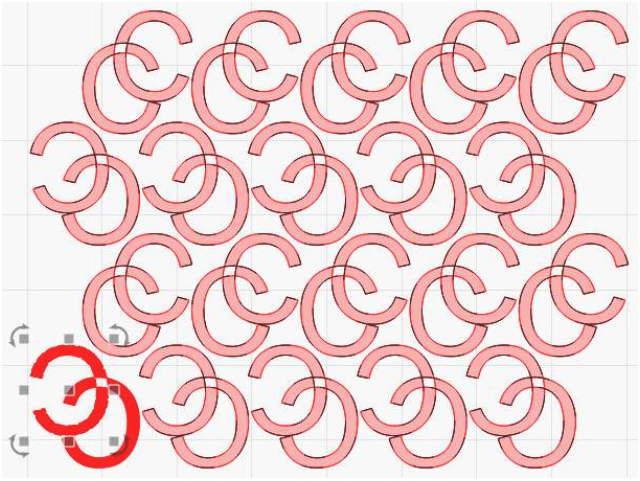
In the above example, the small center circle was selected last, and the 'Use last selected object position as center' option is chosen, along with 'Rotate object copies' to produce the pattern.

Virtual Arrays

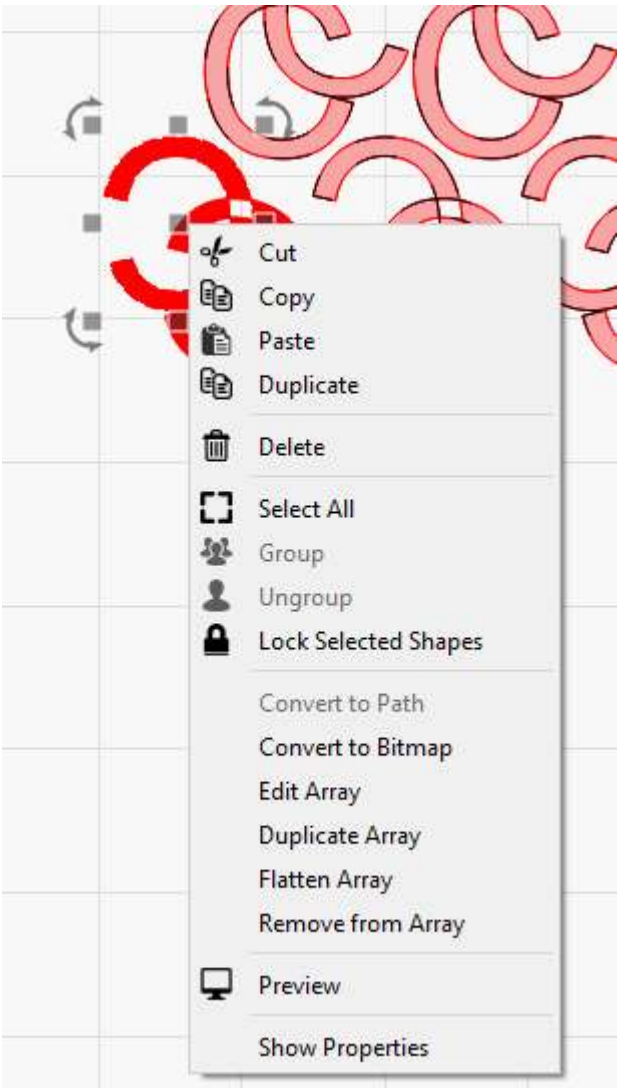
There is also a Virtual Array option that can be selected by checking "Create Virtual Array" at the bottom of the Grid Array dialog. Instead of making copies of the original shapes, this will generate virtual clones of the original that stay synced at all times. When using a virtual array, the virtual clones will render with a dashed outline and muted fill color to denote they are virtual:



Note that these virtual shapes are not selectable and will always be laid out based on the array options you provided. However, any changes made to the original shapes are automatically reflected in the array.



Beyond just altering the original shapes, there are many operations that can be done after the fact to virtual arrays, all of which are available from the shape context menu. This menu is available from any shape that is currently part of a virtual array. You do not have to select all shapes in that array first.



- **Edit Array**: Display the "Create Grid Array" dialog again, but for this existing array. This allows you to modify any of the parameters and even convert it back into a normal array, by unchecking "Create Virtual Array".
- **Duplicate Array**: Virtual arrays cannot be selected directly, only the shapes included in them. So this allows you to duplicate an entire virtual array and all of the shapes in it.
- **Flatten Array**: Convert the virtual array into a standard array where all shapes are separate copies and no longer synced to the original shapes.
- **Remove from Array**: Remove the currently selected shape(s) from the virtual array.
- **Add to Array**: Add any currently selected shapes not in the virtual array to the array. Note, you must select at least one shape that is **in** a virtual array and one shape that is **not in** a virtual array currently.

START POINT EDITOR

The Start Point edit tool lets you tell LightBurn where to start cutting a shape, and in which direction. By default, the starting point is the first point of the shape, and the direction will be the direction that the selection marquee animates in. In the Optimization Settings, if you tell LightBurn to choose the best starting point or best direction, it can choose a different point than the default if it will reduce cutting time. The Start Point editor lets you force the starting point and direction.

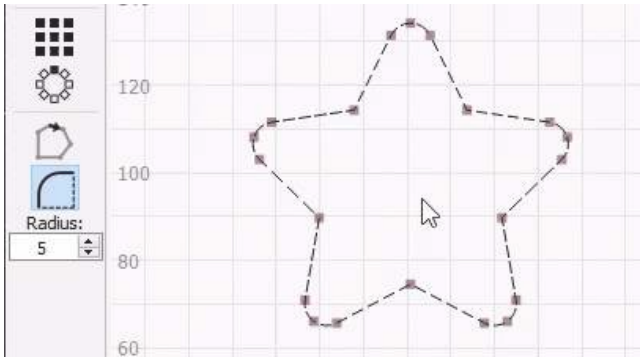
With a shape selected, click the 'Start Point' tool and you'll see the starting point and direction indicated by an arrow. If the arrow is gray, it means this shape is displaying the default point and direction, but it is not forced. If you click any node on the shape, the arrow will move there, and turn blue, indicating that the user has chosen this as the starting point and direction.

Holding Shift and clicking a point will choose the opposite direction, and holding Ctrl and clicking the shape will clear the starting point back to the default.

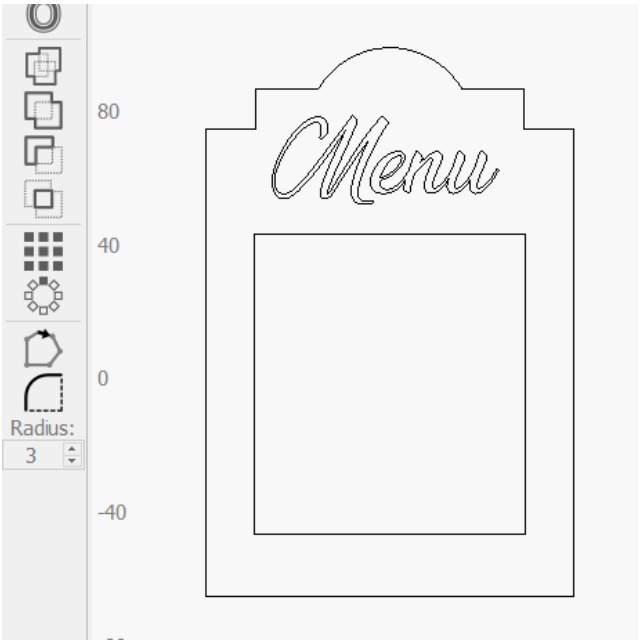
RADIUS TOOL

The **Radius Tool** can be used to fillet (round over) sharp corners, take a round bite out of a corner (using a negative radius value), or remove a radius from a corner.

It also allows you to remove radiuses from corners, turning them into sharp points.

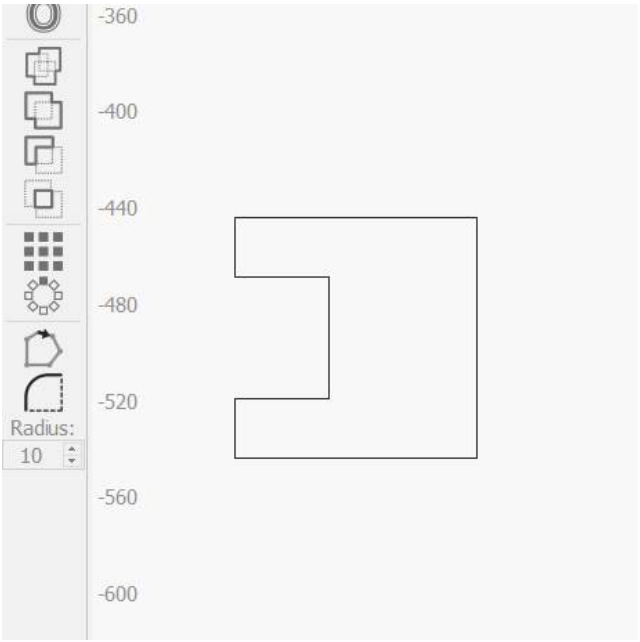


Fillets have all kinds of applications, and they can be combined to form more complex shapes.



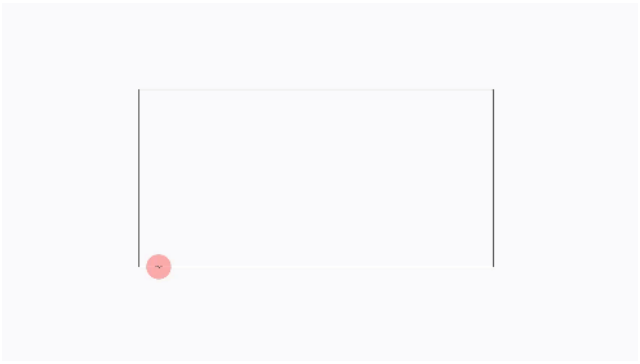
Add a Radius

1. Click the radius tool
2. Set the radius value
3. Select the object you want to modify
4. Click on a corner to apply the radius



If you change the radius to a negative number it takes a fancy little bite out of the corner.

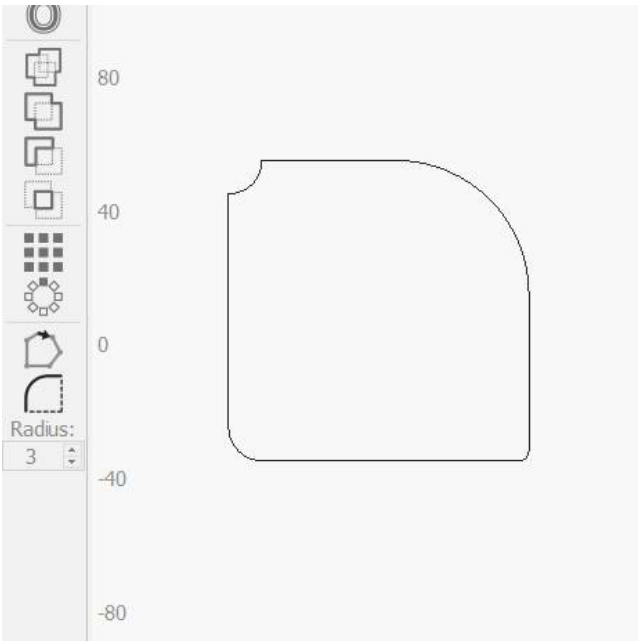
LightBurn 1.5+ Starting in LightBurn 1.5, rectangles have an additional handle available that acts as a shortcut for the Radius Tool. Drag the blue handle away from the corner to increase the radius of all four corners, and drag toward the corner to decrease the radius. Dragging vertically creates a reversed radius, with a bite taken out of the corner.



Remove or Change a Radius

As of release 1.3, you can use the radius tool to delete rounded corners (returning them to a sharp one) by clicking on them. This even works on imported designs that were made in different software, as long as the software exported actual arcs.

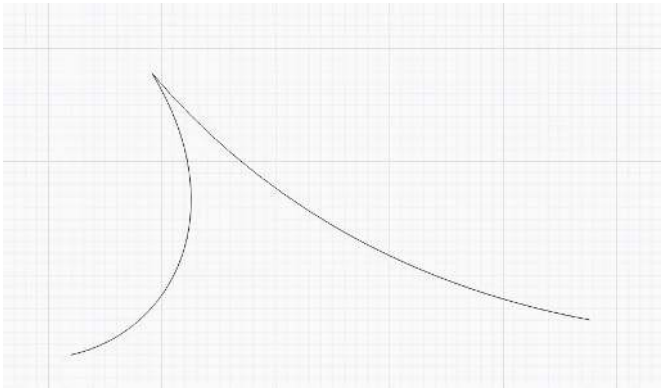
After removing a radius you can then apply a differently-sized one to the corner, as normal.



Troubleshooting Radii

Radii can only be applied where there is room for the radius to be applied.

LightBurn 1.5 and later support applying a radius where curved (Bézier) lines meet, but earlier versions can only apply a radius to a corner where straight lines come together.

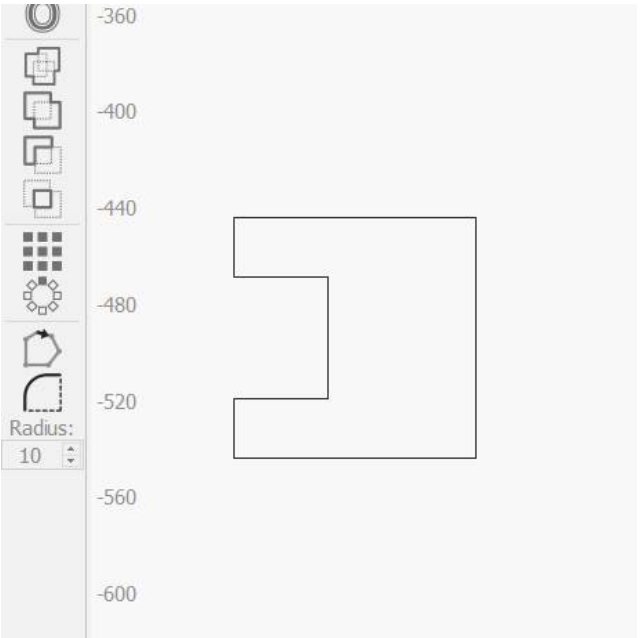


Using the Radius Tool with curved lines

When the radius tool is active, the icon changes as you hover over a corner to indicate whether the radius tool can be used.

Icon	Meaning
	Click to fillet corner
	Click to remove fillet
	Can't fillet - corner is next to a curve
	Can't fillet - not enough space

If the cursor isn't appearing as you hover over a corner, make sure you've selected the radius tool in the Creation Tools. The Radius icon should be highlighted. Also check that you have selected the object you wish to edit by clicking on it.



If that still isn't working, check that the connected lines are straight. It's possible for lines that appear straight to be curves, especially in imported files. Select the Edit Nodes Tool, hover over the line either side of your corner and hit L on your keyboard.

If a radius still can't be applied it might be because the two lines that make up the corner aren't actually joined at that point. To check, move the corner using the Edit Nodes Tool, if it splits off into two lines, bring the one you moved back toward the other so that they snap together and join, and then try the radius again.

If you are having trouble converting a rounded corner back into a sharp one, it could be because there is not a true arc at the corner. This is most common with imported shapes, because some programs export arcs as a series of tiny lines. You can try repairing these with Optimize Selected Shapes.

To exit the radius tool, hit Esc on your keyboard.

WARP AND DEFORM (VERSION 1.4+)

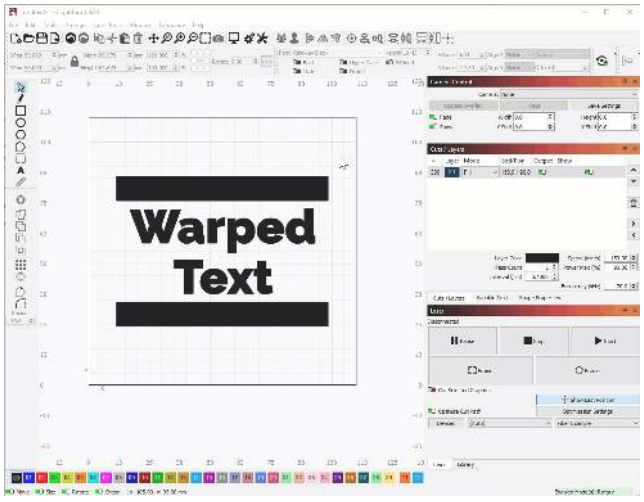
You can find both **Warp Selection** and **Deform Selection** under the **Tools** menu. Both tools can be used on single or multiple objects by selecting the objects and then selecting the tool. You can modify text, shapes, or images by dragging the handles.

While using warp and deform:

- Double-click on a handle to reset it.
- Hold Shift while dragging a handle for horizontal symmetry.
- Hold Alt or Option while dragging a handle for vertical symmetry.

Warp Selection

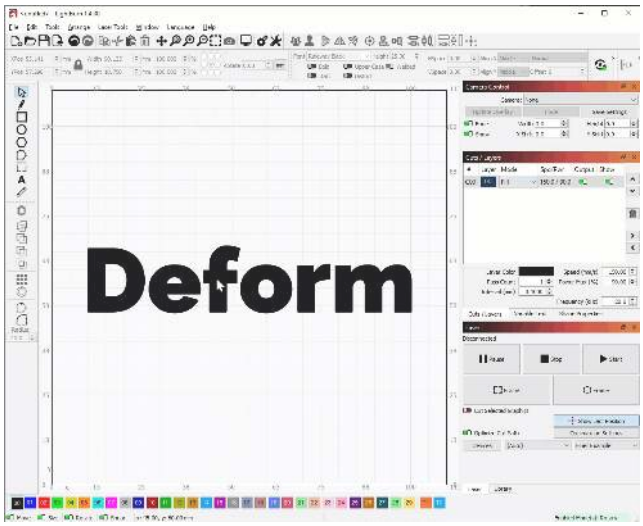
Warp Selection uses four handles, one at each corner.



Deform Selection

Deform Selection uses 16 handles, arranged in a 4x4 grid.

You can grab and drag the blue dots at the corners and intersections of the grid to deform the shape. See the animation below for examples.

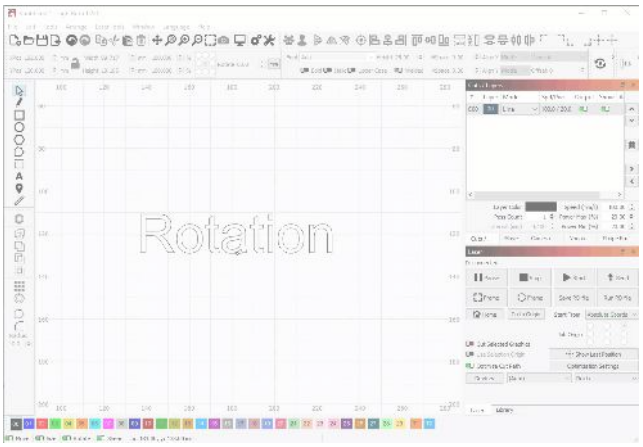


Editing **Primary Docs** **Tools** **UI**

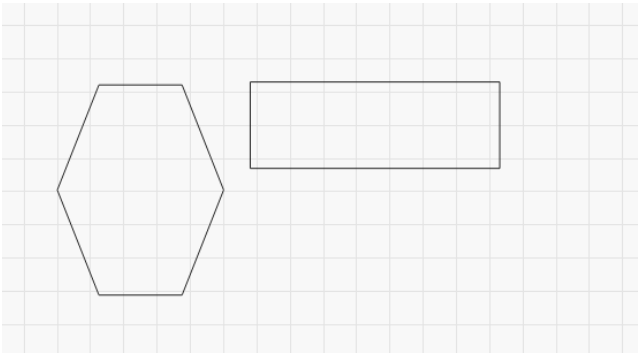
Two-Point Rotate and Scale

This feature allows you to rotate an object around a pivot point.

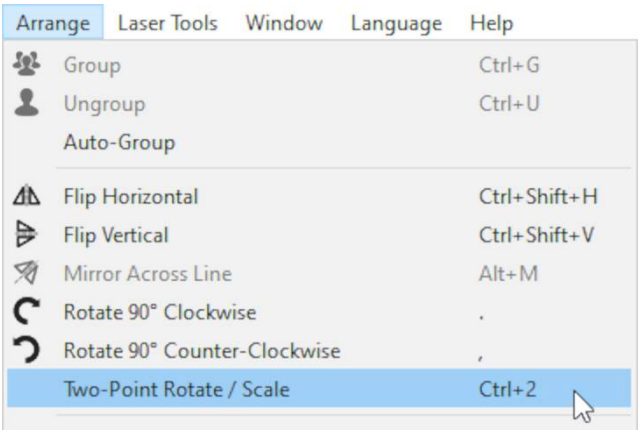
HOW TO USE



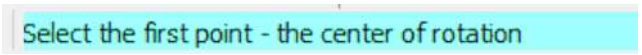
First, select the object you want to rotate.



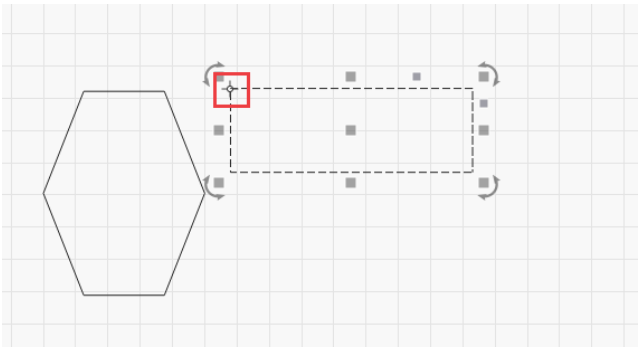
Then, click the "Two-Point Rotate / Scale" button in the "Arrange" menu (or ^ Ctrl + 2) to start the use of the tool.



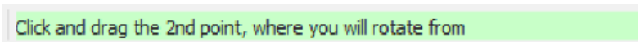
In the bottom right corner of the window, LightBurn will ask you to select the first point (the center of rotation). Click on a point in the editing area to do this.



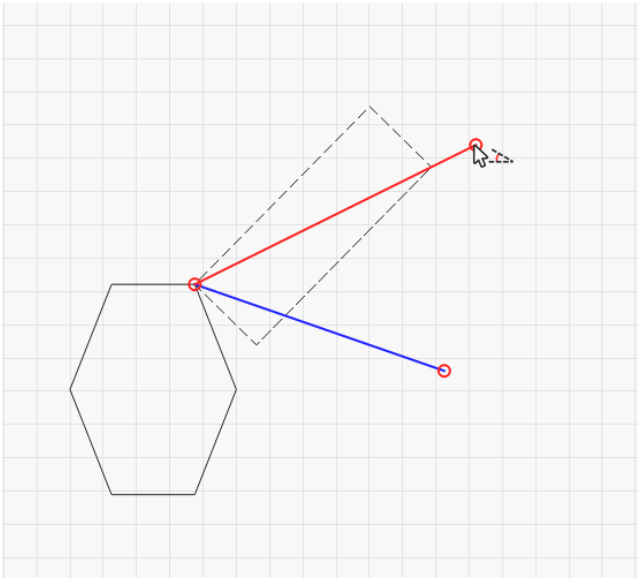
If the point you're selecting is a corner point, the mouse cursor will change to a crosshair. This can help if you're trying to rotate around a very specific point.



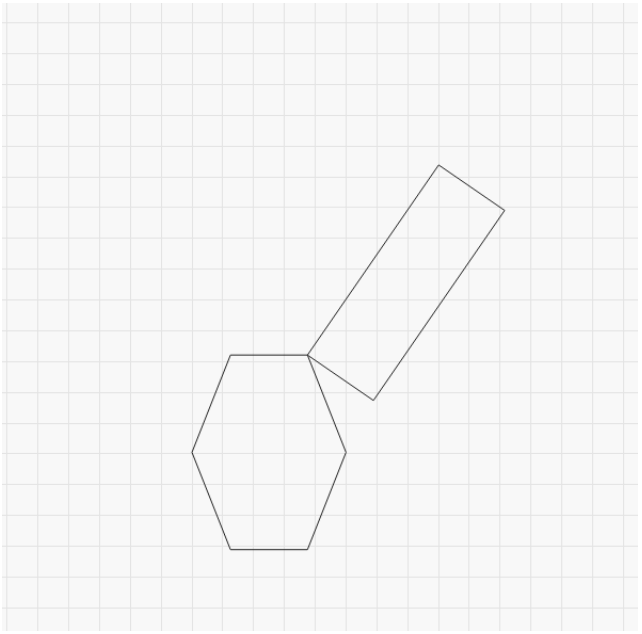
After confirming your first point, the instructions in the bottom right corner will update to ask you to select the second point. Your cursor will also change.



By clicking and dragging you can rotate the shape, and LightBurn will give you a preview as you move your mouse. Holding down ⇧ Shift will allow you to simultaneously scale the shape.



Release the mouse to apply the rotation (and scale, if used).



Slot & Tab Resizer

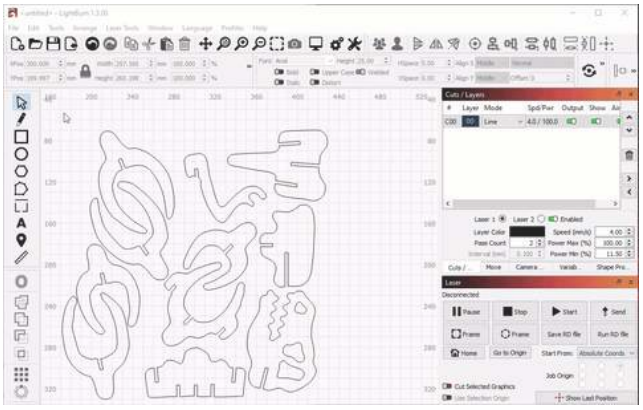
This feature is available in LightBurn 1.3 and higher.

ABOUT

> **Info**
>
> This is a separate tool from the tabs/bridges tool, which can be used to leave a part connected to the material it is being cut from so it doesn't fall out immediately.

Have you ever wanted to use a jointed design that was made for a different thickness of material, or wanted to cut it at a different size/scale, but the thought of manually fixing all the joints is painful?

The *Resize Slots* tool searches for slots or tabs of a specific size, and let you choose a new size for them to be, taking a lot of the hard work out of it!



USAGE

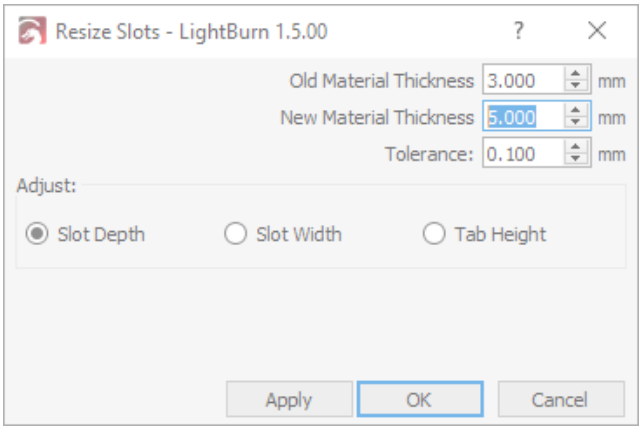
This tool currently works on two main forms of geometry:

- *Slots*, like those found in 3D puzzles or partitions in trays, somewhat similar to a traditional halved joint or dado.
- *Tabs*, like a tenon or the fingers in a box joint, usually found in boxes and drawers.

STEPS

1. You'll need to know the length of the lines you want to adjust. You can use the Measurement Tool to find it if you are unsure.
2. Ungroup your shapes if necessary. Then select your objects and click **Tools → Resize Slots in Selection**.
3. The tool searches for tabs or slots within the selected objects, and then searches within that geometry for lines with the length you specify in **Old Material Thickness**. Any slots or tabs identified by the tool are highlighted in red. The lines that will move are highlighted in blue and shown with an arrow indicating the direction and distance they will move.
4. Click the 'OK' button to confirm.

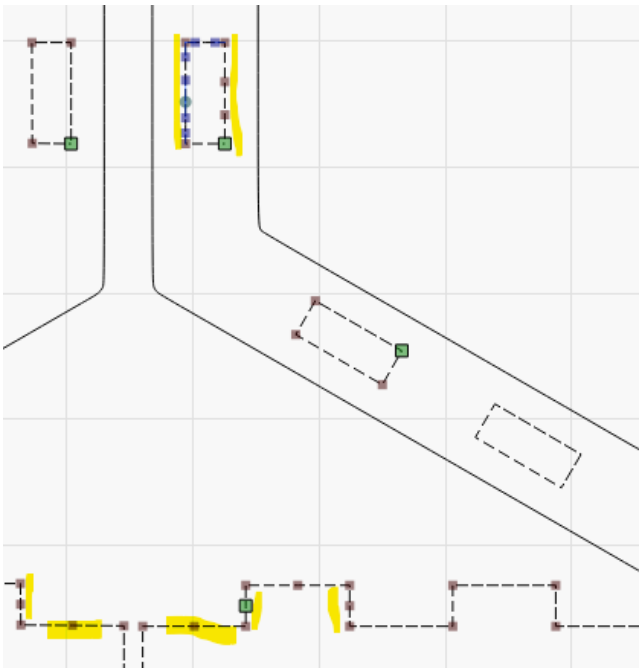
SETTINGS



- **Old Material Thickness**: The current length of the lines you want to adjust.
- **New Material Thickness**: The length you want to adjust the lines to.
- **Tolerance**: Allows you to 'fuzz' the Old Material Thickness slightly. This helps if the lines vary slightly in length. It also allows you to put in the measurement of the material the part was designed for, and use the tolerance to allow for any kerf offsets built into the existing design.
- **Adjust Slot Depth**: Adjust the bottom/innermost line of the slot. This allows you to keep the outer size of the assembled piece the same.
- **Adjust Slot Width**: Adjust the sides of the slot. This would typically be used when the slots are meant to intersect on the interior of a laser cut piece instead of on the corners, like boxes.py's tray insert
- **Adjust Tab Height**: Adjust the top/outermost line of the tab. This allows you to keep the interior size of the assembled piece the same, while making it bigger or smaller on the outside.

TROUBLESHOOTING

- The tool doesn't yet work on internal slots/ cutouts/ mortises as it's tricky for the computer to determine which direction they should grow/shrink.
- The tool searches ungrouped objects. If it's not recognizing the tabs or slots in your design, try ungrouping your objects.
- The tool only works on sharp (not filleted/rounded) corners. Some tools (like boxes.py) default to adding small loops on internal corners and small filets/rounded corners on external ones. The external filets ones can be removed using the Radius Tool and the internal loops can be removed using the Offset tool set to 0.
- The tool requires well-formed shapes as an input. If the shape has extra nodes, or if any of the lines are technically curves (even if they're straight), it will interfere with slot/tab detection. The highlighted sections in the image below show examples of problematic shapes. You can use optimize selected shapes to try to repair these shapes.



Primary Docs **UI**

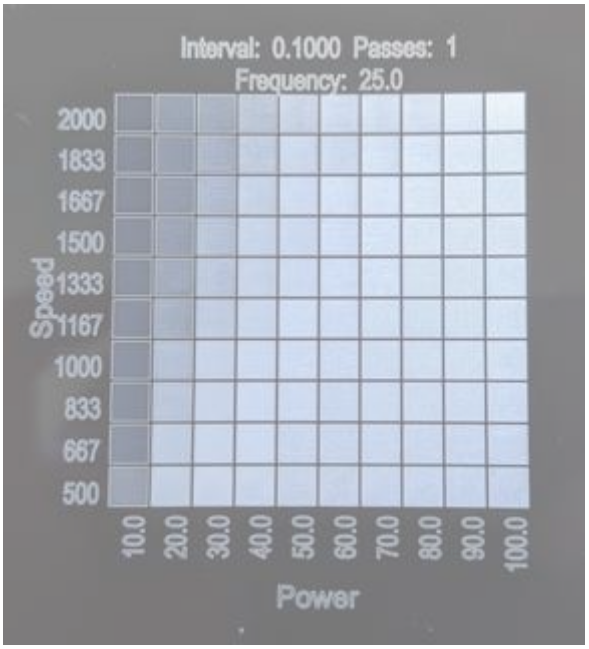
Material Test

ABOUT THE MATERIAL TEST GENERATOR

LightBurn has a built-in test pattern generator to help you find the best settings for your laser and material combination. You can find it in the LightBurn menus by going to **Laser Tools → Material Test**.

Video guide to using the Material Test Generator

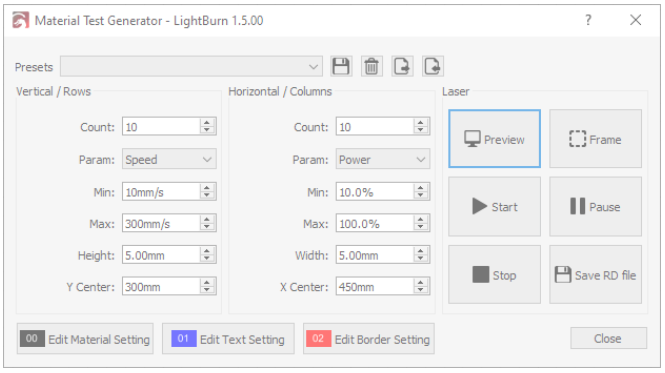
MATERIAL TEST EXAMPLE



A material test showing different speeds and powers on black anodized aluminum

On the left side, each row is labeled with the engraving speed. Along the bottom, columns are labeled with the power level used. At the top, the sample shows additional relevant settings—in this case, Interval, Passes, and Frequency.

USING THE MATERIAL TEST GENERATOR



The Material Test dialog as it appears for a DSP laser

After opening the Material Test Generator, you'll be able to configure your test pattern. By default, the Material Test Generator will create a 10x10 grid of boxes with varying **Power** and **Speed**. Use the **Params** dropdown if you wish to change which values are changed in the test.

Test Configuration

The settings below will enable you to configure your test grid. The parameters tested can be **Power**, **Speed**, **Interval**, **Passes**, or **Frequency**. Q-Pulse can also be tested, if using a galvo laser with the appropriate source.

Test Grid Settings	Explanation
Count	How many rectangles are in each row/column
Param	The setting being tested along this axis
Min	The lowest value to be used for this setting
Max	The highest value to be used for this setting
Height/Width	The height/width of each rectangle in the test grid
Y Center/X Center	The position of the center of the test grid

Cut Settings

The three buttons at the bottom of the dialog box open the Cut Settings Editor for you to adjust the settings to use in your test.

Button	Explanation
Edit Material Setting	Base settings for the test—the two settings chosen in **Param** will be varied in the grid, but other settings will be left unchanged
Edit Text Setting	Settings to use for the text labels
Edit Border Setting	Settings to use for the border around the shape—available in LightBurn 1.5 and higher

Running The Test

The buttons on the right side allow you to preview the test grid, adjust location, and run the laser.

Laser Controls	Explanation
Preview	Generate a preview of the test grid
Frame	Frame the test grid to see its position on the material
Start	Start running the material test
Pause	Pause the material test
Stop	Stop running the material test
Save RD File/ Save GCode	Device-dependent—if available, saves the test grid in RD or GCode format

SAVING AND EXPORTING

At the top are buttons allowing you to save, delete, export, and import presets. There is also a dropdown allowing you to select a saved preset. This is useful if you have custom settings you like to run frequently, for instance a smaller test pattern you want to use on metal tags or a range of settings you want to test on different woods.

To locate the presets saved on your computer, go to **File → Open Prefs Folder**. You'll find the `material_test_presets.lbmt` file inside the `presets` folder.

Primary Docs **UI**

Interval Test Tool

ABOUT INTERVAL SETTINGS

Finding an appropriate interval setting is an important part of optimizing your engraving quality. The interval refers to the distance between lines when raster engraving.

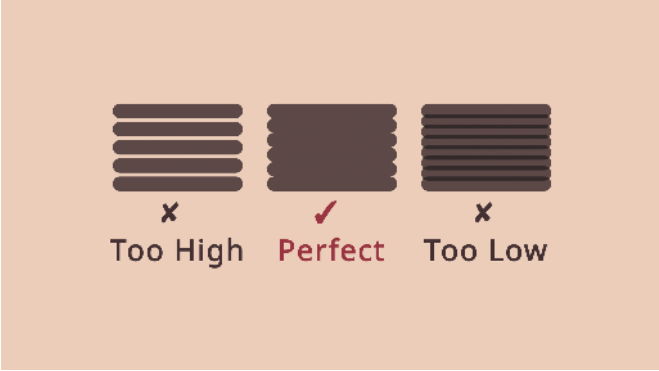


Diagram of the effect of interval spacing on engravings

If your interval setting is too high, you'll need more power to achieve the same burn, and you may see gaps between the lines. You may also see stepping on curved edges.

Appropriate interval settings will give you a darker, deeper engraving with cleaner edges.

Lowering your interval settings too far will increase your engraving time, with minimal increase in engraving quality.

USING THE INTERVAL TEST TOOL

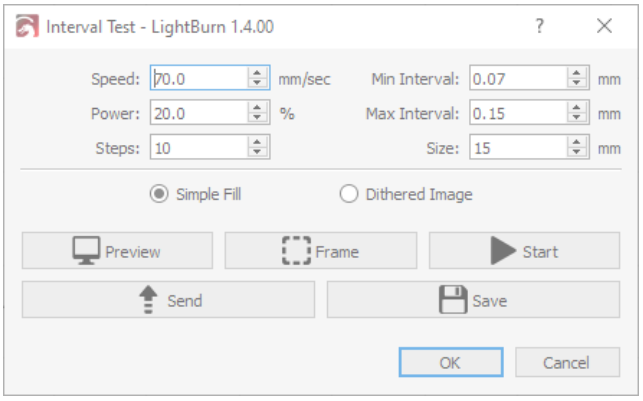
Every type of machine and material will process differently, so the Interval Test is a quick way to determine appropriate settings for a given combination of machine and material.

After running the Interval Test, look at your test squares closely with good lighting. You'll want to look for an etch in which you don't see defined lines between the passes (too high an interval) and passes don't appear to overlap (too low an interval). This can vary significantly between materials. See the video above for visual examples.

1. Place a scrap piece of the material you're testing into your laser, and adjust your focus appropriately.
2. Figure out how much material you have available for the interval test. The default settings for the material test will produce a test grid about 150 mm long and 50 mm tall. You may need to run multiple tests, so keep that in mind.
3. Adjust your settings.
4. Preview the test to make sure the output is what you expect.
5. Frame the test to make sure it's placed and sized appropriately for the material
6. Press start to run the test.

If you're using the Material Library to save and apply cut settings, don't forget to create or update a material preset with the appropriate interval. If you aren't familiar with the Material Library, you might want to give it a try - not having to figure out optimal settings every time saves a lot of time and effort.

INTERVAL TEST SETTINGS



Speed and Power

The speed and power to use for all the swatches. If you've already run a speed and power test with our Material Test tool (see video on YouTube), you can go with those settings. Otherwise, your laser manufacturer likely has recommended settings available to use as a starting point.

Min and Max Interval

The lowest and highest interval settings to use for the test. For most CO2 and Diode lasers, using an interval below 0.1 mm is unnecessary.

Steps

How many sample squares to create. Reducing this will reduce the material needed, but will also result in larger differences between each test square.

Size

The size of the sample square. Reducing this will reduce the material needed, but may make the results harder to read.

Simple Fill or Dithered Image

Simple Fill will generate squares with a solid black fill. **Dithered Image** will fill the square with a dithered gradient to help you see what your gradients will look like when photo engraving.

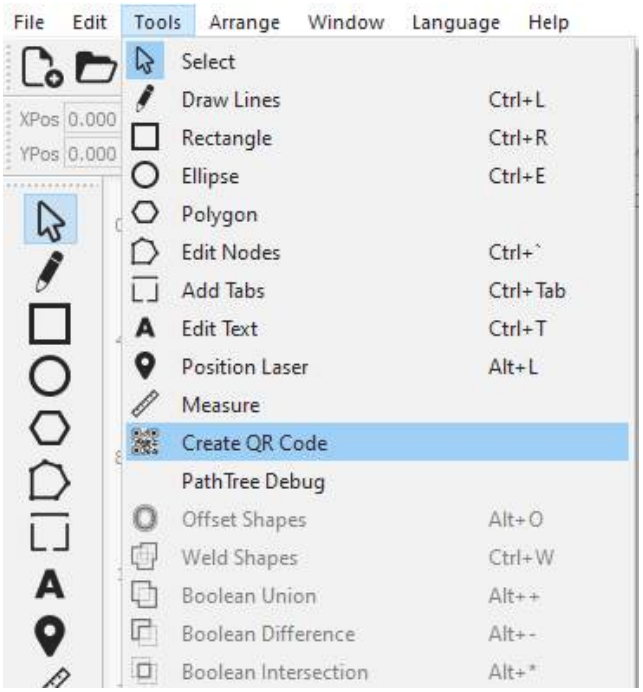
QR Code Generation

QR Codes are square 2D barcodes that can be scanned by a mobile device with a camera. They are able to store and convey a wide variety of information, such as simple text, a URL, or even WiFi access information, such as the example shown below.

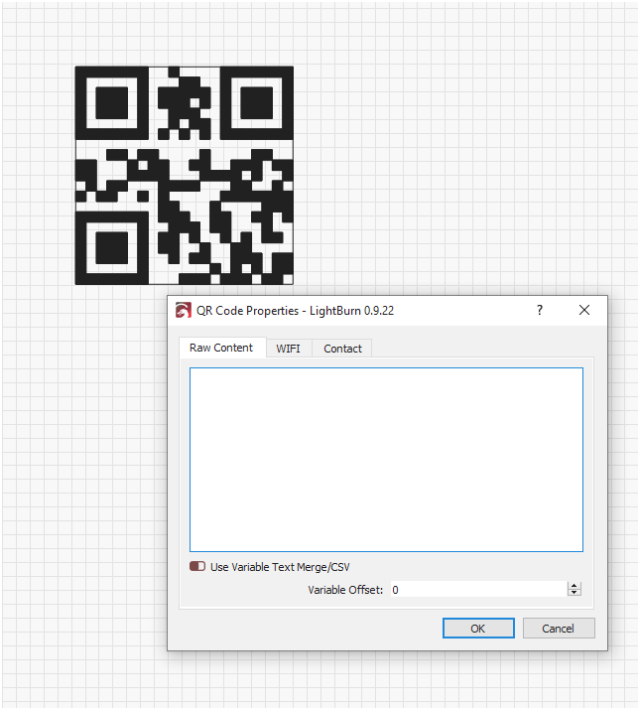
Most modern mobile devices with a camera include some sort of built in QR code scanning ability, often direct from the stock camera application. Simply point the camera at the code and it will recognize it and provide a prompt to proceed with whatever information is contained. If this does not work, check the documentation for your specific device. In some cases, you may need to download a barcode scanning application.

USAGE

LightBurn can easily generate QR Codes for you using the QR Code tool. Navigate to the `Tools` Menu and then select `Create QR Code` as shown below.



With the QR tool selected, click and drag in the Edit Window where it will show a square being drawn, this will be the initial size of your QR Code. Once you release the mouse button, you will be shown the `QR Code Properties` dialog.

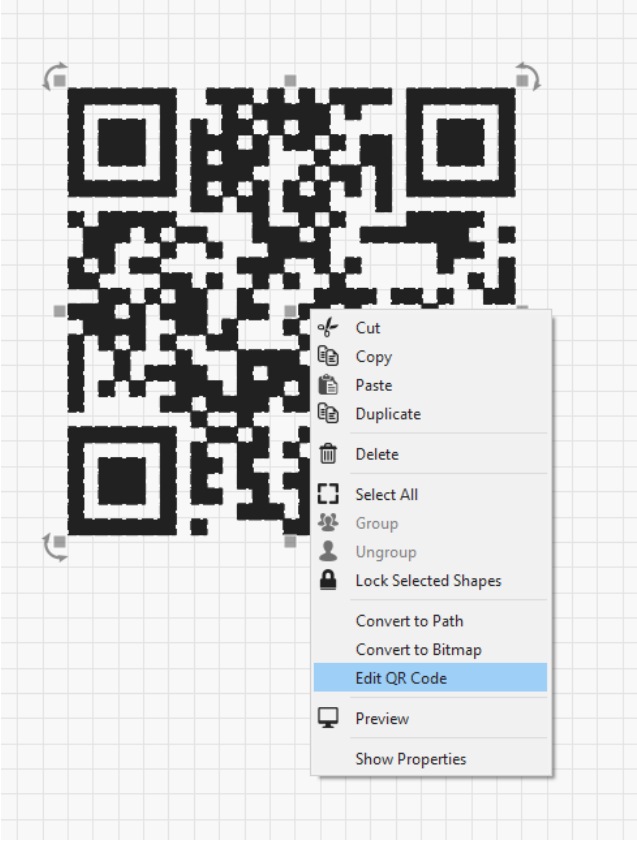


From here there are 3 main options for QR code content:

- Raw content: typically plain text or URLs
- WIFI: Creates a WiFi access point configuration code for mobile devices.
- Contact: Creates a "Contact Card" code which will load contact info into your mobile device's contacts.

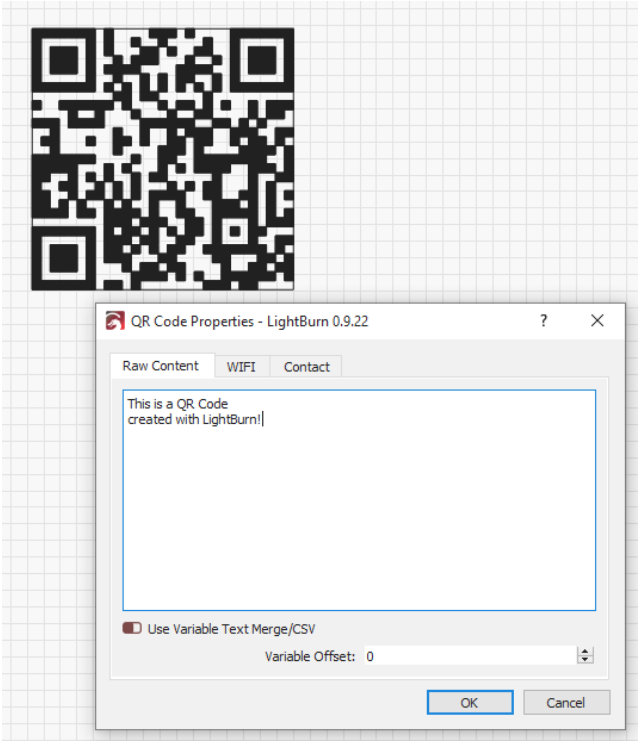
As you enter QR Code content you will see the QR code in the edit window update in realtime. The more content you add, the smaller the sub-squares will become to fit all of that data. You can always scale the size of the QR Code after the fact, if needed.

Note that you may also edit an existing QR code object by selecting it, right clicking, and choosing the `Edit QR Code` option. This will bring up the same `QR Code Properties` dialog as before with all the information filled in.



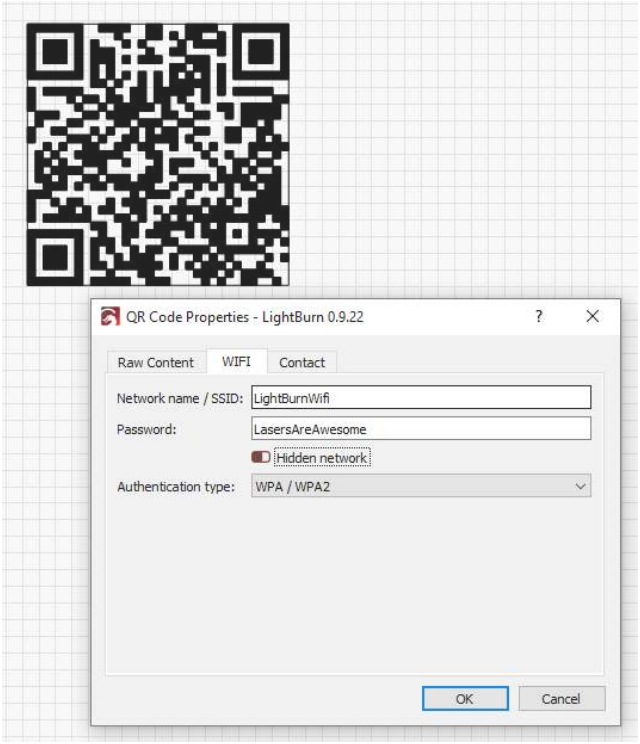
Raw Content

This is the simplest and most flexible option as it allows you to enter any text you would like. At the simplest this is just basic plain text or a URL. But there are a wide variety of other options supported by many mobile devices such as email addresses, phone numbers, geo-location information, and more. There is a great list explaining the options and how the text must be formated on the zxing barcode scanner documentation.



WiFi

With with WIFI tab you can create a barcode that, when scanned, will allow that mobile device to automatically contect to a WiFi access point with all of the connection informtation provided.

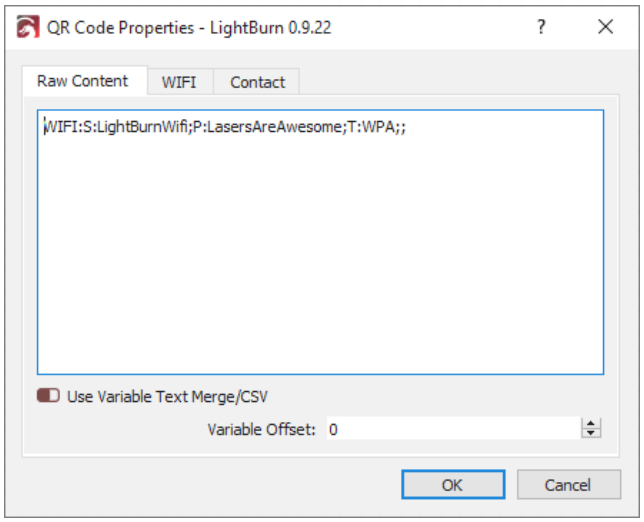


The input options are:

- Network name / SSID: The configured name of the access point

- Password: The WEP or PSK password for the network if one is required (see Authentication type below)
- Hidden network: When checked this specifies that the SSID of the network to connect to is not broadcast publicly and that the mobile device should act accordingly.
- Authentication type: Choose from WPA/WPA2, WEP, or None. Typically most modern access points use WPA2. Check the configuration on your access point if you are unsure.

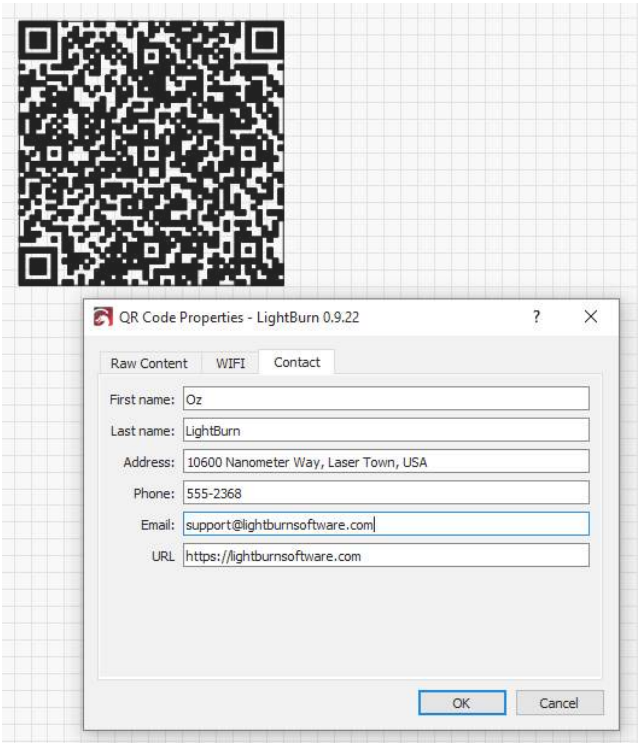
Once you've entered the WiFi access point information the content under the `Raw Content` tab will automatically be updated to reflect the WiFi configuration. As shown below:



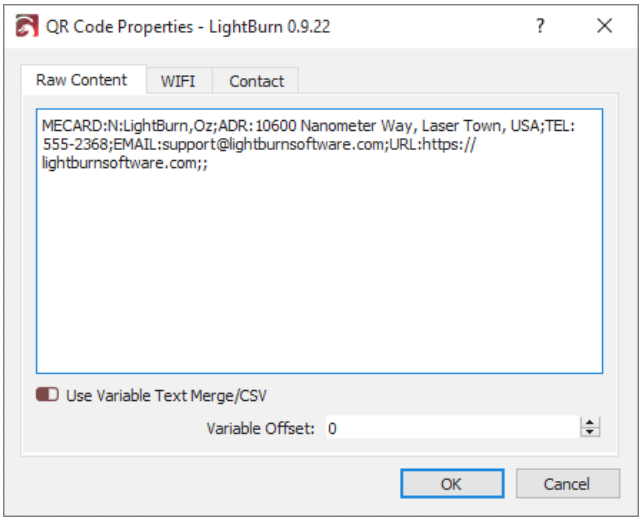
The WiFi raw content format is described in more detail in the zxing barcode documentation.

Contact

With the Contact tab you can create barcodes that contain contact information which can then be automatically loaded into a mobile device's contacts storage.

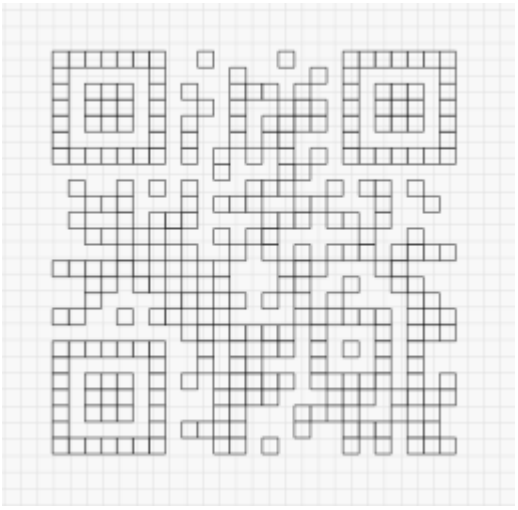


Just like with the WiFi tab, once infomation is entered on the Contacts tab, if you go back to the Raw Content tab you will see the raw contact card shown, which in this case is in the "MECARD" format.

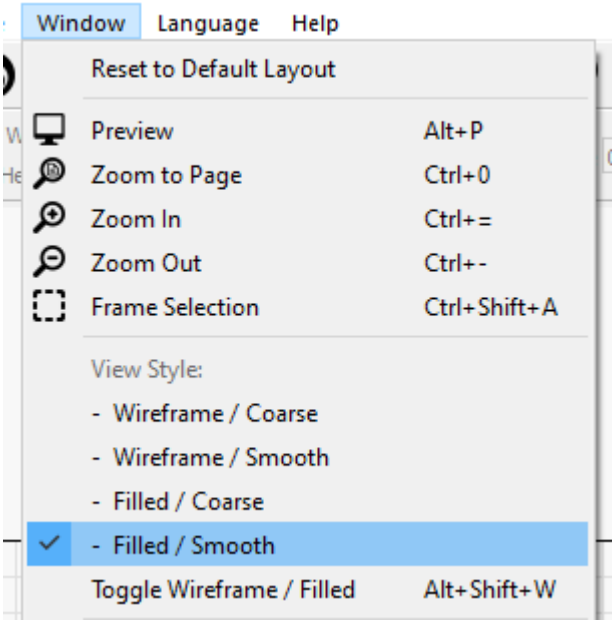


CUT SETTINGS

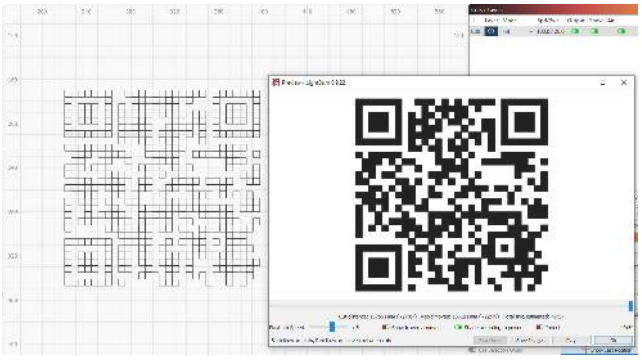
Because of the way QR Codes work it's assumed that there is a high amount of contrast between the light and dark sections of the barcode. Most importantly the dark sections must be completely filled so you should be sure to use the "Fill" mode on the cut layer being used for the QR Code. If in LightBurn you see the QR Code render as shown below, that means you either are not using "Fill" mode on that cut layer or filled rendering is turned off.



You can enable filled rendering from the `Window` menu by choose `Filled / Coarse` or `Filled / Smooth`



If you would rather not enable filled rendering in the edit window, you can also see a preview of what the filled QR code will look like by launching the cut Preview. You will, of course, still need to have the QR code on a "Fill" mode cut layer.



Once in "Fill" mode, be sure to set an appropriate power level for the material you are using in order to provide sufficient contrast between the fill engraved areas and the base material similar to what you see below:

Variable Text

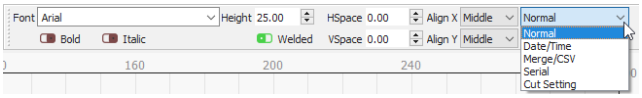
Primary Docs **Text & Fonts** **Tools**

VARIABLE TEXT IN LIGHTBURN

Variable text is a feature that allows you to use special codes in your text entries that will be substituted for something else when you send the data to the laser (or the preview). Variable text can be used for:

- Date or time stamps
- Serial numbers
- Displaying cut settings
- Merging a CSV file into your designs

In all of these cases, the text in LightBurn is set to one of the dynamic text modes, and the text entered is used to tell LightBurn what you want it to display. You select the text mode like this:

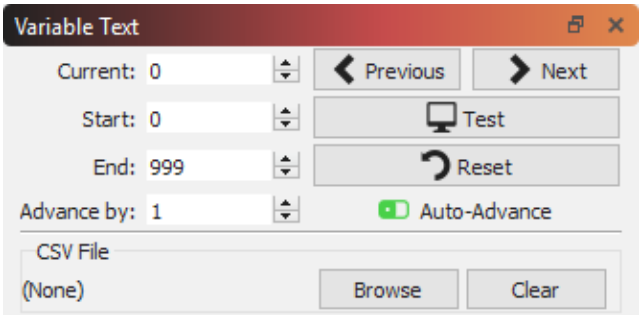


With the mode selected, you enter one of the special codes for that mode, and when you preview, save, or send the file to the laser, LightBurn will replace the text with the desired output.

The different formatting codes are listed here: Variable Text Formats

Variable Text Manager

If using serial numbers or a CSV file, you have additional controls, available in the Variable Text window in LightBurn, shown below:



The values shown are:

Current: The current serial number, or row from the CSV file, that will be displayed.

Start: The first serial number you want to use, or the first row in the CSV file to be used.

End: The last serial number to use, or the last row in the CSV file to use.

Advance by: Imagine you are creating a series of numbered labels. Rather than cutting each one separately, you would most likely want to do several at once on a page. The "Advance by" value tells LightBurn how many entries to advance ahead when you click the Next or Previous buttons, or when it automatically advances to the next page for you.

The buttons on the right are for:

Previous: Go to the previous page of values (decrements the Current entry by the 'Advance by' amount)

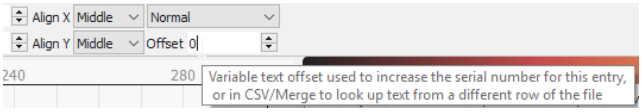
Next: Go to the next page of values (increments the Current entry by the 'Advance by' amount)

Test: Displays the text that will be output, for as long as the button is pressed.

Reset: Resets the Current value to the Start value

Auto-Advance: When this switch is enabled, each time you press one of the **Start**, **Send**, **Save GCode** (GCode devices only), or **Save RD File** (DSP devices only) buttons in the Laser window, LightBurn will automatically advance the Current value by the 'Advance by' amount. If you are running a large batch of parts, names, serial numbers, etc, each time you send a job to the laser the software will advance to the next batch.

Text objects within LightBurn have a property called **Offset**. This value is added to the current variable text index when evaluating the text object. This allows you to have text objects on your design that display different serial numbers, or different rows from the CSV file.



If you created a design with 4 name tag labels on the page, you would set the Variable Offset value for each of the four labels to 0, 1, 2, and 3, and tell the Variable Text manager to advance by 4 with each run.

Automatic Arrays

When copying a text shape using Grid Array, Circle Array, or Copy Along Path, LightBurn can automatically advance the 'Offset' value on your variable text objects for you. In this way you can quickly create full sheets of items containing serial numbers or CSV file references.

VARIABLE TEXT FORMATS

These are the different formatting codes used for Variable Text in LightBurn.

Date / Time text format

When using the Date/Time mode for text, the system will automatically substitute special combinations of characters with values for the current local date and time.

For example, if your text field is "d/MM/yyyy" the system would replace it with "15/6/2019". The values you can use for substitution are listed below.

These expressions may be used for the date:

Expression	Output
d	the day as number without a leading zero (1 to 31)
dd	the day as number with a leading zero (01 to 31)
ddd	the abbreviated localized day name (e.g. 'Mon' to 'Sun'). Uses the system locale to localize the name.
dddd	the long localized day name (e.g. 'Monday' to 'Sunday'). Uses the system locale to localize the name.
M	the month as number without a leading zero (1-12)
MM	the month as number with a leading zero (01-12)
MMM	the abbreviated localized month name (e.g. 'Jan' to 'Dec'). Uses the system locale to localize the name.
MMMM	the long localized month name (e.g. 'January' to 'December'). Uses the system locale to localize the name.
yy	the year as two digit number (00-99)
yyyy	the year as four digit number

These expressions may be used for the time:

Expression	Output
h	the hour without a leading zero (0 to 23 or 1 to 12 if AM/PM display)
hh	the hour with a leading zero (00 to 23 or 01 to 12 if AM/PM display)
H	the hour without a leading zero (0 to 23, even with AM/PM display)
HH	the hour with a leading zero (00 to 23, even with AM/PM display)
m	the minute without a leading zero (0 to 59)
mm	the minute with a leading zero (00 to 59)
s	the whole second without a leading zero (0 to 59)
ss	the whole second with a leading zero where applicable (00 to 59)
z	the fractional part of the second, to go after a decimal point, without trailing zeroes (0 to 999). Thus "`s.z`" reports the seconds to full available (millisecond) precision without trailing zeroes.
zzz	the fractional part of the second, to millisecond precision, including trailing zeroes where applicable (000 to 999).
AP or A	use AM/PM display. *A/AP* will be replaced by either "AM" or "PM".
ap or a	use am/pm display. *a/ap* will be replaced by either "am" or "pm".
t	the time zone (for example "CEST")

Any sequence of characters enclosed in single quotes will be included verbatim in the output string (stripped of the quotes), even if it contains formatting characters. Two consecutive single quotes ('') are replaced by a single quote in the output. All other characters in the input string are included verbatim in the output string.

Formats without separators (e.g. "ddMM") are supported but must be used with care, as the resulting strings aren't always reliably readable (e.g. if "dM" produces "212" it could mean either the 2nd of December or the 21st of February).

Example format strings (for the date & time 21 May 2001 14:13:09.120):

Input	Result
dd.MM.yyyy	21.05.2001
ddd MMMM d yy	Tue May 21 01
hh:mm:ss.zzz	14:13:09.120
hh:mm:ss.z	14:13:09.12
h : m : s ap	2 : 13 : 9 pm

Serial number text format

When using the Serial mode for text, the system will automatically substitute certain special combinations of characters with the current serial number value, and other characters control how it is formatted.

These expressions may be used for serial numbers:

Output	Expression
The serial number as a decimal value	d

Output	Expression
The serial number as a hexadecimal value, lower case	h
The serial number as a hexadecimal value, upper case	H
Tells LightBurn to pad the number with leading zeros	0

The number of characters used controls how many digits the system will display. If the serial number is larger than the number of digits allowed, as many digits as will fit from the end of the number will be displayed. For example, if your serial number is 1234, the table below shows how that number would be formatted for each of the displayed formatting inputs:

Input	Output	Input	Output
d	4	0d	4
dd	34	0dd	34
ddd	234	0ddd	234
dddd	1234	0dddd	1234
ddddd	1234	0ddddd	01234
dddddd	1234	0dddddd	001234

You cannot mix decimal and hexadecimal formatting in the same text entry, and you cannot split a serial number with other characters. For example, this string is not valid: ddd-ddd because of the hyphen between the two groups of format characters.

Like the Date / Time formatting, any text between a pair of single quotes is copied exactly to the output, and a pair of single quotes together is replaced by one single quote in the output.

CSV/Merge text format

When using the CSV/Merge mode for text, the system will automatically substitute certain special combinations of characters with entries from the selected row of a CSV file. A CSV file is "Comma Separated Values" - a very simple text format that uses a line in the file as the row, and commas to separate columns in the file.

For example:

```
LightBurn,80,10
Corel,300,20
```

In a CSV/Merge entry in LightBurn, the text you enter uses the percent sign followed by a number to look up a column in the current row of the CSV file. For example, using this text with the above table:

I'm thinking of buying %0 - it costs $%1

Would display:

I'm thinking of buying LightBurn - it costs $80

Columns are numbered starting from 0.

Cut Setting text format

When using the Cut Setting mode for text, the system will automatically substitute certain characters with values from the cut setting applied to the text.

Like the Date / Time or Serial number formatting, any text between a pair of single quotes is copied exactly to the output, and a pair of single quotes together is replaced by one single quote in the output.

Expression	Output
C	followed by a number, pulls settings from the numbered cut layer (ex, C03) for the remainder of this string
s	speed, as a number in the current speed units
S	speed, including the current units (like mm/sec)
p	max power, as a percentage
P	max power, including the percent sign
m	min power, as a percentage
M	min power, including the percent sign
d / D	DPI, as a number, always dots per inch
i	interval, in the current distance units
I	interval, including the current distance units (like mm)
L	Displays the name of the laser. Can optionally be followed by a character index to start displaying from, and optionally, a comma and a 2nd number for the number of characters to display. For example, if L displayed 'Ruida 6442G', L6 would display '6442G', and L6,4 would display '6442' (without the quotes)
z	Z offset for the current layer, in the current distance units
Z	Z offset for the current layer including the units (eg, mm)
q	Q-pulse width
Q	Q-pulse width, followed by 'ns' to indicate the units
k	frequency in kHz
K	frequency in kHz, followed by 'kHz' to indicate the units

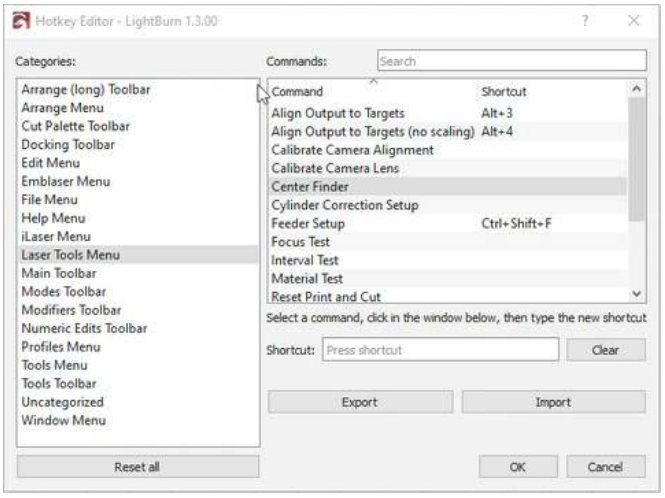
5.5.4 Hotkeys and Gestures

Most feature hot-keys can be found next to the action in the menus.

Hotkey Editor (version 1.3+)

As LightBurn has added more features, it's become harder to find available hotkeys that will work with a variety of keyboard layouts. Version 1.3 has added a hotkey editor, so you can cusomtize most of LightBurn's shortcuts to your liking. Any button on the toolbar can be given a hotkey, and the editor includes a search function to help you find them.

Access the Hotkey Editor through the menu: **File >> Edit Hotkeys**



The Hotkey Editor Window

General Usage Hotkeys

MOUSE

- **Selection:** Left click, or band-box
- Shift + click adds to the current selection
- Ctrl/⌘ + click removes from the current selection
- **Drag:** Left-click & hold on an object, drag it
- When dragging, Shift will keep the drag vertical, horizontal, or 45 degrees
- When dragging, Ctrl means "don't grid / object snap"
- When sizing, the default is retain the current aspect ratio, holding shift unlocks it.
- When sizing, Control means "resize from center"
- **Zoom:** Mouse wheel (zooms relative to the cursor)
- **View drag:** Middle-mouse click and drag
- **Double clicking text**: Auto chooses text mode and places cursor.

KEYBOARD

- **View drag:** Hold space-bar + left-click & drag (useful for Mac, or users without a mouse wheel)
- **Delete:** Backspace or Delete keys
- **Select Mode:** Pressing the Esc key while in the workspace will return to the selection tool

Move

- Arrow keys move the current selection
- Shift + arrow moves in large steps
- Ctrl/⌘ + arrow moves in small steps

MENU HOT-KEYS

File

Action	Windows / Linux	macOS
New	Ctrl + N	⌘ + N
Open	Ctrl + O	⌘ + O
Import	Ctrl + I	⌘ + I
Save	Ctrl + S	⌘ + S
Save As	Ctrl + Shift + S	⌘ + Shift + S
Save As Gcode	Alt + Shift + L	⌥ + Shift + L
Export	Alt + X	⌥ + X
Print (Black Only)	Ctrl + P	⌘ + P
Print (Keep Colors)	Ctrl + Shift + P	⌘ + Shift + P
Exit	Ctrl + Q	⌘ + Q

Edit

Action	Windows / Linux	macOS
Undo	Ctrl + Z	⌘ + Z
Redo	Ctrl + Shift + Z	⌘ + Shift + Z
Select All	Ctrl + A	⌘ + A
Invert Selection	Ctrl + Shift + I	⌘ + Shift + I
Cut	Ctrl + X	⌘ + X
Copy	Ctrl + C	⌘ + C
Duplicate	Ctrl + D	⌘ + D
Paste	Ctrl + V	⌘ + V
Paste in place	Alt + V	⌥ + V
Delete	Delete / BackSpace	Delete / BackSpace
Convert to Path	Ctrl + Shift + C	⌘ + Shift + C
Convert to Bitmap	Ctrl + Shift + B	⌘ + Shift + B

Action	Windows / Linux	macOS
Close Path	Alt + C	⌥ + C
Auto-Join	Alt + J	⌥ + J
Optimize	Alt + Shift + O	⌥ + Shift + O
Delete Duplicates	Alt + D	⌥ + D

Vector Tools

Action	Windows / Linux	macOS
Draw Line	Ctrl + L	⌘ + L
Rectangle	Ctrl + R	⌘ + R
Ellipse	Ctrl + E	⌘ + E
Edit Nodes	Ctrl + `	⌘ + `
Add Tabs	Ctrl + Tab	⌘ + Tab
Create / Edit Text	Ctrl + T	⌘ + T
Offset Shapes	ALt + O	⌥ + O
Weld Shapes	Ctrl + W	⌘ + W
Boolean Union	Alt + +	⌥ + +
Boolean Subtract	Alt + -	⌥ + -
Boolean Intersection	Alt + *	⌥ + *
Boolean Assistant	Ctrl + B	⌘ + B
Break Apart	Alt + B	⌥ + B
Cut Shapes	Alt + C	⌥ + C

Image Tools

Action	Windows / Linux	macOS
Adjust Image	Alt + I	⌥ + I
Trace Image	Alt + T	⌥ + T

Window

Action	Windows / Linux	macOS
Preview	Alt + P	⌥ + P
Zoom In	Ctrl + =	⌘ + =
Zoom Out	Ctrl + -	⌘ + -
Zoom to Page	Ctrl + 0	⌘ + 0
Preview	Alt + P	⌥ + P
Toggle WireFrame/ Filled	Alt + Shift+ W	⌥ + Shift + W
Frame Selection	Ctrl + Shift + A	⌘ + Shift + A
Square Frame Selection	Alt + R	⌥ + R
Rubber Band Frame	Alt + Shift + R	⌥ + Shift + R

Laser Machine Tools

Action	Windows / Linux	macOS
Rotary Setup	Ctrl + Shift + R	⌘ + Shift + R
Position Laser	Alt + L	⌥ + L
Pause	Pause	
Stop	Ctrl + Break	
Reset Device Connection	Right Click "Devices"	

Cuts/Layers

Action	Windows / Linux	macOS
Flash items on Layer	Right Click Layer	Right Click Layer
Select all items on layer	Shift+Click Layer	Shift+Click Layer

GLOBAL HOTKEYS

The following work from anywhere while objects are selected.

Action	Windows / Linux	macOS
Group	Ctrl + G	⌘ + G
Ungroup	Ctrl + U	⌘ + U
Flip Horizontal	Ctrl + Shift + H	⌘ + Shift + H
Flip Vertical	Ctrl + Shift + V	⌘ + Shift + V
Mirror Across Line	Ctrl + Shift + M	⌘ + Shift + M
Align Left	Ctrl + Shift + ←	⌘ + Shift + ←
Align Right	Ctrl + Shift + →	⌘ + Shift + →

Action	Windows / Linux	macOS
Align Top	Ctrl + Shift + ↑	⌘ + Shift + ↑
Align Bottom	Ctrl + Shift + ↓	⌘ + Shift + ↓
Align Centers Vertically	Ctrl + Shift + PgUp	⌘ + Shift + PgUp
Align Centers Horizontally	Ctrl + Shift + PgDn	⌘ + Shift + PgDn
Move H-Together	Alt + Shift + H	⌥ + Shift + H
Move V-Together	Alt + Shift + V	⌥ + Shift + V
Push forward in draw order	PgUp	PgUp
Push backward in draw order	PgDn	PgDn
Push to front	Ctrl + PgUp	⌘ + PgUp
Push to back	Ctrl + PgDn	⌘ + PgDn

EDIT WINDOW SPECIFIC

The following work only while focused on the edit window.

Action	Windows / Linux	macOS
Rotate 5° clockwise	Ctrl + Shift + . (decimal)	⌘ + Shift + . (decimal)
Rotate 5° Counter-clockwise	Ctrl + Shift + , (comma)	⌘ + Shift + , (comma)
Rotate 10 clockwise	Ctrl + . (decimal)	⌘ + . (decimal)
Rotate 10 Counter-clockwise	Ctrl + , (comma)	⌘ + , (comma)
Rotate 90 clockwise	. (decimal)	. (decimal)
Rotate 90 Counter-clockwise	, (comma)	, (comma)
Rotate 45 clockwise	Shift + >	Shift + >
Rotate 45 Counter-clockwise	Shift + <	Shift + <
Two Point Rotate Tool	Ctrl + 2	⌘ + 2
Align Left	L	L
Align Right	R	R
Align Top	T	T
Align Bottom	B	B
Align Centers Vertically	C	C
Align Centers Horizontally	E	E
Move Selection to Page Center	P	P

Tool In-use - Hot-Keys

NODE EDIT

Action	Windows / Linux	macOS	Notes
Smooth corner node	S	S	while hovering over a node
Convert line to smooth curve	S	S	while hovering over a line
Convert curve to line	L	L	while hovering over a curve
Convert smooth node to corner	C	C	while hovering over a node
Delete node	D	D	while hovering over a node
Delete line	D	D	while hovering over a line
Insert node point	I	I	while hovering over a line or curve
Insert node at midpoint	M	M	while hovering over a line or curve
Break shape at point	B	B	while hovering over a point
Trim line	T	T	while hovering over a line, trim line under mouse at

Action	Windows / Linux	macOS	Notes
			next intersection
Extend line	E	E	while hovering over a point, extend line from point under mouse to intersection with another shape

PRINT AND CUT

Action	Windows / Linux	macOS
Start Wizard	Alt + 0	⌥ + 0
Set First Target Position	Alt + 1	⌥ + 1
Set Second Target Position	Alt + 2	⌥ + 2
Align Output to Targets	Alt + 3	⌥ + 3
Align Output to Targets (no scaling)	Alt + 4	⌥ + 4

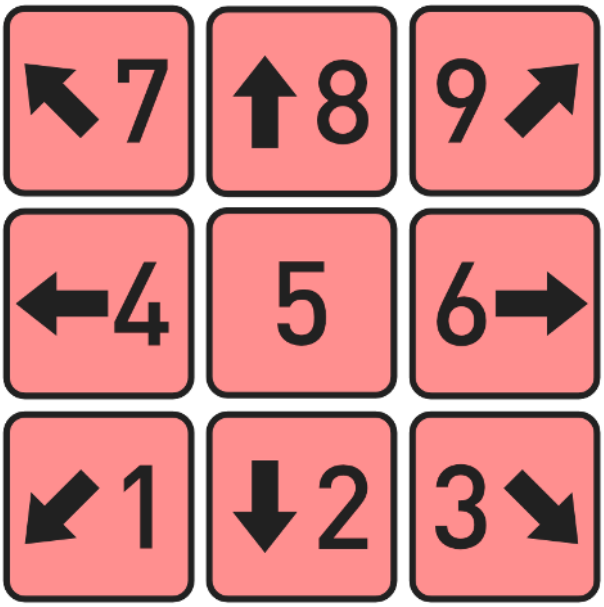
CAMERA

Action	Windows / Linux	macOS
Update camera overlay	Alt + C	⌥ + C

KEYPAD JOG

Note - Numlock must be enabled in Windows and Linux to use Keypad jogging
Jog moves the laser in the jog increments set in the Move tab.

To activate keypad jog you must first click in the workspace area and not have the text tool active. (Press **Esc** for the selection tool for example)



HELP

- Pressing F1 while hovering the mouse over the edit window will bring you to the documentation page for the editing mode you're in.
- Pressing F1 while hovering the mouse over some tools will show you help for that tool.
- Otherwise, pressing F1 will bring up the **Help & Notes** dialog window.

Printable Hot Key Guide

Click to Download

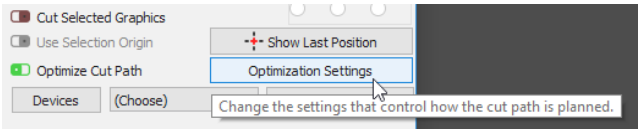
5.6 Advanced Topics

Advanced **Primary Docs**

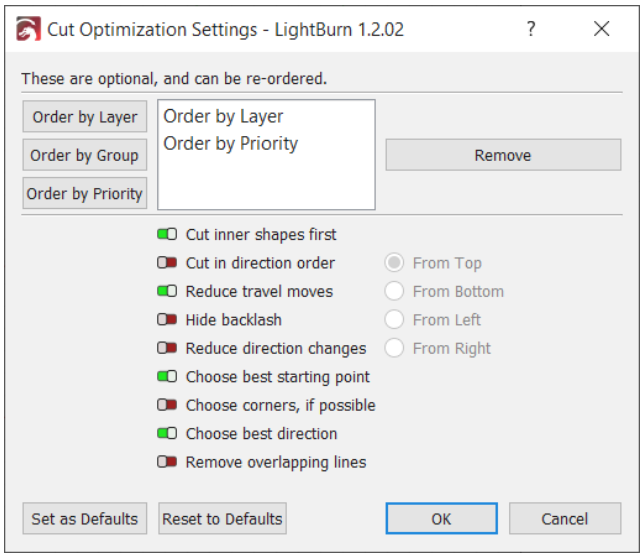
5.6.1 Optimization Settings (Cut Planner)

The cut planner gives you a great deal of control over the ordering of your cuts - you can let LightBurn try to choose the best path for you, order it piece by piece yourself, or somewhere in between. If you have "Order by Layer" as the only entry in the list at the top (the default), it will behave the way you're used to. After selecting your choices in the Cut Planner, use the Preview (Alt-P) to see how your choices have impacted things by using the slider at the bottom of the window.

Access these settings by pressing the Optimization Settings button shown here:



The settings are displayed in this dialog (and the defaults are shown here):



Order By

You can select what the initial ordering parameters will be. You have a choice of Layer, Groups or Priority. As well you can use a combination of these three choices in any order you wish.

Note that the order is important. If you order by layer, then groups, the list of shapes will be split into lists by layer first, then those lists will be sorted by group, and finally, the remaining optimizations will be applied. If you order by groups first, then by layers, the list of shapes will be first split by root-level groups, *then* the shapes within each set will ordered by layer, and so on. This is good for doing large projects where you want an entire multi-layer item to complete before moving on to the next, in case you have to interrupt the project, or something goes wrong.

Each 'Order By' option produces a set of outputs that is then fed into the next option (if any), and so on. Each resulting set is then optimized with the additional options (like inner shapes first, reduce travel moves, etc).

ORDER BY LAYER

If you choose Order By Layer, the cut planner will apply all remaining optimizations to the first layer, then the second layer, and so on.

ORDER BY GROUPS

If you choose Order By groups the cut planner will apply all remaining optimizations to all the objects in a root-level group, then the next Grouped object, and so on. Objects not part of a group are treated as being in a group together.

ORDER BY PRIORITY

If you choose Order By Priority, the cut planner will apply all remaining optimizations to the objects with the highest priority (Assigned in the Shape Properties Window) first, then the next lowest and so on.

Optimizations

These optimizations are applied to each cutting set of outputs from the above ordering as a set.

CUT INNER SHAPES FIRST

As the name implies, if there is an object within another object, and both are being cut, it will cut out the inside object before the outside one.

CUT IN DIRECTION ORDER

This will try to cut the shapes in your project in the specified direction - top to bottom, left to right, etc.

REDUCE TRAVEL MOVES

This will have the cut planner try to order the cuts in a way that it will choose objects beside each other to try and reduce non cutting travel moves.

REDUCE DIRECTION CHANGES

The cut planner will try to choose nearby cuts that allow it to keep moving in the same direction, which keeps the laser moving faster.

HIDE BACKLASH

This option is similar to the 'backlash repay optimize' setting found in RDWorks - It produces a cutting order that reduces or eliminates the misalignment between the start and end

points of a cut caused by loose or flexing belts, or other forms of play in the mechanical parts of the laser. Enabling this option will force some of the other options to give it the most flexibility when planning the cutting path.

CHOOSE BEST STARTING POINT

Allows the system to start a cut at any point within a shape, not just the first point. Works best when "reduce travel moves" is also enabled.

CHOOSE CORNERS, IF POSSIBLE

The cut planner will attempt to start a cut at a sharp corner to minimize burning or staining on the surface of an item.

CHOOSE BEST DIRECTION

The cut planner will attempt to choose the best direction to cut in.

REMOVE OVERLAPPING LINES

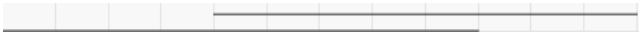
The cut planner will remove lines that overlap each other that would cause the laser to cut in the same place twice.

LightBurn v1.3 and later

Starting in LightBurn 1.3, the cut planner will remove lines that only partially overlap, and has a user-adjustable distance setting for recognizing lines as overlapping.

Older versions

In older versions of LightBurn, the cut planner will remove any line fully covered by another line, but will not remove partial overlaps, like this:



(the lines are offset from each other slightly here to be able to see them)

Primary Docs **Tools**

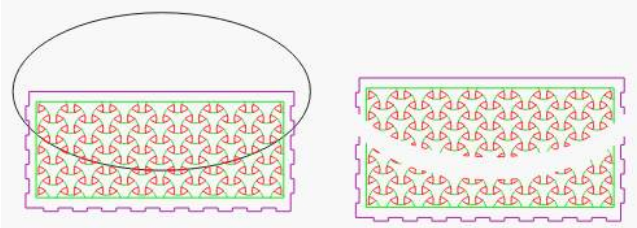
5.6.2 Cut Shapes Tool

The Cut Shapes tool in LightBurn allows you to cut vector shapes in a project using a closed shape as the cutting tool. Cut shapes can be used to cut a project into smaller sections that can be run separately, allowing you to create projects that are larger than will fit within the area of your laser. Large scale designs make heavy use of this feature. (1)

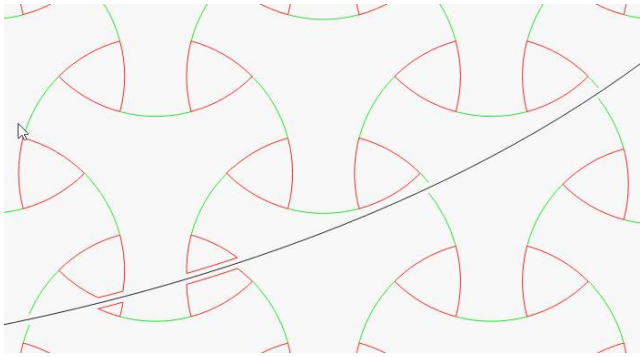
1. Cutting a single project larger than your laser: https://www.youtube.com/watch?v=n__saOKVupA

To use the Cut Shapes tool, select the shapes you wish to cut, then add the cutting tool shape to your selection (the last shape selected is the cutting tool). In the Tools menu, select 'Cut Shapes' and the software will perform the cut.

An example is shown below - the black oval is used as the cutting shape, and the result is shown on the right, separated so you can more easily see the cut line.



In this zoomed in view, near the lower-left you can see that when the red shapes were cut, the software added a new line, closing those shapes, but did not add anything when the green lines were cut. This is because the red layer is set to 'Fill', and in order for the resulting shapes to fill correctly, they need to be closed. The green layer is set to 'Line' mode, so those shapes are not closed when cut.



Key points to remember:

- The last shape you select is used as the cutting tool
- The shape used as the cutter *must* be a single closed shape
- The cutting tool shape is discarded - if you need it again, make a duplicate of it (Ctrl+D)
- Shapes that are cut will be closed if they are set to 'Fill', or left open if they are set to 'Line'

5.6.3 Print and Cut with LightBurn

"Print and Cut" normally refers to the ability to print a design on a printer, then have it automatically cut it out with a blade or laser cutting machine by using registration marks on the print to align the cut to it.

Print and Cut in LightBurn is used to align your current project to something you've previously output. The most common use for this is, as above, printing a file with a design on it and then using the laser to cut out the design, but it can also be used to align multiple jobs on your laser.

You can use it to register two halves of a large job with each other, for example, to cut something larger than your machine. We have a tutorial that shows how to do this here: Cutting a single project larger than your laser

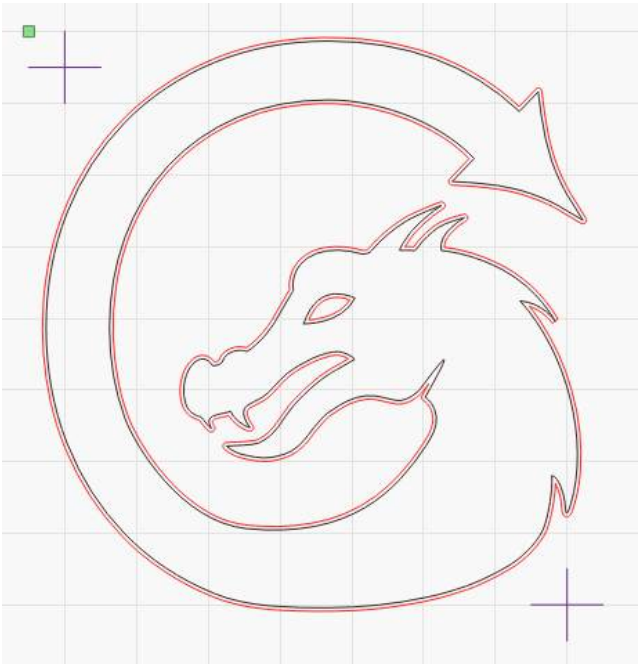
You can also use it to register multiple passes over the same job - For example, you could use your laser to lightly engrave an outline, remove it from the machine to paint it, then put it back in the machine, align it using Print & Cut, then engrave a different area in the same project.

Note: In order for the output to be positioned correctly on your laser, you *must* use *Absolute Coords* as the positioning mode, otherwise the output will not match the position of the print.

Registering a printed file with a laser cut job:

As an example, take this design, printed on sticker paper:

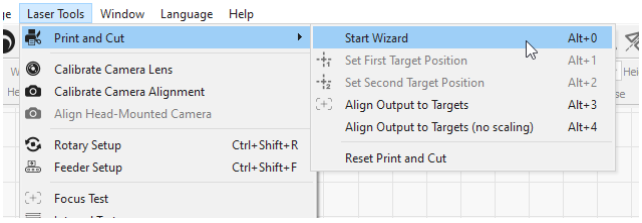
I've imported the same design into LightBurn, with the cross-hair markers, and added an outline to the dragon using the offset tool:



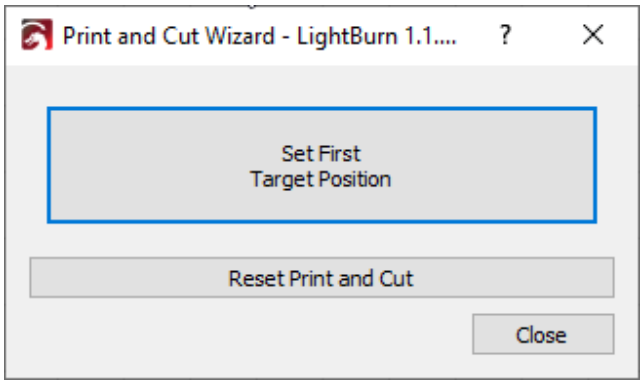
The important part in this file is the two cross-hair marks - these are the target marks that you will use to align the cutting path with the printed sticker. They don't have to be cross-hairs, but these are simplest to align with, as the *center* of the selected object is what is used for alignment when recording positions. Each target marker must be a *single* object that can be selected - If you draw two lines to make a crosshair, group them.

After placing the printed version of the file in the laser, follow these steps to align the laser output with the print.

Note: There is now a wizard for Print and Cut that will guide you through the steps below. You can start the wizard by clicking Laser Tools > Print and Cut > Start Wizard, shown here:



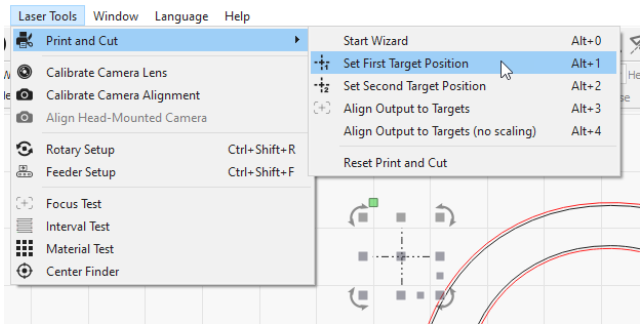
You'll be presented with the Print and Cut wizard, shown here:



Or, you can do the steps using the menu items instead.

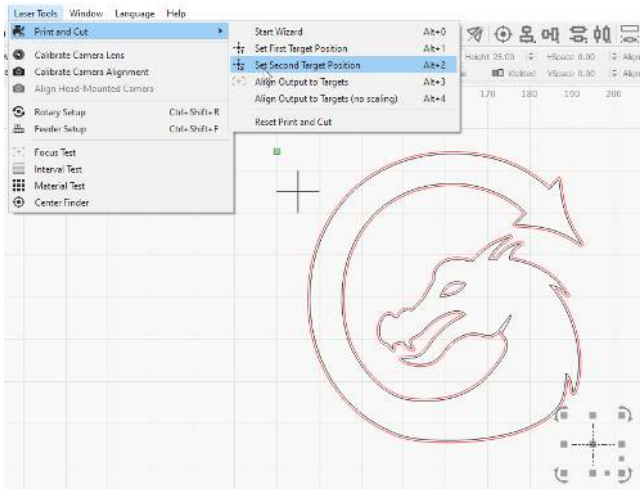
Using the red-dot pointer of your laser, jog the laser head to align with the center point of one of the two cross-hair marks. You cannot move the laser head by hand for this - you have to jog the laser either with the buttons on the laser control panel, or in the Move window in LightBurn.

In LightBurn, select the same cross-hair mark, then go to Laser Tools > Print and Cut > Set First Target Location, like this:



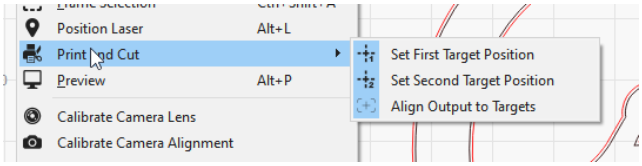
Now, jog the laser to align the red dot pointer to the center of the second marker.

In LightBurn, select that second cross-hair mark, and again choose Tools > Print and Cut > Set Second Target Location:



You will notice that in the above image, the menu option for 'Set First Target Position' has the icon highlighted as well - this means that the First Target Position is set and active.

After setting both targets, the menu will automatically enable the 'Align Output to Targets' option for you, like this:



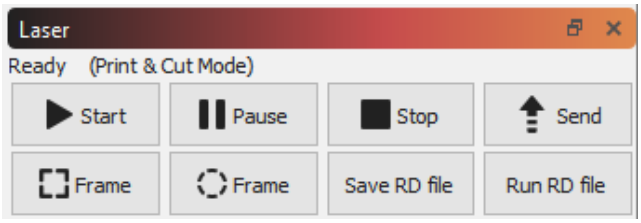
Print and Cut Scaling

After setting targets, you will have the option to **Align Output to Targets (no scaling)** or **Align Output to Targets**.

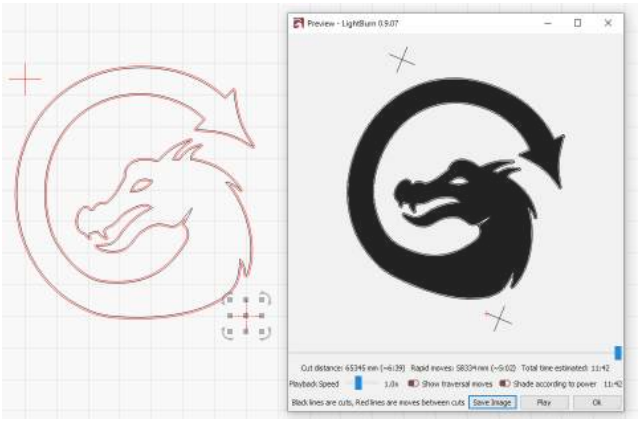
If your design in LightBurn is the same size as the physical design you are using Print and Cut with, you should choose the **Align Output to Targets (no scaling)** option. This will generally be the case if you are resuming a job or performing a multi-step engraving process on your laser.

However, you may sometimes need to scale your design. As an example, you might need to cut out a design on sticker paper that was scaled up or down as part of the printing process. In this case, you should use **Align Output to Targets**. When you select your targets, LightBurn will automatically scale the design to match the real-world size indicated by your targets.

You will also see the "(Print & Cut mode)" message in the status window, like this:



If you preview at this point, the orientation of the preview should match that of the print on your laser:

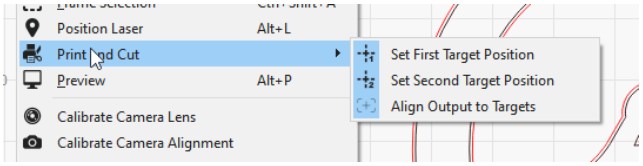


In the above image, you can see the preview image is rotated slightly clockwise, matching the orientation of the printed image in the laser.

Note: In order for the output to be positioned correctly on your laser, you *must* use *Absolute Coords* as the positioning mode, otherwise the output will not match the position of the print. The accuracy of the result will be affected by the accuracy of your red-dot pointer, so using one that is either a cross-hair beam pointer or a red-dot marker that is in the same beam path as your laser is ideal.

After running the job on the laser, this is the result:

When finished, you can turn Print & Cut off by un-highlighting the 'Align Output to Targets' option:

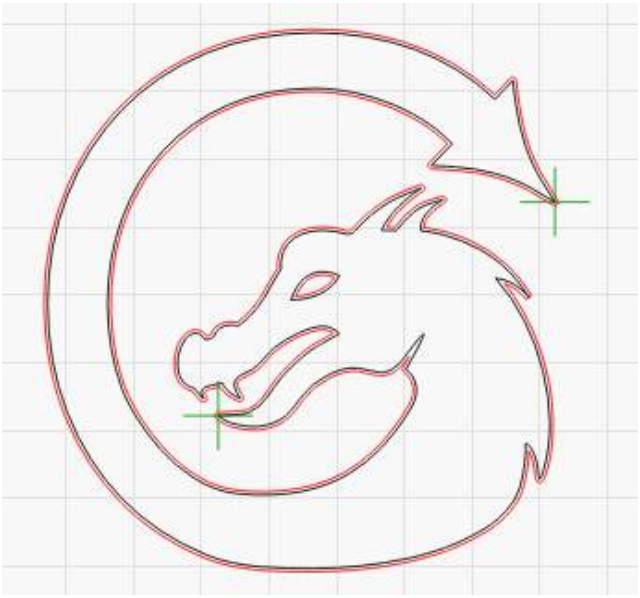


That will turn off the Print & Cut mode.

USING SHARP CORNERS IN YOUR FILE INSTEAD OF TARGETS

The Print & Cut feature measures the difference in position, orientation, and scale between the two positions you mark with your laser and the corresponding positions you select in the software. You do not actually *need* to output the markers in LightBurn, they simply need to exist so they can be selected.

The sticker image shown above has a very sharp corner at the tip of the tail, and one on the lower jaw - These would be acceptable locations to use as alignment targets as well, which would allow you to register to a job even without visible registration marks:



By putting the markers on the green layer, then setting that not to output, they're available in LightBurn to select, but wouldn't be part of the actual cutting job sent to the laser. When aligning to the first target, you'd point the red dot at the tip of the tail, and in LightBurn select that marker. Then repeat the process by pointing your red dot at the tip of the lower jaw, and select the marker in that location in LightBurn.

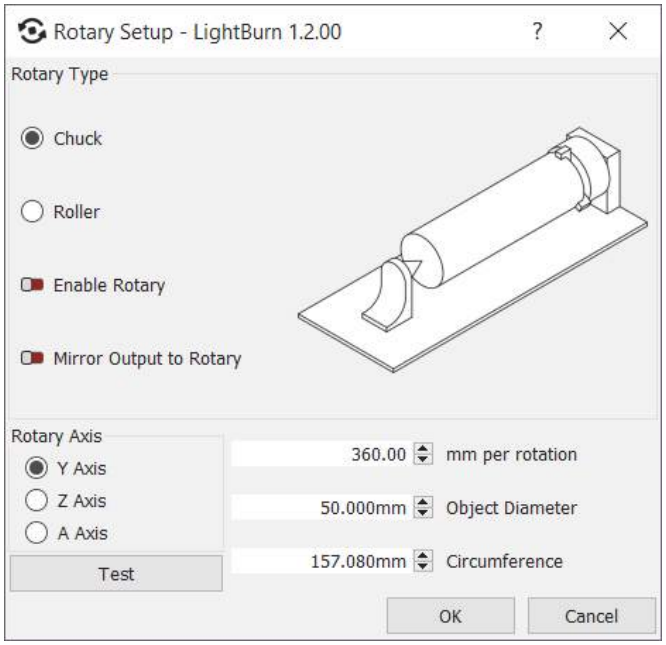
DSP **Gantry** **Rotary** **UI**

5.6.4 Rotary Setup (DSP)

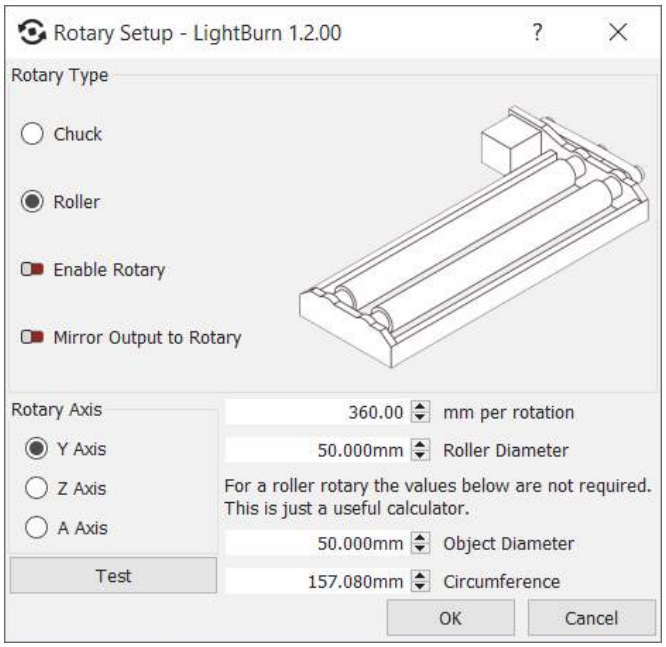
> **Info**
>
> This will walk you through setting up and using your rotary attachment with LightBurn for gantry (non galvo) lasers. To set up a rotary with a galvo laser, please see Rotaries for Galvo Lasers.

In the top menu bar, click the Laser Tools menu (or just Tools in older versions of LightBurn), then Rotary Setup, and it will open the rotary setup window, shown here:

Rotary Setup



Rotary Setup (with chuck)



Rotary Setup (with roller)

The window may look different depending on the type of controller you have, and in fact, you may not be able to access this menu item at all - most Trocen controllers, for example, require setting rotary parameters through a menu on the controller panel itself.

General Rotary

- Choose whether you have a chuck style or roller attachment.
- Click the enable rotary check box (it will turn green when enabled).
- In the steps per revolution box, enter the number of steps it takes your attachment to make one full revolution. For a chuck rotary, this will be one rotation of the chuck, and for a roller, it will be one full rotation of the roller, NOT the item. For GCode devices with a dedicated rotary axis, this number should just be "360 degrees". If not using a dedicated rotary axis, you'll have to use trial and error to dial in the correct travel distance using the *Test* button.
- Click the *Test* button to verify that the roller or chuck makes one full rotation, pauses, then returns.
- Enter either the diameter of the object to be engraved or it's circumference, the other value will be automatically calculated.
- Align your object under the laser head in a position where the X axis will start and rotate the object in the rotary attachment to the point where you want the Y axis to start engraving.
- When using the rotary, it's generally a good idea to use "current position" as the "Start From" setting.
- Click Start to run your job, or if you have a DSP controller, you can use Send to send it to the controller to run it from there.

- ***Remember to uncheck the use rotary attachment check box once you are finished*** so that you do not impact your next regular project.

Notes

- If the object slips on the rollers of a roller type attachment, wrap the rollers with some sort of non-slip material or even rubber bands.
- You can also try placing some weights inside the object such as ball bearings or other small round objects, this will help press the object against the rollers.
- **If you end up with a flat part at the 'bottom' of the engraving**, it means your rotary gear mechanism has backlash. In general, tightening any belts in the rotary device will fix this, but if not, you can place a small line a few mm below the bottom of your design, set to very low power, like 0.1%, and set it as the first layer to run. The rotary will spin to this position, then back up over that few millimeters of gap, and will take up the backlash with that movement.

DSP Specific Setup

If using a Ruida controller, disconnect the Y axis stepper connection and connect the rotary attachment to the Y axis. If using Smoothie or GRBL, C3D, or Smoothieware controllers, click the "A" axis selection. (See below on how to configure your controller steps before you proceed).

Note

If you are using a DSP controller (Ruida, etc), when you change the rotary setting you need to power-cycle the controller, as the internal logic isn't adjusted for the rotary setting unless you do this. Change the setting, close the Rotary Setup window to write the change to the controller, then power off the control board and power it back on. You will likely need to press the Esc (or stop) button on the controller to prevent it from trying to home itself, as the Y axis will not home properly.

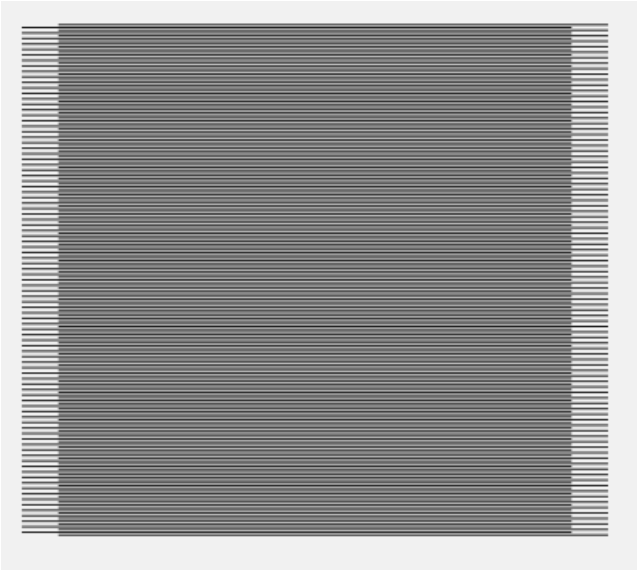
5.6.5 Scanning Offset Adjustment

Modern lasers are capable of moving very fast, and with remarkable precision, however firing the beam still takes time. Some power supplies and tubes may respond in microseconds, but others take longer. At higher speeds, belts will pull slightly as well, and all of these things can cause the output of the laser to shift slightly when engraving.

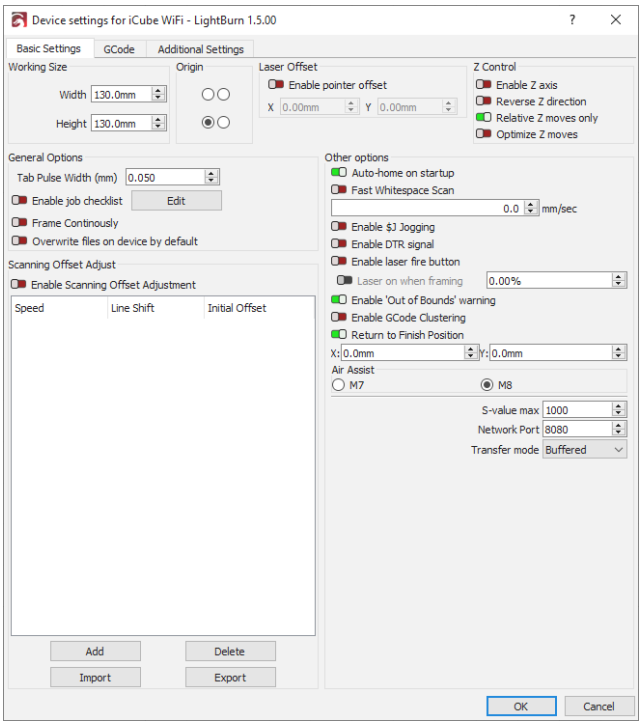
At 100 mm/second, 254 dots per inch means your dots are 0.1 mm in length, fitting 1000 of them in 100 mm. At 100 mm/sec, if your power supply and tube take 1 millisecond to fire, your engraving will be offset by a full dot width.

At 500 mm/second, that 1 millisecond delay means you'll be off by 5 dots, or ½ a millimeter. Still not very much, but visible. Adding a bit of mechanical stretch to this will increase the offset.

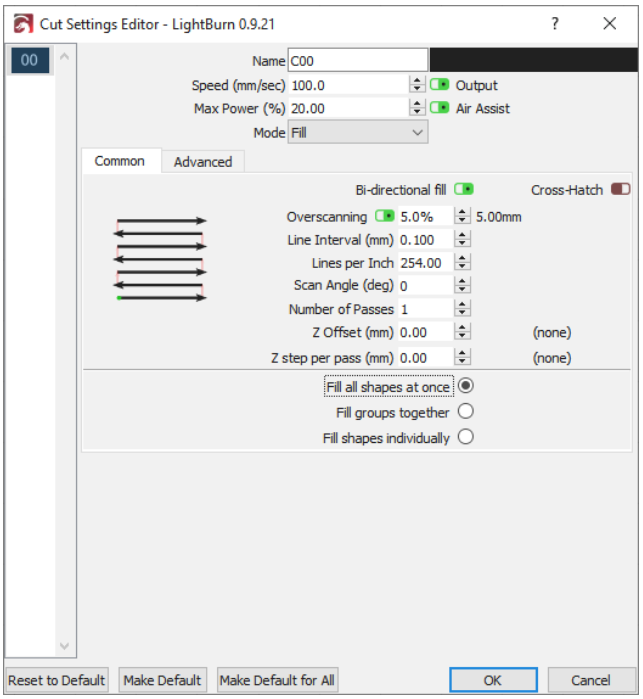
The result often looks like ghosted edges. The image below is a 20 mm square at 1000 mm/sec, with a 1ms delay, resulting in a full mm of skew between scans:



LightBurn has a setting to counter this, called Scanning Offset Adjustment, in the Device Settings. Other software may refer to it as 'Reverse Interval' or 'Reverse Compensation':

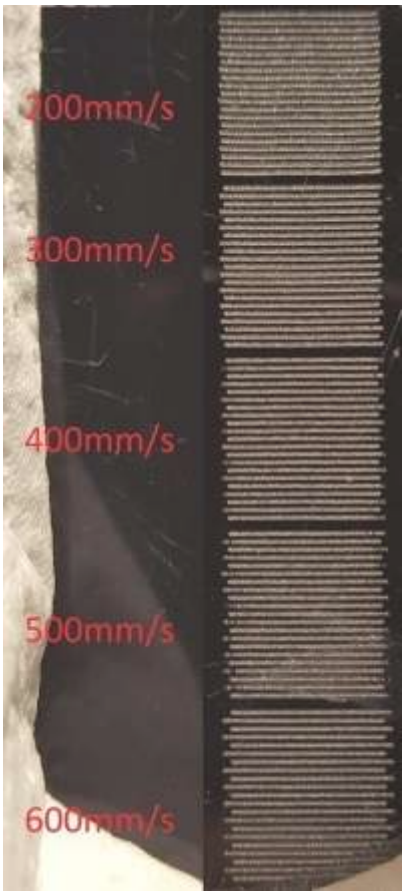


To use this feature, you need to measure the response of your machine at a couple of different speeds. Create a small rectangle in LightBurn, 50 mm wide and 10 mm high, set it to scan, and set the interval to 0.5 mm. If you are on a GCode based device, enable overscan, and set it to 5% or greater to be sure the machine is not slowing down before reaching the ends. (Ruida devices overscan automatically). Note that in the image below I have power set to 0 - Don't do this. You will need to set the power high enough to mark your material.



Run this rectangle at multiple speeds, like 100 mm/sec, 200 mm/sec, 300 mm/sec, and so on. Depending on your

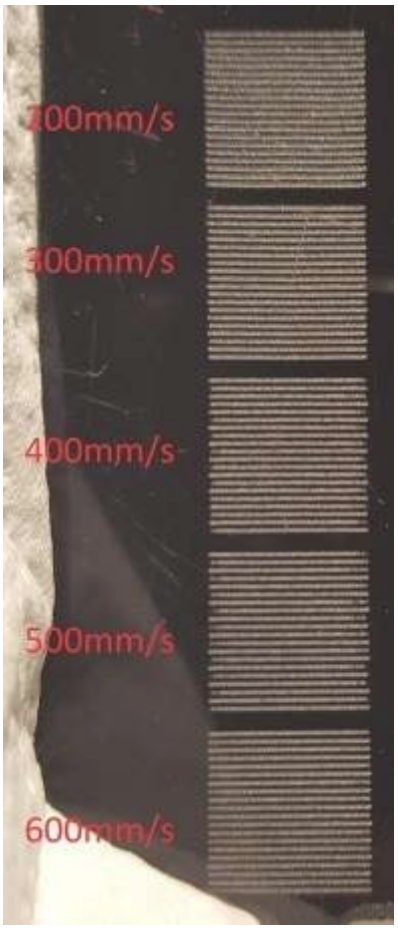
hardware you may not even need to use these settings, however here is example output from a machine that does:



To compensate for this, measure the distance between the ends of the lines at each speed, and enter the speed and distance values into the scanning offset adjustment table. LightBurn will use this information to compute the correct adjustments for other speeds as well. A minimum of two measurements are needed for it to work. **Note** you will need enter *half* the measured value - The software moves each line by the amount you specify, so each pair of lines only needs to move half the distance.

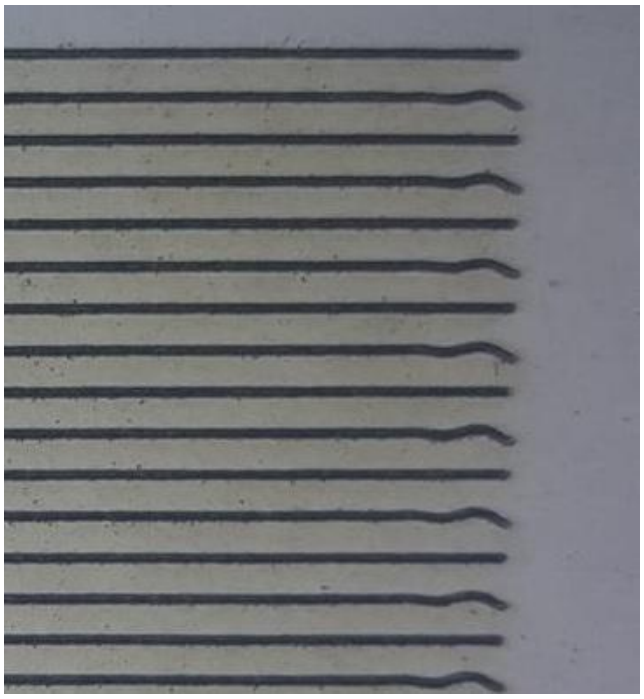
There is an excellent tutorial online at Cartonus.com here: http://cartonus.com/how-to-improve-engraving-quality-of-laser-machine/

You may need to do this multiple times, making minor adjustments to get clean results at each speed. After entering the measurements for the above speeds, the resulting corrected output looks like this:



5.6.6 Line Wobble

A different, but equally common problem, is line wobble, often caused by too high an acceleration setting. When doing the test cuts above, you may notice lines that look like this:



If so, your machine is moving too quickly between the rows, and you're seeing physical "bounce" in the gantry because of it. Lowering the acceleration setting for your Y axis can correct this.

5.6.7 Using a Camera

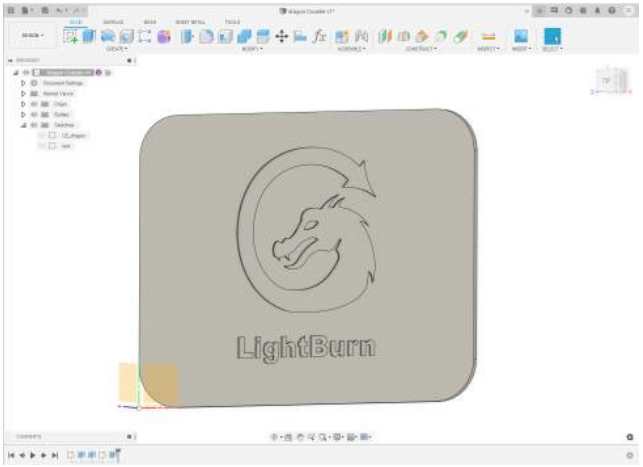
This page is no longer in use, and should redirect you to the updated camera guides. If that fails, please see the updated guides here

5.6.8 Fusion 360 DXF Export

When designing laser cut projects in Autodesk's Fusion 360 the easiest file format to export is DXF. To make sure all the design details we want are present, we'll make a special sketch and export it to get it all into LightBurn.

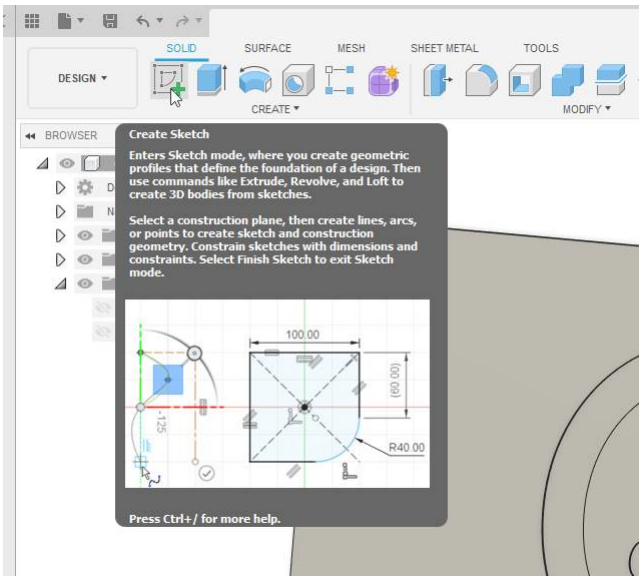
Start file

Finish your part and save your file.

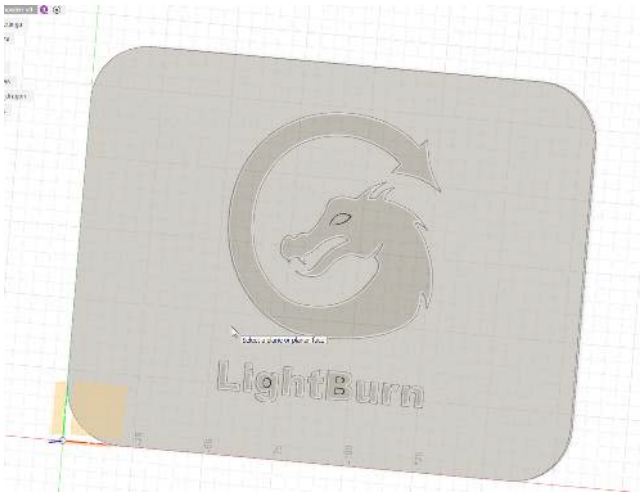


New Sketch for export

Start new sketch



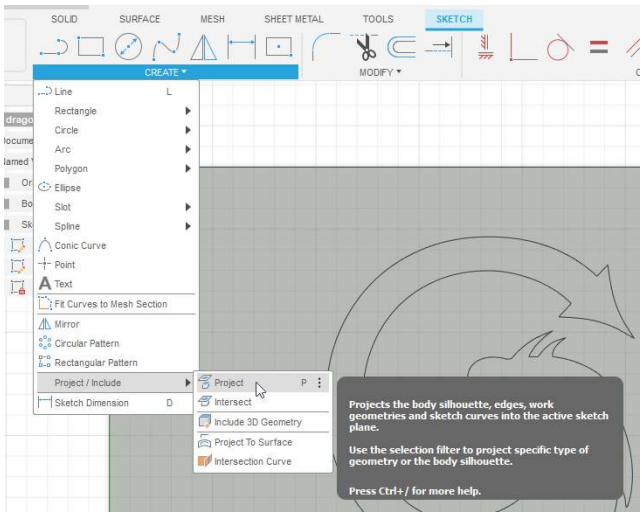
and select the top surface of the part



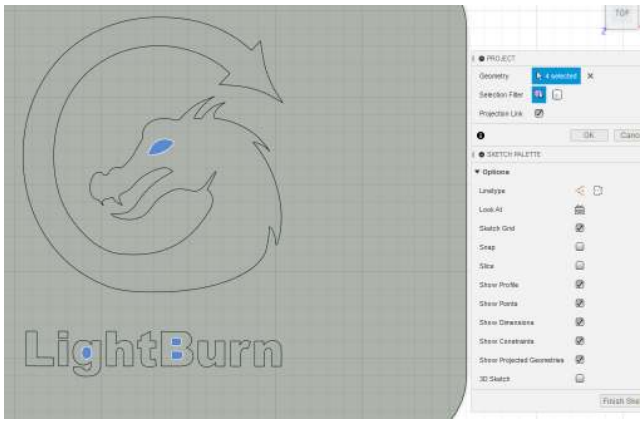
Project Features

When we select the top surface of the part you'll notice that all the connected features highlight. These are automatically projected and their outlines will automatically get added to the sketch.

We will need to add the eye of the dragon and the inner features of the "g" and "B" from the part. To do this start the *Project* tool from the *Create* menu.



Select the islands in the part and hit *ok* on the project menu and Finish Sketch.



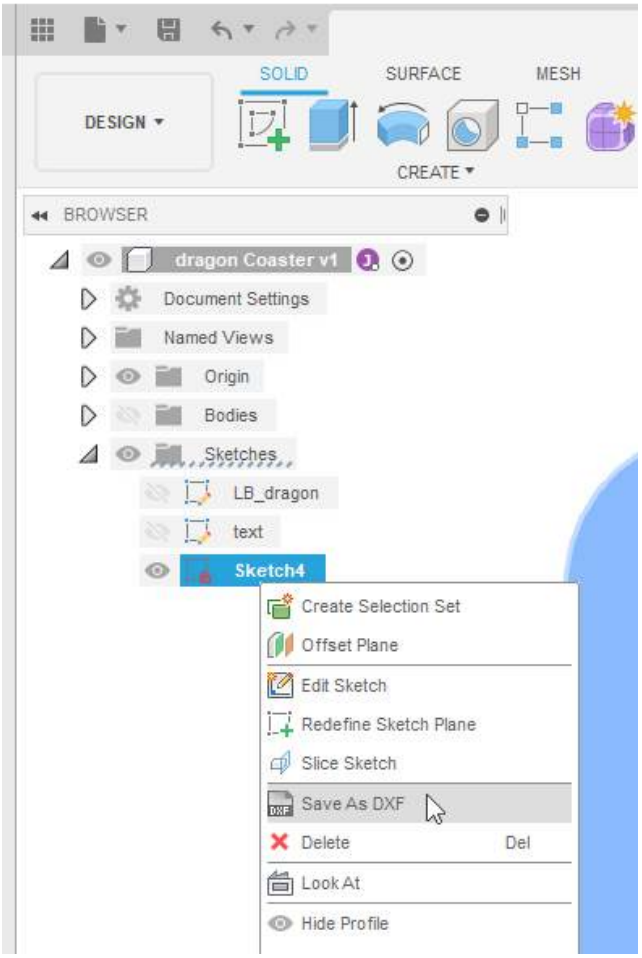
Check the sketch

Once you finish the sketch it will be active so you can see the contents.

> **Tip**
>
> Turning off the rendered body enables you to ensure that all of the design geometry is selected & ready to be used.

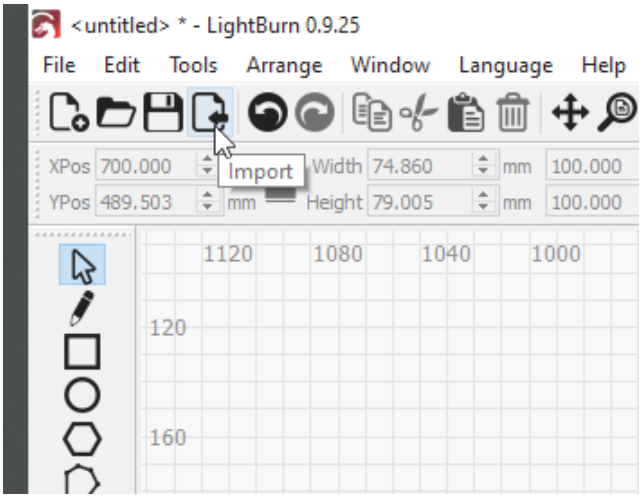
Save as DXF

To export the the sketch, Right Click on the sketch you created in the model tree and click "Save as DXF"

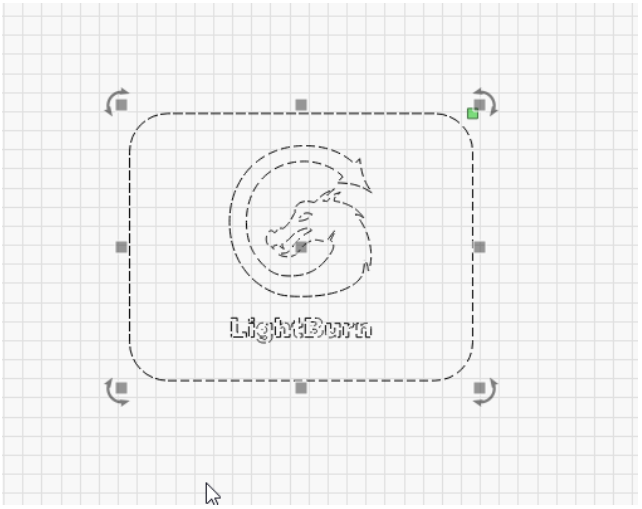


Check Drawing in LightBurn

Open up LightBurn with a new file and Click *Import*.

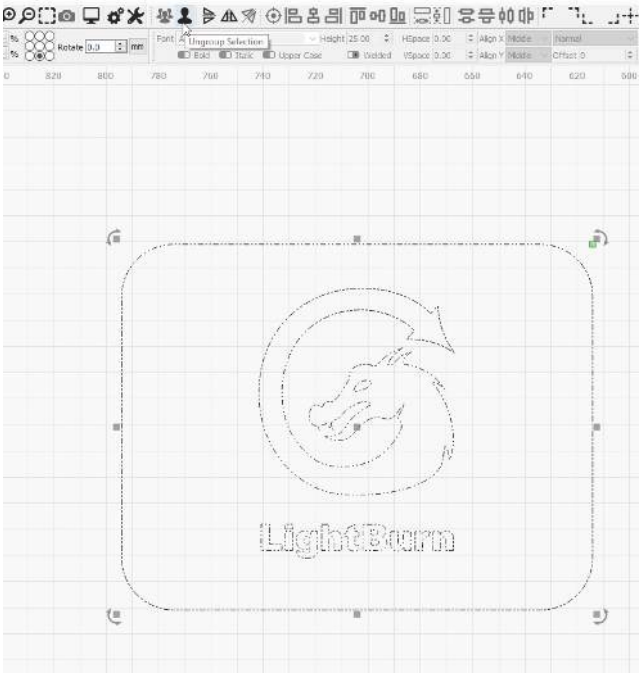


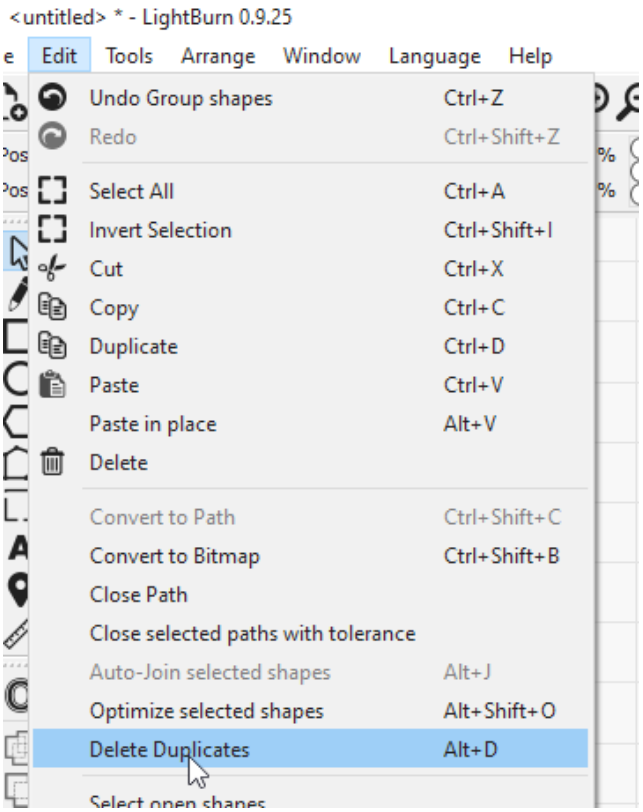
This will bring the .DXF file into LightBurn and the contents will be fully selected automatically.

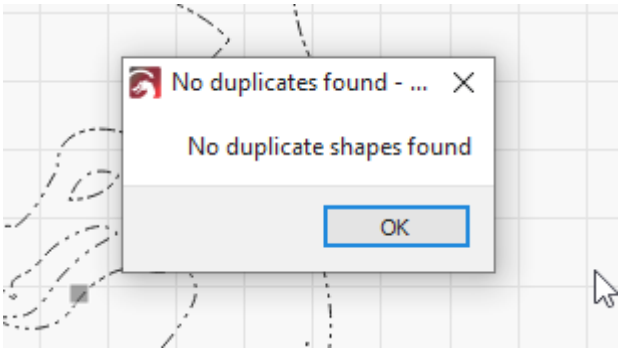


Checking for Errors or Duplicates

Occasionally you can create duplicate lines using the *Project* tool in Fusion 360. To remove any stray or duplicate lines, select the entire design, ungroup the drawing, and use the Delete Duplicates tool in the Edit Menu.







All Finished!

Your drawing is ready to use!

Advanced

5.6.9 Layer Colors

LightBurn assigns operations to layers and objects based on their colors.

When importing graphics, LightBurn will attempt to match the colors used to the default LightBurn color palette. Using exact matches for the colors used by LightBurn will ensure layers are created correctly. We have downloadable color palettes available to make this easier.

Importing Graphics

We have color palettes available for Inkscape, CorelDRAW, Affinity Designer, and Adobe Illustrator. The `.ase` file provided for Adobe and Affinity products can be imported into many other programs as well.

Download .gpl for Inkscape/GIMP

Download .xml for Corel Products

Download .ase for Adobe and Affinity

Please see your preferred program's help for directions on installing color palettes.

RGB and Hex Colors

The table below contains RGB and hex values for each of LightBurn's layer colors.

Layer	RGB Values	Hex Values
00	rgb(0, 0, 0)	#000000
01	rgb(0, 0, 255)	#0000FF
02	rgb(255, 0, 0)	#FF0000
03	rgb(0, 224, 0)	#00E000
04	rgb(208, 208, 0)	#D0D000
05	rgb(255, 128, 0)	#FF8000
06	rgb(0, 224, 224)	#00E0E0
07	rgb(255, 0, 255)	#FF00FF
08	rgb(180, 180, 180)	#B4B4B4
09	rgb(0, 0, 160)	#0000A0
10	rgb(160, 0, 0)	#A00000
11	rgb(0, 160, 0)	#00A000
12	rgb(160, 160, 0)	#A0A000
13	rgb(192, 128, 0)	#C08000
14	rgb(0, 160, 255)	#00A0FF
15	rgb(160, 0, 160)	#A000A0
16	rgb(128, 128, 128)	#808080
17	rgb(125, 135, 185)	#7D87B9
18	rgb(187, 119, 132)	#BB7784
19	rgb(74, 111, 227)	#4A6FE3
20	rgb(211, 63, 106)	#D33F6A
21	rgb(140, 215, 140)	#8CD78C
22	rgb(240, 185, 141)	#F0B98D
23	rgb(246, 196, 225)	#F6C4E1
24	rgb(250, 158, 212)	#FA9ED4
25	rgb(80, 10, 120)	#500A78
26	rgb(180, 90, 0)	#B45A00
27	rgb(0, 71, 84)	#004754
28	rgb(134, 250, 136)	#86FA88
29	rgb(255, 219, 102)	#FFDB66
T1	rgb(243, 105, 38)	#F36926
T2	rgb(12,150, 217)	#0C96D9

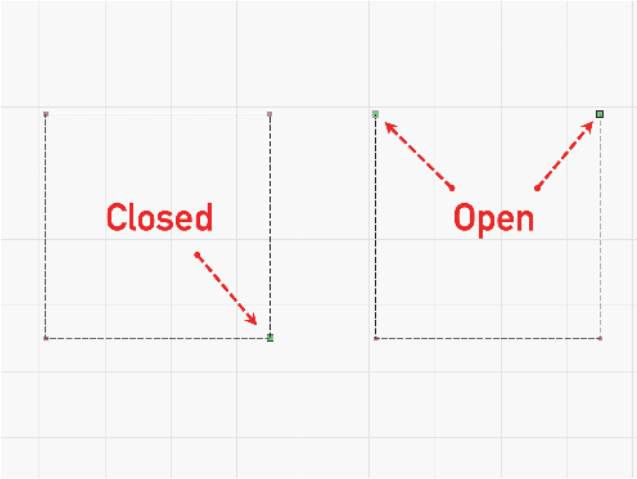
5.6.10 Open vs. Closed Shapes

What Makes a Shape Open or Closed

All shapes in LightBurn are made up of lines, curves, and nodes. Sometimes those nodes are connecting points between lines or curves, and sometimes they represent the start or end point of a segment or sequence of segments.

A shape is *closed* when it is a complete, continuous loop whose start and end points are the same. When a shape's start and end points are different, it is *open*.

You can view a shape's nodes by selecting it and enabling the **Edit Nodes** tool. Start and end nodes are green, and somewhat larger than connecting nodes.



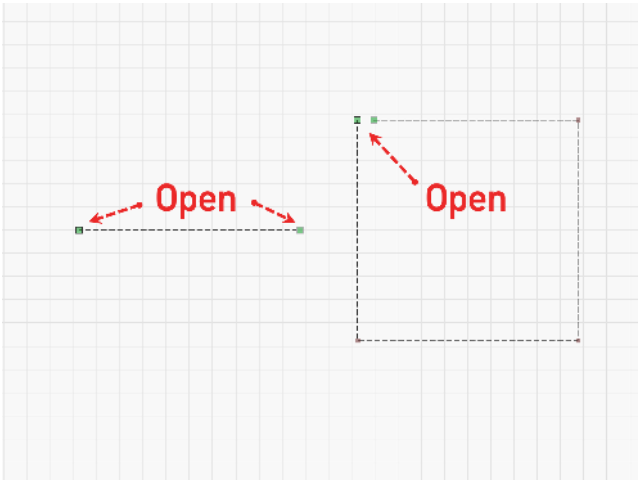
When and Why Shapes Must be Closed

Some functions require LightBurn to determine the inside and outside of a shape, and in order to make that determination, the shape must be closed.

The most commonly used function that requires closed shapes is **Fill** mode, which commands your laser to engrave or mark an area that falls within the outline of a single specified shape, or between the outlines of two shapes. Without knowing what area is inside a shape, LightBurn can't determine what to fill.

This is most obvious to the human eye when looking at line segments. If you draw a simple line segment with a node on each end, it makes no sense to say there is an inside and an outside to it. Following from that, if you assign that line segment to a layer set to Fill mode, it will not be possible for LightBurn to determine an area to be filled.

In other cases, as with shapes that have only small gaps, it may be relatively clear to a human what is meant to be the inside and outside, but software must interpret things literally, based on formal rules. That means if there is any gap at all, any open shape is the same to LightBurn as a line segment, for the purpose of determining an inside and outside.



Some other functions that require the use of closed shapes are:

- **Offset Fill mode**
- **Weld**
- **Boolean Modifiers**
- **Cut Shapes**
- **Slot and Tab Resizer**
- **Kerf Offset**
- **Cut Inner Shapes First**

Identifying Open Shapes

In some cases, as with simple line segments or shapes with large gaps, it's easy to see that a shape is open, but in others it may not be as obvious.

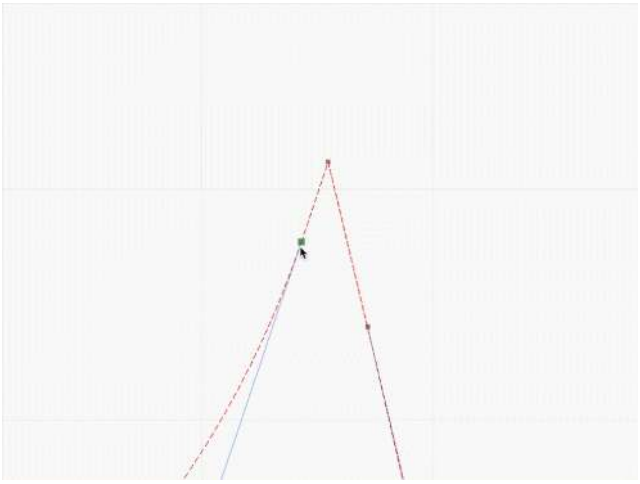
At times, the gaps can be very small, often so small that they are not visible without zooming in very close. Be aware: it is even possible for a start and end point to be directly on top of one another, but not connected, making a shape open.

LightBurn provides several methods for identifying whether a shape is open or closed.

EDIT NODES

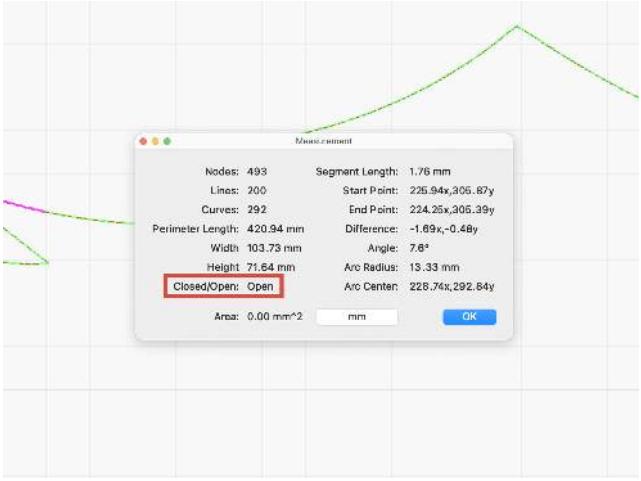
As mentioned above, it is always possible to select a shape and the **Edit Nodes** tool to identify where its start and end nodes are, and whether they are the same, making a closed shape, or different, making an open shape.

In some cases, you may need to zoom in to see gaps.



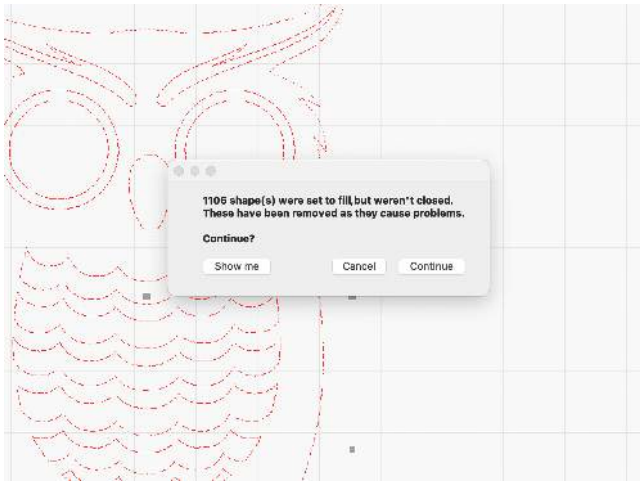
MEASURE TOOL

Select the **Measure** tool from the **Creation Tools** toolbar (or press Alt / ⌥ + M) and hover over a segment of any shape to see a readout of its attributes. In the bottom right, you'll see the **Closed/Open** descriptor, and a value telling you whether that shape is closed or open.



POP UP WARNING

If you have open shapes set to a **Fill** or **Offset Fill** layer, and attempt to **Preview** or **Start** a job, LightBurn will warn you, and give you the option to click **Continue** and proceed with the job, removing the open shapes, or **Show Me** to automatically select them.

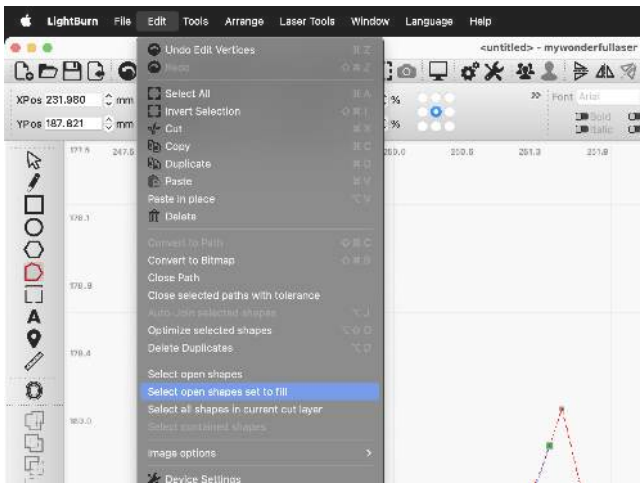


SELECT OPEN SHAPES

From the **Edit** menu, you can click the **Select open shapes** option to automatically select any open shapes in your workspace.

SELECT OPEN SHAPES SET TO FILL

Also found in the Edit menu, this option works the same as the Show Me button from the pop up warning, automatically selecting only those shapes in your workspace that are set to a Fill or Offset Fill layer.



Correcting Open Shapes

CHANGE LAYER OR MODE

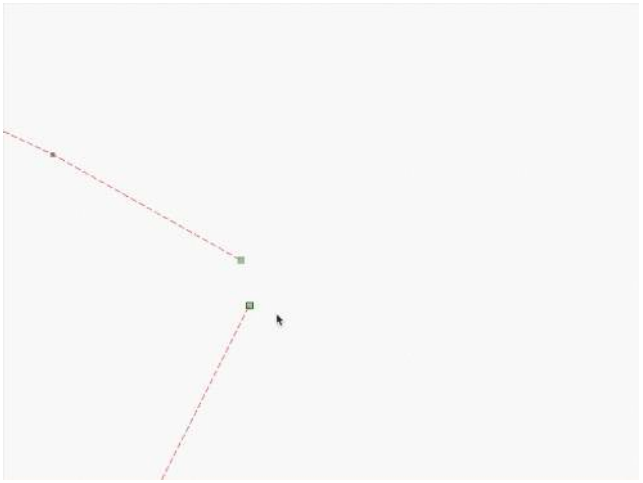
Before attempting to close an open shape, it's important to decide whether that is the best step to take to get the result you're looking for.

In some cases, especially when working with a project you did not design yourself that has shapes with start and end points that are very far apart, the best course of action is to assign those shapes to a layer set to **Line** mode. Open shapes like these are often meant to be set to a speed and power appropriate to score a material along outlines defined by those shapes, and not to be filled at all.

To see how your result will look, you can set the open shapes to a Line layer, and use the **Preview** window to check whether the simulation matches your desired output.

EDIT NODES

The **Edit Nodes** tool is not just an option for identifying open shapes, it can also be used to close them. To join open shapes with the Edit Nodes tool, select and drag a start point onto an end point (or vice versa).



Because this option requires you to close open shapes manually, in cases where you have many shapes to close it is often easier to use a tool that does so automatically.

CLOSE PATH

Found in the **Edit** menu, the **Close Path** option will connect a shape with one start and one end node by creating a new line between them. The start and end nodes must be within .5 mm of one another, so this option is only for shapes with very small gaps. It cannot be used to closed shapes made up of more than one disconnected line segment.

CLOSE SELECTED PATHS WITH TOLERANCE

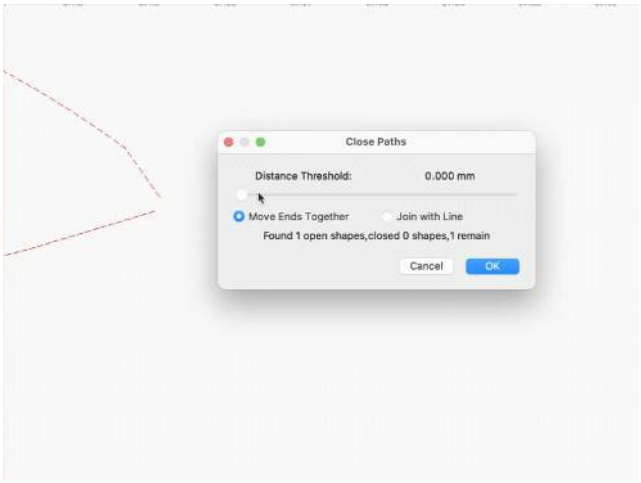
Close selected paths with tolerance is also found in the Edit menu, and, like Close Path, can connect a shape with one start and one end node.

Unlike Close Path, this option opens a pop up menu that allows you to specify the **Distance Threshold**, or tolerance, between start and end nodes you'd like to close.

You can also choose whether you would like to join the start and end nodes by bringing the existing lines together with **Move Ends Together**, or by creating a new line segment between them using **Join with Line**.

At the very bottom of the window, you'll see a readout of how many open shapes were found, how many shapes have been closed, and how many open shapes remain in your workspace.

Click **OK** to confirm the changes and close the selected shapes, or **Cancel** to discard them and leave the shapes open.



AUTO-JOIN SELECTED SHAPES

Auto-Join selected shapes (Alt / ⌥ + J) is also found in the Edit menu, and is able to join many disconnected segments at once. In order for Auto-Join to work, the start and end points of two segments must be very close together, within .05 mm of one another.

In some cases where Auto-Join fails to join segments with start and end points within the necessary .05 mm tolerance, it can help to first go to the **Arrange** menu and select **Break Apart** (Alt / ⌥ + B), before again trying Auto-Join.

Related Videos

5.7 Camera

Advanced **Camera** **DSP** **GRBL** **Galvo** **Tools**

Help! I can't find the camera info I'm looking for.

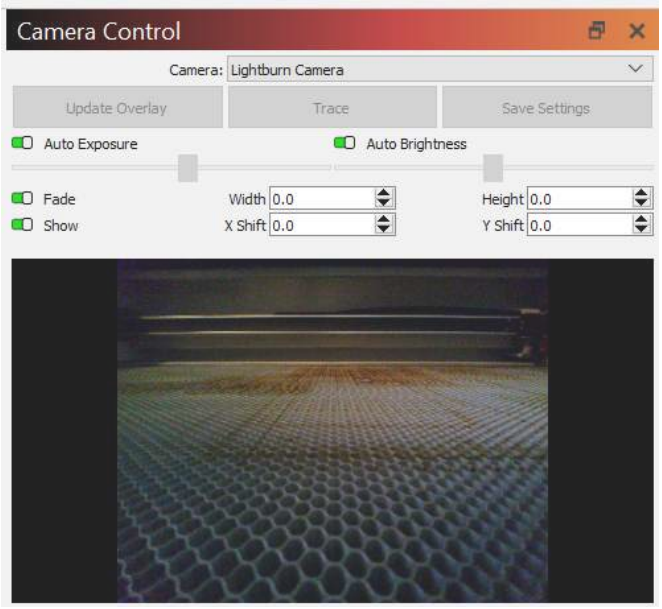
We've split the camera guide up into multiple pages. If you followed a link to a specific section of the older guide, you may need to go to one of those additional pages.

5.7.1 Camera

You can use LightBurn's camera features to:

- Position artwork on material/objects
- Trace designs from the camera image
- Monitor your laser

To use the camera, enable the **Camera Control** window by going to the Window menu and selecting it. You'll see a window like the one below, and you can select a camera from the dropdown.



Screenshot of the camera control window.

Using a Camera

If you've already got a camera installed and calibrated, and it shows a clear, undistorted view of your laser's bed when you select it, you can use your camera to position designs with the camera overlay and to trace artwork using the camera.

Camera Setup

Info

LightBurn only supports the use of UVC-compatible cameras. Because of differences in how cameras work between operating systems, some software cameras (such as OBS Studio's "Virtual Camera") may not present as a camera at all to LightBurn, or may render incorrectly.

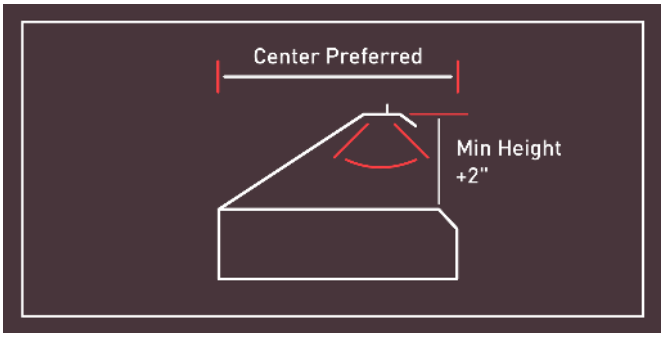
If you don't have a camera installed, or if your camera's view is distorted, our guides can help you with selecting, installing, and calibrating a camera.

- Selecting a camera
- Installing a camera
- Calibrating a camera
- Aligning a camera

Camera **DSP** **GRBL** **Galvo** **Tools**

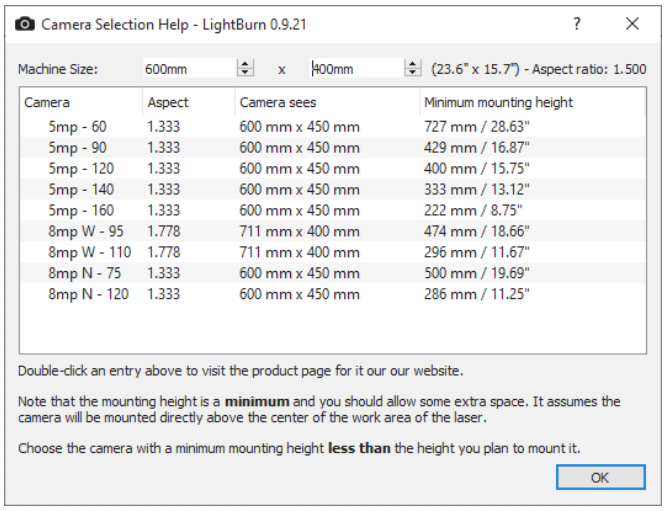
5.7.2 Camera Selection

LightBurn's camera features require the use of a USB camera. A wide range of cameras have been used successfully, but if you don't currently have a camera and want one known to work well with LightBurn, we sell several different cameras along with a suitable mount. LightBurn also includes calibration presets for these cameras, which simplifies the setup process. You'll need to choose an appropriate camera for your laser based on the size of your laser and the height you'll mount the camera at.



Aim to select a camera with a minimum mounting height about 2" more than the distance from your intended mounting point to the surface of the work area

If you're planning to buy one of LightBurn's cameras, we have a built in tool to help you select an appropriate camera. Open the "Help" menu in LightBurn and choose "Camera Selection Help". LightBurn will use the laser size shown at the top to create a list of the minimum mounting heights for each of our cameras. Select a camera that needs about 2" **less** than the distance from the laser bed to your mounting location to leave a little room for adjustment.



LightBurn's camera selection tool, showing minimum mounting heights for each camera given the size of the laser

Can I use a camera I already have?

Interactions between cameras and computers are, unfortunately, a complex topic. LightBurn currently only works with USB cameras, and only some cameras will work correctly. For proper calibration and alignment, make sure you have a fixed zoom camera. Additionally, some computers may cause complications with the use of cameras. In some cases (especially with newer computers such as M1 Macs), this comes from incompatibilities between USB 3.0 ports and older USB 2.0 cameras.

Camera **DSP** **GRBL** **Galvo** **Tools**

5.7.3 Camera Installation and Focusing

The best place to mount the camera is directly above the center of the bed of the laser, with the bed completely visible. The best way to accomplish this is usually to mount the camera on the inside of the lid, so the placement is correct when the lid is open.

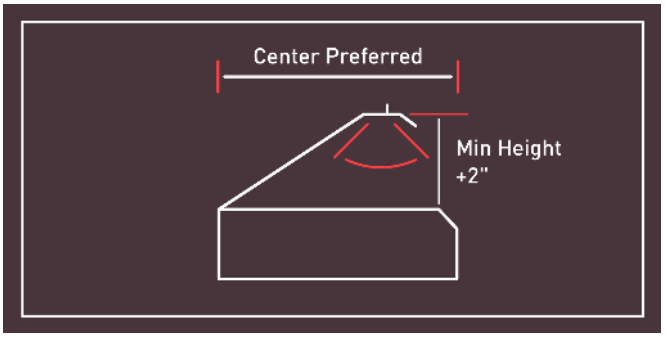
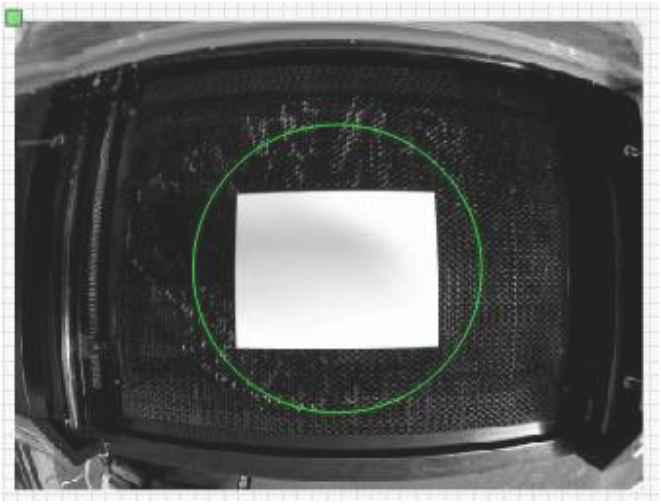


Diagram showing ideal placement

Camera installed in a laser

Mounting tips:

- The camera should be focused as well as possible. Most LightBurn cameras are manually focused by twisting the lens.
- The camera must be solidly mounted to be in ***exactly*** the same position when using it. If you mount to the lid of your laser, make sure the lid opens to the same place every time. You can use a cord or rod to ensure the lid is always at the same position when opened.
- If your camera is in a mount, make sure it doesn't move within the mount. A small piece of EVA foam or even tissue can hold the camera securely in the mount.
- Mount your camera so it isn't in the path of the laser head, and run the cable so it is not in the path of the beam. Ramming the laser head into your shiny new camera is a great way to increase your blood pressure.
- Focus the camera so as much of the bed is in focus as possible. Some cameras, like the 5mp-60, have a narrow focus depth, and if mounted high, can be tricky to focus. If this happens, focus on a circle that is roughly half-way from the center of the bed to the edge of the image, like this:



If you can't get the entire area in focus, try to focus approximately where the green circle is

Warning

The camera system depends on the camera being in the same position relative to the work area of your laser *and* the same distance from the top of the material. If your laser uses a variable *focus distance* instead of a variable height *work table*, you will need to align for the material height you are using.

Info

Cameras used with LightBurn should plug in to your computer as directly as possible. An active USB 2.0 amplifier to extend the distance may work, but is not guaranteed. Do not connect your USB camera to any USB port on your laser. USB 2.0 has a native max length of approximately 16 feet. (5 meters).

Info

To use LightBurn's camera functionality, you must use *Absolute Coords* mode, so LightBurn can accurately position the work. If you use an older Trocen controller, they do not allow setting this mode from software, so you must change the working mode through the controller menu.

Camera **DSP** **GRBL** **Galvo** **Tools**

5.7.4 Camera Calibration

Don't forget about alignment!

Calibration and alignment are both essential to proper camera setup. Please don't forget to go through the alignment process after completing calibration.

Camera lenses are not perfectly flat, and distort the image they capture. This effect is stronger on the fisheye lenses needed to capture the viewing area of larger lasers. To use your camera effectively, you'll need to calibrate the camera. This takes a little effort, but once your camera is calibrated well, it's not a process you'll need to repeat often.

If you're using an official LightBurn camera you can use one of the presets instead of calibrating manually. Select the preset using the dropdown on the first page of the **Calibration Wizard**.

Overview

Calibration Image Details

In order to work properly, the calibration image must be:

- undistorted
- perfectly flat
- surrounded by a 6 mm (¼") or larger margin
- About ⅓ of the size of the camera's viewing area, when viewed through the camera

Older versions of this guide gave a specific size for the calibration image, but that will vary based on the size of your work area and the height of your camera. You want the image to take up about **⅓ of your camera view**. You can scale the image up or down when printing it, as well as raising or lowering the image to adjust how much of the camera view it takes up.

- Download and print the following image: Calibration-Circles.png.
- If your laser has a honeycomb bed or other surface with a lot of visible circles, you should cover it with something to block that pattern.
- Make sure the bed of your laser has good, consistent lighting and the camera is in focus.
- In the "Laser Tools" menu, open the "Camera Lens Calibration" wizard.
- Mount the calibration image to something stiff and flat, such as cardboard, foam board, wood, or a clipboard.
- Follow the directions in the Camera Lens Calibration wizard. For more help, continue below.

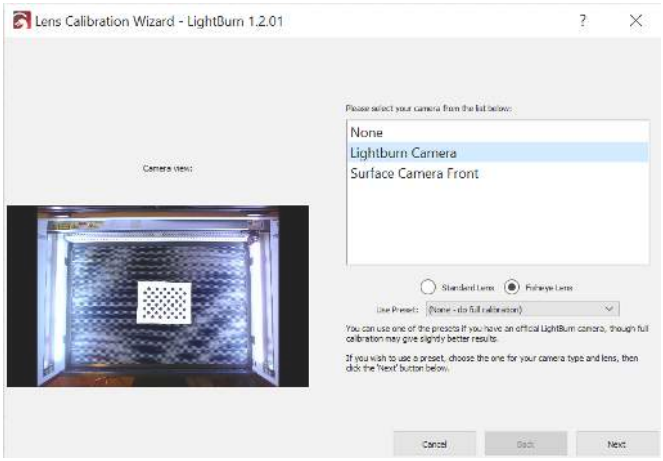
CAMERA LENS CALIBRATION WALKTHROUGH

Note on camera placement

This process only depends on the camera's lens, not on its placement in your machine - as long as the camera and calibration pattern are perfectly still, you do not need to mount the camera in the machine to perform the lens calibration.

Camera Lens Calibration walks you through capturing multiple images of the calibration image you've printed out. The software analyzes how the pattern appears in the images, and compares that against its internal knowledge of how the pattern should look. It determines the amount and shape of distortion produced by the lens of the camera, and computes a lens correction that is accurate for your camera.

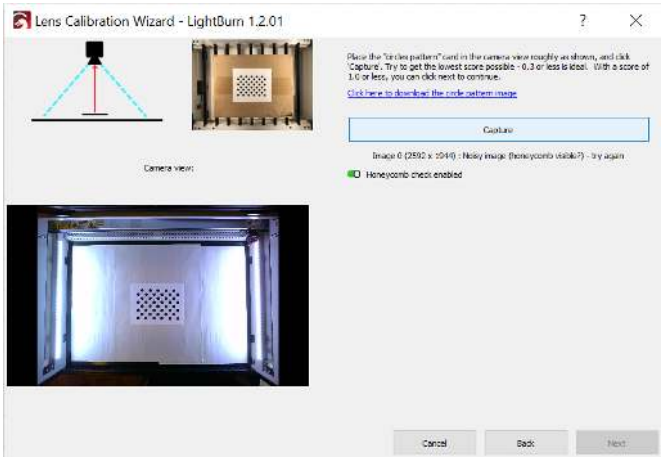
After following the steps from the overview above, you should be ready for the calibration process and looking at a screen like this one:



Lens calibration window. The honeycomb bed in the background will cause problems later if it isn't covered.

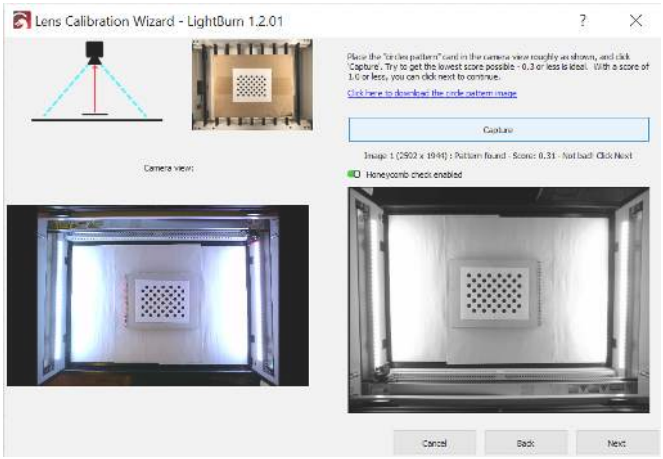
Choose your camera in the list, and you'll see the view from the camera in the area to the left. With the correct camera selected, click Next.

The view will change to include a capture button, and a diagram to show you how to position the printed pattern. For the first capture, place the pattern in the center of the field of view of the camera, with the printed face of the card pointed directly at the camera, as shown in the small view up top. If you cannot easily match your capture image with the suggested image, you may need to adjust the scale of your printed card, or leave the camera out of the machine for lens calibration.



Preparing for the first image capture. I've covered the honeycomb bed with sheets of newsprint.

Click the Capture button and you should see something like this:



First capture complete. I've attached the calibration pattern to a piece of cardboard to keep it flat and smooth.

Above the image on the right you see:

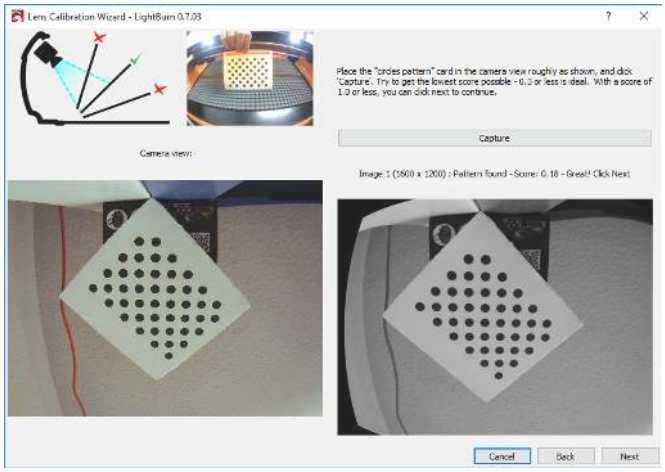
```
Image 1 (2592 x 1944) : Pattern found - Score: 0.31 - Not bad! Click Next
```

This tells you:

- The image was successfully captured
- The resolution of the captured image is 2592 x 1944 (higher is better)
- The calibration pattern was found in this image
- This image scored reasonably well - Lower scores are better. In this image, after distortion removal, the positions of the dots in the image align with the positions of the real dots with an average error of only 0.31 pixels - That's pretty good, and just barely outside our target score of 0.3 pixels of error.

You may find that although the circles themselves are clear and undistorted, the background around them is noticeably worse. This is temporary and is the result of only having a single calibration image to work with. As you continue, your computer will collect more information about your camera's lens distortion and the rest of the image will clear up.

If the calibration pattern is not found, LightBurn will tell you so. Make sure the calibration image faces directly toward the camera and occupies roughly the same amount of view area shown in the "suggestion" image. It is okay if the calibration image is rotated within the view if that makes it easier to place.



Example of calibration image rotated within camera view

As you advance through the captures, the suggestion image will update. The first five images are the center of view, followed by bottom, left, right, then top. If your camera has a very strong fisheye effect, it may be necessary for you to move the non-center images inward a little to get a successful capture. This is ok.

The final four images are the corners, and these can be difficult to capture with high-distortion cameras. If your first 5 images score very well (below 0.3) you are allowed to skip the final four images (the 'Next' button will shows as 'Skip' in this case). If you are having trouble capturing the last four images and don't have the option to skip, you can place the card anywhere within the view and capture that instead - We don't verify that your placement matches what we're suggesting.

Even after only a few good captures, the image on the right should appear to be free of lens distortion, as shown here:

A poorly calibrated result will still show lens distortion, and may have other artifacts, like the "wobble" seen in the lower-left of the gray image below:

If you aren't getting good results, you can re-capture the current image, or just go back to the beginning and try again. It can take a few tries to get a feel for how to align the card with the camera to get the lowest score.

When you have advanced through all the steps, and you are satisfied that you have a good calibration result with a nicely undistorted image, click Finish to save the results. You can also click the "Align Camera" button in the final page to take you to the next wizard automatically.

Camera **DSP** **GRBL** **Galvo** **Tools**

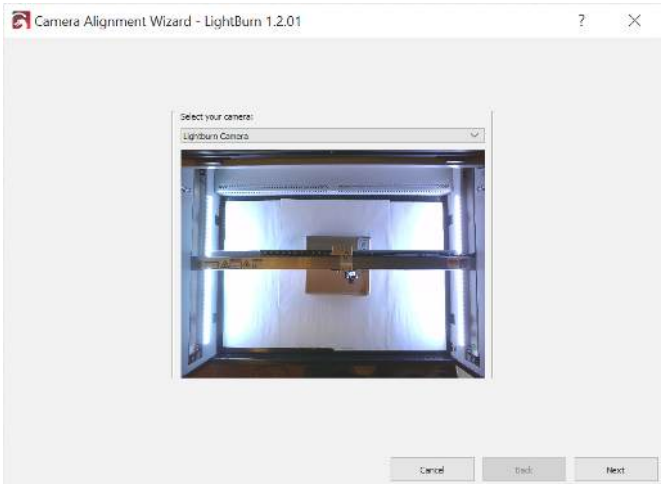
5.7.5 Camera Alignment

Now that the camera is calibrated, you can move on to the next step, camera alignment. This process tells LightBurn where your camera is in relation to the workspace of your machine.

Before you start, make sure the camera is firmly mounted in the position it will be when using it. You can mount the camera to a movable piece of your laser, like the lid, as long as the position of the camera is the same when you use it as it is when you go through the alignment process.

Preparation

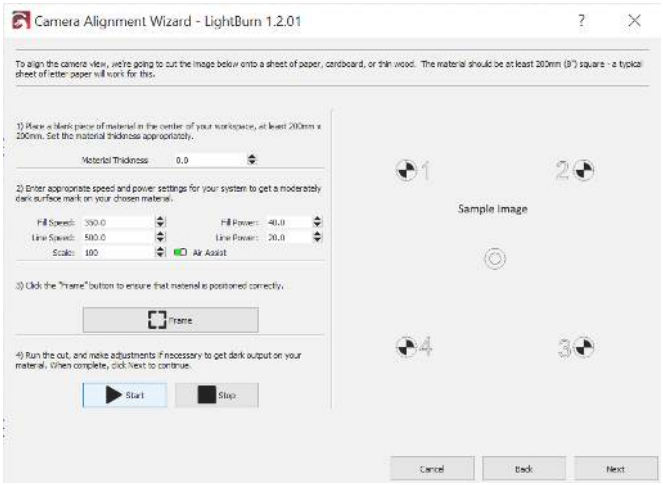
- Make sure your camera is securely mounted and correctly positioned, as described above
- Make sure you have a piece of material you can burn the calibration pattern onto. This should be at least 200 mm x 200 mm (roughly 8" square), but you may want larger materials for large lasers.
- Focus your laser based on the material you're using.
- In the "Tools" menu, choose "Calibrate Camera Alignment" to start the alignment wizard. Choose the same camera you did for the Lens Calibration wizard.
- After verifying that you see an image from the camera, click "Next" to enter the alignment wizard.



You should see something similar to this.

Cutting the Alignment Pattern

The rest of this process will be completed within the Camera Alignment Wizard. This tool uses your laser to cut a target pattern onto a piece of material, such as card stock, paper, cardboard, or thin wood and asks you to indicate the center of the targets.



Camera Alignment Wizard window

Important Preparation

Before starting the alignment process, please make sure your camera is securely mounted in the position you'll be using it in.

STEP 1

Place your material in the center of your workplace. The material thickness setting can be ignored if you don't usually use it.

STEP 2

Enter appropriate speed and power settings to get a moderately dark mark without burning through. This will vary based on your laser and the material you're using, so we can't provide these for you.

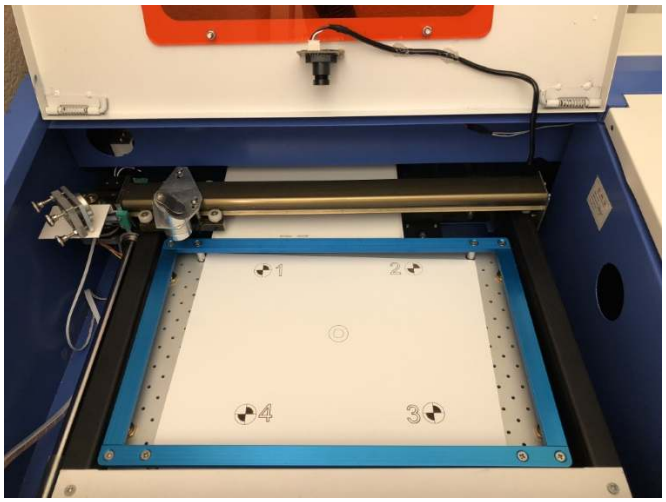
On a large laser, it may help to scale the pattern up in this step to increase accuracy. Make sure you use large enough material. On a 900x600 mm laser, I used a little over 200% scale.

STEP 3

Frame the pattern to make sure it's positioned on the material you're using.

STEP 4

Run the cut. If it's not dark enough, you can adjust the settings and run it again. When the pattern is clearly visible and easy to see, click "Next".



Your target pattern should look like something like this

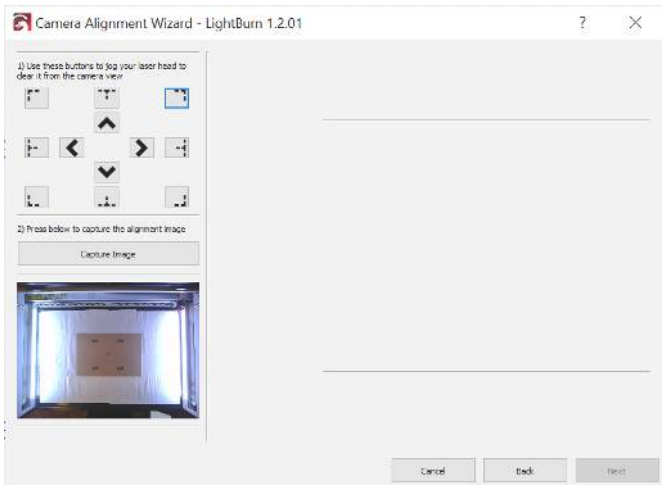
Warning

Don't move the target marker image after cutting it! The location within the laser is important to make sure the process works correctly.

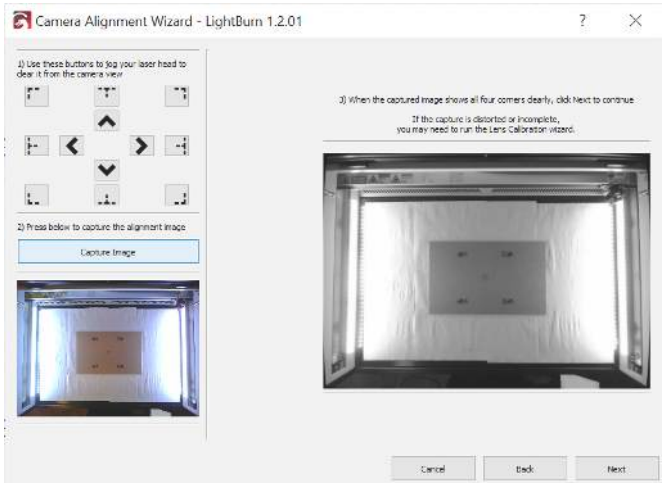
If your camera is mounted to a moving part of the laser, such as the lid, make sure that before you begin capturing the target marker image, you have the camera in the same position it will be in when you're using it.

Capturing the Target Marker Image

From this screen, you'll capture the alignment image. Use the jog or "send to corner" buttonsto move the laser out of the view of the camera. When the camera has a clear view of all four targets, click the Capture button. You should see an undistorted version of the camera view appear in the right side of the window, with all four corner targets visible, as shown below:



Camera alignment capture window

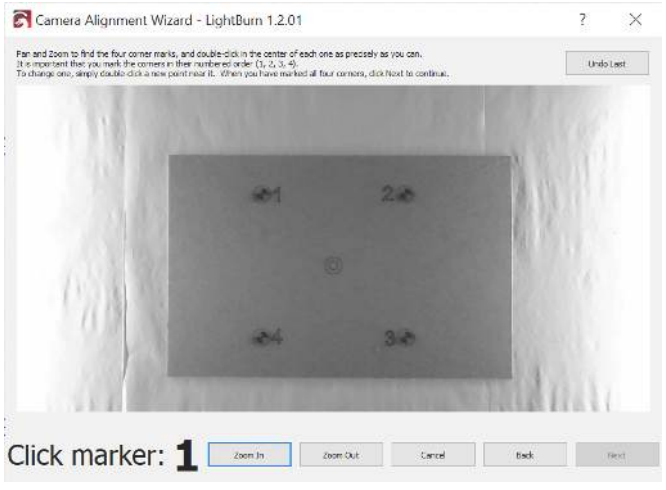


Camera alignment capture completed. The image should be clean and undistorted. If not, please use the lens calibration wizard to calibrate the camera.

Click "Next" when complete

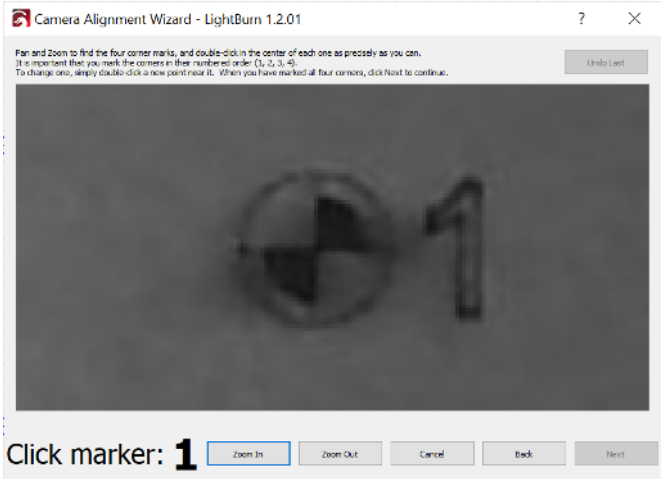
Marking the Targets

On this page you 'tag' each of the targets by double-clicking in the center of each one in order. You can pan and zoom around the image using the same controls as the LightBurn edit and preview windows. When you double-click, a red '+' mark will appear. Place a marker in the center of each of the four targets, in the order they are numbered (1, 2, 3, 4). If you place one incorrectly, you can double click near it to shift it around, or click "Undo Last" to remove it and try again.



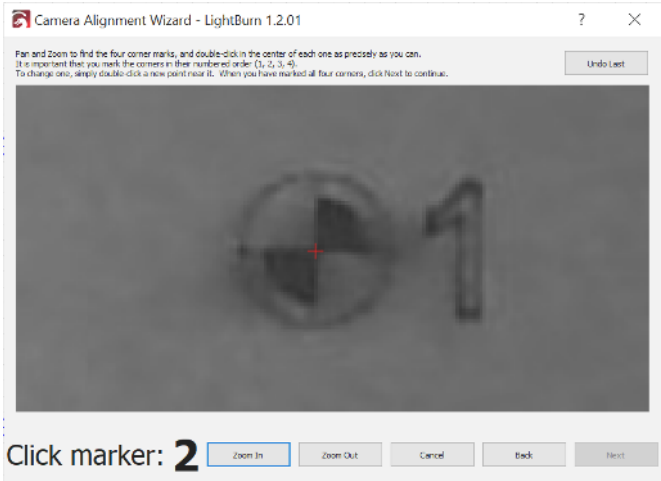
Marking the targets.

Place each marker as accurately as you can. Zooming in can help.



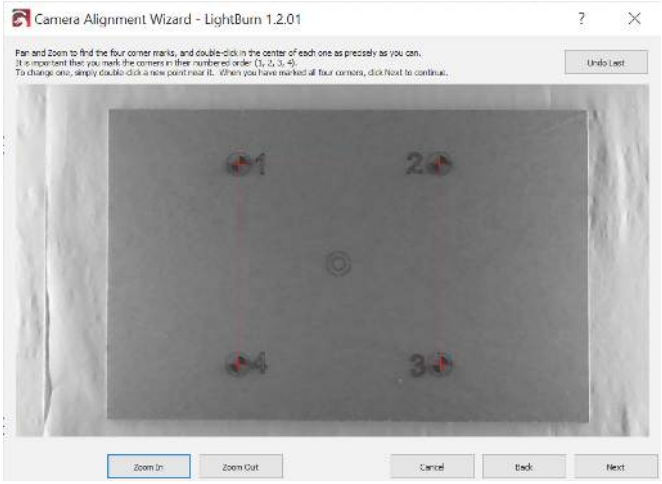
Zooming in on the target

Here's an example of a correctly placed marker.



Marking the target

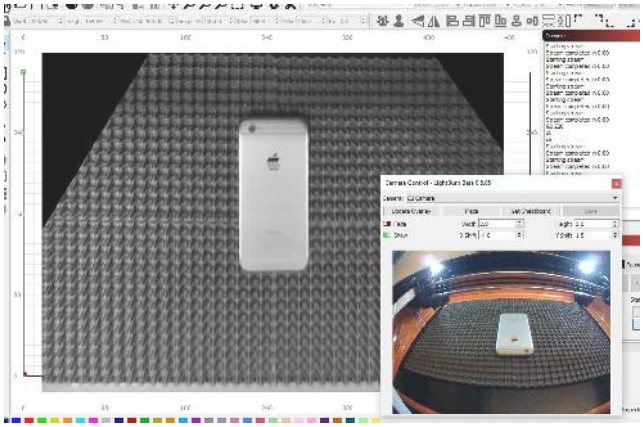
When you have placed all four markers in order, zoom back out and verify that all four are visible and clearly centered on the targets, like this:



Final placement of all four markers.

Click Next to finish the marker placement screen and click Finish to complete the process and store the results. You're done!

Now that everything is aligned, open the Camera Control window again, and click "Update Overlay" or use ⎇ Alt + C to capture and project whatever happens to be in the camera view onto your workspace, as shown:



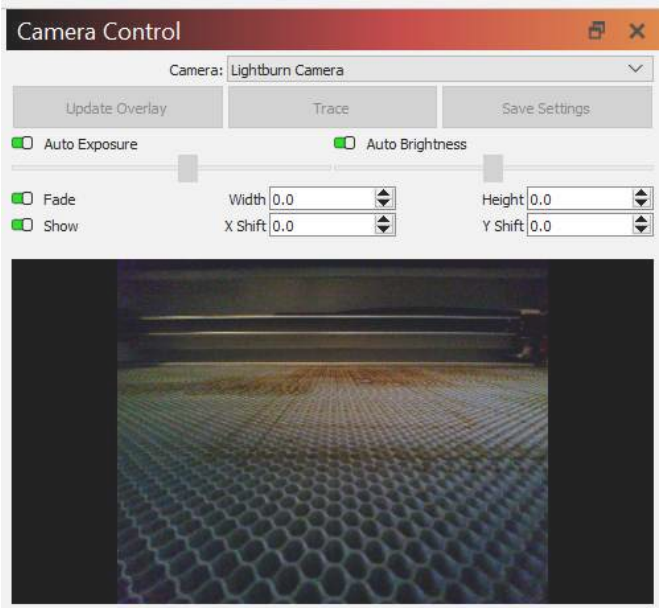
Click the "Fade" button to dim the background image, or the "Show" button to toggle it off and on.

Camera **DSP** **GRBL** **Galvo** **Tools**

5.7.6 Using the Camera

You can use the camera in LightBurn to display an overlay in the workspace, allowing placement of designs directly on objects or oddly shaped materials. You can also trace artwork from the camera.

To begin, you'll want to make sure the **Camera Control** window is visible. It can be turned on from the **Window** menu if not currently active.



The camera control window.

Camera Control Window

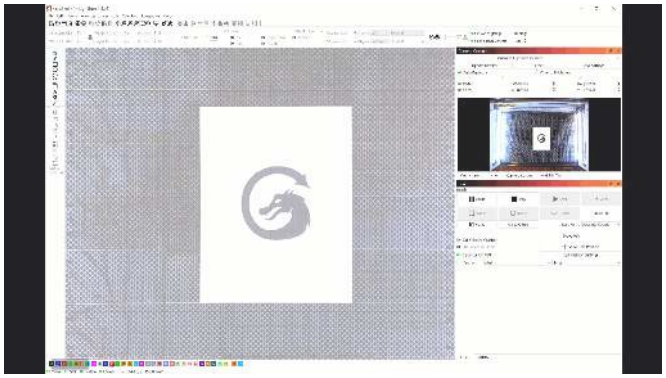
Camera	Select the appropriate camera
Update Overlay	Capture a new image to use as the camera overlay
Trace	Open the camera trace dialog
Save Settings	Save the Shift and Scale adjustments
Fade	Toggle whether or not the camera overlay is dimmed
Show	Toggle whether or not the camera capture is visible as an overlay
Width/ Height	Scale settings for the camera capture
X Shift/Y Shift	Shift the camera capture
Preview	A preview image of what the camera sees

You can also right-click on the window to open the camera selection tool, calibrate and align your camera, and import/ export your camera calibration and alignment settings. As of version 1.4, you can import and export head-mounted camera settings in addition to fixed cameras.

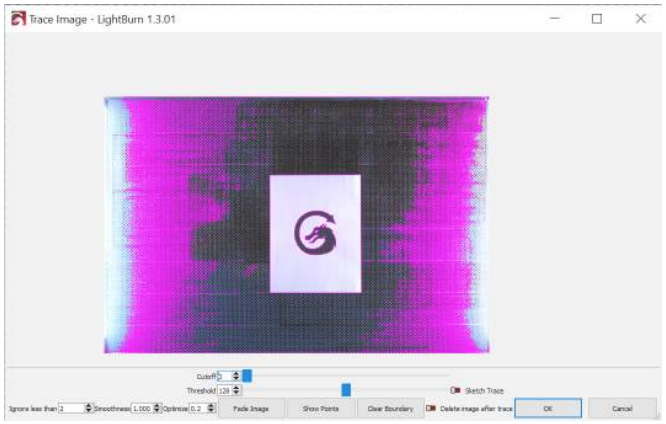
Tracing from the camera

Tracing an image using the camera works in the same way as the regular image trace function, and you can find more detail on the trace settings on that page.

To begin tracing, click the **Trace** button in the **Camera Control** window. This will bring up a preview of what will be traced.

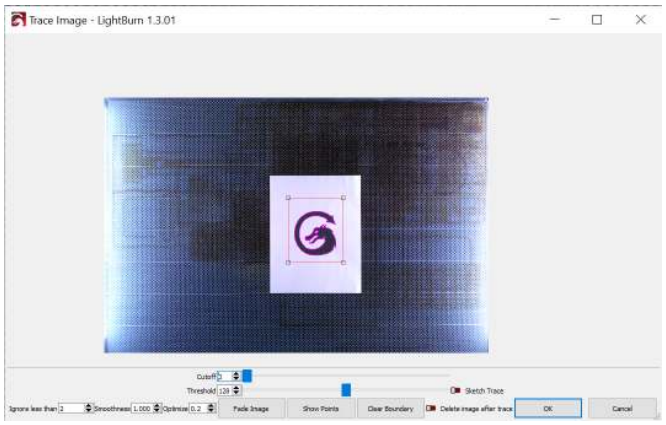


Tracing artwork from the camera



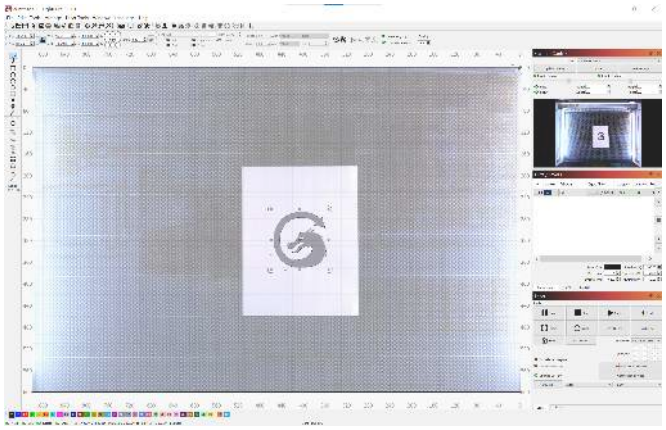
Camera trace preview

It's likely that the artwork you're tracing won't take up the camera's entire view. In the image above, you can see that the edge of the paper and the honeycomb bed are both being caught in the trace, when all I really want is the LightBurn logo. You can draw a boundary around the artwork you want to trace to tell LightBurn to ignore everything outside that boundary.



Only the area inside the rectangle will be traced.

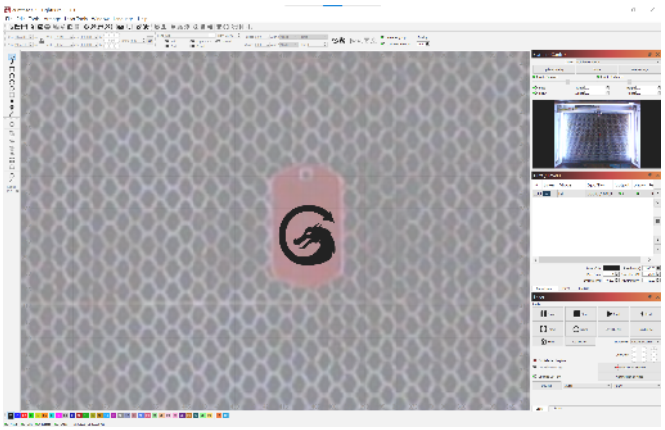
After pressing the **OK** button, the artwork is processed.



The traced logo is visible on top of the camera overlay

Using the Overlay

The camera overlay can make placing designs easier. When using it, LightBurn will automatically switch the **Start From** setting to **Absolute Coords**. This is necessary so the artwork placement on the screen matches the output on the laser. Also remember to update the overlay when you move things around on the laser bed.



Using the camera overlay to place the traced logo on an object

Final result, showing the LightBurn logo engraved on a tag as shown in the overlay

5.8 Machine Guides

Machine Guides **Ruida** **Thunder Laser**

5.8.1 Connecting via Ethernet to Ruida Controllers

To avoid using long USB cables, you may want to send jobs to the Ruida controller in your laser via Ethernet networking. This is a guide on how to do so.

Networking

Ruida controllers operate over IPv4, or Internet Protocol Version 4, which consists of unique external and unique "local" addresses within a network. Ruida controllers need a "static" IP, or one that's unchanging. Most modern networking involves DHCP, where addresses are "loaned" temporarily to devices, like laptops and phones. More in-depth networking information can be found at Google Support, Simple Wikipedia's explanation, or other technical resources like Cisco or Meraki's websites. This is a complex topic with a wide range of possible setups, so we are unable to cover every situation.

In order to connect a Ruida controller over Ethernet, you'll need to select a static IP address that doesn't interfere with other devices on your network. If you're comfortable doing that on your own, select an IP address appropriate for your network and jump ahead to setting the IP address on the controller. Otherwise, keep reading for help.

Choose an IP address

Choosing a static IP address that doesn't interfere with other devices on your network can be a little tricky if you aren't already comfortable with computer networking, but home networks are usually small enough that we can get by with picking an address that's unlikely to be used already.

For more complex network situations, such as a school or work network, we recommend working with your IT/networking team to select an IP address and connect your laser to ensure that you don't cause problems for your network infrastructure.

1. FIND YOUR COMPUTER'S IP ADDRESS

To start, you'll want to find your computer's local IP address. It will be four sets of numbers separated by periods, similar to `192.168.1.19`. See below for tips on how to do that on Windows and Mac.

Windows

Open the command prompt (type "cmd" in the start menu or in the `⊞ Win` + `R` search box). At the command prompt, type `ipconfig`, and press `Enter ⏎`. Your results will look similar to this:

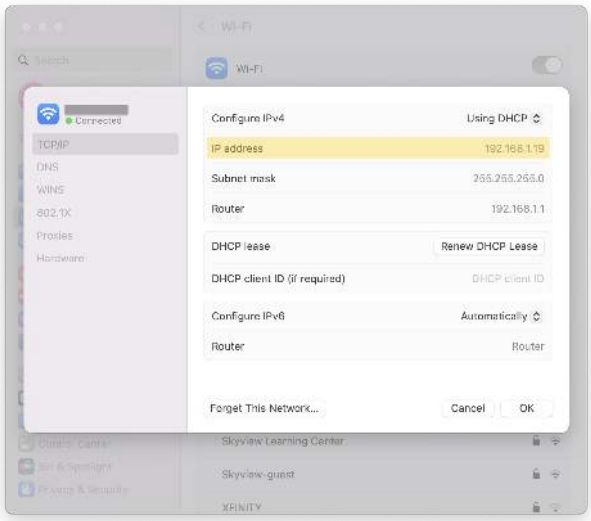
```
Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . : frontierlocal.net
   Link-local IPv6 Address . . . . . : f...
   IPv4 Address. . . . . . . . . . . : 192.168.254.14
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.254.254
```

The line that says `IPv4 Address` is what you're looking for. Make a note of this address and move on to choosing a unique IP address.

Mac

Open Spotlight with `⌘ Cmd` + `Space` and type "IPv4" into the search bar to bring up your IP address in system settings.



Make a note of this address and move on to choosing a unique IP address.

2. CHOOSE A UNIQUE IP ADDRESS FOR YOUR LASER

Start with the IP address you found in the previous step. The first three segments need to stay the same, but the last segment needs to be a value from 1 to 255 that isn't already used on your network. An easy trick that usually works is to add or subtract 100 from your computer's address. This makes it less likely that another device connecting to your network will automatically be given the same IP address you choose.

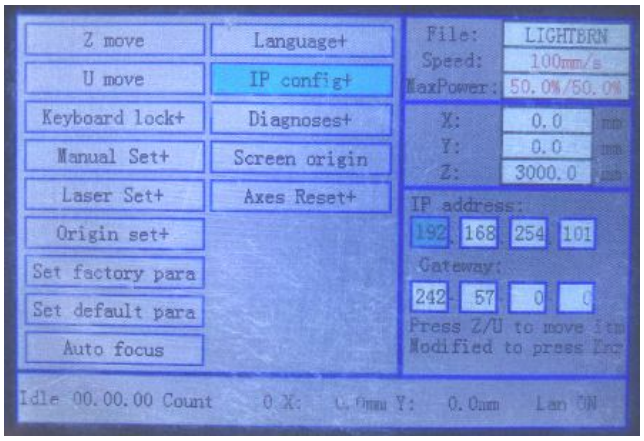
Starting IP address	Try this IP address
`10.10.1.154`	`10.10.1.54` (subtracted 100)
`192.168.2.201`	`192.168.2.101` (subtracted 100)
`10.100.50.14`	`10.100.50.114` (added 100)

This trick doesn't guarantee a unique address, so if it's not working, try a few different IP addresses by varying the last segment.

Set the IP address on the controller

> **Note**
>
> Some Ruida controllers have different menu and button configurations. This is a guideline, not a hard and fast rule.

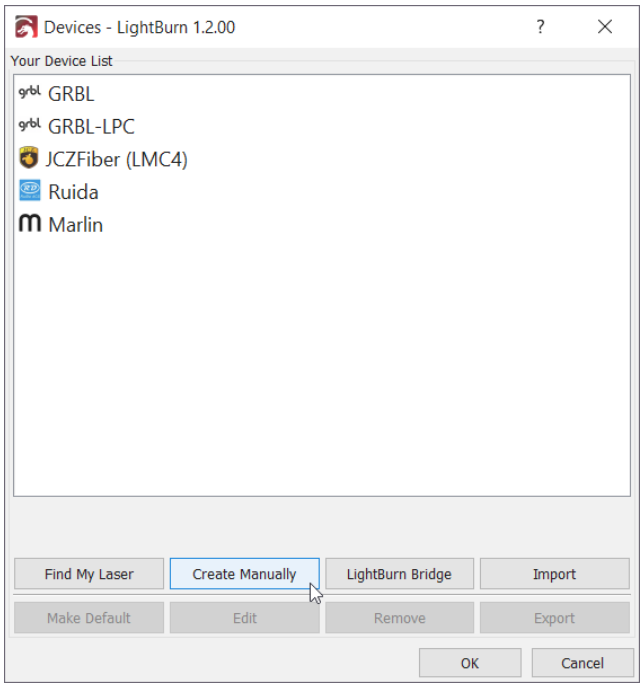
On the Ruida controller, use the Z/U or Menu buttons to enter the menu, navigate to "IP config+" , and press enter to access that menu setting. On the right side of the screen, the IP address field and gateway will be visible. Use the left/right arrows to move through the octets (sections), and the up/down arrows to change the value. Press and hold the up/down arrows to quickly change the value.



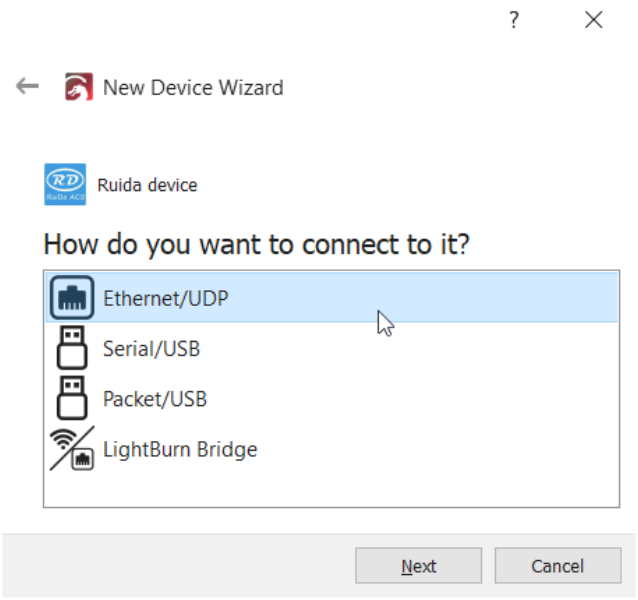
When done, press the "Enter" button.

Add the laser in LightBurn

Ruida controllers accessed over a network are their own type of connection for a device, so in the "Devices" menu, click "Create Manually".



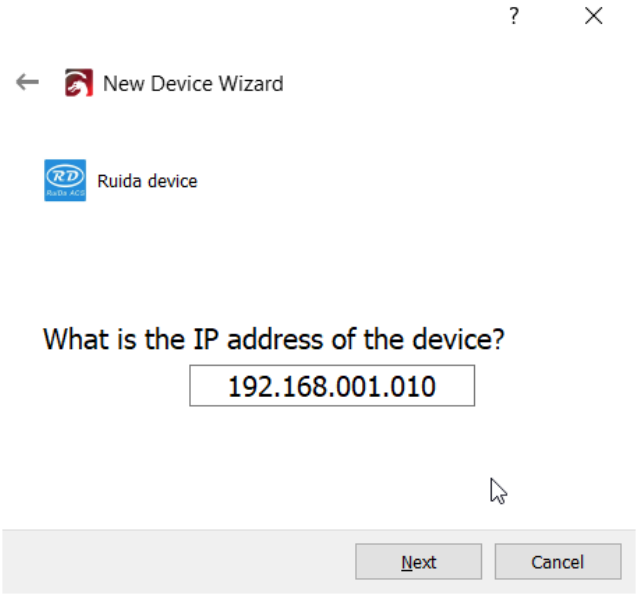
Select the Ruida controller from the list of compatible controllers.

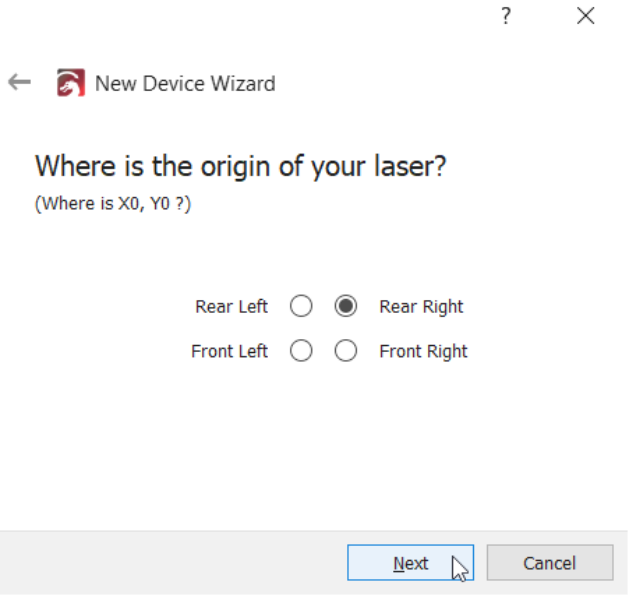


Select "Ethernet/UDP" as the communication method.

> **Warning**
>
> In the event this communication method proves unreliable, you may want to consider using a LightBurn Bridge, especially if you're using macOS. The Bridge provides a much more stable network connection than the Ruida controller's UDP connection.

Enter the IP that you assigned to your laser.

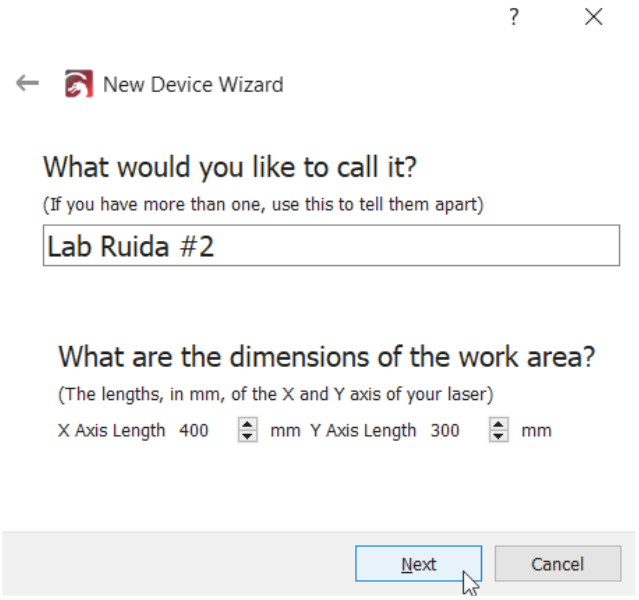




Note

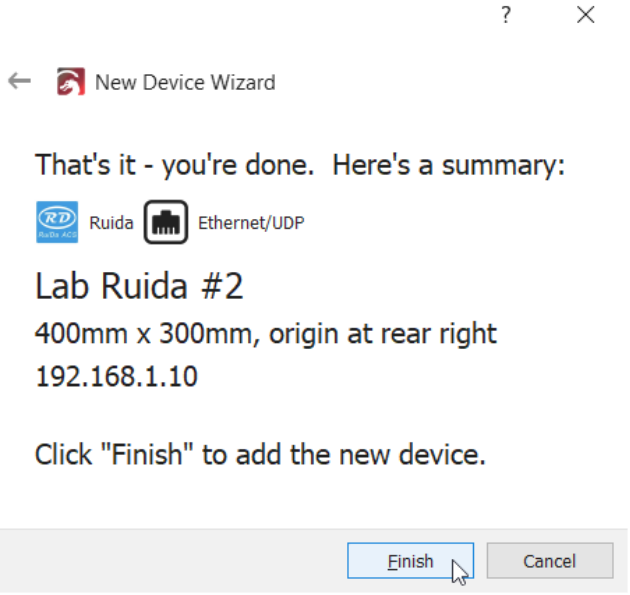
Steps below this point are likely to mirror the setup of any prior USB connections set up for the same hardware.

Enter the size of your laser's bed and name the device as it'll show up in your menus.



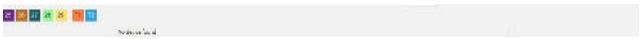
Enter the origin (0,0) position of your machine.

And now you're ready to go!



Verifying

In LightBurn, the status bar on the bottom of the main window will show connection status to the device. In the event LightBurn cannot find your laser, it's likely to show like below.



In the event your networking is spotty, you can right-click the "Devices" button to restart the currently selected device connection.

Source

This guide was originally made for our Forums on October 20th, 2019. You can find the original guide here.

Machine Guides **Trocen**

5.8.2 Connecting via Ethernet to Trocen Controllers

To avoid using long USB cables, you may want to send jobs to the Trocen controller in your laser via Ethernet networking. This is a guide on how to do so.

> **Attention**
>
> This section is new, and is a work in progress. Be sure to let us know on the forums or via support if we need to change something. Thank you!

Networking

Trocen controllers operate over IPv4, or Internet Protocol Version 4, which consists of unique external and unique "local" addresses within a network. Trocen controllers need a "static" IP, or one that's unchanging. More modern networking involves DHCP, where addresses are "loaned" temporarily to devices, like laptops and phones.

In Windows, if you open the command prompt ("cmd" in the start menu or in the Win+R "Run" box) and type "ipconfig", it'll look something like this.

```
Ethernet adapter Ethernet 2:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::8062:587f:6f02:dc31%5
   IPv4 Address. . . . . . . . . . . : 192.168.1.233
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.1.1
```

CHOOSING AN IP

> **IP Address Example For Home Networks**
>
> 1. Look for the line in `ipconfig` giving your IP address
>   `IPv4 . . . 192.168.1.225`
> 2. Remove the last section 192.168.1.~~225~~
> 3. Replace it with a number between 230 and 250 192.168.1.**235**
>
>   This will probably be safe to use on a home network, but it isn't guaranteed. See links to the left for help.

Unfortunately, choosing a static IP address can be a little tricky. Home networks are usually small and pretty simple, so the steps in the blue box to the right will *usually* be enough to help you choose an unused IP address. If you run into problems with the first number you try, it may be worth trying one or two others to see if there's a conflict.

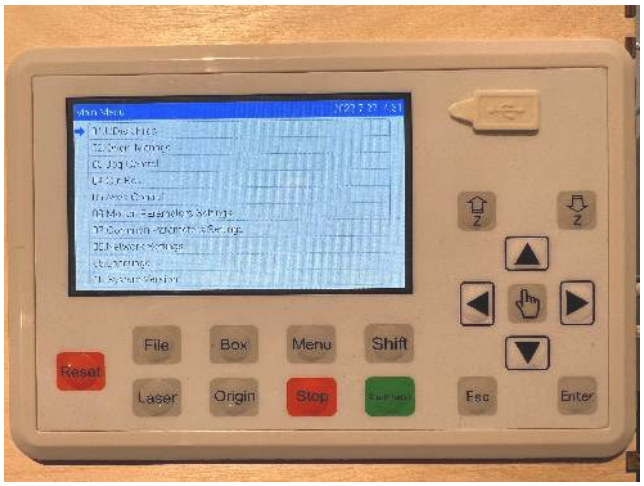
In more complex network situations, such as a school or shop network, we recommend working with your IT/ networking team to select an IP address and ensure that you don't cause problems for your network infrastructure.

More in-depth networking information can be found at sources like Google Support, Simple Wikipedia's explanation, or other technical resources like Cisco or Meraki's websites. This is a complex topic with a wide range of possibile setups, so we are unable to cover every situation.

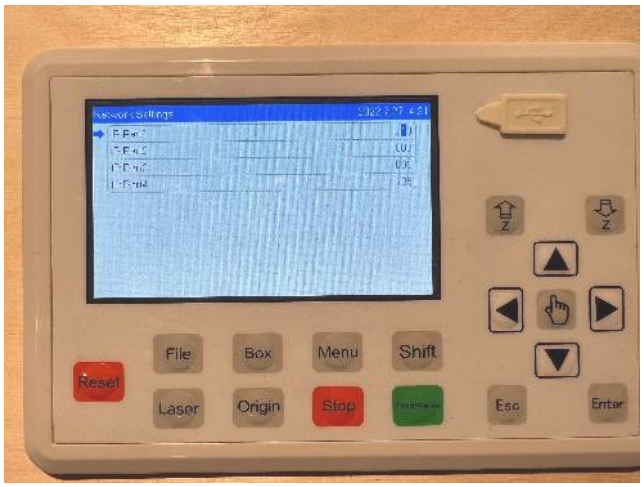
ON CONTROLLER

> **Note**
>
> Some Trocen controllers have different menuing and button configurations. This is a guideline, not a hard and fast rule.

On the Trocen controller, use the Menu button to enter the menu, navigate to "Network Settings , and press enter / the mouse pointer button to access that menu setting.



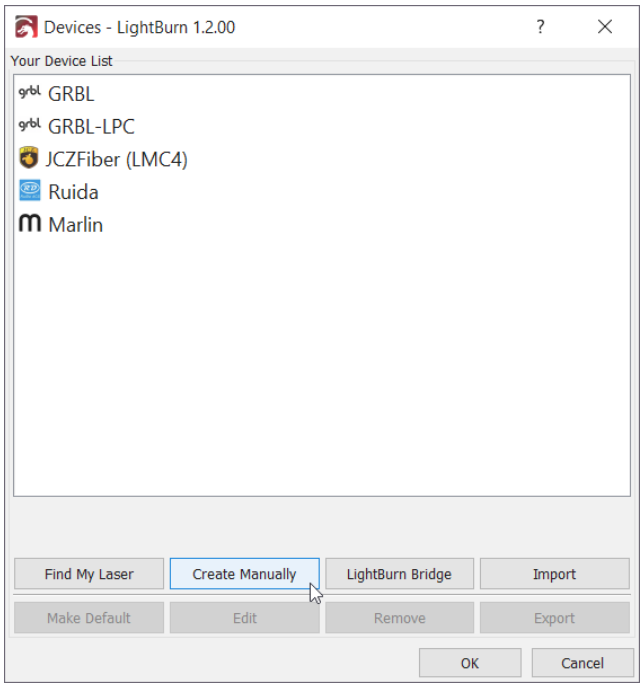
Each octet of the IP will be editable, enter the menu, exit that subsection, and continue to enter your IP for the laser.



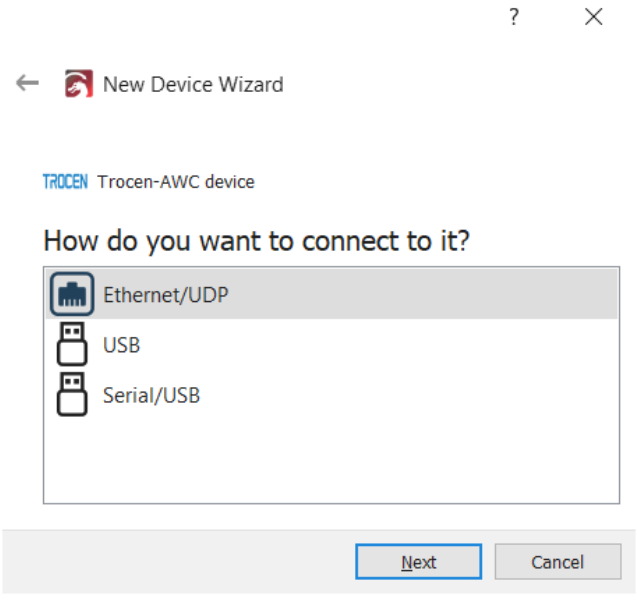
When done, exit the menu.

In LightBurn

Trocen controllers accessed over a network are their own type of connection for a device, so in the "Devices" menu, click "Create Manually".

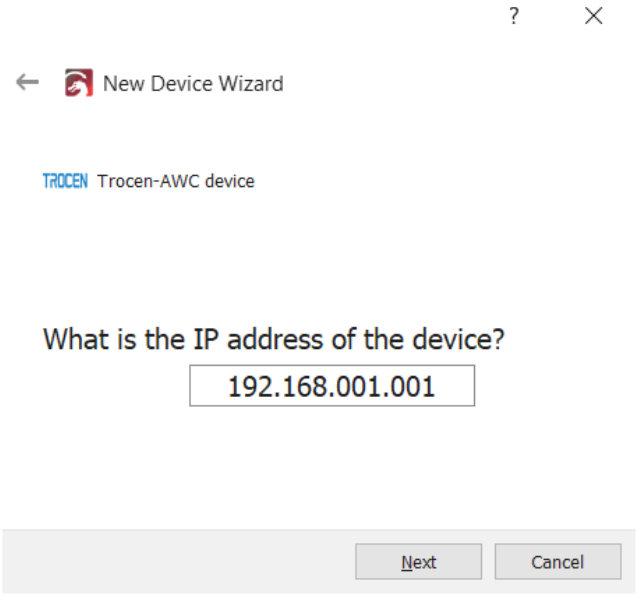


Select the Trocen controller from the list of compatible controllers.



Select "Ethernet/UDP" as the communication method.

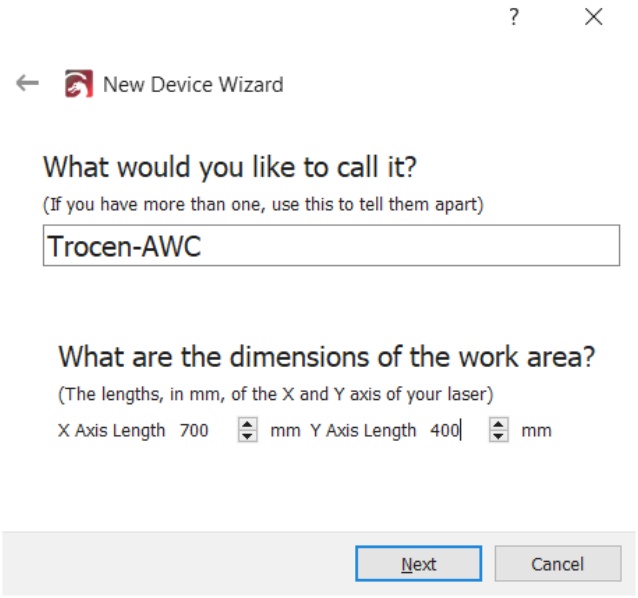
Enter the IP that was assigned or arrived at for use given the information above.



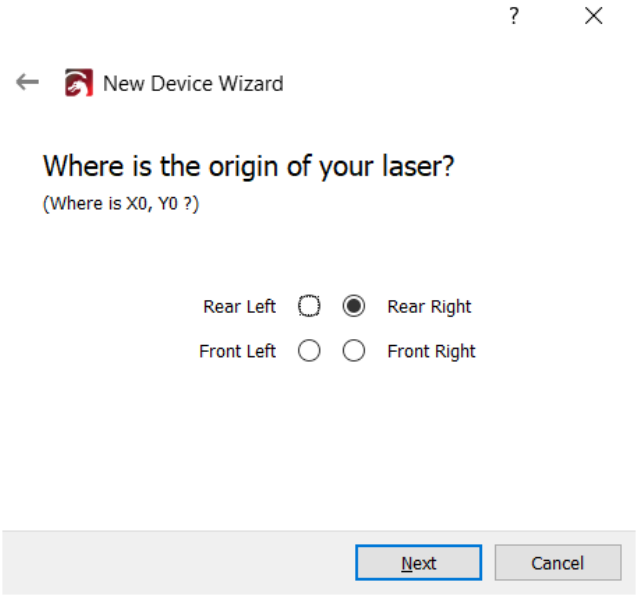
Note

Steps below this point are likely to mirror the setup of any prior USB connections set up for the same hardware.

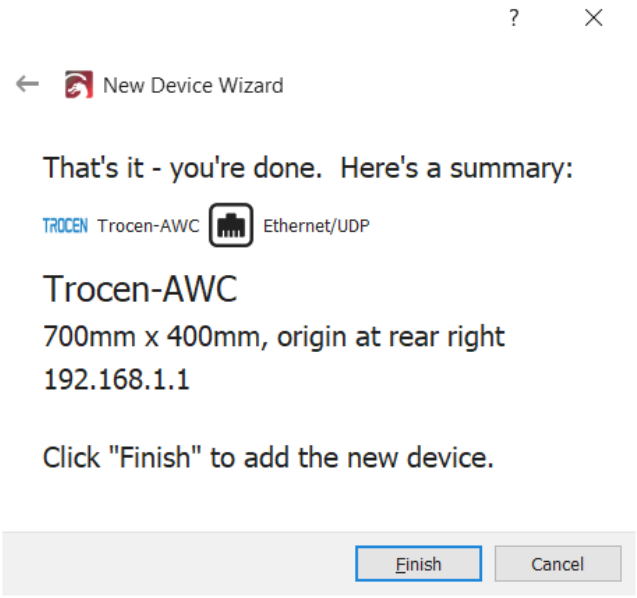
Enter the size of your laser's bed and name the device as it'll show up in your menus.



Enter the origin (0,0) position of your machine.

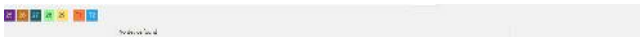


And you're ready to go, assuming all is good!



Verifying

In LightBurn, the status bar on the bottom of the main window will show connection status to the device. In the event LightBurn cannot find your laser, it's likely to show like below.



In the event your networking is spotty, you can right-click the "Devices" button to re-connect to any laser; not just your Trocen controller.

Source

This guide was originally made for our Forums on October 20th, 2019. You can find the original guide here.

GRBL **Network** **WiFi**

5.8.3 WiFi Connection (GRBL)

This tutorial explains how to set up a GRBL laser over a local network (e.g. your home router).

The Sculpfun iCube is used as an example, but the process should be similar for any GRBL device capable of network connections.

We've attempted to point out anything that is device-specific throughout, but GRBL network configuration is not fully standardized. If your device's network settings don't match this guide, please email support or visit our forum, where we can help you with your device and gather the information we need to update this page to help other users.

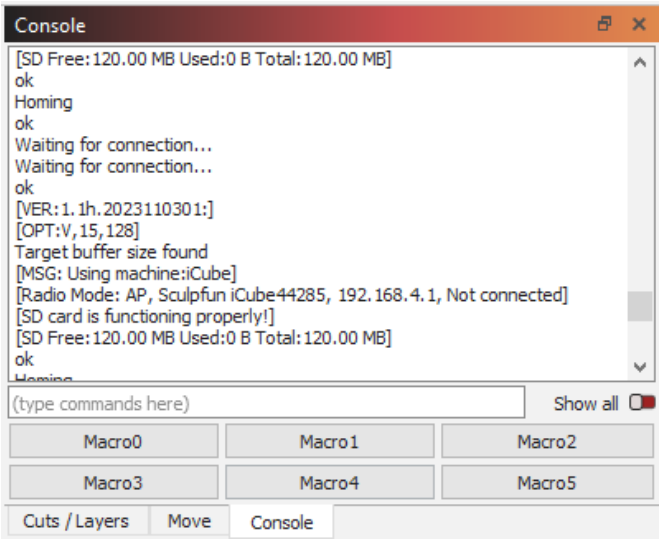
Part 1: Connect Over USB

> **Why do I need USB? Isn't this about WiFi?**
>
> You'll need to connect with USB to update a few settings on your laser. If your laser is already connected with USB, you can skip to Part 2.
>
> If your laser is already connected to WiFi and you just want to connect a second computer to it, you can skip to Part 4.

1. Turn on the device and connect to the computer with a USB cable.
2. Use the USB connection to add the device as described in Find My Laser.
3. Select the device in the **Laser** window:
   - If you see **Ready** right below the title bar of the window, your laser is connected and ready to use.
   - If you see **Busy** and a green progress bar, your device is busy doing something. Many GRBL devices will home themselves when first connected, so you'll see the Busy message until homing is complete.
   - If you see **Disconnected**, your device is not connected. Make sure you have the correct serial port selected (the dropdown that says **COM4** in the above screenshot). If your laser still isn't connecting, select **(Choose)** in the same dropdown and then reselect the serial port to reset the connection. If you're still unable to connect, please see Troubleshooting: Connection Problems.
4. Open up the **Console** window:
   - By default, the Console window is in the same section of the screen as the **Cuts / Layers** and **Move** windows.
   - If you don't see the Console window, go to the **Window** menu and make sure **Console** is checked.
   - In the next two sections of this guide, you'll use the Console window to configure your network connection.

Part 2: Find Network Info in Console

Immediately after you connect to your laser, you should see a series of messages in the console describing your laser's status.



Network status as part of the status messages shown when connecting to a GRBL laser

You need information about your laser's network status, shown in the line starting with `Radio Mode`:

```
[Radio Mode: AP, Sculpfun iCube44285, 192.168.4.1, Not connected]
```

Your laser won't send the exact same message, but you should see something similar. Here's what each part of the message means, based on the example above:

Message	Meaning	Explanation
`Radio Mode: AP`	Network type, typically either `AP` or `STA`	If you see `AP` here, your laser is in *Access Point* mode, allowing you to connect directly to the laser over WiFi. If you haven't changed your laser's network settings, it will likely be in this mode. If you see `STA` here, your laser is in *Station* mode and will attempt to connect to an existing WiFi network. This is not universal, and some devices are

Message	Meaning	Explanation
		configured differently.
`Sculpfun iCube44285`	WiFi network name, or *SSID*	The name of the WiFi network the laser is either broadcasting (in *Access Point* mode) or attempting to connect to (in *Station* mode).
`192.168.4.1`	Laser's IP address	This is the *IP Address* of the machine — it's how a computer knows where to find it on a network.
`Not Connected`	Connection Status	This tells you whether your laser is connected with any devices over the network connection.

Your specific device may not match this exactly. Please email support or visit our forum if you need help with your specific device.

Part 3: Configure Network Connection

This process varies between devices. If you're not sure how to change WiFi settings and the directions below don't work for you, try checking your laser's user manual or seeking support from your laser's manufacturer. These settings are stored on the laser, so once your laser connects to the network, you shouldn't need to repeat this process until your WiFi network changes.

Your laser may come with a mobile app or web interface that allows you to configure network settings. If you aren't able (or don't want) to use these, skip ahead to Configuration in LightBurn.

CONFIGURATION WITH APP OR WEB INTERFACE

> **Tip**
>
> Many devices will automatically disconnect from a WiFi network without an internet connection. You may need to modify your device's network settings to connect directly to your laser. See the support resources for your phone or computer for help with your network settings.

If your laser is in *Access Point* mode, you may be able to configure the network connection using a mobile app provided by the manufacturer or a web interface. This isn't always possible and the process varies between lasers, but in general you will need to start by connecting a phone or computer to the laser's WiFi network. If you need a password to connect, check your laser's user manual for the default password. For the Sculpfun used as an example here, the default password is "12345678".

If your laser uses a web interface, enter the *IP Address* from Part 2 where you would usually type in a website's URL to access it.

Here are the settings you will need to configure, although they may be displayed differently for your laser:

Name	Value	Notes
Network type	Typically *STA* or *Station*	You want to connect to an existing network. You don't want *AP* or *Access Point*
SSID	Your WiFi network's name, or *SSID*	Newer routers may have 2.4GHz and 5GHz connections available. If you see both, choose 2.4GHz
Password	Your WiFi network's password	Enter this carefully to avoid entering it incorrectly

CONFIGURATION IN LIGHTBURN

To configure your laser's network settings, you will need to use the **Console** window.

Network configuration varies between devices, so check your laser's user manual for more information. The Sculpfun used as an example here came with a sheet of paper listing the appropriate parameters. Regardless of what laser you're using, you will need to change the settings listed below, but the number after `$` may be different for your specific laser:

Name	Parameter	Value
Network type	`$50`	Typically `STA`
SSID	`$53`	The name of the WiFi network to connect to
Password	`$54`	The password to connect to the WiFi network

Each command given is entered into the text box at the bottom of the **Console Window** and followed by pressing `Enter ⏎`.

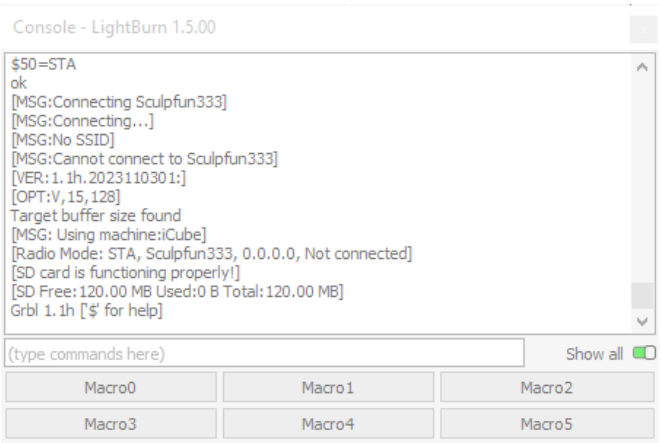
To check the value for any of these parameters before changing it, you can use the parameter without assigning a value. To change the value, add `=YOURVALUE` after the parameter. As an example, `$53` will show the name of the WiFi network to connect to. `$53=MyWifiNetwork` will configure the laser to connect to a network called "MyWifiNetwork".

Each of the following steps will use the parameters shown above. If your laser's manufacturer provides different parameters, use those parameters.

Known Exceptions

The Spider X1 requires that `$50` be set to `2` to enable WiFi. As we identify additional devices that differ from the settings shown above, we will add them here.

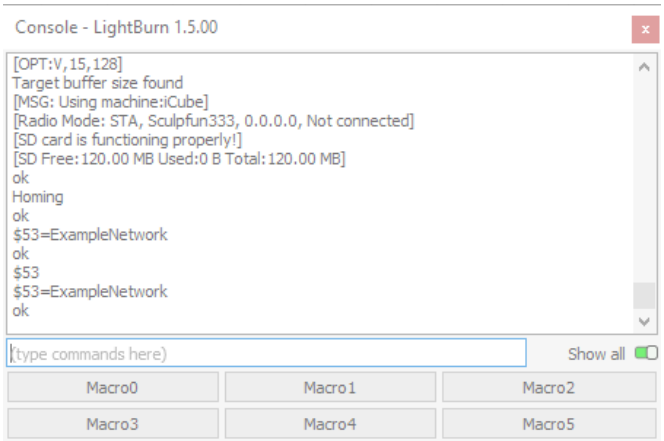
Set Network Type



Use `$50=STA` to set your laser to *Station* mode. This tells it to connect to an existing network.

Don't worry for now if you see `[MSG: No SSID]` or a similar message in the Console window. This is your laser's way of telling you that it doesn't know what network to connect to yet.

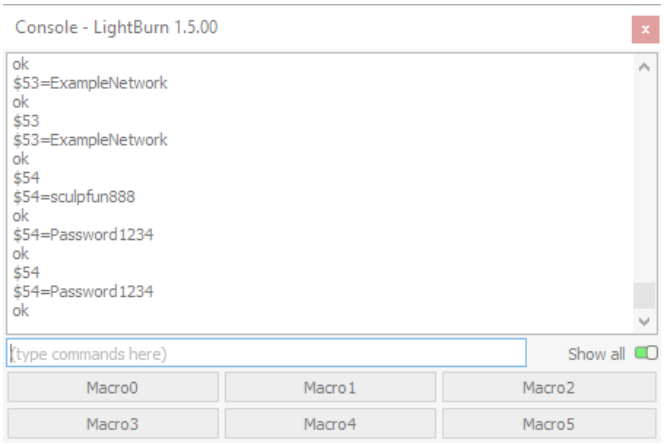
Set Network Name



Use `$53=ExampleNetwork`, to set the *SSID*, replacing "ExampleNetwork" with the actual name of your WiFi network.

Make sure you type accurately, including capitalization.

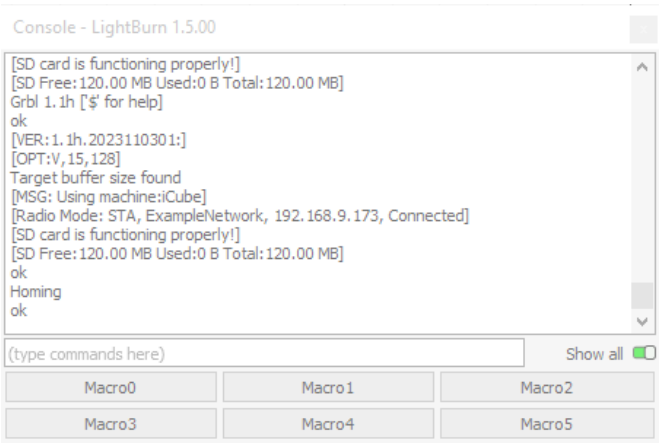
Set Password



Use `$54=Password1234` to set the WiFi password, replacing "Password1234" with your actual password. The screenshot above also shows how to use `$54` to check the saved password.

Make sure you type in your password accurately, including capitalization. This should be the password to connect to WiFi, not the login info for your computer or any accounts you may have.

CHECK CONNECTION



Status message showing successful network connection

After configuring network settings, you may need to restart your laser to get it to connect. The `Radio Mode` status message now shows updated network settings and ends with `Connected`:

```
[Radio Mode: STA, ExampleNetwork, 192.168.9.173, Connected]
```

Make sure you write down the *IP Address* (`192.168.9.173` in the example above) for easy access in Part 4.

Part 4: Network Connection in LightBurn

Once you have an IP address, you can set up a network connection in LightBurn.

1. In the **Laser Window**, click the **Devices** button and choose **Create Manually**. Click **Next** to continue.
2. Select **GRBL** to create a new GRBL device and click **Next**.
3. Select **Ethernet/TCP** as your connection type and click **Next**.

4. Enter your device's IP address from Part 3 and click **Next**.
5. Give the device a name that makes sense to you and set the size of the work area. Click **Next**.
6. Check that the origin and homing settings are correct and click **Next**.
7. Make sure the summary looks correct and click **Finish**.

At this point, you should be able to connect to your laser through the network connection by selecting the device you've just added in LightBurn.

Troubleshooting

- If your laser isn't able to connect to the WiFi network in Part 4:
  - Check that the SSID and password are correct.
  - If you are using a 5GHz WiFi network, try using a 2.4GHz network instead. Most routers that have 5GHz WiFi will also have a second SSID for 2.4GHz.
  - Ensure your computer is connected to the same network as your laser.
  - If you have trouble connecting, you may need to change the network port LightBurn is using to communicate with your laser.
  - If you can connect but the laser is stuttering, stopping, or restarting mid-job, you may need to switch to Synchronous Transfer Mode.

5.8.4 Adding Limit Switches to Sculpfun S9 Diode Lasers

This guide shows the steps to install limit switches on a Sculpfun S9 diode laser using off the shelf components, and some laser cut parts. This enables reliable, consistent alignment within the engraving or cutting area with less work for the operator. This guide will be applicable to other diode lasers (such as an AtomStack), especially those using a MKS DLC 2.0 control board and similar.

This enables the use of LightBurn features on these machines, including:

- Print and Cut
- Center Finder Tool
- Using A Camera

Danger

This guide assumes electrical and mechanical know-how to safely install and enable these features. Please take care to avoid damaging the machine and those around it, including you!

Proceed with caution!

What You'll Need

Some of the materials you'd need (but not neccesarily all) include:

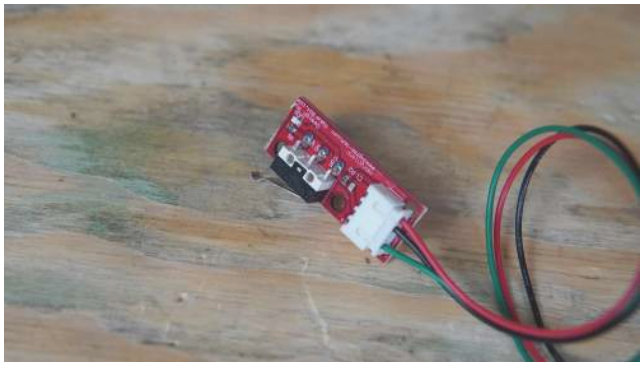
- A compatible diode laser
- 3 Pin Limit Switches
- servo extension cables
- If your cables don't comfortably reach, you may need to purchase or assemble an extension cable yourself.
- Brackets to hold limit switches to your frame (one per limit switch on your frame)
- LBRN File for Laser Cutting (cut from 3 mm wood or acrylic)
- STL File for 3D Printing
- M3 2020 T-nuts
- M3 Screws
- M3 Hex Driver
- 2020 Extrusion Cover
- Scissors (to cut said extrusion cover)
- Zip Ties (to fasten the limit switch cables)

If you'd like to create custom cables rather than use a servo extension cable, here are the ones we used.

- Engineer PA-09 Crimper
- Wire
- JST Connectors

LIMIT SWITCHES

Limit switches are small, electro-mechanical devices that when depressed, create a pathway for a signal to pass through. We can use them to tell the laser's controller that we've reached the end of their motion.



In this guide, we'll be using a 3 wire style limit switch, mounted to a printed circuit board to make installing it on your machine easier.

LIMIT SWITCH CABLING

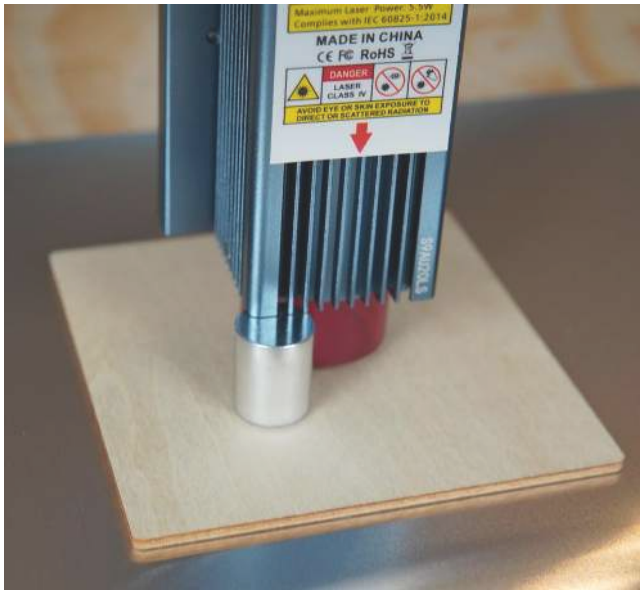
These cables are responsible for passing the signal back to your laser, and through checks are required to connect them correctly. If the cable is too short, it can damage the connector, damage your diode laser, or other components.

Before Disassembly

If you intend to use the laser cut brackets for the limit switches, you'll want to cut those before disassembling your laser for installation.

CUTTING OUT BRACKETS

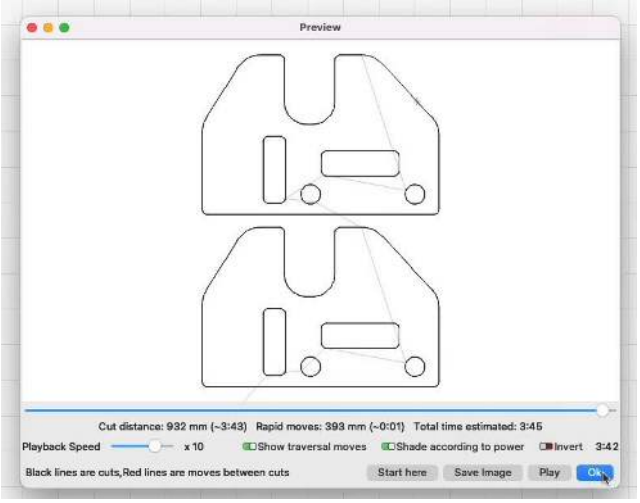
Same as with standard use of your laser, you'll want to focus the head relative to the cutting material, in our case, some thin 3 mm wood.



DOCUMENT SETUP

Use the LightBurn preview window to ensure that your document as set up looks good. The default settings for the S9 should be adequate. We used:

```
250mm/m
100% Power Max (%)
Pass Count: 2
```



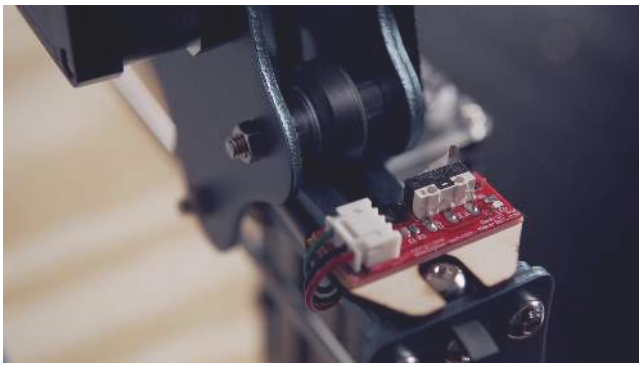
You may want to use the "Square Frame" command within LightBurn to ensure the material you're engraving has the sufficient area to cut out the brackets.

Mechanical Installation

To install the limit switches, you'll need to insert an M3 2020 t-nut into the frame sideways, and then rotate it 90° in the frame slot to align correctly for retention. You may need other tools to insert & rotate them appropriately; we found that a small flat-bladed screwdriver may be helpful.

When mounting the limit switch, place the cut or printed spacer underneath the limit switch board, and oriented it such that the "arm" of the limit switch faces the head of the laser.

Here we use a M3 x 8 mm screw to fasten the board to the frame.



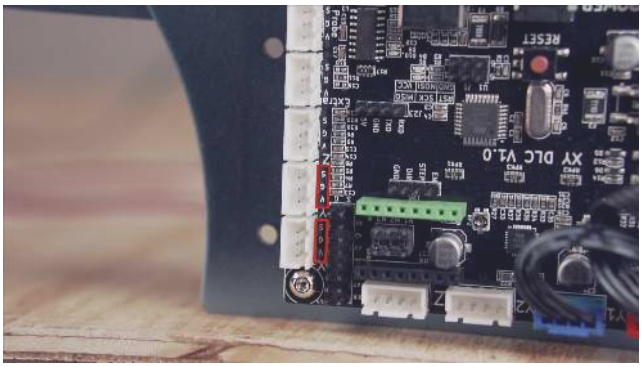
This process should be repeated such that a limit switch is positioned for both the X and Y axes of the machine.

Wiring

Our limit switches are labeled as having three pins for use:

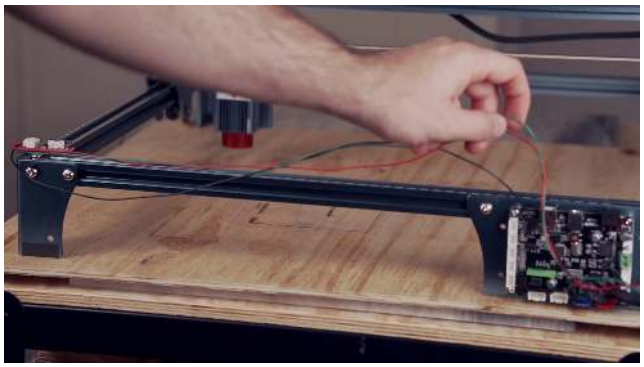
- G - Ground
- V - Voltage
- S - Signal

This labeling also applies to the printed circuit board that has the control electronics of the laser. Be sure to match each axis' limit switch to the correct connector and direction, for X or Y axis as is correct.



Notes on Extensions

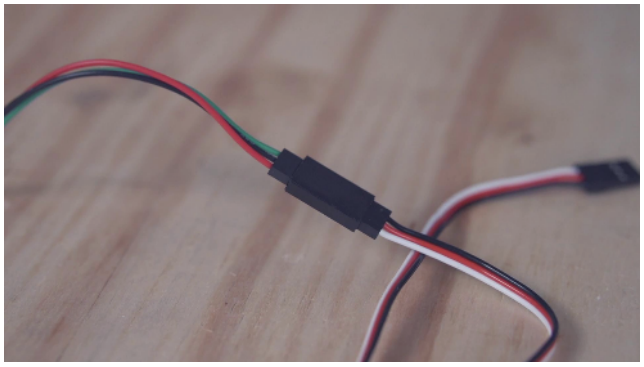
The cables we're using, while they technically fit, aren't what's intended on these connectors. We suggest you use a crimper and make a custom cable, but we understand this isn't possible for everyone and opted to include this as a more accessible option.



The preferred way would have the user crimp JST connections on a single length of cable per axis and make it exactly to length, but we recognize this isn't always an option.

Danger

Please be aware that use of "PWM" style connectors in a JST housing permits the inversion of the connection, potentially damaging your laser. Ensure the pins are connected with the correct labels (i.e. ground to ground, signal to signal, etc.) before turning on your laser on.



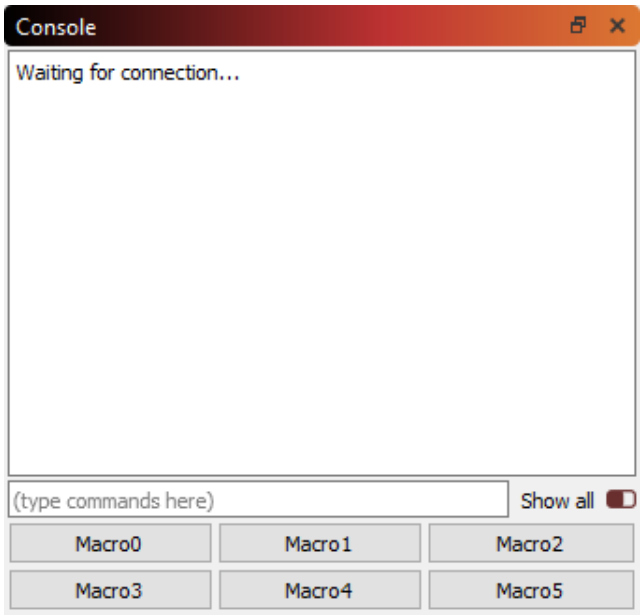
When continuing to hook up the wiring, you'll likely want to route the extensions or connections through the pre-existing hole in the housing, or through the vent holes on the side. This ensures you can re-close the housing and protect your electronics.

Next you'll need to test the machine while opened up. This allows you to resolve those issues you might encounter more easily. Carefully reconnect power and USB to the device, and turn it back on.

The diode laser won't immediately understand how to use the limit switches, and as such, we'll need to do software configuration within LightBurn.

Software

The first major check is to ensure that upon re-powering the device, LightBurn can still see your laser; confirm this through the Console dock. If so, you'll need to use the following codes to enable limit switch homing.




```
$22=1
```

Danger

Be ready to power off the machine in the event it does something unintended and dangerous.

This GRBL command enables limit-switch based homing. To test your homing behavior, click the "Home" button in LightBurn in the "Laser" window.

If your device attempts to home in the wrong direction, you may need to change the "homing location" via more GRBL commands.

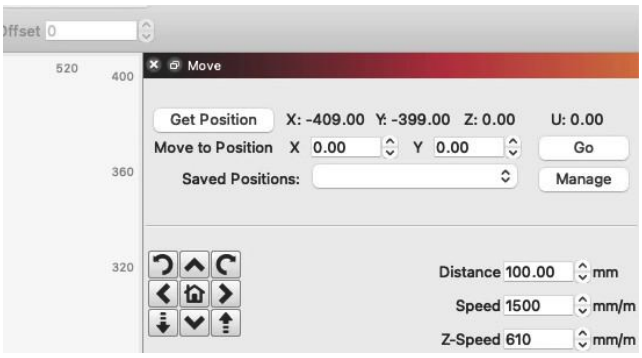
For ours, we needed to do `$23=3` to chose the near, left side as our 'home' location. If your device has the limit switches in another location, you'll want to reference this guide as to what the different values mean with respect to limit switch "bitmasks".

HOMING SPEED

By default, our device was rather slow during the homing process, and we changed the following to allow it to home more quickly.

```
$25=8000 (homing speed)
$24=100 (re-seek speed)
```

The final configuration information needed are for the workspace offset, which we can find by looking in the "Move" window when clicking "Get Position".



Taking these values, go back to the "Console" tab and enter the following GCode command:

```
G10 L2 P1 X-409 Y-399
```

These values directly use the data observed just prior, with the L2 P1 portion indicating to the device the specific offset mode (corrent workspace offsets to the specified values) and P1 to the "tool number" (value of 1, the first and only present on this machine).

We'll also need to tell the machine's status reporting to be relative to the workspace origin, and we can do that with:

```
$10=0
```

STOCK FIRMWARE WARNING

Many devices don't actually have GRBL firmware that by default stores these values in the memory of the laser's controller. As such, rebooting would wipe these values out, reverting the work you've done.

The correct fix would be to re-flash the firmware, of which we'll have a guide for soon. However, in the interim you can use the "Macros" button under the "Console" window.

By right-clicking the button, we can re-name it, and combine all of our commands together for use, which might look something like this:

If you'd like to copy this behavior and simply use it as-is, still verify your `G10` command has the correct offsets.

```
$22=1
$23=3
$25=8000
$24=100
G10 L2 P1 X-409 Y-399
$10=0
```

Reassembly

Once we've confirmed that this configuration works correctly, we can begin to reassemble our housing and more permanently install the wires for the limit switches. Turn the machine off to do so, to avoid any errant connections of the case to the electronics resulting in a short.

You can use 2020 extrusion covers cut to size to protect and hide the wires inside the grooves of the extrusion frame, and zip-tie the limit switch cable for the gantry to the pre-existing cable to the diode head itself.

Machine Guides **Sculpfun S9**

5.8.5 Flashing Guide

If your Sculpfun S9 (or similar laser) doesn't have the ability to permanently save changes made to the firmware, you may need to re-flash the microcontroller inside of it. This lets the brain running the diode use newer features of GRBL (the software controlling your laser inside it's electronics) effectively, and helps you avoid the possibility of forgetting to click the homing button.

Prerequisites

While this guide requires no additional physical components, several downloads are needed.

- Arduino IDE
- GRBL (with tweaks to disable Z axis)

Info

This guide was written for older versions of the Arduino IDE released before 2.0. Major changes were made when that version was released, and as such, this guide may not work with them. Please revert to use these steps, or find a newer guide to update your laser. Thank you!

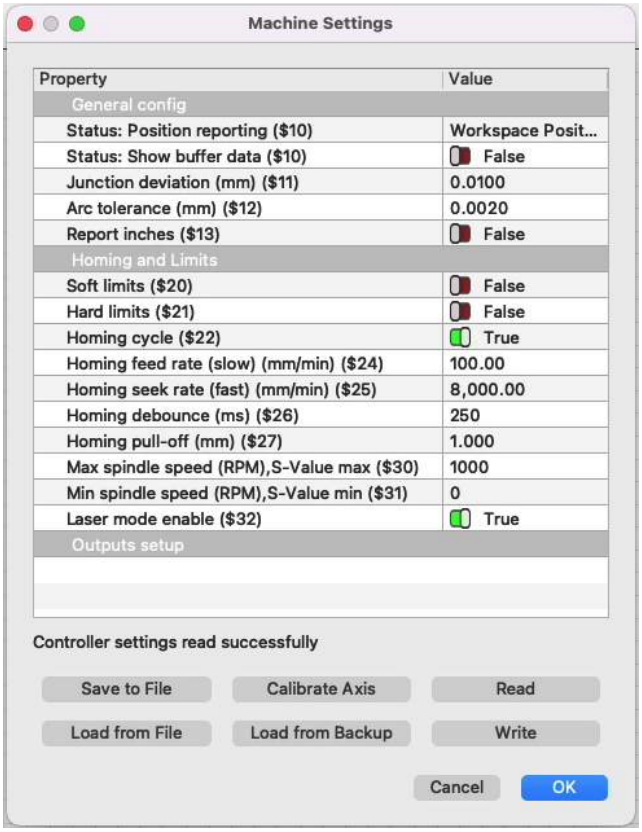
Warning

To successfully flash your laser, high attention to detail is needed. Flashing your firmware incorrectly can damage your machine. Read the whole guide, start to finish, before trying to flash your machine.

Prep

Plug in your laser's power and USB, connect it to your computer, and open LightBurn.

In LightBurn, use the macro created in the Limit Switch Guide to apply the needed limit switch firmware changes, and afterwards use the Edit -> Machine Settings dialog. In this window, you'll want to click "Save to file". This allows you to save a backup of the laser's configuration that's know to work before we flash firmware and reset all of those settings.



BACKUP VIA CONSOLE

Using the Console, you can enter "$$" to get the GRBL values of the machine to supplement those from the Machine Settings window. This gives you a further verification step to make sure the laser's behavior is as intended after flashing. Copy those to a text editor like Notepad or TextEdit and save for safekeeping.

Attention

At this point, please close LightBurn. Not doing so will cause flashing errors later in this process.

Arduino IDE

To flash a newer version of GRBL to your laser, you'll need to download Arduino IDE. As a toolkit to enable microcontroller development in a friendly bundle, it allows you to make any changes we might need to make, connect to the laser, and send the new version of GRBL to your device.

You'l need to install Arduino IDE through the appropriate installer for your system, but the specifics will vary computer to computer.

GRBL

To actually have something to flash to the laser, you'll need GRBL. An off-the-shelf version of GRBL however, assumes we have three axes, not two. As a result, when it goes to

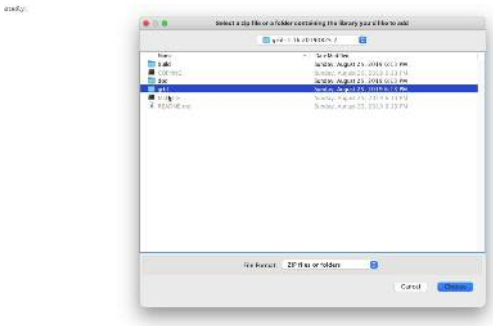
home the "Z" axis, it never proceeds to the next step as it physically cannot trigger a limit switch that doesn't exist.

To make this step easier, we already made the necessary modifications to the last current (1.1h) GRBL version for you, disabling the third axis. Download the file linked and extract it.

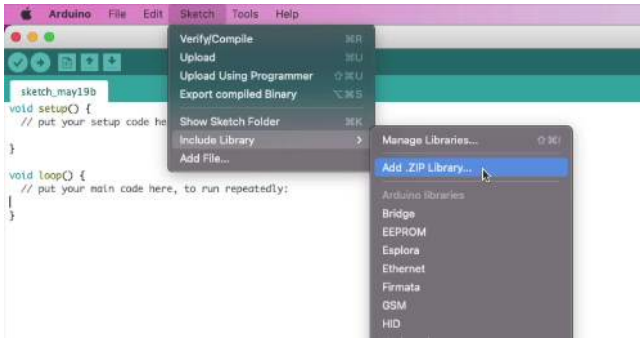
Setting Up Arduino IDE

In Arduino IDE, we'll need to open the Sketch Menu, click "Include Library", and then "Add .ZIP Library". This allows us to tell The Arduino IDE that the code you've downloaded is something you need it to use.

> **Warning**
>
> Make sure that "Makefile", "COPYING" and "README.md" are visible in the folder you select; the folder inside of that one labeled grbl is *not* the correct folder for Arduino IDE to recognize it.
>
> In other words, select the grbl folder in the root of the ZIP you extracted.



You'll then need to go back to the menu by going to Sketch, Include Library and ensure that "grbl" is listed under "Contributed Libraries".



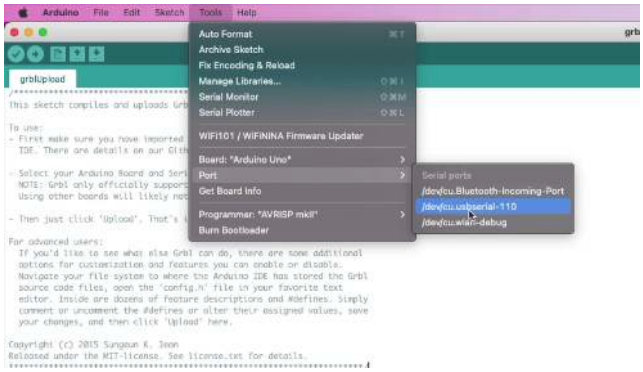
To get ready to flash your board, open the "File" menu, Examples, "grbl" and "grblUpload". It will open a new window containing the sketch mostly ready to go. You'll need to select your board and port still, and tell Arduino how and where to upload the new firmware.

PORT & BOARD CONFIGURATION

We're working with a board resembling the MKS DLC 2.0, running an Atmel 328p. To the Arduino IDE, this is an Arduino Uno, as that's the chip the Uno is based on. Under Tools, Board, select "Arduino Uno" near the top of the list.

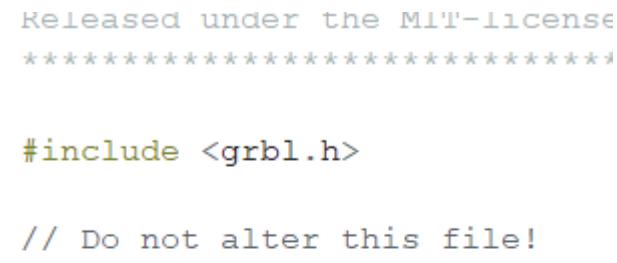
You'll also need to select the correct port to send the firmware on, so open Tools, Port, and take note of the ports listed.

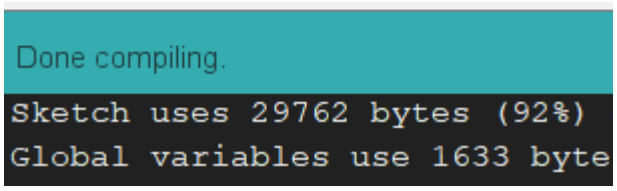
Connect your laser via USB and check the Ports menu again to look for any new devices. Unplug and replug your laser once more to confirm the port the laser is on, and select it.



Flashing

Use the checkmark  at the top left to verify that you've set the project up correctly, and note on the bottom of the screen above the black terminal area says "Done compiling." when you do so. If it does, we're ready to upload!





Click the arrow button  to the right of the checkmark, and it'll begin to flash to your laser! When "Done uploading." is shown, you can continue!

Note

If there's an error shown that it can't access the port in some way, make sure that you closed LightBurn. Only one device can "have control" of certain peripherals, and Arduino IDE needs full control of that device for a moment to send the new firmware.

Restoring Settings

In LightBurn, open the Machine Settings menu again, and click "Load from file", selecting the "lbset" or "LightBurn Settings" file we'd made at the start of the guide. At this point, click "Write" to apply these settings to our machine's firmware. This transfers the configuration back to the machine, and writes them to EEPROM, or programmable memory. This means our homing behavior will be consistent through machine reboots.

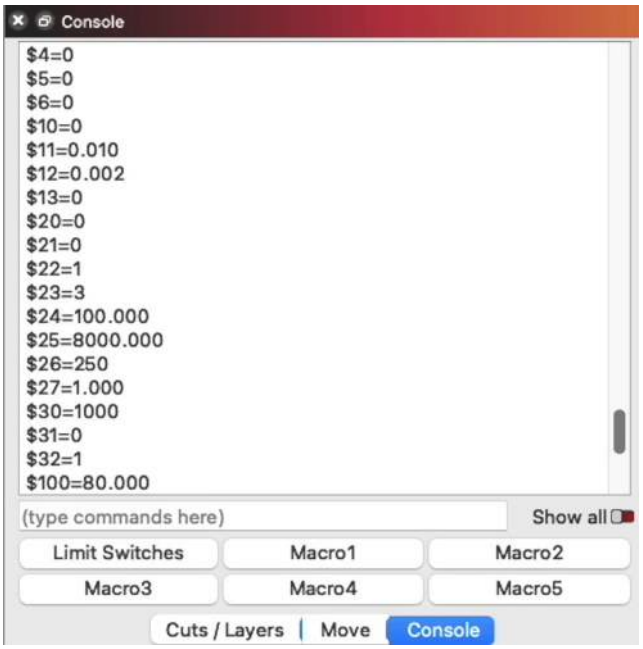
When this has finished, the window will show "controller settings written successfully".

Verifying

In the console, enter

```
$$
```

Once more and verify that the settings match that of the macro made originally, and/or the backup file we made when backing up via Console.



Finished!

If these settings hold, you'll be able to click the "Home" button in LightBurn and have it home automatically, without any additional use of macros.

6. Galvo Docs

Galvo **LightBurn 1.2**

6.1 LightBurn & Galvos

If this is your first time using LightBurn, you'll definitely want to take a look at the user interface guide first and maybe some hotkeys first before diving in.

6.1.1 Getting Started

- Glossary
- Galvo Installation - This is Windows-only and covers the driver changes needed to control your galvo laser. If you're not using Windows, you can skip ahead to Galvo Setup
- Galvo Setup (importing configs, getting them from your manufacturer)
- Lens Correction (Bulge, Skew, Trapezoid, Stretch)
- Framing Mode
- Focusing
- Cylinder Correction
- Galvo Settings
- Sub-Layers
- Rotaries

6.1.2 Intermediate Mechanics

- Changing A Lens
- 3D Sliced Engravings
- Anatomy of a Galvo

6.1.3 Involved Topics & Diagnostics

- Laser Timings (for dealing with the physical limitations of galvo heads)
- IO Port Control (external event triggering)

6.1.4 Galvo Crash Course from Laser Everything

Our friends at Laser Everything have put together some fantastic videos on using LightBurn for Galvo. We encourage you to check out their YouTube Channel for additional resources.

6.1.5 Frequently Asked Questions

Can I import an EZCAD project/parameter/file?

LightBurn as of 1.2.00, does not have the ability to import or open EZCAD project files or parameters. Due to the file format not being documented, and the sheer volume of effort to produce a useful, cohesive importer, it simply isn't possible at the moment. The exception to this is lens correction files, as outlined here.

LightBurn on Linux doesn't recognize fiber laser plugged in with USB

This is an issue we haven't generally encountered in our own testing in Ubuntu and Fedora, the two distros we support. The laser is treated as a libusb device and *should* just work. However, this is occasionally an issue with USB permissions. Please try the following, as discussed on our forum.

- Unplug your laser from the computer.
- Run `sudo gedit /etc/udev/rules.d/usb.rules` (you can use any text editor you prefer) and enter the following contents:

  `SUBSYSTEM=="usb", MODE="0666"`
- Save the file and close.
- Run: `sudo udevadm control --reload-rules`
- Now plug your galvo USB connection back into the machine.
- Run LightBurn without sudo and you should be able to automatically find and connect to the device.

Where are the hatch settings?

Hatch in EZCAD is the equivalent of "Fill" in LightBurn; looking at the different modes for Cut Settings Editor is highly suggested to make the best use of LightBurn with your galvo. We also have a page comparing EZCAD hatch settings with LightBurn fill settings to help you match the settings you're used to.

It won't connect to LightBurn after moving USB ports!

Some lasers require you to fully reboot the device after moving USB ports. The suggested workflow is:

1. Turn the laser fully off.
2. Move the USB cable to the correct port.
3. Turn the laser back on.

Can I convert from EZCAD2 to LightBurn files?

As of 1.2.01, you cannot import an Ezcad2 project file to LightBurn directly. If the grid in Ezcad is turned off temporarily, LightBurn can trace screenshots of Ezcad easily to import placement in many situations.

My galvo is trying to engrave my rotary, what's wrong?

LightBurn allows you to offset your rotary's "center" when engraving with a rotary, to compensate for the rotary being aligned physically to the frame on a different pattern than your lens. Please see the section on output centers for more information.

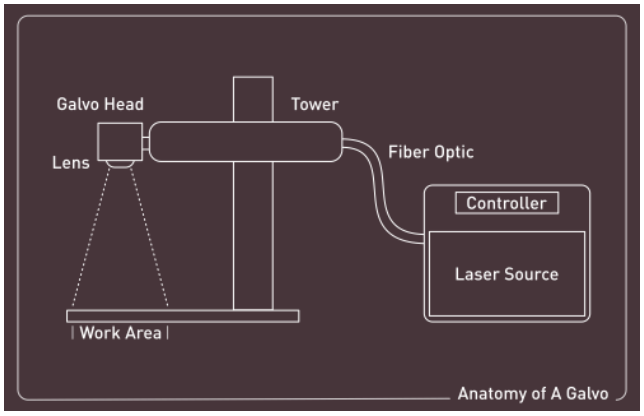
6.2 Glossary (Galvo)

Attention

This section is new, and is a work in progress. Be sure to let us know on the forums or via support if we need to change something. Thank you!

6.2.1 Galvo

A type of laser apparatus that uses a series of actuated mirrors to reflect the beam of a laser source around at high speeds. This contrasts to "gantry" style lasers, that move a series of mirrors along the gantry itself with a "lens" at the end to focus it, or diode lasers that move the laser souce itself, (usually using a gantry).



6.2.2 Source

This is the portion of a galvo laser responsible for producing the beam itself used for operation. While not a laser tube inherently, laser sources are similar in purpose to the tubes found in CO_2 gantry lasers.

6.2.3 MOPA

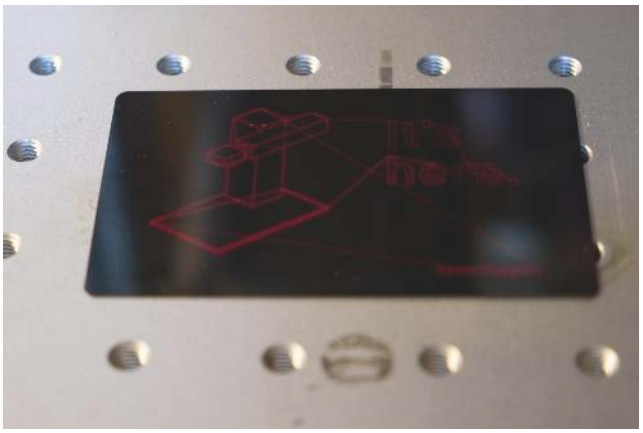
Master Oscillator Power Amplifier lasers are a specific class of fiber laser sources that enable pulse duration to be varied (not just pulse energy and frequency as in other sources). This variability enables use cases such as durable colored marking of stainless steels and titanium by pulsing the beam in such a way it anneals the metal.

6.2.4 Tower

This is the portion of galvo lasers responsible for moving the galvo head up and down, vertically. The tower connects the head to the fiber cable (that carries the beam from the source), and any other apparatus that need to move with the lens to focus and effectively work on the job.

6.2.5 Framing

Framing allows you to accurately position work. It's an operation that outlines the job in real life on the object/material, but using a lower power, so it doesn't cut/engrave it. It usually requires you to be accurately focused.



6.2.6 Frame/Base

This is the portion of a galvo laser that holds up the tower and ensures it's rigid and won't tip over. It usually has a work table larger than the tower above it for stability.

6.2.7 Cleanup Pass

A final pass, usually at a tighter line width, higher frequency, and a lower power. Done to to clean up soot and debris from more ablative processing.

6.2.8 Focal Point (Waist)

The thinnest part of the (focused) beam, the point at which it is the most in focus. See the Focusing page for more info.

6.2.9 Focal Length

The distance from the optical centre of the lens to the focal point. See the Focusing page for more info.

6.2.10 Depth of Field (Focal Range)

The useable range of the (focused) beam. It appears either side of the focal point, and varies based on various factors

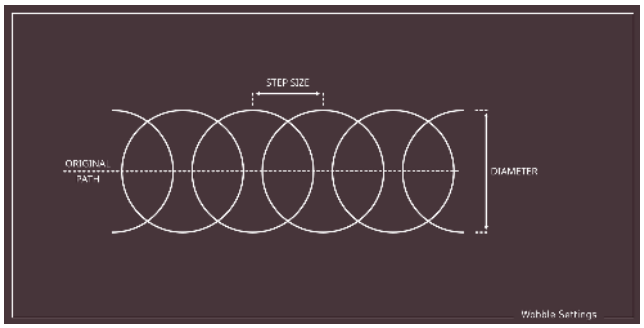
including; the focal length of the lense, the material being cut, the power of the laser source, etc. See the Focusing page for more info.

6.2.11 Field Size (Build Volume, Window Size)

These fields describe the maximum area that the lens installed in the galvo can physically cover when focused. See the Focusing page for more info.

6.2.12 Wobble

Wobble refers to the ability of the beam to rotate about a particular area, imparting more heat to the workpiece and allowing for more material removal.



This feature can be enabled in the Cut Settings Editor on galvo devices.

Galvo LightBurn 1.2

6.3 Installing Drivers (Windows only)

If you haven't already installed LightBurn, please start by installing it on your computer.

6.3.1 Installing The Driver

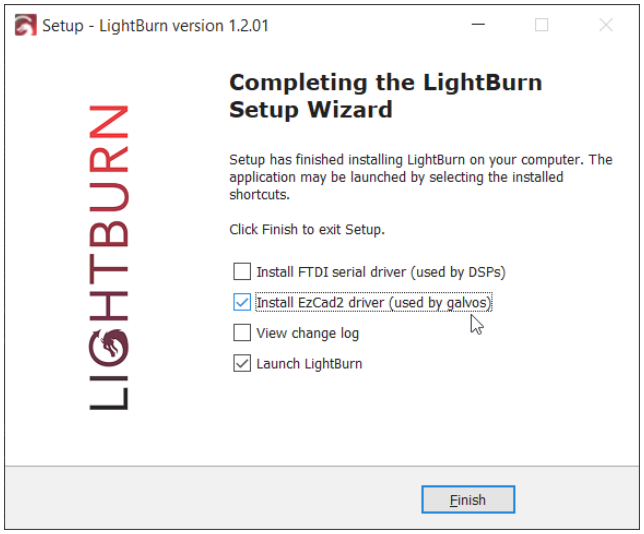
When installing LightBurn, the last screen of the installer has a set of tickboxes to install additional drivers needed for certain types of machines. We'll need to add the "EzCad2 driver" used by galvos before LightBurn can see the galvo you're trying to set up.

If during initial installation you didn't tick this box, you can simply run the installer again, and select this box to ensure the driver is installed for use. Windows will prompt you for permissions escalation to install it, and quickly replace the driver provided by default with one LightBurn can use to communicate with your galvo-based laser.

Alternately, the installer for the driver is in the LightBurn files at "C:\Program Files\LightBurn\EzCad2Driver\" and can be run again via the "dpinst-x64.exe" file directly.

Info

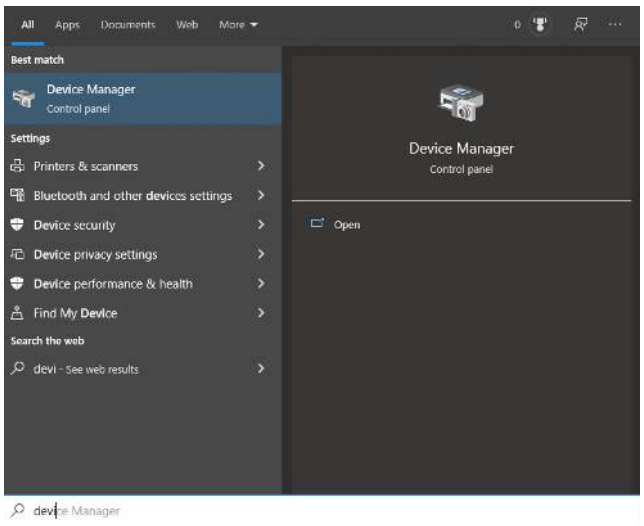
This installed driver may not work correctly with Windows 7. Please see the Zadig method below.



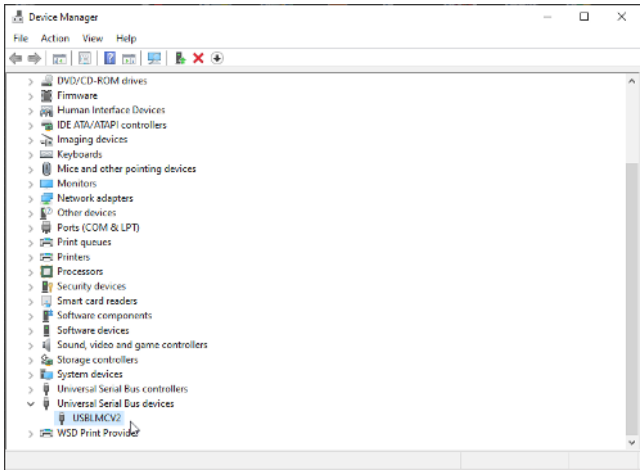
6.3.2 Restoring the Driver

In the event you want to use EZCAD it's a simple task to revert to the original driver.

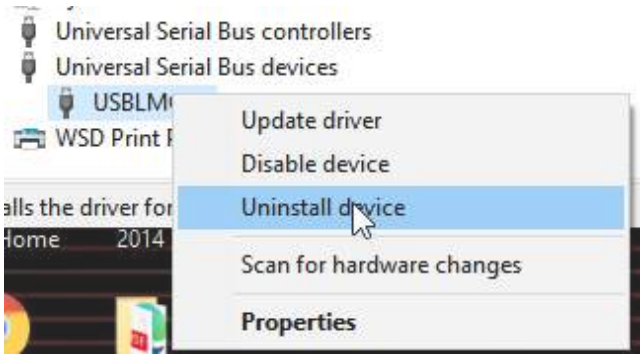
Open your Windows Device Manager - You can do this by clicking 'Start' and typing 'Device' and letting it auto-complete.



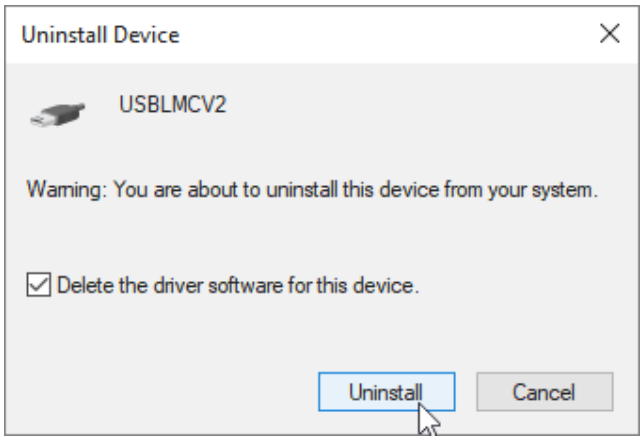
Next, find the USBLMC device in the list - it should be near the bottom, under 'Universal Serial Bus devices', shown below:



Right-Click the device and choose 'Uninstall Device' from the pop-up menu.



In the next window, check the box to delete the driver. (this doesn't actually delete anything from your system, it just completely dis-associates the driver from this device)



Click the 'Uninstall' button. The process should finish quickly.

If you power off the laser and power it back on, Windows will reconnect, realize that it already has a driver for this device (the old LMC driver) and it'll appear in the Devices list again, near the top, as a BJJCZ device. That's it - You can use EZCAD again.

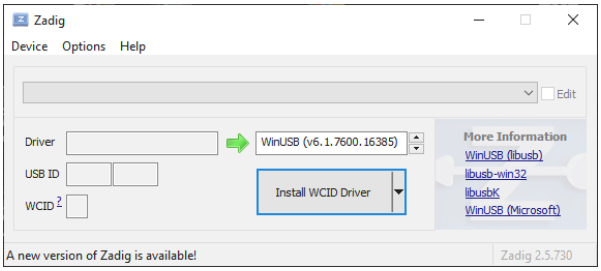
6.3.3 Zadig-based Driver Swap

In the event the driver swap (performed by running the installer) isn't working, it may be suggested to try and use Zadig (a driver tool) to replace the manufacturer's with a generic driver so LightBurn can communicate with it. Below are those steps.

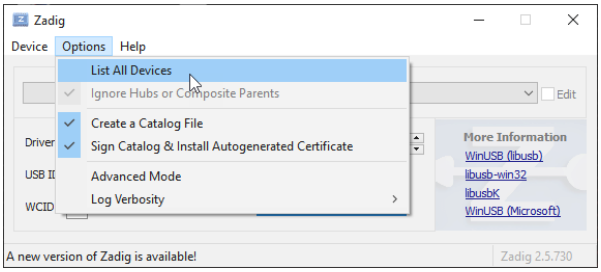
Legacy Zadig-based Driver Swap

Download Zadig, the driver replacement tool from https://zadig.akeo.ie/ and run it. (it doesn't require installation)

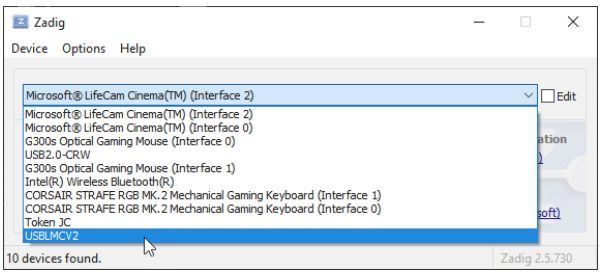
You'll see a window that looks like this:



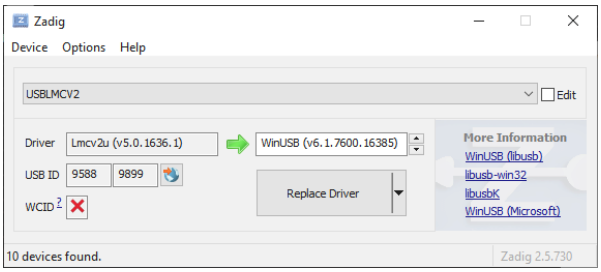
Open the 'Options' menu and enable 'List All Devices'



If your EZCAD laser is powered up and connected with the USB cable, you should see USBLMCV2 (or very similar) in the device list, like this:



Select that device, and choose 'WinUSB' as the target driver, like this:

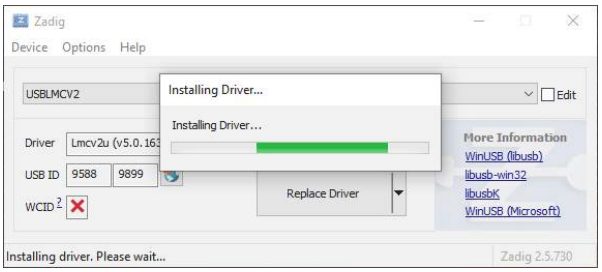


Double check that it says LMCV2U in the 'Driver' box, and that the USB ID under it matches what you see above. If you haven't used the laser with this computer before, the 'Driver' box may be empty instead.

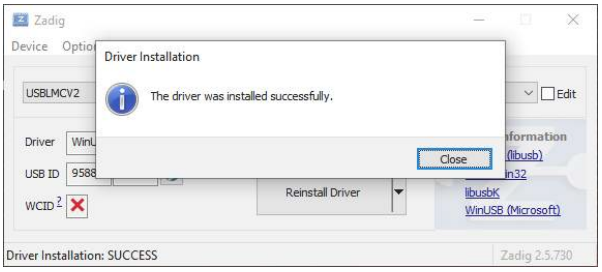
Click 'Replace Driver' and wait for the process to complete. Make sure that you are not running EZCAD when you do this - if anything is actually *using* the hardware, the driver swap will likely not complete, and time-out after five minutes. If

everything goes as expected, it takes about a minute, often less.

You'll see some different messages cycle through while it does the install. When it's done, it might ask you to reboot, but that's rarely required.



On the rare occasion that Zadig fails, just try it again - it almost always works, and sometimes reports a failed installation erroneously, when it actually succeeded. You *should* see this:



Galvo LightBurn 1.2

6.4 Adding & Setting Up Your Galvo

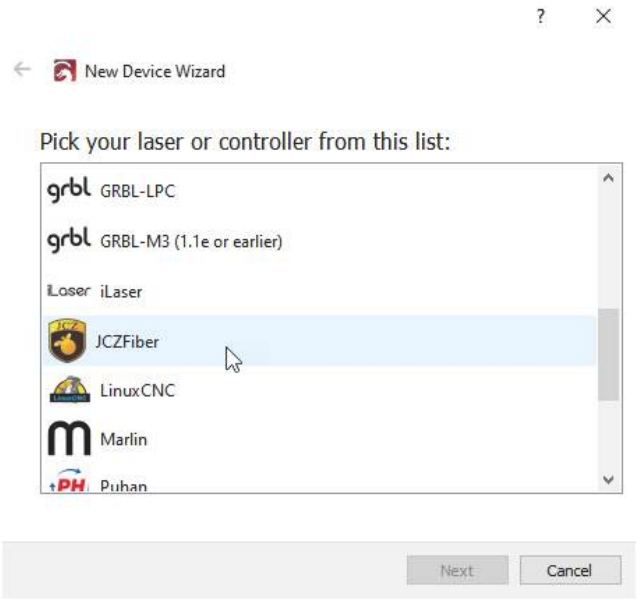
To set up and configure your galvo laser, you'll need to create a new device, and import or manually enter settings provided by your laser manufacturer.

It's also a good idea to set up a new device profile for each lens you have for your galvo, because changing lenses will affect many parameters. You can duplicate a device after setting it up by right clicking on it in the 'Devices' window and choosing 'Duplicate'. This is the easiest way to add a new profile while keeping the settings, so you only have to update parameters that change with the lens.

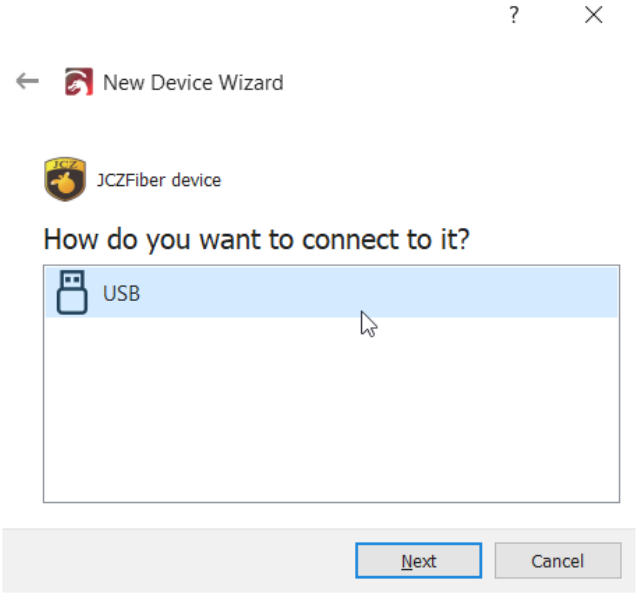
To add a new device LightBurn, click the 'Devices' button. From here you have two options: the importer or manual entry.

6.4.1 Importer

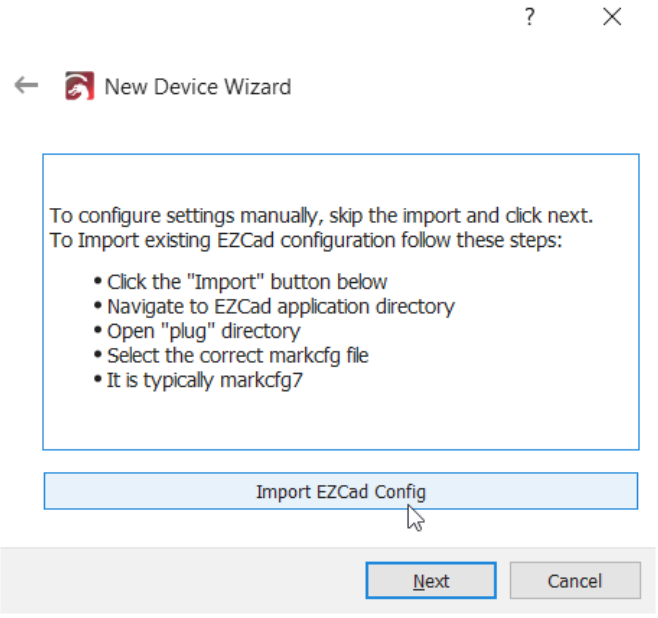
Click 'Find my Laser' and LightBurn should detect the JCZ controller and add it for you. You will need to specify your field size (the size of your workspace), but this can be changed later too.



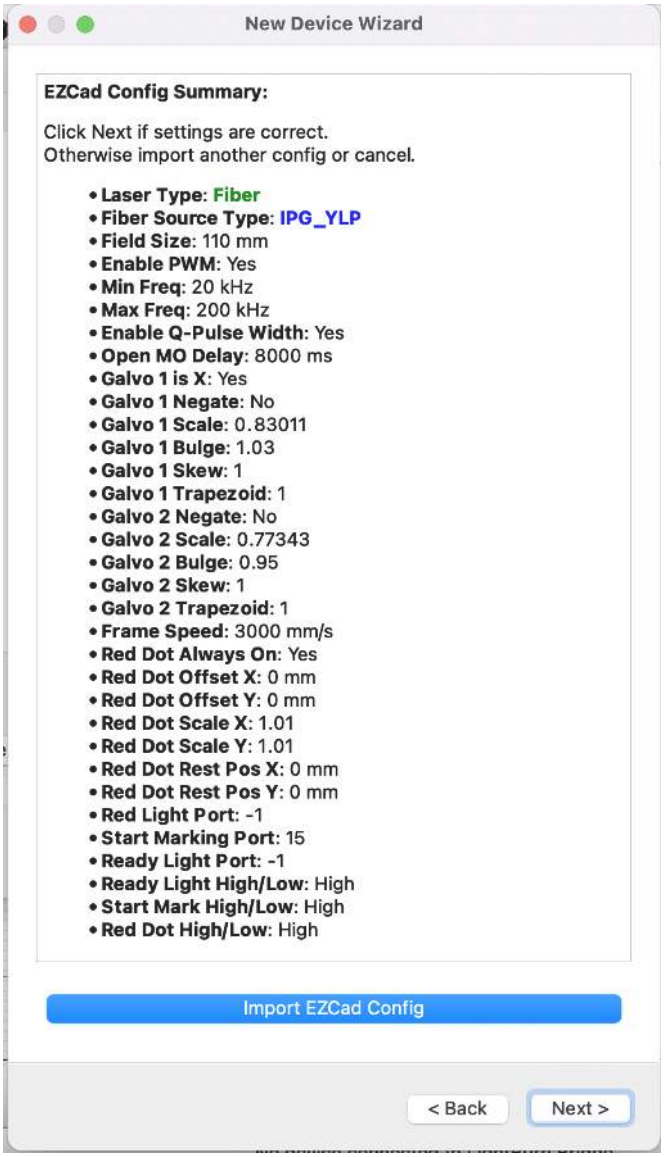
Select JCZFiber, click Next, and choose 'USB'. It's the only supported connection type for now.



As with any other laser device, you'll need to enter your window size. (110 mm x 110 mm is common).



Before Import

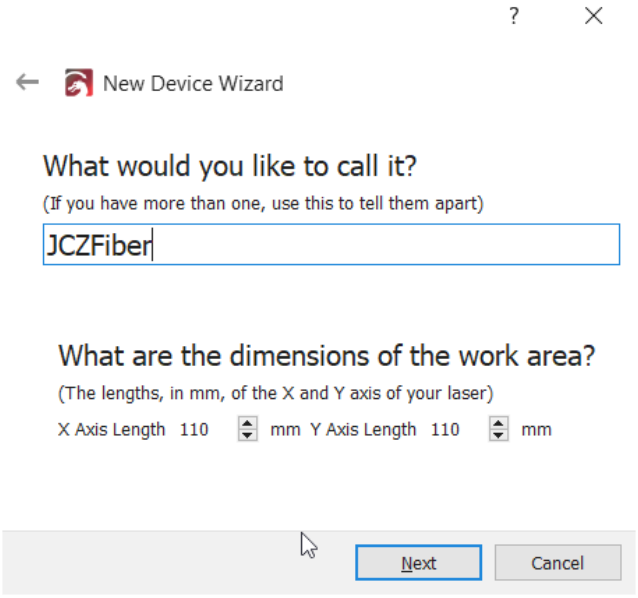


After Import

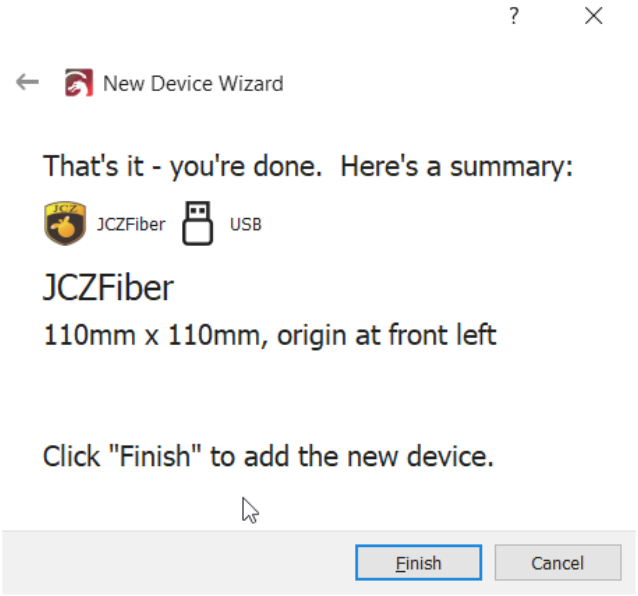
Select your configuration file from your EZCAD setup (or if you received a card, email, etc. with that information in it, please click "Next" anyways) It's likely to be on the USB drive you recieved from the manufacturer. Ours was in the "PLUG" folder of the "Ezcad2" install folder.

Info

If your markcfg7 file includes information about Lens Correction, LightBurn will attempt to automatically import this for you. If your configuration doesn't, you'll need to manually enter it in Device Settings after finishing the New Setup Wizard.



You'll need to enter the specific work area dimensions as selected by your manufacturer. While 110 mm by 110 mm is very common, the different models offered & their respective dimensions are usually listed on the manufacturer's website.



Just like that, you're all finished, and ready to start calibrating!

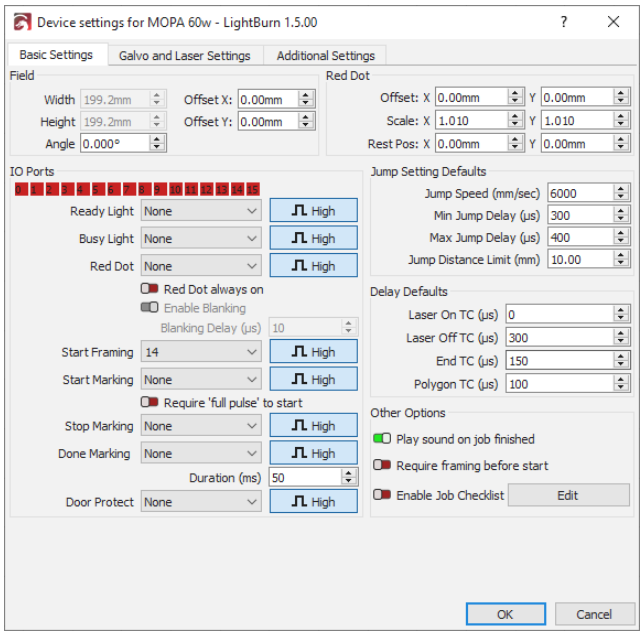
6.4.2 Manual Entry

If your laser did not come with the settings on a USB drive or if you don't have the USB drive available, you may need to contact the manufacturer for settings. Galvo settings can't be found through trial and error, due to the complexity and variety of machine configuration. Settings that work on one laser may destroy another.

If your settings were provided on a card, in an email, or in any other way that doesn't work with the automatic

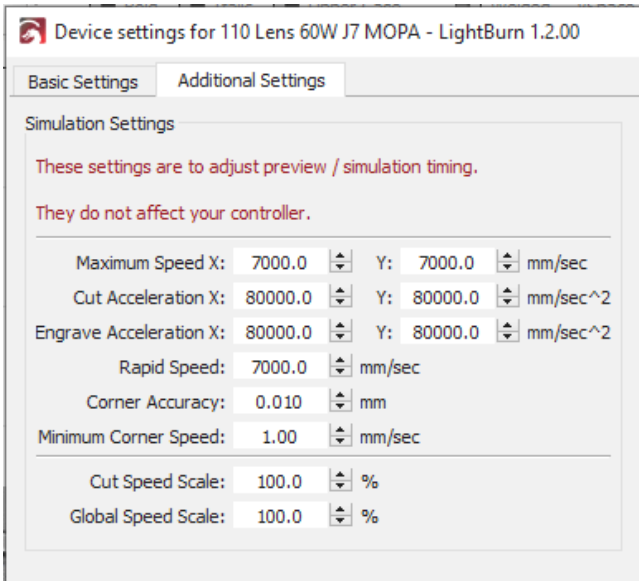
importer, clicking "Next" when asked to Import EZCAD Config will allow you to skip this step.

When in the main window, please open the "Edit" menu item, and select "Device Settings".



The settings can now be manually entered to match what was provided by the manufacturer.

Please note that when entering these settings manually, the Additional Settings tab needs to be updated with the correct information for the simulation in Preview to function correctly.



Advanced **Galvo** **LightBurn 1.2**

6.5 Configuring Galvo Settings

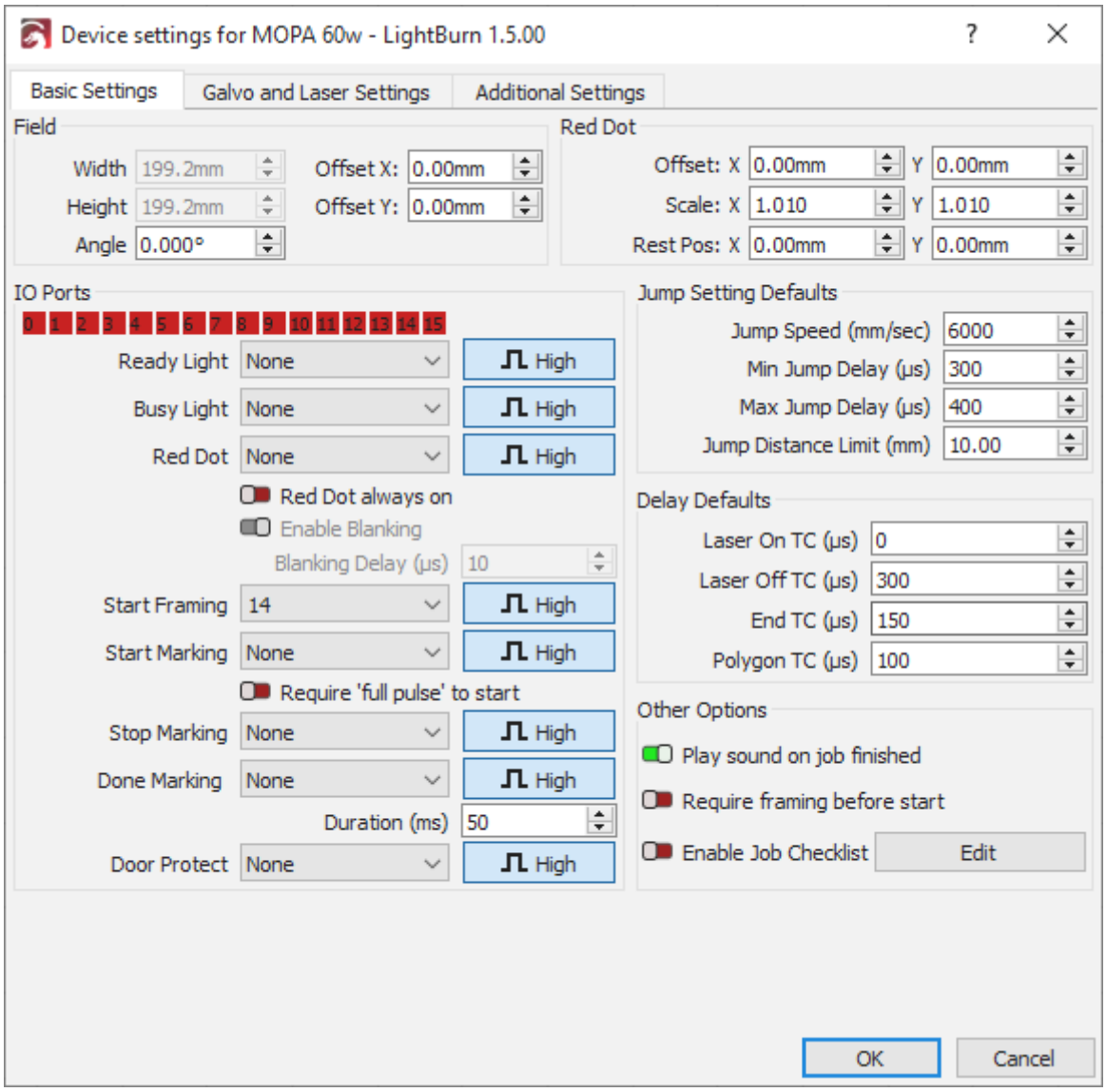
Note

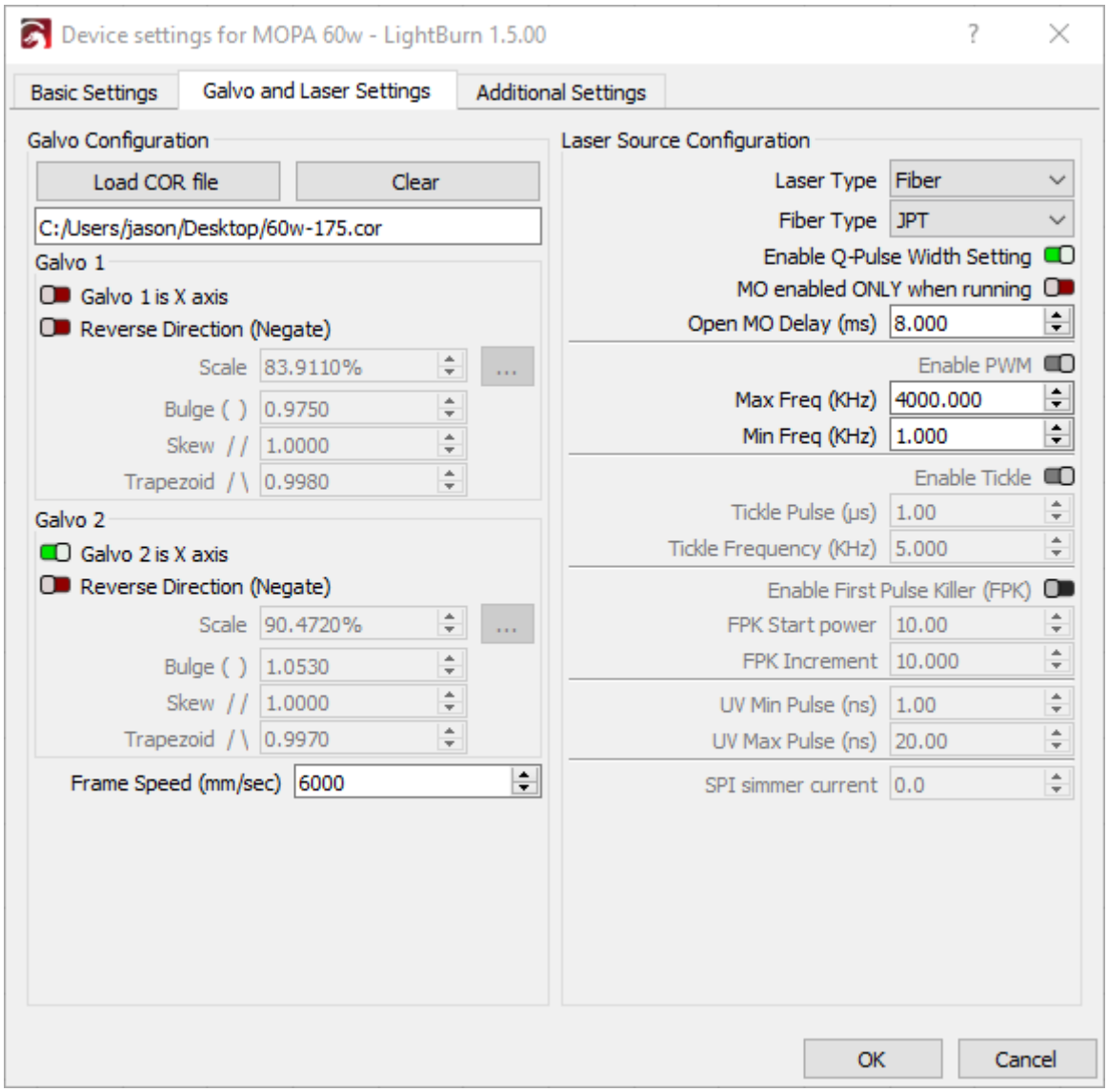
If you did the EZCAD parameter import as part of setting up the device, you can likely skip this part, though we do recommend verifying that everything came across correctly. If you didn't import your EZCAD settings, continue reading.

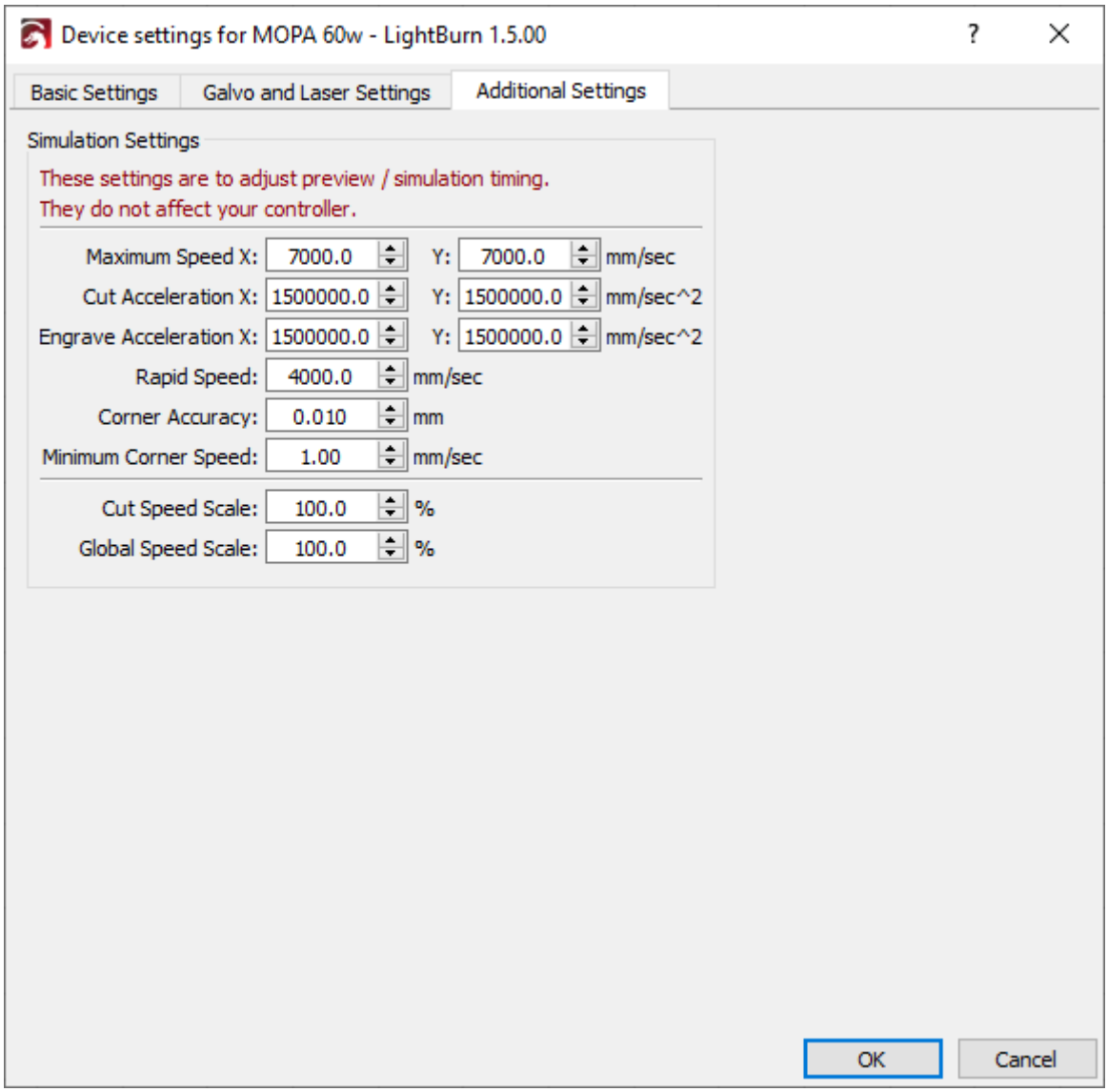
LightBurn needs to know more about your galvo laser before you can use it effectively. Below is an explanation of every currently listed item in the Device Settings for Galvo devices.

To expedite manual entry, you can either run EZCAD and just flip through the Param (F3) pages for this, or take screenshots and use them for reference when setting up LightBurn. All of these settings are taken directly from EZCAD.

Run LightBurn, choose the JCZFiber laser, then click Edit > Device Settings (or click Device Settings on the toolbar.)







Device Settings for galvo lasers

6.5.1 Basic Settings

Field

These fields describe the area that the lens installed in the galvo can physically cover when focused. Changing the lenses always requires going through the setup and calibration to adequately tune and dial in galvos.

SIZE

The maximum area the lens installed in the laser can cover. This value is also used to set up the work area in LightBurn.

ANGLE

Rotational correction for the field - if you're correcting for a rotated galvo head relative to the physical fixturing pattern, you can rotate it to behave as if it were square with this value.

OFFSET (V1.4+)

You can fine tune the position of the field using x and y offset

Red Dot

The red dot laser is a separate mechanism that is in line with the optics of your galvo laser souce. It may require fine adjustment to get it aligned with those optics, and this is where those settings come from. While generally provided in the EZCAD Config during Setup, they may also be found in your installation media as a screenshot or other text file.

Galvo configuration

LOAD COR FILE

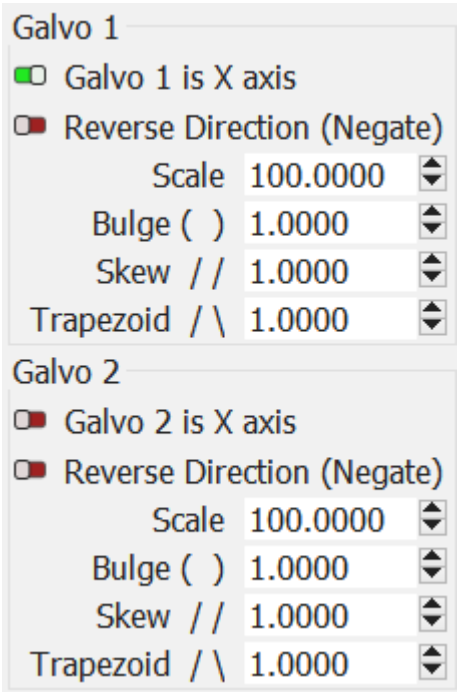
A COR file is an EZCAD lens correction file. LightBurn has the ability to import COR files and automatically apply the lens

correction values they contain. If your EZCad folder contains a COR file, and you used the markcfg7 import during Setup, it will be loaded automatically. If you did not, or you create a new COR file, you can load it here.

Otherwise, this field can be left blank, and the scale, bulge, skew, and trapezoid settings can be imported directly from the markcfg7 file, or entered manually in Per Galvo Settings.

PER GALVO SETTINGS (GALVO 1/GALVO 2)

Each galvo head is responsible for an axis, and has fine-tuning that can be performed to get it operating optimally.



Galvo (N) is X Axis

This toggle is linked for both galvo mirrors, allowing you to specify which mirror is used for the X-motion of LightBurn.

Reverse Direction (Negate)

This flips the output behavior of an axis in the event the control signal is linked backwards to the motion of the mirror.

Scale, Bulge, Skew, and Trapezoid

A more in-depth explanation of the below settings can be found in the Lens Correction section.

Scale

Perentage to scale the output axis by.

Bulge

Distortion near or at the center of the engraving field.

Skew

Distortion at the edges (corners) of the fields, pulling them towards a cardinal direction.

Trapezoid

Corner tapering adjustment, to fix keystoning.

OTHER OPTIONS

Play sound on job finished

This feature mirrors that of EZCAD, causing the computer to play a sound when your current run is done, in leiu of all galvos having a window.

Require framing before start

This option forces the user to use framing mode and align their workpiece before engraving directly. It makes the Start Button in the Laser Window open the Framing Dialog instead.

Enable Job Checklist

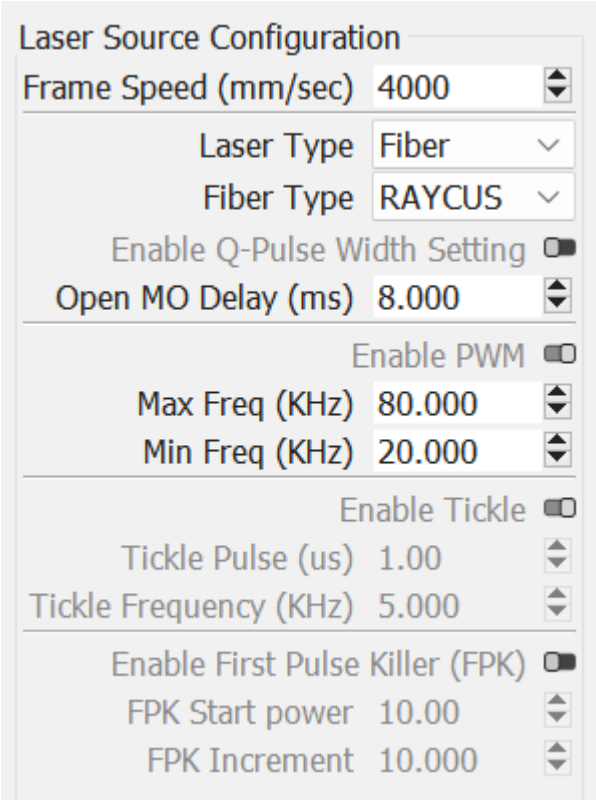
When this option is enabled, LightBurn will display a textbox with a list of items before running the laser. The user will need to press "OK" to confirm they're ready before the laser will start.

The **Edit** button allows you to create or edit this list.

Laser Source Configuration

Danger

All of these settings should be imported from EZCAD, manually changing them to "guess and check" settings is not the correct course of action. Doing so may damage your laser, proceed with caution!



FRAME SPEED

This is the maximum speed of the red dot framing tool in your galvo.

LASER TYPE

This refers to the specific type of galvo laser in use. Fiber or CO_2 are the current options.

FIBER TYPE

The specific manufacturer, or granular type of laser. This may reveal other settings depending on what type and category of laser is in use.

ENABLE Q-PULSE WIDTH SETTING (MOPA)

This is a MOPA specific laser setting to adjust the fine length timing of the pulses from the laser. The larger the timing, the less dense the pulse impact is.

OPEN MO DELAY (MS)

MOPA permits a wider frequency range comparatively to Q switch laser types, and this delay allows you to adjust this fine control.

ENABLE PWM

This permits adjustment of the valid range of PWM timings on CO_2 galvo lasers.

TICKLE

CO_2 lasers require constant low power to be able to fire at lower power densities consistently and reliably. Use of a tickle permits adjusting the controlled location of that threshold to produce better lower power engravings.

These will be provided by your manufacturer.

FIRST PULSE KILLER (FPK)

This setting is also CO_2 specific. To enable the initial power-on of a CO_2 tube, there's a higher power draw needed to energize it. FPK lets you choose and tune that first pulse to get to the normal operation energy.

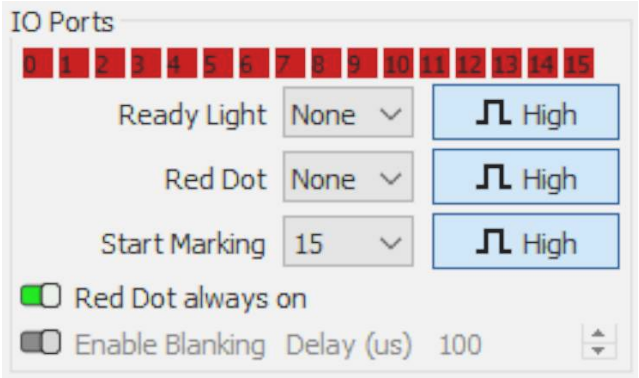
This setting can be found via trial and error if needed.

IO Ports

These are external switches or features attached to the controller on the board.

The High / Low toggle indicates whether the device is normally high, or normally low electrically, and determines what signal to interpret as being toggled.

Not all of these may exist, or be enabled on all galvos. If not, the port number will be shown as "None".



RED 0 THROUGH 15

These red/green rectangles represent the pin state of the Ezcad board inside your galvo laser at any given time, and the port number on the controller. This is useful for diagnosing floating electrical connections, loose wires, and a potential default setting dependent on a foot pedal.

> **Info**
>
> Within LightBurn, a red indicator means the port is "LOW", or off, and green means the port is "HIGH", or on. Some manufactured boards are active LOW as opposed to active "HIGH". If all ports are green by default, you'll likely need to change your trigger type to "LOW" from HIGH.

READY LIGHT

This is the selector to toggle LEDs on the galvo head, aimed at the workpiece.

RED DOT

This is the selector for the external Red Dot enable.

START MARKING

This is the selector for starting an engraving job as set up, typically triggered with a foot switch of some kind on the laser. Like mentioned in IO Ports, a user can change the pin assignment to match that of the board's foot pedal or start signal, the signal trigger type, or disable it entirely. The former is useful to use a foot pedal; the latter for safety.

> **Danger**
>
> Prevent accidental laser activation when using galvo lasers without a foot pedal switch by *explicitly* setting the "Start Marking" pin to "Disabled". Some galvo controllers do not adequately electrically protect the circuit from stray voltage and static that may generate readable signals that will be sent to LightBurn.
>
> LightBurn has debouncing in software to mitigate this as much as possible in 1.2.02. Please update to 1.2.02 or later to ensure you have this functionality automatically in place.

RED DOT ALWAYS ON

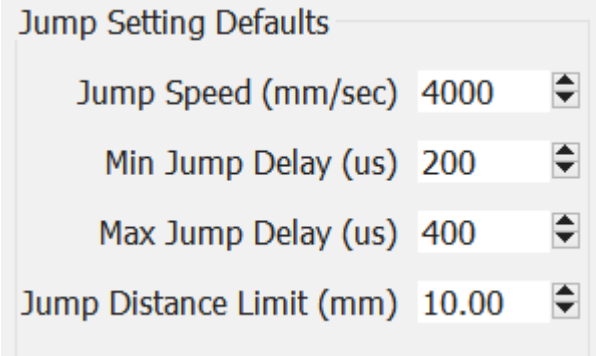
This setting forces the external red dot alignment spot to always be on, permitting constant use or disabling it if desired.

ENABLE BLANKING

This option allows you to attempt to turn off the red dot internal to your galvo between drawing shapes and is not supported on all devices.

Jump Setting Defaults

These settings control the speeds by which to toggle, offset, delay, or fudge the source enable and galvo head motion.



Delay Defaults

LASER ON TC (MS)

When attempting to mark, the physical mirrors of the galvo head must reach the desired speed before they begin marking. This fine-tuning allows the user to reduce the burn-in potential during that initial acceleration by adjusting the source timing.

LASER OFF TC (MS)

Similarly to the above, when the mirrors of the galvo head must slow down as they attempt to end a marking move, there may be a burn-in effect while slowing down. This setting allows the end timing to be adjusted finely.

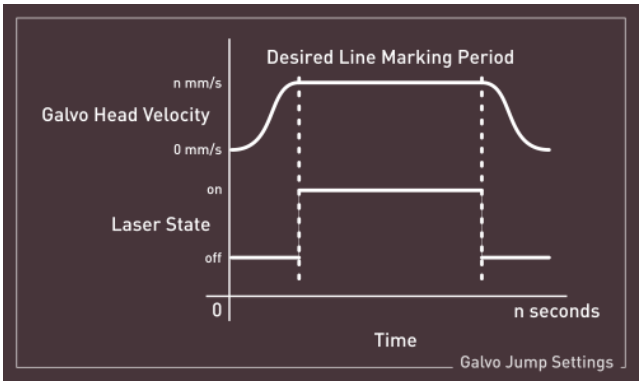
END TC (MS)

This setting adjusts how long the laser waits at the end of a series of vectors. Due to the fact the laser will physically lag behind the commanded state as decided by any software, this delay permits adjustment similarly to the Laser Off TC.

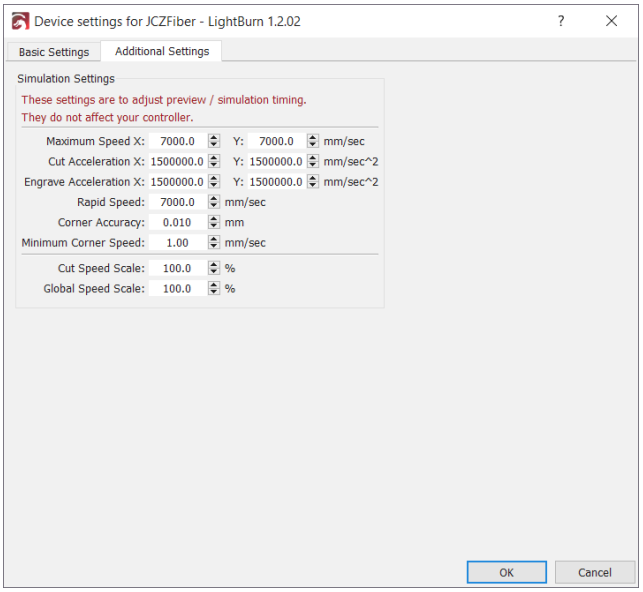
This setting applies to *any* marking move where the laser is turned off after execution.

POLYGON TC (MS)

This setting adjusts how long the laser "waits" at the end of each segment of a polygon, permitting the laser to settle appropriately, compensating for the same lag as outlined in End TC. This adjustment will *only* apply to polygonal execution.



6.5.2 Additional Settings



This settings tab consists of specific timing adjustments for simulation and preview, entirely for the Preview Window. The galvo can function even if these are set incorrectly, so long as the other timings and adjustments are correct.

If the estimate is significantly off from the timings in practice, we recommend editing these settings to match the main device settings  .

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6.6 Lens Correction

Much in the same way that cameras used in LightBurn need to have a calibration routine run for best performance, so do galvo lasers. Many manufacturers ship lasers with these types of settings already present, and when using the importer these should be automatically imported for you.

If the LightBurn Importer does not detect the lens correction setup when following the wizard, *these specific settings* may be copied from EZCAD's Configuration Parameters tool, or found by the user manually. Device Settings otherwise *must* come from the manufacturer for safety, as outlined in Setup.

6.6.1 Field Size

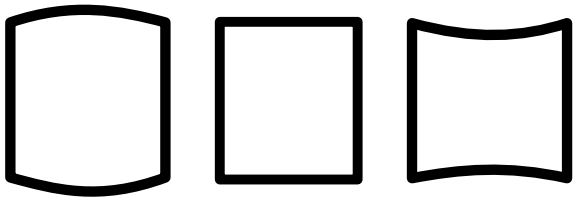
While not strictly part of the lens correction, the intended field area affects all of the correction and calibration settings described below. The field size describes the maximum area the lens can reach at it's focal length. When correcting a new lens, be sure to follow the steps suggested here.

6.6.2 Scale Adjustment

This setting scales the overall size of your intended laser output on X & Y axes. If adjustment of this is needed, please also verify that your [Machine Setup] was finished and your field size was imported. Otherwise, you may be compensating for the field size in the wrong area, complicating further adjustments.

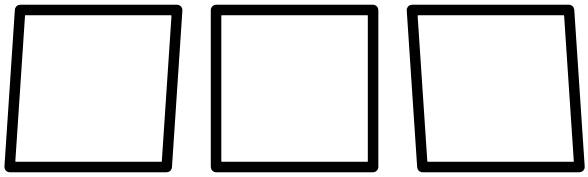
6.6.3  Bulge Adjustment

The bulge factor allows you to change by how much (if at all) the center of shapes are distorted and stretched.



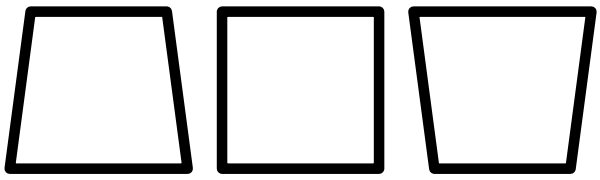
6.6.4  Skew Adjustment

The skew factor allows you to adjust the tension on the corners of your design, pulling the bottom portion of the design left or right relative to the top.



6.6.5  Trapezoid Adjustment

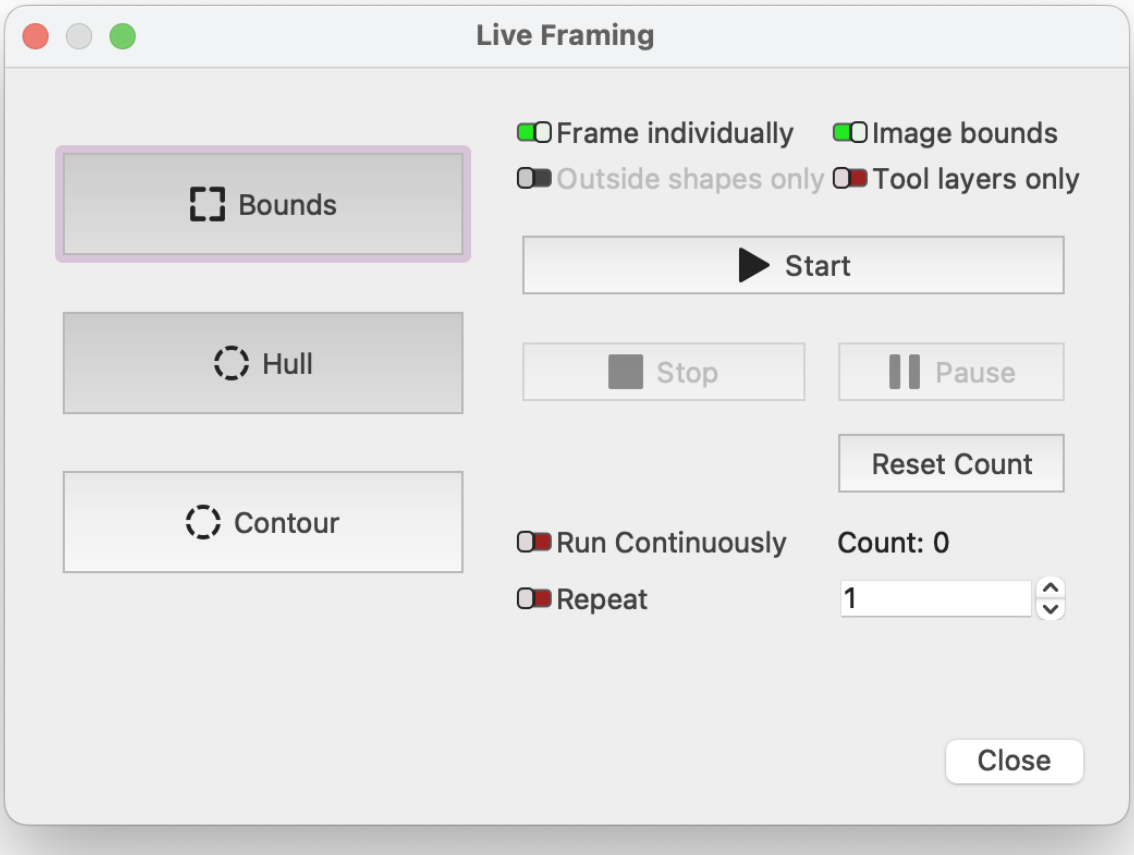
The trapezoid tool works similarly to the Skew adjustment tool, where it permits the distortion of your design by stretching or pinching the "corners" of your design. Trapezoid adjustment allows you to pinch one portion relative to another This is where the name of the tool comes from, as it allows you to make trapezoids into squares, and vice versa.



Galvo **UI**

6.7 Framing

Framing mode is a function of Galvo lasers that permit you to preview the outline of your design on your physical object before engraving it. Clicking the 'Frame' button in the Laser window, or pressing 'F1' brings up the Framing Mode window.



6.7.1 Framing Styles

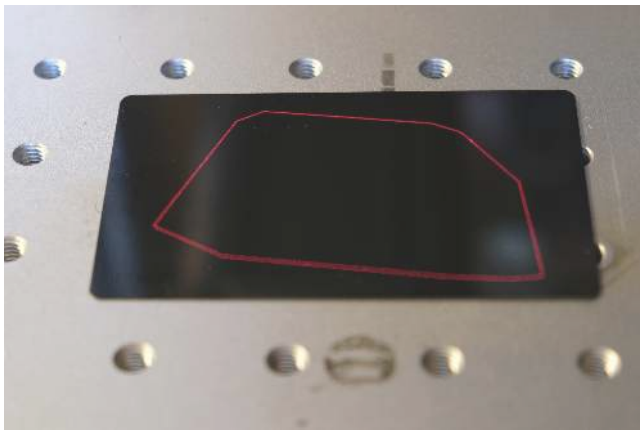
The different options allow you to choose how accurately the red-light frame represents your shapes, and which shapes are shown.

Bounds

This mode is a simple rectangle, drawn just big to enclose your shapes. It is extremely fast, but doesn't represent complex shapes well.

Hull

The 'hull' is what you'd get if you stretched a rubber-band around your shapes. It is nearly as fast to draw as the rectangle bounds, but gives a much closer fit for rounded or smooth shapes.



Contour

Contour follows the exact contours of your shapes - it takes the longest to draw, but it's the most accurate.

6.7.2 Nudging

While framing, the arrow keys can be used to nudge the position of your graphics by 1 mm. Holding Shift will increase the movement distance to 5 mm, and holding Ctrl will decrease it to 0.2 mm.

Starting from version 1.4, you can also nudge the scale of your design. `Page Up` will scale up, and `Page Down` will scale down. If your keyboard doesn't have those keys, try the Function key along with up and down arrows.

6.7.3 Additional Options

Frame Individually

This toggle switch indicates whether you would like to draw a single bounding box or hull around everything together, or around each shape in turn (this only affects **Bounds** and **Hull** modes).

Image Bounds

Enabling this toggle switch attempts to quickly trace the outlines of any images you have in your design, rather than simply showing the rectangular boundary of the entire image.

Outside Shapes Only

This toggle switch tells the software not to trace inner shapes, like the insides of letters - Typically this doesn't affect placement, but allows a faster update of the frame (this only affects **Contour** mode).

Tool Layers Only

Enabling this toggle will tell LightBurn to only frame shapes that are on one of the tool layers.

6.7.4 Job Counter and Multiple Runs

Count

This value is incremented at the end of each successful run of your file. You can use this to keep track of how many parts you have marked, or how many passes of a single job you've run. Press the **Reset** button to reset the count back to zero.

Run Continuously

Turning on this switch will make LightBurn re-start the job automatically after it finishes, and will update the run counter after each run. This is useful when you are doing very deep engraving, and are unsure how many passes a job will need. If you turn off the switch while a job is running, it will stop when the current run completes.

> **Warning**
>
> Please ensure your laser is properly supervised, even during long jobs with multiple passes.

Repeat

Turn on this switch and set the repeat count value to run the entire job a specific number of times. This is similar to 'Run Continuously', except it will stop when it reaches the repeat count. If you turn off this switch while a job is running, it will stop when the current run completes.

Calibration **Galvo** **LightBurn 1.2**

6.8 Lens Focusing & Calibration Tools

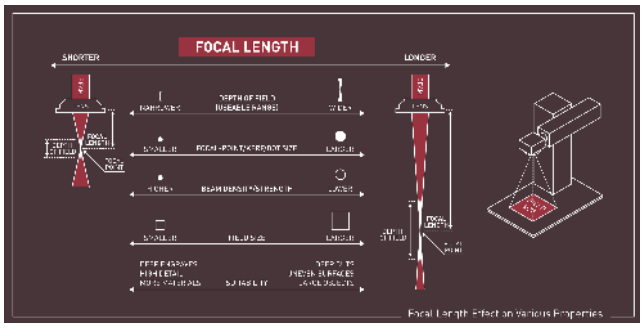
Danger

Any use of a laser, as outlined in this section, requires effective and useful laser safety glasses calibrated to your galvo's output wavelength range.

Laser safety glasses should come with the wavelengths they protect against permanently marked on the glasses themselves.

To be able to use your galvo laser effectively, you'll need to have it in-focus, well tuned, and well calibrated. This enables best use of features like Cylinder Correction, 3D Sliced Engravings, and more.

6.8.1 Finding Your Focal Point



Each lens should be labeled with a focal length, such as F330 for 330 mm lenses or F160 for 160 mm lenses. This is a good starting point for focusing, but manufacturing differences result in differences between lenses so you should still fine-tune the focus. You can fine-tune the focus by looking for crisp outlines in framing or listening for audio cues.

To use "crisp outlines" to find the focal length, you'll need to frame a design and raise/lower the galvo until the edges are as crisp as possible. This requires your galvo to have an in-line red dot. With audio cues, you'll instead listen for louder burning or sizzling noises while the job is running. The correct focal length will generally make the loudest sounds.

While the depth of field is a range that produces engraved results, finding the optimal focal point within that field is important, to ensure the best results, and is best found through trial and error.

A Step-By-Step for Focusing Flat Objects

1. Raise your galvo head as high as it reasonably can go.
2. Start a repeat engraving.
3. Lower the head until it starts making noise.
4. Continue further down slowly until the engraving noise is as loud as it gets.
5. if the noise tapers off, raise it back up and fine tune based on that.
6. Your flat surface is now focused!
7. If your laser has two-diode red-points that are manually moved, re-adjust those at this point. See your laser's user manual for help.

6.8.2 Measuring Focal Length

Tip

Make sure you keep track of what part of the laser your focal length is measured to! You might find it convenient to measure to a point other than the bottom of the lens, and that's fine as long as you keep measuring to the same height.

Accurately measuring the focal length above is a useful process to speed up swaps of different and diverse jobs, given the lens. Use an acrylic ruler (preferably one with the edge of the ruler starting from 0"/0 mm), to measure up to the point the ruler meets outside lip of your lens.

If your acrylic ruler has a lip, you can measure the offset with calipers to produce the formula needed to measure the focal length accurately.

To make it quicker and easier to focus the laser when working with objects of different sizes, it's a good idea to make a tool that you can place between the lip of your lens and your object, so you can easily raise/lower your galvo head to it. This can be as simple as a dowel of the right length marked to indicate which lens it goes with (if you have multiple lenses). Another popular option is to laser cut an acrylic focusing tool for the size you need.

Video Guide For Focus Sticks

6.8.3 Focusing For Cylinder Correction

Cylinder correction within LightBurn maximizes the depth of field usable for engraving by *intentionally* defocusing your laser. See here for more information.

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6.9 Cylinder Correction Marking

Cylinder Correction (called ProjectMark in EZCAD) warps the output of your design to correct for the expansion that happens when you mark on a cylindrical object, like a cup or tumbler, without using a rotary.

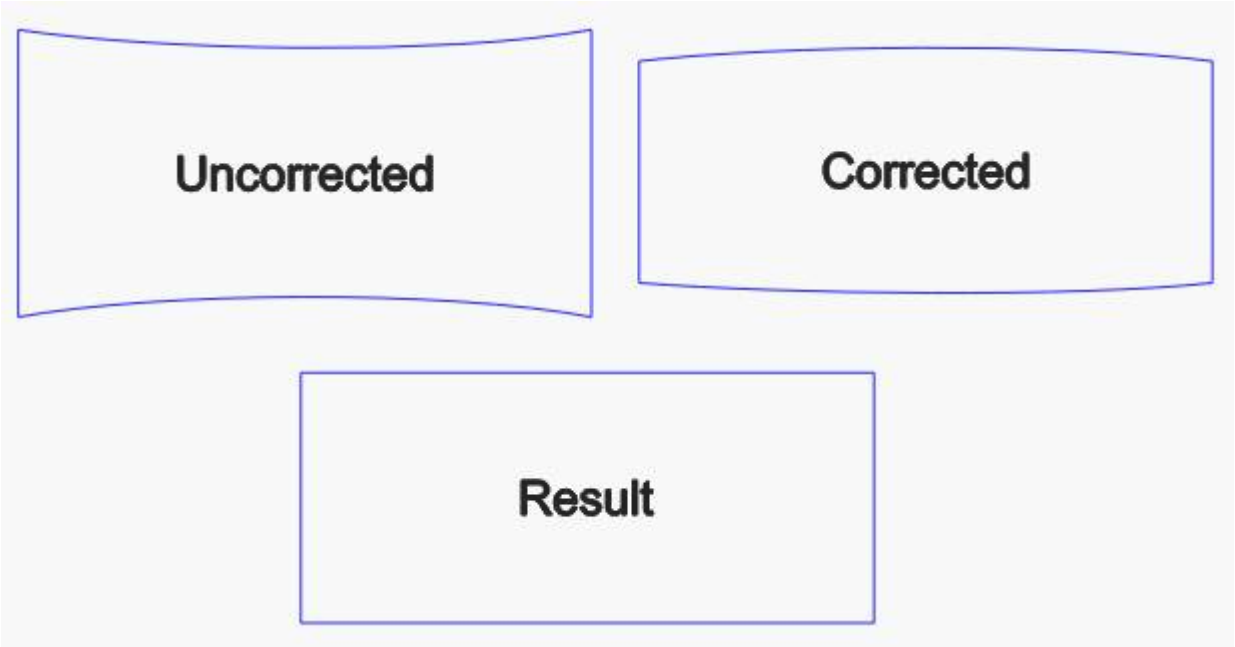
Note

This feature is currently only avalible on galvo machines. While it is on the roadmap to enable this functionality for DSP and GRBL, this will not present itself on DSP or GCode machines until that change is made.

Theory

In the image below, the blue shapes represent a rectangle. If you were to project a rectangle directly onto a cylinder, the sides of the rectangle would hit the cylinder at a lower point than the middle. Since the laser is projected from a single point above your object, the extra distance means the sides of the rectangle will widen and curve, like the rectangle below labeled "Uncorrected".

With Cylinder Correction mode enabled, LightBurn will alter the data sent to the laser to compensate for this. LightBurn sends something similar to the "Corrected" image, and when engraving your object, the effects negate each other. This produces crisp, significantly less distorted results, like the "Result" shape shown below.

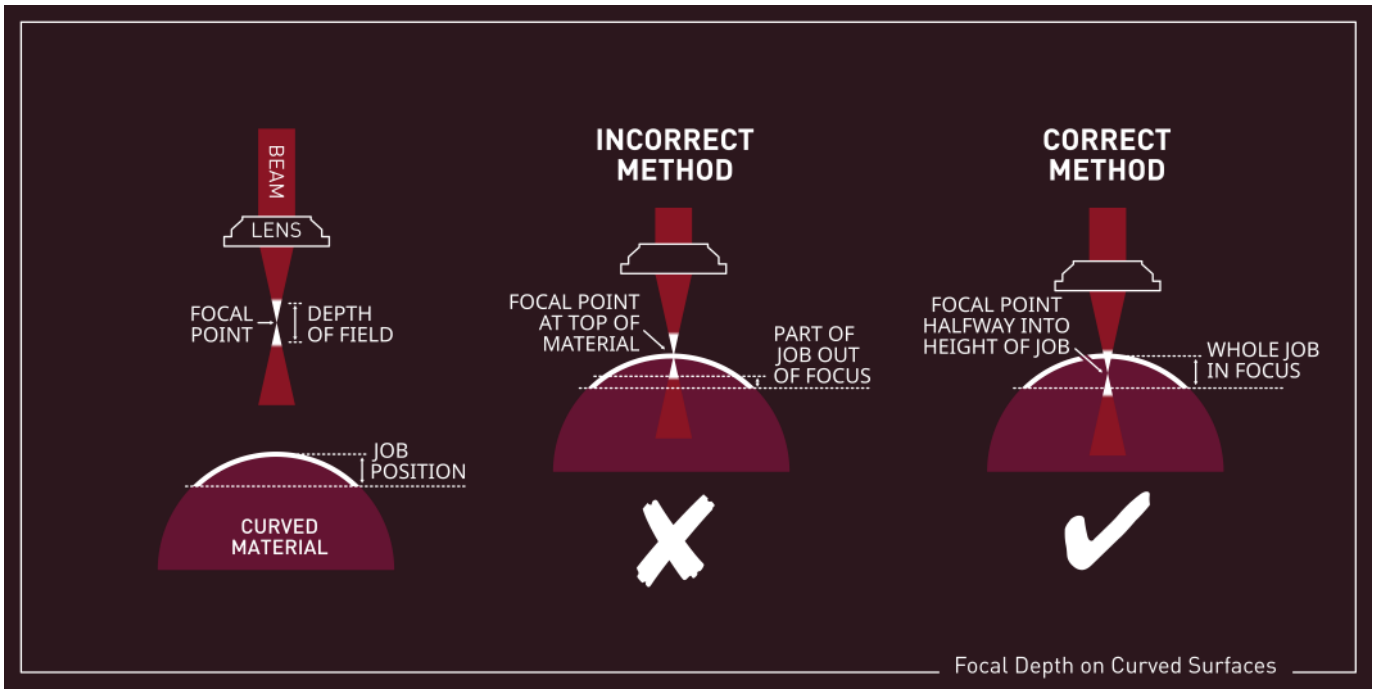


Lens Selection

Using this feature is dependent on being able to make a mark on your target object across a potentially wide focal range. For example, if you have a 75 mm diameter tumbler and are engraving a 50 mm wide graphic, there will be a roughly 10 mm difference in focal distance from the center to the edge of that graphic.

Due to this, you will want to select a lens that has a wider "field" (working area) for your galvo laser. For example, a 110 mm field lens (f=160 mm) may only have a workable focal range of around 1.5-2 mm. However, a 300 mm field lens (f=430 mm) should be able to handle a 10 mm range relatively easily.

You will also want to focus your lense partway into the surface of your cylinder, to take advantage of the full depth of field of your lens, as described in the image below.



Design Placement

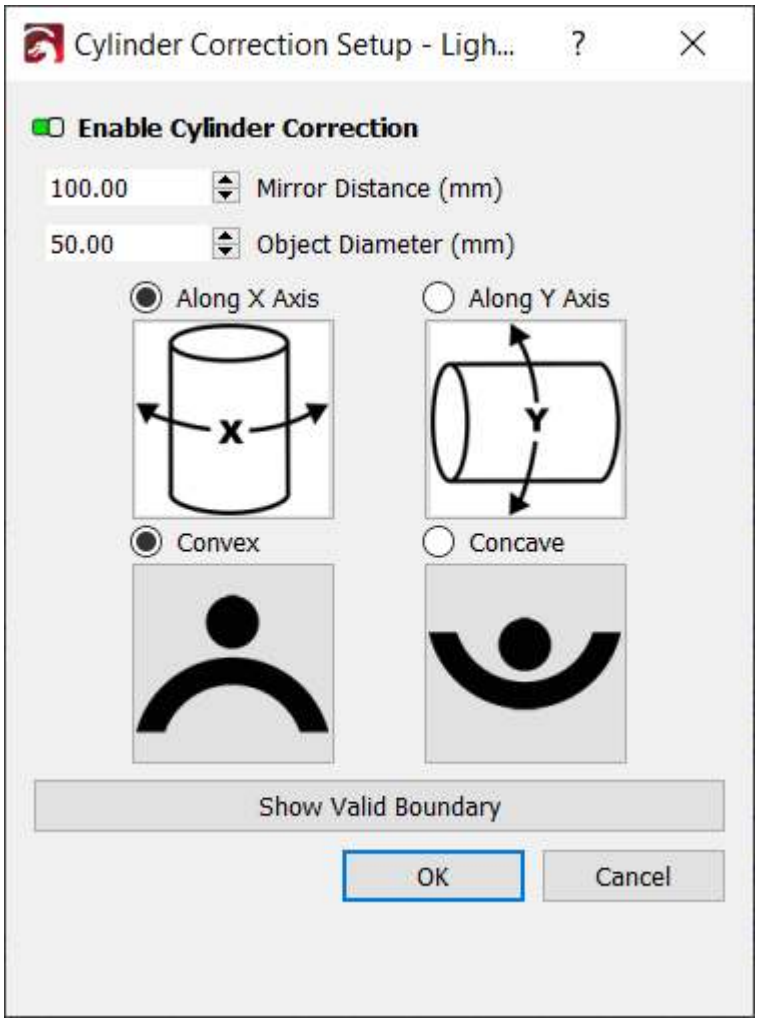
LightBurn will always assume that the center of the provided shapes are at the center of the object you are engraving on. This includes if you are using `Cut Selected Shapes` - where it will base the center calculation on only those shapes. It is done this way so that you do not have to always place your object exactly at the center of your machine working area. If, for example, your placement jig has to be 20 mm off center due to the threaded grid holes being off center, you can simply adjust your design to be 20 mm off center to match. You can, of course, verify the correct placement using the framing option in the `Laser` panel.

This assumption is made because if the object is off center from the actual galvo center, the laser can physically reach more of one side of that curved surface than the other. LightBurn will actually warp each side of your design more or less according to this offset.

It also affects the valid boundary in which your design can be placed for a given mirror distance and object diameter.

Setup

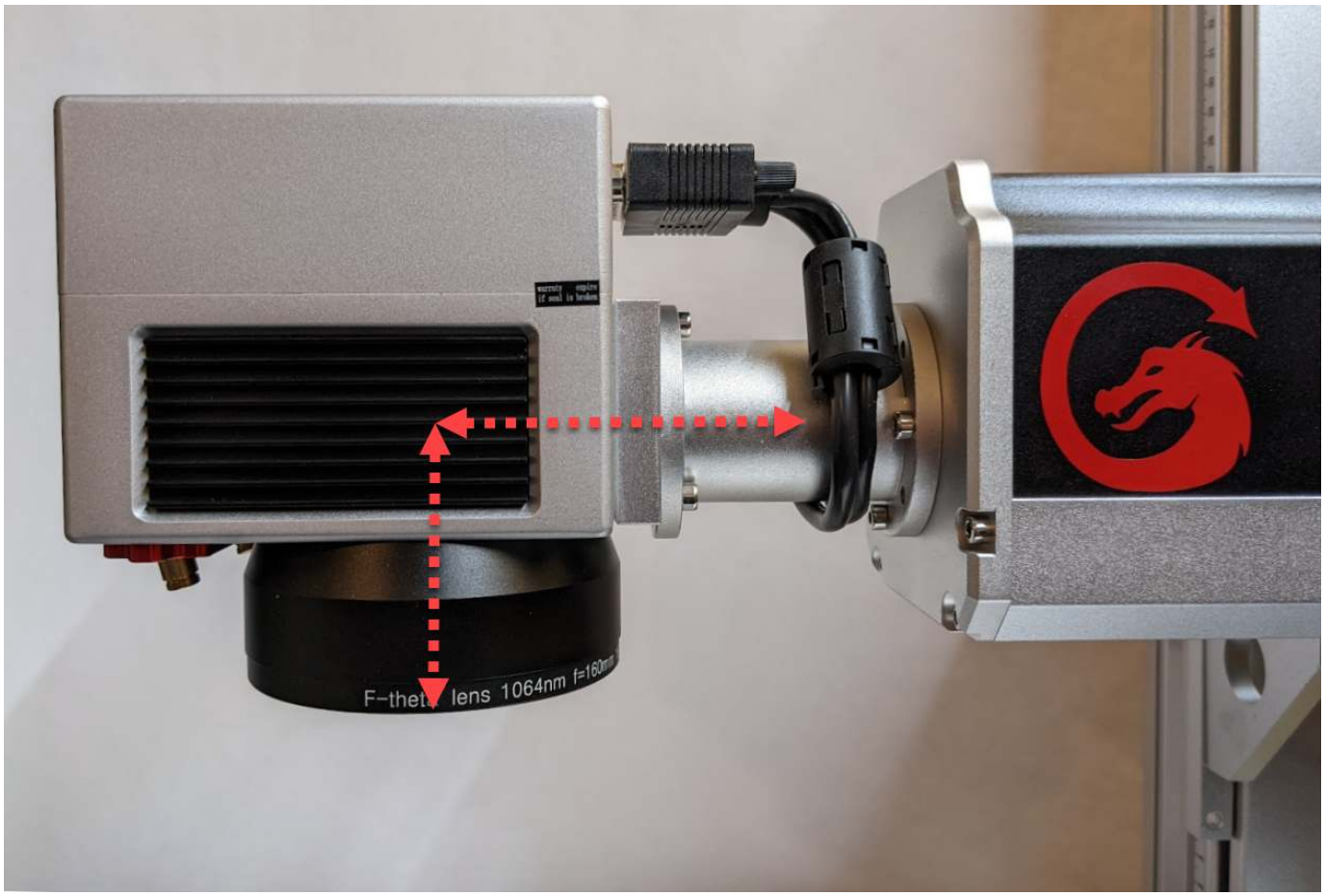
To enable it, go to Tools > Cylinder Correction Setup, and you'll be shown this screen:



Start by toggling the "Enable Cylinder Correction" option at the top. Note: this is not preserved across LightBurn sessions like it is for some rotaries. You will have to re-enable it any time you restart LightBurn and would like to use this feature.

Next, set your mirror distance from the surface of your object. Note: this is **not** the focus distance from the lens, but actually to the mirrors. It is relatively easy to find this distance however. There is typically a tube connecting the galvo head to the laser source and the mirrors are generally centered along that tube.

In the image below, you can see the center plane of that tube marked along with the distance from the bottom of the lens to that center plane marked. Assuming you measure your focus distance from the bottom of the lens to the surface of the object, simply measure the distance from the bottom of the lens to the center plane of the tube and add that to your focus distance. Use that value for the mirror distance.



Finally enter your object diameter and choose the axis along which your target object curves.

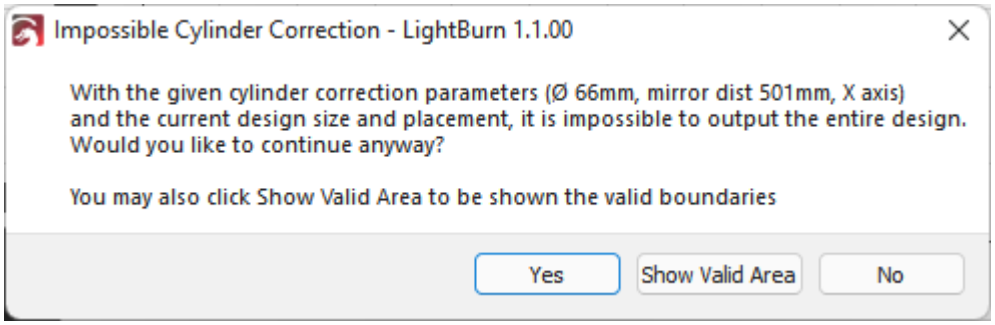
Valid Boundary

Given that the laser is being projected from a fixed point onto a curved surface, there are limits to where on your engraved object your laser can actually reach.

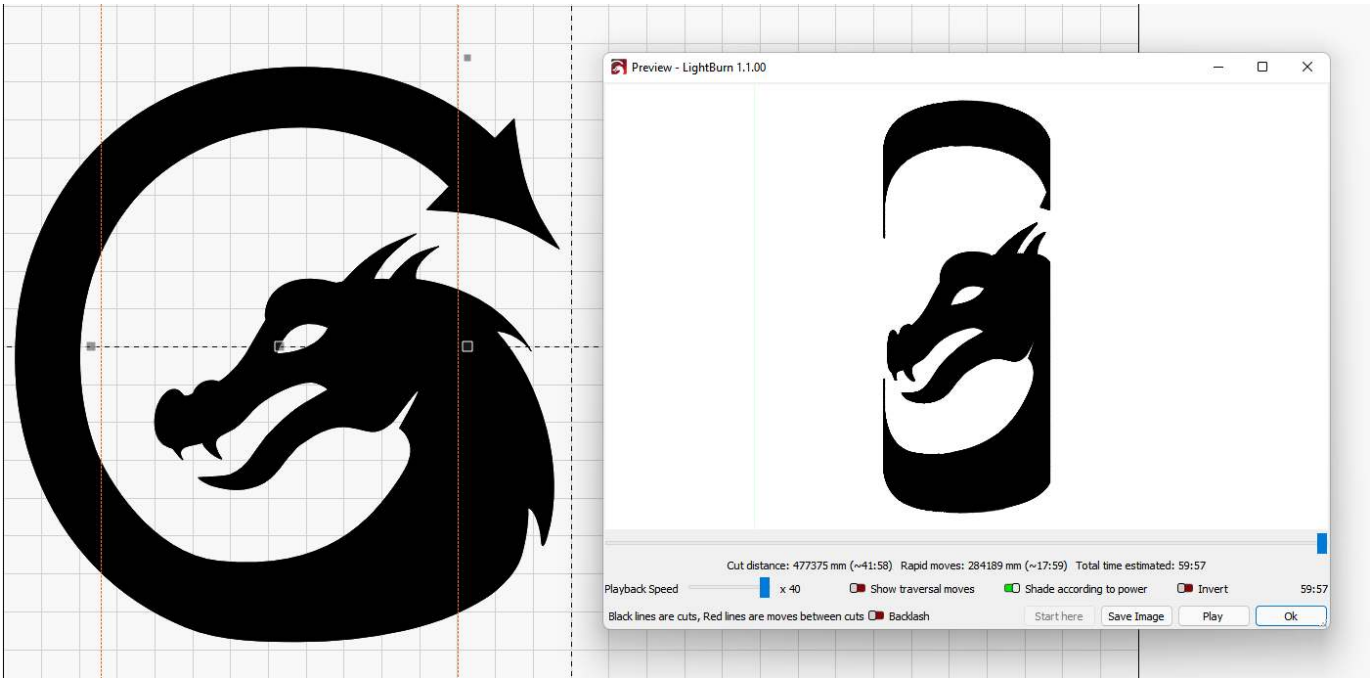
In the Cylinder Correction Setup dialog, shown above, there is a `Show Valid Boundary` button at the bottom. Click on this and it will insert a rectangle, on the T0 tool layer, into your design, showing you the area in which your design can be placed.

This valid boundary area is also affected by how far from center your object is.

If you attempt to run an cylinder corrected engrave or even show the preview while your design is outside of this boundary, you will be presented with the following dialog:



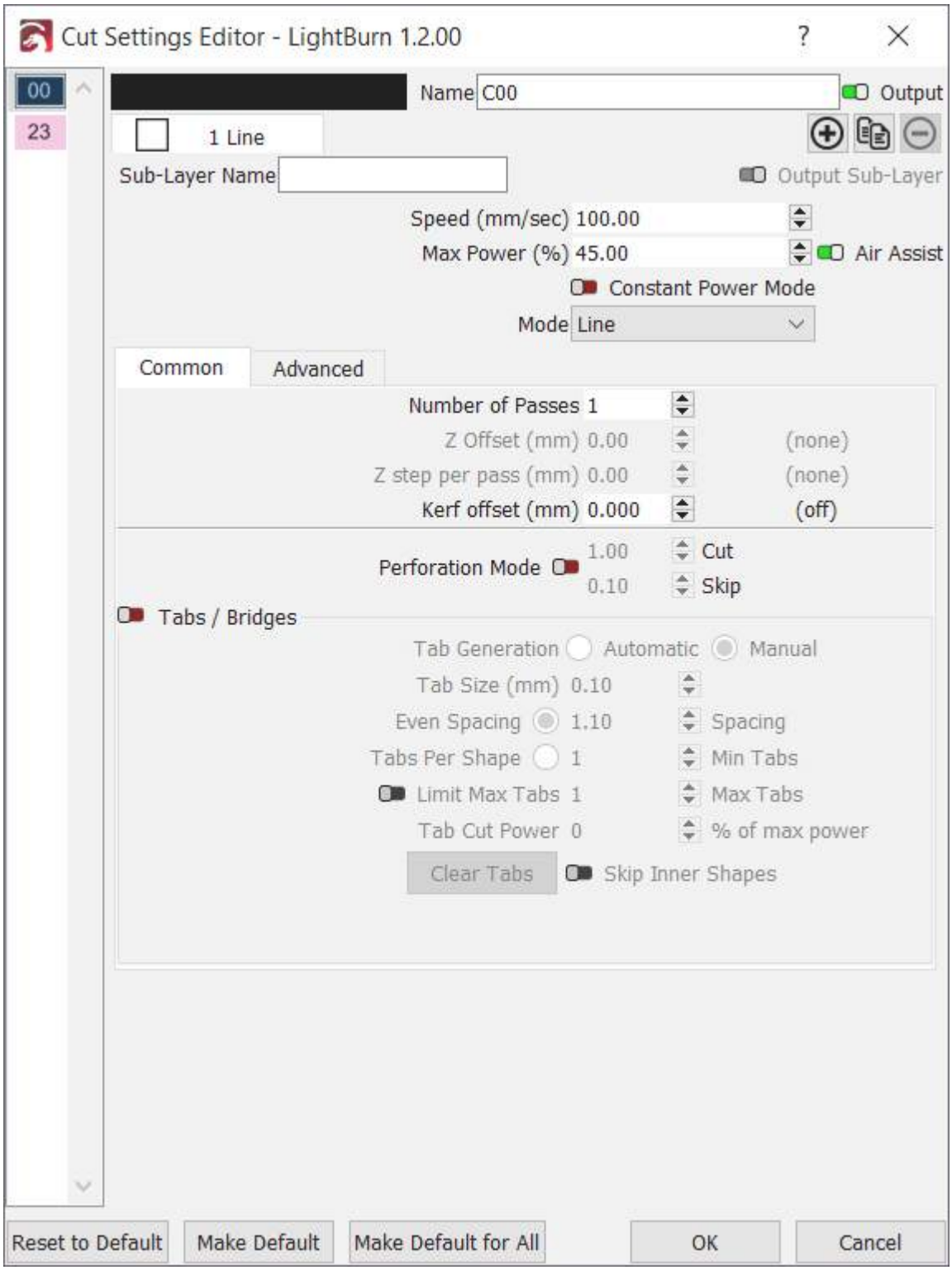
If you choose to continue anyways, the areas outside of the valid boundary will be automatically cut off from the output. In the image below you can see it has actually removed the portions outside of the valid boundary area, shown in orange at the left.



You can also, from that dialog choose to have it show you the boundary just as you would in the setup dialog.

6.10 Cut Settings Editor

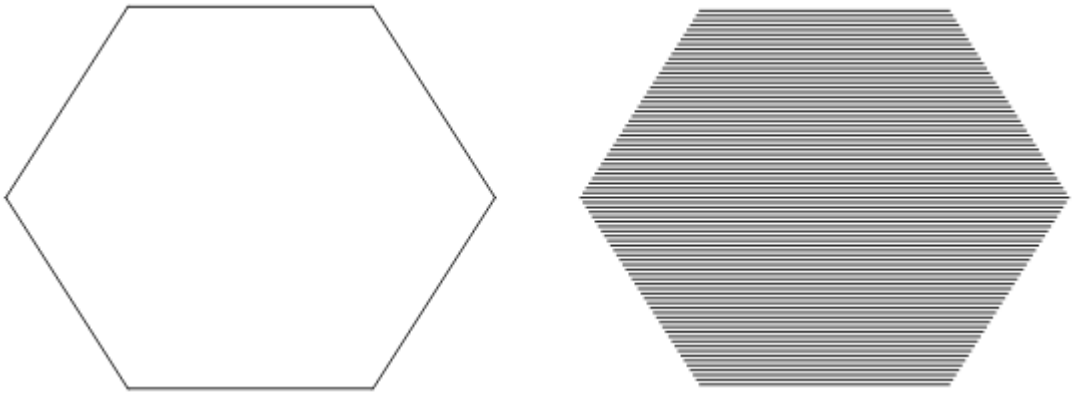
The Cut Settings window in LightBurn is accessed by double-clicking an entry in either the Cuts / Layers window or the Material Library list. The window you see may vary from the screenshot, as different laser features, LightBurn modes (Beginner) or updates can change its appearance and settings.



In the Cut Settings Editor (CSE) you can create, edit, adjust, and clone layers and sub-layers for your projects. This gives you finer control when operating your laser. Line mode follows the vector lines in your design, fill mode scans back and forth to remove

material from the "inside" of a shape, and offset fill removes material on the "inside" of a shape following a spiraling pattern based on the outside shape. You can create sub-layers to combine these modes, which replaces LightBurn's older "Fill + Line" option while also opening up many more options.

For a comparison of Line (left) versus Fill (right) modes, see below.



6.10.1 Operating Modes

There are four different 'modes' in LightBurn that choose how the laser will render your design:

- Line mode - traces along the outlines
- Fill mode - fills the design with parallel lines
- Offset Fill mode - fills the design with lines that follow the original shape
- Image mode - Works similar to fill, but with specific settings for images

In all variations of the Cut Settings Editor, the most basic settings are displayed at the top of the window (speed, power, output toggle, air assist, and mode). The lesser used, more specialized options follow below, and are split into two panes - Common and Advanced.

We'll go through the different settings used in each mode, and explain their use.

Shared / Basic Settings

All layers have a few settings that are the same, regardless of the type of layer.

Speed: how fast the laser will (ideally) move when tracing your design. Depending on your laser, its firmware settings and limits, and the design, it may or may not actually reach this speed.

The next two require a bit of explanation:

Max Power: The power level to run the laser at

Min Power (DSP Only): The min power is used when the laser moves slowly, such as at the ends of lines and direction changes/ corners.

Some DSP controllers refer to this as the **corner power** for this reason.

6.10.2 Defaults and Changing Between Files

Colors normally start with their last used settings, but if you wish you can set LightBurn to load default settings for each layer when you create a new file. If this option is enabled, a new drawing will have a clean slate with default color settings for all layers.

Working With Defaults

At the bottom of the Cut Settings Editor, there are three buttons to manage layer default settings.

Make Default: Remember the settings for this palette color. Whatever your current settings are will become the default for this color.

Reset to Default: Reset the layer to the default settings.

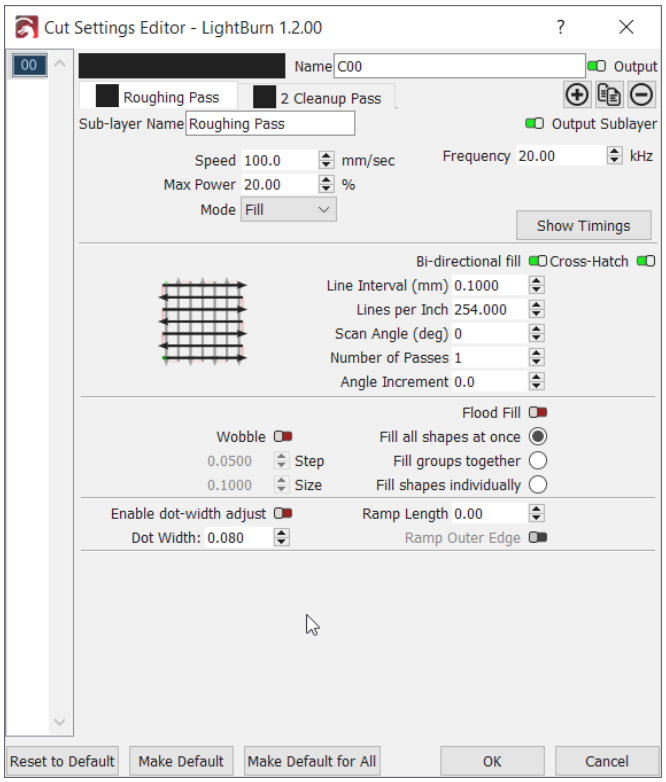
Make Default for All: Your current layer settings will become the default for *all* palette colors.

Layer defaults are separate from material libraries, and you will likely find it useful to use the two together. A common use for layer defaults is to set up layers with common cut settings for your own projects, and then use material libraries to apply settings for different materials and processes.

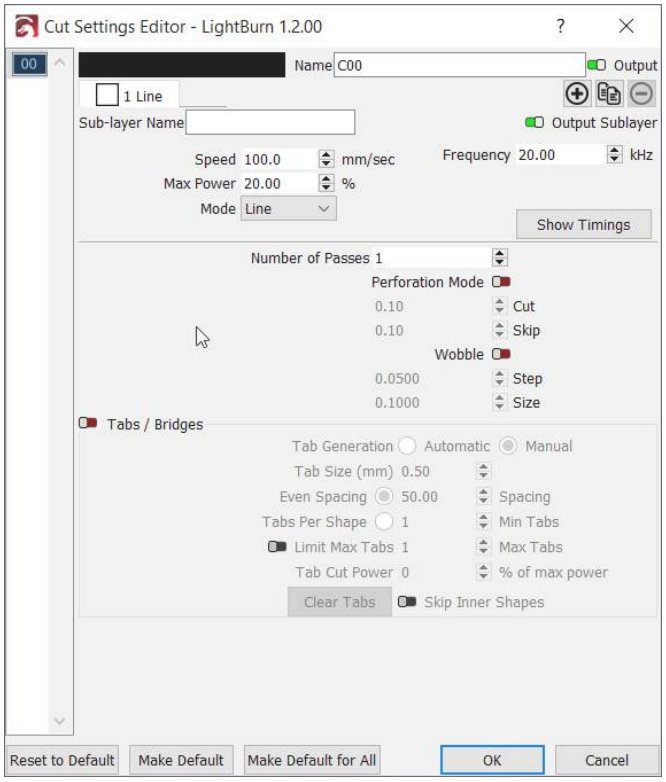
6.10.3 Sub-Layers

Sub-Layers allow you to set multiple cut/engraving settings on the same layer & geometry. This can enable the use of single-setup etching & cleanup passes for galvo lasers, as well as staggered engraving, cutting, and other operations for more complex jobs regardless of machine type. You may have up to 11 sub-layers per layer.

6.10.4 Comparison of Sub-Layers vs Single Layer



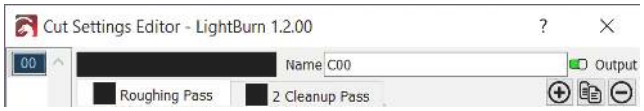
Sub-Layers In Use



Single Layer View

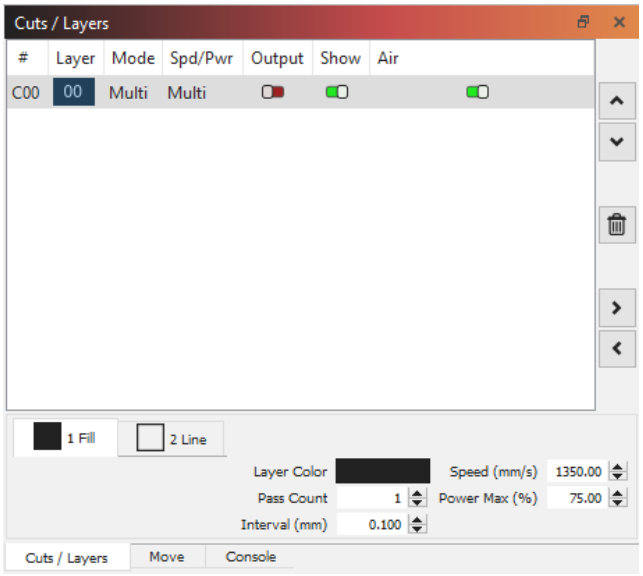
With the Sub-layer feature, you can configure count, type of pass, speed, frequency, and more, without duplicating geometry in your design.

To make a new Sub-layer, you can either click the plus icon or the duplicate icon (two overlapping pages) in the tabs area of the Cut Settings Editor. The plus sign will create a new sub-layer with default settings, and the duplicate icon will create a copy of the current sub-layer. The minus sign icon on the far right will delete the currently open sub-layer, so long as it's not the only sub-layer.



LightBurn 1.2+:

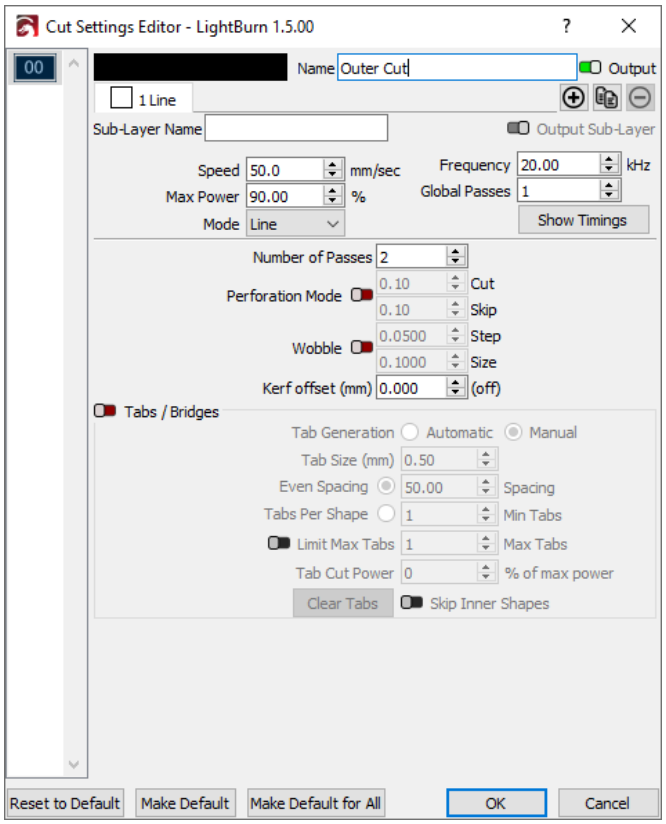
When using sub-layers, your Cuts / Layers window will show the mode as "Multi", as seen below. You can quickly reorganize and edit the tabs as you can within the full Cut Settings Editor in the quick settings, at your convenience.



6.10.5 Additional Settings/Information

6.10.6 Global Passes

Starting with LightBurn 1.5, galvo users will have the new **Global Passes** setting. This setting will repeat all sub-layers in the layer the specified number of times.



Global Passes in the Cut Settings Editor

Constant Power Mode

This setting is only available on GRBL devices. By default, LightBurn uses **Variable Power** mode (M4), which ramps the power level of the laser up and down with the speed, producng a more consistent burn. However, if you ask the laser to move faster than it's able, it will never reach the requested speed or the requested power level. It's generally best to stick with the default of Variable Power mode and adjust the speed to be within the range your machine can achieve, but if you want the same behavior as LaserGRBL, whch defaults to **Constant Power** (M3), you can enable this option. We have more info on this in our troubleshooting section.

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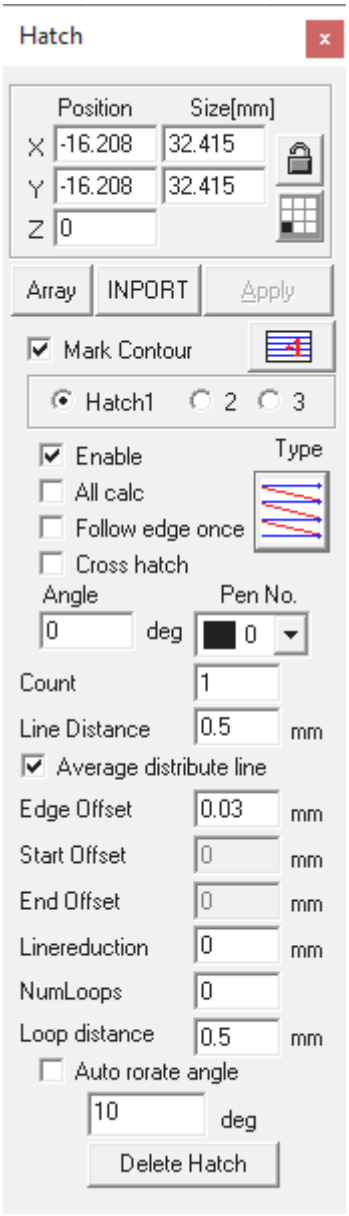
6.11 LightBurn Fill & EZCAD Hatch Quick Translation

If you're coming from EZCAD and having trouble finding hatch settings you're used to, please see below for a guide to matching your usual hatch settings to LightBurn's fill settings.

If you're not sure how to adjust cut & engraving settings, please see the Cut Settings Editor page.



6.11.1 Mark Contour

EZCAD2's "Mark Contour" option can be replicated with LightBurn's sub-layers. By creating a line sub-layer and a fill sub-layer, you can achieve the same effect. To cut the contour first, have the line sub-layer as the first sub-layer. To fill first, have the fill sub-layer as the first sub-layer.

6.11.2 Hatch 1, Hatch 2, Hatch 3

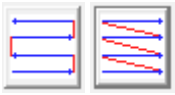
EZCAD2 allows for three different hatches on the same geometry. This is equivalent to LightBurn's sub-layers. Please see the relevant page for help.

6.11.3 Cross-Hatch

This functionality is the same between the two programs, and is a checkbox in both.

6.11.4 Hatch Patterns

Unidirectional hatch & Bidirectional hatch

 EZCAD2's bidirectional hatch and unidirectional hatch are the same as the default hatch in LightBurn, with the **bi-directional fill** toggle either on or off.

Ring-like hatch / Pyramid Hatch

 EZCAD2's ring-like hatch is equivalent to LightBurn's Offset Fill.

Snake Hatch

Snake hatch is equivalent to a regular fill in LightBurn with Flood Fill enabled.

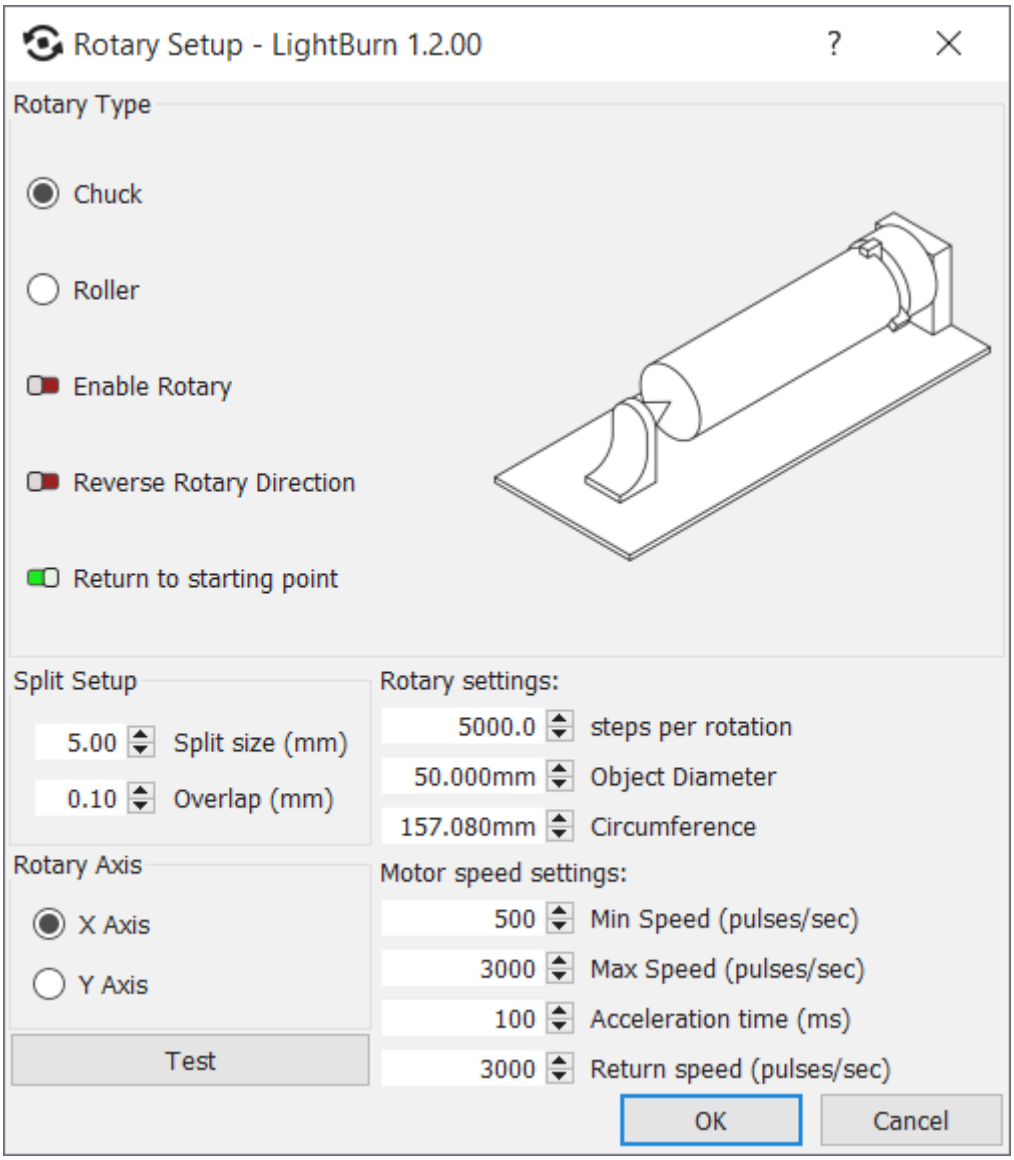
Auto Rotate Hatch Angle

In LightBurn, the EZCAD2 feature of "auto rotate hatch angle" is labeled as "Angle Increment" in your layer / sub-layer settings. While not a fill mode, it's still relevant to replicating EZCAD2 fill styles.

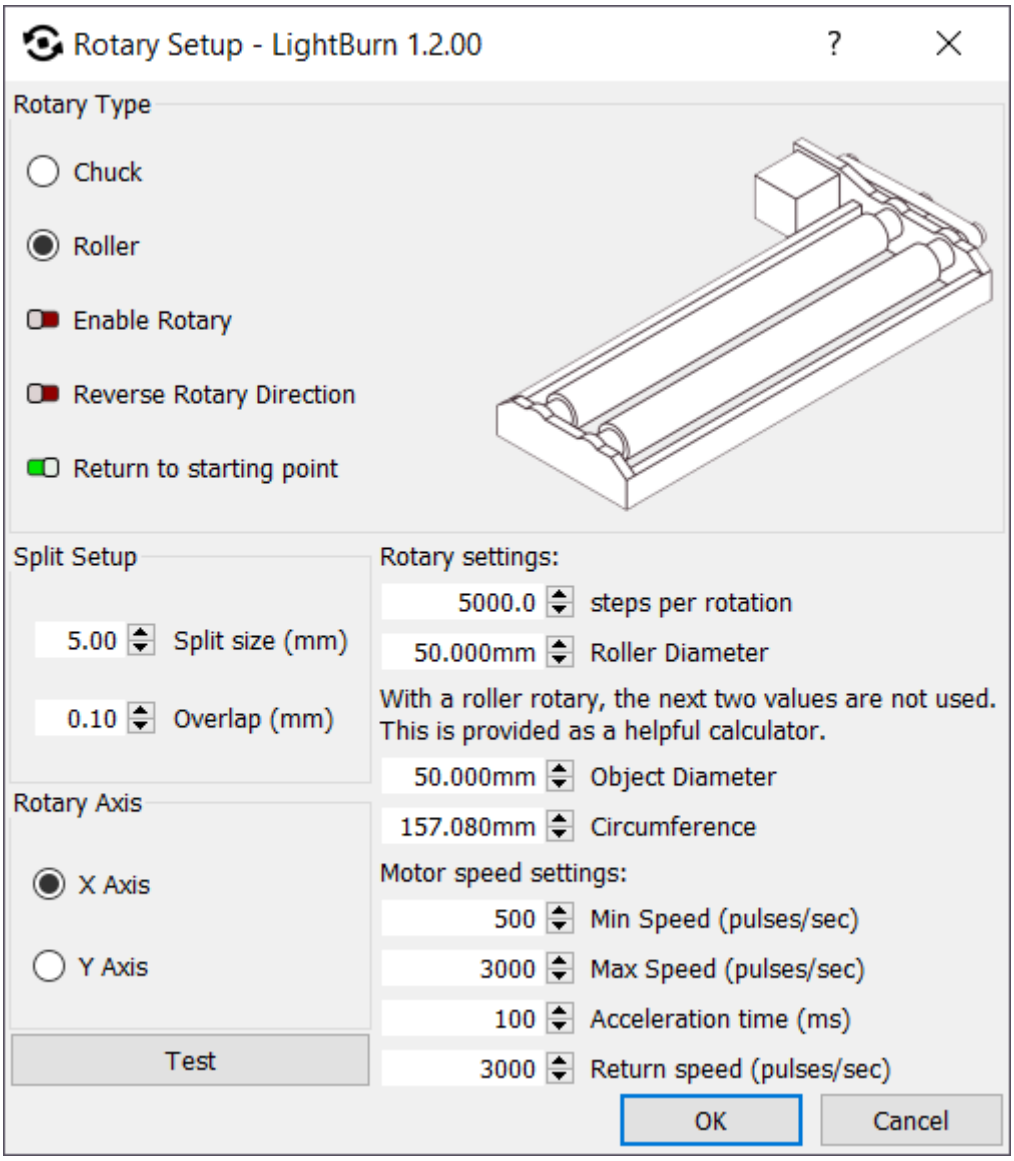
Advanced **Galvo** **LightBurn 1.2** **Rotary**

6.12 Rotary Setup (Galvo)

The Rotary Setup can be found on the toolbar with the rotary icon, in the "Laser Tools" menu near the bottom, or brought up by using ^ Ctrl + ⇧ Shift + R or ⌘ Cmd + ⇧ Shift + R.



Rotary Setup for Galvo (with chuck)



Rotary Setup for Galvo (with rollers)

To use the rotary with your marking laser, you first need to set up the rotary parameters.

> **Note**
>
> When rotating about the X axis, you'll want to engrave along the X axis (with a resultant scan angle of 0 or 180). When rotating about the Y axis, you'll want to engrave along the Y axis (with a resultant scan angle of 90 or 270).

1. First choose whether you have a chuck or roller style rotary.
2. Set the **Steps per Rotation** value to the number of motor steps required to spin the rotary itself one complete rotation when the **Test** button is pressed. (it should rotate a full 360 degrees, pause, then rotate back to the starting point).
3. Set the Min and Max speeds to move the rotary, in pulses per second.
4. Enter the Acceleration time set the ramping speed from Min to Max.
5. Set the Return speed value to adjust how fast to move when returning to the starting point.
6. Choose whether you are rotating around the X or Y axis. If the roller is along the horizontal axis, choose X, if it's along the vertical axis, choose Y.
7. You may need to enable the **Reverse Rotary Direction** switch if the output is backwards or sliced in the wrong order.

Note

In most cases, the steps/rotation and other values will be provided by the manufacturer of your machine, either as a screenshot of the rotary params page in EZCAD or a text document.

If you don't know the correct numbers, the **Test** button in LightBurn will run a single 360 degree movement of the chuck or roller, pause, and return to zero, using the current settings, so it is possible to find usable values by trial and error.

The values listed above, minus object diameter/radius, should only need to be set up once. If the rotary unit or orientation are changed though, performing Rotary Setup again is a good practice.

6.12.1 Setup

Galvo markers will run a portion of the job (a slice), rotate the object, run another slice, and so on.

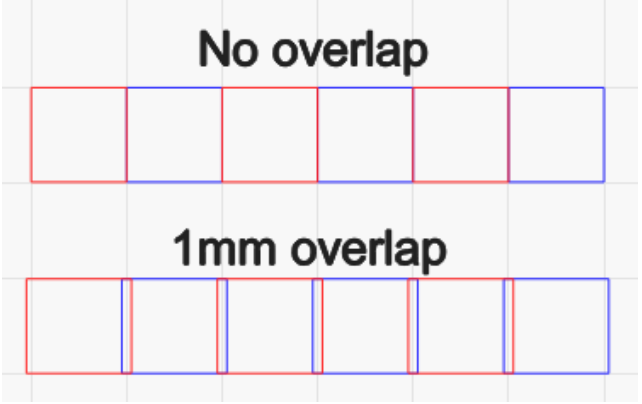
Split Size

The size of each slice is called the 'Split Size'. If your object is tapered, irregularly shaped, or not perfectly aligned with the rotary axis, using a small split size can help reduce gaps or misalignment of the splits.

A larger split size will reduce the time spent running the job, but can be harder to dial in the settings such that no overlaps or gaps are visible.

Overlap

To help eliminate visible gaps between slices, you can tell LightBurn to overlap them — specifying an overlap of zero means that each slice is run on its own. A non-zero overlap value will produce that much overlap on the ends of each slice, like this:



If you are removing paint, anodizing, or other surface coating, using a small overlap is recommended. If you are annealing or marking the material directly, adding overlaps could produce visible artifacts.

Object Diameter

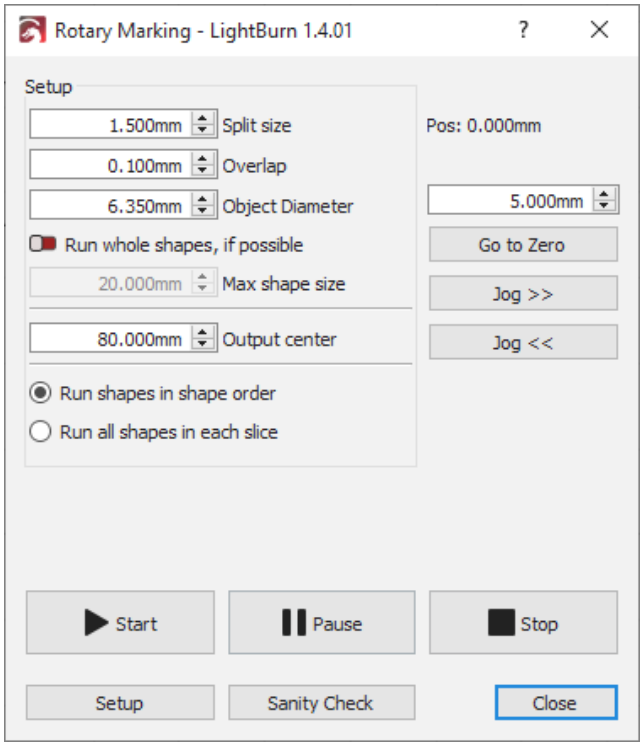
Measure the diameter carefully for best results. If your object is tapered, check out our Taper Warp Tool, added in LightBurn 1.5.

Run Whole Shapes

When **Run whole shapes, if possible** is turned on, LightBurn will attempt to create splits that keep shapes intact. This can produce a higher quality finish without gaps or misalignment within shapes.

6.12.2 Running the job

When rotary mode is enabled, pressing the **Start** button on the main window will bring up the Rotary Marking window, shown here:



From here you can tune the split size, overlap, and object diameter, as well as jog the rotary, and run the job. When running a rotary job, the center of your page is treated as the current rotary position when you clicked **Start**. The **Sanity Check** button will check for some easily overlooked mistakes, and is a good supplement to previewing and framing your design as a final check before running the laser.

Starting in LightBurn 1.5, you can also frame your job from this window.

6.12.3 Rotations

Starting with LightBurn 1.5, you can reset the rotations on the rotary axis to 0. This will not change the position of your rotary, but can help you keep track of positioning.

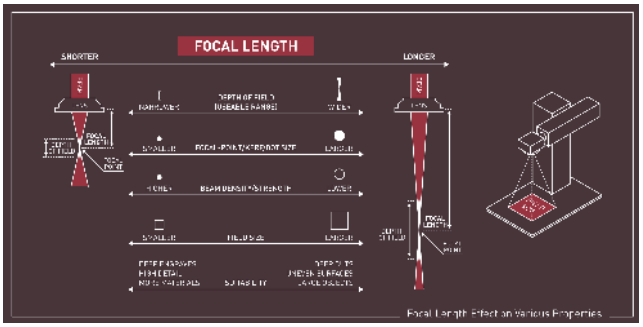
Output Center

This setting allows you to shift the center position of your rotary output to compensate for the center of the rotary not lining up precisely with the center of the field. This value cannot be negative.

> **Note**
>
> This setting is only adjustable in the Rotary Marking "Run" window, and *not* the "Framing" window. If you wish to retain use of the Framing dialog, you can set it here, and then use "Frame" all the same.

Focusing

See Focusing for more information.



Calibration **Galvo** **LightBurn 1.2**

6.13 Changing A Lens

To ensure best performance following a lens swap in LightBurn when using a galvo, there are several changes and settings you'll need to confirm first. Some manufacturers give you the calibration information for your new lens, and it's highly suggested you check their website before proceeding to find this manually.

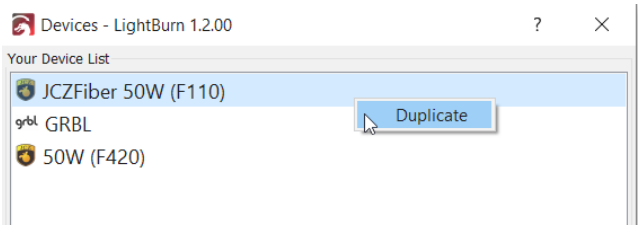
6.13.1 Physical Lens Swap

This video guide from Laser Everything covers the physical installation of the lens, as well as many of the items outlined below with EZCAD analogues. It's suggested this video by Laser Everything is reviewed to help ensure the lens swap doesn't damage your machine or hurt you in the process.

6.13.2 Duplicate Original Laser

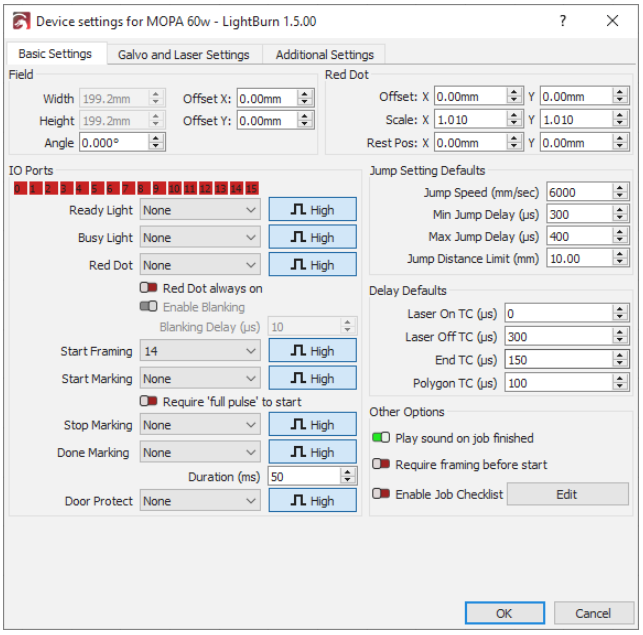
In many cases, changing the galvo lens means that you'll need to adjust many settings and recalibrate it, making it a "new" machine when doing so. To duplicate a laser device in LightBurn, click "Devices" in the "Laser" window, and right click on the given laser to duplicate it.

Be sure to give the duplicate a descriptive and accurate name to contrast it to the original, and ensure that's the one you'll be editing.



6.13.3 Field Size

When changing lenses, the effective Field Size of your laser will also change. The Field Size for your lens is usually listed on the manufacturer's website.



6.13.4 Focus

After changing lenses physically, you'll need to adjust the focus of the laser even without other calibration being done yet to ensure the results are as good as possible.

Spend time and reference the steps outlined in Focusing to ensure your galvo's output is crisp and in focus; keep in mind your red dot framing may no longer be in focus due to the focal length changes.

6.13.5 Scale, Bulge, Skew, Calibration

Once your galvo is focused, you'll need to adjust the bulge, skew, trapezoidal calibration as best you can to match this new lens. Please see Lens Correction and the specific Device Settings for Galvo to get more in-depth explanations of the calibration settings.

Warning

While your initial testing may have been done in the center of your engraving field, it's suggested that you perform one or more tests at the edge of your field to fine-tune the Scale/Trapezoid/Bulge/Stretch to ensure accuracy and consistency.

In the event you find the design severely distorted at the edges but not at the center, it's likely your Field Size was set incorrectly. You'll need to follow the steps from the beginning to try and mitigate this.

Scale

In order to test scale, it's suggested you attempt to frame a square of known size in LightBurn (say, 60 mm), and measure the corner-to-corner with calipers to adjust your X and Y scale as needed.

Bulge

Following that, you'll want to measure your design bulge; frame a square nearly as large as your field allows (errors are amplified at the edges of a galvo). Put the edge of a flat surface directly between the two corners of a side and check to see if the line bulges into or past the straight edge, and adjust your bulge settings accordingly. Repeat this step for both axes.

Trapezoidal

Frame a square nearly as large as your field allows (errors are amplified at the edges of a galvo). Measure the length of the top edge and compare it to the length of the bottom edge, and adjust the trapezoidal value until they match

Skew

The fine-tuning of your skew can be done either by lining a set square along two edges to see if they are 90 degrees, or by framing a rectangle nearly as large as your field allows (errors are amplified at the edges of the field). Measure the distance between opposing corners, and compare it to the measurement of the other opposing corners (so that if you were to trace the lines you measured you'd end up with an X shape across your framed square). Your goal woudld then be to adjust the trapeziodal value until both measurements are the same.

Repeat

You may wish to repeat these checks to ensure they are still correct, following the changes made.

Galvo **LightBurn 1.2**

6.14 3D Sliced Engravings

LightBurn's **3D Sliced Image Mode** enables Galvo users to create engravings with both visual and physical depth. This 2.5D engraving mode does not require a live Z axis and can produce highly detailed engravings, but does not offer precise control over the engraving's depth.

3D Sliced mode uses multiple passes to engrave a design one layer at a time. This mode is intended for use with depth maps – sometimes called height maps – which are specially designed greyscale images in which a pixel's brightness represents depth, rather than shading.

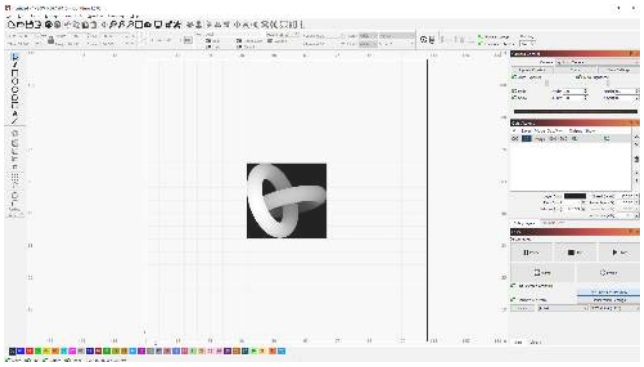
Lighter pixels are engraved with fewer passes than darker pixels, resulting in a deeper engrave in darker areas of the image. Enabling **Negative Image** inverts brightness, leading to lighter areas engraving deeper than darker areas.

Depth maps can be created by hand, although tools like STL2PNG can generate raster images from STL files to create more complex depth maps. Once a depth map is created, it can be imported to LightBurn like any other image.

6.14.1 Using 3D Sliced Mode

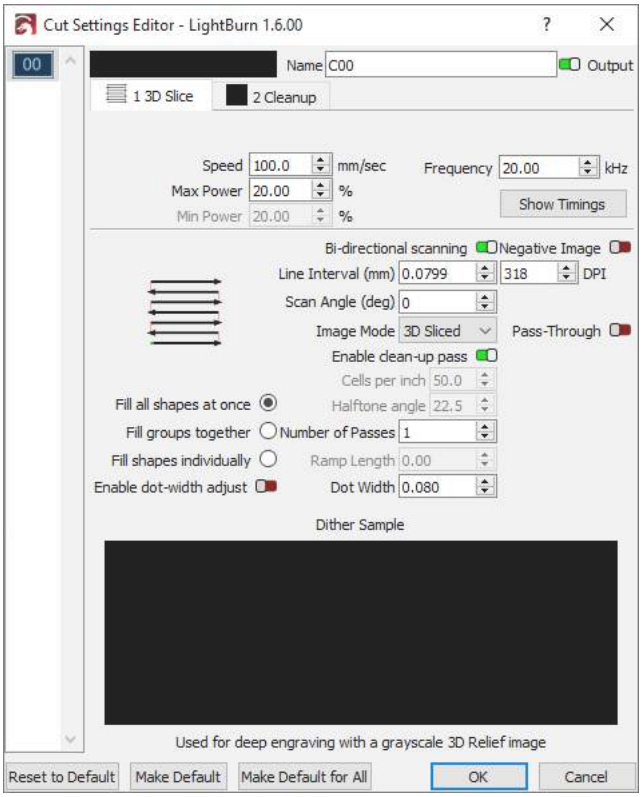
Create a Depth Map

Produce a greyscale depth map image in any tool you choose and import it to LightBurn.



Enable 3D Sliced Mode

Use the **Cut Settings Editor** to set the **Image Mode** to **3D Sliced**. This mode is *only* available when using a Galvo laser.



Adjust Settings

Most settings are shared with the other **Image Modes**, but there are a few details specific to this mode.

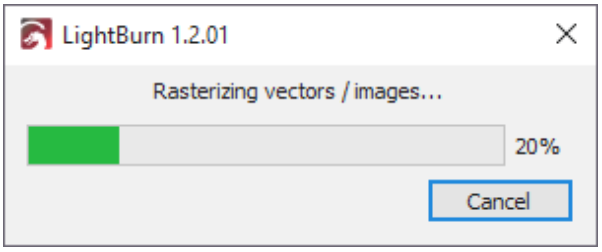
NUMBER OF PASSES

In **3D Sliced** mode, raising the **Number of Passes** splits the depth map into more layers, increasing the effective resolution of the engraving. The darkest shades in your depth map will be engraved with the full Number of Passes, and all lighter shades will be engraved with progressively fewer passes, down to zero passes for pure white shades.

Using a large Number of Passes may require decreasing power to avoid burning deeper than intended. This has a similar effect to decreasing layer height on a 3D printer.

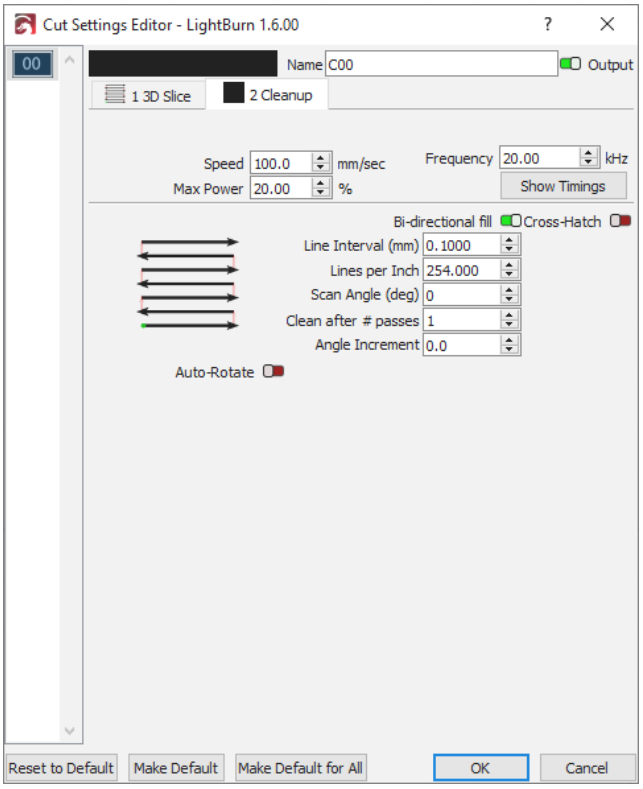
Note

Larger, more intricate designs may take more time to process, due to the complexity of generating each pass. If you see this dialog, please be patient as your computer may need some time to prepare your design.



CLEANUP PASSES

Toggling on **Enable cleanup pass** will automatically add a **Cleanup Sub-Layer** in the **Cut Settings Editor**, where you can specify how often automatic cleanup passes should run, and adjust the settings for those passes.

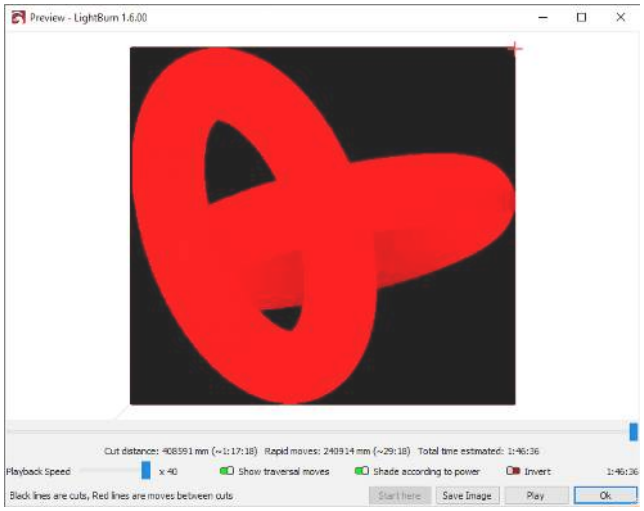


Cleanup passes are typically run with a tighter **Line Interval**, higher **Frequency**, and lower **Max Power** than the main engraving passes, and are used to clear debris and produce a better finish.

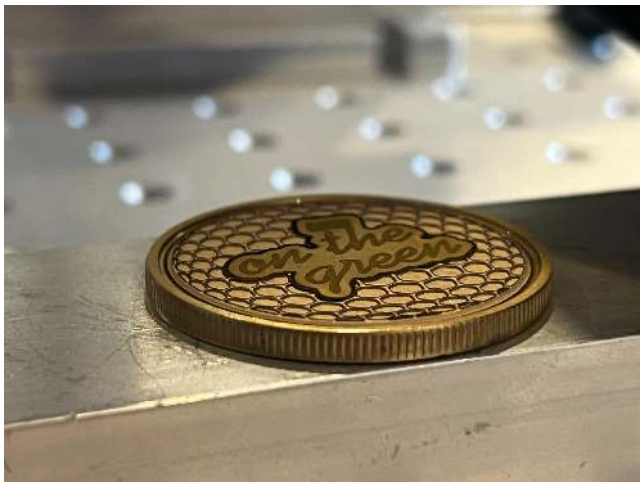
Preview and Run

Check the **Preview** to confirm your design is outputting as you're expecting. If you click the **Play** button, you should see your design render from the bottom to the top, with black indicating the engraved portion for each layer.

Enable **Show traversal moves** and check to make sure that the red areas expand with each pass. The red areas are made up of lines indicating movements made while the laser is off, so, as the job progresses, the laser should be passing over increasingly large areas of lighter shading, while continuing to engrave increasingly small darker-shaded areas.

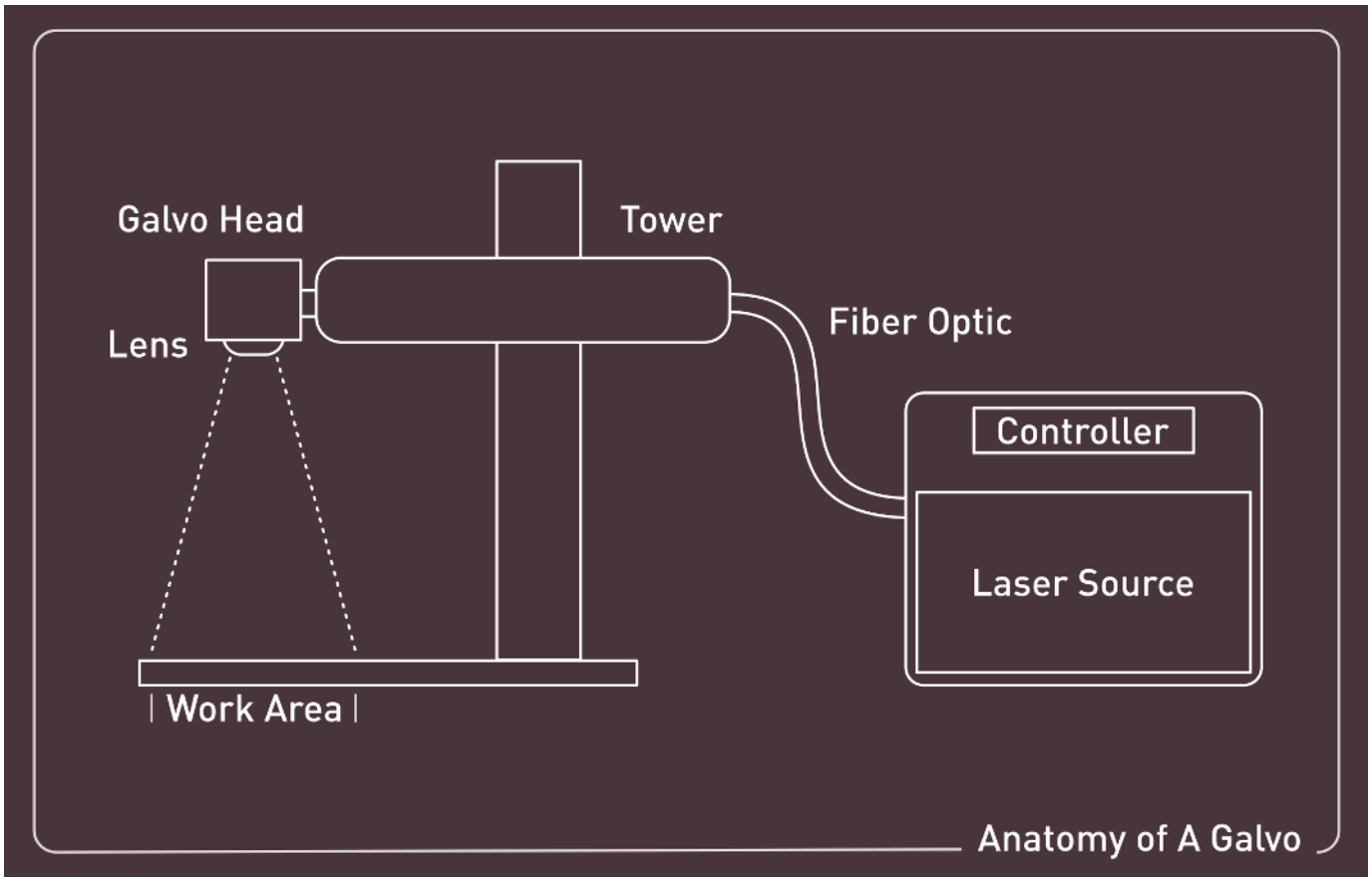


6.14.2 More Examples



Advanced **Galvo** **LightBurn 1.2**

6.15 About Galvos



Note

6.15.1 Supported Types

The current types & manufacturers of galvo laser sources supported (as of LightBurn 1.2.00) are as follows:

- Raycus (RAYCUS)
- JPT (JPT)
- IPG (IPG_YLP / IPG_YLPM)
- MAX (MAX / JPT)
- CO_2
- (as of 1.2.02) UV

6.15.2 Unsupported

These are devices that may work at some point in the future, have been communicated to our staff that users would like to use them, but we can't 100% confirm behavior just yet.

- QUANTEL_M20HF
- QUANTEL_M20
- MANLIGHT_PL
- VGEN_YPFL
- EO
- QUANTEL_M20EG
- QUANTEL_M30EG
- IPG_YLP_E
- HFB
- Orion Laser

6.15.3 Sources

Fiber

Fiber lasers are incredibly common devices, due to their use for long-distance & high bandwidth networking; fiber lasers power the internet.

They make use of an optical pathway, made of silica glass to guide the light, resulting in a narrow, straight beam that's able to carry an incredible amount of energy and data. For galvo actuated fiber lasers, this means that the beam can move extremely quickly, making small adjustments via actuated mirrors, rather than complex gantry systems.

Due to the beam being formed inside of a solid mechanical apparatus, fiber lasers are considered "solid state" devices, whereas CO_2 laser tubes are generally considered "gas state".

STEP BY STEP

1. Light is created in a laser diode, a dedicated source that's "pumped" into the fiber optic cable, resulting in them occasionally being referred to as a "pump source".
2. Pump light is guided into the fiber optic cable. While the fiber optic is able to carry the beam, the cladding (or casing) on the fiber is the reason the beam stays *inside* of the fiber instead of dispersing out of it.
3. Light is amplified inside the laser cavity. As the light passes through this region, the particles rise to a higher energy level, getting caught and excited / relaxed into a singular wavelength of operation. A doped portion of fiber, mixed with certain rare earth elements, makes this possible, reflecting back and forth while doing so inside "Bragg gratings". *This is where it becomes a stimulated emission of radiation.*
4. Laser light of a particular wavelength is created. The specific element(s) used to dope the fiber effect what wavelength the beam becomes.
5. The beam is released and shaped. The light at this point is collimated (straight), and to produce a usable shape for engraving, marking, or more, lenses and/or beam expanders are used to adjust the collimation.

6.15.4 Q-Switched vs MOPA

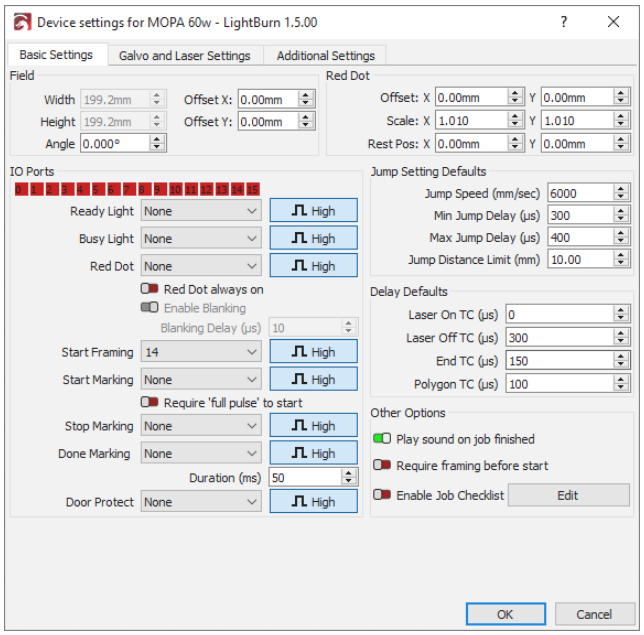
These two terms are often used in conjunction, but what does that even *mean*? What's being switched? Why is it a MOPA?

Master Oscillator Power Amplifier (MOPA) lasers allow more timing adjustment than Q-Switched lasers. MOPA lasers allow for separate control of pulse duration and pulse frequency to produce highly accurate and controlled engravings or etchings. The general range of MOPAs can be as low as 2ns or as high as 500ns, allowing highly accurate adjustment of the energy dispersed into the material.

Q-Switched lasers are typically not adjustable in this manner, and operate at a fixed duration, typically between 80ns to 140ns.

6.15.5 Laser Timing Adjustment

Galvo lasers sometimes have granular, but adjustable tuning of when the beam is commanded on, or off, as well as how the mirrors are adjusted. Some of this calibration and adjustment is in Lens Correction, or provided by your laser manufacturer, but the fine tuning for corner approach and speed may need adjustment.



Laser on TC (µs)

When attempting to mark, the physical mirrors of the galvo head must reach the desired speed before they begin marking. This fine tuning allows the user to reduce the burn-in potential during that initial acceleration by adjusting the source timing.

Laser Off TC (µs)

Similarly to the above, when the mirrors of the galvo head must slow down as they attempt to end a marking move, there may be a burn-in effect while slowing down. This setting allows the end timing to be adjusted finely.

End TC (µs)

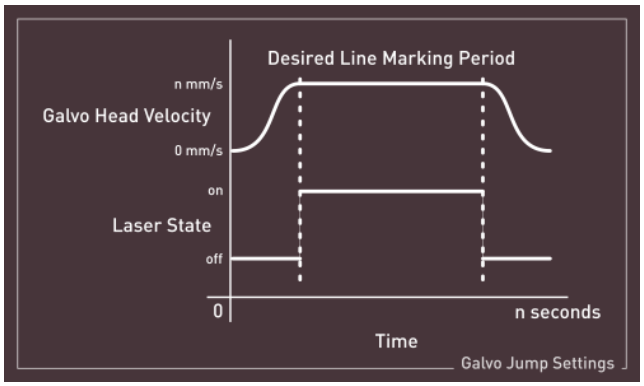
This setting adjusts how long the laser waits at the end of a series of vectors. Due to the fact the laser will physically lag behind the commanded state as decided by any software, this delay permits adjustment similarly to the Laser Off TC, except only for the end of polygons.

This setting applies to *any* marking move where the laser is turned off after execution.

Polygon TC (µs)

This setting adjusts how long the laser "waits" at the end of each segment of a polygon, permitting the laser to settle

appropriately, compensating for the same lag as outlined in End TC.



Galvo **UI**

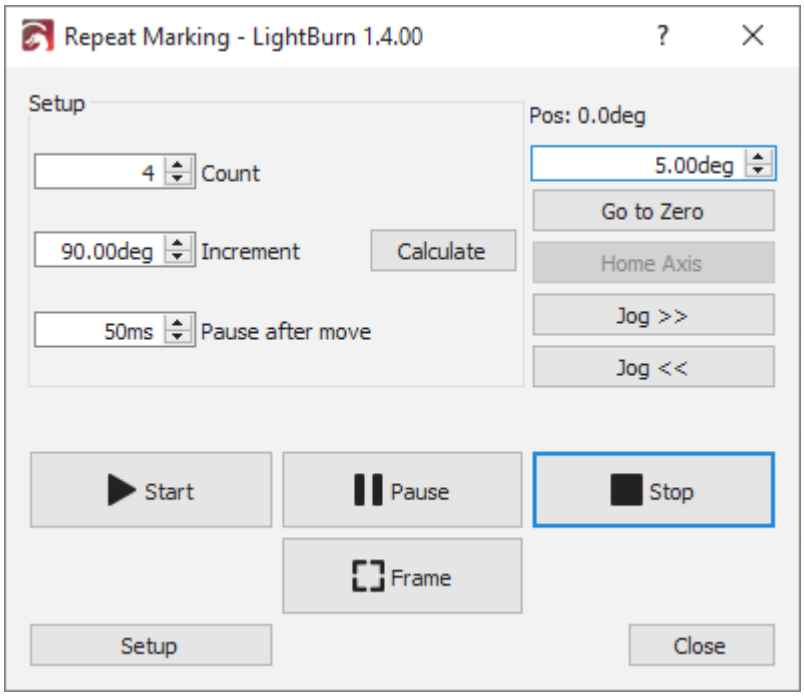
6.16 Repeat Marking Tool

Starting in version 1.4, galvo laser users have access to the Repeat Marking Tool. This tool enables the use of a rotary table or linear axis to move parts past the laser while running jobs. This is typically used so you can engrave multiple pieces quickly and consistently.

You can find the Repeat Marking Tool by going to **Laser Tools >> Repeat Marking**

Warning

The **Repeat Marking** tool is separate from, and incompatible with, the **Rotary** feature. When using **Repeat Marking**, make sure that rotary mode is disabled.



Count

The desired number of repetitions.

Increment

The angle to rotate the axis between repetitions.

The **Calculate** button is only available if the axis type in Setup is set to rotate, and can automatically calculate the rotation increment based on the number of positions in your rotary table. To use it, set **Count** to the number of positions in your rotary table, click **Calculate**, and then set count to the actual number of repetitions you want.

Pause After Move

If your rotary table wobbles when it stops, adding a pause here gives it time to settle before marking starts again.

6.16.1 Position

This section shows the current position of the rotary table or linear axis and allows you to manually control it. The top line shows the current position.

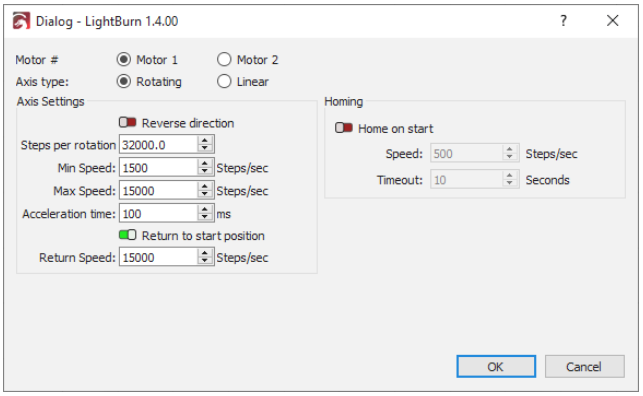
The number box allows you to set how far the motor controlling the axis will turn when manually jogged. **Go to Zero** will return you to your starting point.

6.16.2 Controls

Start, pause, stop, and frame all work as they do elsewhere in LightBurn.

6.16.3 Setup

Click the **Setup** button to enter the setup window and configure your rotary table.

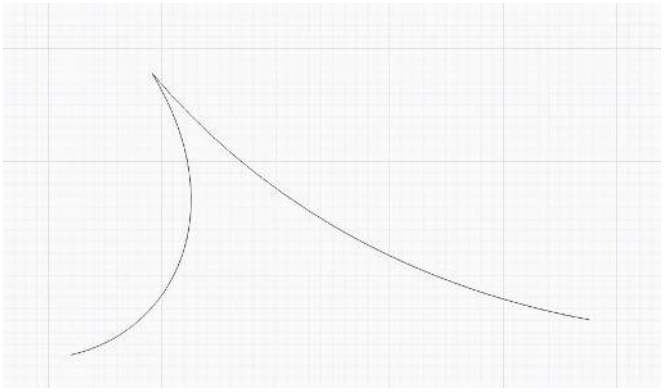


7. What's New In LightBurn 1.5

7.1 Radius Tool Updates

7.1.1 Radius Tool Supports Bézier curves

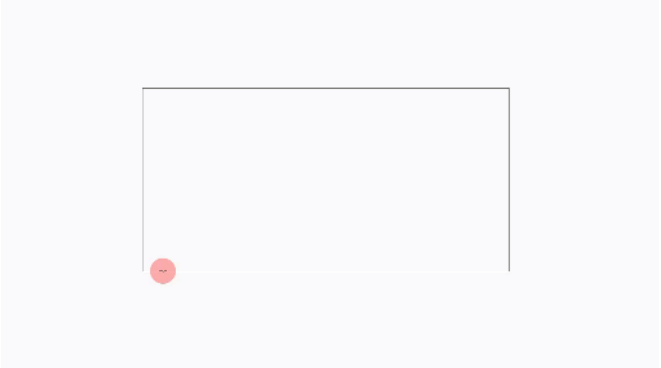
The Radius Tool now supports adding a radius to corners connecting to Bézier segments



*Using the **Radius Tool** with curved segments*

7.1.2 Radius Drag Handles Added

Starting in LightBurn 1.5, rectangles have an additional handle available that acts as a shortcut for the Radius Tool. Drag the blue handle away from the corner to increase the radius of all four corners, and drag toward the corner to decrease the radius. Dragging vertically creates a reversed radius, with a bite taken out of the corner.



*Using the **Radius Drag Handle***

7.2 Improvements For Galvo Lasers

7.2.1 Global Passes Setting

Starting in version 1.5, the Cut Settings Editor for galvo lasers has a new **Global Passes** setting. Increasing this value will repeat all sub-layers in a layer the number of times specified.

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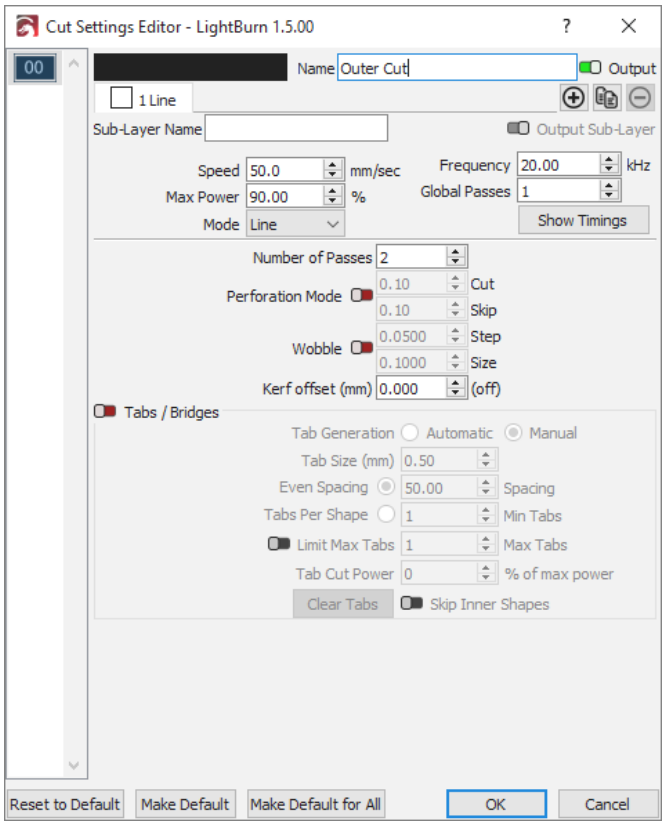


***Global Passes** in the Cut Settings Editor*

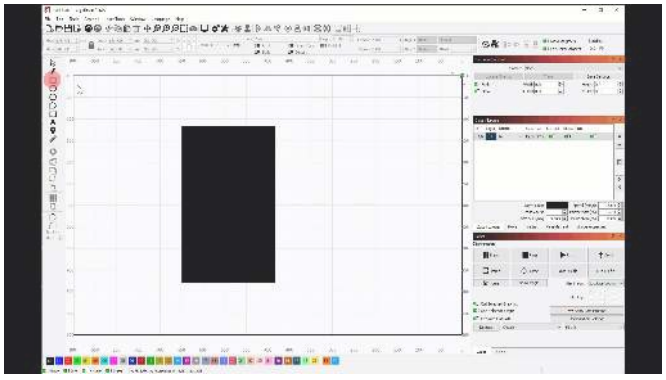
7.2.2 Framing Enabled for Galvo Device Rotary Engraving

LightBurn now supports framing on galvo lasers when doing rotary engravings.

7.3 New Alignment Features

7.3.1 Alignment Guides

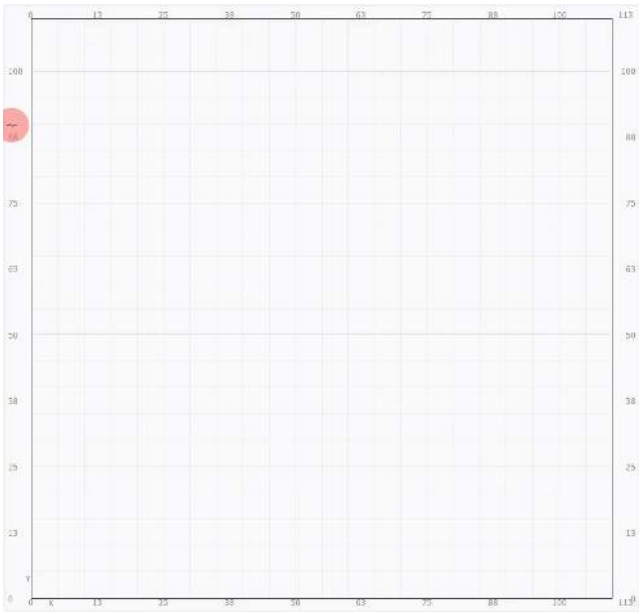
While dragging to draw, move, or scale objects, holding Alt will produce alignment guides for edges and midpoints of existing objects.



Using Alignment Guides by holding down ⎇ Alt *while drawing*

7.3.2 Draggable Guidelines Added

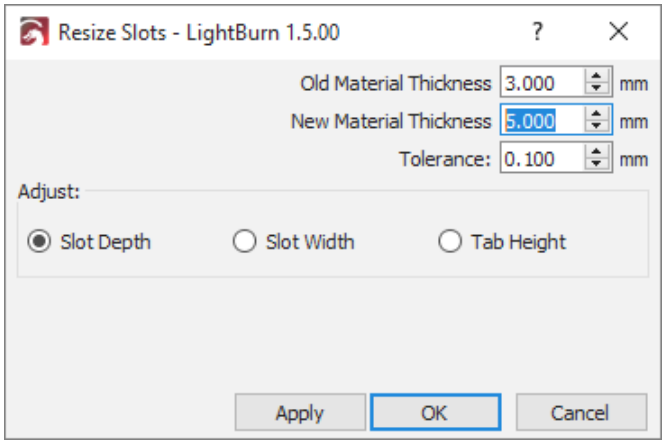
Horizontal and vertical guidelines can now be created by dragging from the ruler area of the LightBurn workspace. Guidelines can be treated like any other line, including locking them to prevent accidental movement.



7.4 Tool Enhancements & New Taper Warp Tool

7.4.1 Slot & Tab Resizer Improvements

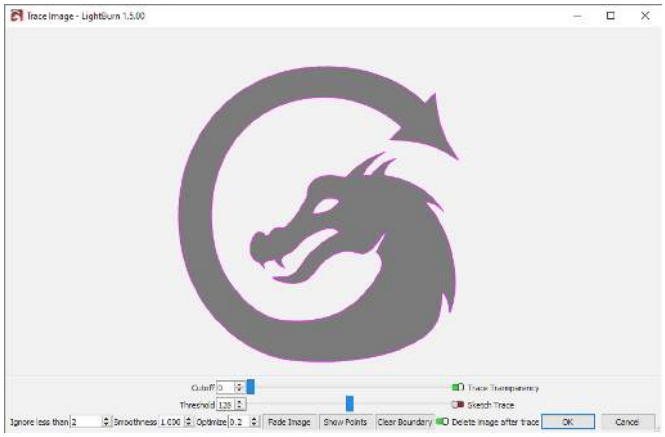
Starting in version 1.5, the Slot & Tab Resizer has an **Apply** button to apply changes without closing the window. This makes performing multiple operations, such as changing both slot depth and slot width, more convenient.



*The new **Apply** button in the Slot & Tab Resizer*

7.4.2 Trace Image Transparency

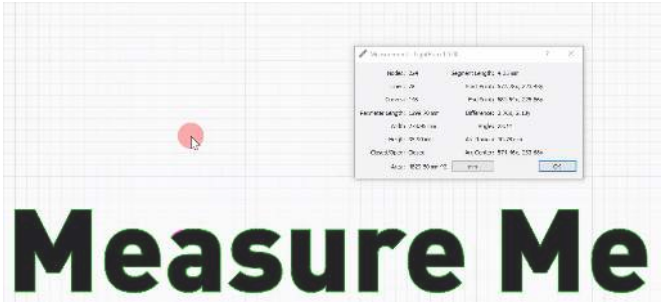
Image Trace can now trace an image's transparency channel.



*Enabling **Trace Transparency** provides an easy way to trace the edges of an image with a transparent background*

7.4.3 Measure Tool Axis Snap

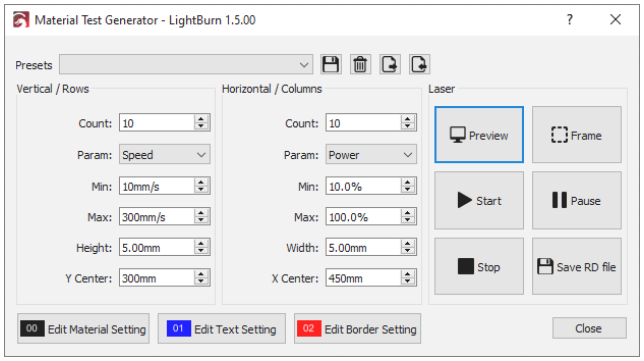
While using the Measure Tool, hold ⇧ Shift and drag to snap to horizontal, vertical, and 45 degree angles.



Dragging with axis snapping

7.4.4 Outer Border Added To Material Test

The Material Test Generator now automatically generates a border to cut out the test grid. Use the **Edit Border Setting** button to change cut settings.



7.4.5 Taper Warp Tool Added

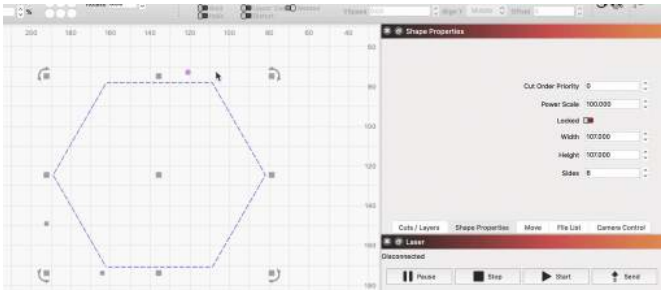
LightBurn now has a Taper Warp Tool for improved rotary engravings on tapered objects.

Select which side of the artwork is at the top of the object, measure the object, and LightBurn will automatically calculate and apply the warp needed to counteract the distortion produced by engraving on a tapered object.

The orange tool layers represent the text and its boundaries before being altered by Taper Warp

7.4.6 Drag Handle For Polygon Side Count

When using the Polygon Tool, there is now a purple handle that can be dragged to change the number of sides. This has the same result as changing the **Sides** property in the Shape Properties Window.



Using the new Polygon Drag Handle

7.5 New Device Types Added

7.5.1 New Dummy Machine Type

When creating a laser manually, LightBurn now has a **No Machine** option, simplifying the process of running LightBurn without a specific device connected.

7.5.2 Custom GCode Added

The new Custom GCode device type can be used to customize LightBurn's GCode output to control less common or custom devices.

7.6 New Shape Property Added For Text

Starting in version 1.5, text objects have a new Shape Property called **Squeeze** that works with the **Max Width** property. With Squeeze enabled, scaling with Max Width will scale the text horizontally to maintain a consistent height. With Squeeze disabled, text scales proportionally to maintain a consistent appearance.

*Using **Max Width** with **Squeeze** on and off*

7.7 Other UI Improvements

7.7.1 Copy Along Path Improvements

Starting in version 1.5, Copy Along Path will use the nearest point on the path as the start point.

***Copy Along Path** now automatically starts from the nearest point on the path*

7.7.2 Merge Button Added to Material Library

The Material Library window now has a **Merge** button. Use this button to merge a material library on disk with your active material library.

7.7.3 Zero Out Rotary Axis

When working with a rotary, LightBurn now has the ability to reset the rotations on the rotary axis to 0.

7.8 Warning For Users of 32-bit Windows Computers

LightBurn 1.5 will be the last version of LightBurn to support 32-bit versions of Windows.

8. Tags

8.1

Advanced

- Advanced LightBurn Bridge Setup
- Cylinder Correction
- Galvo Anatomy
- Galvo Settings
- Index
- Layer Colors
- Lens Correction
- Moving LightBurn To Another Computer
- Multi LB Win
- Optimization Settings
- Rotary for Galvo

8.2

Beginner Docs

- Adding and Configuring a Laser
- Create Manually
- How To use LightBurn
- Installation & Setup
- Laser Types
- What Is LightBurn?
- Your First Project

8.3

Calibration

- Focusing
- New Lens Setup

8.4

Camera

- Camera Alignment
- Camera Calibration
- Camera Installation
- Camera Selection
- Camera Window
- Index

8.5

DSP

- Camera Alignment
- Camera Calibration
- Camera Installation
- Camera Selection
- Camera Window
- Index
- Rotary Setup

8.6

Editing

- Two-Point Rotate

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First Steps

- Adding and Configuring a Laser
- Find My Laser
- How To use LightBurn
- Laser Types
- What Is LightBurn?
- Your First Project

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GCode

- Custom GCode

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GRBL

- Camera Alignment
- Camera Calibration
- Camera Installation
- Camera Selection
- Camera Window
- Common GRBL/GCode Setups
- Console Window
- Custom GCode
- Index
- Move Window
- Rotary Setup (GRBL)
- WiFi Connection (GRBL)

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Galvo

- 3D Sliced Engravings
- Camera Alignment
- Camera Calibration
- Camera Installation
- Camera Selection
- Camera Window
- Cylinder Correction
- EZCAD Hatch & LightBurn Fill
- Focusing
- Framing Mode
- Galvo Anatomy
- Galvo Installation
- Galvo Settings
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- Lens Correction
- LightBurn & Galvos
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Gantry

- Rotary Setup
- Rotary Setup (GRBL)

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Guides

- Create Manually
- Laser Guides
- Multi LB Win

8.13

Job Quality

- Troubleshooting: Corners Are Too Dark, Too Light, Or Missing
- Troubleshooting: Dark & Burned Edges
- Troubleshooting: Engraving Shifted Relative To Cut Lines
- Troubleshooting: Fuzzy, Blurry, or Overblown Edges
- Troubleshooting: Inconsistent Engraving Tone or Color
- Troubleshooting: Incorrect Size
- Troubleshooting: Jagged Lines
- Troubleshooting: Job Results & Quality Issues
- Troubleshooting: Laser Keeps Firing During Travel Moves

- Troubleshooting: Laser Losing Power At Low Speeds Or Not Reaching Full Power
- Troubleshooting: Layers Shift When Cutting Multiple Objects
- Troubleshooting: Periodic Defects In Engravings
- Troubleshooting: Poor Image Quality
- Troubleshooting: Slanted Or Skewed Job Results
- Troubleshooting: Warped Or Disconnected Lines
- Troubleshooting: Wiggly Lines At Corners
- Troubleshooting: Wobbly Engraving
- Troubleshooting: Wrong Orientation
- Troubleshooting: Wrong Start Location

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Libraries

- Art Library
- Material Library

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LightBurn 1.2

- 3D Sliced Engravings
- Cylinder Correction
- Focusing
- Galvo Anatomy
- Galvo Installation
- Galvo Settings
- Galvo Setup
- Lens Correction
- LightBurn & Galvos
- New Lens Setup
- Rotary for Galvo

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LightBurn Bridge

- Advanced LightBurn Bridge Setup
- LightBurn Bridge

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Machine Guides

- Ethernet Connection (Ruida)
- Ethernet Connection (Trocen)
- Sculpfun S9 Flashing Guide

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Network

- WiFi Connection (GRBL)

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Output Issues

- Troubleshooting: Corners Are Too Dark, Too Light, Or Missing
- Troubleshooting: Dark & Burned Edges
- Troubleshooting: Engraving Shifted Relative To Cut Lines
- Troubleshooting: Fuzzy, Blurry, or Overblown Edges
- Troubleshooting: Inconsistent Engraving Tone or Color
- Troubleshooting: Incorrect Size
- Troubleshooting: Jagged Lines
- Troubleshooting: Job Results & Quality Issues
- Troubleshooting: Laser Keeps Firing During Travel Moves
- Troubleshooting: Laser Losing Power At Low Speeds Or Not Reaching Full Power
- Troubleshooting: Layers Shift When Cutting Multiple Objects
- Troubleshooting: Periodic Defects In Engravings
- Troubleshooting: Poor Image Quality
- Troubleshooting: Slanted Or Skewed Job Results
- Troubleshooting: Warped Or Disconnected Lines
- Troubleshooting: Wiggly Lines At Corners
- Troubleshooting: Wobbly Engraving
- Troubleshooting: Wrong Orientation
- Troubleshooting: Wrong Start Location

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Primary Docs

- Advanced LightBurn Bridge Setup
- Arrangement Toolbar
- Art Library
- Center Finder
- Common GRBL/GCode Setups
- Configuring A Ruida
- Console Window
- Creation Tools
- Cut Shapes Tool
- Cuts and Layers
- Device Settings
- Docking Tool
- File List
- Find My Laser
- Image Adjustment
- Interval Test
- Laser Control
- License Management
- LightBurn Bridge
- LightBurn Settings
- Machine Settings
- Material Library
- Material Test
- Measure Tool

- Modifier Tools
- Move Window
- Numeric Edits
- Optimization Settings
- Overview
- Shape Properties
- Text & Fonts
- Trial or License Activation
- Two-Point Rotate
- Variable Text in LightBurn

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Rotary

- Rotary Setup
- Rotary Setup (GRBL)
- Rotary for Galvo

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Ruida

- Configuring A Ruida
- Ethernet Connection (Ruida)
- File List
- Move Window

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Sculpfun S9

- Sculpfun S9 Flashing Guide

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Settings

- Device Settings
- LightBurn Settings
- Machine Settings

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Text & Fonts

- Text & Fonts
- Variable Text in LightBurn

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Thunder Laser

- Ethernet Connection (Ruida)

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Tools

- Camera Alignment
- Camera Calibration
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- Two-Point Rotate
- Variable Text in LightBurn

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Trocen

- Ethernet Connection (Trocen)

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Troubleshooting

- Create Manually
- EZCad Wireshark Data Capture
- GRBL Errors And Alarms
- GRBL: Low or No Power Output
- LightBurn Editor FAQ
- Troubleshooting
- Troubleshooting - Connection Issues
- Troubleshooting - LightBurn
- Troubleshooting - LightBurn Editor
- Troubleshooting - Output Issues
- Troubleshooting - Ruida errors
- Troubleshooting: Connection Problems
- Troubleshooting: Corners Are Too Dark, Too Light, Or Missing
- Troubleshooting: Dark & Burned Edges
- Troubleshooting: Drivers
- Troubleshooting: Electrical Problems
- Troubleshooting: Engraving Shifted Relative To Cut Lines
- Troubleshooting: Fuzzy, Blurry, or Overblown Edges
- Troubleshooting: GRBL Communications
- Troubleshooting: GRBL Errors
- Troubleshooting: Inconsistent Engraving Tone or Color
- Troubleshooting: Incorrect Size

- Troubleshooting: Jagged Lines
- Troubleshooting: Job Results & Quality Issues
- Troubleshooting: Laser Keeps Firing During Travel Moves
- Troubleshooting: Laser Losing Power At Low Speeds Or Not Reaching Full Power
- Troubleshooting: Layers Shift When Cutting Multiple Objects
- Troubleshooting: Linux-Specific Problems
- Troubleshooting: Mechanical Issues
- Troubleshooting: Periodic Defects In Engravings
- Troubleshooting: Poor Image Quality
- Troubleshooting: Serial Port Problems
- Troubleshooting: Setting Up CNC-Based Lasers
- Troubleshooting: Slanted Or Skewed Job Results
- Troubleshooting: USB Cables
- Troubleshooting: Warped Or Disconnected Lines
- Troubleshooting: Wiggly Lines At Corners
- Troubleshooting: Windows-Specific Problems
- Troubleshooting: Wobbly Engraving
- Troubleshooting: Wrong Orientation
- Troubleshooting: Wrong Start Location

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UI

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WiFi

- WiFi Connection (GRBL)

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Windows

- Multi LB Win