

December 23, 2020

# LIGHTBURN

BETTER SOFTWARE FOR LASER CUTTERS

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Welcome to LightBurn! (excuse the mess - these new docs are a work in progress)

Disclaimer and Safety information

Please click the closest match for what you're trying to find.

Beginner topics:

[Setting up LightBurn for the first time](#)

[Adding your laser to LightBurn](#)

[Configuring a laser for use with LightBurn](#)

[User Interface walk-through for beginners](#)

[Zooming, Panning, and Selection](#)

[Getting started - Making a simple project](#)

[Coordinates, Device Origin, and Job Origin - Placing your work](#)

General usage:

[How to use specific features in LightBurn](#)

[Advanced Topics](#)

[Cool tricks and usability tips](#)

[Download PDF Version](#)

## # Disclaimer and Safety

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. CO2 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:***

You will not hold the author or contributors of LightBurn liable for any damage to equipment or persons from the use of LightBurn.

You understand the potential hazards in using high power lasers and high voltages.

You will wear proper eye-protection rated for your laser when operating it.

You will use the LightBurn software in a legal and safe manner.

You relieve the author and contributors from any liability arising from the use or distribution of the LightBurn software.

You are entirely operating at your own risk. Lasers can be lethally dangerous.

# Setting up LightBurn for the first time

Downloading the software

Installing LightBurn

Running LightBurn for the first time

**Skip Ahead:** For more info on how to use LightBurn, check out the [Software walk-through for beginners](#)

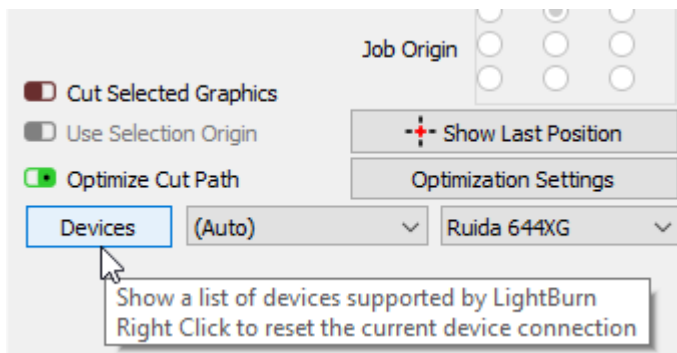
# Adding Your Laser to LightBurn

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 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.

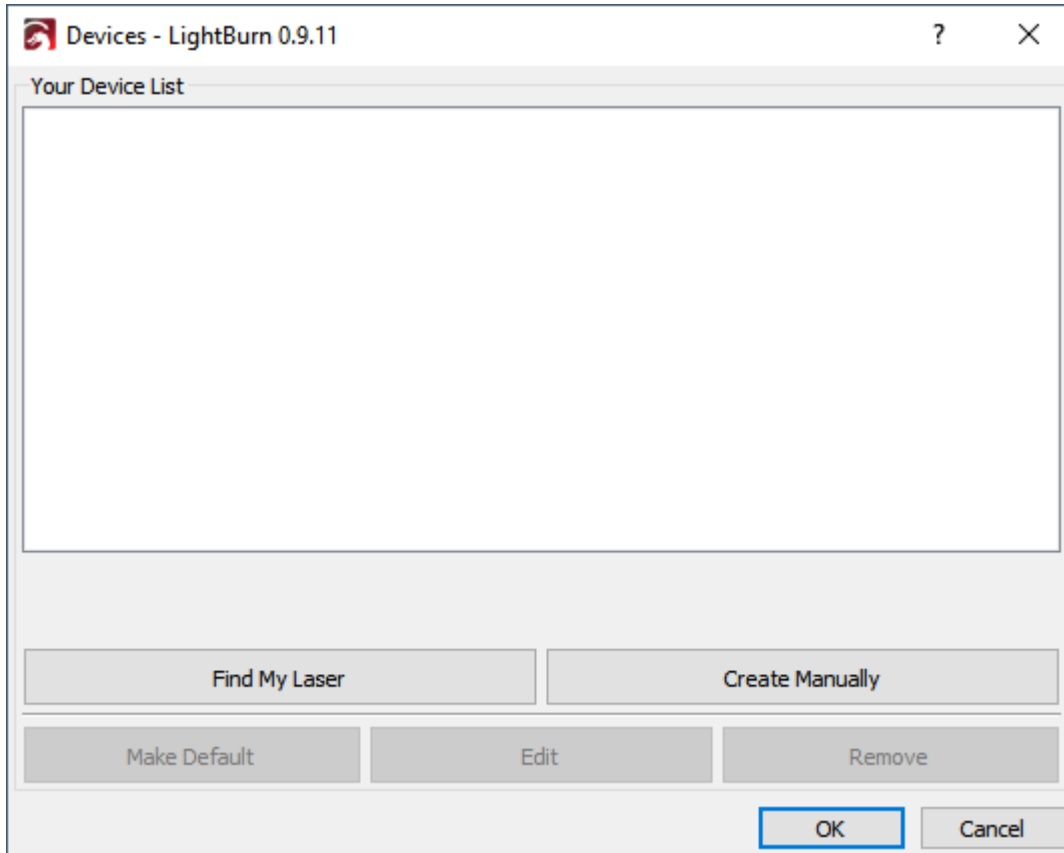
If you've done this before, but want to change your laser, or add a new one, click the 'Devices' button in the **Laser Window** to bring up the devices list.



DevicesButton

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 PAGE



### DevicesPage

This is the Devices page 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 try to figure out what you have. If that doesn't work, your laser connects with Ethernet, or you have a Marlin device, you'll need to use 'Create Manually'.

Find My Laser

Create Manually

# Configuring a laser for use with LightBurn

If you have a DSP controller that came already installed in your laser, you shouldn't need to do anything to set your machine up for use with LightBurn, and can move on to the [beginner walkthrough](#).

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

Troubleshooting (to be completed)

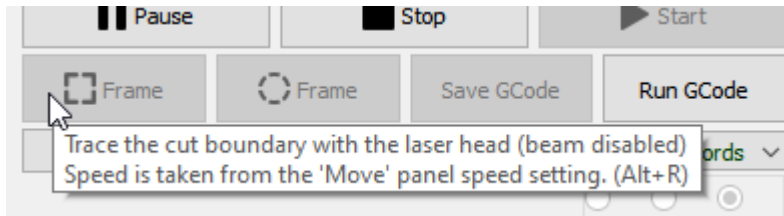
If you have a Ruida DSP controller, and are configuring from scratch, read [here](#):

[Configuring a Ruida](#)

# LightBurn walk-through for beginners

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 a couple features to make it easier to learn:

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

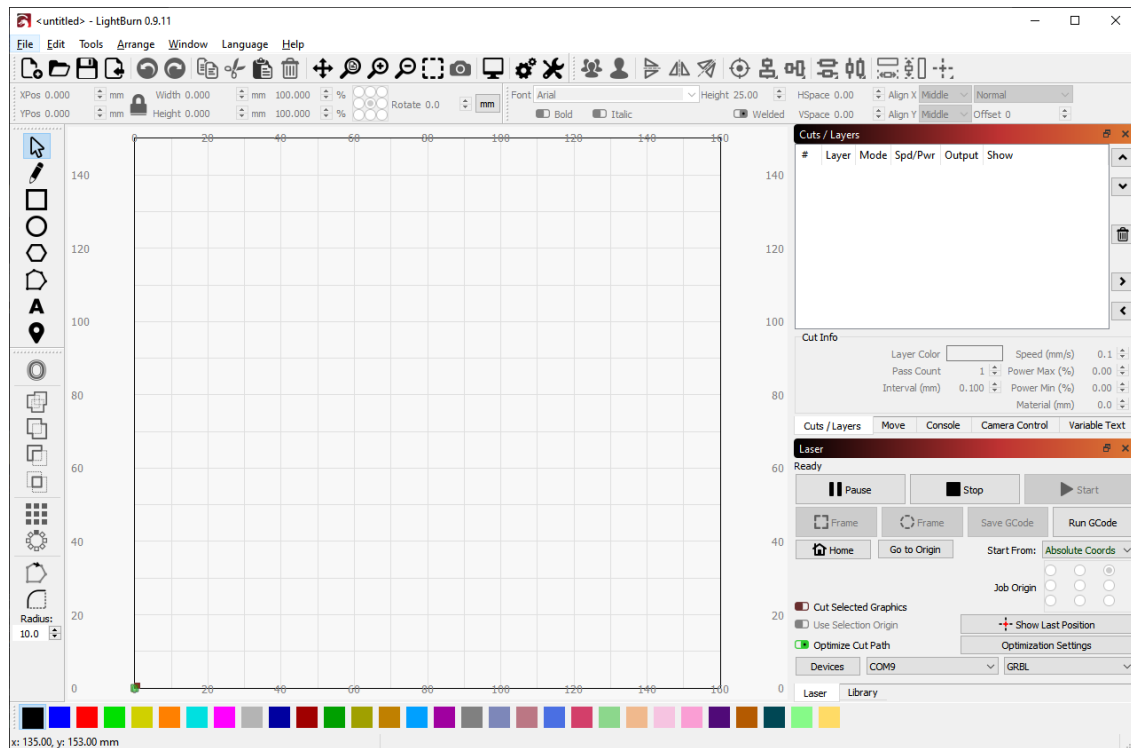


ToolTips-1

Context-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.

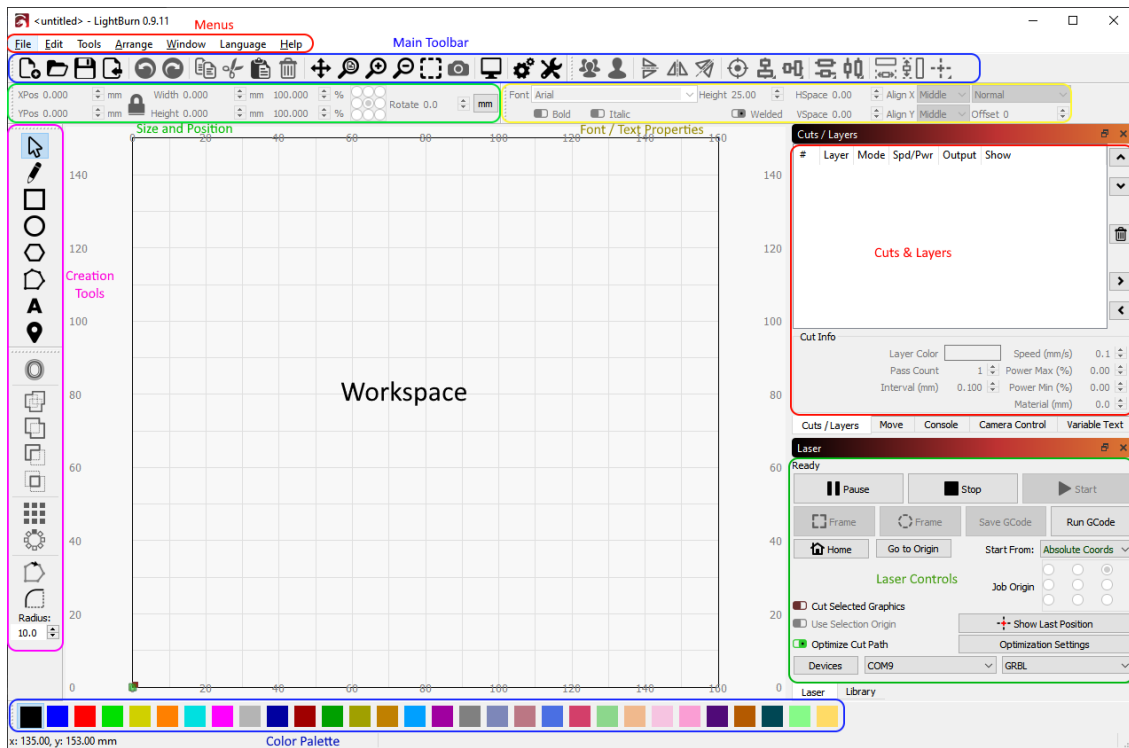
## THE MAIN WINDOW

This is the default layout for the main LightBurn window:



MainWindow

Here it is again, with the sections labeled:



MainWindow

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:

- Menus
- Main Toolbar
- Creation & Modifier Tools
- Color Palette
- Cuts / Layers window
- Size and Position / Numeric Edits
- Font and Text properties
- Laser control window
- The workspace / Edit window

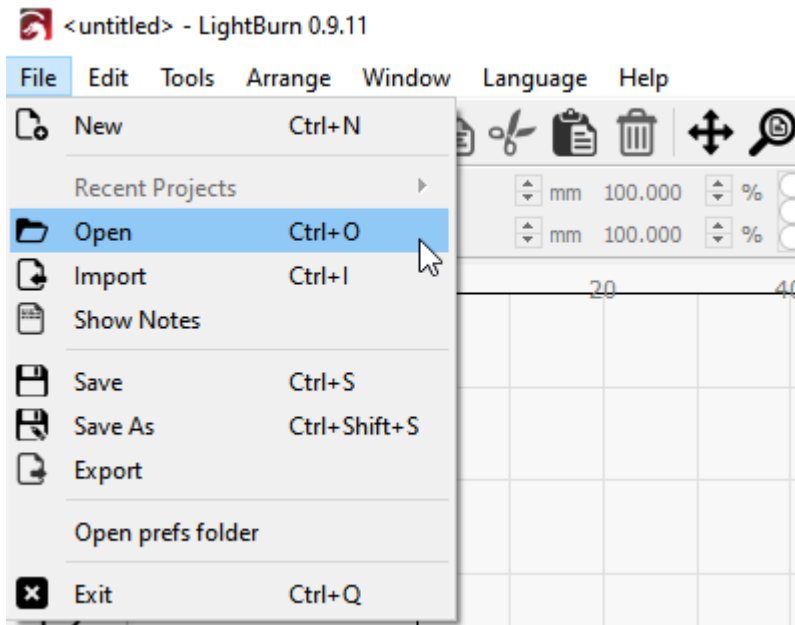
For a full list of the windows in LightBurn, see the [LightBurn Windows](#) topic in the help.

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, click Window, and re-enable the window you want back.

## 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.





### Menus

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.

### Menus in depth

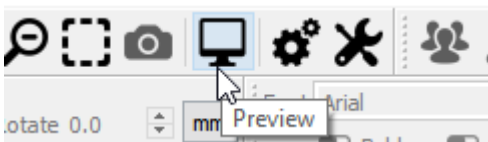
## MAIN TOOLBAR

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.



### MainToolBar

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



### MainToolBar-Tooltip

### Main Toolbar in depth (to be completed)

### Arrangement Toolbar in depth

## 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.



CreationTools

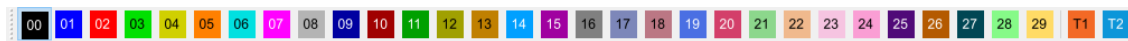
The first tool, 'Select' is probably the one you'll use most, and is the default tool chosen when LightBurn starts. The others are used to create basic shapes like circles and rectangles, text, and lines, and there are few for modifying shapes in more complicated ways, like merging shapes, or creating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

Creation Tools in depth

Modifier Tools in depth

## 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.



ColorPalette

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 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 represents.

### Tool Layers

There are 2 special layers at the end of the cut palette, labeled **T1** and **T2**. These are **Tool Layers** and are purely 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:

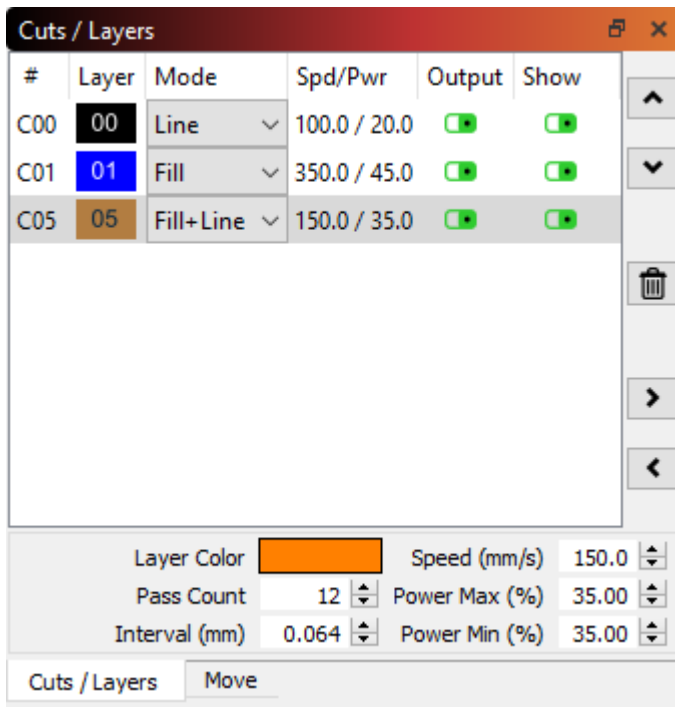
Indicating pre-determined material size and position on your machine

Text on a Path (without the path being output)

Image Masking

## CUTS / LAYERS

This window shows the colors currently in use in your design, and lets you quickly access the settings assigned to them.



CutsAndLayers

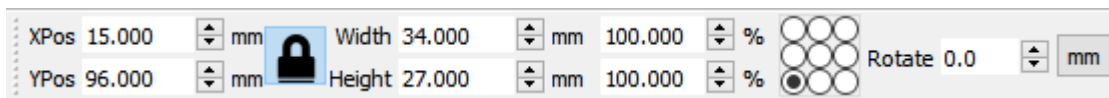
The first column shows the name you've assigned to this layer, followed by the color, then the Mode (Line, Fill, both, or Image). Then the speed and power are displayed, followed by the options to enable or disable sending this layer to the laser, or displaying it in the workspace.

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

Cuts / Layers window in depth (to be completed)

## SIZE AND POSITION / NUMERIC EDITS

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



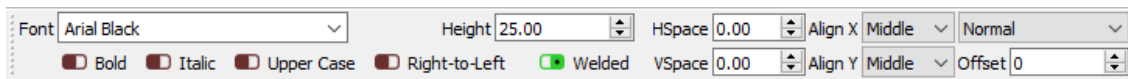
NumericEdits

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 point that positioning and sizing happens from. The number entry boxes accept equations and units, too - You can enter 5mm, 5in, 5", 5\*3mm, and so on, and LightBurn will calculate the correct result for you.

Numeric Edits toolbar in depth

## FONTS AND TEXT CONTROLS

The font and text toolbar will activate when you use the 'Create Text' tool, or select text objects.



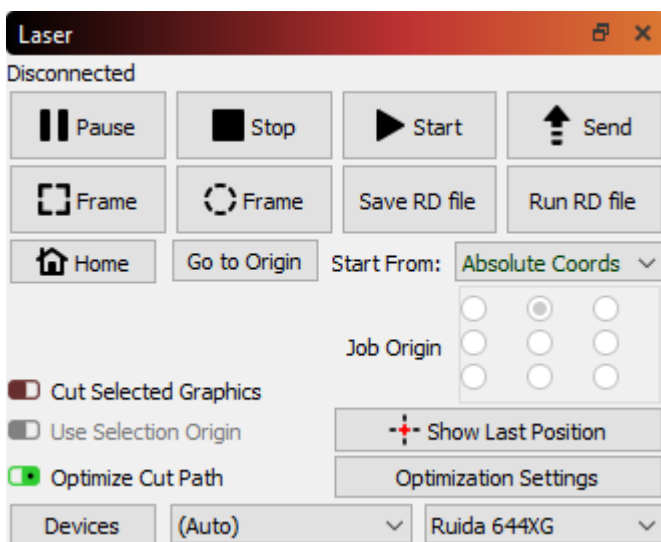
FontAndText

This toolbar lets you change the font, size, spacing, alignment, and automatic welding. It also has settings for variable text options, like serial numbers, dates, and using data tables from a CSV file.

Fonts and Text in depth

## LASER WINDOW

The Laser window is used to choose the laser to use, test the position of a file (frame), run or stop the laser, and choose various options that affect how the current file will be processed, ordered, and positioned on the machine.



LaserWindow

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'.

Laser Window in depth

## WORKSPACE / EDIT WINDOW

Finally, the workspace, or edit window, is the drawing area where you lay out your design. The size of the border and grid drawn in the workspace matches the available work area on your machine. When you import artwork it is displayed here, and the arrangement of things will match the output sent to your laser.

**Next Step:** Zooming, Panning, and Selecting

# Zooming, panning, and selection


The Edit Window, the center of the main display, can be moved around and zoomed with the mouse to help you focus on different parts of your design.

## ZOOMING

Scrolling the mouse wheel will zoom in or out from the location of the mouse - you can simply point at something with the mouse and scroll the mouse wheel to zoom in on that point. If you have a touch-pad (like a Mac) using a two-finger swipe up or down does the same thing.

You can also use the - and + keys in the upper-right of the keyboard to zoom.


## 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.

There are buttons on the main toolbar for panning and zooming too:



PanAndZoom

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.

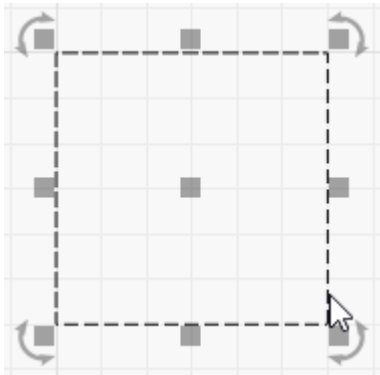
The second button is Zoom to Page - clicking this will reset the view in the workspace to frame the entire work area, which is the view that LightBurn starts with.

The next two buttons are Zoom in and Zoom out. Clicking them will zoom in or out of the center of the view. You can also press the - and + keys in the upper-right of your keyboard for this, or use the mouse wheel.

The 4th button is Frame Selection - Clicking this will zoom the view to focus on whatever is currently selected, or all the shapes in your project if you haven't selected anything.

## SELECTION

There are multiple ways to select things in the edit window (workspace). The simplest is to point the mouse at the outline of a shape and click it with the left mouse button.



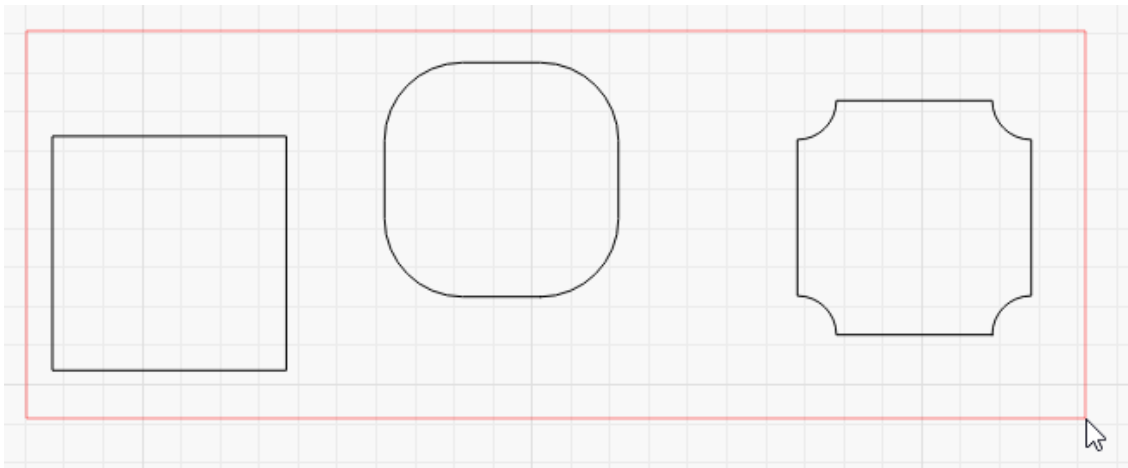
ClickSelect

A few things happen when a shape is selected:

- The selected shape is drawn with an animated pattern instead of solid lines
- The edit handles for resizing, positioning, or rotating the selection appear
- The size and position of your selection is shown in the Numeric Edits toolbar
- Other controls in LightBurn may activate, depending on what you've selected

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

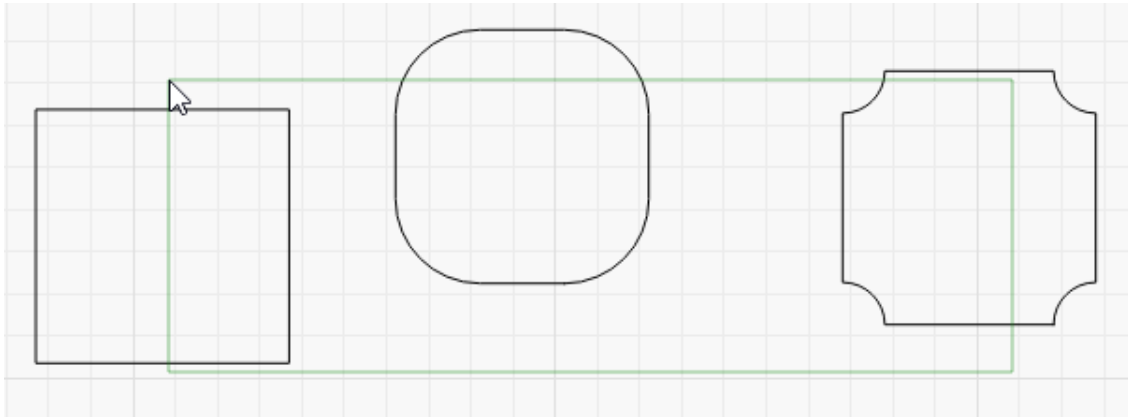
You can select a collection of shapes by pressing and holding the left mouse button and dragging a rectangle around the things to select, from left to right, like this:



DragSelect-Enclosing

The red rectangle will disappear when you release the mouse button, and all the shapes 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:



DragSelect-Crossing

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+Shift:** Holding both Ctrl and Shift will remove the new selection from the current one

**Ctrl:** 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

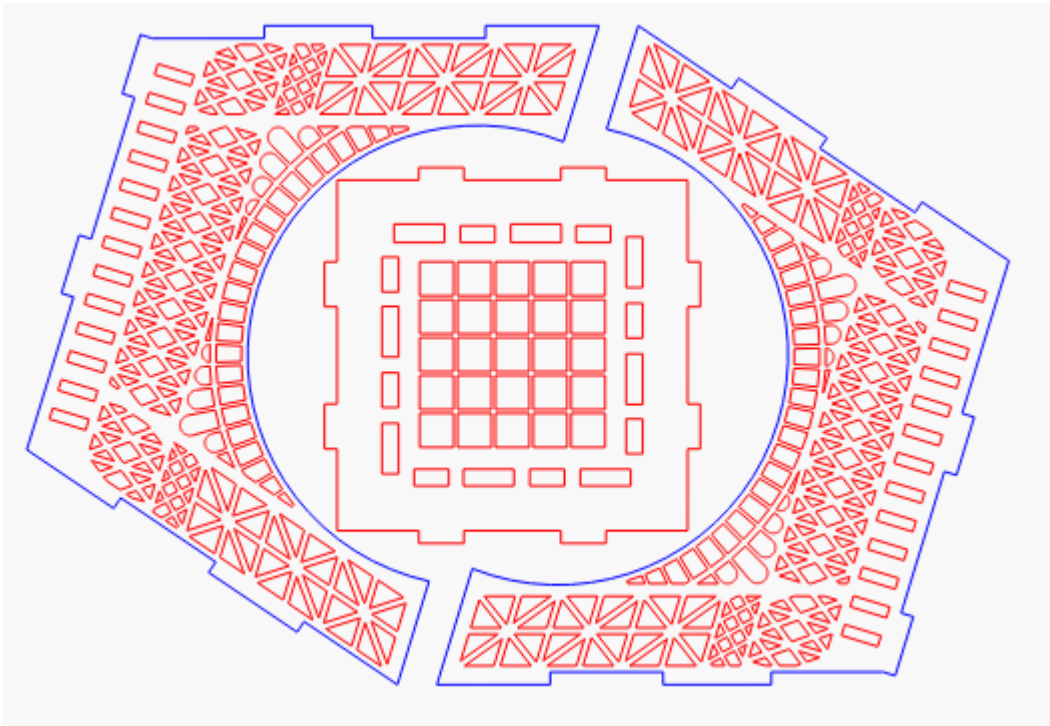
**Invert Selection:** Anything selected becomes unselected, and anything unselected is now selected

**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.

**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:



SelectContainedExample

**Next Step:** Basic Usage - The Essentials



# Making a Simple Project

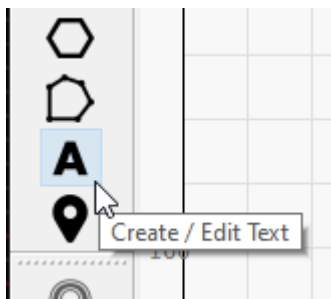
We're going to go step-by-step through creating a small, simple project in LightBurn, from start to finish, to show you how to use a few of the basic editing tools, and give you a feel for how things work.

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:

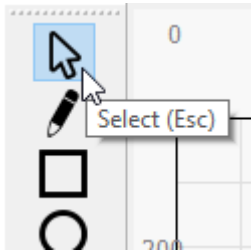


CreateTextButton

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

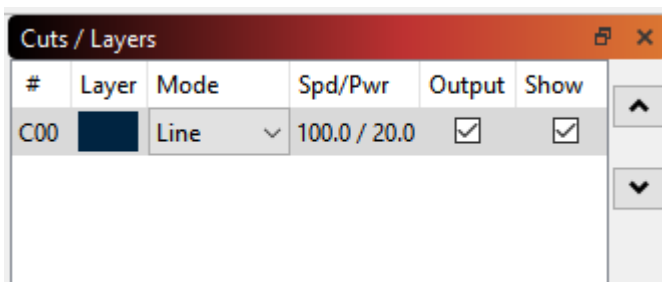


Click the 'Select' tool button on the top left of the edit window, or press 'Esc' twice (once to finish entering text, and again to exit text entry and go back to selection mode).



SelectButton

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:

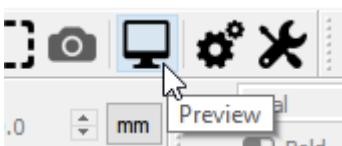


NewLayerEntry

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 default there would be 6000 mm/min. If you have your units set to Inches, you might see 3.9 in/sec, or 236 in/min.

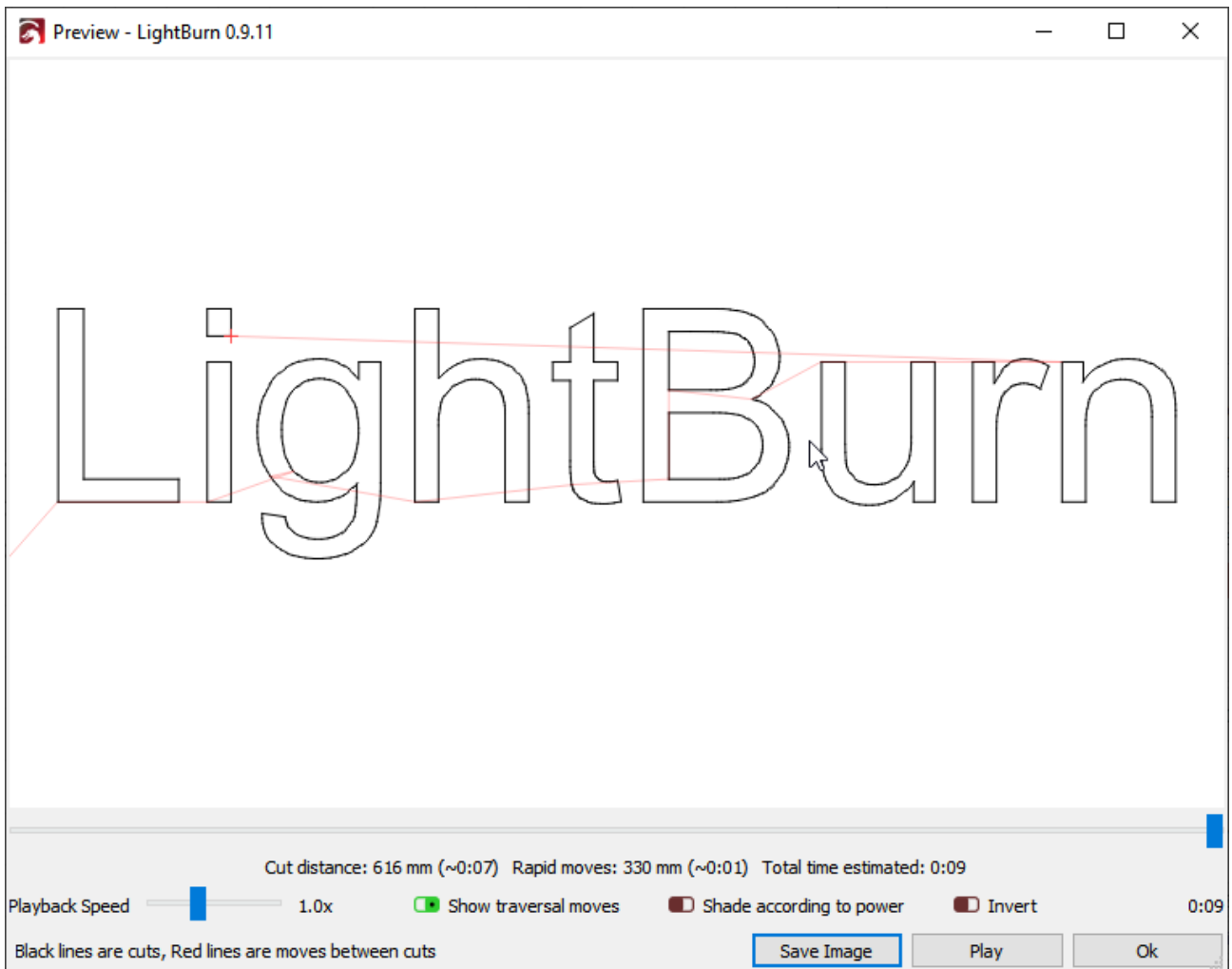
## Previewing

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



PreviewButton

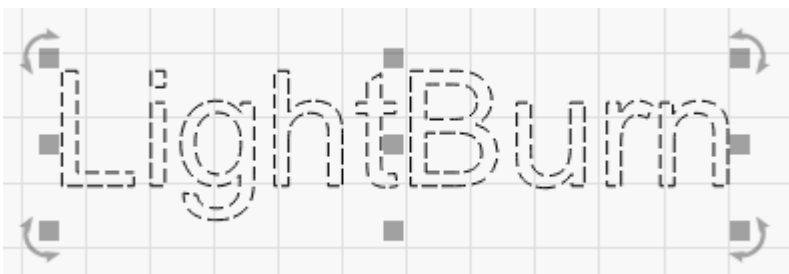
The preview window will pop up, showing the completed job, like this:



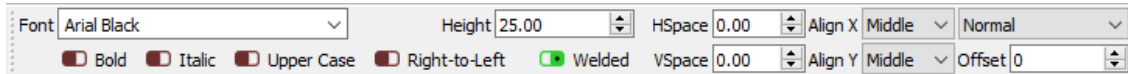
The lighter red lines are showing the laser moving between the shapes (traversal moves), and the black lines are where the laser will burn. Click the 'Play' button and you can watch a simulation of how the laser will run the job. You can also grab the slider and drag it around to see the cut at different 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.

## 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:



TextToolbar

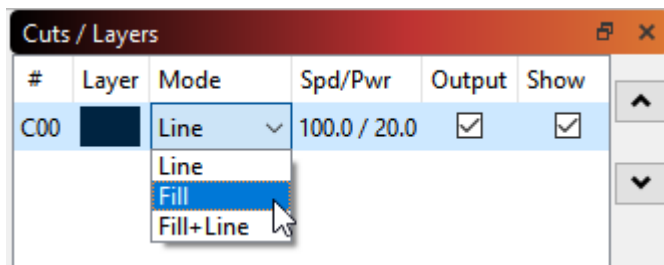
Click the drop down for the font, and change it to anything you like. While you are choosing, the changes will be displayed in real time in the edit window. You can change the height, make it bold or italic, and adjust spacing here too.

## 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). 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:

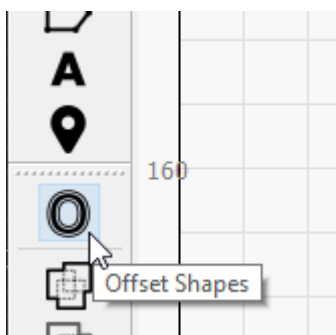


LayerSettingToFill

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.

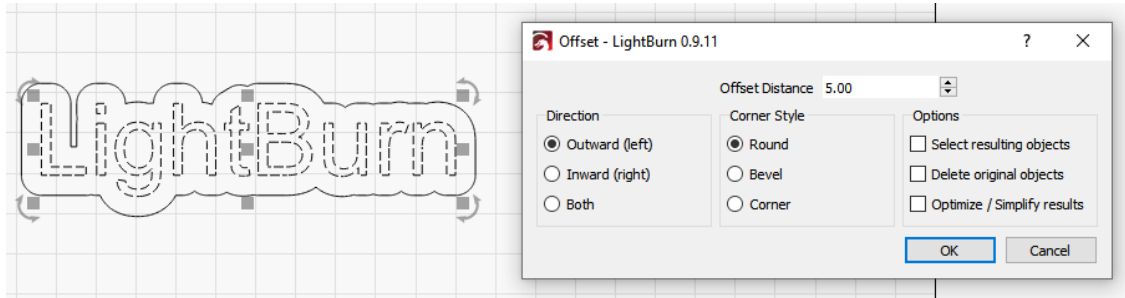
## Adding an outline: The Offset tool

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



OffsetButton

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



OffsetButton

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:



OffsetButton

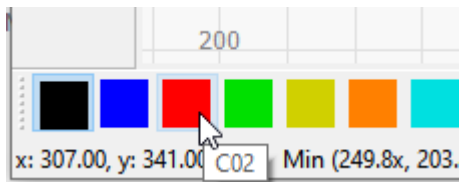
When you're happy with the result, click 'OK'.

## 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:



ClickTheRed

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

#	Layer	Mode	Spd/Pwr	Output	Show
C00		Fill	100.0 / 20.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
C02		Line	100.0 / 20.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>


TwoLayersInList

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 for me, as the author of this tutorial. 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 1/8" basswood uses much less power than cutting through 1/4" plywood or acrylic. I'm going to assume 1/8" (3mm) 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:

Cut Info	
Layer Color	 Speed (mm/s) 100.0
Pass Count	1 Power Max (%) 20.00
Interval (mm)	0.100 Power Min (%) 10.00
	Material (mm) 0.0

CutInfo

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

If you have a CO2 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 CO2 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.

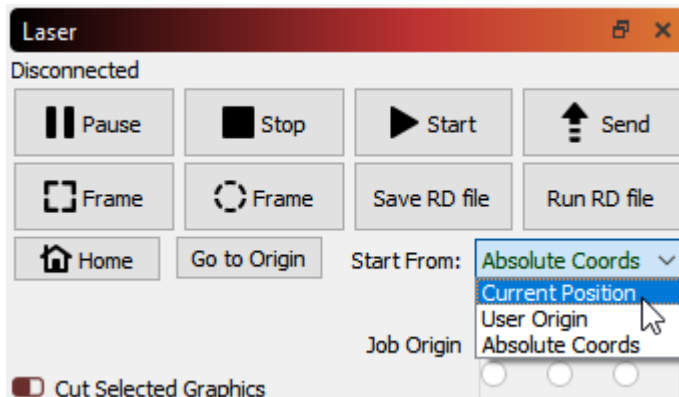
Open the Preview window again (Alt+P, or click the Preview button), then drag the progress slider from left to right to watch how the job will run. You'll see the text engrave first, followed by the outline cut. If you don't see those things, check the settings again, and verify that you have the first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



CutInfo

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 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).

## **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:**

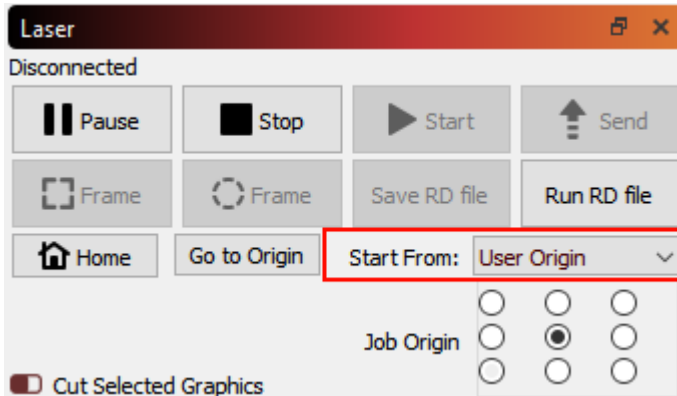
We recommend going through some of our "LightBurn Basics" tutorials on YouTube, and we have a great project tutorial that's a little more in depth called the "WIFI QR Code tutorial" that covers more ground, including importing.

LightBurn YouTube channel  
WIFI QR Code Tutorial



# Coordinates and Job Origin

There are a couple different ways to tell LightBurn how to cut the project within the work area of your machine. You choose them in the “Start From” box on the Laser tab:



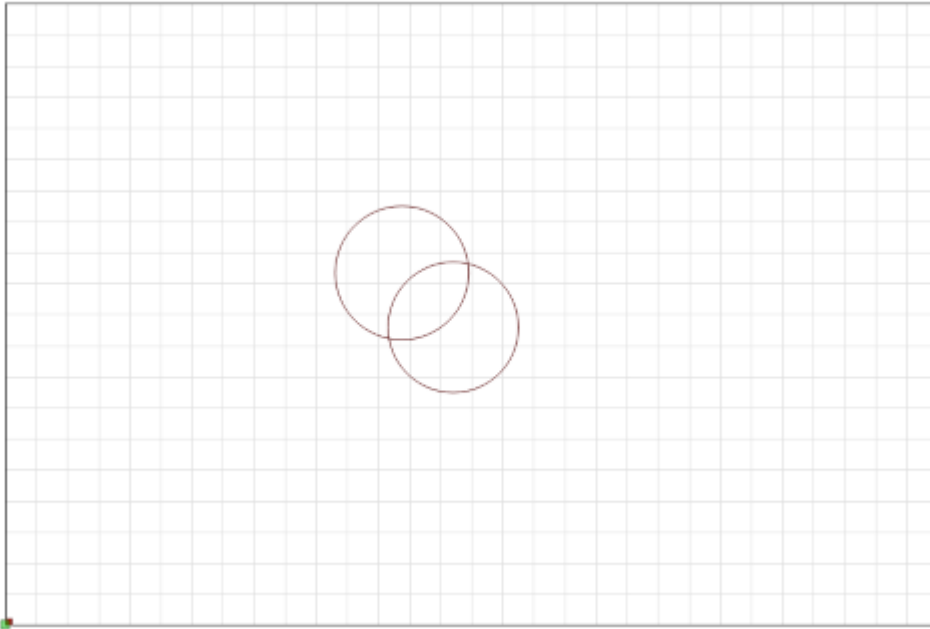
Start From

## ABSOLUTE COORDINATES

**Absolute Coordinates** is the simplest - The page grid you see in the main editing window represents your machine’s work area. Anything you place in that area will be cut in the corresponding place on your machine. Users with small lasers like the K40 will likely find this the simplest and most intuitive option.

**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 sensors, you will need to manually zero the machine. See [Machines without homing sensors / limit switches](#).

In the image below, the two circles placed in the middle of the work area 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. In “Absolute Coordinates” these are always in the same place.

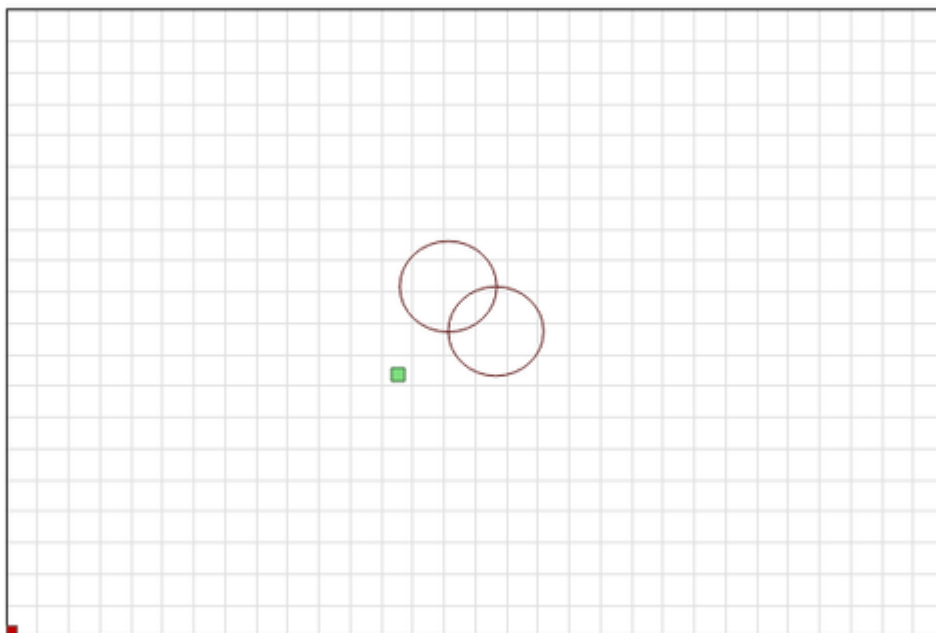


Coordinates Absolute Position

## CURRENT POSITION

**Current Position** is probably the next easiest to use. Your job cuts relative to the current position of the laser head when you hit the Start button. You use the “Job Origin” control in the Laser window to tell LightBurn how to position the job relative to the laser.

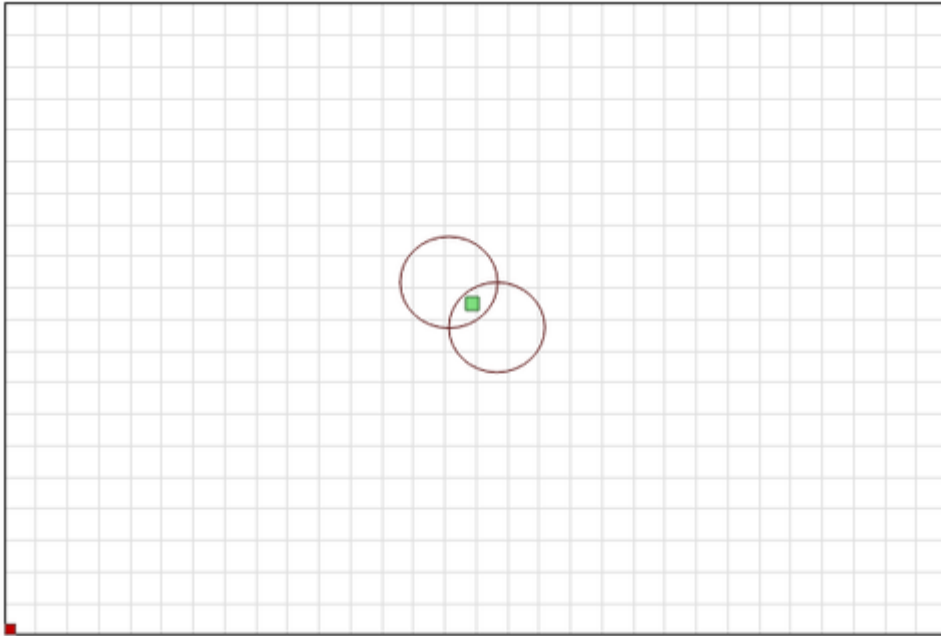
In this image, we’re starting from the Current Position, with the Job Origin set to the lower left:



Coordinates Absolute Position

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.

Imagine that you wanted to cut this amazing two-circle pattern onto a beverage coaster or a phone case. Lining it up like this is not easy. If you change the Job Origin setting to "Center", you get this instead:



Coordinates Center

Now the job is going to be cut centered around the current position of the laser head. If you position the laser directly over the center of the item you want to cut, the resulting image will be centered on the item.

Using Current Position and Job Origin together lets you line up a cut on a piece of material with ease, once you understand how it works.

## USER ORIGIN

**User Origin** works almost exactly the same as Current Position, except that the starting location is "programmable". Some lasers have an "Origin" button on them (like Ruida controllers). GCode based systems use the "Set Origin" button in LightBurn to do the same thing. You jog your laser to the position you want your job to start from, hit the "Set Origin" button, and then you're free to move the laser around again. If you specify "User Origin" as the "Start From" value, the laser will move back to that programmed location and start the cut from there.

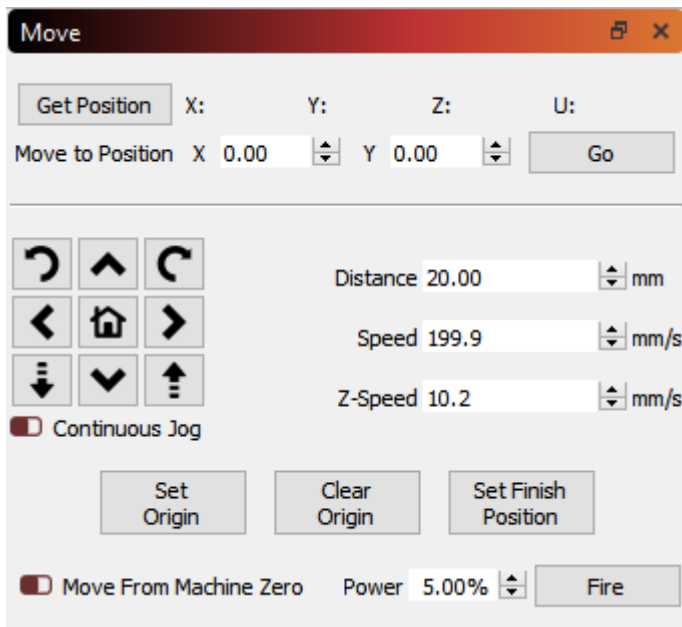
## FINISH POSITION

*Note that the Finish Position setting is for GCode-based controllers only. DSP controllers manage this internally.*

LightBurn gives you the control of where you want the head of the laser to return to after a job is finished. By default it will return to 0,0 however this is not the optimal location for some machines.

To change your finish position, go to the Move tool window and use the arrows to reposition your laser head to where you would like it to return to on job finish. Then click the **Set Finish Position**

button. Your machine will now remember that spot for future jobs. This can be reset at any time by repeating these steps for a new location.



Move Tool Window

# Using Specific Features in LightBurn

Coordinates, Device Origin, and Job Origin - Placing your work

Creating Shapes

Fonts and Text

Node Editing - Editing shapes

Selection

Tracing Images

Variable Text - Serial numbers, mail-merge, and more

# Advanced Topics

Configuring a Ruida Controller

Engraving Images (to be completed)

Optimization Settings - Adjusting the cut order for faster cuts

Print and Cut - Perfectly registered cutting of printed shapes, or multiple jobs

Scanning Offset Adjustment - Correcting shifted fills

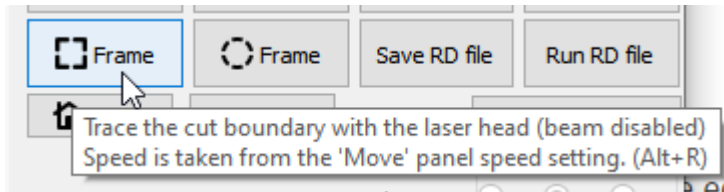
Using a Camera with LightBurn - aligning your work with a USB camera

# Tips and Tricks

LightBurn has a decent number of user interface tricks that aren't always obvious, so we're listing them here.

## Pop-up 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:



---

## Topic-aware help function

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.

###

Reset the window layout  
Sometimes a window gets shoved 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 redock them in the default order. - If that doesn't do it, restart LightBurn while holding the Shift key - this skips restoring the saved window layout, and always works.

## **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 > are rotate 90 counterclockwise and clockwise

Tab - Select the next shape in the shape list


Number pad arrows - Jog the laser

---



## 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

---

## 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:

50mm, 5cm

10 in, 10"

2 ft, 2'

10.25 / 2

$(10+2) * 4 + 1\text{in}$

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

---

## 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

---

## 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).

---

## 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 your 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.

---

### **Auto-Start a job after Sending it to the laser**

Hold the Shift key when you click the **Send** button in LightBurn to, and LightBurn will automatically run the file on the laser when the send 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 having to press **Start** on the controller.

## DOWNLOADING LIGHTBURN

The first step is to go to [lightburnsoftware.com](http://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. On Windows and Mac you can just double-click the downloaded file.

# Installing LightBurn

## Minimum computer system requirements:

LightBurn will run on Windows 7.0 or later, 32 or 64 bit, MacOS 10.11 or later, or 64 bit Linux. LightBurn does not require a powerful computer for most work, though if your designs contain a lot of images, more memory is helpful., and a faster computer will make it easier to work with large images or complex vector graphics.

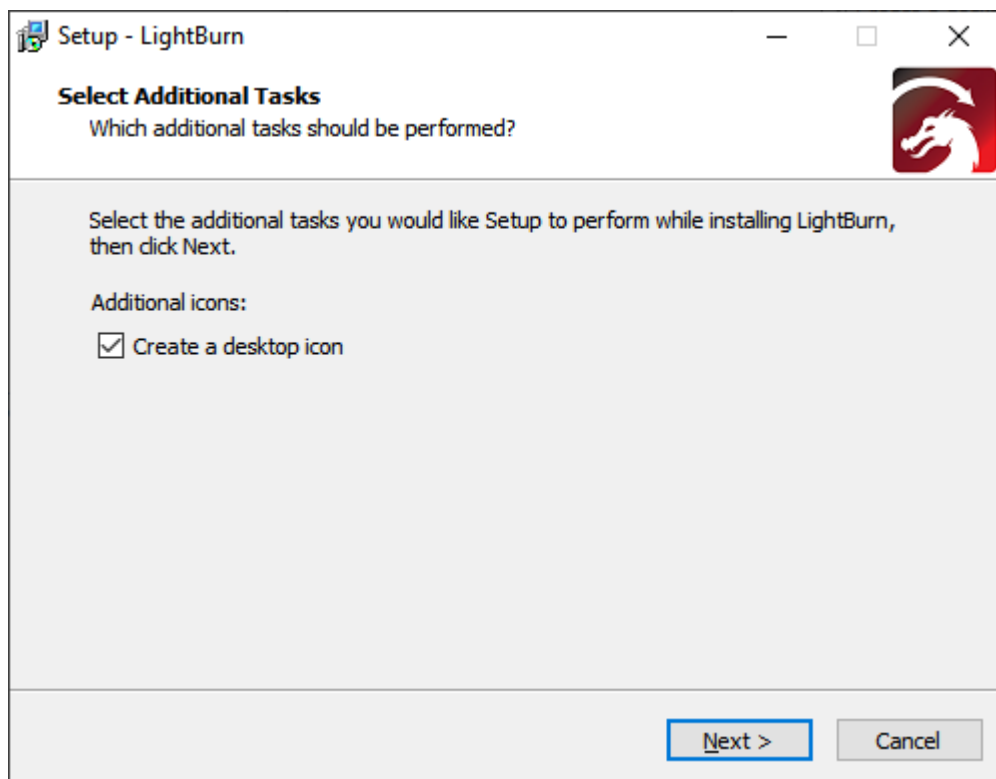
Choose your operating system:

Windows  
MacOS  
Linux

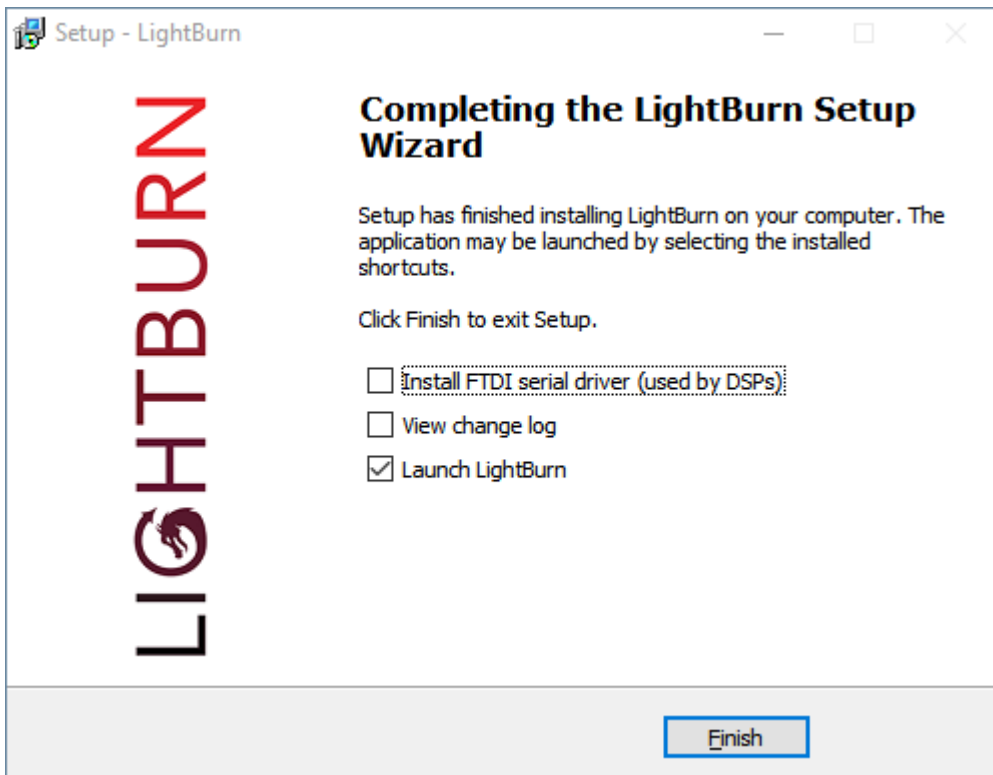
---

## 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

**Next:** Running LightBurn for the first time

---

## MACOS INSTALLATION

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

Please note that at this time, LightBurn for MacOS is not digitally signed. This means that you will need to tell MacOS that you trust us. (Read about this here: <https://support.apple.com/en-gb/guide/mac-help/mh40616/mac>)

To launch LightBurn for the first time:

Open a Finder window  
Browse to the 'Applications' folder  
Hold the Command key and double-click the LightBurn icon, or two-finger tap the icon  
When MacOS asks if it should open the program, say yes, and it will be listed as an exception in your launcher. From now on you can just launch the application normally.

**Next:** Running LightBurn for the first time

---

## LINUX INSTALLATION

Open a terminal and run the following command:

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

**IMPORTANT!** Log out and log back in (this refreshes the permissions we just added)

Download the Linux 64-bit version, either the .run file or the .7z file and follow the appropriate steps below:

### **.run installer**

Open your terminal and cd to the directory you downloaded the file to.

```
Run bash ./LightBurn-Linux64-v*.run
```

It will now automatically install and create a program listing in your desktop environment.

### **.7z installer**

Extract the folder wherever you want Lightburn to exist

Right click AppRun > Properties > Permissions > 'Allow executing file as program'

Double click AppRun inside your Lightburn folder

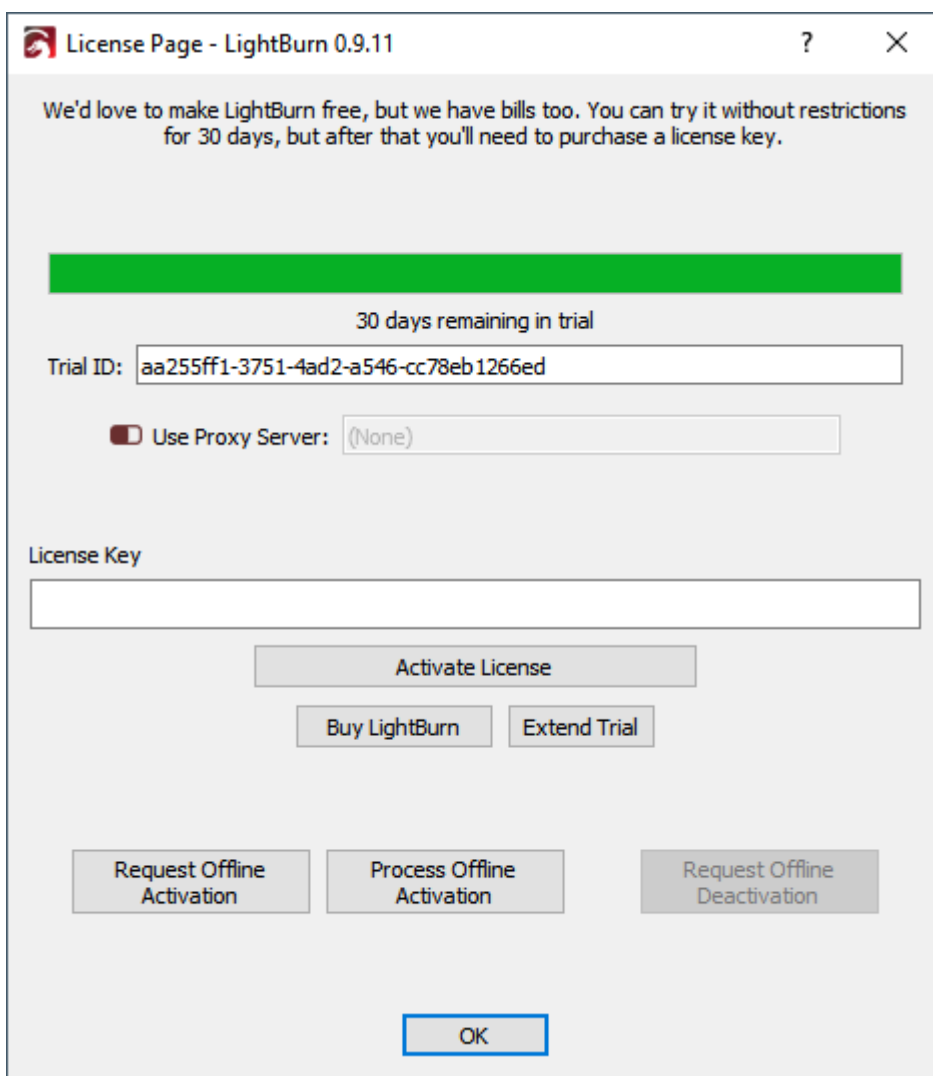
**Next:** Running LightBurn for the first time

# Running LightBurn for the first time

## Activating LightBurn

If you've never used LightBurn before, you'll be shown the License and Trial page first. Here you can either enter and activate a license key if you have one, or you can activate a free 30 day trial by clicking "Activate Trial". If you do have a license key, be sure to enter it *exactly*, including the dashes, then click the 'Activate License' button. We recommend just copying the key and pasting it into the License Key box.

You can get back to this screen in LightBurn at any time by going to the menu and clicking Help > License Management.



LicensePage

Once you have activated your license or the trial, click 'OK'

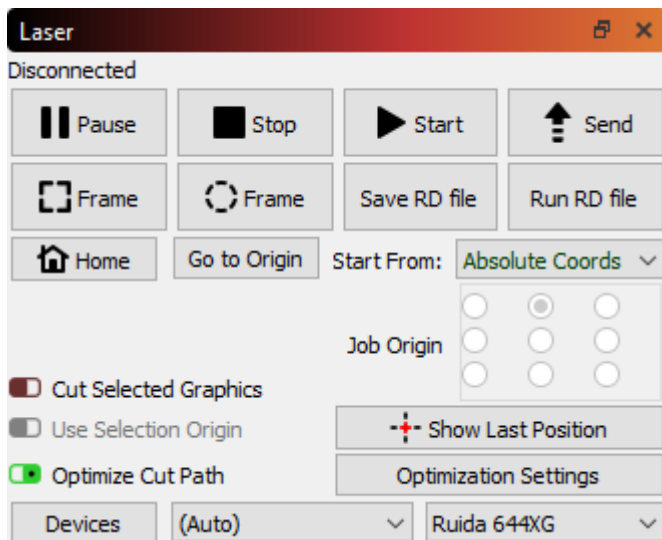
The next thing you'll see is the 'General Usage Notes' page - this is a brief help page just to get you going. You can get back to it any time in the Help menu, under Help > Quick Help and Notes. Click OK.

You're almost done!

**Next Step:** Adding your Laser to Lightburn



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.



LaserWindow

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

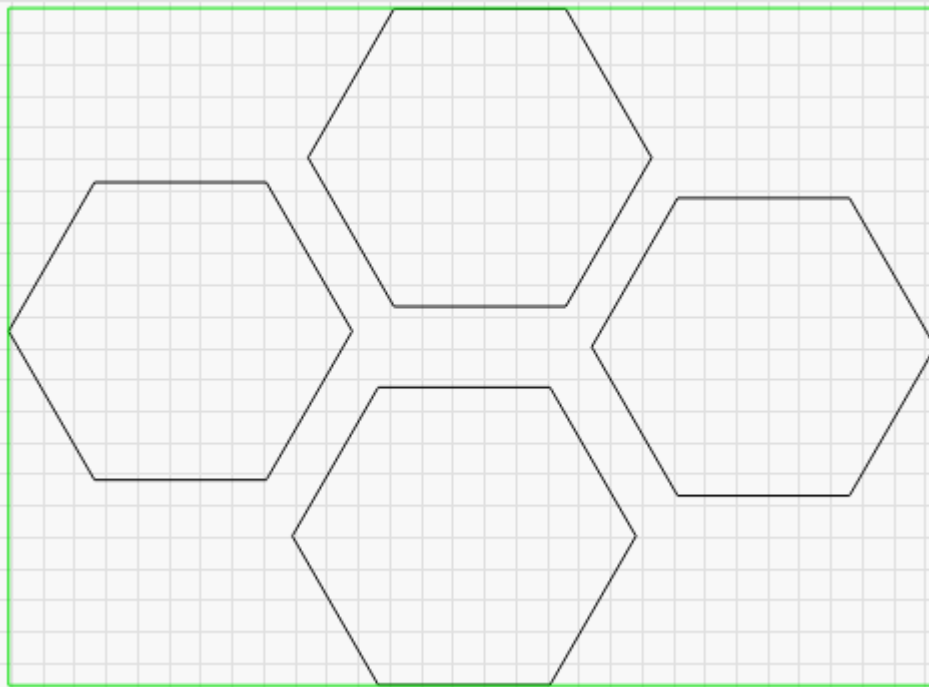
**Stop:** immediately abort the running job

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

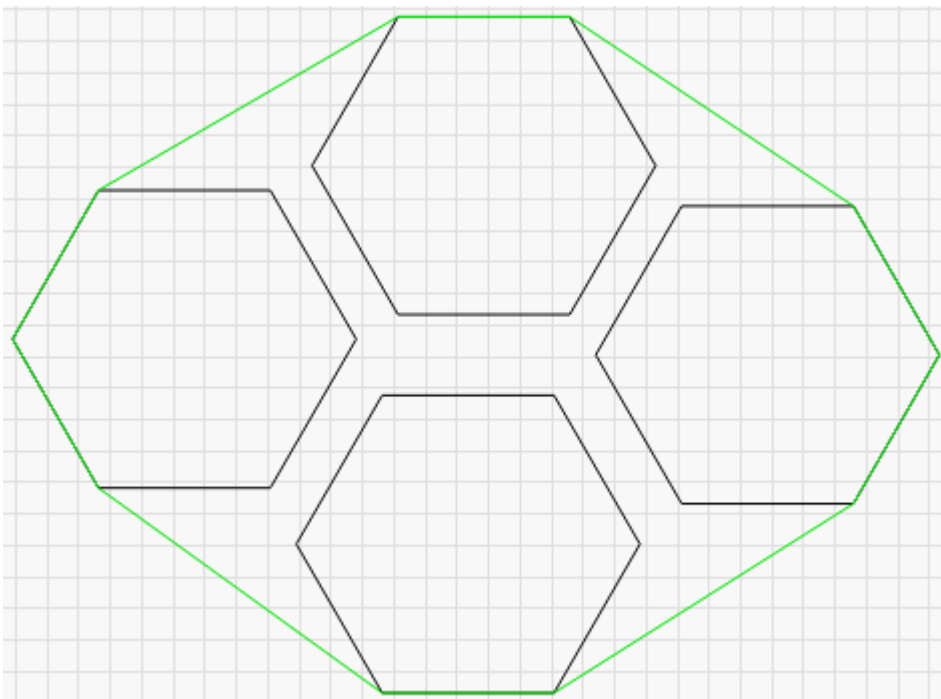
The two **Frame** buttons are used to preview the position of the job on the laser. The first is a standard rectangular frame, also called a 'Bounding Box'. This is the smallest rectangle that will fully contain the shapes you're sending to the laser.

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



BoxFrame

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:



BoxFrame

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.

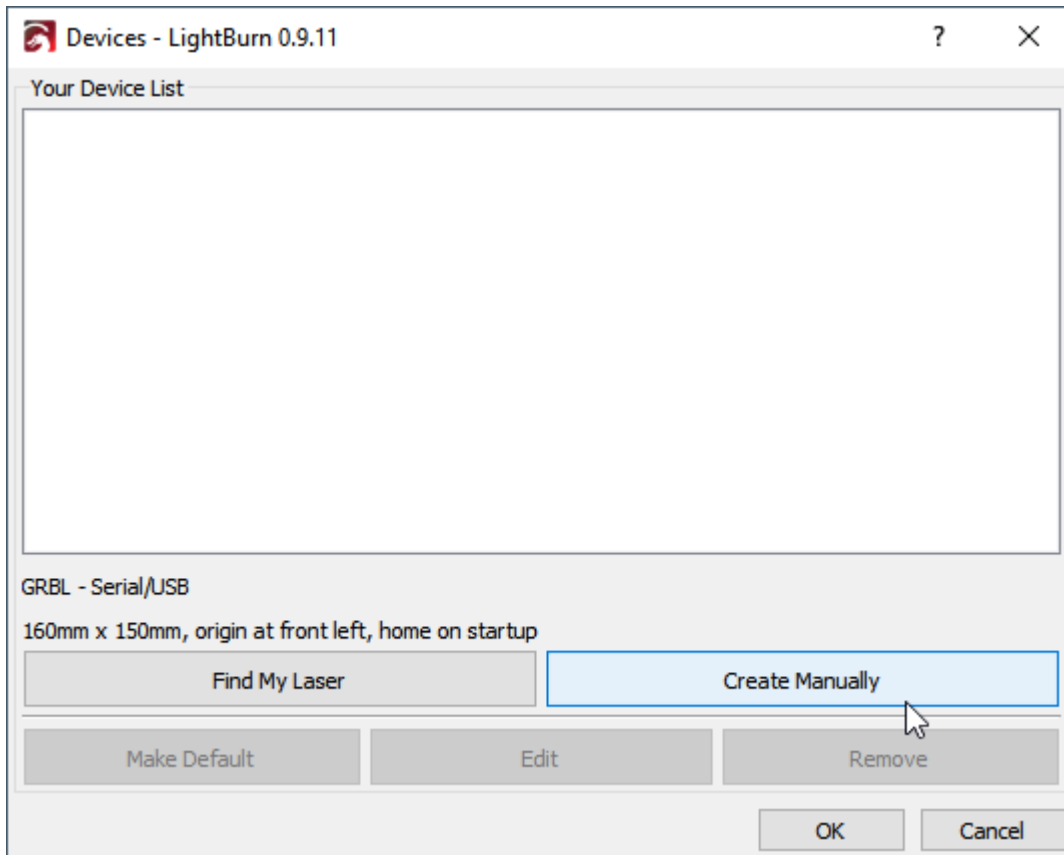
## **Devices**

Opens the **Devices Window**, allowing you to add, remove, or edit device profiles for the lasers you want to use with LightBurn.

[Return to main page](#)

## Manually adding a laser

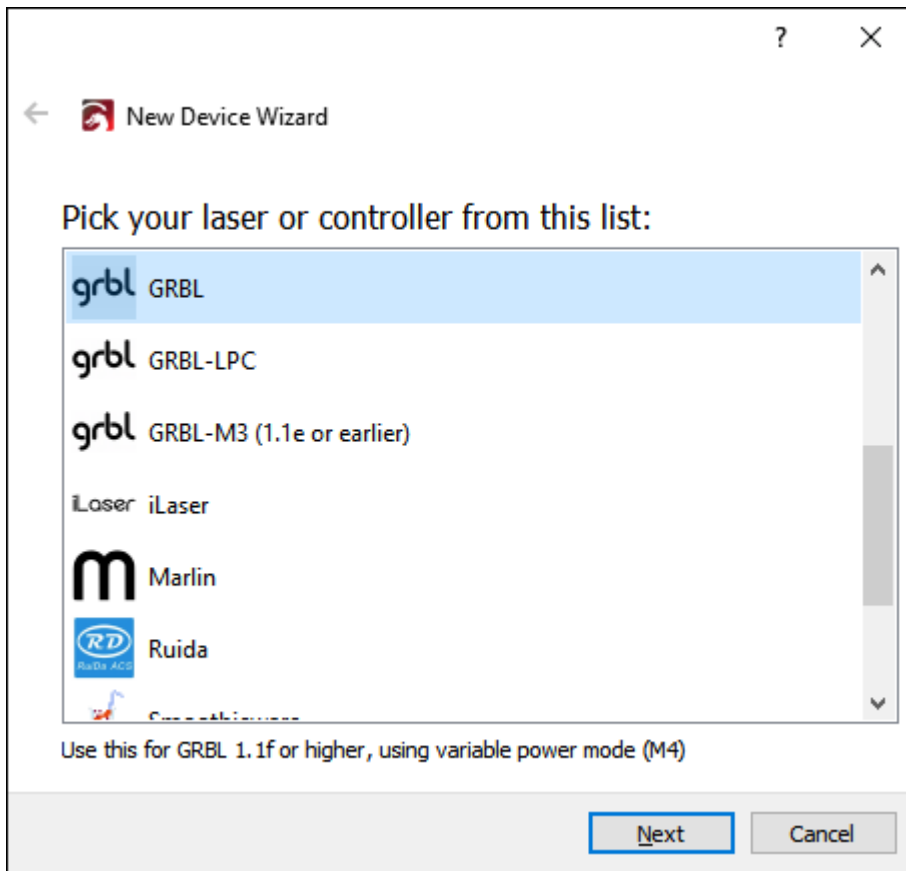
If LightBurn can't automatically add your laser, because it's not connected to your computer, or is connected over a network, you can click the 'Create Manually' on the Devices page.



Create Manually

### 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:

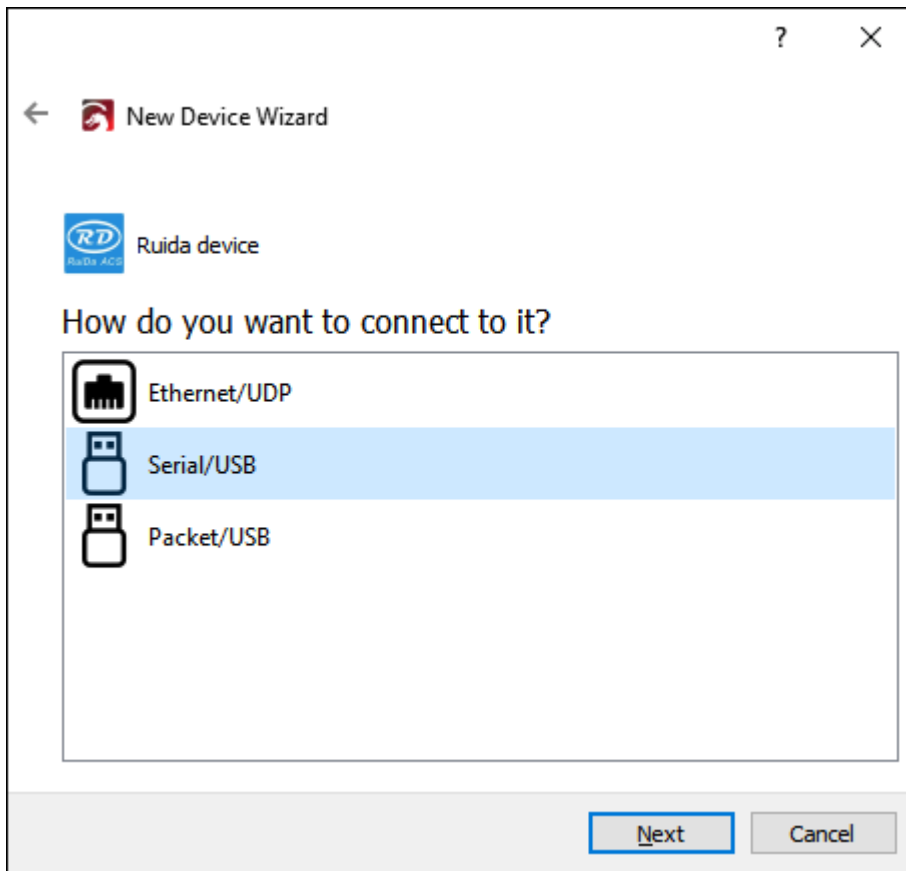


Create Manually

Choose the entry that matches the type of controller or firmware in your laser and click Next.

### 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 WIFI and wired).

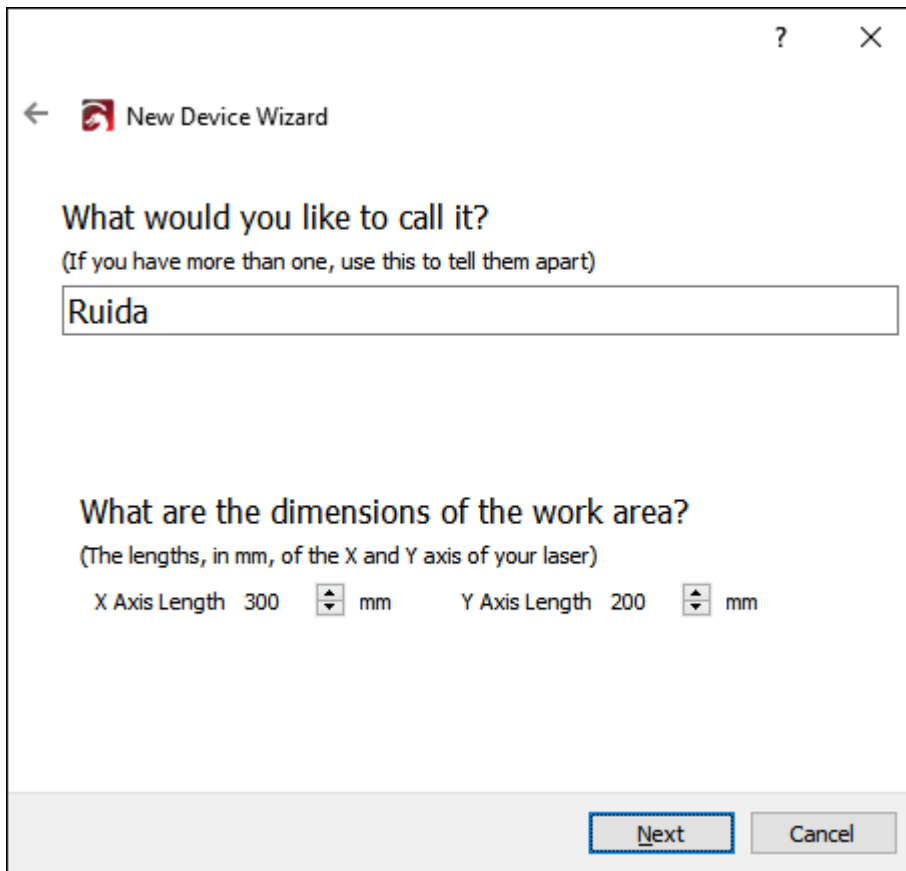


Create Manually

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.



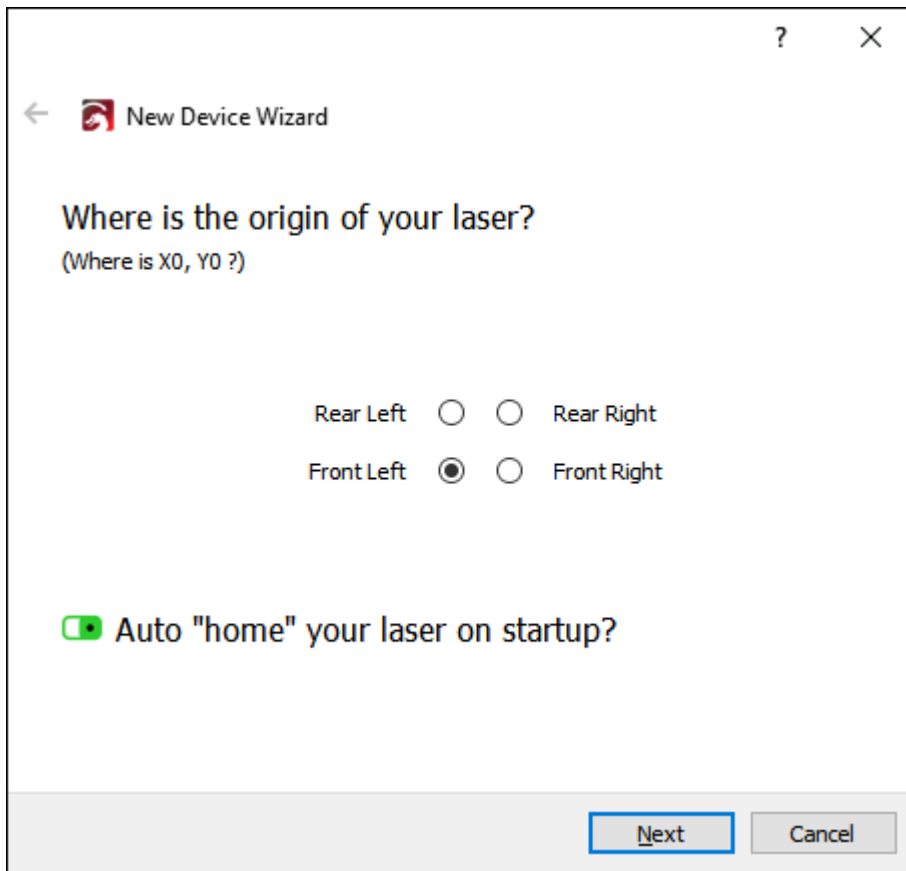
NameAndPageSize

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 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.





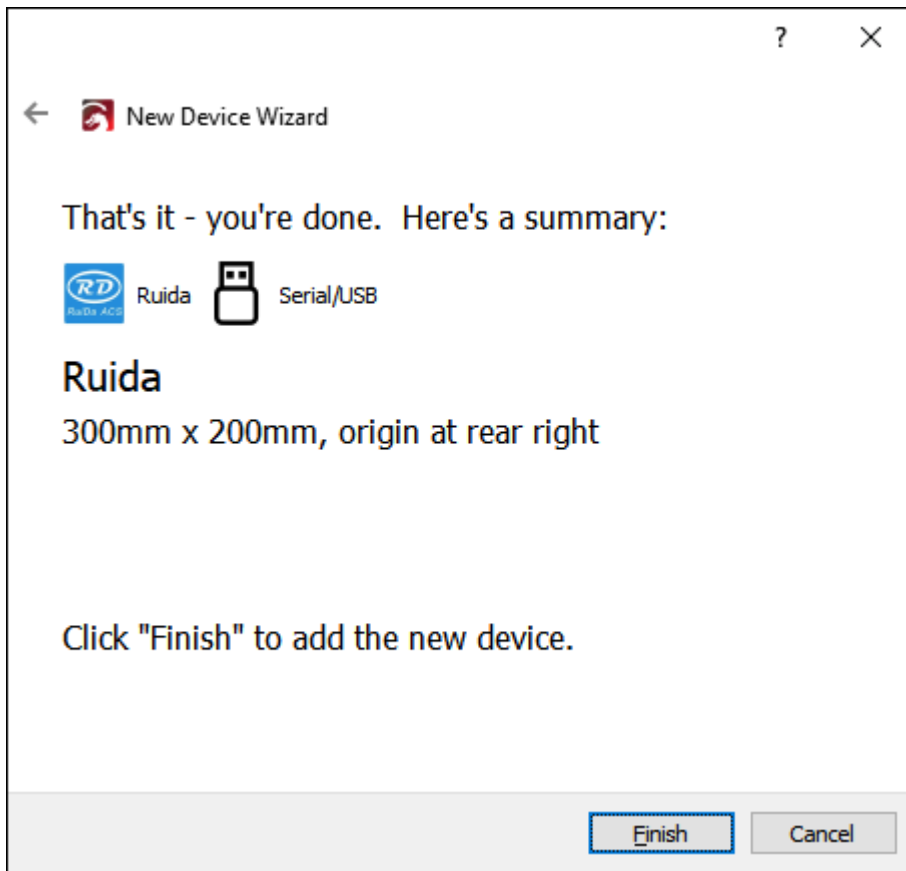
NewDeviceOrigin

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 CO2 lasers with metal cabinets and LCD displays, 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.

### **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.

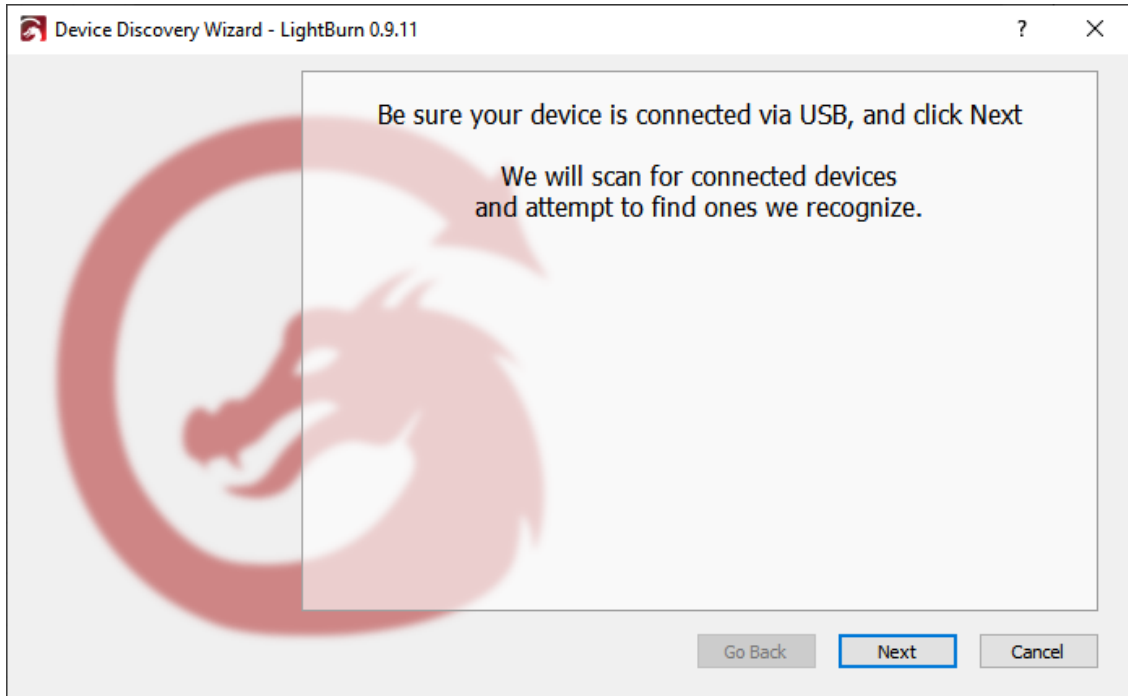


NewDevice-Finished

**Next Step:** Connecting to the Laser

# Find My Laser

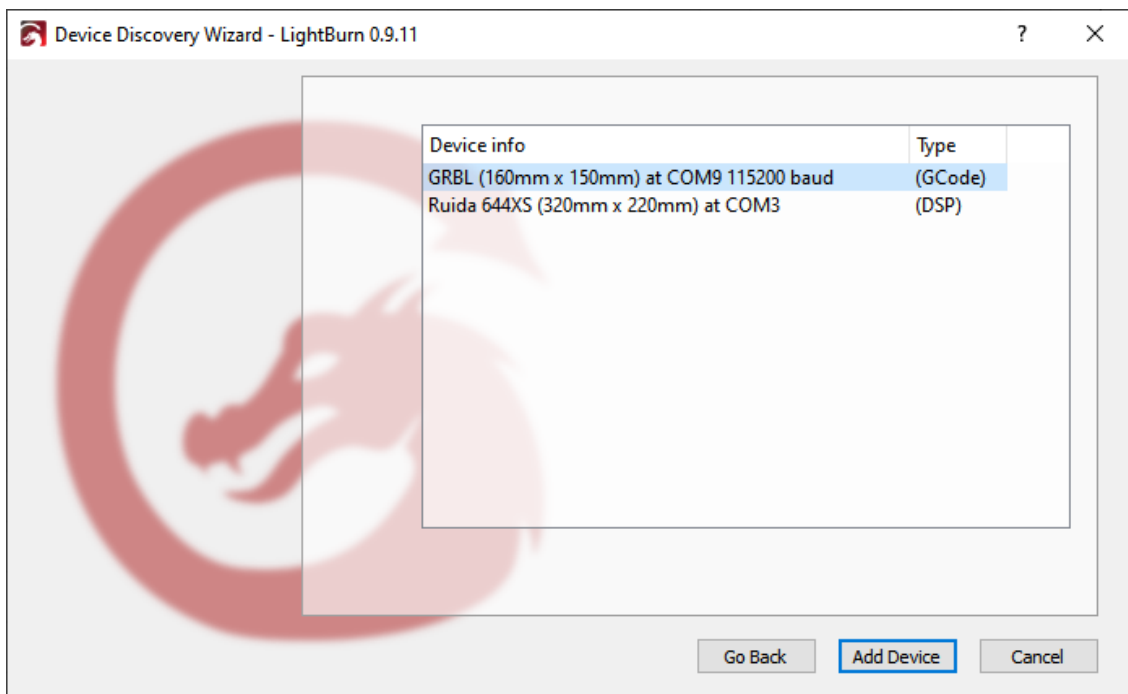
In the Devices page, click the 'Find My Laser' button, and you'll see this screen:



FindMyLaser

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. When the laser is ready, click Next.

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



FindResults

In the above image, I have two lasers connected to my computer - the first, a GRBL controller on COM9, and the second, a Ruida DSP controller on COM3. Select your laser and click 'Add Device'.

Is your laser a GCode or DSP device? What if it wasn't found?

## GCode devices

If you have a GCode controller, you'll be asked if your machine is an X-Carve or Shapeoko, because there are some specific settings that need to be configured for those machines. If you have one, click the appropriate button, if not, click 'Other'. You may 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 as the origin.

If your machine has homing or limit switches, enable the homing on startup, 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.

With some GCode devices, additional configuration of either LightBurn or the controller may be necessary.

**Next:** Connecting to the Laser

## DSP devices

If you have a DSP controller, the next screen will ask you where your machine origin is. This is the corner the machine goes to when looking for the homing switches when it powers up. Click the home corner. If you get it wrong, things may be backwards or upside down, but don't worry - you can easily change it later.

When your laser is added, click 'OK' on the Devices page to exit.

**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** - If your laser came with its own software, install it. Even if you don't plan to use it, sometimes they contain necessary drivers that aren't included with LightBurn.

**Can't connect** - Only one application can talk to your laser at once. 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 steps.

**Marlin controller** - If you are using a Marlin controller, they have a variety of baud rates and configuration options, and they take significantly longer to reset than most other controllers, so it's not practical to auto-search for them - click 'Create Manually' and follow the steps.

# Common Grbl setups

If you have a GCode-based system, like a Shapeoko, Eleksmaker, X-Carve, or Acro system, you might need to make some simple changes to get the most from LightBurn.

## SHORT VERSION

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 the 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) it’s highly recommended to upgrade the firmware, 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.

The more recent versions of Grbl (1.1f and up) support two things that are incredibly useful for lasers. 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.

## Shapeoko, XCarve, and other negative workspace systems

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, which LightBurn doesn't support. This is an easy thing to work around though, using a workspace offset.

We'll use a Shapeoko XXL as our example setup. This machine has an 812mm x 812mm working area, and the origin is set to the rear-right, with negative numbers going down and to the left (onto our workspace). We're going to leave the direction alone, but change the origin position by using this command in the LightBurn Console window:

```
G10 L2 P1 X-812 Y-812
```

That command says "set an offset" (G10 L2) in the first coordinate system (P1) of X -812 and Y -812. (If your machine is a different size, use your width and height values in mm instead of the 812's shown here, and remember the minus signs - those are important)

This shifts the origin point of the machine left and forward by the size of the workspace. Then you tell LightBurn that the origin is at the front-left of the machine, instead of the rear-right, and you're done.

When you want to go back to using your machine for CNC use, clear the offset with:

```
G10 L2 P1 X0 Y0
```

It is simple to set these 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 "User 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, there are some simple steps to take that can help. First, figure out which firmware you're running. In LightBurn, when you first connect to the machine, the console window will usually show a 'hello' message from the controller. For Smoothieware boards it's 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.

With the driver identified, it's time to find the machine origin. First, home the machine by pressing the Home button () on the Move window.

In the console window, type

```
G0 X0 Y0
```

then hit enter. Your machine will head toward its origin position. This isn't always the same as where the home position is. Usually the home position is in one of the corners. Most often it will be the rear-right, or front-left of the machine. In some cases, it might be the center of the work area. If your machine does this, skip ahead to [Center Origin Machines](#) below.

After it stops moving, type

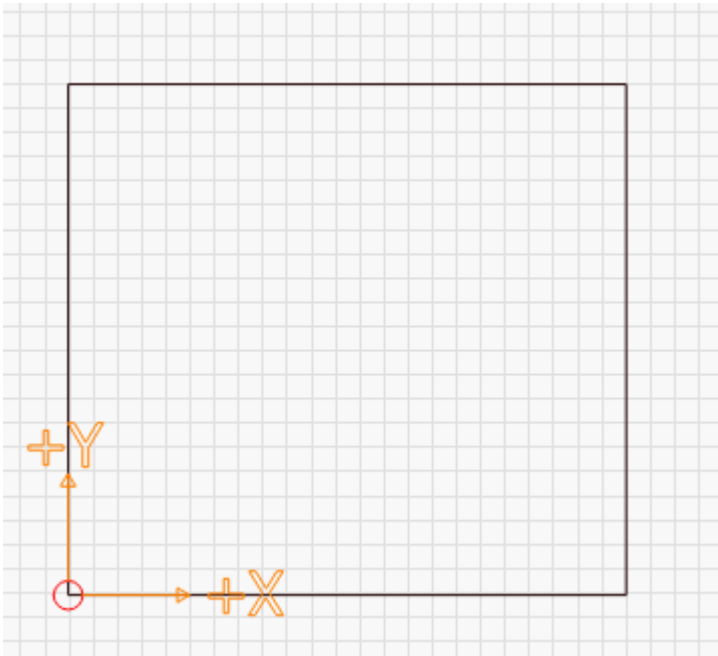
```
G0 X10 Y10
```

then hit enter. If your machine moves 10mm into the work area on both axis that's good - it means your machine uses positive workspace coordinates. You simply set the origin in LightBurn to match the machine origin discovered above. If your machine bumped the rails, it uses negative coordinates.

## Negative Coordinate Machines

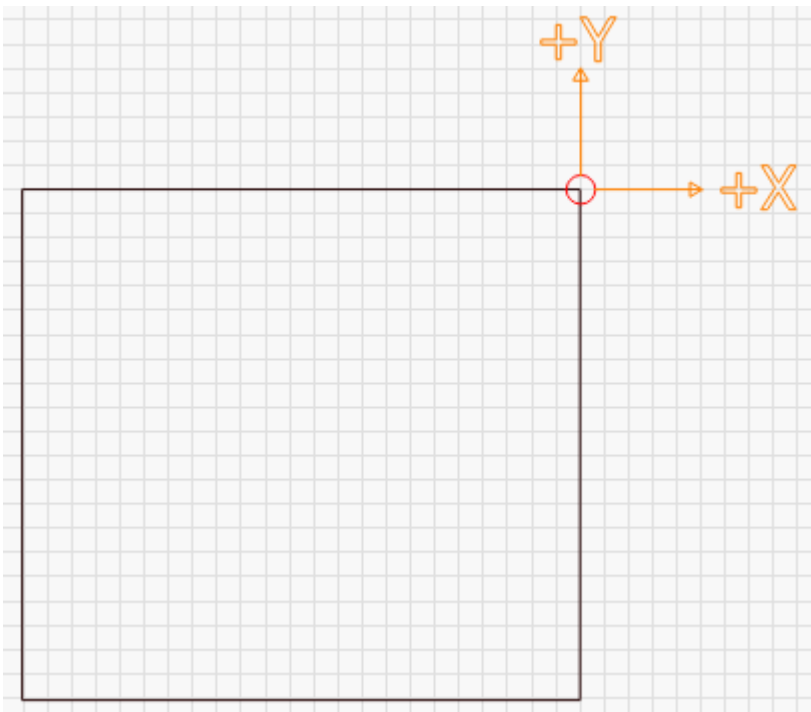
If your machine uses negative coordinate space, we need to offset the origin.

LightBurn wants positive workspace numbers, like this:



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:

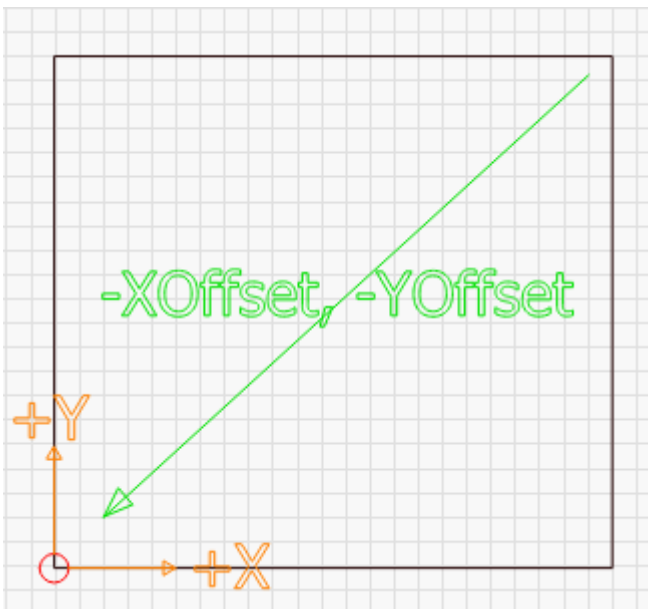


In this image, the origin is at the rear-right of the machine. The X and Y directions are the same as before, but now, to move into the work area, you would need to use negative numbers. Instead, we're going to set up a work offset.

You'll need to know the total distance your machine can travel in both axis. For a Shapeoko XXL, for example, it's 812mm in X and Y. For a 500x500 X-Carve, it's 250mm in X and Y. By applying a



workspace offset that is the size of your machine area, we can shift the offset to the opposite corner, like this:



Enter the following command:

```
G10 L2 P1 X-250 Y-250
```

in the console, and hit enter. Note that the '250' above should be replaced with the total travel width and height of your machine. If your machine had a 600mm width and 400mm height, you would use:

```
G10 L2 P1 X-600 Y-400
```

This command offsets the origin by the given amounts. If the origin used to be in the rear-right of the machine, and you offset it in the negative direction by the width and height of the work area, you've moved the origin to the front-left.

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 is good to remember the existing setting.

### **Center Origin Machines**

Some systems have their origin in the center of the workspace. After homing your machine, enter this command in the console and hit enter:

```
G0 X0 Y0
```

That command says "rapid move to coordinate 0,0"

If your machine does this, you still need to move the origin just like in the "Negative Coordinate Machines" above, but only by half the size of your workspace. Follow the directions for a negative

coordinate space machine, but divide your workspace numbers in half before issuing the GCode offset command.

### **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. You can do this in a couple ways:

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.

# Configuring a Ruida

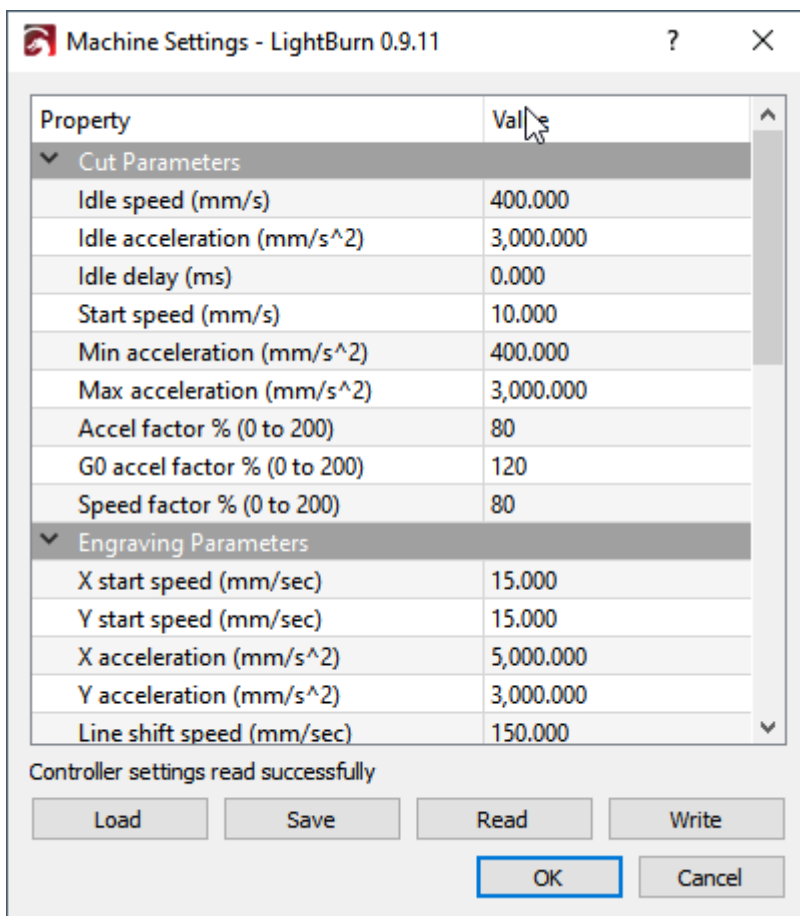
When purchasing a laser with a DSP controller installed, the factory making the machine configures the laser controller for you to tell the controller how fast and in what directions to move, where the homing switches are, and so on.

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:



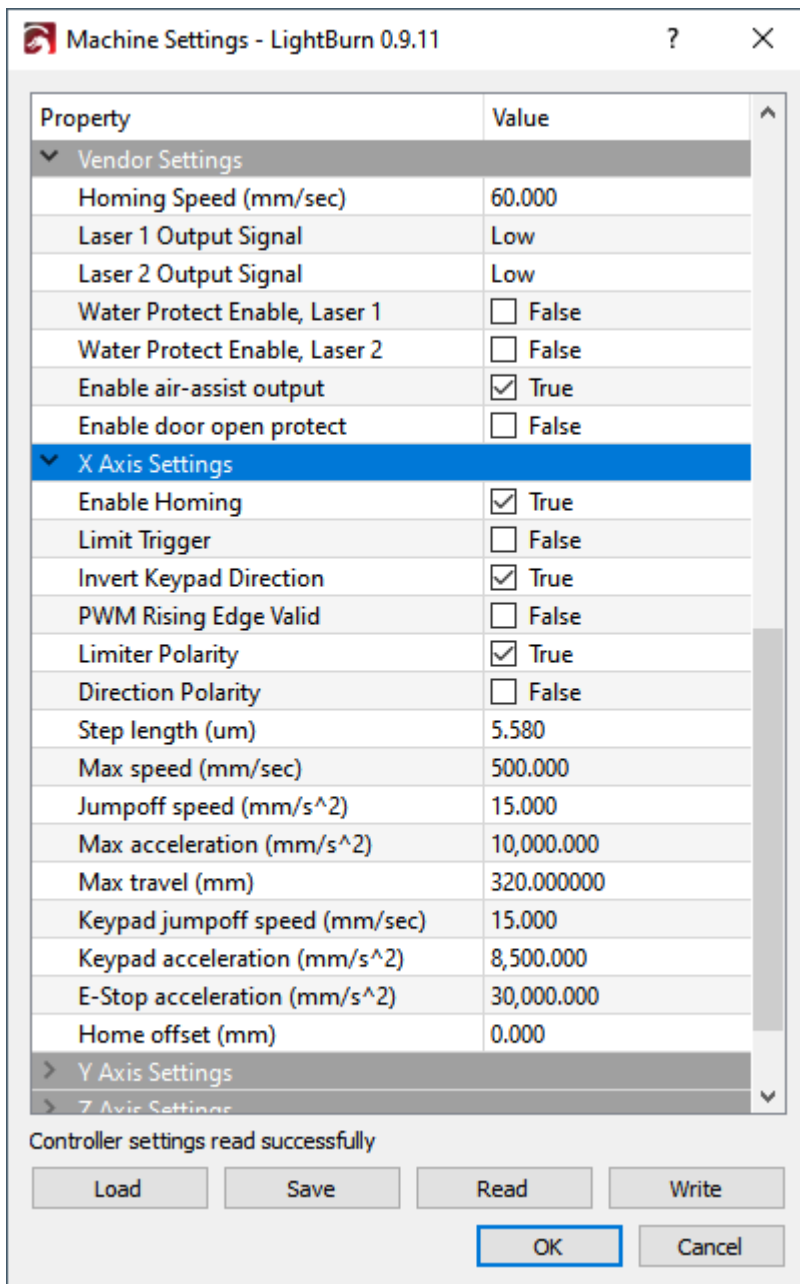
The top section of the list is referred to as user settings - these are settings that are intended to be tunable by the user if necessary. The lower section, under 'Vendor Settings' are things usually

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.

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) controls which side of the machine the laser moves to when looking for home, 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.

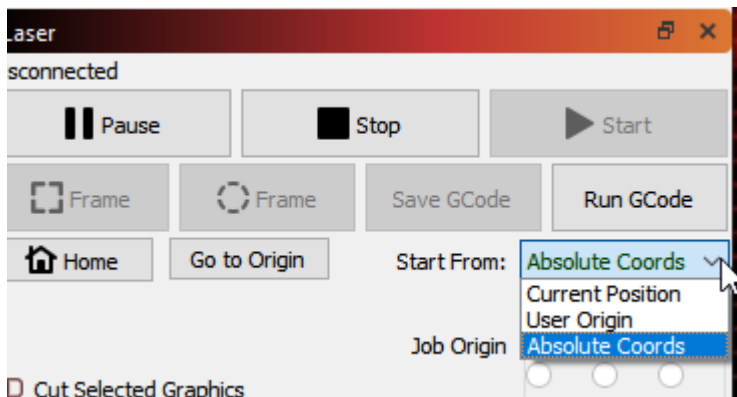
You will also need to set the 'Max Travel' value for the X and Y axis - these numbers dictate the length of each axis, and together define the size of the work area of the machine.

## **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.

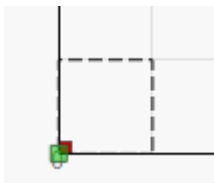
### **Rough Calibration**

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



img

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



img

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.

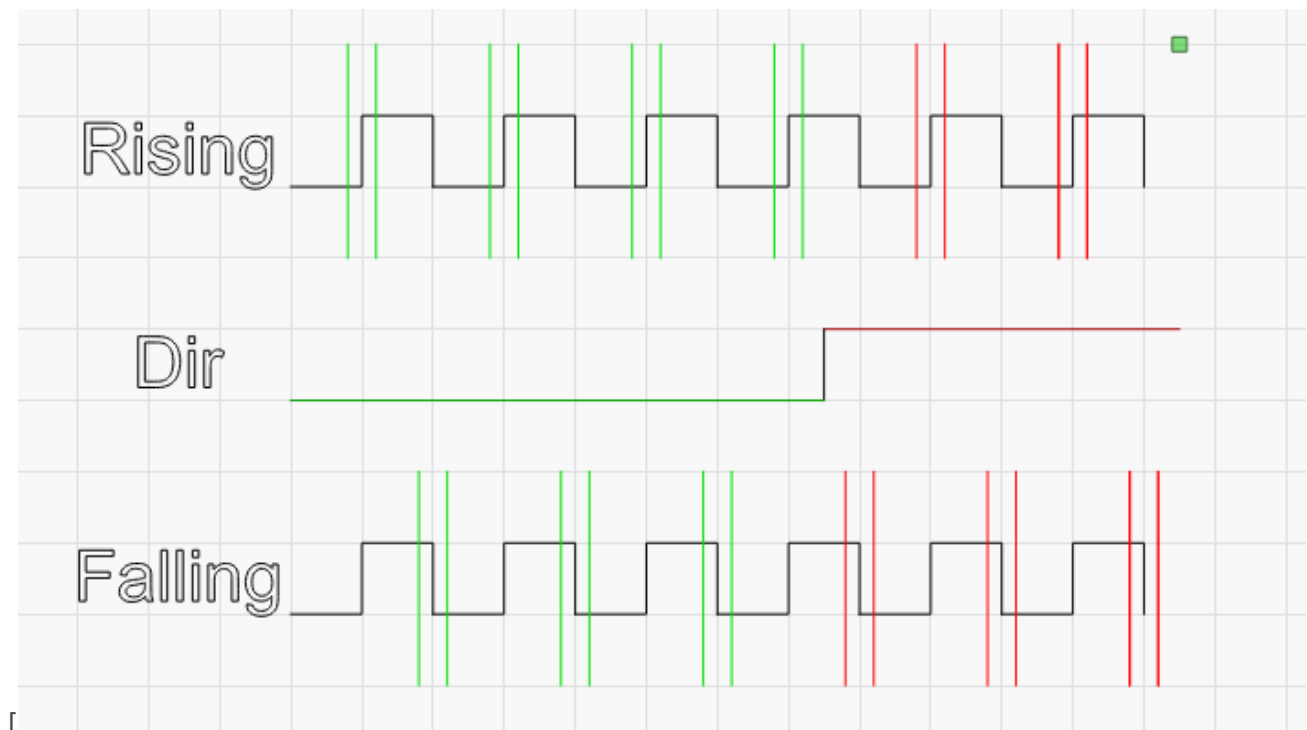
The fix is relatively simple. In Edit > Machine Settings, look in the X & Y axis motor settings section at the bottom, and look for the value of 'PWM Rising Edge Valid' on the X axis. Change that - if it's checked, un-check it, or vice versa. Then, copy the new setting over to the Y axis as well.

### 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.



# LightBurn Windows

This is a list of all the standard windows (and toolbars) available in LightBurn:

- Main window, menus, and status bar
- Main Toolbar (file, clipboard, view, settings)
- Edit window (the workspace)
- Arrangement Toolbar (grouping, mirroring, alignment, distribution)
- Creation tools (selection, shapes, text, node editing)
- Modifier tools (offsetting, Boolean operations, grids)
- Color palette
- Numeric Edits (size, position, units)
- Fonts and Text
- Cuts & Layers (how the laser treats your graphics)
- Laser Control
- Move window (jogging and positioning)
- Shape Properties
- File List
- Console
- Art Library
- Material Library
- Camera Control
- Variable Text
- Settings (global LightBurn settings)
- Device Settings (settings specific to each laser)

# 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

Window Menu

Language Menu

Help Menu

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## 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” (Command + N on Mac).

### Open 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” (Command + O on Mac).

### 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” LightBurn supports importing the following file types: svg, ai, pdf, dxf, hpgl, plt, png, jpg, bmp, tiff, gif.

### Save

To save a project click on “Save” in the File menu or press “Ctrl + S”. Type the name you want the file saved as in the dialog box that opens up. To save a file with changes, but still keep the original file intact, click on the “Save As” icon in the File menu.

### Export

To export a file to a different file format, click on “Export” in the File menu. LightBurn can export to SVG or AI format, though bitmaps and text are currently not exported.

## **Exit**

To exit LightBurn, click on the “Exit” in the File menu or press “Ctrl - Q”. You will be prompted to save your file if you have unsaved changes.

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## **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”.

### **Redo**

To Redo the last editing action done on the current file, click on “Redo” in the Edit menu or press “Shift + Ctrl + Z”.

### **Select all**

To select all objects in the current file click on “Select all” in the Edit menu or press “Ctrl + A” (or Command + A on Mac).

### **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 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 the Delete key. 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. The original shape information is lost, so you won’t be able to change text with the text tool after using this.

### **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

### **Auto join selected shapes**

Looks at the start and end points of all the selected curves, and if any of them are close enough, connects them together into a single shape. Useful when importing DXF files, which don’t contain connectivity information. Click on “Auto join selected shapes” in the Edit menu or press Alt+J

### **Optimize Selected Shapes**

Attempts to fit the selected shapes to arcs and lines within a specified error tolerance. Useful for reducing the point count in a shape, or recovering arcs from software that exports them as many small line segments.

### **Delete Duplicates**

This will delete duplicate items within the drawing, for example if two squares are identical and one on top of the other, this will delete the extra square. This helps to minimize erroneous moves and double-cuts.

### **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.

### **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**

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 lines in the workspace.

### **Rectangle Tool**

Click on “Rectangle” or press “Ctrl + R” to draw rectangles in the workspace.

**Ellipse Tool**

Click on “Ellipse” or press “Ctrl + E” to draw ellipses in the workspace.

**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.

**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.

**Trace Image**

Opens a dialog box where you can trace the content of a bitmap image into vector graphics.  
([Read more here](#))

**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. ([Read more here](#))

**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)

**Position Laser**

Click on “Position Laser” to allow clicking on the workspace to move the laser head to that location.

**Rotary Setup**

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

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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.

### Flip Horizontal

Click on “Flip Horizontal” or press “Ctrl + Shift + H” to flip the selected objects in the workspace horizontally.

### Flip Vertical

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

### 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.

### **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

### **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.

### **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.

### **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.

### **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.

**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.

### **Break apart**

Click on “Break apart” to break selected object into individual parts. [Return to top](#)

---

## **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.

[Return to top](#)

---

## **Language Menu**

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

[Return to top](#)

---

## **Help Menu**

### **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.

### **Online Video Tutorials**

Click on “Online Video Tutorials” to access the tutorial videos.

### **Check for Updates**

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

### **License Activation and Trial**

Click on “License Activation and Trial” to 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.

[Return to top](#)

# Main Toolbar

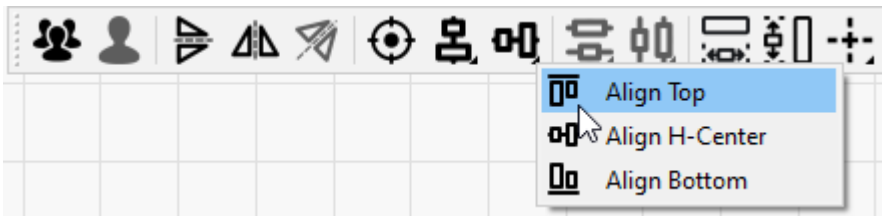


# Arrangement Toolbar



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 pop-up a sub-menu with more choices, like this:



The Arrangement toolbar is 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 to group, and Ctrl+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.

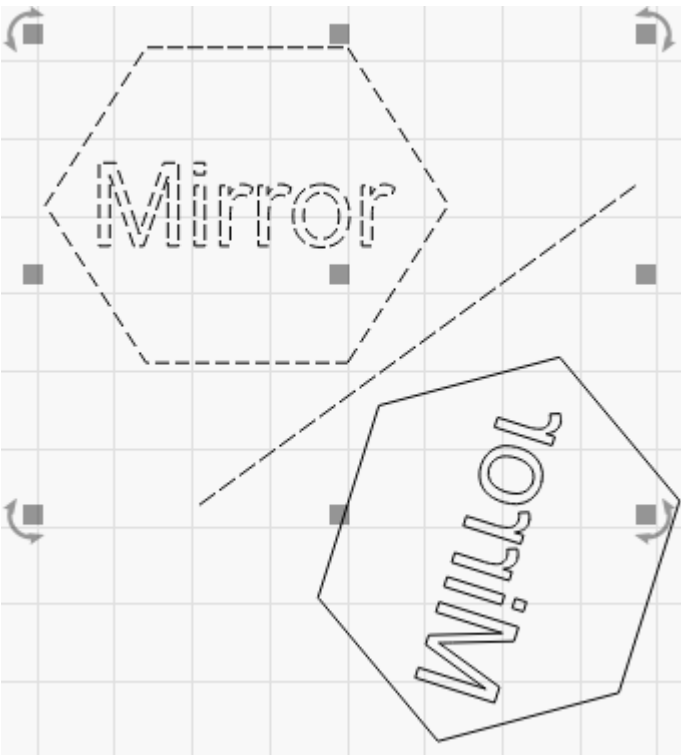
The Ungroup button does the opposite of what the Group button does - it takes a set of grouped objects, removes them from the group, and discards the container. The individual shapes that made up the group are now distinct shapes again.

## **Vertical Mirror** and **Horizontal Mirror**

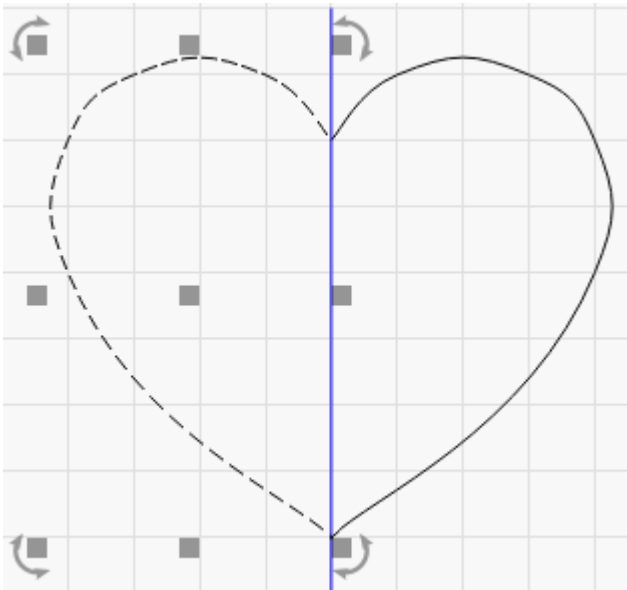
The mirror buttons take the current selection and flip it horizontally or vertically. You can use the hotkeys Ctrl+Shift+H and Ctrl+Shift+V for this, or, if the Edit window has the keyboard focus, just press 'H' or 'V' to flip horizontally or vertically.

## **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.



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**

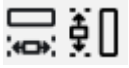
These buttons will move all shapes in the current selection to align the top, bottom, or horizontal centers of the selected shapes to the last item in the selection.

### **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.



## **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 key (Command on MacOS) 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



# Creation Tools



CreationTools

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:

Selection Tool

Draw Lines

Rectangle

Ellipse

Polygon

Edit Nodes

Add Tabs

Create Text

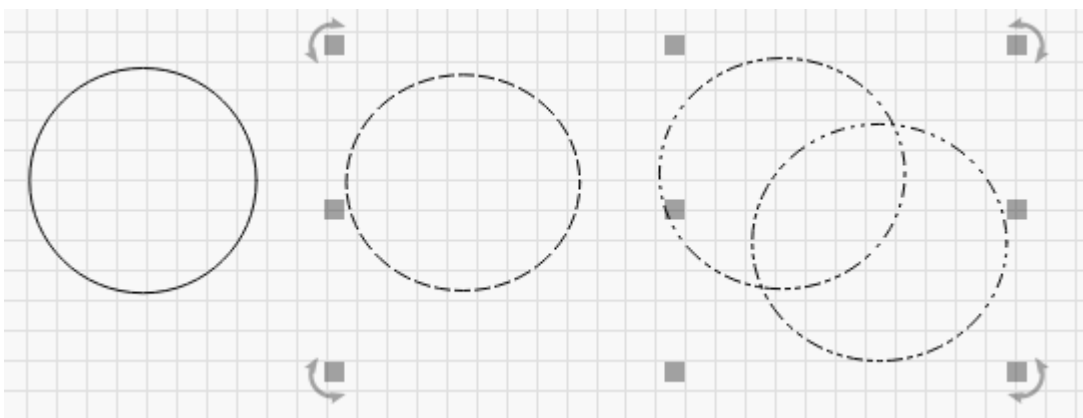
Click-to-Move

## 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 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:



SelectionPattern



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 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).

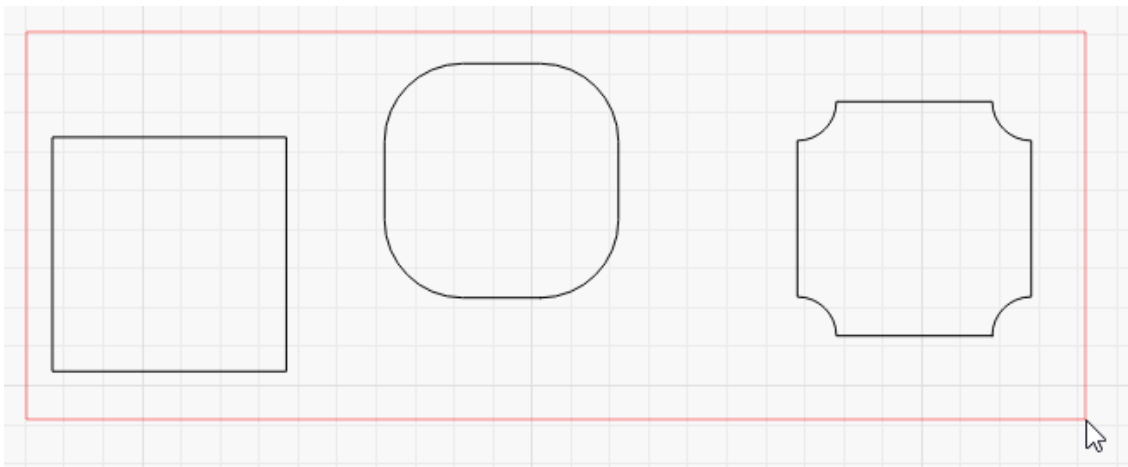
To clear the current selection, left click an empty space in the view, or press the Esc key.

## 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

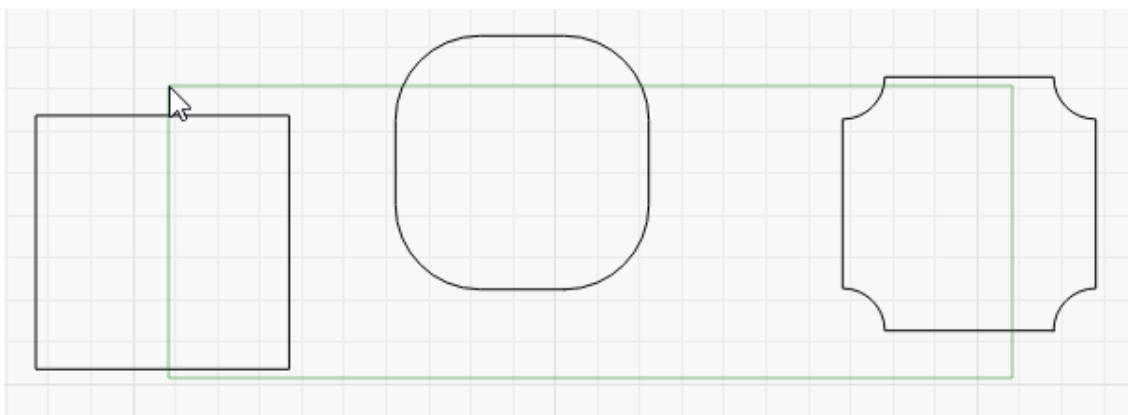
If you drag from left to right, you'll see a red rectangle. Selecting a shape with an enclosing selection means the shape must be completely contained by the rectangle in order to select it.



DragSelect-Enclosing

### 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

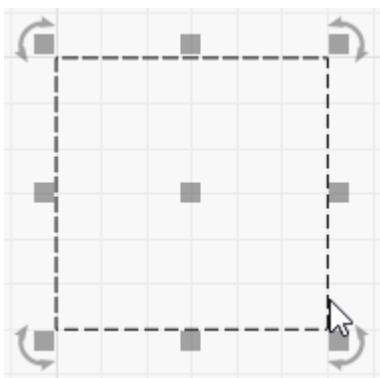
**Ctrl+Shift:** Holding both Ctrl and Shift will remove the new selection from the current one

**Ctrl:** 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, and Rotating

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



ClickSelect

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.

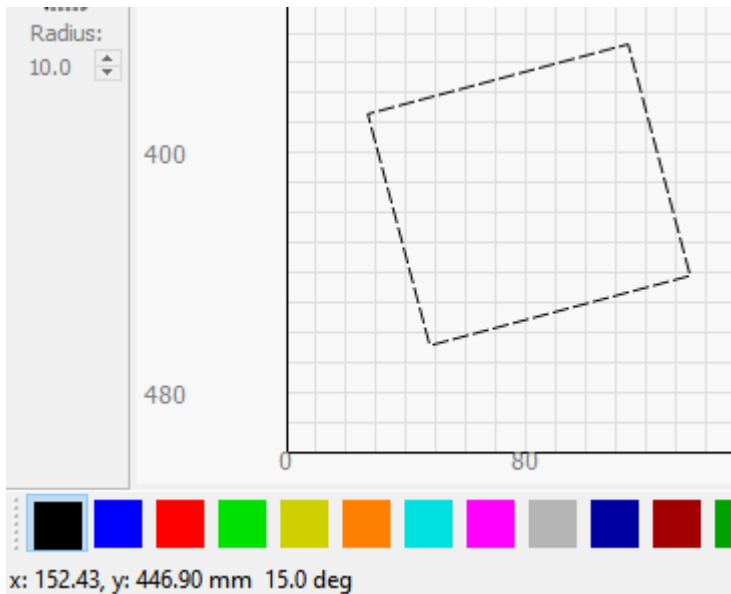
When dragging one of the four corners, the shape will maintain its relative width to height (aspect ratio) so it doesn't 'stretch'. You can override that by holding the Shift key while dragging a corner.

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 key (or Command on MacOS) makes the action symmetrical, using the center of the object as the anchor instead of the other side.

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:

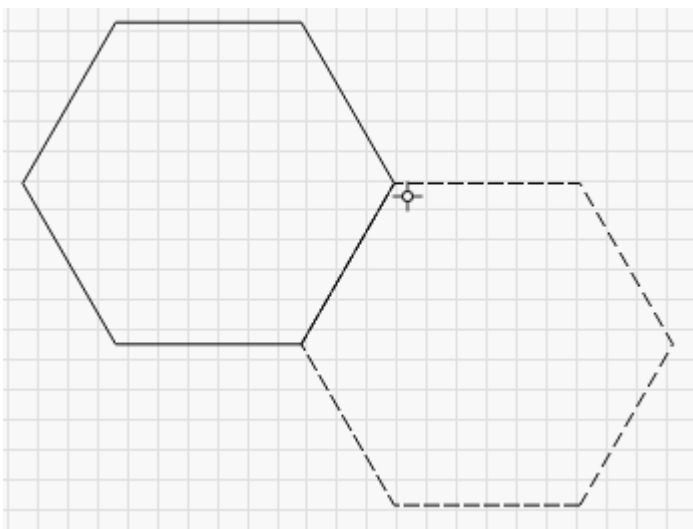
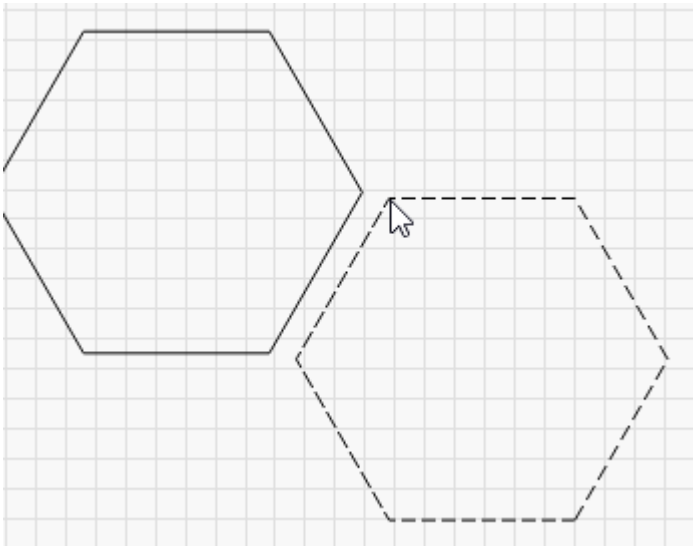


RotateFeedback

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

## Snapping

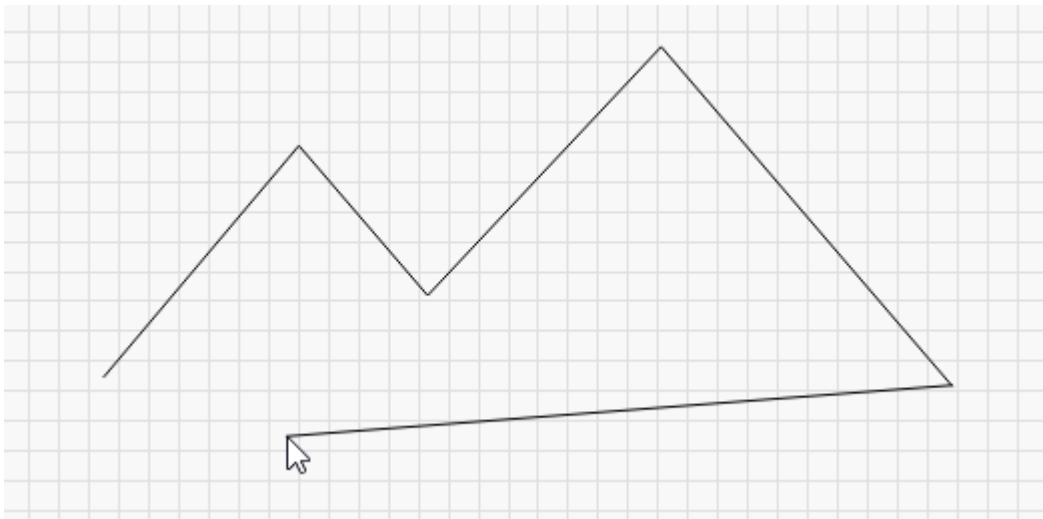
When you move the mouse over a shape to select it, you will occasionally see the cursor change to a small crosshair. This shows that you are over a snap point, like a corner, node, the center of a line, or the center of a shape. If you click at this moment, the point you drag the object from will be 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**

Click the pencil to use the Line tool. Click anywhere on the page to start a line, then move to a new location and click again to finalize the current line at that point. This will continue until you either click back at the starting point of the shape to close it, or click the right mouse button to stop. You can also press the Esc key to cancel the current line.

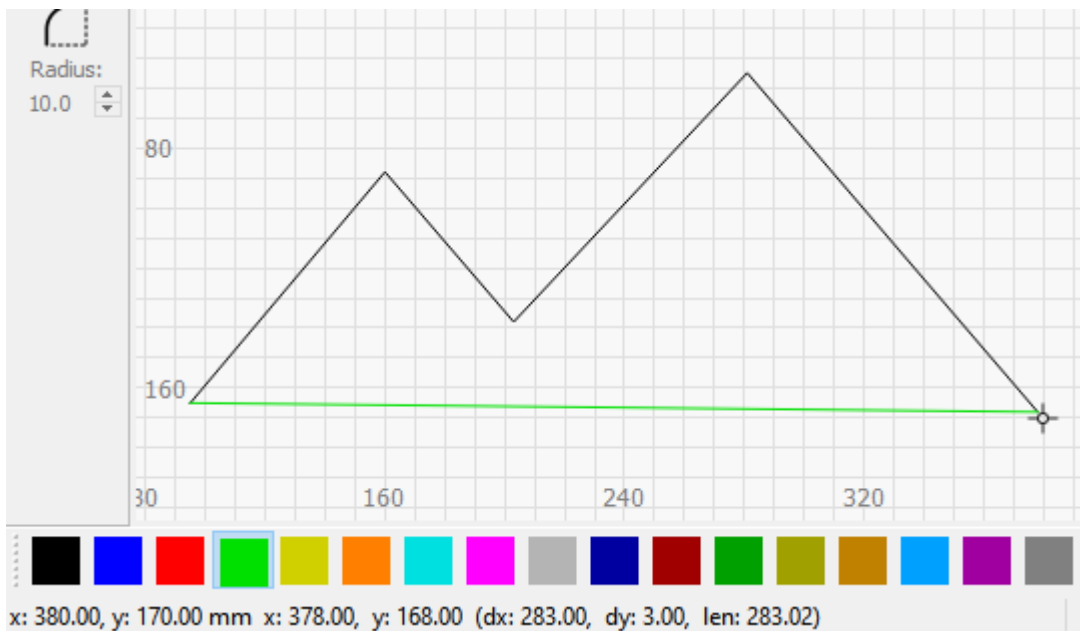


DrawLinesExample

## 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.



LineToolMeasurement

The status window shows:

dx: the distance along the X axis only

dy: the distance along the Y axis only

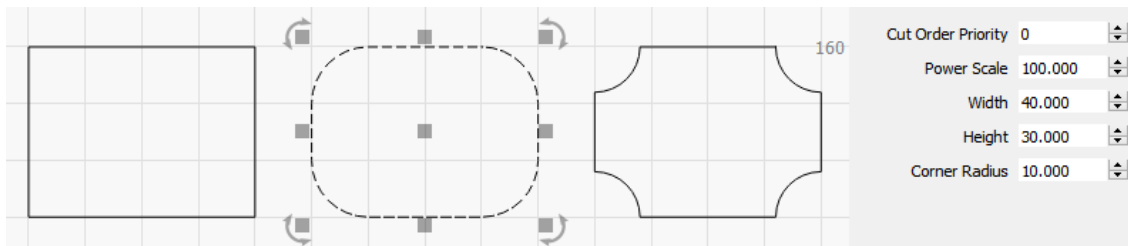
len: the length of the current line segment

It will also show the angle between successive line segments as you create them

## RECTANGLE TOOL

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:



RectangleProperties

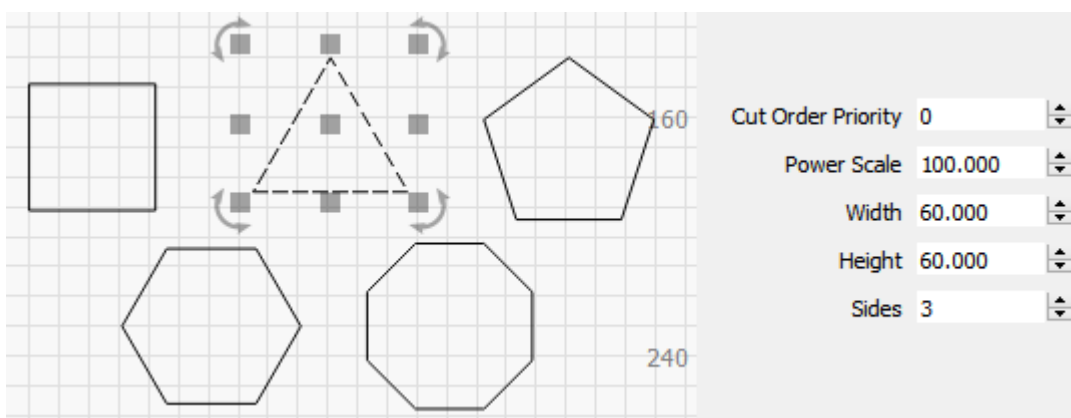
## ELLIPSE TOOL

The ellipse tool is used to draw ellipses and circles. Similar to the Rectangle tool, holding Shift 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.

With a polygon selected, if you look in the **Shape Properties Window** you can adjust the Sides property to change the number of sides the polygon has:



RectangleProperties

## **CLICK TO MOVE TOOL**

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.

# Modifier Tools



ModifierTools

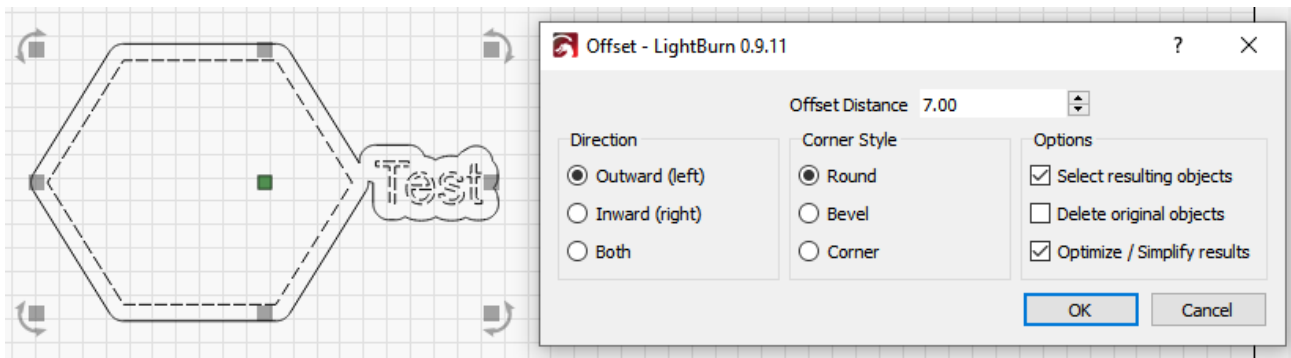
The modifier tools, as the name suggests, are primarily used to modify existing shapes.

The tools are:

- Offset
- Weld
- Boolean Union
- Boolean Subtract
- Boolean Intersection
- Grid Array
- Radial Array
- Start Point editor
- Radiused Corner tool

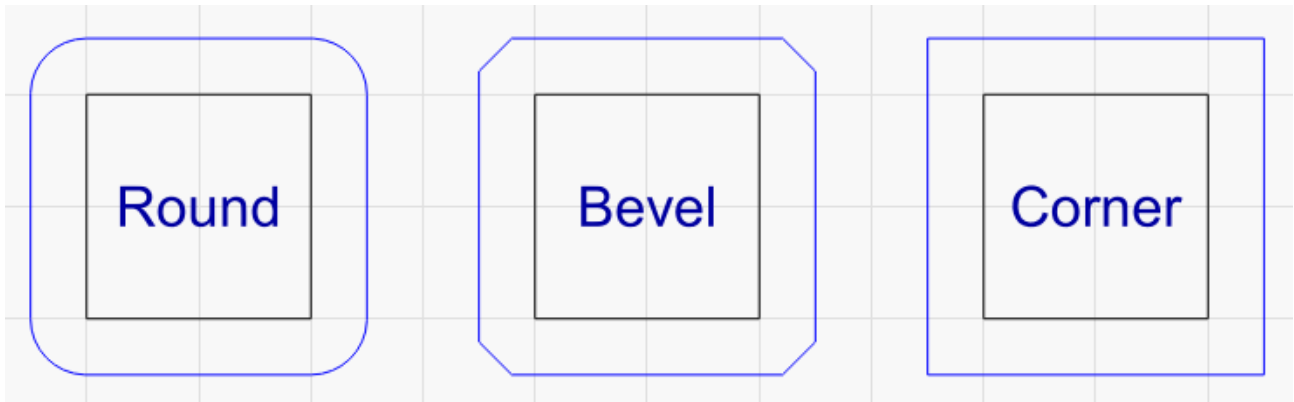
## Offset

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**

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 an arbitrary collection of inputs, and tries to do the right thing, but sometimes gets it wrong. If you weld something and the middle content disappears, use Boolean Union instead.



### **Boolean Union**

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**

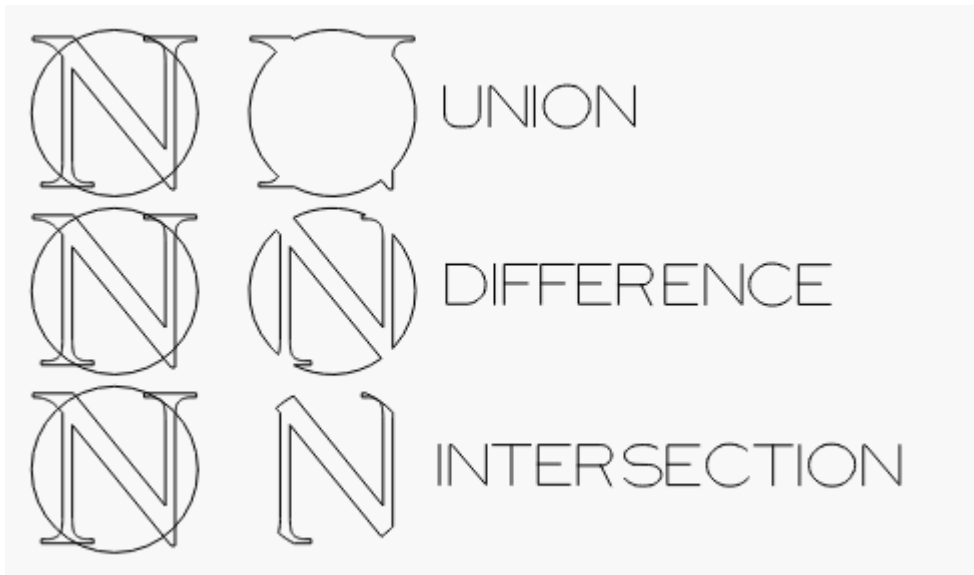
Boolean subtract will remove the area that the second selected shape overlaps the first shape by. The order in which you select shapes will determine the outcome. This tool also works with grouped items. If you end up subtracting the items in the wrong order, Undo, then perform the operation again - 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**

This will create a shape from 2 selected shapes that has an outline defined by only the areas in which the shapes overlap. This tool also works with grouped items.

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.

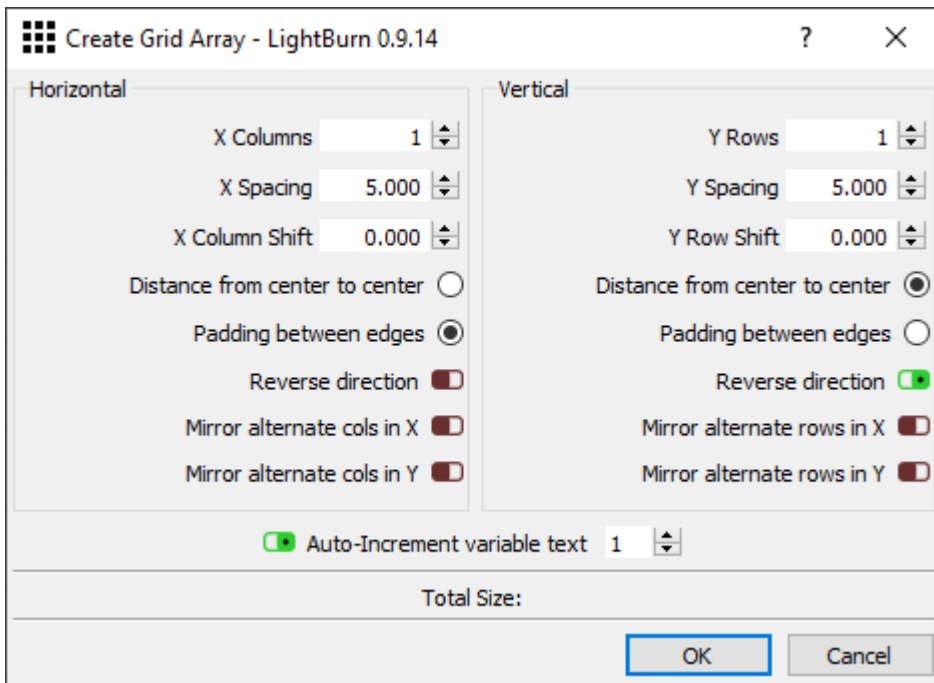
### **Video Walkthrough of the Boolean Operations**

[Click for a Boolean demonstration video](#)

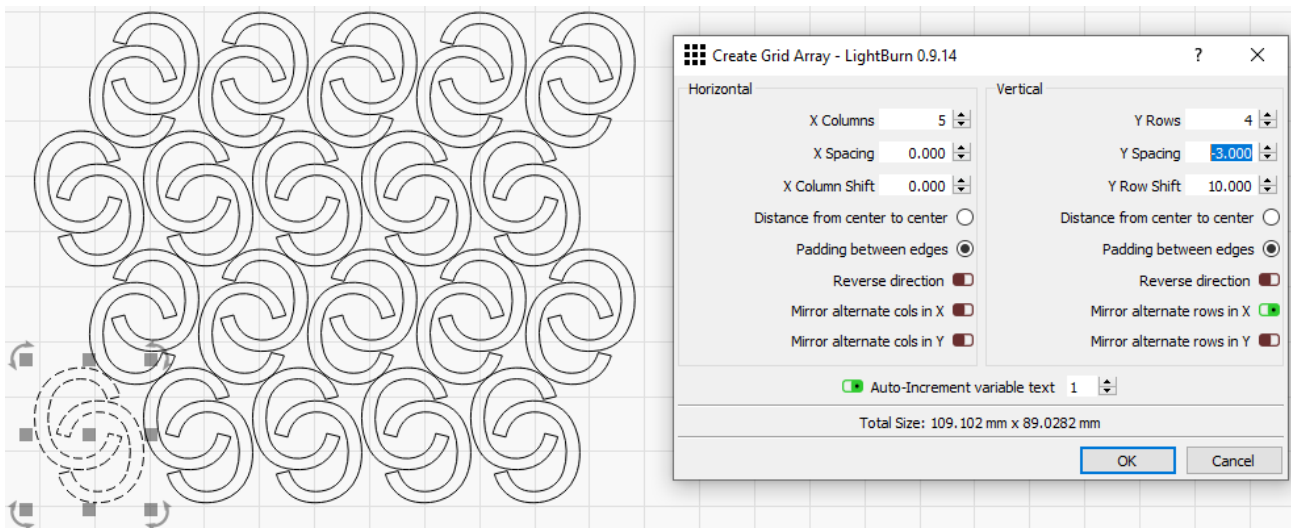
The above video describes in more detail how the various Boolean operations differ, and why welding text to a circle should be done with a Boolean Union instead.

### **■ ■ ■ 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.

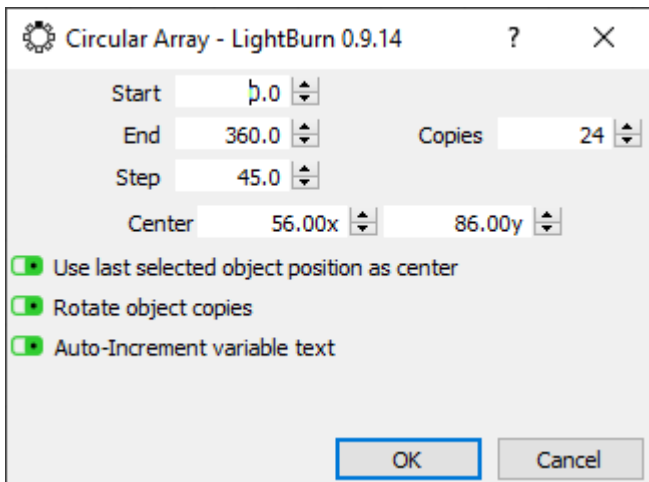


The X and Y columns settings let you specify how many copies of your shape to make in each direction. Spacing can be specified between edges (how much padding between shapes) or between centers (absolute object spacing). Column and Row Shift values let you offset alternate columns or rows, and you can mirror them as well, allowing you to more efficiently pack oddly shaped items together, like this:

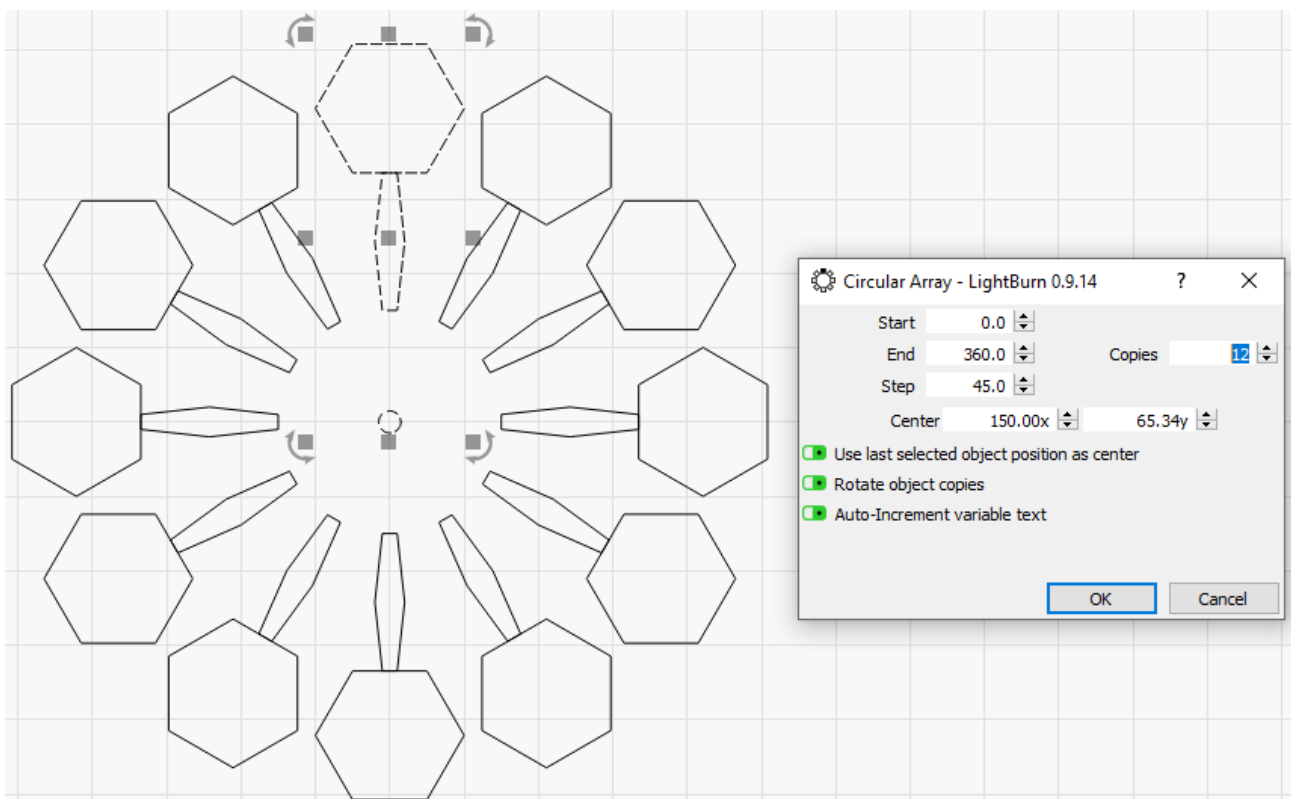


## Radial Array (circular array)

The Radial 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.

## 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.

## **Radiused Corners**

The Radiused Corners tool lets you round sharp corners where two lines meet. After clicking the Radiused Corners tool and entering a radius value below it, select a shape, then hover over a corner. If that corner can be curved, you should see the cursor change, like this:



If you click the corner, it will be rounded to the radius you've chosen, like this:

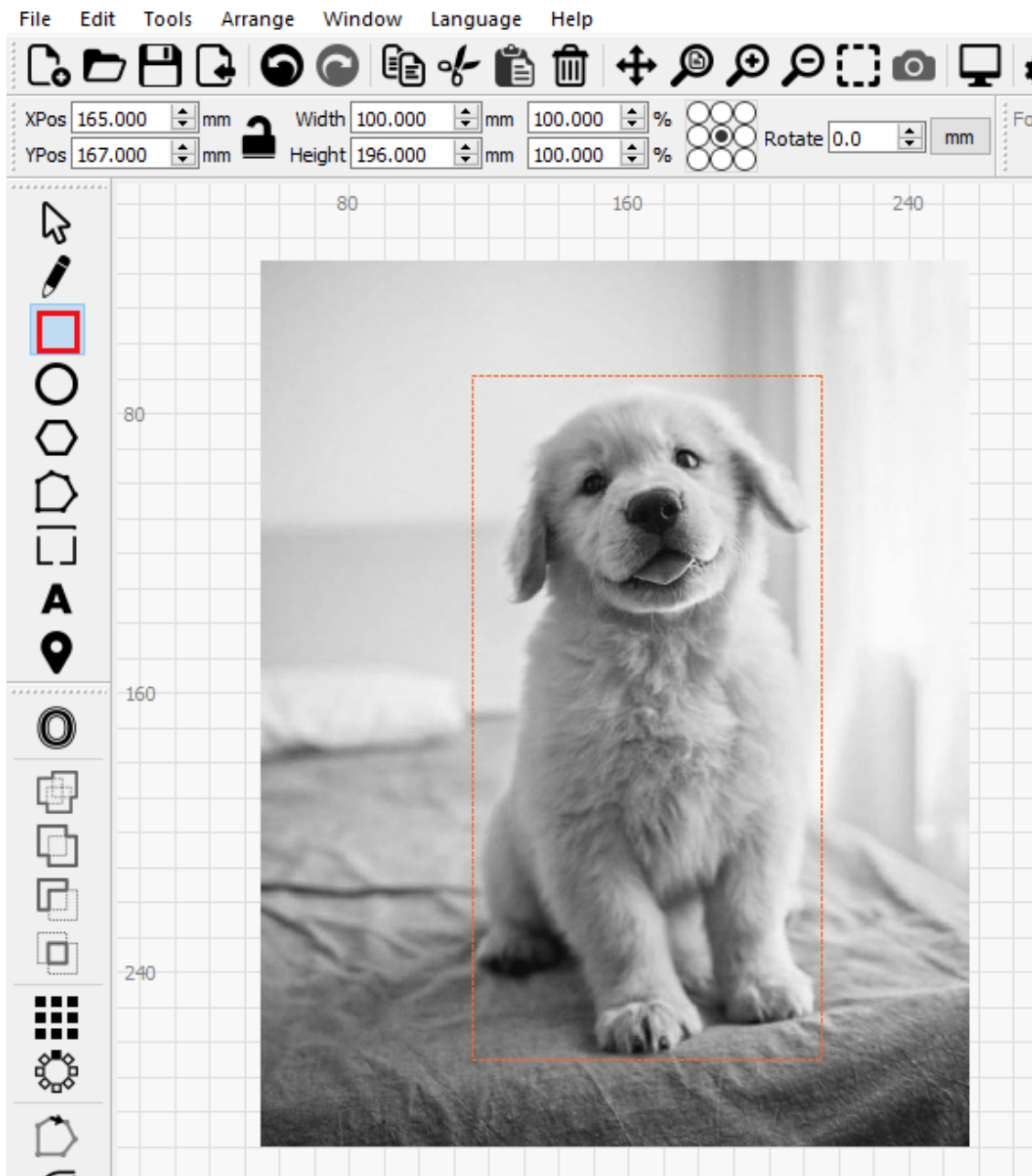


## # Image Masking / Cropping

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

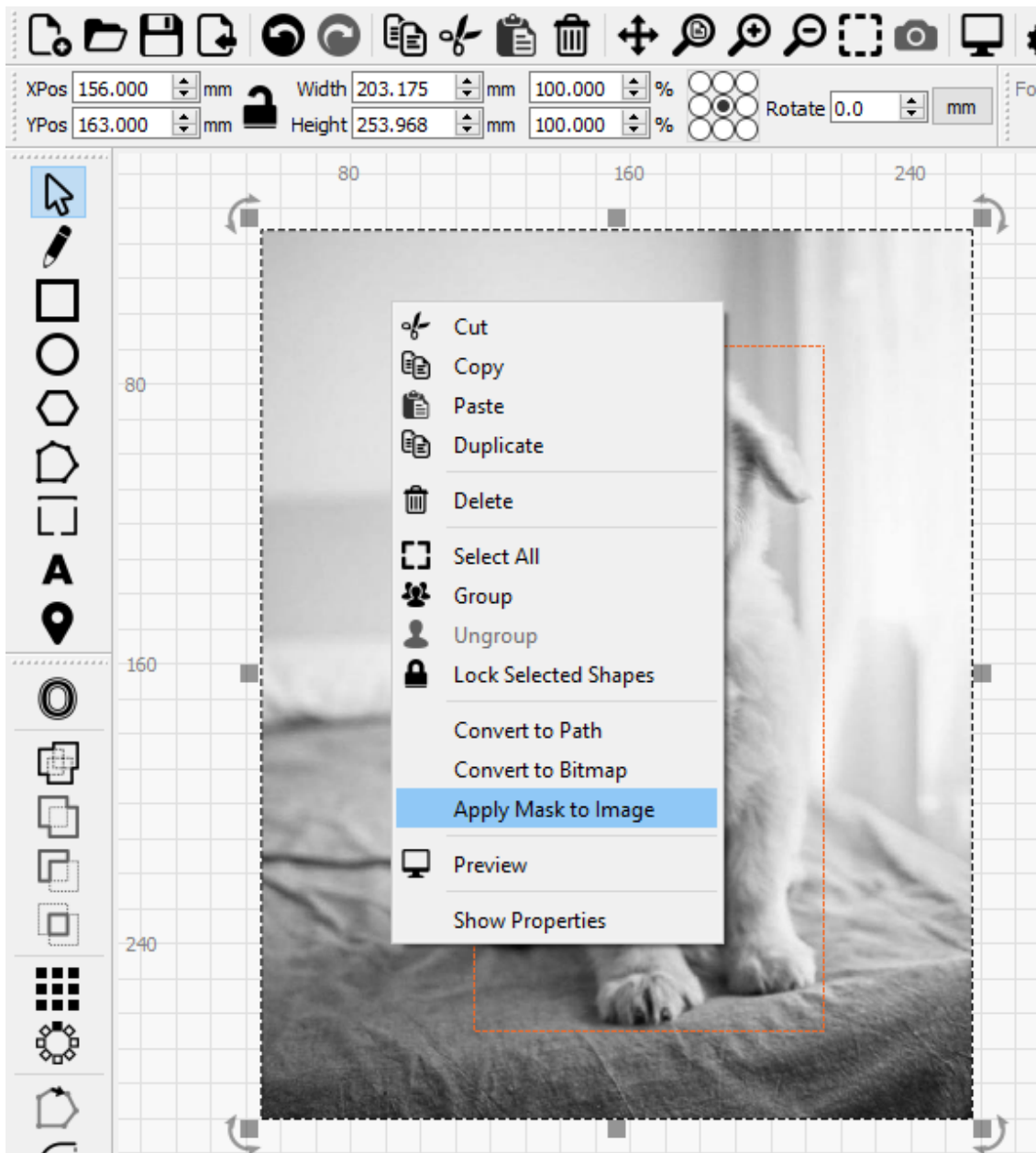
At the simplest this process consists of an image and single, simple shape:



Simple Image Mask

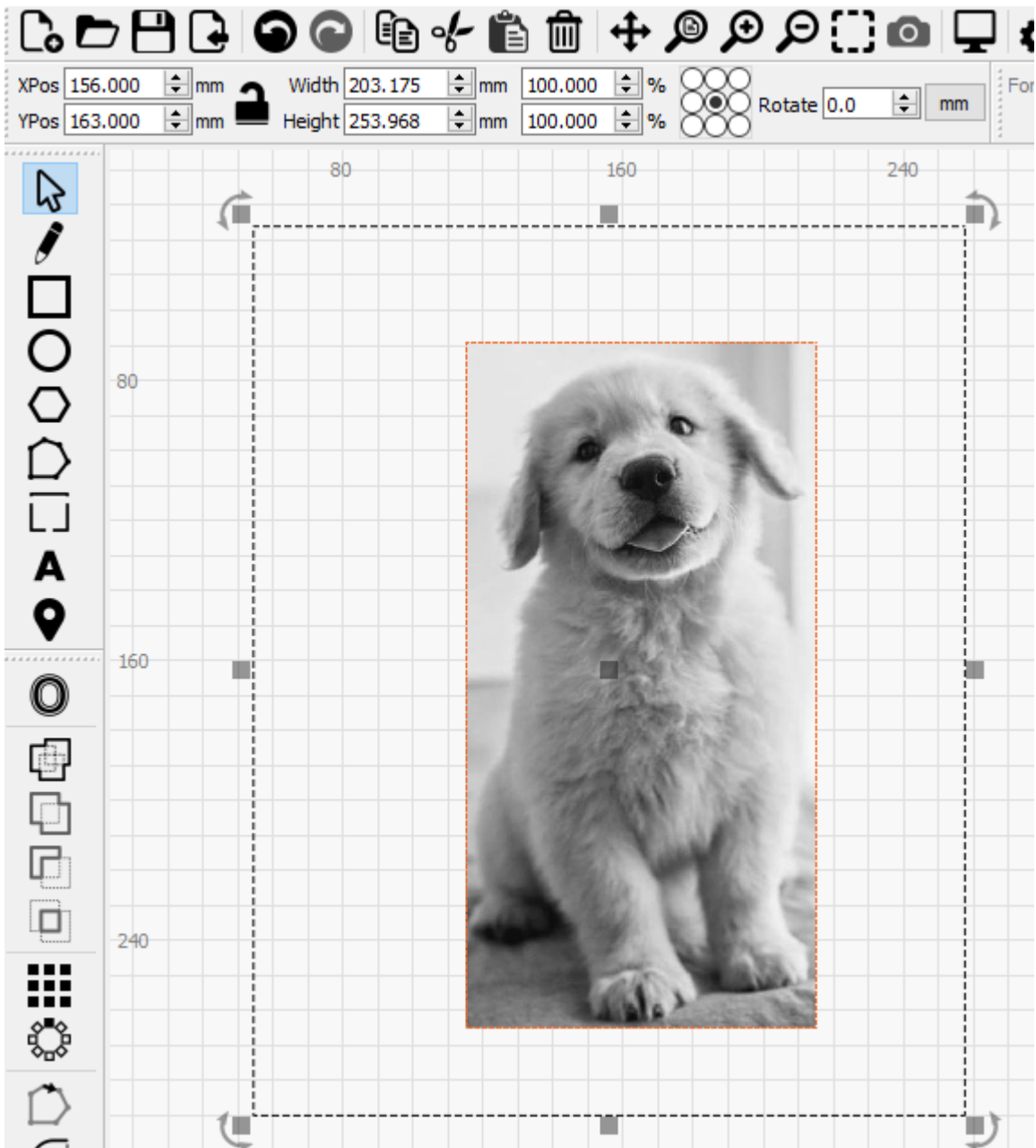
*As shown here, the shape is using a Tool Layer which can be useful for this process as the masking shape will not also be output. If you also need to cut along the mask then simply use any of the normal tool layers for this process.*

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**.



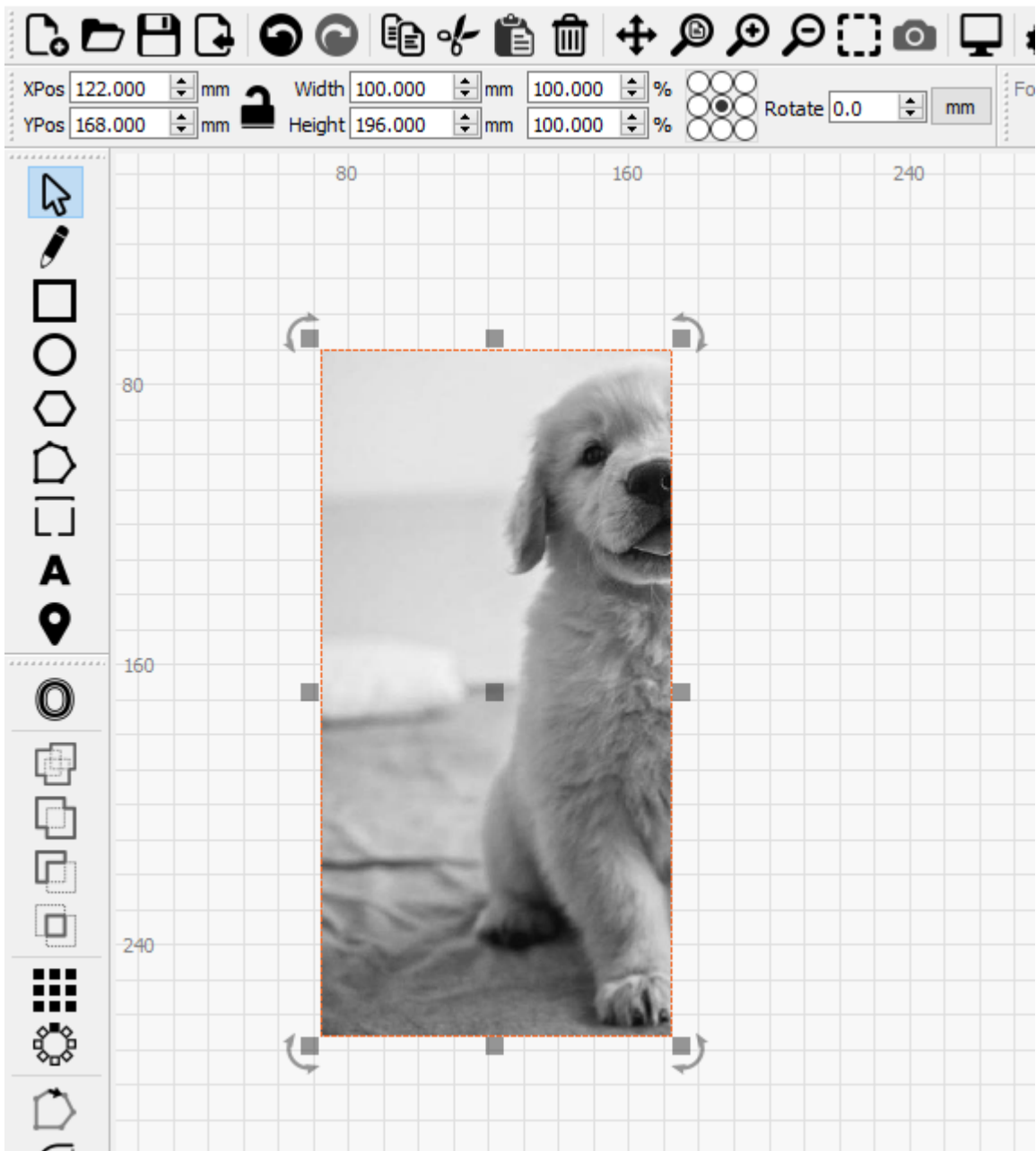
Apply Mask to Image

The mask will now be applied to the image as you can see below:

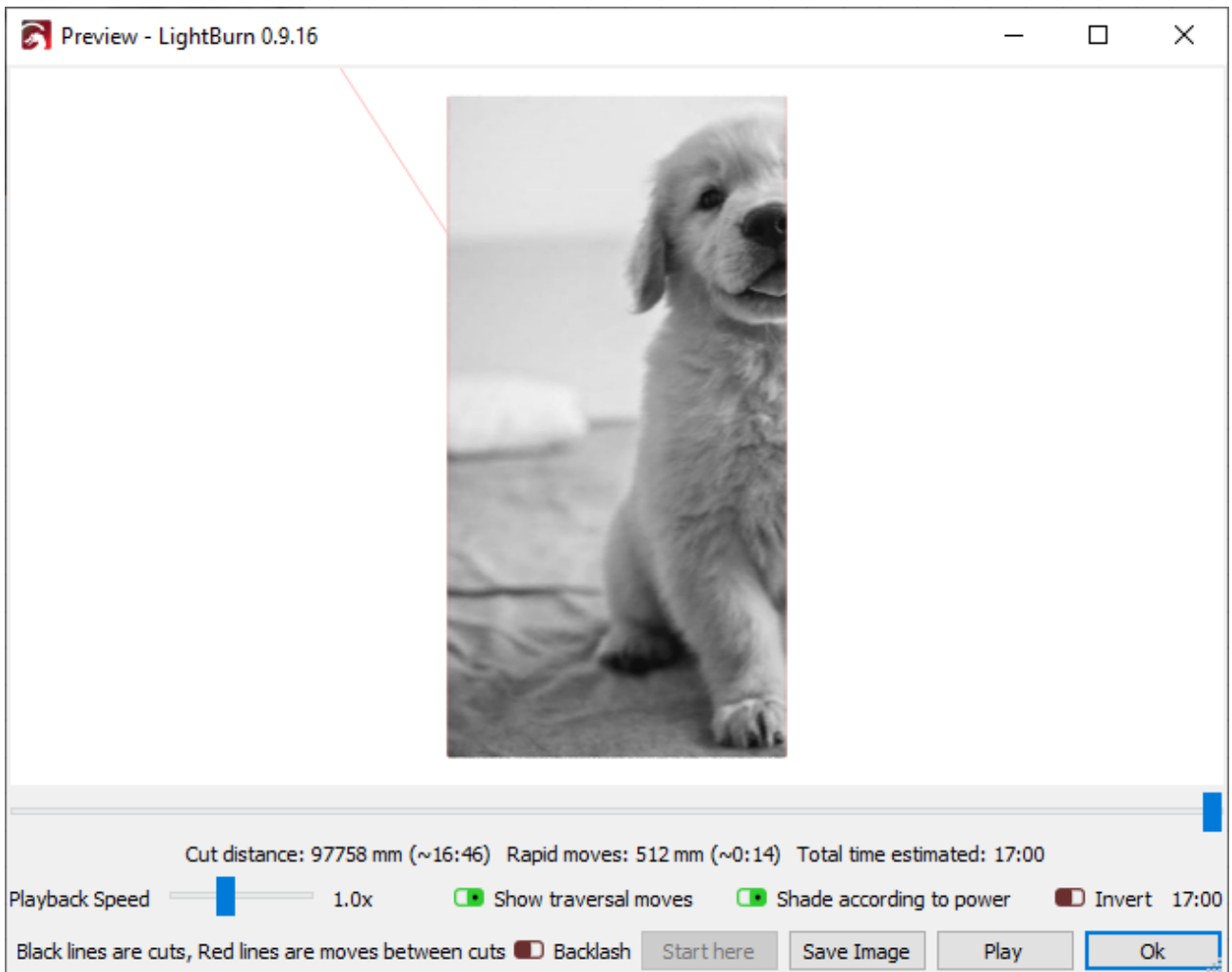


As you can see in the above screenshot, the selection box is still the same size as it was before. This is because the entire image still exists, but the mask is providing a windowed view into that image. If you select just the masking shape or the image, you can move it to reposition the mask.





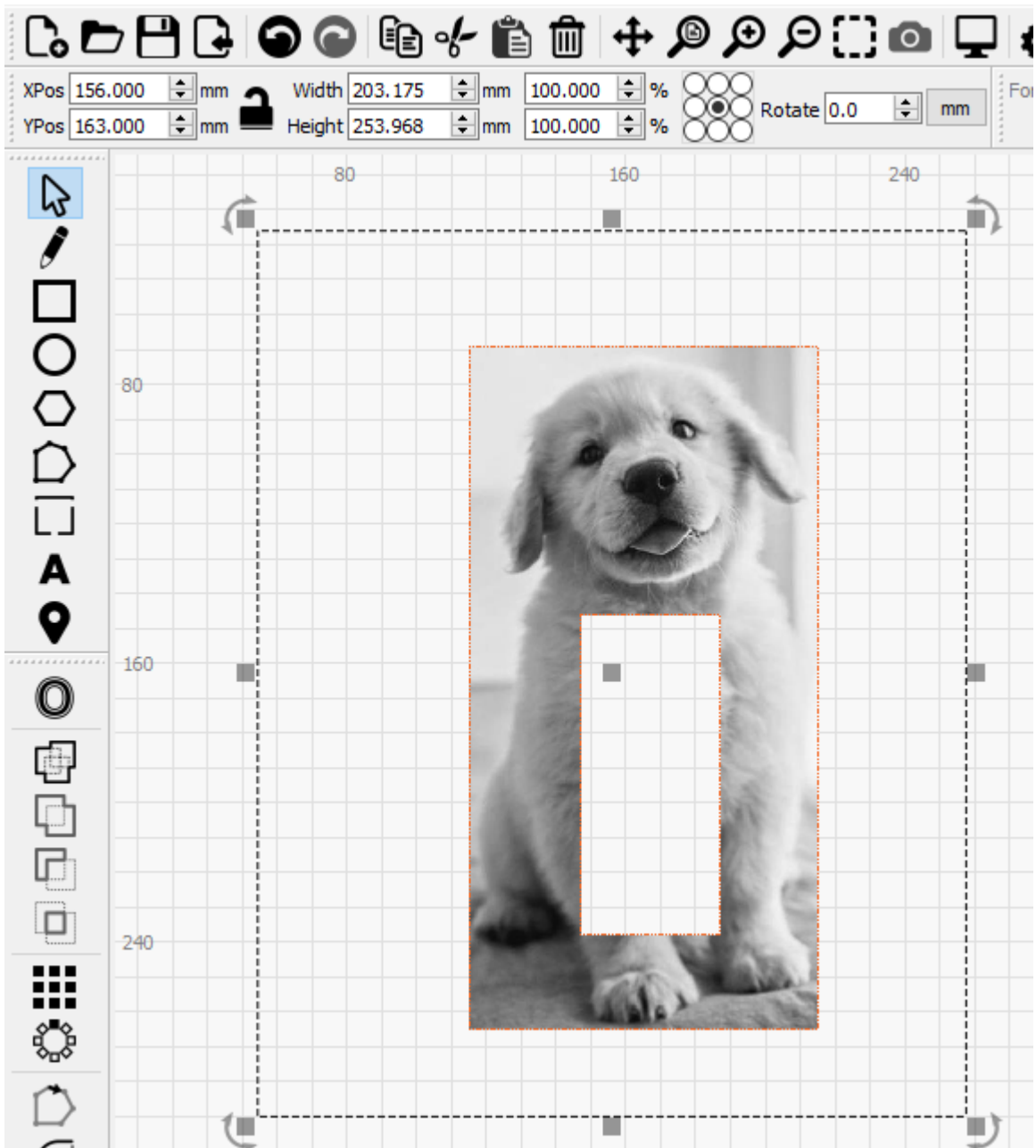
No image data is lost during this process and you can still reposition the image or mask even after saving and reopening a project at a later time. However, as you can see in the preview below, only that part of the image that was masked off will be output:



## 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.



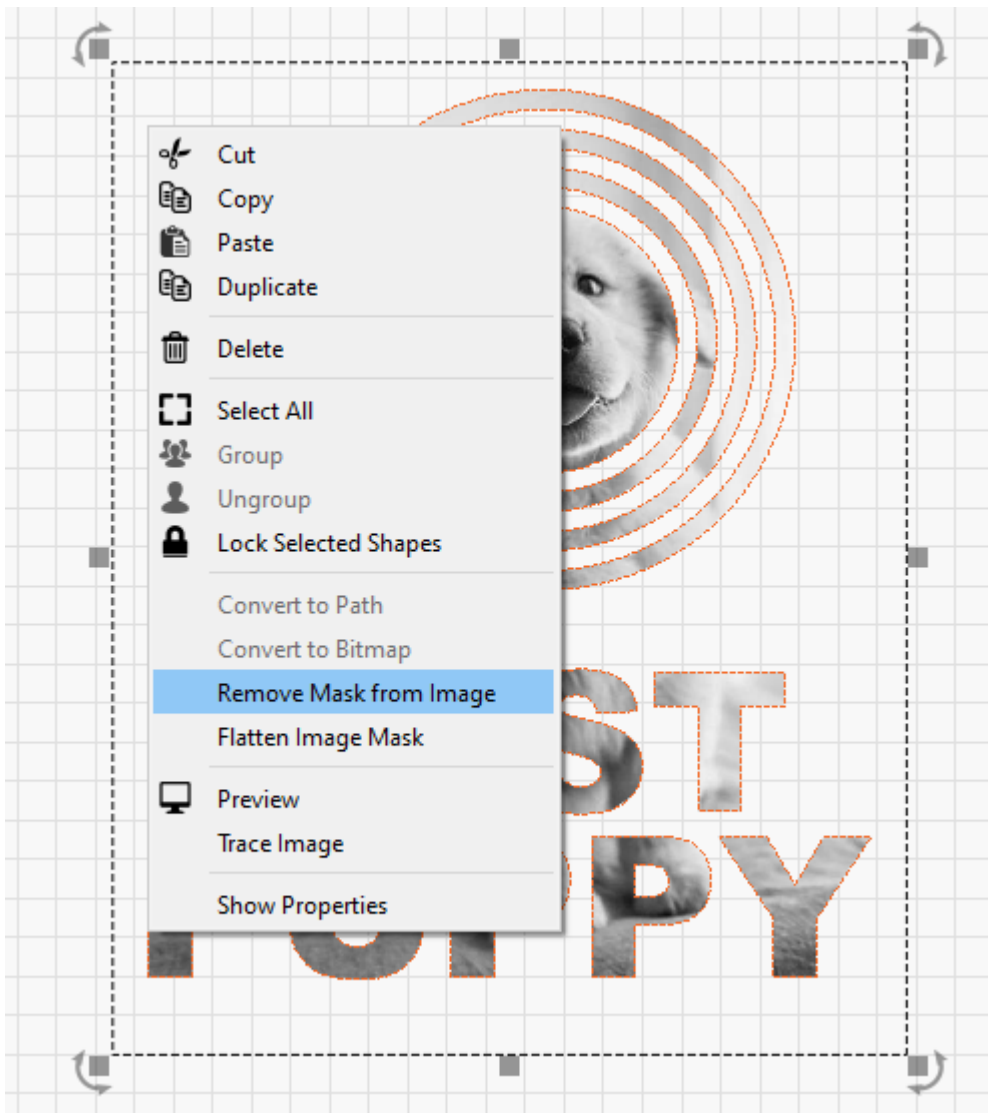
But you can, of course, go far beyond that. Any closed shape can be used as a mask and the easiest way to think about how that mask is applied, is that anywhere LightBurn would normally fill that closed shape in **Fill Mode** will now be “filled” with the image instead. For example:



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**:



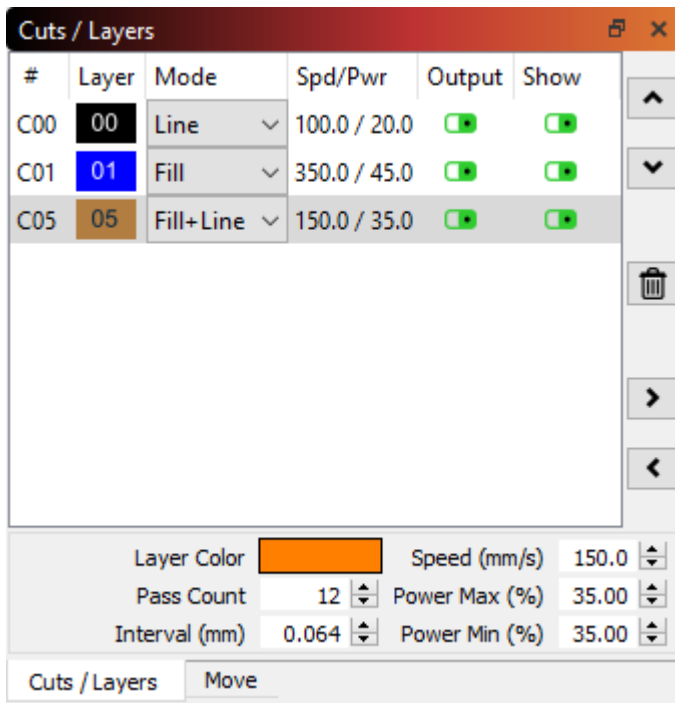
Using the **Remove Mask from Image** option will preserve the mask shape (or shape group) for later use.

### **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:




# Cuts / Layers





The Cuts / Layers window in LightBurn shows the list of operations you have in your design. It's very common to have the layers set to be cut in this order (though it's not required).

The view here gives a summary of the operations, showing the type (Line, Fill, Both, or Image), the main speed and power settings, and the two toggles to choose whether the layer is output (sent to the laser) or shown in the editor. If you select an entry in this list, the values at the bottom of the list will let you edit speed, power, number of passes, and interval (distance between lines when doing a fill).

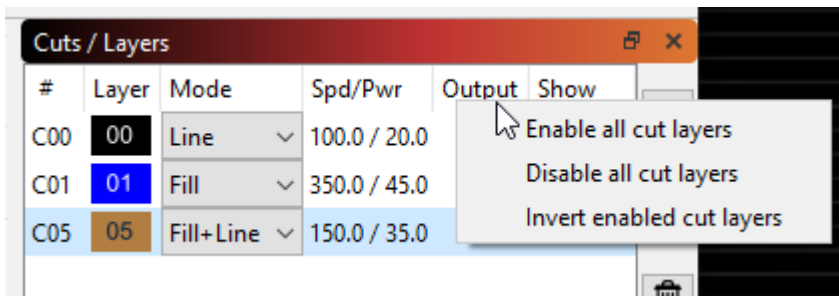
The buttons to the side allow you to manipulate the list of layers:

 **Move** - The first two buttons, "Move up / Move down", allow you to re-order the entries in the list, by shifting the selected entry up or down in the layer order.

 **Delete** - The next button will delete all the content on the selected layer. Note that layers themselves can't actually be deleted, exactly - They disappear automatically when nothing is assigned to this color, so you either have to assign everything using this layer color to a different one, or delete all the shapes using this color.

 **Cache** - The next two buttons let you copy the selected layer into a "cached" setting, and copy the cached setting over top of the selected layer. This allows you to quickly copy the settings from one layer to another if you need to.

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:



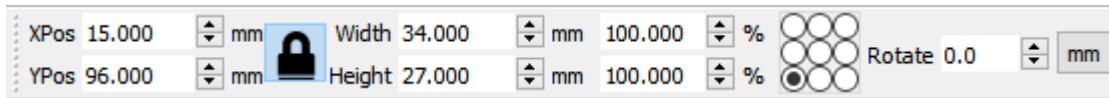
Right-Clicking an entry in the layer list will flash all the shapes using that color in the edit window, allowing you to quickly see what's using this layer setting.

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.



# Numeric Edits Toolbar



MainToolBar

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 50mm wide and 25mm 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](#).

# Fonts and Text

Video Tutorial #2: Text Tool

Creating text in LightBurn is simple - click the Create Text tool ( **A** ) 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.

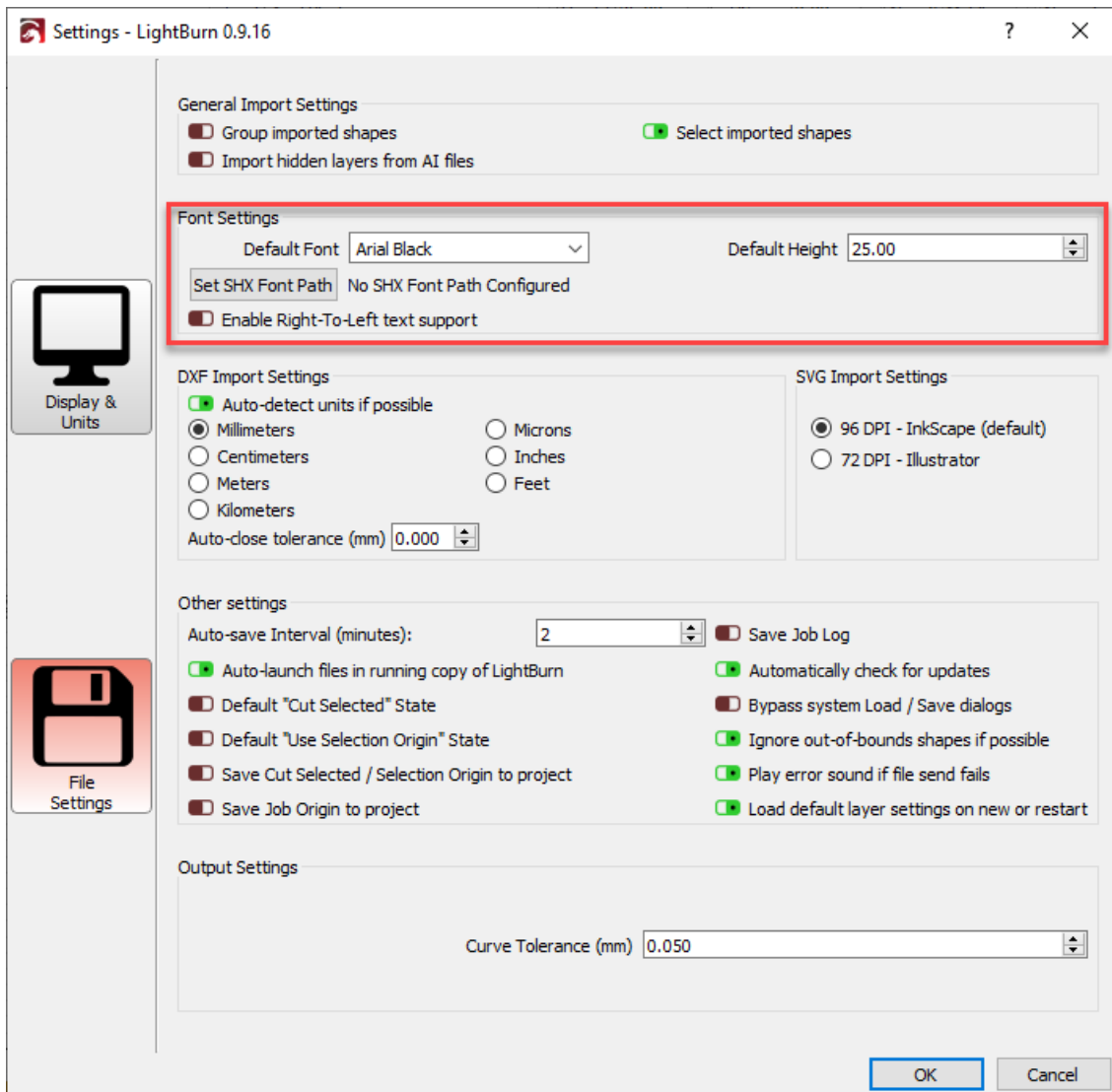
Change font and size, alignment, and spacing

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



FontSettings

**Default Font** - Default selected font for new documents

**Default Height** - Default font height for new documents

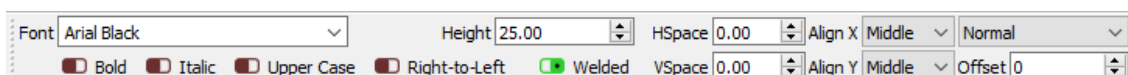
**Enable Right-to-Left text support** - This will automatically be enabled on first run if a Right-to-Left language is the current system input language. But it can be forced on here later if needed. It will allow you to turn on Right-to-Left font rendering for any text.

**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:



FontsAndText

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.

**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

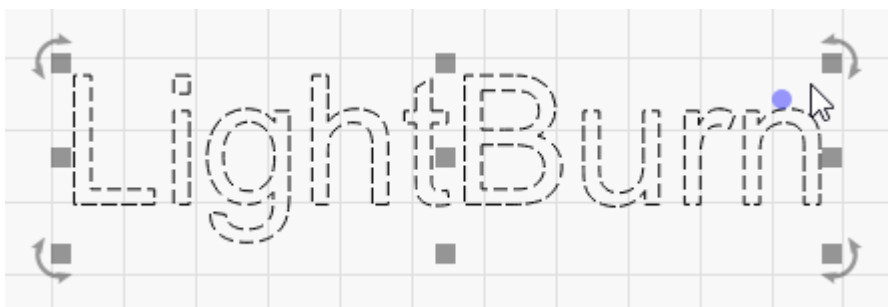
**Upper Case** - Forces all text to be upper case

**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](#).

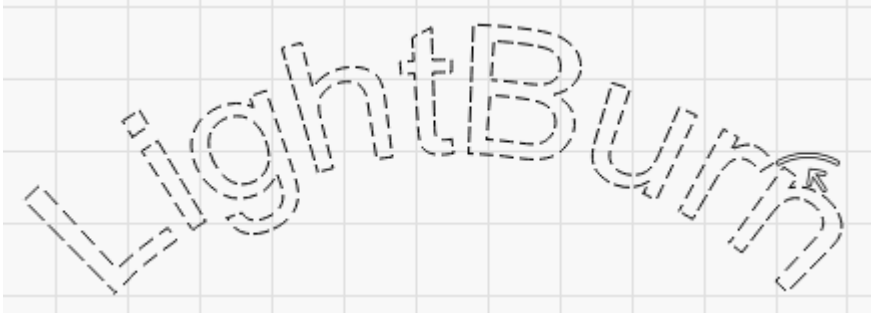
## Curved Text

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. 

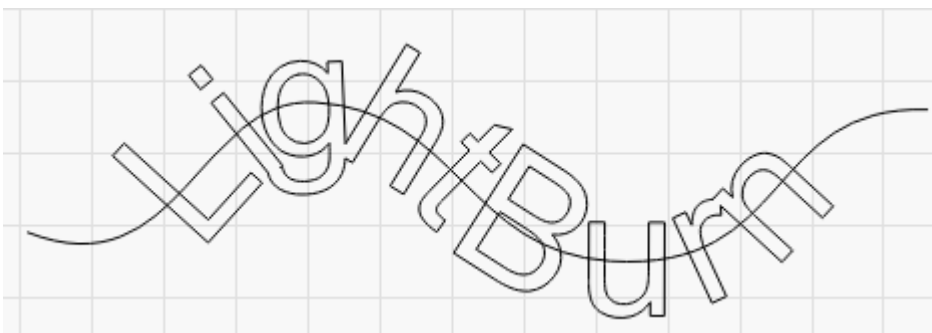
If you click and drag the dot, your text will bend around an invisible circle, like this:



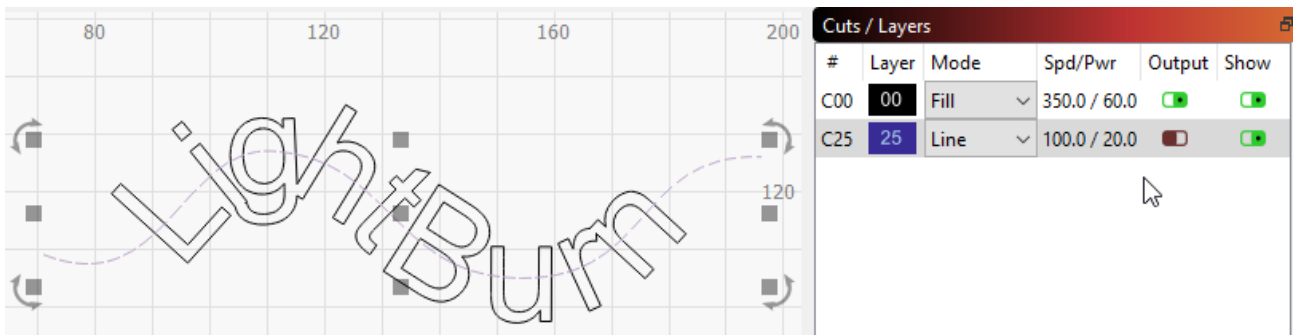
Double click the dot to clear the bend and restore the text.

## Text on a Path

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:



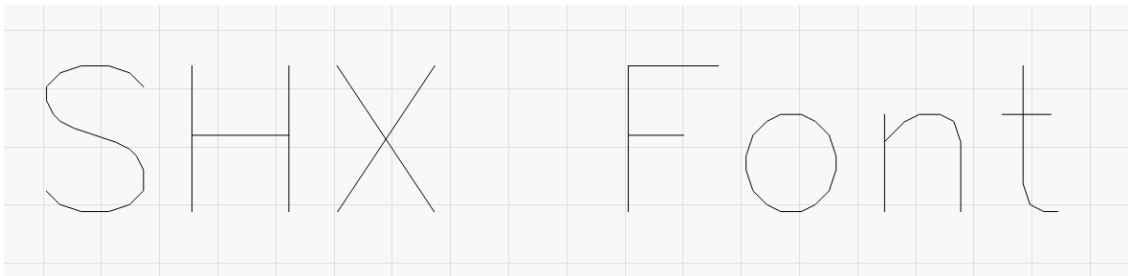
Note that for text to remain editable you cannot delete the path, so if it is not something you want engraved along with your design, put the path on its own layer and set that layer not to output, like this:



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

## SHX Fonts

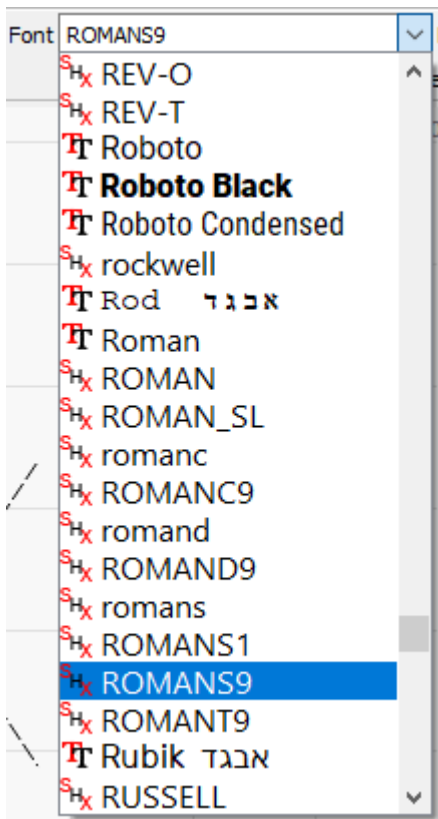
LightBurn also supports the use of SHX font files which are an old AutoDesk font format, mainly intended for use with CNC machines. Most importantly, SHX fonts lack many of limitations of standard system fonts and have the ability to define “single line” fonts, such as this:



Single Line Font

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 Font Dropdown

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

 denotes an SHX font

 denotes a standard operating system font

# **Edit Window (workspace)**



# 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

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, external software like CorelDraw, Adobe Illustrator, InkScape, or AutoCAD would be used. Photo or image manipulation software 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 likely 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

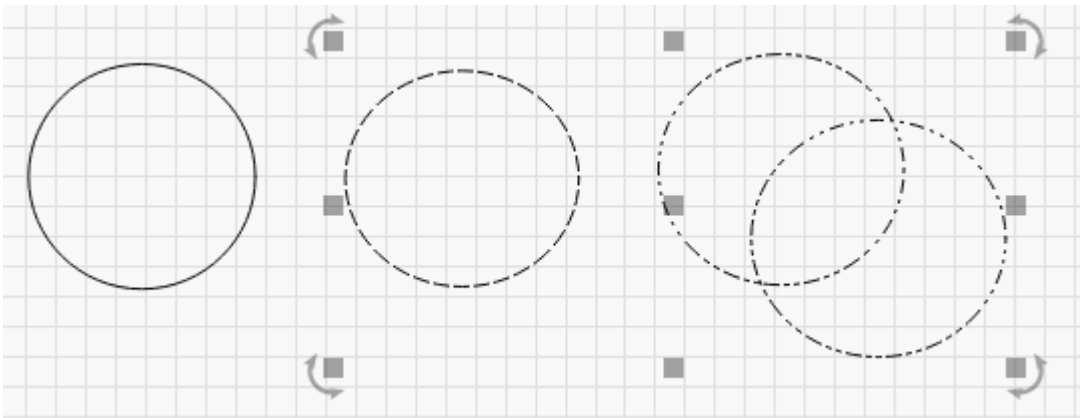
Pressing the Import keyboard shortcut (Ctrl + I)

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.

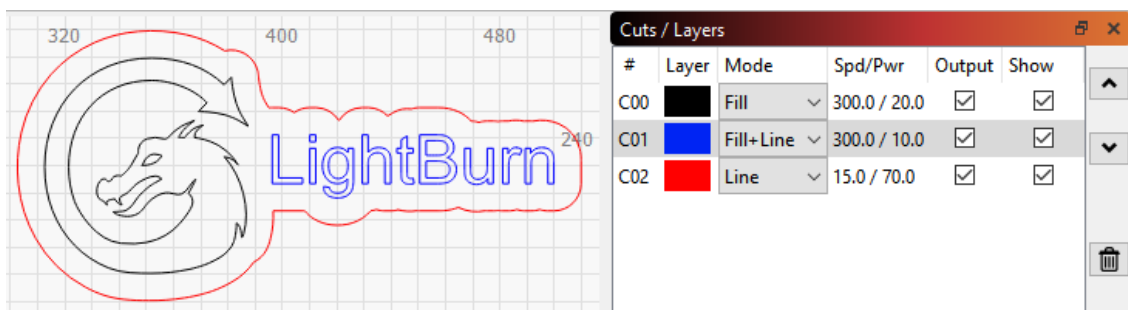
The four rotate handles allow you to rotate the object freely using the mouse. While rotating, the relative rotation is displayed in the status bar. Holding the Ctrl key (Command on Mac) snaps the rotation to the nearest 5 degrees, holding Shift will snap to 15 degrees, and holding Ctrl+Shift snaps to 45 degrees.

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

## 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:



LayerColorsExample

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:



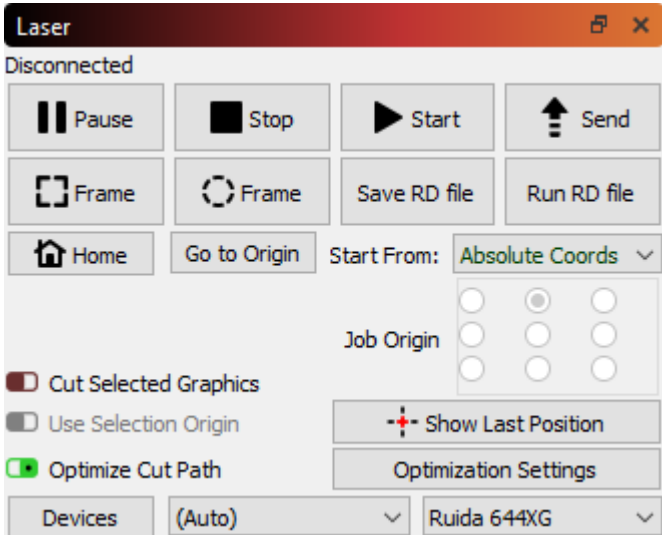
LayerColorsExample

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

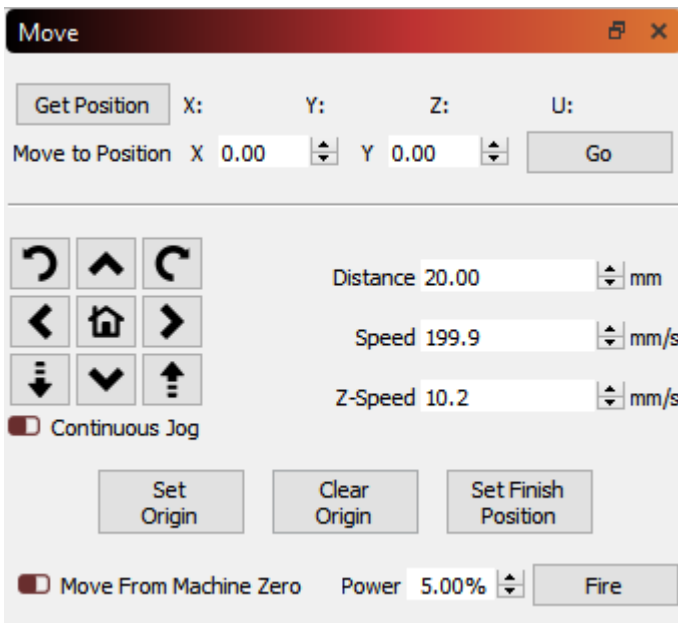
There are two windows primarily used to control the laser:

The Laser Window, shown in the lower right of the display by default, lets you select your laser, Start, Stop, and Pause a job, Frame the design (move the laser head around the boundary of your design to test alignment), and more.



LaserWindow

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.



MoveWindow

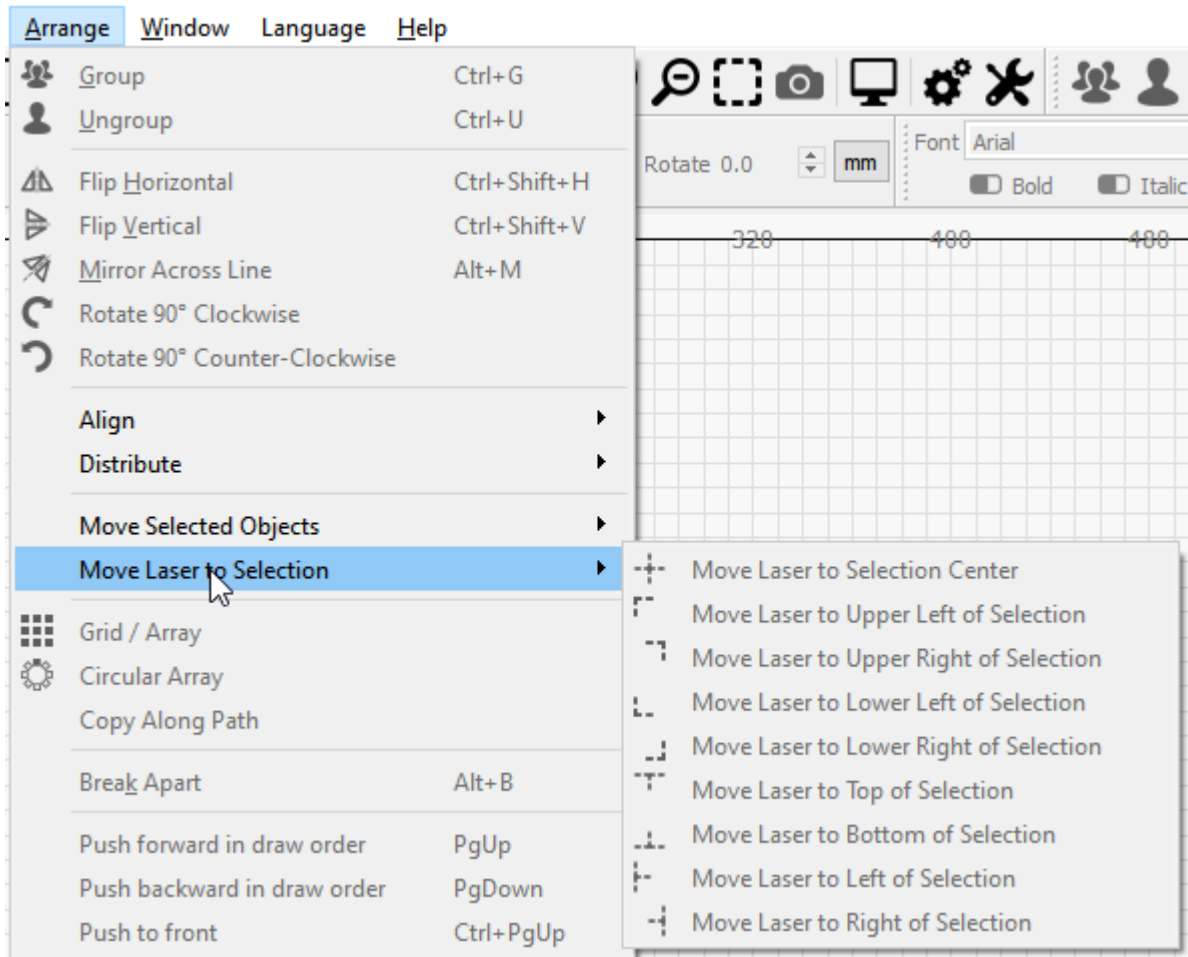
There are a couple other methods for moving the laser that are noteworthy:

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.



# Edit Nodes tool

## Video Tutorial #2: Node Editing

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](#).

Allows you to move the vertices of a selected shape. You can select multiple nodes with the mouse.

Pressing the S key when hovering over a node will convert it to a smooth node, and if required, creates tangent handles that can be manipulated from it.

Pressing S while hovering over a line will convert the line to a smooth curve, with tangent handles, but leaves the shape of the original line intact.

Pressing L while hovering over a smooth curve will convert it back to a straight line.

Pressing C while hovering over a node will convert it to a corner, allowing the two handles to be manipulated independently of each other.

Pressing D when hovering over a node will delete it and connect the lines on either side together.

Pressing D when hovering over a line will delete it and open or split the shape.

Pressing I when hovering over a line or curve will insert a new node at that point along the line

Pressing M when hovering over a line or curve will insert a new node at the midpoint of the line

Pressing B when hovering over a point will break the curve at that point

Video Tutorial: [Trim and Extend](#)

Pressing T when hovering over a line will trim the line under the mouse at the next intersection with another line.

Pressing E when hovering over a point will extend the line from the point under the mouse to the next intersection with another shape.

## 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 and 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.

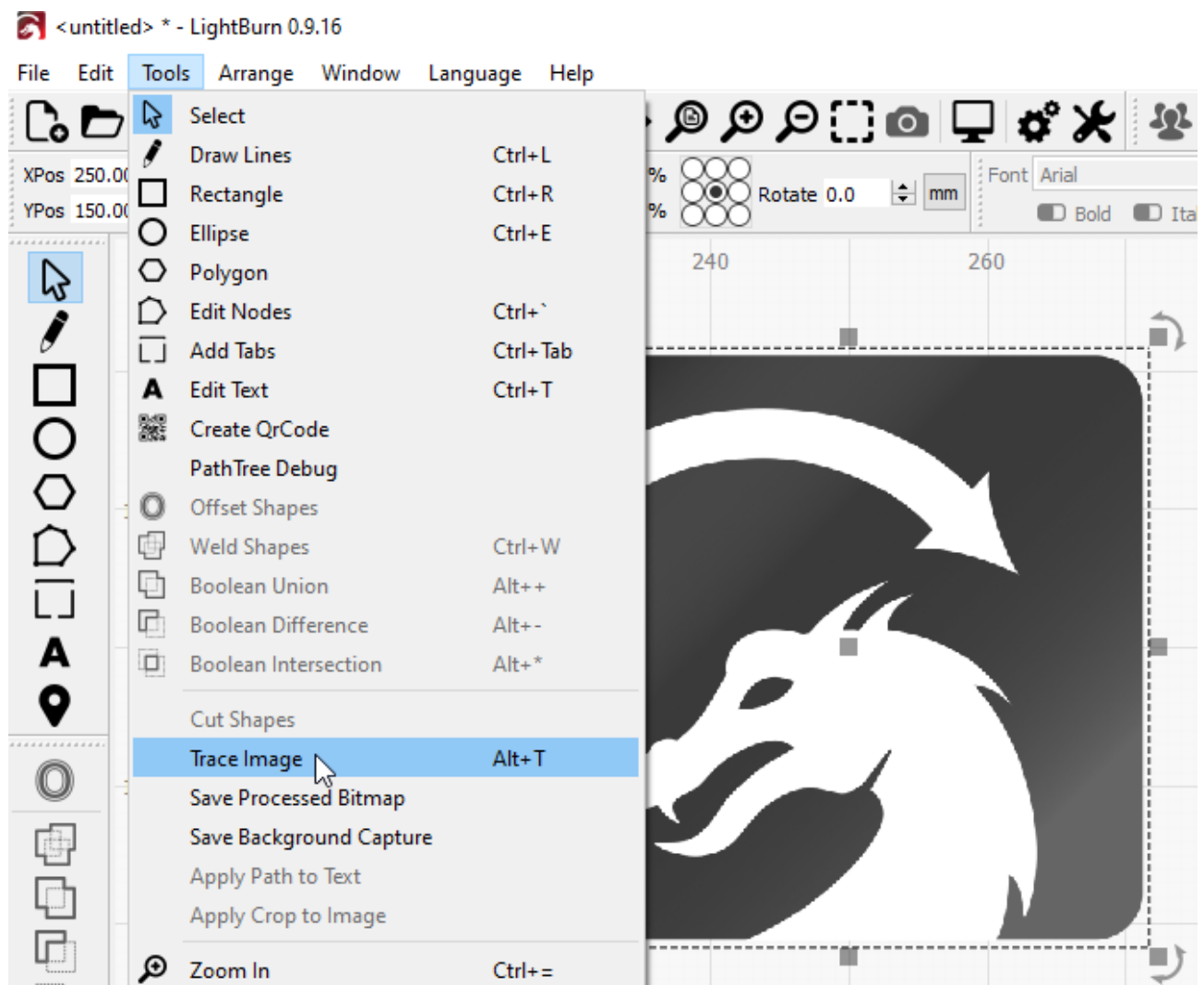
If you want to node edit a shape, it has to be a path shape - using the Convert to Path function in LightBurn on a built-in shape type tells LightBurn to turn it into an editable thing that is just points and curves, and that it's ok to throw away the information about the original type of thing it was.

# 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.

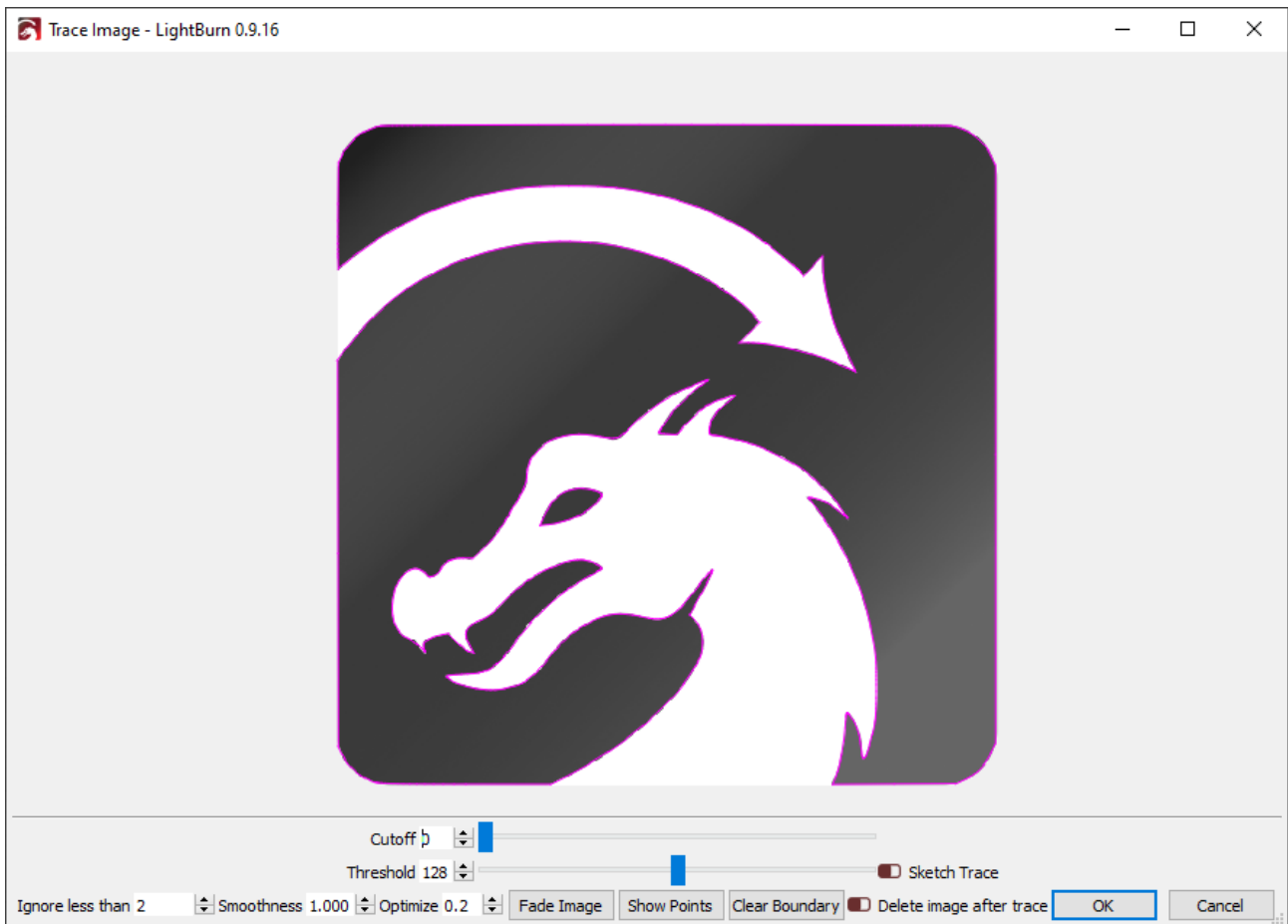
We have an excellent tutorial video for this feature on our YouTube channel here: [Image Tracing Tutorial](#)

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:





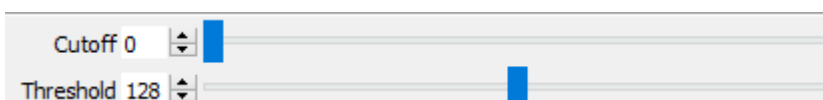
In the image above, the purple lines are the vectors that LightBurn has produced from the image being traced. If you want to be able to see them more clearly, click the “Fade Image” button, and the image will dim. You can also zoom and pan using the same controls as the preview window (mouse wheel to 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.

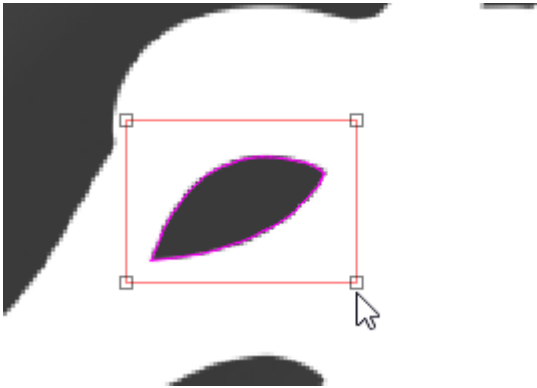
The **Cutoff** slider controls the lower end of the range of values that LightBurn will outline with vectors, and the **Threshold** slider sets the upper end. The default is 0 to 128, which traces around all values in the range of 0 to 128 brightness, excluding lighter values in the range of 129 to 255 brightness.

By adjusting these two controls, it is possible to trace around a narrow range of the image.



### Selection range

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.

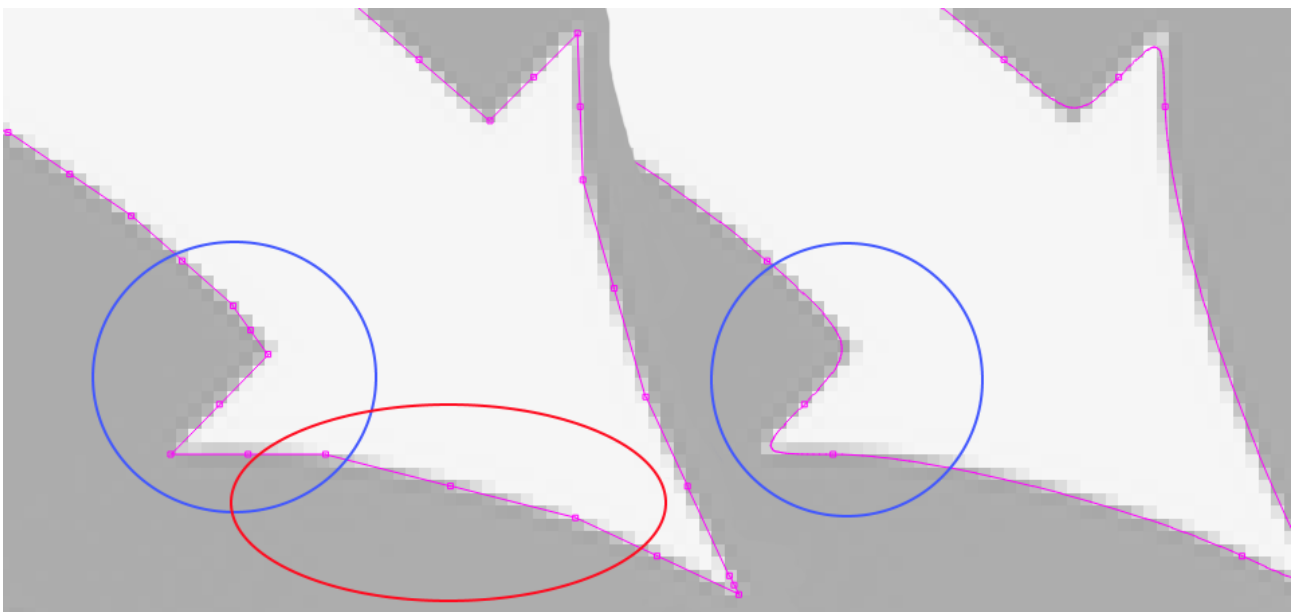


### Ignore less than

This setting tells the vectorizer to ignore anything smaller than this many pixels in area. If you are trying to vectorize a noisy image, increasing this may help.

### Smoothness

Bitmap images are made of pixels, and pixels are rectangles. Image tracing tries to infer shapes from these arrangements of rectangles, and has to smooth out the results or everything would just look like stairs. Part of the process is trying to recover smooth shapes from jagged lines, and this number controls how aggressive the smoothing is. A value of 1.333 is the maximum, and will make almost everything into curves. A value of 0.0 will produce all straight lines. The difference is shown below:



Notice in the left image, with a Smoothness of zero, the area highlighted in red is made of several line segments, whereas the same area in the right image is a continuous curve. The area shown in

blue is also sharp in the left image, but with the Smoothness value set to maximum, the image at right shows how even sharp corners become smoothed, and this is rarely desired. The default value of 1.0 is a good mix between producing smooth curves while still maintaining 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.

## # 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:

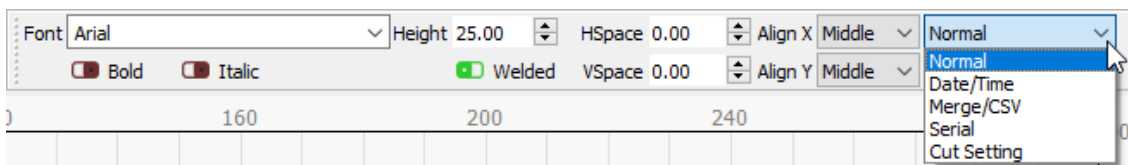
Date or time stamps

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:



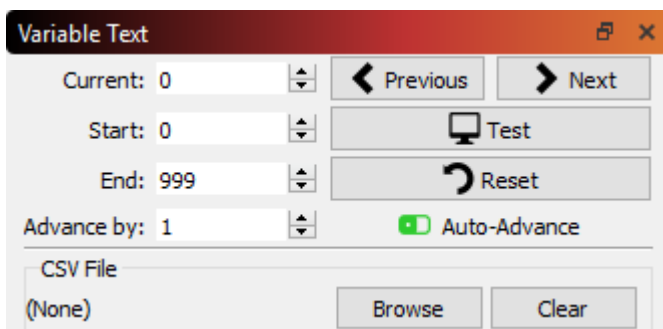
VariableTextDropDown

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:



Variable Text

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)

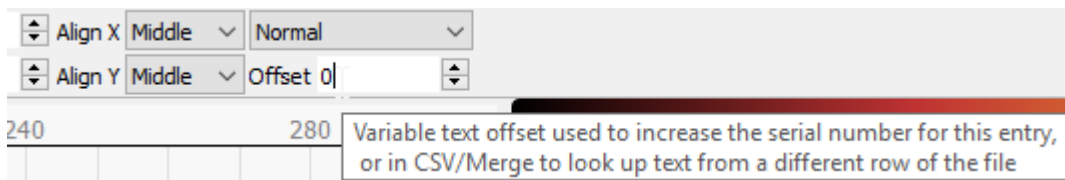
**Next:** Go to the next page of values (increments the Current entry by the 'Advance by' amount)

**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' or 'Save as..' 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.

There is a property on text objects called **Offset** which controls 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.



VariableTextOffset

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.

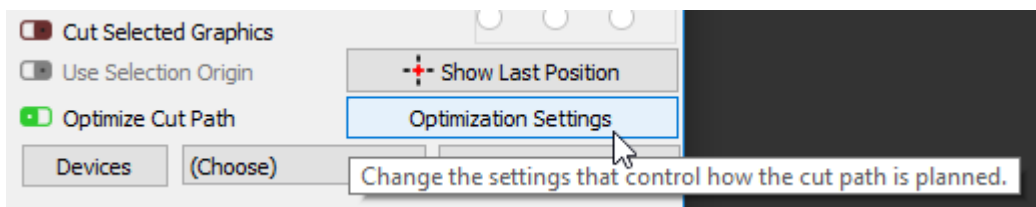
# Engraving Images

# Optimization Settings (the Cut Planner)

Video Tutorial on YouTube - [Click here](#)

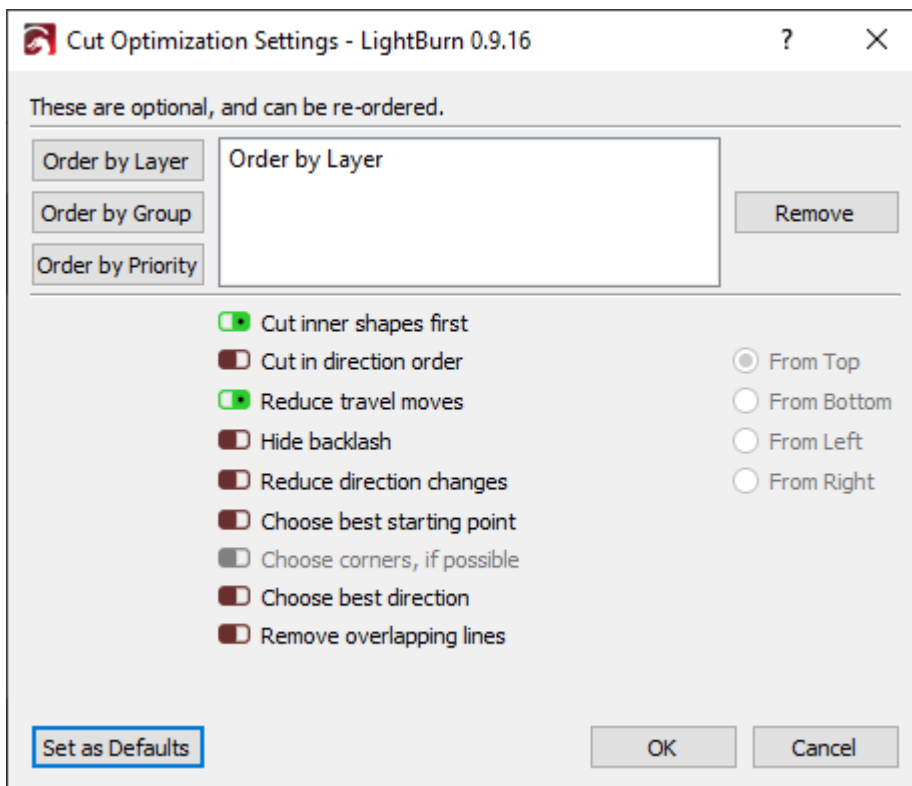
The cut planner gives you a great deal of control over the ordering of your cuts - you can let LightBurn try to choose the best path for you, order it piece by piece yourself, or somewhere in between. The new options are powerful, and we'll have a video coming soon to demonstrate them. If you have "Order 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:



OptimizationSettingsButton

The settings are displayed in this dialog (and the defaults are shown here):



CutPlannerSettings

## 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. This will remove any line fully covered by another line, but will not yet remove partial overlaps, like this:



Optimizer-PartialOverlaps

(the lines are offset from each other slightly here to be able to see them)

# 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.

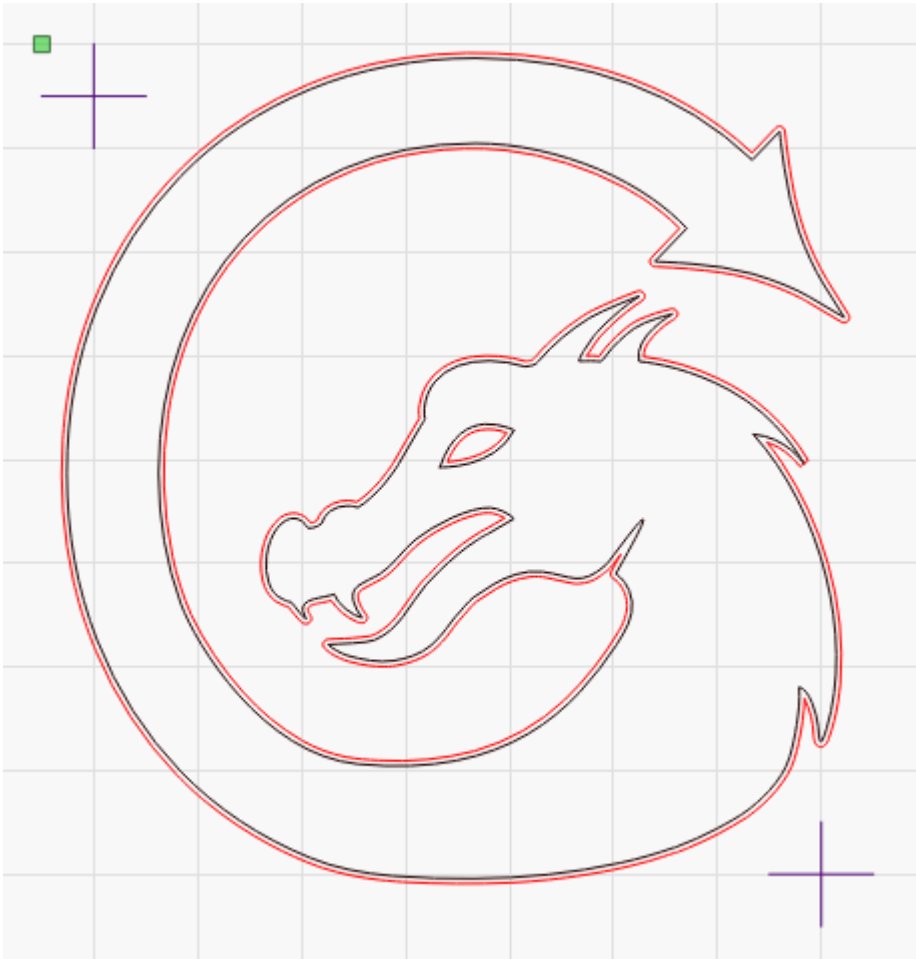
**Note:** In order for the output to be positioned correctly on your laser, you *must* use *Absolute Coords* as the positioning mode, otherwise the output will not match the position of the print.

## 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:



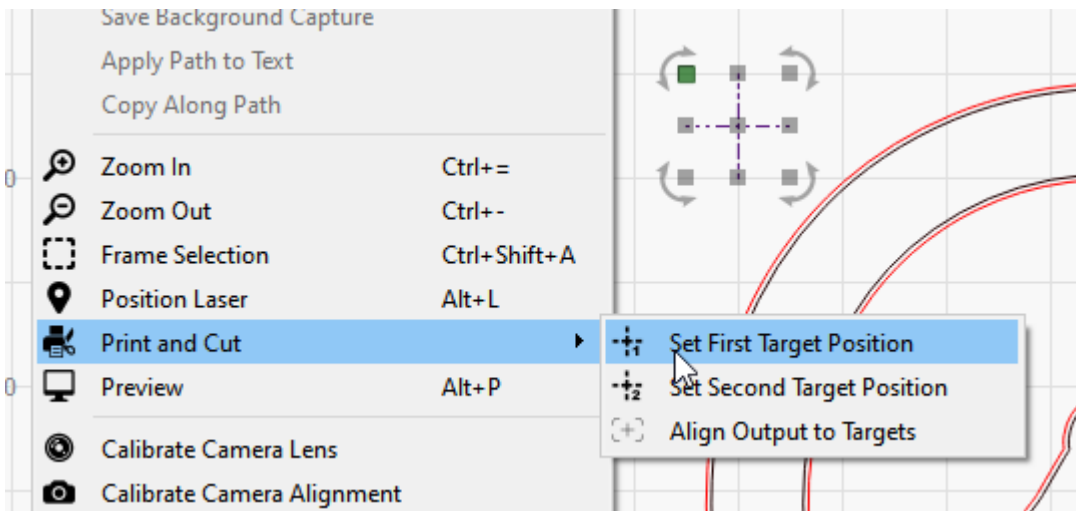
The important part in this file is the two cross-hair marks - these are the target marks that you will use to align the cutting path with the printed sticker. They don't have to be cross-hairs, but these are simplest to align with, as the *center* of the selected object is what is used for alignment 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.

The red lines are set as cut vectors, with an appropriate power and speed, and the black lines can either be set not to output, or simply deleted.

After placing the printed version of the file in the laser, follow these steps to align the laser output with the print.

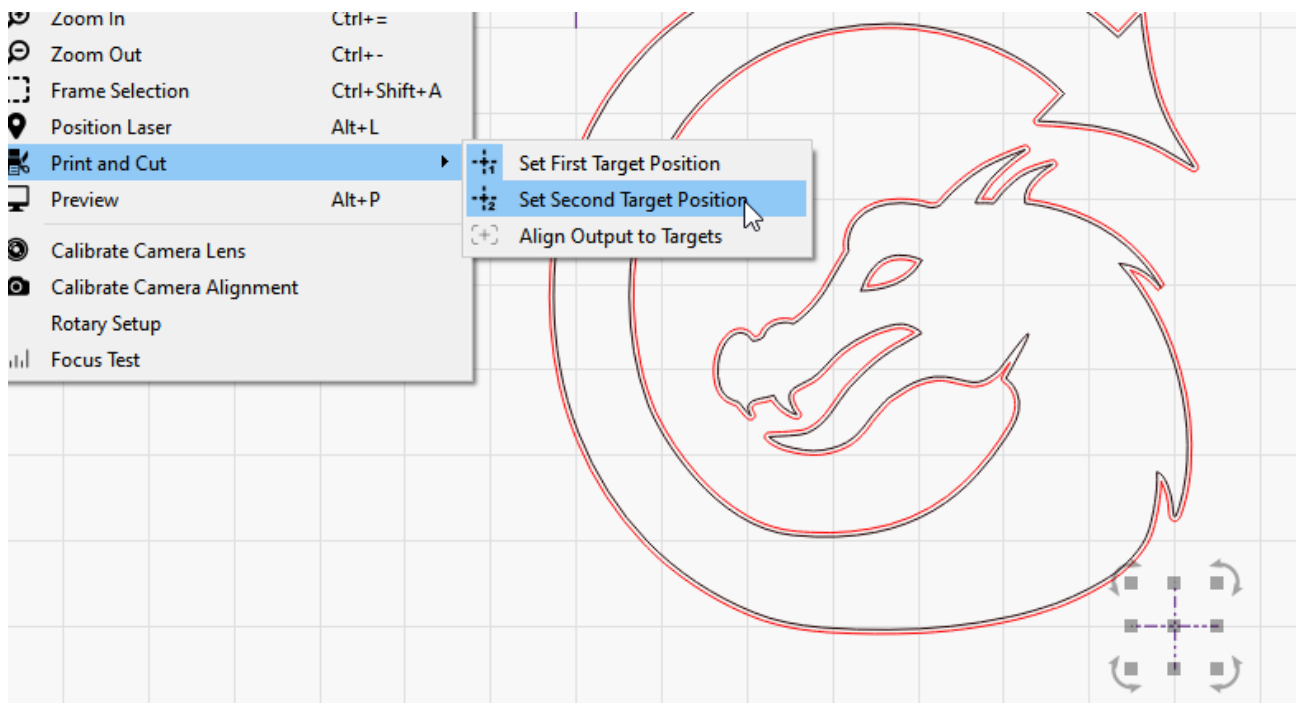
Using the red-dot pointer of your laser, jog the laser head to align with the center point of one of the two cross-hair marks.

In LightBurn, select the same cross-hair mark, then go to Tools > Print and Cut > Set First Target Location, like this:



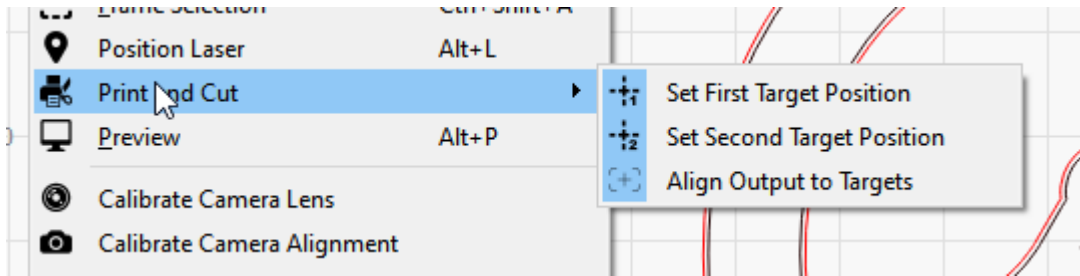
Now, jog the laser to align the red dot pointer to the center of the second marker

In LightBurn, choose Tools > Print and Cut > Set Second Target Location:



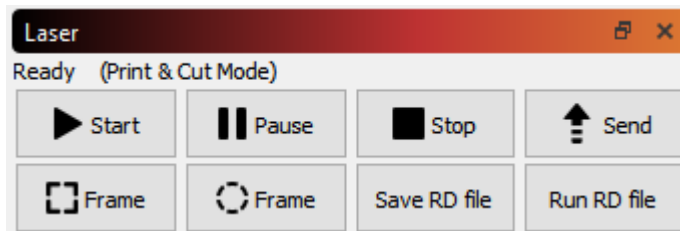
You will notice that in the above image, the menu option for 'Set First Target Position' has the icon highlighted as well - this means that the First Target Position is set and active.

After setting both targets, the menu will automatically enable the 'Align Output to Targets' option for you, like this:



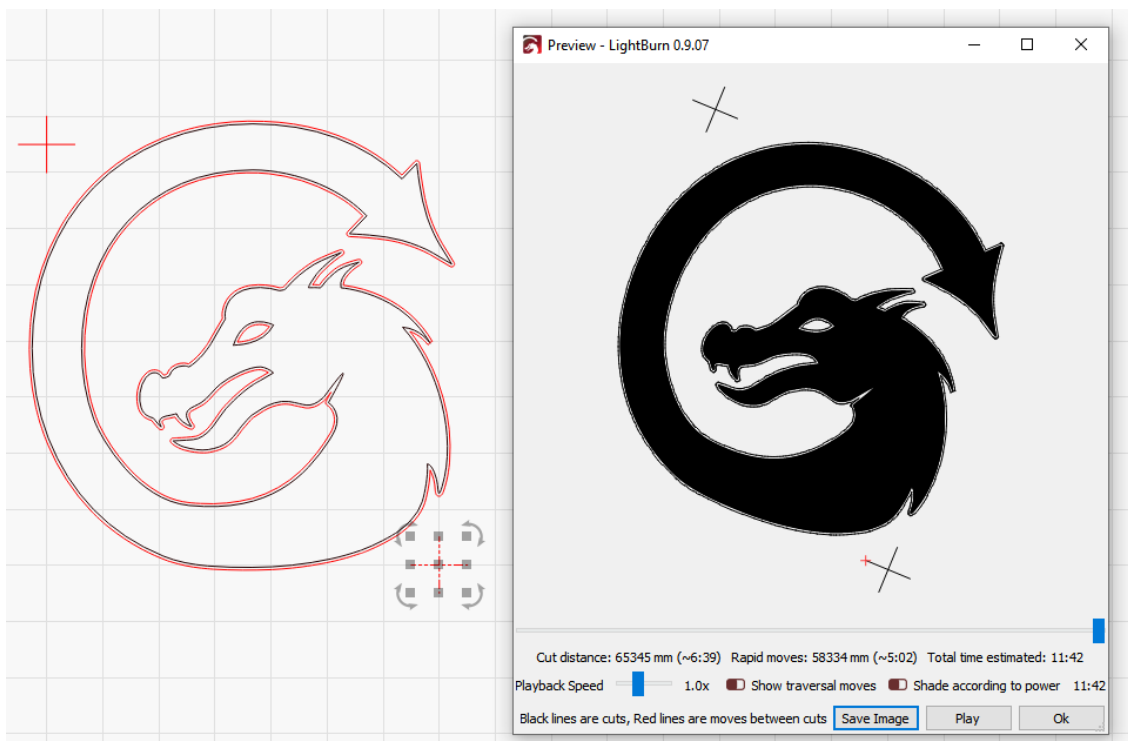
PrintAndCutAlign

You will also see the “(Print & Cut mode)” message in the status window, like this:



PrintAndCutReady

If you preview at this point, the orientation of the preview should match that of the print on your laser:



AlignedPreview

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

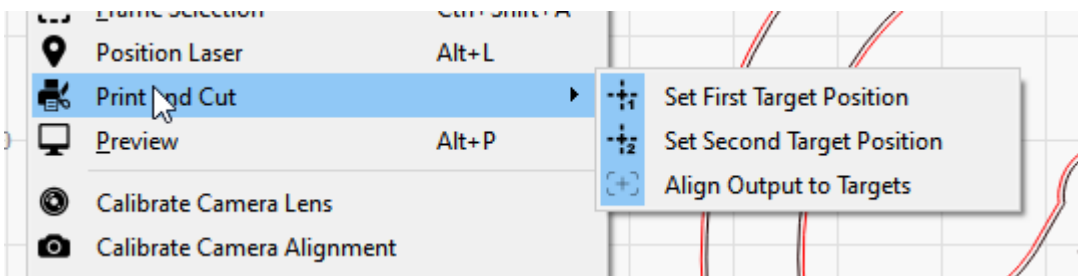
either a cross-hair beam pointer or a red-dot marker that is in the same beam path as your laser is ideal.

After running the job on the laser, this is the result:



PrintAndCutOutput

When finished, you can turn Print & Cut off by un-highlighting the 'Align Output to Targets' option:



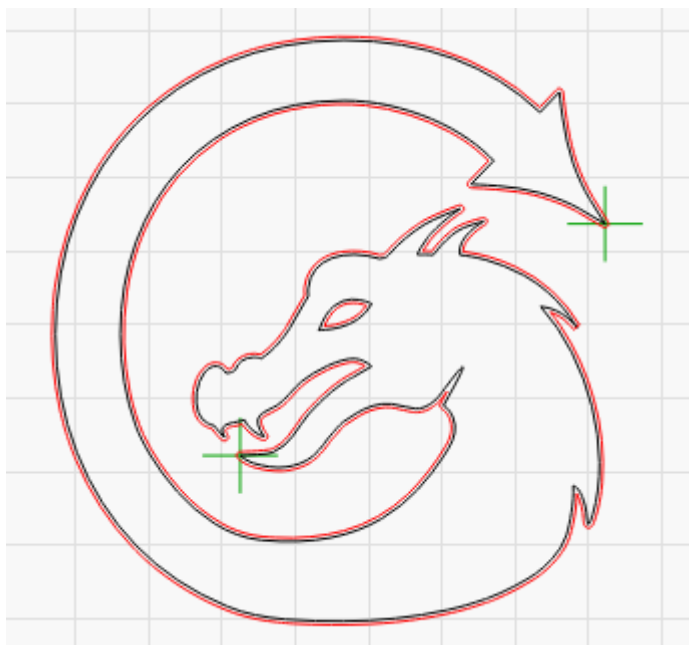
PrintAndCutAlign

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.

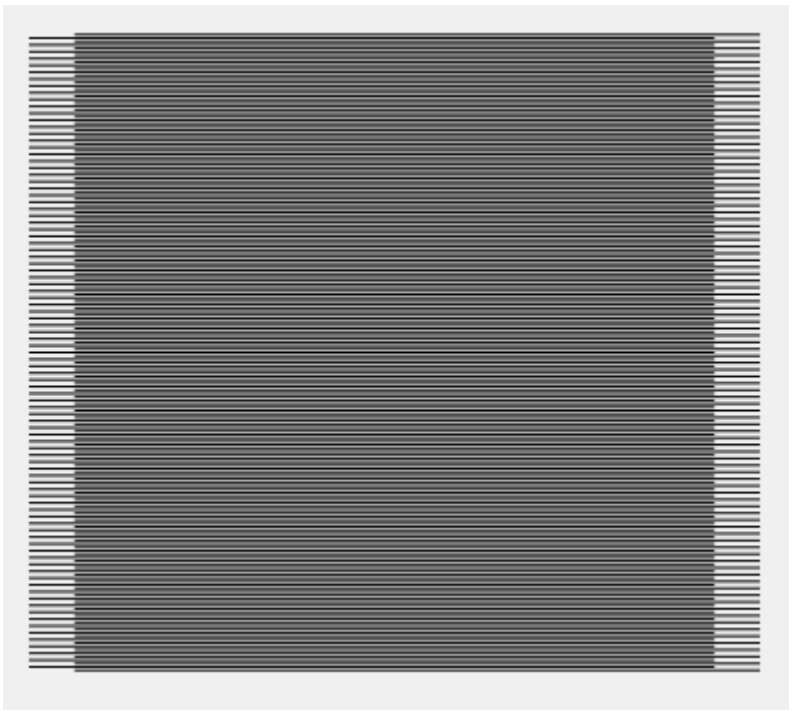
# Scanning Offset Adjustment

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 less than a millisecond, but many take longer.

At 100 mm/second, 254 dots per inch means your dots are 0.1mm in length, fitting 1000 of them in 100mm. 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.

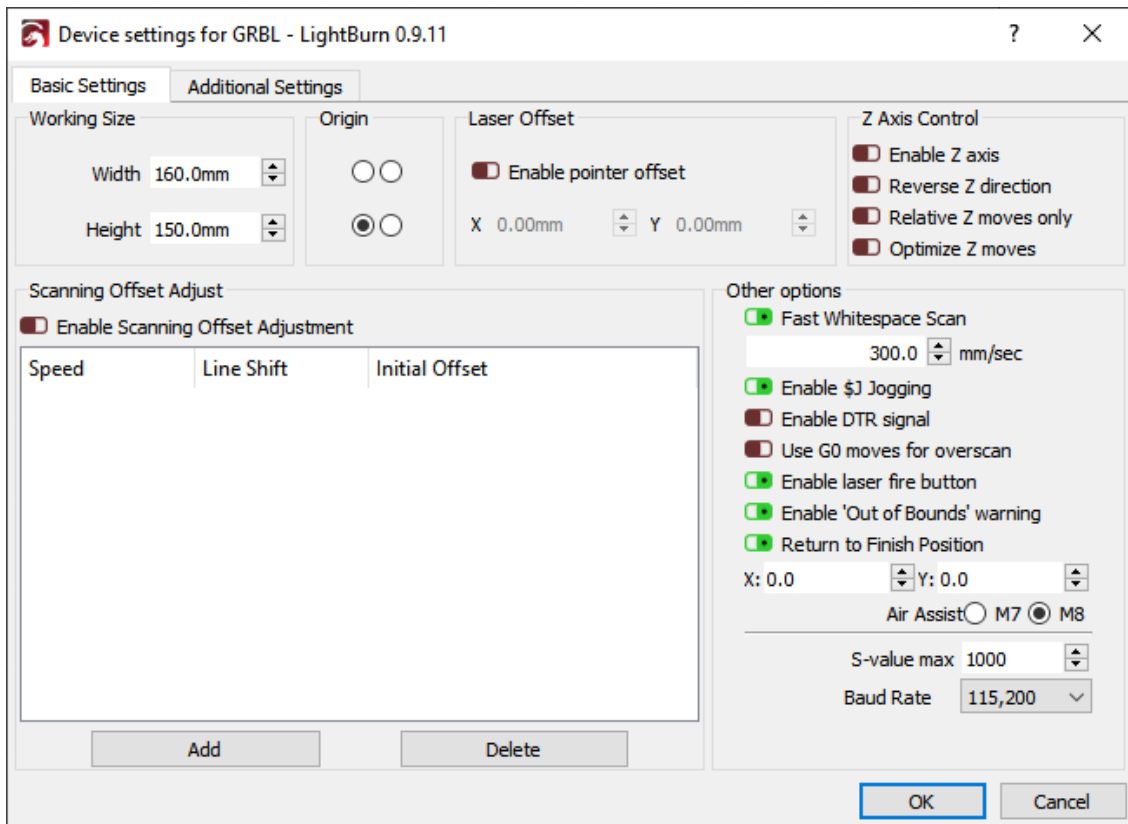
At 500 mm/second, that 1 millisecond delay means you'll be off by 5 dots, or 1/2 a millimeter. Still not very much, but visible. Many power supplies and tubes will take even longer to fire.

The result often looks like ghosted edges. The image below is a 20mm square at 1000 mm/sec, with a 1ms delay, resulting in a full mm of skew between scans:



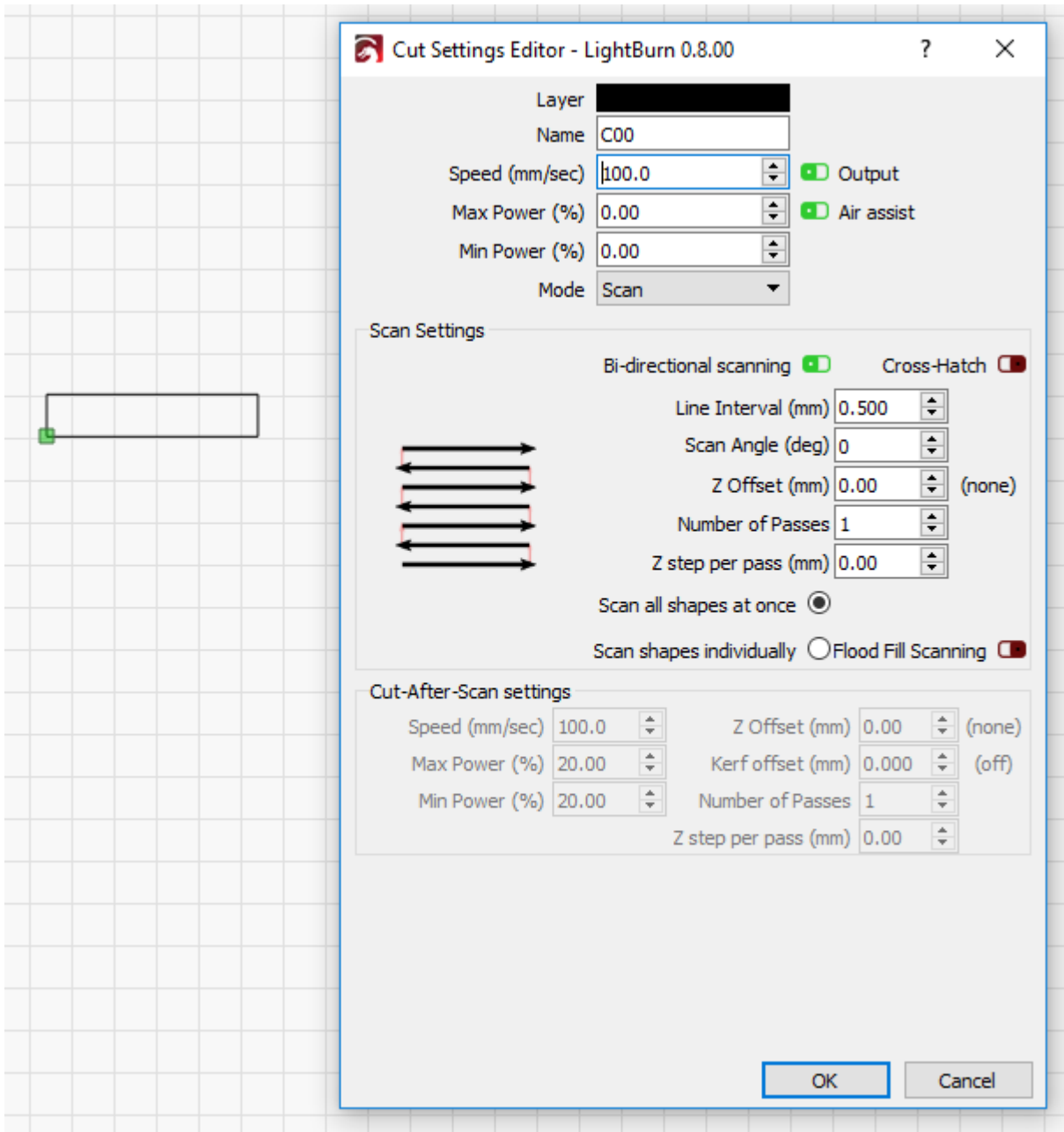
LightBurn has a setting to counter this, called Scanning Offset Adjustment, in the Device Settings:



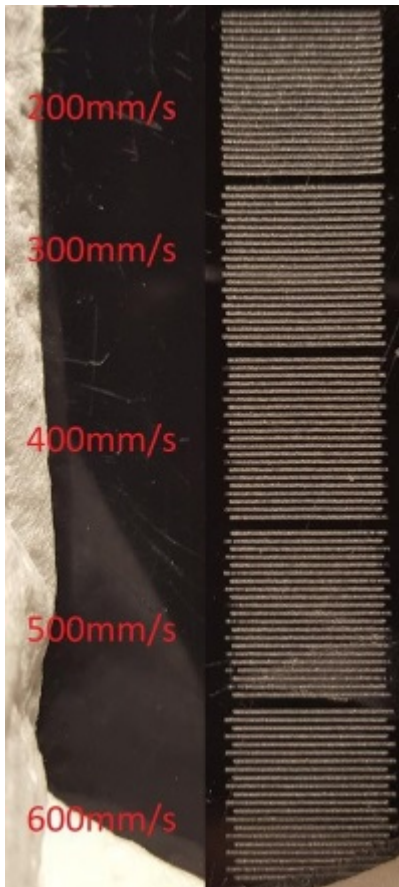


Device Settings Window

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, 50mm wide and 10mm high, set it to scan, and set the interval to 0.5mm. 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.



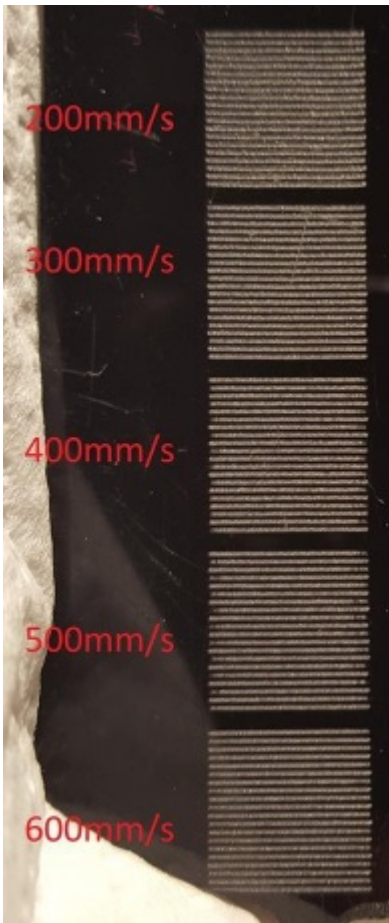
Run this rectangle at multiple speeds, like 100mm/sec, 200mm/sec, 300mm/sec, and so on. Depending on your hardware you may not even need to use these settings, however here is example output from a machine that does:



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.

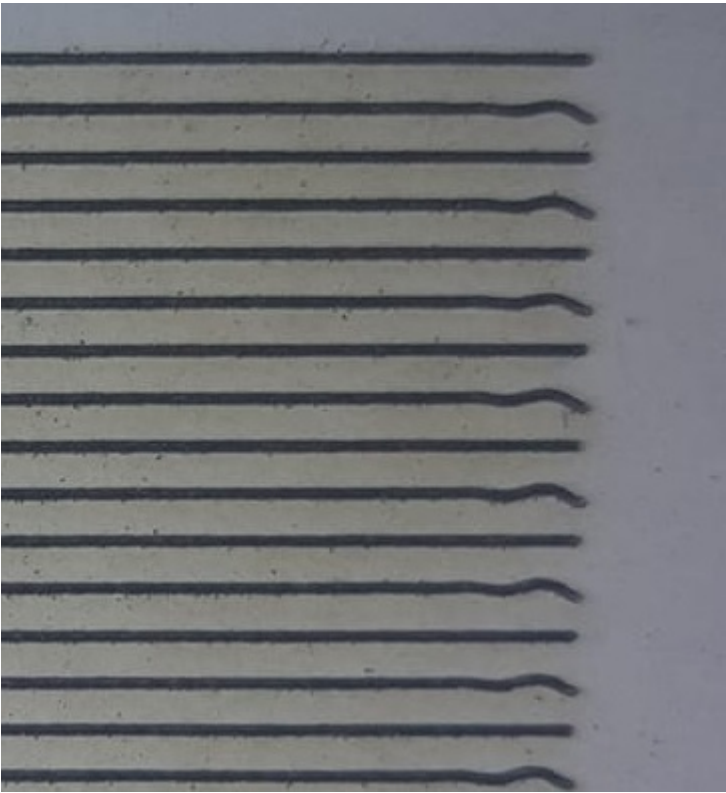
There is an excellent tutorial online at Cartonius.com here: <http://cartonius.com/how-to-improve-engraving-quality-of-laser-machine/>

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:



## 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.

## USING A CAMERA WITH LIGHTBURN

LightBurn's camera feature allows you to use a USB connected camera with LightBurn to:

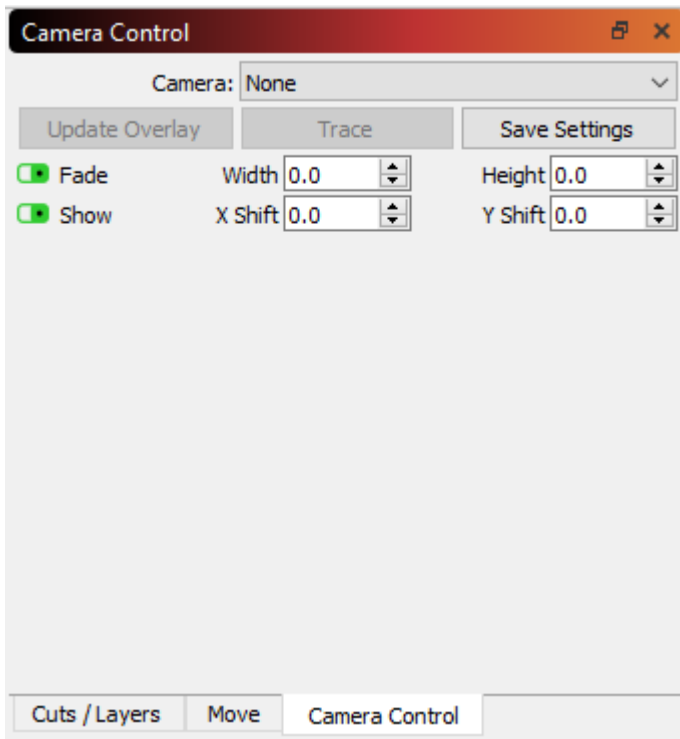
Position designs on material

Trace simple artwork from the camera image

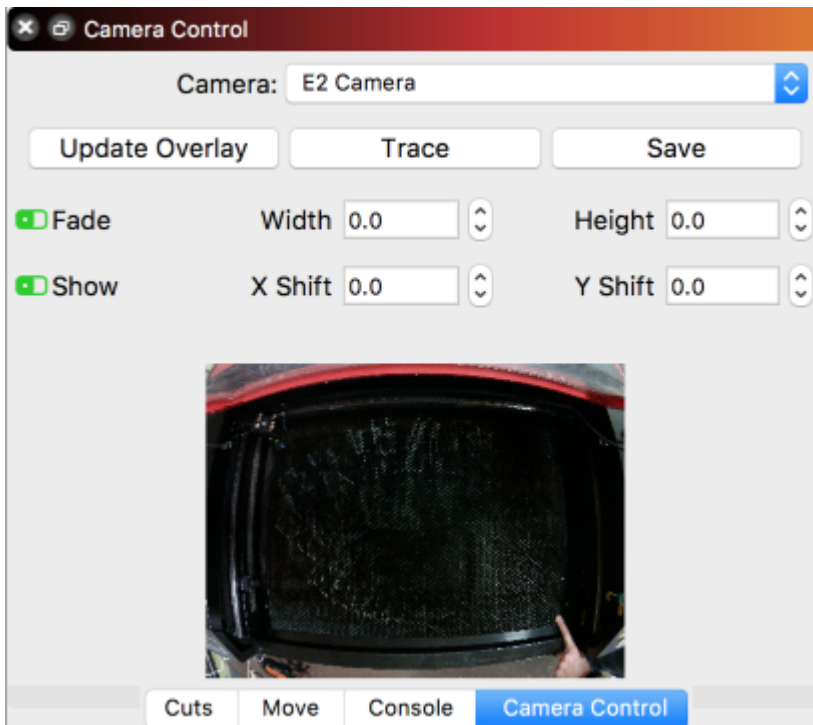
Monitor your laser

In LightBurn, enable the 'Camera Control' window by going to the Window menu and selecting it.

You'll see a window that looks like this:



If your computer has a compatible USB camera connected, it will appear in the Camera drop-down box. Select the camera, and the view from the camera will appear in the window, as shown:



This image is fairly distorted, because the camera used here has a fish-eye lens. LightBurn will correct for this, as well as mounting at odd angles, and will simulate a clean, top-down view of whatever is on the bed of your laser. It takes a bit of effort to set up, but it's worth it.

## MOUNTING AND FOCUSING

If your machine already has a camera installed, you can skip this part. If you are installing the camera yourself, there are a few key things here worth noting.

The ideal mounting position for the camera is directly above the center of the bed of the laser, with the bed completely in view (similar to the image shown above). We generally recommend mounting on the inside of the lid, when opened, like this:



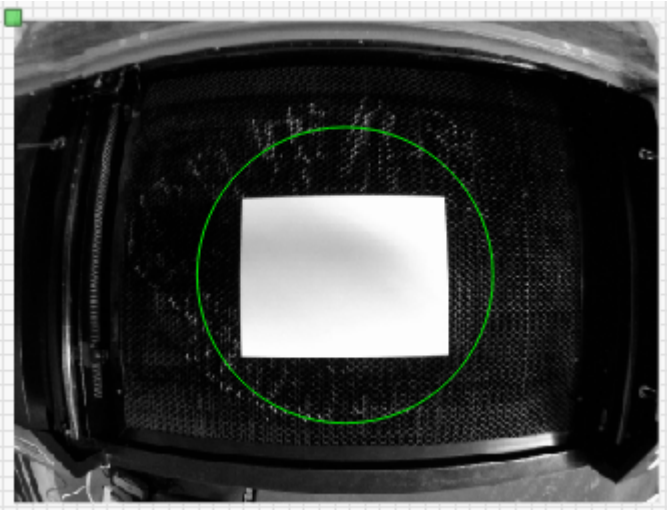
The camera should be focused as well as possible. Most LightBurn cameras are manually focused by twisting the lens. (the 8MP-N-75 is the single exception - it has auto focus)

The camera must be solidly mounted such that it is always in **exactly** the same position when using it, relative to the work area of your laser, and the top of the material. If you mount to the lid of your laser, make sure the lid opens to the same place every time - gas struts have a bit of play in them, so using a cord or rod to ensure the lid is always at the same position when opened can help.

If your camera is in a mount, make sure it does not move within the mount. A small piece of EVA foam or even tissue can hold the camera securely in the mount.

Make sure that wherever you choose to mount the camera that it is out of the path of the laser head, and that you 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:



**Note:** the camera plugs in to your computer, not the laser. If you need a longer cable to reach the computer, you'll need what's called an 'active' or 'amplifying' cable that repeats the USB signal and boosts it. USB cables are only rated for a distance of 5 meters (about 16 feet). Any longer and the signal needs to be boosted. If you do purchase one, make sure you get one that is USB 2.0 rated.

**Also note:** 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.

The camera system also requires the use of *Absolute Coords* mode, so LightBurn can accurately position the work. If you use a Trocen controller, they do not allow setting this mode from software, so you must change the working mode through the controller menu.

## CAMERA CALIBRATION

There is a YouTube video of the calibration process here: [LightBurn Camera Calibration Walkthrough](#)



In order to use the camera for work placement, it's necessary to "teach" LightBurn how to remove the distortion from your camera lens, and where your camera is in relation to the work area of your laser. The first part of this is accomplished in the Lens Calibration wizard.

You will need to download and print the following image: [Calibration-Circles.png](#)

The circles image will be approximately 148mm x 105mm (5.8" x 4.1"), and should have at least 6mm (1/4") of white space around the pattern.

Mount it to stiff card, foam-board, or wood, so the image remains very, very flat. If the image is curved, it will affect the calibration process and reduce the accuracy.

## **The Camera Lens Calibration wizard**

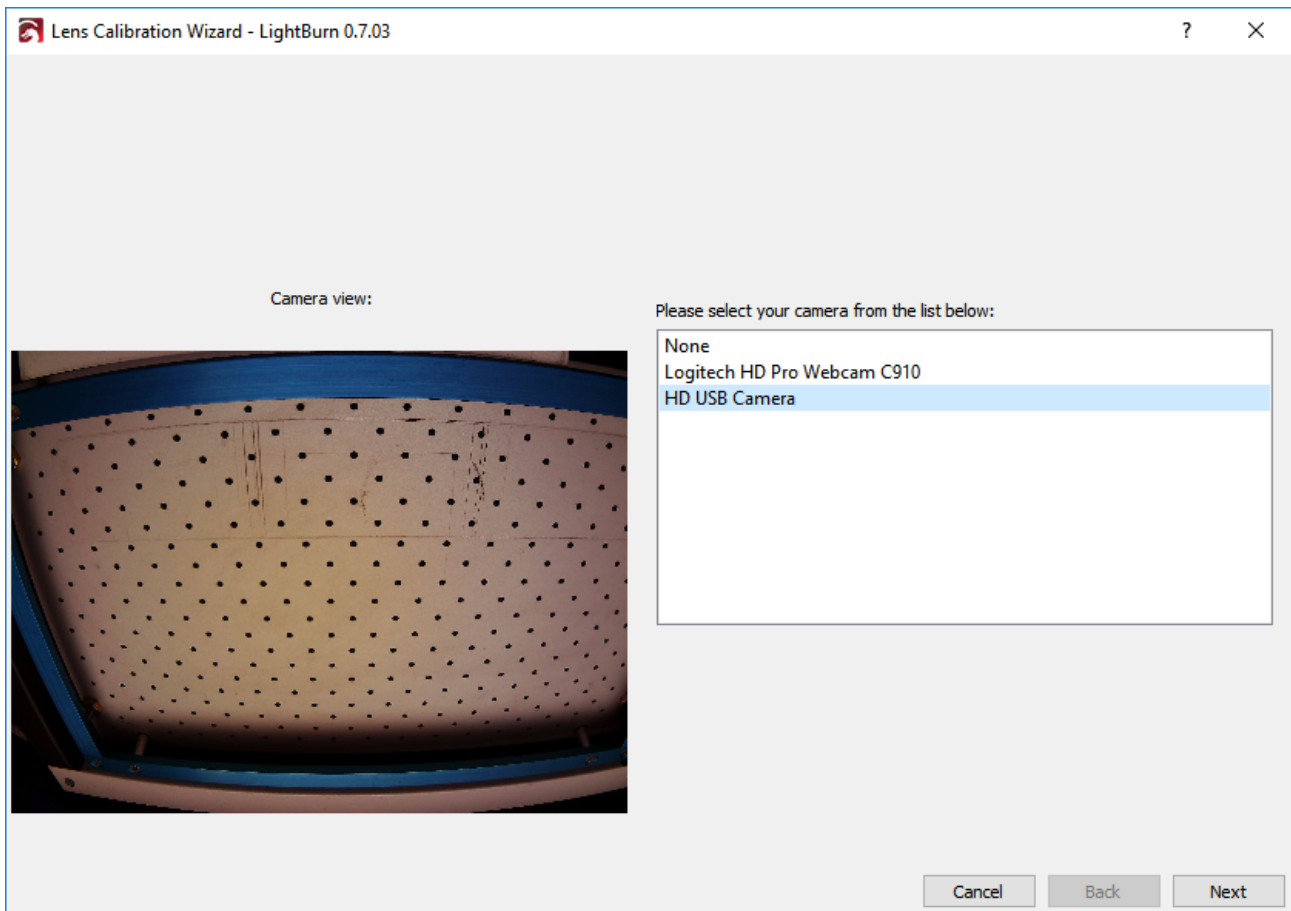
Camera Lens Calibration uses series of captured images of a known pattern. The software analyzes how the pattern appears in the images, and compares that against its internal knowledge of how the pattern should look. It determines the amount and shape of distortion produced by the lens of the camera, and computes an inversion for this distortion.

**Note:** This process is dependent **only** on the camera and 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. If the calibration image cannot be held at the appropriate distance to match the shown image in the display, you may shrink or enlarge the printed pattern.

**Important:** If your machine has a honeycomb bed, or something similar to the image below with a lot of visible circles, it will likely be necessary to cover it with something. The pattern finder is looking for circles, and if it finds anything that looks like thousands of them, it gets confused.

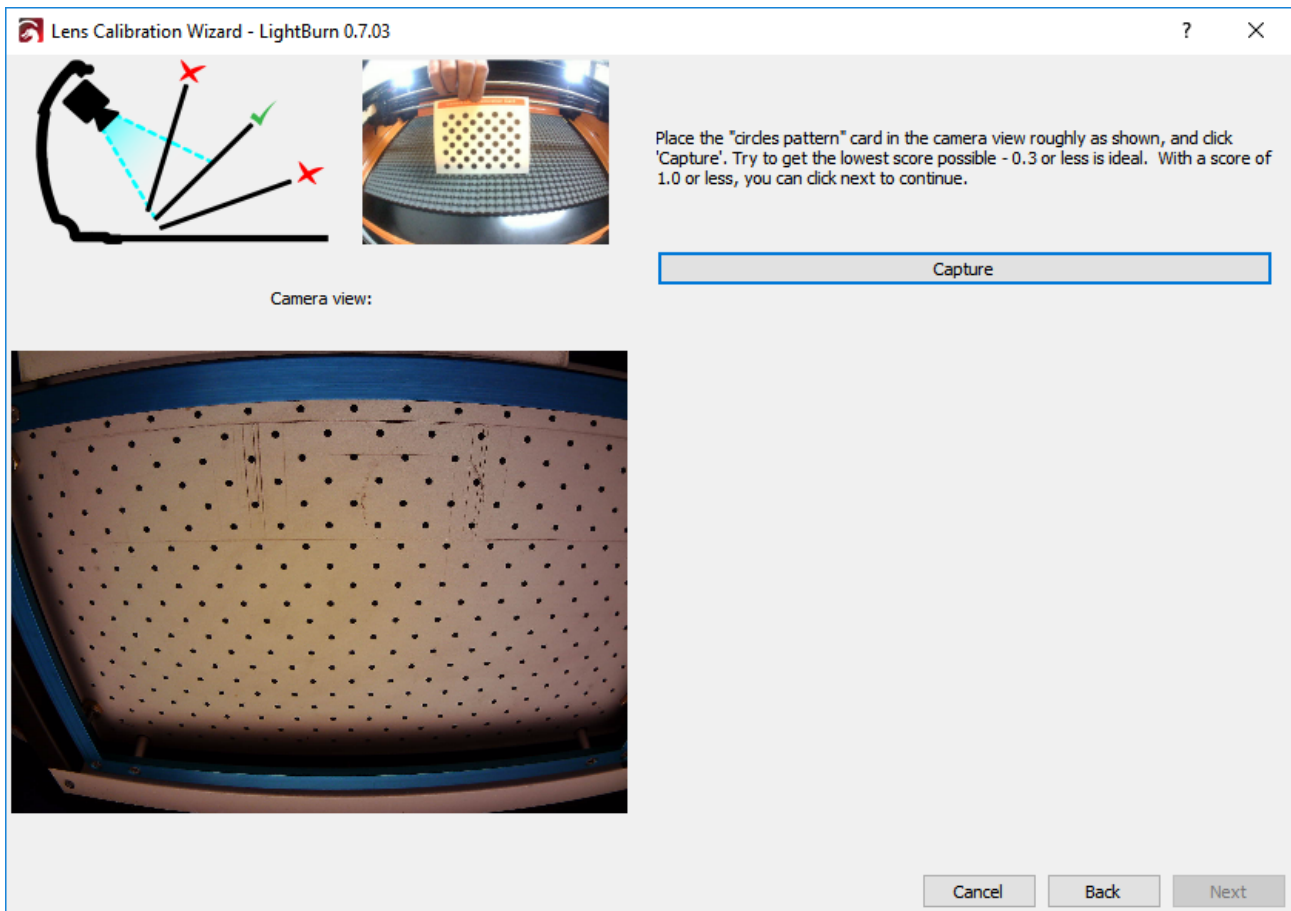
It is best to have good, consistent lighting for the capture process, and the camera should be in focus. A fuzzy image, or shadows falling across the calibration pattern will make the process much harder, if not impossible.

Open the "Tools" menu and choose "Calibrate Camera Lens" from the menu. You will be presented with a screen like the one below.

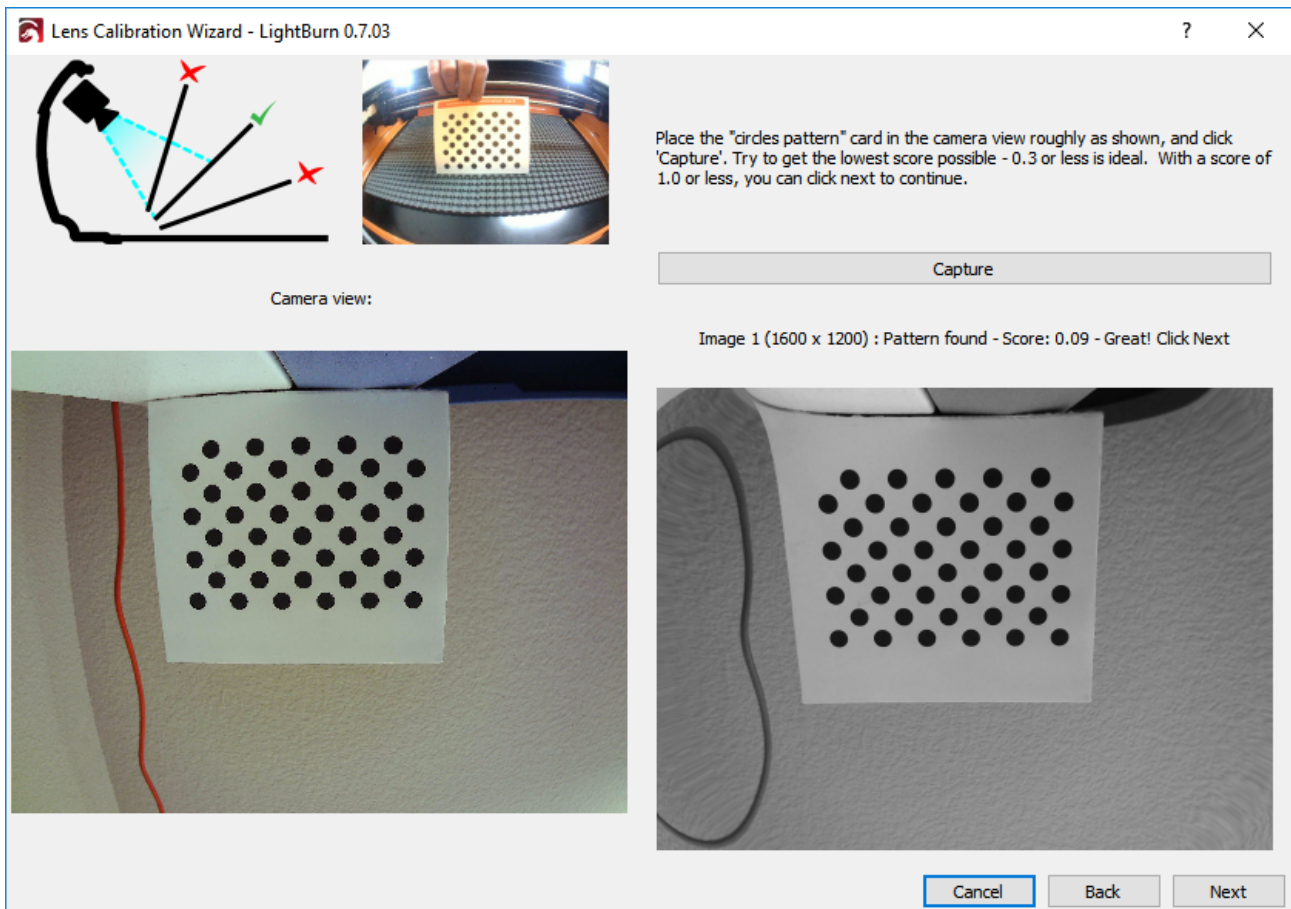


Choose your camera in the list, and you'll see the view from the camera in the area to the left. With the correct camera selected, click Next.

The view will change to include a capture button, and a helper image to show you how to position the printed pattern for capture. 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.



Click the Capture button (highlighted above) and you should see something like this: (note that we've removed the camera from the machine for this one)



Above the image on the right you see:

Image 1 (1600 x 1200) : Pattern found - Score: 0.09 - Great! Click Next

This tells you:

The image was successfully captured

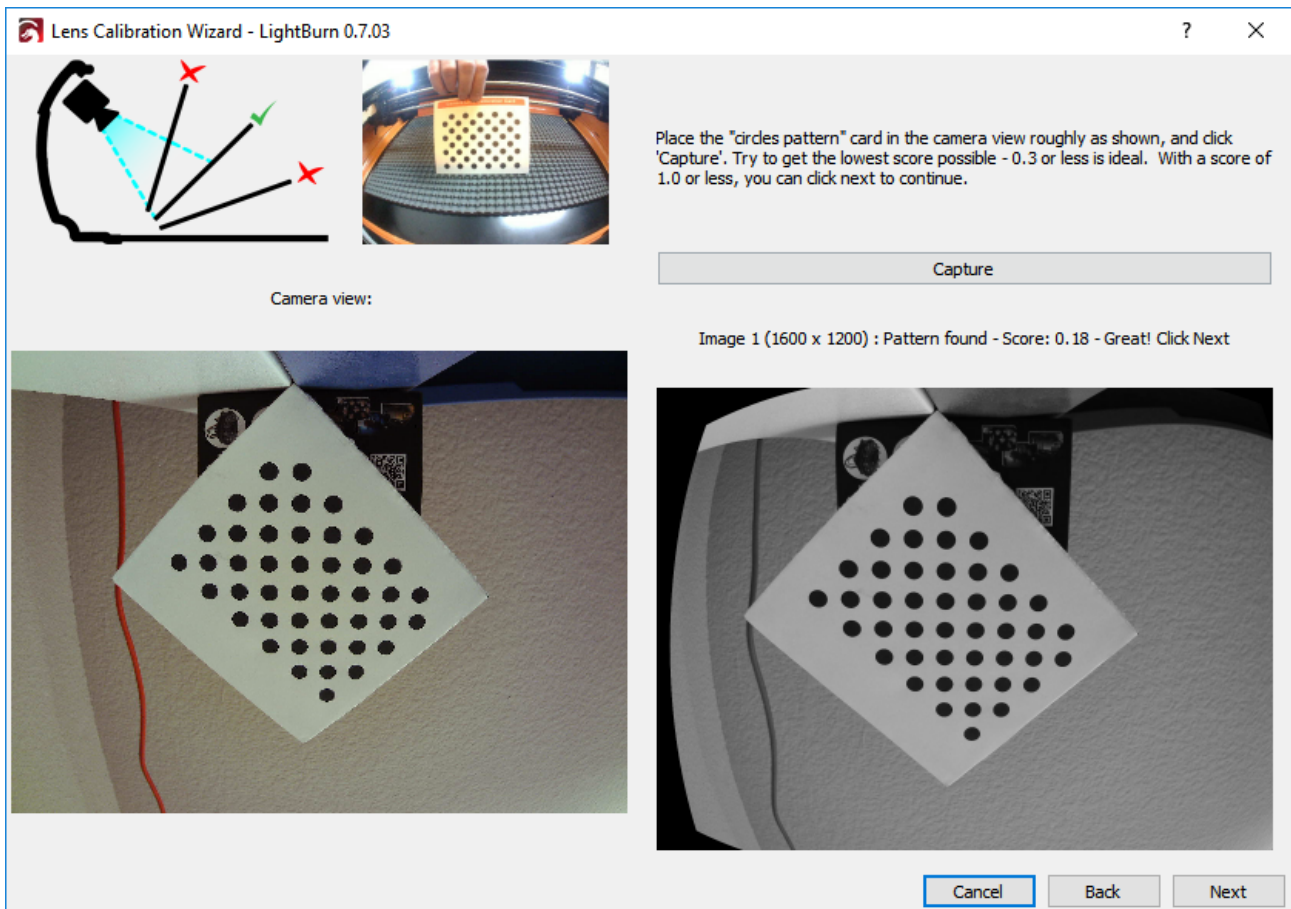
The resolution of the captured image is 1600 x 1200 (higher is better)

The calibration pattern was found in this image

This image scored very 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 0.09 pixels - That's very good, and well within our desired score of 0.3 pixels of error.

Notice that in the gray image that appears to the right, the pattern of circles is not distorted, though the image around them is considerably worse (look just above the dots). That is temporary, and the result of only having a single calibration image to work with. As you progress through the remaining calibration steps, you'll capture more images with the pattern in different parts of the camera view, filling in more information about how your lens distortion affects the image.

If the calibration pattern is not found, LightBurn will tell you so. Make sure the pattern card faces directly toward the camera, and occupies roughly the same amount of view area shown in the "suggestion" image. The pattern card should be parallel with the sensor of the camera, as shown in the upper-left graphic in the capture window, though the pattern can be rotated within the view without affecting the calibration if this is easier, as shown here:

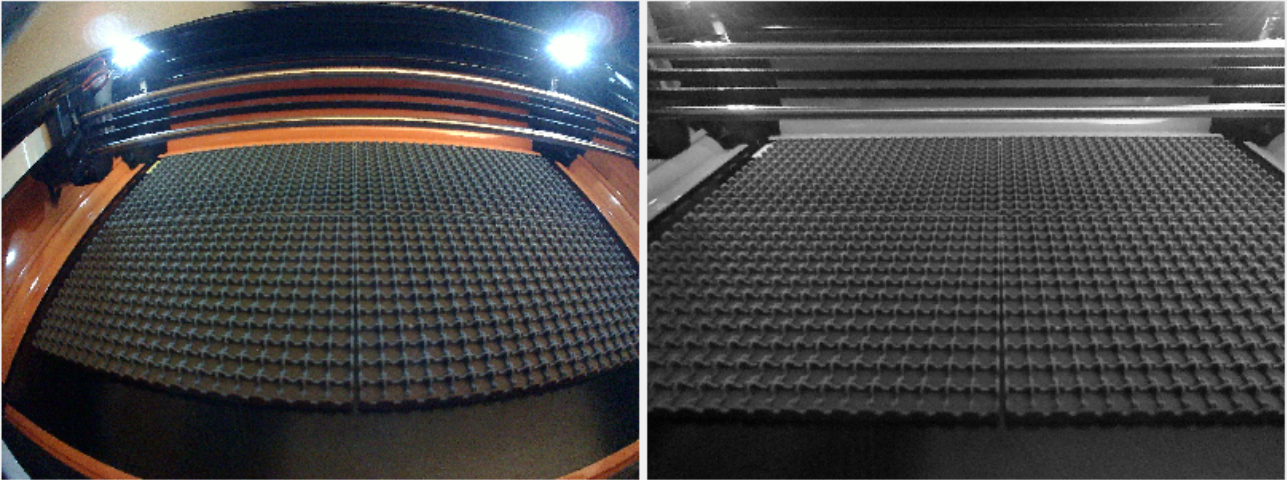


As you advance through the captures, the suggestion image will update. The first five images are the center of view, followed by bottom, left, right, then top. If your camera has a very strong fisheye effect, it may be necessary for you to move the non-center images inward a little to get a successful capture. This is ok.

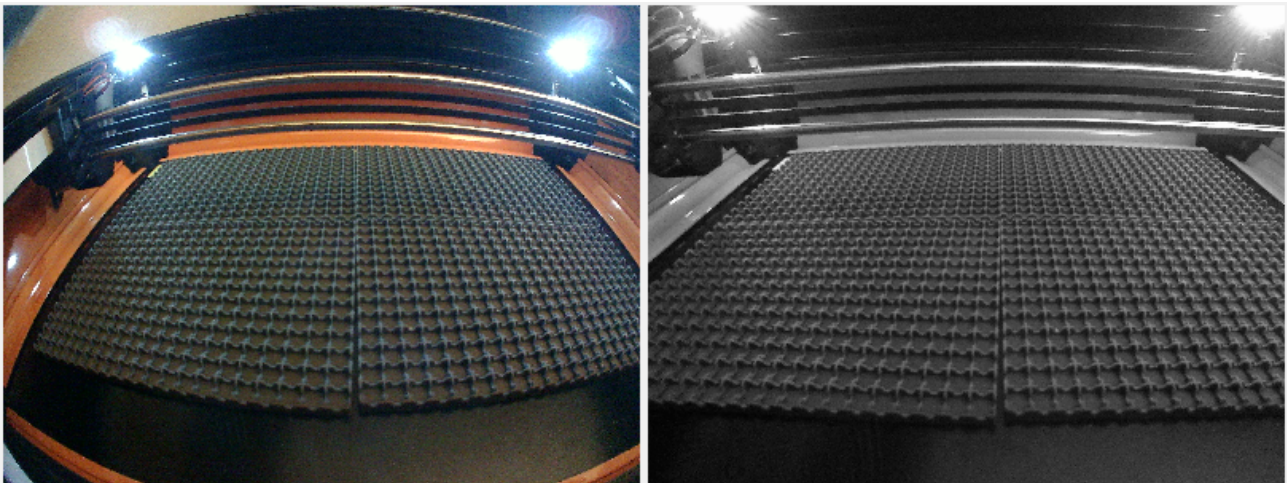
The final four images are the corners, and these can be difficult to capture with high-distortion cameras. If your first 5 images score very well (below 0.3) you are allowed to skip the final four images (the 'Next' button will show as 'Skip' in this case). If you are having trouble capturing the last 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 don’t get it straight away, 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.

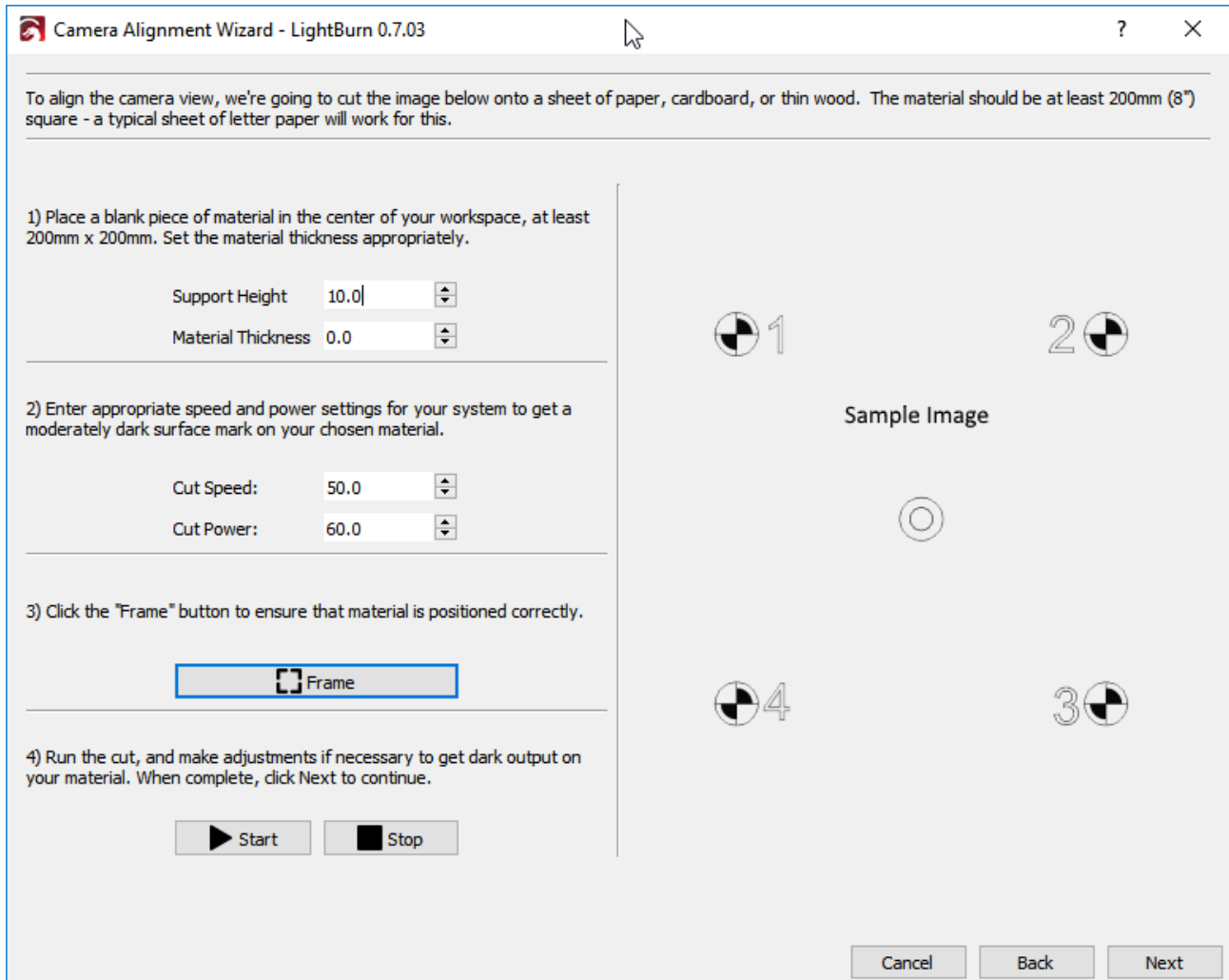
## **ALIGNING THE CAMERA AND WORKSPACE**

Now that the camera is calibrated, you can move on to the next step, camera alignment - telling LightBurn where your camera is in relation to the workspace of your machine. From this step forward, it is very important that the camera not move in relation to the machine. It is possible to mount the camera to a movable piece of your laser, like the cover, as long as the position of the camera is the same when you use it as it is when you calibrate the alignment. The camera should be firmly mounted pointing at the center of the machine work area, with a clear view.

## Cutting the Alignment Markers

In the Tools menu, choose “Calibrate Camera Alignment” to start the alignment wizard. Choose the same camera you did in the Lens Calibration wizard.

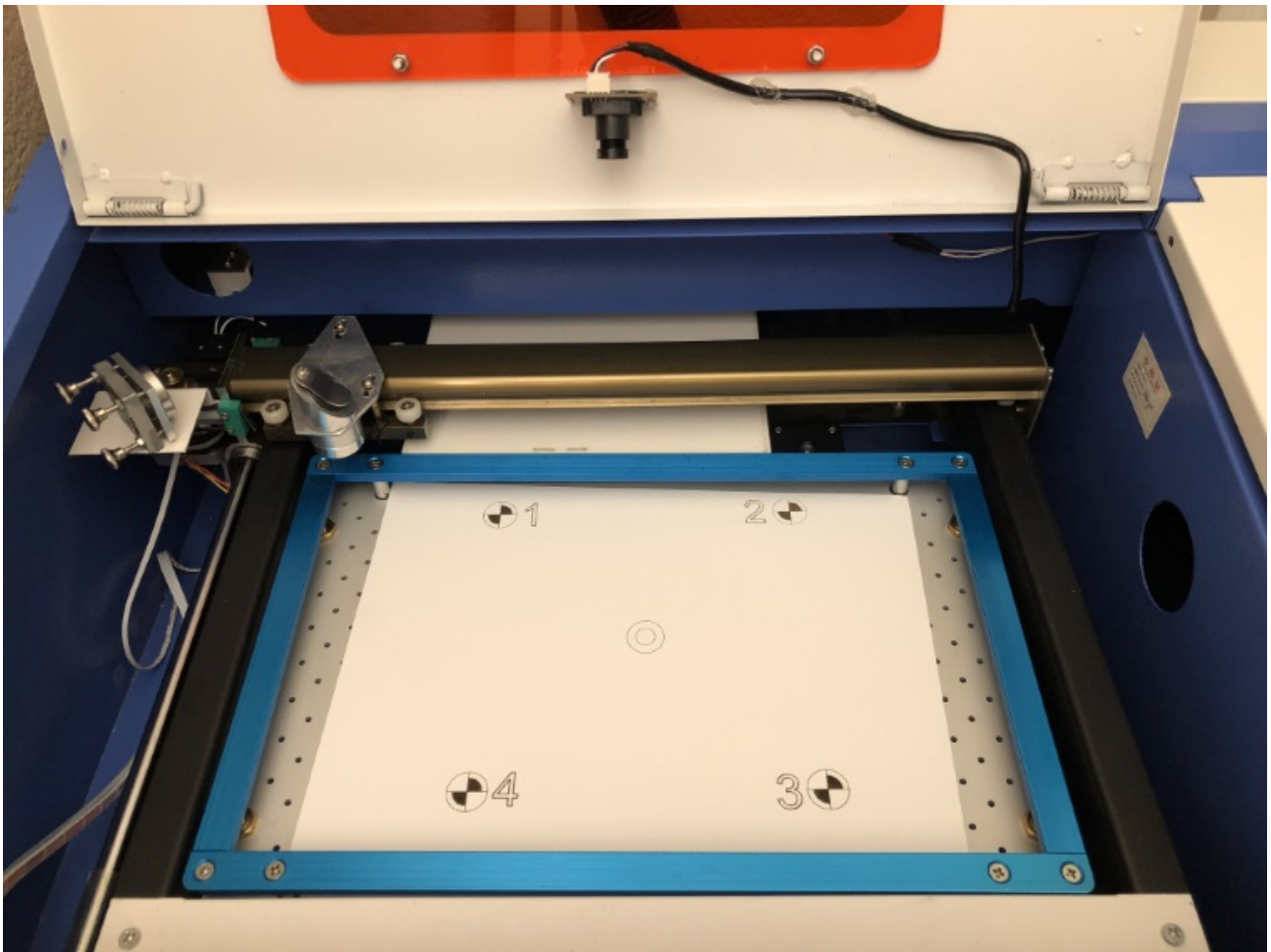
After selecting the camera and verifying that you can see an image from it, click Next and you’ll get to this screen:



This page uses your laser to cut a target pattern onto a piece of material, such as card stock, paper, cardboard, or thin wood. The pattern that will be cut is shown on the right side of the display.

LightBurn supports many different types of laser, so we need you to specify how fast and at what power to do this cut. You should choose settings that will make a dark surface mark on the material, but not cut through it. The “Support Height” and “Material Thickness” values can be set to zero if you do not normally use these values when cutting.

Follow the directions in order - set the numbers appropriately, use the Frame button to check that the material is aligned with the cut, and click Start when you’re ready. If the cut comes out incorrectly (too light, or too strong) change the settings and try again. Your results should look something like this:

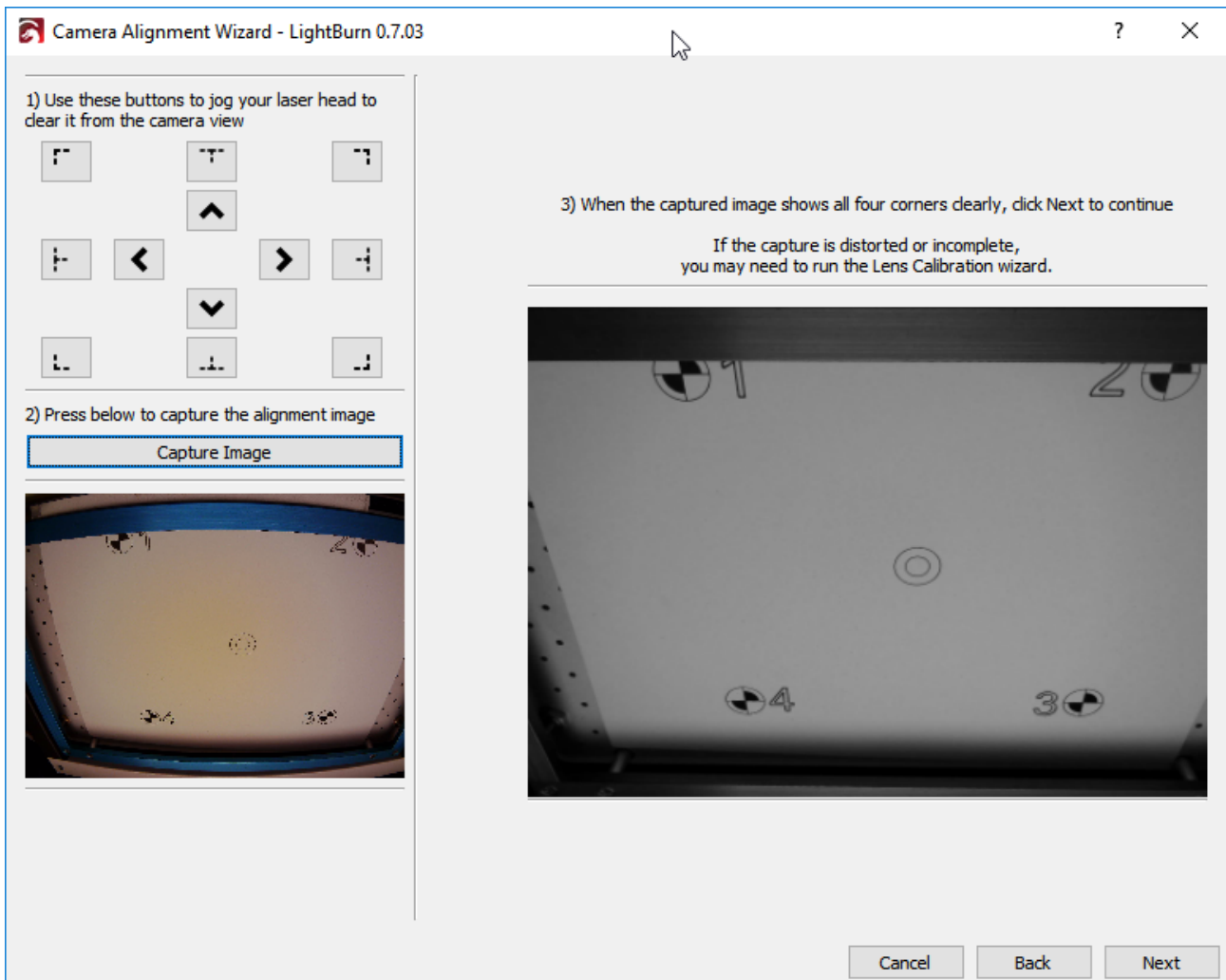


When you have a good result, click next.

### **Capturing the Target Marker Image**

From this screen, you're going to capture the alignment image. *It is very important you do not move the target marker image after cutting it.* Use the jog or "send to corner" buttons here to 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:



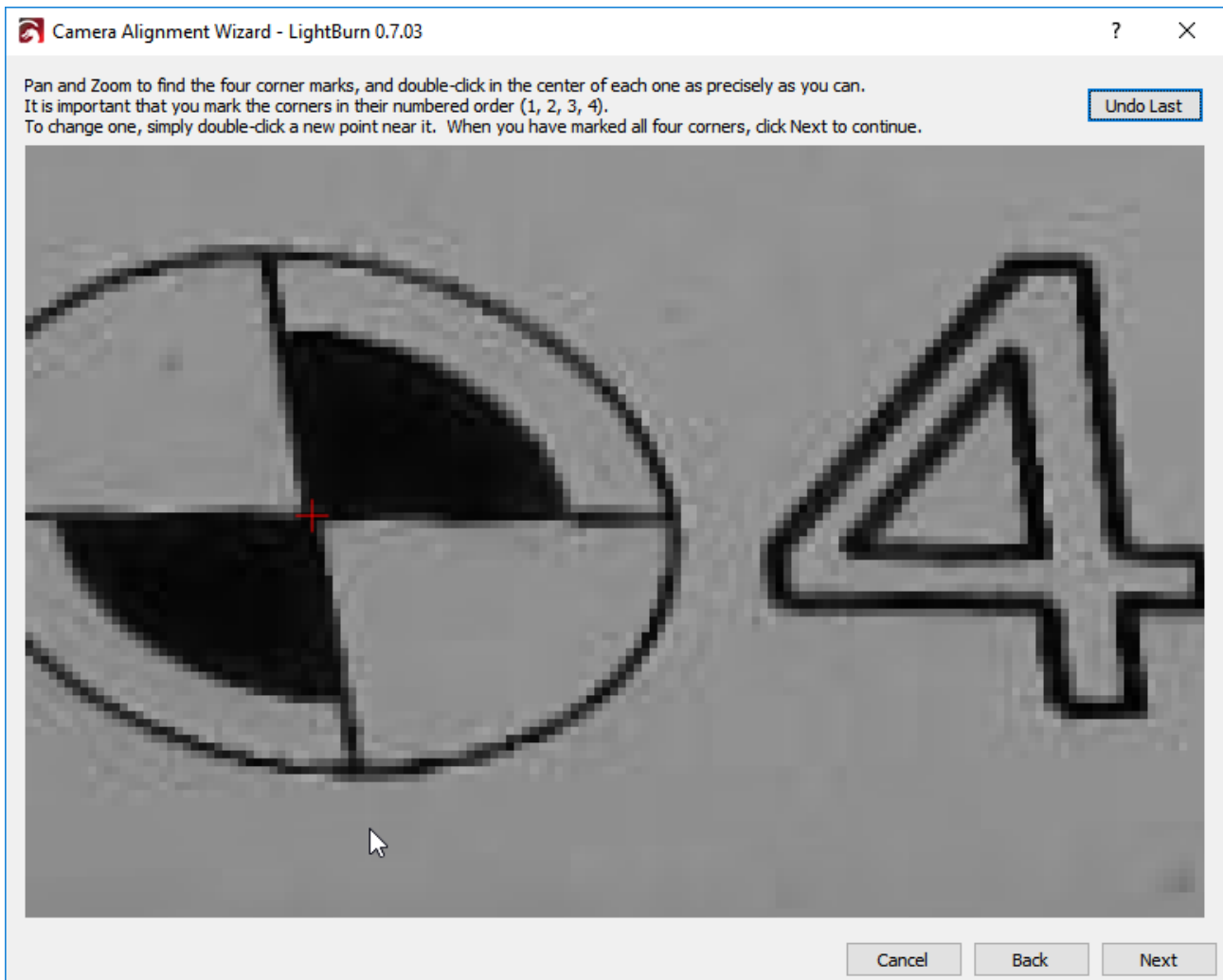


## Marking the Targets

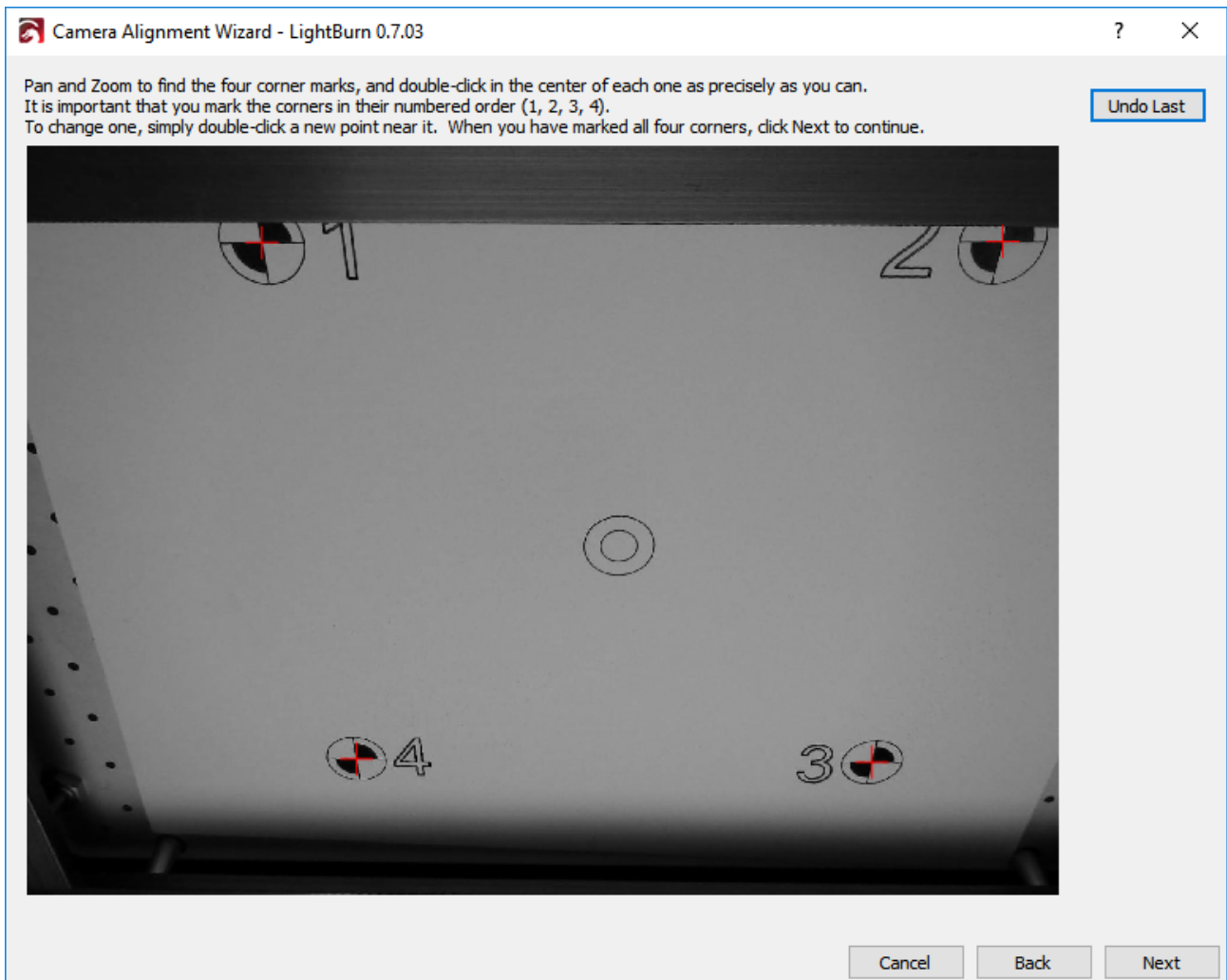
On this page you 'tag' each of the targets by double-clicking in the center of each one in order. You can pan and zoom around the image using the same controls as the LightBurn edit and preview windows. When you double-click, a red '+' mark will appear. Place a marker in the center of each of the four 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.



Place each marker as accurately as you can. You can see the ideal placement here:

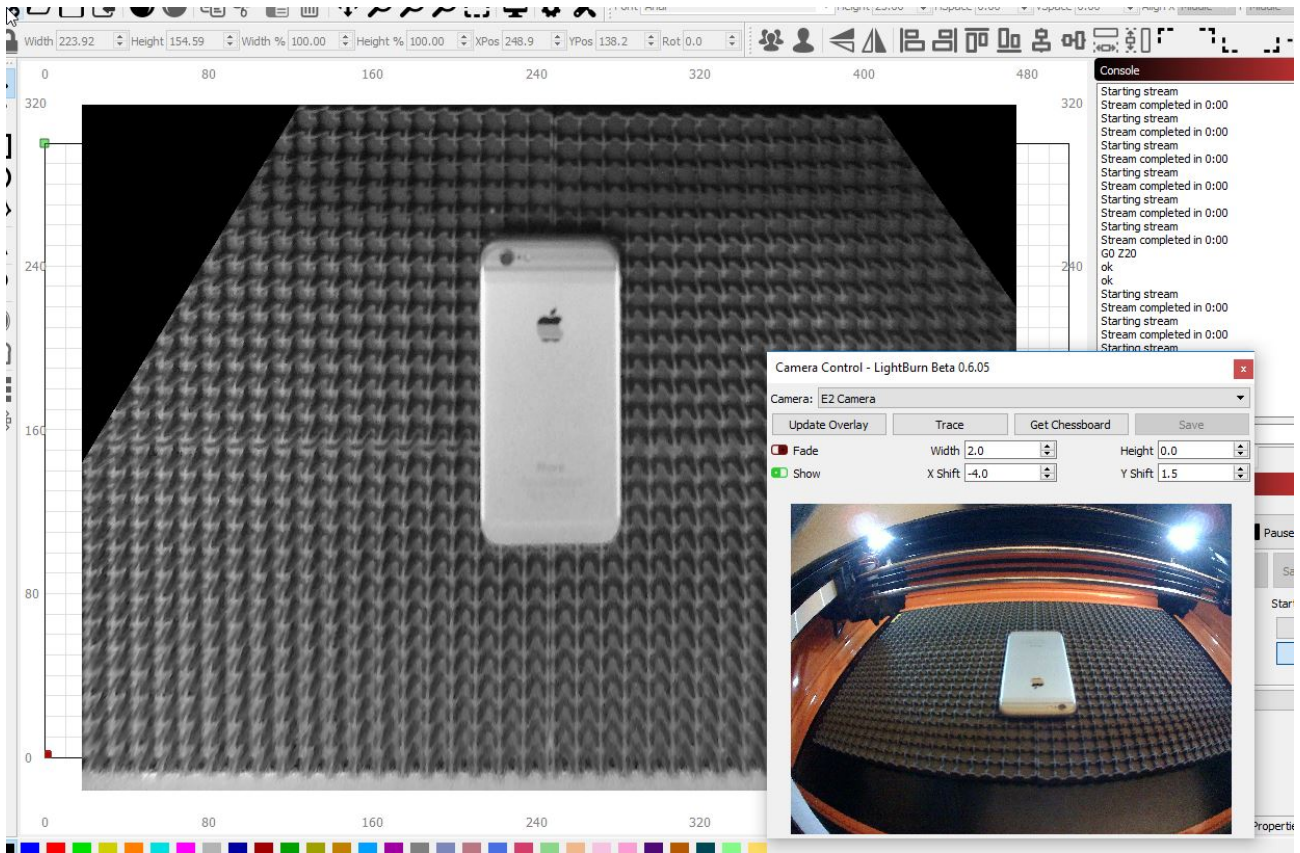


When you have placed all four markers in sequence, zoom back out and verify that all four are visible and clearly centered on the targets, like this:



Click Next to finish the marker placement screen and click Finish to complete the process and store the results. You're done!

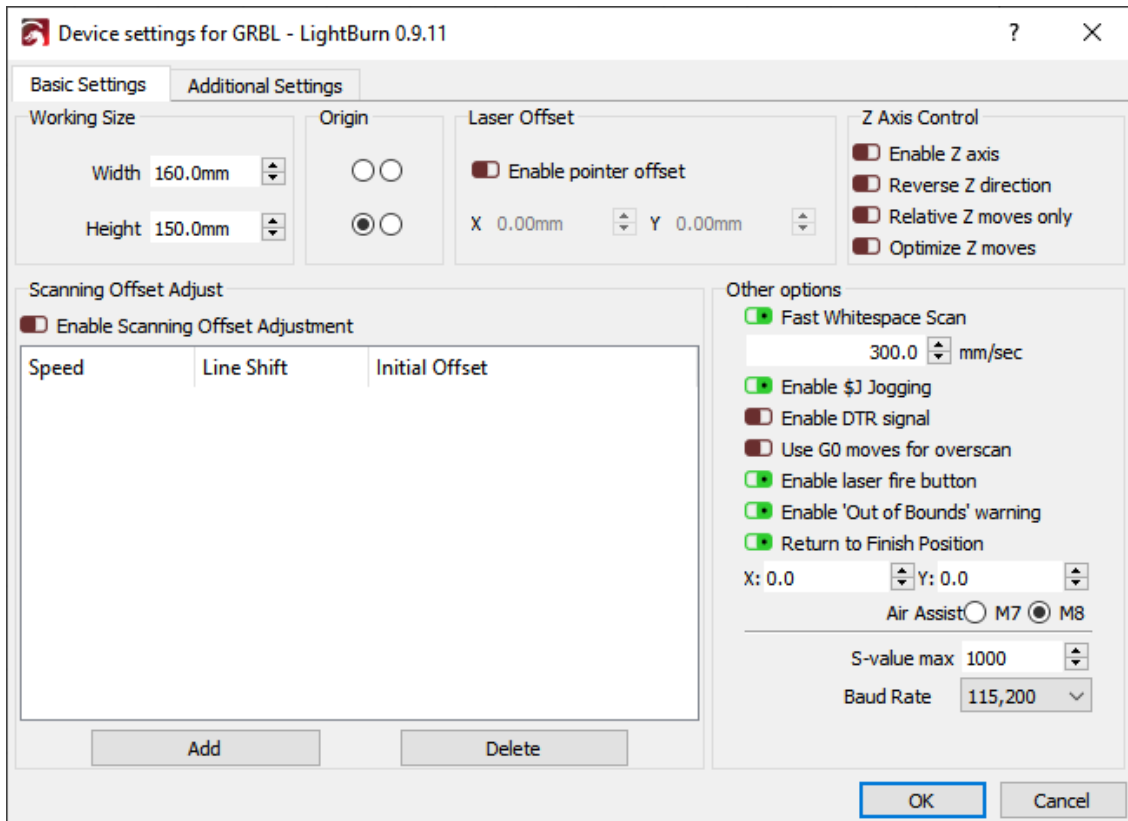
Now that everything is aligned, open the Camera Control window again, and simply click "Update Overlay" to capture and project whatever happens to be in the camera view onto your workspace, as shown:



Click the “Fade” button to dim the background image, or the “Show” button to toggle it off and on.

# Device Settings

After initial setup, you can access device settings under the Edit > Device Settings menu.



Device Settings Window

## Working Size

This is the working size of your laser bed. Set this to the maximum X and Y travel for your laser. Note that this setting does not affect the laser itself, it's just to tell LightBurn how large the work area of the laser is.

## Origin

This is the origin corner or 0,0 location for your laser. If you have a GCode based system, this is almost always at the front left, regardless of the location of your limit switches.

If you have a DSP laser, like Ruida or Trocen, the origin is usually where the limit switches are placed, and will be the corner the laser seeks when powered up.

## Laser Offset

If your laser has a red-dot pointer that is not aligned with your beam, you can enable the Laser Offset value to compensate for this when framing and positioning.

## Scanning Offset Adjust

Scanning offset is useful when doing raster or vector scanning at high enough speeds that delays in your power supply cause the firing point to be a little behind where it should be. See the help for Scanning Offset Adjustment [here](#).

## OTHER OPTIONS

Note that this section will appear differently depending on the type of controller you have, and not all settings will appear for all controllers.

### Fast Whitespace Scan

When engraving an image, LightBurn normally moves at the same speed across the entire image. If you are engraving slowly to get a good burn, but the image contains a lot of empty space (white space), this takes a long time. With the Fast Whitespace switch enabled, LightBurn will boost the speed through blank areas to the speed you indicate, if it is faster than the current engraving speed. This can save significant time.

**A note for Marlin users:** Since Marlin treats G0 and G1 moves identically, this value is used to specify the speed for rapid moves. If you do not set this value, LightBurn will use the same speed as the G1 moves.

### Enable \$J Jogging

On newer versions of GRBL (1.1 and later) \$J is a custom jogging mode that has several benefits over normal jogging, which just sends simple G0 or G1 moves. The new jog format does not affect the GCode parser state, and if soft limits are enabled, any jog command that would go out of bounds is simply ignored, without triggering an error or alarm.

This setting also allows cancelling a jog move, which LightBurn uses for Continuous Jog - You press and hold a move arrow to begin jogging in a direction, then release the button to stop (cancel) the jog move. Continuous Jogging is enabled in the **Move Window**. The switch to enable Continuous Jogging will not appear unless \$J jogging is enabled.

### Enable DTR signal

Standard serial ports have a pin (Data Terminal Ready, or DTR) that the host enables to tell modems that software is ready to receive data, and some devices require this signal to begin communication. Many programmable hobby-level controllers, like Arduino based systems, use the DTR pin to reset the controller. LightBurn usually sets this value for you, but if you find your GCode controller won't communicate, toggling this setting *might* help.

## Use G0 moves for overscan

By default, all scanning moves emitted by LightBurn are G1 moves, where only the power value is varied, for consistent speed and power output. Some controllers, like FabCreator Smoothieware boards, have a non-zero power value for their minimum output, and can end up burning during the overscan portion of an engraving. Turn on this setting to use G0 moves for overscan to eliminate this.

## Enable laser fire button

Diode lasers often don't have a red-dot pointer like CO2 lasers do, so it is often useful to enable them at low power for focusing or framing. (Please do NOT do this if you have a CO2 laser, as the beam is invisible and this could blind you or start a fire). Turning on this setting will enable a button and a power setting on the **Move Window** that allows you to turn on the laser at low power for focusing and positioning.

## Enable Out of Bounds warning

DSP controllers automatically check for out-of-bounds conditions, but GCode controllers do not have advance knowledge of the data being run, and therefore can't do this. Enabling this flag will tell LightBurn to warn you if a job will cause your system to travel out of bounds. Note that this requires your system to have been properly homed, reporting coordinates correctly, and with the workspace size set properly.

## Return to Finish Position

When running jobs in 'Absolute Coords' or 'User Origin' mode, enabling this flag tells LightBurn to send the laser to the specified position after a job is run. This is a convenience to move the laser head out of the way for unloading material.

## S-Value Max

GRBL and Smoothieware use the S-Value (spindle speed setting) to control the PWM power output to the laser. This setting is the number that corresponds to 100% power in LightBurn. Smoothieware typically uses a value from 0 to 1 and supports fractional numbers in between. GRBL defaults to 0 to 1000 for newer versions of GRBL, or 0 to 255 for older ones. The S-Value Max setting in LightBurn must match your controller setting, or you'll either get not enough power output (if LightBurn's setting is lower) or very small power numbers will set your laser to full power (if LightBurn's setting is higher). The corresponding setting in GRBL is \$30 for the firmware versions that support it.

## Z Axis Controls

**Enable Z Axis:** turn this on to allow LightBurn to control the Z axis of your machine, IE the height of the laser above the workpiece.



**Note:** enabling Z control means that LightBurn will **always** emit Z values for a running job, and therefore requires that you set *either* the “Relative Z moves only” toggle below, *or* a material height value on the main cut panel. *If you do not set relative mode, and do not set a material height, the default of 0 may cause LightBurn to raise your bed to a point where the workpiece could contact the head of your laser.*

**Reverse Z Direction:** Most DSP systems have 0 as the highest point, with positive numbers moving the laser head further from the bed, however some systems reverse this. Toggle this switch to change the overall direction for Z moves.

**Relative Z moves only:** This setting tells LightBurn to read the height of the machine when the job starts, and uses that height as the starting point for all Z moves, ignoring any specified material height. This is the simplest way to work, as you just set your focus manually, and LightBurn will perform all moves relative to whatever height your machine is at when the job starts. **Note:** for DSP systems this requires that you are connected to the machine.

**Optimize Z Moves:** By default, LightBurn will always retract the Z back to the initial height (the material height) after completing a shape with a Z offset. This is done for safety. Enabling ‘Optimize Z Moves’ will prevent this constant retract / plunge behavior, only issuing Z moves when the Z changes. If you know your material is flat, and none of the Z moves will position the laser low enough to run into anything on your work table, this can save a lot of time.

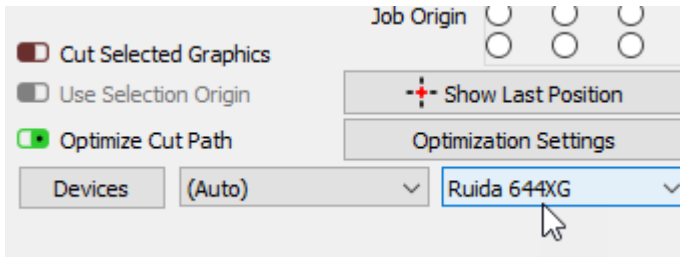
## Additional Settings

The Additional Settings page contains settings used by the preview simulation engine to calculate acceleration timing, traversal speeds, and enforce speed limits when computing the time it will take to complete a job, and when simulating the job. These must currently be set manually by the user to match your controller settings, though our goal is to handle this automatically if possible.

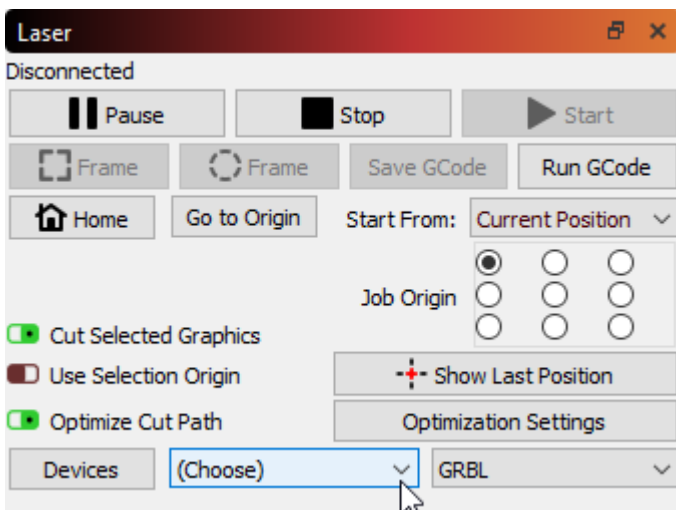
# Connecting to the Laser

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.

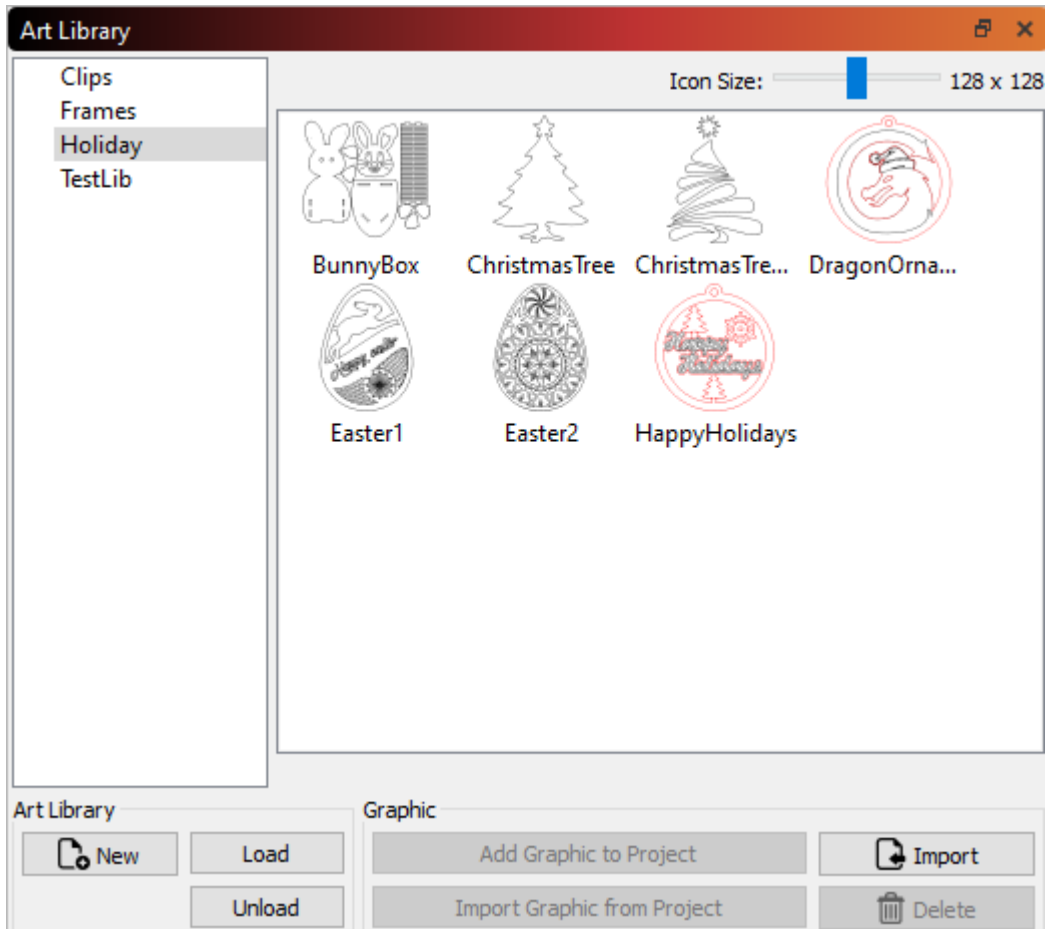
If you see the '(Choose)' as shown above, you need to select the port. If no ports are listed in the drop-down, it means that no devices were found, which could mean that it is not plugged in correctly, isn't powered, or you're missing a driver.

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.

**Next:** Configuring a laser for use with LightBurn

# 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

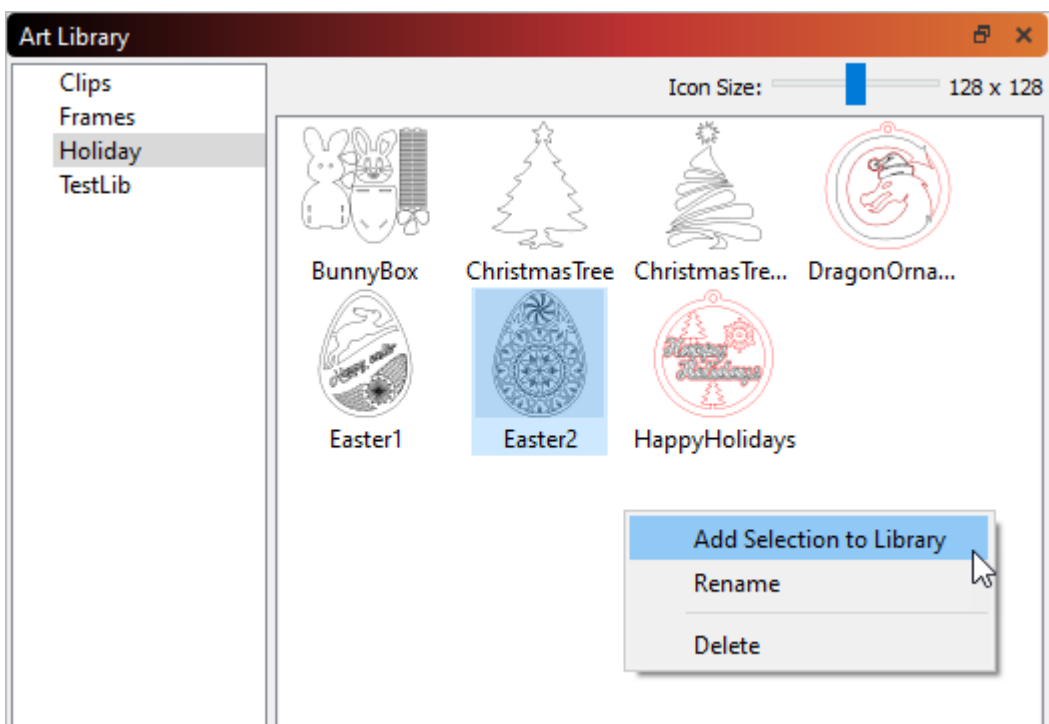
Each library you create is a file on your hard drive containing all the graphics inside it in a compact form. You can copy library files between computers to share the contents. LightBurn remembers which libraries you have loaded. Unloading a library file just removes it from your list of loaded libraries, 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

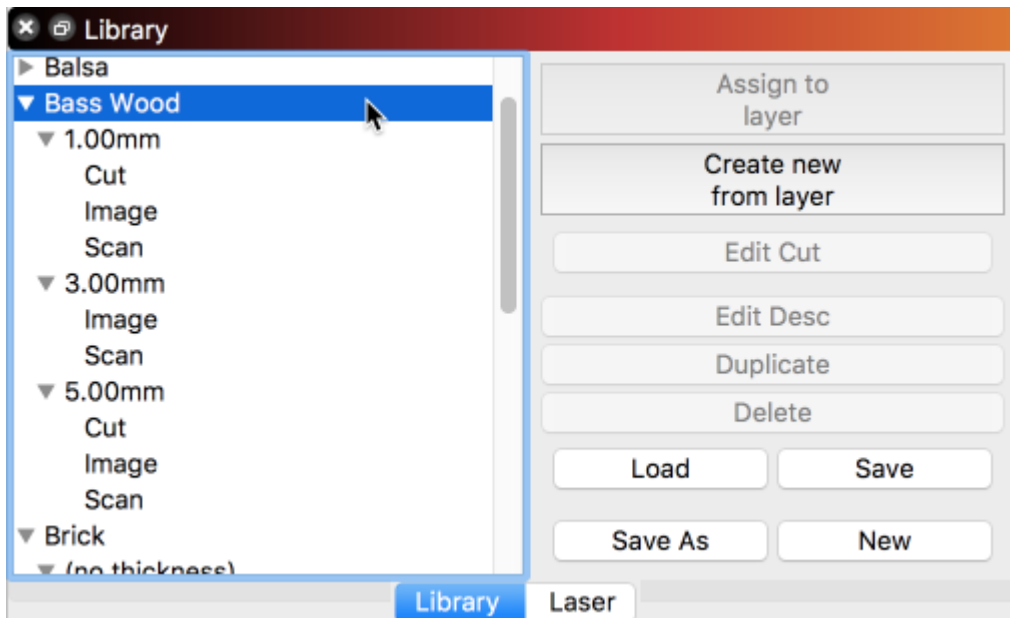
When you want to use an item from the library, locate it in the thumbnail view on the right, then simply drag it into your project wherever you would like it to appear, and drop it. You can also click 'Add Graphic to Project' in the buttons along the bottom.

## 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.

# Material Library

LightBurn's Material Library provides a way to store and organize lots of presets for different operations on different materials, and have a way to quickly apply them. This is entirely user-generated - 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.



Library\_UI.png

Any Library setting can be applied to a cut layer by selecting the library entry and assign it to the layer. Settings are copied, so if you need to make edits to the setting you won't hurt the copy in your library - you can edit those independently.

## UNDERSTANDING MATERIAL LIBRARY

Material Library is a simple yet powerful component of Lightburn intended to assist in the management of the laser cutting process.

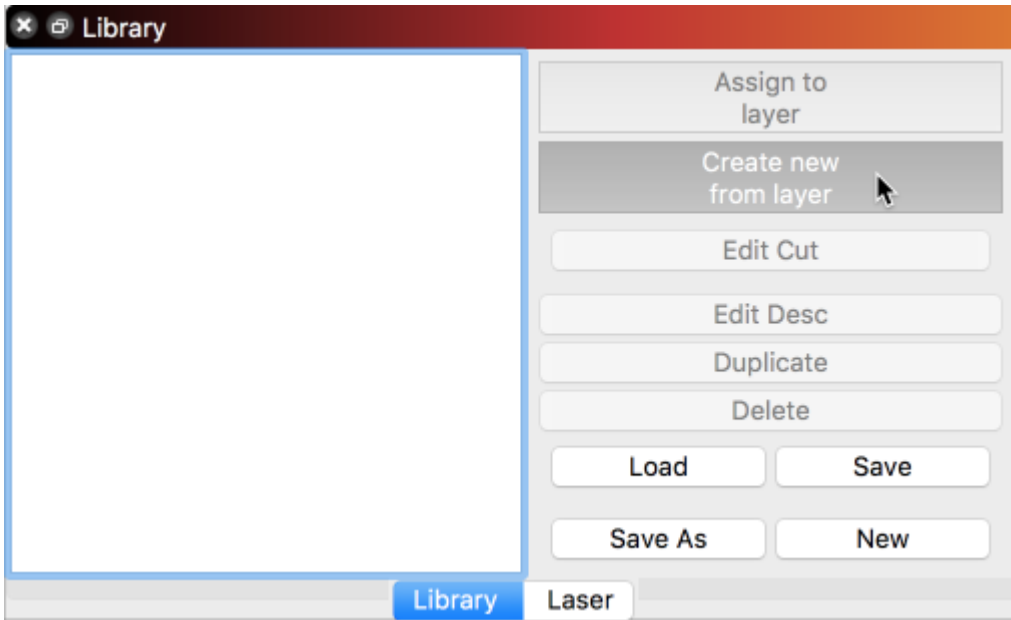
The first time you launch LightBurn, an empty Material Library is automatically set up and ready for new entries. You can easily add to, edit and manage cut settings in this library. Saved libraries can be loaded and shared from local or network accessed and even cloud based storage for convenience. To get started, make sure you can see the Material Library window.

In the top menu, select "Window" to ensure that "Library" is checked on. If not, select it to turn the window on. This will display the Material Library window in the lower-right of the display next to a box called "Laser".

## CREATE NEW FROM LAYER

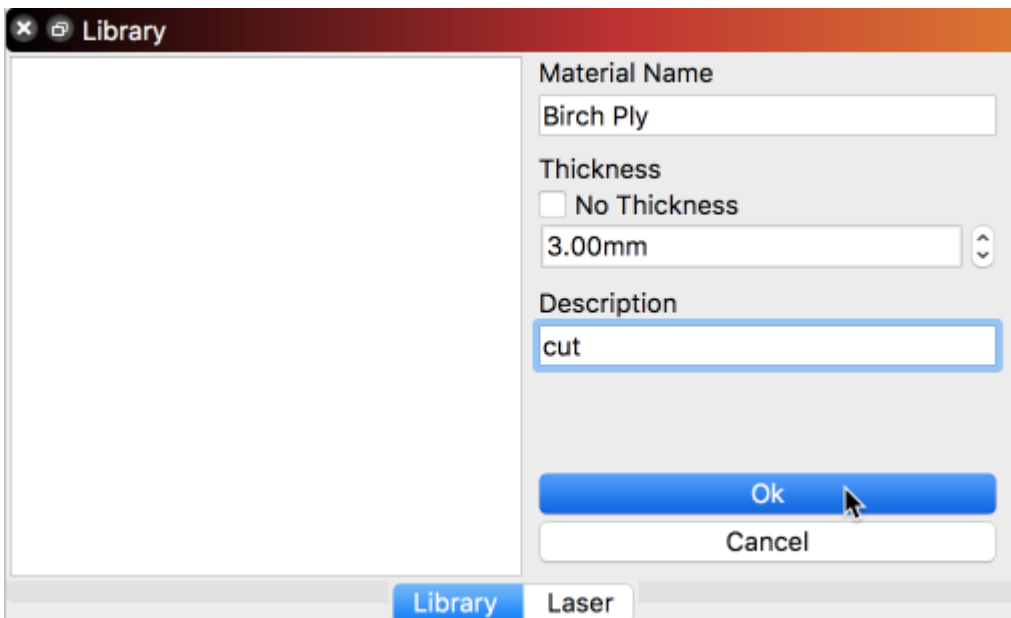
LightBurn makes it easy to build out your library using the current cut settings assigned to any cut layer.

Select one of your cut layers then click the *Create new from layer* button in the “Library” window.



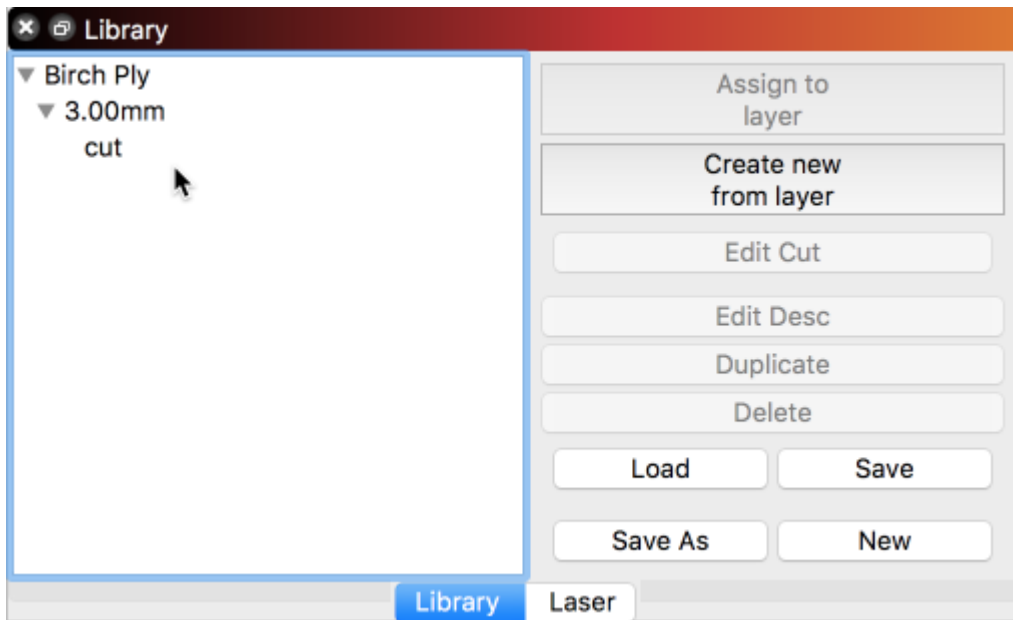
Library\_new\_Layer.png

Fill out the details sheet providing a *Name*, *Thickness* (if appropriate) and a short *Description* of the cut layer parameters. Once completed, click the *Ok* button to save this new entry into your library.



Library\_new\_Layer\_details.png

Now you can use this new entry titled “Birch Ply” anytime in the future and easily assign it to a new cut layer.

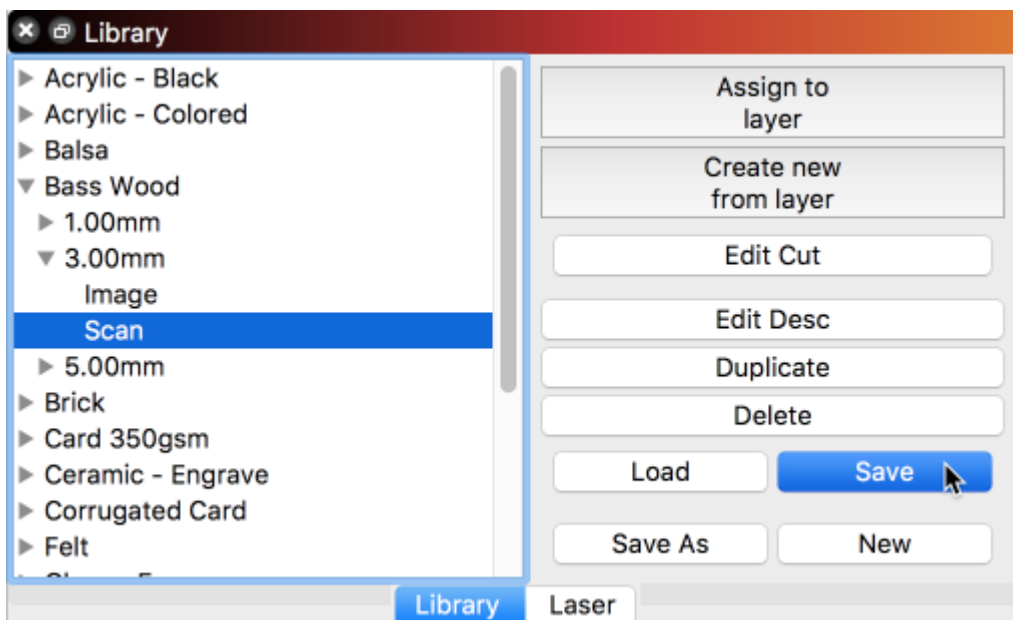


Library\_new\_Layer\_result.png

There are several helpful ways to facilitate adding to and managing your library covered later in the "Manage existing Library" section below.

## SAVE A LIBRARY

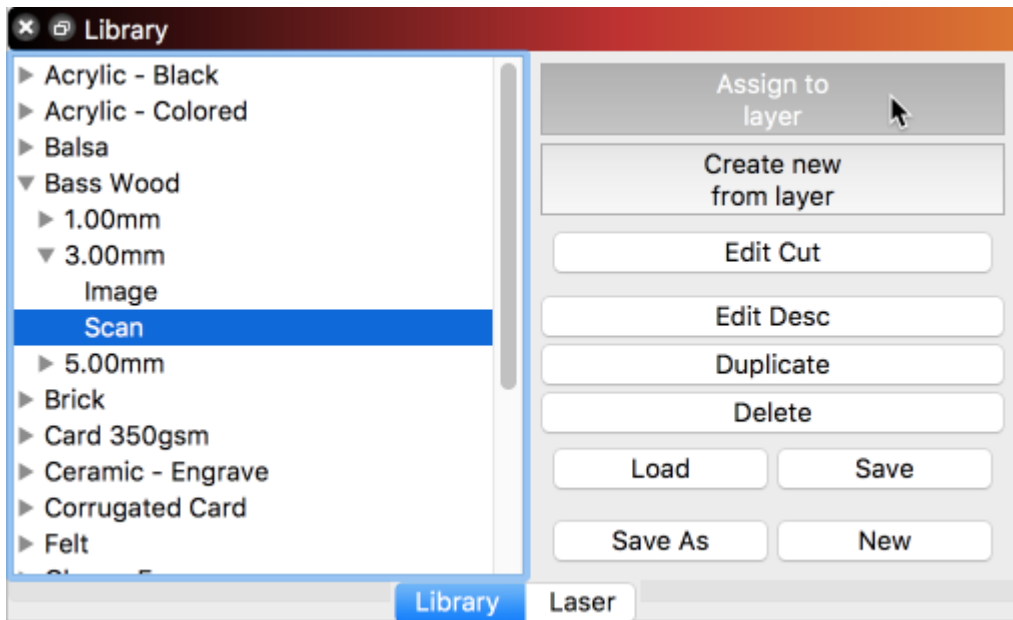
As you fill out the Library with your favorite materials, it is always a good idea to periodically save your additions. To do this, click the Save button.



Library\_Save.png

## ASSIGN LIBRARY SETTINGS TO LAYER

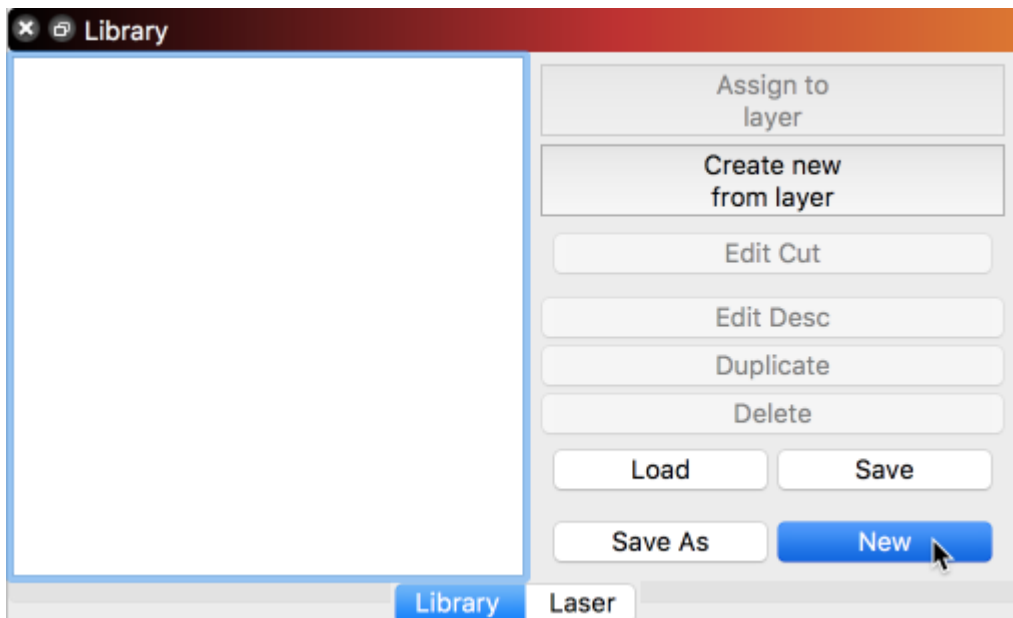
Now that you have some entries added to your library, you can use them to quickly and easily apply these settings to your work. Settings are copied, so if you need to make edits to the setting you have applied you won't hurt the originals in your library.



Library\_Assign.png

## NEW LIBRARY

Depending on your workflow, you may find it desirable to have several libraries to work from. You can start a new Material Library anytime by clicking the *New* button at the lower-right corner of the "Library" window. Now you are presented with a new, blank library ready to fill out and save.

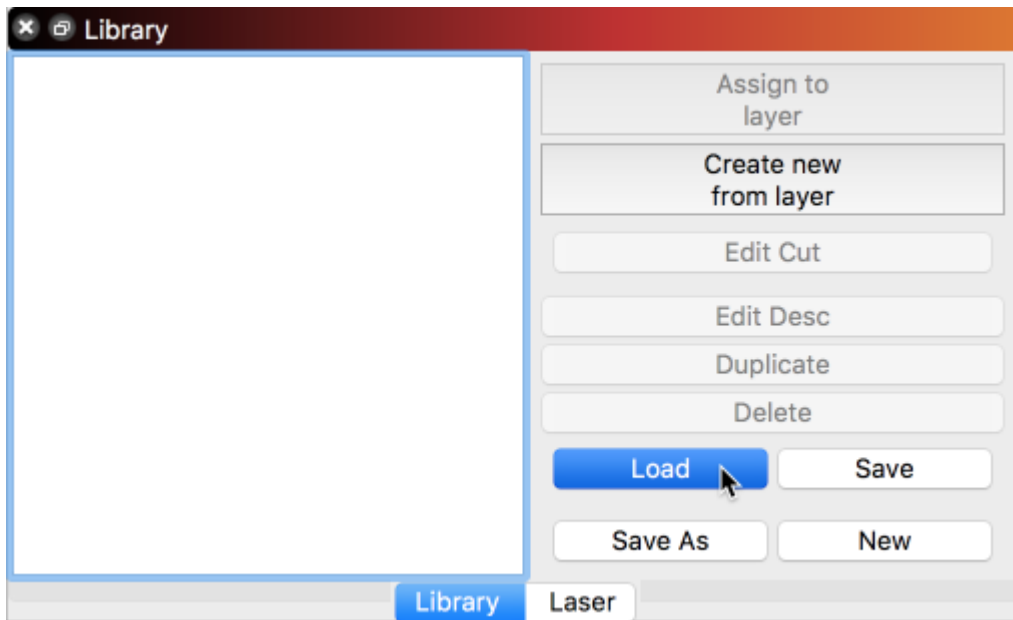


Library\_New.png

## LOAD A LIBRARY

Selecting *Load* provides access to your previously saved Libraries. Once clicked, a file finding window will open allowing you to point to a saved library. Select library of choice and click the *Open* button. Your chosen file will then become the active library for use.



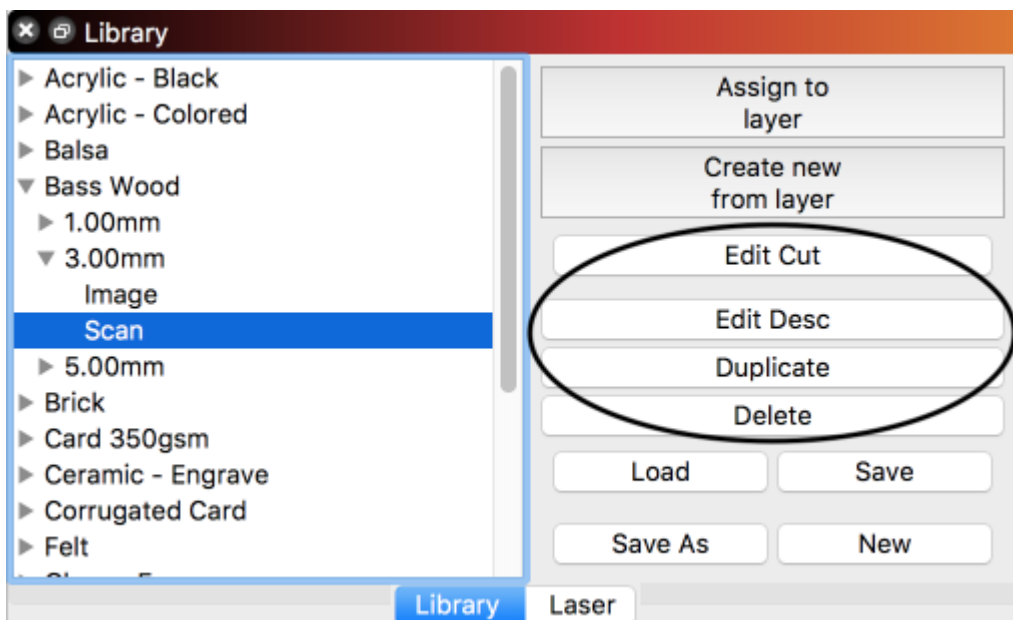


Library\_Load.png

## MANAGE EXISTING LIBRARY

Existing Library entries can be managed in several helpful ways. Changing existing cut settings and descriptions, quickly duplicating entries, removing unwanted entries or producing copies of the entire library can be done in a snap.

**Note:** These items are only selectable when "Description" is selected.



Library\_Edit.png

### 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. 3mm 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 As**

Click *Save As* to create a complete copy of your active library and saves it under a new name of your choice.

## **ADVANCED USAGE**

### **Multiple machines/users access to shared Library**

Multiple machines 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.).

Create a library on one machine and save it to your network or Google drive, DropBox, etc.. Point to that saved library file after hitting ‘Load’ in the ‘Library’ screen of LB for each machine.

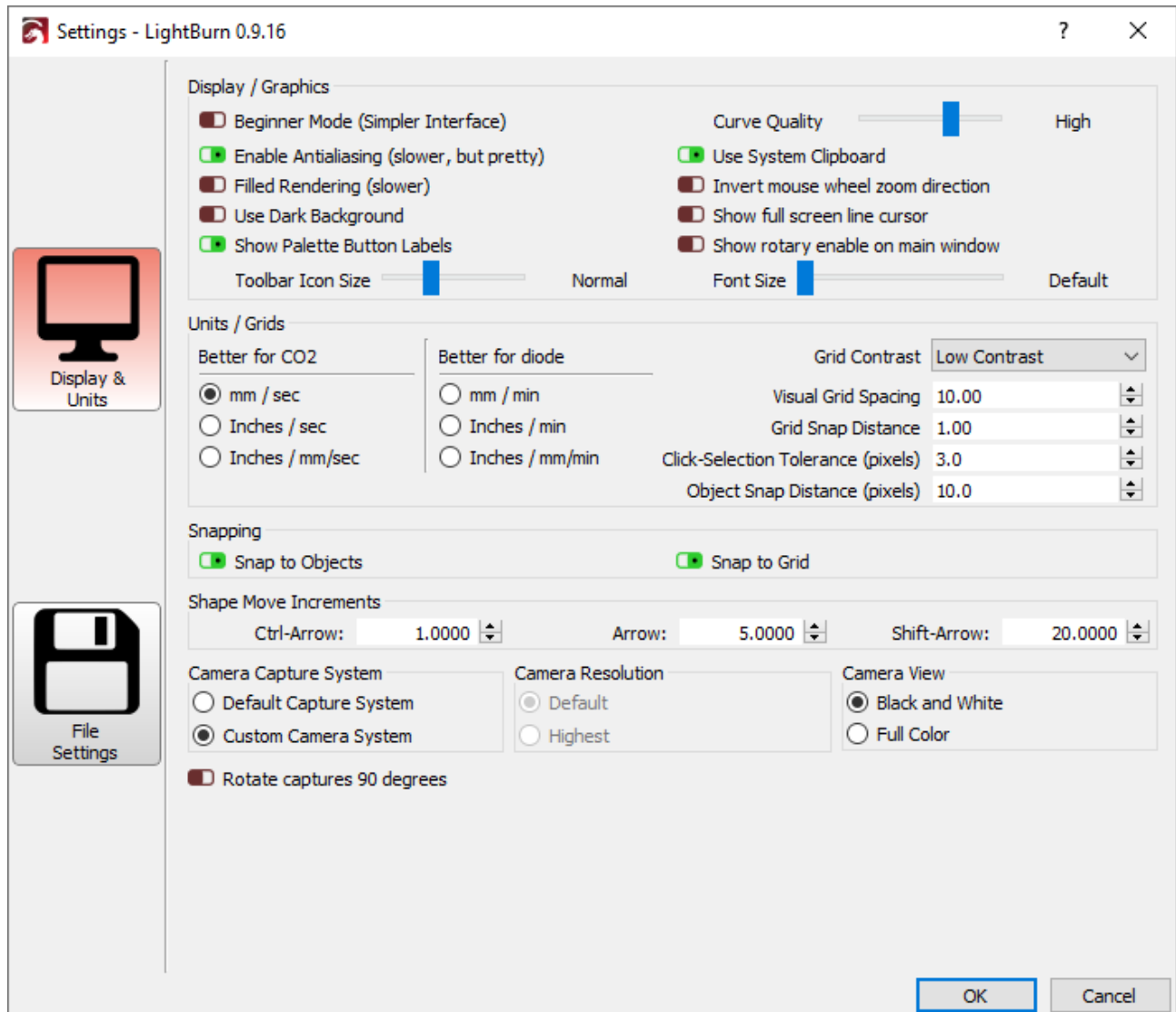
If you edit that library the changes will be there of both machines as they are pointing to the same file.

# Settings

The Settings window in LightBurn controls global user preferences for LightBurn. There are quite a few settings, so we've split it into two pages - Display / Units settings and File settings - though this breakdown was somewhat arbitrary.

## Display & Units Settings

The first page is the display and units settings, shown below:



In here there are a few groups of settings that control different parts of LightBurn.

## Display / Graphics

In here are things that control the overall display and presentation of LightBurn.

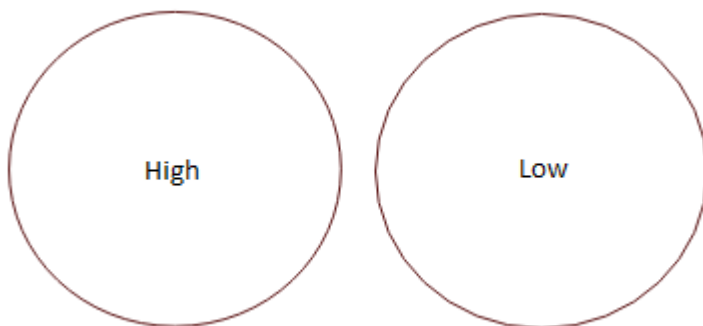
## Beginner Mode

If you are new to LightBurn, enabling Beginner Mode can help you learn your way around LightBurn by removing options that are commonly misunderstood, used by accident, or just used rarely by new users. This reduces the complexity of the UI somewhat, particularly in the cut settings, but be aware that the options you see in the interface will look different than those in video tutorials or screen shots in the documentation.

If you are searching for a button or feature and it doesn't appear where it should, it could be because you have Beginner Mode enabled, but it could *also* be because your laser simply doesn't support that feature - LightBurn's interface adapts and shows only those features supported by your hardware.

## Curve Quality

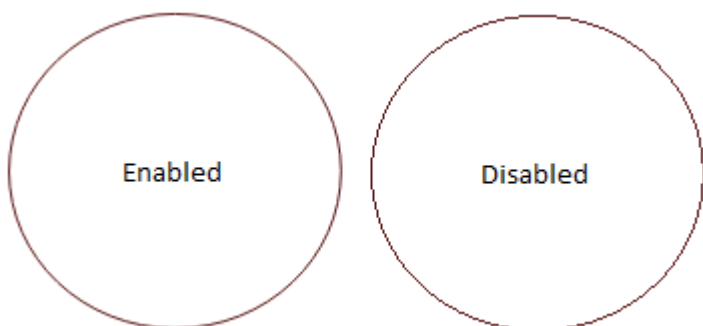
This controls the level of precision that LightBurn outputs splines. If you look closely at the comparison below, you can see the right image is made of straight lines, about 1/8" (4mm) long. The left image is also made of line segments, just many more of them, so the effect is imperceptible. This extra quality comes with a slight cost in speed. You'll only likely notice it in files with thousands of curved shapes.



Curves-High-vs-Low

## Enable Anti-aliasing

Aliasing is commonly called "jaggies" - in our case, it's the visible appearance of pixels when drawing 2d shapes. Anti-aliasing draws shaded pixels on either side of the drawn lines to give the appearance of higher resolution and a smoother result. The image below compares the two - The difference is very apparent, however this comes with a moderate performance penalty. If you are running an older machine, turning off antialiasing may improve the interactivity of LightBurn on dense scenes.



## Antialiasing-vs-Normal

### **Filled Rendering**

When enabled, 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**

I'm a PC user, with a Mac, and the scroll wheel always feels backwards to me, so this switch changes the direction you scroll when zooming. If you're a Mac person stuck on a PC, this is also for you.

### **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.

## **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 CO2 lasers generally express speeds using units per second.

### **Visual Grid Spacing**

The visual grid is set to 10mm 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 1mm.

### **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 / 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**

### **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 5mm 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.

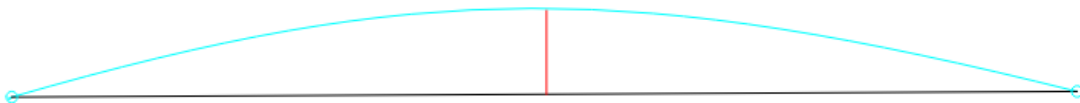
## Other Settings

### 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.

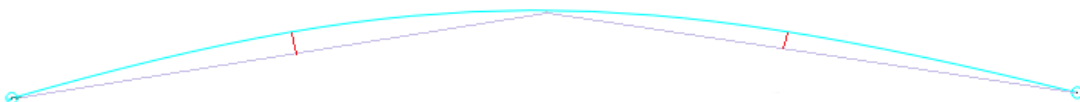
### Curve Tolerance

This setting is similar to the Curve Quality setting above, except that it controls the quality of output to the laser. The number is a measure of how much error to allow in the output. A value of 0 would be “perfect”, but would create very dense data, as some lasers can only process line segments.



OutputTolerance

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.

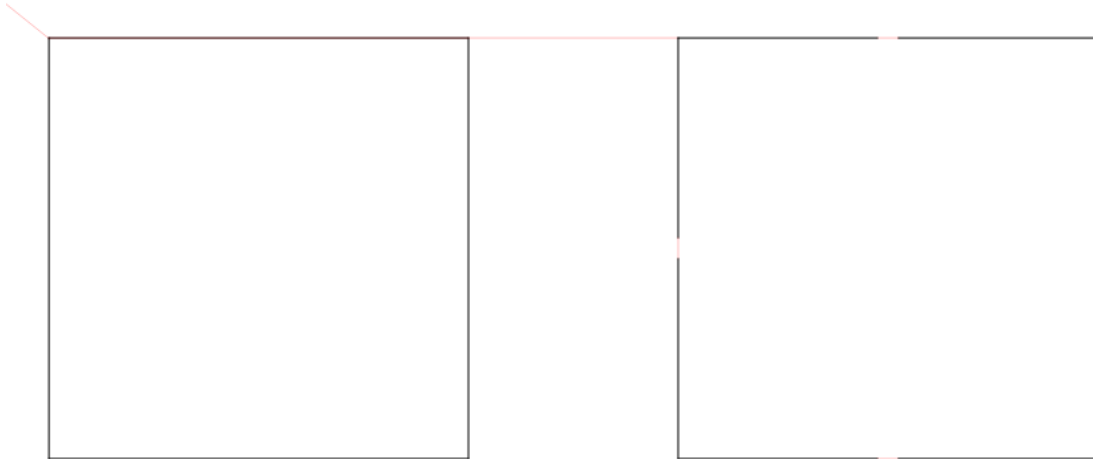


OutputTolerance-SubDiv

Most people will probably never need to change this - the default is 0.05mm, which is about 1/2 the width of a typical beam. Note that this is the *maximum* error value allowed, so typical output will be better than this, and this only affects curves, not straight lines or vertices, which are exact.

## # 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 1mm in length. In the example below, the left square has no tabs applied, while the right has a single 1mm wide tab on each side.




Tab Example

## 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:

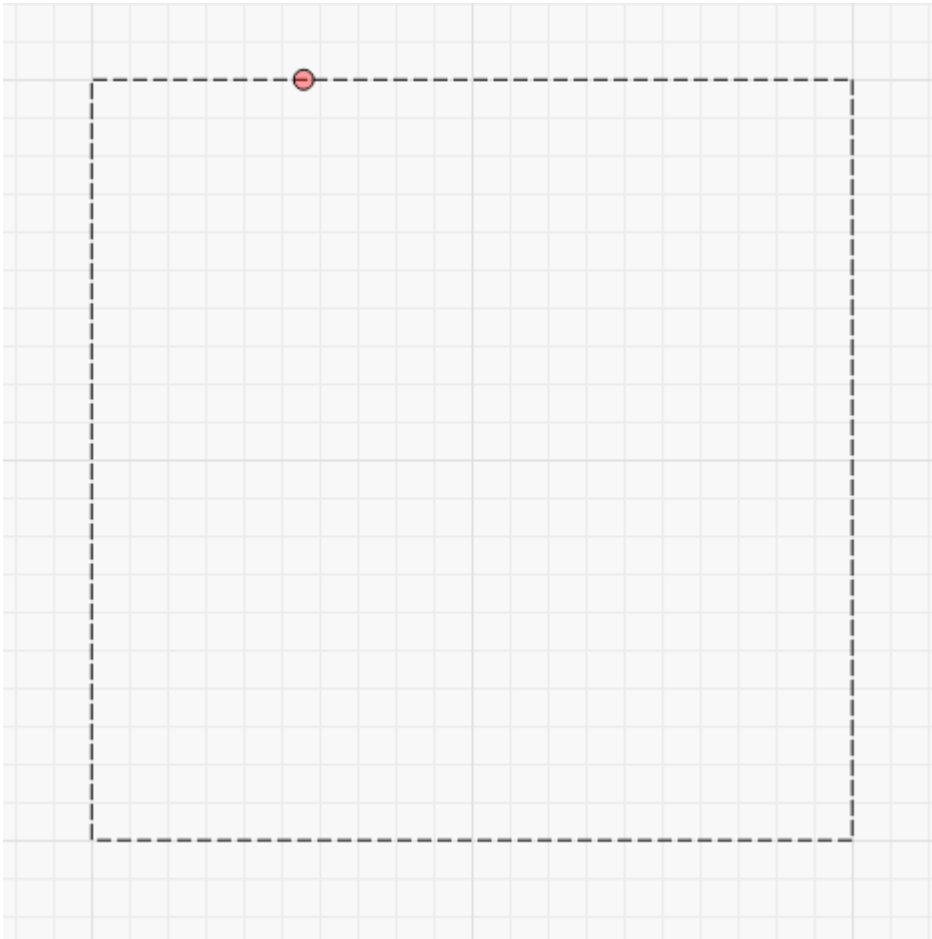


Add Tabs Tool

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 appear where you clicked, denoting that a tab will be placed there.





Inserted Tab

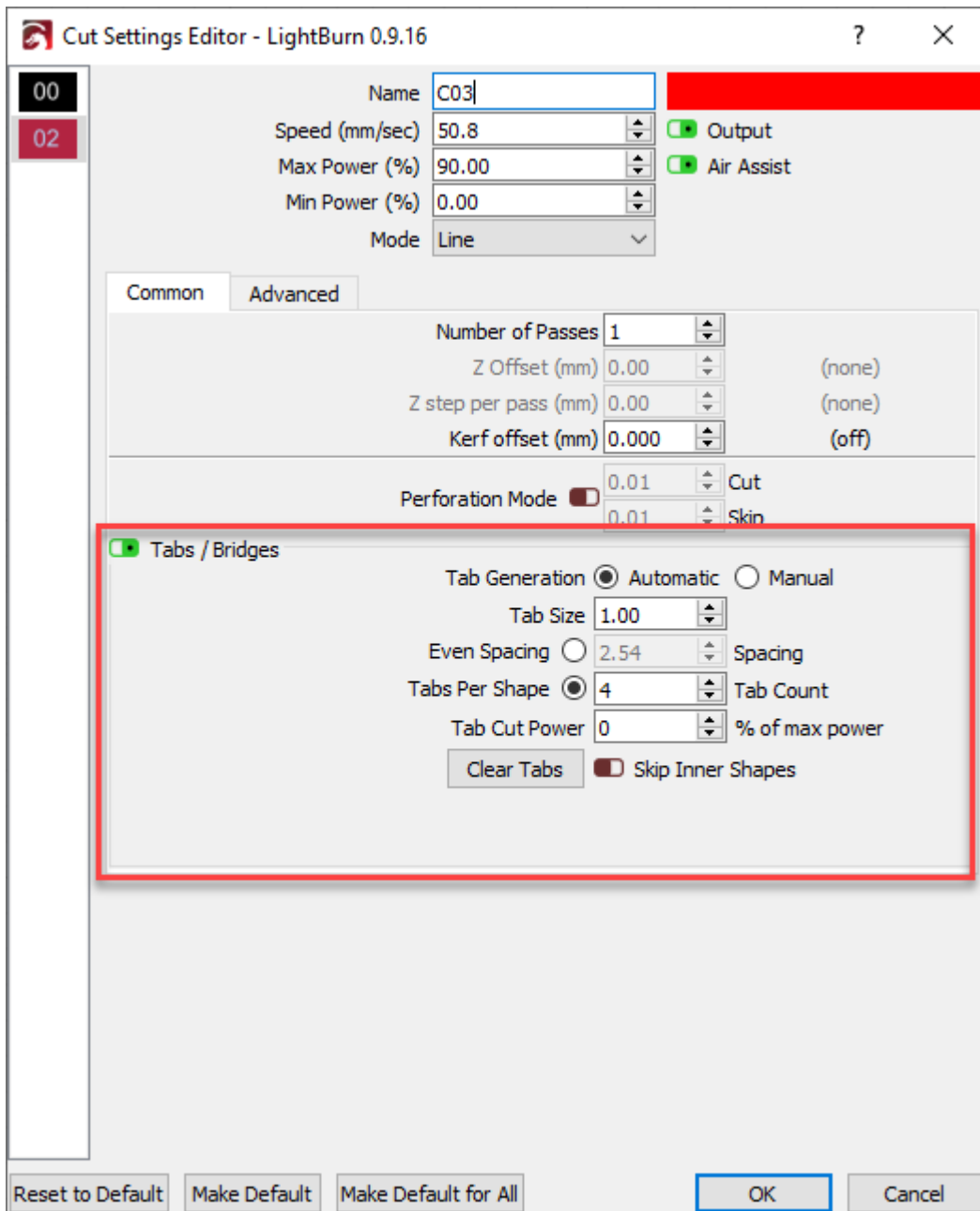
Tabs default to 0.5mm in width and you can place many tabs on any shape. The system will, however, limit how close any two tabs can be based on the currently set tab size.

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.



Tab Settings

### Global Enable / Disable

The **Tabs / Bridges** group has a checkbox in the top-left. Flipping this to off will suppress 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.

### **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%.



### **Tab Pulse**

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.

# Cut Settings Window

The cut settings window in LightBurn is presented when you double-click an entry in the Cuts / Layers window, or in the Material Library list.

The window you see may look different than this one, as it will vary based on which laser controller you have, the type of cut you have selected, and whether or not you are in 'Beginner Mode'.

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

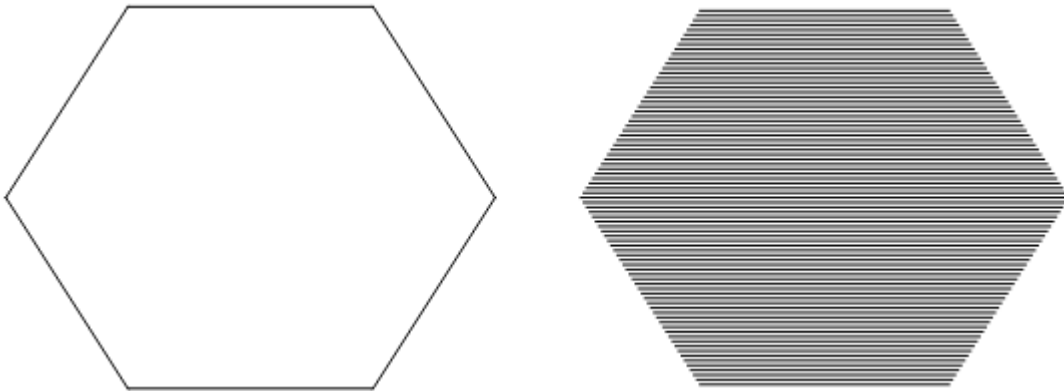
Fill + Line mode - does a fill, followed by an outline

Offset Fill mode - fills the design with lines that follow the original shape

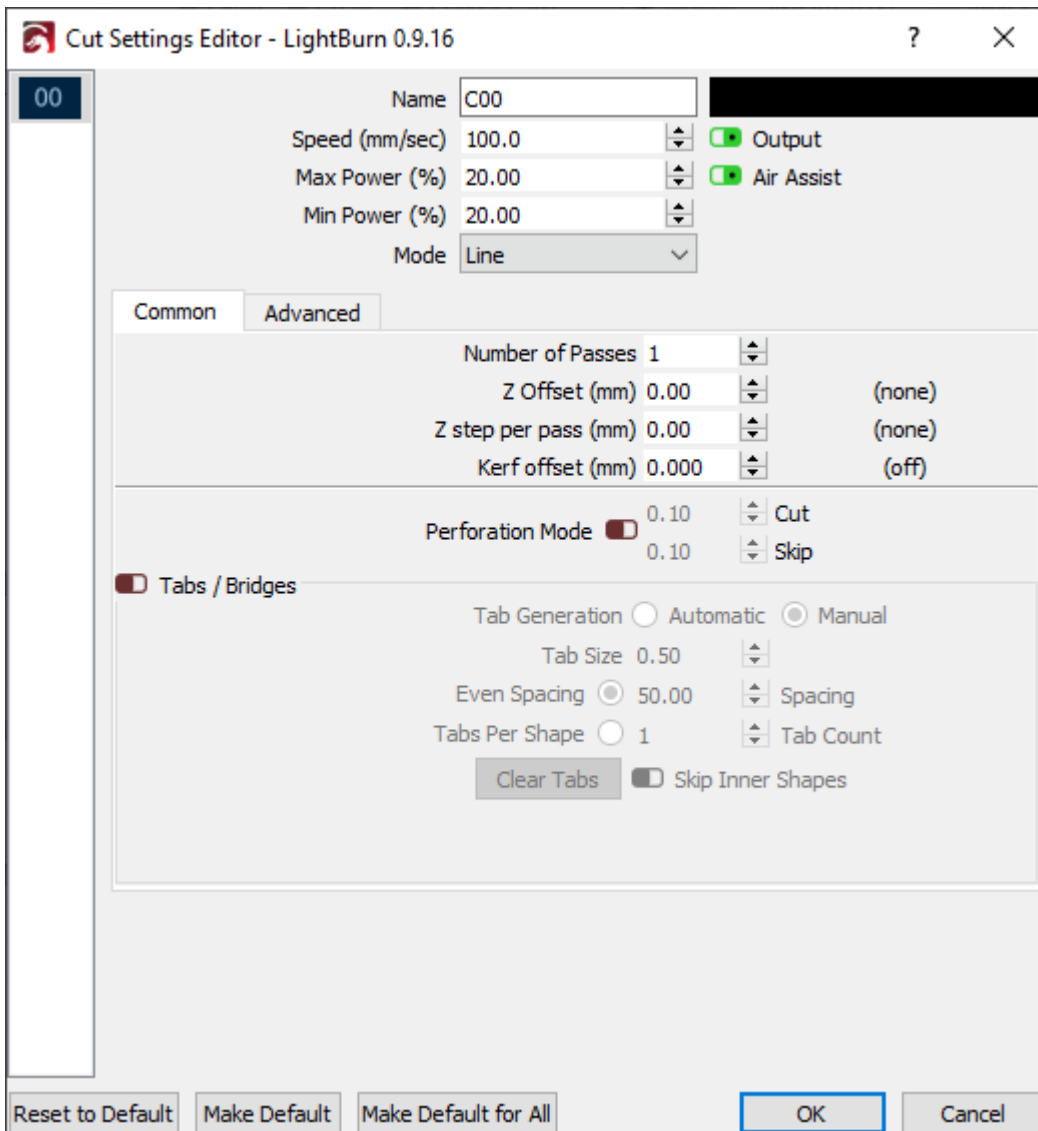
Image mode - Works similar to fill, but with specific settings for images

Where 'Line mode' traces along the vector lines in your design exactly as they appear, 'Fill mode' behaves differently - it scans back and forth with the laser, turning off and on, filling the interior of the shape with straight lines, much like you would do if you were trying to fill an area with a pen.

Given a simple hexagon, 'Line mode' is on the left, and 'Fill mode' is on the right:



Here is an example of what the cut settings window looks like for a 'Line' layer:



In all variations of this window, 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 achieve the speed you request.

The next two require a small amount of explanation:

**Max Power:** The power level to run the laser at

**Min Power:** The power value used for corners, or when moving at low speed (*DSP only*)

**Note:** On GCode based systems, you *only* get “Max Power” - the power the laser will use when running at the chosen speed. On DSP systems, you have the additional ‘Min Power’ setting, which is used when traveling at low speed, or when cornering.

If you are cutting at a low overall speed (for example, 10 to 20 mm/sec on a CO2 machine) the laser might only ever use the ‘Min Power’ setting, so it is recommended when cutting at very slow speeds to set these both the same. If you are doing ‘surface marking’ you ideally want Min Power to be just above the firing threshold of the laser, so corners still produce a burn, but without scorching.

For the settings specific to each of the different modes, click a link below:

[Line Mode settings](#)

[Fill Mode settings \(including Fill + Line mode\)](#)

[Offset Fill Mode settings](#)

[Image Mode settings](#)

# 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:

<b>Output</b>	<b>Expression</b>
the day as number without a leading zero (1 to 31)	d
the day as number with a leading zero (01 to 31)	dd
the abbreviated localized day name (e.g. 'Mon' to 'Sun'). Uses the system locale to localize the name.	ddd
the long localized day name (e.g. 'Monday' to 'Sunday'). Uses the system locale to localize the name.	dddd
the month as number without a leading zero (1-12)	M
the month as number with a leading zero (01-12)	MM
the abbreviated localized month name (e.g. 'Jan' to 'Dec'). Uses the system locale to localize the name.	MMM
the long localized month name (e.g. 'January' to 'December'). Uses the system locale to localize the name.	MMMM
the year as two digit number (00-99)	yy
the year as four digit number	yyyy

These expressions may be used for the time:

<b>Expression</b>	<b>Output</b>
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)

## Expression Output

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. <i>A/AP</i> will be replaced by either "AM" or "PM".
ap or a	use am/pm display. <i>a/ap</i> 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
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:



<b>Input</b>	<b>Output</b>	<b>Input</b>	<b>Output</b>
d	4	0d	4
dd	34	Odd	34
ddd	234	Oddd	234
dddd	1234	Odddd	1234
ddddd	1234	Oddddd	01234
dddddd	1234	Odddddd	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	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)