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Welcome to the LightBurn documentation!

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

You can make LightBurn feature requests on our suggestion site.

Get Started

If you're new to LightBurn or laser cutting in general, we'll walk you through installing LightBurn, setting up your laser, and creating your first project.

New in LightBurn 2.0

Read about all the new features in the latest version of LightBurn.

License FAQ

Information about LightBurn's pricing and licensing model.

How to Use These Docs

Tips on navigating and getting the most out of our documentation.

Tools and Features

Information about using each of LightBurn's tools and features.

Troubleshooting

If you're running into problems, you may find a solution here.

Collections

Take a look at our collections based around common use cases for LightBurn.

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

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

Download PDF Version

safety

⚠ WARNING

LASERS USE INTENSE BEAMS OF LIGHT, INCLUDING LIGHT THAT MAY NOT BE VISIBLE.

IMPROPER USE OF LIGHTBURN SOFTWARE WITH ANY DEVICE MAY BE DANGEROUS AND COULD RESULT IN PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE. ALWAYS FOLLOW THE DEVICE MANUFACTURER'S INSTRUCTIONS AND GUIDELINES.

ALWAYS WEAR PROPER EYE PROTECTION WHEN USING YOUR LASER.

⚠ WARNING

DO NOT LEAVE A LASER UNATTENDED WHILE IN OPERATION.

3 Licensing

license

3.1 How the License Works

A LightBurn license is a digital key used to unlock the software for permanent use.

Every new license comes with a year of free updates from the date you first activate it. After a year, you'll need to renew your software update period in order to receive updates for another year. If you renew *before* your key expires, you'll receive an additional two months on your one-year renewal.

If you choose not to renew, you will *always* be able to continue using the most recent version of LightBurn that is compatible with your operating system and was released within your license's valid update period.

To download an earlier version of LightBurn that is compatible with an operating system no longer supported by current versions of LightBurn, visit our release repository or click on the blue box below for direct links to the most recent version of LightBurn for your operating system.

Support for Other Operating Systems

- LightBurn version 1.7 is the last version compatible with Linux, versions of Windows prior to 10, and versions of macOS prior to 11. Download LightBurn 1.7.06 and see our 1.7 documentation for information and installation instructions.
- macOS users running versions older than 10.13 should download LightBurn 1.6.03, which supports macOS 10.11 or newer. See our legacy documentation for more information and installation instructions.
- Users limited to 32-bit versions of Windows should download LightBurn 1.5.06, which is the final 32-bit release of LightBurn. See our legacy documentation for more information and installation instructions.

3.1.1 License Types

The type of license you need depends on the controller used by your laser. LightBurn supports three device types: GCode, DSP, and Galvo.

- LightBurn Core supports GCode-based devices.
- LightBurn Pro supports *both* DSP and Galvo devices, in addition to GCode-based devices.

If you're not sure what type of license you need, see Identify Your Laser.

If you started with a license that supports one type of device, and now need to use LightBurn with a different type, you can add support for the new device type to your existing key. Please note that adding support for additional devices *does not renew your key*.

A LightBurn license automatically comes with 3 seats, meaning you can activate it on three computers at one time. You can use our License Portal to view and remove activations on your key, freeing up activations in use on old or inoperable computers so you can activate on new ones.

If you already have a key, you can purchase additional seats here. If you would like to purchase a new key with more seats than the default of 3, or are interested in a *Floating* license setup, see our Educational and Volume Licensing page.

If you sell your laser and wish to sell your license along with it, that is permitted. Please note that it is *not permitted* to sell part of your license to someone else.

Have questions? Read our FAQ or contact us at support@lightburnsoftware.com

3.1.2 Additional License Information

License Management Guide

System Locked and Floating Licenses

License Management Reference

License Management Troubleshooting

license FAQ

Is a LightBurn license a subscription?

No. You pay once, and the software will work forever as long as you have your license key.

After a year, you'll need to renew your software update period in order to continue receiving updates.

Which version do I need?

The type of license you need depends on the controller used by your laser. LightBurn supports three device types: GCode, DSP, and Galvo.

- LightBurn Core supports GCode-based devices.
- LightBurn Pro supports *both* DSP and Galvo devices, in addition to GCode-based devices.

If you're not sure what type of license you need, see Identify Your Laser.

Can I use the same license key on any operating system?

Yes, the same key can be used to activate LightBurn on Windows, macOS, or Linux.

How many computers can I use it on?

A LightBurn License automatically comes with 3 seats, meaning you can activate LightBurn on 3 computers at one time. You can use our License Portal to manage your activations.

If you'd like to activate LightBurn on more than 3 computers, you can purchase additional seats for your license here. The cost of each additional seats depends on your license type.

If you would like to purchase a new key with more seats than the default of 3, or are interested in a *Floating* license setup, see our Educational and Volume Licensing page.

I lost my license key — how do I find it again?

If you've lost your license, you can enter your email address in our license key recovery tool to look it up.

You can also use your email address to access our License Portal and view your license.

If you don't turn up any results, or can't access the portal, contact us at support@lightburnsoftware.com

Does the license expire?

No, but your license's update period has an expiration date — a year from when you first activated it. When the update period ends, the key is still valid, but you won't be able to use any version of LightBurn released after the end of the update period. Any version released *before* the key expired will continue to work.

My license expired, how do I revert to a compatible version of LightBurn?

To download and revert to a version of LightBurn compatible with your key, visit our release repository.

How do renewals work?

If your key's update period has expired, a renewal will add a year of updates, starting from the date you purchase the renewal.

If you renew *before* your update period expires, the renewal period will be extended starting from the date your key was set to expire. You'll also receive an additional two months on your one-year renewal.

How much is it to renew?

The price to renew your license's update period and receive another year of software updates is $30.

Starting in 2025, the price to renew your license's update period will depend on when you purchased your key, and how long since you last renewed. A renewal is:

- $50, if you're buying updates again after having lapsed (with a big exception for existing customers, see below)
- $45, if you've been paying for software updates for at least a year, including the year that came with a new license purchase
- $40, if you've been paying for software updates continuously for 2+ years

If your license key dates from 2024 or earlier, we will *always* allow you to buy another year of updates at the lowest offered price, even if you lapse.

Renew your license here.

Do renewals cost more if I have more than 3 seats on my license?

No. The price of a renewal is the same regardless of the number of seats on your license.

Can I add support for a new type of laser to my existing key?

Yes. You can upgrade your license here.

Will I lose support for other devices when upgrading?

No. A license upgrade adds supported device types to your key, but doesn't take any away.

Does adding support for a different device type renew my key?

No. Adding support for a different device type does not renew your key, or affect your key's update period in any way.

I already have a LightBurn license. Can I try a different version before upgrading?

Yes. If you are already have a LightBurn license, but would like to try it with a device type your key does not currently support, go to Help → License Management and click **Deactivate License**, then **Extend Trial**.

How do I know when my upgrade has been applied?

Our systems are fully automated, and all upgrades are processed promptly. However, LightBurn will need to contact our licensing server to register any upgrade, and it can take up to 24 hours for LightBurn to sync with the server. You can force LightBurn to check back in by deactivating and then reactivating your key in the License Management window.

How do I know if my license supports my laser?

If you've already activated your license, but aren't sure if it supports your type of laser, go to Help → License Management to see a list of device types supported by your license.

If you're unsure whether your laser is one of the types listed, see Identify Your Laser.

If you're unable to connect to your laser even though it is supported by your license, see Troubleshooting: Connection Problems.

Can I transfer my key to another user?

Yes. You are free to transfer your key to another user, or sell it along with your laser. The current owner of the key needs to email us from the email associated with the key to request the transfer to the new owner's email address. The new owner will be granted access to our License Portal to manage the key.

Please note that selling or sharing individual seats on your license key is *not permitted.* Keys must be transferred in their entirety, including all seats.

license-management trial activation

3.3 License Management Guide

The license system used by LightBurn has a web portal where you can view the computers activated on your license, deactivate unused computers, or process an **Offline Activation**.

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

Accessing the License Portal

The first time you use the portal you will need to enter the email address assigned to your key and request a password reset.

Follow these instructions to access the License Portal:

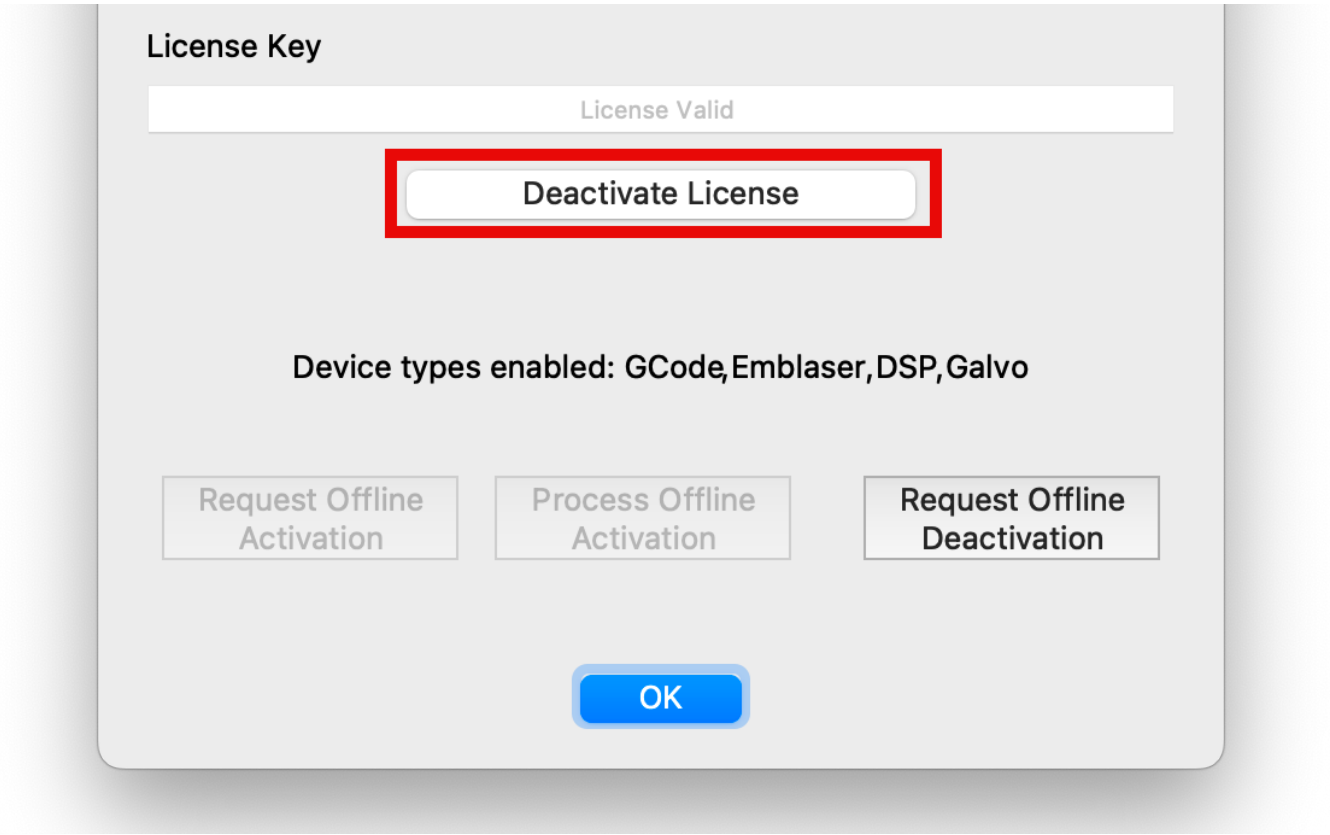
1. Go to https://lightburn.customer.cryptlex.com/.
2. Click **Forgot Password**.
3. Enter the email address where you received your license key, and click **Recover Password**.
4. You will receive an email from Cryptlex with a password reset link.
5. Follow the link, choose your new password, then log in.

> **Note**
>
> If you do not see an email from Cryptlex, check your Promotions or Spam folders — the password reset email sometimes ends up there. If you still cannot find it, your email provider might be blocking the email from ever reaching you. Contact us at support@lightburnsoftware.com to have us reassign your key to an address under a different provider. Gmail accounts work well.

Removing an Old Computer From Your Key

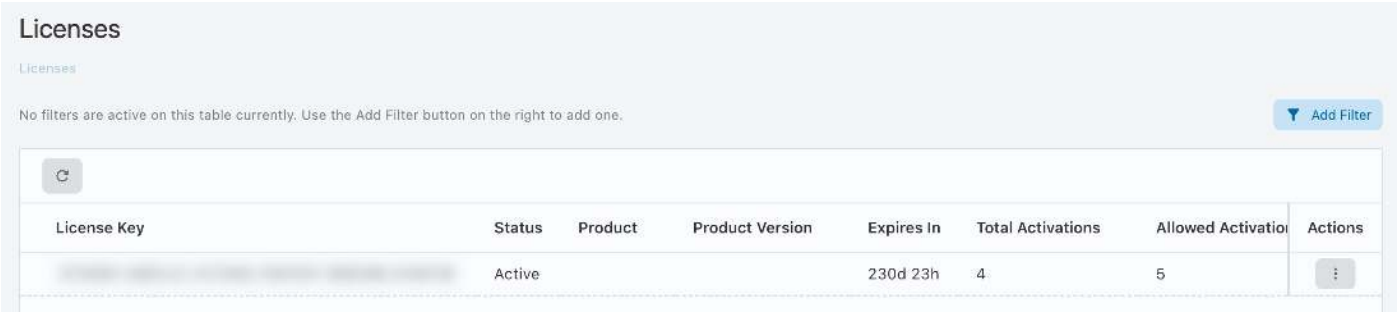
If you still have access to the computer you wish to remove from your license:

1. Open LightBurn on that computer and go to Help → License Management.
2. Click **Deactivate License**.

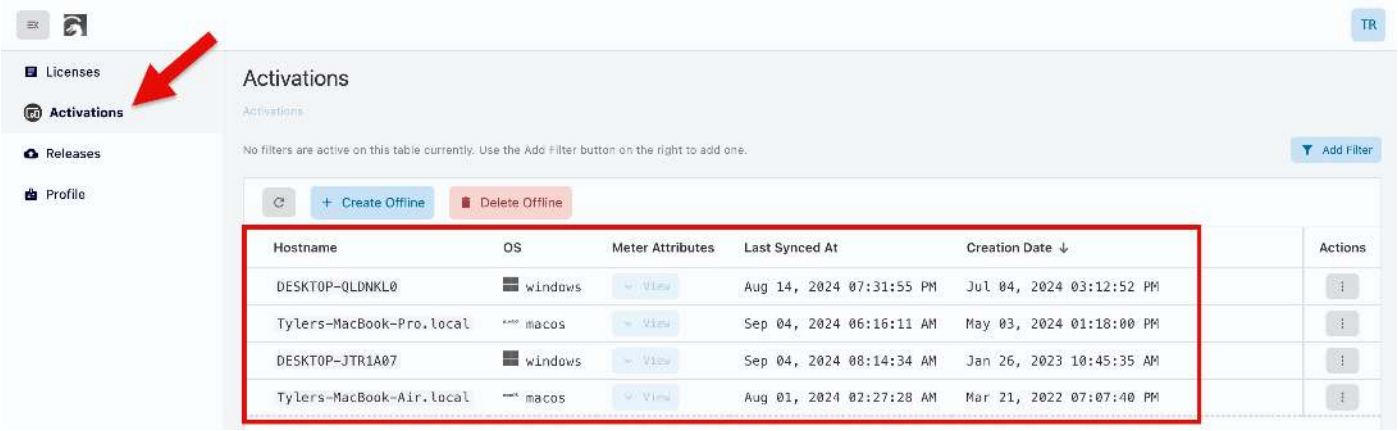


If you no longer have access to the computer you wish to remove:

1. Log in to the License Portal. On the main screen you will see any licenses associated with your email address.



2. Click on **Activations** in the left sidebar to view a list of computers assigned to your license key, when they were last used (**Last Synced At**), and when they were first activated (**Creation Date**).

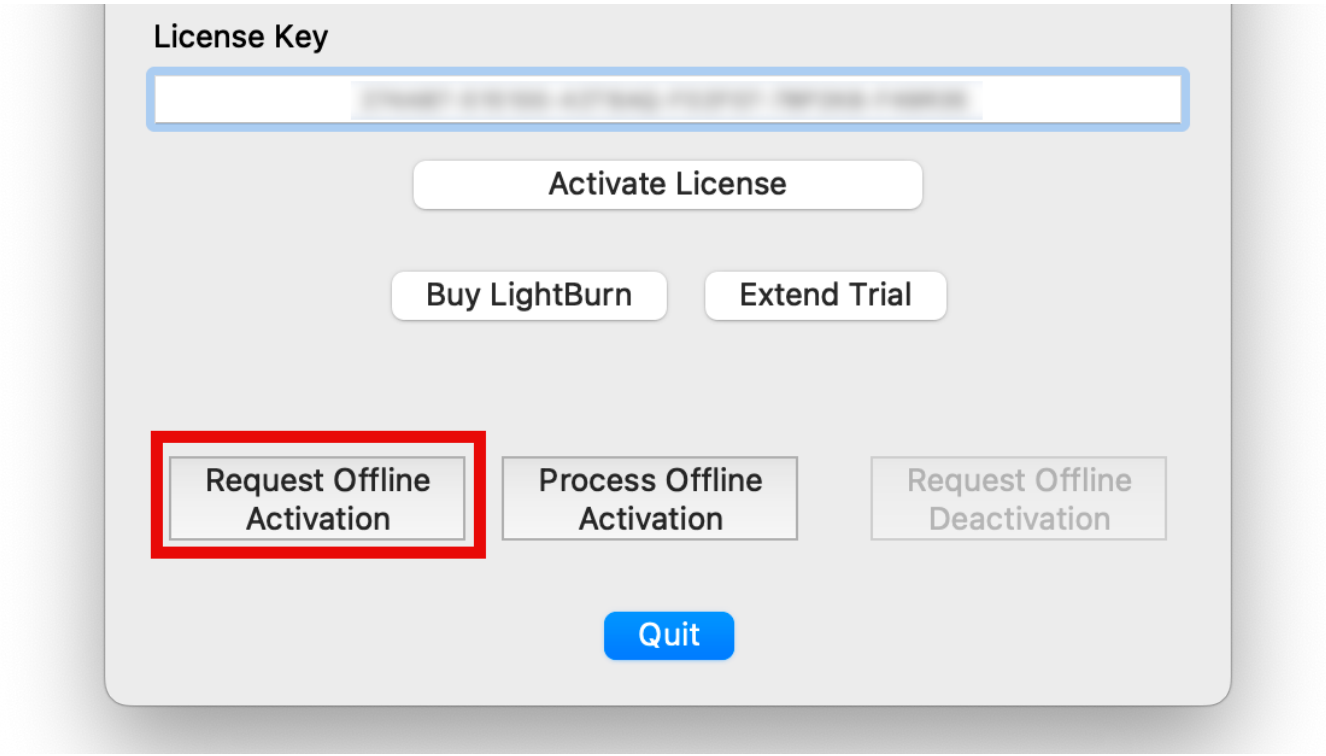


3. Click the three dot icon to the right of any computer in the list, to show the option to **Delete** that computer, removing the license from the computer, and freeing up the license seat for use on another machine.

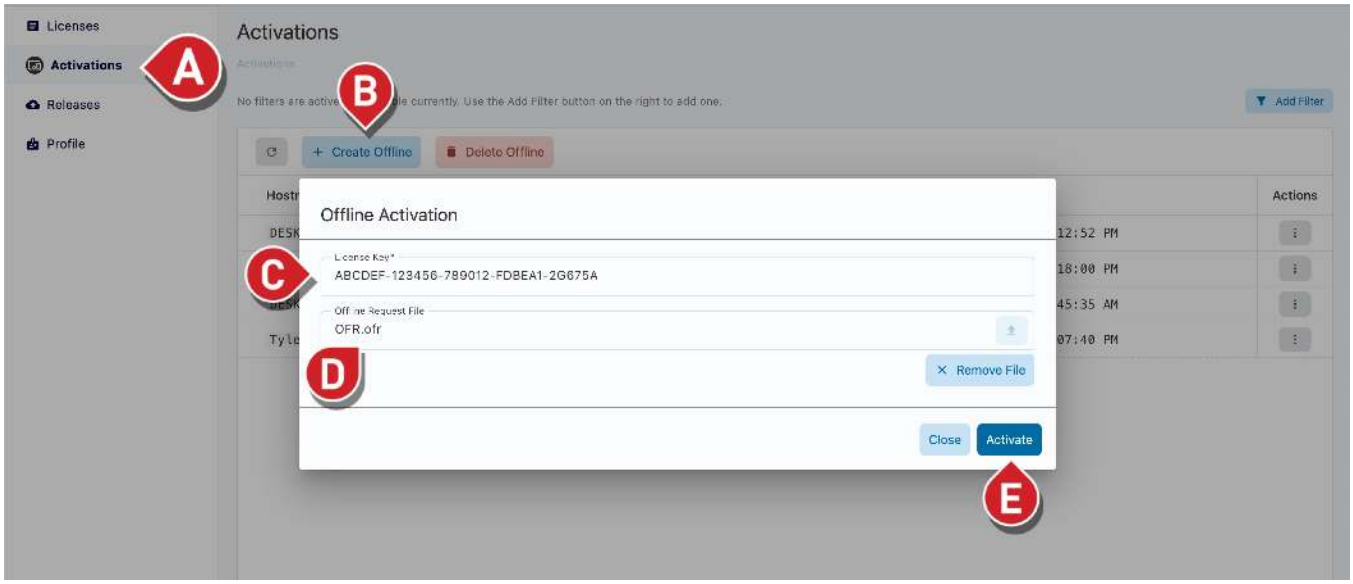
Processing an Offline Activation

Follow the steps below to activate LightBurn on a computer without access to the internet.

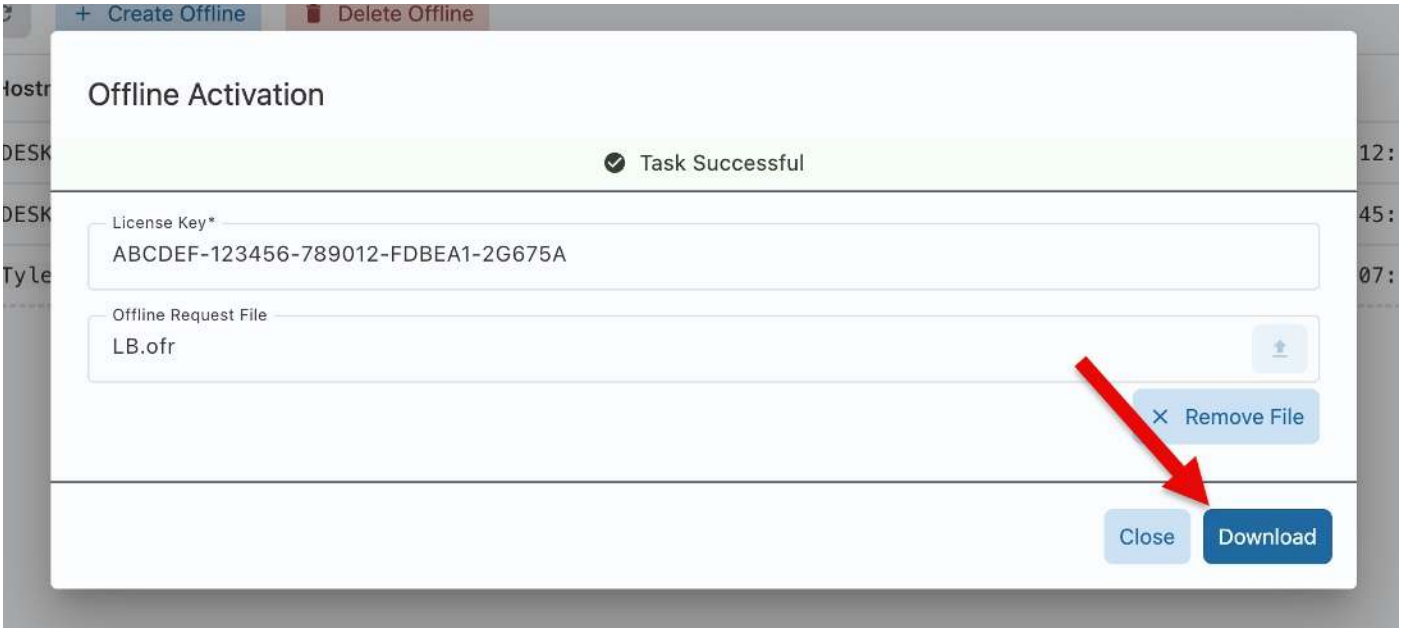
1. Enter your license key in the **License Management** window.
2. Click **Request Offline Activation**.



3. You'll be asked to save a file with an `.ofr` extension that contains the machine fingerprint as an offline request. Save and copy that file to a USB flash drive and bring it to a machine with a network connection.
4. Log in to the License Portal on the machine with a network connection.
    a. While viewing your license in the portal, click **Activations**.
    b. Click **Create Offline**.
    c. Paste your key into the **License Key** field.
    d. Click in the **Offline Request** field to open your system's file browser, navigate to the location the `.ofr` file is saved, and select it.
    e. Click **Activate**.

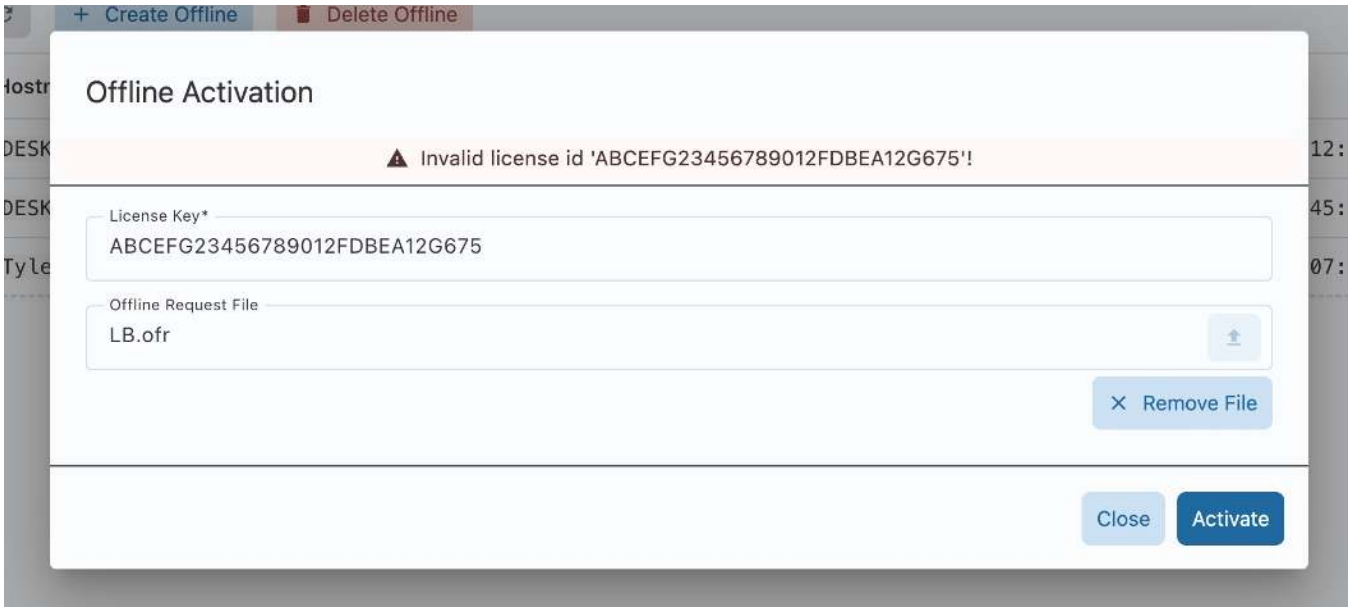


5. You'll see **Task Successful** if you entered everything properly. Click **Download** to download the `.dat` response file.

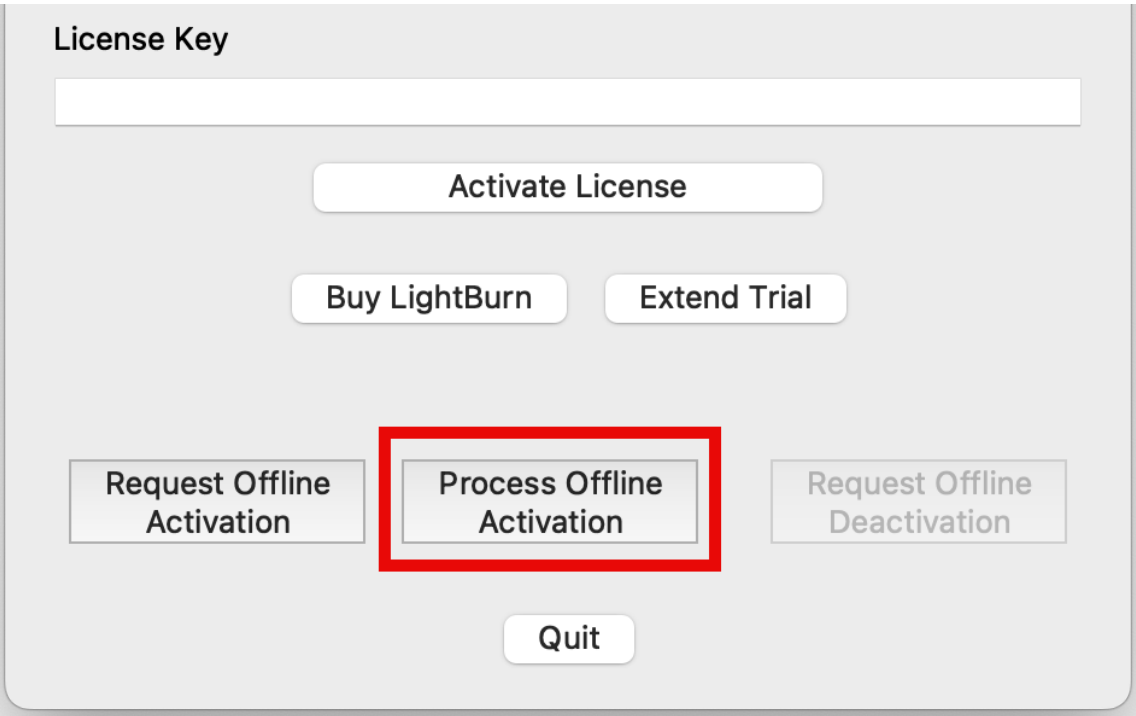


Warning

If you see an **Invalid license id** message instead, you'll need to repeat the process. Take care to enter your exact license — including hyphens — into LightBurn and the field in the Offline Activation window. Copying and pasting the key directly from your original order email is the best way to ensure accuracy.



6. Transfer the `.dat` file back to the offline computer by USB flash drive.
7. On the offline computer, in the License Management window in LightBurn, click **Process Offline Activation**.



8. Navigate to the location the `.dat` response file is saved and select it, completing the Offline Activation process.

If you're not comfortable performing all of the above steps yourself, email us at support@lightburnsoftware.com, with the `.ofr` file and license key, and we will process the file and return the `.dat` response file for you to use to complete the activation.

> **Warning**
>
> It is not possible to complete this process for a Trial ID. LightBurn must connect to the internet once to activate a trial, after which you are free to take your computer back offline.

license

3.4 Educational and Volume Licensing

A LightBurn license key comes with 3 seats by default, meaning that it can be installed and run on up to three computers. If you need more than 3 seats, you can buy additional seats at a reduced price. Keep reading for more information, or skip ahead to our Quote Calculator for volume pricing and purchase links.

For more information on how the LightBurn license works, see our License Info page.

To get started, download our software here and start an unrestricted 30 day free trial.

For more information on purchasing additional seats and a calculator to determine license costs, keep reading.

3.4.1 Volume Licensing

By default, when activating a LightBurn license, the software will be activated for the user account and computer it's activated on, meaning that separate user accounts on the same computer would need to activate a LightBurn license independently.

LightBurn offers two advanced licensing setup options — *System Locked* and *Floating* licenses — to accommodate installation in shared spaces such as school computer labs.

System Locked Licenses

A *System Locked* license is locked to the computer it's activated on, allowing all users on the same computer to use the same license without sharing login info.

Floating Licenses

A *Floating* license is managed by our license server, allowing the license to be allocated when a LightBurn session is started and released when the session is closed. With Floating licenses, you pay for the number of licenses that will be used at the same time, rather than the number of computers LightBurn will be installed on.

- This is intended for environments such as schools, where LightBurn might be installed on a large number of computers, but only used by a class of 30 at any given time.
- Your key must be specially tagged as a Floating license to use this setup option.
- Floating licenses have a 10 seat minimum and require constant internet connection.
- Floating licenses *must* be installed according to our directions.

See our Quote Calculator below for pricing and purchasing links for both standard and floating licenses.

For setup information, please see System Locked License Setup or Floating License Setup.

3.4.2 Quote Calculator

License Type: (•) Core ( ) Pro

Seats Quantity: 10 ✓ **Calculate**

license

3.5 System Locked and Floating License Setup

System Locked and *Floating* licenses are advanced licensing setup options, often required for installations of LightBurn in shared spaces such as school computer labs.

A System Locked license is locked to the computer it is activated on, allowing all users on the same computer to use the same license without sharing login info. Any LightBurn key can be set up as System Locked.

A Floating license is managed by our license server, allowing the license to be allocated when a LightBurn session is started and released when the session is closed. This is intended for environments such as school computer labs where a greater number of computers will need to be activated than instances of LightBurn will be used at once. Your key must be specially tagged as a Floating type in order to utilize this setup option.

See our Educational and Volume Licensing calculator or contact us via email if you would like to learn more about volume licensing options.

3.5.1 System Locked License Setup

Windows

1. Make sure LightBurn is installed and activated as normal, then close out of the program, or the rest of the process will not work.
2. Open up a **Command Prompt** window:
   a. Click the **Start** menu, then type "CMD".
   b. Windows will automatically find the **Command Prompt** app as the best match. Right-click it and select **Run as administrator**.
3. Type the following into the command prompt and press `Enter ⏎`:

```
cd "C:\Program Files\LightBurn"
```

4. Next, type the following into the command prompt, replacing *YOUR_LICENSE_KEY* with your actual license key, and press `Enter ⏎`:

```
LightBurn -l YOUR_LICENSE_KEY
```

> **Note**
>
> Enter a lowercase *letter L*, and *not* the number 1.

Mac

1. Make sure LightBurn is installed and activated as normal, then close out of the program, or the rest of the process will not work.
2. Open up a **Terminal** window.
   a. Press `⌘ Cmd` + `Space` then type "Terminal".
   b. Click Terminal to open it.
3. Type the following into the Terminal window and press `Enter ⏎`.

```
cd /Applications/LightBurn.app/Contents/MacOS
```

4. Next, type the following into the Terminal window, replacing *YOUR_LICENSE_KEY* with your actual license key, and press `Enter ⏎`:

```
sudo ./LightBurn -l YOUR_LICENSE_KEY
```

> **Note**
>
> Enter a lowercase *letter L*, and *not* the number 1.

Once you've completed this process, all users on the same computer will be able to use LightBurn without activating the key individually.

3.5.2 Floating License Setup

Activation

In order to set up a Floating license, first follow the above instructions on setting up a System Locked license.

> **Tip**
>
> Once you've run the command line process successfully on one system, you can copy the "lightburn.ldata" file from the LightBurn program folder on that system to the same location on other systems you want to use the license, so you can avoid having to type the command line on the rest.

Network Restrictions

LightBurn will need to maintain a constant connection with the external license server to verify licenses. If you are experiencing difficulties with a license not being verified, your network may be restricting LightBurn's access.

To ensure LightBurn can contact the license server, *whitelist* **api.cryptlex.com** for port **443**.

It is also possible to configure LightBurn to access the network through a proxy. You can append the proxy connection address using -p ProxyString.

The proxy format is:

```
[protocol://][username:password@]machine[:port]
```

Examples of valid proxy strings:

```
http://127.0.0.1:8000/
http://user:pass@127.0.0.1:8000/
socks5://127.0.0.1:8000/
```

3.5.3 Troubleshooting

The most common error we see in this process is running the commands without administrator permissions. If you just run it in user mode, it doesn't have permission to create a file in the Program Files folder.

- Open the Command Prompt in administrator mode by right-clicking on the Start Menu entry and selecting **Run as administrator** when opening it.
- On macOS, make sure to include **sudo** when entering the command to activate the key and enter your password correctly.

The second most common error we see is entering the license key or command prompt entries incorrectly. Our instructions show the command line like this:

```
LightBurn -l YOUR_LICENSE_KEY
```

That is "LightBurn", followed by a minus sign and a lower-case letter L, a space, then your license key (without the parentheses around it).

Here is an example entry using a fake key:

```
LightBurn -l ABCDEF-123456-789012-FDBEA1-2G675A
```

This page contains answers to common questions we receive from corporate or educational IT departments prior to purchasing. If your question is not answered here, please email support for further assistance.

Is LightBurn a cloud service? Does it require an internet connection?

LightBurn is a software package that runs entirely on the local computer. An internet connection is not required, except to activate a free trial.

Does LightBurn utilize an internet connection in any way?

If available, LightBurn utilizes an internet connection for two purposes:

- License activation and deactivation. If this is not an option, you can complete an offline activation instead.
- Checking for updates to the software and built-in links. This check takes place once a day when the software is opened, and accesses LightBurn's servers as well as a publicly accessible GitHub repository.

LightBurn does not connect to the internet for any other purposes.

How does LightBurn use, collect, and share personal information?

At present, we do not collect or process personal information considered to be "Sensitive Information", "Sensitive Personal Information", or "special category data" in connection with our services.

For customers who license our software or make other purchases, we collect the following information:

- Name and contact information, including company affiliation.
- Order information.
- Payment information, including credit card account or bank account and routing information.

We use this information for the following purposes:

- To process payments and generate license keys.
- Service analysis, security, and administration.

Information is collected directly from the individual, and may be shared with our payment processor, our license key processor, and our sales tax remittance processor. It may also be shared with the following:

- **Processors/service providers:** We share your personal information with third parties that provide services to us. We engage these kinds of third parties with contracts that require them to use your personal information only for the purpose of delivering the services for which we have engaged the third party and as required by law. These kinds of third parties provide website hosting, business, professional, administrative, or technical support functions for us, such as payment processing, billing, data storage, quality assurance, and marketing.
- **Legal compliance recipients:** We disclose personal information to the courts, the government, law enforcement agencies, litigants, and similar recipients when required by law.
- **Successors:** We may disclose personal information associated with a part of our business to a buyer, potential buyer, or other successor to our business.

Where do you store data?

Your personal information will be stored and processed in the United States, where our servers are located. If we transfer personal information to the United States from another jurisdiction, we will do so in a way that complies with applicable legal requirements.

Does LightBurn back up the software configuration?

Yes, LightBurn's preferences are automatically backed up regularly. All backups are saved to the local computer. Read more in our documentation.

Does LightBurn provide regular alerts for software updates?

Yes. If an internet connection is available, LightBurn checks for updates on a daily basis and will notify users of an update when available.

Where can I access more detailed information on privacy and security?

- LightBurn's Privacy Policy
- LightBurn's End User License Agreement (EULA)
- For legal documents such as W9s, please email support

3.7 LightBurn End User License Agreement

Version September 2024

This End User License Agreement (**"EULA"**) is between you or the LightBurn approved entity on whose behalf you accept this EULA (**"you"** or **"your"**) and LightBurn Software LLC (**"LightBurn," "our"** or **"we"**) and applies to your access and use of the version of the LightBurn software made available to you (**"LightBurn Software"**), the unique serial number license key(s) we or our authorized reseller(s) provide to you in connection with such version (each a **"LightBurn Key"**) and our documentation or user manuals covering the use of the LightBurn Software and LightBurn Key(s), (the **"Documentation"**). We provide an end user license agreement with each version of our LightBurn Software that we make available. Such end user license agreement covers that version only. If you download or otherwise access multiple versions of our LightBurn Software, you may be presented with multiple end user license agreements. You must agree to each end user license agreement to use that version of the LightBurn Software and associated LightBurn Key and Documentation. This EULA covers the version of the LightBurn Software which is downloadable or otherwise made available with this EULA (including if delivered via an email or other link to you) and associated LightBurn Key and Documentation (for this EULA, the **"LightBurn Software Materials"**).

LIGHTBURN IS WILLING TO LICENSE THE LIGHTBURN SOFTWARE MATERIALS TO YOU ONLY ON THE CONDITION THAT YOU ACCEPT ALL OF THE TERMS IN THIS EULA. YOU ACCEPT AND AGREE TO BE BOUND BY THE TERMS OF THIS EULA BY DOWNLOADING, INSTALLING OR OTHERWISE USING THE LIGHTBURN SOFTWARE MATERIALS OR OTHERWISE ACCEPTING THIS EULA. IF YOU ACCEPT THIS EULA ON BEHALF OF ANOTHER PERSON, COMPANY, OR OTHER LEGAL ENTITY, YOU REPRESENT AND WARRANT THAT (A) YOU HAVE FULL AUTHORITY TO BIND THAT PERSON, COMPANY OR LEGAL ENTITY TO THIS EULA, (B) YOU HAVE PROVIDED TO LIGHTBURN THE NAME OF SUCH PERSON, COMPANY, OR LEGAL ENTITY THAT WILL BE USING THE LIGHTBURN SOFTWARE MATERIALS, AND (C) UPON RECEIPT OF SUCH NAME, LIGHTBURN HAS NOT DENIED YOU ACCESS TO THE LIGHTBURN SOFTWARE MATERIALS. YOU REPRESENT THAT YOU ARE OF SUFFICIENT LEGAL AGE IN YOUR JURISDICTION OR RESIDENCE TO USE OR ACCESS THE LIGHTBURN SOFTWARE MATERIALS AND TO ENTER INTO THIS EULA. IF YOU DO NOT AGREE TO THIS EULA, YOU SHOULD CEASE ACCESSING OR USING THE LIGHTBURN SOFTWARE MATERIALS, AND, WHERE APPLICABLE, CLICK THE "I DO NOT AGREE" BUTTON BELOW.

This EULA incorporates by reference: (a) our Privacy Policy which can be found at https://lbrn.info/privacy (the **"Privacy Policy"**), which provides details about our privacy practices and information about our processing of personal information. You acknowledge you have reviewed the Privacy Policy and consent to the processing of your personal information as described in it. If there is a conflict between the main body of this EULA and the Privacy Policy with respect to use and disclosure of your personal information, the terms of the Privacy Policy control; and (b) all terms in other uniform resource locators (URLs) herein, as such terms are modified by us from time to time.

We may change this EULA, the Privacy Policy or other terms in URLs at any time. By continuing to access or use the LightBurn Software Materials you agree to be bound by the most recent version of such terms. If we materially change any such terms, we will let you know by placing a notice within the tool or through other reasonable methods.

The disclaimers, exclusions, and limitations of liability under this EULA will not apply to the extent prohibited by applicable law. Some jurisdictions do not allow the exclusion of implied warranties or the exclusion or limitation of incidental or consequential damages or other rights, so those provisions of this EULA may not apply to you.

3.7.1 1. License

The LightBurn Software Materials are licensed not sold to you.

1.1. Permitted Use

We offer design-only licenses and commercial licenses. Each type of license has different use rights. You are permitted to use the LightBurn Software Materials under the applicable license you purchase only as follows (each a **"Permitted Use"**): (a) with any of the compatible computer and laser and laser-cutting devices listed in the following link, which may be broken out by tier: https://lbrn.info/lasers (each a **"Device"**); (b) if you purchase a LightBurn Key for a design-only license or a commercial license, you may create laser and laser-cutting designs which designs may only be implemented on Device(s) under a commercial license; © if you purchase a LightBurn Key for a commercial license, you may implement laser and laser-cutting designs through use of the LightBurn Software with laser and laser-cutting Device(s); and (d) in compliance with the Documentation, this EULA, and all applicable laws and standards of care. A design-only license does not permit you to implement laser and laser-cutting designs through use of the LightBurn Software with laser and laser-cutting Device(s).

1.2. Permitted Users

You are permitted to allow access to and use of the LightBurn Software Materials under the applicable license you purchase only as follows (each a **"Permitted User"**): (a) if the LightBurn Software Materials are being used in a household setting, by you or any members of your immediate household (e.g. your spouse, partner); (b) if the LightBurn Software Materials are being used in an educational institution, by you or your students, or any other professionals in such educational institution; or © if the LightBurn Software Materials are being used in a maker's space or other business, by any individuals using the maker's space or employed, or under contract, at the business. Your access to and use of the LightBurn Software Materials in connection with the uses in subsections (b) and © are subject to you providing the name of the company or legal entity with which you are affiliated. You are responsible for all access to and use of the LightBurn Software Materials, including ensuring that all Permitted Users that access or use the LightBurn Software Materials understand and comply with this EULA.

1.3. Types of Licenses

You may purchase (including for no fee) a trial license to the LightBurn Software or purchase (for a fee) a LightBurn Key for a regular license to the LightBurn Software, with either license being design-only or commercial. Trial licenses are provided on an AS IS basis for thirty (30) days from when you download the LightBurn Software. A trial license does not require a LightBurn Key. To convert to a regular license from a trial license you must purchase a LightBurn Key, and, when you do so and implement such LightBurn Key, your license will automatically convert to the applicable license under Section 1.5. At the end of the trial period, if you have not purchased a LightBurn Key to convert to a regular license and implemented it, your license to the LightBurn Software Materials and this EULA will automatically terminate.

1.4. LightBurn Keys

Except for trial use, you cannot access or use the LightBurn Software without a LightBurn Key. Each LightBurn Key permits the type of license you purchase (design-only or commercial), and will be registered against the email address you provide when you make your purchase (if you purchase through reseller(s), we may not receive your email address till later). You are responsible for the LightBurn Keys you receive and any replacement LightBurn Keys will be handled on a case-by-case basis. The determination whether to replace or reissue LightBurn Keys is in our sole discretion. Please contact us at support@lightburnsoftware.com to seek replacement or reissuance of LightBurn Keys or to add or change the email address associated with your purchases. Each LightBurn Key initially allows you to install the licensed LightBurn Software on three (3) separate Devices (each separate activation is an **“Activation”**). You may de-install from a Device and install on a different Device without using more than one Activation. You may purchase additional Activations under your LightBurn Key. Such purchased additional Activations are also subject to this EULA (and the licenses and restrictions on use herein). You may allow any Permitted User to install the licensed LightBurn Software on a compatible Device up to the aggregate number of purchased Activations. Except in connection with the transfer of the license in accordance with Section 1.6 below, the resale of Activations or LightBurn Keys is prohibited unless you have an authorized reseller agreement with us.

1.5. License

Subject to the terms of this EULA, we grant you, during the term of this EULA, a limited, non-exclusive, non-sublicensable (except use by the applicable Permitted Users is permitted), revocable limited license to (a) download, install and use the LightBurn Software and LightBurn Keys, and (b) use and make copies (so long as all copies have our proprietary notices on them) of the Documentation in connection with your authorized use of the LightBurn Software and LightBurn Keys, in each case for the Permitted Use by the Permitted Users.

1.6. Transferability

Your license is transferable only if you sell, assign or otherwise transfer the Device on which the LightBurn Software is loaded and subject to the following: (a) you must transfer all LightBurn Software Materials and all Activations to the same transferee with the Device being transferred, in other words you cannot split up Activations between transferees; and (b) you must provide this EULA to the transferee, and the transferee is deemed to have agreed to this EULA by accessing or using any of the LightBurn Software Materials. If you do not comply with the foregoing, we may consider the transfer void.

1.7. Safety Warning

We do not manufacture Devices and so we do not control their safety features. The LightBurn Software Materials are intended for use with laser and laser-cutting Device(s). Such Devices are inherently dangerous. Use of incompatible Device(s) or third party accessories may impact the LightBurn Software's performance. Please read all safety instructions for any Device(s) before and when using the LightBurn Software Materials with them. When utilizing the LightBurn Software Materials, you must ensure that Device(s) are not directed to perform functions that may cause injury or property damage, such as, without limitation, by directing a laser to perform functions that could ignite flammable materials, by having untrained people use the laser or laser-cutting Device(s), or by leaving laser or laser-cutting Device(s) unattended or switched on when not in use. You acknowledge that the primary role of the LightBurn Software Materials in laser or laser-cutting Device(s) is to control the motion of the laser head of a compatible Device(s), and not to control the safety features, if any, integrated into the Device(s). Safety features like thermal shutdown, fire detection, and other critical features are typically hardware-level protections built into the Device(s) and are beyond the control of the LightBurn Software Materials. We disclaim all liability arising from any Device(s).

1.8. Your Obligations

You acknowledge and agree that you will comply with the manufacturer terms applicable to the Device(s) used in connection with the LightBurn Software Materials. You, and not LightBurn, are responsible for the safety and security of your use of any Device(s). You will indemnify and hold us harmless from any and all claims, losses, liabilities, damages, fines, penalties, costs and expenses (including attorney's fees) arising from or relating to your use or misuse of the LightBurn Software Materials or Device(s).

1.9. Restrictions

We reserve all rights not granted to you. Except as expressly provided herein, you agree not to, and you will not permit others to: (a) license, sublicense, sell, resell, market, rent, lease, assign, transfer, distribute, transmit, host, outsource, display, perform, disclose or otherwise commercially exploit the LightBurn Software Materials or make the LightBurn Software Materials available to any third party; (b) copy or use the LightBurn Software Materials for any purpose; © remove or alter any trademark, logo, copyright or other proprietary notices, legends, symbols or labels in the LightBurn Software Materials; (d) modify, make derivative works of, disassemble, reverse compile or reverse engineer any part of the LightBurn Software Materials (except to the extent applicable laws specifically prohibit such restriction for interoperability purposes, in which case you agree to first contact LightBurn and provide LightBurn an opportunity to create such changes as are needed for interoperability purposes); (e) attempt to access or derive the source code of the LightBurn Software Materials; or (f) use the LightBurn Software Materials except for the applicable Permitted Use by the applicable Permitted User.

1.10. Third Party Components

Elements of the Software may contain or be derived from materials from third parties (**“Third Party Software”**). Such Third Party Software may be subject to additional terms, which terms are set forth here: https://lbrn.info/thirdparty. You and the Permitted Users are responsible for regularly reviewing such terms to determine the status of, and for complying with, all such applicable Third Party Software terms and conditions. Your use of the LightBurn Software is contingent on compliance with these additional terms of license (however such rights do not expand the Permitted Use and license grants herein). Subject to the observance of the respective Third Party Software terms (as may be amended from time to time), you and the Permitted Users are authorized to use Third Party Software within the Permitted Use of the LightBurn Software only.

3.7.2 2. Updates

We may from time to time provide patches, bug fixes, updates, upgrades and other modifications to improve the performance of the LightBurn Software. You will be entitled to receive such updates free of charge for twelve (12) months from the date you purchase a LightBurn Key for a version of the LightBurn Software you license from us or our authorized resellers (which updates are also licensed under and subject to the terms of this EULA). You must purchase a new LightBurn Key for updates issued after such 12-month period. We will track such dates for you. Such updates will be licensed under a separate end user license agreement covering such LightBurn Software Materials and this EULA does not apply to such updates.

3.7.3 3. Ownership

The LightBurn Software Materials and all worldwide copyrights, trade secrets, and other intellectual property rights therein are the exclusive property of LightBurn and its licensors. There are no implied licenses in this EULA. All suggestions or feedback provided by you to LightBurn with respect to the LightBurn Software Materials (**“Feedback”**) will be our property. We, or our sublicensees or assignees may use, copy, modify, publish, redistribute or otherwise exploit the Feedback for any purpose and in any way without any compensation to you. LightBurn does not waive any rights to use similar or related ideas previously known to us, developed by our employees, or obtained from other sources.

3.7.4 4. Term and Termination

The trial license has the term set forth in Section 1.3 unless earlier terminated as set forth herein. The regular license under Section 1.5 commences when you download the LightBurn Software if there is no trial license or, if there is a trial license, when that trial license converts to the regular license under Section 1.5, and continues for as long as you use the LightBurn Software Materials or the first 12 months' worth of updates to the LightBurn Software, unless this EULA is terminated as set forth in this EULA (as noted above, updates beyond the first 12 months require a separate end user license agreement for such LightBurn Software Materials). We may terminate this EULA and your license(s) at any time if you fail to comply with any term(s) of this EULA, with written notice to you. You may terminate this EULA and your license(s) at any time with written notice to us or by ceasing use of the LightBurn Software Materials and destroying all copies thereof (including when you license a new version of the LightBurn Software under separate end user license agreement from us). Upon termination of this EULA, your license(s) will terminate and you must stop all use of the LightBurn Software Materials and destroy all copies you and your Permitted Users have. The preamble and Sections 1.7, 1.8, 1.9, 1.10, 3, 4, 5, 6, 7, and 10 will remain in effect after any termination of this EULA.

3.7.5 5. Warranty Disclaimer

NOTWITHSTANDING ANYTHING TO THE CONTRARY AND TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, WE PROVIDE THE LIGHTBURN SOFTWARE MATERIALS ON AN "AS-IS" AND "WITH ALL FAULTS" BASIS. WE DISCLAIM ALL WARRANTIES AND CONDITIONS, WHETHER EXPRESS, IMPLIED, OR STATUTORY, INCLUDING THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE, QUIET ENJOYMENT, ACCURACY, AND NON-INFRINGEMENT OF THIRD-PARTY RIGHTS, AS WELL AS WARRANTIES ARISING UNDER COURSE OF PERFORMANCE, COURSE OF DEALING OR TRADE USAGE. WE DO NOT GUARANTEE ANY SPECIFIC RESULTS FROM THE USE OF THE LIGHTBURN SOFTWARE MATERIALS. WE MAKE NO WARRANTY THAT THE LIGHTBURN SOFTWARE MATERIALS WILL BE UNINTERRUPTED, FREE OF VIRUSES OR OTHER HARMFUL CODE, TIMELY, SECURE, OR ERROR-FREE. YOU USE THE LIGHTBURN SOFTWARE MATERIALS AND DEVICE(S) AT YOUR OWN DISCRETION AND RISK. YOU WILL BE SOLELY RESPONSIBLE FOR (AND WE DISCLAIM) ANY AND ALL LOSS, LIABILITY, OR DAMAGES RESULTING FROM YOUR USE OF THE LIGHTBURN SOFTWARE MATERIALS OR DEVICE(S). **THE IMPROPER USE OF THE LIGHTBURN SOFTWARE MATERIALS IN ANY DEVICE(S) MAY BE DANGEROUS OR PRESENT RISKS OF ELECTRIC SHOCK, DEVICE DAMAGE, FIRE, PROPERTY DAMAGE, PERSONAL INJURY, DEATH AND OTHER HAZARDS. YOU ARE RESPONSIBLE FOR ANY ELECTRIC SHOCK, DEVICE DAMAGE, FIRE, PROPERTY DAMAGE, PERSONAL INJURY, DEATH AND OTHER HAZARDS CAUSED BY USE OR MISUSE OF THE LIGHTBURN SOFTWARE MATERIALS OR DEVICE(S), INCLUDING FAILURE TO SWITCH OFF THE DEVICE(S) WHEN NOT IN USE, AND LEAVING THE DEVICE(S) UNATTENDED. WE DO NOT CONTROL THE DEVICE(S) AND HAVE NO RESPONSIBILITY FOR THE DEVICE(S).** SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION MAY NOT APPLY TO YOU.

3.7.6 6. Limitation of Liability

IN NO EVENT WILL LIGHTBURN OR ITS SHAREHOLDERS, AFFILIATES, CONTRACTORS, SUPPLIERS, LICENSORS, DIRECTORS, OFFICERS, EMPLOYEES AND AGENTS (**"LIGHTBURN PARTIES"**) BE LIABLE FOR ANY CONSEQUENTIAL, EXEMPLARY, SPECIAL, PUNITIVE, INDIRECT, INCIDENTAL, TREBLE OR OTHER SIMILAR DAMAGES, INCLUDING ANY DAMAGES FOR LOST DATA OR LOST PROFITS, PROPERTY DAMAGE, DEATH OR PERSONAL INJURY, ARISING FROM OR RELATING TO THIS EULA OR THE LIGHTBURN SOFTWARE MATERIALS OR THEIR USE, EVEN IF LIGHTBURN KNEW OR SHOULD HAVE KNOWN OF THE POSSIBILITY OF SUCH DAMAGES. LIGHTBURN'S TOTAL CUMULATIVE LIABILITY ARISING FROM OR RELATED TO THIS EULA OR THE LIGHTBURN SOFTWARE MATERIALS OR THEIR USE, WHETHER IN CONTRACT OR TORT OR OTHERWISE, WILL NOT EXCEED (a) FOR TRIAL LICENSES, ZERO DOLLARS, OR (b) FOR REGULAR LICENSES, THE RETAIL PRICE OF THE APPLICABLE REGULAR LIGHTBURN SOFTWARE LICENSE LISTED ON OUR WEBSITE ON THE DATE OF YOUR PURCHASE OF THE REGULAR LIGHTBURN SOFTWARE LICENSE, WHETHER SUCH LIGHTBURN SOFTWARE LICENSE IS PURCHASED ON OUR WEBSITE OR FROM ONE OF OUR AUTHORIZED RESELLER(S). THIS LIMITATION WILL NOT BE INCREASED BY THE EXISTENCE OF MORE THAN ONE END USER LICENSE AGREEMENT, INCIDENT OR CLAIM. NOTHING IN THIS EULA AND IN PARTICULAR WITHIN THIS "LIMITATION OF LIABILITY" CLAUSE WILL ATTEMPT TO EXCLUDE LIABILITY THAT CANNOT BE EXCLUDED UNDER APPLICABLE LAW. YOU HAVE NO CLAIM AGAINST ANY OF THE LIGHTBURN PARTIES OTHER THAN LIGHTBURN IN CONNECTION WITH THIS EULA.

3.7.7 7. Confidentiality

"Confidential Information" means the LightBurn Software Materials and all other confidential or proprietary information disclosed or made accessible to you by LightBurn, except for information which you can demonstrate is available to the public prior to disclosure to you or becomes available to the public by publication or otherwise without your fault. You will not use or disclose any Confidential Information except as expressly authorized by this EULA. You will protect all Confidential Information using the same degree of care which you use to protect your own confidential information, but in no event less than a reasonable degree of care. You will take prompt and appropriate action to prevent unauthorized use or disclosure of Confidential Information. If you are legally compelled to disclose any Confidential Information, you will provide LightBurn prompt written notice of such requirement so that an appropriate protective order or other relief may be sought. The breach, or threatened breach, of any provision of this Section, or the breach, or threatened breach, of license rights or restrictions or other violation, infringement, or misuse of LightBurn Software Materials or other Confidential Information may cause irreparable harm to LightBurn without an adequate remedy at law. Upon any such breach, violation, infringement, misuse, or threat thereof, LightBurn will be entitled to seek injunctive relief to prevent you from commencing or continuing any action constituting such breach, violation, infringement, misuse, or threat thereof, or other equitable relief, without having to post a bond or other security, and without having to prove the inadequacy of other available remedies. We may do so in any court of competent jurisdiction.

3.7.8 8. For U.S. Government End Users

The LightBurn Software Materials are a “commercial item,” as that term is defined at 48 C.F.R. 2.101 (OCT 1995), and more specifically are “commercial computer software” and “commercial computer software documentation,” as such terms are used in 48 C.F.R. 12.212 (SEPT 1995). Consistent with 48 C.F.R. 12.212 and 48 C.F.R. 227.7202-1 through 227.7202-4 (JUNE 1995). The LightBurn Software Materials are provided to U.S. Government End Users only as a commercial end item and with only those rights as are granted to all other customers pursuant to the terms and conditions herein.

3.7.9 9. Export Compliance

All use of the LightBurn Software Materials by you and your Permitted Users will be in accordance with (a) the Export Administration Act of 1979, as amended (50 U.S.C. app. 2401-2420), and the Export Administration Regulations, 15 C.F.R. Parts 730-774 (**“EAR”**); (b) the Arms Export Control Act, 22 U.S.C. § 2778, and the corresponding International Traffic in Arms Regulations; © the economic sanctions, laws and regulations enforced by the U.S. Department of the Treasury’s Office of Foreign Assets Control (**“OFAC”**), 31 C.F.R. Part 500 et seq., and the U.S. Department of State’s Office of Terrorist Financial and Economic Sanctions Policy; and (d) the anti-boycott regulations, guidelines, and reporting requirements under the EAR and Section 999 of the Internal Revenue Service Code (collectively, **“U.S. Sanctions and Export Control Laws”**). In particular, you agree that you and your Permitted Users are: (i) not located in, headquartered in, or incorporated under the laws of any country or territory subject to U.S. territorial economic sanctions or anti-terrorism restrictions under the EAR, including Belarus, Cuba, Iran, North Korea, Russia, Sudan, Syria, or the Crimea, Donetsk, or Luhansk regions of Ukraine (collectively **“Sanctioned Locations”**); and (ii) not a person identified on U.S. or other applicable government restricted party lists, including but not limited to the Specially Designated Nationals and Blocked Persons (**“SDN”**) List maintained by OFAC or the Entity List or Denied Persons List maintained by the U.S. Department of Commerce’s Bureau of Industry and Security (collectively, **“Restricted Parties”**), or owned or controlled by or acting on behalf of, any Restricted Party or any party located in, headquartered in or incorporated under the laws of any Sanctioned Locations. You and your Permitted Users will not use or divert the LightBurn Software Materials as follows: (A) to countries for which a specific export license is required; (B) to Restricted Parties or Sanctioned Locations; (C) for activities related to weapons proliferation, such as nuclear, chemical, or biological weapons or missile technology; (D) for end-uses in violation of the EAR relating to a military or military intelligence end-use or end-user, including for incorporation into any military item, for the use, development, or production of military items, for any activity that supports or contributes to the operation, installation, maintenance, repair, overhaul, refurbishing, development, or production of military items, or for use by a military end-user such as the national armed services (army, navy, marine, air force, or coast guard), the national guard and national police, government intelligence or reconnaissance organizations, or any person or entity whose actions or functions are intended to support military end uses in violation of the EAR; or (E) in a manner otherwise inconsistent with end-use and end-user restrictions imposed by the U.S. Sanctions and Export Control Laws implemented by 15 C.F.R. Part 744.

3.7.10 10. General

10.1. Language

The official version of this EULA is in English.

10.2. Waivers

All waivers by us will be effective only if in writing. Any waiver or failure by us to enforce any provision of this EULA on one occasion will not be deemed a waiver of any other provision or of such provision on any other occasion.

10.3. Severability

If any provision of this EULA is held by a court of competent jurisdiction to be illegal, invalid or unenforceable, that will not affect the legality, validity or enforceability of any other provision of this EULA. Any such unenforceable provision will be deemed to be amended to the minimum extent required to accomplish the objectives of such provision. If the illegality, invalidity or unenforceability cannot be cured by such amendment, the provision in question will be deemed to have never formed part of this EULA and all remaining provisions of this EULA will remain unchanged and will continue in full force and effect.

10.4. Governing Law; Venue

This EULA and any matters arising in connection with this EULA will be governed, interpreted, and construed in accordance with the laws of the State of Delaware, USA without regard to the principles of conflicts of laws. Any legal action or proceeding relating to this EULA and any matters arising in connection with this EULA will be instituted exclusively in a state or federal court in the State of Delaware, USA except for equitable relief by us under Section 7 (Confidential Information). Except as set forth in Section 7 (Confidential Information), the parties will submit to the exclusive jurisdiction of, and accept that venue is proper in, these courts in any such legal action or proceeding.

10.5. Assignment

Except as permitted in Section 1.6, neither the rights nor the obligations arising under this EULA are assignable by you except with the prior written consent of LightBurn, and any such attempted assignment will be void and without effect. This Agreement may be assigned, in whole or in part, by us. This EULA is binding on and inures to the benefit of any successors and permitted assigns.

10.6. Miscellaneous

The headings of sections of this EULA are for convenience and are not to be used in interpreting this EULA. This EULA will not be construed as creating a relationship of employment, agency, partnership, joint venture, or any other form of legal association. Neither party has any power to bind the other party or to assume or to create any obligation or responsibility on behalf of the other party. This EULA will not confer any rights or remedies upon any person other than the parties, and their respective successors and permitted assigns and the indemnified parties (with respect to indemnification). All notices and other communications required or permitted under this EULA will be in writing and will be deemed given (a) if to LightBurn, when delivered to 838 Walker Rd Suite 21-2, Dover, DE, 19904 or, (b) if to you, when delivered either by (i) courier service (including via First Class Mail with the United States Postal Service) to the mailing address on file with us, or (ii) e-mail to the e-mail address on file with us. This EULA constitutes the entire agreement between the parties with respect to its subject matter and as of the date of agreement by you supersedes all prior or contemporaneous agreements, negotiations, representations, and proposals, whether written or oral, relating to its subject matter. Except for modifications made by us to this EULA, Privacy Policy or other terms in URLs, no modification of this EULA by you will be effective unless in writing and signed by an authorized representative of LightBurn. The Uniform Computer Information Transactions Act and the United Nations Convention on Contracts for the International Sale of Goods will not apply to this EULA, or any business conducted pursuant to it, regardless of when and however adopted, enacted and amended under the laws of any jurisdiction. In this EULA where we use the words “including” or “include” it means including without limitation or includes without limitation, respectively, and the word “or” means and/or, unless the context dictates otherwise. The parties will execute and deliver any additional contracts, instruments or documents necessary to fully effectuate the terms of this EULA.

3.7.11 11. Variation of EULA Terms for Licensee Based in or Resident of The European Union.

11.1. Generally

This EULA will apply in respect of purchasers of the licenses to the LightBurn Software Materials who, at the time the license for the LightBurn Software Materials is purchased, (in the case of incorporated or unincorporated entities, businesses, institutions and organizations) are based, or (in the case of individuals acquiring the license for the LightBurn Software Materials in their personal capacity) have their main place of residence, in the European Union, subject to the variations set out below in this Section 11.

11.2. Preamble section

The 3rd and 4th paragraph in the preamble are replaced in their entirety with the following:

*This EULA incorporates by reference all terms in uniform resource locators (URLs) referred to herein. Such additional terms will apply as they may be modified by us from time to time, provided that no such modifications unreasonably limit or place unreasonable conditions on your right to use the LightBurn Software Materials in accordance with this EULA.

Our Privacy Policy which can be found at https://lbrn.info/privacy (the **“Privacy Policy”**) provides details about our privacy practices and information about our processing of personal information. You acknowledge you have been given access to a copy of the Privacy Policy.

We may change this EULA, the Privacy Policy or other terms in URLs at any time. Any such changes will apply to you in relation to copies of the LightBurn Software Materials to which you already purchased a license before the date of such change only insofar as the change does not unreasonably limit or place unreasonable conditions on your right to use the LightBurn Software Materials in accordance with the terms of this EULA at the time of purchase. All future changes to this EULA, the Privacy Policy or other terms in URLs will apply to you in relation to copies of the LightBurn Software Materials purchased after the date of the change.*

11.3. Section 1.6

Section 1.6 is replaced in its entirety with the following:

Transferability. Where you purchase a perpetual license for the LightBurn Software and the license fees are paid in full in advance, you may transfer the license (on the terms of this EULA) to another person (a “transferee”) provided that: (a) you must transfer possession of all copies of the LightBurn Software Materials and all Activations to a single transferee and must not retain any copies of LightBurn Software Materials (including any back-up copy of the LightBurn Software or any copy installed on a Device) in your possession or control; (b) you must transfer all of the rights that you purchased in connection with the copy of the LightBurn Software Materials, including all Activations, to a single transferee; accordingly, user rights under this EULA including the Activations purchased with the license (including where you purchase a license for use by multiple users) cannot be split between you and a transferee or amongst several transferees; © the transferee will not have the benefit of and will not be entitled to receive from us any maintenance or support services, software updates, warranty services or any other services that you may be entitled to receive from us (including updates or other services you are entitled to receive from us under Section 2 or any other contract and including any warranties or product guarantees that you may purchase or receive in connection with the LightBurn Software Materials) and you may not transfer your right to receive such services to any transferee; and (d) you must provide this EULA to the transferee, and the transferee will be deemed to have agreed to this EULA by accessing or using any of the LightBurn Software Materials. Except as aforesaid, your license is transferable only if you sell, assign or otherwise transfer the Device on which the LightBurn Software is loaded and subject to the following: (i) you must transfer all LightBurn Software Materials and all Activations to the same transferee with the Device being transferred, in other words you cannot split up Activations between transferees; and (ii) you must provide this EULA to the transferee, and the transferee is deemed to have agreed to this EULA by accessing or using any of the LightBurn Software Materials. If you do not comply with the foregoing, we may consider the transfer void.

11.4. Section 1.7

The last sentence of Section 1.7 is replaced with the following:

Subject only to the last sentence of Section 6 below, we disclaim all liability arising from any Device(s).

11.5. Section 1.8

The following sentence is added at the end of Section 1.8:

The foregoing is subject to and will not derogate from the last sentence of Section 6 below.

11.6. Section 1.9

The opening words in the second sentence in Section 1.9 are replaced with the following:

Except as expressly provided herein, or as may be permitted under Articles 5(2), 5(3) or 6 of Directive 2009/24/EC of the European Parliament and the Council on the legal protection of computer programs, or under any national legislation implementing such provisions in the European Union member state in which you are based or where you are resident (as such legislation may be varied or re-enacted from time to time), you agree not to, and you will not permit others to: […].

[The remaining provisions of Section 1.9 in sub-sections (a) to (f) are unchanged]

11.7. Section 6

The following sentence is added at the end of Section 6:

Anything to the contrary herein notwithstanding, nothing in this EULA or in any terms incorporated by reference into this EULA will exclude or limit our liability: (i) for death or personal injury caused by our negligence; (ii) for our fraud or fraudulent misrepresentation; or (iii) for any matter for which it would be illegal for us to exclude or attempt to exclude our liability.

11.8. Section 10.1.

Section 10.1 is replaced in its entirety with the following:

Language. The official version of this EULA is in English, except where you are purchasing a license to the LightBurn Software Materials as an individual consumer, in which case, if a version of this EULA is provided to you in one of the official languages of the country where you have your main place of residence, that language version will be the official version of this EULA.

11.9. Section 10.4

The following sentence is added at the end of Section 10.4:

The foregoing notwithstanding, if you are an individual and you purchase the license for the LightBurn Software Materials as a consumer, outside your trade or profession, you have the right to bring proceedings against us in the courts of the country where you are domiciled (or, at your choice, if we have a domicile in a member state of the European Union, in the courts of that country, or in a state or federal court in the State of Delaware, USA) and we may only bring proceedings against you in the court of the country where you are domiciled. The European Commission provides a platform, which makes possible online settlement of disputes between consumers and merchants (ODR platform). The ODR platform can be reached in the following link: https://ec.europa.eu/consumers/odr. LightBurn is neither obliged nor prepared to participate in dispute settlement proceedings before consumer arbitration boards.

3.7.12 12. Variation of EULA Terms for Licensee Based in or Residents of The United Kingdom.

12.1. General

This EULA will apply in respect of purchasers of the licenses to the LightBurn Software Materials who, at the time the license for the LightBurn Software Materials is purchased, (in the case of incorporated or unincorporated entities, businesses, institutions and organizations) are based, or (in the case of individuals acquiring the license for the LightBurn Software Materials in their personal capacity) have their main place of residence, in the United Kingdom, subject to the variations set out in this Section 12.

12.2. Preamble Section

*The 3rd and 4th paragraph in the preamble are replaced in their entirety with the following:

This EULA incorporates by reference all terms in uniform resource locators (URLs) referred to herein. Such additional terms will apply as they may be modified by us from time to time, provided that no such modifications unreasonably limit or place unreasonable conditions on your right to use the LightBurn Software Materials in accordance with this EULA.

Our Privacy Policy which can be found at https://lbrn.info/privacy (the **“Privacy Policy”**) provides details about our privacy practices and information about our processing of personal information. You acknowledge you have been given access to a copy of the Privacy Policy.

We may change this EULA, the Privacy Policy or other terms in URLs at any time. Any such changes will apply to you in relation to copies of the LightBurn Software Materials to which you already purchased a license before the date of such change only insofar as the change does not unreasonably limit or place unreasonable conditions on your right to use the LightBurn Software Materials in accordance with the terms of this EULA at the time of purchase. All future changes to this EULA, the Privacy Policy or other terms in URLs will apply to you in relation to copies of the LightBurn Software Materials purchased after the date of the change.*

12.3. Section 1.6

Section 1.6 is replaced in its entirety with the following:

Transferability. Where you purchase a perpetual license for the LightBurn Software Materials and the license fees are paid in full in advance, you may transfer the license (on the terms of this EULA) to another person (a "transferee") provided that: (a) you must transfer possession of all copies of the LightBurn Software Materials and all Activations to a single transferee and must not retain any copies of LightBurn Software Materials (including any back-up copy of the LightBurn Software or any copy installed on a Device) in your possession or control; (b) you must transfer all of the rights that you purchased in connection with the copy of the LightBurn Software Materials, including all Activations, to a single transferee; accordingly, user rights under this EULA including the Activations purchased with the license (including where you purchase a license for use by multiple users) cannot be split between you and a transferee or amongst several transferees; © the transferee will not have the benefit of and will not be entitled to receive from us any maintenance or support services, software updates, warranty services or any other services that you may be entitled to receive from us (including updates or other services you are entitled to receive from us under Section 2 or any other contract and including any warranties or product guarantees that you may purchase or receive in connection with the LightBurn Software) and you may not transfer your right to receive such services to any transferee; and (d) you must provide this EULA to the transferee, and the transferee will be deemed to have agreed to this EULA by accessing or using any of the LightBurn Software Materials. Except as aforesaid, your license is transferable only if you sell, assign or otherwise transfer the Device on which the LightBurn Software is loaded and subject to the following: (i) you must transfer all LightBurn Software Materials and all Activations to the same transferee with the Device being transferred, in other words you cannot split up Activations between transferees; and (ii) you must provide this EULA to the transferee, and the transferee is deemed to have agreed to this EULA by accessing or using any of the LightBurn Software Materials. If you do not comply with the foregoing, we may consider the transfer void.

12.4. Section 1.7

The last sentence of Section 1.7 is replaced with the following:

Subject only to the last sentence of Section 6 below, we disclaim all liability arising from any Device(s).

12.5. Section 1.8

The following sentence is added at the end of Section 1.8:

The foregoing is subject to and will not derogate from the last sentence of Section 6 below.

12.6. Section 1.9

The opening words in the second sentence in Section 1.9 are replaced with the following:

Except as expressly provided herein, or as may be permitted under sections 50A, 50B, 50BA and 296A of the Copyright, Designs and Patents Act 1988 (as such legislation may be varied or re-enacted from time to time), you agree not to, and you will not permit others to: […].

[The remaining provisions of Section 1.9 in sub-sections (a) to (f) are unchanged]

12.7. Section 6

The following sentence is added at the end of Section 6:

Anything to the contrary herein notwithstanding, nothing in this EULA or in any terms incorporated by reference into this EULA will exclude or limit our liability: (i) for death or personal injury caused by our negligence; (ii) for our fraud or fraudulent misrepresentation; or (iii) for any matter which it would be illegal for us to exclude or attempt to exclude our liability.

12.8. Section 10.4

The following sentence is added at the end of Section 10.4:

The foregoing notwithstanding, if you are an individual and you purchase the license for the LightBurn Software as a consumer outside your trade or profession, you have the right to bring proceedings against us in the courts of the part of the United Kingdom where you are domiciled (or, at your choice, if we have a domicile in any part of the United Kingdom, in the courts of that part of the United Kingdom, or in a state or federal court in the State of Delaware, USA) and we may only bring proceedings against you in the courts of the part of the United Kingdom where you are domiciled.

4 Get Started

get-started

Welcome! If you're here, it probably means you're new to LightBurn or the wider world of laser cutting and engraving. If you're not sure where to begin, you're not alone — there's a lot to take in.

We've created this guide to get you going with the essential concepts you need to know in order to use LightBurn and your laser.

We'll cover:

- Identifying your type of laser
- Installing LightBurn
- Creating a device profile
- Connecting to your laser
- Getting to know the LightBurn interface
- Creating and importing artwork
- Assigning colors/layers to artwork, and different layer modes
- Establishing cut or engrave settings
- Previewing the result of your settings
- Determining where your project will output in your laser's work area
- Commanding your laser to Frame the area your project will output
- Telling your laser to start a job

We'll finish up with a step-by-step first project that puts the concepts we covered into action.

Info

Laser cutting and engraving performance, quality, and speed is highly machine and user dependent. Beginners should familiarize themselves with the user guide provided by their laser's manufacturer prior to using it.

At the bottom of each page you'll see a button to direct you to the next step in the process, or return you to the previous page if you need a refresher. You can also jump ahead, or back, using the navigation to the left, but we don't recommend skipping steps unless you're really sure you have a concept down.

Ready? Click below to get started!

Next: Identify Your Laser →

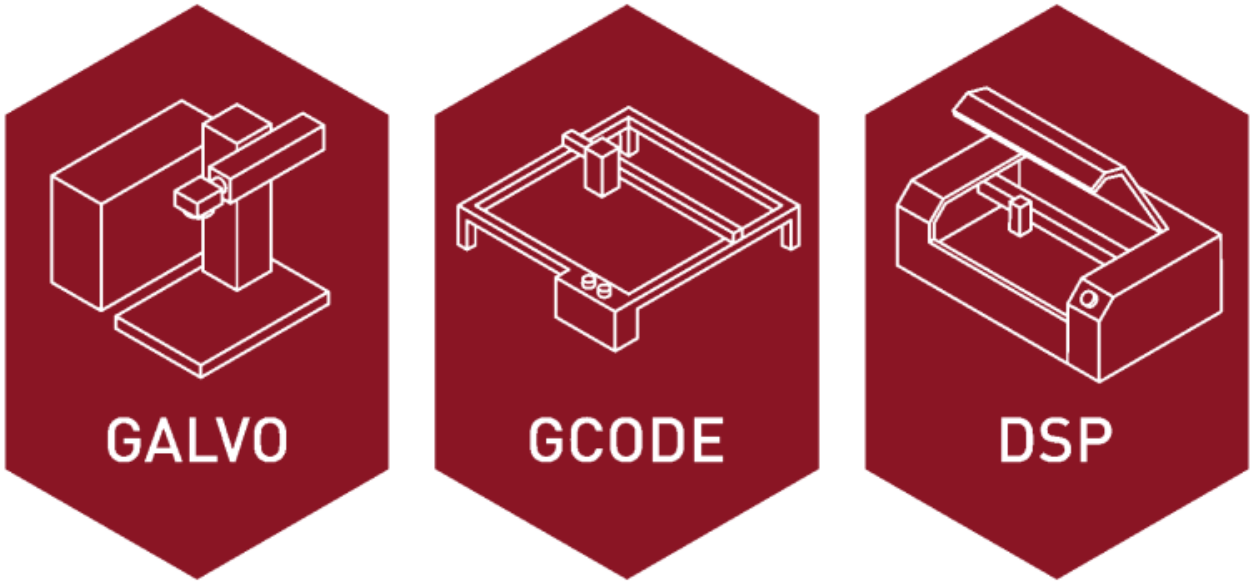
hardware get-started laser-general

4.2 Identifying Your Laser

You'll need to know what type of laser you're using in order to know which LightBurn license you need, and to follow along with some of the terminology used throughout our documentation.

Your laser type also affects what your laser is capable of, what the LightBurn UI looks like, and how you interact with your laser.

While there are many attributes that distinguish the different types of lasers, you'll see us refer most often to three general categories. Each category is depicted by an example of a typical model below:



To get started with LightBurn, you'll need to know two things about your laser:

- What **controller** does your laser use?
- What **motion system** does your laser use?

4.2.1 Controllers and Firmware

The controller — and the firmware it runs — determines whether or not a machine is compatible with LightBurn, and what type of license you need.

A controller is essentially a computer within your laser, and the firmware it runs determines the type of instructions it can translate into signals it delivers to the motion system.

LightBurn needs to know what type of firmware your laser's controller is running to know what "language" to speak to the machine. In most cases, LightBurn can automatically identify the firmware if you set up your machine using Find My Laser, but you'll need to be able to identify the controller yourself in order to complete a manual setup.

LightBurn is currently compatible with three main categories of controllers: GCode, DSP, and Galvo.

- To connect to a GCode-based laser, you'll need a LightBurn Core license.
- To connect to a DSP or Galvo laser, you'll need a LightBurn Pro license. LightBurn Pro licenses *also support GCode-based lasers*.

Below is a brief description of each type, as well as a list of common controllers/firmware used by each. If you're not sure what controller or firmware your laser uses, consult your machine's manufacturer, or contact us at support@lightburnsoftware.com.

GCode

Most entry-level diode lasers use GCode-based controllers.

Supported controllers/firmware: GRBL, Smoothieware, Marlin, FluidNC, grblHAL, xTool

DSP

DSP controllers are common in more industrial-grade machines. If your machine is a CO2 laser in a metal case and has an LCD display, it is most likely a DSP model.

Supported controllers: Ruida, Trocen, TopWisdom

Galvo

Galvo lasers use a fixed scanning head mounted to an arm, and project the beam from above. If your laser uses EZCAD2 or SeaCAD as its default software, it is this type of laser.

Supported controllers: EZCAD2, EZCAD2 Lite, BSL

4.2.2 Motion System

The motion system consists of the mechanical components that direct the beam from the laser source to the material. These include parts such as motors, mirrors, lenses, and axes.

The choice of motion system determines which LightBurn tools are available for your machine, as well as the maximum job size, and the speed of the laser.

> **Note**
>
> Many tools in LightBurn are only available for machines with a particular type of motion system.

There are two common forms of motion systems:

- **Gantry motion systems** have frames, wheels, and motors that move a laser head around a work area. Some Gantry lasers use a system of mirrors to reflect a beam from its source, while others hold the laser source and move it around directly. Gantry systems are relatively slow due to the mass of the components moving around, but can have very large working areas.
- **Galvo motion systems** use tiny moving mirrors to bounce the beam to different locations on a large lense, which focuses the beam and points it back down at the work. Because the mirrors are so lightweight, they can bounce the light around at very high speeds, but Galvos are limited by the size of the lense to relatively small jobs.

> **Note**
>
> All Gantry lasers supported by LightBurn have GCode-based or DSP controllers.
>
> *Almost* all Galvo lasers supported by LightBurn use EZCAD2 or BSL controllers and require a LightBurn Pro license. However, there are a limited number of GCode-based Galvo lasers that are compatible with LightBurn Core, and require special setup — consult your laser's manufacturer for more information.

4.2.3 Additional Information

Knowing your laser's controller/firmware and motion system is enough to get you started, but there's a lot more to know about laser cutting and engraving. For additional information on the ins-and-outs of different types of lasers and accessories, see Laser Types.

← Previous: Getting Started

Next: Install LightBurn →

get-started help-and-software-questions

4.3 Installing LightBurn

The first step to using LightBurn is downloading it and getting it installed on your computer.

See below for information on system requirements, where to download LightBurn, and how to install LightBurn on your preferred operating system. If you've already downloaded and installed LightBurn, skip ahead to Adding a Laser.

4.3.1 Computer Requirements

Current versions of LightBurn run on the following operating systems:

- 64-bit Windows 10 (build 1809) or later
- macOS 11 or later

Support for macOS 11 will end with LightBurn 2.0. Subsequent releases will require macOS 12 or later.

You will always be able to use the most recent version of LightBurn that is compatible with your operating system and was released within your license's valid update period. To download an earlier version of LightBurn that is compatible with an outdated operating system, visit our release repository.

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

Support for other operating systems

- LightBurn version 1.7 is the last version compatible with Linux, versions of Windows prior to 10, and versions of macOS prior to 11. Download LightBurn 1.7.06 and see our 1.7 documentation for information and installation instructions.
- macOS users running versions older than 10.13 should download LightBurn 1.6.03, which supports macOS 10.11 or newer. See our legacy documentation for more information and installation instructions.
- Users limited to 32-bit versions of Windows should download LightBurn 1.5.06, which is the final 32-bit release of LightBurn. See our legacy documentation for more information and installation instructions.

4.3.2 Download LightBurn

To ensure you get the most recent version of LightBurn, download LightBurn directly from the Download / Trial page at lightburnsoftware.com. On this page, you'll find links to download the current version of LightBurn, as well as links to previous versions of the software and public beta versions.

When you've completed the download, you should see the file in your "Downloads" folder or a manually selected folder.

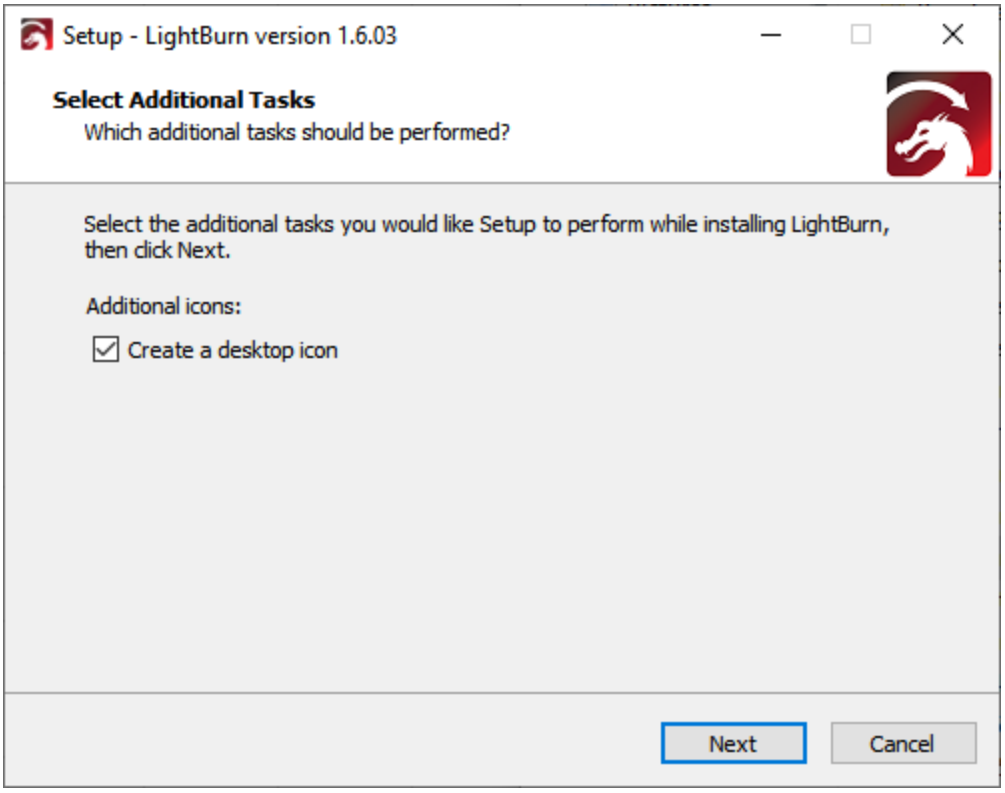
4.3.3 Installation Directions

Choose your operating system below for additional installation help.

Windows Installation

Windows Installation

Installation works the same way as most Windows software. Start the installer by double-clicking the file you downloaded from the LightBurn website. Windows may ask if you trust us first.



Click **Next**, then click **Install** to begin the installation process. When it completes, you'll see the following screen with options for installing drivers, viewing the change log, and launching LightBurn.

Installing Drivers

If you have never installed LightBurn on this computer before, you might need to install drivers. This is not necessary when updating an existing installation.

- Check **Install FTDI Driver** to install the driver used by DSP controllers, like Ruida and TopWisdom.
- The EZCAD2 driver is used by supported Galvo devices using EZCAD2 boards. Read more on our Galvo Driver Installation page.

Installing the driver for BSL Galvo Lasers

If you have a BSL Galvo laser, you may need to separately install a driver supplied by your machine's manufacturer, or install the stock software that came with your machine.

Start LightBurn however you usually do to begin using the software.

macOS Installation

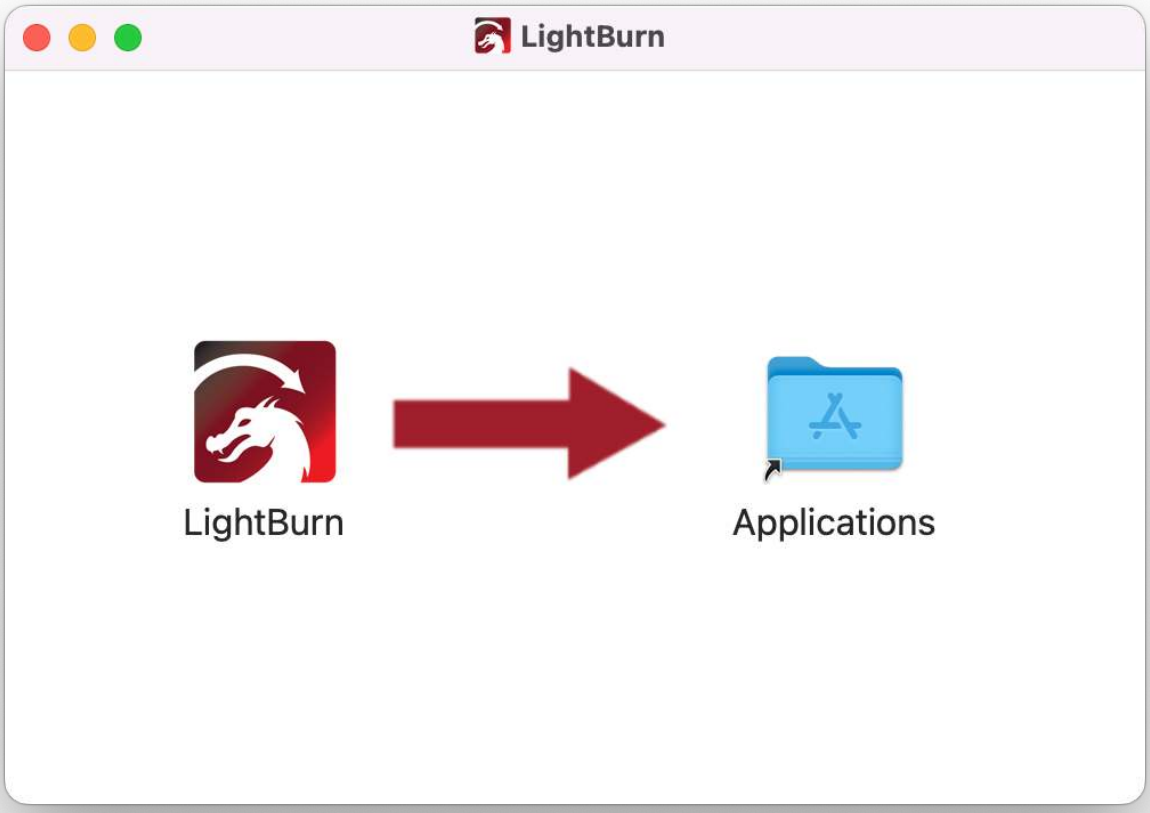
macOS Installation

Installing on M1 or newer Macs

To install LightBurn on an ARM-based Mac (using an M1 chip or later), you must have Rosetta installed.

In most cases, Rosetta is automatically installed on ARM-based Macs, and manual installation is unnecessary. If Rosetta is not installed, you'll be prompted to install it when you attempt to open LightBurn.

Installation works the same way as most macOS software. After downloading the DMG file, open the file and drag LightBurn into your Applications folder.



Notarization bypass for LightBurn 1.1 and earlier

Versions before 1.2 were not notarized to be recognized by your computer as coming from a trusted developer. If you installed an older version, you'll need to follow the steps below the first time you run LightBurn:

1. Open a Finder window.
2. Browse to the **Applications** folder.
3. Right-click or two-finger tap the LightBurn icon.
4. Choose **Open** from the menu.
5. When macOS asks if it should open the program, say yes to add an exception allowing your computer to run LightBurn normally. Once this is done, you will not need to repeat the process unless you reinstall LightBurn.

Figure 1: Video walkthrough

← Previous: Identify Your Laser

Next: Add a Laser →

hardware beginner add-device create-device devices new-device-wizard connection name work-area work-size origin homing settings

4.4 Adding a Laser

Consult Manufacturer Instructions

Always consult the documentation that came with your laser, or the manufacturer's online resources, before beginning the device setup process. Some manufacturers provide settings bundles, importable device profiles, or special setup instructions that are necessary to fully utilize their machines with LightBurn.

The first time you open LightBurn, you'll be greeted by the Devices window, where you'll see an empty list, along with several options for creating a device profile at the bottom. You need to have at least one device profile created in order to use LightBurn, so if you close out of this window without creating one, you'll see a warning message with the option to go back and set up a device, have LightBurn automatically create a dummy profile for you, or close out of the software.

If your laser's manufacturer hasn't provided any special instructions or importable files, the quickest way to add a new laser to your list of devices is with the **Find My Laser** wizard. Follow the instructions below to use the wizard to set up your device.

Info

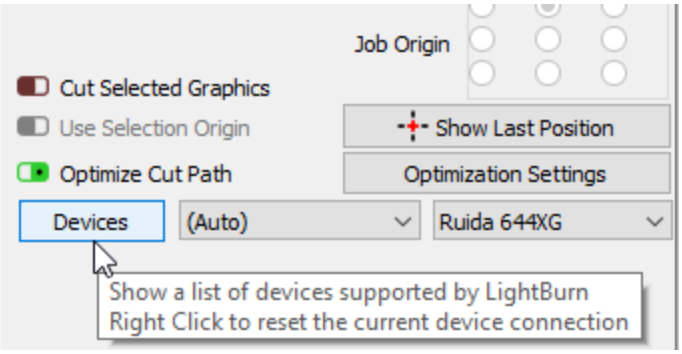
If you don't have a laser yet, go to Create Manually to create a dummy profile as a placeholder until you get a laser.

4.4.1 Automatically Add a Laser to LightBurn

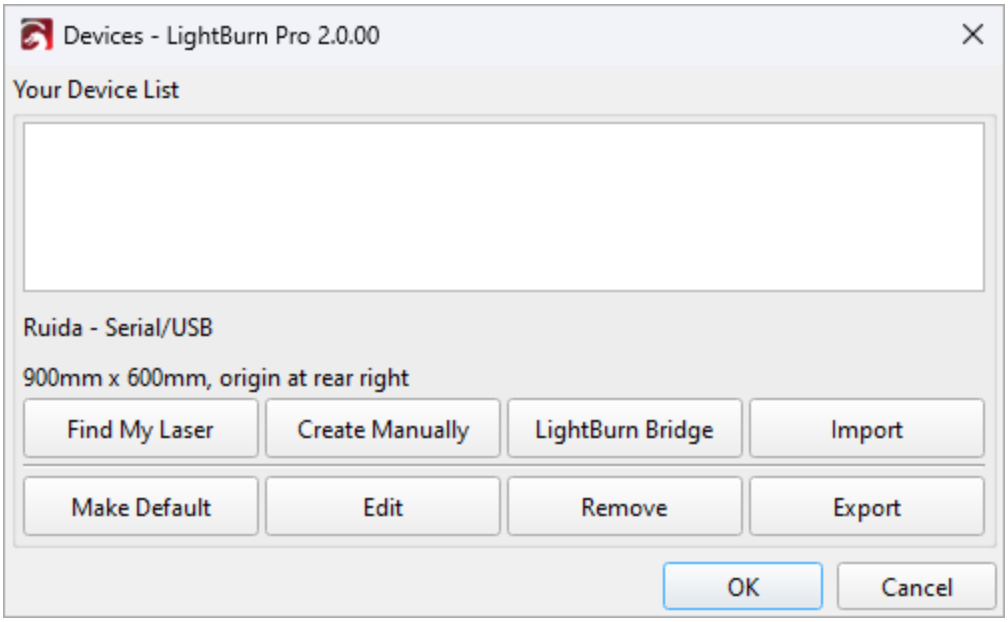
1. Make sure that your laser is powered on and connected by USB cable to a computer running LightBurn. Wait for the laser to complete any power-on moves, like homing, before continuing.
2. Click on the **Devices** button in the Laser Window, found in the lower right-hand corner of the program window by default, to open the Devices window.

   Note

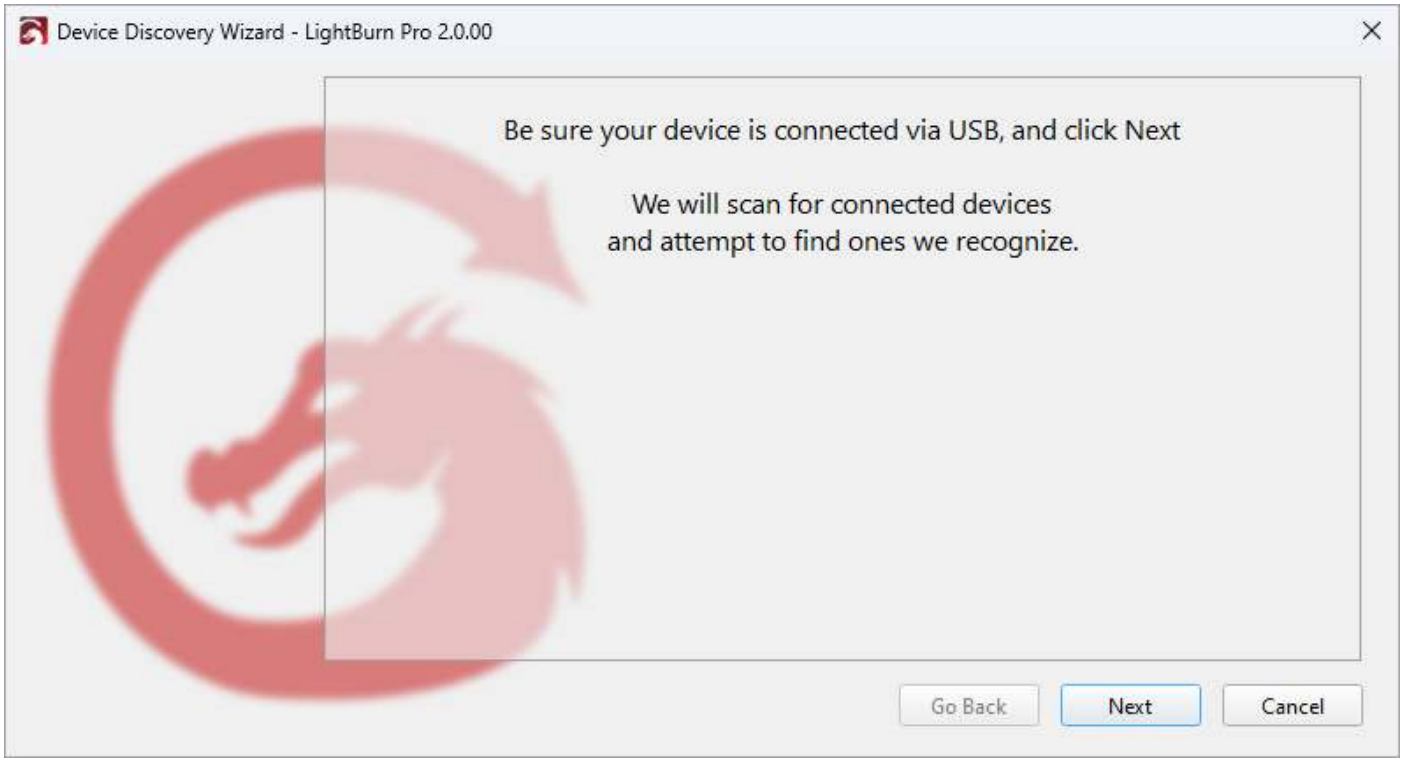
   If this is your first time running LightBurn, the Devices window will open automatically.



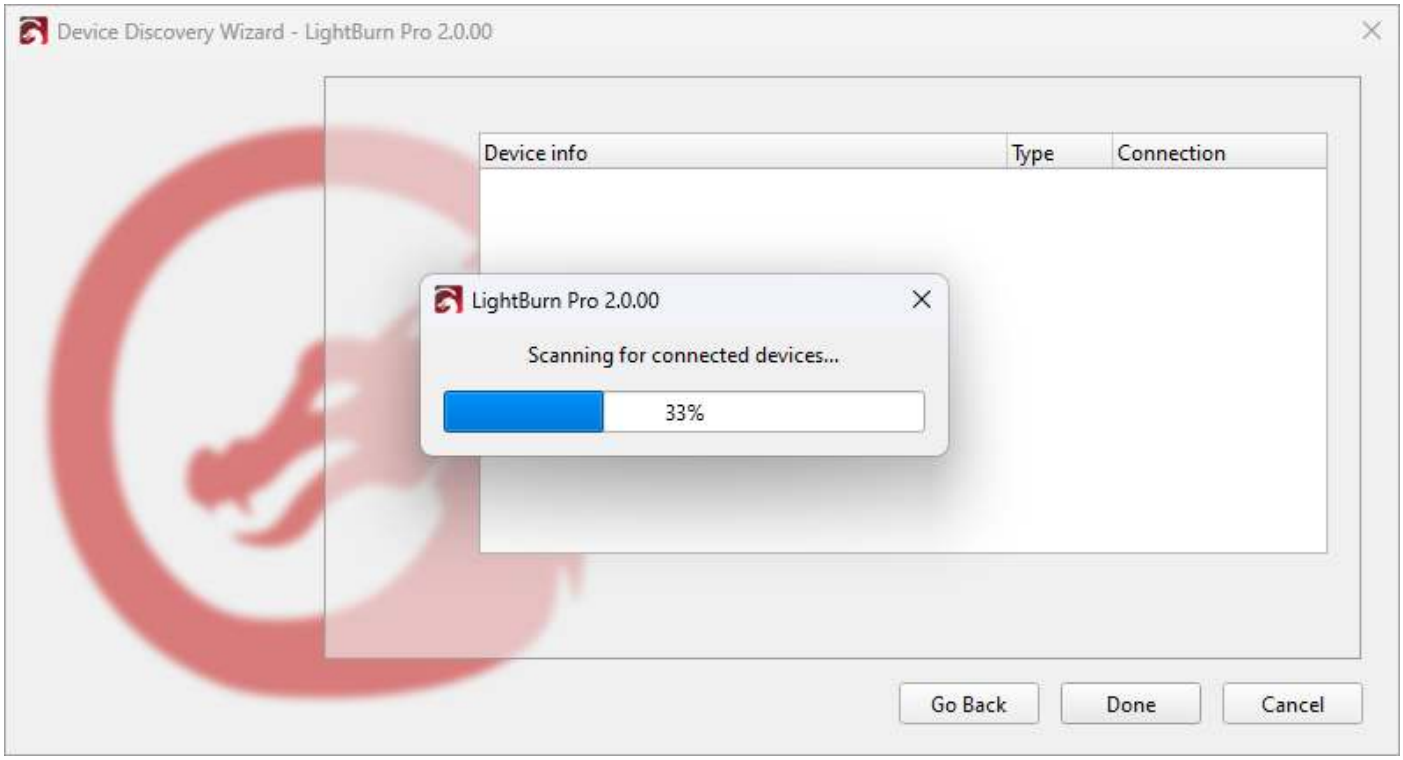
3. Click the **Find My Laser** button to launch the **Device Discovery Wizard**.



4. Click the **Next** button to begin scanning for connected devices.



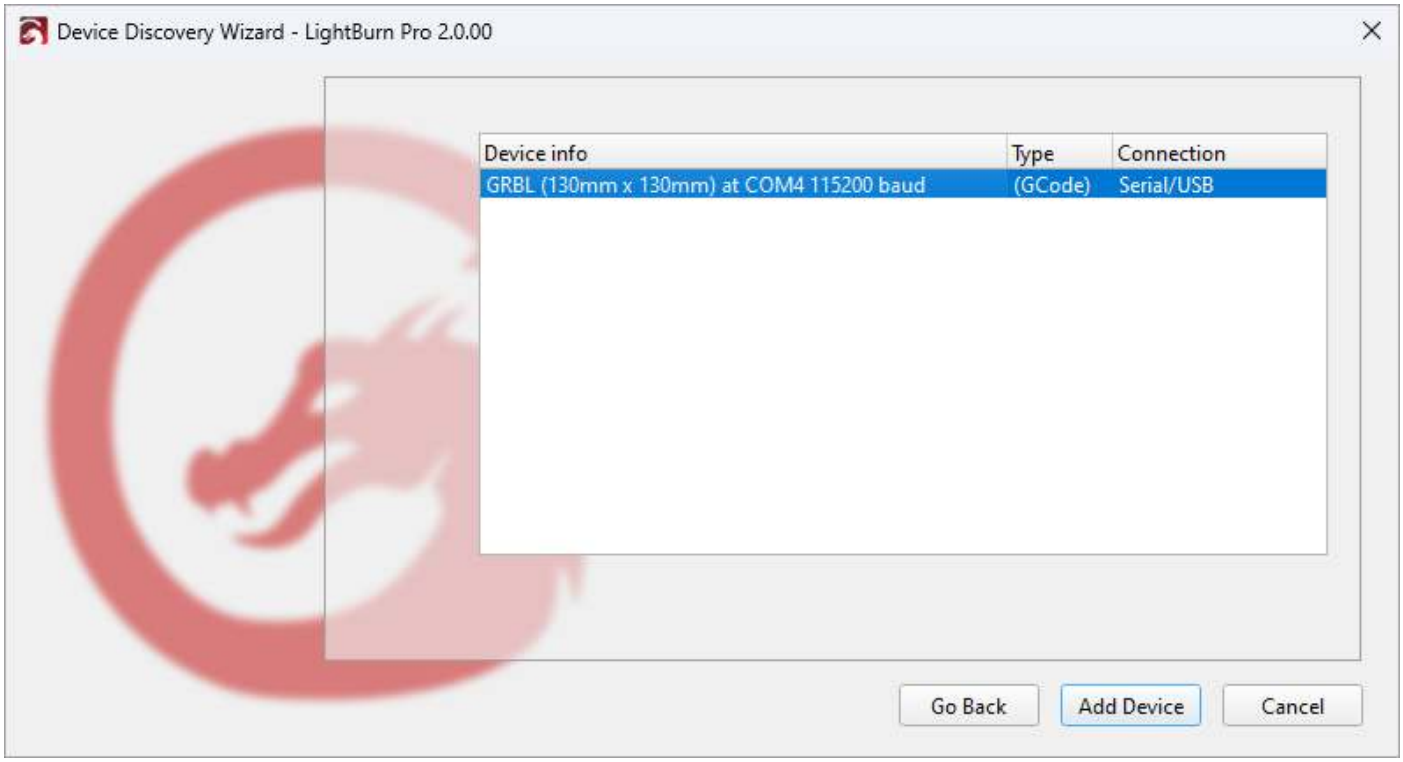
5. A new window will open showing the progress of scanning for USB-connected devices.



6. The Device Discovery Wizard will display a list of recognized devices. Select your laser from the list and click **Add Device**.

Ruida: Packet vs. Serial

Some laser models will appear on the list twice, with two connection types, **Packet/USB** or **Serial/USB**. Serial/USB is the recommended option, while Packet/USB is an alternative option that does not work on all systems, but can sometimes improve file transfer problems.



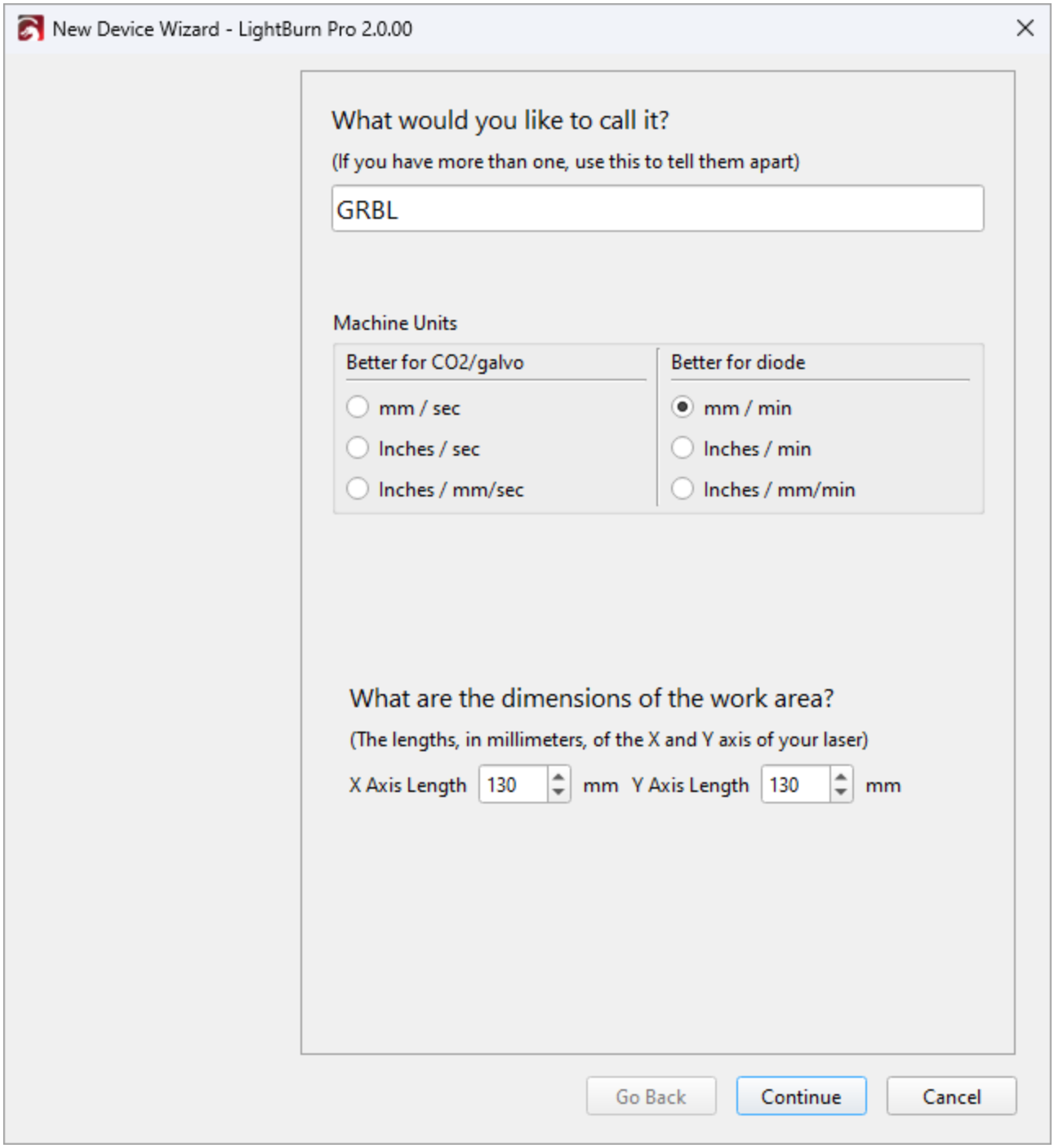
Warning

If your laser wasn't found automatically, see Troubleshooting.

If you don't have a laser available to connect, you'll need to manually create a device profile.

Manually Create Profile →

7. Name your device, choose the units you want to use for this device, and confirm that the dimensions of the work area are correct.



Note

Some lasers require additional information in order to complete the setup process. Continue below.

4.4.2 Additional Hardware-Specific Instructions

Click one of the options below to see instructions specific to your type of laser.

Not sure what type of laser you have? Head back to Identify Your Laser.

GCode Devices

GCode Devices

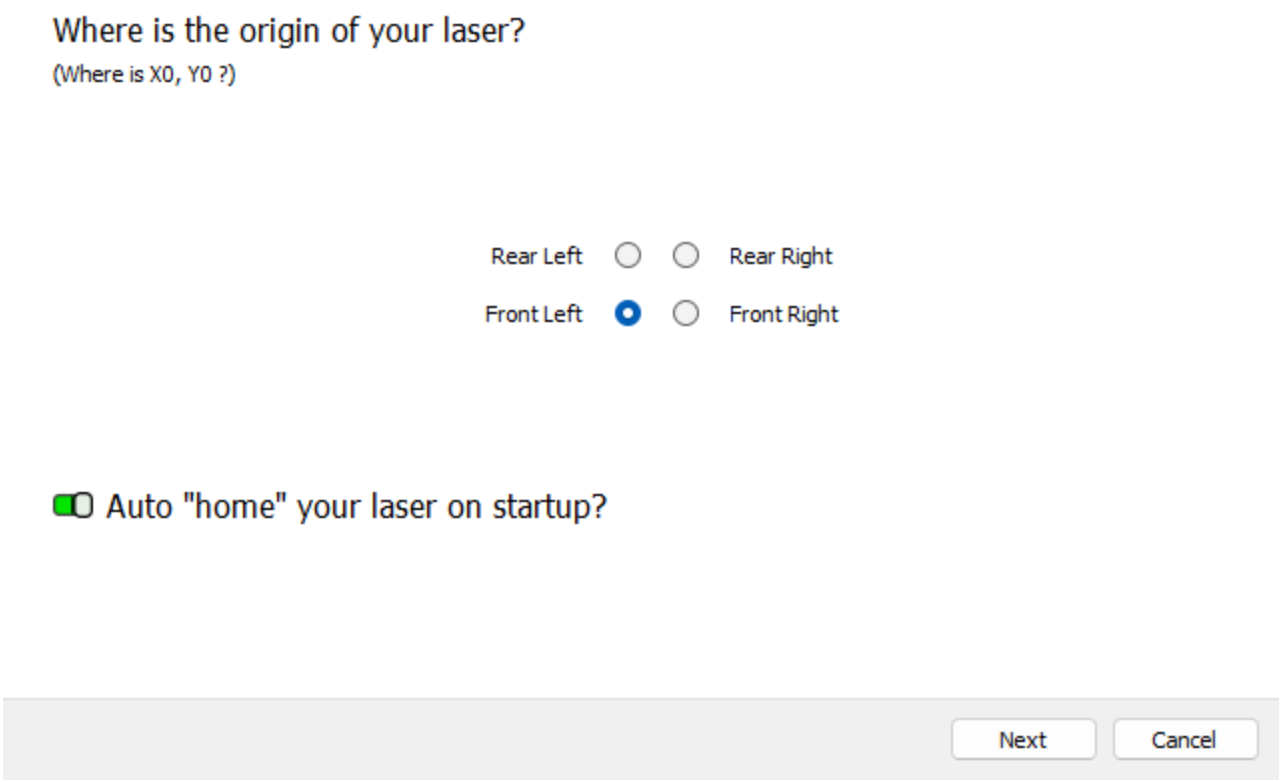
1. Set the machine origin. Nearly all GCode systems use the **Front Left** corner as the origin, regardless of where they home to. If you select the incorrect origin, your output will be flipped or mirrored — you can correct the origin later in Device Settings.
2. Enable **Auto "home" your laser on startup** if your machine has homing or limit switches, to automatically send your laser a homing command each time the device has been connected.

   Warning

   If your laser does not have homing switches, leave **Auto-home** off.

   If you see **Error: 9** in the Console Window later, it means you've enabled this feature but your machine is not equipped or configured for homing. You can disable Auto-Home later in Device Settings.

3. Select **Next** to continue.



4. Click **OK** in the Devices window to exit and save the new device profile.

Note for X-Carve and Shapeoko Users

Some GCode controllers used on X-Carve or Shapeoko devices may need specific configuration settings. If your device is not listed, click **Other**, and refer to manufacturer documentation for machine-specific parameters.

Next: Connecting to the Laser →

DSP Devices

DSP Devices

1. Set the machine origin. For DSP lasers, the machine's origin is the same as the location it homes to when it first starts up. If unsure, select the **Rear Right** corner, as most DSP controllers follow this convention. If you select the incorrect origin, your output will be flipped or mirrored — you can correct the origin later in Device Settings.
2. Select **Next** to continue.
3. Click **OK** in the Devices window to exit and save the new device profile.

Next: Connecting to the Laser →

Galvo Devices

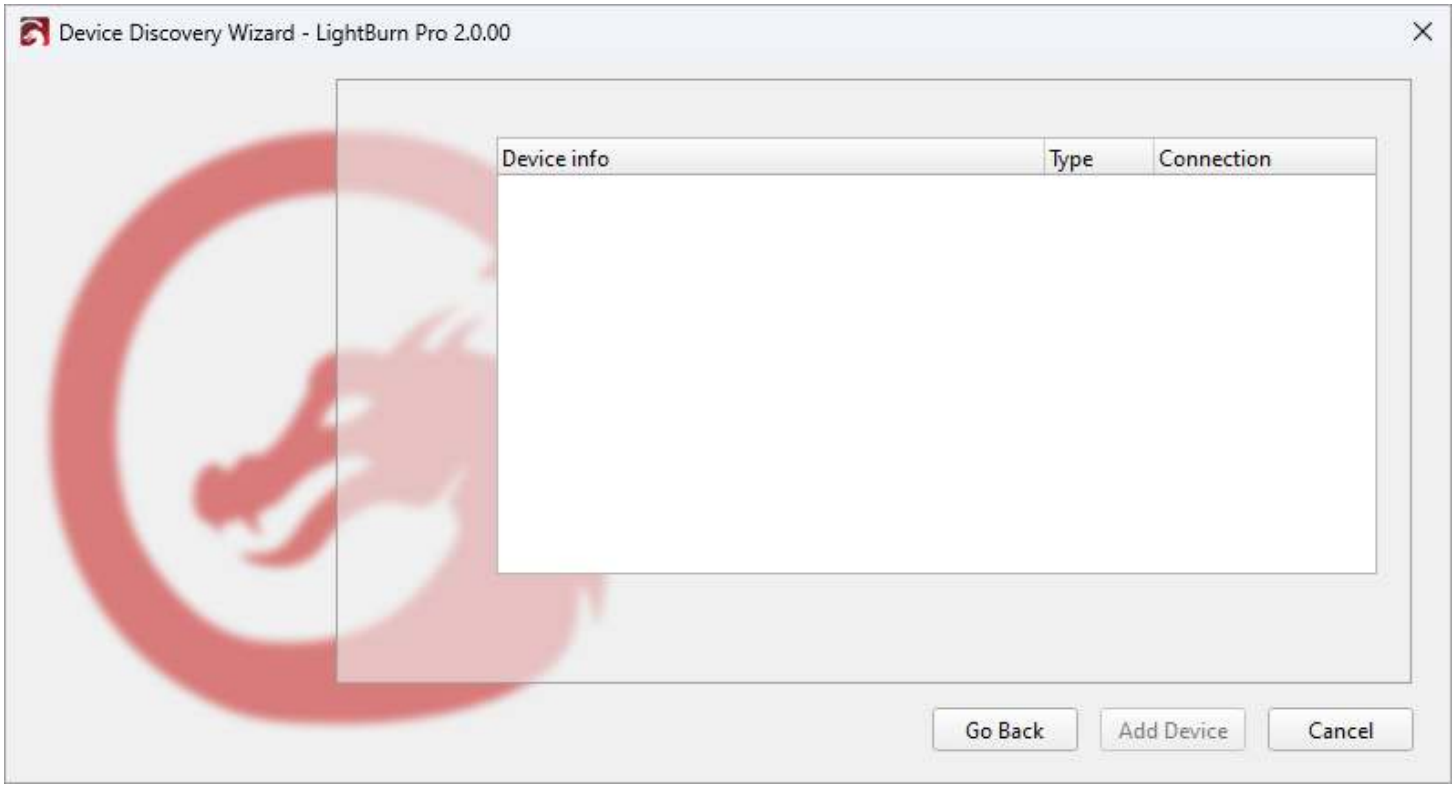
Galvo Devices

When adding a Galvo device, LightBurn will ask you to import the machine-specific configuration file from your EZCAD2 setup or installation drive. Navigate to the location it's saved and select the file to import crucial device settings. See Add a Galvo Laser for more information, including what to do if the configuration file is not available.

Video: Galvo Setup Guide

Next: Add a Galvo Laser →

4.4.3 Troubleshooting



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

- **Missing drivers**: Install your laser-specific drivers and software. Even if you don't plan to use their software, many device manufacturers include the necessary drivers that are not included with LightBurn.
  - Ruida controllers use an FTDI driver available as part of the LightBurn installation process. Re-install LightBurn and select the box for the FTDI driver at the end of the process to install the driver — no LightBurn settings will be lost in the re-installation process.
  - EZCAD2-based Galvo devices require a LightBurn-specific driver. Re-install LightBurn and select the box for the EZCAD2 driver at the end of the process to install the driver — no LightBurn settings will be lost in the re-installation process. See Galvo Driver Installation for more information.
  - If you have a BSL Galvo laser, you may need to separately install a driver supplied by your machine's manufacturer, or install the stock software that came with your machine.
  - Most diode lasers require the CH340 driver, available here.
  - See Troubleshooting: Drivers for more information.
- **Can't connect**: Only one application can talk to your laser at a time. If you run other software, like RDWorks, Easel, Carbide Create, AutoLaser, or LaserCAD, make sure that software is not running when running LightBurn.
- **Networked device**: Network-connected lasers cannot be automatically connected. Follow the steps in Create Manually to set up your device.
- **Marlin controller**: Marlin controllers have a variety of baud rates and configuration options. They take significantly longer to reset than most other controllers, making them incompatible with **Find My Laser**. Follow the steps in Create

Manually to set up your device.

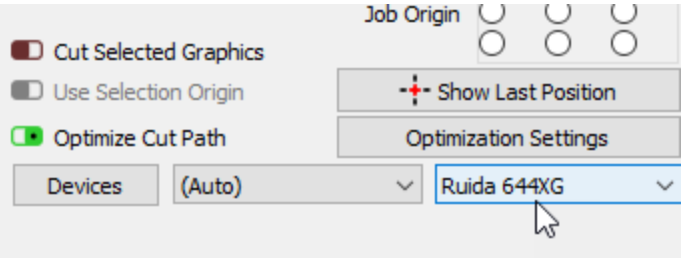
← Previous: Install LightBurn | Didn't work? | Next: Connect to the Laser →

connection get-started

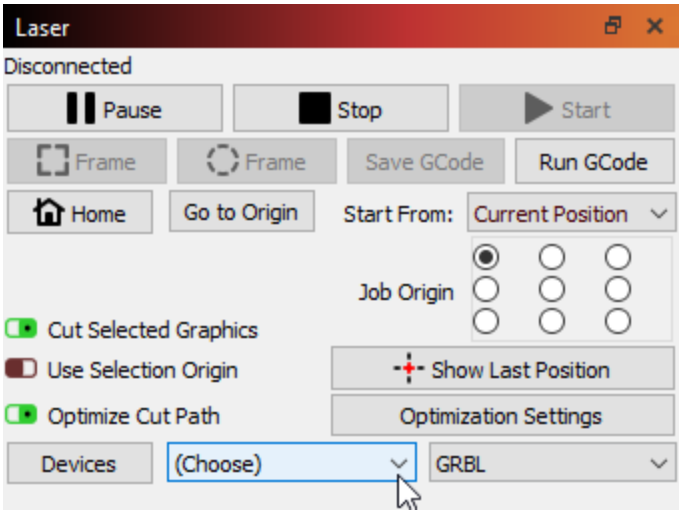
4.5 Connecting to the Laser

Once a laser has been added 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 *(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.

4.5.1 Troubleshooting

If you're having trouble connecting to your laser, see Connection Troubleshooting for help.

← Previous: Add a Laser

Next: UI Tour →

get-started _ui-tour

4.6 User Interface Tour

Once you've installed LightBurn and set up your first device profile, you'll see LightBurn's Main Window. 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 down the most important sections to get familiar with below.

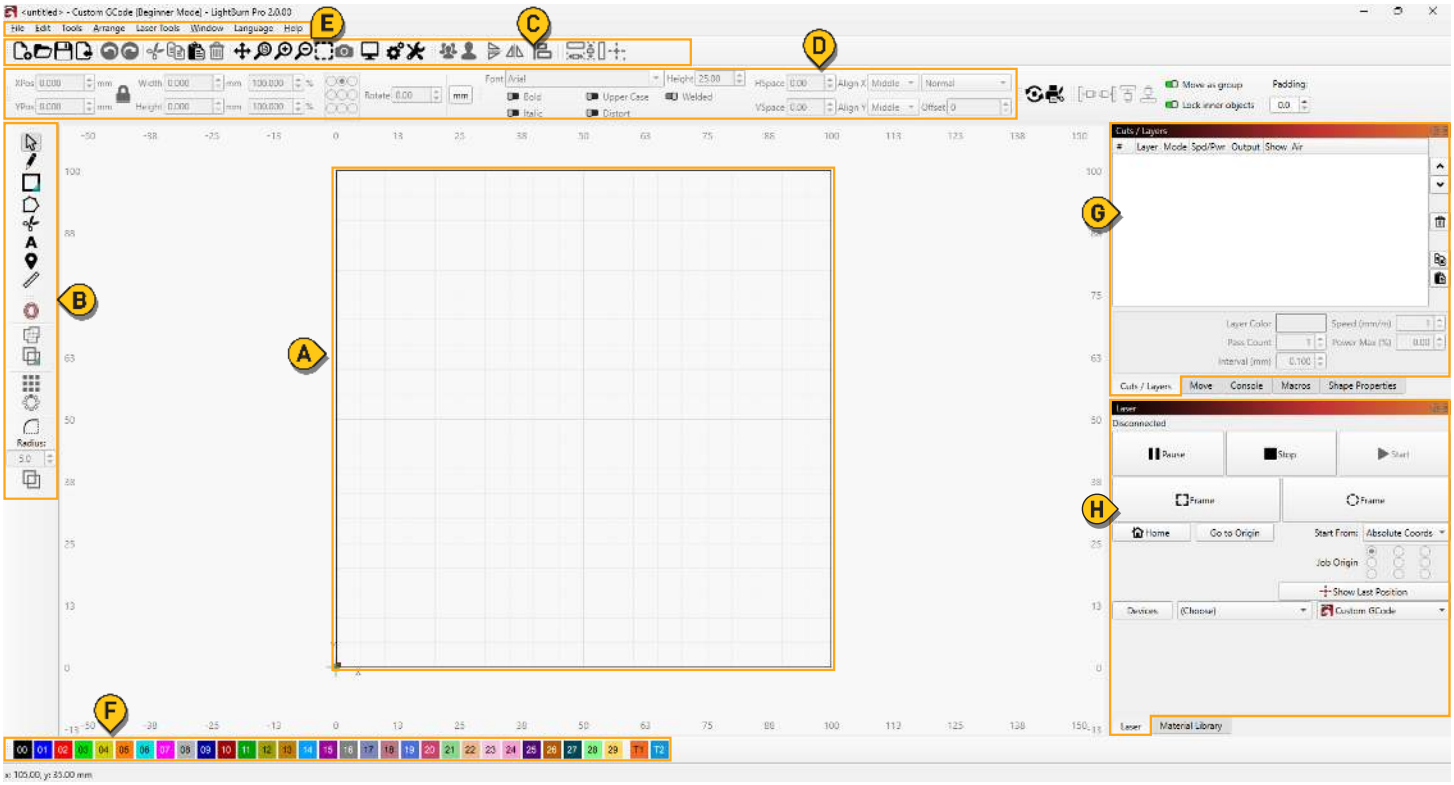
Finding Help

LightBurn has some built-in features to make it easier to learn more:

- **Easy Access Help Pages**: Press F1 while hovering to launch the documentation page for that feature in your default web browser.
- **Tools Tips**: Hover your mouse over a control to see helpful text pop up, with a description of that button or feature.

Below, we've divided the Main Window into labeled sections. The labeled sections contain the tools and features you'll use most frequently in LightBurn, and we'll give a brief explanation of each further down. You can click in the image beneath it to jump directly to the information on that section.

You may notice that some sections are unlabeled — to keep from getting overwhelmed when starting out, it's best to focus on the essentials, and leave those sections for later. At the end of this walkthrough, we'll give you some advice on finding and learning more about tools that are well-suited to your specific needs.



Info

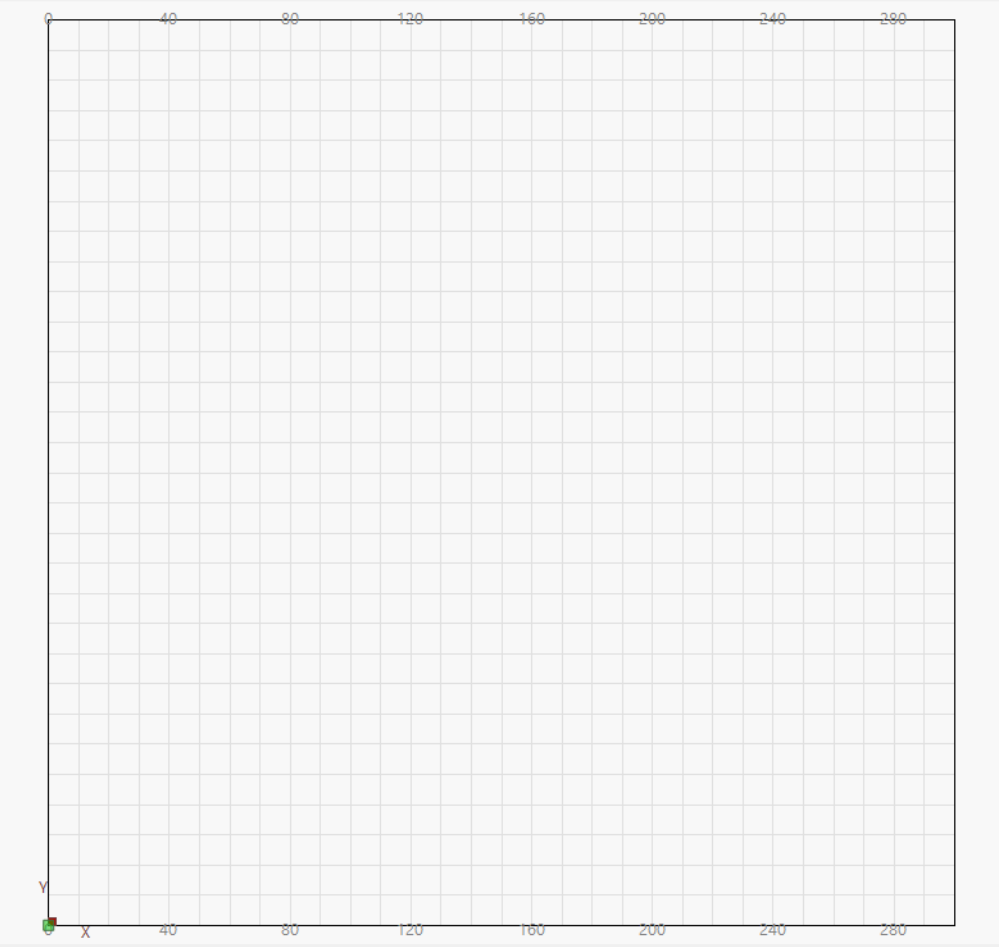
Your LightBurn window may not match the screenshot exactly. LightBurn's user interface changes depending on what type of laser is selected and whether Beginner Mode is active.

A: Workspace / Edit Window	**B: Creation and Modifier Toolbars**
C: Main and Arrange Toolbars	**D: Numeric Edits and Text Options Toolbar**
E: Menus	**F: Color Palette**
G: Cuts / Layers Window	**H: Laser Window**

4.6.1 Workspace / Edit Window

The Workspace, or **Edit Window**, is the area where you create, edit, and lay out graphics in LightBurn. The grid is a representation of your machine's available work area, determined by the settings LightBurn detected or you entered manually when you set up your device profile.

The artwork arranged and displayed within the Workspace will be processed and sent to your laser — we'll explain how that works in greater detail later.



4.6.2 Main, Arrange, Creation, and Modifier Toolbars

These toolbars are comprised of buttons that, when clicked, perform certain actions.

Above the **Workspace**, between the Menus and Numeric Edits and Text Options Toolbars, are the Main and Arrange Toolbars.

Along the left side of your Workspace are the Creation and Modifier Toolbars. They're usually oriented vertically, but we show them horizontally below.

There's a lot to say about all these tools, but here's a brief rundown:

- The **Main Toolbar** contains functions for opening or importing files, saving, using the clipboard (copy and paste), and moving or zooming your view.

- The **Arrange Toolbar** contains tools for positioning objects, both on an individual basis and in relation to each other.

- The **Creation Toolbar** contains tools for selecting objects in your Workspace, or creating Primary Shapes, text, lines, and more.

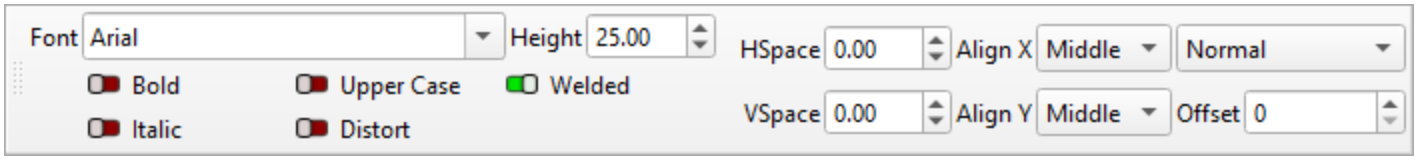
- The **Modifiers Toolbar** contains tools for combining, altering, and producing arrayed duplicates of graphics.

4.6.3 Numeric Edits and Text Options Toolbars

Located just above the **Workspace**, the Numeric Edits and Text Options Toolbars are special toolbars that allow you to directly edit specific properties of shapes.

- Use the **Numeric Edits Toolbar** to adjust objects' position, size, or orientation.

- Use the **Text Options Toolbar** to control the font, size, style, and alignment of selected text.

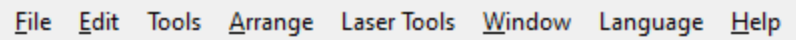


The options in the Numeric Edits Toolbar are only available when you have objects in your selection, and the options in the Text Edit Toolbar are only available when you have a specific type of object in your selection: text made with the Create Text tool.

4.6.4 Menus

The Menus at the top of LightBurn contain almost every tool that's available as a button in one of the toolbars, along with a handful more. Most have icons that correspond with a toolbar button (if applicable), and the keyboard shortcuts for their actions (if available) are listed next to each menu option.

Some tools are *only* available in the Menus or by keyboard shortcut — for the most part these are advanced options that you don't need to worry about when you're starting out, but we'll cover a couple Menu-only options as we go along.

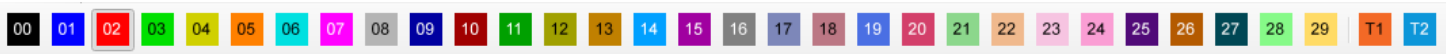


4.6.5 Color Palette

Along the bottom of the Main Window, you'll see the Color Palette.

Lasers don't print in color, so these colors are only used to assign different kinds of operations to the shapes in your design.

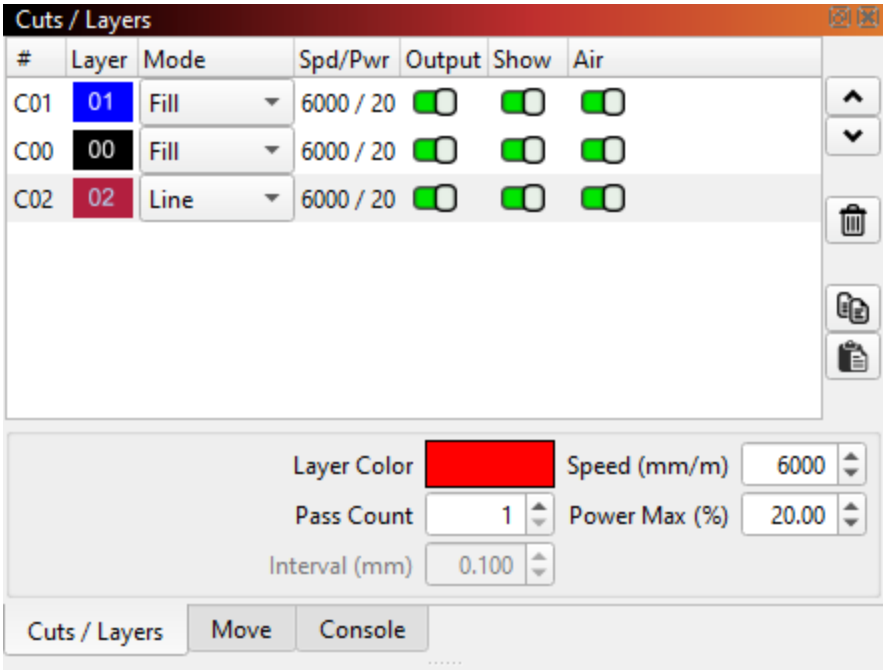
With nothing selected in the Workspace, click a color entry and subsequent new shapes will be created in that color. If you have something selected, clicking a color entry will apply that color to the shapes in your selection. The colors currently in use in your design will also appear as entries in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



4.6.6 Cuts / Layers Window

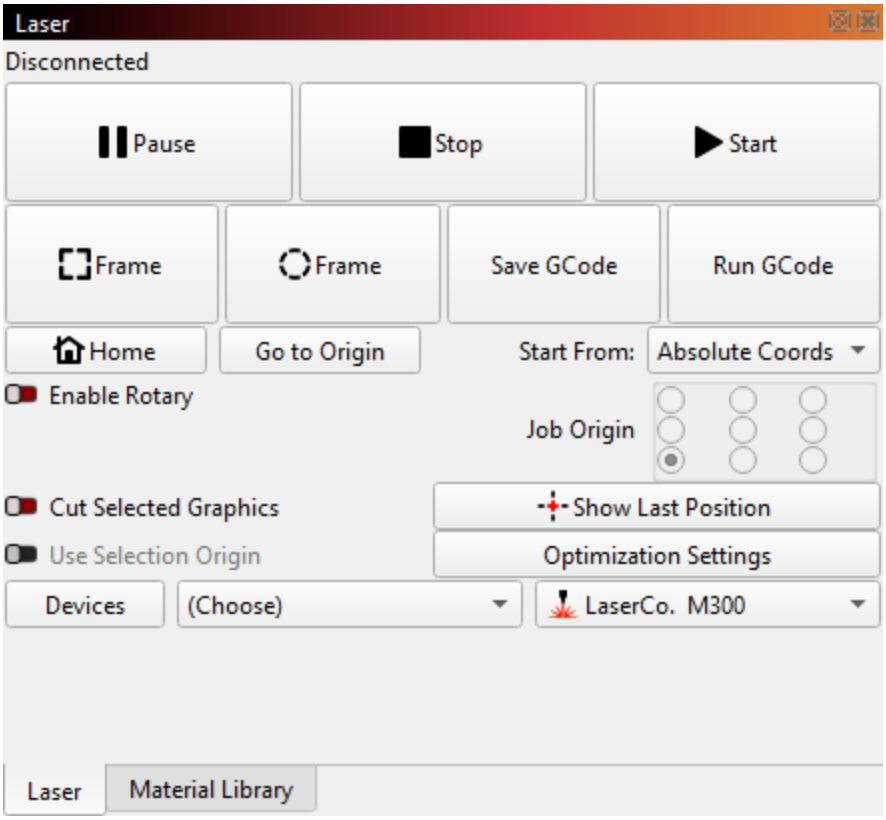
Located in the upper right of LightBurn by default, the Cut / Layers Window shows the layers currently in your design, along with a a handful of essential cut settings like **Speed** and **Power**.

You can double-click a layer in the Cuts / Layers Window to open the Cut Settings Editor, where you can access more detailed settings that change depending on the type of operation you have a given layer set to.



4.6.7 Laser Window

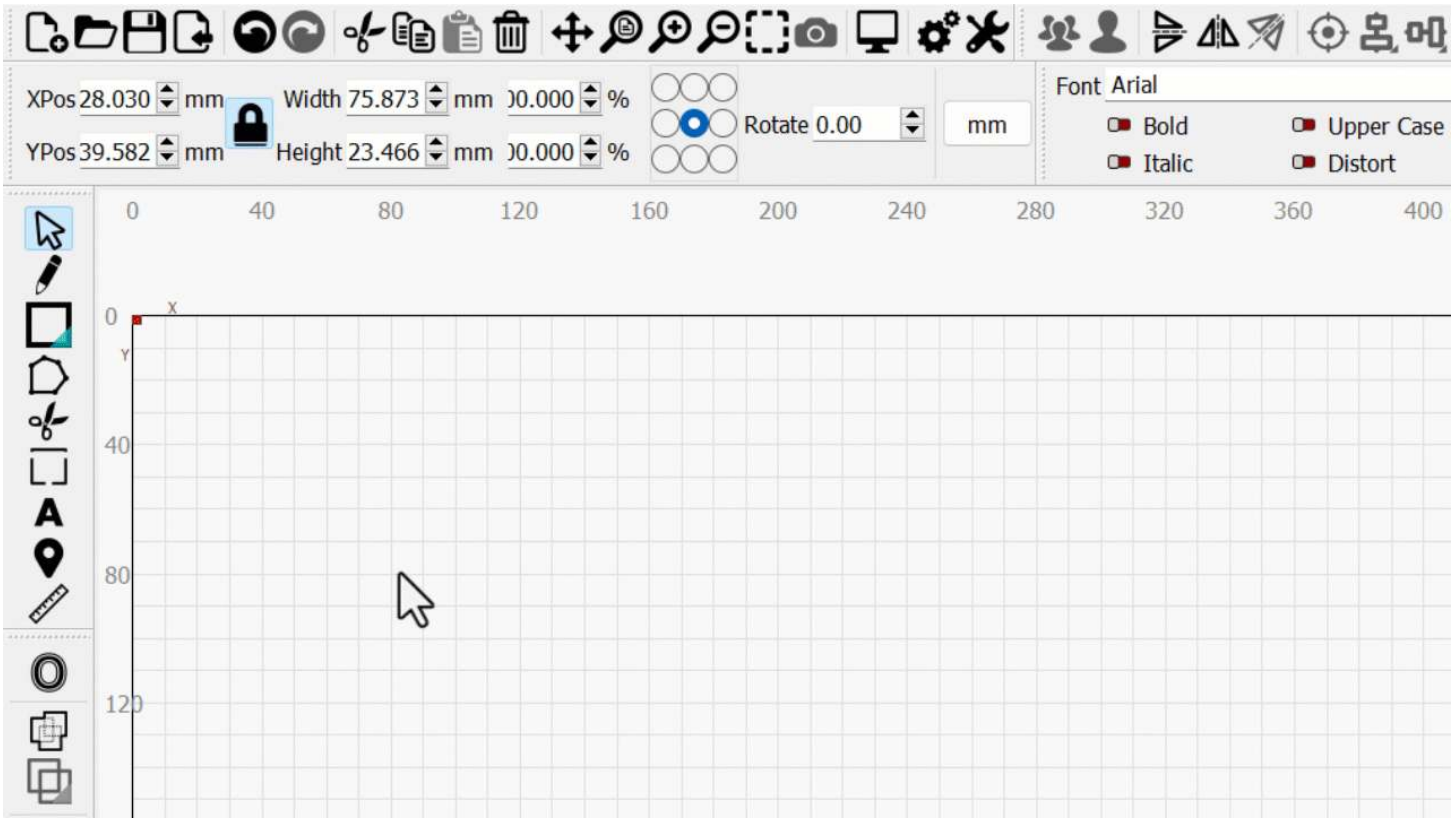
The Laser Window is located in the bottom right corner of LightBurn by default. It's the hub for setting up and selecting a laser, Framing and Starting jobs, determining job positioning, and more. In short — it's an important window!



> **Note**
>
> This window may look a little different depending on the type of device you have selected, whether or not you have Beginner Mode enabled, and a few other options available in your Settings / Preferences.

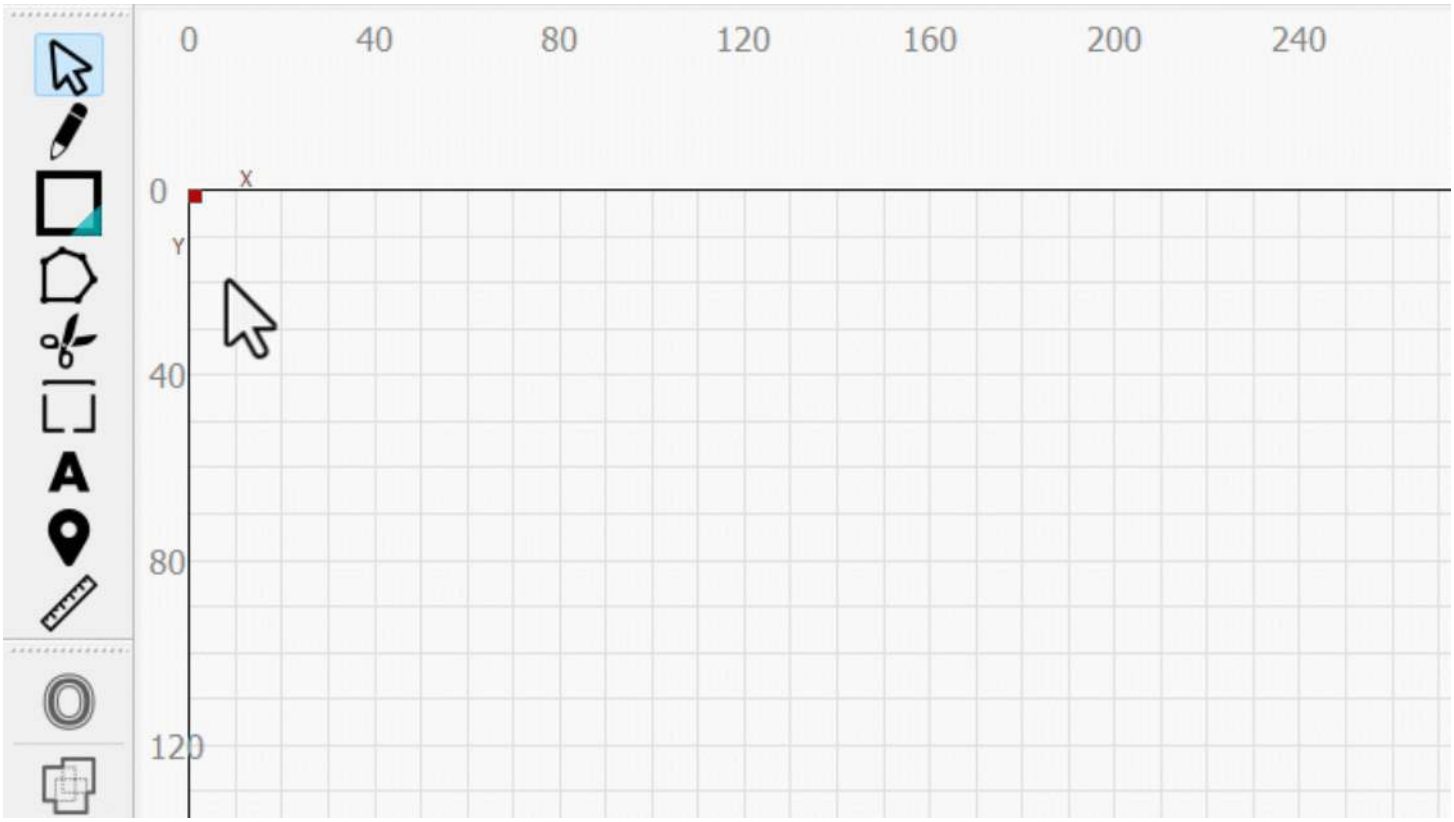
4.6.8 Getting Familiar and Learning More

We'll have more to say about some of these toolbars and windows as we go along, but, for now, spend some time in LightBurn hovering over buttons to see what they do. As you hover, a tooltip will appear and give a brief description of the action the button performs. In many cases, you'll also see a keyboard shortcut — pressing that combination of keys will perform the button's action, or activate that tool.

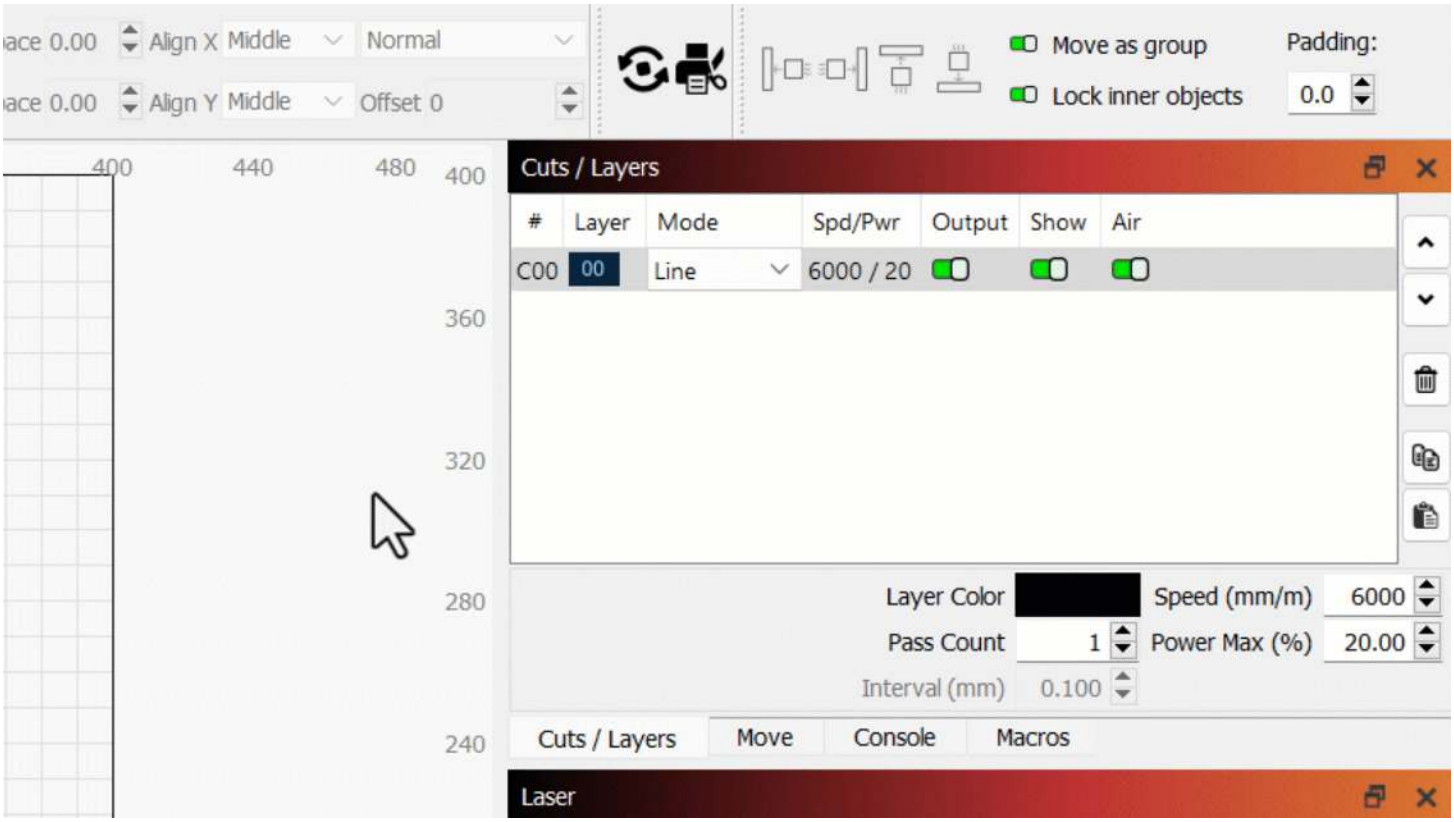


Some buttons will be grayed out and unclickable — that means you can't perform that button's action unless you have valid shapes in your selection. We'll explain how to select objects later, but if you ever run into a case where you *do* have objects selected and aren't sure why a button is still grayed out, try hovering over the button and pressing F1 to go to the docs page for that tool, and learn what types of shapes are required to use it.

You'll also see a few buttons with small arrows in their bottom left corners. That means several tools are collapsed within a single button — click the arrow to expand the list of tools.



Finally, you'll notice labeled tabs beneath the Cuts / Layers and Laser Windows. Clicking on one of these tabs will bring a new window to the front, and hide the previously exposed window behind it. We haven't covered any of the windows that are hidden by default in our brief tour because you won't use them as often, but try clicking tabs to show and hide different windows, just to get the hang of it.



← Previous: Connect to the Laser

Next: Creating and Importing →

get-started creating-and-importing-artwork

4.7 Creating and Importing Artwork

If you've followed along so far, you've installed LightBurn, set up your first device profile, connected to your laser, and gotten familiar with the LightBurn interface. If you need a breather, we wouldn't blame you — we'll be waiting when you get back.

When you're ready, it's time to dig into the reason you're here: using LightBurn to make stuff with your laser. Every laser project requires some sort of artwork to send to the laser, and that artwork has to come from somewhere. You can create original graphics directly in LightBurn, or import graphics created elsewhere and modify them (or just leave them be).

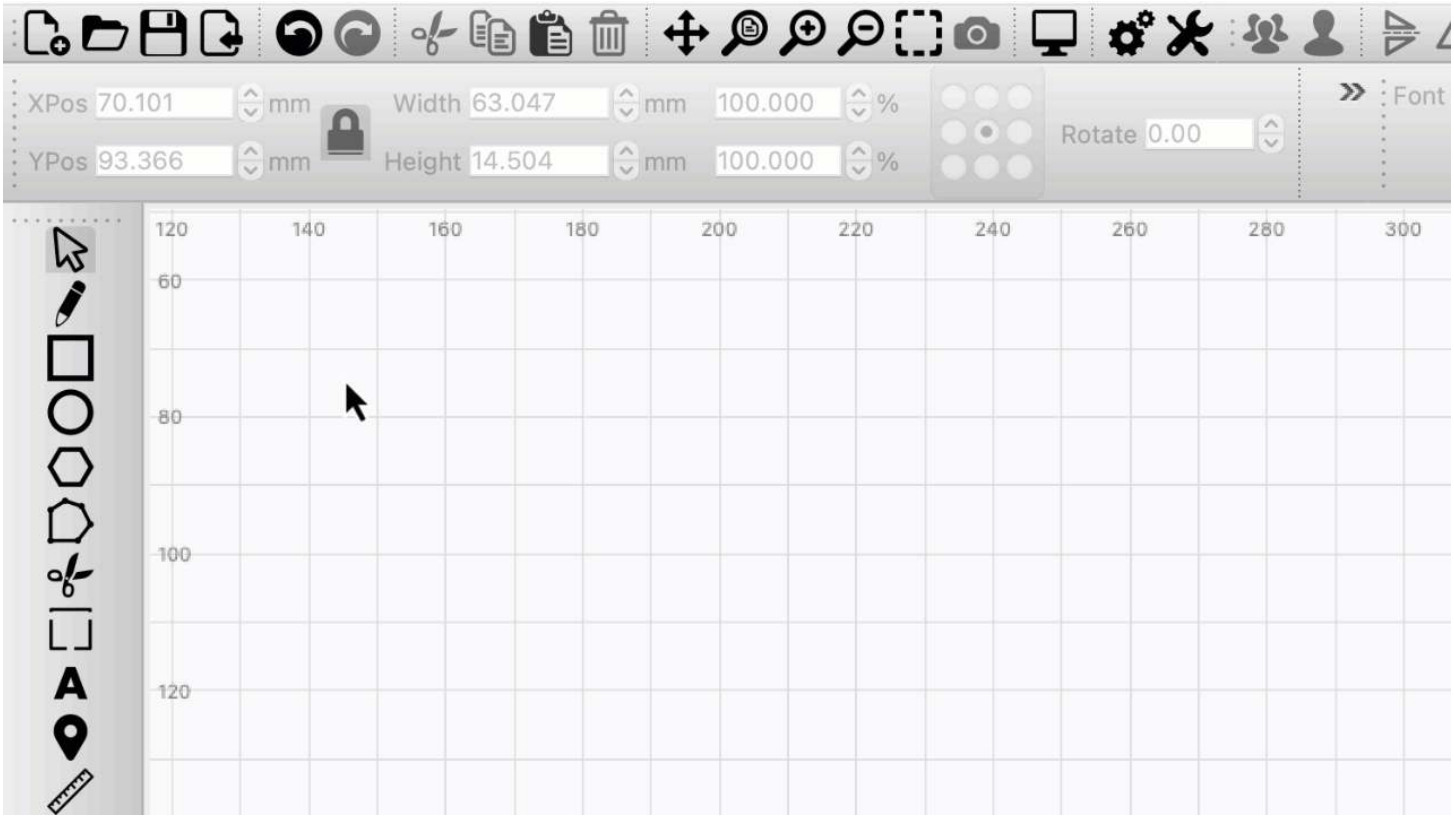
4.7.1 Creating

There are three tools in the Creation Toolbar that you can use to make original graphics in your Workspace. All three work similarly, with minor differences. As with most LightBurn tools, there's a lot we could say about each of them, but we'll stick to brief explanations for now.

Draw Lines

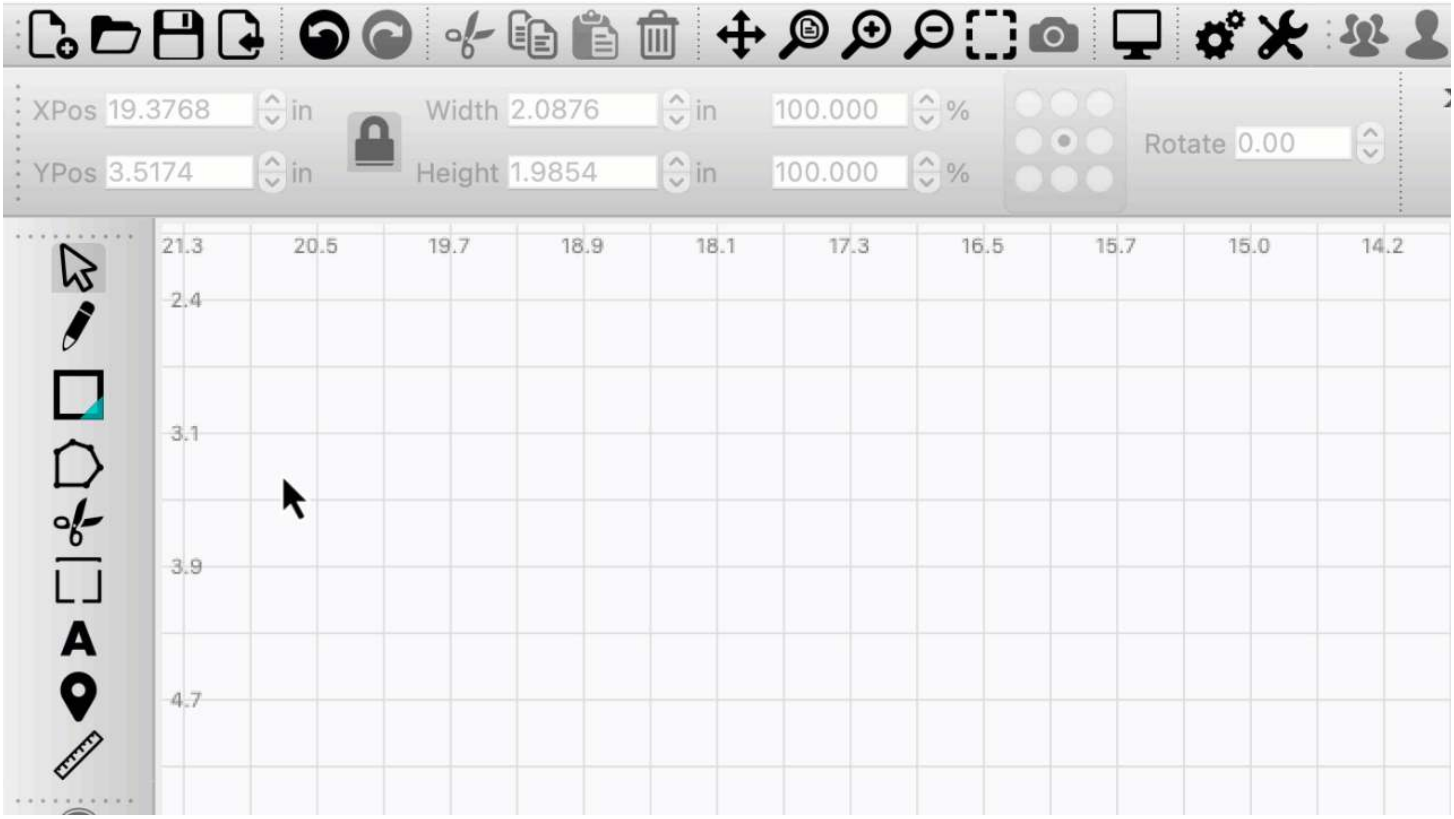
You can use the Draw Lines tool to create custom lines and curves. Select the tool, click in your **Workspace** to place one end of a line, then drag and click again to place another point, and a line between. Press S to toggle between creating straight lines and curves between points.

Click here to see a full video guide on using the Draw Lines tool



Draw Shapes

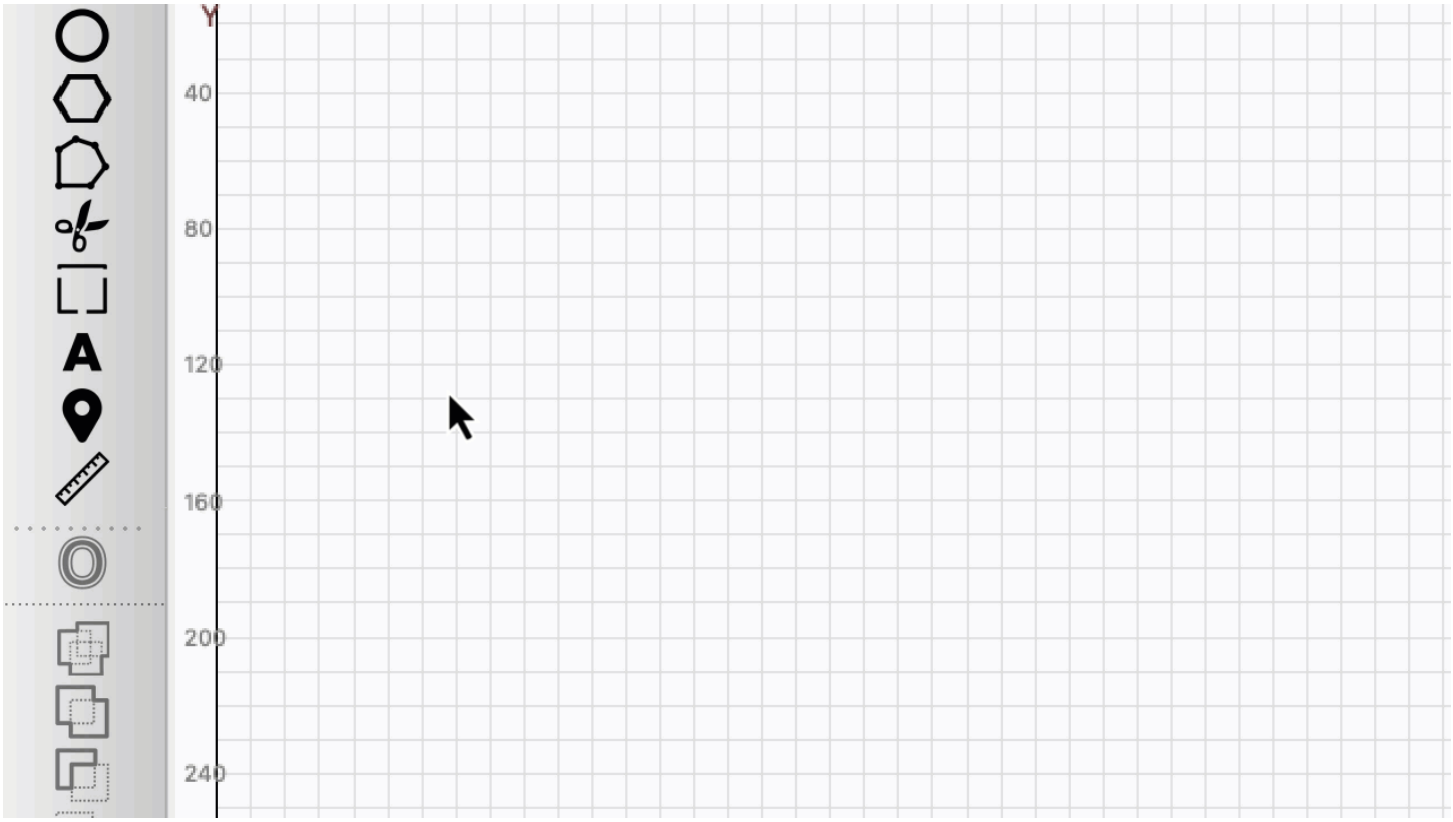
Click the arrow in the bottom right corner of the Draw Shapes icon to select from a menu of eight different types of shapes. Then click in your **Workspace**, hold, and drag to set the size of the shape. Release to finish creating it. If you hold ⇧ Shift while dragging, the shape's width and height will be the same, so you can create perfect circles and squares using the **Ellipse** and **Rectangle** options.



Create Text

Click the Create Text icon to enable the tool, then click anywhere in your **Workspace** and type in the text you'd like to add.

Press Enter ⏎ while typing your text to jump to a new line and continue typing. Press ⎋ Esc to finish creating the text.



4.7.2 Importing

We know that many people prefer to design in other software they're already familiar with, or to work from stock artwork.

For that reason, LightBurn can Import a variety of file formats:

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

Importing Text

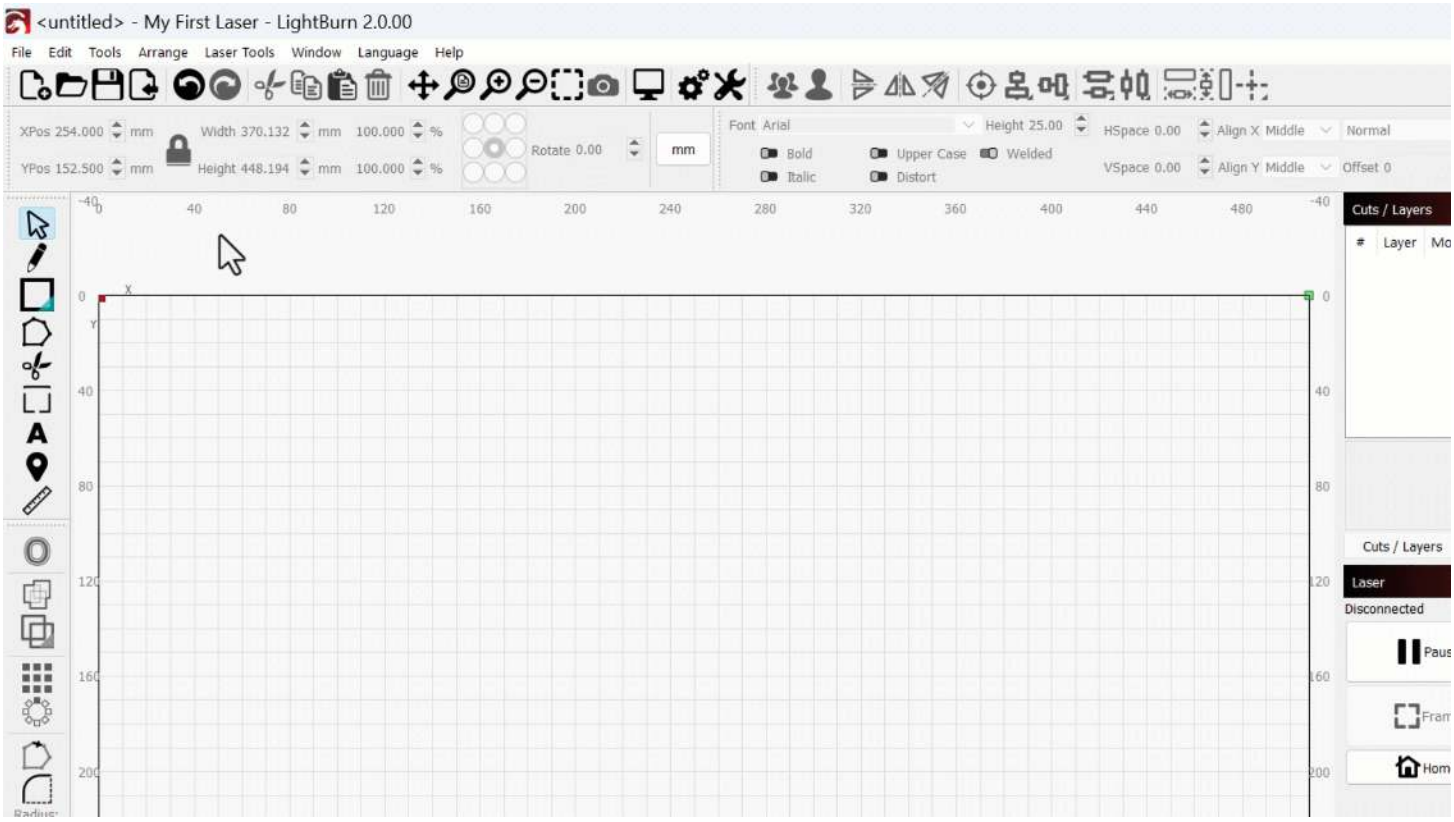
If you import vector files not made in LightBurn that contain text, make sure that any fonts used in the file are installed on your computer, or that the text has been converted to paths using whatever tools are available in the other program. LightBurn is not able to import embedded fonts. If LightBurn is unable to import anything from your file, the status bar will display **Nothing Imported**.

Different programs use different terms for this process, but terms such as *welding*, *convert to outline*, and *convert to path* are common.

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

To import artwork saved in any of the above formats, click the **Import** button in the Main Toolbar, go to File → **Import**, or press `^ Ctrl` / `⌘ Cmd` + `I`, then navigate to the location the file is saved on your computer and select it.



Quick Tip: Drag and drop directly into LightBurn

← Previous: UI Tour

Next: Moving Around the Workspace →

get-started

4.8 Moving Around the Workspace

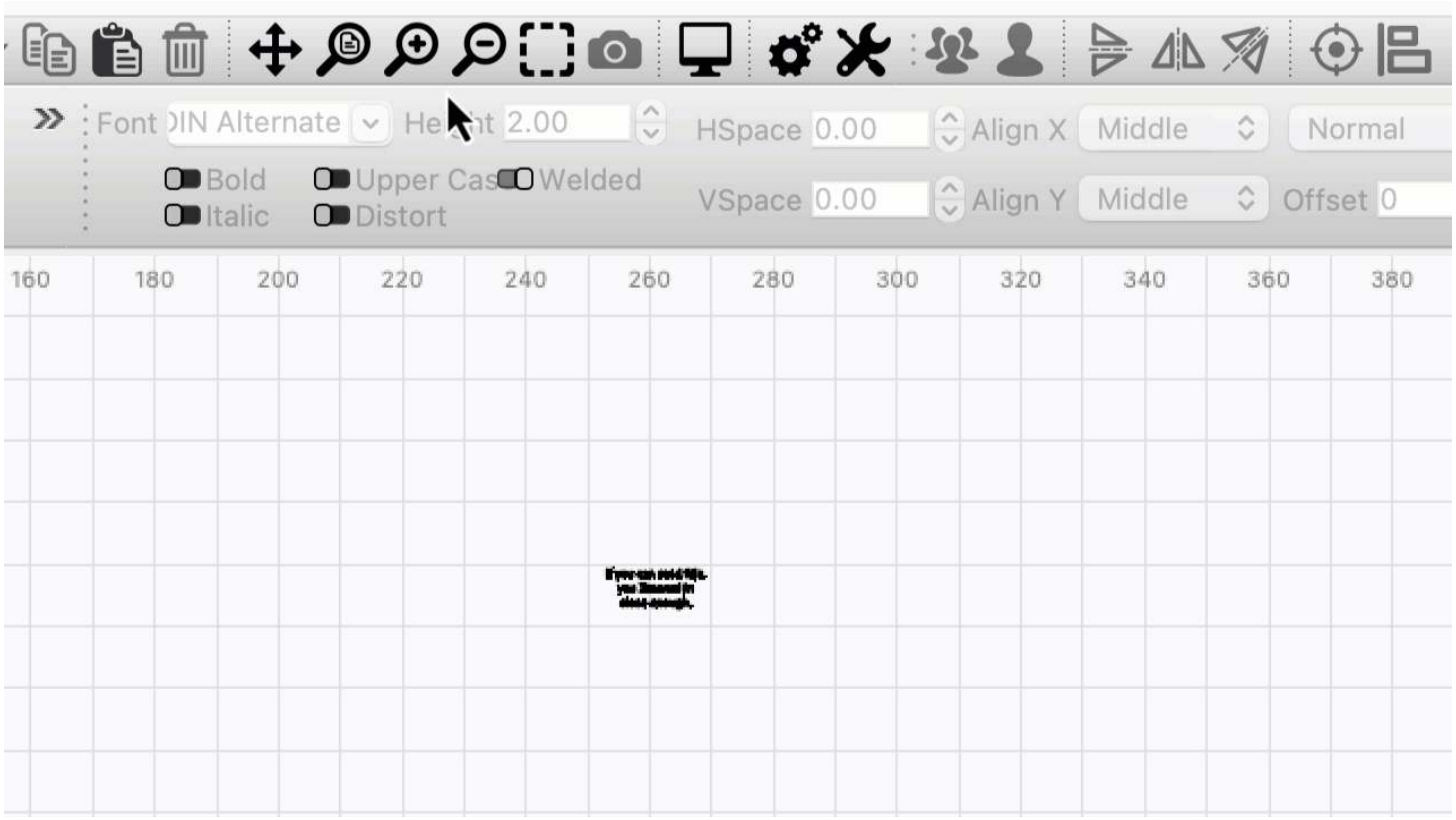
Once you've created or imported artwork into your Workspace, you may want to make modifications, and in many cases the easiest way to do that is to adjust your focus using the **Zooming** and **Panning** tools.

4.8.1 Zooming

Use **Zooming** to get a close-up look at your graphics, or to pull back out and see the bigger picture.

There are a few ways to Zoom In and Out:

- Press the **Zoom In** or **Zoom Out** buttons in the Main Toolbar.
- Press the + or - keys on your keyboard.
- Use your mouse's middle scroll wheel, or two-finger dragging if you're using a trackpad.



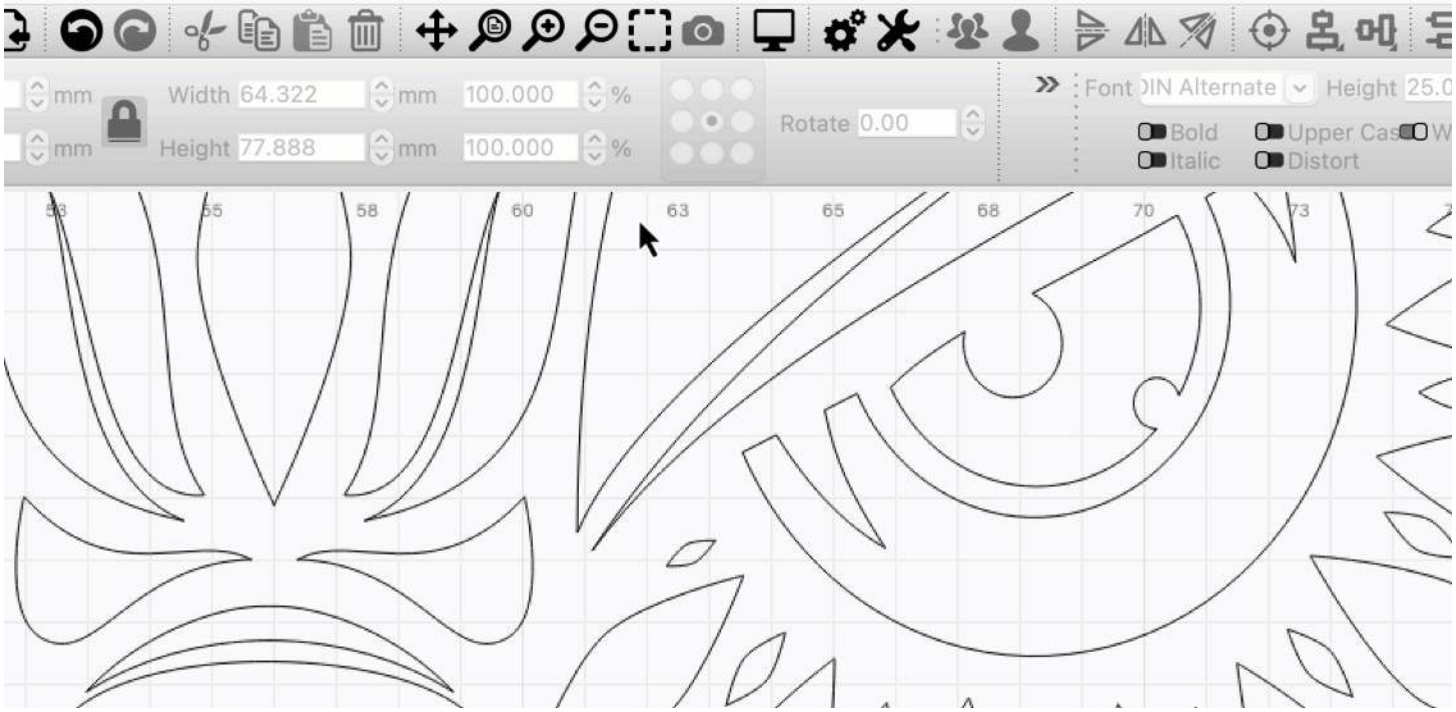
4.8.2 Panning

Panning allows you to move the area your screen is focused over, sliding the field of view between locations in your **Workspace**.

Just as with **Zooming**, there are a few ways to Pan:

- Click the Pan icon in the **Main Toolbar** to enable panning, then click and drag in your Workspace.
- Press and hold your mouse's middle scroll wheel, then move the mouse.
- If you're using a track pad, hold the Space key, then click and drag.

When you've enabled Panning mode using any of the above methods, you'll see the mouse cursor change to a hand . Select another tool, or press Esc to exit Panning mode.



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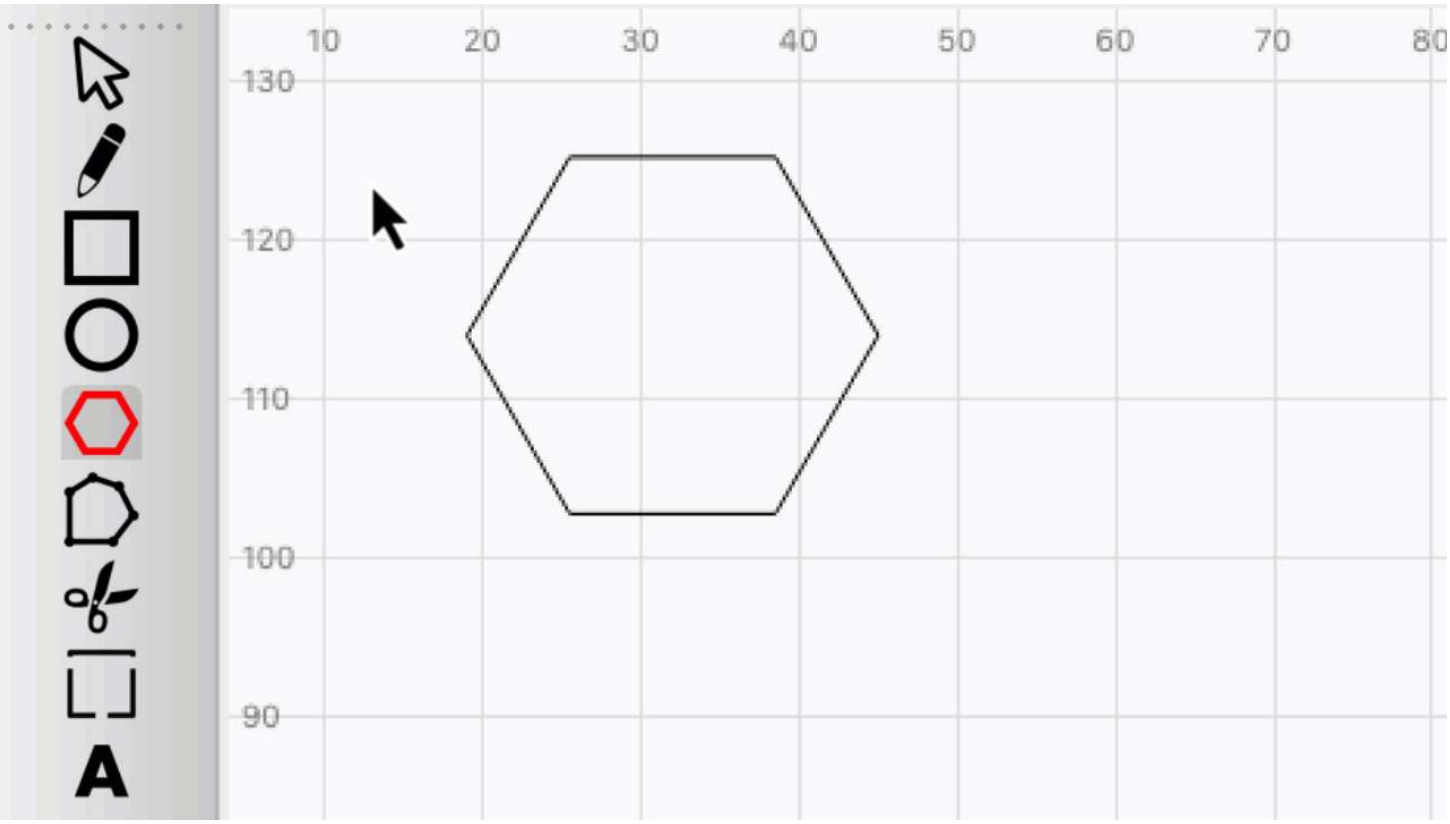
4.9 Selecting, Moving, and Sizing Artwork

Now that you you know how to get around the Workspace, you're ready to start selecting graphics and making modifications. LightBurn has lots of tools to do that, but we'll focus on a handful of options that you can't get by without.

4.9.1 Selecting

The Selection tool is active by default, but if you've been working with another tool, it will be inactive. To activate it, you can click on the cursor icon in the Creation Toolbar, or press the `⎋ Esc` key to close the other tool you were working with.

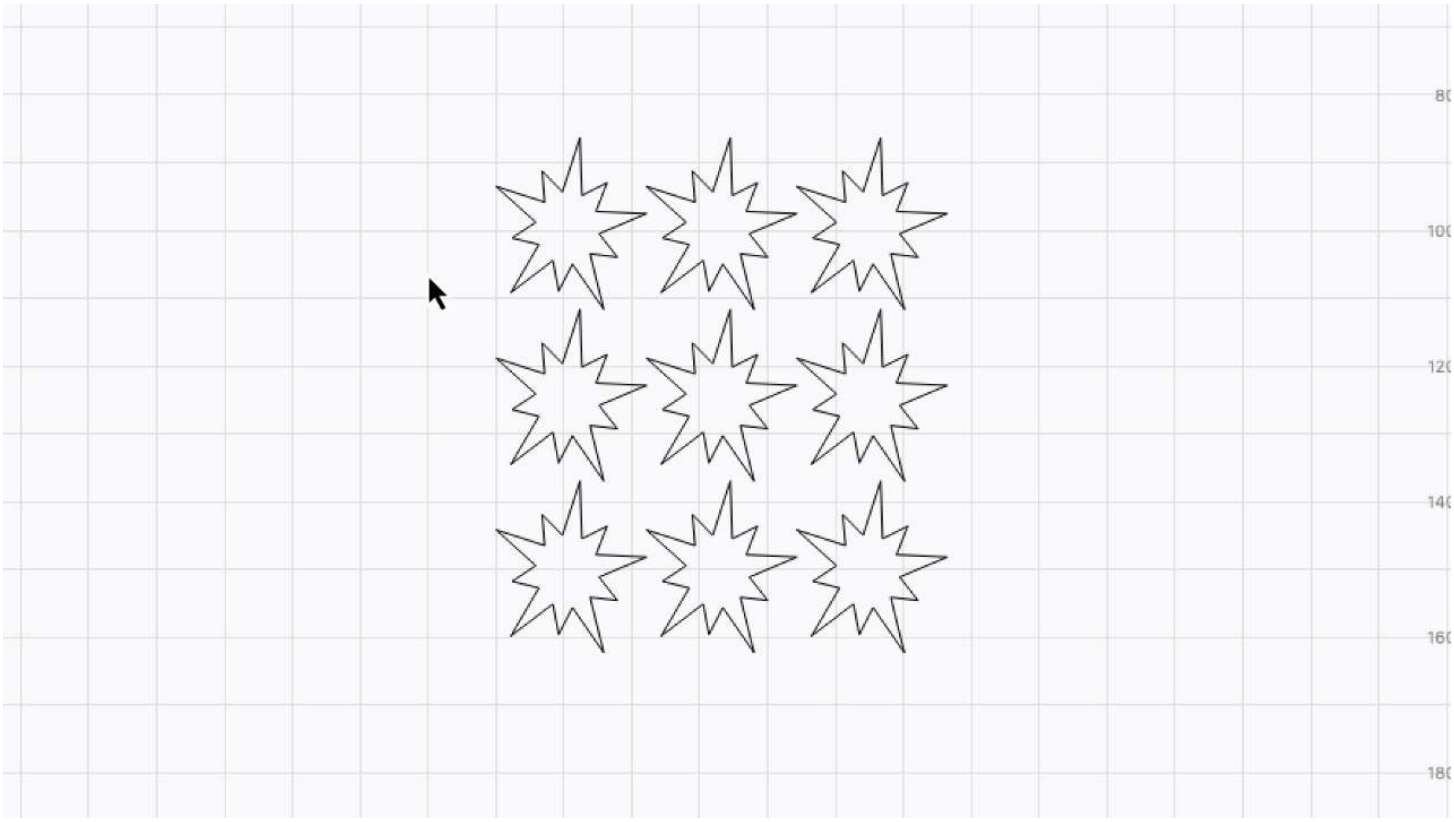
Once it's active, click any object in your **Workspace** to select it.



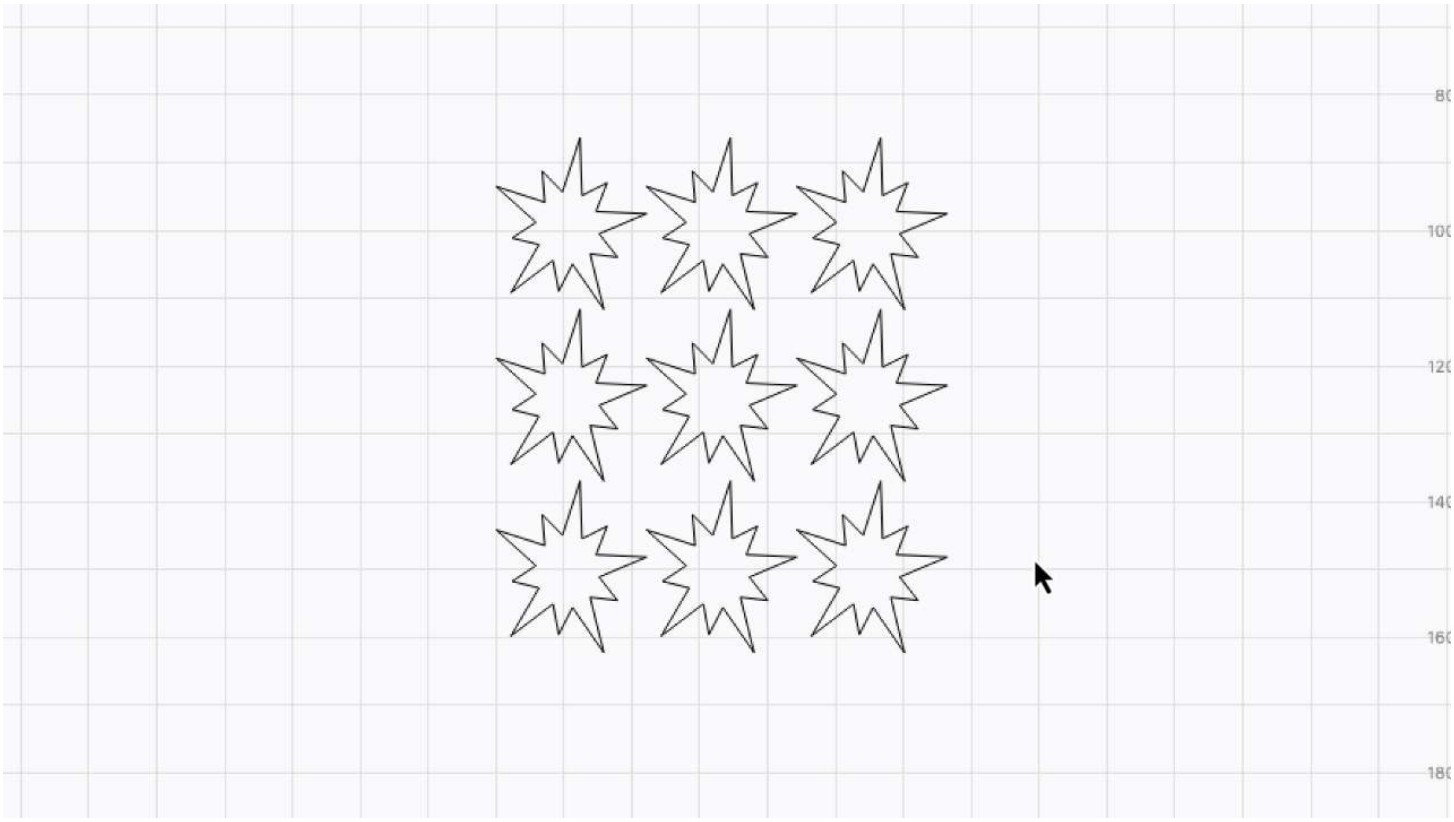
- If you already have an object selected, and want to add another, hold `⇧ Shift` while clicking the next object.
- Holding `^ Ctrl` / `⌘ Cmd` will toggle the selection status of any object, meaning that if it's currently selected it will be removed from your selection, and if it's currently *not* selected it will be added.

You can also click and drag to create boxes that will select objects, or add or remove objects from your selection, when combined with the above modifier keys. There are two types of selection boxes that work slightly differently.

Click, hold, and drag to the *right* to create a red **Enclosing Selection** box. Release to select all objects that are *fully contained* within the box.



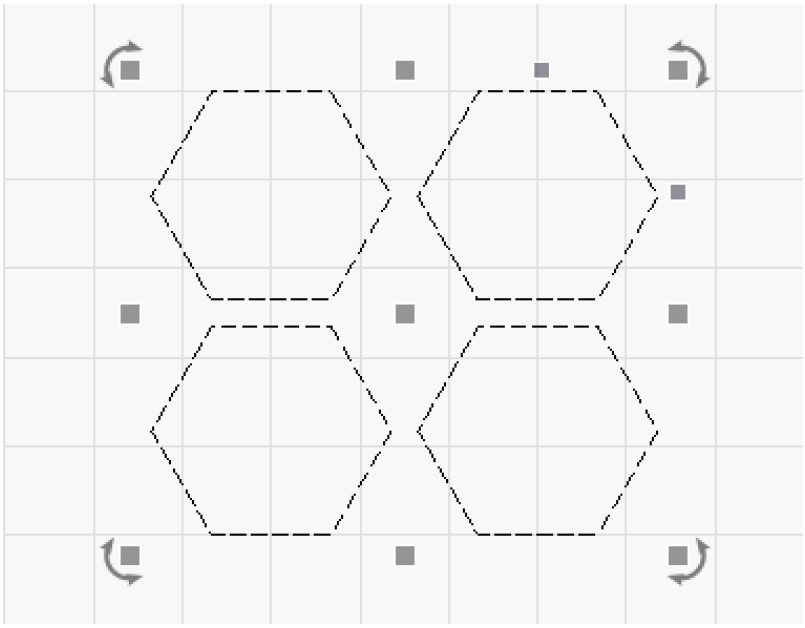
Click, hold, and drag to the *left* to create a green **Crossing Selection** box. Release to select all objects that are fully contained *or crossed by* the lines of the box.



4.9.2 Moving and Sizing

Once you've selected objects, you'll notice a few changes to their appearance.

Selected objects are drawn with an animated dash pattern instead of solid lines, and you'll see several gray *handles* appear on and around the perimeter of the selection area.

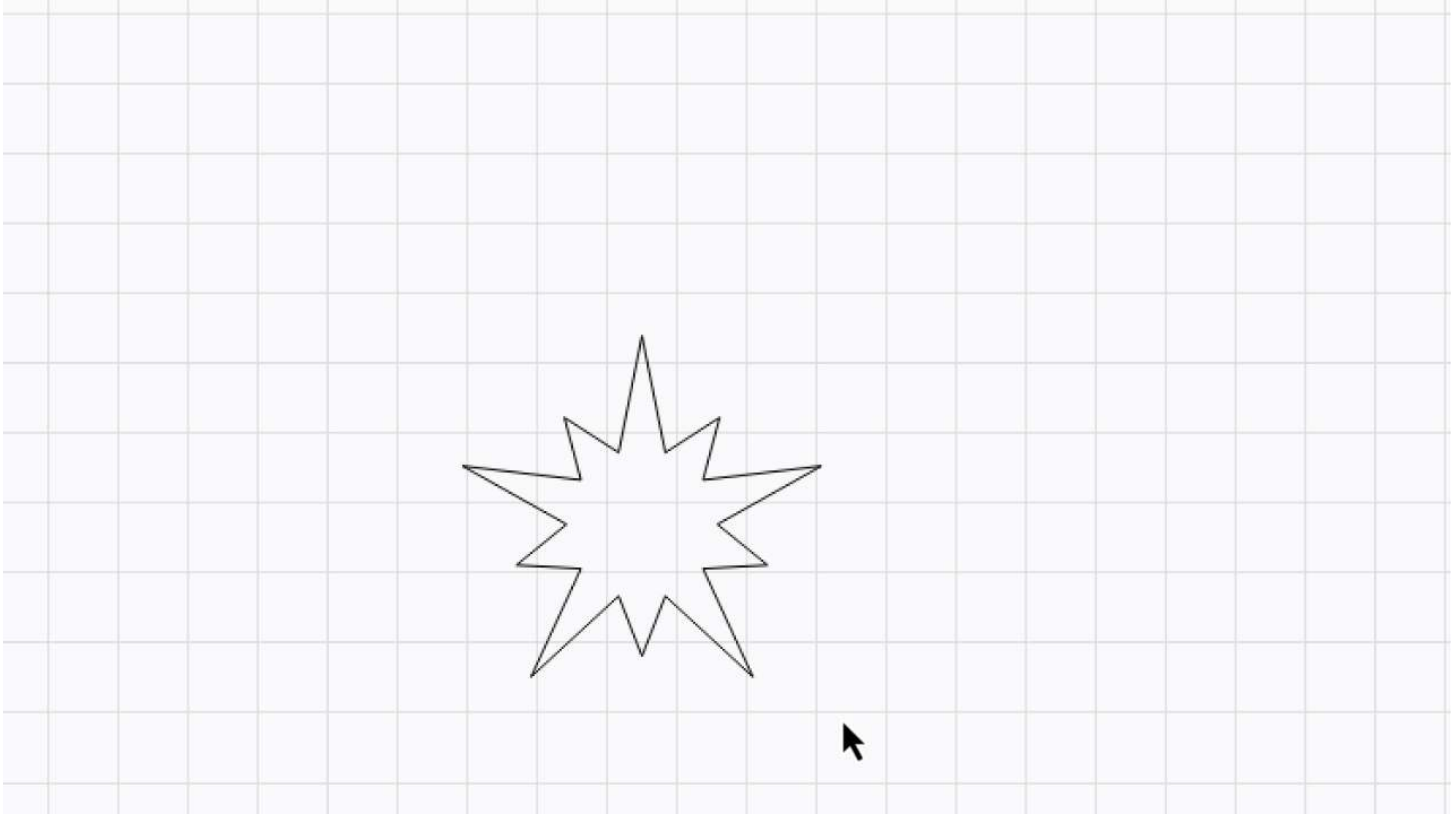


You can use these handles to move, rotate, and resize the selection.

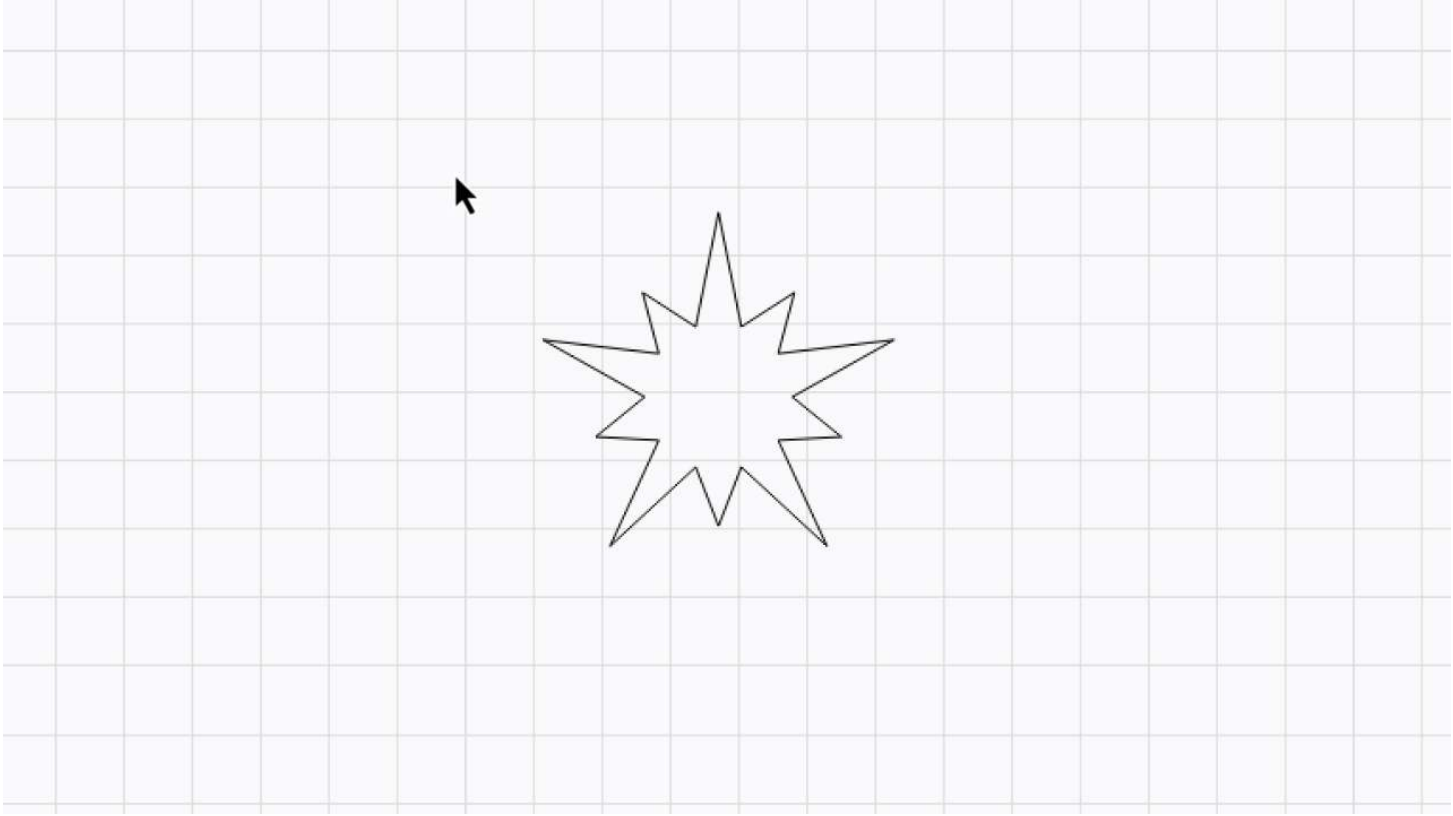
Click, hold, and drag the gray handle in the middle to move an object around.

Snapping

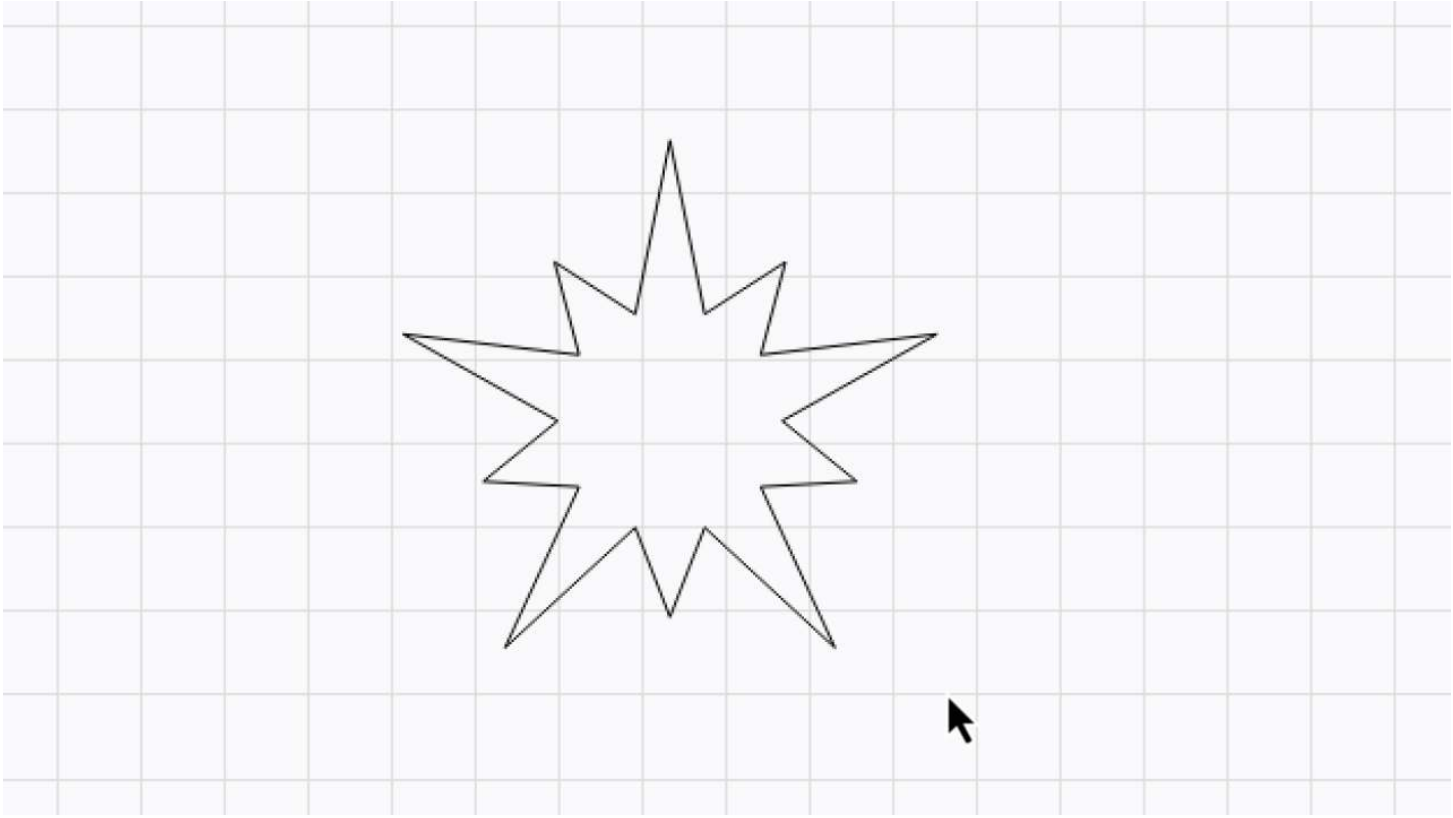
You can also click, hold, and drag over any line in your selection to move the selected objects from that location.



Click, hold, and drag any of the handles around the selection's perimeter to resize the selection. Drag outward to make it bigger, or inward to make it smaller — the handle on opposite the side of the selection from the one you clicked will be anchored in place, meaning the selection will be resized in toward, or out and away from, that point.



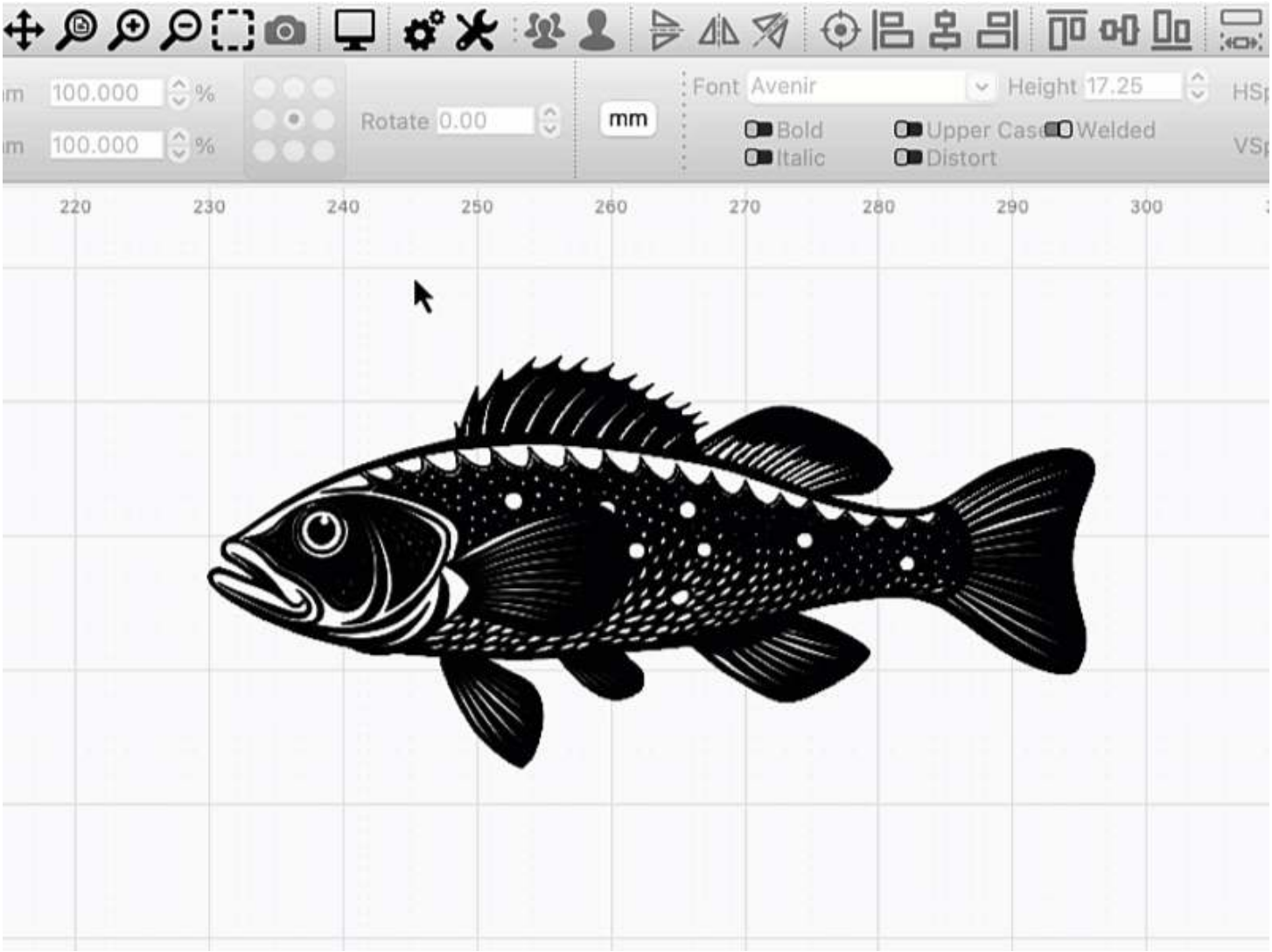
Click, hold, and drag any of the curved double arrow icons around the selection area's corners to rotate the selection.



4.9.3 Grouping

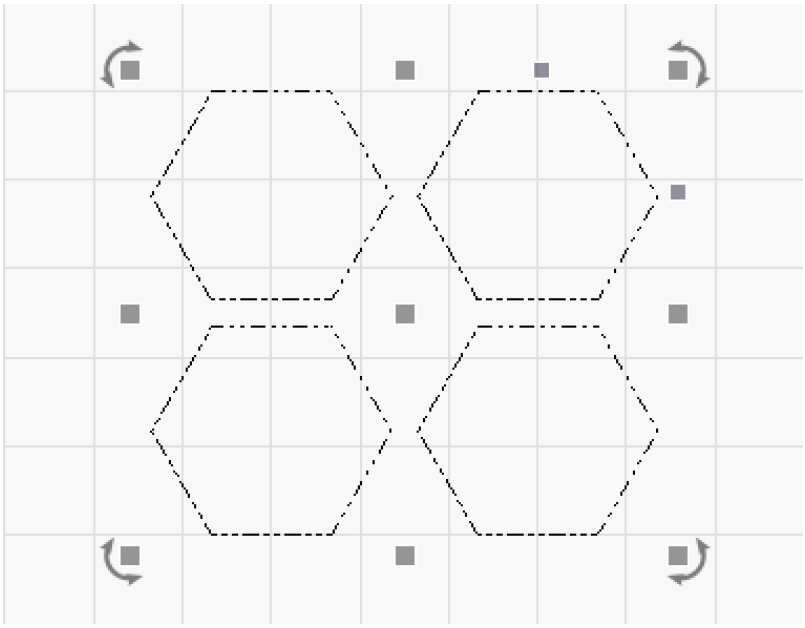
When you move and resize graphics, you'll sometimes want to make sure that certain collections of objects maintain their size and position relative to one another.

You can accomplish that using Grouping, which tells LightBurn to treat several objects as a single unit. To Group objects, first select them, then press the Grouping icon in the Main Toolbar, or `^ Ctrl` / `⌘ Cmd` + `G` on your keyboard.



To treat the objects as individual units again, press the **Ungrouping** icon or `^ Ctrl` / `⌘ Cmd` + `U`.

Grouping objects interferes with the ability to use some of the tools in LightBurn, so if you can't use a given a tool, it could be because you have Grouped objects in your selection. You can tell an object is Grouped when you select it by the animated dash pattern — instead of the normal dash pattern, you'll see a dot-dot-dash pattern.



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4.10 Colors and Layers

If you've worked with other design software in the past, a lot of what we've covered so far may have been pretty familiar to you — you might even have skipped a few pages. That's ok, we forgive you.

From here we get into the areas where LightBurn functions a bit differently from other design software, due to the nature of the end goal: getting graphics ready to be cut or engraved by a laser.

4.10.1 Colors and Layers

In LightBurn, different colors indicate each layer. Lasers don't print in color, so these colors don't represent the final product's colors but instead differentiate each operation needed to complete the job. Each layer defines a process and a collection of settings that is assigned to objects within the project.

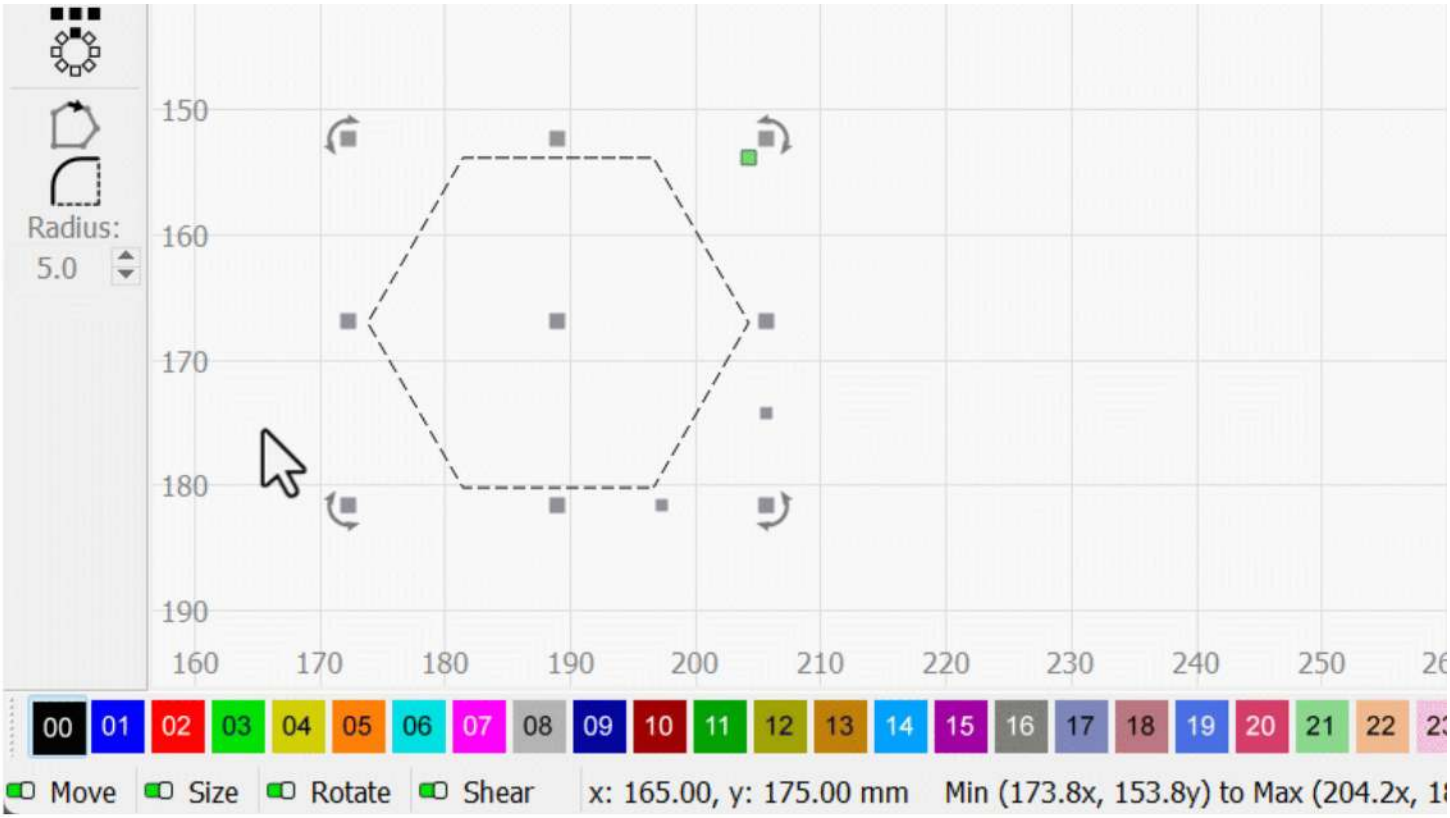
In other words, layers let you tell the machine what it needs to do to produce the final work.

> **Note**
>
> See Images vs. Vectors for more information on the differences between these types of graphics.

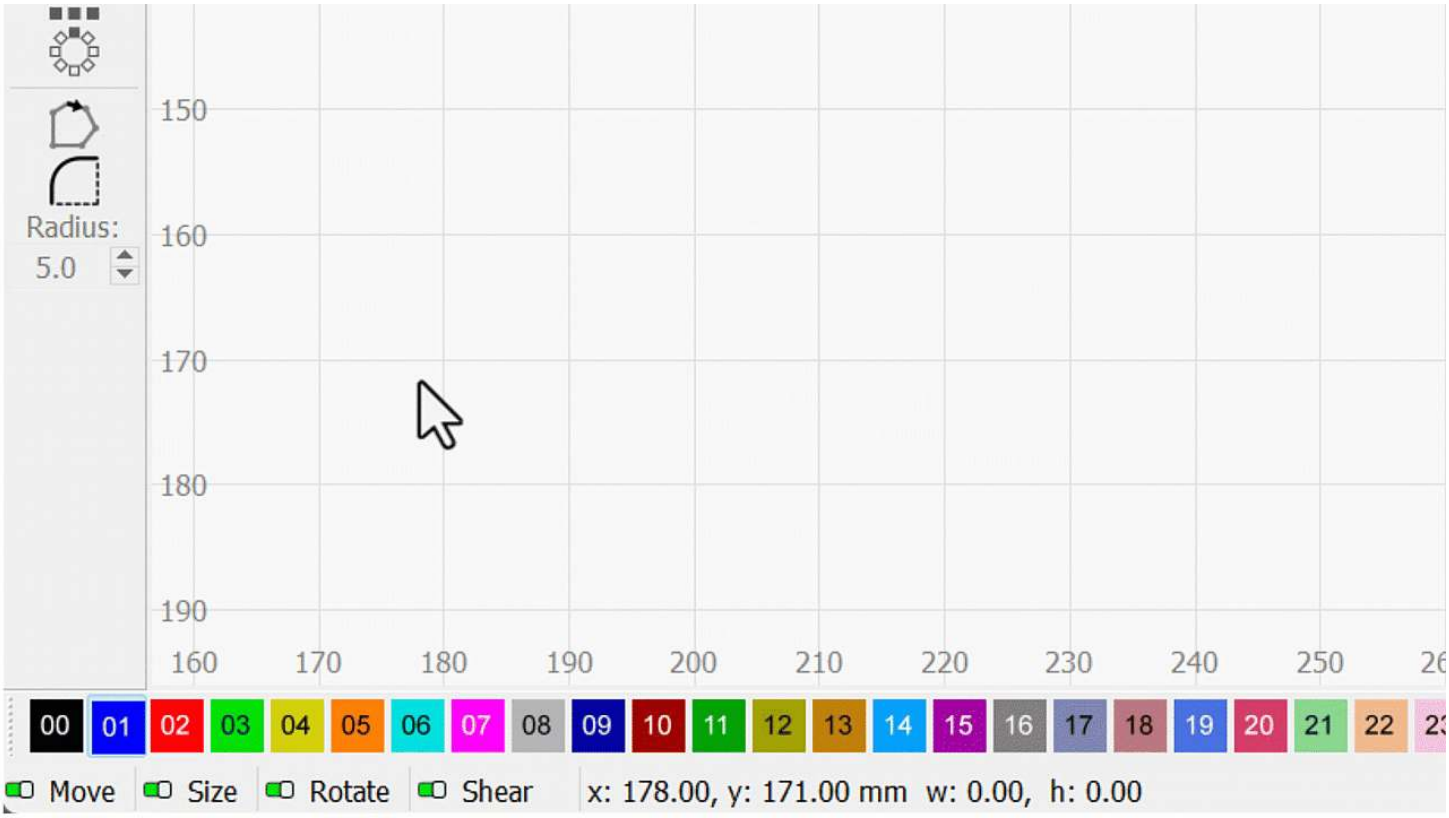
Generally, each color refers to a different layer, with one exception — if you add an image to a vector layer (or vice versa), then the layers will split to show two entries in the Cuts / Layers Window.

In all other cases, all graphics that share the same color/layer will be cut or engraved by your laser with the exact same settings.

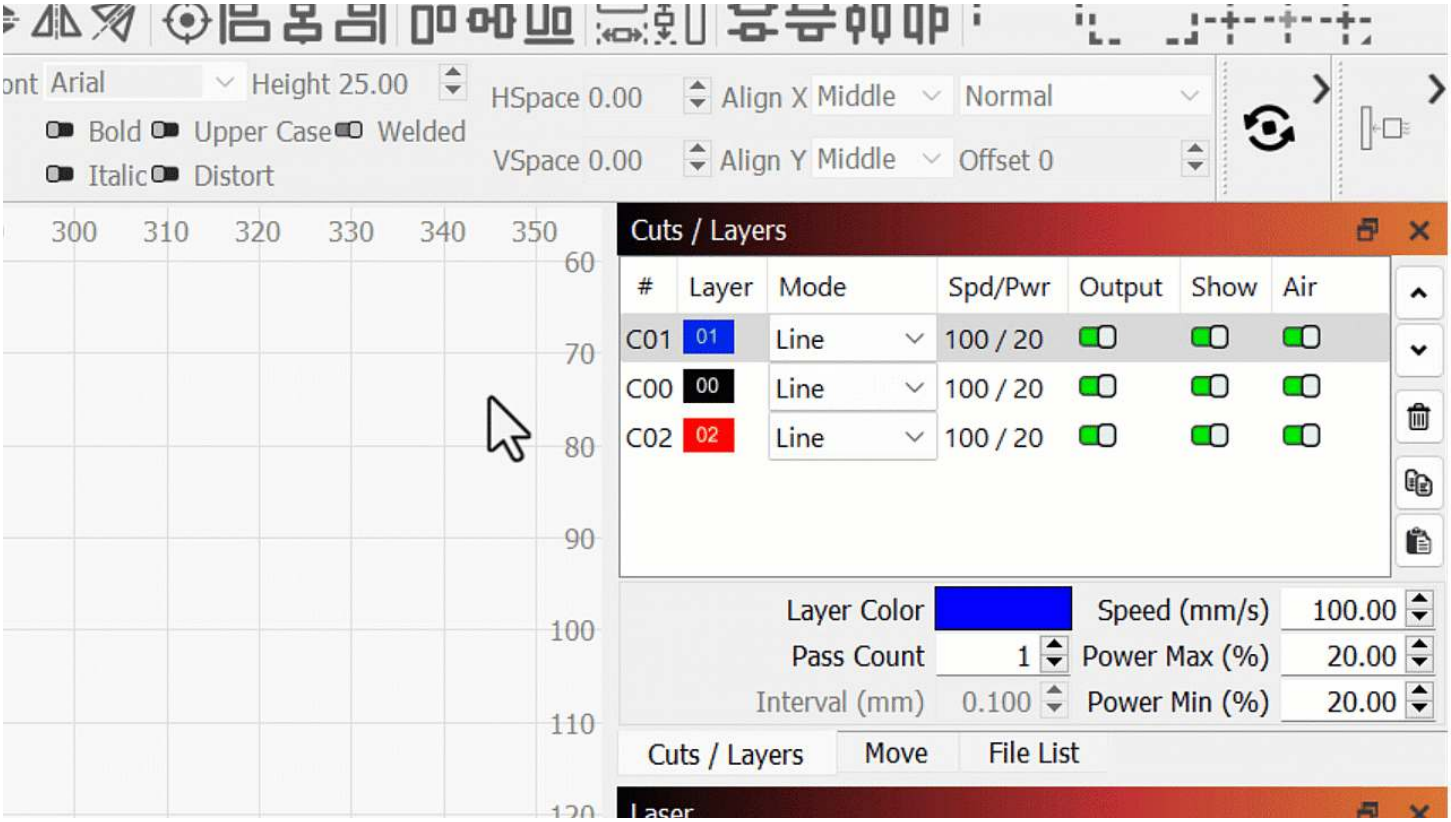
You can use the Color Palette at the bottom of the Main Window to assign colors/layers to graphics in your project. If you already have objects selected, clicking a color will set the selected objects to that color/layer:



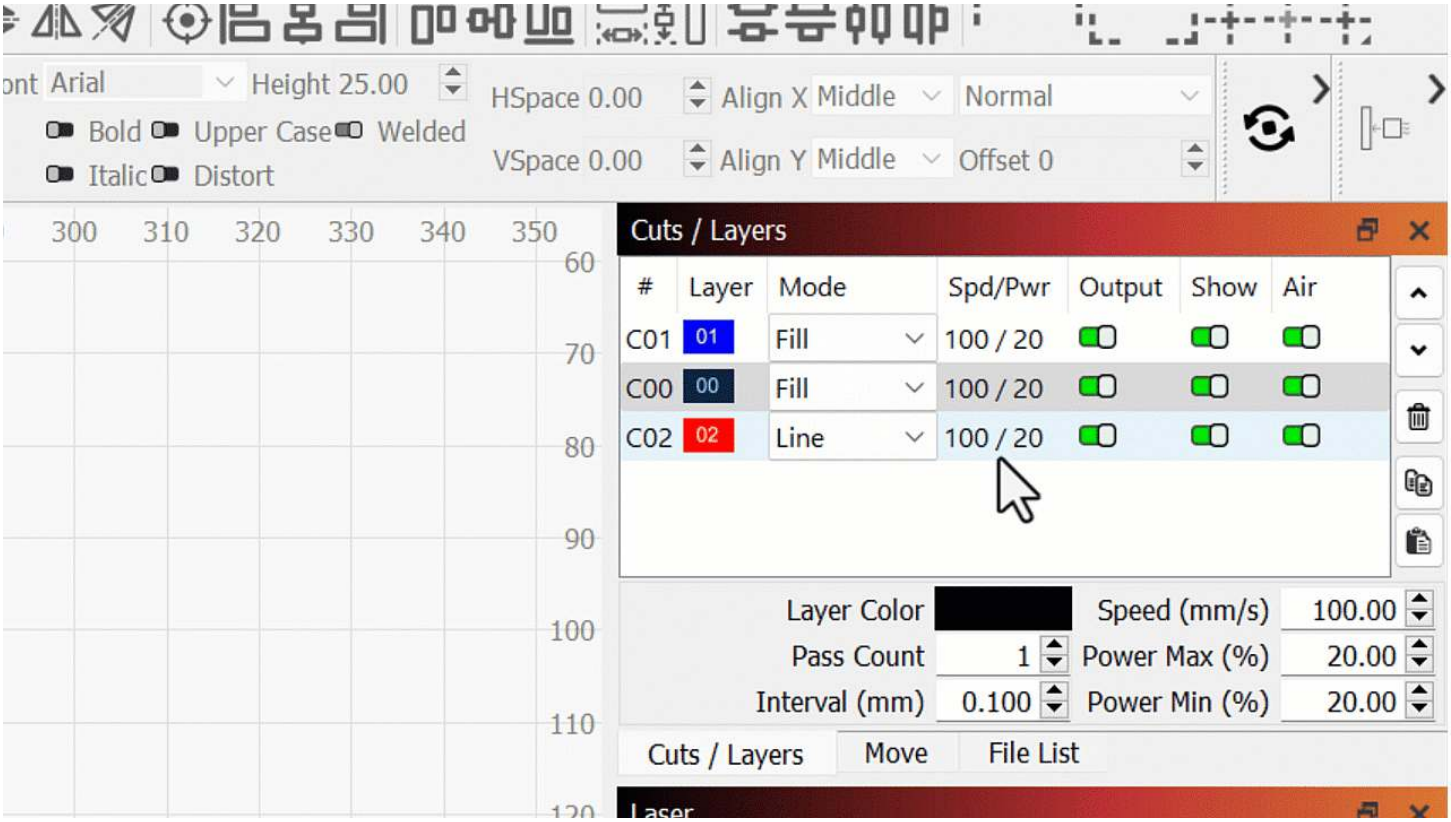
If you don't have any objects selected, clicking a color will determine the color/layer that subsequent new objects you create will be set to:



Once any graphic in your project has been assigned to a color/layer, you'll see that layer appear in the **Cuts / Layers Window**. You can use the drop down menu in the Cut / Layers Window to set the mode of given layer:



By default, operations are performed by your laser according to the order of the layers in the Cuts / Layers Windows. Click and drag a layer or use the arrow button on the side to change the layers' order:



4.10.2 Layer Modes

Note

By default, all vector graphics in LightBurn appear as outlines only, regardless of the type of layer mode they're assigned to. You can change the appearance of graphics set to Fill and Offset Mode by turning on a Filled View Style — we have more information on that below.

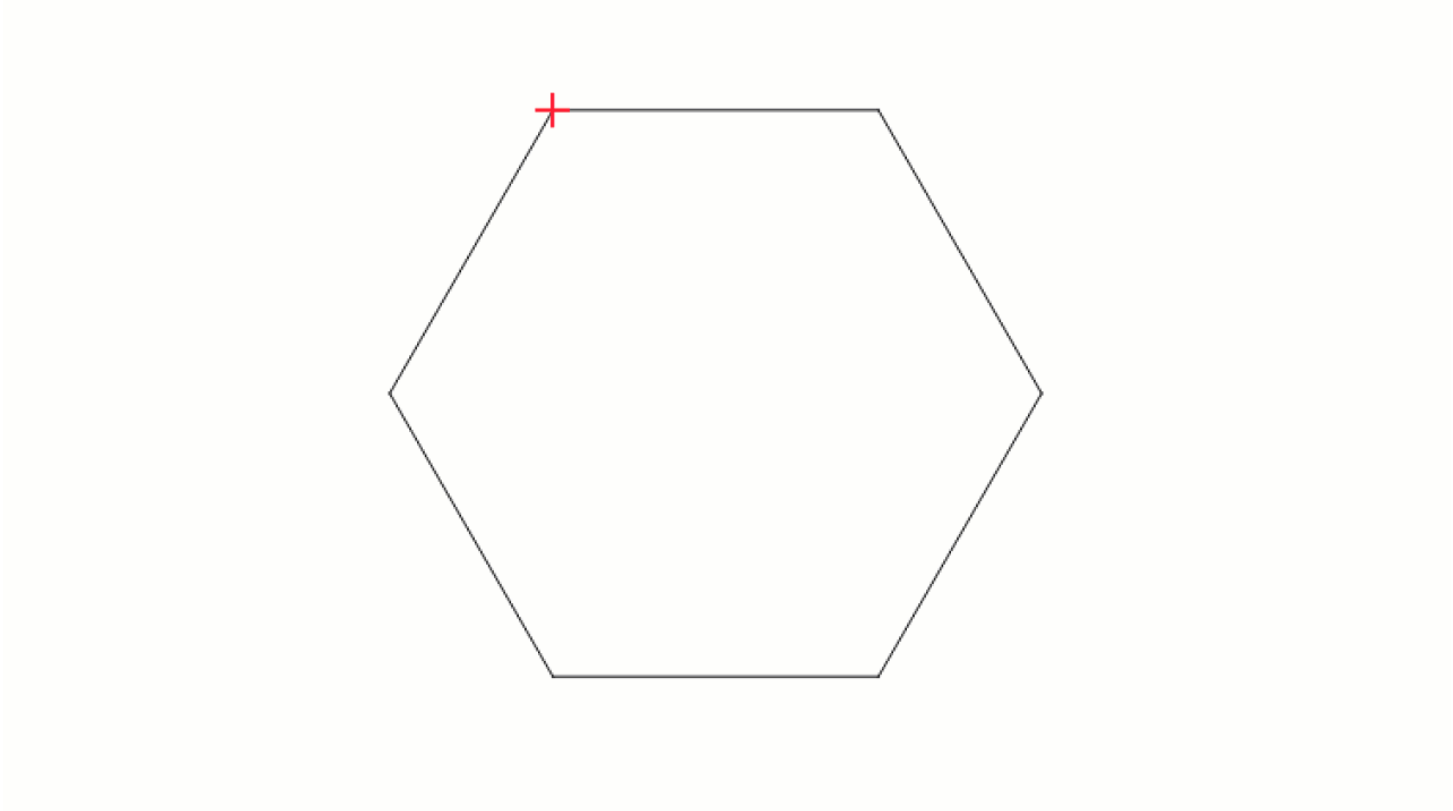
There are four layer modes in LightBurn. You can assign vector graphics — shapes made of lines, curves, and points — to layers set to Line Mode, Fill Mode, or Offset Fill Mode. Image graphics — pictures made up of pixels, or tiny blocks of color in a grid — can only be assigned to Image Mode layers.

Offset Fill Mode is meant for very specific and relatively uncommon use-cases, and Image Mode is a complex topic, best left for after you've gotten the hang of lasering-basics.

We'll focus on the two most commonly-used types of layer modes for the rest of this walkthrough: Line Mode and Fill Mode.

Line Mode

Line Mode tells your laser to trace a path around the contours of vector graphics.

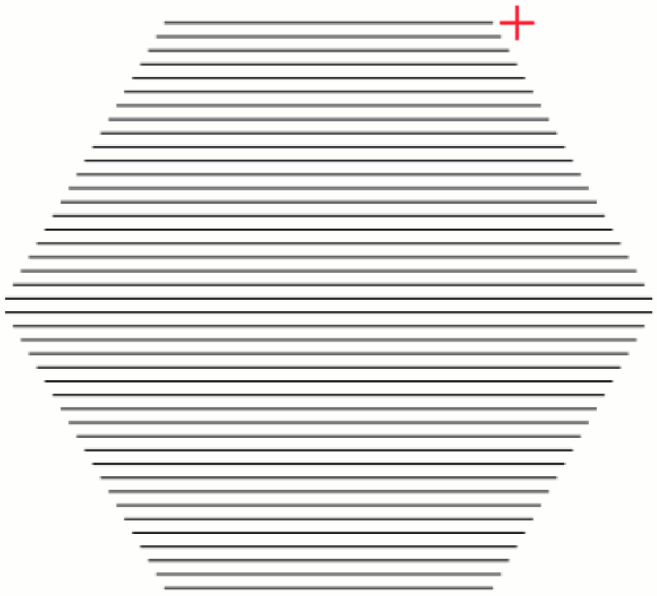


Line Mode is the most straightforward mode for new users to understand, because the output from your laser is the same as the outlines you see in your LightBurn Workspace.

The darkness of a Line Mode engraving or the depth of the cut it achieves depends on your cut settings, which we'll return to on the next page.

Fill Mode

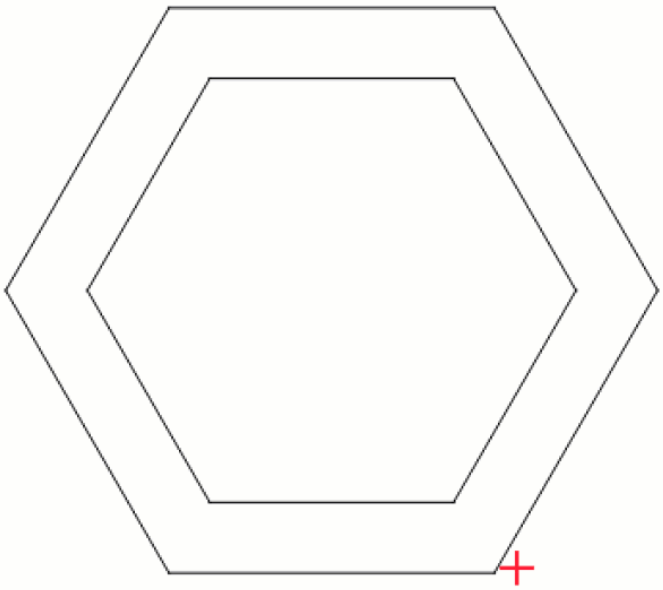
Fill Mode tells your laser to etch parallel lines within the boundaries of vector graphics.



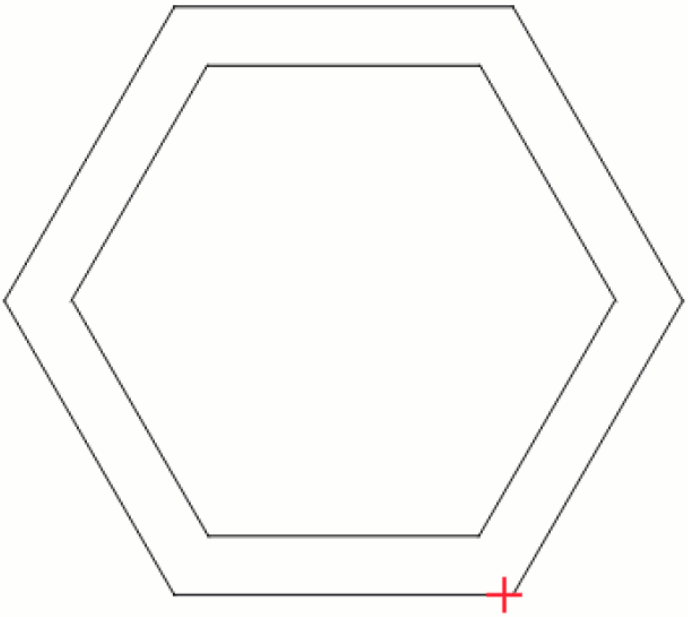
The darkness and depth of a Fill Mode engraving also depend on your cut settings, though not in exactly the same way as **Line Mode**. More on that later.

Fill Mode is a bit more complicated in other ways as well — graphics interact with one another differently depending on whether they are set to the *same* or *different* layers.

For instance, if you have two shapes set to the *same* layer, and one is inside of the other, the area *between* the two outlines will be filled.



If those same two shapes are set to *different* layers, the *entirety* of the outer shape and the *entirety* of the inner shape will both be engraved, meaning the area within the inner shape will be engraved *twice*.



This difference in logic may not be what you're expecting if you come from other design software, where parts of layers can be hidden behind others, and not appear in the final outcome.

The same logic holds true when shapes only partially overlap — if the shapes are assigned to the *same* Fill Mode layer, the area where they overlap will *not be engraved*. If they are set to *different* Fill Mode layers, the area where they overlap will be *engraved twice*.

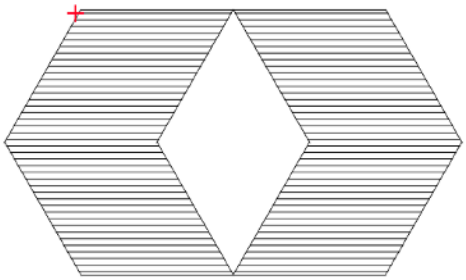


Figure 1: Partially overlapping shapes set to the same layer

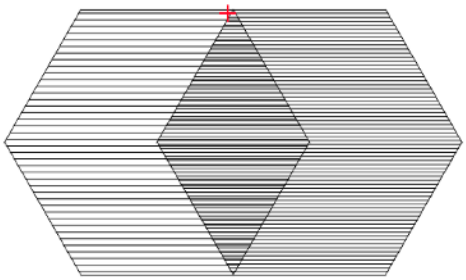


Figure 1: Partially overlapping shapes set to different layers

In most cases (but not all!) you probably do not want these overlapping areas engraved twice, so always keep this in mind as you're creating and modifying designs.

Open vs. Closed Shapes

LightBurn must determine an inside and outside of all shapes in order to know what to tell your laser to fill. That means that all shapes you assign to Fill Mode must be *closed*, meaning they're made up of complete, continuous loops whose start and end points are the same. When a shape's start and end points are different, it is *open*.

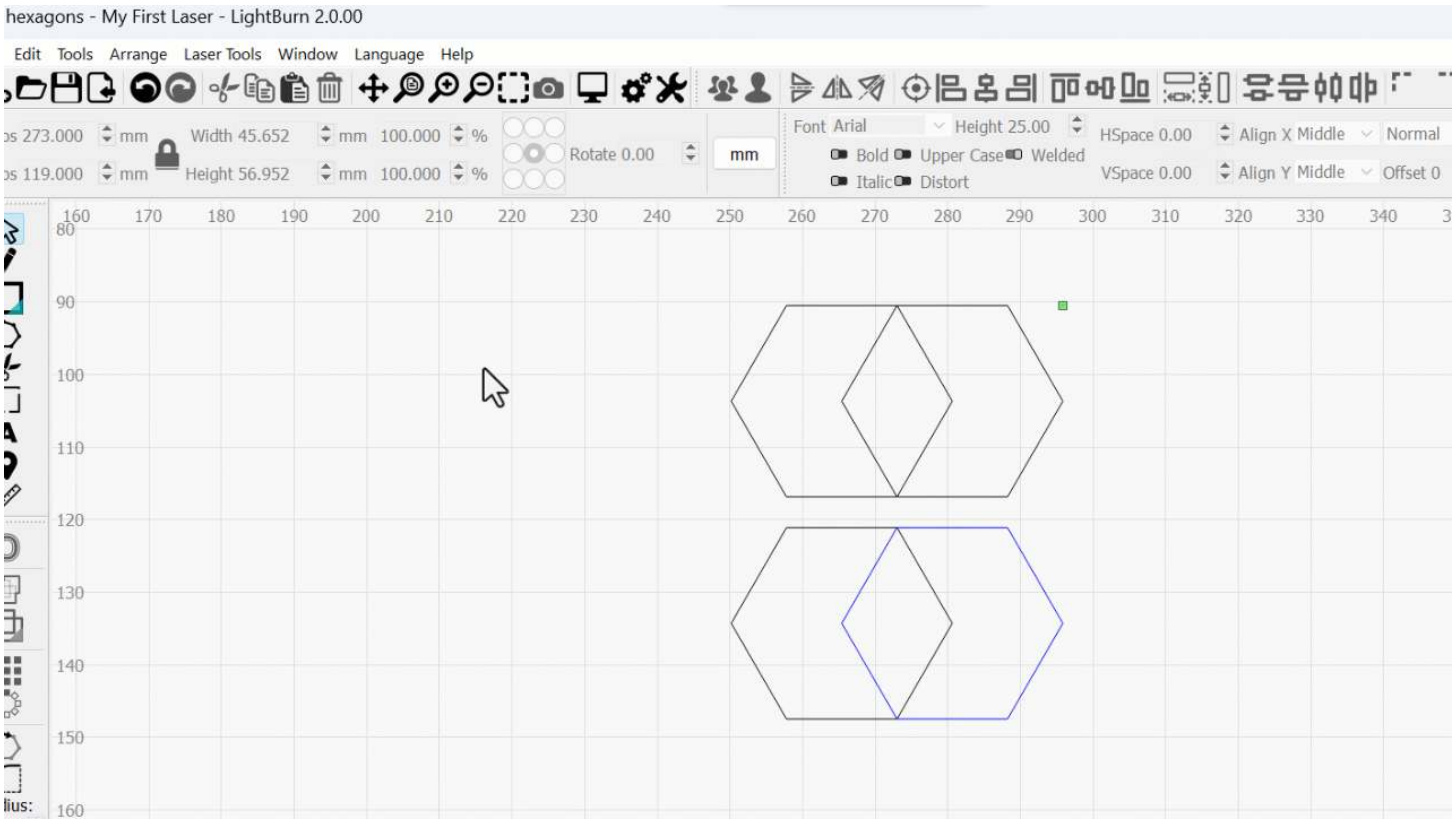
Several other features in LightBurn require closed shapes in order to work. See Open vs. Closed Shapes for more information.

4.10.3 View Style

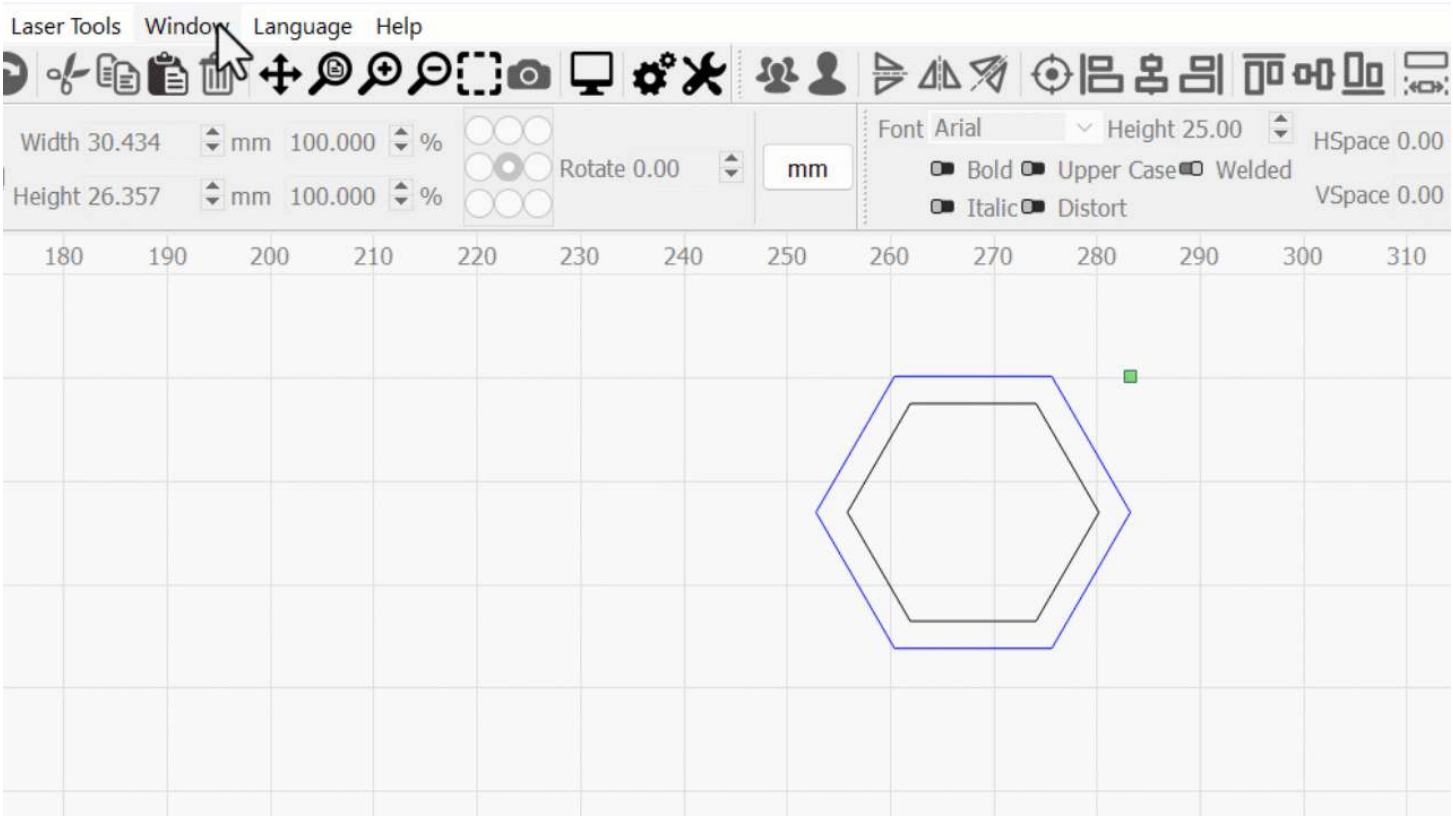
You can change LightBurn's default **View Style** from a **Wireframe** mode to a **Filled** mode to check that your **Fill Mode** layers are arranged properly as you work.

In order for graphics set to a Fill Mode layer to appear filled in your Workspace, go to Window → **Filled / Coarse** (or **Filled / Smooth**), or press `⎇ Alt` / `⌥ Option` + `⇧ Shift` + `W` on your keyboard.

Select **Wireframe / Coarse** or **Wireframe / Smooth** from the same menu, or use the same keyboard shortcut again, to switch back to Wireframe mode.



There is a drawback to using a Filled View Style — while it's helpful for checking on the relationship of graphics set to the *same* Fill Mode layer, if your graphics are set to *different* layers, they can end up hidden behind one another — but they'll still be sent to your laser.



For that reason, it's best never to rely on the appearance of graphics in your Workspace alone, and always check the Preview window. We used the Preview window to make many of the examples shown above, and we'll explain how to use it in more detail later on.

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4.11 Cut Settings

Cut settings are a big topic, and we need to begin with an important caveat: the exact settings required to achieve good engravings, or to cut through material, are highly dependent on your type of laser.

We'll provide some rough guidelines on the relationships between different settings, but the specific settings shown in our examples are not necessarily appropriate for your machine and material. Consult your laser's manufacturer for recommendations directly tailored to your machine.

Always pay attention to units of distance and time when entering Speed settings

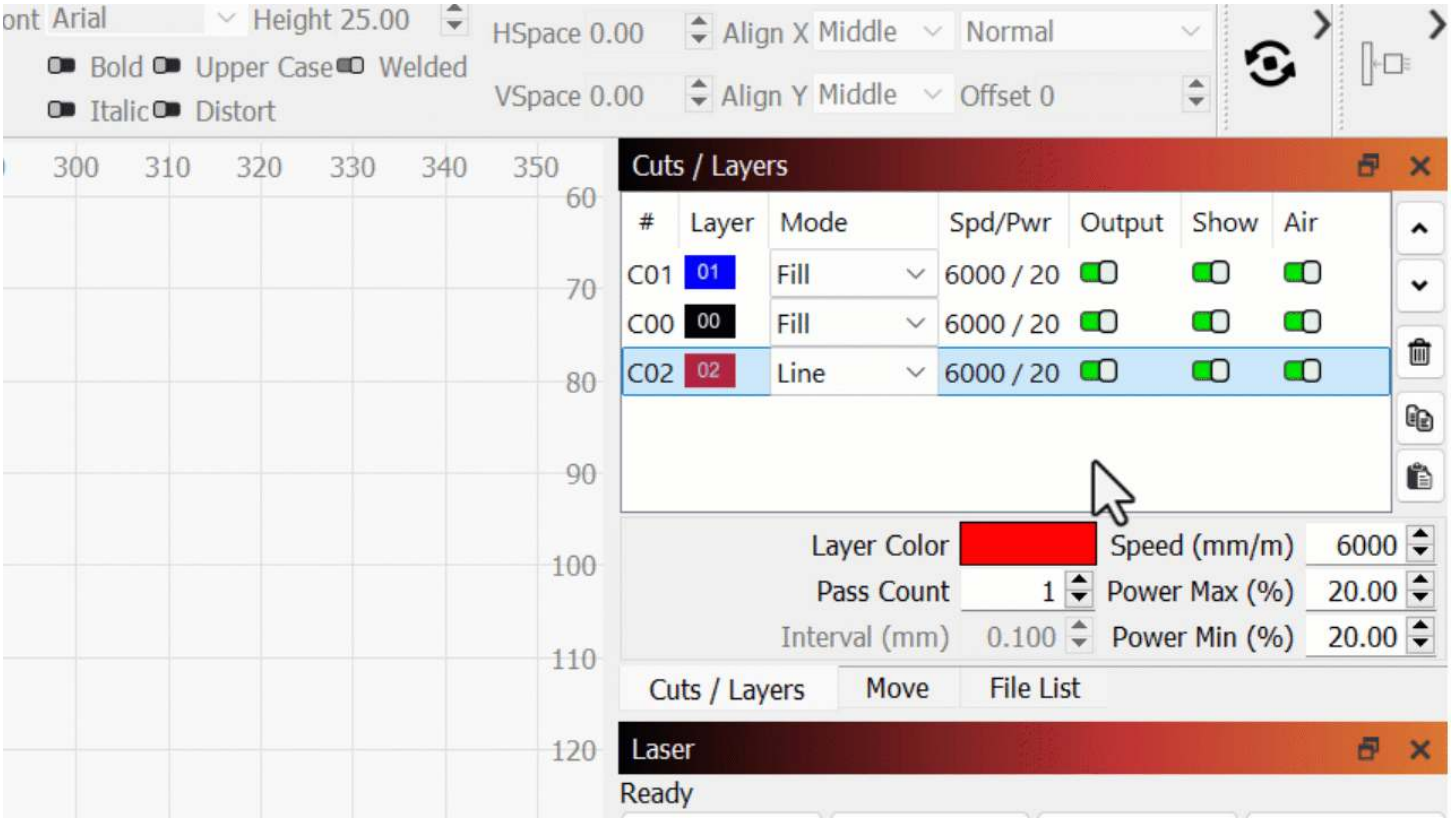
When entering **Speed** values recommended by your laser's manufacturer or other LightBurn users, make sure to use the *same units of distance and time as those from the recommendation*, or to convert the values to your preferred units.

A given number of **millimeters per second** is *much* faster than that same number in **millimeters per minute**. Mixing up units can lead to reduction in power output due to unexpectedly high speeds, or excessive power output — and even fire — due to unexpectedly slow speeds.

Change your units of speed in the **Dimensions / Units** tab of the **Device Settings** window. LightBurn automatically converts any existing values when you switch between units.

4.11.1 Essential Settings

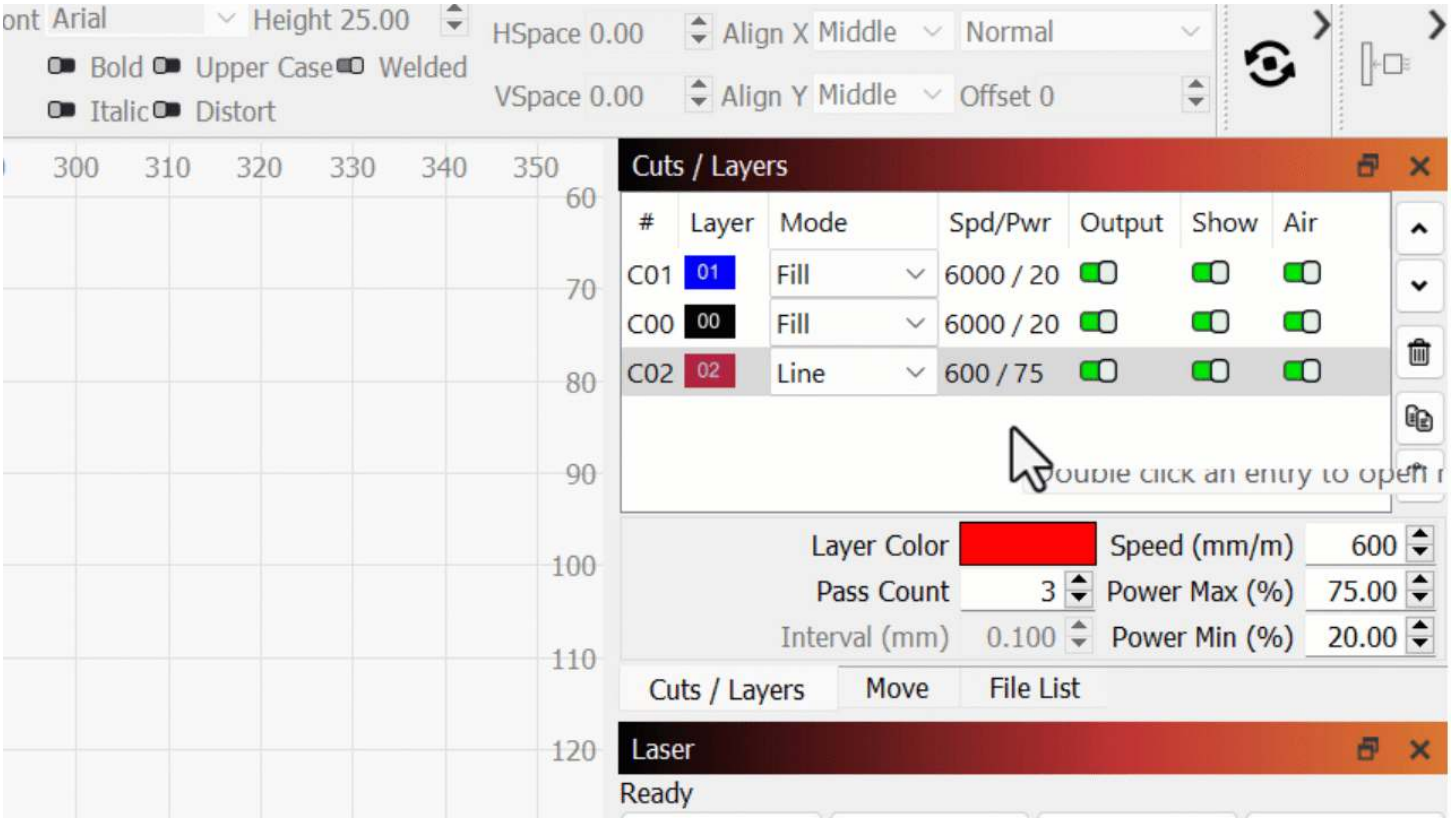
The most important settings for layers set to Line or Fill Mode are accessible directly in the Cuts / Layers Window. Click in any of the fields to adjust a given setting:



Tip

Double-click in a field to select and overwrite current settings.

You can also double-click any layer in the Cuts / Layers Window to access the Cut Settings Editor. You'll see the same essential settings that are available in the Cuts / Layers Window in the Cut Settings Editor, along with several more advanced settings. For now you can ignore the more advanced settings — we just want you to know they're there for down the road.



Output, Show, and Air

You'll see three switches next to each layer in the **Cuts / Layers Window** — turning them on or off changes the behavior of those layers in different ways.

- The **Output** switch controls whether a given layer is sent to your laser when you start a job. In other words, if you turn Output off, none of the graphics on that layer will be cut or engraved by your laser.
- Disabling **Show** hides all the shapes assigned to that layer in your **Workspace**. Hiding shapes like this is sometimes helpful while you're designing, but be careful, hiding a layer isn't the same as turning off the Output switch — it'll still be sent to your laser when you start a job.
- Enabling the **Air** switch tells LightBurn to signal your laser to turn on an air assist, when it begins cutting or engraving a given layer. Disabling it tells LightBurn not to send the signal for that layer.

  Air assists blow air onto the surface of your material at the spot where the laser's beam strikes, which can help prevent soot accumulation and charring, and aid in cutting.

> **Note**
>
> Many lasers do not come with air assists, and others have manual air assists that you can't trigger through software. In those cases, toggling the Air switch will have no effect either way. If you have a Galvo laser, you won't see the Air switch at all.
>
> Consult your laser's manufacturer if you're not sure if your laser has a built-in air assist.

4.11.2 Line Mode

For **Line Mode**, when you're just starting out you only need to worry about a few settings: **Speed**, **Power**, and **Passes**. As a general guideline, relatively slow speeds and relatively high powers produce the darkest burns.

If you command the laser to move quickly, or with low Power, it will likely just etch the surface (sometimes called scoring). If you move slowly and with high power, especially with a CO_2 laser, the laser will cut deeper, or even completely through the material. The only difference between surface marking and cutting with Line Mode is the Power and Speed you set.

If you have a high-powered laser, it should be able to cut through many types of materials with a single Pass, but if you have a relatively low-powered laser, you may need to set multiple Passes to achieve a clean cut. The exact number depends on your machine and material.

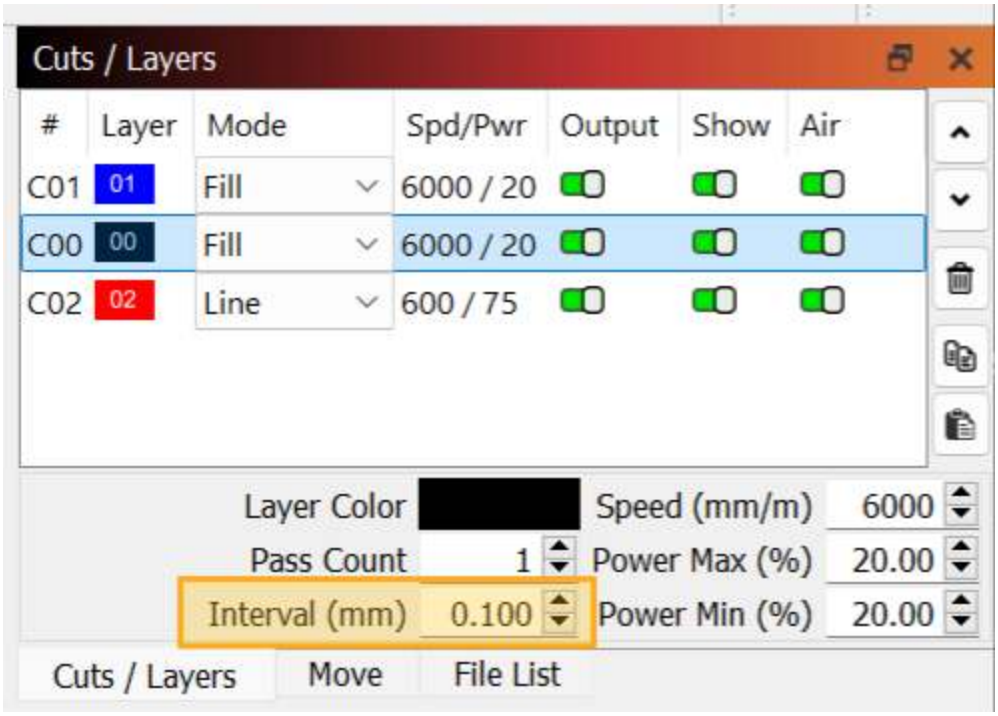
> **Note**
>
> Not all lasers are capable of cutting through all or even *any* materials. Consult your laser's manufacturer for information on your laser's maximum cutting capability.

4.11.3 Fill Mode

For **Fill Mode**, the darkness and depth of an engraving is also determined by the **Speed** and **Power** settings, and follows the same principle: relatively slow speeds and high powers tend to produce the darkest, deepest etches.

But there's another crucial setting for layers set to Fill Mode — **Line Interval**. The Interval setting determines the distance between the parallel lines your laser scans as it engraves your graphics. Smaller Line Intervals lead to lines that are closer together. As a rule, you want the scan lines to be as close together as possible without overlapping (which can lead to overburning).

The necessary Line Interval for optimal results depends on your laser and the material you're engraving, but LightBurn's default value of **.100** is a reasonable starting point for most lasers and materials.



Material Testing

While we've noted that manufacturer recommendations are the best place to begin looking for cut settings, LightBurn also has a built-in Material Test that you can use to test different combinations of **Speed**, **Power**, **Passes**, **Line Interval**, and other settings. The Material Test works by automatically setting up a grid of boxes that will be cut or engraved at a range of different settings.

For more information, check out our guide on completing your First Material Test before starting the First Project at the end of this walkthrough.

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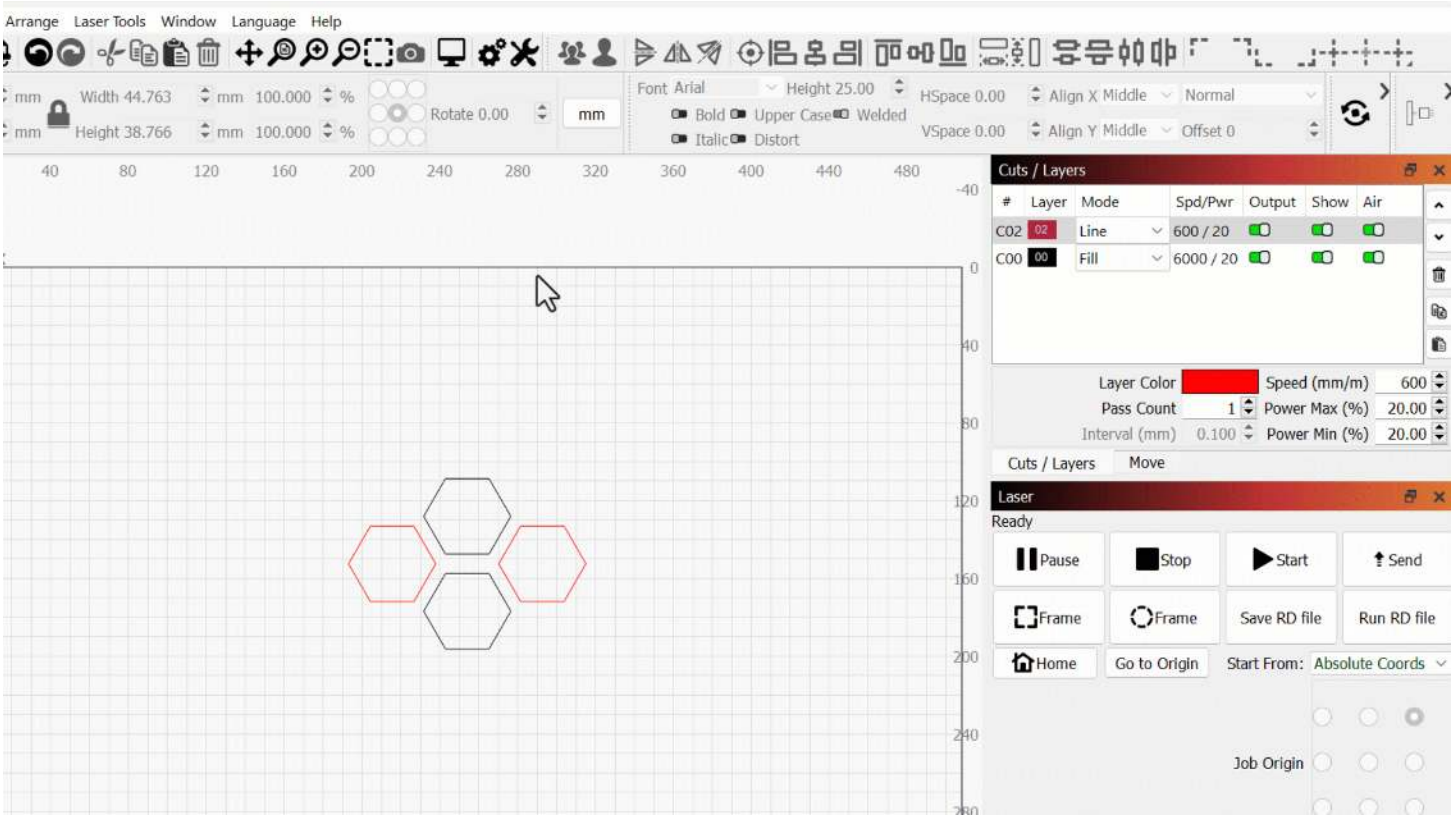
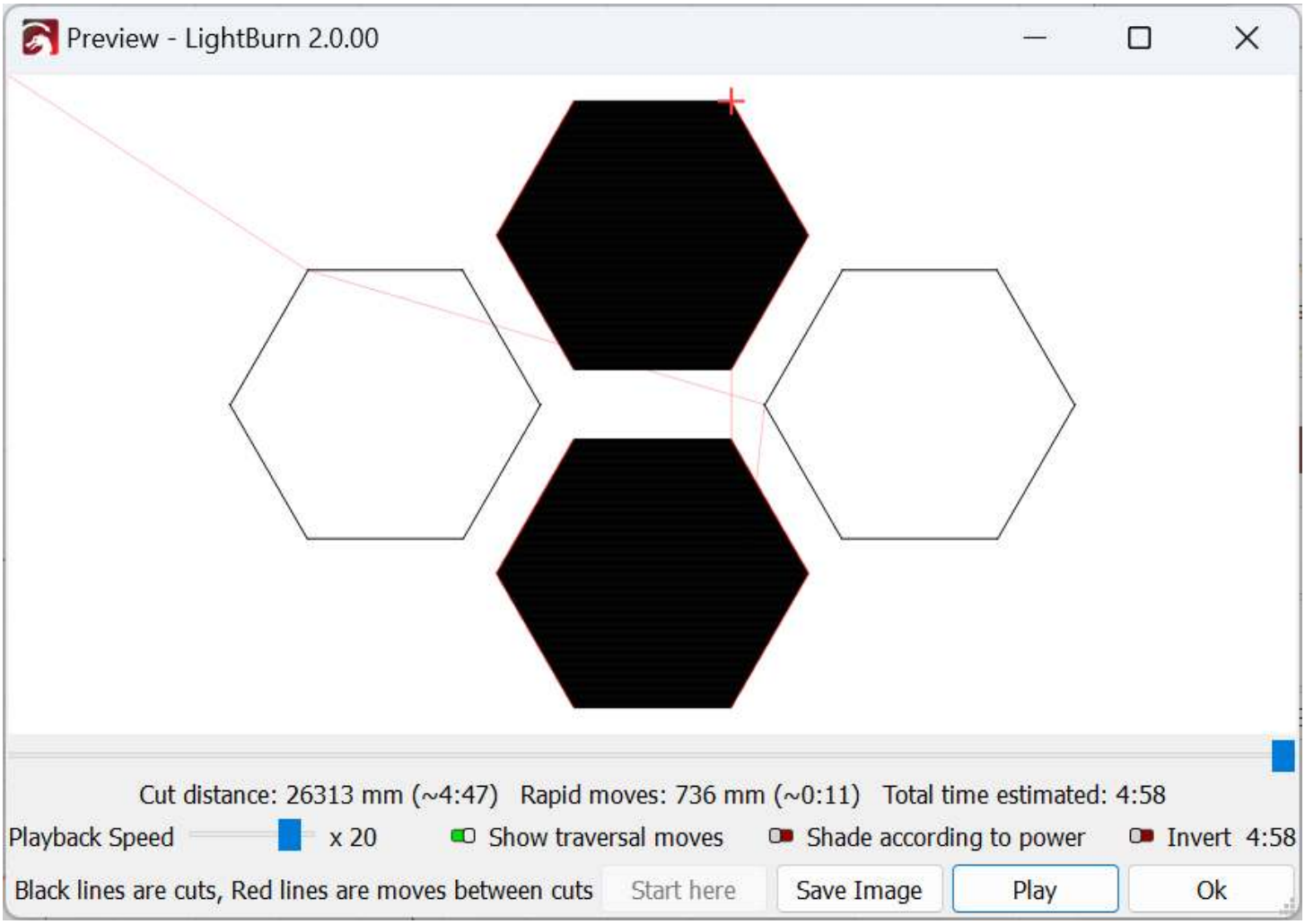
4.12 Previewing

Because it can be difficult even for experienced users to keep track of which layers are set to which mode, and whether all of their cut settings are in order, we strongly recommend previewing every project, before sending it to your laser.

To open the Preview window, go to Window → **Preview**, click the Preview icon in the Main Toolbar, or press `⎇ Alt` / `⌥ Option` + `P`.



4.12.1 Understanding the Preview Window



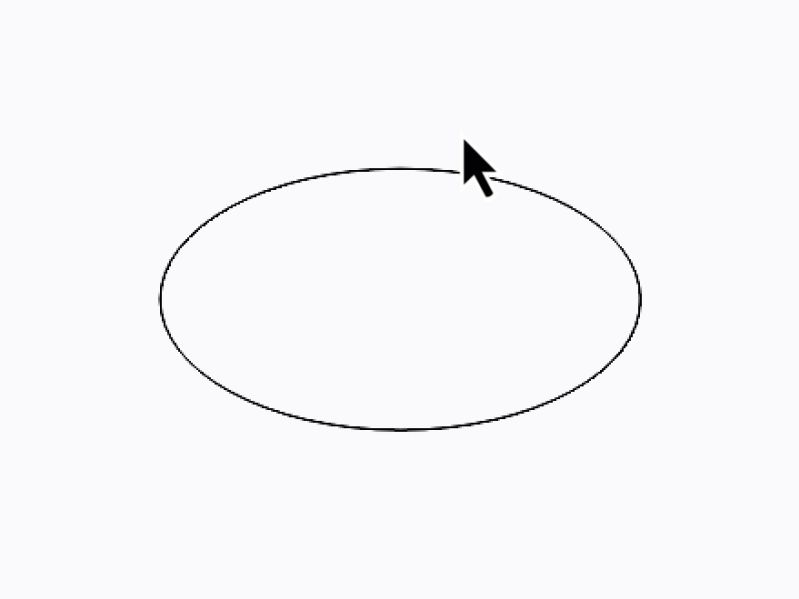
When you first open the **Preview** window, you'll see a still image of the final result of your project — the contours to be scored or cut by Line Mode will be indicated by black lines, and the areas to be etched or engraved by Fill Mode will be shown as solid black areas, or, if your **Line Interval** is relatively large (or you zoom in close enough) as parallel lines running across the filled shapes.

You'll also see red lines — these lines indicate the path your laser will travel while *not* firing. You can toggle **Show traversal moves** at the bottom of the Preview window to switch between showing these moves or not.

If what you see here doesn't align with your expectations, you've got some editing to do. Make sure all of your shapes are set to the correct layers, and those layers are set to the correct modes. If you're working with layers set to Fill Mode, make sure they're overlapping only as you intend.

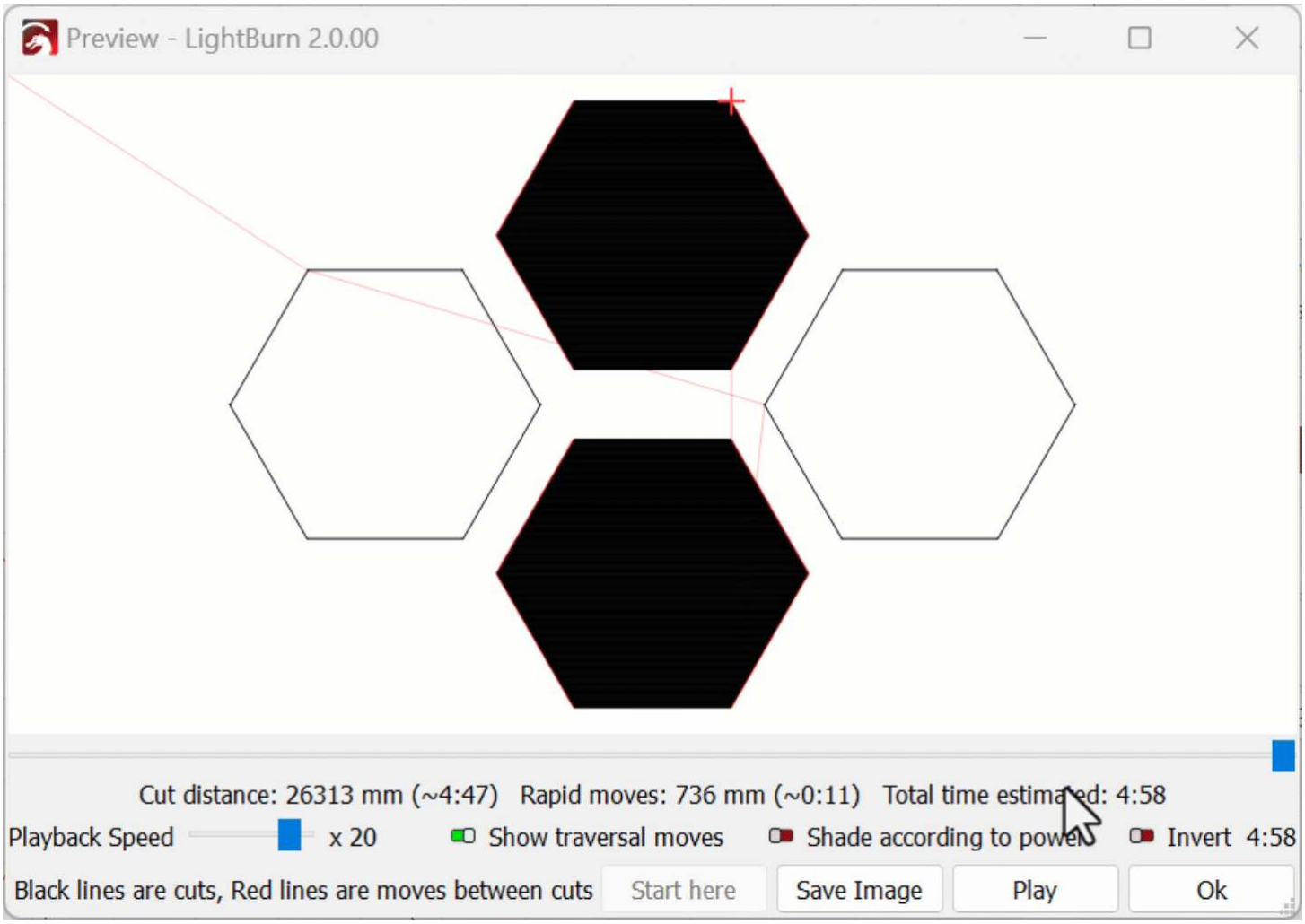
Click here for additional tips on fixing issues you identify in the Preview window

- If you have duplicate copies of graphics directly on top of each other, there are two types of behavior you might see in the Preview window:
  - If they're both set to Line Mode, you'll see the same contour being cut twice (or more, if you have multiple Passes set for the layer they're on).
  - If they're both set to Fill Mode, neither will appear in the Preview window, or be sent to your laser.
  - Go to Edit → Delete Duplicates or press `⎇ Alt` / `⌥ Option` + `D` to delete duplicate shapes.



- If you see several strange things and can't identify the cause, double-click the problematic layer to open up the Cut Settings Editor, click Reset to Default in the lower left corner, then re-apply just the essential settings such as Speed and Power.

Press **Play** to see a simulation of the movements and lasering operations your laser will perform when you start the job. In addition to making sure the laser will outline or engrave the correct graphics and areas, you'll be able to make sure it performs those actions in the order you want.



By default, the simulation will play in an approximation of the job's real runtime, and **Total time estimated** is shown in the bottom right. You can adjust the **Playback Speed** slider to speed up or slow down the simulation.

If you don't like the order the operations are performed, change their position in the Cuts / Layers Window. As a reminder — by default, the first layer in the Cuts / Layers Window is performed first, followed by the second, and so on.

Note

More advanced methods of controlling the order in which your graphics are cut or engraved are available in Optimization Settings — but we don't recommend adjusting those until you've mastered the basics.

← Previous: Cut Settings

Next: Coordinates and Origin →

get-started

4.13 Coordinates and Job Origin

This next section covers a fundamental concept in the world of lasering: your laser has a work area — the bounds within which it can cut or engrave graphics — how do you tell it exactly *where* to do that for any given project?

The answer depends on your type of laser, personal preferences, and needs. We'll run through your choices, and explain how they work, below.

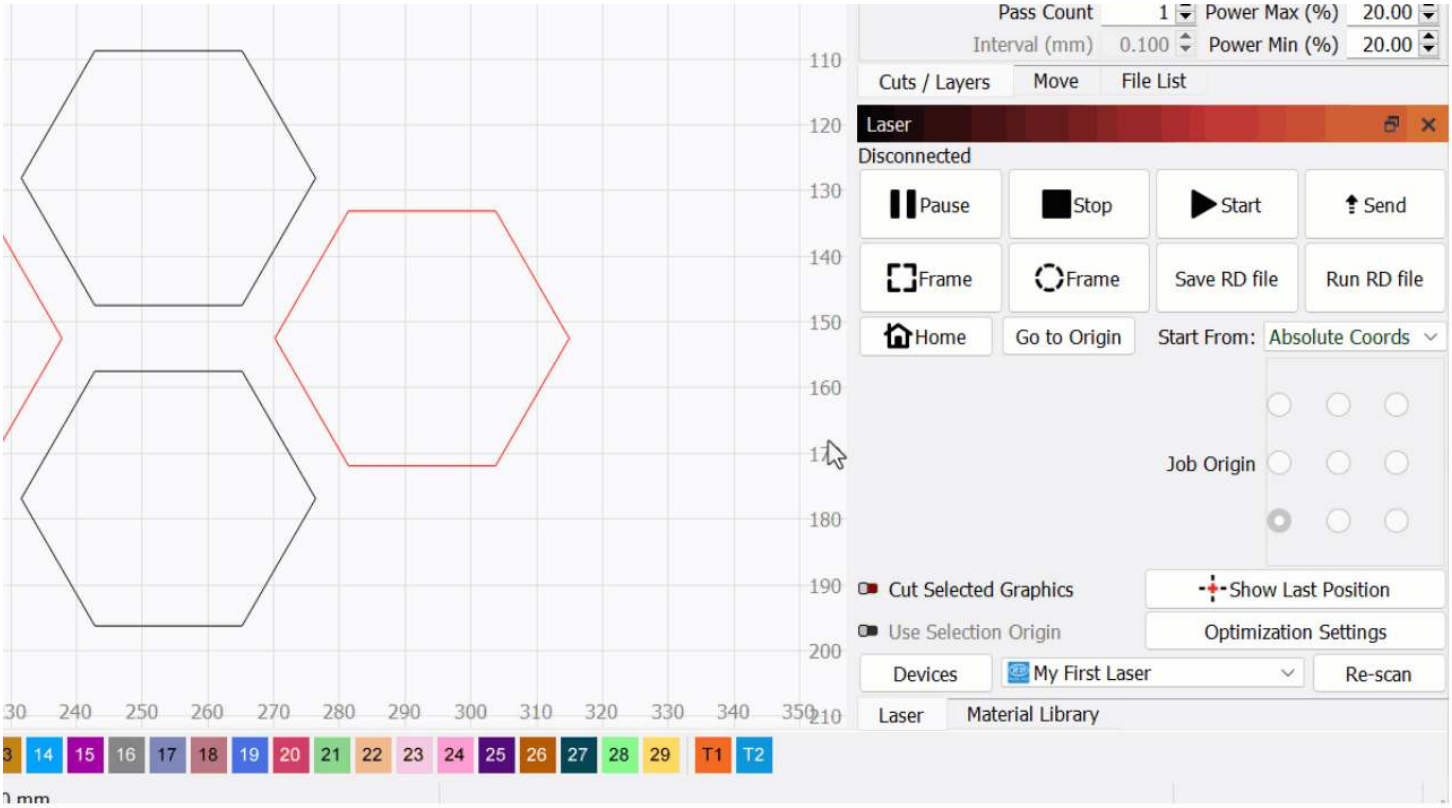
4.13.1 Selecting a Start From Mode

There are three options for determining where graphics will output in your laser's work area.

- **Absolute Coordinates** tells Lightburn to output graphics in your laser's work area at a location that matches their position in your Workspace.
- **Current Position** tells LightBurn to output graphics relative to the position of the laser head at the moment you start a job.
- **User Origin** tells LightBurn to output graphics relative to a custom-defined origin that you set before starting a job.

All three are available in the Start From dropdown menu in the Laser Window.

The 9-dot **Job Origin** selector beneath the dropdown menu determines the orientation of output relative to the Current Position or User Origin. It will be grayed out if you have Absolute Coords selected (Absolute Coords *always* uses the same pre-determined Job Origin), but clickable if you choose Current Position or User Origin.



Note for Galvo Users

If you have a Galvo laser, you won't see the Start From mode dropdown menu or 9-dot Job Origin selector in the Laser Window — that's because Galvo lasers *always* use Absolute Coordinates positioning.

4.13.2 Absolute Coordinates

Absolute Coordinates is often the the most inuitive option. The grid in your LightBurn Workspace has a coordinate system that matches the physical work area of your laser. The 0,0 position in your Workspace's coordinate system is the same as the location of your laser's **Machine Origin**.

With **Absolute Coords** selected as your Start From mode, anything you place in the LightBurn grid will be output in the corresponding location in your machine's work area, relative to that shared 0,0 point.

Not sure where your Machine Origin is? Click here

The Machine Origin is the same origin LightBurn identified (or you selected) when you first set up your laser. If LightBurn identified it for you, you most likely won't ever need to change it again.

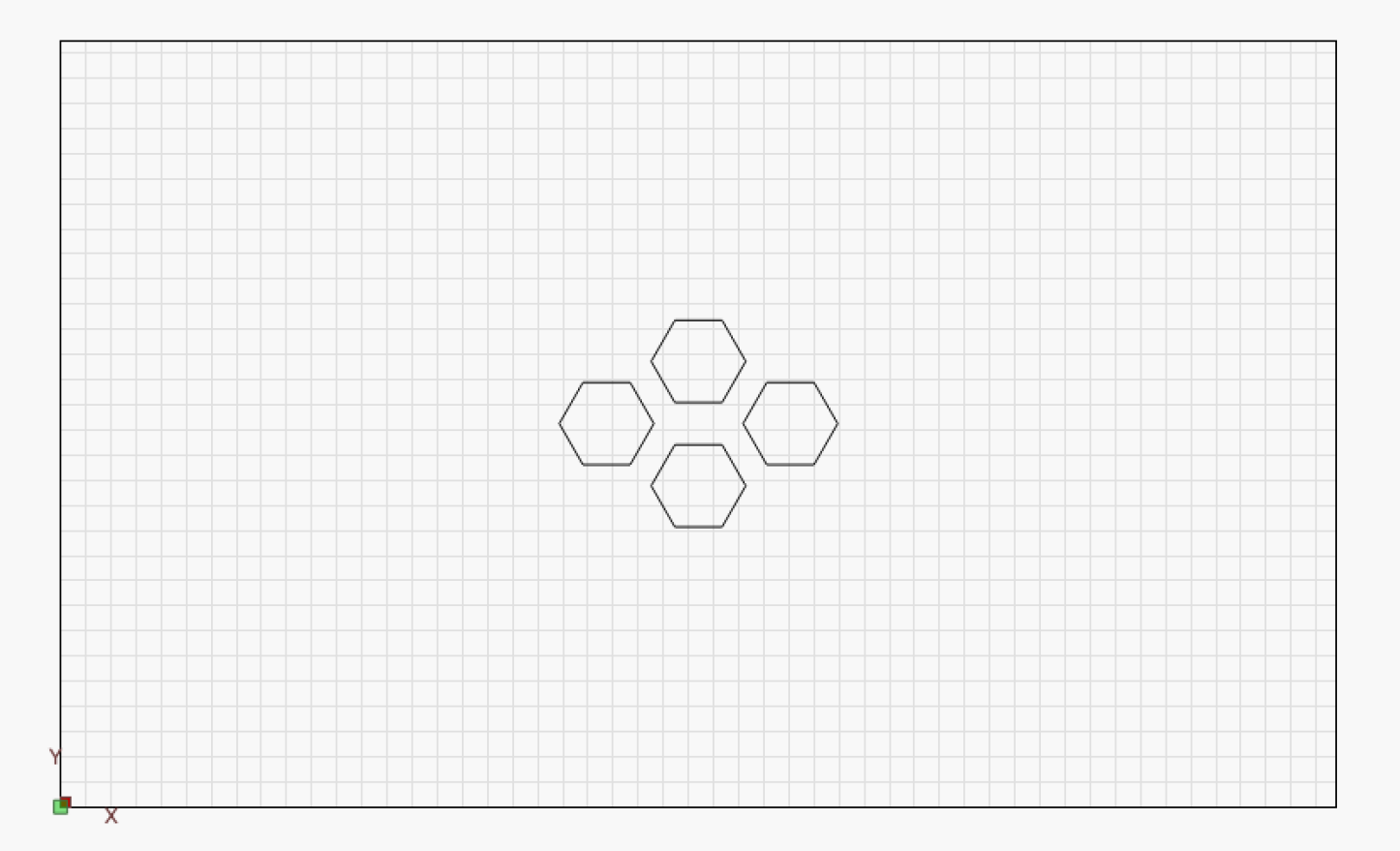
Almost all GCode-based diode lasers use the lower left corner as their origin, and, for DSP lasers, the origin is the same as the location the laser homes to when you first turn it on (usually the back right corner).

If output to your laser is mirrored or backwards, you may need to change the **Origin** setting in the Device Settings window.

Note

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

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



Using a Camera With Absolute Coordinates Positioning

If your laser came with a camera, or you install one yourself, you'll be able to take a picture and produce an **Overlay** of your laser's work area in your LightBurn **Workspace**.

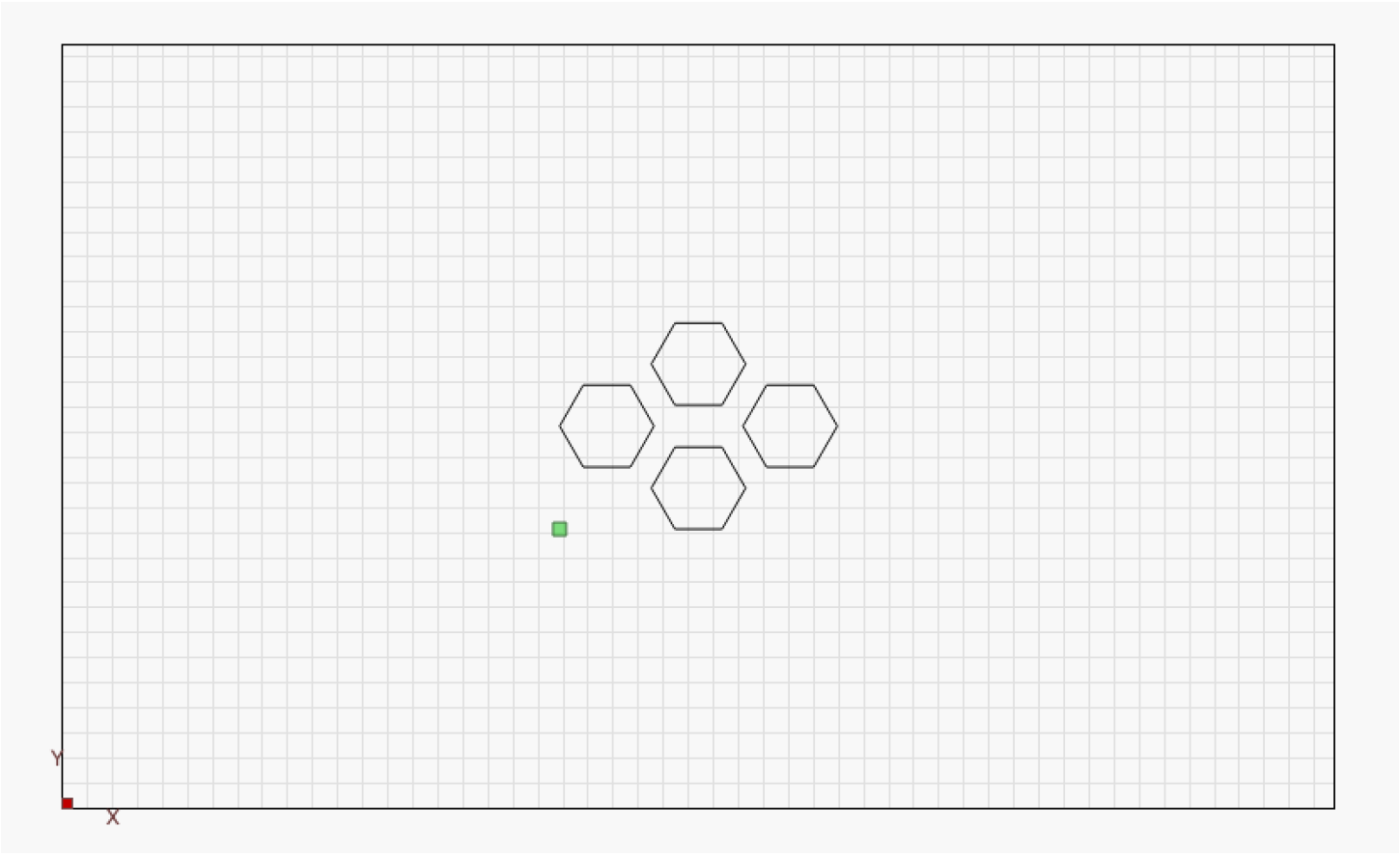
This allows you to position graphics directly over material you've placed in your laser, and use Absolute Coordinates positioning to cut or engrave them in the correct location. Be sure not to select a different Start From mode when you're working with a camera, or things won't line up properly!

See Camera Control Window for more information on using a camera.

4.13.3 Current Position

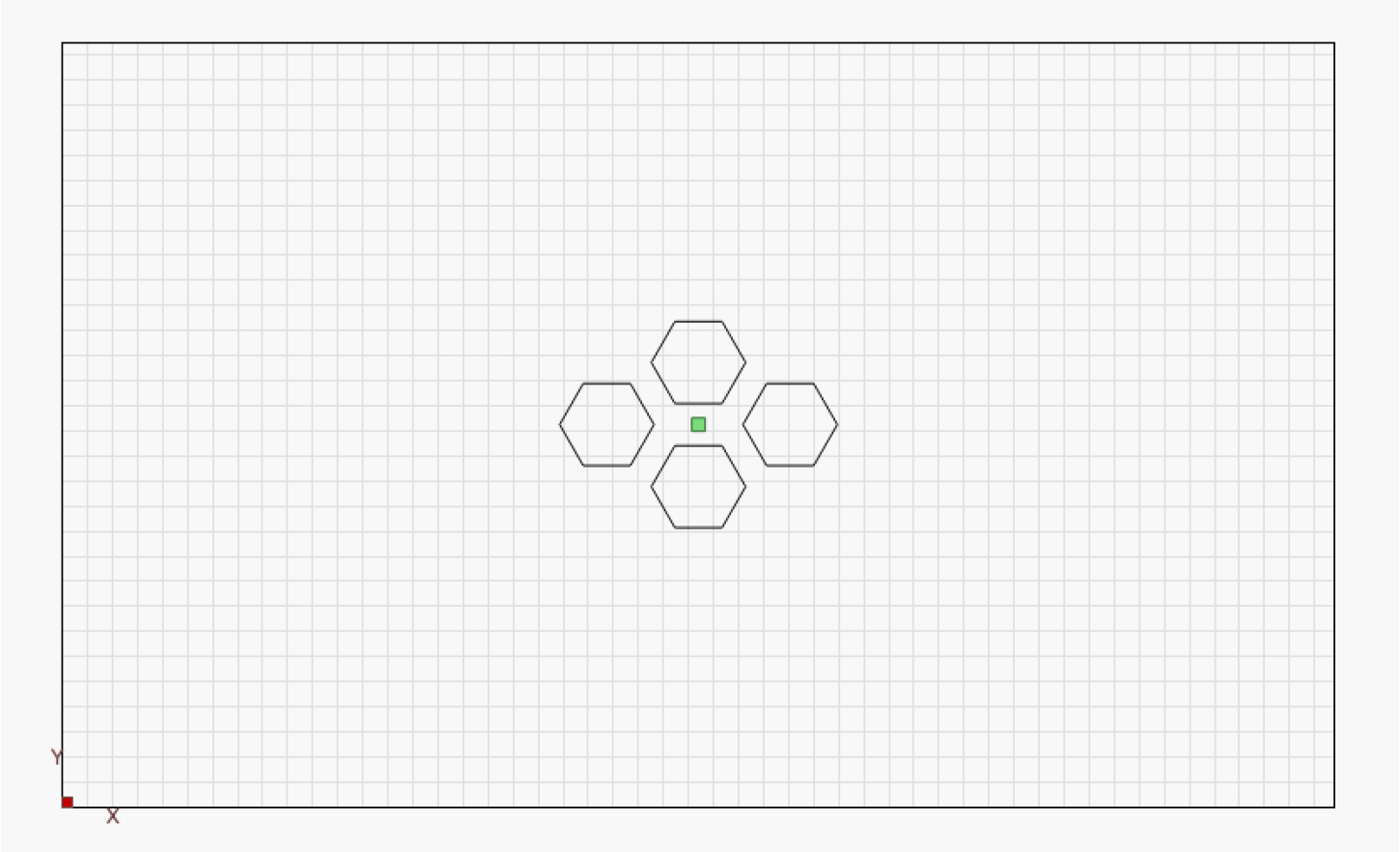
With **Current Position** selected, your job outputs relative to wherever the laser head is located when you press the Start button. The **Job Origin** control in the **Laser Window** tells LightBurn how to orient output relative to the laser head.

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



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

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

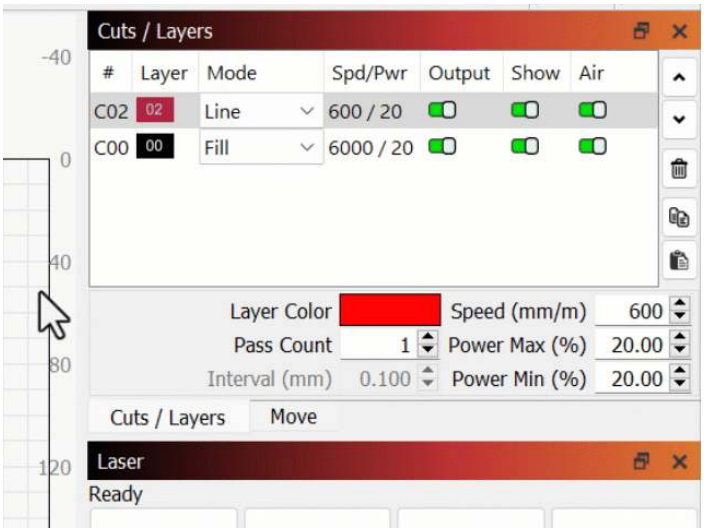


The job will be centered around the current position of the laser head. If you position the laser head directly over the center of the item you want to etch, the output will be centered on the item.

Jogging Your Laser

Both **Current Position** and **User Origin** require you to jog your laser into a desired position to define a custom origin. LightBurn has a few tools for adjusting the location of your laser's head within its work area — the most straightfoward option for beginners is to use the arrow keys in the Move Window. By default, the Move Window is hidden behind the Cuts / Layers Window — click the **Move** tab to expose it.

The arrow keys move your laser up, down, right, or left. You can set the amount the laser travels with each click in the **Distance** field, and the rate at which it travels in the **Speed** field.

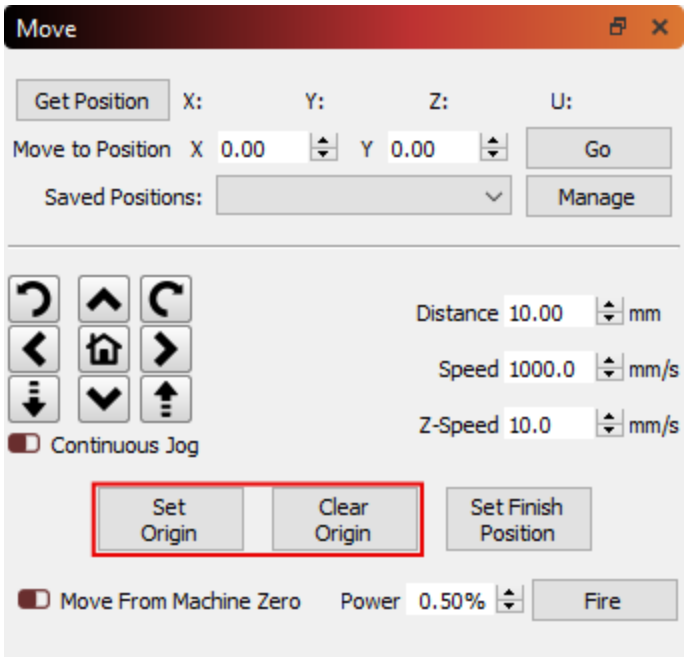


4.13.4 User Origin

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

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

For supported systems, use **Clear Origin** to remove and reset a custom-set origin.



After setting the origin, you are free to jog your laser around its work area. With User Origin selected as the **Start From** mode, the laser will always move back to start the project in a position relative to the programmed location.

You can also use the **Go to Origin** button in the Laser Window to command your laser to travel back to the origin you've set.

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

The best way to get familiar with the way the different Start From modes is to test them out — next we'll explain how to do that using LightBurn's **Framing** features.

← Previous: Previewing

Next: Framing →

Next for Galvo Users: Galvo Framing →

get-started

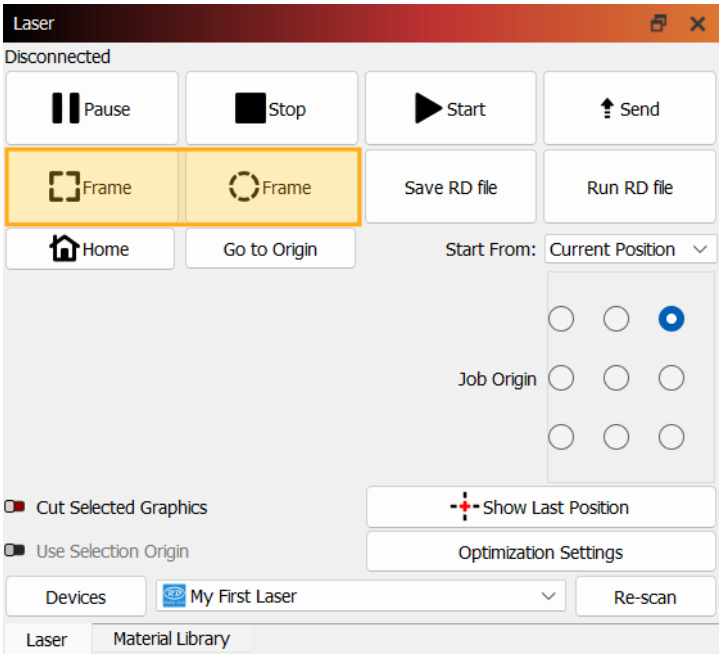
4.14 Framing

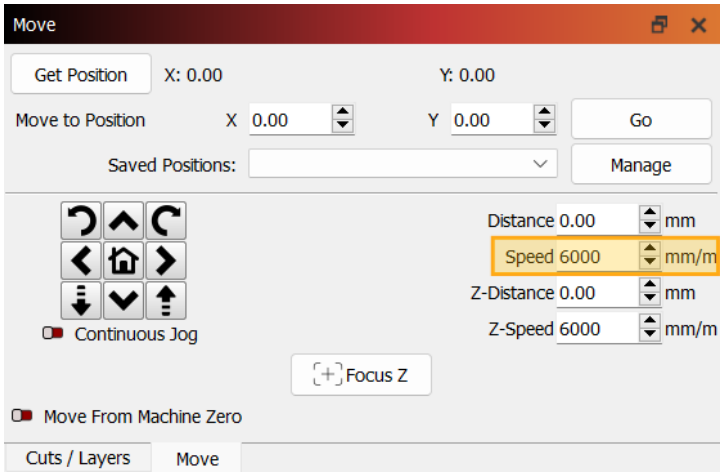
> **Note for Galvo users**
>
> This section covers Framing behavior for Gantry lasers. If you have Galvo laser, see Galvo Framing.

Just as previewing helps you verify that you've applied your layer settings properly, Framing lets you check that you've set your **Start From** mode and **Job Origin** (if applicable) correctly.

There are two **Frame** buttons in the Laser Window — clicking either will command your laser to trace a path around the area where your project will output.

The speed at which the laser travels during Framing is determined by the value set in the **Speed** field in the Move Window.

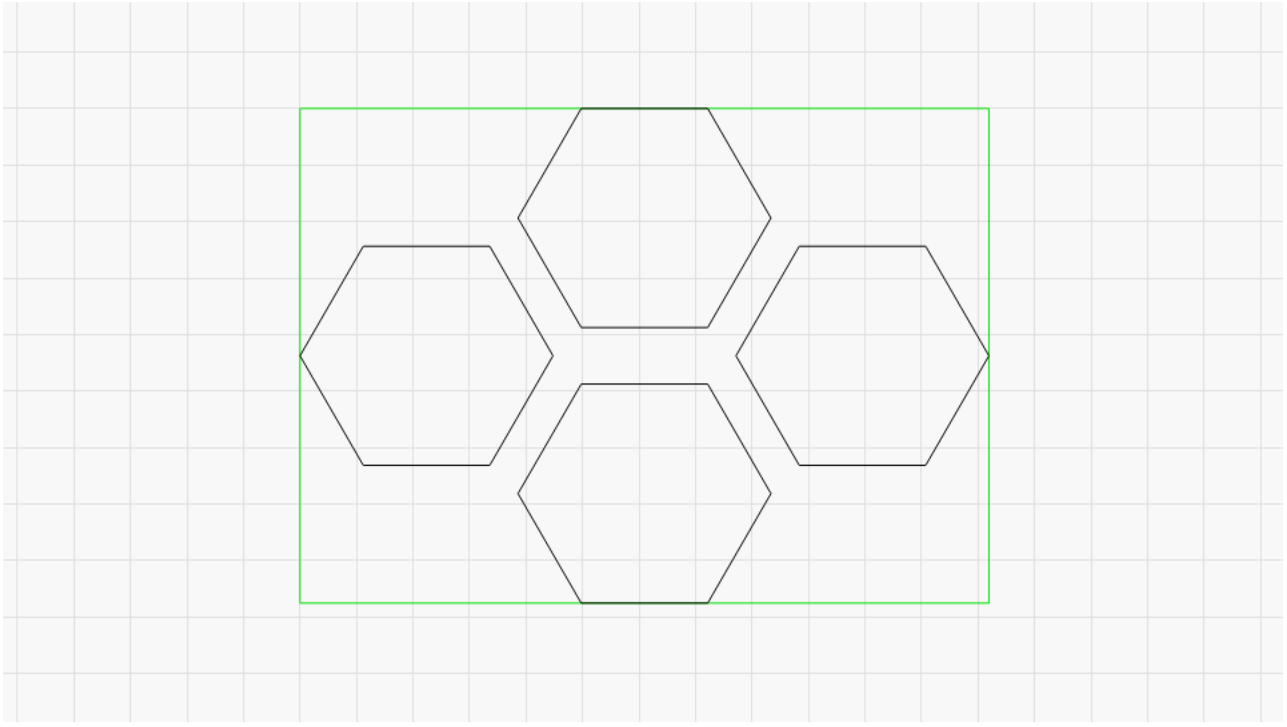




4.14.1 Bounding Box Frame

Bounding Box Framing commands the laser to trace a path defined as the smallest possible rectangle that will fully contain all graphics you're sending to the laser.

Here's a representation of that path in LightBurn:



And here's the laser following that same path during Framing:

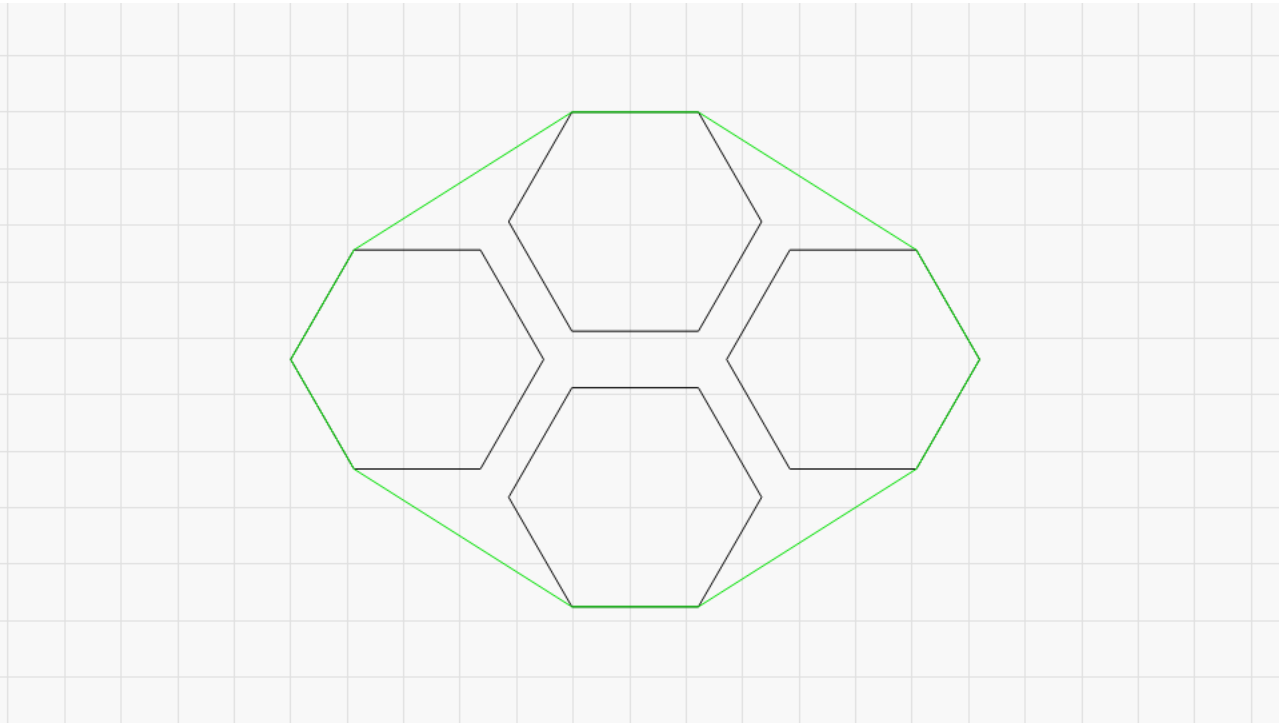
4.14.2 Rubber Band Frame

Frame

Rubber Band Framing commands the laser to trace the smallest possible path that fully contains all graphics in the design you're sending to the laser, as if a rubber band were stretched around them.

Tip

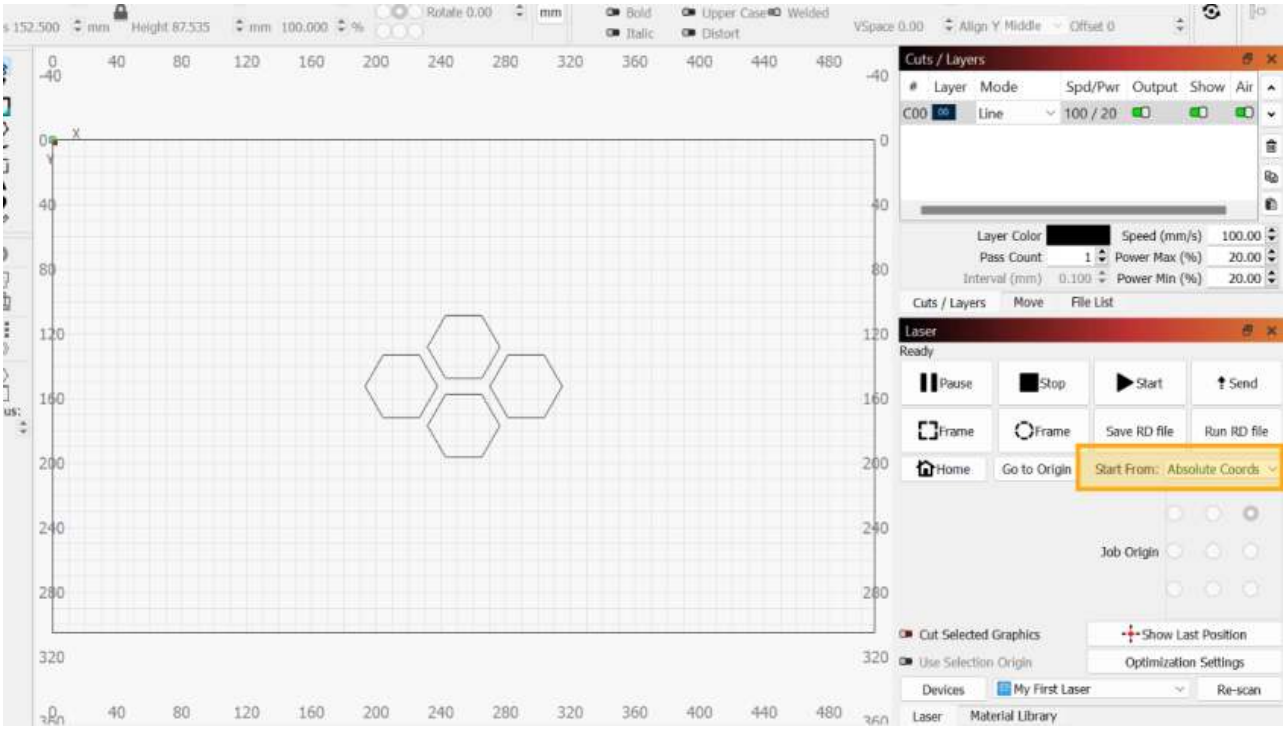
Rubber Band Framing is useful for lining up jobs with irregular shapes where a box outline doesn't fit well. For example, a long, thin diagonal shape, or a triangle.

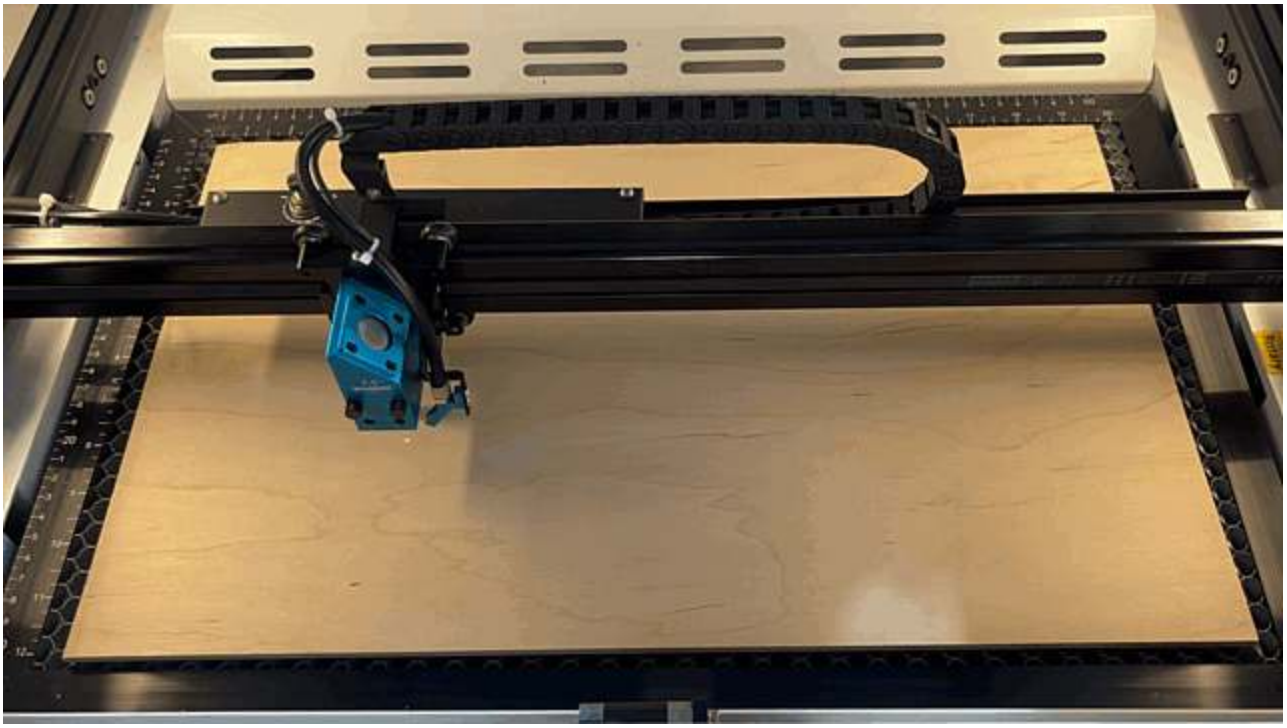


4.14.3 Start From Mode, Job Origin, and Framing

Now let's look at a few examples of how we can test out various **Start From** mode and **Job Origin** combinations. To simplify things, we'll use **Bounding Box Framing** for all of these examples.

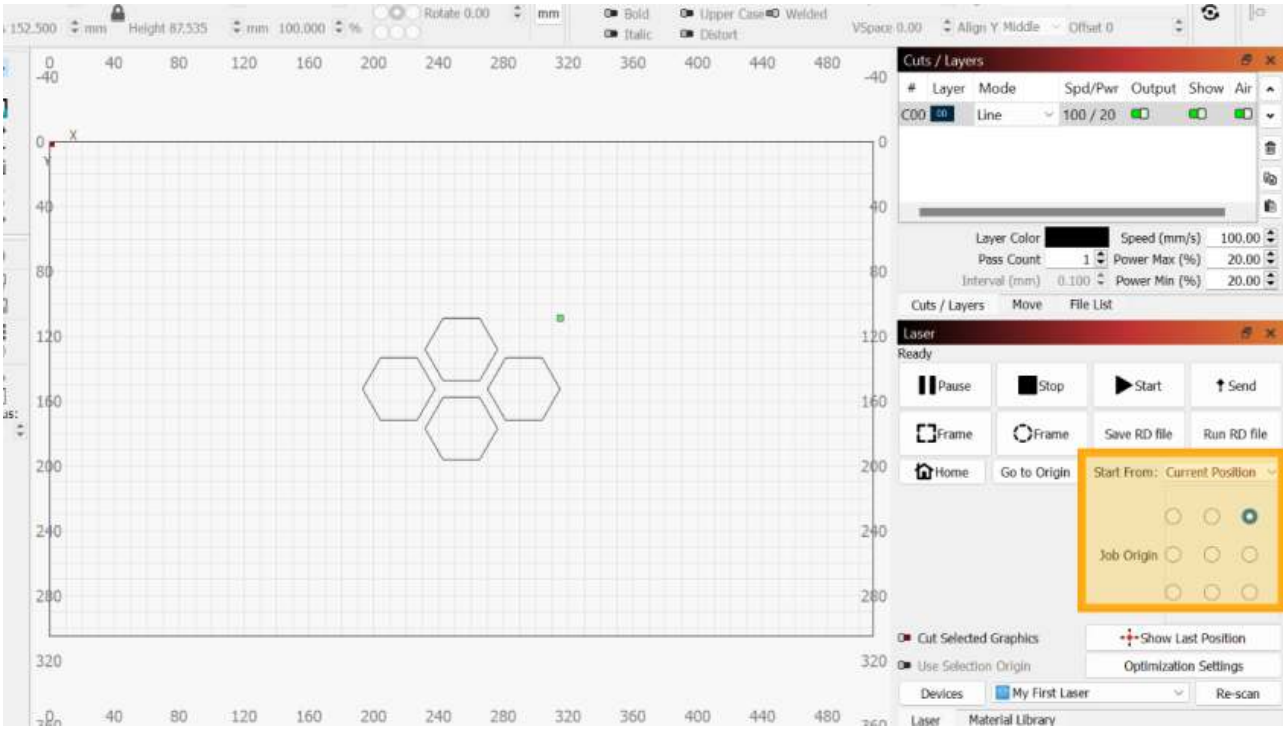
In the first example, we have **Absolute Coords** selected, and our four hexagon design placed directly in the center of the LightBurn Workspace, so when we press the **Frame** button, the laser traces a rectangle in the exact center of its work area:

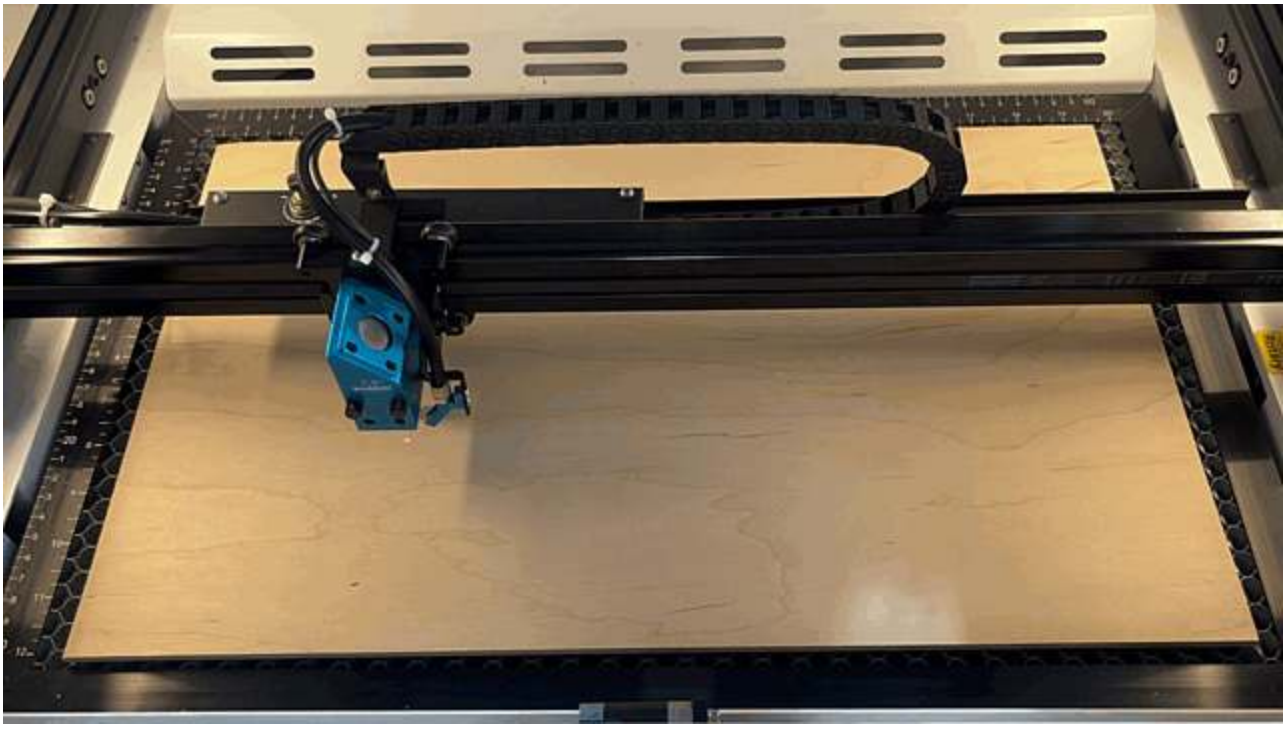




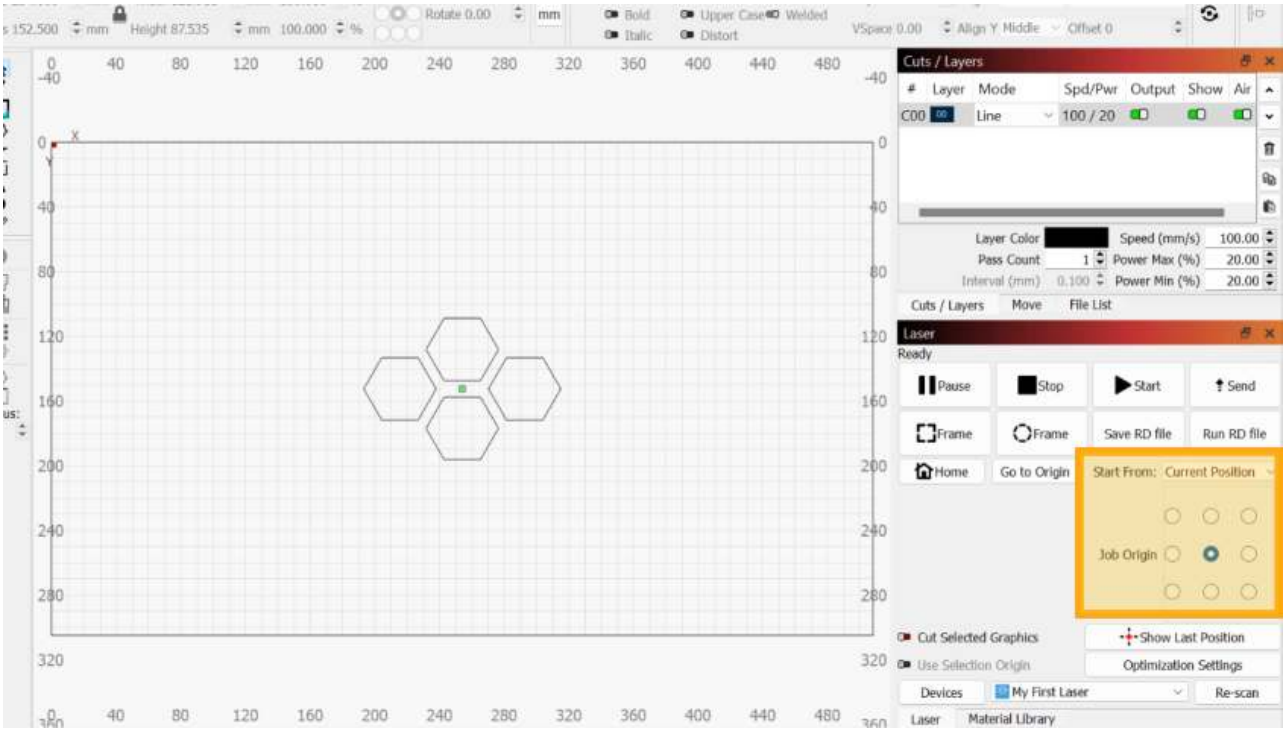
Now we'll leave the design in the same position in our Workspace, but change the Start From Mode, and see how the Framing location changes.

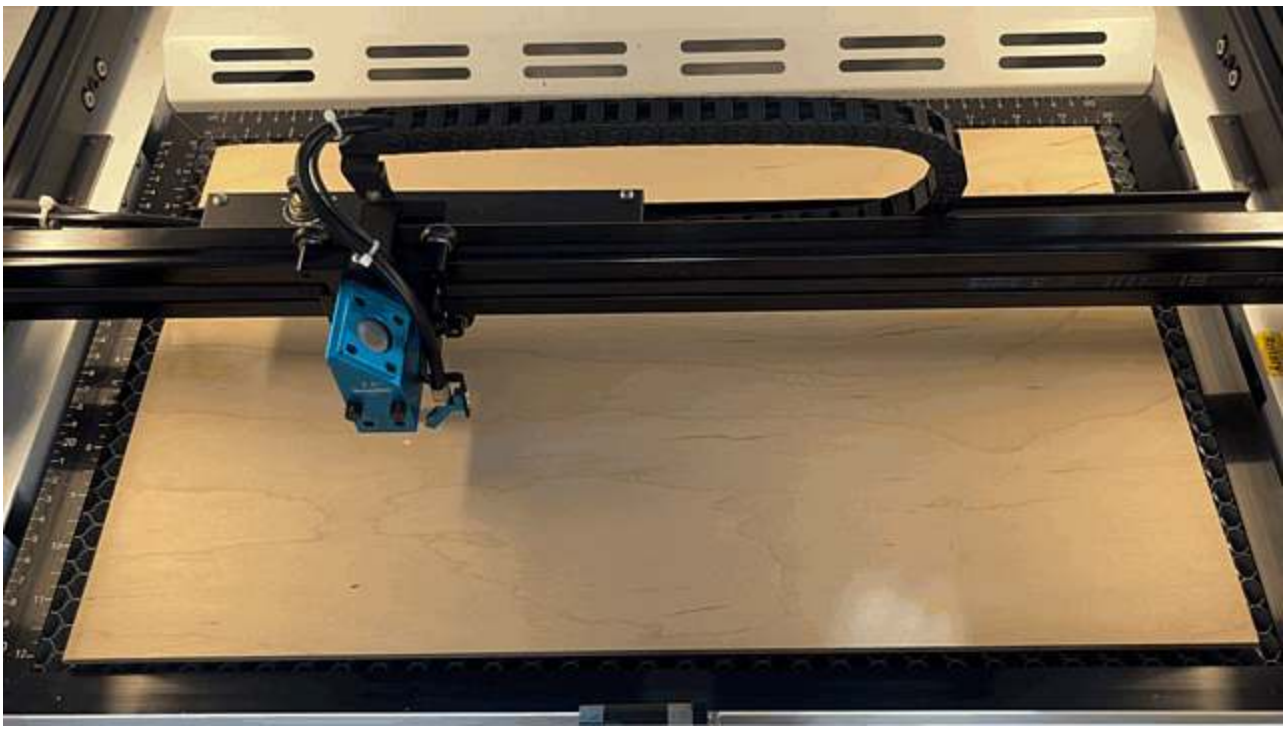
Here we've selected **Current Position** as the Start From mode, and the top right Job Origin position, so the laser moves down and to the left from its starting position:





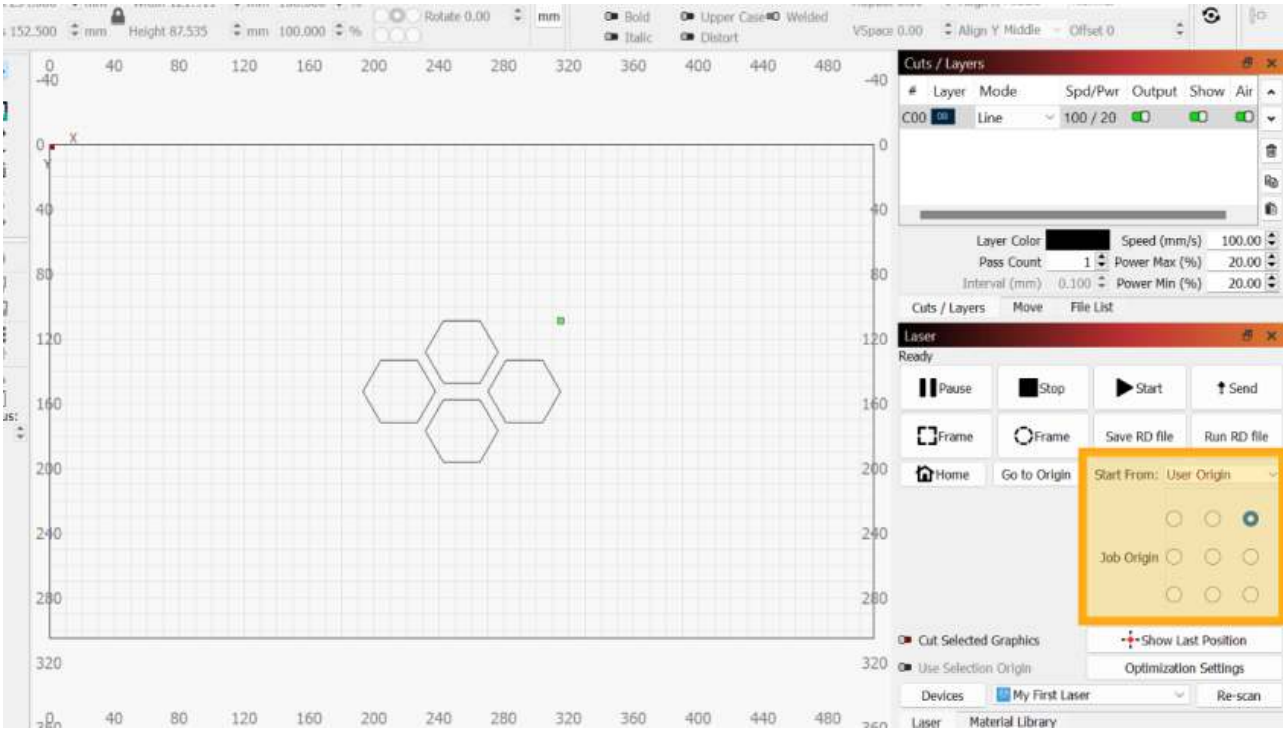
Here's Current Position again, but with the center Job Origin position selected — now the laser moves out from where it's sitting, and traces a rectangle centered on the location where it began:

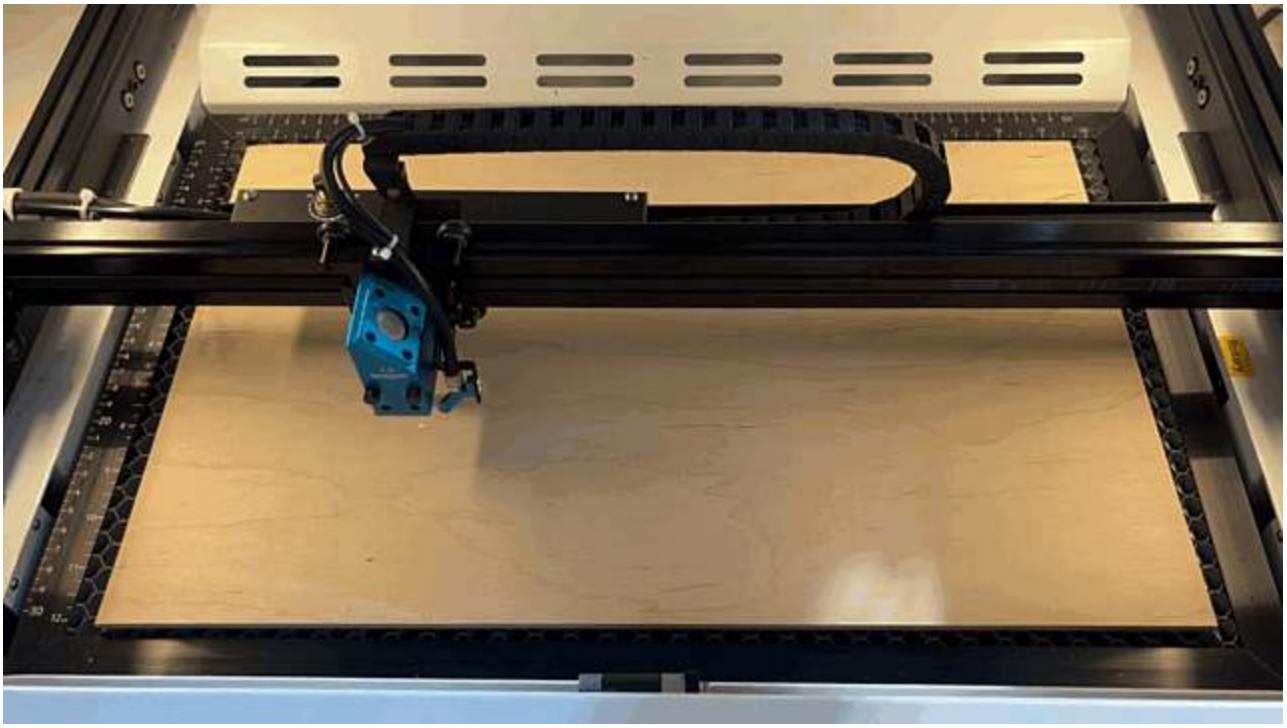




Finally, here's **User Origin** and a top right Job Origin — prior to Framing we'll jog the laser to the top right of its work area, then set the origin (in this case, we used a DSP laser and set the origin from the controller).

Note how even though we jog the laser down to the bottom left after setting the origin, when we press Frame it returns to the top right, to trace a rectangle determined relative to where we set the origin:





4.14.4 Framing Tips

Laser On When Framing

We used a laser with a red dot pointer for the above examples. Pointers are extremely helpful for aligning your laser to material, but many diode lasers do not come with them installed.

Because of this, LightBurn offers the ability to run diode lasers at a very low power to aid in **Framing**. To do so:

1. Go to Edit → Device Settings to open the Device Settings window.
2. In the Basic Settings tab, toggle on the **Enable laser fire button** and **Laser on when framing** settings. Click **OK** to apply.
3. The Move Window should now have a **Fire** button and a box to enter a power level. Keep this value very low to avoid burning the material — start at 0.25%, and only increase that value if the beam is not visible.
4. The **Fire** button will toggle the laser on and off. Now you can use the **Frame** command with the laser visible.

Danger

The Fire button should only be used for diode lasers, which generally don't have a red dot pointer for Framing.

Always wear proper eye protection when Firing your laser. Consult your laser's manufacturer for information on the proper eye protection required for your laser.

This should never be used for a CO_2 laser, which has an invisble beam that could blind you or start a fire.

Frame Continuously

Frame Continuously is an option in the Device Settings window that tells your laser to repeatedly **Frame** the same path until you tell it to stop.

Sometimes you won't get the positioning just right on your first try, but a little nudge of your material is all it takes to get it aligned. Other times, you'll just want to want to double or triple check the position. In either case, Frame Continuously will be a big help.

To enable it:

1. Go to Edit → Device Settings to open the Device Settings window.
2. In the Basic Settings tab, toggle on the **Frame Continuously** setting. Click **OK** to apply.
3. Now when you click either of the Frame buttons, a dialog window will open, letting you know that continuous Framing is active, and to press OK when you're ready to stop.

Using a Camera

With a properly calibrated and aligned camera, you won't need to rely on Framing to align output to material in your laser's work area. Instead, you can position graphics over objects shown in your Workspace Overlay, and they'll be cut or engraved on the object, using **Absolute Coords** positioning.

See Camera Control Window for more information on using a camera.

Although a properly set up camera is very reliable for positioning, Framing is still a helpful check to make sure you have the correct **Start From** mode selected.

← Previous: Coordinates and Origin

Next: Job Control →

start send get-started laser-general

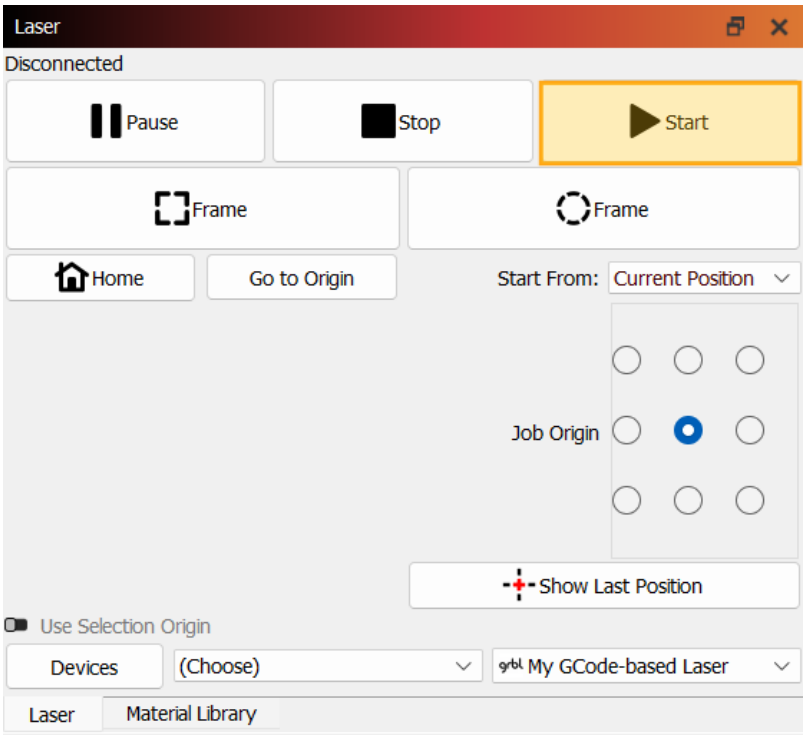
4.15 Job Control

After you've created or imported your design, assigned appropriate layer modes and cut settings, and checked (or double-checked) your project using the Preview window and Framing functions, you'll be ready to start the job. Once the job has begun, you'll have a couple of additional options for controlling your machine.

Danger

Before starting any job, make sure you have taken all safety precautions advised by your laser's manufacturer, including wearing proper eye protection, providing adequate ventilation of dangerous fumes, and keeping fire supression equipment close at hand. Never allow your laser to run unattended.

4.15.1 Start



The **Start** button in the Laser Window is the most common method of starting a project, and is available for all types of lasers.

When you press Start, LightBurn will *immediately* send the project to your laser and it will begin cutting or engraving.

There are a few exceptions to this behavior:

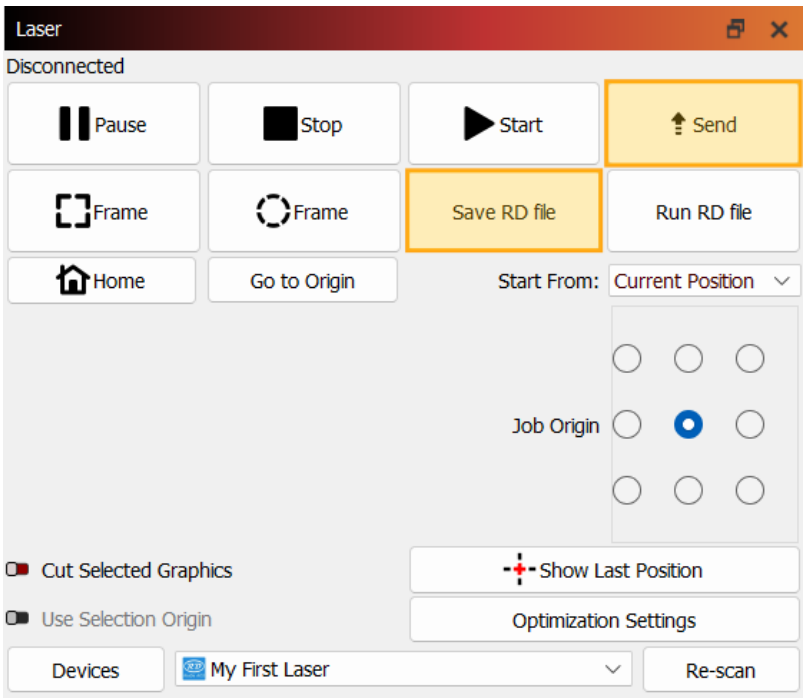
- If you've made a settings or job positioning choice that could cause problems, LightBurn may give you a warning message, and ask you whether you'd like to go ahead with the job, or cancel and correct the issue. We strongly recommend correcting the issue. The warning message will tell you what the problem is, and offer advice on correcting it — be sure to read it in full!
- If you have a Galvo laser, the Live Framing window will open instead. The same job control buttons that area available in the Laser Window appear in the Live Framing window as well, so you can Start the job from there, after checking positioning again, if necessary. You can bypass Framing by toggling off Require Framing Before Start in the **Device Settings** window.
- For any type of device, you can toggle on Enable Jog Checklist in your Device Settings, to have LightBurn show a checklist that you'll need to confirm before starting the job. This is a great way to make sure you haven't forgotten about any crucial safety procedures before starting your job.

Click here to learn about alternate methods of starting a job

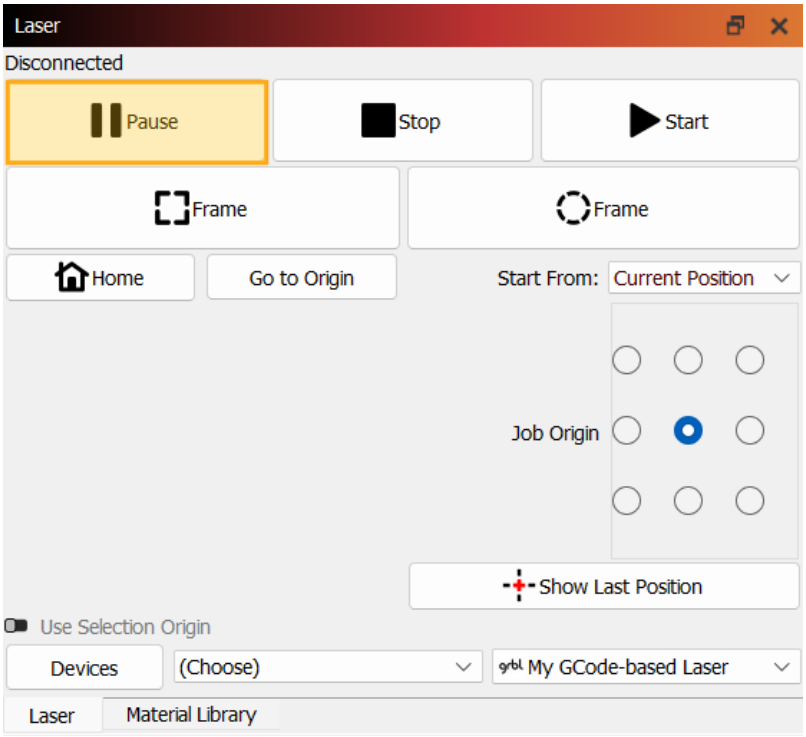
Some types of lasers have additional options for starting projects. If you have a DSP laser, you'll see the option to Send your project to your laser — this option will transfer the probject to your laser's controller. You can use the control panel to access the file and start it from there.

Both DSP and GCode-based lasers have the option to Save in Machine-Specific Format. If you Save in Machine Specific format, LightBurn will save the project with a file extension such as `.nc` or `.rd`. You can then transfer the saved file to your machine using a USB stick. This option is not available for Galvo lasers.

If you're using Beginner Mode you won't see this button in the Laser Window, but the option is also available in the File Menu.

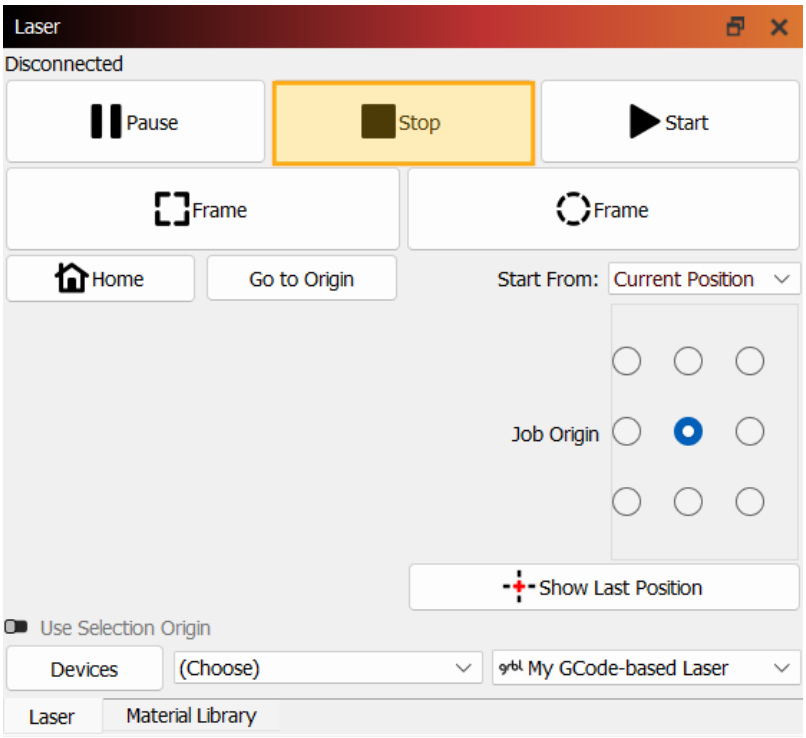


4.15.2 Pause



Click the **Pause** button while your laser is working to temporarily halt the job. You'll be able to click again to **Resume**.

4.15.3 Stop



Clicking the **Stop** button will permanently halt your job, meaning you won't be able to resume right where you left off.

> **Warning**
>
> The Stop button should never be your only means of stopping a job in progress. Locate your laser's emergency stop switch, if available, or be prepared to use another method to *compeletely cut power* to the machine in the event of a fire. Consult your laser's manufacturer for guidance specific to your machine.

4.15.4 First Project

Now that you know how to create, set up, Preview, Frame, and **Start** a project, you're ready to try running your laser for real. You have two options for the next step:

- You can learn how to use the Material Test tool to dial in optimal settings for your laser and material, before moving on to the our First Project guide.
- You can proceed directly to the First Project, if you have settings recommendations from your laser's manufacturer that you're confident in.

← Previous: Coordinates and Origin

Next: First Project →

Optional Detour: First Material Test →

project get-started

4.16 First LightBurn Project

One of the best ways to learn to use Lightburn is to use it. We recommend following along with our laser-engraved QR Code WiFi coaster to start exploring LightBurn. By the end, you'll be familiar with LightBurn's user interface and general workflow, and you'll have a coaster your friends and family can scan to log into your WiFi network without needing to type anything in.

The video above shows the same project in an older version of LightBurn. The overall process is the same, but some tools will look a little different, and the QR Code tool is replaced by the Bar Code tool.

Before you begin, familiarize yourself with your laser and how to operate it safely according to manufacturer instructions. Never run your laser unsupervised.

4.16.1 What You'll Need

- LightBurn installed on your computer.
- A laser added to LightBurn.
- Suitable material for the coaster. Our video uses laser-safe plywood, but you can use any laser-safe material you have on hand if you don't have that available.

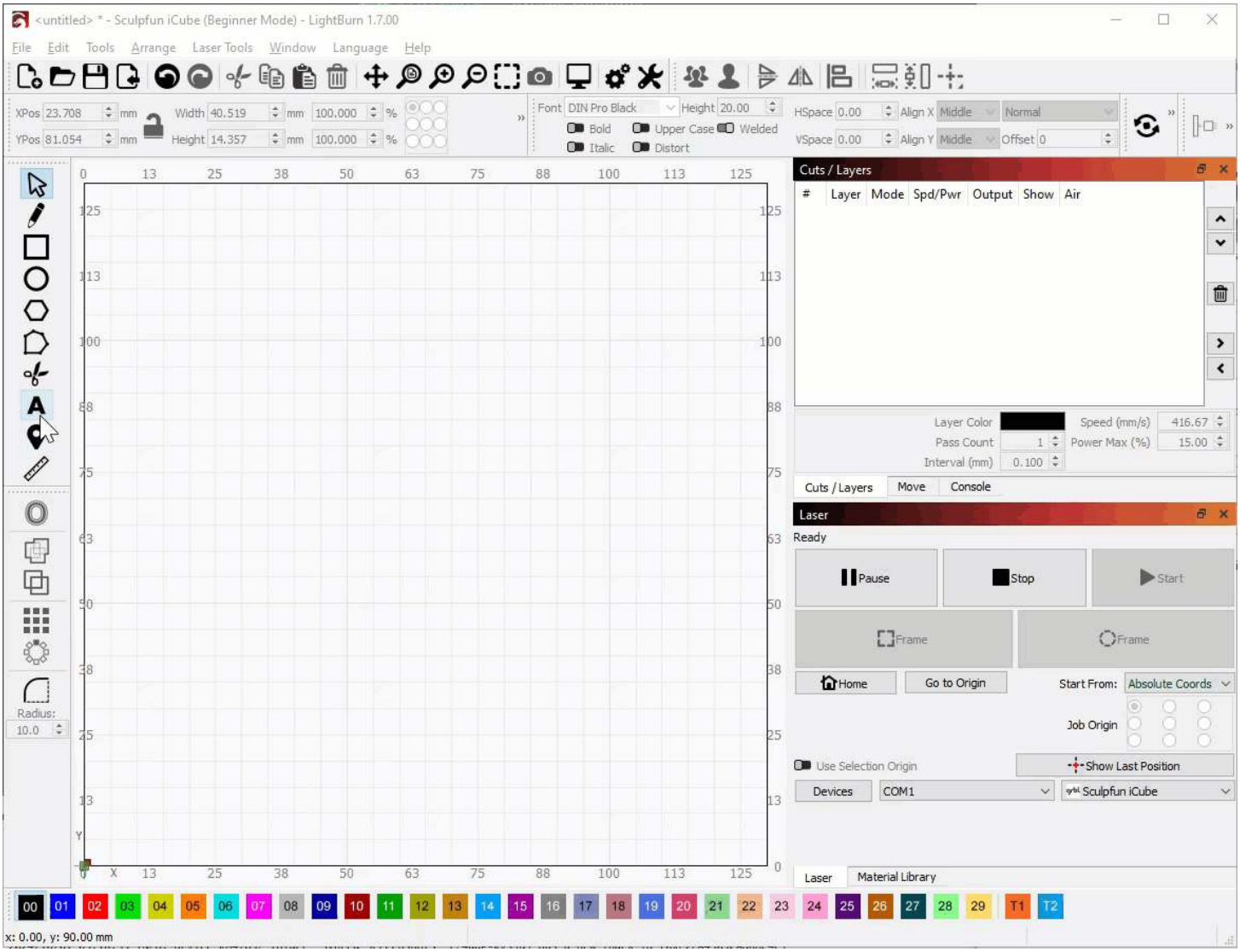
> **Note**
>
> You can use a pre-made coaster blank instead of cutting out your own. Some lasers — including most Galvo lasers — aren't capable of cutting through any materials.

- Your WiFi information to enter into the QR Code.

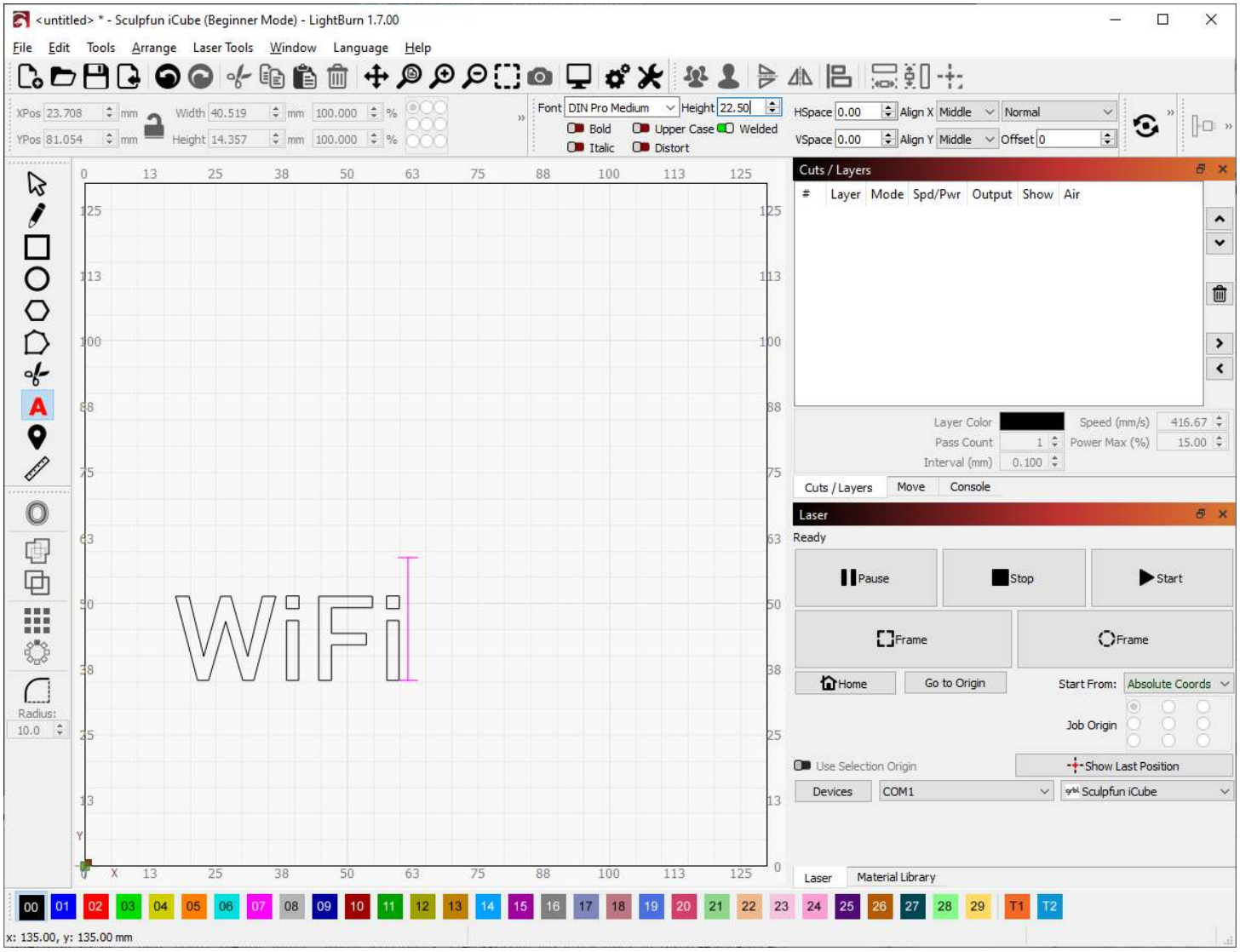
4.16.2 Designing Your Coaster

Create Text

You're going to start by creating text to engrave onto your coaster.

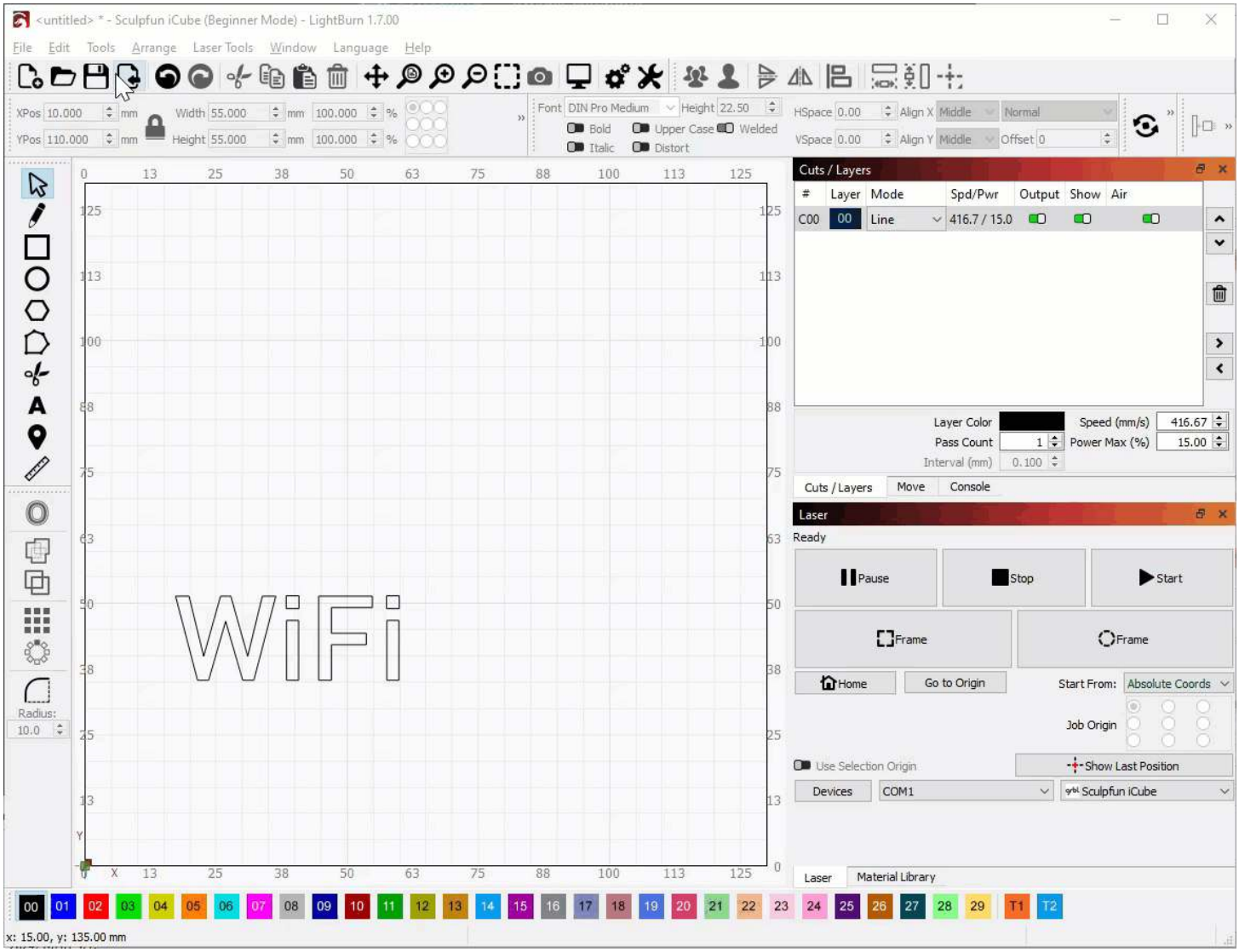


1. Click on the Text tool in the Creation Toolbar.
2. Click in the Workspace to place a cursor and type something out. Our demo coaster will say "WiFi", since that's what the QR Code will be for.
3. Find the Text Options Toolbar near the top of the screen above the Workspace. When you have text selected, this toolbar becomes active, and provides several options for modifying the selected text. For this project, try the following steps:
   - Select a font you like from the **Font** dropdown. LightBurn can use any font installed on your computer.
   - Adjust the size with the **Height** box.
4. When you're done typing, return to the Select tool by pressing Esc or clicking the cursor icon in the Creation Toolbar. You can come back and edit the text later by double-clicking it with the Select tool active.



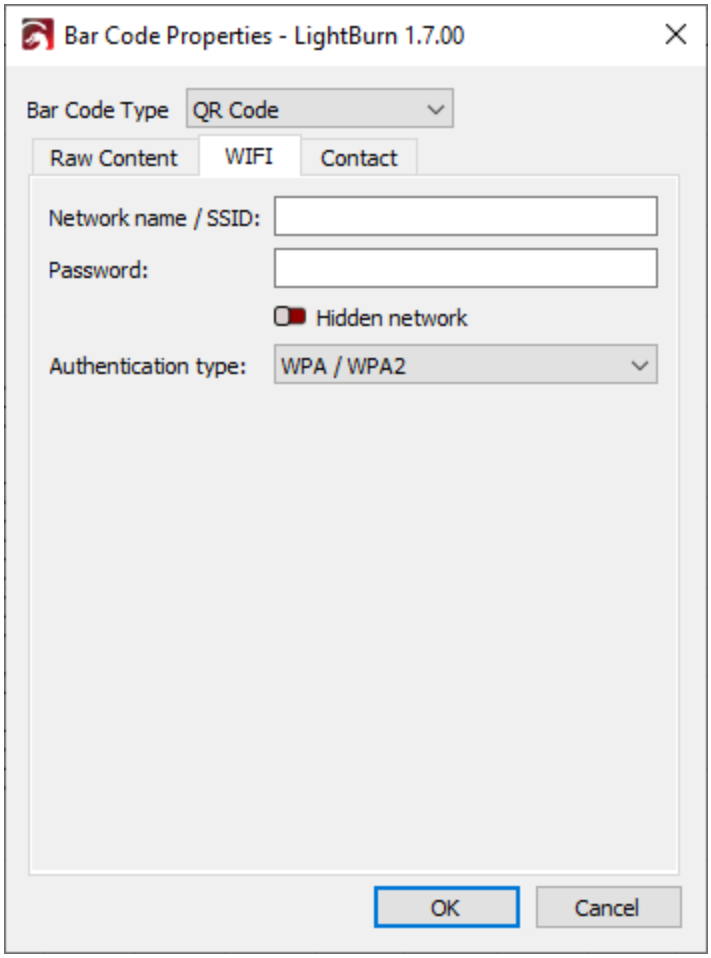
Create a QR Code

LightBurn has a built-in Bar Code tool, which can generate QR Codes as well as a variety of other scannable codes. You'll use this to generate a QR Code that automatically logs someone into your WiFi network.



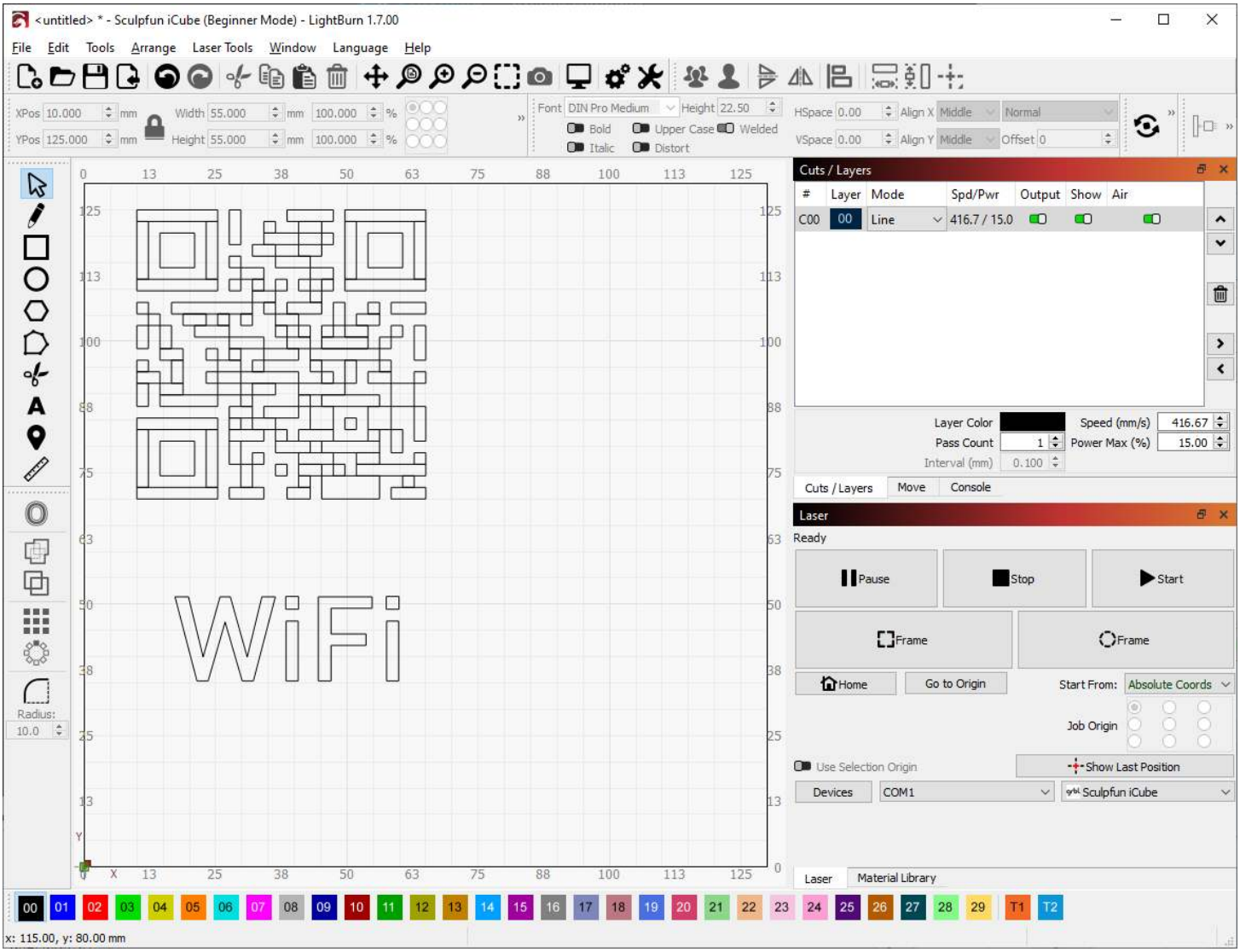
1. Go to Tools → Create Bar Code to open the Bar Code tool. You'll see the cursor change to a QR Code. Click and drag in the Workspace to set the initial size of your QR Code and start creating it. Put it somewhere near where you want it — you'll improve the placement in the next step.

2. Make sure the **Bar Code Type** is set to **QR Code** and click on the **WIFI** Tab.



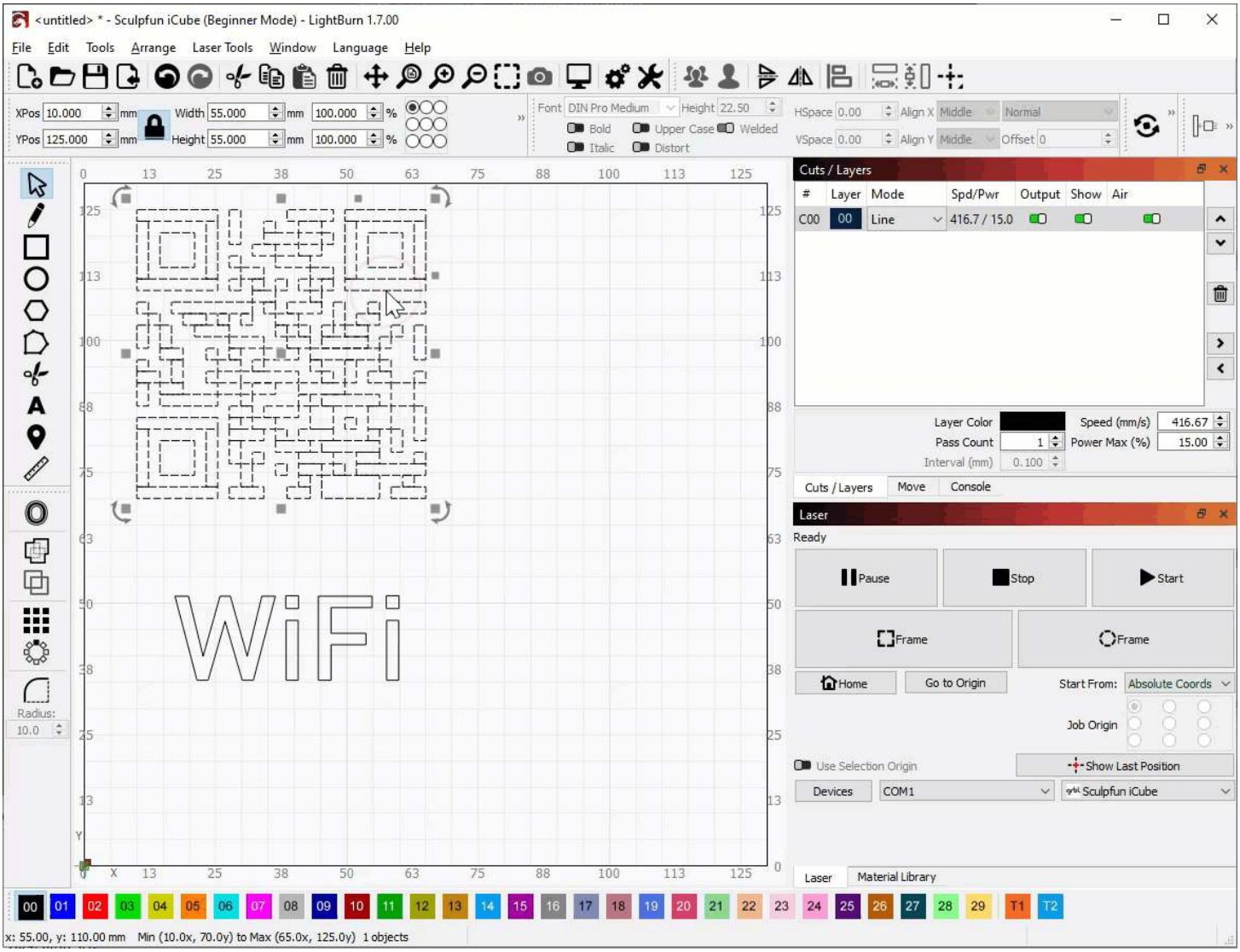
3. Enter your WiFi login info into the window – be very careful with your spelling and capitalization – and click **OK** to create the QR Code.

4. Adjust the size with the **Width** and **Height** boxes in the Numeric Edits Toolbar. Make sure the lock icon is closed so the code's aspect ratio is maintained as you make adjustments, and it doesn't get distorted. Enter a size into either Width or Height — somewhere between 40 and 60 mm is generally a good size.



Aligning and Grouping

Now that you have text and a QR Code, you'll want them to line up nicely. This is a great opportunity to try out the Align and Group tools.



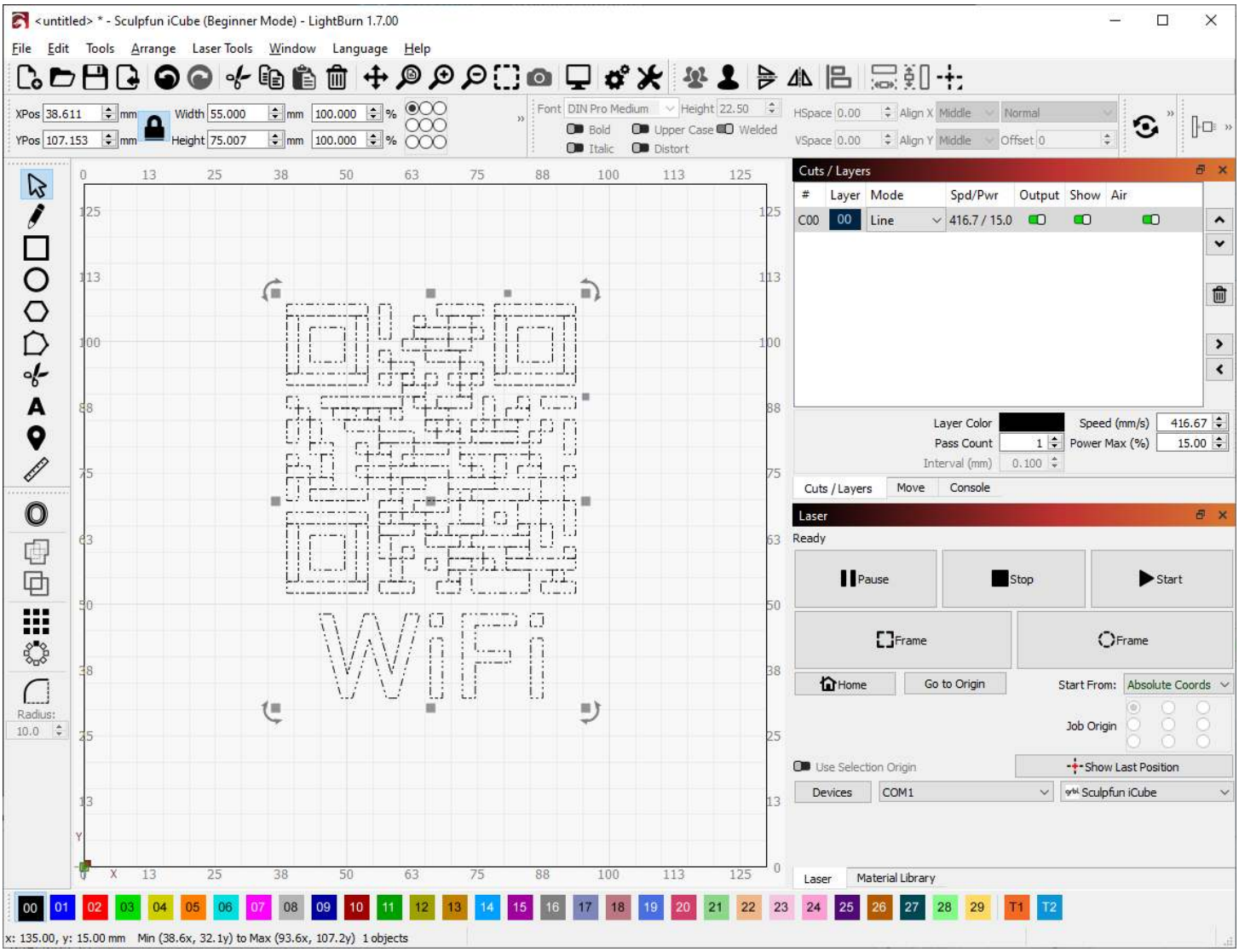
No Alignment Tools Option?

New LightBurn installations start in Beginner Mode, which simplifies the user interface by hiding less-used options. Beginner Mode combines all of LightBurn's alignment tools into the Align Tools Helper.

If you aren't in Beginner Mode, go to **Arrange** → **Align** → **Align V-Center** for this step, or enable Beginner Mode in your Settings.

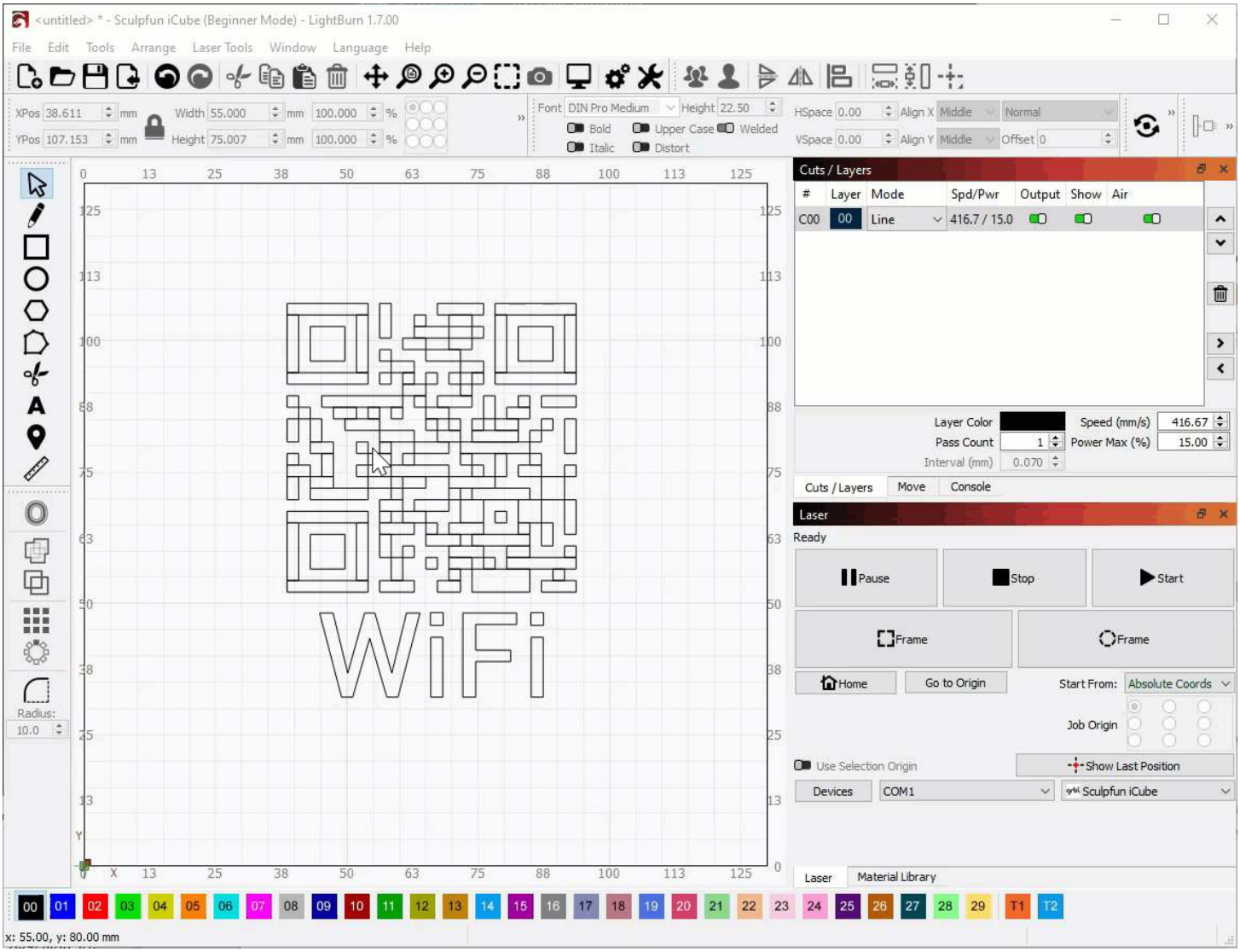
1. Make sure you have the Selection tool active by clicking on the icon or pressing `⎋ Esc`.
2. Select the QR Code by clicking on it. Drag to place it where you want it relative to the text. You can quickly spot selected objects by looking for the animated "marching ants" pattern on the outline of the shape.
3. With the QR Code still selected, hold down the `⇧ Shift` key and click on the text to select that as well.

4. Go to Arrange → **Alignment Tools** to open the Align Tools Helper, which will preview different alignment options as you hover over them. Use the bottom **Align Centers** button to vertically center both shapes.
5. With both objects still selected, press `^ Ctrl` / `⌘ Cmd` + `G` to Group them. This way both shapes will move together without having to remember to select them both. To move them individually, you'll need to **Ungroup** them by selecting them and pressing `^ Ctrl` / `⌘ Cmd` + `U`.



Layer Modes

Now we'll preview your design and edit your cut settings. We'll be introducing the Preview function and the Cuts / Layers Window.



View Styles

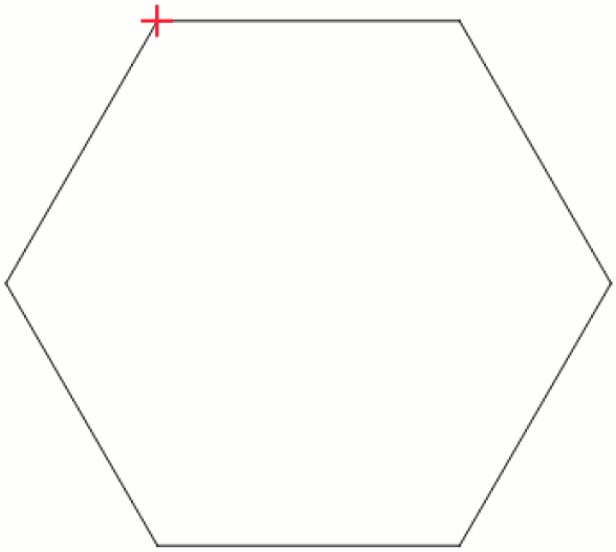
LightBurn offers **Wireframe** and **Filled** options for the **View Style**. After setting Layer 0 to Fill, if you don't see the shape filled in, you can use `⌥ Alt` / `⌥ Option` + `W` to toggle between Wireframe and Filled view styles. Read more at View Style Types.

1. Open the Preview window with `⌥ Alt` / `⌥ Option` + `P`. This window shows your design as it will be sent to the laser, and can even simulate the engraving to estimate time and visualize what the laser will be doing. Try pressing play to see how it works.
2. By default, your design will be on Layer 00 and set to Line Mode, which means the laser will trace the outside of the shapes rather than filling them in. Click on the dropdown under **Modes** and select Fill. Next to **Speed** and **Max Power**, set appropriate speed and power settings for the material you're using. Check your laser's user guide for recommended settings.

Click here to learn more about the difference between Line Mode and Fill Mode

Line Mode tells your laser to trace a path around the contours of vector graphics.

If you command the laser to move quickly, or with low Power, it will likely just etch the surface (sometimes called scoring). If you move slowly and with high power, especially with a CO_2 laser, the laser will cut deeper, or even completely through the material. The only difference between surface marking and cutting with Line Mode is the Power and Speed you set.



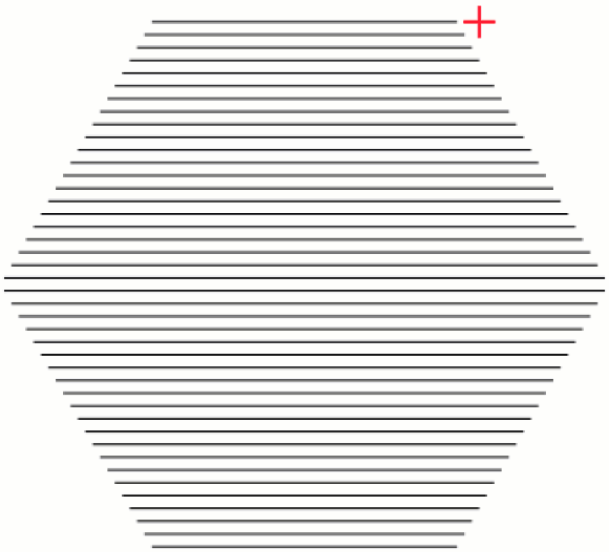
Closed Shapes Only

This feature only works with shapes that are *closed*. A shape is closed when it is a complete, continuous loop whose start and end points are the same. When a shape's start and end points are different, it is *open*.

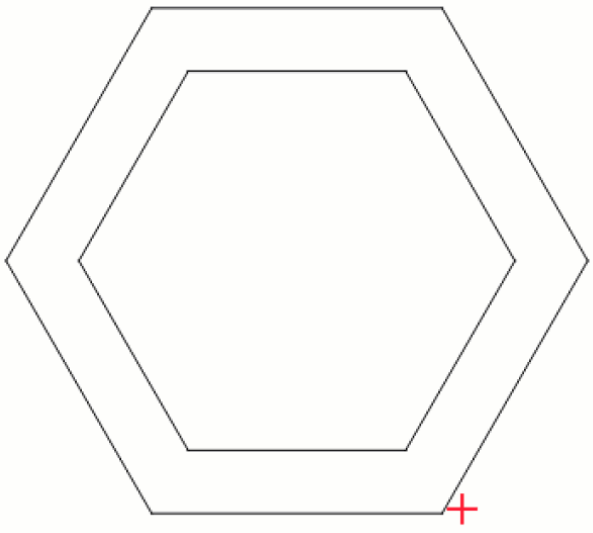
See Open vs. Closed Shapes for more information.

Fill Mode tells your laser to etch parallel lines within the boundaries of vector graphics.

The distance between each line is determined by the Line Interval setting, and the Speed and Power settings control the darkness or depth of the etch. Use low Intervals, low Speeds, and high Powers for deep engravings or dark marks, or tell your laser to move quickly at low Power to lightly etch or mark the surface.



If you have two shapes set to the same layer, and one is inside of the other, the area between the two outlines will be filled.



3. Turn off the **Air** toggle to disable air assist for this layer. It's helpful for cutting, but less useful for engraving.

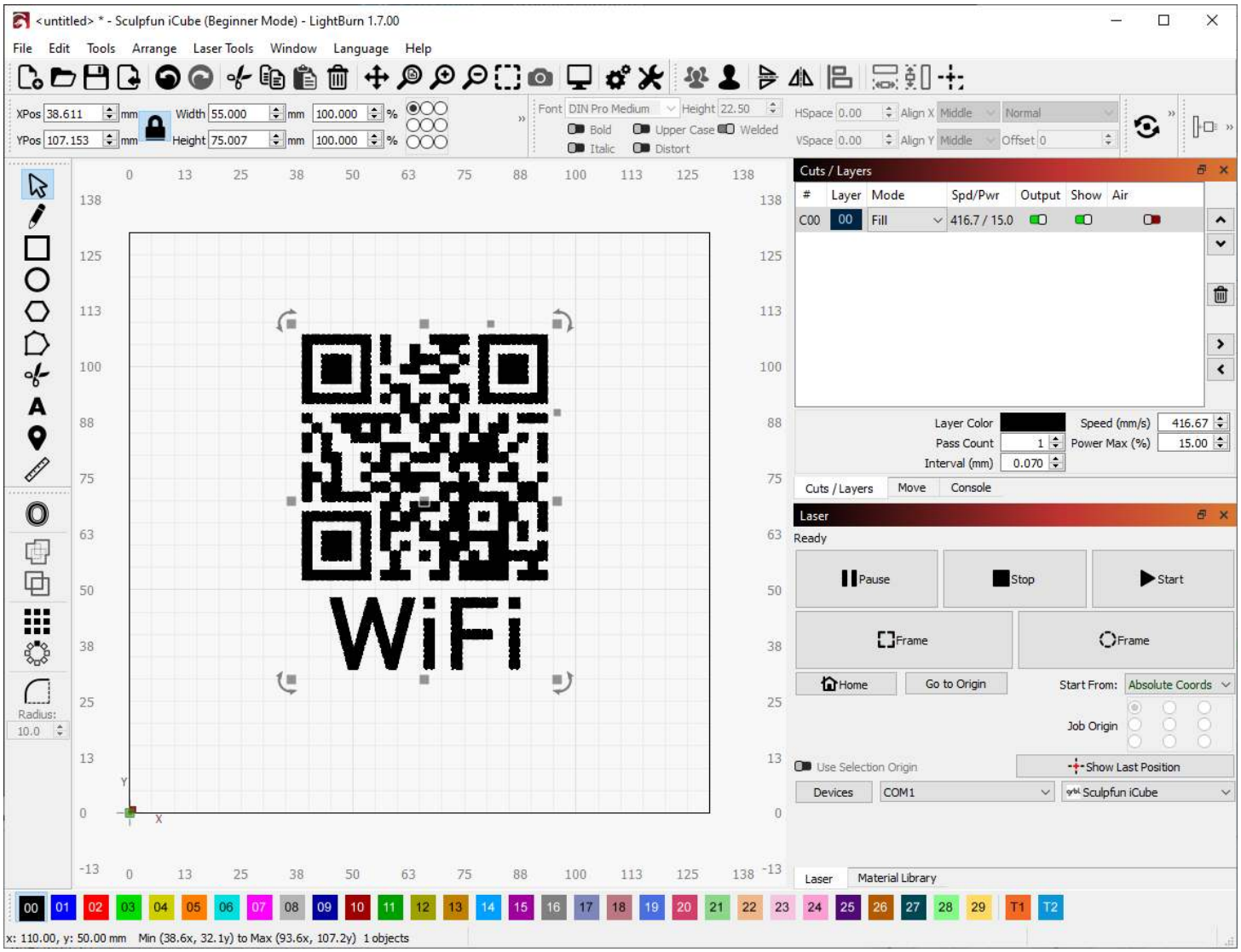
Click here for more information on Air Assist

Air assists are a feature of some types of lasers that blow air onto the surface of your material at the spot where the laser's beam strikes, which can help prevent soot accumulation and charring, and aid in cutting processes.

Some lasers have automatic assists, which you LightBurn can turn on or off when a job begins. Other models have external air assists which you must enable manually when you start a job.

If your laser has a manual air assist or no air assist at all, toggling the Air switch will have no effect.

4. Preview the design again, and you should see the design filled in instead of outlined.

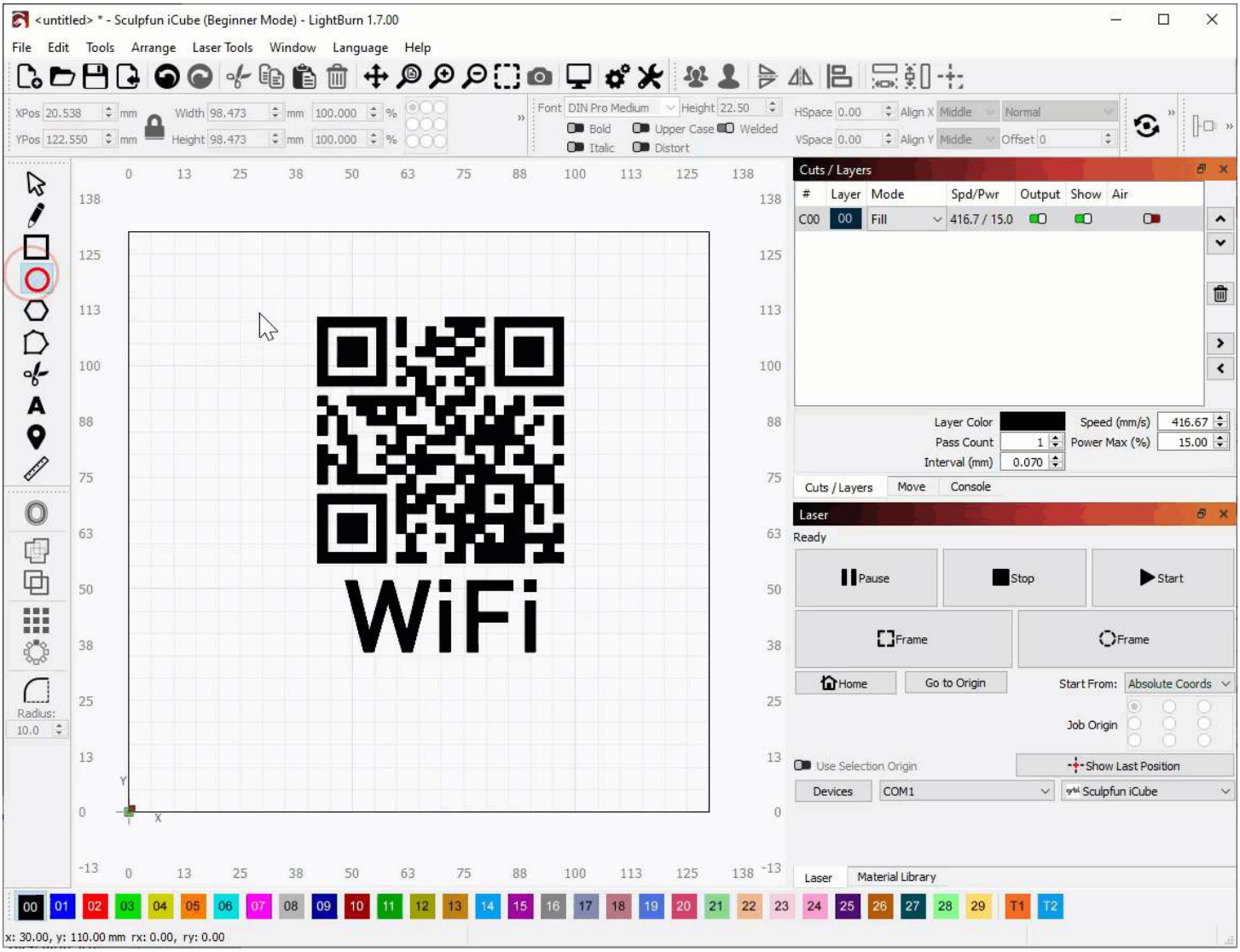


Create a Decorative Border

With the QR Code and text ready to engrave, we'll move onto a different style of engraving.

When you set Layer 00 to **Fill**, the preview shows that the laser will move back and forth over the area to engrave, very much like printing on paper. A raster engraving like this is the most common way to engrave, but you can also engrave (or *score*) in **Line Mode** by using a lower power and higher speed than you would use to cut through the material. This tends to be faster and produce cleaner results on thin lines than a raster engraving. It's particularly effective with single line fonts.

Draw and Position the Circle



1. Select the Ellipse tool from the Creation Toolbar.
2. Click near the top left of your QR Code and text to start drawing the circle. Drag toward the bottom right, holding down the ⇧ Shift key as you go to keep the width and height the same, and then release to draw the circle. Don't worry too much about the exact size and position yet.
3. Press ⎋ Esc to exit the Ellipse tool. This should leave the circle you just drew selected. Hold down the ⇧ Shift key and click to select the Grouped text and QR Code as well.

4. Center the circle around the rest of your design by going back to Arrange → **Alignment Tools** and choosing **Align Center**.
5. If you need to adjust the size of the circle, use the **Width** and **Height** boxes in the Numeric Edits Toolbar to adjust. You may need to repeat Step 4 after doing this.

Layers and Cut Settings

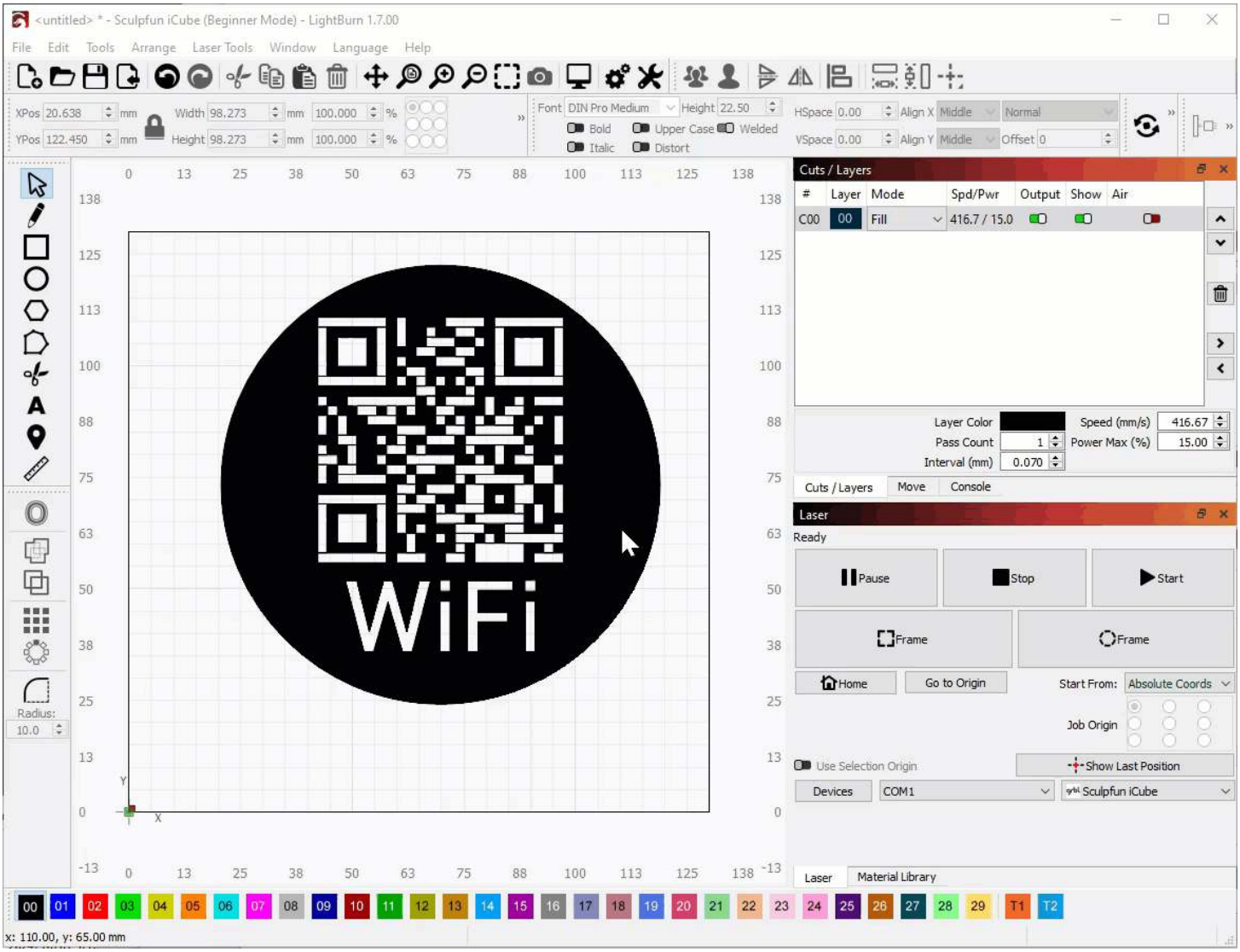
Always pay attention to units of distance and time when entering Speed settings

When entering **Speed** values recommended by your laser's manufacturer or other LightBurn users, make sure to use the *same units of distance and time as those from the recommendation*, or to convert the values to your preferred units.

A given number of **millimeters per second** is *much* faster than that same number in **millimeters per minute**. Mixing up units can lead to reduction in power output due to unexpectedly high speeds, or excessive power output — and even fire — due to unexpectedly slow speeds.

Change your units of speed in the **Dimensions / Units** tab of the **Device Settings** window. LightBurn automatically converts any existing values when you switch between units.

Right now, your circle is on the same layer as the QR Code and text. This means it'll be filled in like them as well. We'll need to move it to a different layer and give it its own cut settings.



My design is reversed!

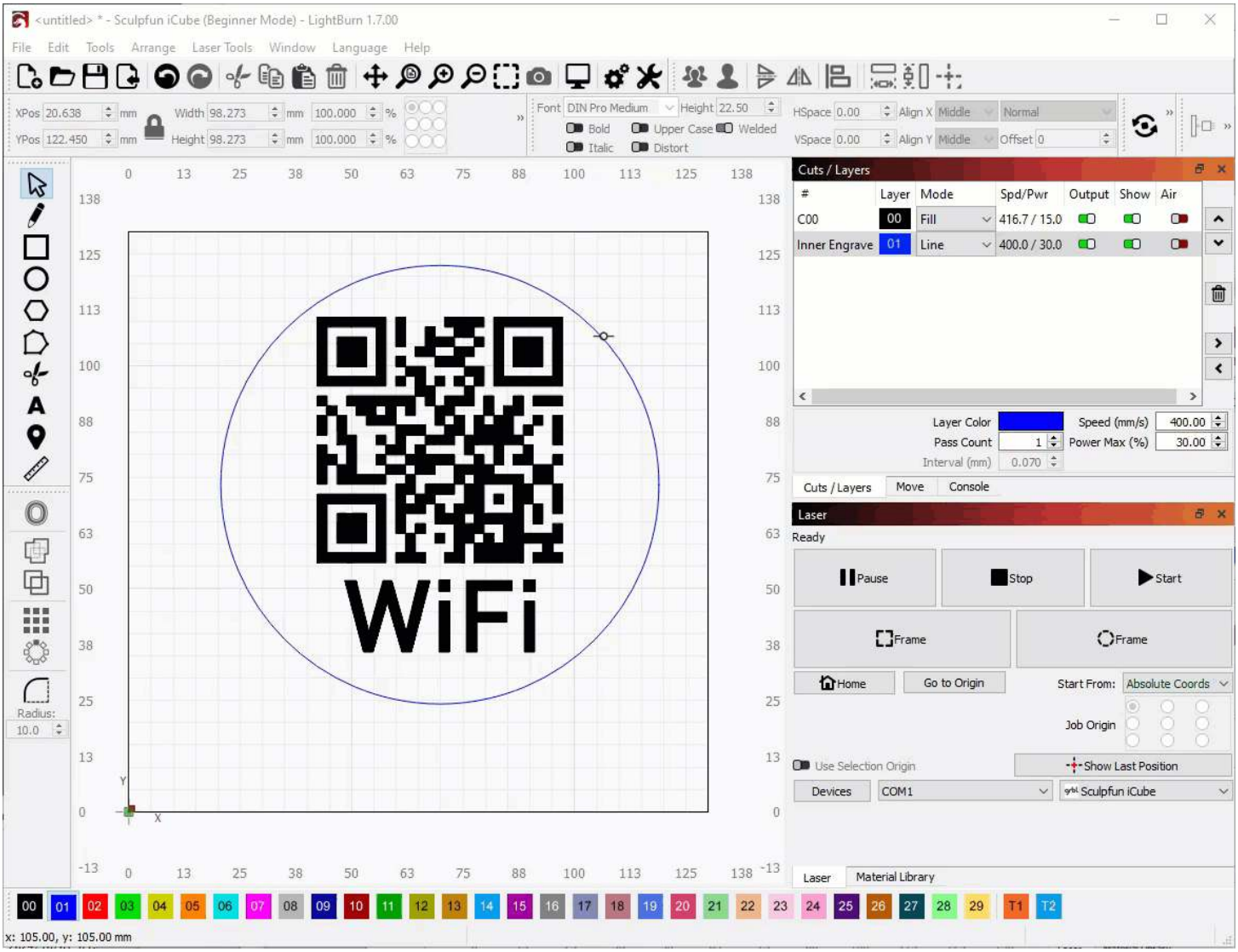
A filled shape inside of another filled shape will act as a cutout, similar to a donut hole. We'll fix this in a moment.

1. Make sure the circle – but nothing else – is selected.
2. At the bottom of the main window, look for the Color Palette. Select a layer other than Layer 00 or the Tool Layers, **T1** and **T2**.
3. In the Cuts / Layers Window, adjust the **Speed** and **Max Power** settings to a higher speed and lower power than your manufacturer recommends for cutting through the material you're using. This will let you engrave (or *score*) a line without cutting through.
4. Preview your design. Your QR Code and text should still be filled in, but the circle should be just a line that the laser travels along.

Creating the Cut Line

> **Note**
>
> If you're using a pre-made coaster blank, you can skip this step.

The last piece of the design is the circle to cut out. You could do the same thing we did for the previous step – draw a circle and center it with the Alignment tools – but this is a wonderful opportunity to get familiar with the Offset Shapes tool.



1. Make sure the circle is selected.
2. Go to Tools → **Offset Shapes** or press ⎇ Alt / ⌥ Option + 0 to open the **Offset** window.

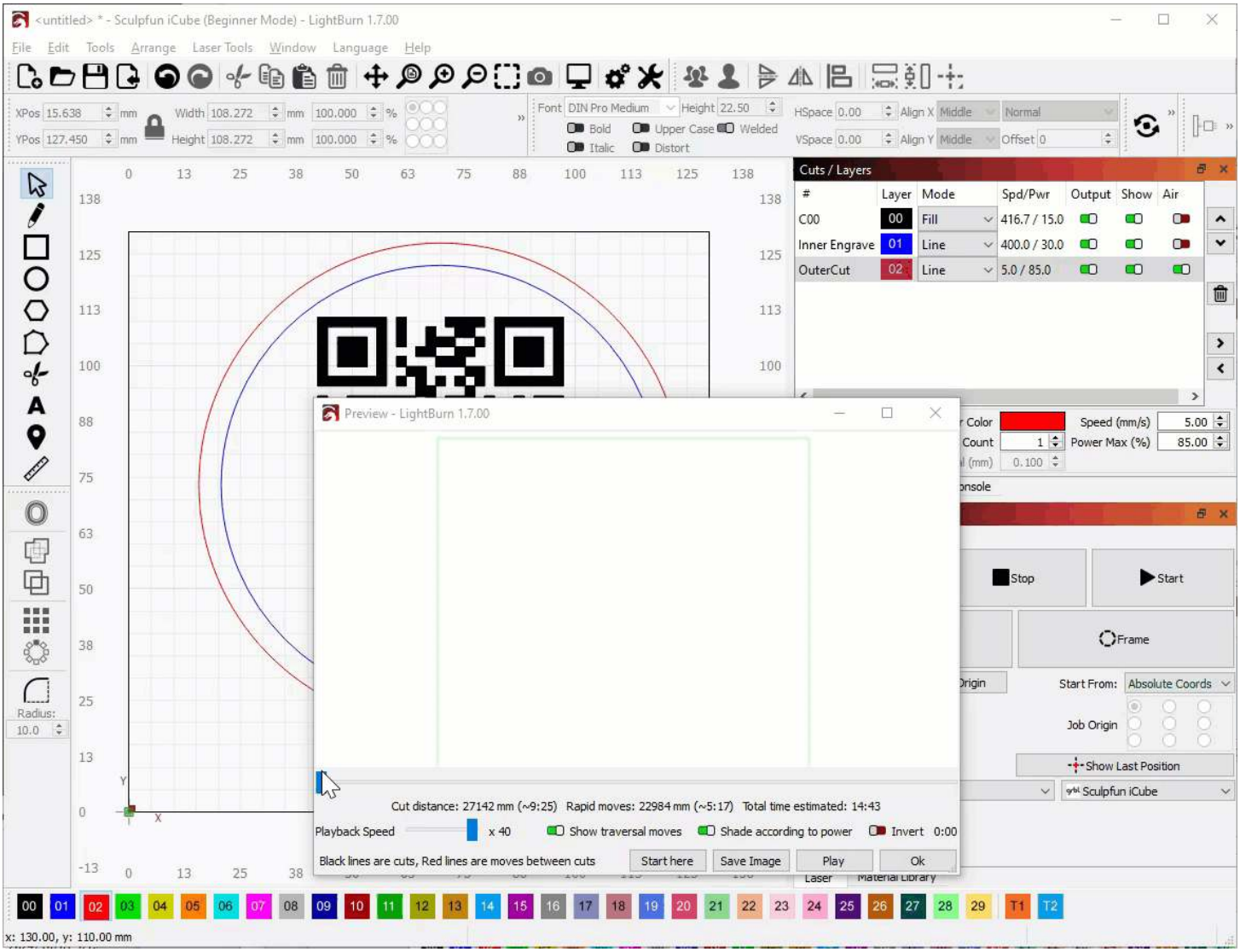
3. Make sure the **Direction** is set to **Outward** and **Optimize / Simplify results** is enabled. Adjust the **Distance** so that it looks good to you – LightBurn will give you a live preview as you adjust it. Somewhere around 6 mm or ¼" should work well, but this is your coaster and it's up to you. Press **OK** to create the new circle.
4. As you did before with the first circle, move this circle to a different layer and adjust the cut settings.
5. See your laser's user guide for recommended speed and power settings to cut through the material you're working with.
6. If your laser has an air assist, keep the **Air** switch on to enable air assist for this layer. Air assists are helpful during cutting operations.

> **Click here for more information on Air Assist**
>
> Air assists are a feature of some types of lasers that blow air onto the surface of your material at the spot where the laser's beam strikes, which can help prevent soot accumulation and charring, and aid in cutting processes.
>
> Some lasers have automatic assists, which you LightBurn can turn on or off when a job begins. Other models have external air assists which you must enable manually when you start a job.
>
> If your laser has a manual air assist or no air assist at all, toggling the Air switch will have no effect.

4.16.3 Previewing Your Design

> **Tip**
>
> It can be tempting to start a design without previewing it, especially when you're in a rush, but it's one of the best ways to catch errors *before* you start burning your material.

Now that your design is complete, preview it one more time. Remember that you can open the Preview window with `⎇ Alt` / `⌥ Option` + `P`. Press **Play** to preview what your laser will do. You can use the slider at the bottom to speed up or slow down the simulation.



In the simulation, you should see the following happen in order:

1. Raster engraving to fill in the text and QR Code.
2. Vector engraving the decorative border — the laser should follow the outline of the circle.
3. Vector cutting the outer circle.

It's generally best to do engravings before cutting out your design. If you followed along with the steps above, your layers should already be in the right order. If they aren't, you can drag them around in the Cuts / Layers Window to change the order – by default, LightBurn will run each layer in order from top to bottom.

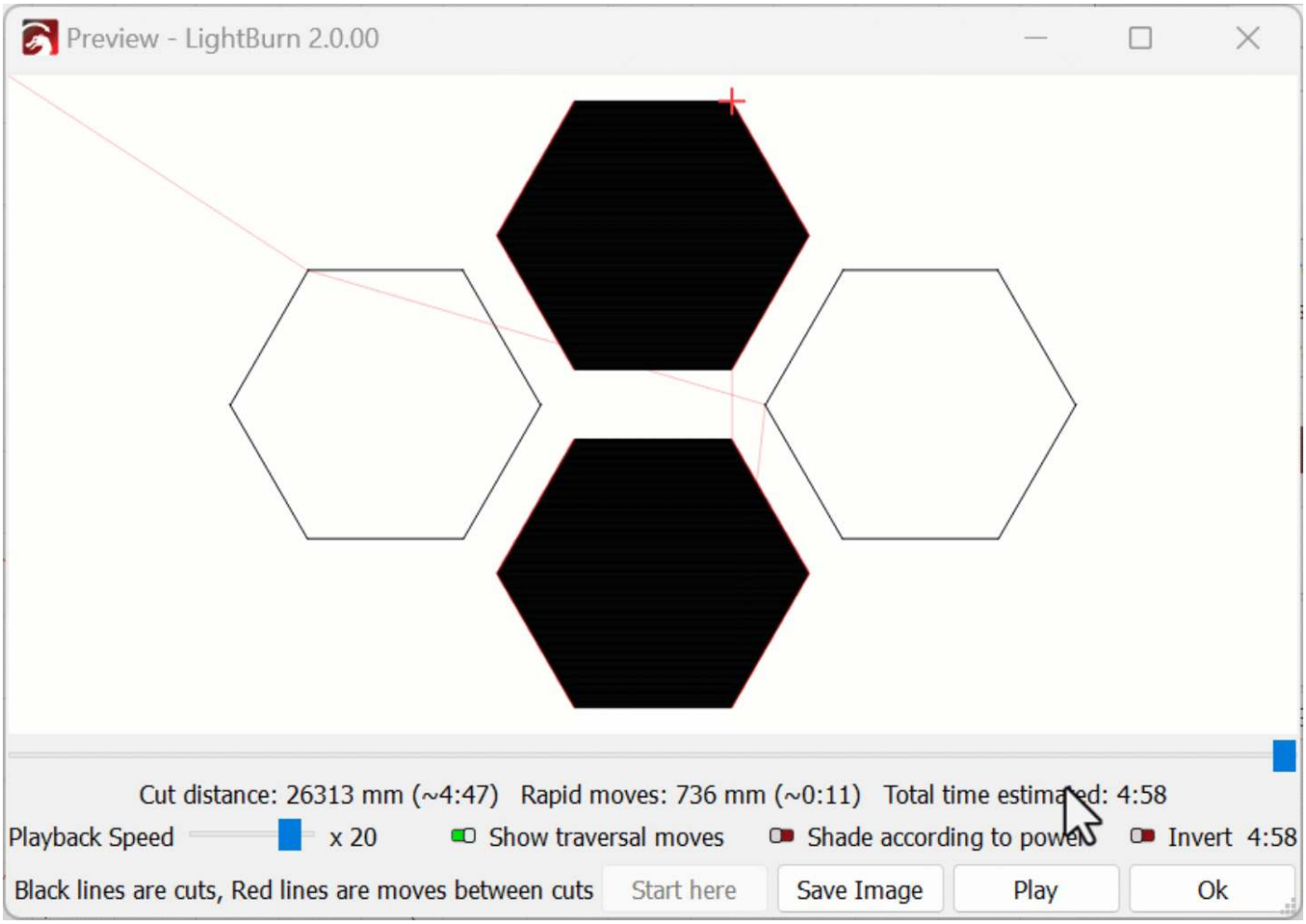
If you make changes, preview them again *before* moving on to cutting your design.

Click here to learn more about the Preview window

When you first open the Preview window, you'll see a still image of the final result of your project — the contours to be scored or cut by Line Mode will be indicated by black lines, and the areas to be etched or engraved by Fill Mode will be shown as solid black areas, or, if your Line Interval is relatively large (or you zoom in close enough) as parallel lines running across the filled shapes.

You'll also see red lines — these lines indicate the path your laser will travel while *not* firing. You can toggle **Show traversal moves** at the bottom of the Preview window to switch between showing these moves or not.

Press **Play** to see a simulation of the movements and lasering operations your laser will perform when you start the job. In addition to making sure the laser will outline or engrave the correct graphics and areas, you'll be able to make sure it performs those actions in the order you want.



By default, the simulation will play in a close approximation of the job's real runtime, and **Total time estimated** is shown in the bottom right. You can adjust the **Playback Speed** slider to speed up or slow down the simulation.

4.16.4 Engraving and Cutting Your Design

Now that you've created and previewed your design, it's time to load material into your laser and begin cutting.

Avoid damaging your work area

Since you'll be cutting through the material, make sure that whatever is underneath your material is either scrap that you don't mind burning into or won't be damaged by lasering. This might be a thin sheet of aluminum, a honeycomb bed, or a piece of scrap wood.

Focusing the Laser

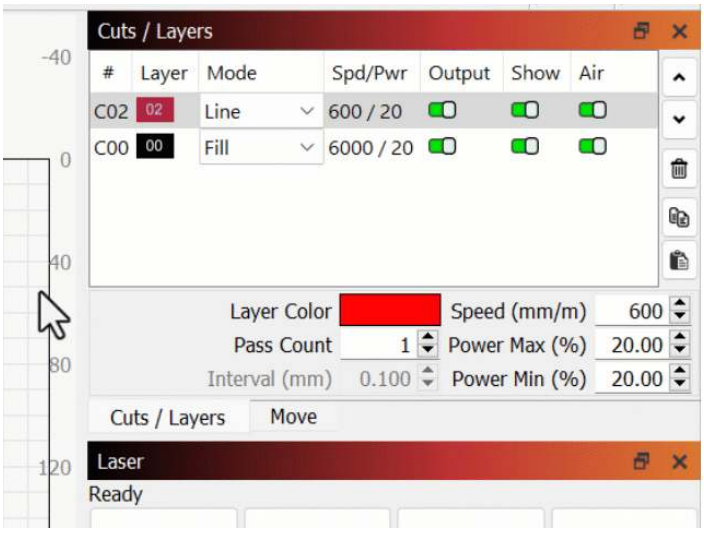
Lasers need to be focused correctly to achieve good results.

1. Place the material in the laser and move the head over the material. LightBurn has jog controls in the Move Window to make this easier.

   Click here to learn more about jogging your laser

   LightBurn has a few tools for adjusting the location of your laser's head within its work area — the most straightfoward option for beginners is to use the arrow keys in the Move Window. By default, the Move Window is hidden behind the Cuts / Layers Window — click the Move tab to expose it.

   The arrow keys move your laser up, down, right, or left. You can set the amount the laser travels with each click in the **Distance** field, and the rate at which it travels in the **Speed** field.



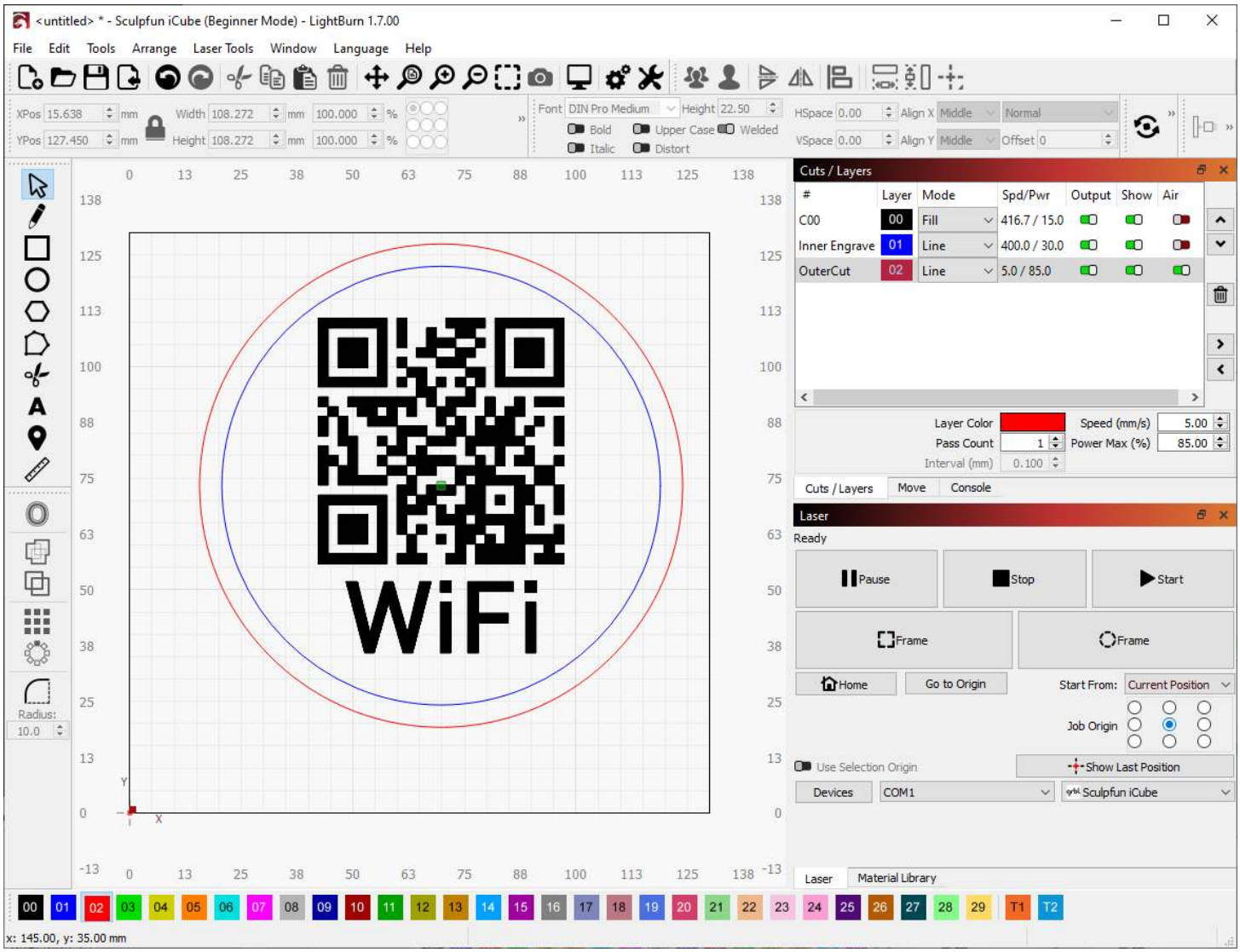
2. Focus the laser according to your laser's user guide:

   - GCode-based Diode lasers usually have a focusing spacer to set the distance between the laser and the material.

- DSP-type CO_2 lasers may require manual focusing with a focusing spacer or may support auto-focus, either through the controller, or with the Focus Z button.
- Galvo lasers require manual focusing. Many galvo lenses are marked with their optimal focal distance, and you can use a ruler to set the correct distane between the lens (or mirrors) and your material. Some are equipped with a two red dot focusing system — adjust the height of the scan head until the dots meet, then the laser is focused. Finally, see our guide on Galvo Laser Focusing for a manual method of determining optimal focus.

Start From

LightBurn has three different **Start From** modes: **Current Position**, **User Origin**, and **Absolute Coordinates**. For this project, you'll be using Current Position.



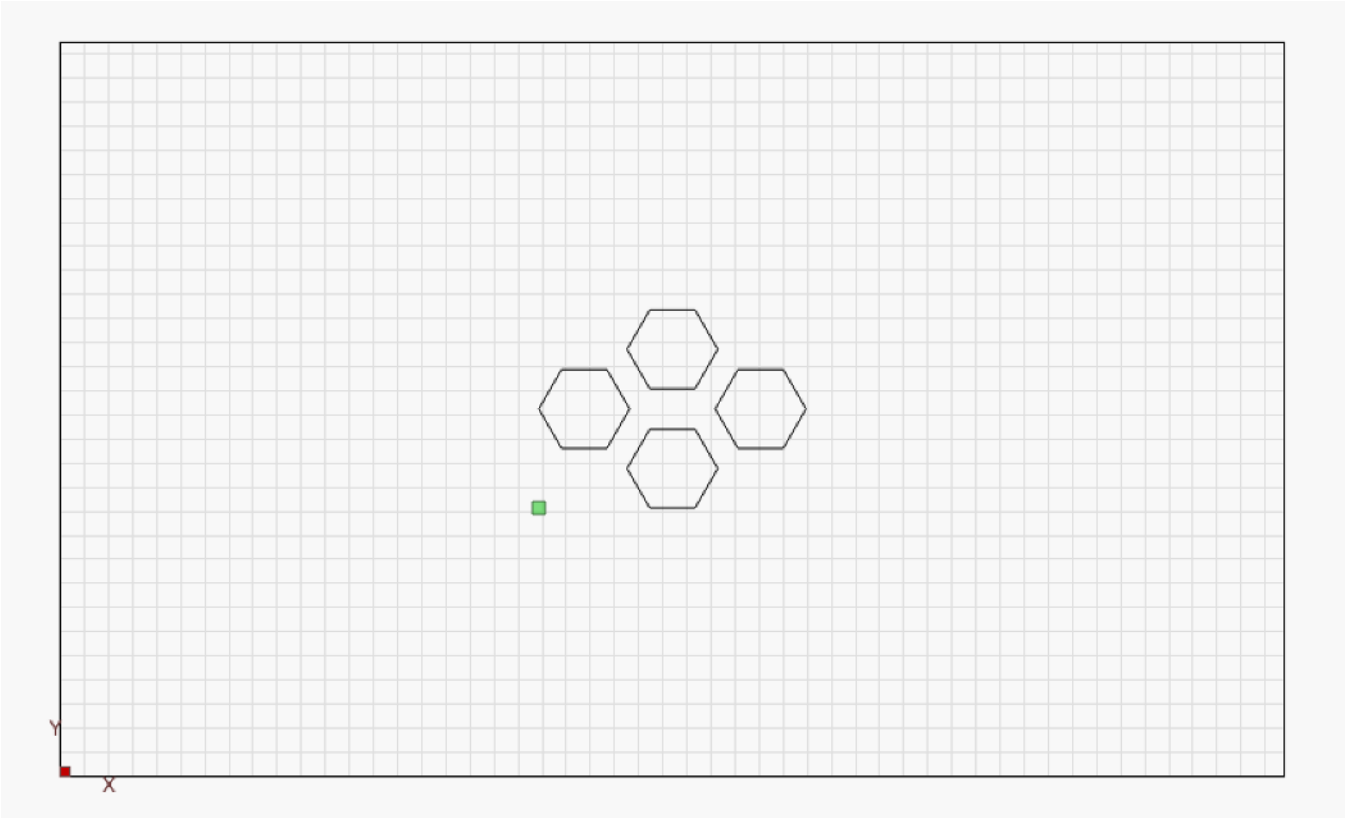
1. Set **Start From** to **Current Position** using the dropdown in the Laser Window.
2. Set the **Job Origin** in the Laser Window to the center of the artwork.

3. With these two settings, your engraving will be centered wherever the laser is positioned when you start the job.

Click here to learn more about Current Postion and other Start From modes

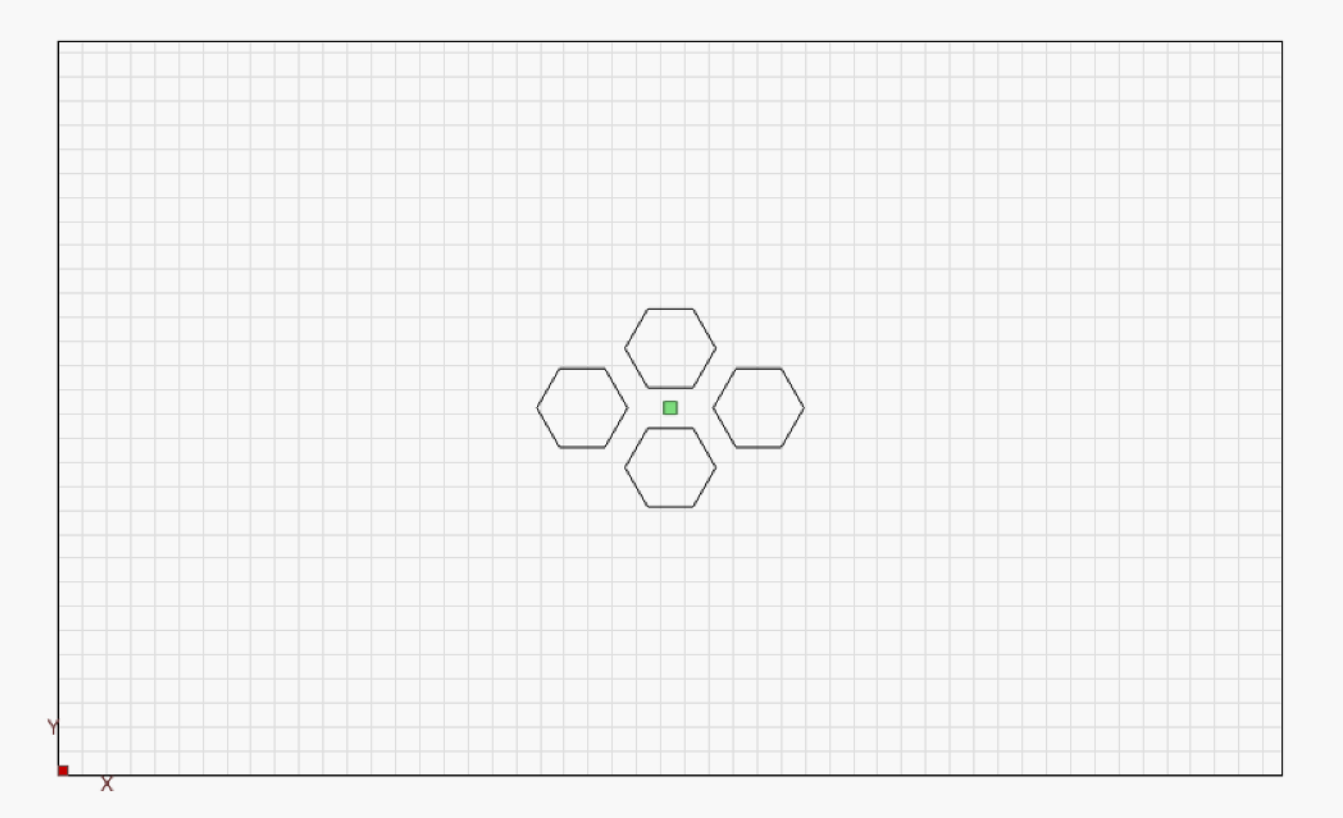
With **Current Position** selected, your job outputs relative to wherever the laser head is located when you press the **Start** button. The **Job Origin** control in the **Laser Window** tells LightBurn how to orient output relative to the laser head.

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



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

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



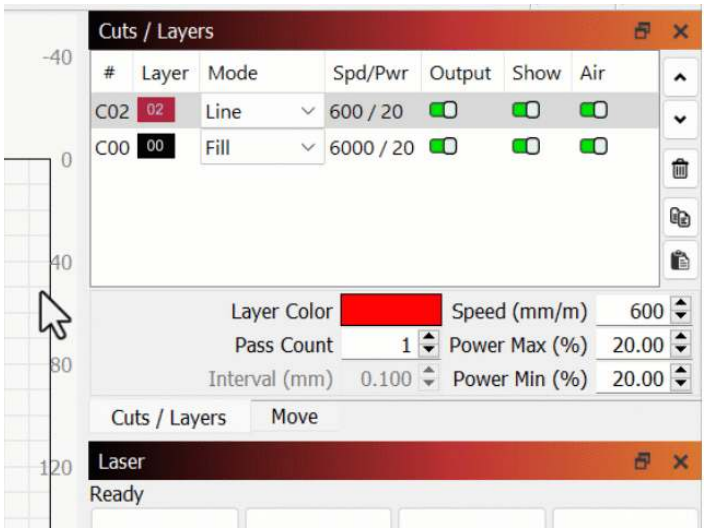
The job will be centered around the current position of the laser head. If you position the laser head directly over the center of the item you want to etch, the output will be centered on the item.

4. Jog your laser to the center of your coaster. If your laser has a controller display and keypad, you can use the buttons there to jog. If not, use the buttons in the Move Window.

Click here to learn more about jogging your laser

LightBurn has a few tools for adjusting the location of your laser's head within its work area — the most straightfoward option for beginners is to use the arrow keys in the Move Window. By default, the Move Window is hidden behind the Cuts / Layers Window — click the Move tab to expose it.

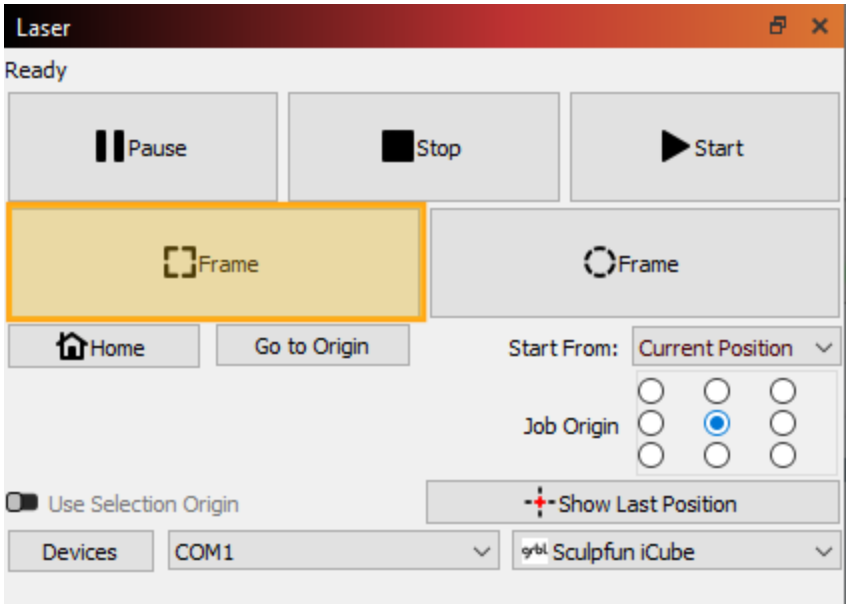
The arrow keys move your laser up, down, right, or left. You can set the amount the laser travels with each click in the **Distance** field, and the rate at which it travels in the **Speed** field.



Framing

The final check before you can run the job is to make sure that it will output in the location you're expecting.

1. Click the **Bounding Box Frame** button to tell your laser to trace a box around the area the coaster will be cut and engraved.


Laser
Ready
Pause
Stop
Start
Frame
Frame
Home
Go to Origin
Start From:
Current Position
Job Origin
Use Selection Origin
Show Last Position
Devices
COM1
Sculpfun iCube

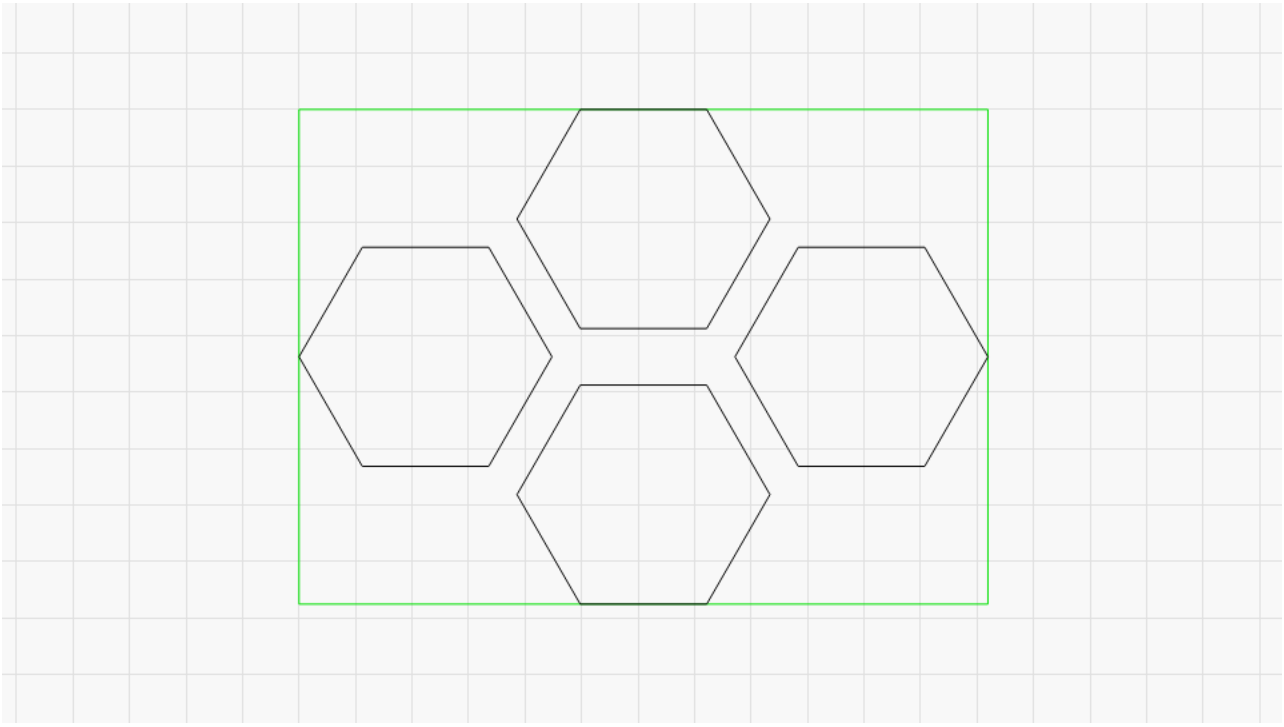
Click here to learn more about Framing

Bounding Box Frame

Bounding Box framing

commands the laser to trace a path defined as the smallest possible rectangle that will fully contain all graphics you're sending to the laser.

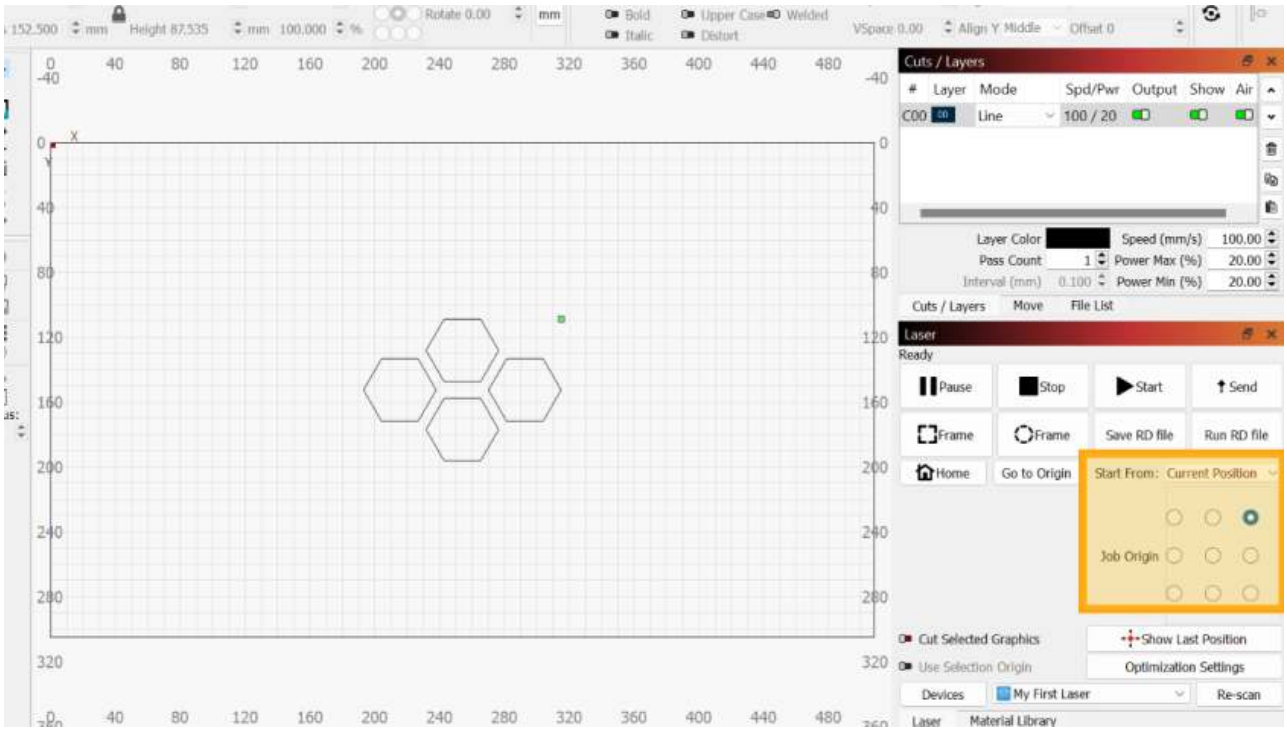
Here's a representation of that path in LightBurn:

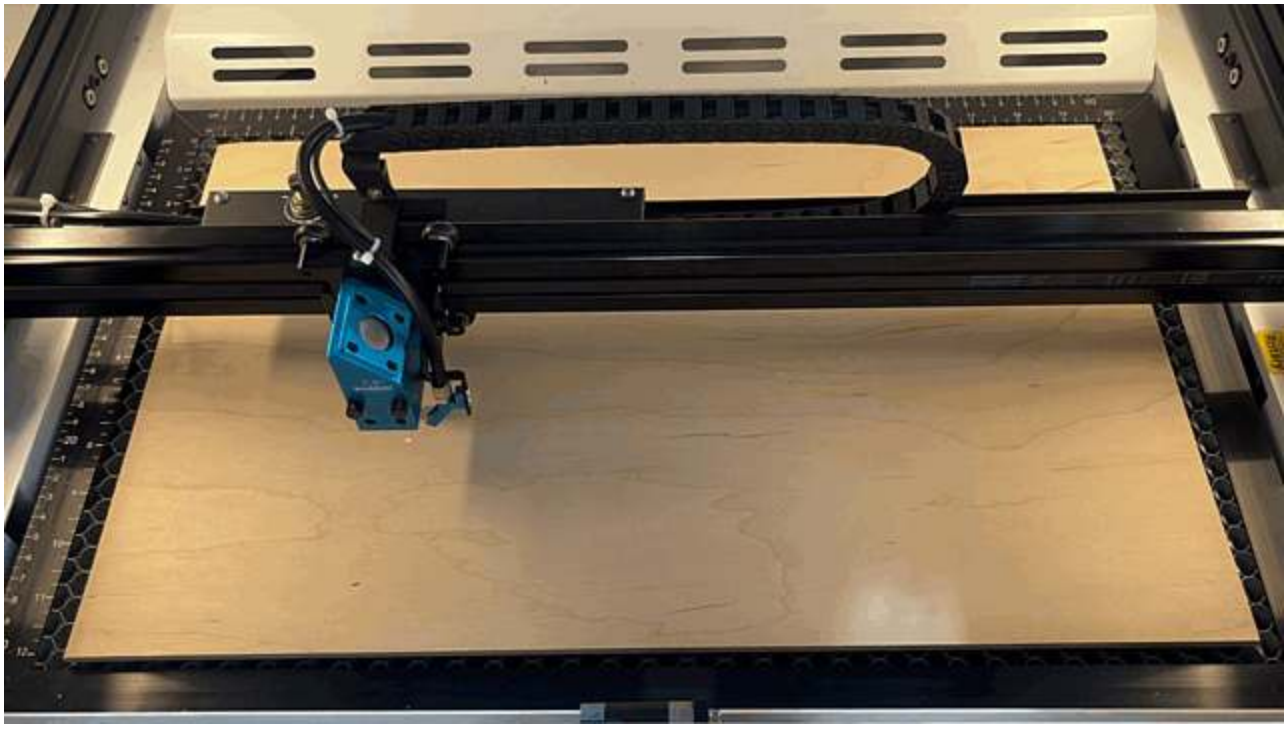


And here's the laser following that same path during Framing:

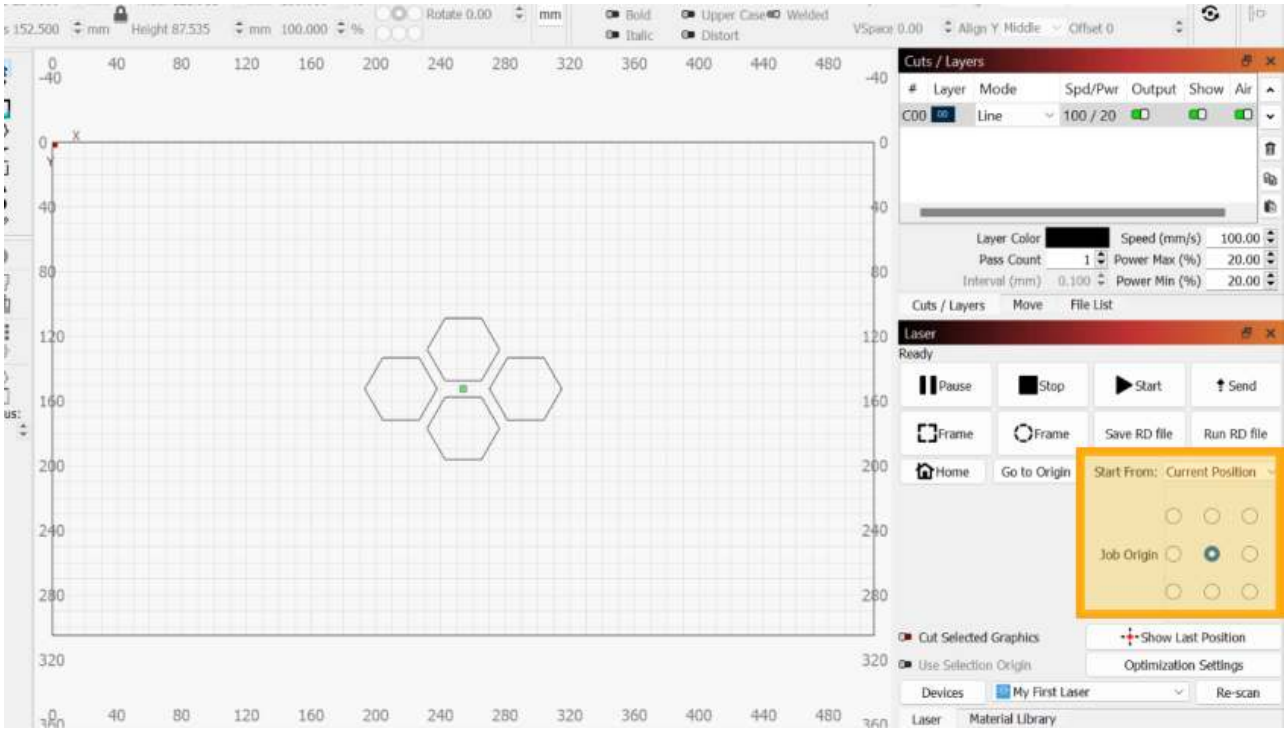
Framing with Current Position

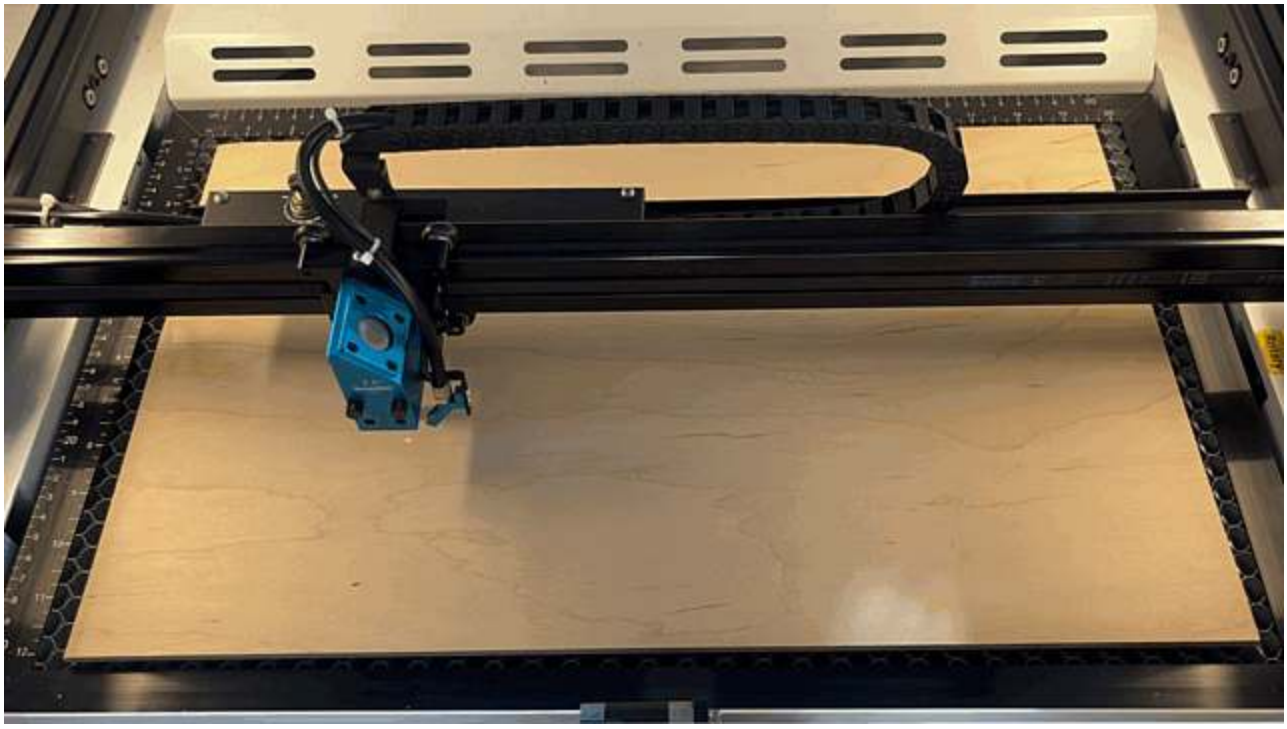
Here we've selected Current Position as the Start From mode, and the top right Job Origin position, so the laser moves down and to the left from its starting position:





Here's Current Position again, but with the center Job Origin position selected — now the laser moves out from where it's sitting, and traces a rectangle centered on the location where it began:





Note for Galvo laser users

If you have a Galvo laser, the design will be outlined by your laser's red dot instead. See Galvo Framing for more information.

2. If the area your laser frames is correct, you're ready to start the job. If not, what you do next depends on how far off it is.

Having trouble seeing where your laser is Framing? Click here for tips

Click here to learn how to fire your laser at low power during Framing (diode lasers only)

If your laser has a red dot pointer, it makes framing easier to see. Otherwise, your laser will travel around with the laser turned off. LightBurn does offer the ability to run diode lasers at a very low power to aid in Framing. To do so:

a. Go to Edit → Device Settings to open the Device Settings window.

b. In the Basic Settings tab, toggle on the **Enable laser fire button** and **Laser on when framing** settings. Click **OK** to apply.

c. The Move Window should now have a **Fire** button and a box to enter a power level. Keep this value very low to avoid burning the material — start at 0.25%, and only increase that value only if the beam is not visible.

d. The **Fire** button will toggle the laser on and off. Now you can use the **Frame** command with the laser visible.

e. Adjust the position of the material and/or the laser head until you're happy with the layout of the design.

Danger

The Fire button should only be used for diode lasers, which generally don't have a red dot pointer for Framing.

Always wear proper eye protection when Firing your laser. Consult your laser's manufacturer for information on the proper eye protection required for your laser.

This should never be used for a CO_2 laser, which has an invisble beam that could blind you or start a fire.

Click here to learn how to run Framing repeatedly, until you tell it to stop

Frame Continuously is an option in the Device Settings window that tells your laser to repeatedly Frame the same path until you tell it to stop.

Sometimes you won't get the positioning just right on your first try, but a little nudge of your material will do the trick. Other times, you'll just want to want to double or triple check the position. In either case, Frame Continuously will be a big help.

To enable it:

a. Go to Edit → Device Settings to open the Device Settings window.

b. In the Basic Settings tab, toggle on the **Frame Continuously** setting. Click **OK** to apply.

c. Now when you click either of the Frame buttons, a dialog window will open, letting you know that continuous Framing is active, and to press OK when you're ready to stop.

3. If it's close, but a little bit off the material, try nudging the material (if you have room) to align it to the framed area. If you don't have room, you'll need to exit the Material Test Generator window and jog your laser to a better position.

4. If it's very far off, it's likely you didn't select the correct Start From mode or Job Origin position. Revisit the Start From step, or see Coordinates and Origin.
5. After making corrections, be sure to Frame again. Repeat if necessary, until you've got everything lined up properly.

Running the Job

1. Press the Start button in the Laser Window to tell your laser to begin running your project.
2. If all goes well, you'll have a new coaster in a few minutes.
3. Go and make more stuff!

> **Note**
>
> If the result isn't what you were expecting, revisit previous steps to make sure you followed them all, visit our Troubleshooting section, join our forum to look for advice, or email us at support@lightburnsoftware.com.

← Previous: Connect to the Laser

Next: Next Steps →

get-started

If you've been following along, you've installed LightBurn, added a laser, learned a great deal about the way LightBurn works, and created your first project. At this point, you know enough to explore LightBurn on your own, but we have some additional resources to help you along.

How to Use These Docs

We're proud to say our documentation is comprehensive, but you might need a few pointers to find your way around. We've got you covered in this brief guide.

Main Window

Find any tool or feature you're looking to learn more about by clicking through interactive UI screenshots, starting from the Main Window.

Collections

Sometimes you don't know what tool you're looking for, you just know what you're looking to do. Here we've assembled a range of tools, features, and resources, organized according to the goals they'll help you accomplish.

LightBurn's YouTube Channel

Our YouTube channel has a variety of videos to help you get familiar with what LightBurn can do and how to make it happen.

LightBurn Forum

Talk with other users and LightBurn staff, see and share finished projects, and ask questions on our forum.

← Previous: First LightBurn Project

5 Tools & Features

_index

5.1 Tools and Features

Our reference pages are here to help you use all of LightBurn's tools and features.

If you know what tool you're looking for, you can search for it or use the navigation list on the left side of the page. If you know what you want to do but not what tool you need, try looking through the categories below.

5.1.1 Essential Functions

File Management

Selection

Zoom and Pan

Undo and Redo

Clipboard

Transform Controls

Grouping

Preview

5.1.2 Layout and Design

Creation Tools

Draw Lines

Create Primary Shapes

Create and Edit Text

Variable Text

Create Bar Code

Shape Properties

Measure

Art Library

Editing

Numeric Edits Toolbar

Edit Nodes

Scissor/Trim Tool

Convert to Path

Auto-join Selected Shapes

Close Path

Break Apart

Optimized Selected Shapes

Warp and Deform

Modifying and Combining

Mirror

Offset Shapes

Boolean and Weld Operations

Cut Shapes

Grid Array

Circular Array

Copy Along Path

Apply Path to Text

Radius/Fillet

Make Same Width/Height

Resize Slots

Arrangement

Align	**Distribute**	**Docking**
Move Selected Objects	**Nest Selected**	

Image Tools

Adjust Image	**Masking**	**Convert to Bitmap**
Save Processed Bitmap	**Trace Image**	**Image Options**

5.1.3 Laser Control

Cut Settings

Cuts/Layers Window	**Cut Settings Editor**	**Line**
Fill	**Offset Fill**	**Image**
Tabs	**Kerf Offset**	**Perforation Mode**

Lead In/Out

Galvo Timing

Dot Width Adjustment

Output and Positioning

Laser Window

Coordinates, Origin, and Start From

Move/Jog

Framing

Optimization Settings

Cut Selected/Use Selection Origin

Position Laser

Set Start Point

Quality Optimization

Material Test

Focus Test

Interval Test

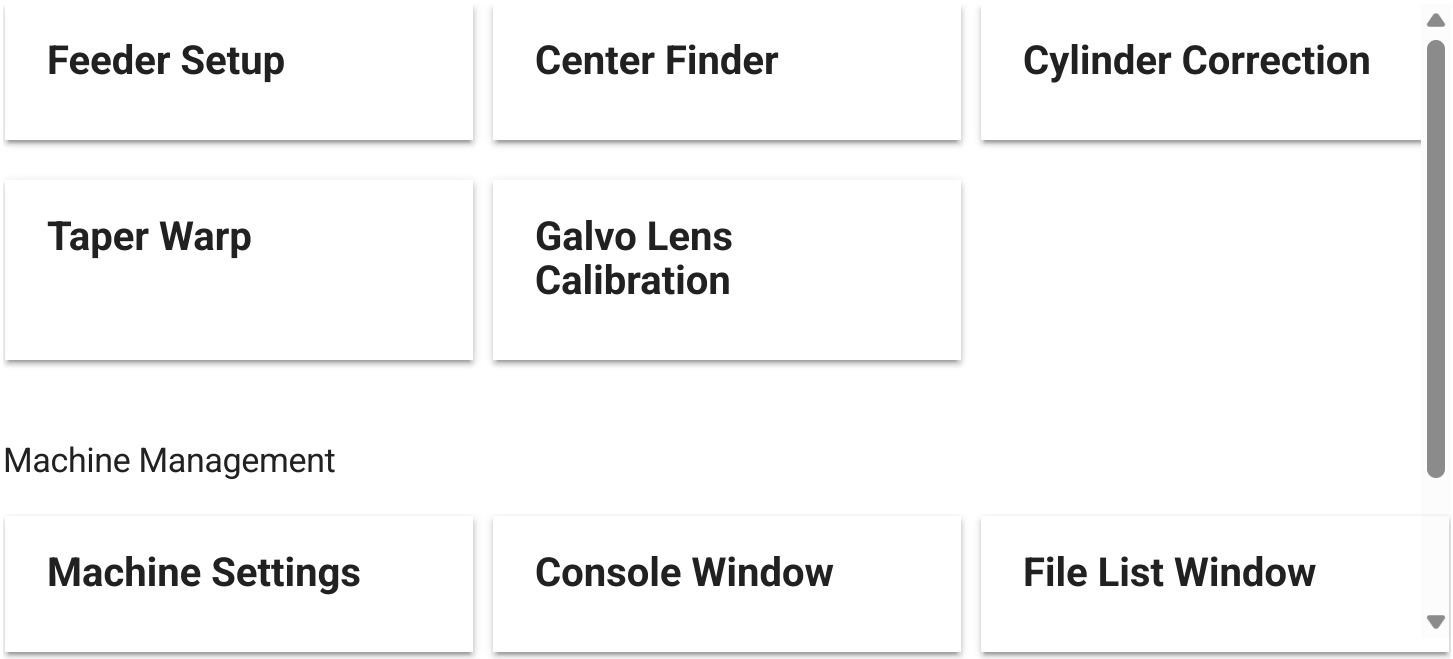
Material Library

Modes and Advanced Control

Print and Cut

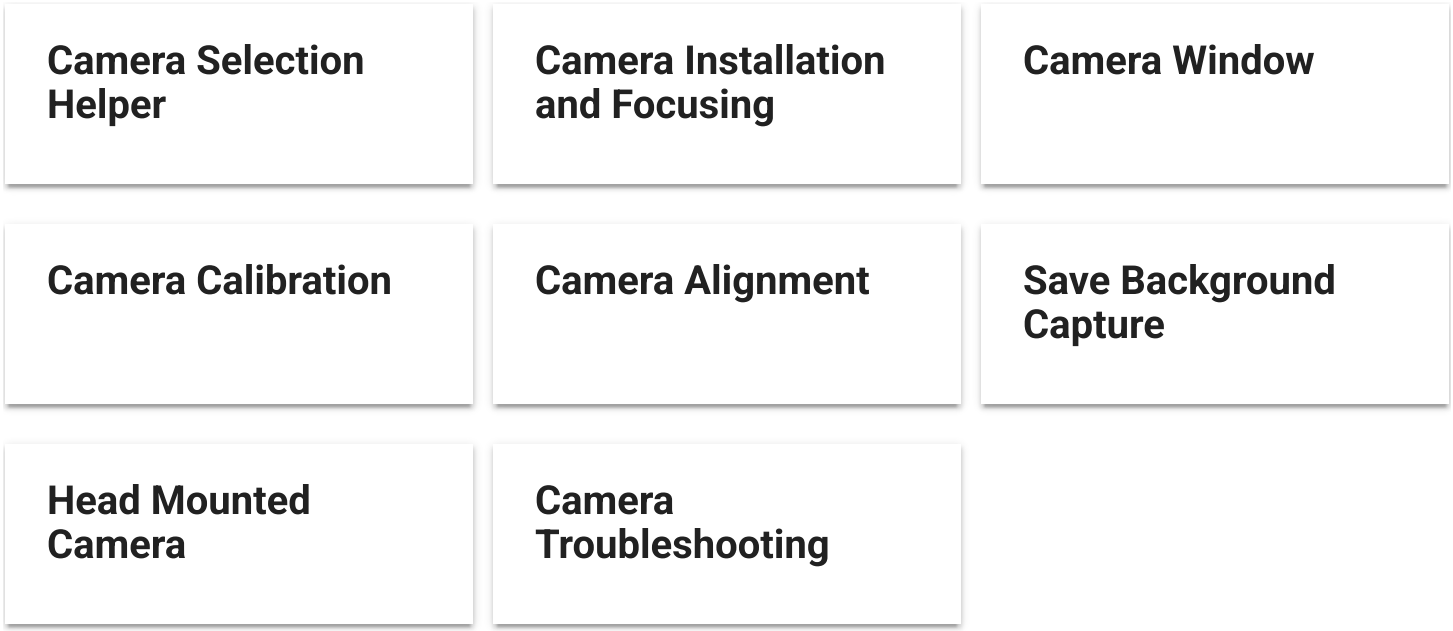
Rotary Mode

Repeat Marking



Machine Management

5.1.4 Camera



5.2 User Interface

UI default-layout main-window first-steps windows-and-toolbars first-steps

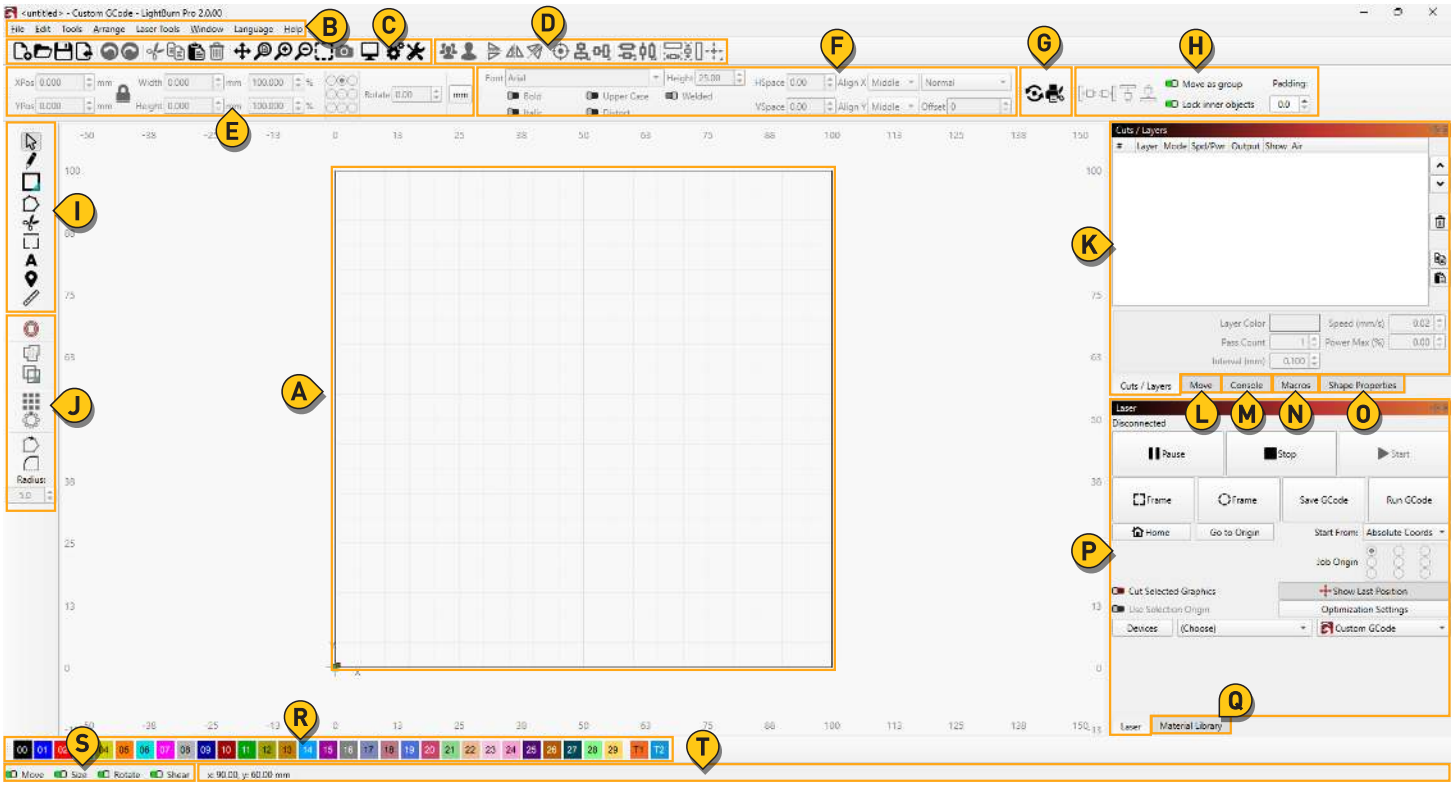
5.2.1 Main Window

Below is the default layout of the full LightBurn window, for a GCode-based device. This layout will be slightly different depending on the type of laser you're working with.

For information on rearranging the layout, see Customizing the LightBurn Window.

For a full list of available windows and toolbars, see Window Menu.

Click any UI element in the image below to go directly to the relevant page for that element, or scroll down for a list of elements.



A: Workspace / Edit Window

B: Menus

C: Main Toolbar

D: Arrange Toolbar

E: Numeric Edits Toolbar

F: Text Options Toolbar

G: Modes Toolbar

H: Docking Toolbar

I: Creation Toolbar	**J: Modifiers Toolbar**
K: Cuts / Layers Window	**L: Move Window**
M: Console Window	**N: Macros Window**
O: Shape Properties Window	**P: Laser Window**
Q: Material Library Window	**R: Color Palette**
S: Transform Control Toggles	**T: Status Bar**

Workspace / Edit Window

The area where you create, adjust, modify, and arrange artwork in LightBurn.

See Workspace for more information.

Menus

Contains all of LightBurn's top-level menus. Individual menus contain a wide range of tools and features.

See Menu Toolbar for a full list of top-level menus.

Main Toolbar

Contains functions for opening or importing files, saving, using the clipboard (copy and paste), moving or zooming the view.

See Main Toolbar for more information.

Arrange Toolbar

Contains tools for positioning objects, both on an individual basis, and in relation to each other.

See Arrange Toolbar for more information.

Numeric Edits Toolbar

Contains options for adjusting the size, position, and orientation of shapes or groups of shapes in your project.

See Numeric Edits Toolbar for more information.

Text Options Toolbar

Contains options for adjusting attributes of Text Objects, including, **Font**, size (**Height**), spacing (**HSpace** and **VSpace**), and more.

See Create and Edit Text — Text Options Toolbar for more information.

Modes Toolbar

Contains buttons to open dialog windows or wizards for advanced lasering processes.

See Modes Toolbar for more information.

Docking Toolbar

Contains tools to move selected objects left, right, up, or down, until they meet the edge of the Workspace or another object.

See Docking for more information.

Creation Toolbar

Contains tools for selecting objects in your Workspace, or creating Primary Shapes, text, lines, and more.

See Creation Toolbar for a full list of tools.

Modifiers Toolbar

Contains tools for combining, altering, and producing arrayed duplicates of graphics.

See Modifiers Toolbar for a full list of tools.

Cuts / Layers Window

Shows the layers currently assigned to graphics in your design, and lets you alter common Cut Settings, or double-click to access additional settings.

See Cuts / Layers Window for more information.

Move Window

Provides buttons to jog and position your laser, along with additional options for users with GCode-based lasers.

See Move Window for more information.

Console Window

> **Note**
>
> Available for GCode-based lasers only.

Displays messages from your laser's controller and commands sent to it by LightBurn. You can also input direct commands to your laser through this window.

See Console Window for more information.

Macros Window

Allows you to create buttons to store frequently used commands for GCode-based lasers. These functions will only work when LightBurn is directly connected to a GCode-based laser.

See Macros Window for more information.

Shape Properties Window

Displays editable properties of selected objects.

See Shape Properties Window for more information.

Laser Window

The hub for setting up and selecting a laser, Framing and Starting jobs, determining job positioning, and more.

See Laser Window for more information.

Material Library

Provides a place to store, organize, and apply preset Cut Settings for different operations and materials.

See Material Library for more information.

Color Palette

Contains the colors/layers that you can assign to individual graphics in LightBurn. Use these colors/layers to assign different kinds of operations and settings to the shapes in your design.

See Color Palette for more information.

Transform Control Toggles

Switches that enable and disable specific types of editing across an entire project, in order to prevent accidental edits, such as inadvertently scaling a design that contains strict sizing, or moving tightly nested parts.

See Transform Control Toggles for more information.

Status Bar

Provides contextual information related to the active tool or process being performed.

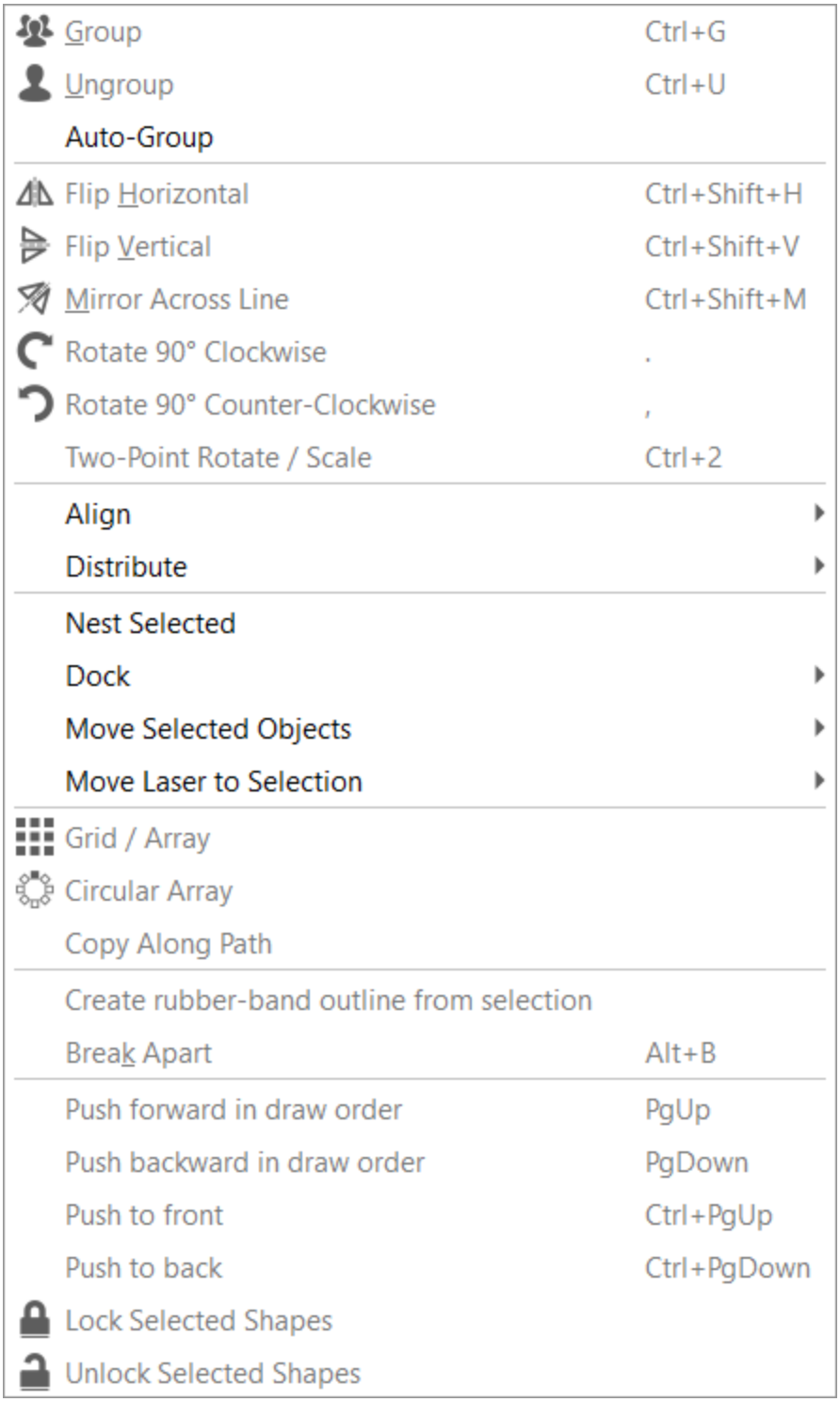
See Status Bar for more information.

UI layout-and-design arrangement

5.2.2 Arrange Menu

The **Arrange Menu** contains tools for positioning objects, both on an individual basis, and in relation to each other. It also contains tools for moving the physical laser in relation to objects within your project.

Click any option in the image below to go directly to the relevant page for that tool, or scroll down for a list of options and descriptions.



Group

`^ Ctrl` / `⌘ Cmd` + `G`

Combines multiple objects into a single entity, allowing you to move, resize, and manipulate them as though they were one object.

See Grouping for more information.

Ungroup

`^ Ctrl` / `⌘ Cmd` + `U`

Splits **Groups** back into the individual objects that make them up.

See Grouping for more information.

Auto-Group

Groups objects that fall within the boundaries of a closed shape together with the outermost shape.

See Auto-Group for more information.

Flip Horizontal / Vertical

- **Flip Horizontal** — Mirrors objects along the X Axis.

  `⇧ Shift` + `^ Ctrl` / `⌘ Cmd` + `H`
- **Flip Vertical** — Mirrors objects along the Y Axis.

  `⇧ Shift` + `^ Ctrl` / `⌘ Cmd` + `V`

See Mirror Tools for more information.

Mirror Across Line

`⇧ Shift` + `^ Ctrl` / `⌘ Cmd` + `M`

Flips objects along a selected line.

See Mirror Tools — Mirror Across Line for more information.

Rotate 90° Clockwise / Counter-Clockwise

- **Rotate 90° Clockwise** — Rotates the object to the right by 90°.

`.`

- **Rotate 90° Counter-Clockwise** — Rotates the object to the left (anti-clockwise) by 90°.

`,`

See Transform Controls — Rotate for more information.

Two-Point Rotate / Scale

`^ Ctrl` / `⌘ Cmd` + `2`

Rotates and resizes objects around custom pivot points in your Workspace.

See Two-Point Rotate / Scale for more information.

Align

Repositions objects according to their edges or centers.

See Align for more information.

Distribute

Evenly spaces objects either vertically or horizontally, spaced from their centers or edges.

See Distribute for more information.

Distribute → Move Together

Arranges objects so that their edges abut along horizontal or vertical planes.

See Distribute — Move Together for more information.

Nest Selected

Arranges objects to minimize material waste using an online service.

See Nest Selected for more information.

Dock

Moves selected objects left, right, up, or down, until they meet the edge of the Workspace or another object.

See Docking for more information.

Move Selected Objects

Moves objects to a corner, midpoint, or center of your Workspace. If you have a Gantry style laser, it can also move selected objects to the last reported position of your laser head.

See Move Selected Objects for more information.

Move Laser to Selection

Moves your laser in its physical work area to a location that corresponds to a position on your current selection in your LightBurn Workspace.

See Move Laser to Selection for more information.

Move Laser To Selection → Jog Laser

Moves the laser by the amount specified in the Move Window, in a chosen direction.

See Move Window — Jogging for more information.

Grid Array

Creates copies of an object (or objects) in regularly spaced rows and columns, and includes options to adjust spacing, mirror the shapes, randomize orientation, and more.

See Grid Array for more information.

Circular Array

Arranges multiple copies of an object — or multiple objects — in a radial pattern around either a point in space, or a central object.

See Circular Array for more information.

Copy Along Path

Creates duplicates of an object that follow the contour of a path.

See Copy Along Path for more information.

Create Rubber-Band Outline from Selection

Makes a new shape outlining the graphics in your current selection. The new shape is defined as the shortest possible path that can contain all graphics in your selection, as if a rubber band were stretched around them.

See Create Rubber-Band Outline for more information.

Break Apart

⎇ Alt / ⌥ Option + B

Separates paths into their constituent lines and curves.

See Break Apart for more information.

Push in Draw Order

Changes the order of objects in the *draw order*, which affects the visual appearance of graphics in your Workspace, when using a Wireframe View Style.

See Push in Draw Order for more information.

Lock Selected Shapes / Unlock Selected Shapes

- **Lock Selected Shapes** prevents editing of selected objects.
- **Unlock** allows them to be edited once again.

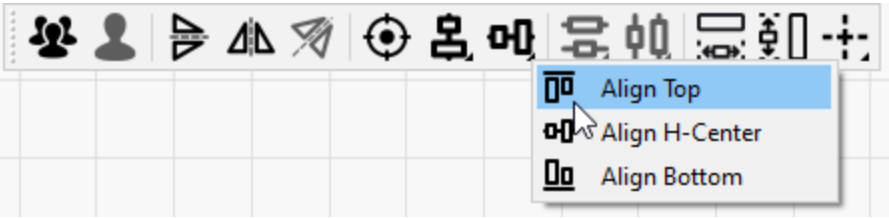
See Lock Shapes for more information.

UI arrangement layout-and-design

5.2.3 Arrange Toolbars

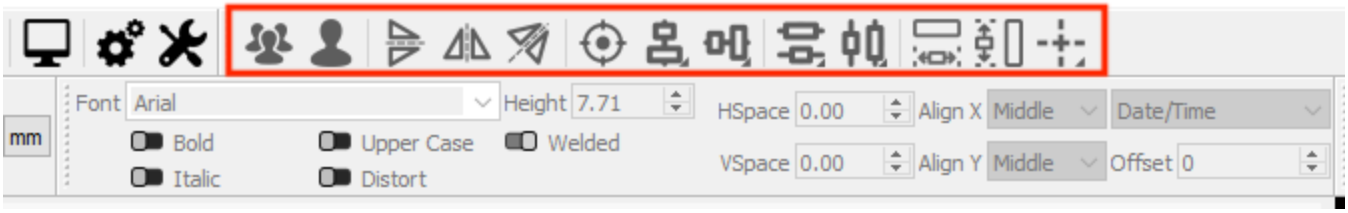
The **Arrange Toolbars** each contain a selection of tools found in the Arrange Menu, that are broadly used for positioning objects.

The toolbars come in a long version, for high-resolution screens, and a shorter one, with sub-menus to fit on smaller screens.



Accessing the Arrange Toolbars

The **Arrange Toolbar** is located near the center of the top toolbar in LightBurn by default, to the right of the Main Toolbar.



If you have closed the Arrange Toolbar, go to Window → **Arrange** to re-enable it.

To restore it and all other toolbars and windows to their default positions, go to **Window** → Reset to Default Layout.

To enable the **Arrange (long) Toolbar**, go to **Window** → **Arrange (long)**.

> **Tip**
>
> The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Arrange Toolbar Options

Click any button in the images below to jump to information on that tool, or scroll down for a list of options and descriptions.

Group and Ungroup

Combines multiple objects into a single entity, allowing you to move, resize, and manipulate them as though they were one object.

See Grouping for more information.

Flip or Mirror

Flips objects across their vertical or horizontal centers, or a custom-selected line.

See Mirror Tools for more information.

Align

Repositions multiple objects in relation to the last object selected, according to their edges or centers.

See Align for more information.

Make Same Width or Height

Resizes the selected object to match the width or height of the last object selected.

See Make Same Width or Height for more information.

Distribute

Evenly spaces objects either vertically or horizontally, spaced from their centers or edges.

See Distribute for more information.

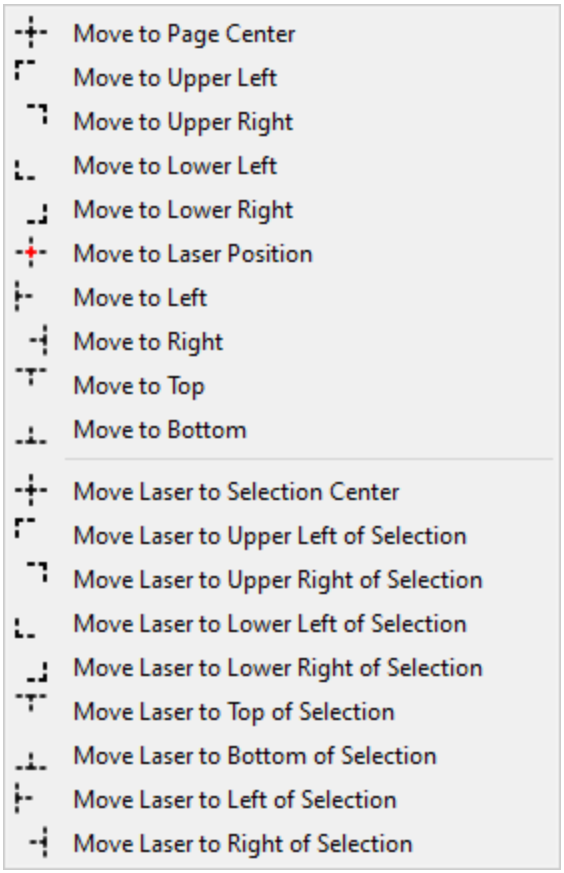
Move Selected Objects

Moves objects to a corner, midpoint, or center of your Workspace. If you have a Gantry style laser, it can also move selected objects to the last reported position of your laser head.

See Move Selected Objects for more information.

Move Selected Objects / Move Laser to Selection Dropdown

This button opens a dropdown menu containing all the Move Selected Objects and Move Laser to Selection options.



UI

5.2.4 Color Palette

In LightBurn, different colors indicate different layers. These colors don't represent the final product's colors but instead differentiate each operation needed to complete the job.

Use the **Color Palette** to assign colors/layers to graphics in your Workspace. A common convention is to use bright red for cuts and black for engravings, but how you use the colors/layers is up to you.

After assigning colors to your graphics, you can adjust their layer settings in two places:

- Cuts / Layers Window — where you can re-order layers and change critical settings.
- Cuts Settings Editor — which contains the full suite of settings available for adjustment.

Accessing the Color Palette

The Color Palette is located along the bottom of the Main Window by default, though a common alternative is docking it along the left side of the Workspace.

The colors currently used in your design will also appear as entries in the Cuts / Layers Window, where you can choose the operations that each color represents.

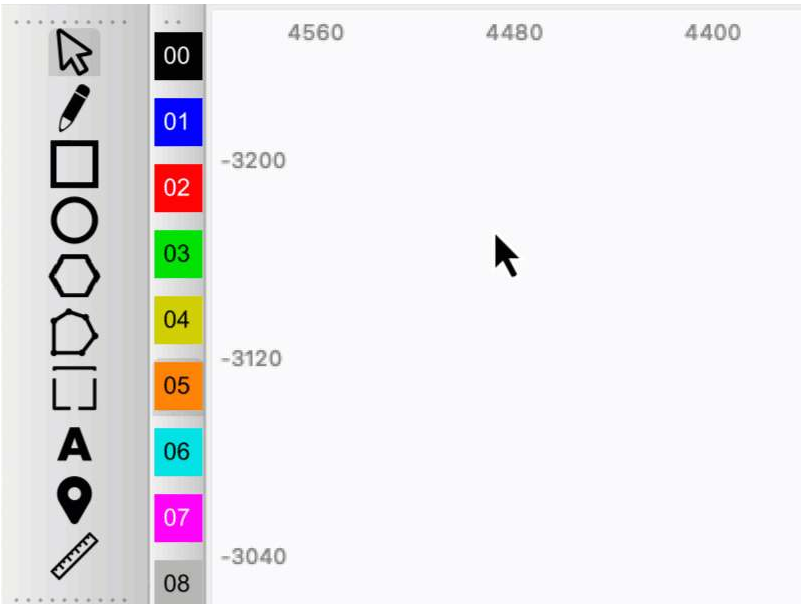
If you have closed the Color Palette, go to Window → **Color Palette** to re-enable it.

To restore it and all other toolbars and windows to their default positions, go to **Window** → Reset to Default Layout.

> **Tip**
>
> The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

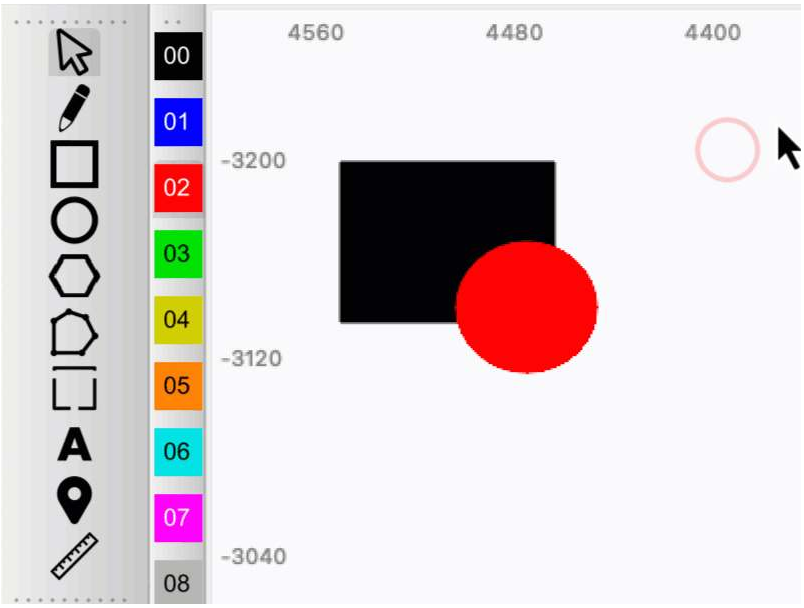
Change the Color for New Objects

With nothing selected in your Workspace, click a color entry. Subsequent new shapes will be created in that color, and assigned to the corresponding layer in the Cuts / Layers Window.



Change the Color of Existing Objects

With the objects already selected, click a color entry to switch them to that color, and assign them to the corresponding layer in the Cuts / Layers Window.



Tool Layers

There are two colors/layers at the end of the palette labeled **T1** and **T2**. These refer to **Tool** layers — special layers that have no cut parameters and will never be output to the laser.

Use Tool layers to create non-output shapes in your designs. For example you can use them to:

- Describe the boundary of your material
- Create guidelines for aligning shapes
- Apply a Path to Text without the path being output
- Apply a Mask to an Image

Importing Graphics from Other Software

When importing graphics, LightBurn will attempt to match the colors used in that file to the default LightBurn **Color Palette**. Use exact matches for the colors used by LightBurn to ensure layers are assigned properly.

Downloadable Color Palettes

We have color palettes available for Inkscape, CorelDRAW, Affinity Designer, and Adobe Illustrator. The `.ase` file provided for Adobe and Affinity products can be imported into many other programs as well.

Download .gpl for Inkscape/GIMP

Download .xml for Corel Products

Download .ase for Adobe and Affinity

Please see your preferred program's documentation for directions on installing color palettes.

RGB and Hex Codes for the LightBurn Color Palette

The table below contains RGB and hex values for each of LightBurn's layer colors. You can use it to assign the right color for any software that doesn't support the above files.

Layer	RGB Values	Hex Values
00	rgb(0, 0, 0)	#000000
01	rgb(0, 0, 255)	#0000FF
02	rgb(255, 0, 0)	#FF0000
03	rgb(0, 224, 0)	#00E000
04	rgb(208, 208, 0)	#D0D000
05	rgb(255, 128, 0)	#FF8000
06	rgb(0, 224, 224)	#00E0E0

07	rgb(255, 0, 255)	#FF00FF
08	rgb(180, 180, 180)	#B4B4B4
09	rgb(0, 0, 160)	#0000A0
10	rgb(160, 0, 0)	#A00000
11	rgb(0, 160, 0)	#00A000
12	rgb(160, 160, 0)	#A0A000
13	rgb(192, 128, 0)	#C08000
14	rgb(0, 160, 255)	#00A0FF
15	rgb(160, 0, 160)	#A000A0
16	rgb(128, 128, 128)	#808080
17	rgb(125, 135, 185)	#7D87B9
18	rgb(187, 119, 132)	#BB7784
19	rgb(74, 111, 227)	#4A6FE3
20	rgb(211, 63, 106)	#D33F6A
21	rgb(140, 215, 140)	#8CD78C
22	rgb(240, 185, 141)	#F0B98D
23	rgb(246, 196, 225)	#F6C4E1
24	rgb(250, 158, 212)	#FA9ED4
25	rgb(80, 10, 120)	#500A78

26	rgb(180, 90, 0)	#B45A00
27	rgb(0, 71, 84)	#004754
28	rgb(134, 250, 136)	#86FA88
29	rgb(255, 219, 102)	#FFDB66
T1	rgb(243, 105, 38)	#F36926
T2	rgb(12,150, 217)	#0C96D9

Related Topics

- Cuts Settings Editor
- Cuts / Layers Window

UI layout-and-design editing creation-tools tools select draw-lines rectangle ellipse polygon nodes edit-nodes trim-shapes cut-lines tabs text move-laser position-laser measure

5.2.5 Creation Toolbar

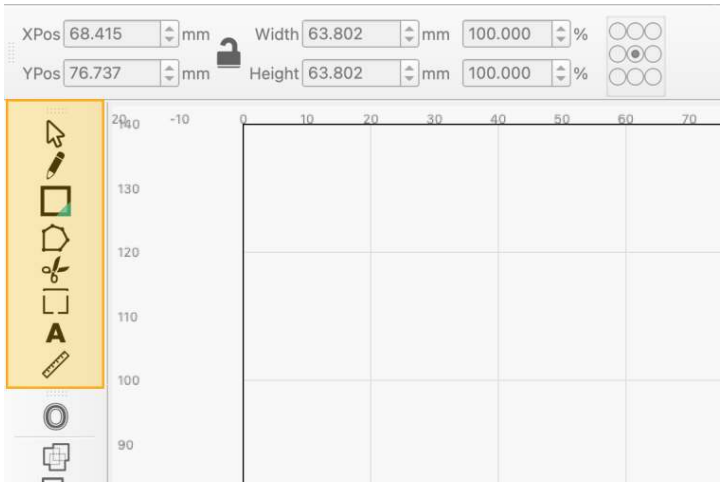
The **Creation Toolbar** contains tools for selecting, creating, and editing objects.

Accessing the Creation Toolbar

By default, the **Creation Toolbar** is the upper toolbar on the left-hand side of the screen.

If you have closed the Creation Toolbar, select Window → **Creation Tools** to re-enable it.

To restore it and all other toolbars and windows to their default positions, go to **Window** → Reset to Default Layout.



Tip

The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Creation Toolbar Options

Click any button in the image below to jump to information on that tool, or scroll down for a list of options and descriptions.

> **Tip**
>
> The Creation Toolbar is normally vertical, but can also be removed from the left-side toolbar and oriented horizontally, as presented above. See Customizing the LightBurn Window for more information.

Select

⎋ Esc

Objects in LightBurn must be selected before they can be modified. With the **Select** tool active, you can click on objects to select them, or click, hold, and drag to select objects contained or crossed by a selection box.

See Selection for more information.

Draw Lines

^ Ctrl / ⌘ Cmd + L

Creates vector paths out of straight and curved lines. With the tool active, click to place points.

See Draw Lines for more information.

Draw Shapes

Several **Primary Shapes** are available in the **Draw Shapes** submenu of the **Creation Toolbar**.

Click and hold the Draw Shapes button, or click the arrow in the lower right corner, to select a shape from the menu, then click and drag in your Workspace to create that shape.

See Draw Shapes for more information.

Edit Nodes

^ Ctrl / ⌘ Cmd + `

Use the **Edit Nodes** tool to edit the nodes, or points, that make up vector paths. This only works on Ungrouped vector paths.

See Edit Nodes for more information.

Trim Shapes

^ Ctrl / ⌘ Cmd + K

Use the **Trim Shapes** tool to remove sections of vector graphics that lie between intersections.

See Trim Shapes for more information.

Add Tabs

^ Ctrl / ⌘ Cmd + Tab ⇥

Use **Add Tabs** to add tabs – small sections of material deliberately left uncut – to your project. Tabs prevent cut objects from immediately falling out of the base material.

See Add Tabs for more information.

Create / Edit Text

^ Ctrl / ⌘ Cmd + T

Use **Create / Edit Text** to create or change Text Objects in your design.

See Create and Edit Text for more information.

Position Laser

⎇ Alt / ⌥ Option + L

With **Position Laser** active, click the Workspace to move the laser to the corresponding location in its physical work area. Make sure nothing is in the path of your laser before using this tool.

See Position Laser for more information.

Measure

⎇ Alt / ⌥ Option + M

With the **Measure** tool active, hover over an object to see measurements and node information, or click and drag to measure the distance between any two points.

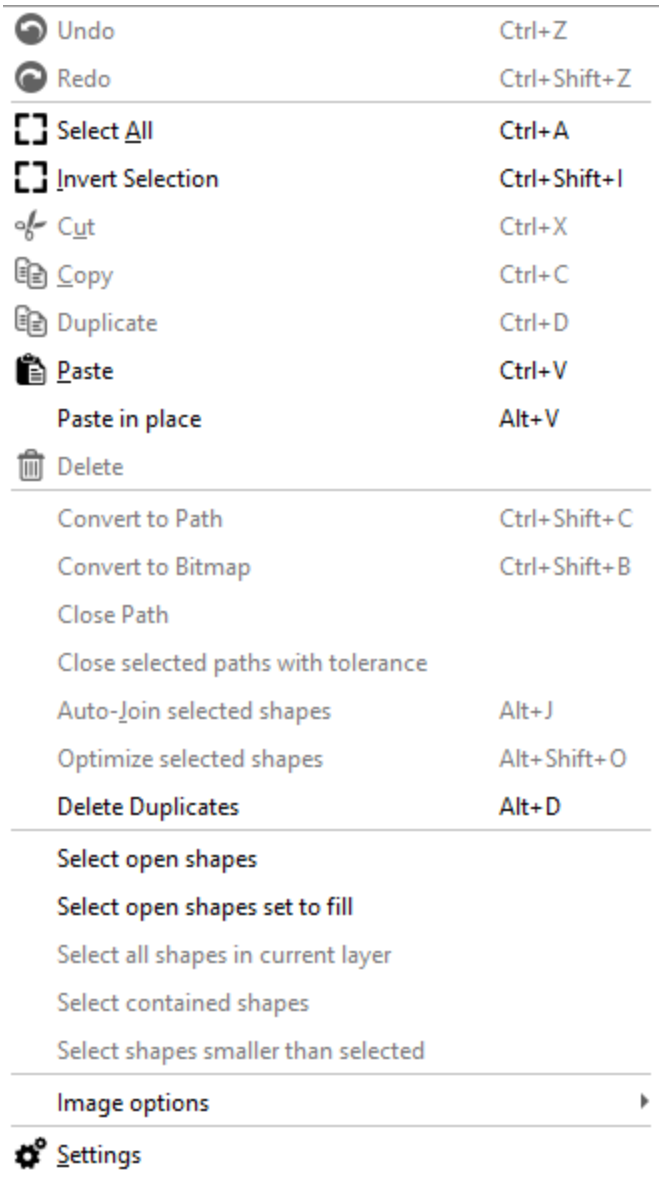
See Measure for more information.

UI layout-and-design editing customization object-manipulation image-editing image-tools image-raster-bitmap image vector-editing vector-tools vector path-editing path-tools path vector-path-curve-lines node-editing object-repair troubleshooting fixing-designs workflow-optimization workflow optimization modifying-and-combining

5.2.6 Edit Menu

The **Edit Menu** contains tools for selecting and manipulating objects, in addition to program, device, and machine settings.

Click any option in the image below to go directly to the relevant page for that tool, or scroll down for a list of options and descriptions.



Undo

^ Ctrl / ⌘ Cmd + Z

Reverses previous actions taken, starting with the most recent action taken, and proceeding to previous actions with successive Undos.

See Undo/Redo for more information.

Redo

^ Ctrl / ⌘ Cmd + ⇧ Shift + Z

Restores actions previously reversed using Undo, starting with the most recent action Undone, and proceeding to previous reversed actions with successive **Redos**.

See Undo/Redo for more information.

Select All

^ Ctrl / ⌘ Cmd + A

Selects all objects in your Workspace.

See Selection Tools for more information.

Invert Selection

^ Ctrl / ⌘ Cmd + ⇧ Shift + I

Deselects all objects that are currently selected and selects all objects that are not currently selected.

See Selection Tools for more information.

Cut

^ Ctrl / ⌘ Cmd + X

Deletes selected objects while copying them to clipboard at the same time.

See Clipboard Tools for more information.

Copy

^ Ctrl / ⌘ Cmd + C

Saves a copy of selected objects to your computer's clipboard (temporary storage location).

See Clipboard Tools for more information.

Duplicate

^ Ctrl / ⌘ Cmd + D

Create duplicates of selected objects directly on top of the existing objects.

See Clipboard Tools for more information.

Paste

^ Ctrl / ⌘ Cmd + V

Inserts objects that are copied to your clipboard (temporary storage location) into your. Pasted objects are centered at the location of the cursor at the time of pasting.

See Clipboard Tools for more information.

Paste in Place

Inserts objects copied to your clipboard (temporary storage location) into your Workspace, and positions them according to their location in the project they were copied from.

See Clipboard Tools for more information.

Delete

⌦ Del

Deletes selected objects, removing the from your Workspace.

See Clipboard Tools for more information.

Convert to Path

^ Ctrl / ⌘ Cmd + ⇧ Shift + C

Converts squares, ellipses, polygons, text, or QR codes created using LightBurn's Creation Tools into editable paths made up of lines, curves, and nodes.

See Convert to Path for more information.

Convert to Bitmap

^ Ctrl / ⌘ Cmd + ⇧ Shift + C

Converts selected vector graphics into a bitmap image.

See Convert to Bitmap for more information.

Close Path

Connects a shape with one start and one end node by creating a new line between them. The existing start and end nodes must be within .5 mm of one another.

See Close Path for more information.

Close Selected Paths With Tolerance

Opens a dialog window to close selected paths with one start and one end node within a specified distance apart from one another, and to move their ends together or join them with lines.

See Close Selected Paths with Tolerance for more information.

Auto-Join Selected Shapes

⎇ Alt / ⌥ Option + J

Joins many disconnected line segments together at once, if the segments' end points are almost touching (within .05 mm of one another).

See Auto-Join Selected Shapes for more information.

Optimize Selected Shapes

⎇ Alt / ⌥ Option + ⇧ Shift + O

Smooths selected shapes or fits them to arcs or lines. The dialog box allows you to set your tolerance for how much deviation from the original shape is acceptable.

See Optimize Selected Shapes for more information.

Delete Duplicates

⎇ Alt / ⌥ Option + D

Deletes duplicated objects (objects with identical shapes, sizes, and positions) in your Workspace.

See Delete Duplicates for more information.

Select Open Shapes

Selects all shapes in the Workspace that are open, meaning they are not paths that form a closed, continuous loop but, instead, have start and end points that are different from one another.

See Selection Tools for more information.

Select Open Shapes Set to Fill

Selects all shapes assigned to a layer set to Fill or Offset Fill mode that are open, meaning they are not closed, continuous loops but, instead, have start and end points that are different from one another.

See Selection Tools for more information.

Select All Shapes in Current Layer

Selects all shapes in the active layer in the Cuts / Layers window.

See Selection Tools for more information.

Select Contained Shapes

Selects all shapes contained by the currently selected shape. The currently selected shape remains in the resulting selection.

See Selection Tools for more information.

Select Shapes Smaller Than Selected

Selects all shapes that are smaller than the currently selected shape. Currently selected shape remains in the resulting selection.

See Selection Tools for more information.

Image Options

Provides a set of tools for updating and changing imported images.

See Image Options for more information.

Refresh Image

Reloads the selected image file. Useful if an imported image file has been updated.

Replace Image

Replaces the selected image with a different image file.

Replace Image to Fit

Replaces the selected image with a different image file, adjusting the size of the new image to fit in the same space as the original image.

Settings

View and edit general, device-independent LightBurn settings.

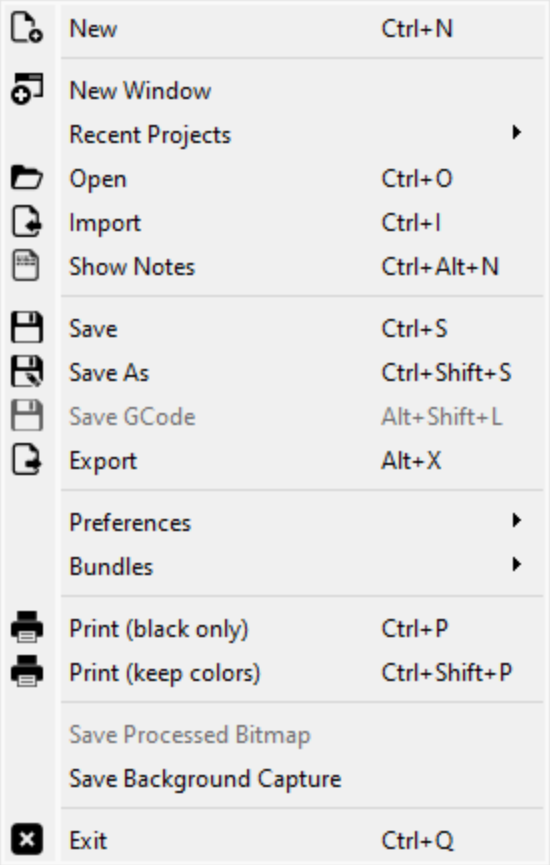
See Settings/Preferences for more information.

UI file-menu settings-and-preferences file-management user-bundles migration

5.2.7 File Menu

The **File Menu** contains tools for creating, opening, and saving projects; importing designs and images; and changing, saving, exporting, or importing your LightBurn preferences.

Click any option in the image below to go directly to the relevant page for that tool, or scroll down for a list of options and descriptions.



New

`^ Ctrl` / `⌘ Cmd` + `N`

Clears your current LightBurn project and starts a new, blank project.

See File Management — New for more information.

New Window

Opens a separate instance of LightBurn in a new window, allowing you to edit multiple projects at once, or edit one file while cutting a different one.

See New Window for more information.

> **Note**
>
> LightBurn will automatically save the current preferences and settings of the most recently closed window — overriding any changes made in other windows.
>
> See Multiple Independent LightBurn Instances for more information on running two completely independent LightBurn instances.

Recent Projects

View a running list of up to 24 projects recently opened in LightBurn.

See File Management — Recent Projects for more information.

Open

`^ Ctrl` / `⌘ Cmd` + `O`

Opens LightBurn project files saved in .lbrn or .lbrn2 format.

Click on the dropdown in your system's file browser to show all supported file types, including supported image and vector file types.

> **Warning**
>
> Selecting a supported image or vector file instead of a project file will create a *new LightBurn project*, replacing the currently loaded project. Use Import to bring artwork files or designs into an existing project.

See File Management — Open for more information.

Import

`^ Ctrl` / `⌘ Cmd` + `I`

Adds additional artwork, designs, and objects stored in a range of file formats to an existing, open project.

File Type	Files
LightBurn Project Files	.lbrn2, .lbrn
MillMage Project Files	.mage
Image Files	.bmp, .jpg, .pg, .gif, .tif, .tiff, .tga, .webp
Vector Files	.ai, .pdf, .dxf, .nc, .hpgl, .svg
Additional Files	.gc, .gcode, .plt, .rd, .sc, .scpro2,

See File Management — Import for more information.

Show Notes

`^ Ctrl` / `⌘ Cmd` + `⎇ Alt` / `⌥ Option` + `N`

Store and view project-specific notes and comments.

See Show Notes for more information.

Save

`^ Ctrl` + `S`

Saves the current project for later editing and production. Saving a file saves it under the current file name. Saving a file without an existing name will open a Save Project window.

See File Management — Save for more information.

Save As

`^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `S`

Saves the current project under a different file name.

See File Management — Save As for more information.

Save Machine Files

⎇ Alt / ⌥ Option + ⇧ Shift + L

This option will change depending on the type of laser you're using — it may say Save GCode (for GRBL, Smoothieware, or Marlin controllers), Save RD File (Ruida), Save OUT File (TopWisdom), or Save UD5 File (Trocen).

All options save your current project as a machine-ready file, in the appropriate format for your type of laser. You can transfer this file to your machine to run it without ever having to directly connect using LightBurn.

See Laser Window — Save Machine Files for more information.

Export

⎇ Alt / ⌥ Option + X

Exports currently selected graphics in `.ai`, `.svg`, or `.dxf` format. If there is nothing in your current selection, the entire contents of your current project will be Exported.

See File Management — Export for more information.

Preferences

See Preferences Submenu for more information.

Import Prefs

Import previously copied or exported `.lbprefs` LightBurn preference files.

> **Note**
>
> A new project is required to import `.lbprefs` LightBurn preference files.

Export Prefs

Export the current LightBurn preferences.

Open Prefs Folder

Opens the folder on your computer containing the LightBurn preferences files, created automatically at program close or when settings are changed. Only the latest 50 preference backup files are preserved.

Windows LightBurn Preferences Folder

`%localappdata%/LightBurn` `C:\Users\username\AppData\Local\LightBurn`

Load Prefs Backup

Import a built-in LightBurn preferences back up file.

Windows LightBurn Preferences Backup Folder

`%localappdata%/LightBurn/backup` `C:\Users\username\AppData\Local\LightBurn/backup`

Edit Hotkeys

Create and change the keyboard shortcuts of many LightBurn functions and commands in the **Hotkey Editor**.

See Hotkey Editor for more information.

Bundles

Bundles simplify the process of migrating LightBurn by bundling everything that needs to be moved into a single `.lbzip` file.

Bundles can include:

- LightBurn Settings
- Custom Hotkeys
- Image Presets
- Devices
- Material Libraries
- Art Libraries

See the User Bundles for more information.

Import Bundles

Load previously exported Bundles into the current instance of LightBurn. Any component contained within the bundle that your computer detects is already present will be grayed out and unavailable on import. Devices can be imported even if already present, and will create a new copy of the device. Bundles can also be imported by dragging the `.lbzip` file into LightBurn.

Export Bundle

Create a Bundle of LightBurn settings, laser devices, Material and Art libraries, and more.

Print (black only)

`^ Ctrl` / `⌘ Cmd` + `P`

Output a black and white document to a printer or built-in "Print to PDF" tool. This document is saved exclusively in black and white.

See Print for more information.

Print (keep colors)

`^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `P`

Output a document to a printer or built-in "Print to PDF" tool. This document is saved with the assigned colors in the current Color Palette.

See Print for more information.

Saved Processed Bitmap

Exports a copy of an adjusted bitmap.

See Save Processed Bitmap for more information.

Save Background Capture

Saves a bitmap image of a Workspace Overlay produced by a camera affixed over your laser's work area.

See Save Background Capture for more information.

Exit

`^ Ctrl` / `⌘ Cmd` + `Q`

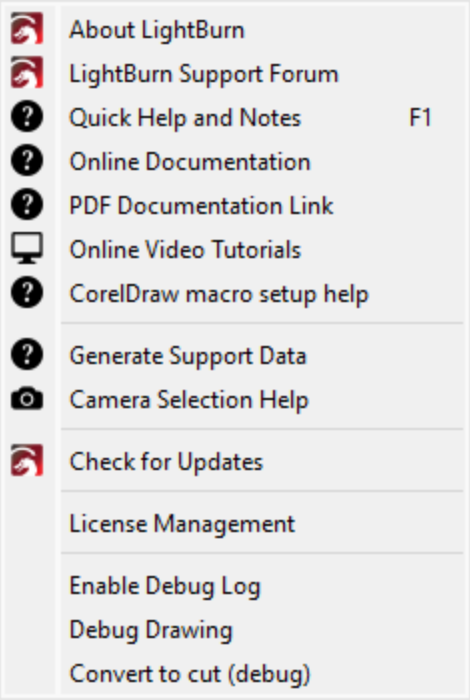
Completely close and exit LightBurn. You will be prompted to save the current project if there are any unsaved changes, discard any changes and close without saving them, or cancel the process of closing LightBurn.

UI help-menu help version build-date hotkeys keyboard-shortcuts support forum help-and-notes documentation video-tutorials CorelDRAW support-data debug convert-to-cut license-management

5.2.8 Help Menu

The **Help Menu** contains links to documentation and instructional videos; information on your LightBurn license and version; and tools for troubleshooting software issues.

Click any option in the image below to jump to more information, or scroll down for a list of options and descriptions.



About LightBurn

Opens the **Help and Notes** window, where additional information on keyboard shortcuts, a few general LightBurn tips, and important program build/version data is listed.

See Help and Notes for more information.

LightBurn Support Forum

Get help with LightBurn from the developers, support staff, and other users. Join the community to share projects, discuss hardware and software settings, and learn how to get the most out of LightBurn.

Access the LightBurn forum at: Forum.LightBurnSoftware.com.

Quick Help and Notes

F1

Opens the **Help and Notes** window, directly to the **Hotkeys** tab, which features a small partial list of mouse gestures, keyboard shortcuts, and other hotkey tips.

See Help and Notes for more information.

Online Documentation

Find guides and detailed information on getting the most out of LightBurn. If you're reading this, you're already here!

PDF Documentation Link

View the current printable PDF of the LightBurn documentation.

This menu entry will always point to the latest copy of the LightBurn documentation PDF.

Online Video Tutorials

Access a curated list of tutorial videos from a library of over a hundred helpful guides at LightBurnSoftware.com.

View the full library of LightBurn tutorial videos on YouTube.

CorelDRAW Macro Setup Help

Simplify and speed up the process of sending work out of CorelDRAW to LightBurn on Windows-based computers.

See CorelDRAW Macro Setup for more information.

Generate Support Data

Generates encoded data that helps the LightBurn support team answer your questions.

See Generate Support Data for more information.

Camera Selection Help

Opens a window to help select an appropriate camera for your laser based on machine size and mounting height.

See Camera Selection Help for more information.

Check for Updates

Checks whether there is a more recent version of LightBurn available than the version currently running, and whether it was released within your license's valid update period.

See Check for Updates for more information.

License Management

Opens the **License Page**, where you can activate or deactive your license, and see the number of days remaining in your license's update period.

See License Management for more information.

Enable Debug Log

Begins recording a log saved to the **My Documents** folder on Windows or **Documents** on macOS, to aide in troubleshooting and bug fixing when communicating with LightBurn support.

See Enable Debug Log for more information.

Debug Drawing

Activates the internal tool that shows the bounds of shapes being drawn in the Workspace, to aid LightBurn developers in troubleshooting and debugging.

See Debug Drawing for more information.

Convert to Cut (Debug)

Activates the internal tool that converts selected shapes into the cuts that would be sent to a laser, and makes a new shape from the result.

> **Warning**
>
> Do not use this tool unless directed to do so by a LightBurn developer or support agent.

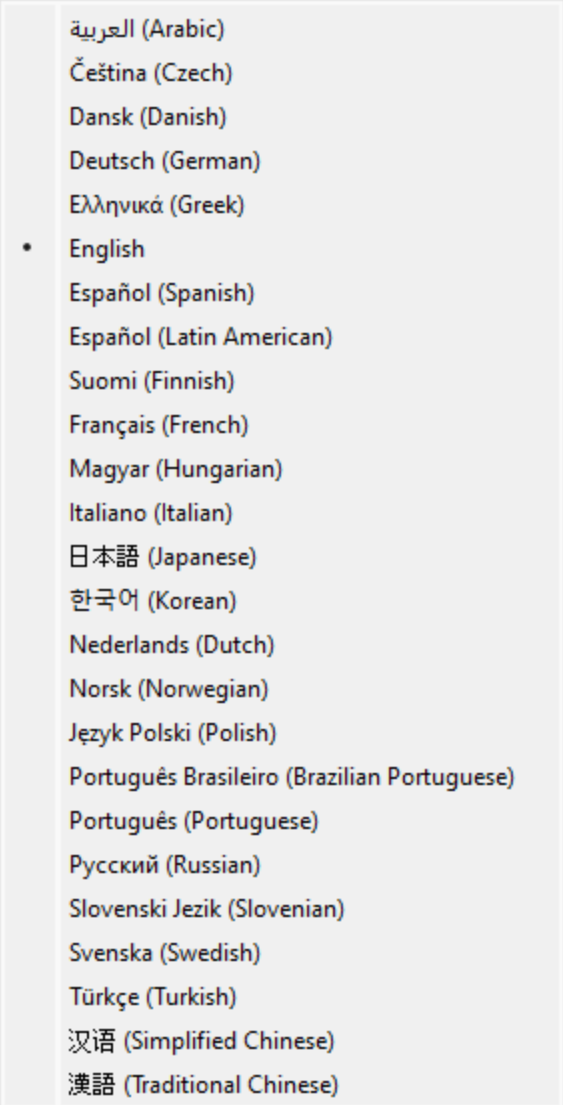
See Convert to Cut for more information.

UI languages localization right-to-left-text settings preferences RTL

Change the LightBurn program interface language by selecting between 25 supported translations. The currently selected language is indicated by a dot next to the language in the list. English (United States) is enabled by default.

See Create and Edit Text — Text Settings for information on additional text settings. The Right-To-Left setting will automatically be enabled when the current program language is set to Arabic or Hebrew.

The Right-To-Left text setting will automatically be enabled in your Settings when the current program language is set to Arabic or Hebrew.



UI laser-control modes advanced-control quality optimization camera rotary cylinder-correction repeat-marking center-finder taper-warp interval-test focus-test rotary-setup feeder feeder-setup print-and-cut camera-calibration camera-alignment

5.2.10 Laser Tools Menu

The **Laser Tools** menu contains tools, tests, and step-by-step wizards for performing advanced lasering operations, dialing in settings to optimize product quality, and setting up accessory hardware.

You'll see different menu options depending on the type of laser you have selected.

Click any option in the images below to go directly to the relevant page for that tool, or scroll down for a list of options and descriptions.

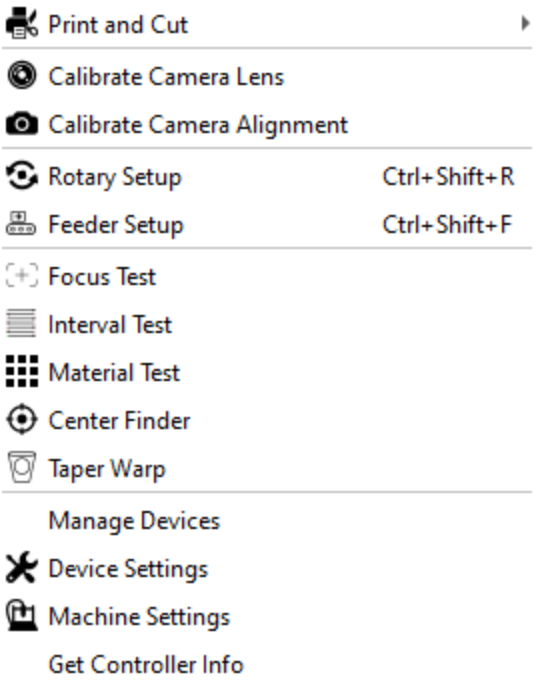


Figure 1: The Laser Tools Menu for Gantry style lasers (GCode and DSP)

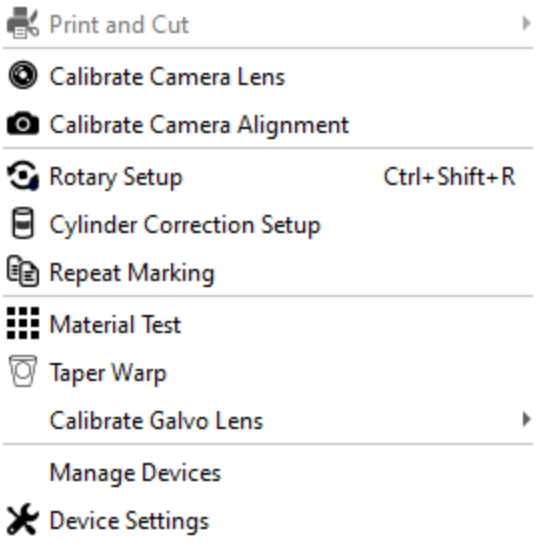


Figure 1: The Laser Tools Menu for Galvo style lasers

Print and Cut

Aligns your current LightBurn project to target locations in a previously output design. Using Print and Cut requires a properly homed Gantry style laser with an accurate motion system.

See Print and Cut for more information.

Calibrate Camera Lens

Corrects for camera lens distortion when producing a camera overlay for the LightBurn Workspace.

See Camera Lens Calibration for more information.

Calibrate Camera Alignment

Aligns a pre-processed camera capture to the LightBurn Workspace and laser coordinate system by engraving and tagging target markers.

See Calibrate Camera Alignment for more information.

Rotary Setup

`^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `R`

Rotaries are used to turn cylindrical objects so that their surfaces can be marked by a laser. In order to use your laser with a rotary, you must first establish several important parameters in the **Rotary Setup** window that control the rotary's motion and adjust the output sent to your laser.

For more information on using a rotary with your type of laser, see:

- Rotary Mode (DSP)
- Rotary Mode (GCode)
- Rotary Mode (Galvo)

Feeder Setup

Opens the Auto-feed settings dialog to set up auto-feeder controls for lasers with Ruida or Trocen controllers and auto-feed devices.

See Feeder Setup for more information.

Cylinder Correction Setup

Warps the output of your design to correct for the expansion that happens when you mark on a cylindrical object, like a cup or tumbler, allowing you to mark cylindrical objects with a Galvo style laser, without using a rotary.

See Cylinder Correction for more information.

Repeat Marking

Enables the use of a **Rotating** or **Linear** axis table with Galvo lasers, to move parts past a laser while running repetitions of identical jobs.

See Repeat Marking for more information

Focus Test

Use the Focus Test setup dialog to set parameters and generate a test pattern to identify optimal focal height. Requires a machine with a mechanized, controllable Z Axis.

See Focus Test for more information.

Interval Test

Generates a test pattern to identify the optimal **Line Interval** for engraving at a given combination of **Speed** and **Power**.

See Interval Test for more information.

Material Test

Generates a test grid of varying combinations of two selected variables. Testable variables are device-dependent, and include **Speed**, **Power**, **Interval**, **Passes**, **Frequency**, and **Q-Pulse**.

See Material Test for more information.

Center Finder

Finds the center of a circular object in the laser's physical work area, by aligning the laser to three points on the object. Can also be used with any object whose shape can be described with a circle diameter.

See Center Finder for more information.

Taper Warp

Adjusts a design to compensate for the difference in diameter between the top and bottom of a cylindrical object, when engraving using Rotary Mode or Cylinder Correction.

See Taper Warp for more information.

Calibrate Galvo Lens

Marks a test pattern that is then measured and input into LightBurn, to compensate for distortion effects from a new or uncalibrated Galvo lens.

See Calibrate Galvo Lens for more information.

Manage Devices

Opens the **Devices** window, where you can create and edit profiles for your lasers.

See Devices for more information.

Device Settings

View and edit device-specific settings for the currently active device. The contents of this window vary depending on the device in use.

See Device Settings for more information.

Machine Settings

View and edit device parameters for lasers with supported controllers.

See Machine Settings for more information.

Get Controller Info

Reads firmware version and usage statistics from supported laser controllers and displays the information.

See Get Controller Info for more information.

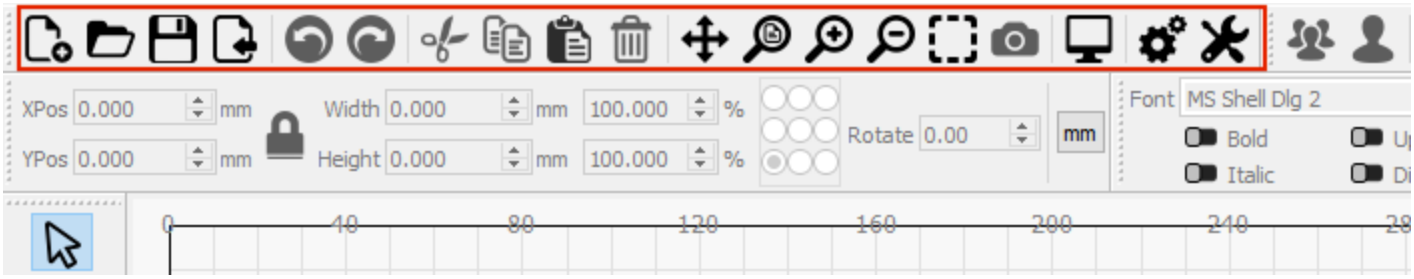
UI essential-functions file-management clipboard settings-and-preferences settings device-settings preview zoom pan

5.2.11 Main Toolbar

The **Main Toolbar** contains tools for creating, opening, and saving projects; copying, pasting, and deleting graphics; accessing your LightBurn preferences and Device Settings; and more.

Accessing the Main Toolbar

The **Main Toolbar** is located on the left side of the top toolbar in LightBurn by default, to the left of the Arrange Toolbar.



If you have closed the Main Toolbar, go to Window → **Main** to re-enable it.

To restore it and all other toolbars and windows to their default positions, go to **Window** → Reset to Default Layout.

Tip

The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Main Toolbar Options

Click any option in the image below to go directly to the relevant page for that tool, or scroll down for a list of options and descriptions.

File Management

See File Management for more information on **New**, **Open**, **Save**, and **Import**.

New

`^ Ctrl` / `⌘ Cmd` + `N`

Creates a new file. A new, unnamed project will replace any existing projects loaded in the LightBurn workspace.

Open

`^ Ctrl` / `⌘ Cmd` + `O`

Opens a file. The dialog box filters for `.lbrn` and `.lbrn2` LightBurn files by default. Click on the dropdown to show all supported file types, including supported image and vector file types.

> **Warning**
>
> Selecting a supported image or vector file instead of a project file will create a **new LightBurn project**, replacing the currently loaded project. Use Import to bring artwork files or designs into an existing project.

Save

`^ Ctrl` / `⌘ Cmd` + `S`

Saves your current project in `.lbrn` or `.lbrn2` format.

Import

`^ Ctrl` / `⌘ Cmd` + `I`

Loads graphics from a variety of file formats into LightBurn.

Undo and Redo

Reverse or reapply past actions and design changes in LightBurn.

See Undo/Redo for more information.

Clipboard Tools

See Clipboard Tools for more information on **Copy**, **Cut**, **Paste**, and **Delete**.

Copy

^ Ctrl / ⌘ Cmd + C

Saves a copy of selected objects to your clipboard.

Cut

^ Ctrl / ⌘ Cmd + X

Deletes selected objects in your Workspace while saving a copy of them to your clipboard at the same time.

Paste

^ Ctrl / ⌘ Cmd + V

Inserts objects copied to your clipboard into your Workspace. Pasted objects are centered at the location of your cursor at the time of pasting.

Delete

⌦ Del

Deletes selected objects.

Pan / Drag View

Click to drag the Workspace around. Mouse users can click the mouse wheel or third button and drag.

See Panning for more information.

Zoom Tools

See Zoom for more information on **Zoom to Page**, **Zoom In**, **Zoom Out**, and **Zoom to Frame Selection**.

Zoom to Page

Adjusts the view in your Workspace to center and show the grid as large as possible.

Zoom In and Zoom Out

Adjusts the view in your Workspace in to get a closer view, or out to see more at once.

Zoom to Frame Selection

Zooms in or out to show all selected objects as large as possible, centered within your view. If no objects are selected, it will instead zoom to show all objects in the Workspace.

Update the Background From the Camera

Captures a new image to use as an Overlay for your Workspace. This button is only selectable when a camera is in use.

See Camera Control Window for more information.

Preview

Opens the **Preview** window, which displays the simulated movements and lasering operations for the project in your Workspace.

See Preview for more information.

Settings

Opens the **Settings** window, which contains global user preferences for LightBurn — these settings apply regardless of what lasers you have set up, and which one you currently have selected.

See Settings/Preferences for more information.

Device Settings

Opens the **Device Settings** window, which contains device-specific settings for your laser. The settings available change based on the device selected.

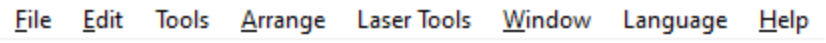
See Device Settings for more information.

UI layout-and-design arrangement editing customization object-manipulation testing-tools material-utilization beginner-mode nesting image-editing image-tools image-raster-bitmap image vector-editing vector-tools vector path-editing path-tools path vector-path-curve-lines node-editing object-repair troubleshooting fixing-designs workflow-optimization workflow optimization modifying-and-combining batch-production laser-control output-and-positioning

5.2.12 Menu Toolbar

The **Menu Bar** contains all of LightBurn's top-level menus.

Click any menu in the image below to go directly to the relevant page for that menu, or scroll down for a list of menus and descriptions.



Note

On macOS, the menus will be shown at the top of the screen, rather than as part of the LightBurn window.

File

Contains options for saving, opening, importing, and exporting files, as well as accessing and exporting your LightBurn settings.

See File Menu for a full list of options in the File Menu.

Edit

Contains tools for selecting and manipulating objects, in addition to program, device, and machine settings.

See Edit Menu for a full list of options in the Edit Menu.

Arrange

Contains tools for positioning objects, both on an individual basis, and in relation to each other. It also contains tools for moving the physical laser in relation to objects within your project.

See Arrange Menu for a full list of options in the Arrange Menu.

Laser Tools

Contains tools, tests, and step-by-step wizards for performing advanced lasering operations, dialing in settings to optimize product quality, and setting up accessory hardware.

See Laser Tools Menu for a full list of options in the Laser Tools Menu.

Window

Use the **Window Menu** to control and customize your Workspace view, enable and disable Windows and Toolbars, or reset LightBurn's layout to its original state.

See Window Menu for a full list of options in the Laser Tools Menu.

Language

Use **Language Menu** to switch the LightBurn interface into 1 of 24 different languages.

See Language Menu for a full list of languages.

Help

Contains links to LightBurn resources, access to the **License Management** window, and a handful of diagnostic tools.

See Help Menu for a full list of options in the Help Menu.

UI modes laser-control advanced-control rotary rotary-mode print-and-cut print gantry galvo cylinder-correction

5.2.13 Modes Toolbar

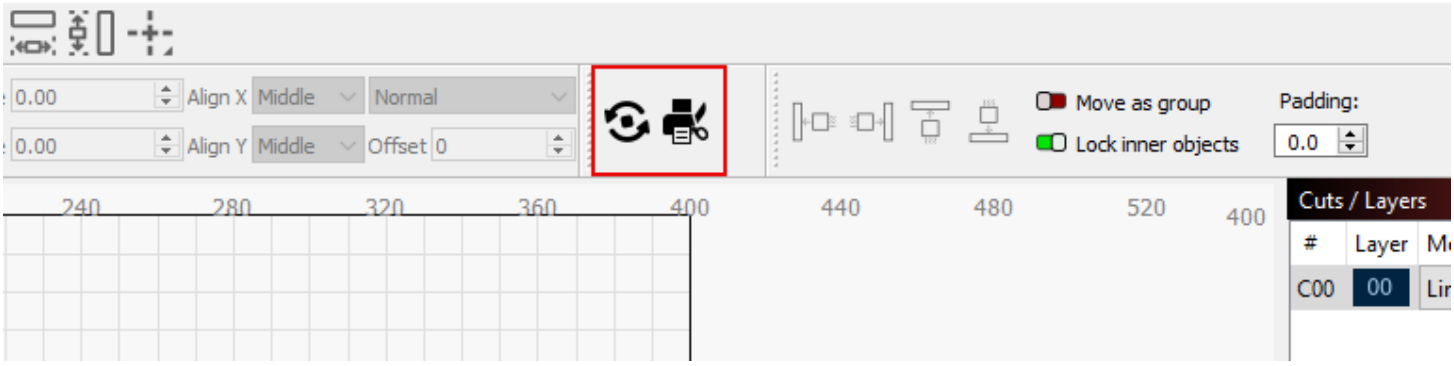
The **Modes Toolbar** contains buttons to open dialog windows or wizards for advanced lasering processes.

The Modes Toolbar appears differently depending on the type of laser you have selected.

- For Gantry style lasers, you'll see buttons for Rotary Mode and Print and Cut.
- For Galvo style lasers, you'll see buttons for Rotary Mode and Cylinder Correction.

Accessing the Modes Toolbar

The **Modes Toolbar** is located near the top right of the top toolbar in LightBurn by default, between the Text Options Toolbar and the Docking Toolbar.



If you have closed the Modes Toolbar, go to Window → **Modes** to re-enable it.

To restore it and all other toolbars and windows to their default positions, go to **Window** → Reset to Default Layout.

> **Tip**
>
> The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Modes Toolbar Options

Click any button in the images below to jump to information on that option, or scroll down for a list of options and descriptions.

Figure 1: The Modes Toolbar for Gantry style lasers (GCode and DSP)

Figure 1: The Modes Toolbar for Galvo style lasers

Rotary Mode

Rotaries are used to turn cylindrical objects so that their surfaces can be marked by a laser. In order to use your laser with a rotary, you must first establish several important parameters in the **Rotary Setup** window that control the rotary's motion and adjust the output sent to your laser.

For more information on using a rotary with your type of laser, see:

- Rotary Mode (DSP)
- Rotary Mode (GCode)
- Rotary Mode (Galvo)

Print and Cut

Print and Cut aligns a current project to existing **Target Positions** — also called registration marks — in a previously output design.

Print and Cut works by measuring the difference in location, orientation, and scale between two Target Positions in your laser's physical work area and the positions of two corresponding graphics in your LightBurn Workspace.

See Print and Cut for more information.

> **Note**
>
> This option is available for Gantry style lasers only.

Cylinder Correction

Cylinder Correction (called ProjectMark in EZCAD) warps the output of your design to correct for the expansion that happens when you mark on a cylindrical object, like a cup or tumbler, without using a rotary.

See Cylinder Correction for more information.

UI modifying-and-combining layout-and-design arrangement editing customization object-manipulation material-utilization vector-editing vector-tools vector path-editing path-tools path vector-path-curve-lines node-editing object-repair troubleshooting fixing-designs workflow

5.2.14 Modifiers Toolbar

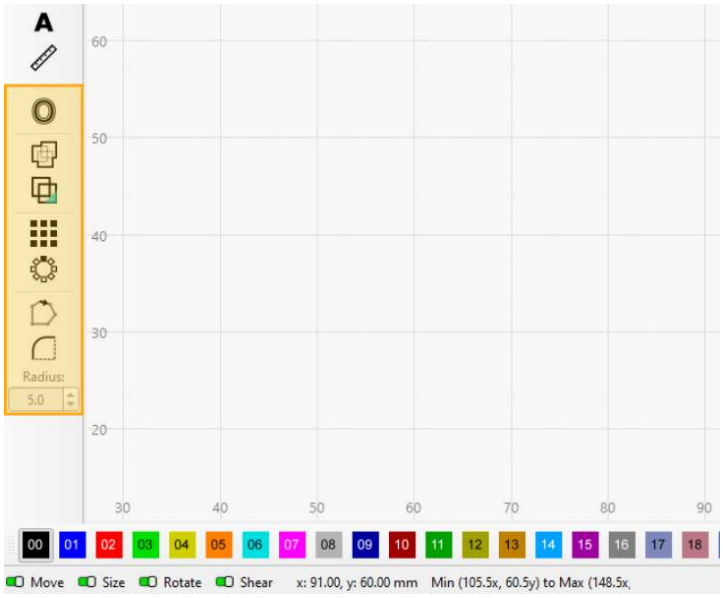
The **Modifiers Toolbar** contains tools for combining, altering, and producing arrayed duplicates of graphics.

Accessing the Modifiers Toolbar

By default, the **Modifiers Toolbar** is located in the bottom half of the left-side toolbar in the main LightBurn window.

If you have closed the Modifiers Toolbar, go to Window → **Modifiers** to re-enable it.

To restore it and all other toolbars and windows to their default positions, go to **Window** → Reset to Default Layout.



Tip

The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Modifiers Toolbar Options

Click any button in the image below to jump to information on that tool, or scroll down for a list of options and descriptions.

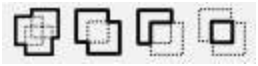
> **Note**
>
> The Modifiers Toolbar is normally vertical, but can also be removed from the left-side toolbar and oriented horizontally, as presented below. See Customizing the LightBurn Window for more information.

Offset Shapes

⎇ Alt / ⌥ Option + O

Creates a new shape by outlining the shapes in your selection at a distance you specify, either inward, outward, or in both directions at once.

See Offset Shapes for more information.

Boolean Tools 

Modify two overlapping shapes (or two Groups of shapes) to create new shapes.

- **Boolean Union** merges two shapes.
- **Boolean Subtract** removes one shape from another.
- **Boolean Intersection** leaves only the area covered by both shapes.
- **Weld** can merge more than two shapes at once.

See Boolean Tools for more information.

Grid Array

Creates copies of an object (or objects) in regularly spaced rows and columns, and includes options to adjust spacing, mirror the shapes, randomize orientation, and more.

See Grid Array for more information.

Circular Array

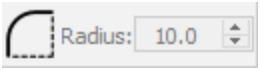
Creates copies of an object (or objects) in a regularly spaced circular (radial) pattern, with options to adjust spacing, rotate copies, and more.

See Circular Array for more information.

Set Start Point

Allows you to specify where on a shape your laser will begin cutting, and in which direction it will cut.

See Set Start Point for more information.

Radius 

Fillets (rounds over) sharp corners, takes a round bite out of a corner (using a negative radius value), or turns a radius back into a sharp corner (removes a radius).

See Radius/Fillet for more information.

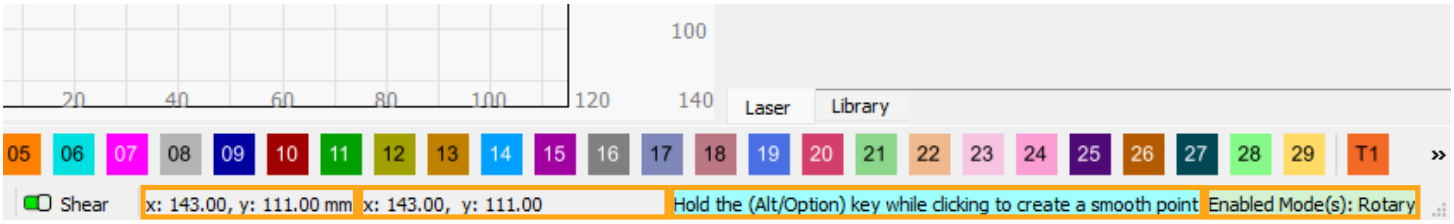
UI status messages notifications selection-status

5.2.15 Status Bar

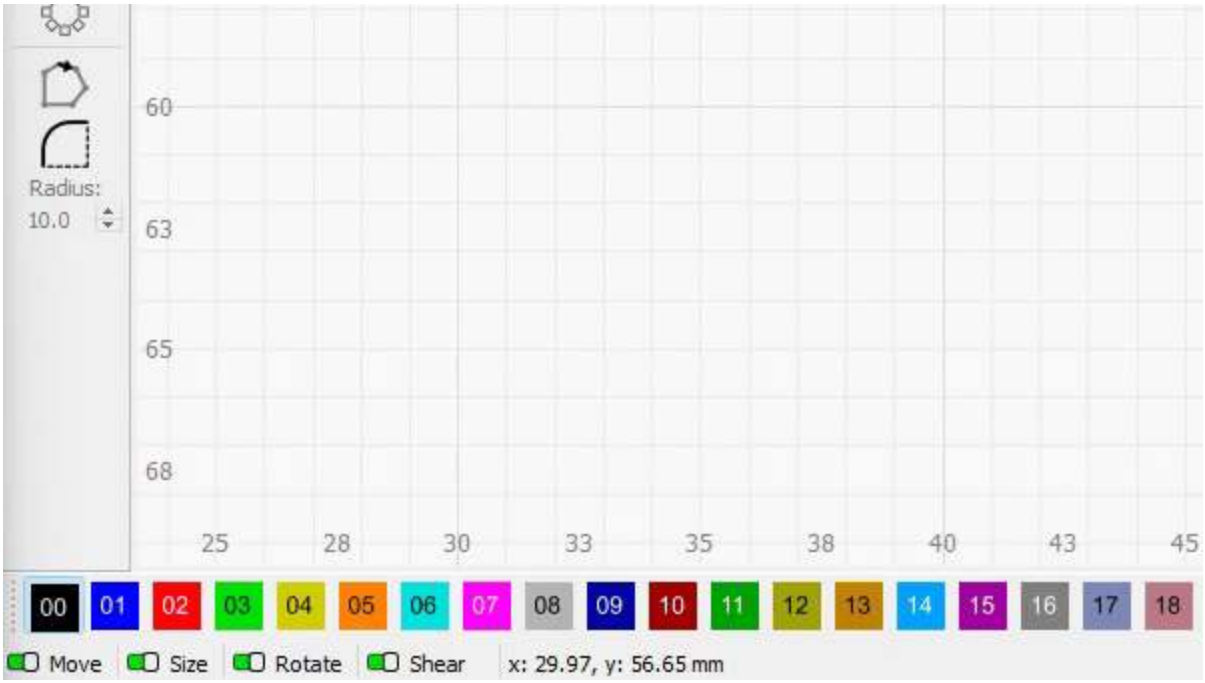
The **Status Bar** provides contextual information related to the active tool or process being performed. Check the Status Bar for related information, instructions on the next steps, or options available.

Locating the Status Bar

The Status Bar is located in the bottom left-hand portion of the LightBurn window directly to the right of the Transform Control Toggles, and shows the precise location of the mouse cursor/pointer; the dimensions and status of items selected; the Notification Area where important tool, program, and laser messages are displayed; and the special Modes indicator.



Cursor Coordinates



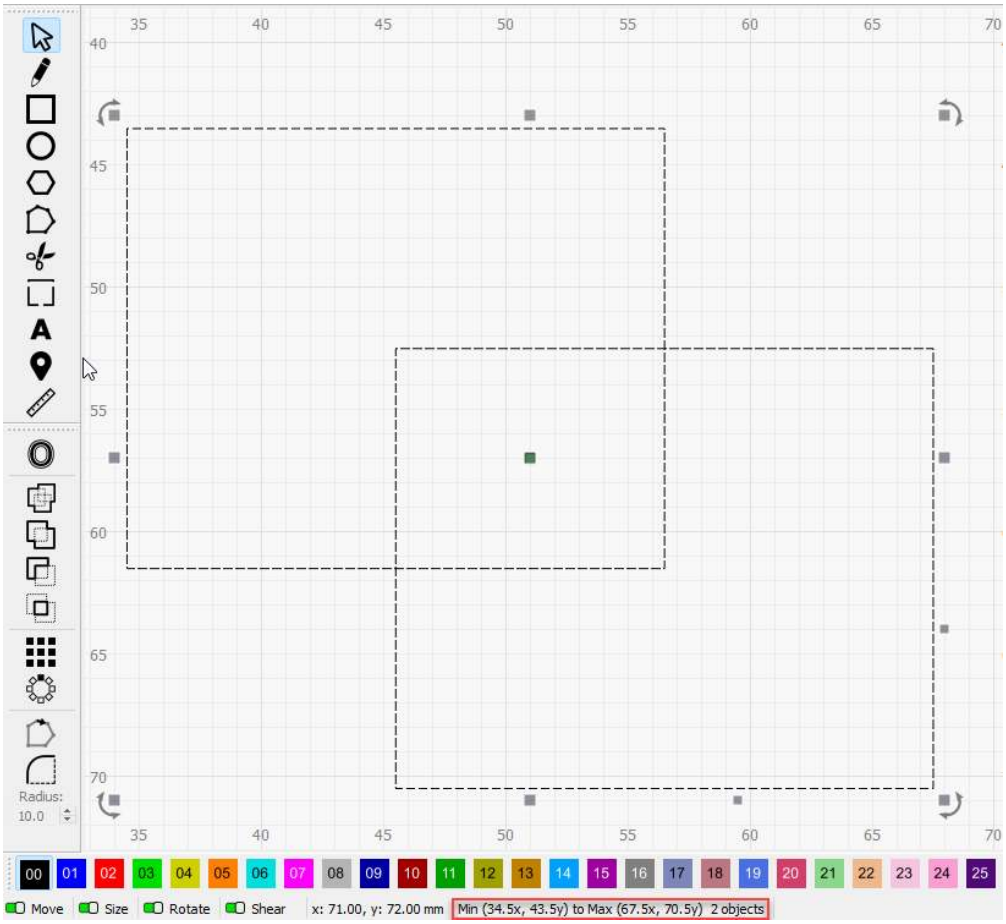
View the live and precise X and Y Axis coordinates of the mouse cursor within and around the LightBurn Workspace on the left side of the **Status Bar**. The displayed coordinates will stop updating when the mouse cursor leaves the area around the Workspace — for example when choosing tools, working within windows and toolbars, or interacting with menus.

Tool Status

The **Tool Status** section to the right of **Cursor Coordinates** displays information on the currently selected object(s) or tool.

Example Tool Statuses

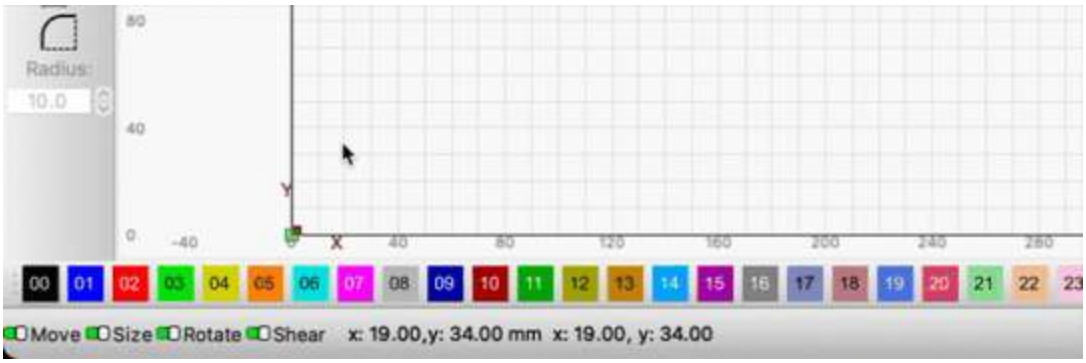
Selection Tool



Message: Min (34.5x, 43.5y) to Max (67.5x, 70.5y) 2 objects

Meaning: The rectangular selection bounding box has the corner closest to the origin at (34.5, 43.5) and the corner the farthest away from the origin at (67.5, 70.5), with two objects included and selected.

Draw Lines Tool

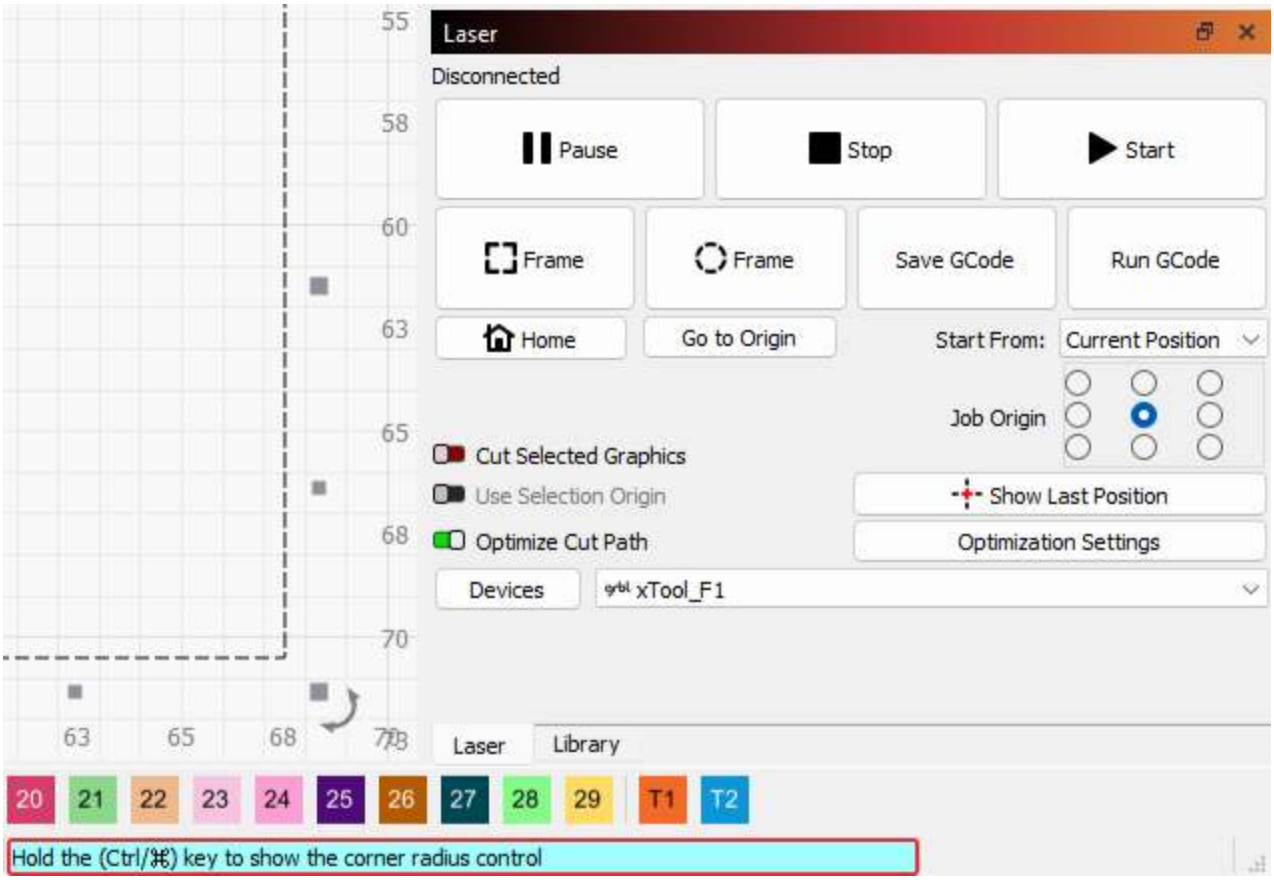


Message: x: 258.00, y: 66.00 (dx: 239.00, dy: 32.00, len: 241.13)

Meaning: Current cursor coordinates (difference in travel from the start of the line in the X and Y Axis, length of line)

> **Note**
>
> The Cursor Coordinates are always displayed to the left of Tool Status, and are displayed twice with this tool.

Notification Area



The **Notification Area** on to the right-hand side of the **Status Bar** displays tool-specific messages, in addition to important information from the program. The exact message that's displayed will change depending on the tool you're currently using, or the last action you took.

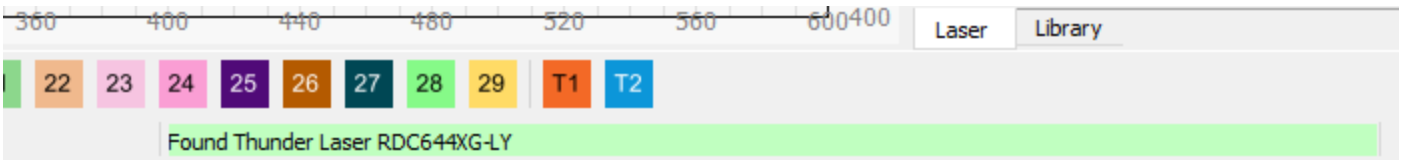
Connection Status

If you've set up and selected a DSP or Galvo device profile, the connection status of your device will be shown in the **Notification Area**.

DSP

If you've selected a DSP profile, and your laser is not connected, you'll see a **No device found** message.

If it is found and connected, you'll see a message identifying the laser's controller, and indicating that the device has been found.



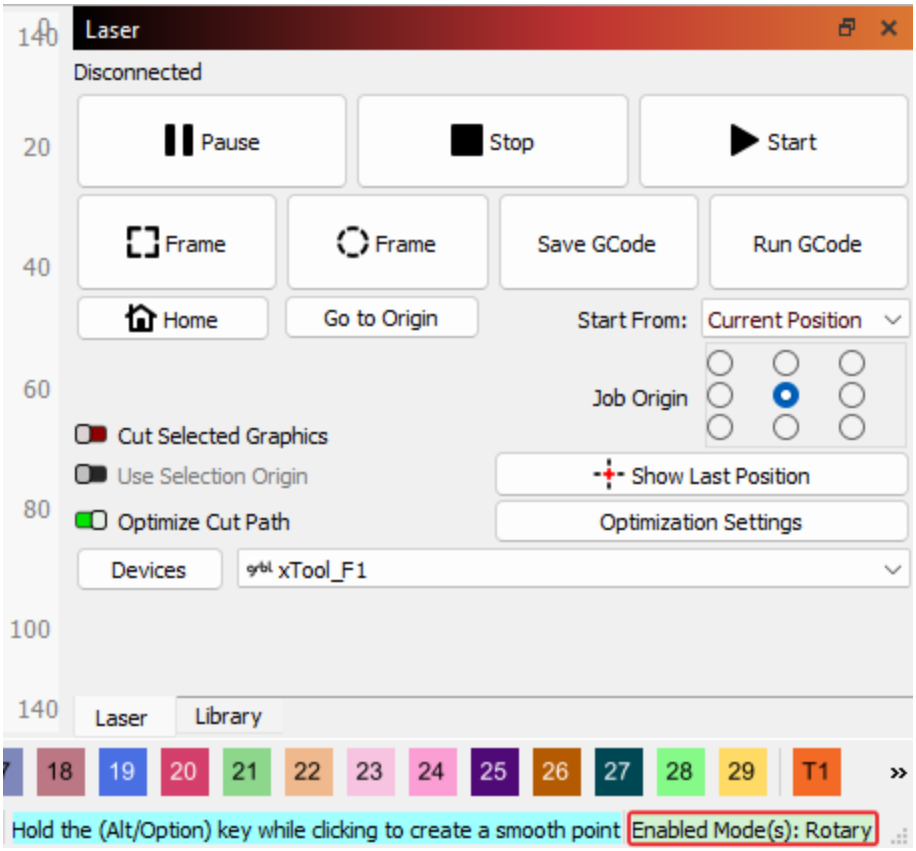
Galvo

If you've selected a Galvo profile, and your laser is not connected, you'll see a **Waiting for connection...** message.

If the connection is established, you'll see message identifying the laser's controller, and indicating that it is connected.

If you are unable to connect to your laser, see Troubleshooting: Connection Problems.

Modes Indicator



The last section of the Status Bar displays the name of any active special Modes, including Rotary Mode, Print and Cut, and Cylinder Correction.

Related Topics

- Workspace / Edit Window
- Transform Control Toggles

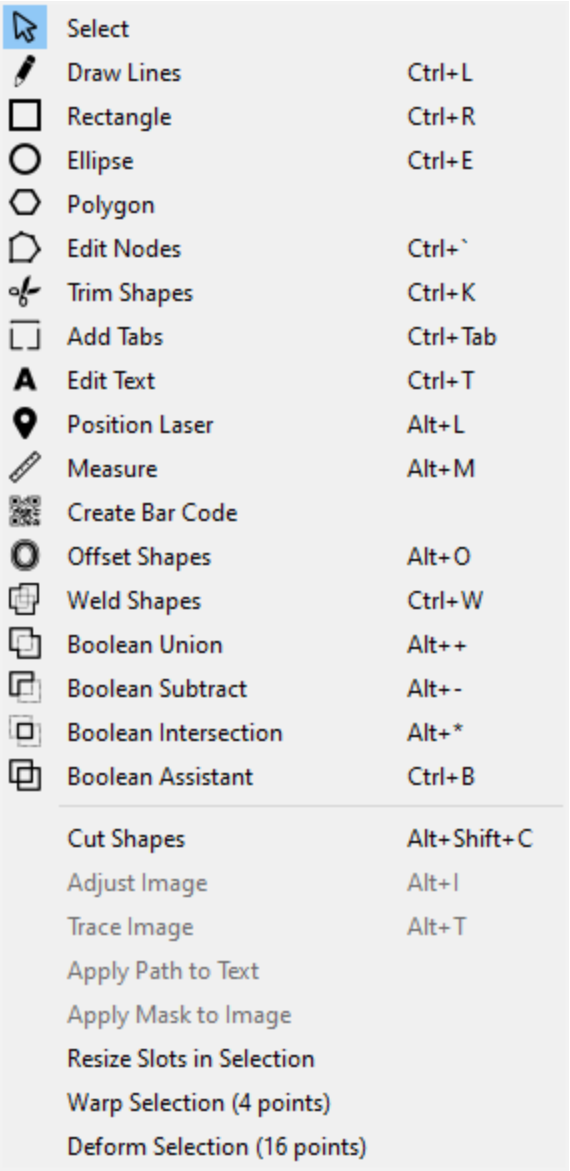
- Color Palette
- Rotary Mode
- Print and Cut
- Cylinder Correction

UI layout-and-design creation-tools editing arrangement editing customization object-manipulation material-utilization vector-editing vector-tools vector path-editing path-tools path vector-path-curve-lines node-editing object-repair troubleshooting fixing-designs workflow modifying-and-combining batch-production

5.2.16 Tools Menu

The **Tools Menu** contains an array of options for selecting, creating, editing, and modifying graphics.

Click any option in the image below to go directly to the relevant page for that tool, or scroll down for a list of options and descriptions.



Select

⎋ Esc

The primary means of selecting and deselecting objects.

See Selection Tools for more information

Draw Lines

^ Ctrl / ⌘ Cmd + L

Allows you to create custom shapes by placing points, with lines or curves between them.

See Draw Lines for more information.

Rectangle

^ Ctrl / ⌘ Cmd + R

Creates rectangles or squares.

See Rectangles, Ellipses, and Polygons for more information.

Ellipse

^ Ctrl / ⌘ Cmd + E

Creates ovals or circles.

See Rectangles, Ellipses, and Polygons for more information.

Polygon

Creates regular polygons — hexagons by default — with an adjustable number of sides.

See Rectangles, Ellipses, and Polygons for more information.

Edit Nodes

^ Ctrl / ⌘ Cmd + `

Allows you to edit vector graphics by adding, deleting, or moving their points, or altering the shape of the lines/curves between.

See Edit Nodes for more information.

Trim Shapes

`^ Ctrl` / `⌘ Cmd` + `K`

Cuts lines back to the next point at which they intersect with another line.

See Trim Shapes for more information.

Add Tabs

`^ Ctrl` / `⌘ Cmd` + `Tab ⇥`

Specifies small sections of cuts that the laser is commanded to skip, used to prevent objects that you are cutting from immediately falling out of the base material.

See Add Tabs for more information.

Edit Text

`^ Ctrl` / `⌘ Cmd` + `T`

Activates the **Create / Edit Text** tool, allowing you to add, edit, and format text.

See Create and Edit Text for more information.

Position Laser

`^ Ctrl` / `⌘ Cmd` + `L`

Commands your laser to jog to a location in its physical work area, by clicking in your LightBurn Workspace.

See Position Laser for more information.

Measure

`^ Ctrl` / `⌘ Cmd` + `M`

Allows you to hover over any shape in your Workspace and display an array of useful information about it, including perimeter and overall dimensions.

See Measure for more information.

Create Bar Code

Generates a Bar Code or QR Code which stores data that's visible when the Code is scanned.

See Bar Code for more information.

Offset Shapes

⎇ Alt / ⌥ Option + O

Creates a new shape by outlining the shapes in your selection at a distance you specify, either inward, outward, or in both directions at once.

See Offset for more information.

Weld Shapes

^ Ctrl / ⌘ Cmd + W

Combines two or more overlapping vector graphics into a single a shape.

See Boolean Tools for more information.

Boolean Union

⎇ Alt / ⌥ Option + +

Combines two overlapping vector graphics into a single shape.

See Boolean Tools for more information.

Boolean Subract

⎇ Alt / ⌥ Option + -

Removes one vector graphic from a second graphic where they overlap, creating a new shape from the area that remains of the second.

See Boolean Tools for more information.

Boolean Intersection

`⎇ Alt` / `⌥ Option` + `*`

Creates a new shape from the area where two vector graphics overlap.

See Boolean Tools for more information.

Boolean Assistant

`^ Ctrl` / `⌘ Cmd` + `B`

Opens a dialog window that shows a preview of what each of the Boolean operations will do to your selected shapes and gives you the option to click **OK** to confirm the change, or **Cancel** to discard it.

See Boolean Tools for more information.

Cut Shapes

`⎇ Alt` / `⌥ Option` + `⇧ Shift` + `C`

Cuts vector shapes — dividing them into new shapes — using a Closed Shape as the cutting tool.

See Cut Shapes for more information.

Adjust Image

`⎇ Alt` / `⌥ Option` + `I`

Opens a window where you can alter image properties such as Contrast, Brightness, and Gamma while also changing Layer Settings.

See Adjust Image for more information.

Trace Image

⎇ Alt / ⌥ Option + T

Outlines the content of a bitmap image, turning the outlines into vector graphics.

See Trace Image for more information.

Apply Path to Text

Attaches text to a vector object, reshaping it to follow the contour of the chosen path.

See Apply Path to Text for more information.

Apply Mask to Image

Cuts a bitmap image using a closed vector graphic, leaving only the area of the image that is contained within the vector.

See Apply Mask to Image for more information.

Resize Slots in Selection

Adjusts the dimensions of slots or tabs in selected objects, based on user specifications.

See Resize Slots for more information.

Warp Selection (4 Points)

Allows you to modify text, shapes, or images by dragging 4 handles — one on each corner of your selection.

See Warp/Deform Selection for more information.

Deform Selection (16 Points)

Allows you to modify text, shapes, or images by dragging 16 handles spread out in a 4 x 4 grid across your selection.

See Warp/Deform Selection for more information.

UI help keyboard-shortcuts hotkeys

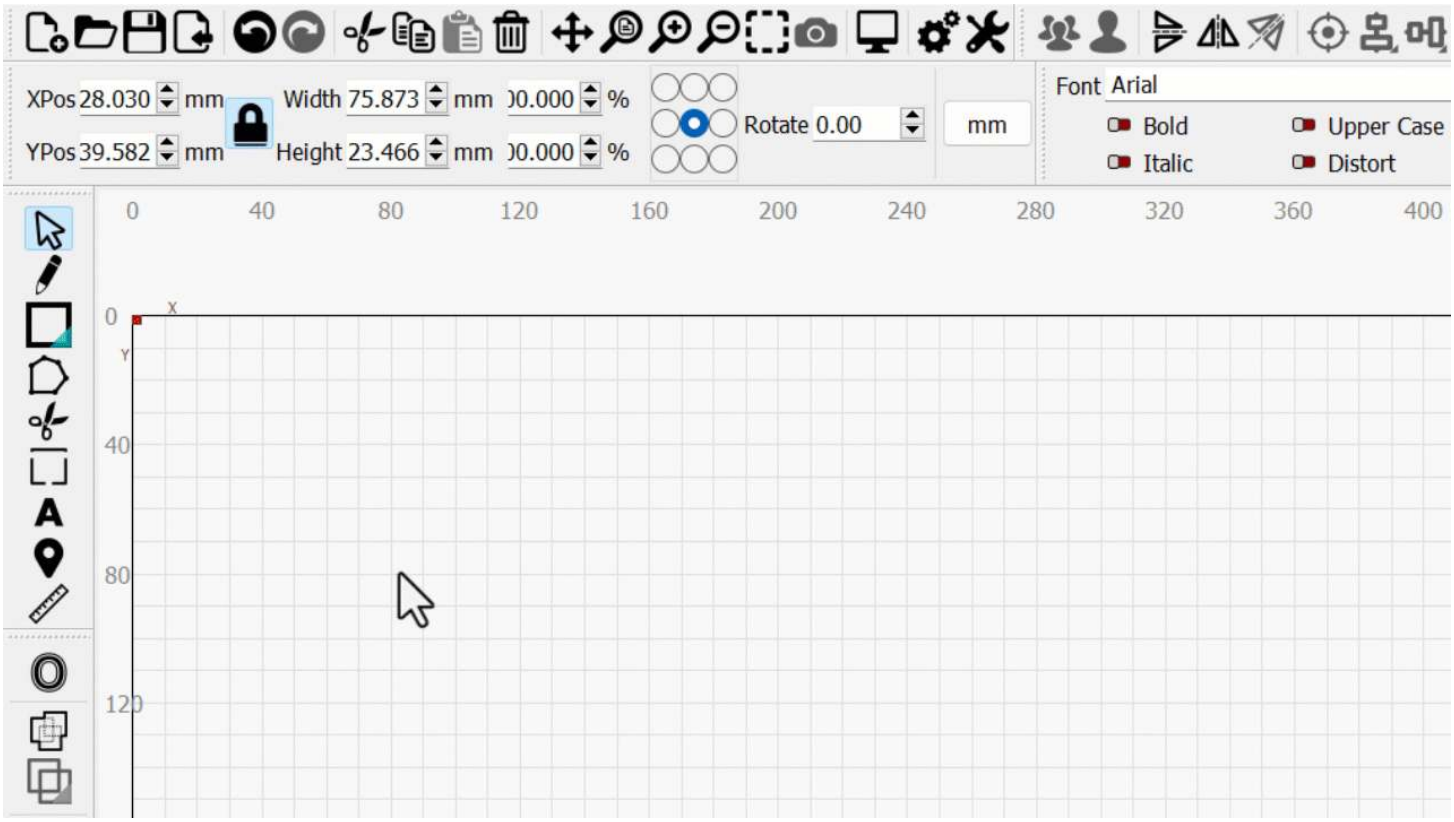
5.2.17 Tooltips and Topic-Aware Help

To help users navigate LightBurn's interface, we've included **Tooltips** and **Topic-Aware Help** for most features.

- Tooltips are brief descriptions of the action a tool performs. In some cases they also include keyboard shortcuts that tell you how to perform an action by pressing a combination of keys instead of clicking a button.
- When you press F1 while hovering over a tool, LightBurn's Topic-Aware Help function launches the relevant documentation page in your default web browser.

Tooltips

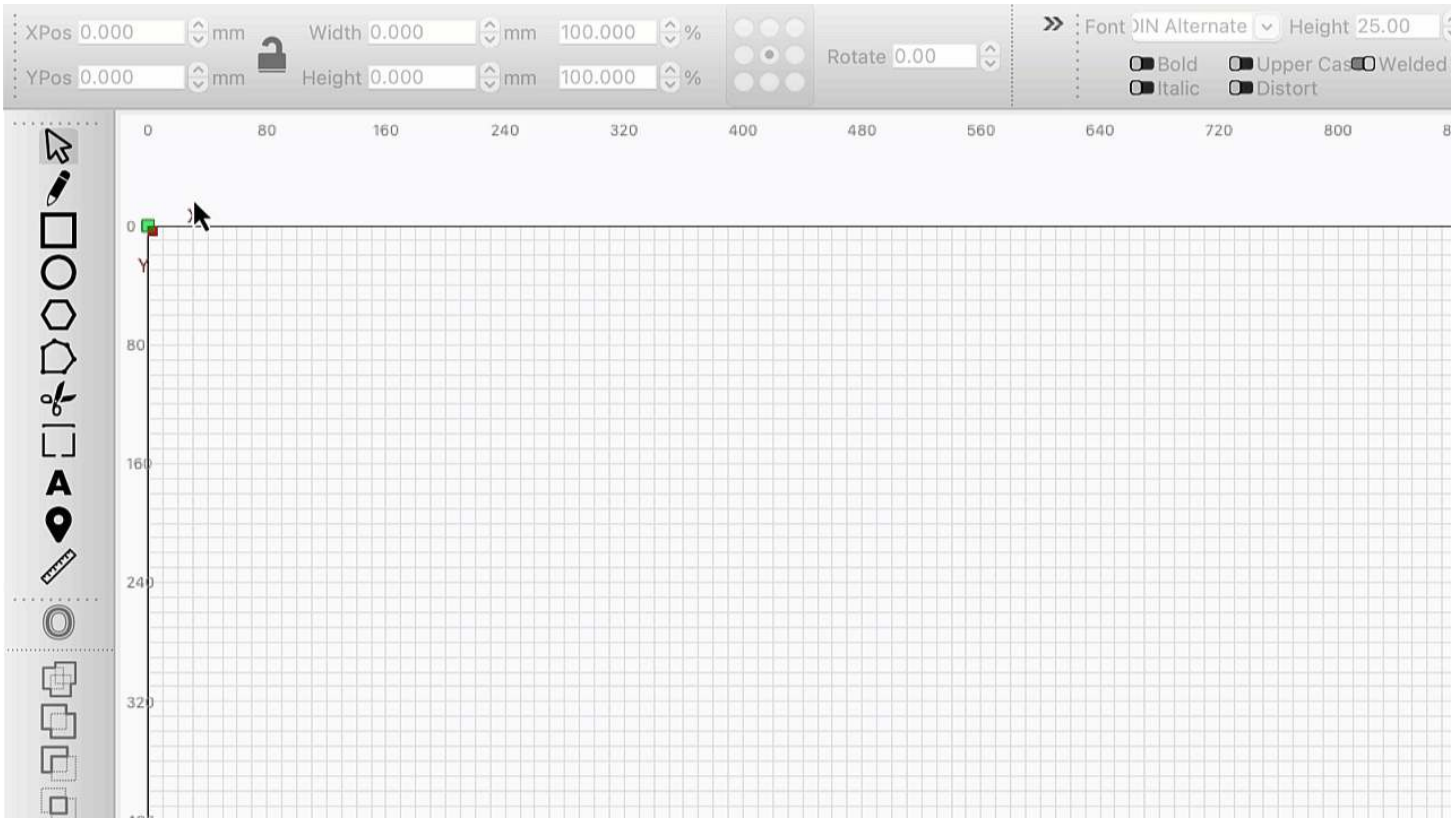
To reveal a **Tooltip**, briefly hover your cursor over anything you'd like to learn more about.



Topic-Aware Help

Press F1 while hovering to open your default web browser to the relevant documentation page for the tool or feature you're hovering over.

> **Note**
>
> If you're using a Mac, hold the Fn key while pressing F1.


XPos 0.000 mm
YPos 0.000 mm
Width 0.000 mm
Height 0.000 mm
100.000 %
100.000 %
Rotate 0.00
Font DIN Alternate
Height 25.00
Bold
Italic
Upper Cas
Welded
Distort
0
80
160
240
320
400
480
560
640
720
800
Y

UI window-menu menus reset-layout zoom frame preview wireframe view-style open-closed-windows restore-windows default-layout

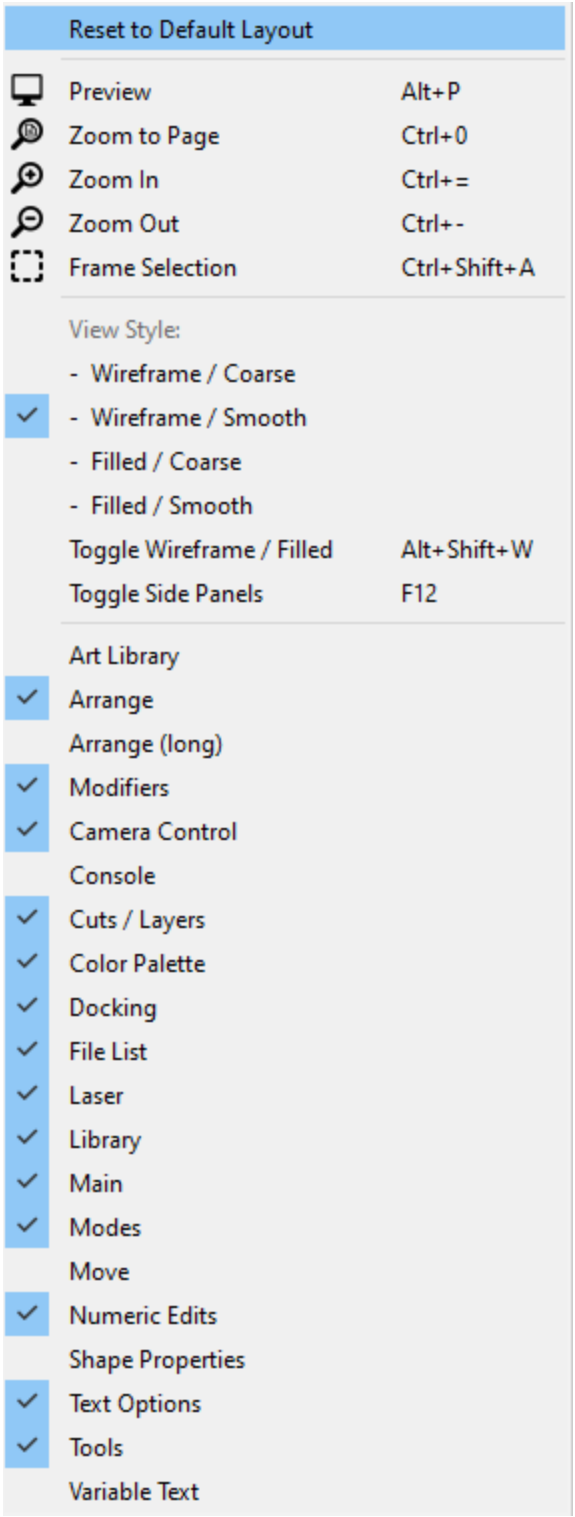
5.2.18 Window Menu

Use the **Window Menu** to control and customize your Workspace view, enable and disable windows and toolbars, or reset LightBurn's layout to its original state.

Any window or toolbar that is currently enabled will have a check mark next to it. Click unchecked windows or toolbars to enable them, and click again to disable them.

For more information on enabling, disabling, and customizing the position of windows and toolbars, see Customizing the LightBurn Window.

Click any option in the image below to go directly to the relevant page for that tool or window, or scroll down for a list of options, toolbars, windows, and descriptions.



Reset to Default Layout

Restores the layout of the full LightBurn window to the same format when first installed.

See Reset to Default Layout for more information.

Preview

⎇ Alt / ⌥ Option + P

Displays a simulation of movements and lasering operations before a project is sent to the machine.

See Preview for more information.

Zoom

The Zoom options allow you to increase or decrease the visual size of your design on your screen, without changing the actual dimensions in the final output to the laser.

See Zoom and Pan for more information.

View Style

Changing the **View Style** alters the appearance of vector graphics in your Workspace, which can be useful for spotting potential design issues and visualizing the final output from a project.

See View Style for more information.

Toggle Side Panels

F12

Toggle off to automatically disable all currently-enabled windows. Toggle back on to re-enable the same set of windows.

See Customizing the LightBurn Window for more information.

Windows and Toolbars

Art Library

Stores artwork, to enable quick access when designing.

See Art Library for more information.

Arrange and Arrange (Long)

Provide tools for positioning graphics, relative to other graphics or positions in your Workspace.

See Arrange Menu for more information.

Modifiers

Contains tools for adjusting, combining, and arraying graphics.

See Modifiers Toolbar for more information.

Camera Control

Provides options for capturing, adjusting, and displaying an overlay image of your laser's work area in the LightBurn Workspace.

See Camera Control Window for more information.

Console

Displays messages from your laser's controller and commands sent to it by LightBurn. You can also input direct commands to your laser through this window.

The Console window functions are only available when LightBurn is directly connected to a GCode-based laser.

See Console Window for more information.

Cuts / Layers

Shows the list of layers and operations in your design. Select an entry on this list to edit select settings for that layer directly in the **Cuts / Layers Window**, or double-click to open the Cut Settings Editor, where additional options are presented.

See Cuts / Layers Window for more information.

Color Palette

Contains colors representing twenty-nine different layers, and two tool layers, which you can select and assign to objects in your Workspace.

See Color Palette for more information.

Docking

Provides tools to move selected objects left, right, up, or down, until they meet the edge of the Workspace, or another object.

See Docking for more information.

File List

Lists the jobs and estimated run times of files physically hosted on DSP controllers.

See File List Window for more information.

Laser

Serves as the hub for setting up and selecting a laser, **framing** and **starting** jobs, determining job positioning, and more.

See Laser Window for more information.

Material Library

Stores preset cut settings for different operations and materials, so you can quickly reapply them later.

See Material Library for more information.

Main

Contains tools for **saving** and **opening** files, **importing** artwork, **copying** and **pasting** graphics, adjusting view, and more.

See Main Toolbar for more information.

Modes

Contains buttons to open dialog windows or wizards for advanced lasering processes.

See Modes Toolbar for more information.

Move

Provides tools to jog your laser, set a custom User Origin, or view, save, and recall machine coordinates.

See Move Window for more information.

Numeric Edits

Contains fields to adjust the scale, position, and rotation of selected objects.

See Numeric Edits Toolbar for more information.

Shape Properties

Displays editable properties of selected objects. Properties vary based on the type of object currently selected.

See Shape Properties Window for more information.

Text Options

Presents options to adjust attributes of **text objects**, including, **font**, size (**height**), spacing (**HSpace** and **VSpace**), and more.

See Create and Edit Text — Text Options Toolbar for more information.

Tools

Contains tools for creating and editing graphics.

See Creation Toolbar for more information.

Variable Text

Provides options for controlling and incrementing **Variable Text** output. Variable Text allows you to use special codes in text entries that will be substituted for something else when a project is sent to your laser.

See Variable Text for more information.

UI workspace first-steps edit-window grid background-image camera

5.2.19 Workspace / Edit Window

The **Workspace**, or **Edit Window**, is the area where you create, adjust, modify, and arrange artwork in LightBurn.

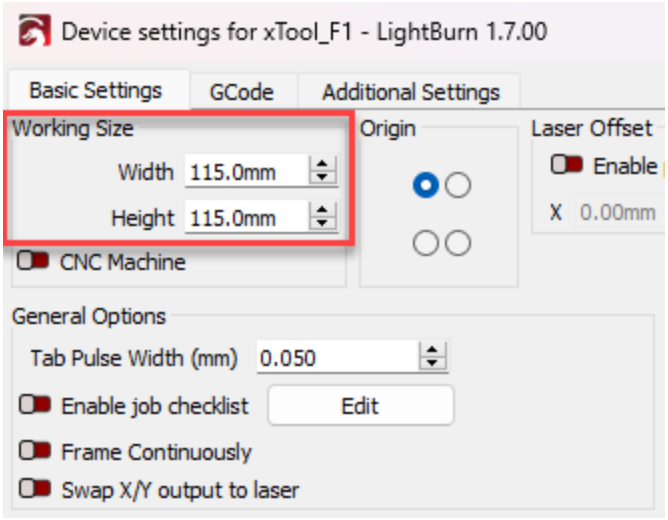
LightBurn sets the size of the border and grid within the Workspace to the machine-specific laser cutting and marking area. Machines equipped with a camera can capture the machine's working area and update the Workspace background image.

The objects arranged and displayed within the Workspace will be processed based on user-configured operations that are established for each artwork element using the Color Palette, Cuts / Layers Window, and Cut Settings Editor.

Customizing the Workspace Appearance

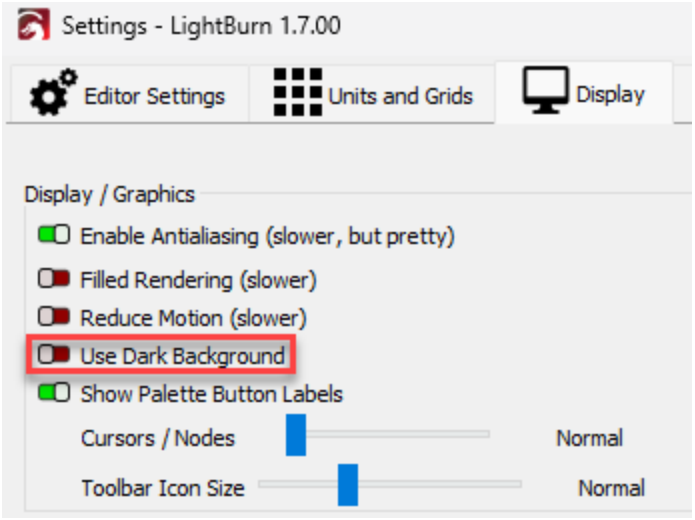
Changing the Size of the Workspace

Change the size of the Workspace in the Device Settings window by clicking on the icon in the Main Toolbar or going to Edit → Device Settings → **Dimensions / Units** → **Working Size**. Adjust the Working Size **Width** and **Height** entries to match the manufacturer-provided values.



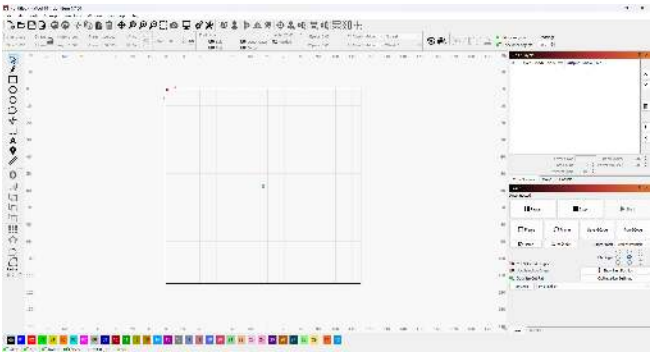
Enabling Dark Background

Switch from the default light background to a dark background in the LightBurn Settings window by clicking on the icon in the Main Toolbar or by going to Edit → Settings → **Display** → **Display / Graphics** → **Use Dark Background**.



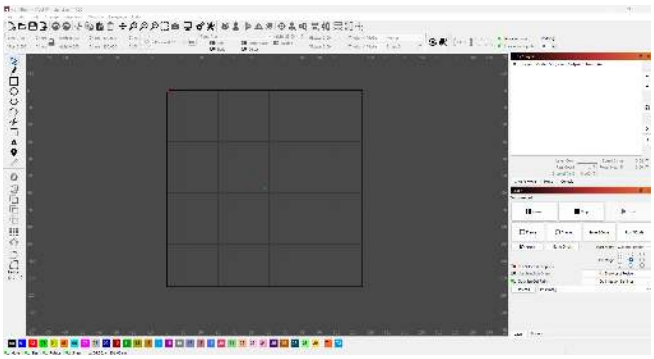
Background Examples

DEFAULT LIGHT COLOR BACKGROUND



Type	Color
Hex	#f8f8f8
RGB	248,248,248,248
CMYK	0,0,0,2.7
HSV	0,0,97

DARK COLOR BACKGROUND



Type	Color
Hex	#484848
RGB	72,72,72
CMYK	0,0,0,71.8

Type	Color
HSV	0,0,28

Customizing the Workspace Background

LightBurn Camera Setup

Machines equipped with a camera can capture an image of the work area and display that behind the Workspace grid to aid in artwork positioning.

Alternatively, the material being cut or marked can be drawn within the Workspace as a Tool layer with the available LightBurn design Creation tools for similar element alignment and laser framing operations.

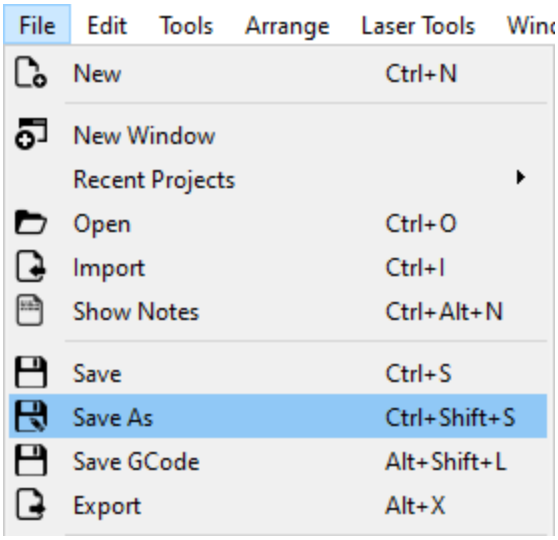
5.3 Essential Functions

beginner essential-functions recent-projects save machine-file import export

5.3.1 File Management

Use the file management tools to start **New** projects, **Save** projects you're working on, **Open** previously saved projects, and **Import** or **Export** artwork in alternative file formats.

Most file management options are available in the Main Toolbar, with a few additional options available in the File Menu.



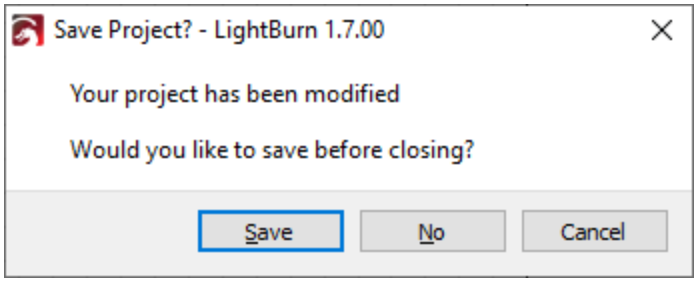
New

^ Ctrl / ⌘ Cmd + N

Clears your current LightBurn project and starts a new, blank project.

Opening a new project does not change any Settings, window customizations, and special modes active from the last opened project.

If you have an existing project open with unsaved changes, LightBurn will ask you if you'd like to Save before starting the new project, click **No** to discard the changes, or **Cancel** to abort the process.

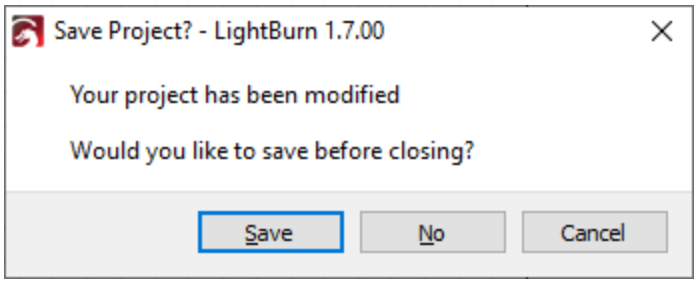


Open

`^ Ctrl` / `⌘ Cmd` + `O`

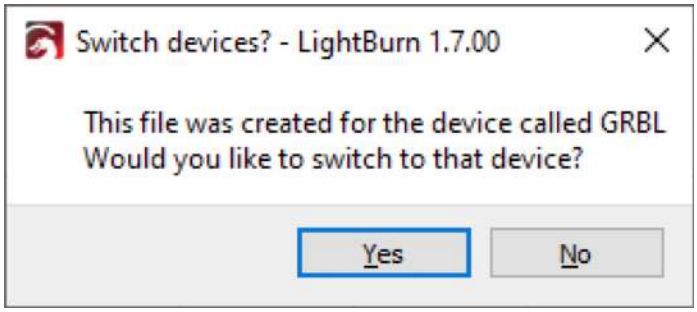
Opens a `.lbrn` or `.lbrn2` project file previously stored on your computer.

If you have an existing project open with unsaved changes, LightBurn will ask you if you'd like to Save before Opening the project, click **No** to discard the changes, or **Cancel** to abort the process.



If you have multiple device profiles, and the device you were using when you Saved the file is not currently selected, LightBurn will ask if you'd like to automatically switch to that device profile.

Click **Yes** to switch or **No** to open the file with your current device.



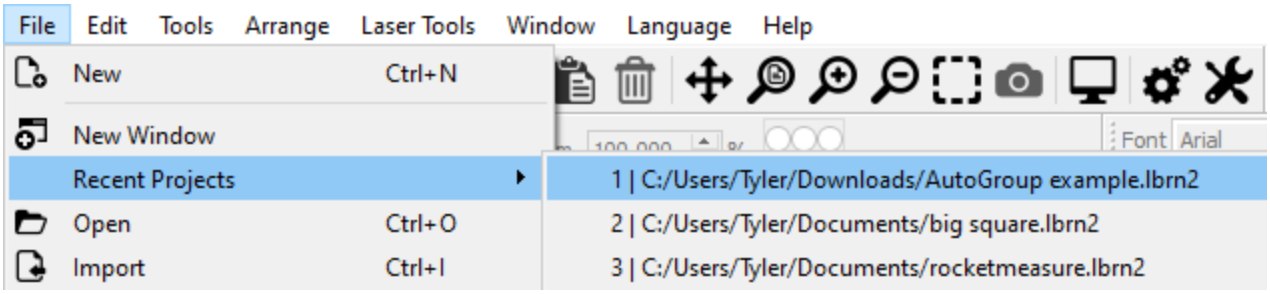
Click on the dropdown in your system's file browser to show all supported file types, including supported image and vector file types.

> **Warning**
>
> Selecting a supported image or vector file instead of a project file will create a *new LightBurn project*, replacing the currently loaded project. Use Import to bring artwork files or designs into an existing project.

Recent Projects

Hover over **Recent Projects** in the File Menu to open a submenu containing a list of projects you've recently worked on and **Saved**.

Click any file in the list to **Open** it.



Save

`^ Ctrl` / `⌘ Cmd` + `S`

> **.lbrn and .lbrn2**
>
> The **Save** and **Save As** commands offer the option of saving as `.lbrn2` (default) or `.lbrn` (LightBurn Legacy Project).
>
> Unless you need to maintain compatibility with extremely old versions of LightBurn or need an easily human-readable file, we recommend leaving the file type set to `.lbrn2`.

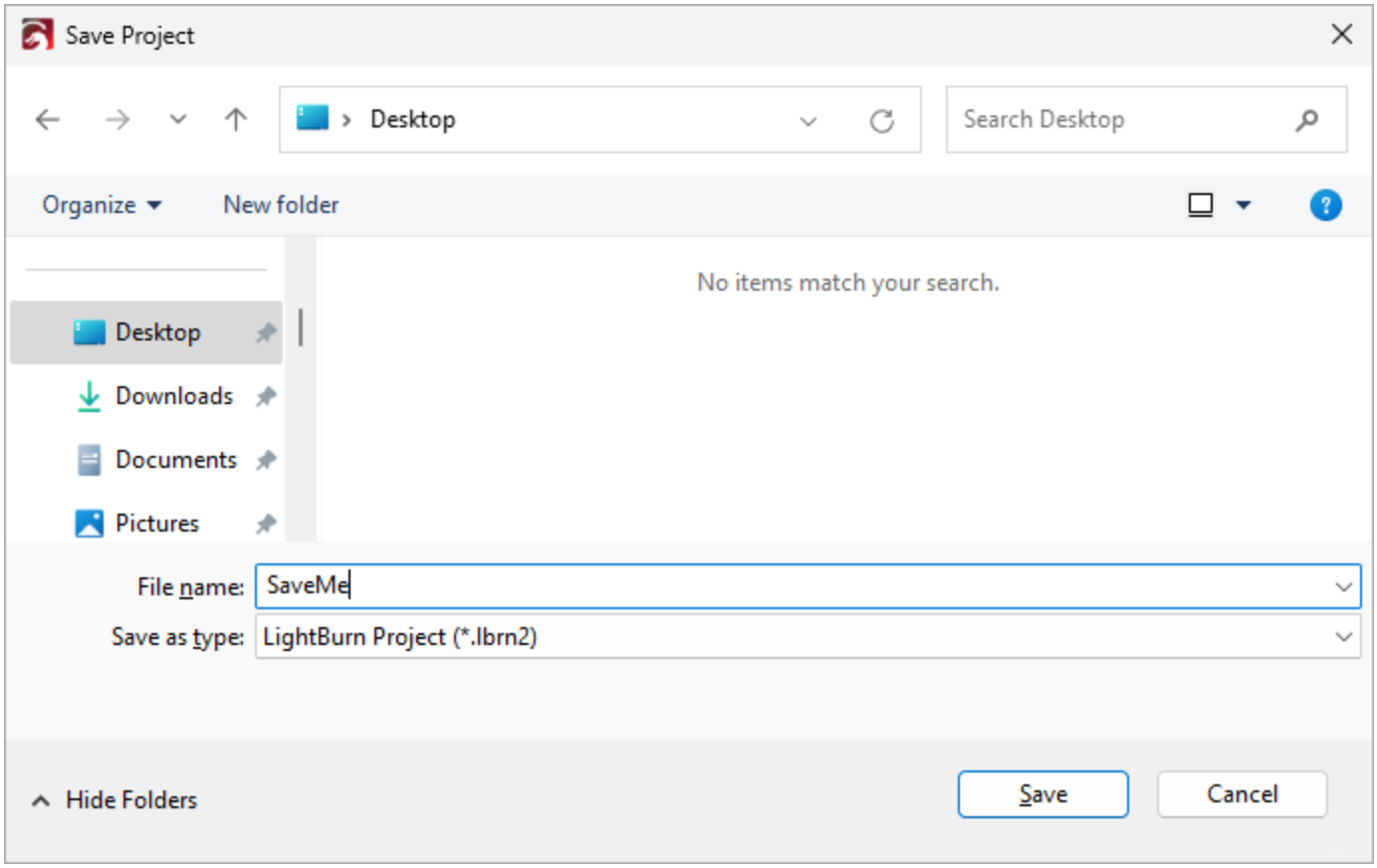
Saves your current project in `.lbrn` or `.lbrn2` format.

- If you haven't Saved it previously, a dialog window will open where you can name it and choose the location to Save it.
- If you have already Saved a copy, the existing copy will be immediately overwritten with any new changes you've made.

Save As

^ Ctrl / ⌘ Cmd + ⇧ Shift + S

Rather than immediately overwriting your existing file, **Save As** opens a dialog window where you can save a renamed copy to a new file, leaving the current file unchanged.



Save Machine File

This option will change depending on the type of laser you're using — it may say **Save GCode** (for GRBL, Smoothieware, or Marlin controllers), **Save RD File** (Ruida), **Save OUT File** (TopWisdom), or **Save UD5 File** (Trocen).

All options save your current project as a machine-ready file, in the appropriate format for your type of laser. You can transfer this file to your machine to run it without ever having to directly connect using LightBurn.

See Laser Window — Save Machine Files for more information.

Import

^ Ctrl / ⌘ Cmd + I

Loads graphics from a variety of file formats into LightBurn. Click on the dropdown in your system's file browser to filter for supported image and vector file types.

LightBurn can **Import** the following formats:

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

> **Importing Text**
>
> If you import vector files not made in LightBurn that contain text, make sure that any fonts used in the file are installed on your computer, or that the text has been converted to paths using whatever tools are available in the other program. LightBurn is not able to import embedded fonts. If LightBurn is unable to import anything from your file, the status bar will display **Nothing Imported**.
>
> Different programs use different terms for this process, but terms such as *welding*, *convert to outline*, and *convert to path* are common.

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

Quick Tip: Drag and drop directly into LightBurn

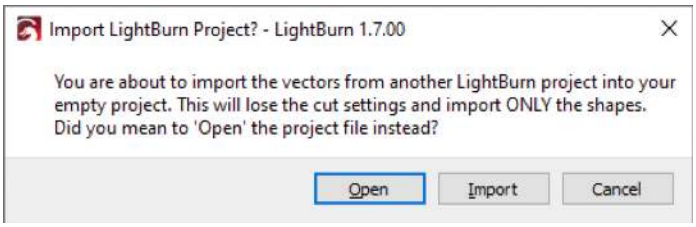
Importing `.lbrn` or `.lbrn2` files

It is also possible to **Import** `.lbrn` or `.lbrn2` files — however, Importing these types of files *does not* load the cut settings or any other project-specific information saved to the file. Only the graphics will be loaded.

In order to load graphics along with all other settings, you must use **Open** instead.

LightBurn will warn you if you attempt to Import a `.lbrn` or `.lbrn2` file.

Click **Open** to load the graphics and all other settings, **Import** to load only the graphics, or **Cancel** to abort the process.



Export

`⎇ Alt` / `⌥ Option` + `X`

Exports currently selected graphics in `.ai`, `.svg`, or `.dxf` format. If there is nothing in your current selection, the entire contents of your current project will be Exported.

Exporting in one of these formats *does not* save cut settings or any other project-related settings.

Related Topics

- Clipboard Tools
- Undo/Redo
- File Menu

first-steps essential-functions selection object-manipulation open-vs-closed-shapes

5.3.2 Selection Tools

In order to modify graphics, you must first select them. The **Select** tool is the primary means of selecting objects, but LightBurn also includes several additional options for making selections based on their type, size, layer, and more.

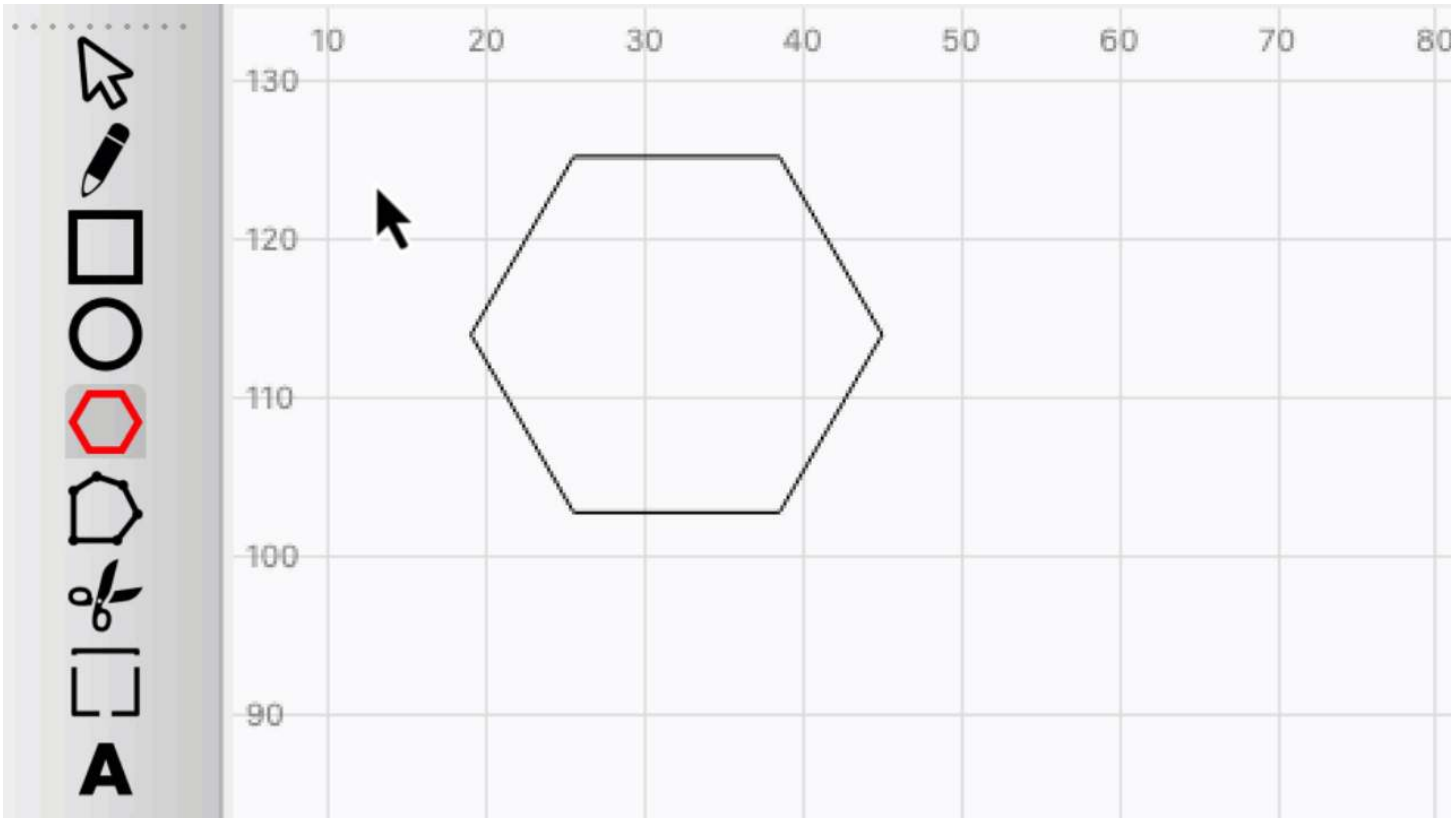
Making Selections

The **Select** tool is active by default. To reactivate it after using a different tool, click the cursor icon in the Creation Toolbar, or press the Esc key.

Click Selection

With the **Select** tool enabled, click any object in your Workspace to select it.

> **Tip**
>
> To increase or decrease the distance your cursor must be from an object in order to select it when you click, adjust Click-Selection Tolerance in your Settings/Preferences.

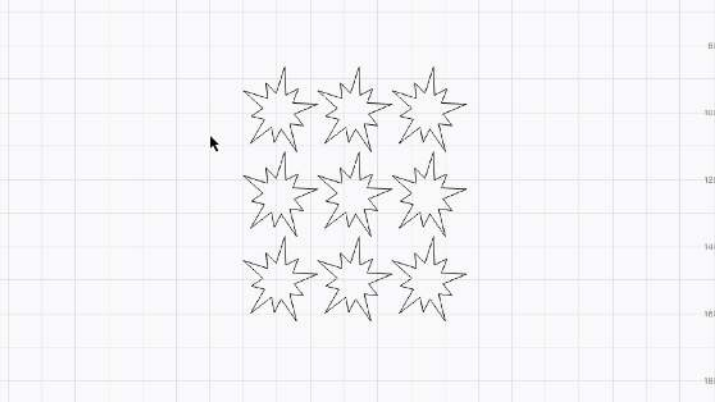


Box Selection

Select several shapes at once using one of two box selection options.

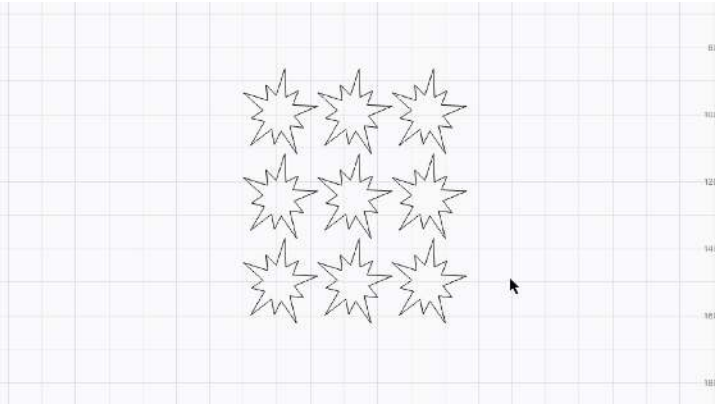
Enclosing Selection

With the **Select** tool enabled, click, hold, and drag to the right to create a red **Enclosing Selection** box. Release to select all objects that are *fully contained* within the box.



Crossing Selection

Click, hold, and drag to the left to create a green **Crossing Selection** box. Release to select all objects that are *fully contained* or *crossed by* the lines of the box.



Selection Modifiers

To supplement both click and box selection, LightBurn supports the following modifier keys.

While clicking or box-dragging:

- Hold `⇧ Shift` to add a new object or objects to your current selection.
- Hold `^ Ctrl` / `⌘ Cmd` to toggle the selection status of an object or objects, deselecting selected objects, or selecting unselected objects.

- Hold both ^ Ctrl / ⌘ Cmd and ⇧ Shift to remove an object or obects from your current selection.

Additional keyboard shortcuts:

- Press the ⎋ Esc key, or click in any open area in your Workspace to remove all objects from your selection.
- Press Tab ⇥ to cycle your selection sequentially through objects or Grouped objects in your Workspace. Sequence is determined by the order in which the objects were created.
- Press both Tab ⇥ and ⇧ Shift to cycle your selection sequentially through objects or Grouped objects in your Workspace, in reverse order.

Selection Indicators

Selected objects are drawn with an animated dash pattern instead of solid lines. If you select Grouped objects, you'll see a dot-dot-dash pattern instead.

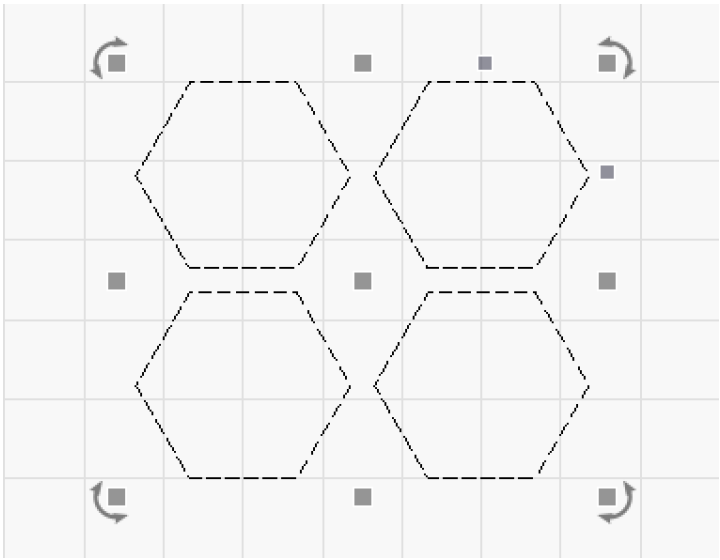


Figure 1: Ungrouped Objects Selected

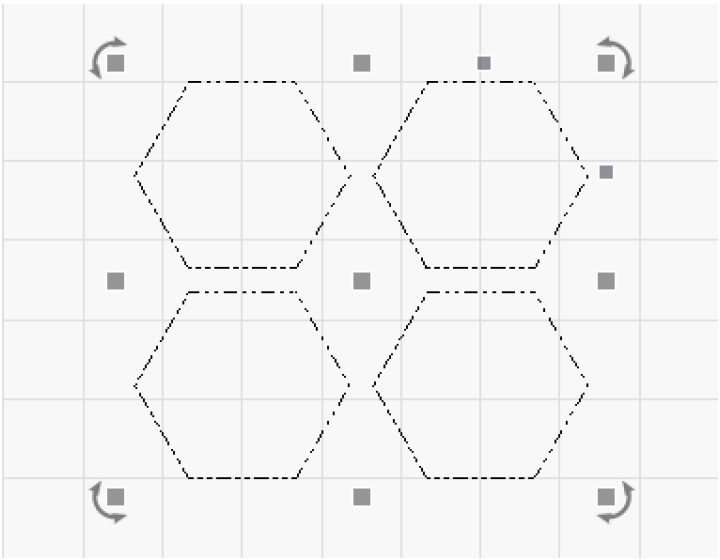


Figure 1: Grouped Objects Selected

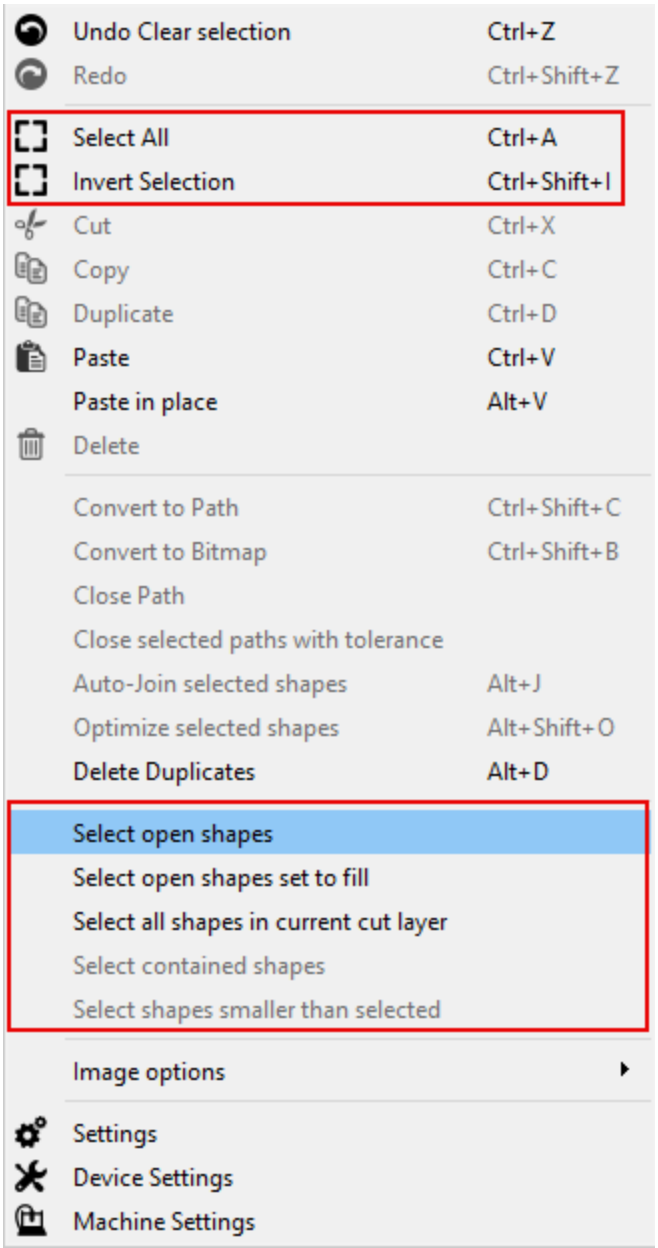
Several options for modifying or manipulating objects are available once they are selected:

- The Transform Control handles for Sizing, Moving, Skewing, or Rotating the selection appear.
- The size and position of your selection is shown in the Numeric Edits Toolbar.
- Other controls are enabled depending on the type of object you've selected:
  - If you select a Text Object, the Text Options Toolbar becomes active.
  - If you select a shape made by the Rectangle, Ellipse, or Polygon tools, shape-specific adjustment options are presented in the Shape Properties Window.

- If you select an Image, image adjustment options are presented in the Shape Properties Window.

Additional Selection Tools

Several other selection options are available in the Edit Menu.



Select All

`^ Ctrl` / `⌘ Cmd` + `A`

Selects all graphics in your project.

Invert Selection

`^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `I`

Deselects all objects that are currently selected and selects all objects that are not currently selected.

Select Open Shapes

Selects all shapes in your project that are open, meaning they are not paths that form a closed, continuous loop. See Open vs. Closed Shapes for more information on open shapes.

Select Open Shapes Set to Fill

Selects all shapes in your project that are open, *and* assigned to a layer set to Fill or Offset Fill Mode. LightBurn is unable to fill open shapes — this tool is a useful option for identifying them.

Select All Shapes in Current Layer

Selects all shapes assigned to the active layer in the Cuts / Layers Window.

You can perform the same action by holding `⇧ Shift` while clicking on a layer in the Cuts / Layers Window.

Select Contained Shapes

Selects all shapes contained by the currently selected shape. To use this tool, the selected shape must be closed — a path that forms a continuous loop. The containing object remains in the resulting selection.

Select Shapes Smaller Than Selected

Selects all shapes that are smaller than the currently selected object. The currently selected object remains in the resulting selection.

Troubleshooting

- Grouped objects are treated as single objects when using click or box selection, and any selection modifiers. All objects in a Group must be entirely contained by an **Enclosing Selection** in order to be selected, and if any object in a Group is crossed by a **Crossing Selection**, the entire group will be selected.
- There are a handful of exceptions to the behavior of Grouped objects with the additional selection tools:
  - **Select contained shapes** does not select *any* contained shapes that are Grouped.
  - When using **Select shapes smaller than selected**, any Grouped objects that are smaller than the selected shape will be selected, and automatically removed from their Group. The objects they were Grouped with will not be selected.
  - When using **Select open shapes** or **Select open shapes set to Fill**, any Grouped objects that are open will be selected, and automatically removed from their Group. The objects they were Grouped with will not be selected.
- If you find that you're getting odd flashing instead of the expected pattern when selecting objects, the most likely problem is overlapping geometry. This is often the result of importing the same file twice, or other design software exporting paths improperly.

  To solve this problem, try deleting duplicate shapes using Edit → Delete Duplicates (⎇ Alt + D).

  For more manual control, you can also try Ungrouping(^ Ctrl / ⌘ Cmd + U) and deleting individual shapes.

Related Topics

- Group/Ungroup
- Workspace
- Zoom
- View Style
- Open vs. Closed Shapes

essential-functions zoom pan workspace view invert-zoom settings preferences

5.3.3 Zooming and Panning

Use the **Zooming** and **Panning** functions to adjust the visible area in your Workspace while designing and making edits.

Zooming In can make fine details easier to work on, and **Zooming Out** can provide a better view of an overall composition.

Panning allows you to move the area your screen is focused over, sliding the field of view between locations in your Workspace.

Zooming

Zoom In and Out

The most common method to quickly navigate a design is by zooming with the scroll wheel on a mouse, followed by two-finger dragging if you're using a trackpad. By default, rolling it backwards will **Zoom Out**, and rolling it forward will **Zoom In**, toward whatever your cursor is pointing.

These directions can be swapped by going to File → Settings (**LightBurn** → **Preferences** on Mac) and toggling on **Invert mouse wheel zoom direction**.

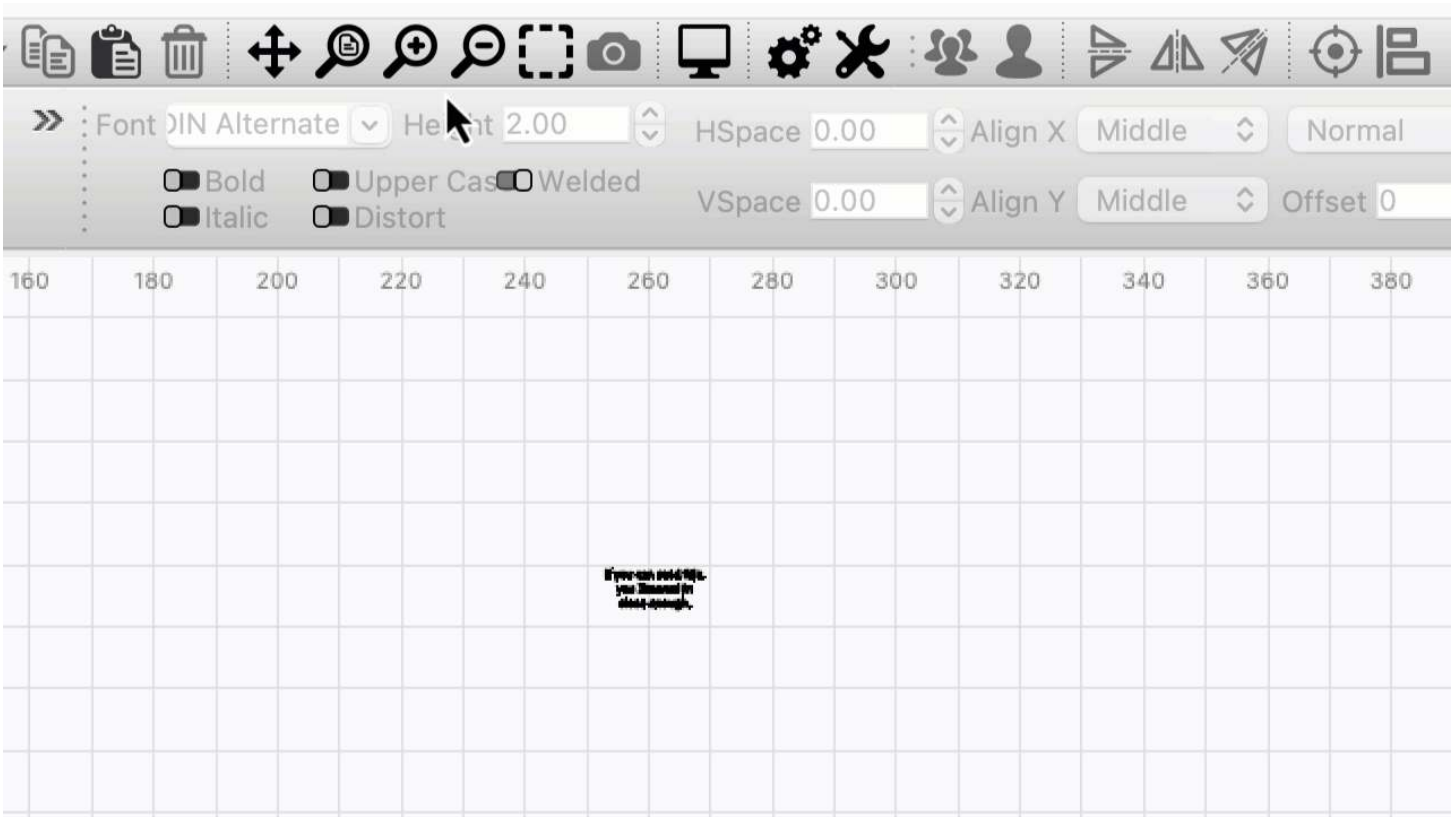
However, there are many ways to Zoom In and Out:

Method	Zoom In	Zoom Out
Roll the scroll wheel on a mouse	Forward	Backward
Slide two fingers on most touchpads	Backward	Forward
Window Menu	Zoom In	Zoom Out
Keyboard shortcuts (Edit Window in focus)	`+`	`-`
Keyboard shortcuts (Edit Window *not* in focus)	`^ Ctrl` / `⌘ Cmd` + `+`	`^ Ctrl` / `⌘ Cmd` + `-`
Main Toolbar		

What does it mean for a window to be in focus?

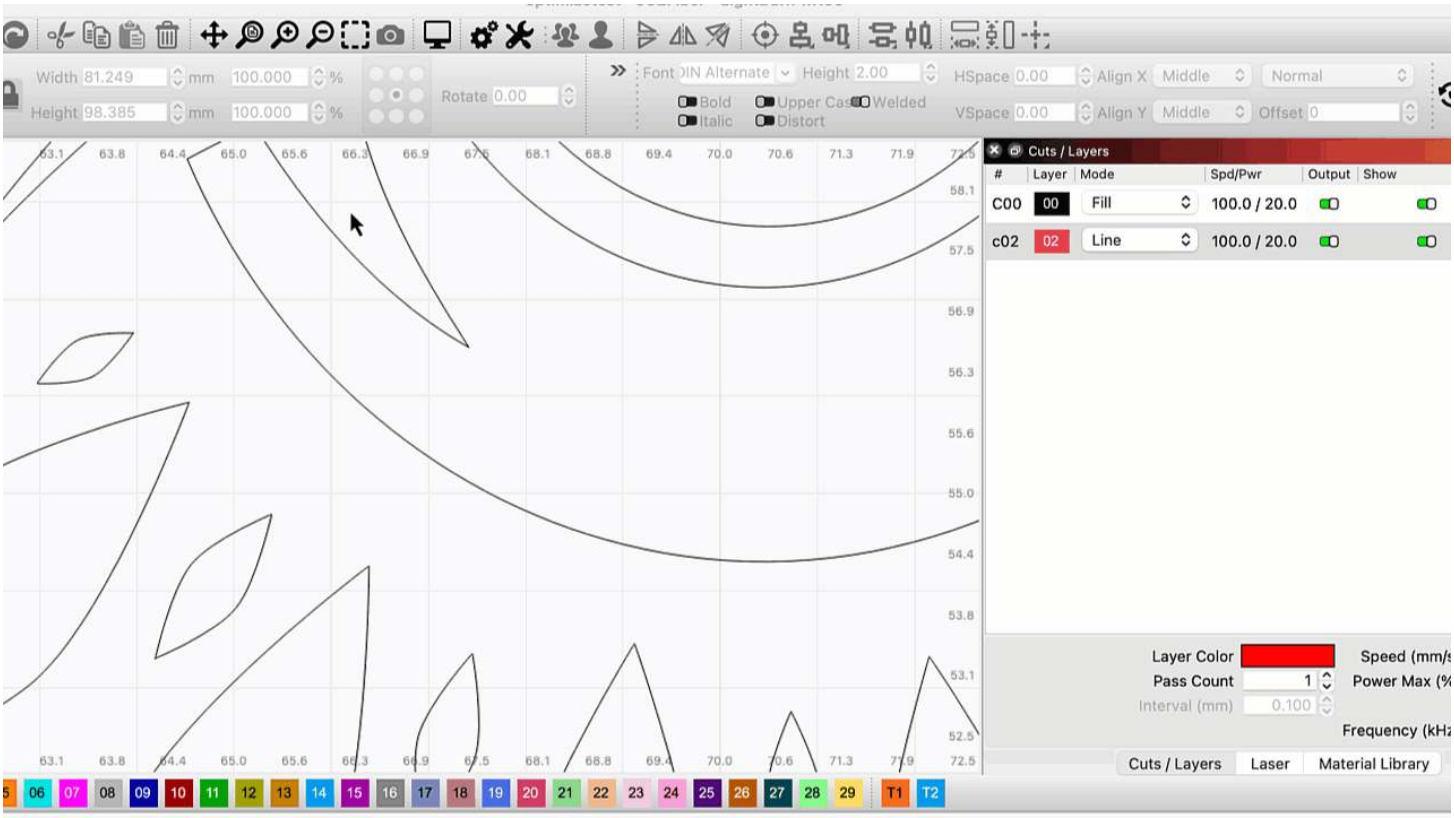
There are several Windows and Toolbars in LightBurn that accept user input — when a window is clicked on, it is in focus and accepting input.

If a window other than the Edit Window is in focus, click anywhere in the Workspace to bring it into focus. Selecting objects in the Workspace will also bring it into focus.



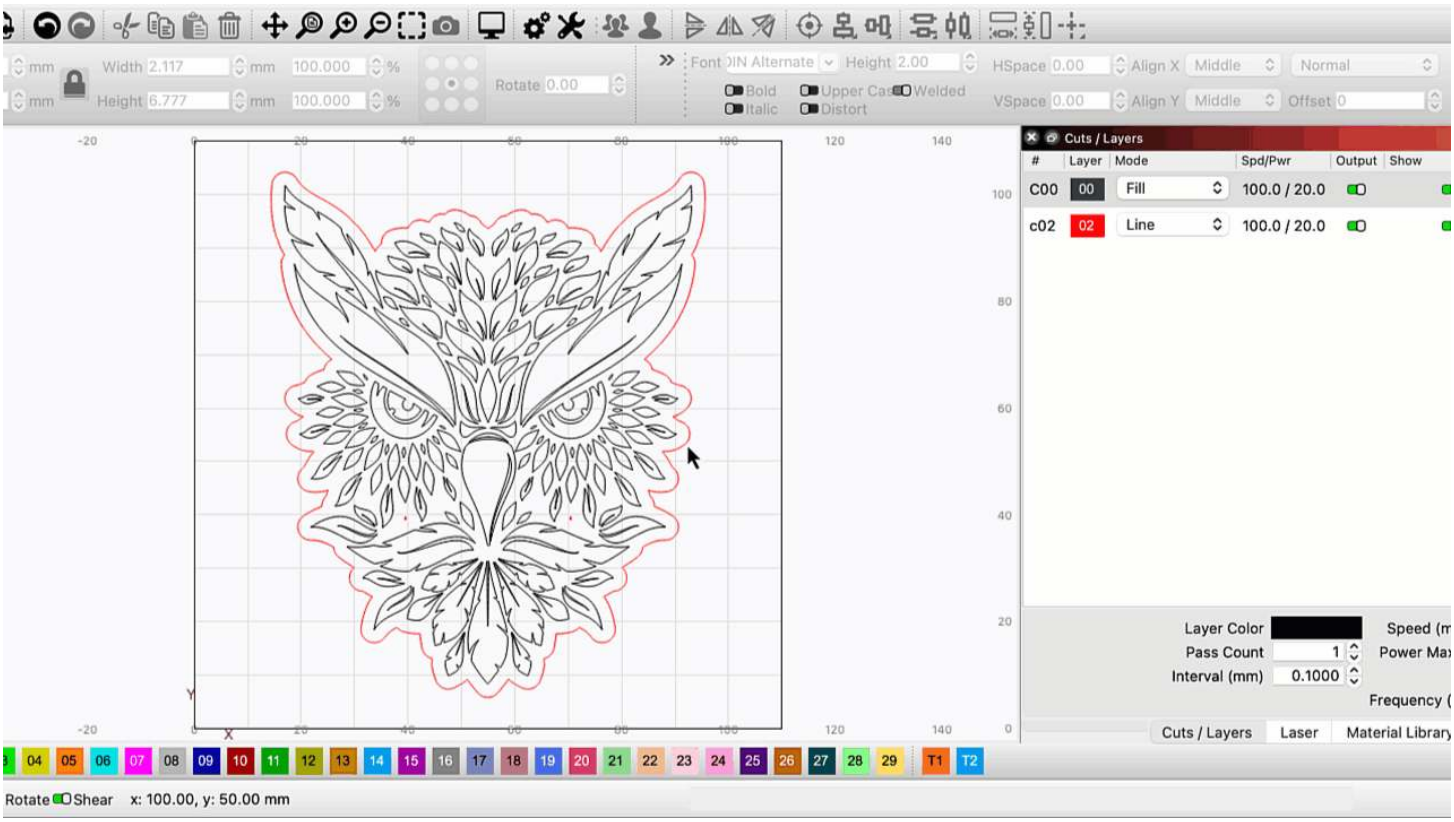
Zoom to Page

To **Zoom** your field of view to show the entire Workspace, go to Window → **Zoom to Page**, press `^ Ctrl` / `⌘ Cmd` + `0`, or click the Zoom to Page button in the Main Toolbar.



Frame Selection

To **Zoom** your field of view to frame your current selection, go to Window → **Frame Selection**, press ^ Ctrl / ⌘ Cmd + ⇧ Shift + A, or click the Frame Selection button in the Main Toolbar.



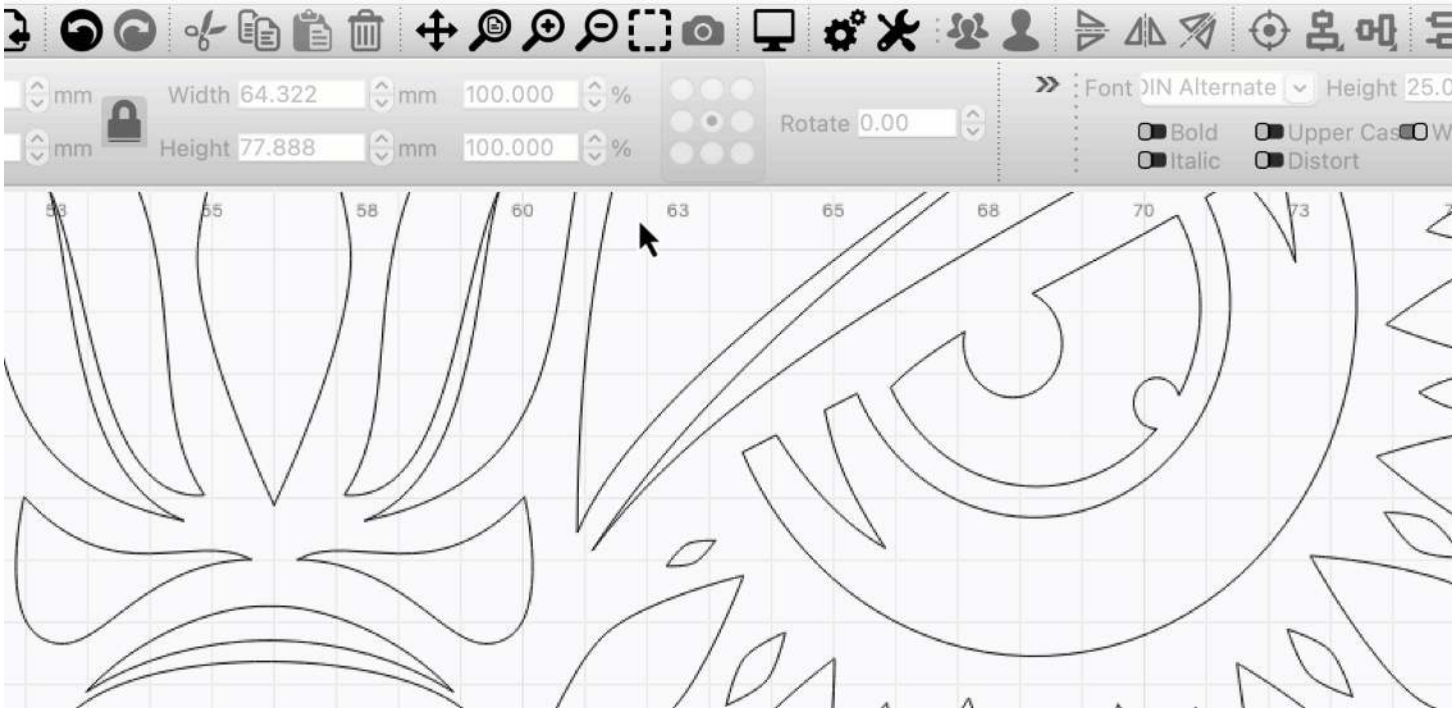
Panning

Panning slides your field of view around the Workspace. There are a few options for enabling Panning mode:

- Click the **Pan / Drag View** icon in the Main Toolbar.
- Press and hold the middle mouse button and move your mouse.
- Hold down `Space` on your keyboard.

When you've enabled Panning mode using any of the above methods, you'll see the mouse cursor change to a hand , and then you can click and drag the view with the left mouse button.

To exit Panning mode, press the `⎋ Esc` key, or enable any other tool.



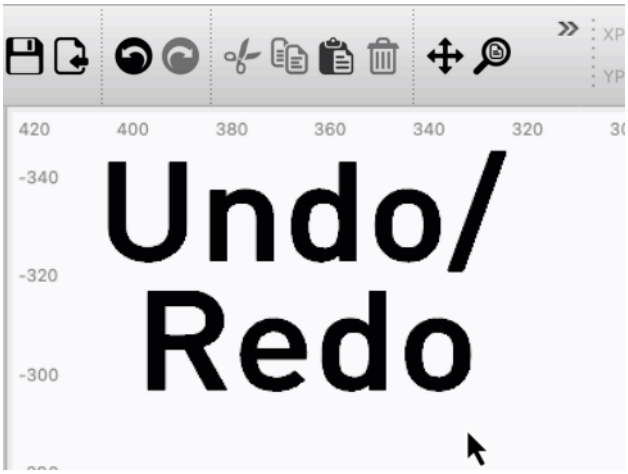
Related Topics

- Selection
- Main Toolbar
- Window Menu

essential-functions editing workflow optimize

5.3.4 Undo/Redo

Quick Reference: Undo/Redo



Reverses or reapplies changes.

Location

Main Toolbar

Edit → Undo/Redo

Keyboard Shortcuts

Undo

Windows: ^ Ctrl + Z

Mac: ⌘ Cmd + Z

Redo

Windows: ^ Ctrl + ⇧ Shift + Z

Mac: ⌘ Cmd + ⇧ Shift + Z

Undo and **Redo** reverse or reapply changes you've made to your project, allowing you to backtrack if you've made edits you regret, or restore the edits you reversed, if that regret was only temporary.

Undo and Redo in LightBurn are unlimited — the list of actions that can be reversed and reapplied is only reset when closing out of the program or opening a new project.

Using Undo and Redo

Undo reverses previous actions taken, starting with the most recent action, and proceeding to previous actions with successive Undos.

To Undo, press ^ Ctrl / ⌘ Cmd + Z, click the Undo icon in the Main Toolbar, or go to the Edit Menu and select Undo.

Redo restores actions previously reversed using Undo, starting with the most recent action Undone, and proceeding to previous reversed actions with successive Redos.

To Redo, press ^ Ctrl / ⌘ Cmd + ⇧ Shift + Z, click the Redo icon in the Main Toolbar, or go to the Edit Menu and select Redo.

essential-functions beginner clipboard

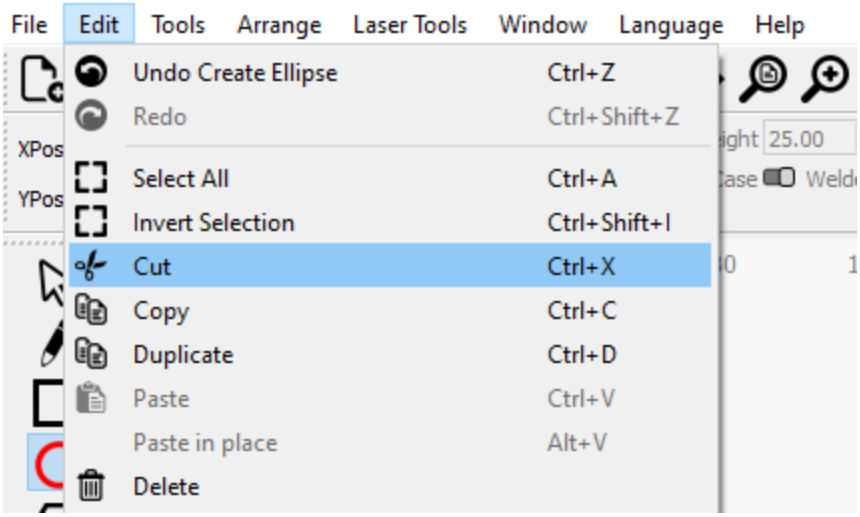
5.3.5 Clipboard Tools

The clipboard commands are tools for copying, inserting, removing, or duplicating objects in your Workspace, and transferring graphics into and out of LightBurn.

The clipboard commands are accessible in the Edit Menu, Main Toolbar, by hotkey, or by right-clicking in your Workspace to open a context menu.

Info

Your computer's clipboard is a temporary storage location used to save items that you copy, so you can paste them to another location shortly after.



Copy

^ Ctrl / ⌘ Cmd + C

Saves a copy of selected objects to your clipboard.

Cut

^ Ctrl / ⌘ Cmd + X

Deletes selected objects in your Workspace while saving a copy of them to your clipboard at the same time.

Duplicate

`^ Ctrl` / `⌘ Cmd` + `D`

Creates copies of selected objects, directly on top of the existing objects.

Paste

`^ Ctrl` / `⌘ Cmd` + `V`

Inserts objects copied to your clipboard into your Workspace. Pasted objects are centered at the location of your cursor at the time of pasting.

Drag and drop directly into LightBurn

You can copy text, vector graphics, and images from other design software, and paste them directly into your LightBurn Workspace.

Paste in Place

`⎇ Alt` / `⌥ Option` + `V`

Inserts objects copied to your clipboard into your Workspace and positions them according to their location in the project they were copied from.

Delete

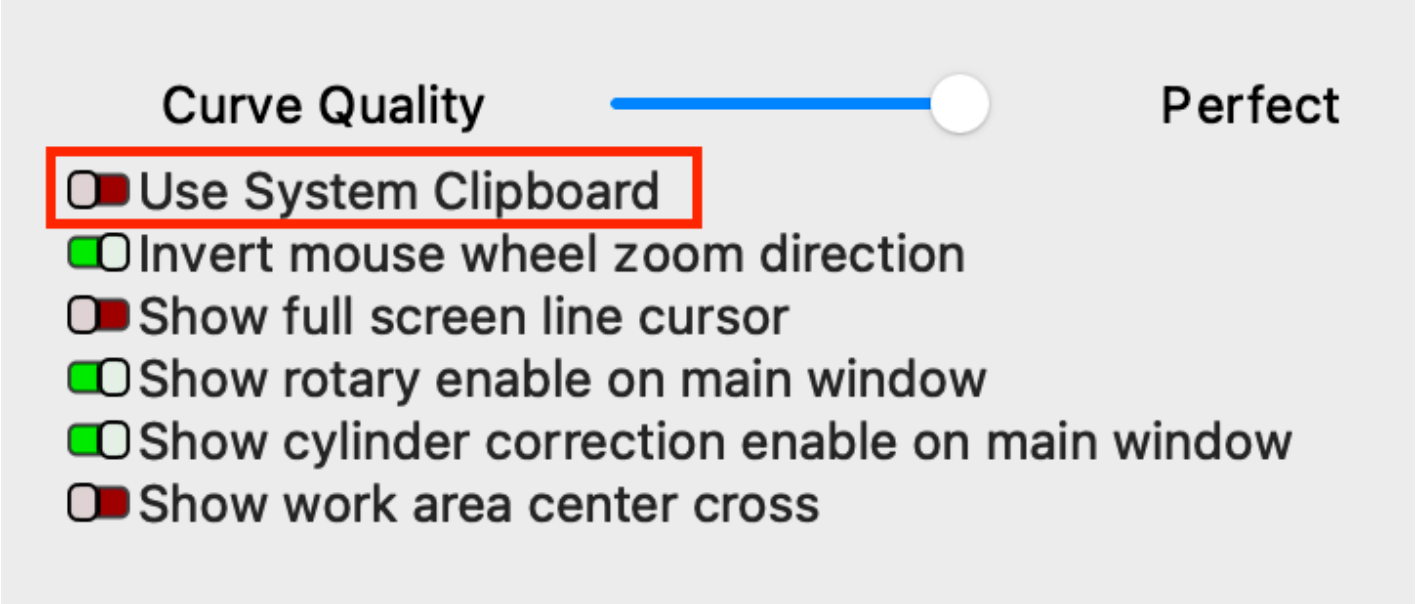
⌦ Del

Deletes selected objects.

Troubleshooting

- By default, LightBurn uses your system's clipboard. If you're experiencing slow performance when using the clipboard commands, disable **Use System Clipboard** in the Settings/Preferences window.

  With this setting disabled, you'll no longer be able to copy and paste from other programs into LightBurn, or between LightBurn windows.



Related Topics

- Selection Tools
- Undo/Redo
- Zoom
- Edit Menu
- Main Toolbar

essential-functions control handles move snap size rotate shear transform disable-rotate disable-shear disable-size disable-move

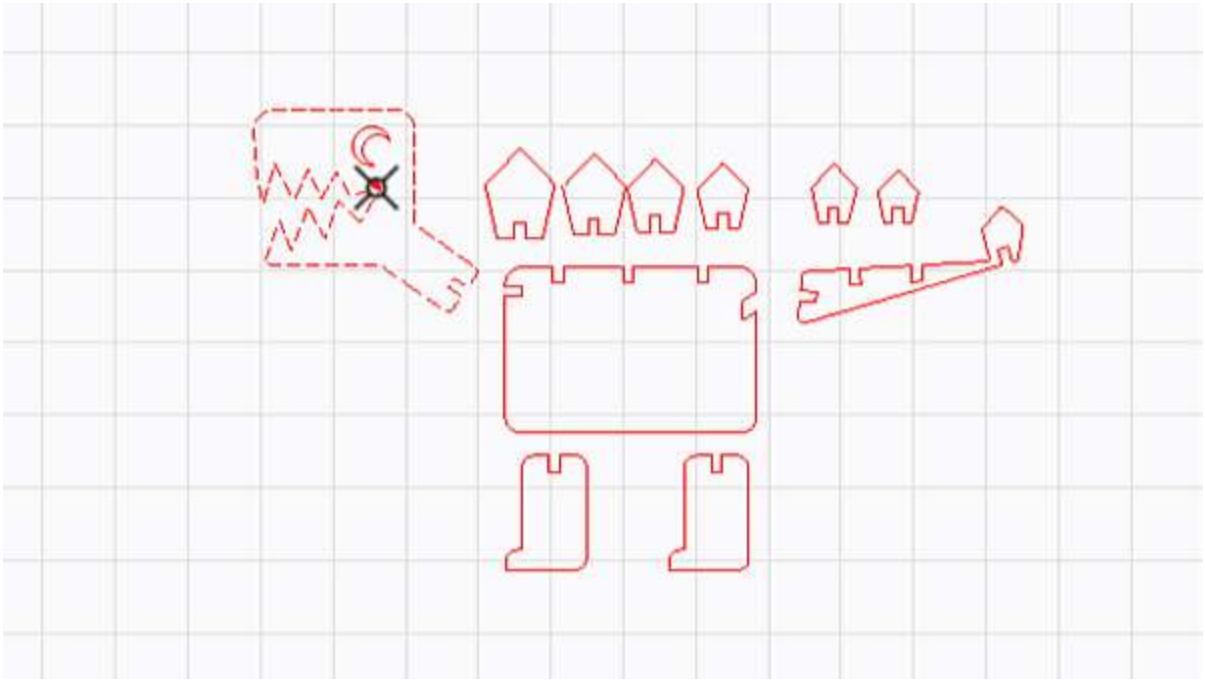
5.3.6 Transform Controls

The **Transform Controls** are tools for directly editing selections in your Workspace by clicking and dragging control handles that alter their position, dimensions, orientation, or shape.

Control Handles

Control handles appear on and around the selection area of any object or objects you select.

Imagine the selection area as the smallest possible rectangle that can contain every object in your selection. The edges and center of a selection are the same as the edges and center of that imaginary rectangle.

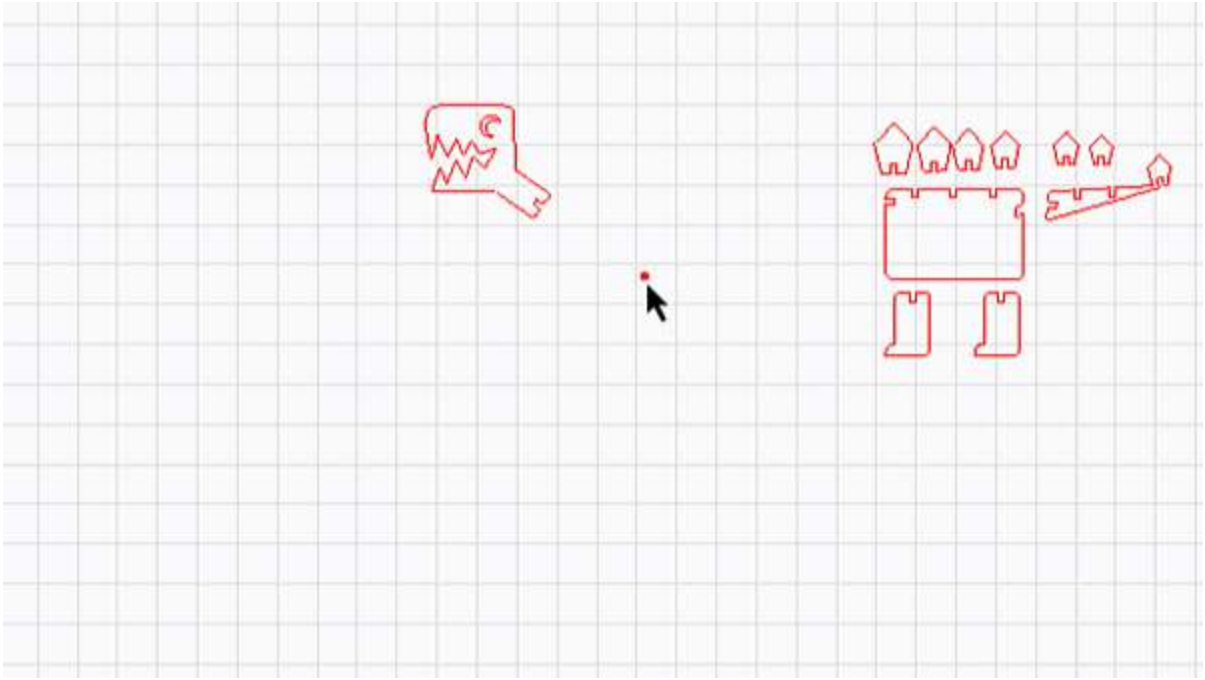


Move

The **Move** handle is a square located in the center of your selection area. When you hover over the Move handle, the four-arrow icon will appear.

- Click, hold, and drag the Move handle to move the selection around your Workspace.
- Release to place the selection in its new position.

- Press Esc before releasing to deselect and return the selection its original position after releasing.



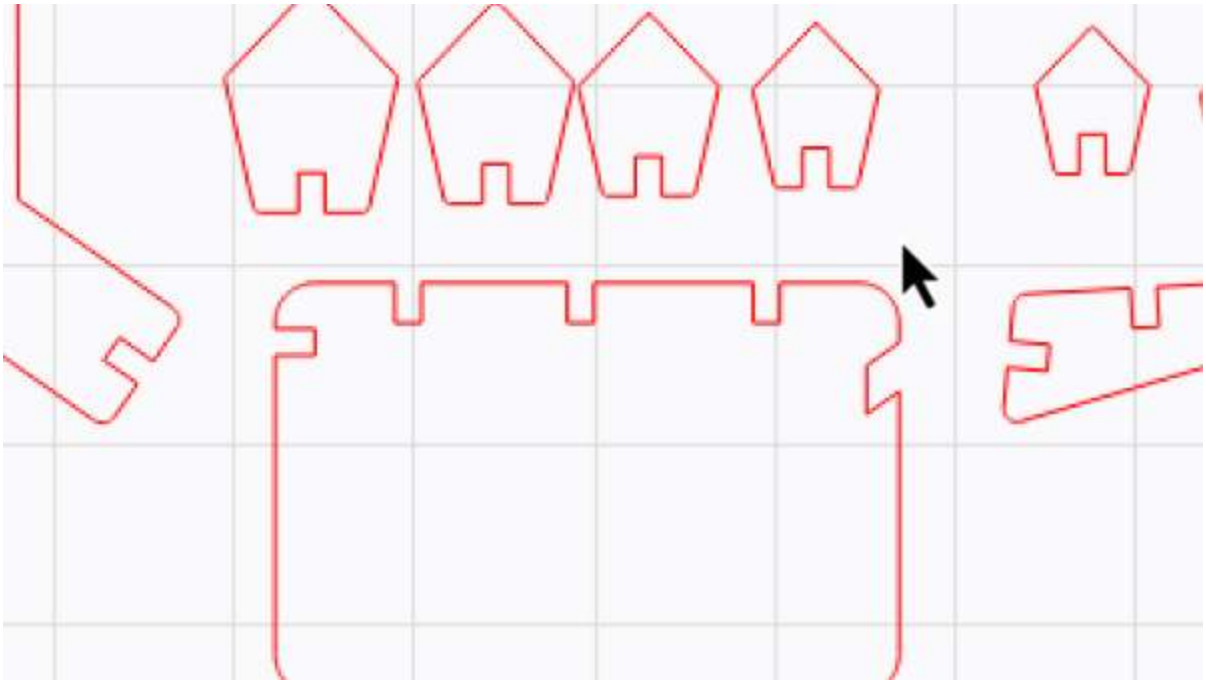
Tip

To precisely adjust a selection's position, use the Numeric Edits Toolbar.

Moving From Snapping Points

Hover over a line, corner, intersection, midpoint, or other node on any shape in your selection, then click, hold, and drag to move all objects in the selection from that point, and snap it to another point on another shape in your Workspace.

See Snapping for more information.



Modifier Keys

- Hold ⇧ Shift while dragging to lock a selection's movement to a 90° or 45° angle from its current position.
- Hold ⎇ Alt / ⌥ Option to show temporary Alignment Guides for selection snapping.
- Hold ^ Ctrl / ⌘ Cmd to disable snapping while moving selections.

Move Increment Hotkeys

You can use your keyboard's arrow keys to move objects in your Workspace by set increments.

These hotkeys only work when you have objects selected and the **Edit Window** (Workspace) — the area where you create and edit graphics — is in focus.

What does it mean for a window to be in focus?

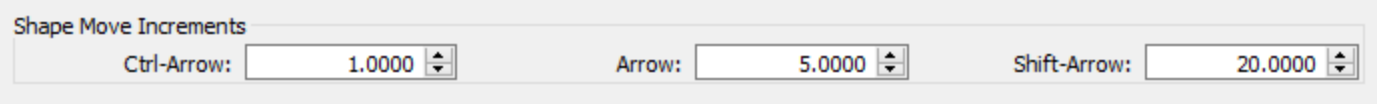
There are several Windows and Toolbars in LightBurn that accept user input — when a window is clicked on, it is in focus and accepting input.

If a window other than the Edit Window is in focus, click anywhere in the Workspace to bring it into focus. Selecting objects in the Workspace will also bring it into focus.

- The ← Left, → Right, ↑ Up, and ↓ Down arrow keys nudge your selection by **5 mm**, by default.

- Hold ^ Ctrl / ⌘ Cmd while pressing an arrow key to nudge your selection **1 mm**, by default.
- Hold ⇧ Shift while pressing an arrow key to nudge your selection **20 mm**, by default.
- Hold ^ Ctrl / ⌘ Cmd + ⇧ Shift while pressing an arrow key to nudge your selection **0.1mm**, by default. This value is always 1/10th of the ^ Ctrl / ⌘ Cmd nudge increment.

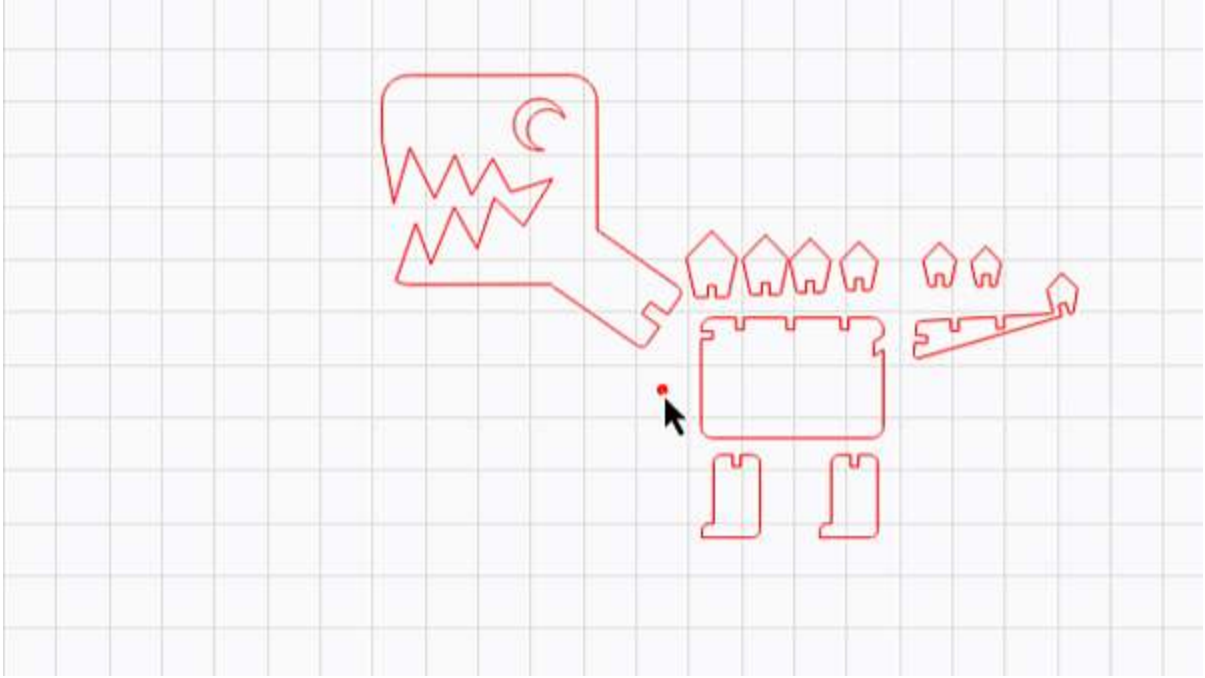
You can adjust the nudge distance of each arrow key and modifier in the **Units and Grids** tab of the Settings window, under Shape Move Increments.



Size

The **Size** handles are squares located around the perimeters of your selection area — at each corner, and the midpoints of each side. When you hover over a Size handle, the two-arrow icon will appear.

- Use the corner handles to rescale both dimensions of your selection while maintaining its aspect ratio.
- Use the midpoint handles to rescale a single dimension at once.
- When dragging any of the Size handles, the behavior is asymmetric — the other side of the object acts like an anchor and stays in place.
- Click, hold, and drag a Size handle to rescale your selection. Drag outward to make it larger, or inward to make it smaller.
- Release to set the selection to its new scale.
- Press ⎋ Esc before releasing to deselect and return the selection its original scale after releasing.



Modifier Keys

- Hold ⇧ Shift while dragging from a corner handle to rescale both dimensions at once, while not maintaining the original aspect ratio. Left-right movement will adjust the width, while up-down movement will adjust the height.
- Hold ^ Ctrl while dragging from any **Size** handle to rescale the selection symmetrically from its center, rather than from the chosen handle.

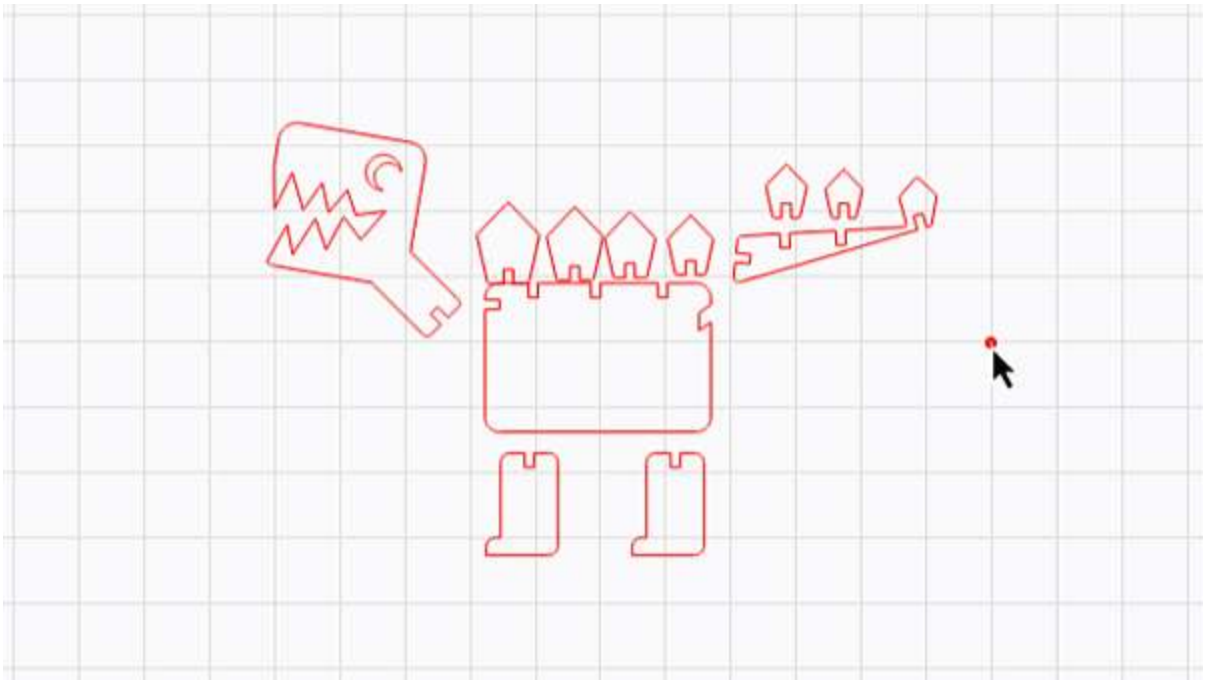
> **Tip**
>
> To precisely adjust a selection's dimensions, use the Numeric Edits Toolbar.

Rotate

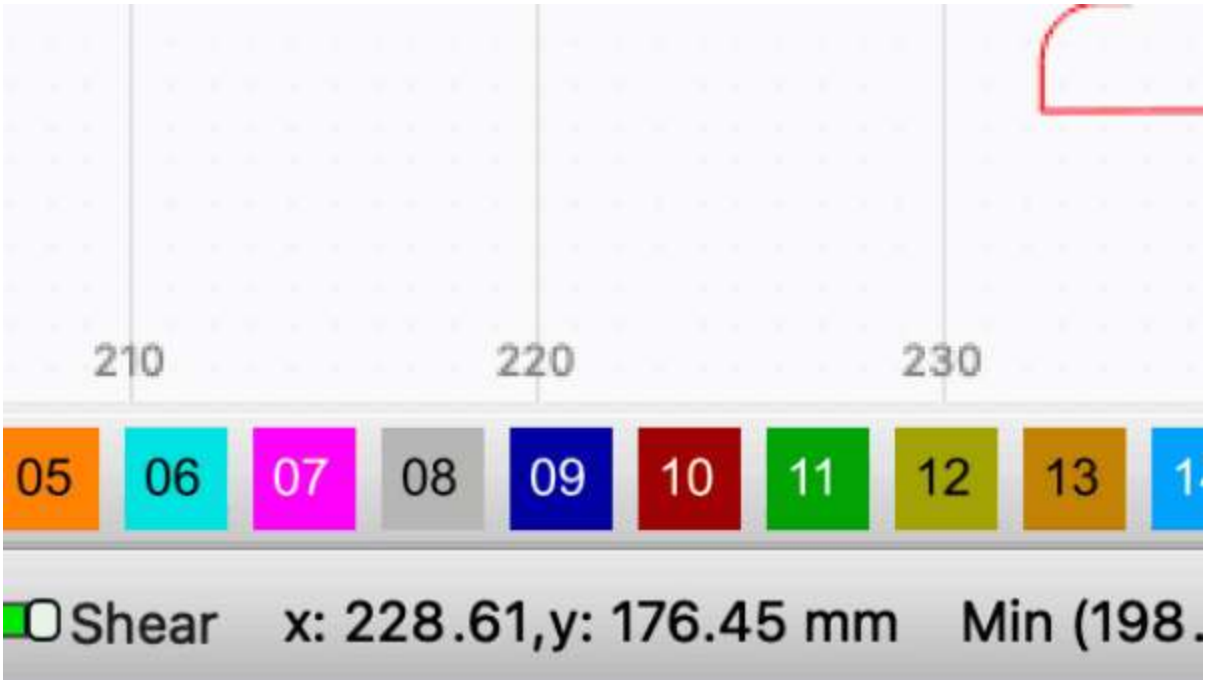
There are four **Rotate** handles — they're the curved two-arrow icons, one on each corner of your selection. When you hover over a Rotate handle, your cursor will change to the curved two-arrow icon as well.

- Click, hold, and drag a Rotate handle clockwise or counterclockwise to turn the selection around its center point.
- Release to leave the selection in its new orientation.
- Press ⎋ Esc before releasing to deselect and return the selection its original orientation after releasing.

Use Two-Point Rotate / Scale to turn your selection from a custom pivot point instead of a Rotate handle.



As you Rotate your selection, the Status Bar will actively show the change in degree of rotation.



Modifier Keys

- Hold ⇧ Shift while dragging to lock rotation to 15° increments.
- Hold ^ Ctrl / ⌘ Cmd to lock to 5° increments.

Rotate Hotkeys

You can rotate objects by set increments using hotkeys.

These hotkeys only work when you have objects selected and the **Edit Window** (Workspace) — the area where you create and edit graphics — is in focus.

What does it mean for a window to be in focus?

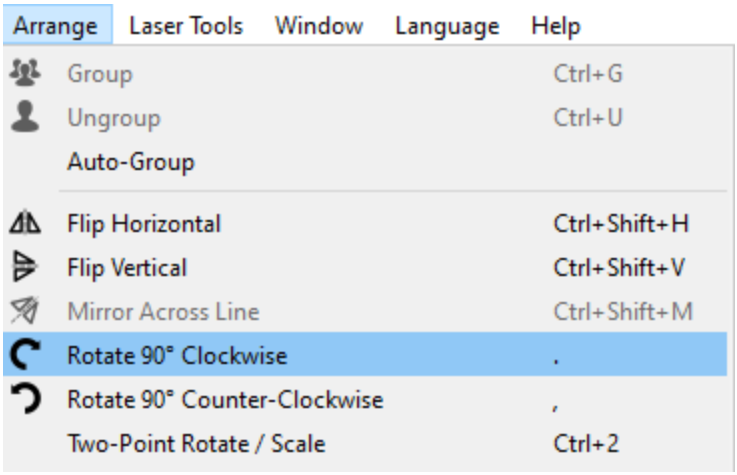
There are several Windows and Toolbars in LightBurn that accept user input — when a window is clicked on, it is in focus and accepting input.

If a window other than the Edit Window is in focus, click anywhere in the Workspace to bring it into focus. Selecting objects in the Workspace will also bring it into focus.

Action	Windows	macOS
Rotate 90° clockwise	`.`	`.`
Rotate 90° counterclockwise	`,`	`,`
Rotate 45° clockwise	`⇧ Shift` + `.`	`⇧ Shift` + `.`
Rotate 45° counterlockwise	`⇧ Shift` + `,`	`⇧ Shift` + `,`
Rotate 15° clockwise	`^ Ctrl` + `.`	`⌘ Cmd` + `.`
Rotate 15° counterclockwise	`^ Ctrl` + `,`	`⌘ Cmd` + `,`
Rotate 5° clockwise	`^ Ctrl` + `⇧ Shift` + `.`	n/a
Rotate 5° counterclockwise	`^ Ctrl` + `⇧ Shift` + `,`	n/a

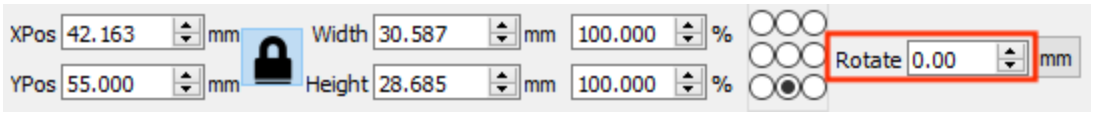
Rotate in the Arrange Menu

You can also select **Rotate 90° Clockwise** or **Rotate 90° Counter-Clockwise** from the Arrange Menu.



Rotate in the Numeric Edits Toolbar

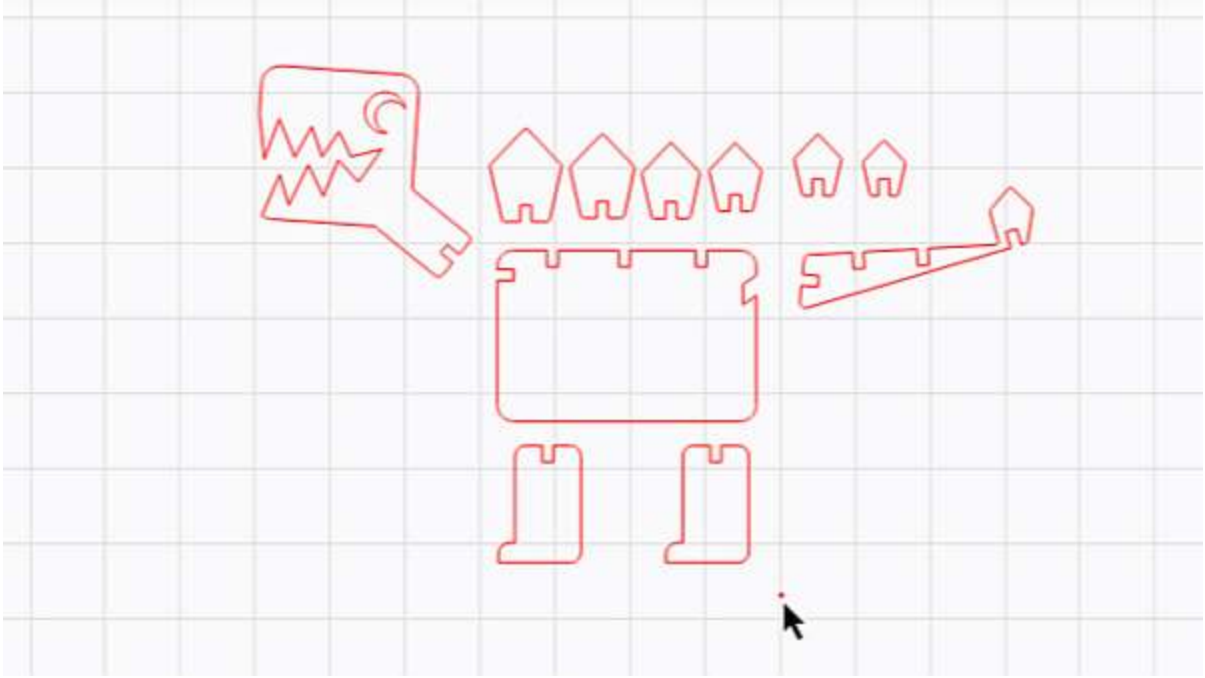
Enter an angle of rotation in the **Rotate** field of the Numeric Edits Toolbar to Rotate objects at any angle. This field accepts negative values.



Shear

The two **Shear** handles are small squares located just above or below and just to the left or right of a corner of your selection.

- The handle above or below skews your selection vertically, while the handle to the left or right skews it horizontally.
- Click, hold, and drag a Shear handle to skew the selection.
- Release to apply the new skew to the selection.
- Press Esc before releasing to deselect and return the selection to its original skew.



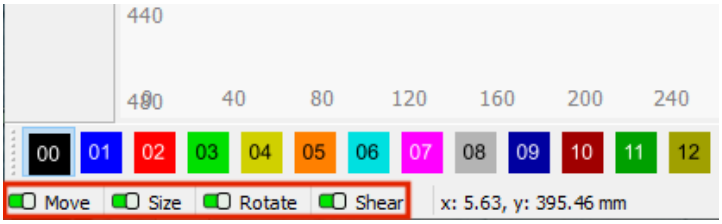
Tip

Use Warp/Deform Selection to skew selections in any direction.

Transform Control Toggles

Use the **Transform Control Toggles** in the bottom left of the LightBurn window to enable and disable specific types of editing across an entire project, and prevent accidental edits, such as inadvertently scaling a design that contains strict sizing, or moving tightly nested parts.

> **Note**
>
> This feature is disabled when using Beginner Mode.

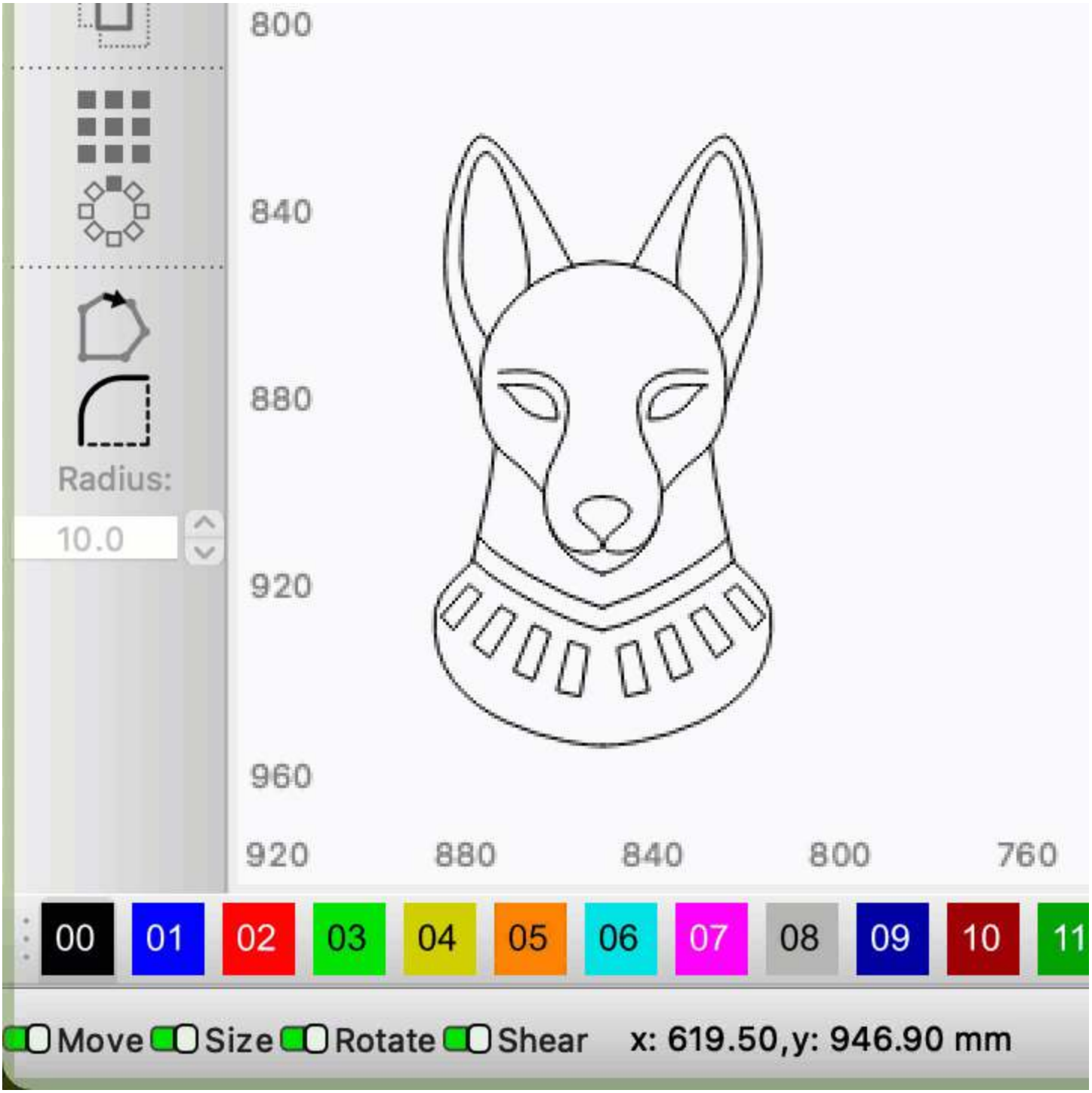


The Transform Control Toggles are all enabled by default. Each toggle enables or disables a different type of editing:

- **Move**: shifting, repositioning, relocating, dragging, or rearranging objects.
- **Size**: scaling, resizing, enlarging, or shrinking objects.
- **Rotate**: spinning, turning, tilting, or adjusting the angle of objects.
- **Shear**: skewing or slanting objects.

When a toggle is enabled, the corresponding Transform Controls appear around selected objects. As toggles are disabled the controls disappear, restricting that type of editing.

> **Tip**
>
> Use Lock Shapes to lock editing of *individual objects* in a design.



Related Topics

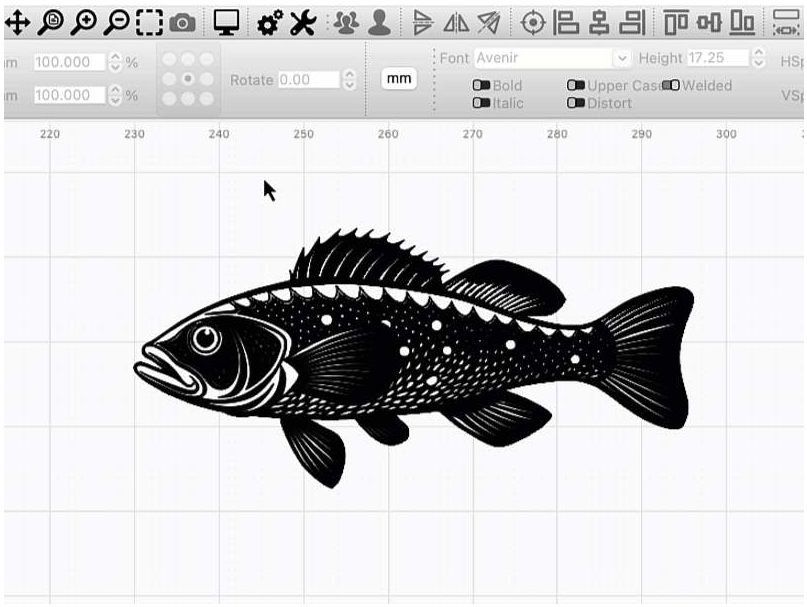
- Lock Shapes
- Selection Tools
- Snapping

- Select
- Numeric Edits Toolbar
- Warp/Deform Selection
- Status Bar

essential-functions layout-and-design arrangement object-manipulation workflow

5.3.7 Grouping and Ungrouping

Quick Reference: Grouping/Ungrouping



Group combines collections of objects into single units, which can be split using **Ungroup**.

Location

Arrange Toolbar

Arrange → Group/Ungroup

Right-click → Group/Ungroup

Keyboard Shortcuts

Grouping

Windows: ^ Ctrl + G

Mac: ⌘ Cmd + G

Ungrouping

Windows: ^ Ctrl + U

Mac: ⌘ Cmd + U

The **Group** tool combines collections of objects into single units, and the **Ungroup** tool splits Groups back into the individual objects that make them up.

Normally, all objects are independent of one another, and can be manipulated individually. But it's sometimes helpful to treat a collection of things as a single unit, to make sure they keep their relative position and size when you're moving them around.

LightBurn also provides options in Optimization Settings to tell your laser to engrave Grouped objects together or to cut and engrave multi-layer Groups in order, completing each layer in each Group before moving on to the next one.

Both Group and Ungroup are available in the Arrange Menu, Arrange Toolbar, and by hotkey.

Grouping and Ungrouping

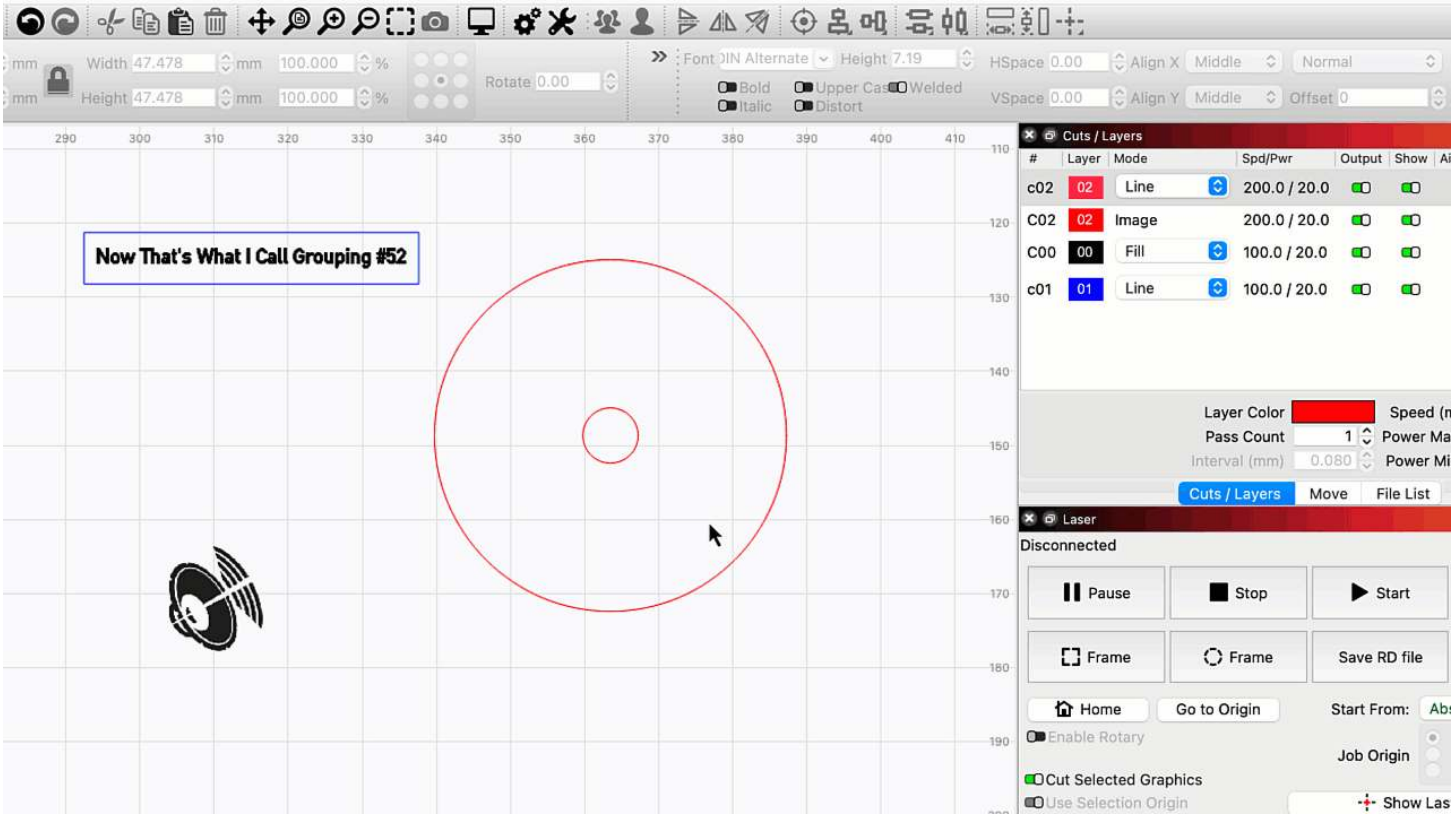
Group

`^ Ctrl` / `⌘ Cmd` + `G`

Group selected objects to treat them as a single unit when they are:

- Selected
- Moved
- Resized
- Used with the Boolean tools

You can create Groups out of any objects, including objects assigned to different layers, and multiple types of objects such as lines, shapes, text, and images. You can even combine objects that have already been Grouped into other Groups.

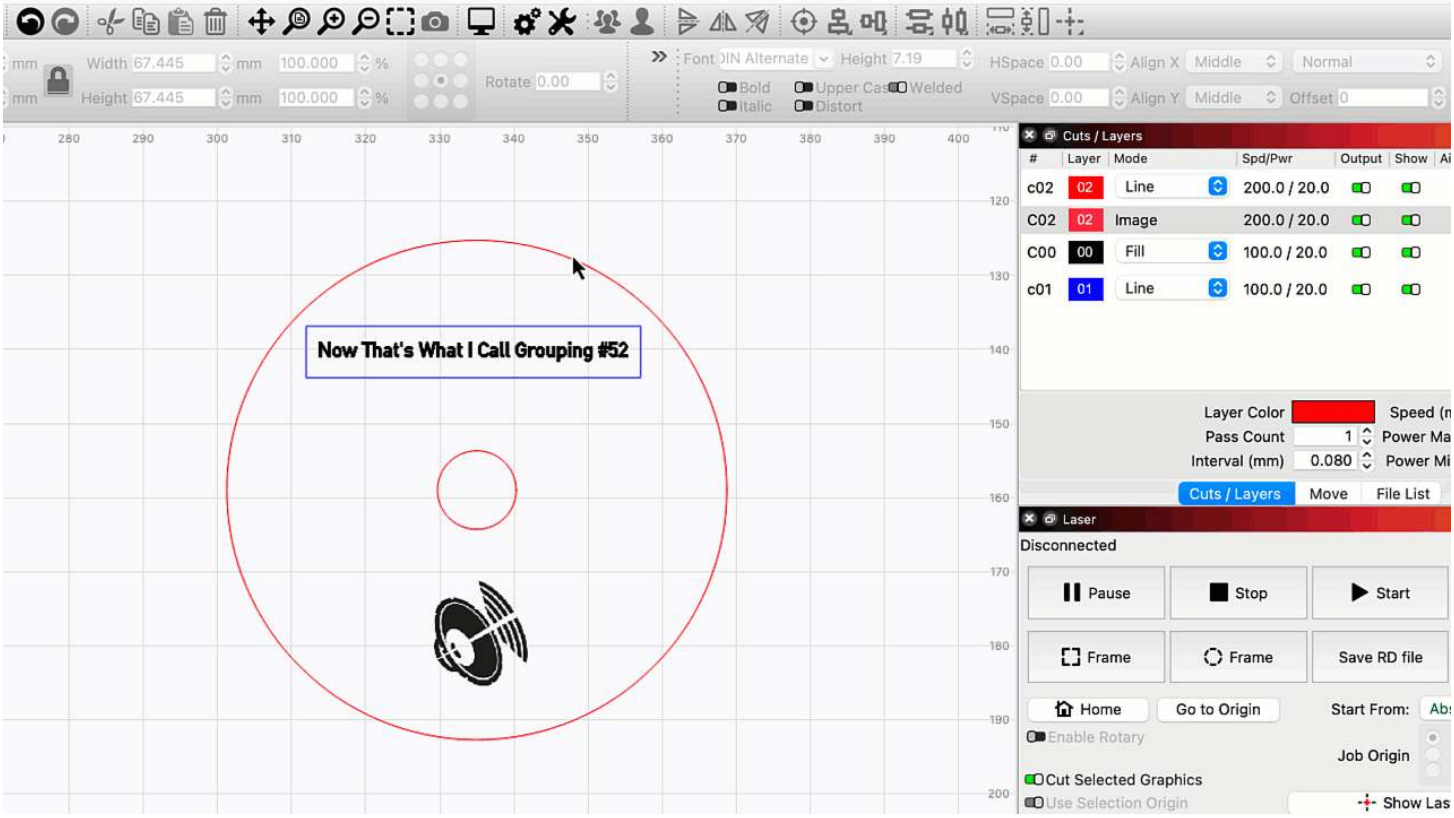


Ungroup

`^ Ctrl` / `⌘ Cmd` + `U`

Ungroup selected (previously Grouped) objects to treat them as discrete, independently adjustable units again.

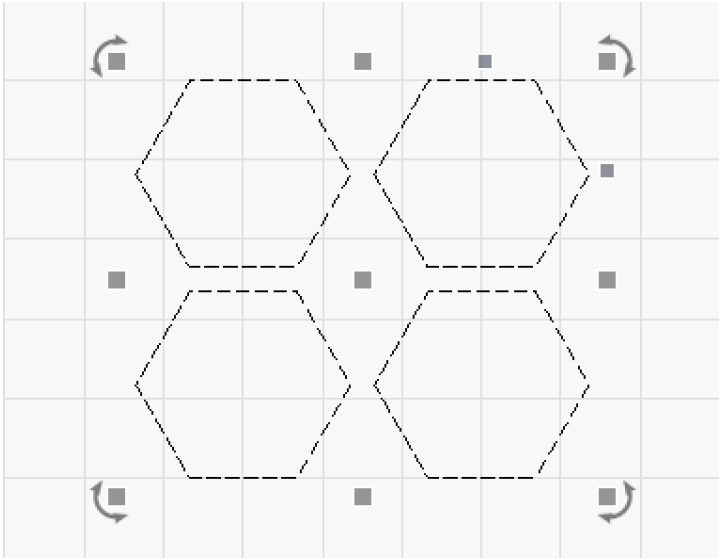
If you have a Group made up of other Groups, you'll need to Ungroup multiple times to separate all objects into individual units again.



Selection Appearance of Grouped Objects

You can tell whether an object is **Grouped** based on its appearance when you select it.

Ungrouped objects are drawn with an animated dash pattern instead of solid lines, while Grouped objects are drawn with a dot-dot-dash pattern.



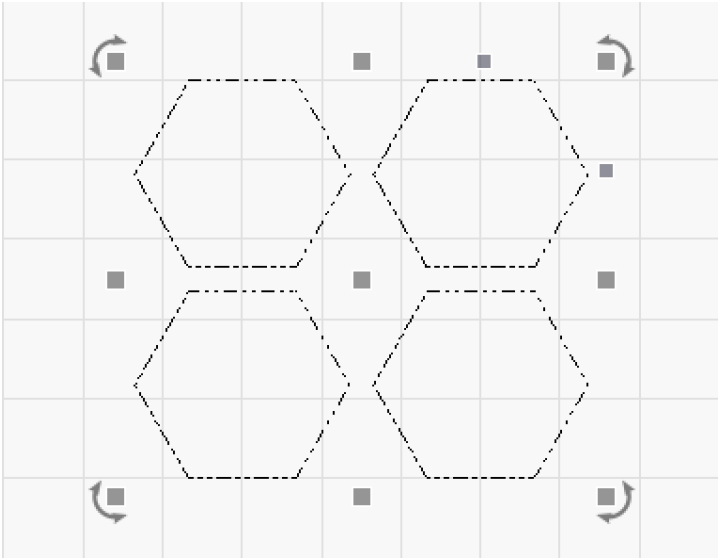
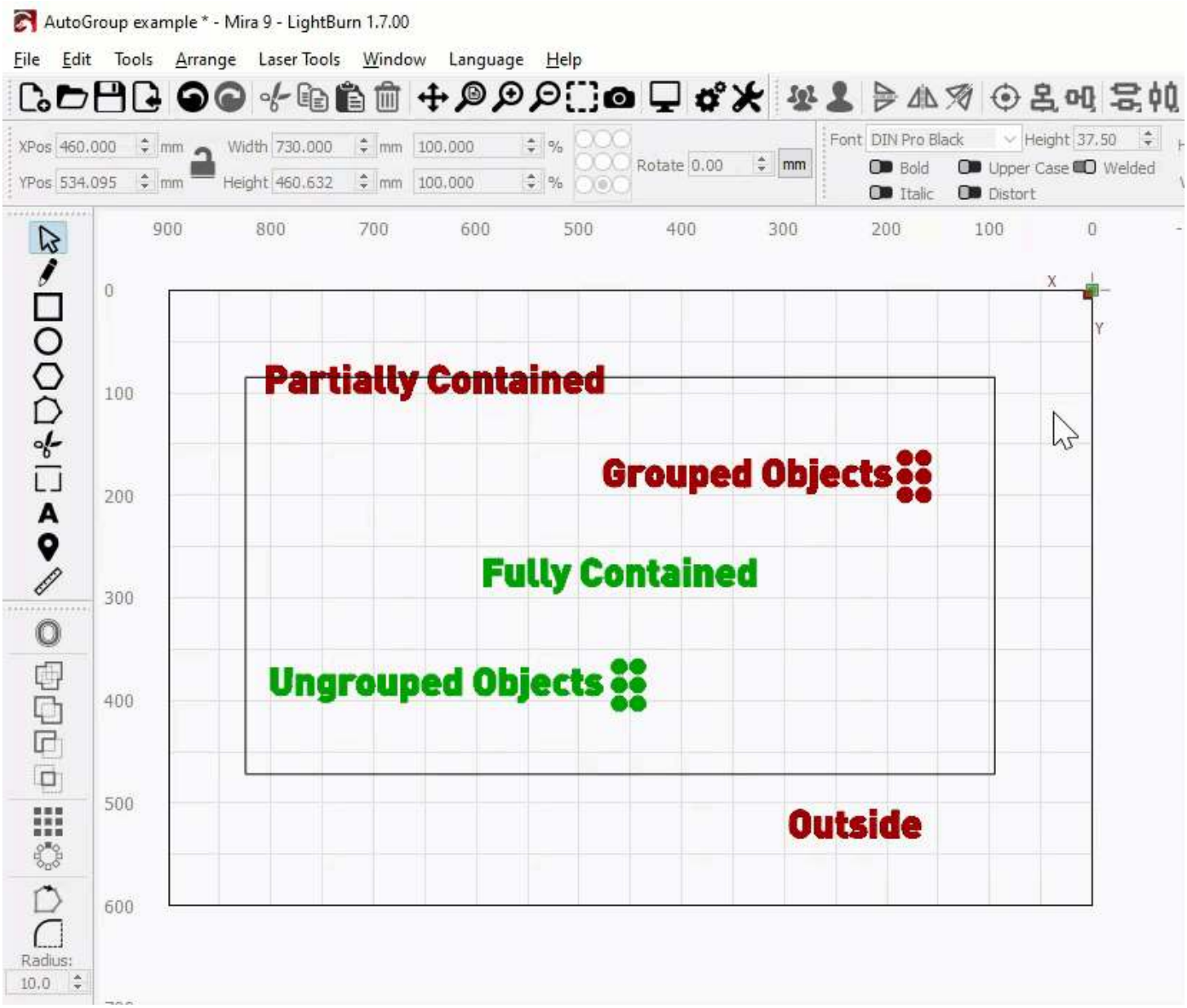


Figure 1: Ungrouped Objects Selected

Figure 1: Grouped Objects Selected

Auto-Grouping

Auto-Group identifies shapes that are fully contained within another shape and Groups them together with the outer shape.



In the animation above, the objects shown in red are unaffected by Auto-Group, either because they're not fully contained within the rectangle or because they are already Grouped. The green objects are automatically Grouped with the rectangle.

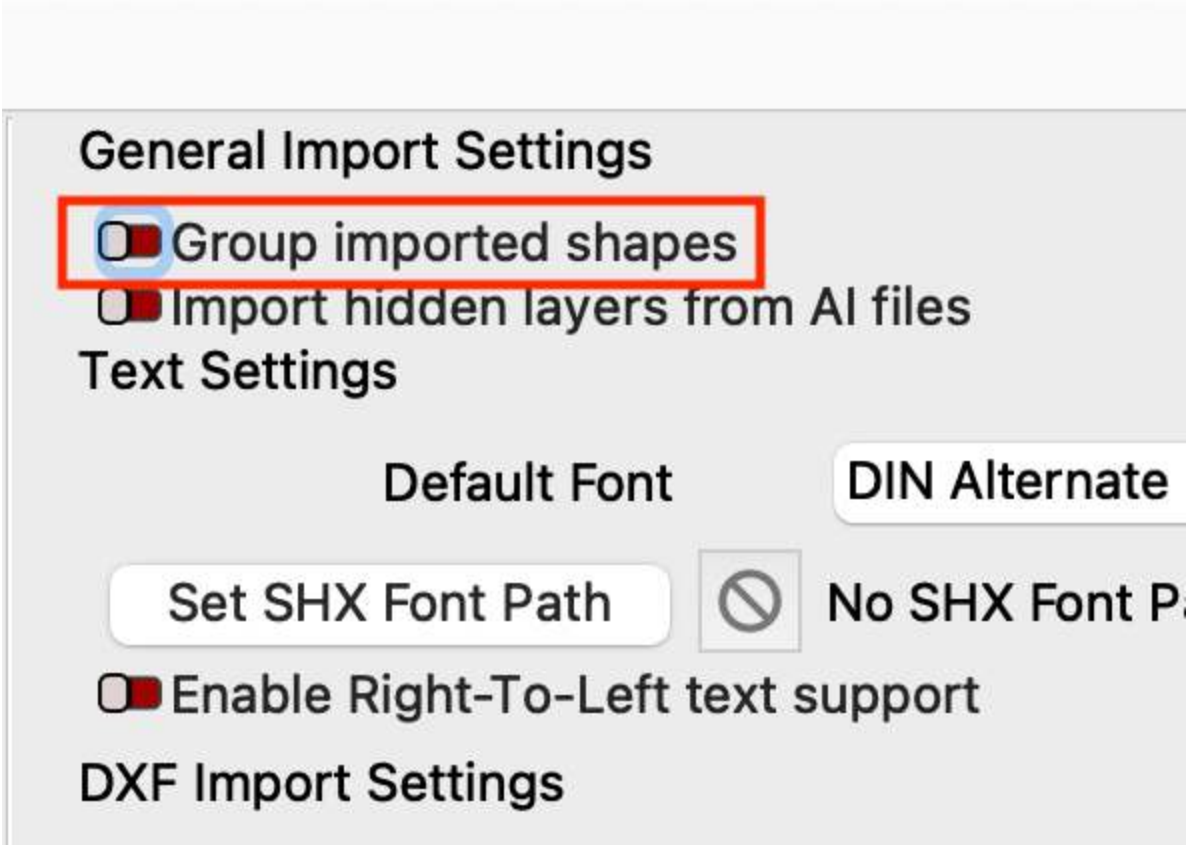
To use Auto-Group:

1. Select the shapes you want to use Auto-Group on.
2. Make sure the shapes are not Grouped using Arrange → **Ungroup** or `^ Ctrl` + `U`.
3. Use Arrange → Auto-Group to automatically group all fully contained shapes inside the outermost shape.

Troubleshooting

Note

Imported shapes are Grouped by default. Disable **Group imported shapes** in your Settings to turn off automatic Grouping upon importation.



- The following tools cannot be used with **Grouped** objects:
  - Edit Nodes
  - Trim Shapes
  - Resize Slots
  - Convert to Path
  - Auto-Join Selected Shapes
  - Close Path
  - Close Selected Paths with Tolerance
  - Break Apart
  - Optimize Selected Shapes

    - Select contained shapes

- Grouped objects are treated as single units when working with the Boolean tools. If any object in a Group is an open shape, the entire Group cannot be used with the Boolean tools.
- Using Select open shapes, Select open shapes set to Fill, and Select shapes smaller than selected will select applicable Grouped shapes, and remove them from their Group.
- **Auto-Group** only works on shapes that are *fully contained* within the outer shape. If any portion of a shape extends outside the outer shape, it will be left out of the Group.
- Auto-Group only works on Ungrouped shapes. Use Ungroup to remove shapes from an existing Group.

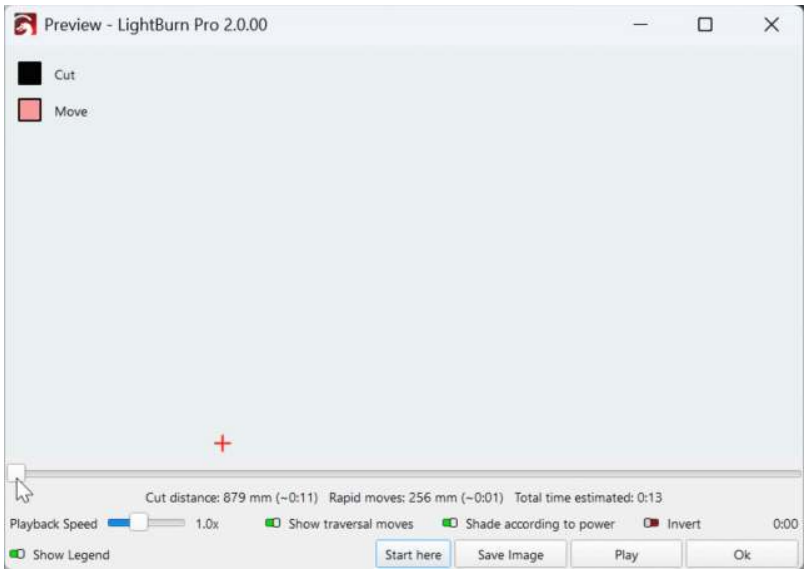
Related Topics

- Fill Groups Together
- Order by Group
- Selection Tools
- Numeric Edits Toolbar
- Align
- Docking
- Grid Array
- Boolean Tools

essential-functions

5.3.8 Preview

Quick Reference: Preview



The **Preview** window shows what LightBurn will send to the laser, with black lines representing cuts and red lines travel.

Location

Main Toolbar

Window → Preview

Keyboard Shortcuts

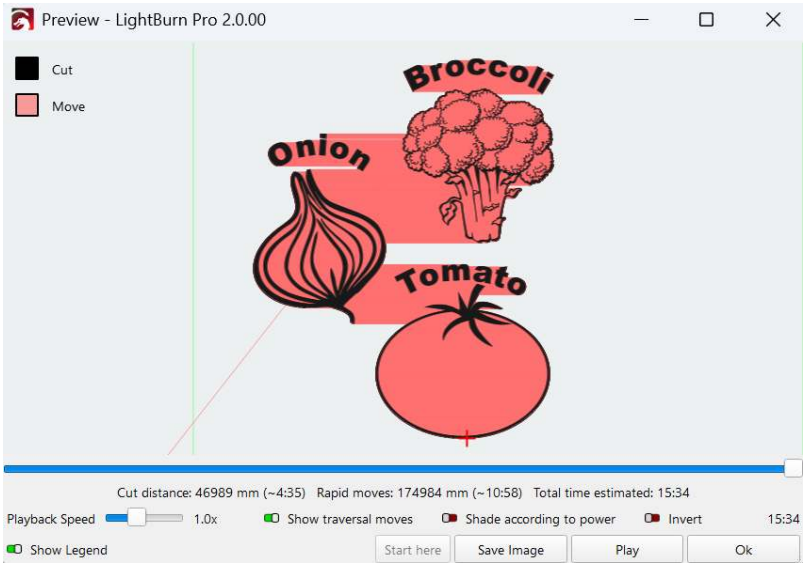
Windows: ⎇ Alt + P

Mac: ⌥ Option + P

The **Preview** window is an accurate representation of what LightBurn will send to the laser. Black lines represent cut moves, while red lines are travel moves between cuts.

It's a good practice to check the Preview window before starting any job, to make sure the simulated output matches your expectations, or to identify any problems before it's too late.

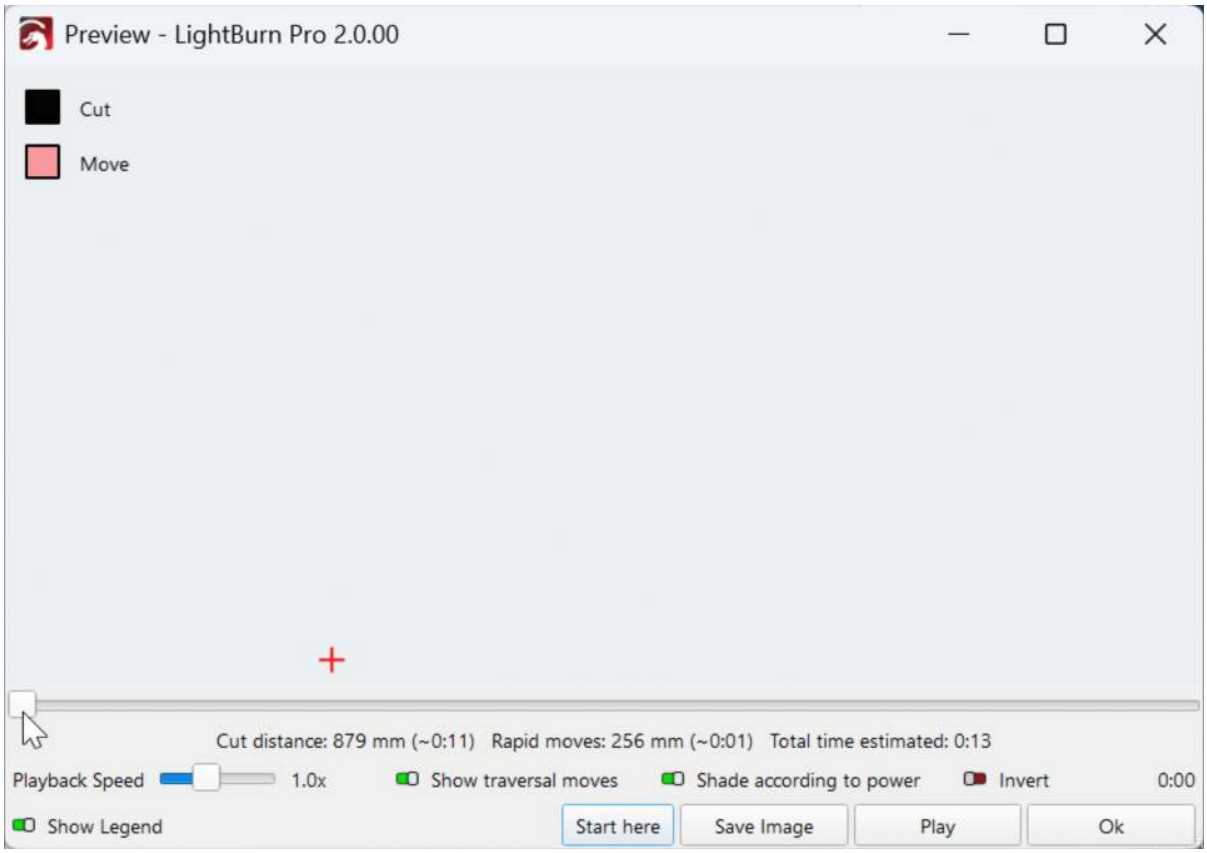
To open the Preview window, use one of the following methods: - Go to Window → **Preview** - Click the Preview icon in the Main Toolbar - Press ⎇ Alt / ⌥ Option + P - Right-click in your Workspace and select Preview from the context menu



Using the Preview Window

Time Slider

The **Time Slider** allows you to slide quickly through the project and see the cut order.



Job Time Statistics

Below the **Time Slider** are statistics about the job and the estimated run time. The Additional Settings tab in **Device Settings** can help you get more accurate time estimates – see the video above for help.

- **Cut distance** shows the distance the laser will travel while on, and the estimated time it will take the laser to complete those movements in parentheses.
- **Rapid moves** shows the distance the laser will travel while off, between cutting and engraving, and the estimated time it will take the laser to complete those movements in parentheses.
- **Total estimated time** shows the combined time it will take the laser to complete all Cut and Rapid moves.

Preview Settings

The settings here only affect the **Preview** window – they don't change anything about LightBurn's output to the laser.

Setting	Description
Playback Speed	Sets the speed of playback with the **Play** button – ranges from 1/10 of actual speed to 40 times the actual speed.
Show Traversal Moves	If enabled, shows travel moves in red. If disabled, travel moves are hidden.

Setting	Description
Shade According to Power	If enabled, uses grayscale shading to indicate higher and lower power cut moves. This only works with the Grayscale Image Mode or Power Scaling.
Invert	If enabled, sets cut moves to white on a black background. Useful when engraving on dark surfaces that engrave lighter, such as slate.
Show Legend	If enable, shows a legend in the top left indicating which colors represent Cuts and Moves.

Start Here

Use the **Start Here** button to recover interrupted jobs by starting the laser at a precise time partway through the operation. Move the Time Slider to the point at which you want to start, then click **Start Here**.

Save Image

Saves the current **Preview** as an image file.

Play

Animates the simulation to show the job from start to finish at the speed set in **Playback Speed**.

Troubleshooting

- If the time estimates are inaccurate, update the **Simulation Settings** in Device Settings — Additional Settings.
- If the output of the laser doesn't match the **Preview**, see Troubleshooting: Job Quality.

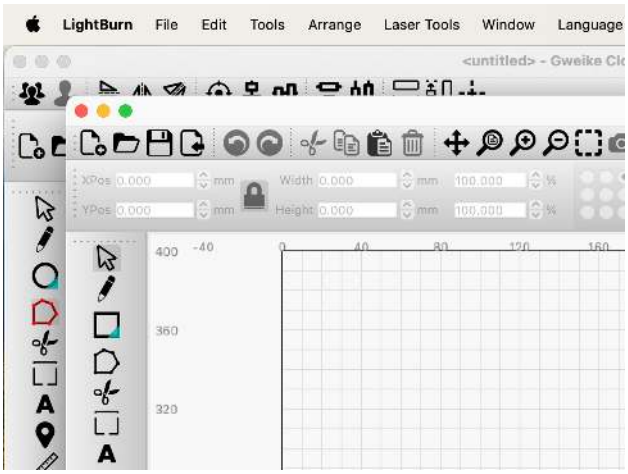
Related Topics

- Print and Cut
- Device Settings — Additional Settings
- Cut Settings
- Optimization Settings

essential-functions editing workflow-optimization workflow optimization batch-production

5.3.9 New Window

Quick Reference: New Window



Work on more than one project at a time.

Location

File → New Window

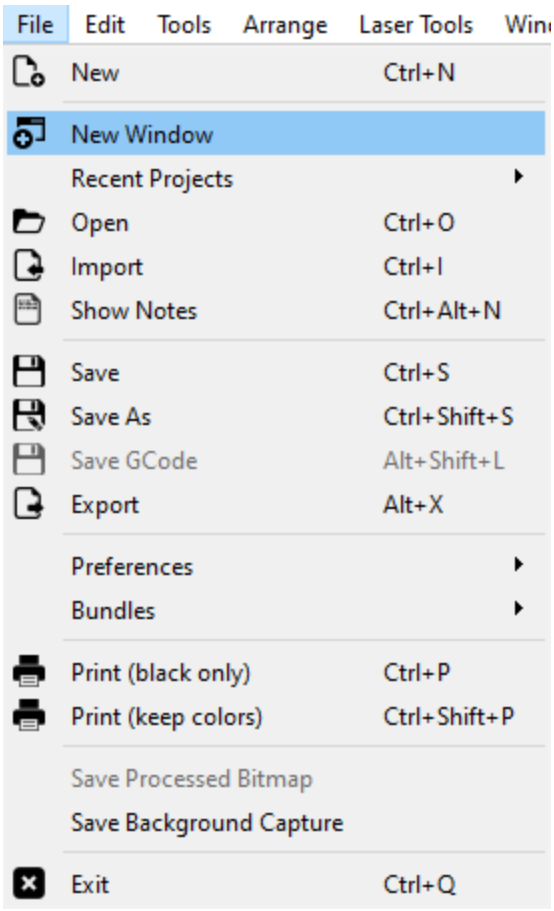
New Window opens a separate instance of LightBurn in a new window, allowing you to edit multiple projects at once, or edit one file while cutting a different one.

Working With Multiple Windows

Go to File → **New Window** to open a separate instance of LightBurn in a new window.

All open windows share the *same* settings and preferences. The last window closed after changing LightBurn settings will save those changes to the preferences file and will overwrite any changes made previously in other open instances.

> **Note**
>
> Windows users can also double-click the LightBurn application or shortcut to open a new instance.



Related Topics

- For an alternate method that creates fully independent instances of LightBurn, refer to the Running Multiple Independent Instances of LightBurn guide.

view wireframe rendering filled fill-mode vector preview edge edge-rendering rendering-quality

5.3.10 View Style

Quick Reference: View Style

Switch between wireframe and filled display rendering.

Location

Window → Toggle Wireframe / Filled

Keyboard Shortcuts

Windows: ⎇ Alt + ⇧ Shift + W

Mac: ⌥ Option + ⇧ Shift + W

Changing the **View Style** alters the appearance of vector graphics in your Workspace, which can be useful for spotting potential design issues and visualizing the final output from a project.

These options only change the rendering of the objects in your Workspace and do not affect the final work produced by the laser.

View Style Types

- **Filled**: shapes that are assigned to layers set to Fill Mode will appear as solid shapes, blocking out shapes behind them on other layers. This is handy for getting a better understanding of the overall design, but may hide duplicate or unwanted shapes on different layers. Filled View Styles may also be trickier to edit, as some objects are hidden behind others and not easily selected. Render times may be longer on older or less-powerful computers.
- **Wireframe**: all vectors in the design appear as outlines (strokes). This style renders quickly and makes issues in a design more obvious, but does not provide a visual indication of which graphics are assigned to layers set to Fill Mode. Use Preview to see a rendering of your finished result instead.

Edge Rendering Quality

- **Smooth**: High detail, slower rendering.
- **Course**: Lower detail, faster rendering.

Changing View Style

Select your desired **View Style** from the Window Menu.

Toggle between **Wireframe** and **Filled** mode at any time by pressing ⌥ Option / ⎇ Alt + W.

editing workflow optimization organization

5.3.11 Show Notes

Show Notes allows you to add, edit, and view notes for a project. This is often useful for files that will be shared with others, or to store related information for working with a project in the future. Go to **File** → **Show Notes** or press ^ Ctrl + ⎇ Alt + N.

Edit the **Notes** by typing into the text box and clicking **OK** to save. Press **Cancel** to discard any changes and close the window.

Enable the **Show on File Open** toggle to show the notes automatically when the file is opened in LightBurn.

Related Topics

- Job Checklist
- File Management

print export file-management

5.3.12 Print

Use **File → Print (Black Only)** or **File → Print (Keep Colors)** to print the current contents of the work area using your computer's print dialog. Most computers have built-in PDF creation tools, allowing you to export a PDF using these tools as well.

Page Size Warning

Be aware that the page size is controlled by the print dialog, not by LightBurn. If your work area is larger than the paper selected for printing, your design will be scaled to fit on the paper.

Figure 1:

Windows 10 print dialog showing options including sending to a printer and Print to PDF

Troubleshooting

If your design is printing too small, check the paper size you're printing on.

Beyond that, printing problems are likely to be related to your computer and/or printer, rather than LightBurn. Please see the relevant customer service resources for more help.

Related Topics

- Save Processed Bitmap
- Export

5.4 Layout and Design

5.4.1 Creation Tools

layout-and-design creation-tools customization vector-creation vector-editing vector-tools vector path-editing path-creation path-tools path vector-path-curve-lines node-editing draw-lines

5.4.1.1 Draw Lines

Quick Reference: Draw Lines

Places nodes with straight lines or curves between them.

Location

Creation Toolbar

Tools → Draw Lines

Keyboard Shortcuts

Windows: `^ Ctrl` + `L`

Mac: `⌘ Cmd` + `L`

Keyboard Modifiers

Press `S` to toggle between placing corner and smooth nodes.

Draw Lines is the fundamental tool for creating vector paths out of straight lines and curves. Use it to create designs from scratch, modify existing graphics, or to manually trace outlines around images (see Trace Image for automatic tracing).

Draw Lines allows you to place **nodes** (points in space, sometimes called *anchor points*) that are linked by straight **lines** or **curves** (*Béziers*). Curved lines are described by the length and direction of **handles** (tangents) that appear at one or both of the nodes at either end of a curve.

Tip

It's often helpful to refine designs with the Edit Nodes tool after roughing them out with the Draw Lines tool.

Using the Draw Lines Tool

Activate the **Draw Lines** tool by clicking the pencil icon in the Creation Toolbar or pressing `^ Ctrl` / `⌘ Cmd` + `L`.

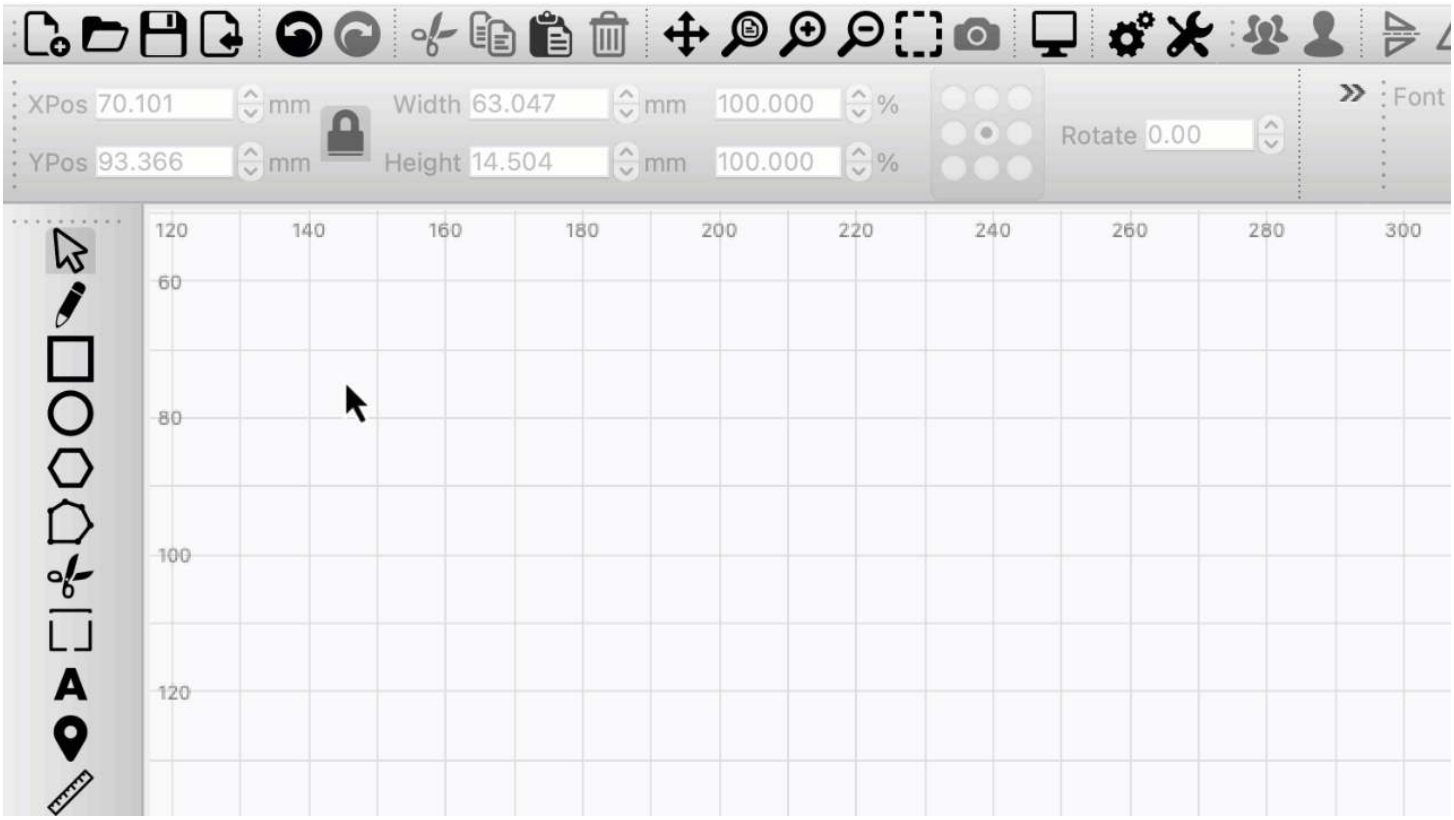
Once the tool is active, the cursor will change to indicate when you are placing corner or smooth nodes.

Lines

Placing corner nodes and creating lines is the default behavior of the **Draw Lines** tool.

Click anywhere in the Workspace to place a node at the start of a new line, then move your cursor and click again in a different location to place another node with a line in between.

Draw Lines will continue adding nodes with line segments between them as you click, until you either click back at the starting point to close a shape, right-click your mouse to stop, or press the Esc key.



Curves

There are two options for placing smooth nodes and creating curves:

- **Auto-Smoothed Mode**: press S to toggle between creating corner and smooth nodes (the cursor will change to indicate which mode you're in). After toggling, click to place a smooth node. The next line you create after placing a smooth node will be curved, and its direction and intensity will be determined by the placement of the next node.

- **Controlled Mode**: click, hold, and drag while placing a node to create a smooth node with control handles — move your cursor while holding the click to control the direction and intensity of the curve handle. Release to place the handle, then click to place a node.

Constrain Placement Angle

Hold ⇧ Shift while moving your cursor to constrain node and handle placement to a horizontal, vertical, or 45 degree angle from the last node placed.

Continue an Existing Drawing

Click on the start or end point of an open path to continue an existing drawing — new lines started from these points are automatically connected to the pre-existing path.

If you create a line or curve that connects the start or end points of two existing open shapes, LightBurn will Auto-Join them, and the new, combined path will be indicated by the animated dash selection pattern.

Hold ^ Ctrl / ⌘ Cmd while placing nodes to disable the Auto-Join behavior.

Snapping

In either placement mode, you can add nodes by Snapping to points on existing geometry: lines, corners, midpoints of lines, intersections of lines, and other nodes.

Your cursor will change to indicate the type of Snapping point you're hovering over, and when you move your cursor close enough to a valid point, it will Snap into position — click to place a node perfectly aligned to that point.

Hold ⌥ Option / ⎇ Alt while moving your cursor to Snap to points from farther away.

Measuring

To measure while drawing a line, check the Status Bar.

It shows:

- **dx:** the placement of the cursor along the X (horizontal) axis
- **dy:** the placement of the cursor along the Y (vertical) axis
- **len:** the length of the line segment that is currently being placed
- The **angle** between successive line segments as you create them

How to Practice

Related Topics

- Edit Nodes
- Snapping
- Selection
- Images vs. Vectors
- Open vs. Closed Shapes

- Trace Image

rectangle square ellipse circle primary-shapes radius sides node-editing dimensions shapes

5.4.1.2 Draw Shapes: Rectangles, Ellipses, Polygons, and Stars

This page covers the creation and editing of various **Primary Shapes**:

- **Rectangles** and squares
- **Ellipses** (ovals) and circles
- **Triangles**
- **Pentagons**
- **Polygons** with an adjustable number of sides (hexagons, by default)
- **Octagons**
- **Stars**
- **Dual Radius Stars**

The products of these tools are often used to create the foundation of a design, either on their own, or combined with other objects to build up complexity.

These shapes are a special kind of vector object called **Built-in Shapes** that retain editable properties such as number of **Sides** for Polygons, or **Corner Radius** for Rectangles.

Shape Selection

Each **Primary Shape** is available in the **Draw Shapes** submenu of the Creation Toolbar or Tools Menu.

In the Creation Toolbar, click the arrow in the lower right corner of the icon, or click and hold anywhere on the icon, to open a submenu with the indivual tools.

Click one of the **Primary Shape** tools from the submenu to enable it.

By default, the Draw Shapes icon is set to the **Rectangle** tool, and clicking once anywhere on the icon (other than the arrow in the bottom right) *without* holding will enable Rectangle creation.

Once you've selected a *different* shape from the submenu, its icon will appear, and you'll be ready to create it. If you exit the Draw Shapes tool, you can click once to re-enable creation of the last-selected type of shape.

You can also enable Rectangle or Ellipse creation by hotkey:

- **Rectangle/Square**: `^ Ctrl` / `⌘ Cmd` + `R`
- **Ellipse/Circle**: `^ Ctrl` / `⌘ Cmd` + `E`

Shape Creation

Click, hold, and drag in your Workspace to create the selected Primary Shape.

The behavior of shape creation changes if you use certain keyboard modifiers:

- By default, the shape will begin at the first point you click, and extend from that point in both directions as you drag.
- Holding `^ Ctrl` / `⌘ Cmd` will instead draw the shape from the center outward, which can be useful when aligning shapes to other parts of a design.
- Holding `⇧ Shift` while dragging will make the shape into its *regular* form — the **Rectangle** tool will make a square, the **Ellipse** a circle, any of the polygon tools will make an equal-sided polygon, and the **Stars** will have sides of equal lengths (in the case of **Dual Radius Stars**, there will be two types of sides with matching lengths).
- Hold both keys at once to combine their effects.

> **Tip**
>
> After creating a new shape, you can immediately use the handles to Move, Size, Rotate, or Shear it, while the **Draw Shapes** tool remains active.
>
> Enable Switch to Select mode after drawing a shape in the **Editor Settings** tab of your Settings to immediately exit the Draw Shapes tool after creating a shape and enable Selection mode instead.

Editing Primary Shapes

It's possible to adjust various aspects of an existing **Primary Shape** in the Shape Properties Window, or by using special *control handles* on the shape in your Workspace. The aspects vary between shape types but include dimensions, rotation, **Corner Radius**, and number of **Sides**. These control handles are available both immediately after creating the shape and when selecting a shape you've created previously.

Dimensions

You can change **Width** and **Height** in the Shape Properties Window and the Numeric Edits Toolbar.

Corner Radius — Rectangle Only

Corner Radius rounds out the corners by a given amount, which remains consistent even if the dimensions of the rectangle are later changed.

With a **Rectangle** selected, hold `^ Ctrl` / `⌘ Cmd`, and a blue *control handle* will appear. Drag the blue handle away from the corner to increase the radius of all four corners, and drag back toward the corner to decrease it. Dragging vertically creates a reversed radius, with a bite taken out of the corner.

You can also edit Corner Radius numerically in the Shape Properties Window.

Sides — Polygons Only

Adjust the number of **Sides** of a **Polygon** in the Shape Properties Window to form different shapes — 3 will create a triangle, 6 will create a hexagon, 8 will create an octagon, and so on.

The **Triangle**, **Pentagon**, and **Octagon** tools all create polygons with the appropriate number of sides already set in the Shape Properties window, but each can be changed to a different type of Polygon after they've been created.

It's also possible to change the number of sides by holding `^ Ctrl` / `⌘ Cmd` and dragging the purple *control handle* that appears near the polygon.

Points, Bulge, and Ratio — Stars Only

Points

The **Points** field controls the number of points on a **Star**.

For **Dual Radius Stars**, two sets of points are created, the Points field controls the amount of each individual set — in other words, the total number of points is two times the value entered in the Points field.

Bulge

Applying a **Bulge** value creates an arc from the top of each point to its base. Accepted values range from 0 to 1.

Ratio

Ratio defines the relationship between the distance from the **Star's** center to an outer point and to an inner corner, effectively determining the length and angle of star points.

For **Dual Radius Stars**, you can enter a separate value in Ratio and the **Ratio2** fields to adjust the two sets of points individually.

Accepted values range from 0 to 1.

Node-Editing a Primary Shape

Primary Shapes must be Converted to Paths to make editing their nodes possible. This process permanently removes the ability to edit a shape's dimensions, **Corner Radius**, or number of **Sides** in the Shape Properties Window.

Related Topics

- Create and Edit Text
- Draw Lines

- Shape Properties
- Convert to Path

layout-and-design creation-tools editing text customization

5.4.1.3 Create and Edit Text

Quick Reference: Text

Create, edit, and apply effects to text.

Location

Creation Toolbar

Tools → Edit Text

Keyboard Shortcuts

Windows: ^ Ctrl + T

Mac: ⌘ Cmd + T

Use the **Create Text** tool to add text to your projects. Text created using the Create Text Tool is a special type of built-in shape called a **Text Object**.

There are several special settings you can apply to Text Objects through the Text Options Toolbar, Shape Properties Window, or by directly editing them in your Workspace.

Use these settings to adjust font and size, change spacing, bend or curve your text, create Variable Text, and more.

Creating Text

To add a **Text Object** to your project, click the **Create Text** icon in the left sidebar, go to Tools → **Edit Text**, or press ^ Ctrl / ⌘ Cmd + T.

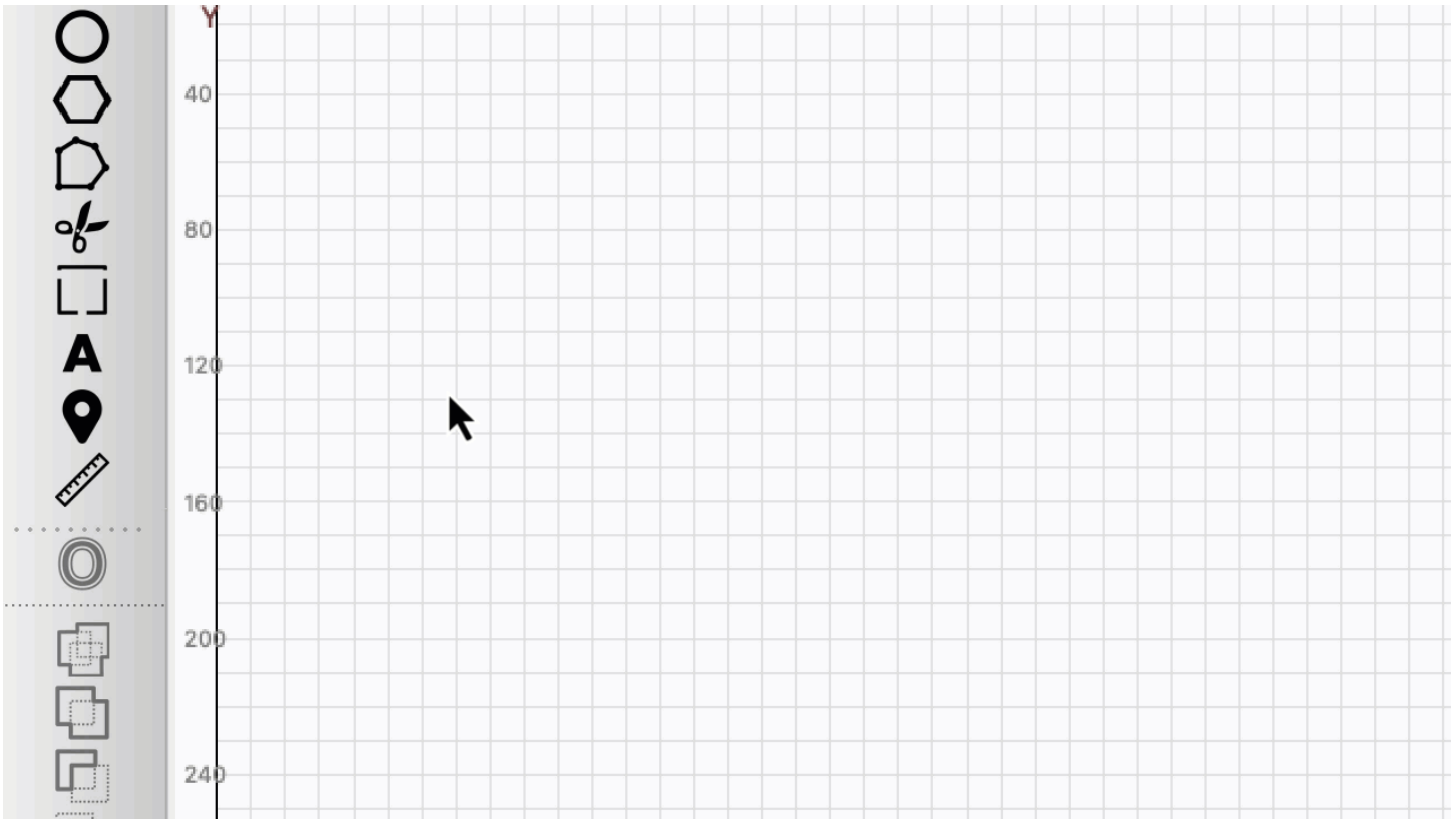
Click anywhere in your Workspace and type in the text you'd like to add.

Press Enter ⏎ while typing your text to jump to a new line and continue typing.

Press ⎋ Esc to finish creating the Text Object.

Note

By default, the location you click will be the center of the Text Object you create, but you can adjust alignment in the **Text Options Toolbar**.



Editing Text

To edit a **Text Object** after creating it, enable the **Create Text Tool** and click on it again, or double-click it without the Create Text Tool enabled.

Right-click any Text Object and select **Edit Text Shape** to open a dialog window where you can directly edit and adjust the text's attributes.

Enable **Selection double-click shows Text Edit dialog** in the Settings window to open the Edit Text Shape window by double-clicking instead.

Quick Tip: Text Box Edits in LightBurn

Bending Text

In addition to the Transform Control Handles used to **Move**, **Resize**, **Rotate**, and **Shear** objects, **Text Objects** have a special handle for **Bending**.

Select any Text Object to show a blue dot over the the text, then hover your cursor over the dot until you see the Bend cursor .

Click, hold, and drag the cursor up or down to curve the text around a circle.

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

Enable or disable the **Distort** toggle in the **Text Options Toolbar** to choose whether to distort the text as part of the curve, or leave the individual characters unchanged.

To curve text around more complex paths, use Apply Path to Text.

.

Text Options Toolbar

The **Text Options Toolbar** is where you adjust attributes of **Text Objects**, including, **Font**, size (**Height**), spacing (**HSpace** and **VSpace**), and more.

Accessing the Text Options Toolbar

The **Text Options Toolbar** is located in the top toolbar in LightBurn by default, to the right of the Numeric Edits Toolbar.

Tip

The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Options

- Use the **Font** dropdown menu to select a a font. See below for more information on fonts.
- **Height** sets the overall height of text. Height varies based on your selected font, and 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 spacing between individual characters, as a percentage of the font size. Positive numbers space the characters out more, and 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, and negative numbers reduce it.

> **Note**
>
> In the case of text, *horizontal* always refers to the direction of the text as it is read, regardless of whether the Text Object is rotated. *Vertical* refers to the opposite direction, regardless of rotation.
>
> HSpace always controls distance between individual characters,and VSpace always controls distance between lines.

Adjusting HSpace and VSpace

- **Align X** determines the horizontal anchor position of the text — **Left**, **Right**, or **Middle**.
- **Align Y** determines 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 using Apply Path to Text.

Using Align X and Align Y

- Enabling **Bold** displays the font in bold typeface, if available for the selected font.
- Enabling **Italic** displays the font in italics, if available.
- Enabling **Upper Case** forces all characters to be upper case.
- **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. Characters will also weld together if HSpace is reduced to a point where they overlap.

Welded vs. Unwelded comparison

- **Distort** controls whether individual characters in a Text Object will be warped when Bending them.
- Enabling **Right-to-Left** forces Right-to-Left text rendering. This option will not appear unless it's enabled in your Settings. Right-to-Left will automatically be enabled if your current input language is Right-to-Left.

- The Text Mode dropdown menu and Offset field are used when working with **Variable Text**. For information on these options, see Variable Text.

  Leave this value set to **Normal** if you are not using Variable Text

Fonts

The list of fonts in LightBurn is taken from your computer system. If you want to use a new font in LightBurn, install it on your computer, then re-start LightBurn.

Installing fonts

On Windows, after you have downloaded a font, right-click it and choose **Install**. On Mac, double-click the font and click **Install** in the font preview window that opens.

Favoriting and Filtering Fonts

Your most recently used fonts will always appear near the top of the font list in the **Recent** section.

After selecting a font, you can right-click it in the dropdown menu for additional options.

Select **Add to Favorites** to add the font to the your **Favorite** list. Favorites will appear at the top of the font list. To remove it from the list, right-click again and select **Remove from Favorites**.

Select **Hide this font** to remove the font from your list.

Click to enable or disable **Show System Fonts**, **Show SHX Fonts**, or **Show Hidden Fonts** — a checkmark will appear next to each option when it's enabled. SHX and System fonts are always displayed by default, while Hidden fonts are not. When displayed, Hidden fonts are shown in red.

See below for more information on SHX Fonts.

Note

You will only see the Show System Fonts and Show SHX Fonts options if you have set an SHX file path.

Text Settings

There are several global font settings in the **Editor Settings** tab of the Settings window.

- **Default Font** changes the automatically selected font for new projects.

- **Default Height** changes the automatically applied font **Height** for new projects.
- **Enable Right-to-Left text support** allows you to turn on Right-to-Left font rendering for any text. This setting is automatically 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 necessary.
- Enable **Selection Double-Click Shows Text Edit Dialog** to open a text edit window when you double-click text in your Workspace.

Quick Tip: Text Box Edits in LightBurn

SHX Fonts

Set SHX Font Path sets the directory containing SHX font files — clicking this button will open up your system's file explorer window, where you can navigate to the location of the SHX font folder on your computer. Click the button next to Set SHX Font Path to clear the path.

Once LightBurn knows where to load the SHX fonts from, they will automatically appear in the **Font** dropdown menu in the **Text Options Toolbar**.

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

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

SHX fonts lack many of limitations of standard system fonts and have the ability to define *single line* fonts, such as this:

Moving LightBurn Files With Fonts

If you want to move designs containing text between computers and continue to edit the **Text Objects**, be sure to install all necessary fonts on all computers you're using.

When you save a copy of a file that contains text, LightBurn automatically includes a copy of the text as a path and embeds it into the file. If you open the file on another computer that has the same font, you will be able to edit the Text Objects as usual.

However, if you open the design on a computer *without* the font, LightBurn will warn you about the missing font(s) and load the path embedded in the file. This prevents the file from breaking when you move to another computer, but you won't be able to edit the text without the correct font.

If the font is installed at a later time, LightBurn will recognize it and the text will become fully editable again.

Right-click the imported text and select **Convert to Text** to change the font of the text, and regain the ability to fully edit it.

Right-click the imported text and select Convert to Path to change the text into a standard vector graphic that can be edited using the Edit Nodes tool. Note that this change is permanent, and you'll be unable to edit any of its text properties later.

Importing Other Files With Text

If you open files not made in LightBurn that contain text, make sure that any fonts used in the file are installed on your computer, or that the text has been converted to paths using whatever tools are available in the other program.

Different programs use different terms for this process, but terms such as *welding*, *convert to outline*, and *convert to path* are common.

Converting Text to Paths in LightBurn

In order to directly edit the lines and nodes of text in LightBurn, select all **Text Objects** you wish to convert, then go to Edit → **Convert to Path**, press `^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `C`, or right-click in your Workspace and select Convert to Path from the menu.

Read more about Convert to Path here.

Related Topics

- Variable Text
- Apply Path to Text
- Convert to Path
- Rectangles, Ellipses, and Polygons

5.4.1.4 Variable Text

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5.4.1.4.1 Variable Text

Use **Variable Text** to have LightBurn automatically substitute specially formatted expressions with alternate data when you output a project to your laser.

In addition to outputting alternate text when you Start or Send a project to your laser, the expressions will be replaced when you Preview, save a project in machine-specific format, or Export graphics in SVG, DXF, or AI format.

You can use Variable Text to replace special expressions with:

- Date or time stamps
- Entries in a CSV file
- Serial numbers
- Cut Settings

See Variable Text Formatting for full details on supported formatting expressions.

Selecting a Variable Text Mode

To create **Variable Text**, first use the Create Text tool to enter the appropriate expressions for the type data you'd like to output, then select the matching **Text Mode** from the dropdown menu in the Text Options Toolbar.

Select Date/Time (for date and time stamps), Merge/CSV (for entries in a CSV file), Serial Number, or Cut Setting.

If you select Merge/CSV or Serial Number formatting, you'll have additional controls available in the **Variable Text Window**.

Accessing the Variable Text Window

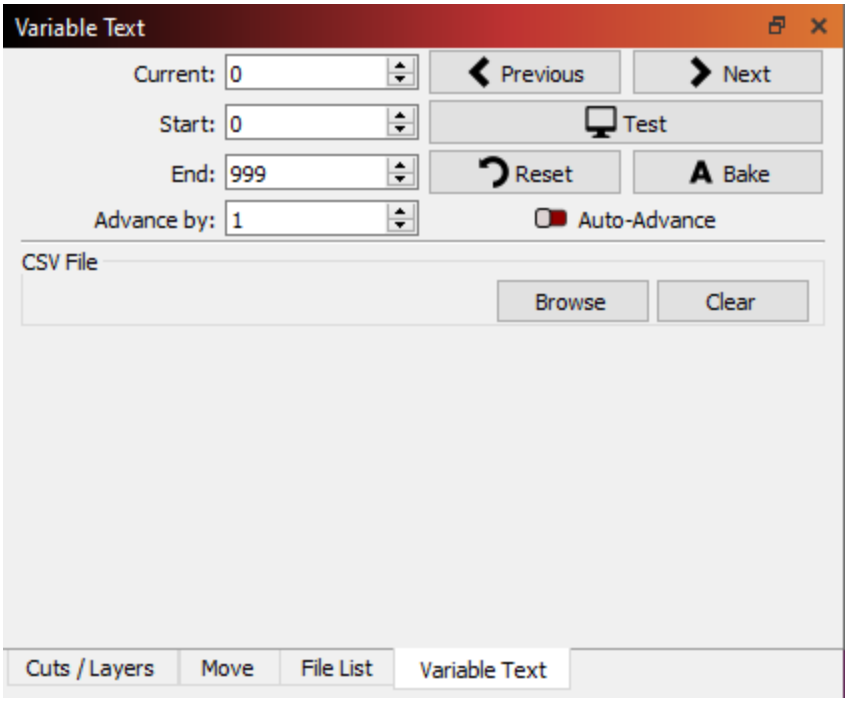
The **Variable Text Window** is not enabled by default. To enable it, go to Window → **Variable Text**.

The Variable Text Window will appear docked behind the Cuts / Layers Window on the upper right side of your screen. Click the Variable Text tab to bring the Variable Text Window to the front.

> **Tip**
>
> The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Variable Text Window Options

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Current

Determines the serial number or row from a CSV file that will be substituted in place of the formatted expressions the next time the project is output.

> **Note**
>
> The **Current** value advances *between* the **Start** and **End** values. In other words, the sequence returns to the Start value when increasing beyond End, or to the End value when decreasing beyond Start.

Start

Determines the first serial number or row from a CSV file to be output.

> **Warning**
>
> For values other than 0, on the first run of a project you must Reset the **Current** value to the **Start** value, or the values will not match. The Current and Start values are only matched automatically when advancing forward from the **End** value, returning to the beginning of the sequence.

End

The last serial number or row from a CSV file to output, before advancing back to the **Start** value.

Advance By

Tells LightBurn how many entries to advance (or reverse) the **Current** value each time you click **Next** or **Previous**.

Auto-Advance

When enabled, tells LightBurn to advance the **Current** value by the amount entered in the **Advance by** field each time you Start, Send, or save a project in machine-specific format.

Previous

Decreases the **Current** value by the amount set in the **Advance by** field.

Next

Decreases the **Current** value by the amount set in the **Advance by** field.

Reset

Resets the **Current** value to the **Start** value.

Test

Displays the text that will be output in place of the formatted expressions, for as long as the button is held.

> **Using Variable Text in Virtual Arrays**
>
> When using Variable Text in a **Virtual Array**, using the Test button will not show the final output of the Variable Text in LightBurn's workspace. To see an accurate preview, you'll need to use the Preview window.

Bake

Converts the formatted expressions to whatever data would be output based on the **Current** value in the **Variable Text Window**, in your Workspace.

The Baked text will no longer increment as a Variable Text Object — the displayed text is exactly what will be output to your laser.

Browse

Opens your systems's file browser, where you can navigate to and load a CSV file saved to your computer. The name of the CSV file will display in the **Variable Text Window** after it has been loaded.

Clear

Unloads a previously loaded CSV file.

Variable Text Offsets

Text Objects in LightBurn have an adjustable property called **Offset**, available in the Text Options Toolbar. Using Offsets allows you to use the same formatting expression to output different data.

The Offset value is added to the **Current** value in the **Variable Text Window** when LightBurn evaluates the Text Object to determine the data to output in its place.

For example, if you applied an Offset of 2 to a Text Object formatted to output a serial number, with a Current value of 1000, the output serial number will be 1002.

> **Tip**
>
> Use the **Offset** value in conjunction with the Advance by value to increment batches of the same design using **Variable Text**. For instance, if you created a design with 4 name tag labels on the page, you would set the Offset value for the four labels to 0, 1, 2, and 3, and set the **Current** value to Advance by 4 with each run.

Automatic Offsets

Some LightBurn tools can apply automatically advancing **Offset** values to duplicated objects.

Use Grid Array, Circular Array, or Copy Along Path to lay out copies of designs while increasing the Offset of each copy by a specified amount.

Shape Properties and Variable Text

There are three settings in the Shape Properties Window that are useful when working with **Variable Text**.

- **Max Width** sets the maximum possible width of selected Text Objects — use this field to prevent Variable Text outputs from exceeding a specified width after they're converted from formatted expressions.
- The **Squeeze** toggle determines whether Text Objects will be rescaled in both directions in order to fit within the Max Width value.

  When enabled, text will be shrunk horizontally, if necessary to stay within the Max Width, but maintain the same height.

  When disabled, text will be shrunk proprotionally, both horizontally and vertically.
- **Ignore Empty Vars** instructs LightBurn to remove *newlines* preceding empty Variable Text fields when aligning text.

Related Topics

- Variable Text Formatting
- Create and Edit Text
- Repeat Marking
- Grid Array
- Circular Array
- Copy Along Path

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5.4.1.4.2 Variable Text Formatting

Use the following formatting expressions with the appropriate Variable Text mode to have LightBurn replace the expressions with alternate data when you output a project to your laser.

In order for each type of formatting expression to be replaced with alternate data, you must also select the corresponding mode from the dropdown menu in the Text Options Toolbar.

Tip

Use the Test button to verify that you have entered the formatting expressions correctly, before sending a project to your laser.

Date/Time

When using **Date/Time** formatting, LightBurn will automatically substitute special combinations of characters with values for the current local date and time, as determined by your system's clock.

Use the following expressions for dates:

Output	Expression
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 numeric week of the year in ISO-8061 format (e.g. 51)	w

Output	Expression
The year/week of the year in ISO-8061 format (e.g. 2025/51)	W
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

Use the following expressions for time:

Expression	Output
h	The hour without a leading zero (0 to 23 or 1 to 12 if AM/PM display)
hh	The hour with a leading zero (00 to 23 or 01 to 12 if AM/PM display)
H	The hour without a leading zero (0 to 23, even with AM/PM display)
HH	The hour with a leading zero (00 to 23, even with AM/PM display)
m	The minute without a leading zero (0 to 59)
mm	The minute with a leading zero (00 to 59)
s	The whole second without a leading zero (0 to 59)
ss	The whole second with a leading zero where applicable (00 to 59)

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. *A/AP* will be replaced by either "AM" or "PM".
ap or a	Use am/pm display. *a/ap* will be replaced by either "am" or "pm".
t	The time zone (e.g. "CEST")

Additional Notes

- 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 non-formatting characters in the input string are included verbatim in the output.

Tip

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).

Serial Number

When using **Serial Number** formatting, LightBurn will automatically substitute special combinations of characters with the Current serial number value.

Use the following expressions 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 controls how many digits will output. If the Current 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 Current serial number is 1234, the table below shows how that number would be formatted for each of the displayed formatting inputs:

Input	Output	Input	Output
d	4	0d	4
dd	34	0dd	34
ddd	234	0ddd	234
dddd	1234	0dddd	1234
ddddd	1234	0ddddd	01234
dddddd	1234	0dddddd	001234

Additional Notes

- 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.
- All other non-formatting characters in the input string are included verbatim in the output.
- Use the Offset field in the Text Options Toolbar to enter multiple indentical formatting strings that output a different serial number.

- You cannot mix decimal and hexadecimal formatting in the same text entry.
- You cannot split a serial number with other characters. For example, because of the hyphen between the two groups of format characters, this string is not valid: ddd-ddd.
- Invalid strings will output as "bad serial format".

Merge/CSV

When using **Merge/CSV** formatting, LightBurn will automatically substitute special combinations of characters with an entry from a CSV file.

A CSV file is a *Comma Separated Values* file — a very simple text format that uses a line in a file as the *row*, and commas to separate *columns*. You can create a CSV file using a plain text editor, or by exporting from most common spreadsheet software.

In a Merge/CSV 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.

- Columns and rows are numbered starting from 0.
- Refer to the first column in a CSV using the formatting "%0", the second using "%1", the third using "%2", and so on.
- A Current value of 0 refers to the first row, 1 to the second, 2 to the third, and so on.

For example, using a CSV file with the following content:

```
LightBurn,laser cutter
MillMage,CNC router
```

And entering this formatting:

"I use %0 with my %1"

Would output:

"I use LightBurn with my laser cutter"

Additional Notes

- Use the Offset field in the Text Options Toolbar to enter multiple indentical formatting strings that output a different row from a CSV.

Cut Setting

When using **Cut Setting** formatting, LightBurn will automatically substitute certain characters with values from the Cut Settings applied to the text, or another specified layer.

Use the following expressions for Cut Settings:

Expression	Output
C	Followed by a number, pulls settings from the numbered cut layer (e.g. 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
n	Number of passes for the current layer
d / D	DPI, as a number, always dots per inch
i	Interval, in the current distance units
I	Interval, including the current distance units (like mm)
L	Displays the name of the laser. Can optionally be followed by a character index to start displaying from, and optionally, a comma and a 2nd number for the number of characters to display. For example, if L displayed "Ruida 6442G", L6 would display "6442G", and L6,4 would display "6442" (without the quotes)
z	Z Offset for the current layer, in the current distance units

Expression	Output
Z	Z Offset for the current layer including the units (eg, mm)
q	Q-Pulse width
Q	Q-Pulse width, followed by "ns" to indicate the units
k	Frequency in kHz
K	Frequency in kHz, followed by "kHz" to indicate the units

Additional Notes

- 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.
- All other non-formatting characters in the input string are included verbatim in the output.

Related Topics

- Variable Text
- Create Text
- Repeat Marking
- Grid Array
- Circular Array
- Copy Along Path

creation-tools layout-and-design batch-production variable-text QR-code bar-code object-customization

5.4.1.5 Create Bar Code

Quick Reference: Create Bar Code

Generates a Bar Code which stores data that's visible when the code is scanned later.

Location

Tools → Create Bar Code

Create Bar Code generates a Bar Code which stores data that's visible when the Code is scanned. This tool offers a wide range of common Bar Code formats, including QR Codes.

Creating Bar Codes

To activate **Create Bar Code**, go to Tools → **Create Bar Code**.

Click, hold, and drag in your Workspace to define the size of the Bar Code, then release to create it. You can resize the Bar Code later.

The **Bar Code Properties** window will automatically open, where you can select a Bar Code format, enter data, and adjust additional options.

The appearance of the Bar Code will live-update in your Workspace as you make changes.

Click **OK** to finish creating the Bar Code, or **Cancel** to delete it.

Editing Bar Codes

There are two ways to re-open the **Bar Code Properties** window after making a Bar Code:

- Double-click the Bar Code.
- First select it, then right-click in your Workspace, and select **Edit Bar Code** from the context menu.

> **Note**
>
> Edit Bar Code will only appear in the context menu if you have exactly one Bar Code — and nothing else — in your selection.

Bar Code Properties

Bar Code Type

Select a **Bar Code Type** from the dropdown menu at the top of the **Bar Code Properties** window.

The default Bar Code Type for all newly created Bar Codes is **QR Code**, or the last format you selected.

Full list of supported Bar Code Types

- 2 of 5
- 2 of 5 IATA
- 2 of 5 Industrial
- AprilTag 16h5
- AprilTag 25h9
- AprilTag 36h10
- AprilTag 36h11
- ArUco MIP 36h11
- ArUco OpenCV 7x7
- Aztec
- Chinese Sensible Code
- CodaBar
- Code 128
- Code 93
- Data Matrix
- EAN
- Grid Matrix
- ISBN
- PDF417
- PDF417 Compact
- PDF417 Micro
- Plessey
- QR Code
- QR Micro
- QR Micro Rectangular
- UPC A
- UPC E
- VIN

Data Entry Field

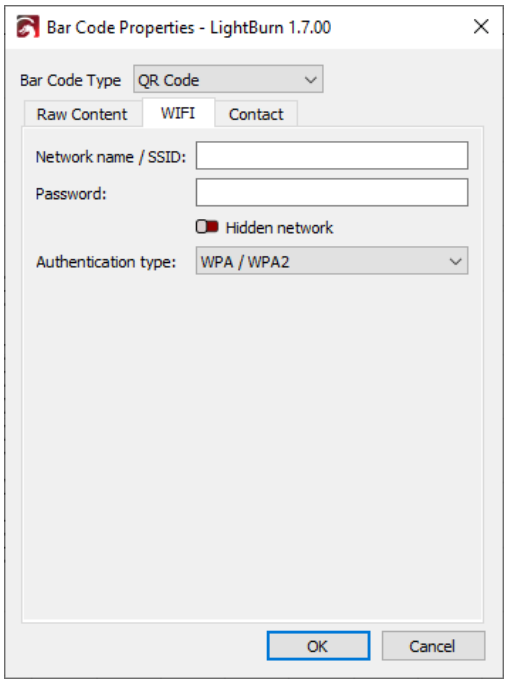
Enter data to store in the Bar Code in the **Raw Content** field. The type of data allowed depends on the type of Bar Code selected.

For **QR Codes**, you can choose to enter data as Raw Content, **WIFI** credentials, or **Contact** information.

- Any data entered in the WIFI or Contact tab will automatically populate the Raw Content tab.
- The last tab you enter data into overwrites data previously entered into another tab.

AprilTag and **ArUco** markers are used differently from typical Bar Codes. These markers are typically used as computer vision targets – we use AprilTags for Camera Calibration – and come from a list of pre-defined symbols. To get a specific marker, enter the identifier into the **Raw Content** field. This is a number from 0-1000, although not all types of AprilTag and ArUco markers use that full range.

The WIFI and Contact tabs for QR Codes



Character Limit

The character limit beneath the **Raw Content** field displays the amount of remaining characters supported by the **Bar Code Type** you have selected.

Text Evaluation

> **Info**
>
> See Variable Text and Variable Text Formatting for full details on working with Variable Text in LightBurn.

The **Text Evaluation** dropdown menu allows you to select a Variable Text format that will substitute different output in place of specially formatted codes.

Normal is selected by default — the data stored in your Bar Code will match the **Raw Content** exactly, if you leave Normal selected.

You'll see the output that will result from your formatted codes in the **Evaluated Text** field.

Variable Offset

Variable Offset adds to the **Current** value in the Variable Text Window by the entered amount, allowing you to have multiple Bar Codes in your Workspace using the same Variable Text formatting, but displaying different **Serial Numbers**, or referring to different rows of a **CSV**.

Process Control Characters

Enable this switch to convert specially formatted characters (`<RS>` , `<ACK>` , etc.) into non-printable characters used by GS1 compliant systems.

Control characters should be enclosed in <> brackets like this:

`[)><RS>06<GS>17V8X691<GS>1P02551706-01<GS>S062<RS>`
`<EOT>`

When **Process Control Characters** is enabled and valid characters are entered, you'll see converted characters in red in the **Evaluated Text** field.

Error Correction Level

Error Correction helps to keep Bar Code data readable even if the Bar Code is partially damaged or obscured — use the Error Correction slider to adjust the amount of Error Correction in a Bar Code.

Different **Bar Code Types** provide different ranges of possible Error Correction — the highest Error Corrections produce Bar Codes that are more resilient to damage, but are visually denser and more complex.

Not all Bar Code Types support Error Correction.

Bar Code Types supporting Error Correction

- Aztec
- Chinese Sensible
- Grid Matrix
- PDF417
- PDF417 Compact
- PDF417 Micro
- QR Code
- QR Micro
- QR Micro Rectangular

Show Bar Code Text

For supported **Bar Code Types**, tells LightBurn to output the text from the **Raw Content** field along with the Bar Code. This switch is enabled by default.

Bar Code Types supporting Barcode Text

- 2 of 5
- 2 of 5 IATA
- 2 of 5 Industrial
- CodaBar
- Code 128
- Code 93
- EAN
- ISBN
- Plessey
- UPC A
- VIN

Extra Data Spacing

Some **Bar Code Types** support adding a secondary Bar Code based on extra data input after a "+" symbol. The **Extra Data Spacing** slider controls the distance between the primary and secondary Bar Codes.

Bar Code Types supporting Extra Spacing

- EAN
- ISBN
- UPC A
- UPC E

Force Square

When **Data Matrix** is the selected format, some data inputs can result in a rectangular Bar Code. Enable **Force Square** to have the Data Matrix always remain square. This switch is enabled by default.

Error Messages

If the data you've entered is invalid for the type of Bar Code you've selected, you'll see an X in the Workspace and an error message in the **Bar Code Properties** window.

The error message will indicate which characters are invalid.

Related Topics

- Variable Text
- Repeat Marking
- Create and Edit Text

image vector built-in-shapes polygon circle ellipse rectangle square QR-code text path

5.4.1.6 Shape Properties Window

The **Shape Properties Window** displays editable properties of selected objects.

Accessing the Shape Properties Window

The **Shape Properties Window** is not enabled by default. Select Window → **Shape Properties** to enable the window.

The Shape Properties Window will appear docked behind the Cuts / Layers Window on the upper right side of your screen. Click the Shape Properties tab to bring the Shape Properties Window to the front.

> **Tip**
>
> The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Shape Properties Options

The options available in the **Shape Properties Window** depend on the type of object you have selected.

Three options are available for all types of objects, or when you have multiple types of objects selected at once.

- **Cut Order Priority**: sets the order this shape is cut by the laser. Lower values are cut first, starting with 0 as the highest priority. You must also select **Order by Priority** in the Optimization Settings for this setting to take effect.
- **Power Scale**: rescales the power used to cut this shape by this percentage, between Min Power and Max Power. For devices that do not support the Min Power setting, power is scaled as a percentage between 0 and Max Power.

Video: Fine Tune Laser Output With Power Scaling

- **Locked**: prevents any edits to the selected shape(s). See Lock Shapes for more information.

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

See below for additional properties that are presented only when you've selected specific types of objects.

Image

These settings are presented for image graphics.

Gamma: adjusts mid-tones shades — Lower values lighten the mid-tones, and higher values darken them. **1.0** is normal.

Contrast: increases or decreases image contrast — higher values make light tones lighter and dark tones darker.

Brightness: increases or decreases image brightness, making both light tones and dark tones lighter or darker.

Enhance: increases the contrast of edges within the image - also known as *Unsharp Masking* and *High-Pass Sharpening*.

Enhance Radius: controls the spread of edge contrast — a larger radius spreads the Enhance effect further from the edges within an image.

Enhance Amount: controls the intensity of the edge contrast.

Enhance Denoise: reduces noise in smooth areas.

Ellipses

These settings are presented for shapes made using the Create Ellipse tool.

Width: the length of the ellipse in the horizontal (X Axis) dimension.

Height: the length of the ellipse in the vertical (Y Axis) dimension.

Polygons

These settings are presented for shapes made using the Create Polygon tool.

Width: the length of the polygon in the horizontal (X Axis) dimension.

Height: the length of the polygon in the vertical (Y Axis) dimension.

Sides: sets the number of sides of the shape — 3 = triangle, 6 = hexagon, 8 = octagon, etc.

Rectangles

These settings are presented for shapes made using the Create Rectangle tool.

Width: the length of the rectangle in the horizontal (X Axis) dimension.

Height: the length of the rectangle in the vertical (Y Axis) dimension.

Corner Radius: applies a radius to corners. Positive values create curved corners, negative values takes a bite out of the corner.

Text

These settings are presented for text made using the Create Text tool.

Max Width: text begins scaling if the length in the horizontal (X Axis) dimension exceeds this — use **0** for no limit.

Squeeze: when enabled, as the text exceeds the Max Width, the horizontal axis is scaled, but the vertical height remains the same, resulting in a squished appearance. When disabled, text will shrink proportionally, both horizontally and vertically.

Ignore Empty Vars: instructs LightBurn to remove *newlines* preceding empty Variable Text fields when aligning text.

Related Topics

- Adjust Image
- Primary Shapes
- Create and Edit Text

laser-control cut-settings line layout-and-design creation-tools

5.4.1.7 Add Tabs

Quick Reference: Add Tabs

Tells your laser to skip small sections of cuts, to prevent cut objects from immediately falling from the base material.

Location

Creation Toolbar

Tools → Add Tabs

Keyboard Shortcuts

Windows: ^ Ctrl + Tab ⇥ Mac: ⌘ Cmd + Tab ⇥

Tabs are small sections of cuts that the laser is commanded to skip, used to prevent objects that you are cutting from immediately falling out of the base material. When sized appropriately, the tabs can be broken with minimal force and the objects removed from the material after the job is finished cutting.

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

You can create tabs manually using the **Add Tabs** tool, or LightBurn can generate them automatically. Options controlling the size of **Manual** tabs, and spacing, number, and positioning of **Automatic** tabs, are available in the Cut Settings Editor.

Adding Tabs Manually

To manually add tabs, select **Add Tabs** from the Creation Toolbar (or press ^ Ctrl / ⌘ Cmd + Tab ⇥), then hover over a shape in your Workspace that's assigned to a layer set to Line Mode.

If you are hovering over a valid shape, you'll see the **Insert Tab** cursor (). Click to insert a tab at that location. A red dot will appear on the shape, indicating that the tab has been placed.

Click and drag the red dot to move its location on the shape, or even to another valid shape in your Workspace.

The default width of manually-placed tabs is .5 mm. Tabs cannot be placed closer together than is allowed by their width. See the next section for information on adjusting tab width.

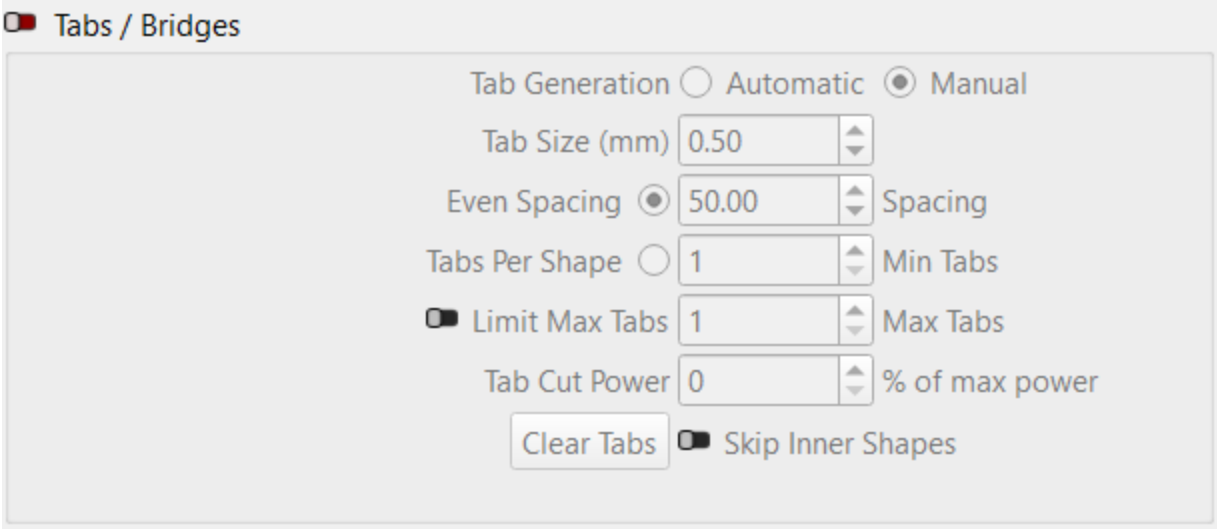
To remove an existing tab, double-click the red dot, or hold the ⇧ Shift key while clicking it.

Automatic Tab Generation and Tab Settings

To adjust the settings for **Manual** tabs, or enable and adjust settings for **Automatic** tabs, double-click a layer set to Line Mode in the Cuts / Layers Window, to open the Cut Settings Editor.

Tab settings are available in the lower half of the Cut Settings Editor.

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Global Enable / Disable

The switch next to **Tabs / Bridges** controls whether tabs are enabled for the layer. If you have manually added tabs to a shape, this will automatically be switched on for the layer the shape is assigned to.

Switch Tabs / Bridges off to disable tabs. Tab settings and placement are not lost when this switch is turned off, and are restored exactly as they were if it is switched on again.

Tab Generation

- **Manual**: all tabs must be manually placed using the methods described above.
- **Automatic**: tabs will be placed on shapes assigned to the layer, based on the values of **Even Spacing**, **Tabs Per Shape**, and **Skip Inner Shapes**.

Tab Size

This setting affects both **Manual** and **Automatic** tabs.

Tab Size defines the total length of all tabs, in the currently configured system unit type (mm or inch). The laser will skip cutting for this distance, if possible.

Even Spacing

With **Even Spacing** selected, each contiguous path section will have at least one tab applied at the very start of the path and then again at the distance interval set in the **Spacing** field.

Spacing is set in the currently configured system unit type (mm or inch).

Limit Max Tabs

Enable **Limit Max Tabs** to set an upper bound on how many tabs can be automatically generated for each path, when using **Even Spacing**.

Tabs Per Shape

Select the **Tabs Per Shape** option to specify the number of tabs to create on each path assigned to the layer. Tabs will be automatically spaced evenly along the path.

Detailed placement info

To calculate automatic placement of tabs when using **Tabs Per Shape**, LightBurn does the following:

1. Calculates the total perimeter length.
2. Divides the perimeter into segments – one more segment than the number of tabs selected.
3. Places tabs where the segments meet, shifting the start point by half a segment so things are evenly placed on closed shapes.

Tab Cut Power

This setting affects both **Manual** and **Automatic** tabs.

If **Tab Cut Power** is set to any value other than 0%, the laser will make pulsed cuts across the width of the tabs instead of skipping them completely.

Increasing the percentage increases the amount the laser pulses on during tabs, resulting in tabs that are more weakly connected to the base material.

In the example below, the top tab is set to 25%, while the bottom tab is set to 75%. The black lines represent areas along the path where the laser is on, and the red lines represent areas where the laser is off.

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 affect **Manual** tab placement.

> **Closed Shapes Only**
>
> This feature only works with shapes that are *closed*. A shape is closed when it is a complete, continuous loop whose start and end points are the same. When a shape's start and end points are different, it is *open*.
>
> See Open vs. Closed Shapes for more information.

Clear Tabs

Deletes all tabs (**Manual** or **Automatic**) from every shape on this cut layer.

Troubleshooting

- Tabs functions are not available if you are using Beginner Mode. You can disable Beginner Mode in Settings/Preferences.

Related Topics

- Cut Settings Editor
- Perforation Mode
- Kerf Offset
- Ramp Length

layout-and-design arrangement editing testing-tools troubleshooting workflow

5.4.1.8 Measure

Quick Reference: Measure

Displays an array of useful information about objects.

Location

Creation Toolbar

Tools → Measure

Keyboard Shortcuts

Windows: ⎇ Alt + M

Mac: ⌥ Option + M

Keyboard Modifiers

Hold ⇧ Shift while dragging a temporary line to lock it to horizontal, vertical, or a 45 degree angle.

Use the **Measure** tool to hover over any shape in your Workspace and display an array of useful information about it, including perimeter, overall dimensions, whether it is Open or Closed, and the lengths of individual line or curve segements within it. You can also click and drag to create and measure a temporary line between two points.

To enable the Measure tool, click on the ruler icon in the Creation Toolbar, or press ⎇ Alt / ⌥ Option + M.

Using the Measure Tool

Hover your cursor over any shape in your Workspace to see information on a given shape. Move your cursor over any individual line or curve segment in a shape to see information on that specific segment.

As you hover the cursor over shapes, individual shapes are highlighted in green, and the segment the cursor is currently hovering over is highlighted in purple, as shown below:

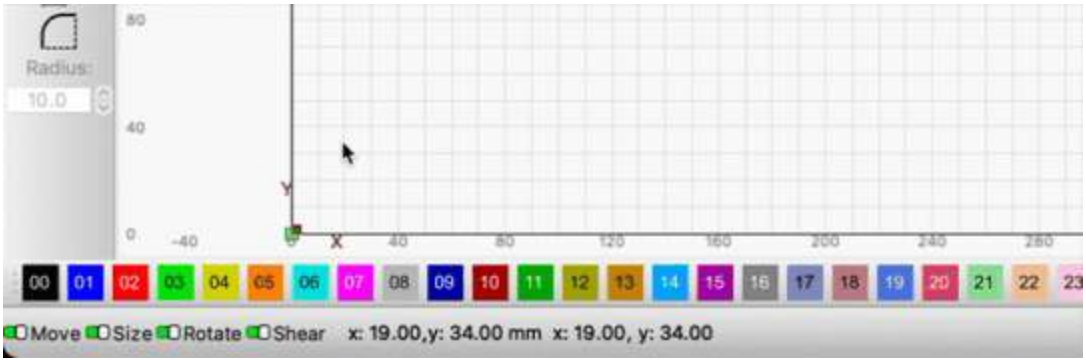
Drag Measure

Click, hold, and drag between any two points in your Workspace to display information on a temporary line created between those points. You can snap to a shape or node on a shape, or click anywhere in your Workspace, even if no shape is present.

Hold ⇧ Shift while dragging to lock the temporary line to horizontal, vertical, and 45 degree angles.

View shape dimensions as you create them

When using any of LightBurn's shape creation tools, you can also view the measurements of the shape you're creating in the Status Bar.



Measurement Window

The Measurement dialog window describes the highlighted shape and individual segment. You can click the button displaying **mm** or **in** to switch between either unit of measurement.

The dialog displays the following values:

Value	Explanation
Nodes	Number of nodes (points at starts and ends line segments and curves)
Lines	Number of straight lines
Curves	Number of arcs or Bézier curves
Perimeter Length	Total length of all line/curve segments
Width	The total span of the object in the X dimension
Height	The total span of the object in the Y dimension
Closed/Open	Whether or not the shape is closed
Area	The total area of the shape. Empty for open shapes
Segment Length	Length of the highlighted line/curve segment
Start Point	X, Y coordinate of the start node of the highlighted segment
End Point	X, Y coordinate of the end node of the highlighted segment
Difference	Difference in X and Y between the start and end nodes
Angle	Angle of the line between the start and end points
Arc Radius	Radius of the arc, if the curve is a true circular arc. Empty otherwise

Value	Explanation
Arc Center	Center point of the arc, if the curve is a true circular arc. Empty otherwise

Related Topics

- Selection Tools
- Numeric Edits Toolbar
- Shape Properties
- Align Tools

UI libraries workflow-optimization editing design

5.4.1.9 Art Library

An **Art Library** provides a way to store artwork so you can quickly access and reuse it in future projects.

You can load multiple Art Libraries at the same time, and separate Libraries are a great way to split artwork up by theme (holidays, birthdays, animals), or purpose (tests, tools, templates, boxes).

An entry in an Art Library can contain any combination of objects that would normally make up a project, including text, Primary Shapes, paths, and images.

> **Note**
>
> The Library only stores artwork, much like the contents of AI, SVG, DXF, or image files — it doesn't store any Cut Settings applied to the artwork. If you wish to store cut settings with your design, you must Save your work instead.

Accessing the Art Library Window

The **Art Library Window** is not enabled by default. To open it, go to Window → **Art Library**.

By default, the Art Library will appear docked on the left side of your Workspace.

Tip

The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Using the Art Library

You'll see a list of Art Libraries on the left, and thumbnails of the artwork within the currently selected Library on the right.

Note

If there are no Libraries listed, a **New** Library must be created, or an existing one **Loaded**, in order to access artwork.

Creating a Library

To create an empty Library, click the **New** button, then choose a location and name for the `.lbart` file — this is where added artwork will later be stored, in compact form.

Loading and Unloading Libraries

To add a previously saved Library, click the **Load** button in the bottom of the **Art Library Window**. Saving, transferring, and Loading Libraries makes it possible to share artwork between computers and users.

To remove a Library from the list, click **Unload**. Unloading a Library removes it from view, but does not delete the file or its contents from the hard drive where it is saved.

Storing Art in a Library

Use the **Import** button to add artwork from saved files to your Library. You can import multiple files at once using this method, and each will become an individual entry in the current Library.

To add selected objects from your current project, click **Import Graphic from Project**, or right-click in the **Art Library Window** and choose **Add Selection to Library**.

Editing Art and Libraries

Right-clicking artwork in an **Art Library** brings up the options to **Delete** or **Rename** it.

To change the name of a Library, change the `.lbart` file name in your file browser, and then **Unload** and **Reload** the Library in LightBurn.

To copy artwork from one Library to another, drag and drop in the Art Library window. To move artwork, hold `⇧ Shift` while dragging the artwork.

Adding Art to a Project

Dragging a thumbnail from the **Art Library** into a project adds it to the project wherever the mouse is released.

Clicking the **Add Graphic to Project** button adds the selected artwork into the center of the current field-of-view in the Workspace.

Related Topics

- Import
- Save
- Material Library

5.4.2 Editing

layout-and-design arrangement editing customization object-manipulation vector-editing vector-tools vector path-editing path-tools path vector-path-curve-lines node-editing

5.4.2.1 Edit Nodes

Quick Reference: Edit Nodes

Edit vector paths by moving, changing, or deleting nodes, lines, and curves.

Location

Creation Toolbar

Tools → Edit Nodes

Keyboard Shortcuts

Windows: ^ Ctrl + `

Mac: ⌘ Cmd + `

Edit Nodes allows you to make precise, granular edits to vector paths, by controlling the placement and behavior of **nodes** (points in space, sometimes called *anchor points*) which are linked by straight **lines** or **curves**. The curved lines are described by the length and direction of **handles** (tangents) which appear on one or both nodes at either end of a curve.

Using Edit Nodes

To enable **Edit Nodes**, click on the Edit Nodes icon in the Creation Toolbar or press `^ Ctrl` / `⌘ Cmd` + `` ` `` on your keyboard.

If you already have a valid object (or objects) in your selection, its nodes will appear. If you do not have anything currently selected, click an object to view and edit its nodes.

> **What is a valid object?**
>
> The **Edit Nodes** tool works on vector paths. Paths must be ungrouped. Text Objects, Primary Shapes, and Barcodes must be converted to a path before using Edit Nodes.

Edit Nodes Toolbar

When you enable the **Edit Nodes** tool, an additional toolbar will appear to the right of the Creation Toolbar.

Hover over any button in the **Edit Nodes Toolbar** to see a tooltip explaining the action it will perform.

Click the enable a given type of action, then click on a valid node or line in your Workspace to perform that action.

Mouse Actions

With the **Select** action enabled in the **Edit Nodes Toolbar**, you can select and adjust nodes and lines directly with your mouse.

- Click and and drag on nodes, handles, or curves to move them.
- Click any node or handle to select it, and then use the keyboard arrow keys and modifier keys to move it by the increments set in the Shape Move Increments fields in the Settings window.

- With a node or handle already selected, hold ⇧ Shift while clicking on another node or handle to add it your selection, then drag or use the arrow keys to move each selected node or handle in unison.
- Click any straight line and drag to automatically turn it into a curve.
- Drag disconnected nodes on top of one another to automatically join them, turning the lines on either side into a single shared path.

Keyboard Actions

Each of the actions in the **Edit Nodes Toolbar** has a corresponding hotkey, listed below, that you can use to edit and manipulate lines, curves, and nodes.

You can quickly reference the keyboard commands for each of these at any time by hovering over the **Edit Nodes** tool in the toolbar.

Action	Key	Description	Method
Delete node	D	Delete nodes and combine adjacent lines	Hover over a node (or select multiple nodes) and press key
Insert	I	Insert node anywhere on path	Hover over curve or line and press key
Insert node at midpoint	M	Insert node at the halfway point between two nodes	Hover over curve or line and press key
Convert smooth node to corner	C	Convert node to corner (curve handles will have independent angles)	Hover over smooth node and press key
Smooth corner node	S	Convert node to smooth (curve handles will have same angle)	Hover over corner node and press key
Break shape at point	B	Open path at node	Hover over a node and press key (move one of the nodes to reveal the gap)

Action	Key	Description	Method
Delete line	D	Delete line or curve (open or split path)	Hover over a line or curve and press key
Convert curve to line	L	Convert to line (straighten a curve and remove handles)	Hover over a curve and press key
Convert line to smooth curve	S	Convert to curve (add handles either side of line)	Hover over line and press key
Align Selected	A	Rotate selection by aligning segment to nearest horizontal, vertical, or 45° angle — all selected objects will rotate along with the segment	Hover over line and press key
Trim line	T	Cut line under mouse back to the next place it intersects with another line	Hover over curve or line and press key
Extend line	E	Extend line to nearest intersecting path	Hover over an open end point and press key

Requirements

- You can only use **Edit Nodes** with paths. You can create paths with Draw Lines or the Trace Image tools. Otherwise you can Import vector objects into LightBurn from another source.
- To use Edit Nodes with other, built-in vector objects, you must first use Convert to Path to turn them into standard paths. This requirement applies to:
  - Text Objects
  - Primary Shapes: Rectangles, Ellipses, and Polygons
  - Barcodes
- You cannot use Edit Nodes with Grouped objects. Ungroup them first.

Snap to Existing Geometry

Snapping allows you to align your nodes or handles to specific points on existing objects.

Constrain Movement

Hold ⇧ Shift while moving a node or handle to constrain movement to a 90° or 45° angle from its starting position, indicated by temporary guidelines in your Workspace.

If you select multiple nodes or handles at once, only the movement of the last-selected node or handle will be constrained, and the other nodes or handles will move along with it.

Trim and Extend Demo

There is also a separate tool, Trim Shapes that you can use to perform the **Trim Line** function.

Align to Angles Demo

How to Practice

Related Topics

- Draw Lines
- Trim Shapes
- Snapping
- Selection
- Images vs. Vectors
- Open vs. Closed Shapes
- Auto-Join Selected Shapes
- Break Apart
- Trace Image

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5.4.2.2 Trim Shapes

Quick Reference: Trim Shapes

Cuts lines back to the next place they intersect with another line.

Location

Creation Toolbar

Tools → Trim Shapes

Keyboard Shortcuts

Windows: ^ Ctrl + K

Mac: ⌘ Cmd + K

Keyboard Modifiers

Hold ^ Ctrl / ⌘ Cmd to disable Auto-joining.

Use the **Trim Shapes** tool to cut line segments back to the next intersection with another line.

If a shape does not intersect with any other lines, Trim Shapes deletes the entire shape.

Using Trim Shapes

To enable **Trim Shapes**, click the scissor icon in the Creation Toolbar or press `^ Ctrl` / `⌘ Cmd` + `K`.

After activating the Trim Shapes tool, hover over any vector object in your Workspace to see a preview of the effect Trim Shapes will have on that object.

- When you hover over a valid line segment, the cursor will change to the scissor icon, and the segment to be deleted will turn red.
- Click to delete the segment.

> **Primary Shapes**
>
> This feature works with Primary Shapes, but will remove the ability to edit their special Shape Properties, as they are Converted to Paths in the process.

If you hover over a shape that does not intersect with any other lines, the entire shape will be highlighted in red, and deleted when you click.

Auto-Joining With Trim Shapes

When possible, **Trim Shapes** joins the new vector objects at the points where they used to intersect, combining them into a single path.

When a shape has been joined with another, it will automatically be selected, and you'll see the animated dash pattern that indicates selected objects.

> **Note**
>
> Hold `^ Ctrl` / `⌘ Cmd` while clicking to disable automatic joining when using Trim Shapes.

Troubleshooting

- **Trim Shapes** does not work on Grouped objects — you'll need to **Ungroup** them first.

Related Topics

- Edit Nodes
- Boolean Tools
- Cut Shapes

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5.4.2.3 Numeric Edits Toolbar

Use the **Numeric Edits Toolbar** to adjust the size, position, and orientation of shapes in your selection using precise numeric values.

When adjusting objects through the Numeric Edits Toolbar, all objects in your current selection are treated as a single unit, maintaining their relative positions and scale as you make changes.

Accessing the Numeric Edits Toolbar

The **Numeric Edits Toolbar** is located in the top toolbar in LightBurn by default, to the left of the Text Options Toolbar.

If you have closed the Numeric Edits Toolbar, go to Window → **Numeric Edits** to re-enable it. To restore it and all other windows to their default positions, go to **Window** → Reset to Default Layout

Tip

The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Numeric Edits Toolbar Options

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.

9-Dot Control

> **Note**
>
> When working with any of the Numeric Edits options, imagine the selection area as the smallest possible rectangle that can contain every object in your selection. Each position in the 9-Dot Control is a point around the perimeter of that rectangle, or in its center.

The **9-Dot Control** determines the location on the current selection that is referenced when displaying and adjusting selection coordinates; the anchor point which objects are rescaled in toward or away from; and which point to use as the center of rotation when rotating the selection.

XPos and YPos

XPos and **YPos** display the current X (horizontal) and Y (vertical) positions of your selection, relative to the point in your selection indicated by the **9-Dot Control**, and your laser's Origin.

The laser's Origin is indicated by a small red square in a corner of the Workspace. Positive XPos and YPos values are always within the Workspace, and negative values outside of it.

Adjusting either field will move the indicated position on the current selection to the new location you enter, and all objects in the selection will move in unison.

> **Tip**
>
> You can adjust position by imprecise values directly in your Workspace using the Move handle on your selection.

Width and Height

Width and **Height** display and determine the length of your selection in the X (Width) and Y(Height) dimensions. You can enter exact values in the field directly to the right of Width and Height, or change the size of either dimension by percentage in the fields to the right of those.

The chosen location in the 9-Dot Control determines an anchor point that objects will be rescaled in toward or away from.

> **Tip**
>
> You can adjust Width and Height by imprecise values directly in your Workspace using the Size handles on your selection.

Lock

The **Lock** icon to the left of **Width** and **Height** determines whether the aspect ratio of the selection is maintained as objects are resized.

- In locked mode — indicated by a highlighted, closed lock icon — the proportions of your selection remain consistent as they're resized.

  As an example, a rectangle that is currently 50 mm wide and 25 mm tall is twice as wide as it is tall, for a 2:1 aspect ratio. If the aspect ratio is locked, changing the width to 80 mm will automatically change the height to 40 mm.
- In unlocked mode — indicated by an unhighlighted, open lock icon — the proportions of your selection will not remain consistent as they're resized, and will instead change independently.
- Click the icon to change modes.

Rotate

Use the **Rotate** field to turn the current selection by a precise number of degrees. Positive values rotate the selection clockwise, while negative values rotate it counterclockwise.

The chosen location in the 9-Dot Control determines the center of rotation.

Tip

You can rotate your selection by imprecise values directly in your Workspace using the Rotate handles, or by precise values using hotkeys.

Units Toggle

Click the **Units Toggle** to switch your current unit of measurement between imperial and metric. You can also adjust units in the Settings window.

The current unit of measurement is displayed as **mm** for millimeters or **in** for inches.

Equation Support

The **XPos**, **YPos**, **Width**, **Height**, and **Rotate** fields all accept equations.

Examples of valid equations are:

- 58 + 37
- 89 - 13
- 10.25 / 2
- (10+2) * 4 + 1

Press enter to process the equation and adjust the value.

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

Automatic Unit Conversion

The **XPos**, **YPos**, **Width**, and **Height** fields accept units of measurement as well.

If you are working in millimeters, but you want to create a shape that is 5 inches wide, you can enter 5in or 5" into the width field and LightBurn will convert it to millimeters for you.

This works in the opposite direction too — if you're working in inches, you can enter mm or cm and LightBurn will convert the values to inches.

Related Topics

- Transform Controls
- Text Options Toolbar
- Shape Properties

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5.4.2.4 Convert to Path

Quick Reference: Convert to Path

Turns built-in shapes (text, polygons, etc.) into editable paths.

Location

Edit → Convert to Path

Right-click → Convert to Path

Keyboard Shortcuts

Windows: ^ Ctrl + ⇧ Shift + C

Mac: ⌘ Cmd + ⇧ Shift + C

Convert to Path transforms built-in shapes created in LightBurn into paths made up of lines, curves, and nodes, that can be edited using the Edit Nodes tool.

The following built-in shapes must be converted to paths in order to edit their lines, curves, and nodes:

- Primary Shapes
- Text Objects
- Bar Codes

Using Convert to Path

Select all shapes you wish to convert, then go to Edit → **Convert to Path**, press ^ Ctrl / ⌘ Cmd + ⇧ Shift + C, or right-click in your Workspace and select Convert to Path from the context menu.

The objects become normal paths, and their lines, curves, and nodes can be adjusted using the Edit Nodes tool. The letters of Text Objects are separated into discrete shapes that can be moved and manipulated individually.

Troubleshooting

- Grouped objects cannot be converted to paths, and the option will be grayed out or unavailable if you have Grouped objects selected. **Ungroup** any object you'd like to convert.
- After converting an object to a path, you will lose the ability to adjust attributes associated with the type of shape it was converted from.
  - The following attributes can no longer be edited in the Shape Properties Window:
    - The **Width** and **Height** of Rectangles, Ellipses, and Polygons.
    - The **Corner Radius** of Rectangles.
    - The number of **Sides** of Polygons.
    - The **Max Width** of Text.
  - Text properties are no longer adjustable in the Text Options Toolbar.
  - Variable Text input will no longer be substituted for different output.
  - The content of a Bar Code can no longer be edited.

Related Topics

- Edit Nodes
- Create Rectangle
- Create Ellipse
- Create Polygon
- Create and Edit Text
- Create Bar Code

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5.4.2.5 Auto-join Selected Shapes

Quick Reference: Auto-join Selected Shapes

Auto-join selected shapes connects ends of lines or curves that are near one another or touching, but not technically connected.

Location

Edit → Auto-join selected shapes

Keyboard Shortcuts

Windows: ⎇ Alt + J

Mac: ⌥ Option + J

Auto-join selected shapes connects line or curve segments whose start and end nodes are directly on top of (or very near to) one another, but not technically connected. When the segments are connected, they are combined into a single path (a sequence of lines, curves, and nodes).

Auto-Join is most often helpful in cases where you've Imported graphics containing open shapes that you would like to use with a function that requires closed shapes.

To connect start and end nodes using Auto-Join, the nodes must be within .05 mm of one another.

To use Auto-Join, select all segments you want to join, then go to Edit → **Auto-join selected shapes**, or press ⎇ Alt / ⌥ Option + J.

Troubleshooting

In some cases where **Auto-Join** fails to join segments with start and end points within the necessary .05 mm tolerance, it can help to first go to the Arrange Menu and select Break Apart (⎇ Alt / ⌥ Option + B), before again trying Auto-Join.

Related Topics

- Edit Nodes
- Close Path
- Close Selected Paths With Tolerance
- Break Apart
- Open vs. Closed Shapes

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5.4.2.6 Close Path

Quick Reference: Close Path

Joins the start and end of a path.

Location

Edit → Close Path

Close Path connects individual shapes with one start and one end point by creating a new line between the points.

Several functions in LightBurn, including Fill Mode, require shapes that are closed loops, with start and end points that are the same. If the start and end points of a shape are very close, but not quite connected, use Close Path to connect them.

Using Close Path

Select all shapes you wish to close, then go to Edit → **Close Path**.

You can select and close multiple paths at once, but, in order for a path to be connected by Close Path, it must already be completely connected except for its start and end nodes.

Close Path cannot connect fully separate paths, each with their own start and end nodes.

The start and end nodes of selected paths must be within .5 mm of one another in order for Close Path to connect them.

For gaps larger than .5 mm, use Close Selected Paths with Tolerance instead.

Related Topics

- Edit Nodes

- Open vs. Closed Shapes
- Close Selected Paths with Tolerance
- Auto-Join Selected Shapes

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5.4.2.7 Close Selected Paths With Tolerance

Quick Reference: Close Selected Paths With Tolerance

Connects the start and end of a path, within a specified distance.

Location

Edit → Close selected paths with tolerance

Close selected paths with tolerance connects individual shapes with one start and one end point by creating a new line between the points, or moving the two points together. By specifying a tolerance, you can determine how near to one another the start and end points must be in order to be closed.

Several functions in LightBurn, including Fill Mode, require shapes that are closed loops, with start and end points that are the same. This option works similarly to Close Path to close shapes with start and end points that are not the same, while providing greater control over how far apart they must be in order to connect them, and how they will be connected.

Using Close Selected Paths With Tolerance

Select all paths you wish to close and go to Edit → **Close selected paths with tolerance** to open a dialog window.

- Use the slider to set the **Distance Threshold**, or *tolerance*, which determines the maximum distance between start and end points to be connected. Start and end points that are farther apart than this threshold will be ignored.
- Select **Move Ends Together** to connect the start and end points by bringing existing lines together.
- Select **Join with Line** to create a new line segment between start and end points.
- The readout at the bottom of the window shows how many open shapes were found, how many shapes have been closed, and how many open shapes remain in your selection.

- Click **OK** to confirm the changes and close the selected shapes, or **Cancel** to discard them and leave the shapes open.

Close selectected paths with tolerance can close muliple paths at once, but they must already be completely connected except for their start and end nodes. This tool cannot connect fully separate paths, each with their own start and end nodes.

Related Topics

- Close Path
- Auto-Join Selected Shapes
- Edit Nodes
- Open vs. Closed Shapes

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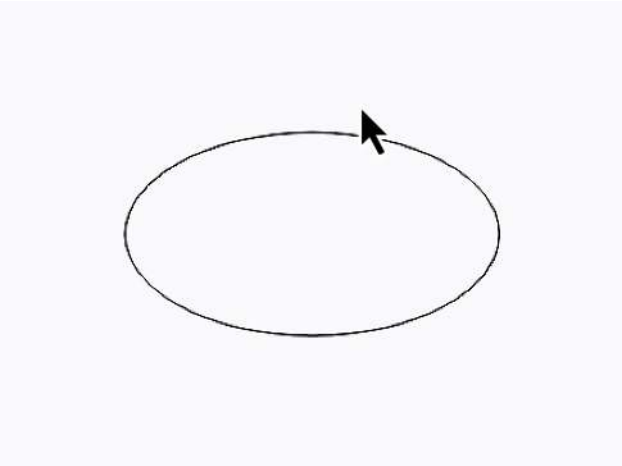
5.4.2.8 Delete Duplicates

Quick Reference: Delete Duplicates



Eliminates identical, overlapping objects.

Location

Edit → Delete Duplicates

Keyboard Shortcuts

Windows: ⎇ Alt + D

Mac: ⌥ Option + D

Delete Duplicates finds and removes duplicated objects in your project. Objects don't need to be selected in order to be identified and deleted, but must be Ungrouped and identical in size, shape, and position.

To use Delete Duplicates, go to Edit → **Delete Duplicates** or press ⎇ Alt / ⌥ Option + D.

Figure 1:

Delete Duplicates in use. The circle furthest to the right is duplicated.

Duplicated objects can cause filled objects to appear as outlines in the Workspace, even with View Style set to Filled. Those objects may also disappear in the Preview window. Duplicated objects can cause extra passes in Line Mode and failures to engrave in Fill Mode.

Troubleshooting

- Make sure objects are Ungrouped in order to be detected by **Delete Duplicates**.

Related Topics

- Preview
- Additional Selection Tools

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5.4.2.9 Break Apart

Quick Reference: Break Apart

Seperates paths into pieces.

Location

Arrange → Break Apart

Keyboard Shortcuts

Windows: ⎇ Alt + B

Mac: ⌥ Option + B

Break Apart separates the paths of selected vector graphics into the individual curves and lines that make them up. The individual segments become disconnected, allowing them to be selected and manipulated independently.

To use Break Apart, select all objects you wish to break, then go to Arrange → **Break Apart**, or press ⎇ Alt / ⌥ Option + B.

For example, a rectangular vector graphic is a path made of four straight lines connected by four nodes, with one node that is both the start and end of the path. Breaking Apart a rectangle results in four disconnected lines, each with their own start and end node.

Figure 1: Left: an unbroken rectangle with one start and end node in green Right: four separate lines with eight start and end nodes

Related Topics

- Edit Nodes
- Auto-Join Selected Shapes
- Open vs. Closed Shapes

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5.4.2.10 Optimize Selected Shapes

Quick Reference: Optimize Selected Shapes

Simplifies and smooths objects.

Location

Edit → Optimize selected shapes

Keyboard Shortcuts

Windows: ⎇ Alt + ⇧ Shift + O

Mac: ⌥ Option + ⇧ Shift + O

The **Optimize Shapes** tool simplifies and smooths selected shapes by reducing the node-count or by fitting them to arcs or lines. This is often useful when importing art created in other software, or cleaning up traced artwork.

Using Optimize Shapes

To use **Optimize Shapes**, select the shapes you want to Optimize, and make sure they're Ungrouped. Go to **Edit** → **Optimize selected shapes** or use the shortcut ⎇ Alt / ⌥ Option + ⇧ Shift + O to open the Optimize Shapes window.

Text objects or Primary Shapes must be Converted to Paths in order to Optimize them.

Optimize Shapes Window

The **Optimize Shapes** tool adjusts selected shapes within a specified *error tolerance*, which defines the maximum amount the new optimized shapes can deviate from the original source shapes.

Error tolerance is controlled by the sliders beneath each optimization option. Switches next to each option control whether they are enabled or disabled.

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

Press **OK** to confirm changes and Optimize the source shapes, or **Cancel** to discard the changes and leave the shapes as they are.

Smooth source shapes

Smooth source shapes smooths out wavy or jagged lines. This is often useful for cleaning up vectors from Image Tracing. Increase the value to strengthen the smoothing effect, at the expense of potentially losing small details or rounding off sharp corners.

Fit shapes to lines

Fit shapes to lines simplifies shapes by turning sections that are close to being a line into lines. This can reduce node count or help clean up graphics with many small or overlapping lines.

Fit shapes to arcs

Fit shapes to arcs simplifies shapes by converting lines into arcs. This can reduce node count or recreate true arcs from software that exports them as many small line segments.

Points, Lines, and Curves

At the bottom of the window, LightBurn displays the number of **Points** (nodes), **Lines**, and **Curves** (arcs) in the original shapes and in the optimized versions of the shapes.

Troubleshooting

- If the **Optimize selected shapes** menu option is grayed out, or the shortcut key doesn't open the **Optimize Shapes** window, make sure you have at least one object selected.
- If the **Optimize Shapes** window shows 0 points, 0 lines, and 0 curves, make sure your shapes are Ungrouped and that any Primary Shapes and Text have been Converted to Paths.

Related Topics

- Trace Image
- Edit Nodes

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5.4.2.11 Warp and Deform

Quick Reference: Warp and Deform

Stretch and shape objects by dragging handles positioned around or over your selection.

Location

Tools → Warp Selection

Tools → Deform Selection

Use **Warp Selection** and **Deform Selection** to stretch and shape objects in a non-linear fashion by dragging handles positioned around the perimeter of the selection or in a grid overlaid on the selection.

Using Warp or Deform

Select all objects you wish to edit, and choose either **Warp Selection** or **Deform Selection** from the Tools Menu.

Then click and drag the handles that appear on the object to make your changes.

You can modify the edit behavior in the following ways:

- Double-click on a handle to reset it.
- Hold ⇧ Shift while dragging a handle to maintain horizontal symmetry.
- Hold ⎇ Alt / ⌥ Option while dragging a handle to maintain vertical symmetry.

Warp Selection

Stretch and compress your selection according to its rectangular perimeter by dragging the handles at each of the four corners.

Use **Warp** to:

- Adjust the percieved perspective of an object (apply a perspective warp)
- Stretch or compress the corners of objects
- Create dramatic text effects

Deform Selection

Distort your selection in an organic manner by moving the 16 handles at the intersections of the overlaid grid.

Use **Deform** to:

- Fit text into the shape of another object
- Make an object fit the countours of another
- Create interesting organic shapes

Related Topics

- Transform Controls
- Shear
- Bend Text
- Apply Path to Text

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5.4.2.12 Two-Point Rotate / Scale

Quick Reference: Two Point Rotate / Scale

Rotates and resizes objects around custom pivot points.

Location

Arrange → Two Point Rotate / Scale

Keyboard Shortcuts

Windows: ^ Ctrl + 2

Mac: ⌘ Cmd + 2

Two-Point Rotate / Scale allows you to turn and resize objects around custom pivot points in your Workspace.

Using Two-Point Rotate/Scale

Select the objects you wish to edit and go to Arrange → **Two-Point Rotate / Scale**, or press ^ Ctrl / ⌘ Cmd + 2.

The Status Bar will prompt you to **Select the first point - the center of rotation**. Any object can be Rotated and Scaled using this tool, including images, Text Objects, Primary Shapes, and custom paths.

Click anywhere in the Workspace to choose this point — you can choose a point on any object in your project (such as nodes, midpoints, intersections, corners), or even a point in empty space.

The Status Bar will then prompt you to **Click and drag the 2nd point, where you will rotate from**. As you click and drag, the object Rotates.

Hold ⇧ Shift while dragging to also Scale the shape while rotating it.

As you drag, your cursor will Snap to existing objects in your Workspace, including lines, corner points, or other nodes.

Release the mouse to apply the previewed edits, or press ⎋ Esc to discard the edits and return the object to its original position.

Matching the Sides of Two Objects

To align the sides of two objects and make their sides an equal length, start by aligning a node from each side of each object using the Select tool and Snapping. As the cursor hovers over a node, it will change to a crosshair, to assist in precise placement.

Next, select the object you wish to edit, open the **Two-Point Rotate / Scale** tool, and select the aligned node as the center of rotation.

Click and drag the node at the other end of the side on the edited shape to the point on the other end of the side on the stationary shape while holding ⇧ Shift.

Release your mouse once it has snapped into place, to finalize the rotation.

Calibrating an Image to Known Dimensions

You can use **Two-Point Rotate / Scale** to straighten and calibrate an image to its real-life dimensions. This is especially useful when designing to fit existing, tangible items.

Take a photo or scan of your object with a ruler (or other object of known-size) next to it, and import that image into LightBurn.

Create a line the length of your ruler.

Align one end of the line to one end of the ruler.

Run the Two-Point Rotate / Scale tool on the image, with the first point being the aligned end, and the second being clicked from the other end of the ruler in the image, and dragged to the other end of the line.

After that, you can use the calibrated image in your project — for example, by Tracing it — and your project will be made to the correct, real-life scale.

Related Topics

- Align Tools
- Docking
- Snapping
- Transform Controls — Rotate

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5.4.2.13 Create Rubber-Band Outline

Quick Reference: Create Rubber Band Outline

Outlines a selection of objects with a new path.

Location

Arrange → Create Rubber Band Outline

Create rubber-band outline automatically makes a new shape outlining the graphics in your current selection. The new shape is defined as the shortest possible path that can contain all graphics in your selection, as if a rubber band were stretched around them.

Use this tool to quickly create cut lines around images or complex graphics, or to negate Filled areas in vector engravings.

After making a selection, go to Arrange → **Create rubber-band outline from selection**.

The outline that's created will automatically be set to the last layer you selected from the Color Palette.

Related Topics

- Offset
- Selection Tools
- Draw Lines
- Edit Nodes
- Trace Image

5.4.3 Modifying and Combining

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5.4.3.1 Flip and Mirror Tools

Quick Reference: Flip and Mirror

Reverse/invert objects along various axes.

Location

Arrange Toolbar

Arrange Menu

Keyboard Shortcuts

Various

Flip Vertical and **Flip Horizontal** mirror selected objects across their vertical or horizontal centers.

Mirror Across Line creates a mirrored duplicate of selected objects across a custom-selected line, at any angle.

Use these tools to correct orientation of graphics, or to speed up the design process when making symmetrical projects.

Flip Vertical and Horizontal

Flip Vertical and Horizontal are both available in the Arrange Menu, Arrange Toolbar, and by hotkey (see below).

Flip Vertical mirrors all selected objects across the vertical center of the selection area. The vertical center is an imaginary line across the halfway point of a selection's full height.

Flip Horizontal mirrors all selected objects across the horizontal center of the selection area. The horizontal center is an imaginary line across the halfway point of a selection's full width.

Imagine the selection area as the smallest possible rectangle that can contain every object in your selection. The vertical and horizontal centers of a selection are the same as the vertical and horizontal centers of that imaginary rectangle.

Mirror Across Line

Mirror Across Line is available in the Arrange Menu, Arrange Toolbar, and by hotkey (see below).

Mirror Across Line creates a mirrored duplicate of your selection across a custom-selected line.

- The line must be the last object added to your selection — in other words, you must first select the objects you'd like to Mirror, then select the line you'd like to Mirror them across.
- The line must be a straight line with only two points.

Use Mirror Across Line to create a symmetrical shape

Draw half the original shape, then mirror it to create the other half, like this:

Hotkeys

The keyboard shortcuts listed under **Edit Window in Focus** will only work when the Workspace — the area where you create and edit graphics — is in active focus.

What does it mean for a window to be in focus?

There are several Windows and Toolbars in LightBurn that accept user input — when a window is clicked on, it is in focus and accepting input.

If a window other than the Edit Window is in focus, click anywhere in the Workspace to bring it into focus. Selecting objects in the Workspace will also bring it into focus.

Action	Icon	Hotkey	Edit Window in Focus
Flip Vertical		^ Ctrl / ⌘ Cmd + V	V
Flip Horizontal		^ Ctrl / ⌘ Cmd + H	H
Mirror Across Line		^ Ctrl / ⌘ Cmd + ⇧ Shift + M	n/a

Related Topics

- Transform Controls
- Align
- Distribute
- Grid Array
- Circular Array
- Copy Along Path

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_offset _offset_shapes _offset_objects _border _outline

5.4.3.2 Offset Shapes

Quick Reference: Offset Shapes

Creates an outline around selected shapes, at a specified distance away or within.

Location

Modifiers Toolbar

Tools → Offset Shapes

Keyboard Shortcuts

Windows: ⎇ Alt + O

Mac: ⌥ Option + O

Keyboard Modifiers

Hold ^ Ctrl / ⌘ Cmd and click to apply the last-used Offset parameters.

The **Offset Shapes** tool creates a new shape by outlining the objects in your selection at a distance you specify, either inward, outward, or in both directions at once.

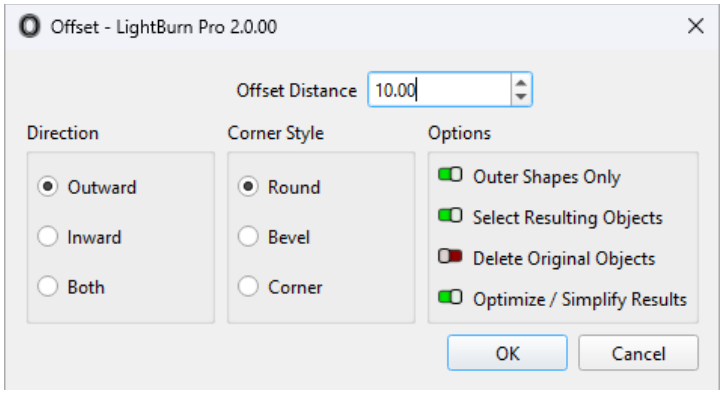
Offset Shapes works with any vector graphic, including paths, Primary Shapes, and Text Objects. You can offset multiple shapes, as well as Grouped shapes, all at the same time.

It's great for making borders around text, cut lines around engravings, inverting engravings, and creating a variety of patterns.

Using the Offset Shapes Tool

To open the **Offset Shapes** tool, first select all shapes you'd like to offset, then go to Tools → **Offset Shapes**, click the Offset button in the Creation Toolbar, or press `⎇ Alt` / `⌥ Option` + `O` to open the **Offset** dialog window, where you establish the settings that will determine the size, shape, and direction of your offset.

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Offset Distance

Offset Distance controls the amount the new shape will be offset away from the original. Adjust the distance by typing a value into the adjacent field, clicking the arrow buttons, hovering over it and scrolling with your mouse wheel, or dragging with two fingers, if you're using a trackpad.

Direction

Direction determines on which side of the original shapes the new offset shape will be created.

- **Outward (left)** offsets away from the original shapes.
- **Inward (right)** offsets in toward the center of the original shapes.
- **Both** creates two new offset shapes, one Outward and one Inward from the originals.

Note

You can only create Inward offsets for shapes that are closed, meaning they are complete, continuous loops whose start and end nodes are the same.

Corner Style

Corner Style controls the style of the corners in the offset shapes. You can choose **Round**, **Bevel**, or **Corner**.

Corner Style and Inward/Outward Corners

Corner Style affects outward- and inward-pointing corners differently — offset corners are only beveled or rounded when they're created in the direction a corner points. In the opposite direction, offset corners are *always* corners as well.

Notice the difference in the inward and outward offsets for the letter T below. The corners of the outer offset are beveled and rounded where the corners of the T point out, while the corners of the inner offset are beveled and rounded where the T's corners point in.

Options

Each switch beneath **Options** can be enabled or disabled. When enabled:

- **Outer shapes only**: will ignore any shapes contained within others when creating the offset, leaving just the outermost border.

Use Offset Shapes to create a cut around a complex engraving

- **Select resulting objects**: will select the new path you created upon completion of the offset.
- **Delete original objects**: will delete the objects that you had selected before opening this dialog, replacing them with the new offset.
- **Optimize / Simplify results**: will reduce the number of nodes in the result, great for reducing file size of complex objects such as image traces.

Previewing and Completing the Offset

When you open the **Offset** dialog window, the offset that will be created as the result of your settings will appear in your Workspace, and will live-adjust to reflect settings changes you make.

Click **OK** to create the offset, or **Cancel** to discard the settings and exit the window.

Tip

To repeat an offset with the last settings you used, select the shapes you wish to offset, then hold `^ Ctrl` / `⌘ Cmd` while clicking the **Offset** button. It will perform the offset operation using the previous settings, without bringing up the dialog.

Tips

- **Offset Shapes** can sometimes fix odd or broken vectors by running the offset with a **Distance** of 0.
- You can use Offset to invert/negate an engraving:

Use Offset Shapes to invert an engraving

Related Topics

- Create Rubber-Band Outline
- Draw Lines
- Edit Nodes

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5.4.3.3 Boolean Tools

Quick Reference: Boolean Tools

Use the **Boolean** tools to combine existing shapes (or Grouped shapes) into new or more complex shapes.

Location

Modifiers Toolbar

Tools Menu

Keyboard Shortcuts

Various

Use the **Boolean** tools to combine existing shapes (or Grouped shapes) into new or more complex shapes. There are three Boolean options, along with one very similar option, **Weld**.

Using the Boolean Tools

All of the **Boolean** tools and **Weld** are available in the Modifiers Toolbar, Tools Menu, or by keyboard shortcut.

The **Weld** tool sits above the **Boolean** tools in the Modifiers Toolbar.

All Boolean tools are stacked into a single button.

- The Boolean Assistant is the default option, and clicking once will open it.
- You can click the arrow in the lower right corner of the icon, or click and hold anywhere on the icon, to open a submenu with the individual tools.
- Selecting an option will perform that operation, and will also make it the button's active operation, meaning you can subsequently click the button once to perform that operation again.

There are a few important things to keep in mind when using the Boolean tools and Weld:

- All selected shapes must be closed shapes, meaning they are complete, continuous loops whose start and end points are the same. If there are open shapes in your selection, the tools will be grayed out and unavailable.
- The Boolean tools work with vector objects only. If there are any images in your selection, the tools will be grayed out and unavailable.
- To use any of the Boolean tools, you must have exactly two shapes, two Groups of shapes, or one shape and one Group selected. If you have more than two shapes or Groups selected, the Boolean tools will be grayed out and unavailable.
- You can use Weld to combine more than two shapes at once.

- Grouping multiple shapes together tells MillMage to treat them as a single shape. For example, Group an outer circle with an inner circle to treat it as a donut shape rather than two separate circles. Grouping shapes in this way can sometimes yield different results than you'll see with the same objects when they're not Grouped.

Boolean Union

`⎇ Alt` / `⌥ Option` + `+`

Boolean Union merges two shapes into one.

Boolean Subtract (Boolean Difference)

`⎇ Alt` / `⌥ Option` + `-`

Boolean Subtract removes one shape from another.

The second shape you add to your selection is subtracted from the first, and deleted.

If you select the shapes in the incorrect order, and subtract the wrong shape from the other, Undo the action, then use Boolean Subtract again — the alternate shape will be removed instead.

Boolean Intersection

`⎇ Alt` / `⌥ Option` + `*`

Boolean Intersection creates a new shape out of the overlapping area of two shapes.

Weld

`^ Ctrl` / `⌘ Cmd` + `W`

Weld works similarly to Boolean Union, but instead of being limited to combining only two shapes or two Groups of shapes, you can use Weld with any number of objects.

Boolean Assistant

^ Ctrl / ⌘ Cmd + B

> **Note**
>
> If you have Beginner Mode enabled, all three Boolean tools will be replaced in the Modifiers Toolbar with a single icon that opens the Boolean Assistant.

The **Boolean Assistant** is a dialog window that shows a preview of what each of the **Boolean** operations will do to your selected shapes, and gives you the option to click **OK** to confirm the change, or **Cancel** to discard it and close the Boolean Assistant.

To open the Boolean Assistant, go to Tools → **Boolean Assistant**.

Click an operation to see a preview of the result in your Workspace. If the shapes are not too complex, hovering over an operation without clicking will also show what the result will be.

Click or hover over **Reset** to return the shapes to their original appearance, while keeping the Boolean Assistant open.

Weld vs. Boolean Union

In cases where some shapes are fully contained within other outer shapes, using **Weld** won't yield the result you're looking for, but Grouping related shapes together and using **Boolean Union** will.

If you Weld something and some or all of the middle content disappears — for example if you are trying to Weld text inside a ring, and the text disappears — use Boolean Union after making two Groups: one of the border pieces, and one of the middle content.

Hotkeys

Action	Icon	Hotkey
Boolean Assistant		^ Ctrl / ⌘ Cmd + B
Boolean Union		⎇ Alt / ⌥ Option + +
Boolean Subtract		⎇ Alt / ⌥ Option + -

Action	Icon	Hotkey
Boolean Intersection		⎇ Alt / ⌥ Option + *
Weld		^ Ctrl / ⌘ Cmd + W

Related Topics

- Cut Shapes
- Trim Shapes
- Grouping
- Masking

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5.4.3.4 Cut Shapes

Quick Reference: Cut Shapes

Divides selected objects along the perimeter of another shape.

Location

Tools → Cut Shapes

Keyboard Shortcuts

Windows: ⎇ Alt ⇧ Shift + C

Mac: ⌥ Option ⇧ Shift + C

The **Cut Shapes** tool divides selected vector objects into separate shapes, using a closed shape as the cutting tool. The last shape you add to your selection is used as the cutting tool, and all other selected shapes are cut at the locations they intersect with the cutting tool.

Using Cut Shapes

To use **Cut Shapes**, first select the shapes you wish to cut, then add the cutting tool shape to your selection.

Go to Tools → **Cut Shapes** or press ⎇ Alt / ⌥ Option + ⇧ Shift + C to activate the tool.

Use Cut Shapes to cut a project into smaller sections that can be run separately, allowing you to create projects that are larger than your laser's work.

A few things to always keep in mind when selecting and using a cutting shape:

- The last shape you add to your selection is used as the cutting tool.
- The cutting tool must always be a closed shape, meaning it is a complete, continuous loop whose start and end points are the same.
- The cutting shape must not be Grouped with any other shapes. Ungroup any shape you'd like to use as a cutting shape.
- The cutting tool is deleted in the process — if you'd like the shape you're using as a cutting tool to remain in your design after using it with Cut Shapes, first Duplicate it, and then select just one copy to use with Cut Shapes.

And note the following about the resulting shapes:

- The resulting shapes are automatically sorted into two Groups — one Group for shapes that were inside the cutting tool, and another for shapes that were outside it. You'll need to Ungroup the shapes to manipulate them individually.

- The resulting shapes are automatically closed if they were set to a Fill or Offset Fill layer, or left open if they were set to a Line or Tool layer.

  In other words, for shapes set to a Fill or Offset Fill layer, LightBurn will automatically add a new line on all new shapes, connecting the gap where the cutting shape severed the originals. If they are set to a Line or Tool layer, the gap will remain.

Cut Shapes and Images

If you use **Cut Shapes** with an image, LightBurn will automatically create two masked copies of the images — one copy will be masked to show the part of the image that was inside the cutting shape, and the other copy will be masked to show the part that was outside. The cutting shape will also be duplicated, and each copy will be reassigned to a Tool layer.

Troubleshooting

If **Cut Shapes** is grayed out in the Tools Menu, it means the object you selected last is not a valid shape to use as a cutting tool.

- The cutting tool must be a closed shape, meaning it is a complete, continuous loop whose start and end points are the same.
- The cutting tool must not be Grouped with any other objects.

Related Topics

- Trim Shapes
- Boolean Tools
- Apply Mask to Image
- Print and Cut — Cutting a Project Larger Than Your Laser's Workspace
- Open vs. Closed Shapes

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5.4.3.5 Grid Array

Quick Reference: Grid Array

Copies objects into rows and columns.

Location

Modifiers Toolbar

Arrange → Grid / Array

The **Grid Array** tool creates copies of an object (or objects) in regularly spaced rows and columns, and includes options to adjust spacing, mirror the shapes, randomize orientation, and more.

Use the Grid Array tool to:

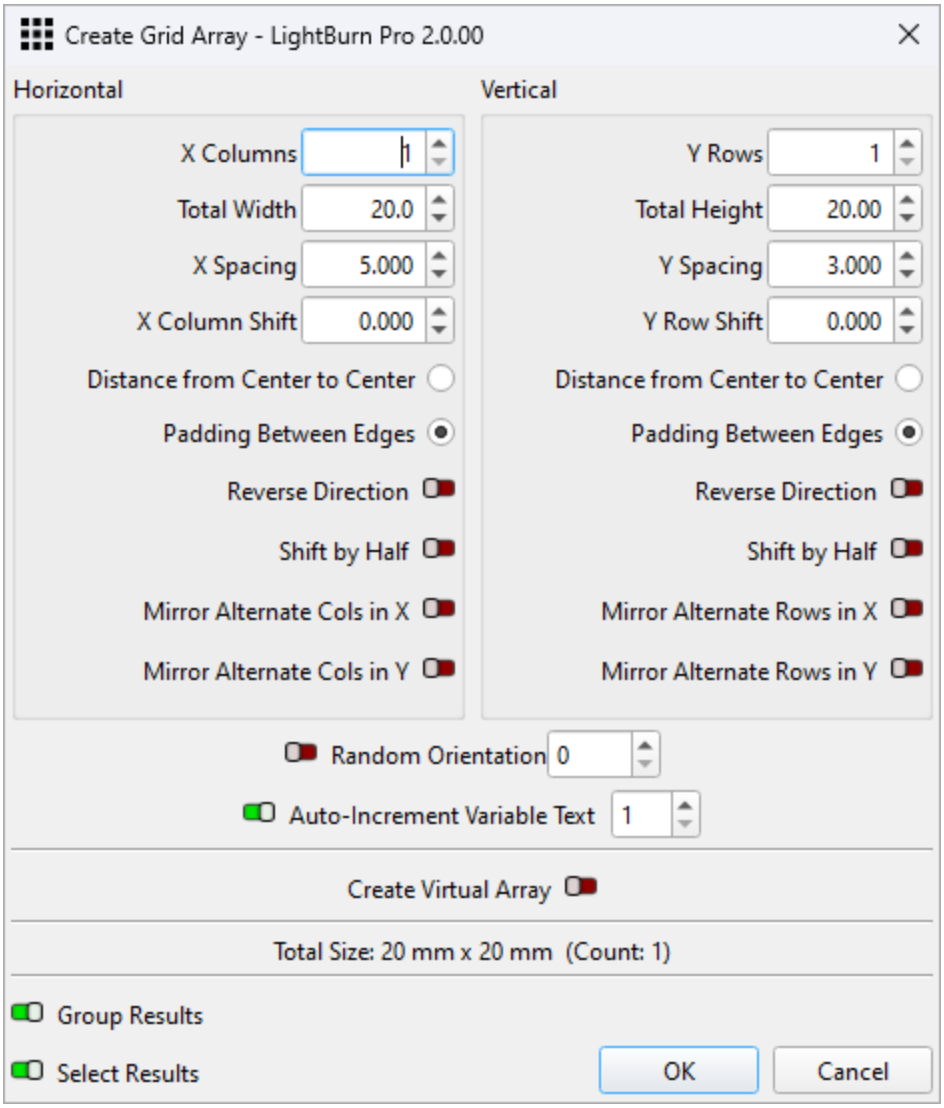
- Duplicate designs for batch production

- Maximize material utilization
- Create designs that require precise spacing
- Make interesting patterns

Grid Array Settings

To open the **Create Grid Array** window, select all objects you'd like to array, then go to Arrange → **Grid / Array**, or click the Grid Array button in the Modifiers Toolbar.

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



X Columns and Y Rows

Specify the number of copies to make in the horizontal (X) and vertical (Y) dimensions.

Total Width and Total Height

Alternative options for specifying the number of copies to make in each dimension. Set the values in these fields to match the size you'd like the grid to occupy, and LightBurn will set X Columns and Y Rows to whatever is necessary to fill the specified size without going over, taking into account the other settings below.

If you do not adjust these fields directly, they will automatically change to reflect the width and height of your grid, as determined by your other settings.

X Spacing and Y Spacing

Determine the distance between each copy, in the horizontal and vertical dimensions. For each dimension, you can select to space based on **Distance from center to center** of objects or **Padding between edges** of objects (see below).

Distance From Center to Center

When selected, **X** and **Y Spacing** will set the distance between the centers of each copy in the grid.

Padding Between Edges

When selected, **X** and **Y Spacing** will set the distance between sides of each copy in the grid.

X Column Shift and Y Row Shift

Offset every other column or row by the specified amount, shifting alternate columns or rows left, right, up, or down.

Reverse Direction

Changes the direction in which copies are produced. Can be enabled individually for each dimension.

Shift by half

Offsets alternate columns or rows by half the total width or height of the original object.

Mirror Alternate Columns in X or Y and Mirror Alternate Rows in X or Y

Flip copies of the original object(s) in the selected dimension, for alternate columns or rows.

Maximize material utilization with Grid Array

Use the X/Y Spacing, X/Y Shift, and Mirror options individually or in combination with one another to efficiently lay out objects for maximum material utilization.

Random Orientation

Randomly rotates each copy of the original object(s). Use the field next to the Random orientation switch to enter a *seed number* that is used as the starting point of the randomly generated orientation. Re-using the same seed number will duplicate the same randomly generated orientation later on.

Auto-Increment Variable Text

Applies an **Offset** to text in each copy created in the array, automatically advancing output if you are using **Merge/CSV** or **Serial Number** formatting. The field next to the switch determines the amount by which each duplicates' Offset will advance.

See our documentation on using Variable Text for more information.

Use Grid Array to automatically increment Variable Text

Create Virtual Array

Makes an array of synced clones of the original object(s), instead of independent copies. See below for more information.

Total Size and Count

Display the resulting array's size in and X and Y, and total number of copies, including the original.

Group Results

When enabled, automatically Groups all objects in the array after it's created.

Select Results

When enabled, all objects in the array are automatically added to your selection when it's created.

OK and Cancel

Press **OK** to confirm your settings and create the array, or **Cancel** to discard settings and not create the array.

Virtual Arrays

Enabling the **Create Virtual Array** option in the **Create Grid Array** window generates an array of synced clones, instead of making copies of the original objects.

The clones render with dashed outlines and muted fill colors, to indicate that they are virtual copies.

Any changes made to the original copy in the array will be applied to the clones, but the clones themselves are not selectable or adjustable.

Using Variable Text in Virtual Arrays

When using Variable Text in a **Virtual Array**, using the Test button will not show the final output of the Variable Text in LightBurn's workspace. To see an accurate preview, you'll need to use the Preview window.

Modifying Virtual Arrays

Select and right-click any original object that is part of a **Virtual Array** to open a context menu where you'll see several additional actions you can perform after creating the array.

You do not have to select *all* original objects used in the array.

- **Edit Array** displays the **Create Grid Array** dialog again, allowing you to modify any of the parameters, and even convert the array into a normal array by unchecking **Create Virtual Array**.
- **Duplicate Array** duplicates the entire Virtual Array and all of the objects in it.
- **Flatten Array** converts the Virtual Array into a standard array where all objects are separate copies and no longer synced to the original objects.
- **Remove from Array** remove the currently selected object(s) from the virtual array.
- **Add to Array** adds any currently selected object not in the virtual array to the array. Note: to see this option, you must select at least one object that is currently in a virtual array and one object that is not.
- **Exit Array** removes the Virtual Array, without deleting the original copies.

Related Topics

- Variable Text
- Circular Array
- Copy Along Path

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5.4.3.6 Circular Array

Quick Reference: Circular Array

Creates copies of objects in a circular pattern.

Location

Modifiers Toolbar

Arrange → Circular Array

Circular Array arranges multiple copies of an object — or multiple objects — in a radial pattern around either a point in space, or a central object.

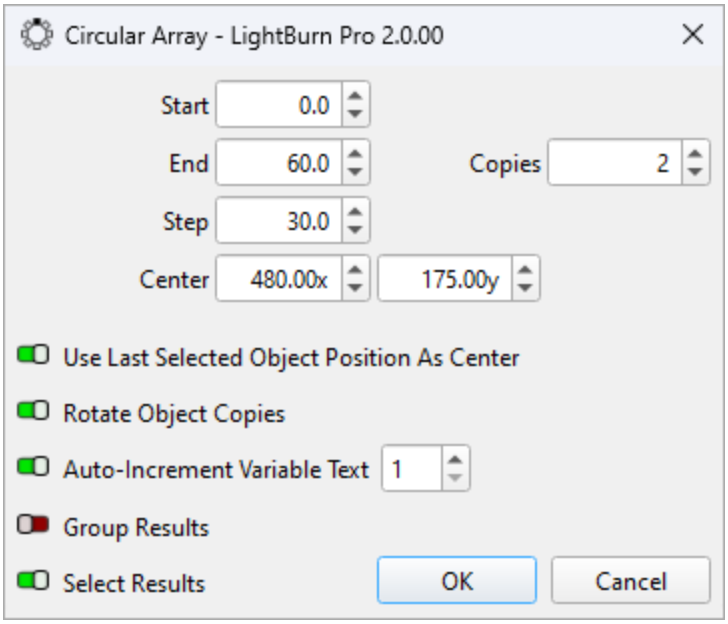
Use the Circular Array Tool to:

- Create organic radial patterns such as mandalas and flowers by duplicating simple shapes
- Create even spacing around a circle, such as numerals and markings on a clock face
- Make geometric radiating designs such as starburts or cogs
- Create decorative round frames or borders
- Distribute mounting holes in a circular formation

Circular Array Settings

To open the **Circular Array** window, select all objects you'd like to duplicate, then go to Arrange → **Circular Array**, or click the Circular Array button in the Modifiers Toolbar.

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Copies

Enter the number of items you wish to appear in the final array into the **Copies** field.

Center of Rotation

There are two ways to set the center of rotation for your array:

- Enter the x and y coordinates of a spot in your Workspace into the **Center** fields.
- Turn on **Use last selected object position as center** to array the copies around the center of the last object you added to your selection.

Start and End

An array doesn't have to span the whole 360-degree rotation, you can limit the duplications to only part of the circle using the **Start** and **End** fields.

Step

You can specify the angle between the copies in the **Step** field. This value is mathematically tied to the **End** and **Copies** fields.

Rotate Object Copies

Enable **Rotate object copies** to turn copies so that the same part of each duplicate faces the center, like the tickmarks on a stopwatch. Disable it to keep the copies in their original rotation, like the numerals of a clock that remain upright for readability.

Auto-Increment Variable Text

Auto-Increment variable text works in conjunction with Variable Text, increasing the Offset value in the Text Options Toolbar value by the specified amount for each copy. Using Offsets allows you to use the same formatting expression to output different data.

Group Results

Enable **Group Results** to have the output automatically Grouped upon completion of the array.

Select Results

Enable **Select Results** to have output automatically selected upon completion of the array.

OK and Cancel

Press **OK** to confirm your settings and create the array, or **Cancel** to discard settings and not create the array.

Related Topics

- Grid Array
- Variable Text
- Copy Along Path

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5.4.3.7 Copy Along Path

Quick Reference: Copy Along Path

Duplicates an object along a line, curve, or other shape.

Location

Arrange → Copy Along Path

Use **Copy Along Path** to create repeated designs that follow a line, curve, or perimeter of a shape, for example:

- Decorative borders along, inside, or outside edges of a shape.
- Repetitive designs that flow along a line such as ropes, vines, and chains.
- Precisely-spaced patterns that follow a vector path, for example measurements on a curved ruler.

Using Copy Along Path

Copy Along Path works by duplicating copies of one object along the path of another.

Select the object to be copied first. Add the path to the selection (hold `⇧ Shift` while clicking the path), and go to Arrange → **Copy Along Path** to open the tool.

Adjust the options according to your needs — you'll see a preview of the result in the Workspace as you make changes.

Click **OK** to confirm the copies, or **Cancel** to discard them.

Requirements

The **object to be copied** must be:

- A vector object — *not* an image
- A single object or a single Group of objects
- Selected first

The **path** must be:

- A vector — *not* an image
- A single, individual object — *not* a Group
- Selected second

Placement

The placement of the original object to be copied relative to the start of the path determines the position of the copies.

Place the center of the object to be copied on the start of the path to superimpose each copy over the path.

Offset the object to be copied from the start of the path to maintain that distance from the path with each copy.

Open vs. Closed

When using a closed path, the copied objects will start at whatever part of the path is closest, and then wrap around the circuit of the path to meet back up at the same point.

When using an open path, it's best to center the object to be copied over an end point of the path. This will create even spacing along the entire path.

Options

Spacing

The spacing of copied objects is measured from the centers of each copied object. There are two ways of spacing the copies objects along the path:

- **Number of Copies** spreads a certain quantity of them along the path, with even spacing between.
- **Space Between Copies** fills the path with as many copies as it can fit, given the spacing you provide. This usually leaves some excess line at the end of the path.

Rotate Copies

Enable **Rotate Copies** to create duplicates that are oriented acording to the changes in direction of the path. Disable this option to create objects that remain in the same orientation as the originally-copied object.

Scale Copies

Enable **Scale Copies** and enter a value in the adjacent field to incrementally change the size of each copy, with the final one reaching a size equal to this percentage of the original's size. A number larger than 100 will increase the sizes of the copies, a number lower than 100 will decrease them, and setting it to 100 (or disabling the switch) will keep the copies the same size as the original.

Auto-Increment Variable Text

Use **Auto-Increment variable text** in conjunction with Variable Text to add text-based codes that are substituted for other data when you send a project to your laser. Enabling Auto-Increment variable text will apply an Offset to each copied Text Object, so different data will output in the place of the same formatting expressions.

Select Results

Toggle this on to automatically select the resulting copies after clicking **OK**.

Troubleshooting

- **Copy Along Path** is not to be confused with Apply Path to Text, which attaches a single Text Object to a vector object, reshaping it to follow the contour of the chosen path.
- If your copies aren't appearing where you expected, check that their starting placement is set appropriately for your goals.
- If Copy Along Path is grayed out in the menu, it's likely that your objects are not suitable or they haven't been selected in the correct order.

Related Topics

- Apply Path to Text
- Circular Array
- Grid Array

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5.4.3.8 Apply Path to Text

Quick Reference: Apply Path to Text

Attaches text to a vector object.

Location

Tools → Apply Path to Text

Right-click → Apply Path to Text

Apply Path to Text attaches text to a vector object, reshaping it to follow the contour of the chosen path. This tool makes it possible to use existing or custom-created paths to apply more complex curves to text than can be achieved using the text Bend tool.

Using Apply Path to Text

Select a single block of text and single shape at the same time, then go to Tools → **Apply Path to Text**, or right-click and select Apply Path to Text from the context menu.

The text is automatically moved to the location of the shape, and adjusted to follow its contour.

The text can no longer be independently moved after it is attached to the path, but all text attributes in the Text Options Toolbar can still be modified.

Making Adjustments in the Text Options Toolbar

Note

In the case of text, *horizontal* always refers to the direction of the text as it is read, regardless of whether the Text Object is rotated. *Vertical* refers to the opposite direction, regardless of rotation.

The horizontal position of the text is oriented relative to the start and end points of the path using the **Align X** options. **Middle** aligns the text between the start and end points, **Left** aligns it so that the start of the text is next to the start point of the path, and **Right** aligns it so that the end of the text is next to the end of the path.

The vertical position of the text is positioned using the **Align Y** options. **Middle** places the text's vertical center on the path, **Bottom** places the bottom of the text directly on top of the path, and **Top** places the top of the text directly under the path.

Manipulating and Deleting Paths

The position and shape of the path remain manipulable, and the text will automatically adjust to follow any changes made to the contour of the path.

Using Edit Nodes to manipulate paths

Use the Edit Nodes tool to manipulate nodes on a path that has already been applied to text, and adjust its appearance according to your visual preference.

To remove the text from the path, the path must be deleted. Deleting the path returns the text to its original orientation, but does not affect any settings in the Text Edit toolbar.

Tip

If you have applied text to a path that you do not want cut or engraved by your laser, but do not wish to delete either, assign the path to a Tool layer, as shown in the demonstrations above. Tool layers are special layers that are never sent to your laser.

Troubleshooting

- If text applied to a path is upside down or mirrored, you may need to Flip the text before applying the path to it, or Rotate or re-construct the path to correct the orientation.

  When manually creating a path with the Draw Lines tool, the first point you click is always the start point, and the last is always the end point.
- To use **Apply Path to Text**, you must have exactly one Text Object and one vector object selected. If the option is grayed out and unavailable, make sure the vector object you have selected is a single, connected path, and not multiple adjacent but disconnected paths. Use Edit Nodes or Auto-Join Selected Shapes to join disconnected paths.
- Grouped objects do not work with Apply Path to Text. **Ungroup** all text or vector objects you wish to use with this tool.

Related Topics

- Create and Edit Text
- Text Options Toolbar
- Copy Along Path
- Draw Lines
- Edit Nodes

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5.4.3.9 Radius/Fillet

Quick Reference: Radius/Fillet

Rounds over sharp corners, takes a round bite out of a corner, or removes an existing radius.

Location

Modifiers Toolbar

Use the **Radius Tool** to fillet (round over) sharp corners, take a round bite out of a corner (using a negative radius value), or turn a radius back into a sharp corner (remove a radius).

You can use Radiuses to:

- Round out corners for a softer appearance
- Create smooth transitions between sharp lines
- Form more complex shapes (varying sizes and types)
- Add rounded details to projects
- Round out corners of tabs, to enable easy assembly

Using the Radius Tool

You can apply a radius to any corner node of any Ungrouped path or Primary Shape, provided that the lines on either side of the node can accomodate the size of the radius. Radiuses can be applied to text if you first convert it to paths.

Add a Radius to a Path

To add a radius, first click the **Radius Tool** icon in the Modifiers Toolbar.

Set the radius value to the size of the radius you wish to create — there must be enough room between the corner and nearby points to accomodate this value.

If you change the radius to a negative number it takes a fancy little bite out of the corner.

Select the object you want to modify, and click on a corner to apply the radius.

To exit the Radius Tool, press ⎋ Esc on your keyboard.

When the Radius Tool is active, the icon changes as you hover over a corner to indicate whether the Radius Tool can be used. If it can't be used, the cursor will change to indicate that there is not enough space.

Icon	Meaning
	Click to fillet corner
	Click to remove fillet
	Can't fillet — not enough space

Remove or Change a Radius

You can also use the Radius Tool to remove rounded corners (returning them to a sharp one) by clicking on them. This even works on imported designs that were made in different software, as long as the software exported actual arcs.

After removing a radius, you can then apply a differently-sized one to the corner, as normal.

Adding a Radius to a Rectangle

You can apply radiuses to Rectangles in the Shape Properties Window. This method has the advantage that resizing the rectangle won't change the size of the radius, allowing you to maintain consistency in a design.

Rectangles also have a handle that acts as a shortcut for the Radius value. With a Rectangle selected, hold ^ Ctrl / ⌘ Cmd, and a blue *corner radius control* will appear. Drag the blue handle away from the corner to increase the radius of all four corners, and drag back toward the corner to decrease it. Dragging vertically creates a reversed radius, with a bite taken out of the corner.

Troubleshooting

- The **Radius Tool** cannot be used with Grouped shapes. **Ungroup** any shapes you'd like to apply a radius to.
- If the cursor isn't appearing as you hover over a corner, make sure you've selected the Radius Tool in the Modifiers Toolbar. The Radius icon should be highlighted. Also check that you have selected the object you wish to edit by clicking on it.
- Radiuses can only be applied where there is room for the radius to be applied. If you see the following icon, it means there is not enough room:

- If a radius still can't be applied, it might be because the two lines that make up the corner aren't actually joined at that point. To check, move the corner using the Edit Nodes tool. If it splits off into two lines, bring the one you moved back toward the other so that they snap together and join, and then try the radius again.
- If you are having trouble converting a rounded corner back into a sharp one, it could be because there is not a true arc at the corner. This is most common with imported shapes, because some programs export arcs as a series of tiny lines. You can try recovering the arcs with Optimize Selected Shapes.

Related Topics

- Edit Nodes
- Primary Shapes: Rectangles, Ellipses, and Polygons
- Shape Properties
- Offset Shapes

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5.4.3.10 Make Same Width or Height

Quick Reference: Make Same Width or Height

Resizes objects to the same X or Y dimensions.

Location

Arrange Toolbar

Keyboard Modifiers

Hold `⇧ Shift` to lock aspect ratio.

The **Make Same Width** and **Make Same Height** buttons resize all objects in your selection to the width or height of a single object in the selection.

By default, all selected objects will be resized to the width or height of the *last object* you added to the selection. For exceptions to that rule, see below.

Using the Make Same Width and Height Tools

Both buttons are available in the Arrange Toolbar and **Arrange (long) Toolbar**.

Option	Icon
Make Same Width	
Make Same Height	

Select all objects you wish to resize, followed by the object whose width and/or height you wish to match, then click either **Make Same Width** or **Make Same Height**.

Grouped objects are treated as single objects when using the Make Same tools — the overall width or height of an object or entire Group will change to match the width or height of the last-selected object or other Group.

Hold `⇧ Shift` while clicking to lock the aspect ratio of the objects you're resizing, adjusting both dimensions at once.

Note

Holding `⇧ Shift` *does not* change both dimensions of objects in your selection to match those of the last-selected object — it only matches the selected dimension to that of the last-selected object, and adjusts the alternate dimension to maintain the same proportional length to the changed dimension.

For example, for a 40 mm (wide) x 20 mm (high) square, if you held `⇧ Shift` while clicking Make Same Width to match it to a 10 mm wide object, it would become a 10 mm x 5 mm square.

Resizing Priority

When using either of the **Make Same** options, all selected objects are matched to the width or height of a single object or Group in your selection.

The object that is matched to is determined according to the following priorities:

- Selection order: by default, all objects are resized to match the last object you added to your selection.
- Draw order: if you have nothing selected, then select multiple objects at once, they are matched to the first object in your selection's draw order. Use Push to front to move an object to the first position in the draw order.
- Combined order: if you add multiple objects at once to an existing selection, all selected objects are matched to the first object in the draw order of the objects you added to your selection last.
- If a single object in your selection is Locked, all objects are matched to the Locked object.
- If multiple objects in your selection are Locked, the Locked objects are not matched, and the rest of the objects are matched according to selection order or draw order.

Related Topics

- Numeric Edits Toolbar
- Align Tools
- Push in Draw Order
- Distribute

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5.4.3.11 Resize Slots

Quick Reference: Resize Slots

Adjusts the dimensions of slots, fingers, or tabs.

Location

Tools → Resize Slots in Selection

Use **Resize Slots** to adjust the dimensions of slots or tabs in selected objects.

You can use Resize Slots to adjust a jointed design that was intended for a material of a different thickness, or to adjust slots or tabs back to their original size after you rescaled an entire design.

This tool works on two main forms of geometry:

- Slots, like those found in 3D puzzles or partitions in trays, somewhat similar to a traditional halved joint or dado.
- Tabs, like a tenon or the fingers in a box joint, usually found in boxes and drawers.

> **Note**
>
> This is a separate tool from Add Tabs, which creates small sections of cuts that the laser is commanded to skip, to prevent objects that you are cutting from immediately falling out of the base material.

Using Resize Slots

Before opening the **Resize Slots** tool, you'll need to know the existing length of the lines you want to adjust. Use the Measure tool to read the length of an individual slot or tab.

Select all objects with slots or tabs you'd like to resize, then go to Tools → **Resize Slots in Selection** to open the **Resize Slots** dialog window.

Settings

- **Old Material Thickness** defines the current length of the slots or tabs you want to identify and adjust.
- **New Material Thickness** defines the length you want to adjust the slots or tabs to.
- **Tolerance** specifies an added amount of padding to Old Material Thickness — slots or tabs that are within the range of Old Material Thickness plus or minus Tolerance will be identified by the resizer.

  This helps if the slots or tabs vary slightly in length, or if there are kerf offsets built into the original design.
- Select **Adjust Slot Depth** to adjust the bottom/innermost line of slots. This allows you to keep the outer size of the assembled piece the same.
- Select **Adjust Slot Width** to adjust the sides of slots. Typically used when the slots are meant to intersect on the interior of a laser cut piece instead of on the corners, like boxes.py's tray insert.
- Select **Adjust Tab Height** to adjust the top/outermost line of tabs. This allows you to keep the interior size of the assembled piece the same, while making it bigger or smaller on the outside.
- Click **Apply** to implement a given set of adjustments and continue working in the Resize Slots dialog window.
- Click **OK** to implement of a set of changes and immediately exit.
- Click **Cancel** to immediately exit and discard changes, if you have not already pressed Apply to implement them. To revert changes you already implemented with Apply, exit the Resize Slots dialog window, then press `^ Ctrl` / `⌘ Cmd` + `Z` to Undo them.

Troubleshooting

- The tool doesn't work on internal slots/cutouts/mortises, as it's tricky for the computer to determine which direction they should grow or shrink.
- The tool searches Ungrouped objects. Exit the Resize Slots dialog and Ungroup your objects if you see a warning message indicating that there are Grouped objects in your selection.

- The tool only works on sharp (not filleted/rounded) corners. Some tools (like boxes.py) default to adding small loops on internal corners and small fillets/rounded corners on external ones. Remove the external fillets using the Radius tool and the internal loops using the Offset tool, set to 0.
- The tool requires well-formed shapes as an input. If the shape has extra nodes, or if any of the lines are technically curves (even if they're straight), it will interfere with slot/tab detection. The highlighted sections in the image below show examples of problematic shapes. Use Optimize Selected Shapes to try to repair these shapes.

Related Topics

- Kerf Offset
- Measure
- Grouping
- Optimize Selected Shapes

5.4.4 Arrangement

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5.4.4.1 Align Tools

Quick Reference: Align

Arrange selected objects along edges or center points.

Location

Arrange Toolbar

Arrange → Align

Keyboard Shortcuts

Various

The **Align** tools reposition selected objects to align them along their:

- Top, bottom, left, or right edges
- Vertical or horizontal centers
- Center points

By default, the **Align** tools move objects in your selection to align them to an edge or center of the *last object* you added to your selection. For exceptions to that rule, see below.

Align Options

The **Align** tools are available in the Arrange Menu and Arrange Toolbar.

In the standard Arrange Toolbar, they are presented in dropdown menus for the vertical and horizontal options:

In the **Arrange (long) Toolbar**, the Align tools are each presented individually:

Hotkeys

All seven **Align** options and their actions are listed in the table below.

The hotkeys listed under **Windows** and **macOS** will work at any time that you have objects selected.

The hotkeys listed under **Edit Window in Focus** will only work when the Workspace — the area where you create and edit graphics — is in active focus.

What does it mean for a window to be in focus?

There are several Windows and Toolbars in LightBurn that accept user input — when a window is clicked on, it is in focus and accepting input.

If a window other than the Edit Window is in focus, click anywhere in the Workspace to bring it into focus. Selecting objects in the Workspace will also bring it into focus.

Align Option	Icon	Action	Windows	macOS	Edit Window in Focus (All Systems)
Align Centers		Aligns the center points of selected objects.	n/a	⌥ Option + Fn + ← Left	n/a

Align Option	Icon	Action	Windows	macOS	Edit Window in Focus (All Systems)
Align Vertical Centers		Aligns selected objects along their vertical centers.	⎇ Alt + Pg Up	⌥ Option + Fn + ↑ Up	C
Align Horizontal Centers		Aligns selected objects along their horizontal centers.	⎇ Alt + Pg Dwn	⌥ Option + Fn + ↓ Down	E
Align Left		Aligns selected objects along their left edges.	⎇ Alt + ← Left	⌥ Option + ← Left	L
Align Right		Aligns selected objects along their right edges.	⎇ Alt + → Right	⌥ Option + → Right	R
Align Bottom		Aligns selected objects along their bottom edges.	⎇ Alt + ↓ Down	⌥ Option + ↓ Down	B
Align Top		Aligns selected objects along their top edges.	⎇ Alt + ↑ Up	⌥ Option + ↑ Up	T

Using the Align Tools

Click a given **Align** icon or use its hotkey to align selected objects to the last object you added to your selection (exceptions below).

Edges of individual objects are defined according to their farthest points in each direction. For example, the top edge of a triangle is a horizontal line extending from its top point, its left edge is a vertical line extending from its bottom left corner, and so on.

An object's vertical center is defined as a vertical line dividing it halfway along its total width, and its horizontal center is a horizontal line halfway along its total height. Its center point is the location where those lines intersect.

Grouped objects are treated as single objects when using the Align tools — they will always maintain their relative position to one another, and their edges and centers are defined according to the dimensions of the entire Group.

Align Tools Helper

If you're using Beginner Mode, clicking the **Align Left** icon in the Arrange Toolbar will open the **Align Tools Helper**.

Click or hover over any button in the Helper to see a preview of how alignment will change.

Click **OK** to confirm the changes, or **Cancel** to discard them.

Alignment Priority

Selecting an object to align to

After selecting multiple objects, hold down `^ Ctrl` and click twice on the object you want to align to. This will deselect and reselect it, making it the top priority for alignment.

When using any of the **Align** options, all selected objects move to align to an edge or center of a single object or Group in your selection.

The object that is aligned to is determined according to the following priorities:

- Selection order: by default, all objects are aligned to the last object you added to your selection.
- Draw order: if you have nothing selected, then select multiple objects at once, they are aligned to the first object in your selection's draw order. Use **Push to front** to move an object to the first position in the draw order.
- Combined order: if you add multiple objects at once to an existing selection, all selected objects are aligned to the first object in the draw order of the objects you added to your selection last.
- If a single object in your selection is Locked, all objects are aligned to the Locked object.
- If multiple objects in your selection are Locked, the Locked objects are not moved, and the rest of the objects are aligned according to selection order or draw order.

Related Topics

- Automatic Guidelines
- Selection Tools
- Push in Draw Order

- Docking
- Distribute
- Move Together
- Move Selected Objects

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5.4.4.2 Distribute and Move Together

Quick Reference: Distribute and Move Together

Seperates objects evenly or abuts them together.

Location

Arrange Toolbar

Arrange → Distribute

The **Distribute** tools move selected objects to evenly space them either vertically or horizontally, with options to set the same distance between the centers, or edges of each object.

The **Move Together** tools move selected objects so that they are evenly distributed, and their edges are abutting along horizontal or vertical planes.

Distribute

The **Distribute** tools are available in the Arrange Menu and Arrange Toolbar.

In the standard Arrange Toolbar, they are presented in dropdown menus for the vertical and horizontal options:

In the **Arrange (long) Toolbar**, the Distribute tools are each presented individually:

Distribute Vertically

Distribute V-Spaced creates even spacing between the *edges* of all selected objects in the vertical dimension.

Distribute V-Centered creates even spacing between the *centers* of all selected objects in the vertical dimension.

Distribute Horizontally

Distribute H-Spaced creates even spacing between the *edges* of all selected objects in the horizontal dimension.

Distribute H-Centered creates even spacing between the *centers* of all selected objects in the horizontal dimension.

Notes on Spacing

The **Distribute** tools take an average of the current spacing between the edges or centers of your selected objects and move them to equalize that distance.

It is not always the case that the resulting average distributes objects such that there is *positive* spacing between all edges of all objects — only that the distance is even. If the amount of existing negative spacing (overlap) between objects in your selection exceeds positive spacing, the resulting distribution will also have overlap.

If large and small objects are distributed together with even spacing between their centers, they may overlap afterward, even if they were not overlapping to begin with.

Move Together

Both **Move Together** options are available in the **Distribute** submenu of the Arrange Menu, and by hotkey.

Move H Together

⎇ Alt / ⌥ Option + ⇧ Shift + H

Moves all selected objects so that they are evenly distributed, and their horizontal edges are abutting along vertical planes.

The last objected added to your selection is anchored in place, and all other objects will be moved relative to its location.

Move V Together

⎇ Alt / ⌥ Option + ⇧ Shift + V

Moves all selected objects so that they are evenly distributed, and their vertical edges are abutting along horizontal planes.

The last objected added to your selection is anchored in place, and all other objects will be moved relative to its location.

Related Topics

- Align Tools
- Docking
- Move Selected Objects
- Grid Array
- Selection Tools

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5.4.4.3 Docking

Quick Reference: Dock

Shifts objects together, removing blank space.

Location

Docking Toolbar

Arrange → Dock

The **Docking** tool moves selected objects left, right, up, or down, until they meet the edge of the Workspace or another object. Docking can bring objects together or move them in unison, making sure they maintain their relative position to one another.

Docking is helpful for laying out graphics to efficiently utilize space and material.

Accessing the Docking Tools

The **Docking** options are available in the **Dock** submenu of the Arrange Menu, or in the **Docking Toolbar**.

If you do not see the Docking Toolbar, go to Window → **Docking** to enable it. By default, it will appear on the far right of the top toolbar when enabled.

Tip

The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Docking Options

Each of the **Docking** buttons moves selected objects in a specified direction, until they hit something — either the outer edge of another object, or an inner edge of your Workspace.

Objects contained within another object will not Dock to the inside edge of the object they are contained in, instead, they will continue past the inner edge until they hit the outer edge of another object, or an edge of your Workspace.

You can Dock objects:

- Left
- Right
- Up
- Down

In the **Docking Toolbar** there are three additional options to control Docking behavior.

- **Move as group** tells LightBurn to treat all selected objects as a single group when Docking them — that means they will all stop when one object in the group hits the edge of another object or the Workspace, and all selected objects will maintain their relative position to one another when they're Docked.

  > **Note**
  >
  > Grouped objects will *always* move together when Docked, regardless of whether Move as group is enabled.

- **Lock inner objects** maintains the relative position of objects contained within other objects, when both are Docked at the same time.
- **Padding** sets an amount of space to maintain between objects or the edge of the Workspace when docking.

The units used for Padding (in / mm) are the same as the units you have selected in the Numeric Edits Toolbar or your Settings.

Creating even Padding in both directions

Padding is only applied in the direction the objects are Docking, and if an object is already closer to another object or the edge of the Workspace than the Padding distance is set to, the object won't be moved. To apply consistent Padding in both directions, Dock objects away, then back again.

Related Topics

- Snapping
- Distribute
- Move Together
- Move Selected Objects
- Grid Array

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5.4.4.4 Move Selected Objects

Quick Reference: Move Selected Objects

Move objects to a corner, midpoint, or center of your Workspace.

Location

Arrange Toolbar

Arrange → Move Selected Objects

Keyboard Modifiers

Hold `^ Ctrl` / `⌘ Cmd` to Move Laser to Selection instead.

The **Move Selected Objects** tools move objects to a corner, midpoint, or center of your Workspace. If you have a Gantry style laser, it can also move objects to the last reported position of your laser head.

Use these tools to rearrange objects in your Workspace, or to align graphics in LightBurn to the location of material placed in your laser's bed, when using Absolute Coordinates positioning.

UI Locations

All **Move Selected Objects** tools are available in the Arrange Menu or as a drop down menu in the Arrange Toolbar.

In the **Arrange (long) Toolbar**, the options to move to the center of your Workspace, a corner of your Workspace, or the last reported position of the laser head are available in the full toolbar, while other options are available in a drop down menu.

Move Selected Objects in the Arrange Menu

Move Selected Objects in the Arrange Toolbar

Move Selected Objects in the Arrange (long) Toolbar

Options and Icons

Info

Holding the `^ Ctrl` or `⌘ Cmd` key while pressing one of these buttons will move the laser to the indicated location on the selection, in machine coordinates, instead of moving the selected objects.

Warning

In order to use **Move to Laser Position**, LightBurn must be connected to your laser, and it must be capable of reliably homing and reporting its position accurately. If the position reported by the laser is inaccurate, using this feature may cause your laser to attempt to travel outside of its physical bounds.

Option	Icon	Action
Move to Laser Position		Moves selected objects in your Workspace to the location that corresponds to last reported position of the laser in machine coordinates. This option is not available for Galvo lasers.
Move to Page Center		Moves selected objects to the center of your Workspace.
Move to Upper Left		Moves selected objects to the top left corner of your Workspace.
Move to Upper Right		Moves selected objects to the top right corner of your Workspace.

Option	Icon	Action
Move to Lower Left		Moves selected objects to the bottom left corner of your Workspace.
Move to Lower Right		Moves selected objects to the bottom right corner of your Workspace.
Move to Left		Moves selected objects to the far left of your Workspace, centered between the top and bottom.
Move to Right		Moves selected objects to the far right of your Workspace, centered between the top and bottom.
Move to Top		Moves selected objects to the top of your Workspace, centered between the left and right.
Move to Bottom		Moves selected objects to the bottom of your Workspace, centered between the left and right.

Move to Page Center Hotkey

Press P to move selected objects to the center of your Workspace.

This hotkey only works if the Workspace / Edit Window — the area where you create and edit graphics — is in active focus.

What does it mean for a window to be in focus?

There are several Windows and Toolbars in LightBurn that accept user input — when a window is clicked on, it is in focus and accepting input.

If a window other than the Edit Window is in focus, click anywhere in the Workspace to bring it into focus.

Movement of Selections

When using the **Move Selected Objects** tools, all objects in your selection move as a single unit, maintaining their relative position to one another.

Edges of selections are defined according to the farthest points of any object in the selection area, in each direction — imagine the selection area as the smallest possible rectangle that can contain every object in your selection. The edges of a selection are the same as the edges of that imaginary rectangle.

Selections are moved so that their edges abut the location you move them to — for example, the left edge of a selection will move to touch the left side of your Workspace when you use **Move to Left**, and the top and right edges of a selection will touch the top and right sides of your Workspace when you use **Move to Upper Right**.

When using **Move to Page Center**, the center point of the entire selection is moved to the center of your Workspace.

Related Topics

- Move Laser to Selection
- Align Tools
- Distribute
- Move Together
- Selection Tools

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5.4.4.5 Nest Selected

Quick Reference: Nest Selected

Arranges objects for efficient material usage.

Location

Arrange → Nest Selected

Nesting is method of arranging objects to maximize material usage. LightBurn does not have a built-in nesting feature, but you can use **Nest Selected** to automatically create and export an SVG of selected graphics, upload it to SVGnest.com, and re-import it after it nests the graphics contained in the file.

Using Nest Selected

1. Select any graphics you'd like to nest along with a container shape — usually a shape that has the same dimensions as the material you are going to cut the nested graphics out of — then go to the Arrange Menu and click **Nest Selected**.

   Important Note on Inner Shapes

   LightBurn does not export graphics that are contained inside another graphic — this means all of the graphics you'd like to nest must be *outside* the container shape you choose.

   Once your graphics have been nested within the container shape and re-imported, LightBurn will automatically move any shapes that were contained within them so they maintain their relative position.

2. Your default web browser will automatically open to SVGnest.com, and a dialog window will open in LightBurn, informing you that an SVG has been created and its file name (LightBurnNest.svg, along with a file path), has been copied to your clipboard.

3. On SVGnest.com, click **Upload SVG**. Paste the automatically copied name into the file browser, or navigate to the location the SVG saved to and select it.
4. Select the container shape, then click **Start Nest**.
5. When you are satisfied with the resulting nest, or the process is complete, click **Stop Nest**, then **Download SVG**. Save the nested SVG.
6. Back in LightBurn, click **OK** in the dialog box. Your file browser will open — navigate to the location of the SVG you downloaded from SVGnest, and import it into LightBurn.

> **Note**
>
> LightBurn will automatically delete the LightBurnNest.svg file it created and exported after you import the new file from SVGnest.

Related Topics

- Docking
- Grid Array
- Align
- Distribute
- Move Together
- Move Selected Objects

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5.4.4.6 Push in Draw Order

Quick Reference: Push in Draw Order

Visually re-order the stack of objects.

Location

Arrange Menu

Keyboard Shortcuts

Various

The *draw order* is an internal list of objects in your Workspace. By default, all objects are ordered according to when they were created or added to your project — the last object added to your project is the first in the draw order, the second to last added is the second in the draw order, and so on.

The **Push** options change the order of objects in the draw order. This is primarily useful when working with images and vector graphics. Vector graphics may end up hidden behind Images, making them difficult to manipulate — Push them forward to get them back in view.

Note

Changing the draw order only affects the display order when in Wireframe rendering mode, and not Filled. In Filled rendering mode, the display order will *always* match the layer order.

Push Tools and Hotkeys

All **Push** options are available in the Arrange Menu or by hotkey.

Push Option	Action	Hotkey
Push forward in draw order	Moves selected objects up one position in the draw order	PgDwn
Push backward in draw order	Moves selected objects up one position in the draw order	PgUp
Push to front	Moves selected objects to the first position in the draw order	^ Ctrl / ⌘ Cmd + PgUp
Push to back	Moves selected objects to the last position in the draw order	^ Ctrl / ⌘ Cmd + PgDwn

Using the Push Tools

Select an object and one of the **Push** options to move the selected object in the *draw order*.

If you have more than one object selected, they'll each move in the draw order, but maintain their position in the order relative to one another — in other words, if you Push the third and fourth objects in your draw order to the front, they'll become the first and second objects.

Related Topics

- View Style
- Cuts / Layers Window
- Align Tools Priority

lock transform move rotate shear size

5.4.4.7 Lock Shapes

Quick Reference: Lock Shapes

Enable or disable any form of editing on selected objects.

Location

Shape Properties Window

Arrange → Lock/Unlock Selected Shapes

Right-click → Lock/Unlock Selected Shapes

The **Lock Shapes** tool locks selected objects in your design, preventing any form of editing (including moving, resizing, deleting, changing text, and more).

Use Lock Shapes to prevent unintentional design edits, secure graphics used for alignment, preserve templates, and restrict editing in collaborative projects.

Locking and Unlocking Objects

Lock selected objects by toggling the **Locked** state *on* in the Shape Properties Window, by going to Arrange → **Lock Shapes**, or by right-clicking the objects and choosing **Lock Selected Shapes**.

To Unlock and enable editing of a Locked object, toggle the Locked state *off* in the Shape Properties Window, go to **Arrange → Unlock Shapes**, or right-click the objects and choose **Unlock Selected Shapes**.

Tip

Use the Transform Control Toggles to restrict specific types of editing for the *whole project*.

Related Topics

- Transform Controls
- Transform Control Toggles
- Shape Properties

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5.4.4.8 Snapping

LightBurn's automatic **Snapping** tools help align objects to other shapes in your Workspace, or to the Workspace grid itself — when you move objects close to a valid location, they will snap to that point.

As you hover your cursor over an object, the icon will change to indicate when it is over a node, line, midpoint, center, or intersection. Use these Snapping points when selecting, moving, or creating objects to ensure exact alignment.

Object Snapping

Object Snapping Points

Snapping Point	Icon	Description
Node		The cursor is over any node in a vector graphic, or the corner of an image.
Midpoint		The cursor is over the exact halfway point between two nodes.
Center		The cursor is over the center point of an object.
Intersection		The cursor is over the intersection of two lines.
Line		The cursor is over a line, but not a node, midpoint, or intersection on that line.

Moving to Snapping Points

When you move objects near enough to a **Snapping** point, they'll automatically align to that point, and the cursor will change to indicate the type of Snapping point they've aligned to.

Note

You can adjust how close your cursor must be to a point before Snapping behavior is activated in the **Units and Grids** tab of the Settings window. This value is set in pixels — when your cursor is within that distance from a valid point, it will automatically snap to it, and change appearance to indicate the type of point it is over.

Selecting from Snapping Points

You can select and move objects directly from **Snapping** points by clicking and dragging from a location where the cursor has changed to one of the Snapping icons.

- To move multiple objects at once from a Snapping point on just one object, you'll need to select them all at once, or Group them first.

Snapping multiple objects at once

- To move objects from a center point when using a Wireframe View Style, you'll need to select them before hovering your cursor over the center of the selection.
- The center of objects that are already selected is indicated by the four-arrow icon

Selecting from a center point

Creating From Snapping Points

When creating new objects using the Draw Lines tool or any of the Primary Shapes tools, your cursor will change to indicate when it is over a **Snapping** point.

- Click and drag from any of those points to start a new line or shape at that point.
- When you drag near a Snapping point, the cursor will automatically align to the point, and change to indicate the type of point it is aligned over.
  - If you're using the Draw Lines tool, click again to place a node at that point.
  - If you're using a Primary Shape creation tool, release to finish creating the shape.

Snap to Grid

Grid Snapping automatically aligns your cursor to nearby grid corners when you're dragging objects or creating new ones.

> **Note**
>
> Grid Snapping points are determined by the Grid Snap Distance setting in the Settings window, and *not* the Visual Grid Spacing distance.
>
> - Grid Snap Distance determines the size of the grid squares whose corners your cursor will snap to — for example, if your units are set to millimeters, and your Grid Snap Distance is set to 1, your cursor will snap to the corners of a grid of 1 mm x 1 mm boxes.
> - Visual Grid Spacing determines the visual size of grid squares at the standard zoom level. As you Zoom In, you'll see a secondary 10 x 10 grid of squares within each larger square. Each smaller square is $1/10^{th}$ the size of the Visual Grid Spacing value.

Keyboard Modifiers

- Hold `⎇ Alt` / `⌥ Option` while dragging to make **Object Snapping** "stickier", meaning objects will automatically align to Snapping points from further away.

  > **Tip**
  >
  > If you're moving an object or creating a shape, this will also enable Alignment Guides — temporary visual indicators that show when an object's edge or center is aligned to an edge or center of another object in your Workspace.

- Hold `^ Ctrl` / `⌘ Cmd` while dragging to toggle either type of Snapping on or off for as long as the key is held down.

Tip

By default, this *disables* both types of Snapping. However, if you've disabled Snap to Objects or **Snap to Grid** in the Settings window, it will instead *enable* that type of Snapping for as long as the key is held down.

Related Topics

- Automatic Guidelines
- Align Tools
- Docking
- Edit Nodes

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5.4.4.9 Automatic Guidelines

LightBurn features two types of automatic guidelines to help you align objects relative to one another, or along vertical or horizontal planes.

Alignment Guides are temporary visual guides that indicate when an object's edge or center is aligned to an edge or center of another object in your Workspace.

Draggable Guidelines are persistent lines set to the T1 Tool layer — they are perfectly vertical or horizontal by default, and you can snap other objects to them.

Alignment Guides

To enable **Alignment Guides**, hold ⎇ Alt / ⌥ Option while dragging a selected object or objects in your Workspace.

As you move the selection around, temporary visual guides will appear, indicating when an edge or midpoint of your selection has Snapped into alignment with an edge or midpoint of another object.

Draggable Guidelines

To create **Draggable Guidelines**, hover over the ruler to the top or left of the Workspace until the cursor changes to the line icon , then click and drag. Release when you've placed the Guideline where you want it — you'll also be able to adjust its position later.

Dragging from the top creates a perfectly horizontal guideline, and dragging from the left creates a perfectly vertical guideline.

These guidelines are set to the T1 Tool layer, and are treated like any other object in LightBurn. You can move them around, snap other objects to them, or Lock them to prevent accidental movement.

> **Warning**
>
> Since they're set to a Tool layer, Draggable Guidelines will never be output to your laser, but if you're using **Current Position** or **User Origin** as your Start From mode, you'll need delete them first, or toggle off the **Frame** option in the Cuts / Layers Window to exclude them when calculating **Origin**.

Related Topics

- Snapping
- Align Tools
- Docking
- Distribute and Move Together

5.4.5 Image Tools

layout design image-tools contrast brightness gamma invert presets save-preset delete-preset import export bundles

5.4.5.1 Adjust Image

Quick Reference: Adjust Image

Tweak image settings like contrast, brightness, and gamma while also changing layer settings.

Location

Tools → Adjust Image

Right-click → Adjust Image

Keyboard Shortcuts

Windows: ⎇ Alt + I

Mac: ⌥ Option + I

The **Adjust Image** tool streamlines the process of tweaking Image Settings such as **Contrast**, **Brightness**, and **Gamma** while also changing Layer Settings, allowing you to adjust all of these properties from a single window, and see an instant preview of resulting output.

To open the Adjust Image tool, select any single image, right-click, and choose Adjust Image from the context menu, or press ⎇ Alt / ⌥ Option + I.

Adjust Image Window

The original source image is displayed in the top left of the **Adjust Image** window. The result of your chosen settings is displayed as a processed image in the top right.

Making any adjustment allows you to see an immediate preview of the processed output, side-by-side against the source image.

Click and drag to pan around the image, and use the mouse scroll wheel (or two-finger dragging if you're using a trackpad) to Zoom In and Out. The source image and processed image are kept in sync while zooming and moving around.

Layer Settings

The **Layer Settings** group on the left contains settings that correspond to those found in the Cut Settings Editor, as highlighted below:

For more information on these settings, see Cut Settings — Image Mode.

After adjusting settings, click **OK** to confirm and automatically apply changes to the Layer Settings for the image you are adjusting, or **Cancel** to discard the changes and leave the settings unchanged.

> **Note**
>
> These settings will affect *any* image on the same layer as the one you have selected.

Image Settings

The **Image Settings** group on the right contains settings that correspond to those found in the Shape Properties Window. Adjust these settings by dragging the sliders or directly editing the numeric value of each property.

For more information on these settings, see Shape Properties — Image.

As with **Layer Settings**, click **OK** to confirm changes, or **Cancel** to discard them.

Invert Display

Turn on the **Invert Display** option to show the processed image with black for the background and white for lasered lines.

Inverting provides a preview of what the resulting output will look like when engraved on slate, black painted tile, black anodized aluminum, or any other material where the marked area will be lighter than the surface of the unmarked material.

> **Note**
>
> This option affects the preview image only — it has no effect on actual output.

Presets

You can select **Presets** from the dropdown above **Image Settings** on the right side of the **Adjust Image** window.

Selecting a Preset automatically applies all the settings saved to it, overwriting your existing settings.

LightBurn provides two **Built-In Presets**, as well as the option to save your own frequently used image settings as **User Presets**.

- **Basic** is a good starting point for your own engravings or for creating User Presets.
- **Black Paint on White** is similar, but inverted for engraving light marks onto dark surfaces.

Save Image Preset

The first button next to the **Presets'** dropdown allows you to save your current settings as an image Preset.

1. Enter a name for your Preset in the **Preset Name** field near the top right of the window.
2. You can choose which **Layer** and **Image Settings** are included in the Preset by toggling the switches next to each option.
3. Click **All** to include all settings, **None** to exclude all settings, or **Invert** to include settings that are currently excluded, and exclude settings that are currently included.

   Excluded settings well be ignored when loading the Preset later.
4. Click **Save** to store the selected settings as a Preset, or **Cancel** to exit without saving.

Delete Image Preset

The second button allows you to **Delete** image **Presets**. Make sure the Preset you want to delete is selected in the dropdown first.

Import/Export Image Preset

The third and fourth buttons allow you to **Import** and **Export** image **Presets**, which is useful for backing up your Presets and for moving them between computers.

> **Tip**
>
> You can also include these Presets as part of a User Bundle.

Related Topics

- Cut Settings — Image Mode
- Shape Properties
- Apply Mask to Image
- Save Processed Bitmap

layout-and-design editing customization object-manipulation image-editing image-tools image-raster-bitmap image

5.4.5.2 Apply Mask to Image

Quick Reference: Apply Mask to Image

Hide and cut out parts of images.

Location

Tools → Apply Mask to Image

Right-click → Apply Mask to Image

Use **Apply Mask to Image** to hide portions of images that you do not want to engrave, or to divide them into more complex engraving patterns.

By default, image masking doesn't delete the data of the removed part of the image, it just hides it from view and doesn't output those parts to the machine.

Tip

You can use masking to remove the background of an image, for example to isolate a pet or person from an photograph — a great way to get more clarity in an image that doesn't have a well-contrasted background.

Masking an Image

In addition to an image, masking
requires a vector object, in any desired shape. The vector object must be:

- Placed on either a Tool or Line layer
- A closed shape, with a single, shared start and end point

You can use use rectangles to perform standard crops, but the shape can be a more complex path as well, or even a Group of vectors (including text) provided that the Group is all on the same layer. When shapes are placed on a shared layer, Grouped, and used for masking, the area between the shapes that would normally be solidly engraved with Fill Mode will be "filled" with the image instead.

To Mask an Image, select the image and vector, then go to Tools → **Apply Mask to Image**, or right-click the selection and choose Apply Mask to Image from the context menu.

To immediately Flatten the mask in the process, you can select **Crop Image** from the same menus instead — if you choose to Crop an image, you will be unable to remove or edit the mask.

Hidden Vector

If the vector is hidden by the image, use Push to Front to move it forward in the draw order if you're also using a Wireframe View Style.

If you're using a Filled View Style, adjust the order of the layers in the Cuts / Layers Window.

Removing a Mask (Restoring an Image)

You can fully restore the original image in two
ways:

- Select the vector object you used for the mask and press `⌫ Backspace` / `delete` on your keyboard to delete it.
- Select the image, right-click it, and choose **Remove Mask from Image**.

Editing a Mask

To change which parts of the image are revealed
and hidden, you can edit the existing mask as you would any other vector object, for example with the Select, Edit Nodes, and Boolean tools.

> **Grouping**
>
> Once you have the mask as you want it, it's a good idea to Group the vector and image to avoid accidentally moving one without the other.

Flattening (Baking-In) a Mask

The downside of preserving the hidden parts of the
image is that it can make masked images harder to align to other objects, but it is possible to permanently remove the hidden areas of a masked image (also called "baking in" the mask).

To do so, right-click the masked image and select **Flatten Image Mask**.

This also removes the masking shape, leaving you with a only an image in the shape it had been masked.

Related Topics

- Cut Settings — Image Mode
- Adjust Image

layout-and-design arrangement editing customization object-manipulation layout-and-design arrangement editing customization object-manipulation vector-editing vector-tools vector path-editing path-tools path vector-path-curve-lines node-editing object-repair troubleshooting fixing-designs image-editing image-tools image-raster-bitmap image

5.4.5.3 Convert to Bitmap

Quick Reference: Convert to Bitmap

Turns paths (vectors) into images (pixels).

Location

Edit → Convert to Bitmap

Right-click → Convert to Bitmap

Keyboard Shortcuts

Windows: `^ Ctrl` + `⇧ Shift` + `B`

Mac: `⌘ Cmd` + `⇧ Shift` + `B`

Convert to Bitmap turns selected vector graphics into bitmap images.

Vector graphics are made up of lines, curves, and nodes that define the contours of shapes, while bitmap images are made of a grid of shaded pixels.

See Images vs. Vectors for more information on the differences between images and vector graphics.

Once a vector graphic has been converted to a bitmap image, it is set to Image Mode and can be engraved using a dithered pattern.

Using Convert to Bitmap

Select all vector graphics you wish to convert and go to Edit → **Convert to Bitmap** (`^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `B`), or right-click and select Convert to Bitmap.

- At the top of the Convert to Bitmap window you'll see a preview of the bitmap image that will be created. As you adjust the options the preview will live-update.

- The **Render Type** option determines whether the resulting bitmap will show just the **Outlines** of the vector graphics, will **Fill All** areas between the outlines, or **Use Cut Settings** to determine whether to render outlines or solid fills depending on whether the graphics are assigned to a layer set to Line Mode.

> **Note**
>
> In order to Render a vector graphic as a solid, filled bitmap it must be a closed shape. See Open vs. Closed Shapes for more information.

- Set the **DPI** for the resulting bitmap by manually entering a value into the DPI field, or by adjusting the slider below it. DPI controls the density of the pixels in the bitmap — higher pixel densities lead to sharper images.
- The brightness value of each pixel is automatically set to 50% gray. After converting vector graphics to bitmap images, you can adjust their brightness using the Adjust Image tool.
- Press **OK** to create the bitmap image, or **Cancel** to discard the changes and leave the vector graphics as they are.
- The image produced will be in the last layer selected. If the image immediately disappears, check to see if it's on a layer that's not set to be visible.

> **Warning**
>
> Converting a vector graphic into a bitmap image deletes the vector graphic. To preserve the original graphic while creating a bitmap from it, Copy or Duplicate it, then convert the second copy.

Related Topics

- Image Mode
- Adjust Image

reference layout-and-design editing customization import-export export image-editing image-tools image-raster-bitmap image troubleshooting

5.4.5.4 Save Processed Bitmap

Quick Reference: Save Processed Bitmap

Export an image with changes.

Location

File → Save Processed Bitmap

Right-click → Save Processed Bitmap

Use **Save Processed Bitmap** to save an image you have edited in LightBurn, including any changes made using Adjust Image, or any dithering mode applied to the image.

Saving Processed Bitmaps

To save a processed image, first select an image, then go to File → **Save Processed Bitmap** or right-click in your Workspace and select Save Processed Bitmap from the context menu.

Your system's file management window will open, where you can name and select a location to save the processed image. After, you'll be able to open the processed image using any software that can open images.

Related Topics

- Adjust Image
- Image Mode

image-tools vector image trace-image fade-image trace-options transparency sketch optimize smoothness cutoff threshold ignore boundary

5.4.5.5 Trace Image

Quick Reference: Trace Image

Converts images into vector graphics.

Location

Tools → Trace Image

Right-click → Trace Image

Keyboard Shortcuts

Windows: ⎇ Alt + T

Mac: ⌥ Option + T

Use the Trace Image tool to convert imported images into vector graphics.

This is useful if you want to edit an image that has high contrast or well-defined edges, including logos, silhouettes, cartoons, sketches, and handwriting. You can trace photographs as well, but results will vary based on the composition of the photograph.

Trace Image Window

After selecting an image in your Workspace, select Tools → **Trace Image**, right-click the image and select **Trace Image** from the context menu, or press ⎇ Alt / ⌥ Option + T to open the Trace Image window.

Preview

In the image above, the purple lines are the vectors that LightBurn has produced from the image being traced. As you adjust settings in the **Trace Image** window, the purple lines will change to reflect the new vectors that will result from the updated settings.

Navigation

You can Zoom and Pan the preview using the same controls as in the Workspace, and double-click the middle mouse button to reset the view.

Fade Image

Click **Fade Image** to dim the image, increasing the visibility of the vectors (purple lines) in the preview.

Boundary

Click and drag in the preview to specify a portion of the image to trace. Click **Clear Boundary** to reset it.

Show Points

Click **Show Points** to toggle visibility of the nodes in the preview of the resulting vectors.

Trace Options

Cutoff and Threshold

The **Cutoff** slider controls the lower end of the range of brightness 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.

Increase **Threshold** to include lighter values.

Increase **Cutoff** to remove darker values.

Ignore Less Than

Instructs LightBurn not to trace areas where the amount of pixels in the valid brightness range is lower than this number. Increase the number of pixels in the **Ignore Less Than** field to clean up noisy images by removing small areas from the result.

Optimize

Increase the value in the **Optimize** field to reduce the number of nodes in the resulting vectors, similar to Optimize Selected Shapes.

A value of **0** leads to no optimization, while excessively high values can reduce accuracy. The default of **0.2** usually provides a good balance between accuracy of the result and node count.

Smoothness

Increase **Smoothness** to turn more line segments of the resulting vector into curves. Set it to **0.0** to create only lines (left), and **1.33** to create only curves (right).

Trace Transparency

Turn on **Trace Transparency** to trace an image based on its alpha layer. This can be useful if, for instance, you want to trace the outline of a shape with a transparent background.

Sketch Trace

Turn on **Sketch Trace** for photographs of pages with uneven lighting — for example handwriting, sketches, and documents. LightBurn will look for edges in the image with this setting enabled, based on local differences in contrast, rather than relying on the brightness or darkness of the whole image.

Delete Image After trace

Turn on **Delete Image After trace** to automatically remove the image from your project upon hitting **OK**.

Editing the Trace

After hitting **OK**, you will be presented with a Group containing the resulting vectors. To edit the shapes individually, you must first **Ungroup** them.

After they are Ungrouped, you can edit them as you would any other shape.

Hidden Vector

If you can't see the vector, it may be hidden by the original image, click and drag the image out of the way to reveal it, or Push the image to the back of the draw order.

Troubleshooting

Tracing works by automatically creating an approximation of the pixel-based image in vector format, and while LightBurn's trace function is extremely robust, it remains limited by both the computationally-difficult nature of this task, and the quality of the image it is presented with. In some instances fine details — for example sharp corners and small text — may not be converted well during this process. If changing the Trace options doesn't overcome this issue, exit the **Trace Image** window and try using Threshold Image Mode to engrave the original image instead of tracing it.

Related Topics

- Adjust Image
- Apply Mask to Image
- Convert to Bitmap
- Edit Nodes

image-tools image trace-image

5.4.5.6 Multi-File Trace Image

Labs Feature

Labs features are new tools in development that we couldn't wait to get into the hands of our users. Please experiment with caution, and report any unexpected results on our forum.

The **Multi-File Trace Image** tool automates image tracing for multiple files using LightBurn's Trace Image tool. Images are traced using LightBurn's default settings, and saved as SVG files in the same location as the source images.

Using Multi-File Trace Image

1. Go to Tools → **Multi-File Trace Image (Labs)** to open the file import dialog box.
2. In the dialog box, navigate to the folder containing images you want to trace.
3. Select all the images to be traced. Use `⇧ Shift` to select a range of files or `^ Ctrl` / `⌘ Cmd` to pick multiple files individually.
4. Click **Open** to select and trace files.
5. Go to the folder containing the source images to find your traced SVG files.

image refresh replace replace-to-fit edit image-options

5.4.5.7 Image Options

Quick Reference: Image Options

Refresh or replace images in your project.

Location

Edit → Image Options

The three commands under Edit → **Image Options** — **Refresh Image**, **Replace Image**, and **Replace Image to Fit** — provide ways to refresh or replace images in your project. This is most often useful if you've edited the image in a different editing software and want to reload or replace the image currently open in LightBurn.

Refresh Image

After importing an image into a LightBurn project, changes to the original image file aren't automatically reflected in LightBurn. Use **Refresh Image** to reload the image file in its most recent version.

Replace Image

Replace Image opens a dialog box to select a new image. The new image replaces the originally selected image in the LightBurn project.

Replace Image to Fit

Replace Image to Fit replaces the image as described above, automatically scaling it to fit in the space taken up by the originally selected image.

Troubleshooting

If these commands are unavailable, check the following:

- Make sure you have a pixel-based image selected in LightBurn.
- Make sure the image is not Grouped with other objects.

Related Topics

- Trace Image
- Adjust Image

5.5 Laser Control

5.5.1 Cut Settings

laser-control cut-settings

5.5.1.1 Cuts / Layers Window

The **Cuts / Layers Window** shows the list of layers in your project. From the Cuts / Layers Window, you can assign different operations to specific layers, control the order the laser processes the layers, adjust an abbreviated set of settings for each layer, and more.

To adjust all layer settings, double-click any layer in the Cuts / Layers Window to open the Cuts Settings Editor, which contains all available settings.

Use the Color Palette to change the layer selected objects are assigned to.

About Layers in LightBurn

In LightBurn, different colors indicate each layer. These colors don't represent the final product's colors but instead differentiate each operation needed to complete the job. Each layer defines a process and a collection of settings that is assigned to objects within the project.

In other words, layers let you tell the machine what it needs to do to produce the final work.

Generally each color refers to a different layer, with one exception — if you add an image to a vector layer (or vice versa), then the layers will split to show two entries in the Cuts / Layers Window.

Accessing the Cuts / Layers Window

The **Cuts / Layers Window** is located in the upper right of LightBurn by default. If you have closed the Cuts / Layers Window, go to Window → **Cuts / Layers** to re-enable it. To restore it and all other windows to their default positions, go to **Window** → Reset to Default Layout.

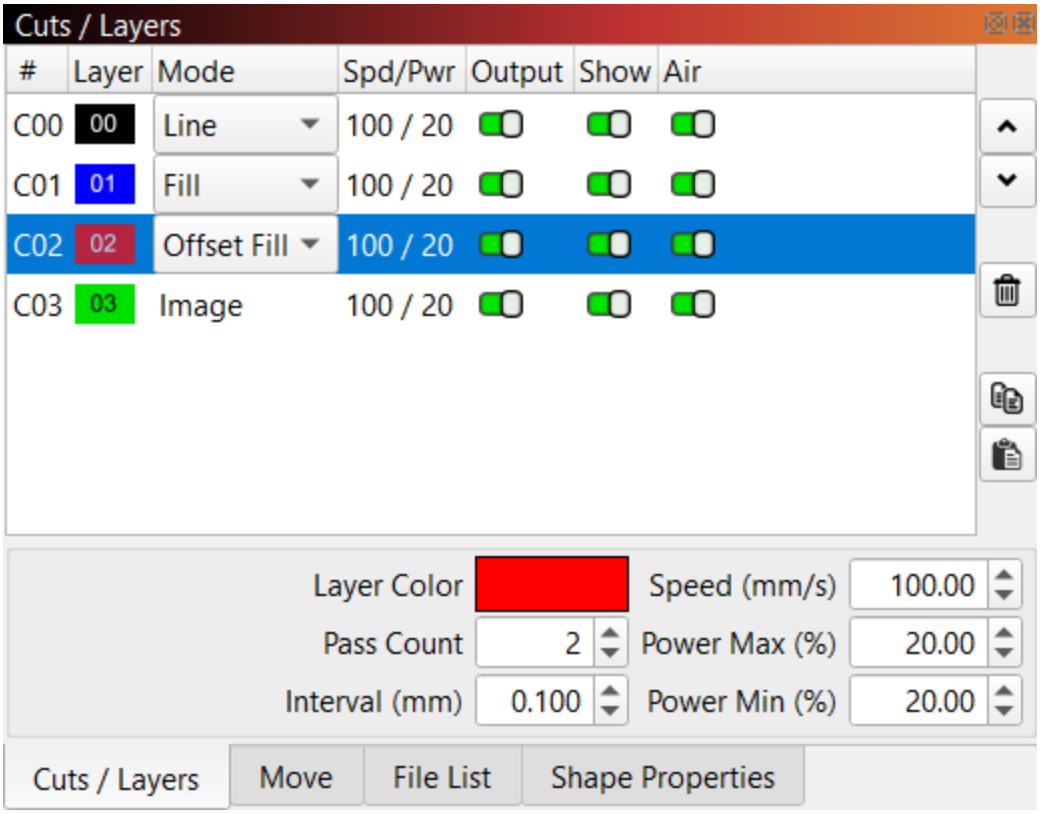
Tip

The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Cuts / Layers Window Options and Settings

The type of laser you have active will affect which settings are presented in the **Cuts / Layers Window**. The image below shows the Cuts / Layers Window for a DSP laser, but not all options shown here are available for all lasers, and some lasers have additional options that are not shown, but are listed below.

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Columns

 # (Layer Name)

Shows the layer name. You can adjust a layer's name in the Cuts Settings Editor.

Layer

Shows the color and title of the layer. Colors and titles have matching entries in the Color Palette.

Mode

View and change the Layer Mode of layers in your project.

- You can adjust the mode of vector graphics between Line, Fill, and Offset Fill.
- Layers containing images are automatically set to Image and cannot be adjusted.

- Layers with multiple Sub-Layers are set to **Multi**. Open the Cut Settings Editor to adjust Sub-Layer modes and other settings.

Spd/Pwr

Shows Speed and Power settings.

You can adjust these settings in Speed and Power Max fields beneath the list of layers, or by opening the Cut Settings Editor.

Output

> **Tip**
>
> Use Preview to verify that only intended layers are set to output.

Toggle to enable or disable which layers are output when you Preview, Start, Send, or save a project in machine-specific format.

The color of layers not set to output will be faded in your Workspace.

Show

Toggle which layers are visible in your Workspace.

Air

> **Note**
>
> Available for Gantry lasers only.

Toggle to enable or disable Air Assist for individual layers in your project.

Air assists blow air onto the surface of your material at the spot where the laser's beam strikes, which can help prevent soot accumulation and charring, and aid in cutting.

Note

Many lasers do not come with air assists, and others have manual air assists that you can't trigger through software. In those cases, toggling the Air switch will have no effect either way.

Consult your laser's manufacturer if you're not sure if your laser has a built-in air assist.

Column Header Context Menu

Right-click anywhere over the column headers to open a context menu with options for enabling, showing, and sorting layers.

Option	Action
Enable all layers	Turn on the Output switch for all layers
Disable all layers	Turn off the Output switch for all layers
Invert enabled layer	Turn off the Output switch for all currently enabled layers and turn off for all currently enabled layers
Show all layers	Turn on the Show switch for all layers
Hide all layers	Turn off the Show switch for all layers
Invert visible layers	Turn on the Show switch for all hidden layers, and turn off for all visible layers
Enable all air assist	Turn on the Air switch for all layers
Disable all air assist	Turn off the Air switch for all layers
Invert all air assist	Turn off the Air switch for all layers it is currently enabled for, and turn off for all layers it is currently disabled for
Sort Cuts Last	Move cut layers to the bottom the list. See below for more information.

Layer Context Menu

Right-click over any layer in the list to open a context menu with options to disable, hide, flash, or select layers.

Option	Action
Disable this layer	Turn off the Output switch for this layer
Disable all layers but this one	Turn off the Output switch for all layers *except* the layer you right-clicked
Hide this layer	Turn off the Show switch for this layer
Hide all layers but this one	Turn off the Show switch for all layers *except* the layer you right-clicked
Select all shapes in current layer	Select all shapes on the layer you right-clicked
Flash the content on this layer	Flash the objects assigned to the layer you right-clicked

Settings

Pass Count

Sets how many times the laser will repeat the shapes on this layer.

Speed

Adjust the Speed to run the laser at for this layer.

Power Max

Adjust the maximum power output level of the laser for this layer.

Power Min

Adjust the minimum power output level of the laser for this layer.

> **Note**
>
> This setting is only shown when you're using a DSP laser *or* are engraving an image using Grayscale Mode, with any type of laser.

Interval

Adjust the space between each scan line in a Fill or Offset Fill operation.

Frequency

> **Note**
>
> Available Galvo lasers only.

Adjust the Frequency setting for this layer.

Q-Pulse

> **Note**
>
> Available MOPA and UV Galvo lasers only.

Adjust the Q-Pulse Width setting for this layer.

Rearrange Layers

By default, layer operations are performed by your laser in the order from top to bottom in which they are listed in the **Cuts / Layers Window**.

> **Note**
>
> See Optimization Settings for information on alternate options for ordering operations.

The order that layers are completed is often important, as pieces shift after being cut out. It's therefore best to engrave images and marking/scoring lines before any cuts through the material.

To change the order of the selected layer in the list you can click and drag to change its position or select a layer and click the up and down buttons in the window.

Sort Cuts Last

You can also automatically sort all layers, based on how likely they are to cut through the material — with the least likely being performed first.

To do so, right click any heading on the table (e.g. **Mode**) and choose **Sort Cuts Last**.

This process orders layers first by their *strength* — stronger layers have higher **Power**, lower **Speed**, and more **Passes**. It then pushes all Line Mode layers to the end, so all engraving operations are performed before cutting operations.

Copy Layer Settings

To copy settings between layers, first select a layer in the list and click **Copy** button to copy its settings. Next, select the layer you want to copy to, and click the **Paste** button.

Delete Layers

Click the **Delete** button to delete a layer and *all objects* assigned to it in your Workspace.

By default, you'll see a warning message asking if you're sure — hold `⇧ Shift` while clicking the Delete button to bypass the warning message.

Select All Objects on a Layer

In addition to right-clicking a layer and choosing **Select all shapes in current layer** from the context menu, you can hold `⇧ Shift` and left-click any layer in the list to select all objects on that layer.

You can also select any object in your Workspace, then go to Edit → Select all shapes in current layer.

Related Topics

- Cut Settings Editor
- Color Palette

5.5.1.2 Cut Settings Editor

laser-control

The **Cut Settings Editor** is where you adjust all settings for the layers in your project.

The settings presented in the Cut Settings Editor vary depending on the type of laser you're working with, and the Layer Mode the selected layer is set to.

In all variations of the Cut Settings Editor, the most essential settings — including **Speed**, **Power**, and **Mode** — are displayed at the top of the window. More specialized options follow below, split into two tabs — **Common** and **Advanced**.

Access the Cut Settings Editor by double-clicking any entry in the Cuts / Layers Window or Material Library.

The window will open to settings for the entry you double-clicked — click any other layer in the column along the left side to access the settings for that layer.

Figure 1: The Cut Settings Editor for a layer set to Line Mode, using a GCode-based laser.

Note

You can adjust a narrower set of critical settings directly in the Cuts / Layers Window, instead of opening the Cut Settings Editor.

The settings presented in the Cut Settings Editor depend on the selected Layer Mode and the type of laser you're working with. Select an option below to learn more about different groups of settings.

Main / Shared Settings

Settings shared by almost all types of lasers and Layer Modes, including critical settings like **Speed** and **Power**.

Line Mode

Tells your laser to trace a path along the outlines of geometry in your project.

Fill Mode

Tells your laser to etch or engrave parallel lines inside the bounds of closed shapes in your project.

Offset Fill Mode

Tells your laser to fill closed shapes with lines that follow the contour of the outer shape.

Image Mode

Works similarly to **Fill Mode**, but applies additional special settings to adjust output based on the pixels in your image.

Galvo-Specific Settings

Special settings that are available for users with Galvo style lasers only.

Sub-Layers

A tool for setting up and applying multiple cut/engraving settings to the same geometry or layers in your project.

Default Layer Settings

Built-in or custom-created settings stored on a per-layer basis, that you can reset to at any time.

Note

Some options in the Cut Settings Editor are hidden if you have Beginner Mode enabled.

laser-control

5.5.1.2.2 Main / Shared Settings

Several settings in the Cut Settings Editor are shared among nearly all laser types and Layer Modes.

Note

See Additional Options for information on specialized settings not covered on this page.

Essential Settings

The settings near the top of Cut Settings Editor are fundamental to all laser operations. You can edit many of these settings directly in the Cuts / Layers Window as well.

Click any option in the images below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.

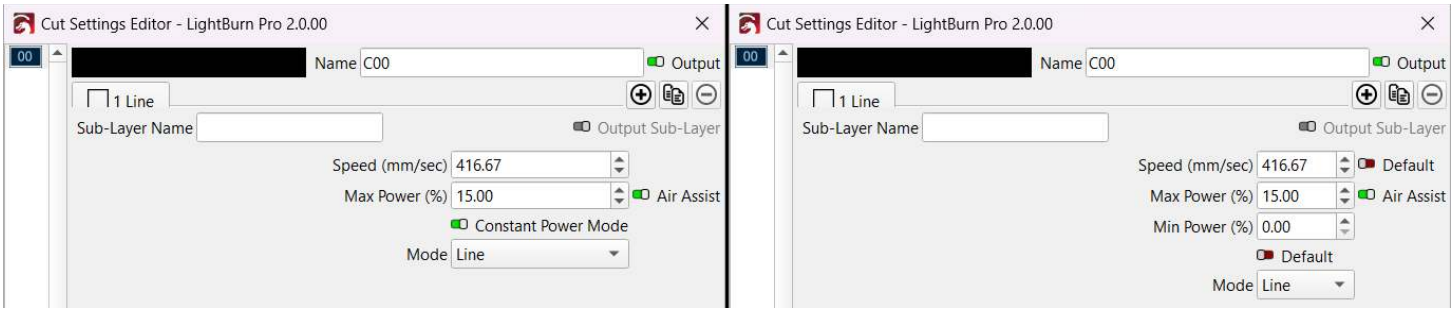


Figure 1: Left: Essential settings for a GCode-based laser

Right: Essential settings for a DSP laser

Figure 2:

Name

You can rename layers to help keep track of their settings and purpose in your project.

Output Switch

Toggle the **Output** switch on or off to determine whether a given layer is included in the output when you Preview, Start, Send, or save a project in machine-specific format.

The color of layers not set to output will be faded in your Workspace.

Speed

The maximum speed the laser will reach when cutting or engraving your design.

Higher speed values can decrease the amount of time your laser spends completing a job, but also tend to produce lighter marks or shallower engravings than slower speed values. Cutting through many materials requires relatively slow speeds, though the exact values vary significantly depending on your laser and material.

Note

Depending on your laser, its firmware settings, and the design you tell it to cut or engrave, the laser may not actually reach the speed you set. Consult your laser's manufacturer for guidance on the maximum speed your laser is capable of.

Always pay attention to units of distance and time when entering Speed settings

When entering **Speed** values recommended by your laser's manufacturer or other LightBurn users, make sure to use the *same units of distance and time as those from the recommendation*, or to convert the values to your preferred units.

A given number of **millimeters per second** is *much* faster than that same number in **millimeters per minute**. Mixing up units can lead to reduction in power output due to unexpectedly high speeds, or excessive power output — and even fire — due to unexpectedly slow speeds.

Change your units of speed in the **Dimensions / Units** tab of the **Device Settings** window. LightBurn automatically converts any existing values when you switch between units.

Default Speed Switch (Ruida Only)

Enable this switch to use the default **Speed** setting from the laser's controller. You can adjust this default through the controller's display.

Max Power

Tip

Use the Material Test to find optimal settings for your laser, material, and desired outcome.

The maximum power level the laser will reach when cutting or engraving your design.

High power levels produce darker marks and deeper engravings, and relatively high powers are required to completely cut through many materials.

GRBL Power Ramping

GRBL-based lasers ramp up to the maximum power level as they increase in speed, only reaching Max Power when they also reach the Speed you've set. If you set a Speed higher than your laser can actually reach, it will never reach Max Power either.

See Troubleshooting: Low or No Power Output for more information.

Min Power

Note

This setting is only shown when you're using a DSP laser *or* are engraving an image using Grayscale Mode, with any type of laser.

Min Power determines the power level the laser will use when it travels at slow speeds, such as when it slows down to reach the ends of lines, changes directions, or turns corners.

Some DSP controllers refer to this as the **Corner Power** for this reason.

The laser's controller will automatically ramp power between Min and Max Power as it accelerates to the maximum Speed you've set.

Min Power Troubleshooting

Reduce Min Power if your laser is scorching or charring your material when it turns corners, or increase it if it's having trouble cutting through material on corners.

See Troubleshooting: Corners Are Too Dark, Too Light, or Missing for more information.

Default Power Switch (Ruida Only)

Enable this switch to use the default **Max** and **Min Power** settings from the laser's controller. You can adjust these defaults through the controller's display.

Constant Power Mode (GRBL Only)

By default, LightBurn uses **Variable Power** mode (M4), which ramps the power level of the laser up and down with the speed, producing a more consistent burn.

However, if you ask the laser to move faster than it's able, it will never reach the requested speed *or* the requested power level. It's generally best to stick with the default of Variable Power mode and adjust the speed to be within the range your machine can achieve, but if you want the same behavior as LaserGRBL, which defaults to **Constant Power** (M3), you can enable this option.

See Troubleshooting: Low or No Power Output for more information.

Air Assist

Enable this switch to turn on **Air Assist**, if your laser supports it. Air assist can help in cutting through material.

Users with GCode-based lasers can select whether their air assist is activated by an M7 or M8 command in Device Settings.

> **Note**
>
> This setting is available for DSP and GCode-based lasers only.
>
> If your laser has no air assist, or it must be activated manually, enabling and disabling this switch will have no effect.

Mode Dropdown Menu

Select Line, Fill, or Offset Fill from the dropdown menu to change how the laser will cut or engrave graphics assigned to a given layer.

Images are automatically set to Image Mode and this dropdown menu is not available for layers they are assigned to.

Additional Options

The settings presented in the Cut Settings Editor depend on the selected Layer Mode and the type of laser you're working with. Select an option below to learn more about different groups of settings.

Main / Shared Settings	**Line Mode**	**Fill Mode**

Settings shared by almost all types of lasers and Layer Modes, including critical settings like **Speed** and **Power**.

Tells your laser to trace a path along the outlines of geometry in your project.

Tells your laser to etch or engrave parallel lines inside the bounds of closed shapes in your project.

Offset Fill Mode

Tells your laser to fill closed shapes with lines that follow the contour of the outer shape.

Image Mode

Works similarly to **Fill Mode**, but applies additional special settings to adjust output based on the pixels in your image.

Galvo-Specific Settings

Special settings that are available for users with Galvo style lasers only.

Sub-Layers

A tool for setting up and applying multiple cut/engraving settings to the same geometry or layers in your project.

Default Layer Settings

Built-in or custom-created settings stored on a per-layer basis, that you can reset to at any time.

Note

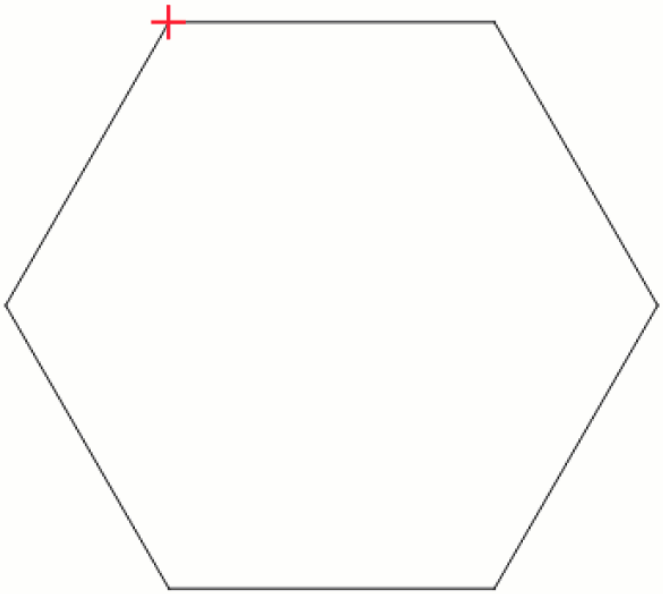
Some options in the Cut Settings Editor are hidden if you have Beginner Mode enabled.

laser-control

5.5.1.2.3 Line Mode

Line Mode tells your laser to trace a path around the contours of vector graphics.

If you command the laser to move quickly, or with low Power, it will likely just etch the surface (sometimes called scoring). If you move slowly and with high power, especially with a CO_2 laser, the laser will cut deeper, or even completely through the material. The only difference between surface marking and cutting with Line Mode is the Power and Speed you set.



Line Mode Settings

There are several specialized options available in the Cut Settings Editor for layers set to **Line Mode**, split into two tabs, **Common** and **Advanced**.

Note

See Main / Shared Settings for information on applying essential settings like Speed and Power.

See Additional Options for information on specialized settings not covered on this page.

Click any option in the images below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.

Many of the settings presented in the images below are available for users with DSP lasers only, but most are shared between all types of lasers.

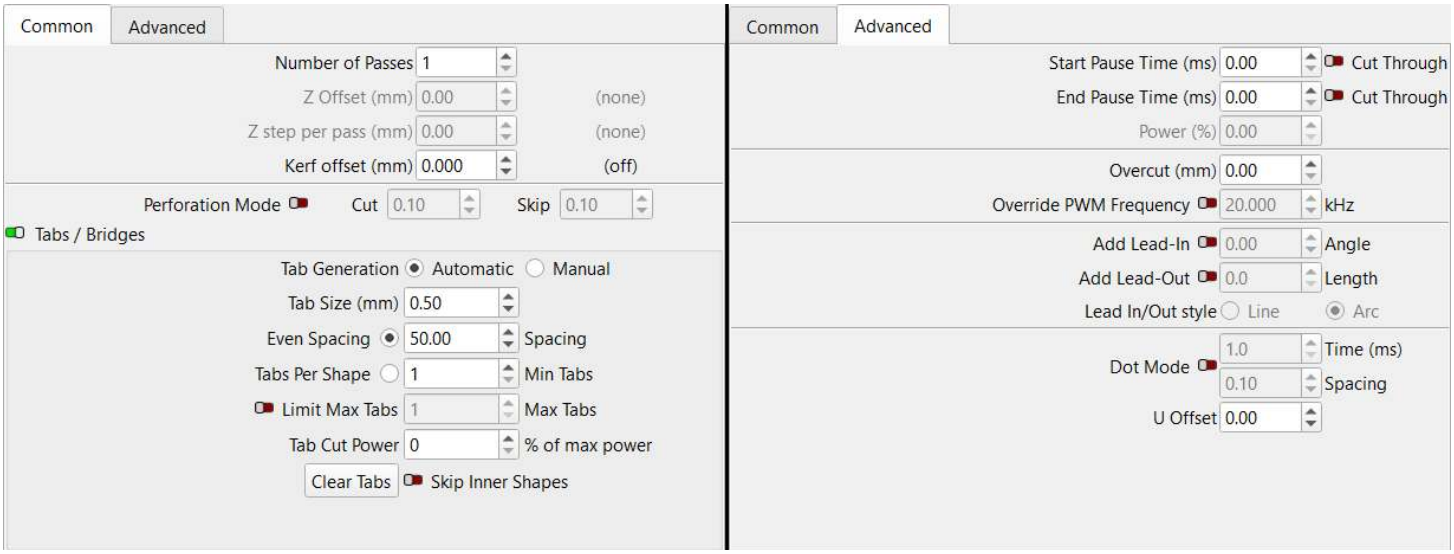


Figure 1: Left: Common Line Mode settings tab

Right: Advanced Line Mode settings tab

Figure 2:

Common Settings

Number of Passes

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

Z Offset

If you have Z movement enabled, and your controller supports it, you can use the **Z offset** setting to move the laser head closer to the material (inward) or farther away from it (outward). Positive values move the Z Axis inward, and negative values move it outward.

Focusing deeper into the material can sometimes help to cut thicker material, and lifting the laser away from the material can produce a thicker line.

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

Z Step per Pass

When doing more than a single pass over a shape, the Z step per pass setting allows you to tell LightBurn to raise or lower the laser with each pass by the same amount.

By allowing you to shift the focus point deeper with each pass, this is often useful for cutting thick materials or achieving deep engravings,

Kerf Offset

> **Closed Shapes Only**
>
> This feature only works with shapes that are *closed*. A shape is closed when it is a complete, continuous loop whose start and end points are the same. When a shape's start and end points are different, it is *open*.
>
> See Open vs. Closed Shapes for more information.

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

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

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

Perforation Mode

Enable **Perforation Mode** to specify a distance to **Cut**, followed by a distance to **Skip**.

As the laser traces the contours of shapes assigned to this layer, it will turn on over the specified Cut distance, and off over the specified Skip distance.

Perforation mode is useful if you're trying to cut fold lines in card stock, stitch holes in leather, or make dashed lines.

Use Perforation Mode to reduce effective power output

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

Tabs / Bridges

Tabs are small sections of cuts that the laser is commanded to skip, used to prevent objects that you are cutting from immediately falling out of the base material. When sized appropriately, the tabs can be broken with minimal force and the objects removed from the material after the job is finished cutting.

See Add Tabs for information on creating and adjusting **Tabs / Bridges** settings.

Advanced Settings

Under the **Advanced** tab you'll find several less frequently-used options. Many of the options presented here are available only for particular types of lasers.

> **Note**
>
> The Advanced tab is not available if you're using a Galvo laser. See Galvo-Specific Cut Settings for information on advanced settings for Galvo lasers.

Start / End Pause Time

Use these options to add a delay, in milliseconds, at the beginning of a cut, the end, or both.

If you also enable the **Cut Through** option, the beam will be turned on during this pause, which can be used to *prime* the cut and help pierce through thick material. The **Power %** value sets the power of the laser during this pause.

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

> **Note**
>
> This setting is not available for lasers with TopWisdom controllers. Dwelling without Cut Through enabled is not available for lasers with Trocen controllers.

Overcut

Enable **Overcut** to tell your laser to extend a cut by a specified amount past the end of closed shapes, on the final Pass.

Override PWM Frequency

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

> **Note**
>
> This setting is only available for lasers with Ruida controllers.

Enable PPI

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

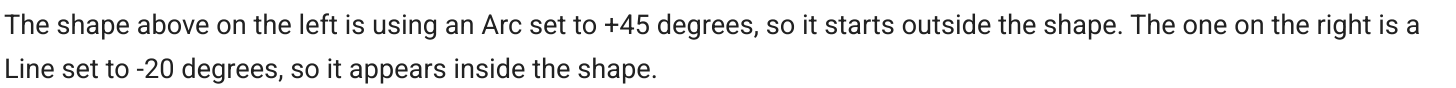
> **Note**
>
> This setting is only available for lasers with Trocen controllers.

Lead In / Lead Out

Lead-In and **Lead-Out** are optional lines or curves added to the start or end of a cut. You can toggle each on or off individually, and specify their **Length**, **Angle** and **Style**.

When cutting thick material, particularly if using Cut Through delays, or cutting metal, there is often a mark left at the start of the cut that is slightly thicker than the rest, and can leave an indent on an otherwise smooth edge. With this setting, you can add a small line to the start or end of a cut, so that mark happens off the cut line itself.

The **Angle** value controls the placement of the lead line — a positive number tells LightBurn to put the lead line outside the shape, and a negative number means to put it inside. You can choose to make the lead a straight **Line**, or a short **Arc**.



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

Dot Mode

When enabled, the laser will pause and pulse at regular intervals along the path, instead of cutting continuously. The **Time** value specifies the pause delay in milliseconds, and the spacing parameter sets how far apart the pulses are.

This can be an effective way to do stitching holes, or cut very thin or delicate materials, but the constant pausing can shake the machine - using Perforation Mode is often preferable for this reason.

> **Note**
>
> This setting is only available for lasers with Ruida controllers.

U Offset

Enter a distance here to set a per-layer U Axis offset. To use this setting, your laser must support U Axis control, and you must enable the U Axis in Device Settings.

> **Note**
>
> This setting is only available for lasers with Ruida controllers.

Additional Options

The settings presented in the Cut Settings Editor depend on the selected Layer Mode and the type of laser you're working with. Select an option below to learn more about different groups of settings.

Main / Shared Settings

Settings shared by almost all types of lasers and Layer Modes, including critical settings like **Speed** and **Power**.

Line Mode

Tells your laser to trace a path along the outlines of geometry in your project.

Fill Mode

Tells your laser to etch or engrave parallel lines inside the bounds of closed shapes in your project.

Offset Fill Mode

Tells your laser to fill closed shapes with lines that follow the contour of the outer shape.

Image Mode

Works similarly to **Fill Mode**, but applies additional special settings to adjust output based on the pixels in your image.

Galvo-Specific Settings

Special settings that are available for users with Galvo style lasers only.

Sub-Layers

A tool for setting up and applying multiple cut/engraving settings to the same geometry or layers in your project.

Default Layer Settings

Built-in or custom-created settings stored on a per-layer basis, that you can reset to at any time.

Note

Some options in the Cut Settings Editor are hidden if you have Beginner Mode enabled.

laser-control

5.5.1.2.4 Fill Mode

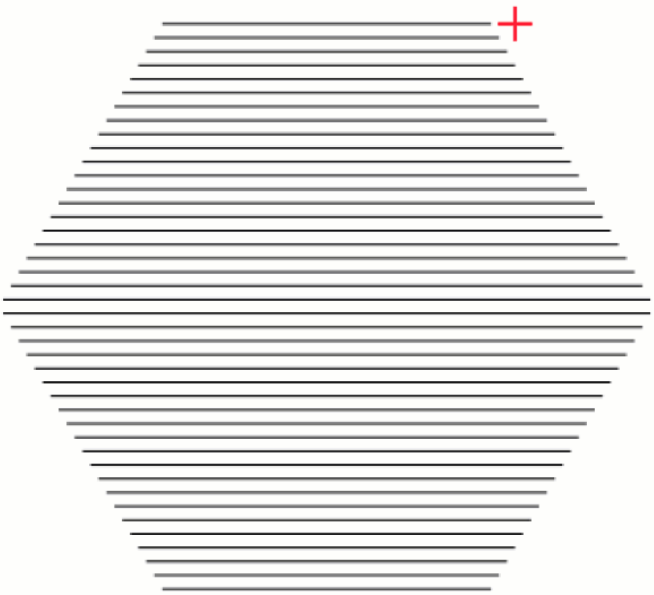
Closed Shapes Only

This feature only works with shapes that are *closed*. A shape is closed when it is a complete, continuous loop whose start and end points are the same. When a shape's start and end points are different, it is *open*.

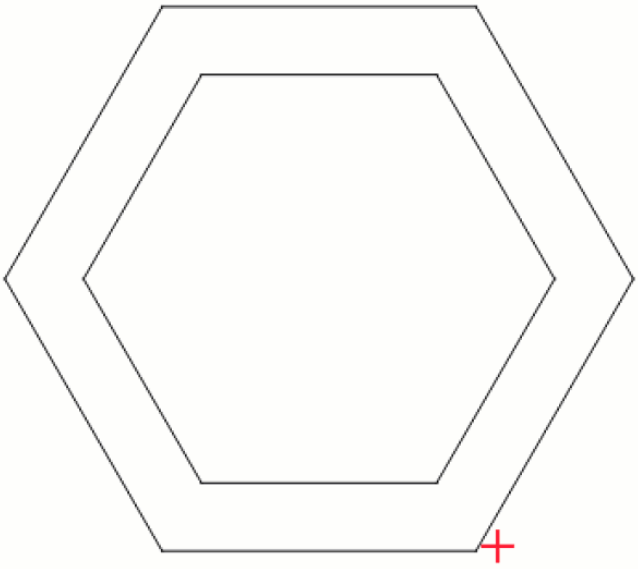
See Open vs. Closed Shapes for more information.

Fill Mode tells your laser to etch parallel lines within the boundaries of vector graphics.

The distance between each line is determined by the Line Interval setting, and the Speed and Power settings control the darkness or depth of the etch. Use low Intervals, low Speeds, and high Powers for deep engravings or dark marks, or tell your laser to move quickly at low Power to lightly etch or mark the surface.



If you have two shapes set to the same layer, and one is inside of the other, the area between the two outlines will be filled.



Fill Mode Settings

There are several specialized options available in the Cut Settings Editor for layers set to **Fill Mode**, split into two tabs, **Common** and **Advanced**.

Note

See Main / Shared Settings for information on applying essential settings like Speed and Power.

See Additional Options for information on specialized settings not covered on this page.

Click any option in the images below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.

Many of the settings presented in the images below are available for users with specific kinds of lasers, but most are shared between all types of lasers.

Figure 1: Left: Common Fill Mode settings tab

Right: Advanced Fill Mode settings tab

Figure 2:

Common Settings

Bi-directional Fill

When enabled, the laser will engrave in a side-to-side sweeping motion with the laser on and engraving in both directions.

When disabled, the laser will engrave while traveling in one direction, then return to the start of the next line without engraving the return pass. Depending on the type of laser, enabling this can save significant time on long engraving jobs.

Bi-directional vs. Uni-directional Fill Comparison

Figure 1: Bi-directional fill

Figure 1: Uni-directional fill

Cross-Hatch

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

Cross-Hatch Demonstration

Overscanning

Note

This switch is not available for DSP controllers or Galvo lasers. DSP controllers handle Overscanning automatically, while Galvo lasers compensate for extra burning at edges with Delay settings.

When enabled, adds extra moves to the beginning and end of each line to give the laser time to speed up before firing, and slow down afterward. Overscanning distance is calculated as a percentage of Speed.

When **Overscanning** is not used or not set correctly, engraved jobs appear more burned at the edges and lighter in the middle, due to the laser slowing down to change scanning direction, while firing.

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

Excessive Overscanning: GCode

If Overscanning is enabled on a GCode laser and there isn't enough room at the edge of the job to accommodate the extra travel distance, you may see LightBurn's **Cut may be out of bounds due to overscan settings** error, or your laser's controller may return an ALARM:2 error.

To correct the error, reduce Speed or Overscanning distance, or move your graphics in toward the center of your Workspace, if you are using Absolute Coordinates positioning. If you are using Current Position or User Origin to set a custom Origin, set it closer to the center of your laser's work area.

Excessive Overscanning: DSP

DSP controllers handle Overscanning in hardware, but the Speed value you enter affects the amount of distance required. If a job on a DSP laser requires Overscanning and there isn't enough room at the edge of the job to accommodate it, your DSP controller may return the **Not Enough Extend Space** error.

To correct the error, reduce Speed or move your graphics in toward the center of your Workspace, if you are using Absolute Coordinates positioning. If you are using Current Position or User Origin to set a custom Origin, set it closer to the center of your laser's work area.

Overscanning Demonstration

Figure 1: The extra Overscanning movements are indicated in red. Toggle on Show traversal moves in the Preview window to see these movements.

Line Interval

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

Optimizing Line Interval

Lower Line Interval values lead to a greater density of lines. The ideal Line Interval will produce lines that just touch, without overlapping.

Increasing Line Interval to the maximum amount that doesn't leave gaps between lines will lead to reduced runtimes for your projects, with no loss in quality, but you may also need to increase Power to achieve dark engravings.

Use the Interval Test or Material Test to find the optimal Line Interval for your laser and material.

Lines Per Inch

A different, often more intuitive way of controlling the Line Interval, or spacing between rows.

Scan Angle

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

DSP Scan Angle Warning

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

Number of Passes

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

Z Offset

If you have Z movement enabled, and your controller supports it, you can use the **Z offset** setting to move the laser head closer to the material (inward) or farther away from it (outward). Positive values move the Z Axis inward, and negative values move it outward.

Focusing deeper into the material can sometimes help to cut thicker material, and lifting the laser away from the material can produce a thicker line.

Warning for Z Moves

Z moves have the potential to physically damage your laser by crashing the head into the material.

If your system uses auto-focus, you may not be able to push the focus point lower, because most systems treat the auto-focus height as the lowest possible height (Z limit) to avoid crashing the laser head.

Z step per Pass

When doing more than a single pass over a shape, the Z step per pass setting allows you to tell LightBurn to raise or lower the laser with each pass by the same amount.

By allowing you to shift the focus point deeper with each pass, this is often useful for cutting thick materials or achieving deep engravings,

Fill Grouping

The Fill Mode order-by options control which shapes are engraved at the same time by the laser. If you run your laser fast, *or* your laser accelerates slowly, it is often most efficient to scan things all at once, so the laser spends most of its time moving at the speed you've chosen, and less time changing direction.

If you are engraving slowly, your laser accelerates fast, or the design contains a lot of blank space, it can be more efficient to fill clusters of close shapes, or to fill the shapes one by one.

Fill All Shapes at Once: the default, this setting means that everything on this layer will be filled at the same time, sweeping back and forth across the whole job. If you are running the laser fast (300 mm/sec or more) this is usually the most efficient option, with some exceptions.

Fill Groups Together: this setting will fill all shapes in a Group at the same time.

Fill Shapes Individually: this setting fills all shapes one by one.

> **Tip**
>
> If you aren't sure which choice is ideal, try different options and use Preview to estimate the time.

Advanced settings

Under the **Advanced** tab you'll find several less frequently-used options. Many of the options presented here are available only for particular types of lasers.

> **Note**
>
> The Advanced tab is not available if you're using a Galvo laser. See Galvo-Specific Cut Settings for information on advanced settings for Galvo lasers.

Ramp Length

Use this setting to slope the sides of an engraving by varying the laser power. The ramp length controls how far from the design the slope will extend.

This setting is useful if you create rubber stamps, particularly if the designs have thin regions that need extra support.

Enable **Ramp Outer Edge** to slope the outer sides of an engraving, and not just the inner sides (it's usually best to leave this setting disabled for stamp-making).

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

Flood Fill

Flood Fill calculates an engraving path that attempts to reduce or eliminate travel moves across blank space. It's useful for engraving designs with lots of empty space within graphics, where traveling across the empty portions would otherwise consume a great deal of time.

Flood Fill sometimes separates individual shapes into segments, engraving a portion of one, then a portion of another, before returning to the first shape (it may also jump within individual shapes to engrave disconnected portions). While Flood Fill will always scan back and forth at the angle you apply, it may change directions, going first from top to bottom, then bottom to top (or right to left, then left to right, and so on for any given angle).

Flood Fill is an especially useful option for machines that accelerate quickly, and for Galvo lasers in particular.

> **Note**
>
> For Galvo lasers, Flood Fill is presented in the **Common Settings** tab.

Warning

Flood Fill is *very* sensitive to machine tuning and backlash, and can cause gaps in your engraving if the design is too complex and/or your machine is not set up optimally. Use it sparingly, and use Preview to see how the option will engrave your design, so you aren't surprised by the path it takes.

Override PWM Frequency

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

Note

This setting is only available for lasers with Ruida controllers.

Enable PPI

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

Note

This setting is only available for lasers with Trocen controllers.

U Offset

Enter a distance here to set a per-layer U Axis offset. To use this setting, your laser must support U Axis control, and you must enable the U Axis in Device Settings.

Note

This setting is only available for lasers with Ruida controllers.

Additional Options

The settings presented in the Cut Settings Editor depend on the selected Layer Mode and the type of laser you're working with. Select an option below to learn more about different groups of settings.

Main / Shared Settings

Settings shared by almost all types of lasers and Layer Modes, including critical settings like **Speed** and **Power**.

Line Mode

Tells your laser to trace a path along the outlines of geometry in your project.

Fill Mode

Tells your laser to etch or engrave parallel lines inside the bounds of closed shapes in your project.

Offset Fill Mode

Tells your laser to fill closed shapes with lines that follow the contour of the outer shape.

Image Mode

Works similarly to **Fill Mode**, but applies additional special settings to adjust output based on the pixels in your image.

Galvo-Specific Settings

Special settings that are available for users with Galvo style lasers only.

Sub-Layers

A tool for setting up and applying multiple cut/engraving settings to the same geometry or layers in your project.

Default Layer Settings

Built-in or custom-created settings stored on a per-layer basis, that you can reset to at any time.

Note

Some options in the Cut Settings Editor are hidden if you have Beginner Mode enabled.

laser-control

5.5.1.2.5 Offset Fill Mode

Closed Shapes Only

This feature only works with shapes that are *closed*. A shape is closed when it is a complete, continuous loop whose start and end points are the same. When a shape's start and end points are different, it is *open*.

See Open vs. Closed Shapes for more information.

Offset Fill mode works similarly to Fill Mode, but instead of telling your laser to scan parallel lines within the boundaries of a vector graphic, it tells your laser to etch concentric lines that follow the outline of the shape.

As with both Line and Fill Mode, Speed and Power control the depth and darkness of the etch, and, as with Fill Mode, the Line Interval setting controls the spacing of the lines.

Offset Fill is intended for designs with a lot of empty space within graphics, to cut down on the amount of travel time necessary to fill large, hollow shapes. If that description fits your design, Offset Fill will most likely be much faster than Fill Mode. If that *doesn't* apply to your graphics, it's usually best to use Fill instead of Offset Fill.

Offset Fill Computation Time

Offset Fill is very computationally expensive, and the more complex the design, or the smaller the Line Interval set, the more potential there is for the computation to cause LightBurn to hang. Sometimes graphics with stray nodes or unusual paths can confuse the calculation interminably.

Offset Fill Mode Settings

There are several specialized options available in the Cut Settings Editor for layers set to **Offset Fill Mode**, split into two tabs, **Common** and **Advanced**.

Note

See Main / Shared Settings for information on applying essential settings like Speed and Power.

See Additional Options for information on specialized settings not covered on this page.

Click any option in the images below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.

Many of the settings presented in the images below are available for users with specific kinds of lasers, but most are shared between all types of lasers.

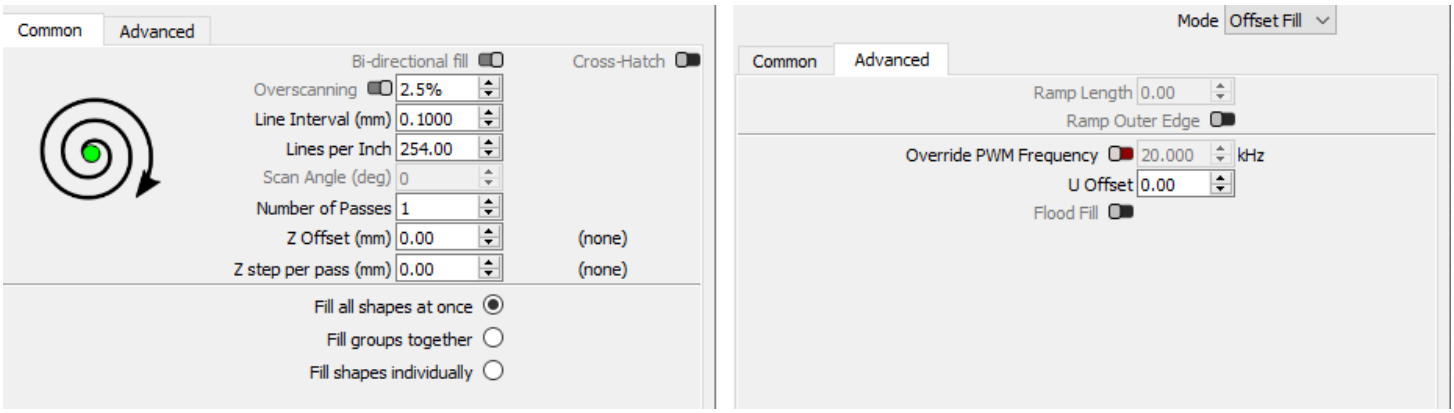


Figure 1: Left: Common Offset Fill Mode settings tab

Right: Advanced Offset Fill Mode settings tab

Figure 2:

Common Settings

Bi-directional fill, Cross-Hatch, Overscanning, and Scan Angle are presented in this tab, but are grayed out and unavailable for use with layers set to **Offset Fill Mode**. To use these settings, set the layer to Fill Mode.

Line Interval

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

Lower Line Interval values lead to a greater density of lines. The ideal Line Interval will produce lines that just touch, without overlapping.

Increasing Line Interval to the maximum amount that doesn't leave gaps between lines will lead to reduced runtimes for your projects, with no loss in quality, but you may also need to increase Power to achieve dark engravings.

Use the Interval Test or Material Test to find the optimal Line Interval for your laser and material.

Lines Per Inch

A different, often more intuitive way of controlling the Line Interval, or spacing between rows.

Number of Passes

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

Z Offset

If you have Z movement enabled, and your controller supports it, you can use the **Z offset** setting to move the laser head closer to the material (inward) or farther away from it (outward). Positive values move the Z Axis inward, and negative values move it outward.

Focusing deeper into the material can sometimes help to cut thicker material, and lifting the laser away from the material can produce a thicker line.

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

Z step per Pass

When doing more than a single pass over a shape, the Z step per pass setting allows you to tell LightBurn to raise or lower the laser with each pass by the same amount.

By allowing you to shift the focus point deeper with each pass, this is often useful for cutting thick materials or achieving deep engravings,

Fill Grouping

The Fill Mode order-by options control which shapes are engraved at the same time by the laser. If you run your laser fast, *or* your laser accelerates slowly, it is often most efficient to scan things all at once, so the laser spends most of its time moving at the speed you've chosen, and less time changing direction.

If you are engraving slowly, your laser accelerates fast, or the design contains a lot of blank space, it can be more efficient to fill clusters of close shapes, or to fill the shapes one by one.

Advanced Settings

Under the **Advanced** tab you'll find a few less frequently-used options. The options presented here are available only for particular types of lasers.

Ramp Length and Flood Fill are presented in this tab, but are grayed out and unavailable for use with layers set to **Offset Fill Mode**. To use these settings, set the layer to Fill Mode.

> **Note**
>
> The Advanced tab is not available if you're using a Galvo laser. See Galvo-Specific Cut Settings for information on advanced settings for Galvo lasers.

Override PWM Frequency

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

> **Note**
>
> This setting is only available for lasers with Ruida controllers.

Enable PPI

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

> **Note**
>
> This setting is only available for lasers with Trocen controllers.

U Offset

Enter a distance here to set a per-layer U Axis offset. To use this setting, your laser must support U Axis control, and you must enable the U Axis in Device Settings.

Note

This setting is only available for lasers with Ruida controllers.

Additional Options

The settings presented in the Cut Settings Editor depend on the selected Layer Mode and the type of laser you're working with. Select an option below to learn more about different groups of settings.

Main / Shared Settings

Settings shared by almost all types of lasers and Layer Modes, including critical settings like **Speed** and **Power**.

Line Mode

Tells your laser to trace a path along the outlines of geometry in your project.

Fill Mode

Tells your laser to etch or engrave parallel lines inside the bounds of closed shapes in your project.

Offset Fill Mode

Tells your laser to fill closed shapes with lines that follow the contour of the outer shape.

Image Mode

Works similarly to **Fill Mode**, but applies additional special settings to adjust output based on the pixels in your image.

Galvo-Specific Settings

Special settings that are available for users with Galvo style lasers only.

Sub-Layers

A tool for setting up and applying multiple cut/engraving settings to the same geometry or layers in your project.

Default Layer Settings

Built-in or custom-created settings stored on a per-layer basis, that you can reset to at any time.

Note

Some options in the Cut Settings Editor are hidden if you have Beginner Mode enabled.

laser-control

5.5.1.2.6 Image Mode

Image Mode is a special engraving mode for images, which works similarly to Fill Mode, but allows you to select an additional image processing mode that affects the appearance of the engraving.

Speed, Power, and Line Interval are all crucial settings for achieving great image engravings, but the appropriate settings are heavily dependent on your laser and material.

Several additional settings that affect the quality of the engraving are applied on a per-image basis, using the Adjust Image tool or Shape Properties Window.

Image Mode Settings

There are several specialized options available in the Cut Settings Editor for layers set to **Image Mode**. All settings are located in a single **Image Settings** tab.

> **Note**
>
> See Main / Shared Settings for information on applying essential settings like Speed and Power.
>
> See Additional Options for information on specialized settings not covered on this page.

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.

Some of the settings presented in the images below are available for users with specific kinds of lasers, but most are shared between all types of lasers.

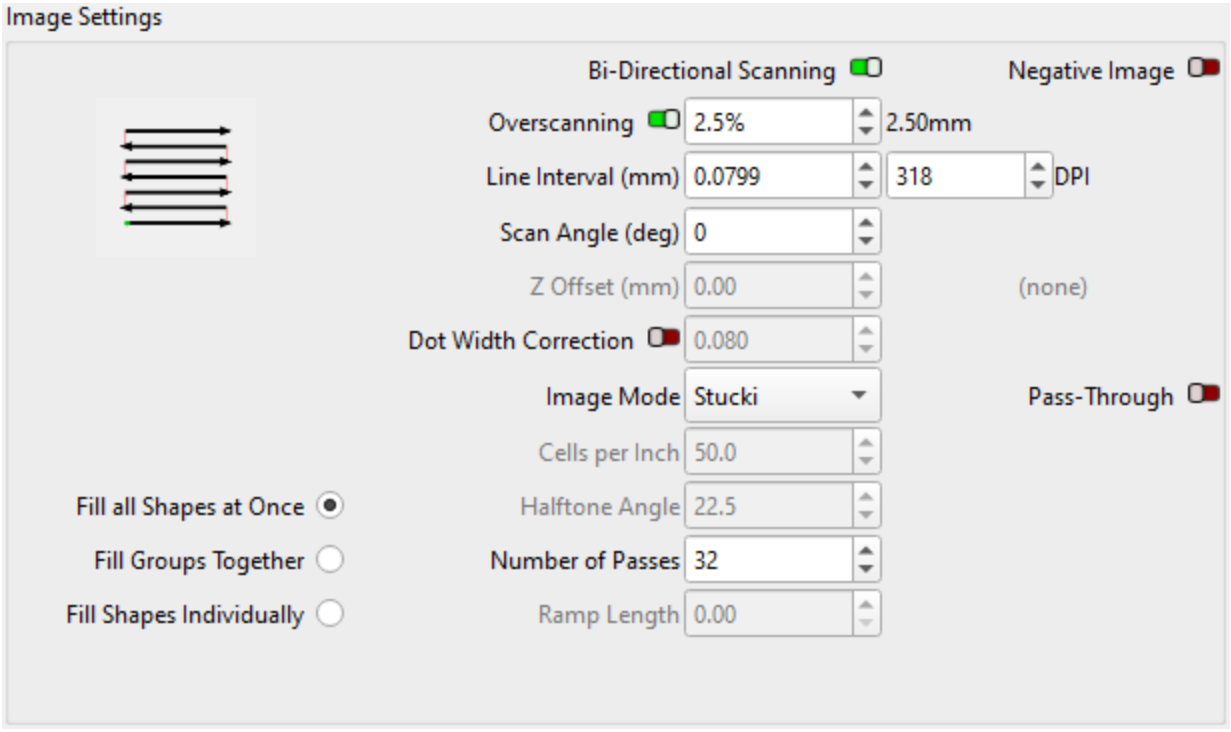


Figure 1: Image Mode settings for a GCode-based laser

Figure 2:

Bi-directional Scanning

When enabled, the laser will engrave in a side-to-side sweeping motion with the laser on and engraving in both directions.

When disabled, the laser will engrave while traveling in one direction, then return to the start of the next line without engraving the return pass. Depending on the type of laser, enabling this can save significant time on long engraving jobs.

Bi-directional vs. Uni-directional Scanning Comparison

Figure 1: Bi-directional scanning

Figure 1: Uni-directional scanning

Negative Image

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

Tip

Use this in conjunction with the Invert switch in the Preview window to see how your engraving will look on dark surfaces.

Overscanning

Note

This switch is not available for DSP controllers or Galvo lasers. DSP controllers handle Overscanning automatically, while Galvo lasers compensate for extra burning at edges with Delay settings.

When enabled, adds extra moves to the beginning and end of each line to give the laser time to speed up before firing, and slow down afterward. Overscanning distance is calculated as a percentage of Speed.

When **Overscanning** is not used or not set correctly, engraved jobs appear more burned at the edges and lighter in the middle, due to the laser slowing down to change scanning direction, while firing.

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

Excessive Overscanning: GCode

If Overscanning is enabled on a GCode laser and there isn't enough room at the edge of the job to accommodate the extra travel distance, you may see LightBurn's **Cut may be out of bounds due to overscan settings** error, or your laser's controller may return an ALARM:2 error.

To correct the error, reduce Speed or Overscanning distance, or move your graphics in toward the center of your Workspace, if you are using Absolute Coordinates positioning. If you are using Current Position or User Origin to set a custom Origin, set it closer to the center of your laser's work area.

Excessive Overscanning: DSP

DSP controllers handle Overscanning in hardware, but the Speed value you enter affects the amount of distance required. If a job on a DSP laser requires Overscanning and there isn't enough room at the edge of the job to accommodate it, your DSP controller may return the **Not Enough Extend Space** error.

To correct the error, reduce Speed or move your graphics in toward the center of your Workspace, if you are using Absolute Coordinates positioning. If you are using Current Position or User Origin to set a custom Origin, set it closer to the center of your laser's work area.

Overscanning Demonstration

Figure 1: The extra Overscanning movements are indicated in red. Toggle on Show traversal moves in the Preview window to see these movements.

Line Interval

Controls the spacing between scanned rows, and indirectly controls **DPI**.

Optimizing Line Interval

Lower Line Interval values lead to a greater density of lines. The ideal Line Interval will produce lines that just touch, without overlapping.

Increasing Line Interval to the maximum amount that doesn't leave gaps between lines will lead to reduced runtimes for your projects, with no loss in quality, but you may also need to increase Power to achieve dark engravings.

Use the Interval Test or Material Test to find the optimal Line Interval for your laser and material.

DPI (Dots Per Inch)

Controls the pixel density of the output — this is another way of representing **Line Interval**. DPI is 25.4 / Line Interval.

Dot Width Correction

Dot Width Correction compensates for the thickness of the laser's beam by shortening the length of engraved scan lines. The ideal Dot Width Correction value is about half the total thickness of the laser's beam. Due to varying affects of power output on different materials, this ideal value can vary depending on the material you're working with.

The number should always be smaller than whatever you're using as your interval setting. The valid range is from 0 to your Line Interval value.

Scan Angle

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

DSP Scan Angle Warning

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

Z Offset

If you have Z movement enabled, and your controller supports it, you can use the **Z offset** setting to move the laser head closer to the material (inward) or farther away from it (outward). Positive values move the Z Axis inward, and negative values move it outward.

Focusing deeper into the material can sometimes help to cut thicker material, and lifting the laser away from the material can produce a thicker line.

Warning for Z Moves

Z moves have the potential to physically damage your laser by crashing the head into the material.

If your system uses auto-focus, you may not be able to push the focus point lower, because most systems treat the auto-focus height as the lowest possible height (Z limit) to avoid crashing the laser head.

Cells per Inch

Number of Halftone shading dots to compute per inch. Only enabled when the Halftone Image Mode is selected.

Halftone Angle

Angle of the Halftone shading pattern. Only enabled when the Halftone Image Mode is selected.

Number of Passes

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

Ramp Length

Use this setting to slope the sides of an engraving by varying the laser power. The ramp length controls how far from the design the slope will extend.

This setting is useful if you create rubber stamps, particularly if the designs have thin regions that need extra support.

This setting is only available if you have Threshold Image Mode selected.

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

Pass-Through

When working with images that have been pre-processed for laser engraving, enable this setting to engrave the image as-is, rather than resampling using the Image Modes described below. **Line Interval/DPI** will be directly tied to the size of the image.

Image Mode

The Image Mode setting controls how LightBurn processes your image. Below you can see a description of each Image Mode in LightBurn, along with an example of how that mode changes the look of the example image. Click on the image previews to see a larger version.

THRESHOLD

A simple on / off switch if the image is dark / bright at a given location. This should only be used for images that are two-color black/white to begin with, such as an image you dithered outside of LightBurn. Don't use this mode for grayscale or color images.

ORDERED

Also called ordered dithering, this is a step above threshold for grayscale images, and uses densely packed on/off dots to approximate shading, using an ordered/regular grid pattern. This is ok for general use, but works best for images with large areas of solid fill, where diffusion dithering can cause unwanted artifacts (see below).

ATKINSON

A good "in between" mode for solid color or smooth shaded images. It resembles Jarvis but preserves detail better, though struggles to show detail in very light and dark areas.

DITHER

Also called error diffusion dithering, this is the best choice for smoothly shaded images, like photos. This also approximates shading with simple dots, but does so without evident patterning, and tends to produce more subtle shading.

STUCKI

A good choice for smooth-shaded or photo images, with slightly faster processing than Jarvis. Stucki works somewhat similarly to Dither mode to produce smooth shading, and likewise struggles in midtones.

JARVIS

Generally the best choice for smooth-shaded or photo images, with slightly slower but better processing than Stucki. Jarvis works somewhat similarly to Dither mode to produce smooth shading, and doesn't struggle with midtones.

NEWSPRINT

A decorative pattern that imitates newsprint halftoning by generating a grid of spots that are larger in darker areas. It has good tonal range, but is visibly patterned. Smoothest shading is achieved with higher DPI settings, or Smoothieware controllers.

HALFTONE

Good quality shading for high DPI images. It is similar to Newsprint but can have variable cell size and pattern angle.

SKETCH

GRAYSCALE

Useful for line drawings or handwriting, as it tries to detect hard edges. Sketch engraves only at the areas where light and dark values meet at hard edges (highpass filtering).	Varies power output as a percentage between Min and Max Power, using Min Power for the lightest shades and Max Power for the darkest. With a diode laser this can provide great shading but is harder to get right than plain dithering. With a CO2 laser, grayscale mode can achieve variable depth (3D) engraving rather than shading. Images typically need to be specifically created for this use.

Note

When Previewing a Grayscale engraving, be sure to enable Shade according to power, otherwise you will see a completely black Preview since, unlike other modes, Grayscale scans every portion of the image, just at varying levels of laser power.

Fill Grouping

The Fill Mode order-by options control which shapes are engraved at the same time by the laser. If you run your laser fast, *or* your laser accelerates slowly, it is often most efficient to scan things all at once, so the laser spends most of its time moving at the speed you've chosen, and less time changing direction.

If you are engraving slowly, your laser accelerates fast, or the design contains a lot of blank space, it can be more efficient to fill clusters of close shapes, or to fill the shapes one by one.

Tip

If you aren't sure which choice is ideal, try different options and use Preview to estimate the time.

Override PWM Frequency

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

Note

This setting is only available for lasers with Ruida controllers.

U Offset

Enter a distance here to set a per-layer U Axis offset. To use this setting, your laser must support U Axis control, and you must enable the U Axis in Device Settings.

> **Note**
>
> This setting is only available for lasers with Ruida controllers.

Additional Options

The settings presented in the Cut Settings Editor depend on the selected Layer Mode and the type of laser you're working with. Select an option below to learn more about different groups of settings.

Main / Shared Settings

Settings shared by almost all types of lasers and Layer Modes, including critical settings like **Speed** and **Power**.

Line Mode

Tells your laser to trace a path along the outlines of geometry in your project.

Fill Mode

Tells your laser to etch or engrave parallel lines inside the bounds of closed shapes in your project.

Offset Fill Mode

Tells your laser to fill closed shapes with lines that follow the contour of the outer shape.

Image Mode

Works similarly to **Fill Mode**, but applies additional special settings to adjust output based on the pixels in your image.

Galvo-Specific Settings

Special settings that are available for users with Galvo style lasers only.

Sub-Layers

A tool for setting up and applying multiple cut/engraving settings to the same geometry or layers in your project.

Default Layer Settings

Built-in or custom-created settings stored on a per-layer basis, that you can reset to at any time.

Note

Some options in the Cut Settings Editor are hidden if you have Beginner Mode enabled.

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5.5.1.2.7 Galvo-Specific Cut Settings

Several settings are only available in the Cut Settings Editor when working with Galvo lasers with EZCAD2 or BSL control boards.

Among these settings, some options are only available for specific types of Galvo lasers, or specific Layer Modes.

Note

See Main / Shared Settings for information on applying essential settings like Speed and Power.

See Additional Options for information on specialized settings not covered on this page.

Click any option in the images below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.

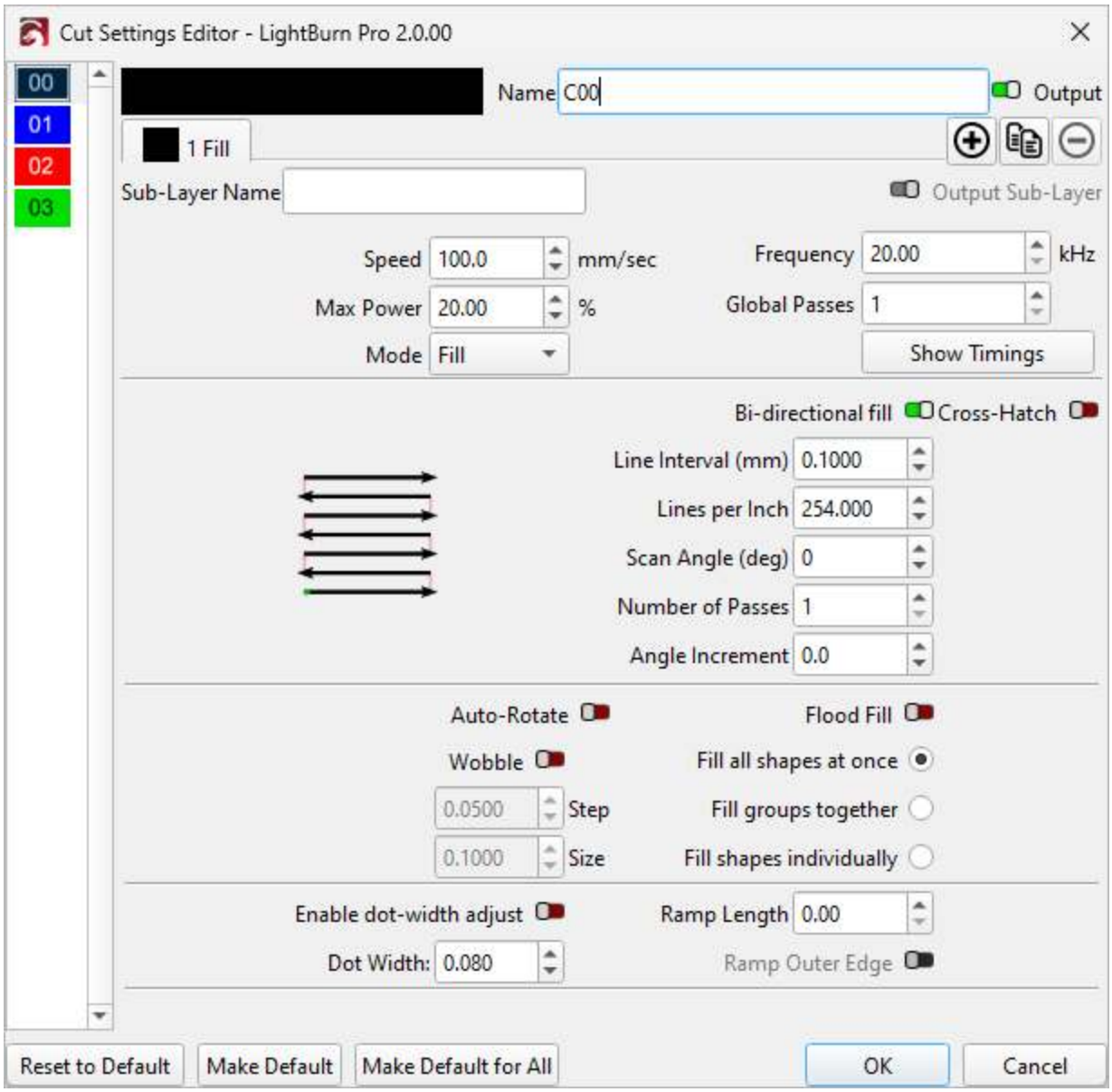

Figure 1: Galvo-specific cut settings

Main Settings

For Galvo lasers, the following settings are available in the top portion of the Cut Settings Editor, along with other essential settings shared by all types of layers.

Frequency

The **Frequency**, in kHz, at which the laser will pulse during operation. Relatively low Frequencies yield fewer pulses at greater power output with each pulse, while relatively high Frequencies yield more pulses at lower power output with each pulse.

Frequencies in the mid-range of your laser's capability will often produce the most even markings, but the exact effect of given Frequency values varies greatly depending on your laser, material, and other settings, such as Power, Speed, and Line Interval.

> **Tip**
>
> Use the Material Test to try out different combinations of Frequency, Q-Pulse Width, and other settings on a given material.

Q-Pulse Width

> **Note**
>
> This setting is available for MOPA Fiber and UV Galvo lasers only.

Q-Pulse Width determines the duration of each pulse of your laser, in nanoseconds. As with Frequency, the exact effect of given Q Pulse Widths varies greatly depending on your laser, material, and other settings, such as Power, Speed, and Line Interval.

> **Note for UV Lasers**
>
> For UV lasers, the Power setting is grayed out because power output is controlled solely by adjusting Frequency and Q-Pulse Width.
>
> Max power is achieved by applying the correct combination of Frequency and Q-Pulse — your laser may have come with a chart that shows expected power outputs at different combinations. In general, you will see power increase as you increase Frequency and Q-Pulse values, a leveling off of power output in the middle-to-high values, and then a tailing off with very high values.

Global Passes

Enable this setting to repeat all Sub-Layers in the layer, in sequence, the specified number of times.

Specialized Settings

For Galvo lasers, the following settings are available in the bottom half of the Cut Settings Editor.

- Auto-Rotate and Angle Increment are only available for layers set to Fill Mode.
- Dot Width Adjust is available for layers set to Fill or Image Mode.
- 3D Sliced Image Mode and its related settings are only available for layers set to Image Mode.

Wobble

Because Galvo lasers are not optimized for cutting, it can be hard to apply enough power to a given area while using Line Mode to cut through material.

Enable Wobble to tell the laser to trace small circles along the path of the line, creating a thicker line and forcing the beam to spend longer in each section of the line. The **Step** value refers to how far apart the circles are, and the **Size** value refers to the diameter of the circles (in millimeters).

Auto-Rotate

Enable to adjust the Scan Angle by the Angle Increment with each run of a given job, such as when you enable Run Continuously, specify a Repeat count in the Galvo Framing window, or manually Start a job multiple times.

Click Reset Count to reset to the original Scan Angle.

Angle Increment

For layers set to multiple Passes or Global Passes, adjusts the Scan Angle by this increment with each successive pass.

Dot Width Adjust

Dot Width Correction compensates for the thickness of the laser's beam by shortening the length of engraved scan lines. The ideal Dot Width Correction value is about half the total thickness of the laser's beam. Due to varying affects of power output on different materials, this ideal value can vary depending on the material you're working with.

The number should always be smaller than whatever you’re using as your interval setting. The valid range is from 0 to your Line Interval value.

3D Sliced Image Mode

3D Sliced is a special Image Mode for Galvo lasers only, which uses multiple passes to engrave a design one layer at a time. This mode is intended for use with depth maps – sometimes called height maps — which are specially designed grayscale images in which a pixel's brightness represents depth, rather than shading.

Lighter pixels are engraved with fewer passes than darker pixels, resulting in a deeper engrave in darker areas of the image. Enabling **Negative Image** inverts brightness, leading to lighter areas engraving deeper than darker areas.

See 3D Sliced Engravings for more detailed instructions on creating and working with grayscale depth maps.

Enable cleanup pass

Toggle on **Enable cleanup pass** to add a **Cleanup** Sub-Layer, where you can specify how often automatic cleanup passes should run, and adjust the settings for those passes.

Cleanup passes are typically run with a tighter Line Interval, higher Frequency, and lower Max Power than the main engraving passes, and are used to clear debris and produce a better finish.

Clean after # of passes

Specify the number of passes to run in between Cleanup passes.

Clean whole image

Enable **Clean whole image** to run Cleanup passes over the entire image, rather than recent passes only.

Timings

Click **Show Timings** to adjust per-layer timing settings. Click **Hide Timings** to return to the main tab of the Cut Settings Editor.

Override Default Timings

Enable **Override Default Timings** to set custom timings on a per-layer basis. If you leave it disabled, your laser will instead use the timings established in your Device Settings.

- Jump Settings control how the laser moves between cuts. Each jump causes the mirror to shake, with higher speeds and longer distances increasing the shaking. If you have wobbly lines at the start of a marking move, you may need to increase the delay and/or reduce the speed of jumps.
- Delay Settings control the delay between starting (or stopping) mirror movement and firing the laser. **Laser On/Off TC** and **End TC** control the delays for the start and end points of a path. **Polygon TC** controls the delays for other corners within a path.

Setting	Description
Jump Speed	The speed at which the galvo mirrors move between cuts. Higher values will make your job run faster at the cost of increased vibration for the mirrors.
Min Jump Delay	The minimum time the laser will wait to allow the galvo mirrors to stop shaking.
Max Jump Delay	The maximum time the laser will wait to allow the galvo mirrors to stop shaking.
Jump Distance Limit	Any jump above this limit will use the **Max Jump Delay** setting above. Jumps below this limit will use a delay value between the minimum and maximum settings.
Laser On TC	Microseconds the laser will wait to fire after the mirrors begin to move. Too high a value will leave gaps, while too low a value may cause excessive burning at the start of a cut.
Laser Off TC	Microseconds to delay turning off the laser at the end of a marking move. Too high a value may cause excessive burning at the end of a cut, while too low a value may cause gaps.
End TC	Microseconds to pause the laser's movement after completing a cut.
Polygon TC	Microseconds the galvo head will pause when turning corners. Too long a delay may cause excessive burning, while too short a delay can cause rounded or cut-off corners.

Pause Before

The number of milliseconds to pause before starting a Sub-Layer. Click the **Show Timings** button to show this setting or **Hide Timings** to hide it.

Pause After

The number of milliseconds to pause after finishing a Sub-Layer. Click the **Show Timings** button to show this setting or **Hide Timings** to hide it.

Additional Options

The settings presented in the Cut Settings Editor depend on the selected Layer Mode and the type of laser you're working with. Select an option below to learn more about different groups of settings.

Main / Shared Settings

Settings shared by almost all types of lasers and Layer Modes, including critical settings like **Speed** and **Power**.

Line Mode

Tells your laser to trace a path along the outlines of geometry in your project.

Fill Mode

Tells your laser to etch or engrave parallel lines inside the bounds of closed shapes in your project.

Offset Fill Mode

Tells your laser to fill closed shapes with lines that follow the contour of the outer shape.

Image Mode

Works similarly to **Fill Mode**, but applies additional special settings to adjust output based on the pixels in your image.

Galvo-Specific Settings

Special settings that are available for users with Galvo style lasers only.

Sub-Layers

A tool for setting up and applying multiple cut/engraving settings to the same geometry or layers in your project.

Default Layer Settings

Built-in or custom-created settings stored on a per-layer basis, that you can reset to at any time.

Note

Some options in the Cut Settings Editor are hidden if you have Beginner Mode enabled.

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5.5.1.2.8 Sub-Layers

Sub-Layers allow you to assign multiple cut or engraving settings to the same layer and geometry. This can enable the use of single-setup etching and cleanup passes for Galvo lasers, as well as staggered engraving, cutting, and other operations for more complex jobs, regardless of machine type.

All settings of individual Sub-Layers are independently editable and presented as tabs in the Cut Settings Editor. Click a tab to access and adjust that Sub-Layer's settings.

You may have up to 11 Sub-Layers per layer.

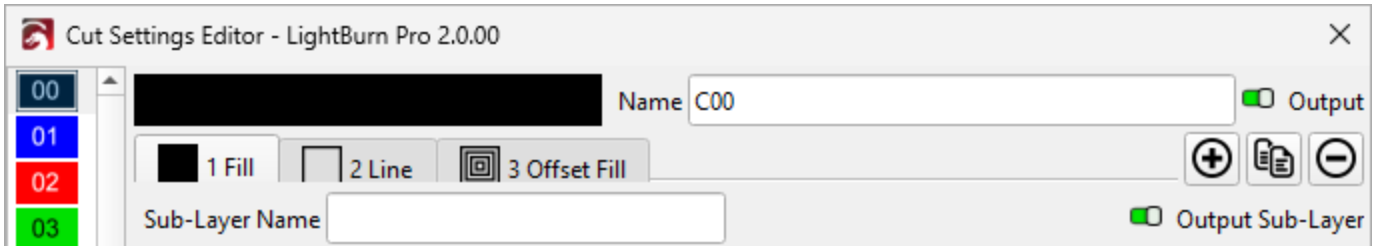
Note

See Main / Shared Settings for information on applying essential settings like Speed and Power.

See Additional Options for information on specialized settings not covered on this page.

Creating and Managing Sub-Layers

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Adding

Click the plus icon to create a new **Sub-Layer**, with the Default Settings of the parent layer.

Duplicating

Click the duplicate icon to create a new **Sub-Layer**, with identical settings to the currently-open Sub-Layer.

Deleting

Click the minus icon to delete the currently-open **Sub-Layer**. This option is not available if you have only one Sub-Layer.

Enabling and Disabling

Toggle the **Output** switch on or off to determine whether a given **Sub-Layer** is included in the output when you Preview, Start, Send, or save a project in machine-specific format.

The universal Output switch at the top of the window determines whether an entire layer, including every Sub-Layer, is output.

Rearranging Sub-Layers

Click and drag a **Sub-Layer**'s tab to change the order in which it will be output. Sub-Layers are output in sequence, starting from left to right.

Naming Sub-Layers

To keep track of the purpose of individual Sub-Layers, you can give them unique names in the **Sub-Layer Name** field.

Sub-Layers in the Cuts / Layers Window

In the Cuts / Layers Window layers with **Sub-Layers** display their mode as **Multi**, and you may not edit the modes of individual Sub-Layers through that window. as seen below.

Click an individual Sub-Layer tab in the Cuts / Layers Window to edit a limited number of settings.

You can reorganize, as you can within the full Cut Settings Editor in the quick settings, by clicking and dragging. Sub-Layers are output in sequence, starting from left to right.

Legacy Behavior: Fill + Line

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

Danger

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

Additional Options

The settings presented in the Cut Settings Editor depend on the selected Layer Mode and the type of laser you're working with. Select an option below to learn more about different groups of settings.

Main / Shared Settings

Settings shared by almost all types of lasers and Layer Modes, including critical settings like **Speed** and **Power**.

Line Mode

Tells your laser to trace a path along the outlines of geometry in your project.

Fill Mode

Tells your laser to etch or engrave parallel lines inside the bounds of closed shapes in your project.

Offset Fill Mode

Tells your laser to fill closed shapes with lines that follow the contour of the outer shape.

Image Mode

Works similarly to **Fill Mode**, but applies additional special settings to adjust output based on the pixels in your image.

Galvo-Specific Settings

Special settings that are available for users with Galvo style lasers only.

Sub-Layers

Default Layer Settings

A tool for setting up and applying multiple cut/engraving settings to the same geometry or layers in your project.

Built-in or custom-created settings stored on a per-layer basis, that you can reset to at any time.

Note

Some options in the Cut Settings Editor are hidden if you have Beginner Mode enabled.

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5.5.1.2.9 Default Layer Settings

Cut settings are normally pre-filled with the last settings used for a given layer, but LightBurn has an option to automatically reset to either universal settings or your own customized defaults each time you start a new project.

You can also reload custom or universal defaults at any time in the Cut Settings Editor.

Use the Material Library to save a wider range of settings

Material Libraries are also available for saving and reusing cut settings, and are recommended for users who need to store and reapply many distinct, frequently-used settings.

Note

See Main / Shared Settings for information on applying essential settings like Speed and Power.

See Additional Options for information on specialized settings not covered on this page.

Setting Defaults

At the bottom of the Cut Settings Editor, there are three buttons to manage default layer settings.

Make Default: remember the settings for this palette color. Whatever your current settings are will become the default for this color. Default settings are saved separately for each device profile.

Reset to Default: reset the layer to the default settings. Hold ⇧ Shift while clicking Reset to Default to reset to LightBurn's universal defaults.

Make Default for All: your current layer settings will become the default for *all* palette colors.

Always pay attention to units of distance and time when entering Speed settings

When entering **Speed** values recommended by your laser's manufacturer or other LightBurn users, make sure to use the *same units of distance and time as those from the recommendation*, or to convert the values to your preferred units.

A given number of **millimeters per second** is *much* faster than that same number in **millimeters per minute**. Mixing up units can lead to reduction in power output due to unexpectedly high speeds, or excessive power output — and even fire — due to unexpectedly slow speeds.

Change your units of speed in the **Dimensions / Units** tab of the **Device Settings** window. LightBurn automatically converts any existing values when you switch between units.

LightBurn's Universal Defaults

The universal default layer is set to Line Mode, at 6000 mm/min (100 mm/sec) speed and 20% power, with no advanced options enabled.

Layers switched to **Fill**, **Offset Fill**, or **Image** mode after having been restored to default will be set to the same speed and power as above, a **Line Interval** of .100, and to **Fill all shapes at once**. The default dithering mode of Image layers is **Stucki**.

Load Default Layer Settings on New or Restart

To automatically load defaults instead, enable **Load default layer settings on new or restart** in the **Editor Settings** tab of the Settings window.

Additional Options

The settings presented in the Cut Settings Editor depend on the selected Layer Mode and the type of laser you're working with. Select an option below to learn more about different groups of settings.

Main / Shared Settings

Settings shared by almost all types of lasers and Layer Modes, including critical settings like **Speed** and **Power**.

Line Mode

Tells your laser to trace a path along the outlines of geometry in your project.

Fill Mode

Tells your laser to etch or engrave parallel lines inside the bounds of closed shapes in your project.

Offset Fill Mode

Tells your laser to fill closed shapes with lines that follow the contour of the outer shape.

Image Mode

Works similarly to **Fill Mode**, but applies additional special settings to adjust output based on the pixels in your image.

Galvo-Specific Settings

Special settings that are available for users with Galvo style lasers only.

Sub-Layers

A tool for setting up and applying multiple cut/engraving settings to the same geometry or layers in your project.

Default Layer Settings

Built-in or custom-created settings stored on a per-layer basis, that you can reset to at any time.

Note

Some options in the Cut Settings Editor are hidden if you have Beginner Mode enabled.

5.5.2 Output and Positioning

laser-control output-and-positioning workflow

5.5.2.1 Laser Window

The **Laser Window** is the hub for setting up and selecting a laser, **Framing** and **Starting** jobs, determining job positioning, and more.

Accessing the Laser Window

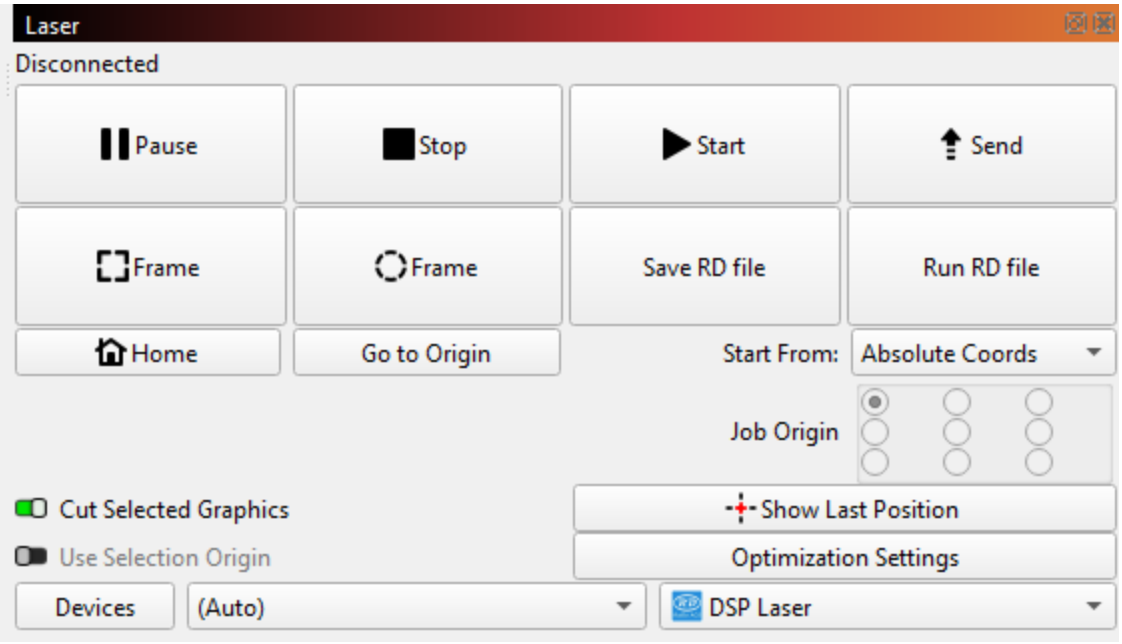
The **Laser Window** is located in the bottom right corner of LightBurn by default. If you have closed the Laser Window, go to Window → **Laser** to re-enable it. To restore it and all other windows to their default positions, go to **Window** → Reset to Default Layout.

> **Tip**
>
> The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Laser Window Options and Settings

The type of laser you have active, and certain options in the Settings window, including enabling Beginner Mode, will affect the way the **Laser Window** looks.

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Note

The above image shows the default layout of the **Laser Window** as it appears for a DSP laser. Some settings that are not available for DSP lasers, or are not enabled by default, are listed in the page below. Check this page's table of contents if you do not see the setting you're looking for in the image.

Start

Commands your laser to immediately begin running your current project.

Note

If you have a Galvo laser, you'll see the Framing window first, unless you turn off **Require framing before start** in your Device Settings.

Pause and Stop from the keyboard

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

Stop

Immediately aborts a currently running job.

Pause

Halts a running job. Click the **Resume** button to continue a paused job.

Send

The **Send** button, if your laser supports it, transfers the current job to the laser as a named file, so you can select and run it from the laser's controller.

When you use **Start**, the controller begins running the job as soon as sufficient data has reached the controller. Using Send instead of Start can sometimes help prevent file corruption during transfer.

Hold `⇧ Shift` while clicking Send to have the laser immediately start the job after the entire project has been sent.

> **Note**
>
> The Send option is only available for DSP lasers.

Framing

> **Note for Galvo users**
>
> This section covers Framing behavior for Gantry lasers. If you have Galvo laser, see Galvo Framing.

Use the two **Frame** buttons to preview the position of the job in your laser's work area, by commanding the laser to trace a path around the area where your project will output.

The speed at which the laser travels during Framing is determined by the value set in the **Speed** field in the Move Window.

Frame Continuously

Enable **Frame Continuously** in the **Basic Settings** tab of Device Settings to command your laser to run the Framing path repeatedly, until you tell it to stop. Framing Continuously is often helpful when adjusting material positioning in your laser's work area.

Laser on When Framing

Enable **Laser on when framing** in the Device Settings window to **Fire** the laser during the Framing process, at the **Power** level set in the Move Window.

If Laser on when framing is not enabled, you can hold ⇧ Shift while pressing Frame to enable the laser during the framing process.

Danger

This changes the default behavior of the laser and can cause the laser to fire when a user is not expecting it. Enable this setting with caution, with a very low power level, and only when using a diode laser.

Bounding Box Frame

Commands the laser to trace a path defined as the smallest possible rectangle that will fully contain all graphics you're sending to the laser.

Rubber Band Frame

Traces the smallest possible path that fully contains all graphics in the design you're sending to the laser, as if a rubber band were stretched around them.

Tip

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

Save Machine Files

This button will change depending on the type of laser you're using — it may say **Save GCode** (for GRBL, Smoothieware, or Marlin controllers), **Save RD File** (Ruida), **Save OUT File** (TopWisdom), or **Save UD5 File** (Trocen).

All options save your current project as a machine-ready file, in the appropriate format for your type of laser. You can transfer this file to your machine to run it without ever having to directly connect using LightBurn.

These options are also available in the File Menu.

Run Machine Files

Use this option to load and run a file previously saved in the appropriate format for your type of laser. To use this option, LightBurn must be directly connected to your laser.

This button will change depending on the type of laser you're using — it may say **Run GCode**, **Run RD File**, **Run OUT File**, or **Run UD5 File**.

Home

For GCode lasers: Commands your laser to execute a homing cycle, during which it moves toward the home position looking for the switches that activate when it hits the boundary.

For DSP lasers: Moves the head of the laser to the machine origin.

Homing is how your laser locates its 0,0 position, and all subsequent positioning information is determined relative to that point.

> **Warning**
>
> Do not use this button if your laser does not have homing switches. If you are unsure, contact your laser's manufacturer.

Go to Origin

Commands your laser to jog to the position currently set as the **User Origin**.

See Coordinates and Job Origin for more information.

Start From and Job Origin

These two controls determine where the job is placed on the bed of your laser.

See Coordinates and Job Origin for more information.

Cut Selected Graphics

This toggle switch tells LightBurn to only send the portion of your design that is currently selected when you click **Start**, **Send**, or **Save Machine File**.

See Cut Selected Graphics for more information.

Use Selection Origin

Only available in combination with **Cut Selected Graphics**, the **Use Selection Origin** button tells LightBurn to calculate origin relative to selected graphics only, and not the whole design.

See Cut Selected Graphics – Use Selection Origin for more information.

Show Last Position

Places a cross-hair cursor in the Workspace at the last reported 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. Live updating might encourage some users to watch the screen rather than their laser — lasers should never be left unattended while running.

Enable Rotary

This switch controls whether **Rotary Mode** is enabled. When enabled, rotational commands are sent to the laser to control rotary motion.

In order to see this switch in the **Laser Window**, you must turn on Show rotary enable in main window in your Settings/Preferences.

Rotaries are used to turn cylindrical objects so that their surfaces can be marked by a laser. Before using your laser with a rotary, you must first establish several important parameters in the **Rotary Setup** window that control the rotary's motion.

See Rotary Mode for more information.

Enable Cylinder Correction

> **Note**
>
> This setting is available for Galvo lasers only.

This switch controls whether **Cylinder Correction** is enabled. When enabled, LightBurn warps the output of your design to correct for distortion caused by engraving cylindrical objects, without using a rotary.

In order to see this switch in the **Laser Window**, you must turn on Show cylinder correction enable in main window in your Settings/Preferences.

Before using Cylinder Correction, you must first establish several important parameters in the **Cylinder Correction Setup** window that determine how LightBurn will warp your output.

See Cylinder Correction for more information.

Enable Red Light

> **Note**
>
> This setting is available for Galvo lasers only.

This switch controls whether your laser's Red Dot light is enabled. In order to see this switch in the **Laser Window**, your laser's Red Dot light must be controlled by an IO Port, and the appropriate port must be set in your Device Settings.

Optimization Settings

This button opens the **Optimization Settings** window, where you can adjust various options that control the order in which your graphics are cut or engraved by the laser.

See Optimization Settings for more information.

Devices

Opens the **Devices** window, where you can create, remove, or edit device profiles for lasers you want to use with LightBurn.

Right-clicking the Devices button closes and re-opens the connection to the currently selected device.

See Devices for more information.

Device Selection Dropdown

If you've created multiple device profiles for multiple lasers, select the laser you are currently working with the dropdown menu.

Serial Port Dropdown

LightBurn will attempt to automatically select the correct serial port and connect to your laser, but you may need to manually select it from this dropdown. When connected, the **Disconnected** message in the top left corner of the Laser window will change to **Ready**. If you are using a GCode-based laser, you will see a startup message in the Console window.

You may need to right-click the **Devices** button in the Laser window to refresh the list of available ports.

If you're having trouble connecting to your laser, see Troubleshooting: Connection Problems.

Device Status

The readout in the top left of the **Laser Window** indicates the current status of the laser.

- **Disconnected** indicates that the laser is not connected to LightBurn.

- **Ready** indicates that the laser is connected to LightBurn and ready to receive commands.
- **Busy** indicates that the laser is connected to LightBurn and actively completing a process.

  The progress bar indicates the percentage of commands that have been streamed to the laser, along with a time estimate indicating how long the laser has been streaming, and how much longer it will continue streaming. These estimates can be close to the total runtime of the project, but are not identical.

- **Framing** appears for Galvo lasers only, to indicate that the Framing process is active.

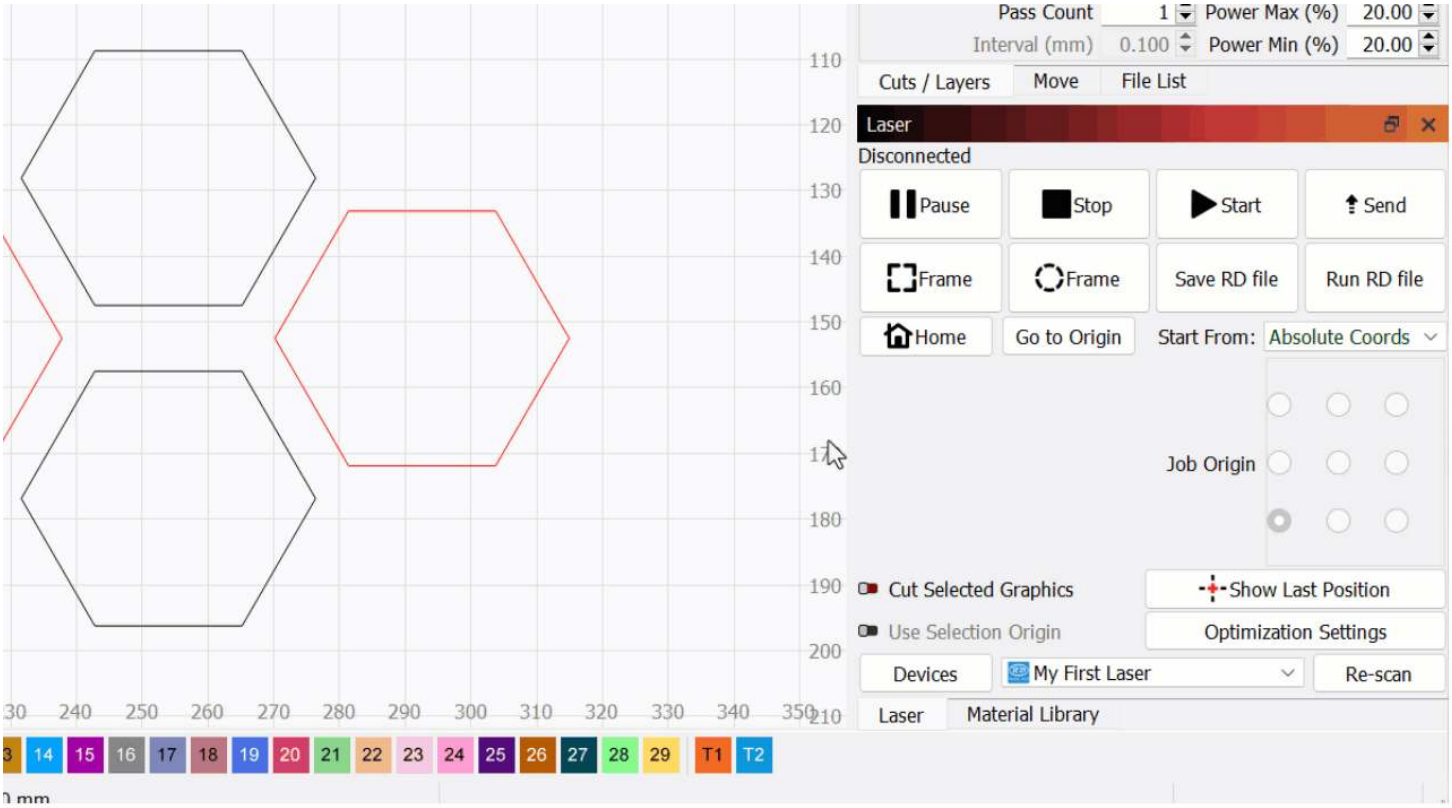
laser-control output-and-positioning gantry

5.5.2.2 Coordinates and Job Origin

There are three options for telling LightBurn where to ouput your project within the work area of your machine, each available in the **Start From** menu in the Laser Window.

- **Absolute Coordinates** tells Lightburn to output graphics in your laser's work area at a location that matches their position in your Workspace.
- **Current Position** tells LightBurn to output graphics relative to the position of the laser head at the moment you start a job.
- **User Origin** tells LightBurn to output graphics relative to a custom-defined origin that you set before starting a job.

The 9-dot Job **Origin** selector beneath the dropdown menu determines the orientation of output relative to the Current Position or User Origin. It will be grayed out if you have Absolute Coords selected, but clickable if you choose Current Position or User Origin.



Note for Galvo Users

If you have a Galvo laser, you won't see the Start From mode dropdown menu or 9-dot Job Origin selector in the Laser Window — that's because Galvo lasers *always* use Absolute Coordinates positioning.

Absolute Coordinates

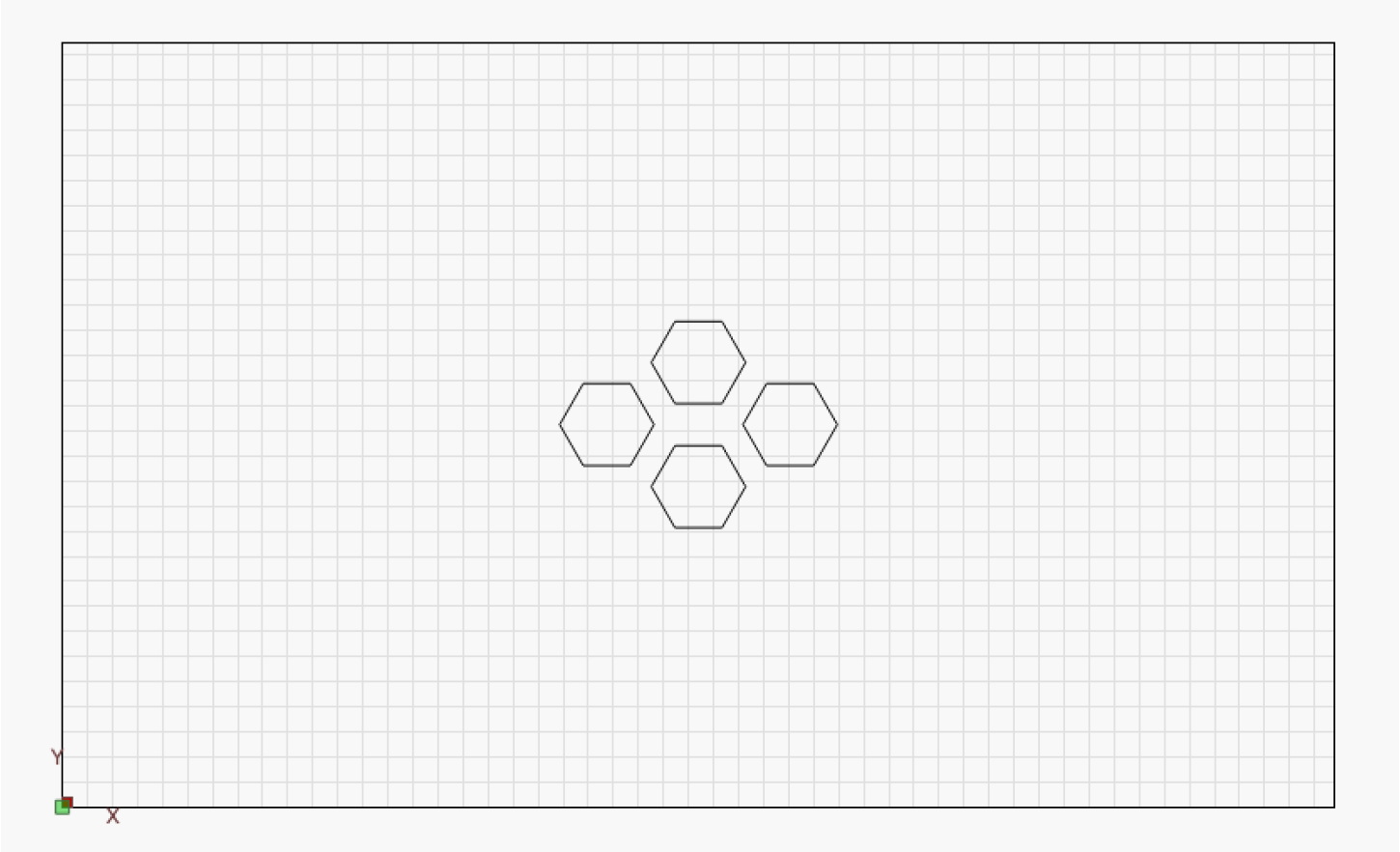
Absolute Coordinates is the the most inuitive option. The grid in your LightBurn Workspace has a coordinate system that matches the physical work area of your laser. The 0,0 position is always the location of your laser's **Machine Origin**.

With **Absolute Coords** selected as your Start From mode, anything you place in the LightBurn grid will be output in the corresponding location in your machine's work area.

Note

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

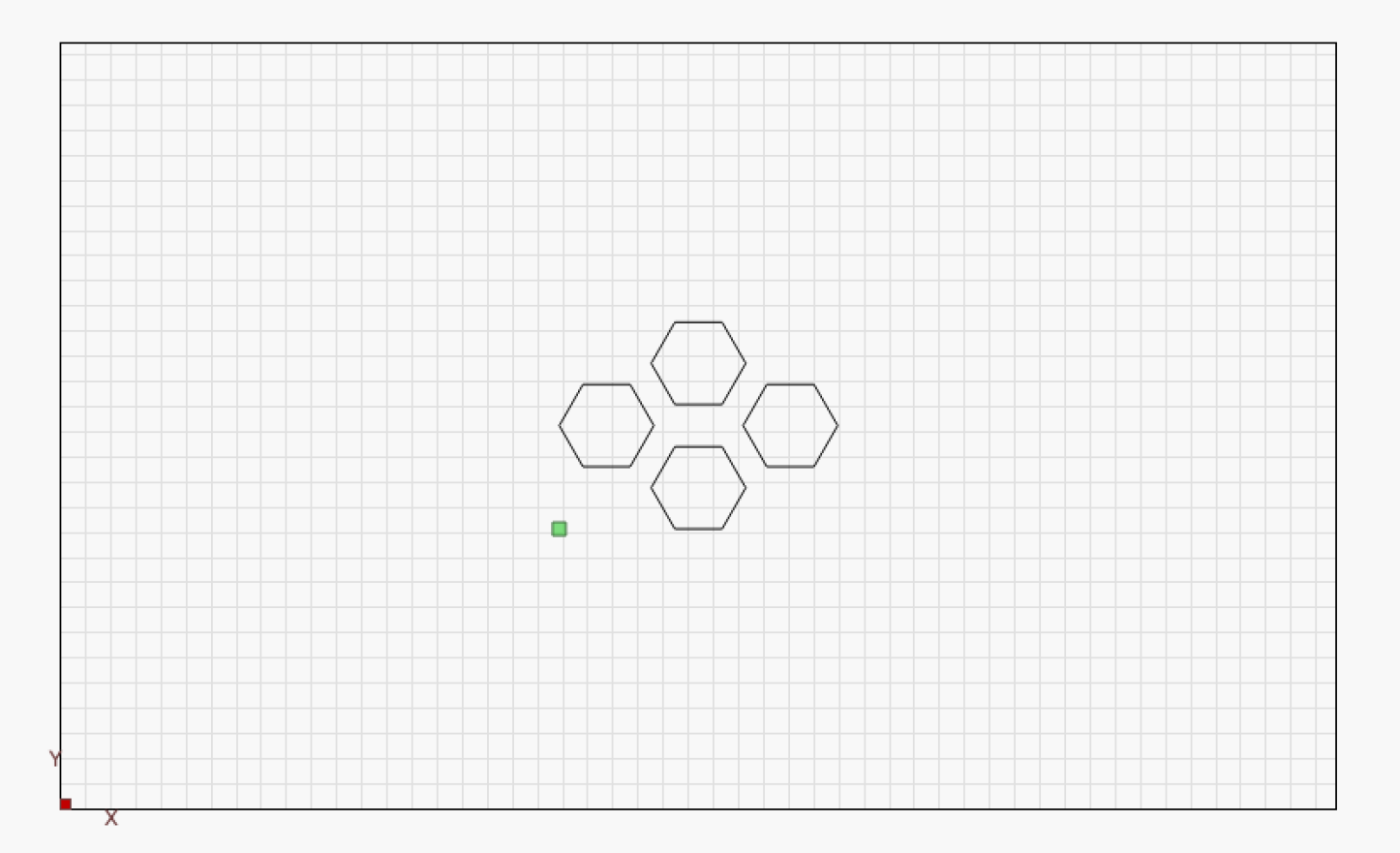
In the image below, the four hexagons placed in the middle of the LightBurn grid will be cut in the middle of the machine work area. The green square in the lower left of the image represents the **Job Origin**, and the red square in the same place shows the **Machine Origin**. When using Absolute Coords,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



Current Position

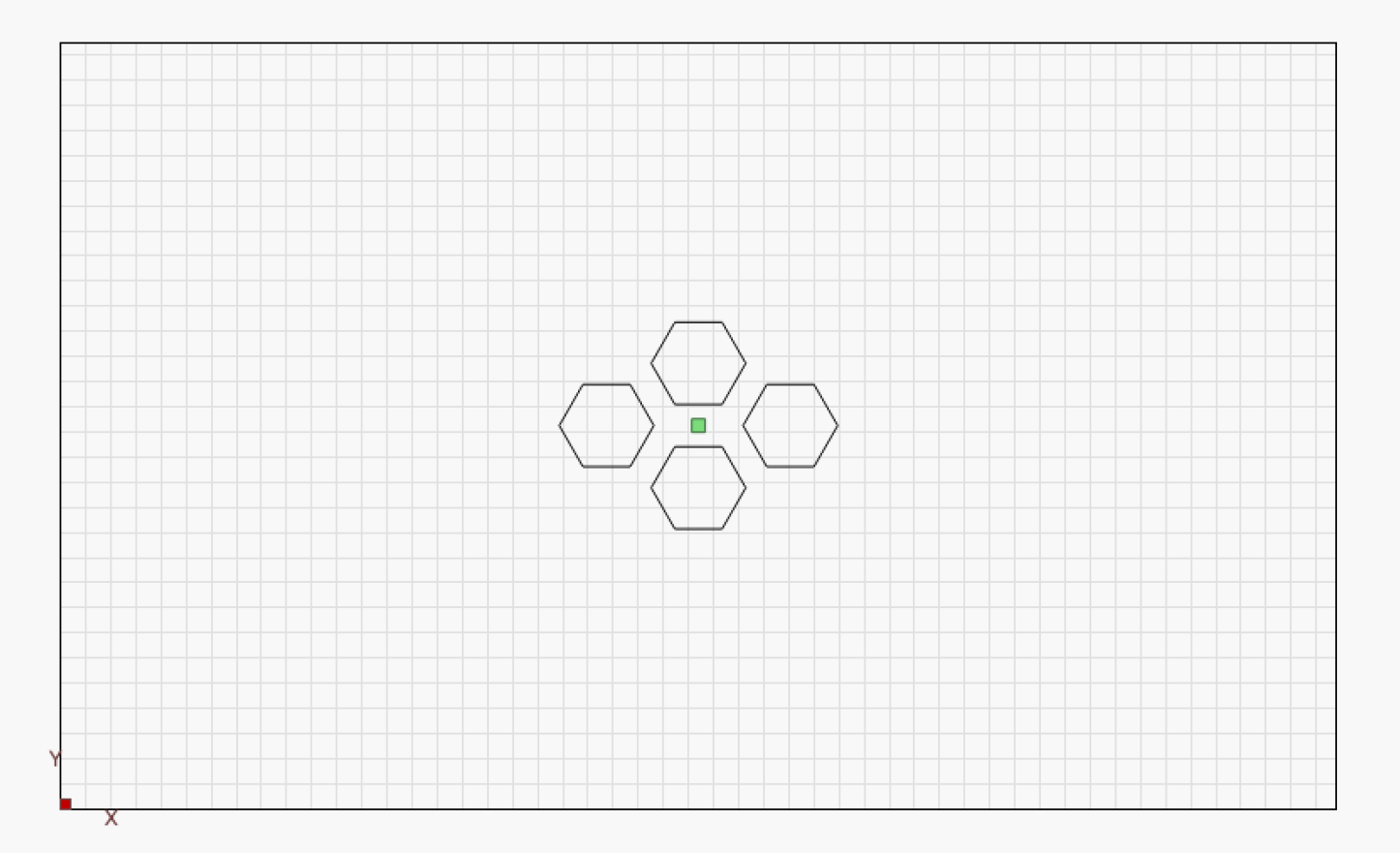
With **Current Position** selected, your job outputs relative to wherever the laser head is located when you press the **Start** button. The **Job Origin** control in the **Laser Window** tells LightBurn how to orient output relative to the laser head.

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



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

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

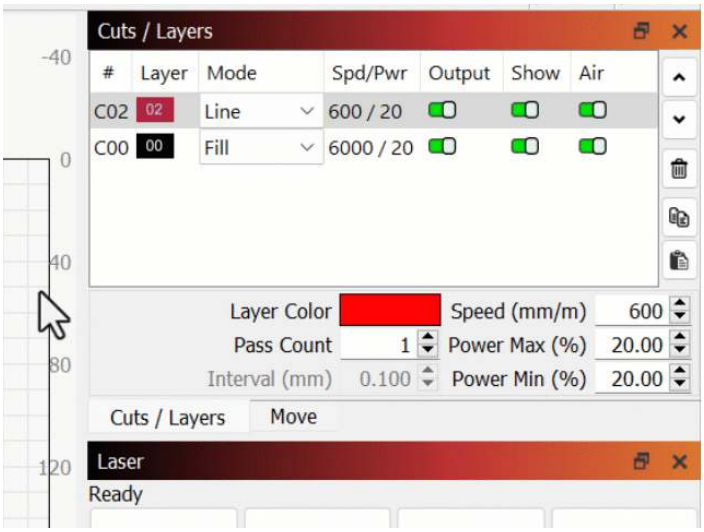


The job will be centered around the current position of the laser head. If you position the laser head directly over the center of the item you want to etch, the output will be centered on the item.

Jogging Your Laser

Both Current Position and User Origin require you to jog your laser into a desired position to define a custom origin. LightBurn has a few tools for adjusting the location of your laser's head within its work area — the most straightfoward option for beginners is to use the arrow keys in the Move Window. By default, the Move Window is hidden behind the Cuts / Layers Window — click the Move tab to expose it.

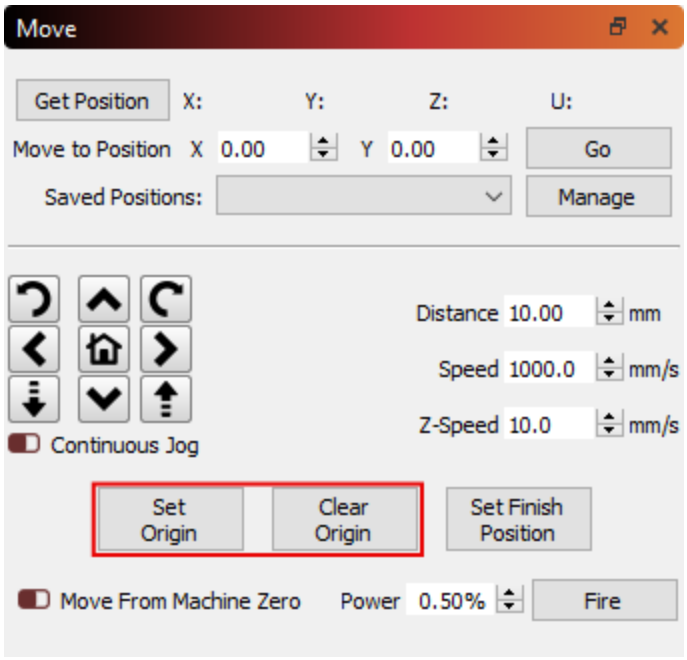
The arrow keys move your laser up, down, right, or left. You can set the amount the laser travels with each click in the **Distance** field, and the rate at which it travels in the **Speed** field.



User Origin

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

Some lasers with digital displays, such as those with Ruida controllers, have an `Origin` button which you press to set the origin. GCode-based systems use the **Set Origin** button in the Move Window in LightBurn to do the same thing. For supported systems, use **Clear Origin** to remove and reset a custom-set origin.



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

You can also use the **Go to Origin** button in the Laser Window to command your laser to travel back to the origin you've set.

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

Finish Position

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

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

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

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

user-interface UI GRBL stored-positions framing enable-fire-button user-origin set-origin clear-origin finish-position workflow laser-control output-and-positioning

5.5.2.3 Move Window

The **Move Window** is used primarily for jogging, positioning, and homing the laser.

Accessing the Move Window

By default, the **Move Window** is docked behind the Cuts / Layers Window on the upper right side of your screen. Click the Move tab to bring the Move Window to the front.

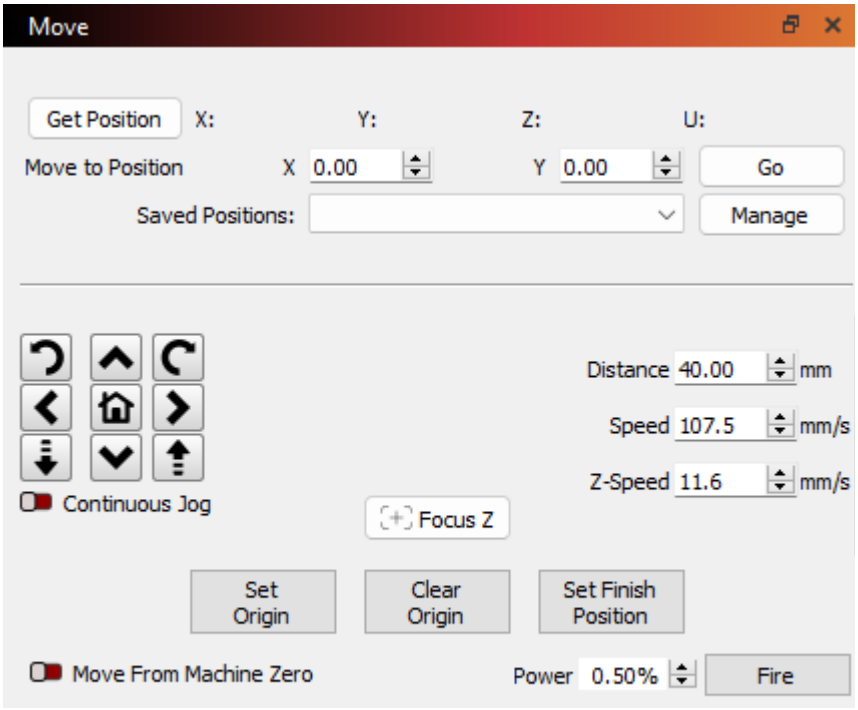
If you have closed the Move Window go to Window → **Move** to re-enable it. To restore it and all other windows to their default positions, go to **Window** → Reset to Default Layout.

> **Tip**
>
> The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Move Window Options and Settings

The type of laser you have active and certain options in the Settings window — including enabling Beginner Mode — will affect the way the **Move Window** looks.

Click any option in the image below to jump to more information, or scroll down for a list of options and descriptions.



Info

Ruida Controller Devices: The **Set Origin**, **Clear Origin**, or **Set Finish Position** controls will not be displayed as these are handled by the controller itself. LightBurn will generally show only controls you can use.

Galvo Devices: none of the functions in the Move Window are applicable to Galvo lasers, so this window will not be displayed in your default layout.

Get Position

The **Get Position** button queries the controller for its current location and displays the current X, Y, Z, and U Axis coordinates.

Move to Position

Selecting the **Go** button will move the laser to the X and Y Axis coordinates in the **Move to Position** entry boxes.

Saved Positions

The **Saved Positions** drop-down displays a list of previously stored positions. Use Saved Positions for jogging to known locations on the work area — for example a specific corner, the location of your rotary tool, and commonly used jigs. Manage the contents of this list by clicking the **Manage** button.

Managing Saved Positions

1. Add new positions to the Saved Positions list by pressing the **Add New** button and entering the desired coordinates.
2. Activate Z Axis movements by toggling the **Enable Z Axis** option and updating the Z Axis coordinate.
3. Optionally, press the **Sort by Name** to sort the position list alphabetically.
4. Press **OK** to save the list.

Manual Movement

Move the laser by a specific amount in a given direction through a process called *Jogging*.

Move Window Directional Arrows

Jog the laser throughout its work area by clicking any of the arrow buttons that surround the **Home** button. Each click will move the laser by amount entered in the **Distance** field, at the rate set in the **Speed** field.

> **Note**
>
> The Speed settings also control the Framing speed and the movement speed of the Position Laser tool.

If your laser has a motorized Z Axis, the dashed up and down arrows move the Z Axis up or down.

The rotational arrows jog the A Axis, commonly used for rotaries.

> **Note**
>
> If you're using an A Axis rotary, the Distance field determines degrees of movement of the rotary axis with each click.

Continuous Jog

The **Continuous Jog** toggle allows supported lasers to move continuously, by pressing and holding any of the directional arrows. The laser will keep moving until the button is released.

See Device Settings → **Enable $J Jogging** for more information.

Keyboard Shortcuts

Each keyboard shortcut will move your laser by the amount entered in the **Distance** field, at the rate set in the **Speed** field.

- **Jog Laser Left**: ⎇ Alt / ⌥ Option + ^ Ctrl / ⌘ Cmd + [
- **Jog Laser Right**: ⎇ Alt / ⌥ Option + ^ Ctrl / ⌘ Cmd +]
- **Jog Laser Up**: ⇧ Shift ^ Ctrl / ⌘ Cmd +]
- **Jog Laser Down**: ⇧ Shift ^ Ctrl / ⌘ Cmd + [

Keypad Jogging

You can use a keypad to Jog your laser. In order to use keypad Jogging, you must enable **Numlock** on your keyboard, and the **Edit Window** (Workspace) — the area where you create and edit graphics — must be in focus.

What does it mean for a window to be in focus?

There are several Windows and Toolbars in LightBurn that accept user input — when a window is clicked on, it is in focus and accepting input.

If a window other than the Edit Window is in focus, click anywhere in the Workspace to bring it into focus. Selecting objects in the Workspace will also bring it into focus.

Each press will move your laser by amount entered in the **Distance** field, at the rate set in the **Speed** field. If Continuous Jog is enabled, the laser will Jog until you release the key.

Arrange Menu → Move Laser to Selection

The Jog options are also available in the Arrange Menu, within the Move Laser to Selection submenu.

Move From Machine Zero

The **Move From Machine Zero** toggle moves the laser from machine zero instead of from the current position of the laser.

Instead of determining the amount of travel, the **Distance** field controls the coordinate location the laser will travel to.

Device-specific Buttons

Focus Z

Focuses the Z Axis of the laser. To use this function, your laser must have a movable Z Axis and have an automatic focusing feature that is supported by LightBurn.

Set Origin

Creates a custom-set starting point, known as the User Origin.

Clear Origin

Press **Clear Origin** to remove and reset a custom-set User Origin.

Set Finish Position

Press **Set Finish Position** to establish the position the laser head will move to after a job is finished.

See Finish Position for more information.

Fire

Turns your laser on at the **Power** level specified in the adjacent field.

Use the **Fire** button to enable the laser at low power for focusing, Framing, and positioning.

Danger

The Fire button should only be used for diode lasers, which generally don't have a red dot pointer for Framing.

Always wear proper eye protection when Firing your laser. Consult your laser's manufacturer for information on the proper eye protection required for your laser.

This should never be used for a CO_2 laser, which has an invisble beam that could blind you or start a fire.

See Device Settings — Enable Laser Fire Button for more information.

Power

Sets the **Power** level the laser will use when you press the **Fire** button, or when Framing, if you have enabled Laser on when framing in the **Device Settings** window.

GCode Only — the Move Window During an Active Job

For GCode lasers only, the **Move Window** changes in appearance while LightBurn is actively streaming a project to your laser.

The original interface is replaced by new buttons which allow you to adjust the Speed and Power settings of your active project.

The buttons beneath **Adjust Speed** and **Adjust Power** each adjust those settings as a *percentage* of the original values — *not* by absolute values.

As you increase or decrease Speed, Power will automatically adjust to match the change, but you can increase or decrease Power without affecting Speed.

You can click **Reset** to restore either setting to your project's original values.

Adjusting settings through the Move Window *only* affects the active job, and makes no change to your original project settings.

output-and-positioning laser-control optimization workflow

5.5.2.4 Optimization Settings

LightBurn's **Cut Planner** controls the order in which your laser cuts or engraves graphics in your project. The **Cut Optimization Settings** window is where you adjust the variables by which the Cut Planner decides on cut order and pathing.

To open the Cut Optimization Settings window, click the **Optimization Settings** button in the Laser Window.

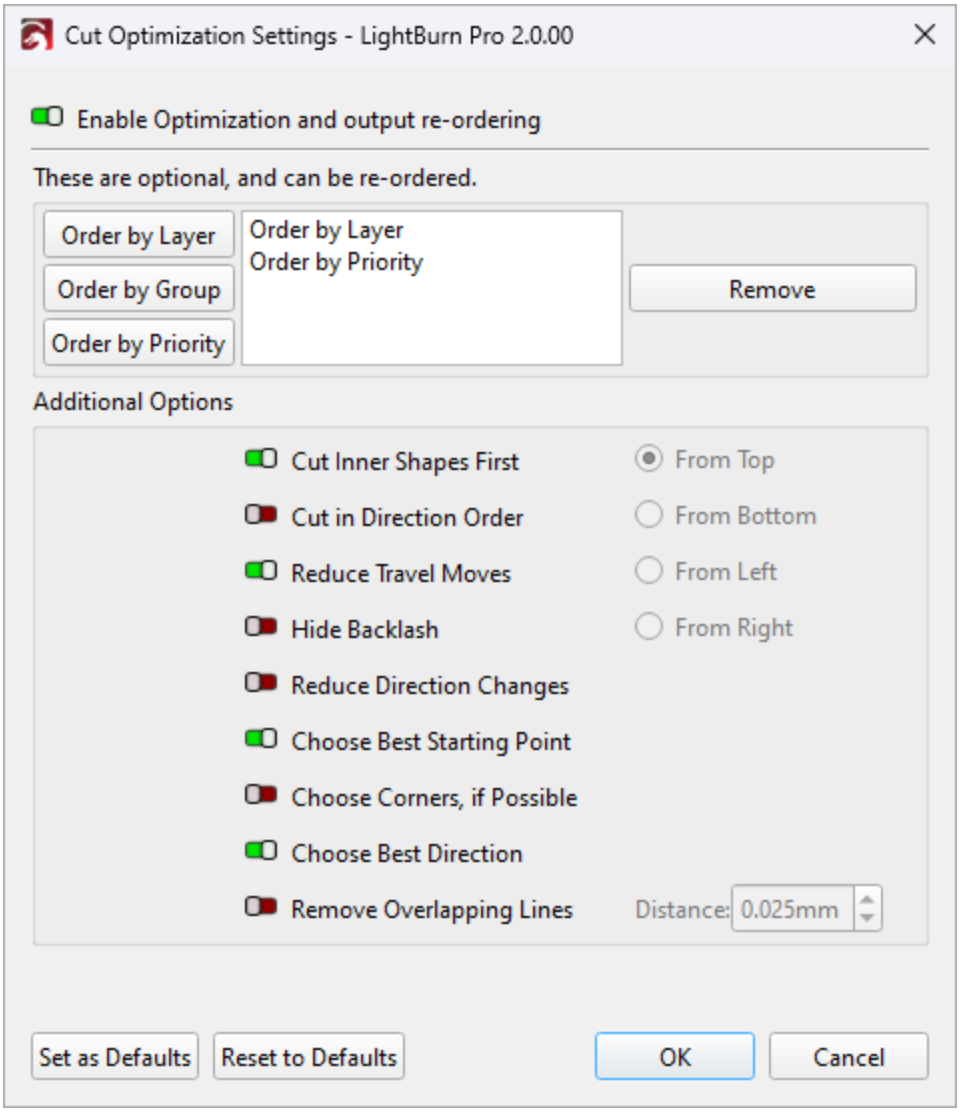
Optimization Settings only take effect when the **Optimize Cut Path** switch in the Laser Window is toggled on. If Optimize Cut Path is toggled off, graphics are output in the order in which they were first created.

Tip

After adjusting **Optimization Settings**, you can see the resulting path the laser will take, along with a runtime estimate, in the Preview window.

Optimization Settings Window

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Enable Optimization and Output Re-ordering

Toggle this setting on to enable the **Optimization Settings** described below. To disable optimizations without losing your settings, turn the toggle off.

If this switch is disabled, the laser will cut or engrave graphics in the order in which they were drawn.

Order By

The **Order by** options determine the initial ordering parameters for your jobs, which is the primary way in which LightBurn decides the order of cuts. You can choose to Order by Layer, Group, Priority, or combinations of these parameters.

Using the Order by Options

When determining the order of cuts, the **Cut Planner** sorts all objects in your project into ordered lists based on the parameters you've selected. If you select multiple Order by options, their order within the list is important.

After splitting all the objects in your projects into lists based on the first Order by parameter, the Cut Planner then splits each of those lists based on the next Order by parameter in the list, and repeats that process for however many parameters you've selected.

Example lists

With the default settings shown in the screenshot above — **Order by Layer** positioned first in the list, and **Order by Priority** positioned second — the Cut Planner will first split all objects in your projects into lists based on the Layer they are assigned to, and will then sort the objects in each layer based on the Priority you've set for each object.

With 2 layers and 3 objects on each layer, each set to a different Priority, the lists will look like this:

1. Objects on Layer 1
    a. Objects set to Priority 0
    b. Objects set to Priority 1
    c. Objects set to Priority 2
2. Objects on Layer 2
    a. Objects set to Priority 0
    b. Objects set to Priority 1
    c. Objects set to Priority 2

If the positions in the ordered list are reversed so that Order by Priority is first, and Order by Layer is second, the lists will look like this:

1. Objects set to Priority 0
    a. Objects on Layer 1
    b. Objects on Layer 2
2. Objects set to Priority 1
    a. Objects on Layer 1
    b. Objects on Layer 2
3. Objects set to Priority 2
    a. Objects on Layer 1
    b. Objects on Layer 2

After sorting, each set of shapes created through this process is then optimized with the options in the lower section of the window.

Clicking any of the Order by options adds it to the list of ordering parameters to use. If an Order by option is already on the list, clicking again moves it to the top of the list, making it the first parameter the Cut Planner will sort by.

Order by Layer

Orders cuts according to the position of the layers in the Cuts / Layers Window.

Move layers up and down in the Cuts / Layers Window by selecting and dragging them, or using the buttons to the right of the list

Order by Group

Orders cuts by Group — all objects in a given Group are cut together, then the next Group of objects, and so on. Ungrouped objects will all be treated as a single group for the purposes of this setting.

Order by Priority

Orders cuts according to individual **Cut Order Priority**. Priorities are ordered such that 0 is the first priority, 1 is the second, and so on. Assign Cut Order Priority in the Shape Properties Window.

Select objects and go to the Shape Properties Window to adjust their Cut Order Priority

Remove

Select an **Order by** option from the list and click **Remove** to remove it from the list of ordering parameters.

Optimizations

The following optimizations are applied to all objects sent to your laser, after they are sorted into lists according to the above ordering parameters.

Cut inner shapes first

If there is an object within another object, and both are being cut, tells your laser to cut the inner object before the outer one. The outer shape must be closed in order for this optimization to apply.

> **Tip**
>
> This is often useful to ensure engravings and inner cutouts are completed before cutting a shape out of the stock material, which can cause the shape to drop or shift, depending on how the material is held in place.

Cut in direction order

Attemps to order the shapes in your project so they're cut in specified direction — Top to Bottom, Left to Right, etc.

When the **Cut in direction order** switch is enabled, you can select one of the buttons on the right to determine order.

Reduce travel moves

Attempts to reduce non-cutting travel moves by ordering cuts based on proximity to other shapes.

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.

Reduce direction changes

Attempts to choose nearby cuts that allow the laser to keep moving in the same direction, which keeps it moving faster.

Choose best starting point

Allows the **Cut Planner** to start a cut at any point within a shape, not just the first point.

> **Tip**
>
> This options works best in combination with Reduce travel moves.

Choose corners, if possible

Attempts to start cuts at sharp corners, to minimize burning or staining on the surface of an item.

Choose best direction

Attempts to choose the direction to cut that will result in the most efficient path.

Remove Overlapping Lines

Tells the **Cut Planner** to remove lines that are overlapping between two graphics, and would cause the laser to cut in the same place twice.

The **Distance** field to the right of the switch controls how close two lines need to be in order for the Cut Planner to remove one of them when sending the job to your laser.

Quick Tip Video: Remove Overlapping Lines

Defaults

Set as Defaults

Saves your current **Optimization Settings** as your custom defaults.

Each time you start a new project, your Optimization Settings revert to these defaults.

Reset to Defaults

Restores your current **Optimization Settings** to your default settings.

Hold `⇧ Shift` while clicking **Reset to Defaults** to restore to LightBurn's standard default settings (as shown in the screenshot above).

OK

Saves any adjustments you've made in the **Optimization Settings** window, overwriting previous settings.

Any Optimization Settings you save are also stored within `.lbrn` and `.lbrn2` files, and opening any previously saved file will automatically overwrite your current settings with those saved to the file.

Cancel

Discards any adjustments you've made in the **Optimization Settings** window, reverting to previous settings.

Related Topics

- Preview
- Cuts / Layers Window
- Shape Properties
- Grouping

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5.5.2.5 Cut Selected Graphics / Use Selection Origin

By default, LightBurn outputs all graphics in your Workspace when you Preview, Frame, Start, Send, or save a project in a machine-specific file format. This works well if you have one design in each project, but is less ideal when storing multiple designs within the same file.

In order to output only specific design elements, you can enable **Cut Selected Graphics** instead.

Use Selection Origin allows you to choose whether to orient output relative to the entire project's Origin, or just the Origin of the graphics in your selection.

Both switches are available in the Laser Window.

Note

Use Selection Origin will be grayed out if you've selected **Absolute Coords** as your Start From mode, or do not have Cut Selected Graphics enabled.

Cut Selected Graphics

Enable **Cut Selected Graphics** to tell LightBurn to only output the portion of your design that is currently selected.

Tip

The Preview window only shows graphics that will be output to your laser — use it to check that you've selected just the graphics you want.

Use Selection Origin

When used in combination with **Cut Selected Graphics**, the **Use Selection Origin** button tells LightBurn to calculate the Job Origin from only the parts that are selected, not the whole design.

- If you have many different graphics in a project that are intended to be cut completely separately, *enabling* Use Selection Origin simplifies the process of positioning output to your laser, by excluding unselected graphics when calculating the Origin.
- If you're looking to rerun just one part of a larger design that didn't cut through, *disabling* Use Selection Origin will ensure that the cut lines up, by using the entire design to calculate the origin.

The Job Origin is indicated on your design as a green square. You'll see its position move as you toggle Cut Selected Graphics and Use Selection Origin on and off in different combinations.

Troubleshooting

If **Cut Selected Graphics** is enabled, but you have nothing in your selection, and attempt to **Preview**, **Start**, **Send**, or **Save** a project in machine-specific format, you'll see a warning message, and be given the option to click **Ok** and abort the process but leave Cut Selected Graphics enabled, or **Turn off Cut Selected** to abort the process while automatically disabling Cut Selected Graphics at the same time.

Related Topics

- Laser Window
- Coordinates and Job Origin
- Preview

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5.5.2.6 Position Laser

The **Position Laser** tool is a quick way to jog your laser to a location in its physical work area, by clicking in your LightBurn Workspace.

In order to use this tool, LightBurn must be directly connected to your laser, and your laser must be properly homed and reporting its position accurately.

To enable Position Laser, go to Tools → **Position Laser**, click the Position Laser button in the left side toolbar, or press ⎇ Alt / ⌥ Option + L.

Use With Caution

If your laser is not properly homed and reporting its position accurately, using this tool may cause your laser to attempt to travel outside its physical bounds, in some cases even crashing into the side rails.

Before using this tool, make sure nothing is in the path of your laser.

Using Position Laser

The grid in your LightBurn Workspace has a coordinate system that matches the physical work area of your laser. The 0,0 position is always the location of your laser's Origin. You can see the exact location of your cursor at any given position in the Status Bar.

After enabling Position Laser, click anywhere in your Workspace, and LightBurn will issue a command to send your laser to the corresponding location in its physical work area.

The speed at which the laser travels when using Position Laser is determined by the value set in the **Speed** field in the Move Window.

Position Laser automatically turns itself off after about 10 seconds, in case you accidentally leave it on.

Related Topics

- Move Laser to Selection
- Move Selected Objects

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5.5.2.7 Set Start Point

Quick Reference: Set Start Point

Sets the point at which your laser begins to cut a shape, and the direction of travel.

Location

Modifiers Toolbar

Keyboard Modifiers

`⇧ Shift` while clicking to reverse the direction

`^ Ctrl` / `⌘ Cmd` while clicking to revert Start Point and direction to default

Use the **Set Start Point** tool to control where your laser begins cutting a shape, and in which direction.

By default, the Start Point is the first point of the shape, and the direction is the same as the direction of the animated dash pattern that indicates when an object is selected.

Set Start Point is available in the Modifiers Toolbar, located on the left side of the LightBurn window, by default.

Using Set Start Point

Click the **Set Start Point** icon in the Modifiers Toolbar to activate it.

If you had an object selected before you activated the Set Start Point tool, you'll see its nodes and the current Start Point. To select a new or different object, click any object in your Workspace.

The default Start Point is indicated by a gray arrow, while a user-defined Start Point is indicated by a blue arrow.

- Click any node to move the Start Point to that node.
- Hold `⇧ Shift` while clicking to reverse the direction. Click again without holding `⇧ Shift` to return it to the default direction.
- Hold `^ Ctrl` / `⌘ Cmd` while clicking any node to revert the Start Point and direction back to the default.

Additional Notes

- Use the Edit Nodes tool to add a custom node to use as a Start Point, if one does not already exist at the point you'd like a cut to begin.
- Default and user-defined Start Points are overridden by certain Optimization Settings. If you select **Choose best starting point** or **Choose best direction**, LightBurn will select a different Start Point if doing so will reduce overall cutting time.
- The Start Point does not affect the direction of Fill or Image engravings. To change the direction of an engraving, invert the **Scan Angle** from 0° to 180°.

Related Topics

- Edit Nodes
- Line Mode

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5.5.2.8 Galvo Framing

Quick Reference: Galvo Framing

Outlines projects in your laser's work area using a red dot light.

Location

Laser Window

Keyboard Shortcuts

F1

Compatibility

LightBurn Pro

Galvo lasers

Framing is a function of Galvo lasers that outlines projects in your laser's work area using a red dot light, allowing you to see where your design will output on a physical object.

Click the **Frame** button in the Laser Window or press F1 to open the **Live Framing** window.

Note

You may need to hold the Fn key while pressing F1 to open the Live Framing window.

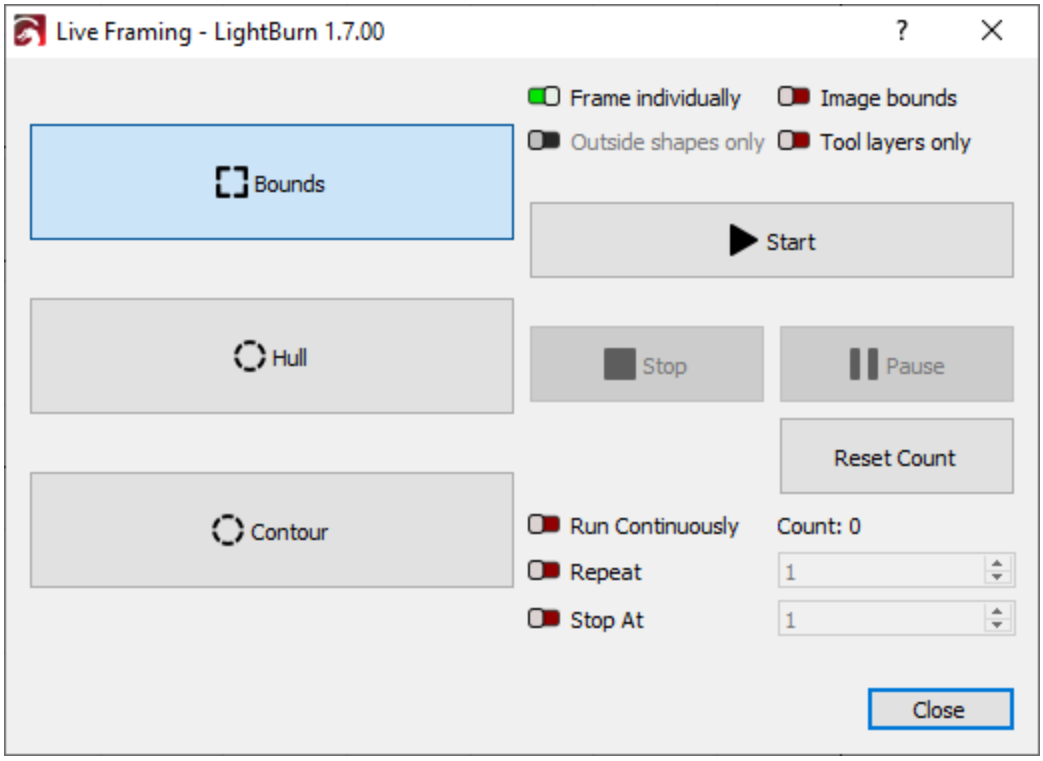
By default, the Live Framing window will also open when you press the **Start** button in the Laser Window, but you can disable **Require framing before start** in your Device Settings.

The Live Framing window contains options that determine the style of framing, which graphics are framed, and how many times to repeat a given project.

You can **Start**, **Stop**, and **Pause** your projects from the Live Framing window, which remains open while your job is running.

While framing, you can nudge, rotate, and rescale graphics, adjusting them in your Workspace and live-updating them in your laser's work area.

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Framing Styles

The different options determine how the red dot light represents your shapes, and which shapes are shown.

> **Tip**
>
> Press F1 while framing to cycle through the **Bounds**, **Hull**, and **Contour** framing modes.

Bounds

Commands the red dot light to trace a path defined as the smallest possible rectangle that will fully contain all graphics you're sending to the laser.

This mode is extremely fast, but doesn't represent complex shapes well.

Hull

Commands the red dot light to trace the smallest possible path that fully contains all graphics in the design you're sending to the laser, as if a rubber band were stretched around them.

It is nearly as fast as **Bounds**, but gives a much closer fit for rounded or smooth shapes.

Contour

Commands the red dot light to trace a path that follows the exact contours of your shapes — it takes the longest to draw, but it's the most accurate.

Additional Options

Frame Individually

Determines whether to trace a single **Bounds** or **Hull** frame around everything in your project, or around each individual shape.

This option is grayed out when using **Contour** framing.

Image Bounds

Attempts to quickly trace the outlines of any images you have in your design, rather than only showing the rectangular boundary of the entire image.

LightBurn determines the outline based on transparancy and whitespace in the image — accuracy may vary.

Outside Shapes Only

Tells the software not to trace inner shapes, like the insides of letters — typically this doesn't affect placement, but allows a faster update of the frame (this only affects **Contour** mode).

Tool Layers Only

Tells LightBurn to *only* frame shapes that are on one of the Tool layers.

Job Control

Start

Commands your laser to immediately begin running your current project.

Stop

Immediately aborts a currently running job.

Pause

Halts a running job. Click the **Resume** button to continue a paused job.

Job Counter and Multiple Runs

Count

This value is incremented at the end of each successful run of your file. You can use this to keep track of how many parts you have marked, or how many passes of a single job you've run.

Reset Count

Resets the **Count** value to 0.

Run Continuously

Tells LightBurn to re-start the job automatically after it finishes, and update the **Count** after each run.

If you turn off this switch while a job is running, the laser will stop when the current run completes.

> **Tip**
>
> This is useful when you are doing very deep engraving, and are unsure how many passes a job will need.

> **Warning**
>
> Ensure your laser is properly supervised, even during long jobs with multiple passes.

Repeat

Enable this switch and set a value in the adjacent field to tell LightBurn to run the entire job the specified number of times, and then stop.

If you turn off this switch while a job is running, the laser will stop when the current run completes.

> **Tip**
>
> To run multiple passes of specific layers, sub-layers, or combined sequences of sub-layers, see the **Number of Passes** and **Global Passes** settings in the Cut Settings Editor.

Stop At

Enable this switch and set a value in the adjacent field to tell LightBurn not to start the laser if the **Count** is greater than the specified **Stop At** value.

This option is useful when the job is externally triggered (e.g. with a foot switch), rather than started through LightBurn.

Nudging, Rotating, and Rescaling

While framing, you can use the keyboard to nudge, rotate, and rescale your graphics.

Key(s)	Result
`← Left` / `→ Right` / `↑ Up` / `↓ Down`	Move graphics by 1 mm
`⇧ Shift` + arrow keys	Move graphics by 5 mm
`^ Ctrl` + arrow keys	Move graphics by .2 mm
`⇞ Page Up`	Scale graphics up
`⇟ Page Down`	Scale graphics down
`.` (period)	Rotate graphics 15° clockwise
`,` (comma)	Rotate graphics 15° counter-clockwise

Key(s)	Result
⇧ Shift + . (period)	Rotate graphics 5° clockwise
⇧ Shift + , (comma)	Rotate graphics 5° counter-clockwise
^ Ctrl + . (period)	Rotate graphics 45° clockwise
^ Ctrl + , (comma)	Rotate graphics 45° counter-clockwise

If your keyboard doesn't have ⇞ Page Up or ⇟ Page Down, try using Fn + ↑ Up or Fn + ↓ Down.

Troubleshooting

- If the framing location or scale is inaccurate, you may need to adjust your laser's focus, or fine-tune the values found in Device Settings → Galvo and Basic Settings → Red Dot.

  See our video guide for more information on adjusting red dot alignment.

- If **Contour** framing doesn't work, try toggling off **Enable Blanking Delay**, in Device Settings, under **IO Port Settings**.
- For information on framing behavior when using a rotary, see Rotary Mode (Galvo).

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5.5.2.9 Move Laser to Selection

Quick Reference: Move Laser to Selection

Moves laser to parts of design.

Location

Arrange Toolbar

Arrange → Move Laser to Selection

The **Move Laser to Selection** tools move your laser in its physical work area to a location that corresponds to a position on your current selection in your LightBurn Workspace.

Use these tools to align your laser and physical objects to the positions of graphics in your LightBurn grid.

Warning

In order to use **Move Laser to Selection**, LightBurn must be connected to your laser, and it must be capable of reliably homing and reporting its position accurately. If the position reported by the laser is inaccurate, using this feature may cause your laser to attempt to travel outside of its physical bounds.

UI Locations

All **Move Laser to Selection** tools are available in the Arrange Menu or in drop down menus in the Arrange Toolbar and **Arrange (long) Toolbars**.

You can also hold the `^ Ctrl` or `⌘ Cmd` key while pressing one of the Move Selected Objects buttons to move the laser head to the location on the selection, rather than moving the objects.

Move Laser to Selection in the Arrange Menu

Move Laser to Selection in the Arrange Toolbar

Move Laser to Selection in the Arrange (long) Toolbar

Hold `^ Ctrl` / `⌘ Cmd` while clicking the Move Selected Objects buttons in the Arrange (long) Toolbar to move the laser to the chosen location on your selection instead, or open the dropdown menu to select any option.

Options and Icons

All below options move the laser to the location in its physical work area that corresponds with the location of the chosen point on your current selection in your LightBurn Workspace.

The grid in your LightBurn Workspace has a coordinate system that matches the physical work area of your laser. The 0,0 position is always the location of your laser's Origin.

For example, if the bottom right corner of your selection is at 100 mm in the horizontal (**X**) dimension, and 200 mm in the vertical (**Y**) dimension in your LightBurn Workspace, selecting **Move Laser to Lower Right of Selection** will move the laser head to X: 100 and Y: 200 in its physical work area.

Option	Icon	Action
Move Laser to Selection Center		Moves laser to the center of selected objects.
Move Laser to Upper Left of Selection		Moves laser to the top left corner of selected objects.
Move Laser to Upper Right of Selection		Moves laser to the top right corner of selected objects.
Move Laser to Lower Left of Selection		Moves laser to the bottom left corner of selected objects.
Move Laser to Lower Right of Selection		Moves laser to the bottom right corner of selected objects.

Option	Icon	Action
Move Laser to Left of Selection		Moves laser to the left-center of selected objects.
Move Laser to Right of Selection		Moves laser to the right-center of selected objects.
Move Laser to Top of Selection		Moves laser to the top-center of selected objects
Move Laser to Bottom of Selection		Moves laser to the bottom-center of selected objects.

Selection Coordinates

Edges and centers of selections are defined according to the farthest points of any object in the selection area, in each direction — imagine the selection area as the smallest possible rectangle that can contain every object in your selection. The edges and center of a selection are the same as the edges and center of that imaginary rectangle.

You can read the coordinates of any location on your selection in the Numeric Edits Toolbar. Click a point in the 9-dot control to see the horizontal position (**XPos**) and vertical position (**YPos**) of that location on your selection, in your Workspace.

Laser Coordinates

You can read your laser's current cooridinates in the Move Window, by clicking the **Get Position** button.

> **Note**
>
> The **Move Laser to Selection** tools can only move your laser in the **X** and **Y** dimensions.

Related Topics

- Move Selected Objects
- Position Laser
- Selection Tools

- Coordinates and Origin
- Move Window
- Numeric Edits Toolbar

5.5.3 Quality Optimization

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5.5.3.1 Material Test

Quick Reference: Material Test

Creates and outputs a test grid to compare combinations of settings.

Location

Laser Tools → Material Test

LightBurn has a built-in test pattern generator to help you find the best settings for your laser and any material you're working with.

To open the **Material Test Generator**, go to the Laser Tools Menu and select **Material Test**.

Material Test Example

Figure 1: A material test showing different speeds and powers on black anodized aluminum

On the left side, each row is labeled with the engraving speed. Along the bottom, columns are labeled with the power level used. At the top, the sample shows additional universal settings — in this case, **Interval**, **Passes**, and **Frequency** — that are used for each box in the grid.

Using The Material Test Generator

Figure 1: The Material Test dialog as it appears for a DSP laser

After opening the **Material Test Generator**, you'll be able to configure your test pattern. By default, the Material Test Generator will create a 10x10 grid of boxes with varying **Power** and **Speed**. Use the **Param** dropdown to select different parameters to test.

Positioning

The output location of the test grid is determined by the **Start From** mode you select *before* opening the Material Test Generator. Current Position and User Origin work exactly as they do for all other output, while Absolute Coordinates location is controlled by the **X/Y Center** options in the Material Test configuration.

Test Configuration

Use the settings below to configure your test grid. The parameters tested can be **Power**, **Speed**, **Interval**, or **Passes**. **Frequency** and Q-Pulse width can also be tested, if your laser supports those settings.

Test Grid Settings	Explanation
Count	How many rectangles are in each row/column
Param	The setting being tested along this axis
Min	The lowest value to be used for this setting
Max	The highest value to be used for this setting
Height/Width	The height/width of each rectangle in the test grid

Test Grid Settings	Explanation
Y Center/X Center	The position of the center of the test grid (if using Absolute Coordinates)

Cut Settings

The three buttons at the bottom of the dialog box open the Cut Settings Editor, where you can adjust the settings to use in your test. There are two switches to enable or disable the text labels and border.

Button	Explanation
Edit Material Setting	Base settings for the test — the two settings chosen in **Param** will be varied in the grid, but all other settings applied here will apply to *every* test box
Edit Text Setting	Settings to use for the text labels
Enable Text	This switch controls whether text labels are output
Edit Border Setting	Settings to use for the border around the test grid — available in LightBurn 1.5 and higher
Enable Border	This switch controls whether the border around the test grid is output

Always pay attention to units of distance and time when entering Speed settings

When entering **Speed** values recommended by your laser's manufacturer or other LightBurn users, make sure to use the *same units of distance and time as those from the recommendation*, or to convert the values to your preferred units.

A given number of **millimeters per second** is *much* faster than that same number in **millimeters per minute**. Mixing up units can lead to reduction in power output due to unexpectedly high speeds, or excessive power output — and even fire — due to unexpectedly slow speeds.

Change your units of speed in the **Dimensions / Units** tab of the **Device Settings** window. LightBurn automatically converts any existing values when you switch between units.

Running the Test

The buttons on the right side allow you to Preview the test grid, Frame to check output location, run the laser, and more.

Laser Controls	Explanation
Preview	Generate a preview of the test grid
Frame	Frame the test grid to see its position on the material
Start	Start running the material test
Pause	Pause the material test
Stop	Stop running the material test
Save RD File/Save GCode	Device-dependent — if available, saves the test grid in RD or GCode format
Send	Device-dependent — if available, sends the material test to the laser

Material Test Cutting and Engraving Order

The order in which test boxes are cut or engraved is determined according to an ascending list of potential risk of burning or charring material.

In other words, boxes with the highest **Speed**, lowest **Power**, lowest **Interval**, and fewest **Passes** will run first, followed by the next highest, lowest, fewest, and so on.

Saving and Exporting

There is also a dropdown allowing you to select a saved **Preset**. This is useful if you have custom settings you like to run frequently, such as a smaller test pattern you want to use on metal tags, or a range of settings you want to test on various woods.

At the top are buttons allowing you to save, delete, export, and import presets.

To locate the presets saved on your computer, go to **File** → **Preferences** → **Open Prefs Folder**. You'll find the `material_test_presets.lbmt` file inside the `presets` folder.

Presets can also be exported in a User Bundle.

Built-in Presets

LightBurn provides four **Built-in Presets** for users with Diode or CO_2 lasers. All four are selectable from the dropdown menu in the **Material Test Generator** dialog window.

Related Topics

- Material Library
- Interval Test
- Focus Test

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5.5.3.2 Focus Test

Quick Reference: Focus Test

Tests for the optimal focus height.

Location

Laser Tools → Focus Test

Tip

You can also use the Focus Test to try out different amounts of defocusing. Defocusing your laser produces thicker lines where it marks the material, which in turn allows you to increase the Line Interval setting on Fill layers, and speed up jobs.

The **Focus Test** generates and runs a test pattern to help you identify the optimal focal height for your laser.

Focal height affects the strength and size of the laser dot where it meets the material. A laser that is perfectly focused will have the strongest power output and smallest dot size possible.

The Focus Test pattern is made up of a user-specified number of lines, each engraved at a different Z Axis height. Text is engraved beneath each line to indicate the Z height the line was engraved at.

Go to Laser Tools → **Focus Test** to open the Focus Test setup window, where you set the parameters used to generate the test pattern.

Preparation

Z Axis Control

In order to use the **Focus Test**, your laser must have a motorized Z Axis that is controllable through LightBurn, and Z Axis control must be enabled in your Device Settings.

You'll receive a warning message if Z Axis control is not enabled in your Device Settings, and you attempt to open the Focus Test.

If you are *not* using **Relative Z moves**, you must set the **Material** height for the material you will be testing on in the Cuts / Layers Window, before opening the Focus Test. You'll need at least one object in your Workspace in order to adjust the Material height — any objects in your Workspace will be ignored when the Focus Test pattern is sent to your laser.

Material

You'll be engraving a test pattern onto a piece of material placed in your laser's bed. It's best to have the material loaded into your laser before opening the **Focus Test**, so you can set and check positioning.

Your laser's optimal focus doesn't depend on the type of material you're engraving on, but if you're purposely testing a range of defocused heights, you may need to run unique tests on each different material you work with to get the most accurate results.

Positioning

The **Focus Test** pattern will be output in your laser's work area according to the **Start From** mode and **Job Origin** you select *before* opening the Focus Test.

If you select **Absolute Coords**, the Focus Test pattern will be centered in your laser's work area.

Current Position and **User Origin** work exactly as they do for all other output.

See Coordinates and Job Origin for more information on these settings.

Focus Test Setup Window

Interpreting Results

After engraving the test pattern, inspect the results.

The thinnest line in the engraving is the one that was run at the Z height closest to your laser's optimal focal height.

To dial in the optimal focal height further, you can re-run the **Focus Test** — select the two lines that look closest to ideal, and set **Start Z** and **End Z** to match their Z heights.

Related Topics

- Material Test
- Interval Test
- Z Axis control
- Fill Mode - Interval

GCode

- **Start Z** determines the Z height of the first line in the **Focus Test** pattern.
- **End Z** determines the height of the final line in the test pattern.

> **Note**
>
> If you are using **Relative Z moves only**, Start Z, End Z, and all Z heights tested in between are determined relative to the current Z position of your laser, at the time the test begins. In other words, the first line will be engraved at the laser's current Z position *plus* the value you enter in the Start Z field, and so on for all Z heights tested, until the End Z.
>
> If you are *not* using Relative Z moves only, Start Z, End Z, and all Z heights tested in between are determined relative to the **Material** height you enter in the Cuts / Layers window before opening the **Focus Test**.

- **Steps** determines the total number of lines to create in the test pattern. The total number of lines is equal to Steps + 1. The amount that Z height will advance between each step is equal to: (End Z - Start Z) / Steps.

- **Speed** sets the speed at which your laser will engrave the lines.
- **Max Power** sets the power at which your laser will engrave the lines.

> **Tip**
>
> Set Max Power just high enough to mark your material — if the power is set too high, the laser may char or cut through your material, making it challenging to determine which Z height was the optimal focal height.

- Turn on **High Power Laser Mode** to enable Perforation Mode for the labels beneath each line, if they are overburning. Perforation Mode switches the laser off and on during cuts, reducing overall power output.
- Preview shows a preview of the Focus Test pattern, as it will output to your laser.
- Frame commands your laser to travel around the area the Focus Test pattern will be output to in your laser's work area.
- **Save GCode** saves the test pattern in GCode format.
- **Start** commands your laser to begin engraving the Focus Test pattern.
- Press **OK** to save your Focus Test settings — saved settings will be present when you open the Focus Test later.
- Press **Cancel** to discard any changes you've made to the Focus Test settings — settings will revert to previously saved settings when you open the Focus Test later.

DSP

- **Start Z** determines the Z height of the first line in the **Focus Test** pattern.
- **End Z** determines the height of the final line in the test pattern.

> **Note**
>
> If you are using **Relative Z moves only**, Start Z, End Z, and all Z heights tested in between are determined relative to the current Z position of your laser, at the time the test begins. In other words, the first line will be engraved at the laser's current Z position *plus* the value you enter in the Start Z field, and so on for all Z heights tested, until the End Z.
>
> If you are *not* using Relative Z moves only, Start Z, End Z, and all Z heights tested in between are determined relative to the **Material** height you enter in the Cuts / Layers window before opening the **Focus Test**.

- **Steps** determines the total number of lines to create in the test pattern. The total number of lines is equal to Steps + 1. The amount that Z height will advance between each step is equal to: (End Z - Start Z) / Steps.
- **Speed** sets the speed at which your laser will engrave the lines.

- **Max Power** sets the power at which your laser will engrave the lines, once it reaches the Speed you've set.

> **Tip**
>
> Set Max Power just high enough to mark your material — if the power is set too high, the laser may char or cut through your material, making it challenging to determine which Z height was the optimal focal height.

- **Min Power** sets the power at which your laser will begin engraving the lines. As the laser accelerates, power will increase until the laser reaches maximum Speed, and Max Power.

- Turn on **High Power Laser Mode** to enable Perforation Mode for the labels beneath each line, if they are overburning. Perforation Mode switches the laser off and on during cuts, reducing overall power output.
- Preview shows a preview of the Focus Test pattern, as it will output to your laser.
- Frame commands your laser to travel around the area the Focus Test pattern will be output to in your laser's work area.
- **Save RD file** saves the test pattern in RD file format.
- **Start** commands your laser to begin engraving the Focus Test pattern.
- Press **OK** to save your Focus Test settings — saved settings will be present when you open the Focus Test later.
- Press **Cancel** to discard any changes you've made to the Focus Test settings — settings will revert to previously saved settings when you open the Focus Test later.

laser-control quality-optimization fill-mode image-mode line-interval dpi lpi testing-tools

5.5.3.3 Interval Test

Quick Reference: Interval Test

Generates an engraving pattern to test a range of Line Interval settings.

Location

Laser Tools → Interval Test

The **Interval Test** provides a quick way to determine the optimal **Line Interval** for a given combination of machine, material, and focal length.

The Interval Test pattern is made up of a user-specified number of sample squares, each engraved at a different Line Interval. Text is engraved next to each square to indicate the Line Interval it was engraved at.

Line Interval is the distance between scan lines when raster engraving, making it one of the key settings determining the quality of engravings on Image and Fill Layers. It is mathematically tied to the **Lines per Inch** value.

Both Line Interval and Lines per Inch are set in the Cut Settings Editor.

Unlike in traditional print media, a higher density of scan lines (lower interval) doesn't necessarily produce a higher quality image when laser-engraving — an optimal value must be found.

If Line Interval is set too *low*, the engraving time is vastly increased, and the images appear dark and muddy.

If the Line Interval is set too *high*, more power is required to achieve the same depth and darkness, and gaps may appear between the lines. Stepping may also appear on curved edges.

Using the Line Interval Test

Preparation

Place a scrap piece of the material to be tested into the laser, and focus the laser as per your manufacturer's instructions.

The location of the test on your material is determined by the **Start From** mode and the **Job Origin** that you select *before* opening the Interval Test. If you select **Absolute Coords**, the test will be centered on your laser's bed. **Current Position** and **User Origin** work exactly as they do for all other output. See Coordinates and Job Origin for more information on these settings.

Interval Test Setup Window

Open the **Interval Test** by navigating to Laser Tools → **Interval Test**, and adjust the settings:

- **Speed** sets the maximum speed the laser head will travel. The Material Test can help you find the optimal speed.
- **Power** sets the maximum power output the laser source should deliver. The Material Test can help you find the optimal power.
- **Steps** determines the number of sample squares to make. Reducing this will reduce the material needed, but will also result in larger differences between each test square.
- **Min Interval** determines the minimum distance between lines to test (try 0.08 mm as a start).
- **Max Interval** determines the maximum distance between lines to test (try 0.16 mm as a start).
- **Size** sets the size of each sample square. Reducing this will reduce the material required, but may make the results harder to read.
- Select **Simple Fill** to created sample squares with a solid black fill.

- Select **Dithered Image** to create sample squares that are a gradient from black to white. These are often easier to read and provide more information to those seeking to engrave images.
- Preview shows a preview of the Interval Test pattern, as it will output to your laser.
- Frame commands your laser to frame the area the Interval Test pattern will be output to in your laser's work area.
- **Save** saves the test pattern in the appropriate file format for your type of laser.
- **Start** commands your laser to begin engraving the Interval Test pattern.
- Press **OK** to save your Interval Test settings — saved settings will be present when you open the Interval Test later.
- Press **Cancel** to discard any changes you've made to the Interval Test settings — settings will revert to previously saved settings when you open the Interval Test later.

Interpreting Results

Results are best observed under good lighting and with magnification, if available. Look for the sample square where the scan lines touch without overlapping.

Adjust your **Line Interval** setting in the Cut Settings Editor, and save your settings to the Material Library for future use.

Related Topics

- Focus Test
- Material Test

cut-settings UI libraries laser-control quality-optimization device-management

5.5.3.4 Material Library

LightBurn's **Material Library** provides a place to store, organize, and quickly re-apply preset Cut Settings for different operations and materials.

LightBurn's **Material Library** provides a place to store, organize, and quickly re-apply preset Cut Settings for different operations and materials.

Accessing the Material Libary

In the default layout, the **Library Window** is the tab after Laser, in the bottom right of the screen.

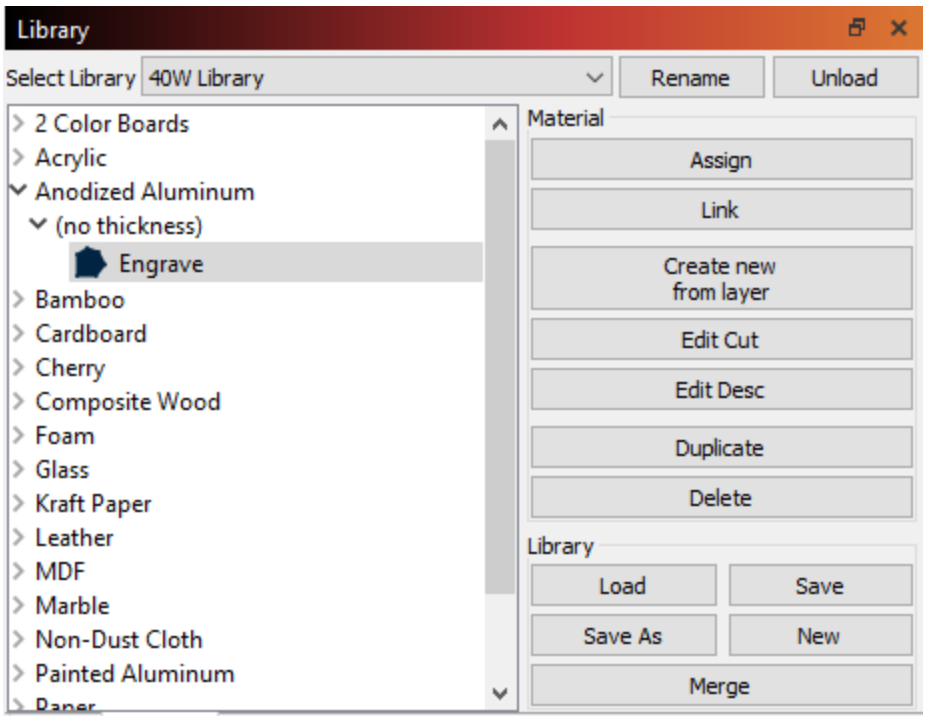
If you have closed the Library Window, go to Window → **Library** to re-enable it. To restore it and all other windows to their default positions, go to **Window** → Reset to Default Layout.

Tip

The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Options and Settings

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Creating New Material Library Presets

Click **Create new from layer** to save settings from the active layer (including Sub-Layers) to a new preset entry in the Library. Enter the below details and hit **OK** to save the material preset to the active Library.

- **Material Name**: The highest folder within the Library to include this material in.
- **Thickness**: The Z-height of the material to be cut through. Appears as the sub-folder name when in use.
- For surface operations like "Engrave" or "Score" that don't depend on the material thickness enable **No Thickness** and enter the operation into **Title**. This disables the Thickness option, and appears as the sub-folder name when used.
- **Description**: Provide greater detail about these settings, for example "Cut — Quick and Dirty". Appears as the name of the entry in the list.

All saved presets are organized in collapsible folders on the left side of the **Library Window**.

Using Material Library Presets

To apply presets to a layer in your project, first activate the layer by selecting a graphic set to that layer, or clicking the layer in the Cuts / Layers Window.

Next, select a preset from the list in the **Library Window**, and click Assign or Link.

Assign

Applies the preset settings from the selected entry to the active layer.

After applying the presets to the layer, you may adjust them in the Cut Settings Editor, and edits made in the Cut Settings Editor will not affect the Library entry, or vice-versa.

Link

Syncs the active layer to the settings stored in the selected preset entry. This disables the ability to edit the layer in the Cut Settings Editor, but any changes made to the Library entry will be automically applied to the layer.

> **Tip**
>
> This is often useful for files that you'll be running again in the future, so that future improvements to your custom presets will be automatically applied in your project.

Modifying Presets

You can modify existing presets by selecting them in the list, then clicking one of the options in the right side of the window.

Edit Cut

Opens the Cut Settings Editor for this preset. After making changes, click **OK** to override the existing entry in the Library with your changes.

Edit Description

Click **Edit Description** to modify the **Name**, **Thickness** and **Description** for the highlighted entry.

Duplicate

Copies the highlighted preset to a new entry in the Library.

> **Tip**
>
> Combined with **Edit Description** and **Edit Cut**, you can keep the same **Material Name** and **Thickness** to create *nested* entries (e.g. 3 mm cut, scan, and image). Keeping just the Name while changing the Thickness allows nesting of different thicknesses of the same material.

Delete

Permanently removes the selected preset from the Library.

Managing Material Libraries

New

Creates a blank Library.

Save

Stores or overwrites a previously a stored Library with an updated version containing any changes you've made since you last saved the Library. Libraries are saved with the `.clb` file extension.

Save As

Saves a copy of the active Library to your files with a different file name. Useful for archival purposes.

Merge

Combines two Libraries together. Useful when importing settings from external parties.

Load

Open your system's file browser, where you can navigate to the location of a previously saved `.clb` file and select it, to add it to the **Select Library** dropdown list.

Select Library

Select one of the Loaded Libraries from the dropdown list.

Rename

Changes the name of the Library.

Unload

Removes the Library from the **Select Library** list.

Advanced Usage

Multiple Lasers

If you have multiple lasers, it's typically best to create a **Material Library** for each laser.

When you save a Library, it is linked to the currently active device. In the future, when you select that device, the Library associated with it will load automatically.

When you change Libraries, LightBurn will check any Linked layers against the newly-loaded Library. If there's a Linked preset in each of the old and new Libraries that have matching details — **Material Name**, **Thickness/Title**, **Description** — LightBurn will automatically Link the layer to the preset in the new Library, and update the layer's Cut Settings accordingly.

Multiple Computers

Multiple computers can access a single **Material Library** file hosted on a network drive or from cloud service storage (e.g. Dropbox, Google Drive, iCloud, OneDrive, etc.). To open up a shared Material Library on a different computer, use the Load button in the **Library Window**.

> **Note**
>
> If you have multiple computers pointing to the same Material Library file, updates made from one computer won't show on the other computer(s) until LightBurn is restarted or the Library is reloaded with the **Load** button.

Related Topics

- Cut Settings Editor
- Color Palette
- Art Library

5.5.4 Modes and Advanced Control

DSP GCode gantry laser-control modes-and-advanced-control output-and-positioning coordinates-and-origin recovering-a-halted-job cutting-a-project-larger-than-your-workspace modes wizards

5.5.4.1 Print and Cut

Quick Reference: Print and Cut

Aligns new output to pre-existing target locations.

Location

Modes Toolbar

Laser Tools → Print and Cut

Keyboard Shortcuts

Windows: Alt + 0

Mac: ⌥ Option + 0

Compatibility

Gantry lasers

Print and Cut aligns a current project to existing **Target Positions** — also called *registration marks* — in a previously output design.

Print and Cut works by measuring the difference in location, orientation, and scale between two Target Positions in your laser's physical work area and the positions of two corresponding graphics in your LightBurn Workspace.

Use Print and Cut to cut around a pre-printed design, to cut a project larger than your laser's work area, to run a second pass over a previous cut, or to restart a halted job.

To open the Print and Cut Wizard, go to Laser Tools → **Print and Cut** → **Start Wizard**, press ⎇ Alt / ⌥ Option + 0, or click the Print and Cut Icon in the Modes Toolbar.

All individual Print and Cut steps are also selectable from the Print and Cut submenu, without opening the wizard.

Print and Cut Requirements and Notes

- **Print and Cut** is only available for Gantry style lasers.
- In order to use Print and Cut, your laser must be connected to your computer, reporting its position accurately, and properly homed — for best results, you'll need a laser capable of automatic homing.
- You must use Absolute Coordinates positioning with Print and Cut. When you **Align Output to Targets** with Print and Cut, Absolute Coordinates will automatically be selected as your **Start From** mode — switching out of that mode will cause misalignment.
- When aligning your laser to the **Target Positions**, you must jog it using the commands in the Move Window, its controller's keypad (if applicable), or the button in the Print and Cut Wizard. *You must not move your laser by hand at any point in the process.*
- The accuracy of Print and Cut depends on the reliability of your laser's motion system and the precision of your laser's beam or red dot pointer's alignment to the Target Positions.
  - If your laser slips, snags, or loses position in any other way due to to mechanical problems, you will be unable to achieve accurate alignment with Print and Cut. See Troubleshooting: Mechanical Issues for advice on addressing those issues.
  - If the beam or red dot is not perfectly aligned to the center of the Target Positions, output will not be perfectly aligned either.
  - Alignments with sub-millimeter accuracy are achievable, but you should anticipate minor deviations in most cases.

Using Print and Cut

Notes on Target Positions

To use **Print and Cut**, you must align your laser to two **Target Positions** in a previously output design, and have corresponding, selectable Target Position graphics in your LightBurn Workspace. LightBurn uses the reported position of the laser over the Target Positions to align new output to the existing design.

The standard use case of Print and Cut is to align laser output to registration marks that were specially added to a file in order to use them as Target Positions later. In this case, the original file is intended to be printed by one device, and cut out (or around) by a laser later on.

- In order to align to a previously printed design, the printed file must be in a format that can be Imported by LightBurn.
- The Target Position graphics must always maintain their relative position to the design after it is first output, in order to accurately align to them later.

> **Tip**
>
> Lock all objects in your project to ensure they always maintain their relative position to one another.

- The Target Position graphics must be a single object or single Group of objects.
- Output is aligned relative to the *center* of the object or Group used as a registration mark.
- The farther apart the Target Positions are positioned from one another, the greater the accuracy of your alignment will be.
- Crosshair marks make ideal Target Positions. Include them in any printed design you intend to cut with your laser.
- In LightBurn, crosshairs must consist of one vertical and one horizontal line, Grouped together.

> **Tip**
>
> Create a circle with lines between its top and bottom and left and right midpoint Snapping locations to make a perfect crosshair.

- The crosshairs cannot be images, or part of a larger image. They must be individually selectable vector graphics.
- Set the crosshairs to a Tool layer if you do not want them to be cut or engraved by your laser.
- To cut a project larger than your laser, you can divide it and engrave sets of crosshairs with each section, and use them to align the next section to the previous section.
- You can also center crosshair marks over sharp corners in an existing cut or engraving, and align to those corners. Useful for running a second pass over an incomplete cut, or recovering halted jobs.

Figure 1: Left: Crosshairs imported from a pre-existing design for use as Target Positions.

Right: Crosshairs placed over sharp corners in pre-existing design, to use as Target Positions.

See below for more information on alternate use cases:

- Rerunning a project or recovering a halted job
- Cutting a project larger than your laser's workspace

Aligning Your Project to Target Positions

1. Start by Importing or creating a project that contains Target Position graphics — ideally crosshair marks — following the above guidance.
2. Go to Laser Tools → **Print and Cut** → **Start Wizard**, or press `⎇ Alt` / `⌥ Option` + `0` to open the Print and Cut Wizard.

> **Using Print and Cut from outside the Wizard**
>
> Optionally, you can choose not to open the wizard and instead set Target Positions and align output from the Print and Cut submenu, or by using hotkeys.

3. In your LightBurn Workspace, select the first crosshair mark.
4. Using the buttons in the Move Window or on your controller's keypad (if applicable), jog your laser over the first Target Position in the existing output in your laser's work area.
5. Use the laser Fire button in the Move Window or the Pulse button on your laser's controller (if applicable) to align the laser's beam to the center of the Target Position. If your laser has a red dot pointer, position it over the center of the Target Position instead of firing or pulsing the laser.

> **Warning**
>
> Make sure you are wearing properly rated safety glasses before firing or pulsing your laser. Consult your laser's manufacturer to make sure your safety glasses are properly rated for your laser.

6. After aligning the laser to the Target Position, click **Set** to set the laser's current location as the first Target Position. If you are not using the Print and Cut Wizard, select **Set First Target Position** from the Print and Cut submenu, or press `⎇ Alt` / `⌥ Option` + `1`.
7. The selected crosshair mark in your Workspace will be highlighted in red.

8. Select the second crosshair mark in your LightBurn Workspace.
9. Jog your laser over the second Target Position in the existing output. The **Jog** button beneath **Jog To Selection** in the Print and Cut Wizard will automatically jog your laser to the predicted location of the second Target Position. Use the Move Window or controller's keypad to correct or fine-tune alignment if the predicted location is imprecise.
10. After verifying alignment, click Set to set the laser's current position as the second Target Position. If you are not using the Print and Cut Wizard, select **Set Second Target Position** from the Print and Cut submenu, or press `⎇ Alt` / `⌥ Option` + `2`.

11. The second crosshair mark in your Workspace will be highlighted in blue.

12. Select **Scaled** (`⎇ Alt` / `⌥ Option` + `3`) or **No Scaling** (`⎇ Alt` / `⌥ Option` + `4`) to align the current project in your LightBurn Workspace to the Target Positions in your laser's work area. In the Print and Cut submenu, these options appear as **Align Output to Targets** and **Align Output to Targets (no scaling)**.
    - The Scaled option resizes your project to account for any discrepancy between the size of your project in LightBurn and the size of the pre-existing output in your laser's work area, based on the distance between the Target Positions.
    - The No Scaling option aligns the project but does not resize it according to the distance beteween the Target Positions.
13. The wizard will close when you select one of the above options. You can select an alternative option by re-opening the wizard, selecting it from the Print and Cut submenu, or by using the appropriate hotkey.

    Choose **Reset Print and Cut** to remove the current alignment and start the process over.

14. The **Enabled Mode(s): Print and Cut** indicator will appear at the bottom right corner of your screen:

    And green outlines will appear around both crosshair marks:

> **Warning**
>
> Absolute Coordinates will automatically be selected as your **Start From** when you enable Print and Cut. Make sure *not* to switch to a different Start From mode.

15. After verifying that your project will output correctly by Framing and viewing it in the Preview window, Start the job.

Expected appearance of Print and Cut Preview

You should expect to see your project rotate in the Preview window, if the location of the Target Positions you've set indicates that a change in orientation is required.

Error Messages

There are a few error messages you may receive when setting the **Target Positions**.

Multiple Shapes Selected

You may not use multiple shapes as a registration mark, unless they are Grouped. If you are using a crosshair mark as your Target Position graphics, you must Group the lines before setting the positions.

Need to Select a Different Target

After setting your first Target Position, you did not select a different Target Position graphic in your LightBurn Workspace, before clicking to set the the second position.

Select the second graphic, and try again.

Must Move the Laser

The laser has reported no movement from the position it was in when you set the first Target Position.

Make sure the laser is still connected and reporting its position. If the laser has disconnected, you must re-home and start the process over.

Make sure you are moving the laser using the jog buttons in the Move Window or on its controller's keypad (if applicable), and *not* by hand.

Insufficient Separation

The laser has reported a change in position, but the second Target Position is too close to the first. Make sure you have jogged your laser the whole way to the second position using the jog buttons in the Move Window or on its controller's keypad (if applicable), and *not* by hand.

If the Target Positions are physically too close together, you must amend your original design to increase their separation. That requires re-printing or re-outputting the original design, *and* making sure the design in your LightBurn Workspace is updated to match.

Alternate Use Cases

Rerunning a Project or Restarting a Halted Job

If a design has suitable sharp corners, you do not need to have special **Target Positions** in the original design to use **Print and Cut**.

Using sharp corners in existing output allows you to align a project that was not originally intended to be used with Print and Cut, either to run a second pass over an incomplete cut, or to align to and restart a halted job.

To align to corners of existing output, you must create two crosshair marks and position them so that they are perfectly centered over two sharp corners in your design in LightBurn.

> **Tip**
>
> Use Snapping to ensure that the centers of the crosshairs are directly over the points of the corners.

Move the laser to the corresponding corners in the existing output, and select the appropriate crosshair for each corner when setting the Target Positions.

These crosshairs do not ever need to be output to the laser, so they should be set to a Tool layer.

Alternate method for restarting a halted job

Cutting a Project Larger Than Your Laser's Workspace

In order to cut a project larger than your laser's work area, divide it into sections using Cut Shapes, and add crosshair marks to each section, to use as **Target Positions** to align the subsequent section to.

Be sure to divide the sections and position the crosshair marks such that each section and the crosshairs from the previous section can fit in your laser's work area.

After a set of crosshairs of each section have been engraved, set them to a Tool layer, so they are not output to your laser again — be sure not to delete or move them, you'll still need them for alignment. Set the rest of the graphics in each completed section to a Tool layer as well, or delete them.

Related Topics

- Coordinates and Origin

5.5.4.2 Rotary Mode

laser-control modes-and-advanced-control rotary

Rotaries are used to turn cylindrical objects so that their surfaces can be marked by a laser. In order to use your laser with a rotary, you must first establish several important parameters in the **Rotary Setup** window that control the rotary's motion.

> **Info**
>
> If you're working with a tapered object, use the largest end of the taper for the object diameter.

To open Rotary Setup, go to Laser Tools → **Rotary Setup** (`^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `R`), or click the rotary icon in the Modes Toolbar.

For more information on setting up and using a rotary with your type of laser, see:

- Rotary Mode (DSP)
- Rotary Mode (GCode)
- Rotary Mode (Galvo)

You can enable or disable **Rotary Mode** by toggling the **Enable Rotary** switch in the **Rotary Setup** window, or, if Show rotary enable in main window is enabled in your Settings/Preferences, by toggling the switch in the Laser Window.

When Rotary Mode is enabled, you'll see a status indication in the bottom right corner of your screen:

DSP gantry rotary modes-and-advanced-control laser-control rotary-mode

5.5.4.2.2 Rotary Mode (DSP)

> **Note**
>
> The Rotary Setup window is not available for lasers with TopWisdom or Trocen controllers. See below for more information on setting up a rotary with these controllers.

Rotaries are used to turn cylindrical objects so that their surfaces can be marked by a laser. In order to use your laser with a rotary, you must first establish several important parameters in the **Rotary Setup** window that control the rotary's motion.

> **Info**
>
> If you're working with a tapered object, use the largest end of the taper for the object diameter.

To open Rotary Setup, go to Laser Tools → **Rotary Setup** (`^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `R`), or click the rotary icon in the Modes Toolbar.

Rotary Setup (Ruida)

Click any option in the images below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.

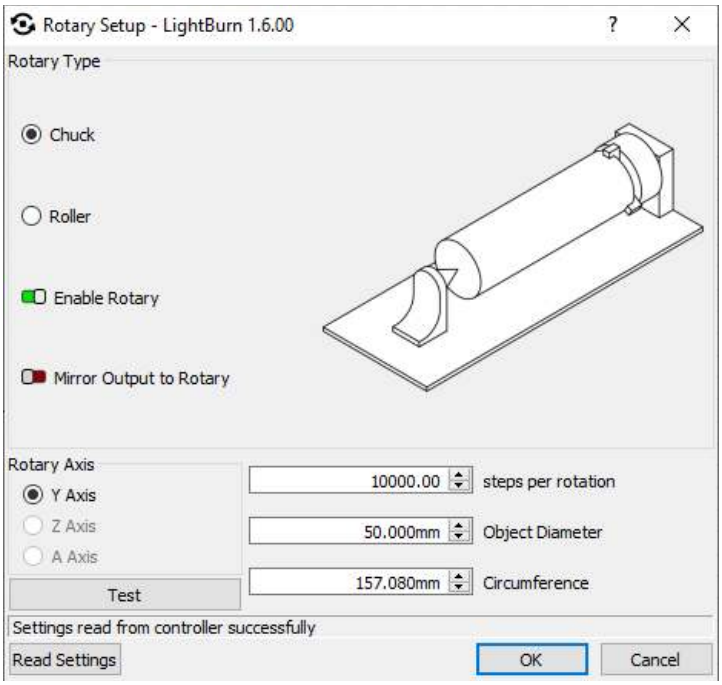


Figure 1: Rotary Setup for Ruida Controllers (Chuck)

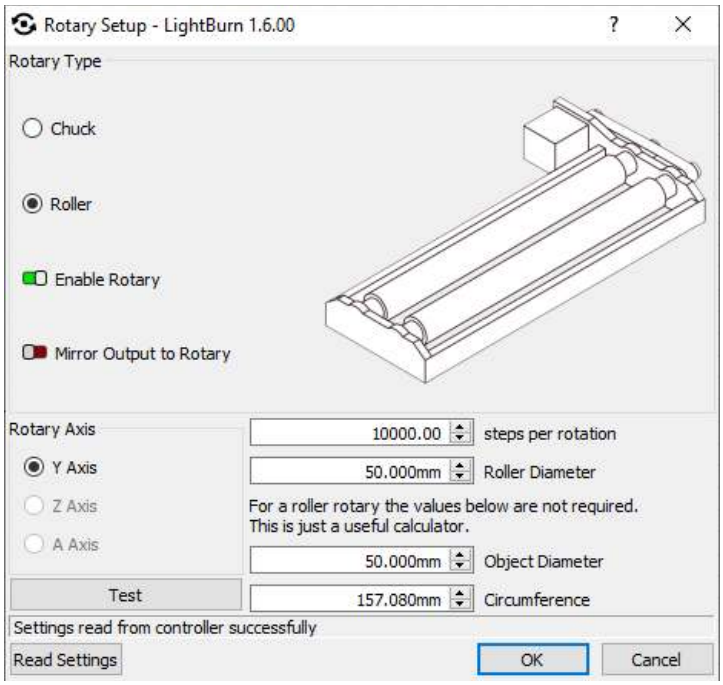


Figure 1: Rotary Setup for Ruida Controllers (Roller)

Rotary Type

Select whether your rotary is a **Chuck** or **Roller** style rotary. Chuck rotaries have adjustable jaws that grab and hold objects, while Roller rotaries have revolving rollers or wheels that objects are placed on top of.

Enable Rotary

> **Tip**
>
> If Show rotary enable in main window is enabled in your Settings/Preferences, you can also enable or disable Rotary Mode using the switch in the Laser Window.

This switch controls whether **Rotary Mode** is enabled. When enabled, rotational commands are sent to the laser to control rotary motion, and output is split into segments.

When Rotary Mode is enabled, you'll see a status indication in the bottom right corner of your screen:

Mirror Output to Rotary

Enable the **Mirror Output to Rotary** switch if output to the rotary is inverted in the dimension of rotation.

Rotary Axis

For most lasers with Ruida controllers, the **Rotary Axis** is automatically set to **Y** and cannot be changed.

If your rotary is connected to a U Axis port, the controller will handle transferring the commands the correct axis, provided the firmware version running on the controller supports U Axis rotary output. In some cases, you may need to manually select the U Axis through the controller.

Consult your laser's manufacturer for more information on U Axis rotary support.

Rotary Settings

Steps Per Rotation

> **Note**
>
> With a **Roller** style rotary, it is the *roller or wheel* driven by the motor that must make one complete rotation when you click the Test button, and *not* an object on the rotary.

Set the **steps per rotation** value to the number of motor steps required to spin the rotary one complete rotation.

If this value is incorrect, output will be shrunk or stretched.

In most cases, steps per rotation will be provided by the manufacturer of your rotary or machine — consult the manufacturer if the steps per rotation value was not provided in the instructions included with your device.

Test

When the **Test** button is pressed, the rotary should turn a full 360 degrees, pause, then rotate back to the starting point. If the rotary turns too far, reduce the steps per rotation value. If it does not turn far enough, increase it.

Roller Diameter

This option is only presented for **Roller** style rotaries.

In most cases, **Roller Diameter** is provided by your rotary's manufacturer. If not, carefully measure the diameter of the roller or wheel driven by the rotary motor.

Once this measurement is accurately identified and set, it never needs to be adjusted again. If it is inaccurate, output will be shrunk or stretched.

Object Diameter

> **Tip**
>
> Use high precision calipers to guarantee the accuracy of your diameter measurement.

For **Chuck** style rotaries, carefully measure and enter the **Object Diameter** of the item on your rotary. This value must be updated every time you place an object with a different diameter on your rotary. If it is inaccurate, output will be shrunk or stretched.

For **Roller** style rotaries, Object Diameter does not affect output, but can be entered here to calculate the **Circumference** of your object.

If your object is tapered, check out our Taper Warp tool.

Circumference

Object **Circumference** is automatically calculated based on the value entered in the **Object Diameter** field. The converse is also true — Diameter is automatically calculated from Circumference.

Use this value to adjust the size of your graphics — for full wrap designs, the combined height of your graphics should be identical to the Circumference.

Read Settings

Instructs LightBurn to read rotary settings settings from your laser's controller.

Writing Changes

After changing rotary settings, you must power-cycle the controller, as the internal logic isn't adjusted for the new settings until you do.

Change the setting, press **OK** to close the **Rotary Setup** window and write the changes to the controller, then power off the control board and power it back on.

You may need to press the Esc (or stop) button on the controller to prevent it from trying to home itself, if the rotary is plugged into the Y Axis port and the laser cannot travel in Y.

Rotary Setup (TopWisdom and Trocen)

TopWisdom

Users with TopWisdom controllers must enable Rotary Mode and set parameters through the Machine Settings of the controller itself.

In LightBurn, go to Edit → Machine Settings to enable Rotary Mode as well as view and adjust the rotary controls.

The options presented here are the same as those available in AutoLaser, the stock software for the TopWisdom. For more information on these settings, refer to this manual, or contact your machine's manufacturer.

Trocen

Users with Trocen controllers must enable Rotary Mode and adjust settings through the controller display. For more information on these settings, refer to this manual, or contact your machine's manufacturer.

Positioning

> **Tip**
>
> If your rotary is plugged into your laser's Y Axis, position the laser head toward the center of its work area *before* plugging in the rotary.

In most cases, Current Position is the best **Start From** mode to use when working with a rotary.

Align the object under your laser head in the X dimension. Output will be positioned on the object in the X dimension relative to the laser head and **Job Origin** selection. The Job Origin is indicated on your graphics by a green square. Parts of the graphic to left of the green square will output to the left of your laser head, and parts to the right will output to the right.

Turn the rotary or object on the rotary to determine where the engraving will output on the object in the dimension of rotation. Output in this dimension is also determined relative to your Job Origin selection — the rotary will turn to reach graphics positioned above or below the Origin.

See Coordinates and Job Origin for more information on the Start From mode and Job Origin settings.

Figure 1: In the above example, output will be centered around the starting position of the laser head.

> **Note**
>
> For some Trocen controllers, the Start From mode must always be selected through the controller display.

Troubleshooting

- If your output is shrunk or stretched in the direction of rotation, either **steps per rotation**, **Object Diameter** (if working with a **Chuck** style rotary), or **Roller Diameter** (if working with a **Roller** style rotary), is incorrect.
  - Use the **Test** button in the **Rotary Setup** window to check steps per rotation. The rotary should make one 360 degree rotation before returning to the start. If you are working with a Roller rotary, it is the roller or wheel driven by the motor that must make one complete rotation and *not* an object on the rotary. If it turns too far or not far enough, adjust steps per rotation.
  - Use high precision calipers to double-check the Object or Roller Diameter value.
- If the controller returns a "Y Slop Over" or similar error when you try to start a job, jog the rotary using the Y Axis arrows until it reports a position near to the center of its work area (half the max travel distance in Y.)
- If an object slips on a Roller rotary, try:
  - Wrapping the rollers with a non-slip material, or even rubber bands.
  - Placing weights inside the object, such as ball bearings or other small round objects, to help press the object against the rollers.
  - Going to Edit → Machine Settings and reducing the Acceleration value of your rotary axis, in your machine's firmware settings.
- If you end up with a flat part at the bottom of the engraving, it means your rotary gear mechanism has backlash. Usually, tightening any belts in the rotary device will fix this, but, if not, you can place a small line a few mm below the bottom of your design, set to very low power (0.1%) and set it as the first layer to run. The rotary will spin to this position, then back up over that few millimeters of gap, and will take up the backlash with that movement.

Related Topics

- Taper Warp

GCode GRBL gantry rotary modes-and-advanced-control laser-control rotary-mode

5.5.4.2.3 Rotary Mode (GCode)

Rotaries are used to turn cylindrical objects so that their surfaces can be marked by a laser. In order to use your laser with a rotary, you must first establish several important parameters in the **Rotary Setup** window that control the rotary's motion.

> **Info**
>
> If you're working with a tapered object, use the largest end of the taper for the object diameter.

To open Rotary Setup, go to Laser Tools → **Rotary Setup** (`^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `R`), or click the rotary icon in the Modes Toolbar.

Rotary Setup

Click any option in the images below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.

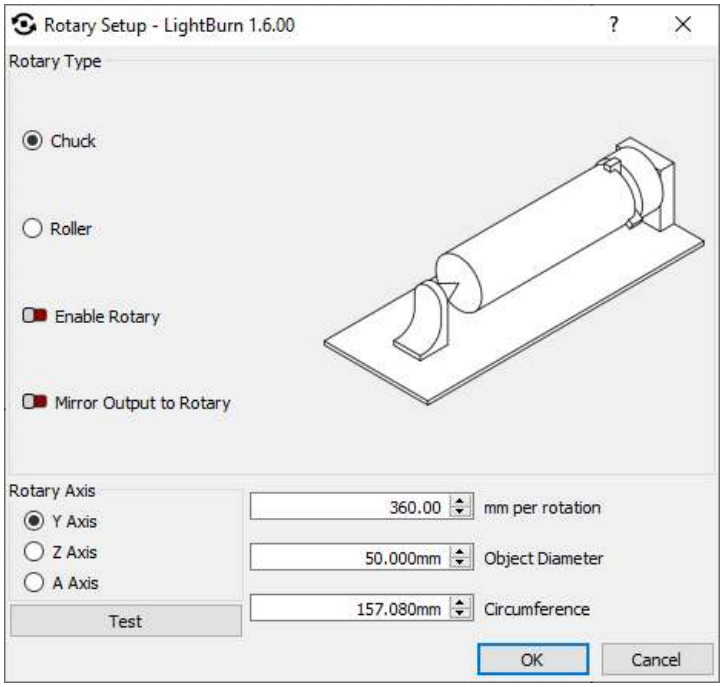


Figure 1: Rotary Setup for GCode (Chuck)

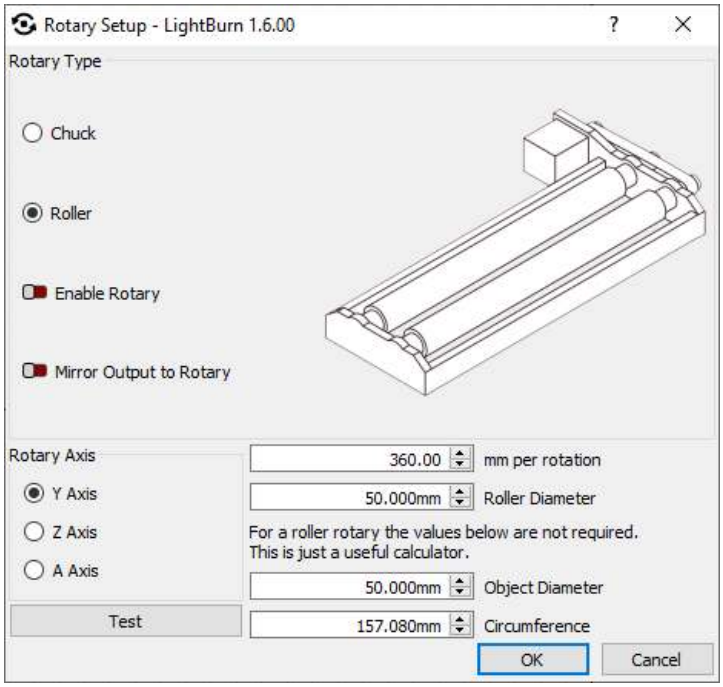


Figure 1: Rotary Setup for GCode (Roller)

Rotary Type

Select whether your rotary is a **Chuck** or **Roller** style rotary. Chuck rotaries have adjustable jaws that grab and hold objects, while Roller rotaries have revolving rollers or wheels that objects are placed on top of.

Enable Rotary

> **Tip**
>
> If Show rotary enable in main window is enabled in your Settings/Preferences, you can also enable or disable Rotary Mode using the switch in the Laser Window.

This switch controls whether **Rotary Mode** is enabled. When enabled, rotational commands are sent to the laser to control rotary motion, and output is split into segments.

When Rotary Mode is enabled, you'll see a status indication in the bottom right corner of your screen:

Mirror Output to Rotary

Enable the **Mirror Output to Rotary** switch if output to the rotary is inverted in the dimension of rotation.

Rotary Axis

Select which axis LightBurn will output rotational commands to.

Select **Y Axis** if you are unplugging your Y Axis stepper motor wire and plugging it into the rotary instead. Some lasers use the Y Axis with a dedicated port and switch.

Select **Z Axis** or **A Axis** if you are plugging your rotary into a dedicated rotary axis. Consult your laser's manufacturer for help identifying the correct axis.

Rotary Settings

MM Per Rotation

> **Note**
>
> With a **Roller** style rotary, it is the *roller or wheel* driven by the motor that must make one complete rotation when you click the Test button, and *not* an object on the rotary.

Set the **mm per rotation** value to the distance of commanded movement in millimeters required to spin the rotary one complete rotation.

If this value is incorrect, output will be shrunk or stretched.

In most cases, mm per rotation will be provided by the manufacturer of your rotary or machine — consult the manufacturer if the mm per rotation value was not provided in the instructions included with your device.

Test

When the **Test** button is pressed, the rotary should turn a full 360 degrees, pause, then rotate back to the starting point. If the rotary turns too far, reduce the mm per rotation value. If it does not turn far enough, increase it.

Roller Diameter

This option is only presented for **Roller** style rotaries.

In most cases, **Roller Diameter** is provided by your rotary's manufacturer. If not, carefully measure the diameter of the roller or wheel driven by the rotary motor.

Once this measurement is accurately identified and set, it never needs to be adjusted again. If it is inaccurate, output will be shrunk or stretched.

Object Diameter

> **Tip**
>
> Use high precision calipers to guarantee the accuracy of your diameter measurement.

For **Chuck** style rotaries, carefully measure and enter the **Object Diameter** of the item on your rotary. This value must be updated every time you place an object with a different diameter on your rotary. If it is inaccurate, output will be shrunk or stretched.

For **Roller** style rotaries, Object Diameter does not affect output, but can be entered here to calculate the **Circumference** of your object.

If your object is tapered, check out our Taper Warp tool.

Circumference

Object **Circumference** is automatically calculated based on the value entered in the **Object Diameter** field. The converse is also true — Diameter is automatically calculated from Circumference.

Use this value to adjust the size of your graphics — for full wrap designs, the combined height of your graphics should be identical to the Circumference.

Notes for Smoothieware Users

Before configuring the above, you may need to set up the rotary axis on your controller. LightBurn sends rotary moves as angle values, and the GCode controller translates those angles into actual movements. To do this, it needs to know the correct number of motor steps to take for one degree of movement on the rotary motor.

If you have a Smoothieboard or other uncommon GCode-based controller, the number is usually 200 times your microstepping multiplier (usually 8 or 16) times any gear reduction, divided by 360.

For a Cohesion3D or HolgaMods rotary, this is usually

3200 steps (200 x 8 micro steps x 2x reduction) / 360 = 8.88888888 steps per degree 6400 steps (400 x 8 micro steps x 2x reduction) / 360 = 17.7777778 steps per degree

The steps per degree number, along with acceleration and maximum speed will need to be set in the appropriate location for the controller. With Smoothieware, those are the **delta** settings in the config.txt file on the controller.

Positioning

Tip

If your rotary is plugged into your laser's Y Axis, position the laser head toward the center of its work area *before* plugging in the rotary.

In most cases, Current Position is the best **Start From** mode to use when working with a rotary.

Align the object under your laser head in the X dimension. Output will be positioned on the object in the X dimension relative to the laser head and **Job Origin** selection. The Job Origin is indicated on your graphics by a green square. Parts of the graphic to left of the green square will output to the left of your laser head, and parts to the right will output to the right.

Turn the rotary or object on the rotary to determine where the engraving will output on the object in the dimension of rotation. Output in this dimension is also determined relative to your Job Origin selection — the rotary will turn to reach graphics positioned above or below the Origin.

See Coordinates and Job Origin for more information on the Start From mode and Job Origin settings.

Figure 1: In the above example, output will be centered around the starting position of the laser head.

Troubleshooting

- If your output is shrunk or stretched in the direction of rotation, either **mm per rotation**, **Object Diameter** (if working with a **Chuck** style rotary), or **Roller Diameter** (if working with a **Roller** style rotary), is incorrect.
  - Use the **Test** button in the **Rotary Setup** window to check mm per rotation. The rotary should make one 360 degree rotation before returning to the start. If you are working with a Roller rotary, it is the roller or wheel driven by the motor that must make one complete rotation and *not* an object on the rotary. If it turns too far or not far enough, adjust mm per rotation.
  - Use high precision calipers to double-check the Object or Roller Diameter value.
- If your controller returns an Alarm:2, *Soft Limits* error, enter `$20=0` in the Console Window to temporarily disable Soft Limits. When you are done working with the rotary, be sure to enter `20=1` to re-enable Soft Limits in your machine's firmware.

  Additional Information

  This error is due to the amount of commanded travel on the rotary axis exceeding the Max Travel limit for the Y Axis, as set in your laser's firmware. During flat engraving, this protects the machine from attempting to travel out of bounds and potentially damaging itself. Since the rotary can turn forever, it is ok to disable this setting when engraving with a rotary, but take care not to give the laser commands that could cause it to travel out of bounds in the X dimension.

- If the object slips on a Roller rotary, try:
  - Wrapping the rollers with a non-slip material, or even rubber bands.
  - Placing weights inside the object, such as ball bearings or other small round objects, to help press the object against the rollers.
  - Going to Edit → Machine Settings and reducing the Acceleration value of your rotary axis, in your machine's firmware settings.
- If you end up with a flat part at the bottom of the engraving, it means your rotary gear mechanism has backlash. Usually, tightening any belts in the rotary device will fix this, but, if not, you can place a small line a few mm below the bottom of your design, set to very low power (0.1%) and set it as the first layer to run. The rotary will spin to this position, then back up over that few millimeters of gap, and will take up the backlash with that movement.

Related Topics

- Taper Warp

galvo rotary modes-and-advanced-control laser-control rotary-mode

5.5.4.2.4 Rotary Mode (Galvo)

Rotaries are used to turn cylindrical objects so that their surfaces can be marked by a laser. In order to use your laser with a rotary, you must first establish several important parameters in the **Rotary Setup** window that control the rotary's motion.

> **Info**
>
> If you're working with a tapered object, use the largest end of the taper for the object diameter.

To open Rotary Setup, go to Laser Tools → **Rotary Setup** (`^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `R`), or click the rotary icon in the Modes Toolbar.

Rotary Setup

Click any option in the images below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.

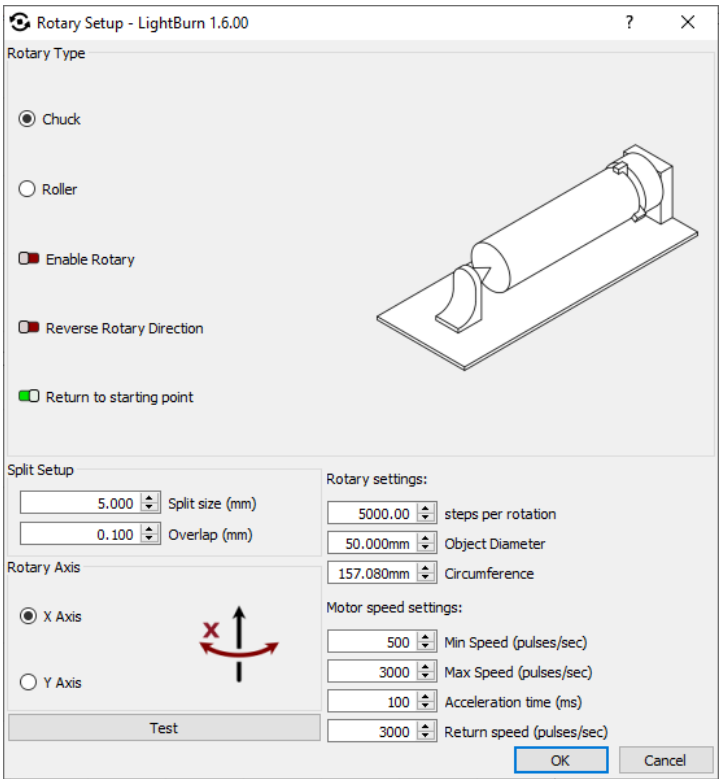


Figure 1: Rotary Setup for Galvo (Chuck)

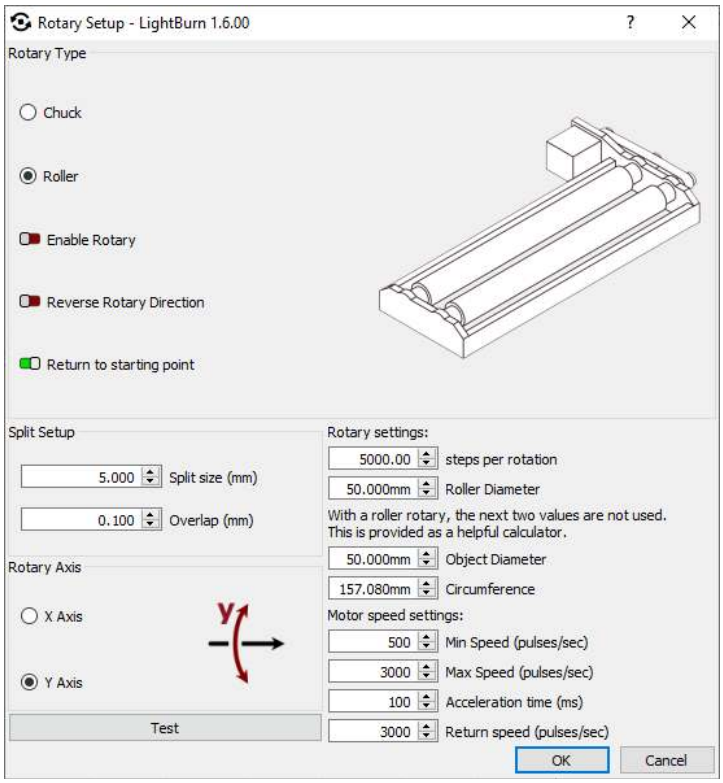


Figure 1: Rotary Setup for Galvo (Roller)

Rotary Type

Select whether your rotary is a **Chuck** or **Roller** style rotary. Chuck rotaries have adjustable jaws that grab and hold objects, while Roller rotaries have revolving rollers or wheels that objects are placed on top of.

Enable Rotary

> **Tip**
>
> If Show rotary enable in main window is enabled in your Settings/Preferences, you can also enable or disable Rotary Mode using the switch in the Laser Window.

This switch controls whether **Rotary Mode** is enabled. When enabled, rotational commands are sent to the laser to control rotary motion, and output is split into segments.

When Rotary Mode is enabled, you'll see a status indication in the bottom right corner of your screen:

Rotary Settings

Steps Per Rotation

> **Note**
>
> With a **Roller** style rotary, it is the *roller or wheel* driven by the motor that must make one complete rotation when you click the Test button, and *not* an object on the rotary.

Set the **steps per rotation** value to the number of motor steps required to spin the rotary one complete rotation.

If this value is incorrect, output will be warped or disconnected.

In almost all cases, steps per rotation will be provided by the manufacturer of your machine, either as a screenshot of the rotary params page in EZCAD or in a text document.

Common steps per rotation values for Galvo rotaries are 9,600, 12,800, and 25,600.

Test

When the **Test** button is pressed, it should rotate a full 360 degrees, pause, then rotate back to the starting point.

Roller Diameter

This option is only presented for **Roller** style rotaries.

In most cases, **Roller Diameter** is provided by your rotary's manufacturer. If not, carefully measure the diameter of the roller or wheel driven by the rotary motor.

Once this measurement is accurately identified and set, it never needs to be adjusted again. If it is inaccurate, output will be warped or disconnected.

Object Diameter

> **Tip**
>
> Use high precision calipers to guarantee the accuracy of your diameter measurement.

For **Chuck** style rotaries, carefully measure and enter the **Object Diameter** of the item on your rotary. This value must be updated every time you place an object with a different diameter on your rotary. If it is inaccurate, output will be warped or disconnected.

For **Roller** style rotaries, Object Diameter does not affect output, but can be entered here to calculate the **Circumference** of your object.

If your object is tapered, check out our Taper Warp tool.

Circumference

Object **Circumference** is automatically calculated based on the value entered in the **Object Diameter** field. The converse is also true — Diameter is automatically calculated from Circumference.

Use this value to adjust the size of your graphics — for full wrap designs, the combined height of your graphics should be identical to the Circumference, if the rotary is set to the **Y Axis**, or the width, if it is set to the **X Axis**. See below for information on Axis selection.

Split Setup

Split Size

When working with a rotary and Galvo laser, graphics are split into segments (slices). Each slice is marked on the object, then the rotary turns, the next slice is marked, and so on, until the entire graphic has been marked.

The size of each segment is determined by the **Split size** setting. If your object is tapered, irregularly shaped, or not perfectly aligned with the rotary axis, using a small Split size can help reduce gaps or misalignment of the splits.

A larger Split size will reduce the time spent running the job, but it can be harder to dial in the settings such that there are no overlaps or gaps.

Overlap

> **Tip**
>
> If you are removing paint, anodizing, or other surface coating, using a small overlap is recommended. If you are annealing or marking the material directly, adding overlaps may produce visible artifacts.

To help eliminate visible gaps between slices, you can tell LightBurn to overlap them. Enter an **Overlap** value to produce that much overlap on the ends of each slice, like this:

Rotary Axis

> **Tip**
>
> When rotating on the X Axis, you'll want to engrave along the Y Axis, with a Scan Angle of 90 or -90. When rotating on the Y Axis, you'll want to engrave along the X Axis, with a Scan Angle of 0 or 180.

Select the **X Axis** if your rotary is oriented across your laser's work area from top to bottom (or vice versa), and will be rotating in the direction of X Axis motion.

Select the **Y Axis** if your rotary is oriented across your laser's work area from right to left (or vice versa), and will be rotating in the direction of Y Axis motion.

Motor Speed Settings

The following settings control how fast the rotary moves and accelerates. In most cases, you do not need to adjust these settings from their default values.

Min Speed

The minimum speed at which in the rotary will rotate, in pulses/second.

> **Tip**
>
> If your rotary is losing steps, or an object on a Roller type rotary is slipping, reduce Max Speed and increase Acceleration time.

Max Speed

The maximum speed at which in the rotary will rotate, in pulses/second.

Acceleration Time

Time to accelerate the rotary to full speed, in milliseconds. Lower values mean the rotary will accelerate *faster*.

Return Speed

The speed at which the rotary will return to its starting position, in pulses/second.

Reverse Rotary Direction

Enable the **Reverse Rotary Direction** switch if output is backwards or sliced in the wrong order.

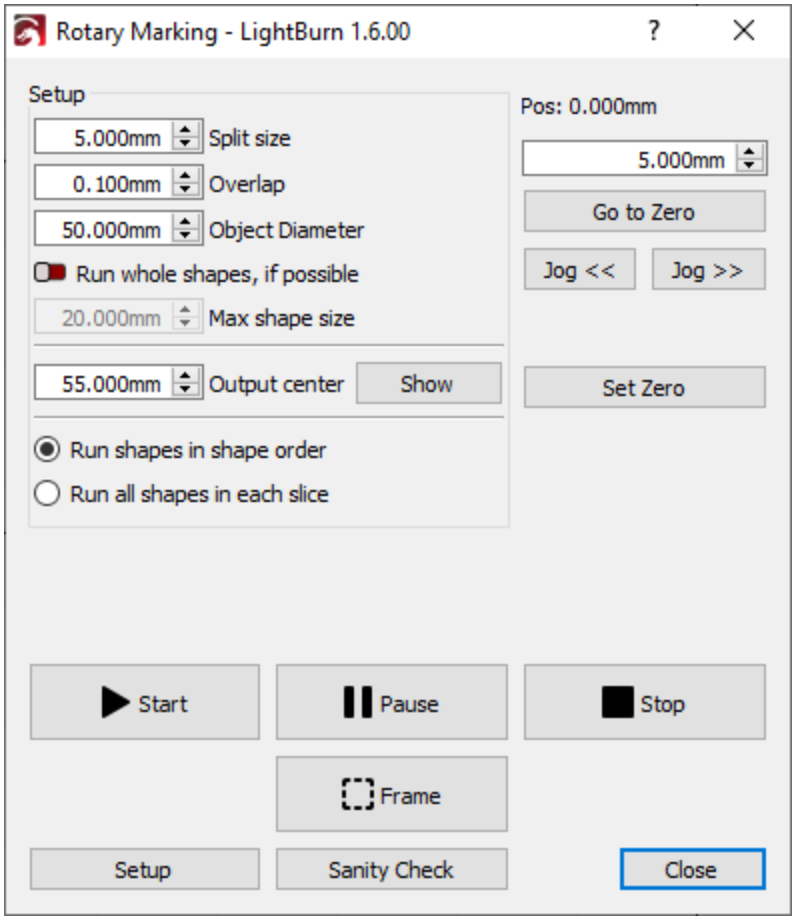
Return to Starting Point

Enable **Return to starting point** to have the rotary return to its starting point after the job is complete.

Rotary Marking Window

When Rotary Mode is enabled, pressing the **Start** button in the Laser Window will bring up the **Rotary Marking** window.

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Split Size and Overlap

Split size and **Overlap** in the Rotary Marking window are linked to the values set in **Rotary Setup** window. Changing either value in either window automatically changes it in both places.

You will see a warning message if you set Split size lower than the smallest possible Split size. Minimum split size is equal to the circumference of your object divided by **steps per rotation**. For a roller style rotary, it is the circumference of the roller divided by steps per rotation.

See above for more information on these settings.

Object Diameter (Rotary Marking Window)

Object Diameter is linked to the value set in the **Rotary Setup** window. Changing the value in either window will automatically update it in both places.

See above for more information.

This option is not presented in the Rotary Marking window when working with a Roller style rotary.

Run Whole Shapes, If Possible

Enabling **Run whole shapes if possible** tells LightBurn to create splits in such a way that shapes are not broken into segments. The rotary will jog to the center of each valid shape and mark it in its entirety. This can produce a higher quality finish without gaps or misalignment within shapes.

Max Shape Size

When **Run whole shapes if possible** is enabled, **Max Shape Size** determines the maximum size of objects that the laser will run in their entirety. Objects larger than the Max Shape Size will be split into segments.

> **Warning**
>
> If Max Shape Size is set too high, the laser's beam may go out of focus toward the edges of large shapes due to the curvature of the object on your rotary, and mark weakly, or not at all.

Output Center

Output will be centered on this line on the axis your rotary is set to. By default it is set to half of the maximum length of your Workspace, meaning output defaults to the center of the laser's field.

This setting allows you to shift the center position of your rotary output to compensate for the center of the rotary not lining up precisely with the center of the field. This value cannot be negative.

Show

The **Show** button commands your laser to **Frame** a line in the location **Output Center** is set to.

Run Shapes in Shape Order

Shapes will be run in their planned order, allowing the rotary to rewind. This option is best suited to Chuck style rotaries.

Run All Shapes in Each Slice

All shapes in each slice will be run before the rotary advances, preventing the rotary from rewinding. This option is best for Roller style rotaries, where objects may lose position due to rewinding.

> **Run shapes in shapes order vs. Run all shapes in each slice behavior comparison**
>
> Imagine your project has two layers, and you've selected **Order by Layer** in Optimization Settings.
>
> If you select **Run shapes in shape order**, the rotary will run all splits containing the first layer, rewind back to the beginning, and then run all splits containing the second layer.
>
> If you select **Run all shapes in each slice**, the rotary will run the first layer and then the second layer on each split, before advancing to the next split, until the job is complete.

Rotary Positioning

Position

The value displayed next to **Pos.** shows the current location of the rotary along the axis of rotation.

Go to Zero

Commands the rotary to return to the zero point on the axis of rotation.

Jog

The **Jog << / >>** buttons command the rotary to turn forward or backward in the increment set in the field above the **Go to Zero** button.

Set Zero

Sets the current position of the rotary as the zero point.

Start, Pause, Stop

These options work exactly as they do in the Laser Window during flat marking operations to begin (**Start**), temporarily pause (**Pause**) a job until your press **Resume**, or permanently halt (**Stop**) a job.

Frame

Frames individual slices that show where graphics will be engraved on the surface of your object.

Click **Previous Slice** and **Next Slice** to command the rotary to turn forward or backward to frame each slice in order.

The current segment being framed and total number of segments are displayed beneath the buttons.

> **Framing slice size**
>
> The size of slices when framing is distinct from the user-specified **Split size** used during engraving. Instead, the amount of slices is automatically determined based on the size of your object and the graphics you'll be engraving.
>
> Larger objects have less curvature and therefore more area that the red dot can reach and adequately frame, often resulting in fewer framing slices for larger objects than smaller ones.

Setup

Opens the Rotary Setup window.

Sanity Check

Checks whether your settings make sense, including whether your **Scan Angle** is set to engrave along the dimension of rotation, or have enabled **Run whole shapes if possible** but selected **Fill all shapes at once** in the Cut Settings Editor.

Positioning Graphics

> **Tip**
>
> Enable Show work area center cross for a clear visualization of your Workspace's center lines.

When using a rotary with a Galvo device, the center line of your LightBurn Workspace represents the starting position of the rotary. If the rotary is set to the **Y Axis**, it is represented by the horizontal center line, and if it's set to the **X Axis**, it is represented by the vertical center line.

The farther away from the center line a graphic or part of a graphic is positioned in LightBurn, the more the rotary will turn to reach the location it will be marked on your object.

If graphics are straddling the center line, the rotary will first turn in one direction to reach the furthest extent of the graphics, then begin marking, eventually crossing the zero point to mark graphics positoned on the other side of the center line.

> **Tip**
>
> Use the **X** and **Y Position** fields in the Numeric Edits Toolbar to guarantee precise positioning.

To have the rotary begin marking without turning first, position your graphics so that their edge is just above or below (if the rotary is set to Y) or to the left or right (if the rotary is set to X) of the center line of your Workspace.

Graphics can be positioned as normal in the dimension the rotary is *not* set to rotate on, to adjust the location they will output to along the object you're marking.

Troubleshooting

- If output is stretched or there are gaps between slices, double check the **steps per rotation** and **Object Diameter** values. If you are using a Roller style rotary, check **Roller Diameter** instead of Object Diameter.
  - In the Rotary Setup window, make sure the rotary — and not an object *on* the rotary — makes a single 360 degree rotation before returning to the starting location when you click the **Test** button.
  - Use high precision calipers for best results when measuring the diameter of your object or roller.
- If output to your rotary is sent to the far left or bottom of your laser's work area, check to make sure the Output Center value is not set to 0. By default, it should be set to half of your Workspace's maximum width or height.
- If your graphics are only outputting as a line or narrow band on your object, switch to the alternate Rotary Axis setting, or change the physical orientation of your rotary to match the current setting.
- If output to your rotary is backwards or sliced in the wrong order, enable Reverse Rotary Direction.

Related Topics

- Cylinder Correction
- Taper Warp
- Repeat Marking

galvo laser-control modes-and-advanced-control LightBurn-Pro batch-production

5.5.4.3 Repeat Marking

Quick Reference: Repeat Marking

Enables the use of a rotating or linear axis table with Galvo lasers to repeat identical jobs.

Location

Laser Tools → Repeat Marking

Versions

LightBurn Pro

Galvo lasers

The **Repeat Marking** tool enables the use of a **Rotating** or **Linear** axis table with Galvo lasers, to move parts past a laser while running repetitions of identical jobs.

By specifying an **Increment** of movement as well as a desired number of repetitions, or **Count**, you can command your laser to mark a design, move an external axis by the specified increment, then run the project again, and repeat that process until it has completed the set number repetitions.

To open the Repeat Marking tool, go to Laser Tools → **Repeat Marking**.

Warning

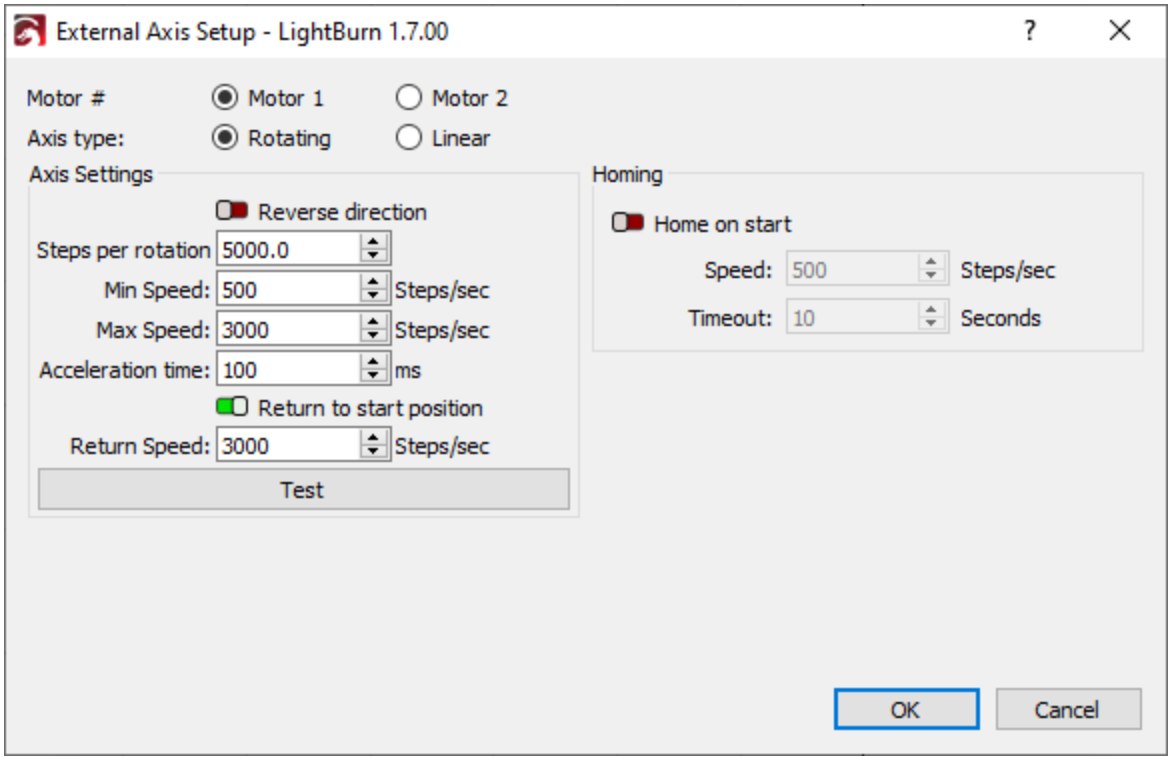
The Repeat Marking tool is separate from, and incompatible with, Rotary Mode. When using Repeat Marking, make sure that Rotary Mode is disabled.

External Axis Setup

Before you use **Repeat Marking** for the first time, you must configure the settings for the **Rotating** or **Linear** axis table connected to your laser.

Click the **Setup** button in the Repeat Marking window to open the **External Axis Setup** window.

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Motor

If your laser has two motor outputs, select which is connected to your **Rotating** or **Linear** table.

Axis Type

Select whether your device is a **Rotating** table that can make continuous, complete revolutions, or a **Linear** table that moves back and forth along an axis.

Reverse Direction

Enable **Reverse Direction** to tell your device to travel in the opposite direction it travels by default, without changing its orientation or rewiring it.

Steps Per Rotation / Steps Per MM

- For **Rotating** tables, the **Steps per rotation** value is the number of commanded steps required for the table to make on complete rotation.

- For **Linear** tables, the **Steps per mm** value is the number of commanded steps required to move the table one millimeter.

Your device's manufacturer should provide you with the correct value for your device.

Test

For **Rotating** tables, when the **Test** button is pressed, and **Steps per rotation** is correct, the table will rotate a full 360 degrees, pause, then rotate back to the starting point.

For **Linear** tables, when the **Test** button is pressed, and **Steps per mm** is correct, the table will move 50 mm, then back to its starting point.

Min Speed

The minimum speed at which in the table will travel, in **Steps/second**.

Max Speed

The maximum speed at which in the table will travel, in **Steps/second**.

Acceleration Time

Time to accelerate the table to full speed, in milliseconds. Lower values mean the table will accelerate *faster*.

Return to Start Position

Enable **Return to starting point** to have the table return to its starting point after the job is complete.

Return Speed

The speed at which the table will return to its starting position, in **Steps/second**.

Homing

Home on Start

Enable **Home on start** to have LightBurn send a command to home a **Linear** table at the start of a job.

Speed

The speed at which the table will home.

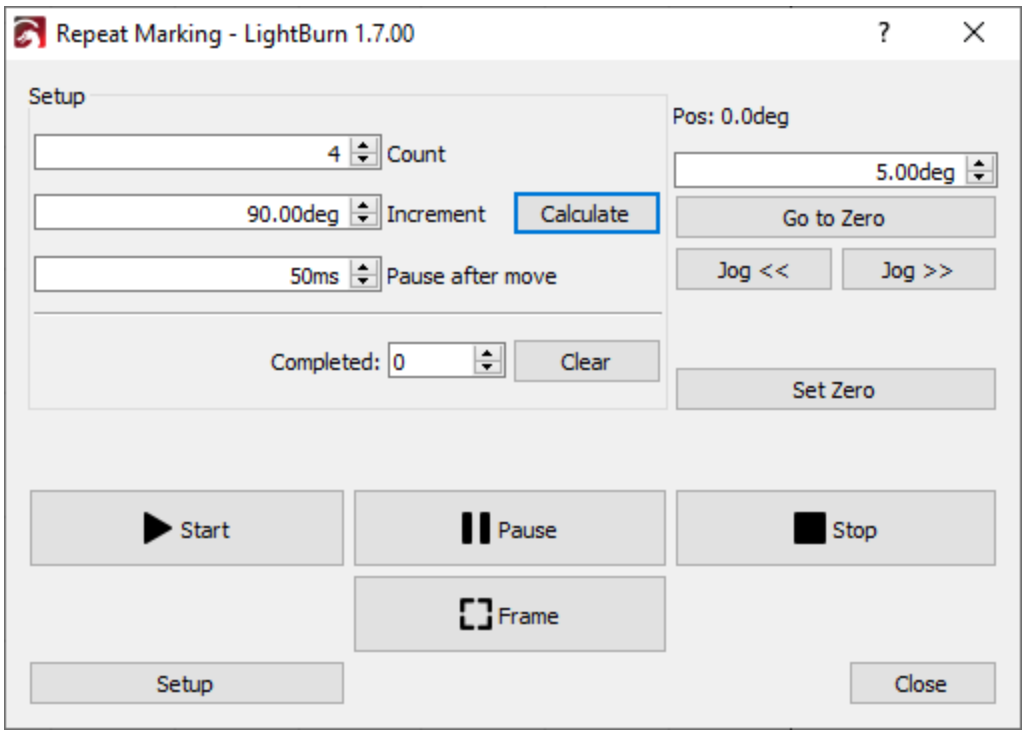
Timeout

Amount of time before the table will abort the homing process.

Repeat Marking Window

Use the **Repeat Marking** window to jog your table into its starting position, set the number of repetitions it will run, and determine the amount of movement between each repitition.

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Count

The number of times (repetitions) your laser will mark a given set of graphics.

Your laser will mark a single set of graphics once, then the table will rotate or move, and the laser will mark the same set of graphics again, and so on until it reaches the **Count** you've set.

Increment

For **Rotating** tables, the angle, in degrees, to rotate the axis between repetitions.

For **Linear** tables, the distance, in millimeters, to move the axis between repetitions.

Calculate

The **Calculate** button is only available if the axis type in **External Axis Setup** is set to **Rotating**, and can automatically determine the correct rotation **Increment** based on the number of positions in your Rotating table. To use it, set **Count** to the number of positions in your table, then click Calculate.

Afterward, you can change the Count to any other number of repetitions, but make sure not to click Calculate again, or the correct Increment value will be lost.

Pause After Move

If your **Rotating** table wobbles when it stops, adding a pause here gives it time to settle before marking starts again.

Completed

The total number of runs of a given project, from the time you first open the **Repeat Marking** window, until you close it. Use this number to track the total number of parts you have marked.

Clear

Resets the **Completed** count to zero.

Positioning

Position

The value displayed next to **Pos.** shows the current location of the **Rotating** or **Linear** table.

Go to Zero

Commands the table to return to the zero point on the axis.

Jog

The **Jog << / >>** buttons command the table to turn (or move) forward or backward in the increment set in the field above the **Go to Zero** button.

Set Zero

Sets the current position of the table as the zero point.

Start, Pause, Stop

These options work exactly as they do in the Laser Window during regular marking operations to begin (**Start**), temporarily pause (**Pause**) a job until your press **Resume**, or permanently halt (**Stop**) a job.

Frame

Framing works as it does with regular marking operations.

> **Tip**
>
> The **Rotating** or **Linear** table will not jog to Frame each repetition — to verify that your **Increment** and **Steps per rotation** or **Steps per mm** values are correct before running a job, try Jogging the table by the amount you've set for your Increment, and Framing multiple positions on the table.

Setup

Click the **Setup** button to open the External Axis Setup window and configure the settings for your table table.

Related Topics

- Rotary Mode (Galvo)
- Variable Text

hardware workflow batch-production advanced-control LightBurn-Pro

5.5.4.4 Feeder Setup

Auto-feeders are conveyers that feed materials such as fabric or leather into a laser in stepped increments. The laser runs repetitions of the same engraving or cutting job between each increment.

Go to Laser Tools → **Feeder Setup** (`^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `F`) to open the **Auto-feed settings** window, where you can set the parameters by which your auto-feeder will feed material into your laser, and the laser will run repeat jobs.

> **Note**
>
> Feeder Setup is only available for DSP lasers with Ruida or Trocen controllers.

Auto-Feed Settings

Ruida

- **Enable Auto-Feed** turns on Auto-Feed mode. This setting must be enabled in order to operate your auto-feeder.
- **Feed before cutting** commands the feeder to move material into the laser before the laser performs its first run of the job.
- **Pause after feed move** tells the laser to pause after a feed move, before cutting. This option is not available on all controllers.
- There are three options for feed distance in the drop-down menu. Feed distance controls the amount that the feeder will advance your material with each repetition.
  - **Job Height**: the feeder will advance the same distance as the height of the job you send to the laser.

    > **Tip**
    >
    > You can see your job's height in the Numeric Edits Toolbar after selecting all graphics you'll be outputting to the laser.

  - **Y Axis length**: the feeder will advance the same distance as the length of your laser's bed in the Y dimension.
  - **Manual**: the feeder will advance by the amount you specify in the field next to the drop-down menu.
- **Distance Adjust** offsets the feed distance by the amount entered. For example, with Job Height selected, and a project height of 50 mm, entering 5 mm in the Distance Adjust field will command the feeder to advance 55 mm with each repetition. Offsets can also be negative.
- **Repeat Count** determines the number of times the laser will run the job and the feeder will advance.
- Press **OK** to save Auto-feed settings or **Cancel** to discard any settings changes made and restore to previous settings.

> **Warning**
>
> Be sure to click OK to save settings after enabling or disabling Auto-Feed mode, or adjusting any settings. Cancelling or "X-ing" out of the Auto-feed settings window will *not* apply the changes you've made.

Trocen

- **Enable Auto-Feed** turns on Auto-Feed mode. This setting must be enabled in order to operate your auto-feeder.

- There are three options for feed distance in the drop-down menu. Feed distance controls the amount that the feeder will advance your material with each repetition.
  - **Job Height**: the feeder will advance the same distance as the height of the job you send to the laser.

    > **Tip**
    >
    > You can see your job's height in the Numeric Edits Toolbar after selecting all graphics you'll be outputting to the laser.

  - **Y Axis length**: the feeder will advance the same distance as the length of your laser's bed in the Y dimension.
  - **Manual**: the feeder will advance by the amount you specify in the field next to the drop-down menu.
- **Distance Adjust** offsets the feed distance by the amount entered. For example, with Job Height selected, and a project height of 50 mm, entering 5 mm in the Distance Adjust field will command the feeder to advance 55 mm with each repetition. Offsets can also be negative.
- **Repeat Count** determines the number of times the laser will run the job and the feeder will advance.
- **Delay after feed (secs)** tells the laser to pause for the specified amount of time after each feed.
- Press **OK** to save Auto-feed settings or **Cancel** to discard any settings changes made and restore to previous settings.

> **Warning**
>
> Be sure to click OK to save settings after enabling or disabling Auto-Feed mode, or adjusting any settings. Cancelling or "X-ing" out of the Auto-feed settings window will *not* apply the changes you've made.

Related Topics

- Rotary Mode (DSP)

laser-control modes-and-advanced-control output-and-positioning gantry

5.5.4.5 Center Finder

Quick Reference: Center Finder

Finds the center of circular stock in your laser's work area.

Location	Compatibility
Laser Tools → Center Finder	Gantry lasers

The **Center Finder** is a tool for finding the center of circular stock, as well as defining that stock in your LightBurn Workspace.

By jogging your laser to three positions on a circle (or other regular shape), and setting those positions in the **Center Finder Wizard**, LightBurn can calculate the circle that passes through those three points, jog your laser to its center, and create a circle in your LightBurn Workspace matching those dimensions, to represent your stock.

The Center Finder is available in the Laser Tools Menu.

Using the Center Finder

First Steps

- Home your machine.
- If your machine does not have homing switches, make sure to start the machine with the laser head at the 0,0 point of its work area — that is typically the lower left corner for GCode-based devices.
- If the stock you are referencing is light or can be moved easily, make sure to secure it so it does not get bumped during the operations.

Set the Points

Point 1

Jog the laser head to the first position on the edge of your circle, as shown in the wizard, then click **Set First Circle Point**.

> **Warning**
>
> You must jog the laser head with the laser control panel or from the Move Window. **Center Finder** will not work if you move the laser head by hand.

Point 2

Jog the laser head to the next position on the edge of your circle, as shown in the wizard, then click **Set Second Circle Point**.

Point 3

Jog the laser head to the last position on the edge of your circle, as shown in the wizard, then click **Set Third Circle Point**.

Align to Center

Move to Center

The last step will show you the calculated center of your circle and allow you to jog to that point.

Create Guide Circle

Toggle on **Add Guide Circle to Project** to create a circle on the T1 Tool layer, that will provide a representation of your stock in your LightBurn Workspace.

Set Origin

Absolute Coordinates

If you use Absolute Coordinates for your workflow, move your design to the guide circle, and make sure your **Start From** mode is set to **Absolute Coords**.

User Origin — Center

If you use User Origin make sure the center radio button is selected as **Job Origin**.

After you move the laser to the center of your stock, press the **Origin** button on your DSP control panel or the **Set Origin** button in the Move Window.

Notes

- You can set the points in any order, and they do not need to be positioned exactly as shown in the reference photos — they need only be far enough apart from one another along the perimeter of the shape that they are valid for calculating the center. The reference photos are meant as guidelines for acceptable distance.
- This tool can find the center of any shape that can be *described* with a circle diameter:
  - Squares (pick 3 corners)
  - Equilateral Triangles
  - Hexagons

Error Messages

Unable to Query the Current Position of the Laser

This happens when LightBurn is unable to get the position of the laser from the controller.

- Often, the laser is still moving, or another command is still in process. Click **OK**, and try again after waiting a few seconds.
- If the warning persists, make sure the controller is still connected and is showing **Ready** at the top of the Laser Window. If you are unable to connect, see Troubleshooting: Connection Problems.

Not Enough Separation Between Points

You have not moved the laser away from the last point or have not moved it far enough to make an acceptable calculation.

- Try moving farther away and setting the point again.
- You must jog the laser using its control panel or the Move Window, and not by hand.

Unable to Calculate Center

LightBurn can't calculate center, or it would be outside your laser's work area.

- This typically happens on machines without homing switches that were not manually homed properly.
- Restart your machine with the head at your machine origin and try to run the wizard again.

Troubleshooting

- The accuracy of the **Center Finder** depends on the accuracy of your point placement. If you have a red dot laser that is accurate, one trick is to try to split the dot on the edges of your stock.
- If you set a point incorrectly, hit the **Reset** button. This will clear *all* points saved. After, restart from the current point. You can set the points in any order.

laser-control modes-and-advanced-control rotary galvo

5.5.4.6 Cylinder Correction

Quick Reference: Cylinder Correction

Warps the output of your design to correct for distortion caused by engraving cylindrical objects.

Location

Modes Toolbar

Laser Tools → Cylinder Correction Setup

Compatibility

LightBurn Pro

Galvo lasers

Cylinder Correction warps the output of your design to correct for distortion caused by engraving cylindrical objects, without using a rotary. This tool is currently only available for Galvo lasers. EZCAD users may be familiar with this tool by the name ProjectMark.

Using Cylinder Correction

Open the **Cylinder Correction Setup** window by going to Laser Tools → **Cylinder Correction Setup**, or clicking the Cylinder Correction button in the Modes Toolbar.

Make sure **Enable Cylinder Correction** is turned on.

Tip

If Show cylinder correction enable in main window is enabled in your Settings/Preferences, you can also enable or disable Cylinder Correction Mode using the switch in the Laser Window.

From the setup window, you'll adjust the **Mirror Distance**, **Object Diameter**, axis to curve around, and direction of the curve.

LightBurn will calculate the Cylinder Correction assuming the design to be output is centered on the object. If you are unable to place the item you're engraving at the center of the laser's working area, move your design to match the actual location of the object.

Mirror Distance

> **Warning**
>
> This is *not* the focus distance between the object and the lens, but the distance to the galvo mirrors themselves. Keep reading for help measuring this.

To use **Cylinder Correction**, you'll need to identify where your mirrors are. The mirrors are typically centered along a tube connecting the galvo head to the laser source. In the image below, a horizontal line marks the center of this tube.

Measure the vertical distance from this line to the bottom of the lens — shown with a vertical line in the image above — and add this to your focus distance to find the mirror distance. We recommend saving this measurement so you don't have to keep re-measuring.

Object Diameter

Measure the diameter of the object and enter it into this box.

X or Y Axis

Select whether the object curves along the X (horizontal) axis or Y (vertical) axis. Only one of the two can be selected. The images below the options show a simplified representation of what each option would look like.

Convex or Concave

Select whether the object is **Convex** — curving outwards to make up the outer surface of a cylinder — or **Concave** — curving inwards to make up the inner surface of a cylinder. As with the X and Y Axis, the images show a simplified representation of Convex and Concave curves.

Show Valid Boundary

There are limits to where on a given object your laser can actually reach. The **Show Valid Boundary** button will insert a rectangle on the T1 Tool layer into your design to show the area that can be engraved.

If you try to Preview or run a cylinder-corrected engraving while a portion of your design is outside of the valid area, LightBurn will pop up a warning asking you whether you'd like to continue anyway, show the valid boundary, or cancel. If you engrave anyway, LightBurn will automatically cut off the portions of the design outside the valid boundary area, as shown below.

How It Works

Galvo lasers project the laser from a single point above your object. When marking a cylindrical object, the increased travel distance for the laser as the surface of the object curves away causes the shape to widen and bend, similarly to the uncorrected rectangle in the diagram below.

Cylinder Correction alters the output to warp your design in the opposite direction, negating the warping caused by the curve of the object. If your measurements are correct, this produces clean, undistorted output like the result shown in the diagram above.

Lens Selection

When using **Cylinder Correction**, you'll be marking across a larger range of focal distances than is typical when marking flat surfaces. For instance, if you have a 75 mm diameter tumbler and are engraving a 50 mm wide graphic, there will be about 10 mm difference in focal distance across your design.

For best results, use a lens with a larger field (working area) if possible. Wider field lenses have a lower power density but a longer focal range. To take advantage of the full focal range, focus your lens below the upper surface of the cylinder, as shown in the diagram below.

Troubleshooting

- If the outer parts of your design are missing, make sure that it's fully within the valid boundaries.
- If the placement of your engraving is wrong, check that the location of your design matches the actual location of the object you're marking. Confirm that the placement is right by framing before running the job.

Related Topics

- Rotary Mode
- Taper Warp

modes-and-advanced-control laser-control object-manipulation rotary-mode laser-tools

5.5.4.7 Taper Warp

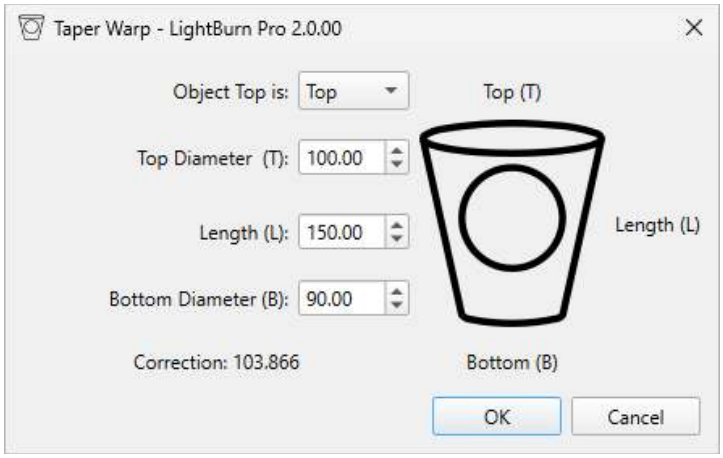
Quick Reference: Taper Warp

Warps graphics to compensate for the taper of physical objects.

Location

Laser Tools → Taper Warp

The **Taper Warp** tool assists in rotary engravings on tapered objects by adjusting graphics to compensate for the difference in diameter between the top and the bottom of the object. Open the Taper Warp window by going to Laser Tools → **Taper Warp**.



Using Taper Warp

Warning

Taper warp operates in millimeters. If your project is set to inches, please either switch to millimeters before using taper warp or convert your measurements to millimeters (multiply them by 25.4).

Open the **Taper Warp** window and adjust the settings shown to match your object. The diagram on the right side of the window helps illustrate what the settings refer to.

As you adjust the settings, you'll see a preview of the effects of the Taper Warp in your Workspace. The image below shows the effect of Taper Warp on parallel rectangles.

Press **OK** to confirm settings and adjust the graphics, or **Cancel** to discard the changes.

When engraving your object, make sure that it's positioned so that the surface to engrave on is parallel to the bed of the laser.

Object Top

Set **Object Top** to either *Top*, *Left*, or *Right* so LightBurn knows where the top and bottom of the taper are — this is where the top of the physical object you're engraving is.

Top Diameter

Measure the diameter of the top of the object. Be as precise as possible – calipers can be very helpful, especialy dealing with round objects.

Length

Measure the length of the object and enter it here.

Bottom Diameter

Measure and enter the diameter of the bottom of the object.

Troubleshooting

- **Taper Warp** corrects for the difference in diameter between the top and bottom of the object. It does not account for different focal lengths or distances from the laser. Make sure the object you're engraving is held in the rotary so the surface to engrave is parallel to the laser's bed.
- The results of Taper Warp depend on the accuracy of the measurements you enter — if Taper Warp does not properly compensate for the taper of your object, double-check your measurements.

Related Topics

- Rotary Mode

- Cylinder Correction
- Warp and Deform

laser-control modes-and-advanced-control galvo calibration hardware devices LightBurn-Pro

5.5.4.8 Galvo Lens Calibration

All Galvo lenses have distortion which must be corrected in order for output from your laser to have an appearance that's true to the design you see in your LightBurn Workspace.

When working with a new laser, you can usually import lens correction values provided by your machine's manufacturer when you first set up your laser with LightBurn.

If your manufacturer didn't provide the necessary file, or you purchase a new lens for a laser you already own, however, you may need to use LightBurn's **Galvo Lens Calibration** wizard to find the appropriate corrections.

To open the Galvo Lens Calibration wizard, go to Laser Tools → **Calibrate Galvo Lens** → **9 Point Correction (Easy)**.

Requirements

To complete the **Galvo Lens Calibration** process, you will need:

- A properly set up device profile for your laser, with the correct **Laser Type** and (if applicable) **Fiber Type** selected in the Device Settings window.
- A material your laser is capable of marking with high contrast. Black construction paper works well for lasers with Fiber sources, and white paper works well for lasers with CO_2 sources.
- A ruler or calipers, to measure the distance between markings made on the material you selected.

Galvo Lens Calibration Wizard

Field Size and Test Area

Each of the fields in this step will be automatically populated based on the **Field** setting in the Device Settings window, but can be adjusted manually if those settings are inaccurate.

Enter the **working area** of your lens (this value is usually provided by the manufacturer) as well as the **size of the box to output** — a value between 85% and 90% of the working area is ideal.

Click **Next** to continue to the next step, or **Cancel** to exit the process (progress will not be saved).

Laser Output Settings

Enter appropriate settings for your laser to mark the material you selected, with strong contrast. If you are unsure what settings to use, try running a Material Test first, or consulting your laser's manufacturer for suggested settings.

The Frame, Start, and Stop buttons work exactly as they do for all other output.

Use the Frame button to verify that the **size of the box to output** is valid for your laser's working area. Mark the design if it fits, or return to the previous step using the **Go Back** button, if you need to adjust the size.

Click **Next** to continue to the next step, or **Cancel** to exit the process (progress will not be saved).

Orientation

Select the LightBurn Dragon that matches the orientation of the output from your laser. Only one orientation will match exactly — take care to select the correct one.

Click **Next** to continue to the next step, **Go Back** to return to a previous step and adjust settings, or **Cancel** to exit the process (progress will not be saved).

Horizontal Measurements

Measure and enter the horizontal distances between lines, as indicated in the graphic. Take care to measure the distances as accurately as possible — the accuracy of the lens correction depends on the accuracy of these measurements.

Click **Next** to continue to the next step, **Go Back** to return to a previous step and adjust settings, or **Cancel** to exit the process (progress will not be saved).

Vertical Measurements

Measure and enter the vertical distances between lines, as indicated in the graphic. Take care to measure the distances as accurately as possible — the accuracy of the lens correction depends on the accuracy of these measurements.

Click **Next** to continue to the next step, **Go Back** to return to a previous step and adjust settings, or **Cancel** to exit the process (progress will not be saved).

Results

The final page displays the resulting corrections that will be applied to each Galvo.

Toggle on **Maximize working area** to increase your laser's **Field** to the maximize size possible, if a larger possible size is indicated by the measurements you entered. Note that you may see a reduction in power output in areas outside the dimensions specified by the lens' manufacturer.

Click **Done** to exit the process and automatically apply the corrections to your Device Settings, **Go Back** to return to a previous step and adjust settings, or **Cancel** to exit the process (progress will not be saved).

Related Topics

- Add Galvo
- Changing a Lens
- Focusing

advanced-features dual-laser

5.5.4.9 Dual Laser Control

LightBurn provides special setup options for machines with two laser tubes. These settings will only be available when using DSP devices.

Enable Laser 2 Controls

Three options for working with dual lasers are available in the Basic Settings tab of Device Settings.

Turn on **Enable Laser 2 Controls** to expose switches in the Cuts / Layers Window and Cut Settings Editor that will allow you to enable or disable each tube for a given layer and adjust their power settings separately.

Enable **Only allow one laser at a time** to automatically disable the alternate tube when you enable Laser 1 or Laser 2. In other words, when you enable Laser 1 on, LightBurn will automatically disable Laser 2, and vice versa.

Turn on **Enable Laser 2 Offset** to specify an offset to account for the distance between the second and first laser head, if your laser has dual heads in addition to dual tubes.

Individual Laser Controls

The switches in the Cuts / Layers Window and Cut Settings Editor are used to enable one or both lasers on a per-layer basis. Each laser's **Max Power** and **Min Power** settings can be managed individually, but all other settings are shared when both laser lasers are enabled at the same time.

In the Cut Settings Editor, both lasers' switches and power settings are visible simultaneously. In the Cuts / Layers Window, select the button for the laser you wish to adjust to show the switch and cut settings for that laser.

Both Lasers Enabled at Once

The option to enable both lasers at once is intended for lasers with dual heads. With both lasers enabled for the same layer, the lasers will run simultaneously in tandem, meaning two copies of the same output will be cut or engraved at once, without any offset applied to the output from the second laser.

Make sure your laser heads are physically spaced far enough apart from one another that each has room to cut or engrave the entire graphic, without overlapping or running into the side of your machine. This means that any graphic you run with both lasers enabled must be narrower than the distance between the two heads.

Only One Laser Enabled at a Time

If each of your laser tubes is optimized for different processes, you may choose to enable one laser for engraving and the other laser for cutting. Any layer or Sub-Layer can be set to output using *only* Laser 1 or *only* Laser 2.

To have one laser engrave a graphic and the other cut the outline of the same graphic, create a Sub-Layer for the layer the graphic is assigned to, and enable only the appropriate laser for the operation assigned to each Sub-Layer.

> **Tip**
>
> Enable Only allow one laser at a time in your Device Settings to guarantee you never accidentally enable both lasers for a given layer.

If you are engraving and cutting separate graphics in the same job, set each to their own layer, and enable only the appropriate laser for the operation assigned to each layer.

If each of your laser tubes also has its own head, in order for output from Laser 2 to align to output from Laser 1, you must measure and apply an accurate Laser 2 Offset.

See our Set Laser 2 Offset Guide for more information.

5.5.5 Machine Management

5.5.5.1 Device Settings

device-settings settings device-management units

5.5.5.1.1 Dimensions / Units

The **Dimensions / Units** tab of **Device Settings** contains settings related to units and measurement and is available regardless of device type.

The image below shows the Dimensions / Units tab for a DSP device. Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a full list of options and descriptions.

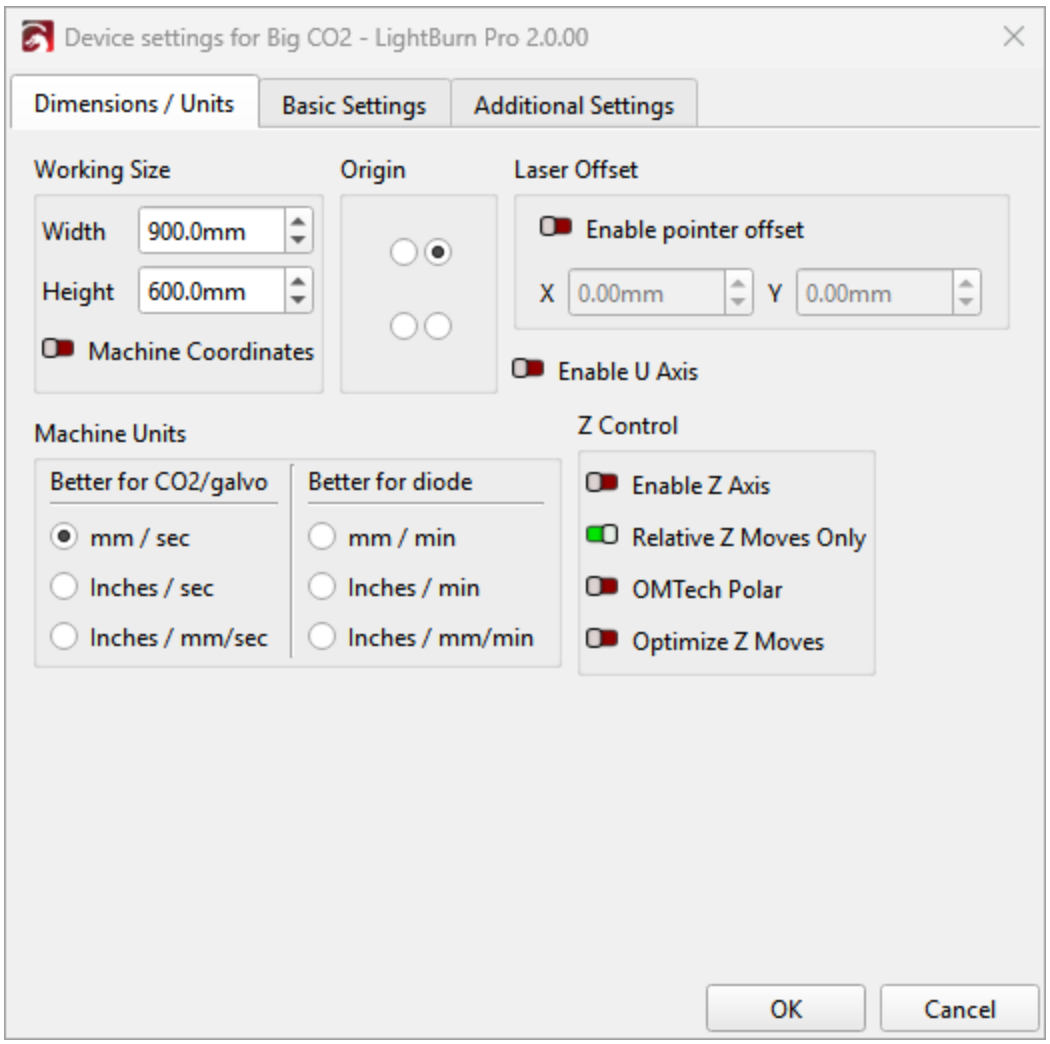


Figure 1:

The Dimensions / Units tab of Device Settings

Dimensions / Units | **Basic Settings** | **GCode**

Per-device unit and dimension settings.

The most commonly used device settings.

Modify GCode output for GCode Devices.

Additional Settings

Settings for simulating previews and estimating time.

Custom GCode

Advanced GCode customization for the Custom GCode device type.

Galvo and Basic Settings

The most commonly used device settings for Galvo lasers.

Ports and Laser Settings

Configure a Galvo laser's ports and laser source.

Working Size

The maximum X (**Width**) and Y (**Height**) travel for your laser. This sets the size of the work area in LightBurn, but does not affect the laser itself.

CNC Machine

Enable this setting if working with a machine with a rear-right origin and negative workspace coordinates. CNC machine users may also want to try MillMage.

Machine Coordinates

Enable this setting when working with a CNC machine that uses G54 offsets.

Origin

The location of your laser's **Origin**, or home. If this is set incorrectly, the orientation of your laser's output will be mirrored or inverted.

For help with troubleshooting your laser's Origin, please see Troubleshooting: Wrong Orientation.

Laser Offset

If your laser has a red dot pointer for Framing and positioning, this setting allows you to compensate for misalignment between the pointer and the actual cutting location. Enable this setting to shift the laser's output relative to the red dot location.

See Laser Offset Setup for instructions on calculating the offset.

Enable U Axis

Enable this setting to apply per-layer U Axis offsets. This is not supported by all controllers.

Machine Units

This section controls the units that LightBurn will use for the size of your machine's work area and for the speed when cutting and engraving. The options are grouped based on device type they're recommended for.

If you prefer to design in inches but use metric units for speed, choose **Inches / mm/sec** for CO_2 and Galvo lasers or **Inches / mm/min** for diode lasers.

Z Control

This section contains settings for your laser's Z Axis, which controls the distance between the laser and the workpiece. The options available will vary depending on what laser you're using.

Enable Z Axis

Enable this to allow LightBurn to control the Z Axis of your machine.

> **Warning**
>
> Enabling this setting means that LightBurn will *always* emit Z values for a running job. If using this setting, you *must* either enable **Relative Z moves only** or set a **Material** height value in the **Cuts / Layers** window.
>
> ***If you do not take either of these steps, the default Material height of 0 may result in your laser head crashing into the workpiece.***

Reverse Z Direction

If your machine's Z Axis moves in the opposite direction of what you expect, toggle this switch to flip the direction for Z moves.

Relative Z Moves Only

This setting treats the machine's height at the start of the job as 0, and uses that height as the starting point for all Z moves. Material height is ignored when **Relative Z Moves** are enabled.

This is the simplest way to work, as you set your focus according to the manufacturer's directions and LightBurn will treat that height as the correct height to start from.

> **Info**
>
> For DSP devices, LightBurn must be connected to your machine to use Relative Z moves.

Optimize Z Moves

By default, LightBurn always retracts the Z back to the starting height after completing a shape with a Z Offset. This is done to prevent the laser head from crashing into the workpiece.

With **Optimize Z Moves** enabled, LightBurn will only issue Z moves when the Z height actually changes. If you know your material is flat and that none of the Z moves will result in the laser moving low enough to run into anything on your work table, this can save a lot of time.

OMTech Polar

Enable this if using an OMTech Polar device.

Troubleshooting

- If you aren't seeing a setting you expected to see, check which tab you're in and make sure it's applicable to your laser.

Related Topics

- Settings/Preferences
- Machine Settings
- Devices

device-settings settings device-management GCode DSP

5.5.5.1.2 Basic Settings

The **Basic Settings** tab of **Device Settings** contains the most commonly used settings, and is available regardless of device type.

The image below shows the Device Settings window for a DSP device — several alternate options will be presented if you are using a different type of device.

Click any option in the images below to jump directly to the relevant section for that option, or scroll down for a full list of options and descriptions, for both DSP and GCode-based lasers.

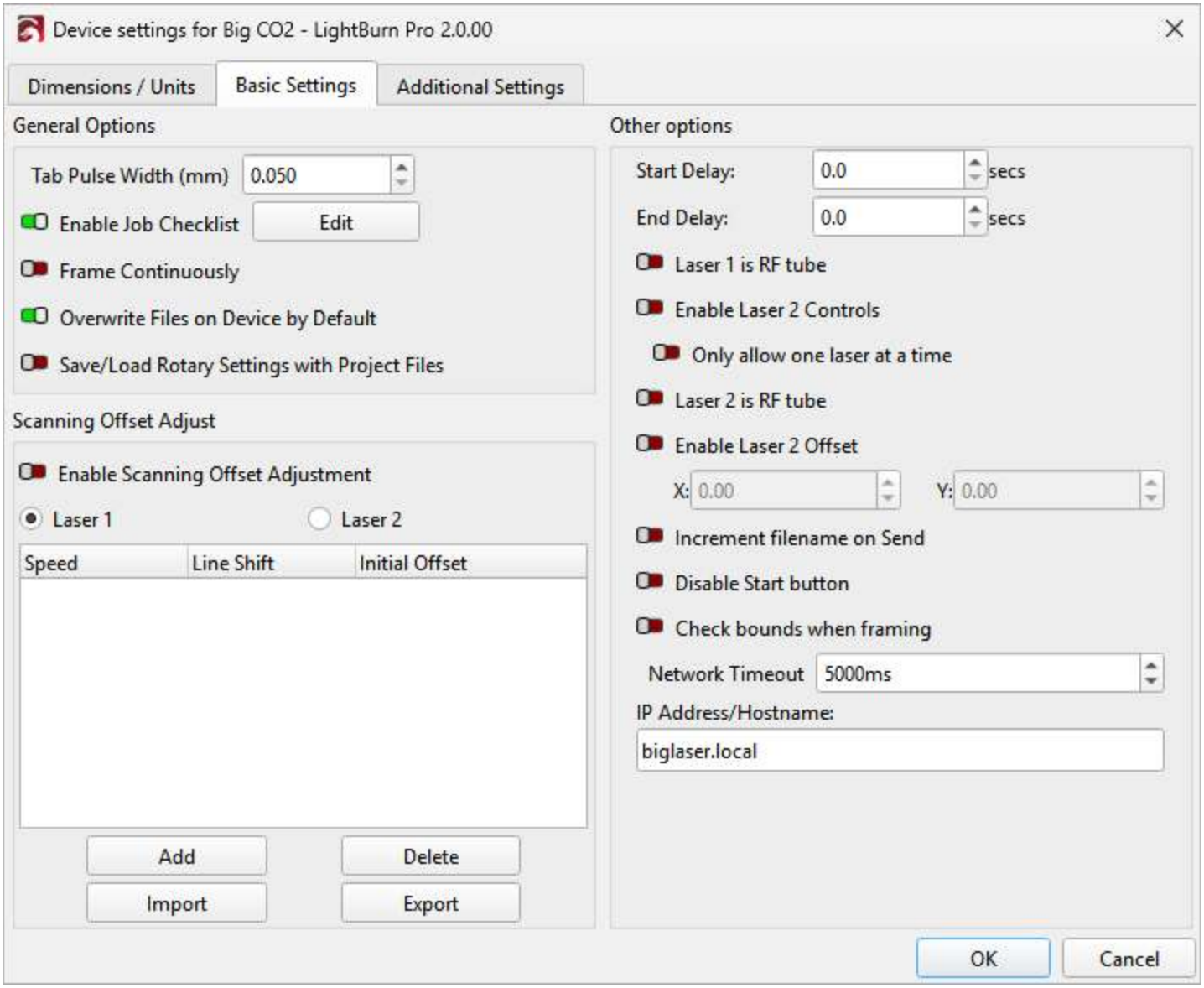


Figure 1:

The Basic Settings tab of Device Settings on a DSP laser

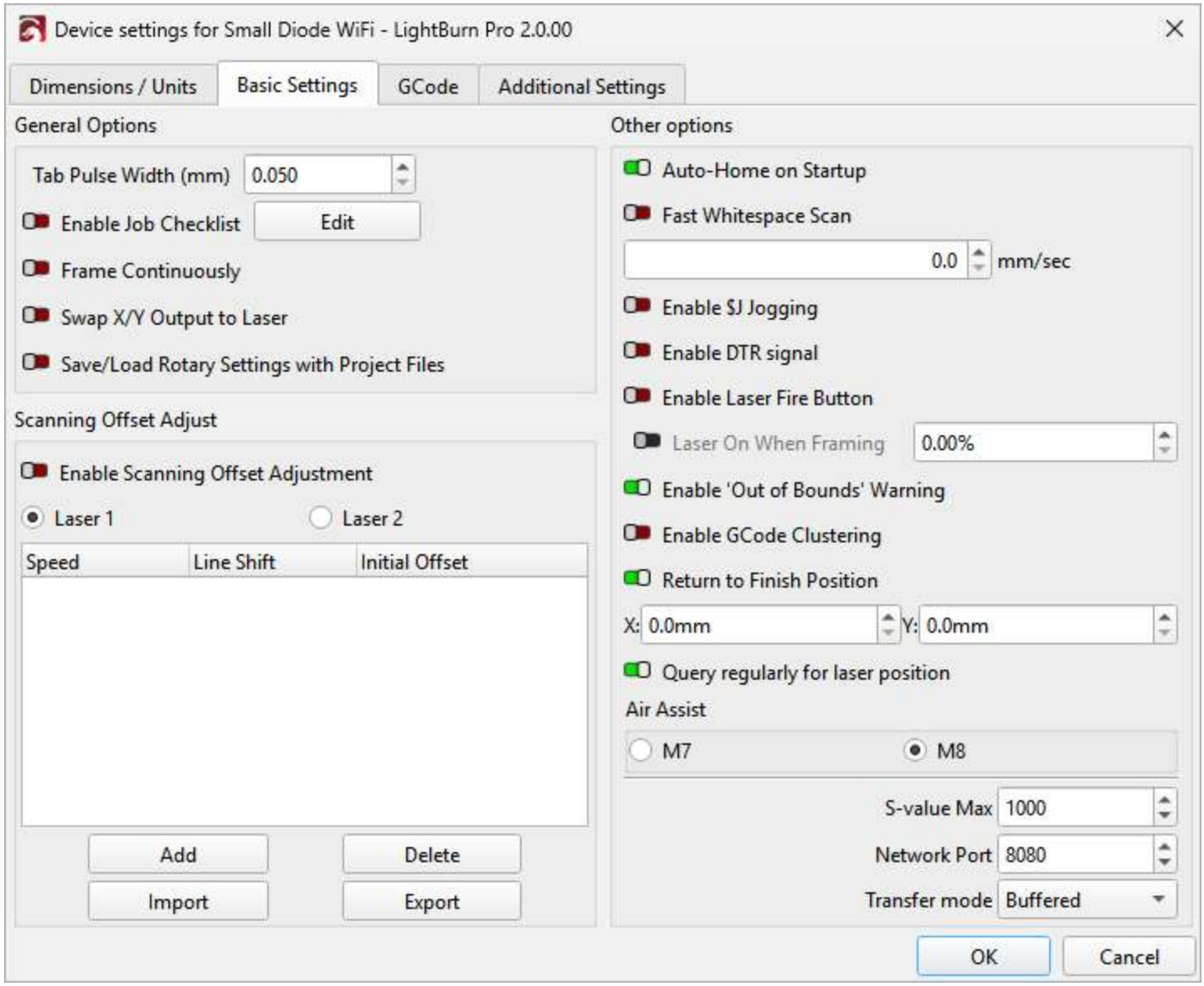


Figure 1:

The Basic Settings tab of Device Settings on a GCode laser

Dimensions / Units

Basic Settings

GCode

Per-device unit and dimension settings.

Additional Settings

Settings for simulating previews and estimating time.

The most commonly used device settings.

Custom GCode

Advanced GCode customization for the Custom GCode device type.

Modify GCode output for GCode Devices.

Galvo and Basic Settings

The most commonly used device settings for Galvo lasers.

Ports and Laser Settings

Configure a Galvo laser's ports and laser source.

General Options

Tab Pulse Width

When using Tabs, the **Tab Pulse Width** allows for additional control of the Tab Cut Power setting. Change this length to increase or decrease the width of the pulses used to simulate reduced power cuts.

Enable Job Checklist

When this setting is enabled, LightBurn will display a text box with a list of items whenever you **Start** or **Send** a job to your laser. This is typically used as a reminder of things that need to be done before starting the laser, such as turning on an exhaust fan or putting on protective glasses.

To create a custom checklist, click the **Edit** button.

Frame Continuously

This setting alters the behavior of the Frame button. When enabled, LightBurn will frame your project repeatedly until stopped, instead of a single time.

Continuous Framing is often useful for adjusting material placement within the laser.

Overwrite Files on Device by Default

When enabled, LightBurn will automatically overwrite pre-existing files of the same name when sending a project to your laser's controller. Keep this setting disabled to receive a warning message whenever LightBurn will need to overwrite a file in order to send a new one.

Save/Load Rotary Settings with Project Files

When enabled, LightBurn will include rotary settings when saving a project, and will load those settings when re-opening the file. This can streamline job setup when working with rotaries.

Scanning Offset Adjust

This setting is used to compensate for minor delays in your power supply causing the laser's firing point to be a little behind where it should be when scanning back and forth at high speeds. For more information, see Scanning Offset Adjustment. For an example of what Scanning Offset problems might look like, please see Troubleshooting: Blurry Edges.

The **Add**, **Delete**, **Import**, and **Export** buttons allow you to create, edit, load, and save your Scanning Offset settings. You can use this to Import settings provided by your machine's manufacturer, share adjustments with other users, or back up your settings before making changes.

Other Options

GCode Devices

These settings are only available for GCode-based lasers.

Auto-Home on Startup

If your laser has homing switches, enable this to automatically home the machine on startup. For lasers without homing switches, disable this setting to prevent GRBL Error 5.

Swap X/Y Output to Laser

Enable this setting to rotate your LightBurn Workspace to match your machine's physical orientation, and swap X/Y output to your laser accordingly.

The green dot in the dialog window indicates the location of the machine's 0,0 point (the location it homes to) in the machine's physical orientation. Select the image that matches your machine's orientation, then click **OK**. LightBurn will automatically adjust your Origin and rotate your Workspace and output to your machine to account for the new orientation.

This option is intended for machines with Y dimensions that are longer than their X dimensions.

Fast Whitespace Scan

This setting boosts your laser's travel speed through blank areas of an image engraving, if the speed you set here is faster than your laser's engraving speed.

This can save a lot of time if you're engraving an image slowly to get a good burn, particularly if there are large blank areas in the image.

> **Note**
>
> 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

Newer versions of GRBL (1.1 and later) can use this custom jogging mode. **$J Jogging**, also called **Continuous Jogging**, has several benefits over normal jogging:

- It does not affect the GCode parser state.
- If soft limits are enabled, jog commands that would go out of bounds are ignored without triggering an error or alarm.
- It allows for cancelling a jog move. After enabling Continuous Jogging in the Move Window, hold an arrow key to begin jogging in a direction, and release to stop (cancel) the move.

Enable DTR Signal

This setting controls whether LightBurn sends a **Data Terminal Ready** signal to the controller to start serial communication. Many programmable hobby-level controllers, including Arduino-based systems, use the DTR pin to reset the controller. LightBurn usually sets this value for you, but if your GCode controller won't communicate, toggling this setting may help.

Enable Laser Fire Button

Enable this setting to add a **Fire** button and power setting to the Move Window to allow you to turn on the laser at low power for focusing, Framing, and positioning. When the Fire button is enabled, you can hold the `⇧ Shift` key while Framing to enable the beam.

This setting should only be used for diode lasers, which generally don't have a red dot pointer for Framing. This should never be used for a CO_2 laser, which has an invisible beam that could blind you or start a fire.

Laser on When framing

This setting turns on the laser at the power level you specify while Framing.

> **Safety Warning**
>
> This changes the default behavior of the laser and can cause the laser to fire when a user is not expecting it. Enable this setting with caution, with a very low power level, and only when using a diode laser.

Enable 'Out of Bounds' Warning

Enable this setting to have LightBurn warn you if a job will cause your machine to travel out of bounds. This setting requires that your device has been properly homed and is reporting coordinates correctly, and that your Workspace size is set accurately in LightBurn.

Enable GCode Clustering

GCode Clustering condenses the commands sent to your device. For devices that support it, this reduces the bandwidth needed for communication and allows the controller's motion planner to see further ahead. For devices that don't support this feature, enabling it will result in a GRBL error. More information is available in this post in our forum.

Return to Finish Position

This setting tells LightBurn to send the laser to the specified position after a job is run. This requires that the job is running in **Absolute Coords** or **User Origin** mode.

Air Assist

This setting determines whether LightBurn uses an M7 or M8 command to enable air assist.

S-value Max

This setting tells LightBurn how to represent 100% power for GRBL and Smoothieware controllers. Current versions of GRBL default to **1000** for this, while older versions use **255**. This value needs to match what your controller expects. Read more in GRBL: Low or No Power Output.

Baud Rate

This setting controls the speed at which LightBurn attempts to communicate with your laser's controller.

LightBurn defaults to 115,200 baud for GRBL controllers and 250,000 baud for Marlin controllers. Some Marlin controllers use 115,200 baud, and some GRBL controllers go as low as 9600 baud. If you are having trouble communicating with your controller and are certain the controller and firmware are supported, contact the manufacturer for the correct baud rate for the board, which may be different from the default value.

Network Port

The network port a device uses to connect. The default value is 23, but some devices use a different port, such as 8080.

Transfer Mode

LightBurn defaults to the **Buffered Transfer mode** for communication with GRBL devices. This is faster and more reliable than the **Synchronous** Transfer mode. However, there are a few devices that are incompatible with Buffered Transfer mode. These devices will stutter, stop, or even restart when buffered communication is selected. If you notice this happening, try switching the Transfer mode to Synchronous.

Query Regularly for Laser Position

When enabled, LightBurn will regularly check the laser's current position and update it in the Move Window.

DSP Devices

These settings are only available for DSP lasers.

Start and End Delay

Start Delay allows you to set a delay before the job starts cutting, and **End Delay** allows you to delay the end of the job after the cut is complete. This is typically used to allow the exhaust fan to start up and spin down.

This feature is only available on Ruida controllers, and only works if the controller's wiring is compatible. Your success in enabling it will be dependent on your specific hardware.

Laser Is RF Tube

Enable this switch if your laser has an RF tube.

If your laser has a single tube, only the adjust the **Laser 1 is RF Tube** switch. If your laser has two tubes, you can enable this switch for either Laser 1 or Laser 2 individually, as appropriate.

This will disable an automatic warning message, intended for CO_2 lasers, which is sent when you start a job which uses an RF tube and includes a layer whose Min Power is set to zero.

Enable Laser 2 Controls

This setting enables controls for a second laser tube within the same machine. Enable this setting only if your machine has two laser tubes.

ONLY ALLOW ONE LASER AT A TIME

Enable this switch to automatically disable the alternate tube when you enable Laser 1 or Laser 2.

In other words, when you enable Laser 1, LightBurn will automatically disable Laser 2, and vice versa.

Enable Laser 2 Offset

If you are using a dual head laser, use this setting to specify the position of the second laser head relative to the main one.

See Dual Laser Control for more information on dual laser setup.

Increment Filename on Send

This option will automatically increment file names when sending jobs to your laser, to make identifying separate runs easier and maintain your file history. Your file name must contain a digit in order to auto-increment.

Disable Start Button

Use this setting to disable the **Start** button.

On some lasers, streaming a job with the **Start** button can be unreliable, so this feature allows you to ensure that all jobs are sent to the laser using the **Send** button, which transfers the entire job to the laser before it can be started.

Check Bounds When Framing

Enable this setting to have LightBurn check that a job won't travel out of bounds when Framing.

Network Timeout

This setting determines how long LightBurn will attempt to communicate with a networked device before reporting a communication failure. Increasing the value from the default of 5000 ms (5 seconds) can help with slower connections.

IP Address/Hostname

The IP address or hostname to use when connecting to a networked device. This value is set when adding a device, and can be viewed or edited here.

Troubleshooting

- If you aren't seeing a setting you expected to see, check which tab you're in and make sure it's applicable to your laser.

Related Topics

- Settings/Preferences
- Machine Settings
- Devices

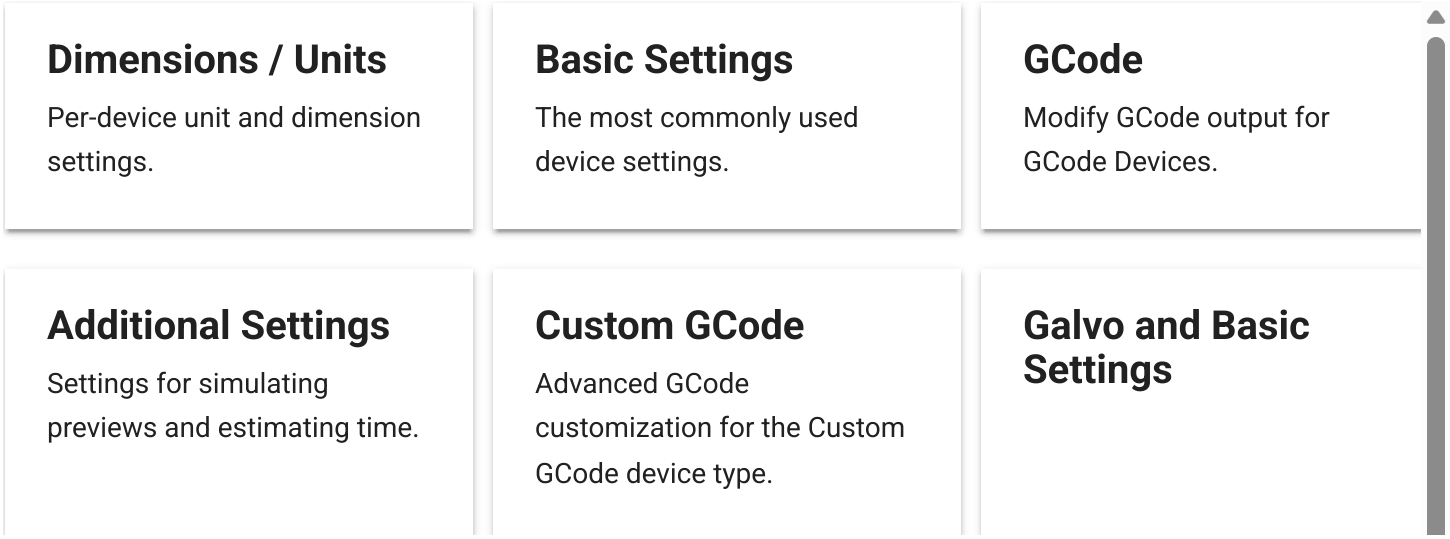
device-settings preview speed acceleration accuracy

5.5.5.1.3 Additional Settings

The **Additional Settings** tab of **Device Settings** controls the settings used in Preview for simulating a preview and estimating time. Changing these settings will not change anything about how the job actually runs, but can make time estimates more accurate.

Figure 1:

The Additional Settings tab of Device Settings



The most commonly used device settings for Galvo lasers.

Ports and Laser Settings

Configure a Galvo laser's ports and laser source.

Read From Controller

Use the **Read From Controller** button to sync these settings with your laser's internal settings, providing much more accurate time estimates without manual adjustment.

Manual Adjustment

Note

Y Axis Speed and Acceleration values are often set lower than X. Due to the greater mass of the Y Axis gantry, many lasers must travel slower in the Y dimension to avoid slipping.

Setting	Description
Maximum Speed X/Y	The maximum speed at which the laser can travel on the X and Y axes, individually.
Cut Acceleration X/Y	The maximum rate at which the laser can speed up or slow down during Line operations.
Engrave Acceleration X/Y	The maximum rate at which the laser can speed up or slow down during Fill operations.
Corner Accuracy	A value used to estimate cornering speed. Corner Accuracy is not read from the controller. Read more about how this value works for lasers with GRBL controllers here.

Setting	Description
Minimum Corner Speed	The slowest possible speed the laser will turn corners at.
Cut Speed Scale	Scales cut speed estimates by this percentage when simulating job times. Not read from controller. Use this value to manually fine-tune estimates.
Global Speed Scale	Scales all estimates by this percentage when simulating job times. Not read from controller. Use this value to manually fine-tune estimates.

Troubleshooting

- If you aren't seeing a setting you expect to see, check which tab you're in and make sure it's applicable to your laser.

Related Topics

- Settings/Preferences
- Machine Settings
- Devices

device-settings device-management settings GCode

5.5.5.1.4 GCode

The **GCode** tab of **Device Settings** allows for modification of the GCode output for GCode devices. Please see Device Settings: Custom GCode if you are using a Custom GCode device.

Click an option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.

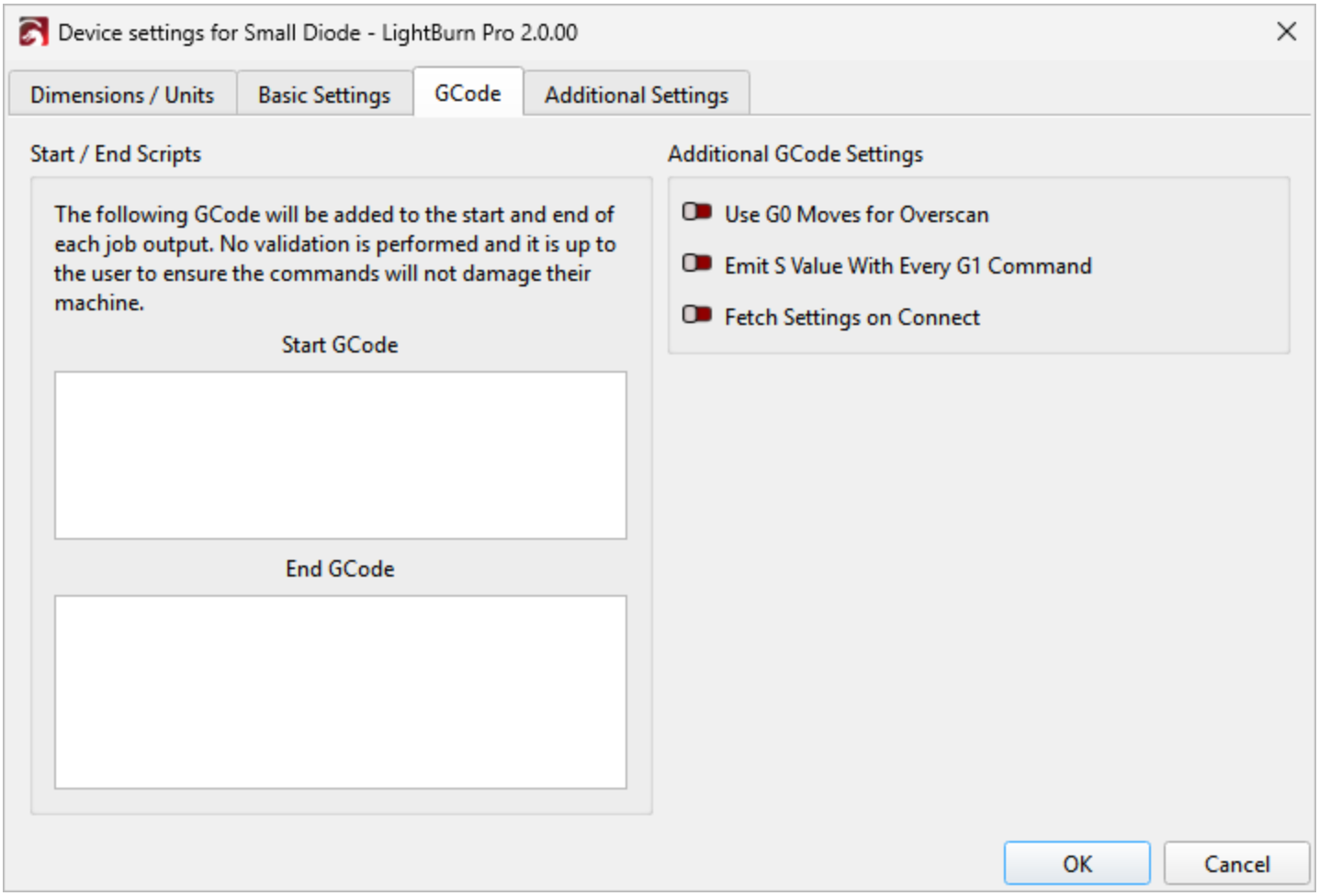


Figure 1:

The GCode tab of Device Settings

Dimensions / Units

Basic Settings

GCode

Per-device unit and dimension settings.

The most commonly used device settings.

Modify GCode output for GCode Devices.

Additional Settings

Settings for simulating previews and estimating time.

Custom GCode

Advanced GCode customization for the Custom GCode device type.

Galvo and Basic Settings

The most commonly used device settings for Galvo lasers.

Ports and Laser Settings

Configure a Galvo laser's ports and laser source.

Start / End Scripts

Some devices may need additional commands before or after running a job. GCode entered into these boxes will be added to the start or end of each job LightBurn sends to your device.

> **Warning**
>
> LightBurn does not validate whether these commands are valid or safe. Any modifications here are done at your own risk.

Use G0 Moves for Overscan

Enable this setting to use G0 moves for overscan instead of G1. Some controllers, such as FabCreator Smoothieware boards, have a non-zero power value for their minimum output, causing them to burn during the overscan portion of an engraving. If you find that your laser doesn't shut off completely for overscan moves, try enabling this setting.

Emit S Value With Every G1 Command

Enable this setting to have LightBurn specify the output power of the laser with every move command, rather than only when the power level changes. Enable this setting if your laser does not turn back on after travel moves.

Fetch Settings on Connect

Enable this setting to have LightBurn read your laser's firmware settings from the controller each time it connects.

Troubleshooting

- If you aren't seeing a setting you expected to see, check which tab you're in and make sure it's applicable to your laser.

Related Topics

- Settings/Preferences
- Machine Settings
- Devices

device-settings settings device-management GCode

5.5.5.1.5 Custom GCode

The **Custom GCode** tab of **Device Settings** allows for advanced GCode customization when using the Custom GCode device type.

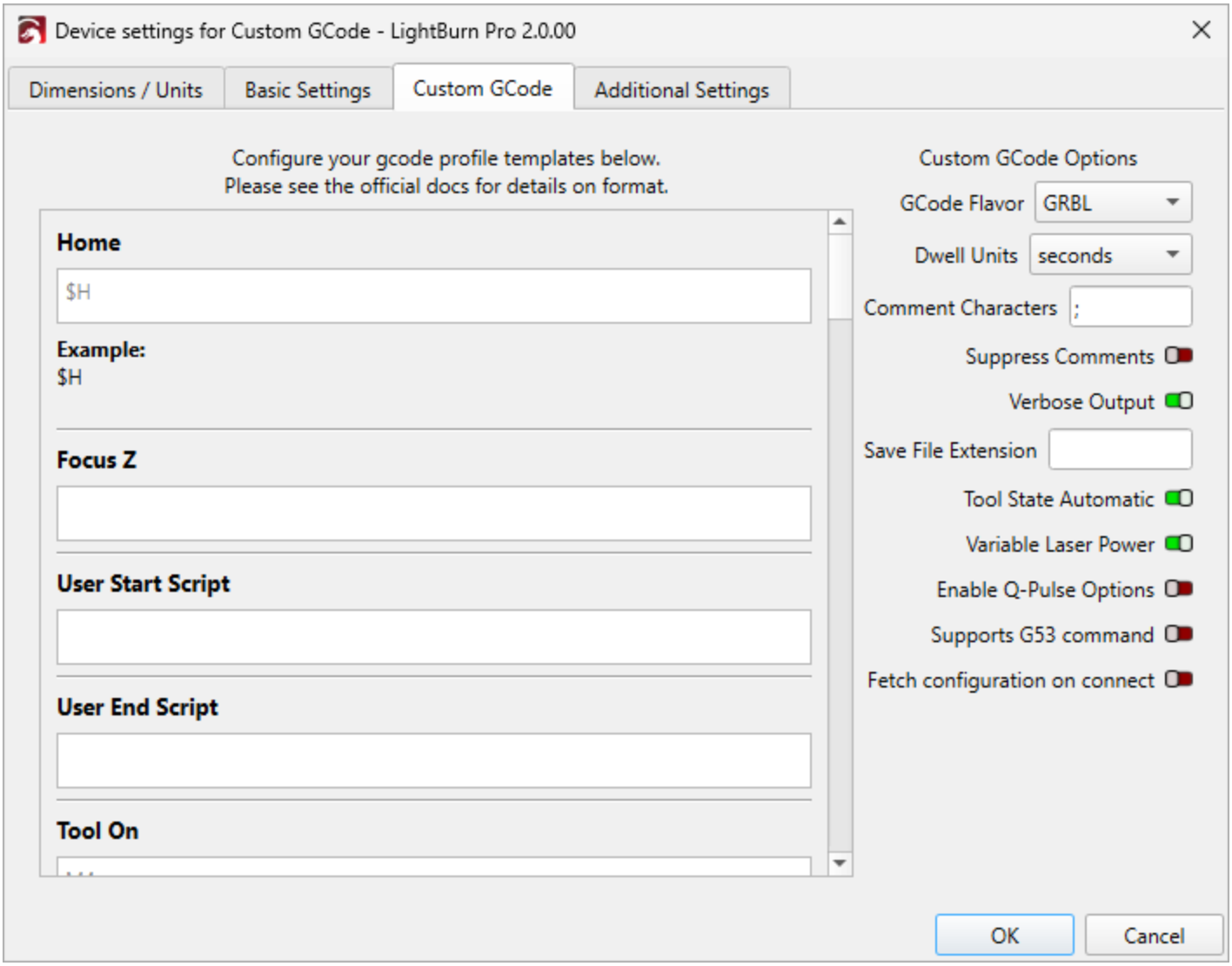


Figure 1:

The Custom GCode tab of Device Settings

Dimensions / Units

Basic Settings

GCode

Per-device unit and dimension settings.

The most commonly used device settings.

Modify GCode output for GCode Devices.

Additional Settings

Settings for simulating previews and estimating time.

Custom GCode

Advanced GCode customization for the Custom GCode device type.

Galvo and Basic Settings

The most commonly used device settings for Galvo lasers.

Ports and Laser Settings

Configure a Galvo laser's ports and laser source.

Custom GCode Options

In this section, you can set some baseline options for your custom GCode profile.

Name	Description
GCode Flavor	What flavor of GCode to use as a base
Dwell Units	Whether pause times are given in seconds or milliseconds
Comment Characters	What character(s) are used to indicate comments
Suppress Comments	Enabling this will strip all comments from the GCode LightBurn generates
Verbose Output	Enabling this output will include additional detail in the generated GCode that can help with debugging
Save to Single File	Enabling this will cause LightBurn to always export GCode as a single file, rather than showing the export file dialog box

Name	Description
Save File Extension	Specify the file extension to be used, if you need something other than the default of `.gc`
Tool State Automatic	Enabling this will cause the tool to automatically turn on during a cut move
Variable Laser Power	Enabling this will allow you to control the laser's power beyond on and off
Enable Q-Pulse Options	Enabling this will allow you to control Q-Pulse settings. Only relevant with fiber laser sources
Supports G53 Command	Specify whether or not the device supports the G53 command. Disable for WeCreat devices
Fetch configuration on connect	Specify whether or not to fetch the device's configuration on connection. Disable for WeCreat devices

GCode Commands

This section lists each command that can be customized. Leaving a command blank will leave it unchanged from the default based on your Custom GCode Options.

- The title indicates what command you're working with.
- The text box contains the default value in gray text, if there is a default. If there is no default value, the text box is blank.
- Below the text box is a preview of what the output for the command would look like, based on current settings.

Hover over a section for more detailed information. For information on variables to use in the commands, see Custom GCode Variables.

Custom GCode Variables

These variables can be used in your GCode templates. Some variables are only available for MillMage.

Variable	Description	Availability
`x`	X Axis position	

Variable	Description	Availability
`y`	Y Axis position	
`z`	Z Axis position	
`r`, `a`, `u`, `rot`, `rotation`	Rotary axis position	
`x_probe`	X probe offset	MillMage-only
`y_probe`	Y probe offset	MillMage-only
`z_probe`	Z probe offset	MillMage-only
`s`, `speed`	Movement speed	
`feed`, `feedrate`	Movement speed	MillMage-only
`p`, `power`	Laser Power	
`rpms`, `spindlespeed`	Spindle speed or RPM/s	MillMage-only
`dwell`	Dwell time	
`tool`	Tool number	

Custom GCode Macros

Relative and absolute mode are controlled by the software, so if you need to change it within your GCode template, use the following macros to prevent the software overriding your changes. You must always use `|RESTORE|` when you're done to ensure a return to the previous mode.

Macro	Description
`|REL|`	Enter relative mode
`|ABS|`	Enter absolute mode

Macro	Description
`|RESTORE|`	Restore previous mode

Optional and Required Values

Surrounding the letter before a variable with `[]` will tell LightBurn that this portion of the command has not changed since the last emit. Putting a `*` in front of any variable will tell LightBurn to skip the entire line if it has not been changed.

- `G1 X{x} Y{y} Z{z}` will *always* output the X, Y, and Z values.
- `G1 [X]{x} [Y]{y} [Z]{z}` will skip any values that have not changed.
- `M106 S{*power}` this will output the `M106` command only if it has been changed.

Reserved / Prohibited Characters

Certain characters — `[]`, `<>`, and `{}` — are reserved for use by LightBurn and MillMage and are only permitted as shown above in Optional and Required Values. As of LightBurn 2.0, there is no way to escape these characters for other purposes.

Non-Printable / Non-Typeable Characters

Control characters can be output by using `\x` followed by the two digit hex value of the character. For instance, `\x18` represents an immediate job abort on a GRBL device.

Troubleshooting

- If you aren't seeing a setting you expected to see, check which tab you're in and make sure it's applicable to your laser.

Related Topics

- Settings/Preferences
- Machine Settings
- Devices

device-settings device-management devices settings galvo

5.5.5.1.6 Galvo and Basic Settings

The **Galvo and Basic Settings** tab of **Device Settings** is the Galvo laser version of Basic Settings and contains the most commonly used settings for Galvo lasers.

> **Info**
>
> If you used the EZCAD importer when setting up your Galvo laser, these settings will be pre-configured for you.

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.

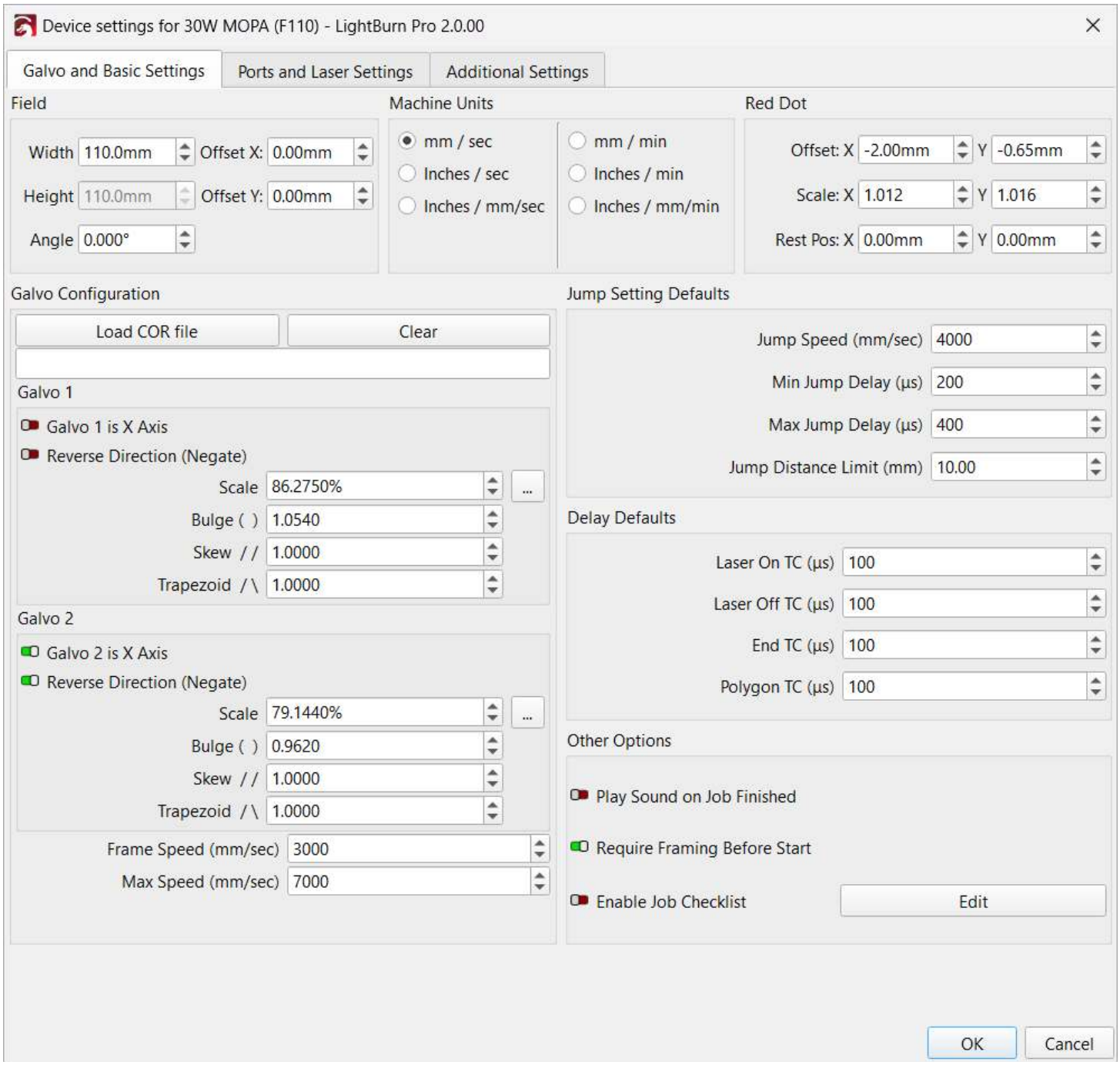


Figure 1:

The Galvo and Basic Settings tab of Device Settings

Dimensions / Units

Basic Settings

GCode

Per-device unit and dimension settings.

The most commonly used device settings.

Modify GCode output for GCode Devices.

Additional Settings

Settings for simulating previews and estimating time.

Custom GCode

Advanced GCode customization for the Custom GCode device type.

Galvo and Basic Settings

The most commonly used device settings for Galvo lasers.

Ports and Laser Settings

Configure a Galvo laser's ports and laser source.

Field

These settings refer to the field — the area that the lens installed in a Galvo laser can physically cover when focused. Changing lenses requires going through setup and calibration again, and we recommend setting up additional devices for each lens you use with your Galvo laser.

Setting	Description
Width/Height	The size of the field for the currently installed lens. Sets the size of the Workspace in LightBurn.
Offset X/Y	Fine-tune the position of the field by offsetting it if needed.
Angle	Rotational correction. Use this to compensate for the Galvo head being rotated relative to the physical fixturing of your work.

Machine Units

This section controls the units that LightBurn will use for the size of your machine's work area and for the speed when cutting and engraving. The options are grouped based on device type they're recommended for. If you prefer to design in inches but use metric units for speed, choose **Inches / mm/sec** for CO_2 and Galvo lasers or **Inches / mm/min** for diode lasers.

Red Dot

The red dot laser is separate from the marking laser and is used for framing and positioning. It fires through the same optics as the marking laser, but may require fine-tuning for alignment. For additional help, see our video on Galvo Laser Red Dot Alignment below.

Setting	Description
Offset X/Y	Fine-tune the position of the framing output.
Scale X/Y	Fine-tune the size of the framing output.
Rest Pos X/Y	Set the resting position of the red dot when not in use.

Galvo Configuration

Load COR File

This section allows you to import and apply EZCAD lens correction files, also known as COR files.

- If your EZCAD folder contains a COR file, it will automatically load when using the EZCAD importer during Setup.
- If you skipped the importer, or you create a new COR file, you can load it here.
- If you don't have a COR file, you can enter lens correction settings manually in the Per Galvo Settings below.

Per Galvo Settings (Galvo 1/Galvo 2)

Each Galvo head is responsible for an axis and can be fine-tuned individually.

Setting	Description
Galvo # is X Axis	Specifies which axis is responsible for horizontal motion. If your output is rotated 90 degrees, switch which Galvo is toggled on.
Reverse Direction (Negate)	Reverses the direction for the selected Galvo. If output to an axis is mirrored or inverted, toggle this setting.
Scale	Percentage by which to scale output for a given axis.
Bulge	Adjusts for distortion near the center of the engraving field.
Skew	Adjusts for distortion near the edges of the field.
Trapezoid	Adjusts corner tapering to fix keystoning.

Frame Speed

The travel speed for the red dot laser while framing.

Max Speed

The maximum travel speed for the laser during cuts.

Jump Setting Defaults

Jump Settings control how the laser moves between cuts. Each jump causes the mirror to shake, with higher speeds and longer distances increasing the shaking. If you have wobbly lines at the start of a marking move, you may need to increase the delay and/or reduce the speed of jumps.

Setting	Description
Jump Speed	The speed at which the galvo mirrors move between cuts. Higher values will make your job run faster at the cost of increased vibration for the mirrors.
Min Jump Delay	The minimum time the laser will wait to allow the galvo mirrors to stop shaking.
Max Jump Delay	The maximum time the laser will wait to allow the galvo mirrors to stop shaking.
Jump Distance Limit	Any jump above this limit will use the **Max Jump Delay** setting above. Jumps below this limit will use a delay value between the minimum and maximum settings.

Delay Defaults

Delay settings control the delay between starting (or stopping) mirror movement and firing the laser. **Laser On/Off TC** and **End TC** control the delays for the start and end points of a path. **Polygon TC** controls the delays for other corners within a path.

Setting	Description
Laser On TC	Microseconds the laser will wait to fire after the mirrors begin to move. Too high a value will leave gaps, while too low a value may cause excessive burning at the start of a cut.
Laser Off TC	Microseconds to delay turning off the laser at the end of a marking move. Too high a value may cause excessive burning at the end of a cut, while too low a value may cause gaps.
End TC	Microseconds to pause the laser's movement after completing a cut.
Polygon TC	Microseconds the galvo head will pause when turning corners. Too long a delay may cause excessive burning, while too short a delay can cause rounded or cut-off corners.

Other Options

Setting	Description
Play Sound on Job Finished	If enabled, the computer will play a sound when your current run is complete.
Require Framing Before Start	If enabled, the **Start Button** in the Laser Window will open the Live Framing window instead of starting the laser directly.
Enable Job Checklist	If enabled, LightBurn will display a window with user-configured text before running the laser. The user will need to press **OK** to confirm they're ready before the laser will start. This is often used for a checklist of reminders before running the laser. Use the **Edit** button to create or edit the checklist.
Save/Load Rotary Settings with Project Files	If enabled, LightBurn will include rotary settings when saving a project, and will load those settings when re-opening the file. This can streamline job setup when working with rotaries.

Troubleshooting

- If you aren't seeing a setting you expected to see, check which tab you're in and make sure it's applicable to your laser.

Related Topics

- Settings/Preferences
- Devices
- Galvo Lens Calibration

device-settings galvo

5.5.5.1.7 Ports and Laser Settings

The **Ports and Laser Settings** tab of Device Settings allows you to configure your laser's Input and Output (IO) ports and laser source.

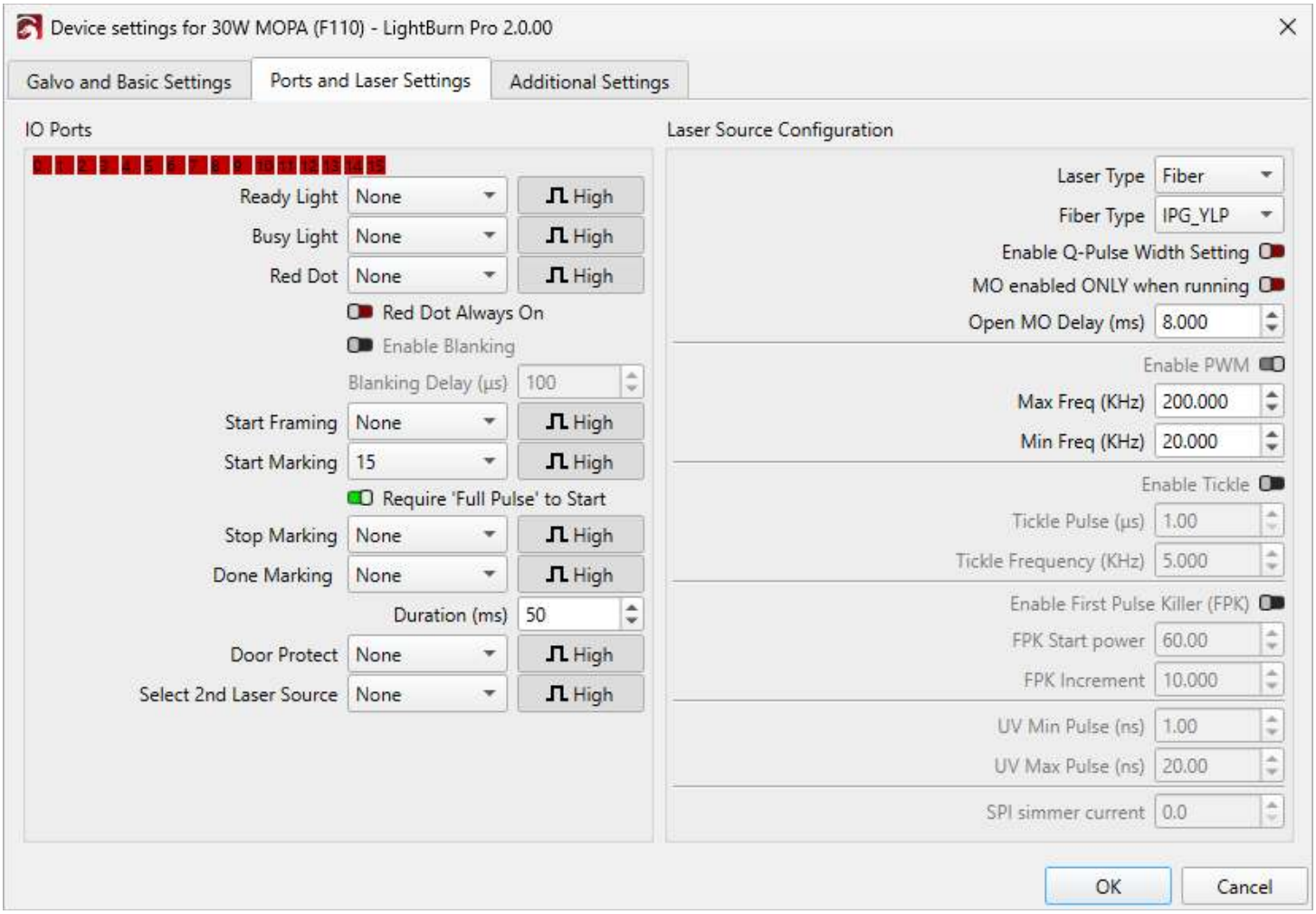


Figure 1:

The Ports and Laser Settings tab of Device Settings

Dimensions / Units

Per-device unit and dimension settings.

Basic Settings

The most commonly used device settings.

GCode

Modify GCode output for GCode Devices.

Additional Settings

Settings for simulating previews and estimating time.

Custom GCode

Advanced GCode customization for the Custom GCode device type.

Galvo and Basic Settings

The most commonly used device settings for Galvo lasers.

Ports and Laser Settings

Configure a Galvo laser's ports and laser source.

IO Ports

This section controls external switches or features attached to the laser's control board.

Low vs High

Most boards use a *High* signal to indicate that a port is active, but some instead use a *Low* signal as the trigger. If most or all of your ports are green by default, you'll probably need to change the trigger type to *Low* using the button next to the port selection.

The numbered boxes at the top show the current state of each port. Red indicates that the port is currently *Low* (off), while green indicates that the port is currently *High* (on).

Use the dropdowns to select a port to assign to a feature, and use the **High**/**Low** button to set the trigger type. If the port is set to **None**, the feature is disabled or unavailable.

Setting	Description
Ready Light	Select the appropriate port to enable on/off control of LEDs mounted on the galvo head to illuminate your work.
Busy Light	If you have a light hooked up to indicate the laser is in use, select the appropriate port to allow LightBurn to enable it when the laser is in use.

Setting	Description
Red Dot	If you are using an external switch to enable the red dot laser, select the appropriate port.
Red Dot Always On	Enable this setting to force the red dot laser to be always on.
Enable Blanking	If enabled, attempts to turn off the red dot laser between drawing shapes. Not supported on all devices. Disable if your laser will not frame when you select Contour Framing.
Start Framing	Select the appropriate port to enable an external switch to start framing.
Start Marking	Select the appropriate port to enable an external switch – typically a foot switch – to start an engraving job. If not using a foot switch, it's best to set this to **None** to prevent accidental firing as a result of static or electrical noise.
Require 'Full Pulse' to Start	Enable this toggle to require the external switch to activate and be released before starting a job.
Stop Marking	Select the appropriate port to use an external switch to stop running an engraving job.
Done Marking	Select the appropriate port to send a signal when an engraving job is complete.
Door Protect	Select the appropriate port to look for a signal from an enclosure's safety interlock to prevent unprotected laser firing.

Laser Source Configuration

Warning

Laser Source settings should be imported from EZCAD or copied *very* carefully if entering manually. Incorrect settings may damage your laser.

Setting	Description
Laser Type	The source for the Galvo laser. Currently **CO_2**, **Fiber**, **UV**, or **SPI**.

Setting	Description
Fiber Type	For **Fiber** lasers, the specific manufacturer or type of Fiber laser. Certain options enable additional settings.
Enable Q-Pulse Width Setting	MOPA **Fiber** lasers only. Allows fine adjustment of the laser's pulse timing in Cut Settings. Smaller timing values increase the density of the pulse's impact.
MO Enabled ONLY When Running	MOPA fiber lasers only.
Open MO Delay	MOPA fiber lasers only. Allows fine control of the laser's frequency.
Enable PWM	Always enabled for Fiber and SPI lasers. Toggle on or off for CO_2 Galvo lasers, to enable or disable PWM. When enabled, adjust the valid range of minimum and maximum frequencies in the boxes below.
Enable Tickle	For CO_2 Galvo lasers only. CO_2 lasers require constant low power to fire consistently at low powers. Enable **Tickle** to provide this constant low power. Appropriate settings for Tickle Pulse and Frequency should be provided by your manufacturer.
Enable First Pulse Killer (FPK)	For CO_2 Galvo lasers only. CO_2 lasers require a higher power draw when initially turned on. FPK settings allow you to tune that initial pulse. Check with your manufacturer for settings, but this can be found through trial and error if needed.
UV Min/Max Pulse	For UV Galvo lasers only. Minimum and maximum **Q-pulse** values to use.
SPI Simmer Current	For SPI lasers only.

Troubleshooting

- If you aren't seeing a setting you expected to see, check which tab you're in and make sure it's applicable to your laser.

Related Topics

- Settings/Preferences

- Devices

device-settings settings basic-settings additional-settings working size origin laser-offset z-control u-axis delay dual-laser scanning-offset offset

5.5.5.1.8 Device Settings

The **Device Settings** window contains device-specific settings for your laser. The settings available change based on the device selected — not all settings described below will necessarily be shown in your instance of LightBurn.

Access Device Settings by selecting Edit → **Device Settings** or by clicking in the Main Toolbar.

Have Multiple Lasers?

Select the correct device in the Devices dropdown in the Laser Window.

Device Settings Window

Figure 1:

The Device Settings window

The **Device Settings** window is split into several tabs, not all of which will be available for all machines.

Dimensions / Units

Per-device unit and dimension settings.

Basic Settings

The most commonly used device settings.

GCode

Modify GCode output for GCode Devices.

Additional Settings

Settings for simulating previews and estimating time.

Custom GCode

Advanced GCode customization for the Custom GCode device type.

Galvo and Basic Settings

The most commonly used device settings for Galvo lasers.

Ports and Laser Settings

Configure a Galvo laser's ports and laser source.

Troubleshooting

- If you aren't seeing a setting you expected to see, check which tab you're in and make sure it's applicable to your laser.

Related Topics

- Settings/Preferences
- Machine Settings
- Devices

laser-control machine-management laser-window find-my-laser create-manually LightBurn-Bridge

5.5.5.2 Devices

The **Devices** window shows all the devices you've added to LightBurn. Use this window to add new devices, **Import** and **Export** devices, and manage existing devices.

Accessing the Devices Window

To open the **Devices** window, click the Devices button in the Laser Window.

Managing Devices

Device List

The main section of the **Devices** window lists all the devices you've added to LightBurn. Click a machine to select it and see a device summary below the Device List. Some buttons in this window are only available with a device selected.

On a fresh install, this list will be empty. LightBurn will ask you to set up a device in order to continue. There are a few ways to do this:

- Use Find My Laser to attempt to automatically detect a laser connected over USB.
- Use Create Manually to manually set up a laser that can't be automatically detected.
- Import a `.lbdev` file to load a pre-configured machine profile.

You must add at least one device in order to use LightBurn. If you don't have a laser yet, you can choose **Create Manually** and select **No Machine** to create a device to act as a placeholder.

Find My Laser

Starts the Device Discovery Wizard to attempt to automatically detect a laser connected over USB. If your laser is not detected, use Create Manually.

Create Manually

Starts the New Device Wizard to manually set up a laser. If you don't have a laser yet, a **No Machine** option is available.

LightBurn Bridge

Starts the Bridge Discovery Wizard to set up a LightBurn Bridge device.

Import

Imports a `.lbdev` file to recreate a device you've exported from another LightBurn installation. See Migration for more information.

Make Default

Sets the currently selected device as the default. If you have multiple devices, use this to set which device is active when LightBurn launches. The current default device has an asterisk before the name.

Edit

Opens the New Device Wizard to go back through the device creation process on the selected laser. You can also double-click any device in the list to re-open the New Device Wizard for that device.

See Device Settings for help with settings not covered in the device creation process.

Remove

Removes the selected laser from LightBurn. Make sure you have the right device selected!

Export

Exports a `.lbdev` file for the selected device. Use this to back up a device or recreate the device on a different computer. See Migration for more information.

Devices Context Menu

Right-click any device in the list to open a context menu with additional options.

Duplicate

Opens the **New Device Wizard** and populates each step with identical settings from the selected device, with the exception of appending **(Duplicate)** to the name. You can adjust any setting, including the name, during this process.

Set Icon

Opens your system's file browser, where you can select a custom icon for the selected device from your computer. The icon must be 1024 x 1024 pixels or fewer in size.

Order by Name

Rearranges the list of devices in alphabetical order.

Order by Type

Rearranges the list of devices by type. Sections of types are arranged in alphabetical order.

OK and Cancel

Click **OK** to save any changes you've made and exit the **Devices** window.

Click **Cancel** or X-out of the window to discard any changes you don't want to save.

Troubleshooting

- If the button you want is disabled, make sure you have a device selected.
- If you haven't added any lasers yet and try to close the window, LightBurn will open a window asking you to either go back and create a device profile, create a dummy machine, or quit LightBurn. Use the **Create a dummy machine** button if you don't have a laser to add yet.

Related Topics

- Migration
- Device Settings
- Add a Laser

firmware settings machine-settings machine-management troubleshooting

5.5.5.3 Machine Settings

The **Machine Settings** window allows you to view and edit firmware settings on lasers with Ruida, TopWisdom, or GRBL-based controllers.

To open the Machine Settings window, go to Edit → **Machine Settings**.

Figure 1: Left: The Machine Settings window for a GRBL controller.

Right: The Machine Settings window for a DSP controller.

Working With Machine Settings

The settings available are determined by your laser controller's firmware. In general, if your laser is working correctly, you can (and should) leave the settings here alone. For additional information on specific settings, consult your laser's manufacturer, or see the documentation for your laser's controller.

Outputs Setup / Vendor Settings

This section will display differently depending on whether you are connected to a DSP or GRBL laser. All settings in this section are hidden by default, and you'll see a warning message if you click to expand and view them. These settings are typically set by the manufacturer, and should generally be left alone unless instructed otherwise by support.

Save to File

Saves your current controller firmware settings to a `.lbset` file. We strongly recommend using this feature to back up firmware settings before making any modifications.

Load from File

Loads a `.lbset` file and overwrites *all* firmware settings with its contents. In some cases, your laser manufacturer may make this file available as a backup.

> **Warning**
>
> This will overwrite *all* values. Make sure you back up your existing settings first using the Save button, and only load parameters from a known and trusted source.

Load From Backup

Use **Load from Backup** to restore automatically-generated backups of firmware settings. LightBurn will automatically store backups each time you Write new settings to your controller.

Read

Reload the settings from the controller. Any changes that haven't been written to the controller will be lost.

Write

Writes all currently modified settings back to the controller, saving your changes. Changes are *not* saved unless you click **Write**.

Calibrate Axis

The **Calibrate Axis** tool is a shortcut to help you calculate the **Steps/mm** or **Step Length** value for each axis, if they need adjustment — if the current values are inaccurate, output may be stretched or squished.

See Explainer: Steps/MM for more information.

To use Calibrate Axis:

1. Choose an axis to calibrate in **Calibration Axis**.
2. Enter a distance to travel in **Requested Distance**. Larger distances can be helpful when measuring with less precise tools.
3. Mark the start point, move the laser the specified distance, and mark the end point. The easiest way is to burn a line the specified length, although you can also use the Jog functions in the Move Window or built into some controllers.
4. Measure the actual distance traveled and enter it into **Actual Distance**.
5. Click on **Write** to save the value to the controller.

This may need to be done multiple times, especially for less precise measuring tools, to reach an acceptable level of accuracy.

Troubleshooting

- If LightBurn is unable to read the **Machine Settings**, make sure your laser is connected and turned on.
- See Troubleshooting: Connection Issues for help connecting to your laser.

Related Topics

- Device Settings
- Console Window

laser-control machine-management device-management troubleshooting devices

5.5.5.4 Get Controller Info

The **Controller Status Info** window provides information about your connected laser's controller. It primarily shows usage statistics, but also contains information about the controller's firmware version.

To view Controller Info, go to Edit → **Get Controller Info**.

> **Note**
>
> Get Controller Info is only available for lasers with Ruida controllers.

Controller Status Info

Name	Description
Total 'on' time	Total time the laser has been on for.
Total job processing time	The total time the laser has spent processing jobs sent to it.
Previous job processing time	The time the laser spent processing the most recent job sent to it.
Total job 'laser on' time	The total time the laser has spent running jobs.
Total job count	The total number of jobs run on the laser.
X Total travel	The total horizontal distance traveled in meters.
Y Total travel	The total vertical distance traveled in meters.
Mainboard firmware version	The firmware version installed on the laser controller.

Troubleshooting

- If LightBurn is unable to open the **Controller Status Info** window, make sure the laser is connected and turned on.
- See Troubleshooting: Connection Issues for help connecting to your laser.

Related Topics

- Device Settings
- Machine Settings
- Devices

control firmware communication GCode UI GRBL console commands error-messages change-settings macros

5.5.5.5 Console Window

The **Console Window** displays messages from your laser's controller and commands sent to it by LightBurn. You can also input direct commands to your laser through this window.

The Console Window functions are only available when LightBurn is directly connected to a GCode-based laser.

> **Note**
>
> Users with DSP or Galvo lasers with Ruida, TopWisdom, Trocen, EZCAD2 or BSL boards cannot use the Console Window to communicate with their laser's controllers.

Accessing the Console Window

If you have a GCode-based device profile selected, the **Console Window** will be located in the upper right side of LightBurn, docked behind the Cuts / Layers Window, by default.

If you have closed the Console Window, go to Window → **Console** to re-enable it. To restore it and all other windows to their default positions, go to **Window** → Reset to Default Layout.

> **Tip**
>
> The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Startup Message

When you first connect to your laser you will see a response message in the **Console Window**, indicating that LightBurn is successfully communicating with the controller.

The startup response message displays the type and specific version of firmware your laser's controller is running. Most GCode-based lasers run GRBL firmware, version 1.1f or later.

If you do not see a similar message from the controller when you start up and attempt to connect to your laser, see Troubleshooting: Connection Problems.

Error Messages

The **Console Window** will sometimes display alarm or error messages sent to LightBurn by the laser's controller, indicating that there was a problem with the machine's operation.

See Troubleshooting: GRBL Errors to find solutions to common alarms and errors.

Common GRBL Commands

Use the text box in the **Console Window** to directly enter commands to your laser's controller. These commands are only valid for lasers running GRBL firmware.

Request Information

Use the following commands to prompt your laser to return information on its settings or status.

- `$I` : display the controller's firmware version.
- `$$` : display GRBL settings. See the official GRBL documentation for more information on each setting.
- `$#` : display stored offsets in the machine's coordinate systems.
- `?` : display status and current position.

Alter Settings and Status

Use the following commands to adjust firmware settings or change machine status.

- `$X` : unlock machine if it has been locked due to an alarm or error.
- `$[setting]=[value]` : adjust a specific GRBL setting by entering `$` , followed by the number of the setting to be adjusted, `=` , and the new value to assign to the setting.
  - Example command: `$110=6000`
- `RST=#` : reset all offsets stored in the machine's coordinate systems.
- `RST=$` : restore all GRBL settings to "factory" default.

- `RST=*`: reset all EEPROM data used by GRBL, including all offsets stored in the machine's coordinate systems and GRBL settings.

> **Warning**
>
> Do not reset these settings unless directed by to do so by your machine's manufacturer, or LightBurn support.
>
> In most cases, resetting GRBL settings restores all values to those set by your machine's manufacturer, but can sometimes restore them to stock GRBL settings, which will necessitate significant reconfiguration in order to operate your laser.

Show All

Enable the **Show All** switch to display all communications between LightBurn and your controller. When Show All is disabled, the **Console Window** will display startup messages, simple commands, alarm or error messages, and all responses to status queries, but hide extensive commands such as those used to jog or fire your laser.

Macros

> **Where did the macro buttons go?**
>
> Prior to LightBurn 2.0, LightBurn had 6 slots available for macros. LightBurn 2.0 has a new interface for creating any number of macro buttons you want, which can be found in the Macros Window.

LightBurn allows the creation of **Macro** buttons to store and access frequently used commands instead of typing them into the **Console Window** manually each time. For more information, please see our page on the Macros Window.

Related Topics

- Identify Your Laser
- Troubleshooting: Connection Problems
- Troubleshooting: GRBL Errors
- Macros Window

control communication GCode UI GRBL console macros customization

5.5.5.6 Macros Window

The **Macros Window** allows you to create buttons to store frequently used commands for GCode-based lasers. These functions will only work when LightBurn is directly connected to a GCode-based laser.

Click on macro buttons in the Macros Window to use them.

Accessing the Macros Window

If you have a GCode-based device profile selected, the **Macros Window** will be located in the upper right side of LightBurn, docked behind the Cuts / Layers Window by default.

If you have closed the Macros Window, go to Window → **Macros** to re-enable it. To restore it and all other windows to their default positions, go to **Window** → Reset to Default Layout.

> **Tip**
>
> The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Creating and Managing Macros

To create, edit, and rearrange macros, click the **Manage** button in the bottom right of the **Macros Window** to open the **Manage Macros** dialog.

This window allows you to add, edit, delete, and rearrange macros.

Add a Macro

1. Click **Add** to open the **New Macro** dialog.
2. Enter a name for the button under **Button Label**.
3. In the **Macro Content** section, enter one or more commands.
4. Click **OK** to save the macro or **Cancel** to discard changes.

Edit a Macro

Edit a macro by selecting it in the **Manage Macros** window and clicking **Edit**. From here, the process is the same as adding a new macro.

Delete a Macro

Delete a macro by selecting it in the **Manage Macros** window and clicking **Delete**.

Rearrange Macros

Change the order in which macros appear by selecting the macro you want to move and clicking **Move Up** or **Move Down**, or by clicking, holding, and dragging a macro from the list to a new position.

Troubleshooting

- If you're unable to use or manage macros, make sure you've selected a GCode device profile.
- If your macros don't work as expected, please check that you've entered them correctly. We recommend testing your commands in the Console Window first.

Related Topics

- Console Window
- Troubleshooting: GRBL Errors
- Troubleshooting: Connection Problems

Ruida | file-list | DSP | machine-management | laser-control

5.5.5.7 File List Window

Use the **File List Window** to browse and manage files stored on your laser's controller. This window is only available for users with DSP controllers that allow saving files to the controller.

Accessing the File List Window

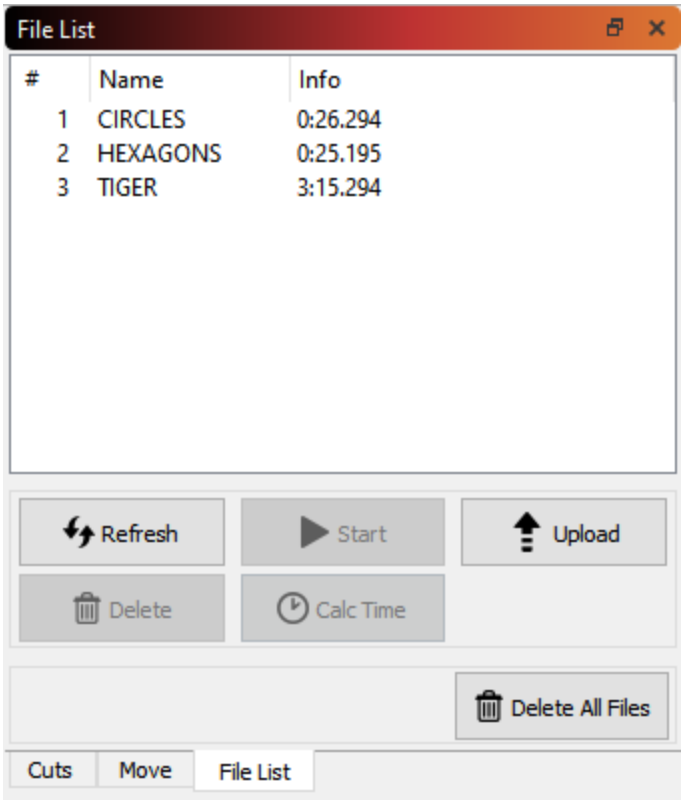
If you have a DSP device profile selected, the **File List Window** is located in the upper right side of LightBurn, docked behind the Cuts / Layers Window, by default.

If you have closed the File List Window, go to Window → **File List** to re-enable it. To restore it and all other windows to their default positions, go to **Window** → Reset to Default Layout.

> **Tip**
>
> The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

File List Window Options

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.



Select File

Select a file from the list to enable all relevant buttons.

Refresh

Queries the DSP controller to update the list of files stored on the laser file system.

Start

Commands the laser to run the selected file.

Upload

Opens your system's file browser, where you can select and send any files previously saved to your computer in machine-specific format to the laser's controller.

Upload Current Project

Use the Send button in the Laser Window to upload the current project in the LightBurn Workspace.

Delete

Removes the selected file from the DSP controller file system.

> **Warning**
>
> Deleted files cannot be recovered.

> **Tip: Ruida Controllers**
>
> Start deleting from the bottom of the list. Starting from the top of the list may lead to extended file compaction time.

Calc Time

Press the **Calc Time** button to begin computing the job completion time for the selected file. The **Calc Time** button is available only on supported DSP controllers (Ruida). This can take a considerable amount of time for engraving jobs, as the controller is simulating the job through the onboard DSP microprocessor. Once complete, the calculated completion time will be shown in the **Info** column.

Delete All Files

Removes *all* files from the DSP controller file system.

> **Warning**
>
> Deleted files cannot be recovered.

Related Topics

- File Management
- File Menu
- Laser Window
- Identify Your Laser

bridge Ethernet Ruida Wi-Fi DSP

5.5.5.8 LightBurn Bridge

The LightBurn Bridge was created by LightBurn to simplify Ethernet connections to Ruida controllers, especially for computers without Ethernet ports or where running a cable between the laser and computer is impractical. The LightBurn Bridge connects to your laser with an Ethernet cable and to your computer using Wi-Fi, and acts as a relay between the two. There are no drivers to install, and the Bridge typically sends data much faster than a USB connection.

Figure 1:

LightBurn Bridge

Warning

LightBurn Bridge is intended to be an appliance. The software is thoroughly tested, but we do not support modifications to the hardware or firmware. If you alter the system to add functionality beyond what is covered here or in the LightBurn Bridge Guide, we will not be able to provide support.

Basic Setup

The steps below cover basic setup for the LightBurn Bridge. For additional help or more advanced configuration, please see the LightBurn Bridge Guide.

Hardware Setup

Before you can configure the Bridge in LightBurn, you will need to connect the hardware and set the appropriate IP address on your Ruida controller:

- Use the Ruida control panel on your laser to set the IP address to **10.0.3.3**.
- Use an Ethernet cable to connect the Bridge to the laser's Ethernet port.
- Power up the Bridge with its power adapter.

Add Device to LightBurn

In LightBurn's Devices window, click **LightBurn Bridge** to open up the **Bridge Discovery Wizard**, which will walk you through connecting LightBurn to the Bridge. If you need to go back later, you can double-click the laser in the Devices window to re-open the wizard and change the LightBurn Bridge configuration, or you can adjust your device's configuration from Device Settings, just as if you were connecting directly to the laser.

Troubleshooting

- If you're not sure which corner to use for the origin, power on your laser. The corner the head goes to is your origin.
- The LightBurn Bridge is only for use with Ruida controllers. Other lasers will not work with it.
- If you're on macOS 15 or higher, please see our directions on allowing access to the local network.

Related Topics

- Devices
- LightBurn Bridge Guide

5.6 Camera

camera help help-menu troubleshooting

5.6.1 Camera Selection Helper

The **Camera Selection Help** window provides information to help you select an appropriate camera for your laser. The information provided is specifically for the cameras sold on LightBurn's website, which are known to work well with LightBurn and have calibration presets built into the software for easier Lens Calibration.

Can I Use a Camera I Already Have?

Possibly. Interactions between cameras and computers are complex, and although a wide range of cameras are compatible with LightBurn, we can't guarantee your camera will work. If you want to try using your own camera, make sure it's a fixed-zoom USB camera.

Selecting a Camera

To select a camera, you'll need to know two things:

1. The size of your laser's work area, in millimeters.
2. The distance between the height from which you want to mount the camera and the surface of your laser's work area.

Figure 1: Diagram showing ideal mounting location

To select a camera:

1. Enter the machine size into the **Camera Selection Help** window.
2. Look through the list to find a camera with a minimum mounting height about 2 inches less than the height you intend to mount at. This leaves room for adjustment.
3. Double-click an entry in the list to visit the product page to purchase it.

Troubleshooting

Some computers may cause complications with the use of cameras. In some cases – especially with newer computers such as M1 or newer Macs – this comes from incompatibilities between USB 3.0 ports and older USB 2.0 cameras. Try using a USB 2.0 hub or adapter between the camera and the computer.

See Camera Troubleshooting for more information.

Related Topics

- Camera Installation and Focusing
- Calibrate Camera Lens
- Calibrate Camera Alignment
- Camera Control Window

camera

The best place to mount an overhead camera is directly above the center of the bed of the laser, with the bed completely visible. The best way to accomplish this is usually to mount the camera on the inside of the lid, so the placement is correct when the lid is open.

Figure 1: Diagram showing ideal placement

Figure 1: Camera installed in a laser

Mounting tips:

- The camera should be focused as well as possible. Most LightBurn cameras are manually focused by gently twisting the lens.
- The camera must be solidly mounted to be in ***exactly*** the same position when using it as it was when you performed the alignment process. If you mount it to the lid of your laser, make sure the lid opens to the same place every time. You can use a cord or rod to ensure the lid is always at the same position when opened.
- If your camera is in a mount, make sure it doesn't move within the mount. A small piece of EVA foam or even tissue can hold the camera securely in the mount.
- Mount your camera so it isn't in the path of the laser head, and run the cable so it is not in the path of the beam. Ramming the laser head into your shiny new camera is a great way to increase your blood pressure.
- Focus the camera so as much of the bed is in focus as possible. Some cameras, like the 5mp-60, have a narrow focus depth, and if mounted high, can be tricky to focus. If this happens, focus on a circle that is roughly halfway from the center of the bed to the edge of the image, like this:

Figure 1: If you can't get the entire area in focus, try to focus approximately where the green circle is

Warning

The camera system depends on the camera being in the same position relative to the work area of your laser *and* the same distance from the top of the material. If your laser uses a variable *focus distance* instead of a variable height *work table*, you will need to align for the material height you are using.

Info

Cameras used with LightBurn should plug in to your computer as directly as possible. An active USB 2.0 amplifier to extend the distance may work, but is not guaranteed. Do not connect your USB camera to any USB port on your laser. USB 2.0 has a native max length of approximately 16 feet. (5 meters).

Info

To use LightBurn's camera functionality, you must use Absolute Coords mode, so LightBurn can accurately position the work. If you use an older Trocen controller, they do not allow setting this mode from software, so you must change the working mode through the controller menu.

camera output-and-positioning

5.6.3 Camera Control Window

The **Camera Control Window** is where you capture and adjust an **Overlay** produced by a camera, allowing you to position designs directly over objects in your laser's work area. You can also trace artwork or objects placed in your laser and captured by the camera.

> **Note**
>
> To use all of the features in the Camera Control Window, you must first properly Calibrate and Align your camera.

Accessing the Camera Control Window

The **Camera Control Window** is not enabled by default. To enable it, go to Window → **Camera Control**.

The Camera Control Window will appear docked behind the Cuts / Layers Window on the upper right side of your screen. Click the Camera Control tab to bring the Camera Control Window to the front.

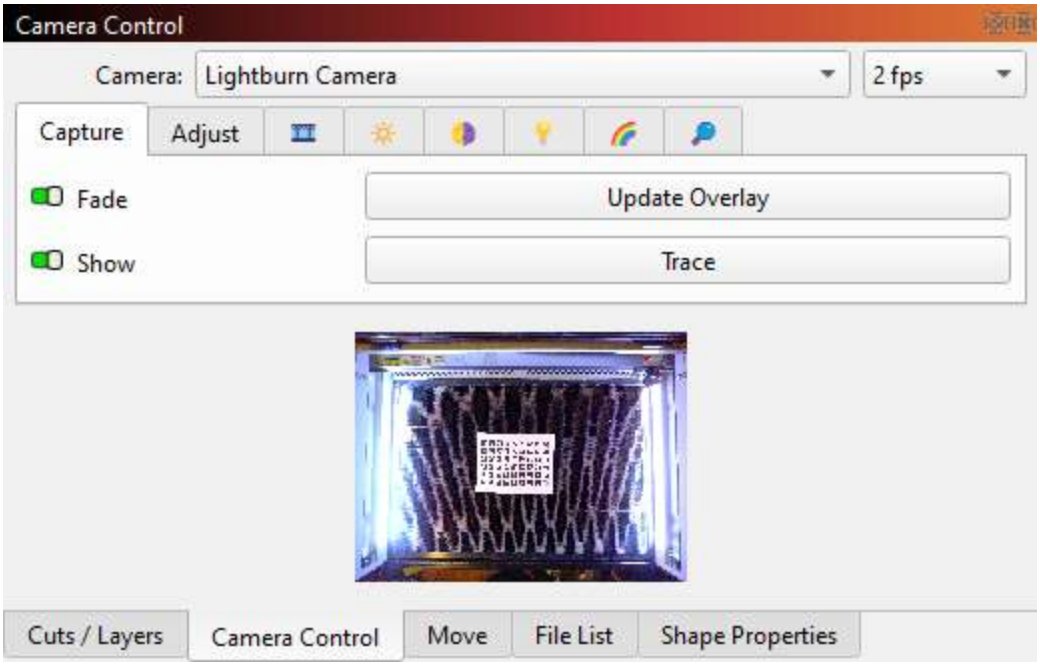
> **Tip**
>
> The layout of LightBurn is highly customizable. For more information on enabling and disabling windows and toolbars, or rearranging the default layout, see Customizing the LightBurn Window.

Camera Control Window Options and Settings

The image at the bottom of the **Camera Control Window** is the pre-processed picture from your camera. In order to produce an accurate alignment, the camera must be able to see your laser's entire work area in its pre-processed field of view.

Click any option in the image below to jump directly to the relevant section for that option, or scroll down for a list of options and descriptions.

Camera Capture Tab



Camera Selection Menu

Opens a dropdown menu where you can select the appropriate camera — in order to use all the features in the **Camera Control Window**, this must be the same camera you selected during the Calibration and Alignment process.

CAMERA INFORMATION TOOLTIP

After selecting a camera, hover over it to view information on that camera, indicating its **Resolution** and whether it is **Calibrated** and **Aligned**.

A camera that is properly set up will have its Resolution indicated at the top of the tooltip, followed by the words **Calibrated, Aligned**.

A camera that has not yet been set up will have its Resolution indicated, followed by the words **Not Calibrated, Not Aligned**. Perform the Camera Calibration and Alignment processes to use your camera.

Finally, if your camera's calibration was performed at a different Resolution than the one it is now presenting, you will see two Resolutions indicated.

- If you see a discrepancy in these resolutions, verify that you've selected the correct camera from the dropdown menu.
- If you're sure you have, you'll need to perform the Camera Calibration and Alignment processes over again.

- If the problem reocurrs with the same camera, it may not be fully compatible with LightBurn.

Camera Framerate Dropdown

With a camera selected, use this dropdown to select the rate at which LightBurn will update the camera. Higher values will update more frequently at the cost of higher demand on your computer.

Fade

Toggle whether or not the Overlay in your Workspace is dimmed.

Figure 1: A faded Overlay

Figure 1: An unfaded Overlay

Show

Toggle whether or not the Overlay in your Workspace is visible.

Update Overlay

Captures a new image to use as an Overlay for your Workspace.

You can also click the **Update Overlay** icon in the Main Toolbar, or press ⎇ Alt / ⌥ Option + C.

USING THE OVERLAY

When you press Update Overlay, the Start From mode in the Laser Window is automatically set to **Absolute Coords**. As long as this mode remains selected, anything you place in the LightBurn grid will be output in the corresponding location in your machine's work area. Position graphics over objects captured in the Overlay to engrave or cut directly on them.

> **Warning**
>
> If you switch to an alternative Start From mode, your graphics will no longer be aligned to the objects visible in your Overlay.

Figure 1: Graphics positioned over a physical object in an Overlay.

Figure 2:

Figure 1: The final result of the engraving on the object.

Figure 2:

Head-Mounted Camera Overlays

If you completed the Camera Alignment process for a Head-Mounted camera, see Head Mounted Camera — Capturing an Overlay for information on producing an Overlay.

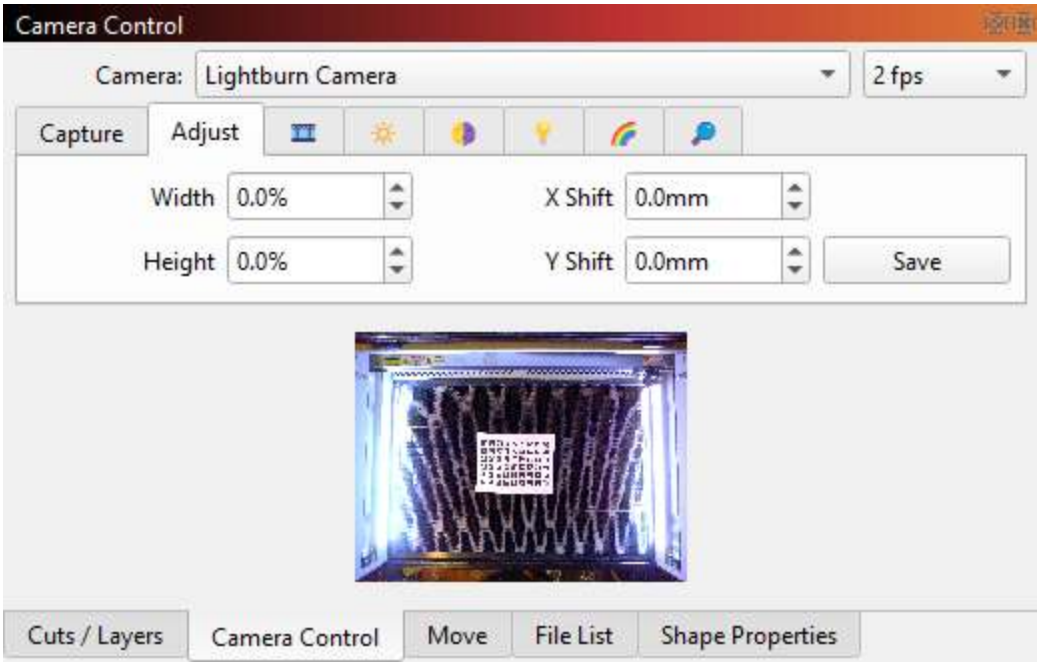
Trace

Captures an image and opens the Trace Image dialog window, where you can adjust settings to produce a vector graphic from the captured image.

Tip

It's likely that the artwork you're tracing won't take up the camera's entire view. Click and drag within the Image Trace dialog window to select a specific area of the capture to trace.

Camera Adjustment Tab



Width and Height

Tip

Use Width, Height, X, and Y Shift to fine-tune placement and scale if your Overlay's alignment is close, but not quite accurate. For larger discrepancies, see Troubleshooting: Using a Camera — Overlay Misaligned.

The **Width** and **Height** fields increase or decrease the size of the Overlay in the X (Width) or Y (Height) dimension.

X and Y Shift

The **X** and **Y Shift** fields move the Overlay left, right, up, or down, in the X and Y dimension.

Save Settings

Saves any adjustments you've made in the Width and Height or X and Y Shift fields.

Exposure

Use the slider to adjust the camera's exposure, or enable the switch to turn on auto-exposure.

Brightness

Use the slider to adjust the camera's brightness, or enable the switch to turn on auto-brightness.

Contrast

Use the slider to adjust the camera's contrast, or enable the switch to turn on auto-contrast.

White Balance

Use the slider to adjust the camera's white balance, or enable the switch to turn on auto-white balance.

Hue

Use the slider to adjust the camera's hue, or enable the switch to turn on auto-hue.

Focus

Use the slider to focus the camera, or enable the switch to turn on auto-focus.

Camera Control Window Context Menu

Right-click anywhere in the **Camera Control Window** to open a context menu with additional options.

Camera Selection Help

Opens the Camera Selection Help dialog window.

Export Camera Settings

Opens your system's file browser, where you can name and select a location to save your camera settings on your computer. The file will be saved with the `.lbcm` extension, and can be transferred to another computer, where it can be imported.

Import Camera Settings

Opens your systems file browser, where you can name and navigate to the location of a previously saved `.lbcm` file, select, and Import it, to load the settings contained in the file.

Calibrate Camera Lens

Opens the Lens Calibration Wizard.

Calibrate Camera Alignment

Opens the Camera Alignment Wizard.

Related Topics

- Camera Selection Helper
- Camera Installation and Focusing
- Calibrate Camera Lens
- Calibrate Camera Alignment
- Troubleshooting: Using a Camera

camera output-and-positioning laser-control laser-tools

5.6.4 Calibrate Camera Lens

Don't forget about alignment!

Calibration and alignment are both essential to proper camera setup. Don't forget to go through the alignment process after completing calibration.

Quick Reference: Calibrate Camera Lens

Compensates for camera lens distortion when producing an Overlay.

Location

Laser Tools → Calibrate Camera Lens

Camera lenses are not perfectly flat, and distort the image they capture. This effect is stronger on the fisheye lenses needed to capture the working area of larger lasers.

To use your camera, you must compensate for this distortion using the **Lens Calibration Wizard**. This process takes a little effort, but once your camera is calibrated well, it's not something you'll need to repeat often.

To begin the calibration process:

1. Make sure the correct camera is selected in the Camera Control Window.
2. Go to Laser Tools → **Calibrate Camera Lens** or right-click in the Camera Control window and select Calibrate Camera Lens from the context menu.

Calibration Presets

> **Pre-calibrated cameras**
>
> Some lasers come with pre-calibrated cameras. If your camera doesn't require calibration, you can select the **None - precalibrated camera** option in the **Preset** dropdown.

If you're using an official LightBurn camera, you can use a preset instead of calibrating manually. Select the appropriate preset for your camera from the **Use Preset** dropdown menu on the first page of the **Lens Calibration Wizard**.

After selecting a preset, click **Next** then **Finish** to close out of the Lens Calibration Wizard and save the calibration information, or **Align Camera** to move immediately on to the **Camera Alignment Wizard**.

Manual Camera Lens Calibration

Overview

Calibration Pattern Details

In order to work properly, the calibration pattern must be:

- undistorted
- perfectly flat
- surrounded by a 6 mm (¼") or larger margin
- About ⅓rd of the size of the camera's viewing area in both directions ($1/9^{th}$ of the its total field of view)

The size of the printed calibration pattern is not important, as long as it is positioned to take up about **$1/9^{th}$ of your camera view** which each capture. You can scale the image up or down when printing it, as well as raise or lower the printed pattern to adjust how much of the camera view it takes up.

- Download and print one of the following images:
  - AprilTags in PDF or LBRN2 format (recommended)
  - CalibrationCircles.png
  - You'll need to select the corresponding **Calibration Pattern** in the Lens Calibration Wizard later.
- Mount the printed image to something stiff and flat, such as cardboard, foam board, wood, or a clipboard.
- If you're using the **Calibration Circles** pattern, and the laser has a honeycomb bed or other surface with a lot of visible circles, cover it with a patternless material (cardboard, paper, or bedsheets all work). This is not necessary with the **AprilTags** calibration pattern.

Note on camera placement

It is not necessary to mount the camera in the machine to perform the lens calibration. This process depends only on the camera's lens, not its placement in your machine — as long as the camera and calibration pattern are perfectly still, calibration can be performed anywhere.

- Make sure the bed of your laser has good, consistent lighting and the camera is in focus.

Focusing a LightBurn camera

Most offical LightBurn cameras can be manually focused by *gently* twisting their lenses.

- In the Laser Tools Menu, select **Camera Lens Calibration**.
- Follow the directions in the Lens Calibration Wizard. For more help, continue below.

Walkthrough

The **Lens Calibration Wizard** walks you through capturing multiple images of the **Calibration Pattern** you've printed out. The software analyzes how the pattern appears in the images, and compares that against its internal knowledge of how the pattern *should* look. It determines the amount and shape of distortion produced by the lens of the camera, and computes a lens correction that is accurate for your camera.

After following the steps from the overview above, you should be ready for the calibration process and looking at a screen like this one:

Figure 1: Lens Calibration window.

Choose your camera from the list, and you'll see the view from the camera in the area to the left.

Choose the same Calibration Pattern as the one you downloaded and printed earlier.

With the correct camera and Calibration Pattern selected, click **Next**.

The view will change to include a **Capture** button, and a diagram to show you how to position the printed pattern. For the first capture, place the pattern in the center of the field of view of the camera, with the printed face of the card pointed directly at the camera, as shown in the small view up top. If you cannot easily match your capture image with the suggested image, you may need to adjust the scale of your printed card, or take the camera out of the machine for lens calibration.

Figure 1: Preparing for the first image capture.

Click the Capture button and you should see something like this:

Figure 1: First capture complete. The calibration pattern is attached to a piece of cardboard to keep it flat and smooth.

Above the captured image you see:

```
Image 1 (2592 x 1944) : 54 Markers found - Score: 0.17 - Great! Click Next
```

If you used the circles pattern instead, you'll see a similar message:

```
Image 1 (2592 x 1944) : Pattern found - Score: 0.31 - Great! Click Next
```

This tells you:

Distorted images during the calibration process

You may find that early captures are strongly distorted. This is temporary and is the result of only having a single calibration capture to work with. As you continue, LightBurn will collect more information about your camera's lens distortion and the rest of the image will clear up.

- The image was successfully captured
- The resolution of the captured image is 3840 x 2160 (higher is better)
- All 54 Markers were identified in the April Tags pattern
- This image scored reasonably well — lower scores are better. In this image, after distortion removal, the positions of the dots in the image align with the positions of the real dots with an average error of only 0.17 pixels — that's great, and well below the target score of 0.5 pixels of error.

If the Calibration Pattern is not found, LightBurn will tell you so. Make sure the pattern faces directly toward the camera and occupies roughly the same amount of view area shown in the reference image. It is okay if the pattern is rotated within the view if that makes it easier to place.

Figure 1: Example of pattern rotated within camera view.

As you advance through the captures, the reference image will update. The first five images are the center, 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. That is ok.

The final four images are the corners, and those can be difficult to capture with high-distortion cameras. If your first 5 images score very well (below 0.3) you may 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 — the placement does not always need to match the suggested images to successfully complete this process.

Even after only a few good captures, the image on the right should be free of lens distortion, as shown here:

A poorly calibrated result will still show lens distortion, and may have other artifacts, like the "wobble" seen in the lower-left of the gray image below:

If you aren't getting good results, you can re-capture the current image, or just go back to the beginning and try again. It can take a few tries to get a feel for how to align the card with the camera to get the lowest score.

When you have advanced through all the steps, and you are satisfied that you have a good calibration result with a nicely undistorted image, click **Finish** to save the results. You can also click the **Align Camera** button on the final page to move immediately on to the **Camera Alignment Wizard**.

Troubleshooting

See Camera Troubleshooting for guidance on common camera issues.

Related Topics

- Calibrate Camera Alignment
- Camera Control Window
- Camera Selection Helper
- Camera Installation and Focusing

camera camera-alignment camera-calibration overhead-camera head-mounted-camera

5.6.5 Calibrate Camera Alignment

Quick Reference: Calibrate Camera Alignment

Align a camera capture to your LightBurn Workspace.

Location

Laser Tools → Calibrate Camera Alignment

After your camera's lens is calibrated, you can move on to the next step, alignment.

By engraving a target marker pattern and then tagging the markers in your camera's field of view, the alignment process tells LightBurn where your camera's capture is in relation to the work area of your machine.

Before you start, make sure the camera is firmly mounted in the position it will be in when you use it.

Selecting Camera Position

To begin the alignment process, go to Laser Tools → **Calibrate Camera Alignment** or right-click in the Camera Control window and select Calibrate Camera Alignment from the context menu.

If you have a Gantry style laser, the first dialog will ask you to choose your camera's mounting location. If you have a Galvo style laser, you'll be taken directly to the Overhead Camera Alignment Wizard.

- If you have an Overhead camera, mounted above your laser, select the option on the left side: **Camera is over the work area, in a fixed position.** This type of camera is the most common option. Proceed to Overhead Camera Alignment for instructions on the rest of the setup process.
- If you have a Head-Mounted camera, attached to your laser head, selection the option on the right side: **Camera is mounted to the laser head, and moves with the laser.** This option is less common, and Head-Mounted camera support is still in beta. Go to Head-Mounted Camera Alignment for instructions on the rest of the setup process.

> **Warning**
>
> Head-Mounted Camera support is still in beta, and your results may vary. Report any issues you encounter while using this feature to support@lightburnsoftware.com.

Overhead Camera Alignment

Preparation

- Make sure your camera is securely mounted and correctly positioned, as described in Camera Installation and Focusing.

> **Warning**
>
> You can mount the camera to a movable part of your laser, like the lid, but the camera *must* be able to return to the *exact same position* it was in when you completed the alignment process, with each subsequent use. If the camera's position changes relative to your laser's work area, the overlay will be misaligned.

- Place a piece of material into your laser that is large enough to engrave the target marker pattern onto — it must be at least 200 mm x 200 mm (roughly 8" square), but larger materials and engravings are much better for larger lasers.
- Focus your laser to the material you're using.
- In the Laser Tools Menu, select **Calibrate Camera Alignment** to start the **Camera Alignment Wizard**. Select the option on the left side: **Camera is over the work area, in a fixed position.**
- Select the same camera you used with the Lens Calibration Wizard.
- After verifying that you see an image from the camera, click **Next** to begin the alignment process.

Engraving the Target Markers

The rest of this process will be completed within the **Camera Alignment Wizard**, which will command your laser to engrave a target pattern onto a piece of material, such as card stock, paper, cardboard, or thin wood, and ask you to tag the center of the targets.

Important Preparation

Before starting the alignment process, make sure your camera is securely mounted in the position you'll be using it — any movement of the camera relative to your work area after completing the alignment process will cause misalignment later.

Step 1

Place your material in the center of your laser's work area.

Ignore the **Material Thickness** setting if you don't usually use it for your laser.

Additional Info

The Material Thickness setting is only used by lasers with a motorized Z Axis that are *not* normally operated using Relative Z moves only.

Step 2

Enter appropriate **Speed** and **Power** settings to get a moderately dark engraving without burning through. This will vary based on your laser and the material you're using, so we can't provide these for you.

For best results, increase the **Scale** value to the maximum amount you can adjust it to while still fitting the target marker engraving to your material and work area.

Click **100% Scale** to automatically adjust scale to a 200 mm (8") square — the engraving will fit on a typical sheet of A4 letter paper at this scale.

Click **Fit Workspace** to increase the scale to the maximum size that will fit in your laser's work area.

Step 3

Frame the pattern to make sure it's positioned on the material you're using.

Step 4

Start the engraving. If it's not dark enough, you can adjust the settings and run it again. When the pattern is clearly visible and easy to see, click **Next**.

> ⚠ **Don't move the target marker pattern after engraving it!**
>
> It's vital that the alignment pattern maintain its **exact** location within the laser for the alignment process to work correctly.
>
> If the pattern has been moved, it **cannot be used again** for a subsequent alignment.
>
> If your camera is mounted to a moving part of the laser, such as the lid, make sure that the camera is in the exact position it will be in when you use it later, before continuing on.

Capturing the Target Marker Image

From this screen, you'll capture the alignment image.

- Use the **Jog** or **Send to Corner** buttons in the bottom left corner 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 Image** button.
- You should see an undistorted version of the camera view appear in the top left side of the window, with all four corner targets visible, as shown below.
- Click **Next** when done.

Figure 1: The camera alignment capture window before capturing an image.

Figure 1:

Camera alignment capture completed. The image should be clean and undistorted. If not, use the Lens Calibration Wizard to calibrate the camera.

Marking the Targets

In this step, 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 Workspace and Preview window, or use the **Zoom In** and **Zoom Out** buttons.

When you double-click, a red "+" mark will appear. Place a tag 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.

> **Warning**
>
> You must tag the targets in their exact numbered order, or the alignment will not be correct. If the markers are upside down or mirrored in your camera's field of view, that's ok — as long as you mark them in the correct order, LightBurn will correct for that when it produces an overlay.

Place each marker as accurately as you can. Zooming in can help.

Here's an example of a correctly placed marker:

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

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

Now that everything is aligned, open the **Camera Control Window** again, and click **Update Overlay** or press `⎇ Alt` / `⌥ Option` + `C` to capture and project whatever is in the camera view onto your Workspace, as shown here:

See Camera Control Window for full instructions on using the camera after it has been successfully aligned.

Troubleshooting

See Camera Troubleshooting for guidance on common camera issues.

Related Topics

- Camera Control Window

- Calibrate Camera Lens
- Camera Selection Helper
- Camera Installation and Focusing

camera output-and-positioning laser-control laser-tools

5.6.6 Calibrate Camera Lens (Labs)

Labs Feature

Labs features are new tools in development that we couldn't wait to get into the hands of our users. Please experiment with caution, and report any unexpected results on our forum.

Quick Reference: Calibrate Camera Lens (Labs)

Compensates for camera lens distortion when producing an Overlay.

Location

Right-click in Camera Control Window → Calibrate Camera Lens with Tag Tracking (Labs)

Camera lenses are not perfectly flat, and distort the image they capture. This effect is stronger on the fisheye lenses needed to capture the working area of larger lasers.

To use your camera, you must compensate for this distortion using the **Camera Calibration Wizard**.

LightBurn 2.0 features a new, experimental Camera Calibration Wizard with a more robust and seamless process.

To begin the experimental calibration process:

1. Make sure the correct camera is selected in the Camera Control Window.
2. Right-click in the same window and select **Calibrate Camera Lens with Tag Tracking (Labs)**.

Don't forget about alignment!

Calibration and alignment are both essential to proper camera setup. Don't forget to go through the alignment process after completing calibration.

Overview

Calibration Pattern Details

In order to work properly, the calibration pattern must be:

- undistorted
- perfectly flat
- surrounded by a 6 mm (¼") or larger margin

The size of the printed calibration pattern is not important, but should be positioned relative to your camera so that it takes up as much of the camera's field of view as possible. You can scale the image up or down when printing it, as well as raise or lower the printed pattern to adjust how much of the camera view it takes up.

- Download and print the following image:
  - AprilTags in PDF
- Mount the printed image to something stiff and flat, such as cardboard, foam board, wood, or a clipboard.

Note on camera placement

It is not necessary to mount the camera in the machine to perform the lens calibration. This process depends only on the camera's lens, not its placement in your machine — as long as the camera and calibration pattern are perfectly still, calibration can be performed anywhere.

- Make sure the bed of your laser has good, consistent lighting and the camera is in focus.

Focusing a LightBurn camera

Most offical LightBurn cameras can be manually focused by *gently* twisting their lenses.

- Make sure the correct camera is selected in the Camera Control Window.
- Right-click in the same window and select **Calibrate Camera Lens with Tag Tracking (Labs)**.

Walkthrough

The **Camera Calibration Wizard** walks you through capturing multiple images of the **Calibration Pattern** you've printed out. The software analyzes how the pattern appears in the images, and compares that against its internal knowledge of how the pattern *should* look. It determines the amount and shape of distortion produced by the lens of the camera, and computes a lens correction that is accurate for your camera.

After following the steps from the overview above, you're read to begin the calibration process.

To open the wizard:

1. Make sure the correct camera is selected in the Camera Control Window.
2. Right-click in the same window and select **Calibrate Camera Lens with Tag Tracking (Labs)**.

You'll see a link to download the AprilTags calibration pattern, as well as instructions on completing the calibration process.

You can use the arrow buttons to the left side of the window to jog your laser out of the way, if its current position will obstruct your ability to place and capture the calibration pattern in your laser's work area.

The **Sample** field lets you control the number of frames per second used during the capture process.

After reading the instructions, and adjusting the sample rate or jogging your laser if necessary, click **Next** to proceed.

The view will change to include a live image from your camera, along with several new buttons.

The wizard will overlay green squares on top of each AprilTag it identified in the calibration pattern. Position the pattern so that the camera sees and identifies as many tags as possible.

If the wizard can't identify very many or any tags, you may need to adjust your camera's focus.

Click the **Capture** button and you should see something like this:

Move and rotate the calibration pattern around the camera's field of view, clicking the Capture button again for each new position.

You can click to **Discard** any capture you are disatisfied with, for example if you accidentally click twice, clicked before the samples settled and were identified, or moved the pattern or camera while clicking.

After you've captured 9 samples, you have enough to proceed to the next step of the calibration process, but you can continue taking additional captures to increase accuracy.

Click Next when you're ready to proceed.

The calibration wizard will take a few moments to build two camera models: **Standard Camera** and **Fisheye Camera**.

Select each model from the dropdown menu in the lower left, and compare the results. The better model will show less distortion in the example capture. You can also select **Original Calibration** from the menu to view and compare to your current calibration.

> **Tip**
>
> Look for lines that you know to be straight in the real world — if they're wavy in the capture, that means there is distortion in the selected model.

If the captures from both models look comparable, or you're unsure which to choose, select the model that shows the lower **Error** reading, displayed beneath the dropdown menu.

> **Note**
>
> If both models appear distorted, click **Back** to capture additional samples, or discard the previous samples and begin the process over. Make sure the physical calibration pattern is undistorted, perfectly flat, and surrounded by a 6 mm (¼") or larger margin.

After you've selected the least-distorted model, click **Next** to advance to the final page of the Calibration Wizard.

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 **Save** to store the results.

> **Don't forget about alignment!**
>
> Calibration and alignment are both essential to proper camera setup. Don't forget to go through the alignment process after completing calibration.

Troubleshooting

See Camera Troubleshooting for guidance on common camera issues.

Related Topics

- Calibrate Camera Alignment
- Camera Control Window
- Camera Selection Helper
- Camera Installation and Focusing

camera export image-tools image file-menu

5.6.7 Save Background Capture

Quick Reference: Save Background Capture

Saves a copy of a camera Overlay to your computer.

Location

File → Save Background Capture

Use **Save Background Capture** to save a bitmap image of an Overlay produced by a camera affixed over your laser's work area.

Saving Background Captures

In order to use **Save Background Capture** you must first properly Calibrate and Align your camera.

Click **Update Overlay** in the Camera Control Window to produce an overlay.

Go to File → **Save Background Capture** to save the camera overlay.

A dialog window will open, allowing you to name and navigate to the location you'd like to save the capture.

Related Topics

- Camera Control Window
- Calibrate Camera Lens
- Calibrate Camera Alignment
- Camera Installation and Focusing

- Save Processed Bitmap

camera

5.6.8 Head-Mounted Camera Alignment

> **Warning**
>
> This feature is still in beta, and your results may vary. Report any issues you encounter while using this feature to support@lightburnsoftware.com.

Head-Mounted cameras are affixed to a laser's head and travel with it as it moves around its work area. After properly Calibrating and **Aligning** your Head-Mounted camera, LightBurn will be able to stitch together captures taken by the camera at multiple locations in the work area, producing an Overlay for your Workspace that you can use to position graphics over material.

Selecting Camera Position

To begin the alignment process, go to Laser Tools → **Calibrate Camera Alignment** or right-click in the Camera Control window and select Calibrate Camera Alignment from the context menu.

Select the option on the right side: **Camera is mounted to the laser head, and moves with the laser.**

Head-Mounted Camera Alignment

Preparation

- Make sure your camera is securely mounted to your laser head, with no ability to move or wiggle as the laser jogs.
- Place a piece of material into your laser that is large enough to engrave the target marker pattern onto — it must be at least 50 mm x 50 mm (roughly 2 in square). The closer it is to that minimum, the harder it will be to make sure the engraving location matches your material.
- Focus your laser to the material you're using.
- In the Camera Control Window, select same camera you used with the Lens Calibration Wizard.
- In the Laser Tools Menu, select **Calibrate Camera Alignment** to start the **Camera Alignment Wizard**. Select the option on the right side: **Camera is mounted to the laser head, and moves with the laser.**

Engraving the Alignment Pattern

The rest of this process will be completed within the **Head-Mounted Camera Alignment Wizard**, which will command your laser to engrave a pattern onto a piece of material, such as card stock, paper, cardboard, or thin wood, and ask you to tag points on the pattern.

Step 1

Place your material in the center of your laser's work area.

Step 2

From the dropdown menu, select **Automated Alignment** (recommended), or **Manual Alignment**.

Step 3

Enter appropriate **Speed** and **Power** settings to get a moderately dark engraving without burning through. This will vary based on your laser and the material you're using, so we can't provide these for you.

Step 4

Frame the pattern to make sure it's positioned on the material you're using.

If necessary, you can adjust the size of the Pattern to fit your material, but make sure it is small enough that your camera will be able to see a substantial portion of the pattern at once.

Step 5

Start the engraving. If it's not dark enough, you can adjust the settings and run it again. When the pattern is clearly visible and easy to see, click **Next**.

Warning

Don't move the target marker pattern after engraving it! It's vital that it maintain its exact location within the laser for the alignment process to work correctly.

Automatic Alignment

Note

Follow these instructions if you selected Automatic Alignment at the beginning of the alignment process. If you selected Manual Alignment, jump ahead to Manual Alignment.

Centering the Laser Over the Pattern

Use the Jog arrows to move the laser head, and with it the camera, until the pattern is postioned roughly in the center of the camera's field of view.

You can click **Auto Center** to automatically jog the camera to the predicted center of the pattern, before fine-tuning its position.

The field in the center of the arrows controls the amount of distance the laser will move with each click.

When the pattern is centered, click **Next** to proceed to the next step.

Scaling the Capture

> **Tip**
>
> You can zoom in and out by hovering over the image and using your mouse's scroll wheel.

Adjust the **Scale** value in the lower left of the window until the entire image is filled with "good" pixels.

- None of the black fisheye effect along the borders should be visible.
- Make sure no areas that are badly lit or blurry are visible.
- The best part of the image is typically directly in the center.

> **Note**
>
> Zooming in for a tight focus on the sharpest areas of the image will lead to higher quality captures, but longer scanning times when the camera captures your laser's work area.

Click **Next** to proceed to the next step.

Verifying Alignment

Double-click a point in the view to jog the laser there. The point you clicked should be centered in the field of view after the laser finishes jogging.

Repeat the alignment process if the position is innaccurate. If it's accurate, click **Finish** to save the alignment and exit the wizard.

Manual Alignment

> **Note**
>
> Follow these instructions if you selected Manual Alignment at the beginning of the alignment process. If you selected Automatic Alignment, head back to Automatic Alignment.

Centering the Laser Over the Pattern

Use the Jog arrows to move the laser head, and with it the camera, until the pattern is postioned roughly in the center of the camera's field of view.

The field in the center of the arrows controls the amount of distance the laser will move with each click.

When the pattern is centered, click **Next** to proceed to the next step.

Tagging the Pattern

Next you'll mark four locations near the center of the pattern, and finally four more around the outside of the grid.

When you double-click, a red "+" mark will appear. If you place one incorrectly, you can double-click near it to shift it around.

1. Double-click the center of the grid to place a red "+" mark there. When the marker is accurately placed, click **Next**.

2. Double-click the intersection nearest to Point 1 in the engraved pattern. Click **Next** when you're satisfied with the location.

3. Based on the location you clicked for Point 1, LightBurn will predict a new location at the next grid intersection over. If the "+" mark is not perfectly aligned to a grid intersection, double-click at the closest intersection to align it. Click **Next**.

4. Double-click the intersection nearest to Point 2 in the engraved pattern. Click **Next**.

5. Based on the location you clicked for Point 2, LightBurn will predict a new location at the next grid intersection over. If the "+" mark is not perfectly aligned to a grid intersection, double-click at the closest intersection to align it. Click **Next**.

6. LightBurn will now predict 4 intersections around the outside of the grid. If they are not perfectly positioned over an intersection, click the nearest intersection to realign them to that point. Click **Next** when each "+" is aligned to the nearest intersection.

7. Double-click a point to Jog the laser to that location — the point should be centered in the camera's field of view after it is finished jogging.

If the alignment is accurate, click Next to close and finish the process. If it's inaccurate, click **Back** until the beginning of the tagging process, and try tagging the points again.

Capturing an Overlay

Click Update Overlay in the **Camera Control Window** to command your laser to jog, pause, take a capture, and repeat, producing multiple images that LightBurn will stitch together to produce an Overlay.

- If you have an object in your selection, the laser will jog to take captures of only the area within the selected object, and produce an Overlay confined to that area in your Workspace.
- If you have nothing in your selection, the laser will jog to take captures of the entire work area and produce an Overlay that covers your entire Workspace.

Troubleshooting

- If the Overlay is misaligned, try rerunning the entire process, taking care to mark the points in the pattern as precisely as possible, and to not move the pattern at all from its original, engraved position.
- This feature is still in beta. If you encounter bugs or other unexpected behavior, please contact us at support@lightburnsoftware.com.

Related Topics

- Camera Control Window
- Calibrate Camera Alignment (Overhead)
- Calibrate Camera Lens
- Camera Selection Helper
- Camera Installation and Focusing

5.7 Settings and Preferences

beginner transform-control-toggles laser-window arrange-toolbar boolean-assistant cut-settings-editor tabs set-start-point settings editor-settings main-window interface-settings

5.7.1 Beginner Mode

Beginner Mode simplifies the LightBurn interface by removing several options that new users are unlikely to use.

You can enable or disable Beginner Mode at any time in the **Editor Settings** tab of the Settings window.

When Beginner Mode is active, you'll see a message in the title bar, next to the location where your currently selected device profile is indicated.

Note

Although Beginner Mode can make it easier to get started, it also means that your interface will look a little different than most video tutorials or screenshots you'll see.

If you're searching for a button or features and you don't see it, it might be because of Beginner Mode, but it could *also* be because you're using a machine that doesn't support the feature you're looking for. LightBurn's interface adapts to only show you the features that are compatible with your machine type.

Beginner Mode Changes

Transform Control Toggles

- The toggles for Move, Rotate, Shear and Scale are hidden.

Laser Window

The following buttons and options are hidden in the Laser Window:

- Save Machine File
- Run Machine File
- Optimization Settings
- Cut Selected Graphics
- **Enable Rotary** and **Enable Cylinder Correction**

> **Note**
>
> These options only appear if **Show rotary enable on main window** and **Show cylinder correction enable on main window** in your Settings. Enabling **Beginner Mode** hides them, but disabling Beginner Mode does not show them, by itself.

Arrange Toolbar

- The simplified version of the Arrange Toolbar is automatically selected.
- The Move Selected Objects tools appear in a dropdown menu.
- The Distribute tools are hidden.
- Mirror Across Line is hidden.
- The **Align** tools are replaced with the Align Tools Helper. Click the Align left icon to open a dialog window where you can select any Align option and see the result before clicking **OK** to confirm the changes, or **Cancel** to discard them.

Boolean Assistant

- In the Modifiers Toolbar, the Boolean tools are replaced with the **Boolean Assistant**. Click the **Boolean Union** icon to open a dialog window where you can select any Boolean option and see the result before clicking **OK** to confirm the changes, or **Cancel** to discard them.

Cut Settings Editor

- All advanced setting are hidden in the Cut Settings Editor. Advanced settings are ignored in cases where enabling them is optional, and defaults are applied in cases where a selection is required.
- **Fill** layers are always set to **Bi-directional fill** and **Fill all shapes at once**. **Scan Angle** is set to 0°.

Tabs

- The **Tabs / Bridges** section of the Cut Settings Editor for **Line** layers is hidden.
- The Add Tabs tool is removed from the Creation Toolbar.

Set Start Point

- The Set Start Point tool is hidden in the Modifiers Toolbar.

Related Topics

- Get Started
- Main Window

settings preferences display interface import export editor editing units grid camera troubleshooting workflow-optimization workflow optimization

5.7.2 Settings/Preferences

The **Settings** window contains global user preferences for LightBurn — these settings apply regardless of what lasers you have set up, and which one you currently have selected.

The Settings window is split into five tabs:

- Editor Settings
- Units and Grids
- Display
- Import / Export
- Camera

Accessing the Settings Window

To open the **Settings** window, click the gears icon in the top toolbar, or go to Edit → **Settings**.

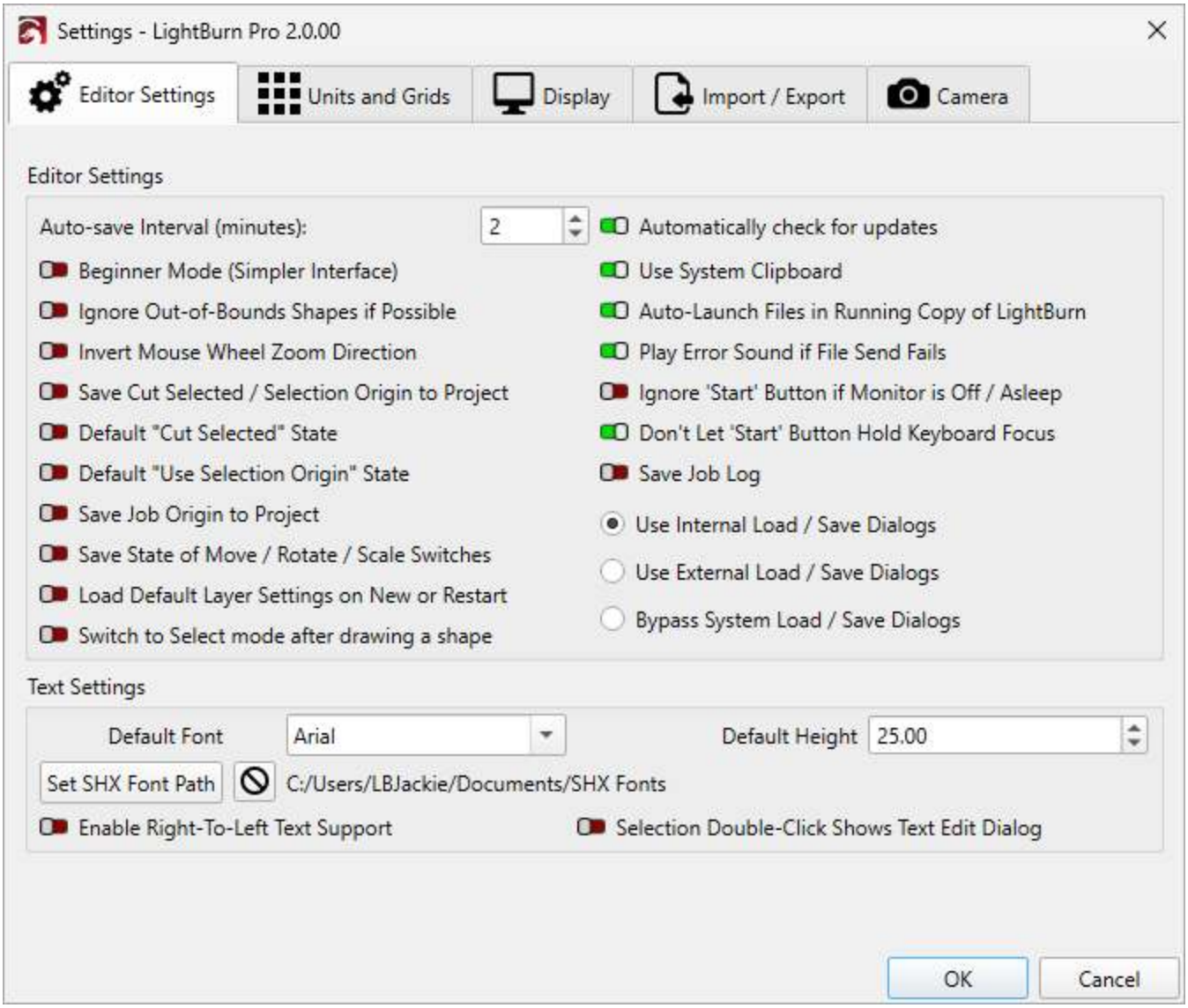
If you're on macOS, go to **LightBurn** → **Preferences** instead.

Settings Window

Click any option in the images below to jump directly to the relevant section for that option, or scroll down for an alphabetized list of options and descriptions for each tab.

Click a tab to jump to the relevant section for that tab and the settings it contains.

Editor Settings



Automatically check for updates

Permits (or denies) LightBurn the ability to automatically check for updates, and inform you of them.

Auto-save Interval (minutes)

Sets the frequency of auto-saves, in minutes. Setting the **Auto-save Interval** to 0 disables auto-saving.

Auto-saves are stored in the same location as you saved the original file, with `_backup` appended to their name. If you've never named a file, the auto-save will be in your computer's Documents folder.

Each auto-save overwrites the previous auto-save, and when you manually save the file, the auto-saved copy is deleted.

Auto-launch files in running copy of LightBurn

When opening projects through your system's file explorer, automatically open any LightBurn project files on your computer within a running copy of LightBurn, rather than opening an additional copy of the program.

Beginner Mode

Enables a simplified version of the LightBurn interface which removes several options that new users are unlikely to use.

See Beginner Mode for more information.

Default "Cut Selected" State

Automatically enables **Cut Selected Graphics** each time you restart LightBurn.

Default "Use Selection Origin" State

Automatically enables **Use Selection Origin** each time you restart LightBurn.

Ignore out-of-bounds shapes if possible

When Starting or Sending projects to your laser, tells LightBurn not to send graphics positioned outside of the grid in your Workspace.

Graphics that are partially inside and partially outside the grid will be ignored.

Ignore 'Start' button if monitor is off or asleep

Prevents you from accidentally starting the laser by pressing the wrong key when waking the computer. This is particularly useful on lasers that don't have enclosures with safety interlocks, such as most diode and Galvo lasers.

Don't Let 'Start' Button Hold Keyboard Focus

Prevents you from accidentally starting the laser by pressing the wrong key while using other software with LightBurn running in the background. This is particularly useful on lasers that don't have enclosures with safety interlocks, such as most diode and Galvo lasers.

Invert mouse wheel zoom direction

Overrides the default scrolling behavior within LightBurn to match preferences for macOS or Windows.

Load default layer settings on new or restart

Cut settings are normally pre-filled with the last settings used for a given layer. If **Load default layer settings on new or restart** is enabled, any time you open up a new project or restart LightBurn, all settings for all layers will be restored to defaults.

If you've never set up your own defaults, all layers will be restored to LightBurn's universal defaults.

See Working With Default Layer Settings for more information.

Load / Save dialogs

These settings permit you to use non-native system dialogs to perform **Save/Open/Import/Export** operations with LightBurn.

- **Use internal Load / Save dialogs** uses LightBurn's internal code to load and save files.
- **Use external Load / Save dialogs** opens a second application to load and save files.
- **Bypass system Load / Save dialogs** bypasses your system's Load / Save dialogs.

Try external Load / Save dialogs or Bypass system Load / Save dialogs if LightBurn crashes when when performing Save/Open/Import/Export operations.

Play error sound if file send fails

Produces an audible chime if uploading a file to a DSP controller fails.

Save Cut Selected / Selection Origin to project

Stores the status of the **Cut Selected Graphics** and **Use Selection Origin** switches to any project you save.

Save Job Log

Instructs LightBurn to save a log of projects that are run, on what laser profile, and at what time.

It will save a file called LightBurnJobs.csv in your system's Documents folder.

Save Job Origin to Project

Stores your selected Job Origin with any project you save.

Save state of Move / Rotate / Scale switches

Stores the state of the Transform Control Toggles so they persist between restarts of LightBurn.

Switch to Select mode after drawing a shape

Enable this to automatically switch back to Select mode after drawing a shape. When disabled, the drawing tool will remain active after completing a shape.

Text Settings

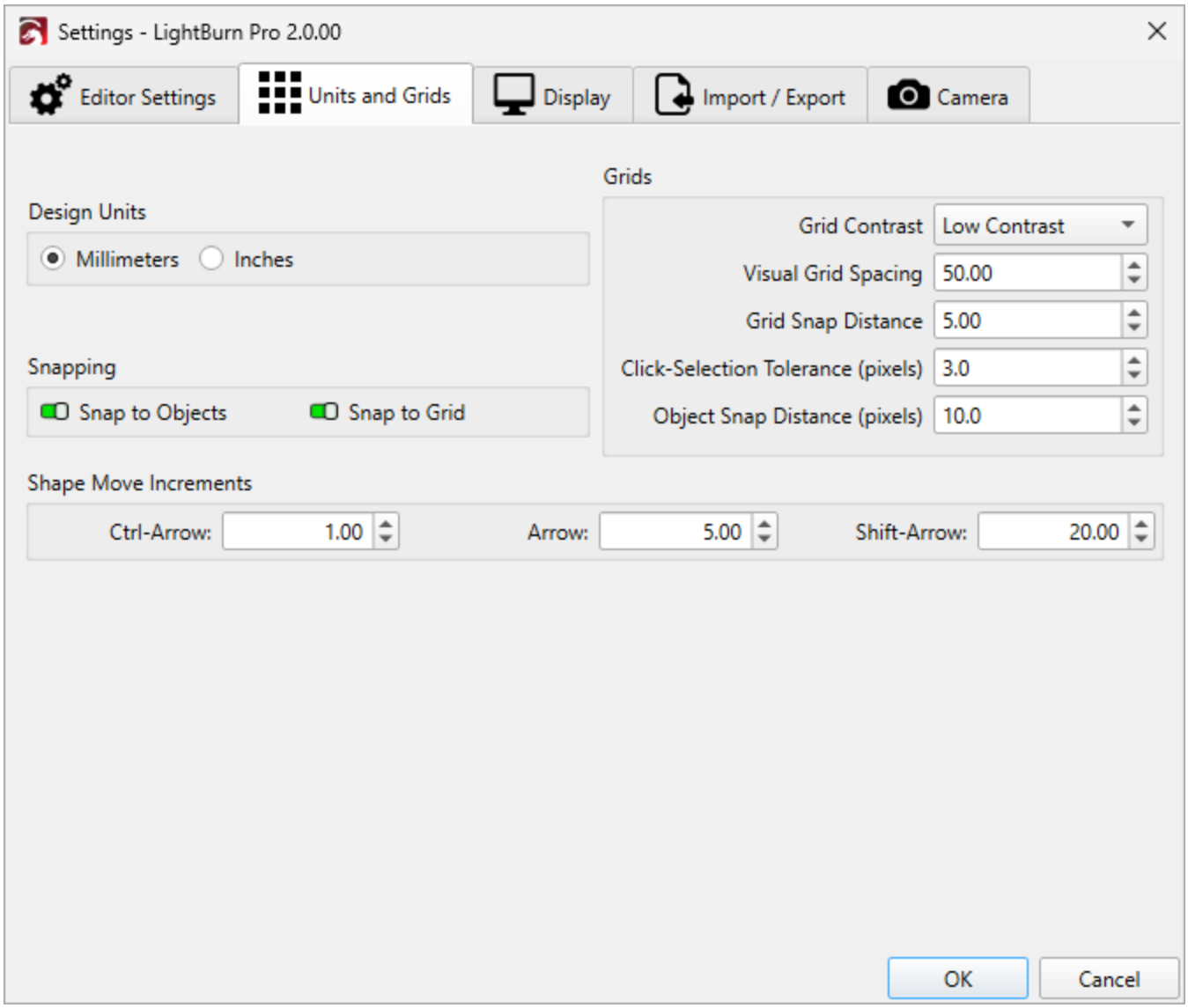
See Create and Edit Text — Text Settings for information on these settings.

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 Workspace, auto-creating a Text Object

Units and Grids



Click Selection Tolerance (pixels)

Determines how close your cursor must 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.

Grid Contrast

Adjust the brightness of the grid in your Workspace, relative to the background.

Grid Contrast Comparison

Figure 1: Grid Contrast off

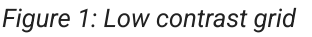


Figure 1: Low contrast grid

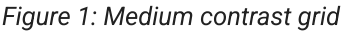


Figure 1: Medium contrast grid

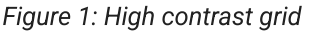


Figure 1: High contrast grid

Grid Snap Distance

Determines how close lines and other primitives must be to a grid line to snap to it.

Object Snap Distance (pixels)

Controls how close, in screen pixels, your cursor has to be to an object node or center to activate the Object Snapping behavior.

Shape Move Increments

When moving objects with the arrow keys in the Workspace, these values control the distance to move the selection.

Assign individual values to movements when pressing:

- The `← Left`, `→ Right`, `↑ Up`, and `↓ Down` arrow keys
- `^ Ctrl` while pressing an arrow key
- `⇧ Shift` while pressing an arrow key

Snapping

LightBurn has two snapping behaviors which you can enable or disable here.

Snap to Objects will snap your pointer location to the nearest object center or vertex when creating new objects, drawing lines, or moving objects, 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 Distance value. Note that the Grid Snap Distance and the Visual Grid Spacing do not have to be the same.

Hold `^ Ctrl` / `⌘ Cmd` while moving an object to toggle the status of the snapping behaviors — if they are currently enabled, they will be temporarily disabled, and if they're disabled, they'll be temporarily enabled.

See Snapping for more information.

Design Units

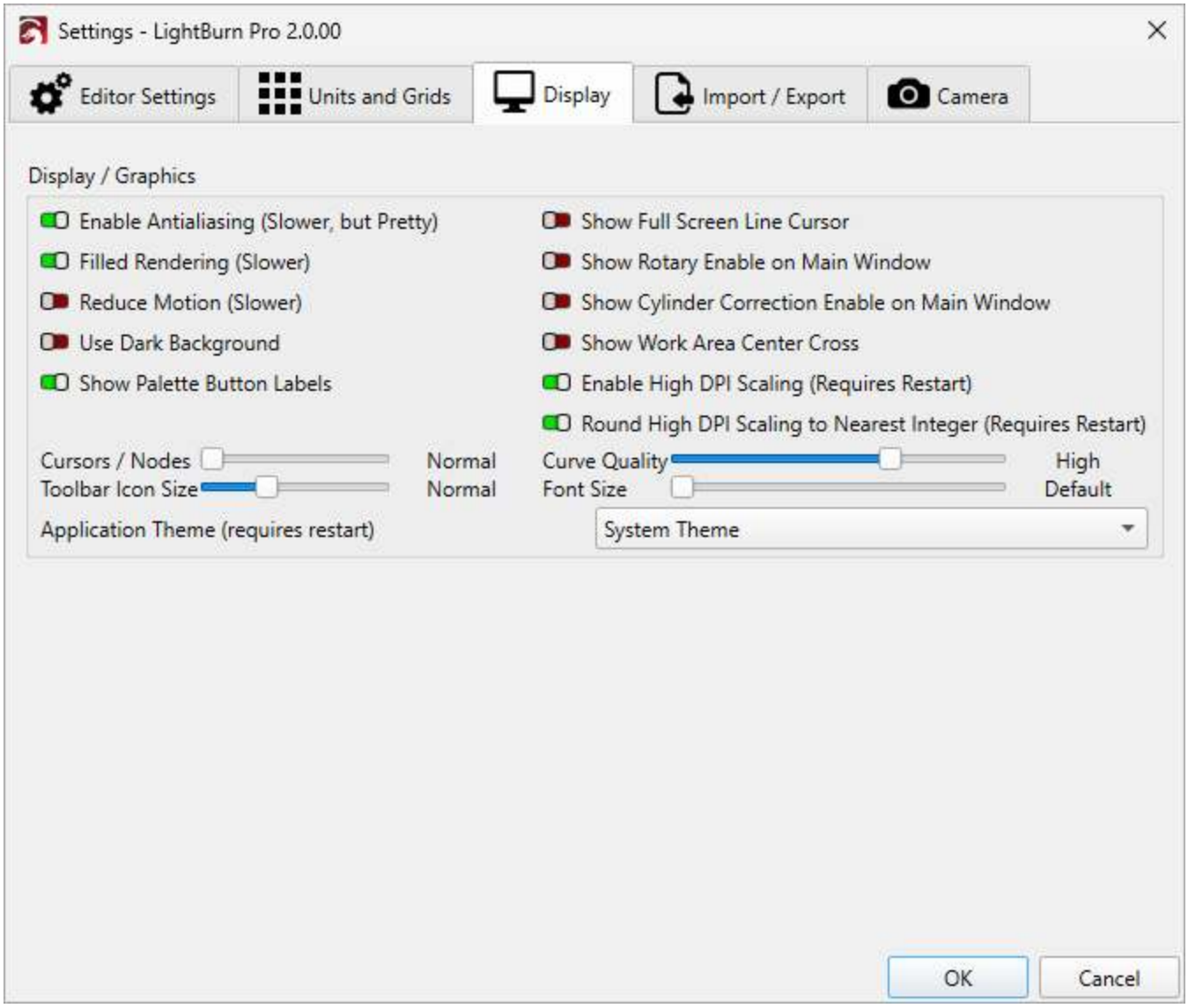
Determines the units LightBurn will use for design purposes. This is not necessarily the same as the units used for cutting speed, which can be changed in the Dimensions / Units tab of **Device Settings**.

Visual Grid Spacing

Visual Grid Spacing determines the visual size of grid squares at the standard zoom level. As you Zoom In, you'll see a secondary 10 x 10 grid of squares within each larger square. Each smaller square is 1/10th the size of the Visual Grid Spacing value.

Note that this setting is independent of the Grid Snap Distance, which controls how close lines and other shapes must be to a grid line to snap to it.

Display



Application Theme

Tip

When using a dark **Appication Theme**, enable Use Dark Background to darken your Workspace along with LightBurn's UI.

Use this dropdown to switch between LightBurn's light and dark themes. The default **System Theme** setting will match your operating system's theme setting.

Note

Switching themes requires a restart to take effect.

Cursors / Nodes

Adjusts the size of special cursors used when Snapping, applying radiuses, Bending text, and more, as well as the size of individual nodes when using Edit Nodes.

Adjust the slider to select between **Normal**, **Larger**, and **Largest**.

Node Size Comparison

Figure 1: Normal nodes

Figure 1: Large nodes

Figure 1: Largest nodes

Curve Quality

Controls the precision LightBurn uses in displaying curves on the screen. All curves are displayed as a series of short lines, but the higher this value is, the shorter those lines will be.

Reduce this value to improve performance if your system is slow.

Curve Quality comparison

Enable Antialiasing (slower, but pretty)

Antialiasing smooths the appearance of lines on your screen. Enabling anti-aliasing will make your design rendering look much nicer, but increases demand on your machine.

If you notice your computer lagging, especially on older computers or when working with very complex designs, try disabling this setting.

Antialiasing comparison

Enable High DPI Scaling

High DPI scaling can make the LightBurn interface easier to use on high resolution screens. If the interface is unreasonably small, try enabling this and restarting LightBurn.

Tip

If enabling High DPI Scaling causes blurriness or other visual artifacts, try enabling **Round High DPI Scaling to Nearest Integer**.

Filled Rendering (slower)

Renders shapes that are assigned to layers set to Fill Mode as solid shapes.

This takes longer than rendering the wire outlines, and it can hide graphics behind 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.

See View Style for more information.

Filled vs. Wireframe comparison

Font Size

Increases or decreases the font size for LightBurn window text anywhere in the program. This allows for manual overrides for HiDPI screens, UI scaling, and visually impaired users. Not all UI elements may fit on screen if increased too high.

Adjust the slider to select **Default**, or a size between **8** and **24**.

> **Warning**
>
> Setting this slider too high may result in clipping of UI elements. If you scale font up or down such that you cannot reach the menu items to re-open the **Settings** window and shrink it, use the method listed here to reset LightBurn.

Reduce Motion (slower)

Instructs LightBurn to try to reduce motion or other flickering effects in the rendering.

If you notice your computer lagging, especially on older computers, or when working with very complex designs, try disabling this setting.

Show cylinder correction enable on main window

Adds a toggle to the Laser Window to enable or disable Cylinder Correction mode.

Show full screen line cursor

Draws a moving crosshair, centered on your cursor, that spans the entire edit screen.

Show Palette Button Labels

Shows numbered labels on the Color Palette swatches, making it easier to tell similar colors apart.

Show rotary enable on main window

Adds a toggle to the Laser Window to enable or disable Rotary Mode.

Show work area center cross

Draws an immovable crosshair through the center of your Workspace, spanning the entire grid.

Toolbar Icon Size

Changes the scaling of icon elements in the LightBurn UI. This allows for manual overrides for HiDPI screens, UI scaling, and visually impaired users. Not all UI elements may fit on screen if this is increased too high.

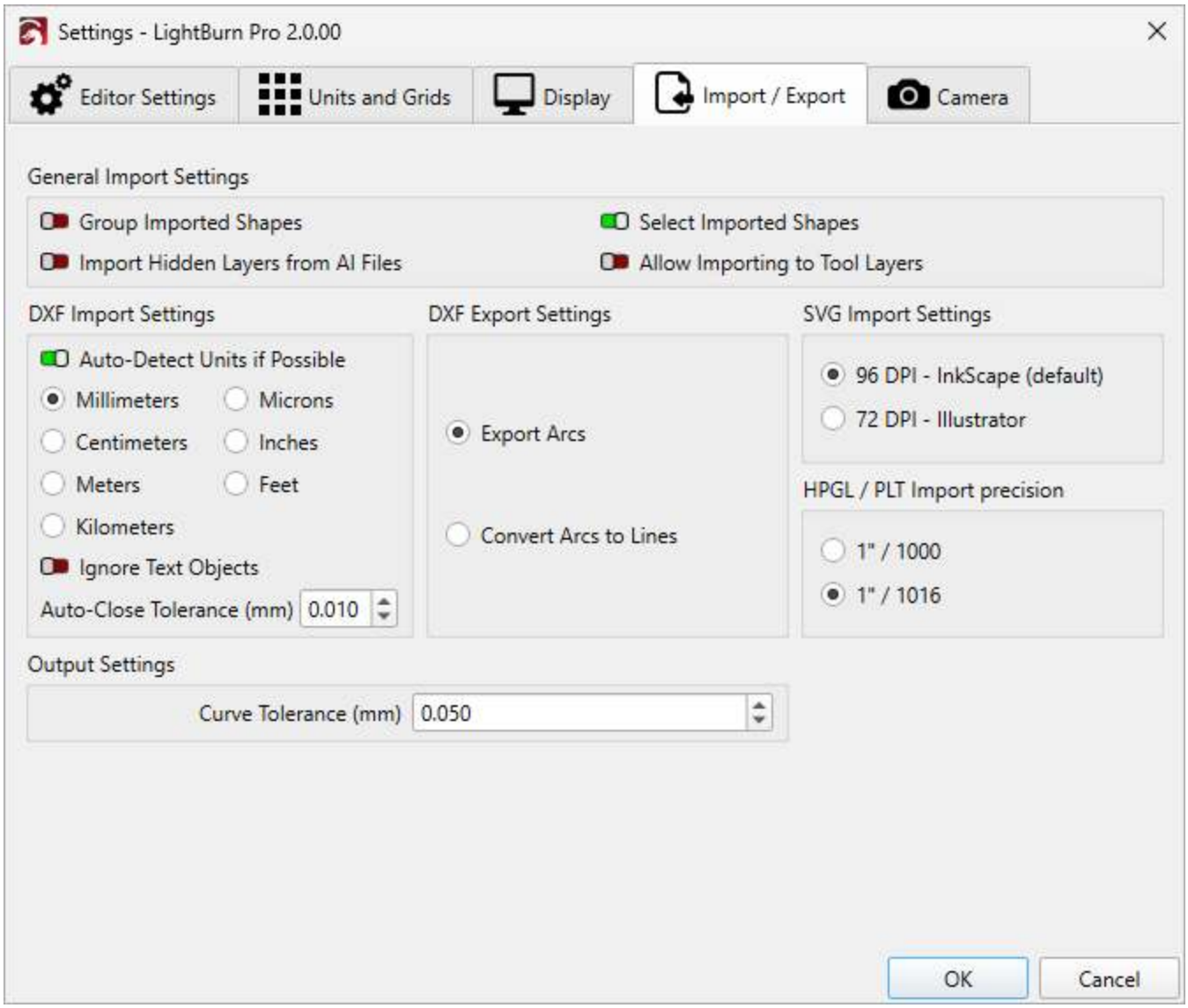
Adjust the slider to choose between **Smallest**, **Smaller**, **Normal**, **Larger**, **Large**, **Very Large**, and **Largest**.

> **Warning**
>
> Setting this slider too high may result in clipping of UI elements. If you scale icons up or down such that you cannot reach the menu items to re-open the **Settings** window and shrink them, use the method listed here to reset LightBurn.

Use Dark Background

Shows the Workspace using a dark color scheme.

Import / Export



DXF Export Settings

When exporting in DXF format, choose whether to **Export Arcs** or **Convert Arcs to Lines**.

When Convert Arcs to Lines is selected, arcs in your LightBurn designs will be exported as a series of small line segements.

DXF Import Settings

Enable **Auto-detect units if possible** to have LightBurn automatically detect the units used to produce the DXF, if it can.

Select the appropriate unit of measurement for your DXF if the units are not contained in the file, or the DXF may import at an incorrect scale.

Auto-close tolerance (mm) determines how close together imported nodes must be for LightBurn to automatically close them, placing them on a shared path.

Ignore Text Obejcts ignores text objects included in a DXF file. This can be useful for leaving out dimensions and other notes and only importing relevant shapes.

Allow importing to Tool layers

Enables importing graphics directly onto Tool layers in LightBurn.

Group imported shapes

Automatically Groups shapes imported from a single file together, so they don't get scattered in a complex design.

HPGL / PLT Import precision

Determines the precision of files imported from HGPL or PLT format.

Import hidden layers from AI files

Enables importation of layers hidden in the source file, when importing from AI (Adobe Illustrator) files.

Output Settings

Curve Tolerance specifies the maximum amount of error allowed when projects are output to your laser. The *lower* the value, the more accurate the curve will be. A value of 0 would be "perfect", but would create very dense data, as some lasers can only process line segments. Most users will be fine leaving this at the default value of 0.05 mm.

Technical Details

In the above image, the blue curve between the two points is the ideal shape. The black line is a straight line between them, and the red line shows the error (how far the line is from the curve). LightBurn measures this error, and if it's equal to or lower than the Curve Tolerance value, it outputs the straight line. If not, the curve is subdivided into two linear segments and the process repeats with each new segment. Those segments are shown below in violet, along with their new error values. You can see that the two new lines do a much better job of approximating the original curve.

Most people will probably never need to change this — the default is 0.05 mm, which is about ½ the width of a typical beam. Note that this is the *maximum* error value allowed, typical output will be better than this, and this only affects curves, not straight lines or vertices — which are exact.

Select imported shapes

Automatically selects shapes upon importing them.

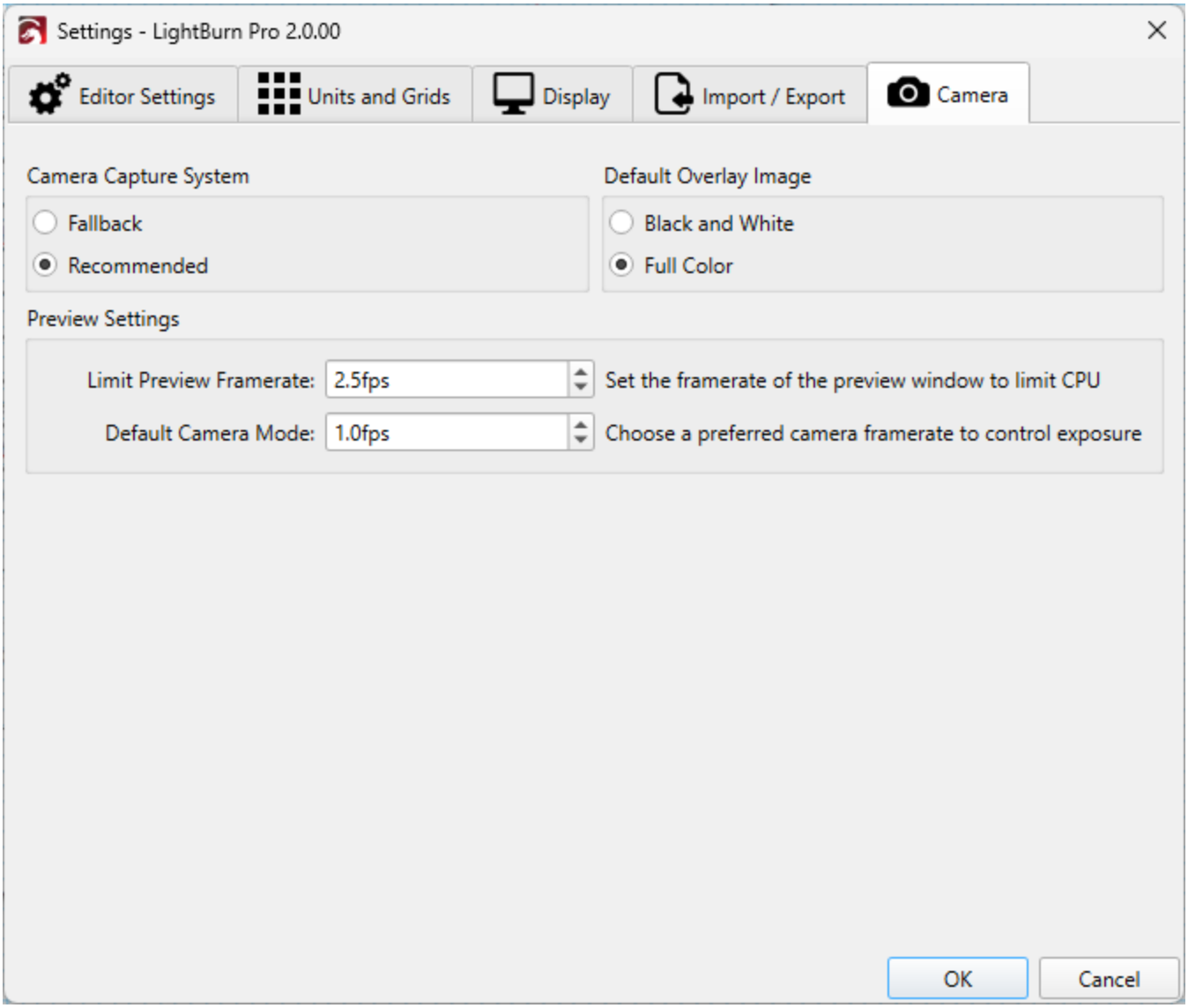
SVG Import Settings

Select whether to import SVGs at:

- **96 DPI** — the default for Inkscape
- **72 DPI** — the default for Adobe Illustrator

If your SVGs import at the incorrect scale, try the alternate setting to the one you currently have selected.

Camera



Camera Capture System

Windows Only

For most users, the default **Recommended** setting should work. If you are having trouble accessing your camera, try the **Fallback** option for an alternate camera capture method.

Default Overlay Image

Select whether to show overlay captures from your camera in **Full Color** or **Black and White**.

Limit Preview Framerate

Sets the limit of the framerate of the preview image in the Camera Control Window. Lower this setting to improve CPU performance.

Default Camera Mode

Sets the limit of the framerate to use when the camera captures an overlay. Lower this setting to control exposure.

preferences settings migration settings-and-preferences

5.7.3 Managing Preferences

The **Preferences** submenu provides several tools to manage your LightBurn Preferences. Access the Preferences submenu by going to File → **Preferences**. For information about adjusting Preferences themselves, see Settings/Preferences.

Importing and Exporting Preferences

The following tools are useful for backing up, restoring, saving, importing, and migrating LightBurn Preferences between computers.

> **Tip**
>
> User Bundles streamline the process of migrating between computers, allowing you to export not only your Preferences, but also your Custom Hotkeys, Material Test Presets, Image Presets, Devices, Material Libraries, and Art Libraries, all in one bundle.

Import/Export Prefs

The **Export Prefs** command allows you to save a copy of your LightBurn Preferences as a `.lbprefs` file. You can import this file to another LightBurn installation using the **Import Prefs** command.

Open Prefs Folder

The **Open Prefs Folder** command opens the folder containing your LightBurn Preferences.

Load Prefs Backup

The **Load Prefs Backup** command allows you to import preferences from a timestamped list of automatic backups. Click a backup in the list to see the list of Devices available in that backup, on the right side of the window.

Click **Load** to restore the settings from the selected backup, or **Cancel** to close the window and maintain your current settings.

Edit Hotkeys

Opens the Hotkey Editor window, where you can customize keyboard shortcuts.

Related Topics

- LightBurn Migration
- Settings/Preferences
- User Bundles
- Hotkey Editor

settings migration

5.7.4 User Bundles

Quick Reference: User Bundles

Groups and exports LightBurn data for migration to a new computer.

Location

File → Bundles

User Bundles simplify the process of migrating LightBurn between computers. Go to File → **Bundles** → **Export Bundle** to create a bundle, and import a bundle by dragging the `.lbzip` file into the LightBurn Main Window or using **File** → **Bundles** → **Import Bundle**.

A bundle can include any of the following. You can export everything, or select only the components you want to include:

- LightBurn Settings
- Custom Hotkeys

- Material Test Presets
- Image Presets
- Devices
- Material Libraries
- Art Libraries

It's important to keep in mind that this list *does not* include your project files. If you want these available on your new computer, be sure to copy or move them separately.

Working With Bundles

Export Bundle

1. In an existing and already configured LightBurn installation, go to **File** → **Bundles** → **Export Bundle**.
2. Make sure that all components of the current installation that you want to include are selected and click **Export**. Save the file somewhere you can find it again easily.

Import Bundle

1. Move the `.lbzip` file created by **Export Bundle** to the new computer.
2. Open LightBurn on the new computer. Go to File → **Bundles** → **Import Bundle** and select the file. Click **Okay**.
3. Make sure that all components you want to import are selected, and uncheck any components you don't want to import. Components that are already detected on the computer will be grayed out and unavailable, with some exceptions:
   - If you choose to a import a Device that conflicts with one that already exists, a duplicate will be created, and the existing profile preserved.
   - If the new computer has an existing Material Library or Art Library with the same name but different contents as the one contained in the bundle, a new copy of the library will be created, without overwriting the original.
4. Click **Import** to complete the process.

> **Tip**
>
> You can also import a bundle by dragging the `.lbzip` file into LightBurn.

Related Topics

- Migration Guide
- Managing Preferences

hotkeys preferences

5.7.5 Edit Hotkeys

Use the **Hotkey Editor** to customize LightBurn's hotkeys. From this window, you can add new keyboard shortcuts and edit or delete existing ones. Access the Hotkey Editor by going to **File** → **Preferences** → **Edit Hotkeys**.

Using the Hotkey Editor

To customize hotkeys:

1. Find the command you want to modify using the categories on the left or the search bar at the top of the window.
2. Select the command.
3. Click in the **Shortcut** text box.
4. Type the new hotkey, or press **Clear** to erase the hotkey.
5. Click **OK** to save your changes when you're finished.

From this window, you can also use **Reset All** to return hotkeys to their defaults, or use the **Export** and **Import** buttons to back up your custom hotkeys or restore a backup. Custom hotkeys can also be imported and exported as part of a User Bundle.

Related Topics

- Settings/Preferences
- User Bundles

troubleshooting ui workflow

5.7.6 Reset to Default Layout

Reset to Default Layout restores the layout of the full LightBurn window to the same format it was in when you first installed and opened LightBurn. If you've made lots of changes to your layout that you want to reverse all at once, or you've lost sight of the Laser Window, Cuts / Layers Window, Color Palette, or any other default windows or toolbars, use this option to get them back.

Resetting the layout doesn't reset anything else — your preferences, devices, and libraries are all preserved.

Go to Window → **Reset to Default Layout** to re-open and re-dock all default windows in their original order, while closing any that are not visible by default.

Holding ⇧ Shift while clicking to open LightBurn will also reset the layout.

Related Topics

- Workspace
- Main Window
- Customizing the LightBurn Window
- Reset to Default Settings

5.8 Help and Software Questions

license-management

5.8.1 Check for Updates

Check for Updates checks whether there is a more recent version of LightBurn available than the version currently running, and whether it was released within your license's valid update period. If a valid newer version is available, you can begin downloading it from the Check for Updates dialog window.

Check for Updates Responses

Go to Help → **Check for Updates** to tell LightBurn to check for available updates. There are three possible responses.

Version Up to Date

The currently running version is up to date. No further action is required.

Newer Version Available

A newer version is available. Click **Yes** to automatically begin downloading the newer version. Click **No** to remain on the current version.

License Expired

A newer version is available, but your license has expired. To use the newest version, you must renew your license. You will be able to continue receiving updates for one year after you renew your license.

> **Note**
>
> If you choose not to renew, you will always be able to continue using the most recent version of LightBurn that was released within your license's valid update period.

Related Topics

- How the License Works
- Install LightBurn

UI help-menu help version build-date hotkeys keyboard-shortcuts help help-and-notes

5.8.2 Help and Notes

Open the **Help and Notes** window by going to Help → **About**, Help → **Quick Help and Notes**, or pressing F1.

This window has three tabs:

- **Hotkeys** summarizes some of the most frequently used mouse and keyboard shortcuts. See Hotkey Editor for information on setting custom hotkeys.
- **Usage** contains tips to help you get started.
- **About** contains information about the version of LightBurn installed on your computer.

Related Topics

- Help Menu

license-management trial activation

5.8.3 License Management

If your LightBurn installation has not been activated, you'll see the **License Page** as soon as you open LightBurn. From this page, you can:

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

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

Figure 1: Left: The License Page before activation

Right: The License Page after activation

Activate Trial

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

Extend Trial

Click **Extend Trial** to automatically extend your trial period. You can extend your trial up to 3 times, for an additional 15 days each time. Trial keys over a year old are extended for 30 days, but may only be eligible for a single auto-extension.

Activate License

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

Use Proxy Server

See System Locked and Floating Licenses: Network Restrictions for information on connecting to LightBurn's licensing server through a proxy.

Troubleshooting

If you receive an error message when trying to activate your license, see Troubleshooting: License Activation and Management.

Request Offline Activation and Deactivation

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

Deactivate License

Click **Deactivate License** to deactivate LightBurn on your computer, freeing up an activation to be used on another computer.

See our License Management Guide for information on deactivating a computer that you no longer have access to.

After Activation Information

License Expiration

After you've activated your license, you'll see the number of days remaining on your license at the top of the **License Page**.

After your key has expired, you'll still be able to use the last version of LightBurn released before it expired forever, but you'll need to Renew your key in order to receive future updates.

Devices Supported

Beneath the **Deactivate License** button, you'll see the list of device types supported by your key. To add support for new device types to your key, see our website.

5.8.4 Enable Debug Log

Use **Enable Debug Log** to begin recording a log saved in the **My Documents** folder on Windows or **Documents** on Mac. You can send a Debug Log to LightBurn Support to aid in troubleshooting or bug fixing.

Enabling and Disabling the Debug Log

Go to Help → **Enable Debug Log** to begin recording a log of the actions you take in LightBurn. A check mark will appear next to it when it's enabled, and logging will continue until you select Enable Debug Log again to disable it, or restart LightBurn.

Figure 1: No check mark — Debug Log not enabled

Figure 1: Check mark — the Debug Log is enabled

The Debug Log will automatically save to **My Documents** on Windows or **Documents** on Mac, with the file name `LightBurnLog.txt`.

The Debug Log is cumulative — each time you use Enable Debug Log it will append to any existing log, so it's a good idea to delete it after you're finished and have sent the log to LightBurn Support.

Related Topics

- Generate Support Data
- Get Controller Info
- Troubleshooting

6 Collections

_index

6.1 Collections

Lasers are versatile machines, and what you do with them is up to you. No matter your aim, it's likely LightBurn has a tool to help you achieve it, as long you know where to look. We've assembled a range of tools, features, and resources into collections, organized according to the goals they'll help you accomplish.

Click in the navigation to the left to learn more about a collection you're interested in, or scroll down for quick links to resources contained in each collection.

6.1.1 LightBurn Fundamentals

New to lasers or LightBurn? Everyone's a beginner once, and we know there's a lot to learn — these resources cover first time set up and other fundamental concepts, so you can hit the ground running, and get to making things with your machine.

Learn More

- **Beginner Pathway**
- **Layer Modes**
- **Images vs. Vectors**
- **Open vs. Closed Shapes**
- **How to Invert a Vector Engraving**
- **Speed vs. Power**
- **Coordinates and Job Origin**
- **Laser Types**
- **Customizing the LightBurn Window**

6.1.2 Tips and Tricks

LightBurn is packed with tools that speed up the process of getting from idea to finished product. We've listed some of our most useful learning tools and workflow optimization features below — check them out to become a LightBurn ace.

Learn More

- Tooltips and Topic-Aware Help
- Quick Tip Videos
- Single-Key Align Tool Shortcuts
- Arrow Key Nudging and Modifiers
- Single-Key Rotation Shortcuts
- Tab Key Selection Cycling
- Automatic Guidelines
- Snapping
- Number Pad Jogging
- Galvo Framing: Nudging, Rotating, and Rescaling
- Equation Support in Number Boxes
- Copy and Paste From Other Applications
- Drag and Drop From the File Browser
- Automatic File Backups
- Auto-Start a Job on Send
- Pause and Stop From the Keyboard
- Reset to Default Layout
- Load Preferences Backup
- Reset to Default Settings
- Setting Up a New Computer

6.1.3 Job Time Optimization

The faster your laser finishes one job, the sooner you can start another. These tools will help you speed up your project runtimes, without any loss in quality of the finished product, so you can spend less time waiting and more time making things.

Learn More

- Preview Window Time Estimates
- Line Interval
- Fill Mode Grouping
- Offset Fill Mode
- Flood Fill
- Fast Whitespace Scan

Optimization Settings | Material Test

Material Library | Overscanning

6.1.4 Material Utilization

No one likes it when unusable scraps pile up in their workshop, so the more you can get out of a sheet of acrylic or piece of wood, the better. These tools will help you lay out and arrange graphics so they're close-fitting, directly next to each other, or perfectly positioned for the material you're working with.

Learn More

Grid Array | Docking

Distribute and Move Together | Align Tools

Using a Camera | Nest Selected

Snapping | Move Laser to Selection

Move Selected Objects | Remove Overlapping Lines

6.1.5 Batch Production

Once you've mastered the craft of making one thing really well, you're going to want to make many more of that thing really well. Use these tools to lay out copies of your design, or set your laser up for several runs in succession. If you're a small business owner with orders to fill, these features will help you scale up and expedite your production process.

Learn More

Grid Array | Virtual Array

Variable Text | Bar Codes and QR Codes

- Repeat Marking
- Print and Cut
- Feeder Setup
- Rotary Mode

6.1.6 Design Tools

Looking to get creative? LightBurn contains a suite of tools for designing projects from scratch. If you have a background in other design software, many of these tools may be familiar to you — instead of bouncing between programs, you can keep all your laser-design work under one roof.

Learn More

- Creation Toolbar
- Transform Controls
- Shape Properties Window
- Art Library
- Grouping and Ungrouping
- Lock Shapes
- Tool Layers
- Automatic Guidelines
- Circular Array
- Copy Along Path
- Apply Path to Text
- Creative Uses for Advanced Cut Settings

6.1.7 Getting a Design Laser-Ready

So you've imported a design into LightBurn that wasn't made with laser engraving in mind, and it's going to take some work to get it ready to go. Don't worry — the tools below are up to the job and then some.

Learn More

- Preview
- View Style
- Delete Duplicates
- Boolean Tools

- Trim Shapes
- Edit Nodes
- Convert to Path
- Close Path
- Close Selected Paths With Tolerance
- Auto-Join Selected Shapes
- Optimize Selected Shapes
- Resize Slots
- Kerf Offset
- Measuring Kerf Width

6.1.8 Working With Images

Engraving images is one of the coolest things your laser can do, but it's also one of the hardest processes to get just right. Check out the following pages to learn the basics of image engraving with LightBurn, along with some advanced techniques for when you're a seasoned pro.

Learn More

- Image Mode
- Images vs. Vectors
- 5 Steps to Perfect Image Engraving
- Dot Width Correction
- Adjust Image
- Apply Mask to Image
- Image Tracing
- Convert to Bitmap

6.1.9 LightBurn for Galvo Lasers

Learn More

- Galvo Driver Installation
- Galvo Device Profile Setup
- Galvo Lens Correction
- Changing a Galvo Laser Lens

- Timing Settings
- IO Port Settings
- First Project Video Guide
- Galvo Framing
- Using a Rotary With a Galvo Laser
- Cylinder Correction
- 3D Sliced Engraving
- Glossary of Galvo Terminology
- EZCAD Hatch Quick Translation
- Anatomy of a Galvo
- Galvo Troubleshooting and FAQ

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6.2 LightBurn Fundamentals

New to lasers or LightBurn? Everyone's a beginner once, and we know there's a lot to learn — these resources cover first time set up and other fundamental concepts, so you can hit the ground running, and get to making things with your machine.

6.2.1 Beginner Pathway

We created this guide to get you going with the essential concepts you need to know in order to use LightBurn and your laser, starting with installation and finishing with a step-by-step first project that puts the concepts we covered into action.

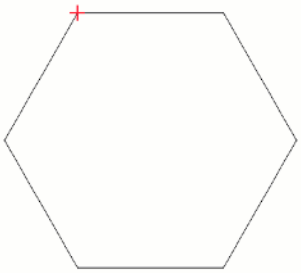
At the bottom of each page you'll see a button to direct you to the next step in the process, or return you to the previous page if you need a refresher. You can also jump ahead, or back, using the navigation to the left, but we don't recommend skipping steps unless you're really sure you have a concept down.

Learn More

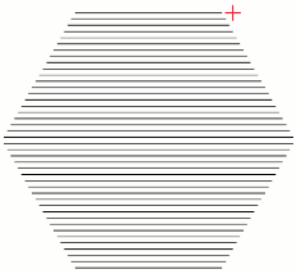
6.2.2 Layer Modes

In LightBurn, there are four **Layer Modes** that determine how your laser will cut or engrave graphics in your design. This page explains the effect and purpose of each type of Layer Mode.

Learn More



Line Mode



Fill Mode

Offset Fill Mode

Image Mode

6.2.3 Images vs. Vectors

Understanding the difference between **images** and **vectors** is essential for creating and editing custom projects. It influences the tools and methods used in LightBurn, as well as the settings, speed, and quality of jobs.

Learn More

Images	Vectors
Images are made up of pixels — tiny blocks of color in a grid. Sometimes called bitmaps or rasters, Images include digital photographs, flatbed scans, digital drawings, and computer-generated renders.	**Vectors** are essentially lines made of mathematical formulas. No matter how far you zoom in on a vector it will always be perfect quality, so it's a great way to make logos and graphics.

6.2.4 Open vs. Closed Shapes

All shapes in LightBurn are made up of lines, curves, and nodes. Sometimes those nodes are connecting points between lines or curves, and sometimes they represent the start or end point of a segment or sequence of segments.

A shape is *closed* when it is a complete, continuous loop whose start and end points are the same. When a shape's start and end points are different, it is *open*.

Some functions require LightBurn to determine the inside and outside of a shape, and in order to make that determination the shape must be closed.

Learn More

6.2.5 How to Invert a Vector Engraving

To invert a vector engraving, so that the opposite of whatever area is currently set to be engraved is engraved instead, you need to add an outline around it, and make sure the outline is set to the same layer as the original vector graphic.

Learn More

6.2.6 Speed vs. Power

Understanding the relationship between **Speed** and **Power** is an essential part of being able to produce high quality cuts and engravings, as well as optimizing your settings to finish jobs faster.

Learn More

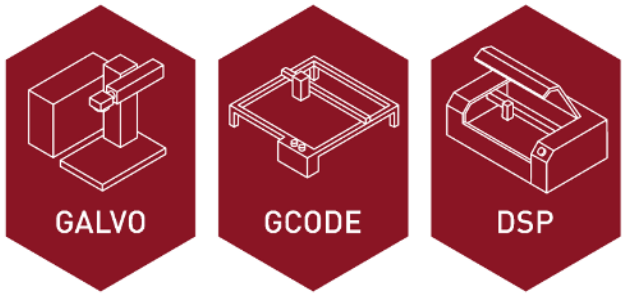
6.2.7 Coordinates and Job Origin

This page covers a fundamental concept in the world of lasering: your laser has a work area — the bounds within which it can cut or engrave graphics — how do you tell it exactly where to do that for any given project?

Learn More

6.2.8 Laser Types

There is a diverse array of laser cuttting and engraving machines, defined by various characteristics. These characteristics — and how they interact with each other — dictate the qualities of results, safety, speed, and ease-of-use for that machine.



Learn More

6.2.9 Customizing the LightBurn Window

The LightBurn layout is highly customizable — you can choose which windows and toolbars to expose and hide, or undock, move, and re-dock them to a location other than their default position.

Learn More

_collections

6.3 Tips and Tricks

LightBurn is packed with tools that speed up the process of getting from idea to finished product. We've listed some of our most useful learning tools and workflow optimization features below — check them out to become a LightBurn ace.

6.3.1 Tooltips and Topic-Aware Help

To help users learn how to use LightBurn, we've included **Tooltips** and a **Topic-Aware Help** feature in the software.

Tooltips are brief descriptions of the action a tool performs. To reveal a Tooltip, hover your cursor over anything you'd like to learn more about.

When you press F1 while hovering over a tool, LightBurn's Topic-Aware Help function launches the relevant documentation page in your default web browser.

Note

If you're using a Mac, hold the Fn key while pressing F1 .

Learn More

6.3.2 Quick Tip Videos

Check out our YouTube channel to see dozens of short videos with tips and tricks for using LightBurn effectively.

We're always producing new videos with time-saving tips, so be sure to subscribe while you're there so you never miss out.

Visit Our Channel

6.3.3 Single-Key Align Tool Shortcuts

You can perform most of the Align commands with single-key shortcuts when the **Edit Window** (Workspace) — the area where you create and edit graphics — is in active focus.

What does it mean for a window to be in focus?

There are several Windows and Toolbars in LightBurn that accept user input — when a window is clicked on, it is in focus and accepting input.

If a window other than the Edit Window is in focus, click anywhere in the Workspace to bring it into focus. Selecting objects in the Workspace will also bring it into focus.

Align Option	Icon	Action	Hotkey
Align Vertical Centers		Aligns selected objects along their vertical centers.	C
Align Horizontal Centers		Aligns selected objects along their horizontal centers.	E
Align Left		Aligns selected objects along their left edges.	L
Align Right		Aligns selected objects along their right edges.	R
Align Bottom		Aligns selected objects along their bottom edges.	B
Align Top		Aligns selected objects along their top edges.	T

Learn More

6.3.4 Arrow Key Nudging Modifiers

You can use your keyboard's arrow keys to move objects in your Workspace by set increments.

These hotkeys only work when you have objects selected and the **Edit Window** (Workspace) — the area where you create and edit graphics — is in focus.

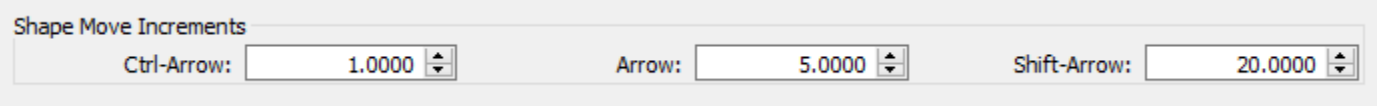
What does it mean for a window to be in focus?

There are several Windows and Toolbars in LightBurn that accept user input — when a window is clicked on, it is in focus and accepting input.

If a window other than the Edit Window is in focus, click anywhere in the Workspace to bring it into focus. Selecting objects in the Workspace will also bring it into focus.

- The `← Left`, `→ Right`, `↑ Up`, and `↓ Down` arrow keys nudge your selection by **5 mm**, by default.
- Hold `^ Ctrl` / `⌘ Cmd` while pressing an arrow key to nudge your selection **1 mm**, by default.
- Hold `⇧ Shift` while pressing an arrow key to nudge your selection **20 mm**, by default.
- Hold `^ Ctrl` / `⌘ Cmd` + `⇧ Shift` while pressing an arrow key to nudge your selection **0.1mm**, by default. This value is always 1/10th of the `^ Ctrl` / `⌘ Cmd` nudge increment.

You can adjust the nudge distance of each arrow key and modifier in the **Units and Grids** tab of the Settings window, under Shape Move Increments.



Learn More

6.3.5 Single-Key Rotation Shortcuts

You can rotate objects by set increments using hotkeys.

These hotkeys only work when you have objects selected and the **Edit Window** (Workspace) — the area where you create and edit graphics — is in focus.

What does it mean for a window to be in focus?

There are several Windows and Toolbars in LightBurn that accept user input — when a window is clicked on, it is in focus and accepting input.

If a window other than the Edit Window is in focus, click anywhere in the Workspace to bring it into focus. Selecting objects in the Workspace will also bring it into focus.

Action	Windows	macOS
Rotate 90° clockwise	.	.
Rotate 90° counterclockwise	,	,
Rotate 45° clockwise	⇧ Shift + .	⇧ Shift + .
Rotate 45° counterlockwise	⇧ Shift + ,	⇧ Shift + ,
Rotate 15° clockwise	^ Ctrl + .	⌘ Cmd + .
Rotate 15° counterclockwise	^ Ctrl + ,	⌘ Cmd + ,
Rotate 5° clockwise	^ Ctrl + ⇧ Shift + .	n/a
Rotate 5° counterclockwise	^ Ctrl + ⇧ Shift + ,	n/a

Learn More

6.3.6 Tab Key Selection Cycling

Press Tab ⇥ to cycle your selection sequentially through objects or Grouped objects in your **Workspace**. Press both Tab ⇥ and ⇧ Shift to cycle in reverse order.

Sequence is determined by the order in which the objects were created.

Learn More

6.3.7 Automatic Guidelines

LightBurn features two types of automatic guidelines to help you align objects relative to one another, or along vertical or horizontal planes.

Alignment Guides are temporary visual guides that indicate when an object's edge or center is aligned to an edge or center of another object in your Workspace.

Draggable Guidelines are persistent lines set to the T1 Tool layer — they are perfectly vertical or horizontal by default, and you can snap other objects to them.

Learn More

6.3.8 Snapping

LightBurn's automatic **Snapping** tools help align objects to other shapes in your Workspace, or to the Workspace grid itself — when you move objects close to a valid location, they will snap to that point.

As you hover your cursor over an object, the icon will change to indicate when it is over a node, line, midpoint, center, or intersection. Use these Snapping points when selecting, moving, or creating objects to ensure exact alignment.

Snapping Point	Icon	Description
Node		The cursor is over any node in a vector graphic, or the corner of an image.
Midpoint		The cursor is over the exact halfway point between two nodes.
Center		The cursor is over the center point of an object.
Intersection		The cursor is over the intersection of two lines.
Line		The cursor is over a line, but not a node, midpoint, or intersection on that line.

Learn More

6.3.9 Number Pad Jogging

You can use a keypad to Jog your laser. In order to use keypad Jogging, you must enable **Numlock** on your keyboard, and the **Edit Window** (Workspace) — the area where you create and edit graphics — must be in focus.

What does it mean for a window to be in focus?

There are several Windows and Toolbars in LightBurn that accept user input — when a window is clicked on, it is in focus and accepting input.

If a window other than the Edit Window is in focus, click anywhere in the Workspace to bring it into focus. Selecting objects in the Workspace will also bring it into focus.

Each press will move your laser by amount entered in the **Distance** field, at the rate set in the **Speed** field. If Continuous Jog is enabled, the laser will Jog until you release the key.

Learn More

6.3.10 Galvo Framing Mode Nudging, Rotating, and Rescaling

If you're using a Galvo laser, you can use your keyboard to nudge, rotate, and rescale graphics while framing.

Key(s)	Result
← Left / → Right / ↑ Up / ↓ Down	Move graphics by 1 mm
⇧ Shift + arrow keys	Move graphics by 5 mm
^ Ctrl + arrow keys	Move graphics by .2 mm
⇞ Page Up	Scale graphics up
⇟ Page Down	Scale graphics down

Key(s)	Result
. (period)	Rotate graphics 15° clockwise
, (comma)	Rotate graphics 15° counter-clockwise
⇧ Shift + . (period)	Rotate graphics 5° clockwise
⇧ Shift + , (comma)	Rotate graphics 5° counter-clockwise
^ Ctrl + . (period)	Rotate graphics 45° clockwise
^ Ctrl + , (comma)	Rotate graphics 45° counter-clockwise

If your keyboard doesn't have ⇞ Page Up or ⇟ Page Down, try using Fn + ↑ Up or Fn + ↓ Down.

Learn More

6.3.11 Equation Support and Automatic Unit Conversion

Each of the fields in the **Numeric Edits Toolbar** accepts equations — enter the appropriate symbols for addition (`+`), subtraction (`-`), multiplication (`*`), or division (`/`) and press `Enter ⏎` to perform a calculation.

The **XPos**, **YPos**, **Width**, and **Height** fields accept units of measurement as well.

If you are working in millimeters, but you want to create a shape that is 5 inches wide, you can enter 5in or 5" into the width field and LightBurn will convert it to millimeters for you.

This works in the opposite direction too — if you're working in inches, you can enter mm or cm and LightBurn will convert the values to inches.

Learn More

6.3.12 Copy and Paste From Other Applications

You can copy text, vector graphics, and images from other design software, and paste them directly into your LightBurn Workspace.

Learn More

6.3.13 Drag and Drop From the File Browser

Drag and drop graphics saved in supported file formats directly from your system's file browser into your LightBurn Workspace.

Learn More

6.3.14 Automatic File Backups

LightBurn automatically saves backups of your projects as you work. Auto-saves are stored in the same location as you saved the original file, with `_backup` appended to their name. If you've never named a file, the auto-save will be in your computer's Documents folder.

You can adjust the frequency of auto-saves in your Settings.

Learn More

6.3.15 Auto-Start a Job on Send

The **Send** button, if your laser supports it, transfers the current job to the laser as a named file, so you can select and run it from the laser's controller.

When you use **Start**, the controller begins running the job as soon as sufficient data has reached the controller. Using Send instead of Start can sometimes help prevent file corruption during transfer.

Hold `⇧ Shift` while clicking Send to have the laser immediately start the job after the entire project has been sent.

> **Note**
>
> The Send option is only available for DSP lasers.

Learn More

6.3.16 Pause and Stop From the Keyboard

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

Learn More

6.3.17 Reset to Default Layout

Reset to Default Layout restores the layout of the full LightBurn window to the same format it was in when you first installed and opened LightBurn. If you've made lots of changes to your layout that you want to reverse all at once, or you've lost sight of the Laser Window, Cuts / Layers Window, Color Palette, or any other default windows or toolbars, use this option to get them back.

Resetting the layout doesn't reset anything else — your preferences, devices, and libraries are all preserved.

Go to Window → **Reset to Default Layout** to re-open and re-dock all default windows in their original order, while closing any that are not visible by default.

Holding `⇧ Shift` while clicking to open LightBurn will also reset the layout.

Learn More

6.3.18 Load Preferences Backup

The **Load Prefs Backup** command allows you to import preferences from a timestamped list of automatic backups. Click a backup in the list to see the list of Devices available in that backup, on the right side of the window.

Click **Load** to restore the settings from the selected backup, or **Cancel** to close the window and maintain your current settings.

Learn More

6.3.19 Reset to Default Settings

Follow these steps to restore LightBurn to the same settings as when you first installed — be aware that you will also lose any device profiles you've created in this process.

> **Warning**
>
> While this process can be helpful in cases where you have a great many incorrect settings and want to start over, we recommend trying Load Prefs Backup or Reset to Default Layout before a full reset.

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

That's it. When you re-run you'll be asked to set up your laser again, and everything will be as new.

6.3.20 Setting Up a New Computer

LightBurn has tools to help you move your settings and devices from an existing installation to a new computer without any hassle.

The migration process starts with exporting a User Bundle from the existing installation and importing it into the new installation.

Learn More

6.3.21 Choosing a Device on Launch

To open LightBurn with a specific device active, launch LightBurn from the command line, using the `--devname` argument to specify a device.

For instance, using PowerShell in Windows, running `.\LightBurn.exe -- devname SmallDiode` would open LightBurn with the "SmallDiode" device selected.

_collections

6.4 Job Time Optimization

The faster your laser finishes one job, the sooner you can start another. These tools will help you speed up your project runtimes, without any loss in quality of the finished product, so you can spend less time waiting and more time making things.

6.4.1 Preview Window Time Estimates

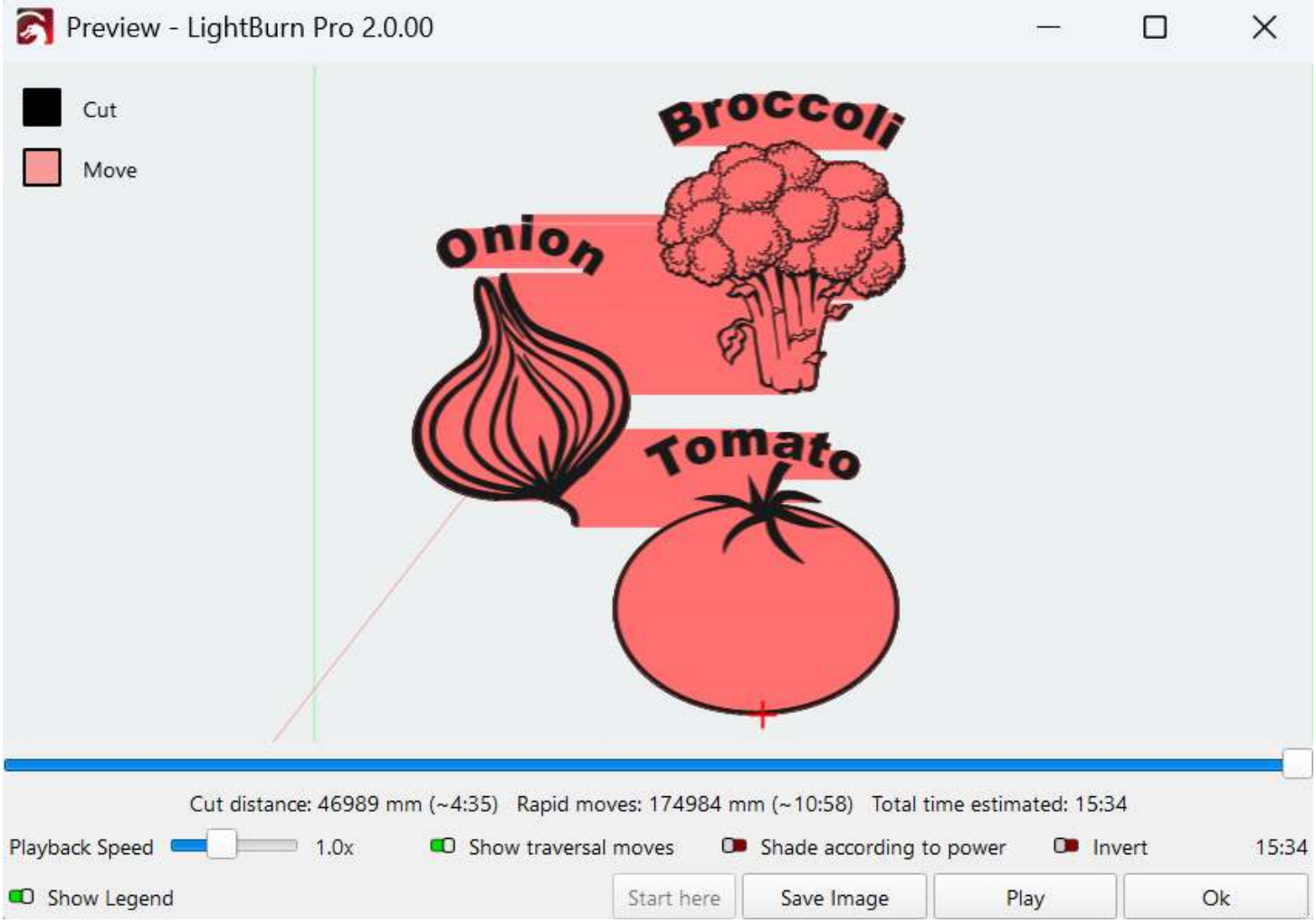
The **Preview** window simulates movements and lasering operations before sending a project to the machine. You can use it to see the order in which cuts will be completed, and check that your laser will do what you expect, but that's not all.

One of the most useful features in the Preview window is the ability to calculate and show the **Total estimated time** it will take your laser to complete your project. As you make changes to optimize your project's runtime, check back in the Preview window to see which settings result in the fastest times.

Learn More

Video: Getting Accurate Time Estimates

The **Additional Settings** tab of **Device Settings** controls the settings used in Preview for simulating a preview and estimating time. Changing these settings will not change anything about how the job actually runs, but can make time estimates more accurate.



6.4.2 Line Interval

Line Interval is the distance between scan lines when raster engraving, making it one of the key settings determining the quality of engravings on Image and Fill Layers. It is mathematically tied to the **Lines per Inch** value.

Lower Line Interval values lead to a greater density of lines. The ideal Line Interval will produce lines that just touch, without overlapping.

Increasing Line Interval to the maximum amount that doesn't leave gaps between lines will lead to reduced runtimes for your projects, with no loss in quality, but you may also need to increase Power to achieve dark engravings.

Use the Interval Test or Material Test to find the optimal Line Interval for your laser and material.

Learn More

6.4.3 Fill Mode Ordering

The Fill Mode order-by options control which shapes are engraved at the same time by the laser. If you run your laser fast, *or* your laser accelerates slowly, it is often most efficient to scan things all at once, so the laser spends most of its time moving at the speed you've chosen, and less time changing direction.

If you are engraving slowly, your laser accelerates fast, or the design contains a lot of blank space, it can be more efficient to fill clusters of close shapes, or to fill the shapes one by one.

Learn More

6.4.4 Offset Fill

Offset Fill Mode is a special type of Fill operaton that tells your laser to etch concentric lines that follow the contour of the shape.

Offset Fill is intended for designs with a lot of empty space within graphics, to cut down on the amount of travel time necessary to fill large, hollow shapes. If that description fits your design, Offset Fill will most likely be much faster than Fill Mode. If that *doesn't* apply to your graphics, it's usually best to use Fill instead of Offset Fill.

Learn More

6.4.5 Flood Fill

Flood Fill calculates an engraving path that attempts to reduce or eliminate travel moves across blank space. It's useful for engraving designs with lots of empty space within graphics, where traveling across the empty portions would otherwise consume a great deal of time.

Flood Fill is an especially useful option for machines that accelerate quickly, and for Galvo lasers in particular.

Learn More

6.4.6 Fast Whitespace Scan

> **Note**
>
> This setting is only available for GCode-based lasers.

This setting boosts your laser's travel speed through blank areas of an image engraving, if the speed you set here is faster than your laser's engraving speed.

This can save a lot of time if you're engraving an image slowly to get a good burn, particularly if there are large blank areas in the image.

Learn More

6.4.7 Optimization Settings

LightBurn's **Cut Planner** controls the order in which your laser cuts or engraves graphics in your project. The **Cut Optimization Settings** window is where you adjust the variables by which the Cut Planner decides on cut order and pathing.

Understanding these settings will help you optimize for both quality and speed. One of the most powerful options is the Remove Overlapping Lines setting, which tells your laser to cut lines that are shared by two graphics just once.

Learn More

6.4.8 Material Test

LightBurn has a built-in test pattern generator to help you find the best settings for your laser and any material you're working with.

To open the **Material Test Generator**, go to the Laser Tools Menu and select **Material Test**.

It will take you a little extra time up front, but identifying the ideal combinations of **Speed**, **Power**, and other settings to produce high quality engravings as quickly as possible will help you maximize efficiency down the line.

Learn More

6.4.9 Material Library

LightBurn's **Material Library** provides a place to store, organize, and quickly re-apply preset Cut Settings for different operations and materials.

Learn More

6.4.10 Overscanning

When your laser engraves graphics set to Fill or Image Mode, the line-by-line, back-and-forth movement across the graphics is sometimes called *scanning*.

Overscanning refers to additional moves added to the beginning and end of each line to give the laser space to speed up before firing, and slow down afterward, which in turn prevents the edges of engraved areas from burning darker than the centers.

To optimize job time it's important to understand the relationship between job **Speed** and Overscanning amount. Because high Speed settings require more distance and time for acceleration and deceleration, increasing Speed does not always lead to a much faster overall job time — in some cases, increasing past a certain point can actually lead to an *increase* in job time, rather than a reduction.

Learn More

_collections

6.5 Material Utilization

No one likes it when unusable scraps pile up in their workshop, so the more you can get out of a sheet of acrylic or piece of wood, the better. These tools will help you lay out and arrange graphics so they're close-fitting, directly next to each other, or perfectly positioned for the material you're working with.

6.5.1 Grid Array

The **Grid Array** tool creates copies of an object (or objects) in regularly spaced rows and columns, and includes options to adjust spacing, mirror the shapes, randomize orientation, and more.

It's a powerful tool for duplicating graphics and creating patterns, but that's not all it can do — you can use the **X/Y Spacing**, **X/Y Shift**, and **Mirror** options individually or in combination with one another to efficiently lay out objects for maximum material utilization.

Learn More

6.5.2 Docking

The **Docking** tool moves selected objects left, right, up, or down, until they meet the edge of the Workspace or another object. Docking can bring objects together or move them in unison, making sure they maintain their relative position to one another.

Learn More

6.5.3 Distribute and Move Together

The **Distribute** tools move selected objects to evenly space them either vertically or horizontally, with options to set the same distance between the centers, or edges of each object.

The **Move Together** tools move selected objects so that they are evenly distributed, and their edges are abutting along horizontal or vertical planes. a **Learn More**

6.5.4 Align Tools

The **Align** tools reposition selected objects to align them along their:

- Top, bottom, left, or right edges
- Vertical or horizontal centers
- Center points

By default, the Align tools move objects in your selection to align them to an edge or center of the last object you added to your selection.

Learn More

6.5.5 Using a Camera

With a properly calibrated and aligned camera, you'll be able to position graphics directly over objects shown in your Workspace Overlay, and they'll be cut or engraved on the objects, using Absolute Coords positioning.

Cameras are especially helpful for getting the most of out of oddly shaped or previously cut materials.

Learn More

6.5.6 Nest Selected

Nesting is method of arranging objects to maximize material usage. LightBurn does not have a built-in nesting feature, but you can use **Nest Selected** to automatically create and export an SVG of selected graphics, upload it to SVGnest.com, and re-import it after it nests the graphics contained in the file.

Learn More

6.5.7 Snapping

LightBurn's automatic **Snapping** tools help align objects to other shapes in your Workspace, or to the Workspace grid itself — when you move objects close to a valid location, they will snap to that point.

As you hover your cursor over an object, the icon will change to indicate when it is over a node, line, midpoint, center, or intersection. Use these Snapping points when selecting, moving, or creating objects to ensure exact alignment.

Snapping Point	Icon	Description
Node		The cursor is over any node in a vector graphic, or the corner of an image.
Midpoint		The cursor is over the exact halfway point between two nodes.
Center		The cursor is over the center point of an object.
Intersection		The cursor is over the intersection of two lines.

Snapping Point	Icon	Description
Line		The cursor is over a line, but not a node, midpoint, or intersection on that line.

Learn More

6.5.8 Move Laser to Selection

The **Move Laser to Selection** tools move your laser in its physical work area to a location that corresponds to a position on your current selection in your LightBurn Workspace.

Use these tools to align your laser and physical objects to the positions of graphics in your LightBurn grid.

> **Warning**
>
> In order to use **Move Laser to Selection**, LightBurn must be connected to your laser, and it must be capable of reliably homing and reporting its position accurately. If the position reported by the laser is inaccurate, using this feature may cause your laser to attempt to travel outside of its physical bounds.

Learn More

6.5.9 Move Selected Objects

The **Move Selected Objects** tools move objects to a corner, midpoint, or center of your Workspace. If you have a Gantry style laser, it can also move objects to the last reported position of your laser head.

Use these tools to rearrange objects in your Workspace, or to align graphics in LightBurn to the location of material placed in your laser's bed, when using Absolute Coordinates positioning.

Learn More

6.5.10 Remove Overlapping Lines

The **Remove Overlapping Lines** setting of the Optimization Settings window tells your laser to cut lines that are shared by two graphics just once.

The **Distance** field to the right of the switch controls how close two lines need to be in order for the Cut Planner to remove one of them when sending the job to your laser.

Learn More

6.5.11 Tool Layers

There are two colors/layers at the end of the palette labeled T1 and T2. These refer to Tool layers — special layers that have no cut parameters and will never be output to the laser.

You can use them to describe the boundaries of your material in your LightBurn Workspace, and position graphics within to maximize usage.

Learn More

_collections

6.6 Batch Production

Once you've mastered the craft of making one thing really well, you're going to want to make many more of that thing really well. Use these tools to lay out copies of your design, or set your laser up for several runs in succession. If you're a small business owner with orders to fill, these features will help you scale up and expedite your production process.

6.6.1 Grid Array

The **Grid Array** tool creates copies of an object (or objects) in regularly spaced rows and columns, and includes options to adjust spacing, mirror the shapes, randomize orientation, and more.

It's one of the fastest tools you can use to duplicate your designs for batch production.

Learn More

6.6.2 Virtual Array

When using the **Grid Array** tool, you can even toggle on an option to create a **Virtual Array**, which allows you to continue modifying your original design, and automatically apply the changes to virtual copies.

You can even adjust your original Grid Array parameters, or add new objects to the array.

Learn More

6.6.3 Variable Text

You can use **Variable Text** to have LightBurn automatically substitute specially formatted expressions with alternate data when you output a project to your laser. LightBurn can substitute those special expressions for serial numbers, date/time stamps, or even your project's cut settings.

But one of the most powerful options is Merge/CSV formatting, which tells LightBurn to swap in entries from a spreadhsheet, making it extremely handy when you're batch-producing personalized products.

Learn More

6.6.4 Barcodes and QR Codes

Create Bar Code generates a Bar Code which stores data that's visible when the Code is scanned. This tool offers a wide range of common Bar Code formats, including QR Codes.

You can even use Bar Codes in combination with Variable Text, so each successive code you engrave stores different data from the last.

Learn More

6.6.5 Repeat Marking

> **Note**
>
> This feature is available for Galvo lasers only.

The **Repeat Marking** tool enables the use of a **Rotating** or **Linear** axis table with Galvo lasers, to move parts past a laser while running repetitions of identical jobs.

By specifying an **Increment** of movement as well as a desired number of repetitions, or **Count**, you can command your laser to mark a design, move an external axis by the specified increment, then run the project again, and repeat that process until it has completed the set number repetitions.

Learn More

6.6.6 Print and Cut

Print and Cut aligns a current project to existing **Target Positions** — also called *registration marks* — in a previously output design.

Print and Cut works by measuring the difference in location, orientation, and scale between two Target Positions in your laser's physical work area and the positions of two corresponding graphics in your LightBurn Workspace.

You can use Print and Cut to align laser output to registration marks that were specially added to a file in order to use them as Target Positions later. In this case, the original file is intended to be printed by one device, and cut out (or around) by a laser later on.

Learn More

6.6.7 Feeder Setup

Auto-feeders are conveyers that feed materials such as fabric or leather into a laser in stepped increments. The laser runs repetitions of the same engraving or cutting job between each increment.

Go to Laser Tools → **Feeder Setup** (`^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `F`) to open the **Auto-feed settings** window, where you can set the parameters by which your auto-feeder will feed material into your laser, and the laser will run repeat jobs.

> **Note**
>
> Feeder Setup is only available for DSP lasers with Ruida or Trocen controllers.

Learn More

6.6.8 Rotary Mode

Rotaries are used to turn cylindrical objects so that their surfaces can be marked by a laser. In order to use your laser with a rotary, you must first establish several important parameters in the **Rotary Setup** window that control the rotary's motion.

> **Info**
>
> If you're working with a tapered object, use the largest end of the taper for the object diameter.

To open Rotary Setup, go to Laser Tools → **Rotary Setup** (`^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `R`), or click the rotary icon in the Modes Toolbar.

Learn More

_collections

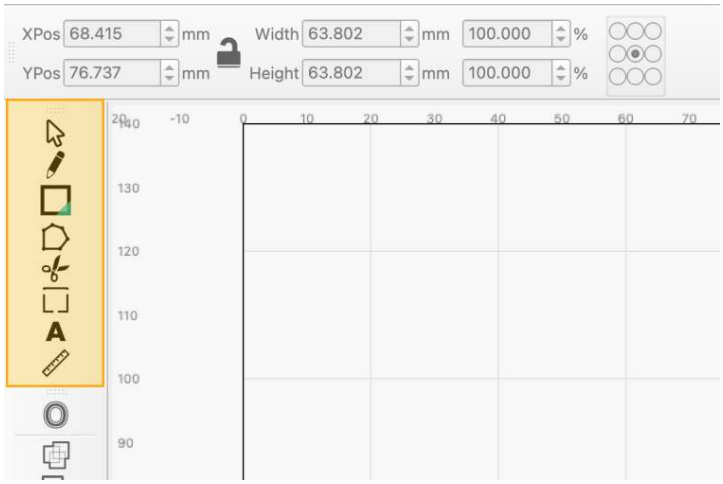
6.7 Design Tools

Looking to get creative? LightBurn contains a suite of tools for designing projects from scratch. If you have a background in other design software, many of these tools may be familiar to you — instead of bouncing between programs, you can keep all your laser-design work under one roof.

6.7.1 Creation Toolbar

The **Creation Toolbar** contains all of LightBurn's most essential design tools, including tools to Draw Lines, create Primary Shapes, Create and Edit Text, Edit Nodes, and more.

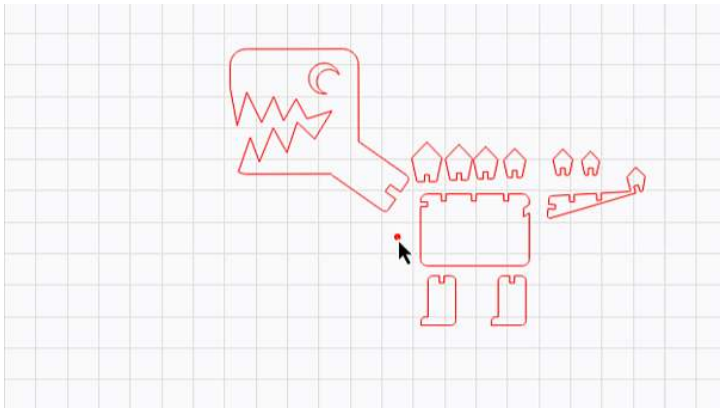
Learn More



6.7.2 Transform Controls

Transform Controls are tools for directly editing selections in your Workspace by clicking and dragging control handles that alter their position, dimensions, orientation, or shape.

Learn More



6.7.3 Shape Properties Window

The **Shape Properties Window** shows editable properties of selected shapes. Those properties vary depending on the object, but include **Power Scale** and **Cut Order Priority** for all objects, as well as **Width** and **Height** for all vectors, number of **Sides** for polygons, **Corner Radius** for rectangles, and **Max Width** for text.

Learn More

6.7.4 Art Library

An **Art Library** provides a way to store artwork so you can quickly access and reuse it in future projects.

You can load multiple Art Libraries at the same time, and separate Libraries are a great way to split artwork up by theme (holidays, birthdays, animals), or purpose (tests, tools, templates, boxes).

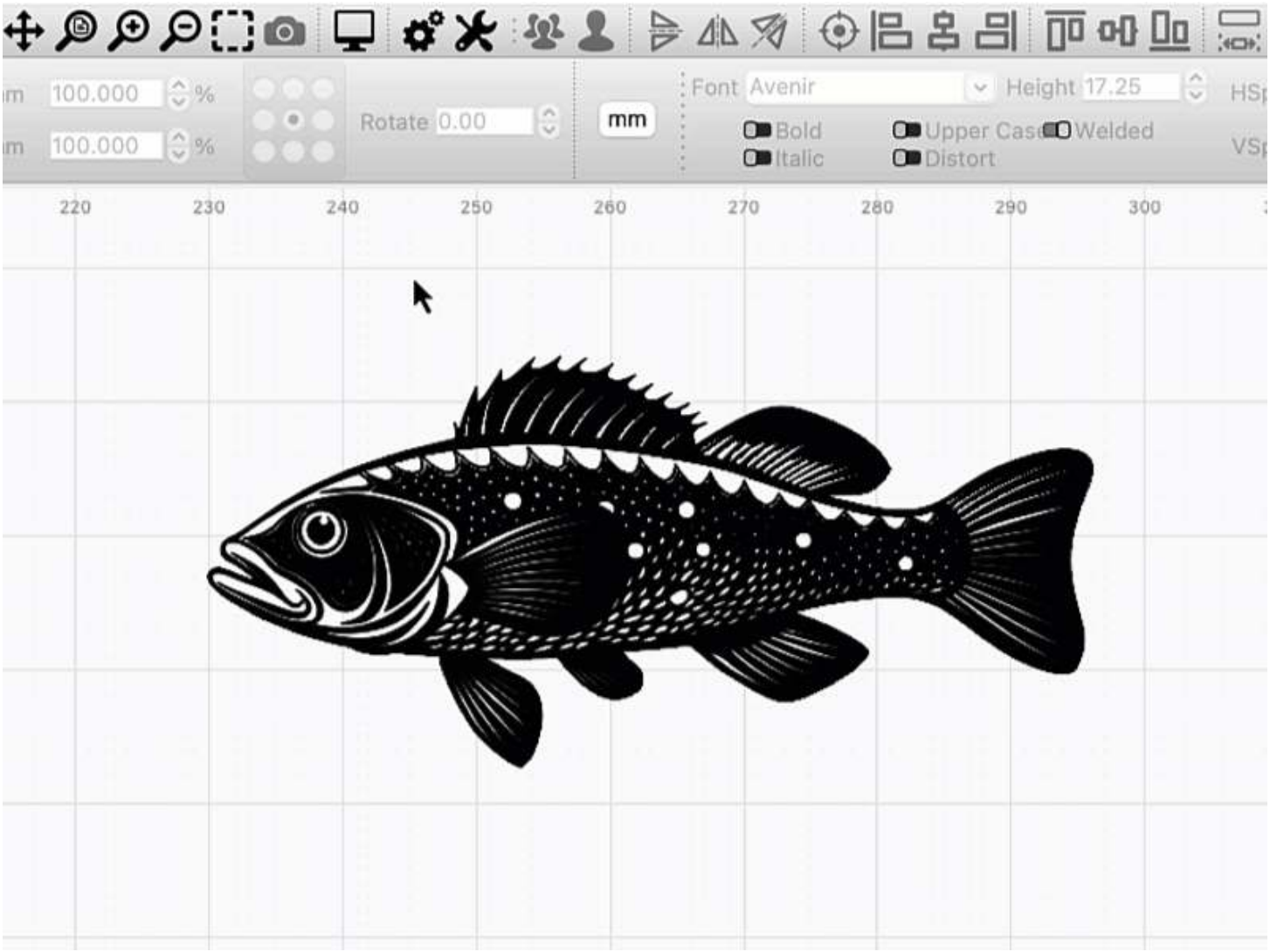
Learn More

6.7.5 Grouping and Ungrouping

The **Group** tool combines collections of objects into single units, and the **Ungroup** tool splits Groups back into the individual objects that make them up.

Normally, all objects are independent of one another, and can be manipulated individually. But it's sometimes helpful to treat a collection of things as a single unit, to make sure they keep their relative position and size when you're moving them around.

Learn More



6.7.6 Lock Shapes

The **Lock Shapes** tool locks selected objects in your design, preventing any form of editing (including moving, resizing, deleting, changing text, and more).

Use Lock Shapes to prevent unintentional design edits, secure graphics used for alignment, preserve templates, and restrict editing in collaborative projects.

Learn More

6.7.7 Tool Layers

There are two colors/layers at the end of the palette labeled **T1** and **T2**. These refer to **Tool** layers — special layers that have no cut parameters and will never be output to the laser.

Use Tool layers to create non-output shapes in your designs. For example you can use them to:

- Describe the boundary of your material
- Create guidelines for aligning shapes
- Apply a Path to Text without the path being output
- Apply a Mask to an Image

Learn More

6.7.8 Automatic Guidelines

LightBurn features two types of automatic guidelines to help you align objects relative to one another, or along vertical or horizontal planes.

Alignment Guides are temporary visual guides that indicate when an object's edge or center is aligned to an edge or center of another object in your Workspace.

Draggable Guidelines are persistent lines set to the T1 Tool layer — they are perfectly vertical or horizontal by default, and you can snap other objects to them.

Learn More

6.7.9 Circular Array

Circular Array arranges multiple copies of an object — or multiple objects — in a radial pattern around either a point in space, or a central object.

Use the Circular Array Tool to:

- Create organic radial patterns such as mandalas and flowers by duplicating simple shapes
- Create even spacing around a circle, such as numerals and markings on a clock face
- Make geometric radiating designs such as starburts or cogs
- Create decorative round frames or borders
- Distribute mounting holes in a circular formation

Learn More

6.7.10 Copy Along Path

Use **Copy Along Path** to create repeated designs that follow a line, curve, or perimeter of a shape, for example:

- Decorative borders along, inside, or outside edges of a shape.
- Repetitive designs that flow along a line such as ropes, vines, and chains.
- Precisely-spaced patterns that follow a vector path, for example measurements on a curved ruler.

Learn More

6.7.11 Apply Path to Text

Apply Path to Text attaches text to a vector object, reshaping it to follow the contour of the chosen path. This tool makes it possible to use existing or custom-created paths to apply more complex curves to text than can be achieved using the text Bend tool.

Learn More

6.7.12 Creative Uses for Advanced Cut Settings

You can use settings to achieve some neat and speedy effects. We explore some of them in this video!

_collections

6.8 Getting a Design Laser-Ready

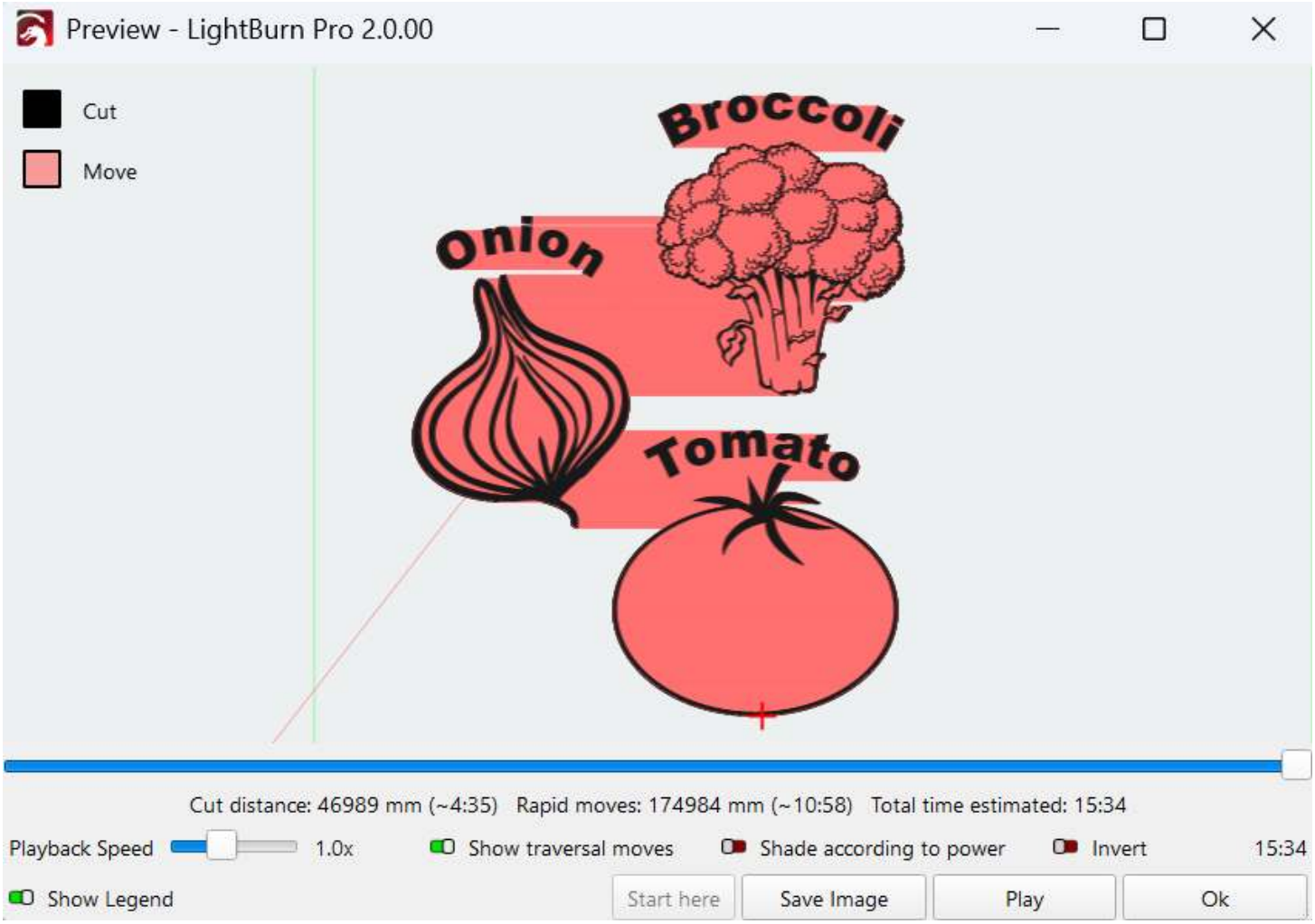
So you've imported a design into LightBurn that wasn't made with laser engraving in mind, and it's going to take some work to get it ready to go. Don't worry — the tools below are up to the job and then some.

6.8.1 Preview

The **Preview** window simulates movements and lasering operations before sending a project to the machine. Because it can be difficult even for experienced users to keep track of which layers are set to which mode, and whether all of their cut settings are in order, we strongly recommend previewing every project, before sending it to your laser.

If what you see here doesn't align with your expectations, you've got some editing to do. Make sure all of your shapes are set to the correct layers, and those layers are set to the correct modes. If you're working with layers set to Fill Mode, make sure they're overlapping only as you intend.

Learn More



6.8.2 View Style

Changing the **View Style** alters the appearance of vector graphics in your Workspace, which can be useful for spotting potential design issues and visualizing the final output from a project.

These options only change the rendering of the objects in your Workspace and do not affect the final work produced by the laser.

Learn More

6.8.3 Delete Duplicates

Delete Duplicates finds and removes duplicated objects in your project. Objects don't need to be selected in order to be identified and deleted, but must be Ungrouped and identical in size, shape, and position.

To use Delete Duplicates, go to Edit → **Delete Duplicates** or press `⎇ Alt` / `⌥ Option` + `D`.

Learn More

6.8.4 Boolean Tools

Use the **Boolean** tools to combine existing shapes (or Grouped shapes) into new or more complex shapes. There are three Boolean options, along with one very similar option, **Weld**.

Learn More

6.8.5 Trim Shapes

Use the **Trim Shapes** tool to cut line segments back to the next intersection with another line.

If a shape does not intersect with any other lines, Trim Shapes deletes the entire shape.

Learn More

6.8.6 Edit Nodes

Edit Nodes allows you to make precise, granular edits to vector paths, by controlling the placement and behavior of **nodes** (points in space, sometimes called *anchor points*) which are linked by straight **lines** or **curves**. The curved lines are described by the length and direction of **handles** (tangents) which appear on one or both nodes at either end of a curve.

Learn More

6.8.7 Convert to Path

Convert to Path transforms built-in shapes created in LightBurn into paths made up of lines, curves, and nodes, that can be edited using the Edit Nodes tool.

The following built-in shapes must be converted to paths in order to edit their lines, curves, and nodes:

- Primary Shapes
- Text Objects
- Bar Codes

Learn More

6.8.8 Close Paths and Auto-Join Shapes

Several functions in LightBurn, including Fill Mode, require shapes that are closed loops, with start and end points that are the same. The following tools help to close shapes that are currently open.

Close Path connects individual shapes with one start and one end point by creating a new line between the points.

Learn More

Close selected paths with tolerance works similarly to Close Path to close shapes with start and end points that are not the same, while providing greater control over how far apart they must be in order to connect them, and how they will be connected.

Learn More

Auto-join selected shapes connects line or curve segments whose start and end nodes are directly on top of (or very near to) one another, but not technically connected. When the segments are connected, they are combined into a single path (a sequence of lines, curves, and nodes).

Auto-Join is most often helpful in cases where you've Imported graphics containing open shapes that you would like to use with a function that requires closed shapes.

To connect start and end nodes using Auto-Join, the nodes must be within .05 mm of one another.

Learn More

6.8.9 Optimize Selected Shapes

The **Optimize Shapes** tool simplifies and smooths selected shapes by reducing the node-count or by fitting them to arcs or lines. This is often useful when importing art created in other software, or cleaning up traced artwork.

Learn More

6.8.10 Resize Slots

Use **Resize Slots** to adjust the dimensions of slots or tabs in selected objects.

You can use Resize Slots to adjust a jointed design that was intended for a material of a different thickness, or to adjust slots or tabs back to their original size after you rescaled an entire design.

This tool works on two main forms of geometry:

- Slots, like those found in 3D puzzles or partitions in trays, somewhat similar to a traditional halved joint or dado.
- Tabs, like a tenon or the fingers in a box joint, usually found in boxes and drawers.

Learn More

6.8.11 Kerf Offset / Measuring Kerf Width

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

Kerf Offset Guide

Follow this guide to learn how to calculate **Kerf Offset** accurately and easily, while using minimal material.

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

Learn More

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6.9 Working With Images

Engraving images is one of the coolest things your laser can do, but it's also one of the hardest processes to get just right. Check out the following pages to learn the basics of image engraving with LightBurn, along with some advanced techniques for when you're a seasoned pro.

6.9.1 Image Mode

Image Mode is a special engraving mode for images, which works similarly to Fill Mode, but allows you to select an additional image processing mode that affects the appearance of the engraving.

Speed, Power, and Line Interval are all crucial settings for achieving great image engravings, but the appropriate settings are heavily dependent on your laser and material.

Learn More

6.9.2 Images vs. Vectors

Understanding the difference between **images** and **vectors** is essential for creating and editing custom projects. It influences the tools and methods used in LightBurn, as well as the settings, speed, and quality of jobs.

Learn More

Images	Vectors
Images are made up of pixels — tiny blocks of color in a grid. Sometimes called bitmaps or rasters, Images include digital photographs, flatbed scans, digital drawings, and computer-generated renders.	**Vectors** are essentially lines made of mathematical formulas. No matter how far you zoom in on a vector it will always be perfect quality, so it's a great way to make logos and graphics.

6.9.3 Five Steps to Perfect Image Engraving

Getting an image to engrave well is a task that often stumps even experienced laser-folk. Often images appear too dark, too light, or "muddy" and lacking detail.

There are many settings that influence the quality of an engraved image, and each one needs to be refined for the overall image to engrave well. In this article we briefly explain the purpose of these settings and, more importantly, how to get them perfect.

Learn More

6.9.4 Line Interval

Line Interval is the distance between scan lines when raster engraving, making it one of the key settings determining the quality of engravings on Image and Fill Layers. It is mathematically tied to the **Lines per Inch** value.

Lower Line Interval values lead to a greater density of lines. The ideal Line Interval will produce lines that just touch, without overlapping.

Increasing Line Interval to the maximum amount that doesn't leave gaps between lines will lead to reduced runtimes for your projects, with no loss in quality, but you may also need to increase Power to achieve dark engravings.

Use the Interval Test or Material Test to find the optimal Line Interval for your laser and material.

Learn More

6.9.5 Dot Width Correction

Dot Width Correction compensates for the thickness of the laser's beam by shortening the length of engraved scan lines. The ideal Dot Width Correction value is about half the total thickness of the laser's beam. Due to varying affects of power output on different materials, this ideal value can vary depending on the material you're working with.

Learn More

6.9.6 Adjust Image

The **Adjust Image** tool streamlines the process of tweaking Image Settings such as **Contrast**, **Brightness**, and **Gamma** while also changing Layer Settings, allowing you to adjust all of these properties from a single window, and see an instant preview of resulting output.

Learn More

6.9.7 Apply Mask to Image

Use **Apply Mask to Image** to hide portions of images that you do not want to engrave, or to divide them into more complex engraving patterns.

By default, image masking doesn't delete the data of the removed part of the image, it just hides it from view and doesn't output those parts to the machine.

Learn More

6.9.8 Image Tracing

Use the Trace Image tool to convert imported images into vector graphics.

This is useful if you want to edit an image that has high contrast or well-defined edges, including logos, silhouettes, cartoons, sketches, and handwriting. You can trace photographs as well, but results will vary based on the composition of the photograph.

Learn More

6.9.9 Convert to Bitmap

Convert to Bitmap turns selected vector graphics into bitmap images. Once a vector graphic has been converted to a bitmap image, it is set to **Image Mode** and can be engraved using a dithered pattern.

Learn More

_collections

6.10 LightBurn for Galvo Lasers

If you're new to using LightBurn with your Galvo laser, you might be feeling like there's a lot to learn — and there is! But don't let that worry you, we've got you covered with resources on getting started with LightBurn, learning what you can do with your Galvo laser, and overcoming common stumbling blocks.

Note

If this is your very first time using LightBurn, we recommend taking a look at our beginner pathway for an introduction to LightBurn's interface and features.

6.10.1 Setting Up Your Galvo Laser

These resources will help you connect your Galvo laser to LightBurn, create a device profile, and adjust settings as needed.

Galvo Driver Installation

If you're using a Galvo laser with Windows, you'll need to make sure the correct driver is installed.

If you have an EZCAD-based laser, this can be achieved by checking the **Install EZCAD2 Driver** box in the LightBurn installer.

If your laser uses a **BSL** control board, you may need to install a different driver by installing your laser's stock software, or searching the files provided by your machine's manufacturer for an executable file named `CypressDriverInstaller.exe` or similar. Both the stock software and driver are usually provided with your laser on a USB drive.

Not sure if your laser has an EZCAD2 or BSL board?

If your laser uses EZCAD2 as its stock software, it has an EZCAD2 control board.

If your laser uses SeaCAD, SimpleCAD, or BSLCAD as its stock software, it most likely has a BSL control board. There are many other variants — consult your laser's manufacturer for further assistance identifying your type of laser.

Learn More

Galvo Device Profile Setup

When adding a Galvo device, LightBurn will ask you to import the machine-specific configuration file from your EZCAD2 or SEACAD installation drive or an existing installation. If you don't have this file, you can also manually configure your laser with settings provided by the manufacturer, or use LightBurn's built-in Lens Calibration tool.

Learn More

Galvo Lens Correction

All Galvo lenses have distortion which must be corrected in order for output from your laser to have an appearance that's true to the design you see in your LightBurn Workspace.

When working with a new laser, you can usually import lens correction values provided by your machine's manufacturer when you first set up your laser with LightBurn.

If your manufacturer didn't provide the necessary file, or you purchase a new lens for a laser you already own, however, you may need to use LightBurn's **Galvo Lens Calibration** wizard to find the appropriate corrections.

To open the Galvo Lens Calibration wizard, go to Laser Tools → **Calibrate Galvo Lens** → **9 Point Correction (Easy)**.

Learn More

Changing a Lens

To ensure optimal performance following a physical lens swap on a Galvo laser, there are several changes and settings you'll need to confirm. Some manufacturers provide the calibration information for your new lens, and we strongly recommend you check their website before proceeding to perform the calibration manually.

Learn More

Timing Settings

Timing settings correct for the physical limitations of your Galvo laser's lenses. Usually these values are provided by your laser's manufacturer, but you may also need to adjust them manually for perfect results.

Jump Settings control how the laser moves between cuts. Each jump causes the mirror to shake, with higher speeds and longer distances increasing the shaking. If you have wobbly lines at the start of a marking move, you may need to increase the delay and/or reduce the speed of jumps.

Delay settings control the delay between starting (or stopping) mirror movement and firing the laser. **Laser On/Off TC** and **End TC** control the delays for the start and end points of a path. **Polygon TC** controls the delays for other corners within a path.

Learn More

Check out this video guide to timing settings made by our friends at the Laser Everything YouTube channel.

IO Port Settings

IO (input/output) Ports control external switches attached to your laser's control board. They can trigger the beginning of a marking operation, activate your laser's red dot for framing, monitor a safety switch to ensure it's engaged before laser fires, and more.

Learn More

6.10.2 First Project Video Guide

There's no better way to learn how to use your laser than to get started with a beginner project. Follow our step-by-step video guide to complete your first project with your Galvo laser.

6.10.3 Galvo Framing

Framing is a function of Galvo lasers that outlines projects in your laser's work area using a red dot light, allowing you to see where your design will output on a physical object.

Click the **Frame** button in the Laser Window or press F1 to open the **Live Framing** window.

> **Note**
>
> You may need to hold the Fn key while pressing F1 to open the Live Framing window.

By default, the Live Framing window will also open when you press the **Start** button in the Laser Window, but you can disable **Require framing before start** in your Device Settings.

Learn More

6.10.4 Using a Rotary With a Galvo Laser

Rotaries are used to turn cylindrical objects so that their surfaces can be marked by a laser. In order to use your laser with a rotary, you must first establish several important parameters in the **Rotary Setup** window that control the rotary's motion.

> **Info**
>
> If you're working with a tapered object, use the largest end of the taper for the object diameter.

To open Rotary Setup, go to Laser Tools → **Rotary Setup** (`^ Ctrl` / `⌘ Cmd` + `⇧ Shift` + `R`), or click the rotary icon in the Modes Toolbar.

Learn More

6.10.5 Cylinder Correction

Available for Galvo lasers only, Cylinder Correction is a special mode that warps the output of your design to correct for distortion caused by engraving cylindrical objects, without using a rotary. EZCAD users may be familiar with this tool by the name ProjectMark.

Open the **Cylinder Correction Setup** window by going to Laser Tools → **Cylinder Correction Setup**, or clicking the Cylinder Correction button in the Modes Toolbar.

Learn More

6.10.6 3D Sliced Engraving

LightBurn's 3D Sliced Image Mode enables Galvo users to create engravings with both visual and physical depth. This 2.5D engraving mode does not require a live Z Axis and can produce highly detailed engravings, but does not offer precise control over the engraving's depth.

Learn More

6.10.7 Terminology and Hardware Information

In many fundamental ways, Galvo lasers work differently from other types of lasers LightBurn supports. Below you'll find information on common terminology, as well as the nuts and bolts of how a Galvo laser works.

Glossary of Galvo Terminology

Find definitions for the common terms you'll come across when you read about working with your Galvo laser.

Learn More

EZCAD Hatch Quick Translation

If you're new to LightBurn but not to Galvo lasers, there's a good chance you've previously worked in EZCAD. This page explains how the hatch-related terms you're familiar with from EZCAD translate over to LightBurn.

Learn More

Anatomy of a Galvo

If you've ever wondered how a Galvo laser works, check out this page.

Learn More

6.10.8 Troubleshooting and Frequently Asked Questions

Find answers to common problems and frequently asked questions related to using a Galvo laser with LightBurn.

Learn More

7 Explainers

_index

Our explainers go into detail about the concepts behind using LightBurn effectively.

LightBurn Cut Settings and EZCAD2 Hatches

How to Invert a Vector Engraving

Images vs. Vectors

Laser Types and Features

Layer Modes

Open vs. Closed Shapes

Overscanning

Steps Per Millimeter

explainer galvo

7.2 About Galvos

7.2.1 Sources

Supported Types of Galvo Lasers

The current types and manufacturers of Galvo laser sources supported are as follows:

- Raycus (RAYCUS)
- JPT (JPT)
- IPG (IPG_YLP / IPG_YLPM)
- MAX (MAX / JPT)
- CO_2
- UV

These are devices that may work at some point in the future, have been communicated to our staff that users would like to use them, but we can't 100% confirm behavior just yet.

- QUANTEL_M20HF
- QUANTEL_M20
- MANLIGHT_PL
- VGEN_YPFL
- EO
- QUANTEL_M20EG
- QUANTEL_M30EG
- IPG_YLP_E
- HFB
- Orion Laser

Fiber

Fiber lasers are incredibly common devices, due to their use for long-distance and high bandwidth networking; fiber lasers power the internet.

They make use of an optical pathway, made of silica glass to guide the light, resulting in a narrow, straight beam that's able to carry an incredible amount of energy and data. For galvo actuated fiber lasers, this means that the beam can move extremely quickly, making small adjustments via actuated mirrors, rather than complex gantry systems.

Due to the beam being formed inside of a solid mechanical apparatus, fiber lasers are considered *solid state* devices, whereas CO_2 laser tubes are generally considered *gas state*.

Step By Step

1. Light is created in a laser diode, a dedicated source that's "pumped" into the fiber optic cable, resulting in them occasionally being referred to as a *pump source*.
2. Pump light is guided into the fiber optic cable. While the fiber optic is able to carry the beam, the cladding (or casing) on the fiber is the reason the beam stays *inside* of the fiber instead of dispersing out of it.
3. Light is amplified inside the laser cavity. As the light passes through this region, the particles rise to a higher energy level, getting caught and excited / relaxed into a singular wavelength of operation. A doped portion of fiber, mixed with certain rare earth elements, makes this possible, reflecting back and forth while doing so inside "Bragg gratings". *This is where it becomes a stimulated emission of radiation.*
4. Laser light of a particular wavelength is created. The specific element(s) used to dope the fiber determine what wavelength the beam becomes.
5. The beam is released and shaped. The light at this point is collimated (straightened), and to produce a usable shape for engraving, marking, or more, lenses and/or beam expanders are used to adjust the collimation.

7.2.2 Q-Switched vs MOPA

These two terms are often used in conjunction, but what does that even *mean*? What's being switched? Why is it a MOPA?

Master Oscillator Power Amplifier (MOPA) lasers allow more timing adjustment than Q-Switched lasers. MOPA lasers allow for separate control of pulse duration and pulse frequency to produce highly accurate and controlled engravings or etchings. The general range of MOPAs can be as low as 2ns or as high as 500ns, allowing highly accurate adjustment of the energy dispersed into the material.

Q-Switched lasers are typically not adjustable in this manner, and operate at a fixed duration, typically between 80ns to 140ns.

7.2.3 Laser Timing Adjustment

Galvo lasers sometimes have granular, but adjustable tuning of when the beam is commanded on, or off, as well as how the mirrors are adjusted. Some of this calibration and adjustment is in Lens Correction, or provided by your laser manufacturer, but the fine tuning for corner approach and speed may need adjustment.

Laser on TC (µs)

When attempting to mark, the physical mirrors of the galvo head must reach the desired speed before they begin marking. This fine tuning allows the user to reduce the burn-in potential during that initial acceleration by adjusting the source timing.

Laser Off TC (µs)

Similarly to the above, when the mirrors of the galvo head must slow down as they attempt to end a marking move, there may be a burn-in effect while slowing down. This setting allows the end timing to be adjusted finely.

End TC (µs)

This setting adjusts how long the laser waits at the end of a series of vectors. Due to the fact the laser will physically lag behind the commanded state as decided by any software, this delay permits adjustment similarly to the Laser Off TC, except only for the end of polygons.

This setting applies to *any* marking move where the laser is turned off after execution.

Polygon TC (µs)

This setting adjusts how long the laser dwells at the end of each segment of a polygon, permitting the laser to settle appropriately, compensating for the same lag as outlined in End TC.

Galvo Advanced

7.3 Anatomy of a Galvo Laser

Note

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- MAX (MAX / JPT)
- CO_2
- (as of 1.2.02) UV

7.3.2 Unsupported

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explainer galvo cut-settings

7.4 LightBurn Cut Settings and EZCAD Hatches

If you're coming from EZCAD2 and having trouble finding hatch settings you're used to, follow this guide to match your usual hatch settings to LightBurn's Fill settings.

If you're not sure how to adjust cut and engraving settings, see the Cut Settings Editor page.

7.4.1 Mark Contour

EZCAD2's "Mark Contour" option can be replicated with LightBurn's Sub-Layers. By creating a Line Sub-Layer and a Fill Sub-Layer, you can achieve the same effect. The Sub-Layers will be cut in the order they appear in the Cut Settings Editor.

7.4.2 Hatch 1, Hatch 2, Hatch 3

EZCAD2 allows for three different hatches on the same geometry. This is equivalent to LightBurn's Sub-Layers.

7.4.1 Cross-Hatch

This functionality is the same between the two programs, and is a checkbox in each.

7.4.2 Hatch Patterns and Settings

Unidirectional hatch & Bidirectional hatch

EZCAD2's bidirectional hatch and unidirectional hatch are the same as the default hatch in LightBurn, with the Bi-directional fill toggle either on or off.

Ring-like hatch / Pyramid Hatch

EZCAD2's ring-like hatch is equivalent to LightBurn's Offset Fill.

Snake Hatch

Snake hatch is equivalent to a regular fill in LightBurn with Flood Fill enabled.

Auto Rotate Hatch Angle

LightBurn's Angle Increment setting is equivalent to EZCAD2's "auto rotate hatch angle".

explainer galvo

7.5 Glossary of Galvo Terminology

Below you'll find definitions of many terms commonly used when working with a Galvo laser.

7.5.1 Galvo

A type of laser apparatus that uses a series of actuated mirrors to reflect the beam of a laser source around at high speeds. This contrasts to gantry style lasers, that move a series of mirrors along a gantry with a lens at the end to focus the beam, or diode lasers that move the laser souce itself.

7.5.2 Source

This is the portion of a Galvo laser responsible for producing the beam itself used for operation. While not a laser tube inherently, laser sources are similar in purpose to the tubes found in CO_2 gantry lasers.

7.5.3 MOPA

Master Oscillator Power Amplifier (MOPA) lasers are a specific class of fiber laser sources that enable pulse duration to be varied (not just pulse energy and frequency as in other sources). This variability enables use cases such as durable colored marking of stainless steels and titanium by pulsing the beam in such a way it anneals the metal.

7.5.4 Tower

This is the portion of Galvo lasers responsible for moving the galvo head up and down, vertically. The tower connects the head to the fiber cable (that carries the beam from the source), and any other apparatus that needs to move with the lens to focus and effectively work on the job.

7.5.5 Framing

Framing allows you to accurately position work. It's an operation that outlines the job in real life on the object/material, but using a lower power, so it doesn't cut/engrave it. It usually requires your laser to be accurately focused.

7.5.6 Frame/Base

This is the portion of a Galvo laser that holds up the tower and ensures it's rigid and won't tip over. It usually has a work table larger than the tower above it for stability.

7.5.7 Cleanup Pass

A final pass, usually at a tighter line width, higher frequency, and a lower power. Done to to clean up soot and debris from more ablative processing.

7.5.8 Focal Point (Waist)

The thinnest part of the (focused) beam, the point at which it is the most in focus. See the Focusing page for more info.

7.5.9 Focal Length

The distance from the optical centre of the lens to the focal point. See the Focusing page for more info.

7.5.10 Depth of Field (Focal Range)

The useable range of the (focused) beam. It appears either side of the focal point, and varies based on various factors including; the focal length of the lense, the material being cut, the power of the laser source, etc. See the Focusing page for more info.

7.5.11 Field Size (Build Volume, Window Size)

These fields describe the maximum area that the lens installed in the Galvo can physically cover when focused. See the Focusing page for more info.

7.5.12 Wobble

Wobble refers to the ability of the beam to rotate about a particular area, imparting more heat to the workpiece and allowing for more material removal.

This feature can be enabled in the Cut Settings Editor on Galvo devices.

explainer fill offset-fill invert

7.6 How to Invert a Vector Engraving

To invert a vector engraving, so that the opposite of whatever area is currently set to be engraved is engraved instead, you need to add an outline around it, and make sure the outline is set to the same layer as the original vector graphic.

7.6.1 How It Works

This behavior is due to the way LightBurn calculates what to engrave when you assign graphics to a layer set to Fill Mode or Offset Fill Mode.

When you assign a closed shape to a layer set to Fill or Offset Fill Mode, LightBurn tells your laser to engrave everything inside that shape.

That calculation changes when you put one closed shape around another. Now, instead of telling your laser to engrave everything inside each shape, LightBurn tells it to engrave only the space between the outlines of both.

The below example shows three different collections of graphics — first in Wireframe View Style, and then, below, in **Filled View Style**. Filled View Style shows the areas of your graphics that will be engraved as a solid color, while Wireframe only shows the graphics' outlines.

Switching View Styles

Press ⎇ Alt / ⌥ Option + ⇧ Shift + W to quickly toggle between Wireframe and Filled View Style.

- The first is the outline of the the letter O. Because this is just a single outline, LightBurn will tell your laser to engrave the entire area inside the outline.
- The second is the letter O with a center ring. Now, because there are two closed shapes set to a shared Fill layer, LightBurn will tell your laser to engrave everything between both.
- In the third, we've put a box around the complete letter O. Because of this new outline, the space that LightBurn considers to be between outlines is flipped, and nothing between the rings of the O will be engraved. Instead, everything between the outer ring and the rectangle, and everything inside the inner ring, will be engraved.

Each additional outline you add around a vector graphic will effectively toggle the area to be engraved, from within certain shapes, to between certain shapes, and so on.

An important note: this behavior only works if the inner and outer shapes are set to the *same* layer — if they're set to *different* layers, LightBurn will tell your laser to engrave the entire area inside the inner shapes, *and* the entire area inside the outer shapes, meaning some areas will be engraved twice.

7.6.2 Adding Outlines

There are several options for adding outlines to graphics.

- The Offset tool can create outlines at a specified distance around your shapes.
- You can use any of the Draw Shapes tools to manually create a new shape around your original graphics.
- Create Rubber-Band Outline creates an outline around your shapes, defined as the shortest possible path that can contain them all, as if a rubber-band were stretched around them.
- You can Duplicate an existing shape, and then increase its size using the Size handle, or in Numeric Edits Toolbar.

explainer layout-and-design

7.7 Images vs. Vectors

Understanding the difference between **images** and **vectors** is essential for creating and editing custom projects. It influences the tools and methods used in LightBurn, as well as the settings, speed, and quality of jobs.

There are two main ways a computer can describe something visually:

Images	Vectors
Images are made up of pixels — tiny blocks of color in a grid. Sometimes called bitmaps or rasters, Images include digital photographs, flatbed scans, digital drawings, and computer-generated renders.	**Vectors** are essentially lines made of mathematical formulas. Thankfully, you don't need to know the math! LightBurn takes care of that behind the scenes, and provides you with a visual way of editing these. No matter how far you zoom in on a vector it will always be perfect quality, so it's a great way to make logos and graphics.

Both Images and Vectors can either be made within LightBurn, or imported from files made in other software. See Importing for more information about file types that are compatible with LightBurn, and read on for more information about images and vectors.

7.7.1 Images

Image Uses and Laser Behavior

Images can only be used for engraving, not cutting. When a laser produces an image, it does so by *scanning* side-to-side across the material surface. As it moves, it can create shading by either switching the beam on and off to form little dots, or by varying the power. Producing an image in this way generally takes a considerable amount of time, as each line is usually a fraction of a millimeter apart, and it takes hundreds of lines to form most images.

Image Appearance and Quality

When an image is used, LightBurn assigns it to a layer set to Image Mode. When selected, images appear encircled by a border in the color of the layer they are assigned to. If you zoom in on an image, or make an image larger, the blocks of color will eventually become noticable, resulting in an undesirable "pixelized" quality.

Image Operations

There are various types of image processing modes, the choice of which has a significant effect on the final result.

7.7.2 Vectors

Vector Uses and Behavior

You can use Vectors to:

- Cut through a material
- Score/mark lines and perimeters
- Engrave areas

To use a vector to cut, score, or make a line or perimeter, you must assign the shapes to a layer set to Line Mode. This tells the laser to trace/follow the paths and shapes of the vector.

Vectors used to engrave an area must be closed shapes and
assigned to a layer set to either Fill or Offset Fill. Engravings are produced in a similar fashion to images — with many lines next to each other — however, there is no variation in power, nor dot-dithering, so the result is a flat color without gradients or shading.

Filling areas is generally much more time consuming than marking or scoring them, so it's a good idea to consider if a design can be produced using Line layers.

Wireframe vs Filled View

By default, Fill Mode layers will appear as outlines, which makes it easier to spot and select vectors that are behind other vectors.

Select a View Style from the Window Menu, or toggle between View Styles by pressing ⎇ Alt / ⌥ Option + ⇧ Shift + W.

Creating and Editing Different Types of Vectors

The most simple form of vectors in LightBurn are **paths**, created using Draw Lines and edited using Edit Nodes. These paths can be open or closed.

LightBurn also offers more intelligent vectors in the form of **built-in shapes**. These have properties that remain editable so long as the object isn't converted to a path. Built-in shapes include Text, Bar Codes and Primary Shapes such as Ellipses, Rectangles, and Polygons.

7.7.3 Converting Between Images and Vectors

There are a few ways to convert graphics between images and vectors. However, these processes are often not required, and may negatively impact quality.

You can turn images into vectors using Trace Image. This is often used by people wishing to engrave "clip art". However, this process results in an estimation of the image, and often the results from using Threshold image processing mode are better. Trace Image is best used when you cut, edit, or scale up an image that is too small to result in a nice engraving at the current size — vectors can be upscaled infinitely without losing quality.

You can turn vectors into images using Convert to Bitmap. This is often used by people wishing to repair a vector that was not well optimized for lasering. However, this conversion process eliminates the ability to scale infinitely and edit the vector directly, so it is usually better to repair the vector.

explainer

7.8 Laser Types

There is a diverse array of laser cuttting and engraving machines, defined by various characteristics. These characteristics — and how they interact with each other — dictate the qualities of results, safety, speed, and ease-of-use for that machine.

7.8.1 How a Laser Project is Made

To understand the parts each of the characteristics play, let's briefly touch on how a project goes from idea to physical product.

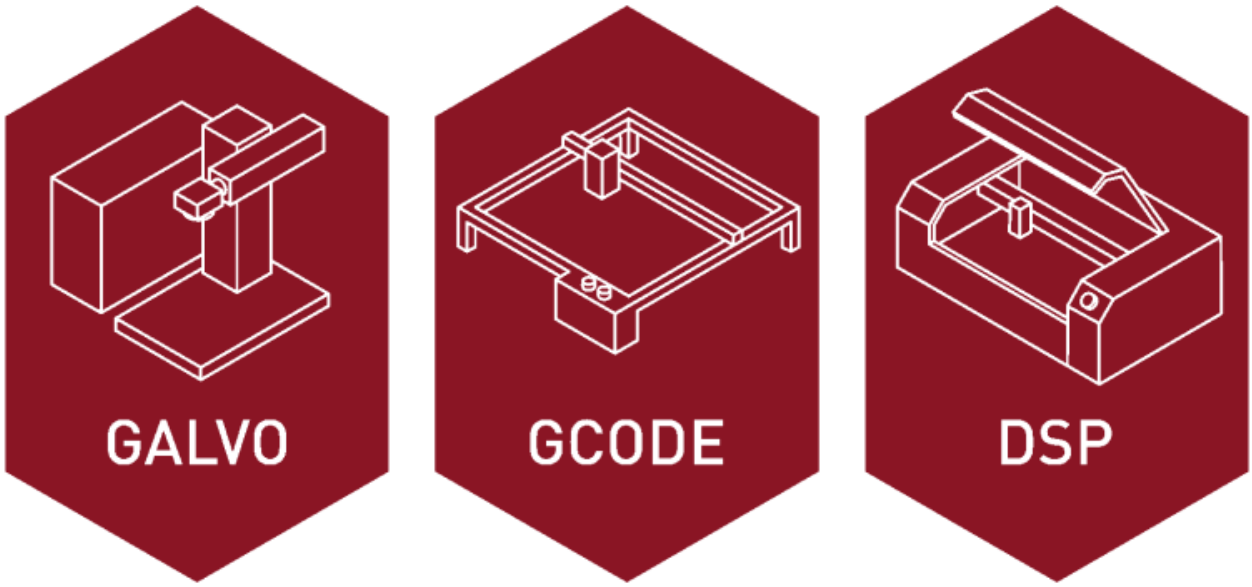
A **design** is created by a user in **design software**, and turned into machine **instructions** (code) through a **control software**.

LightBurn operates as both a design *and* control software.

The instructions are delivered to a computer within the laser machine called a **controller**. The controller translates the instructions into electrical signals that control the machine's **motion system**. The movement of the motion system delivers the laser beam from the **laser source** (where the beam is generated) to the directed locations on the material.

Each part of this process is explored in more detail throughout the rest of this article.

7.8.2 Controllers and Firmware



The controller — and the firmware it runs — determines whether or not a machine is compatible with LightBurn, and what type of license you need.

A controller is essentially a computer within your laser, and the firmware it runs determines the type of instructions it can translate into signals it delivers to the motion system.

LightBurn needs to know what type of firmware your laser's controller is running to know what "language" to speak to the machine. In most cases, LightBurn can automatically identify the firmware if you set up your machine using Find My Laser, but you'll need to be able to identify the controller yourself in order to complete a manual setup.

LightBurn is currently compatible with three main categories of controllers: GCode, DSP, and Galvo.

- To connect to a GCode-based laser, you'll need a LightBurn Core license.
- To connect to a DSP or Galvo laser, you'll need a LightBurn Pro license. LightBurn Pro licenses *also support GCode-based lasers*.

Below is a brief description of each type, as well as a list of common controllers/firmware used by each. If you're not sure what controller or firmware your laser uses, consult your machine's manufacturer, or contact us at support@lightburnsoftware.com.

GCode

Most entry-level diode lasers use GCode-based controllers.

Supported controllers/firmware: GRBL, Smoothieware, Marlin, FluidNC, grblHAL, xTool

DSP

DSP controllers are common in more industrial-grade machines. If your machine is a CO2 laser in a metal case and has an LCD display, it is most likely a DSP model.

Supported controllers: Ruida, Trocen, TopWisdom

Galvo

Galvo lasers use a fixed scanning head mounted to an arm, and project the beam from above. If your laser uses EZCAD2 or SeaCAD as its default software, it is this type of laser.

Supported controllers: EZCAD2, EZCAD2 Lite, BSL

7.8.3 Motion System

The motion system consists of the mechanical components that direct the beam from the laser source to the material. These include parts such as motors, mirrors, lenses, and axes.

The choice of motion system determines which LightBurn tools are available for your machine, as well as the maximum job size, and the speed of the laser.

> **Note**
>
> Many tools in LightBurn are only available for machines with a particular type of motion system.

There are two common forms of motion systems:

- **Gantry motion systems** have frames, wheels, and motors that move a laser head around a work area. Some Gantry lasers use a system of mirrors to reflect a beam from its source, while others hold the laser source and move it around directly. Gantry systems are relatively slow due to the mass of the components moving around, but can have very large working areas.
- **Galvo motion systems** use tiny moving mirrors to bounce the beam to different locations on a large lense, which focuses the beam and points it back down at the work. Because the mirrors are so lightweight, they can bounce the light around at very high speeds, but Galvos are limited by the size of the lense to relatively small jobs.

> **Note**
>
> All Gantry lasers supported by LightBurn have GCode-based or DSP controllers.
>
> *Almost* all Galvo lasers supported by LightBurn use EZCAD2 or BSL controllers and require a LightBurn Pro license. However, there are a limited number of GCode-based Galvo lasers that are compatible with LightBurn Core, and require special setup — consult your laser's manufacturer for more information.

7.8.4 Laser

The laser beam is generated by a source that dictates its power and wavelength.

These properties determine which materials the beam will be able to mark, engrave, or cut through.

Source

- **Diode**: similar to an LED light, a semiconductor is pumped with electrical current to produce light. These are generally lower power, with a very fine focal dot which forms a rectangular shape. These generally make nice engraves, but poor cuts.
- **Diode stack/array**: combines the power of many diodes into one beam, to overcome some of the downsides of single-diode beams.
- **Glass tube**: contains a gas (CO_2) that is excited by a DC current to produce a beam. Is cheaper than a Metal RF tube, but needs water-cooling, wears out quicker, and produces a (comparatively) slow "pulsating" beam which has a wider focal dot, and thus is less suited to engraving. The focal dot is round.
- **Metal RF tube**: contains a gas that is excited by a radio frequency to produce a beam. Is more expensive than a Glass tube, but can be air-cooled, lasts much longer, and produces a more rapid beam-pulse, with a finer focal dot, and is more suited to engraving than Glass tubes. The focal dot is round.
- **Solid State Drive**: Use a solid (e.g. ruby) as the lasing medium, instead of a gas.
- **Fiber**: combines several beams into one using fiber optics, to generate more power output.

Wavelength

The wavelength of the light generated by the source dictates what materials the beam can interact with, or will pass through.

- **Blue Diode** — 400-500 nm: interacts with dark-colored materials such as wood, veg-tan leather, and black acrylic, but struggles with light-colored or transparent materials. Can't interact with metals or glass. Produces dark engravings that are great for photos and images.

- **CO_2 Glass/Metal Tube** — 10600 nm: great for cutting most laserable materials, including wood, veg-tan leather, fabric, plastics, transparent and light-colored materials, as well as engraving glass and some metals, and removing rust.
- **Near Infra Red (IR) Diode** — 750-1400 nm (commonly 1064 nm): mostly used for engraving some metals.
- **Infra Red (IR) Fiber** — 1030-2100 nm: great for engraving most metals, removing rust and oxides from metals, and even cutting some.
- **Ultra Violet (UV) (Solid State Drive)** — 150-400 nm — used for cutting and engraving most materials, including glass.

Power

The power dictates the strength of the beam. Lower powered beams may not be able to cut a material that a higher powered version of the same wavelength can, or may require more passes to achieve the same result (increasing job time).

Generally it's best to purchase the highest-powered laser possible, as you can lower power in your settings, to produce "softer" results, where required.

7.8.5 Connection

The connection is the method by which LightBurn transfers the instructions to the machine. The current methods supported are as follows:

- **USB cable**: limited to short distances, USB cables and prone to errors, but are common in many machines. They don't work well when connected via hubs, splitters, or extension cables.
- **Network/Data Cable**: assentially an internet cable, these can be used over long distances and retain great signal strength.
- **LightBurn Bridge**: for use with Ruida controllers where a network cable is impractical, LightBurn Bridge relays a signal over TCP.
- **Wifi**: available on some GRBL controllers, this communication method is wireless.

7.8.6 Accesories

There are various accesories and non-critical or optional features available from manufacturers for machines. Some are explored below.

- **Homing/limit switches**: critical for acurate job-placement and replicability, these small buttons are triggered when the axis of a gantry machine reached its "home" position, and allow the machine to position the laser according to a known physical location.

- **Cameras**: allow the user to visually place their design onto locations on their physical material. There are two main kinds:
  - **Stationary cameras**: by far the more popular, these cameras are mounted in a position over the laser's work area that remains the same between jobs and enables a full picture of a machine's bed.
  - **Head-mounted cameras**: these cameras are attached to the head of a laser, near to the beam. These allow close and safe vicsibility of the laser as it works, along with greater accuracy of design placement, at the cost of having to move the head into a location in order to see it.
- **Rotaries**: allow cylindrical objects to be engraved. There are two main types, chucks and rollers.
  - **Roller-based rotaries**: carry an object by rotating wheels beneath it. This style of rotary is not suited to objects that aren't perfectly cylindrical or are prone to slipping, and are tricky to dial in for full-wrap engraves.
  - **Chuck-based rotaries**: physically hold the workpiece in jaws, and rotate around a known axis by a known number of steps (pulses of the motor).
- **Pass-through gates**: these are doors that allow material larger than the laser's bed to be placed in the machine, so that a job can be completed in sections.
- **Exhaust**: a critical safety feature of all laser-machines, these systems ferry the smoke and fumes produced by a job away from the user.
- **Enclosures**: another critical safety feature, appropriate enclosures protect a user's eyes (by shielding the user's eyes from the beam), and lungs (by containing the fumes so the exhaust can work effectively).

explainer laser-control

7.9 Layer Modes

In LightBurn, there are four **Layer Modes** that determine how your laser will cut or engrave graphics in your design. Below, we'll explain the effect and purpose of each type of Layer Mode.

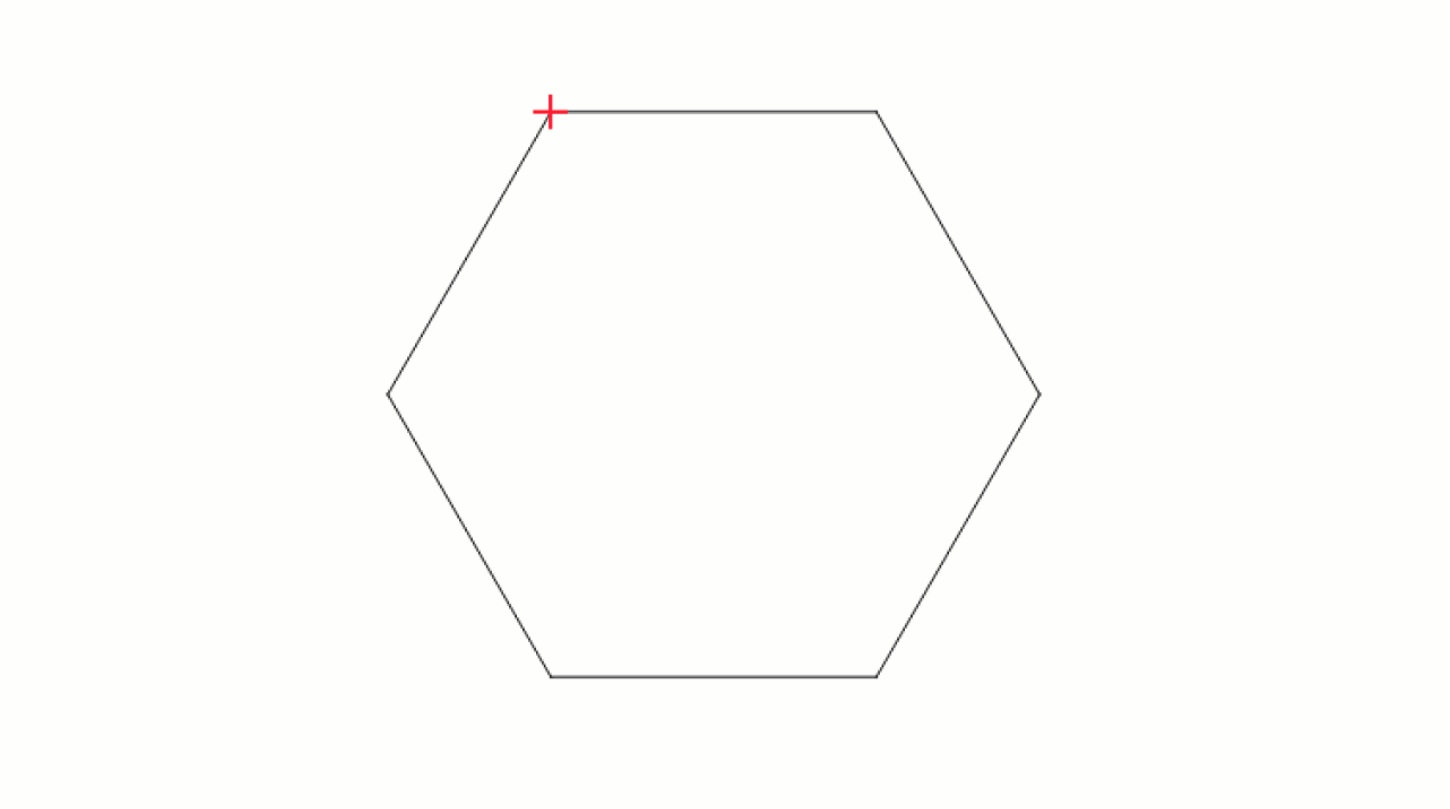
You can use the Color Palette to assign different colors/layers to your graphics, and adjust the mode of those layers in the Cuts / Layers Window or Cut Settings Editor.

> **Tip**
>
> Use the Preview window to view a simulation of the output to your laser *before* starting the job.

7.9.1 Line Mode

Line Mode tells your laser to trace a path around the contours of vector graphics.

If you command the laser to move quickly, or with low Power, it will likely just etch the surface (sometimes called scoring). If you move slowly and with high power, especially with a CO_2 laser, the laser will cut deeper, or even completely through the material. The only difference between surface marking and cutting with Line Mode is the Power and Speed you set.



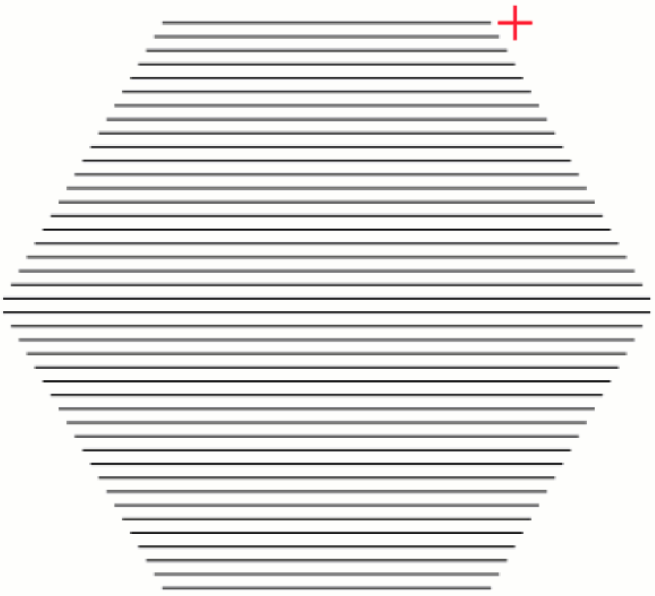
See Cut Settings Editor — Line Mode for information on additional settings specific to Line Mode.

7.9.2 Fill Mode

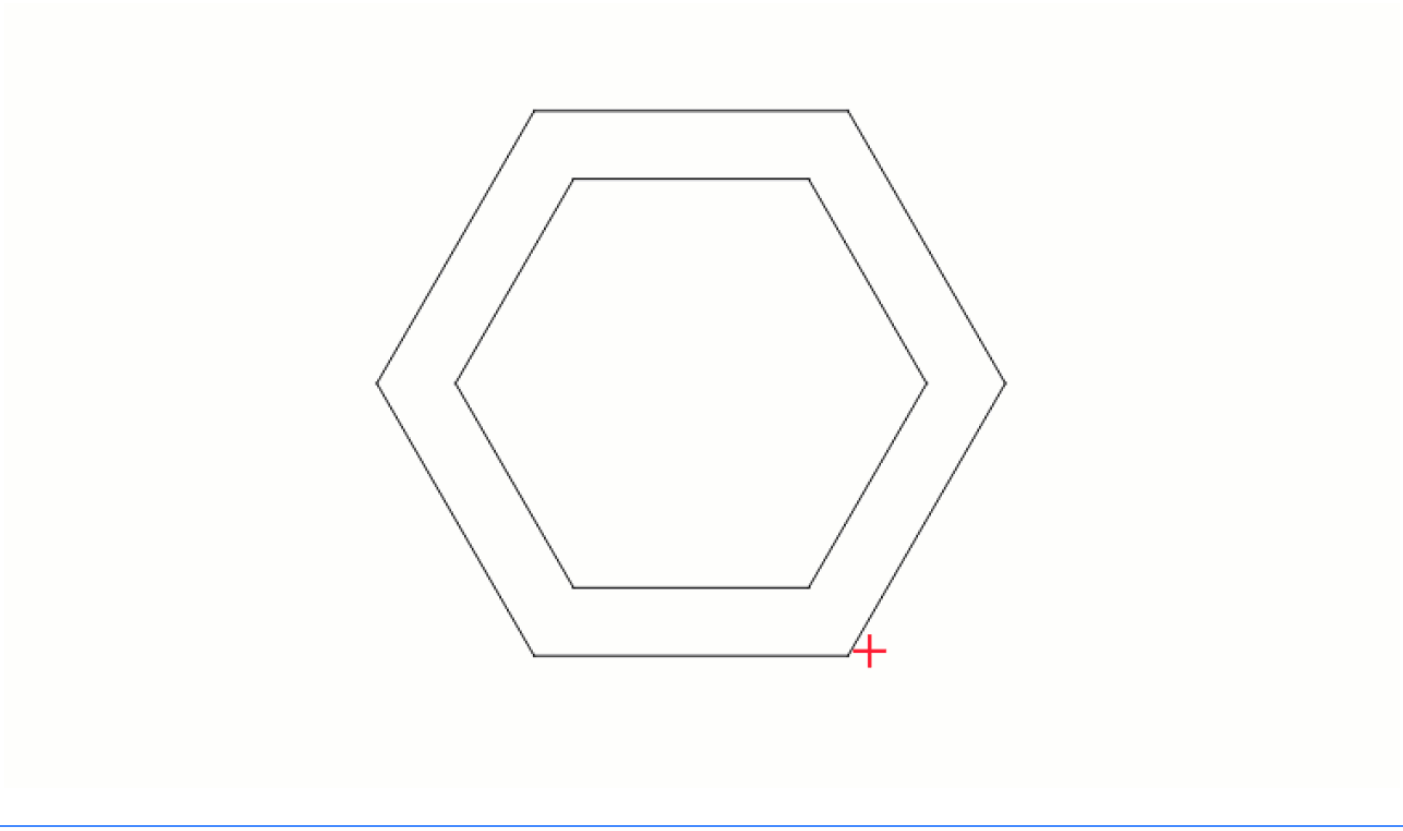
> **Closed Shapes Only**
>
> This feature only works with shapes that are *closed*. A shape is closed when it is a complete, continuous loop whose start and end points are the same. When a shape's start and end points are different, it is *open*.
>
> See Open vs. Closed Shapes for more information.

Fill Mode tells your laser to etch parallel lines within the boundaries of vector graphics.

The distance between each line is determined by the Line Interval setting, and the Speed and Power settings control the darkness or depth of the etch. Use low Intervals, low Speeds, and high Powers for deep engravings or dark marks, or tell your laser to move quickly at low Power to lightly etch or mark the surface.



If you have two shapes set to the same layer, and one is inside of the other, the area between the two outlines will be filled.



See Cut Settings Editor — Fill Mode for information on additional settings specific to Line Mode.

7.9.3 Offset Fill Mode

Closed Shapes Only

This feature only works with shapes that are *closed*. A shape is closed when it is a complete, continuous loop whose start and end points are the same. When a shape's start and end points are different, it is *open*.

See Open vs. Closed Shapes for more information.

Offset Fill mode works similarly to Fill Mode, but instead of telling your laser to scan parallel lines within the boundaries of a vector graphic, it tells your laser to etch concentric lines that follow the outline of the shape.

As with both Line and Fill Mode, Speed and Power control the depth and darkness of the etch, and, as with Fill Mode, the Line Interval setting controls the spacing of the lines.

Offset Fill is intended for designs with a lot of empty space within graphics, to cut down on the amount of travel time necessary to fill large, hollow shapes. If that description fits your design, Offset Fill will most likely be much faster than Fill Mode. If that *doesn't* apply to your graphics, it's usually best to use Fill instead of Offset Fill.

Offset Fill Computation Time

Offset Fill is very computationally expensive, and the more complex the design, or the smaller the Line Interval set, the more potential there is for the computation to cause LightBurn to hang. Sometimes graphics with stray nodes or unusual paths can confuse the calculation interminably.

See Cut Settings Editor — Offset Fill Mode for information on additional settings specific to Line Mode.

7.9.4 Image Mode

Image Mode is a special engraving mode for images, which works similarly to Fill Mode, but allows you to select an additional image processing mode that affects the appearance of the engraving.

Speed, Power, and Line Interval are all crucial settings for achieving great image engravings, but the appropriate settings are heavily dependent on your laser and material.

Several additional settings that affect the quality of the engraving are applied on a per-image basis, using the Adjust Image tool or Shape Properties Window.

See See Cut Settings Editor — Image Mode for information on additional settings specific to Image Mode.

explainer layout-and-design editing

7.10 Open vs. Closed Shapes

All shapes in LightBurn are made up of lines, curves, and nodes. Sometimes those nodes are connecting points between lines or curves, and sometimes they represent the start or end point of a segment or sequence of segments.

A shape is *closed* when it is a complete, continuous loop whose start and end points are the same. When a shape's start and end points are different, it is *open*.

You can view a shape's nodes by selecting it and enabling the Edit Nodes tool. Start and end nodes are green, and somewhat larger than connecting nodes.

7.10.1 When and Why Shapes Must Be Closed

Some functions require LightBurn to determine the inside and outside of a shape, and in order to make that determination the shape must be closed.

The most commonly used function that requires closed shapes is Fill Mode, which commands your laser to engrave or mark an area that falls within the outline of a single specified shape, or between the outlines of two shapes. Without knowing what area is inside a shape, LightBurn can't determine what to Fill.

This is most obvious to the human eye when looking at line segments. If you draw a simple line segment with a node on each end, it makes no sense to say there is an inside and an outside to it. Following from that, if you assign that line segment to a layer set to Fill Mode, it will not be possible for LightBurn to determine an area to be Filled.

In other cases, as with shapes that have only small gaps, it may be relatively clear to a human what is meant to be the inside and outside, but software must interpret things literally, based on formal rules. That means if there is any gap at all, any open shape is the same to LightBurn as a line segment, for the purpose of determining an inside and outside.

Some other functions that require the use of closed shapes are:

- Offset Fill Mode
- Weld
- Boolean Tools
- Cut Shapes
- Resize Slots
- Kerf Offset
- Cut Inner Shapes First

7.10.2 Identifying Open Shapes

In some cases, as with simple line segments or shapes with large gaps, it's easy to see that a shape is open, but in others it may not be as obvious.

At times, the gaps can be very small, often so small that they are not visible without zooming in very close. Be aware: it is even possible for a start and end point to be directly on top of one another, but not connected, making a shape open.

LightBurn provides several methods for identifying whether a shape is open or closed.

Edit Nodes

As mentioned above, it is always possible to select a shape and the Edit Nodes tool to identify where its start and end nodes are, and whether they are the same, making a closed shape, or different, making an open shape.

In some cases, you may need to zoom in to see gaps.

Measure Tool

Select the Measure tool from the Creation Toolbar (or press ⎇ Alt / ⌥ Option + M) and hover over a segment of any shape to see a readout of its attributes. In the bottom right, you'll see the **Closed/Open** descriptor, and a value telling you whether that shape is closed or open.

Warning Message

If you have open shapes set to a **Fill** or **Offset Fill** layer, and attempt to Preview or Start a job, LightBurn will warn you, and give you the option to click **Continue** and proceed with the job, removing the open shapes, or **Show Me** to automatically select them.

Select Open Shapes

From the Edit Menu, you can click the **Select open shapes** option to automatically select any open shapes in your Workspace.

Select Open Shapes Set to Fill

Also found in the **Edit Menu**, this option works the same as the **Show Me** button from the pop up warning, automatically selecting only those shapes in your Workspace that are set to a **Fill** or **Offset Fill** layer.

7.10.3 Correcting Open Shapes

Change Layer or Mode

Before attempting to close an open shape, it's important to decide whether that is the best step to take to get the result you're looking for.

In some cases, especially when working with a project you did not design yourself that has shapes with start and end points that are very far apart, the best course of action is to assign those shapes to a layer set to Line Mode. Open shapes like these are often meant to be set to a speed and power appropriate to score a material along outlines defined by those shapes, and not to be filled at all.

To see how your result will look, you can set the open shapes to a Line layer, and use the Preview window to check whether the simulation matches your desired output.

Edit Nodes

The Edit Nodes tool is not just an option for identifying open shapes, you can also use it close them. To join open shapes with the Edit Nodes tool, select and drag a start point onto an end point (or vice versa).

Because this option requires you to close open shapes manually, in cases where you have many shapes to close it is often easier to use a tool that does so automatically.

Close Path

Found in the Edit Menu, the Close Path option will connect a shape with one start and one end node by creating a new line between them. The start and end nodes must be within .5 mm of one another, so this option is only for shapes with very small gaps. It cannot be used to closed shapes made up of more than one disconnected line segment.

Close Selected Paths With Tolerance

Close selected paths with tolerance is also found in the **Edit Menu**, and, like **Close Path**, can only connect a shape with one start and one end node.

Unlike Close Path, this option opens a pop up menu that allows you to specify the **Distance Threshold** (tolerance), between start and end nodes you'd like to close.

You can also choose whether you'd like to join the start and end nodes by bringing the existing lines together with **Move Ends Together**, or by creating a new line segment between them using **Join with Line**.

At the very bottom of the window, you'll see a readout of how many open shapes were found, how many shapes have been closed, and how many open shapes remain in your Workspace.

Click **OK** to confirm the changes and close the selected shapes, or **Cancel** to discard them and leave the shapes open.

Auto-Join Selected Shapes

Auto-Join selected shapes (⎇ Alt / ⌥ Option + J) is also found in the **Edit Menu**, and is able to join many disconnected segments at once. In order for Auto-Join to work, the start and end points of two segments must be very close together, within .05 mm of one another.

In some cases where Auto-Join fails to join segments with start and end points within the necessary .05 mm tolerance, it can help to first go to the Arrange Menu and select Break Apart (⎇ Alt / ⌥ Option + B), before again trying Auto-Join.

7.10.4 Related Topics

- Edit Nodes
- Edit Menu
- Measure Tool
- Close Path
- Close selected paths with tolerance
- Auto-Join selected shapes

explainer fill image

7.11 Overscanning

When your laser engraves graphics set to Fill or Image Mode, the line-by-line, back-and-forth movement across the graphics is sometimes called *scanning*.

Overscanning refers to additional moves added to the beginning and end of each line to give the laser space to speed up before firing, and slow down afterward, which in turn prevents the edges of engraved areas from burning darker than the centers.

Note

Only gantry-style lasers with GCode-based or DSP controllers use Overscanning.

Galvo lasers compensate for overburning at edges using Delay settings.

Figure 1: The extra Overscanning movements are indicated in red. Toggle on Show traversal moves in the Preview window to see these movements.

7.11.1 How Overscanning Works

Engravings made *without* **Overscanning** are prone to overburning at the edges due to the relationship of Speed and Power output in laser engraving.

The longer your laser spends passing over any part of an engraving, the more effective power it will output over that area. That means that the same Power setting will burn more at a slower Speed than a faster one.

When your laser approaches the end of a scan line, it needs to decelerate so it can change direction, and, after turning around, accelerate to reach the Speed you told it to engrave at. It can only slow down and speed up so quickly — just how quickly depends on the laser, but all lasers have physical limits.

That means if you tell your laser to engrave an area, and it's not allowed to travel beyond the bounds of that area, it will be engraving as it slows down and speeds up, and so the edges will absorb more power than the center, and burn darker.

By giving your laser extra room to accelerate and decelerate with the laser *off*, you can ensure that it only fires once it's reached the full Speed you set it to engrave at, resulting in an even burn across the entire engraved area.

7.11.2 Applying Overscanning

DSP controllers apply **Overscanning** automatically, so DSP users never have to do so manually, and do not have the option to disable it.

Users with GCode-based lasers have the option to enable or disable Overscanning in the Cut Settings Editor, and to specify the distance.

Overscanning distance is calculated as a percentage of Speed. You'll see the amount of required distance for your combination of Speed and Overscanning percentage to the right of the percentage field.

If you increase Speed, Overscanning percentage, or both, the amount of required distance will go up.

Figure 1: The Overscanning setting for a GCode-based laser

7.11.3 Speed, Overscanning Distance, and Job Time

Although you can't control the percentage through LightBurn, Overscanning distance varies based on Speed for DSP lasers as well, and in the same way — as you increase engraving Speed, Overscanning distance increases as well.

This is, again, due to the physical limits of your laser — while every laser is different, there is a limit to how quickly any laser can slow down or speed up.

No matter what that limit is, it will always require more space and time to slow down from or speed up to a relatively high speed than a relatively low one.

Imagine driving a car and quickly pressing the brakes to bring it to a halt. The car will require a longer distance to stop if you are traveling at 60 miles per hour than if you are only traveling at 10 miles per hour. It will also take more time to halt the faster-traveling car than the slower-traveling one.

Because high Speed settings require more distance and time for acceleration and deceleration, increasing the Speed you set your laser to engrave at will yield diminishing returns in time savings the higher you go, and, in some cases, increasing past a certain point can actually lead to an *increase* in job time, rather than a reduction.

You can use the Preview window to check the your project's estimated run time, and see the effect of a range of Speeds on overall time.

Figure 1: Set to 100 mm/second (6000 mm/minute), this graphic will take 26:39 to engrave.

Figure 1: The same graphic, now set to engrave at 400 mm/second (24,000 mm/minute), will take nearly 3 minutes longer to engrave, due to the high amount of Overscanning required.

7.11.4 Troubleshooting

Error Messages

GCode-based lasers

If you enable Overscanning for a GCode-based laser and there isn't enough room at the edge of the job to accommodate the extra travel distance, you may see LightBurn's **Cut may be out of bounds due to overscan settings** error, or your laser's controller may return an ALARM:2 error.

DSP lasers

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

Because **Overscanning** requires your laser to travel extra distance outside the exact boundaries of your graphics, if your graphics aren't positioned properly, or you are too close to the edge of your machine when using Current Position or User Origin as your **Start From** mode, you may accidentally command your laser to travel outside of its physical limits, once the Overscanning distance is included.

To correct excessive Overscanning:

- Reduce Speed or Overscanning percentage (if you have a GCode-based laser).
- Move your graphics in toward the center of your Workspace, if you are using Absolute Coordinates positioning.
- If you are using Current Position or User Origin to set a custom Origin, set it closer to the center of your laser's work area.

Overscanning Distance in the Preview Window

You can check for excessive **Overscanning** using the Preview window.

Make sure **Show traversal moves** is toggled on, and you'll see the additional Overscanning moves indicated as red lines (black lines indicate engraving or cutting moves).

The maximum boundaries of your laser's work area are indicated by a green outline. To see the outline you may need to zoom out by pressing `-` on your keyboard, or by using your mouse's scroll wheel (or two-finger dragging if you're using a trackpad).

If the red lines cross the green border on one side, and you've selected Absolute Coordinates as your **Start From** mode, the Overscanning moves will command your laser to travel outside its work area. If you're using Current Position or User Origin, it may still be ok, depending on where you establish your custom origin.

If the red lines cross the green border on *two sides*, no matter which Start From mode is selected, it means the Overscanning distance is excessive, and will command your laser to travel outside its physical bounds.

Figure 1: Overscanning crossing a single side of the green outline — this will be a problem if the Start From mode is set to Absolute Coordinates, or if the custom User Origin or Current Position is too close to the edge.

Figure 1: Overscanning crossing two sides of the green outline — this will be a problem no matter what Start From mode is selected.

Figure 1: Overscanning crossing neither side. This is a normal amount of Overscanning, and will work well with Absolute Coordinates positioning, but you still need to make sure that any custom User Origin or Current Position isn't too close to the edge of the machine's work area.

7.11.5 Related Topics

- Fill Mode

- Image Mode

explainer job-optimization cut-settings material-test

7.12 Speed vs. Power

Understanding the relationship between **power** and **speed** is an essential part of being able to produce high quality cuts and engravings, as well as optimizing your settings to finish jobs faster.

Always pay attention to units of distance and time when entering Speed settings

When entering **Speed** values recommended by your laser's manufacturer or other LightBurn users, make sure to use the *same units of distance and time as those from the recommendation*, or to convert the values to your preferred units.

A given number of **millimeters per second** is *much* faster than that same number in **millimeters per minute**. Mixing up units can lead to reduction in power output due to unexpectedly high speeds, or excessive power output — and even fire — due to unexpectedly slow speeds.

Change your units of speed in the **Dimensions / Units** tab of the **Device Settings** window. LightBurn automatically converts any existing values when you switch between units.

7.12.1 Speed vs. Power Basics

The two primary settings controlling the depth of a cut or the darkness of an engraving are power and speed.

Power controls the laser's intensity. Higher powers allow you to cut deeper or make darker marks for engravings, but at the cost of potentially charring or melting edges, producing excessive smoke, and making a wider kerf.

Speed controls how fast the laser moves. Lower speeds will deliver more power and heat to the material, as the laser takes longer to pass over any one point. Higher speeds can complete a job faster, but will require higher power. High speeds can also exacerbate or make any existing mechanical issues more apparent.

The image to the right shows a simplified example of a test grid similar to what LightBurn's Material Test Generator produces. This example helps show the relationship between speed and power:

- In the top left corner, where the speed is high and the power output is low, the mark is faint and barely visible.
- The marks get darker both going to the right (increasing power) and going down (decreasing speed).
- In general, to make darker marks or deeper cuts, you can increase power, decrease speed, or do both.

You might also have noticed that the bottom right corner isn't noticeably darker than the circled mark. Beyond a certain point, increasing power or decreasing speed has limited usefulness. In this example, the circled mark would get similar results to a slower and higher power cut, but faster and with reduced power consumption.

For a more realistic example, see the picture below showing an actual material test. As with the example above, the marks get darker and deeper with increasing power and decreasing speed.

7.12.2 Optimizing Cut Settings

The best power and speed combination will depend heavily on not only your laser and material, but what you're aiming to achieve.

- For image engraving, especially with CO_2 lasers, going slowly at a low power typically gives the best results. See 5 Steps to Perfect Image Engravings for more information.
- When cutting, it's best to use LightBurn's Material Test Generator to find a setting that cuts through the material cleanly without scorching. Look for the lowest power and highest speed that cuts through reliably.
- If you're having issues with scorching or melting the edges of your material, try using multiple passes rather than continuing to increase power.

7.12.3 Related Topics

- Material Test Generator
- Cut Settings Editor
- 5 Steps to Perfect Image Engraving

explainer calibration

7.13 Steps/MM

If the output from your laser looks like it's squished or stretched in one or both directions, it may be because your **steps/mm** settings are configured incorrectly.

All laser cutters / engravers must be configured with the correct steps/mm (steps per millimeter) setting to function correctly. If your movement is already close, LightBurn has a built-in Calibrate Axis tool that will help you dial in the correct setting. If you would like to better understand how the **steps/mm** setting works and how to find or calculate the *true* value, read on.

7.13.1 Background

Your laser moves by using stepper motors which, unlike basic motors, don't spin continuously, but in discrete steps, each of which is a specific number of degrees in a full rotation. For example, the most common motor type has a 1.8° step angle, meaning that a full rotation is 200 steps (360° / 1.8° = 200).

In order to tell your machine how to move the correct distance, it has to know how many steps to instruct each motor to move. What that value is, however, depends on not just the motor but the rest of the machine's setup. For small, diode-based lasers, a common setup might look like:

- 1.8° Nema 17 stepper motor
- GT2 belts (2 mm distance between each tooth)
- 20 tooth GT2 pulley

Fortunately, calculating this is made easy by many great online tools, like this Stepper Motor Calculator.

For the above configuration, setup the calculator as shown below:

You would needs 5 steps per mm of movement. This is because a 20 tooth pulley represents 40 mm of movement for one full rotation (20 teeth * 2 mm per tooth) and there are 200 steps per full rotation. So `200 / 40 = 5`.

7.13.2 Microstepping

Very few machines will ever run in "full step" mode as shown in the example above. As you can see at the bottom of the example above, the resolution is 200 micron or 0.2 mm. That means the absolute smallest distance that can be moved is 0.2 mm, which is not nearly good enough. Modern stepper motor drivers, however, can pull off a trick known as microstepping, in which they can move in steps *between* the natural steps of the motor. A common option is 1/16th microstepping which means that it divides each natural step into 16 sub-steps, multiplying the number of steps required per full rotation from 200 to 3200!

As you can see now, the steps/mm value jumped from 5 to 80 and now has a resolution of 12.5 micron or 0.0125 mm.

7.13.3 What settings does your machine use?

The above is merely explaining the theory, now we need to put it all together.

First off, the best place to find your correct steps/mm setting is generally going to be from the manufacturer of the machine (unless you built it yourself). We highly recommend starting by looking for the correct settings direct from the source.

If that information is unavailable, it can be arrived at with a little work.

Motors

It is highly unlikely the motors you are using are anything other than the 1.8° variety. Sometimes 0.9° are used and those are very often marked as such on the motor body somewhere. You will also likely find a model number marked somewhere on the motor. Find that and look it up online, for example: `17HS19-2004S1`

You will then typically be able to find specs or a datasheet on that specific motor model which will tell you the **step angle**.

Belts

Small hobby diode lasers typically use GT2 (Sometimes called 2GT) belts, which is just the name of a common belt profile that has a 2 mm **pitch**. The pitch of a belt is the distance from the center of one tooth to the center of the next. You can use calipers or an accurate ruler to check if you are unsure. Just note that belts will always use nice round numbers. Commonly you will find 2 mm, 3 mm, or 5 mm pitch. Anything beyond that is unlikely to be used in a laser.

Once you've found this value enter it in the **Belt pitch** field in the stepper motor calculator, or use one of the **Belt presets** from the drop-down.

Screws

Some machines use lead screws instead of belts, such as the 3018 CNC machines which we see converted to laser use very often. Determining the pitch of a screw is very much the same, except that you need to follow a single thread of the screw (sometimes they have multiple threads, unlike a bolt might) for one full rotation (it may be helpful to mark it with a Sharpie) and then measure the distance from start to finish of that rotation.

Just like with the belts, there should be no odd numbers here, as there are very standardized screw pitches. 2 mm, 4 mm, and 5 mm are very common for this application. Just be sure to use the **leadscrew driven systems** version of the calculator, lower on the page:

Motor Driver Microstepping

Finally, you need to determine what microstepping value is configured for your drivers. This is either something that cannot be changed on your particular controller (in which case you need to find out from the manufacturer), or can be changed via DIP switches or jumpers.

Many GCode based devices use what are commonly referred to as "StepStick" style motor drivers - a little 0.6" x 0.8" circuit board with 8 pins on each side that plugs into your controller. On the controller will often be either jumpers or DIP switches to configure 3 different states that control the microstepping.

These will typically be labeled MS1, MS2, MS3 or CFG1, CFG2, CFG3. You will need to then determine what driver chip is being used by looking at the black IC on the StepStick board. You may need magnification to read the markings. Once you know the type, you can look up the configuration options online for that specific driver.

For example, the common (though a bit old at this point) DRV8825 from Texas Instruments has the following configuration table:

CFG1	CFG2	CFG3	MicroSteps
O	O	O	1/1
X	O	O	½
O	X	O	¼
X	X	O	⅛
O	O	X	1/16
X	X	X	1/32

`O` means that config pin is left open (no jumper) or off (in the case of a DIP switch). `X` means closed (with jumper) or on. So, for example, with no jumpers on CFG1 and CFG2 but a jumper on CFG3, the driver would be running in 1/16th microstepping mode. In other words, it divides each step into 16 sub-steps, therefore multiplying the total number of steps per revolution by 16.

8 How-To Guides

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Our step-by-step guides will walk you through how to accomplish a range of tasks in LightBurn.

- Customize the LightBurn Window
- Migrate Between Computers
- Manage Your LightBurn License
- Set Up System Locked and Floating Licenses
- Configure GRBL Devices
- Connect to a GRBL Device using WiFi
- Connect to a Ruida Device using Ethernet
- Set Up the LightBurn Bridge
- Configure a Ruida Controller
- Set Up Laser Offset
- 5 Steps to Perfect Image Engraving
- Adjust the Scanning Offset
- Set Up the CorelDRAW Macro
- Run Multiple LightBurn Instances
- Set Laser 2 Offset for Dual Head Laser
- Align the WeCreat Camera

Install Galvo Drivers

Focus a Galvo Laser

Work With 3D Sliced Images

Change a Galvo Laser Lens

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8.2 3D Sliced Engravings

LightBurn's 3D Sliced Image Mode enables Galvo users to create engravings with both visual and physical depth. This 2.5D engraving mode does not require a live Z Axis and can produce highly detailed engravings, but does not offer precise control over the engraving's depth.

3D Sliced mode uses multiple passes to engrave a design one layer at a time. This mode is intended for use with depth maps – sometimes called height maps – which are specially designed greyscale images in which a pixel's brightness represents depth, rather than shading.

Lighter pixels are engraved with fewer passes than darker pixels, resulting in a deeper engrave in darker areas of the image. Enabling Negative Image inverts brightness, leading to lighter areas engraving deeper than darker areas.

Depth maps can be created by hand, although tools like STL2PNG can generate raster images from STL files to create more complex depth maps. Once a depth map is created, it can be imported to LightBurn like any other image.

8.2.1 Using 3D Sliced Mode

Create a Depth Map

Produce a greyscale depth map image in any tool you choose and Import it into LightBurn.

Enable 3D Sliced Mode

Use the Cut Settings Editor to set the Image Mode to 3D Sliced. This mode is *only* available when using a Galvo laser.

Adjust Settings

Most settings are shared with the other Image Modes, but there are a few details specific to this mode.

Number of Passes

In **3D Sliced** mode, raising the **Number of Passes** splits the depth map into more layers, increasing the effective resolution of the engraving. The darkest shades in your depth map will be engraved with the full Number of Passes, and all lighter shades will be engraved with progressively fewer passes, down to zero passes for pure white shades.

Using a large Number of Passes may require decreasing power to avoid burning deeper than intended. This has a similar effect to decreasing layer height on a 3D printer.

> **Note**
>
> Larger, more intricate designs may take more time to process, due to the complexity of generating each pass. If you see this dialog, please be patient as your computer may need some time to prepare your design.

Cleanup Passes

Toggling on **Enable cleanup pass** will automatically add a **Cleanup** Sub-Layer in the **Cut Settings Editor**, where you can specify how often automatic cleanup passes should run, and adjust the settings for those passes.

Cleanup passes are typically run with a tighter **Line Interval**, higher **Frequency**, and lower **Max Power** than the main engraving passes, and are used to clear debris and produce a better finish.

Preview and Run

Check the Preview to confirm your design is outputting as you're expecting. If you click the **Play** button, you should see your design render from the bottom to the top, with black indicating the engraved portion for each layer.

Enable **Show traversal moves** and check to make sure that the red areas expand with each pass. The red areas are made up of lines indicating movements made while the laser is off, so, as the job progresses, the laser should be passing over increasingly large areas of lighter shading, while continuing to engrave increasingly small darker-shaded areas.

8.2.2 More Examples

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8.3 Advanced LightBurn Bridge Setup

If you either want to roll your own LightBurn Bridge with a Raspberry Pi you already own or just want to dive deeper into configuration options, this page is for you.

First, please note that LightBurn Bridge is *only* supported on Raspberry Pi **3b, 3b+, or 4** models. Any others will not work. We can only provide limited support for self-built LightBurn Bridge devices.

We *do not* provide the option to install LightBurn Bridge on an existing Raspberry Pi OS installation, as it's designed as a single purpose *appliance* device. Any modification to the installation, aside from those mentioned below, will void any warranty or support obligations from LightBurn Software.

8.3.1 Flashing the LightBurn Bridge Mmage to an SD Card

If you purchased a pre-flashed SD card or complete kit, you can skip this section, unless you're upgrading the kit you have to a newer version. If you're upgrading, power off the Pi, and remove the SD card from the bottom, shown here:

To remove the card, use a fingernail, the tip of a pen, or a pair of tweezers to hook the small lip and the end of the card and pull it out.

Download the LightBurn Bridge disk image file from here and save it to your computer.

After you've downloaded the LightBurn Bridge image file, you will need to flash it to a 4GB or larger micro SD card. For that task, we recommend you download Raspberry Pi Imager. It's cross platform and will handle the task with ease. Install the tool and open it:

Click on **CHOOSE OS** (the left-most button in the middle), then scroll to the bottom and click on **Use custom**:

Browse to the folder you downloaded the `.img.xz` file to (most likely your Downloads folder), select the file, then click **Open**.

Insert your SD card into your computer and, back on the main Raspberry Pi Imager window, click on **CHOOSE STORAGE**. Select the correct device — in most cases it will be the only option. If you don't see it, try removing the card and re-inserting it, or unplugging your card reader and connecting it again. You can leave the **Storage** window open when you do this — when the SD card appears, select it.

Finally, click the **WRITE** button. It will warn you that you're about to overwrite the SD contents — click **OK**, and wait for it to write the image. At the end of the process, it will verify it was written correctly.

That's it! You now have your own LightBurn Bridge SD card to use in your own Raspberry Pi. If you want to do any sort of advanced configuration ahead of time, head on to the section below. Otherwise just insert the card into the Raspberry Pi, then connect it to your laser as detailed in the main guide, turn it on, and continue with the LightBurn Bridge setup.

8.3.2 Advanced Configuration

Manual WiFi Setup

By default, the LightBurn Bridge automatically presents a WiFi access point which you can connect to and configure your WiFi connection through. However, if that option is not working for you — for example, if you have a network with a hidden SSID — or if you would simply like to pre-configure your device, you can use the `wifi.txt` option.

Insert the micro SD card into your computer (either one you made or a pre-flashed card you purchase) and find the newly mounted drive labeled `boot` as shown below.

This will, of course, be a little different on each operating system. Some systems may show two drives/partitions and the other will likely be unreadable. That's ok, just find the one labeled `boot` and open it.

Now create a file called `wifi.txt` and open it in the text editor of your choice. Note, this must be a simple text editor like notepad, TextEdit, or gedit, and not a rich document editor like Word.

Now add two lines as follows:

```
ssid=YourNetworkSSID
pass=YourNetworkPassword
```

Replace the values after the `=` with whatever matches your network.

> **Note**
>
> Both of these fields **are case-sensitive**. Double check your network name and password for proper capitalization!

If your network is not password protected, you may leave out that line of the file.

> **Warning**
>
> Do not include anything else in this file!

Now eject the drive, remove the SD card, re-insert it into your Raspberry Pi, and power it back on.

It will read this file on boot and attempt to connect to the network.

If it succeeds, it will be renamed to `wifi.txt.loaded`. If it fails, it will be renamed to `wifi.txt.failed` and the WiFi configuration access point will make itself available as normal. The access point will generally be the first indication that the connection failed, but you can confirm by checking that file name after re-inserting the card into your computer.

If it fails, recheck the SSID and password in the file, rename it back to `wifi.txt` and try again.

LightBurn Bridge Configuration Options

You can also configure a few items manually via another file on the `boot` partition (as described above) called `bridge.json`. This file will not be created on the `boot` partition until the device has been booted up at least once, but you can create it yourself ahead of time, if desired, using the template below.

```
{
    "laser_ip": "10.0.3.3",
    "device_type": "ruida",
    "ap_name": "LightBurn Bridge E4B7"
}
```

These options are as follows:

- `laser_ip`: The static IP address configured on your Ruida laser controller. By default you will need to set it to `10.0.3.3` which we've chosen because it's unlikely to use this IP subnet for a private WiFi network. For complicated reasons, the IP address of the Ruida must be on a different subnet (the `10.0.3` part of the address) than your WiFi network. In general, you should never change this value unless this conflict exists.
- `device_type`: At the time of writing this `ruida` is your only option. There will likely be options added in the future though, so don't change this!
- `ap_name`: By default the WiFi configuration Access Point name will be `LightBurn Bridge` followed by four random letters or numbers, for example: `LightBurn Bridge E4B7`. This is so that you can have multiple devices in the same area and their access points won't conflict. But you can also set it to be whatever you want here. You may use any alpha-numeric characters and symbols, with the exception of `?"$[\]+`, and it must be between 6 and 32 characters.

After making changes, save it back to the `boot` drive/partition that is mounted from the SD card on your computer. Then insert the card back into your Pi and turn it on.

_guide galvo calibration laser-control modes-and-advanced-control LightBurn-Pro

8.4 Changing a Galvo Laser Lens

To ensure optimal performance following a physical lens swap on a Galvo laser, there are several changes and settings you'll need to confirm. Some manufacturers provide the calibration information for your new lens, and we strongly recommend you check their website before proceeding to perform the calibration manually.

8.4.1 Physical Lens Swap

This video guide from Laser Everything covers the physical installation of the lens, as well as many of the items outlined below with EZCAD analogues. We suggested you review this video by Laser Everything to help ensure the lens swap doesn't damage your machine or hurt you in the process.

8.4.2 Duplicate Original Laser

In many cases, changing the galvo lens means that you'll need to adjust many settings and recalibrate it, effectively making it a "new" machine when you do so. To duplicate a device in LightBurn, click Devices in the Laser Window, right-click on a given laser, and select Duplicate.

> **Tip**
>
> Be sure to give the duplicate a descriptive and accurate name to contrast it to the original, and ensure that it's the on you edit later.

8.4.3 Focus

After changing lenses physically, you'll need to adjust the focus of the laser, even before other performing the calibration process, to ensure the results are as good as possible.

Review the steps outlined in Galvo Laser Focusing to ensure your laser's output is crisp and in focus — keep in mind your red dot framing may no longer be in focus due to the focal length changes.

8.4.4 Field Size and Lens Calibration

All Galvo lenses have distortion which must be corrected in order for output from your laser to have an appearance that's true to the design you see in your LightBurn Workspace.

When working with a new laser, you can usually import lens correction values provided by your machine's manufacturer when you first set up your laser with LightBurn.

If your manufacturer didn't provide the necessary file, or you purchase a new lens for a laser you already own, however, you may need to use LightBurn's **Galvo Lens Calibration** wizard to find the appropriate corrections.

To open the Galvo Lens Calibration wizard, go to Laser Tools → **Calibrate Galvo Lens** → **9 Point Correction (Easy)**.

For more information on this process, see Calibrate Galvo Lens — Galvo Lens Calibration Wizard.

8.4.5 Related Topics

- Add a Galvo
- Red Dot Offset

_guide Ruida

8.5 Configuring a Ruida Controller

> **Info**
>
> A factory reset of a Ruida controller resets it to the stock configuration supplied by Ruida, not the configuration your laser's manufacturer applied to it. Because of this, a factory reset is *not* recommended. If you've already done it, this guide is here to help.

When you purchase a laser with a DSP controller installed, the manufacturer configures the laser controller to match the machine configuration.

This guide is here to help you if you need to do this configuration yourself, either because you are installing a new controller into a machine or because you did a factory reset of your controller.

8.5.1 Ruida Machine Settings in LightBurn

> **Tip**
>
> It's a good idea to use the **Save to File** button to back up your settings before making changes, so you can revert to what you had before if needed.

With the laser/controller connected to your computer and powered on, go to Edit → **Machine Settings** to open the Machine Settings window. LightBurn will automatically read the settings from the controller when this window is opened.

As you're making changes, the **Read** button will tell LightBurn to read the configuration from the controller, and **Write** will save the settings in LightBurn back to the controller. For more information on the Machine Settings window, see our page on Machine Settings.

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.

Click to expand the Vendor Settings section, and, after acknowledging the warning, you'll see the below settings.

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

Homing, Directions, and Travel

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

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

To fix this, you'll need to go to the **X Axis Settings** and **Y Axis Settings** under Vendor Settings. Near the top of each will be three check boxes:

- Invert Keypad Direction: Controls which way the arrow buttons move the laser.
- Limiter Polarity: Tells the controller whether the limit switch triggers high (normally open) or low (normally closed) when contacted.
- Direction Polarity: Controls which way the motor moves in general.

Step 1: Correct direction of travel

Before continuing onto other steps, make sure that the X axis and Y axis move properly when you power on the machine.

There are only 4 possible combinations of **Limiter Polarity** and **Direction Polarity** for each axis. Without access to your machine, we can't tell you the correct combination, but change those settings for the X axis until it moves properly and recognizes the homing switch when you power up the machine. Once the X axis is correct, do the same for the Y axis.

Step 2: Correct keypad controls

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.

Step 3: Set Max travel

You will also need to set the **Max Travel** value for the X and Y Axes - these values 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

You'll need to start by doing rough adjustments to get close enough to the correct values to be able to calibrate the step length properly.

In LightBurn, set the **Start From** setting in the Laser Window to **Absolute Coords**. See Coordinates and Job Origin for help.

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

> **Tip**
>
> Note that your origin corner might be in a different spot than shown here. You should set it in Device Settings to match the origin corner of the machine.

Now, use the **Frame** button and compare the size of the frame to the size of the rectangle.

- If the laser is barely moving, your step size is too big – the controller thinks it's moving more than it actually is.
- If the framing is much too large, the step size is too small – the controller thinks it needs to take more steps than are actually necessary.

Adjust the X Axis and Y Axis settings for **Step Length** based on what you saw with the framing. The changes are proportional to the difference between the size of the rectangle and the amount of travel:

- If the laser moved twice as far as it should, double the step length value.
- If the laser only moved half as far as it should, cut the step length in half.

Frame again and repeat the adjustment process until the size of the framing is reasonably close to the size of the rectangle you drew.

Final Calibration

Draw a box similar to the first box, but make it larger – 100 mm or 200 mm is generally a good size to work with. The larger box makes it easier to get precise enough measurements without specialized equipment.

Set the Min Power and Max Power values low, but high enough to make a mark. Run the job to engrave the rectangle on a piece of scrap material. Measure the result as accurately as you can.

This time, you'll need to do just a of math to calculate the with the step size:

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

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, each axis has a setting called **PWM Rising Edge Valid**. This setting tells the controller whether the rising edge or falling edge of a step pulse is what the motor driver is looking for, and fixing it may correct skewed engraving.

To fix this problem, Find the **PWM Rising Edge Valid** setting on the X axis, and toggle the value – enable it if it's disabled, or disable if it's enabled. Do the same for the Y axis.

What is this setting and why does it matter?

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

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

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

Start and End Delay

This feature adds in a delay at the start or end of jobs. This is often used to give fants time to get to speed at the start of job or finish venting the air in the laser before stopping.

8.5.2 Related Topics

- Machine Settings

_guide export export-to-LightBurn import CorelDRAW help help-menu workflow-optimization workflow optimization

8.6 CorelDraw Macro Setup

LightBurn offers CorelDRAW users on Windows an optional macro to simplify and speed up the process of sending work to LightBurn directly through CorelDRAW.

> **Note**
>
> macOS users can **Export** work out of CorelDRAW as an .AI or an .SVG file and Import into LightBurn.

8.6.1 Installation

1. Make sure LightBurn and CorelDRAW are both installed on the same computer.
2. Open the LightBurn install folder, typically located at `C:\Program Files\LightBurn`. Find the `ExportToLightBurn.gms` file inside this LightBurn folder.
3. Copy the `ExportToLightBurn.gms` file by right-clicking and choosing **Copy** or by pressing `^ Ctrl` + `C`.

Figure 1: Copy the ExportToLightBurn.gms file

4. Open the CorelDRAW install folder, typically found at `c:\Program Files\Corel`. Locate the folder called `CorelDRAW Graphics Suite ###` or `CorelDRAW Technical Suite ###`, with `###` being your CorelDRAW program version number.
5. Open the `CorelDRAW Technical Suite ###` folder, with `###` being your CorelDRAW program version number, the `Draw` folder, and finally the `GMS` folder. Paste the the `ExportToLightBurn.gms` file copied earlier into this `GMS` folder.
6. Grant permission to copy into the `GMS` folder if prompted.

Figure 1: Paste into CorelDRAW's GMS folder

8.6.2 Loading the Macro

1. Open CorelDRAW.

2. Open the **Script Manager** (**Macro Manager** on older versions) by going to **Tools** → **Scripts** → **Scripts** or by using ⎇ Alt + ⇧ Shift + F11. Older versions can open the Macro Manager by selecting **Tools** → **Macros** → **Macros Manager**.

Figure 1: Open the Macro/Script Manager

3. If the **ExportToLightBurn** macro doesn't show up in the **Visual Basic For Applications** category, load it manually.

   A. Right-click on the background of the Script Manager window, select **Load Macro Project**, and select `ExportToLightBurn.gms` from CorelDRAW's GMS folder (located earlier in this guide).

Figure 1: Load the macro if needed

8.6.3 Configuration

1. Open CorelDRAW's customization window from **Tools** → **Options** → **Customizations**. On older versions select **Tools** → **Customizations**.
2. Open the **Commands** section on the left. On older versions, select **Workspace** → **Customization** → **Commands**.
3. Select **Macros** from the pane that appears on the right.
4. Select the LightBurn entry.
5. Click on the **Browse** button next to the icon. On older versions, select the **Appearance** tab to select an icon.
6. Select the LightBurn icon found in the `C:\Program Files\LightBurn` folder and click **Open**.
7. Grab the macro from the customization window and drag it to a toolbar for an easier workflow in the future.
8. Set the caption to `Export to LightBurn`.
9. Click **OK** to close the Script/Macro Manager window.

Figure 1: Suggested configuration for the macro

8.6.4 Using the Export to LightBurn Macro

Click the Export to LightBurn macro button to launch LightBurn with your current selection from CorelDRAW loaded in your Workspace. If nothing is currently selected, the entire file will load instead.

8.6.5 Related Topics

- File Management
- Workspace

_guide UI

8.7 Customizing the LightBurn Window

The LightBurn layout is highly customizable — you can choose which windows and toolbars to expose and hide, or undock, move, and re-dock them to a location other than their default position.

8.7.1 Enabling and Disabling UI Elements

Use the Window Menu to enable or disable any toolbar or window in LightBurn. Several windows are not shown by default, and you'll need to enable them in order to access the tools and options they contain.

Enabled windows and toolbars have checkmarks next to their names, and disabled windows do not.

Click any unchecked window or toolbar in the list to enable it.

Click any checked window or toolbar to disable it. You can also click the X in the upper right corner of any window to disable it.

Right-Click Context Menu

Right-click over any toolbar, or over the top bar of any window, to open a window and toolbar selection context menu. Just as in the Window Menu, enabled windows and toolbars have checkmarks next to their names, and disabled windows do not. Click any unchecked window or toolbar to enable it, and any checked window or toolbar to disable it.

Toggle Side Panels

Click **Toggle Side Panels** or press F12 to disable all windows that are docked on the left or right side of the Workspace. Click or press F12 again to re-enable them.

8.7.2 Docking and Undocking

Windows

Click and drag any window from its top bar to undock it — you can leave the window floating anywhere you'd like, or re-dock it to another position.

The dockable area for windows is to the left, right, top, or bottom of the Workspace. You can stack multiple windows on top of one another vertically, or dock them so that they are tabbed together in a shared space.

By default, several windows are stacked and tabbed together on the right side, and no windows are visible on the left.

When you've dragged a window over an area it's possible to dock it to, the area will turn blue or light gray. Release to dock the window.

> **Note**
>
> The current positions of existing toolbars and windows, size of your computer's display, and the size of the LightBurn window all determine where and how many windows can be stacked on top of one another — if you're unable to dock an additional window above another, it is most likely not a valid location. If your LightBurn window is not expanded to the full size of your screen, try maximizing it.

Click and drag the side or bottom of a window or docking area to adjust its width. Note that each window has a minimum size requirement, and every window in that docking area must fit within the new width (including tabbed windows that aren't currently visible).

Toolbars

Click and drag any toolbar from the dotted line to undock it — you can leave the toolbar floating anywhere you'd like, or re-dock it to another position.

The dockable area for toolbars is above, below, to the left, and to the right of the Workspace. Toolbars can be stacked on top of one another or docked next to each other.

If the space in which several toolbars are docked is too small to show all of the buttons the individual toolbars contain, you'll see an arrow symbol in a collapsed version of the toolbar. Drag the dotted line to adjust the size of a toolbar, or click the arrow to temporarily expand a toolbar and show all tools it contains.

Space permitting, you can stack toolbars in spaces that are not occupied by any toolbars in the default layout.

8.7.3 Reset to Default Layout

Reset to Default Layout restores the layout of the full LightBurn window to the same format it was in when you first installed and opened LightBurn. If you've made lots of changes to your layout that you want to reverse all at once, or you've lost sight of the Laser Window, Cuts / Layers Window, Color Palette, or any other default windows or toolbars, use this option to get them back.

Resetting the layout doesn't reset anything else — your preferences, devices, and libraries are all preserved.

Go to Window → **Reset to Default Layout** to re-open and re-dock all default windows in their original order, while closing any that are not visible by default.

Holding `⇧ Shift` while clicking to open LightBurn will also reset the layout.

8.7.4 Related Topics

- Workspace
- Main Window
- Reset to Default Settings

_guide GRBL settings machine-settings device-settings coordinates-and-origin

8.8 GRBL Configuration

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

8.8.1 Quick Reference

- You might need to adjust your spindle max RPM value (`$30`) to match the LightBurn default (1000) or vice versa. The value in LightBurn is called **S-Value Max** in Device Settings.
- You might need to enable **Laser Mode** if you have GRBL 1.1f or later (`$32=1`)
- If you have an older version of GRBL (prior to 1.1f) upgrading the firmware is highly recommended, as Laser Mode also prevents the machine from pausing with every power change. The pause, which happens on older versions, or when not using Laser Mode, will cause excessive burn spots when engraving images.
- If your machine uses negative workspace coordinates you'll need to enable CNC Machine in Device Settings.
- 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

8.8.2 GRBL Flavors

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

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

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

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

8.8.3 Getting Machine Settings

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

The Machine Settings window provides you with a formatted table with the parameters labeled. You can also export these settings to a file for later restoration.

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

8.8.4 Other Machines

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

Figure out which firmware you're running

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

Find the machine origin and coordinate direction

1. Home the machine by pressing the **Home** button in the **Move** window.
2. In the console window, type `G0 X0 Y0` and press `Enter ⏎`. This will command your machine to head toward its origin position - the location represented by (0, 0) in the machine's coordinate system. This is not always the same as the home position. The origin is usually either the front left corner or the rear right corner of the machine, but can be a different corner or the center of the work area. If your machine moved to the center, skip to Center Origin Machines for more information.

3. After the machine has stopped moving from the previous command, type `G0 X10 Y10` and press `Enter ⏎`. If your machine moves 10 mm into the work area on both axes, your machine uses positive workspace coordinates. You can set the origin in LightBurn to match the machine origin you found in step 2. If your machine bumped the rails, it uses negative coordinates.

8.8.5 Machines without homing sensors or limit switches

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

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

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

xTool Wi-Fi Upload

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

Legacy Instructions: Negative Coordinate Machines

8.8.6 Legacy Instructions: Negative Coordinate Machines

If you're using a version of LightBurn released before 1.6, follow these instructions to work with a machine that uses negative coordinates.

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

Set A Workspace Offset

In the console, enter `G10 L2 P1 X-WIDTH Y-HEIGHT` and hit `Enter ⏎`. Replace `WIDTH` and `HEIGHT` with the actual X and Y travel distances of your machine. Set your machine to use workspace coordinates with the `$10=0` command.

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

Clear a Workspace Offset

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

Detailed Explanation.

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

A negative workspace system looks like this:

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

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

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

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

Set Macros

For a one click way to set or clear workspace coordinates, you can create macro buttons for these commands in the Macros Window. See the linked page for directions.

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

Center Origin Machines

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

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

_guide network GRBL Wi-Fi

8.9 GRBL Network Connection Setup

This guide explains how to set up a GRBL laser over a local network (e.g. your home router).

The Sculpfun iCube is used as an example, but the process should be similar for any GRBL device capable of network connections.

We've attempted to point out anything that is device-specific throughout, but GRBL network configuration is not fully standardized. If your device's network settings don't match this guide, please email support or visit our forum, where we can help you with your device and gather the information we need to update this page to help other users.

8.9.1 Part 1: Connect Over USB

Why do I need USB? Isn't this about WiFi?

You'll need to connect with USB to update a few settings on your laser. If your laser is already connected with USB, you can skip to Part 2.

If your laser is already connected to WiFi and you just want to connect a second computer to it, you can skip to Part 4.

1. Turn on the device and connect to the computer with a USB cable.
2. Use the USB connection to add the device as described in Find My Laser.
3. Select the device in the Laser Window:
   - If you see **Ready** right below the title bar of the window, your laser is connected and ready to use.
   - If you see **Busy** and a green progress bar, your device is busy doing something. Many GRBL devices will home themselves when first connected, so you'll see the Busy message until homing is complete.
   - If you see **Disconnected**, your device is not connected. Make sure you have the correct serial port selected (the dropdown that says **COM3** in the screenshot below). If your laser still isn't connecting, select **(Choose)** in the same dropdown and then reselect the serial port to reset the connection. If you're still unable to connect, see Troubleshooting: Connection Problems.
4. Open up the Console Window:
   - By default, the Console window is in the same section of the screen as the Cuts / Layers and Move Windows.
   - If you don't see the Console window, go to the **Window** menu and make sure **Console** is checked.
   - In the next two sections of this guide, you'll use the Console Window to configure your network connection.

8.9.2 Part 2: Find Network Info in Console

Immediately after you connect to your laser, you should see a series of messages in the console describing your laser's status.

You need information about your laser's network status, shown in the line starting with `Radio Mode`:

```
[Radio Mode: AP, Sculpfun iCube44285, 192.168.4.1, Not connected]
```

Your laser won't send the exact same message, but you should see something similar. Here's what each part of the message means, based on the example above:

Message	Meaning	Explanation
`Radio Mode: AP`	Network type, typically either `AP` or `STA`	If you see `AP` here, your laser is in *Access Point* mode, allowing you to connect directly to the laser over WiFi. If you haven't changed your laser's network settings, it will likely be in this mode. If you see `STA` here, your laser is in *Station* mode and will attempt to connect to an existing WiFi network. This is not universal, and some devices are configured differently.
`Sculpfun iCube44285`	WiFi network name, or *SSID*	The name of the WiFi network the laser is either broadcasting (in *Access Point* mode) or attempting to connect to (in *Station* mode).
`192.168.4.1`	Laser's IP address	This is the *IP Address* of the machine — it's how a computer knows where to find it on a network.
`Not Connected`	Connection Status	This tells you whether your laser is connected with any devices over the network connection.

Your specific device may not match this exactly. Please email support or visit our forum if you need help with your specific device.

8.9.3 Part 3: Configure Network Connection

This process varies between devices. If you're not sure how to change WiFi settings and the directions below don't work for you, try checking your laser's user manual or seeking support from your laser's manufacturer. These settings are stored on the laser, so once your laser connects to the network, you shouldn't need to repeat this process until your WiFi network changes.

Your laser may come with a mobile app or web interface that allows you to configure network settings. If you aren't able (or don't want) to use these, skip ahead to Configuration in LightBurn.

Configuration With App or Web Interface

> **Tip**
>
> Many devices will automatically disconnect from a WiFi network without an internet connection. You may need to modify your device's network settings to connect directly to your laser. See the support resources for your phone or computer for help with your network settings.

If your laser is in *Access Point* mode, you may be able to configure the network connection using a mobile app provided by the manufacturer or a web interface. This isn't always possible and the process varies between lasers, but in general you will need to start by connecting a phone or computer to the laser's WiFi network. If you need a password to connect, check your laser's user manual for the default password. For the Sculpfun used as an example here, the default password is "12345678".

If your laser uses a web interface, enter the *IP Address* from Part 2 where you would usually type in a website's URL to access it.

Here are the settings you will need to configure, although they may be displayed differently for your laser:

Name	Value	Notes
Network type	Typically *STA* or *Station*	You want to connect to an existing network. You don't want *AP* or *Access Point*
SSID	Your WiFi network's name, or *SSID*	Newer routers may have 2.4GHz and 5GHz connections available. If you see both, choose 2.4GHz
Password	Your WiFi network's password	Enter this carefully to avoid entering it incorrectly

Configuration in LightBurn

To configure your laser's network settings, you will need to use the Console Window.

Network configuration varies between devices, so check your laser's user manual for more information. The Sculpfun used as an example here came with a sheet of paper listing the appropriate parameters. Regardless of what laser you're using, you will need to change the settings listed below, but the number after `$` may be different for your specific laser:

Name	Parameter	Value
Network type	`$50`	Typically `STA`
SSID	`$53`	The name of the WiFi network to connect to
Password	`$54`	The password to connect to the WiFi network

Each command given is entered into the text box at the bottom of the **Console Window** and followed by pressing `Enter ⏎`.

To check the value for any of these parameters before changing it, you can use the parameter without assigning a value. To change the value, add `=YOURVALUE` after the parameter. As an example, `$53` will show the name of the WiFi network to connect to. `$53=MyWifiNetwork` will configure the laser to connect to a network called "MyWifiNetwork".

Each of the following steps will use the parameters shown above. If your laser's manufacturer provides different parameters, use those parameters.

Known Exceptions

The Spider X1 requires that `$50` be set to `2` to enable WiFi. As we identify additional devices that differ from the settings shown above, we will add them here.

Set Network Type

Use `$50=STA` to set your laser to *Station* mode. This tells it to connect to an existing network.

Don't worry for now if you see `[MSG: No SSID]` or a similar message in the Console window. This is your laser's way of telling you that it doesn't know what network to connect to yet.

Set Network Name

Use `$53=ExampleNetwork`, to set the *SSID*, replacing "ExampleNetwork" with the actual name of your WiFi network.

Make sure you type accurately, including capitalization.

Set Password

Use `$54=Password1234` to set the WiFi password, replacing "Password1234" with your actual password. The screenshot above also shows how to use `$54` to check the saved password.

Make sure you type in your password accurately, including capitalization. This should be the password to connect to WiFi, not the login info for your computer or any accounts you may have.

Check Connection

After configuring network settings, you may need to restart your laser to get it to connect. The `Radio Mode` status message now shows updated network settings and ends with `Connected`:

```
[Radio Mode: STA, ExampleNetwork, 192.168.9.173, Connected]
```

Make sure you write down the *IP Address* (`192.168.9.173` in the example above) for easy access in Part 4.

8.9.4 Part 4: Network Connection in LightBurn

Once you have an IP address, you can set up a network connection in LightBurn.

1. In the Laser Window, click the Devices button and choose Create Manually. Click **Next** to continue.
2. Select **GRBL** to create a new GRBL device and click **Next**.
3. Select **Ethernet/TCP** as your connection type and click **Next**.
4. Enter your device's IP address or hostname from Part 3 and click **Next**.
5. Give the device a name that makes sense to you and set the size of the work area. Click **Next**.
6. Check that the origin and homing settings are correct and click **Next**.
7. Make sure the summary looks correct and click **Finish**.

At this point, you should be able to connect to your laser through the network connection by selecting the device you've just added in LightBurn.

8.9.5 Troubleshooting

- If your laser isn't able to connect to the WiFi network in Part 4:
  - Check that the SSID and password are correct.
  - If you are using a 5GHz WiFi network, try using a 2.4GHz network instead. Most routers that have 5GHz WiFi will also have a second SSID for 2.4GHz.
- Ensure your computer is connected to the same network as your laser.

- If you have trouble connecting, you may need to change the network port LightBurn is using to communicate with your laser.
- If you can connect but the laser is stuttering, stopping, or restarting mid-job, you may need to switch to Synchronous Transfer Mode.

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8.10 Galvo Driver Installation

Note

These instructions are for Windows users only — macOS users do not need to install a driver to connect to a Galvo laser.

If you're using a Galvo laser with Windows, you'll need to make sure the correct driver is installed.

If you have an EZCAD-based laser, this can be achieved by checking the **Install EZCAD2 Driver** box in the LightBurn installer.

If your laser uses a **BSL** control board, you may need to install a different driver by installing your laser's stock software, or searching the files provided by your machine's manufacturer for an executable file named `CypressDriverInstaller.exe` or similar. Both the stock software and driver are usually provided with your laser on a USB drive.

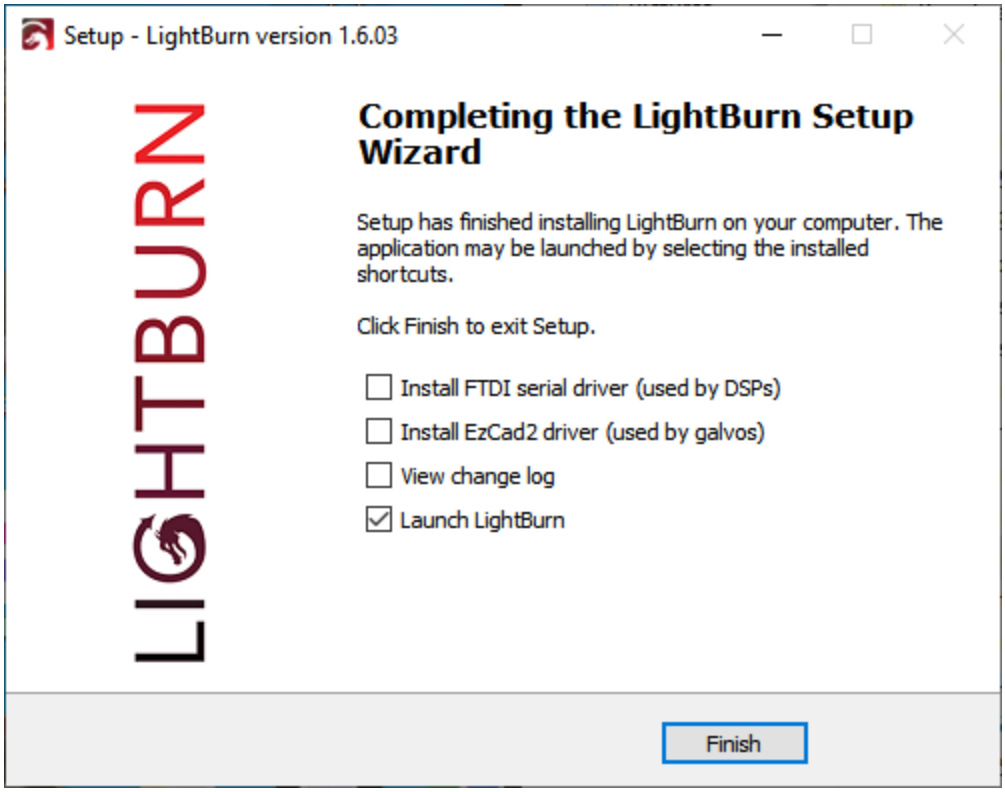
Not sure if your laser has an EZCAD2 or BSL board?

If your laser uses EZCAD2 as its stock software, it has an EZCAD2 control board.

If your laser uses SeaCAD, SimpleCAD, or BSLCAD as its stock software, it most likely has a BSL control board. There are many other variants — consult your laser's manufacturer for further assistance identifying your type of laser.

8.10.1 Installing the Driver (EZCad2-Based Lasers)

When installing LightBurn, the last screen of the installer has a set of checkboxes to install additional drivers needed for certain types of machines. You'll need to select **Install EZCAD2 driver** in order for LightBurn to communicate with the Galvo laser you're trying to set up.



If during initial installation you didn't check this box, you can run the installer again, and select the box to ensure the driver is installed. Windows will prompt you for permissions escalation to install it, and replace the driver provided by default with one LightBurn can use to communicate with your galvo-based laser.

If you prefer to install the driver manually, you can find the installer at `C:\Program Files\LightBurn\EzCad2Driver\` and can be run again via the `dpinst-x64.exe` file directly.

Legacy Zadig-based Driver Swap

Legacy Zadig-Based Driver Swap

If the driver installed automatically isn't working, you can try using Zadig to replace the manufacturer's driver with a generic one so LightBurn can communicate with it. This occurs most often on Windows 7 computers.

Download Zadig, the driver replacement tool from https://zadig.akeo.ie/ and run it. Zadig doesn't need to be installed.

You'll see a window that looks like this:

In Zadig, go to **Options** → **List All Devices**.

If your EZCAD laser is powered up and connected with the USB cable, you should see **USBLMCV2** (or very similar) in the device list, like this:

Select that device and choose **WinUSB** as the target driver, like this:

1. Double check that it says **LMCV2U** in the **Driver** box, and that the USB ID under it matches what you see above. If you haven't used the laser with this computer before, the 'Driver' box may be empty instead.
2. Click **Replace Driver** and wait for the process to complete. Make sure that you are not running EZCAD when you do this — if anything is actually *using* the hardware, the driver swap will likely not complete, and time-out after five minutes. If everything goes as expected, it takes about a minute, often less.
3. You'll see some different messages cycle through while it does the install. When it's done, it might ask you to reboot, but that's rarely required.

4. On the rare occasion that Zadig fails, try it again — it almost always works, and sometimes reports a failed installation erroneously, when it actually succeeded. You *should* see this:

Restoring the EZCAD Driver

Restoring the EZCAD Driver

In the event you want to use EZCAD, you'll need to return to the original driver. You can switch back and forth as many times as you need to.

Open the Windows Device Manager.

Next, find the **USBLMC** device in the list - it should be near the bottom, under **Universal Serial Bus devices**, shown below:

Right-click the device and choose **Uninstall Device** from the pop-up menu.

In the next window, check the box to delete the driver. This doesn't actually delete anything from your system, it just completely disassociates the driver from this device.

Click the **Uninstall** button. The process should finish quickly.

If you power off the laser and power it back on, Windows will reconnect, realize that it already has a driver for this device (the old LMC driver) and it will appear in the Devices list again, near the top, as a **BJJCZ Device**. Now you can use EZCAD again.

Verify Driver Installation

Opening Device Manager

To open the Device Manager, type "device manager" in the search box on the taskbar, then select Device Manager from the menu.

Your laser will appear differently in the Windows **Device Manager** before and after the driver has been successfully installed.

- Before installing the driver, the laser will appear as a **BJJCZ Device**. If you see this, the correct driver is *not* installed.
- After installing the driver, the laser will appear under **Universal Serial Bus devices** as **USBLMCV2**, **USBLMCV4**, or something else similar.

Figure 1: An EZCAD-based Galvo device as it appears before the driver has been installed

Figure 1: Success! An EZCAD-based Galvo device as it appears after the driver has been installed

8.10.2 Installing the Driver (BSL-Based Lasers)

To connect a BSL Galvo laser to LightBurn, you may need to install the same driver used by the stock software that came with your laser, in one of two ways.

Not sure if your laser has a BSL board?

If your laser uses SeaCAD, SimpleCAD, or BSLCAD as its stock software, it most likely has a BSL control board. There are many other variants — consult your laser's manufacturer for further assistance identifying your type of laser.

Install Stock BSL Software

Search the USB drive that came with your laser for the executable file that installs your laser's stock software. Double-click the file to begin the installation process.

Figure 1: The SeaAPP.exe file will install SeaCAD, along with the necessary driver. The specific name of this file and stock software may vary for your laser.

Install the Cypress Driver

Search the USB drive that came with your laser for the executable file that installs the Cypress driver. Double-click the file to begin the installation process.

Figure 1: The CypressDriverInstaller.exe file will install the necessary driver for this laser. The specific name of this file may vary for your laser.

Verify Driver Installation

Opening Device Manager

To open the Device Manager, type "device manager" in the search box on the taskbar, then select Device Manager from the menu.

Your laser will appear differently in the Windows **Device Manager** before and after the driver has been successfully installed.

- Before installing the driver, the laser will appear with a caution/warning symbol next to its name. If you see this, the correct driver is *not* installed.
- After installing the driver, the laser will appear under **Universal Serial Bus controllers** as **SEA-LASER** (with no caution/warning symbol), **Cypress FX2LP Sample Device**, or something else similar.

Figure 1: A BSL-based Galvo device as it appears before the driver has been installed

Figure 1: Success! A BSL-based Galvo device as it appears after the driver has been installed

8.10.3 Related Topics

- Add a Galvo Laser
- Galvo Troubleshooting

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8.11 Galvo Laser Focusing

Danger

Any use of a laser as outlined in this section requires effective and useful laser safety glasses, calibrated to your laser's output wavelength range.

Laser safety glasses should come with the wavelengths they protect against permanently marked on the glasses themselves.

To use your Galvo laser effectively, you'll need to have it in focus, well tuned, and well calibrated. This enables effective use of features like Cylinder Correction, 3D Sliced Engravings, and more.

8.11.1 Finding Your Focal Point

Each lens should be labeled with a focal length, such as F330 for 330 mm lenses or F160 for 160 mm lenses. This is a good starting point for focusing, but manufacturing differences result in discrepancies between lenses, so you should still fine-tune the focus by looking for crisp outlines in framing or listening for audio cues.

To use "crisp outlines" to find the focal length, you'll need to Frame a design and raise/lower the galvo until the edges are as crisp as possible. This requires your galvo to have an in-line red dot.

With audio cues, you'll instead listen for louder burning or sizzling noises while the job is running. The correct focal length will generally make the loudest sounds.

While the depth of field is a range that produces engraved results, finding the optimal focal point within that field is important to ensure the best results, and is best found through trial and error.

Step-By-Step Guide for Focusing Flat Objects

1. Raise your galvo head as high as it can go.
2. Start a Repeat engraving.
3. Lower the head until it starts making noise.
4. Continue farther down slowly until the engraving noise is as loud as it gets.
5. If the noise tapers off, raise it back up and fine tune based on that.

6. Your flat surface is now focused!
7. If your laser has two diode-red-dots that are manually moved, re-adjust those at this point. See your laser's user manual for help.

8.11.2 Measuring Focal Length

> **Tip**
>
> Make sure you keep track of what part of the laser your focal length is measured to! You might find it convenient to measure to a point other than the bottom of the lens, and that's fine as long as you keep measuring to the same height.

Accurately measuring the focal length above is a useful process to speed up swaps of different and diverse jobs, given the lens. Use an acrylic ruler (preferably one with the edge of the ruler starting from 0"/0 mm), to measure up to the point the ruler meets the outside lip of your lens.

If your acrylic ruler has a lip, you can measure the offset with calipers to produce the formula needed to measure the focal length accurately.

To make it quicker and easier to focus the laser when working with objects of different sizes, it's a good idea to make a tool that you can place between the lip of your lens and your object, so you can easily raise/lower your galvo head to it. This can be as simple as a dowel of the right length marked to indicate which lens it goes with (if you have multiple lenses). Another popular option is to laser cut an acrylic focusing tool for the size you need.

Video Guide For Focus Sticks

8.11.3 Focusing For Cylinder Correction

Cylinder correction within LightBurn maximizes the depth of field usable for engraving by *intentionally* defocusing your laser. See here for more information.

8.11.4 Related Topics

- Changing a Galvo Laser Lens
- Red Dot Offset
- Add a Galvo

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8.12 Laser Offset Setup

If your laser has a red dot pointer that is not aligned to the location of your laser's beam, use the Laser Offset in the Device Settings window to shift your laser's output to match the location of the red dot.

With the Laser Offset properly set up, you can use the red dot location to:

- Align output to material using Current Position or User Origin
- Frame output location

When you run your project, the location of the laser head will shift to match the location of the red dot when you performed one of the above actions.

8.12.1 Establishing a Laser Offset

1. In the Device Settings window, make sure **Enable pointer offset** is *disabled* before beginning this process.

2. Load an inexpensive, expendable material into your laser's bed. Place it in a location that both the red dot and laser's beam can reach. Position your laser over the material.
3. Download this 2 square pattern, and Import it into LightBurn.
4. Make sure the pattern is assigned to a layer set to Line Mode, and apply appropriate settings to mark it on the material you loaded into your laser, without cutting through.
5. Select Current Position as the **Start From** mode, and *center* for the **Job Origin** position.

> **Note**
>
> If you are using a DSP device, go to Edit → Machine Settings and make sure **Return Position** is set to **No Return**.

6. Press **Start** in the Laser Window to run the job.
7. In the Move Window, press **Get Position**, and record the **X** and **Y** positions reported.
8. Jog your laser until your pointer's red dot is perfectly aligned to the center of the 2 square pattern — where the squares' bottom right and top left corners meet.
9. Press Get Position once again, and record the X and Y positions reported.

10. To calculate your X and Y offsets, subtract the X and Y positions you recorded in **Step 9** from the ones you recorded in **Step 7**.

    For example, if you recorded X: 180 in **Step 7** and X: 200 in **Step 9**:

    ```
    180 - 200 = -20
    ```

    And if you recorded Y: 200 in **Step 7** and Y: 195 in **Step 9**:

    ```
    200 - 195 = 5
    ```

11. In the Device Settings window, enter the results from **Step 10** in the X and Y fields in the **Laser Offset** section and toggle *on* Enable pointer offset.

    > **Note**
    >
    > If you are using a DSP device, reverse the sign of the values you calculated in **Step 10** — make negative numbers positive, and vice versa.

12. Test your offset by re-running the same job, exactly as it was set up in **Step 6**, with the red dot still directly centered over the the pattern, where the points of the 2 squares meet.

    The laser head should shift to match the location of the red dot, and the output should overlap with the first engraving.

8.12.2 Troubleshooting

- If output shifts in the wrong direction in one or both dimensions, reverse the sign of the offset you entered in the Device Settings window — make it positive if it is negative, or vice versa.
- If it is close, but slightly misaligned, re-run the setup process, taking care to align the red dot as perfectly as possible to the center of the 2 square pattern in **Step 8**.
- If alignment is lost between uses, make sure the red dot pointer is mounted securely, so that its location cannot drift, then re-run the setup process.

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8.13 LightBurn Bridge Setup

Follow the steps below to connect to your laser using a LightBurn Bridge.

> **Note**
>
> The LightBurn Bridge is only compatible with lasers using Ruida controllers.

8.13.1 Ruida Controller Configuration

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

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

Connecting the LightBurn Bridge to Your Network

Ethernet on macOS 15+

If you're using macOS 15 or higher, you'll need to allow LightBurn access to the local network.

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

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

Note

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

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

Note

You may also configure the WiFi manually, as shown on the Advanced Setup page.

Configuring the Bridge in LightBurn

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

Setting the WiFi name and password

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

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

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

Finding the LightBurn Bridge From Your PC

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

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

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

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

Name and Work Area Size

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

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

Laser Origin

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

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

All Done!

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

Next Steps

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

_guide migration user-bundles

8.14 Moving LightBurn to Another Computer

This guide will help you move your LightBurn settings and devices from an existing installation to a new computer.

Before you begin, please make sure that you have:

- An existing, already configured LightBurn installation running at least LightBurn 1.6.
- A new LightBurn installation that you wish to migrate to, also running at least LightBurn 1.6.
- Some way of moving files between computers. A USB flash drive is typically a convenient way to do this.

What if I'm using an older version of LightBurn?

This guide makes use of LightBurn's User Bundles feature, introduced in LightBurn 1.6. If you are using an older version of LightBurn, please either upgrade before migrating or see our legacy documentation for assistance.

License Management

Each LightBurn license key comes with 3 seats, allowing you to activate LightBurn on up to 3 computers simultaneously. If you will no longer be using LightBurn on a particular computer, you can deactivate LightBurn to free up the seat for use on another computer. See License Management for more information.

You can add additional seats without purchasing a separate license here.

8.14.1 Migration Overview

Most of the migration process is handled by LightBurn's User Bundles feature, which can export and import the following:

- LightBurn Settings
- Custom Hotkeys
- Material Test Presets
- Image Presets
- Devices
- Material Libraries
- Art Libraries

Please be aware that **User Bundles** do *not* contain:

- Your project files, which you'll need to move yourself.
- Your SHX fonts folder, which you'll need to move yourself.
- Ordinary fonts, which are handled by your computer, not by LightBurn.

Migrate Settings and Devices With User Bundles

The migration process starts with exporting a **User Bundle** from the existing installation and importing it into the new installation.

Start by exporting user bundles containing all the settings you want to bring into the new installation:

1. In an existing and already configured LightBurn installation, go to **File** → **Bundles** → **Export Bundle**.
2. Make sure that all components of the current installation that you want to include are selected and click **Export**. Save the `.lbzip` file somewhere you can find it again easily.

Next, import the bundle into the new installation:

1. Move the `.lbzip` file from **Export Bundle** to the new computer.
2. Open LightBurn on the new computer, and drag the `.lbzip` file into LightBurn to load it.
3. Make sure that all components you want to import are selected, and uncheck any components you want to ignore. Components that are already detected on the computer will be grayed out and unavailable, with two exceptions:
   - Devices that conflict with an existing one will create a duplicate to preserve the existing profile.

- **Material Libraries** and **Art Libraries** with the same name but different contents will create a new copy of the library without overwriting the original.

4. Click **Import** to complete the process.

Move Project Files

Because users are free to store and organize their project files however they want, LightBurn is unable to move project files automatically. Please make sure that you copy any project files you want over to your new computer yourself.

Move SHX Fonts

SHX Fonts are handled separately from other fonts installed on your computer. To move your SHX fonts to the new computer, please do the following:

1. Copy your **SHX Fonts** folder to the new computer.
2. If your SHX fonts aren't recongized, update the SHX Font path on the new computer.

8.14.2 Related Topics

- User Bundles
- SHX Fonts
- Devices
- LightBurn Settings

_guide

8.15 Multiple LightBurn Instances

8.15.1 Open Additional LightBurn Windows

Each LightBurn window can open a single project and communicate with a single device at a given time. To jump quickly between projects or run jobs on multiple lasers simultaneously, open a new window by going to File → New Window.

All windows will share the same settings and preferences. Be careful if you're changing your preferences in LightBurn – the last window closed will save changes to the preferences file, overwriting any changes you may have made in other open windows.

If you need fully independent LightBurn instances, with separate settings and preferences, we have directions for running multiple independent instances below.

8.15.2 Running Multiple Independent Instances of LightBurn

Info

These directions will only work on Windows. The steps required to adjust this behavior and replicate it on macOS will not be the same.

Danger

This guide is for advanced users comfortable making changes to their operating system. Follow these directions carefully and at your own risk.

To run multiple fully independent instances of LightBurn on the same computer, you will need to create separate profiles. This workflow is *not* suggested, but is documented for the users who need it.

Steps

1. Open LightBurn and export your current preferences by going to File → Preferences → **Export Prefs**.
2. Save the `.lbprefs` file and note its location.

3. Close all LightBurn windows.

4. Open File Explorer and navigate to the Windows Start Menu links storage location. The easiest way is to enter the file path below into the File Explorer address bar.

```
C:\ProgramData\Microsoft\Windows\Start Menu\Programs\LightBurn\
```

5. Copy the LightBurn shortcut and paste it twice. Rename each file – this guide uses `LightBurn_A` and `LightBurn_B`. Grant administrator privileges in the User Account Control window by selecting **Ok** and then **Continue** to save each change.

6. Right-click on the first shortcut file and select **Properties**.

7. Select the **Shortcut** tab and replace the text in the **Target** field to match.

> **Info**
>
> Replace `LightBurn_A` with whatever name you want your first profile to use. Do not include a space between the file name and the `&&` characters as formatting and syntax matters.

```
C:\Windows\System32\cmd.exe /c "SET LB_SETTINGSFOLDER=%USERPROFILE%\LightBurn_A&& START /D
^"C:\Program Files\LightBurn\^" LightBurn.exe"
```

8. Click **Apply** followed by **OK** and grant admin permissions again to save the changes.

9. Repeat **Step 6** through **Step 8** for the second shortcut, this time using this target link:

> **Info**
>
> Replace `LightBurn_B` with whatever name you want your first profile to use. Do not include a space between the file name and the `&&` characters as formatting and syntax matters.

```
C:\Windows\System32\cmd.exe /c "SET LB_SETTINGSFOLDER=%USERPROFILE%\LightBurn_B&& START /D
^"C:\Program Files\LightBurn\^" LightBurn.exe"
```

Two new LightBurn shortcuts are now located in the Windows Start menu. Reentering your license key will not be required.

10. Open the Windows Start Menu and click on the first newly created LightBurn shortcut – `LightBurn_A` in our example – to launch the first independent instance of LightBurn.

11. Click **OK** to close the first run Help & Notes window.
12. Click on **Import Preferences** in the bottom left corner of the Devices window.
13. Select and load the preference file you saved in **Step 1** to load all devices in the preferences file.

14. Select and remove any devices you do not want associated with this LightBurn instance and click **OK**.
15. Open the second application link – `LightBurn_B` in our example – and repeat **Step 11** through **Step 14** to load the original preference file into the second independent instance of LightBurn.

Summary

Two new preferences directories can now be found in your Windows user profiles folder at `%USERPROFILE%\LightBurn_A` and `%USERPROFILE%\LightBurn_B`. The `%USERPROFILE%` shortcut will resolve to the full file system path on for your user directory.

Starting LightBurn with the new shortcuts will launch multiple LightBurn instances that are completely independent of one another. They will not overwrite the other's preferences file and any changes you make to the device on each will persist, and will include completely independent recent file lists, rotate/shear options, and more. Each LightBurn instance will be completely independent.

Danger

While LightBurn allows for simultaneous use of multiple devices without conflicts, cameras and lasers cannot be used by multiple instances of LightBurn concurrently. For example, a DSP controller set up as "Ruida A" will not be able to be accessed in the `A` and `B` configurations simultaneously.

Origin

This guide originated as a post on our forum by one of our developers. For reference, that guide can be found here.

_guide image-mode image adjust-image interval-test focus-test modes-and-advanced-control cut-settings-editor material-test line-interval dpi dot-width-correction

8.16 5 Steps to Perfect Image Engravings

8.16.1 Steps:

1. Focal Length

Figure 1: Diagram of the effect of focal length on image engravings

Focal length affects the strength and size of the laser dot where it meets the material. A laser that is perfectly focused will have the smallest dot possible, with the highest strength of the beam.

To find the correct focal length for your hardware, use Laser Tools → Focus Test, if your machine has a motorized Z Axis.

For lasers without a motorized Z Axis, use the method of focusing described by your machine's manufacturer.

Tip

Some people prefer the look of a slightly defocused laser for engraving, as it softens the edges between scan lines. However, adjusting settings is easiest with a focused laser. We recommend keeping the laser focused while conducting the following steps, and playing with defocusing as an optional step at the end.

2. Speed & Power

Figure 1: Relationship between speed and power in laser engraving

The Speed and Power settings affect the depth and darkness of an engraving.

Go to Laser Tools → Material Test to test varying Speed and Power settings, and find a value that engraves nice and dark but doesn't cut too deep. Dark engravings are generally more difficult with CO2 lasers than diode lasers — CO2 users will typically have more success with slow speeds and low power.

Apply the optimal Speed and Power values you identified to a layer set to Image Mode in the Cut Settings Editor, or save them to an entry in the Material Library.

3. Line Interval/DPI

Figure 1: Ideal settings for Line Interval/DPI

Line Interval and DPI are tied together. They change the distance between each pass (scan) of the laser head. If Line Interval is too low (and DPI too high), images will be very dark (as the lines overlap). Too high and the image will be too light.

Use Laser Tools → Material Test to find the ideal interval. You're looking for the value that creates lines that just touch (don't overlap, nor have a gap). Try values between 120 and 300 dpi (0.08-0.2 mm). You will need a microscope or strong magnifying glass.

If you don't wish to use the Interval Test, or you are having trouble seeing the overlap of lines on your material, try engraving a gradient and manually varying the Line Interval in the Cut Settings Editor.

When you have found an ideal Line Interval setting, apply it to a layer set to Image Mode in the Cut Settings Editor, or save it to an entry in the Material Library.

Tip

- When working with material with a grain (e.g wood), orient the test so the scan lines are perpendicular to the grain — parallel makes it difficult to distinguish between engraving texture and material texture.
- A raking light can help to differentiate scan lines.
- For best results, create future images with the same DPI as dictated by the Line Interval you found in this step.

4. Dot Correction

Figure 1: Diagram showing different levels of Dot Correction

Beams have a thickness which makes dots longer than they should be — we can correct that with Dot Width Correction. Make sure you adjust your settings in Cut Settings Editor as described below:

- Use the settings for **Speed**, **Power**, and **Line Interval/DPI** you found in the previous steps.
- Set the Image Mode to Ordered.
- Turn off Bi-directional scanning.
- Make sure Negative Image is turned off.

Additional information on these settings

Using a smoother/more organic image mode (e.g. Jarvis) would not produce this consistent pattern. Bidirectional scanning can result in every other layer being slightly offset, unless you've already perfected your Scanning Offset Adjustment table. This doesn't matter for the more organic image modes, but it's very visible in Ordered.

Ordered Image Mode on a 50% gray rectangle should produce a checkerboard pattern that is 50% engraved and 50% not. Test out the same image with different Dot Width Correction values — the number should always be smaller than whatever you're using as your Line Interval setting. The valid range is from 0 to your interval value.

Tip

Use Convert to Bitmap to create a 50% gray rectangle.

Once you have found the optimal Dot Width Correction value, apply it to a layer set to Image Mode in the Cut Settings Editor, or save it to an entry in the Material Library.

Make sure to switch back to Jarvis Image Mode, and turn Bi-directional scanning back on (it's a lot quicker).

5. Adjust Image

Try engraving your image. If you are still not getting the look you desire, it's likely because the image you're using needs some adjusting, which you can do using the Adjust Image tool. Try changing the Brightness, Contrast, and Gamma, along with the Enhance features.

_guide machine-guides network Ethernet

8.17 Connect to a Ruida Laser via Ethernet

If you have a laser using a Ruida controller, you may want to connect via Ethernet to avoid using excessively long cables. This guide will help you determine an appropriate IP address to use and set that IP address on the laser controller itself.

8.17.1 Networking

Ethernet on macOS 15+

If you're using macOS 15 or higher, you'll need to allow LightBurn access to the local network.

Ruida controllers operate over IPv4, or Internet Protocol Version 4, which consists of unique external and unique local addresses within a network. Ruida controllers need a *static* – or unchanging – IP address.

In order to connect a Ruida controller over Ethernet, you'll need to select a static IP address that doesn't interfere with other devices on your network. If you're comfortable doing that on your own, select an IP address appropriate for your network and jump ahead to setting the IP address on the controller. Otherwise, keep reading for help.

More on Networking

Most modern networking involves DHCP, where addresses are *loaned* temporarily to devices, like laptops and phones. More in-depth networking information can be found at Google Support, Simple Wikipedia's explanation, or other technical resources like Cisco or Meraki's websites. This is a complex topic with a wide range of possible setups, so we are unable to cover every situation.

8.17.2 Choose an IP Address

Choosing a static IP address that doesn't interfere with other devices on your network can be a little tricky if you aren't already comfortable with computer networking, but home networks are usually small enough that we can get by with picking an address that's unlikely to be used already.

For more complex network situations, such as a school or work network, we recommend working with your IT/networking team to select an IP address and connect your laser to ensure that you don't cause problems for your network infrastructure.

1. Find Your Computer's IP Address

To start, you'll want to find your computer's local IP address. It will be four sets of numbers separated by periods, similar to `192.168.1.19`. See below for tips on how to do that on Windows and Mac.

Windows

Open the command prompt (type "cmd" in the start menu or in the `⊞ Win` + `R` search box). At the command prompt, type `ipconfig`, and press `Enter ⏎`. Your results will look similar to this:

The line that says `IPv4 Address` is what you're looking for. Make a note of this address and move on to choosing a unique IP address.

Mac

Open Spotlight with `⌘ Cmd` + `Space` and type `IPv4` into the search bar to bring up your IP address in system settings.

Make a note of this address and move on to choosing a unique IP address.

2. Choose a unique IP address for your laser

Start with the IP address you found in the previous step. The first three segments need to stay the same, but the last segment needs to be a value from 1 to 255 that isn't already used on your network. An easy trick that usually works is to add or subtract 100 from your computer's address. This makes it less likely that another device connecting to your network will automatically be given the same IP address you choose.

Starting IP address	Try this IP address
`10.10.1.154`	`10.10.1.54` (subtracted 100)
`192.168.2.201`	`192.168.2.101` (subtracted 100)
`10.100.50.14`	`10.100.50.114` (added 100)

This trick doesn't guarantee a unique address, so if it's not working, try a few different IP addresses by varying the last segment.

8.17.3 Set the IP address on the controller

Note

Some Ruida controllers have different menu and button configurations. This is a guideline, not a hard and fast rule.

On the Ruida controller, use the Z/U or Menu buttons to enter the menu, navigate to **IP config+** , and press enter to access that menu setting. On the right side of the screen, the IP address field and gateway will be visible. Use the left/right arrows to move through the octets (sections), and the up/down arrows to change the value. Press and hold the up/down arrows to change the value.

When done, press the **Enter** button.

8.17.4 Add the laser in LightBurn

Ruida controllers accessed over a network are a separate type of connection than connecting directly over USB, and must be added separately, even if you've already added the laser to LightBurn over a USB connection.

Networked Ruida controllers can't be detected by **Find My Laser**, so you'll need to add the laser manually.

Warning

In the event this communication method proves unreliable, you may want to consider using a LightBurn Bridge, especially if you're using macOS. The Bridge provides a much more stable network connection than the Ruida controller's UDP connection.

Next: Add a Laser

8.17.5 Source

This guide was originally made for our forums on October 20th, 2019. You can find the original guide here.

_guide laser-control modes-and-advanced-control troubleshooting device-settings

8.18 Scanning Offset Adjustment

Modern lasers are capable of moving very fast, and with remarkable precision, but firing the beam still takes time. Some power supplies and tubes may respond in microseconds, but others take longer. At higher speeds, belts will pull slightly as well, and all of these things can cause the output of the laser to shift slightly when engraving.

Don't forget to check for mechanical problems

Before adjusting **Scanning Offset**, make sure you check for mechanical problem such as loose belts which can also cause slipping and shifting.

At 100 mm/second, 254 dots per inch means your dots are 0.1 mm in length, fitting 1000 of them in 100 mm. At 100 mm/sec, if your power supply and tube take 1 millisecond to fire, your engraving will be offset by a full dot width.

At 500 mm/second, that 1 millisecond delay means you'll be off by 5 dots, or ½ a millimeter. Still not very much, but visible. Adding a bit of mechanical stretch to this will increase the offset.

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

LightBurn has a setting to counter this, called **Scanning Offset Adjustment**, in the **Basic Settings** tab of Device Settings.

Note

Other software may refer to it as "Reverse Interval" or "Reverse Compensation".

8.18.1 Determining Scanning Offset Adjustments

Already have Scan Offset settings in a `.lbso` file?

If your laser manufacturer provided a `.lbso` file or you've exported your own settings, skip ahead to Importing and Exporting Scan Offset Settings.

To use this feature, you need to measure the response of your machine at a few different speeds.

1. Create a rectangle in LightBurn, 50 mm wide and 10 mm high,
2. Make sure the rectangle is assigned to a layer set to Fill Mode, and apply an appropriate Power setting to visibly engrave the material you loaded into your laser without charring.
3. Set the Line Interval to 0.5 mm.
4. If you are on a GCode based device, enable Overscanning, and set it to 5% or greater to be sure the machine is not slowing down before reaching the ends. (Ruida devices overscan automatically).

5. Run the rectangle at multiple Speeds. At least two will be required for this process, but using more will improve the quality of your results. Make sure you use speed settings your laser is capable of reaching, and keep track of the speed used for each run. The exact speed settings you use will depend on your machine, but you should test several different speeds representing a range of speeds your laser can achieve.

6. To compensate for the misalignment of lines, measure the distance between the ends of the lines at each Speed. You'll need to enter *half* that distance in the next step.
7. In the **Scanning Offset Adjust** section of the **Device Settings** window, click **Add** to enter the **Speed** and **Line Shift** (distance between ends of lines) values into the Scanning Ofset Adjustment table. LightBurn will use this information to compute the correct adjustments for other speeds as well.

> **Note**
>
> You will need to enter *half* the measured distance between lines — LightBurn moves each line by the amount you specify, so each pair of lines only needs to move half the distance.

8. Make sure to toggle **Enable Scanning Offset Adjustment** on, and click **OK** to exit the Device Settings window and save your changes.
9. You may need to perform this process 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:

8.18.2 Importing and Exporting Scan Offset Settings

Importing

Use the **Import** button in the **Scanning Offset Adjustment** section of **Device Settings** to load and apply an existing `.lbso` file containing Scan Offset settings. Some manufacturers provide these files to simplify the process. You can also export and import your own Scan Offset settings to move them between different computers.

Exporting

Use the **Export** button in the **Scanning Offset Adjustment** section of **Device Settings** to create a `.lbso` file that can later be imported on another computer to transfer Scan Offset settings.

8.18.3 Line Wobble

A different, but equally common problem is line wobble, often caused by too high an acceleration setting. When performing the test engraving 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.

8.18.4 Related Topics

- Mechanical Issues
- Fill Mode

_guide advanced-features dual-laser

8.19 Set Laser 2 Offset

If you have a DSP laser with dual laser tubes *and* dual laser heads, the directions below will help you set your **Laser 2 Offset** values.

8.19.1 Laser 2 Offset

The **X** and **Y** fields beneath the **Enable Laser 2 Offset** switch in the Device Settings window are used to compensate for the distance between two laser heads. By shifting output to the 2nd laser head by specified X and Y values, output from Laser 2 will line up with output from Laser 1.

Follow the instructions below to measure the distance between Laser 1 and Laser 2 and apply appropriate offsets.

1. Before beginning this process, make sure **Enable Laser 2 Controls** is toggled *on*.

2. Load an inexpensive, expendable material into your laser's bed. Make sure it is large enough for both laser heads to mark it at once. Position it beneath both laser heads.
3. Use the Draw Lines tool to create a short, perfectly vertical line in your LightBurn workspace.

> **Tip**
>
> Hold `⇧ Shift` while drawing to ensure the line is perfectly vertical.

4. Assign the vertical line to a layer set to Line Mode.
5. In the **Cut Settings Editor**, enable *both* Laser 1 and Laser 2, and apply appropriate settings to mark the vertical lines on the material without cutting through.

6. Select Current Position as your **Start From** mode.
7. Press Start to mark the lines on the material.
8. Measure and record the distance between the lines.

9. In the Device Settings window, turn *on* **Enable Laser 2 Offset**.
10. If Laser 2 is farther from your machine's origin than Laser 1, enter the measured distance between the lines as a *negative* value in the **X** field. If it is closer to the origin, enter the distance as a *positive* value.

> **Note**
>
> The machine's origin is the location it homes to when it first starts.

11. Rotate the vertical line 90 degrees to make it horizontal.

> **Tip**
>
> Press the `.` key to rotate objects 90 degrees clockwise.

12. In the Cut Settings Editor, add a **Sub-Layer** to the layer the horizontal line is assigned to.
13. You'll now have two Sub-Layers. Keep both set to Line Mode.
14. Disable Laser 2 for the first Sub-Layer, but enable it for the second Sub-Layer. Disable Laser 1 for the second Sub-Layer.
15. On the second Sub-Layer, apply appropriate settings for Laser 2 to mark your material.
16. Select Current Position as your Start From mode, and make sure the first laser head is positioned over the material.
17. Press Start.
18. If you measured the distance between the vertical lines accurately in *Step 8*, each horizontal line should line up perfectly in the X dimension.
    - If they are misaligned and the output from Laser 2 shifted in the opposite direction of what you expected, reverse the sign of the X dimension Laser 2 Offset in the Device Settings window. In other words, if the value is positive, make it negative, or vice versa.
    - If they are misaligned but Laser 2 output was shifted in the correct direction, repeat *Steps 1-8*, taking care to measure as precisely as possible.
19. If the horizontal lines are aligned in both the X dimension and the Y dimension, the process is complete. If they are aligned in X but *misaligned* in Y, measure the distance between the 2 lines.
20. If the line output by Laser 2 is farther from your machine's origin than the one output by Laser 1, enter the measured distance between the lines as a negative value in the X field. If it closer to the origin, enter the distance as a positive value.

> **Note**
>
> The machine's origin is the location it homes to when it first starts.

21. Mark the horizontal lines again to verify alignment.
    - Reverse the sign of the Y offset if output was shifted in the incorrect direction.
    - If output was shifted in the correct direction in Y but is still misaligned, reset the Y offset to 0 and repeat Steps 17-20.

_guide camera

8.20 WeCreat Camera Calibration and Alignment

Follow the steps below to Calibrate and Align your WeCreat Vision camera with LightBurn.

> **Note**
>
> These instructions are only for users with WeCreat Vision lasers. Follow our standard camera Calibration and Alignment instructions if you do not have a WeCreat vision laser.

8.20.1 Preparation

In order to complete this process, you will need:

- WeCreat firmware version 2.0.24 or later. To update, open WeCreat MakeIt and go to **Settings** → **Firmware** → **Check for Updates**. If you need assistance with the firmware update process, contact WeCreat support.
- LightBurn version 1.7.00 or later.
- A WeCreat device profile in LightBurn, created by importing the `.lbdev` file supplied by WeCreat. Download the file here. For instructions on setting up the device profile, see here.
- A piece of material in your laser that is large enough to engrave the target marker pattern onto — it must be at least 200 mm x 200 mm (roughly 8" square).

8.20.2 Steps

1. Select the WeCreat device from the dropdown menu in the Laser Window to make it active.
2. Open the Camera Control Window and make sure it is displaying an image from the WeCreat camera, indicating that it's connected.
3. Right-click in the Camera Control Window and select **Calibrate Camera Lens**.
4. In the **Lens Calibration Wizard**, select the WeCreat camera from the list, then select **(None - precalibrated camera)** from the **Use Preset** dropdown menu.

> **Note**
>
> This option is used for the WeCreat camera because the device automatically corrects for the lens distortion — no additional corrections are needed.

5. Click **Next**, then **Align Camera** to open the **Camera Alignment Wizard**. Make sure the WeCreat camera is still selected. If your laser is already focused to your material, proceed to **Step 10**.
6. If your laser is not currently focused to the material in your work area, exit the Camera Alignment Wizard.
7. Using the controls in he Move Window, jog your laser over the material in your work area and press **Focus Z**.

> **Warning**
>
> You *must* have WeCreat firmware version 2.0.24 or later in order to use the Focus Z button.

8. Right-click in the Camera Control Window and selected **Calibrate Camera Alignment**, or go to Laser Tools → **Calibrate Camera Alignment** to re-open the Camera Alignment Wizard.
9. Select **Camera is over the work area, in a fixed position**. Select the WeCreat camera from the list and click Next.
10. Choose between **Fit Workspace** or **100% Scale**. The 100% Scale option is roughly A4 or US letter sized pattern. Fit Workspace scales the pattern up larger, if your laser's working area can accommodate a larger size, which can sometimes improve the accuracy of your alignment.
11. Enter appropriate **Speed** and **Power** values for both **Fill** and **Line**. The precise values you need will depend on your model of laser, and the material you're using. For the WeCreat 20W, we chose 3000 mm/minute for Speed, and 30% power.

> **Warning**
>
> Make sure to adjust these settings to appropriate values for your material and laser, and if you use WeCreat's recommendations note that they use mm/second, *not* mm/minute, and convert appropriately. If you have the 40W model, be sure to adjust to appropriate settings for your machine — you can lower the power, set speed a bit higher, or some combination of the two.

12. Press **Frame** to make sure the area the pattern will engrave is aligned to your material.
13. Once the engraving is done, click **Cancel** to close the window, then click the **Home** button in the Laser Window to return your laser to its top Z height.
14. Once it has reached the top position, re-open the Camera Calibration Wizard.
15. Make sure the WeCreat camera is still selected then click Next, and Next again, to proceed past the window where you set up engraving parameters and ran the job.
16. Click **Capture Image**, then Next.
17. Tag each of the target markers 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 Workspace and Preview window, or use the **Zoom In** and **Zoom Out** buttons.

    When you double-click, a red "+" mark will appear. Place a tag 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.
18. Once you've marked each target, click Next and then **Finish** to exit the Camera Alignment Wizard.
19. Click Update Overlay in the Camera Control Window to capture an Overlay for your Workspace. You can use this Overlay to align graphics over the material in your laser's work area.

> **Note**
>
> Your WeCreat must always be at its top Z height prior to capturing an Overlay, or the resulting capture will be misaligned.

9 Troubleshooting

_index

9.1 Troubleshooting

If you're having trouble using LightBurn, our troubleshooting resources are a great place to start looking for help with common problems and frequently asked questions.

9.1.1 What's Wrong?

Choose a category below for more help.

Connection Problems

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

Job Quality

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

LightBurn Editor Help

Frequently asked questions about creating and editing designs in LightBurn.

GRBL Errors

Resources to help you understand GRBL-specific errors.

License Activation and Management

Solutions to common license activation and management issues.

9.2 Job Quality

_troubleshooting/job-quality

This page contains a collection of various issues you may see in your completed cuts and engravings, along with their most probable solutions.

Job mirrored or backwards

GRBL: Low or No Power Output

Job starting in wrong location

Warped or disconnected lines

Move actions are burned

Incorrect size

Fuzzy, blurry, or overblown edges

Edges of engravings are dark or burned

Wobbly engraving

Poor image quality

Inconsistent engraving tone or color

Periodic defects in engravings

Jagged lines

Corners are too dark, too light, or missing

Laser is losing power or not cutting at low speeds

Slanted or skewed jobs

Engravings within cuts are shifted

Layers shift when cutting multiple objects

Wiggly lines at corners

_troubleshooting/job-quality

9.2.2 Fuzzy, Blurry, or Overblown Edges

Description

Fine details are blown out, or edges of engravings are fuzzy or blocky.

Solution

If alternating lines of an engraving are offset, add or adjust the Scanning Offsets.

If the lines are correctly positioned but look 'blocky' or staggered at the edges, consider:

- Lowering your Line Interval (increasing DPI)
- Using Sub Layers to add an outline to your engrave
- De-focusing your laser by a few millimeters so each scan line blends into the surrounding ones

_troubleshooting/job-quality

9.2.3 Dark & Burned Edges

Description

When doing a **Fill** or **Image** engraving, the edges or slow areas are darker or more burned than the center or faster areas.

Solution

This is caused by **Overscanning** not being set or being set incorrectly in the Cut Settings Editor for either Fill or Image operations.

_troubleshooting/job-quality

9.2.4 Corners Are Too Dark, Too Light, Or Missing

Description

Corners or any area where your laser changes directions while cutting are too dark, too light, or missing entirely.

Solution

This usually means you need to adjust your Min/Max Power settings.

DSP Controllers

If the Min Power setting is too high, the laser can leave scorch marks or wide kerfs at the slow areas of your jobs.

If your Min Power value is too low, you will see under-burned areas in slow spots.

If Min Power is so low that it falls below the firing threshold of your laser you will find completely unburned areas. If you are running a cut at very low speed, set your Min Power and Max Power to the same value to avoid this.

The firing threshold is usually around 10% of your laser's wattage. In other words, a laser with an 80W tube will usually fire around 8% power, but not below.

Start Speed in Machine Settings specifies the value where the controller begins ramping the power from Min to Max power. If the laser is moving at the 'Start Speed' or slower, the Min Power is used. The **Start Speed** is 10 mm/sec by default on most Ruida controllers, but some machines may have it set as high as 15 to 20 mm/sec, or may have it set lower.

If you are cutting at a low overall speed (for example, 10 to 20 mm/sec on a CO_2 machine) the laser might only ever use the 'Min Power' setting, so in that case it is best to use the same value for both. 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.

GRBL Controllers

> **Warning**
>
> Setting the Max Acceleration too high can cause mechanical problems. Increase acceleration in small increments and test each time you adjust it.

With the exception of engraving Images in Grayscale mode, Min Power is not available on GRBL controllers. However, if the acceleration is set too low in the firmware, the laser may not speed up fast enough to fire at sufficient power when turning corners. Raising the X and Y Max Acceleration to 100-500 in Machine Settings may correct this.

You may also need to reduce your speed or adjust your **S-Value Max** setting. See more about GRBL Power Output problems.

_troubleshooting/job-quality

9.2.5 Engraving Shifted Relative To Cut Lines

Description

Engravings on small pieces aren't matching up with the cut lines around them.

Solution

This can happen when a piece is cut out and falls down or shifts before the engraving step.

Preview the path to check that the laser's intended output matches what you expect to see.

Change the order of operations in the Layers window, order of Sub-layers in the Cut Settings Editor, Cut Order Priorities, or Cut Optimization Settings ensure that engravings are performed before cuts.

If the misalignment persists, check on your machine's mechanical setup. For more information, see Troubleshooting: Mechanical Issues.

_troubleshooting/job-quality

9.2.6 GRBL: Low or No Power Output

Description

Low or no power output with a GRBL device. The two most common causes of this behavior are:

Setting Speed Too High in Variable Power Mode

The most common cause of this issue is commanding your laser to run faster than its maximum allowable speed, leading to power downscaling. When **Variable Power** mode is enabled, the power level is 0 when the laser is stopped, and increases as the laser head accelerates toward the requested speed. This makes the resulting burn more consistent. However, if you ask the laser to go faster than it is able, it will never reach the requested speed and therefore never reach the requested power level either.

Solution

- Set speed within the allowed range of your machine. Go to Machine Settings or enter `$$` in the Console window to see the **$110/$111**, **X/Y Max rates** set in your machine's firmware. The X and Y Maximum rates are the fastest you can command your machine to travel, in *mm/minute*.

- Double-check the units of speed you are using. A given value in mm/*second* is much faster than the same value in mm/*minute*. Most diode manufacturers provide suggested settings in mm/minute. If you prefer to use mm/second, take care to properly convert the values. You can switch to mm/minute, or another unit of measurement, in the Settings window.
- If you want the same behavior as LaserGRBL, which uses **Constant Power** mode (M3), enable the **Constant Power** toggle in the Cut Settings Editor.

S-Value Max Set Incorrectly

If you've already lowered your speed and are still seeing lower than expected power output, the **S-value max** setting in the **Device Settings** window could be incorrect. This number tells LightBurn how to represent 100% power for your machine. Current versions of GRBL default to **1000** for this, while older versions use **255**. The important thing is for the numbers to match. If your machine expects 1000 to mean full power and receives 255 from LightBurn, you'll get roughly ¼ of the expected power output.

Solution

- Go to Machine Settings or enter `$$` in the Console window to see the **$30, Max spindle speed** setting in your laser's firmware.

- Adjust the **S-Value max** setting in Device Settings to match.

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9.2.7 Inconsistent Engraving Tone or Color

Description

Dark and light patches within your engraving.

Solution

Usually this is a product of inconsistencies within the material itself. Either it has natural variation, like the grain in wood, else the surface of the material might vary in distance to the laser so that it's moving in and out of focus. This is usually caused by warped materials, or materials with uneven thickness. Potentially this can also be a result of the machine's beam path not being properly aligned, or the gantry not being trammed (parallel) to the work surface.

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9.2.8 Incorrect Size

Description

Job is larger or smaller than the sizes shown in LightBurn

Solution

If only the Y (vertical axis) is the wrong size and you have used a rotary previously, ensure the Enable Rotary setting is disabled.

If the size is incorrect in both dimensions, use the Calibrate Axis tool to correct your machine's step settings.

_troubleshooting/job-quality

9.2.9 Jagged Lines

Description

Your laser is outputting shaky, jittery, jagged, or sharp lines.

Solution

This is the result of a failed license integrity check. You may have downloaded LightBurn from an unauthorized source. Reverse any changes made to your system during the original installation, and then download an authorized copy of our software directly from our website. To activate LightBurn permanently, purchase a license from our website or from an authorized reseller.

If you're encountering this issue despite purchasing the software from our website, please email support for help. If you purchased from a reseller, reach out to them.

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9.2.10 Laser Losing Power At Low Speeds Or Not Reaching Full Power

Description

Laser doesn't fire when moving slowly or doesn't reach full power.

Solution

You most likely need to adjust your Min Power setting. If you are running a cut at a very low speed, set your Min Power and **Max Power** to match.

For DSP lasers, **Start Speed** in Machine Settings specifies the value where the controller begins ramping the power from Min to Max power. If the laser is moving at the Start Speed or slower, the Min Power is used. The Start Speed is 10 mm/sec by default on most Ruida controllers, but some machines may have it set as high as 15 to 20 mm/sec, or may have it set lower.

If Min Power is so low that it falls below the firing threshold of your laser, it will not fire at all when moving slower than the Start Speed. The firing threshold is usually around 10% of your laser's wattage. In other words, a laser with an 80W tube will fire around 8% power.

If you are cutting at a low overall speed (for example, 10 to 20 mm/sec on a CO_2 machine) the laser might only ever use the Min Power setting, so in that case it is best to use the same value for both. 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.

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9.2.11 Wrong Orientation

Description

Job flipped, mirrored, reversed, inverted, upside down, or reflected when comparing appearance in your LightBurn workspace to the real-world cut/engrave.

Solution

- Check that the Device Origin is set correctly. This setting controls the orientation of the laser's output. If this is set incorrectly, your job will be mirrored or inverted.
  - The Origin for GCode devices (including most diode lasers) is typically in the front left corner, regardless of where limit switches are installed.
  - The Origin for DSP controllers (including Ruida, Trocen, and TopWisdom) should match the corner your laser homes to when first powered up.
  - To correct a mirrored or inverted engraving:
    - If your engraving is flipped upside down, change whether the origin is in the front or back corners.
    - If your engraving is mirrored sideways, change whether the origin is on the left or right side.
    - If your engraving is flipped in both directions, move the origin to the opposite corner.
- In rare circumstances, jobs can be mirrored due to flipped motor cables within the machine. Seek assistance from the manufacturer if you have set your **Device Origin** properly and are still having issues.
- For Galvo lasers, you may need to adjust Per Galvo settings to set the correct Galvo to X, and to **Reverse Direction (Negate)** one or both Galvos.

_troubleshooting/job-quality

9.2.12 Laser Keeps Firing During Travel Moves

Description

Unexpected lines where they shouldn't be. Laser doesn't turn off when moving between cuts.

Solution

- If you have a GRBL device, and your laser is still on when moving between shapes, like the image above, it most likely means you are using GRBL 1.1f or later, but do not have the controller in Laser Mode. Fix this by typing `$32=1` in the Console window and pressing `Enter ⏎`.
- If you have a Ruida or other DSP controller and are seeing this happen, it is most likely a dying high-voltage power supply unit (PSU). The drive circuit that turns the laser power off and on tends to go first, before the part that controls the overall power level. Contact your laser's manufacturer for assistance on sourcing a replacement.

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9.2.13 Layers Shift When Cutting Multiple Objects

Description

Cuts and engravings aren't lining up as expected when cutting multiple objects, but are correctly (or almost correctly) aligned for a single object.

Solution

This can happen when the laser's travel distance while jumping between shapes doesn't quite match the distance it should be traveling. The layer shift may not be visible on a single object if the difference in distances is small, but as the number of jumps between shapes increases, small shifts add up to become very visible toward the end of a job. See the image above for an example.

If the Preview window shows the layers aligned correctly, this is most likely a mechanical issue. See Troubleshooting: Mechanical Issues for more help.

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9.2.14 Periodic Defects In Engravings

Description

A repeated pattern visible in the output of engravings.

Solution

This typically indicates a defect or adhesion of some kind on a moving mechanical part such as a lead screw or the motors that drive the belts. For more information, see Troubleshooting: Mechanical Issues.

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9.2.15 Poor Image Quality

Description

The photo/ image engraved doesn't look good in some way or another.

Solution

Image engraving is a complex topic, learn more on the 5 Steps to better image engravings page.

- You may also find Image Cut Settings helpful for understanding cut settings related to working with images

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9.2.16 Slanted Or Skewed Job Results

Description

Engraves are angled or skewed. Lines might be either correct or skewed.

Solution

Ruida-Specific Settings

If only the fill is slanted on a Ruida device, your motor pulse step polarity is probably reversed. To fix this, you can toggle the **PWM Rising Edge Valid** setting for one or both axes, depending on the angle of the skew or angle. You can find this setting by going to **Edit** → **Machine Settings** and expanding **Vendor Settings**. You'll find the setting under the X and Y Axis sections.

More about this setting

The controller sends commands to the motor drivers with a series of step pulses in which a signal is briefly switched from high to low or low to high. Motor drivers will look for either a transition from high to low (falling edge) or low to high (rising edge) to count as a step.

If the laser controller expects the motor driver to look for the leading edge signal, 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 below, the upper line of steps is interpreted as 4 steps in one direction followed by 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.

All Gantry-Style Machines

If both lines and engraves are slanted (not necessarily in the same way) and you have a gantry style machine, you likely have one of the following problems:

- Your frame and/or mirrors may be misaligned

- Your motors might be losing steps for some reason, such as overheating
- You may have other mechanical issues

Galvo-Specific Issues

If you're running a galvo machine, you may need to go through the Lens Correction process.

_troubleshooting/job-quality

9.2.17 Warped Or Disconnected Lines

Description

Circles and other closed shapes are not joining up.

Solution

- This is generally a result of inertia combined with some play or slop in your machine's mechanics. Check out our page on Mechanical Issues for more information.
- You can also try enabling Hide Backlash in **Optimization Settings**.
- If the lines are disconnected, but otherwise lining up properly, you may also want to try increasing your Cut Through or Overcut settings.

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9.2.18 Wiggly Lines At Corners

Description

A wavy 'ringing' pattern in places where direction changes suddenly and at high speed. .

Solution

This is typically a result of inertia/speed combined with some play or slop in your machine's mechanics. Check out our page on Mechanical Issues for more info.

If you are using a Galvo laser, you may need to adjust your Jump settings:

- If you did not import the markcfg7 file from the EZCAD configuration folder that came with your laser when you first set up your device profile, do so now.
- If you already imported the configuration file, try decreasing **Jump Speed** and increasing **Min Jump Delay** and **Max Jump Delay**.

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9.2.19 Wobbly Engraving

Description

Shaky, warped, or wiggly engravings on images and fills.

Solution

This is generally a result of inertia combined with some play or slop in your machine's mechanics. Check out our page on Mechanical Issues for more information.

_troubleshooting/job-quality

9.2.20 Wrong Start Location

Description

Job is starting in an unexpected locaation.

Solution

- Check that you have selected the correct **Start From** mode and **Job Origin** to position output the way you expect. Read more about these settings here.
- In the Device Settings window, verify that your machine's **Working Size** is set correctly.

9.3 Setting Up CNC-Based Lasers

Some of our users have set up CNC routers – particularly the inexpensive and widely available 3018 machines – as lasers. Although these are GRBL devices similar to most diode lasers, they are pre-configured for use as CNC machines and you will need to modify settings to account for several important differences.

To see your device's current settings, type `$$` into the Console Window and press `Enter ⏎`, or go to **Edit → Machine Settings**. Both show the same values, but the Machine Settings view may be a little easier to use.

Although we can't account for every possible variation in machines, you will most likely need to do the following:

- Use GRBL Device Profile
- Enable Laser Mode
- Change Status Reporting Mode
- Set Max Speed
- Enable Overscanning
- Homing

9.3.1 Use GRBL Device Profile

What To Do

When you add your machine to LightBurn, make sure you select the **GRBL** device profile, not **GRBL-M3**. If you've already added your machine, click the **Devices** button in the Laser Window, select your machine, and click the **Edit** button to check the device profile and reassign it if needed.

Explanation

Machines set up with the **GRBL-M3** profile don't support **Variable Power** mode.

9.3.2 Enable Laser Mode

What To Do

Type `$32=1` into the Console Window and press `Enter ⏎` or set **Laser mode enable ($32)** to **True** in Machine Settings.

Explanation

Laser Mode will do three things:

- Remove the pause when power output changes, since there's no need to wait for a rotating spindle to speed up or slow down
- Set the power output to 0 to turn off the laser when moving between cuts
- Enable **Variable Power** mode to adjust the laser's power output from 0% when the laser is stopped, to 100% of the power output you've set, once the laser reaches the full speed you've requested the job run at.

9.3.3 Change Status Reporting Mode

What To Do

Type `$10=0` in to the Console Window and press `Enter ⏎` or set **Status: Position reporting ($10)** to **Workspace Position** in the dropdown menu.

Explanation

GRBL-based CNC routers typically have their origin in the rear right corner and use a negative coordinate system, while GRBL-based lasers typically have their origin in the front left corner. This is specific to using a machine intended as a CNC router as a laser, and is typically not needed for other lasers.

9.3.4 Set Max Speed

What To Do

Increase the maximum speed settings to account for the higher speeds needed for a laser compared to a CNC router.

Find your machine's steps/mm values:

In the console, type `$100` and press `Enter ⏎` to find the X steps/mm value, and repeat the process with `$101` for Y. If you prefer to use the Machine Settings window, look in **Outputs setup** for **X Steps per mm ($100)** and **Y Steps per mm ($101)**. These values will typically be the same.

Set your max speed based on steps/mm

Check the table below for the recommended max speed:

Steps/mm Value	Recommended Max Speed
800	2250
1600	1125

Set the max speed for the X Axis by typing `$110=SPEED` (with SPEED replaced by the actual number) and pressing `Enter ⏎`. Repeat with `$111` for the Y Axis.

If you prefer to use the Machine Settings window, look for **X Max rate (mm/min) ($110)** and **Y Max rate (mm/min) ($111)** and set the appropriate speeds there.

Explanation

Most 3018 and similar CNC routers have their maximum speed set to about 500 mm/minute (8.3 mm/second), which is *really slow* for a laser.

Torque is more important than speed for a CNC routers, so these machines typically have their motor stepping rates set very high (either 800 or 1600 steps/mm). An 8-bit GRBL controller will only output about 30,000 steps per second, so you're limited to a maximum of 2250 mm/minute (37.5 mm/second) or 1125 mm/minute (18.75 mm/second).

With variable power mode enabled, if you ask the controller to go faster than it's allowed to go, it will reduce the output power to compensate. If you ask for 100% power at 50 mm/second, but the controller can only go 25 mm/second, the laser will only move at half the speed you asked for. Without variable power mode, the power will remain at 100%, resulting in a much darker mark than expected. With variable power mode, the power will be reduced to 50% to match the reduced speed.

More information about configuring GRBL can be found at the GRBL documentation.

9.3.5 Enable Overscanning

What To Do

Enable overscanning in the **Cut Settings Editor** for Fill or Image layers.

If your machine accelerates slowly, you may need to set the overscanning value significantly higher than the default.

Explanation

The **Overscanning** setting prevents engravings from appearing darker at the edges and lighter in the middle as a result of the laser slowing down to change directions.

With Overscanning disabled, the laser slows down and changes directions while within the bounds of the engraving. The reduced speed near the edges make the engraving darker. With Overscanning enabled, LightBurn runs the tool head a bit past the boundaries of the engraving with the laser off to change directions.

9.3.6 Homing

What To Do

Homing your machine allows you to identify a consistent, repeatable starting point.

If your device has limit switches to enable automatic homing, you can use the **Home** button in the **Laser Window** combined with a workspace offset for automated and repeatable positioning. The linked directions include information on saving the offset command to a macro button.

Unfortunately, the 3018 and other similar machines typically don't come with homing switches, so the zero point is reset to the head's current location every time you turn it on. To set the zero point properly, do one of the following:

- Make sure the head is in the front left corner before turning on the machine
- Jog the head over to the front left corner with the arrow buttons in the **Move** window, type `G92 X0 Y0` into the console window, and press `Enter ⏎`

Either way, don't forget to make sure your machine is set to Workspace Position mode

Explanation

The `G92 X0 Y0` command tells the machine's controller "Your current location is X=0 Y=0".

Workspace Position mode tells the controller to report its position relative to the origin you've set, not the machine's zero position. With this set, you can use the machine in **Absolute Coords** mode, which is recommended. This and other **Start From** modes are described in Coordinates and Job Origin.

camera

9.4 Using a Camera

Don't forget to calibrate and align your camera

If you haven't already done so, make sure you've gone through the lens calibration and alignment process for your camera.

9.4.1 Can't Connect to Camera, or No Camera Image

If LightBurn can't see your camera, or its capture is only a black screen:

- If you're using a USB extender, try taking it out of line and connecting the camera directly to your computer. USB cables are limited to 3 meters (16 feet) long — anything longer can cause transmission loss. To connect over a greater distance, you must use an active, externally powered extender.
- Make sure you have granted LightBurn permission to access your camera in your system settings:
  - For **Windows**:
    - Click the **Start** menu, type “camera privacy” and click the **Camera Privacy Settings** entry.
    - Check that **Allow apps to access your camera** is enabled.
    - Scroll down below the list of Windows apps and check that **Allow desktop apps to access your camera** is enabled too.
    - If LightBurn isn’t in that list, it should be.
    - You might need to reboot your machine and try again after the settings change.
    - If LightBurn still can't access the camera, and you're using Windows, try changing the **Camera Capture System** from **Custom** to **Default** in your Settings/Preferences.
  - For **Mac**:
    - Go to **System Preferences** → **Security & Privacy** → **Privacy** → **Camera**
    - Make sure the box next to LightBurn is checked
    - In some cases, Macs require active, externally powered USB-A to USB-C adapters/hubs in order to connect to cameras.

9.4.2 Lens Calibration

If you're having trouble getting valid captures, or a good final calibration:

- Keep the calibration pattern as flat as possible by gluing it to wood, foam board, or any other perfectly flat material. If it isn't flat, the curvature will be considered part of your lens distortion.
- Make sure the pattern is in focus, and not shaking. If you're unable to keep your hand steady while holding it, place it on something instead.
- The calibration card should be facing directly at the camera for a fisheye lens, or perfectly flat and parallel with the lens for a non-fisheye lens.
- The pattern should fill roughly $1/9^{th}$ of the view of the camera for each captures. If it's much too small or too large, you won't get good results. You can rescale the pattern or move the pattern or camera closer or farther from one another to adjust the relative size of the pattern in the camera's field of view.
- The camera doesn't need to be on the machine for the lens calibration — it's *only* the lens and pattern that matter for this part.
- If you do it on the machine, are using the circle calibration pattern, and you have a honeycomb bed, cover it (bedsheet, paper, wood, etc) — the pattern gets misinterpreted as more circles and confuses the software.

9.4.3 Overlay Misaligned

Misaligned on First Setup

If your camera overlay is misaligned immediately after your first setup:

- Re-run the camera alignment process, taking care to tag the target markers as precisely as possible.
- To improve accuracy, zoom in on the target markers using the mouse scroll wheel or two-finger dragging.
- If possible, increase the **Scale** of the target marker engraving. The farther apart the target markers are from one another, the more accurate the alignment will be.
- If the alignment is close, but still a bit off, use the **Width**, **Height**, **X Shift**, and **Y Shift** fields in the Camera Control window to fine-tune placement and scale.

Misaligned Between Uses

If the overlay becomes misaligned between uses, it means the position of your camera relative to your laser's work area has changed from when you did your initial alignment.

- Make sure your camera is securely mounted, with no room to wiggle.
- If it's mounted on a lid, make sure the lid is returning to exact same position it was in when you completed the alignment process.
- Make sure there is no side-to-side play in the lid's hinges.
- You can use a cord or rod to ensure the lid is always at the same position when opened.

- If you have tabletop engraver, make sure it cannot move at all — the motion of the laser head during engraving can sometimes jostle the entire machine if it is not secured down.

You'll need to address these issues, and then re-run the alignment process.

Misaligned When Switching to Thicker/Thinner Materials

If you switch to a thicker or thinner material than the one you used to complete the alignment process, and your laser does not have an adjustable height bed, that will cause a misalignment — the height between camera and work area will have effectively changed.

The amount of misalignment will depend on the lens angle of the camera, the mounting angle, and how different the height is from the aligned height. If you're using a top-down view with a narrow angle lens, the difference will be much less than if your camera is wide angle, or viewing from an angle.

- You can perform an alignment for a given height by engraving the and tagging the alignment marks at that height.
- Right-click in the Camera Control window and select **Export Camera Settings** to save that alignment information.
- Then, perform another alignment at a different height, and save that one too.
- Give the saved alignments names based on the heights they were performed at.
- Later, right-click and **Import Camera Settings** for the closest height to whatever material you're engraving.

9.5 Connection Problems

9.5.1 Can't Connect Laser to Computer

First steps:

- Make sure your laser is turned on
- If your laser has an Emergency Stop button, make sure it's released, typically accomplished by twisting the button
- If you're connecting with a cable, make sure it is plugged in securely on both ends
- Close any other control software that might be communicating with your laser
- Make sure you've selected the correct device in LightBurn, and that the controller type and connection method are correct

If you still can't connect to the laser:

- Check USB Cables
- Check Drivers
- Check Serial Port

9.5.2 Laser Doesn't Stay Connected To Computer

If your laser connects to the computer but doesn't stay connected, please try the following:

- Check USB Cables
- Check For Electrical Issues
- Windows-Specific Issues

9.5.3 Laser Behaves Unexpectedly

If your device is restarting when you try to use it, you are most likely experiencing either communication problems or brief losses of power. This is often visible when a device set to home on startup homes unexpectedly. Please try the following:

- Check for Electrical Issues
- GRBL Communication Problems

If you're experiencing unexpected behavior from a device not originally intended as a laser, such as a diode module mounted to a 3018 CNC router, you may need to adjust the settings:

- Configuring CNC-Based Lasers

9.5.4 Laser Is Connected, But Not Responding

If your laser appears to be connected to the computer but is not responding, try the following:

- If your device has a screen, check for error messages or alarms
  - Some enclosed lasers have sensors to detect if the lid is open, and will not run until the door is closed and the error is cleared
  - Some lasers with water cooling have sensors to detect the flow of water, and will not run if they don't detect water flow
- Check to see if the correct serial port is selected, if relevant
- For GRBL devices, check the Console Window for Errors and Alarms

9.6 Drivers

If you have trouble connecting to your laser, you may need to install or update the drivers that allow your computer to communicate with the laser's controller software.

We've done our best to list the driver requirements for a variety of devices and operating systems, along with information on how to install the drivers. If you have a device with a driver that isn't listed, we'd appreciate you letting us know by clicking the envelope icon next to the header below to send an email to our support and documentation teams.

Some lasers that come with their own software may require you to install that software to install the drivers.

9.6.1 Driver List

Laser Type	OS	Notes
Diode lasers	All	If not specified, probably requires the CH340 driver. The latest version is available from the WCH website for Windows and Mac
Ruida or Top Wisdom	Windows	FTDI driver required. If unsure, rerun the LightBurn installer and check the box to install the FTDI driver. You can also manually install the driver by going to `C:\Program Files\LightBurn\` and double-clicking `FTDI_Driver.exe` to run the installer
Trocen	Windows	Might need to install LaserCad to get Trocen's driver
Galvo lasers	Windows	See Galvo Installation for directions

9.7 Electrical Problems

9.7.1 Shared Power Circuits

Other devices sharing the same power circuit as your laser, such as chillers and external air assists, can cause a small power drop that causes your laser to brown out and temporarily disconnect or reset. Try isolating the laser to its own breaker if possible.

> **Info**
>
> You can check if other outlets are on the same breaker by turning off the breaker controlling your laser's power outlet and seeing if other outlets also turn off.

9.7.2 Poor Bonding/Grounding

Bonding is tying the various metal parts of a device together, so that if one part builds up a charge, all the other parts build up the same charge. If your laser isn't bonded correctly, static can build up on the laser head or rails. If the laser is not grounded (earthed), that static build-up can eventually discharge through the USB connection to the computer, causing communication errors. This is especially common with lasers driven by belts that interact with plastic wheels. You can prevent this by tying the laser's frame elements together electrically and making sure your laser controller is grounded correctly.

9.7.3 Electrical Noise

Route your USB cable so that it avoids the stepper motors or anything else that could cause electrical interference.

9.8 GRBL Communications

9.8.1 Check Transfer Mode

LightBurn defaults to the **Buffered** transfer mode for communication with GRBL devices. This is faster and more reliable than the **Synchronous** transfer mode. However, there are a few devices that are incompatible with buffered transfer mode. These devices will stutter, stop, or even restart when buffered communication is selected. If you notice this happening, try switching the transfer mode to **Synchronous**.

9.8.2 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 in Device Settings might help.

9.8.3 Electrical Noise

Route your USB cable so that it avoids the stepper motors or anything else that could cause electrical interference.

9.8.4 Network Connection Port

If you're connecting to the laser over a network instead of with a USB cable, you may need to change the network port setting in Device Settings.

The **Network Port** setting is in the bottom right of the Basic Settings tab of the **Device Settings** window. The default setting is **23**, but some devices use a different port. Try setting the port to **8080**, and if it still doesn't work, check your laser's user manual for more information.

9.9 GRBL Errors

GRBL devices have a number of different alarms and error codes you may encounter. These will be visible in the Console Window.

This page contains information about the errors and alarms LightBurn users are most likely to encounter, as well as some other frequently encountered problems with GRBL devices. For additional information, we've found the following resources helpful:

Official GRBL Documentation

DomoticX's GRBL Error List

9.9.1 GRBL Alarm Codes

Alarms are emergency messages, and are used when something has gone very wrong. These are shown in the Console Window as `ALARM:#`, with a number to tell you what caused the alarm.

ALARM:1

A limit switch was triggered while the machine was moving. The machine position is probably lost, which causes the machine to hit the edges of its workspace.

Fix this alarm by rehoming the machine. If this continues to happen:

- Review your **Start From** and **Job Origin** selection, and make sure you are not commanding the laser to move outside of its physical bounds. See Coordinates and Job Origin.
- Make sure your machine is homing correctly by comparing the position shown in the Move window in LightBurn to the machine's actual position within its work area.
- Some limit switches are triggered by reading resistance to stepper motors. Make sure the wires aren't snagging and causing a false trigger, and check your machine for mechanical problems.

ALARM:2

You're trying to send the machine outside of its known working area, and GRBL has prevented this to prevent damage to the machine. This can happen for several reasons:

- You're trying to run a job that exceeds the size of the machine work area.
- You're trying to run a job in **Current Position** or **User Origin** mode and haven't properly set the **Job Origin** or User Origin settings. See Coordinates and Job Origin.

- You're working with a Y Axis rotary and the distance you are commanding the rotary to travel exceeds the Y Axis max travel limit set in your laser's firmware. Temporarily disable **Soft Limits** in the Machine Settings window, or by entering `$20=0` in the Console Window. Be sure to re-enable Soft Limits in the Machine Settings window or by entering `$20=1` in the Console Window when returning to flat engraving.
- You have your machine misconfigured, possibly trying to run a negative workspace machine without a workspace offset. See GRBL Configuration.

ALARM:3

The laser halted abruptly, sometimes due to another Alarm or Error, or, often, the computer losing connection to the machine. Rehome the machine to ensure the machine reports its coordinates correctly. See Connection Troubleshooting for help if this happens repeatedly.

ALARM:8

The machine failed to pull off one or both limit switches after homing.

- Inspect your laser's limit switches to make sure they are not stuck in the closed position.
- Check your machine's belt tension and overall mechanical setup to make sure it is capable of moving, homing properly, and clearing the limit switches. See Troubleshooting: Mechanical Issues for more information.
- Make sure your power supply is securely plugged in and functional. A USB connection can sometimes be enough to power a laser's control board, but it will not provide enough power for the stepper motors to move off the limit switches.

ALARM:9

The machine's attempt to home failed because it didn't locate a limit switch. GRBL will stop homing to prevent potential damage to the machine if it doesn't encounter a limit switch within 1.5x the maximum travel distance.

- Make sure your machine has limit switches. If you installed them yourself, make sure they're wired correctly and the connectors are snug.
- Check your machine's belt tension and overall mechanical setup to make sure it is capable of moving and homing properly. See Troubleshooting: Mechanical Issues for more information.
- Make sure your power supply is securely plugged in and functional. A USB connection can sometimes be enough to power a laser's control board, but it will not provide enough power for the stepper motors to respond to the homing command.

9.9.2 GRBL Error Codes

These error codes are less severe than alarm codes, and are used when your machine receives a command it can't act on. Like alarms, these are shown in the Console window as `error:#`, with a number to tell you what caused the error.

Error:1

The machine received an invalid GCode command. This error code is usually the result of enabling **GCode Clustering** for a device that does not support it, or combining multiple commands into one line.

Make sure GCode Clustering is disabled in Device Settings.

If you are using Custom GCode, check your settings for accuracy. If you're typing commands in by hand in the **Start** or **End GCode** fields under GCode tab of the Device Settings window, check for typos.

Error:3

The machine received the `$` system command but does not recognize or support it.

Error:5

LightBurn sent the command to the controller to home it, but the controller does not have homing enabled or configured.

Typically, this occurs when Auto-Home On Startup is enabled in Device Settings for a machine without homing switches. Disable this setting if your laser does not have homing switches.

If your laser does have homing switches, enter $22=1 in the Console Window to enable homing in your machines firmware. Consult your laser's manufacturer if you are not sure.

Error:8

A command was sent to your laser while it was still processing another command. If your laser is homing, wait and try again.

This error can also be caused by communications corruptions or electrical interference.

- In the Device Settings window, try changing **Transfer Mode** to **Synchronous**.
- Try a new, shielded USB cable.
- See Troubleshooting: Electrical Issues for more information.

Error:9

LightBurn tried to send a command to your device, but the machine is locked. GRBL locks devices while jogging (moving the gantry) or when the machine has an active GRBL alarm.

- If the machine is moving, wait for it to finish moving.
- Enter $X in the Console window to unlock the machine.
- If there is an active alarm, identify the alarm and address the cause.

Error:20

The machine received an unsupported or invalid GCode command. This is usually the result of the wrong device type being selected.

> **Tip**
>
> To check what version of GRBL your laser is running, enter `$I` into the **Console** window and press `Enter ⏎`. The messages shown in response should include the GRBL version in a message starting with `VER`.

- Make sure your device type is set correctly. In most cases, your device should be set to **GRBL**. If your laser is running GRBL 1.1e or earlier, change your device type to **GRBL-M3**. To check or change your device type:
  - Click the **Devices** button in the **Laser** window
  - Double-click your device
  - Change the device type if needed
  - Click **Next** and then **Finish** to complete the setup prompts and save the changes
- If your laser is running GRBL 1.1f or later, and the Error:20 message is accompanied by `MSG: M4 requires laser mode or a reversible spindle`, enter `$32=1` in the **Console** window and press `Enter ⏎` to enable Laser Mode.

Error:24

The machine received an invalid GCode command, combining two GCode commands that both require X/Y/Z Axis parameters. This is usually the result of communications corruption.

- Try a new, shielded USB cable.
- See Troubleshooting: Electrical Issues for more information.

9.9.3 Other Common Problems for GRBL Machines

Busy

The **Busy** bar in the Laser Window is not necessarily an error — it shows that the machine is busy doing something. However, if you are seeing **Busy** but the machine is not moving, it may not be connected to the computer.

- You may need to select the correct communication port.
- If you don't have an appropriate port available, you may need to install drivers.

Laser Not Connecting

If you see **Disconnected** in the Laser Window, your computer is unable to communicate with the laser. Make sure it's plugged in and turned on. If it still does not connect:

- You may need to select the correct communication port.
- If you don't have an appropriate port available, you may need to install drivers.
- Check Connection Troubleshooting for more help troubleshooting your connection to the laser.

9.10 Galvo Laser Troubleshooting and FAQ

Below are some common problems and frequently asked questions related to using a Galvo laser with LightBurn.

Can I import an EZCAD project/parameter/file?

LightBurn does not have the ability to import or open EZCAD project files or parameters. Due to the file format not being documented, and the sheer volume of effort to produce a useful, cohesive importer, it isn't possible at this time.

If the grid in EZCAD is turned off temporarily, LightBurn can trace screenshots of EZCAD to import placement in many situations.

Why won't LightBurn recognize fiber laser plugged in with USB on Linux?

> **Warning**
>
> LightBurn version 1.7 is the last version compatible with Linux, versions of Windows prior to 10, and versions of macOS prior to 11. Revert to version 1.7 and see our 1.7 documentation for information and installation instructions.

This is an issue we haven't generally encountered in our own testing in Ubuntu and Fedora, the two distros we support. The laser is treated as a libusb device and *should* just work. However, this is occasionally an issue with USB permissions. Please try the following, as discussed on our forum.

- Unplug your laser from the computer.
- Run `sudo gedit /etc/udev/rules.d/usb.rules` (you can use any text editor you prefer) and enter the following contents:

  ```
  SUBSYSTEM=="usb", MODE="0666"
  ```
- Save the file and close.
- Run: `sudo udevadm control --reload-rules`
- Now plug your galvo USB connection back into the machine.
- Run LightBurn without sudo and you should be able to automatically find and connect to the device.

Where are the hatch settings?

Hatch in EZCAD is the equivalent of Fill Mode in LightBurn. See our EZCAD Hatch Quick Translation page for help matching the settings you're used to.

Why won't LightBurn connect to my laser after moving USB ports?

Some lasers require you to fully reboot the device after moving USB ports. Try these steps:

1. Turn the laser fully off.
2. Move the USB cable to the correct port.
3. Turn the laser back on.

My Galvo is trying to engrave my rotary, what's wrong?

LightBurn allows you to shift the center position of your rotary output to compensate for the center of the rotary not lining up precisely with the center of the field.

If your offset value is set incorrectly, output may be shifted far to the left, right, top, or bottom of your laser's work area. See Rotary Mode (Galvo) — Output Center for more information.

9.11 License Activation and Management

This page contains solutions to common License Activation errors, and other License Management issues.

See our License Management Guide for full instructions on activating your license and How the LightBurn License Works for details on licensing terms.

9.11.1 Invalid License Key

Your license key has been entered into LightBurn incorrectly. To avoid typos when entering your key into LightBurn, we strongly recommend copying and pasting the key directly from your original order email.

Highlight the key and press `^ Ctrl` / `⌘ Cmd` + `C` to copy it, then click in the **License Key** field in the License Management window in LightBurn, and press `^ Ctrl` / `⌘ Cmd` + `V` to paste it.

If you must type your key manually, take care to follow the exact formatting of the original key, including dashes. The letter O is never used in a LightBurn license — enter the number 0 instead.

9.11.2 System Time Incorrect

Your computer's system time is inaccurate, most likely because it is not set to sync automatically.

If you're using Windows, right-click on the clock on your toolbar, click **Adjust date / time**, then make sure **Set time automatically** is enabled. If it is, click the **Sync now** button as well.

If you're using a Mac, go to **System Settings** → **Date and Time** and enable **Set time and date automatically**.

9.11.3 Failed to Connect to the Server

LightBurn was unable to connect to our license server to verify your key. Make sure your computer is connected to the internet.

If you are certain your computer is connected to the internet but you are receiving this error message, your network may be restricting LightBurn's ability to connect to our license server.

If you are using a Firewall or have any other restrictions in place, try temporarily disabling them. LightBurn only needs to connect once in order to activate a license.

To permit access without disabling restrictions, *whitelist* **api.cryptlex.com** for port **443**.

It is also possible to configure LightBurn to access the network through a proxy. You can append the proxy connection address using `-p ProxyString`.

The proxy format is:

```
[protocol://][username:password@]machine[:port]
```

Examples of valid proxy strings:

```
http://127.0.0.1:8000/
http://user:pass@127.0.0.1:8000/
socks5://127.0.0.1:8000/
```

If you are still unable to connect, use our **Offline Activation** process instead. For full instructions, see License Management: Offline Activation.

> **Note**
>
> Offline activation does not work with Trial Keys. LightBurn must connect to the internet once in order to activate the Trial Key, after which you are free to take your computer offline again.

9.11.4 Activation Limit

You have used up the maximum amount of simultaneously allowed activations for your key. Deactivate LightBurn from an unused computer by opening LightBurn on that computer and clicking **Deactivate License** in the **License Management** window, or log in to our License Management Portal to manage your activations there. For full instructions on using the License Management Portal, see License Management.

A LightBurn license comes with 3 allowed activations (*seats*) by default. If you'd like to activate LightBurn on additional computers simultaneously, you can purchase additional seats for your key here.

9.11.5 Deactivation Limit

LightBurn limits the amount of times a license key can be deactivated, to discourage sharing or other misuses of the key. If you reach this limit, contact us at support@lightburnsoftware.com to request an increase to your limit.

9.11.6 Unable to Access the License Portal

See License Management for full instructions on accessing the License Portal.

Select **United States** as your region in the upper-right corner of the License Portal login page, regardless of your location, or our License Management server may fail to send the password reset email.

If you purchased your key through our web store, make sure you are attempting to access the portal using the email address you used to purchase your key. If you purchased your key through a 3rd party vendor, you'll need to contact us support@lightburnsoftware.com so we can assign the key to your email address and grant you access to the portal.

If you do not see an email from Cryptlex when requesting a password reset, check your Promotions or Spam folders — the password reset email sometimes ends up there. If you still cannot find it, your email provider might be blocking the email from ever reaching you. Contact us to have us reassign your key to an address under a different provider. Gmail accounts work well.

9.11.7 License Expired

A LightBurn license is perpetual, but its update period expires one year after you first activate it. You will need to renew your key in order to continue receiving updates for another year. If you renew your key *before* your license expires, you'll receive an additional two months added to the one year renewal.

To download and revert to a version of LightBurn compatible with your key, visit our release repository.

You can renew your exsting key here.

9.11.8 Application is Being Run Inside a Virtual Machine

LightBurn keys are, by default, restricted from running in virtual machines. If you receive this error message, contact us at support@lightburnsoftware.com to request an exemption from this restriction.

9.11.9 Lost License Key

If you do not know your license key, try accessing our License Portal using the email address you used to purchase the key. Your key is visible in the License Portal.

If you did not purchase your key through our website, you will be unable to access the License Portal. Search your email inbox for the original purchase email from the vendor you purchased your key through.

If you are still unable to find your key, contact us at support@lightburnsoftware.com.

9.11.10 Have to Enter Key on Each Computer Login

Follow our instructions on setting up a System Locked license key to activate the same key for all users on a given computer.

This page contains help for common pitfalls, errors, and frequently asked questions that users have encountered while using LightBurn. If you're looking for help figuring out why your laser's output doesn't look like you expected, please visit our page on job quality and output issues.

Example	Summary	Resources
	Text or contents of a frame disappear when using **Weld**	You probably need **Boolean Union** instead. Please see our Boolean Tools for more help.
	Filled shapes look like outlines. "Shapes weren't closed" error when previewed	This is caused by a shape that isn't fully closed. Some points which may appear closed aren't actually. Try Auto-Join. If that doesn't work, drag the open points together using Node Editing.
	Filled shapes look like outlines	If you don't have Filled Rendering enabled, enable Filled Rendering from the **Window** menu, or toggle Filled Rendering with ⎇ Alt + ⇧ Shift + W (Windows) or ⌥ Option + ⇧ Shift + W (Mac). If you do have Filled rendering enabled, or the shapes disappear when previewed, this is caused by a duplicated shape. Try Delete Duplicates.
	Need to invert which parts of a vector shape are engraved	To reverse the colors of a vector shape, you need to add (or remove) a closed border surrounding it on the same layer. See How to Invert a Vector Engraving for more information.

9.13 macOS-Specific Problems

9.13.1 Unable to Connect over Ethernet

Starting with macOS Sequoia (macOS 15), connecting to a laser over Ethernet requires granting LightBurn access to the local network. If you're using macOS 15 or higher, you'll need to enable this in your computer's settings. To do this:

1. Go to the **Privacy & Security** section of the settings.
2. Find LightBurn in the list (not pictured in this screenshot) and enable it.

troubleshooting device-settings machine-settings

9.14 Machine Size Mismatch

A machine size mismatch occurs when the machine size LightBurn reads from your device's firmware doesn't match the machine size saved in Device Settings.

Machine Size Mismatch

The error message reads:

"Your machine is configured as *width x length* but the controller reported *firmware width x firmware length*.

You may have connected to the wrong machine.

It must be configured correctly for jogging to work safely.

If you ignore this check, you won't be prompted again. However the software then cannot be held responsible for any machine crashes that may happen."

This message occurs when the **Working Size** in LightBurn's device settings is different from the device's firmware machine size values. If this happens, one of the following is likely the cause:

- The **Working Size** in LightBurn's Device Settings were entered incorrectly, either during manual setup or when modifying the device settings.
- The device's firmware has the wrong values for machine size, which may be an error from the manufacturer.
- If you have multiple device profiles, the device you've selected may not be the one you've connected to.

It's important for your machine to be set to the correct size. If the working size is set to be larger than the machine, the laser head can crash into the edges of its work area. If it's smaller than the actual size, you will be unable to use the full area of the laser.

9.14.1 Resolving the Error Message

The error message provides you with three options.

Update Device Settings

Click this button to automatically adjust the Device Settings to match the device's firmware. Check your device's user manual or contact your machine's manufacturer to verify the correct dimensions and make sure they match the firmware before choosing this option.

Read More

This button brings you to this troubleshooting page for more information, and does not make any changes in LightBurn. You can still make changes manually.

Ignore

Ignore the error for this machine. You won't be prompted again, but the software cannot be held responsible for any machine crashes that may happen.

9.14.2 Correct the Mismatch

If you're certain the **Working Size** value is correct, you most likely either have the wrong device selected or have firmware with incorrect size values.

- If you have multiple device profiles, you may be connecting to a machine other than the one you intended. To check, use the dropdown menus in the Laser Window to switch to the correct profile, or select the correct communications port to connect to a different machine.
- In some rare cases, your machine's firmware may be set incorrectly. If this is the case, you will need to update the size in firmware using Machine Settings. This should be done with caution and only after verifying the correct size in your device's user manual.

9.14.3 Related Topics

- Device Settings
- Machine Settings

If there is play/ slop/ backlash somewhere in the machine's mechanics you will see wobbly engraves, closed shapes that don't match up at the end, wiggly bits on corners of lines and a range of other issues.

The most likely culprits are loose belts or debris on the rails, but it could also be an unsecured lens, mirror, toolhead, axis, leadscrew, frame, etc.

- Follow your laser manufacturer's directions for cleaning the rails and any other motion components in your laser.
- Identify the issue by attempting, gently, and with the machine off and unplugged, to wiggle mechanical parts of the machine. See if anything is loose and tighten as necessary. Belts should be taut but not overtightened. They should be able to be plucked like a guitar string. See your device's user manual for more information on maintaining your specific device.
- If you can’t find anything loose it could be that your table is wobbly, and the inertia is carrying into your machine or moving your material. If it is possible to do so, try putting your laser on the ground in order to identify this issue. To correct wobbliness, consider adding cross-bracing or a backer board to stiffen and square up your table.

If it’s still occurring after these checks, you are likely running speeds that are too fast for your machine. It is not always possible to preserve quality when running at or near to your machine's theoretical maximum speed. Try a lower speed.

troubleshooting

Follow these steps to restore LightBurn to the same settings as when you first installed — be aware that you will also lose any device profiles you've created in this process.

> **Warning**
>
> While this process can be helpful in cases where you have a great many incorrect settings and want to start over, we recommend trying Load Prefs Backup or Reset to Default Layout before a full reset.

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

That's it. When you re-run you'll be asked to set up your laser again, and everything will be as new.

9.17 Serial Port Problems

Depending on the type of device you have and the connection method you're using, you may have a dropdown in the **Laser** window to choose the serial port. The screenshot below highlights its location between **Devices** and the name of the active device.

LightBurn will attempt to automatically select the correct serial port, but you may need to manually select it from this dropdown. When connected, the **Disconnected** message in the top left corner of the **Laser** window will change to **Ready**. If you are using a GCode-based laser, you will see a startup message in the Consolewindow.

You may need to right-click the **Devices** button in the Laser window to refresh the list of available ports.

9.17.1 CU.BLTH or cu.bluetooth-incoming-port

Ports with these or similar names are for Bluetooth connections, and are not the correct ports for a USB connection. If you select one of these ports, you may see a **Ready** message in the **Laser** window, but your laser will be unresponsive.

If you see these ports but not a USB connection, you probably need to install the CH340 driver, or refresh the list of available ports.

9.17.2 How To Ignore Unwanted Ports

This will be unnecessary for most people, but if LightBurn is attempting to connect to serial ports for devices other than your laser and it becomes a problem, you can specify ports for LightBurn to ignore.

To exclude a port:

1. Select the port in the dropdown.
2. Right-click the dropdown and choose **Exclude <portname>**.

To include an excluded port:

1. Right-click the dropdown and choose **Show Excluded**.
2. Select the port you want to include and choose **Include <portname>**.

Method Two: `PortExclude.txt`

1. Go to **File** → **Preferences** → **Open Prefs Folder** to open LightBurn's prefs directory.
2. Create a file in this folder called `PortExclude.txt` – use this name exactly, including capitalization.
3. In the file you just created, list the ports you want to exclude, exactly as they show up in the port selection drop down in LightBurn. Each port should be on its own line.
4. Save the file.

LightBurn will now ignore the ports you've told it to filter out.

9.18 USB Cables

If you're connecting over USB, cable problems can be a frustrating problem to solve. The steps below may help you identify and solve problems. If you're not sure what type of USB port or connector you have, please compare the shape to the diagram below.

Figure 1: Common USB connector styles used on computers and laser cutters

9.18.1 Check Your USB Cable

- Try upgrading to a higher quality USB cable, especially if you're still using the cable that came with your laser. The shielding in a good USB cable prevents electrical interference with the signals between your laser and your computer. Low cost USB cables, including many of the ones supplied with laser cutters, often have inadequate shielding
- USB cables are limited to 3 meters (16 feet) long. If you need a longer cable, look into active USB extenders or alternate methods of connecting to your laser. For example:
  - For Ruida devices with Ethernet ports, use LightBurn Bridge or Ethernet connections
  - For GRBL devices with WiFi avaible, use our guide to GRBL Network Connections to set up a WiFi connection in LightBurn

USB C Cable Problems

More on USB C Cable Problems

The USB C connectivity of some lasers isn't built to industry standards, which can cause connection issues when trying to connect directly with a USB C to USB C cable. These devices **require** a USB A to USB C cable. If you don't have a USB A port on your computer, you can use a USB A to C adapter/dongle or a USB hub to connect a USB A cable to the computer.

If your device came with a USB A to USB C cable and you're having connection problems with a USB C to C cable, try a USB A to USB C cable instead. This is due to a hardware limitation of some lasers. There's a more detailed explanation of the problem in the info box to the right.

Lasers known to have USB C connectivity problems:

- Sculpfun iCube
- Creality Falcon

- Ortur LM3

9.18.2 Try A Different USB Port

USB ports can occasionally fail, even without physical damage. If your computer has multiple USB ports, try plugging into a different USB port and see if that makes a difference.

9.18.3 Windows: Check Power Management Settings

If you're on a Windows computer and find that you can connect over USB but the connection fails after a while, you may need to adjust your power management settings

9.19 Windows-Specific Problems

9.19.1 Power Management Causes Dropped Connection

If you're on a Windows computer and can connect to your laser, but tend to lose your connection after a period of time, you may need to change your power management settings. This is most common with laptops, but can happen with desktop computers as well.

When Windows thinks a USB connection is idle, it can put the port into power-save mode. This reduces power usage, but can also cause communication problems for your device. The following directions will help you disable this feature.

Directions for Windows 10

If you're on a laptop, you'll have separate power plans for **On Battery** and **Plugged In**, so make sure to repeat this process for both.

- Open the **Control Panel**
- Click on **Hardware and Sound**
- Click on **Power Options**
- Under "Preferred Plan", click on **Change plan settings** for the active power plan
- Click on **Change advanced power settings**
- Expand **USB settings**
- Expand **USB selective suspend settings** and select **Disabled** from the drop down menu
- Click **Apply** and then **OK** to close the window.

Directions for Windows 7

Part 1

- Open the **Control Panel**
- Find **Power Options**
- Click on **Change Power Plan/Settings**
- Click on **Advanced Power Settings**
- Uncheck both boxes in **USB Settings**
- **Save** settings and close the window

Part 2

- Go to **Device Manager**
- Double click on the first listed **USB Root Hub** and go to the **Power Management** tab
- Uncheck both boxes
- Repeat this process for each USB Root Hub listed in Device Manager

When you're done, restart the computer to make sure these settings are applied

10 Tags

tags.md:0-22/name