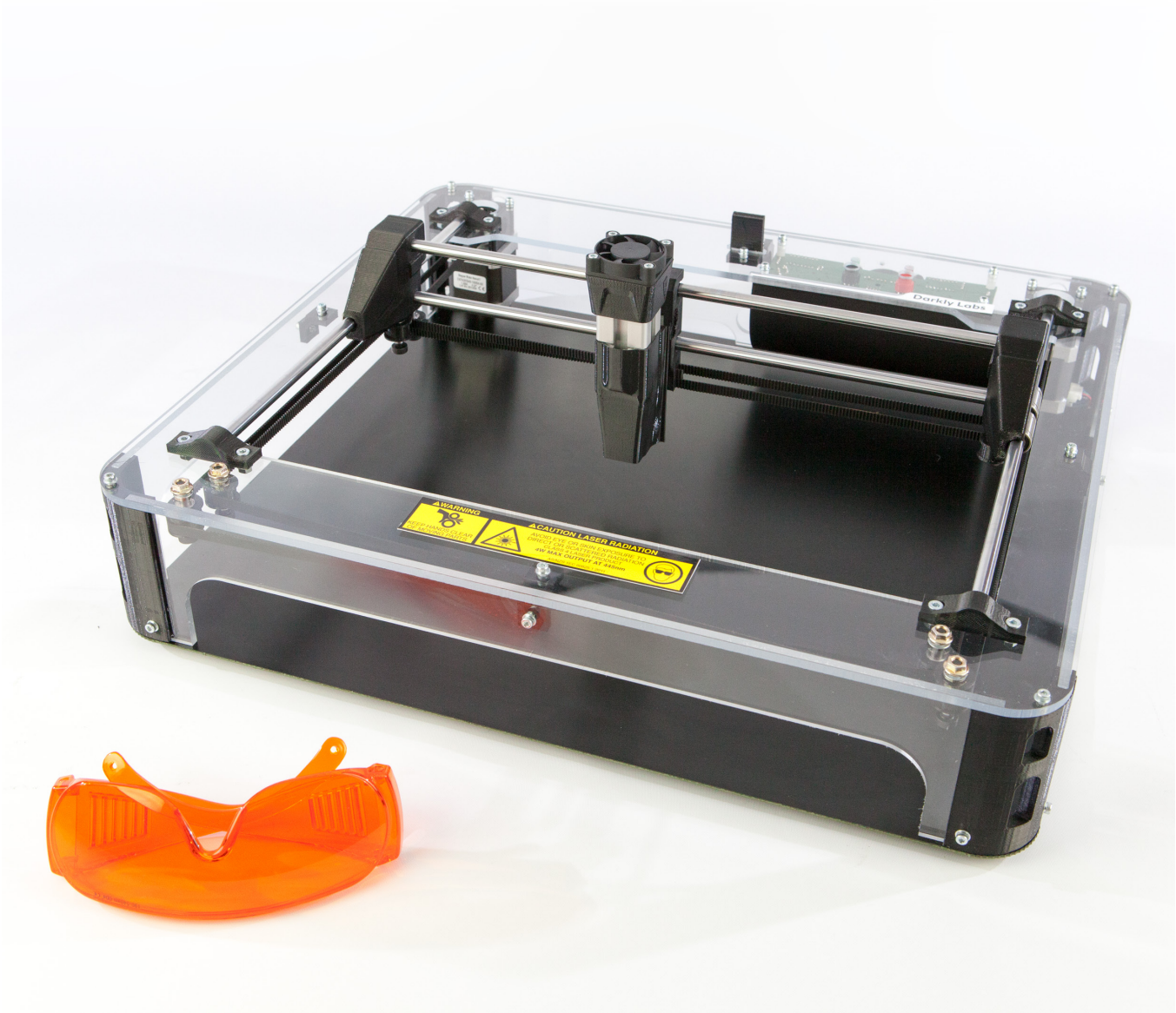
Darkly Labs

Emblaser

-User Manual-



Revision 6.0

IMPORTANT

Read this manual carefully and save it for future reference.

The Emblaser is a cost effective laser cutting and engraving kit for the general hobbyist and maker. The Emblaser is not designed for use in applications such as volume manufacturing.

Danger

Water and electricity are a dangerous combination. Do not use the Emblaser in wet surroundings

Always follow the recommended safety procedures outlined in this manual.

This includes, but is not limited to:

Always wearing appropriate safety eye-ware when operating the Emblaser.
Always ensuring your work material is safe to use in the Emblaser.
Always following the Safety Check List supplied.
Never use the Emblaser on reflective materials.

Ensure the Emblaser is not used in the vicinity of combustible materials.

Warnings

The Emblaser is not intended to be used by persons (including children) with reduced physical, sensory or mental capabilities, unless they have been given supervision or instruction concerning use of the Emblaser by a person responsible for their safety.

And/or

Children should be supervised to ensure that they do not play with the Emblaser.

The Emblaser is not intended for children under the age of 15 years. Teenagers aged between 15 and 18 years can use the Emblaser with the consent and/or assistance of their parents or persons who have Parental authority over them.

Operation of the Emblaser without the baseplate attached or any other modifications that reduce beam containment or safety interlock functions inherent to the design place the user and bystanders at increased risk of beam exposure and injury.

Damage

Never subject the Emblaser to heavy shocks and do not shake or drop.
Never leave the Emblaser unattended when it is switched on.
Always switch off the Emblaser after use.
Never operate the Emblaser with the base plate removed.

Contents

Welcome to the Emblaser

This Manual is designed to start your journey with the Emblaser.

Take the time to learn about your new machine by reading this manual carefully.

General Specifications

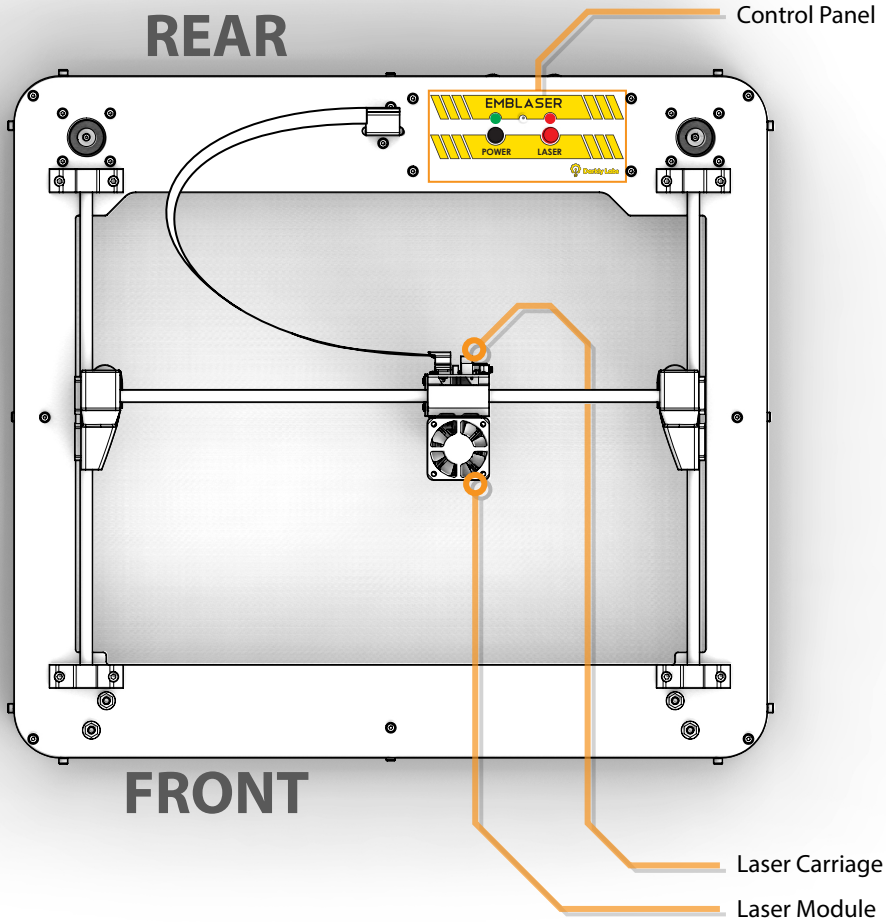
	A4	A3
Physical Dimensions	490mm x 440mm [19.3” x 17.3”]	630mm x 520mm [24.8” x 20.5”]
Working Area	305mm x 210mm [12” x 8.27”]	410mm x 285mm [16.5” x 11.22”]
Max. Material Height	45mm [1.77”]	45mm [1.77”]
Weight	7kg	8kg

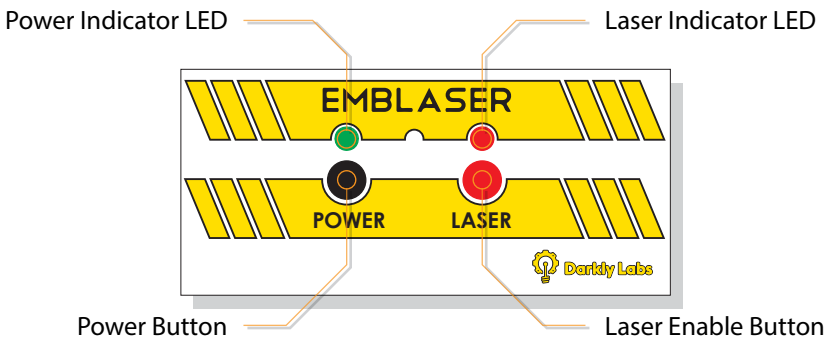
Operating Temperature	Ambient Operation	10-32 C [50-90 F]
Electrical	AC input DC output	100-240V, 50-60Hz 12V @ 3amps
Mechanical	Chassis Material Stepper Motors Resolution	Polycarbonate / ABS / PLA 0.9degree step angle 0.08mm / step
Laser	9mm 445 nm laser diode (Class 4) Or 5.6mm 445 nm laser diode (Class 4)	

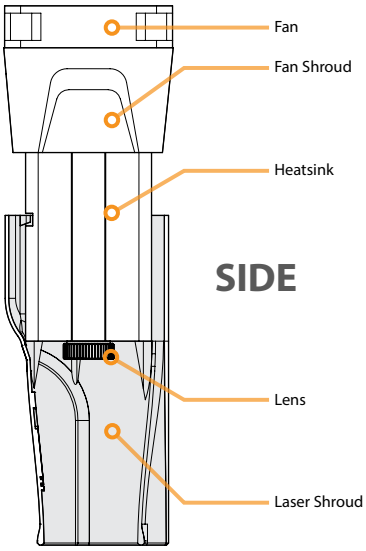
Software

Design & Toolpathing	Vectric Cut2D-Laser Desktop 8
Machine Control	Vectric Transfer (VTransfer) Ultimate GCode Sender
GCode Interpreter	GRBL 9g (custom)

Layout


REAR
Control Panel
EMBLASER
POWER
LASER
FRONT
Laser Carriage
Laser Module


Power Indicator LED
Laser Indicator LED
EMBLASER
POWER
LASER
Darkly Labs
Power Button
Laser Enable Button


Fan
Fan Shroud
Heatsink
SIDE
Lens
Laser Shroud

Safety

Safety Overview

How can a laser injure me?

What Precautions Should I Take?

Important Health Warning Information

Safety Checklist

Safety Overview

The following chapter outlines important safety information.

Please read through all the safety information carefully.

The information outlined in this safety chapter are not intended to replace any existing national or international standards as well as national or local Occupational Health and Safety (OH&S) regulations. These specific responsibilities should be followed. However, in the absence of any specific legislation or regulations, the following constitutes general guidance on responsibilities for the safe use of lasers.

It is crucial that a competant adult is always in charge of the Emblaser and its operation. This individual is responsible for providing laser safety training to users and for ensuring that safe methods of work are always adhered to by users of the Emblaser.

Any potential laser user should ensure that appropriate procedures are followed. This is cannot be reinforced enough, not only to prevent possible irreversible injury to the laser user, but to protect visitors or others who may inadvertently become exposed to any of the hazards of the laser equipment.

Users are encouraged to refer to the references for additional resources and are strongly encouraged to confirm that they are in compliance with all local OH&S requirements.

Watch out for the following symbols to indicate specific laser precautions.

How can a laser injure me?

The Emblaser uses a **Class 4** laser to perform its cutting and engraving tasks. This class of laser can injure or affect the user in three main ways:

1) Thermal Injury

Unlike many light sources that dissipate their power rapidly with distance traveled, lasers produce a collimated (focused) beam that remains concentrated even over long distances.
This concentrated beam of light entering the eye can cause some permanent damage to the retina.

Lasers can also quickly cause thermal injury (burns) to the skin. Continuous exposure to shorter wavelengths, such as ultraviolet, can over time increase the risk of skin cancer.

Important: The danger of retinal injury is always present when working with lasers. This can be from both direct and also indirect (bounced light) beam exposure.

2) Exposure to fumes from laser cutting

The heating which occurs during laser cutting or engraving can cause charring, pyrolysis and even combustion of the material being worked on.

Exposure to the fumes and particulates released during laser engraving or cutting can cause irritation to the airways and potentially be extremely dangerous.

For example, exposure to Isocyanate from thermally degraded polyurethanes has the potential to cause hypersensitivity to develop over time in predisposed individuals, which can lead to subsequent life threatening asthma like reactions on re-exposure to even trace amounts.

Important: See Appendix for information on chemical reactions with various materials during laser cutting and engraving. Always research the material you plan to work with to ensure it is safe to do so.

3) Fire

A laser cutter / engraver works by amplifying light to such a degree as to either melt or burn material while following a designated path. The heat generated during this process could potentially cause combustion (fire) within the material being worked on.

Important: We highly recommend keeping a Fire Safety Blanket within reach when operating the Emblaser.

What Precautions Should I Take?

Always wear the correct protective eye-wear

Lasers operate at a specific wavelength. It is important to ensure the protective eye-wear you are using is designed to protect you against these wavelengths.

Emblaser laser diode wavelength:	**445nm**
Protective eye-wear minimum rating:	**Filter the 445nm wavelength** **OD4 (Optical Density)**

- Make it a habit to always wear appropriate protective eye-wear when using the Emblaser.
- Make sure anyone in the vicinity is also wearing appropriate protective eye-wear.
- If you change the laser diode in the Emblaser, ensure you have the correct protective eye-wear for the laser wavelength you will be using.
- Maintain your protective eye-wear and do not use if damaged.

Do not cut or engrave under the following conditions

- When any part of the Emblaser is damaged or not functioning correctly.
- If anyone is standing within 5 meters of the Emblaser without appropriate protective eye-wear.
- When the Emblaser cannot be constantly supervised.
- If children under the age of 15 are present and cannot be constantly supervised by a responsible adult.
- Where flammable solvents or gases are present.
- In wet surroundings.

Do not cut or engrave the following materials

- Do not engrave or cut materials containing **CHLORINE**.
- Do not engrave or cut **Polyvinyl-chloride (PVC)** based materials.
- Do not engrave or cut materials with reflective surfaces such as glass or metal.
- Do not engrave or cut highly flammable materials.
- Do not engrave or cut any material you cannot ascertain is safe to do so.

Avoid cutting or engraving the following materials without adequate ventilation

- Materials containing melamine resins.
- Plastics containing nylon.
- High Density Foam or other material containing polyurethane.
- MDF or other materials containing either urea or phenol-formaldehyde.
- Foam-core board or other materials containing Polystyrene or Styrene foam.

Ensure your Emblaser is setup in a safe location

Where you setup your Emblaser is as important as the materials you will be working on.

- The Emblaser should always be used on a dry, sturdy, flat surface. The surface should be high enough to avoid tampering from young children and pets. There should be no possibility of the Emblaser being bumped or knocked causing it to dislodge or fall.
- The Emblaser should be placed in an area with adequate ventilation.
- The Emblaser should be placed away from any highly flammable materials.
- Ideally, a smoke / fire detector should be installed in the area the Emblaser is being used.
- A fire blanket and smoke extinguisher should always be readily accessible.

Never leave your emblaser unattended

- Do not leave unattended - Always watch your work
- Ensure children and pets are ALWAYS supervised. Never allow children and pets to have access to the Emblaser without parental supervision. The Emblaser is not intended for children under the age of 15 years.
- If you see flame or fire - Immediately stop the machine and extinguish. Not only could a flame grow into a larger fire, its heat will damage the laser guard and possibly the laser optics.

Always follow your local Occupational Health and Safety (OH&S) rules

- Ensure that you comply with local occupational health and safety legislation. Failing to do so could put you in breach of the law. Even if not being used in a business, owners may be in breach of the law if injuries occur, since injury to a member of the general public could conceivably constitute a breach of the owner's OH&S obligation under law, subject to penalties.
- Visit your local government website for OH&S information on laser safety requirements.
- Those operating the Emblaser within an established business should nominate a designated laser safety officer, responsible for the safe use, training, and upkeep of the Emblaser and associated personal protective equipment, administrative controls such as user credentialling and safe operating procedures (SOPs), and engineering controls, such as ventilation

Important Health Warning Information

Color Blindness

The small percentage of the population (0.01%) that have blue-yellow colour blindness (tritanopia) may struggle to see the Emblaser's laser beam at all, and may not realise they are being exposed although permanent damage is occurring. Tritanopic users must therefore be particularly careful.

Hypersensitivity

Isocyanate exposure from thermally degraded polyurethanes has the potential to cause hypersensitivity to develop over time in predisposed individuals, which can lead to subsequent life threatening asthma like reactions on re-exposure to even trace amounts.

Recommendations:

- Those with a history of asthma should avoid laser cutting polyurethanes.
- If a wheeze develops during or after cutting polyurethanes in any user, further polyurethane cutting should cease and medical advice should be sought.
- Isocyanate by products from decomposition of polyurethanes can remain in exhaust ducting and can still cause sensitisation with skin contact.
- If you get a sore throat or eyes while laser cutting polyurethanes, you have developed isocyanate pharyngitis and your precautions are not working effectively.

Airway Irritation

Many of the chemicals liberated by laser cutting and engraving have the potential to cause airway irritation, but few, if any, permanent effects. Some of the chemicals are known carcinogens, but with appropriate local or general exhaust ventilation, exposures are unlikely to add significantly to background environmental exposures (i.e. formaldehyde from MDF furniture, benzene in fuels).
If you are experiencing airway irritation, your ventilation is not adequate.

SAFETY CHECK LIST

- **Are you wearing your safety glasses?**
- **Are there any people in the vicinity and are they wearing safety glasses?**
- **Are there any reflective objects within the laser cutting area?**
- **Is there anything that will potentially obstruct the movement of the laser?**
- **Is the material you are planning to cut / engrave safe to do so?**
- **Do you have adequate ventilation?**
- **Do you have a Fire Blanket within reach?**
- **DO NOT USE THE EMBLASER ON REFLECTIVE MATERIALS**

Be vigilant with safety when using the Emblaser.

Starting Up

Software Installation

Powering Up

Connecting

Focusing

Installation (Windows)

Installing the driver

Before plugging in your Emblaser, you will need to install a software driver.

Step 1: Windows drivers can be downloaded here: **https://darklylabs.com/support/download/**

Step 2: Unzip the downloaded file.

Step 3: Run the appropriate installer based on whether you have a 32 bit or 64 bit operating system and follow the installer prompts.

Install 'Cut2D-Laser Desktop 8' & 'VTransfer'

Cut2D-Laser is a powerful CNC design and tool-pathing program developed with the Emblaser in mind. It will allow you to import/create vector graphics, define how you would like them cut/engraved and send them directly to your Emblaser.
VTransfer is the software that forms the link between Cut2D-Laser and your Emblaser. It not only allows you to seamlessly control the Emblaser within Cut2D-Laser, but also offers a number of useful features for running cutting / engraving jobs.

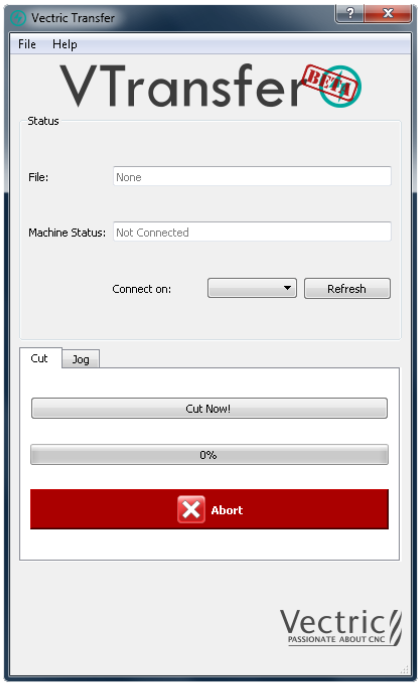
Step 1: Download and install the latest version of Cut2D-Laser.

The latest install (Cut2D-Laser Desktop 8) can be downloaded through Vectric's 'portal'.
New and existing customers will receive a link to access their copy and their new license file.
Installation is simple. Run the installer and follow the prompts.

After installation, two icons will be available on your desktop.

Step 2: Start VTransfer and change settings.

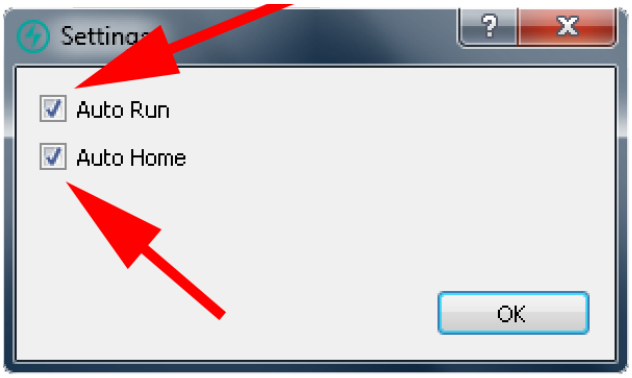
Double click the **'Transfer'** icon to start VTransfer.



Select **'File / Settings'** from the top menu bar. This will open up the settings window.

Tick the **'Auto Run'** and '**Auto Home'** check-boxes.

Press **'OK'**



VTransfer is now setup.

INSTALLATION (OS X)

The software options available for OS X are somewhat limited compared to Windows.

We highly recommend either:

Using a Windows based computer for working with the Emblaser.

OR

Installing Windows on your Mac via Bootcamp or Parallels.

If these are not an option, here are the steps for installing the required software in OS X.

INSTALL 'CUT2D-LASER V1.0'

At present, the latest version of Cut2D-Laser is not OS X compatible. To enable Mac users to use the software, we have created a Mac-Friendly version of 'Cut2D-Laser V1.0' which can be run under OS X.

Step 1: Obtain a Cut2D-Laser V1.0 license

The 'Cut2D-Laser Desktop 8' license you were issued with the purchase of your kit is not compatible with Cut2D-Laser V1.0. You will need to contact Vectric support and be issued with a V1.0 license number. Please contact **support@vectric.com**.

Step 2: Download Cut2D-Laser V1.0 'Mac-Friendly' version.

This can be downloaded from: **https://darklylabs.com/support/download/**

Step 3: Install

Uncompress and copy the 'Cut2D-Laser.app' to your 'Applications' folder.

Step 4: Run

Double-click 'Cut2D-Laser.app' to run.

Step 5: Register

Enter your registration and license details.

INSTALL 'ULTIMATE GCODE SENDER'

In order communicate with the Emblaser, a program to send data to it is required. 'Ultimate GCode Sender' is the most common choice.

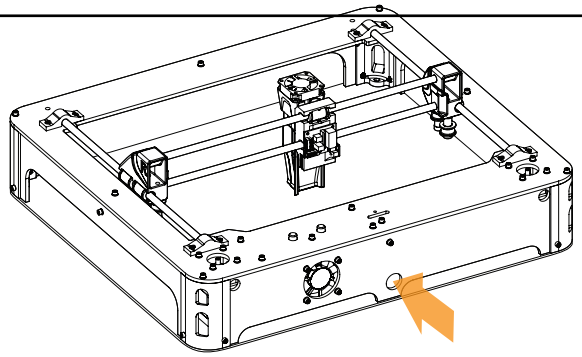
Please see the section titled **'Installing Ultimate GCode Sender'**.

Follow the installation steps in this section.

Powering Up

Step 1.

Thread the power and USB cables through the circular opening in the back panel and plug them into the main Emblaser PCB.



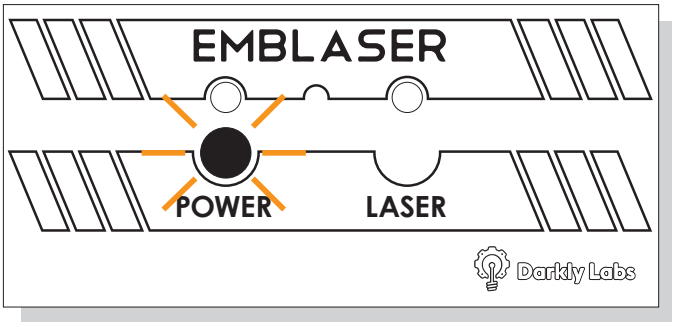
Step 2.

Do not power up your Emblaser yet.

Run through the **Safety Checklist** before proceeding.

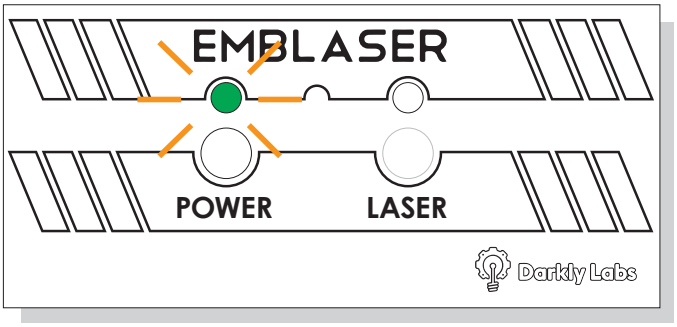
Step 3.

Press the **'Power'** button to turn on the Emblaser.



You will see the LED above the power button turn green and the fan on the laser unit will now be running.

Note: When powered up, the Laser Unit Fan and Chassis Fan should always be running. If they are not, do not proceed. Check for a solution on the Help Centre or contact support.

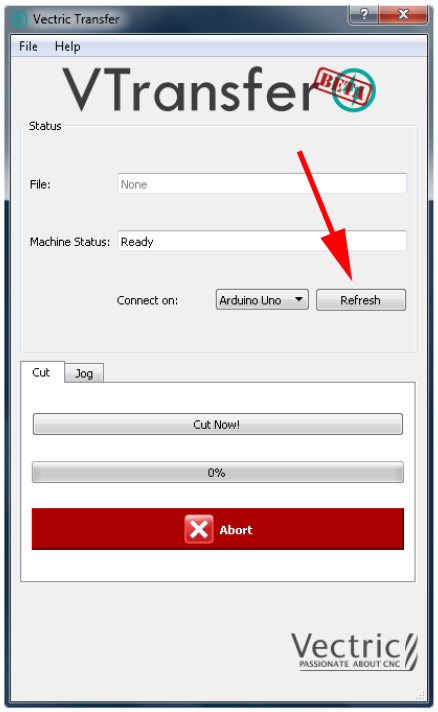


Connecting to the Emblaser (Windows)

IMPORTANT: The next process will automatically 'home' your Emblaser.
Please ensure the workspace is clear of obstacles.

'Homing' is the process used by CNC machines to determine their exact position. It needs to be performed whenever the Emblaser is first turned on or when the laser is moved by hand.

On the VTransfer window, press the **'Refresh'** button.



After completed, the **'Machine Status'** will read **'Ready'**.

You are now ready to start working directly through Cut2D-Laser with your Emblaser.

Connecting to the Emblaser (OS X)

Please see the appendix titled 'Connecting via Ultimate GCode Sender'.

Follow the steps in this section.

Focusing the laser

Laser focusing is the process of creating the narrowest, sharpest focused beam from your laser. This will give you the best cutting and engraving results.
Focusing does not have to be performed very often, but is required the first time you have assembled your kit and if the lens has been changed or moved.

Important: Focusing involves removing the laser guard. Extreme care should be taken to ensure anyone in the vicinity is wearing protective eye-ware. Eye damage will occur if you look at the laser focus spot without protective eye-ware.

How to focus the laser

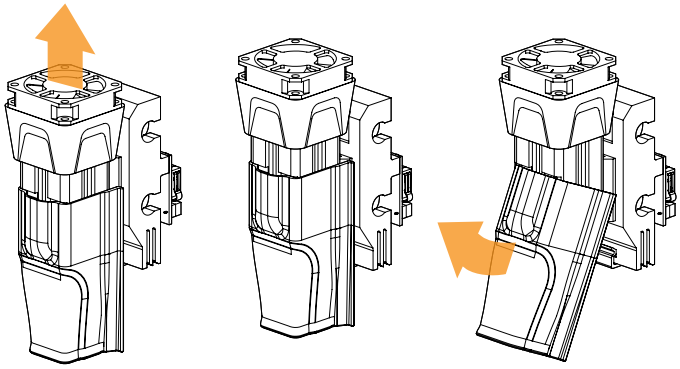
Step 1.

Put on your safety eye-wear.

Check for anyone in the vicinity and ensure they are wearing protective eye-wear.

Step 2.

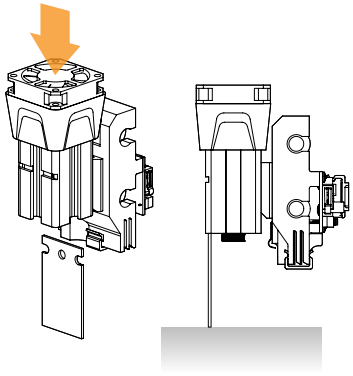
Slide the laser unit up and remove the laser guard.



Step 3.

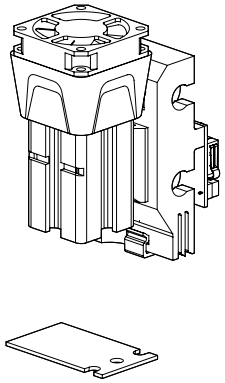
Set the laser unit height with the focus tool.

This is done by placing the focus tool vertically onto the machine base and sliding the laser unit down until the heat-sink touches it.



Step 4.

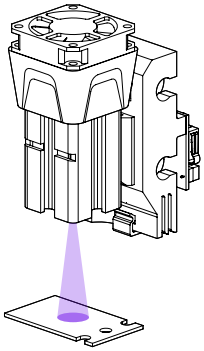
Place the focus tool flat on the work piece under the laser.

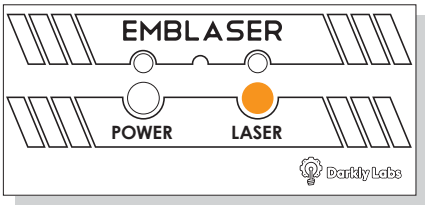


Step 5.

Enter focus mode by holding down the enable button.
The laser will ramp up to 10% power after one second and remain there while focusing is taking place.

Danger: This laser power is enough to cause eye damage. Do not look directly at the focus spot without protective eye-ware. BE CAREFUL.



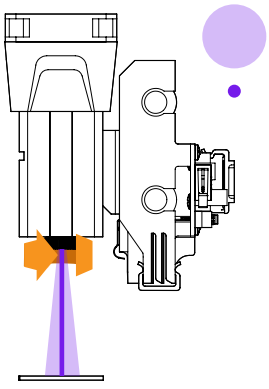


Step 6.

Turn the laser lens until the smallest laser spot is obtained.

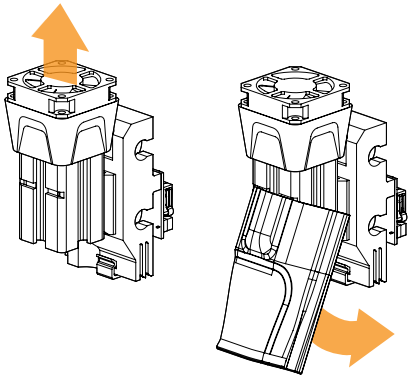
Be careful not to unscrew the lens too far or it will come out, along with the focus spring.

Once complete, release the enable button.



Step 7.

Slide up the laser unit and re-fit the laser guard.



Running your first job:

Setting the correct laser height

Understanding the Laser Modes

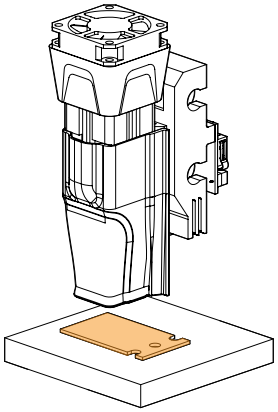
Running your first cutting job

Setting the correct laser height

Setting the correct height will ensure the laser is focused correctly onto your workpiece. The following process can be used after the laser has been focused.

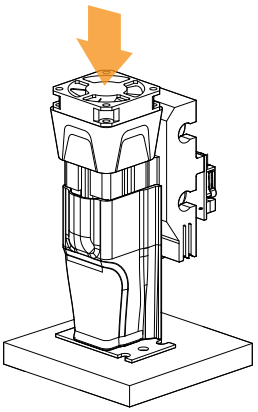
Step 1.

Place the focus tool on top of your work piece



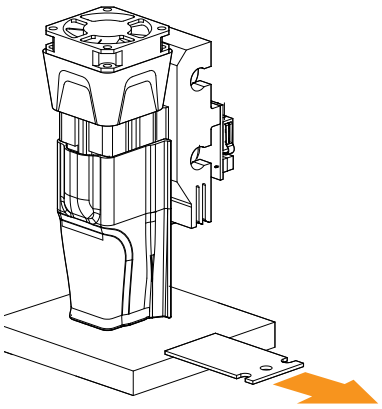
Step 2.

Carefully slide down the laser unit down until the laser shroud touches the focus tool



Step 3.

Slide out the focus tool being careful not to move the laser unit's height.



The laser height is now correctly set for your work piece.

Understanding the Laser Modes

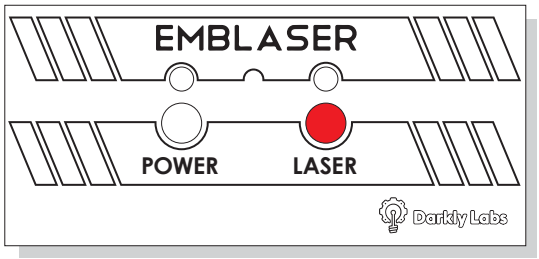
The Emblaser can have its laser in one of three different ‘modes’.

Mode: Disabled

The laser will always default to ‘disabled’ mode when first turned on.

This mode is indicated by the Laser LED being off.

In this mode, the machine will move as normal, but the laser will not power up.

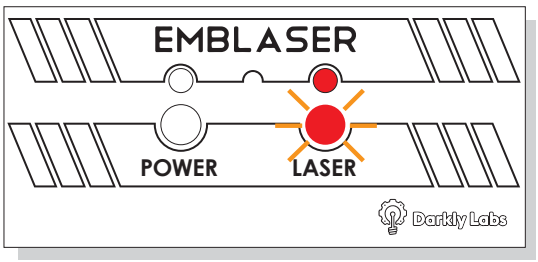


Mode: Enabled

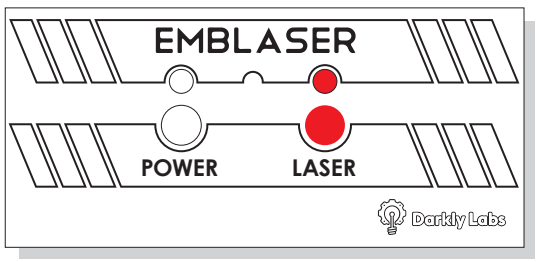
In ‘enabled’ mode, the laser will power up as requested by the software.
This mode is indicated by the Laser LED being on.

To enter ‘enabled’ mode:

1:
Depress the laser button for 2 seconds until the red Laser LED blinks once.



2:
Then release the laser button.
The red Laser LED will remain on.

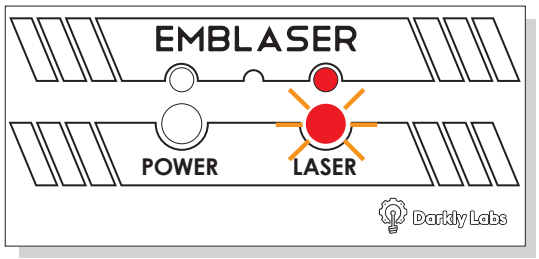


Mode: Focus

This mode becomes active when the Laser Guard is removed.

Pressing and holding down the Laser button will allow the laser to power up at a low level for focusing.

Releasing the Laser button will immediately turn off the laser.



For more information about Laser Modes, see Appendix ‘Laser Modes’.

Running your first cutting job

After assembling your Emblaser, it will be useful to run the 'Calibration' file. This will help ensure the machine is aligned and working correctly.

Step 1.

Run through the **Safety Checklist** before proceeding.

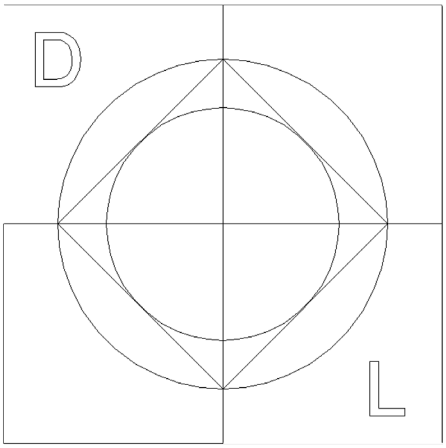
Ensure you have your safety eyewear handy.

Step 2.

Download the 'Calibration' file from our website.

https://darklylabs.com/support/download/

The file you need is called:
Emblaser_CalibrationTest.crv

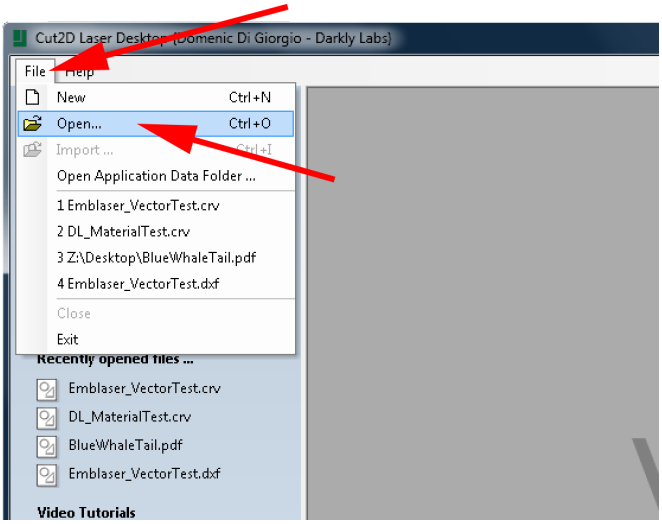


Step 3.

Double click on the Cut2D-Laser icon to start the program.

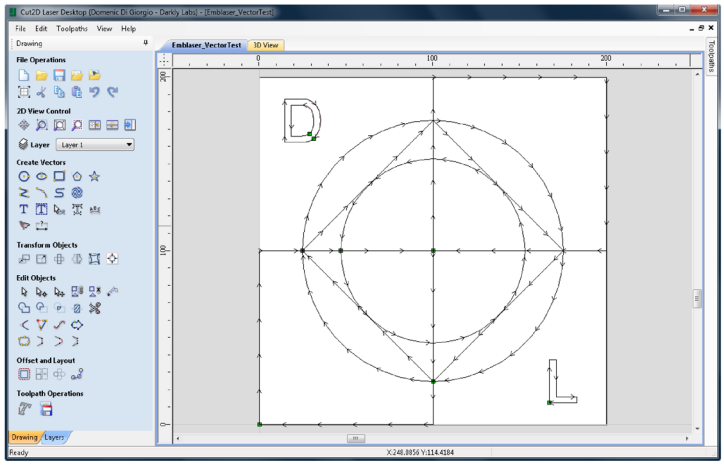
Select **'File / Open'** from the top menu bar.

Navigate to where you saved the calibration file and open it.



Step 3 (cont).

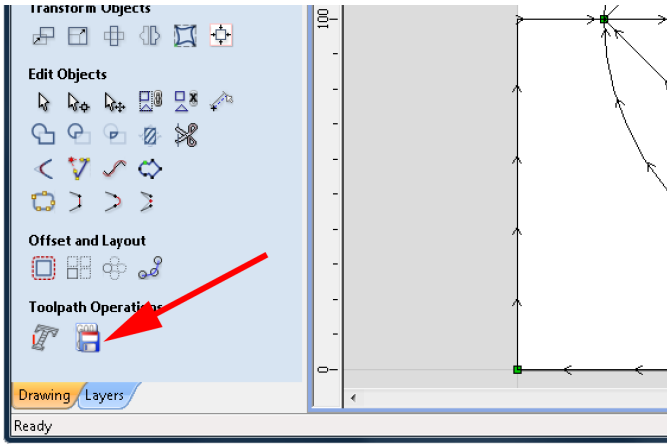
Once the file loads, you will be presented with this screen.



Step 4.

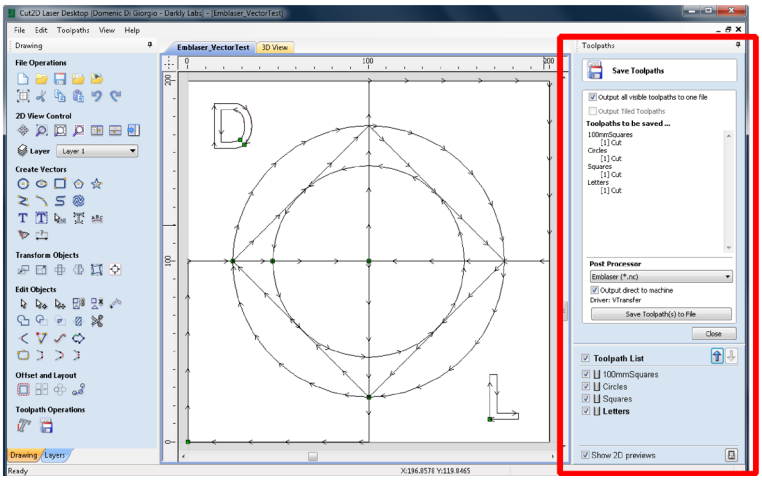
In this project, all the toolpaths have already been created and are ready to send to the Emblaser.

Click on the **'Save Toolpath'** icon.



Step 4 (cont).

This will reveal the 'Save Toolpaths' panel on right side of the window.



Step 4 (cont).

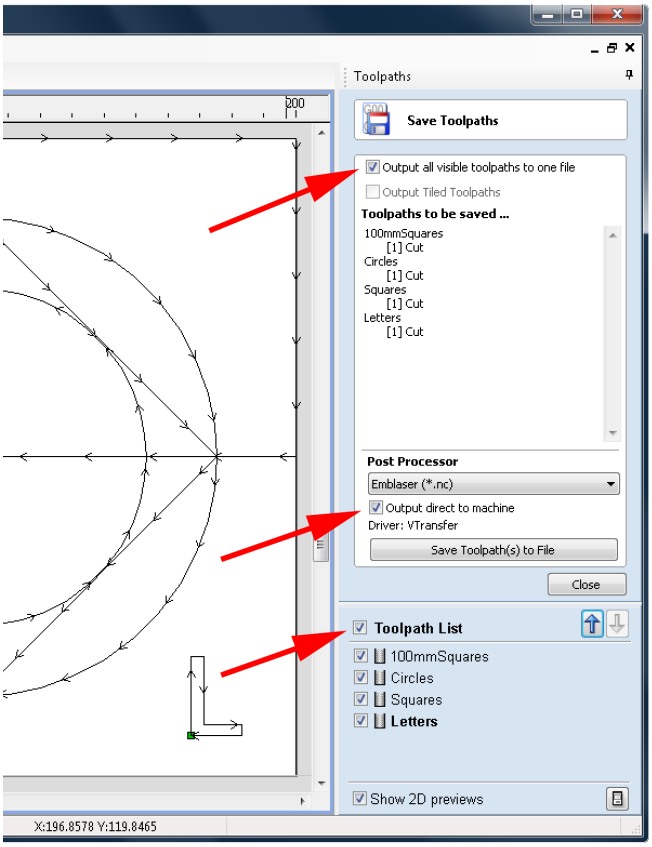
Ensure the indicated checkboxes are ticked.

‘Output all visible toolpaths to one file’
This will compile all the separate toolpaths within the project into one file.

‘Output direct to the machine’
This sends the toolpaths directly to VTransfer rather than saving a file to disk.

‘Toolpath List’
This makes all the toolpaths visible, since it this example we want them all to be sent to the Emblaser.

DO NOT CLICK ‘Save Toolpath(s) to File’ yet.

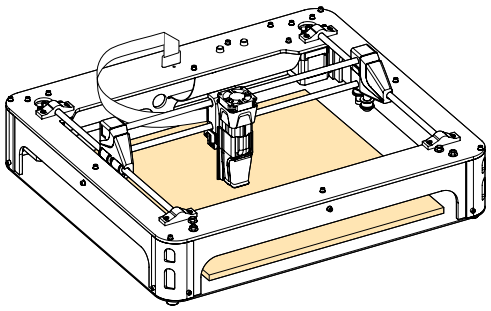


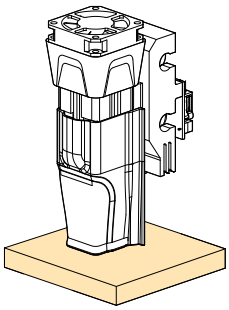
Step 5.

IMPORTANT: The following steps will result in your Emblaser starting the cutting job.

Make sure you have placed your material in the workspace and set the correct laser height. For this example a piece of thick card or flat plywood will be suitable. The aim of this calibration file is to determine alignment, hence engraving is prefered over cutting.

Ensure you are wearing your safety glasses and the workspace is clear of ovstructions.



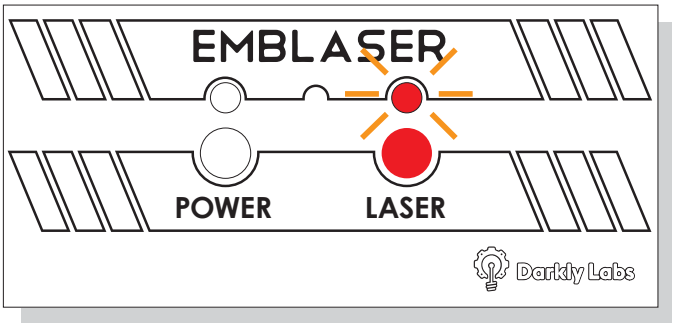


Step 5 (cont).

Hold down the **'Laser'** button for two (2) seconds until you see a short blink from the red LED above it.

Release the 'Laser' button and the LED above it should remain on.

The laser is now ENABLED.

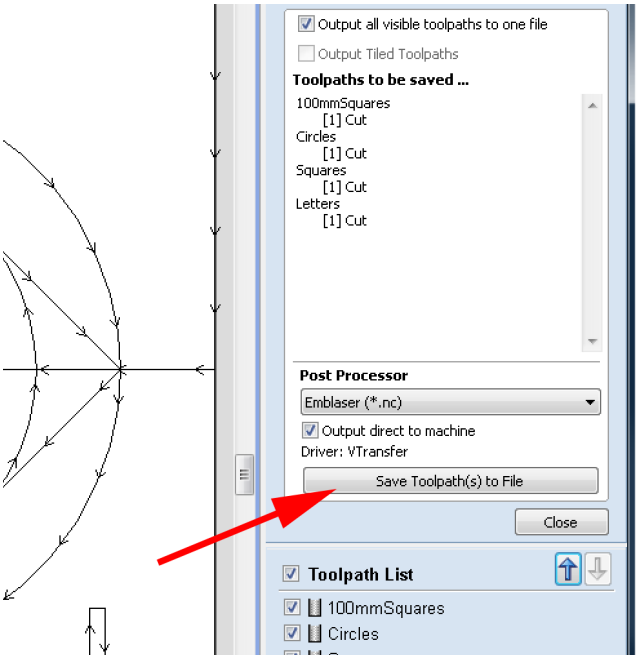


Step 5 (cont).

Click the 'Save Toolpath(s) to File' button.

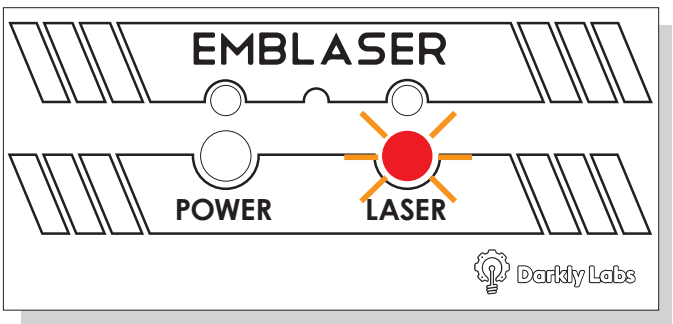
If VTransfer is not running it will start automatically and instruct the Emblaser to perform a 'Homing' process.

The Emblaser will then run through the toolpaths from the project file.



Step 5 (cont).

Once your job is completed, disable the laser by pressing the 'Laser' button once.



Never leave the Emblaser unattended when it is running a job.

Advanced:

Changing the Maximum Laser Power Setting

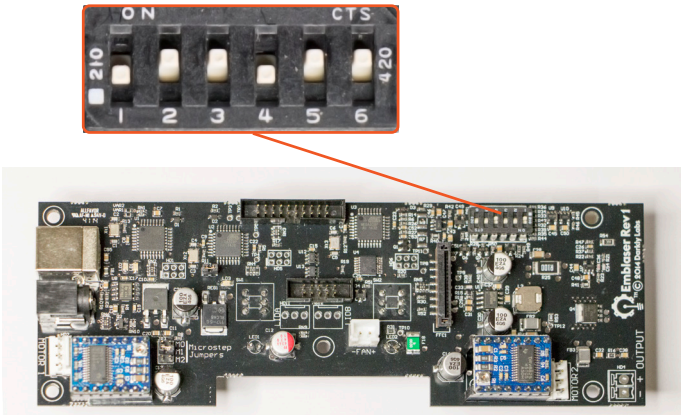
Swapping out a Laser Unit

Updating Firmware

Changing the maximum laser power setting

Changing the maximum laser power can be used to tailor your system for different laser diodes and also help extend the life of your laser diode. The laser power is determined by the amount of current allowed to pass through the laser diode.

WARNING: Changing these settings could **permanently damage** your laser diode. **Extreme care** should be taken to ensure the chosen current setting is not above the maximum current your laser diode can support.



0 = Switch OFF 1 = Switch ON

Current	Switches		Current	Switches		Current	Switches
mA	123456		mA	123456		mA	123456
450	000000		1350	010010		2250	110000
500	000001		1400	010011		2300	110001
550	000010		1450	010100		2350	110010
600	000011		1500	010101		2400	110011
650	000100		1550	010110		2450	110100
700	000101		1600	010111		2500	110101
750	000110		1650	011000		2550	110110
800	000111		1700	011001		2600	110111
850	001000		1750	011010		2650	111000
900	001001		1800	011011		2700	111001
950	001010		1850	011100		2750	111010
1000	001011		1900	011101		2800	111011
1050	001100		1950	011110		2850	111100
1100	001101		2000	011111		2900	111101
1150	001110		2050	101100		2950	111110
1200	001111		2100	101101		3000	111111
1250	010000		2150	101110			
1300	010001		2200	101111			

Factory default setting is 1800mA

0 1 1 0 1 1

(off-on-on-off-on-on)

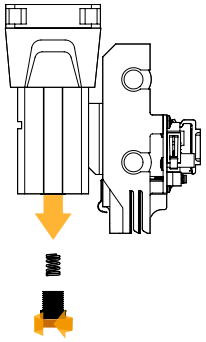
(1 2 3 4 5 6)

Swapping out a Laser Unit

Step 1.

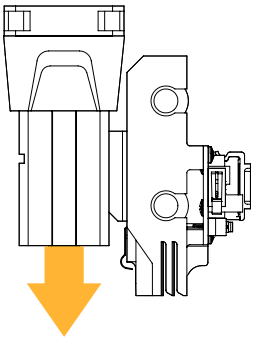
Carefully unscrew the lens and remove along with the focus spring.

Important: With the lens removed, be careful to keep dust and debris out of the laser diode. A small piece of tape over the opening will help prevent this.



Step 2.

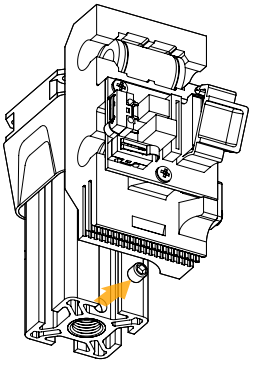
Slide the laser unit all the way down to its lowest position.



Step 3.

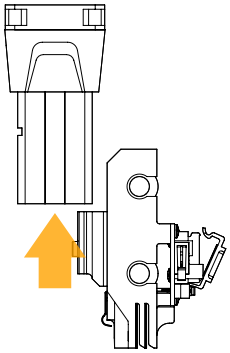
Unscrew and remove the set screw holding in the laser diode.

Important: The laser diode will remain inside the heatsink because of friction. Be careful to not dislodge it.



Step 4.

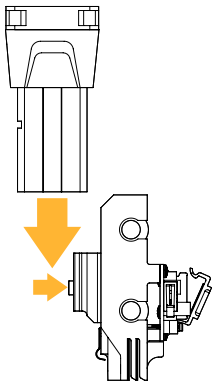
Slide the laser unit up and off.



Step 5.

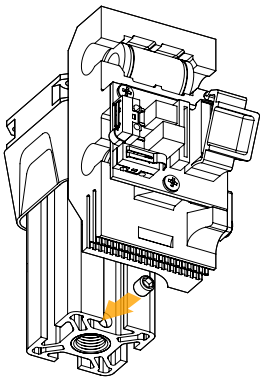
Slide on the replacement laser unit. You will need to depress the adjustment pin to allow the unit to slide on.

Important: Some force may be needed to depress the adjustment pin. It is a very tight fit.



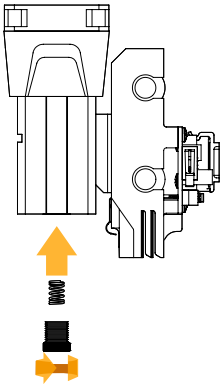
Step 6.

Replace the setscrew to lock the laser diode in place.



Step 7.

Carefully insert the focus spring and screw in the lens.



Important

If you have replaced the laser unit with one of a different power rating, you must adjust your maximum laser power settings before turning on your Emblaser.

Failure to do this could result in permanent damage to your laser diode.

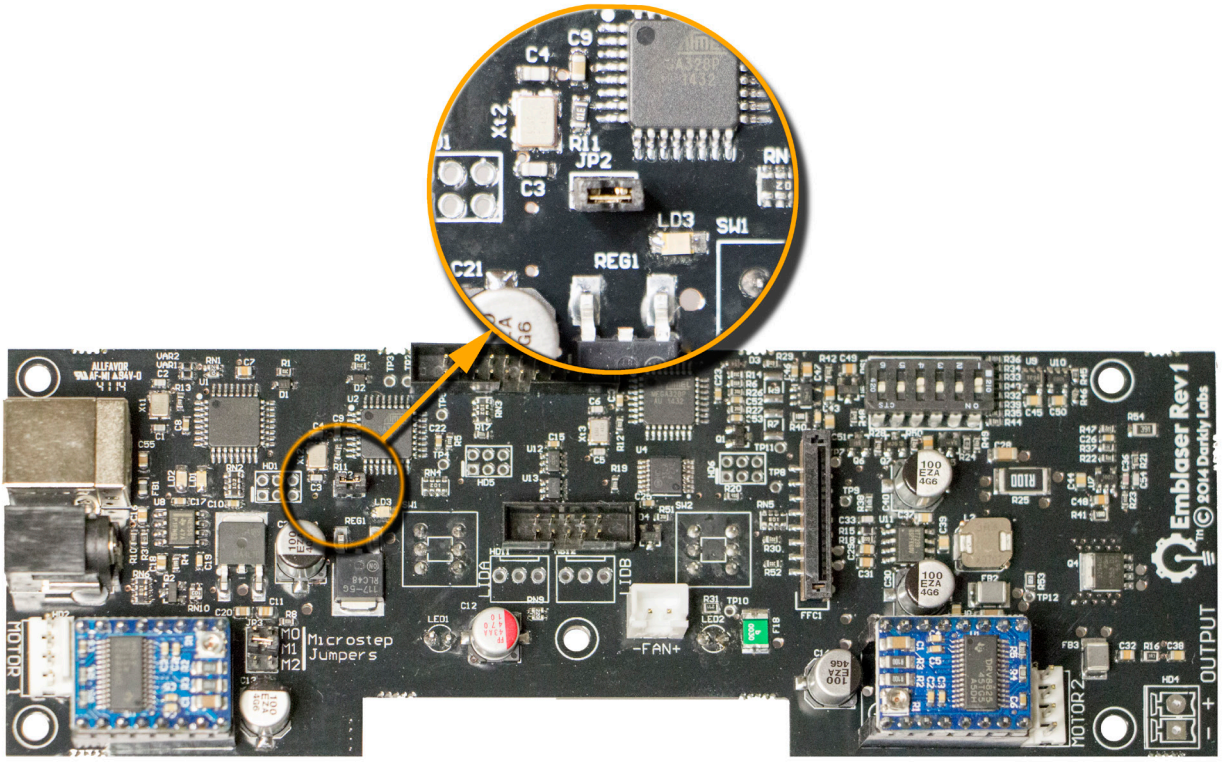
Updating Firmware

The Emblaser allows you to update the firmware on the two microprocessors as updates become available. This process can be performed via the USB connection and the update software package supplied by Darkly Labs.

Choosing between the GRBL and Watchdog processors is via a jumper (JP2) on the main PCB.

GRBL MCU = Jumper **in place** (default)
Safety MCU = Jumper **removed**.

Warning: Incorrectly programming the MCUs can cause the Emblaser to malfunction, be permanently damaged or operate in an unsafe manner. Extreme care should be taken to follow instructions when performing this process.



Detailed instructions will be provided with each firmware update.

Maintenance

Lubrication

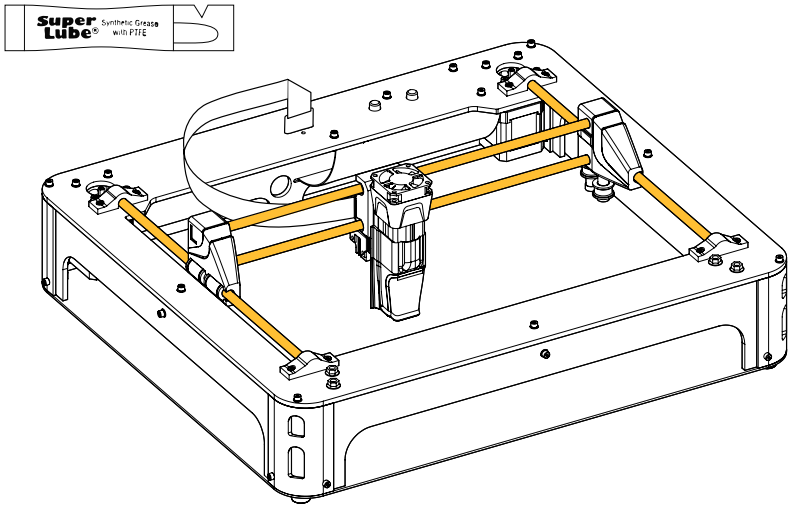
Lens Cleaning

Lubrication

Keeping the rails clean and lubricated will ensure your machine maintains its accuracy over time.

After every 50 hours of use:
You will require: Super-Lube Synthetic Grease (supplied with kit)
Lint Free Micro Fiber Cloth

1: Wipe down the rails with a clean lint-free cloth to remove any build up residue or dust.
2: Apply a small amount of the lubricant supplied to each rail.
3: Gently move the gantry and laser unit back and forward to ensure the lubricant works its way into the linear bearings.



Lens Cleaning

The laser lens is a very delicate part of your machine. It is rare that you will need to clean it as the airflow is designed to keep fumes moving away from contaminating its surface.

Cleaning the lens is not recommended unless you feel it is absolutely necessary.
You will require: Isopropyl Alcohol
Lint Free Micro Fiber Cloth

1: Carefully unscrew the lens from the laser module.

2: Look through your lens and determine whether it looks cloudy or has visible debris on it. If not, reassemble your laser unit and do not proceed with cleaning.

3: If you have determined your lens needs cleaning proceed carefully.
Never touch the glass part of the lens with your fingers or anything other than a lint-free micro fiber cloth. Paper towel, cotton and tissues will scratch the coatings on the lens and leave it permanently damaged.

4: Spray a small amount of Isopropyl Alcohol onto the glass surfaces of the lens and wipe them extremely gently with a micro fiber cloth.

5: Look through your lens once more to determine whether you have removed the debris.

6: Carefully screw the lens back into the laser unit being sure to include the focus spring.

Appendices

PCB specifications

Workspace specifications

Laser Modes

Installing ‘Ultimate GCode Sender’

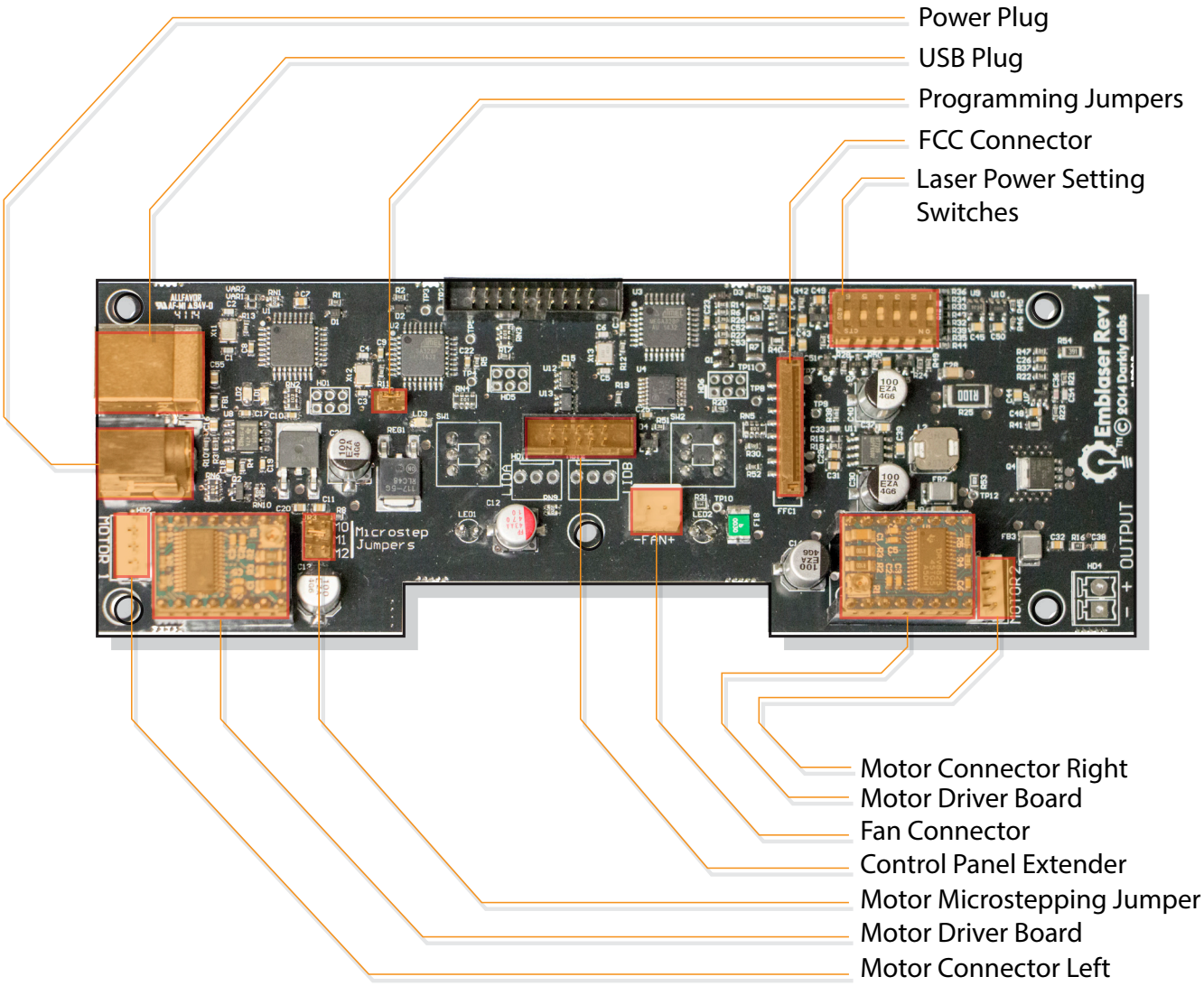
Connecting via ‘Ultimate GCode Sender’

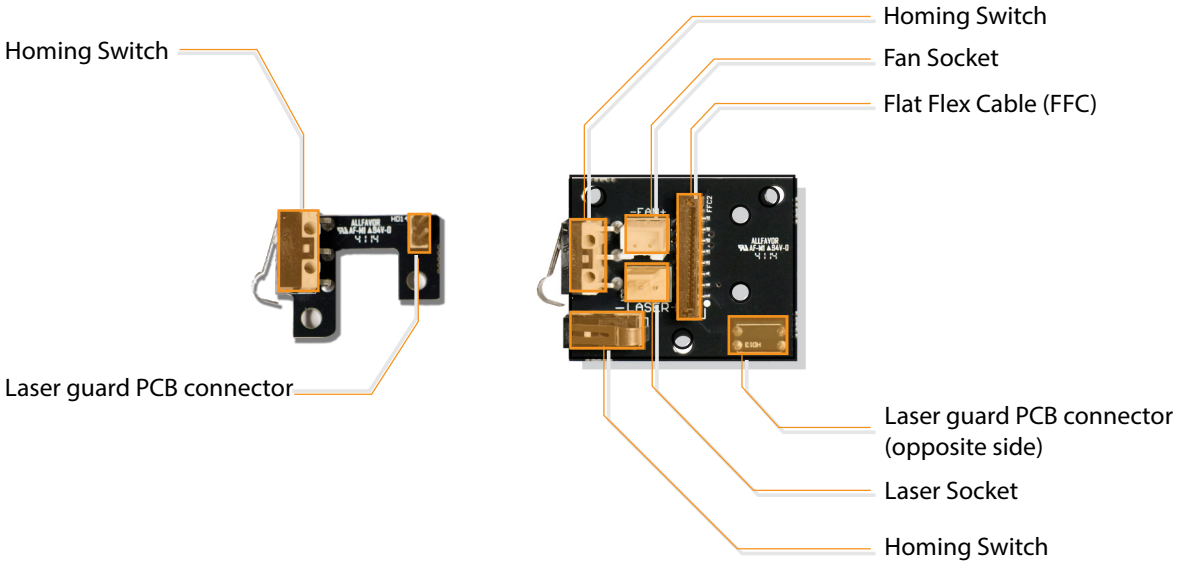
Material Properties Table

Basic GCode program for Emblaser

Terms and Conditions

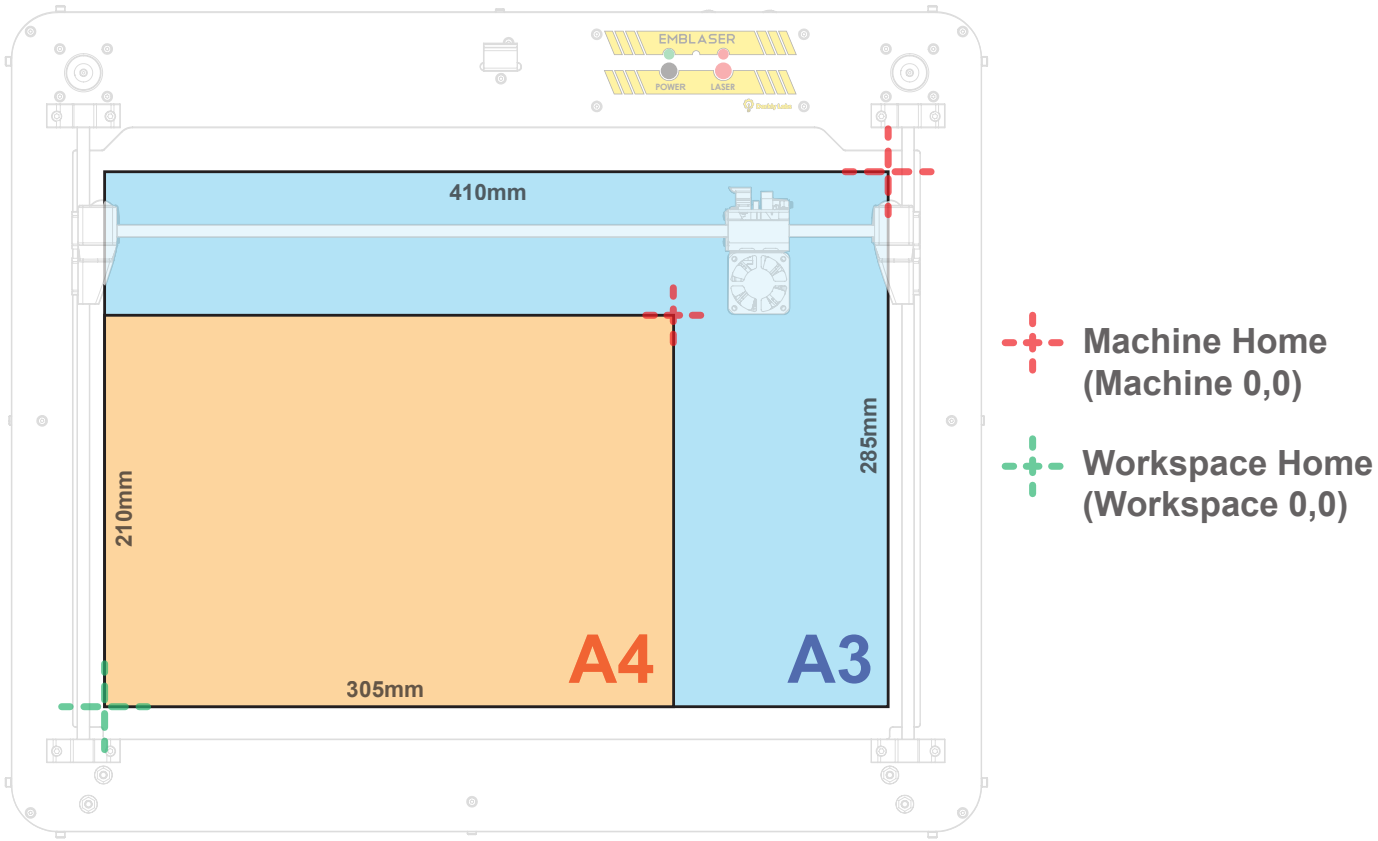
PCB SPECIFICATIONS





Workspace Specifications

Workspace Maximum Travel



The difference between Workspace & Machine Home

Workspace Home
This is always the bottem-left corner of your machine.
It represents the origin of your workspace, x=0 & y=0.
Your cutting / engraving jobs will be relative to this position.

Machine Home
This is always the top-right corner of your machine.
This is used for the 'homing' process and a convenient place for the laser head to be placed when adding or removing material in the workspace.
It is rare that you will need to consider this position in your day-to-day working.

Important: Directing the Emblaser to travel beyond these distances will cause it to hit its end stops. This will not damage the machine but will produce an awful noise and require re-homing.

If you do find yourself in this situation, immediately press the power button to turn the machine off. Then proceed with the normal startup procedure.

Laser Modes

The Laser can be in any of three modes

Disabled

In this mode, the machine can move normally but the laser will not operate.

Conditions that result in Emblaser disabled mode:
- When first turned on, the Emblaser always defaults to disabled mode.
- The enable button is pressed while laser is enabled.
- The laser shroud is not in place or removed while laser is enabled.
- The stepper motors remain motionless for 60 sec.
- A 'button stuck' condition is detected.

Enabled Mode

In this mode, the machine and laser can be operated normally.

There are two possible results when enabling the laser:
- A non-flashing enable LED indicates the laser will be enabled to a non-lasing low power.
  In this mode, the laser will be visible, but will below the lasing threshold of the laser diode.

- A flashing enable LED indicates the laser may potentially be enabled at a power level above the lasing threshold. This could be the result of a previously set laser power or a currently running cutting job.

How to enter 'Enabled' mode
1. Note whether the enable LED is flashing as discussed above.
   Enter an 'M05' command to ensure the laser is below the lasing threshold when enabled.
2. The laser shroud must be correctly installed.
3. Press and hold down the 'enable' button for 2 seconds, until it blinks. Then release the button.
4. The 'Enabled' light will now remain lit and the laser is enabled.

Focus Mode

The Laser can be enabled into a limited-power mode to assist in lens focusing. This is the only mode in which the laser can be operated without the laser shroud being in place.
Important: Extreme care should be taken in this mode and eye protection is mandatory.

How to enter Focus Mode

1. The user and anyone in the vicinity of the machine must be wearing safety eye-wear.
2. Remove laser shroud.
3. Press and hold down the enable button.
   After 1 sec the laser will ramp up power to a focusing power.
4. Releasing the button will exit focus mode and disable the laser instantly.
   Focus mode will be exited automatically after 1 minute.

Installing Ultimate GCode Sender

Ultimate GCode Sender is an open-source, multi-platform program for communicating with GRBL based controllers, similar to the Emblaser. Being multi-platform, it works on Windows, OSX and Linux platforms and provides a number of useful features for the more advanced user.

Installation Steps:

Step 1.

Download and install the latest version of Java: **https://java.com/en/download/index.jsp**

Step 2.

Download the latest version of 'Ultimate GCode Sender': **https://darklylabs.com/support/download/**

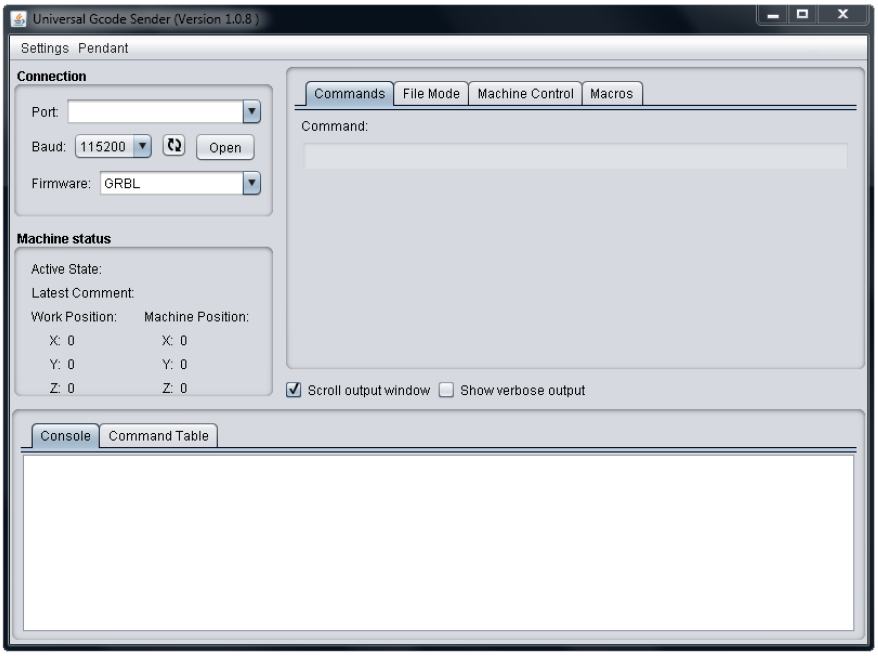
Step 3.

Unzip / Uncompress the 'Ultimate Gcode Sender' zip file to a location on your computer.
This will create a folder containing the software needed. No installation is necessary as the program can be run directly from within the folder.

Step 4.

Start 'Ultimate GCode Sender'

Windows Double-Click 'start-windows.bat'
OS X Double-Click ` UniversalGcodeSender.jar`

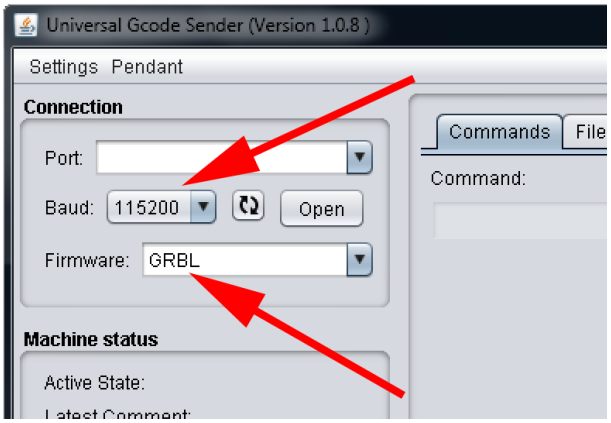


Step 5.

In the ‘Connection’ area:

Set ‘Baud’ to 115200.

Set ‘Firmware’ to GRBL.

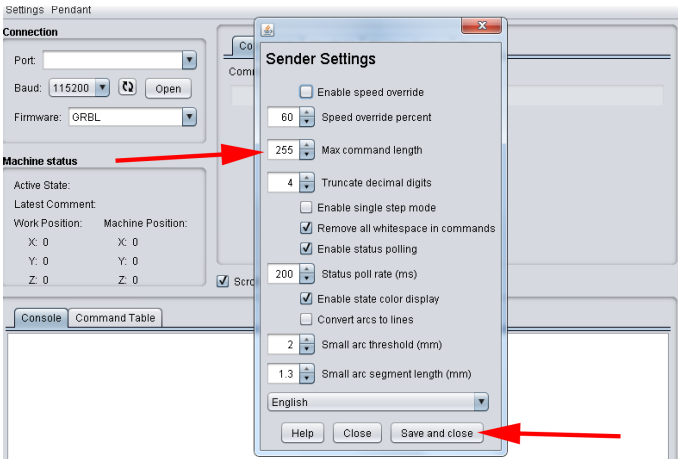


Step 5 (cont).

Select ‘Settings / Sender Settings’ from the top menu bar.

Set ‘Maximum command length’ to 255.

Click the ‘Save and Close’ button.

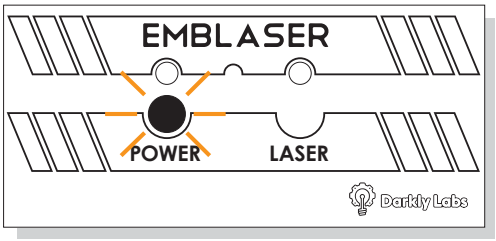


The Ultimate GCode Sender is now setup.

Conecting via Ultimate GCode Sender

Step 1.

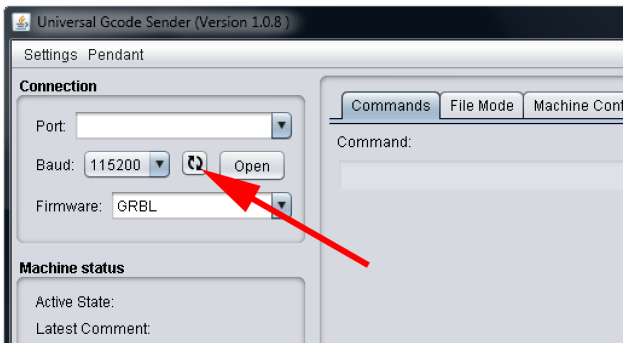
Press the **'Power'** button to turn on the Emblaser.



Step 2.

Start 'Ultimate GCode Sender', if not already running from the previous steps.

Press the button to the right of the Baud value. This refreshes the ports available on your computer.



Step 3.

From the 'Port' pull down list, select your Emblaser port.

Windows

This is likely to be COM3 or higher.
To find out, you can turn off your Emblaser and re-open the menu; the entry that disappears should be the Emblaser port. Turn on the Emblaser and select that serial port.

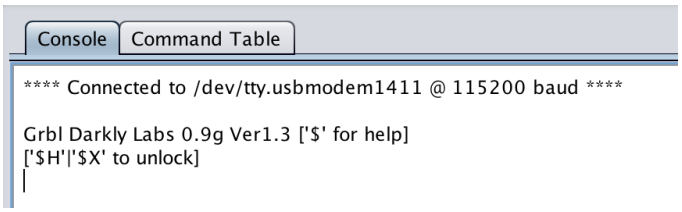
OS X

This is likely to start with /dev/tty.usbmodem.
To find out, you can turn off your Emblaser and re-open the menu; the entry that disappears should be the Emblaser port. Turn on the Emblaser and select that serial port.

Step 4.

Press the 'Open' button.

You should see the Emblaser respond in the Console window with the following:



You are now talking directly with the Emblaser and it is awaiting your instructions.

Material Properties Table

Below is a summary of commonly encountered polymers and their thermal breakdown products.

Polymer	Chemical Bonds	Breakdown Products	Effects
Polyolefins:			
Polyethylene	C-H	propane, propene, ethane, ethene, butene, hexene, and butene-1	Flammable
Polypropylene	C-H	pentane, pentene, heptene	Flammable
Polyacrylics:			
polyacrylonitrile (Sail cloths, ABS constituent)	N-H	ammonia, hydrogen cyanide, ketones	Potent airway irritants, toxic at high concentrations
Polyamide polymers:			
wool	O=C-N-H, S-S	carbon disulphide, carbon dioxide, hydrogen cyanide, benzene, toluene, and carbon monoxide	Toxic, irritant
polyurethane	N=C=O	nitrogen oxides, nitriles, isocyanate monomers, liquid polyols	Isocyanate pharyngitis, hypersensitivity and severe asthma in predisposed individuals
nylon	C–N, CO–CH2	Potential for water, carbon oxides, benzene, hydrogen cyanide (HCN), toluene, and benzonitrile, hydrogen and ammonia	Toxic, irritant
Polydienes and rubbers			
Polyisoprene (Synthetic rubber)	Isoprene, potentially other catalysts, crosslinking agents	Isoprene monomers, polymers, thermal cracking products, sulfides if vulcanised	Irritants, toxic
Polybutadiene (component of ABS)	butadiene	Butadiene monomers, cyclic compounds	toxic
Polychloroprene (Neoprene)	Chlorine	hydrogen chloride, polyene	Potent, acidic irritant of mucous membranes, corrosive, toxic

Polymer	Chemical Bonds	Breakdown Products	Effects
Synthetic carbon – oxygen chain polymers			
Polycarbonate (constituent of ABS)	O-CO2	carbon dioxide, bisphenol A, phenol	toxic
polyethylene tetraphthalate (PET)	C-O	acetaldehyde, carbon monoxide, carbon dioxide, compounds with acid and anhydride end groups	Irritant, toxic
Phenolic resins	methylene–benzene	carbon oxides, water, aromatic compounds, methane	Toxic, flammable
Epoxy resins	complex	Varied, mostly phenolic compounds	toxic
Cellulosics			
Wood, paper	Cellulose, lignin	tars	toxic
Halogenated polymers			
PVC	Chlorine	hydrogen chloride gas, polyaromatic hydrocarbons	Potent, acidic irritant of mucous membranes, corrosive, toxic
PTFE	Fluorine	hydrogen fluoride gas, hexafluoro-propene	Potent, acidic irritant of mucous membranes, corrosive, toxic
Related vinyl polymers			
polyvinyl bromide	Bromine	hydrogen bromide	Potent, acidic irritant of mucous membranes, corrosive, toxic
polyvinyl alcohol (PVA)		Water, thermal cracking products	potential irritants
polyvinyl acetate	Acetate	acetic acid	irritant
Styrenics			
Polystyrene (also a component of ABS)	Styrene	Styrene monomers, dimers, trimers, tetramers	Irritant, toxic

Table based on “Thermal Decomposition of Polymers - Craig L. Beyler and Marcelo M. Hirschler”

Basic GCode program for Emblaser

A cutting file comprises a simple GCode program which instructs the Emblaser on exactly what to do.

Cutting Example
Here is a sample cutting file, which cuts a square shape with 100mm sides.

```
G21                 ( Set the units to mm)
M5                  ( Turn off the laser, just in case it was on from a previous program)
G00 X0.000 Y0.000   (Move the laser unit to WORKSPACE home, bottom left corner)
M3 S127             (Turn on the laser and set its power level to half [127/255])
G1   F800.0         (Set the move mode to 'feed' and set the feed-rate [speed of travel] to 800mm/min)

G1  Y100.000        (Start drawing the outline of the square)
G1 X100.000         (..)
G1  Y0.000          (..)
G1 X0.000           (Finish drawing the outline of the square)

M5                  (Turn off the laser)
G00                 (Set the move mode to 'rapid')
G28                 (Move to MACHINE home position, top right corner)
```

Engraving Example
This is an example of an image engraving file.
Notice the laser power is being adjusted on each line once engraving starts.

```
G21                 (Set the units to mm)
F1500               (Set the feed-rate [speed of travel] to 1500 mm/min
G01 M05             (Set the move mode to 'feed' turn off the laser)
G01 X0.00 Y0.00     (Move the laser unit to WORKSPACE home, bottom left corner)
M03                 (Turn on the laser)

X0 Y0.254 S162      (Move to the first engraving position and set the laser power to 162/255)
X0 Y0.508 S57       (Move to the second engraving position and set the laser power to 57/255)
..
..
..
X75.692 Y80.01 S5   (Move to the last engraving position and set the laser power to 5/255)

M05                 (Turn off the laser)
G28                 (Move to MACHINE home position, top right corner)
```

Terms and Conditions

Terms and Conditions of Use and Purchase

In taking delivery or ownership of the contents of this package (the "Goods") as manufactured by Darkly Digital Pty Ltd trading as Darkly Labs ("Darkly Labs" or "Manufacturer) the end-user acknowledges and accepts or agrees that:

(a) The Goods are intended to provide end-users who are early adopters of a novel technology that is continually being refined and the Goods will require adjustment and maintenance;

(b) While specific training qualifications are not necessary to operate the Goods, they should be willing to learn and to interact with the Manufacturer and the Manufacturer's user community (www.forum.darklylabs.com).

(c) The Goods must be operated in accordance with the instructions provided by the Manufacturer. The end-user must ensure that all safety precautions as recommended by the Manufacturer are followed and that the Goods are not modified so as to circumvent any safety mechanisms that are part of the Goods.

(d) Without limiting the warranties provided under the Australian Consumer Law, the Manufacturer's warranty is on an Acceptable Quality basis and only covers manufacturing defects, including but not limited to failure or faults with electrical components including circuit boards, displays, wiring/connectors and motors that affect the Goods ability to function correctly, as determined by the Manufacturer and parts found to be faulty will be replaced or repaired at the Manufacturer's sole discretion and expense. In the event of a major failure you are entitled to a replacement or refund;

(e) The Manufacturer does not have to repair or replace the Goods if the Goods have been used for a commercial purpose; misused, improperly or inappropriately installed, operated or repaired; abused; damaged or not maintained in accordance with the Manufacturer's instructions. The warranty will become void if repairs are carried out by anyone not authorized by the Manufacturer to carry out such repairs.

(f) The end-user is responsible for the cost of freight to return the Goods to Darkly Labs at the address below, or as amended from time to time. Warranty claims are on a return to base basis. For accepted claims the Manufacturer will cover the cost of repairs and return freight. To ensure the Goods are transported safely we strongly recommend retaining the original packaging materials for reuse as/when service is required. Transport damage is the sole responsibility of the end-user. In the event that repairs or damage is not deemed to be covered under the Manufacturer's warranty the cost of the repair and return freight is the responsibility of the end-user. Payment in full is required prior to the Goods being returned.

(g) As far as the law permits, Darkly Labs will not be liable for any loss or damage caused to property or persons arising from any cause whatsoever. The Goods must be constructed and used in strict adherence to the guidelines and instructions provided by the Manufacturer.

(h) Except as noted above the Manufacturer does not provide any warranty, express or implied, as to the performance of the Goods, their merchantability or fitness for a particular purpose.

(i) The Manufacturer disclaims all liability for claims based on normal wear and tear, misuse or abuse, modification, or damage to the Goods resulting from any negligent or willful act or omission of the end-user, or the use of the Goods with any consumables, supplies, equipment, devices or software not manufactured or supplied by the Manufacturer.

(j) The end-user shall indemnify and hold harmless Darkly Labs against any claim, suit or proceeding arising of or relating to any exclusions noted in (i) above.

(k) The end-user will comply with all applicable laws, rules and regulations with respect to the use of the Goods and abide by all applicable foreign trade/export restrictions or similar rules. In addition the end-user will not transfer, export or re-export the Goods except in full compliance with all applicable export controls administered by the applicable territory.

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