

Laser CNC Engraving and Cutting + EdLaser

Site: StemAcademy: Projects & Resources - Maker Space - Coding & Robotics

Course: StemAcademy: Projects & Resources - Maker Space - Coding & Robotics

Book: Laser CNC Engraving and Cutting + EdLaser

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1. Ed Laser Overview

This manual is under development and incomplete. Hopefully it will be finished by Easter 2018.

Ed Laser CNC is designed and manufactured by Steminabox and is based on a 3.5W Diode laser using the Smoothieware control system.

1.1. Firmware & Config

Ed Laser has a Smoothieware control board and the firmware and config files are located on the mini-SD card on the smoothie board itself (not the SD card on the LCD screen). To access these files you can either plug in a USB to the smoothie board and it will show up as a Drive letter or remove the micro-SD card and access it via your PC etc then put it back (make sure the Ed Laser is off and that no USB cable is plugged in because the SD card will be corrupted if it is removed while powered).

Ed Laser comes preconfigured but if you need to reset then copy the following to the SD card of the Smoothieboard:

Firmware for Ed Laser

Configuration file for Ed Laser

2. Interfacing Ed Laser

All CNC machines including 3D Printers are controlled via GCode which can get to Ed Laser either through the SD card on the LCD screen, network interface or through a serial computer console program such as LaserWeb or Pronterface. Details for using CAD/CAM software to generate GCode are in the following chapter.

2.1. USB Driver

If you are going to use a serial control interface i.e. not use the SD card on the LCD screen unit to transfer your GCode files then install Smoothie USB Driver and determine COM Port of Ed Laser as per the video below.

2.2. Network Setup

Ed Laser can be controlled and connected to your Network via the RJ45 ethernet port at the rear and will need to be setup as follows:

1. Install Web App onto the SD of the Smoothie control board (not LCD) in the rear of the printer as per these instructions

2. Setup up and network config.

2.3. PC Control

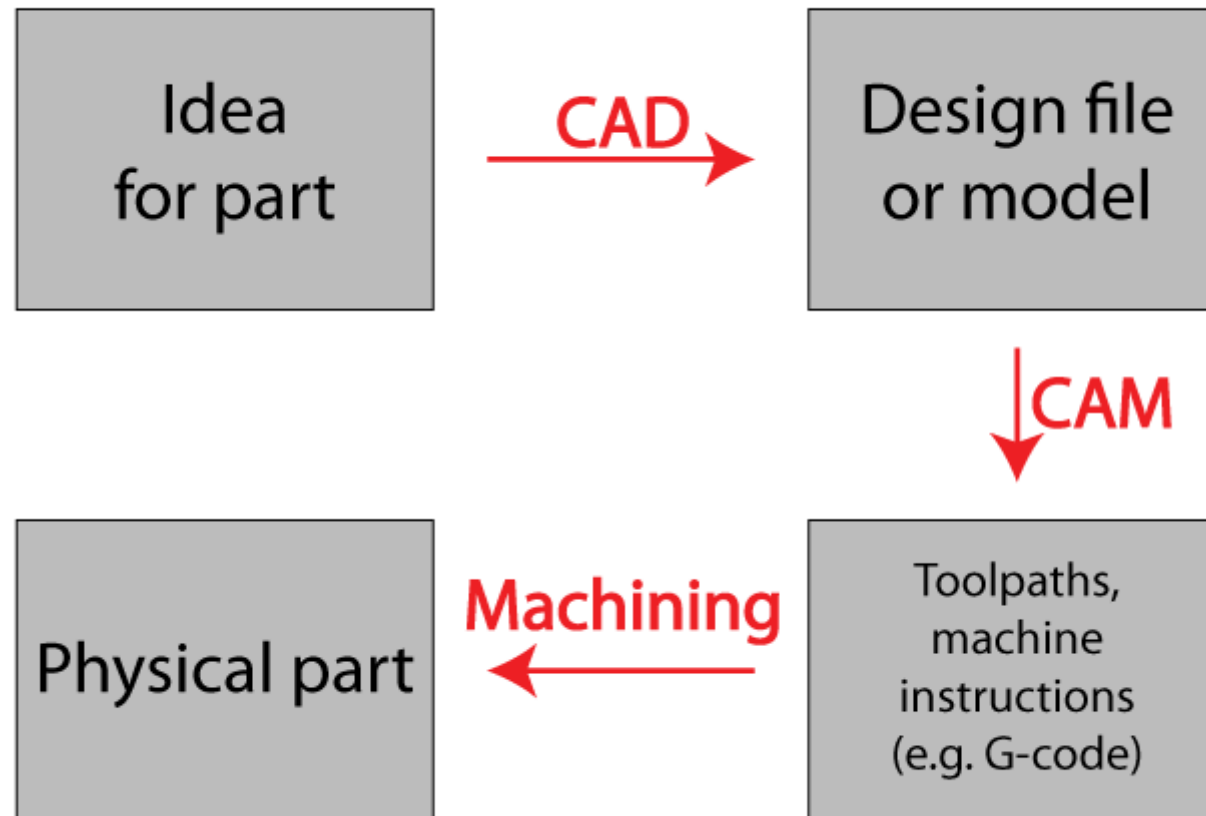
PC Control Interface: If you are going to use a serial control interface i.e. not use the SD card on the LCD screen unit to transfer your GCode files then install Smoothie USB Driver and determine COM Port of Ed Laser as per the video below.

LaserWeb4 is the recommended PC control interface software for Ed Laser and is covered in more detail in a following chapter. However many CNC interfaces will work (same ones as for 3D printers). Checkout the Smoothieware site for Software options.

3. CAD CAM Overview

The recommended PC control software for Ed Laser is LaserWeb and is discussed in the next chapter with other options to suit your current work-flow discussed below.

Designing and making using 3D Printers and Laser CNC machines etc is traditionally known as CAD-CAM, Computer Aided Design-Computer Aided Manufacturing.



The CAD/CAM process involves two main

steps with many software options:

Create design artwork (CAD) eg AutoCAD, VCarve Pro, Inkscape, Sketchup, etc

Generate GCode (CAM) for the Laser CNC machine eg LaserWeb, VCarve Pro, Inkscape with plugins etc.

Note that some programs do both CAD and CAM such VCarve Pro, Fusion 360 (currently not allowed by DET as it is cloud) and even Inkscape with plugins

There are a myriad of other CAD CAM software options that can be used with the Smoothieware control system (Ed Laser controller)

3.1. Vectors Vs Bitmaps

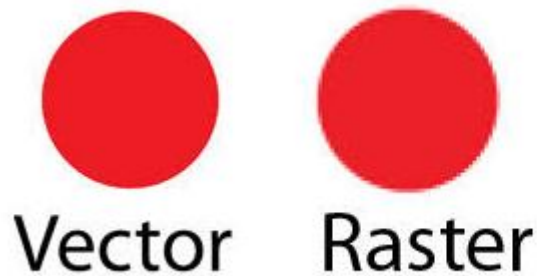
There are two ways to store graphics data:

1. **Vector:** "vector graphics" - shapes are stored as mathematical code- infinitely scalable without resolution issues - small efficient code/files- formats are "SVG" and "DXF" etc.
2. **Bitmaps:** older method of storing images/text- grid of pixels (dots) for which the colour is stored fore each pixel- inefficient and large files for relatively small images and resolution decreases as image is expanded- examples are JPG, BMP & PNG

Normal CAD-CAM and CNC machines work with vector graphics where the CNC machine "follows" the mathematically defined lines and cannot work with "pictures" or bitmaps. Special software or techniques are needed to get CNC machines to engrave bitmap images.

It is extremely important to understand the difference and what file type you have because the technique used depends on being either "Vectors" or "Bitmaps".

"**Raster Engraving**" is a technique that processes bitmap images, pixel by pixel and allows the image to be engraved. Raster Engraving takes is very slow because it sweeps the image at a fraction of a millimeter per pass and fires the laser whenever a "dot" is required.



Bitmap / Raster	Vector
<ul style="list-style-type: none">· Measured in DPI· Resolution dependant (when scaled, the pixels get larger and make the image blurry or pixilated with jagged edges).· Edited using image editing software (i.e. Photoshop)· Get the best results when you scan and work at the correct resolution and size from the beginning.	<ul style="list-style-type: none">· Created by a mathematical formula, which forms smooth lines, curves and geometric objects.· Resolution independent.· Can be scaled up or scaled down without the image deteriorating- they remain sharp and clear.· Makes excellent line drawings, DDS kigis, type, t-shirt images for sportswear etc.· Much smaller file size than BITMAP.· Secs and flats ideal to send via email.· Once downloaded can be scaled to required size.

4. LaserWeb4

LaserWeb4 is both a host controller for EdLaser and GCode generator.

LaserWeb4 is recommended for EdLaser, particularly if you don't need any CAD software and mainly want engraving and very simple cutting.

LaserWeb4 download

LaserWeb4 wiki

The screenshot displays the LaserWeb4 web interface. At the top, there are status indicators: "SERVER: OK", "SMOOTHIE LPC1768 EDGE-2163CCD", "HELP", and "CHECK FOR UPDATE". The main interface is divided into several sections:

- Job Configuration (Left):** Shows "Material Thickness: 3 mm" and "Status: Lasering". Below this is a list of GCODE commands:


```

      # GCODE
      0 ; GCODE generated by Laserweb
      1 ; Firmware: Smoothie LPC1768 edge-2163cod
      2 ; Laser Min: 76%
      3 ; Laser Max: 76%
      4 ; Black Speed: 1200mm/min
      5 ; White Speed: 4800mm/min
      6 ; Laser Spot Size: 0.13mm
      7 ; Laser Feedrate: 2000mm/min
      8
      
```

 A "SAVE GCODE" button is at the bottom of this section.
- Machine Control (Right):** Shows "Port: /dev/ttyACM0: Uberclock" and "SETTINGS". It includes a "3D Printer mode (BETA)" checkbox and coordinate fields:
 - X: 37.800
 - Y: 100.100
 - Z: 0.000
 A "MACHINE CONTROL" button is located below these fields.
- Console (Bottom Right):** A window showing the GCODE being sent to the machine:


```

      SEND: M9 P1.1 F10000
      SEND: G1 X38.8 Y0.4 S0.76
      SEND: G0 Y0.3
      SEND: G0 X38.2 Y0.3 S0
      SEND: G1 X2.5 Y0.3 S0.76
      SEND: G0 Y0.1
      SEND: G0 X2.9 Y0.1 S0
      SEND: G1 X37.8 Y0.1 S0.76
      SEND: G91
      SEND: G0 Y100 F5000
      SEND: G90
      
```

 A "SEND" button and a progress indicator showing "0%" are also present.
- Central View:** A 2D grid showing the "OPENBUILDS" logo. The logo is a green gear with a red center, set within a red square border. The grid has a scale of 50 units. A "50" label is at the top left, and "0" and "50" labels are at the bottom left and bottom right respectively.

At the bottom left, there is a "Support" section with a PayPal logo and "VISA" and "MasterCard" logos.

4.1. Install & Setup

Check COM Ports & Drivers

Download and run the LaserWeb4 install file.

After turning on EdLaser and connecting either via USB cable or ethernet cable:

1. Goto "Comms" and connect
2. Goto "Settings" then "Tools" and import EdLaser Machine Profile and import EdLaser Settings or both at once by importing "EdLaser Snapshot"

The video below explains the setup process.

4.2. Raster Engraving- Images

4.3. Tracing Images to Vectors & Cutting

4.4. Vector Cuts + Raster Engrave

5. VCarve Pro

VCarve Pro is an excellent choice as it does both CAD & CAM for impact CNC and Laser and is easy enough for students to learn and use (Vectric lets you buy one license and use it as a site license so its very economical for schools).

The logo for VCarve Pro features the word "VCarve" in a blue, sans-serif font, followed by "Pro" in a black, sans-serif font. To the right of the text is a stylized graphic element consisting of a yellow triangle pointing upwards and to the right, with a grey curved shape behind it, resembling a stylized 'V' or a tool tip.

5.1. Laser Tool & Post Processor

For VCarve Pro to generate GCode ready for the Ed Laser there are two steps required:

1. Import the Ed Laser Tool into the "Tool Library"
2. Paste the Ed Laser Post Processor into the Program Data Folder of VCarve Pro "C:\ProgramData\Vetric\VCARVE Pro V7.0 (or 8?)\PostP"

When generating GCode ensure that the *Ed Laser Tool is selected* and the *Ed Laser Post Processor is also selected*. This GCode is ready to go to Ed Laser as per normal.

