DAC_PWM Signal Board Instructions

This DAC board solution has been developed with Jeff and John at picengrave.com for use with their picengrave software for laser image engraving. This board uses the STEP and DIRECTION signals from a spare axis to output an analog or PWM signal to a laser driver for laser power control. This allows software controlled CNC machines (like Mach3) to adjust the laser power on the fly for image engraving applications.

Features

- Convert Step and Direction signals into analog output or PWM output for laser drivers.
- Analog output for analog modulated drivers
- PWM output for PWM modulated drivers
- Output Enable Relay to control output with M03 command
- Pass Through power control with Relay for drivers needing to be turned On/Off with G Code

Contents of the box

In the box for the DAC_PWM board there should be the board and a barrel OEM power connector for connecting to a power supply.

Safety

This board is designed to work in conjunction with high power lasers. When using lasers always make sure you take the appropriate precautions for safety including the use of protective eyewear and shielding. Always use caution when operating CNC equipment.

Using the board

There are two ways in which to use the DAC_PWM board:

1. Connecting it to a laser driver that uses PWM to modulate the laser intensity.
2. Connecting it to a laser driver that uses ANALOG to modulate the laser intensity.

Set-Up Video

https://youtu.be/Jqj29GKFXdo

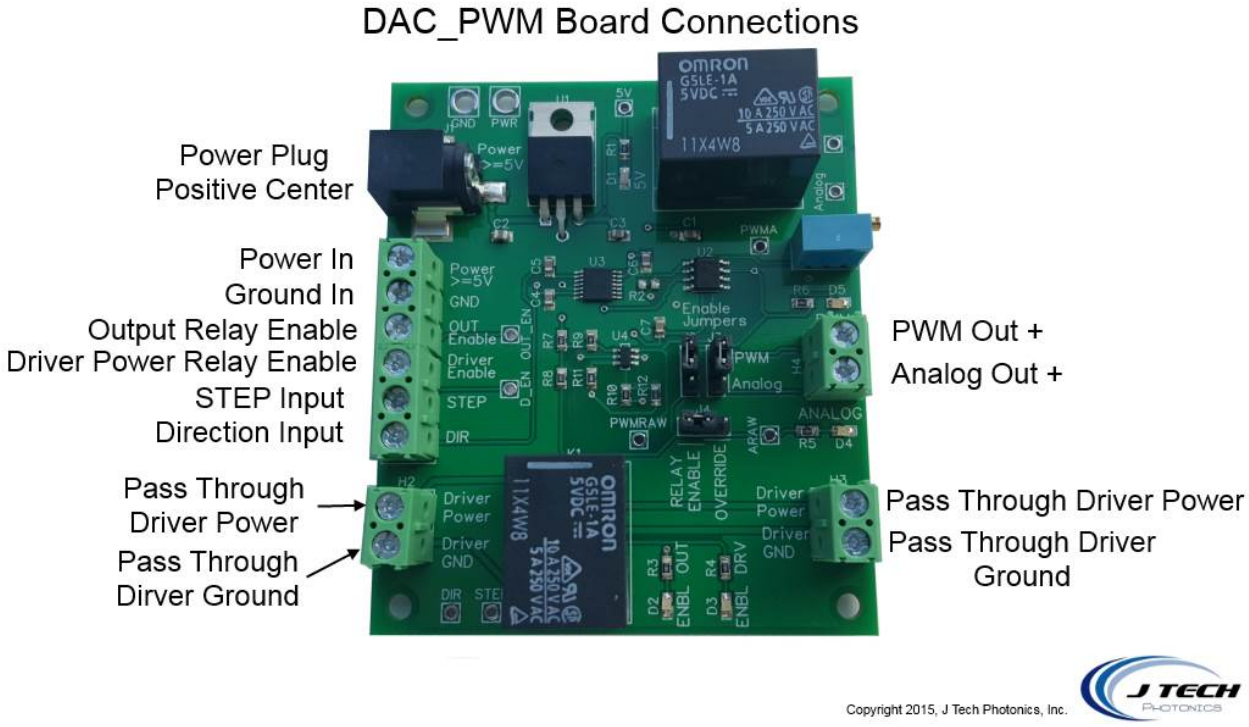
Input Specifications

The DAC_PWM board requires 5v signals for step, direction, and enable pins.

Power Specifications

The board requires 5v. You can use a power supply that is larger (up to 24volts), but make sure the regulator does not get too hot.

Connection Overview



INPUTS (left side of the board):

Direction Input:	Direction encoder signal for the axis chosen in control software.
Step Input:	Step encoder signal for the axis chosen in control software.
Driver Enable:	In Analog Mode, this turns on and off the pass through power for powering the analog modulated laser driver.
Output Enable:	This will enable the output of PWM or Analog on header H4.
Driver Power:	Optional "pass through" power for a laser driver that needs to be shut off to turn the laser off.
Driver GND:	Optional "pass through" ground for a laser driver that needs to be shut off to turn the laser off.

OUTPUTS (right side of the board):

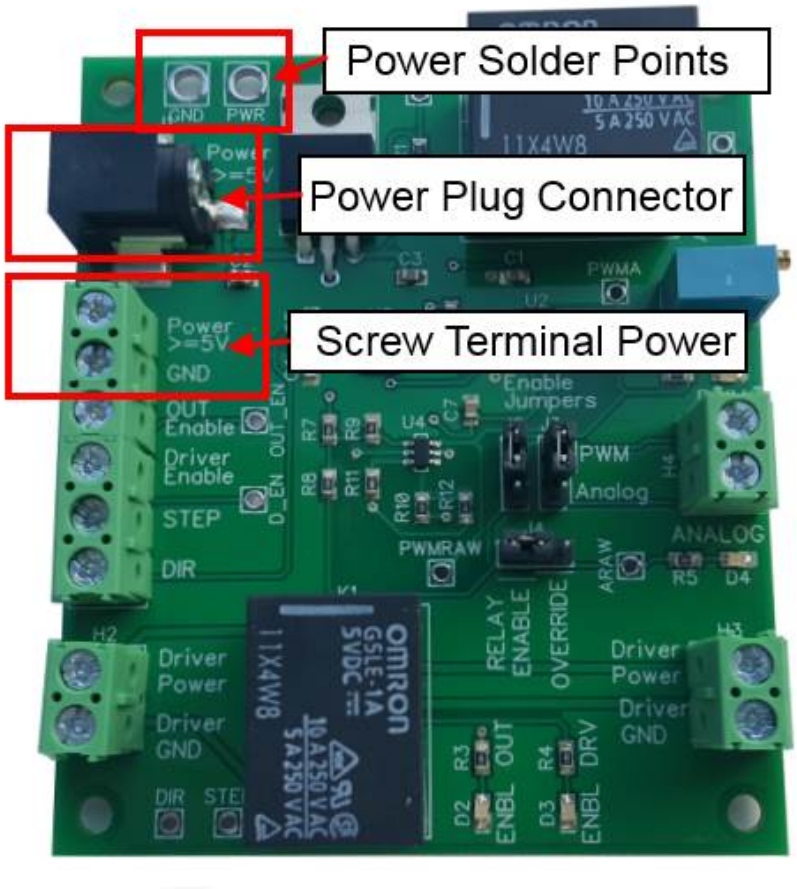
PWM:	Output for the PWM signal.
Analog:	Output for the Analog signal.
Driver Power:	Output for the "pass through" power for a laser driver.
Driver GND:	Output for the "pass through" ground for a laser driver.

Power Overview

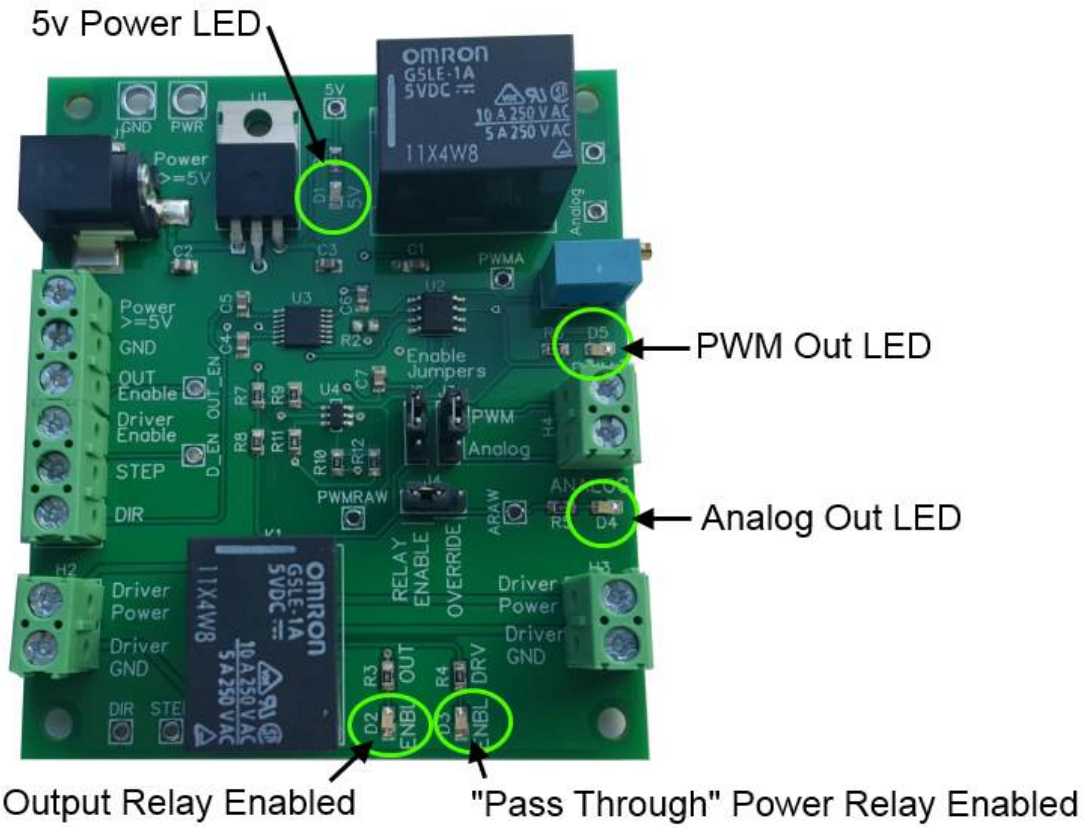
The board requires 5v. You can use a power supply that is larger (up to 24volts), but make sure the regulator does not get too hot. The regulator is the IC right next to the barrel power connector. If needed for higher voltage operation, a heatsink can be added via the screw hole on the package.

There are three ways to power the DAC_PWM board:

1. Barrel type connector power supply. Either use the enclosed plug to wire connector provided
2. Screw Terminals connections.
3. Solder points for wire connection.



LED Overview



Jumper Settings

The jumpers come pre-set at the factory for PWM and Relay Enabled.

J2 and J3:	To enable PWM output, set to PWM (top two) on both J2 and J3. To enable ANALOG output, set to Analog (bottom two) on both J2 and J3.
J4:	To enable relay control input signals, jumper on right two (Relay Enable). To override the output relay, jumper on left two (OVERRIDE).

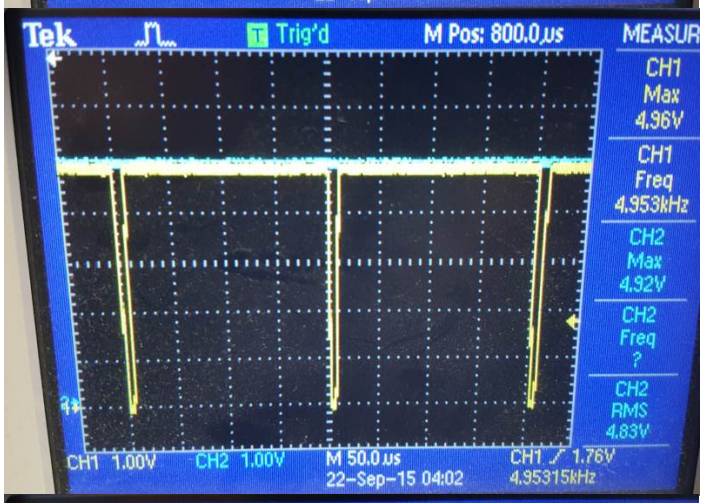
Theory Of Operation:

This board takes the step and direction output of an axis on your controller and turns it into an analog voltage and a PWM duty cycle based on the position of the axis. You can choose any extra axis your controller has, or you can use the Z axis. If you use the Z axis, just remember to either disable your motors or take off the motor connections before you run.

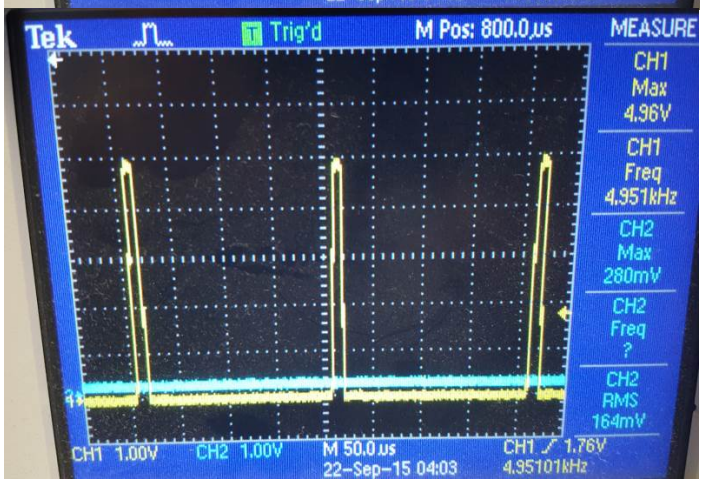
PWM (Yellow)

Analog (Blue)

50% Power.



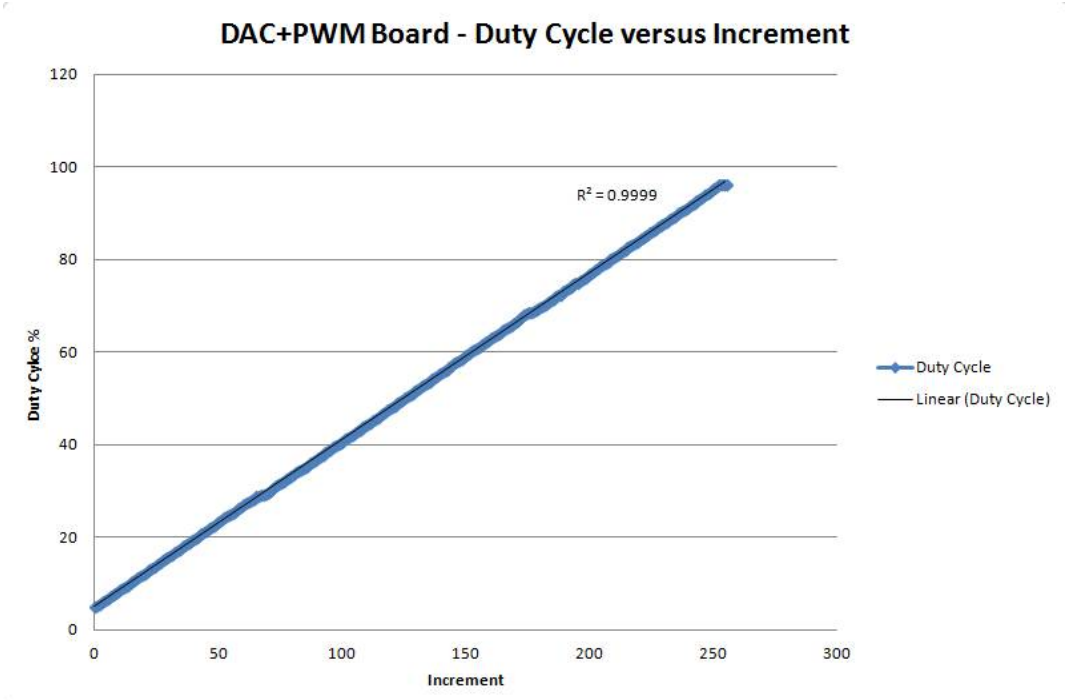
100% Power.

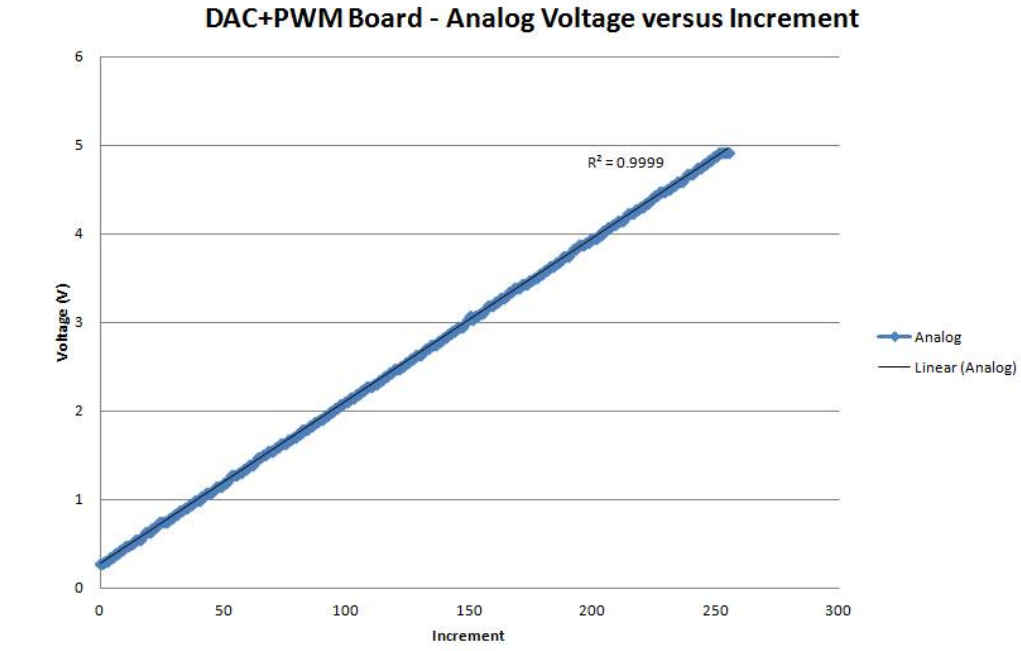


0% Power.

Linearity

The DAC+PWM board provides a duty cycle or analog voltage output based on an increment from the step and direction output on your controller. It is imperative that this output is linear for the 256 shades of greyscale will show exactly on your image. Here is the output for both versus increment. It is 99.99% linear in both applications.





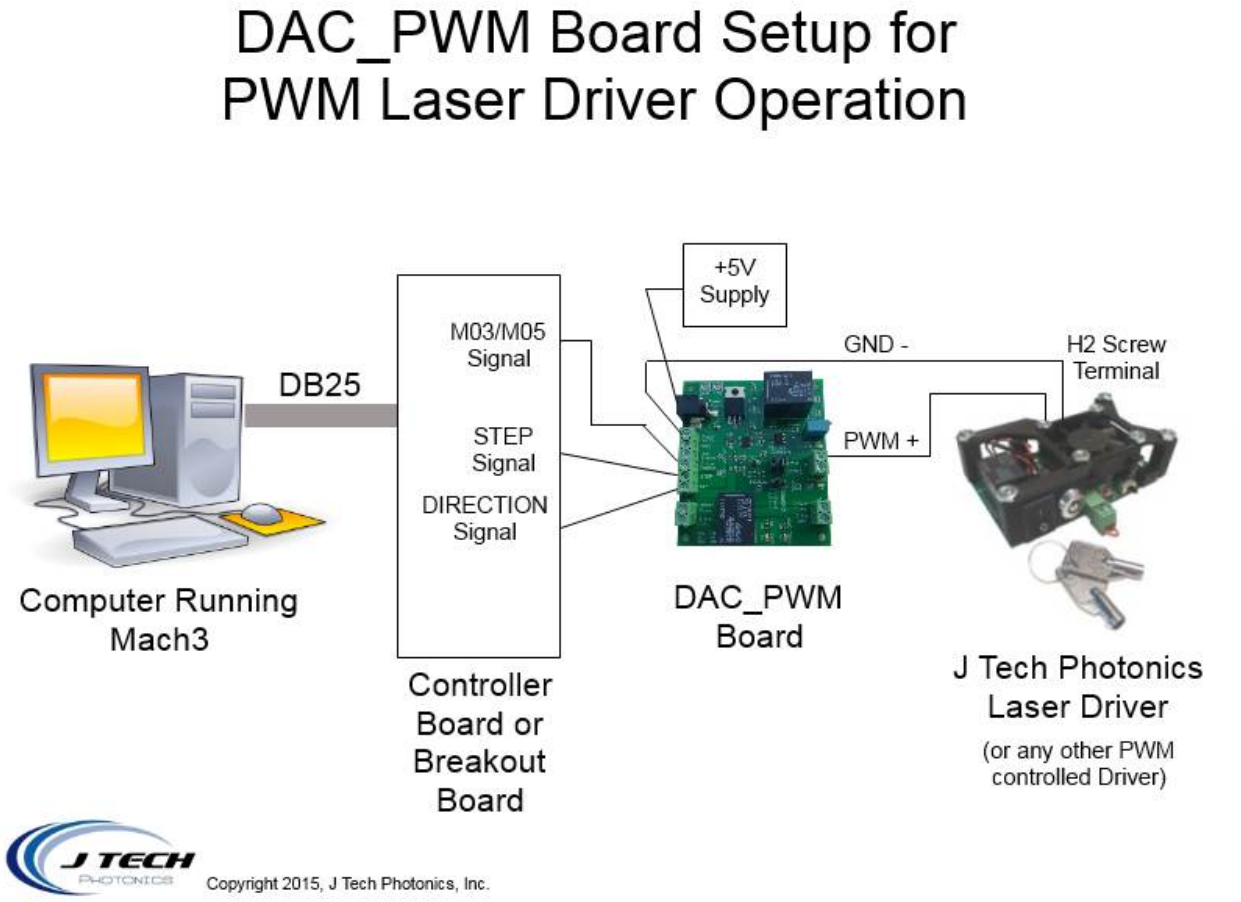
Set Up for PWM Output (J Tech Photonics Driver Example)

In order to use the DAC_PWM board for a PWM output you will need to get the step and direction signals for the axis you are using. You can either get them from your breakout board or you can use a dual breakout board to get the signals. You can get a dual breakout board from our store if you need to find one.

Once you have these signals, connect them to the appropriate input screw terminals on the DAC_PWM board. You can also use another output to control the relay to enable the output of the board with the M03/M05 command. This adds an extra safety precaution that the laser will not be enabled without the appropriate command from the controller. Connect this to the "OUT ENABLE" screw terminal.

A suitable supply must also be found to power the board, preferably 5V.

Make sure the jumpers on J2, J3 and J4 are set correctly for PWM operation.



Setup For Analog Output with Power Enable Control

This setup is similar to the PWM connections. You will still need the Step and Direction signals for your axis of choice. You will connect them the same as in the previous example.

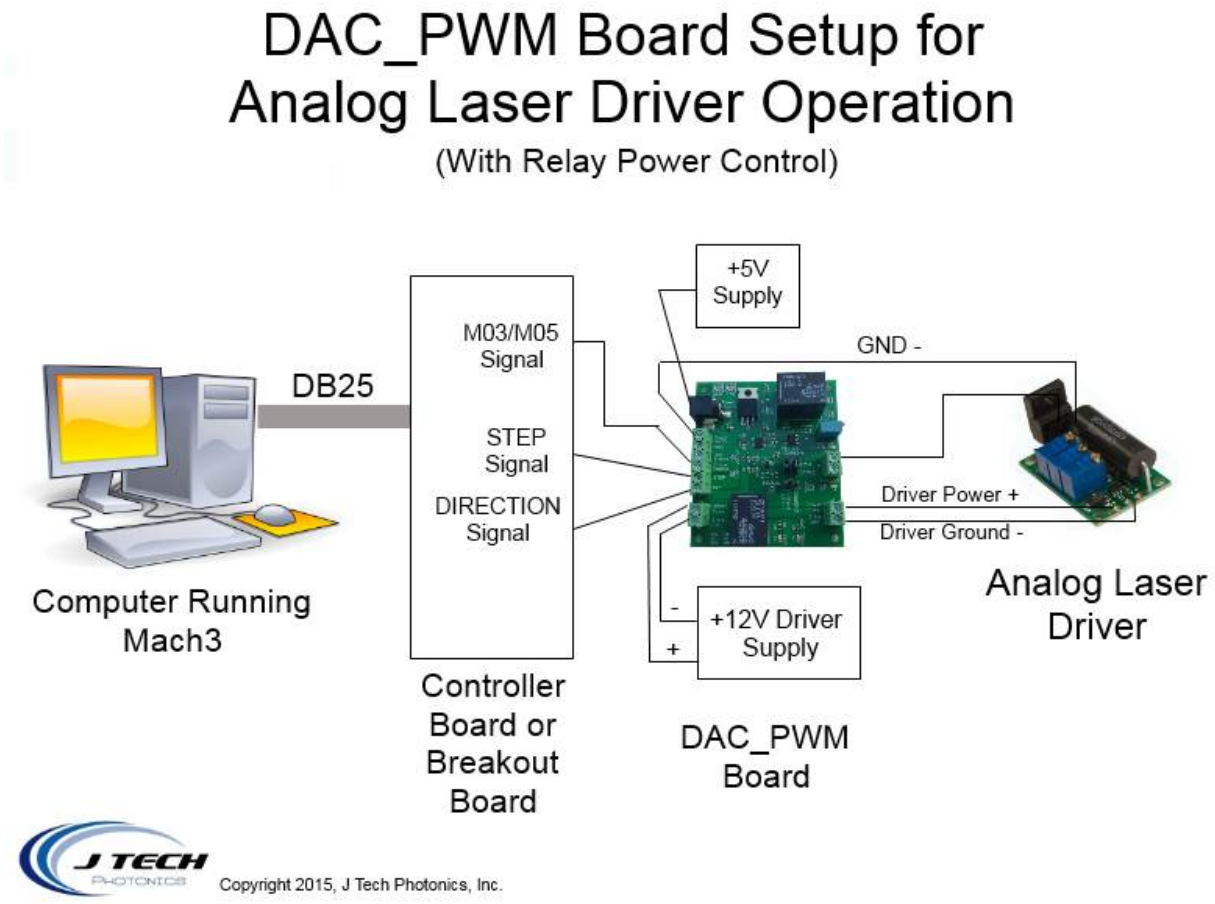
Set the Jumpers J2, J3 and J4 to ANALOG (lower on J2 and J3). If you want relay power control then choose it on J4.

Connect the controller output M03/M05 signal to the "Driver Enable" input if you want to control the pass through power.

Connect the modulation input of the laser driver to the Analog output screw terminal on the DAC_PWM board.

If you want to be able to "de-power" the laser driver when the laser is not supposed to be on, connect the laser driver power supply through the pass through power screw terminals on the bottom of the board.

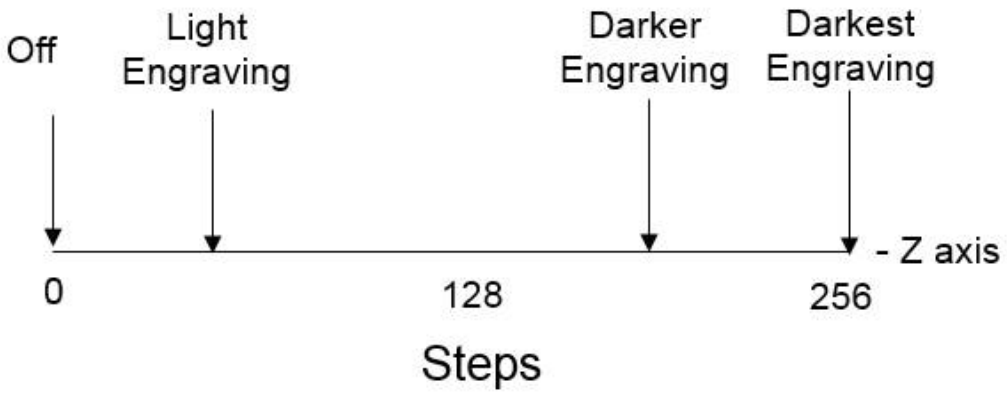
In this example, it shows how to connect the analog output and using the pass through power relay.



General Software Settings

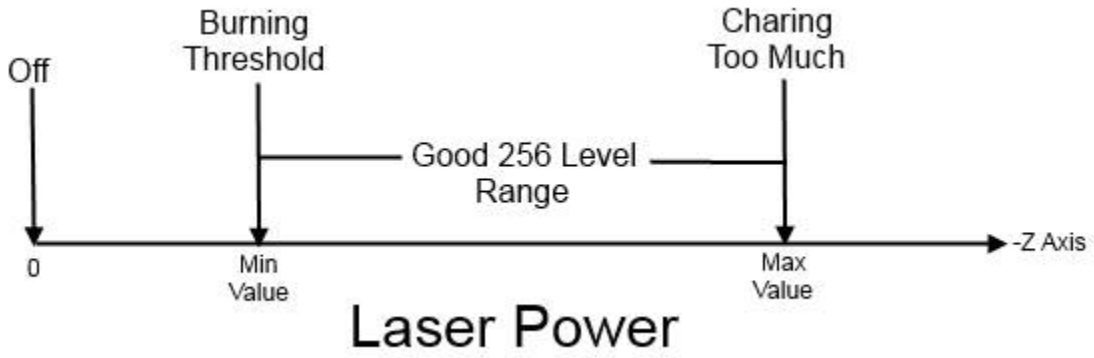
Like in the theory section, we saw that the board has different levels for each position on the axis. Depending on how you have your steps per inch (or mm) set will determine the distance you will need to achieve your proper engraving.

In this example we have it set on the Z axis:



You will need to set your machine to get the perfect settings. The board is 8 bits, so there will be 256 steps in this range.

In order to get the "perfect" results for your material, you need to first find the minimum value for just starting to burn the material. This level will be your minimum. Then, add 256 step increments to it. This will be your max level. If your steps are 10000 per inch, then your increment will be 0.0001". Here is what it looks like conceptually:



So, if your wood starts to burn at -0.002", then your minimum value will be -0.002" and your maximum value will be 256 increments more at -0.0275". This will give you the full "grey scale" levels you need.

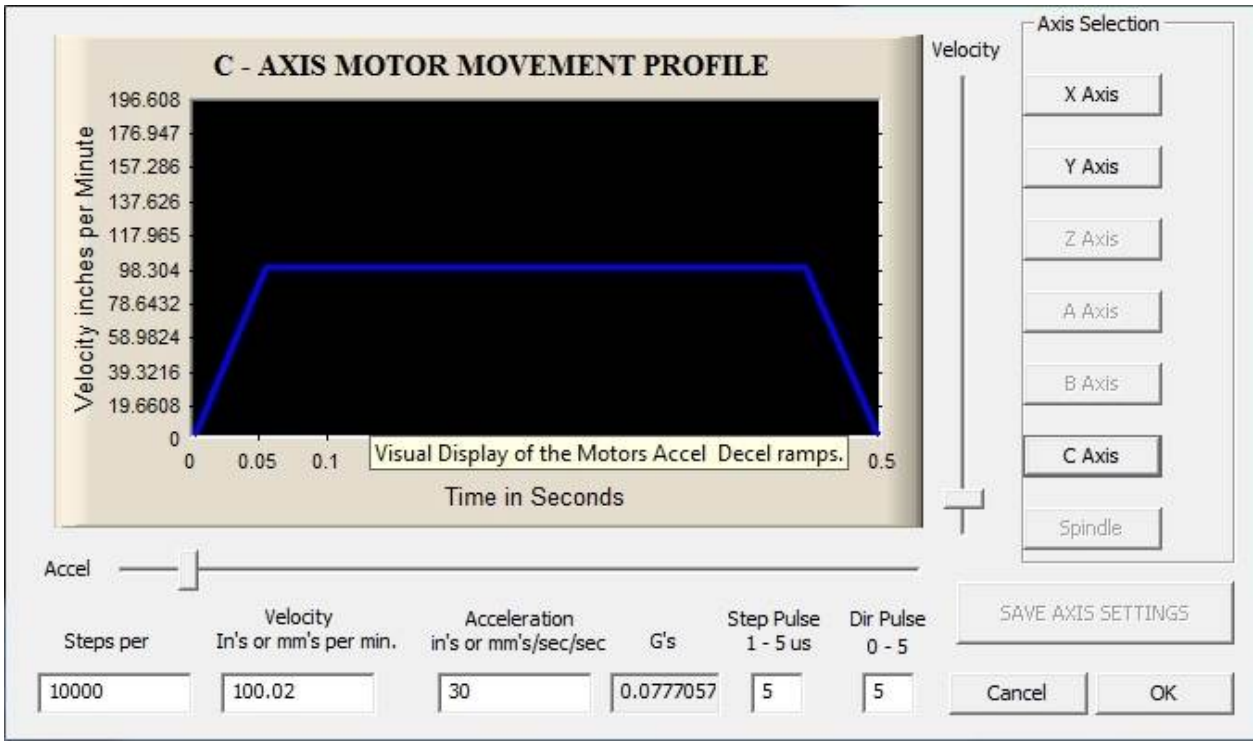
Mach3 Setup

Here are some standard settings in Mach3 that Jeff at picengrave.com suggests from his experience with the DAC_PWM board. Units are in **INCHES**.

Steps per inch:	10000
Velocity:	Calculated by your machine controller
Accel:	30
Step Pulse:	5
Direction Pulse:	5

This makes your incremental move distance = 0.0001"

This example is for the C axis, but it can be also "A", "B", or "Z" as well:



PicLaserLite Setup

Using the details from the mach3 setup, we can use them to enter details into the PLL program. Use YOUR correct AXIS that you set up in your controller. It can be Z, A, B, or C.

Units are in inches and example using the Z axis:

Max laser value:	0
Min laser value:	-0.0255
Laser Off Command:	M05 (if using the output relay)
Laser Off Command:	Z0 (if overriding the output relay)
Laser Control Command:	Z
Output setting:	Std Gcode
Machine Codes:	G90 G64 (absolute mode, constant velocity)

We are running this with a 2.8W laser kit at 90 inches/min. The focus for us is about 0.006 inches, so we use this for the pixel resolution.