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PWM Control		

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ABSTRACT

This tech note details all the steps necessary to set up PWM control of your laser from your controller

SAFETY

- *Visible lasers can PERMANENTLY damage your eyes. Use protection and ensure any other person or animal in the same area is suitably protected.*
- *ALWAYS wear safety goggles when operating the laser, even if you have it inside a case*
- *BE RESPONSIBLE – ensure a clear work area, ensure you have fire-suppression at hand*
- *Use the laser at your own risk – you only have ONE set of eyes.*
- *NEVER aim a laser beam at anyone and use it only for its designed purposes: laser cutting or engraving.*
- *NEVER leave the laser unattended - to avoid accidental fires and careless actions of humans and animals.*
- *When choosing your material, keep in mind that during the laser operation combustion products are released, some of which can be harmful to health or to your machine.*
- *ALWAYS use an air funnel and ventilation.*
- *If you plan to cut any material underlay a piece of metal to protect the worktable from damage and fire.*
- *If you are not sure about anything, please contact us (email, fill the website form or call) for advice.*

OVERVIEW

To enable different rates of cutting, you need to control two things: feed rate (speed) and laser power.

Feed rate is controlled through your CAM application when you create your GCode. Laser power is controlled using PWM (Pulse Width Modulation) signals from your controller.

If your controller doesn't have TTL/PWM modulation, you will cut at 100% power and control your cut by adjusting the feed rate.

Every controller firmware has different methods for implementing TTL/PWM, with different parameters.

Why do we need to change power?

If you are working on something delicate, like lightweight paper or card, and you want to just mark the surface, rather than cut through, you can push the feed rate up so the laser doesn't have time to cut through the material. But, what if your laser is too powerful and your CNC machine is too slow – no matter how fast you travel, it's still burning through the material. In this case you will need to control the power. If your machine is fast enough, but the noise and wear and tear of running it at maximum power causes you other issues, you will want to run it slower, at a lower power.

If you want to raster engrave, rather than cut, you will find the same reasoning as above – you may find you have to push your machine too hard to stop excessive burning, so you will want to reduce the laser's power.

If, however, you find you are constantly cutting at 100%, you probably need a new laser. We have the right laser for the job!.

Process

TTL vs PWM

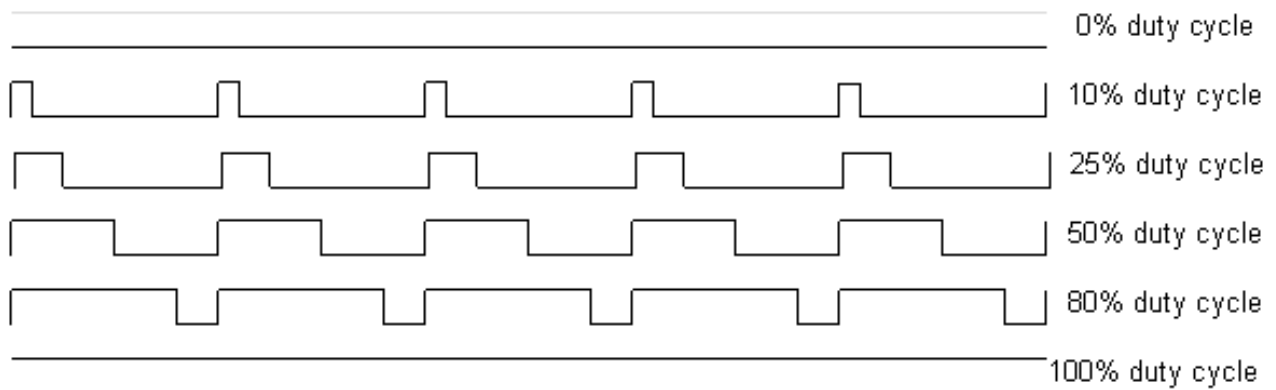
In hobbyist controllers, the terms TTL and PWM are often used to describe the method used to vary power of the laser.

TTL (Transistor-to-Transistor Logic) describes the signal itself, PWM (Pulse Width Modulation) is the method of controlling the power of the laser. As the laser isn't voltage-driven, like a dimmer, the effective power is controlled by turning the MOSFET on and off in varying frequencies – the more it is off, the lower effective power, the more it is on, the higher effective power.

In Endurance Lasers, PWM is the method used to control the effective output power.

Signal

Each controller and firmware implements PWM in its own way, but all have to offer the same functions: PWM frequency – how fast is the signal being transmitted; PWM duty cycle – how long between PWM signal changes.



Most hobbyist controllers use 8-bit registers for PWM, giving you a maximum of 255 levels of power, but you don't have to use all 255 – most times you can settle for ten different levels – 10% - 100% in steps of 10%. This, along with feed rate, should allow you to engrave or cut at the detail level you need.

You will need to find out the way your particular controller implements PWM, the voltages it uses on its control pin (important, if you don't want to burn out your controller) and the way you can control PWM with your GCode.

Implementing PWM

Connection

GRBL

TinyG

Smoothieboard

Marlin

Testing

Calibration