FEMI BANDSAW LASER ALIGNMENT MODULE

Introduction

I recently acquired a Femi NG120ABS bandsaw which you might think seems a bit strange given how much I talk about my Burgess BK3 bandsaw. I regard them as two different animals. The Femi has replaced my Kennedy for cutting stock ready for milling. The Femi auto feed facility means it can be left unattended while I get on with other things. The BK3 upgraded with my modified guide assemblies is a more precise 'cutting to a line' device with the benefit of a wide throat for cutting sheet stock. (See https://altrish.co.uk/2021/04/12/burgess-bk3-replacement-lower-blade-guide/)

The Femi is a recent arrival and to date I am impressed by its performance. Speed of cut is excellent and build quality is very good. The vice action clamps well and is very rigid.

The one frustration with the Femi has been when loading material ready for cutting. You have to iteratively and repeatedly move the stock in the vice to match where you want the blade to be cut. This means constantly raising and lowering the cutting arm to check you have it in the right place.

My solution has been to make a laser line alignment guide facility. This is common on chop saws where there are centrifugally switched devices integral to the blade mounting. My adaption of this is to use an EBay sourced laser light with the line lens option. This is mounted in a 3D printed tube with internal battery pack and auto on/off timer. The tube mounts on the Femi with a simple 3D printed bracket that allows the beam to be adjusted.

For those people not needing a timer, a simple switched version variant is possible. Assembly is straightforward but if the timer version is needed then this does require the ability to assemble a surface mount board albeit with only a few components.

Construction

General

The 'line laser' can be bought on EBay with various power output ratings but all versions are housed in a similar 12mm diameter body with an adjustable front knurled lens focus ring. The body is made of three parts, the knurled focussing ring, a retaining bezzle containing a pressure spring against the focus ring and lens and the main body which is a simple shell to protect the wiring to the laser.

The lowest power rating for the lasers found on EBay is 5mW. This is more than adequate for the application. The 5mW version appears to operate down to 3V or better and consumes around 6mA of current. This makes it ideal for short burst battery operation.

As mentioned earlier, the laser could be manually switched ON/OFF with a simple PUSH ON/PUSH OFF button but I have a propensity for forgetting to switch off battery powered devices. I decided to have an electronic switch off and this would need a simple push-to-make momentary switch.

Having decided to electronically switch the laser I needed a suitable battery. After some investigation I opted to use a 3.6V ½ AA size wire ended cell using Lithium Thionyl Chloride technology. These are available from CPC/RS etc (RS 436-4768). The quiescent current using the timer module is 60uA and the battery is rated at 1.2Ahr. This particular battery technology has a very flat discharge curve which should give a useful operational life to the laser.

For the ON/OFF timing control I designed a simple monostable timing circuit based on a CMOS version of the 555 timer (ICM7555). The circuitry is laid out on a motherboard that holds the battery and the switch. Messy interconnection wiring is also integrated into the PCB.

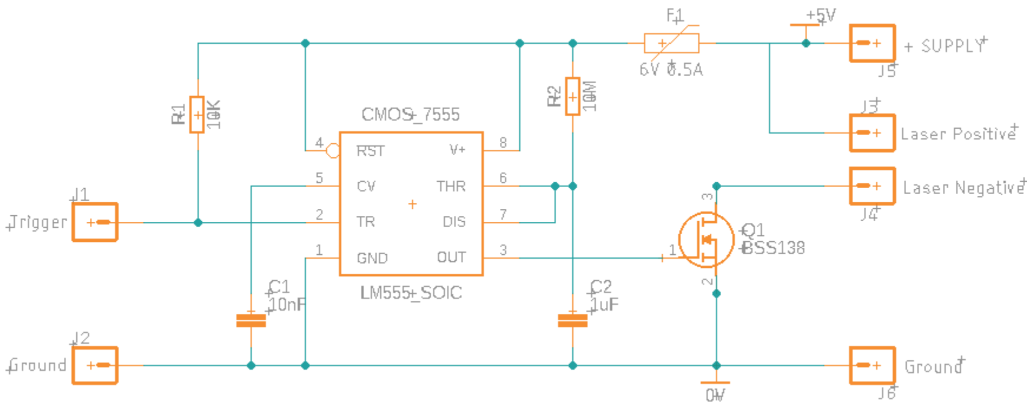
The battery has a nominal 15mm diameter and the PCB is 19mm wide.

I bought the switch from CPC in the UK as part number SW04279 and the matching button is SW02388. For those wanting just a simple switch ON/OFF then CPC also stock a different style switch which has a push on / push off action (SW03234). These switch styles are also available on EBay. As an alternative, RS stock a toggle body style switch but with a press button action. Once again these are available as push to make, or, push on push off. The is one issue with the RS push on/push off in that it does not have a threaded mounting. The PCB as designed, will accommodate any of these switch variations. For readers not wanting the timing circuitry the PCB can still be used to facilitate the assembly and locate the switch but will need appropriate linking across to the battery.

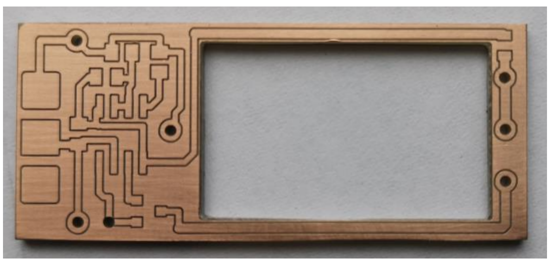
Time PCB Module

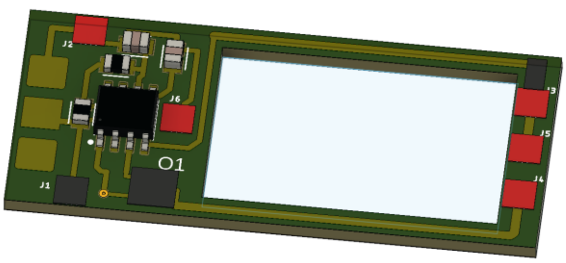
Fusion 360 has an Electrical Module based on the Eagle design package. I am becoming more familiar with this and very quickly had both the circuit entered and the PCB layout completed. (It is staggering that Fusion offer integrated CAD/CAM and PCB design for an annual subscription less than someone might pay for SKY … and even less if you buy one of AutoDesk's regular 30% discount offers).

The circuit is shown below. The ON time is set by R2/C2 combination and with the values shown gives around a 10 second period. The fuse is to protect the battery which has a lot of stored energy in a small volume. The MOSFET switch could be replaced with a digital transistor such as a DTC144.

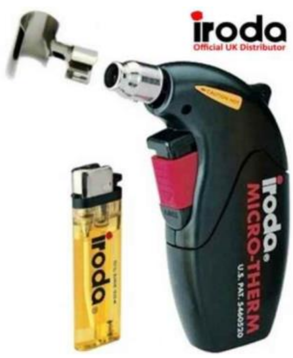


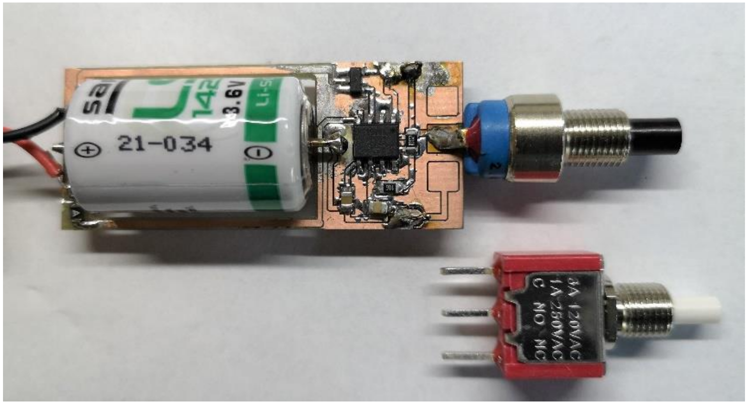
The PCB was CNC milled on 1.6mm double sided PCB on my Tormach PCNC440 using the export manufacturing files produced by Fusion. These are in Gerber/Excellon format and needed post processing in FlatCAM to create GCode. The board was milled using a Think & Tinker 5.1 thou milling tool which gave more than adequate cutting resolution. The finished board is shown below along with the Fusion modelled 3D image of the assembly. The board is double sided with the lower copper ground plane linked through to the top side copper and acting as the battery negative.





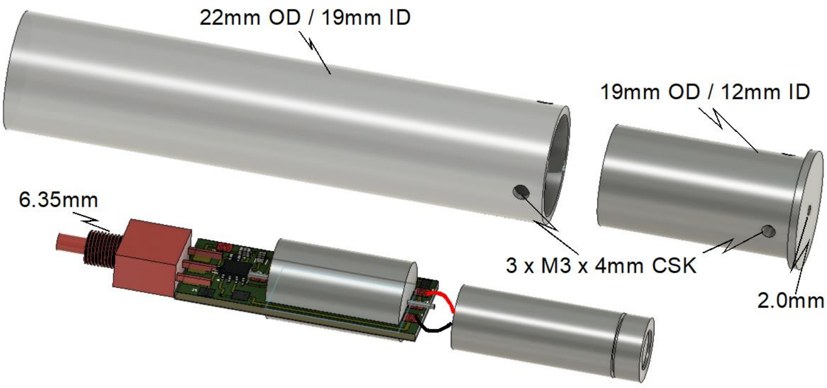
The finished milled board copper was scrubbed clean and SMD solder paste dotted on all the component pads before the parts were tweezered into position. The board was reflowed using a cigarette lighter based miniature hot air gun. This style of hot air source does not have sufficient air blast to disturb the parts while reflowing the paste. The hot air gun heats very quickly and is useful when fitting heat shrink sleeving. Here is the heat gun and also a close-up view of the finished assembly. This shows the alternative switch style from RS.





Body Shell

The body shell is in two parts and both are 3D printed. These are the outer shell and the inner laser centralising boss.



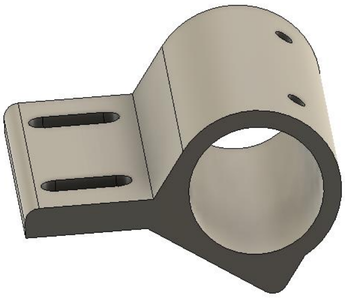
The PCB is inserted switch first into the outer shell and the PCB mounted switch mates with a hole in the end of the body shell where it is fastened in place with the switch nut and washer. A reducing boss mounts and holds the laser centrally at the other end of the outer tube. The reducing boss acts as the end stop to the outer shell and fastens in place with three M3 screws. I had to do some fettling on the printed boss as I wanted the laser to sit right at the end of the tube and the PLA print quality had some flash at the bottom of the hole. A 12mm end milling tool was used in the lathe to clean up the finish.

The threaded holes in the centralising boss are tapped into the PLA. In situations where there is no real stress on the threads, I model the 3D hole to be tapping size just as would be done in metal. Fusion allows the threads to be modelled and this does work but usually requires a tap to be run through the modelled hole to clean up the print. From experience a conventional tapping method seems to be better. The alternative is to fit some form of brass bush or embed a nut but this requires more material depth.

Note that the laser as supplied has a very wide beam which is excessive for the application. I restricted this by having just a 2mm hole in the end wall of the centralising boss.

Mounting Block

The mounting block to hold the laser tube body is designed to fit the contours of the Femi blade guide geometry. I drilled and tapped two M4 holes in the Femi guide to match the slots in the mounting block. The Fusion image is below together with a picture of the mounting block when fastened in place. There are tapped holes in the PLA for two M4 nylon screws that grip the laser in place once it has been correctly aligned.



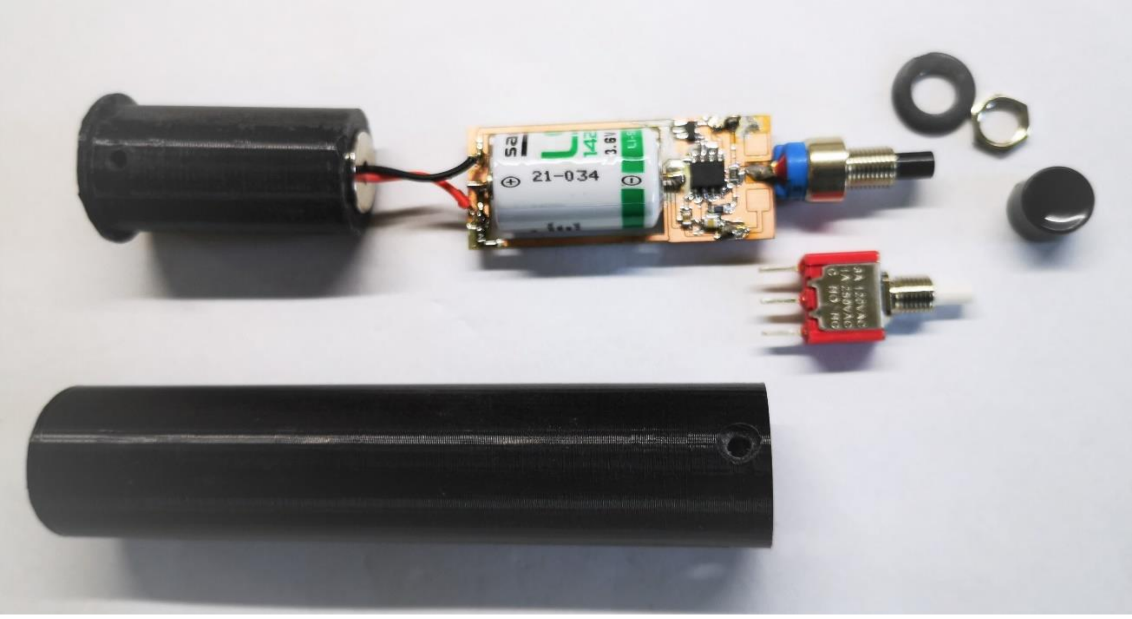
Assembly

The assembly is straightforward.

1. Fit the switch to the PCB. This has to sit central on the end of the PCB and depending on the style of switch there is a choice of pads. The simple push button with the blue body as shown in prior pictures has one connection to the top side central pad and the second connection to the lower surface of the PCB (which is at battery negative potential).
2. Trim the laser leads to around 10mm long and connect to the PCB taking note of polarity.
3. Fit the battery taking due note of polarity.
4. Press the button and make sure the laser lights for 10 to 20 seconds and that it then switches off. While lit, adjust the laser focus to be a fine line.
5. Slide the laser into the centralising boss.
6. Feed the switch down into the outer body shell and push it through the hole in the end wall. The centralising boss will need to follow into place to accommodate this. Fasten the switch in place with its nut and washer.
7. Rotate the centralising boss so that the fixing holes align with the outer shell and fit 3 x M3 x 4mm countersink screws.
8. Fit the mounting boss to the tool you wish to use the laser on. It is best to undertake a dry fit to make sure the laser is roughly in the right position before committing.
9. Slide the completed laser assembly into the mounting boss. The body should be rotated inside the mounting boss to give a vertical red line on the object being cut. The laser also needs careful adjustment to ensure the laser line coincides with the correct cutting position to match the cutting blade. When correctly aligned, tighten the mounting and locking screws.

That completes the assembly and mounting of the laser line module.

Here is a completed view of the assembly ready to slide into the outer cover and also showing an alternative switch.



Here is the completed assembly in place on the Femi.

<u>Warning</u>

<u>This project uses a laser diode which while low powered still has sufficient output power to do severe damage to the human eye. The author takes no responsibility for any such injury no matter how caused by anyone attempting to reproduce the concept outlined in this article.</u>