Interface to Mumford Microset Timer

The Mumford Microset Timer is an indispensable device for working on clocks and watches. It allows all manner of diagnostics to be recorded using external sensors mounted in and around a clock or watch.

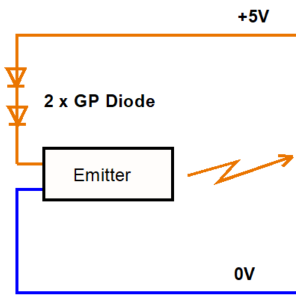
Emitter

I prefer to use laser emitters and these are readily available on EBay. They are tubular devices with a focussing lens on one end and the two-wire connection on the other end. Red +3V and Blue 0V.

The ones that I have used are designed to powered with 3V or thereabouts. Either a separate power supply can be used for this or the 5V internal supply from the Microset. The 5V supply from the Microset can be shared by both the emitter diode and the detector electronics.

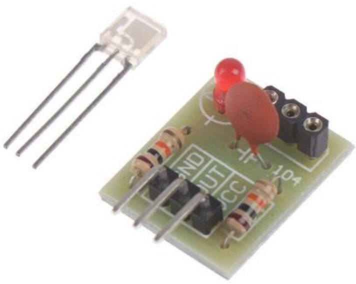
If an external supply is used then I recommend the use of one of the many 3.3V regulators that are available and are designed for logic circuits such as the Arduino devices. The AMS1117 is one such device or the RS part 669-4897 is another. A ready made AMS1117 regulator module can be bought on EBay as shown below.

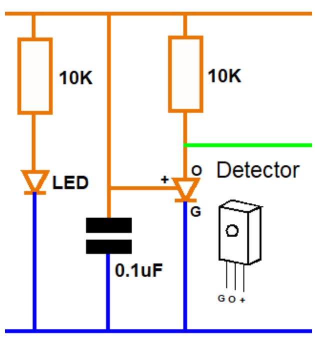
If you use the internal 5V supply from the Microset then a simple solution is to use two general purpose diodes (BAW62 or IN916 etc) in series with the 5V supply. Each diode will drop 0.6V to 0.7V and leave you with 3.6V for the laser.

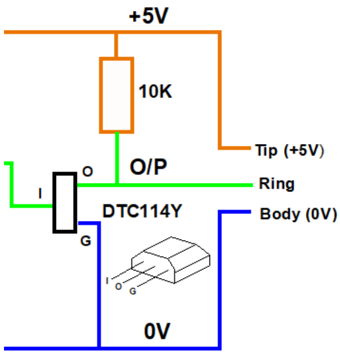


Detector

The laser sensor can be sourced on EBay mounted on a small PCB. This is shown below and the middle image shows the circuitry on the PCB module

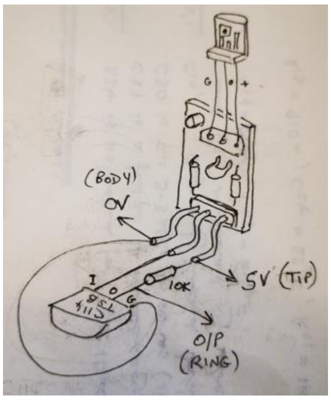






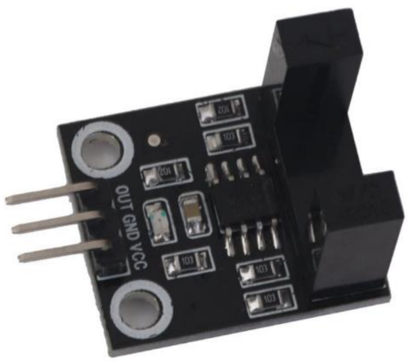
The sensor can be bought as a component separate from the module and would only need the 10K resistor and the decoupling capacitor added to get it to function. The problem with the module and just using the diode in its own right is that there is no buffer to adequately drive the Microset at a consistent level. I recommend adding a transistor of some sort to achieve this. My choice is the DTC114Y which is a digital transistor with 10k resistors built into the chip input terminal. The additional circuit to add this type of buffer is shown in the third diagram above.

Depending on orientation needed for the detector device, using the PCB module as is may or may not be convenient. If this is a problem than I usually mount the diode remote from the PCB and make the connections with short jumper wires. Here is a sketch of this arrangement and a typical assembly picture with the added DTC114 buffer device.



Note that the detector diode orientation and pin connections are critical otherwise damage to the device will result. If you look at the front of the body where the nodule is, the 0V connection goes to the large metal electrode inside the transparent body.

Light Sensitive Switches

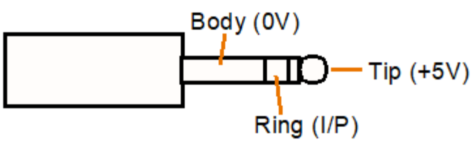


An alternative to a laser diode and detector is to us an optical coupler type device with has a light emitting diode and detector built into a single body with slot between the two. Anything passing through the slot will break the beam and cause the output to switch. Mumford supply this style of detector as standard but there are various physical presentations of these.

The one shown to the left operates from 5V and is based on the LM393. This can be used with the same interface circuits as used above in the laser version.

Connections

The external sensors are connected to the Microset using a 3.5mm miniature stereo jack plug. The 3.5mm refers to the diameter of the connecting shaft. Jack plugs are coaxial and the term stereo refers to the fact that the shaft has 3 separate contact areas unlike the mono equivalent that only has two connection areas.



Above is a picture of such a connector and the associated solder connection terminals at the rear. In old engineering parlance the connections are referred to as 'body' 'tip' and 'ring. The mono version does not have the 'ring'.

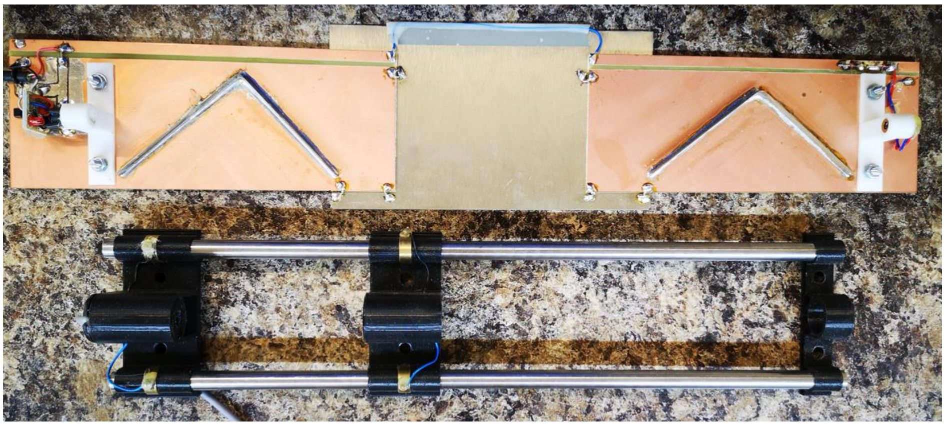
The 'body' is the body of the connector and this is generally used as the ground or the braided screen on the cable. The 'tip' is the bulbous end and on the Microset this connects to the 5V supply inside the Microset. The 'ring' is the small ring between the tip and the body and this is the data input to the Microset.

Soldering the connections to the jack can be a tricky activity and care is needed to not get any of the connections overheated as this can melt the insulting sleeves inside the connector and lead to a short circuit. Likewise it is important to not overheat the cable or a similar short can occur. Finally I recommend that a small section of heatshrink sleeving or similar is placed over the 'tip' and 'ring' connections to avoid a short to the 'body' connection. The 'tip' and 'ring' connections are not rigidly held in the 'body' sleeve and can rotate. The alternative is a blob of hot melt glue. The cable can be held rigid by squeezing the 'body' connection or hot glue or a heatshrink as below.

A simple low-cost source of miniature cable is to chop up a USB charging lead. These have four wires, usually a red, black, green and white. Use the red and black for the +5V and OV and use the white or the green for the data. Chop the unwanted cable short.

Completed Assemblies

Here are two versions of my swing detectors using laser diodes.

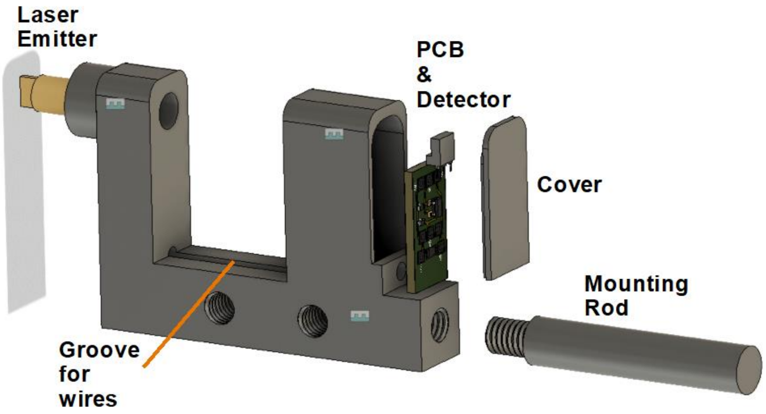


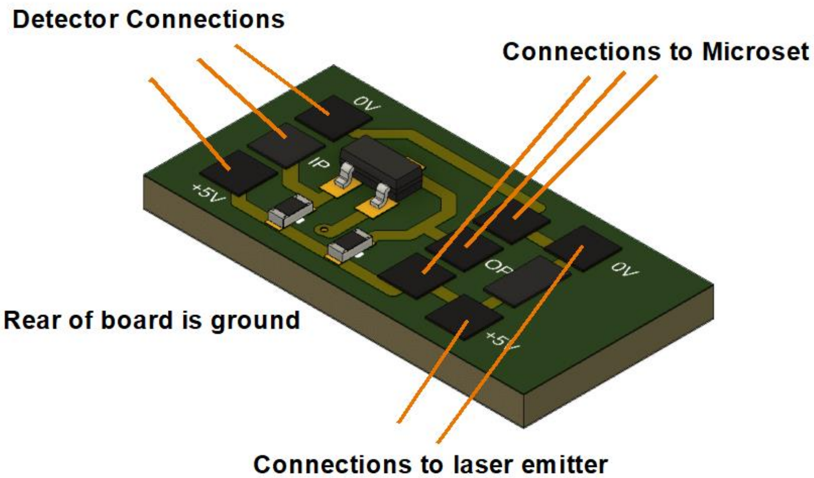
The top PCB mounted version uses 3D printed holders for the emitter and detector. The 0V is made via the large copper area and the 5V feed to the laser emitter runs via the track down the side of the PCB where there are two diodes dropping the 5V to 3V. The detector end uses one of the EBay PCB modules mentioned above and uses the DTC114 interface transistor with a 10K resistor. All the electrical connections are done by cutting (hacking) tracks in the PCB material. This particular version was originally one piece of PCB but while working on a church clock the rating nut was almost touching the floor and the PCB material was too thick to pass under it. The centre section had to be thinned down using some nickel silver sheet and the 5V connection linked across using a jumper wire. The zig zag vee pieces are simply strips of nickel silver to make the board remain flat.

The second version with the silver steel rods is a totally over the top design. The laser emitter sits in the sliding module and has its power supplied via the two steel rods. The detector is mounted with the DTC buffer transistor in the fixed end. All the parts are 3D printed apart from the brass sliding contacts and the silver steel rods.

Latest Swing Detector

Here is a new version for use on a pendulum. The body is 3D printed from a Fusion 360 design. There is a small SMD printed circuit board that contains the digital transistor interface as per the details above. The PCB was CNC milled from the Fusion 360 Electrical module design but could be bird nested in the cavity where the PCB would sit. The body has various modelled mounting holes for M6 screws.





The Fusion 360 file for the body and cover are available on request.