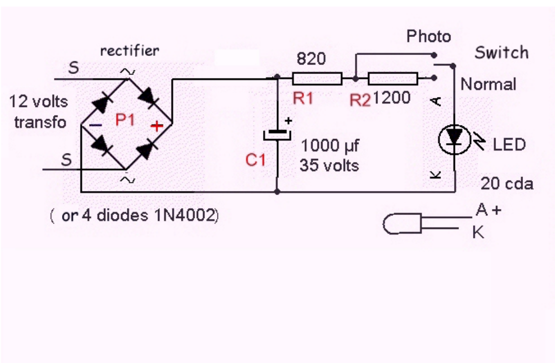
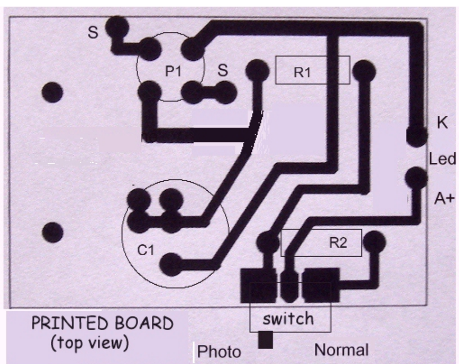
LED Lighting for a stereo microscope **Jean-Marie Cavanihac, France**

I have owned for some years, a stereo microscope, which is very useful to examine samples in a Petri dish or flat jar and very convenient for sorting smaller creatures. The magnification is only 20x on mine, but same models exist with 20x and 40x using a rotating turret. The integrated lighting uses two bulbs: the first one is above the subject (episcopic lighting) and the second under a frosted glass below the subject (diascopic lighting). Both use 12 volts 6 watts bulbs but the lower has a small disadvantage: it produces heat which transmits through the frosted glass and warms the sample, sometimes up to 50°C in less than 15 minutes. At this temperature, live critters are rapidly killed!

One approach is to replace the bulb with an LED which produces less heat. But the bulb is powered by alternating current and LEDs use only direct current! This current must also be limited into the LED using a serial resistor. Fortunately the base of the stereo which contains the transformer has some room to install an LED and its small electronic control circuit. A schematic is below:





Voltage from the transformer (12 volts) is applied to the rectifier P1 then smoothed by capacitor C1 (*see Note 1); 12 volts AC becomes 19 volts DC.

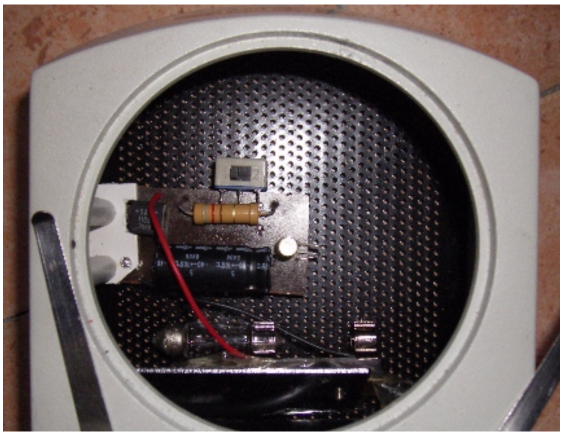
It's not very difficult to calculate the R1 value: If you know threshold voltage of the LED (here 3,6 volts for a white LED and its current limit, here 20 milliamps or 0,02 Amp for this LED): R1 = (19-3,6)/0,02 = 16,6/0,02= 830 ohms (the nearest normalized value is 820

ohms). Don't use a lower value!
I made a little refinement by adding R2 which dims the light during long observations, and by using the switch soldered onto the printed circuit board it's possible to choose a bright light to take a picture (photo) for example or normal light.

- *Note1 : If you don't use C1, and if you want to take pictures or video you will have dark stripes on the screen!*

- *Note 2: Don't forget: LEDs are polarity dependent components: the shortest wire of the device must be connected to the negative side of the power supply*

Choice of the LED: it's a simple, low cost 5 mm diameter ultra bright LED (20 000 millicandela). If the LED is located in the lower position (away from the frosted glass) the illuminated field is sufficiently covered even when using a magnification of 20x.



Last choice: «color temperature » of the LED: cold white (6000K) or warm white (3600K)? Personally I prefer warm white because it's less stressful for my eyesight ...! See below for a comparison with examples of the two types.

COLD WHITE LED WARM WHITE LED

The image below is of planktonic larvae (stained with eosin and mounted in glycerine jelly) which are difficult to see completely with a compound microscope because they are larger than the typical field of view of the lower power objectives. The image was taken with a warm white LED.

The vignetting (dark corners) isn't produced by the LED but by limitations of the camera lens (handheld camera).

I think some recent models of stereo microscopes have LED lighting but you can easily modernise your older model!

If you wish, you can also replace the external incident bulb (located near the objectives) with an LED too, but it's not truly necessary .

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