The Prior School Microscope

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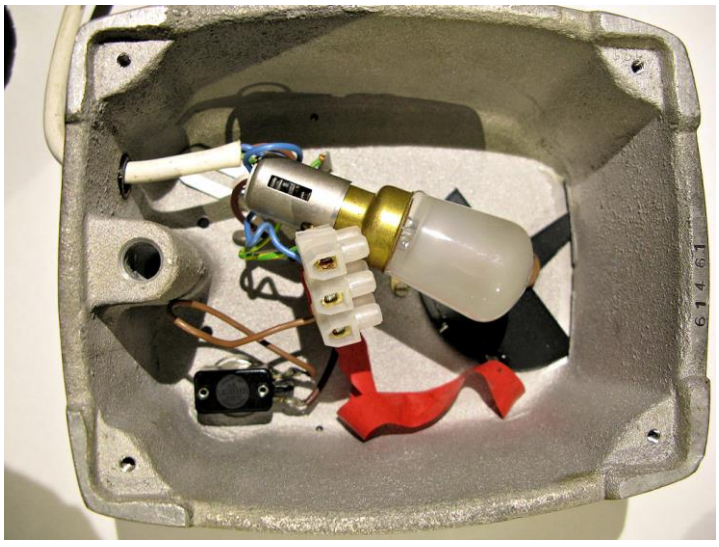
The Prior school microscope – old model
New brightness control on rear

The Prior school microscope – newer model
New brightness control knob on top

Finding a basic microscope that is cheap and will not discourage the beginner, be they youngsters or rather more advanced in years, is not an easy task. Amongst microscopists the “toy” microscope is notorious for promising much but delivering little.



The insides of an unmodified Prior

Every now and again the Prior school microscope pops up on eBay or appears in car boot sales, second hand markets or the like. These microscopes at first sight seem outmoded and of no great prospect. They have crude illumination with a mains powered 15W filament lamp that gets hot and the electrical safety by current standards leaves much to be desired. They also have no

substage and the field diaphragm is a rotating disc or half disc with different sized holes.

I came by one of these a while ago and more recently another five.

They do in fact have several things in their favour. They are small, lightweight, robust and take RMS objectives in the triple nosepiece. The prior objectives are good quality, provided they haven't been abused too much in service. The stands usually come with 10x eyepieces (sometimes 5x), a 10x and 42x objective and sometimes a 4x. The 42x is rather over ambitious for the instrument at least in its basic form. There appear to be at least three versions of the microscope. The oldest I have is a black model with the limb fixed by bolts from underneath, then there is a later grey model that has a raised stage and the limb fixed by bolts from the top. Some of the later stands seem to have been fitted with a hemispherical lens under the field aperture and this improves the performance with the 42x objective. The objectives in most of the stands I have seen are not DIN objectives, but one stand I have did in fact have DIN objectives and had a taller limb to accommodate these. I assume this is probably the latest model and it also had the hemispherical field lens. Unfortunately this particular instrument has severe lateral focus drift as the focus was adjusted and the image moved across the field during focus changes. Not a keeper.

The focus mechanism is simple and perfectly adequate.

The focus mechanism

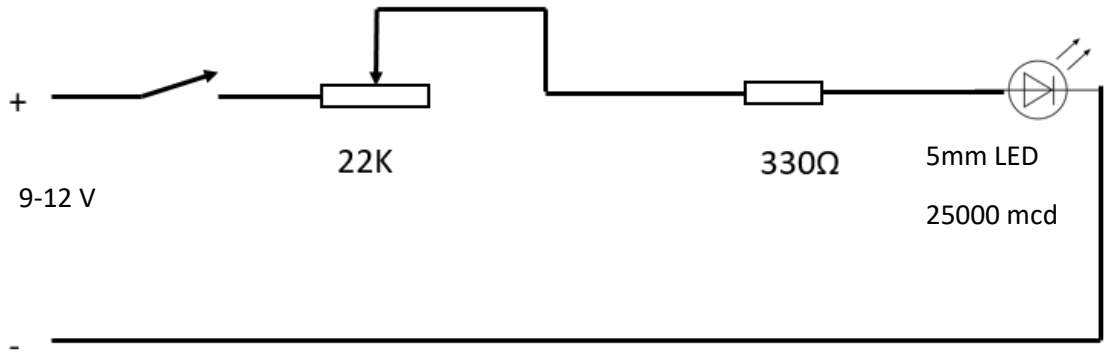
The dismantled limb shows the simple focus mechanism which consists of a pivoted right-angle arm engaging in a hole in a dovetail slide on the microscope tube and adjusted with a coarse threaded screw in the limb with a coaxial internal fine threaded screw for fine focus.

The one shown here is in fact the DIN limb, but all the models work on the same principle.

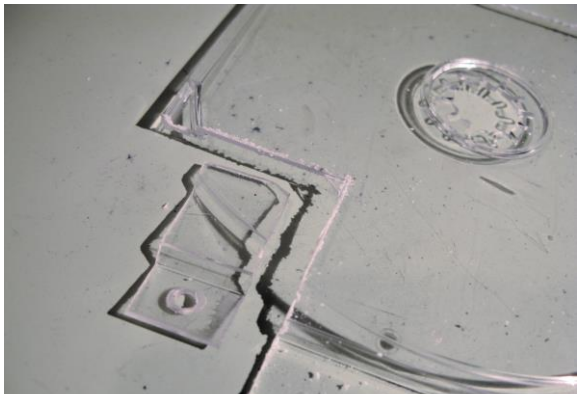
So, how to make the best use of one of these microscopes? I decided to convert the lighting to LED lighting. A small 25000 mcd 5 mm LED was chosen. All the mains wiring and lighting was removed and a bracket constructed with the LED in a simple tight fit hole aligned with the field disc aperture. I drilled a new hole in the base of one stand to take a brightness control on the other side of the limb to the on/off switch on another I used the mains cable aperture. Power is provided by a PP3 9V battery, although in the stand with the brightness control on the top, I made provision for an external power source such as a 9-12V mains adapter, in which case the battery is isolated when the

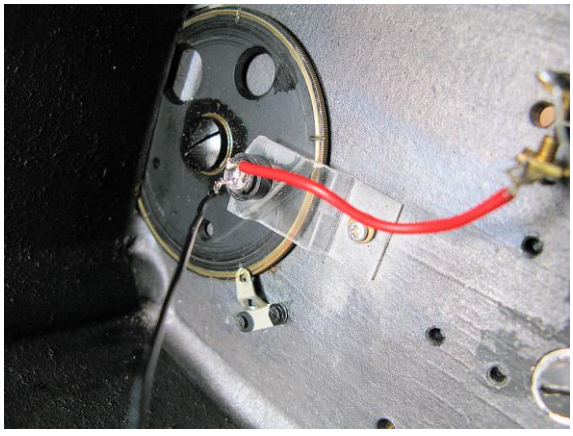
external power is plugged in. The socket for this is located in the aperture originally used for the mains cable.

The LED circuit is as simple as they come and consists of a 330Ω resistor and a 22K potentiometer in series with the LED. I have also used a 250K potentiometer successfully.

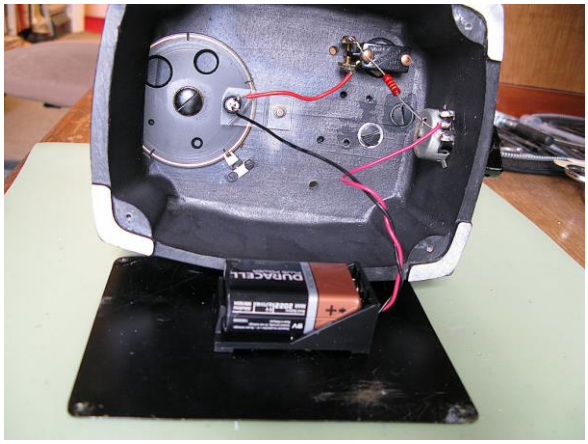


Circuit diagram





LED Mounting bracket in place



The new lighting arrangement

The battery can be mounted in a holder on the microscope base

I made the LED mounting bracket from an old CD tray, and used a heated metal tube to make the mounting holes, rather than drilling the plastic, as it is brittle and can crack when drilled. In the illustration one hole is shown, but as can be seen in the other illustrations, two are in fact required and another is required in the microscope base in order to fix the LED mounting bracket. The bracket has an oversized hole to facilitate alignment. Alignment is by eye looking through the microscope on lowest

power and moving the LED bracket until the light is central in the field. The screw is then tightened to fix the ED position. On one microscope that appeared to have had a hard life I had to re-align the limb by slackening the limb mounting screws and, again at lowest magnification, reset the limb position so that the field aperture was central.

Once the new lighting is in place and working we need to consider how best to use the microscope. All the stands I have seen have been fitted with Prior 10x and 42x objectives. The 42x does not give a great image without some sort of substage condenser, which is presumably why the later stands had a hemispherical lens in the field aperture. The maximum sensible objective power is probably around 25x without a hemispherical lens. I found a non-DIN Bausch & Lomb 21x was pretty good. As I only had one stand with a Prior 4x objective fitted, I checked out a number of non-DIN 4x objectives of different makes. For example, Lomo objectives are not suitable and cannot be brought into focus, but Watson black & chrome objectives are near-parfocal with the Prior objectives.

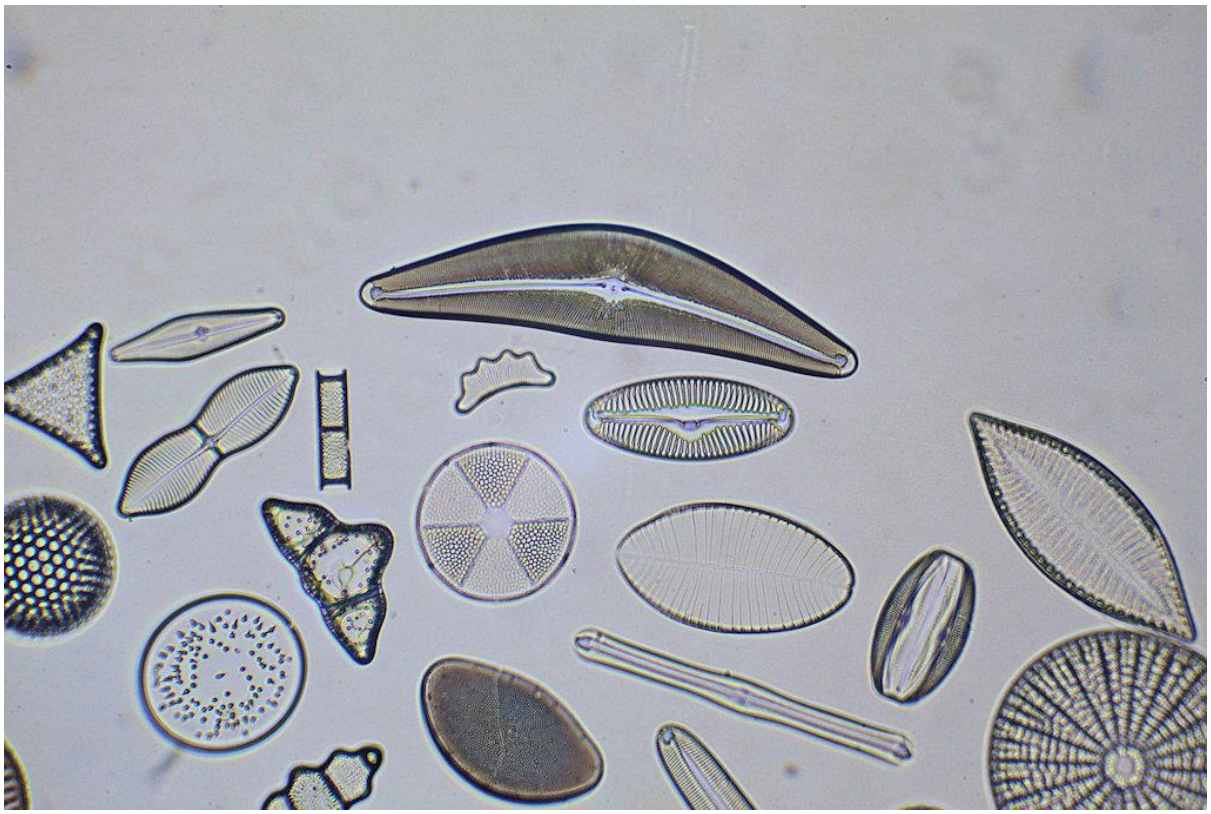
Another improvement worth considering is black floccing of the tube interiors. I found this reduces image hotspots and improved image contrast.

Now, let's look at the image quality we can achieve.

Daphnia pulex **taken at the pond-side using the grey Prior and Prior 4x objective**

Grey Prior with Prior 10x Objective

Black Prior with Prior 10x objective



Grey Prior with Bausch & Lomb 21x objective

Grey Prior with Prior 42x objective (this stand has a substage lens)

Black Prior with Prior 42x objective (no substage lens)

From my tests with these stands, I think that they are potentially good basic instruments for low power work and not too bad with the Prior 42x objective, considering the poor substage arrangements. The addition of the hemispherical substage lens in the later instruments appears to provide some improvement in image quality at higher powers.

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