ULTRA LOW COST CADMIUM SULPHIDE ENLARGER DENSITOMETER

How To Turn Your Enlarger into a Densitometer for less than £12

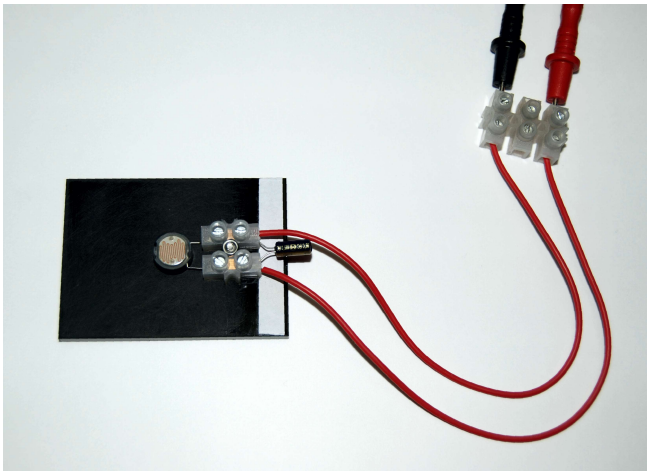
b-wtechnik has several articles concerning exposure of film and using the correct part of film characteristic curves, and also how to determine film gamma.

Ordinarily, this is not easy and normally depends on trial and error unless a densitometer is available to make measurements of film density. A suitable bench densitometer costs upwards of £700 which is outside the scope of most amateur photographers. Also they do not take into account the characteristics of the enlarger.

What is proposed is ridiculously cheap and is capable of adequate accuracy bearing in mind all the other variables in monochrome photography that need to be kept under control.

The parts list is as follows:-

		Source
1. ORP12 CdS sensor	£ 3.50	ebay / b-wtechnik
2. Screw terminals , qty 5	£ 1	b-wtechnik
3. Digital Multimeter 200mV to 600V	£ 5.00	ebay / b-wtechnik
4. Flexible insulated stranded cable	30p	b-wtechnik
5. A perspex base, 70 x 80 x 3 mm	60p	b-wtechnik
6. Calibrated film samples size 35 x 50, log density of 1.2	60p each	b-wtechnik



All the parts are available as a complete kit or as individual items.

In order to encourage amateur photographers to get control of their processing, the intention is to provide the parts at cost price plus postage.

A spreadsheet is available for download which explains the procedure required to calibrate the CdS sensor and how to make density measurements.

Cds_cell_densitometer_20_11_25.ods (Libreoffice)
Cds_cell_densitometer_20_11_25.xlxs (Excel)

Other spreadsheets are also available such as the following:
2_frame_6.66_stop_gamma_calculations_template_19_11_25.ods (Libreoffice)

Exposure.pdf and Exposure_2.pdf (see website Welcome page) which discuss the use of light meters, densitometry and Duplexing.
This document is : **cds_cell_densitometer_info_20_11_25.pdf**

Download densitometer information from:
http://b-wtechnik.pp7.uk/densitometers.htm

Each CdS sensor is provided with initial calibration constants that depend on the light level from the enlarger being adjusted by altering the height of the enlarger from the baseboard. If this adjustment is not possible then the sample films have to be used using a different calibration procedure given in the spreadsheet.

There are limitations to the overall accuracy which are caused by the following:

1. Random light sources if there are significant reflections in the darkroom. Most of this can be controlled by minimising the size of the projected image around the CdS sensor using a mask of black card and placing an A4 black card on the enlarger base. A drawing of a typical mask is given in later pages.

2. Mains power supply fluctuations are the major cause of errors. When making a density measurement, the film base + fog level is measured at the start of the session before density measurements are made. During the delay between measurements small rapid voltage fluctuations may take place which are easy to see on the meter. This problem can be partially solved by adding a capacitor across the CdS output which is shown on the previous image.

Despite these restrictions, the typical accuracy is still better than 3%.

The CdS sensor is very sensitive and so all measurements, in particular at levels as low as 6 stops down from a highlight reading, have to be taken in total darkness. This means that meter readings will need a low level light source such as a small modified LED torch or by selecting a voltmeter with a readout having a temporary low level light source.

Typical Film Holder mask