Calibration: For Plus and Pro Versions ONLY!

(Plus versions of ZoneMaster and Analyser have f-stop increments of 12ths, 6ths, 4ths and 3rds.)

Note, since revising the calibration method in the Plus meters, the need for complicated calibrations has largely disappeared. There is still a value in doing a detailed calibration with the aid of a test wedge, to examine and compare different printing papers, the effects of toning and the effect of filtration.

Test Method1: for users without access to a Densitometer

This method is recommended for those users who need to calibrate the contrast and exposure for their individual working practices. Once the calibration is complete, it would make sense to make a greyscale, attach it to the meter, and use the method described in the manual to make small adjustments to compensate for batch to batch variations. The beauty of this method is that it also enables you to determine what filter settings you need for a colour head (or blue/green system) to obtain even contrast grade spacing.

This alternative method can be achieved without the aid of a step-wedge, but is certainly more convenient with one. The step wedge is a convenient method of making a series of exposures onto a piece of paper in one go. The step size ideally should be 1/2 stop or 0.15 density units. (You can of course vary the exposure by varying the time, similar to a test strip, but this not only takes longer, but can also introduce variations from reciprocity failure and lamp warm-up effects, although the Analyser does make a 100ms adjustment for lamp warm up)

You can use the sensor to measure the densities of the projected negative strips. A sheet of graph paper or a spreadsheet program on a PC is all that you need to plot the results. An additional benefit of this method is that it takes into account any small variations within the meter itself and more significantly, the room conditions. The resulting calibration data will be personalised for your darkroom and materials.

The method starts with measuring and adjusting the contrast settings, followed by the exposure adjustment needed to just register a tone on the paper.

Step1: Measuring the stepwedge

Measure the densities of the step wedge, either by projecting with the enlarger or placing the wedge on the meter cell. Either way, ensure that the safe light is off. Measure and record the densities of each strip, starting with the lightest strip. With Analysers or ZoneMasters, you will need to press Clear and measure the brightest strip again after 8 readings. The latest models have a density mode, which allows an unlimited number of density measurements to be taken.

Step2: Making the test prints

Set up the enlarger for the lowest contrast setting, either with full yellow or a dedicated filter. A strip of the paper under test is exposed to a projected (or contact printed) test wedge image for 10-40 seconds, at an aperture setting that enables a full range of tones from maximum black to base white to show. Expose further strips for the same time and aperture for the other paper grade settings.

If you are a first time user with a colour head, it may be appropriate to do a series of tests at 25 unit yellow or magenta intervals over the full adjustment range of the colour head. The reasoning behind

this is that each enlarger is different, so it makes sense to make a series of tests at regular intervals so that after the contrast results have been plotted on graph paper any particular grade setting can be determined. This avoids any trial and error approach to filtration values for different contrast grades. An example might be, in order :

Yellow (200,175,150,125,100,75,50,25,0) followed by Magenta(25,50,75,100,125,150, 175, 200).

Since the meter can calculate the different exposure times automatically, it makes sense to only use a single Yellow or Magenta filter, to keep the printing time to a minimum.

Step 3: Evaluation of Contrast

Develop, fix and treat the strips, as you would a normal print. Next, for each strip, mark the first non-white strip and the first off-black strip. It may happen, especially at high contrast settings that a tone, somewhere in-between strips has the correct tonal value. The subjective appraisal of these wedges is important and should be done with similar lighting and viewing distances as with a print. For each strip calculate the exposure difference between the highlight and shadow areas. If you were using a test wedge, the exposure difference is the same as the wedge density difference. If the density of the highlight strip was D1.3 and the shadow strip was D0.05 then the contrast is D1.3-D0.05 = 0.8 or ISO(R) 80.

As mentioned earlier, if you are using a colour head, it is a useful idea to use a graph to show the contrast range for different yellow and magenta settings, so that you can decide on a set of filter values that give evenly spaced paper grades.

Step 4: Evaluating Exposure

Having measured the contrast values for the different paper grades, you now need to enter them into the meter. So for grade 2, a value of about 100 is to be expected, and grade 5, 50. Having entered the values into the meter we can now determine the exposure adjustment.
Since highlight tonal values are easier to judge than shadow values, the exposure adjustment uses a standard automatic test strip to determine the correct exposure for an off-white print tone.
Remove any negatives and set the aperture to about f16. Turn on the lamp and use the meter to take an exposure reading. Set the meter and enlarger to the softest paper grade and reduce the exposure time until the lightest print tone indicator lights up on the meter. Insert your test strip maker and paper and press the print button to make an automatic test strip as normal. Develop and process the print. The middle strip is the nominal exposure, so if one more step was required to register a tone, then the required exposure change is plus one. If two steps less exposure were required then the change is minus 2 and so on. If all the strips were too dark or light, then apply a negative or positive compensation (respectively) of 7 steps and try again. Photographers who have cold cathode heads will find that their light source is very efficient (lots of blue and green light!), and will need quite large amounts of negative compensation.
This procedure then needs to be repeated for each harder grade setting, (filtration and meter setting). At the end, you will have a set of exposure changes that need to be applied to whatever exposure compensation values that are already in each grade memory. So, if the existing exposure setting for grade 2 was +10 and your exposure test said it was 2 steps too dark, then the final exposure setting would be +8. At this point you should have a set of evenly spaced grades with contrast values and exposure adjustments.

Test Method 2:for users with a Step-wedge and Densitometer

This second method is similar to the one we use to calculate the master calibrator unit. We use an Agfa stepwedge with 18 half stop increments and a Heiland densitometer. This method is still attainable, even if you do not have access to a Densitometer as RH Designs offer a measurement service for a small fee and can supply calibrated Step-Wedges. We gain of our master calibrator is set so that projected stepwedges with a typical colour head correspond accurately to the dedicated transmission densitometer readings. The advantage of this technique is that we measure the reflection densities more accurately and can produce complete graphical representations of the paper characteristics in the process.

Step 1: Setting up a predefined light level for testing

All testing is done referenced to a constant light level. This light level is set JUST below the maximum level that the meter can read. Remove any negatives from your enlarger and move the head three quarters up the column. Change the lens aperture and/or move the enlarger head, until the light reading JUST stops reading 'HI'. Make a contact print of the Step-Wedge at the softest grade setting and for 15 seconds. Develop and examine the dry print in good lighting. If there is not a full range of print tones, double or half the exposure time until there is a full range. From this point, do not move the enlarger head, alter the aperture or exposure time.

Step2: Making the test print

The best results (most consistent) happen if all the test exposures are on the same piece of paper and developed in one go. I use a test strip maker with 7 fingers for my own tests, (one for each grade). Take a piece of printing paper and place on your baseboard, use your test strip maker if you have one. Set up the softest grade setting on the enlarger, or whatever filtration system you use. Raise the first finger of the test strip maker and place the Step-Wedge on the paper. Make an exposure. Move the Step-Wedge over to the next finger, dropping the first, set up for the next grade and make another exposure. Repeat until you have an individual contact print of the step wedge, one for each grade, across the paper.

Step3: Development

Develop, agitate, stop and fix in your normal way. Standardise on the development time. Dry the print and clearly identify the settings on the back, making sure to include; exposure time, filter settings, developer and paper.

Step4: First Analysis

Take a look at the print, each scale at each grade setting should have a white and black tone on the scale. Some papers can be quite slow, so it may be necessary to change the exposure and repeat. Again, keep things simple for later on, and either double or half the exposure time and repeat Step2. Extreme yellow filtration, may not yield a full black.

Step5: Detail Measurement

At this point, if you do not have access to a reflection densitometer, mail the test print to RH Designs and we will do the rest. If you have an un-calibrated Test Wedge, mail that to us too. Otherwise measure and plot the reflection densities for each grey-scale. The print density is plotted on the vertical axis, in logarithmic units as displayed by the Densitometer.
The horizontal axis represents the paper exposure. The number system used is related to an internal number in the software, every 30 units represents one stop. It is calculated thus: 255-(Density of step wedge x 100). For example if a stripe of the test wedge has a transmission density of 1.2, then the

exposure is 255-(1.2 x 100) = 135. If you had to use 30 seconds, add 30 units to each exposure value, if you used 7.5 seconds, subtract 30 units from each exposure value. In this way, both vertical and horizontal axis will be in logarithmic units. You should end up with a graph like Figure 1. (Clearly, as before, with colour head filtration, intermediate points may be assessed)

Step6: Calculating end points

Draw a curve for each paper grade setting. Record the exposure for the reflection density of 0.04 and 90% of the maximum print density value for each grade.
Enter the values into the table provided. Use the table to calculate the offsets for each grade and the contrast setting. On the meter, press and hold the Cal button, dial in the meter steps into the exposure offsets and the contrast settings directly into the meter.

You should now have a complete set of calibration constants for your paper and for those of you who use colour heads, rather better insight into the effect of yellow and magenta filtration, grade spacing and maximum contrast available. For instance, if you were to draw a graph of colour head filter value versus contrast, it would enable you to calculate intermediate filter settings to obtain an evenly spaced set of grades.

Table 1: Paper, Developer, Exposure: (Plus / Pro versions only)

Grade	Meter Software Constant (A)	Dark Exposure in 30ths stop (90% Dmax) (B)	Light Exposure in 30ths stop (D0.04) (C)	Meter Offset in 30ths stop (C-A) (D)	Meter Steps 12ths (D)*(12/30)	Meter Contrast in ISO (30ths stop) =B-C
example 4	112	230	100	-12	-5	130
00	55					
0	60					
1	65					
2	68					
3	75					
4	112					
5	133					