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Grade	OO	O	1	2	3	4	5
Exposure correction							
Contrast value							

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# Analyser Pro ZoneMaster II

## Calibration Manual

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RH Designs  
Greystones, Burtersett, Hawes, North Yorkshire DL8 3PH  
Tel / fax: 01969 667776



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described in this manual to improve accuracy. The figures assume the use of Ilford Multigrade under-lens filters except where indicated.

- 4 Choose your set-up from the list below, and enter the exposure correction (offset) and contrast values from the table into the meter's calibration tables. These figures are to be regarded only as starting points and for best results the full calibration procedure should be carried out, as actual values will depend on the characteristics of your enlarger, your working methods and materials. However if you use these starting figures it's likely that only fine tuning will be required. (The figures for Ilford Multigrade IV RC are the factory standard and are listed here only for reference purposes.)

Paper type	Grade	00	0	1	2	3	4	5
<b>Ilford Multigrade IV Resin coated (standard)</b>	Offset	0	0	0	0	0	0	0
	Contrast	179	144	132	109	89	65	47
<b>Ilford Multigrade IV Fibre-based</b>	Offset	3	1	2	1	0	-4	-10
	Contrast	155	136	110	84	68	52	45
<b>Ilford MG Warmtone RC</b>	Offset	10	10	9	9	9	8	7
	Contrast	200	163	149	123	101	81	66
<b>Ilford MG Warmtone FB</b>	Offset	12	12	11	12	12	13	13
	Contrast	189	166	148	119	98	71	56
<b>Ilford Multigrade III RC</b>	Offset	-1	0	0	0	0	-3	-5
	Contrast	188	164	142	127	100	85	72
<b>Ilford MG Cooltone RC</b>	Offset	-2	-4	-5	-5	-7	-11	-16
	Contrast	160	138	116	93	77	60	55
<b>Ilford MG IV RC Leitz V35 MG head</b>	Offset	-	-8	-10	-9	-10	-19	-24
	Contrast	-	180	157	123	100	75	51
<b>Agfa Multicontrast Premium RC</b>	Offset	0	-2	-4	-5	-3	-6	-6
	Contrast	168	140	123	105	85	69	65
<b>Agfa Multicontrast Classic FB</b>	Offset	1	1	-1	0	-1	-11	-13
	Contrast	176	148	127	105	88	76	66
<b>Kodak Polymax II RC (Kodak filters)</b>	Offset	-4	-6	-6	-7	-8	-3	-3
	Contrast	174	144	120	113	102	73	55
<b>Kentmere VC FB warmtone</b>	Offset	-6	-8	-10	-11	-14	-15	-14
	Contrast	138	121	109	95	86	72	75
<b>Kentmere Fineprint VC FB</b>	Offset	-5	-6	-8	-8	-13	-18	-24
	Contrast	139	121	108	89	83	72	76
<b>Kentmere VC Elite (Colour head)</b>	Offset	3	2	0	-1	-2	-15	-26
	Contrast	210	179	158	141	121	103	92
<b>Ilford MG IV (Ilford 500 head)</b>	Offset	---	-25	-24	-24	-20	-14	-20
	Contrast	---	177	136	119	100	73	48
<b>Agfa Multicontrast Premium (Ilford 500 head)</b>	Offset	---	-30	-26	-25	-23	-30	-30
	Contrast	---	147	114	98	86	67	51



- 2 Make a test strip **with 1/3rd or 1/6th stop step-size** at this exposure time and with the appropriate paper/ grade/ filter setting.
- 3 Examine the test strip and decide on the position (with respect to the middle strip) on the test strip where the tone matches the reference tone on the black reference tile provided. If it is in the middle, then no adjustment is required.
- 4 If the middle strip is too *light* then the contrast range needs to be *increased*. Similarly, if the middle strip is too *dark* then the contrast range needs to be *decreased*.
- 5 In the example on page 9 the matching black tone is two steps darker than the middle. That means that the ISO(R) number for the grade being adjusted requires increasing by 2 steps.
- 6 There are 30 ISO(R) units per full stop of contrast, so if 1/6th stop steps were used to make the test strip, alter the contrast setting by 5 units per step. If 1/3rd stops were used, alter the contrast by 10 units per step.
- 7 To enter the contrast adjustments into the calibration tables, see the instructions in section 5.3.

## 6. Starting Point calibration settings for alternative papers and/or equipment

- 1 The meter's basic calibration suits Ilford Multigrade IV Resin-Coated variable contrast paper, used with a standard diffusion-type halogen-illuminated enlarger and Ilford under-lens filters. This is the most popular configuration here in the UK, and if you use it you should get good results "out of the box".
- 2 If you are using a colour enlarger, use the filter settings in the table below which are a fairly good match to Ilford under-lens filters. See your meter's instruction manual for more information about different enlargers.
- 3 If you are using a different paper, we have derived exposure correction factors and contrast values for a number of popular papers which you can enter into the meter's calibration tables. These figures should be regarded as a starting point; you can refine them using the calibration methods

Grade	Durst (max 170M)		Durst (max 130M)		Kodak		Leitz Focomat V35		Meopta	
	Y	M	Y	M	Y	M	Y	M	Y	M
00	115	0	120	0	162	0	135	6	105	0
0	100	5	88	6	90	0	105	12	85	10
0.5	88	7	78	8	78	5	77	11	-	-
1	75	10	64	12	68	10	67	17	60	20
1.5	65	15	53	17	49	23	52	28	-	-
2	52	20	45	24	41	32	39	43	40	45
2.5	42	28	35	31	32	42	32	51	-	-
3	34	45	24	42	23	56	23	62	20	60
3.5	27	60	17	53	15	75	14	79	-	-
4	17	76	10	69	6	102	10	95	10	75
4.5	10	105	6	89	0	150	15	154	-	-
5	0	170	0	130	0	200	0	200	0	200



## 1. Introduction

- 1 Calibration is the process of matching the characteristics of your Analyser or ZoneMaster to those of your own methods, materials and equipment. Once completed, calibration does not need to be repeated unless you change either your paper, your enlarger, or your working methods and chemicals. A full calibration will be worth the effort involved as when complete, your Analyser or ZoneMaster will be able to predict accurately the results you will get on your prints.
- 2 Within the remainder of this manual we will use the term "meter" when descriptions apply to both the Analyser and the ZoneMaster. If certain items are specific only to either the Analyser or the ZoneMaster, then the product name will be used.
- 3 Your meter will have been shipped with a calibration test kit comprising three items:
  - A calibration test negative
  - A highlight density comparison tile with two patches, one paper-base white, the other a density of approx. 0.04 log.D
  - A shadow density comparison tile with two patches, one maximum black, the other a density of approx. 1.80 log.D

Keep these items clean and in a safe place, and handle them with care. Replacement kits are available from RH Designs should any item be lost or damaged.

## 2. Why calibration is necessary

- 1 Photography is a very inexact science, and while the meter has been designed so that it can be used with popular materials more or less straight out of the box, there are many factors which can affect its performance and which are outside our control. Major factors are the paper type and surface and the enlarger type and filtration. Filter factors vary between enlarger types, and the notion of contrast "grade" is very unspecific. One paper's grade 2 may have a contrast range close to another's grade 3 for example. We have therefore provided the meter with a comprehensive calibration system which can be used to personalise it to your requirements in terms of both exposure correction and contrast matching.
- 2 Put another way, exposure correction is equivalent to determining your own personal film speed and setting your camera's ISO dial to that number instead of the film manufacturer's recommended setting. Contrast matching is similar to refining your film development time.

### 2.1 What's involved

- 1 There are two separate aspects to calibration; exposure correction and contrast matching. Of these, exposure correction is the most frequently required. If, when you made your first prints, you determined the amount of exposure correction required and entered it into the meter's calibration tables then you already have a good starting point. The procedures described in this manual will help you to refine your corrections and make the meter more accurate in its predictions.
- 2 Because filter factors etc. can vary from grade to grade, the meter can be



calibrated for both exposure and contrast at every full grade. The half grade settings are calculated from the adjacent full grades.

- 3 Exposure calibration involves making a test strip to determine the correct highlight exposure. You need to do this at each full grade so you will need to make seven test strips, one each for grades 00 through 5. Once you have done this, you compare the test strip to the supplied highlight density tile to determine the correction required.
- 4 Contrast calibration must not be attempted until you have satisfactorily completed a full exposure calibration. This is because exposure errors will affect the contrast measurement. To calibrate contrast, you need to make a test print using the supplied calibration negative, and then compare the result to the supplied shadow density tile and find the density patch which is the closest match to it. The number of the matching density patch is then used to determine the contrast setting with the help of a graph or a table of numbers. Again, you will need to do this for each full grade.

## 2.2 Other calibration methods

The basic method described here can achieve good results with care. If you have a step-wedge and/or a densitometer, there are other methods which can be used as an alternative and these will be described in later editions of this manual.

## 3. Before you start

- 1 Since calibration is best done in a single session for optimum consistency, it's as well to prepare your equipment and materials in advance and adopt a methodical approach. It is assumed in this manual that you are familiar with the basic operations of your meter such as taking measurements, making prints and test strips, etc. Keep your Instruction Manual to hand for reference if you are not.
- 2 Set up your meter as usual, and choose the PAP channel you want to calibrate. This is especially important if you have already entered some exposure corrections, determined either from regular printing or from a previous calibration.
- 3 Gather together the following:
  - The test negative and the two density comparison tiles that came with this manual.
  - Some sheets of the paper you want to calibrate. Usually 2 or 3 10x8 sheets will be sufficient. Cut test strips approximately 5" x 1" (125mm x 25mm) for the exposure tests, and approximately 5" x 4" (125mm x 100mm) for the contrast tests. (If you have a test-strip easel then obviously cut the strips to fit that!)
  - Print developer and fixer, freshly mixed at the dilution and temperature you normally use for printing.

## 4. Determining Exposure Corrections

### 4.1 Making the exposure test strip

- 1 Remove any negative from your enlarger; the tests are made using a blank exposure.
- 2 Raise your enlarger's head to the top of the column and close the lens down



## 5.3 Entering the Contrast Values into the meter's calibration table

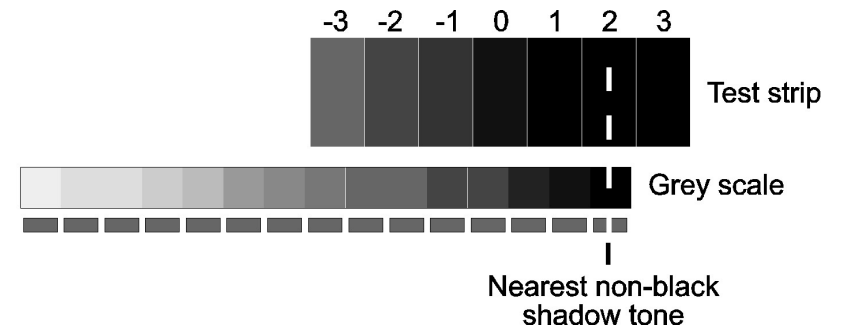
To store the contrast values that you just determined into the meter, proceed as follows

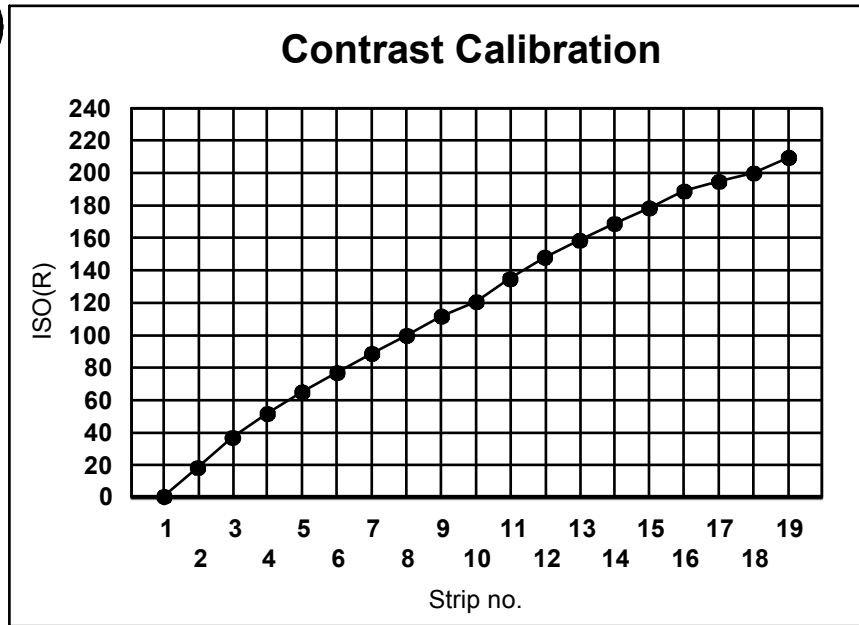
- 1 Press and hold  $\diamond$  for one second until "CAL" appears in the display.
- 2 Release the  $\diamond$  button. The displays shows in sequence the current PAP number, then "off", then "o 00". (Note - if you have previously entered an exposure correction then the time display will show that correction instead of 00.)
- 3 If you are using an Analyser, press  $\star$ . If you are using a ZoneMaster press  $\odot$ . The display shows "cont" and then "o 179". (Note - if you have previously entered a contrast figure the time display will show that figure instead of 179.)
- 4 Using the  $\blacktriangle$  and  $\blacktriangledown$  buttons, change the time display so that it shows the contrast value for grade o.
- 5 Press  $\blacktriangleleft$  to advance to grade 0. Using the  $\blacktriangle$  and  $\blacktriangledown$  buttons, change the time display so that it shows the contrast value for grade 0.
- 6 Press  $\blacktriangleleft$  to advance to grade 1 and enter the factor for grade 1. Continue until you have reached grade 5 and entered its contrast value factor.
- 7 If you are using an Analyser, press  $\star$ . If you are using a ZoneMaster press  $\odot$ . The meter will revert to normal mode, and the display will show "PAP1", then the default step size, then "2 15.0"
- 8 Your contrast values are now stored. Note - the default PAP channel is now selected (normally PAP1); if you entered factors for a different PAP channel you will need to select that again before testing the results.

## 5.4 Refining the Contrast Calibration

For more accurate contrast calibration, the figures derived using the procedure in 5.2 and 5.3 can be refined using the test-strip procedure described below. This procedure is not a necessity but is described here for users who want the highest accuracy of calibration.

- 1 With the lens stopped down and with a blank negative in the enlarger, take a meter reading for the appropriate grade to be calibrated, and increase the suggested exposure time until the LED on the shadow end of the bar-graph lights up.





- 2 Compare the exposures on the test strip to the shadow density reference tile and find the exposure that most closely matches the lighter of the two patches on the tile. Note the number of the matching strip.
- 3 Use the graph above to determine the paper contrast as follows:
  - Reading along the horizontal axis marked "Strip no.," find the number of the matching strip you just determined.
  - With the help of the graticule on the graph or a ruler, read vertically upwards until you reach the thick line on the graph.
  - Now read horizontally to the left until you reach the axis marked "ISO(R)" and read the contrast from the scale. If the value is between index marks you can estimate the true value. Mark the test print with the grade and the corresponding contrast value.
  - If the correct density lies between two strips, you can use the graph to estimate the contrast corresponding to a point between two strips.

(If you prefer, you can use the tabulated values in Table 2. Find the strip number and read off the corresponding contrast from below it.)

<b>Strip no</b>	1	2	3	4	5	6	7	8	9	10
<b>ISO(R)</b>	0	18	37	52	65	77	89	100	112	121
<b>Strip no</b>	11	12	13	14	15	16	17	18	19	20
<b>ISO(R)</b>	135	148	159	169	179	189	195	200	210	-



to its minimum aperture.

- 3 Set the meter's step size to 1/4 stop.
- 4 Remove all filters, take a measurement from the centre of the baseboard and check the exposure time on the meter's display. If it is between approximately 10 and 20 seconds then all is well and you can proceed to the next section. If it is longer than 20 seconds or so, open the lens aperture, press the **X** button on the meter, and try again - repeat until the exposure time is within range. If it is between 5 and 10 seconds and the lens is already at minimum aperture and the enlarger head at the top of the column, then you can proceed but accuracy will be reduced because of the short incremental test strip exposures. If the indicated exposure time is less than 5 seconds, use separate test strips mode rather than the usual incremental mode.
  - If you have trouble achieving a long enough exposure time, you can use a neutral density filter to reduce the light level. This can simply be a piece of unexposed processed film leader. Alternatively if you're using a colour enlarger, dial in equal amounts of cyan, magenta and yellow filtration.
- 5 For the entire remainder of the process, do not touch the meter's **▲** or **▼** buttons, or the **X** button!
- 6 Set the meter to the grade to be calibrated. Set the enlarger filters to that same grade, and make the test strip.

#### 4.2 Examine the test strip

- 1 Process, wash and dry your test strip and inspect it. Compare the exposures on the test strip to the highlight density reference tile and find the exposure that most closely matches the darker of the two patches on the tile.
- 2 Note the number of steps (if any) this exposure is offset from the center. In Table 1, look down the "Test Strip Offset" column to find this offset number, and read the figure in the column corresponding to the 1/4 stop step

		Test Strip Step Size				
Table 1		1/12	1/6	1/4	1/3	1/2
Test Strip Offset	-3	-3	-6	-9	-12	-18
	-2	-2	-4	-6	-8	-12
	-1	-1	-2	-3	-4	-6
	Centre	0	0	0	0	0
	1	1	2	3	4	6
	2	2	4	6	8	8
3	3	6	9	12	12	



size we're using. This is the exposure correction factor for the current grade. Mark the test strip with the grade and the correction factor.

- 3 Repeat this process for each full grade. There is no need to take a new measurement for each grade provided you have not touched the meter's exposure or clear controls, and you have not altered the lens aperture or enlarger head height.
  - **If you are using a colour or variable contrast enlarger**, you will need to correct the exposure at grades 4 and 5 because standard above-lens and below-lens filters require an exposure increase at these grades. This increase is built into the meter's basic calibration. Before you make the grade 4 test strip, reduce the exposure setting by one full stop (i.e. for a step size of 1/4 press ▽ four times). Leave the exposure setting the same for grade 5 as well.
- 4 When you have finished this process you should have seven test strips, each with a grade and a correction factor.

#### 4.3 Entering the exposure correction factors into the meter's calibration table

To store the exposure corrections you just determined in the meter, proceed as follows

- 1 Press and hold ⇨ for one second until "CAL" appears in the display.
- 2 Release the ⇨ button. The display shows in sequence the current PAP number, then "off", then "o 00". (Note - if you have previously entered an exposure correction then the time display will show that correction instead of 00.)
- 3 Using the ▲ and ▽ buttons, change the time display so that it shows the correction factor for grade 0.
- 4 Press ⇨ to advance to grade 0. Using the ▲ and ▽ buttons, change the time display so that it shows the correction factor for grade 0.
- 5 Press ⇨ to advance to grade 1 and enter the factor for grade 1. Continue until you have reached grade 5 and entered its exposure correction factor.
- 6 If you are using an Analyser, press ✱. If you are using a ZoneMaster press ☺.
- 7 The display shows "cont" and then "o 179". (Note - if you have previously entered a contrast figure the time display will show that figure instead of 179.) If you have contrast figures that you want to enter, you can do that now - proceed to section 5.3.4.
- 8 Press the same button again. The meter will revert to normal mode, and the display will show "PAP1", then the default step size, then "2 15.0"
- 9 Your exposure correction factors are now stored. Note - the default PAP channel is now selected (normally PAP1); if you entered factors for a different PAP channel you will need to select it again.

#### 4.4 Refining the accuracy of the exposure correction factors

- 1 For maximum accuracy you can repeat the process using a smaller step size. This is especially useful at the hard grades 4 and 5 where a small difference in exposure can result in a large change of density on the test strip. We

recommend using a step size of 1/12th for grades 4 and 5, 1/6th for grades 2 and 3, and 1/4 for the softest grades 00, 0 and 1.

- 2 When you read the correction factors from Table 1, remember to choose the column corresponding to the step size you used to make the test strip!

## 5. Determining Contrast Values

- 1 Before attempting to calibrate the contrast values you must have determined all the exposure corrections and entered them into the meter's calibration tables as described in the foregoing sections. If you do not do this, the contrast calibration will be **wrong!**
- 2 To calibrate the contrast range you will need to make a test print from the calibration test negative supplied with your meter, for each full contrast grade, and then find the strip on each test print which most closely matches the reference density on the shadow density test tile.

### 5.1 Making the Test Print

- 1 Put the calibration test negative into your enlarger's negative carrier and compose and focus the image on the enlarging easel. You will need an image size of around 5" x 4" (125mm x 100mm) although the actual size is not critical. A 10" x 8" (250mm x 200mm) sheet cut into quarters makes convenient test prints.
- 2 Set your lens to the aperture you normally use to make a print. Adjust the meter's grade setting to the grade you are calibrating (it's usually convenient to start at grade 00 and work up to grade 5)
- 3 Remove all filters and take a measurement from the strip no.1 on the test image. If the resulting exposure time is inconveniently long or short, adjust the lens aperture accordingly, press the ✕ button and try again.
- 4 Set the enlarger filtration to the grade you're working at and switch off the enlarger. Position a piece of paper on the easel and expose the paper.
- 5 Process and dry your test print using your usual technique.
- 6 Repeat for each grade. You do not need to take a new measurement for each grade providing you do not clear or adjust the meter's exposure settings, or change the enlarger height or lens aperture between prints.



### 5.2 Examine the Test Print

- 1 Check that the density of strip no.1 is the same as the reference patch on the highlight test tile. If it is noticeably different, take a new measurement and make a new test print. A possible cause of difference is stray light reflected from the surroundings (including your fingers!) so be careful how you position the sensor. The dense strip opposite no.19 should be paper-base white.