



ZoneMaster + Enlarging Meter

Instructions for use



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IMPORTANT BATTERY INFORMATION

The ZoneMaster is designed to operate from a 6v supply using 4 x AAA size cells. Do NOT attempt to fit a 9v PP3 / 6F22 / MN1604 type battery as this will cause severe damage to the electronic circuits in the unit and invalidate the guarantee.

We recommend alkaline type batteries for long reliable service. Suitable batteries include:

Varta type 4003

Duracell type MN2400

Ever-Ready type LR03

Nickel-cadmium rechargeable cells (AAA size) can also be used.

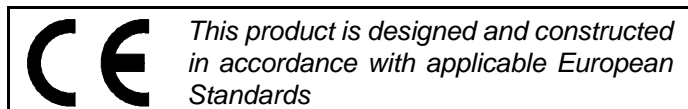
Replace the batteries if the ZoneMaster's display becomes dim or the meter behaves erratically. Remove the cover on the back of the ZoneMaster and extract the battery pack. Replace the four cells ensuring correct polarity, then replace the pack and cover. Always replace all four cells at the same time.

Standby Mode

The ZoneMaster incorporates a standby mode which it will automatically enter after 30 seconds after the last button was pressed. This saves battery life by turning off the display. To wake up the meter, press any key. While the ZoneMaster is in standby, the decimal point of the Grade display will flash.

GUARANTEE

This equipment is guaranteed against faulty components or manufacture for a period of two years from the date of original purchase. Should a fault develop within this period, please telephone us for advice before returning the unit. If there is a fault, we will repair or replace (at our option) the equipment at no charge. This guarantee does not affect your statutory rights. Damage due to misuse of the equipment, and any consequential loss arising out of the use or misuse of the equipment are not covered by this guarantee.





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Introduction

Thank you for choosing The ZoneMaster, the f-stop timer / meter designed by photographers for photographers. Since darkrooms are potentially hazardous places, please read the installation and safety parts of this guide before setting up or using your new meter.

The ZoneMaster is not an 'automatic meter'; it does not replace the intelligence or stifle the creativity of the photographer. It allows you to pre-visualise and manipulate the print according to your taste without the need for making test strips.

The ZoneMaster is intended for Black and White printing, using fixed and variable contrast papers. Built-in basic calibration suits Ilford Multigrade IV RC paper together with a tungsten-illuminated enlarger and Ilford's Under-the-Lens Multigrade Filter Set. The use of discrete filters will ensure best results with minimum calibration; however the ZoneMaster can easily be calibrated to suit your own equipment, preferred materials and methods. The ZoneMaster uses a sensor which measures a 4 mm diameter spot of the projected image. The unit displays grade and exposure information. To get the best from it you need a good enlarger timer, with 1/10th second resolution. Used in combination with a RH Designs 'Timer2' the exposure times are automatically fed into the enlarger timer so that exposures and test strip exposures are automatically controlled. It is the presentation of the exposure information which is significantly different to other meters.

Features

Print Tone Control

The ZoneMaster can record and display up to eight spot measurements from the negative as projected on the enlarger baseboard, and will suggest an initial exposure based on a correct highlight exposure for the selected paper contrast grade. Each exposure reading lights a LED alongside a 15 segment grey scale, thereby indicating the equivalent tone on a print made using the current time and grade settings. It is possible to adjust exposure and paper contrast using this grey scale display to visualise and refine the print tones without making a test print.

Film Development Control

The ZoneMaster incorporates a densitometer function. Each time a measurement is made, the display shows the image intensity relative to the brightest sample taken. In combination with a controlled exposure of the negative with a reference subject (e.g. a Zone System test), negative contrast control and film-to-film de-

velopment consistency can be assessed without the need for an expensive purpose-made densitometer.



Automatic Intelligent Test Strips

The ZoneMaster has the ability to calculate seven-exposure test strips in 1/3rd, 1/4th, 1/6th or 1/12th stop increments centred about the displayed exposure time. Incremental exposures for test strips are displayed to the nearest 1/10th second. Test strips can be helpful when refining exposures from difficult negatives or when visualisation using the grey scale alone is not sufficient. The test strip generator is also used for calibration purposes.

F-Stop Exposure Times

Exposure times can vary between 1.5 and 250 seconds and are displayed to the nearest 1/12th stop. These exposure times are calculated in equal exposure steps of 1/3rd, 1/4th, 1/6th or 1/12th stop. The exposure can be adjusted manually using the exposure override buttons both before and after exposure metering. The ZoneMaster's timer can be used independently - it is not necessary to take a light reading in order to use the countdown timer.

Additionally, the ZoneMaster has built in adjustment to compensate for paper reciprocity failure. Our measurements from a selection of popular papers show that they all lose or gain about 2/3 to 1/3 stop sensitivity if the light intensity lowered or increased by 4 stops. This is apparent and measurable with short and long exposure times alike. The time calculations built into the unit reduce the exposure error to +/- 1/6th stop for a four stop change in light intensity. This improves exposure accuracy with big enlargements and dense negatives.

Calibration

The built in calibration suits Ilford Multigrade paper but can be modified to cover many different enlarger / paper combinations. Both exposure time and contrast range can be adjusted for all paper grades, so for example if your prints are coming out too light, you can enter a positive exposure compensation into the ZoneMaster to restore correct exposure. This is akin to adjusting your camera's ISO setting for optimum results with a particular film. Eight separate calibration tables (called paper sets, and shown on the display as PAP 1 (i.e. Paper 1), PAP 2, PAP 3 ... PAP8) can be programmed to accommodate eight different materials e.g. RC and FB papers, or matt and gloss surfaces. Instructions are included for you to make your own custom print grey scale which will maximise the accuracy of the ZoneMaster's readings.



Measurement Range

The ZoneMaster calculates exposure times to the nearest 1/12th EV step. It has a thirteen stop working range, and will give out of range warnings for dark and light extremes. The internal measuring system works to an accuracy of 1/60th stop.

Terminology

The following frequently used expressions are defined here:

Exposure compensation: a change to the ZoneMaster's calculated exposure time in order to produce a correctly exposed print. This compensation will normally be entered into the calibration tables for permanent use.

Exposure offset: a temporary change to the ZoneMaster's calculated exposure time in order to darken or lighten a print to taste.

Calibration: the process of matching the ZoneMaster to a particular combination of equipment and materials. Both exposure and contrast settings can be calibrated and the data are stored in calibration tables in the ZoneMaster's memory.

Paper set: any of the eight sets of calibration data stored in the ZoneMaster's calibration tables.

Step-size: A full stop represents a large change to a print exposure! The timer system uses a range of alternate fractional f-stop exposure step-sizes; 1/12th, 1/6th, 1/4th or 1/3rd stop for each single press of the time buttons. The test strip mode uses the same exposure increment. User calibrations are specified in the finest, 1/12th stop step size.

Basic Use


Setting Up

Switch the meter on using the switch on the left hand side. The display will light all segments, display the default step-size and then show the paper set in use (e.g. PAP 1) followed by the initial grade (2) and exposure time (15.0) The front panel of the main unit and its display and controls are illustrated in Fig. 1. The sensor area is defined by the circular aperture at the centre of the cross-hair graphic at the top of the unit.



Controls

There are 8 buttons on the box (refer to Fig.1):

1. **=** Darker (Exposure Increase) button / step-size change
2. **B** Lighter (Exposure Decrease) button / step-size change
3. **@;** Harder (Contrast Increase) Button
4. **?<** Softer (Contrast Decrease) Button
5.  Print countdown/test strip
6. **;** Initiates a light measurement.
7. **7** Clear measurements / test strip / calibration
8. **G** Calibration button

Darker =

Press to increase exposure by one step before or after making an exposure measurement. During calibration, this button is used to increase the exposure compensation and contrast range settings. (See Calibration)

Lighter B

Press to decrease exposure by one step before or after making an exposure measurement. During calibration, this button is used to decrease the exposure compensation and contrast range settings. (See Calibration)

Darker and Lighter together

Press both together to allow the exposure step-size to be changed. This can be done during use and sets the default exposure step-size. After the current step-size is displayed, press Darker or Lighter to select the desired step-size. Press both together to store and resume normal operation. This step-size is now the default and will be remembered when the unit is turned off.



Fig.1. Controls and Display



Harder @;

Press to increase the paper contrast setting by one half grade.

Softer ? <

Press to decrease the paper contrast setting by one half grade.

Print ⌚

a) Press Print briefly to start a count down of the print exposure time, for use with manual enlarger control. (This can also be used as a general purpose count down timer)

b) Press Print during the calibration sequence to step through the process. (See Calibration)

c) Press and hold Print to start a test strip sequence; subsequent short presses of Print will step through the sequence. Note that this is a display only; the count down timer function is not available during a test strip sequence.

Clear 7

a) Press to clear any measurement values from memory. The currently displayed exposure time is retained.

b) When making a test strip, press between strip exposures to abort the sequence.

c) During Calibration, press Clear to remove any calibration offset or contrast adjustment and restore the factory settings. (See Calibration)

Calibrate G

a) Press briefly to select the desired paper set. These are selected in order (i.e. the sequence PAP1, PAP2, PAP3,... PAP8, PAP1 etc.)

b) Press and hold (for one second or more) to enter calibration mode. (See Calibration)

Measure ;

a) Press and release this button briefly to take light measurements. On its own the ZoneMaster cannot determine whether the safelight is illuminated; to obtain accurate readings the safelight must be switched off while taking measurements.

b) Press and hold this button for one second or more to enter or exit Densitometer Mode.



Understanding the Display

The display is divided into four sections; refer to fig.2.

1) The Grade digit shows the currently selected paper grade. Half grades are indicated by illuminating the decimal point of the grade digit. The lowest contrast grade, called 00 by Ilford and -1 by Kodak, is indicated by a small o.

2) The Time display has three digits, and indicates the currently selected exposure time (from 1.5 to 250 seconds). During calibration, this area of the display is also used to show exposure offsets and contrast range. Simple messages are also shown on the Grade and Time digits at certain times.

3) The Bar-graph is used to indicate print tones by lighting LEDs next to the grey scale.

The Grade setting can be altered at any time using the Harder and Softer buttons. The Time setting can be altered at any time using the Darker and Lighter buttons. Fig.3 shows the result of pressing Harder and Lighter once each, giving a Grade of 2.5 and a Time of 13.1 seconds.

Making your first print

For accuracy, all metering must be carried out with **no filters in the enlarger** and with **all safe-lighting turned off**. The following instructions assume that variable contrast paper is in use; we suggest you learn how to use your ZoneMaster using VC paper (ideally Ilford MG IV) even if you will be using fixed-grade papers for

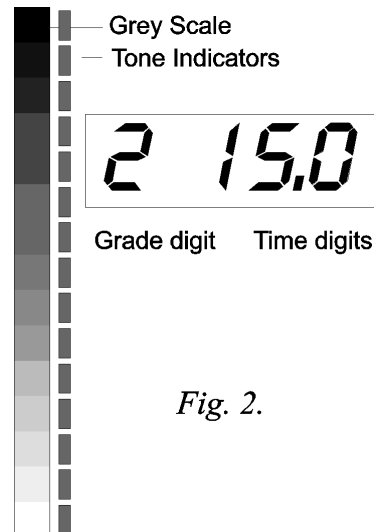


Fig. 2.

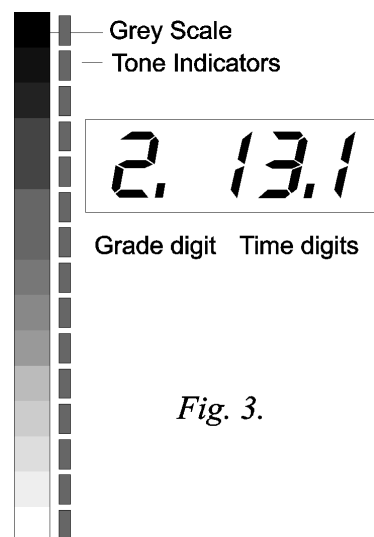


Fig. 3.



most of your work. It is reassuring and instructive to obtain useful results from the start with a minimum of calibration adjustments.

Remove any contrast filters from the light path. Set colour and variable contrast heads to white light. If you are using a variable contrast head with green and blue tubes such as the Zone VI or Ilford Multigrade 500, set it to the Focus position.

Choose a familiar negative **with a full range of tones** that you know prints well on a medium grade of paper (1-3). Switch the enlarger on and compose and focus the image. Set the lens aperture to the setting you will use to make the print exposure. **SWITCH OFF YOUR SAFE-LIGHT(S).**

Position the remote sensor in a shadow (clear negative) area of the image and press and release the Measure button. During a short delay whilst the sensor settles, the message 'BUSY' is shown on the display followed by a brief display of the density (d0.00). Finally the display indicates a suggested highlight exposure time as shown as in Fig.4.

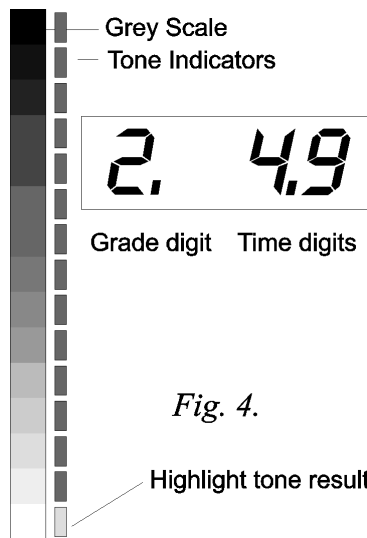


Fig. 4.

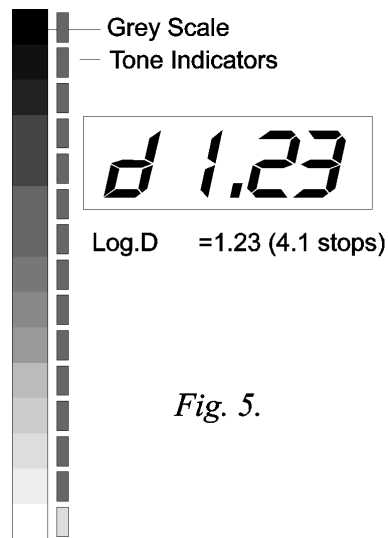


Fig. 5.

Position the remote sensor in a highlight (dense negative) part of the image and press and release the Measure button. After a longer delay (allowing the light sensor to react to the lower light level), the measured density range in logarithmic units is shown temporarily (Fig.5) followed by the new exposure time and two print tone indications as shown in Fig.6. Again, the suggested exposure is adjusted to give near-white (a print density of D0.04) for the highlight exposure.

Adjust the paper grade setting as follows:

If either of the LEDs at the ends of the grey scale are flashing, this indicates that the contrast range of the negative may be too great for the paper grade setting. Reduce the grade setting using the Softer button until the LEDs just stop flashing. Note: if for your measurements you chose highlight and shadow areas with little or no detail, set the grade so that the LEDs just flash.

If the LEDs are not at the ends of the grey scale, but close together, this indicates that the contrast range of the negative is too small. Increase the paper grade setting using the Harder button until the end point LEDs are illuminated. If you increase the grade too far, the shadow LED will flash to warn you that shadow detail will be lost; however if for your measurements you chose highlight and shadow areas with little or no detail, set the grade so that the LEDs just flash. Refer to Fig.7.

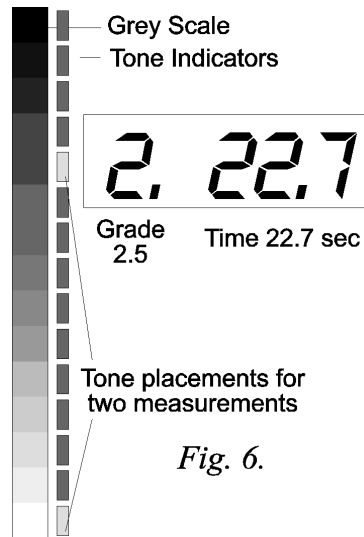


Fig. 6.

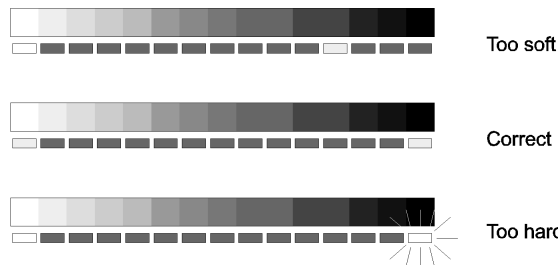


Fig.7

When you are happy with the grade setting, switch off the enlarger. Do not be alarmed if the grade and time settings on the ZoneMaster are significantly different from those you have used in the past with the same negative; there are a number of possible reasons for this which we'll come to later.

Set your enlarger filtration to the grade indicated on the ZoneMaster's grade display. (If you are using a colour enlarger, use the dual-filter (yellow and magenta) settings. Single filter settings will give erroneous results without using the alternative calibration in the tables. Filter settings are published by the paper manufacturers, and are also listed on Page 31 of this handbook, but please re-



member that they are only a guide to be used as a starting point.)

At this point either press Print on the ZoneMaster (manually switch the enlarger on and off with the aid of the countdown display) or transfer the displayed time to your current enlarger timer. Either way, expose the paper for the displayed time. Process and dry your print and examine it carefully. In most cases, if you are using a standard enlarger with tungsten/halogen illumination and a VC filter set, the print will be close to correct in both exposure and contrast. However, under some circumstances this may not be the case.



Fig. 8.

Print too light or too dark - making a Test Strip.

If your print is close to being correctly exposed but is a little too light or too dark, (Fig.8) adjustments can be quickly made with the help of auto test strip. Without altering any of the ZoneMaster's settings, press and hold Print again to calculate a test strip sequence around the displayed time. The grade digit will show t to indicate a test strip sequence. Place a piece of paper in the easel, and expose the whole of the paper for the indicated time. Press Print on the ZoneMaster to display the next exposure time. Two times are shown, the first is the incremental time, and the second is the total time. Cover a strip of paper, and expose for the incremental time. Repeat this sequence, progressively covering the paper, for the complete test strip sequence of seven exposures (Fig.9). Process and dry your test strip, and examine it carefully.

One strip should be correctly exposed. If, for example, it is two strips to the darker side of centre, this indicates that the correct exposure is two exposure steps more than the Zone-Master's calculations. If it is

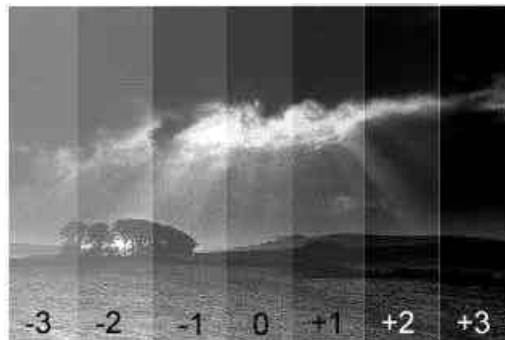


Fig. 9.

one strip to the lighter side, that means one step less than calculated. The number of steps is the exposure compensation that is necessary for that paper type and grade combination. Fig.9 shows a correctly exposed test strip. Note: The step-size, can be 1,2,3 or 4 twelfths of a stop at this time, so for convenience avoid changing the step-size before making the exposure adjustment.



Change the ZoneMaster's exposure setting by the amount just determined from the test strip. For example, if the required compensation is two steps darker than recommended, press Darker twice, and so on. (When you adjust the exposure time setting, the display will briefly show the offset; the grade digit shows C and the time digits the amount of compensation in 1/12ths of a stop, e.g 3, -1 etc.) Make another print; this one should be correctly exposed. Make a note of the exposure compensation display; you can enter it into the ZoneMaster's memory later on so that future prints at that setting will be correctly exposed.

If your first print is much too light or much too dark, first of all check that you have taken the measurements in white light, with all safe-lighting switched off, and then remembered to replace the filters in the enlarger. This is an easy mistake to make! There are many possible reasons for a result which is a long way out from the calculated exposure; these include the type of enlarger illumination and the type and age of the filters in use. There are others which we'll discuss later. Cold light enlargers will typically require a considerable negative offset (2 or 3 stops is not unusual, i.e. 24-36 twelfth exposure steps) owing to the different light spectrum they emit compared to the tungsten-halogen source for which the ZoneMaster is set up. Some VC heads and colour heads have filter factors widely different to those of the standard Ilford filter set.

To find the exposure compensation required when the amount is greater than the test strip mode can accommodate, first increase or decrease (as appropriate) the exposure time by five steps. Then make a test strip as described above. You should find that you have a correctly exposed area on the test strip. If still more compensation is required, increase the offset by another 5 steps and try again. To work out the compensation necessary, don't forget to add the initial offset to the figure you derive from your test strip; for example, if the offset on the test strip is -1, and you've already increased the exposure by five steps, then the required figure is $-1 + 5$, or 4 steps.

You can continue to use your ZoneMaster for printing by adjusting the exposure by the required amount each time you make a print, but we suggest you enter the figures into the calibration memory as described later on so that the ZoneMaster's calculations will in future be correct without manual intervention. Remember that if you were using a step-size of 1/3rd stop, each step is 4/12ths!



Print too soft or too hard

This situation is unlikely if you are using standard VC filters, although bear in mind that your own personal taste will have some bearing on your interpretation of the result. The extremes of the grey scale are not paper-base white and maximum black. Rather, they represent the points at which the curve of the paper starts to flatten out and detail is lost. In Zone System terms, this represents zones 2 and 8 approximately. If you like a punchy print, you may find that setting the grade such that the LEDs just flash gives you a result more to your taste.

If you are using a colour or VC head, the filter settings may not correspond exactly to those of discrete filters. You have two choices under these circumstances; either you can adjust your enlarger's filtration to match the contrast range of the ZoneMaster, or you can adjust the ZoneMaster's settings to match your enlarger. Of course, you can also simply make adjustments using the grade settings - after some practice you will learn how the grey scale indicators correspond to the results you obtain; if your favoured result involves flashing LEDs, that doesn't indicate a problem, it is merely a warning of possible detail loss. If your measurement was from an area with little or no detail on the negative, then the corresponding LED should be flashing. Fig.10 shows the effect of contrast adjustments.



Fig. 10.

Full details of exposure and contrast adjustments are given in the Calibration section. Please note that the described contrast measurement technique can only be carried out after exposure compensation is corrected!

A Note on the Use of Filters and Colour / VC Enlargers for Changing Paper Contrast

The ZoneMaster only stores full grade exposure and contrast settings for convenience and simplicity of calibration. Half grade settings are calculated from a simple average of the two adjacent full grades.

When using a Colour Enlarger head to change print contrast, the exposure adjustment from Grades 00 to 5 is smooth and continuous, so all half grade calculations will be accurate. We recommend that at first the constant exposure

filter settings are used; these are a combination of yellow and magenta filtering intended to maintain consistent exposure across the grades. If the simpler single filter settings are used, wider exposure compensation settings will be needed. Published filtration guidelines are given on Page 31 of this manual.



Variable Contrast enlarger heads normally incorporate exposure compensation, and will often have neutral density filters in addition. Again, contrast adjustment is smooth and continuous.

If you are using discrete filters, e.g. Ilford's Multigrade Filter Set, the required exposure for grades 4 to 5 is approximately twice that for grades 00 to 3.5. As a result the calculated exposure for grade 3.5 can be 0.3 to 0.5 stop over exposed. Before printing at Grade 3.5 reduce the exposure time by two or 3/6ths stop.

More Advanced Metering and Printing

Multi-spot metering

The ZoneMaster can measure and store up to eight light readings from any one negative. This allows you to inspect the tonal range of the resulting print and make any necessary adjustments. Typically, the extremes of the negative are measured, together with one or more important mid-tones. Using the Grade and Exposure buttons together with the grey scale you can observe the tonal relationships between important areas of the print and how they change relative to each other without the need to make test prints. This can be very useful for portraiture for example, in which it is important to place skin tones accurately.

Points about Metering

1. Exposure will be calculated only with respect to the highlight measurement (i.e. darkest negative area). Mid and shadow tones will be indicated but do not affect the calculated exposure time.
2. The LED representing the most recent measurement will flash briefly to assist identification. During this period, the display shows the relative density of the negative as a log.D figure (refer to Fig.5). The density measurements are always relative to the brightest measurement so for them to be useful ensure that you meter the brightest negative area (deepest print shadow) first.
3. If the exposure time required to print the metered negative is out of range (too short or too long), press Clear to clear the measurements, adjust the lens aperture accordingly, and repeat the measurements.
4. Clear can be used at any time to clear all the current measurements, but it



cannot be used to clear only the most recent.

5. Switching to a different paper set (press Calibrate briefly) will illustrate the results obtained on the new paper; measurements are stored, and the exposure time will be recalculated to suit the new paper setting. This paper set will become the default should you turn the unit off and on again.

6. If a manual exposure offset has been entered after taking measurements, changing the grade setting will clear it.

7. An attempt to take more than eight measurements results in the display showing EEE and the measurement will be ignored.

Other Features and Facilities

Judging the Negative

The two negative areas that concern most printers are the shadow and highlight areas. If the negative has been exposed and developed well, both will have detail in them. It is the relative negative density of these textured extremes that often mandates the grade of paper. With variable contrast paper, it is additionally possible to use split-grade exposures and various dodging and burning-in techniques to make the most of the negative. The following sections describe various features of the ZoneMaster which are useful to the more advanced worker.

Contact Sheet Exposures

It is good practice to make a contact sheet of the entire film before printing. To find the maximum information from the film it is often best to use a soft grade of paper, i.e. Grade 1 or 0. The meter can be used quickly and easily to determine the optimum exposure for this contact sheet.

With no negative in the enlarger, set a medium aperture, turn the enlarger on and place a piece of clear negative over the remote sensor window. Take a light measurement; this gives a highlight indication. Check the meter grade setting, and set up the enlarger filtration accordingly.

Using the Darker button, increase the time until the LED moves to the far shadow end of the bar-graph (the black end). Turn the enlarger off with the Focus button and place the contact sheet maker under the enlarger.

Press Print to expose your contact sheet. If there are some very dark areas on the print, it is sometimes possible to detect the presence of detail by placing the print over a light-box or similar.



Calculating Fog and Flash Exposures

Fog exposures are just faint exposures of a blank image onto paper. They can be used to accentuate fine highlight detail or to put tone in an otherwise blank area of the image. Fog exposures are easy to calculate with the ZoneMaster.

With no negative in the enlarger, set a small aperture and take a meter reading. Adjust the exposure until the required pale white print tone is indicated, and make the exposure. For flashing (non-intrusive fogging), adjust the exposure until the highlight end LED blinks. (Tip: Use a soft grade setting for fog and flash exposures to leave shadow print density unaffected)

Calculating Burning In-Exposures (Single Grade)

A familiar problem, particularly to the landscape photographer, is the presence of an area in the negative which is much denser than the remainder such as a bright sky. Metering the sky and the deepest shadows usually results in the mid tones being squashed up against the black end of the grey scale and this would produce a most unsatisfactory print.

If the desired result is to have black shadows with mid grey grass and detail in the sky, it is unlikely that you can achieve this with one exposure. This is where the ZoneMaster excels.

Take readings from the sky, the shadow area, and the important mid tones. Positioning the extreme measurements at the ends of the grey scale results in the mid tones being displaced too far to the dark end of the scale (Fig.11a). Ignore the sky reading for the moment. Increasing the grade setting will separate the mid tones and shadow areas but can result in the extreme LEDs flashing. Decrease the

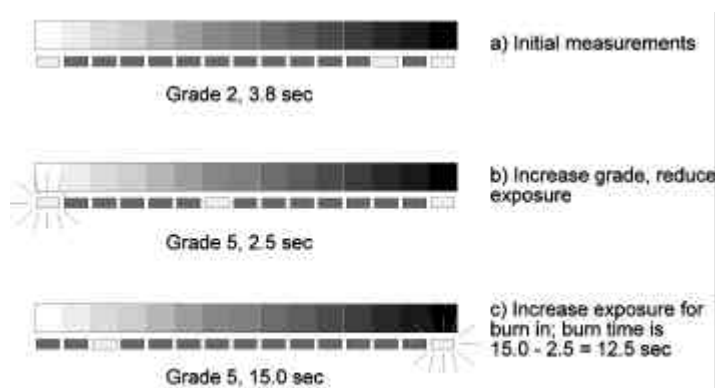


Fig.11. Burning in



time setting until LED representing the shadow area just stops flashing. Optimum shadow separation occurs one or two steps from the end of the grey-scale. The mid tones should now be close to the required shades of grey. Continue to adjust the grade and exposure settings until these tones are where you want them. (Fig.11b) We'll call this time T1 for reference. In Fig.11, it's 2.5 seconds.

Increase the exposure time until the LED representing the sky area stops flashing, or until it lies adjacent to the required sky tone (Fig.11c). The new exposure time indicated is that required to place the sky tone at the desired level. Call this time T2. In Fig.11, it's 15.0 seconds.

Set the exposure time back to T1, and expose the whole of the paper. Now change the time to T2, this is the burn in time. In Fig.11, it's 12.5 seconds. Set your timer to this time (if it's not possible to set the exact time, choose the nearest available setting), mask all of the print except the sky area to be burned in, and expose the sky.

With practice, you will find that you can control individual areas of the print very accurately using this method. For finest control use a step-size of 1/12th stop.

Metering Split Grade Burn In Exposures

There are some excellent books on this subject which explain the many varied techniques of split exposure and contrast printing. Some examples are listed in the Bibliography. The ZoneMaster can calculate the effect of split grade exposures for a single tone at a time. In the landscape example above, say the first print exposure was at Grade 4, and the sky was a pale grey tone. To calculate the burn in exposure for a moody sky at a softer Grade follow the simple sequence below:

Make the first exposure at Grade 4, noting the sky tone indication. Change the grade setting to, for example, Grade 1, and change the time until the same sky tone indication is shown. Note this exposure time. Change the time to darken the sky tone indication to the desired level. Note this longer exposure time. The required burn in exposure time is the difference between the previous noted times. This is much easier to do than to explain in writing!

Adjusting Exposure and Contrast for Portraiture etc.

The skin tones in a Black and White portrait are critical. After using the ZoneMaster for a short while it will become apparent which print tones best represent skin highlights and shadows. By altering the contrast and exposure settings it will be possible to place the skin tones, clothing and backgrounds on the required grey tones.

Remember that an increase in grade will widen the gap between two tones, but may require some dodging and/or burning in to restore the correct tones in other areas. The reverse is of course also true. After some experience you will learn the feel of the various controls and how they interact, allowing you to control the exact appearance of the print with minimum effort.



The Exposure and Grade Controls and the Grey Scale

The Exposure Increase and Decrease (Darker and Lighter) buttons adjust the exposure in steps of one 1/3rd, 1/4th, 1/6th or 1/12th of a stop. This does not necessarily correspond to one step on the grey scale, so at times you may find that a change in exposure is not enough to change the position of the grey scale LEDs. This will be more noticeable at the softer grades. Also, occasionally, only the darkest or lightest LED may change. This is perfectly normal and is due to the fact that the grey scale's 15 steps cover a wider exposure range on the softer grades of paper. Similar effects may be observed as the paper grade is changed. For information, the middle grey print density on the scale lies between the ISO speed point and a standard grey card. It is made using Ilford materials and filters. If the results from your own prints vary a little, please consider all the factors below:

Factor: Development time, temperature, dilution, agitation, age and usage. Result: Change in Contrast, DMax (i.e. maximum black)

Factor: Paper age, storage. Result: Loss of Contrast and Sensitivity

Factor: Safe-lighting, blackout, baseboard reflectance, enlarger light leakage. Result: Loss in Contrast

Factor: Filter Age, accuracy, type, colour head setting. Result: Change in contrast.

Factor: Enlarger lamp age, voltage fluctuations, warm up and cool down time. Result: Change in Exposure

Effects of Paper and Film Type and Enlarger Illumination

In general the type of film will have little effect on the results from the Zone-Master, so you can change film stock without worrying too much about the effects. However, chromogenic films such as Ilford XP2 do give different results, and if you use this type of film as well as conventional b/w stock it's worth calibrating one or more paper channels specifically for this film type.

Papers however can vary, and not just in speed and contrast. The characteristic curve of the paper will have a direct result on the ZoneMaster's accuracy and for this reason it can be worthwhile making your own grey scale for maximum print



prediction accuracy. For example, Agfa Multicontrast has a different curve to Ilford Multigrade IV and the mid grey on Agfa paper is typically slightly paler than the equivalent Ilford. The result of this in practice is that there are differences in the tonal separation of the papers in the highlight and shadow areas. Matt papers have a lower maximum density than gloss.

A full discussion of these effects is outside the scope of a handbook such as this; we mention it only to draw your attention to the number of possible factors that can affect the results you will obtain with the ZoneMaster. You should be prepared to experiment with your own materials, equipment and methods in order to determine the settings which are right for you.

The type of enlarger illumination, i.e. diffusion or condenser, has little effect on the ZoneMaster as it is always reading what the paper sees. However, there are considerations which should be borne in mind. Cold light heads typically produce light with more blue and green content and less red. This will result in the ZoneMaster tending to over-expose. Cold light enlargers which are not specifically designed for variable contrast paper will often produce a harder contrast, particularly when exposing at the softer grades. This can be compensated for to some extent by additional fixed-yellow filtration.

Certain other enlarger models have filter factors which differ markedly from the norm. These include the Leitz Focomat VC head which has neutral density filters incorporated, allowing a brighter image for focussing. These heads typically require an exposure compensation of about one stop (i.e. +12 twelfths or equivalent). The Durst M670 VC head often requires about 1/2 stop less exposure (i.e. -6 twelfths).

It's a little known fact that even halogen bulbs exhibit changes in their light output as they warm up. You can see this happening if you switch such an enlarger on from cold and then take several meter readings over a period of a minute or two. Once fully warmed up, the lamp will emit less light than when cold. It's advantageous therefore to ensure your enlarger is fully warmed up before starting to print, especially if you are calibrating your ZoneMaster. Halogen bulbs also gradually emit less light as they age, but this will be compensated for by the ZoneMaster; it is short-term variations that you need to be aware of. Cold light heads are particularly troublesome in this respect.

Changing Step Size

Press Darker and Lighter buttons together to display the exposure step-size. This can be done in the middle of metering process without losing exposure information. After the current step-size is displayed, press Darker or Harder to get the desired step-size. Press both together to store and resume normal operation. This

step-size now is the default and is remembered when the unit is turned off.



Densitometer Mode

In normal use, each time a measurement is taken the ZoneMaster briefly displays the density of the measurement relative to the brightest sample. There is a limit of eight on the number of measurements which can be taken in this way. For convenience when you wish to analyse only the density of negative(s), the ZoneMaster offers a Densitometer Mode. In this mode, the relative density of each measurement is displayed continuously, the light level is not stored, and the print tone indicators are not used. There is no limit to the number of measurements which can be taken. For maximum accuracy, the meter disregards the low intensity end of the light measuring range: If the light levels drops into this range the display will show 'Lo' as a warning. With this system a D.max of 2.55 is possible, with short measuring times and optimum performance.

To enter Densitometer Mode, switch on the enlarger. Press and hold the Measure button for approximately one second until the display shows LOG. Press and release the Measure button to take a density measurement. The first measurement will be displayed as 0.00, and subsequent measurements will be relative to this one. If a subsequent measurement is brighter than the first, 0.00 will be displayed and the new measurement becomes the zero point. For meaningful results therefore, ensure that the first measurement is taken from the brightest area (e.g. film base, or negative rebate area).

To exit Densitometer Mode, press and hold the Measure button until the display returns to normal grade and time display. Any measurements which were stored before entering Densitometer Mode will have been lost.

Calibration



Introduction

Calibration is the process of matching your ZoneMaster's characteristics 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 can be worth the effort involved as when complete, your ZoneMaster will be able to predict accurately the results you will get on your prints.

Why it's necessary

Photography is a very inexact science, and while the ZoneMaster 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 therefore provide the ZoneMaster with a comprehensive calibration system which can be used to personalise it to your requirements in terms of both exposure compensation and contrast matching.

Put another way, exposure compensation 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.

What's involved

There are two separate aspects to calibration; exposure compensation and contrast matching. Of these, exposure compensation is the most frequently required. If, when you made your first prints, you determined the amount of exposure compensation required then you have already done the hardest part of entering an exposure compensation.

Because filter factors etc. can vary from grade to grade, the Analyser can be calibrated for both exposure and contrast at every full grade. The half grade settings are calculated from the adjacent full grades. If you have already determined the required compensation for the grades you use most often, you can enter these into the calibration tables as described below.

Contrast matching is trickier, and should not be attempted until you have correctly calibrated the exposure compensation.

Entering an Exposure Compensation

1. Press and hold Calibrate until the display shows "CAL". Release the button;



the display will show 'oFF' (to confirm exposure offset mode) and then the paper set currently selected (PAP 1 etc) and then show the softest grade "o". The time digits will show the current compensation, if any, in twelfths of a stop.

2. If necessary, select the paper set you want to calibrate by briefly pressing the Calibrate button until the display shows the correct PAP number.

3. Using the Harder and Softer buttons, select the grade at which the compensation is to be entered.

4. Using the Lighter and Darker buttons, enter the required compensation. For example, if the compensation required is -1/6th stop, press Lighter twice. Note: if a compensation has already been entered the display will show the original amount plus the -2 you've just entered. For example, if PAP 2 already contains a compensation of -1, if you enter another -2 the time display then shows -3.

5. Repeat steps 3 and 4 for any additional grades for which you have determined the compensations. If you want to enter data for more than one paper set, repeat steps 2 to 5 as necessary.

6. Press Print to proceed to the contrast calibration mode. The contrast mode is confirmed by 'cont' on the display. If you are not going to enter any contrast data, just press Print again. The ZoneMaster will reset and your exposure compensations will have been stored.

7. If at any point you become confused or uncertain about the exposure compensations you have entered, the factory settings can be restored. To clear offsets, press Clear whilst in the offset mode. This restores a value of zero exposure compensation to all grades in the current paper set.

Entering Contrast Information

The ZoneMaster stores contrast information as an ISO(R) number. ISO(R) is a logarithmic number such that 30 units represents one stop of contrast range. So a paper with an ISO(R) of 150 can accommodate five stops of negative contrast and is equivalent to grade zero. Typical papers range from 40 to 180 units. Please do not confuse negative contrast with subject contrast; the relationship of the two depends on the film and development characteristics.

ISO(R) information can normally be supplied by the manufacturers of the paper you are using and should be used as a starting point if you are attempting to calibrate a new paper type. To enter or modify contrast information proceed as follows:



1. If you are not already in calibration mode, follow step 1 of the previous section so that 'off' is briefly shown on the display. Otherwise proceed to step 2.
2. Press Print again. The display shows 'cont' briefly to confirm. The Grade digit shows 'o' and the time digits show a three figure number. This is the present value of ISO(R) for grade 00.
3. If necessary, select the paper set you want to calibrate by briefly pressing the Calibrate button until the display shows the correct PAP number.
4. Using the Harder and Softer buttons, select the grade at which the ISO(R) data is to be entered.
5. Using the Lighter and Darker buttons, adjust the ISO(R) number to the desired value.
6. Repeat steps 3 and 4 for any additional grades for which you have determined the ISO(R) numbers.
7. If at any point you become confused or uncertain about the contrast figures you have entered, the factory settings can be restored by pressing Clear while in the contrast setting mode. This restores the values for Ilford MG IV to all grades in the current paper set.
8. When you have finished entering the data, press Print. The ZoneMaster will reset and your contrast figures will have been stored.

Advanced Calibration Instructions

Introduction

This section describes some of the more advanced calibrations and techniques that make the most of the ZoneMaster's potential. Advanced calibration is worthwhile, especially when you are combining special papers with developer, toner and paper finishes. The purpose of calibration is to match the displayed print tones as closely as possible to the tones on the final print.

We suggest that you don't attempt the processes described in this chapter until you are familiar with the ZoneMaster's general operation, in particular the making of test strips.

Advanced Calibration. How to Determine an Exposure



Compensation

The keen user will want to derive any adjustments for their particular materials or needs by a repeatable process. This can be done by altering the built in calibration to match the printed grey-scale OR by making your own grey-scale OR a combination of both.

A correct grey-scale is one that starts on near white and finishes on near black. Due to the typical paper characteristics the middle tone is usually a shade lighter than Kodak grey, at about 22% reflectance. You need to adjust the exposure compensation for each grade accurately before considering the contrast range adjustment. (Most papers follow the ISO(R) contrast value guidelines, so there is often less need to adjust the contrast calibration anyway).

Because filter factors etc. vary from grade to grade, the ZoneMaster's calibration tables have a compensation entry for each individual full grade, so a full calibration requires that a test strip (as described below) is made at each full grade. A particular grade can be calibrated at any time; there is no need to repeat the full procedure if only one grade requires changing.

To match the exposure calibration to the meter's grey scale, place a blank negative (i.e. one with no detail, such as unexposed film leader) in the enlarger and take a single meter reading so that the highlight end LED on the grey scale lights up. Choose the lens aperture such that the indicated exposure is between 10 and 20 seconds (clear and repeat the measurement if necessary until this is the case). Make a test strip at this exposure. (Press and hold Print to enter the test strip mode.) You should end up with a test strip which contains a very pale grey somewhere. If the 'off-white' grey tone that matches the highlight end of the ZoneMaster's grey scale is in the centre of the test strip, no compensation is necessary. If the strip is too dark or too light so that no area matches the 'off-white', increase or reduce the exposure time by 5 steps and repeat.

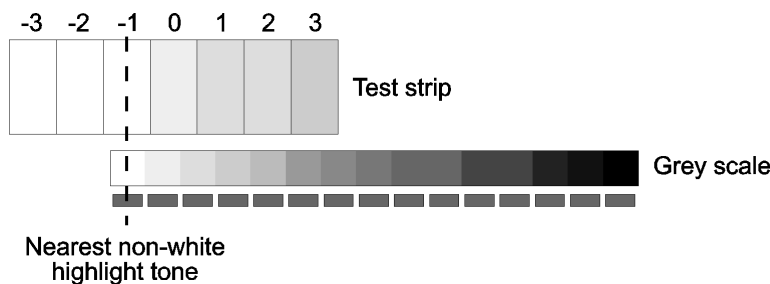


Fig.12



The exposure compensation is measured in 1/12th stop increments. The position (with respect to the central test strip exposure) of the grey tone on the test strip that matches the highlight tone on the ZoneMaster's grey scale gives the necessary compensation in STEPS. The correct compensation is the number of steps multiplied by 1,2,3 or 4 for a step-size of 1/12th,1/6th,1/4th or 1/3rd stop. In Fig.12 the nearest tone to 'off-white' is one step to the left of the middle, i.e. the whole strip is one step too dark, so the required compensation is -1. With a 1/4th stop step-size, the compensation amount is -3. This exposure compensation can then be programmed into the meter, for that particular grade, using the procedure in the section "Entering an Exposure Compensation" on page 23.

Calibrations only exist for full grades since half grade calibrations are calculated as the average of the two neighbouring full grade values.

Advanced Calibration. How to Determine Contrast Adjustments

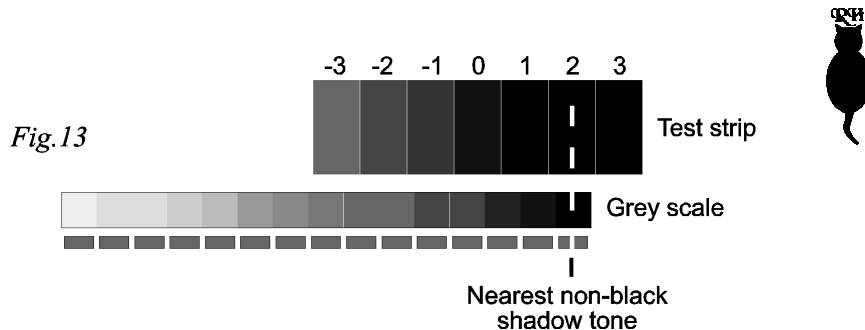
Do not attempt this contrast calibration technique until the exposure calibration is correct! With an accurate highlight calibration, accurate contrast calibrations using the built in test strip maker are straightforward.

Contrast calibration should begin with the built in setting or the paper's ISO(R) setting.

The contrast setting can be derived by determining the accuracy of the grey scale shadow exposure or by recording the difference in negative densities which reproduce as near white and black in a final print. The factory settings are derived by examining a contact sheet of a calibrated step-wedge in 0.5 stop increments with a densitometer. Contact sheet images are selected that represent near white and black (logD 0.03 and logD 1.9) and the density difference of the respective step wedge strip is programmed into the software.

Without the necessity of specialist equipment, the ZoneMaster's test strip maker can be used to make accurate adjustments to the contrast calibration.

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 shadow end LED on the bar-graph lights up. 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. Examine the test strip and decide on the position (with respect to the middle strip) on the test strip where the tone matches the darkest tone on the ZoneMaster's grey scale. If it is in the middle, then no adjustment is required. If the middle strip is too light then the contrast range needs to be increased. In the example in Fig.13 the matching black tone is two



steps darker than the middle. Hence, in the example in Fig.13, the ISO(R) number for the grade being adjusted requires increasing by 2 steps. If 1/6th stop step-size is being used, increase the contrast setting by $2\text{steps} \times 5 = 10$ units. If thirds are being used, increase the contrast by $2\text{steps} \times 10 = 20$ units. To alter the calibration setting, see the instructions in the previous section.

If you are attempting to calibrate a new paper type, first of all enter the manufacturer's published ISO(R) settings into the ZoneMaster's calibration table you intend using (PAP1, PAP2, etc). If figures are not available, start with either of those listed (i.e. Ilford or Agfa) on page 21 of this handbook.

Advanced Calibration. Making your own Grey Scale.

This section describes how to make your own grey-scale to replace the one that comes with the unit. Making your own enhances the accuracy of print predictions for your own paper, enlarger and chemicals. It takes a little concentration to do this the first time, but it is worth it.

It is only necessary to do this once for each paper type since The ZoneMaster can use the same grey-scale for all the paper grades. For best results you need to make a good 15 step test strip, starting on a near white, finishing on a near black. To achieve this full range of tones you need to:

1. Identify the grade of paper whose contrast range is closest to ISO(R) 105, or approximately 3.5 stops. (Normally grade 2 or no filtration)
2. Ensure that the meter exposure calibration for this grade is accurate such that a blank negative prints a shade darker than base white. To verify the exposure is accurate, follow the instructions in 'How to Determine Exposure Compensation'. Half grades can be used if appropriate.

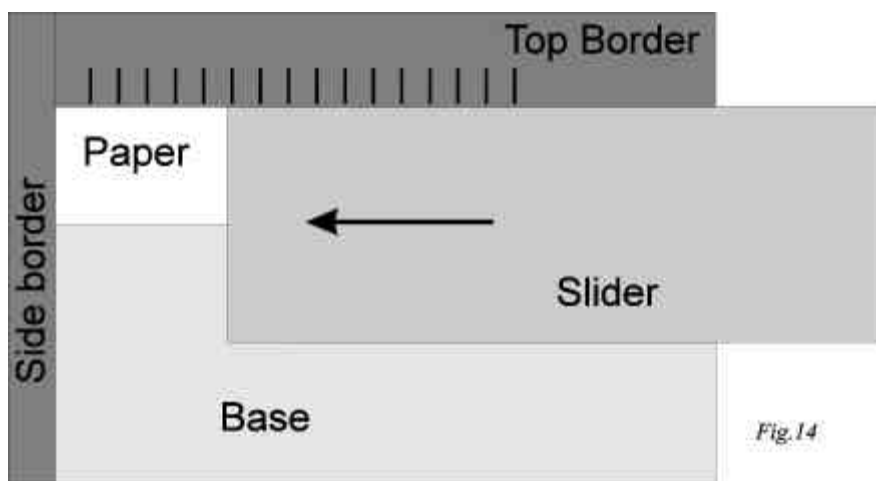
Making the Grey Scale

To make a neat scale, which has the same spacing as the bar graph LED's, a simple cardboard template design is described with a sample ruler on page 36 of



this booklet, and shown assembled in Fig.14.

Fix the template to the enlarger baseboard with some sticky tape, and put a blank negative into the enlarger. Take a measurement so that the highlight LED lights and an exposure time is shown. If necessary adjust the aperture and repeat the measurement to get a meter reading, (for the identified grade), of about 15 seconds. The scale is made using an extended (15 step) test strip sequence on a blank image.



Fix a piece of paper to your template with some tape and uncover all the paper. Press and hold the Print button to start a test strip sequence, then press the Calibrate button to initiate a 15-step test strip. ('grEY' is displayed briefly).

Using the Print button, expose, then slide the mask over the paper and repeat until the sequence finishes. As with a normal test strip sequence, Clear will abort this process.

Last but not least, develop with your standard settings, fix, dry and trim to fit for the aperture provided; refer to the diagrams on the back cover.

If your grey scale is too soft (i.e. the white and black are too grey) repeat at a half-grade harder setting. If it is too hard, repeat at a half-grade softer setting.

Suggested filter settings for colour heads, and suggested ISO(R) values



The use of proprietary under-the-lens filters gives accurate grades, short print times, and minimum enlarger movement during multiple printing. If you wish to use a colour head, the table on page 31 gives Ilford's suggested Yellow and Magenta filter settings for colour enlargers using Kodak units. Exposure index is (nominally) constant over the grade range so that minimal compensation is required. Note that with nearly all colour heads, grades 4.5 and 5 are not available with full magenta filtration, but extremely soft (with poor blacks) is possible with full yellow filtration. Similar tables can be obtained from published literature (see bibliography) and from paper and equipment manufacturers. The tables on Page 32 list suggested exposure compensation and ISO(R) values for several popular VC papers. These values are suggested as a starting point for the contrast settings in the ZoneMaster's calibration tables.

As shipped from the factory, PAP1-8 are set up for Ilford MGIV RC using filters. Pressing Clear during calibration of ANY table will restore basic Ilford MGIV settings.

For other papers, see the table on page 31. If the paper of interest is not listed please consult the paper supplier or manufacturer for the suggested settings but always remember that these settings are a guide only. We have measured a number of papers during recent months and keep an up to date set of calibration information on our web-site. Filters vary between enlarger types and often between two examples of the same enlarger, and may fade over time.



GRADE	FILTER SETTINGS	
	Y	M
0	90	0
0.5	78	5
1	68	10
1.5	49	23
2	41	32
2.5	32	42
3	23	56
3.5	15	75
4	6	102
4.5	0	150
5	0	200+

Ilford's recommended settings for colour heads using Kodak filtration units

GRADE	FILTER SETTINGS	
	Y	M
0		
0.5		
1		
1.5		
2		
2.5		
3		
3.5		
4		
4.5		
5		

Use this table for your own preferred filter settings



Iford Multigrade RC Warmtone	Exposure offset (Steps)	Contrast Range
Grade 00	10	200*
Grade 0	10	163
Grade 1	9	149
Grade 2	9	123
Grade 3	9	101
Grade 4	8	81
Grade 5	7	66

Iford Multigrade FB Warmtone	Exposure offset (Steps)	Contrast Range
Grade 00	12	189
Grade 0	12	166
Grade 1	11	148
Grade 2	12	119
Grade 3	12	98
Grade 4	13	71
Grade 5	13	56

Iford Multigrade IV Fibre	Exposure offset (Steps)	Contrast Range
Grade 00	3	155
Grade 0	1	136
Grade 1	2	110
Grade 2	1	84
Grade 3	0	68
Grade 4	-4	52
Grade 5	-10	45

Barclay VC RC	Exposure offset (Steps)	Contrast Range
Grade 00	-14	140
Grade 0	-12	124
Grade 1	-14	115
Grade 2	-12	100
Grade 3	-14	90
Grade 4	-13	75
Grade 5	-12	61

Agfa Multicontrast Premium RC	Exposure offset (Steps)	Contrast Range
Grade 00	0	168
Grade 0	-2	140
Grade 1	-4	123
Grade 2	-5	105
Grade 3	-3	85
Grade 4	-6	69
Grade 5	-6	65

Agfa Multicontrast Classic FB	Exposure offset (Steps)	Contrast Range
Grade 00	1	176
Grade 0	1	148
Grade 1	-1	127
Grade 2	-1	105
Grade 3	-1	88
Grade 4	-11	76
Grade 5	-13	66

Kodak Polymax II RC	Exposure offset (Steps)	Contrast Range
Grade 00	-4	174
Grade 0	-6	144
Grade 1	-6	120
Grade 2	-7	113
Grade 3	-8	102
Grade 4	-3	73
Grade 5	-3	55

Kentmere VC Fibre	Exposure offset (Steps)	Contrast Range
Grade 00	-5	139
Grade 0	-6	121
Grade 1	-8	108
Grade 2	-8	89
Grade 3	-13	83
Grade 4	-18	72
Grade 5	-24	76!

Suggested calibration settings for popular variable contrast papers. These are provided *as a starting point* and should not be regarded as absolute. All figures assume the use of Ilford Multigrade Filters except those for Kodak Polymax II which were derived using Kodak filters.

(* No Dmax attainable on this paper at Grade 00)



Display Messages

EEE

1. Attempt to take more than eight measurements
2. Attempt to make a test strip when the exposure time setting is too long or too short

HI

The light level is too high (out of measurement range or would require an exposure which is less than 1.5 seconds)

LO

The light level is too low (out of measurement range or would require an exposure time which is more than 240 seconds)

Other messages are described in context within the text of the manual.

Quick reference for common operations

Making Test Strips

Press and hold Print to enter test strip mode. (Press Cal for a 15 step grey scale test strip.) Press Print for subsequent exposures until CLR appears on the display. Press Clear to abort at any time.

Densitometer Mode

Press and hold Measure to enter and exit Densitometer mode.

Change Paper Set

Press Calibrate briefly until display shows desired PAP number.

Bibliography

The following books contain helpful information on monochrome printing. This is by no means an exhaustive list, nor is it in any order of preference.

Nocon, Gene: *“Photographic Printing”*, 2nd edition, Virgin

Ephraums, Eddie: *“Creative Elements”*, 21st Century

Ephraums, Eddie: *“Gradient Light”*, Working Books

Rudman, Tim: *“The Photographers Master Printing Course”*, Mitchell Beazley

Notes





“Timer 2” Dual Mode Enlarger Timer

Timer 2 is a dual mode enlarger timer which can operate as a straightforward seconds timer or in an f-stop mode in which time is set in equal density steps. In the f-stop mode, changing the time by a given number of steps will always produce the same density change on the print, regardless of the original exposure. This makes dodging and burning-in easier and more predictable, and as a result can save time and paper. Timer 2 also has a built-in test strip mode which can time seven exposures centred around the set time.

A unique feature of Timer 2 is the ability to link to our ZoneMaster Enlarging Meter; the combination then behaves very similarly to our Analyser Meter/Timer. The ZoneMaster is used to take light readings from the projected negative, and the exposure time that it calculates is automatically transferred to Timer 2.

Timer 2 also has a safelight switching facility, a dimmable display, and can also compensate for the switch-on delay inherent in certain stabilised colour enlargers.

Features

Timing range 1.0 to 240 seconds with “pause and resume” interrupt facility. Microprocessor controlled.

Two modes, linear (seconds) and f-stop time settings.

Connects to our ZoneMaster enlarging meter for exposure measurement and print previewing.

Resolution (linear mode) 0.1 seconds from 1.0 to 14.9 seconds, 1 second from 15 to 60 seconds, 2 seconds from 60 to 240 seconds.

Resolution (f-stop mode) user-selectable steps of 1/12, 1/6, 1/4 and 1/3 stop intervals

“Burn - in” feature exposes for the difference between current and previous time settings

Safelight switching facility.

Socket for optional Footswitch.

Clear LED display with two brightness settings.

Optional start delay to compensate for the bulb “soft-start” time inherent in some stabilised enlargers.



StopClock - the f-stop Enlarger Timer

The ideal companion for your ZoneMaster

The StopClock Enlarger Timer uses the latest microprocessor technology to provide you with a versatile and accurate tool for total enlarger control. StopClock handles all aspects of exposure timing, leaving you free to concentrate on the creative aspects of print making. The f-stop method of printing is fundamental to StopClock's unprecedented ease of use; exposure time adjustments are made in terms of f-stops just like enlarging lens aperture and all camera exposure controls. Complex sequences of dodging and burning in can be programmed into StopClock's memory, so you can focus all your attention on the image. If you want to make the same print at a different size, or on a paper with a different speed, just change the basic exposure time for the new size or speed and StopClock's microprocessor calculates all the remaining steps automatically.

Ideal for use with the ZoneMaster, the StopClock provides the quartz-controlled digital accuracy essential for repeatable and reliable fine print making.

Features

Basic exposure times from 0.5 to 255 seconds, resolution 0.1 seconds from 0.5 - 25.5 seconds, 1 second thereafter. Two independent channels - perfect for split-grade printing.

Nine subsequent exposure times of 0.25 - 2.00 stops (resolution 0.25 stops) can be programmed, each calculated either relative to the base exposure or to the total exposure time thus far.

Each programmed step can follow on immediately from the preceding one, or the sequence can be paused and the enlarger lamp switched off.

Automatic test strip mode, for quickly producing test strips with 0.25 to 2.00 stop increments.

The clear LED display can be set to count up or down during exposure, and its brightness adjusts automatically to room lighting levels. In total darkness, the display dims to a level safe for colour printing.

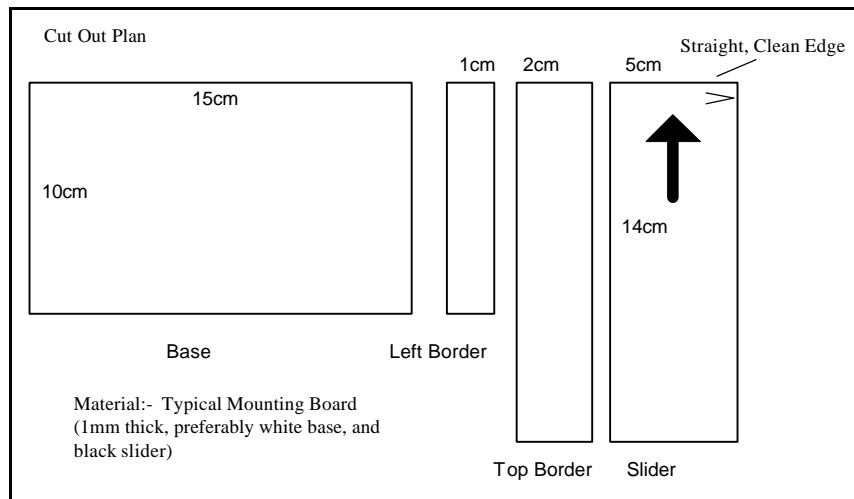
Audible beep at the end of each exposure, and optional seconds tick whilst the enlarger is switched on.

Automatic safelight switching; manual (focus) mode; "real time" mode for fine tuning of exposure; 750 watt switching capacity; comes complete with a footswitch for hands-free operation.

Exceptionally easy to use!



Plans for a cardboard grey scale template



Scale Ruler

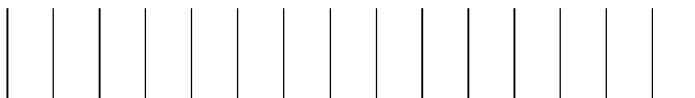
Spacing = 6.0 mm (0.24 inches)

Greyscale Markings

Black end

White End

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1



Once made, the grey scale can be trimmed (the final size should be 90x6mm) and attached to the front panel of the Analyser with a low strength adhesive. Suitable adhesives (such as Blu Tack or Prit Stick) will allow removal and replacement of the scale should you wish to change the paper type. (The grey scale supplied with the unit should be removed before attaching your own.)

Remember, when you attach the grey scale to your unit, align it carefully in the aperture with the black end uppermost!