ZoneMaster
Enlarging Meter

Instructions for use

Issue 2: March 1998.

RH Designs
Greystones, Buretersett, hawes, North Yorks DL8 3PH
***Tel*/Fax 01969 667776**
e-mail: info@rhdesigns.co.uk World Wide Web: http://www.rhdesigns.co.uk

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 Zone-Master 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.

CE *This product is designed and constructed in accordance with applicable European Standards*

Contents

Introduction

Thank you for choosing The ZoneMaster, the enlarging meter designed *by* photographers *for* photographers.

While it incorporates a system of calculating an appropriate exposure for the negative, the ZoneMaster is not an 'automatic meter'; it does not replace the intelligence or stifle the creativity of the photographer. It allows you to previsualise 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 3 mm diameter spot of the projected image. The display indicates grade and exposure information; it is the control and presentation of this information which is significantly different to other meters.

For accurate enlarger control, the ZoneMaster can be linked to the **RH Designs** *Timer2* dual-mode enlarger timer. The calculated exposure times will automatically be transferred to the timer.

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 the average tonal value 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 calculate the timings for seven-exposure test strips in 1/5th or 1/10th 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 97.5 seconds and are displayed to the nearest 1/10 second. These exposure times are calculated in equal exposure steps. For lower contrast grades 00 to 3.5, 1/5th stop exposure steps are used, and for higher grades, 1/10th stop steps. The exposure can be adjusted manually using the exposure override buttons both before and after exposure metering. The ZoneMaster incorporates a count-down timer with audible indication of the start and end of an exposure and as such can be used to time exposures in conjunction with a manual enlarger on-off switch. However, best results will be obtained either by using the **RH Designs** *Timer2* or manually transferring the indicated exposure time to an accurate electronic timer such as the **RH Designs** *StopClock*.

Calibration

The in-built 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 adusting your camera's ISO setting for optimum results with a particular film. Four separate calibration tables (called "paper sets", and shown on the display as PAP 1 (i.e. Paper 1), PAP 2, PAP 3 and PAP4) can be programmed to accommodate four 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 1/10th EV steps. It has an in-built 9 stop working range, and will give out of range warnings for dark and light extremes.

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 permanet 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 four sets of calibration data stored in the ZoneMaster's calibration tables.

Basic Use

Setting Up

Switch on by sliding the switch on the left hand side of the ZoneMaster towards the white end of the grey scale. The display will light all segments, show the paper set in use (PAP 1) and then display an initial grade (2) and exposure time (15.0). The front panel of the 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
2. ▽ Lighter (Exposure Decrease) button
3. ◁▶ Harder (Contrast Increase) Button
4. ▷◀ Softer (Contrast Decrease) Button
5. 🕓 Print start button
6. ✛ Measure button

7. ✗ Clear measurements / test strip / calibration

8. ✧ Paper Selection and Calibration button

Darker ▲

Press to increase exposure by one step before or after making an exposure measurement. If the grade setting is 4, 4.5 or 5, the step interval is one tenth of a stop; otherwise it is one fifth. During calibration, this button is used to increase the exposure compensation and contrast range settings. (See **Calibration**)

Lighter ▽

Press to decrease exposure by one step before or after making an exposure measurement. If the grade setting is 4, 4.5 or 5, the step interval is one tenth of a stop; otherwise it is one fifth. During calibration, this button is used to decrease the exposure compensation and contrast range settings. (See **Calibration**)

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

b) Press and hold Print to commence a test strip sequence, with further presses for each subsequent strip exposure. Note that owing to the short time intervals normally involved with making test strips, the count-down function is not provided.

c) During calibration Print is used to step through the calibration modes. (See **Calibration.**)

Clear ✗

a) Press to clear any measurement values from memory, but retain the last exposure time.

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

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

Calibrate ✧

a) Press briefly to select the desired paper set. These are selected in order (i.e. the sequence PAP1, PAP2, PAP3, PAP4, PAP1 etc.)

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

Measure ✢

a) Press and release this button 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 97.5 seconds). During calibration, this area of the display is also used to show exposure offsets and contrast range. Simple messages are also

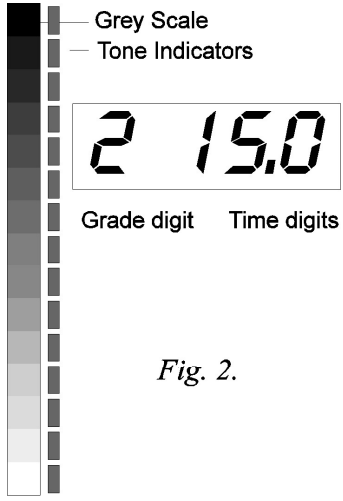


Fig. 2.

shown on the Grade and Time digits at certain times.

3) The Bargraph 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.

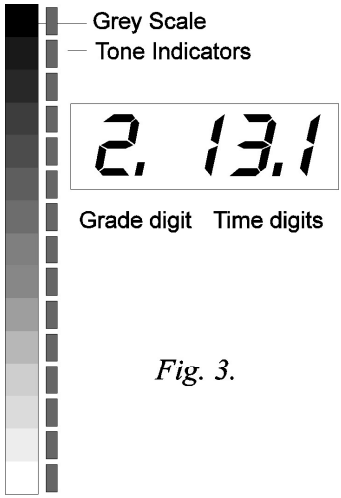


Fig. 3.

Making your first print

For accuracy, all metering is 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 most of your work, as this ensures that you will obtain useful results from the start with a minimum of calibration adjustments.

Remove any contrast filters from the light path. Set colour and multigrade 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 and compose and focus the image. Set the lens aperture to the setting you will use to make the print exposure.

Switch off the safelight.

Position the 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 exposure time as shown as in Fig.4.

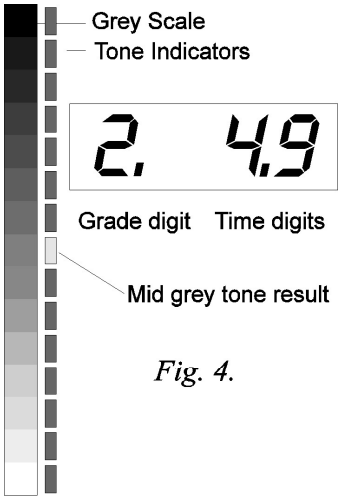


Fig. 4.

Position the 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. Adjust the paper grade setting as follows:

If the LEDs at the ends of the grey scale are flashing, this indicates that the contrast range of the negative is 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, this indicates that the contrast range of the negative is too small. Increase the grade setting using the **Harder** button until the end point LEDs are illuminated. If you increase the grade too far,

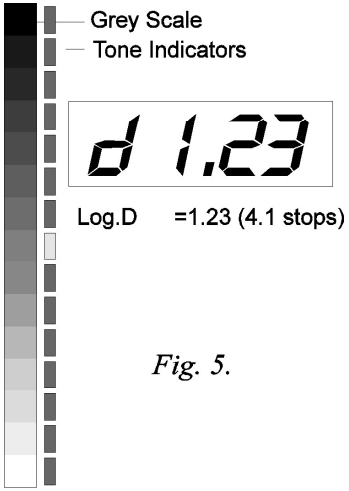


Fig. 5.

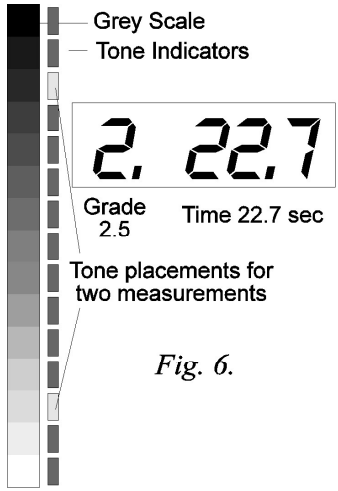


Fig. 6.

the LEDs will flash to warn you that highlight and/or 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.

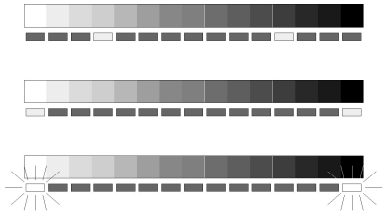


Fig.7

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. (Filter settings are published by the paper manufacturers, and are also listed on Page 29 of this handbook, but please remember these are only a guide to be used as a starting point.) Set your enlarger's timer to the time indicated by the ZoneMaster, position and expose your paper.

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.

Too light Correct Too Dark

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 a test strip. Press and hold **Print** to enter test-strip mode.

Place a piece of paper in the easel, and expose the whole of the paper for the indicated time. The grade digit will show "t" to indicate a test strip sequence. Cover a strip of paper, and press **Print** again; the time display shows the required exposure time. Expose the remaining paper for this 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 ZoneMaster's calculations. If it is 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.

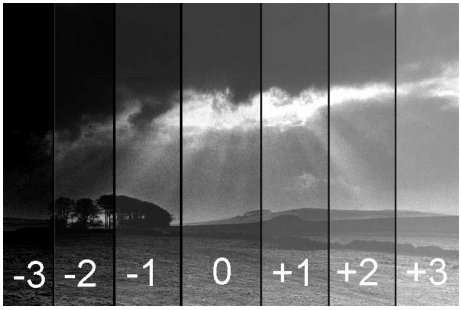


Fig.9

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, e.g 3, -1 etc.) Make another print; this one should be correctly exposed. Make a note of the exposure compensation; 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 safelighting 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 come on to later. Cold light enlargers will typically require a considerable negative offset (2 or 3 stops is not unusual, i.e. 10-15 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 accomodate, first increase or decrease (as appropriate) the exposure time by five steps (one stop, assuming a grade less than 4). 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.

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.

Too Hard | Correct | Too Soft

Fig.10.

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.

Full details of exposure and contrast adjustments are given in the **Calibration** section. **Don't even *consider* adjusting the contrast settings until the exposure compensation is correct!**

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 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 29 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 greater than for grades 00 to 3.5. This is equivalent to a halving of paper speed at grades 4 to 5. After exposure compensations have been entered, the calculated exposure for grade 3.5 will normally be about a half stop over as a result. Before printing at Grade 3.5 reduce the exposure time by 2 or 3 steps.

More Advanced Metering

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 rela-

tionships 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.

General Points about Metering

1. Exposure will be calculated only with respect to the two extreme measurements (i.e. lightest and darkest). Mid 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 the current measurements, but *not* 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. It is *not* necessary to retake measurements when changing papers.

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 mid-grey 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 right of the bargraph (the black end). Turn the enlarger off and place the contact sheet maker under the enlarger.

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. These are simple to calculate with the ZoneMaster.

With no negative in the enlarger, set a small aperture and take a meter reading. Using the **Lighter** button, 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 left-hand LED blinks.

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 will normally result in the extreme LEDs flashing. Decrease the time setting until LED representing the darkest shadow area just stops flashing. 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

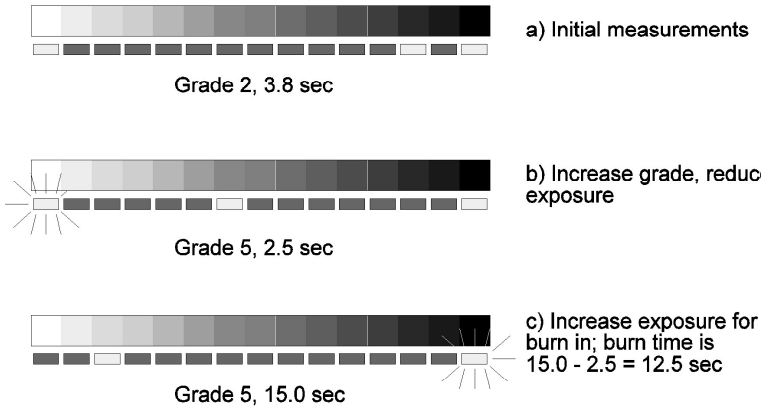


Fig.11. Burning in

want them. (Fig.11b) Make a note of this exposure time; we'll call it 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, and make a note of it. In Fig.11, it's 15.0 seconds.

Set the exposure time back to T1, and expose the whole of the paper. Now work out the difference between T2 and T1; this is the burn in time. In Fig.11, it's 12.5 seconds. Set your timer to this time (if it's not be possible to set the precise 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.

Calculating Split Grade 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 fifth (grades 00 to 3.5) or one tenth (grades 4 to 5) 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. The middle grey on the scale lies between the 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 ZoneMaster, 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 do 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's worth making your own grey scale for maximum 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. The characteristic curve is also developer dependent. 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 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 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. +5 and +10). The Durst M670 VC head often requires about 3/5 stop less exposure (i.e. -3 and -6).

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.

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.

To enter Densitometer Mode, 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 is well 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 seperate 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 ZoneMaster 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 the paper set currently selected (PAP 1 etc) and then show a grade of "o". The time digits will show the current compensation, if any.

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 -2, 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, PAP 2 as set at the factory contains a compensation of -1, so 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. If you are not going to enter any contrast data, then *without touching any other buttons,* 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 by pressing **Clear** while the "Cal Offset" LED is lit. This restores a value of zero compensation to all grades in the current paper set. (Note: if a paper set other than PAP 1 is in use, the factory offsets will not be restored and should be re-entered if necessary - the values are in the table on page 29.)

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 accomodate five stops of negative contrast and is equivalent to grade zero. 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 your ZoneMaster is in normal mode follow step 1 of the previous section. Otherwise proceed to step 2.

2. Press **Print.** 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 the "Cal Range" LED is lit. This restores the values for Ilford MG IV to all grades in the current paper set. (Note: if a paper set other than PAP 1 is in use, the factory offsets will not be restored and should be re-entered if necessary - the values are in the table on page 29.)

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, 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 an 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 centre LED on the grey scale lights up. Choose the lens aperture such that the indicated exposure time is between 10 and 20 seconds (repeat the measurement if necessary until this is the case). Make a test strip at this exposure. (Press and hold Print to initiate the test strip mode.) You should end up with a test strip which contains a mid grey somewhere. If the grey tone which matches the mid grey 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

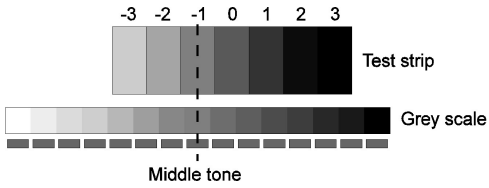


Fig.12

light so that no area matches the mid grey, increase or reduce the exposure time by 5 steps and repeat.

The exposure compensation is measured in steps, the same steps that the test strip maker uses. The position (with respect to the central test strip exposure) of the grey tone on the test strip that matches the middle tone on the ZoneMaster's grey scale gives the necessary compensation. In Fig.12 the nearest tone to mid grey 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**. This exposure compensation can then be programmed into the meter, for that particular grade, with the calibration procedure in the previous section.

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 a contrast calibration until the exposure calibration is correct!

Contrast adjustments are more tricky, and should begin with the built in setting or the paper's ISO(R) setting. ISO(R) is a logarithmic number such that 30 units represents 1 stop of range. So a paper which can accomodate five stops of contrast has an ISO(R) range of 150 and would be equivalent to grade zero. Note that this is referring to *negative* contrast, not *subject* contrast.

The contrast setting can be derived by determining the accuracy of the grey scale endpoints 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 35mm negatives. These negatives are made by photographing an evenly illuminated wall, in half stop steps, from -5 to +6 stops compensation. These negatives are projected in the enlarger and negative densities recorded with the ZoneMaster. Contact sheet images are selected that represent near white and black (logD 0.03 and logD 1.9) and the density differ-

ence of the respective negatives is programmed into the software.

A small adjustment can be made as follows. 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 reduce the suggested exposure time until the extreme left (white) bar-graph LED lights up. Make a test strip with 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 palest tone on the ZoneMaster's grey scale. If it is in the middle, then no adjustment is required. If it is to the left of the middle then the contrast range needs to be decreased. In the example in Fig.13 the matching non-white tone is two steps to the left of the middle. At grades 00 - 3.5, each test strip increment is one fifth of a stop, therefore each increment represents 6 units of contrast at the white end of the scale. Because both ends of the scale are adjusted at once, this number needs to be doubled to 12. At grades 4 - 5, each increment represents 3 units of contrast so the adjustment figure is 6. Hence, in the example in Fig.13,

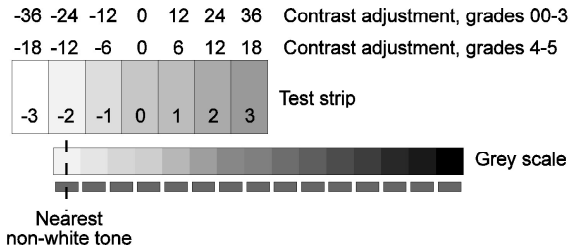


Fig.13

the ISO(R) number for the grade being adjusted requires reducing by either 12 or 6 as appropriate.

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 and with a good mid tone in the middle. To achieve this full range of tones you need to:

1. Identify the grade of paper whose contrast range is closest to ISO(R) 84, or approximately 3 stops.

2. Ensure that the meter exposure calibration for this grade is accurate and a blank negative prints a shade lighter than a Kodak grey card. (About 2 stops darker than white paper)

To identify this grade (normally Grade 3 or 3.5), use manufacturer's literature or scan through the contrast calibration settings in the meter whilst in the calibration mode. Half grades can be used if appropriate.

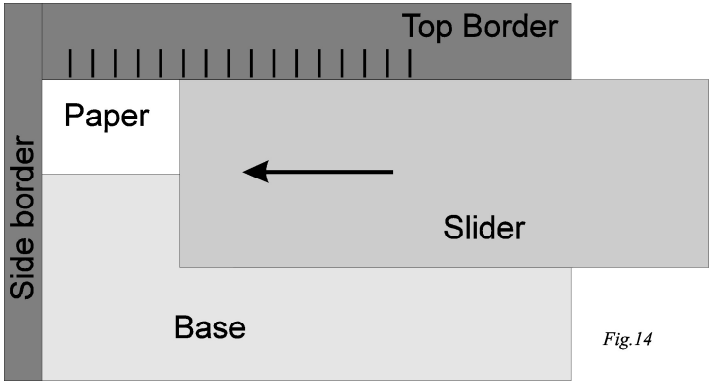


Fig.14

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 mid-grey 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 stage test strip. ('Grey' is displayed briefly).

Press Print to display the next exposure time, 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 00 and 5 are not available. Similar tables can be obtained from published literature (see bibliography) and from paper and equipment manufacturers. The table also gives the ISO(R) values for Ilford Multigrade IV and Agfa Multicontrast (Premium and Classic) 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 is set up for Ilford MGIV RC using filters, PAP2 for Agfa, PAP3 for Ilford with Y/M filtering and PAP4 for Ilford MGIV FB using filters. **NOTE**: The settings in PAP2, PAP3 and PAP4 are offsets to the basic calibration (PAP1), and so pressing Clear during calibration of ANY table will restore basic PAP1 settings (i.e. MGIV RC with Filters). If you wish to retain any of the preset calibrations for PAP2-4, make a note of the settings before making any adjustments. The table on Page 29 lists the settings preset at the factory. For grade 00, we suggest a figure of around 170; Agfa do not publish a grade 00 figure.

For other papers, please consult the paper supplier or manufacturer for the suggested settings but always remember that these settings are a guide only. Filters vary between enlarger types and often between two examples of the same enlarger, and may fade over time.

GRADE	PAPER TYPE				
	MG4RC	MG4FB	MCP	MCC	RR
OO	175	165	-	-	-
O	155	145	130	140	-
1	135	135	110	120	150
2	112	102	90	100	120
3	93	83	75	85	90
4	65	65	60	70	70
5	48	48	50	55	-

MG4RC	Ilford Multigrade IV resin coated
MG4FB	Ilford Multigrade IV fiber
MCP	Agfa Multicontrast Premium (RC)
MCC	Agfa Multicontrast Classic (fibre)
RR	Agfa Record Rapid (graded fibre base)

PRE-SET PAPER SETTINGS	
PAP1	MG4RC using Multigrade Filters
PAP2	MCP using fliters
PAP3	MG4RC using Y/M filtering on a colour enlarger
PAP4	MG4FB using filters

	PAP1		PAP2		PAP3		PAP4	
GRADE	OFFSET	RANGE	OFFSET	RANGE	OFFSET	RANGE	OFFSET	RANGE
OO	**0**	**175**	**-1**	**145**	**0**	**175**	**0**	**165**
O	**0**	**155**	**-1**	**125**	**1**	**155**	**0**	**145**
1	**0**	**135**	**-1**	**115**	**0**	**135**	**0**	**135**
2	**0**	**112**	**-1**	**92**	**-1**	**112**	**0**	**102**
3	**0**	**93**	**-1**	**78**	**3**	**93**	**0**	**83**
4	**0**	**65**	**-2**	**65**	**0**	**65**	**0**	**65**
5	**0**	**48**	**-2**	**58**	**0**	**48**	**0**	**48**

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+

The filter settings in the table are a guide only, and apply to those enlargers using Kodak units. Enlarger and paper manufacturers publish similar tables and these should be used where available. Note that a true grade 5 is not available on most colour heads.

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 97.5 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.) Expose the whole of the paper for the indicated time. Press Print and progressively cover the paper for subsequent exposures, until CLR appears on the display. Press Clear to abort at any time.

Densitometer Mode

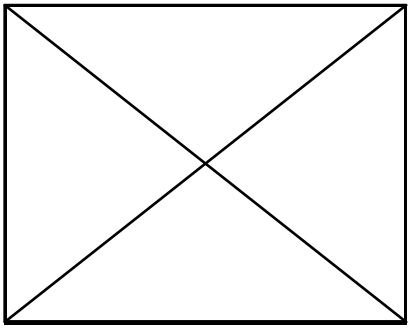
Press and hold Measure to enter and exit Densitometer mode.

Changing Paper Set

Press Calibrate briefly until display shows desired PAP number.

Entering an Exposure Compensation

Select the desired Paper Set. Press and hold Calibrate until CAL appears on the display. Set the grade at which you wish to enter the compensation. Use the Lighter and Darker buttons to set the required compensation. Press Print. Press Print again.



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 preceeding 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.

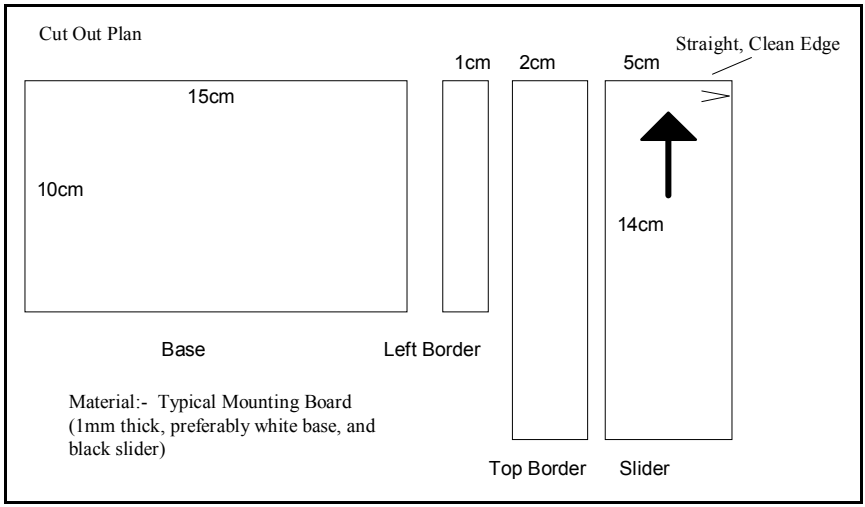
The clear LED display can be set to count up or down during exposure, and its brightness adjusts automatically to room lighting levels. In total darkness, the display dims to a level safe for colour printing.

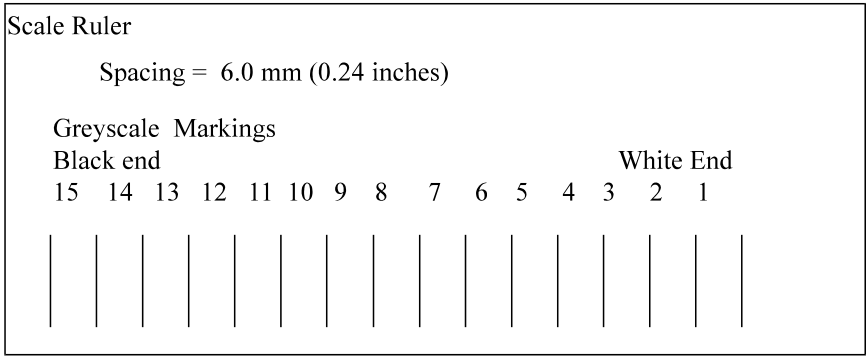
Audible beep at the end of each exposure, and optional seconds tick whilst the enlarger is switched on.

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





Once made, the grey scale can be trimmed (the final size should be 90x6mm) and attached to the front panel of the Zonemaster with a low strength adhesive. Suitable adhesives (such as Blu Tack or Prit Stick) will allow removal and re-placement 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 at the top!