

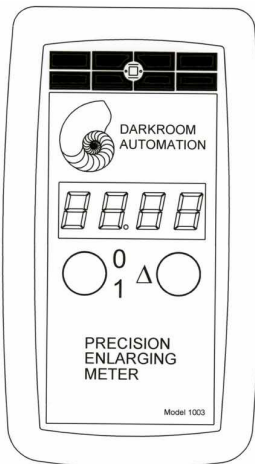
# DARKROOM AUTOMATION

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## PRECISION ENLARGING METER INSTRUCTION MANUAL

### DESCRIPTION

#### Controls



- The 0-1 button turns the meter on and off:
  - Tapping the button turns the meter on;
  - Holding the button down for one second turns the meter off;
  - The meter turns itself off if no button is pressed for 5 minutes.
- The  $\Delta$  button controls the delta difference mode:
  - Tapping the button toggles the meter between normal mode and delta mode;
  - Holding the button down for one second takes a reference reading and places the meter in delta mode.

#### Display

The four digit LED display shows the intensity of the light falling on the photodiode in 1/100ths of a stop. The display can show:

- Normal Mode:
  - **6.24** Absolute light intensity;
  - **Und** Too little light for meter to register, less than a reading of 0.00;
  - **0Vr** Too much light, greater than a reading of 9.99.
- Delta Mode:
  - **r1:24** Light intensity greater than the reference reading;
  - **-2:24** Light intensity less than the reference reading;
  - **Und** Too little light;
  - **0Vr** Too much light.

The display shows “-----” for one second when the meter is turned on.

## Batteries

The meter uses 2 AA size alkaline batteries - replace every two years or when the display becomes dim. Batteries will last 200 on-hours/6,000+ readings.

# OPERATION

## Modes

### Normal Mode

Normal mode shows the absolute light intensity. It is used to determine the base exposure by measuring the most important part of the photograph: detailed shadows for low key subjects; mid-tones or skin for portraiture and normal subjects; highlights for high key subjects.

9.99 is full scale and indicates an intensity of light that will produce a full black in roughly one second on Ilford MGIV RC. The other end of the scale, 0.00, indicates a light intensity that will produce full black in 1024 seconds.

### $\Delta$ -Delta Mode

Delta mode shows the difference in light intensity between any two spots in the image.

To use  $\Delta$ -Delta Mode place the photodiode under the reference spot in the image and hold the  $\Delta$  button down for one second. The display will show r0.00 and then track the intensity difference between the current spot and the reference spot. Tap the  $\Delta$  button to change from  $\Delta$  mode to normal mode and back again. The last reference reading is remembered.

$\Delta$ -Delta Mode is used to:

- Determine paper grade by measuring the intensity difference ('delta') between the shadows and the highlights or between the two most important tones in the image.
- Make fine corrections after making a test print by measuring the difference between two spots in the image: a spot where the print has the tone you want and a spot that has the tone you want to correct. The delta reading is the adjustment to the F-Stop timer/print time.

- Determine dodging and burning requirements. Several methods are possible but an example is: Measure the foreground highlights and the highlights in the clouds - the delta reading is the added exposure in stops needed to burn in the sky.
- Measure negative density by taking a reference reading of the clear film to zero out the base+fog density. The display will then show the effective negative density in stops over base+fog. To measure the base+fog density take the reference reading with no negative in the carrier, insert the negative and measure a clear area of the film.

## TIPS FOR USING THE METER

Always take readings with white light: no filters in the light path; VC and color heads set to white; VC cold-light and LED heads set to 'focus'.

Always stop the lens down to the working aperture when making readings.

Turn off all safelights when using the meter.

Keep a free field: leave the meter on the easel when taking readings; keep hands and body back so they don't reflect light onto the meter; wait for reading to settle when taking readings of highlights.

Use fresh developer: developer that is only a day old causes a fall off in effective paper speed, paper contrast and Dmax. Most of this fall-off can be compensated for by increasing developing time. If developer is re-used the developing time to reach Dmax should be established at the beginning of the printing session. Some developers degrade faster than others; even with commercial products it is not uncommon for 2 day old developer to require twice the developing time.

### The Volvele

A volvelle (calculating wheel) is provided to aid in calculating enlarging times from meter readings. Cut the two wheels and cursor from the card, attach the larger back wheel to heavy cardboard, mount board or foam core and pin the cursor and small wheel to the large wheel at the center. Two back wheels are provided: one back wheel reads the exposure time in stops if for users of the Darkroom Automation f-Stop Timer; the other reads in seconds for users of conventional timers.

To use the volvelle:

1. Rotate the inner wheel so the paper speed is opposite the outer wheel arrow.
2. Move the cursor so it aligns with the meter reading in the inner wheel.
3. Read the exposure time from the outer wheel at the cursor position. Note the outer wheel's numbers run counter-clockwise - an arrow on the cursor shows the direction of numbering.

## Meter Height

For normal use the height of the meter will make little difference when taking a reading, however for critical work, or when small prints are made, the enlarger head should be moved up 0.9" to compensate for the meter thickness. A set of arrows for attachment to the enlarger chassis is provided, cut them from the volvelle card. The distance between the arrows is the height of the meter. Note the position of the upper arrow against the enlarger column, raise the head so the lower arrow comes up to the position, take the meter reading and then lower the head so the upper arrow comes back down to the noted position and make the print.

## Enlarger Light Source and Compensation

Meter readings will change if the spectrum of the light source changes. The enclosed paper speed charts are for a standard 150 watt GE #212 incandescent enlarger lamp in a condenser lamp housing. If you use a different light source a constant correction may need to be added to or subtracted from the values in the chart. Spread-sheets for the paper speed charts are available at the Darkroom Automation web site <http://www.darkroomautomation.com/support/index.htm>. The spread sheets have cells for entering a 'wavelength correction factor'. This factor is the difference between the values found in your testing and the values given in the original chart. After entering your wavelength correction factor print a new chart on your computer.

# F-STOP PRINTING

The Darkroom Automation Precision Enlarging Meter works with an exposure method called "F-Stop Printing". In F-Stop Printing the exposure time is controlled in stops, like the aperture on a lens or the clicks on a shutter speed dial. The relation between stops of time and seconds is:

<u>Stops of Time</u>	<u>Seconds</u>
0.0	1.0
1.0	2.0
2.0	4.0
...	...
3.0	8.0
3.1	8.6
...	...
9.9	955.4

Each whole number increment doubles the exposure time and is equivalent to increasing the exposure by one f-stop.

The Darkroom Automation F-Stop Timer works in stops of time and is the perfect accompaniment to the meter.

However, any timer can be used for f-stop printing. A stops-to-seconds chart is provided for use with digital seconds-timers and a circular stops dial is provided for clock faced analog timers like the GraLab. If you use the seconds version of the volvelle you will calculate exposure times directly in seconds.

More information on f-stop printing can be found by Google search and in the books [Beyond Monochrome](#) and [The Master Printing Course](#).

# A DARKROOM EXPOSURE VALUE SYSTEM

The original Exposure Value [EV] system was designed to simplify exposure setting with manual cameras and separate exposure meters and is still used on Hasselblads and Rolleiflexes. An EV number specifies a quantity of exposure - all combinations of f-stop and shutter speed that provide the same exposure have the same EV number. EV numbers are 1 stop apart, starting with EV-0 at f1.0 and 1 second. As an example EV-15 can be: f22 1/60; f16 1/125; f11 1/250; f8 1/500 ...

The darkroom Exposure Value system developed by Darkroom Automation is an extension of the EV system. It is based on the simple relationship:

$$\text{Exposure} = \text{Meter Reading} + \text{f-Stop Timer setting}$$

All three values are in stops: stops of exposure (similar to an EV number); stops of light intensity measured by the meter; and stops of time set on the f-stop timer (or set in the equivalent seconds on a conventional timer). A chart converting stops of time to seconds is provided with the meter.

Given a paper and a desired tone there is an exposure that will produce that tone. This exposure is the 'Paper Speed' for that tone. A paper has many paper speeds, not one, as there is a paper speed for each tone, and the paper speed for that tone is different for each grade and type of paper. The same situation exists for film, but with film we only use the speed for an 18% grey tone and a given film, such as Tri-X, only comes in one contrast grade. When a film's contrast is manipulated by changing development time then the film speed for 18% grey also changes - the film now has different speeds for different contrasts.

When the Paper Speed is known the timer setting in stops is simply:

$$\text{Timer Setting} = \text{Paper Speed} - \text{Meter Reading.}$$

The volvelle (round slide rule) can be used to make this calculation. If you use a seconds timer then there is an alternate volvelle that reads directly in seconds.

# USING A PAPER SPEED CHART

Charts of paper speeds for popular Ilford MGIV papers are provided with the meter. The chart is first used to determine the paper grade and then used to determine the base exposure.

## Determine Paper Grade

The bottom section of the chart gives the difference for various light to dark tone ranges for each grade. The columns in the chart are:

Light: The tone/zone measured for the light/white spot used to determine paper grade.

Dark: The tone/zone used for the dark/black spot.

Grade: In each paper grade/contrast filter column the number gives the exposure difference in stops between the light and dark tones.

		Paper Grade					
Light	Dark	2 1/2	3	3 1/2	4	4 1/2	5
White	Black	4.49	4.09	3.48	3.20	2.65	2.33
VIII		3.21	2.92	2.53	2.08	1.68	1.49
VIII	II	2.85	2.60	2.27	1.84	1.42	1.25
VIII	Shad III	2.55	2.30	2.02	1.62	1.24	1.07
Hilite VII		2.71	2.43	2.09	1.68	1.33	1.18
Hilite VII	II	2.35	2.11	1.82	1.44	1.07	0.94
Hilite VII	Shad III	2.05	1.81	1.57	1.22	0.89	0.77

The steps in using the chart are:

1. Focus the negative on the easel, stop the lens down to the working aperture and remove any contrast filters or set the contrast/color head to white light.
2. Determine the important tones that set the contrast of the photograph. The choice can depend on the subject matter:
  - Highlights and shadows - these tones are the large areas of light grey and dark grey that still hold full detail.

They should not be confused with the lightest and darkest portions of the print - using the light/dark points for highlights/shadows will result in a muddy compressed print.

- Light/dark points - these are normally the lightest and darkest points in the print, usually a bright specular point highlight and the deepest part of a shadow.
  - For stark images pure black and pure white might be chosen.
  - For very bright highlights, such as sun on a waterfall, Zone VIII - almost but not quite pure white - might be a better choice.
  - For deep or very deep shadows Zones I or II might be used.

Care needs to be used as often the lightest and darkest parts of a print need to be burned or dodged and shouldn't be used as the metering points to set the overall contrast of the print.

- Midtones and highlights for high-key work, midtones and shadows for low-key work.
- Light midtones and dark midtones (often the highlight/shadow zones) but placed at the extremes of the negative's (often limited) tonal range for foggy, misty subjects.

3. After deciding on the points to meter, turn the meter on and meter the contrast range:

- Place the metering spot under the highlight/light spot, wait for the reading to steady and hold down the  $\Delta$  button for one second. The meter will switch to  $\Delta$ -Delta mode and the display will show  $r\Delta:00$ .
- Move the measuring spot under the shadow/dark spot and note the reading on the meter.

This reading is the contrast range - the 'delta' - of the two spots in the image that you are using to determine the best grade of paper.

4. Using the bottom section of the chart locate the closest paper contrast delta and look up to the paper grade/contrast filter.

Example:

- You use detailed highlights and shadows (zones III and VII). The meter shows  $r1.85$  stops as the contrast range.
- In the 'Highlight|Shadow' row at the bottom, you read across to 1.81, the closest value to the meter reading.
- You go up to the top of the column to find the paper grade - in this case a grade 3 paper will best fit the image.



## Determine Base Exposure

The top section is used to determine the base exposure and gives the paper speed for various tones with each grade of paper. The columns in the chart are:

- Zone: The print zone number as described in Ansel Adams' The Print.  
 Tone: A description of the tone.  
 OD: The Reflection Optical Density of the tone.  
 Grade: The 'paper speed' or amount of exposure required to produce that tone on that grade of paper.

Zone	Tone	OD	Paper Grade					
			2 1/2	3	3 1/2	4	4 1/2	5
IX	White	0.05	5.59	5.53	6.05	6.83	7.49	7.50
VIII		0.12	6.24	6.19	6.61	7.45	8.01	7.97
VII	Highlight	0.27	6.74	6.68	7.05	7.86	8.36	8.27
VI	Skin	0.47	7.32	7.19	7.54	8.23	8.64	8.47
V	18%	0.70	7.91	7.72	7.96	8.55	8.83	8.69
IV		1.00	8.36	8.14	8.33	8.84	9.04	8.86
III	Shadow	1.32	8.79	8.49	8.62	9.07	9.26	9.04
II		1.60	9.09	8.79	8.87	9.29	9.43	9.21
I		1.90	9.45	9.11	9.14	9.53	9.69	9.45
0	Black	2.10	10.08	9.62	9.53	10.04	10.15	9.83

The steps in finding the base exposure are:

1. Tap the  $\Delta$  button to return the meter to normal mode and place the measuring spot under the low tone [shadow] spot used to determine the contrast grade.
2. Look up the paper speed for the metered tone.
3. Set the timer to the value given by:  $\text{Timer setting} = \text{Paper Speed} - \text{Meter Reading}$ . The supplied volvelle is designed to perform this calculation.

Example:

- The detailed shadow spot meters **5.72**;
- The paper speed for grade 3 paper to produce a shadow tone is 8.49;
- Set the timer to  $2.8 = 8.49 - 5.72$ , insert the contrast filter for #3 (or set the VC/Color head or load grade 3 paper into the easel);
- Insert the paper into the easel and expose the print.

# Δ-MODE: BURNING and DODGING

## Quick Method

The most common burning procedure is to burn in the sky, especially a sky with clouds in it:

1. Place the meter under a highlight in the foreground and press the delta button down for one second to take a reference reading and place the meter in delta mode.
2. Place the meter under the highlight in the clouds. The meter will read the stop difference between the two highlights - this is the amount to burn the sky for fluffy white clouds that hold highlight detail.
3. For darker ominous clouds select a light to medium grey in the foreground and follow the above procedure. This will burn the sky so that the highlights in the clouds are the same grey as selected in the foreground.

For dodging the meter will indicate the number of stops to dodge.

If you are using the Darkroom Automation F-Stop Timer the meter's delta reading is entered into the timer as the dodge or burn exposure.

To use the Darkroom Automation F-Stop Timer's progressive burn feature measure the difference between any two areas in the burned section that are to be brought to the same tone and enter this for the progressive burn exposure.

## Determining Dodge and Burn with a Paper Speed Chart

1. Determine the paper grade and base exposure.
2. Meter a tone in the area to be dodged or burned.
3. Add the base exposure to this meter reading and subtract this number from the paper speed of the desired tone - this will give the number of stops to burn or dodge.

If the number is negative ignore the sign and use the magnitude as the entry to the F-Stop Timer

## Δ-MODE: QUICK TONE CORRECTION

If a print's tones are a bit too light or a bit too dark use the delta function to find the required adjustment to the base exposure.

1. Take a reference reading of the area of the print that is too light or dark by holding the Δ button down for a second.
2. Locate an area on the print that has the tone you desire for the spot you measured in step #1 and take a reading at that point.
3. This delta reading is the adjustment to make to the base exposure.

As an example:

- You find the skin tone for the forehead of your subject is too light, you want the tone there to be closer to the tone you presently have on the cheek (which is also a bit too light).
- Take a Δ reference reading of the forehead.
- Move the meter to the cheek and read the meter, say it reads **r0.32**.
- Add 0.3 stops to the timer setting.

You can also do the same with the aperture of the lens, but the metering is then done the other way: take a reference reading of the cheek, move to the forehead and adjust the aperture so the meter reads **r0.00**.

## Δ-MODE: ENLARGING COMPARATOR

When making a large number of non-critical prints it can be faster to leave the printing time constant and vary the lens aperture to control print exposure.

Determine the base exposure for a representative negative and meter a representative tone, such as skin or detailed highlight, and note the reading or take a reference reading using Δ mode. For each subsequent negative place the meter under an area of the same tone and adjust the lens aperture for the same reading on the meter.

## Δ-MODE: DENSITOMETRY

The Darkroom Automation Enlarging meter can be used as a densitometer. It will not give the same results as a bench densitometer because the optics of an enlarger are different from those of a densitometer. However, the reading obtained from the Enlarging Meter will give the effective density of the negative when used in your enlarger, a number that is of more practical interest when making tests of films and developers.

Moving the meter across the image will affect density measurements. The effect will differ with the type of enlarger, the fall-off of the enlarging lens and the Callier effect of the film being measured. To see the effects of these variables insert blank [or better, an evenly grey toned] film into the enlarger, take a reference reading at the middle of the projected image and with delta mode see how much the indicated density varies as the meter is moved to the corners and edges of the image. If measurement accuracy is critical then measurements should be made with the meter in a fixed position on the easel. The negative should be moved in the negative carrier to bring the desired spot over the meter.

To measure the base+fog of a negative take a  $\Delta$  reference reading with no negative in the enlarger. Insert the film and take a reading of a clear section of the film.

To measure exposed areas of a negative take the reference reading of the clear section of film - as between frames. Then move the negative or meter to bring the area to be measured over the meter's measuring spot.

The Darkroom Automation Precision Enlarging Meter indicates the density in stops. To convert stops to OD multiply the Exposure Meter's readings by 0.3.

# DETERMINING PAPER SPEED

The meter comes with a paper speed charts for Ilford MGIV papers, untuned, developed in D-72/Dektol. New speed charts are posted to <http://www.darkroomautomation.com/support/index.htm> as they become available.

Suggested methods for determining the paper speeds for the papers you are using and to fine-tune paper speeds to your particular enlarger and processing methodology are:

## Paper Speed • Using a Reference Negative

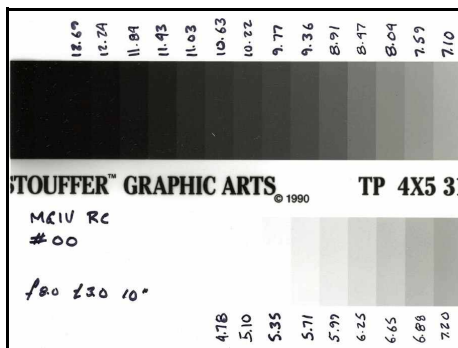
1. Pick a negative with a complete tonal range and large areas of smooth tone and make a good straight print from it, noting the exposure time and aperture. This will become the 'reference print'.
2. Mark areas with important tones on the reference print: almost pure white, detailed highlights, skin, detail shadows, etc..
3. Raise the enlarger head by 0.9" and with no filtration measure each of the marked areas on the reference print. Add the exposure time [in stops] used in making the print to the meter reading and note this number on the reference print - this number is the paper speed for that tone.
4. Make such reference prints for all the papers and grades that you are interested in. Use high and low contrast reference negatives as needed for the various grades of paper.
5. Use these marked up prints to determine exposure for subsequent prints on the same paper/grade: meter an area with the new negative that is to have the same tone as one of the marked areas on the reference print, subtract the meter reading from the noted paper speed and set this stop value into the timer.

## Paper Speed • Using a Projection Step Wedge

Although requiring a transmission projection step wedge, this is the easiest and most precise method of determining paper speeds and characterizing printing papers. Step wedges in 35mm, 2-1/4" and 4x5" sizes are available from large photographic suppliers or directly from the manufacturer:

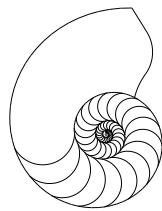
Stouffer Industries  
922 So. Cleveland Street  
Mishawaka, Indiana 46544 USA

Phone: (+1) 574-252-5772  
Fax: (+1) 574-252-5776  
<http://www.stouffer.net/photo.html>



Completed step-wedge test print showing paper speeds for each tone.

1. Set the enlarger to project the step wedge onto a 5x7" or other conveniently sized sheet of paper.
2. Using the lowest contrast filter or lowest contrast grade of paper, determine the exposure time to get a maximum black on one of the first few tablet steps. Note the time, lens aperture and enlarger height and use these standard settings for all subsequent tests.
3. For each filter/paper grade make a print at the standard settings determined above. It is a good idea to make exposures with each grade of paper or contrast filter at one time and develop them as a batch so all prints are made at under identical conditions.
4. With no filter in the light path raise the enlarger head 0.9", measure each projected step with the meter and note the meter reading.
5. Add the meter readings to the number of stops of exposure time to get the paper speed and note this number next to each strip on the test print(s) as shown in the illustration above. The paper speeds for each step will be the same on all test prints but tones for each speed will be different.
6. Now when a desired tone is desired for a given paper and contrast the paper speed for that tone can be read from the step wedge test print.
7. A paper speed chart, like the one provided for Ilford MGIV RC, can be made if a densitometer is available. A spread sheet for Quattro Pro is available on the Darkroom Automation web site <http://www.darkroomautomation/support/index.htm>.
8. A paper speed chart can be made with visual matches to a reference set of tones, such as a Kodak or Stouffer grey scale. Paper speeds may need to be interpolated when a zone's tone is between steps on the test print.



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