BLUEPRINT SERIES

How To Use a Luna-Pro Light Meter As a Densitometer

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PROJECT: To determine film densities using a Gossen Luna-Pro light meter.

PURPOSE: To determine how a specific emulsion responds to light and to permit you to check your exposure and processing procedures by plotting the film's characteristic curve.

EQUIPMENT: 1. Luna-Pro densitometer as described in "Blueprint," January, 1978 issue; 2. Camera/gray card/lighting setup as described in "Blueprint," August, 1977 issue; 3. Previously tested film (three rolls or 39 sheets); 4. Your normal developer; 5. Graph paper; 6. Notepad and pencil.

PROCEDURE GUIDE: In previous "Blueprints," tests on exposure and development were empirically proven effective via printing of the Zone Ruler and comparative prints made at your Standard Printing Time. Here, you will study the effects of exposure and development by plotting the film's characteristic curve ("H & D" curve). By noting key points of such a curve you will be able to interpolate various film/developer combinations into useful information pertinent to your picture taking.

To plot the curves, you will need the densitometer constructed from last month's "Blueprint."

PROCEDURE: Using the same lighting setup as in the August, 1977 "Blueprint," set up the camera and calculate your exposure for a proper Zone V at 1/30 at f/8. Expose three rolls (or three sets of thirteen 4×5 sheets) of film with exposures from six stops below Zone V (1/500 at f/16) to six stops over (½ at f/4), in one-stop increments. Make a blank (Zone 0) exposure at the end of each series. Expose the remainder of the roll to Zone V exposures.

After exposing the film, develop one roll (or one set of sheets) according to your normal plan. Develop the other rolls (or sets of sheets) for N+2 and N-2 development levels as described in the December, 1977 "Blueprint."

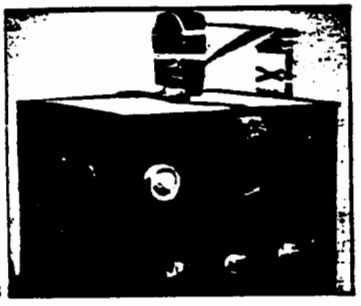
Now that you have prepared three sets of negatives, you will evaluate the film's response graphically. This will give you a quantitative understanding of how exposure and development affect the film.

Set up your densitometer as shown in photo No. 1. Switch the meter to the "on" position for several minutes to stabilize its response to the light. Adjust the illuminator so that the pointer needle of the horizontal exposure scale rests on "20" with no film in place (see photo No. 2).

In your notebook make the following table: in the first column, labeled "Log Exposure," number the rows from 1 to 13. These correspond to the 13 exposures in each film set. Each row represents one stop more exposure than the preceding one. (For the scientifically minded, the difference in log E between adjacent rows is 0.3.)

1

2



3

1. Luna-Pro light meter is lowered into place on the film. Light cone must lie flush against film and read only the portion of negative within each frame.

2. Horizontal scale of Luna-Pro is calibrated to read "20" on the scale before inserting any film in place.

3. Luna-Pro is shown in place for valid reading.

Using the modified light meter, measure the light transmitted by the first exposure on the normally processed film. Record the reading across from No. 1 under the "Log Exposure" column. Label this column "Meter Readings in Stops." Repeat this procedure for the remaining 12 frames. (See Chart 1 for sample of proper method of making notations.) At the top of this table list the reading obtained from the blank, Zone 0 exposure. (Note: It is important when making your readings that the light cone does not extend beyond the edges of any of the frames. This will be of no great concern for sheet-film users, since the film is comparatively larger than 35mm film).

Now, make a third column, labeled "Density," in which each of the readings in column No. 2 is subtracted from the calibration reading ("20"). The numbers in this column give the density of the film as measured in stops. (The scientifically minded person may convert this to normally used sensitometric units by multiplying the readings also by 0.3.) Make similar tables

Calibration reading (no film meter) is "20." (Set your meter for this reading. See chart No. 2. Note: Exposures two stops below Zone 1 and two stops above Zone IX have been incorporated into the curve to make it more complete and to illustrate the poor tonal separation encountered at the extreme ends of the film's response curve.

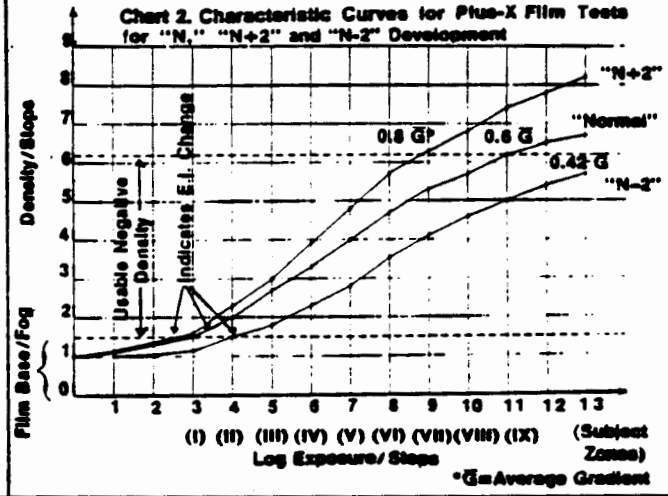
Chart 1. Notations for Plus-X Film Developed "Normally"

	Log Exposure	Meter Readings/ Stops	Density/ Stops
Zone 0—Film Base—	0	19.0	1.0
	1	18.9	1.1
	2	18.7	1.3
Zone I—	3	18.5	1.5
	4	18.0	2.0
	5	17.3	2.7
	6	16.7	3.3
Zone V—	7	16.0	4.0
	8	15.3	4.7
	9	14.7	5.3
	10	14.3	5.7
Zone IX—	11	13.8	6.2
	12	13.5	6.5
	13	13.3	6.7

Notations for "N" curve are derived from chart No. 1. Notations for "N+" and "N-" are not given but can be derived from the curves. My "Normal" film is slightly overdeveloped (proper development would render an average gradient of .56). Note shift in E.I. with increased and decreased development. Curves are irregular due to slight inaccuracies in reading the meter, nonlinear response of film to light and probable inconsistencies in shutter speeds when exposing the film. However, these slight errors are minor, and the information derived is quite usable.

The characteristic curve takes on more meaning when other film/developer combinations are compared. You can use this procedure to prove or disprove claims of increased film speed by some manufacturers, to test esoteric films and developers and to mate one manufacturer's developer to another's film, etc.

Chart 2. Characteristic Curves for Plus-X Film Tests for "N," "N+2" and "N-2" Development



*G=Average Gradient

for the N+2 and N-2 series of negatives.

Now, on a single sheet of graph paper plot the "Density" on the vertical axis against the "Exposure" along the horizontal axis. The results should look qualitatively like those in Chart No. 2.

GENERAL DISCUSSION: Looking at chart No. 2, "H&D Curves," note the disproportionate increase in density at the higher exposures among the films. This is the keynote of negative contrast control via the Zone System. Note the slight change in Exposure Index (E.I.) as is evident at exposure No. 3 (Zone I) of the graph. Also note that in going from N to N+2, a Zone V exposure is developed near to a Zone VII. Likewise in going from N to N-2 we expect a Zone IX exposure to be developed to Zone VII, which is very closely the case.

With a rule draw a horizontal line through the "N" at Zone I (exposure No. 3) and also at Zone IX (exposure No. 11). This is the range of usable negative density.

To determine the contrast range (average gradient) of your negative on the graph, locate your density reading for Zone I (1.5) and Zone IX (6.2) and compute the difference (4.7). (Our film will probably differ from yours.) Since there are eight zones between Zones I and IX, the average gradient of the "N" curve is 4.7 divided by eight, which equals 0.6. Since the ideal average gradient is 0.56 for negatives printed on Kodak normal paper, our result indicates that our film has been slightly overdeveloped. For the "N+2" curve, six zones fall in the same range. Thus the average gradient in this case is 4.7 divided by 6, which equals 0.8. For the "N-2" curve, only 4.2 stops of usable negative density appear on the negatives although the exposures span 10 stops. The average gradient in this case is 4.2 divided by 10, or, 0.42.

The purpose of this exercise is to simplify sensitometric readings for the working photographer and serious amateur. Keep in mind that the handheld meter is a viable tool for measuring film densities and rendering graphs. It is not as accurate a device as a true densitometer and certainly not as sensitive to slight density differences. You will note in published film curves that the "toe" of the slope (lower left portion of the curve) will not begin at the same point for extended or reduced developing times for the same film. This is due to a slight change in the fog level. This difference is too slight to be accurately read with the Luna-Pro. Consequently, all the curves seem to converge to the same point. Even so, these procedures will provide you with all the information you will need to know about your film and developing procedures.

For more information consult *The New Zone System Manual* by White, Zakia and Lorenz and *Photographic Sensitometry* by Todd and Zakia, both published by Morgan & Morgan, Dobbs Ferry, New York.

This concludes the "Blueprint" series on the Zone System. □