Histograms & Light Meters

HOW THEY WORK TOGETHER

WHAT IS A HISTOGRAM?

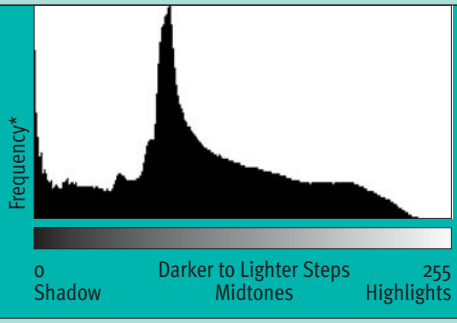


Figure 1 – Anatomy of a Photographic Histogram
*Frequency indicates the number of each tonality occurrence

A histogram is basically a bar chart used in statistical analysis and was initially applied to photography by the original group of engineers who were designing the first digital cameras. Since histograms are not fully understood by the average photographer, they are typically not used or fully utilized correctly.

Take a look at Figure 1 for an explanation. Every scene you capture in your camera is located on a horizontal scale with tones ranging from 0 (Black) to 255 (White). Your image processing system (camera or computer) places each part, or picture element (pixel) on that scale in position relative to its brightness. Every time a pixel of a particular brightness appears (frequency), it is stacked on top of other pixels of the same brightness to build a line of varying heights. The result is a graph of very fine vertical lines (bar chart) which can appear as a smooth curve, a series of lines or a combination of both.

Using a light meter to determine your proper lighting and exposure, plus a histogram to see how and where the range of tones is recorded is the ideal way to insure that your subject and scene can be reproduced with optimal results.

Although many people think that there are good histograms and bad histograms and that there is an ideal shape for a histogram – a histogram is only a graph. All of the examples here are accurate histograms yet they are all extremely different because their shapes represent the tonal distribution of each scene which is equally very different. It is up to you, the photographer to determine how to use a histogram as a guide.

Digging deeper into histograms...

While all of the other illustrations in this guide show histograms of full range scenes, a more graphical example of how data appears can be seen by looking at subjects that have discrete steps such as the gray scales in Figures 2 - 6. Because there are only a certain number of steps that are all evenly spaced, and each patch of tonality is the same size, the corresponding histograms clearly show each tone as equal height lines uniformly distributed across the horizontal scale.

Even when you increase the number of steps to the degree where it gives the impression of a continuous gradation, the histogram will appear smoother but can still show you all the discreet tones, Figure 6.

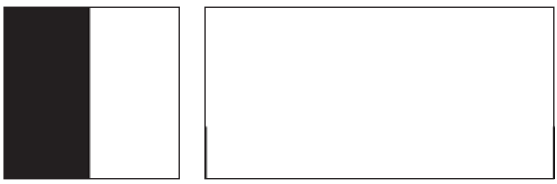


Figure 2

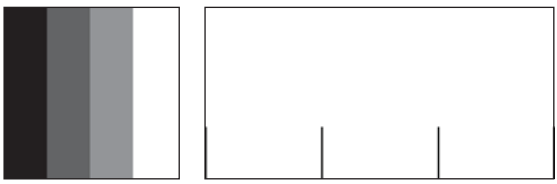


Figure 3

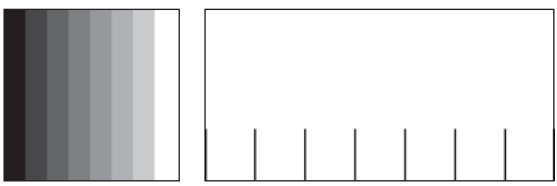


Figure 4

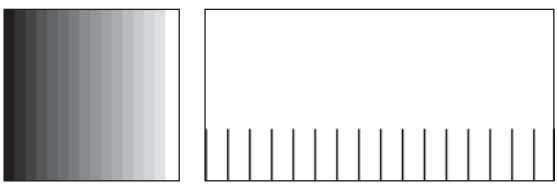


Figure 5

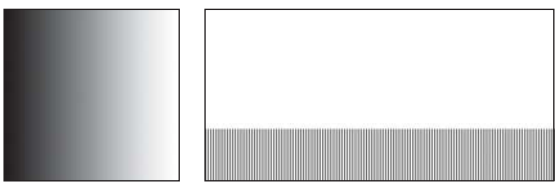


Figure 6

So what kind of guide you ask? Histograms are not typically helpful in determining exact exposure or evaluation of precision lighting or mixed lighting conditions. And because a histogram may appear in a very small window on the back of your digital camera, it's not always easy to read.

A histogram is a great way to judge the overall exposure you make with respect to the full range of the scene. In other words, if the tonal distribution falls within the confines of the left and right sides of the histogram, you're most likely going to have a printable image. And if the histogram is pushed up against either side you might want to consider if you have a scene that's high-key, low-key, or if it's the effect of exposure which will cause you to loose highlight or shadow detail – or emphasize part of the scene.

Do You Need a Light Meter?

Yes! While a histogram is the most convenient way to see how the entire scene will reproduce (or not), it really doesn't tell us the whole story. There's information about absolute subject exposure and lighting but it's difficult to interpret. Plus there's no feedback in terms of numbers that match your camera settings (i.e. f/stops) – that's the job of a light meter, Figures 34-36.

In addition, most camera manufacturers only give you an approximate representation of the subject histogram, figure 35 because they realize the viewing window is too small to provide accurate detail. Although there are some exceptions to this, Figure 36. Cameras that offer more information are more expensive and/or are designed for the slower paced studio environment where you have lots of time to analyze and reanalyze both lighting and exposure.

And don't be fooled into thinking you can determine exposure accurately on the LCD screens on the back of digital cameras. While they generally offer a fair representation of the image, they are most often low resolution and difficult to see, which makes them hard to use to judge subtle subject variations, as well as misleading when viewed under different lighting conditions.

The best insurance for proper exposure is a good light meter – period!

Figure 34

Figure 35 Typical Digital Camera Histogram

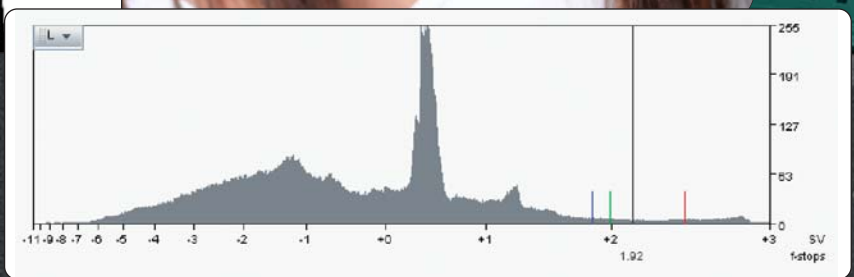


Figure 36 High End Digital Camera Histogram (Spot Reading Only Available with Proprietary Software

Histograms and Light Meters - 4 ways they compare...

Although everyone has their own preferences and shooting styles, photographic imaging can be optimized by understanding what a light meter and histogram can show you in the four scenarios presented here. Virtually every common shooting situation is represented, and each example shows proper exposure as determined by a light meter while including an interpretation of the accompanying histogram.

(1) Avoid subject failure and expose for proper High Key and Low Key scenes...

The most common problem of built-in camera meters is subject failure. It caused the exposure system to try and average the reflected value of the tones in each one of these scenes, Figures 7-9. The result of accepting the camera meter settings would have been an underexposed white plate (trying to make it middle gray), and an overexposed black plate (again trying to make it middle gray). Proper exposure required the use of an incident handheld meter to measure the light falling on the subject. It determined that all three images required the identical camera exposure.

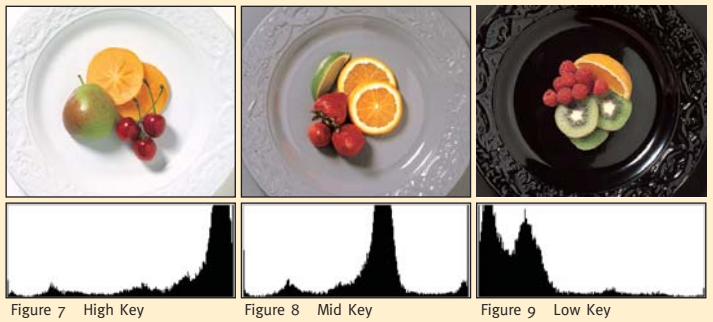


Figure 7 High Key — Figure 8 Mid Key — Figure 9 Low Key

The histograms, while inadequate for determining proper exposure show the bias in tonal distribution and give a good indication of how High Key, Mid Key, and Low Key subjects will reproduce

(2) Control multiple light sources, set light ratios and adjust tonal range...

When working with more than one light, a meter is essential to evaluate and compare each light source to determine both proper exposure and the effect that every light will have on all parts of the scene, Figures 10-15.

The histogram is useful to insure an understanding of how the overall tonal range will reproduce and show the possible extreme contrasts and placements of tonal values. But considering it's difficult to interpret the visual effect of each of these curves, the histogram is basically unable to provide guidance in positioning and controlling the power of each light source – especially when making small one tenth of an f/stop adjustments.

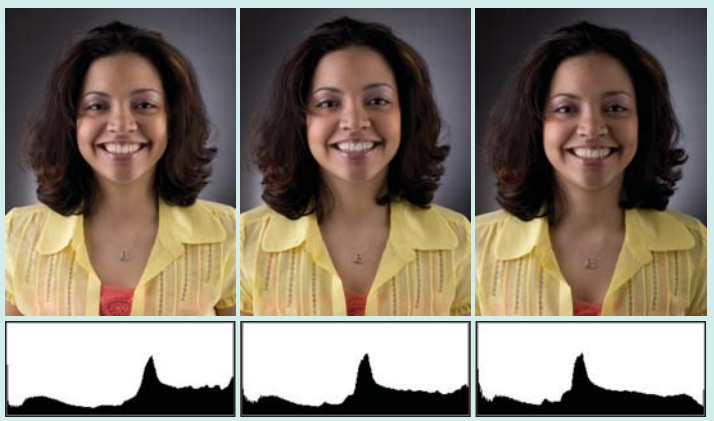


Figure 10 1:1 Ratio — Figure 11 1:2 Ratio — Figure 12 1:3 Ratio

Figure 13 1:4 Ratio — Figure 14 1:5 Ratio — Figure 15 1:6 Ratio

(3) Balance different kinds of lighting on location...

Even with the best TTL systems, properly mixing flash and ambient light sources can be unpredictable – especially if your subjects are not "average". Only handheld metering assures accuracy by measuring both kinds of lighting, Figures 16-18.

Although the histograms provide an interesting look at the distribution of tones, and indicate a difference in the effective contrast of the lighting, there's very little useful information regarding how these two different light sources relate to each other both in terms of light levels (ratio) and optimum exposure.

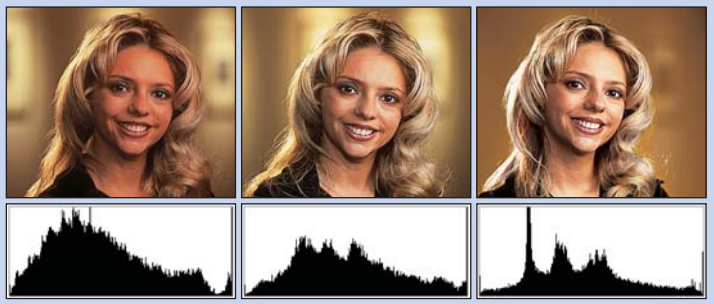


Figure 16 Ambient Only — Figure 17 Flash Only — Figure 18 Ambient & Flash

(4) Avoid under and over exposure...

For those slide shooters that tend to underexpose for saturation, the images in Figures 19-23 show the subtle change in the histogram as compared to the f/stop metered value of the image) This is a example of why you should rely on your light meter instead of the histogram for accurate and repeatable exposures.

For negative shooters who are partial to overexposing and letting the lab compensate, the images in Figures 23-27 show the subtle change in the histogram as compared to the f/stop metered value of the image). This is a example of why you should rely on your light meter instead of the histogram for accurate and repeatable exposures.

The photographic results show how even a halfstop variation can cause a rapid blocking of tonal information. A histogram shows this in a much more subtle way but it is almost impossible to see on the average D-SLR's LCD panel. And because there is no horizontal scale (even in most software, figure 28), it's hard to visualize and gauge that the error in each exposure here equals a half stop -- so there's almost no chance you'll be able to use an histogram to fine tune settings to get within the ideal one tenth of an f/stop.

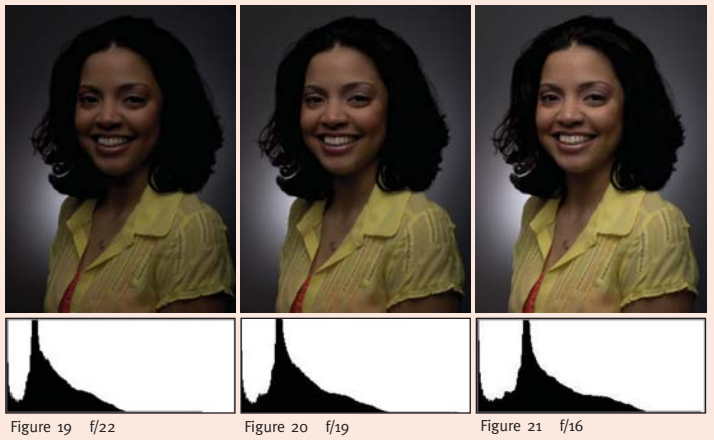


Figure 19 f/22 — Figure 20 f/19 — Figure 21 f/16

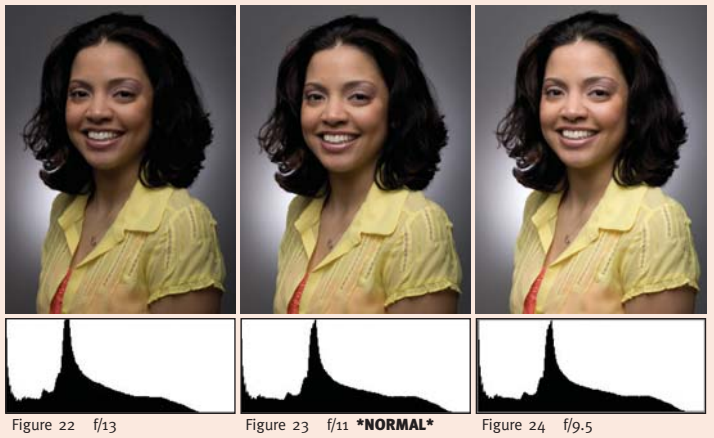


Figure 22 f/13 — Figure 23 f/11 ***NORMAL*** — Figure 24 f/9.5

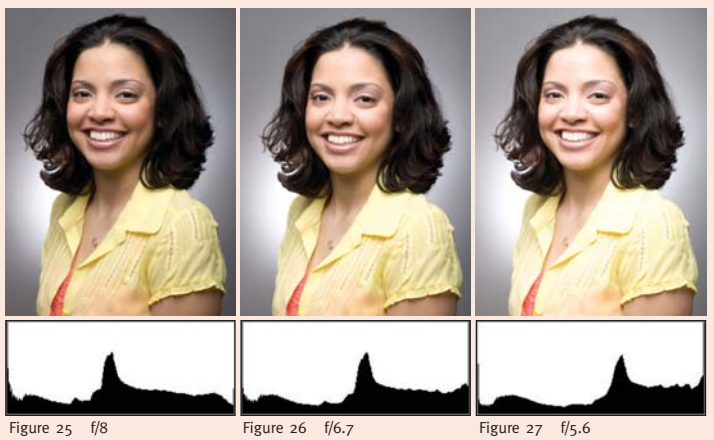


Figure 25 f/8 — Figure 26 f/6.7 — Figure 27 f/5.6

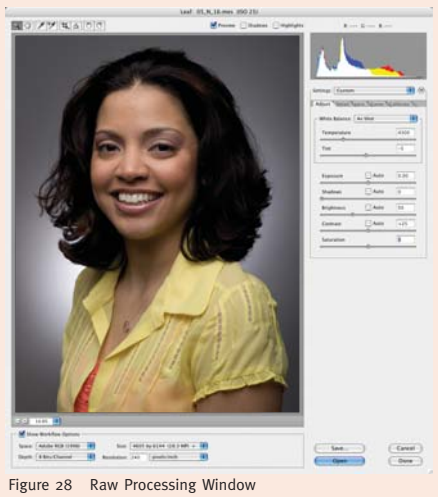


Figure 28 Raw Processing Window

Push/Pull Processing?

Film and Pixel Quality Still Sufffers

Fig 29 In-Camera Meter Exposure

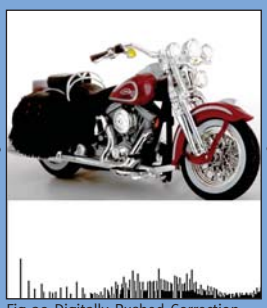


Fig 30 Digitally Pushed Correction

Fig 33

Fig 31 Handheld Meter Exposure

Fig 32 No Compensation Required

In today's digital age, although the technology behind photography is much more advanced, obtaining professional quality results still require the best techniques and tools.

Digital capture has a dynamic range and latitude roughly comparable to transparency film. What this means is if you're used to properly exposing transparencies, you're off to a good start. But if you're accustomed to the wider exposure latitude (extra margin of exposure error) that color negative film gave you, it's time to change your thinking.

Although it may seem that any miracle can happen in the digital darkroom, correcting a bad exposure has its limits. At first glance it may look like it's possible to make corrections, but upon closer inspection you may notice that image quality has suffered. In addition, the time spent on the computer fixing a bad exposure will far exceed the amount of time it takes to get it right in the camera.

As an example, look at Figure 29. In this case the exposure was calculated by an in-camera meter which read the excessive amount of light reflecting off of the white background and averaged it with the subject lighting in an attempt to reproduce a middle gray value. This averaging caused underexposure of the image ("subject failure"). Figure 30 shows the same improperly exposed scene "fixed" in the computer. For Figure 31 a handheld meter measured the incident light falling on the subject to determine proper exposure, so Figure 32 looks great without any computer manipulation. Although to some people images in both Figures 30 and 32 might be considered acceptable, when they are seen next to each other in Figure 33 it's clear that the "fixed" image is of much lower quality. By using the computer software to "push" process the image it had to "stretch" the limited information and could not fill in or "fake" the missing data. This literally caused gaps in the range of tones as shown in the histogram.

Of course higher-end digital cameras and digital backs will yield better results with some variations in proper exposure. And multiple exposure techniques as well as the use of RAW capture will allow you to effectively extend exposure latitude; although, once again these techniques will add additional computer processing time and require proper exposure control.

Today you now have two very versatile tools to assist you in your quest for proper exposure – the histogram and the light meter.

CHALLENGE! Can you match each image to its Histogram?

Trying to judge an image only based upon its histogram is like trying to tell what someone looks like based upon their fingerprint. Like a pilot's instruments, a photographer's light meter is the key to gaining valuable information about a scene's tonal values and hues before it is captured. **ANSWERS ON BOTTOM**

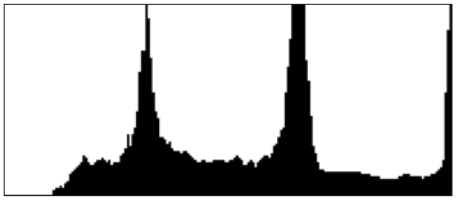
1)

2)

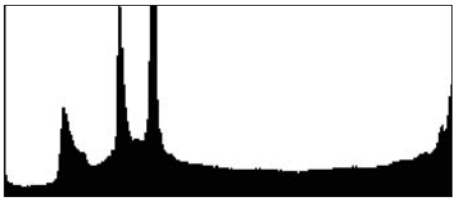
3)

4)

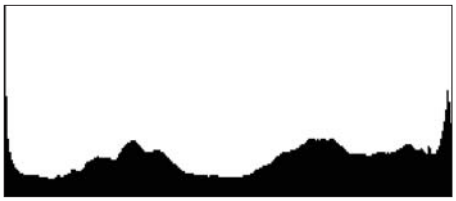
a)



b)



c)



d)

ANSWERS

1d 2c 3b 4a

Sekonic L-558R

Features:

1° spot that measures reflected flash output down to an amazing f/2.0 (ISO 100) Analyzing Function for simultaneous reading of flash and ambient light Selectable full, 1/2 or 1/3 stop settings Retractable and Rotating Lumisphere Built-in Radio Transmitter for simultaneously triggering and measure flash exposures wireless. Selective Quad-Triggering control buttons for quick selection of which flash unit to trigger and measure. Illuminated 1 degree LCD viewfinder. The power of control....the freedom of wireless

Sekonic L-358

Features:

Analyzing Function for simultaneous reading of flash and ambient light Optional Plug-in radio transmitter module to simultaneously trigger and measure the flash exposure wirelessly Compatible with all PocketWizards Selectable full, 1/2 or 1/3 stop settings Retractable-Removable-Rotating Lumisphere Optional 1°, 5° and 10° Spot Attachments. The world's most affordable light meter with Digital Wireless Freedom.

What is Digital Wireless Freedom?

It is a system of professional photographic products which incorporate a compatible digital wireless radio system, eliminating the need for PC sync and shutter release cables.

Electronic Flash

Select which flash unit you want to trigger (using Quad-Triggering mode) and measure the light without wires.

Camera & Flash

Trigger your flash and camera simultaneously without wires and measure the light output from your Sekonic meter.

Nikon D-Series

Upgrade your Nikon with PocketWizard Transceiver technology and trigger flash, cameras or both at the same time with a Sekonic radio ready light meter.

Norman D & ML Series

Norman offers PocketWizard Radio Receiver technology inside their power pack units and monolights. Both can be triggered and measured with a Sekonic radio triggering light meter.

PocketWizard

The perfect companion to Sekonic radio triggering meters. PocketWizards trigger your flash, cameras or both without wires from the palm of your hand or when attached to your camera.

Profoto

Profoto Acute2R, D4 and ProB2 with built-in radio receiver accepts digital radio triggering signals from the Sekonic transmitter module without wires.

Kodak DCS Pro SLR/n

With full PocketWizard Transceiver software control built-in, trigger flash, cameras or both at the same time with a Sekonic radio-ready light meter.

Dyna-Lite Wi Series

The Wi series incorporates PocketWizard Receiver technology inside. It accepts the radio triggering signals from a Sekonic radio- ready light meter wirelessly.

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