Understanding Camera Settings

What is an F-Stop?

by Rhetta Carl

So what exactly is an f-stop? Well, to put it in the very simplest terms, it is the opening that lets light into your camera. And so the numbers on the f-stop relate to the size of the opening that is letting light into your camera. F-stops are measured by a scale, and this is known as the f-stop scale. If you are not familiar with a camera, the f-stop numbers can be very confusing as they do not seem to make any sense. The f-stops are actually a measurement of the diameter of the aperture. Logically, they should be expressed as a fraction and this number would tell you the diameter in millimeters as a fraction of the actual focal length of the lens. So if you had a zoom set at 40 mm with an aperture of F8, the diameter of the aperture opening is 5 mm (40 divided by 40).

Adding to this confusion, the numbers that correspond to different f-stops seem backwards, because an aperture of F8 is actually smaller than an aperture of F4. So, the larger the number the smaller the opening. And the smaller the number the larger the opening. And then you get into the fact that most f-stop numbers are not a full number. They are an f5.6, or an f19, or an f6.3, or an f1.4. If you are not familiar with f-stops and aperture openings none of this makes any sense. These numbers depict half stops and third stops, as well as full f-stops.

The typical range for f-stops on a camera, progressing from a wide setting to a small setting is f4, f5.6, f8, f11, and f16. Some lenses will have a wider range and may offer half stops and/or third stops. Another funny thing about f-stops, is if you halve the number of the f-stop, the aperture lets in a quarter amount of light, because it is it two stop decrease. If you are thinking about it logically, you would naturally assume that if you took and halved your f-stop that you would be letting in half the light. But that is not true because with each f-stop decrease you are halving the amount of light, therefore with two f-stops, you would only have one quarter of the light.

If you take your f-stop scale, and add your half stops, the scale is F4, F4.8, and F5.6. If you then do your third stop range. It would go F4, F4.5, F4.8 (for your half), F5 and F5.6.

The key thing to remember about f-stops is that it is a measure of the amount of light that is being let in through your lens. You can think of it as having a paper towel roll, and looking through the roll at the light. If you took a piece of tinfoil and put it over the end of the paper towel roll and poked a pinhole in it, you would have a high f-stop or small aperture opening. The bigger you made the hole, the smaller your f-stop number would become and the more light you would be letting in. Using your aperture control with your shutter control on your camera will give you the proper exposure. The best way to figure out what is happening with the different settings, is just to play with it. Especially if you have a digital camera, you can just delete whatever doesn't turn out well.

Don’t worry if you don’t know what all the controls on your camera mean. You can learn as little or as much as you want. After all, you can always just set it on auto and your camera will take the picture for you, and chances are it will turn out great. The manual controls are for those shots your camera has a hard time taking, or just for some creative control. Maybe you don’t want your shot to look like reality. I post information that you may find helpful in learning how to use

What is Shutter Speed?

Defined most basically – **shutter speed is ‘the amount of time that the shutter is open’**.

In digital photography shutter speed is the length of time that your image sensor ‘sees’ the scene you’re attempting to capture.

Let me attempt to break down the topic of “Shutter Speed” into some bite sized pieces that should help digital camera owners trying to get their head around shutter speed:

- **Shutter speed is measured in seconds** – or in most cases fractions of seconds. The bigger the denominator the faster the speed (ie 1/1000 is much faster than 1/30).
- **In most cases you’ll probably be using shutter speeds of 1/60th of a second or faster**. This is because anything slower than this is very difficult to use without getting

camera shake. Camera shake is when your camera is moving while the shutter is open and results in blur in your photos.

- **If you're using a slow shutter speed (anything slower than 1/60) you will need to either use a tripod** or some some type of image stabilization (more and more cameras are coming with this built in).
- **Shutter speeds available to you on your camera will usually double (approximately) with each setting.** As a result you'll usually have the options for the following shutter speeds – 1/500, 1/250, 1/125, 1/60, 1/30, 1/15, 1/8 etc. This 'doubling' is handy to keep in mind as aperture settings also double the amount of light that is let in – as a result increasing shutter speed by one stop and decreasing aperture by one stop should give you similar exposure levels (but we'll talk more about this in a future post).
- **Some cameras also give you the option for very slow shutter speeds** that are not fractions of seconds but are measured in seconds (for example 1 second, 10 seconds, 30 seconds etc). These are used in very low light situations, when you're going after special effects and/or when you're trying to capture a lot of movement in a shot. Some cameras also give you the option to shoot in 'B' (or 'Bulb') mode. Bulb mode lets you keep the shutter open for as long as you hold it down.
- **When considering what shutter speed to use in an image you should always ask yourself whether anything in your scene is moving** and how you'd like to capture that movement. If there is movement in your scene you have the choice of either freezing the movement (so it looks still) or letting the moving object intentionally blur (giving it a sense of movement).
- **To freeze movement in an image** (like in the surfing shot above) you'll want to choose a faster shutter speed and to let the movement blur you'll want to choose a slower shutter speed. The actual speeds you should choose will vary depending upon the speed of the subject in your shot and how much you want it to be blurred.

- **Motion is not always bad**. I spoke to one digital camera owner last week who told me that he always used fast shutter speeds and couldn't understand why anyone would want motion in their images. There are times when motion is good. For example when you're taking a photo of a waterfall and want to show how fast the water is flowing, or when you're taking a shot of a racing car and want to give it a feeling of speed, or when you're taking a shot of a star scape and want to show how the stars move over a longer period of time. In all of these instances choosing a longer shutter speed will be the way to go. However in all of these cases you need to use a tripod or you'll run the risk of ruining the shots by adding camera movement (a different type of blur than motion blur).
- **Focal Length and Shutter Speed** - another thing to consider when choosing shutter speed is the focal length of the lens you're using. Longer focal lengths will accentuate the amount of camera shake you have and so you'll need to choose a faster shutter speed (unless you have image stabilization in your lens or camera). The 'rule' of thumb to use with focal length in non image stabilized situations) is to choose a shutter speed with a denominator that is larger than the focal length of the lens. For example if you have a lens that is 50mm 1/60th is probably ok but if you have a 200mm lens you'll probably want to shoot at around 1/250.

Shutter Speed – Bringing it Together

Remember that thinking about Shutter Speed in isolation from the other two elements of the Exposure Triangle (aperture and ISO) is not really a good idea. As you change shutter speed you'll need to change one or both of the other elements to compensate for it.

For example if you speed up your shutter speed one stop (for example from 1/125th to 1/250th) you're effectively letting half as much light into your camera. To compensate for this you'll probably need to increase your aperture one stop (for example from f16 to f11). The other alternative would be to choose a faster ISO rating (you might want to move from ISO 100 to ISO 400 for example).

Introduction to White Balance

White Balance is an aspect of photography that many digital camera owners don't understand or use – but it's something well worth learning about as it can have a real impact upon the shots you take.

At its simplest – the reason we adjust white balance is to get the colors in your images as accurate as possible.

Why would you need to get the color right in your shots?

You might have noticed when examining shots after taking them that at times images can come out with an orange, blue, yellow etc look to them – despite the fact that to the naked eye the scene looked quite normal. The reason for this is that different sources of light have a different 'color' (or temperature) to them. Fluorescent lighting adds a bluish cast to photos whereas tungsten (incandescent/bulbs) lights add a yellowish tinge to photos.

The range in different temperatures ranges from the very cool light of blue sky through to the very warm light of a candle.

We don't generally notice this difference in temperature because our eyes adjust automatically for it. So unless the temperature of the light is very extreme a white sheet of paper will generally look white to us. However a digital camera doesn't have the smarts to make these adjustments automatically and sometimes will need us to tell it how to treat different light.

So for cooler (blue or green) light you'll tell the camera to warm things up and in warm light you'll tell it to cool down.

Adjusting White Balance

Different digital cameras have different ways of adjusting white balance so ultimately you'll need to get out your camera's manual out to work out the specifics of how to make changes. Having said this – many digital cameras have automatic and semi-automatic modes to help you make the adjustments.

Preset White Balance Settings

Here are some of the basic White Balance settings you'll find on cameras:

- **Auto** – this is where the camera makes a best guess on a shot by shot basis. You'll find it works in many situations but it's worth venturing out of it for trickier lighting.
- **Tungsten** – this mode is usually symbolized with a little bulb and is for shooting indoors, especially under tungsten (incandescent) lighting (such as bulb lighting). It generally cools down the colors in photos.
- **Fluorescent** – this compensates for the 'cool' light of fluorescent light and will warm up your shots.
- **Daylight/Sunny** – not all cameras have this setting because it sets things as fairly 'normal' white balance settings.
- **Cloudy** – this setting generally warms things up a touch more than 'daylight' mode.
- **Flash** – the flash of a camera can be quite a cool light so in Flash WB mode you'll find it warms up your shots a touch.
- **Shade** – the light in shade is generally cooler (bluer) than shooting in direct sunlight so this mode will warm things up a little.

Manual White Balance Adjustments

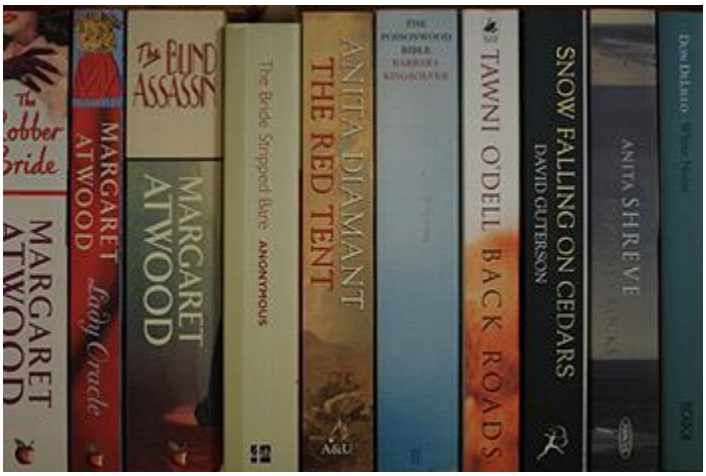
In most cases you can get a pretty accurate result using the above preset white balance modes – but some digital cameras (most DSLRs and higher end point and shoots) allow for manual white balance adjustments also.

The way this is used varies a little between models but in essence what you do is to tell your camera what white looks like in a shot so that it has something as a reference point for deciding how other colors should look. You can do this by buying yourself a white (or grey) card which is specifically designed for this task – or you can find some other appropriately colored object around you to do the job.

I've done this with the following two shots.

The first shot is one of some books on my wife's bookshelf taken in Auto White Balance mode. The light in my room is from three standard light bulbs and as a result the image is quite warm or yellow.

After taking this picture I then held up a piece of white paper to my camera to tell it what color white is. Then I took a second shot with this setting and got the following result – which you'll see is a much truer color cast than the first image.



This manual adjustment is not difficult to do once you find where to do it in the menu on your camera and it's well worth learning how to do it.

DEPTH OF FIELD

Depth of field refers to the range of distance that appears acceptably sharp. It varies depending on camera type, aperture and focusing distance, although print size and viewing distance can also influence our perception of depth of field. This tutorial is designed to give a better intuitive and technical understanding for photography, and provides a depth of field calculator to show how it varies with your camera settings.

Understanding the Histogram

The histogram is a useful but often misunderstood tool that your camera provides to help you get the correct exposure on your images.

Getting the best exposure (there is not such thing as the “correct” exposure, as it’s all subjective) in camera should be your goal every time you click the shutter. Using these tips should help you increase your success rate.

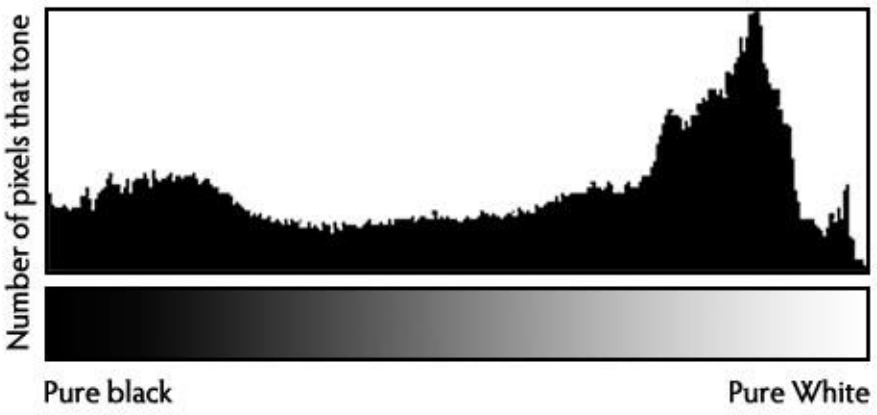
What is a histogram?

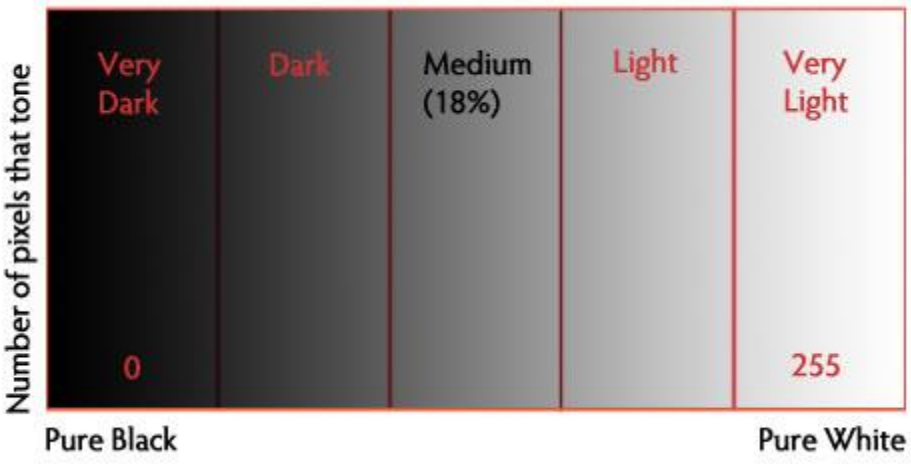
Dictionary definition: *A bar graph of a frequency distribution in which the widths of the bars are proportional to the classes into which the variable has been divided and the heights of the bars are proportional to the class frequencies.*

HUH?! Anyone else confused? But what does it do? How do you read it? Let’s have a look!

How to read the Histogram

A histogram is a graphical representation of the pixels exposed in your image. The left side of the graph represents the blacks or shadows, the right side represents the highlights or bright areas and the middle section is mid-tones (middle or 18% grey). How high the peaks reach represent the number of pixels in that particular tone. Each tone from 0-255 (o being black and 255 being white) is one pixel wide on the graph, so imagine the histogram as a bar graph all squished together with no spaces between each bar. Have a look at the diagrams below:

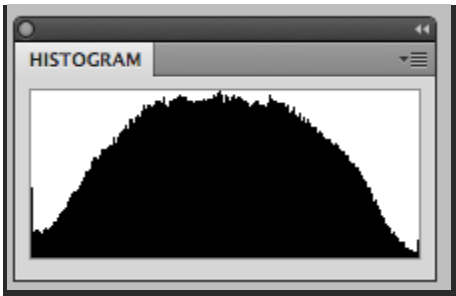




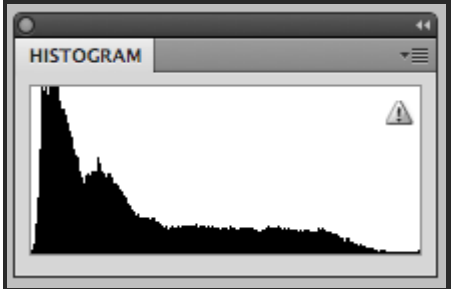
What can we learn from this histogram?

There are many things we can learn about an image just by looking at the histogram.

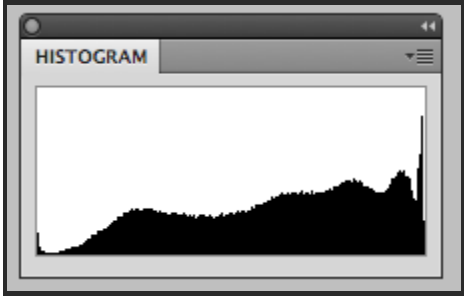
We can tell an image is well exposed if it reaches fully from edge to edge without a space on one side of the graph, and isn't heavily going up one side or the other. In an ideal world, it should just touch the left and right edges, and not spill up the sides, with a nice arch up in the center. However that doesn't always apply in every situation, for every scene. Here are a few examples:



This is how an ideal histogram might look, evenly distributed, edge to edge, not up the sides



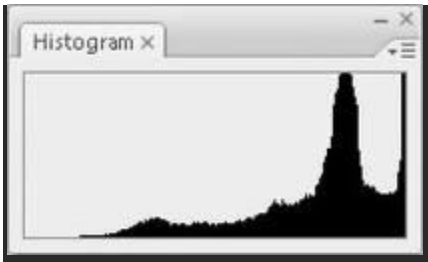
This is a histogram for a dark subject, it is not wrong it is just more shifted to the right to represent the tones of the subject. This might be a black cat on the dark pavement.



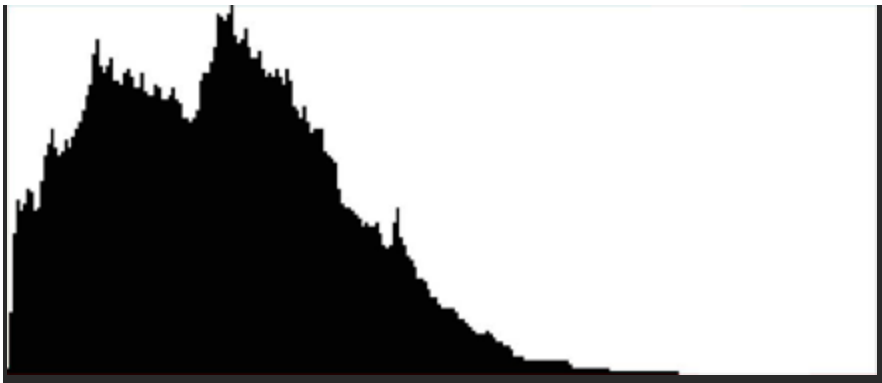
This is a histogram for a light subject (white cat) with mostly light tones in the scene and few dark areas. See how it is shifted to the right now versus the dark subject. This is correct. If you change your exposure on this to make it in the middle you will have grey cat and not a white one.

When the histogram tells you to adjust your exposure

Gaps on either end indicate you are missing information and your exposure can be shifted safely without losing detail. When your graph is shifted too far in one direction or the other so that it does not even touch the other edge – that means you can safely shift your exposure to cover more of the range of tones. Let's look!



This graph shows an overexposed image, notice the gap on the left side indicating a lack of any blacks represented. It also means you will lose lots of detail in the white areas that may not be recoverable. In this case shift to give your image less exposure and shoot the scene again.



This one shows the opposite. Now we see a gap on the right side of the graph indicating there are no whites represented so the image will be dark, too dark. You can safely give the image more exposure until you see the graph just touch the right edge of the graph.

What do the spikes up the sides mean?

Spikes up the left or right edge indicate “clipping” of that tone and loss of detail in that area. Clipped areas are often unrecoverable, especially in the highlight area but it is generally advised to expose so you your graph just touches the right edge and keep your highlight details. It is usually easier to recover some shadow detail and retain a decent image, than try and create highlight detail that isn’t there on the file.

In some scenes, however, it may not be possible to keep the graph within an acceptable range. For example, if you are photographing a scene with extreme contrasts such as: a sunset; bright sunlight and deep shadows; or an inside a building where you show outside the windows as well. In all of those cases you will not be able to keep from clipping either your blacks, or whites, or even both.

High contrast graph

This graph shows an image with extreme contrast, lots of blacks, a spike of white and not much in the middle.

Is it wrong? Can you correct for it?

No it's not wrong. You can't really "correct" for it but you do have a decision to make when you see something like this. Do you shift the graph left and maintain highlight detail, or shift it right and keep shadow detail?

There is no right or wrong here, it's how you interpret the scene before you. If in doubt, shoot both and decide later. The graph above comes from the image below, so as you can see it is not the incorrect exposure at all.

There are no mid-tones in this scene.

Here's another example of a scene that will potentially go off the graph on both ends.

Notice the skylight at the top of the roof is blown out, and the deep shadows have little detail.

Notice in this image the details have been retained in both areas.

Using advanced techniques like image merge/blend, HDR and processing in Lightroom 4 (or PS CS6) you can compress the contrast range of the scene to fit within the histogram and therefore have details in all areas.

In the image above, I've used 4 bracketed images (taken 2 stops apart), and the HDR tone