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Camera Techniques & Exposure

Exposure Basics

Understanding exposure is the key to creating controlled images. If you consistently practice good exposure techniques, you will produce well-exposed photographs, instead of photographing by the "hit-and-miss" approach. You will also be able to avoid bracketing, except in very tricky lighting situations.

Exposure can be defined simply as the amount of light that hits your sensor.

- Exposure is determined by two factors:
    1) The amount of light in the scene
    2) The sensitivity of your sensor (ISO)

- Exposure is controlled by two things:
    1) Shutter speed
    2) Aperture (f-stop)

Exposures in photography are measured in values that are called "stops." A "stop" is one of the most important terms in photography. A stop is defined as double or half a given amount of light. You will learn that you can describe a stop of light in many different ways, including f-stops, shutter speeds, film speeds and even zones.

Before you dive into the meat of this section, you may want to watch Forest Chaput de Saintonge's video about the basics of exposure to give you a brief introduction to the concepts.

Shutter Speed

The shutter speed measures the length of time that your shutter stays open, exposing your sensor to light. The shutter is positioned in front of the sensor in the back of the camera. The sensor is exposed when the shutter opens horizontally or vertically in front of it. (This is why you can change lenses on your camera without exposing the sensor.)

Shutter speeds are measurements of time that can range (depending on your particular camera) from a nearly infinite number of seconds to (usually) about 1/8,000 of a second.

Full shutter-speed increments are as follows:

> Full second increments – 30, 15, 8, 4, 2, 1
> Continuing to…
> Fractions of seconds – ½, ¼, 1/8, 1/15, 1/30, 1/60, 1/125, 1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/8000.

Each full shutter speed is exactly one stop apart from the one that precedes it and the one that follows it.

As such, each full shutter speed is one-half as much light as the one that precedes it and twice as much light as the one that follows it. For example, 1/30 of a second lets in twice as much light as 1/60 of a second and one-half as much light as 1/15 of a second.

Note: Many cameras have 1/2 or 1/3 stop shutter speed increments as well, but the same rules apply. You will simply see more options for fractions to choose, in between the full-stop shutter speeds.

To achieve an exposure longer than 30 seconds, you can use a setting that most professional cameras have called BULB. Bulb allows you to set the shutter open for as long as you want.

F-Stops

The opening in your lens is called the aperture and the measurement of this opening is called the f-stop. Light enters your camera through the aperture and exposes your sensor to light. F-stops are also measured in stop increments. F-stops range from (depending on your particular lens), f/1 to f/64 and up.

F-stops that are commonly available on lenses for digital photography are:

Figure EXP.01 Common F-Stops

Each f-stop on your lens is exactly one-half or twice the amount of light as the f-stop on either side of it. Note: Many lenses also have intermediate f-stops in 1/2 or 1/3 increments. For example, f1.8, 2.2, 3.5, 4.5, etc. Keep in mind that these are not full f-stop increments.

Remember that f-stops denote the size of the lens opening. The higher the f-stop number, the smaller the size of the opening. So f1.4 is a much larger opening than f22 on a lens. And because the f-stops are measured in stops, f4 lets in exactly twice as much light as f5.6 and exactly one half as much light as f2.8.

Opening Up and Stopping Down

Two important photographic terms are opening up and stopping down (or closing down). Opening up means letting in more light and stopping down means letting in less light. You perform these functions by changing either your shutter speed or your f-stop (or both!). You open up or stop down in stop increments.

For example, if you were at f5.6 and you wanted to let in twice as much light, you would open up to f4. If you were at 1/125 of a second and you wanted to let in one-half as much light, you would stop down to 1/250. Opening up and stopping down works as follows:

Changing by one stop means letting in one-half as much light (or twice as much if you go in the other direction).

Changing by two stops means letting one-fourth as much light (or four times as much if you go in the other direction).

Changing by three stops means letting one-eighth as much light (or eight times as much as you go in the other direction)

And so on……

ISO

ISO refers to the sensitivity of the sensor in a digital camera (or film in traditional cameras). The higher the ISO, the less light you need in your scene in order to accurately expose your image. With traditional cameras, if you needed to get a faster shutter speed because of low light or fast action, you had to change to a higher ISO film. This could be wasteful or inconvenient at best. With digital cameras, you can change the ISO on the fly. Now it is possible to be photographing outside in bright sunlight with a low ISO (for better color and image quality) and then walk indoors, change the ISO and continue shooting.

This increased sensitivity does have its drawbacks however. With film you get an excess of grain; with digital you get what is called "noise". The grain of film, in most cases, is considered acceptable and in some cases even desired. Noise, however, does not have the same allure.

To function using an increased ISO, or during very long exposures, the camera must send more power to the sensor, which results in the appearance of small specks or dots of white or color (noise). A *blotchy* look can also be created from higher ISOs or long exposures. Most of the noise will generally manifest itself in the darker areas of your image. This is an important point to pay attention to if you like to shoot in dark situations or create long-exposure images.

Just like shutter speeds and f-stops, ISO works in stops. Each sensor has a native ISO of usually 100 or 200. That is the ISO at which the sensor is meant to operate. You want to use your lowest ISO as much as possible, because you should not see any noise at that setting. When you increase the ISO, even by just a couple of stops, you will begin to see noise, because the sensor is pushing itself to be able to see light in darker areas.

Most cameras have an ISO range of 100, 200, 400, 800, 1600, 3200, and 6400. Some newer cameras also have ISO 12800 and 25600. These settings do allow the photographer to shoot in very dark situations, but noise will be very apparent.

Higher-end and newer cameras will be the best at reducing the noise level at middle and high ISOs. Noise is much more common on older and lower-cost models.

Look to online reviews to see how much noise individual cameras will produce.

How Shutter Speeds, F-Stops and ISO Work Together

Shutter speeds, f-stops, and ISO are directly related to each other since any of these controls can affect the amount of light that the sensor records, either by the amount of time the shutter remains open (shutter speed), how large the lens opening is (f-stop), or how sensitive the sensor is to light (ISO). If you desire to maintain the same amount of light hitting your sensor, but you make a one-stop change with either your shutter speed, f-stop, or ISO, you must make a corresponding change in the opposite direction with another control. If you open up one stop with your shutter speed, in order to keep the equivalent exposure, you must stop down one stop with your f-stop or ISO.

For example, if the proper exposure of your scene is f16 @ 1/125 of a second and at ISO 400, you could photograph at that exposure, OR you could photograph it at any of the following exposures and you would be letting in the exact same amount of light. In the chart below, controls that have been adjusted are in **bold**.

- Initial exposure: f16 1/125 ISO 400

- Others choices are:

f16	**1/60**	**ISO 200**
f11	**1/250**	ISO 400
f8	1/125	**ISO 100**
f5.6	**1/250**	**ISO 100**

How Shutter Speeds and F-Stops Affect the Photograph

Shutter speeds and f-stops are important in governing the amount of light that reaches your sensor, but they are also important in determining how your photograph looks.

Shutter speeds can freeze action or register motion in your final image. The faster the shutter speed you use, the more likely you are to stop or freeze motion.

Four important points about shutter speeds:

1) If you want to freeze motion, use the fastest shutter speed you can use. For example, stopping a person running in a race. Generally you will need a shutter speed of 1/500th of a second or shorter to stop action.

2) If you want to show motion, use one of the slowest shutter speeds you can use. For example, blurring the motion of running water. Generally, you will need a shutter speed of 1/2 of a second or longer to show motion and have it look intentional.

3) If you are handholding your camera, you must shoot at a fast enough speed to prevent natural camera shake from blurring your photo. Shoot at a speed that is as fast or faster than the reciprocal of your lens length. For example, if you are shooting with a 50mm lens, shoot at 1/60 of a second or faster. If you are shooting with a 100mm lens, shoot at 1/125 of a second or faster, and a 200mm lens at 1/250 of a second or faster.

4) When using flash, always set your shutter speed at the sync speed for your camera. That sync speed is usually 1/125 or higher.

How F-Stops Affect Depth of Field

F-stops are also important in determining how your photograph will look. Aperture size is critical to "depth of field". Depth of field measures the area of the photograph that is perfectly sharp from front to back. The greater the size of the aperture opening, the less depth of field you will have. The smaller the aperture, the greater depth of field you will have.

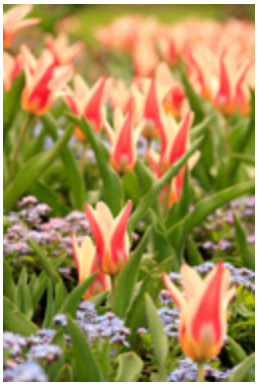
Landscape and architectural photography typically call for a great depth of field where the f-stop is in the neighborhood of f/16 or f/22. Portrait, sports, and wildlife photography call for a shallow depth of field where the subject is sharp but the background is out of focus, often in the range of f/2.8. You may have a depth of field scale on your lens and/or a depth of field "preview" button that can help you check your depth of field before you take a photograph.

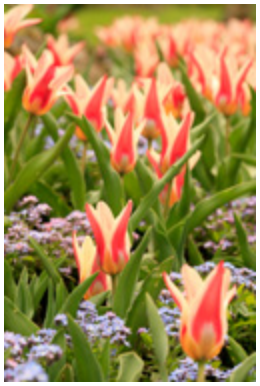
To see how f-stops affect depth of field, look at the following images of tulips.

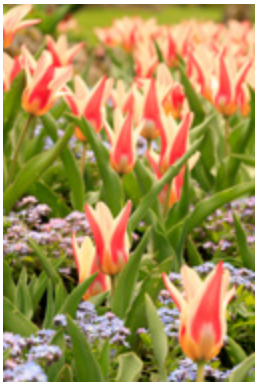

f/3.5

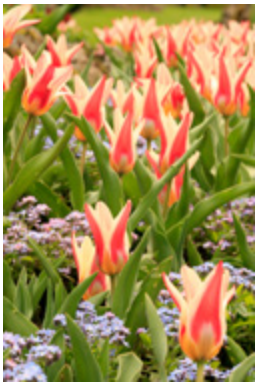

f/4

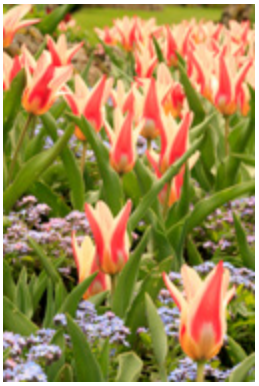

f/5.6


f/8


f/11


f/16


f/22


f/32

Resolution

Probably the least understood and most talked about feature of digital cameras is Resolution. The more the better, right? Well, most of the time. More resolution doesn't always mean better photographs.

So, what is resolution? It's commonly defined as the amount of pixels in the final image. The width and height of the final image will help you calculate resolution. A high resolution allows you to make larger prints without sacrificing the quality of the image.

These days almost all digital cameras shoot with very high resolutions. Even the less expensive cameras all come with resolutions sufficient enough to make good 8"x10" – 11"x14" prints. So what is the big attraction to higher resolutions? Mostly, it is a selling point for the manufacturers!

More resolution is good but what is even better is a larger sensor size. The bigger, the better. This is a much better measure of the camera's final image quality.

There are two common sensor sizes in DSLRs, the full-frame sensor (equal in size to one frame of 35mm film) and the crop sensor (about half the length and width of a full-frame sensor).

Crop sensors have some benefits such as making lenses seem longer through the viewfinder than they actually are, but in general, a full-frame sensor provides higher image quality and the capability of wider lenses.

However, the camera you have with you is always the best camera for you! Exhaust the capabilities of what you own before buying more gear.

Exposure Modes

Exposure modes set how much control you give your camera in setting the proper exposure of a scene. We know that there are three things that determine your exposure: the f-stop or aperture, shutter speed and ISO. Depending on our exposure mode we choose, we can determine which of these controls the camera will set and which we will have to set manually.

There are four main exposure modes on today's professional cameras: Program, Shutter Preferred, Aperture Preferred and Manual. Let's take a look at each of these modes.

Program (P):

This is the most automatic of all the exposure modes. In this mode, the camera sets all of your exposure settings based on what the meter tells it. It does its best to make a proper exposure. In Program mode we do have slight control over the settings but the camera is doing most of the work.

Shutter Preferred (S, Tv):

In this mode the photographer chooses the shutter speed and ISO and the camera determines the proper aperture to create a suitable exposure. Many sports photographers like this mode as it ensures that, because they set the shutter speed, a shutter speed fast enough to stop action is always used.

Aperture Preferred (A, Av):

Aperture Preferred is the exact opposite of Shutter Preferred. Here the photographer sets the aperture and ISO and the camera calculates the best shutter speed to create a well-exposed image. Landscape photographers who want a lot of depth of field (and are not trying to stop or show motion) often prefer to use this exposure mode.

Manual (M):

Manual mode is the favored mode of most professional photographers as it allows for the greatest amount of control. Here the photographer sets all three exposure controls manually with the help of the camera's meter. If you are hoping to outsmart the meter or use the Zone System you will want to be set on Manual.

	Camera Sets	**You Set**
Program	Shutter Speed, Aperture	ISO
Shutter Preferred	Aperture	Shutter Speed, ISO
Aperture Preferred	Shutter Speed	Aperture, ISO
Manual	Nothing	Shutter Speed, Aperture, ISO

Figure EXP.02 Exposure Modes

Most professionals choose between one of two exposure modes: Manual or Aperture Preferred. Manual gives the most control, but Aperture Preferred allows the photographer to think more about things such as composition and posing, while allowing the camera to make a proper exposure.

Metering

These days, all cameras–even the ones in cell phones–are equipped with a light meter. In fact, the meter is one of the most important elements of the camera. It helps determine the proper exposure to be used in your images.

A meter is simply a light detector that measures the amount of light coming through the lens. Meters aren't able to see colors. They see the world in black and white. If you point your meter at a field of red, yellow and purple flowers, all the meter sees is shades of dark and light grey. This can be a little confusing at first, but it allows us to use more advanced techniques such as the Zone System!

Camera light meters are calibrated to give you an average reading of 18% gray on every photograph you take. They are designed this way because most scenes have a mixture of lights and darks that roughly translates to "average", or a value halfway between black and white (18%).

What this means is that when you look through your camera and adjust your controls until the meter reads "0" (see page 12 for instructions on how to zero out the meter), your camera is going to record your image as if everything in the scene is of medium brightness.

Let's say you have your camera set to one of the automatic modes (or you are using the camera in your cell phone). In this mode, the camera will use the light meter to automatically determine the best exposure. Say you want to take an image of a beautiful snowy winter scene. You point your camera at the scene and take a photograph. Would the image be too bright or too dark?

The answer is "too dark", but let's take a look at why. Remember, all meters think the world should be 18% grey. If I were to ask anyone what color snow is, they would tell me snow is white. White and 18% grey definitely aren't the same! When you point the camera at the snowy field, it sees all that bright white snow and thinks "Wow, that's a lot brighter than 18% grey. I better darken the image to make that bright snow as close to 18% grey as possible." This means that the camera is intentionally making this image too dark.

On the other hand, let's say we are now shooting a portrait of a black bear. Again, we leave the camera in automatic mode. This time, will the image be too dark or too bright? In this case the image would be too bright. The camera will see the dark black fur on the bear and think that it needs to brighten the image to make the black turn out as close as possible to 18% grey.

What would be an example of a subject that would allow the meter to garner a perfect exposure? Anything that is actually 18% grey in real life. This sounds very limiting, right? Our options would be concrete, sheet metal and dark storm clouds. But we need to remember that a meter can't see colors. It translates colors into shades of grey. This means that anything that would be 18% grey if it were converted to black and white will work as well. A few examples would be bright blue sky, a fire engine, or green grass. To the meter, those are all 18% grey, or "average."

So the easy answer is, in automatic mode, just be sure you point your meter at something "average," where there are roughly equal areas of lights and darks, and your camera will provide you with a perfect exposure!

Metering Modes

Before we talk more about that, let's take a look at how the meter goes about reading the light in a scene. By changing the metering mode, we can determine how the meter will read the light coming into the lens.

If we take a look at the photo below, we see that there are many areas of varying brightness across the image.

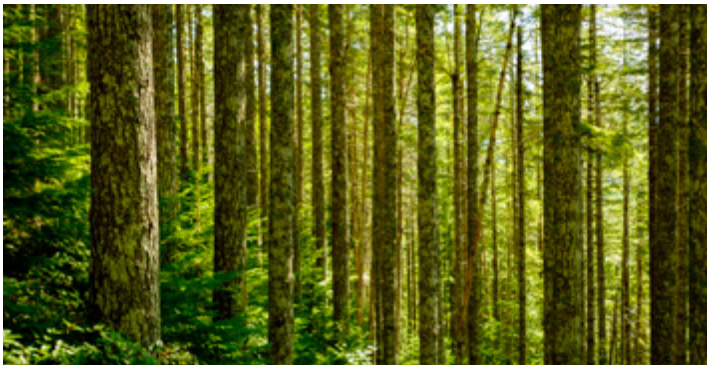


Figure EXP.03 Photo Example

When we talk about "pointing the meter," we need to know how much of the image the meter is actually looking at. Is it metering the whole scene or only looking at a small area? The answer to that question would have influence over what the final exposure looks like. This is actually controllable. By changing our metering mode, we can set how much of the scene is being considered by the meter.

There are three metering modes photographers commonly use. They are called slightly different things depending on your camera manufacturer but the way they operate is much the same. The chart below shows what some major camera manufacturers call them.

Canon	Nikon	Fuji	Olympus
Evaluative	Matrix	Multi	Digital ESP
Center Weighted	Center Weighted	Average	Center Weighted Average
Spot	Spot	Spot	Spot

Figure EXP.04 Metering Modes

We will be using Canon's nomenclature for the different metering modes throughout the rest of this PDF.

Evaluative

Evaluative metering is the smartest of all your metering modes. In simple terms it tries to average the light across the entire scene. If you have areas of both light and dark in a scene it will see both and average to generate a meter reading. This is by far the best metering mode to use when operating your camera on one of the automatic modes (Program, Aperture Preferred, Shutter Preferred).

Center Weighted

Center-weighted metering still looks at the entire scene, but it puts more emphasis on things that are in the center of the frame. This mode was designed mostly for amateur photographers who always put the subject in the center of the image. As we progress in photography we learn that centering the subject isn't always the best choice. If you plan on putting the subject of the image anywhere other than the center, this mode will not work well for you.

Spot

Spot metering ignores the vast majority of the image and only looks at the light in the very center of the frame. This means you can point the camera to the exact location where you would like to measure the light from, and it will ignore everything else. You could point your camera at a patch of green grass that equates to an 18% grey tone, and zero out your meter on the grass to achieve a proper exposure for your entire scene. Spot metering is the best mode to use if you're planning on using the Zone System to give you the proper exposure. Do not use spot metering if you are using an automatic exposure mode, as it will usually produce an improper exposure.

By choosing the appropriate metering mode, we can ensure that only the light we want the meter to consider is being considered. In Figure EXP.03 on the previous page, there are roughly equal areas of light and dark across the image. If we set our camera to evaluative metering and trust what the camera tells us for an exposure, our image will come out correctly exposed. We know this to be true because all meters try to make things 18% grey, and evaluative metering looks at an average of the whole scene. The scene in question, when averaged would be roughly 18% grey and therefore the meter will give you a correct exposure when set on evaluative metering mode.

It's important to use and understand these metering modes in order to create properly exposed images. We recommend using evaluative metering most of the time unless you are familiar with the Zone System. In that case, we recommend the spot metering mode.

Using the Meter

Most professionals will agree that the Manual exposure mode is the place to be. It allows photographers the greatest amount of control over their images and exposures.

When using Manual we must manually set the shutter speed, aperture and ISO. However, this can't be done blindly. We must use the camera's meter to give us an idea of what a correct exposure will be. Let's delve into this and see just what's involved when working in manual mode.

The process starts by taking a meter reading. Let's assume we have our camera set to spot metering (for more on metering modes, see page 10). In order to take a reading, we point the camera–more specifically, the spot meter circle– somewhere in the scene we are shooting.

Let's say we are shooting the scene below. We point the spot meter at the green grass and push in the shutter button halfway. This tells the camera to read the amount of light coming through the lens from that specific portion of the scene.

Figure EXP.05 Green Grass Photo

The meter will now tell us, given our currently set shutter speed, aperture and ISO, how bright or dark the resulting image would be if we were to click the shutter. It shows us the results on a scale in the bottom of the viewfinder. This will look something like the following scale.

Figure EXP.06 Exposure Scale

There will be a needle pointing somewhere on this scale telling us how bright or dark the resulting image will be. This scale is measured in stops (for more on stops, see page 5-6). This means that if the needle were pointing at -2, the resulting image would be two stops underexposed (too dark). The idea is that we change our shutter speed, aperture and ISO until that needle points right at the 0 on the scale (unless you are using zone system). This is called "zeroing out your meter."

Figure EXP.07 Zeroing Out

Sometimes, if the needle is all the way to one side of the scale it might not appear to move when you change an exposure setting. This simply means that the exposure is so far off that the needle is beyond the range of the scale. If this is the case, keep changing the exposure to a brighter or darker setting until the needle begins to move. This can be confusing at first, but you soon will become accustomed to it.

Outsmarting the Meter

At this point we all know how light meters work and how different metering modes can change the way your meter sees and reacts to light.

Now let's take a look and learn how we can be smarter than our light meter. It's actually quite simple. As explained on page 10, meters are programmed to think the world is 18% grey. If a meter sees white snow, it intentionally darkens down the exposure to make the snow look closer to middle grey (of average tone) in the final image.

It will do the opposite to something dark, adjusting your exposure to ensure that the dark object ends up 18% grey in the final image. This occurs when your camera is set to manual and you are centering out ("zeroing out") the needle –as well as when your camera is set on any automatic mode.

But we can do better than that! The meter can't learn anything new; it is stuck forever thinking the world should be middle grey. We just need to adjust how we do things to compensate for this.

Let's start with a few basics. From now on, let's assume you have your camera set to manual exposure mode and you use "spot" metering. This will make it easier to understand exactly what we're doing to outsmart the meter.

The most basic way to learn how to outsmart the meter is to use what's called a photographer's "grey card."

A grey card is simply a piece of grey cardboard that is exactly 18% grey (halfway between black and white). We can use this grey card to achieve perfect exposures when shooting by following the steps below.

How to Outsmart the Meter:

1. Put or hold the grey card under the same lighting conditions as your subject.

2. Using your spot meter, point the meter at the grey card. Ensure that the whole spot meter circle is within the area of the grey card. Be careful not to create a shadow on the grey card with your body if you hover over it.

3. Adjust the exposure controls (shutter speed, f-stops, and/or ISO) until you zero out the meter to obtain a proper exposure of the grey card.

4. Remove the grey card from the scene.

5. Recompose the shot, but do not adjust the exposure, even if the meter tells you it is incorrect.

6. Shoot your well-exposed shot!

This technique works, because by basing the meter reading on something that is actually 18% grey (the grey card), we are in essence "calibrating" the meter. Grey will come out grey. Because of this calibration, what is white will be white, what is black will be black and all the shades in between will be correctly exposed.

Let's take this one step further. Using this grey card technique can be inconvenient because it requires a photographer to always carry a grey card. There's hope though! By thinking this through, we can eliminate the need for a grey card in almost all situations.

Remember, meters are blind to colors; they only see the world in shades of grey. We can use this to our advantage when outsmarting the meter. To the meter there are a few colors that "read" as 18% grey. A few examples are bright green, bright red and medium blue. The good news is that these colors are everywhere. Green grass is almost exactly 18% grey, as is pure blue sky and the red of a fire engine.

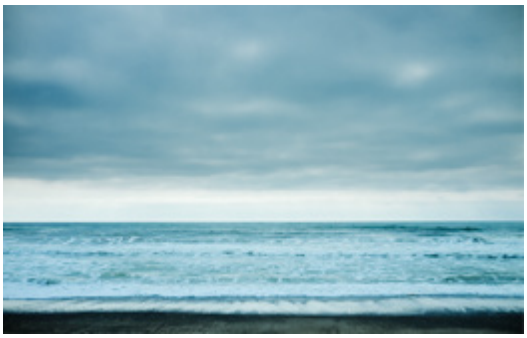
If any of these objects (or something similarly colored) are nearby when you're shooting, you can repeat the same process as above but instead of using a grey card, set your exposure based on a color that your camera will read as 18% grey. For example, point your camera at bright green grass (making sure it's in the same light as your subject), set the meter, recompose the scene and take the shot.

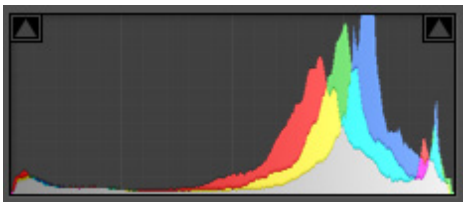
The obvious downside to this solution is that when there is nothing 18% grey in a scene, you will have nothing to meter off of, and would need to have a grey card or take your skills a step further and learn the Zone System of exposure!

Understanding Camera Histograms

The Histogram is a bar graph that shows the number of pixels for each density ranging from pure black to pure white. It enables you to view overall image contrast and the amount of data present in a photograph. The vertical spikes in the graph are a representation of large numbers of pixels within that specific tone. A lack of information in both the dark values and the light values would show us that we have an image that is made up mostly of midtones. The histogram should be used as an aid to evaluate the exposure of your image. Do not automatically assume that because your histogram lacks information in the highs and lows that you have a bad image. Let's examine the images below and their corresponding histograms.

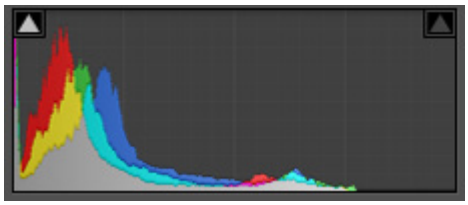
Good Histogram :





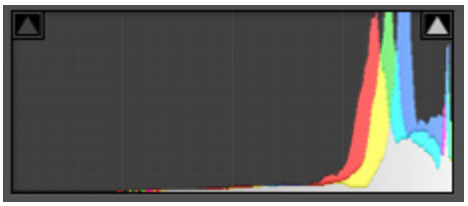
Good initial exposure. We would consider this a good histogram. There is a full range of tones from pure black to pure white. In this histogram, all of the information lies between the black and white points, which means we are not losing any information from the initial exposure.

Blocked Shadows :



This histogram suggests that there are more pixels to the left of the Black Point that are being "clipped." This means there is more to the image than what we have captured. The image should be reshot.

Blown Highlights :



This histogram suggests that there are more pixels to the right of the White Point that are being "clipped." This image needs to be reshot.

Dear Reader,

Thank you for choosing to learn from us today! We hope you've gained a deeper understanding of basic photography concepts.

If any questions came up, don't hesitate to call our school or write us on Instagram to ask for some guidance.

Here at RMSP, we're all about connection, genuine support, and prioritizing the needs of our students. We take great pride in how we teach complicated concepts and foster community in our non-competitive learning environments. We improve our programs year after year–a benefit of our small, family-run school–because we think it's important to both keep up with trends in photography as well as learn from student feedback.

Teaching is our passion and photography is our subject. We give our students all we've got. Whether you're interested in mastering your camera, documenting your life, or actually building a professional career, we have a course for that. In each course, we'll show you how we can help you pursue your dream of having confidence in your photography, and that we take that responsibility seriously.

If you loved what you read in this book and want to see what we're all about, check out our website at www.rmsp.com. Let us show you why we're worth your consideration.

Sincerely.

The Chaput de Saintonge Family

Owners/Founders/Directors of Rocky Mountain School of Photography

rmsp
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