

Chapter 13

Photographic Techniques for the Field and Laboratory

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Controlling Exposure

Understanding and controlling exposure are the two biggest problems for all photographers. Being able to control exposure with consistency is what makes a good photographer stand out from the others.

Everything dealing with photographic exposure works in values called stops, therefore a camera will become easier to use if you think of the controlling factors of exposures in terms of stops. A stop represents the doubling or halving of the amount of light that reaches the film.

The actual exposure is determined by three things: aperture, shutter speed, and film sensitivity or speed. The aperture is measured in terms of f-stops, or the size of the lens opening through which the light passes. The shutter speed is the length of time that the camera's shutter remains open, thereby admitting light to the film. Together, the aperture and shutter speed control the amount of light striking the film plane. The film sensitivity measures the intensity of the light necessary to record an image on the film. Each of these three variables work in values called stops.

Aperture

The f-stops, or apertures, marked on a lens are designed so that each of the numbers are one half ($1/2$) the size of the previous one and twice the size of the one that follows. The usual series of f-stops is: $f/1.4$, $f/2$, $f/2.8$, $f/4$, $f/5.6$, $f/8$, $f/11$, $f/16$, and $f/22$. Each number represents the size of lens opening, and as the numbers increase in size the aperture size decreases.

Example: An opening of $f/5.6$ lets in twice the amount of light as the following number or $f/8$ (a one stop difference) or one half ($1/2$) the light of $f/4$ (a one stop difference in the opposite direction).

The f-stop you choose controls the depth of field, or area of the photograph that is actually in focus. The smaller the lens opening, the greater the depth of field; the larger the lens opening, the more shallow the depth of field.

The following two terms are used to refer to a change in aperture: (1) stopping down, or reducing the amount of light reaching the film which increases the depth of field, and (2) opening up, which means letting more light reach the film which decreases the depth of field.

Shutter Speed

The shutter speeds normally found on a 35-mm camera are a progression of fractions of a second. Generally speaking, the shutter speeds on most cameras run through the following sequence: 1, 1/2, 1/4, 1/8, 1/15, 1/30, 1/60, 1/125, 1/250, 1/500, and 1/1000 of a second. Each shutter speed in the series is one-half of the preceding speed and double the following speed.

Example: A shutter speed of 1/30 second is one-half (1/2) as long as 1/15 second and twice as long as 1/60 second, each change from 1/15 to 1/30, and 1/30 to 1/60 being a one-stop difference.

The effects of motion are controlled by the shutter speed. Motion can be stopped by a fast speed or blurred by a slow one.

Film Speed (ISO)

The last value having an effect on exposure is film-speed rating or ISO number. Different speed films have different sensitivities to light. A “slow” film which has a low ISO number needs a lot of light to record a properly-exposed image, where as a “fast” film with a high ISO number needs less light.

Film speed ratings also work in doubles and halves known as stop values. Each numerical doubling is a one-stop jump.

Example: Going from 50 ISO to 100 ISO, or 100 ISO to 200 ISO, etc., is a one-stop change.

The normal progression of ISO film speeds in one-third stop increments is as follows: 16, 20, 25, 32, 40, 50, 64, 80, 100, 125, 160, 200, 250, 320, 400, 500, 640, and 800.

Aperture and shutter speed both affect the amount of light reaching the film plane. Both of these factors work in the same doubles and halves progression. Therefore a direct relationship between them, called reciprocity exists. A one-stop change in one value equals a one-stop change of the other value in the opposite direction. Doubling the time and halving the intensity will let the same amount of light reach the film as halving the time and doubling the intensity. In other words, you can use a slow shutter speed with a small lens opening or a fast shutter speed with a large lens opening to obtain the same amount of light. Of course the ability to stop motion and the depth of field will change accordingly, but the amount of light reaching the film will remain the same.

With many cameras you have the ability to adjust the depth of field as well as control motion by manually setting the apertures and shutter speeds. If your camera's light meter suggests that 1/60 second and f/16 is the correct exposure then you can adjust the camera's settings to any one of the following and still obtain a proper exposure. All of the settings below will allow the same amount of light to reach the film plane, provided all are used with the same film speed (ISO number).

	<i>Aperture</i>	<i>Shutter Speed</i>	
Increase in depth of field ↑	f/22	1/30	↓ Increase in ability to stop motion
	f/16	1/60	
	f/11	1/125	
	f/8	1/250	
	f/5.6	1/500	
	f/4	1/1000	

Calibrating a Light Meter

Taking a meter reading or having the camera automatically set the aperture and shutter speed will not necessarily guarantee a correct exposure. Light meters do not think, but they generally average the tonal ranges within the composition.

The most practical way for determining a proper exposure is to calibrate a light meter to a known (constant value) exposure setting. Bright sunlight is that constant. In a bright, sunny situation, anywhere in the world, the correct exposure for a middle-toned subject that is lit from the front is expressed as the “sunny f/16 rule.” The definition of a middle-toned subject is one being photographically average in tonality, or one which reflects 18% of the light falling on the subject.

With the camera lens set at f/16 the correct shutter speed is the one with the number closest to the film's ISO rating. For example, take a film that has an ISO rating of 50, the proper bright sunlit exposure of f/16 is 1/60 second, which corresponds to the shutter speed closest to 50. Once you know the correct shutter speed for f/16, you can use any of the reciprocating apertures and shutter speeds which will give numerous possibilities for controlling depth of field and motion within your photograph.

To calibrate a light meter use the one correct exposure you have just learned, the “sunny f/16” exposure. While outside on a clear, sunny day meter a middle-toned subject. An 18% gray card, green grass, dry tree trunks, or a clear north sky are all subjects with an average tonality.

Using a normal or longer lens with the focus set at infinity, point the camera at the clear north sky (at approximately 45° above the horizon). Adjust the film speed (ISO) dial until you obtain the right “sunny f/16” reading for whatever film speed you are using.

Example: If you want to calibrate your meter to the ISO number of 50 (Fujichrome 50), the correct exposure (according to the “sunny f/16” rule) is 1/60 second at f/16. Setting your camera on the manual mode, adjust the shutter speed to 1/60 second, and the aperture to f/16. Next, meter a clear north sky (do not calibrate a light meter to a hazy or polluted atmosphere) or any middle-toned subject leaving the lens focus set at infinity. Rotate the ISO dial until the meter indicates that 1/60 second at f/16 is the correct exposure. It really does not matter what number the ISO dial ends up on, the numbers are just reference marks. All light meters should be adjusted in this manner because all of them have a tendency to vary to a small degree. Having calibrated your camera's meter to a middle-toned subject you should be able to photograph a middle-toned subject and obtain a perfect exposure.

How to Meter Subjects Which Are Very Light or Very Dark

If a scene which is being photographed contains more light or dark tones than usual, the camera will expose them as if they were middle-toned. The camera's light meter tends to read light and dark scenes in an average tonality or neutral gray. If you choose to follow the meter's indications a predominately dark scene will be recorded lighter and a light scene will be recorded as a dullish gray. If the subject to be photographed is not middle-toned there are alternate ways to determine the proper exposure.

Example: If you are photographing a sunrise or sunset, the scene will more than likely be very bright and it will cause a light meter to misread or malfunction. The easiest method for properly exposing the scenes is to meter a middle-toned subject or area in the same lighting situation as your subject. Focus on the subject, then swing the camera to the middle-toned area, and meter it without refocusing. Now return to the original subject, and use the exposure from the middle-toned area to take the photograph. Since the camera's light meter tends to read everything as middle tones, light subjects can be grossly underexposed and dark can be overexposed. So, with light subjects you need to open the lens up one or more stops to give the subject more exposure. With dark subjects you need to stop down the lens one or more stops to give the subject less exposure.

One of the most difficult situations to meter is a subject with back lighting. Excessive meter readings can be caused by the light coming from behind the subject which will generally result in an underexposed photograph lacking in detail on the shadow side of the subject. In order to correct for this type of exposure you must open up one or two stops.

Experimenting is in order before attempting this procedure in the field. Sometimes there are no middle-toned areas to meter. In this case it would be wise to carry an 18% gray card or some other subject with a middle tone.

An object which is always with you is the palm of your hand. With most people the palm of the hand is one stop brighter than a middle tone. To check to tonal value of your hand, meter it and a middle-toned subject and compare the two readings, making sure both are in the same light (do not refocus while making the two readings).

Now assuming your palm is one stop brighter than a middle tone prepare to make the exposure. First focus on the subject, then without refocusing meter your palm in the same light as your subject. Open up one stop from what the meter indicates. To correct to the proper exposure you must add light.

What Film Speed Should Be Used for Field Work and Close-Ups?

Transparency or color slide films which are designated by the suffix of chrome are generally best suited for projection, or for use in magazines, books, and other publications. The most important qualities of a color slide film are: color accuracy, speed and graininess, sharpness of the image, and richness of the color. When shooting close-ups the photographer should be interested in sharply rendered detail within the subject. The slower speed films tend to be sharper and finer grained than the higher speed ones.

Among professional nature and wildlife photographers, Kodachrome 25 and 64 are probably the most popular of all the slide films, with Kodachrome 64 being the number one choice. However, Fujichrome 50 and 100 are gaining in popularity for their fine image qualities and their beautiful color renditions.

I suggest choosing one or two films and learn all the characteristics about them. Once you have worked with a film it is much easier to understand how it portrays color and reacts to different lighting situations. Also make sure that the film you choose is readily available wherever you plan to photograph.

Now that the mechanics of exposure (i.e., aperture, shutter speed, and film sensitivity) have been discussed, I would recommend committing them to memory. Once you understand the basics behind photography it is much easier to control the outcome of your photographs, whether you want to record an image as you actually see it or create a specific mood.