Exploring the Digital Camera

CHAPTER 1

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Welcome to the *Digital Photography Digital Field Guide*. This book will help you get the most out of your digital camera in field conditions. Digital cameras are used in field conditions for applications that range from action photography through architectural and nature photography. You'll also find information and tips about using your digital camera in a studio setting, as well as enhancing your digital photographs on the computer, but that's not what this book is primarily about. My goal is to help you get the most out of your digital camera when you take it somewhere outside—in the field—whether you are photographing clouds, flowers, rainbows, buildings, people, or anything else that grabs your attention.

If you are like me, you probably don't find the instruction manual that came with your camera very easy to read (or useful!). But you do need to know something about how your camera works before you bring it with you in the field. One of the biggest secrets to taking great pictures is preparation. This chapter helps you get prepared for your digital photography fieldwork by providing a quick and fun tour of digital camera anatomy.

Suitability to Tasks

Each kind of digital camera is more suitable for specific tasks than others. Table 1.1 looks at some specific kinds of photography and the kind of digital camera that is most likely to give you good results.

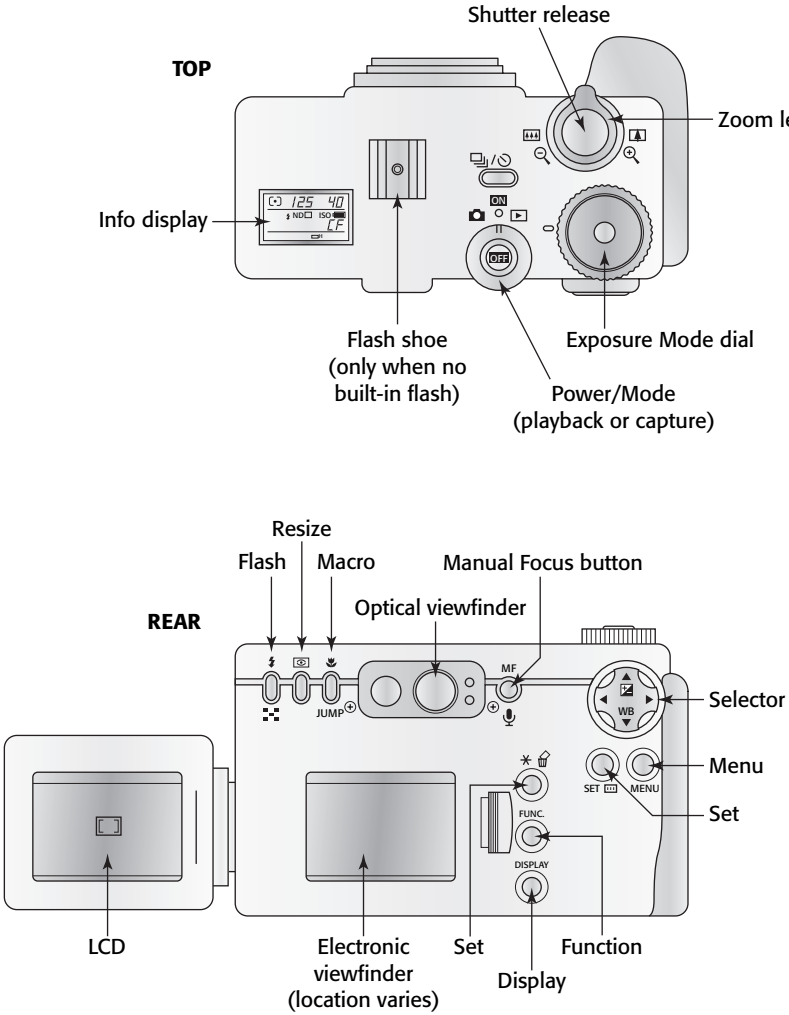
Table 1.1
Choosing the Right Camera for the Job

Task	*Best Type of Digital Camera to Use*
Easy access and accessibility virtually anywhere	Mobile phone cameras and compact point-and-shoot models
Portraits	Advanced non-reflex cameras; SLRs
Sports and other action photography	Point-and-shoot models with manually adjustable shutter speeds or the availability of a high shutter speed and SLRs
Landscapes	Almost any digital camera provided the lens is good enough
Close-ups	SLRs; some point-and-shoot models with a good enough lens

Typical Non-SLR Controls

Where the actual controls are on your camera, how they work, and what various settings are named depends on the brand and model of your camera. Almost any advanced non-reflex digital camera (a non-reflex camera is one where you don't view the picture through the lens used to take the picture) provides controls and settings appropriate for serious photography like those shown in figure 1.1, including

- An optical viewfinder. This, however, does not give an exact image that is comparable to the one seen through the camera lens — although some models provide electronic viewfinders that do view through the lens but present the image on a tiny TV tube.
- An LCD electronic viewfinder that provides an accurate rendition of the picture being composed.
- Automatic exposure and focus capabilities.
- Mode settings, for optimizing the camera's settings for specific kinds of pictures.
- A mechanism for enabling specific exposure modes, such as aperture preferred or shutter preferred. With a camera in aperture preferred, for example, you pick the camera aperture, and the camera automatically chooses the shutter speed that corresponds to control the exposure.
- Manual override controls for focusing and exposure, so that the camera can be used in a completely manual mode.
- A mechanism for playing back photographs on the LCD screen, so they can be reviewed, deleted, and enhanced in minor ways.



1.1 Typical controls for an advanced non-reflex digital camera (selected controls shown).

In addition to these controls, the camera provides a slot for the memory card and a digital connector for attaching the camera to a computer. In some cases, you recharge the batteries by taking them out of the camera and using an external charger. If the camera batteries are recharged while still in the camera, a connector plug for this purpose will also be provided.

Adding Useful Accessories

The most useful accessories in the field for your digital camera are a tripod, a good waterproof case, and a lens shade.

The tripod lets you take long exposures without shaking the camera, resulting in sharper images than those taken without a tripod, provided your subject is not moving. In addition, with the camera on a tripod you can use longer shutter speeds. This means that the exposure can be set with a correspondingly small aperture (such as f/22), increasing depth of field in the final result. A tripod is an extremely important accessory for photographers interested in photographing nature in the field for a number of reasons, including

- ✦ A great deal of field photography happens at sunrise or sunset when light conditions are low
- ✦ Many landscape photographs require a great deal of depth of field
- ✦ Close-ups tend to require exposures that are too long to be handheld

A good waterproof case helps keep your camera dry and snuggly no matter what the weather is. It's always important to keep you camera dry.

Your camera may have come with an accessory lens shade (if not, you can easily buy one). A lens shade helps protect the lens when you are using it. More importantly, it helps to keep extraneous light out of the lens so you don't get optical flares in your photos.

Typical SLR Controls

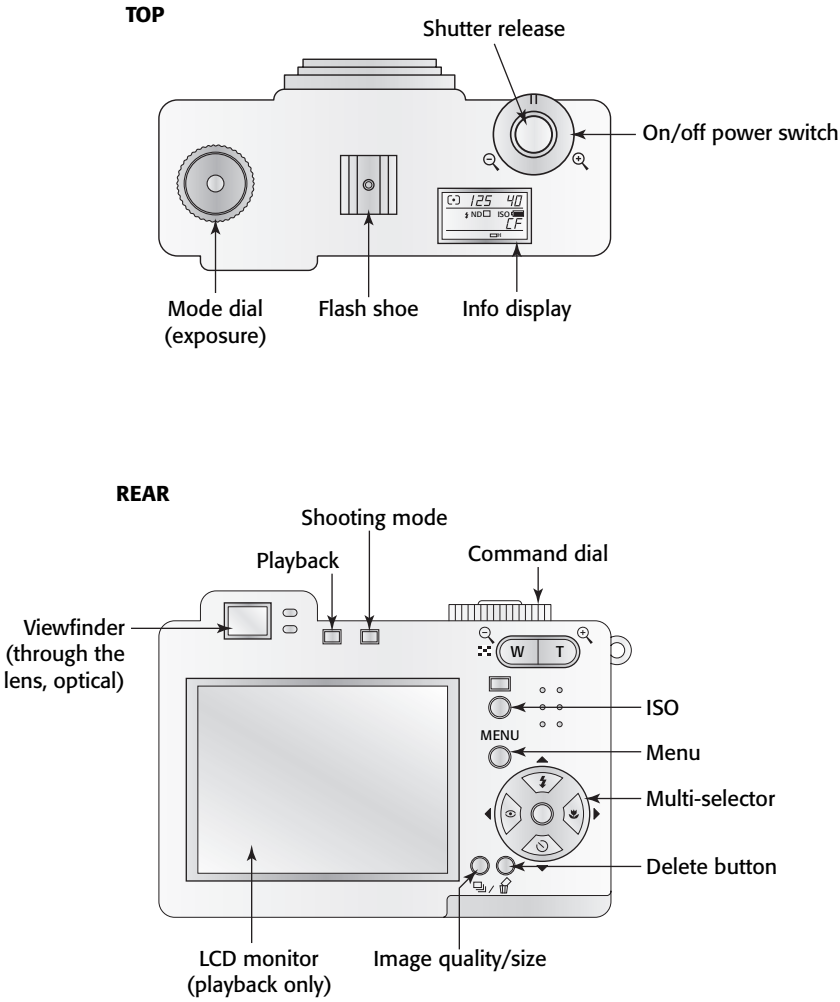
A digital SLR camera generally provides automatic, semiautomatic, and manual settings for both exposure and focus.

However, the process of viewing and composing a picture before you take it works differently in a digital SLR than it does in an advanced non-reflex (and will feel very familiar to users of traditional 35mm film SLRs). Depending on the camera model, an optical or electronic viewfinder is used to preview the photograph. A system of mirrors sends the image to the viewfinder (rather than to the media used to capture the image). When the photo is actually taken, the mirrors are repositioned so the image is sent to the capture media for the duration of the exposure rather than to the viewfinder. The LCD in a true digital SLR cannot be used to compose photos because the mirror blocks exposure to the image capture device until the moment of exposure.

An electronic viewfinder (EVF) camera has many features similar to an SLR (but is not a true SLR). That is, you view through the lens, but you are seeing an electronic image in the viewfinder. EVF cameras do not let you change lenses.

Typical digital SLR controls are shown in figure 1.2.

After a photograph has been taken, it can be viewed in the LCD screen for review, minor editing, or possible deletion. What can be done depends on your camera's capabilities.



1.2 Typical controls for a digital SLR (selected controls shown).

Understanding Zoom Lenses

Advanced non-reflex digital cameras and digital SLRs usually come equipped with a zoom lens. Some digital SLR cameras are sold without a lens—so you aren't necessarily stuck with the standard lens that comes with the camera. You can buy another one if you prefer, but make sure it is compatible with your specific camera. In contrast, the zoom lens is an integrated part of an advanced non-reflex camera, so what you buy is what you get, which is not necessarily a bad thing if it is a good lens.

To say a lens is good means that it has good optical qualities — a hard thing to know without taking pictures using the lens. However, if you stick to a lens made by major camera manufacturers, particularly if you can find positive reviews of the lens in photography magazines or online, you probably won't go wrong.

By the way, the term digital zoom is a misnomer because a digital zoom does not accomplish its effect optically — the program inside the camera simply crops an image to produce a zoom-like effect.

How close or far away a subject appears in a photograph depends on several factors, including

- How far the camera (and photographer) is from the subject.
- The focal length of the lens used on the camera.

The *focal length* of a lens is the length from the front piece of glass on the lens to the image capture device in the camera.

A zoom lens is a lens with a continuous series of focal lengths, for example, 18mm–70mm. In this example, 18mm represents a wide-angle lens, meaning the subject matter looks farther away than it really is. 70mm represents a telephoto lens, meaning the subject matter is brought closer than it really is. The zoom lens provides a ring on its barrel that allows you to continuously shift to any focal length between these two extremes.

Zoom lenses come in a great number of varieties. Some zoom lenses, such as the 18mm–70mm variety, provide more wide-angle focal lengths. In contrast, other zoom lenses emphasize telephoto focal lengths.

What gets a little complicated is that the apparent closeness of the subject to the camera is controlled not just by the focal length of the lens, but by the *ratio* of the focal length of the lens to the size of the image capture mechanism. This did not present a problem in 35mm film photography. For every 35mm film camera, the image capture size was the same: a frame of 35mm film. So the degree to which a lens was wide angle or telephoto could always be determined by the focal length of the lens.

Roughly speaking, in 35mm film photography, a lens with a 50mm focal length is considered normal, meaning no magnification or reduction of a subject occurs. Anything less than 50mm, such as 28mm, is wide angle, which results in subjects that appear farther away. Anything greater than 50mm, such as 135mm, means that subjects are magnified and appear closer.

In digital photography, the actual sensors are smaller than in 35mm photography, and they are also non-standardized; that is, one digital camera may have a different image capture size from another (even within the same brand). Without knowing the dimensions of the sensor, the focal length of a zoom lens is just a number: It doesn't provide the information you need. Digital camera manufacturers provide 35mm film equivalent focal length information, which is an estimate of what the range of focal

lengths provided by the zoom lens would have been if the lens were on a 35mm film camera rather than a digital camera. For example, the 7.2mm–28.88mm zoom lens that ships with models of the Canon PowerShot camera has a 35mm film equivalence of 35mm (moderate wide angle) to 140 mm (moderate telephoto).

You should know that focal lengths for digital cameras tend to be less than the 35mm equivalents (because digital image capture sensors are smaller than a piece of 35mm film). Also, there aren't very many extreme wide angles for digital cameras for technical reasons related to optical properties and the smaller image capture size.

Knowing the 35mm film equivalence of your zoom lens lets you get a ballpark feeling for how close or far away your subjects will be, and lets you compare your zoom lens to other digital cameras equipped with zoom lenses (as illustrated in figures 1.3 through 1.5).

Whether a lens is wide angle or telephoto impacts the optical properties of a photograph as well as its apparent distance from objects. You may have noticed curvature and distortion that occur with wide-angle lenses. Another effect that is a little less obvious is the compression of apparent depth that occurs when you use a zoom lens in its telephoto mode. These optical properties of the focal length of your zoom lens can be used in the field to create more interesting photographs.

1.3 This wide-angle photo was taken with the digital equivalent of a 35mm lens.

1.4 When you use a normal focal length, things appear neither farther away nor closer than they do in real life (50mm equivalence).

1.5 A telephoto lens brings objects closer and compresses perspective (135mm equivalence).

It's important to understand that the actual focal length on a digital camera depends on the camera model and the size of the sensor (and may not correspond to the actual focal length numbers shown in figures 1.3, 1.4, and 1.5 through 1.9, which are from a Canon PowerShot advanced non-reflex camera). In particular, digital SLRs are likely to have larger sensors (and be capable of capturing images with correspondingly greater resolution). This is reflected in larger focal lengths for lenses; for example, the Nikon AF-S ED 18–70mm zoom lens, intended primarily for use with the Nikon D70 digital SLR, is roughly equivalent to the Canon PowerShot zoom lens.

You may also encounter the distinction between optical and digital zoom lenses. An optical zoom lens is a true zoom lens in the sense that it uses optics, which are usually glass, to provide a range of focal lengths. In contrast, a digital zoom simply edits a captured image by zooming into the desired parts. Although this is done in the camera, it is in theory no different than editing your images by cropping them on your computer, and produces images without the full resolution of optical zooms.

Using a digital zoom provides exactly equivalent results to cropping with your computer a picture taken optically. There are no resolution advantages or disadvantages to the digital zoom. So if your optical zoom doesn't bring you close enough to a subject, consider cropping and using the portion of the photo that you want using digital editing.

Understanding your zoom lens doesn't have to be too complex. The zoom lens on your digital camera will most likely allow you to select from moderate wide angle through moderate telephoto and everywhere in between.

Depth of Field

Put simply, *depth of field* means how much of a photo is in focus. If all the things in a photo are in focus—particularly if their distance from the camera varies, as with a flower in the foreground and a landscape behind—then the photo is said to have high depth of field. If only one element in the photo is in focus—for example, the flower in the foreground of figure 1.6 but not the foliage behind—then the photo is said to have shallow depth of field.

1.6 The flower is emphasized in this picture because the rest of the photo is out of focus due to shallow depth of field.

Although not entirely the same thing as *sharpness* (photos that appear crisp and defined are said to be sharp), images with wide depth of field tend to appear sharper than images with shallow depth of field. However, using shallow depth of field can also be a wonderful digital field technique: If your photo is only concerned with a flower, and shallow depth of field is used to make the flower the only element in focus, then the flower will look like the only thing that matters in the photo because the rest of the photo is blurred and unfocused.

If you are going to use depth of field with control in your photos, you need to understand the simple relationship between aperture and depth of field. *Aperture* is the opening in the lens. The smaller the aperture, the greater the depth of field.

Both wide and shallow depth of field can be useful techniques when the subject matter that you care about in a photo (for example, a flower or a face) is sharp and in focus, and everything else in the photo is blurred. Shallow depth of field can be used in this way as a powerful photographic technique. So there's no good or bad with depth of field, only levels of in-focus subject matter. Figure 1.7 shows an attractive landscape image that uses wide depth of field to bring all elements within it in focus, and figure 1.8 shows a shallow-depth-of-field flower image that also works because the central object of the photograph is the only thing in it that appears sharp.

As mentioned, the smaller the aperture of the lens, the greater the depth of field. Somewhat confusingly, smaller lens aper-

1.7 Everything seems sharp in this landscape image due to high depth of field.

tures are indicated by larger *f-stop* numbers; so a photo taken with the camera lens set to f/32 (a small aperture) will have wider depth of field than a photo taken with the camera lens set to f/2.0 (a large aperture). Table 1.2 gives you some idea of what to expect with aperture settings and depth of field.

With your digital camera operating in automatic mode, you have no control over the aperture setting of the lens and the resulting depth of field (or lack thereof). To control the depth of field, you have to take your digital camera off Auto mode and set the aperture yourself:

- Manually set the exposure.
- Select an aperture-preferred exposure mode, in which you pre-select the aperture and the camera chooses the rest of the settings to match. Different digital camera manufacturers have different designations for this exposure mode. For example, Canon calls it AV (Aperture Value), and Nikon calls it A (Aperture preferred).

1.8 Only the flower is sharp in this image that uses shallow depth of field.

You should also know that (generally more expensive) digital SLRs that employ true through-the-lens viewing do so with the lens aperture wide open. This is because there would not be enough light to see by if the lens were *stopped down* (meaning the aperture is adjusted to a higher f-number) to the actual small apertures (such as f/32) used for many photos. But it does mean that with these cameras you are not viewing the actual depth of field that will appear in the photo. (35mm film SLR users encounter the same problem.) Note that this is not an issue with LCD viewfinders or with high-end EVF cameras.

Table 1.2
Aperture, Depth of Field, and Photo Appearance

Size of Lens Aperture	*f-stop*	*Depth of Field*	*Photo Appearance*
Large	f/2.0	Extremely shallow	Only one plane appears in focus
Medium	f/4.0 to f/5.6	Medium	Objects close together in their distance from the camera are in focus
Small	f/8.0 to f/11	Wide	Most planes in the photo are in focus
Very Small	f/16 and greater	Very wide	All the objects in the photo appear to be in focus and sharp

Digital SLRs with optical through-the-lens viewing provide a facility called *depth-of-field preview.* Depth-of-field preview is usually activated by pressing a small button near the base of the lens mount on the camera. With depth-of-field preview activated, you see the photo as it will actually appear (at really small apertures, there may be so little light coming through that it may be hard to view the results).

Understanding ISO

ISO is short for International Standards Organization, an organization that defines standards. *ISO speed* is a term for expressing the light sensitivity of a digital camera. Although it is not exactly the same thing, you can think of ISO speed as corresponding to film speed in an old-fashioned film camera; the higher the ISO speed, the dimmer the light in which you can take pictures.

Of course, nothing in life is free or without trade-offs. By increasing ISO speed so that you can capture images in dimmer light, you will also increase image *noise* or graininess, essentially lowering image quality.

Increasing the ISO you use with your digital camera is like replacing a fine-grained but low-speed film in a film camera with high-speed but grainy film—you can take pictures in low light conditions, but the pictures aren't as crisp.

Sometimes crispness isn't everything. To a photojournalist, capturing a once-in-a-lifetime photo is worth the introduction of some grain or noise. And some photographers add noise, either by boosting the ISO or by using Photoshop post-production, on purpose as a creative effect.

The normal ISO speed used by most digital cameras is either 100 or 200. Some digital cameras automatically adjust the ISO speed to changing conditions (you can usually override this). In addition, you can manually set ISO speed to a greater number. Depending on the digital camera, you can select ISO speeds as high as 1600, but beware of image degradation at higher ISO speeds.

With some digital cameras, particularly digital SLRs, the default mode does not automatically adjust ISO speeds to conditions. However, you can change this default so the camera does adjust ISO speeds (although not in all exposure modes).

Of course, sometimes you can boost ISO speed intentionally to create the effect of an image with noise (see figure 1.9).

Table 1.3 should give you an idea of when it might make sense to use a higher ISO speed.

1.9 Images taken with a high ISO appear grainy.

Table 1.3
ISO and Applications

ISO	*Best Used For*
100–200	Landscapes, general photography
400–1600	Nighttime or dim interiors where flash is not an option and image quality isn't paramount

Exposure Modes

Advanced non-reflex and SLR digital cameras can be operated in automatic exposure mode, in a variety of semiautomatic modes, or manually. The next few sections should help you better understand what your camera is capable of in these modes.

Automatic exposure

Automatic exposure mode works well for the most part. The digital camera's light meter reads the light and processes it using a set of preformulated instructions to set the camera's aperture and shutter speeds. But, if you take an image, view it, and aren't happy with the results, you'll want to use a semiautomatic exposure mode or manual exposure mode instead.

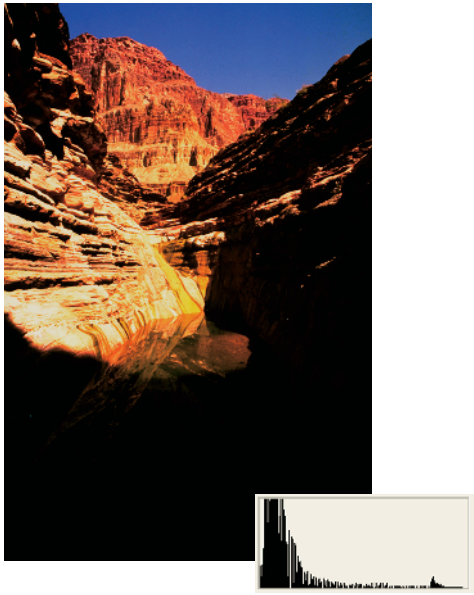
Some cameras have both Automatic and Programmed modes. Programmed mode tries to combine the highest shutter speed with the smallest f-stop, depending on the lighting in the scene. In many cameras the user can choose a program that looks for either higher speeds or wider f-stops. Also Programmed mode allows the user to make some adjustments that Automatic mode does not.

Most digital SLRs provide histogram information about the exposure values in a photo after you take the picture. The *histogram* shows the distribution of tones in a photo. The horizontal axis in a histogram corresponds to pixel brightness (dark tones are to the left and bright tones are to the right). The vertical axis displays the number of pixels at each level of brightness.

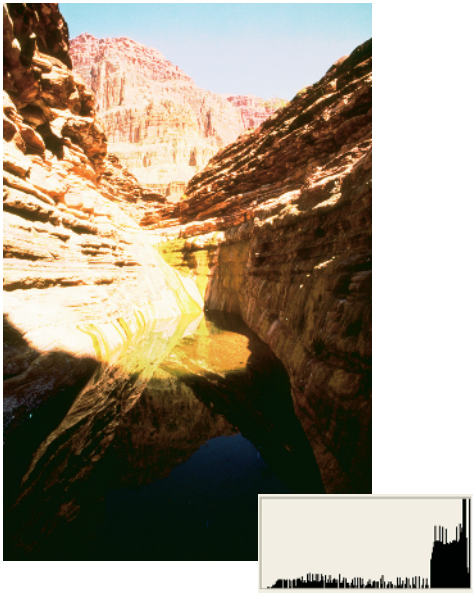
This sounds complex, and in fact a histogram needs to be evaluated depending on what you want to accomplish in your photo, but it's pretty simple to get the key information out of a histogram. For example, if the histogram is shaped like a mountain on the left with nothing on the right, the image is probably underexposed, as shown in figure 1.10. In contrast, a histogram showing mountains on the right and nothing on the left is probably overexposed, as shown in figure 1.11.

It's important to understand the area that the light meter in your digital camera is using to calculate its exposure. Most advanced non-reflex and SLR digital cameras have several metering modes, including

- Full screen, sometimes called *evaluative* or *matrix* metering (usually this metering mode is the default).
- Center-weighted, which gives more exposure emphasis to subjects in the center of the image.
- Spot, which only measures the light hitting a small spot in the center of the image.



1.10 You can tell from the histogram that this image is underexposed.



1.11 You can tell from the histogram that this image is overexposed.

If your camera has these different modes, full screen is usually the default; however, you can switch between them. Spot metering can be particularly useful if the portion of the image you really care about has very different exposure values than the rest of the picture, like the image in figure 1.12.

Note that pressing the shutter release button on the camera halfway down locks the exposure; so you can compose a picture, determine the exposure, and then shift the camera viewpoint while still maintaining the exposure. Some digital cameras also have an Exposure Lock button, which does the same thing and also may allow the first measured exposure to be used in multiple photos in a series.

1.12 It makes sense to use spot metering to determine the exposure for an image when the image is not evenly lit.

Semiautomatic exposure

There are two kinds of semiautomatic exposure modes:

- Those in which the camera adjusts automatically for a particular kind of image, like a portrait or a close-up.
- Those where you set either the aperture or the shutter speed and the camera automatically adjusts the remaining settings.

The name given to each mode varies depending on the digital camera brand, but typical names include the following:

- Portrait
- Landscape
- Close-up
- Sports and action
- Night

Choosing one of these modes tells the exposure program to make the choices that best optimize results for that type of subject matter. For example, when you choose Portrait, the exposure is optimized for mid-range skin tones, and a wide f/stop is selected to throw the background out of focus. In Landscape mode, the camera's integrated flash will not go off, no matter how dark it is, such as in figure 1.13. In Sports mode, a high shutter speed that stops the action is automatically selected.

With shutter-preferred exposure, you can set the shutter speed high to freeze motion or to create special effects, such as blurring moving objects, as shown in figure 1.14. Remember that when you raise the shutter speed, the f-stop will be wider, and conversely when you lower the shutter speed, the f-stop will be smaller.

1.13 In Landscape mode, the camera does not use the flash even in low light conditions.

The primary reason for using aperture-preferred exposure is to control depth of field. For example, you might want to be sure that everything in a close-up photo is in focus as in figure 1.15.

Manual exposure

By setting the camera exposure manually, you are taking complete control of the exposure settings of your digital camera. It certainly makes sense to experiment from time to time because, unlike film cameras, a digital camera doesn't waste anything if your experimental image doesn't come out; you can simply erase the image and begin again.

1.14 You can use shutter-preferred exposure to stop motion.

1.15 Using aperture-preferred exposure, you can control depth of field.

To get good pictures in the field using manual exposure, you need to use an external light meter, or have a good feeling for what shutter speed and aperture combinations create the right exposure at a given ISO.

There are a couple of special situations in which you'd probably want to use fully manual exposure control. One is for very long exposures, sometimes called *bulb* exposures. In a bulb exposure, the shutter is kept open as long as the shutter release button is depressed (as in figure 1.16).

1.16 This extreme macro shot with a Canon PowerShot G3 required a long bulb time exposure.

Note

Unless you are trying for an experimental or shaky effect, you should have the camera mounted on a tripod when you take any long exposure.

Note

It's called a bulb exposure because a long time ago a bulb (it looked roughly like the end of a kitchen turkey baster), was used, rather than a button, to hold the shutter of a camera open. The bulb was attached to a length of hose attached to an air-operated shutter.

The other situation in which manual exposure is mandatory is when you use old lenses with an interchangeable-lens digital SLR. This is because typically you cannot use automatic exposure modes with lenses that predate the digital era.

Using Automatic Focusing

Almost all digital cameras provide an automatic focusing mechanism. The camera focuses when the shutter release button is pressed halfway down.

Automatic focus works very well most of the time, but you should be careful to point the camera at the object you want in focus when you depress the shutter release. You can then move the camera with the shutter partially depressed to better compose the picture.

You should also remember to monitor the depth of field of the photo you are making. Depending on the aperture you select, more or less of your photo may be in focus than you planned.

Overriding Automatic Focus

Sometimes automatic focus just doesn't work. (For example, highly reflective metal or glass surfaces tend to fool automatic focus devices.) If automatic focus is not working, you should manually focus your digital camera.

How you override automatic focus depends on the camera model. An upper-end interchangeable-lens digital SLR most likely has a switch to move from one position to another, and then you focus using the lens focus ring as you would with a 35mm film camera.

In most advanced non-reflex digital cameras, manual override of autofocusing is set using a menu item on the LCD monitor. You then use a multipurpose camera control, such as a dial, to focus manually.