

## Digital Camera Functions

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All photography is based on the same optical principle of viewing objects with our eyes. In both cases, light is reflected off of an object and passes through a lens, which focuses the light rays, onto the light sensitive retina, in the case of eyesight, or onto film or an image sensor the case of traditional or digital photography.

The shutter is a curtain that is placed between the lens and the camera that briefly opens to let light hit the film in conventional photography or the image sensor in digital photography. The shutter speed refers to how long the curtain stays open to let light in. The higher the number, the shorter the time, and consequently, the less light gets in. So, a shutter speed of 1/60th of a second lets in half the amount of light than a speed of 1/30th of a second. For most normal pictures, shutter speeds range from 1/30th of a second to 1/100th of a second. A faster shutter speed, such as 1/500th of a second or 1/1000th of a second, would be used to take a picture of a fast moving object such as a race car; while a slow shutter speed would be used to take pictures in low-light situations, such as when taking pictures of the moon at night. Remember that the longer the shutter stays open, the more chance the image will be blurred because a person cannot usually hold a camera still for very long. A tripod or other support mechanism should almost always be used to stabilize the camera when slow shutter speeds are used.

Now, let's look at aperture. The aperture is actually part of the lens, not the camera. It is a circular, adjustable opening that functions much like the lens of the eye. It opens wide in low light situations to let in more light, and closes down to a small opening in brightly lit situations to let in less light. The size of the opening of the lens aperture is measured in numerical values called f-stops. Typical f-stops are f2.8, f-4, f-5.6, f-8, f-11, f-16 and f-22. The larger the number, the smaller the opening. Increasing the size of the aperture by one f-stop doubles the amount of light that enters the lens.



the aperture settings on a lens corresponds to how wide the lens opens when a picture is taken.

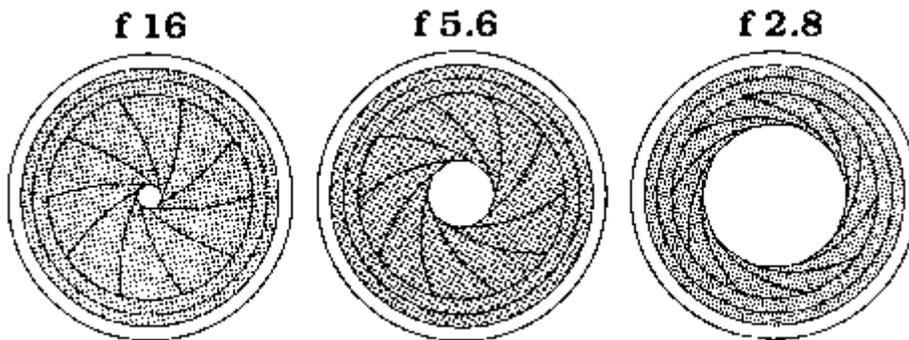
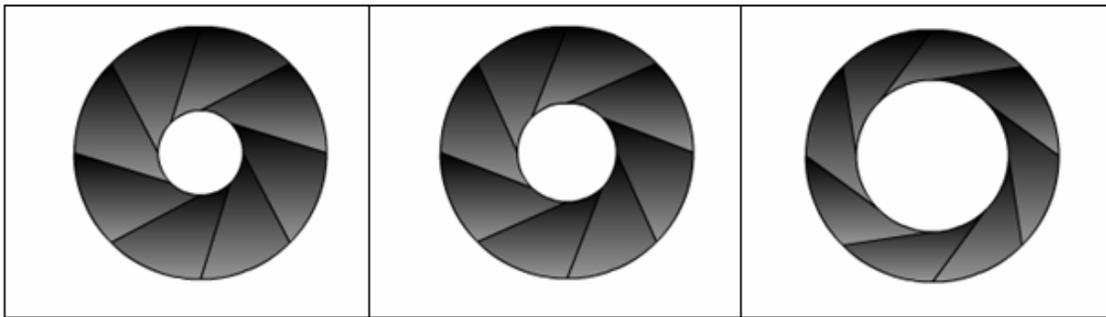


photo from: <http://www.scphoto.com/html/camera.html>



A good description of aperture, shutter and depth of field is online at:  
[http://www.ted.photographer.org.uk/photoscience\\_control.htm](http://www.ted.photographer.org.uk/photoscience_control.htm)

Another online resource that describes the lens aperture - be sure to scroll all the way to the bottom of the page:

[http://www.freehandsource.com/frames/tips/archive/tip\\_week111.html](http://www.freehandsource.com/frames/tips/archive/tip_week111.html)

Even more information about shutter speed can be found at:

The Shutter Controls Light and Motion

<http://www.shortcourses.com/using/cameracontrols/chapter1.htm#The%20Shutter%20Controls%20Light%20and%20Motion>

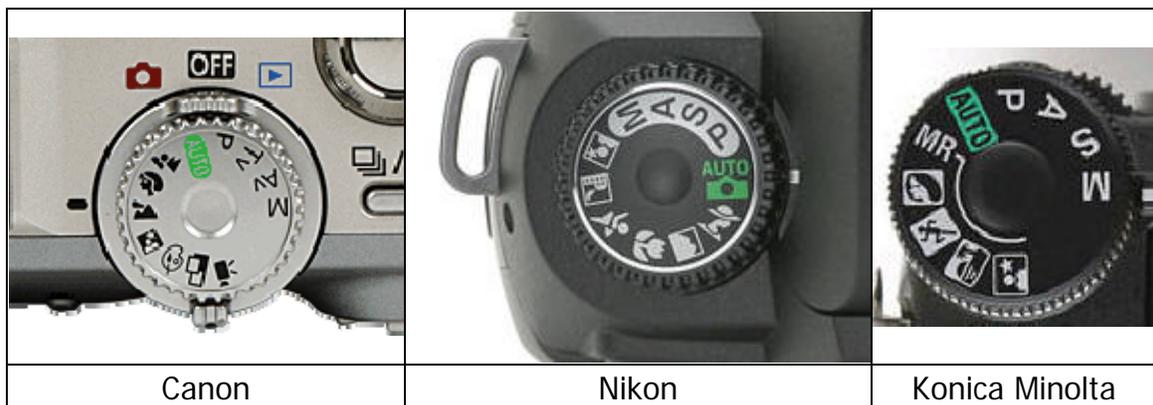
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**Automatic vs. Manual Shooting Modes**

## Automatic Shooting Modes

All photography, including digital photography, involves light being reflected off of objects and being captured by film or in the case of digital cameras, image sensors. If too much light hits the sensor, the image will be overexposed and the picture will look overly bright and the colors will appear washed out. If not enough light hits the sensor, the image will be underexposed and will appear dark and difficult to see details in the picture.

Many of the newer higher-end digital cameras and digital SLR (Single Lens Reflex) cameras have a variety of small pictures on a dial that indicate the various exposure settings the cameras are capable of using. As you will see in the images below, most digital cameras have similar controls for their various exposure settings.



### Fully Automatic Mode

Just about all digital cameras use some type of automatic mode for determining the correct exposure of pictures. On some cameras you will see the term **Auto** or **AE** which stands for **Automatic Exposure**. On the Canon Digital Rebel, the fully automatic exposure setting is designated by the green square. Just about all digital cameras, regardless of their type or cost, provide a fully automatic exposure mode that makes all the decisions for you. The electronics in the camera work with the image sensor to evaluate the light, select the correct ISO, perform the white balance and then set the aperture and the shutter speed to get the best exposed image. Most cameras also automatically control a built-in flash and have it fire when the lighting conditions make it necessary.

There is nothing wrong with letting the camera make decisions for you, as this takes much of the guess work out of taking pictures and lets the photographer concentrate on finding the subject and then framing and composing the image. However, many photographers like to have some measure of control so that they

can be more creative and have the ability to customize the pictures they take. With the level of sophisticated electronics in today's digital cameras and the ability to take very high resolution images, how much control to leave to the camera and how much to retain for yourself is a decision that every photographer will have to make for her or himself. But having some knowledge about what is possible can aid in this decision making process.

### **Programmed AE/Program Mode (P)**

Program Mode is similar to Fully Automatic but lets you change some settings, such as whether the flash will fire or not, and the type of metering the camera will use when taking a picture.

### **Aperture Priority (Av)**

Aperture Priority mode allows the photographer to set the size of the aperture, also known as the f-stop, and then have the camera decide what shutter speed will be used to take a correctly exposed image.

### **Shutter Priority (Tv)**

Shutter Priority mode is just the opposite of Aperture Priority in that it allows the photographer to set the shutter speed and then have the camera decide the size of the aperture's opening to take a correctly exposed image.

## **Other Modes**

### **Portrait**

Sets the camera for minimum depth of field so that the background of the portrait will have a soft and less distracting look.

### **Landscape**

The reverse of the portrait mode, sets the camera for maximum depth of field so that everything in the picture will be in focus. This mode works best when using a wide angle lens (a lens with a shorter focal distance).

### **Close-Up**

This mode is used when taking pictures of small objects. However, this is not the same as using a macro lens, which we will explore later.

### **Sports**

Used to stop motion when taking pictures of fast-moving objects, such as athletes at sporting events. On some cameras, this mode works in conjunction with the auto-focus mechanism to keep moving subjects in focus. In this mode,

the camera may also be set to burst, to continuously take pictures while the shutter release is held down.

### **Night Portrait**

This mode is used to take pictures of people under low light conditions, such as dawn, evening and night. When the subjects are in the foreground, a slower shutter speed will be used to lighten the background and a fill-in flash will fire to illuminate the foreground objects.

### **Flash Off**

As the name suggests, this mode turns the flash off.

### **Manual Exposure (M)**

Allows you to select the shutter speed and the aperture so that you have control over the amount of light, the amount of motion and the depth of field in your pictures.

### **Auto Depth of Field (A-DEP)**

This setting is used so that the camera's automatic focusing capability evaluates various locations within the field of view and then selects the aperture setting that will provide enough depth of field to keep everything in focus.

### **Exposure Compensation**

Exposure Compensation lets you override the camera's automatic exposure setting, usually in 1/3, 1/2 or 1 f-stop increments, either on the plus side for more exposure, or on the minus side for less exposure.

### **Exposure Lock**

Many cameras have this capability that lets you maintain the previous exposure value for additional pictures.

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## **Depth of Field**

Depth of field is an important concept in photography and helps determine the focus of foreground and background elements and how they relate to each other. This relationship between items closer to the camera and those farther away can be modified through the effective use of depth of field.

In the following series of images, you will see four different objects, a head, a bird, a vase and a fence, all in various stages of focus. By manipulating the

camera's aperture and shutter speed, the photographer can determine which of the four individual objects will be in sharpest focus and which will be out of focus. This is important because at times, you will want the viewer to pay closest attention to specific elements in your picture and using depth of field is a good way of accomplishing this.

These images were taken either with the camera set to manual exposure or by using the auto depth of field setting.



Only the Head is in Sharp Focus

f/7.1 1/80th of a second focal length 51mm



Only the Bird is in Sharp Focus

f/5.6 1/60th of a second focal length 45mm



Only the Vase is in Sharp Focus

f/5.6 1/100th of a second focal length 46mm



Only the Fence is in Sharp Focus

f/5.6 1/60th of a second focal length 45mm



All Four Objects are in Sharp Focus

f/36 1/4th of a second focal length 51mm

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## Shutter Speed and Depth of Field

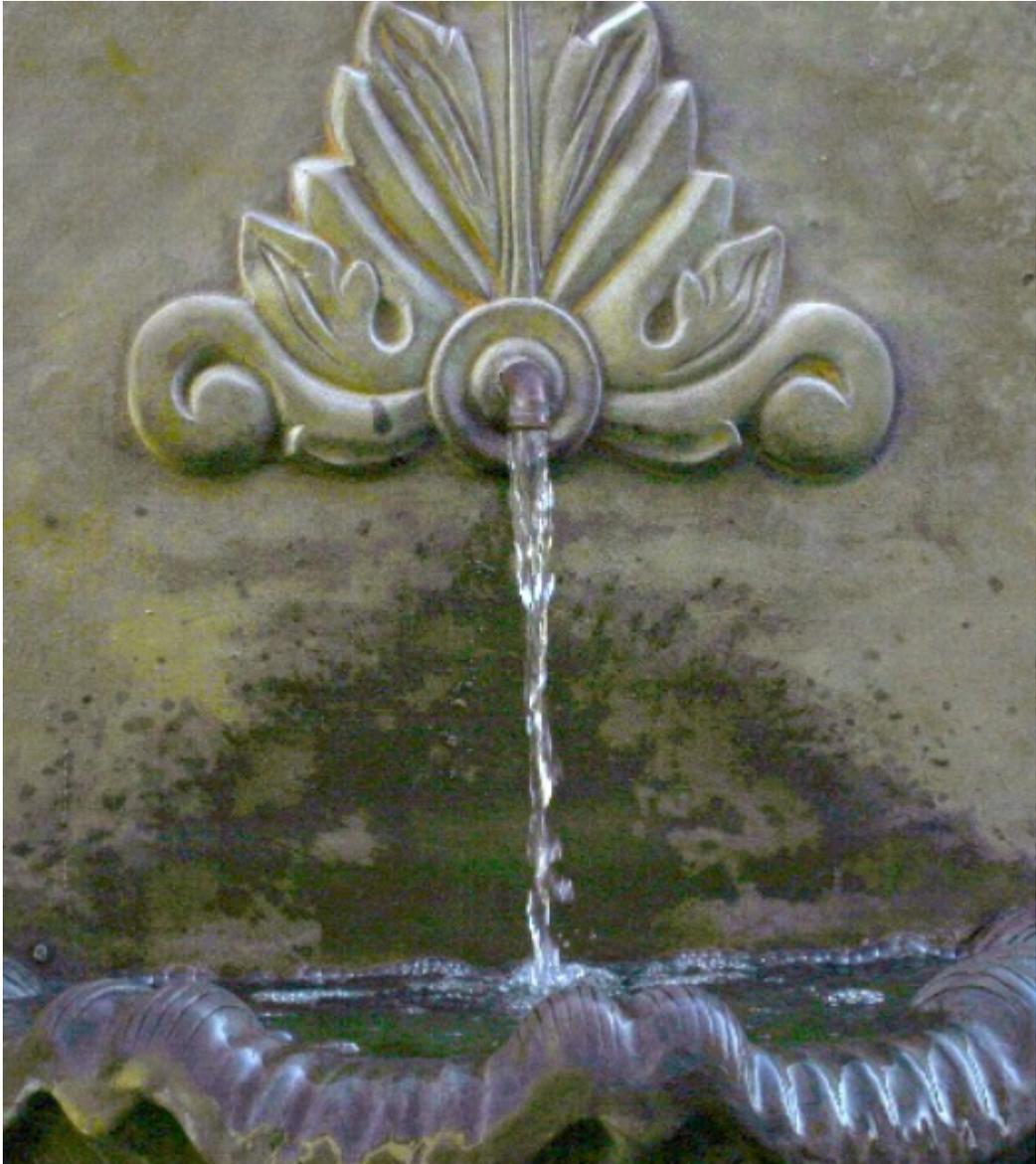
### Shutter Speed

The shutter speed of a camera determines how long of an exposure is made, in other words how long light will travel through the lens to expose the film or a digital camera's sensor.

In the images below, you should look closely at the water coming out of the fountain's faucet.



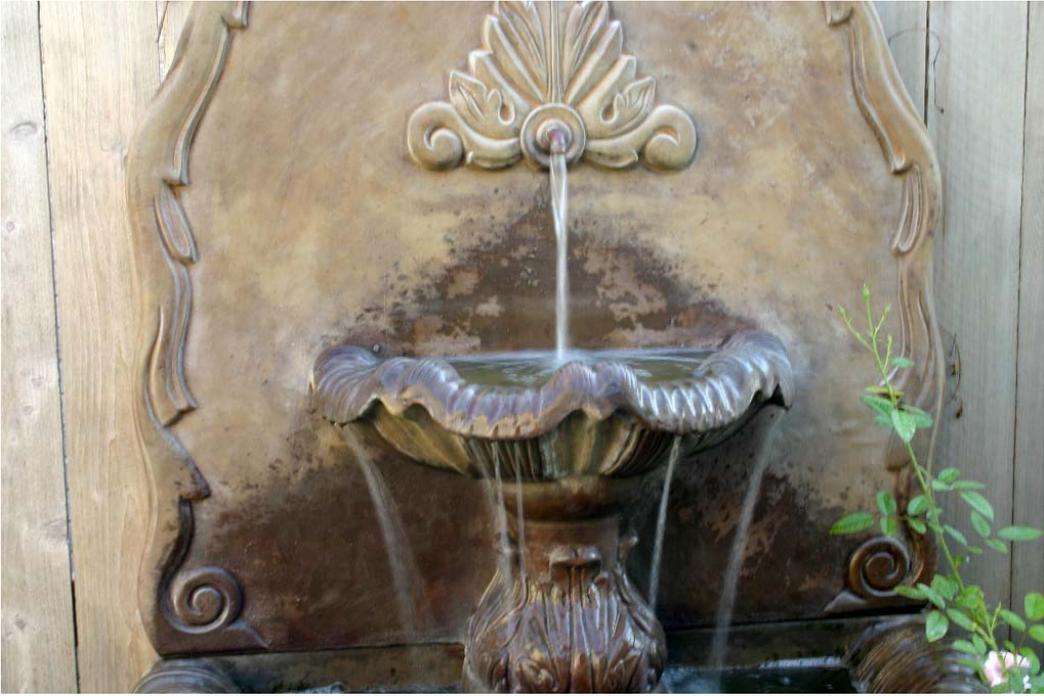
With the shorter shutter speeds, such as 1/250th of a second, the water is captured in mid-stream and on close examination, some of the individual drops can be seen.





f/8 - 1/250th of a second

But as the shutter speed is set to longer numbers (remember that the shutter speed indicates the amount of time that the shutter remains open letting light hit the camera's image sensor), the water drops begin to merge together until it looks like the water has been painted, rather than captured by a camera.



f22- 1/2 second



The photograph below of the UH fountain sculpture behind the College of Education building, taken by Will Rowell - a student in an earlier Digital Photography course, beautifully captures this effect by using a long exposure of about 15 seconds.



Obviously, in a case such as this one, the camera must be extremely still while the shutter is open. This can be done by resting the camera on a stable surface, such as a bench, or preferably, by using a tripod. You will also notice that the image shows a horizontal curve to the ground and the buildings being photographed. This is because the lens used to take this picture has a very wide angle of view which distorts the true perspective of the subject. Another attribute of a wide angle lens such as the one used here, is that there is a high depth of field, so that everything in the picture is in focus.

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