



## Shutter Speed in Digital Photography

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Photography is the process of recording light. Film cameras recorded the light on to the film while digital cameras record light on an image sensor. In order to prevent bright or dim light from creating an overexposed or underexposed image the shutter must open and close in the right amount of time. The amount of time it is opened depends on three factors: the light intensity, the aperture setting, and the ISO or film speed. (Refer to separate factsheets on ISO and aperture for a more detailed definition of these concepts.) In order to achieve proper exposure these three features must be balanced. The shutter speed is the easiest to adjust in order to obtain proper exposure.

### Exposure

In digital photography exposure refers to the amount of light that reaches the image sensor. When too much light is recorded the picture will be washed out — overexposed. When too little light is recorded the image will be dark — underexposed. Usually, neither situation is desirable.

In low light situations the ISO can be increased and/or the aperture can be opened wider. Either of these choices may alter the image's clarity, potentially yielding an undesirable image. In such situations the shutter speed can be set at a slower speed to help maintain the other desirable qualities.

Alternately, in high light situations the ISO can be decreased and/or the aperture can be adjusted smaller. However, increasing the shutter speed allows flexibility with the other two settings.

### The Shutter

The shutter is located behind the lens and mirrors and opens when a photograph is taken. Most consumer cameras can shoot pictures with shutter speeds from 1/2000<sup>th</sup> of a second to several seconds (or indefinitely.) This feature is useful for freezing motion or capturing effects like fireworks or running water.



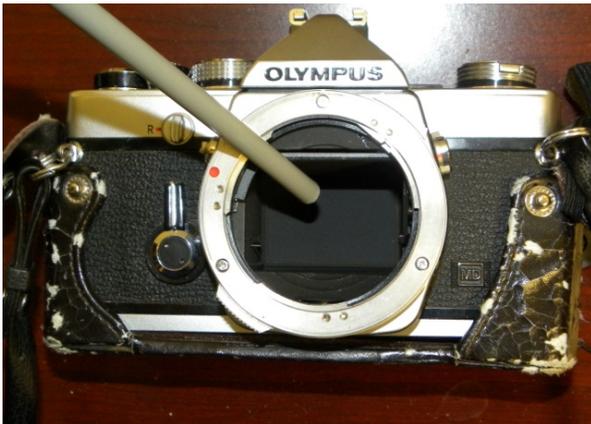
*Figure 1. The inside of a film camera. The mirror and shutter behind it move when it shoots a photograph.*

The shutter opens electronically on digital cameras, which makes very quick shutter speeds possible. Some cameras have a sliding screen as the shutter, while others have several thin plates that form a circular pattern capable of opening and closing from the center.

When the camera's shutter opens the light is exposed to the image's sensor as referenced in Figure 4.



*Figure 2. The circular diaphragm is a precision aligned plates that can open and close in a small fraction of a second.*



*Figure 3. The shutter, which is the sliding screen, on this older film camera is capable of opening and shutting at 1/1000<sup>th</sup> of a second*

The image sensor captures the colors and saves the photo. While the recording processes for digital and film cameras are different, the mechanics are the same. The size of the picture (megapixels) and the speed of the digital processor determine how long before the camera is ready to take the next picture.



*Figure 4. The shiny surface on this old camera was where a roll of film was placed. A sensor is located there on a digital camera that records the image.*

## Adjusting the Shutter Speed

On most digital cameras there is a setting that allows shutter speed adjustment. Usually there is a letter **S** or another symbol that will allow a person to choose which speed is appropriate for the picture. Some of the point-and-shoot cameras will have a “manual” mode which may allow selection of shutter speed, film speed or aperture settings in the menu that displays on the LCD screen. Consult the specific camera manual to see if the shutter speed can be manually adjusted and become familiar with how to do it.

A tripod, which is a device that holds the camera still during exposure, is very helpful when the shutter speed is slower than 1/30<sup>th</sup> second.



*Figure 5 This dial shows the camera in a mode capable of adjusting the speed.*

## Capturing Still Shots

Generally, in order to freeze a shot of a person moving without a blur, the shutter speed should be no slower than 1/60<sup>th</sup> second. (This does depend on how fast the individual is moving of course, a portrait can be shot at a much lower speed.) If the desired effect is a still shot involving sports, moving vehicles, or similar situations, then the speed would likely need to be set at 1/500<sup>th</sup> second or faster such as the galloping horse in Figure 6.



*Figure 6. This feral horse was frozen in mid-air with its mane and tail in still shot.*

In cases where lighting is low, a flash is not appropriate, and the subject is relatively still, then a slower shutter speed allows more exposure. Taking pictures of moving objects using shutter speeds below 1/60 of a second will likely result in a blurred image.



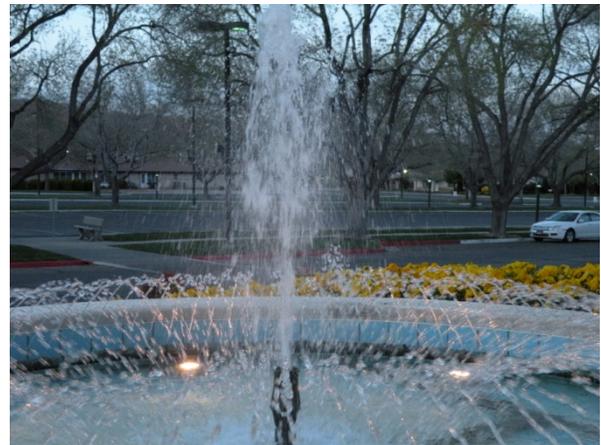
*Figure 7. Due to the low lighting, slow shutter speed and movement of the subject this picture is blurred.*

## **Special Effects with the Shutter**

One of the most common reasons to adjust the shutter speed is for special effects. Shooting moving objects or streams of light that imply motion require adjustments to the shutter speed to achieve these special effects. While getting a fast shot allows a person to see more detail, a slower exposure gives a softer, flowing appearance.



*Figure 8. This picture was shot at 1 second. This allowed the water to stream across the ice formation.*



*Figure 9. This picture was shot at 1/125 of a second. Instead of a flowing motion, the water droplets can be seen in detail.*

Figures 8 & 9 illustrate the difference between exposure speeds and their effects with moving water. Slowing the shutter speed down allows streams to form rather than catch individual droplets. However, care must be taken to reduce the risk of overexposure. Most often, these pictures must be taken in the early morning or evening, and the aperture must be very small, to prevent overexposure from occurring.

Fireworks are another type of picture that must have shutter speed adjustments for proper exposure. It is important to have a tripod to hold the camera in position since the human body naturally sways. The slower shutter speed allows the fireworks to stream across the photo as shown in Figure 10.



*Figure 10. Slower shutter speeds on a mounted tripod let the light streams from fireworks suggest motion.*

The following guidelines will help you achieve suggestion of running water or fireworks. The shots are best when done in the early morning, evening, or night (if fireworks are the subject).

- Position camera on a tripod.
- Set shutter speed to 1-2 seconds.
- Set film speed (ISO) to 100 or 200.

These settings will create an effect where even small streams of water show implied motion. This is one way shutter speed adjustment can be manipulated to show certain special effects. As with any other concept, a photographer will learn through trial and error.



*Figure 11. This picture of a stream shows the look of water when the shutter speed is set at 1 second.*

## Summary

The shutter speed is used to control how much light is exposed to the image sensor. It not only regulates the light but also allows still pictures of fast moving objects.

The shutter also is used for special effects. When shooting certain subjects, motion can be implied. It is always necessary to consider the lighting when adjusting the speed.

## References

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