

Digital Photography – how it works

Most of the major technological breakthroughs in consumer electronics have really been built around the same basic process: converting conventional analog information into digital information.

The digital camera is one of the most remarkable instances of this shift. Conventional cameras depend entirely on chemical and mechanical processes-- you don't even need electricity to operate them. On the other hand, all digital cameras have a built-in computer, and all of them record images electronically.

As digital imaging technology has improved, digital cameras have rapidly become more popular.

Understanding the Basics

Let's say you want to take a picture and e-mail it to a friend. To do this, you need the image to be represented in the language that computers recognize -- bits and bytes. Essentially, a digital image is just a long string of 1s and 0s that represent all the tiny colored dots -- or pixels -- that collectively make up the image.

If you want to get a picture into this form, you have two options:

You can take a photograph using a conventional film camera, process the film chemically, print it onto photographic paper and then use a digital scanner to sample the print

You can directly sample the original light that bounces off your subject, immediately breaking that light pattern down into a series of pixel values -- in other words, you can use a digital camera.

Storage

Most digital cameras have an LCD screen, so you can view your picture right away. This is one of the great advantages of a digital camera -- you get immediate feedback on what you capture. Of course, viewing the image on your camera would lose its charm if that's all you could do. You want to be able to load the picture into your computer or send it directly to a printer. There are several ways to do this.

Early generations of digital cameras had fixed storage inside the camera. You needed to connect the camera directly to a computer with cables to transfer the images. Although most of today's cameras are capable of connecting through serial, parallel, SCSI, USB or FireWire connections, they usually also use some sort of removable storage device.

Digital cameras use a number of storage systems. These are like reusable, digital film, and they use a caddy or card reader to transfer the data to a computer. Many involve fixed or removable flash memory. Digital camera manufacturers often develop their own proprietary flash memory devices, including SmartMedia cards, CompactFlash cards and Memory Sticks. Some other removable storage devices include:

Hard disks, or microdrives
Writeable CDs and DVDs



No matter what type of storage they use, all digital cameras need lots of room for pictures. They usually store images in one of two formats -- TIFF, which is uncompressed, and JPEG, which is compressed. Most cameras use the JPEG file format for storing pictures, and they sometimes offer quality settings (such as medium or high).

Image Size	TIFF (uncompressed)	JPEG (high quality)	JPEG (medium quality)
640X480	1.0 MB	300KB	90KB
800X600	1.5MB	500KB	130KB
1024X768	2.5MB	800KB	200KB
1600X1200	6.0MB	1.7MB	420KB

Summary

It takes several steps for a digital camera to take a picture. Here's a review of what happens from beginning to end:

1. You aim the camera at the subject and adjust the optical zoom to get closer or farther away.
2. You press lightly on the shutter release.
3. The camera automatically focuses on the subject and takes a reading of the available light.
4. The camera sets the aperture and shutter speed for optimal exposure.
5. You press the shutter release all the way.
6. The camera resets the charge coupled device and exposes it to the light, building up an electrical charge, until the shutter closes.
7. The analog-to-digital converter measures the charge and creates a digital signal that represents the values of the charge at each pixel.
8. A processor interpolates the data from the different pixels to create natural color. On many cameras, it is possible to see the output on the LCD at this stage.
9. A processor may perform a preset level of compression on the data.
10. The information is stored in some form of memory device.

Top 10 Tips for Great Pictures

Look your subject in the eye- Direct eye contact can be as engaging in a picture as it is in real life. When taking a picture of someone, hold the camera at the person's eye level to unleash the power of those magnetic gazes and mesmerizing smiles. For children, that means stooping to their level. And your subject need not always stare at the camera. All by itself that eye level angle will create a personal and inviting feeling that pulls you into the picture.

Use a plain background- A plain background shows off the subject you are photographing. When you look through the camera viewfinder, force yourself to study the area surrounding your subject. Make sure no poles grow from the head of your favorite niece and that no cars seem to dangle from her ears.

Use flash outdoors- Bright sun can create unattractive deep facial shadows. Eliminate the shadows by using your flash to lighten the face. When taking a picture of a person on sunny days, turn your flash on. With a digital camera, use the picture display panel to review the results. On cloudy days, use the camera's fill-flash mode if it has one. The flash will brighten up people's faces and make them stand out. Also take a picture without the flash, because the soft light of overcast days sometimes gives quite pleasing results by itself.

Move in close- If your subject is smaller than a car, take a step or two closer before taking the picture and zoom in on your subject. Your goal is to fill the picture area with the subject you are photographing. Up close you can reveal telling details, like a sprinkle of freckles or an arched eyebrow. But don't get too close or your pictures will be blurry. The closest focusing distance for most cameras is about three feet, or about one step away from your camera.

Move it from the middle- Center-stage is a great place for a performer to be. However, the middle of your picture is not the best place for your subject. Bring your picture to life by simply moving your subject away from the middle of your picture. Start by playing tick-tack-toe with subject position. Imagine a tick-tack-toe grid in your viewfinder. Now place your important subject at one of the intersections of lines.

Lock the focus- If your subject is not in the center of the picture, you need to lock the focus to create a sharp picture. Most auto-focus cameras focus on whatever is in the center of the picture. But to improve pictures, you will often want to move the subject away from the center of the picture. If you don't want a blurred picture, you'll need to first lock the focus with the subject in the middle and then recompose the picture so the subject is away from the middle.

Know your flash's range- The number one flash mistake is taking pictures beyond the flash's range. Why is this a mistake? because pictures taken beyond the maximum flash range will be too dark. For many cameras, the maximum flash range is less than fifteen feet—about five steps away. What is your camera's flash range? Look it up in your camera manual. Can't find it? Then don't take a chance. Position yourself so subjects are no farther than ten feet away.

Watch the light- Next to the subject, the most important part of every picture is the light. It affects the appearance of everything you photograph. On a great-grandmother, bright sunlight from the side can enhance wrinkles. But the soft light of a cloudy day can subdue those same wrinkles. Don't like the light on your subject? Then move yourself or your subject. For landscapes, try to take pictures early or late in the day when the light is orangish and rakes across the land.

Take some vertical pictures- Is your camera vertically challenged? It is if you never turn it sideways to take a vertical picture. All sorts of things look better in a vertical picture.

Be a picture director- Take control of your picture-taking and watch your pictures dramatically improve. A picture director takes charge, picks the location, adds props, and arranges people: "Now move in close, and lean toward the camera."

More Photo Tips

Use a camera that helps you get the type of pictures you want.

Think about how you want to use a digital camera before you buy a digital camera. If you want to make lots of 8x10 prints, you'll need at least 3 mega pixels. If you want to take pictures of a family vacation at the beach, you'll need a camera that has special flash options. Make a list of must-have features, then find a camera that can help you get there.

Use a high-resolution file format.

One way to squeeze more photos onto a memory card is to set the camera at a low resolution. That's OK if all you want to do is email photos. If you want to make print, you're in trouble. Keep the resolution turned up to its highest JPEG or TIFF setting. When a great photo comes along, you'll be glad you did.

Always have extra batteries.

Digital cameras need lots of power. Make sure that the batteries are fully charged, and have a backup battery, too. That way the camera is ready when you are.

Have enough memory cards.

If you take a lot of pictures you need lots of memory. Buy the biggest memory card you can afford. Or have lots of smaller ones. You won't worry about running out of memory when you need it most.

Turn off the camera before removing the memory card.

When you take a picture, the digital camera writes the photo to a memory card. Taking the card out of the camera while it's still being used can break the camera and destroy the photos. A good rule of thumb is to turn off the camera before taking the card out.

Learn your camera's timing.

Some cameras have something called "shutter lag." It's when there is millisecond delay between pressing the shutter and the camera taking the picture. If you use the camera enough, you learn the timing and don't miss a shot.

Use the "continuous" mode for fast-action pictures.

Every digital camera has a single-shot mode. It lets you take one picture at a time. This works fine when taking pictures of things that don't move. But if you want to take fast-action pictures — like sports — you need to change the camera's settings. If your camera has a "continuous" mode that lets you take several pictures right after another, use it. If not, turn off the LCD screen preview and the camera may work faster.

Create a digital workflow.

Like a jigsaw puzzle, digital needs all the pieces to fit to make a picture. There are four parts to a digital workflow:

take a picture

transfer and organize photos

edit photos

print and share photos.

It sounds boring, but if you don't do these in the right order, you're asking for trouble. Following these four steps is what makes digital fun and easy.

Some photos can't be fixed.

In the movies, computers can restore even the most damaged photos to their full focus and glory. Or they can make a picture taken at night look like it was shot in the middle of the day.

Good image editing software cleans up odd color in a photo caused by indoor lighting, removes red-eye, makes color brighter, and more.

There is a limit to how much a photo can be fixed. A low-res photo can't make a hi-res print. Bad "framing" can't be corrected. But if you pay attention to the details before taking a picture, you won't have to worry about it.

Always, always, always make copies of your original photos.

Just like with film, digital cameras create a "negative" of every picture it takes. It's the original photo file — or negative — that you transfer to the computer. If the digi-neg gets lost or damaged, the picture is gone forever.

Make a copy of the digi-negs before you do any editing. Burn a CD with the original photo files and you're photos are safe. And remember that you only edit copies of the original photo files. Never edit the digi-negs.