

## **Digital Cameras - the basics**

What is a digital camera, and how does it compare with its' film counterpart? Perhaps the first important point to realise is that most digital cameras are remarkably similar to film cameras in terms of their operation, with a lens focussing the image, an aperture and shutter, built-in flash and various metering systems to determine the right exposure. The fundamental difference of course is that the light is focussed not on to film, but instead onto a light sensitive silicon chip, called a CCD or CMOS sensor. The camera will also have a means of storing the recorded images onto some kind of memory card, and outputting images to television for example.

### **The Sensor**

The "digital film", the CCD or CMOS, is a small rectangular silicon chip containing many thousands, or millions of light sensitive picture elements, or "pixels". Light falling on a pixel causes it to generate an electrical voltage. The more light the greater the voltage. This voltage is converted into a stream of digital data to be read by the computer. In general, the more pixels the sensor contains, the better the quality, or resolution of the final image. Colours are recorded by coating each individual pixel with a red, green or blue transparent filter. In most sensors, each group of four pixels has one blue and red, and two green pixels. The final colour for each individual pixel is determined by complex formulae which evaluates each pixel in relation to the surrounding cluster.

Right from the start of digital camera technology, manufacturers related the sensitivity of the CCD chips to photographic film, with most having a sensitivity, or speed, of 100 or 200 ISO. In many models of camera the sensitivity of the chip can be adjusted, so that the speed of a 200 ISO sensor can be increased to 400, 800 or even 1600 ISO by amplifying the signal. Like film, the slower ISO speeds are used where highest possible definition is required, whilst faster speeds are

used for shooting action images. This is a very useful feature as it allows the use of a different speed for each image if necessary. Increasing the sensitivity of the sensor may result in an increase in increased “noise” in the image – an effect rather similar to coarse film grain, particularly in shadow areas of the image.

Nowadays, digital cameras with 5 megapixel sensors (megapixel is one million pixels) are common, and give results comparable to conventional film images if they are not enlarged too much. As a rough guide, a camera with perhaps 5 million pixels will easily give ink jet prints of around 10 x 8" at photographic quality, though this is subject to a number of different factors, including the quality of paper and ink used in the printer. “Photo quality” glossy paper will give a much better print than ordinary inkjet paper for example. The figures quoted for CCDs will either show a total number of pixels, for example, 5 or 6 million, or as two figures, for example 3000 (horizontal number) x 2000 (vertical number) pixels.

If 5 million pixels are not enough for your purposes, then imaging processing software such as Photoshop can be made to invent or “interpolate” new pixels, effectively increasing the resolution of images.

## **Camera Types**

The first digital cameras were modified SLR types, where the film back was replaced with a digital sensor. These still remain the best type for professionals, who can use their existing lenses and other accessories, but their price still puts them out of reach for many people, although new, cheaper models are being introduced all the time!

Most digital cameras are of the “compact” type, with direct vision viewfinders and non-interchangeable lenses. Some “hybrid” types have single lens reflex viewing systems, without the facility of interchangeable lenses. One advantage of these over interchangeable lens types is that no dust can enter the camera body and fall onto the imaging sensor.

Like their film counterparts most compact cameras have zoom lenses, and can imprint date and time data on the images if required. All will have an LCD video screen on the rear of the camera which can display a “live video” view of the subject, or be used to review and perhaps edit images already taken. The screen can be difficult to see in sunny conditions, and does tend to drain the battery if used too much! The screen can also display other useful information such as the image histogram, enabling you to tell if you have got the correct exposure for example.



**A typical “compact” digital camera showing the main controls**



## Rear view showing LCD screen and other controls

### Batteries

A problem often cited with digital cameras is that of battery consumption. The situation has improved greatly over the last few years, and many more images can be taken than previously. Even so, try to carry spare batteries with you at all times if you are on location for any length of time.

### Image Quality

Many digital cameras give various options for image quality, with settings such as "good", "better" and "best". These result from the way in which the image is stored - the software in the camera can "compress" the image when saving it, so that a 15 Megabyte image may be stored in just a half a megabyte of space or less, enabling more images to be stored on the memory card. In general, the compression process degrades the image somewhat, and the more an image is

compressed, the lower the quality. Some cameras give the option of saving uncompressed images which will result in the very best quality. Obviously, you will get fewer “best” quality images on a disc than “good” ones, but wherever possible use the “best” setting.

The usual “file formats” for saving images are TIFF and JPEG, though RAW files are becoming increasingly common. JPEG is the commonest format for compressing images, and very high rates of compression can be achieved. RAW files are unprocessed files, rather like an unprocessed negative, where you choose the type and amount of development. With digital files, if you retain the RAW file you can go back and re-process the “negative”, allowing maximum control over the imaging process.

### **Downloading your shots**

Having recorded some digital images you will need to transfer them from the camera to a computer. Some systems allow you to send images directly from the camera to a printer, removing the need for a PC. Whilst this might be very useful for certain users, it is most likely that you will want to enhance, retouch or manipulate your images in some way in an image processing program, which can only really be carried out on a computer. There are two main ways of getting the images from the camera to the PC - either by using a cable directly linking the camera to the computer, or by using a special card reader which attaches to the computer, and which receives the storage card from the camera. The latter is the more convenient as you do not need the camera, and it will not use up the batteries. The software supplied with most digital cameras allows you to preview the images as low resolution “thumbnail” versions before downloading the high resolution versions, rather like a photographer’s contact sheet.

### **Storage Media**

A major factor to consider with digital cameras is that of image storage. Most cameras use one of a range of removable cards (digital film). There are various types, such as CompactFlash, SD and xD cards. All of these systems are

available in differing capacities, from 32Mb to over 4Gb, with new, high capacity ones being introduced all the time. The size will obviously govern how many images can be stored.

### **The Future?**

Digital cameras are, compared to film cameras, still very much in their infancy, with new models arriving all the time. Trying to predict their future is very difficult, but there is no doubt that quality will continue to improve, and the cameras give increasingly excellent value to their users. Will they completely replace film? Probably not, at least for a few years yet, as there are still millions of film cameras in use, though film sales are declining rapidly.

***Adrian Davies/PIC 2006***