

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 “charge coupled device”, or CCD (some models use another types of chip, called CMOS - “Complementary Metal Oxide Semiconductor”, but the principles are very much the same). The camera will also usually have a means of storing the recorded images onto some kind of disc or magnetic card.

The CCD Sensor

The “digital film”, the CCD, 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 CCD 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 CCDs, 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 some models of digital 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.

Nowadays, digital cameras with “megapixel” CCDs (those with a million or more pixels) are common, and can give results comparable to conventional film images if they are not enlarged too much. As a rough guide, a camera with perhaps 1.5 million pixels will give ink jet prints of up to 7 x 5" at photographic quality, though this is subject to a number of different factors, including the quality of paper 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, 2 or 3 million, or as two figures, for example 1536 (horizontal number) x 1024 (vertical number) pixels.

Cameras with 4 million pixels or more are now standard, but even this is not the end, as computer software can be made to invent or “interpolate” new pixels, effectively increasing the resolution of images. However, this does not necessarily lead to better image quality, as the interpolated data may not be as good as that obtained by the camera lens.

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 most people, although new

models are being introduced all the time!

Most digital cameras are of the “compact” type, with direct vision viewfinders and non-interchangeable lenses. You will need to take account of parallax when shooting close-ups, whereby the image is viewed through a different lens from the one which takes it. In extreme cases this can lead to cutting off the tops off heads or feet! Like their film counterparts most have zoom lenses, and can imprint date and time data on the images if required. Many 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!



Front view of Typical Digital Camera

Batteries!

One of the biggest practical problems with digital cameras is that of battery consumption. Many will only allow perhaps 50 or so shots with a set of batteries, and some, particularly those with LCD displays, use the batteries much more rapidly than that! Don't use the LCD display for more than you need to as this. It is essential to have spare batteries with you at all times.

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 2 Megabyte image may be stored in just a half a megabyte of space or less. 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. JPEG is the commonest format for compressing images, and very high rates of compression can be achieved. Most image processing programs recognise both TIFF and JPEG.



Rear view of digital camera

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. Probably the most important aspect of using any computer for imaging is to have enough RAM (Random Access Memory). You should really have a minimum of 64Mb, and preferably more than that!

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, including various types of PCMCIA, or PC cards, SmartMedia, CompactFlash cards, the recently introduced IBM MicroDrives, and even standard 3.5" floppy discs. All of these systems are available in differing capacities, from 2 to over 500Mb, with new, high capacity ones being introduced all the time. The size will obviously govern how many images can be stored. By far the commonest systems at the moment with "consumer end" digital cameras are either the SmartMedia or CompactFlash cards. Both can be used in special card readers, available as an extra for PC's, or fitted into an adapters to be used in the standard PCMCIA slot on laptop computers.

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. When mobile phones first arrived, people buying them did not throw away the phone in their home. Many people now have two or more phones, and that is the likely scenario with digital cameras.

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