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FAQ

frequently asked questions on digital photography

The Olympus Digital Library – Volume 5

Frequently Asked Questions on Digital Photography

Digital Library Vol. 5

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"A picture is worth a thousand words." This is certainly one explanation for why photography has lost none of its power to fascinate and enthral in its almost 200-year history.

Even though cameras were still expensive, heavy, cumbersome and complicated well into the 20th century, these failings proved to have little influence on the technology's success. The reason: for the first time it was possible to capture moments in time and illustrate feelings, moods and desires at more or less the press of a button. Photography was here to stay.

Whether digital or analogue, in the studio or out in the open, photography is always much more than just capturing reality. It is also the interpretation of what the photographer sees and the transformation of this into a new, two-dimensional reality so that the moment comes back to life when the image is viewed.

It's a pity then that with conventional analogue photography the results cannot be seen immediately, checked or edited until the film has been exposed and developed.

While the instant photo technology introduced by Polaroid went some way to changing this, it was digital imaging that really revolutionised the photographic experience.

Initially, this new technology was prohibitively expensive and really only attractive to technologically adventurous pro users. However, as a result of the internet and email boom, demand for easy-to-produce and affordable digital images rose to unforeseen levels. This, together with the ever lower cost of components (LCD displays,

CCD chips, etc.), led to the first affordable digital cameras appearing on the consumer market in the mid '90s.

Similar to the development of the computer, digital photography has experienced a dramatic increase in performance power. For example, whereas the first consumer camera had a resolution of only around 300,000 pixels, today there are models with eight million pixels or more that not only meet the needs of professional photographers but also fit the price range of amateurs.

1. The fascinating world of digital photography

The growth in the number of manually adjustable functions is equally impressive. While the earliest models featured as good as no individually adjustable settings, modern digital cameras are on a par with their analogue counterparts when it comes to manual control.

The reasons for the appeal of this imaging technology are manifold. These are just ten examples:

1. No need to buy film ever again.

2. Storage media are reusable.

3. Images can be checked and enjoyed immediately after capture.

4. The cameras' optical systems are of the highest quality. To meet the requirements of CCD image sensors, the lenses have a resolution superior to those designed for analogue models.

5. Silent operation for discreet shooting.

6. Creative effects possible even at the recording stage.

7. Presentation of the images on a TV (slide show).

8. No loss of quality when copying and transferring data.

9. Editing images later is easy.

10. Prints can be produced and photos sent via email immediately.

So, it's hardly surprising that the digital camera market has been enjoying such an extraordinary growth rate. While the number of digital cameras sold in 1996 reached just about 1.2 million (of which only 100,000 were sold in Europe), this number had risen to 65 million worldwide in 2005, of which 24 million were sold in Europe.

With so many newcomers to the world of digital photography, and because of the rapid development in this field, new questions constantly arise and older ones go unanswered. Even experienced digital camera users often find they want to refresh their understanding of the technology. In this booklet we have therefore tried to present short, to-the-point answers to frequently asked questions. We hope that it will serve as an ever-ready reference. Naturally, this brochure will not be able to cover all aspects of this complex subject. We do hope, though, that the FAQ will help you get more enjoyment from digital photography and obtain even better results.

2. Digital camera technology

2.1 How does a digital camera work?

Basically, digital cameras aren't that different from their 35mm counterparts. Both feature the core elements of lens, aperture and shutter; the only difference is how they capture and store the image information. So if you can use a film camera, you can shoot with one of these too.
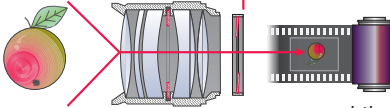
First, let's look at how an analogue camera works.

The analogue camera

Simply put, it consists of a **lens system**, an **aperture** and a **shutter**. The lens system ensures the captured image is in focus while the →aperture and →shutter control the amount of light reaching the film. As soon as the shutter is released, light is let into the camera through the →lens system and aperture to land on the photosensitive film. The resulting chemical reaction records the image on the film surface. This image is then set in the developing process.
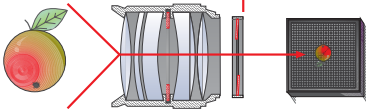
Although digital cameras may often look like their analogue counterparts and share many components, such as the aperture,

The digital camera

shutter and a lens system, their methods for recording images are quite different. Instead of light-sensitive film, they use a combination of →CCD chip, →imaging processing engine and storage media to capture the image.

The heart of the digital camera is hidden behind the shutter. The CCD (**C**harge-**C**oupled **D**evice)

sensor – sometimes CMOS (**C**omplementary **M**etal **O**xide **S**emiconductor) sensors are used – is a light-sensitive semiconductor element made up of many silicon diodes. Each one of these photodiodes represents one dot or →pixel in the final image. When light hits the individual photo-sensitive diode, this causes it to generate an electrical charge which is registered by the camera.

The →analogue-digital conversion process turns the millions of analogue charges into digital values. Those digital values are then calculated by the camera's imaging processing engine, comprising an →ASIC chip and software, to make better images (for example, by optimising gamma conversion and colour reproduction). The reconstructed digital image is then transferred to the camera's storage medium.

2.2 What is a CCD chip?
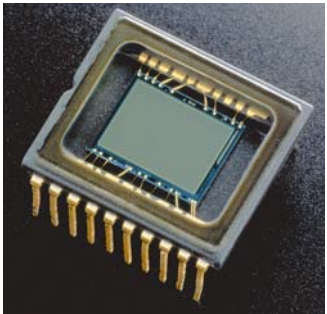
→**Pixel:**
Abbreviation for "picture element". It is the smallest element of a raster display or digital picture, containing information about brightness and colour.

The CCD chip is about as large as your fingernail and has millions of photosensitive diodes arranged in columns and rows on its surface, much like the dots, or pixels, on a computer monitor.
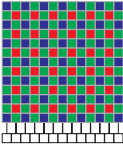
As all of the sensors on a CCD chip react to incoming light in the same way, a digital camera would only take black & white pictures. However, to ensure that all colours can be captured, the sensors are covered with different colour filters – either RGB (Red, Green, Blue) or CMY (Cyan, Magenta, Yellow) with additional green filters for more true-to-life results.

Besides colour, brightness data is also required for correct image reproduction. The light for each of the three colours is divided up into 256 levels of intensity. This combination of 256 x 256 x 256 yields 16.7 million possible colours for true colour reproduction.

The captured data is transformed into digital signals so that all relevant image information can be stored by the digital camera.
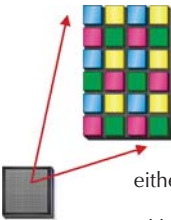
Basically, there are two different kinds of CCD chips which can be used in digital cameras. The first was originally developed for television and video and has since been optimised for still cameras. Called the video, or interlaced CCD, it has the advantage of high light sensitivity and features either RGB or CMY and green colour filters.

Although this CCD captures the information in one shot, the data is read in two sequences: first, rows 2, 4, 6, etc. of the CCD, and then rows 1, 3, 5, etc.

Video CCD

Even and odd rows are read separately
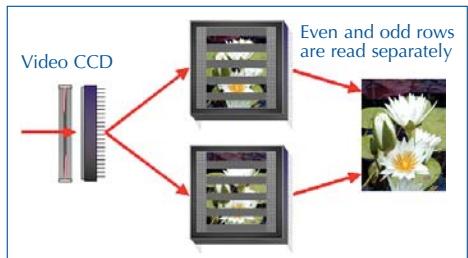
To allow uninterrupted reading, the digital camera uses a mechanical shutter to prevent more light entering the camera. Due to their high performance, relatively simple construction and low production costs, video CCDs are found in many digital cameras.

Another type of CCD called the progressive scan CCD, or simply progressive CCD, can record a number of complete images per second. Because the image is captured and read in one movement, that is row after row (1, 2, 3, 4, etc.), a mechanical shutter is superfluous and exposure time can be controlled electronically, enabling extremely high shutter speeds. Consequently, cameras with progressive CCDs are ideal for sports and action photography.

Progressive CCD

Data read in one pass.

A CCD is coated with RGB (Red, Green, Blue) colour filters. Since each pixel in the picture corresponds to one of the three types of CCD pixels, only one colour is recorded for each dot. An imaging processing engine is used to calculate and complete the missing colour data. The better the imaging processing engine, the better the resulting picture will be.

An additional improvement in picture quality is achieved by a relatively simple trick. By modifying the CCD chip's proportion of green-filtered pixels to contain two green filters for every red and blue filter, the subject can be reproduced even more precisely.
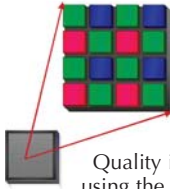
The reason for this: not only is the human eye more sensitive to green but the colour green also significantly influences our perception of brightness.

Quality image capture is not just a matter of using the right colour filters. The layout of the components on the chip – the photodiode, where the signals are generated, and transfer channels for transporting the signals to the processors – can also greatly influence the end result. The difference this makes can be seen by comparing two types of CCD: the Interline Transfer CCD used in the majority of digital cameras and the Full Frame Transfer CCD sensor inside most of the Olympus E-System cameras.

As you can see in the illustration, the Full Frame Transfer CCD sensor features a larger pixel area,

Interline Transfer Type   Full Frame Transfer Type

Photo Diode
Transfer Channel
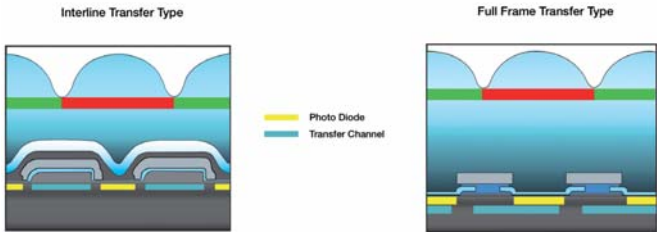
with bigger photodiodes and transfer channels. This means more electrons (light) can be captured for a high signal/noise ratio and a wider dynamic range for images with greater exposure latitude and detail, with less noise. Or, to put it more simply: clearer, more detailed pictures.

An alternative to the CCD chip is the CMOS chip, which also employs light-sensitive diodes for capturing images. While these chips have certain advantages over the CCD, not least in being relatively cheap to produce and having comparatively low energy requirements, many manufacturers still prefer to use CCDs in their cameras because the CMOS chips usually produce far too much noise, significantly affecting image quality.

For all their technical finery and innovative flare, neither the CCD nor CMOS chip can defend themselves against a very basic hazard – dust. While a little speck of dirt or sand poses no great problem for a film camera, it's quite a different story for digital models. Even the tiniest speck of dust can cover hundreds of pixels so that its presence can be seen on all the photos. And as resolutions increase – meaning there are ever more pixels spread across the same area – the problem of dust is becoming even greater. However, since most cameras have closed bodies, the user will very rarely have to worry about any dust getting inside and settling on the chip. Unfortunately, the same is not true for SLR models with interchangeable lenses. No matter how carefully the lenses are changed, there is always the chance of dust entering and landing on the CCD.
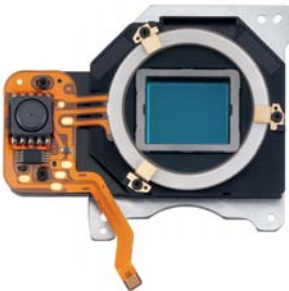
If this does happen, the camera usually has to be sent in for servicing. However, Olympus has developed a unique form of protection for its Olympus E-System digital SLRs. These feature the innovative Supersonic Wave Filter. When this function is activated, it generates a series of ultrasonic vibrations, which shake off any dust and other foreign particles from the filter in front of the sensor.

2.3 What should I take into account when shopping for a digital camera?

Before buying a digital camera you should think about what you intend to use it for. If you are looking for a model for taking snapshots at family gatherings or on holiday, for example, you would be best served by a fully automatic compact or compact zoom camera that takes care of all the details.

For users who want the convenience allowed by a compact, easy-to-use model but also wish to be able to add their own personal touches from time to time, there are a number of competitively priced user-friendly cameras that offer a range of adjustable settings, such as shutter speed, aperture and white balance, as well as picture effects like →sepia recording.

To meet the quality and performance requirements of the professional photographer, the camera needs to combine a very high →resolution and precise lens with extensive shooting control. It should also allow the connection of accessories, such as converter lenses and external flash systems, including, via an →x-contact, studio flashes. A variety of models, mainly digital SLRs, meet these criteria.

So, what features should you look for in a digital camera? Digital photography is all too often described as digital technology plus some photo technology. However, it is actually photo technology that uses digital technology. Therefore high resolution lenses, efficient flash systems and, if desired, manually adjustable parameters are important in a digital camera.

→Zoom lenses let you get closer to the subject. Generally, the larger and more powerful the zoom lens, the more expensive and heavier the camera (though digital camera zoom lenses are far more compact and lighter that those on film cameras). For everyday use, a 3x lens is usually sufficient. Where it is too difficult – or too dangerous – to get close to the subject, such as when taking pictures of the action at large sporting events or

Zoom versatility

of animals in the wild, an 8x or 10x lens is very helpful. Many models also feature digital zooms. While these provide additional magnification power, they are accompanied by a reduction in resolution, which in turn means a decrease in image quality.

Fast shutter speeds of 1/1000 sec. and quicker are also desirable when taking pictures of quickly moving subjects, such as birds or cars. On the other hand, you should look for a camera that offers very slow exposure times if you intend to take pictures in low light or at night, for example.

As a rule of thumb, if you ensure that the digital camera you want to buy has all the features you would look for in a traditional (film) camera, you can hardly go wrong.

Undeniably, price is also a strong factor when choosing a camera, but this should not be the only criterion. With photography, it's the result that counts and therefore you should consider the picture quality of the camera before you decide to buy.

2.4 What factors affect picture quality?

Four factors play a primary role in establishing the quality of a digital camera: the resolution of the CCD, the way the CCD works, the "intelligence" of the camera's imaging processing engine and, most importantly, the optical constituents of the camera.

The camera's resolution, which is usually written on its body and given in millions of pixels, or →megapixels, acts as an initial, basic quality guide.

However, if you have a quick look at the products on sale or read the reviews in specialist magazines you will soon discover that there are quite large differences between cameras that offer the same resolution, especially when the photos are printed. Why is this?

There are various reasons. One explanation is the difference in methods used by image sensors, e.g. CCDs (see section 2.2) and the quality of their production. With millions of pixels compacted on a miniature surface, it is hardly surprising that the majority of all CCDs produced can have a number of more or less insignificant faulty pixels. Pixel mapping (see section 3.3.3) helps compensate for some pixel errors. Yet, if the CCD has been poorly manufactured and contains too many pixel errors, there can be a noticeable effect on picture quality.

That's why a critical comparison of different models is the only way to ensure you get the best product. Pay special attention to the sharpness of the image outlines and the acuteness of the pixels. If these results appear to be satisfactory, check the reaction of the camera to different lighting situations. Asking for a printout of a digital photograph is also recommended. By this point, you will be able to tell how good the CCD sensors really are.

Another factor that significantly determines the quality of pictures is the camera's imaging processing engine. Comprising an ASIC chip and software, this is responsible for, among other things, image enhancement (such as →interpolation, gamma conversion and colour reproduction). Using special computational processes, the processing engine adds information to the partially recorded image information and separates the important from the unimportant image data. The more effective the camera's ASIC chip and software are in carrying out these tasks, the faster it can be done and the better the quality of the final picture. For more about this, turn to section 3.3.1 (TruePic TURBO).

In addition to the resolution and quality of the CCD and the camera's software, the optical technology of the lens system also plays a key role in delivering excellent digital photographs. More about camera optics can be found in the following section.

2.5 What role does the lens system play in a digital camera?
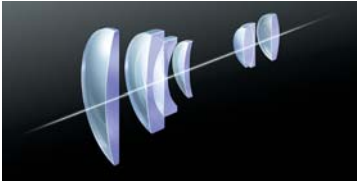
As mentioned in section 2.4, the digital camera's →lens system is often not given enough consideration. Many manufacturers draw the consumer's attention away from the lens, stressing instead resolution, price or other aspects. This is all the more surprising when you consider that digital cameras demand an even higher degree of optical performance than analogue compacts or even analogue →SLR models. The following explains why this is so: Digital camera lenses have to focus the light onto a far smaller area than those in film cameras. Where CCDs have a diagonal measurement of, in some cases, 0.55cm, 35mm negative film measures 4.3cm. Also, as CCD resolutions increase while CCD sizes stay virtually the same, the actual area of the individual pixels decreases so they can fit into the same or similar area. On a CCD under 1" in size with three or four megapixels, for example, the width (or pitch) of the pixel is just six microns or less (1 millimetre is 1,000 microns). Whereas film-based camera technology only requires
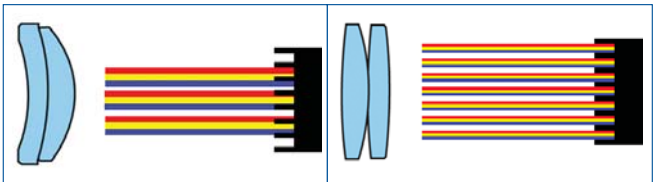
In the diagram on the left, the lens from the analogue camera is unable to focus the light into a resolution fine enough to fit the individual sensors on the CCD. Lenses used in digital cameras, as shown in the diagram on the right, have to be of a higher quality to provide the lens resolution matching the incredibly small sensors on the CCD.

optical systems that focus light to a resolution of 10 microns, the CCD in our example requires a lens that can focus light to a resolution of three or four microns.

Also, due to the construction of the individual sensors, which are surrounded by a "wall" on four sides, the CCD cannot accept light coming at an angle. Therefore, to focus the light so it hits the sensor surface at a more or less perpendicular angle, the lens should have a nearly telecentric construction. This is possible in most compact models because of their small CCD size (which is only a fraction of the area of a 35mm film). However, it is too impractical to make nearly telecentric lenses for digital SLRs with CCDs based on the larger 35mm film format. The lenses would be so large and expensive that many manufacturers decided to trade in quality for convenience.

However, the Four Thirds Standard put an end to this unsatisfactory compromise. Jointly developed by Olympus and Kodak, it established, among other things, the optimum sensor size for DSLRs to allow the production of near telecentric lens systems. The standard also describes the method of communication between the lens and body, which allows some unavoidable optical aberrations to be corrected electronically. The Four Thirds Standard is open to any manufacturers wishing to follow its guidelines, allowing photographers to use camera bodies and lenses from different manufacturers.
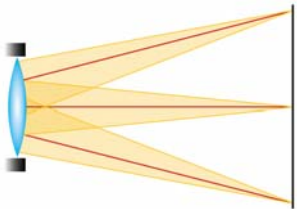
Lens designed for 35mm film cameras.   Film
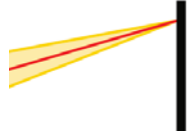
Film is tolerant with respect to light hitting it at an angle. Even at high resolutions, film can collect light falling at a high angle of incidence without a critical loss of brightness.
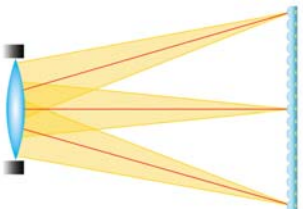
Lens designed for 35mm film cameras.   CCD
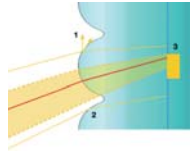
The following effects occur when light hits the sensor at high angles.
1. Reflection onto neighbouring pixels.
2. Crosstalk between neighbouring pixels.
3. Loss of brightness since some of the light cannot be captured by the sensor.
These effects reduce the charge on the pixel, resulting in poorer signal to noise ratio, corner shading and poor colour reproduction.
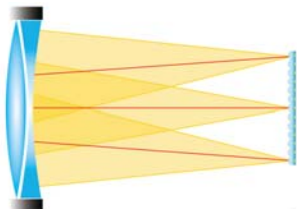
Near telecentric lens as in ZUIKO DIGITAL lenses.   CCD
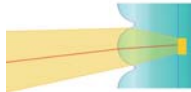
The near telecentric construction of lenses optimised for the Four Thirds Standard ensures light hits the sensor at almost perpendicular angles. This guarantees edge-to-edge colour, clarity and higher brightness.

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There is another reason why you should always look for good optical performance. In addition to picture sharpness, the lens system significantly influences colour reproduction and the ability to shoot in poor light conditions.

Finally, it would be misleading to think that all photographic errors could be corrected with the help of newer and improved →image editing software. The opportunities offered by various software programs are certainly fascinating, yet even they cannot perform miracles. What has not been recorded in the first place cannot be improved or added to. An excellent picture can rarely be made from an image which has been over or underexposed, for example, or poorly digitised. Therefore, people who insist on first-class picture quality and do not want to waste time on image editing should make sure that their camera includes a high quality optical system.

2.6 Can I leave the pictures on the memory card? What happens to the digital images if the camera is not used for a long time?

Nothing really. The pictures remain on the memory card. Even if battery power weakens, no picture loss is to be feared with most of today's cameras. In particular, the flash memory storage technique (Flash ROM) used by e.g. →xD-Picture Card, →SmartMedia, →Compact-Flash, SD card or Memory Stick, to name a few, provides a relatively safe form of storage, as does, but to a lesser degree, magnetic disk technology (e.g. Micro-drive). However, you should also ensure your irreplaceable images are saved on

your computer's hard drive. Better still, transfer your photos to a medium that offers an extremely secure storage solution, for example a →CD or →DVD (see chapter 5).

Whether on a hard drive, CD or DVD, multimedia PC software like →Olympus Master is particularly handy as it lets you organise, browse, print and archive your images.

2.7 What are the advantages of the camera's LCD?

The presence of an LCD is certainly a decisive factor in the appeal of digital cameras, as it shows the captured image immediately after taking the shot – something impossible with film cameras. In the vast majority of models, it also provides a Live Preview: a large, clear view of what will be recorded, greatly facilitating framing and freeing the photographer from being glued to the viewfinder. So – to give just a few examples – they can keep eye contact with the model during a shooting in the studio, and outdoors they still notice what is going on around them, something particularly useful when taking photos under water. Some monitors can even be tilted and/or twisted so the user is able to get a clear view of the subject when holding the camera in an unusual position, such as on the floor or high above everyone's heads. Until recently, the Live Preview functionality was solely a characteristic of compact cameras, while digital SLR users had to rely on the viewfinder to frame the shot. In early 2006, Olympus introduced Live Preview into the DSLR domain. The first

camera to feature this technology was the E-330. Here, the incorporation of a second image sensor mounted in the viewfinder's optical path allows a continuous view of the scene while retaining full autofocus capability (mode A). In mode B the mirror is locked in the up position so the camera's Live MOS sensor supplies a macro live preview, combined with manual focus control.

You may have heard or noticed yourself that some monitors have trouble displaying images in bright light. The reason is that, in standard Thin Film Transistor LCDs, the image is displayed with the help of a back light. To keep the power consumption as low as possible, the brightness is calculated so as to be fully sufficient for standard situations – but not in very bright sunlight or in strong direct light.

A:mode   B:mode

However, this is not the end of the story. Some digital cameras now feature the HyperCrystal LCD which provides a clear image, even in strong sunlight. This innovative LCD technology not only uses the available back light but also employs an additional layer that reflects light from any external light source, thus improving monitor brightness. Thanks to the use of a normally black mode transparency control and low-temperature polysilicon, wide viewing angles of 170° horizontally and vertically as well as high contrast and a fast response time can be achieved.

In dim-light situations framing the subject is sometimes hard, as the image on the monitor can be so dark it is hardly recognisable. This is where →BrightCapture Technology comes in. It needs only a fifth of the luminosity usually necessary to display a bright picture on the LCD. But it not just improves the brightness of the monitor display but also that of the shots taken.

2.8 Do digital cameras have to be serviced?

Digital cameras do not require any special servicing. You should, of course, take care of your digital camera just as you would a film camera or any other electronic instrument. Protect it from falls, bumps or water and replace the lens cap or barrier when not shooting. Removing the batteries from the camera when not in use for a long period of time is also recommended, as is storing your camera in a dry environment. The handbook supplied with your camera will give you many helpful tips on how to care for it.

To ensure you can always take pictures quickly, it is recommended that you check the batteries regularly (e.g. once a month). This can easily be done with the help of the battery gauge, a standard component in every good digital camera.

If your digital camera has a date and time indicator, you need not worry about losing this information after changing the battery. Most digital cameras contain an energy buffer that safeguards against memory deletion. If the camera contains a backup battery, to protect against unpleasant surprises this should be replaced periodically according to the manufacturer's instructions. (Note: this should be done after replacing the main battery.)

2.9 Rechargeable batteries, non-rechargeable batteries or AC adapters: what is the best power supply for me?

The more photos you take, the faster battery power is used up. Therefore, if you love to take photos often, you should consider buying a battery charger and rechargeable batteries. Many Olympus cameras are supplied with a high performance lithium-ion rechargeable battery and custom charger. For models using regular batteries, the Olympus →Ni-MH (Nickel-Metal Hydride) rechargeable batteries are highly recommended. These environmentally-friendly, cadmium-free batteries have a long life and are ideal for the busy photographer. When it comes to selecting the charger, it pays to choose one with a battery protection system to help extend the batteries' life span. It is also a good idea to buy an extra set of batteries so you can carry on shooting while the other set charges.

A compact and clever solution for less active digital photographers is the non-rechargeable →CR-V3 lithium battery. This is a very powerful battery for digital cameras and provides hours of shooting.

While rechargeable →NiCd, regular alkaline and lithium batteries may be used in most digital cameras, they do not have the power or endurance of Ni-MH or CR-V3 lithium batteries.

Some of the more professional-orientated digital SLR models allow the attachment of a battery pack. This rechargeable system supplies power for marathon shootings, so they are particularly suited for professional photographers working on location.

If you find yourself short of power or just want to save energy, there are a few ways you can cut down your camera's power requirements. Excessive use of the flash, zoom lens or LCD monitor, for example, shortens the life of your battery faster than normal camera use. Battery drain can be greatly reduced by using these features sparingly.

Last but not least, an AC adapter is ideal for shooting at home or places where a mains socket is close at hand. This provides a constant power supply without the need to buy and change batteries.

3.1 What does the camera measure to help me get the optimum results?

Most digital cameras are equipped with several systems that measure the conditions to select the best settings for the scene. These are not just ideal for first time users looking for no-fuss photography. The sharpness, clarity and colour delivered by the precision metering systems also mean they are valuable features for experienced amateur and professional photographers, too.

3.1.1 Exposure systems

Light is the photographer's raw material. The way the photographer uses it and how well the camera is able to detect it determines the look of the shot. Whether they are called light or exposure metering systems, these are used by the camera to measure the brightness of the light in the frame so that →aperture and →shutter speed can be adjusted accordingly for optimally exposed results. Most digital cameras use at least one exposure metering system while others feature a choice of systems. This lets you select the one best suited to achieve the intended result.
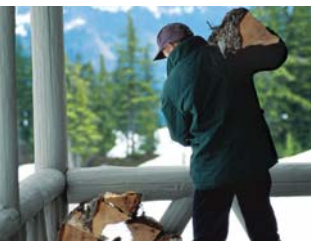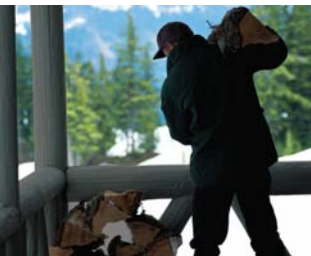
Average and centre-weighted metering systems are the most common and usually the most practical solutions for typical, everyday scenes. As their respective names suggest, the first measures the light evenly from all areas in the frame and sets the exposure to suit the average light value. The second also takes measurements from every area of the frame but gives extra weight to the central part of the frame when calculating the exposure settings.

However, when the main subject of the photo fills only a relatively small portion of the frame and/or reflects significantly more or less light than the surrounding area, such as a black cat on a bright white sheet, the average exposure for the whole frame may not produce the best results. In such cases, spot metering is far more effective since it only takes light readings from the very centre of the frame and sets the exposure accordingly. This is ideal for picking out certain motifs in the frame. But even spot metering can have trouble determining the best exposure settings for rich black or white subjects, such as a jet black or snow-white cat. The reason here is that the metering system is calibrated to work with the average reflection ratio of objects, which is 18%. But, a black cat does not reflect as much light, and the metering system overexposes the shot, producing a grey toned cat. With a white cat, the camera miscalculates again, and this time underexposes the shot, also producing a grey feline. Therefore, when shooting such subjects, it is worth bearing this in mind and using the exposure compensation function, too.

When taking pictures of a subject in front of a bright (or dark) background, some average exposure metering systems may select the wrong exposure settings. Spot metering, taking readings from the subject, provides better results in such cases (above). If the camera's system still has trouble finding the optimum exposure and the main subject is too dark, activate the fill-in flash mode to ensure it is properly illuminated.

If you don't want the main subject in the centre of the frame, you just need to first set the exposure for the object by placing it in the centre and half depressing the release. Then, while holding the release in place, reframe your shot.

Some models may also feature multispot metering. Here, you can determine a number of points where the camera is to take readings, such as first the brightest section followed by the darkest section of the main subject. Several points may be selected and the camera determines the average exposure from all the light values recorded.

Many Olympus cameras also feature a system called →digital ESP metering. This stands for digital Electro-Selective Pattern metering. Using this system, the camera analyses the distribution of brightness as well as its intensity to determine which of a range of scenarios best suits the photo and then adjusts the settings accordingly. It is a particularly effective form of exposure metering for most situations, particularly high-contrast shots.

In very difficult lighting situations, it pays to use →auto bracketing. This takes a few shots in quick succession, but slightly alters the exposure for each so that you can select the best image later and discard the others. Alternatively, you may use exposure correction, increasing or decreasing the exposure level from the initial setting by specific steps.

Some cameras offer an option to brighten darker areas in the picture after the shot has been taken. In Olympus cameras this is included in the so-called →Perfect Fix function.

3.1.2 How does the camera's autofocus operate?

There are basically two autofocus techniques: active and passive. In the one, by actively emitting e.g. infrared light, a light beam or sonar signal, and then receiving the returning signal, the camera is able to judge the distance to the subject and adjust the focus of the lens accordingly. This is called an active autofocus system. While it has the advantage of working even in the dark, it does have a drawback in that it cannot be used on objects that are far away or through a window.

With passive autofocus systems, the camera doesn't actively emit a light beam or signal. Rather, in the contrast detection system, for example, it examines the contrast in the image captured on its →CCD prior to shooting the actual shot. It then alters the focus to produce the best contrast, thereby ensuring the sharpest result. Unlike the active system, the contrast detection system can focus on far away objects. However, it does require a certain amount of light as well as scenes with some contrast (it could have problems working with white subjects on white backgrounds, for example.) To get around this problem, some cameras are equipped with an autofocusing light which shines on the subject so the camera can set the focus. Another type of passive autofocus is the phase difference system. Here the camera uses two sensors to calculate the amount of phase difference in an image and can thereby determine the distance to the subject.

There are some camera models which feature a dual autofocus system. Usually, the camera takes one measurement to determine the approximate setting and then activates another to fine tune the focus.

3.1.3 What is white balance?

Different types of light from different sources, such as the sun in a clear sky, an electric lamp or neon tube, have different light temperatures. While the human brain automatically adjusts for these variations and we therefore don't notice the differences, this is not necessarily the same in cameras. Depending on the light source, photos can show the same object in widely differing colours. For example, without correction, scenes shot in the light from a tungsten lamp bulb display a yellow-red tinge. Therefore, besides measuring the light intensity, the camera – or user – also needs to know the colour temperature of the ambient light to ensure correct colour reproduction. This is true both for digital and film cameras.

Left: Daylight
setting under
tungsten light.
Right: Tungsten
white balance
setting under
tungsten light.

With film cameras, in order to achieve optimal
picture results, you have to choose a film
specifically for either artificial light or daylight. If
photos are taken with the "wrong" type of film
for that particular light condition, the pictures
may come out with either a blue, green or red
cast. This isn't a problem with digital cameras.
Almost all feature automatic white balance, which
optimises the settings of the CCD for the relevant
light temperature. Many also allow users to adjust
the white balance themselves. As a result, it is
easy to ensure shots have the true-to-life colours
they need.

When digital imaging was in its infancy, only
video cameras were available and these had to
be manually adjusted to the colour temperature
of the immediate surroundings. A piece of white

paper was held up in front of the video camera to determine how strongly the surrounding light deviated from neutral white light. Using the values obtained, the camera could be calibrated to match the ambient lighting conditions.

Today, both video and digital still cameras feature automatic white balance. Simply put, it works like this: the integrated light meter analyses the composition of the surrounding light. Using these measurements, the camera determines a precise colour temperature range and then compensates for any colour deviation with the help of complicated →algorithms. In this way, a camera can take pictures with true-to-life colours, despite changing lighting conditions.

→**Kelvin scale:** Used to describe colour temperature. When a "black body" is heated, its colour changes from black to red, yellow, blue, then white as the temperature rises. Colour temperature matches the actual temperature of the heated black body. The temperature of daylight on a sunny day, for example, is about 5,500 K; light from a tungsten lamp is expressed as 3,200 K to 3,400 K.

Most digital cameras, for example, react to colour temperatures between approximately 3,000 and 6,700 Kelvin. These values are oriented on two naturally occurring lighting conditions: about 6,400 Kelvin corresponds to cloudy daylight, while the equivalent for twilight with a large component of red is around 3,200 Kelvin. If the digital camera measures a colour temperature of about 3,200 Kelvin, the camera automatically adjusts to compensate for these lighting conditions. The result is an improved picture: both better exposed and with truer colours. The Olympus E-1 digital SLR even features a dual white balance metering system for absolute precision and has an external white balance sensor to detect the light source when shots are taken.

Many digital cameras further enable manual adjustment of the white balance and generally offer pre-set parameters to match the light temperatures of sunlight, overcast days, tungsten and fluorescent light.

If your camera has a "one touch" function, it will let you adjust the white balance to best suit the current light situation. Here, train the lens on something white and then activate the one-touch button to save the values for use in later shots.

3.1.4 What does sensitivity mean?

In conventional, film-based photography, the sensitivity of the film to light plays a decisive role. People who take photography seriously should always have a selection of films on hand with different sensitivity levels – ISO 100 for shooting in bright sunlight, ISO 200 for all-round situations and ISO 400 and 800 film for low-light photography. Film with even higher sensitivity, such as 3,200, is also available for high-speed photography.

In most digital cameras, the level of light sensitivity can be adjusted to levels comparable to those of film cameras. Therefore, to aid understanding, ISO values are also used in digital cameras. If, for example, you want to let in more light but cannot either make the aperture any larger or increase the exposure time, just a few presses of the camera's buttons will increase the sensitivity of the digital camera. In this way you can work with the available aperture settings and faster shutter speeds.

The default equivalent ISO setting on most digital cameras is 100 and a number of models allow manual adjustment of sensitivity, for example between 100 and 400. By increasing the value, you increase the number of situations in which you can use the available shutter speeds and aperture stops.

This strategy, however, does have a particular drawback in that the higher the ISO setting, the greater the likelihood of noise. For more about this, see section 3.3.2.

3.2 What should I do if the scene is not bright enough?

Normally, the camera will answer this question for you and fire the flash. A built-in flash is an indispensable feature for every photographer and most cameras offer a range of flash modes for a variety of situations and effects. Besides auto,

red-eye-reduction, fill-in and off, for example, some cameras offer a →slow synchronisation mode, which allows for particularly interesting results by firing the flash at either the beginning or the end of a long exposure.

To open up further creative possibilities, some cameras allow connection of an external flash via a hot shoe. Others permit a studio flash system to be connected to a camera using an →x-contact.

Hot shoe

x-contact
connection cable

Cameras that feature BrightCapture technology offer a solution for dimly-lit surroundings without using the flash – see section 3.3.4.

3.3 Why is the camera's internal software so important?

It is not just the way data is captured that is important, how the data is processed can also have a considerable influence on the quality of the final result. Examples of important imaging processing engines are TruePic TURBO, noise reduction, pixel mapping and BrightCapture Technology.

3.3.1 What is TruePic TURBO?

Brightness

Conventional Image Processing

Brightness

TruePic Image Processing
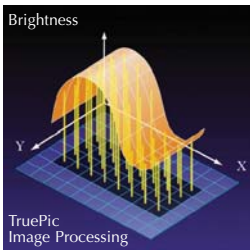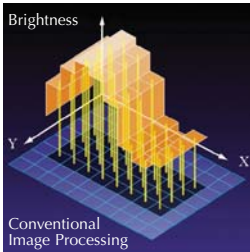
TruePic TURBO is an "intelligent" imaging process developed by Olympus, which utilises an algorithm and processors to enhance colour reproduction (colour range, saturation and brightness) and picture sharpness. This is achieved by optimising all the image information gathered by the CCD – even for lower resolution photos – and then matching up that information with the picture data of the neighbouring pixels. TruePic TURBO even accelerates the image processing procedure and camera operation so that, for example, the camera is ready significantly faster after being turned on or after taking a shot.

Algorithm:
A set of processing or working instructions which, because of their high precision, can be carried out independently by a mechanical or electronic device. Algorithms simply allow the computer to solve particular problems. In image editing, algorithms are used to alter images, e.g. 3-D Cubic Algorithm. (TruePic)

By removing a significant amount of noise, the noise reduction feature dramatically enhances the quality of the shot, especially for night-time scenes.

3.3.2 What is noise and how can it be avoided?

Noise is the visible effect of interference on the CCD's sensors. It appears as unwanted colour spots in an image – especially one taken at night with a slow shutter speed. Noise can basically be divided into two types. First of all there is fixed pattern noise, which always appears on the same pixels in long exposure shots – sometimes also called hot pixels. To reduce this, many cameras feature a noise reduction mode. In this mode, the camera takes two images: the normal shot and one with the same exposure time but with the shutter closed. It is then able to determine the areas of an individual image that are susceptible to noise and compensates for this. By removing a significant amount of noise, the noise reduction feature dramatically enhances the quality of the shot, especially for night-time scenes.

The other type of noise is called random pattern noise. This can occur, for example, when shooting with a high ISO setting and may appear in dark areas of a photo. It is also worse under hot conditions. By intelligently analysing and processing the image information, some cameras are able to help remove much of this noise, smoothing the contours of the objects in the photo. The benefits of such a feature are particularly noticeable in lower contrast areas of the shot, such as a blue sky or person's skin.

3.3.3 What is pixel mapping?

Despite the greatest care being taken, CCDs will always have a small number of faulty pixels. Since these cannot pass on the image information, their presence could be noticed in shots as dots of a wrong colour in a large area with an otherwise uniform tone. To avoid this, some cameras use their powerful internal processors to recognise and record the location of the →dead pixels. Then, when photos are taken, the data from neighbouring pixels is employed to optimally fill in the gap left by the faulty pixel. This solution also detects and therefore helps remove the hot pixels from fixed pattern noise.

3.3.4 How does BrightCapture Technology help in low-light situations?

BrightCapture Technology was specially developed for taking photos in dimly-lit surroundings such as a bar in the evening or a concert hall. In such situations it is normally very difficult to make out what is displayed on the LCD. BrightCapture Technology, however, only needs a fifth of the luminosity usually required to depict a bright image on the monitor, so framing becomes easy even in a dark environment. For this, it reads all of the pixel information from the camera's

CCD, not just part of it, as is traditionally the case. But it does not only improve the visibility of the subject on the screen, it also delivers well-lit shots without using the flash. In certain shooting modes, sensitivity is boosted to produce images that are rich in colour, contrast and definition, using just the ambient light. In other modes the flash additionally fires to properly expose areas of the image that would otherwise be left in darkness. While the total image resolution is lowered in these modes, the resulting higher light sensitivity provides the extra benefit of more rapid focusing in low light and the possibility to use faster shutter speeds which effectively reduces the potential for image blurring due to camera-shake or fast moving objects.

3.3.5 Image stabilisation technologies to prevent image blur

The longer the focal length of the lens or the bigger the zoom you are using, the harder it is to avoid the effect of camera shake and achieve sharp images without unwanted blur. When holding the camera in the hand, as a rule of thumb, normal camera shake will not result in blurred images if the exposure time is not longer than the reciprocal of the lens's focal length. I.e.: if you are using a 200mm lens, the slowest shutter speed which will probably enable you to shoot without shaking is 1/200 second (figures in equivalent 35mm camera values). If lighting conditions require longer exposure times, such as

indoors, at dusk or in bad weather the easiest and traditional way to avoid camera shake and thus blurred images is to support the camera on a tripod or a solid object. Sometimes, however, this may not be a viable option, or you might not even notice that the camera has set the exposure to a value where it is necessary to keep the camera particularly steady. For these situations several image stabilisation methods have been developed.

Digital image stabilisation
This is a special shooting mode where the camera automatically increases sensitivity to allow shorter shutter speeds to avoid image blur caused by camera shake or by fast-moving objects.

Digital image stabilisation edit
Here, the blurred image is "repaired" by a dedicated editing mode in the camera after the shot has been taken. A gyro sensor traces the direction of the camera shake, records it as a motion vector and writes it to the image file's EXIF information. When the user chooses to sharpen the image using this process the information is retrieved and fed to a microprocessor, which uses a special →algorithm to calculate the corrections. The edited image is then written to the storage card as a separate file. In some Olympus cameras this feature is also part of the so-called →Perfect Fix function.

Left: Image with blur
Right: Image after digital image stabilisation edit

Mechanical image stabilisation
There are currently two different flavours of this advanced image stabilisation technology. In one, gyro sensors in the lens (DSLR interchangeable lenses) or camera (compact cameras) register camera shake and micromotors in the lens move special lens elements so that the effects of the camera shake are compensated for and not recorded in the image. These types of lenses extend exposure time by two to four F-stop compared to the rule of thumb explained at the beginning of this section. While this is a very effective method, utilised mainly in lenses with a large focal length or great zoom capabilities, it adds some size to the lens and also means that if you want to rely on this feature all your DSLR lenses need to have it built in. In the second method of mechanical image stabilisation it is not lens elements that get shifted but the CCD itself. Here, no matter which lens you attach to your camera, with all of them you will benefit from the anti-shake mechanism.

Dual Image Stabilization
This special function featured in some Olympus cameras combines the CCD-based mechanical image stabiliser, where a built-in gyro sensor detects camera movement and adjusts the CCD accordingly, with high ISO values in order to further reduce the risk of image blur caused by camera shake or by fast-moving objects.

3.4 What are the scene modes?

Known as sport, landscape, portrait, etc., scene mode names make their purpose very clear and they have pre-set shooting parameters to suit their particular subjects. For example, the sport programme automatically selects a fast →shutter speed because it knows the photographer wants to capture fast-moving action. The portrait programme, on the other hand, instantly selects a large aperture to ensure background is out of focus, highlighting the subject.

Night scene and landscape mode.
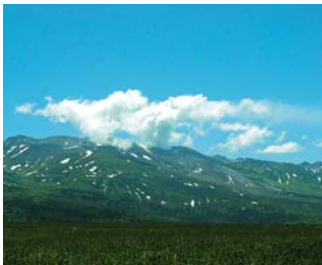
These modes can save you a lot of time and effort and, by telling the camera what type of subject you want to shoot, they usually deliver first-rate results.

3.5 What are the benefits of manual exposure control?

Automatic operation is perfect for effortless shooting and scene modes are fine for a little experimentation. But if you really want creative control, manual adjustment of the aperture and shutter is a must.

3.5.1 What effect does the aperture have?

The size of the aperture can influence the size of the area in focus. A small aperture (high F-stop) provides a large depth of field; a large aperture (low F-stop) produces a short depth of field.

Simply put, the aperture is an opening through which the light passes to get to the →CCD. Increasing the aperture size by choosing a low aperture number (F-stop), such as 2.8, allows more light into the camera. Besides controlling exposure, the aperture also alters the shot's →depth of field, i.e. the part of the area between the foreground and the background that is in focus. A low F-stop (large aperture) provides

a very short depth of field and therefore focuses attention on the subject, as the area in front of and behind the subject is out of focus. This is ideal for portraits or picking people out in crowds. Alternatively, a high F-stop (small aperture) provides a long depth of field so most or all of a scene is in sharp focus. Such a setting is suited to landscapes and architecture. If the camera features an Aperture Priority mode, you can set the aperture to your desired level and the camera adjusts the shutter speed accordingly.

3.5.2 What effect does the shutter speed have?

In addition to exposure time, the shutter speed also influences the way movement is depicted. With fast shutter speeds, a speeding car can be frozen as it races past. Alternatively, a slow shutter speed lets you blur the action – giving an even greater impression of speed. Slow shutter speeds are also required for shooting low light shots, such as night-time cityscapes. In Shutter Priority mode, the exposure time is manually adjustable and the camera alters the aperture to match the chosen speed.

The creative possibilities of shutter speed control. Above: slow shutter speed. Right: fast shutter speed.

3.6 What is a histogram?

Digital camera users have a great advantage over their colleagues shooting with analogue models since they are able to check the results immediately on the →LCD. Some digital cameras also contain histograms. These show, in graphic form, the distribution of tones in an image. From the information displayed, experienced users can judge the exposure quality. Some

cameras feature a more comfortable, so-called direct, histogram function, automatically marking the over and underexposed areas in the image on the LCD.

3.7 What is best for me, an optical or digital zoom?

A digital zoom often provides additional magnification power – but at the expense of quality.

Cameras with either a zoom lens or digital zoom provide the user with more flexibility, letting him or her get closer to objects that are far away or difficult to reach, such as football players on a field or the ornate designs on cathedral architecture. When choosing a digital camera, you should make sure to differentiate between cameras with optical and digital zooms.

With a zoom lens, the focal length can be adjusted at pre-selected stops or moved smoothly between a range of stops. By simply lengthening or shortening the →focal length, the subject

→**Focal length**
For a simple lens (a single lens element), focal length is the distance from the centre of the lens to the point where an infinitely distant object is brought into focus. For a compound lens (such as fitted to a modern camera) the focal length is more a gauge of image magnification. For example, a 28mm compound lens produces an image of the same magnification as a 28mm simple lens, although the compound lens might be closer to or further from the focus point.

appears to move either closer or further away, i.e., the magnification changes. However, as the zoom power extends, the lens' increased magnification causes the image to dim slightly, sometimes making slower shutter speeds necessary for correct exposure.
Even though this problem does not arise with a digital zoom, images magnified using an optical zoom will always be of a better quality because the digital system simply recalculates the image data already captured to produce a zoom effect. For example, the digital zoom crops the central 50% of the image and then doubles the size of this section, which results in a lower resolution shot. Therefore, it is always best to stick with the optical zoom, since this actually magnifies the whole scene so there is no loss in detail. And you can always zoom in after capture using either an image editing program on the computer or, if available, the zoom feature in the camera's playback mode.

Camera shake is also sometimes a problem when shooting with high magnification – particularly when there is only low light. In such instances, a tripod can help steady the camera, thereby also allowing slower shutter speeds to be used. Some methods of image stabilisation might also help to avoid the effects of camera shake – see section 3.3.5.

3.8 What is there to consider when taking macro shots?

As CCDs are much smaller than conventional film, digital cameras are particularly suited for taking detailed shots of small objects in comparison to film cameras. When taking macro shots, it may help to follow these simple tips: use the LCD rather than the viewfinder to frame the shot. Because of the short distance to the subject, the parallax error may cause the viewfinder not to depict the image correctly so that the top of the

subject may get cut off in the photo. (Note: This potential problem does not exist in SLR models.) The LCD, however, displays an almost 100% field of view, so what you see is what you actually get. Until recently, only the LCDs on compact cameras provided a →Live Preview, but this benefit is now also being introduced to digital SLRs as well. If the LCD on your camera can be tilted and/or swivelled, framing becomes even easier when taking photos from unusual positions, e.g. close to the ground. Avoid camera shake by placing the camera on a tripod, or make sure you hold the camera very steady and use either the self-timer or remote control to release the shutter. A long →depth of field is usually best for macro photography, so select the smallest possible →aperture. Also, because the front of the camera is so close to the subject, you may have difficulty getting the subject properly lit. Do not use the built-in flash unit. Instead, try to work with the ambient light or an external flash directed on the object. Finally, remember that macro shots may feature slight distortion. If you want to photograph documents, you should move the camera back a bit.

3.9 What are panorama photos?

Panoramic shots are composed of several photos joined together to provide a sweeping scene – and can even show a 360° view. Each individual picture is taken from the same position, but after each shot the camera is moved slightly left or right or up and down along an axis. When shooting photos for a panoramic composition, it is recommended to use a tripod and to take the photos relatively quickly, so that the scene does not change too much, such as by clouds moving into the picture. It is also best to use a long focal length because tele positions produce less distortion than wide angles so the shots fit better together. Some cameras facilitate the process by superimposing lines over the image in the →LCD so that the photographer is quickly able to tell where the scenery in the next frame should overlap that of the previous shot.

By combining several individual shots, you can create stunning panoramic scenes.

Once saved, the photos can be transferred to the computer where the individual shots are stitched together. This is particularly easy if the software includes a panorama function. The final composition can then be printed out at home (special panorama-length paper is available for this) or sent to a printing service. Alternatively, by saving the image in a file format such as →QuickTime VR, a virtual scene can be created in which viewers navigate their way around the shot using the mouse to go left, right, up and down.

3.10 What is sequence shooting?

After the digital camera captures an image, it usually needs some time to save the data to the memory card before it can record the next shot. Depending on the picture's resolution, this can take anywhere between milliseconds and a few seconds. However, if the photographer wants to record the progression of an action, such as a skateboarder performing a jump, he or she needs to be able to shoot in quick succession. How?

One way to do this is by reducing the resolution to speed up the data recording time. Alternatively, you can use the sequence mode found in many digital cameras and the internal memory. By saving the first and subsequent images in the →RAM, you can take several shots in quick sequence. Once the maximum number of shots has been reached (the actual limit depends on the resolution and memory capacity) or the user removes his or her finger from the release, all the photos are saved to the storage card.

3.11 How can I get myself in the picture?

While some models offer a self-portrait mode for holding the camera at arm's length and turning it towards you, the more conventional (and more flattering) method of getting yourself in the picture is to use the self-timer. Before activating the timer, place the camera on a stable surface or a tripod so it will not fall or slip and then frame the shot. Take care not to stand in front of the camera when pressing the shutter release, or the focus may lock on the short distance rather than

the actual subject distance. The self-timer function is also handy if you want to avoid camera shake, such as when shooting with slow shutter speeds in low light, as manual operation of the release could cause the camera to move.

3.12 How can I take black & white or sepia photos with a digital camera?

Just change the settings from colour to black & white or →sepia recording in the camera's menu (if available) and resume shooting. Recording in →monochrome can significantly alter the impact of a shot, giving it a more classic, old-fashioned look or artistic quality. While some cameras don't allow recording in black & white or sepia, they do let the user change the tones after capture. Of course, you can still change the shots on the computer later.

3.13 What should I do if I want to photograph text?

If you wish to record text so that it can be easily read later on, it is best to use the →blackboard or whiteboard modes, if available. Utilising only black and white with no grey tones, these provide superb contrast because they save the text as black type on a white background or vice versa.
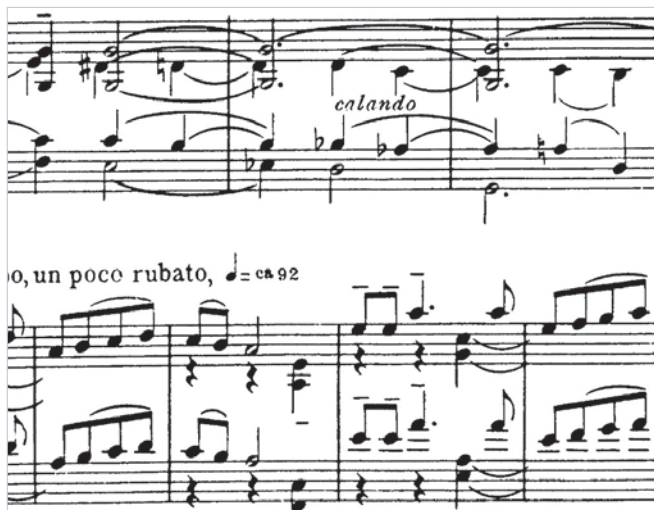
On cameras without the blackboard or white-board functions, increase the image contrast to its highest setting. Then use the exposure compensation setting – for black on white images overexpose slightly, and for white on black images underexpose slightly.

3.14 What can I do in movie mode?

Many cameras today offer a movie mode that allows you to record low resolution (e.g. 320 x 240 →pixels) or higher resolution (e.g. 640 x 480 pixels) scenes lasting from a few seconds to more than half an hour in the MPEG-4 format. These make ideal additions to homepages or presentations and they often feature sound too.

3.15 Is it also possible to record sound with the images?

Yes, many cameras allow this. Besides recording sound as the shot is taken, the user may also (if supported by the camera) save a brief comment or sound effect after taking a still image. Furthermore, a large number of cameras also let users record short movie sequences with sound.

3.16 Can I take my camera underwater?

Yes, you can, if you are using the camera along with an underwater case. And recently, the first digital cameras have been launched which are waterproof – so you do not even need an underwater case unless you are a diver wanting to go deeper with your camera. It is also much easier to use a digital camera underwater than a film camera. With the latter, you can only estimate the framing and won't know whether you got the shot until much later on dry land. Thanks to the digital models' LCD, you

can easily frame the shot as there is no need to somehow bring the camera's viewfinder close to your eye with the underwater housing and the dive mask in the way. This is now even possible with digital SLRs that feature a →Live Preview. Here, too, a special technology allows using the LCD to frame the shots. But most importantly, there's no need to wait for days to check the results, this can be done straight away. And that's not all. With a high capacity storage card, you can save literally hundreds of shots before needing to surface. There is a variety of specially-designed cases to protect cameras from the high pressure and water (e.g. waterproof for depths of up to 3, 40 or 60m). These cases are perfect on land as well, as they also protect the camera when used in tougher environments against dirt, dust, sand or bumps. Make sure the case you choose has been designed to fit your camera. Best of all, choose a model by your camera manufacturer. Remember, while some cameras are called weatherproof, this usually just means they can be used in the rain and are resistant to splashes at the beach or round the pool. They cannot be taken into the water. Finally, with all cases it is important to check specifications carefully for the maximum water depth allowed and to ensure the cases are properly maintained to remain waterproof over time.

3.17 What should I bear in mind when taking photographs?

Here are a few points to remember when shooting to avoid common mistakes and to enhance results.

• Cameras usually →focus on the subject in the centre of the frame. Therefore, always first place your point of interest in the centre of the frame when setting the focus (by half depressing the release) and then reframe if necessary, afterwards.

The fill-in flash mode can ensure your subject is not lost in the shadows.

- Brightness can be deceiving. The human eye is able to adapt itself to poor lighting conditions, but a digital camera cannot. Always remember this when taking photos in difficult light conditions. Thanks to the built-in LCD monitor, it is easy to judge your results, for example to see whether a fill-in flash setting yields better results or not.

- Beware of scenes that could trick the camera. If the camera's exposure metering system is set to →average-exposure metering, this can lead to poorly →exposed images if the scene includes areas of strongly contrasting brightness. To prevent this, try using →spot metering.

- Backlight situations can confuse the camera. However, the result can be improved simply by invoking the fill-in flash. This trick is especially useful when taking portraits of people positioned in front of a bright background, such as a window.

- To avoid red-eye when shooting in low light with the flash, use the red-eye reduction mode. If a regular flash is employed, the eyes of your subject may seem unnaturally red because the light from the flash is reflected off the blood vessels in the retina and out through the wide-open pupils. In red-eye reduction mode, a lamp shines or the flash fires a few bursts before the shot is actually taken. The pupils contract, and the effect of the reflected light is less noticeable.

- Avoid shots with too much empty space since this can often appear boring. You may get better results if you let your subject fill the frame or place additional details in the picture.

Experiment with shooting from different, unusual angles.

- Try shooting from different perspectives. Shots of people and events taken from unusual angles often stand out from others. Experiment with photographing from the floor or an elevated position.

- Images shot in →monochrome can have a significantly different impact than colour shots and help emphasise the texture of surfaces.

- Don't be afraid to place your subject off from the centre of the composition. Photos with subjects closer to the edge of the frame can have a more dynamic feel than when they are placed in the centre. Refer to the "Rule of Thirds" (see left).

- And of course, always have a spare set of batteries on hand.

4. Printing digital photos

4.1 How do conventional photo prints differ from digital photos?

Nowadays, if you send your digital images to a photo lab you will receive your prints on the same type of photographic paper as you would if you sent in your films. This is because industrial photo labs use the same process to bring your digital images onto paper. With digital images, there's just no film development. So, whether it's digital images or film – there is no difference in terms of print quality.

4.2 Can I print at home?

Thanks to its ability to deliver immediate results, good quality, diverse performance features and ease-of-use, the home photo printer enjoys great popularity among digital photographers. You don't even need a PC to print. By connecting a PictBridge compatible camera to a printer that also supports the communication protocol, direct printing is possible. Alternatively, many printers are equipped with memory card slots for computer-free printing. Others even feature their own LCD screen and editing functions so the photographer can edit or crop shots on the printer. There are also a few models designed for portable use.

You can choose from a wide range of printing techniques. However, not all printers are capable of producing realistic photos. Therefore it pays to read about the models and, if possible, compare printouts before making your purchase.

Colour laser, solid ink-jet, thermal wax, and thermal fusion printers are hardly the ideal printers for photo-realistic prints. Only ink-jet

printers and dye-sublimation printers are able to meet the high standards required.

By far the best results are achieved with →dye-sublimation printers. A short explanation of the technique used in dye-sublimation printers explains why this is the case:

The dye-sublimation process involves heating a special film coated with the elementary printing colours cyan, magenta, and yellow. The coloured vapour released in the heating process diffuses directly into a special type of paper. By controlling the heat, it is possible to regulate the size of the image dots to produce photo-realistic (nonrastered or patterned) prints with perfect colour transitions. The benefit of this process is particularly noticeable when displaying colours and shadows in which transitions in tone appear to flow smoothly. Good dye-sublimation printers also add a protective coating to prints to ensure longer life. This is normally part of the ink ribbon the printer uses. Such a level of performance is not possible with ink-jet and other printing systems, which use a raster print technique. Print quality is also improved by the use of transparent dye in

Thermal print head   Ink ribbon

Special dye-sub paper
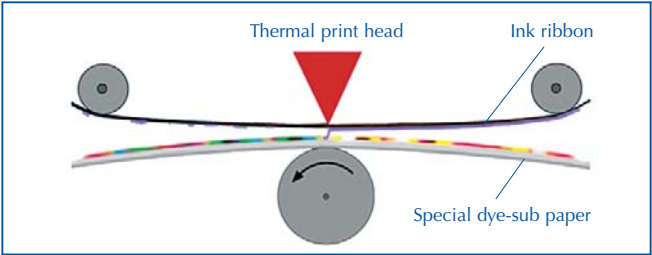
The thermal print head heats the ribbon, causing the dye to diffuse into the paper.

dye-sublimation models, allowing the creation of new colours by positioning colour dots on top of each other. The Olympus dye-sublimation printers are capable of reproducing 16.7 million colours as 256 different tones for each colour can be created.

High-end →ink-jet printers containing six or more colour cartridges and ultra slim nozzles can achieve print resolutions of around 5,760 x 1,440 dpi or even higher and produce impressive results. It is best to select printers that use separate ink cartridges so you can replace the individual colours as they run out, thereby reducing costs.

→**dpi**
Dots per inch. A unit used in printing for the geometric resolution of a picture. Bear in mind that ink-jet printers use a high number of dots to reproduce the colour for one pixel, and therefore have such high dpi counts.

An ink-jet printer injects the colour contained inside the printing head's storage chambers into each nozzle of the printing head. The ink can be brought to paper in either of two ways: the bubble jet technology works by heating the corresponding nozzle, while the piezo printer uses a small crystal which contracts under electrical current to eject the ink. Each printer has a special chip that determines which nozzles should be heated or activated.

Although this system produces images that are built from a rastered pattern, high-quality ink-jet models can still provide impressive photo prints in up to A3 format.

The type of paper used has a significant influence on the quality of the final print. For best results, you should use the paper types (and inks) recommended by the printer manufacturer. Today, there is a wide selection of photo papers available. Besides glossy types, there are also media with rough surfaces that produce a watercolour effect and others with a surface similar in texture to silk.

An innovation that helps improve the quality of prints is the Exif standard. Exif ("Exchangeable Image File Format") is a file header format which records additional data about an image, like the shooting parameters, such as the focal length and flash setting used by the camera. Under Exif Print (also called Exif 2.2), additional information is stored which is especially important for printing, such as the white balance setting and shutter speed and whether or not night scene mode was activated. Many printing devices can use this information to significantly improve the quality of the final images. Print Image Matching (→P.I.M.) and its enhancement P.I.M. II are innovations that work on a similar principle to Exif Print and are used by Epson printers.

Printers with an integrated ICC profile, like the Olympus P-440, ensure such a high reproduction fidelity that on-the-spot proofing and quality control is possible. The profile helps by ensuring the printer uses a palette of colours corresponding to those used by the camera.

Finally, a word about resolution. Compared with the high resolution of ink-jet printers, the approximately 300 dpi resolution of many dye-sublimation printers sounds rather low. However, due to the differences between the technologies, a comparison of the two values does not permit a fair assessment of each printer's capabilities. The fact that the dye-sublimation printers produce prints of a far higher quality than the ink-jets is proof of this. In this case, less can often mean more.

4.3 Do photo stores and developing labs also provide digital photo prints?

As with film, you can also take your digital pictures to photo stores or send them to developing labs to get printouts of your photos. While you do not receive the images immediately as with home printing, this often has the benefit of being cheaper. A more recent solution is the photo terminal. Commonly found in photo stores, these

let you print out your photos yourself quickly and cost-effectively.

But how can you be sure you get the prints you want? The Digital Print Order Format (DPOF) makes ordering photo prints much easier. The user can pick out which images are to be printed and select the number of copies – either when the photos are shot or later on. This information is saved in the DPOF format and used by the printer – at home or in the processing lab – to provide you with the print results you desire.

There are various ways of sending images to the lab. Photographers with a PC and internet connection can upload the files directly to an online photo processing lab. Their photo prints usually arrive by regular post a few days later.

However, if the user wants prints of many photos or just some prints of very high resolution shots, sending the files via the internet may be impractical since it takes time (and, depending on the internet provider, adds to the cost). Print terminals are a user-friendly and cheaper alternative.

These print stations, like the Olympus picture express (pex), can be found in photo stores, coffee shops and airport lounges. Comprising a touch screen plus slots for a wide range of storage media, ranging from xD-Picture Cards to CD-ROMs, they are very easy to use. The image data is quickly read and the image files displayed on the screen. The user then simply selects the shots to be printed, which are delivered moments later. With the Olympus picture express, the entire process takes only about eleven seconds per image.

4.4 To what size can a digital image be enlarged?

Like every traditional slide or negative, a digital picture can be enlarged unlimitedly. However, the quality decreases proportionally as the size increases. With enlargement, the photo or print can become fuzzy or begin to show signs of "pixelisation".

Every picture is made up of lots of individual pixels. Their organisation into rows and columns creates the picture we see. Enlarging a picture also enlarges each of the individual pixels. When the picture reaches a certain size, the eye no longer sees the sum of all the pixels as one unit but rather each pixel as single objects.

So if you want to have large prints (larger than A4) of your digital pictures, you should make sure that the digital camera you are planning to buy has a resolution that is high enough to meet your requirements.

Some cameras have a special feature that optimises the image data for producing large format prints. These intelligently recalculate the raw image data to produce shots with a resolution higher than that of the actual CCD. This system returns better results than interpolation of compressed files.

The following table provides a helpful guide, showing up to which recommended size you can print your digital images.

Based on the fact that almost all digital cameras record images with a resolution of 72 dpi, we have calculated the respective print sizes for the dpi values listed. Please note, however, that the figures here should only serve as a guideline. In fact, many photos can usually be printed in good quality in larger formats.

Default image resolution in camera (72 dpi)	Print (width x height at 150 dpi)	Print (width x height at 300 dpi)
640 x 480 pixels	10.84 x 8.13 cm	5.42 x 4.06 cm
1,024 x 768 pixels	17.34 x 13.00 cm	8.67 x 6.50 cm
1,280 x 960 pixels	21.67 x 16.26 cm	10.84 x 8.13 cm
1,600 x 1,200 pixels	27.09 x 20.32 cm	13.55 x 10.16 cm
2,048 x 1,536 pixels	34.68 x 26.01 cm	17.34 x 13.00 cm
2,288 x 1,712 pixels	38.74 x 28.99 cm	19.37 x 14.49 cm
2,560 x 1,696 pixels	43.35 x 28.72 cm	21.67 x 14.36 cm
2,560 x 1,920 pixels	43.35 x 32.51 cm	21.67 x 16.26 cm
2,816 x 2,112 pixels	47.68 x 35.76 cm	23.84 x 17.88 cm
3,200 x 2,400 pixels	54.19 x 40.64 cm	27.09 x 20.32 cm
3,264 x 2,448 pixels	55.27 x 41.45 cm	27.64 x 20.73 cm
3,488 x 2,616 pixels	59.06 x 44.30 cm	29.53 x 22.15 cm
3,648 x 2,736 pixels	61.77 x 46.33 cm	30.89 x 23.16 cm

The image resolution (given in dpi) can be viewed and changed in many image editing programs under the menu option "Picture Size". Select your resolution:

150 dpi for good results.

300 dpi for excellent photo prints and professional prints. (Though posters and other prints intended to be viewed from a distance and not close up do not require such a high resolution.)

As a comparison, the standard paper formats are:

Width x height	DIN format
118.90 cm x 84.10 cm	A0
84.10 cm x 59.40 cm	A1
59.40 cm x 42.00 cm	A2
42.00 cm x 29.70 cm	A3
29.70 cm x 21.00 cm	A4
21.00 cm x 14.80 cm	A5
14.80 cm x 10.50 cm	A6
10.5 cm x 7.40 cm	A7
7.40 cm x 5.20 cm	A8
5.20 cm x 3.70 cm	A9
3.70 cm x 2.60 cm	A10
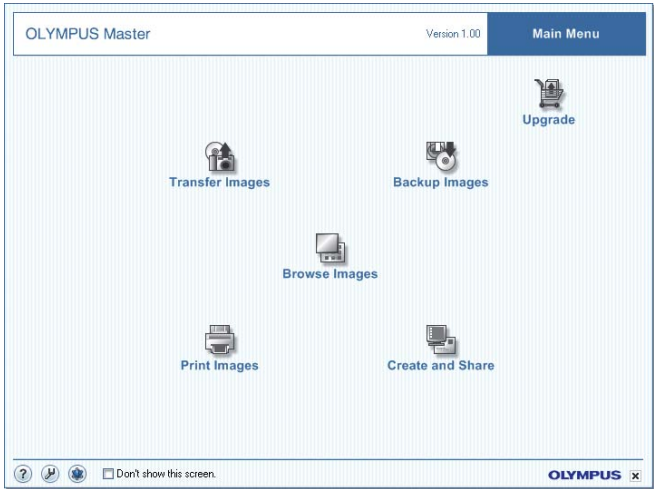
5.1 Are there special software packages for archiving digital images?

You can, of course, create your own directories to archive your image files. However, as the volume of files rapidly expands, it becomes increasingly difficult to keep track of them.

Imagine that you are looking for a certain photo but the files have not been named clearly. Only by opening the files one after the other do you have a chance of finding the right image.

It would be much simpler if you had software to help you archive and organise your data collection. Such programs can create a catalogue with single or multiple directories. These catalogues show miniature images (or thumbnails) of the originals as well as give directions to where the files are

stored. The catalogue files can then be saved on the →hard drive or to a →CD-ROM. Nowadays, →DVDs are also becoming an increasingly viable alternative for image archiving. Using the appropriate software, you can open the image catalogue and quickly look through the thumbnails to find the image.

With →Olympus Master, Olympus offers a convincing and easy-to-use solution suited to not only the organisation and processing of images but also multimedia files such as sound and movies. This software automatically identifies the camera type, enabling easy file downloading and subsequent retrieval. Furthermore, you can optimise and customise your images by, for example, stitching together individual pictures captured with an Olympus digital camera in panorama mode.

Meanwhile, Olympus Master Plus additionally offers functions for emailing, creating →HTML photo albums and to back up files plus further editing possibilities. The software provides templates to which your photos can be added to

produce attractive calendars or menus, for example. Moreover, printouts can be made utilising a variety of predefined layouts (including contact sheets that also provide detailed image information), slide shows with sound may be produced for viewing on a monitor and the free stitch panorama function allows a number of

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individual photos to be combined into one. For professionals and other advanced users, there is the Olympus Studio software. Besides many image editing options, it features a RAW file developing engine and a light box function for comparing shots.

5.2 What hardware is needed for archiving?

Digital images are usually first transferred to a computer's hard drive for archiving.However, this is not an ideal solution, as hard drives can sometimes fail or crash resulting in partial or complete data loss including that of the carefully constructed image archive. Whereas texts and tables can at least be rewritten, each photo is an irreplaceable original.

Because of this, it makes sense to think about backing up your images using external data storage, such as CD or DVD. A recorder is required for this process. These devices use a laser beam to "engrave" or "write" the data onto a recordable CD or DVD. Generally, up to 700 MB of data can be stored on a single CD, or up to 4.7 GB on a single-layer DVD with this method. However, CD and DVD surfaces are quite sensitive, and scratches, heat and even sunlight can potentially lead to data errors. Therefore it is very important to take proper care when handling and storing such discs. It is also recommendable to make new back-up copies of your image discs every few years to ensure the longevity of your image archives.

5.3 How are digital images downloaded from memory cards?

Digital photos can be copied to the computer's hard drive without a direct connection to the camera. The data can be downloaded from the removable memory card used by the camera using a variety of techniques:

1. USB card reader/writers allow super fast and trouble-free data transfer to either a PC or Mac from a compatible memory card. The xD-Picture Card-compatible Olympus MAUSB-300, for example, slots into any USB-equipped computer and is automatically identified as an external drive. The user is then able to access it like a customary drive using the computer's usual file management system. Because the device takes its power from the computer, no additional electricity cables are needed. There are also a variety of similar devices available from other manufacturers.

2. A PC-card adapter allows you to copy data quickly and comfortably to a notebook or, if it has the necessary hardware and software configuration, a computer. Separate adapters are available for virtually all types of removable storage media.

5.4 How do I connect my digital camera to my computer system and download images?

Generally, assuming the relevant software drivers for the operating system used are available, and as long as the camera's interface is identical to that of the computer, it is easy to connect your camera to your computer. The main connection type is USB which can be divided into two main versions: USB 1.1 and USB 2.0. USB 2.0 comes in three different speeds: Hi-Speed (480 MBit/s), Full-Speed (12 MBit/s) and Low-Speed (1.5 MBit/s). Most cameras use the USB 2.0 Full Speed.

A development of this technology, USB Storage Class (also called USB AutoConnect) makes downloading photos even easier. The majority of computer systems with USB Storage Class no longer require you to install a special driver in order to download images from the camera. Simply connect the camera to the computer's USB slot and it recognises the camera as a regular drive. Image files can then be transferred across to individual folders via drag & drop or using the usual copy functions available on your operating system. →IEEE 1394, also called Firewire or i.Link by some manufacturers, is a similar interface system.

5.5 What are the most important image formats?

There is a great variety of formats in which you can store your digital pictures. Two kinds have established themselves so well in recent years that they can be regarded as standard and are also supported by the →Exif file management format for added versatility.

Bit
Binary dig**it**. The smallest digital unit. It can only be one of two states (0 or 1). 8 bits make up 1 byte.

The first kind of image format became firmly established in the photographic world with the emergence of digital image processing. Originally designed for use with the Macintosh computer, the constantly improved Tagged Image File Format, or TIFF for short, found a wide acceptance among PC users as well. TIFF's main advantage is its flexibility. This format can be used, for example, to store any colour tone at all, from 1 to 32 bits. This complete support of the 32-bit →CMYK format in particular makes it the preferred method for editing in →DTP and printer applications.

5. Archiving digital photos

You should choose the TIFF storage format if you want to use your pictures in a DTP program or if you want them to be edited elsewhere.

The second standard format, abbreviated JPEG (Joint Photographers Expert Group), has become increasingly popular, not least because of its suitability for use with online systems. This format combines two specific characteristics: complete colour range with low storage requirements (accompanied, however, with more or less significant reductions in quality).

Saving a picture with a complete colour range in a →JPEG format takes up only a fraction of the storage space it would require if saved in TIFF format using LZW compression. The JPEG format uses an →algorithm which recognises certain colours and image data as redundant and eliminates them during compression. In addition, the JPEG format lets you set the degree of compression. If you want to save storage space, you can compress the images so that they are considerably smaller than the original file.

These qualities mean JPEG is the most commonly used format for the internet and most online services. If you are planning to put a photo on your homepage, you should save it in JPEG format.

Both TIFF and JPEG are used frequently – most digital cameras save images in these formats – but naturally there are many other image formats.

For professional photographers and those specifically wishing to obtain "clean" data, for example to edit photos on the computer after capture or for scientific purposes, another type of file format is available in some pro-level digital cameras. The RAW file format records a "pure depiction" of the image as captured by the camera's CCD. This means no in-camera processing takes place, such as white balance, thereby providing an untouched "digital negative" that can later be processed as required using the appropriate computer software (e.g. Olympus Master/Olympus Studio or Adobe Photoshop CS). RAW is a lossless format, yet it takes up considerably less storage space than its TIFF counterpart. However, RAW files cannot be opened by most consumer photo editing programs and may require special plugins for professional image editing software such as Adobe Photoshop (from version 6 and above).

5.6 How do I save digital images onto DVDs and CDs?

Besides a DVD or CD recorder and media on which to record, in most cases you will also need a computer and software for writing to DVDs and CDs. Today's burning software is usually quite easy to use and often has a similar operating structure to other computer application programs. A number of the better image editing programs also enable DVDs/CDs to be burned directly, without the need for dedicated DVD/CD burning software, thereby enhancing user-friendliness. Nevertheless, it is always best to consult the manual of the software you are using for specific operating instructions.
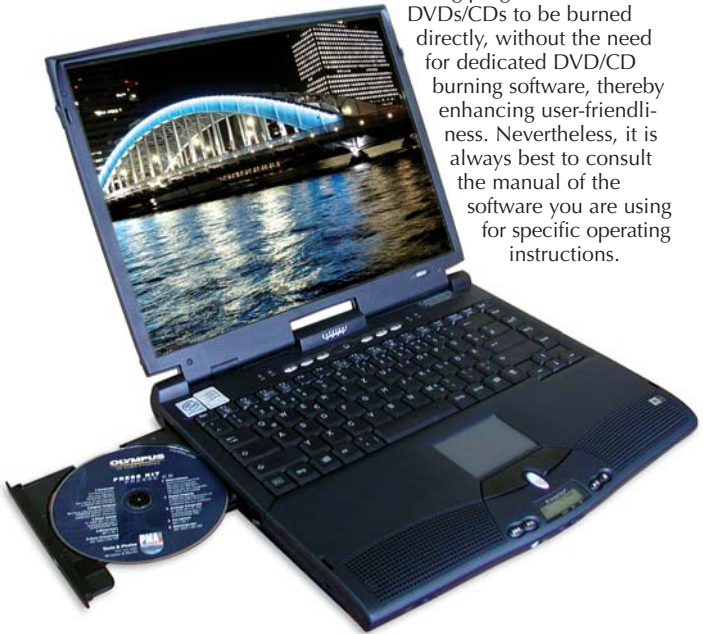
Before burning digital images to a DVD or CD, consider which computer systems will need to read the disc. If you would like both Macintosh and PC computers to be able to read your digital image DVD/CD-ROM, you should also check the software's instruction manual or help facility.

Once you have selected the images you wish to archive on the CD or DVD, you can commence the recording session. Remember not to exceed the maximum storage capacity of the media you are using (around 700 MB for CDs and 4.7 GB for single-layer DVDs).

Finally, you should always run a test to make sure the DVD/CD production has been completed successfully. Simply insert the DVD/CD into a different drive and open one or more files.

6. Compressing Image Data

6.1 How much storage space do digital photos need?

To calculate the required storage for one digital image, the number of horizontal pixels is multiplied by the number of vertical pixels. A picture with a size of 3,200 x 2,400 would yield a value of 7,680,000 pixels. But since the brightness values for each of the colours red, green and blue are saved for each pixel, this intermediate value must be multiplied by three. This adds up to a required storage capacity of 23,040,000 bytes or 22 →megabytes (MB). If you are using a 32 MB card in your camera, you would only be able to record one shot before you reached your limit. However, there is very rarely a reason to record images in a non-compressed format. The SHQ mode, for example, provides a quality virtually comparable to that of non-compressed files but requires just a fraction of the space. The same card would hold around 6 SHQ images in a 3,200 x 2,400 resolution; in HQ mode, about 18 such shots would fit on the 32 MB card.

Most cameras today offer a variety of →compression levels, so you can change between large, high-quality files and smaller-sized files depending on your requirements and/or the remaining space on the card. As an additional help, many models also display the approximate number of images of a certain quality that still can fit on the card.

Byte
A byte consists of 8 →bits and can represent one of 256 possible characters, numbers or colour values.

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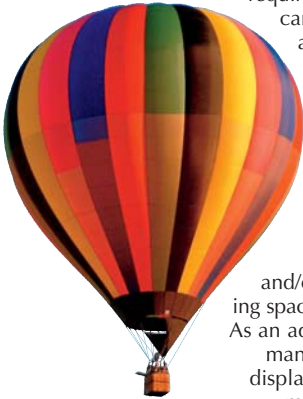
6.2 What are the most important compression methods and how do they differ?

Compression
Compression means the reduction of a file's storage requirements, e.g. for image and graphic files. With the help of certain →algorithms, data is saved more efficiently in a new format. The advantage is obvious: More information can be stored on a hard drive or on a digital camera's memory card.

There are two different types of compression: lossless and lossy. Lossless data compression, as the name suggests, reduces the required storage capacity by organising the file's data more efficiently but without losing any data. This is the obvious advantage of this method.

Here is an example. Let's say an image contains pixels with these colours together in a row:

White, White, White, White, Red, Red, Red, Yellow, Yellow etc.

Lossless data compression makes the data look like this:

4 x White, 3 x Red, 2 x Yellow.

As you can already see, by comparing the two diagrams, the data has been greatly reduced in size without changing its contents.

Lossless compression works much like this. An example is →LZW compression used in →TIFF formats.

Lossy compression works quite differently. It is based on the fact that the human eye can only perceive about 2,000 different colours at once. That means that 16.7 million colours do not need to be saved at all. (The 16.7 million colours are made up of 256 colours (Red) x 256 colours (Green) x 256 colours (Blue).)

This is the key to lossy compression. It searches the picture for unnecessary or "redundant" colour data and simply erases it. You can determine the degree of lossy compression you want in the camera's menu by choosing between the different recording modes or, once the files are on the computer, using software like →Photoshop.

Here is another example. A picture contains the following colour pixels:

White, White, Bright Red, Pink, Red, Dark Red, Red, Pink, etc.

The compression recognises the similarity between the different degrees of red and compresses them together like this:

White, White, Bright Red, Bright Red, Red, Red, Red, Bright Red

A higher degree of compression would give the following results:

White, White, Red, Red, Red, Red, Red, Red.

So, the higher the degree of lossy compression (e.g. in →JPEG files with high compression ratios), the more difficult it becomes to represent an object's contours correctly. However, if you only want to display a shot on a screen, you can reduce a picture's required storage capacity from more than 2 megabytes to less than 100 kilobytes without a significant visible loss in image quality.

If you wish to print images later, however, it is always best to record the files in a high-quality format, i.e. one with a low level of compression.

Image file formats of Olympus cameras (not all Olympus cameras offer all formats)	lossless	lossy
RAW	X	
TIFF	X	
JPEG (SHQ, HQ, SQ1, SQ2) SHQ – low compression, high quality SQ2 – high compression, low quality		X

Despite using lossy compression, JPEGs still provide great results for most needs. In fact it is extremely difficult – if not impossible – to see the difference between an SHQ JPEG and a TIFF in a normal print.

6.3 Which compression rates are best for which applications?

Low compression

High compression

Since you might often not be sure when you take your photos whether you'll just want to display them on the computer monitor or TV, or print them out, it is better to have a very high quality mode (SHQ or TIFF) as the default setting on your camera. Then, you can compress the files on the PC later using →image editing software.

When it comes to printing or editing images, the higher the resolution, and the lower the level of compression, the better. However, high compression images are fine for viewing on a monitor, especially if they are to be used on an internet site, since their low resolution and size means they can be loaded quickly. (You can find more about displaying pictures on the internet in section 7.)

6.4 How can the space needed for digital images be reduced without file compression?

If, after copying your digital photos to the computer, you want to save space on your →hard drive without using file compression, special archiving programs provide the answer. They save one or more images in a specially compressed archive file. Metaphorically speaking, this method stores files in a sort of "compression cocoon" from which they can be extracted at any time without changing their original file structure. There is no loss of quality with this kind of compression.

The most well-known archiving programs are WinZIP for PC systems and StuffIt for Mac systems. Programs like these are used in a variety of applications, mostly for online servers and the internet, and are also useful for sending several files together via email.

6.5 Is the number of pixels reduced during compression or decompression?

No. The picture resolution remains the same for all types of compression. When you compress a digital image with a resolution of, for example, 2,560 x 1,940 pixels, the compressed data file still has the same resolution.

Additional storage capacity can also be saved by manually reducing a picture's resolution. For example, you may only need a resolution of 1,280 x 1,024 pixels to display a photo on your monitor.

6.6 Can a single digital image be stored in different formats?

Once you have digitised a photo, you can convert it into any image file format you want, for example by using imaging editing software. After all, that is one of the great advantages of digital image editing. Nevertheless, you should always remember that while it is possible to enhance certain qualities like the colour or contrast with an image editing program, it is impossible to retrieve image detail not captured in the original image or lost in compression. If you have saved your photos using lossy compression (in JPEG format, for example), you cannot "undo" the data loss afterwards by saving the photos in a lossless format.

Photographers should also be aware that each time a JPEG is opened, edited and then subsequently resaved in an image editing program, it is recompressed in the saving process, thereby losing another slight amount of image information. It is therefore recommendable to edit files exclusively in lossless formats (such as TIFF) and only save the final versions as JPEGs.

We recommend a double strategy: Save your most important pictures in a lossless format (such as TIFF) on a CD-ROM or DVD but, to save yourself time and effort, use a compressed format for files you want to show on the internet or just display on a monitor.

7. Editing digital photos

7.1 What are the most important image editing programs?

First of all, there is no single image editing program which can be described as the best or most important. Almost all of the most common programs sufficiently master the basic functions needed for editing a digital image. The differences lie in the additional features offered. Although they cannot be clearly categorised, a division can be made between programs that have been created for professional and for personal use.

Adobe's Photoshop and Painter from Corel are examples of software designed for professional use. These programs offer a wide variety of features, including the simulation of natural painting and editing methods. These features do, however, have their price.

Besides the programs →Olympus Master and Olympus Master Plus from Olympus, there are many companies that produce affordable software with a high level of functionality for the non-professional market. Many are offered as bundles with cameras and can provide an impressive array of high-quality functions for editing digital photos. Some of them also include options that until recently were not even available in professional programs.

The development in the area of digital imaging is illustrated by, among other things, the rapidly increasing demand for image editing software.

It therefore comes as no surprise that the companies mentioned above regularly present updates of their programs and continually introduce new products into the market. To keep

up to date with the latest developments in this fast-moving sector, it is recommendable to regularly consult your local dealer, read the photo and computer press and check the internet.

7.2 How do you send digital images by email?

Everything in digital format can be sent via email. In today's email programs, "attaching" a picture to an email is a very simple procedure. Most email programs incorporate an attachment icon on the toolbar, for example, or feature a button somewhere in the program window. The sender just has to select the image or images he or she wishes to send, and attach it to the message.

Even easier is sending emails with image files using an →HTML compatible mailing program. These allow the pictures to be viewed in the message itself.
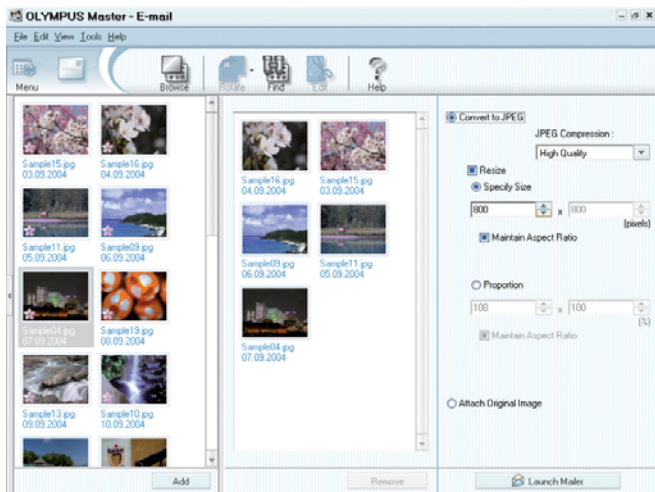
7.3 Can digital images be transferred by mobile phone?

Yes, of course. Besides sending the small images captured by the integrated camera in some mobile phones via MMS (Multimedia Messaging Service), it is also possible to use a mobile phone to transmit the much higher resolution photos taken with digital cameras and saved, for example, on laptop computers.

PCMCIA
Personal **Com**puter **M**emory **C**ard **I**nternational **As**sociation. Committee for the standardisation of storage cards.

You will, however, need to have a mobile phone with an integrated →modem – a feature included in most modern phones. The mobile phone is usually connected by a special cable to a PC card (also called PCMCIA card). The card inserts simply into the appropriate slot of your notebook. You are then ready to send digital images or faxes, contact →mailboxes, or connect to online services. There is, however, one main drawback to sending digital images with mobile phones. Speed – or rather, the lack thereof. Most current mobile phones have data transfer rates of 9,600 or 14,400 →bits per second. In comparison, at between 1 and 6 →Mbit/s, a home →DSL connection can be up to approx. 6,000 times faster! The introduction of UTMS technology, however, will make data transmission using mobile phones much faster than at present, but for the time being these phones are generally still very expensive. So if you want to send or receive pictures with a mobile phone, to save time and costs you should first compress them to ensure faster transfer of the "data package". See also section 6.4.

PC-Card
Also called PCMCIA Card. A small card that is often used with notebooks. A PC-Card may function as a modem, a storage device or interface for PC peripheral devices. When used as the latter, it could act as a connection between a mobile phone and a notebook.

7.4 How can digital images be displayed on the internet?

In order to be able to display and view digital photos on the internet, they have to be in either →GIF or, better still, →JPEG or →PNG format. If your images are already compressed in one of these formats, all you need is an HTML editor, which saves you the trouble of complicated programming with the internet language HTML.

HTML
Hyper**t**ext **m**arkup **l**anguage, a file format used in the WWW (World Wide Web).

The majority of these can be found gratis as →freeware or inexpensively as →shareware. More recent word-processing programs, like Microsoft Word, integrate HTML editors. These programs allow you to design your internet page in a word processing program and then save it as an HTML document.
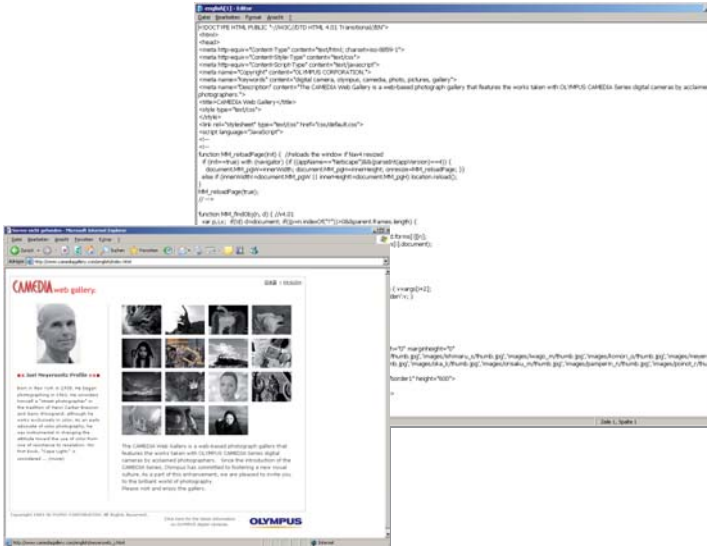
When preparing your photos for the internet, you should not forget that each picture shown on an internet browser has to be downloaded by the receiving party. Therefore, as a guideline, no picture (even very detailed ones) should be larger than 50 →kilobytes.

The photo you want to show is then imported to the HTML editor. Note: the photo will not be saved in the HTML document. The only thing to be found here is a reference to the picture. The internet browser brings the HTML text and the image file together to produce the page you see on your screen. This is important to remember because you have to copy your picture together with the HTML document to your internet server in order for the browser to display the picture.

Transferring data from your hard drive to the internet server is done with an →FTP program.

7.5 Is it possible to view an image on a TV screen?

PAL
Phase **A**lternating **L**ine. A colour television standard developed in Germany in 1967 and used in many European and non-European countries.

Yes. Since the video CCD chip was originally made for video cameras, it works in exactly the same format as the one required for recording and displaying images in PAL or NTSC. (The SECAM standard in France is not usually supported). As videos and televisions work according to the same principles, it is not a problem to show images taken with a digital camera on the television.

Viewing images on a television is a convenient way to look at photos in a large format and share them with friends and family. Many cameras also let you rotate images, so you can comfortably view pictures with a portrait format.

Connecting the camera to a TV is easy. For most models, simply connect the camera via AV cable to the TV and view pictures as you would on the camera's LCD via the buttons on the camera or by activating the slide show which is offered by many digital cameras. Some cameras also provide a remote control, allowing you to display the photos without having to hold the camera in your hand.

Of course, it is also possible to show pictures via a JPEG-compatible DVD player. However, for this the images from the camera have to be burned onto a CD-ROM or DVD beforehand (see section 5.6.).

A

Aberration Imperfections in the image formed by a lens. These include spherical aberration, curvature of field, coma, astigmatism, curvilinear distortion (also known as barrel or pincushion distortion) and chromatic aberration. Chromatic aberration, for example, can be corrected by using special →ED lens elements.

AC adapter Mains adapter. Enables the connection of the digital camera to the mains electricity supply.

ADC Analogue-Digital Converter. Hardware that converts analogue information into digital data. (→AD conversion)

AD conversion Analogue-Digital conversion. In order to process an analogue signal (e.g. a photo) in a computer, it must first be digitised (converted into a specific mathematical format of binary code). Pictures are usually digitised with the help of a digital camera or a scanner.

Additive colour mixing Describes a system of colour reproduction for self-luminous devices. It is based upon the combination of light of the wavelengths of the three →primary colours red, green and blue. For example, colour televisions and computer monitor displays use the principle of additive colour mixing.

Add-on / Add-in Extension to a program such as Excel or Word that increases the available functions. These add-ons/add-ins are developed and distributed by the respective software company or other firms.

AE Automatic exposure.

AF →Autofocus.

AF metering field Spot or area in the frame marking the position where the autofocus system takes readings to set the focus.

Algorithm A set of processing or working instructions that, because of their high precision, can be carried out independently by a mechanical or electronic device. Algorithms are, for example, the set rules for addition and subtraction etc. However, they are also the instructions that are established in a programming language. Algorithms simply allow the computer to solve particular problems. In image editing, algorithms are used to alter images, e.g. 3-D Cubic Algorithm. (→TruePic TURBO)

Aliasing The step-like (pixel-shaped) appearance of curves and diagonal edges of a subject in an image. This can sometimes occur since all graphics consist of individual →pixels. Antialiasing reduces this unwelcome effect by recalculating the contrast values of the neighbouring pixels and matching them up with each other.

Analogue Opposite of →digital. The components of analogue data merge continuously into each other without clearly defined steps. (E.g. the colours of a rainbow are not obviously separable from one another.)

Aperture Mechanism within the lens that controls the amount of light entering the camera. The aperture not only influences image brightness but also regulates →depth of field. Most cameras are equipped with an iris aperture that can be freely adjusted or set according to pre-selected values.

Aperture Priority In this mode, the user can adjust the aperture and the camera automatically selects the best shutter speed for the exposure. In most cameras, the Aperture Priority mode is denoted by the letter "A". →Shutter Priority.

APS Advanced Photo System. Developed together by five companies, this film system is distinguished by simple operation, a new picture format (16 x 30mm) and a choice of three picture formats. Additional information (such as exposure, aperture and date) can be recorded on the magnetic strip of the APS film. However, APS is not digital photography.

ASCII American Standard Code for Information Interchange. The commonly used →binary code for a total of 128 symbols (letters, numbers, punctuation and special symbols, though not for umlauts) enables the correct data transfer between software and hardware. The ASCII-code employs the first seven →bits of a →byte. The first 32 symbols are used as control symbols, e.g. to control a printer.

ASIC Application Specific Integrated Circuit. A chip designed for a specific application. They are used by cameras to quickly process the captured image data.

Aspherical lens Literally: not spherical. Normally lenses are shaped like part of a sphere (a single continuous curve) on both surfaces. Aspherical lenses have at least one surface which is not a continuous curve, i.e. it is made up of many complex curves. Being more difficult to manufacture than spherical lenses, they are sometimes used in good quality wide-angle and zoom lenses to correct aberrations.

Auto bracketing Using this mode, a series of shots – each adjusted to a different exposure value – is taken in quick succession. This is very useful in tricky lighting conditions where it is difficult to assess the settings. After all shots have been taken, the best may be selected and the others deleted. (→Exposure correction)

Autofocus (AF) Automatic focus adjustment. There are basically two main AF methods: the focus detecting method (or passive autofocus) usually employs a →CCD and works by evaluating the amount of contrast or the phase difference in a scene. Distance metering (or active autofocus) utilises an (infrared) light emitter and receiver in a triangular surveying system. Alternatively, the camera may use ultrasound (sonar) and measure the time taken for the sound signal to return. This data is converted by a microprocessor into information about distance and thereby enables the automatic focusing of the lens.

Autofocus-illuminator Some cameras are equipped with an AF illuminator which assists the normal autofocus in poor lighting conditions by illuminating the subject. In this way, the regular passive AF system (e.g. contrast detecting / phase differential method) can determine the correct focus settings – even in dark surroundings.

Average metering An →exposure metering technique that measures the average light intensity across the entire frame.

AVI Audio Video Interleave. Standard file format from Microsoft (and therefore for Windows computers). It is used for saving video sequences with or without sound.

B

Banding Depiction error often occurring in dark sections of an image when shooting with a high sensitivity setting. Smooth lines of brightness or colour look like bands of brightness or colour.

Battery pack Also called power pack. Rechargeable battery protected by casing. It provides camera, external flash, etc., with additional power.

Baud Named after the French engineer Baudot. It is the unit used to measure the data transfer rate (1 Baud = 1 bit/sec.). For example, the specification "28,800 Bauds" means that data can be transferred at a rate of 28,800 bits per second.

Binary This is the name given to the representation system of numbers consisting solely of the figures 0 and 1. Just like the ten figure decimal system (0-9), in the binary system, larger numbers are made up by combining the numbers 0 and 1.

BIOS Stands for Basic Input / Output System and describes the basic program of a computer.

Bit Binary digit. The smallest →digital unit that can show only two states, 0 or 1. 8 bits produce one →byte.

Bit depth →Colour depth.

Bitmap An image defined by a grid (map) of pixels, each pixel having a bit-value representing the image appearance at that particular point.

Blackboard/ Whiteboard These two picture effects record images using only pure black and white to heighten the images' contrast value. This makes them ideal for capturing text.

Blooming The spreading of highlights which occurs at the capture stage of a digital image. An image error that has been more or less eradicated in the newer digital cameras. It describes the "overflow" of electrical charges between the individual sensors on a →CCD element.

Bluebox A process from television and movie production. Actors stand in front of a coloured wall, usually painted blue. Later, a different background is put in for the blue areas on the recorded image, giving the impression that the actors are e.g. on top of a mountain, although they never left the studio.

Bluetooth Standard introduced by Ericsson, Intel, IBM, Nokia and Toshiba for wireless radio-wave communication between different devices. Unlike the infrared data transfer method, which is also wireless, Bluetooth does not even require visual contact between the communications devices. It operates on a frequency of 2.4 GHz and offers transfer rates of up to 2.1 Mbit/s. Depending on the device's class, it has a range of up to 100 metres.

bps →Bits per second. Refers to the number of bits transferred in one second. The bps notation is often found on →modems and →serial interfaces.

BrightCapture Technology A technology developed for better shooting results in low light situations. This is achieved in two ways: i) By utilising all available pixel information from the image sensor to provide a much brighter view on the LCD, framing is made easy even in dark surroundings. ii) In certain shooting modes sensitivity is increased (and resolution reduced at the same time), which results in well-exposed images with accurate colour reproduction, high contrast and definition, even when not using the flash.

Browser Describes a program used to display information, especially on the internet.

Buffer (Buffer memory) A form of temporary memory (→RAM) where images are saved briefly before being written to the storage media. This type of memory is necessary because memory cards are comparably slower due to their architecture and cannot save the files at the speed the camera produces them. Buffer memory is particularly helpful when shooting in →sequence mode.

Bug Describes a programming error. This can be removed by correcting or rewriting the program code. (→Patch)

Bug-Fix Removing a software error by installing a software →patch.

Bulb mode Long →exposure mode. In bulb mode, the shutter stays open as long as the release is held down. This allows exposure times of several minutes or even hours. However, in some models the bulb mode is limited to a number of minutes regardless of how long the release is held. Denoted by the letter "B" on most cameras.

Burst mode Another term for sequence mode or continuous shooting.

Bus Internal interface for data transfer between individual system components such as micro-processor, memory, etc.

Byte →Binary data packet made up of 8 →bits. A byte can represent values between 0 and 255. It can depict any of 256 symbols, numbers or colours. In the computer field, larger byte size is described using the prefix letter for the abbreviation of the exponent of 2. Therefore:
1 kilobyte = 1 KB = 1,024 bytes
1 megabyte = 1 MB = 1,048,576 bytes
1 gigabyte = 1 GB = 1,073,741,824 bytes
1 terabyte = 1 TB = 1,099,511,627,776 bytes.

C

Calendar view A function found in certain camera models. This automatically saves the pictures according to their capture date and then shows them in a virtual calendar.

Calibration The reciprocal balancing or tuning of input and output devices to achieve a matching value. In this way, the colours on a monitor can be matched with the printer's colours. (→Colour management)

Candela Unit of illumination (cd). 1 cd is 1/683 W per steradian.

Card adapter Device in which the memory card can be inserted for transferring the data on a memory card between a →PC Card slot and disk drive to the computer.

Card reader/ writer Device that accepts memory cards and, through connection to a computer, allows data to be transferred between the media and PC.

Cast When a colour of one type is in excess in a picture, such as too much yellow or red. Often appears if the wrong →white balance setting is used.

CCD Charge-Coupled Device. A light sensitive semi-conductor that converts received light into voltage according to the level of brightness. It is used as a →chip or line sensor in digital cameras and →scanners. (→progressive CCD, →video CCD)

CD-ROM Compact Disc Read-Only Memory. A "read only" CD-ROM can hold up to approximately 650 or 700 MB of data, e.g. pictures and text.

CD-R Compact Disc Recordable. CD on which data can be saved (at intervals if desired) but not deleted. Besides the standard size of 12cm diameter, smaller versions of 8cm are also available.

CD-RW Compact Disc Rewritable. Compact disc that can be re-written around 1,000 times. Besides the standard size of 12cm diameter, smaller versions of 8cm are also available.

Centre-weighted average metering A form of →average exposure metering which places more emphasis on readings taken at the centre of the frame, making it less prone to being influenced by dark or light subjects at the edge of the frame. (→Digital ESP [selective multi-zone metering]; →reflected-light metering; →exposure metering, →light metering, →spot metering)

CF →CompactFlash.

Charger Battery-charger.

Chip General description for →integrated circuits whose components (e.g. transistors, diodes, resistors) are manufactured on a small plate of the semiconducting material silicon.

CIE Commission Internationale de l´Eclairage. An international standard commission for colour metric measurements. The set standards are the basis for the colour definition in DTP standards.

CISC Complex Instruction Set Computer. A type of →processor that recognises and processes a large number of complex and powerful instructions without the need for additional software.

CMOS Complementary Metal Oxide Semiconductor. Light sensitive chip. Unlike in →CCDs, the pixel elements on the CMOS are read individually.

CMYK Cyan, Magenta, Yellow, and Key/Black. These are the printer colours used to create colour prints. (→Subtractive colour mixing)

Colour depth This refers to the maximum number of colours that can be recorded by digital cameras and scanners or that can be displayed by graphics cards. A true colour representation can be achieved at a colour depth of 8 bits for each of the three primary colours, which gives a 24 bit colour depth. The 8 bits per primary colour can give 256 levels for each of those colours, which when multiplied together amounts to 256 (red) x 256 (green) x 256 (blue) = 16,777,216 colours that can be displayed. High-end scanners, graphics cards, etc. provide a minimum colour depth of 24 bit.

Colour management The calibration of all peripheral devices that feature in the production of colour images (monitors, →scanners, colour →printers etc.). For example, by using a colour management system, the data from a scanner is converted into values for a standard colour range. The data is then arranged so that the printer can produce good colour prints.

Colour noise The incorrect reproduction of colour in an image, e.g. coloured dots on an area which is supposed to be pure white. (→Noise)

Colour space Refers to a model that specifies how colour information is represented. It defines a multi-dimensional space where the various dimensions represent intensity values.

Colour temperature Describes the spectral energy distribution and thereby the colour quality of a light source. The temperature of a colour is given in Kelvin (K). It is important to choose the correct colour temperature so that a subject can be photographed in its true colours. Most digital cameras can be automatically or manually set between a range of around 3,000K to 8,000K (→White balance).

Compact digital camera Smaller dimensions and reduced weight make these easy to handle models ideal for travel and everyday use.

CompactFlash card Rewritable removable memory or function card developed by SanDisk in 1994. In contrast with →SmartMedia or →xD-Picture Card technology, it has a built-in controller. The newer CF type II (CF/2) cards are 5mm thick, the CF type I are only 3.3mm thick. (→PCMCIA-Cards/PC Cards)

Compatibility The ability of data, programs (software), and equipment (hardware) to run and/or work together. This allows for the individual components to be put together to form a system.

Complementary colours Any two colours, such as cyan and red, yellow and blue or magenta and green, that when mixed together give white or grey.

COM port Describes the →serial interface of a computer. Often used to connect devices such as digital cameras to a computer. (→USB)

Compression In order to store digital pictures economically, the image data is compressed. However, compression often causes a reduction in picture quality. The most common compression format is →JPEG.

Computer-controlled flash Almost all compact or grip-type →flashes are computer controlled. They set their intensity by directing a sensor at the subject, thus gathering the information from which the flash duration can be attained. The light sensor often gathers the data through the camera's lens. (→TTL)

Converter/Lens converter Lens extension that increases or shortens the focal distance. (→Macro-converter, →tele converter, →wide-angle converter)

CPU Central Processing Unit. The main processor of a PC (personal computer).

CR123A 3V lithium battery with a standard size of 34 x 16.5mm, also called DL123A in America.

Cross-button Special operating element. By altering the point of pressure, a single button is all that is needed to choose various menus or select and activate functions.

CRT Cathode Ray Tube. Electron guns inside the tube send beams onto the front surface of the tube, causing it to glow, creating a display. (→LCD)

CR-V3 3V lithium battery with a standard size of 52 x 14 x 28mm. Olympus description: LB-01E.

D

Data security A collective term used for any measure to protect and store files as well as programs for an extended period of time.

Data transmission The exchange of digital information between two or more computers. Data is usually transmitted via a direct cable connection, a computer network or telephone lines.

DCF Design Rule for Camera File System – an industry standard for saving digital images. This not only determines the file type, but also sets the rule for naming the folder and file structure. It allows the conversion of uncompressed →TIFF files into compressed →JPEG files. This JPEG file is of the →Exif type and can contain camera information such as the date and shooting parameters. (→DPOF)

Dead pixels Dead →pixels do not react at all (unlike →hot pixels) and can be seen in the resulting image as black spots.

Depth of field   The distance between the closest and most distant points at which a subject appears to be in focus, without changing the focus setting of the lens.

Depth of focus   The distance, forwards and backwards, through which the film plane (or CCD surface) can be moved while still maintaining an acceptably sharp focus of a set subject, without altering the focus setting of the lens. (→Depth of field)

Digital   Opposite of analogue. Digital information is made up of a limited number of gradations (e.g. 256 colours, 8 →bit). The change from one digital element to the next is always "step by step" and not continuous.

Digital camera   Usually captures images with the help of a →CCD chip. The image data received is then saved to special memory cards or other storage media. (→SmartMedia, →xD-Picture Card, →CompactFlash, →Memory Stick, →SD Card, →MMC Card)

Digital ESP   Digital Electro-Selective Pattern. The employment of a selective multi-zone metering system ensures an optimal exposure even in difficult lighting conditions. While simple multi-zone systems work out the average exposure from readings throughout the frame, the digital ESP system analyses the distribution and degree of brightness to see which of a range of scenarios the picture best matches (e.g. a shot with strong backlight or sunset). It then adjusts the settings accordingly. (→Exposure metering, →spot metering, →reflected-light metering, →light metering)

Digital flash	→Computer-controlled flash. (→Flash)
Digital Imaging Software	→Image editing software. (→Olympus Master)
Digitisation	→AD conversion.
Digital zoom	This achieves a zooming effect by calculating (or interpolating) the available image data. Picture quality is reduced when a digital zoom is used. (→Interpolation)
Diode	A semiconductor device that allows current to flow in one direction only. See also →Photodiode.
Dioptre	Unit for measuring a lens' refractive power. In photography, the term is used with close-up lenses and corrections to the viewfinder to adjust it to the user's eyesight.
Dioptric adjustment	The adjustment of the viewfinder to the photographer's eyesight (unit: dpt).
Direct print function	→PictBridge
Display	→LCD; →TFT.
Distortion	Misrepresentation of an image. →Wide-angle lenses normally produce more distortion than →tele lenses.
DNG	(Digital Negative) Open →file format developed by Adobe for camera →RAW files.
Dot	The smallest raster element of an image.

A
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V
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X
Y
Z

Dot pitch Used with monitors, it indicates the distance between individual →dots. The smaller the distance between dots, the sharper the image.

Download Describes the process of receiving data, usually via either a mailbox, the internet or another device like a digital camera to a PC (→data trans-mission).

dpi Dots per inch (1 inch = approx. 2.54cm). A measuring unit in printing to describe the geometric resolution of an image.

DPOF Digital Print Order Format. A format introduced by the photo industry that enables images stored, for example on →SmartMedia or →xD-Picture Card, to be accessed directly by certain printers and copiers as well as allowing simpler professional treatment by photo labs.

DRAM Dynamic →RAM. A type of memory chip that is used in most personal computers as a fast storage medium.

Driver A small program that allows communication between the application program and a certain device, for example a →printer or →digital camera.

DSL Abbreviation for **D**igital **S**ubscriber **L**ine, a data connection with a much higher transfer rate than →ISDN (usually between 1 and 16 Mbit/s).

DSLR →Digital →single lens reflex camera.

DTP Desktop Publishing. This refers to the design and illustration of texts and graphics directly on the monitor screen.

Dual Image Stabilization A special function to avoid image blur caused by camera shake or fast-moving subjects. It combines the CCD-based →mechanical image stabiliser, where a built-in gyro sensor detects camera movement and adjusts the CCD accordingly, with high →ISO values.

DVD+R/DVD-R Recordable DVD.

DVD-RAM Rewritable storage medium which, unlike other writable DVDs, does not require separate burning software but can only be read and written to by special DVD-RAM-compatible drives. The medium is treated like a regular →hard drive. The big advantage of DVD-RAM is the increased level of data security.

DVD-ROM Digital Versatile Disc. A standard for CD-ROM with a much greater capacity (e.g. 9.4 GB) than a regular CD-ROM.

DVD+RW/ DVD-RW Rewritable DVD (up to 1,000 times).

Dye-sublimation Describes a printing method for half-tone images or pictures. This process uses heat to transfer colour from a printer ribbon into paper. The picture quality is exceptional. The photo printer P-440 from →Olympus produces A4 size prints within 90 seconds and at a resolution of 314 →dpi with up to 16.7 million colours.

E

ED lens Lens made of special glass with extra low dispersion characteristics.

Electronic viewfinder The electronic viewfinder consists of a small LCD which displays the picture seen through the lens, just like with a regular →SLR. This is achieved with the help of the →CCD which continually sends the captured image information to the electronic viewfinder. As a result, composition is much easier because the photographer is shown the very same image seen by the camera. Furthermore, shooting data, such as picture number and settings, may also be displayed here.

Email A worldwide electronic mail system. Digitised data can be sent almost immediately throughout the world via telephone lines using only a PC. Every email user has his or her own internationally distinct address where he or she can be reached electronically. Files, such as digital pictures, can be sent with any email message.

EPS Encapsulated PostScript. A computer →file format based on the →PostScript standard. It is supported by most graphic design and page layout (→DTP) programs. In addition to the PostScript code, the EPS file also contains a low resolution PICT.

ESP Electro-Selective Pattern, →Digital ESP.

EVF →Electronic viewfinder.

Exif Exchangeable image format. A standard for image files created with digital cameras and other input devices. Exif files can be either uncompressed →TIFF or compressed →JPEG images and can hold data about the camera and settings employed. Using special programs, the information saved can be shown. Exif 2.2 saves even more information, such as the shooting mode, white balance and flash settings used. Compatible printers can then intelligently apply this data to produce optimal printed results.

Exposure During exposure, the sensors on the →CCD (or chemicals on the film) are subjected to light for a certain amount of time.

Exposure control Describes how the shutter speed and aperture are controlled by the camera. This can be either automatic (→fully automatic, →programmed auto or →scene mode), or semi-automatic (→Aperture Priority, →Shutter Priority) or manual (full manual control of the →aperture and →shutter).

Exposure correction (compensation/ control) Conscious deviation from the value ascertained by the light meter. The change can be made manually (→under and →overexposure) or through Digital ESP.

Exposure meter →Light meter

Exposure metering →Light metering

Exposure time The length of time for which the →shutter is open.

F

FAQ Frequently Asked Questions.

FDD Flexible or Floppy Disk Drive. A disk drive that can read from and write to floppy disks, a storage medium commonly with a capacity of 1.44 →megabytes (MB).

FFT-CCD (Full Frame Transfer CCD) A type of →CCD with a very light-sensitive surface. The advantage of the FFT-CCD over regular CCDs is the reduced level of →noise and an ability to capture more subtle variations in brightness.

File A set of data that has been arranged according to specific rules. Files are managed in the computer by the →operating system and can be stored long-term on an external storage medium.

File format Describes the contents of files. Common file formats include <txt> for a text file, →<eps> (Encapsulated PostScript) for →PostScript, and <tif> for →"TIFF"-images.

Fill-in flash A →flash mode that is particularly useful when shooting a subject in front of a strong light source or bright background. Normally, because of the backlight, the subject would be in shadow. However, the flash provides the additional illumination to ensure a well-lit subject.

Film plane →Focal plane.

Film scanner Hardware for digitising negatives and slides. (→Flash Film Scanner)

Film sensitivity The measure of reaction of a light sensitive film to light, given as an →ISO value, which replaced the earlier DIN (Deutsches Institut für Normung) and ASA (American Standards Association).

Filter 1. A transparent, usually coloured sheet of glass or plastic that can be placed in front of a →lens to create a certain effect.
2. An option in an image editing program that enables certain adjustments to the picture, e.g. colour and brightness or sharpening. (→Imaging software)

Firewire A term introduced by Apple to describe the →IEEE1394 interface.

Firmware Software contained in →ROM that manages the camera's operation.

Fisheye Special mode featured in some cameras where the shot is saved as though it were taken with a →fisheye lens, providing a very surreal, artistically distorted result.

Fisheye lens Having a viewing angle of 180°, these lenses can provide a very surreal image. Can be divided into diagonal types, which provide a frame-filling picture, and circular lenses which project a round image on the frame.

Fixed focal length When the camera's lens has a set focal length, optical zooming is not possible.

Fixed focus Fixed focus cameras do not have →autofocus or manual →focus systems. The focus and →aperture have been set so that everything within a certain distance is captured clearly. However, the drawback is that they do not have a very close focusing range and they only have a small aperture.

Flash   Produces a large amount of light for a brief moment to illuminate the subject. Modern flashes work with gas discharge tubes. Computerised camera flashes can measure and automatically control their intensity by means of a sensor directed at the subject. (→Guide number)

Flash duration   The period for which the flash tube emits light. This can be from around 1/250 to 1/40,000 of a second depending on the amount of light required.

Flash Film Scanner   Attachment for certain digital cameras that allows the copying of 35mm negatives and slides. (→Film scanner)

Flash range   The distance needed to be covered by the flash to give the subject optimal illumination. This can be calculated using Lambert's law. As the distance from the light source is doubled, only a quarter of the original amount of light will reach the subject. (→Guide number)

Flash-ROM   A type of memory storage that can retain information even after the power has been switched off. Unlike conventional →ROM, the contents of a Flash-ROM can be deleted and rewritten with the help of a pre-programmed electrical current. Therefore, a Flash-ROM is a combination of →RAM and →ROM.

Flash synchronisation   Coordinates the opening of the camera's →shutter with the time and duration of the →flash. Some cameras allow you to synchronise the beginning or end of the exposure time ("first curtain" and "second curtain" flash respectively).

Focal length The distance between the point of focus of a subject at infinity and the rear nodal point of the lens. For a simple lens (a single lens element) it is the distance from the centre of the lens to the point where an infinitely distant object is brought into focus. A compound lens (such as that fitted to a modern camera) would produce an image the same size as a single lens element of the same focal length, but the compound lens could be closer to, or further from the point of focus. The "standard" focal length gives an image impression roughly corresponding to the human eye (about 50mm in a conventional film camera and about 7mm in a digital camera with a 1/3" →CCD).

Focal plane The place in the body of the camera where the film or CCD is placed, perpendicular to the lens. This is the point at which the image is formed inside the camera. Also known as the film plane.

Focusing Adjusting the position of the lens elements to bring the image into focus, i.e. so that it is clear and sharp.

Format In computers as well as digital cameras writable storage media such as floppy and hard disks as well as →removable storage media and some types of →CD-Rs need to be formatted. During the process they are prepared to accommodate the respective →operating system's file system, so data can be written to and read from the medium correctly. Format may also refer to the type of file, such as →JPEG, →TIFF or DOC. In photography the format or size of the film or the image sensor has a major bearing on the angle of view of a lens. Format is also used to describe the two dimensional size of an image. In film cameras, the photos typically have a ratio of 3:2 (Format: 36 x 24mm). With digital images, the ratio is normally 4:3 but can be changed to 3:2 in some

cameras. For prints, the format means the size of the print out, such as 9 x 13cm, 10 x 15cm, 13 x 18cm.

Four Thirds The first open standard for digital →SLRs. As the name suggests, Four Thirds systems use a 4/3-type image sensor, the size of which allows the development of tailor-made interchangeable lenses. These are not only smaller and lighter, but also offer a greater light gathering power than lenses based on the 35mm film format.

FreeHand Popular graphics program from Macromedia.

Freeware Software that is free to use and pass on but not sell. Unlike shareware, there is no need to register the software.

Full automatic In this mode, the camera not only controls the →aperture and →shutter but all other settings, too. (e.g. →flash).

FTP File Transfer Protocol. Protocol for transferring files between computers over a →network such as the →internet.

G

Gamma correction A process whereby contrast values are optimised.

GB →Gigabyte.

GIF Graphic Interchange Format. A compressed image →file format with a maximum of 256 colours. Often used on the →internet, especially for simple graphics and animation.

Gigabyte 1 gigabyte = 1,024 →megabytes.

Glass lens →Lens

Google Well-known →internet search engine.

GPS Global Positioning System. The GPS receiver uses satellites allowing you to determine the exact longitude, latitude, and height above sea level anywhere on earth.

Graphics card Component of a computer that is necessary to display an image on the monitor screen.

Grey scale A scale of shades ranging from white to black. Devices that can only display data in black and white translate colour differences into various shades of grey.

Guide Number Value for the maximum power of a camera →flash based on a film with an →ISO of 100. Built-in camera flashes have a guide number (GN) of approx. 10 – 20, compact flashes between 20 – 40, and the GN for grip-type flashes is between 45 – 60.

H

Hand-held exposure meter External →exposure meter. (→reflected-light metering, →incident-light metering)

Hard drive/disk Device for the permanent storage of programs and information that remain after a computer has been turned off.

Hardware All actual physical computer components such as the computer itself and →peripheral devices like monitor, mouse, →printer, →digital camera, etc.

HDD Hard Disk Drive. (→Hard drive)

Hi Colour Describes an image having at least 32,000 colours. (→True Colour)

Histogram This shows the distribution of tones for a particular image. With some cameras, the histogram can be used in real time or after capture. The histogram is particularly helpful for recognising incorrect →exposure.

Homepage First page of an internet site.

Hot pixels Faulty →pixels which are always on, causing a white spot in the image, usually slightly larger than one pixel in size.

Hot plugging The connection and uncoupling of external devices while the PC is running. Restarting the computer is unnecessary. Requirements: →USB, and the relevant →operating system. (→Plug and Play)

Hot shoe An interface for attaching flashguns (or accessories like flash adaptors) to cameras, usually found on the top of the camera. It has two metal brackets and normally one or several electrical contacts in the centre to allow communication between the camera and flash. If it has no contact, this is an accessory shoe. The flash also features a hot shoe contact and normally a locking mechanism to prevent it falling out of the shoe.

HQ resolution High Quality resolution. Description for high digital photo quality using the camera's maximum resolution with a high level of compression.

HTML HyperText Markup Language, a file format used in the World Wide Web.

http Hypertext transfer protocol: transmission format and communication basis for the exchange of data in the internet.

HyperCrystal LCD A semi-transmissive technology used in LCDs, which employs an additional layer at the bottom of the LCD to reflect light from external light sources. This enhances the brightness of the LCD, so even in direct sunlight images are displayed sharply and with three times the contrast of conventional displays. Also, it provides for viewing angles of up to 170° without glare or shadow, so images can be framed from a variety of angles and viewed by several people at once.

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I

ICC profile An ICC (International Color Consortium) profile describes the colour range of a device that processes colour (like →scanners), displays colours (such as monitors), or produces colours (→printers). The ICC profiles for each of these devices help ensure that colour reproduction is consistent. (→Colour management)

IEEE1394 A →serial data transfer interface with a transfer speed of up to 400 Mbit/s (50 →MB per second). The new IEEE1394b interface should provide speeds of 800 Mbit/s (100 MB per second). Supports →Plug & Play and up to 63 devices at the same time.

i.Link Term from Sony for →IEEE1394.

Illustrator Popular graphics program from Adobe.

Image capacity The number of images that can be taken before the storage medium needs to be replaced.

Image compression In order to store digital pictures economically, the image data must be compressed. However, compression often causes a reduction in picture quality.

Image converter A software program for converting files from one type to another, e.g. →TIFF to →JPEG.

Image editing software Describes software that allows the user to view and alter digital images. A commonly used image editing program is Adobe Photoshop.

Image plane The plane behind the lens where an image is brought into sharp focus. For a subject at infinity, this point would be the same as the →focal plane.

Imaging software Software for the administration and editing of digital images (as well as other multimedia files). (→Olympus Master)

Image stabiliser Either opto-mechanical or electronic system that helps prevent camera shake to ensure sharp, clear results even at high magnifications (long focal lengths). Upon detecting any unintentional movement of the lens, the system compensates optically or electronically to keep the subject steady.

Image transmission/ transfer The digitisation of images means they can be transmitted via data carriers or networks without the loss of quality or copied an infinite number of times. (→Data transmission)

Incident-light metering A →light metering technique using a handheld →exposure meter with a diffuser over the sensor. The meter is held at the subject position and pointed towards the camera. A method often used in photographic studios.

Index print Reduced display of several photos on one print.

Ink jet printer A printer that by spraying tiny black or coloured ink dots onto paper produces a hardcopy image.

Integrated Circuit An electronic circuit consisting of many transistors, →diodes, resistors, etc., formed on a single chip of semiconducting material. Also known as an IC. (→Chip)

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Interface Connecting point between the computer and an external device, e.g. mouse, →scanner, →modem, →digital camera. (→Serial interface, →parallel interface)

Internal memory Memory built into a camera that cannot be removed.

Internet Worldwide →network of computers that allows for the global exchange of information.

Interpolation Calculating non-existent image data from captured image data. Interpolation is used by all digital cameras to determine colour data from neighbouring sensors. (The reason: a sensor can only record one colour.) Interpolation can also be used to increase (or decrease) an image's resolution. The quality of the resulting photo depends on the capabilities of the →algorithm used. It is important to remember, interpolation cannot produce detail that has not been captured.

ISDN Integrated Services Digital Network. Digital network for the transmission of voice, data, pictures, etc. between uniformly standardised user interfaces.

ISO International Organization for Standardization, which was responsible for combining the old ASA and DIN film speed standards into the current ISO system. (→Film sensitivity)

J

Jaggies Slang term for the stair-stepped appearance of a curved or angled line in digital imaging. The smaller the pixels, and the greater their number, the less apparent the "jaggies". Also known as pixelisation.

JAVA A programming language developed by SUN. Among its features is the possibility to program interactive software for the →internet.

JEIDA Japan Electronics Industry Development Association. Japanese standards committee for storage cards.

JPEG Joint Photographic Experts Group. The de facto standard for image compression in digital imaging devices, which enables different levels of compression to be selected. Because brightness information is more important than colour data, most pixels only store the brightness information. When the JPEG file is opened, the missing colour data is automatically calculated from the existing information. (→MPEG)

JPG File ending for →JPEG files.

K

KB →kilobyte.

Kbit/s Kilobits per second. The number of →kilobits transmitted per second. (→Baud)

Kbyte →kilobyte.

Kelvin scale Temperature scale beginning at absolute zero (approx. −273° Celsius = 0 Kelvin). Therefore Celsius values can easily be converted into Kelvin by adding 273 degrees to the Celsius value. (→Colour temperature)

Kilobit 1 kilobit = 1,000 →bits.

Kilobyte 1 kilobyte = 1,024 →bytes.

L

LAB LAB colours consist of a luminance or brightness component and two chromatic components.

Laser printer A printer that uses a laser beam to project characters and graphics onto a drum, which then electrographically transfers the image, using toner, onto paper. Laser printers are known for their high quality reproduction and printing speed.

LCD Liquid Crystal Display. LCDs are commonly used in calculators, watches, digital cameras, notebook computers, flat-panel monitors and projectors.

LED A Light Emitting Diode is often used as an indicator lamp.

LED printer As opposed to →laser printers, the printed image is not brought on to a drum by a laser beam, but by a row of densely located light diodes.

Lens Transparent glass or plastic that has been formed and polished to form a certain shape, usually spherical. When a beam of light reaches the area between the air and the lens, a part of this light is always reflected. The remaining light passes into the lens and alters its propagation direction, i.e. the light is refracted. The incorporation of various lenses (converging and diverging lenses) creates a →lens system. When optimally arranged, they allow the subject to be presented correctly on the →image plane.

Lens adapter Adapter between the end of the camera's lens and the lens converter. A step-up-ring is also a type of lens adapter.

Lens hood Made from metal or plastic, the hood fits on the end of the lens to shade the front lens element from incidental light, which could otherwise cause reflections, glare and ghosting.

Lens system Group of →lenses (sometimes just one lens) that enable the sharpest and brightest pictures to be taken. Often simply referred to as the lens or objective. There are various lenses available such as →wide-angle, normal, →macro, and →tele with fixed focal distances as well as →zoom lenses with adjustable focal distances.

Light intensity A measure of light energy from a light source measured in →candela. (→Flash)

Light meter To ensure correct exposure, most analogue and digital cameras feature an automatic light meter. Internal or external cells measure light intensity and convert the information into an electrical signal. This is then used by the camera to set the right shutter speed and aperture for the relevant light conditions. Modern exposure metering systems can measure the brightness of just a section of the scene, all areas or give more weight to certain areas. (→Digital ESP/selective multi-zone metering, →centre-weighted average metering, →spot metering, →reflected-light metering, →incident light metering, →light metering)

Light metering Method of →exposure metering by measuring the amount of light reaching an object. (→reflected-light metering, →incident light metering, →Digital ESP/selective multi-spot metering, →centre-weighted average metering, →spot metering)

Light sensitivity →Film sensitivity.

Li-Ion rechargeable battery Very lightweight rechargeable battery with a very high capacity (up to twice that of a →Ni-MH rechargeable battery) and one that does not suffer from memory effect problems. While regular lithium ion batteries are available as mignon batteries, the rechargeable versions are only used in custom-made forms requiring special chargers.

Line sensor An image sensor with pixels arranged in a single row (or several individual rows), normally used in scanners and autofocus sensors.

lpi lines per inch. Unit of measurement for the resolution of printed images. (→dpi)

Li-Po rechargeable battery The lithium polymer battery represents a new type of technology that unlike →Ni-MH, →NiCd and Li-Ion cells does not need a metal casing. Instead, the electrodes are covered with flexible plastic or aluminium foil. They also have a very high energy density so that they can be smaller but provide higher performance than other rechargeable batteries. Furthermore, they are easier and cheaper to produce in the medium term than Li-Ion rechargeable batteries (→Lithium battery) but, like the latter, they are only available in custom-made forms requiring special chargers.

Lithium battery An accumulator-type battery with a high energy density making it ideal for mobile phones, still and video cameras. Generally, the lithium battery is the main battery and the lithium ion battery is a secondary, rechargeable battery.

Live MOS sensor Image sensor that combines image quality of an → FFT-CCD with the low power requirements of a CMOS sensor. Provides high processing speed, enlarged light sensitive surface area and low-noise signal amplification for improved image quality, even in low-light environment. It also enables the display of → Live Previews on DSLR cameras' LCDs.

Live Preview An alternative to framing the shot through the viewfinder. The image sent through the lens to the image sensor is displayed directly on the camera's LCD. Whereas most compact digital cameras have been equipped with Live Preview functionality for many years, this feature has now for the first time entered the DSLR domain with the Olympus E-330.

Luminance Another word for brightness.

LZW Developed by Lempel, Zif, and Welsh: a special kind of compression reducing required storage capacity for →Bitmap formats without loss of quality.

M

Mac Abbreviated name of the Apple Macintosh computer. This computer is often used for graphics applications and →image processing.

Mac OS The Apple Macintosh computer's operating system.

Macro converter Lens attachment that permits fascinating detailed close-up shots. (→Tele converter, →wide-angle converter)

Macro lens A lens (usually for SLRs) that is designed to be highly optically corrected especially for close-focusing and reproduction work. A macro lens will normally give a maximum reproduction ratio of the subject of around 1:10 to 1:1 on the focal plane (without additional extension).

Macro mode A special camera setting allowing the camera to focus closer than normal, giving detailed close-up photographs of small objects.

Mass Storage Class →USB Mass Storage Class.

MB →megabyte.

Megabyte 1 MB = 1,024 →kilobytes.

Megapixel 1 megapixel = 1 million →pixels.

Memory effect A problem with →NiCd rechargeable batteries where, if the battery is repeatedly charged when not fully empty, the battery just remembers its capacity when it was "topped up" and not its actual capacity. The result: the battery loses power over time.

Memory Stick A removable memory medium developed by Sony.

MF Manual Focus.

Microdrive A miniature hard drive developed by IBM that fits the →CompactFlash Type II format. To record images to a Microdrive, a digital camera not only needs to be compatible with CompactFlash Type II, but also electronically compatible (able to provide the power required and have the necessary firmware.)

Micro processor The programmable →chip controlling the computer. It is composed of either one or more integrated circuits.

MMC →Multimedia Card.

Modem Word derived from Modulation and Demodulation. A device which transforms digital data into analogue signals in order to send the information through a telephone line.

Moiré An interference pattern brought about when images of regular lines, or patterns of slightly differing resolution are superimposed. This problem may occur, for example, if small diamond shapes are to be reproduced on a television screen.

Monochrome A picture in only one colour or in black and white.

Motion JPEG Some digital cameras can record a fast sequence of images in →QuickTime Motion JPEG format.

MOV File extension of →QuickTime films.

Movie recording An increasing number of digital cameras now allow the photographer to capture movie sequences. By taking hundreds of shots over the space of about a minute, a movie effect can be achieved (many cameras allow sound to be recorded with the movies too). These can then be included in presentations or incorporated into internet sites. (→Sound recording.)

MPEG Motion Picture Expert Group. The abbreviation is used to describe a compression format for →digitised video images. (→JPEG)

MPEG-4 Standard for video →compression. The format is used by some digital cameras for recording videos.

MPU Mathematical Processing Unit. Either an integrated or separate component of a →processor which carries out the mathematical calculations, e.g. for certain image processing tasks.

Multimedia card A flash memory card used in some digital cameras and MP3 players.

Multi-spot autofocus An →autofocus system that uses readings from several different points in the frame to determine the proper focus.

Multi-spot exposure metering With this system, the user can take readings from a number of freely-definable points. The camera recalculates the average →exposure after each reading.

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N

Negative Film coated with a light-sensitive emulsion that after exposure and processing produces the image in tones that are reversed relative to the original subject.

Network The connection of several individual computers to aid data exchange and communication.

NiCd battery Nickel-Cadmium rechargeable battery.

Ni-MH battery Nickel-Metal Hydride battery. Rechargeable batteries that have an energy density 100% higher than →NiCd batteries and can supply high energy levels when required, e.g. when using the flash in quick succession. They can be recharged more than 300 times and are environmentally friendly (free of cadmium and mercury). Among other devices, Ni-MH batteries are used to power digital cameras.

Noise Unwanted variations or disturbances that reduce the amount or quality of information in a signal. In digital imaging, noise is a term used to describe the visible effect of interference on the CCD sensor. It appears as unwanted colour spots on images – especially those taken at night with a slow shutter speed. (→Colour noise)

Noise reduction In noise reduction mode, the camera takes two shots: the normal shot and one with the same exposure time but with the shutter closed. It is then able to determine the areas of an individual image that are susceptible to noise and compensates for this.

NTSC National Television Standards Committee. American television standard for the coding/ encoding of colours. Developed in 1953 this US TV norm is defined by an image size of 640 x 480 pixels and a frequency of 60 Hz (interlaced, i.e. 2 x 30 half images per second). (→PAL, →SECAM)

O

Offline Describes the state when no data connection exists. (→Online)

OLE Object Linking and Embedding: Enables "objects" (graphics, tables, etc.) to be embedded into different files/documents in order to create, for example, a report.

Olympus Olympus is a leading international provider of professional opto-digital products and a pioneer in key technologies in the area of imaging and voice products, endoscopy, microscopy, bioanalysis and diagnostics.

Olympus E-System Based on the FourThirds Standard, the Olympus E-System sets new standards in the areas of both professional image quality and performance. All components and the complete range of accessories – body, interchangeable lenses and flash system – have expressly been designed to meet the needs of digital photography. This ensures the camera is able to achieve the full potential of the digital medium.

Olympus Master/ Olympus Master Plus The Olympus Master software offers many functions for organising, viewing and easily editing digital images. In addition, it allows users to update their camera's firmware online. The Plus version features even more functions.

Online Describes the state when two or more devices are directly connected and are communicating efficiently. (→Offline)

Operating system The basic program needed by a computer for operation. Well-known operating systems include →Windows from Microsoft and →Mac OS from Apple.

Optical real image viewfinder A viewfinder system that produces a virtual image, correct way round and right way up. Separate to the camera's main lens, it gives a representational view of the image to be taken. (compare →Single Lens Reflex Camera.)

Optical zoom →Zoom lens.

ORF Olympus →RAW format; used by all →Olympus digital cameras that can record images in RAW format.

Outdoor cases These are special cases that protect your camera when you go snorkelling or from the sand while playing on the beach. They are designed for a water depth of about 3m, so are not suitable for scuba diving. For this you need special → underwater cases. Make sure you have a case designed especially for your camera.

Overexposure When a shot receives too much light so that the photo is too bright and the colours are bleached out. (→Underexposure)

P

PageMaker Popular →DTP program.

PAL Phase Alternating Line. A colour television standard developed in Germany in 1967 and used in many European and non-European countries. The image size is 720 x 576 pixels with a frequency of 50 Hz interlaced (2 x 25 half images are generated each second). (→NTSC, →SECAM)

Panorama function Special function that allows the stitching together of numerous pictures to create a panorama effect. →SmartMedia and →xD-Picture Cards from →Olympus make it particularly easy to create such compositions when used in conjunction with a compatible Olympus digital camera.

Pantone A colour scale consisting of about 3,000 gradations in tone that is used in editing digital images.

Parallax error When the image seen through the camera's viewfinder does not correspond with what will be captured by the lens due to the different viewing positions of the two. When shooting close up, the degree of error can lead to incorrectly framed images. Some cameras feature a viewfinder with correction markings to prevent this while others automatically compensate for the parallax effect. In digital cameras, the parallax error can be avoided by framing shots with the LCD (if available).

Parallel Simultaneous but independent execution of individual tasks.

Parallel interface Allows external devices to be connected to the computer, such as printer, external storage media and digital cameras. The data is transmitted →parallelly, that is, byte by byte (8 bits at once).

Patch A piece of programming code that can be "patched" into an already existing program to correct a →bug. (→Bug-Fix)

PC Card Also referred to as a →PCMCIA Card. It is a card that stores information and is often used with notebooks. A PC Card may function as a modem, or act as a connection between a mobile phone and a notebook. (→Card adapter)

PCMCIA Personal Computer Memory Card International Association. Committee for the standardisation of storage cards.

PCMCIA Card →PC Card.

PDF File suffix for the "Portable Document Format" from Adobe. The big advantage of the PDF format is that files in this format can be saved and processed using all well-known operating systems.

Perfect Fix A collection of functions to correct imperfections in images after they have been taken. They can be accessed at the press of a button on some Olympus cameras and include corrections for image blur, backlight (shadowy areas) and red eye.

Peripheral device General term for computer accessories.

Photo CD A process developed by Kodak and Philips for saving regular, 35mm photos or slides to a →CD-ROM. The CD can then be inserted into a CD drive and the images downloaded directly to the computer for further processing.

Photocell A device that produces an electrical current or voltage in response to light. (→Photodiode)

Photodiode A semiconductor which measures or converts light into an electrical current. Photodiodes are commonly used in →scanners, →CCD sensors and →exposure meters.

Photoshop Popular →image processing program from Adobe.

PICT file A →file format developed by Apple.

PictBridge Standard for the communication between printers and cameras. With the help of PictBridge, the images can be printed directly from the camera to the printer without requiring a computer.

Picture effects Allow images to be captured in, for example, black & white, →blackboard/whiteboard or →sepia to produce a specific look.

picture express (pex) This is a type of instant photo kiosk from Olympus which lets users get photo laboratory-quality prints of digital images quickly and easily. Usually found in photo stores and shops, it is very easy to use. The storage medium is inserted in the machine and the pictures appear on the touch screen for individual selection and printing. It also allows image editing plus the burning of images onto CDs.

Picture resolution →Resolution.

P.I.M. Print Image Matching technology. Developed by Epson for even more realistic colours in digital photo prints. Information about the colour scale and other relevant data (such as light values, colour saturation, colour balance, contrast etc.) is recorded in the →Exif file header and can then be used by P.I.M. compatible printers when printing.

Pixel Abbreviation for "picture element". It is the smallest element of a raster display or digital picture, containing information about brightness and colour.

Pixel mapping Term for a process by which defective pixels on a →CCD are recognised and compensated for. The missing data is calculated by using the values from surrounding pixels.

Pixel modulation A process used in printing, which changes the brightness of individual →pixels by changing the pixel size.

Plug and Play Developed by Intel, this standard allows the installation of extension cards and other peripherals into a computer without the subsequent need to alter the configuration. This is directly supported by →Windows 95 and all newer Windows versions.(→USB)

Plug-In Some software authors provide their programs with a plug-in interface so other developers can write additions to these programs that extend their functionality. As an example, there are many plug-ins for web →browsers that make it possible

to display file formats that are not in →HTML, such as music and video files. Well-known plug-ins are: "Flash" and "Shockwave" (for multimedia), "QuickTime" and "RealAudio/RealVideo" (for music/video through the internet), and "Acrobat Reader" (for →PDF files). Some digital camera manufacturers provide Photoshop plug-ins to make development of their RAW digital imaging format possible from within this →image editing program.

PNG Portable Network Graphics. A lossless compression file format used for storing images. (→JPEG, →MPEG, →LZW, →ZIP)

Polarisation filter A filter that blocks polarised light waves when turned to oppose the plane of polarisation of those waves. Light is polarised when reflected by a non-metallic surface (glass, water, etc.). By blocking those waves, the filter effectively reduces the amount of reflection. Use of the filter also increases colour saturation, making blue skies appear even bluer, for example.

PostScript A standard format for the printing or reproduction of text and graphical documents.

ppi Pixels per inch. A value to denote the resolution of digital images.

Primary colours The three basic colours red, green and blue to which the human eye is primarily sensitive. These three colours are used in the additive system of colour reproduction. (→Additive colour mixing)

Printer Some types of printers include: →dot-matrix, →ink-jet, →laser, →LED or →dye-sublimation.

Print functions In addition to trimming and image selection, some printers offer users greater independence from the computer by presenting them with more print functions. For example, individual backgrounds may be created and picture effects like sepia used to personalise the print. And if the printer and camera feature →DPOF compatibility, print settings selected on the camera immediately after taking photos will also be recognised. (→Picture effects.)

Printing media (paper) For optimum printing results, it is important to choose the best printing media.

Processor The "heart" of a computer. All programs and user commands are executed here. →CPU.

Programme Automatic In the Programme Automatic setting, (on most models denoted by "P") the camera sets the →aperture and →shutter speed to suit the relevant conditions.

Progressive CCD Describes a →CCD specially developed for digital cameras. (→Video CCD)

Prosumer camera Term to describe a camera with features of professional models that also appeal to the consumer.

Protocol Basis of communication (rules, format, procedures) for passing data between individual devices. It is the "language" devices use to communicate with each other. Well-known protocols are →TCP/IP and →FTP for internet communication and →PTP for exchanging images.

PSD →Photoshop file.

PTP Picture Transfer Protocol is an image data transfer →protocol (like the →TCP/IP protocol for the →internet) that is intended to do away with the need for special digital camera drivers. PTP compatible devices, such as digital cameras, computers, mobile phones, printers, etc., should be able to transfer data among themselves without the user needing to install any drivers.

Q

Quark Xpress Popular →DTP program.

Quick shooting mode Several shots are taken automatically in a row. (→Sequence shooting mode)

QuickTime Developed by Apple, this is a standard for digital videos and streaming media. Many internet videos are in QuickTime format.

QuickTime Motion JPEG A file format created by Apple for saving and compressing animated audio/video data (video-clips, for example). Best played with Apple QuickTime-Player.

QuickTime VR Addition to QuickTime for saving and displaying panorama images.

QXGA Quad Extended Graphics Array. Standard for displaying images on a screen. Typical resolution is 2,048 x 1,536 pixels. (→SXGA, →VGA, →UXGA, →XGA)

R

RAM Random Access Memory. The user can read and write data from/onto this type of memory. RAM is used to temporarily store both data and programs. As opposed to →ROM, all memory stored in RAM is lost when the power is turned off and is therefore called volatile memory.

Raster The regular arrangement of addressable points within, for example, printers, scanners, monitors and digital cameras.

RAW Some cameras allow files to be saved in RAW format. These contain the image information as it is sent directly from the →CCD, i.e. before the camera has carried out any processing at all. The RAW files are usually smaller than if saved in →TIFF format because the colour information has not been processed at that point. To see and edit the files and then save them in a more conventional format, a special program or →plug-in is required.

Real image viewfinder →Optical real image viewfinder.

Rechargeable battery Type of battery that once empty can be recharged using a charger. The most common types of rechargeable batteries are nickel metal hydride (→Ni-MH) nickel cadmium (→NiCd), lithium ion (→lithium) and lithium polymer (→li-po) batteries. (→Battery pack)

Red-eye reduction A →flash mode. Dim light causes the pupils of the eyes to widen. This can lead to the well known red glow in the eyes when a flash is fired as the light may reflect from the blood vessels on the retina. That's why most cameras offer a red-eye reduction mode. In this setting, the camera fires a number of flashes, or one single long one, before the actual flash. This causes the pupils' diameter to shrink, reducing the possibility of red-eye.

Reflected light metering Method of →exposure metering by which the amount of light reflected from the subject is measured. (→Incident light metering, →Digital ESP/selective multi-zone metering, →light metering, →spot metering, →centre-weighted average metering)

Removable lens →Lens that is not permanently fixed to the camera and can be removed and replaced by another lens.

Removable memory Memory card that may be inserted into and taken out of the camera. Examples are →xD-Picture Card, →SmartMedia and →CompactFlash.

Resolution Measurement of the image detail (→ppi, →dpi) that a device can capture or reproduce. With a monitor or printer, the resolution describes the number of →pixels that can be shown. When used with devices for image capture, such as digital cameras or scanners, the resolution refers to the number of pixels that record the image. The result is given in ppi (often dpi – although not strictly correct – is used instead) or the horizontal and vertical total of pixels (e.g. 2,272 x 1,704, equivalent to 4 million pixels). In general, it can be said that the higher the resolution, the better the quality.

RGB Red, Green, Blue – the three primary colours for →additive colour mixing.

RISC Reduced Instruction Set Computer. A processor or system that has extremely fast processing times, but recognises only a small number of commands.

ROM Read Only Memory. This type of memory storage only allows the user to "read" the information it contains, i.e. the user cannot store (write) any information on the ROM. Once written, the contents of the ROM cannot be changed. (→Flash ROM, →CD-ROM, →RAM)

RS232C →Serial interface.

S

Scanner A device used to →digitise printed information (pictures, graphics, and text).

Scene mode Modes for certain types of shots. In a scene mode, the camera automatically selects the best parameters (such as →aperture, →shutter, →flash mode, etc.) for the type of scene in question. Typical scene modes include night scene, landscape, portrait, sport.

SCSI Small Computer System Interface. A general inter-face standard used, for example, to connect external storage devices or scanners with a computer. It is necessary to differentiate between SCSI I, SCSI II, and SCSI III.

SD Card →Secure Digital Card

SECAM Sequential Couleur Avec Memoire. French television standard. Also used in former Eastern Bloc countries. (→PAL, →NTSC)

Secondary colours A colour produced by combining any two →primary colours. Common secondary colours are cyan, magenta and yellow, which are often used in the →subtractive colour mixing system as colours for printing inks.

Secure Digital Card Removable storage media for images and audio files.

Selective multi-zone metering →Digital ESP. (→Exposure metering, →spot metering, →reflected-light metering, →light metering)

Selective zone metering As with →spot metering, selective zone metering just takes the readings for a specific section within the frame – usually in the centre. The measurement area covers a larger proportion of the total, up to 20%, whereas in spot metering this is under 5%.

Self-timer A function that delays opening of the →shutter for the purpose of taking self-portraits. It can also be used to ensure vibration-free operation when using long →exposure times.

Sepia This picture effect gives images a brown-golden colour that resembles old photographs.

Sequence shooting mode This function allows a number of photos to be taken in quick succession. When temporarily written to →DRAM, very fast sequences are possible, however only with a limited number of photos because of capacity limitations. The number of photos can be increased if saved directly to memory card, but this will be at the expense of sequence speed.

Serial interface Also called →RS232C or →RS422 interface. An interface which allows →peripheral devices such as a mouse, →modem, and certain digital cameras to be connected to the computer. Data is transferred serially, which means bit by bit, one piece after another, via a connection cable. Also called COM Port.

Server The main computer in a →network, responsible for the management/regulation of all other computers.

Shooting range The range within which a camera is able to capture sharp, focused images.

SHQ resolution Super High Quality →resolution. Term describing a very high digital photo quality using the camera's maximum resolution, saved as a JPEG file with a low level of →compression.

Shutter Either mechanical and/or electronic shutters are possible. Mechanical systems can use a leaf (or iris) shutter or curtain shutter. In digital cameras a third alternative is also possible: the electronic shutter. This works by activating and then deactivating the →CCD so that no further light can be recorded, regardless of whether light is hitting the CCD. The shutter controls the exposure time, which can range from thousandths of a second to several minutes or more. Fast shutter speeds freeze action, slow speeds are more suited to stationary subjects. A tripod is recommended for slow exposure shots to avoid camera shake. (→Aperture)

Shutter time lag Time between the instant the release is fully depressed and the actual moment of capture. This does not include the time when the release is half depressed to activate (if available) the →autofocus system, etc.

Shutter Priority In this mode, the user can adjust the →shutter speed manually and the camera then selects the →aperture setting for the best exposure. Often described as "S" mode on the camera.

Single lens reflex camera Camera type that directs the image coming in through the →lens into the viewfinder by means of a mirror and prism/mirror system. When the →shutter is released the mirror swings out of the way to allow light on the image plane. The picture seen through the viewfinder is almost 100% identical to the resulting photo.

Slot Expansion interface in computers, notebooks and other devices. Expansion cards, e.g. →PC Cards, can be plugged or built in here to increase performance, capacity or the capabilities of the device.

Slow synchronisation Flash mode that uses a slow →shutter speed in combination with a →flash. Since the duration of the flash is far shorter that the selected shutter speed, the flash fires at either the beginning (first curtain) or end (second curtain) of the exposure time. Because the fired flash freezes action in the foreground while capturing background scenes in low light conditions with slow shutter speed, the slow synchronisation mode can produce particularly attractive, atmospheric shots. (The night scene mode found in some cameras acts in a similar fashion.)

SLR →Single Lens Reflex.

SmartMedia card SmartMedia cards are small (45mm x 37mm x 0.76mm) and light (approximately 2g) storage media. The controller is located in the drive instead of being incorporated in the card to allow simple construction. (→xD-Picture Card)

Softfocus Image effect offered by some digital cameras where the contours in the image are gentle but the shot is not actually out of focus.

Software General term for all computer →programs.

Solarization An image effect, similar to a mixture between a negative image and colour image. The end effect slightly resembles pictures from a heat-sensitive camera.

Sound recording Some modern digital cameras enable sound to be recorded to either movie sequences or still images. Therefore, through the use of the built-in (or external) microphone, sound effects can be added to images. (→movie recording)

Spot metering →Exposure metering method where the exposure reading is taken from the centre of the frame. This is often used when working with backlight. (→Digital ESP/selective multi-zone metering, →reflected-light metering, →light metering)

SQ resolution. Standard Quality →resolution. Normal or standard digital photo quality where the camera is not used with its full resolution capabilities. It produces a JPEG file with a high level of →compression. In some cameras, you can additionally choose between high and low SQ resolution modes.

SRAM Static RAM. A special type of →RAM that, due to its speed, is particularly suited to tasks where time is a critical factor.

sRGB Abbreviation for "small RGB". The aim of sRGB is to allow different devices to produce colours that look as natural as can be without too much effort. For this to be possible, these devices have to support sRGB. Then, ideally, the colours in a print produced by an sRGB compatible printer should resemble those that were displayed on the sRGB monitor.

SSFDC Solid State Floppy Disc Card. (→SmartMedia card)

Standard interface Standard interfaces include serial, parallel, USB and monitor interfaces. (→Interface)

Step-up-ring →Lens adapter, with which a filter/conversion lens with a wider diameter than that of the camera's lens is attached.

Storage Class →USB Mass Storage Class.

Streamer Internal or external drive for data security involving a so-called streamer tape.

Studio flash Stationary, high power →flash that is mostly used by advertising and fashion photographers. Normally consisting of simply a flash tube and pilot lamp that shines continuously to enable the user to check the exposure, they have no automatic metering system and must be adjusted manually. Studio flashes can be equipped with diverse accessories, such as softboxes, filters, reflectors, Fresnel lenses etc. to achieve special lighting or effects. These flash systems are generally much more powerful than compact flashes and their output is measured not by a →guide number but by watts per second (Ws). Models over 400 Ws usually have to be powered by an external power source. The studio flash is connected to the camera via an →x-synchronisation cable. If several flashes are used, the other units are activated by an activation light from the first flash unit.

Subtractive colour mixing A special method for the production of colour prints that involves layering the colours cyan, magenta, yellow, and black in appropriate proportions, to produce the required colours. (→additive colour mixing)

Sunshine LCD This is a display technology that allows camera →LCD monitors to display bright, clear images even under bright sunlight.

Super CCD A →CCD type developed by Fujifilm that utilises octagonal-shaped pixels arranged in an interwoven pattern.

Super Macro This special feature lets you focus on objects that are only a short distance from the lens – sometimes just 2cm away. As such, it is perfect for capturing detail in very small objects, such as jewellery, flower petals or insects.

Supersonic wave filter A transparent filter located between the camera's →shutter and →CCD. It makes sure no dust is able to land on the CCD. Instead, the particles land on the filter and are then shaken off by a series of ultrasonic vibrations generated by the filter when activated.

SVGA Super Video Graphics Array. Refers to a display screen resolution of 800 x 600 →pixels. (→QXGA, →SXGA, →VGA, →UXGA, →XGA)

SXGA Super Extended Graphics Array. Describes a resolution of 1,280 x 1,024 image →pixels. (→QXGA, →SVGA, →VGA, →UXGA, →XGA)

System camera Camera that can be used with a wide range of accessories from the same manufacturer (lens converters, external flash, external power source, etc.)

T

TCP/IP Transmission Control Protocol over Internet Protocol. Standard →protocol for sending data packets over the internet or network. The data is automatically broken up into small packets. An error correction procedure takes place automatically.

Tele Short for telephoto lens. A lens that offers a narrower angle of view than the standard lens for a given format, e.g. focal lengths above 50mm for the 35mm format, or above 25mm for the FourThirds format. Typical characteristics include a narrow field of view (around 30° or less depending on focal length), short depth of field and the flattening of perspective between objects (i.e. near and distant objects appear closer together) (→Wide angle, →zoom.)

Tele converter Lens attachment that extends the focal length. (→Macro converter, →wide-angle converter)

TFT Thin Film Transistor. TFT displays are used in notebooks as well as in digital cameras from OLYMPUS.

Thumbnail The miniature representation of a digital image that usually serves as a preview in →image editing programs.

TIFF Tagged Image File Format. A specific, high quality →file format used for the storage of →digitised images.

Tripod   Stand to which the camera can be attached to hold it steady, especially during slow exposure shots where camera shake must be avoided. While tripods have three legs, many professionals use single legged monopods to help support long telephoto lenses, giving them more manoeuvrability for action shots.

True Colour   Describes the colour output on a monitor or printer. Requires at least 16 million colour nuances.

TruePic TURBO   Developed by Olympus, the TruePic TURBO image processor automatically enhances important aspects of image quality: colour reproduction (colour range, saturation and brightness), picture sharpness, as well as processing speed.

TTL metering   Through The Lens metering.

TTL flash metering   With →TTL flash metering, the flash light and ambient light is measured through the lens so the intensity of the flash can be set. All work is done by the camera so the flash does not need any metering cells or control circuits. Also, no manual adjustments are necessary.

TWAIN driver   Allows the transfer of →scans or digital photos into →image editing programs.
(The word TWAIN is from Kipling's "The Ballad of East and West" – "...and never the twain shall meet...", reflecting the difficulty, at the time, of connecting scanners and personal computers. It was up-cased to TWAIN to make it more distinctive. This led people to believe it was an acronym, and then to a contest to come up with an expansion. None were selected, but the entry "Technology Without An Interesting Name" continues to haunt the standard.)

U

Underexposure When a shot does not receive enough light with the result that the picture is too dark.

Underwater cases These are special cases that let you take your camera diving with you. Make sure you have a case designed especially for your camera and that you look after the case, especially its seals, as described in the manual. For →DSLR underwater photography additional →underwater lens ports as well as underwater housings for external flash units are required.

Underwater lens ports Water-tight cases for →DSLR interchangeable lenses used in combination with DLSR →underwater cases for underwater photography.

Unsharp Masking Often abbreviated to USM. Describes an image sharpening process. The quality of the result depends on the characteristics of the →algorithm used.

Update An updated version of a →software program or the →firmware (e.g. of a camera).

Upgrade A new improved version of →hardware or →software that is already available.

Upload Process of copying a file from a computer to a remote computer. Opposite of download.

USB Universal Serial Bus (USB) enables the effortless connection of →peripheral devices without the need to install cards into the computer or reconfigure parts of the operating system. The most important advantages are: the support of →Plug and Play, →hot plugging, automatic configuration of external devices upon

connection (no re-start necessary), faster data transfer and the possible operation of up to 127 devices from a single port. USB 2.0 comes in three different speeds: Hi-Speed (480 MBit/s), Full-Speed (12 MBit/s) and Low-Speed (1.5 MBit/s). A further benefit of USB 2.0 is backward compatibility with existing USB technology, so older devices will still work with USB 2.0 at the original speed of the USB 1.1 specification. Newer, Hi-Speed USB-compliant devices will profit from the much faster data transfer speed of USB 2.0.

USB AutoConnect →USB Mass Storage Class.

USB Mass Storage Class With USB Mass Storage Class support, the camera (or any other compatible device) is automatically displayed as an external drive. It can then be easily accessed in any program as a regular drive. Since most operating systems contain the generic Mass Storage Class driver, the camera is recognised without any driver having to be installed. Also called USB Storage Class or USB AutoConnect.

USB Storage Class →USB Mass Storage Class.

Utility A →program that performs special tasks for the operating system, for example: file administration, controlling a digital camera, a CD-ROM drive or printer.

UXGA Ultra Extended Graphics Array. This refers to a display screen resolution of 1,600 x 1,200 →pixels. (→QXGA, →SVGA, →SXGA, →VGA, →XGA)

V

VGA Video Graphics Array. Refers to a display screen with a resolution of 640 x 480 →pixels. (→QXGA, →SVGA, →SXGA, →UXGA, →XGA)

Video output Interface that connects a digital camera with a TV or video recorder.

Video CCD Describes a →CCD specially developed for television and video, also used in digital still cameras. (→Progressive CCD)

Vignetting Fading off the sides of a picture into plain white or black instead of having abrupt edges. Also unintentional loss of brightness at the edge of the image. →Wide-angle lenses are particularly susceptible. However, the problem can be more or less avoided by removing the elements causing the effect, such as a filter with a frame that is too large or an ill-fitting →lens hood.

Virtual Dial The image of a dial displayed in a camera's →LCD monitor. By pressing the control buttons, the user is able to turn this virtual dial to select the different shooting modes.

Virus Describes a computer →program that usually causes damage or destruction of →software and/or data.

W

Weatherproof Weatherproof cameras can be used on rainy days without any danger of water entering the camera. However, they are not waterproof and should not be immersed in water.

White balance The adjustment of a digital camera to the respective type of light (→colour temperature) such as daylight, overcast, tungsten, or fluorescent light for even truer colours, or alternatively, to create a different, striking effect.

Wide angle A lens that offers a wider angle of view than the standard lens for a given format, e.g. focal lengths below 50mm for the 35mm format, or less than 25mm for the FourThirds format. Typical characteristics include a wide field of view, from around 60° and up to 180° (→fisheye lens) depending on focal length, large depth of field and the deepening of perspective between objects (i.e. near and distant objects appear farther apart.) (→Tele, →zoom.)

Wide-angle converter Lens attachment that reduces the →focal length. (→Macro converter, →tele converter)

Windows →Operating system developed by Microsoft.

World Wide Web Currently the most popular service offered through the internet. The WWW provides the possibility to transmit files with multimedia content (texts, sounds, pictures).

Write Acceleration Lexar-developed technology that aims to reduce the overhead required to store images to memory cards for faster write speed performance.

WWW →World Wide Web.

X

xD-Picture Card An innovative memory card standard developed by Olympus and Fujifilm, launched in 2002. Particularly small digital memory medium for digital cameras that is very durable and robust, and allows speedy data transfer rates. Capacities of up to 8 →GB will be possible in the future. (Max. available capacity 2006: 2 GB.)

XGA Extended Graphics Array. A graphics standard developed by IBM, which allows the display of 1,024 x 768 →pixels with up to 65,535 colours. (→QXGA, →SVGA, →SXGA, →UXGA, →VGA)

X-synch cable Cable for connecting a non-dedicated →flash or →studio flash. The cable only passes the command to fire and no other instructions.

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ZIP →File format used for data compression.

ZIP-Drive A device that allows the storage of up to 750 →MB of data.

Zoom lens A type of lens that allows the photographer to vary the angle of view of a scene. By adjusting the focal length the degree of image magnification can be altered. The focal length markings on the lens give an indication of the range of the zoom; e.g. 35-105mm* would be a 3x zoom giving a good range from medium wide-angle to short telephoto angles of view. Some cameras offer a 10x magnification (e.g. 38-380mm*), giving a high magnification for capturing distant objects in close-up. When using such high magnifications it is important to hold the camera steady to achieve good sharp results, especially in low-light conditions. If necessary, brace the camera against a fixed object or use a →tripod.
(* refers to a 35mm camera equivalent focal length) (→Tele, →wide angle, →digital zoom, →focal length)