PHPC Beginners' Guide to Photography #1

This Guide covers Camera Types, the Components of a Camera and Image Formats

Congratulations! If you are reading this guide you have become or are about to become a member of the Pennant Hills Photographic Club (PHPC). In addition you are about to commence an adventure that covers the foundations and basic skills of photography. PHPC for a long time has encouraged learning within the club in fact several of our tenets cover learning and the acquisition of photographic skills:

- **Support learning.**
- **Help members to improve their photography.**
- **Encourage members to share their skills.**
- **Facilitating fellowship and friendship.**
- **Provide entertainment and ensure that each member has a good time.**
- **Continually encourage members to improve.**
- **Ensure that experienced photographers continue to be stimulated and share their skills.**

We are a club with a mix of skill levels but we all share a common interest - **Photography**. With this in mind these guides have been prepared to facilitate the person who is new to photography or who wants to progress from the smart phone currently used.

This guide is by no means critical of smart phones as they are very sophisticated tools with immediate access to social media. However, they do have certain limitations when used as a camera and we will see through these guides the benefits of modern digital cameras that offer interchangeable lenses, larger sensors, and controls that vary lens aperture, shutter speed, and sensor sensitivity. These guides are to be used as a framework to be viewed with a PHPC member who has agreed to pass on his or her knowledge of photography in general as well as the particular camera currently used by you.

Happy learning!

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Let's Talk about Film

In the scheme of things the lifetime of the digital camera can be equated to the opening titles of a Hollywood movie whilst pre-digital cameras would take up the whole movie and closing titles! The camera, oddly enough, was invented many centuries before photography by way of the **camera obscura** that projected a view of an outdoor scene into a darkened room.

In the 19th century, and well into the 20th century, the majority of photographs were recorded on large glass plates and contact printing created the photographs.

In 1835 **W.H. Talbot** made a vital step towards photography by producing prints on paper sensitised with silver chloride that gave image permanency. Steady improvements in lenses, emulsions and illuminants (for simplicity lets say light emitting) soon made projection printing possible and started the steady decrease in format size. The advent of roll film hastened this process and brought about the introduction of the very popular 120-size film just before WWII.

Oskar Barnack took yet another direction, between 1913 and 1914, when he was head of development at Leitz. He was the driving force behind the making of the first mass-marketed 135 camera (Leica) and the introduction of the 36 x 24 mm film format that used 35mm cine film which was popular at the time. The 36 × 24 mm format has been continued today in the use of full frame sensors in digital cameras.

There are many fine photographers who only had film or glass plates available at their time of working but one photographer in particular, Ansel Adams, totally captured the essence of the light sensitive medium (film and glass plate) photography. He molded a style that the modern photographer would find hard to replicate.

Whilst sales of film cameras are extremely small a recent re-emergence has developed by people who are still attracted by the film look in the same way that many audiophiles love the sound of vinyl.

Today film photographs are either produced in the dark room using conventional methods or by scanning the processed film and using computer software to manipulate/improve the image.

Film cameras are still manufactured by such companies as **Leica, Voigtlander, Nikon, Linhof, Fuji, Lomo and Holga.**

These guides will be concentrating on digital photography as digital cameras are so accessible and relatively inexpensive to use but let us not forget that the legacy of film camera design is carried over to many aspects of the modern digital camera.

Modern Film Cameras sold today include Linhof, Nikon, Leica and Lomo

The technology that allows us to snap pictures on our phones in order to upload to Instagram and Facebook was all thanks to engineer Steven Sasson, who invented the digital camera in 1975 at the age of 24 while working for Kodak, the biggest photographic film company at the time. His employers forced him to hide the camera, but decades later, digital photography has disrupted an entire industry and made Kodak film obsolete.

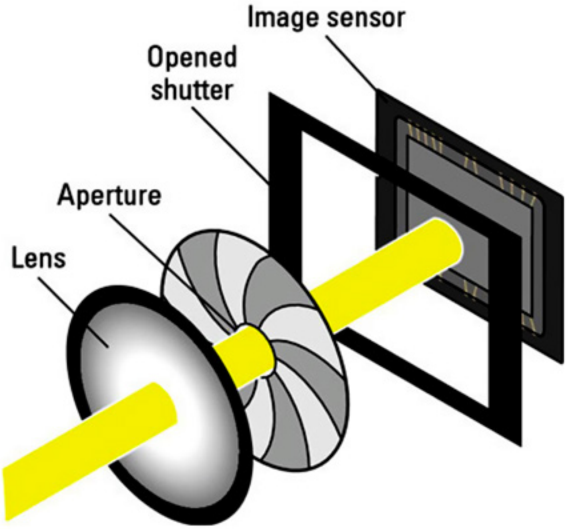
The Digital Camera

The following is a simple definition of a digital camera.

A digital camera is a hardware device that captures digital images and consists of a lightproof box with a light gathering sensor within the box. Attached is a lens that is an optical device that takes scattered light rays and focuses them neatly onto the sensor. The aperture controls the amount of light falling on the sensor by way of an iris built into the lens.

When a picture is taken, the camera's shutter, which is encased in the lightproof box, opens and closes (or turns on and off) exposing the light gathering sensor which translates into an image by electrical means.

The next few pages cover the components of the digital camera and digital camera types in more detail.



Types of Digital Cameras

Click on the Camera for Description

The Body

A camera body is the primary part of the digital camera, and contains the controls, the viewing screen and viewfinder, the internal image sensor, the shutter, the memory card, battery, flash, and associated circuitry … basically it contains all of the components needed to record the photograph.

It is also the part of the camera that you'll hold when using the camera. Some bodies (as in the case of DSLR and mirrorless cameras) allow the coupling of **interchangeable lenses** that greatly add to the versatility of the camera. In compact, advanced compact and bridge cameras the lens is permanently fixed to the body.

We will be talking about the controls of the camera in the next guide but as a taster they will all have exposure controls, a white balance dial, focusing aids, and a shutter release button.

Some cameras have a flip **Liquid Crystal Displays (LCD)** that are particularly useful when taking photographs from a high or low angle and in the case of mirrorless cameras, in particular, inbuilt **stabilisation** is a feature. With the extensive use of rubber gaskets some bodies are advertised as being weatherproof and can be used in stormy weather providing, of course, the front lens element can be kept clear of rain droplets!

These days the main material for the body casing is polycarbonate, which is very tough with high impact and abrasion resistant. Some cameras use a combination of polycarbonate and magnesium alloy whilst other more expensive bodies use magnesium and aluminium alloys.

Whilst a body is very important there is no doubt amongst professional and keen amateur photographers that the lens is the most significant part of a camera. Lenses still continue to perform over numerous upgrades of the body.

Pentax's first full-frame digital image camera, the K-1 DSLR, packing in a 36.4MP CMOS sensor. The K-1's image sensor omits the anti-aliasing, or optical low-pass, filter, relying on an AA Filter Simulator function to reduce moire when needed. Additionally, the camera has a built-in 5-axis Shake Reduction system rated for up to 5 stops of compensation.

The Sensor

An image sensor is a **solid-state** device, the part of the camera's hardware that captures light and converts what you see through a view-finder or LCD monitor into an image.

Think of the sensor as the electronic equivalent of film. With film cameras, you could choose from hundreds of film brands, each with its own unique and identifiable characteristics. With digital cameras, much of that technology is built into the hardware, and you can apply special film-like effects later with software.

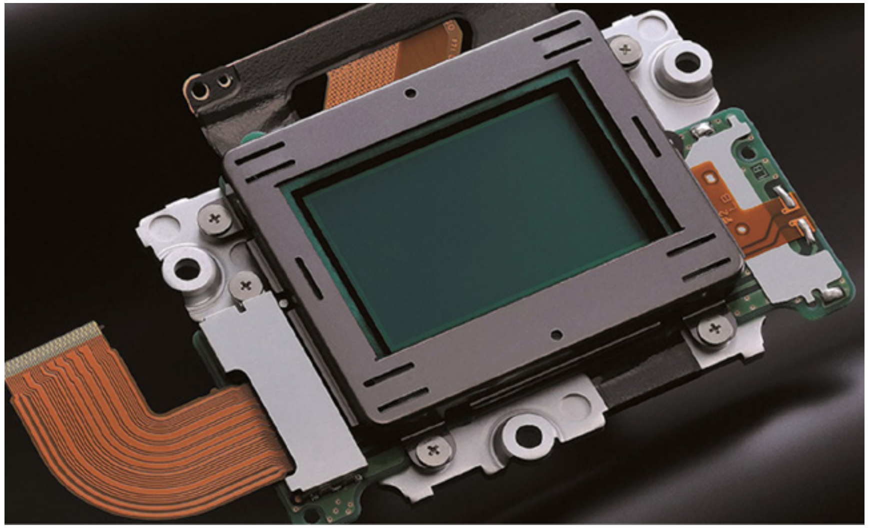
Your camera's sensor determines how good your images look and how large you can scale them or print them. Image quality depends not only on the size of the sensor, but also on how many millions of pixels (light-sensitive photosites) fit on it, and the size of those pixels.

The sensor size also affects what you see through the viewfinder—the relationship between what you're shooting and what actually gets recorded in the frame and passed through to the memory card. Smaller sensors apply a crop factor to lenses, capturing less of the scene than full-frame sensors do. The full-frame reference point is always traditional 35mm film.

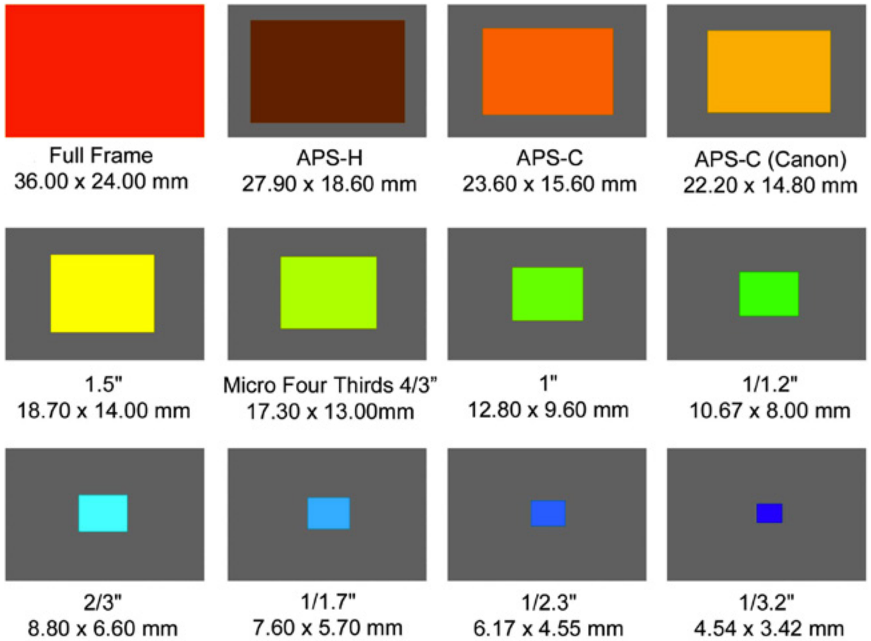
The number of pixels, measured in **megapixels**, are a passionate issue for photographers; they're up there with the "which is better, Canon or Nikon?" debate. Some argue that no-one needs more than 16 megapixels (a few years ago it was 8) while others are of the opinion that the added detail is worth the trade off in terms of noise and the computer processing power needed to handle the extra large files. The truth is that it's always going to be a balancing act between the efficiency of sensor technology, lens quality, image sensor size and ultimately what you want to do with your photographs. If you're going to heavily crop images or print them very large, extra resolution could be useful, if you're only sharing them on line or producing normal prints, not so much. What can conclusively be said is that only you can make a call on megapixels in conjunction with considering sensor size.

The most common sensor types used today are **CCD** (semiconductor charge-coupled device) and **CMOS** (complementary metal–oxide–semiconductor). Used for a number of years in video and stills cameras, CCD sensors long offered superior image quality to CMOS sensors, with better dynamic range and noise control. To this day they are used in budget compacts, but their higher power consumption and more basic construction has meant that they have been largely replaced by CMOS alternatives. They are, however, still used in medium format backs where the benefits of CMOS technology are not as necessary. Long seen as an inferior competitor to the CCD, CMOS sensors have progressed to match or better the CCD standard. With more functionality built in than CCDs, CMOS sensors are able to work more efficiently and require less power to do so, and are better suited to high-speed capture.

To summarise, in general terms, cameras with larger sensors tend to be bigger and more expensive than those with smaller sensors. The laws of physics dictate that larger sensors produce better quality images. But for most photographers budget and the burden of weight play an important part in the selection of sensor size.



Above: the full frame CMOS sensor from a Nikon D600
Below: the relative sizes of commonly used sensors. The APS-H format was developed by Canon but is not widely used today. The chart below excludes medium format cameras.



The Shutter

Before the existence of digital sensors it was vital your camera had a **mechanical shutter/(focal-plane shutter)**. This is because you can't simply turn film on or off like a digital sensor. Pre-developed film is light sensitive, meaning any exposure to outside light would severely damage your images. However, in the age of digital photography the landscape is certainly different. Modern sensors are fully capable of taking photographs without a mechanical shutter.

Smaller consumer cameras, like point-and-shoots and phone cameras, are all examples of **shutterless** cameras. Shutterless cameras tend to have more image noise in the image than their traditional shuttered counterparts. This is because shutterless cameras constantly send power to the sensor. When a user hits the shutter button the sensor is flooded with more power and the image is captured and when you become familiar with ISO you know that more power equals more noise. Even though there are many types of mechanical shutters, those that are used in modern cameras are composed of thin curtains that quickly expose or hide the sensor. Exposure can happen in two different ways. The first curtain opens and it exposes the whole sensor, then the second curtain closes and it terminates the exposure. This is possible only at slower shutter speeds: the fastest shutter speed that allows the camera to work in this way is the "syncro-X" or "syncro-flash" speed, and usually it is around 1/250 of a second. At fast shutter speeds, the second curtain begins to close while the first curtain is still not fully opened: the result is that the whole frame is not exposed in the same instant, but it is reached by light in slightly different moments (we are talking about extremely small fractions of second!)

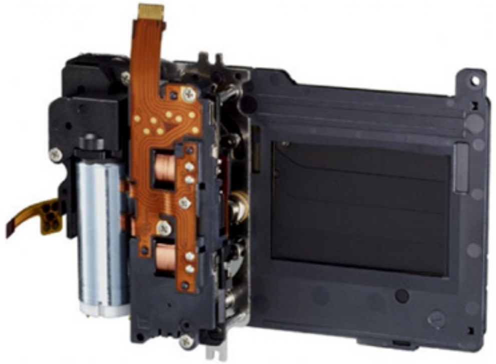
In a DSLR there is a further complication. When you look through a DSLR viewfinder you are essentially looking through a series of mirrors (by way of a **pentaprism**) that get their light directly from the lens. When you click the shutter button that system of mirrors flips upwards to allow light to pass to the sensor. This is why the viewfinder goes black for a short amount of time when taking photos. Once the mirror flips upwards the shutter works as previously described. The entire action is known as an **actuation**. To see a schematic diagram of a DSLR click here.

A typical DSLR can withstand over 100,000 actuations in its lifetime whilst a high performance DSLR is rated around 400,000 actuations. Note that some cameras use an electro-mechanical shutter that increase flash synchronisation speeds but their life cycle is inferior to mechanical.

It seems strange that manufacturers still use mechanical shutters especially if we look at the pros and cons of electrical shutters but there is one very important reason why manufacturers retain their mechanical shutters. Despite this clinching reason electronic shutters are more robust and reliable, because there are no moving parts. They are silent. They eliminate the risk of image blur at slow shutter speeds created by the shutter and mirror vibrations in the case of DSLR's. They allow extremely fast shutter speeds: while most mechanical shutters top out at 1/8000 sec, electronic shutters can go far beyond. They improve battery life because there are no moving curtains. They improve autofocus (AF) speed and tracking, because the AF sensors (placed directly into the main image sensor) are always exposed to light.

The critical problem with electronic shutters is **rolling shutter.** Instead of capturing the whole photo at a time, the electronic shutter 'scans' the sensor from top to bottom. If you take a photo of something that is moving fast, the top and the bottom areas of the sensor will record it in slightly different instants, and the result is that it looks distorted or 'skewed'. This is called the **jello effect**. This problem could be eliminated if electronic shutters became as fast as mechanical shutters to scan the frame, but sadly we are not there yet. However high end video cameras are being produced with a global shutter which is an electronic sensor that captures an entire frame at once. Global shutters are expensive to manufacture and it could be some time before we see them in still cameras. Note that mechanical shutters are also prone to rolling-shutter but to a far lesser degree.

The shutter from a modern DSLR.

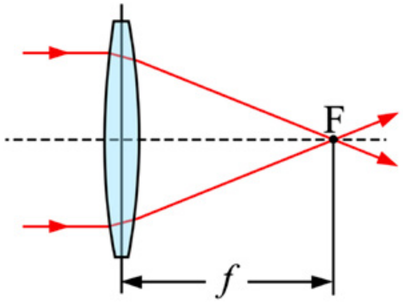


The effect of rolling-shutter where the sensor scans from top to bottom recording the image at different time intervals producing the jello effect.

The Lens

Lenses are arguably the most important part of your camera set-up, they make or break your pictures. They control the image that's projected onto your imaging sensor, and ultimately what photos you are taking home. As such, many photographers would prefer to shoot with an okay camera and a great lens, than a great camera with ho-hum glass attached. But knowing the importance of good glass is one thing, it's another to know what lens will give you the creative freedom to capture the photos you want to get.

The jargon associated with lenses is confusing and we will be covering many of the attributes of lenses in a later guide. In the meantime one important feature is worth discussing – the **focal length** of a lens.



Focal length f is the distance in mm from the **optical centre** of a lens to a point where a subject at **infinity** appears in sharp focus - usually the surface of a piece of film or a digital camera's sensor. In the days when 35mm film cameras ruled the roost, we all got used to what the various quoted focal lengths of lenses meant. For example, we knew that a 28mm lens gave a wide-angle view while, say, a 300mm telephoto lens offered a much narrower angle of view that brought far-away subjects much closer.

These days, with digital cameras using different and generally smaller sized sensors, it can be harder to get a feel for the angle or field of view of a given lens. When you consider that some compact cameras have lenses with focal lengths as short as 6mm, it's almost impossible to know what sort of field of view that lens offers. To get around this confusing situation, camera manufacturers often quote their lenses or cameras as having a 35mm equivalent focal length. This is an indication of what the angle of view of a lens would be if it were scaled up to work on a 35mm film camera.

So, when you read that a compact camera has a zoom lens covering a range of 24-105mm… that isn't the actual focal length of the lens - it's the 35mm equivalent. This system of using a focal length equivalent works well for most of us as it makes comparing models of cameras and zoom ranges with different sized sensors so much easier.

This Canon full frame lens is a 50mm f1.2 prime lens. Extremely fast and expensive!

This Nikon full frame zoom lens has a focal range of 70mm to 200mm with a vibration reduction mechanism built into the barrel of the lens.

Memory Cards

Memory cards are small devices (some no bigger than your thumbnail) that are used to store electronic data. Memory cards, also referred to as flash memory, are essentially chips that allow users to write and rewrite data multiple times. Some of the key features of flash memory cards include their small size and the ability to retain data without a power supply. This allows them to fit into a variety of portable consumer devices such as cameras.

The memory card market does sometimes seem overcomplicated, but if there's one thing you need to remember image quality is completely unaffected by your choice of memory card. The difference, however, is that the cheaper card may do it much more slowly, be less reliable, have fewer backup measures, different components, and, in terms of memory card data recovery, may not be such a wise choice if things go wrong and your images go missing.

Today by far the most popular memory card is the **SD (Secure Digital) card**. The original SD cards only went up to 2GB, so **SDHC (Secure Digital High Capacity)** was invented with a maximum capacity of 32GB. They are identical in shape and size, but they are different media types. Though your camera may fit a SDHC, be careful because if the camera was made before SDHC came along it may not recognise it.

SDXC (Secure Digital 'Xtra Capacity') Memory Cards are SD cards but with a much higher capacity and faster processing speeds. These have a maximum capacity of 2TB (Terabytes). Similar to SDHC, in that an SDXC fits in a normal SD slot – but your camera may not be able to recognise this newer technology, so always check in advance. Refer to the matrix opposite to see class nomenclature and suggested applications. The markings on an SD card are explained **here**.
A new range of SD cards has been introduced, the V range, to handle the requirements of videographers.

Other types of cards include **CompactFlash, Micro SD** and **XQD**.

For a detailed review of memory cards and their relative speeds click on this internet link *Fast Memory Cards*

The SD Card is a very common memory card used in digital cameras

A card reader can be used to transfer images to a computer.

	Mark	Minimum Serial Data	SD Bus Mode	Application
UHS Speed Class	U3	30MB/s	UHS-II UHS-I	4K2K Video Recording
UHS Speed Class	U1	10MB/s	UHS-II UHS-I	Full HD Video Recording HD Still Image Continuous Shooting
Speed Class	CLASS 10	10MB/s	High Speed	Full HD Video Recording HD Still Image Continuous Shooting
Speed Class	CLASS 6	6MB/s	Normal Speed	HD and Full HD Video Recording
Speed Class	CLASS 4	4MB/s	Normal Speed	HD and Full HD Video Recording
Speed Class	CLASS 2	2MB/s	Normal Speed	Standard Video Recording

Batteries

Cameras have long required batteries in order to work, and whereas the small button batteries used in older 35mm film cameras would always last for several weeks if not months, digital cameras are a different proposition altogether. That's essentially because all the extra electrical circuitry, LCD displays, electronic viewfinders, built-in flashguns and suchlike add up to a much more power-hungry device.
In technical terms, battery manufacturers refer to digital cameras as 'high-drain' devices, which essentially means you can expect to have to change or, more likely, recharge your camera battery much more often than many other small electrical devices you might own, except your mobile phone of course, which is also classed as high-drain.

Batteries come in all shapes and sizes and employ a range of different chemical reactions in order to produce power.
As far as photographers are concerned though the most popular battery size is AA. These can be used in a relatively small number of budget compacts and bridge cameras, though advanced compact cameras, mirrorless and DSLRs almost universally use their own proprietary batteries.

Lithium-Ion (Li-ion) cells are by far the most common type of proprietary camera battery. The main reason for this is that they are extremely lightweight, can be recharged many times over and are capable of delivering a higher than average voltage than other cell types.
In addition, subject to being stored at a reasonable temperature, they are also much less prone to self-discharging when not in use.

The overwhelming majority of Li-ion camera batteries are moulded so that they fit snugly inside the battery compartment of your camera. Depending on the make and model of your camera you may have to charge them inside the camera via a proprietary lead, or you might have to take them out and place them inside a charger provided as an accessory with your camera. If you have the option to do both then the common-sense approach is to take them out and use the charger – that way if something goes wrong during the charging process your camera won't get damaged and you are able to continue using your camera with a second pre-charged battery.

An option open to many DSLR and some mirrorless owners is to purchase an optional **battery grip**. These serve a number of purposes, not all of which are related to battery performance. For example, battery grips often come with an extra shutter button and/or mode dials so that you can more easily use the camera in portrait mode. In addition many battery grips also increase the maximum continuous shooting rate of the camera.

A Panasonic Lithium-ion Battery used in a variety of Panasonic Cameras including the GH2, GX8, G7, G85, FZ1000

Example of a Battery Grip made for the Canon EOS D5 Mark IV DLSR camera. The grip can hold 2 LP-E6/LP-E6N Li-ion batteries.

Connectivity

WiFi

A feature that's beginning to appear more and more often in compact high-end digital cameras is the ability to connect to a **WiFi** network. When you can send photos wirelessly through your home WiFi network, it can greatly simplify the process of creating backup copies of your images, as well as sharing photos with others. Some cameras allow you to make direct connections to Facebook or other social networking sites, too, which can be a great feature. Many WiFi-enabled digital cameras also now give you the option of uploading your photos to the cloud, which usually is a storage site that's owned by your camera's manufacturer. Using the cloud to store your photos is a great idea, as you'll always have backup copies away from your home computer, where they'll be safe from a fire or other natural disasters. The wireless capabilities that have been included in many of the cameras on the market are truly incredible. Most cameras with Wi-Fi also have a partner App for either iOS or Android that allow you to control the camera from a smartphone or tablet.

NFC

Near Field Communication, better known as NFC, is an alternative type of wireless connectivity that enables a short-range communication between mobile devices. To initiate a NFC connection, two NFC enabled products are required to be placed within 10cm of each other, after which data or images can be transferred via a Wi-Fi connection. Rather than relying on radio waves, NFC uses electromagnetic radio fields to form its communication.

BLE

Some manufacturers such as Nikon and Panasonic are revising their wireless connectivity protocol to make it easier to pair a camera with a mobile device. Introduced into the new Nikon D500 DSLR and Panasonic GH5 **Bluetooth low energy** (BLE) is used to establish an "always on" connection for transferring images from the camera to the connected device.

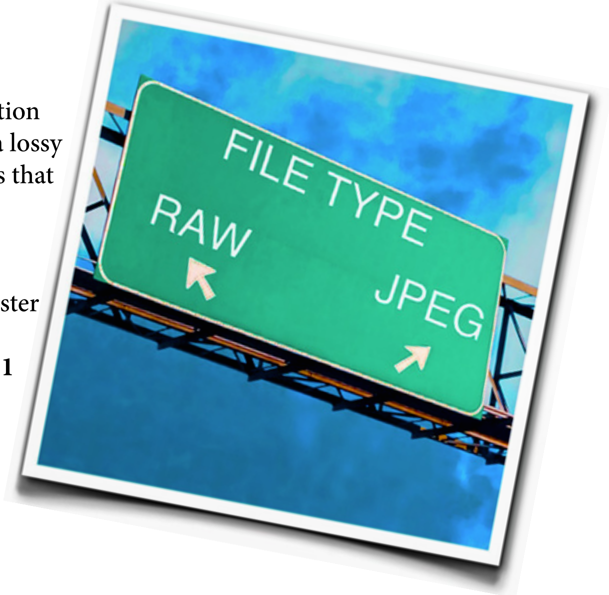
GPS

Cameras that have a built-in **Global Positioning System** (GPS) can record the location of each of your photos directly in the image. This way you can remember where you took them, and organize them by location automatically! The geo tag info that gets embedded with each photo is just another way to jog your memory on where and why a photo was taken. You can quickly see the location or view your photos via a map - no more guessing where in Europe you took a photo of that statue or where you were with friends when that awesome photo was taken. Most people don't have time to label all their photos and the GPS goes a long way to labeling them for you. Coupled with places of interest databases you don't just get co-ordinates you can actually get human readable places – Niagara Falls, Venice Beach, Eiffel Tower, etc. Note that some downloaded Apps allow you to use the geolocation established by your smart phone or tablet for transfer to your image through connectivity.

To activate the above functions you will need to consult the instruction manual supplied with your camera.

Digital Image Formats

Today most cameras record images in JPEG (Joint Photographic Expert Group) and RAW. The inclusion of Tiff (Tagged Image File Format) is no longer supported by the majority of manufacturers and some compact cameras will record JPEG only. A very useful feature promoted by some manufacturers is the ability to shoot in both **JPEG and RAW at the same time.**



Compression

File compression can be achieved in basically two ways: **lossless** and **lossy**. A lossless compression algorithm does not discard any information from the file. Moreover, it looks for efficient ways to represent an image without compromising on its original quality. On the other hand, a lossy compression algorithm reduces the file size by compromising to a certain extent on the image quality. The advantage of compression files is that it increases the storage capacity of the camera and file sizes are such that they allow the easy transfer of files to social media and email.

JPEG

This is the most popular form of storing digital images. When you shoot using JPEG you get more photos on your memory card, and it's faster (in terms of saving the image to the camera). However, JPEG does have disadvantages because the compression algorithm used to save the image disregards far too much image information that cannot be reconstructed during decompression. JPEG usually achieves a **10:1 to 20:1 compression** with little perceptible loss of image quality. You can adjust the amount of compression, so you can control the image quality and the file size. JPEG compression discards so much information that it is much more difficult to effectively post process your image (i.e. correcting colour, sharpness and increasing the size of the image.)

TIFF

Even if your camera doesn't include TIFF as a capture option, you might convert your raw files into TIFF format for subsequent editing.
The advantages of the TIFF format are few - but significant:
1. Like raw files, they can contain all the pixel data that makes up the image. This provides much more editing flexibility than JPEGs.
2. Like JPEGs they can be 'read' and manipulated in almost all editing software and printed on almost every printer.
However, TIFF files have a couple of disadvantages. For starters, they are usually very large. A 16-bit TIFF file from a 10-megapixel DSLR camera can contain more than 60MB of image data. This makes them unusable in web-based situations and too large to send via emails. TIFF files also contain adjustments applied by the image processing system in the camera (in the case of cameras that include TIFF capture) or in the editing software. These adjustments may not be appropriate for your requirements and will, therefore, need to be over-ridden, which can compromise picture quality.

RAW

RAW is basically just that – **the raw, unprocessed, naked image**. Think of it as the digital negative, because it performs the same function as negatives do in film photography. Just like with film negatives, RAW files need to be "processed" into a viewable format usually **TIFF, JPEG or PSD** (Photoshop Document). Also, RAW files – like film negatives – have a wide dynamic range (the measurement between maximum and minimum values.) You shoot RAW if you expect to do a good amount of post processing work in your digital darkroom. Let's say you shot indoors under tungsten lights, but you forgot to change the camera's white balance from daylight. If you save the image as a JPEG, you'll be junking most of the colour information and you'll end up with that red/yellow image (that we've all cringed at). With a JPEG you can't get that lost information back, manipulating the image would be difficult, and you still might not get a pleasing image. However, as a RAW file, all the colour data is still available, and you can recover the image; correct the white balance and… voila, a much more appealing photograph.

When using the RAW format the file is saved in the file extension offered by the manufacturer eg CR2, (Canon) NEF, (Nikon) ORF, (Olympus) and RW2, (Panasonic). The images are converted to a viewable format and enhanced via a raw converter such as Adobe Camera Raw, Lightroom, Capture One Pro, FastStone Image Viewer (free) and DXO Optics Pro.

Digital Image Formats....cont

To introduce some commonality, with added side benefits, the **DNG (Digital Negative)** format was developed by Adobe and released in 2004. You might want to consider converting your RAW files to the DNG format as it offers some serious benefits.

One of the problems in photography right now is that the vast majority of camera manufacturers have their own proprietary RAW formats. Proprietary formats eg NEF or CR2 might be difficult to read in the distant future since the format hasn't been openly documented and support from the manufacturer may not always be there. It's hard to imagine not being able to open Nikon or Canon or files today, but ten or twenty years from now who knows where those companies could be!

Since the DNG format (**.dng**) is open source anyone can write software to read or write the format. It's not limited to Adobe software like Lightroom and Photoshop. Many different software developers support the DNG format.

There are also no license restrictions so camera manufacturers could use DNG as their default RAW format instead of their proprietary format. Some camera manufacturers, like Leica, already capture in the DNG format. If other camera manufacturers adopt a universal format in the future it's highly likely it will be the DNG. Other benefits include smaller file size (DNG files are around 15-20% smaller in file size than proprietary RAW files without any loss of quality) XMP sidecar files (instructions about the files) are included in the DNG file so you only have one file to worry about.

What is best JPEG or RAW?

That's a decision that you make based upon your photographic wants and needs. It's more than just considering file size; it's anticipating how much post processing work that you might have to do get the best image possible. One major drawback to RAW is that there's no standardisation, so each camera manufacturer has their "style" of RAW unless you **convert to DNG**. Professionals mainly shoot in RAW because they need to be able to make as many unrestricted changes as the client wants for the final image, and you may want that too. You need to be computer savvy to get the most out of RAW.

In addition, the unprocessed nature of RAW files allows you to keep options open for the future with your images as new photo imaging software comes out and your ability to edit images changes. While JPEG is one of the most widely used file formats that allows you to save an image as a small file and high quality, RAW files are larger in size **but maintain exceptionally good picture quality**, which is preferred by serious photographers.

"I wanted to see how a Panasonic Lumix LX100's jpeg file compared to a processed RW2 file using my usual workflow with Lightroom and Photoshop. The RAW file is on the right hand side. The jpeg straight from the camera on the left, and it's by no means horrible but I find it quite flat in several ways. First the white balance, which I had set for cloudy, gives the whole image a rather warm tone that doesn't show the different tonalities I could see, especially the blue hues coming from the fog in the background. Then the detail and sharpness are not great in the jpeg.

However, the processed RW2 file shows the potential of this little camera. I could tweak the white balance to try and match the different tonalities I could see with my bare eye. The warmer tones of the red and orange leaves provided a lovely contrast with the colder tones of the fog. Detail and sharpness can be improved vastly and even though the LX100 could not match my full frame Canon cameras, it produces some really nice RAW files to work with.

I would say to anybody using the Lumix LX100 to forget about its jpeg from camera files and use exclusively the RW2 format. If you are in need of sharing an image from the camera you can always use the in-camera RAW processor, produce a jpeg and then send it anywhere."
Alfonso Salgueiro Lora

Glossary

aperture	Aperture refers to the opening of a lens's diaphragm through which light passes. It is calibrated in f/stops and is generally written as numbers such as 1.4, 2, 2.8, 5.6, 8, 11, 16, 22
compression	Image compression is minimizing the size in bytes of a graphics file without degrading the quality of the image to an unacceptable level.
contact printing	In a darkroom an exposed and developed piece of photographic film is placed emulsion side down, in contact with a piece of photographic paper, light is briefly shone through the negative and then the paper is developed to reveal the final print.
digital zoom	Digital zoom is a function of a digital camera used to make the image seem more close-up. Digital zoom on a digital camera works the same as cropping and enlarging a photo in a graphics program. This type of zoom will result in a loss of quality and image resolution because the image is simply being enlarged without any extra details or pixels being added.
dynamic range	Dynamic range in photography describes the ratio between the maximum and minimum measurable light intensities (white and black, respectively).
field of view - angle of view	The field of view is that part of the world that is visible through the camera at a particular position and orientation in space; objects outside the FOV when the picture is taken are not recorded in the photograph. It is most often expressed as the angular size of the view cone, as an angle of view.
focal flange length	The flange focal distance (FFD) (also known as the flange-to-film distance, flange focal depth, flange back distance (FBD), flange focal length (FFL), or register, depending on the usage and source) of a lens mount system is the distance from the mounting flange (the metal ring on the camera and the rear of the lens) to the film plane. This value is different for different camera systems. The range of this distance which will render an image clearly in focus within all focal lengths is usually measured in hundredths of millimeters and is known as the depth of focus (not to be confused with the similarly named depth of field).
focal length	Focal length, usually represented in millimeters (mm), is the basic description of a photographic lens. It is not a measurement of the actual length of a lens, but a calculation of an optical distance from the point where light rays converge to form a sharp image of an object to the digital sensor or 35mm film at the focal plane in the camera. The focal length of a lens is determined when the lens is focused at infinity. See page 9 of this guide.
iris diaphragm	The iris diaphragm is placed in the light path of a lens. Setting the aperture regulates the amount of light that passes through the lens.
memory card	A memory card, or flash card is an electronic flash memory data storage device used for storing digital information.
pentaprism	A pentaprism is a five-sided reflecting prism used to deviate a beam of light by a constant 90°, even if the entry beam is not at 90° to the prism. The beam reflects inside the prism twice, allowing the transmission of an image through a right angle without inverting it (that is, without changing the image's handedness) as an ordinary right-angle prism or mirror would.
pixel (megapixels)	A pixel is generally thought of as the smallest single component of a digital image. Megapixel means one million pixels.
prime lens	A prime lens is a photographic lens whose focal length is fixed, as opposed to a zoom lens.
resolution	Resolution is the detail an image holds. The term applies to raster digital images, film images, and other types of images. Higher resolution means more image detail.
roll film	Roll film is any type of spool-wound photographic film protected from white light exposure by a paper backing, as opposed to film which is protected from exposure and wound forward in a cartridge.
selective focus	Use of limited depth of field to focus sharply on a specific object in a scene, while other parts are clearly out-of-focus.
sensor	A sensor is a solid-state device which captures the light required to form a digital image. See page 7 of this guide.
sensor size/format	The image sensor format is the shape and size of the image sensor. See page 7 of this guide.
shutter	A shutter is a device that allows light to pass for a determined period
stabilisation	Image stabilization (IS) is a family of techniques used to reduce blurring associated with the motion of a camera or other imaging device during exposure.
syncro X syncro flash speed	X-sync is the flash synchronization setting to be used with electronic flash units. It is important that the moment of flash maximum output coincides with the shutter being fully open.
zoom lens	A zoom lens is a mechanical assembly of lens elements for which the focal length (and thus angle of view) can be varied, as opposed to a prime lens which has a fixed focal length.

Ansel Adams was born on February 20, 1902, in San Francisco, California. Adams rose to prominence as a photographer of the American West, particularly Yosemite National Park, using his work to promote conservation of wilderness areas. His iconic black-and-white images helped to establish photography among the fine arts.

On his first trip to the Sierra Nevada, in June of 1916, Ansel Adams went armed with a camera—a Kodak No. 1 Brownie—and started shooting. “I expect to be broke if I keep up the rate I am taking pictures,” the budding 14-year-old photographer wrote to his Aunt Mary in San Francisco that summer. “I have taken 30 already.”

He kept shooting for almost seven decades, until his death at age 82 in 1984, by which time he had become a world-famous photographer and a powerful voice for wilderness. He liked using a large format camera 8x10inches. For the last 20 years of his life, he used a Hasselblad medium format camera on which he created the famous “Mood and Half Dome” image.

Adams developed the *“Zone System”* of controlling and relating exposure and development, enabling photographers to creatively visualize an image and produce a photograph that matched and expressed that visualisation.

Click on the thumbnail for larger view

Digital Noise

In digital photographs, "noise" is the commonly-used term to describe visual distortion. It looks similar to grain found in film photographs. While there are absolute numbers that are used to define levels of noise, the amount of noise that would be considered unacceptable to one photographer might be fine for someone else. A snapshooter, for instance, may not care about noisy images as much as an enthusiast or professional photographer. It also depends on usage. Higher noise might be tolerated in, for example, a night time sports action shot, but that same amount of noise would render an architecture photo, where detail and colour fidelity are critical, unusable. The size of the prints you make also factor into the "how much noise is too much" equation. Bigger prints will show noise artifacts more than small ones. Also "acceptable" noise is a very subjective concept!

Causes of Noise

Higher ISO, which you may need when shooting in low light, is the main culprit in causing more noise. In a photograph, the higher the ISO, the more noise shows in the image. When it comes to noise, sensor size matters. Cameras with smaller sensors, such as cell phones and compact cameras, have thumbnail-sized sensors, and on these cameras noise can reach unacceptable levels even at ISO 400. By the time you reach ISO 800 or higher, the picture may end up looking like an impressionist painting and lose sharpness, detail and colour fidelity. Cameras with larger sensors, such as DSLRs and Mirrorless cameras, produce lower grain at higher ISOs. The larger the sensor, the better the grain at comparable speeds. Pixel Density is also an important consideration. A sensor with 14 million pixels (megapixels) will produce more digital noise than an equal-sized sensor with 10 megapixels. That's because, in order to squeeze those extra 4 million pixels, the actual pixel size has to shrink, which means each pixel will let in less light. To compensate, the amplification "gain" is turned up, and this causes distortion. Conversely, a larger sensor with 14MP will produce less grain than a smaller 14MP sensor.

Long exposures can introduce static, which can also be a cause of digital noise. If you are shooting in broad daylight at a higher ISO, the grain might not be so obvious…unless you look at the shadow areas. Grain shows up more against darker subjects or backgrounds. It gets even worse if, using image-editing software such as Adobe Photoshop, you lighten an image. Then the grain in the shadow areas will become even more obvious.

How to reduce noise

Shoot at a low ISO. Since higher ISOs produce more noise, choose the lowest ISO you can while still getting a good exposure. For a compact camera, that might mean only shooting at ISO 100. For a DSLR, you might get away with ISO 1600-4000, or even higher on some recent models. If you shoot only at low ISOs, however, you will likely need a tripod or a flash for low-light photography.

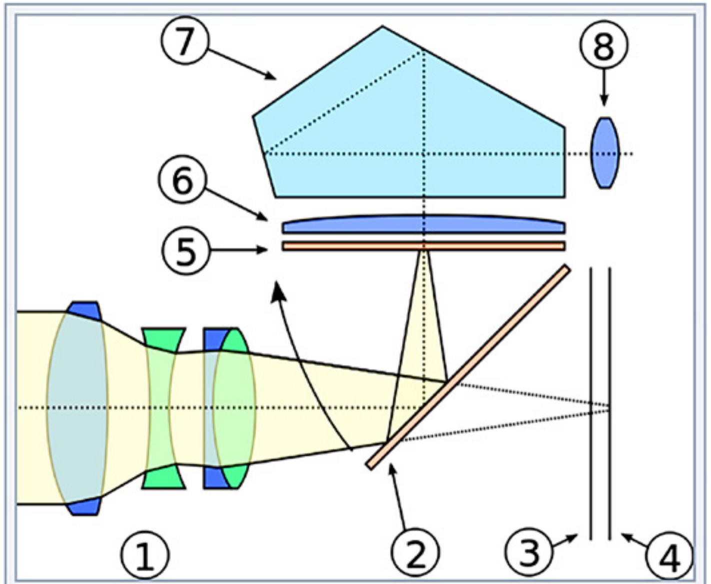
Get a camera with a larger sensor. Give your compact camera to your kids and move up to a DSLR, and you'll see a major improvement in image quality. DSLR too big or heavy? Consider one of the new breed of mirrorless cameras.

Use your camera's on-board noise-reduction. Many modern digital cameras, both compacts and DSLRs, have built-in noise reduction, and many compact cameras will apply noise-reduction to JPEG images as a default. DSLRs tend to have the option of noise reduction on, off, or on at high or low settings. If you definitely want noise reduction off, shoot in RAW mode.

Use noise-reduction software on your computer
If your camera doesn't have noise reduction built in, or you prefer shooting in RAW and adjusting the noise levels after the fact, use noise reduction software such as Nik Dfine, Topaz DeNoise, and Noiseware. The advantage of using noise reduction software over in-camera noise reduction is that you have more powerful tools such as reducing grain selectively to parts of the picture where it's needed while leaving other areas alone.

Anatomy of a DSLR

Courtesy of Wikipedia



The photographer can see the subject before taking an image by the mirror. When taking an image the mirror will swing up and light will go to the sensor instead.

1. Camera lens
2. Reflex mirror
3. Focal-plane shutter
4. Image sensor
5. Matte focusing screen
6. Condenser lens
7. Pentaprism/pentamirror
8. Viewfinder eyepiece

To hear the shutter of a Nikon D5 at 12 frames per second double click the recorder.

This 20.8MP full frame DSLR is designed as a workhorse for professional photographers. It will shoot at 12 frames per second and has an ISO range of 100 - 102,400 which can be expanded to ISO 50-3,280,000.

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Memory Card Markings

1 - Maximum Read Speed -This is the maximum read speed of the card usually given in Megabytes per second (MB/s). Note that cards rarely are able to sustain these speeds for long periods of time.

2 - This is another (rather outdated) way of expressing the max read speed. It is based on the read speed of audio CDs at 150 KB/s. You can figure out how fast a 1000x card is in KB/s by multiplying 150 by 1,000 and converting KB/s to MB/s by dividing by 1,000 (the answer is 150 MB/s).

3 - Type - This is the type of card; different card types use different file formats and newer cards won't work in older card readers.

4 - UHS (Ultra High Speed) Class Rating - This is the minimum sustained writing speed of the card; important for video recording. UHS Speed class 3 cards will never write slower than 30 MB/s, UHS Speed class 1 cards never slower than 10 MB/s.

5 - Speed-Class Rating - This is an older speed-class rating. It is redundant of the UHS speed class, but many card manufacturers include it, as well, since many consumer products still recommend products based on the old standard. A class 10 is the fastest of the old speed class ratings and a class 10 card is verified to never write slower than 10 MB/s, class 4 would be never slower than 4 MB/s.

6 - UHS Rating - The UHS rating of a card determines the maximum bus speed at which a card can read, assuming the memory in the card is fast enough to match it. Non-UHS cards max out at 25 MB/s, while UHS-I cards support up to 104 MB/s, and UHS-II cards support up to 312 MB/s. Both the card reader and card must support the same standard to benefit from the increased speeds, but UHS cards are backward compatible with older readers—they just won't be as fast in them.

7 - Capacity - This is the card's capacity: SD cards range up to 2GB, SDHC cards range from 2GB to 32GB, and SDXC cards range from 32GB to 2TB.