

4 technofile: digital cameras

Still using a traditional film camera? Here's a test, then: over the past decade, total up how much money you've paid in terms of developing photos and must-have reprints. Scary, isn't it? Purchase a digital camera, though, and you never need visit Boots' photo lab again. Gordon Laing explains the technology behind these devices

Digital cameras have truly come of age, evolving from expensive gadgets into affordable devices that combine the best in features, quality and value. They're now within reach of anyone wanting a fun yet powerful camera. And such is their popularity that this year's sales overtook those of traditional film models. It's not hard to see why.

Digital cameras let you see your photos only moments after you've taken them, allowing you to reshoot any that have gone awry. Better still, you need only print the ones you want and delete the rest from reusable memory cards. Most digital cameras can also be connected to TV sets for large-screen slideshows and many can even capture short video clips with sound.

As such, modern digital cameras out-perform and out-feature most film cameras and are therefore ideal for virtually every photographer. But with a huge choice and range of prices, where do you start?

Here at *PC Advisor* we've identified three types of buyers and cameras to suit them. First up there's beginners who want a no-nonsense introduction to digital photography with models costing up to £299. Then there's those users who need greater sophistication and quality, whether buying for the first time or upgrading; this intermediate category ranges from £300 to £699. Finally

there's the serious enthusiasts and professional photographers who can justify spending over £700 to enjoy the ultimate in quality, features and handling.

Over the following pages, we'll explain how digital cameras work, focus on their important features and list what you should look out for in each price category. We'll tell you how many megapixels and megabytes you really need, what kind of lens is best, not to mention which gadgetry is really worth having. Whether you're a seasoned professional or simply buying your first digital camera, this is the place to come.

Let's get digital

Digital cameras may represent the height of modern technology, but they have plenty in common with their traditional film counterparts. Both devices essentially consist of just three main elements: a lens to focus the light, a sensitive material for recording the image and a light-proof box to house them along with user controls.

In the case of traditional cameras, the photo-sensitive emulsion of the film itself is both sensor and storage medium. After chemical processing, the film loses its light sensitivity and subsequently can be stored and used for producing a photographic print if desired.





Beginner cameras

Up to £299 inc VAT

While digital cameras are now available from £39, they remain little more than a novelty purchase. Prices start around £99 for a useful entry-level 2Mp model, although you're unlikely to get an optical zoom or much creative control at this price. Increase your budget to £199 and you'll be able to purchase a 2Mp camera with a 3x optical zoom or a 3Mp device with no optical zoom.

If you have between £249 and £299 to spend, things really start to look up. You'll be able to afford numerous 3Mp cameras sporting 3x optical zooms, decent creative control and good features.



Intermediate cameras

£300-699 inc VAT

If you have a £300-£399 budget you'll be able to afford a selection of 4Mp cameras with 3x optical zooms and fair creative control. Around the £399 mark is also where you'll find the slim and sexy lifestyle models sporting 3Mp or 4Mp resolution.

The first 5Mp 3x zoom cameras start around £449-£499, although for similar money you could go for a lower resolution camera with a much longer optical zoom – a better choice if you concentrate on small and distant subjects. The £599-£699 range will buy you an excellent compact 5Mp model with a 4x optical zoom and tons of features. These devices will satisfy all but the most demanding photographers.



Professional cameras

Over £700 inc VAT

From £700-plus you're in the Professional market, with models falling into two categories. The £700-£999 range sees cameras sporting 5Mp to 8Mp resolution, optics from 5x to 8x and plenty of manual control. Above £1,000 buys you a digital SLR, which takes existing 35mm lenses and offers fast handling with superb control. Be warned, though: prices are for the body alone and don't include a memory card. Around £1,500 will get you a 6Mp digital SLR. But since their sensors are smaller than 35mm film, all lenses will have their focal length multiplied by around 1.5 times. Digital SLRs with full-frame sensors cost from £3,999 but these boast a resolution of 11Mp to 14Mp.

Rather than using film, digital cameras employ fixed electronic sensors to capture the image (see *Sensor overload* on page 75 for more details).

The image data is immediately converted into digital information then stored in non-volatile computer memory. Unlike film, this memory doesn't require chemical processing to reveal the image and it can also be re-used.

The prime advantage of digital photography is being able to view your image immediately after taking it, using a small colour screen at the back. This instant feedback is wonderful for checking the photo, not to mention great fun. The screens on some intermediate and professional models can also flip out and twist round, letting you shoot at low angles or over the heads of crowds.

With reusable memory cards and no chemical processing, digital photography

is also cheap to use and environmentally friendly. You can delete images that have gone wrong and only print the ones you really want. There's also no need to finish a roll to see your photos.

Modern digital cameras additionally feature a raft of extra gadgetry including movie modes that can capture short clips of video, often with audio. This footage may be below camcorder quality but it's still a useful facility. And if you want to use your PC to retouch or email snaps, as well as print them out at home or online, digital is perfect because there's no need for a scanner.

And the down side

Digital cameras may be the current darlings of the technological world, but they're not without their faults. Most devices generate images measuring between 1MB and 2MB each (using best

quality settings), so you'll normally only squeeze 10 to 20 on the supplied memory card. Buyers ideally need to budget for a bigger card. Prices vary depending on format, but you're looking at between £35 and £60 for 128MB.

Since memory cards can be reused, you might think you'll only ever need one. Before erasing your card's contents, though, you'll want to copy the images safely on to your PC. But what happens if you run out of memory while in the field? Short of carrying a notebook with you (as many professionals do), you'll need to stump up for at least one extra card.

If you're purchasing a new camera and anticipate buying lots of memory, it can be worth choosing a device that uses the cheapest format. Prices are falling but the ageing CompactFlash format remains around half the price of Memory Stick or the recent xD formats.

CompactFlash is normally available in the largest capacities and some CompactFlash cameras can also handle the IBM Microdrive, a tiny hard disk. That said, you shouldn't let memory format sway your decision too much. It's just worth being aware of the prices.

Batteries are another thing you'll run out of sooner rather than later. Lifespans vary, but you're unlikely to get more than 50 pictures over several days before the battery dies. Always carry spares and take your recharger on holiday.

Digital cameras may offer better quality with each new generation, but in terms of ultimate detail film remains hard to beat. One frame of professional quality 35mm can contain 10Mp (megapixels) to 15Mp worth of resolution, thrashing all but the most expensive digital cameras. Most people never want prints bigger than 7x5in but there's still plenty of life in the old silver-halide process yet.

Lastly, while the running costs of digital are cheaper, the initial equipment purchase is currently higher than film for an equivalent level of control and quality.

Quality control

So how much resolution do you need? The more megapixels you have, the greater the detail captured and the bigger the prints before jagged edges appear. To achieve photographic quality prints from an inkjet, stick to the following maximum sizes: 8x6in from 2Mp, 10x8in from 3Mp, 11x9in from 4Mp and 13x10in from 5Mp. If you're using high street or online minilabs, estimate maximum print sizes around one third smaller.

While higher resolutions seem targeted at people wanting big prints, it's worth remembering having more megapixels will allow you to crop in on a picture and still have enough detail remaining to make a decent print.

Consequently, for some flexibility we'd recommend going for nothing less than 3Mp unless you're on a tight budget, in which case 2Mp will be adequate for small prints. Fortunately, decent 3Mp cameras have fallen in price and can now be found for less than £299 in our Top 10 Beginner chart (see page 208).

Note: when emailing photos or using them on websites, you normally shrink them down to sizes that measure less than a third of a megapixel. So if you're only using photos online, almost any resolution will do.

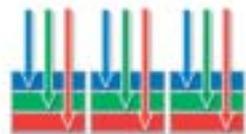
Optics and focal lengths

The vast majority of digital cameras come with built-in zoom lenses. Most models offer 3x optical zooms, described as having focal lengths equivalent to around 35-105mm on a 35mm camera. Most digital cameras additionally offer a digital zoom facility that claims to extend the

Foveon X3 capture



A Foveon X3 image sensor features three separate layers of photo-detectors embedded in silicon



Silicon absorbs different wavelengths of light at different depths, so each layer captures a different colour



As a result, only Foveon X3 image sensors capture red, green and blue light at every pixel location

proportional to the amount of light that strikes it – the brighter the light, the higher the charge stored. At the end of the exposure, the charge is digitised and assigned a brightness value. By converting the charge from millions of pixels in a grid, it's possible to create a digital image.

The pixels in most sensors only record brightness and are unable to

Sensor overload

Digital cameras use electronic sensors to record images. The two most common technologies are CCD and Cmos. Sensors on sub-£1,000 cameras measure around half the size of a postage stamp and are packed with light-sensitive elements arranged in a rectangular grid. A typical sensor may feature around 1,500x2,000 square elements, making three million in total. Each element is called a pixel, so such a sensor would have three million pixels or 3Mp (megapixels).

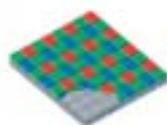
Most sensors are made by Sony, but Fujifilm's SuperCCD sensors employ 45-degree octagonal pixels arranged in a honeycomb pattern. The company claims this ups resolution and consequently applies internal scaling to produce higher resolution output. Its 3Mp and 6Mp models generate 6Mp and 12Mp images respectively, although in our tests they capture no more detail than normal 3Mp and 6Mp models.

Whatever the technology used, each pixel on the sensor stores an electrical charge

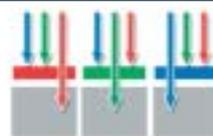
see colour. To make a colour picture, each pixel is normally covered by either a red, green or blue filter. Groups of four pixels are arranged in a two-by-two 'Bayer' pattern featuring one red, one blue and two green filters. Twice as many green filters are employed as these wavelengths contain the most image detail. The camera's software then interpolates the filter data to create a full-colour image (see below).

The exception is Foveon's X3 sensor that captures full RGB colour on every pixel (see above). Despite only having three million elements, the X3 captures up to three times more colour detail than conventional 3Mp sensors.

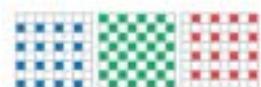
Mosaic capture



In conventional systems, colour filters are applied to a single layer of photo-detectors in a tiled mosaic pattern



The filters let only one wavelength of light – red, green or blue – pass through any given pixel, allowing it to record only one colour



As a result, typical mosaic sensors capture 50 percent of the green and only 25 percent of the red and blue light

effective focal length. They do so by simply cropping the middle of the image and enlarging it, thereby losing quality. Ignore the digital zoom figure and concentrate on the optical range instead.

If you're into distant subjects such as sport, wildlife or even celebrities, then choose a camera with an optical zoom of 5x or higher. Long lenses are generally found in our Professional chart (see below) such as the 7x zoom of Nikon's

If you're looking for a Professional digital camera then see the chart below. For budget models, turn to page 208 for our updated Beginner and Intermediate charts

Coolpix 5700. But a handful of lower resolution models sport huge zooms in our Intermediate chart (page 212), including the HP Photosmart 850.

If you take closeup shots of small subjects such as flowers then you'll want a decent macro mode – look for a model that can focus at 6cm or closer. These devices don't have to be expensive, though. Canon's PowerShot A70, for example, falls in our Beginner chart yet can focus at 5cm.

Creative control

All digicams have auto modes but for greater creativity look for scene preset modes. These take care of complex

settings to deliver great action, portrait, landscape and night-time shots. Models in each of our three charts feature several presets. If you want greater power over your shots, opt for a model with manual control rather than aperture and shutter.

Adjusting the aperture by selecting different f-numbers controls the depth of field – for example, the amount of the picture in focus. Lower f-numbers mean a small depth of field with only the main subject in focus. Higher f-numbers mean large depths of field where everything near and far is sharp. Controlling the shutter speed lets you freeze or blur action, as well as select longer exposures essential for night-time photography.

Professional cameras		Actual sensor	Optical zoom	Equivalent range	Max aperture range
	<p>Sony Cybershot DSC-F717 08705 111 999 www.sony.co.uk</p> <ul style="list-style-type: none"> • £700 inc VAT • 1-year warranty • 659g inc battery 	5Mp	5x	38-190mm	f2.0-2.4
	<p>Canon EOS-10D 08705 143 723 www.canon.co.uk</p> <ul style="list-style-type: none"> • £1,499 inc VAT • 1-year warranty • 790g ex battery 	6.3Mp	no lens supplied	n/a	depends on lens
	<p>Nikon Coolpix 5700 0800 230 220 www.nikon.co.uk</p> <ul style="list-style-type: none"> • £900 inc VAT • 1-year warranty • 512g inc battery 	5Mp	8x	35-280mm	f2.8-4.2
	<p>Minolta Dimage 7Hi 01908 200 400 www.minolta.co.uk</p> <ul style="list-style-type: none"> • £999 inc VAT • 1-year warranty • 414g inc battery 	5Mp	7x	28-200mm	f2.8-3.5
	<p>Sigma SD9 01707 329 999 www.sigma-imaging-uk.com</p> <ul style="list-style-type: none"> • £1,299 inc VAT • 1-year warranty • 803g ex battery 	3.5Mp	no lens supplied	n/a	depends on lens

While most cameras feature built-in flashes, these tend to be effective only over a short distance. If you need more powerful lighting, choose an Intermediate or Professional model with a hotshoe for an external flashgun or a synchronisation plug for studio lights. Be aware that some cameras can only communicate with flashes from the same manufacturer.

Getting your prints

While most digital cameras can be connected to a television for a quick slideshow, many photographers still want a set of prints to thumb through. The most obvious and convenient solution is to buy a photo inkjet printer and output

them at home, but this is only an option for small quantities of large prints.

The most economical solution for large numbers of small prints is a high street minilab with a digital kiosk – check out larger branches of Jessops, Snappy Snaps or Boots. Simply insert your card, select the relevant snaps and choose the correct size. You're guaranteed perfect photo-quality prints as it's done in the same machine used for traditional film pics.

There's also a number of online photo printing services – for example, Fotango (www.fotango.co.uk) and Photobox (www.photobox.co.uk). Upload your images and the company then posts you the printed photos. Once online, the

snaps can be viewed by friends and family who can then order and pay for their own prints. Wonderful news for the party photographer who always ends up paying for extra sets. On the down side, uploading high resolution images is slow and costly for those without broadband.

Hey, good looking

While features and price are two important factors when purchasing a digital camera, it's also critical that you purchase a model that looks and feels good. A camera that has the best capabilities but feels uncomfortable, heavy or even unattractive will be one that's left at home. Happy snapping. ■

Viewfinder type	LCD size	Shutter speeds	Storage media	Supplied media	Closest focus distance (macro)	Accessories
EVF	1.8in	1/2,000 to 30 secs	Memory Stick	32MB	2cm	Hotshoe, sync plug
The F717 is an impressive Best Buy, producing the most detailed pictures we've seen from any professional 5Mp model. Its bright optical aperture means that faster shutter speeds can be used under dim conditions, while additional features like the autofocus illuminator and infrared night mode are excellent.						
SLR	1.8in	1/4,000 to 30 secs	CompactFlash	none	depends on lens	Hotshoe, sync plug
With its tough magnesium body, many impressive features and RRP of £1,499 (street prices should be around £200 lower), the EOS-10D is Canon's most affordable and impressive digital SLR yet. It's a shame there's no support for FireWire or USB 2.0, but there is a TV output which is unusual for a digital SLR.						
EVF	1.5in	1/4,000 to 8 secs	CompactFlash	32MB	3cm	Hotshoe
Nikon's Coolpix 5700 boasts a 5Mp CCD, flip-out-and-twist LCD screen and a 32MB CompactFlash card that stores up to 20 best-quality Jpeg images (although we'd prefer slightly less compression on these). Its giant 8x optical zoom is equivalent in coverage to 35-280mm, which makes it top dog for focal length.						
EVF	1.8in	1/4,000 to 15 secs	CompactFlash	16MB	25cm	Hotshoe
The Minolta is one of the best-featured high-end digital cameras on the market. The Dimage's 7x optical zoom is operated by a mechanical ring, which makes for a more responsive experience. On the down side, the 7Hi is costlier than most of its rivals and you'll need to purchase extra memory from day one.						
SLR	1.8in	1/6,000 to 30 secs	CompactFlash	none	depends on lens	Hotshoe
The Sigma may only have 3.5Mp, but its X3 technology matches the detail captured by 6Mp rivals. It can't generate Jpegs, forcing you to process RAW images using PC software, but it's by far the lowest-cost digital SLR available. The SD9 is good value for money – if you're happy with its unique way of working.						