

The Ins & Outs of Digital Cameras

Digital cameras have become ubiquitous over the last few years. The quality and features available continue to improve as costs come down. Many centers as well as their clients already have cameras or are considering their purchase. Whether you have a camera or are looking to purchase, you should know what factors will have an impact on the quality of the images and usability of the camera. These factors include:

- Input Resolution
- Output Resolution
- Compression
- Optics
- Features

INPUT RESOLUTION

Inside your computer, picture information for photographs is saved as what we call a *raster* image. A raster image is made up of a grid of boxes, much like a sheet of graph paper. Each of these boxes (called picture element, or pixel, for short) has an individual color value assigned to it. The different shades of each element blend together to form what we see as a photograph.

It's common to hear companies advertise their cameras in terms of "mega-pixels" (millions of pixels) these days. The number of pixels advertised is a way of representing a camera's maximum *true resolution*. True resolution is the measure of total number of pixels captured; it's the total number of pixels across in an image multiplied by the total number of pixels down. For example, the true resolution of your monitor might be something like 1600 pixels across by 1200 pixels down. An image from that screen would therefore be $1600 \times 1200 = 192000$ pixels, or 2.1 mega-pixels.

Some typical resolutions advertised for digital cameras are:

Advertised	Pixel Resolution	Total Pixels
1.3 mega-pixels	1280 x 960	1,228,800 pixels
2.1 mega-pixels	1600 x 1200	1,920,000 pixels
3.4 mega-pixels	2048 x 1536	3,145,728 pixels
4.1 mega-pixels	2272 x 1704	3,871,488 pixels
5.0 mega-pixels	2560 x 1920	4,915,200 pixels
6.0 mega-pixels	3072 x 2048	6,291,456 pixels

To tell the true resolution of any image, open it in PhotoShop and select Image > Image Size. The top two entries will tell you the number of pixels across and down in the image.

Note: When dealing with digital cameras, keep in mind that often the camera settings can be changed so that the best quality camera still captures a low quality image. When taking images for print, you should always set your camera to its highest resolution. Extra pixels can always be removed, but we can't create more detail if the image doesn't have enough resolution to begin with.

OUTPUT RESOLUTION

How much pixel detail you need depends on what you'll be doing with the image. It translates to the physical size the photo can be reproduced at on different output devices. For example, if you are printing on a color copier, you will need 200 pixels for every inch of size on paper ("pixels per inch" or "ppi"). The 1.3 mega-pixel image couldn't be printed much larger than 6.4" wide by 4.8" high ($1280 \div 200$ and $960 \div 200$), or you'd start to notice pixelization. But if you took the same picture with the 4.1 mega-pixel camera, you could print it at 11.4" wide by 8.5" high ($2272 \div 200$ and $1704 \div 200$), and it would still look good!

If instead you wanted to print the photos on a true offset full-color press, instead of 200 pixels per inch, you need 300. So that 1.3 mega-pixel image can only print at 4.25" x 3.2", and the 4.1 mega-pixel can print up to 7.6" x 5.7". Some common size limitations include:

Resolution Required	Inkjet Printer 72 ppi	B&W Copier 170 ppi	Color Copier 200 ppi	Offset Printing 300 ppi
1280 x 960	17.75" x 13.3"	7.5" x 5.6"	6.4" x 4.8"	4.26" x 3.2"
1600 x 1200	22.2" x 16.7"	9.4" x 7"	8" x 6"	5.3" x 4"
2048 x 1536	28.4" x 21.3"	12" x 9"	10.24" x 7.7"	6.8" x 5.1"
2272 x 1704	31.5" x 23.7"	13.4 x 10"	11.4" x 8.5"	7.6" x 5.7"
2560 x 1920	35.5" x 26.7"	15" x 11.3"	12.8" x 9.6"	8.5" x 6.4"
3072 x 2048	42.7" x 28.4"	18" x 12"	15.4" x 10.24"	10.24 x 6.8"

Keep in mind when you take your photos, though, that you may not be using the full photo. If you crop an image to use only a portion at output, you won't be able to print it at as large a size as listed.

COMPRESSION

Most digital cameras save their images in JPEG format. JPEG is a lossy method of compression, meaning that when a file is saved in JPEG format, some of the image data is thrown away – irretrievably. The more often a file is opened and resaved in JPEG, the more degradation will be apparent in the image. JPEGs use the file extension .jpg on Windows computers.

When saving an image as a JPEG, it is vitally important that you pay attention to the trade-off between quality and file size. The better the quality, the less the compression and the larger the file size. The greater the compression, the poorer the quality and the smaller the file size. At it's highest level of quality, a JPEG compressed file can take one quarter the size of a full TIFF and still have no noticeable image degradation. The more compression you apply, the poorer the image, until pixelization becomes obvious to even untrained eyes.

Professional level digital cameras generally provide the option to save in uncompressed (TIFF) or compressed (JPEG) formats, but few point-and-shoot cameras support TIFF. Most save their files in JPEG format by default, in order to store more images on a single chip. Before using a digital camera to take photographs for print reproduction, it is critical that the compression settings be checked and set to the minimum compression possible. That means you won't be able to fit as many photos on a memory stick/chip/card, but that's okay! As with resolution, you can't re-create image quality that's been lost to high compression.

OPTICS

Even more important to your image quality than resolution can be the optics on your camera. There are essentially three ranges of optics: point-and-shoot, digital SLR (single lens reflex) and professional grade.

Point-and-shoot cameras are the most affordable cameras on the market today. With a point-and-shoot, you'll get decent resolution and fairly good optics, but you'll notice a loss of image quality the farther away from your subject you shoot. If you're looking at a camera for taking close-up snapshots, head shots, or small product photos, you may be just fine with a point-and-shoot camera. Keep in mind that on these cameras, the viewfinder you look through is not attached to the lens, making it less accurate when framing a shot.

A point-and-shoot camera is suitable for most novice photographers and range in price from \$300 to \$600. In this range, the following cameras come with good control features as well as good optics for their price.

Model	Pixel Resolution	Estimated Price
Canon Powershot G-3	2272 x 1704	\$550
Olympus C-4000	2288 x 1712	\$500
Minolta Dimage S-404	2272 x 1704	\$600

Digital SLR cameras are more expensive, ranging around \$800 to \$1000, but they boast far better optics than the point-and-shoot models. You'll notice better detail in distance images, and the resolution of these will allow you to print higher-quality images at larger sizes. The SLR (single reflex lens) allows you to see through the camera's lens as you look in the viewfinder, giving you better accuracy for your shots. Light metering and flash control also operate through the lens. For a feature-rich camera with great optics, check out the following models.

Model	Pixel Resolution	Estimated Price
Minolta Dimage 7Hi	2560 x 1920	\$900
Olympus E-20N	2560 x 1920	\$850
Nikon Coolpix 5700	2560 x 1920	\$760

Professional grade cameras* are also digital SLR and can run anywhere from \$1,500 to \$4,000. For the extra price, though, you will get a camera that takes pictures rivaling a high end 35mm camera. Professional grade cameras are also the ultimate in control — you have the ability to swap lenses and shoot beautiful images from a distance. If you're serious about the quality of your photography, take a look at the following excellent professional grade models.

Model	Pixel Resolution	Estimated Price
Canon EOS D60	3072 x 2048	\$2,000
Nikon D1X	3008 x 1960	\$4,000

**This is what we refer to as professional grade — it's really considered "professional-consumer" by true professional photographers, whose digital camera choices range up to \$10,000 and beyond.*

FEATURES

When purchasing a camera, you'll be inundated by the features each models provide. Don't feel overwhelmed! Most features are rarely used by the average photographer. There are a few, however, that you should pay attention to.

Media. Digital cameras come with many different media types. Settle on a camera with media that will be easy for you to use when you need to get your pictures from the camera to the computer. Typical media types are Compact Flash, Smart Media and Sony's Smart Stick. Most all of these types of media are compatible with other computer and video related devices. Many of the high-end cameras accept more than one type of media, which could be useful to some photographers. Also, you may want to consider buying an external device for your computer that will accept the media your camera uses — transfer of photos over USB directly from a camera can be a really slow process.

Exposure. Most point-and-shoot digital cameras have good control over exposure. As you move into the digital SLR cameras you get much more control in exposure with a variety of exposure modes that will cover about any situation. In the high end you get all the control you could want in a camera.

Digital vs. Optical Zoom. Most point-and-shoot cameras come with a 3x to 5x zoom but few come with zoom more than 10x. Digital zoom should not be a factor when purchasing a digital camera. It is not really much of a feature, it only enlarges the pixels on the CCD (the CCD is to a digital camera what the film is to a traditional camera). That makes for a very grainy photo, not really suitable for framing.

The rule is, the better the optic lens the higher the quality of picture. You want to bring the subject to the camera and a high quality lens with optical zoom does just that. With professional grade digital cameras you can change the lenses for an even greater degree of zoom.