

SCANNERS

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Q.: What is the difference between a bit and a pixel?

A.: Bit, the binary digit, is a smallest component of information in a digital data file. A bit can have values of only a “0” and “1”. A pixel, a tiny square, is the smallest piece of information seen on a screen of a monitor. In other words, a bit is software related and a pixel is hardware related.

A byte consists of eight bits. A kilobyte has 1024 bytes, a megabyte (MB) consists of 1024 kilobytes (KB) or 1.08576 million bytes, and a gigabyte (GB) is equal to 1024 megabytes.

Q.: What is the meaning of 24-bit color?

A.: The word “24-bit” indicates the depth of color. One bit is the smallest unit of computer information representing binary colors (“0” and “1”). An 8-bit color depth per channel corresponds to 256 colors (2 to the 8th power). The RGB color system used for editing color images has three channels: red, green, and blue. The 24-bit color includes three channels with 8-bit color in each channel. The total number of colors is 256 x 256 x 256 equals 16.78 million colors. This is the same number as 2 to the 24th power. The number of colors corresponding to a 24-bit color is the minimum number of colors needed to make a print look like a real photograph.

Some scanners allow scanning with 14-bit or 16-bit colors per channel, including 16384 and 65536 colors, respectively, per channel. A 48-bit color depth, resulting from 16-bit color per channel, represents a huge number of colors indeed. Because the Adobe Photoshop uses 24-bit colors, why is it necessary to increase the file size in order to accommodate more colors? As a rule, always scan with the largest bit depth. The file should be larger and have more colors than needed for the final output, in order to avoid the degradation of the image during editing.

Q.: What does the dynamic range of a scanner mean?

A.: The dynamic range indicates how well shadow detail and highlights can be captured by the scanner. A value of 0 represents white and black has a value of four. A dynamic range of four indicates that the scanner can capture the whole range of tonal values ranging from white to black, as recorded on film. A value of 3.4 is the minimum dynamic range for getting an acceptable scan. Best scanners have dynamic range values above 4.0. It is not quite obvious how the dynamic range can exceed the value of four. This is like saying that the scanner is better than the film.

Q.: Multiple sampling increases the scan time. Is it really needed?

A.: Multiple sampling is not always needed but is very useful for a smooth gradation of color and reducing noise in the shadow areas. The noise is caused by electronic circuitry of the scanner and the sensor. The noise is random and is cancelled out by multiple sampling.. Four times sampling should be sufficient in most cases but I use the 16 x setting when making high quality scans.

Q.: I will buy a scanner. What are the options?

A.: The selection of a scanner depends entirely on your needs. A flatbed scanner is used for scanning prints or documents. Most flatbed scanners can scan film but not as well as a film scanner or a drum scanner.

In a flatbed scanner a light source and a sensor move slowly under a print on a glass plate. The sensor measures the light reflected from the print, placed on the plate face-down. Most flatbed scanners have a light source in the lid for scanning negatives or transparencies. The sensor measures then the light transmitted through the film, instead of measuring reflected light.

A film scanner is dedicated for scanning negatives or transparencies. The quality of scans made by a good film scanner is better than the quality of film scans made by the best flatbed scanners. A drum scanner is used for the highest quality film scans. The film is attached to a transparent cylinder which rotates. A narrow beam of light scans the film. The resolution of the drum scan is extremely high, about 8000 ppi or higher. Drum scanners are expensive, in the \$5000 to 20,000 price range.

Q.: Do I need an expensive flatbed scanner for copying prints?

A.: A flatbed scanner is the most versatile scanner but most versatility comes with a higher price. An inexpensive flatbed scanner is barely adequate for copying documents but not for scanning photographs. The higher end flatbed scanners can scan medium format or larger negatives with a sufficient quality. The 35mm film scans do not quite equal scans made with a film scanner. The expensive flatbed scanners come with sophisticated software for optimizing the image.

As an example, the Epson Perfection 4990 Photo scanner has an optical resolution of 4800 ppi, a color depth of 48-Bit RGB, and a dynamic range Dmax of 4.0. The scanner can scan letter size prints and film in the size from 35mm to 8 x 10 inches. The scanner has software for grain reduction, color restoration, and digital ICE for dust and scratch removal.

The Epson V700 flatbed scanner has a 6400ppi optical resolution with a dual lens system which selects one lens from the two lenses for the desired resolution.

High quality flatbed scanners are made also by Canon, HP, Microtek, Pentax, and others.

Q.: I have to scan 35mm negatives and color slides for editing in the Photoshop. Which scanner should I buy?

A.: For high quality scans of 35 mm film or color slides, a film scanner is needed. A LED light source of the film scanner shines light on the film. The light transmitted through the film is focused by a lens on a linear CCD array. A good film scanner has resolution of 4000 ppi and a dynamic range of Dmax 4.0, a minimum for high quality scans. The quality of the Nikon Super Coolscan 5000 ED approaches that of a drum scanner costing over \$ 5000. The resolution of the Nikon Super Coolscan 5000ED is 4000 ppi and the dynamic range is Dmax 4.8. The scanner has two color depth settings, 8-bit and 14-bit. The output is raised to 48-bit color by software enhancement. The Nikon 5000ED has a SF-210 slide feeder accessory which holds 50 slides and automatically saves scanned image files.

The Nikon Coolscan V ED is a lower cost and a slower version of the Coolscan 5000 ED. The resolution is 4000 ppi and the dynamic range is 4.2.

The quality of a scan is not determined by the resolution of the scanner alone, the quality of the optical system is important as well. The ICE⁴ software has ICE for removing scratches, GEM for grain equalization management, ROC software for color restoration, and the DEE (Dynamic Exposure Extender) compensating for both over and under exposure. The new ICE software, unlike the older ICE, can remove dust and scratches from Kodachrome as well. Software for optimizing the image during scanning (levels, curves) is useful as well.

Q.: I have about 500 35mm slides with a large number to follow. Scanning is my problem. The quality of my flatbed scans is inadequate and slide scanners are expensive.

A.: You have two problems: You need high quality scans and a scanner of a high scanning speed. Flatbed scanners costing about \$500 (The Epson Perfection 4990 Photo can scan eight slides and the Microtek Scan Maker i900 can scan twelve slides) make good scans but the process is slow.

If the cost is not prohibitive, the Nikon 5000 ED can produce higher quality scans in less time. A SF-210 slide feeder accessory holds 50 slides and automatically saves scanned image files while you are doing something else. If the cost of the 5000ED and the slide feeder is too high you may send the slides to a photo lab and have the slides scanned onto Kodak Picture CDs. The commercial scans will not have the high quality of the scans you can make yourself. The cost of having 1500 slides scanned equals the price of the Coolscan 500ED with the slide feeder.

Minolta made good film scanners with an attractive price but Konica Minolta has left the photographic business.

Q.: I would like to get a film scanner that would allow me to scan slides and enter DPS digital competitions for the least amount of money. I have some info on the Pacific Image 1800u (about \$ 130) but I don't know if it will be adequate.

A.: This is an interesting question because it implies that a digital competition is a step down in quality. You are asking, how low can the quality of the scanner be, instead of asking, how high must the quality to be in order to be acceptable. This is indeed the new reality that the resolution of an image is not as critical as before. However, the optical resolution of a scanner is not the only important property. Other factors, such as the dynamic range, quality of the lens and the sensor, software, the convenience, scanning speed, and the computer connectivity are important as well. The 1800 ppi resolution may be sufficient for a digital competition but the Minolta Dimage Scan Dual IV for about \$ 300 has a 3200 ppi resolution, a dynamic range of 4.8, and good optics. The Minolta scanner is useful for making prints, if you should ever decide to do it. The low priced scanners do not have ICE software for the removal of dust and scratches but the Scan Dual IV has software called the Auto Dust Brush. (Unfortunately, the Minolta scanner may not be available.).

Q.: Some scans of my slides and negatives have dust specks. Which is the best procedure to clean the scans?

A.: The best way of getting clean scans is to start with a clean slide or film. Remove all dust particles with a Staticmaster brush. Fingerprints and dirt can be removed by wiping gently with a microfiber cloth.

If the dust particles on the negative or slide cannot be brushed away, the ICE software can help. ICE is an excellent program for removing dust particles and scratches but it softens the image slightly and increases the scanning time considerably, about 2 to 5 min per scan, depending on other variables. The ICE software does not work on silver based black and white film. The older ICE software cannot scan Kodachrome either.

If ICE cannot be used or the dust removal is incomplete, the Adobe Photoshop and the Adobe Elements have excellent tools for spot and scratch removal: the healing brush, the spot healing brush, and the clone stamp tool.