

Scanners - an Introduction

In order to convert the “analogue” information contained on photographic film or paper into “digital” images, the photographs will need to be scanned. There are two basic types of scanner, the flatbed scanner, designed primarily for prints, (though several models can scan transparent materials as well), and film scanners.

Basic principles

The CCD found in digital cameras is a rectangular chip containing light sensitive picture elements or “pixels”. In scanners, a single row (or sometimes three rows) of pixels are mounted on a bar which travels across the surface of the film or paper. This is called a “linear array CCD”. With flatbed scanners, a light source is shone onto the surface of the print, and the amount of light reflected back is measured by the pixels. Areas reflecting a relatively large amount of light cause the pixel to generate a relatively large amount of electricity, whilst darker areas of the print will reflect less light and so generate less electricity.

Film scanners, and several flatbeds shine light through the original negative or transparency, with the CCD measuring light in the same way.

Quality issues

The quality of a scanned image will be largely dependent on the number of pixels in the CCD. If the CCD sensor is 8.5” wide, and contains 2540 elements, then the maximum resolution possible is 2540 divided by 8.5 i.e. approximately 300 per inch (usually referred to as “pixels per inch”, or ppi). This figure is the true, “optical” resolution of the scanner. Another figure will often be quoted by manufacturers - the interpolated resolution. This is where the scanner software “invents”, or interpolates new data, so that a 600dpi scanner can effectively scan at resolutions of 1200 or even 2400 ppi. Generally, scanning at the optical resolution will give better results than interpolated resolutions.

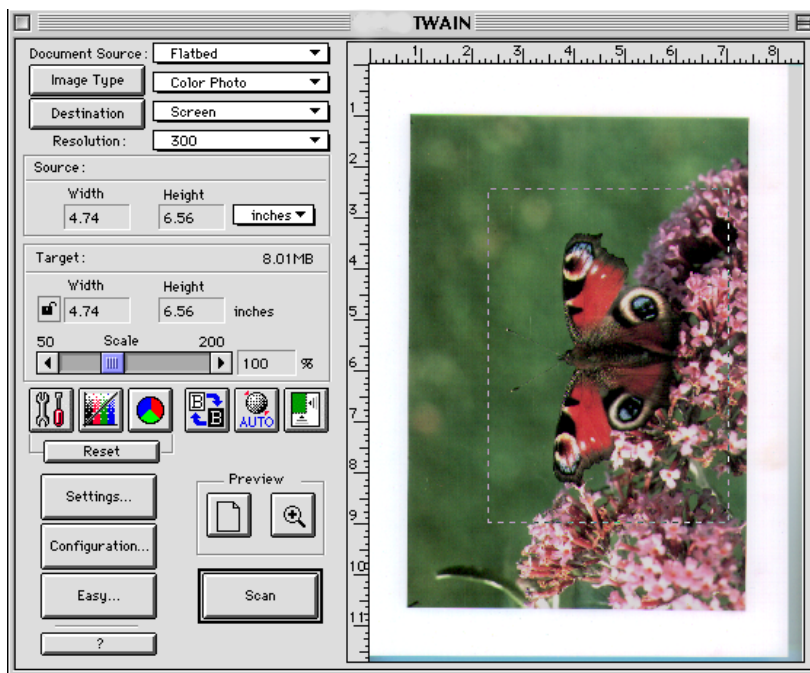
Because they are dealing with smaller originals such as 35mm or APS, film scanners usually have higher resolution capabilities - a typical film scanner may scan up to 2,400 or above.

A major factor determining the quality of the scanned image will be the quality and size of the original. Generally, scanners cannot record all of the tones from a full toned print, negative or transparency, and often detail will be lost from the shadow or highlight areas of an image. This is known as the “dynamic range” of the scanner. Look for one that has a range of at least 2.8. When shooting pictures which are to be scanned, try to keep the contrast down, perhaps by shooting in bright but overcast conditions, or by using a flash to “fill-in” shadow areas.

Controlling the scanner

Most scanners have no physical controls on the exterior. Instead, the scanner is controlled through the software. Every scanner will come with a piece of software known as a driver, or plug-in, usually accessed through an image processing program. Many are called TWAIN drivers (TWAIN stands for Technology Without an Interesting Name!). Upon opening this software, various options are given. Typically, the first stage in the scanning process is to perform a preview or pre-scan. This

produces a low resolution “thumbnail” image of your original, rather like a photographer’s contact print. You choose whether to scan the whole image, or select just a part of it. Don’t scan the whole thing if you don’t need to as it will just make the file sizes larger.



Screen shot” of typical TWAIN interface for flatbed scanner, showing selected mode and resolution, and selected area for scanning. Other controls include brightness, contrast and colour corrections.

Next, choose the scan “mode”. This might be line art, greyscale or full colour. Line art is for originals such as pen and ink drawings, which have no tone. You will probably want to scan these at high resolution to retain very fine detail. Greyscale is for black and white photographs, but can also be used with colour originals if you want to remove the colour. Colour images will usually be scanned in RGB mode, and give files three times then size of a greyscale image.

Most driver software allows users to correct the brightness, contrast and colour of the image at the scanning stage. If you have a large number of images to scan then it would probably save time to make adjustments at the scanning stage, and to save the settings you use for future use. If you only are doing one or two at a time, then probably much finer control can be achieved with the image processing software that you use. Some film scanners come with facilities for automatically removing dust and scratches, which can be very useful!

What Resolution is Needed?

If an image is scanned at too low a resolution, then the pixels with which the image is made will be visible - we would say the image is “pixellated”. Scan at too high a resolution, and the file will be very large, and will take a long time to print.

Knowing what resolution to scan at is not always easy, and whilst you may only need a 5 x 7” print now, there is always the chance you might need a 10 x 8” print at a later date. Basically, whether or not a print is acceptable in terms of quality is highly

subjective, but certain guidelines can be made. If you are printing on a “photo quality” ink jet printer, the optimum printing resolution of that is around 220 dots per inch (*see the article: “printers”*). A 10 x 8” (25 x 20cm) print would require a file of around 8 - 10Mb to guarantee a good print. The size of the original will determine the scanning resolution. The following examples show the approximate scan resolutions required for different sized originals to give a 10Mb file:

35mm negative	1500ppi
5 x 4” print	400ppi
10 x 8” print	200ppi

These figures are subject to many factors, including type of printer, paper surface, type of image (i.e. how much detail does it contain), and personal choice. It may well be possible to achieve a similar result with smaller files, but the figures do give some idea as to the resolutions required.

Post scan processing

Having scanned your images it is likely that they will require some enhancement in an image processing program such as MGI PhotoSuite, or Adobe Photoshop. Changes to the brightness, contrast and colour balance can be easily made using a variety of controls within the software. One of the most important enhancements to make is to sharpen the image. Most digital images will benefit from being sharpened. How much you sharpen will depend on personal preference, but if possible use a sharpen filter that can be controlled by the user. This is usually called an Unsharp Mask (USM - a rather unfortunate name for the best sharpen filter!).

Other uses!

One novel trick with flatbed scanners is to scan 3D objects. It is possible to scan items of jewellery to get images for insurance purposes, but try scanning other objects. Interesting effects can be obtained if the object has depth. It is probably worth masking off the area around the object with black card, and perhaps putting a black box over the object to prevent flare.

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