

Photo Formats

If you look at the file name of any of your digital photos, you'll notice something like ".jpg", ".tif", or ".raw" at the end. That indicates the format in which your photo has been saved. Each file format has a purpose, depending upon what you plan to do with the photo. Are you going to put it on a web page? Are you archiving this photo? Are you going to edit it and print it in a book? Are you just going to print it out on your computer to have and share? Are you going to keep it on your computer to view? Each of these can require a different saved format of your photo. And there are many more than just the three mentioned above. So how are you to know which is best for what?

All photo formats are grouped into two "graphic formats". When you save an image in a specific format (JPEG, GIF, PNG, etc) you are creating either a *raster* or *meta/vector* graphic format. Learning what these two graphic formats are can help us understand what photo format (JPEG, GIF, RAW, etc) will work best for our needs.

Raster Graphic Formats

Raster graphic formats (RIFs) should be the most familiar to anyone who uses the Internet. A Raster format breaks the image into a series of colored dots called pixels. The number of ones and zeros (bits) used to create each pixel (dot) denotes the depth of color. If your pixel is denoted with only one bit-per-pixel then that pixel must be black or white; because that pixel can only be a one or a zero, on or off, black or white.

Bump that up to 4 bits-per-pixel and you're able to set that colored dot to one of 16 colors. If you go even higher to 8 bits-per-pixel, you can save that colored dot at up to 256 different colors. Does that number, 256, sound familiar to anyone? Remember when computer monitors could only display 256 colors? That was a revolution from the black and green! Well, 256 is the upper color level of a GIF image. GIF use to be "the" format several years ago and the only format a computer could display. But a GIF image doesn't work overly well for photographs and larger images that we have today. There are a whole lot more than 256 colors in the world. Images now can carry millions.

Raster image formats can also save at 16, 24, and 32 bits-per-pixel. At the two highest levels, the pixels themselves can carry up to 16,777,216 different colors. The image looks great! Bitmaps saved at 24 bits-per-pixel are good quality images, but of course they also run about a megabyte per picture.

The three main Internet formats, GIF, JPEG, and Bitmap, are all Raster formats. Some other Raster formats include the following:

- CLP Windows Clipart
- DCX ZOFT Paintbrush
- DIB OS/2 Warp format
- FPX Kodak's FlashPic
- IMG GEM Paint format
- JIF JPEG Related Image format
- MAC MacPaint
- MSP MacPaint New Version
- PCT Macintosh PICT format
- PCX ZSoft Paintbrush
- PPM Portable Pixel Map (UNIX)
- PSP Paint Shop Pro format
- RAW Unencoded image format
- RLE Run-Length Encoding (Used to lower image bit rates)
- TIFF Aldus Corporation format
- WPG WordPerfect image format

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Meta/Vector Graphic Formats

You may not have heard of this type of graphic formatting, not that you had heard of Raster, either. This formatting falls into a lot of proprietary formats, formats made for specific programs. CorelDraw (CDR), Hewlett-Packard Graphics Language (HGL), and Windows Metafiles (EMF), Adobe Illustrator (AI) are a few examples. There are a lot more for 2D and 3D formats created specifically for specialized industries.

Where the Meta/Vector formats have it over Raster is that they are more than a simple grid of colored dots. They're actual vectors of data stored in mathematical formats rather than bits of colored dots. This allows for a strange shaping of colors and images that can be perfectly cropped on an arc. A squared-off map of dots (Raster format) cannot produce that arc as well. In addition, since the information is encoded in vectors, Meta/Vector image formats can be blown up or down (a property known as "scalability") without looking jagged or crowded (a property known as "pixelating").

At some point, all vector graphics must be rasterized in order to be displayed on digital monitors. However, vector images can be displayed with analog CRT technology such as that used in some electronic test equipment, medical monitors, radar displays, laser shows and early video games. Plotters are printers that use vector data rather than pixel data to draw graphics.

Unless you are blowing up a photo or document to a very large size, (a huge wall chart of your family tree?) want a 3D image, or working in a specialized industry or using one of the specific programs listed above, you will probably be using the photo formats found in the Raster graphic format list.

Compression of Photos

Besides what file format to save a photo in, one must also consider "Compression" of the photo. Compression makes your photo file smaller by giving up some quality. This is necessary if you are going e-mail or upload a photo onto a web site, or if you are creating a book that has a limit on picture file size. Many photo formats are too big in size to be accepted on the internet or a smaller book publisher. Therefore it is necessary to edit and make the photo smaller by "compressing" it. Compression uses an algorithm that stores an exact representation or an approximation of the original image in a smaller number of bytes. This is all done within photo editing software, like Adobe Photoshop. There are two types of image file compression algorithms: lossless and lossy.

Lossless compression algorithms reduce file size while preserving a perfect copy of the original uncompressed image. Lossless compression generally results in larger files than lossy compression. Lossless compression should be used whenever available or given a choice between Lossless and Lossy. Think of Lossless as losing less quality in the photo. However, if you need a smaller file size, you will need to use Lossy compression.

Lossy compression algorithms preserve a *representation* of the original uncompressed image that may appear to be a perfect copy, but it is not a perfect copy. Often times lossy compression is able to achieve smaller file sizes than lossless compression. Most lossy compression algorithms allow for variable compression rates (various file sizes) but each smaller size file trades image quality for file size. Many of the Raster file formats, such as JPEG, will lose more picture quality with each compression done on the file. Which is why it is important to always use a copy of the original file to edit, and not the original itself.

Okay, so now we know that for most of us we will be using file formats that are listed in Raster format list, and we want to use Lossless compression if we can in our editing software program. So, when we take a picture, download a picture or scan a picture we want to keep those facts in mind. However, choosing which Raster format to save a photo in, and knowing what compression we need all depends upon how we are going to use the photo. Each file format has a purpose, depending upon what we plan to do with the photo. Are we going to put it on a web page? Are we archiving this photo? Are we going to edit it and print it in a book? Are we just going to print it out on your computer to have and share? Let's take a look at some of those possibilities.

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Taking pictures with your camera

Let's start with when a picture is taken with a camera. What format should you save it? Newer high-end digital cameras offer a few different formats. So which is best then? Again it depends upon what you plan to do with the picture and how much space you have on your camera memory or memory card.

Compact digital cameras are usually designed to be easy to use, sacrificing advanced features and picture quality for compactness and simplicity; images can usually only be stored using "lossy" compression, which preserves a *representation* of the original uncompressed image but it is not a perfect copy. Think of "lossy" as losing some image quality for a smaller file size. JPEG format is usually the only format for these cameras, with a choice of a "low", "medium", or "high-quality" JPEG settings on the camera. Pictures are good quality if saved at a "high-quality" JPEG format and a "low", "best", or "less than 10%" compression. However, if you plan on editing this photo, each time you edit it and save it, you lose more of the photo quality.

Higher end digital cameras offer **TIF** and **RAW** formats as well as JPEG. The **TIFF** (Tagged Image File Format) format is a flexible format that normally saves 8 bits or 16 bits per color (red, green, blue) for 24-bit and 48-bit totals, respectively, usually using either the TIFF or TIF filename extension. TIFF remains widely accepted as a photograph file standard in the printing business.

The RAW file format is digital photography's equivalent of a negative in film photography: it contains untouched, "raw" pixel information straight from the digital camera's sensor. A RAW image file, like a negative, is not directly usable as an image, but has all of the information needed to create an image. The process of converting a raw image file into a viewable format is sometimes called developing a raw image and takes special software that can handle RAW files. The Raw files are usually converted to JPEG files by editing software. Raw formats usually use a lossless or nearly-lossless compression, and produce file sizes much smaller than the TIFF formats. Although there is a standard raw image format, (ISO 12234-2, TIFF/EP), the raw formats used by most cameras are not standardized or documented, and differ among camera manufacturers.

Most camera manufacturers have their own software for decoding or developing their raw file format, but there is also a lot of 3rd party raw file converter software available that accepts the raw format from most cameras including Phase One's Capture One, Adobe Photoshop, Paint Shop Pro, and Picasa. There are actually about 40 different RAW formats. Each camera manufacturer has their own Raw format, which causes problems with editing and developing software. Some graphic programs and image editors may not accept some or all raw file formats, and some older ones have been effectively orphaned already.

Adobe's Photoshop, using Digital Negative (DNG) specification, is attempting to standardize a raw image format to be used by all cameras, or for archival storage of image data, and is already used by a few camera manufacturers including Pentax, Leica, and Samsung. The raw image formats of more than 230 camera models, including those from manufacturers with the largest market shares such as Canon, Nikon, Phase One, Sony, and Olympus, can be converted to DNG even though these camera manufactures recommend using the manufactures own photo software. This makes Adobe's Photoshop one of the top photo editors in the market today.

Web Pages and the Internet

Web pages generally require JPG, GIF, PNG, or BMP image types, because that is all that browsers can show. On the web, JPG is the best choice (smallest file) for photo images, PNG is most common for screenshot images, and GIF is most common for graphic images. BMP (Windows bitmap) handles graphics files within the Microsoft Windows OS. Typically, BMP files are uncompressed, hence they are large; the advantage is their simplicity and wide acceptance in Windows programs. Bitmap images are good but not great. If you are creating a web page and uploading photos to it, or emailing photos, JPG is probably the way to go. While JPEG compresses the photo file so that it is small enough to upload onto the web, or email, most of the quality can still be there to give a nice crisp picture. However, it must be originally saved in a "high-quality" JPEG file format.

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All in All the End Result

If you take a picture, scan a picture, or download a picture that is or can be saved in RAW or TIF format, you will be happy. Save these pictures in a special folder and make copies of them when you want to edit or change them to JPEG, using a good software editing program. RAW and TIF photos are the best quality and the closest to real colors. However, they are also the largest. Because of their size not only will they use up space (on your Camera Card and Hard Drive), they also are too big to upload onto the internet, or email. However, you can copy them and make them a JPEG file without losing too much quality. And you will still have the original RAW and TIF files in your folder for future use.

Saving a photo in JPEG is the next best format. You can do a lot with JPEG files as they are universally accepted. However, each time you edit it, you lose some of the quality. So try and save, scan or download JPEG files in “high-quality” and as little compression as possible. Again, save the original and make copies for any editing or compression adjustments needed for the internet.

In conclusion, for the

- Internet, viewing or printing and sharing – JPEG
- book publishing – TIF if the publisher allows, otherwise JPEG
- archiving – RAW
- Save originals and make copies for editing in a software program

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Here is a handy guide to understanding available file formats and how you use them.

	RAW	TIFF	JPEG	GIF
What you use it for	Professional-grade cameras offer a couple more compression formats, like RAW. The RAW file format is best for archiving because it is the purest unaltered format available (retains the most digital information).	The TIFF file format is ideal for editing and making large prints because it still retains a large amount of image information (almost as much as RAW).	For most printing jobs and sharing through e-mail and over the Internet , JPEG is the perfect file format.	Commonly used for Web graphics with a limited color range rather than photographs .
Benefits	No compression has been applied. Every bit of information collected from a camera's sensor has been preserved.	TIFF supports layered files, which allows you to edit images in software programs like Photoshop. TIFFs retain color information while being much smaller than RAW. TIFF files can be saved with very little compression making it ideal for printing large sized high-resolution images.	JPEG has the highest compression of the three and therefore offers the smallest file size. It is also the most common file format in use. Just about every photo-editing or photo-organization program supports it.	Because they use fewer colors, GIF file sizes are very small, which makes them perfect for online use.
Drawbacks	RAW image files can be very large, easily upwards of 40 to 50MB per photo with a high-megapixel camera. Professional photographers are often the only ones with enough space to dedicate to such oversized files. Once a RAW image has been manipulated, a copy has to be saved in another form, such as a TIFF or JPEG.	Though they are smaller than RAW files, TIFF files are not small. Depending on the resolution of your camera, you could easily end up with files in the 5 to 15MB range. TIFFs are not widely supported by Web browsers, which make them a poor choice for online use.	Unlike RAW and TIFF formats, a JPEG will degrade each time you save it. This is known as a "lossy" type of compression. That's why it's important to save a high-quality original and then edit copies of that file.	GIF files don't support as many colors as other types of file formats.
Print directly from your camera's memory card with an HP printer?	No. RAW files are very large and would need to be resized and saved as a JPEG or TIFF file to edit or print	Yes. You can edit and print TIFF files. Though keep in mind that TIFF files are more suited to editing with photo software on a PC.	Yes. This common photo file format is supported on all current printers.	No. The GIF format is not supported by photo printers and is not a good format for photo files.