

**Background and definition**

The Tag Image File Format (TIFF) is a way of storing and exchanging digital image data. Aldus, Microsoft, and major scanner vendors developed TIFF to help link scanned images with desktop publishing applications. It is used for many different types of applications and fields, ranging from medical imagery to FAX modem data transfers, CAD programs, 3-D graphic packages, elaborate painting applications, and much more.

The TIFF specification supports several main data types:

- Black-and-white data

This type of image data is generally produced by paint-type graphics or a line-art scanner when copying pen and ink drawings. The image consists of black-and-white dots and does not contain any representation of gray shades.

- Halftones or dithered data

A dithered image, or halftone, contains black-and-white dots arranged in patterns to represent various shades of gray. Since most monitors and printers can only display or print black and white, not actual shades of gray, these patterns are put together to simulate the desired gray level. Your eye blends these dots together to give the illusion of a shade of gray.

- Gray-scale data

Gray-scale images consist of dots (or pixels) that each represent some shade of gray (from 0 to 256). These dots hold information about the gray levels of the image rather than forming patterns to simulate the shades of gray. However, when actually displayed or printed, the shades of gray of these images must be converted to patterns of black and white dots (halftones) on most monitors or printers. The advantage of storing an image with gray-scale information is that its resolution is not limited to a fixed number of dots by the scanner. Instead, the image is represented according to the resolution

**Converting gray-scale data into halftone patterns**

of the output device.

**Scanners**

Gray-scale TIFF data is converted into halftone patterns by scanner applications, PageMaker, PostScript printers, or all three. A halftone created by a scanner is called dithered data. PageMaker will display a gray-scale image as a halftone if the monitor cannot display shades of gray. A PostScript printer will convert a gray-scale image to halftones at print time. For non-PostScript printers such as dot-matrix or PCL, PageMaker will convert the image to a halftone for the printer.

**Halftone Cells**

The dot pattern used to represent a particular gray shade is often called a halftone cell. The size of the halftone cell is determined by the number of lines per inch and printer resolution. The lines per inch (also known as screen rulings, screen frequency, or line screen) indicate the size of the halftone cells. As the number of lines per inch increases, the size of the halftone dots decreases. Newspaper-quality halftones are typically printed using a 65 to 85 line screen, whereas magazine quality requires a 120 to 150 line screen. For this reason you may want to increase the number of lines per inch in PageMaker's "Image control..." dialog box when printing to higher resolution printers and typesetters.

The following formulas calculate the size of the halftone cell and the approximate number of different gray shades that can be represented on a specific printer.

<b>Resolution of scan</b>	<b>Resolution of printer =</b>	<b>Halftone cell size</b>
		<b>(DPI)/Lines per inch</b>
	<hr/>	
	<b>(Halftone cell size) <sup>2</sup> =</b>	<b>Approximate shades</b>
		<b>of gray that can be</b>
		<b>represented on printer</b>

**Levels of  
grey**

When changing the line screen in the "Image control..." dialog box, keep in mind that this value will very likely be adjusted according to the capabilities of your printer.

The number of gray shades your gray-scale TIFF image contains may be quite different from the number of shades that your printer can represent. The gray values in the TIFF file are determined by the number of bits per sample. More bits per sample gives you a smoother boundary between gray shades. PageMaker accepts images up to 8 bits, that is, 256 levels of grey.

	Bits per Sample	Levels of Gray (plus 1 for white/black)
<b>Compression schemes</b>	2	4
	3	8
	4	16
	5	32
	6	64
	7	128
	8	256

**Grey-scale image.** Since the scanner gives you more gray information per pixel than your printer can use, it is to your advantage to scan at a lower resolution than your printer's resolution. You will find that the images take up less disk space and print faster without degrading the quality of your output. Scanning at 75 dots per inch (dpi) is recommended for a 300 dpi printer. And 150 dpi works well to 600 and 1270 dpi printers and typesetters. However, if you are going to increase the size of your image dramatically in PageMaker, you may get better results scanning at a higher resolution. It is important to note that this rule of thumb only applies to gray-scale TIFF files.

**Dithered or black-and-white images.** With dithered or black-and-white TIFF files it is important to scan your image as close as possible to the resolution of your printer. It is possible to resize your non-gray-scale image to match your printer's resolution in PageMaker by holding down the Command key on the Macintosh, or the Control key on the PC, as you resize with the pointer tool. For more information on PageMaker's printer resizing features, see the PageMaker Reference Manual and the PageMaker Read Me text file.

The "Image control..." dialog box works, to some degree, on all bit-map images placed in PageMaker. Among these are images generated by paint programs in a paint format and by image scanners in the TIFF format. For more details, see page 1 of this Technical Note.

There are currently three forms of bit-map or TIFF data that PageMaker imports: black-and-white data (generated by paint programs and line-art scanners); halftone or dithered data (generated by a scanner or a paint package when using shades); and gray-scale data (generated by a grey-scale scanner).

### **Image control**

The “Image control...” dialog box works best on two of these three types of bit-map images: black-and-white and gray-scale. It will not produce the expected results on already screened images (i.e., halftones or dithered images). Essentially, you would be laying a second halftone screen over a halftone image.

With the “Image control...” dialog box you can manipulate contrast and lightness as well as line/dot screen and screen angle. These are typically thought of as PostScript commands but PageMaker is capable of making these changes to non-PostScript printers too.

### **Scanners**

Since scanned images tend to be large, PageMaker links TIFF images over 64K to the publication. It is important to note that any change made to an image with “Image control” does not affect the original placed file. Both the larger linked images and those under 64K can be reset to their original settings by selecting “Default” in the “Image control...” dialog box.

Transfer a TIFF image from one environment to the other using a binary transfer option. For PageMaker 3.0 to recognize a transferred TIFF image, the file must have a legal DOS name (no more than eight characters) with the extension .TIF. Otherwise it will place as text. On the Macintosh you can change the file type from TEXT to TIFF with an editor such as DiskTop if you don’t want a DOS-type name. Keep in mind that some transfer software on the Macintosh, like MacLink, will add {space}{BIN} to the DOS file name (indicating a binary transfer). Remove these characters before attempting to place the image into PageMaker.

The byte order of a TIFF file is different between a PC TIFF file and Macintosh TIFF file. The IBM PC is based on an Intel chip and reads the file from the least significant to the most significant byte. The Macintosh is based on a Motorola chip and reads the file from the most significant to the least significant byte. Although PageMaker will take care of the differences in PC and Macintosh TIFF files, other applications supporting TIFF may not.

### **Linking TIFF images**

For images larger than 64K, PageMaker links the image file to the publication and only stores a lower resolution, screen version in the publication. Not only does this keep the publication size down, it allows faster screen display when using im-

### **Transferring TIFF images**

age control or when moving or cropping the image in PageMaker.

If the file is moved out of the directory from which it was originally placed, PageMaker will ask where it is upon reopening the publication. The images can be placed in multiple publications and have multiple links without problems. Keep in mind, though, that the displayed version is of the originally placed file. If you link the wrong file or edit the original, the screen representation will remain as originally placed. Any changes will show up at print time when PageMaker uses the link to get the full resolution version of the image for printing.

### **Print times**

A TIFF file can take anywhere from less than a minute to more than an hour to print. The time it takes depends on the size of the TIFF file, the size of the area to be halftoned and the speed of the printer. If it is gray-scale TIFF you may be able to reduce the size of the TIFF file by making sure that the image has been scanned at an appropriate resolution for the printer.

Gray-scale images convert to halftone patterns appropriate to the resolution of the printer regardless of any resizing you do in PageMaker.

### **Resizing TIFF images**

Resizing black-and-white and dithered bit-map images may result in unsightly checkered patterns in the printed image. This occurs when the number of dots per inch in the image cannot be evenly distributed over the number of dots per inch of the printer. The printer tries to make the image fit by adding or skipping rows of dots. These added or skipped rows create the checkerboard, or moire, effect.

To avoid this problem, PageMaker has a printer resizing feature that sizes the image according to the resolution of your printer. Hold down the Control key on the PC as you use the pointer tool to resize. You will see the image snap into sizes that are optimal for your printer's resolution. This information is obtained from the "Printer Setup" menu.

### **Capabilities**

The most common early concern about TIFF as a standard image file format was that there was not a standard TIFF file. For example, a developer may choose to support only a subset of the file format according to the application's need, development time, or money. Adobe, with the help of other interested vendors, worked on revisions to the original specifi-

cation to define these subsets more clearly to eliminate confusion.

### **Color TIFF files**

With the new emphasis on color, TIFF specifications now include a comprehensive set of color tags. One stumbling block is representing color data on a printer in a useful manner. Currently there are tags for Red-Green-Blue (RGB) video color.