



Graphics - An Introduction

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The ability to include graphics in a document is a basic requirement of good technical documentation. The graphic must, however, be of such quality that it is easily viewable in the final format. Without taking care to ensure the quality and format of the graphic, the final viewable image can be below acceptable quality. The information presented here is meant as an introduction to the issues including graphics in electronic documents. There are many sources of detailed information available for those who care to dig deep.

Vector vs. Raster Graphics

Vector Graphics

There are two basic types of graphic data. Vector data is a collection of information that includes the location and characteristics of lines, arcs and other shapes that comprise an image. The information is stored as location descriptions of each element of the image and may be further defined in mathematical terms. Text information can also be stored within the file.

Vector data is best used for line drawings or definable shapes including text. Most engineering drawings are created and saved in vector based formats. This format is unacceptable for screen captures and photographs.

Vector based data storage has several important advantages.

- It can be resized without any loss of quality
- Text information can be included
- File sizes are usually smaller
- Images look the same on-screen and printed

The following series of examples demonstrate the scalability of a vector based drawing with no loss of quality.

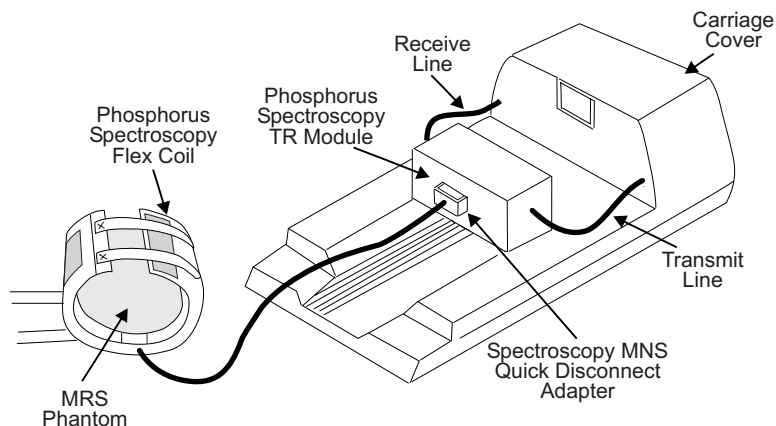


Figure 1: Vector based graphic - Normal size

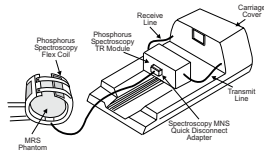


Figure 2: Vector based graphic - Reduced size

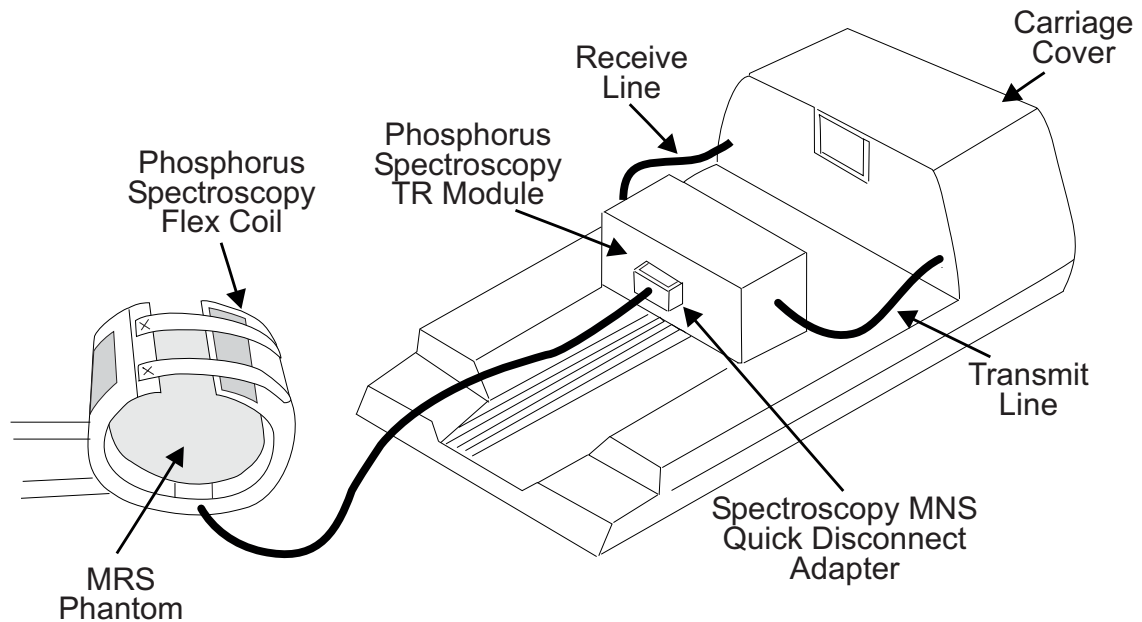


Figure 3: Vector based graphic - Enlarged size

Acceptable Vector Formats

FrameMaker supports many vector based file formats. The on-line documentation for FrameMaker provides a list of supported formats. There is one format that seems to work better consistently than many of the others for electronic publishing. Encapsulated PostScript (EPS) always works well with FrameMaker and Acrobat. EPS files are very similar to the PostScript output that is channeled to Acrobat Distiller from FrameMaker. In fact, included text within an EPS file can be cataloged and indexed as if it were any other text in Acrobat file.

Exporting existing graphics from Interleaf in the Windows Metafile (WMF) format usually produces acceptable files that then can be imported into FrameMaker. There can be an occasional error in the conversion of arcs as a full circle but that can usually be fixed within FrameMaker.

There are several graphics tools available that create vector based graphics. Adobe Illustrator and CorelDraw are probably the two most popular. Vector format graphics can also be created within FrameMaker using the graphics tools. This toolset is a little difficult to use but is quite powerful.



Raster Graphics

Raster graphic formats record information on a pixel-by-pixel basis noting color and intensity. Resolution of a raster based graphic is based in dots-per-inch or dpi. The greater the resolution, the greater the detail and the greater the file size. When a file is resized, several issues can affect the quality of the image.

- Low resolution originals store less information and therefore have less information to display when enlarged.
- “Jaggies” or the stair-step look can become a major issue when a raster graphic is enlarged
- “Rounding” can contribute to severe reduction in quality. When a raster graphic is displayed or printed a conversion of resolution takes place when. For example: when a 72dpi graphic is resized and has an effective dpi of 61 and then displayed on a monitor at 96 dpi, the rounding error is relatively small as each two pixels of the graphic display as three pixels.

$$2 \times \frac{\text{Screen resolution (96 dpi)}}{\text{Effective file resolution (61 dpi)}} = 3.15\text{dpi}$$

The remainder of 0.15 which is discarded information is relatively small and should not create a significant loss of data. If the effective dpi was 54 dpi for example, the remainder would now be 0.556 dpi and that now becomes a much more significant loss of data which would affect the image quality. The same exercise can be followed with a 600 dpi printer and one could see what percent of data is discarded.

Acceptable Graphic Resolution

All three issues listed above have one common issue. The higher the resolution of the original file, the less effect these issues have on quality. 72 dpi was long considered the standard for on-screen display but that has changed with the newer hi-rez monitors. Most monitors now display in the range of 96 - 120 dpi. This matches the higher resolution of printers where 600 dpi is standard and 1200 dpi has become more available.

By experience, we have found that the optimal minimal resolution of a raster file is 120 dpi. If the resolution of the original file is in this range, the three issues listed above are greatly minimized. It is possible to do screen captures near this level on most systems. If you are scanning an drawing to include in an electronic document, scan at 300 dpi.

The following example demonstrates the difference between a 72 dpi image and a 150 dpi image. Zoom in and compare the “jaggies” on the numbers. Notice how much better looking Figure 5 is. This will be true at any image size. You may notice the line weight is not always consistent around the buttons. When you change screen magnification, you will notice that this inconsistent line weight will also change. That is because of the “rounding” errors.

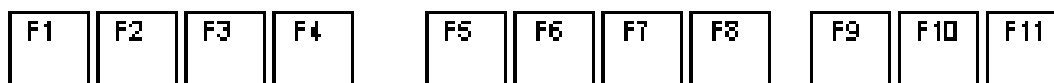


Figure 4: 72 dpi image enlarged to full column width

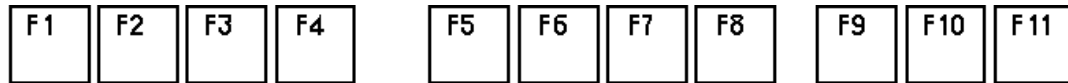


Figure 5: 150 dpi image enlarged to full column width

Acceptable Raster Formats

There are many formats that a raster graphic can be saved in. Some of the more common formats are JPEG, TIFF, and GIF. Each format has its strengths and weaknesses. The real issue in many cases is image compression. Because raster based files can become very large, file compression can be a major issue.

JPEG File Format

Stands for Joint Photographic Experts Group. A compression technique that can reduce file size up to 96%. It removes some color information, while retaining the brightness data. At higher compression it can result in a visible loss of quality. It is best used for photographs and images that contain a variety of tonal values. It is not recommended for files with large areas of the same color as found in screen captures. This is demonstrated by Figure 6. When you zoom in further you will notice significant differences pixel-by-pixel in the color. As this file receives further manipulation, these color differences will get worse.



Figure 6: JPEG file format with moderately compressed screen capture that has been enlarged

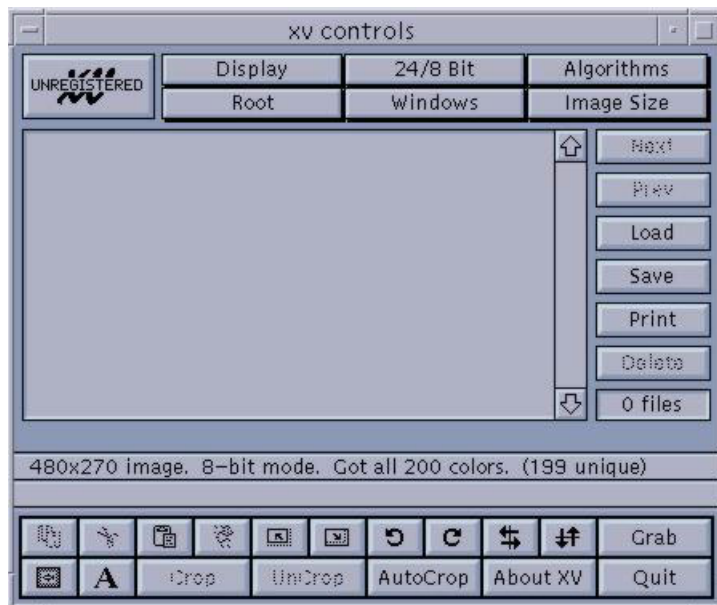


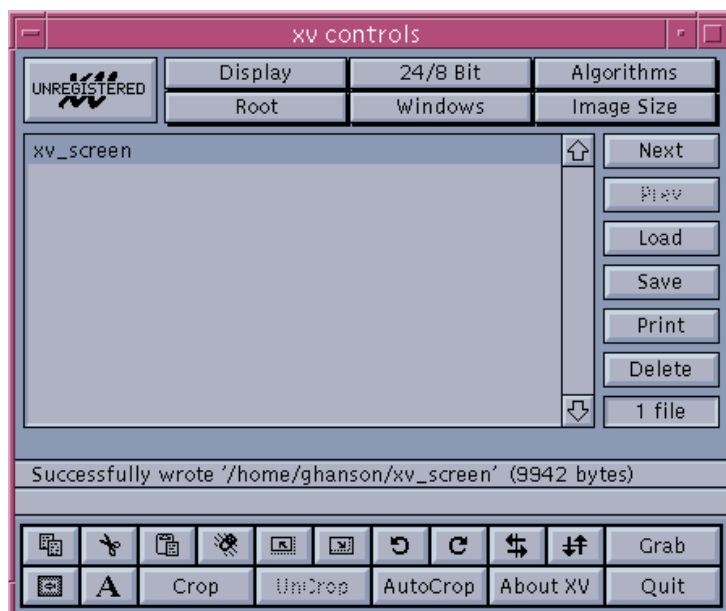
Figure 7: Screen Capture saved as JPEG

TIFF File Format

Stands for Tagged Image File Format. A file format used for scanning, storing and interchanging color and greyscale images. The most common compression method is LZW compression for color images. This compression works very well with files that have large areas of the same color as can be seen in Figure 8. Notice how the button color is consistent across the whole button.



Figure 8: TIFF file format with LZW compression that has been enlarged



GIF File Format

Stands for Graphic Interchange Format. This format was developed by Compuserve for Internet usage. It uses lossless compression and is limited to 256 colors. The major trade off with this format is the limited color pallet that it supports. Figure 10 demonstrates file quality when “exact” color replacement is used. The actual number of colors supported is always less than 256 colors. In this case eight colors were identified. Figure 11 demonstrates the trade off of using the 256 color Windows system pallet. Note that most colors are dithered because the colors used on the Unix machine where this image was captured were not part of the standard Windows system pallet.

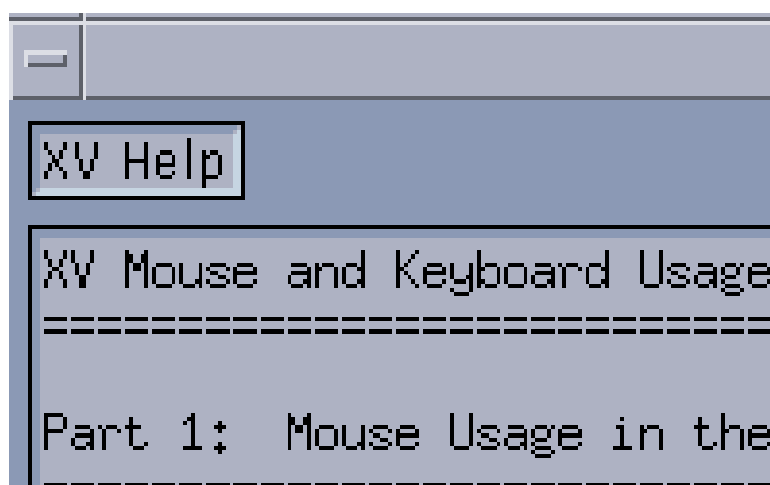


Figure 10: GIF file format with “exact” color replacement

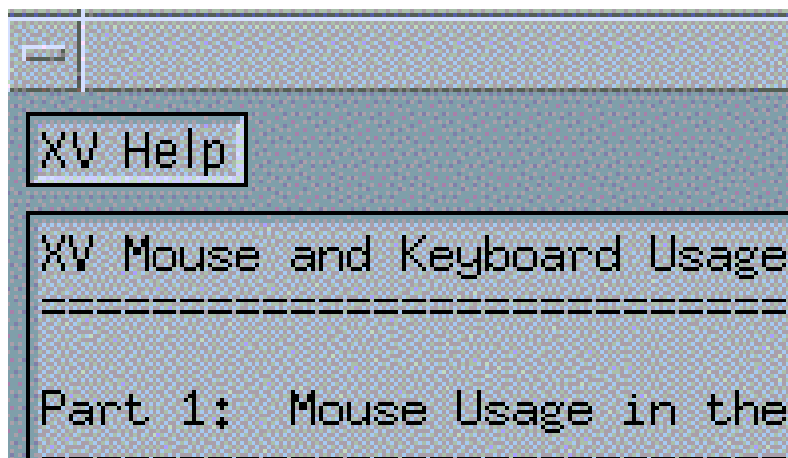


Figure 11: GIF file format with Windows system color replacement

Color Conversion to Black and White

As is often the case color images will be printed in black and white. If some advance planning does not take place, the results are unacceptable. You may or may not be able to control color choices but if you can, test your results. Notice how the colored text disappears in the black and white version.



Figure 12: Colored Text in color and as greyscale

Compare the color grid in Figure 13 with Figure 14. Note that reds and blues have about the same greyscale values as well as green, magenta and cyan.



Figure 13: Color sampler

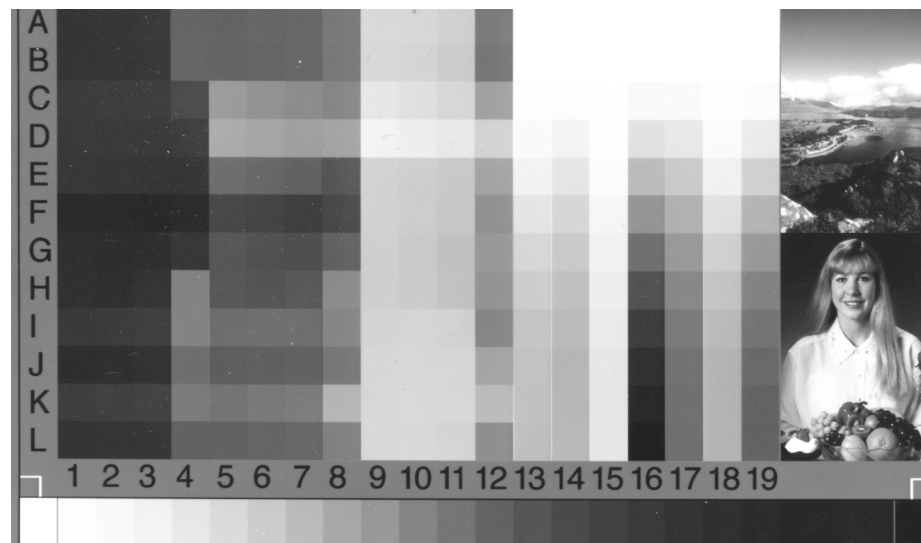


Figure 14: Color sampler as greyscale



What Should I Do?

All suggestions following should create quality images for both the screen and printed copy. File size for the graphic may be larger than what you have been used to. The question is what is more important quality images or file size. None of these recommendations will create huge files, just slightly larger.

Screen Capture

The TIFF format with LZW compression is really the only choice of file format to use when doing screen captures. Not only does it most faithfully reproduce the color, it is the only format when using XV to do the screen captures that saves the file at the highest possible screen resolution. It will save the file at 1200 dpi. Before you think, “Why so high,” you need to note one other fact. The image size is small, very small. Figure 15 is a XV screen capture with no resizing. Pretty small, but if you zoom in as tightly as possible, all the information is there.



Figure 15: XV-screen no resizing 1200 dpi

Here is the same file resized to a more useful size and it is about 120 dpi. As you can see, it displays clean and is very readable. This file was imported into FrameMaker at 150 dpi and was then resized further by dragging the corner while holding down the shift key to maintain proportions.

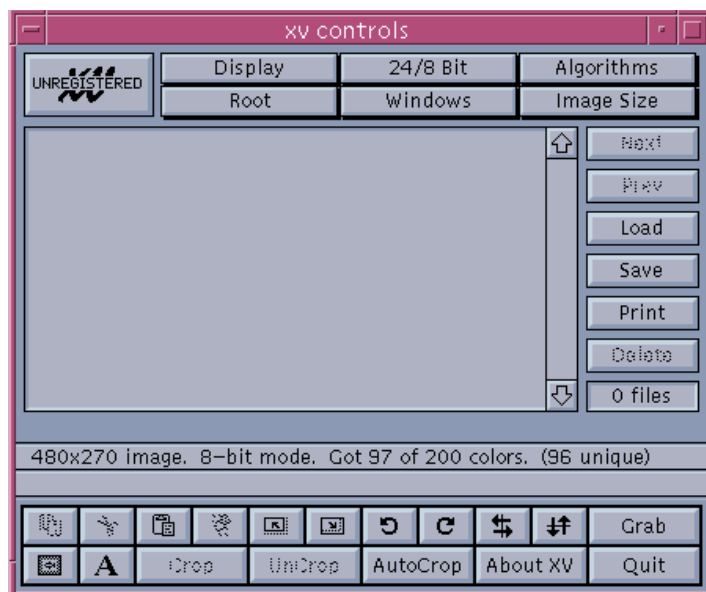


Figure 16: XV-screen resized to about 120 dpi



Scanned Images

Scan images at 300 dpi saving in TIFF format again with LZW compression for color images. If the image is a black and white line drawing, you may use CCIT Group 4 compression. It is important to select the correct file type when scanning. Selecting color, greyscale or black and white affects not only the image but the file size. Figure 13 was scanned at 300 dpi and inserted into the FrameMaker file.

Color images that Don't Print Well in Black and White

Paint Shop Pro, which sells for less than a hundred dollars, has a Color Replacer Tool which allows you to replace one color with another either at the swipe of the mouse or on a global basis. Adobe Photoshop also has a similar tool. This can be used to change text color in a screen capture to a more contrasting color. It could also be used to change a button color to highlight the button under discussion. Complete instructions on how to use the Color Replacer Tool can be found in the user documentation or in the on-line help.

Note the improved readability of the text in Figure 18 when compared to Figure 17.

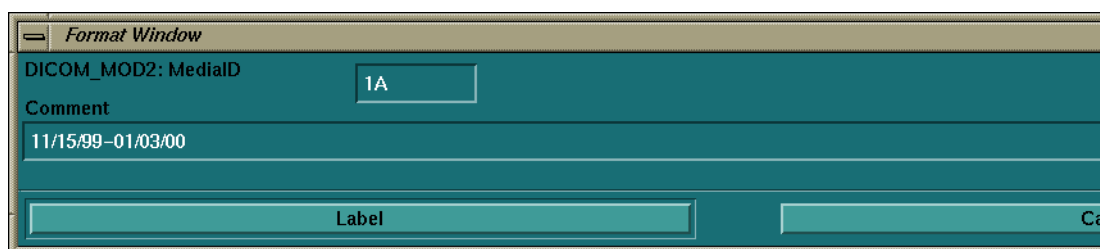


Figure 17: Screen capture unmodified

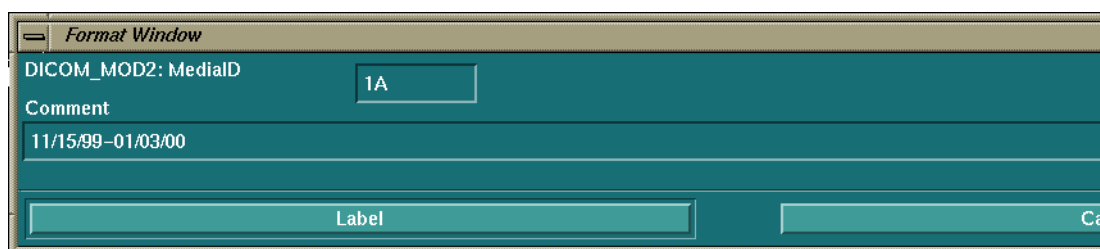


Figure 18: Screen capture with black text changed to white.