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Macintosh Display Cards Overview (1 of 3)

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Revised:        7/16/90
Security:       Everyone
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This article last reviewed: 19 March 1990

The Apple Macintosh Display Cards 4/8, 8/24, and 8/24 GC greatly extend the performance and flexibility of the Macintosh video card product line. The Display Card 4/8 and the Display Card 8/24 provide the Macintosh II family with a single interface to all Apple displays, and a broad range of graphics capabilities. The Display Card 8/24 GC augments the features of the Display Card 8/24 with the power of a dedicated graphics coprocessor to provide sophisticated graphics capabilities at significantly faster drawing speeds.

The Macintosh Display Card 4/8 provides support for up to 256 colors or grays on the Apple High-Resolution Monochrome and AppleColor High-Resolution RGB Monitors. It also provides up to 16 grays on the Apple Macintosh Portrait Display and Apple Two-Page Monochrome Monitor.

The Macintosh Display Card 8/24 and 8/24 GC support all Apple displays to the maximum of their capabilities, including full 256-level "true grayscale" on all Apple displays. The cards also support full 24-bit "true color" capability on the AppleColor High-Resolution RGB Monitor, which allows users to display any of 16.7 million colors simultaneously.   The combination of true grayscale and true color capabilities let you display and work with photographic quality images as well as lifelike simulations, animations, and visual effects.

The Macintosh Display Card 8/24 GC contains an Am29000 RISC-based microprocessor that runs a version of QuickDraw that has been optimized for a coprocessing environment. The Am29000 and the Macintosh CPU work together to speed the QuickDraw environment from five to 30 times depending on the application.   As a result, graphics-intensive applications work faster and more smoothly, especially when using full 24-bit color.

All three cards support RS-170 standard timing for compatibility with numerous interlaced video devices. The Macintosh Display Card 8/24 and 8/24 GC provide highest possible quality interlaced video though the use of Apple Convolution.

Macintosh Display Cards 4/8 and 8/24

Macintosh Display Cards 4/8 and 8/24 offer 24-bit color at an affordable price. The following paragraphs discuss the advantages of 24-bit color and features of the 4/8 and 8/24 display cards.

- CLUT and 8-bit Color Images

With the earlier 8-bit Macintosh II video card, each pixel is represented by an 8-bit color value. The 8- bit value is used as an index into a "color look up table" (CLUT), where a 24-bit value is derived from the table of 256 pre-selected colors . The 24-bit value represents the nearest color to the one indicated by the 8-bit pixel value. The 24-bit color value consists of 8-bit values for red, green, and blue; each is then sent through one of the three 8-bit digital to analog converters (DACs) for conversion to analog color signals.

An 8-bit image is drawn by taking each 24-bit pixel value and, using the Color Manager, finding the closest approximation of that color within the CLUT. The 8-bit index of the closest approximate color is then placed in the frame buffer and represents that pixel's value.

Graphic imaging with 8-bit color video is reasonably accurate if the CLUT is set up with colors that are appropriate for the color mix of the image being drawn, and if the image does not require a large number of colors. Very complex colored images tend to lose much of their detail and shading because they tend to be drawn with a high ratio of "best approximation" colors. A color printed copy of a complex color image scanned at 8-bit per pixel could look quite different from the original.

One drawback of 8-bit color is an effect known as "blocking," which refers to the result of several slight variations of a single color being CLUT represented by the same color. This effect makes it difficult to represent subtle shading and leads to a loss of detail. For instance, a very gradual lightening of the color red across an image may be completely represented by single red.

A similarly problematic side-effect of 8-bit color is known as "banding." Banding can be seen in an 8-bit representation of an image made of only a few different colors, but an almost infinite number of shades of those colors. A 256 color CLUT doesn't have enough colors to handle such an image, and it loses subtlety. Areas where one color gradually blends into the other eventually look like bands of one color blending into bands of the other, with each band of color being the CLUT's closest approximation of several marginally different colors.

Dithering is an effect that may allow a closer approximation to the original image. Dithered colors rely upon grouping a number of pixels in a certain pattern to give the effect of a color not found in the CLUT. Since pixels are so small and so close together, a grouping of blue and yellow pixels gives a similar effect to seeing green pixels. While dithering can improve the rendering of a complex image, the result is still an approximation.

- 24-bit Direct Color

24-bit color, also known as Direct Color, avoids the color approximation issues of 8-bit color by allowing 8 bits for each color. 24-bit color delivers an impressive 16,777,216 red green and blue combinations all the color shades discernable by the human eye.

With 24-bit color, color approximation and the CLUT are no longer necessary. 24-bit color is directly interpreted by the video card firmware as each 8-bit red, green, and blue color definition is fed to the appropriate digital to analog converter for output to the monitor. Images that are problematic for 8-bit color video cards can be drawn with all their brilliant nuances by Direct Color. The Display Card 8/24 supports 24-bit color on the Macintosh RGB 13" monitor.

- True Grays

The 256 shades of gray are accomplished by using 8-bits each of red, green, and blue of equal saturation.   The 4/8 card supports true grays on all but the Portrait and Two-Page displays, where 16 grays are supported. The 8/24 card supports true grays on the Portrait and Two-Page displays. When driving the two larger monochrome displays, the 8/24 cards use only the blue signal in all its 256 saturation levels to accomplish the full gray spectrum.

- Monitor Support

A programmable pixel clock chip and a 100 MHz oscillator on the new display cards makes it possible to support all current Macintosh monitors. The pixel depth supportable on each monitor is a function of the amount of VRAM installed on the display card. Display Card 4/8 has 512K of VRAM and Display Card 8/24 has 1 megabyte. The 100 MHz oscillator provides support for the Macintosh Two-Page Display.

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Tech Info Library Article Number:5210