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Macintosh AV Series: Monitor Support (12/93)

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TOPIC ----------

This article provides information on monitors supported on the Quadra 840AV, Quadra 660AV, and Centris 660AV and on how two frame buffers are used to support both computer graphics and video.

DISCUSSION ----------

Frame Buffers

The members of the Macintosh AV Series are the first Macintosh computers to use two different frame buffers. These are the graphics frame buffer, and the video frame buffer. VRAM can be used in two different ways, either used completely by the graphics frame buffer (standard Macintosh display), or split 50/50 between the graphics frame buffer and the video frame buffer.

To achieve the highest graphics bit depth, the two frame buffers are often used together for graphics. Consequently, video-in is not available when displaying graphics at the highest bit depth for many monitors. When displaying live video, the two frame buffers are merged so the video-input appears as a window on the graphics display.

For example, a Quadra 840AV with 2MB of VRAM can support a 14-inch color monitor at 24-bits in a strictly graphic environment or can provide support for a 16-bit graphics window and a 16-bit video window.

VRAM & Bit Depth

The Quadra 840AV and Centris 660AV come standard with 1 MB VRAM. The Quadra 840AV is expandable to 2 MB VRAM. Upgrading the Quadra 840AV's VRAM to 2 MB permits 24 bit display (millions of colors) on monitors up to 16 inches and 16 bit (thousands of colors) on the 21-inch color monitor.

The machines can drive an NTSC or PAL monitor directly, without the use of an encoder box. In order for that feature to be enabled, the display resolution should be either 512x384 or 640x480 for NTSC, or 640x480 or 768x576 for PAL. Hence the different resolutions available for each display.

Notes:

1) The Macintosh Centris 660AV always has 1 MB of VRAM.

2) The Macintosh Quadra 840AV comes standard with 1 MB of VRAM and may be expanded to 2 MB of VRAM. Four 80 ns (nanosecond) 256K VRAM SIMMs are required.

3) Where multiple resolutions are available, an asterisk (*) indicates the standard resolution. Additional resolutions allow you to display more colors by only using a portion of the monitor. Select the resolution by using the Options dialog of the Monitors Control Panel. You must reboot to change resolutions. The size of the pixels will not change in these alternate modes. Instead, a black border will appear around the smaller active video area.

4) A "Flicker-free" mode (sometimes referred to as Apple Convolution) is available when displaying on a TV. This mode is available at up to 8 bits/pixel and is not available when using video-in.

5) bpp is Bits Per Pixel. A range is given in table below, indicating which of the following are available:

    1 bpp - Black & White
    2 bpp - 4 colors or greys
    4 bpp - 16 colors or greys
    8 bpp - 256 colors or greys (greys only for Video in)
   16 bpp - Thousands of colors (5 bits each of R, G, and B)
   32 (24 plus 8) bpp - Millions of colors (8 bits each of R, G, and B)

6) The maximum visible number of colors is millions. In the past, Apple has labeled this as 24 bit color. However, 24 bpp or 32 bpp are interchangeably used to mean support for millions of colors. When you see 32 bpp listed on the chart below, think 24 plus 8: 24 bpp for displaying millions of colors plus 8 bpp for special uses, such as alpha channel support and chroma key support.

7) Both the video and graphics portions of VRAM are often used together to display graphics at the highest available bit depth. In the table below, the range of graphics bit depths is marked with # when video-in is available at the maximum graphics bit depth. In all other cases video-in is not available when using the highest graphics bit depth.

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	1 MByte VRAM	2 MByte VRAM

		Graphics	Video-in	Graphics	Video-in
Display	Resolution	bpp	bpp	bpp	bpp
12-inch RGB	512x384*	1-32	8-16	1-32	8-16
	560x384	1-32	8-16	1-32	8-16
13-inch, 14-inch RGB	512x384	1-32	8-16	1-32	8-16
& 12-inch Monochrome	640x400	1-32	8-16	1-32	8-16
	640x480*	1-16	8-16	1-32	8-16
15-inch Portrait	512x384	1-8#	8-16	1-8#	8-16
Full-Page Monochrome	640x480	1-8#	8-16	1-8#	8-16
	640x870*	1-8	8-16	1-8#	8-16
15-inch Portrait Full-Page RGB	640x870*	1-8	8-16	1-16	8-16
16-inch RGB	512x384	1-32	8-16	1-32	8-16
	640x480	1-16	8-16	1-32	8-16
	768x576	1-16	8-16	1-32	8-16
	832x624*	1-16	8-16	1-32	8-16
19-inch RGB	1024x768*	1-8	8	1-16	8
21-inch Two-Page	512x384	1-8#	8	1-8#	8
Monochrome	640x480	1-8#	8	1-8#	8
	768x576	1-4#	8	1-4#	8
	1152x870*	1-8	8	1-8#	8
21-inch Two Page RGB	512x384	1-16	8	1-16	8
	640x480	1-16	8	1-16	8
	768x576	1-4#	8	1-4#	8
	1152x870*	1-8	8	1-16	8
VGA/SVGA Displays	640x480*	1-16	8-16	1-32	8-16
56Hz	800x600	1-16	8-16	1-32	8-16
72Hz	800x600	1-16	8-16	1-32	8-16
60Hz	1024x768	1-8	8	1-16	8
70Hz	1024x768	1-8	8	1-16	8
Composite and S-Video Output Modes:					
NTSC convolved (flicker-free mode)					
Underscan (Safetitle)	512x384	1-8	NA	1-8	NA
Overscan (Fullframe)	640x480*	1-8	NA	1-8	NA
NTSC non-convolved					
Underscan (Safetitle)	512x384	1-32	8-16	1-32	8-16
Overscan (Fullframe)	640x480*	1-16	8-16	1-32	8-16
PAL convolved (flicker-free mode)					

Underscan (Safetitle)	640x480	1-8	NA	1-8	NA
Overscan (Fullframe)	768x576*	1-8	NA	1-8	NA

PAL non-convolved

Underscan (Safetitle)	640x480	1-16	8-16	1-32	8-16
Overscan (Fullframe)	768x576*	1-16	8-16	1-32	8-16

* Default resolution. See note 3 above.
\# Video-in is availble at the highest graphics bit depth.
See note 6 above.

(Note: Special thanks to Noah Price of Apple's AV Design Team for portions of this article.)

Article Review History:
14 December 1993 - Retitled and revised to include all members of the Macintosh AV Series.
12 August 1993 - Revised definitions of 32 bpp, 24 bpp.

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