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Macintosh II: Video Overview (2 of 3)

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TOPIC ---

This is the second part of a three-part article describing how the
Macintosh II produces video.

DISCUSSION --

STANDARD RGB DISPLAY SIGNAL

The Macintosh II Video Card uses an approximation of the RS343 display
signal. (RS video standards are set by the Electronic Industries
Association.) The RS343 display standard is essentially a monochrome video
signal combined with a composite sync signal (horizontal and vertical scan
control) with timings that produce a non-interlace, or progressive, scan.
This means that the horizontal and vertical scan rates are timed to cause
the display electron guns to produce even progressively horizontal scans.
This is by comparison to the interlaced video standards. The importance of
the RS343 standard is its provision for a timing and voltage level signal
that allows the display and generation of high resolution video.

While the Macintosh II version of the RS343 signal varies somewhat, it
essentially follows the guidelines necessary for connection to RS343
display devices. The major differences are:

- the separate TTL level composite sync signal found on pin 3
- the separate video lines used to produce RGB color
- a vertical scan rate of 66.67Hz to reduce screen flicker
- a voltage white level of 1 volt for its red and blue signals and 1.3
  volts on its green signal

RS343 provides for a 60hz signal but has been changed to 66.67Hz on the

Macintosh II Video Card to prevent the screen flicker visible at 60Hz. The inclusion of the analog composite sync found on pin 5 of the video card connector, called the green signal, allows for monochrome composite video.

COMPONENTS OF AN NTSC/RS170 TIMING SIGNAL

RS170 is a standard that defines the timing of broadcast video in the United States, Japan, and several other markets. It specifies a 15.75KHz horizontal and a 60Hz vertical interlaced scan frequency. Interlacing is the process by which two fields, called scan lines, are interleaved on the screen. Due to the limitations of video devices at the time of the RS170 standard's creation in 1957, the speed of broadcast signals and picture tubes required the image to be displayed in part. The solution allowed for the partial update of video pictures to remain unnoticed to the viewer. An RS170 video frame contains 525 lines and is displayed 60 times per second -- for a total of 15,750 lines, or 15.75KHz. Of these lines, only the odd or even lines are displayed with each frame. A total of 60 frames per second allows for 30 frames per second, or 30Hz update of each line. Like the RS343 standard, RS170 is strictly a timing specification for monochrome video signals. By combining three such signals to control individual red, green, and blue sweep circuits, a full color system can be created. The RS170 mode was included on the Macintosh II video card as a way for large screen projectors, not capable of high frequency scans, to display the Macintosh II video in the usual broadcast standard of RS170.

THE MACINTOSH VIDEO CARD RS170 MODE

To produce RS170 video, software can be written to logically select the proper timing values and pixel clock from the Macintosh II video card. The pixel clock is a 12.2727MHz oscillator built on the video card and is selected over the 30.24MHz oscillator used in the RS343 mode. With the selection of the RS170 mode, a red, green, and blue signal with a separate TTL composite sync are produced. An analog composite sync pulse is superimposed on the green channel, allowing this signal to drive broadcast devices such as a television, to produce a monochrome image.

NTSC VIDEO (RS170A)

This is not available directly from the Macintosh II video card, but can be produced from the video signals supplied.

When color televisions became available, studios had to decide how to place color onto the broadcast bandwidths delivering black and white signals. There being very little space to work with, the solution was to use a color subcarrier signal modulated onto the luminance signal. The luminance signal controls the intensity of the black and white image. To place the color signal, or chrominance, onto the video signal, an NTSC color encoder is used. This effectively combines the primary additive colors red, green, and blue into a wave form. An output device filters the color signal from the luminance signal and recalculates the original values. To connect an NTSC color encoder, outputs for horizontal sync, vertical sync, blanking period, red, green, and blue in RS170 levels are required. These signals are all available on the Macintosh II video card

and are discussed in the document "About Macintosh II Video Signals."

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