
The video display

The Apple IIe produces a video signal that creates a display on a standard video monitor or, if you add an RF modulator, on a black-and-white or color television set. The video signal is a composite made up of the data that is being displayed plus the horizontal and vertical synchronization signals that the video monitor uses to arrange the lines of display data on the screen.

- ❖ *Video standards:* Apple IIe's manufactured for sale in the U.S. generate a video signal that is compatible with the standards set by the NTSC (National Television Standards Committee). Apple IIe's manufactured for sale in European countries generate video that is a modified NTSC signal.

The display portion of the video signal is a time-varying voltage generated from a stream of data bits, where a 1 corresponds to a voltage that generates a bright dot, and a 0 to a dark dot. The display bit stream is generated in bursts that correspond to the horizontal lines of dots on the video screen. The signal named WNDW' is low during these bursts.

During the time intervals between bursts of data, nothing is displayed on the screen. During these intervals, called the *blanking intervals*, the display is blank and the WNDW' signal is high. The synchronization signals, called *sync* for short, are produced by making the signal named SYNC' low during portions of the blanking intervals. The sync pulses are at a voltage equivalent to blacker-than-black video and don't show on the screen.

The video counters

The address and timing signals that control the generation of the video display are all derived from a chain of counters inside the IOU. Only a few of these counter signals are accessible from outside the IOU, but they are all important in understanding the operation of the display generation process, particularly the display-memory addressing described in the next section.