

Video signal concepts

Video systems for audio-visual presentations can be grouped into different categories based on the characteristics of the signal being displayed.

- 1 The scan rate of the signal
2. Composite video or component video
- 3 The type of signal timing coupled with the picture information

SCAN RATES

In order to have a basic understanding of scan rates it is necessary to talk a bit about how a TV monitor and a computer monitor display picture information. On a TV or computer monitor the picture is displayed by an electron beam that projects one line of picture information at a time horizontally across the display making elements on the inside of the picture tube glow with the picture information. When the beam reaches the side of the picture tube it is signaled by a horizontal sync pulse to return to the other side and trace a new line in a new location. When the scan beam reaches the bottom it is signaled by a vertical sync pulse to return to the top to start a new horizontal scan series. The lines of picture information are displayed fast enough (30 complete frames per second with television) to give the perception that there is a persistent display.

On a NTSC (National Television Standards Committee) system an interlacing of the horizontal scans is used to overcome several problems that arise when trying to transmit and display complex television signals. The beam first scans the odd numbered horizontal lines then returns to the top to scan the even lines. The odd and even scans of the video image are referred to as fields and they combine totaling 525 total lines to create one frame of video. This scan technique completes a reasonably sharp picture that is displayed fast enough (~30 frames per second) to fool your eye into seeing a smooth persistent image. The interlacing of the video image helps to smooth out motion artifacts and flicker that would be more apparent if the image were displayed one line at a time. This display format also enables the transmission of video signals with a relatively low signal bandwidth requirement. The down side to this interlacing technique is that there is a loss of resolution in the picture information because only half of the total picture information is displayed at a time.

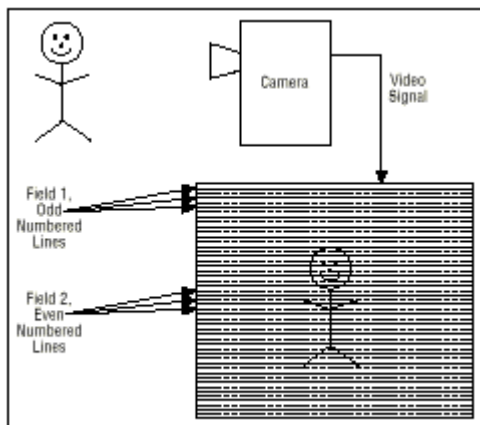


Figure 1. Interlaced scanning.

Computer displays need to carry much more detailed text and picture resolution than a NTSC Television system can deliver. To achieve the display of this fine resolution the rate or speed of the scanning beam is increased, and the total number of lines displayed is also increased. The beam also scans in a progressive

mode, one line at a time, instead of the interlace mode of a TV system to eliminate the blurring of the image that is inherent in the interlaced scan. There are several scan rates that are in use by computer systems corresponding to advancements in graphic display technology. One of the early computer scan rates referred to as VGA displayed a picture made up of 640 horizontal lines by 480 vertical pixels have been all but abandoned for higher scan rates of 800 X 600 known as SAGA, followed by 1024 X 768 known as GAD and most recently 1280 X 1024 known as SAGA. In very simple terms these new scan rates pack more and more total lines of information in the picture, more and more pixels per line, and refresh the display faster and faster increasing the resolution of the image.

In summary, scan rate of the video signal refers to the how fast the picture refreshes itself on the display device. There are two components of the scan rate information, vertical and horizontal. These scan rates work together with the picture detail and color information to complete a video image. Horizontal rates tell the display how fast to draw a new line of picture information and the vertical scan rate tells the display to return to the top of the display and begin a new series of horizontal scans. In a very general sense, the higher the scan rate of the computers output, the sharper and finer the resolution and the more total lines of picture information that need to be displayed.

NTSC Television systems displayed on a CRT (TV monitor) are the lowest resolution display devices that are used in the AV business and are limited to a scan rate of 15.75 kHz. These low-resolution signals are either carried on a single composite coaxial cable or a component, 3-cable format called Y,R-y,B-y, a Y/C video cable, or a less common 3 cable RGsB format.

Computer CRT displays, and video projectors are usually capable of a much higher display rate of up to 120 kHz that allows the use of fine text that would look like a blurry mush on a standard NTSC display at 15.75kHz. The high scan rate signals are always delivered on some form of component format, usually a 15 pin VGA, RGBS four wire, or RGBHV five wire component signal. These higher scan rates also require cables and processing equipment that can process a signal with a much higher bandwidth than a standard NTSC system requires.

It is very important when setting up a video or a computer video display to keep track of the different scan rates that are used by the respective devices and the capabilities of the switching devices, cables, monitors and projectors that you have to use for the event. Some projector and monitors will not accept the high scan rates that are output by computers and the signals need to be “scan converted” to a lower rate. There are several different devices that transform the signals from a high rate to a low scan rate and visa versa and help you display a stable clear, stable signal.

SIGNAL TYPES

Composite video:

The most common and basic type of video signal used in AV presentations is composite video. Composite video is carried to its destination by a single coaxial video cable that carries all the picture color, brightness or luminance, and signal timing information. What this amounts to is a case of the proverbial 10 pounds of potatoes in a 5 pound bag. To squeeze all of this signal information into one cable, all of this separate information is compressed or encoded into a single 1-volt electrical signal that is decoded at the display device resulting in a degraded image quality. This signal is different from the coaxial RF (radio frequency) video signal or cable video that you might use in home video systems. Encoding audio with the video signal degrades RF transmissions even further but they can be transmitted through the air to your home.

Component Video:

Component video signals are used to maintain the quality of the picture by keeping the color, luminance or brightness information, and signal timing information separated on different cables. These cables must be of equal length so that they deliver the information to the display device at the same time.

There are many different forms of component video and computer signals developed by video and computer manufacturers but in the AV business the most common types are;

Y, R-y, B-y

Y/C

R,G,B,Sync

R,G,B,Horizontal,Verticle sync

15 pin VGA Cables

There are advantages and disadvantages to all of these component signals but it is safe to say that component signals, when used properly, are always sharper and cleaner than a composite video signal.

The first component format, Y, R-y, B-y commonly referred to as component video or betacam component is a NTSC video format that is carried on 3 coaxial cables of equal length. The Y signal carries the luminance or brightness information as well as the image fine detail information. The Y signal also carries the sync or signal timing information that tells the scan to begin another line of information. If viewed on a standard composite monitor the Y signal would display a black and white image. The R-y and B-y signals carry all the color information being displayed in the picture without the luminance, sync information or picture detail. It is a common convention in the industry to use a green cable to carry the Y signal, a red cable for the R-y signal and a blue cable for the B-y signal.

The Y/C cable is a consumer version of component video that is commonly used for display of Svhs and Hi-8 video sources. Y/C, also known as S-Video, maintains a separation of the Luminance (Y) and Color information (C). Although this format can deliver a clean picture it is not a preferred format for A/V presentations due to the fragile nature of the small cable that carries the video signal as well as the non locking connection that can be prone to slipping out easily.

15 Pin computer cable is a simple method for connecting a computer to a display. These cables, sometimes referred to as a VGA connector, are the same as your computer to monitor connections at home. The down side to the 15 pin cables is that they are more fragile and prone to braking as well as limitations to the total distance that you can run the signal from its source to the display.

RGBS is a component format that spans both NTSC video scan rates as well as the higher scan rates used for computer video display. In this format the signal color information is carried on three cables that combine to form a color image and a forth cable carries both the horizontal and vertical scan timing information to the display device. This scan information is combined onto one cable and therefore is referred to as composite sync.

In RGBHV format the scan and sync information separation is maintained on independent cables. This is usually referred to as component sync or five-wire signal. One cable carries the horizontal timing info and the other carries the vertical sync information. The remaining 3 cables carry the red blue and green picture information. Some computer video display equipment requires that you maintain separated sync in order to display a picture.

It is very important to keep close track of the signal format for the computer display whether it be four wire or five as well as the color of the cables you connect to carry the colors and sync. Careless wiring of the sync and color cables can lead to an AV nightmare with non-syncing images and bizarre color displays. The importance of quality cables and the cable connections becomes more important with the high scan rates due to the high bandwidth needed to carry the signal. Kinked or damaged cables might pass a low bandwidth signal of composite video but reject a high bandwidth computer sync signal and cause a computer display to glitch and loose sync.

4 and 5 wire RGSB and RGSBV are the preferred methods for sending computer signals over long distances. The video card outputs on most computer systems, especially laptops, are designed to send their signal for a short distance. If you need to send a signal a long distance, it is recommended that an interface be used to convert the signal from the computers monitor output to the more stable RGSB or RGSBV signal format. This component computer signal can then be carried on a more robust medium of a coaxial cable. There are several companies that make interface devices to make this conversion. Exrton and Covid are two of the leading manufacturers of interface equipment