White Paper

Video Signal and Connector Types

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Overview

With the increase of technological advances such as the cable television, the VRC, the S-VHS VCR, the LaserDisk and DVD players, the satellite receiver, the PVR, the Home Theater PC, and the High-Definition TV, there is a huge assortment of video standards to handle along with a variety of cable types, terminations, and configurations to deliver them. There are three distinct concepts: signal formats, cable types, and connector types. Video devices use a variety of different interfaces. However, most video connector types share the common trait of being easy to connect. Because manufacturers need to balance convenience for the consumer use with balance, they prefer to use simple interfaces for video connectors that average users can connect and disconnect without having to tighten thumbscrews, or release tabs and latches. Digital Video connectors are used to deliver the highest quality video signal. The technology uses TMDS (Transition Minimized Differential Signaling) to transmit large amounts of digital data from the source to the display, resulting in high-image quality.

A cable is a transmission line; its function is get signals from point to point without meaningful alteration. Consequently, when one has incompatible source signals and destinations, a cable won't solve the problem. One can't simply wire up a cable with an F-connector at one end and a DVI-D plug at the other and expect to pull digital video out of an antenna. It can get confusing when the terms are mixed together but separating out these concepts will help understand what can and can't be hooked together, and how. It is almost always possible to fabricate a cable which will physically join two components, but whether that cable once installed will actually successfully convey a signal from point A to point B is another question, which has more to do with signal types than with connector types. Connections that look perfectly compatible with one another can be completely incompatible. This article will discuss further into the signal, cable, and connector types.

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Signal Types

The best way to understand what can and cannot be hooked together is to understand what kind of signal is running through the line. When there are two pieces of equipment, one putting out and the other receiving the same signal type, they can talk to one another as long as there is a cable to join them.

Composite Video

Composite is the lowest common denominator of video signals. Composite Video is a single signal which carries both the chrominance (color) and luminance (brightness) components of a video signal, along with sync information, on a single wire. It does not need to be demodulated to be understood by a video display. Like other baseband video formats, a composite video signal does not carry any audio content, which must be handled separately. Nearly all video devices have a composite input and output. This format uses a single RCA or BNC connector. In professional editing environments, composite video signals are most commonly used for troubleshooting, for menu outputs, and for low-quality preview monitoring. For consumer and home use, composite signals are often used to connect VCRs or DVD players to television.

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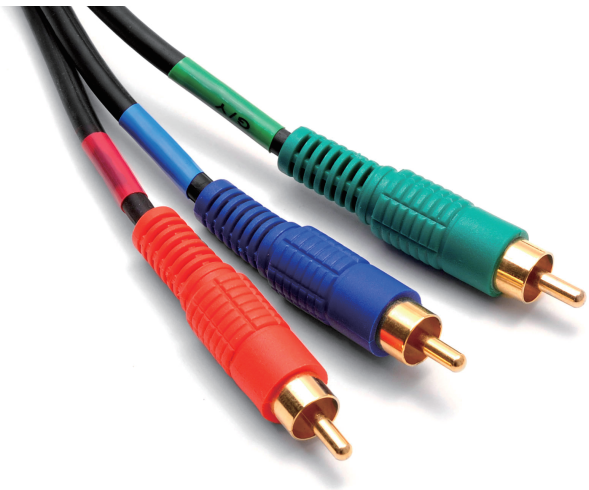
S-Video

The 4-pin Mini Din connector is the proper name for what is commonly referred to as an S-Video connector. The connector has 4 pins arranged in 2 rows, as well as a keying black to make certain the plug cannot be inserted improperly. Even though the S-Video connector has 4 pins, it only carries two signals- luminance and chrominance. The format splits the chrominance and luminance out onto two separate lines, “C” and “Y”, each requiring its own cable; the sync pulses are carried on the luminance line. The Luminance is a black-and-white-wide-bandwidth television signal. The Chrominance is the color information of the video. The other 2 pins are used for signal ground connections.

Component Video



Component video ordinarily refers to “Y/Pb/Pr” or “YUV” video. In Y/Pb/Pr Component Video, there is a luminance channel, “Y”, which carries the luminance along with the sync pulses, and two color-difference channels, which carry signals representing Blue minus Luminance (B-Y, or Pb) and Red minus Luminance (R-Y, or Pr). Component YUV separates color and brightness information into three signals, which keeps the color

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quality more accurate than that of other systems. Component YUV is as good as analog video gets. Both component YUV and RGB signals use from three to five connectors. Three BNV connectors plus a fourth can send a timing signal. Sync can also be embedded in the Y or G part of the signal (using three connectors), a separate composite signal on a forth connector, or separate H and V drive signals (using five connectors).

RGB and its variants: RGsB, RGBS, RGBHV

The original "component video" was RGB, which appears in three principal varieties, each requiring a different number of connections. The most common type is RGBHV, with five lines: red, green, blue, horizontal sync, and vertical sync. RGBHV is the standard use in VGA and other analog PC computer monitors. RGBS, having four connections, differs from RGBHV in having the vertical and horizontal sync combined on a single channel, while RGsB, or "sync-on-green", places the sync information on the green channel.

DVI and its several flavors: DVI-D, DVI-A, DVI-I

DVI is identified both with more than one signal type and more than one connector type. "DVI-A" is nothing but RGBHV in a funny connector and is not digital at all. "DVI-I" is

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not really a signal type, but a connector type which combines DVI-A and DVI-D. DVI-I connector has extra pins at one end, which carry most of the analog video signal. It can be used either for a digital or analog signal because it contains both the digital and analog pins. DVI-D is a parallel digital standard which consists of up to seven balanced lines (all other common video standards are run unbalanced) carrying the video itself, and five miscellaneous conductors carrying other information. Because this is a signal rather than an analog signal, it can only be converted to another format through device that is equipped to decode the digital bitstream and render it in analog form.

SDI

SDI (Serial Digital Interface) is the standard for high-end, uncompressed digital video formats such as D1, D5, and Digital Betacam. To capture digital video from these formats at the highest possible quality, a video interface with an SDI input and output as well as a high-performance disk array is needed to accommodate the high data rates. Many devices can send both video and audio data through a single SDI connection.

HD-SDI

HD-SDI (High Definition Serial Digital Interface) is a higher-bandwidth version of SDI designed for the extremely high data rates required by uncompressed HD video. Like SDI,

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HD-SDI is capable of sending both video and audio through a single connection. There are discussions of HD-SDI performing better than HDMI. HD-SDI was created by the broadcasting industry to be the very best way to transmit HD video and therefore do not need HDCP (high-bandwidth digital content protection), a type of security protocol that forces the source device to generate a security key in order for the TV to display content. HDMI would need such component and so it slows down the connection speed from input to output meaning that HD-SDI will respond quicker and smoother while video switching. HD-SDI uses locking BNC connectors guaranteeing the cable won't get pulled out. HD-SDI uses standard coax cable (RG-6) which is drastically cheaper to produce than HDMI, which uses a proprietary cable. HD-SDI cables can run to lengths of 300 meters before needing help. HD-SDI can easily be scaled down and because of HDCP, HDMI is not backwards compatible with VGA without a device that generates HDCP keys. HD-SDI carries video signal and time code in one able whereas HDMI has no time code support. On the consumer market, HDMI does a great job holding the position of being the standard HD video connection. In the professional video industry where things like quality, durability, speed, time code, and flexibility are all must haves, HD-SDI is the way to go.

Connector Types

When trying to figure out a connection problem, it is important to ensure Type A signal type is really an input of Type A since it is always possible to hook up two devices that employ the same video signal type whether they use the same connector.

HDMI

HDMI stands for High Definition Multimedia Interface. This technology carries the same video information as DVI but adds the capacity for digital audio and controls signals as well. It is a proprietary audio/video interface for transferring uncompressed video data

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and compressed or uncompressed digital audio data from an HDMI-compliant source device, such as display controller, to a compatible computer monitor, video projector, digital television, or digital audio device. HDMI is a digital replacement for analog video standards.

VGA

An increasing number of devices are showing up with 15-pin connectors; there are about as many names as pins for this computer, which is well known as the plug used with most PC computer monitors and consequently is often called a “VGA” plug. Because the plug can be used with so many different video standards, it is important to note to use a 15-pin connector on a device and to know what sort of video it can put our or take in. The “pinout” is the same either way; a cable designed to carry RGBHV will carry Y/Pb/Pr on the Green/Blue/Red lines, respectively, so that all one needs to do is match up the color-coding on the plugs.

DisplayPort

DisplayPort is an interface technology that is designed to connect high-end graphics capable PCs and displays as well as home theater equipment and displays. Like HDMI and DVI, DisplayPort utilizes TMDS (Transition Minimized Differential Signaling) link

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technology to send high bandwidth video and audio signals. DisplayPort has the ability to daisy chain multiple monitors due to the double bit rate advantage. DisplayPort can passively convert to HDMI. It supports graphic card manufacturers, the primary drivers for display. It also support major computer and monitor manufacturers like Apple, Intel, Dell, HP, and the like.

The RCA Plug and Jack

The RCA is the most common connector type on consumer gear for composite and component video, as well as for both digital and analog audio. RCA jacks color-coded yellow on a device usually are composite video inputs and outputs. The RCA connector is not a 75 Ohm design but it is used in a multitude of 75 Ohm applications.

The BNC Plug and Jack

The BNC is the standard connector for most video signals on professional gear, and is showing up increasingly on high-end consumer gear as well. It will be labeled similarly to the RCA, indicating composite video (one connection), Y/C s-video (two connections), Y/Pb/Pr (three connections), or one form or another of RGB. BNC plugs have good impedance characteristics, and their locking mechanism keeps them securely in place once connected. Because they are more expensive and harder to connect than RCA plugs, they are often used for higher-end and/or professional audio/video equipment. They are very common in CCTV and surveillance camera applications.

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