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The Audio/Video Technology Guide

Read all about …

Video formats, conversions, and distribution methods

Plus, how to build up end-to-end solutions

Analog Video Formats

Most analog formats were designed primarily for broadcast TV transmissions, so they limit the transmission bandwidth required for the signal. The video is typically formatted by combining TV signals into a lower-bandwidth encoded signal. But other analog formats, such as VGA, were designed primarily for computer graphics, so they're far less restricted in bandwidth and, therefore, keep the red, green, and blue signals separate to allow higher-resolution pictures that are suitable for viewing from short distances. Here's a comparison of the various formats:

Composite video

Among the connector formats designed originally for TV, Composite video is the analog TV signal before modulation onto an RF carrier. It's the standard that connects most older consumer video equipment, including VCRs, CCTV cameras, and video CD players.

As its name suggests, Composite video has the luminance (black and white), chrominance (color) and sync pulses combined in one signal. When developed, Composite video was designed to work with both color and black-and-white TV signals. This backwards compatibility ensured a smooth transition between the two formats in the 1950s. Black-and-white TV sets were able to ignore the color component while newer sets separated it out and displayed it with the luminance information.

Although this format solved the problem of backward compatibility at the time, by today's standards, Composite video doesn't project a very sharp picture. Because all the video components are transmitted together, they can interact with each other and cause picture defects like dot crawl and color smear.

S-Video

Also often called Y/C video, S-Video was introduced in the 1980s to overcome some of the shortfalls associated with Composite video. It's a less encoded video format. In the S-Video signal, color (C) and luminance (Y) information are transmitted separately to produce a sharper picture image on the display device.

Most video equipment with an S-Video connector typically also has a Composite connector. When connecting devices that support both interfaces, it's best to use the S-Video connector.

Component video

RCA Component

Next up the resolution scale from S-Video is Component video (YCbCr). It separates the signal to an even greater extent than S-Video, further reducing the chance of interference and, as a result, improving picture quality. It provides images with higher resolution and better color quality than either traditional Composite video or S-Video.
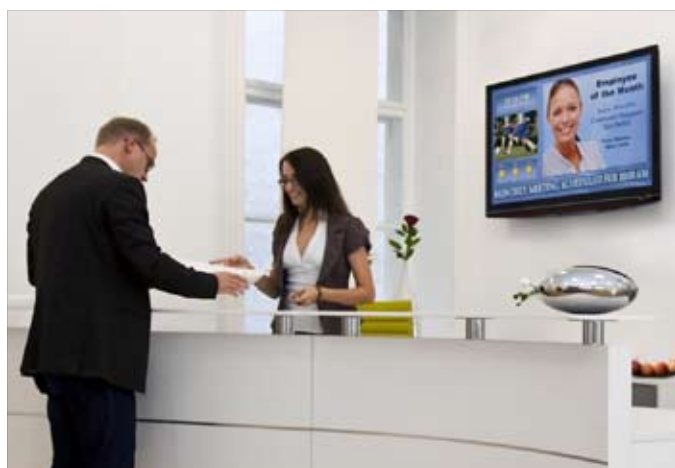
BNC Component

Component video separates color information into two color difference signals: B-Y (blue minus luminance, also called Cb or Pb) and R-Y (red minus luminance, also called Cr or Pr). These along with Y (luminance) result in a total of three signals.

You can find Component video on a lot of DVD players, TV receivers, and other AV equipment, displaying the video of DVDs to their best advantage. Until a few years ago, many video devices typically had all three sets of connectors, with the Component video format communicated via either three BNC connectors (typically the case on higher-end, professional AV equipment) or RCA connectors (consumer-grade electronics).

But today, you might find only a Component connection along with a digital video connector. This way, your TV can make use of the full range of video signals.
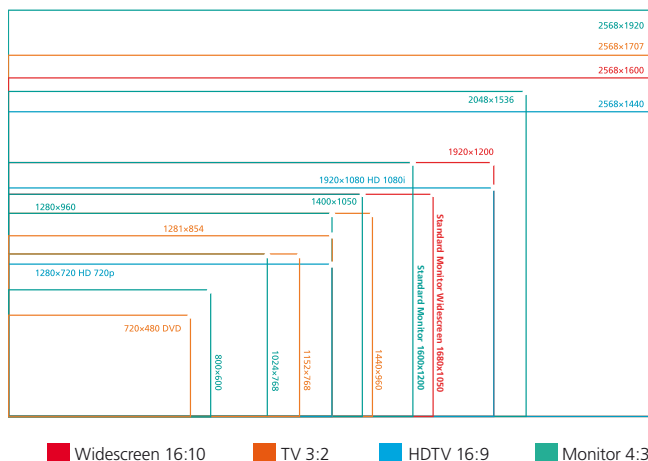
VGA video

Composite, S-Video, and Component were designed primarily as TV formats. However, when discussing analog computer video formats, we're usually talking about variations of the VGA (Video Graphics Array) format.

The VGA interface carries analog RGB with separate horizontal and vertical sync signals and is presented on an HD15 connector (also called 15-pin D-subminiature). When VGA was introduced by IBM® in 1987 for PC video display, it was a huge improvement over the earlier EGA DB9 connector. VGA, the basic format, supports resolutions up to 640 x 480 with 256 colors.

SVGA (Super VGA), XGA, and later formats continued the drive to provide ever-sharper images and greater color depth (see the chart **below**)—oftentimes, rivaling those of digital 1080i and 1080p displays. Plus, over the years, VESA standards have brought interoperability to a market that was becoming a mixture of often incompatible SVGA graphics cards.

VGA Format	Max. Resolution
VGA (Video Graphics Array)	640 x 480
SVGA (Super Video Graphics Array)	800 x 600
XGA (Extended Graphics Array)	1024 x 768
W-XGA (Wide Extended Graphics Array)	1366 x 768
SXGA (Super Extended Graphics Array)	1280 x 1024
UXGA (Ultra Extended Graphics Array)	1600 x 1200
WUXGA (Wide Ultra Extended Graphics Array)	1920 x 1200

Video aspect ratios and resolutions

2568×1920
2568×1707
2568×1600
2048×1536
2568×1440
1920×1200
1920×1080 HD 1080i
1400×1050
1280×960
1281×854
1280×720 HD 720p
720×480 DVD
800×600
1024×768
1152×768
1440×960
Standard Monitor Widescreen 1680x1050
Standard Monitor 1600x1200

■ Widescreen 16:10   ■ TV 3:2   ■ HDTV 16:9   ■ Monitor 4:3

Display standards are a combination of display resolution (specified as the width and height in pixels), color depth (measured in bits), and refresh rate (expressed in hertz).

Digital Video Formats

SDI video

The serial digital interface is a format most commonly found in high-end broadcasting applications. Although SDI transmits uncompressed, unencrypted digital video signals, it typically depends on 75-ohm BNC coax cable for transmission — the same cabling traditionally used for analog video communications.

SDI interfaces are standardized by the Society of Motion Picture and Television Engineers (SMPTE) and include: standard-definition SD-SDI (SMPTE 259M) for 480i and 576i; "expanded" standard-definition ED-SDI (SMPTE 344M) for 480p and 576p; high-definition HD-SDI (SMPTE 292M) for 720p and 1080i; and high-definition 3G-SDI (SMPTE 424M) for 1080p transmitted at 2.970 Gbps.

DVI video

DVI-D, Dual Link
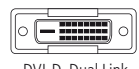
The Digital Video Interface (DVI) is a display technology created by the Digital Display Working Group (DDWG). Its design followed the VESA DFP connector standard, and it was created to accommodate both analog and digital interfaces with a single connector. DVI is the standard digital interface for PCs (in contrast to HDMI, which is more commonly found on HDTVs).

The format is based on transition-minimized differential signaling (TMDS). Single-link DVI uses one TMDS-165 MHz transmitter, and dual-link DVI uses two, doubling the transmission power. A single-link cable can transmit a resolution of 1920 x 1200 vs. 2560 x 1600 for a dual-link cable.

The two most common DVI connector interfaces are:

DVI-D: This digital-only interface provides a high-quality image and fast transfer rates. It eliminates analog conversion and improves the display. Often used to link a source and a display, it can be used when one or both connections are DVI-D.

DVI-I: It integrates both digital and analog RGB support, and it can transmit digital-to-digital or analog-to-analog signals. DVI-I can be used with adapters to enable analog connectivity to a VGA or DVI-I display or digital connectivity to a DVI-D display. You can achieve the best picture quality by using a digital DVI display with a DVI-D video source.

HDMI video

The High-Definition Multimedia Interface (HDMI®) combines uncompressed HD video, multichannel audio, and intelligent format/command data in a single cable with a very compact connector.

HDMI can carry video at resolutions up to 4K x 2K (4096 x 2160 at 24 Hz). It provides superior HDTV video and audio clarity and has enough bandwidth (up to 5 Gigabytes) to spare for future applications. Plus, it's backward compatible with DVI (which simply ignores extra HDMI data).

HDMI also supports multiple audio formats from standard stereo to multichannel surround sound. For video distribution applications, HDMI provides two-way communications between the source and the digital TV, enabling simple, remote, point-and-click configurations.

HDMI also supports High-bandwidth Digital Content Protection (HDCP), which prevents the copying of content transmitted over HDMI cable. If you have a device between the source and the display that supports HDMI but not HDCP, your transmission won't work, even over an HDMI cable.

HDMI offers significant benefits over older analog AV connections. It's backward compatible with DVI equipment. A DVI-to-HDMI adapter can be used without a loss of video quality.

The HDMI standard was introduced in December 2002. Since then, there have been a number of versions with increasing bandwidth and/or transmission capabilities. Version 1.3, introduced in 2006, increased the bandwidth to 10.2 Gbps and added support for up to 16-bit Deep Color. Version 1.4, released in 2009, increased maximum supported resolution to 4K x 2K (4096 x 2160 at 24 Hz), and added support for a 100-Mbps Ethernet connection between the HDMI devices, an audio return channel, and 3D support.

DisplayPort video

Designed by the Video Electronics Standards Association (VESA), it competes directly with HDMI. Unlike HDMI, however, DisplayPort is an open standard with no royalties.

This digital interface is used primarily between a computer and a monitor or an HDTV and is built into many computer chipsets produced today. It's incredibly versatile, with the capability to deliver digital video, audio, bidirectional communications, and accessory power over a single connector.

DisplayPort v1.1 supports a maximum of 10.8 Gbps over a 6.4-foot (2-m) cable; v1.2 supports up to 21.6 Gbps. DisplayPort v1.2 also enables you to daisychain up to four monitors with only a single output cable. Plus, it offers the future promise of DisplayPort hubs that would operate much like a USB hub.

Cables up to 50 feet can be used for lower resolutions.

The standard DisplayPort connector is very compact and features latches that don't add to the connector's size. Unlike HDMI, a DisplayPort connector is easily lockable with a pinch-down locking hood. A quick squeeze of the connector releases the latch. Because it locks into place, accidental disconnections are less likely — a quite useful feature for any video distribution application where there's digital signage in public areas.

DP++ compatible sources are able to output TMDS signals (HDMI or DVI video) by using a compatible DisplayPort to HDMI or DVI adapter. HDMI or DVI sources, on the other hand, require an active powered converter to change the signal to DisplayPort.

Cable-Based Distribution

In-line based

In-line extenders, installed at some point within a link, extend signals over their native cabling with no signal conversion occurring. These amplification or repeater types of devices are designed to equalize and amplify the signal to go greater distances. Some support daisychaining, so by stringing two of them together you can send data double the distance.

But in-line extenders can only take the signal so far and typically use amplification that not only boosts the video signal, but also boosts any

DVI Cable
In-Line Extender
DVD Player
DVI Cable
Remote Display
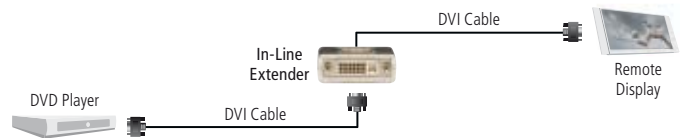
noise on the cable. In addition, they don't solve the problem of having to transmit bidirectional serial control signals to the display.

Non-networked CATx-based

This method uses transmitters and receivers to extend converted signals over non-networked UTP cabling. They're very cost-effective, enabling much longer distances than what's ordinarily possible with analog or digital video cabling.

Copper-based extension is also a great alternative to using standard video or RGB coax cables, which often can't be easily pulled through tight conduits and can be more difficult to terminate (for more on the limitations of simply extending video cabling, see **below**).

A bonus: In most buildings, copper cabling is already installed to service data communications. There's no need to pull new cabling when existing wiring can be used for long-distance AV distribution instead.

Another thing to consider: Coax- or VGA-cabled extension installations usually require a separate RS-232 or other line for transmitting the control signal for a display—yet another cable to fit into the conduit and another distance limitation (most serial signals can travel only a short distance over traditional cable). Some CATx-based extenders also extend serial control

signals in addition to video and audio. Therefore the cable can deliver both the video and control signals through a single transmission medium.

Plus, CATx extension technology continues to evolve. Newer HDBaseT™ technology uses sophisticated encoding and equalization techniques to deliver uncompressed DVI or HDMI video and audio, 100BASE-T Ethernet, power, and control signals to a remote screen—all over a single CATx cable. HDBaseT has made it possible to transmit the video signal as well as the peripheral signals uncompressed up to 100 m.

CATx-Based Extender Transmitter and Receiver
Blu-ray Player
Remote Display
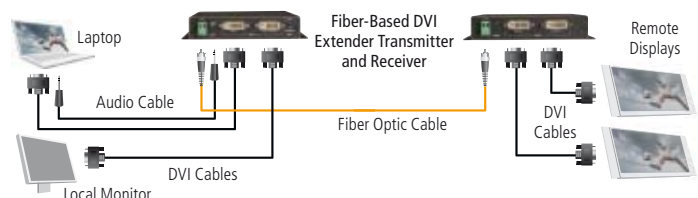HDMI Cable
CATx Cable
HDMI Cable
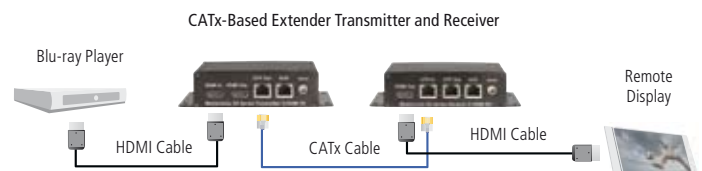
Non-networked fiber-based

Using fiber-based technology has many advantages over copper-based distribution technology. Foremost, it enables you to deliver video at much longer distances than copper—without compromising the quality of the original video signal. This makes it an ideal distribution method for digital signage.

Plus, it supports high resolutions and the sending of large, bandwidth-consuming files, particularly in electronically noisy environments, such as in transit stations. Because fiber is made of glass, which is an insulator, no electric current can flow through. This makes it immune to EMI/RFI interference. You can run fiber next to industrial equipment without worry. And, compared with copper cable, fiber cable is less susceptible to temperature fluctuations.

In addition, fiber distribution is ideal for applications where data security is a priority, such as in medical, military, and government environments. That's because fiber cable is extremely difficult to tap.

And fiber cable is more durable than copper cable, and it's thinner. Its size makes it easier to handle, and it takes up less space in cabling ducts. Yes, fiber is more expensive, but many fiber-based extenders use just a single strand of fiber, for a more economical use of your fiber count.

Laptop
Fiber-Based DVI Extender Transmitter and Receiver
Remote Displays
Audio Cable
Fiber Optic Cable
DVI Cables
DVI Cables
Local Monitor

Why not just run longer cables?

An analog video signal can be run over long lengths of native VGA cable as long as its diameter and shielding is good enough. However, regardless of the cable quality, signal attenuation increases with video frequency and cable length. This means that after 30 to 50 feet, the image quality will start to degrade. This leads to color skew and smeared-looking text.

To solve for signal degradation in VGA video applications, use an equalizer, or an extender that compensates for signal loss. A good extender has separate adjustments for high and low frequencies; HF loss is usually greater than LF loss.

Analog signals travel in a sine-like wave form; digital DVI and HDMI signals travel in a square-like waveform. The signal is broken into a binary format where the audio or video data is represented by a series of 1s and 0s. Like analog signals, digital video also suffers from cable loss, but as long as the cable is of sufficient quality and within the maximum supported distance, the signals don't suffer blurring or color skew.

So what happens when the maximum supported length is exceeded? You get the "cliff" effect, where the signal drops off and you completely lose the picture. To overcome distance limitations, use extenders or repeaters.

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IP-Based Distribution

IP-based distribution technologies use transmitters and receivers to extend signals over a TCP/IP network (a LAN or even a WAN, for instance). Oftentimes, they're called IP streamers when used with codecs. But, when choosing one, be sure you're not looking at the consumer-grade devices for streaming video in small office applications; be sure it's a professional-grade multicasting product.

These sophisticated extenders use CATx cabling infrastructure, but in comparison to standard non-networked CATx extenders, they multicast data over an active Ethernet network. They do this by packetizing media streams for delivery over an IP-based network, so source content can be delivered anywhere you have Ethernet wiring.

By leveraging existing IP network connections to distribute multimedia content, businesses can avoid running expensive dedicated links from a back room to digital signage in lobbies or other public areas. Plus, the video is a lot less susceptible to interference, image skew, and compromised resolution.

Compression makes it possible to run the signal over longer runs—and compression does not have to mean low-quality video. Compressions may be lossy or lossless. The IP-based extension methods we're discussing use visually lossless compression with algorithms that make it possible to run Full HD video over the LAN without any visual loss in quality.

They may even simulcast video and audio synchronously so there's no latency, feature QoS prioritization and bandwidth-management controls, and the ability to use bidirectional (two-way) serial signals to query a remote display to, for example, shut it down and power it on or gather performance data. What's more, the system you choose may even support bidirectional serial connections for use with interactive touchscreens.

Also, they may or may not support existing networking standards. This is important if you need extra distance in your distribution application. If they do support Ethernet standards, you can extend video through networking switches to get extra-long distances, beyond the specified cabling distances of 328 feet (100 m) per the Ethernet standard.

Because IP-based extenders are based on standardized Ethernet protocols, you can even use media converters and run several miles over fiber cabling. Plus, these extenders transmit signals digitally from end to end, so digital content is never compromised.

Meeting existing standards also allows for easy installation and expansion. Simply plug in as many receivers as you need for your remote screens and use a standard Gigabit network switch with IGMP snooping to control the traffic. IGMP is very important in multicasting. This stops an IP switch from passing on multicast data onto every port and prevents performance degradation and wasted network bandwidth. Switches with IGMP support "know" which devices on your IP network want to receive the multicast packet and who doesn't. Otherwise, the traffic may be broadcasted to every end device on your network, slowing it to a halt.
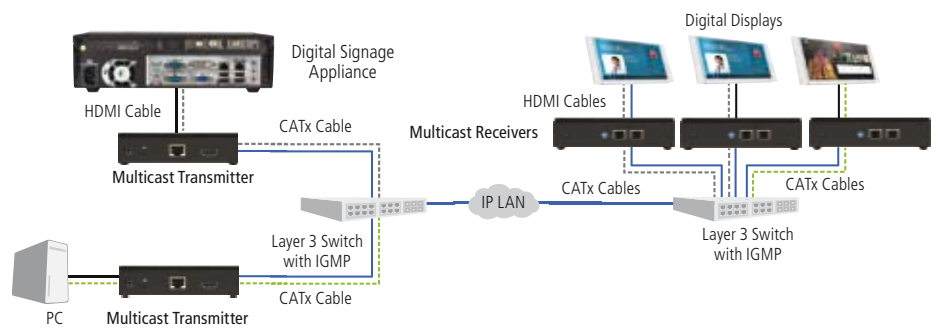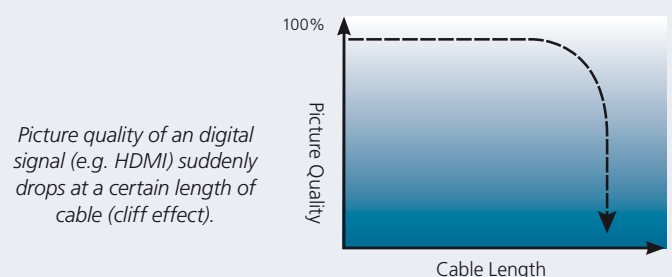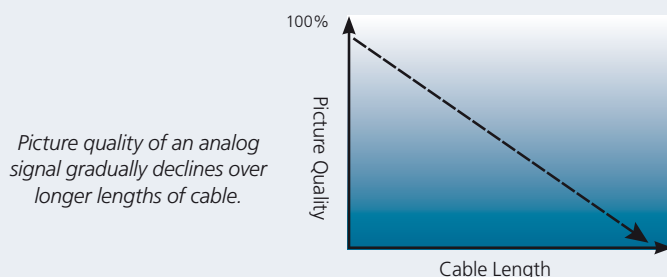
Multcasting isn't limited to just video either. You can also use it for both video and peripheral signal extension and sharing (often called "KVM extension") applications. These types of extenders feature keyboard/mouse emulation and emulation for other standard HID devices, while providing easy access to single-, dual-, or quad-head computers—ideal for applications requiring multiple graphic heads to be switched simultaneously from a single workstation. In command and control room setups, for example, you can multicast video and data to receivers attached to LCDs
in video walls. Users can then interact with computers behind the scenes using separate keyboard, mice, and digital displays.

QUESTIONS to ask.

1. How far do you need to transmit your video? Do you want to go farther than 100 Meter?
2. Do you have copper (CATx or coax) wiring not in use?
3. How important is video quality? Do you intend to transmit medical images or detailed graphics renderings?
4. Is bandwidth an issue on your network? Is your LAN already being used for VoIP or data-intensive applications?
5. Do you want to transmit to one screen or multiple screens?
6. Will you need connectivity to serial touchscreens?
7. Is data privacy an important consideration?
8. Will you be distributing video near machinery?
9. Do your network switches support IGMP snooping?
10. Do you need peripheral support (for instance, for remote users who require keyboard and mouse control, or for command and control room applications)?

Contact the experts at 0811/5541-110.

Picture quality of an analog signal gradually declines over longer lengths of cable.

Picture quality of an digital signal (e.g. HDMI) suddenly drops at a certain length of cable (cliff effect).

Source Devices

Digital signage publishers

Also called digital signage appliances, these function essentially as storage devices to play back digital content, such as MPEG or Windows® AVI media, Flash® animations, PowerPoint® movie files, and audio. They can operate on their own (directly connected to a screen), but are usually on a network with their own IP address, enabling management via a browser-based interface.

They can also be set up to deliver RSS and XML data feeds, and other Web-based content in real time to your displays. They're usually Windows or Linux® based PCs by design with spacious drives and high-performance processors. They're called publishers because they contain the software that enables you to manage content distribution, as well as creative design tools to set up and insert media into zones within a signage presentation.

Other video sources

This can be as simple as a Blu-ray or DVD player, or a robust dedicated or shared server hosted centrally or in a distributed environment.

These devices can also be used to bridge the connection between your digital signage publisher and a content management system. For instance, prerecorded video and other content can originate from the content management system or a video library. For corporate applications, your AV distribution system can be connected to an Oracle® database or a CRM system, and in retail applications, digital signage screens can link to a PoS database running on a network and tracking available inventory.

Source devices can also be whatever it takes to link a Internet or WAN feed to your video distribution or digital signage system, including network gateways or CATV or DTV set-top boxes.

Extenders

For maximum reach and image control in your AV distribution or signage application, you'll likely need devices that enable you to send signals farther than what's possible when using video cabling by itself. These transmitter/receiver combos enable you to send DVI, VGA, or other types of video (as well as audio) from a PC or other source devices to remote screens.

These devices include:

- In-line extenders, like amplifiers and boosters, which are installed within a video cable run.
- Baluns, which are devices that connect a balanced line, such as twisted-pair cable, to an unbalanced line, such as coaxial cable. Many versions are available for VGA and other analog RGB video standards, as well as CCTV camera connections.
- CATx-based extenders, which convert the signal for extension over CAT5 or higher-grade cable, enabling you to use inexpensive wiring for your long-distance extensions.
- Fiber-based extenders (or transceivers), which convert and distribute AV signals over interference-free fiber cabling at very long distances.
- Broadcasters, which are like extenders in that they typically use CATx cabling to distribute video to remote locations. However, they also support multiple channels for multisite distribution.
- QAM modulators. These encode and modulate video input and create an HDTV channel for low-cost video distribution over existing RF cabling. Simply use the QAM tuner of an HDTV to receive the channel.
- IP-based streamers and encoders/decoders. These devices compress and encode source video for extending over a LAN using lossless compression technology. They can be for multipoint distribution (multicast) or point to point (unicast).

Other Signal Distribution Components

Splitters

For displaying images on multiple screens, order a splitter. Unlike CATx-based broadcasters or multichannel extension products, splitters divide a PC's VGA, DVI, HDMI®, DisplayPort, or other type of signal without sacrificing quality.

In some cases, splitters buffer output and drive signals extra distances without any loss, so they essentially function as extenders, too. They're a great choice for splitting signals in retail applications where you want to keep source equipment in a secure area.

Plus, they're very easy to set up. In most cases, you just connect the video cables, power up your system, and you're ready to start duplicating images for multiple monitors or displays.

Switches

Available in VGA, DVI, HDMI, and other versions, these enable you to switch video from PCs with multiple video outputs to a common display. You can do this manually or set it up to switch automatically based on input detection. Many switches also come with IR remote control units so you can switch sources away from the unit itself. Most also include an RS-232 port for connecting to a serial console.

Matrix versions are available for showing video images from separate sources on multiple displays, eliminating the need to constantly swap cables between inputs and outputs.

For instance, if your operation has four PCs and you want to display the video on one monitor to the other three monitors, a matrix video switch is what you need to handle the job. In many cases, they can be linked to a Crestron, AMX, or similar system.

Any source input can be routed to any display output, and their matrix functionality makes them ideal for command and control rooms where one has to frequently switch video from multiple sources to multiple screens. They are also great for video broadcasting, corporate theater, conference room, and training applications. For easy recall, most matrix switches store a number of preset routing patterns.

And because many newer HDMI switches are HDCP compliant, they can be connected to Blu-ray players or other protected-content sources, a function that enables easy integration into video production environments.

What about wireless distribution components?

It is taking the industry longer to offer completely reliable solutions for distributing high-quality video wirelessly. Part of the problem is the inability to consistently transmit full-motion video in real time over an active wireless connection. Because the technology often involves multicasting video, audio, and peripheral signals, there are latency issues at a higher resolutions. Error propagation and latency can make transmittal unreliable if there is insufficient or shared bandwidth.

Yes, it can be done, but bandwidth is still a limitation. Full HD video requires a huge amount of bandwidth, limiting distance. Even the best solutions on the market today are limited to maximum distances of about 30 Meter, and having to go through walls reduces distances further.

Also complicating matters: The wireless video solutions have to share the spectrum with other wireless services, including regular Wi-Fi. This may affect the reliability of the wireless video system as well as the Wi-Fi network, so some planning and careful design is recommended.

If you require a wireless video solution, call our FREE Tech Support at 0811/5541-110.

Advanced video and peripheral sharing systems

In some applications, switching just video and audio isn't enough. You may also need to access and switch between peripheral USB HID devices and remotely located computer CPUs or backracked servers, and provide switching access to more than one employee.

In these applications, a modular video and peripheral matrix switching system can provide you with the flexibility you require. These modular crosspoint switching systems enable you to switch between PC CPUs in applications where HD video is everything. They're designed to interface with and enable non-blocking matrix switching of digital video, USB-HID, USB 2.0, RS-232, and audio ports.

What's more, they enable you to use the existing cabling infrastructure for connectivity between a console/CPU and a switch without a media converter or third-party switching device.

In addition to matrix switching, they may even provide high-performance routing of HD video, audio, and data for complete signal distribution. In this instance, they work as extension devices, and like our IP-based extenders, they use multicasting to distribute signals over a network.

If you don't need such advanced switching and extension capabilities, but just want easy monitoring and switching of video from multiple computer heads, a KVM type of sharing/switching device may be all you need. These give you the ability to control multiple CPUs or servers from one keyboard and mouse plus the ability to display the video from those multiple servers or servers on one monitor — all at the same time, and in real time.

In addition to command and control rooms, KVM switches are ideal for workstations in financial, banking, engineering, graphics, and healthcare.

QUESTI❓NS to ask.

1. Where do you intend to store most of your video content (on a back-racked server, on a workstation PC, at a remote office, on an FTP site)?
2. Do you intend to distribute video from a number of different sources (including Blu-ray or DVD players)?
3. Will you need to integrate a sales CRM system or other database into your AV distribution system?
4. Do you intend to use RSS feeds or other external Web content on digital signage?
5. When outputting video from a single source to multiple displays, do you require extended distance?
6. Will you be transmitting in video areas with interference or vibration?
7. Do you have CATV or other RF coax wiring available?
8. Will you need to distribute signals from more than one source to a display?
9. Will many users, including those in remote offices, require workstation access to multiple computers for routing video to multiple screens?

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# Essential components for converting and upconverting video.

Conversion and Scaling

EDID Ghosts and Emulators

Ghosts can be handy tools to solve problems with certain combinations of video sources, distribution equipment, and displays. Display Data Channel Extended Display Identification Data (DDC EDID) is the data that tells your computer's graphics card what characteristics your monitor/display has, such as resolution, color depth, digital pixel mapping, and more. The monitor automatically sends the DDC EDID straight through to the computer. But, sometimes, when you put a device, such as a KVM switch, between your monitor and computer, the data is not passed through. The result can be blank screens, boot problems, as well as resolution and color issues.

In these cases, use a **ghost**. A ghost will store the data from the display a nd pass it on to the graphics card.
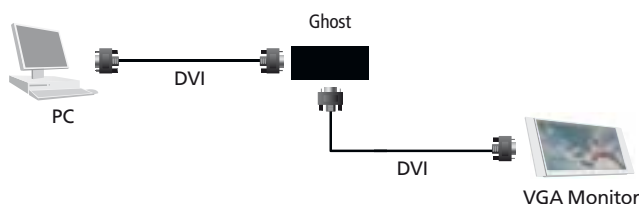
Video Converters

Video converters, at their most basic, convert and reformat signals from one video interface to another type of video interface, such as ones that enable you to display VGA computer video on an NTSC or PAL TV. Basic video converters are neither scalers nor scan converters. This means that the resolution of the video signal at output is the same as the input signal, which can be a problem if you're trying to send PC video to an HDMI-enabled display. Therefore, if you set your PC at a resolution of 1024 x 768 (XGA), your display may not show the HDMI image. In this case, you have to set your PC's resolution to either 640 x 480 at 60 Hz (VGA interpreted as 480p), 800 x 600 at 50 Hz (SVGA interpreted as 576p), 1280 x 720 at 60 Hz (WXGA interpreted as 720p), or 1920 x 1080 (1080p).
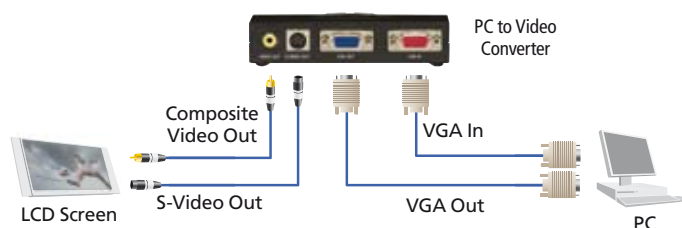

Scalers

A scaler is a device that samples an input signal and scales it up or down to a resolution and timing suitable for the display. A scaler may optionally also convert the signal to a different format. A scaler that downscales video is sometimes called a scan converter.

Scalers are particularly useful when you want to connect different analog and digital equipment for output on a common display, such as in a presentation environment where you don't want to fiddle with controls to get the picture right. All you do is set the output resolution to match the native resolution of the connected display.

Scalers that support switching take this concept further, enabling you to electronically switch video inputs and letting the box automatically make the necessary adjustments.
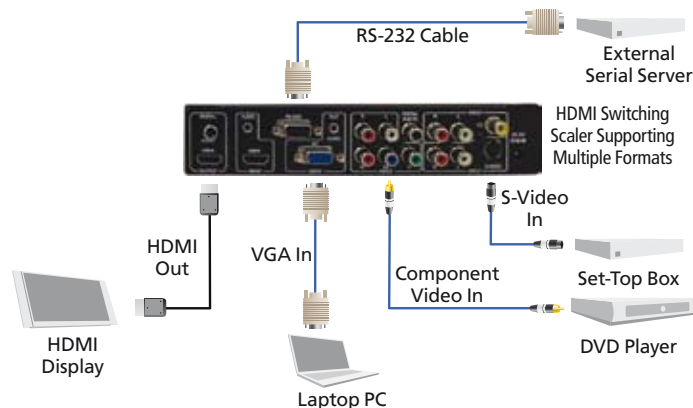
Usually, the scaling involves "upconverting" the signal. This is a process where the number of display pixels is mapped and adjusted to accurately match the resolution of the newer display. Deinterlacing technology with advanced motion compensation intelligently scales the source signal to the desired resolution with virtually no artifacts or distortion. In addition, scalers often perform frame rate adjustments so the proportion of the image isn't resized incorrectly.

There are other products that scale images for larger displays and enable you to manipulate and rotate images on multiscreen video walls.
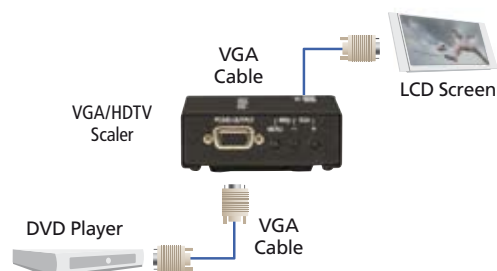
Cabling

DisplayPort

DisplayPort is the newest AV interface. It's incredibly versatile with the capability to deliver digital video, audio, graphics, bidirectional communications, and accessory power over a single connector. DisplayPort is targeted at the computer world rather than at consumer electronics. It is used to connect computers, monitors, projectors, etc.

DisplayPort connectors are found on newer computers and displays; the Mini DisplayPort connector is also found on Apple® products. DisplayPort uses a packetized data structure instead of a serial one, like DVI and HDMI, so it is not directly backwards compatible. But DisplayPort ++ (dual-mode) is able to output DVI and HDMI signals with an adapter.

Quick Facts

DisplayPort/HDMI comparison.

20-pin locking connector

	DisplayPort	HDMI
Cable length	2 m; Reduced bandwidth: 15 m	None
Top bandwidth	21.6 Gbps	10.2 Gbps
Daisychain monitors	4	None
Locking connector	Yes	No
Backward compatibility	HDMI, DVI, VGA with adapter	DVI
Standard	Open	Licensed
Market	PC world	Consumer electronics

HDMI

High-Definition Multimedia Interface (HDMI) was the first digital interface to combine uncompressed high-definition video, up to eight channels of uncompressed digital audio, and intelligent format and command data in a single cable. HDMI is the de facto standard for consumer electronics. HDMI is backward compatible with DVI. Buy only tested cables with the

HDMI logo. This guarantees the cable will perform to specification especially because there is no maximum length specified in the HDMI standard. And because longer lengths require a larger cable, HDMI cables usually have 24–28 AWG copper conductors. For 1080p, Deep Color, or 3D content, choose High-Speed HDMI cables.

Quick Facts

HDMI

Standard HDMI and Standard HDMI with Ethernet	High-Speed HDMI and High-Speed HDMI with Ethernet
4.95 Gbps	10.2 Gbps
720p/1080i	1080p and beyond

NOTE: The HDMI standards with Ethernet have an additional dedicated data channel for device networking.

DVI

These high-speed cables have the bandwidth necessary for high-definition video and are ideal for linking digital signage screens and other equipment. DVI-D is a digital-only connector. DVI-I supports both digital and analog RGB connections. DVI-A is used to carry an analog DVI signal to a VGA device, such as a display. DFP as an early digital-only connector. Dual-link cables double the power of the transmission up to 9.9 Gbps and support QXGA resolutions up to 2048 x 1536 at 60 Hz. Single-link cables transmit up to 4.95 Gbps at 1920 x 1200.
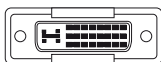
DVI-D, Single-Link

DVI-I, Single-Link
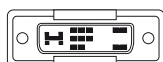
DVI-A

DVI-D, Dual LInk

DVI-I, Dual Link

DFP

HD15 VGA

These cables can contain both 28 AWG mini coax and 24 AWG tinned-copper VGA conductors to provide support for all control leads, including Pins 9 and 15 for DCC compliance. This cable transmits analog video signals. It does not support audio.
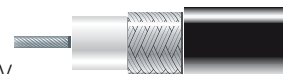
HD15 Male — VGA

HD15 Female — VGA

Coax

Coax cable is used as a transmission line for radio-frequency signals. It is ideal for AV distribution and for connecting CCTV, in-house TV systems, radio transmissions, and surveillance systems. Coax cables are shielded to prevent EMI interference.

QUESTIONS to ask.

1. What type of connector does your equipment have?

Currently, the most commonly found connectors on computers, displays, and projectors are DVI. New computer equipment will most likely have DisplayPort and/or HDMI connectors.
Older equipment will have VGA connectors. And, home theater equipment will have HDMI connectors. Take a look at the connector illustrations on **this page** to determine what type of connector you have.

2. Can I mix equipment with different connectors?

Yes and no. If you need to connect a monitor with a VGA connector to a PC with a DVI-I connector, you can, but you'll need an adapter or a cable with both connectors. Adapters also exist to connect DisplayPort, DVI, HDMI, and VGA equipment. But, if you run a digital signal from a PC into, say, a switch, it can't be converted to analog without an active converter or scaler. Also, to go from DisplayPort to DualLink DVI you need active converters.

Contact the experts at 0811/5541-110.

Pulling it all together— and

Video infrastructure

Most modern digital signage systems operate over Ethernet, enabling you to use the infrastructure you already have in place. Generally these systems consist of a publisher unit connected directly to the network. This is usually located in a central location such as a data center. On the remote side, a digital signage player is connected to the network near the video screen and is linked to the display with an HDMI or a DVI cable.

When installing a video signage system—especially if you're displaying streaming high-definition video—it's important to have an Ethernet network that's up to the task. 100-Mbps Fast Ethernet is a minimum requirement; 1000-Mbps Gigabit Ethernet is preferable, especially if you're also running other high-bandwidth applications such as VoIP.

It's also important that your Ethernet network supports Quality of Service (QoS), which gives streaming video destined for your digital signage system network priority.

Video mounts

There are many options when it comes to mounting video displays, enabling you to mount a screen virtually anywhere you need one.

Flush wall mounts — Place the screen flat against a wall or other flat surface.

Flush with tilt wall mounts — Place the screen against a wall or other flat surface, but enable you to tilt the screen for better viewing.

Articulating wall mounts — Provide swivel articulating arm that enables a full range of motion.
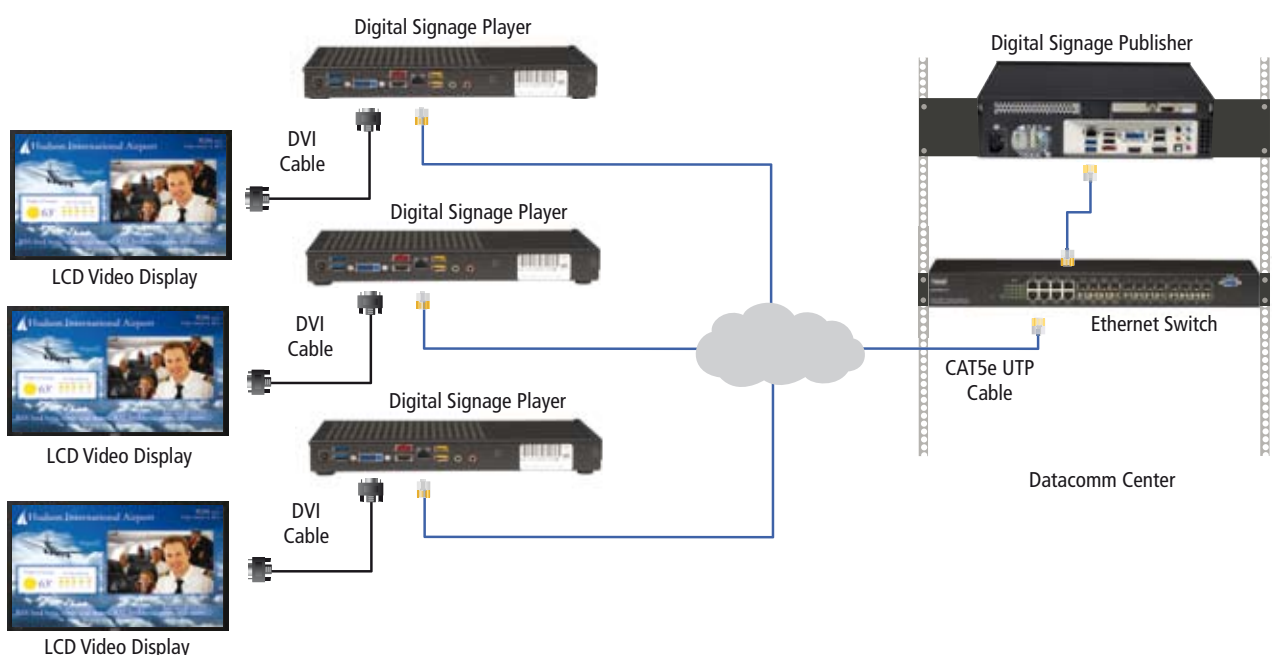
Ceiling mounts — Hangs a video screen from the ceiling, usually on an arm that provides a bit of space between the display and the ceiling.

Video wall mounts — Video displays in video walls require specialized mounts to tile the displays precisely without gaps. These are often specific to each kind of display.

Dual mount adapters — These specialized mounts enable you to mount two screens either side by side or back to back. A back-to-back ceiling mount can be especially useful for displaying information in public spaces such as airports.

Enclosures

When you place digital signage within reach in public areas such as shopping centers, schools, hospitals, restaurants, and hotels, you need an enclosure to provide protection from theft, vandalism, and curious children. Although there are many variations, these are usually simple locking enclosures with a clear pane for viewing the video display.

Digital Signage Player

Digital Signage Publisher

DVI Cable

LCD Video Display

Digital Signage Player

DVI Cable

LCD Video Display

Digital Signage Player

Ethernet Switch

CAT5e UTP Cable

DVI Cable

LCD Video Display

Datacomm Center

adding some finishing touches.

There are also sealed enclosures designed to protect signage outdoors — probably the toughest environment for digital signage. Aside from the obvious moisture issues, extreme heat and cold are the biggest threats to digital signage. If signage is exposed to direct sunlight — for instance, in the drive-through lane at a fast food restaurant — extreme heat and condensation are added to the mix. There are now enclosure solutions on the market, which address these issues to varying degrees, through a built-in climate-control system.

Factory floors and industrial areas may not have the same moisture and temperature issues as the outdoors, but they can also be difficult for digital signage because of the dust often associated with these environments.
For these areas, look for a NEMA 4-rated enclosure to ensure protection against dust and grime.

CCTV
A frequent video application is in the security arena where CCTV cameras are combined with real-time human monitoring and DVR systems to provide visual security for sensitive areas. DVR systems designed for security applications record video from digital or analog cameras in a digital format on a hard drive or in solid-state memory. They're designed to operate maintenance free for weeks or even months.

Many CCTV security systems enable you to remotely view cameras live or to view recordings from anywhere on your network or the Internet.

Motion detectors may be integrated into a CCTV security system, triggering cameras to record only when motion is detected.

Power protection
One good power surge is all it takes to destroy an LCD screen. Digital signage is an expensive investment that must be protected from harmful transient power disturbances such as surges, spikes, voltage fluctuations, and electrical noise.

Video displays as well as the digital signage system and network components should be protected with at least a surge protector with noise filtering.

For even more protection, an uninterruptible power supply (UPS) provides power during short outages and corrects for voltage fluctuations, which you may not notice but which can damage electronics.

A surge protector with noise filtering such as the Digital Signage Power Filter goes a long way towards protecting delicate electronic components from power spikes and surges.

EME1M1-005-R2

EME1K8-005

Digital signage players
The component that feeds video to the video display is called a digital signage player. The player can either be a part of a digital signage system and receive data from a digital signage publisher, or it can be a freestanding device with previously recorded data.

Freestanding players are inexpensive, but must be updated individually from a PC or from a USB flash drive. They're a good choice when the information displayed is relatively limited and static — for instance, a menu displayed at a cafeteria entrance.

The advantage of a choosing a player that's part of a system rather than a freestanding device is that multiple digital signage displays can be managed and updated from one central location and can be updated on the fly. This enables you to, for instance, put out emergency messages, weather updates, and traffic alerts.

Audio speakers
Although digital signage is primarily a visual medium, some presentations may benefit from the addition of sound. Although most video displays have built-in speakers, you may want to add external speakers to improve the quality of the sound. Directional speakers can focus the sound directly in front of the display to get your message across.

Conference room interface equipment
There's a whole subclass of multimedia tools that are tailor-made for conference rooms.

Touchscreen meeting planners — An interactive display at the door to each conference room that enables people to reserve the room and displays the times the room is reserved. Many of these systems are on-line, enabling users to log in remotely from their PCs or smartphones to reserve the room.

Digital projectors — Enable you to import PowerPoint® and other presentations directly from a laptop to show to a group on a screen.

Videoconferencing equipment — Videoconferencing has taken off, saving a lot of long-distance travel time. Today's conference rooms can be equipped with the tools for videoconferencing, either a proprietary system or a PC equipped with microphones, Web cams, and a very large monitor that can be seen clearly by all participants.

Electronic white boards — Provide an electronic surface for notes and enables these notes to be saved to a computer for later review or for e-mailing to meeting attendees.

Accessory and Remote Control Hardware

Network switches

Applications such as network imaging, multimedia production, and digital signage are very demanding. They generate huge data files that often must be transferred between stations based on strict timing requirements. If such traffic is not transmitted efficiently, you end up with jerky video, on-screen graphics that take forever to load, or other problems.

These problems arise because in traditional LANs, only one network node transmits data at a time while all other stations listen. This works in conventional, server-based LANs where multiple stations share files or applications housed on a central server. But if a network has high-bandwidth applications, the one-station-at-a-time model just doesn't work.

This is where the value of a switch comes in. Network switches provide clear paths from each workstation (or other source) to its destination on demand. If your AV distribution system uses IP-based technology to multicast video content over a LAN, a network switch absolutely necessary.

And not just any network switch will do. Multicasting is transmitting data from one network device to multiple devices. When multicasting with ordinary Layer 2 switches, all attached devices receive the packets, whether they want them or not. Because a multicast header does NOT have a destination IP address, an average network switch will not know what to do with it. So the switch sends the packet out to every network port on all attached devices. This extra traffic can slow down a network.

Switches with IGMP support, however, "know" who wants to receive the multicast packet and who doesn't. When a receiving device wants to tap into a multicast stream, it responds to the multicast broadcast with an IGMP request, the equivalent of saying, "I want to connect to this stream."

Therefore, for multicasting, use routers or switches that support the IGMP protocol. Without this support, your devices will be receiving so many multicasting packets, they will not be able to communicate with other devices using different protocols, such as FTP. Plus, a feature-rich, IGMP-supported switch gives you the bandwidth control needed to send video from multiple sources over a LAN.

Specialty KVM extenders

Your AV distribution application may require more than components that extend, split, and switch video. You may also need support for workstation control so users in remote offices can access servers or other computer sources hosted elsewhere.

For this support, a KVM extender can give you the level of control you need. They enable you to place CPUs in cleaner or more secure locations other than your workspace. Plus they extend switching anywhere from a few feet (over CATx cabling) to up to a few miles (over single-mode fiber).

Connect the transmitter (local unit) to a CPU or server and have a KVM console (receiver or remote unit) with a VGA or DVI monitor, keyboard, and mouse in another room or office. Many also support multiuser access, making it easy for multiple users to collaborate in a multimedia workflow.

Remote management/peripheral sharing components

These more sophisticated components enable you and other users to access your media servers from anywhere in the world via an IP network—often at the BIOS level, even when the operating system is down.
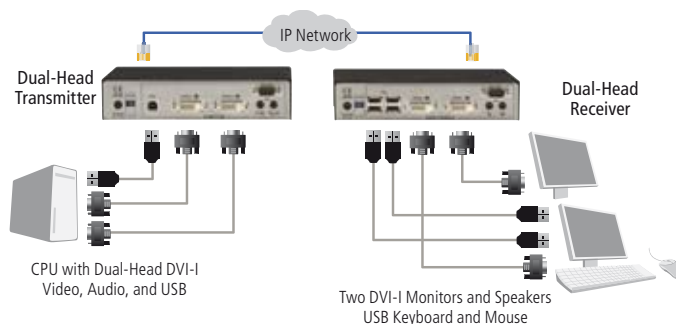
Technically classified as KVM extenders, they're ideal for use where you need to precisely access and control isolated, standalone servers, such as in remote digital displays. And for a digital signage network, all you need is an IP network in the installation to easily deliver content from one playout device via a digital DVI video link.

The latest models support high-quality video, too. This can be a single video head, or dual- or quad-head computers. Because video is transferred digitally, you can count on high color and picture fidelity at LAN speeds.

Standard CATx cabling delivers IP traffic up to 328 feet (100 m), or you can use fiber cable to go farther, over miles, using Ethernet switches or media converters. No-loss compression minimizes bandwidth.

What's nice is, these extension and sharing devices can also extend not just video and keyboard/mouse signals, but they often also provide easy access to external peripherals. In addition to keyboard/mouse emulation, they support emulation for standard Human Interface Devices (HIDs), such as touchscreens.

Dual-Monitor DVI Extension over IP

IP Network

Dual-Head Transmitter

Dual-Head Receiver

CPU with Dual-Head DVI-I Video, Audio, and USB

Two DVI-I Monitors and Speakers USB Keyboard and Mouse

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Security, Optimization, and Troubleshooting

Firewalls/data security equipment
To ensure data privacy, work with your IT department to implement protection and safeguard your content. This is particularly important if you're using your AV distribution system to send video across a hospital or government network and if you have to comply with HIPAA, HITECH, PCI, or other data-protection standards

This may require establishing IPsec VPN tunnels between sites. Newer technologies, however, enable you to establish an instant encrypted connection between locations without the administrative hassle of setting up a separate tunnel for each link. What's more, these technologies don't add latency, which can bog down your video and data communications.

Skew compensators

Some video extenders are not designed to transmit video across cable that's higher than CAT5. In fact, with these extenders, the higher-grade cable may actually degrade video. The problem is with the cable twists of CAT5e and CAT6 cables; the wire distance that a signal has to travel is different for each pair. This doesn't normally cause a problem with data, but if you're sending higher-resolution VGA analog video signals across long cables, you may see color separation caused by the signals arriving at different times. If the extender you're using doesn't have built-in skew compensation, the remedy is a device that compensates for skew. (NOTE: This applies only to VGA analog signals and not to digital HDMI and DVI signals.)

Pattern generators

Use these to ensure video signal reproduction and display are up to par in your AV and digital signage applications. They enable you to generate test patterns to troubleshoot video calibration issues. Pattern generators are particularly useful for testing in applications where accurate video reproduction is important, such as healthcare, biotech, educational, and industrial settings.

Cable testers

In addition to pattern generators, you can ensure a quality video infrastructure by troubleshooting supporting cable runs. With one of these handheld testers, you can spot slow cables, bad connectors, incorrect wiring, improper lengths, and low signal levels from switches, PCs, and other hardware in your AV network. If you have a qualification tester, you can also test for available bandwidth and distinguish between network and cable problems.

▶ *For more troubleshooting products, go to black-box.de*

5 common video errors and how to fix them.

Digital HDMI and DVI formats provide sharp, crystal-clear image quality. However, problems can occur. Here are the five most common:
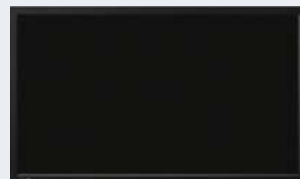
Problem 1:
Black screen (no picture at all).
Possible cause:
A. Bad cable or cable that's too long, causing either the video signals or EDID/HDCP control signals not to be transmitted properly. Make sure that you use quality, high-speed HDMI® cables—they don't even have to be expensive ones—or try an HDMI extender.
B. HDCP is unsupported. Does the display support HDCP? DVI displays usually don't.

Problem 2:
"Sparkles" in the picture.
Usually caused by: HDMI cable that's too long or of inferior grade. The solution is to use a video extender, and/or buy quality HDMI cables from a reputable supplier.

Problem 3:
RGB color tint.
Usually caused by: A color encoding issue, a common problem when using a DVI display with an HDMI source. If you're using a splitter or an extender between your source and the link, make sure it handles EDID. If possible, force the source (for instance, a Blu-ray player) to output HDMI video with RGB color encoding instead of Component (YPbCr) video encoding.

Problem 4:
White noise or "snow" on-screen.
Usually caused by: An HDCP issue. This is actually what the encrypted video looks like. It happens when your display (or any active component, like an extender, used in the transmission) doesn't support HDCP. The display, in turn, isn't able to decrypt the video stream. Be sure to use equipment that supports HDCP.
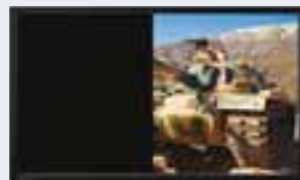
Problem 5:
Flickering or unstable image.
Can be caused by: Electromagnetic or radio frequency interference, bad cable, or cable that's too long. These all can cause issues with HDCP or the signal, resulting in flickering or the video randomly disappearing then reappearing after a second.
The solution: Use certified high-speed HDMI cables instead of standard HDMI cables, or if you need to go long distances, try an extender. If you're already using an extender, try changing to shielded CAT6 solid-core bulk cable.

Choosing the right display

The most popular video display options

LCD
Liquid-crystal displays (LCDs) are today's most popular choice for flat-panel video displays. These low-power, flat-panel displays consist of a liquid containing crystals sandwiched between filtering layers of glass or plastic. When electric current is passed through the material, the molecules of
the liquid crystal twist so that they either reflect or transmit light from an external source, usually a cold cathode fluorescent lamp (CCFL).

LED
LED displays are actually LCD TVs that use LEDs as their light source, instead of traditional CCFLs. In fact, these displays are often referred to as LED LCDs. LED displays tend to be brighter and perform better than LCDs, but they also tend to be higher-end models, which may have more to do with their superior performance than their technology.

Plasma
Plasma flat-panel displays use small cells that contain electrically charged ionized gases, which fluoresce when electrically charged. Although plasma displays are waning in popularity and are available only in larger sizes— generally 42 inches and up—their deep blacks and high contrast ratios
make them a good choice when implementing large displays that are intended to be eye-catching.

Professional grade vs. consumer grade
When selecting a video display, you may find that "professional grade" or "commercial grade" models cost significantly more than televisions you can buy at the local "mega mart." The primary difference is that professional-grade displays are built to stay on 24/7 for weeks and months at a time without breaking down. They may also offer features such as video-wall processors, scheduling options, and lockable control panels not normally found in consumer-grade televisions.

Other video display options

CRT
Older cathode ray tube (CRT) displays are still around; usually they're older analog TVs or VGA monitors. They're bulky, offer low resolutions, and look very dated but can be a low-cost option in areas where appearance is secondary.

Projected
A front or rear LCD/DLP projector is a compact device that projects an image on a screen. These devices are handy for trade shows, meetings, or anywhere it would be impractical to bring along a full-sized monitor.

OLED
Organic light-emitting diode (OLED) displays are the displays of the future. They're lightweight, thin, and energy-saving but not yet available at a price that makes them practical for general use.

Video-wall specific displays
These can be LED video cubes or rear-projection cubes that are designed to be stacked on one another for a virtually seamless video wall display.

Factors to consider when choosing a display

Picture quality
Plasma displays reproduce color more accurately with deeper blacks and display moving images with remarkable clarity. They provide excellent performance with their high-contrast levels and color saturation, and have the edge when it comes to viewing angles. In fact, plasma screens have as much as a 160° viewing angle, whereas LCDs display at 130–140° angles. However, they also carry the risk of image burn-in (the permanent disfiguring of a screen image caused by the continuous display of a high-contrast object).

LCD displays, on the other hand, don't have quite the color accuracy of plasmas, but they're brighter and have a sharpness advantage with a higher number of pixels per square inch. These additional pixels make LCD technology better at displaying static images from computers or VGA sources in full-color detail. Applications with large amounts of data and written material display particularly well on LCDs. What's more, there's no risk of image burn-in.

Durability
With LCD screens, there are essentially no parts to wear out. They last as long as their backlights do, with displays lasting, on average, 50,000–75,000 hours. That's why LCD screens are especially good for applications such as digital signage or displays that require around-the-clock use.

Plasma screens, however, use a combination of electric currents and noble gases (argon, neon, and xenon) to produce a glow, which in turn yields brilliant color. The half-life of these gases, however, is only around 25,000 hours. The glow they produce grows dimmer over time. They're also prone to burn-in or ghosting of images, although this is less of a problem with newer models.

Power consumption
Early plasmas had a very high power consumption; some as high as 5W per square inch. These values are now down in the 0.3–1.0-watt range, depending on screen size. LCDs typically run in the 0.1–0.3-watt per square inch range, and LEDs are even lower. Manufacturers are now required to provide power consumption information, but keep in mind that there are two values for consumption, default and calibrated, so be sure you're comparing like values.

Making the choice
In general, plasma produces a clearer picture with a wider viewing angle and a better response time for fast motion playback, making it a good choice whenever you need a large screen to show a very visually active display, for instance, in applications displaying sports footage or active advertisements.

LCDs are better at displaying detailed, static information. Because LCDs are brighter, they're ideal for venues with lots of ambient light. They're also the best choice for 24/7 applications because of their lower power consumption. For these reasons, LCDs are preferred for professional AV display installations.

Using a video display to your advantage.

Orientation

Most video displays are rectangular, so you have the option of mounting them horizontally (landscape) or vertically (portrait). Although the horizontal configuration is far more common — probably because people are used to seeing TVs like this — a vertical video screen can make a striking display. Also in some situations, such as when mounting a display on an architectural column, a vertical display is more practical.
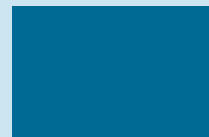
Horizontal (Landscape)

Vertical (Portrait)

Common display configurations

Individual video screens
The most common digital signage application is individual video screens displaying information. Often multiple screens in various locations are networked through a digital signage system, so they all show the same information and can be updated at the same time.

Touchscreens
The same technology you see at ATMs and information kiosks can supplement your digital signage setup when you want to give the viewer the ability to get information on demand. You can use standalone touchscreens or touch bezel overlays that affix to existing plasma or LCD screens and make them interactive.

Touchscreens actively engage people and interact with them, making them an ideal medium for advertising and distributing information.

Video walls
A video wall of four, six, nine, or even more video screens working together to make a single display saves money as compared to a single very large screen. These large, tiled video displays are frequently used in public areas such as stadiums, airports, and shopping malls.

Screens designed for use in video walls have narrow bezels to minimize gaps between active display areas. They usually have connections to daisychain power and video signals between screens to simplify cabling. Although large video walls require special controllers, small video walls can be set up just using multimonitor video cards.

KVM-switched tiling
Some KVM switches enable you to tile images from as many as four video cameras and/or computer screens on a single display while providing control over individual windows. This application is often used in security or control-room situations.

Great places to deploy digital signage

Endcap digital signage
Retail stores are ideal locations for eye-catching digital signage. Displays in endcaps can advertise specials and highlight new products. An interactive touchscreen can help customers locate products, offer serving suggestions, show demos, and help with sizing.

Transit
Riders on public transit — whether trains, buses, or taxis — can be informed of schedules, fares, and service changes. They appreciate having a news scroll and weather information to keep them up on things. This is also a perfect venue for advertising aimed at the busy commuter.

Store windows
A rear LCD/DLP projector can project messages and images on an acrylic projection screen in a store window, providing an animated alternative to a static window display. Or project messages as 3D images with a laser hologram projector.

Restaurants and cafeterias
Digital signage is ideal for displaying menus and the day's special, complete with pictures so guests know what to expect. The addition of a touch-screen ordering system speeds service and cuts down on labor costs.

Museums
Museums often take advantage of digital signage to provide history and background about their exhibits. Touchscreen signage enhances visitors' experiences by enabling them to interact with the exhibit.

Gas pumps
Interactive touchscreens provide prompts that enable customers to use their payment card and advertise specials on car washes or oil changes while customers fill their tanks.

Wearable digital signage
Forget boring name tags — your sales team can wear tiny LCD screens that show advertisements for your company or product on the sales floor or at trade shows.

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application examples.

Our
Digital Signage Guide
shows all the solutions to deliver compelling
content at the right location.

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Digital SIgnage and Multimedia

» Planning of complete end-to-end solutions.

» Recommendations and installation of the infrastructure.

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