Audio/Video Opportunities via UTP

BY JEFFREY HERMAN

Opportunities

The following is a partial list of audio/video opportunities over unshielded twisted pair (UTP) cabling:

- CCTV security and surveillance systems
- Classroom audio/video
- Corporate audio/video projection systems
- Tradeshow systems
- Airline lounge information
- Residential audio/video

Introduction

The growing demand to distribute analog audio/video programming within a building environment has caused many companies to look at ways to use their Category 5 (or higher) structured cabling systems to provide the connections. Category 5 UTP is a hidden asset. With so much preinstalled UTP available, distributing analog audio/video may be as simple as accessing the nearest modular wall outlet. The technology that allows this to happen is the "videobalun". The videobalun converts an unbalanced signal into a balanced one, allowing video to be transmitted via UTP cable. The videobalun provides the essential link between the audio/video source and the cabling system. With this basic building block a host of connectivity products can be offered to allow analog audio/video to be distributed cost-effectively via UTP within a building. This article will discuss some of the ways to achieve audio/video distribution hub via Cat 5 UTP cable.

What is Audio/Video Distribution?

Whenever a single audio/video source needs to be sent simultaneously to multiple destinations, the need for audio/video distribution arises. One way to distribute audio/video is to feed the source program into a splitter box or distribution hub. The hub amplifies and splits the audio/video signal allowing it to be sent to multiple locations. Many of the audio/video splitter boxes on the market are based on the traditional coaxial cable used in the various audio/video environments. The connectors are typically RCA, BNC, DIN, Bantam or XLR among others. In each case the connector is designed for coaxial cable and may not be designed to integrate with structured cabling systems (SCS). Figure 1 illustrates the traditional method for distributing audio/video to multiple displays.

Where is Audio/Video Distribution Applied?

Distribution of a single audio/video source simultaneously to multiple destinations occurs in various applications. Some of these applications include:

- CCTV security and surveillance systems
- Classroom audio/video programming
- Corporate audio/video projection systems
- Tradeshow demonstration systems
- Retail audio/video kiosks
- Airline lounge information systems
- Residential audio/video systems
- Courtroom video arraignment
- Audience response systems
- Video-conferencing systems
- Outlet online advertising

Examples of audio/video equipment that may require distribution to multiple displays include:

- VCRs
- Video conferencing hardware
- Digital Video Discs (DVD) players
- Laserdisc players
- Digital Satellite Dishes
- Collaborative application sharing
- Electronic "whiteboards"
- IP streaming video devices
- CD players
- Video and CCTV cameras
- Cable video tuners
- MPEG video players

A More Cost-Effective Way to Distribute Audio/Video

In order to integrate with in-house structured cabling systems, the audio and video coaxial cable connectors at the audio/video equipment must first be converted to UTP. This is achieved by means of videobalun. Videobaluns convert unbalanced audio/video signals to balanced signals in order to work over UTP. Once the audio/video equipment is "UTP-ready", then a splitter box or hub may be used to distribute the audio/video output via UTP to multiple locations as shown in

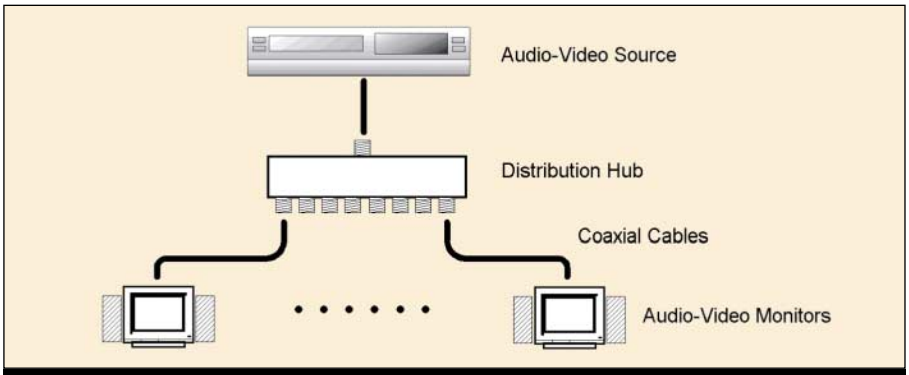


Figure 1: Analog Audio / video Distribution via Coaxial Cable

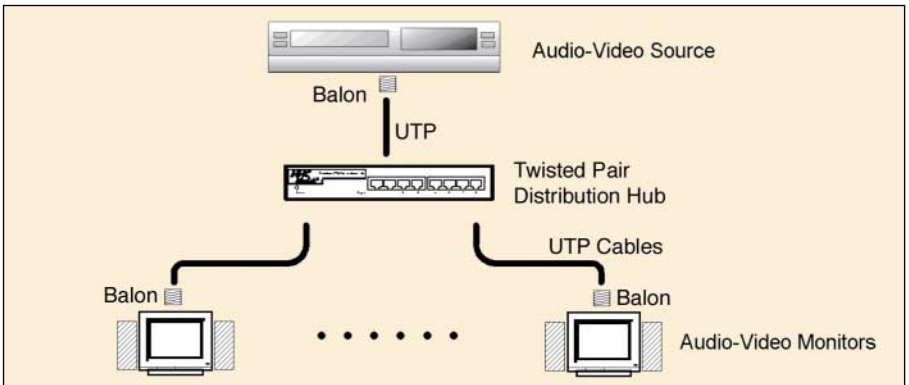


Figure 2: Analog Audio / Video Distribution via UTP

Figure 2.

By converting audio/video equipment at the source with the use of baluns, the cabling may be managed via existing UTP cable instead of coaxial cable. Since the distribution hub is devised to support UTP exclusively, its compact design allows it to be conveniently installed in a local wiring closet. This article will illustrate various applications on how audio/video distribution via UTP is applied in different audio/video environments.

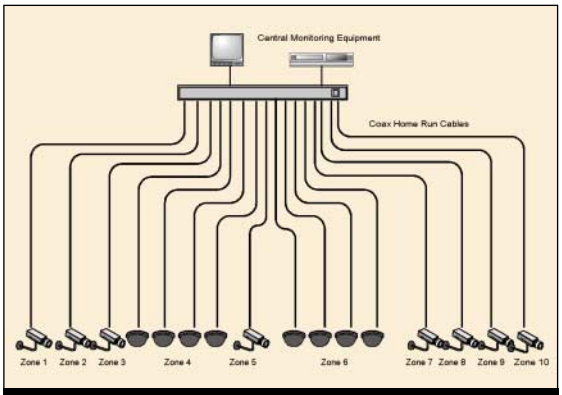


Figure 3: CCTV Security & Surveillance Cabling Using Coax

Closed Circuit Television (CCTV) Opportunity:

Closed Circuit Television (CCTV) is a well-established system used for security and surveillance monitoring. The technology has been around for more than 20 years. A traditional commercial CCTV installation is made up of multiple CCTV cameras connected to a central video multiplexer or switcher. Outputs from the video multiplexer allow the images from the various cameras to be viewed on a monitor or PC and recorded on a VCR or other digital video recorder (DVR) as shown in Figure 3.

If a camera or video multiplexer output needs to be viewed simultaneously at several locations, then it becomes necessary to distribute a single CCTV source to those locations. For example, security guards stationed at multiple locations need to view the same

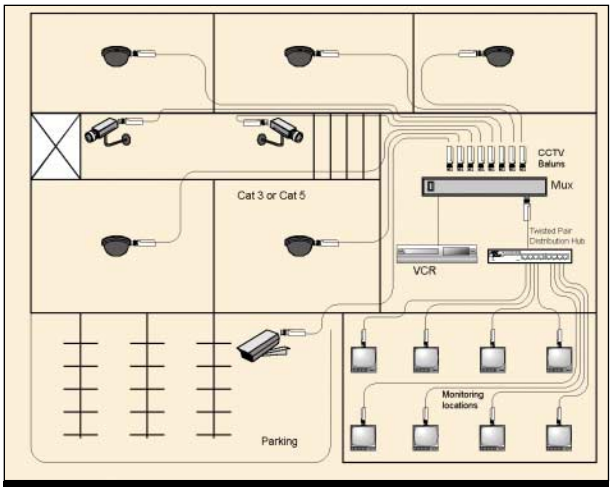


Figure 4: CCTV Security and Surveillance via UTP

camera output. In this instance, the cabling connections are traditionally installed via individual coaxial connectors.

By using a UTP distribution hub and videobaluns, the same video output can be sent to multiple guard stations via cost-effective UTP as shown in Figure 4. If the monitors are near each other, they could share a common home run cable back to the distribution hub to further keep the cabling costs down. Up to four monitors are supported under one 4-pair Cat 5 cable.

Audio and Video Opportunities

There are many applications in which baseband audio and video must be distributed to many locations, for instance in a residential or school environment where audio/video programming is often played back through audio/video sources such as a VCR, DVD or satellite receiver and then distributed to audio/video monitors. Traditionally, this would require an investment in coaxial cabling equipment. And, given that each audio/video connection may require more than one audio and video channel, the cabling could become quite unmanageable. Coax cable is eliminated at the source of the audio/video equipment and a UTP distribution hub is used to bring the output to each outlet. This approach reduces the amount of cable and facilitates moves, adds and changes.

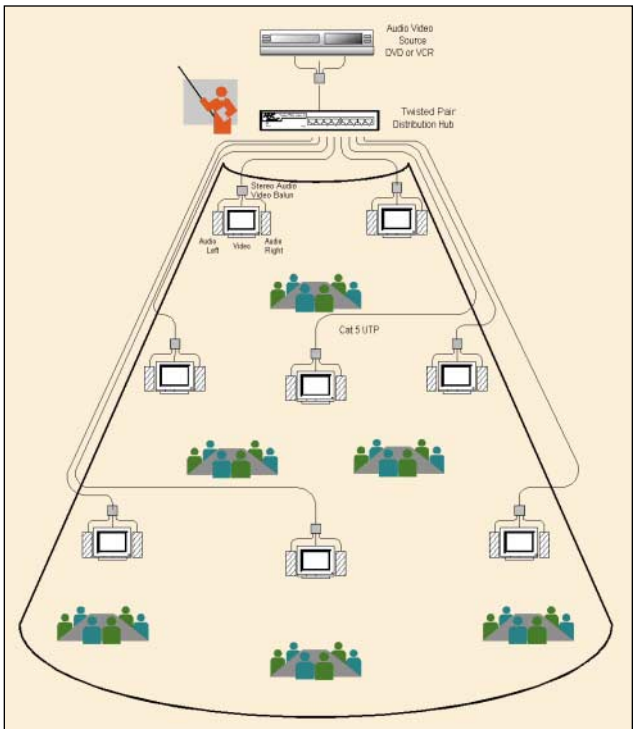
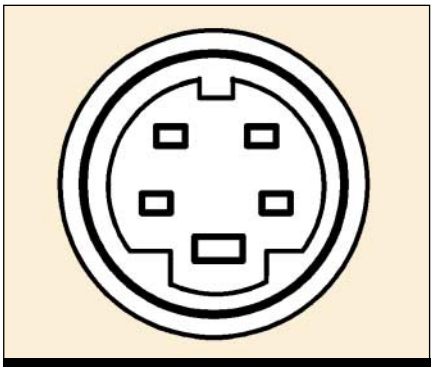


Figure 5: Classroom Audio/Video Distribution via UTP

S-Video

S-Video is a video format that provides a compromise between composite video and higher resolution component RGB and VGA video. S-Video equipment is generally less expensive than component video equipment and may even provide higher picture resolution than composite video. Homes, schools and hospitals are increasing the usage of S-Video for audio/video distribution, as it is a cost-effective alternative to the more expensive RGB or VGA video display equipment. S-Video cabling is characterized by a 4-Pin Mini DIN connector that contains two pairs of wires – one for color (chroma) and one for luminosity (luma).



S-Video Connector

In order to distribute S-Video via UTP cable, an S-Videobalun is used convert the S-Video connector to a modular RJ-45 connector at each S-Video device. Once the S-Video signal is converted to UTP, it may be connected to a UTP splitter hub or directly to another S-Video display device. The wiring would then be connected in a star-configuration to each S-Video display device via UTP. An S-Videobalun at each monitor would convert the signal back to an S-Video connector. Figure 5 illustrates the application.

VGA, RGB, RGBS and RGBHV are all variations of component video. Instead of transmitting the complete video signal (i.e.; composite), red, green and blue are transmitted separately from the video source to the display monitor. In some formats, horizontal and vertical synchronization signals are transmitted separately as well. Component video allows higher image resolution to be achieved versus composite video and S-Video. RGB is used when fine details in graphics or text need to be clear, as in medical or desktop publishing applications. In addition to video itself, other control signals may be transmitted, depending on the brand of VGA equipment. The connectors used for

RGBHV are typically either BNC or DB15HD connectors. Figures 7, 8 and 9 illustrate some of the different connectors that are required to support RGB video. Figure 8 shows a typical VGA connector found on the back of most PCs. The other diagrams show the different RGB standards using individual coaxial cables. From three to five coaxial cables are needed depending on whether the synchronization signals are combined with the video or not.

In order to transmit all five video signals (Red, Green, Blue, Horizontal Sync, Vertical Sync) via UTP, the signal must be converted from an unbalanced one via coax cable to a balanced one via UTP. This is achieved by using either active or passive videobaluns. Active videobaluns have a power supply and actually regenerate, amplify and/or compress the signal. Passive videobaluns have no power supply and as a result do not amplify, regenerate and/or compress the signal. Due to this limitation, passive videobaluns can only support the basic video and synchronization signals but not the additional control signals that may be present. Active videobaluns on the other hand have the capability of supporting the additional control signals by further signal processing. Active videobaluns can also support greater distances than with passive baluns. What the application requires and the End User's budget will determine the choice between the two technologies. Active videobaluns are usually two to three times more expensive than passive videobaluns.

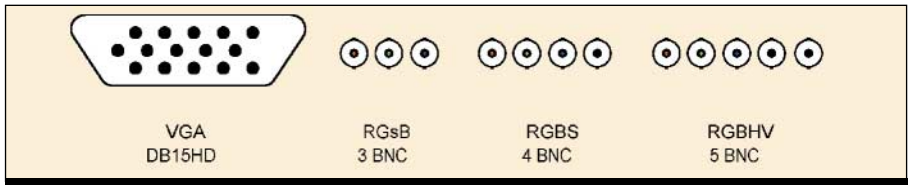


Figure 8: RGB Cabling Interface Variations

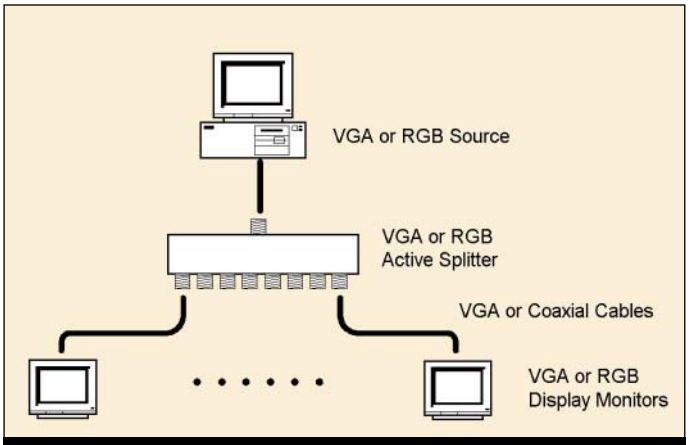


Figure 9: VGA Video Distribution via VGA Cable

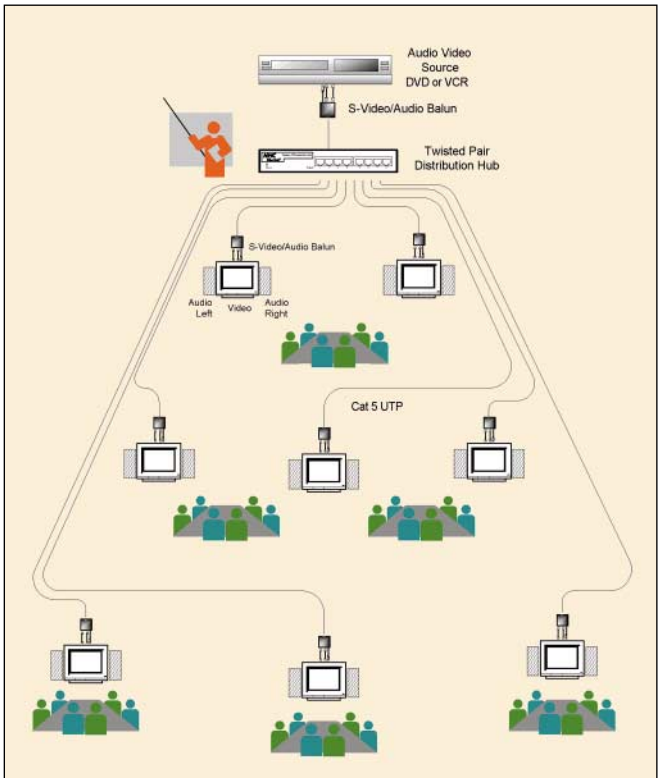


Figure 7: Classroom S-Video and Audio Distribution via UTP

VGA, RGB, RGBS and RGBHV

VGA or RGB video distribution is applied where high contrast and resolution are required. Examples include: high definition video, classroom PC instruction, medical imaging and corporate projection systems. Traditionally, component video is distributed using active video splitters. The problem with that method is that the same bulky VGA or coaxial cable must be used as shown in the diagram below.

In order to distribute component video to multiple destinations via more cost-effective UTP, there are two possible strategies that can be used.

First, use existing active VGA or RGB video splitters in conjunction with passive VGA or RGB videobaluns as shown in Figure 10.

This strategy is relatively inexpensive due to the fact that some of the components are passive. The trade-off is that the picture quality is limited by what the passive components can provide in terms of resolution and distance. In the case of VGA, any control signals that may be present at the VGA interface will not be transmitted using passive balun technology.

Second, use a totally active system whereby active baluns and active splitters are used to provide an end-to-end solution that yields higher picture quality and greater distance performance. Active circuitry will support control signals in addition to video signals. The trade-off of this approach is the cost, since active circuitry is more expensive. Figure 11 illustrates this strategy.

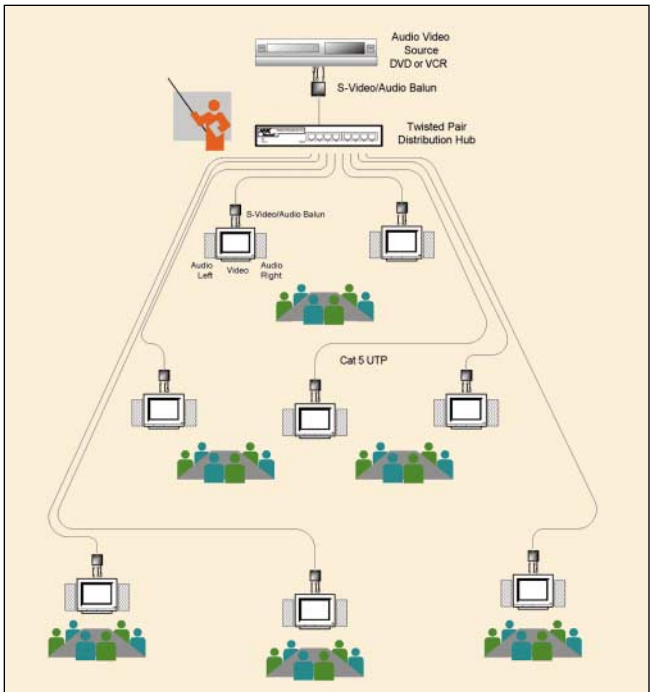


Figure 10: VGA Video Distribution via UTP and Passive Baluns

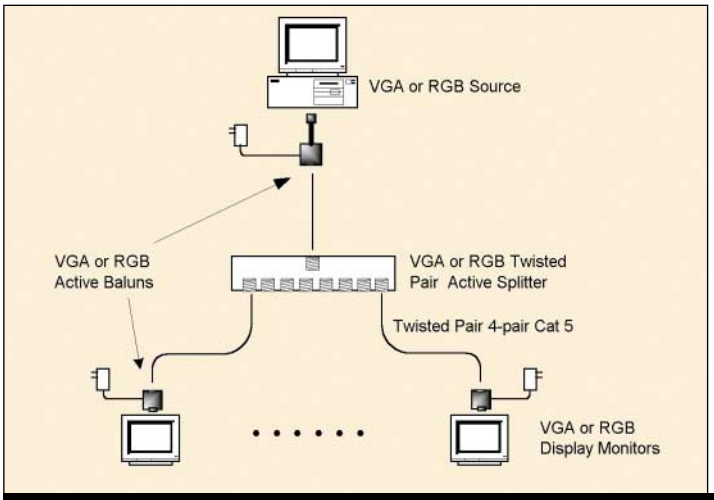


Figure 11: VGA Video Distribution via UTP and Active Baluns

Conclusion

Improvements in cabling and balun technology have made it possible to convey high fidelity analog audio/video signals reliably over Cat 5 UTP. While researching the best technique for video distribution in a given application, it may be wise to consider whether a portion of the installation could benefit from structured cabling techniques using passive or active videobalun technology.

Audio/Video Distribution Vendors

The following is a list of some vendors that provide analog video distribution equipment via UTP:

- Network Video Technologies
- NHC Communications Inc.
- Energy Transformation Systems
- MFICO
- Avaya
- Unicom
- Magenta Research
- Gefen
- Law Enforcement-Security
- Black Box
- Extron
- In-Line

References

For a more comprehensive discussion about the different video standards, please refer to the following link entitled "Understanding Computer Interfacing" at www.inlineinc.com/tech/notes/.

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Glossary

ANALOG SIGNAL – A signal that is transmitted as a pure sinusoidal audio/video without any data encoding.

BASEBAND VIDEO – A single video channel that is transmitted without RF modulation.

BNC – A type of coaxial connector found on many types of audio/video and data equipment.

DB15HD CONNECTOR – A 15–pin connector that is used to connect component video systems such as RGBHV or VGA.

MULTIPLEXER – A device that combines multiple audio, video or data signals onto a single channel.

RCA CONNECTOR – A type of connector commonly found on consumer audio/video equipment. Generally reserved for baseband audio/video.

SWITCHER – A device that allows audio/video inputs to be switched between audio/video outputs.

S–VIDEO – A component video signal that divides a video signal into two components; luma and chroma. When transmitted separately, superior picture quality is achieved versus ordinary composite video.

CCTV – Closed Circuit Television. A method of transmitting composite video in the video surveillance environment.

VGA – Video Graphics Adapter. A standard by which component video (i.e.; red, green, blue) is transmitted in the PC and high-definition video environments. VGA or RGBHV may feature BNC or DB15HD connectors at the interface.

RGBHV – Stands for Red, Green, Blue, Horizontal, Vertical. A component video standard by which video may be transmitted in order to achieve higher resolution than composite or S-Video.