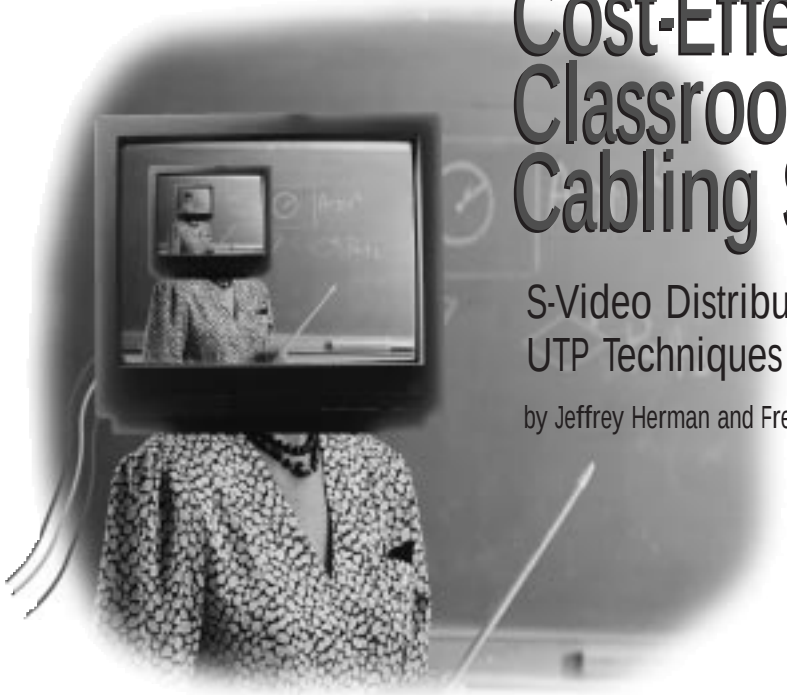
Cost-Effective Classroom Video Cabling Systems



S-Video Distribution via UTP Techniques

by Jeffrey Herman and Fred Marion

STRUCTURED CABLING SYSTEMS

Video is playing a more important role in education today. The video content contains more detailed, text graphics and real-time images than ever before. Classroom monitors must have higher image resolution than traditional composite CCTV (closed circuit television) monitors or television screens. This type of video is called component video. Component video is typically RGB (red, green, blue), VGA (video graphics adapter) or S-Video (super-video). In a typical classroom application, the video monitors receive the source signal from a video distribution center which may be a PC, video distribution switch. (See Figure 1.)

In order to provide high-resolution video, the signal typically must be displayed on RGB or VGA monitors. RGB and VGA monitors are more expensive than standard composite video monitors because of their more complex circuitry. From a cabling standpoint, RGB monitors require three coaxial cables to transmit the signal in three components: red, green and blue. The cables are terminated by BNC connectors. (See Figure 2.)

VGA monitors are of the type used for personal computers. The signal is also transmitted via shielded multi-wire cable and terminated by a nine-pin (DB9) connector. (See Figure 3.)

RGB and VGA monitors are more expensive to implement in a classroom video system than standard composite video monitors and consequently, budget-conscious schools have been discouraged from installing them on a large scale.

A more cost-effective alternative is S-Video which provides sufficiently high resolution for classroom video instruction. S-Video involves less complex circuitry and, thus, is less expensive than RGB or VGA monitors. This article will describe more economical classroom video by using S-Video equipment and standard UTP (unshielded twisted pair) cabling techniques.

Problem

From a cabling perspective, S-Video requires 75-ohm coax cable to carry two video signals, one for colour (chroma) and one for brightness (luma). Coaxial cable is adequate for preserving the signal quality. However, it has its drawbacks. It is more costly and bulky to install than standard UTP found in most structured cabling systems. Its second drawback is that each time a new monitor is added or moved, a new cable must be pulled. A structured UTP cabling system allows standard wall outlets and patch panels to be used to control moves, adds and changes. Therefore the problem is how to provide cost-effective classroom S-Video distribution via standard UTP cabling techniques.

Solution

The solution entails converting the S-Video interface from coax to UTP and then making use of standard wall outlets and patch panels to make the cross-connections.

The S-Video equipment may feature one of the two following connector options: a four-pin DIN connector to support one coaxial cable with two signal wires, or two BNC connectors on 75-ohm coaxial cable.

In order to convey either of these signals, the connection must be converted to two UTP cable pairs by means of a videobalun. Most videobaluns on the market do not have four-pin DIN connectors. Some have RCA phono-type jacks and some have BNC connectors. The following diagram shows a typical videobalun-to-S-Video assembly. If the videobalun does not have a four-pin-mini DIN connector (Figure 4), connector and adapter assemblies may be used to convert the connectors, as shown

in Figure 5.

A typical classroom S-Video cabling solution could look something like Figure 6. Four-pair Category 5 cables are distributed from 110 blocks and terminated at 568A modular outlets.

Now, moves, adds and changes to the video distribution system can be made by moving jumper cables at the 110 blocks. We recommend that all four pair be connected to the patch panel and wall jack. Thus we can provide video directly to a PC or two video and two audio channels via one RJ45 connector.

What To Look for in an S-Video Balun

VIDEO QUALITY AT MAXIMUM DISTANCE. The quality of the picture is the litmus test for the quality of the videobalun. Look for baluns that do not produce ghosting or roll-off on the horizontal sync pulse. Look for baluns that do not produce overshoot on the horizontal sync pulse. Check the chroma levels at the maximum distance. Look for a balun that gives the best video image at the maximum distance. The baluns should be able to support distances of at least 500 feet with minimum distortion and colour (chroma) loss.

CROSSTALK. Look for baluns that will allow video to be transmitted under the same cable sheath as a LAN (local area network). From the cabling perspective this represents a cost-saving to the customer by being able to bring a LAN outlet and video outlet to the same location with one four-pair cable.

SIZE. Look for a balun that is compact enough to place behind the equipment. A balun of this type can be expected to have dimensions of two inches square by 3/4-inch deep.

MACHINE WOUND COILS. Baluns contain transformers that are specially tuned to match the link's impedance and convert unbalanced signals to balanced signals. Use baluns that have machine-wound, sealed coils versus exposed hand-wound coils. The former provide more consistent performance and resist environmental effects such as temperature, moisture and dust. Videobaluns differ from data baluns in that if a data balun is slightly off-spec, the data may still get from A to B without the user noticing errors in the transmission. The computer equipment checks for errors in transmission and resends the data until it is correct. However, if a videobalun is slightly off-spec, the effect will be immediately seen on the screen.

CONNECTOR. Look for videobaluns that have gold contacts on the modular jack (RJ45) to provide the best mating quality.

Figure 1

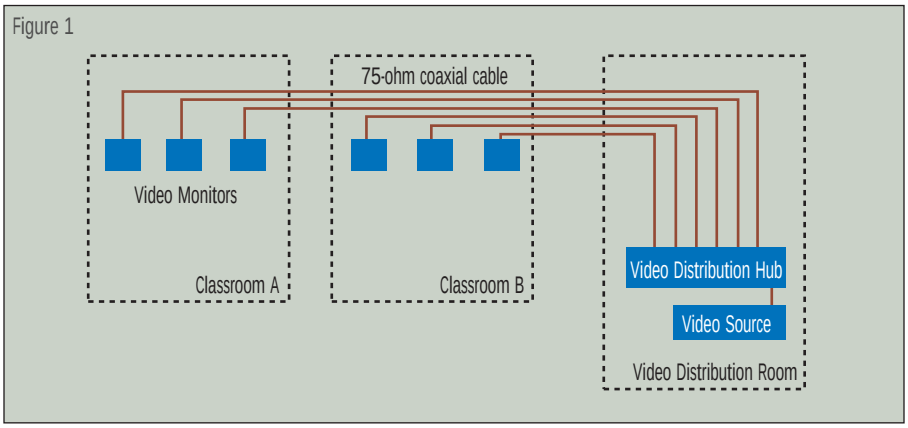


Figure 2

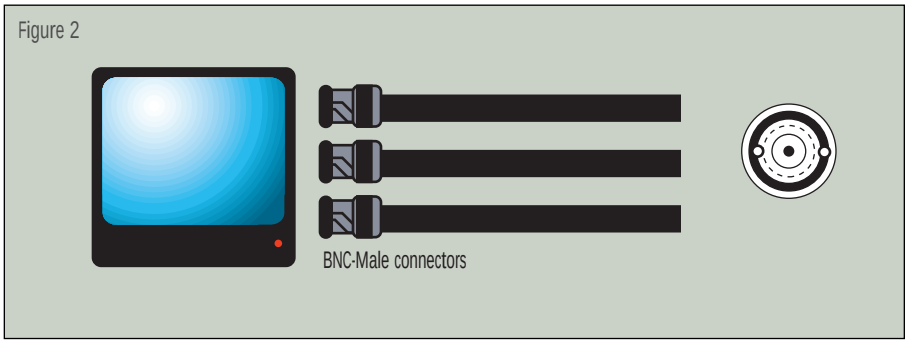


Figure 3

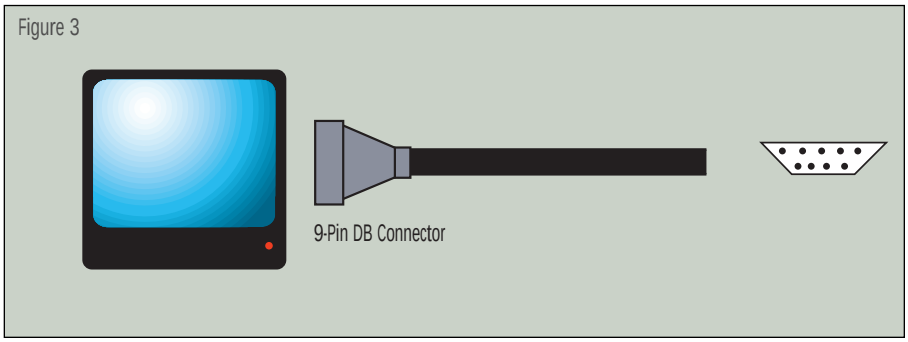
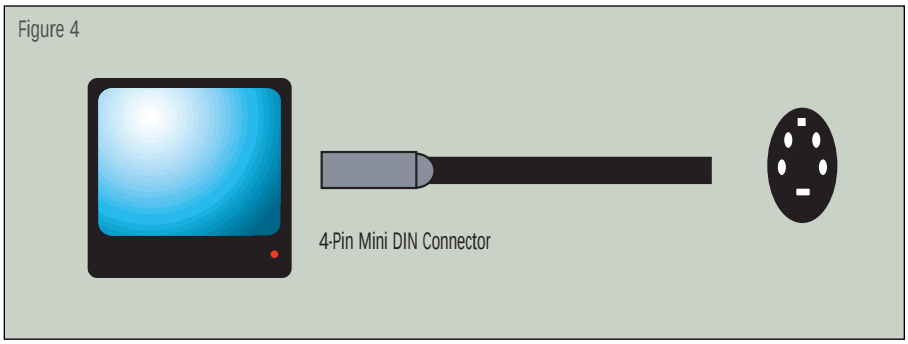


Figure 4



Cabling Guidelines

When planning and installing an S-Video system using UTP, the following guidelines are suggested:

- Keep cabling away from sources of electromagnetic interference such as fluorescent lights, transformers, radio transmitters and power cables.
- In order to minimize crosstalk, avoid using 25-pair bundled cable to pass video.
- Keep distances within the videobalun manufacturer's specifications.
- Adjust the video monitors to compensate for any decrease in colour or brightness due to cable length.

In summary, more flexible and cost-effective classroom video may be achieved by connecting S-video equip-

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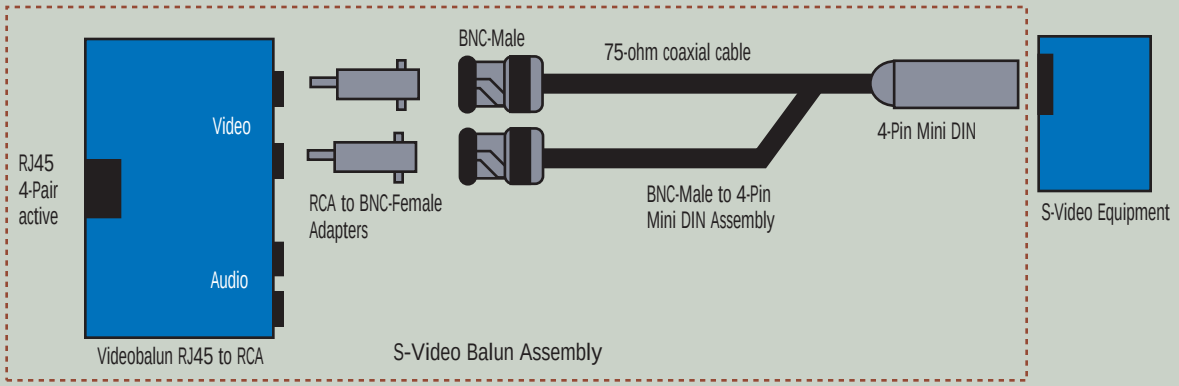
Figure 5



Frequently Used Terms

BALUN. Stands for balanced/unbalanced. Converts an unbalanced signal into a balanced one to allow data/video transmission over UTP.

COIL. The transformer that goes inside a videobalun to convert the unbalanced video signal into a balanced one.

COMPONENT VIDEO. A video signal that is broken up into separate components and recombined at the video monitor, thus maximizing picture resolution and colour quality.

CROSSTALK. The interference caused by a signal traveling over one cable pair and a signal traveling on an adjacent cable pair.

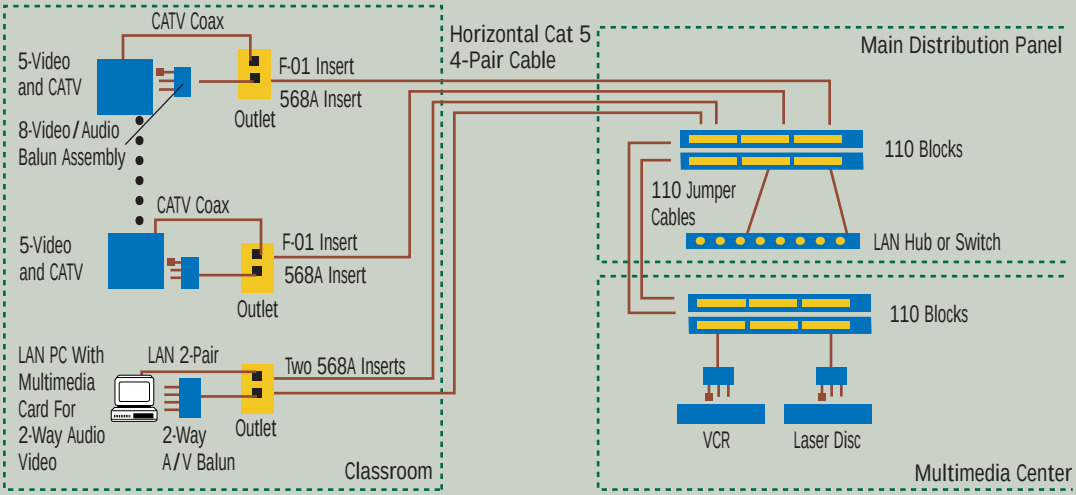
OVERSHOOT. The excess picture signal that appears at the edge of the monitor causing a distortion of the image.

RGB (RED, GREEN, BLUE). Refers to the three colour signals that are transmitted to RGB monitors. By transmitting the signals separately, higher resolution is achieved.

S-VIDEO (SUPER-VIDEO). Video transmission standard whereby the video signal is transmitted in two components; chroma (colour) and brightness (luma).

VGA (VIDEO GRAPHICS ADAPTER). Refers to the type of video signal that is found in most PC monitors. Features a nine-pin DB9 connector.

Figure 6



ment via UTP. In addition to classroom video, component video has been widely used for many years and has found applications in the areas of security and surveillance, boardroom training, machine vision, photo identification, inspection and process control, image analysis, medical imaging, microscopy and investment house information systems. Structured cabling techniques may be applied to these scenarios as well, allowing video equipment to be plugged into the nearest wall outlet for greater flexibility. The advent of higher quality video baluns makes the application more feasible where picture quality is critical. For more information about how balun technology can be applied to structured video-cabling systems, we recommend you contact your local video/cabling installer. CBM

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The following vendors offer baseband videobaluns: NHC Communications Inc., Network Video Technologies (NVT), Vision Televideo Technologies Inc. (VTTI), Energy Transformation Systems (ETS), Lucent Technologies and VIDA Networking Consultants.