

## A-Net and Video: Transmitting Video Over Cat-5 Cables

Aviom's A-Net<sup>®</sup> technology is a proven means of moving high-channel-count digital audio over inexpensive Cat-5 wiring. With a few added external components, this same wiring infrastructure can also be used to transmit composite video, opening new possibilities for musicians, sound technicians, and broadcast professionals.

Video monitoring of remote areas can make communication easier in a range of applications, from orchestra pits to stages to film production to remote recording. Video can also be effectively used to display information such as song lyrics on monitors.

With some simple wire connections and the addition of a pair of Pro16<sup>®</sup> A-Net<sup>®</sup> System Bridges, video can easily be added to the A-Net cables.

### UNDERSTANDING THE COMPOSITION OF CAT-5

In order to configure the video wires and make the proper connections, it is necessary to understand the wiring of Category 5 cables. The Electronic Industries Alliance/Telecommunications Industry Association wiring standards define the pin/pair assignments for eight-conductor twisted-pair cabling, such as Category 5 and Category 6 unshielded twisted-pair (UTP) cables. Two such standards—designated T568A and T568B—exist, differing only in the specific wire assignments. Because these standards are functionally equivalent, there is no reason to prefer one over the other. However, it is essential that both ends of a given cable use the same wiring standard.

A Cat-5 or Cat-6 cable consists of four pairs of color-coded wires. Each wire pair consists of one conductor with a solid color jacket and a second conductor with a white jacket and

| Pin | T568A Color         | T568B Color         |
|-----|---------------------|---------------------|
| 1   | white/green stripe  | white/orange stripe |
| 2   | green solid         | orange solid        |
| 3   | white/orange stripe | white/green stripe  |
| 4   | blue solid          | blue solid          |
| 5   | white/blue stripe   | white/blue stripe   |
| 6   | orange solid        | green solid         |
| 7   | white/brown stripe  | white/brown stripe  |
| 8   | brown solid         | brown solid         |

**Figure 1.** T568A and T568B standards differ only in the order of the wire colors. The pairs for each are the same: 1-2, 3-6, 4-5, and 7-8.



**Figure 2.** Balun with a BNC coax jack and screw terminal connections (TOP) and a pressure-connected balun with a Cat-5e cable attached (BOTTOM).

stripe of the same color as the other wire. The EIA/TIA standards map these wires to specific pins in the connector and plug, and define wire pairs as 1-2, 3-6, 4-5, and 7-8.

### VIDEO CONNECTION OPTIONS

Video devices such as DVD players and closed-circuit security cameras are typically composite video devices, a two-wire format, usually available with RCA or BNC jacks and interconnects. RCA jacks, found on consumer DVD and video devices, are two-conductor connections and fit together with pressure only. BNC jacks are a locking type of connector used frequently with coax cabling and found on cable TV boxes, pro video hardware, and cameras. RCA and BNC devices can be connected to one another by using a standard RCA-BNC adapter.

### CONNECTING VIDEO TO CAT-5

In order to take composite video and transmit it on Cat-5 with little impact on its signal quality, a pair of transformer devices known as baluns (short for "balance/unbalance") is needed. A balun is required at each end of the Cat-5 cable run. For optimal performance, always use Cat-5e or better cables.

Commercially available baluns can convert a wide variety of signal types to Cat-5 cabling. The easiest baluns to implement with Aviom's Pro16 Series<sup>®</sup> products are those that require only two wires for signal transmission and are user configurable. User-configurable baluns have spring-loaded terminals or screw terminals and allow for choosing the wire pair used for transmission in the Cat-5 cable. Aviom's AN-16SBR System Bridges require that data be on pins 1-2.

Note that some commercially available baluns have Cat-5 connectors that use pair 7-8 by default. These should not be used for transmitting video with A-Net.

Connecting the video to the Cat-5 with a balun requires two lengths of Cat-5 cable. One end of each piece of cable will

## Application Note

attach to a balun, while the other ends will need standard RJ45 connectors. Using an existing cable and simply cutting it in half makes assembly quicker by eliminating the need to crimp any RJ45 connectors.

### INTEGRATING VIDEO AND A-NET

Once the video is on the Cat-5 cable, Aviom's Pro16 A-Net System Bridges combine the video signal and the A-Net signal(s) onto a single Cat-5. A System Bridge works by combining the data streams of up to four separate connections (each using a single wire pair in the cable) onto a single cable (now using all four wire pairs). A second System Bridge at the other end of the main cable separates the data streams back onto their own cables for connecting to individual devices (Pro16 output modules, video displays, etc.).

Note that cables carrying both A-Net and video must go through a System Bridge before connecting to any other devices. Similarly, because Pro16 Series A-Net Distributors use other wire pairs in the cable for sending DC power to Personal Mixers, powered outputs from the Distributors should not be used in this application.

Transporting video over inexpensive, readily available Cat-5 cables offers system professionals yet another opportunity to simplify setup while expanding the capabilities and possibilities of their equipment.

### SOURCES FOR BALUNS

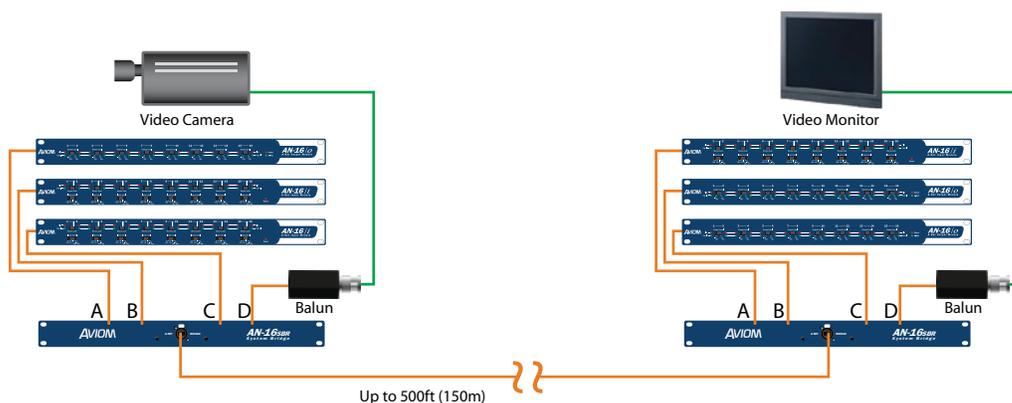
The companies listed below are good sources for baluns and/or related adaptors and cables:

|         |  |
|---------|--|
| Intelix | <a href="http://www.intelix.com">www.intelix.com</a>   |
| MuxLab  | <a href="http://www.muxlab.com">www.muxlab.com</a>     |
| MCM     | <a href="http://www.mcminone.com">www.mcminone.com</a> |
| L-Com   | <a href="http://www.l-com.com">www.l-com.com</a>       |

### STEP BY STEP

Follow the instructions below to build the necessary components and make the connections that will allow transmission of video over your Pro16 audio distribution system.

1. Cut an existing Cat-5e cable in half.
2. Strip away about a 3/4" portion of the Cat-5e cable's insulation to expose the four twisted wire pairs.
3. If starting from an existing cable, inspect the RJ45 connector to determine which wiring convention was used when the cable was originally built. Pins 1-2 will use green wire if the cable is wired to the T568A standard and orange if wired to the T568B standard.
4. Separate the wire pairs; fan them out so that they match either the T568A or T568B pattern.
5. Trim away the unnecessary wire pairs.
6. On the remaining pair, trim back about a 1/2" of the insulation from each wire.
7. Insert the trimmed wires into the balun's spring-loaded terminals (or screw terminals) so that each wire is in its individual slot.
8. Verify each wire is completely inserted. (Tighten the screw terminals, if applicable).
9. Repeat the above steps on the other end of the Cat-5e cable.
10. Verify that the pinout is identical on each end of the custom cables.
11. Connect the balun end of one of the balun-to-Cat-5e cable assemblies to the video source.
12. Connect the Cat-5e to one port on the first AN-16SB System Bridge (port D, for example).
13. Connect the second System Bridge to the video monitoring device using the other balun-to-Cat-5e cable assembly. Use the same lettered port as on the first System Bridge.
14. Connect other Aviom Pro16 gear to the remaining System Bridge lettered ports. Use the same lettered ports for each device as on the first System Bridge.
15. Finally, use a standard Cat-5e cable to connect the two A-Net Bridge ports on the System Bridges.



**Figure 3.** Video can be transmitted over Cat-5e with the use of Aviom's AN-16SBR System Bridges, which are used in pairs to combine multiple Pro16 data streams, as well as video, over a single cable.