

Overview:

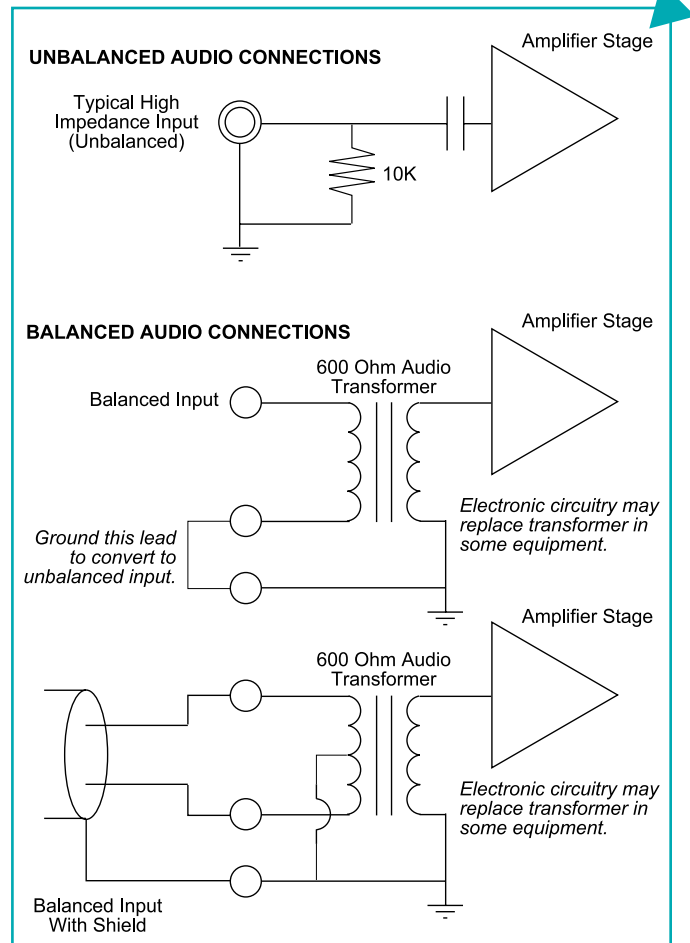
When designing a distribution system for audio, one of the first determinations that an installer must make is whether the system needs to support balanced or unbalanced audio. While, in theory, all audio signals may be transmitted in either a balanced or unbalanced format, in practice, different industries have opted to use one or the other type of signal because of the costs and benefits involved. In general, consumer-level electronics use an unbalanced signal, while professional-level equipment uses balanced audio. As a result, any fiber optic transmission system connecting such equipment must be designed or configured to support the appropriate type of signal.

Within the Fiberlink line of transmission systems there are several products designed to support line level audio in both unbalanced and balanced formats (1 volt rms with 600 Ohms impedance). This TECHnique reviews the basic differences between unbalanced and balanced audio, so that the installer has a better understanding of each underlying technology.

Details:

In short, unbalanced audio is less expensive to support than balanced audio. Among other things, it requires less expensive connectors and fewer wires. Not surprisingly, the trade-off is a lower sound quality and limited cable distance. By comparison, balanced audio generates a cleaner signal with less hum and noise. Due to economics, different industries have adopted either balanced or unbalanced audio as the standard used by audio equipment designed for use within their respective marketplaces. In general, consumer-level electronics, such as simple microphones and VCRs for the home, use unbalanced audio. While the signal from these devices is not as clean as it could be using balanced audio, most consumers would be unwilling to pay the price for these electronics if balanced audio technology were incorporated into their designs. Similarly, industrial applications tend to use unbalanced audio signals, as in these environments, the requirements for sound quality are quite low. Basic functionality is usually sufficient. Conversely, professional level equipment, such as audio mixers, amplifiers and broadcast equipment use balanced audio. In these applications, the users of the equipment are far more concerned with ultimate sound quality than with budgetary restrictions.

The accompanying diagram shows the details of both types of interfaces. In an unbalanced system, the input is referenced to ground. The system is designed to interface with common, single-conductor, shielded



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cable and two conductor connectors, such as RCA phono plugs or standard ¼ inch phone plugs. The reason this design provides lower quality than a balanced system is because signals caused by unequal ground potentials (called “ground loops”) can be conducted through the cable’s shield and interfere with the audio.

In a balanced system, the input is often transformer coupled (although electronic non-transformer equivalent circuitry does exist). This type of system uses twisted pair cable, which can be shielded or unshielded. The audio signal travels through two conductors at the same time, but 180 degrees out of phase. Meanwhile, any interfering signals travel through both conductors in the same phase. The result is that interfering signals, such as hum, are cancelled out, while the original audio signal is conducted in its pure form. Typically, balanced audio configurations use multi-pin connectors, such as common XLR-style connectors, or even simple terminal blocks. A center tap in the transformer winding may also be used to provide additional shielding purposes.

Suggestions:

Note that a balanced input can often be converted into an unbalanced one by simply grounding one side of the transformer or equivalent input.

In those cases where the ultimate in low noise high quality audio transmission is desired, not only should the balanced configuration be used, but shielded twisted-pair cable with proper grounding should also be employed.

CSI Products Used In This TECHnique:

- Pure Digital Fiberlink system for 4 Channels Audio 4040 Series
- Pure Digital Fiberlink system for 16 Channels Audio 4160 Series
- Pure Digital Fiberlink system for 32 Channels Audio4320 Series

Related TECHniques:

- Educational Guide: *An Introduction to Fiber Optics*
- Educational Guide: *Advantages of Digital Transmission Over Fiber*