A DISSCUSSION ABOUT DIGITAL CABLES

30 years ago a very wise man said, "Music is a product of the technology of the times". Stradivarius had the technology to make violins in the 1600's. In 1723, technology was there to build the piano. Pipe organs preceded them by many years.

James B. (Jim) Lansing was the founder of the modern-day JBL loudspeaker manufacturing company. He had the technology to provide sound for the 1920 presidential inauguration with complete intelligibility for 250,000 people. Many of today's modern airport paging and announcement sound systems have little to no intelligibility. That's not much progress for 80 years.

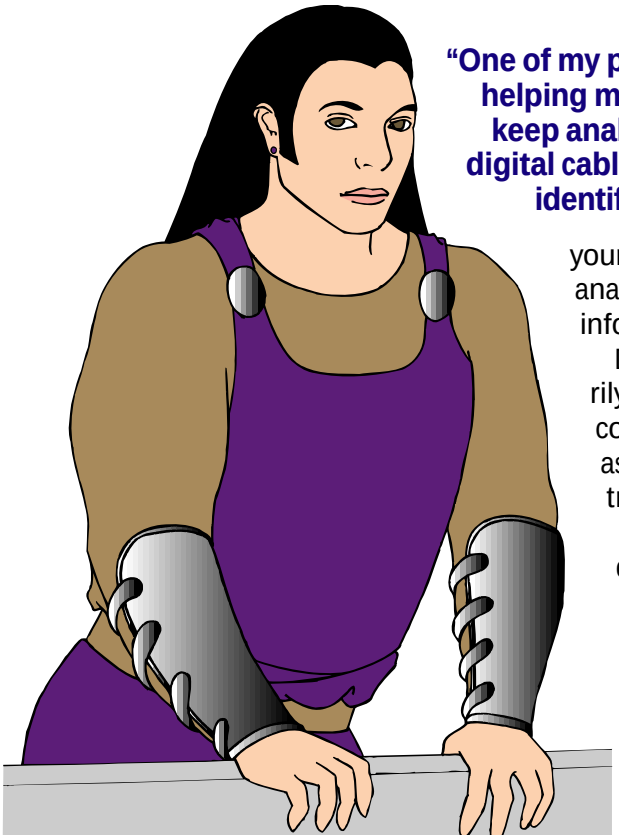
Audio has been analog in its technology until now. With computers controlling more and more of our world, audio is becoming digital in its transmission.

Analog refers to electronic transmission accomplished by adding signals of varying frequency or amplitude to carrier waves of a given frequency of alternating electromagnetic current. Broadcast and phone transmissions are both examples of transmitting through analog technology.

James B. (Jim) Lansing was the founder of the modern-day JBL loudspeaker manufacturing company. He had the technology to provide sound for the 1920 presidential inauguration with complete intelligibility for 250,000 people.

Digital describes electronic technology that generates, stores, and processes data in terms of two states: positive and non-positive. Positive is expressed or represented by the number "1" and non-positive by the number "0". Thus, data transmitted or stored with digital technology is expressed as a string of 0's and 1's. Each of these state digits is referred to as a bit (and a string of bits that a computer can address individually as a group is a byte).

There are times when a modem is used to convert the digital information from a computer to analog signals for your phone line and to convert analog phone signals to digital information for your computer.



"One of my problems is helping musicians keep analog and digital cables clearly identifed."

Digital technology is primarily used with new physical communications media, such as satellite and fiber optic transmission.

So what does this have to do with audio and what are the standards for the new digital audio?

The "AES/EBU" (Audio Engineering Society/European Broadcast Union) digital audio standard is probably the most popular digital audio standard today. Most consumer and professional digital audio devices (CD players, DAT decks, etc.) that feature digital audio I/O support AES/EBU.

AES/EBU provides both "professional" and "consumer" modes. The big difference is in the format of their channel status bits. The professional mode bits include alphanumeric channel origin and destination data, time of day codes, sample number codes, word length, and other goodies. The consumer mode bits have much less information, but do include information on copy protection (naturally). Additionally, the standard provides for "user data", which is a bit stream containing user-defined (i.e., manufacturer-defined) data.

The physical connection media used with AES/EBU are differential, using two wires and shield in (standard looking) three-wire microphone cable (however, with a specific impedance).

Alas, this will add great confusion to the world of audio. Now analog connectors (XLR's and RCA's, along with mini balanced and 1/4' balanced and unbalanced) look just like digital connectors and the wire used looks the same, but the impedance required for optimum digital transmission is different for analog and digital. In analog, the two conductors of the cable carry half of a balanced signal. In digital one cable carries both left- and right-channel audio data to the receiving device.

Adding confusion to this is the S/P-DIF standard. "S/P-DIF" (Sony/Philips Digital Interface Format) typically refers to AES/EBU operated in consumer mode over unbalanced RCA cables. Note that S/P-DIF and AES/EBU mean different things depending on how much of a purist you are in the digital audio world.

S/P-DIF is a standard audio transfer file format. It is usually found on digital audio equipment such as a DAT machine or audio processing device. It allows the transfer of audio from one file to another without the conversion to and from an analog format, which could degrade the signal quality.

M.I.D.I. is a standard for moving digital signals around in a musical setting between digital keyboards, computers and all the peripheral M.I.D.I. gear used to create today's electronic music.

The most common connector used with a S/P-DIF interface is the RCA connector, the same one used for most consumer audio products. Also, optical connectors are sometimes used.

As far as the wire is concerned, for the most accurate transmission, AES/EBU requires a two-conductor, shielded wire with a constant impedance of 110 ohms (61.7 ohms/km). A stable impedance is specified to help keep interface jitter to a minimum. Typically polypropylene insulation material is used to maintain the stable impedance. Working conditions can limit the useful lengths between terminations. Polypropylene is a great insulating material for audio cables as well, second only to Teflon, which is expensive and difficult to extrude into a cable. However, this makes for a less flexible cable overall.

For S/P-DIF, a coax (single-conductor wire with overall shield) cable is used, with a constant impedance of 75 ohms specified.

For comparison purposes, standard microphone wire is typically about 95 ohms impedance.

The audio cable manufacturers are just beginning to offer specific cables for AES/EBU and S/P-DIF use. Proper impedance for accurate transmission is important, shielding is crucial, durability is a really big deal, and clear marking on the wire jacket will become an issue as users try to keep their audio and digital cables clearly identified and separated for proper use, especially in portable situations.

A M.I.D.I. discussion — where digital all began in audio

M.I.D.I. (musical instrument digital interface) cables are not audio cables. M.I.D.I. is a standard for moving digital signals around in a musical setting between digital keyboards, computers and all the peripheral M.I.D.I. gear used to create today's electronic music.

Conceived in 1984, M.I.D.I. uses German standard 5-pin "DIN" connectors and foil-shielded microphone wire to transmit its signals, but uses only three of the five terminals available on the connector.

A major concern for M.I.D.I. cables is shielding. Pro Co uses only 100%-foil-shielded wire in its M.I.D.I. cables. Like computers, it is critical that the digital signals be transmitted absolutely accurately without interference from the outside world. It is also really important to keep the digital signals between equipment contained so that the M.I.D.I. signals do not interfere with the lighting controllers or other musicians' rigs or the recording board.

M.I.D.I. cables typically do not take the stress of instrument and speaker cables, and can be lighter-duty in nature. Also, since they are not flexed much, foil shields are adequate from a reliability standpoint, while offering the best shielding available.

M.I.D.I. is still very much around as a standard. Conceived by some very bright people, it is not without its foibles, but has withstood the test of time.