All About Wire

It's not Sexy, but Wire is One of the Most Important Pieces of "Gear" You'll Ever Use

By Craig Anderton

No matter how much caffeine you've consumed today, you're not as wired as your studio - or your stage rig. But how much do you really think about those little spaghetti-like critters that form the central nervous system of your musical world? Wire is an actual electronic component, and it can affect your sound - so let's investigate ways to make your wires work harder for you.

**SPEAKER CABLES**

With non-powered speakers that are fed from a power amp, the use of proper cables (*never use instrument cords!* ) can make an audible sonic improvement. This is because amplifiers and speakers are very low-impedance devices, so even the slightest resistance between the two makes it more difficult to transfer power efficiently. Because reproducing bass frequencies at high volume require lots of power, cable problems generally manifest themselves as reduced or "thin" bass.
There are plenty of companies that make speaker cables, but in addition to the wire itself, the connectors are important. A corroded connection, or one that doesn't make good contact, can affect the sound. Locking SpeakOn connectors (Fig. 1) are an industry standard, but banana connectors are inexpensive and reliable; screw terminals are also good if your cables have bare wire ends.

1/4" phone plugs are also common for speaker wires, but with standard plugs, there are fewer points of contact with the jack compared to SpeakOn or banana connectors. However, there are phone plugs that have additional compression springs to provide better contact (Fig. 2).

As to the wire itself, the smaller the gauge number, the thicker the wire—and the thicker the wire, the lower the resistance. 16 gauge wire is used for a lot of systems, but for long cable runs or high power, 12 gauge is a better (albeit more expensive) option.
If you’re arguing with your budget and big-bucks speaker cables are out of the question, there’s a somewhat messy but low-cost workaround: Run several wires designed for high current (e.g., AC "zip" cords) in parallel, with an equal number of cables for the hot and ground connections, to lower the overall resistance. For example, if you run two zip cords in parallel, you’ve cut the resistance in half and four zip cords in parallel cut the resistance by 75%. With the decreased resistance, you may hear a difference (the infamous "tighter bass") if the cable runs are fairly long, or if you play at loud volume with a lot of bass. Zip cords are available at local hardware stores.

Another option for those on a budget is to buy a coil of cable and the needed connectors, then assemble your own cables. You won’t save huge amounts of money, but it will be enough to make your wallet happy.

Fig. 2: This Planet Waves 1/4" phone plug has eight compression springs on the shank, providing increased contact with the jack and also holding it more firmly in place to prevent accidental removal.

GOLD-PLATED CONNECTORS: HYPE OR NOT?
You've probably seen cables advertised with gold connectors (Fig. 3) and wondered if it was just hype, or really made a difference. Well, gold is indeed one of the best metals for electrical interconnection, because it is relatively malleable. As a result it will "squish" into place and fill in gaps better than other metals. This provides better contact, which improves the sound quality. (Extreme cases of bad contact produce scratchy noises, but even slight corrosion can do anything from add distortion to reduce levels.)

Unfortunately gold isn't cheap, so you pay a premium for gold-plated connectors. But there is a pretty decent workaround: Contact enhancement chemicals, such as Caig DeoxIT, can restore and improve contact connections with non-gold-plated connectors. I've known studio owners who swear their sound improves if they spray their patch bay connectors every 6-12 months with DeoxIT.

CABLES AND RF (RADIO FREQUENCY) INTERFERENCE
Cables are often correctly blamed for radio frequency interference, but not for the reason most people think: Corrosion at the connectors, not inadequate shielding, is usually the culprit. Corrosion can create a crystalline structure that acts like a diode, and if you're familiar with the concept of a crystal radio, a diode can turn radio frequency signals into audio frequencies. So if you're getting RF interference, before replacing the cable, try cleaning the contacts first. If the interference is cable-related, cleaning will almost always fix the problem. To clean, use either contact cleaner (like the Caig DeoxIT mentioned previously) or if you're desperate, use a pencil eraser or anything that can scrape the metal very lightly (you don't want to scratch off any plating).

**SPIRAL VS. BRAIDED SHIELDS**

Fig. 4: Different types of shielding are designed for different uses.

There are two main types of shielding used with shielded cables: spiral and braided (Fig. 4). If you make your own cables, note that the two types are intended for different applications.

Spiral braids are easier to unravel and solder, but can develop gaps in the shielding if coiled up or bent a lot. Therefore, they're best for permanent installations (e.g., shielded
wires within a mixer console or processor). Braided insulation holds up well to repeated bending and kinking, and while it's harder to work with, I'd recommend it for cables that will be plugged and unplugged often.

**THOSE CRAZY GUITAR PLAYERS!**

Some guitarists will swear to you that their axe sounds better with some cords than others, which usually elicits a chorus of "yeah, right" from the "wire-is-wire" crowd. But cables can indeed make a difference. Cables are essentially capacitors (i.e., two conductors separated by an insulator), which are the same components used for tone controls within guitars (adding capacitance from the hot wire to ground reduces high frequencies proportionately to the amount of capacitance.) However, cable capacitance is relatively small, so it will have an effect only if the guitar has non-active pickups with a high output impedance, and is feeding an amp or direct box with an extremely high input impedance (e.g., 1 megohm or more; most tube gear falls under this category). If you're recording guitar, try several cables to see which sounds better. For more information on guitar cables, check out the article "The Truth About Guitar Cords."

**DOING DIGITAL: WHY AUDIO CABLES AREN'T GOOD ENOUGH**

Cable capacitance isn't only a concern of guitarists. If you hear clicks, pops, and blorps in your digital transfers, the problem could be due to cables rather than errant software or hardware. For example, because S/PDIF uses RCA connectors, a lot of people just assume they can use standard RCA-to-RCA audio cables and all will be well. If the distance is short, this can be true. However, assume a digital sampling rate of 44.1kHz: that's only the fundamental frequency, and the harmonics that determine the waveform's integrity extend several octaves above that, well into the RF range. Long, high-capacitance cables can roll off enough highs at these frequencies to slow down a square wave's attack, which can contribute to jitter problems.
Fig. 5: Mogami is one of several companies that makes cable designed specifically for digital audio. This picture shows one of their AES/EBU digital cables.

For best results with digital audio signals, use low-capacitance cables designed for video work or that are marked as specifically for digital signals (Fig. 5). Often these cables are available at your local electronics emporium with BNC connectors for use with video or test gear. If you need an audio cable in a pinch, clip off these connectors and solder on RCA phono plugs (preferably gold-plated).

**DON'T TREAD ON ME**

Some musicians don't think twice about stepping on cables or rolling gear across them, but they should. A cable's shield is separated from the inner conductor by insulation, which minimizes capacitance. Stepping on a cable can flatten the insulation, pushing the shield closer to the inner conductor and increasing capacitance. While this may not be enough to cause any audible difference, the more times the cable gets stepped on, the better the odds of problems ranging from increased capacitance to intermittent operation.

If you must run cables across the floor, buy some long, raised rubber covers that run over a wire or group of wires. These are often available at office supply stores for covering up connections to printers, lamps, and so on (e.g., Curtis Cord Cover, available in 6 ft lengths at places like Office Depot). Routing your wires through these not only helps protect the wires somewhat, but also serves as a warning that might inspire people to step over them, not on them.
MULTICONDUCTOR CABLES: CAUTION!

Multiconductor cables can be quite delicate, as I first learned when working with SCSI cables. When you're trying to fit so many conductors inside a single jacket, each conductor has to be pretty thin, and therefore is fairly weak.

Frequent plugging and unplugging of multiconductor cables shortens their lives much faster than an equivalent amount of stress with audio cables. Bending, twisting, or setting weighty objects on a multiconductor cable can also ruin it in short order, as can letting its weight pull on the part of the cable attached to the connector. For best results, once you wire up a multiconductor cable, make sure it's well-supported, then leave it there.

Well, that's enough wire talk for now. The whole saying about a chain being only as good as its weakest link also refers to the wires that link your gear together; hopefully the above tips will strengthen some of the weaker links in your setup.