

The Mystery of Balanced Connections Explained

Many pro audio folks are quite used to working with a special type of audio connection called "Balanced Connections". If you go into a professional audio studio, you'll see equipment that uses these types of connections. Typically, you'll find the connectors themselves are rugged XLR or 1/4" TRS connectors, but really the connector has nothing to do with balanced audio. You see, the idea here is to reduce noise – something that most of us have some familiarity with. So how could an audio connection reduce noise? Isn't it just wires and connectors similar to what we use with home audio?

Yes, it's just wire and connectors, but it's also very low noise. A balanced connection will greatly reduce a type of noise called Common Mode Noise. This simply means noise that is common on two wires. Examples are hum, electrical noise, RF noise, etc. By using balanced connections, we don't have to track down the elusive sources of these noises, we'll just eliminate them by our method of cabling. Sounds like magic doesn't it?

It's not really magic, just good design.

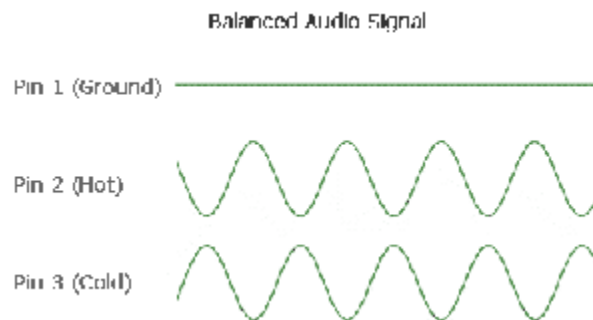
Let's start with the cable:

A Balanced audio cable has three wires but it only carries one channel of audio information. Therefore, the left channel of a balanced flat preamp, for example, is on two of the three wires. These are called Hot and Cold wires. The third wire is ground or earth.

On to the Signal

Now that we know a balanced cable consists of three wires, it's time to consider the signal itself. Why would we want to same signal on two wires in our cable?

The trick is that the special balanced flat preamp applies the same signals on both wires, but puts one of them 180 degrees out of phase with respect to the other, when measured with respect to the shield. You can see this here:



Notice that our signals look exactly the same, but they are offset in time with each other by 180 degrees – as one sine wave is on the way up, the other is on the way down.

Now to the noise

We now know that the signal is on two of the wires in a cable. It's the same signal; just 180 degrees out of phase on the two wires. Our cables will pick up some noise in all likelihood somewhere along the line but that noise will be identical on both signal wires AND it will be IN PHASE. Also important is the fact that the shield inside the cable carries no signal whatsoever, but only the noise that is picked up and returned to system ground.

On to the Soundcard

A soundcard with balanced inputs such as the Audiophile 192 does the final part of our job. The inputs on the sound card move both signals back in phase with each other. This leaves us with

good audio signals that are perfectly in phase and noise that is now 180 degrees out of phase. When we mix together the In Phase audio signals, we'll get a good clean signal, but when we mix together the now Out of Phase noise signals, they will cancel each other out. The result – a good strong audio signal and very much attenuated noise. It's a miracle brought to you via balanced audio connections.