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Attenuators

These devices, also called *pads*, are simple resistor networks that lower the level of an audio signal. At the same time, they can connect a balanced source to an unbalanced input—though without the noise immunity of true balancing.

> Attenuators are often necessary when using a miniDV camera with a field or music-production mixer, or a preamplifier. Most cameras want a –10 dBV line-level signal (though a few require –30 dBV), and most mixers and preamps kick out +4 dBu when their meter reads 0 VU.

Attenuators are available pre-built in XLR male/female barrels, or as cables, for between $30 - $50 at broadcast suppliers. Many of the cable ones also include blocking capacitors.

Or you can build your own for a few dollars. There are three circuits for this, depending on how the equipment is balanced. The value of the resistors in each is determined by how many decibels of attenuation you *need*. Resistors don't have to be fancy: 1/4-watt 1% film resistors, available on special order from Radio Shack (5 for $1), are perfectly fine. Or use 1/8-watt 1% film resistors from an electronics supplier. It won't make any difference in sound quality.

I've specified resistor values that Radio Shack sells, because they're easiest to get. This meant making some small compromises in the pads' designs, and they're not precise to the decibel. But they'll get a signal down to a level that your camera can record well. If you can't find resistors of these exact values, a few percent difference won't matter. The drawings show mono attenuators, but you can double them for a stereo mini-jack input: connect the output of one (marked "to pin or tip" in the drawing) to the mini-plug's tip for the left channel, the other to the mini-plug's ring, and both grounds (from pin 1 on the XLR) to the sleeve.

If you're connecting an electronically-balanced output (most tabletop mixers) to an unbalanced mini-jack or RCA input, wire it like Figure 1. The two resistors marked R1 should be 200Ω, and R2 750Ω, to drop professional +4 dBu line level to consumer –10 dBV line. To drop pro line level to –35 dBu for a camera MIC ATT input, R1 is 590Ω and R2 is 20Ω. If you can't find a 20Ω resistor, use two 10Ω in series or two 39Ω in parallel. If you're using the RCA inputs on an XL1 and want a –30 dBV signal, R1 is 511Ω and R2 is 75Ω (or two 150Ω in parallel).

If you're connecting to a mini-jack input, the jack probably carries DC power for a microphone. Add a capacitor like the 220 microfarad, 16 volt (Radio Shack #272-956), used in the mic adapter earlier in this chapter. Connect it between the output R1 and the mini-plug, with positive (+) side pointing towards the plug.

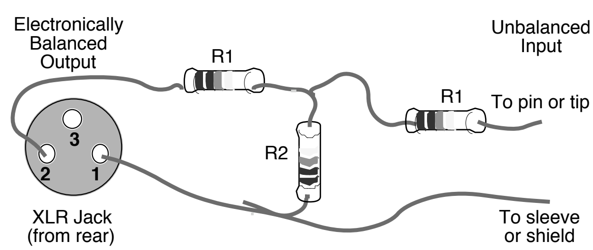

Figure 1: Use this circuit to plug a +4 dBu electronically-balanced output into a prosumer camera. There are two resistors marked R1 because they have the same value; see text for details.

If the mixer or preamp has transformer-balanced outputs (most, but not all, field units), use the circuit in Figure 2 on the next page. To go from

+4 dBu to –10 dBV, all three resistors are 332Ω. To bring +4 dBu down to –35 dBu, R1 is 590Ω and R2 is 25Ω. If you can't find at 25Ω resistor, use two 49Ω in parallel. Use the capacitor described in the previous paragraph for mini-jack mic inputs. To get –30 dBV for an XL1, R1 is 560Ω (or two 1.1kΩ in parallel) and R2 is 38Ω (150Ω and 51Ω in parallel*).

Figure 3 shows the circuit for an XLR-to-XLR balanced attenuator. It can be built into an empty male/female barrel, available from broadcast suppliers, but may be more convenient in a cable long enough to go from preamp to camera. To drop a +4 dBu signal to –10 dBV balanced (for PD150 line inputs), the four R1s are 200Ω; R2 is 249Ω. To drop it to –35 dBu mic level, R1 is 301Ω, and R2 is 15Ω.

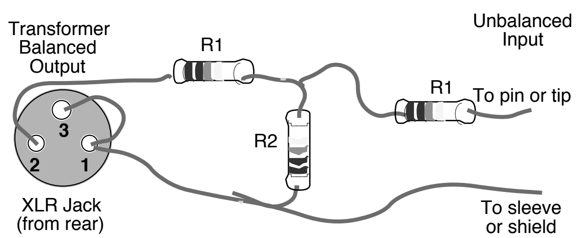

Figure 2: Use this circuit with transformer-balanced outputs

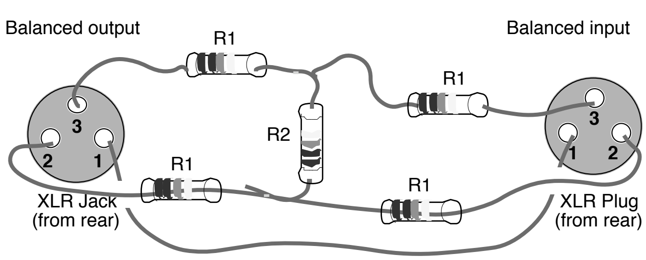

Figure 3: This circuit provides attenuation while keeping the signal balanced

XLR-to-XLR attenuators can be used with long balanced cables. The attenuator should be at the camera, not the mixer. If you're building a cable version, put the resistors in the male end. This keeps the signal at line level for most of the run, for better noise immunity.

In the post suite. . .

If you have just a few low-level unbalanced inputs (such as prosumer VTRs) in otherwise balanced environments, it's best to use buffers or transformers at the decks to make them balanced inputs. This way, all the cabling remains balanced and you won't be facing sudden changes in the grounding scheme when you patch into them.

If you have just a few high-level balanced sources in an unbalanced setup, things are even easier: you can build a simple resistive adapter for a few dollars. Use the circuit in Figure 1, and its first set of resistor values (R1 is 200Ω, and R2 is 750Ω). You'll lose the benefits of balancing at the professional devices, but it's no real loss since you're not using it anywhere else in the room. You may find it more flexible to build a variable version of this circuit using a 5 kΩ trimmer or variable resistor: Just substitute the three terminals on the trimmer for the three resistor connection points in the circuit, with the middle trimmer terminal going to the pin of the -10 device. Set it once for a proper level, then ignore it.

If the balanced source is a classic piece of studio equipment, it may have transformer outputs. In that case, use the circuit in Figure 2, and make all three resistors 332Ω.

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* Why do 150Ω + 51Ω in parallel make 38Ω? The formula is $1/R_{total} = 1/R_1 + 1/R_2 + 1/R_3$... I picked common resistor values, then did the math for you.

This is a tiny excerpt from Jay Rose's *Producing Great Sound for Film & Video, 3rd edition* (Focal Press, March 2008). More information at http://www.dplay.com/book .