

# Connecting the Shell Lug —or not

## Induced noise problems with XLR cables to mics

by Alan Hardiman

**R**epairing a faulty microphone cable one day, I noticed that pin-1 of the XLR connector was connected to the connector shell lug with a small jumper wire, thereby bonding the cable shield to the connector shell. Sometimes known as pin-4, the lug is the connector shell contact in the plug (see Figure 1)

The cable was cheap, and I picked it up at an electronics surplus store. From the quality of the components and the mediocre soldering job, it's a good illustration of you-get-what-you-pay-for. Remember that when you buy something cheap, the best you'll ever feel about it is the day you spend the money. Conversely, when you buy quality at greater expense, the worst you'll ever feel about it is the day you spend the money. (see Figure 2)

From time to time, I've noticed that some cables come with the shell lug soldered to pin-1, the shield conductor, as in the first photo. What's going on here? Should the shell lug be connected to pin-1 or not? I've read opinions pro and con over the years, so I consulted Neil Muncy, an acknowledged expert in the field and author of the ground-breaking AES paper, "Noise Susceptibility in Analog and Digital Signal Processing Systems". (Muncy has since passed away.)

When Muncy wrote his paper most commercially available audio gear had pin-1 problems, and it was difficult to find equipment without it. A number of leading manu-

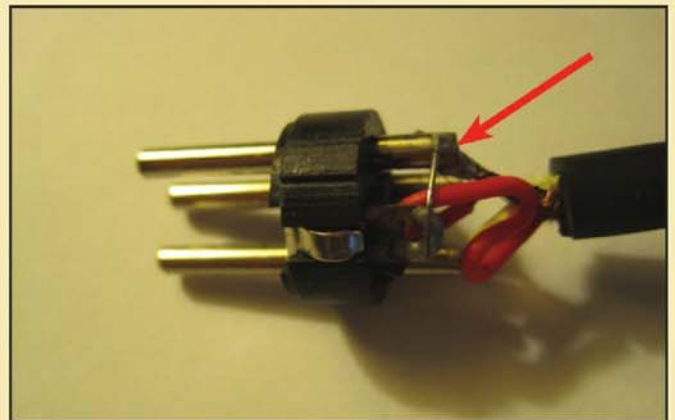


Fig 1: Pin-1 of the male XLR connector bonds to the shell lug by a short jumper Wire

facturers have redesigned their products to correct their mistake, but unfortunately many still have not done so.

Muncy was also a member of the task group that developed the standard AES48-2005, "AES Standard on Interconnections—Grounding and EMC practices—Shields of Connectors in Audio Equipment Containing Active Circuitry," which deals with the pin-1 problem.

I figured he should know how to wire up a microphone cable, so I asked him, "Under what circumstances do you solder the shell lug to pin-1?"

"The short, long, and infinitely long answers are NEVER, NEVER, & NEVER. To do so would introduce ground loops which could totally compromise an otherwise working isolated ground (I.G.) installation, and raise hell with any front-end equipment that is plagued with pin-1 problems. Terminal #4 was introduced by Switchcraft back in the late '50s to address an application in very high impedance medical interfaces. It has no use whatsoever as far as portable A/V cables are concerned. They are simply extension cords."

He went on to point out that the way in which pin-1 is connected to the metal case of a microphone determines whether that microphone is going to have an induced noise problem due to current flowing in the shield of the cable.

"Most legacy microphones from before about 2005 have internal problems the manufacturers never knew anything about. Pin-1 should go straight to the case at the connector. This is especially important with condenser microphones; there should be a ground wire that terminates at the case. If the cable is being bombarded with

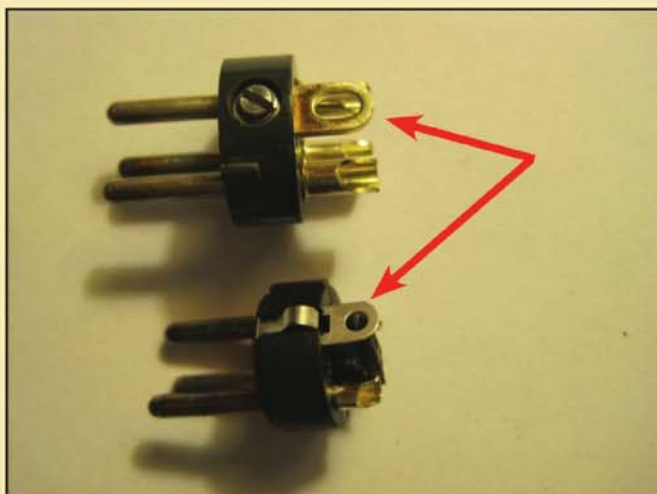


Fig 2: Male XLR connector inserts from Switchcraft (top) and Neutrik; shell lugs identified by arrows. Note Switchcraft's reverse-thread screw



## AUDIO/Wiring Mic Cables

radio frequency interference (RF) and the amplifier inside the condenser mic is sensitive to it, you're going to hear it because it's just demodulating it like a radio would."

One solution is to use the female XLR microphone cable connector to tie the microphone case to ground by intentionally creating an exception to the general recommendation against soldering the shell lug to pin-1.

"It's something I don't generally recommend, but if you're using a metal barreled Switchcraft A3F connector going into the mic, you can take the shield on pin-1 and tie it to the terminal-4 lug, which is the shell contact in the plug. That bonds the shield to the outside of the microphone right there," Muncy said. His solution to get rid of the pin-1 noise problem with the mic is to take a 6" jumper and wire the male end in the usual way and the modified female connection on the other.

"You can't do this with many other XL-connectors, but on the Switchcraft, there are two little spring-loaded ball bearings inside the A3F female connector that make really good contact with the microphone's metal case, or housing. Once you tighten down the mounting screw on the A3F (it's a reverse-thread screw) that fourth terminal is now positively connected to the case via the spring-loaded ball-bearings," he said.

It would be a good idea to label this 6" jumper, or at least wrap it with a couple of turns of colored electrical tape to remind yourself that it's only to be used for special

applications. Remember that if a mic cable wired with pin-1 connected to the shell lug on the male end is plugged into a mic panel bonded to a metal stud, then the frame of the building is now connected to your cable shield, and all sorts of noise can be induced into your signal.

Take a few minutes with a continuity tester or multimeter and test all your mic cables at both ends to ensure that there is no continuity between the connector shell and pin-1 at either end. Note that many cable testers do not have provision to check for this. When you find a miswired cable, it's a simple matter to loosen the connector shell, slip it back a few inches onto the cable, and clip the jumper wire off with your diagonal cutters. ♦

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*Neil Muncy was a Fellow and Life Member of the Audio Engineering Society. His paper, "Noise Susceptibility in Analog and Digital Signal Processing Systems," was published in the June 1995 issue of the Journal of the Audio Engineering Society, which is the most widely accessed issue of the Journal in history.*

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