

CHOOSING THE RIGHT MICROPHONE CABLES



In this chapter, you will learn about microphone cable construction and selection with recommended products for various types of use. We will cover:

- XLR connectors
- Balanced and unbalanced connections
- Wiring of the different types of microphones
- The right wire for microphone cables, including shielding
- A short section for vocalists only

Benchmark

It is really difficult to buy a really flexible, really reliable, really quiet, really good-sound, really good-looking 25' microphone cable for under 30 bucks.

The mic cable situation

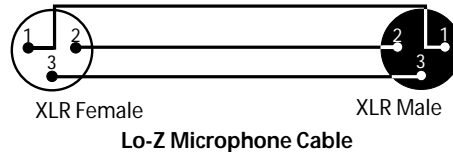
Microphone cables connect microphones to mixers (desk, consoles,

whatever you want to call them). In pro audio, microphones are low impedance (Lo-Z) and are terminated in 3-pin XLR connectors.

Pin 1	(X)ternal	Shield
Pin 2	(L)ive	Hot (+)
Pin 3	(R)eturn	Cold (-)

Another typical configuration is emerging which includes an XLR female (the output of all professional microphones is a 3-pin XLR male)

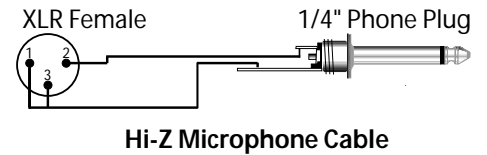
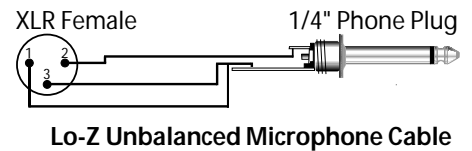
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connector to a 3-pin mini male (1/8" or 3.5mm) connector for inputs to laptop computers and other devices where space is at a premium.

Most professional mixer's microphone inputs are designed with "balanced" circuits to help decrease or eliminate noise and unwanted radio frequency interference (RFI). The understanding of balanced circuits and low-impedance is complicated and is addressed in Pro Co's white papers on microphone cables, which can be found at our website:

www.procosound.com.



Lo-Z Microphone cables can also be wired "unbalanced" and "Hi-Z" (high impedance) microphones are available, for high impedance sound systems (didn't take long to get confusing, did it?).

Hi-Z cables allow the user to plug a Hi-Z microphone directly into the input of, say, a guitar amp or the input of a Hi-Z mixer.



Unbalancing a balanced microphone by using an unbalanced cable allows it to sometimes be used in the input of a Hi-Z mixer. This does not always work, depending on the input impedance of the mixer. When this does not work, a Lo-Z to Hi-Z transformer must be placed in line at the end of a standard Lo-Z mic cable. These commercially available transformers make the proper change from XLR to 1/4" for you.

"One of my problems is making sure the minister does not trip on a microphone cable."



The real world problems with microphone cables

The quality and type of cables needed depend on the application:

“Cannot fail” situations:

- Cables used for live concerts, amateur and professional, TV/ Radio recording and broadcast, ENG (electronic news gathering), recording studios and churches and all other situations where perfection is demanded and failure and noise are not options.

Brutal environments:

- Workhorse cables for touring bands and hard use situations such as A/V (audio visual) rental.

Normal duty use:

- Light-duty church and auditorium use, weekend bands and rehearsal halls.

Light duty/little use

- Beginner use and “thrown-in-with-the-deal” while buying the microphone, that work enough to get you started.

Mission Impossible:

- Lead signers in rock bands who tend to try to destroy mic cables, a real life test of durability.

Note: With the addition of Kevlar to our Ameriquad and Merlin brands of microphone cable assemblies (1998), these cables can be used in situations where everything else breaks.

The Solutions

About Microphone Wire

Microphone wire consists of a twisted pair of copper conductors (typically 22 - 24 AWG — American Wire Gauge). These conductors are covered with one of three types of shielding: braided, spiral (also called “serve” shield), and foil shielding which includes a drain wire. Foil shields work great in snakes, but prove to be unreliable in cables designed for portable use.

Braided shield is best for mic cables and spiral is a little more flexible and less expensive than braid.

Microphone Connectors

XLR audio connectors come in a variety of contact materials, gold, silver and tin. The trade generally likes silver for sound, gold for tarnish-free contacts and tin for price.

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There are about four good suppliers of XLR connectors on the planet and 20 or so copy houses, which wreck havoc on the trade, since they look like industry standard connectors, but are not properly dimensioned.

Microphone cables, unlike guitar cables, use a female connector on one end and a male connector on the other. This enables microphone cables to be daisy-chained, hooked end to end, to increase length when necessary.

This requires a very narrow tolerance for size and pin locations in the connectors, to ensure that the female XLR (the one with the locking mechanism) will lock and unlock when mated to its male counterpart.

Complicating these problems is one manufacturer in America who uses English measurements, a lot of oriental copiers who have approximated the English measurement with metric measurements, and the manufacturers who are not copiers and make great, “to spec” connectors using metric measurements.

Yup! You guessed it. There are compatibility problems. Furthermore, there are some budget minded equipment manufacturers who will use oriental knockoffs in their back panels, exacerbating the problem.

This gets you a cheaper price on the original unit and lots of headaches hooking it up, night after night.

Aside from these occasional compatibility problems and types of connector contact finishes, most XLR connectors will work just fine for most situations. We suggest buying cables which use Neutrik or Amphenol (the original ITT-Canon) connectors for best results.

Let's talk technical about mic cables

Try at all costs to avoid Hi-Z and Lo-Z unbalanced mics. You are not doing your performances any favors by using these products, regardless of price.

4-conductor (quad) mic cable is so dramatic in its noise reduction that the only reason not to use quad mic cables everywhere in your sound system is price.

As sound system operators find out how much quad mic wire reduces noise compared to well-designed and built two conductor assemblies, they are turning to the wire as a logical step up in their system performance.

A friend of Pro Co's, who operates several county fair P.A. systems, working in the absolutely worst conditions imaginable, has found that with the use of Pro Co's Ameriquad wire to help eliminate “hiss” from his systems, that the artists, often times, are unable to detect that the sound system is “on”. They are so used to listening to hiss as an indicator that the equipment is working that this unsettles them greatly. From an engineering standpoint all we can say is, “We get it right and they still complain”. Good grief!

CHOOSING THE RIGHT MICROPHONE CABLES

Solutions

Most professional Lo-Z microphone outputs can easily be run up to 500 feet. However, Hi-Z microphones have the same roll off problems that guitar cables have and their lengths should be limited to 20' or less to avoid high frequency attenuation.

Microphone wire comes in a wide variety of diameters. Lavalier mics require tiny, yet sturdy cables. Nature-sound recording enthusiasts need small cables that will roll up into the compartment provided in their Nagra tape recorders to conserve space. Most microphone cables are about the diameter of a normal pencil (1/4") to provide the user with a reliable cable.

We have found that to present an audience with totally no-hum, no-buzz, no-crackle sound systems requires the use of quad (4-conductor) microphone cables.

In situations such as TV studios with huge hum fields created by TV cameras and county fairs with lots of stray radio frequency interference, 4-conductor mic cables can lower hum and noise up to 20 dB (20 decibels — a lot) compared to any two-conductor



XLR Female to XLR Male Balanced Lo-Z Microphone Cable



XLR Female to Balanced Mini (1/8") Male Microphone Cable



XLR Female to Unbalanced 1/4" Phone Plug, either Unbalanced Lo-Z or Hi-Z depending on how it is wired

microphone cable.

Why does quad mic cable work?

For vocalist only: spending more on a great vocal mic that sounds like you, and picks up your tone and your emotions, is something you owe yourself and your audience.

Here's the easiest way to think about it. Balanced mic cables are quieter than unbalanced mic cables because 1/2 of the signal travels on one of the two conductors and they tend to cancel out extraneous signals that

jump on both conductors. The tighter the two conductors are twisted together, and the shorter their twist, the better the wire is at canceling out noise. When two pairs of conductors are twisted together (four conductors total), this makes the conductors much more tightly wound, and, subsequently, ten times better at defending against interference.

25' Lo-Z microphone cables run in price from about \$15 to \$75, depending upon the connectors and wire used. The watertight cables used to film the "Titanic" are worlds apart from the "thrown-in-with-the-mic" cables given away by retailers to "clinch the deal!"




For vocalists only

Your microphone is your instrument. There are wireless mics now that sound nearly as good as mics with cables and allow you complete freedom of motion on stage. That is, when they cost \$3,000 each.

For the rest of you, spending more on a great vocal mic that sounds like you, and picks up your tone and your emotions, is something you owe yourself and your audience. It also has to have great feedback rejection if you are using a monitor system.

If you have spent the money to get yourself a great microphone, get a great cable to go with it, one that transmits your sound and your emotions to your audience, without noise and without adding any tone of its own. We build cables that can do that. They are called "Merlin"; and they are truly magicians at work.

So, what kind of mic cables do I need:

	Pro Co Brand	25' Model #	MSRP
 Advanced	Merlin	ME-25	\$77.50
	Ameriquad	AQ-25	\$50.00
 Intermediate	Mastermike	M-25	\$38.75
 Beginner	Excellines	EXM-25	\$28.70

If you are an advanced play, look for a cable with: a braided shield, 95% or better shield coverage, gold contacts, Kevlar reinforced core and 4 conductor cable.

If you are an intermediate player, look for a cable with: a braided shield, 90% + shield coverage and silver/gold contacts.

If you are a beginning player, look for a cable with: a spiral shield, 70-90% shield coverage and silver/tin contacts.

A LOT ABOUT SHIELDING

In this chapter, you will learn way more about shielding than you need. We'll start with what shielding does. Then we will discuss what makes one shield better than another and talk about the characteristics of each and which is "best".

What does the shield do?

The copper shield of a coaxial cable acts as the return conductor for the signal current and as a barrier to prevent interference from reaching the "hot" center conductor. Unwanted types of interference encountered and blocked with varying degrees of success by cable shielding include radio frequency (RFI) (CB and AM radio), electromagnetic (EMI) (power transformers) and electrostatic (ESI) (SCR dimmers, relays, fluorescent lights).

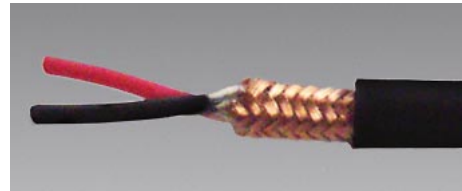
What makes one shield better than another?

To be most effective the cable shield is tied to a ground — usually a metal amplifier or mixer chassis that is in turn grounded to the AC power line. Cable shielding effectiveness against high-frequency interference fields is accomplished by minimizing the transfer impedance of the shield. At frequencies below 100 kHz, the transfer impedance is equal to the DC resistance — hence, more copper equals better shielding. Above 100kHz the skin effect previously referred to comes into play and increases the transfer impedance, reducing the shielding effectiveness. Another important parameter to consider is the optical coverage of the shield, which is simply a percentage expressing how complete the coverage of the center conductor by the shield is.

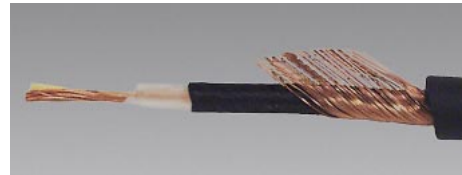
What are the characteristics of the three basic types of cable shields? Which is best?

A braided shield is applied by braiding bunches of copper strands called picks around the insulated, electro-

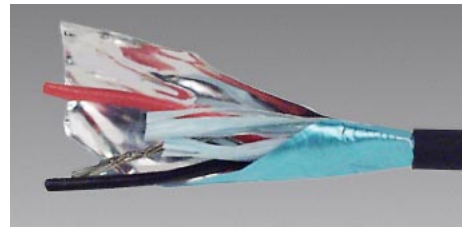
statically shielded center conductor. The braided shield offers a number of advantages. Its coverage can be varied from less than 50% to nearly 97% by changing the angle, the number of picks and the rate at which they are applied. It is very consistent in its coverage, and remains so as the cable is flexed and bent. This can be



Braided Shield



Spiral Shield



Foil Shield

crucial in shielding the signal from interference caused by radio-frequency sources, which have very short wavelengths that can enter very small "holes" in the shield. This RF-shielding superiority is further enhanced by very low inductance, causing the braid to present a very low transfer impedance to high frequencies. This is very important when the shield is supposed to be conducting interference harmlessly to ground. Drawbacks of the braid shield include restricted flexibility, high manufacturing costs because of the relatively slow speed at which the shield-braiding machinery works, and the laborious "picking and pigtailling" operations required during termination.

A serve shield, also know as a spiral-wrapped shield, is applied by

wrapping a flat layer of copper strands around the center in a single direction (either clockwise or counter-clockwise). The serve shield is very flexible, providing very little restriction to the "bendability" of the cable. Although its tensile strength is much less than that of a braid, the serve's superior flexibility often makes it more reliable in "real-world" instrument applications. Tightly braided shields can be literally shredded by being kinked and pulled, as often happens in performance situations, while a spiral-wrapped serve shield will simply stretch without breaking down. Of course, such treatment opens up gaps in the shield which can allow interference to enter. The inductance of the serve shield is also a liability when RFI is a problem; because it literally is a coil of wire, it has a transfer impedance that rises with frequency and is not as effective in shunting interference to ground as a braid. The serve shield is most effective at frequencies below 100 kHz. From a cost viewpoint, the serve requires less copper, is much faster and hence cheaper to manufacture, and is quicker and easier to terminate than a braided shield. It also allows a smaller overall cable diameter, as it is only composed of a single layer of very small (typically 36 AWG) strands. These characteristics make copper serve a very common choice for audio cables.

The foil shield is composed of a thin layer of mylar-backed aluminum foil in contact with a copper drain wire used to terminate it. The foil shield/drain wire combination is very cheap, but it severely limits flexibility and indeed breaks down under repeated flexing. The advantage of the 100% coverage offered by foil is largely compromised by its high transfer impedance (aluminum being a poorer conductor of electricity than copper), especially at low frequencies.