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Whirlwind Technical Articles

Microphone Splitters

by Al Keltz

If your band, school or church's sound system has evolved along a familiar path, what started out as a pretty simple, small group, "sound-on-a-stick" has gradually become more and more sophisticated. Many have replaced that powered mixer with separate components and added a snake to allow for a mix position in the listening area. Words like "direct box", "balanced", "low impedance", "crossover", etc. have become part of the sound team's vocabulary as they strive to provide today's expected level of sound quality and production - for both the listeners and the performers. In this article we just might add some additional terms to your audio vocabulary as we discuss microphone splitters.

WHEN WILL I NEED A SPLITTER?

As your sound system expands, it will eventually be necessary to provide additional mixes from locations other than the main mix position. Although it's possible to provide a separate monitor mix from the main console, a person located nearer to the performance area can hear what the performers hear, see their cues more easily and just generally be able to provide a better monitor mix.

Or you may be called upon to provide a separate mix for recording or broadcasting your performances. That mix will be at its best if the person providing it is isolated from the confusion of hearing the live sound. In any event, you'll most likely need to split your mic signals and feed more than one mixing console.

IMPEDANCE

Proper design of signal flow in an audio system dictates that low impedance outputs (mics) feed high impedance inputs (mixers). When a signal is split to be sent to more than one mixing console, the input impedances of those consoles provide additional paths for the electrical current. This actually increases the overall load presented to the mic signal and limits how many times it can be split without degrading tone or introducing distortion. (See tech article **"High and Low Impedance"** for a more detailed explanation.)

Microphones can usually be split to up to three, and in some cases even four, destinations without the use of electronics. The number of splits that can be accomplished depends on the application, impedances present in the system, length of the cables and the quality of the components used in the splitter. This is called **passive** splitting - no power required.

Active electronic splitters will most likely be required when splitting microphones to four or more consoles.

There are two types of passive splitters: **parallel** and **transformer isolated** .

PARALLEL SPLITS

The simplest form of splitter is the parallel type split. This involves taking a mic cable and simply "Y" connecting the plus, minus and ground wires to two other cables.

This method successfully connects the mic to multiple mixing consoles but connects the consoles directly to each other as well. Most modern consoles behave well when connected to each other but keep in mind that there is no DC isolation between them. Also, differences in the impedances of the legs in active balanced inputs of multiple consoles can make the system more susceptible to hums and buzzes caused by outside interference. However, if a system works well with a parallel split, this type is popular because they are simpler to construct and do not require employing isolation transformers - an added expense. If a splitter is to be used in a noisy environment or is to be connected to many different systems (such as a mobile recording setup) the possibility of encountering problems can be lessened by using a microphone splitting transformer as described below.

TRANSFORMER ISOLATED SPLITS

In a transformer splitter, the microphone is wired straight through to a "Direct Out" and also to the input of a splitting transformer. (See figure below.) This transformer has a 1:1 turns ratio and its output side is connected to the second or "Isolated" split output. (Transformers with two or more secondaries are used for achieving more than one iso split.)

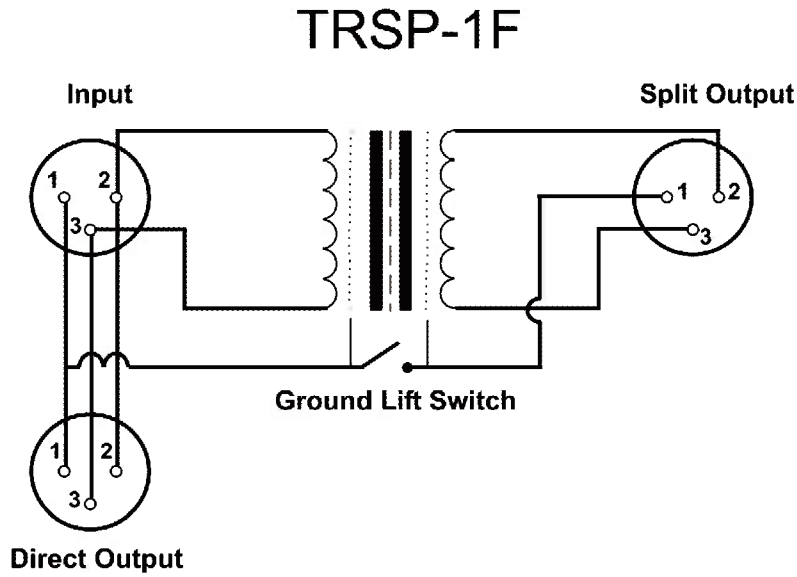
The transformer will pass the microphone's AC audio signal but will block DC voltage in either direction. Impedances are still reflected from the destination to the source across the transformer just as in a parallel split. Therefore, transformer isolation does NOT change the impedance loading of the circuit and does not allow for an increased number of splits over parallel splitting for impedance reasons alone.

One of the outputs is usually wired as a direct connection because the transformer will also block phantom power (DC). Remember to plan on connecting this direct leg of the split to the console that will be providing the phantom power.

A major benefit of using a transformer split is that it increases each leg's ability to reject interference by improving the "balanced" characteristic of the line (called "Common Mode Rejection" or CMR).

(A much more detailed explanation of the theory behind this is discussed in this whitepaper from Jensen transformers, **Theory and Construction of Mic "Splitters"**.)

A disadvantage of this type of split is the added expense of the transformers. High quality transformers are essential for providing proper shielding and for preserving the frequency response of the mic signal - don't cut corners here!



Schematic diagram for a 2-way isolated split with Whirlwind TRSP-1F transformer with dual Faraday shields.

GROUND LIFTS

Not all grounds are created equal. In fact any time two pieces of audio gear are plugged in, their actual resistance to earth ground can vary quite a bit - even when the outlets are on the same circuit. This can be due to the designs of the power supplies, the length of the cable from the outlet to the service box, poor or oxidized connections within the outlet boxes and service panels - anything that can affect the resistance of the path to ground. Even when using a transformer split, a problem can arise when the consoles' grounds are connected directly to each other through a splitter.

If console A "sees" a lower resistance to ground through its connection through the splitter to console B, then part of its AC ground return current will take that path of least resistance. AC current flows in the shields of the cable, through the splitter, and over to console B. This is called a **ground loop** . Now, instead of the shields providing a defense against unwanted interference, they are carrying 60Hz AC and radiating it directly into the signal conductors that they are supposed to be protecting!

Although it might solve the hum problem, you should NEVER use a three-prong ground lifter on the AC power cable of either console! This is not safe and can present an electrical shock danger to the people using the system.

A better solution to this problem is to break the ground connection of one or more channels between the consoles. This is accomplished by disconnecting each offending ground connection at one end (usually the splitter) and leaving it connected at the opposite end. The shield for that channel will continue to work because it is still grounded at one end.

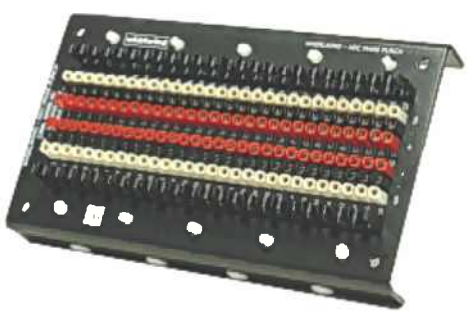
Some technicians will clip all of the split grounds, leaving them permanently disconnected but it's better to install ground lift switches for each channel or use lift adapters when necessary.

This way, the ground can normally be left connected but lifted if there's a problem. Since phantom power requires ground connections to work, if the main console is unplugged or disconnected, the grounds can be left connected to the split console so it can provide phantom power.

Remember that a direct out or passive split will not pass phantom power with the ground lifted at either end and a transformer isolated split will not pass phantom power even with the ground connected at both ends.

SOME DIFFERENT TYPES OF HARDWARE

Single channel, transformer isolated split boxes are available in **SP1X2** or **SP1X3** versions. Both feature ground lift switches.



Screw terminal strips or punchdown blocks are popular for parallel splits in permanent installations as the connections are kept neat and orderly without the need for soldering. They are best used where all the mic lines can be gathered in one fixed location.

Pictured at the left is the Whirlwind/ADC **MASS Punch** . It is available in 58, 28 or 16 channel versions and the punch connections provide quick, solid, gas-tight connections.

For transformer splits in permanent installs, commercial units like Whirlwind's **SPC Series Splitters** provide a pre-made, rack mountable transformer split. Phoenix connectors employ screw terminals for easy on site termination. Phantom power will pass through the direct out or can be injected at the splitter with an external power supply.

Stage boxes using XLR connectors for all ins and outs can be used with standard microphone cables. These are used more often when a splitter is only occasionally needed. However, for permanent use, all those cables make for a lot of "spaghetti" lying around and the mic cables are an added expense.