Tech Note 9
USING MODERN MICROPHONES WITH 'CLASSIC' PREAMPS
October, 2009

Classic preamplifier designs, from the RCA and Siemens/Telefunken vacuum tube modules through the API and Neve solid-state units and even some more recent designs from Studer, for instance, are often valued for the flexibility they provide in dynamics, EQ and tonal characteristics. Modern microphones often have a lower output impedance and higher output level than the mics that were common when these preamps were designed. Sometimes people are concerned that there might be a problem when these mics and preamps are used together.

There are two potential problems, and both can be avoided with the same solutions. The potential problems are (a) disturbing the operation of the preamp's input transformer and (b) driving the preamp beyond the level for which it was designed.

These 'classic' preamps use a high quality input transformer that provides voltage gain and common-mode rejection. The input transformer and its circuit were designed with mics of current production in mind. The highest quality mics were ribbon, condenser and dynamic types, almost all of which have a transformer output and fairly low sensitivity. The quality of the circuit -- indeed much of the 'classic' sound for instance of an RCA 44BX into an RCA BA-2 or BA-21 -- is very much dependent on the mic preamp's transformer working in concert with the mic's transformer. The performance of the input stage is dependent on the loading it sees from the microphone. Some more recent designs provide some of the negative feedback to stabilize the front-end circuit by coupling into a primary winding of the input transformer. There is the potential for these design considerations of the preamp to be compromised if a very low-impedance microphone is connected. The low impedance input loads the transformer so that its transfer characteristic is changed.

The other potential problem is that despite their low impedance, many modern mics have a very high output level, as much as 40 dB higher than classic mics of the 50s and 60s. The Josephson workhorse cardioid mic, the C42, for instance has a sensitivity of 8.5 mV/Pa. This means that on drum peaks or close-up horn pickups it might be producing signal levels around 0 dBu, when the preamp might be expecting -20 at most. Some of our other mics, such as the C617SET, have an even higher level, which means there may be peaks at the output up to around +20 dBu.

We could add these "fixes" to the basic design of our microphones, as a well-known European mic maker did after their USA importer resorted to modifying their microphones on arrival in the 1970s to avoid complaints, but we would rather not compromise their performance with modern preamps. We are particularly concerned with mic performance at

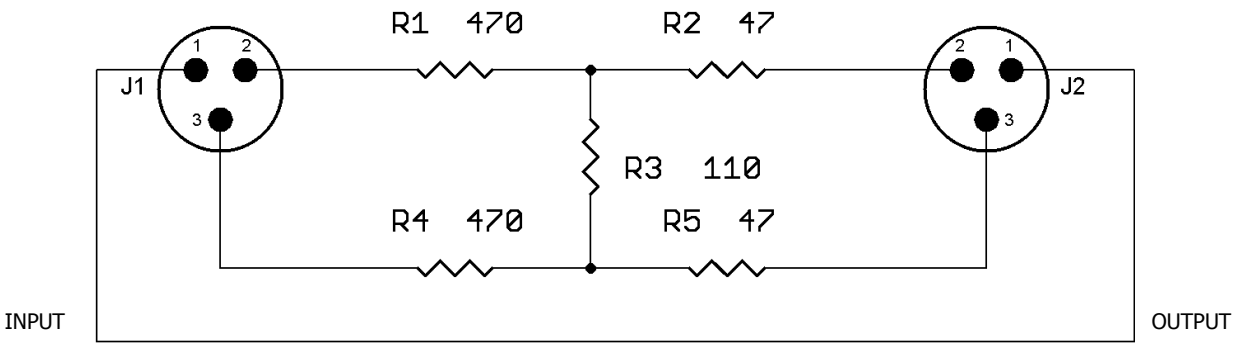
the extremes of noise level and signal overload, and their ability to work with a range of cable lengths and electromagnetic interference environments, so we keep the output impedance low and keep the circuit as clean as possible. This doesn't necessarily solve our users' problems, so this tech note is to explain some solutions that can be employed to make our microphones usable in a wider range of studio environments.

Solution 1: Buildout resistors

Simply putting a few tens of ohms in series with each leg of the circuit between the mic and the preamp will prevent any problems with loading of preamp input stages that need a higher impedance feed. Our microphones come with internal buildout resistors of 10 to 33 ohms, which in series with our electromagnetic interference suppression circuit is enough to make them work well with nearly all preamps. But if these values aren't enough, adding another pair of resistors (try 22, 47 or 100 ohms) in series with the output will do it. This can be done easily in the shell of a cable that connects to the mic, or in an inline adapter like the Switchcraft A3FM. The resistors should be high quality metal film types, preferably thin-film.

Solution 2: Inline pads

A properly constructed inline H-pad (also built into an A3FM or a cable) will have the same effect, and also provide some signal attenuation if this is needed. It should reflect a load impedance to the mic of around 1000Ω and present an impedance to the preamp of around 200 ohms. A 20 dB H-pad can be constructed with five resistors:



In either case, the performance of the microphone and that of the preamp are not compromised. The extra resistance in series with the signal does cause some extra noise, but at high signal levels this isn't typically a problem. High quality metal film resistors, preferably thin-film types, should be used to prevent any signal degradation.