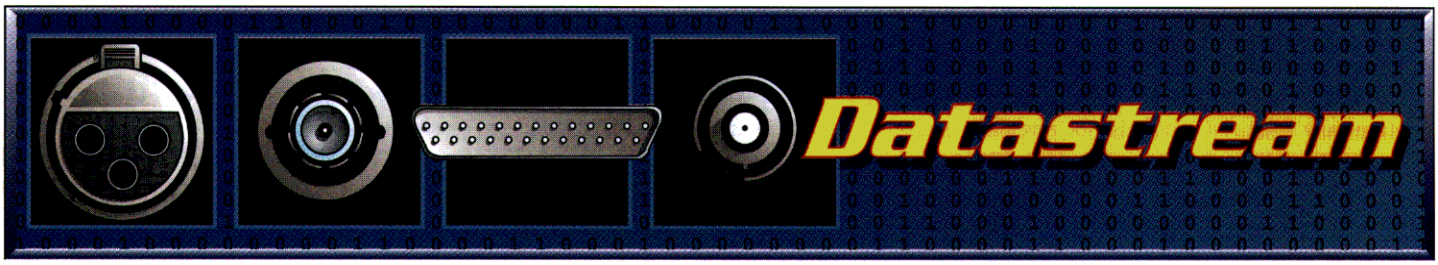
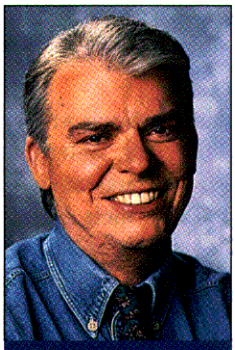
THE NEWSMAGAZINE FOR THE SOUND, VIDEO & ELECTRONIC SYSTEMS BUSINESS • AS SEEN IN THE SEPTEMBER 1997 ISSUE

SYSTEMS Contractor News



System Problems and Equipment Manufacturers

One Manufacturer Finally Fixes Its "Pin 1 Problem," Eliminating Hum and Buzz



by Bill Whitlock
Jensen Transformers

Regular readers of this column know that I don't hesitate to criticize equipment manufacturers for their technically parochial and/or deficient engineering which ultimately drives system installers, maintenance technicians and users crazy.

Although I'm an instructor at a number of seminars and workshops each year, the recent Syn-Aud-Con Grounding and Shielding Workshop provided me with three full days of valuable feedback from engineers, contractors and installers who work "on the front lines."

Even though the students begged us to identify makers of this frustrating equipment by name and model, we had to decline; I refuse to help any lawyer get rich. Perhaps we can work out a non-legally dangerous way to identify makers of good equipment (ideas anyone??). Nevertheless, such extended interaction with students and other instructors helps keep my presentations on track and reconfirms that dealing with interface problems still consumes an awful lot of time and produces an abundance of frustration because:

- Contradictory "rules" about interfacing and grounding abound from many sources,
- Customers expect a steadily increasing dynamic range from systems,
- Input/output impedance specs and "matching" are still widely misunderstood,
- Unbalanced "consumer" equipment is increasingly common in all kinds of "pro" systems,
- Computers and CRT displays are now a major noise producer in many systems,
- Must still believe that hum and buzz result from "bad grounding," and
- "Cut and try" is still the most popular method of fighting ground noise problems.

"System friendly" equipment still not the rule. Regrettably, a large number of equipment manufacturers continue to "bury their heads in the sand" when it comes to system problems. The two biggest problems we common (shared) impedance coupling inside the equipment, a.k.a. the "pin 1 problem," and poor performing "electronically balanced" inputs. These problems are not just academic curiosities, they are the real cause of most system hum, buzz and noise problems.

Both continue to exist because standard lab tests used during product development and sub sequent production tests don't correlate with real world "in-system" use of the equipment.

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The "pin 1 problem" does not show itself in standard bench tests; it must be found with a simple but very specific test. Interested readers are encouraged to read John Windt's engineering report in the June 1995 issue of the *Audio Engineering Society Journal,* which describes the construction and use of this $10 tester. (Our Jensen application schematic AS032—free upon request—is a very condensed single-page version of this article).

Likewise, the real-world inadequacies of electronically balanced inputs is not revealed by standard lab tests. For example, IEC International Standard 268-3, "Sound System Equipment: Amplifiers, specifies a procedure, in section 2.15.1, for testing balanced inputs. The test requires that the signal generator have its source impedance's "tweaked" to produce a maximum CMRR measurement, This absurd procedure absolutely misses the whole point of such tests in general-that test results should be a reasonable prediction of expected performance in a real-world use of the equipment in a system.

In an actual system we can't tweak and tune every source just to make an electronically balanced input perform the way the spec said it would (we'd have to do this every time a system is reconfigured, by the way). I am now working to revise this procedure to better match reality. A footnote in the existing IEC procedure hints at the point I'm trying to make: "*This test is not an adequate assurance of the performance of certain electronically balanced amplifier input-circuits. Such equipment may be adjusted to exhibit a high value of common-mode rejection ratio under the specified measuring conditions, but nevertheless may cause severe signal unbalance when connected to floating balanced circuits. A suitable measuring arrangement for such input circuits is under consideration.*"

The actual concern of this note is probably the unusual but harmless effect a single op-amp differential amplifier (by far, the most commonly used "balanced input" circuit) has on signal symmetry when driven by a floating source. For years, I've been telling anyone who'll listen that signal symmetry has absolutely nothing to do with noise rejection, or "balance," for that matter.

Balance is something defined by impedances, not signal amplitude symmetry, An even more illogical test is widely used to test input stage CMRR. In this test, the balanced inputs are simply shorted to each other and a signal generator connected between this point and ground. This situation, with zero source impedance and zero imbalance, is absolutely and completely unreal. The results of this test tell nothing about what will happen in the real world. No wonder so many people think there's little to be gained from balarmed inputs.

Credit Where Credit is Due

At the Syn-Aud-Con workshop, Steve Macatee, of Rane Corp. talked about the "electro-political" design process as they made subtle but very important design changes to about thirty (to date) of their products. His opening remarks were reminiscent of an AA meeting: "My name's Steve and I've had a pin 1 problem." He explained that Rane, like most manufacturers, was simply unaware of the connection between previously "unexplainable" ground problems that users reported in real systems. Rane had unintentionally designed in some "pin 1 problems." This coupling of ground noise into the signal path results in poor performance (hum and buzz), poor repeatability (everything in the system seems to affect it) and, of course, lots of tech support (phone calls, swapped units, returns, customer dissatisfaction and, ultimately, customers not buying the equipment).

Although Steve recognized the problem, he found some internal resistance to the idea of fixing it or giving up the traditional ground lift switch "feature" (which separated signal ground from chassis ground). However, Dennis Bohn, VP of research and development, decided to liberally apply the Nike theory and "Just Do It," since most products were due for PC board changes anyway due to the acquisition of new automated assembly equipment.

After the changes were implemented, tech support calls related to hum and buzz have dropped more than 50 percent, and there are no more swapped units. Special "floating" test equipment interfaces are now unnecessary during product testing. Even cable performance is much less critical to system performance. Sales are up. Everyone, including the customer, seems pleased with the results. As Steve said, "most product improvements are highly touted, why not improved grounding?"

I wholeheartedly applaud Rane, Steve and Dennis specifically, for having the courage to take this important step. I encourage anyone who experienced hum and bum problems with previous versions to try the new, quietly improved products. And I strongly urge other equipment manufacturers check their own products and fix the "pin 1 problems;" it's cheap and easy to do and it'll make everybody happier.

His opening remarks were reminiscent of an AA meeting: "My name's Steve and I've had a pin 1 problem"

Bill Whitlock has designed pro audio circuits and systems for twenty-five years. In 1989, he left Capitol Records to become president of Jensen Transformers, where his work is focused on interfacing. He holds two patents, writes and lectures about audio and interfacing and is a member of AES, IEEE and SBE.