Subtlety counts

After reading "Subtleties count in wide-dynamic-range analog interfaces" (*EDN*, June 4, 1998, pg 139) and finding it clear, direct, and useful, I decided to file it for future reference. I cut the entire sheaf of pages containing the article, removed the pages that contained only advertisements on both sides, and found that the remaining pages contained only the article.

While I made a special point of examining in detail the advertising pages that I had separated from the article, I peruse all of the ads in *EDN* as part of my job. The ads are of interest to any engineering professional, and I want to commend you for not insulting me by presuming that you have to cram them down my throat. Your evident understanding of this fact reminded me of a conversation that I recently had with a colleague who was lamenting the demise of *Byte* magazine. I told him that I had canceled my *Byte* subscription a long time ago when it became apparent that McGraw-Hill would never understand that expanding a six-page article to 100 pages (this is not an exaggeration) by surrounding every paragraph with ads is an insult. I hope that advertisers take note; we professionals who will buy your products will read your ads but only if we find the publication itself worth reading. *David McCracken*

New circuit looks familiar

I was surprised to see the active transformer in "Subtleties count in wide-dynamic-range analog interfaces" (*EDN*, June 4, 1998, pg 144) represented as something new, much less recently patented. This circuit has been used for at least 30 years in ECG equipment exactly as shown. There were also, of course, many variations on such a useful circuit. In the ECG circuits, the output of A_4 was sometimes connected without the series C. Also, it was usually connected to the shield of the cable. Another common connection was to connect the shield back to the body through a third connection and to then remove R_1 and R_2. Another trick was to add capacitors from the positive and negative inputs to the receive circuitry ground, to remove high-frequency noise that might exceed the amplifiers' common-mode input range or frequency-response capabilities and to prevent RF detection in the amplifiers. Lead-disconnection detection could also be added to the circuit by summing a signal into the feedback path. Because the signal would be common to both inputs, it would not appear at the output but could be checked at the output of A_1, A_2, or V_{CM}.

Tom Blandino
Alert Systems Inc

Author's note: In the process of patenting and licensing this circuit, I've encountered many who claim that "I've seen this before—it's the same as..." To date, none of their circuits have proven to be the same. Although prior art searches by me and my patent attorneys and "office-action" arguments by the patent office made me confident that the circuit is unique, it is entirely possible that the circuit has been previously used, or even published.

I would certainly like to obtain details (documentation) to support Mr Blandino's claim that "this circuit has been used for at least 30 years in ECG equipment exactly as shown."

In the absence of such substantiation, my only response is to explain that the balanced audio interface has unique problems, such as the possibility of sources with no common-mode dc (amplifier-bias) path, which are usually not a concern with ECG instruments. It is a unique combination of features that makes my circuit so useful.

The short answer to the matching question is that the matching ratios of R_1 and R_2 or R_3 and R_4 become an issue only with very high common-mode source impedances (which audio sources are not). In practice, ratio matching to 1% is adequate.

Transient source

Bill Travis' "Automotive power semis rev up to replace mechanical devices," (*EDN*, Aug 17, 1998, pg 48) contains a piece of misinformation.

In **Table 2** (pg 58), the "Alternator-field decay" transient has not existed in anything other than specifications since the introduction of solid-state alternator regulators many, many years ago.

You are not alone in this belief; it is carried by the specifications of many companies and is probably still in the SAE specifications.

Transients of this polarity and magnitude can still exist in the vehicle, but the source is not the alternator; it is some other large inductive load that is turned off and is not clamped!

For some reason, few people other than those who wrote ISO-7637-1 (the definitive automotive-transient spec) acknowledge that the source of this transient is "disconnection of an inductive load," and it applies only to "loads connected in parallel with the disconnected inductor."

Jim Edwards
Motorola, Northbrook, IL

EMR life expectancy

In response to Bill Travis' "Relay: solid state versus heavy metal" (*EDN*, July 2, 1998, pg 67) we found that the life expectancy of electromechanical relays is usually specified as a typical figure. For example, a manufacturer has set up a life test with 100 relays. After 100 million operations, he finds that half of these fail and specifies this figure. But the first one to fail could be already at 25 million operations. If one designs a board with 100 relays, the board is likely to need repair after 25 million operations and not 100 million. So MTBF is maybe four times lower than one would expect at first glance.

Peter van der Velden
Philips Semiconductors Test Equipment

SOUND OFF

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