3.1dB—not an attractive prospect for anyone who has spent money to squeeze down such variations in his system.

The damping effect pertains to rise and hangover of transient sounds. That can be demonstrated with pulsed sine-wave tests. For a few years, those were a standard part of the tests done by audio magazines, but they had difficulty correlating the results with the sound. Since those tests are not part of any industry-standard test regimen, the magazines dropped them. (I think that they should try harder!)

High-fidelity speakers are designed to give proper response when driven from a zero-impedance ("constant-voltage") source. The cone position, or velocity, should correspond exactly with the voltage input. If a resistance, such as the 1 ohm mentioned above, is in series with the speaker, increased rise time and hangover of intrinsic speaker resonances will blur and color the sound. Power amplifiers are designed to have very low output impedances, usually on the order of hundredths or thousandths of an ohm, for just that reason.

There are a few rare amplifiers that run a feedback wire directly from the speaker to get the wiring in the loop, making only the losses important. However, as far as I know, none of those is available for autos.

Thus, the proper policy is to keep the wiring in series with a speaker at, say, a tenth of the lowest speaker impedance or less. For most auto-speaker runs, I would guess 14- or 16-gauge wire would suffice. At home I use 12-gauge for 20- to 25-foot runs. It's hard to find nice fine-stranded wire larger than 12-gauge for less than a king's ransom. Of course, two or more 12-gauge wires can be paralleled.

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## DIGITAL TACHOMETER

I recently built the Digital Tachometer that appeared in the June 1987 issue of **Radio-Electronics**, and it works very well. It is the only digital tachometer circuit I've ever seen that offers accurate tachometer readings without calibration. That is accomplished by the use of a built-in 60-Hz crystal-controlled time base. The author is to be congratulated on that fine project.

It worked perfectly on several standard and Capacitive-Discharge (C-D) ignition systems. However, the tachometer will not work on some C-D systems that use input-triggering circuits that generate extremely low pulse levels across the ignition points. On one such system, which incorporates an unusual triggering network designed primarily to eliminate point "bounce" or "flutter" at high engine speed, the pulse obtained across the ignition points was far too small for tachometer pickup.

To eliminate that problem, I used a miniature broadband amplifier between the ignition points and the tachometer input. I chose the broadband amplifier described by Earl "Doc" Savage in "Hobby Corner" in the April 1980 issue of **Radio-Electronics**. It is small enough to fit easily within the tachometer enclosure. I added a switch to allow the amplifier to be switched in or out of the circuit.

I hope that my solution may prove useful to other readers experiencing similar difficulties. Many thanks for a fine magazine.

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## CALIBRATING VCR COUNTERS

I thought Fred Blechman's article, "Calibrating VCR Counters," (**Radio-Electronics**, January 1988) was interesting—but for cable subscribers there's a technique that's even easier.

Most cable systems use one channel as a 24-hour menu that shows program listings. At the top corner of the screen the day, date, and exact time are displayed. Just set your VCR to record for six hours, starting at any convenient on-the-hour time, and you will have accomplished the same thing Mr. Blechman did with a camera. Of course, that procedure must be repeated for each speed, plotting the results described in the article.

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