SPEAKER PROTECTOR

I would like to make some comments regarding the discussion of fuse selection for speakers that appeared in Mark A. Vaught's article "Speaker Protection" (**Radio-Electronics**, August 1991).

First, fuses are generally selected

by RMS ratings. That should be apparent, since the RMS power value can be synonymous with the product of a steady state voltage and current. Since fuse operation is dependent on the melting of an alloy, selection based on RMS values of current should be apparent.

Second, the generic term "fuse" should not be used. Each fuse type has certain characteristics and a typical time-ampere plot associated with it. When speaking of a specific application, the type of fuse should be specified.

Third, a system should be fused for its weakest link. Murphy's Law works well here: The transistor protecting the fuse blew. In a typical stereo system, that might mean the maximum collector current of the output transistors, the current driving capability of the amplifier, the speaker rating, and common sense. With the proper output transistors and fuse, reasonable short-circuit protection can be provided.

The speakers might have either RMS or peak ratings. Select the fuse based on the equivalent RMS value

of current at the nominal impedance of the speaker voice coil. For example: A 125-watt amplifier driving 8 ohms, with output transistors rated at 30 amps peak collector current, driving speakers recommended for a 15- to 100-watt amplifier at 8 ohms, which includes an internal fused tweeter rated at 35 watts peak, is used in a living room in a single residence home.

For the tweeter fuse amperage, $A = 0.707\sqrt{35 \text{ watts}/8 \text{ ohms}} = 1.5$ amps.

For the overall speaker fuse amperage, $A = \sqrt{100 \text{ watts}/8 \text{ ohms}} = 3.53$ amps.

The amplifier fuse amperage, $A = \sqrt{125 \text{ watts}/8 \text{ ohms}} = 3.95$ amps.

Therefore, the amplifier fuse should be less than 3.53 amps and the tweeter fuse should be less than 1.5 amps. Since we are using this amplifier in the home and not at high-volume levels, it makes sense to pick 1.25A for the tweeter and 3A for the amplifier. If the fuses blow needlessly, then increase the value slightly.

Now, for the fuse-type selection process. The Bussman AGX series, a ¼ × 1-inch, non-time-delay fuse, is a good bet. You cannot physically substitute fuses with different characteristics, such as time-delay, for this application

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The fuse values for the speaker-protection circuit, shown in Table 1 of my article, were calculated using peak voltage values, because peak current flows during these periods. The peak voltage values themselves were determined by calculating the value of the DC rails, which must be present to create a given amount of average power dissipation within a speaker of a given impedance. Because this is true, the values in Table 1 are adequate to protect an amplifier that is capable of delivering the rated output power.

Keep in mind that the fuse is not for direct speaker protection, but for amplifier protection—the purpose of the circuit itself is to protect the speakers from a damaged amp. If you do not drive your amp to peak power levels, then choose a fuse that will protect your amp based on a value of 0.707 times the value from Table 1.

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