

Solid-State Limiter for Tape Recording

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A device for use in recording to prevent a "peak" from driving amplifier or tape into distortion.

IN MAKING TAPE RECORDINGS of live performances it is generally preferable to make the recording at the highest possible level. In recording at such high levels "accidents" may occur which will drive either amplifiers or tape into distortion. A device which would prevent this overdriving on peaks while still preserving the major portion of the dynamic range without modification would be desirable. The solid-state limiter described below will perform this function. The device makes use of the Raytheon "Rayistor" which is basically a light source and a photo-resistive element combined in a transistor-sized capsule. The more current through the light source the lower the resistance of the photo-sensitive element.

A preliminary stereophonic arrangement employed a single side-amplifier as driver for two Rayistors, one for each channel. A sum-signal was used to drive the side amplifier. The intention was to prevent wandering stereo-images by using identical gain reductions in both channels. This did not work out very satisfactorily in practice: proper adjustment was very difficult to obtain. Despite the added complexity it was decided to provide two identical limiters, each with its own side amplifier.

Separate limiters for each channel can result in wandering stereo-images which could be serious in a volume compressor where compression occurs at nearly all signal levels. The device described here is intended only to catch those momentary peaks, which, it is hoped, will occur infrequently.

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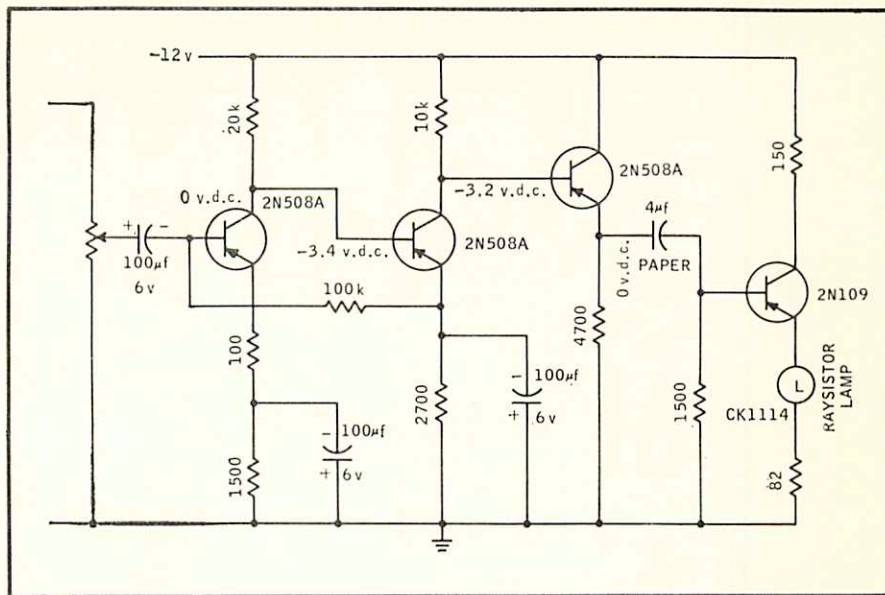


Fig. 2. Solid-state side amplifier.

During these infrequent and short intervals the wandering-image problem should not be serious: in any case it will not be as serious as the occasional overload we desire to prevent.

The general arrangement of the limiter is shown in Fig. 1. Gain reduction occurs whenever the resistance of the Rayistor falls appreciably below that of R_1 . Gain control R_1 is adjusted until limiting occurs at the desired level. The signal used to drive the side-amplifier can be obtained at any convenient point in the amplifier following the point where limiting is introduced. If the impedance to ground is high it may be necessary to employ isolating resistors to prevent shunting by the relatively low input impedance of A_1 . A suitable side-amplifier circuit is shown in Fig. 2. It is based on a preamplifier suggested in the General Electric Transistor Manual. The final transistor (2N109) operates essentially Class B

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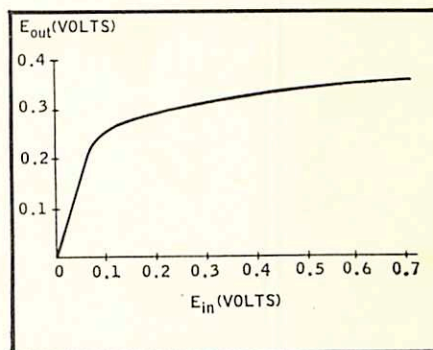


Fig. 3. Limiting characteristics.

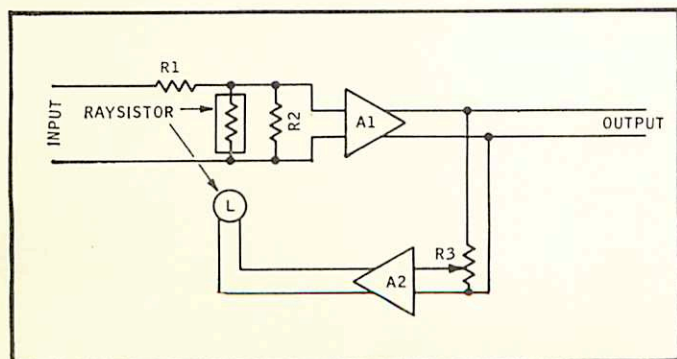


Fig. 1. General setup of limiter.

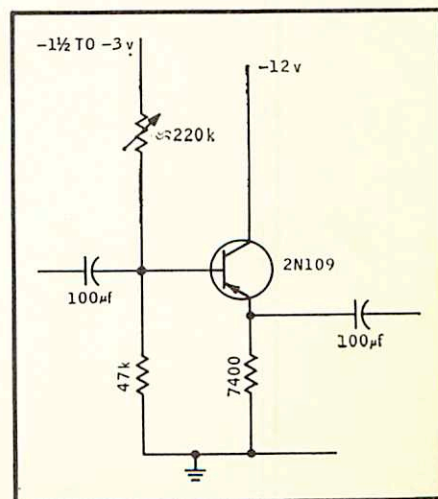


Fig. 4. Threshold circuit.

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so that its emitter current is proportional to the signal level.

Figure 3 shows the kind of limiting which can be expected from the arrangement as described. It must be admitted that limiting is *not* instantaneous but it is quicker than manual "gain riding" and, with proper adjustment, likely to be less noticeable.

An alternate arrangement for determining the threshold of limiting employs a Class-C emitter-follower to drive the side-amplifier. In this case R_1 (*Fig. 1*) is omitted and limiting occurs as soon as the signal is high enough to overcome the base-bias of the Class-C emitter-follower. A suitable circuit is shown in *Fig. 4*. Results with this arrangement are similar to those using R_1 without the Class-C stage.

It should be emphasized that this device is not intended for use as an automatic gain-riding circuit in stereophonic applications. It was designed solely to eliminate or to reduce occasional overloading during the recording of amateur performers whose decibel output cannot always be accurately predicted. For this use, and this use alone, this arrangement is recommended. Æ