

ON a long trip it is often desirable that one can play one's cassette tape-recorder, but then it's battery life becomes very short. Since most cars use a 12 volt battery, the tape recorder cannot be run directly from the car's electrical system. One often used method is to connect a heavy resistor in series with the tape-recorder, but on a radio-cum-tape-recorder this method does not work since the tape recorder draws far more current than does a radio.

This problem can be overcome by using a very simple stabilising voltaged supply consisting of only three components—a transistor, resistor and a zener diode. Before one selects any components, one must know exactly what one's requirements are—the figures given at the end of this article are for a typical cassette tape-recorder that draws a maximum of 350mA. It is however easy to modify one's design to cope with almost any portable tape-recorder.

Firstly, what is the voltage of the machine? This is easily determined by counting the batteries and multiplying by 1.5,—most recorders are either 6, 7.5 or 9 volts. Once the voltage has been determined, it is necessary to find the maximum current that the machine will draw. To do this, remove one battery and solder wires onto the ends of it. Connect an ammeter in series with the battery and by dabbing the wires where the battery was and by playing the tape recorder with it's volume fully turned up, the maximum current can be determined.

Our next job is to choose a transistor. The only specifications that need concern us are it's power and current rating and it's current gain ( $h_{fe}$ ). For a tape recorder, a 2N3054 is normally sufficient, but for a large machine, a 2N3055 might be necessary, while for a small radio, a 2N1611 might suffice. To determine the power rating, we use the formula  

$$\text{Power} = I_x V$$

$$= I(V_{in} - V_{out})$$

The zener diode is a low power device (250mW) and it's breakdown voltage is the required output voltage plus 0.6 volts, the latter being the emitter-

base voltage of a silicon transistor. The zener need not be specially selected, since a volt either way will have very little effect on the tape-recorder.

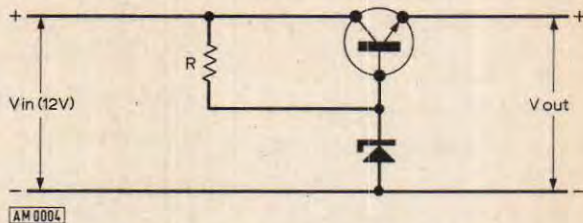


Fig. 1: Stabilising circuit for cassette recorders.

The resistor (R) is the most difficult to calculate. The current that passes through it performs two functions:

- i) A current of normally at least 5mA to maintain the voltage across the zener diode.
- ii) The base current of the transistor. As a rule of thumb, this should be twice the maximum required output current divided by the current gain of the device.

Adding these two we get that the current through the resistor is  $(5 + 2 I_{out}/h_{fe})$  mA and assuming that the car uses a 12 volt battery, the value of the resistance, using Ohm's Law, is found to be:

$$R = \left( \frac{12 - V_{out} + 0.6}{(5 + 2 I_{out}/h_{fe})} \right) \text{ k}\Omega \quad \left( R = \frac{V}{I} \right)$$

The components given below are for a typical tape-recorder that draws 350mA. No list of prices is included as a person who can't build this for less than £1 just isn't trying!

Components.	6V	7.5V	9V
Resistor ( $\frac{1}{2}$ W)	330 $\Omega$	270 $\Omega$	180 $\Omega$
Zener diode	6.6V	8.1V	10V
Transistor.		2N3054	■