ISCE

The Institute of Sound and Communications Engineers

Engineering Note 8.4

'100 V line' dummy load

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What's it for?

When we want to measure the characteristics of an amplifier, we use a test set-up as shown in Figure 1.

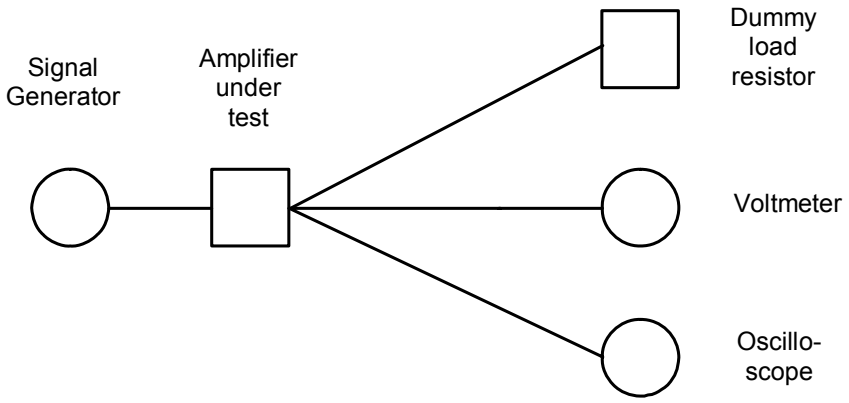

Figure 1 Test set-up for measuring an amplifier

NOTE – A distortion meter or spectrum analyser may also be connected at the amplifier output.

If the amplifier is a pre-amplifier or mixer, the 'dummy load resistor' is probably just a 1 kΩ 0.6 W resistor, but if it is a power amplifier we need something more. If it is for low-impedance loudspeakers, we can use either a single resistor of adequate power rating or, often better in terms of getting rid of the heat, an array of resistors in a suitable series-parallel combination. The aluminium-clad chassis-mounting power resistors are good, being inexpensive and low inductance (the cladding tube forms an excellent shorted turn!).

For '100 volt line' (or 70 V or whatever), something different is appropriate. Amplifiers come in all sizes and we need to be able to select the correct load resistance. Some tests also require the load to be disconnected, so an 'ON/OFF' switch is helpful.

Load resistance

For some measurements, we want the amplifier to be presented with the lowest permitted load resistance R (ohms), since that is what the power rating W (watts) is based on:

$$W = V^2/R, \text{ and V is 100 V, so } W = 10\,000/R \text{ or } R = 10\,000/W$$

So a 10 W amplifier needs a 1 kΩ load resistor and a 500 W amplifier needs a 20 Ω resistor (rated at 500 W, of course!). For other measurements, we may want the amplifier loaded to less than full load.

With nine toggle switches (plus the ON/OFF, which will also do something else, as we shall see) and a modest number of resistors, we can make a box that can be set to any value of load resistance from 20 kΩ (1 W) to 19.5 ohms (512 W), in steps that are the equivalent of 0.5 W on 100 V line! That '512' may give a clue as to how we do it; in these days many people know the powers of 2 up to at least 2^{32} and maybe beyond.

We use the series 1, 1, 2, 4, 8, 16, 32....512, where each number represents 'watts at 100 V'. It is an interesting exercise (if one has time!) to find the minimum number of resistors, and the minimum number of different values, required to build the box,

using, of course, only easily-obtained values. I didn't do that, but the number of resistors and different values that I propose are practicable. The table shows how it was done. The 'ON/OFF' switch is a single-pole double-throw type with a centre-off position. This allows it to select '1 W' in one 'ON' position and '0.5 W' in the other.

Power at 100 V, W	Resistor(s), Ω	Resistor power rating(s) W
0.5	20 k	0.5
1	10 k	4
2	2 ×10 k in parallel	4
4	4×10 k in parallel	4
8	8 ×10k in parallel	4
16	680 in parallel with 8.2 k	680 Ω, 25 W, 8.2 kΩ, 7 W
32	two sets as for 16 W, in parallel	see above
64	100 + 56 in series	100 Ω, 50 W, 56 Ω, 25 W
128	two sets as for 64 W, in parallel	see above
256	7 × 270 in parallel	50

A fairly large box is required to allow the provision of a BIG, THICK sheet aluminium (no need for a costly extrusion) heat sink, preferably black, for the resistors, but the very generous power ratings mean that they don't run all that hot anyway. For extended periods of use at high power, a cooling fan is indicated.

All that is necessary in addition is a pair of terminals and/or a Speakon connector for the signal from the amplifier.

If you want to know exactly how to measure amplifiers, buy BS EN60268-3 from ISCE.