



APPLICATION NOTE

TRANSFORMERS FOR LINE DRIVING AMPLIFIERS

INTRODUCTION - IMPORTANCE OF MISMATCHING

Balanced 600 Ohm lines need to be driven from a low impedance ideally less than 60 Ohms to overcome the effects of the line capacitance and resistance. Good results can be obtained with greater source impedances if the line is short say, less than 10m.

When feeding a power amplifier via a short lead which may be balanced or unbalanced it is important to drive from a low impedance to overcome the effect of input capacitance and minimise insertion loss.

We offer a range of output transformers optimised for the various amplifier device circuits in common use.

TRANSFORMER RATIO

A step-down transformer will reduce the reflected impedance of the source seen by the load in proportion to the ratio squared. It will of course also reduce the voltage from the active device in direct proportion to the ratio.

For example a valve with an internal impedance of 1000 Ohms and a signal of 10V and a step down of 5:1 the load will see a source of $1000/25 = 40$ Ohms and a voltage of 1V.

OPTIMUM LOAD OF THE OUTPUT DEVICE

In the case of a valve output stage the load seen by the anode affects the linearity and hence the sound quality. The anode will see the reflected load connected to the secondary.

In most cases it is recommended to apply a resistive load across the secondary to ensure the anode sees the optimum load. The value of the resistor depends on the impedance of the external load driven by the transformer. If the preamplifier is going to drive a power amplifier with a high input impedance e.g. a grid with a 10K grid leak a load resistor will certainly be required.

For example a valve with an optimum load of 10 kOhms and a 5:1 step down transformer The secondary load needs to be $10,000/25 = 400$ Ohms.

TYPES OF OUTPUT DEVICE

- 1. Single ended valve.** A gapped M6 transformer is required to handle the DC anode current as well as the AC signal. Recommended types 1160 or 1367.
- 2. Push-Pull pair of valves.** An M6 laminated core gives high signal voltage handling capability. In cases where the anode DC currents can be closely matched to within 0.5 mA, we offer a combination core with 50% Mumetal/M6 core to give very high inductance for optimum LF response and good signal voltage capability. Additionally the Mumetal part of the core ensures near zero harmonic distortion for mid and high frequencies. Recommended types 9745 or 8650

- 3. Cathode follower or SRPP stage.** It is necessary to use an isolating capacitor to protect the transformer from DC. These circuits generally provide a low source impedance so a low step-down ratio can be used. A secondary load resistor is not normally required. Recommended types 9041, 9042, 1010, or 8940

MICROPHONE TRANSFORMERS

- 1. 200 microphone to grid or desk.** There is a trade-off between voltage ratio and frequency response. We recommend the 1:7 ratio (4935) unless a higher gain is required in which case we can offer type 9169 which has a ratio of 1:10. Both types have a centre tapped primary for phantom powering. Type 9045 is configurable to give a ratio of 1:5 or 1:10 and it has a larger core than the other types and provided the ultimate in performance.

The load seen by the secondary has an effect on the sound because of the damping effect of the moving parts of the microphone. In general the higher the load the better but some customers have reported a less bright tone if the load is reduced.

GENERAL PURPOSE INPUT TRANSFORMERS

- 1. Very high level 600 Ohm to Grid or other high impedance.** We offer type 9062 which has a step-up ratio of 1:2+2 and 9063 which has a step-up ratio of 1:4+4. Both these transformers use a large 100% Mumetal core and full geometric balance for the ultimate in common mode rejection.
- 2. Input phase splitter.** We offer type 1475 which has a 10 kOhms primary and two identical 10 kOhms secondary windings. The transformer is geometrically balanced so that it can drive both sides of a push-pull amplifier with almost perfect opposite phase signals while maintaining a high input impedance. 1475 uses a large 100% Mumetal core for the ultimate in performance.
8540 is a 600/10 kOhms has a secondary CT to enable it to be used as a lower priced alternative input phase splitter.
- 3. Step up/step down.** Type 4383 is a 600/10 kOhms input transformer with a ratio of 1:4 And a good input level. Sometimes used as a low-level output transformer in reverse with a ratio of 4:1.
- 4. Configurable input transformer.** Type 9145 is configurable with a ratio of 300+300/1.2+1.2 kOhms.
- 5. Ribbon microphone transformer.** Type 8074 is designed to be driven directly from the ribbon which has a resistance of a small fraction of an Ohm.