

THE TETRODE BOARDS™

*Control and Protection
for your
Tetrode RF Power Amplifier*

Application Note 4

Tetrode Drive and Grounding Options

This Application Note is based on Chapter 3 of the ***Tetrode Boards*** manual (AN-1) which is supplied with each set of boards.

It explains the options for grid or cathode RF drive, and for DC-grounding and RF-bypassing.

The ***Tetrode Boards*** allow any of these options.



WARNING

These notes are intended for users who have sufficient experience to work safely with high-voltage circuits.

Use at your own risk! We cannot accept responsibility for any damage or injury.

DANGER - AC mains voltage and high DC voltages!

WARNING

DO NOT use the *Tetrode Boards* with a screen supply derived from the anode high voltage through a dropper resistor – it will cause serious component damage!
Always use a separate transformer winding for the screen supply.

REVISION NOTES

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Any

REC-G1-ALC Board Issue No
Any

Tetrode Grounding Options

1. Introduction

You can use the **Tetrode Boards** with either grid-driven or cathode-driven tetrodes.

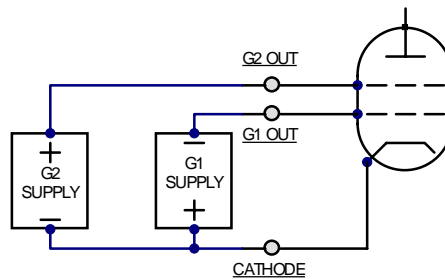
You can use the **Tetrode Boards** with any configuration of DC grounding and RF bypassing of the tube(s).

Take care with that little word “grounding” – remember that RF bypassing and DC (chassis) grounding are different! The screen grid of a tetrode is always RF-bypassed, but in most configurations the screen is **not** DC-grounded to the chassis.

This section explains the three practical combinations of DC and RF grounding, and shows you exactly how to connect the **Tetrode Boards**. Note that some configurations require additional components (shown as C1, VDR1 etc. in the schematics below) – see Section 4 for details.

The **Tetrode Boards** provide two regulated grid bias supplies:

- Negative voltage for the control grid (output from the G1 OUT terminal)
- Positive voltage for the screen grid (output from the G2 OUT terminal)



The two supplies are commoned at the CATHODE terminal, but they are fully floating. This Application Note helps you to choose which of the three terminals – CATHODE, G1 OUT or G2 OUT – to connect to chassis ground.

Follow the tube maker’s recommendations

The G1 and G2 voltages shown in the schematic above should be the ones recommended by the tube manufacturer. These are always referenced to the cathode. However, you can put the DC (chassis) ground point where you like – cathode, G2 or G1 – because the tube still sees the correct G1 and G2 voltages.

Further reading

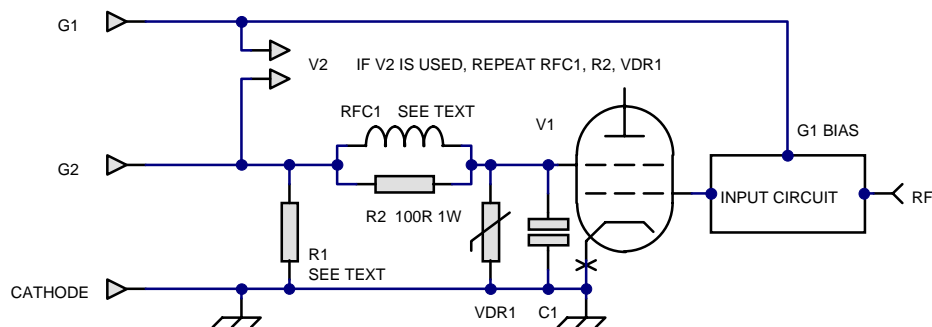
Ian White, G3SEK, *Power and Protection for Modern Tetrodes*. QEX, October 1997.
Downloadable from <http://www.ifwtech.com/g3sek/boards/tetrode/tetrode-3.htm> in PDF or Word format.

The following sections explore the options for DC grounding and RF bypassing. Section 5 describes the extra components that need to be connected to the screen grid if it is not DC-grounded.

Two-tube Amplifiers

The **Tetrode Boards** can handle either one or two tubes, though only one tetrode (V1) is shown in these examples. If yours is a two-tube amplifier, use the connection points marked →V2 on the schematics.

2. Grid Driven, DC-grounded Cathode

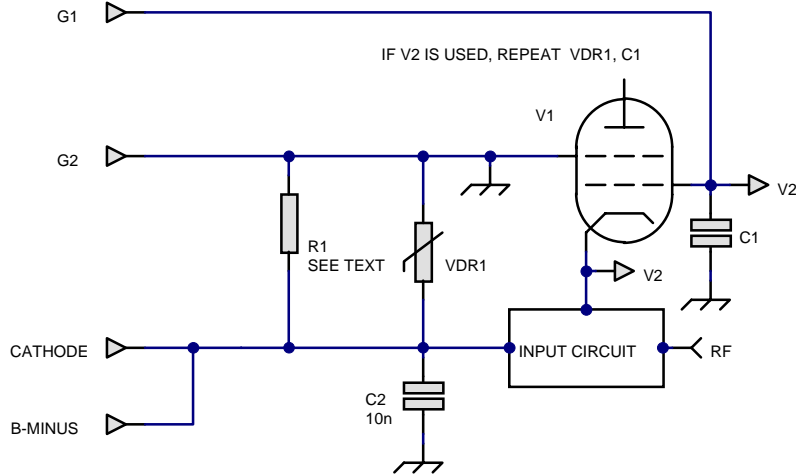


This is the most commonly used option. RF drive is to the control grid, and the screen grid is bypassed by C1 (usually built into the tube socket). The tube cathode is grounded to chassis (maybe through a small RF feedback resistor at X).

Connect the **CATHODE** terminal of the **Tetrode Boards** to chassis ground as shown above. Do **not** connect the **G1 OUT** or the **G2 OUT** rail to chassis!

Note that the G1 meter is at control-grid potential **below** chassis ground, and the G2 meter is at V_{G2} potential **above** chassis ground. Your anode-current meter in the B-minus rail will be at chassis ground potential.

3. Cathode Driven, DC-grounded Screen Grid

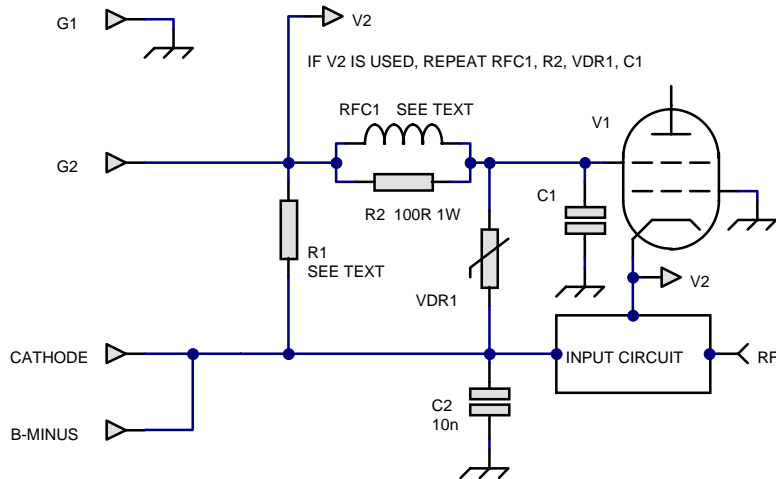


RF drive is to the cathode, the screen grid is DC-grounded (so there is no screen bypass capacitor) and the control grid is bypassed to chassis ground by C1.

Connect the G2 OUT terminal of the **Tetrode Boards** to chassis ground as shown above. Do **not** connect the CATHODE or G1 OUT rails to chassis!

Note that the G2 meter is close to chassis ground potential, but the G1 meter is at $(V_{G2} + V_{G1})$ potential **below** chassis ground. Also your anode-current meter in the B-minus rail will be at V_{G2} potential **below** chassis ground.

4. Cathode Driven, DC-grounded Control Grid



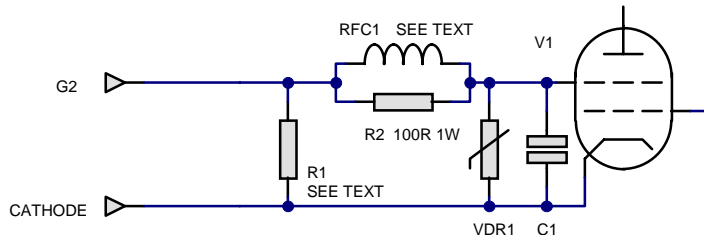
RF drive is to the cathode, the control grid is DC-grounded and the screen grid is bypassed by C1 (usually built into the tube socket).

Connect the G1 OUT terminal of the **Tetrode Boards** to chassis ground as shown above. Do **not** connect the CATHODE or G2 OUT rails to chassis!

Note that the G1 meter is close to chassis ground potential, but the G2 meter is at ($V_{G2} - V_{G1}$) potential **above** chassis ground. Also your anode-current meter in the B-minus rail will be at V_{G1} potential **below** chassis ground.

5. Screen-grid Components

This section describes the components that are common to all of the schematics above.



Screen-cathode bleeder resistor R1

R1 serves two purposes:

1. To prevent the screen grid from 'floating' when the screen switching relay K1 is changing over.
2. To provide a bleed current which makes the screen current meter read up-scale by about 10mA. This allows negative screen currents of up to 10mA to be indicated in an ordinary left-hand-zero meter. A 0–50mA meter will read screen current from –10mA to +40mA.

To obtain a bleed current of about 10mA, $R1 = V_{G2} / 10 \text{ k}\Omega$, e.g. 35k Ω for a 350V screen supply, 40k Ω for 400V etc. The value doesn't have to be exact because you can 'zero' the meter to any major scale mark using the mechanical adjustment.

Power rating for R1 is $V_{G2} \times 0.01$ watts, so a 5-10W resistor will be OK. If you use two tubes, you only need one R1 for both of them.

VDR1

VDR1 protects the screen grid, the screen bypass capacitor and the power supply in the event of a flashover. Connect the VDR directly from the screen tag on the tube socket to the nearest cathode tag, with short leads to minimize inductance.

Two VDRs are provided with the kit, because a two-tube amplifier needs a separate VDR at each tube; for a single-tube amplifier, connect both VDRs in parallel for extra protection.

C1 - R2 - RFC1

These components are not necessary for a DC-grounded screen grid, as in Section 3.2. In other configurations (3.1 and 3.3) C1 is the screen bypass capacitor, usually built into the tube socket.

R2 and RFC1 isolate the screen and bypass capacitor from the LF bypass capacitor C9 on the **G2-CONTROL** board, to avoid spurious resonances that can 'un-ground' the screen at HF. R2 is a 100 Ω 1W carbon or metal-oxide resistor (**not** wire-wound) and RFC1 is about 40 turns of 24-gauge enameled wire, scramble-wound over the body of R2.

If you use two tubes in an grounding option that requires C1-R2-RFC1, you need a separate C1-R2-RFC1 combination at each tube.