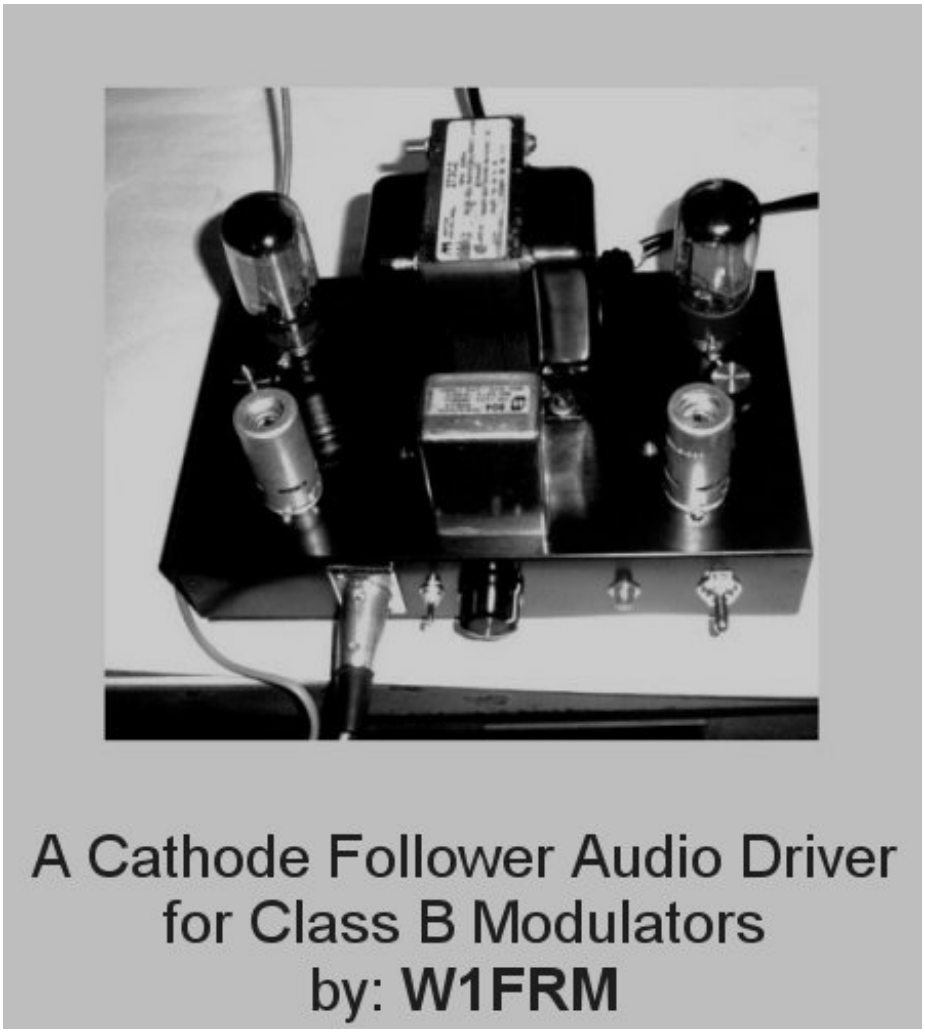
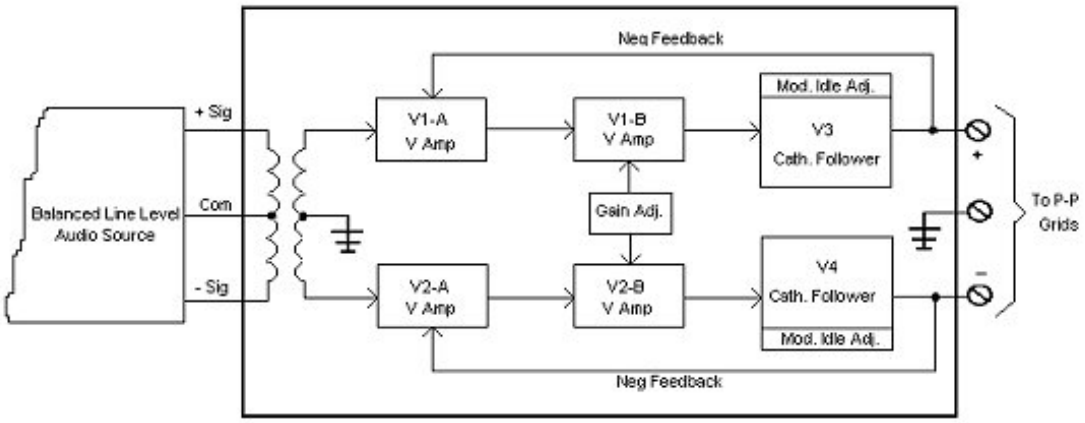


A Cathode Follower Audio Driver for Class B Modulators

by: **W1FRM**

ABSTRACT

This document describes the performance and operation of an Audio Driver Circuit to be used to directly drive the grids of a Push-Pull Class B Modulator/Audio Amplifier. Using this method serves to eliminate the need for an output transformer to drive the modulator grids.



Cathode Follower Driver for Class B Modulator

Circuit Description The circuit is depicted above in block diagram form. As is well known, the problem with driving the non-linear load presented by a class B modulator is not the power required per-se. It is the PEAK power when the grids are conducting. To drive this load requires a low driving impedence which, when using vacuum tubes, can only be obtained via a step-down transformer OR a low impedence cathode follower.

This circuit uses a balanced input to drive two separate and equal cathode follower stages which are directly coupled to the grids of a Modulator. Any required DC bias for the Modulator tubes is provided by the driver. At no signal, each driver output's resting voltage is adjustable from about –30Vdc to Zero.

Performance The circuit requires a balanced line level audio input of about 2V p-p to drive the output to its maximum level without distortion. The load presented at the inputs is 10Kohm from each input to Com. Thus, it will not load the outputs of most modern day audio sources (this permits bridging several other devices to the same output, which is often done these days).

The driving capability of this circuit has been determined to be more than adequate to drive either 811-A or 572B tubes to their full capability without strain. Also, at maximum output, the waveform is essentially free of any discernable "flattening" at peak voltage. The frequency response from input to the transformer to the output under load is essentially FLAT from about 30Hz to 15K. The response was checked with the output operating at about ½ maximum power (5 watts avg.)

Note that all bench testing under load was done with a simple circuit that simulates the grid of a typical triode used in a push-pull class B amplifier. Said circuit consisted of a switching diode with its anode connected to the cathode follower output terminal, and its cathode connected to a 500 ohm resistor to ground (See Drawing, **bottom of Page 2**). With such a circuit connected to each output, both outputs "see" essentially a very high impedance when the output is zero (diode not conducting), and once the output goes positive, the diode conducts and the output now sees the 500 ohms.

This action approximates what happens at the crossover point in a push-pull modulator/amplifier. The use of negative feedback in the driver helps to minimize the "sag" at peak positive output by essentially causing the output impedance to be even lower than it would be *without* the feedback. Measurements under load indicate that the equivalent output impedance of the circuit is on the order of 60 ohms.

Setup A dual cable with shield connects each output of the driver to a grid of the Modulator tubes. The shield is connected to chassis ground of both units. With the supplied dual cable, the **Red** and **Green** pigtails are the signals, and the **Black** pigtail is the shield. If desired, an additional lead may be connected from the driver chassis to the station ground.

Before operating this setup, it is recommended that each grid of the modulator be connected through a 60 – 100 Kohm resistor to DC (chassis) ground. This is not *required*, but it is a safety precaution to protect the Modulator tubes from possible runaway should the Modulator B+ be applied with the grids floating.

Once the connecting cable and the above mentioned resistors are in place, first power up the Driver and pre-adjust the bias voltage on each output. This can be done using a DC voltmeter on each output to ground and turning the Pot associated with the corresponding output. A starting voltage of –5Vdc is recommended. Facing the *front* of the Driver chassis, the pot on the right controls the output terminal on the right. The left pot controls the left output.

Prior to shipping, the bias was set to about –5Vdc. The pots are indexed such that –5Vdc corresponds to the pots being at 12:00, as viewed from the top front of the Driver chassis.

Once the Modulator is connected and operational, the bias pots can be used to balance the idling current of each tube to ½ the desired total. It is recommended that the *total* idling current be from 40 – 80ma.

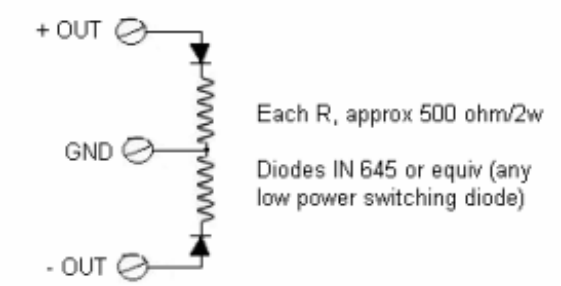
Phasing The relationship of the balanced XLR input to the two outputs which drive the modulator grids can be reversed by means of the two position switch that is next to the input jack.

Referring to the schematic; when the switch is in the "up" position, it is in “Phase A". When down it is "Phase B".

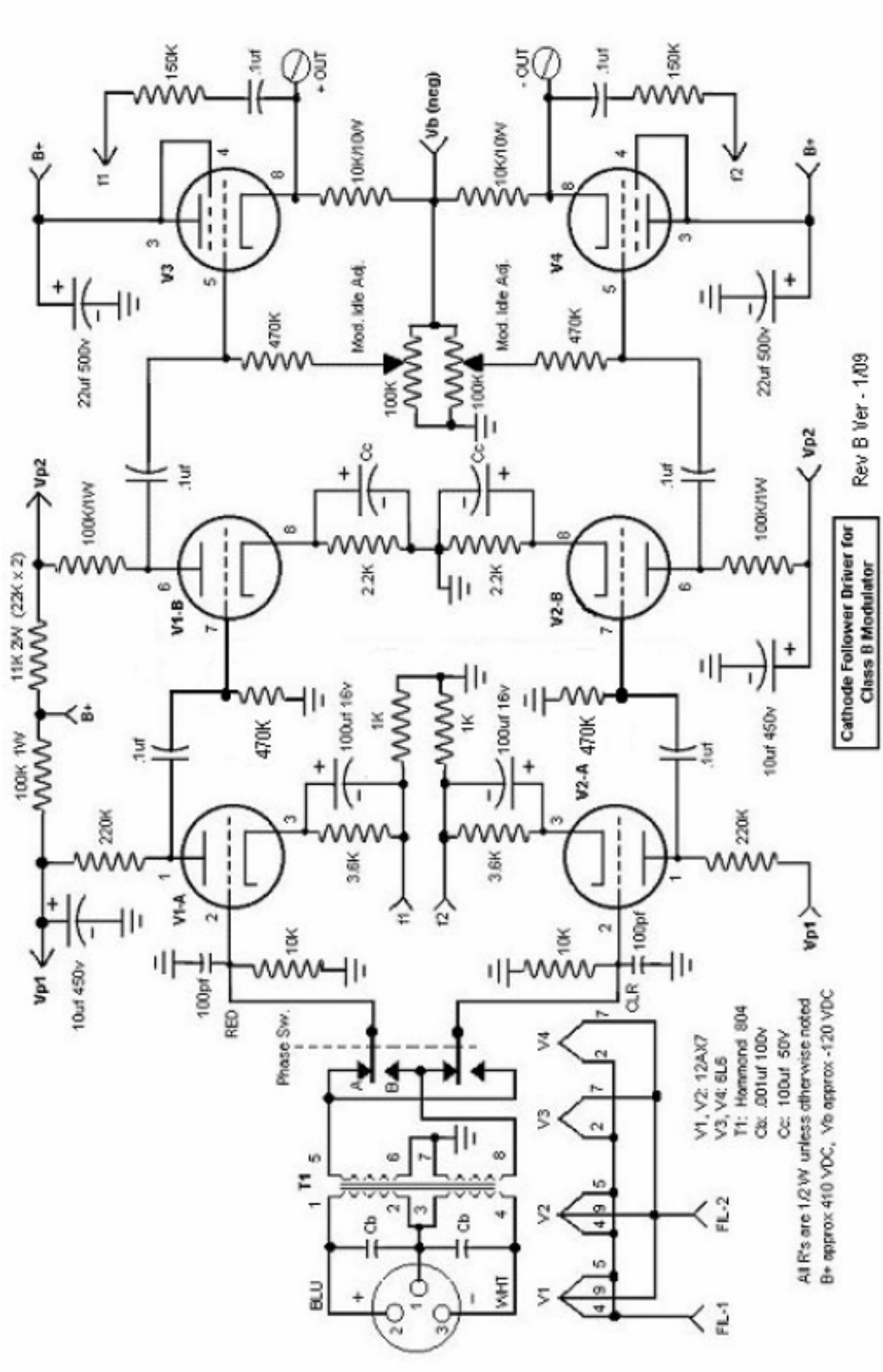
In the A position, the XLR input on terminal 2 (+ sig) drives the tube chain on the Right Side of the Chassis (V1 and V3) and of course the XLR input on terminal 3 (-sig), drives the Left Side (V2 and V4).

Operation The proper phase switch position for a given installation can best be determined by monitoring the modulated RF envelope of the transmitter on a scope. If desired the Phase may of course be reversed by simply switching the leads on the Driver Output Terminals so that the Phase A position is the correct phase.

After the idle is set to the desired point and the correct phase has been set, simply apply audio to the input and adjust the input level and gain on the driver to achieve the desired modulation level (as viewed on a scope). Then all that needs to be done is give several Atomic Yaaaaaaaaallows and watch for smoke!



Dummy Load for Testing


Cathode Follower Driver for Class B Modulator
Rev B Ver - 1.09
V1, V2: 12AX7
V3, V4: 6L6
T1: Hammond 804
Cb: .001uf 100v
Cc: 100uf 50V
All R's are 1/2 W unless otherwise noted
B+ approx 410 VDC, Vb approx -120 VDC
Phase Swv.
RED
BLU
WHT
CLR
FL-1
FL-2
+ OUT
- OUT
B+
Vb (neg)
Vp1
Vp2
Mod. Idle Adj.
V1-A
V1-B
V2-A
V2-B
V3
V4
T1