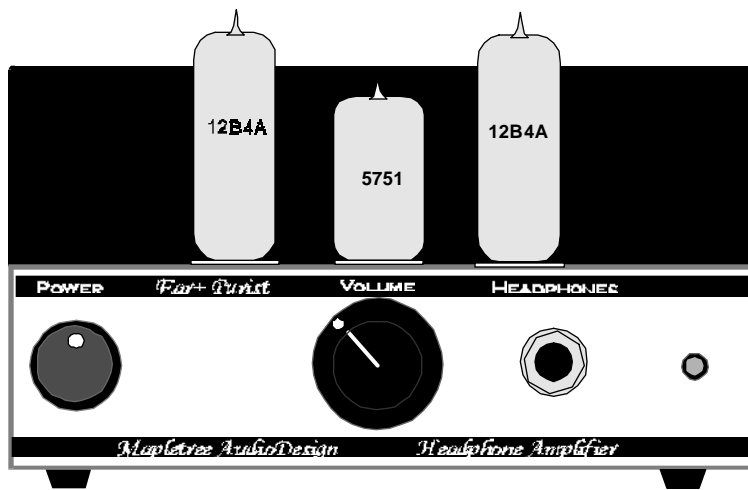




Ear+ Purist Stereo Headphone Amplifier



Users' Manual

Rev. July 5/03

Mapletree Audio Design
Lloyd Peppard
R. R. 1, Seeley's Bay, Ontario, Canada, K0H 2N0
(613) 387-3830
peppardl@post.queensu.ca
<http://hollowstate.netfirms.com>

© Copyright Lloyd Peppard 2003

Introduction

The Mapletree Audio Design *Ear+ Purist* Stereo Headphone Amplifier offers a number of unique features for the serious headphone listener:

- ◆ The exclusive use of high quality new old stock (NOS) and current manufacture tubes that can be obtained at modest cost from many suppliers. The tubes provided are North American and Russian manufactured brand-name types and should exhibit a very long life in this application.
- ◆ Wide frequency response: 10 Hz – 20 kHz –1 dB.
- ◆ A para-feed cathode-follower headphone output circuit capable of driving a wide range of headphones with impedances from 30 to 300 Ohms.
- ◆ DC heater power supply for low noise.

Input/Output Connections

The standard IEC line cord is attached to the receptacle on the rear panel of the Ear+ Basic. It is compatible with a 115-125 VAC line with a frequency of 60 Hz. A 0.5 A/250 V fuse provides primary protection for the power supply. It can be accessed by unscrewing the cap of the fuse holder adjacent to the ac receptacle. Under normal conditions, it should not be necessary to replace the fuse. If power fails to come on, you can check the fuse and replace with a spare if necessary. If the fuse blows a second time, you should not try to operate the unit. Contact Mapletree Audio Design for information regarding service.

The *Input* set of RCA jacks on the rear panel allow connection to a line-level stereo source (e.g. CD player). The input impedance is 75 k Ω which should be compatible with all source output circuits. The input sensitivity is 0.4 V to produce a 10 mW headphone output power.

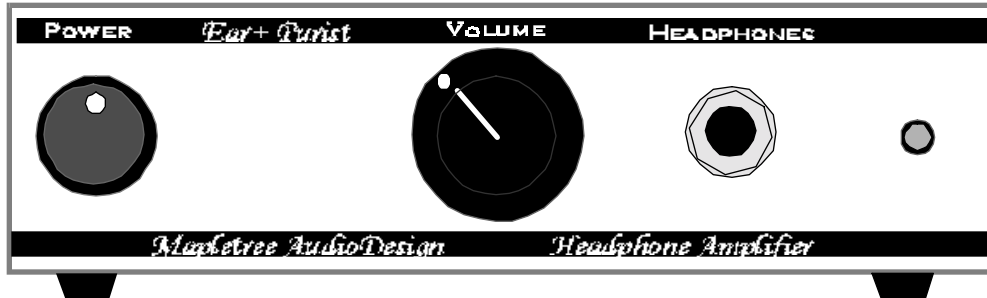
The headphone output jack is a standard 1/4" stereo phones jack with the left channel connected to the tip contact. If your headphones are terminated in a 1/8" plug, an adaptor is required (usually supplied with your headphones). Headphone impedances from 30 to 300 Ω are suitable for use with the *Ear+*. A sensitivity rating of at least 97dB/1mW is recommended.



Controls

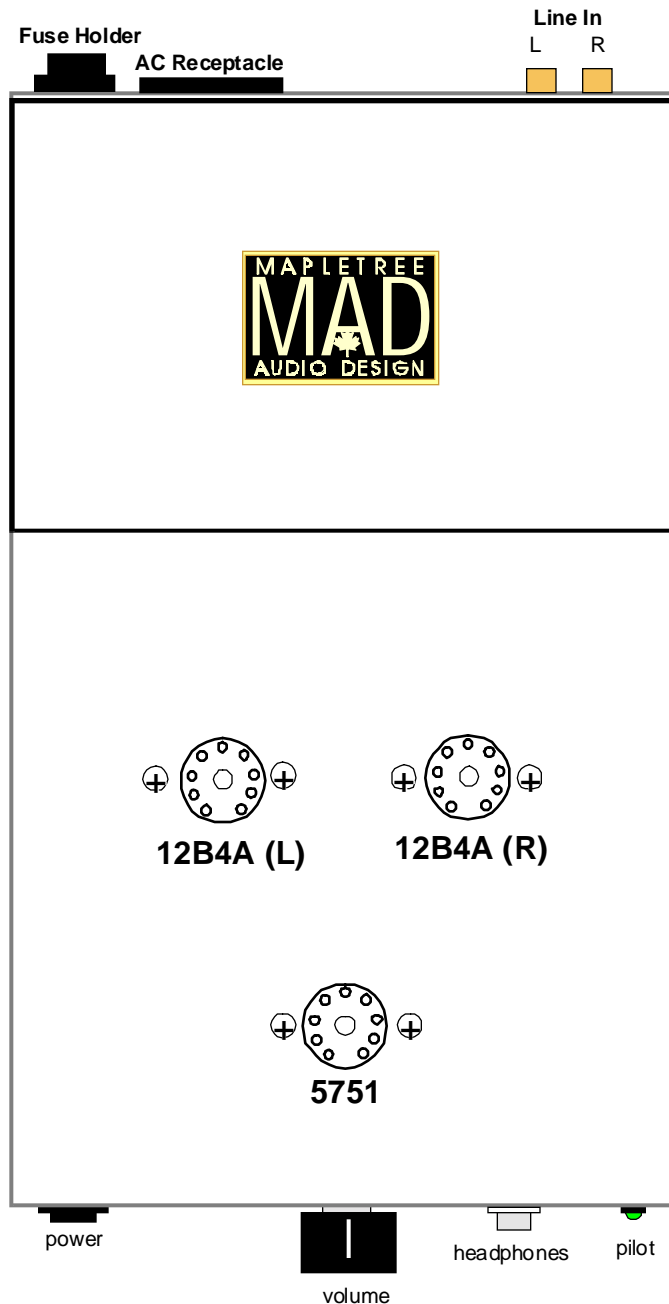
The switch on the left of the front panel turns on the ac power to the amplifier. The power on condition is indicated by the illumination of the green pilot light on the right of the front panel. It takes about 30 seconds for the tubes to reach operating temperature ready for use. During operation, is it normal for the chassis to become warm to the touch.

The front panel volume control acts on both channels simultaneously.



Tubes

A tube burn-in period of several hours may be needed to achieve the best sonic performance. Tube life should be thousands of hours. Aging tubes may result in a reduced gain in one or both channels or an increase in noise levels. Infrequently, a heater may burn out which is indicated by total loss of sound. Replacement tubes can be obtained from several suppliers in the U. S. and Canada. Mapletree Audio Design will attempt to provide replacement tubes to customers at cost plus shipping. Some listeners enjoy trying different brands and variants of tubes. The 5751 premium dual triode tube can be replaced by a 12AX7A or one of its many variants, which may provide slightly higher gain.



Warranty

Factory assembled MAD components are warranted for 2 years to the original purchaser for failure of all parts (excluding tubes). Tubes are warranted for 90 days exclusive of shipping cost. Service, including parts and labor (but excluding shipping), is free within the warranty period.

Parts List

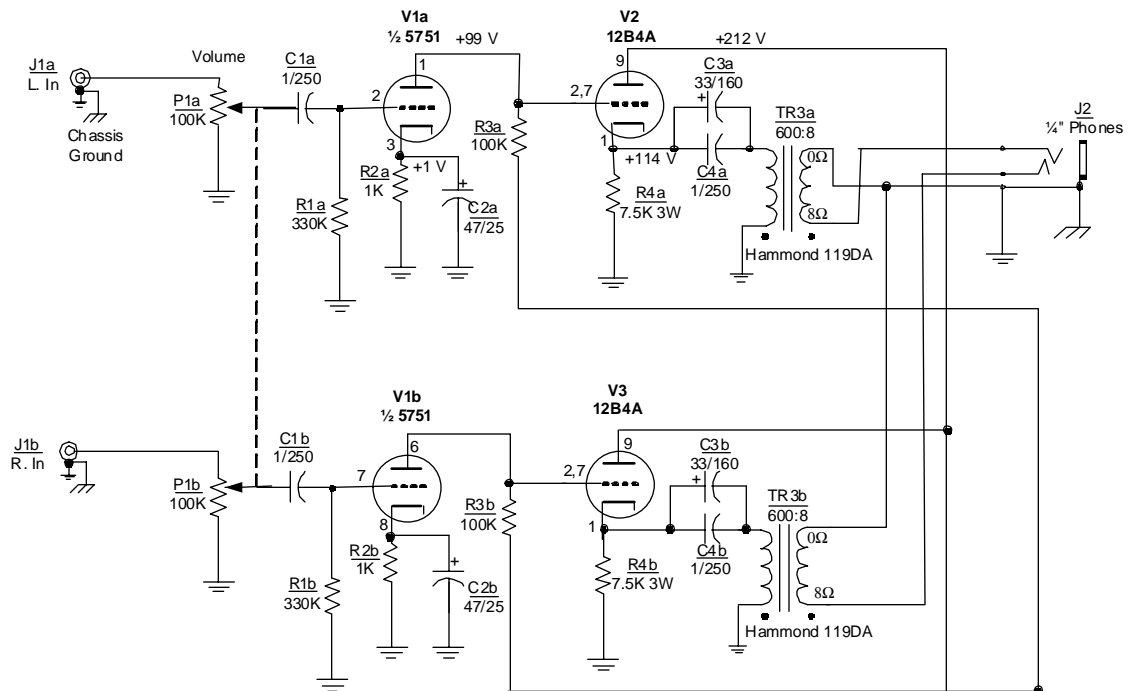
Tolerances and voltage ratings listed are the minimum for replacement purposes.

Reference	Description	Qty.
BR1	3A rectifier bridge	1
C1a,b, C4a,b	1uF/250V polypropylene capacitor	2
C2a,b	47uF/25V electrolytic capacitor	2
C3a,b	33uF/160V electrolytic capacitor	2
C5	47uF/350V electrolytic capacitor	1
C6, C7	47uF/250V electrolytic capacitor	2
C8	4700uF/16V electrolytic capacitor	1
D1-D4	FR107 fast/soft recovery 1A/1000V silicon diodes	4
D5	green LED (pilot light) with holder	1
FU1	0.5 A/250 V 1-1/4" fuse + spare	2
	Fuse holder	1
J1a,b	RCA gold plated phono jack	4
J2	1/4" stereo phones jack	1
J4	IEC ac receptacle	1
	IEC ac line cord	1
P1a,b	100K dual audio potentiometer	1
	Knob	1
R1a,b	330K 0.6W 1% metal film resistor (orange-orange-black-orange)	2
R2a,b	1K 0.6 W 1% metal film resistor (brown-black-black-brown)	2
R3a,b	100K 0.6 W 1% metal film resistor (brown-black-black-orange)	2
R4a,b	7.5K 3 W metal oxide resistor	2
R5	2.7K 5 W 10% wire-wound resistor	1
R6	4.7K 0.6 W 1% metal film resistor (yellow-violet-black-brwon)	1
R7	1K 1 W 5% carbon film resistor (brown-black-red)	1
R8	1.8 Ohm 5W 10% wire-wound resistor	1
SW1	SPST switch	1
TR1	230 V 50 mA power transformer	1
TR2	12.6 V 1 A filament transformer	1
TR3a,b	600:8 Ohm 12W audio output transformer	2
V1a,b	5751 tube	1
V2, V3	12B4A tube	2

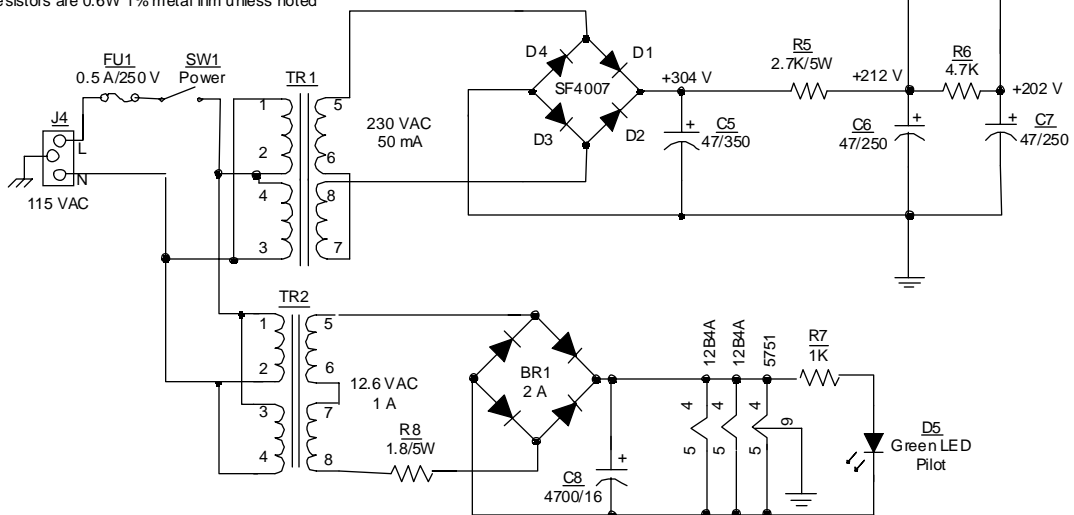
MAD Ear+ Headphone Amplifier

Purist Version

© Copyright Lloyd Peppard 2003
Rev. July 2/03



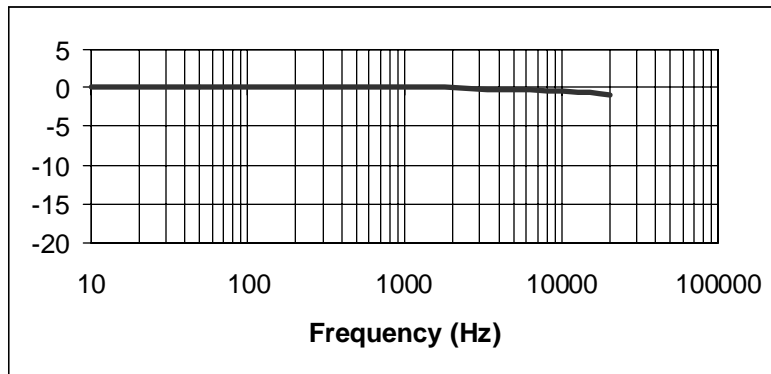
Resistors are 0.6W 1% metal film unless noted



MAD Ear+ Purist Specifications

Headphone Output (100 Ω load)

Frequency response at 1 V rms output:



Maximum undistorted output at 1 kHz: 1.5 V rms (70 mW across 32 Ohms)

Gain 10 dB

Output impedance at 1 kHz: less than 7 Ω

Input impedance: 75 k Ω

Hum and noise at output (max volume): less than 0.2 mV rms

Minimum recommended load impedance: 30 Ω

Recommended headphone sensitivity: 97 dB/1mW

Phase: non-inverting

Circuit Operation

Refer to the schematic diagram for the following description of the operation of the *Ear+ Purist*. The left channel (top of the schematic) will be described. The right channel is identical. The line inputs (J1) are coupled to the volume control potentiometer P1 which controls both channels. The wiper of P1a is capacitor coupled to the grid of tube V1a, which is one of the two high mu triodes in the 5751 envelope. This triode is designed as a common-cathode voltage amplifier stage. A self-bias voltage of about -1 V is obtained from resistor R2a with a plate current of 1 mA. The plate resistor R3a sets the plate voltage (plate-to-cathode) to be approximately 98 V. The output signal of this stage (at the plate of V1a) is direct coupled to the grid of the 12B4A tube, V2, which is configured as a cathode-follower driver stage. The grid voltage of the 12B4A is set by the plate voltage of V1a and the grid bias of about -15 V is obtained from the 7.5K cathode load resistor R4a. The plate of V2 is connected directly to the high voltage supply, which provides a plate voltage of approximately 98 V with a plate current of 15 mA.

The cathode-follower stage provides a low output resistance for driving the output transformer. The low internal plate resistance of the 12B4A helps to make the resistance looking back into the cathode quite low (approximately 500 Ohms). This low impedance is the driving point for the primary of the output transformer TR3a. To reduce magnetic saturation of the iron core, para (parallel)-feed is used so only the signal flows through coupling capacitors C3a/C4a and to the primary of TR3a. Polypropylene capacitor C4a in parallel with electrolytic capacitor C3a ensures that the net impedance of this capacitor does not become inductive at high frequencies. The turns ratio of TR3a is approximately 8.7:1, which reduces the output voltage swing available to drive the headphones. However, it also provides an impedance transformation of 75:1, which reduces the driving (output) impedance from 500 to less than 7 Ohms. The secondary of TR3a is directly coupled to the headphones jack J2 with the winding reversed to provide a non-inverting signal path through the amplifier.

The power supply (bottom of the schematic) provides the dc heater voltage and the plate (B+) voltage for the three tubes. The 12 VDC output supplies the heaters of the two 12B4As and the 5751. The use of a dc heater supply ensures the absence of induced hum throughout the signal portion of the circuit. The secondary of transformer TR1 is fed to the full-wave bridge rectifier formed by diodes D1-D4. The output from the bridge filtered by capacitors C5 and C6 together with resistor R5. The dc voltage at C6 feeds the plates of the 12B4As while the plate supply for the input stage is further filtered by resistor R6 and capacitor C7.