audio~metrics

PA-1 preamplifier

RADIO SYSTEMS
5113 WEST CHESTER PIKE • EDGEMONT, PA 19028 • 215/356-4700

INSTALLATION AND OPERATION

Your "Audio-Metrics" turntable pre-amp can be mounted in any position. While pre-amps are generally installed along side the turntable, keep in mind that close proximity to a conventional turntable motor can cause some hum pick-up. Direct drive motors, however, are not hum sources.

The pre-amp input loading is 100 P.F. Because correct cartridge loading is important, you should check your individual cartridge specifications for recommended loading. Conventional shielded tone arm cables present a load of about 27 PF/FT. If you must reduce your cartridge load, consider shorter cable runs or low capacity cable. Do not attempt to adjust loading by removing the pre-amp input capacitor (C9). This will defeat RF rejection. If additional loading is required, place the desired amount of capacitance directly across the pre-amp input jack terminals.

The pre-amp also contains a two-pole, low end roll off to simulate a subsonic filter. This helps reduce the problems caused by turntable rumble, record warp and mechanical vibrations.

The high audio quality achieved in "Audio-Metrics" pre-amps dictates the omission of output transformers. For this reason, careful consideration should be given to grounding schemes that may have been designed for older, transformer type pre-amps. Contact Radio Systems with any special problems or questions.

WARRANTY

Radio Systems warrants for one year from date of purchase, parts and labor on any unit returned to us for repair. Please ship the unit prepaid with a note detailing the malfunction and reason for return. Repair and return of the unit will be made promptly. Within the warranty period, there is no charge for this service on units which show no sign of misuse or unauthorized alterations.

CIRCUIT DESCRIPTION

Power Supply:

Two full wave rectifiers and two three terminal regulators provide the ±15 volts that is used throughout. This type of supply assures the clean DC that is imperative for low noise and distortion.

Input Stages:

A monolithic matched transistor pair and high speed IC combine to give excellent performance in the front end. High open loop gain and high speed components provide very low THD,TIM and SID. Noise is also maintained to near theoretical minimums.

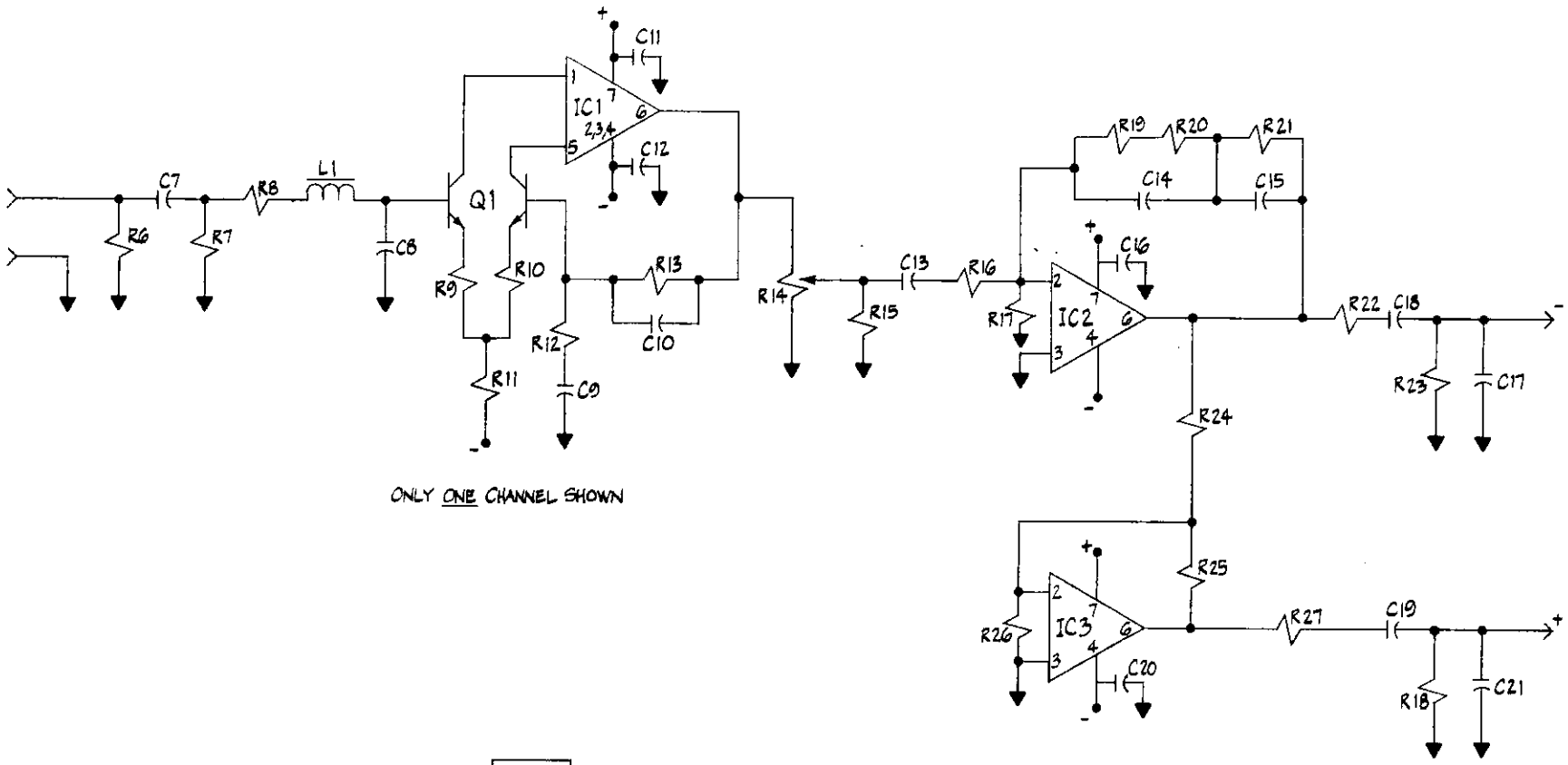
Since no equalization is used in the input stage, cartridge loading is constant throughout the audio spectrum. Level control follows the input stage and, therefore, stage gains are held constant.

An effective input filter inductor gives good RF rejection even in the AM band without resorting to large input capacitance which can adversely affect cartridge loading.

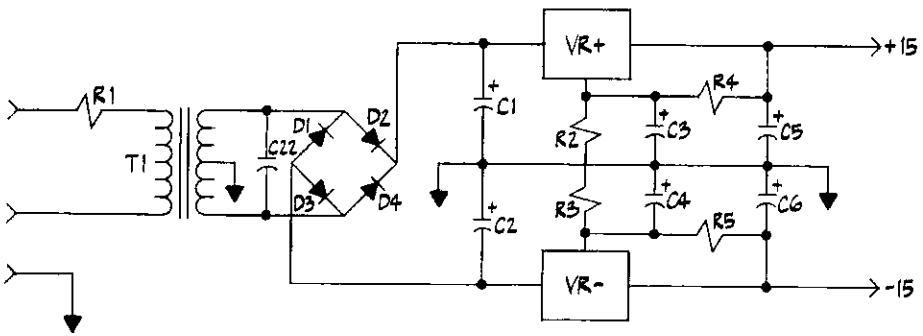
Output Stage:

The output stage consists of two 5534 OP amps. One OP amp is used as an inverter equalizer providing the RIAA response, the second OP amp inverts the output of the first. The output is taken between the two for a balanced system, or either can drive unbalanced loads. This type of circuit gives a 6dB headroom increase in balanced systems. Each OP amp can drive 600 ohms to full output up to 200 kHz.

In keeping with the overall audio integrity of this unit, no output transformers were used.



ONLY ONE CHANNEL SHOWN



PARTS LIST

Resistors:

R1	700 5% 5W
R2	1300 1% 1/4W
R3	1300 1% 1/4W
R4	118 1% 1/4W
R5	118 1% 1/4W
R6	100K 5% 1/4W
R7	100K 5% 1/4W
R8	200 5% 1/4W
R9	100 1% 1/4W
R10	100 1% 1/4W
R11	20K 5% 1/4W
R12	75.0 1% 1/4W
R13	2.2K 5% 1/4W
R14	5K Variable
R15	2.2K 5% 1/4W
R16	5.6K 5% 1/4W
R17	5.6K 5% 1/4W
R18	10K 5% 1/4W
R19	5.76K 1% 1/4W
R20	562K 1% 1/4W
R21	49.9K 1% 1/4W
R22	100 5% 1/4W
R23	10K 5% 1/4W
R24	10K 5% 1/4W
R25	10K 5% 1/4W
R26	10K 5% 1/4W
R27	100 5% 1/4W

Capacitors:

C1	1000 mfd 35V
C2	1000 mfd 35V
C3	10 mfd 50V Low Leakage
C4	10 mfd 50V Low Leakage
C5	10 mfd 50V Low Leakage
C6	10 mfd 50V Low Leakage
C7	10 mfd Non-Polar
C8	100 Pf sm
C9	100 mfd Non-Polar
C10	100 Pf sm
C11	.1 mfd Mylar

Capacitors continued:

C12	.1 mfd Mylar
C13	10 mfd Non-Polar
C14	5600 Pf 2% Polystyrene
C15	1500 Pf 2% Polystyrene
C16	.1 mfd Mylar
C17	.001 Disc
C18	100 mfd Non-Polar
C19	100 mfd Non-Polar
C20	.1 mfd Mylar
C21	.001 Disc
C22	.1 mfd Disc

Diodes:

D1	IN4004
D2	IN4004
D3	IN4004
D4	IN4004

Regulators:

VR+	LM317
VR-	LM337

Transistors:

Q1	LM394CH

Integrated Circuits:

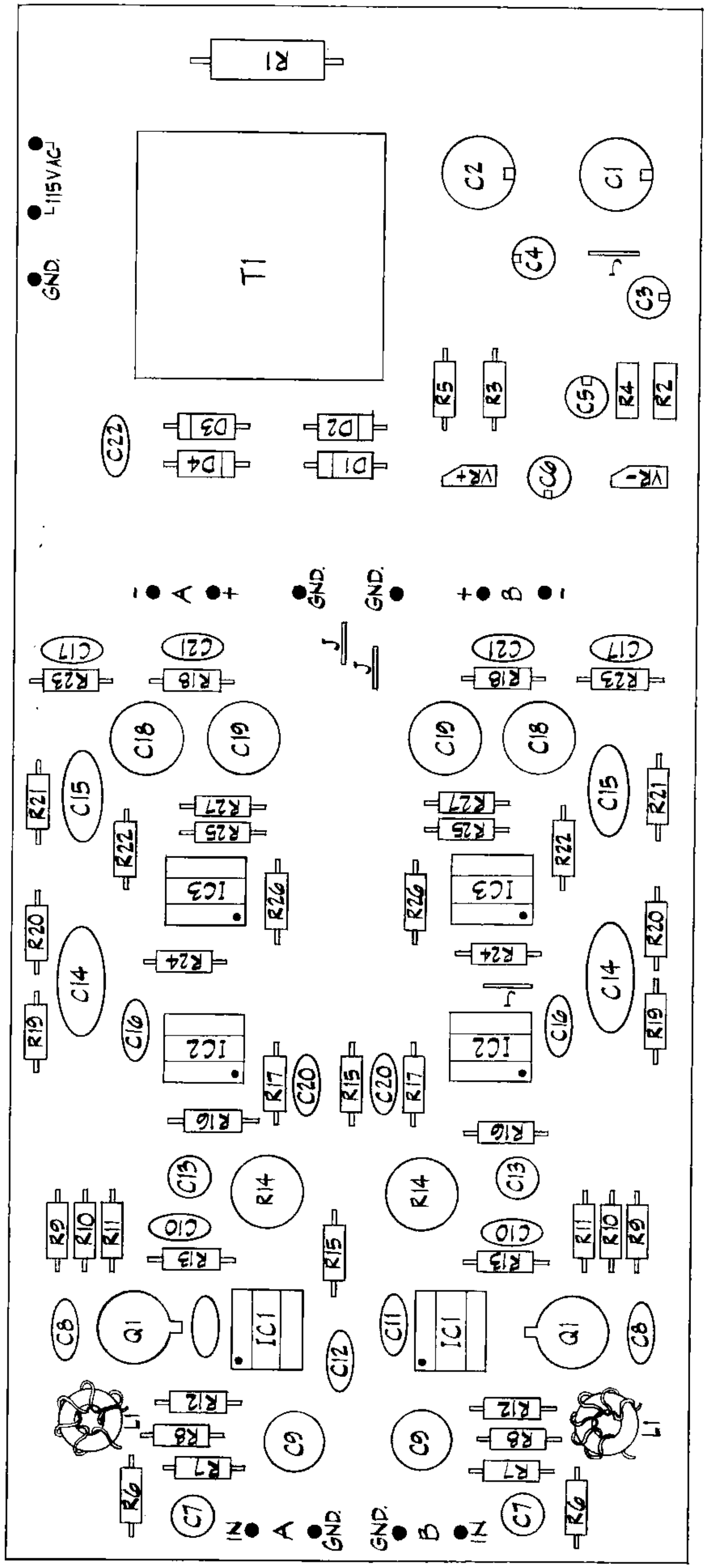
IC1	LM318
IC2	5534
IC3	5534

Inductors:

L1	RF Choke

Transformers:

T1	ST-4-48


R1
115VAC
GND
T1
C1
C2
C3
C4
C5
C6
R2
R3
R4
R5
D1
D2
D3
D4
C22
VR+
VR-
- A +
GND
GND
+ B -
C17
C21
R23
R18
C18
C19
C15
R21
R27
R25
R22
IC3
R26
R20
C14
R24
R19
C16
IC2
R17
C20
R15
R16
C13
R14
R9
R10
R11
C10
R13
C8
Q1
IC1
C11
C12
L1
R12
R8
C9
R7
R6
C7
IN A
GND
GND
B IN

SPECIFICATIONS

INPUT:	- 47k Ohms Parallel 100pf.
MAXIMUM INPUT	- 300mv Any Frequency
MAXIMUM GAIN	- 5mv at 1kHz = +5 dBm Single Ended Out = +10dBm Balanced Out
MAXIMUM OUTPUT	- +20 dBm Single Ended Into 600 Ohms - +25 dBm Balanced into 600 Ohms
OUTPUT IMPEDANCE	- 100 Ohms Single Ended - 200 Ohms Balanced
FREQUENCY RESPONSE	- $\pm$.25dB RIAA (using new curve, specifying low end roll off)
THD	- .01% +18dBm Into 600 ohms
IM DISTORTION	- .01% +18dBm Into 600 ohms SMPTE
SIGNAL TO NOISE	- 76dB Relative 5mv at 1kHz Input Terminated 620 ohms Measured: Unweighted - Broadband - 92dB Relative 12mv at 1kHz Input Shorted Measured: A Weighted
CHANNEL SEPARATION	- 90dB

USING ACTIVE BALANCED CIRCUITRY

Balanced lines have been used for many years and are in continuing use today because of their immunity to stray pickup. Induced signals appear on both sides of the balanced line. The receiving end of the balanced line responds only to the difference voltage between the lines which is the desired signal. Induced signals are common to both and are balanced out.

Transformers have been the mainstay of balanced circuitry for decades. Unfortunately, transformers cause distortion and ringing, and are susceptible to magnetic flux pickup. Further, good quality audio transformers are very expensive.

The use of op-amp balanced circuitry has the advantages of transformers without the disadvantages. The only caveat is that careful wiring practices are more important with active balanced than with transformers.

Active balanced outputs and inputs use three wires: +, –, and ground. The + and – terminals are both driven and neither should ever be connected to ground. For best performance, a three-conductor shielded wire should be used. The third wire completes the ground circuit. The shield should be connected to the ground at one end of the wire only. If a two-wire shielded cable is used, it is important that a ground connection be made between the sending and receiving units. A ground circuit through equipment chassis or through three-prong AC cord ground is also acceptable.

Single-ended audio interconnections lack the interference immunity of balanced hook-ups. For that reason, keep unbalanced connections short, direct, and well separated from AC power wires. To drive a single-ended load from an active balanced source, use coaxial wire: + to center conductor and ground to shield, leaving the – output unconnected. To feed an active balanced input from a single-ended source, use coaxial wire, connecting the hot center conductor to +. Connect the shield to ground and put a jumper from ground to –.

When driving an active balanced input from a transformer balanced floating source, use two conductor shielded wire. Ground the shield at the source end. Establish good ground between the chassis either directly or through AC plug ground prongs. At the load, connect the + lead to the + input and the – lead to the – input. Put two 300 ohm resistors in series between the + input and the – input and connect their mid-point to the load ground. This correctly terminates the source output transformer for optimum frequency and transient response (freedom from ringing) and provides a low impedance return path for leakage and induced hum. If more than one active balanced load is to be placed across a floating balanced transformer source, install this resistive termination once only. From that location to the active balanced loads, run three-conductor shielded wire, shield continued from the source chassis, + from +, – from –, and ground from the mid-point of the terminating resistors.

To drive a balanced floating transformer load from an active balanced source, use shielded wire. Connect the shield to source ground and leave the shield open at the load end. Connect + to + and – to –, and establish a good source ground to load chassis connection, either through a third wire in the interconnect cable or through chassis contact or AC cord third wire ground.

Interconnections between pieces of stereo equipment require doubling the connections described above without duplicating the ground connection. Between pieces of active balanced stereo equipment, then, 5 shielded conductors should be run.

When testing active balanced equipment with single ended test equipment, do not connect the - to test equipment ground. Most modern test equipment provides balanced inputs. In many dual-trace oscilloscopes, balanced signals may be displayed by running the two inputs in the "add" mode with one input switched to invert. To perform a test with single-ended equipment, + and – outputs must be tested independently and their results added. Testing only a single output results in a 6 db loss in output level.

The active balanced equipment interconnection format makes possible state of the art fidelity. Careful attention to detail and conservative practice will be rewarded with outstanding flat frequency response, low distortion, and wide dynamic range.