Barney Oliver AMPLIFIER

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SECTION I
DESCRIPTION

A. GENERAL

The Barney Oliver Amplifier is a high quality all solid state audio amplifier designed for two channel stereo sound reproduction in the home, in studios, and in small to medium sized auditoriums. It is intended for use with full frequency range 8 to 16 ohm speaker systems and with signal sources (phonograph pickups, tape decks, AM and FM tunners) that are themselves flat enough to require little or no equalization. In addition to the power amplifiers, the unit includes phono preamplifiers designed to operate from any of several magnetic phono cartridges. These preamplifiers provide the necessary equalization for the RIAA recording characteristic. Additional plug-in preamplifier boards have been designed for direct moving coil microphone input or for direct input from low-level, high impedance sources. Adding this feature will require that the user build the preamplifier boards, install and wire printed circuit connectors in the deck, drill front or rear panel holes as required, and modify selector switch wiring.

Hum and distortion are inaudible. As a result of careful attention to filtering and to lead routing on printed circuit boards, the residual hum is well below thermal noise (which itself has been minimized by optimum input stage design). The output stages of the amplifiers are operated class-B to reduce standby power drain and are biased and locally degenerated to reduce crossover distortion. A large amount of overall negative feedback, ranging from over 100 dB loop gain at dc and low frequencies to over 50 dB at the top of the audio range further reduces any remaining harmonic and inter-modulation distortion. Since the μ-circuits are direct coupled, overload produces no long time constant transients; the peaks are simply clipped and the original waveform resumes at its proper value immediately afterward. Because of the large amount of feedback, signals only a fraction of a dB below actual overload typically show a total distortion over 75 dB below the fundamental.

Bridged-tee networks in the β-circuits of the amplifiers, and active filters in the mixing and control board, enable the low-end response to be maintained down to 20 Hz and to fall off very rapidly below the audible range. This prevents the amplifier and loudspeakers from being driven beyond their linear excursions by low frequency transients arising from such sources as warped records or breath blasts into microphones. The high end response is reduced at 18 dB per octave above 20 kc by another pair of active filters to protect the amplifiers against overload by, or rectification of, strong r-f signals.

The power amplifiers are protected against damage from accidental short-circuits at their outputs. Momentary shorts will have no effect, but sustained shorts may blow one or more of the protective fuses. In addition, all power supply outputs are either current limited or fused so that shorts from test probes will in general cause no damage.

Finally, considerable effort was devoted to reducing switching transients. A balanced build-up and decay of power supply voltages and careful balancing of function drops minimizes the turn-on transients in the amplifiers. A slow turn-on in the low voltage regulated supplies further reduces the turn-on transient from the pre-amplifiers.

SPECIFICATIONS

OUTPUT PER CHANNEL

SPEAKER Z	CONTINUOUS*	AUDIO PEAK
16	≈ 36 W	≈ 90 W
8	≈ 50 W	≈ 160 W
4	**	≈ 80 W

HARMONIC DISTORTION

< 0.01%, 2 mw to max. power, all freqs.

HUM AND NOISE

Power Amplifier: 100 db below max. output
† **Phono Preamp:** 84 db below one volt output

INPUT VOLTAGE FOR FULL OUTPUT

Tuner, Tape, Aux 1, Aux 2: ≤ 1.0 volt rms
Phono: ≤ 5 mv rms

INPUT IMPEDANCE

Tuner, Tape, Aux 1, Aux 2: 100 K Ω
Phono: Optimized for SHURE V-15 Type II Pickup.

CONTROLS

INPUT: TUNER, TAPE, PHONO, AUX 1, AUX 2.

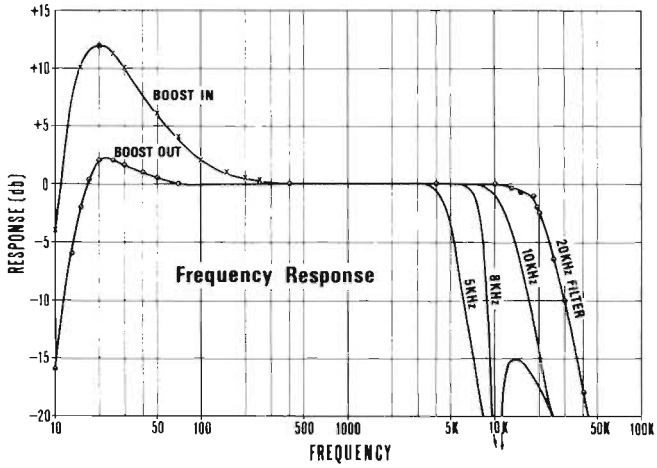
MODE:
STEREO — DIR(ect), REV(erse), L, R
MONO — DUAL, L, R

**Both channels operating simultaneously at maximum output.*

***Continuous high power operation at less than 8Ω not recommended. See instruction manual.*

† Hum pickup by phono cartridge may cause this figure to be exceeded.

FREQUENCY RESPONSE



CONTROLS (Cont'd.)

FILTER: Controls active h.f roll-off filter >18 dB/octave with corner at 5, 8, 10 or 20 kHz. Includes 30 dB notch at 10 kHz in 5 and 8 kHz positions.

VOLUME: Dual precision attenuator, 60 dB range, 2 dB steps. Eliminates need for balance control.

BASS: FLAT, BOOST

Response: RIAA, + 6 dB, – 6 dB

SIZE:

16.72" (425 mm) wide, 5.0" (127 mm) high, 10.93" (278 mm) deep behind panel.

WEIGHT

Approximately 20 pounds net without case.

POWER REQUIREMENTS

115 or 230 V.A.C. ± 10%, 50-60 Hz, 20 W standby power, 135 W at full output into 16 Ω (both channels).

SECTION II

FRONT PANEL CONTROLS

Simplicity of operation has been achieved with a minimum of controls. It is a good idea to mark with a colored dot the **"normal"** settings of special purpose controls so that the inexperienced or technically naive operator need only check these settings and achieve good results using only the input selector and volume control.

A. INPUT Selector

This switch allows a choice of any one of five inputs. From left to right these are:

TUNER	Accepts input at line level (0 dBm) from FM, AM, or FM/AM tuner.
TAPE	Accepts input at line level (0 dBm) from an equalized stereo or single channel tape deck.
PHONO	Accepts input from a magnetic stereo phonograph pickup.
AUX 1 AUX 2	Accepts inputs from any line-level audio circuit such as tuners, tape decks or other sources.

B. MODE Switch

This control allows the left and right channels of the input to be delivered to the speakers in various ways. The center position is normal for stereo operation. From left to right the modes are:

L	Left stereo channel only to left speaker.
R	Right stereo channel only to right speaker.
REV	Stereo channels reversed. Left channel to right speaker, right channel to left speaker.
DIR	Direct presentation. Each stereo channel to corresponding speaker —**Normal position.**
DUAL	Both channels mixed and delivered to both speakers.
L	Monophonic reproduction of **"left"** channel over both speakers.
R	Monophonic reproduction of **"right"** channel over both speakers.

The **L** and **R** positions allow monophonic tapes and other signal sources to be reproduced over either one (**STEREO side**) or both (**MONO side**) speakers.

C. FILTER Switch

This control allows various high frequency roll-offs to be introduced. From left to right the positions are:

5	Introduces a high frequency cutoff at 5 kHz, with a null at 10 kHz. Useful for noisy 78 rpm records and AM reception.
8	Introduces a high frequency cutoff at 8 kHz with a null at 10 kHz. Useful for good 78 rpm records and AM reception.
10	Introduces a maximally flat 18 dB/octave cutoff at 10 kHz. Useful for slightly noisy conditions.
20	**Normal position.** Introduces a maximally flat 18 dB/octave cutoff at 20 kHz.

D. VOLUME Control

A dual precision attenuator allows adjustment of the sound level in 2 dB (or scarcely perceptible) steps over a 60 dB range. Because the attenuation is precisely balanced and because the feedback assures equal gain in both channels, the nuisance and hazard of an improperly set

balance control are eliminated. (Note: Identical speakers are assumed. Good quality speakers of good manufacture will ordinarily be within 1 dB of each other over the audio range. Likewise for the two channels of a good phono-cartridge. However, the perfectionist may want to test his components and introduce appropriate loss into the "hot" side.)

E. Phono Equalization Switch (-6 dB, RIAA, +6 dB)

Below the **INPUT** selector control, and effective only in the **PHONO** position of that control, a three-position slide switch allows some compensation for recording defects. In the center (Normal) position, this switch provides the standard **RIAA** equalization. In the left position, the high frequency response is dropped by 6 dB, while in the right position, the response is enhanced by 6 dB. Some manufacturers (such as Deutsche Gramophone) conscientiously adhere to **RIAA** specifications, while others (names supplied on request) enhance the high end to compensate for the deficiencies of the usual playback system. If your speakers are flat, the -6 dB position will help correct this practice. If you find the +6 dB position better in the majority of cases, your speakers (or your ears) need attention.

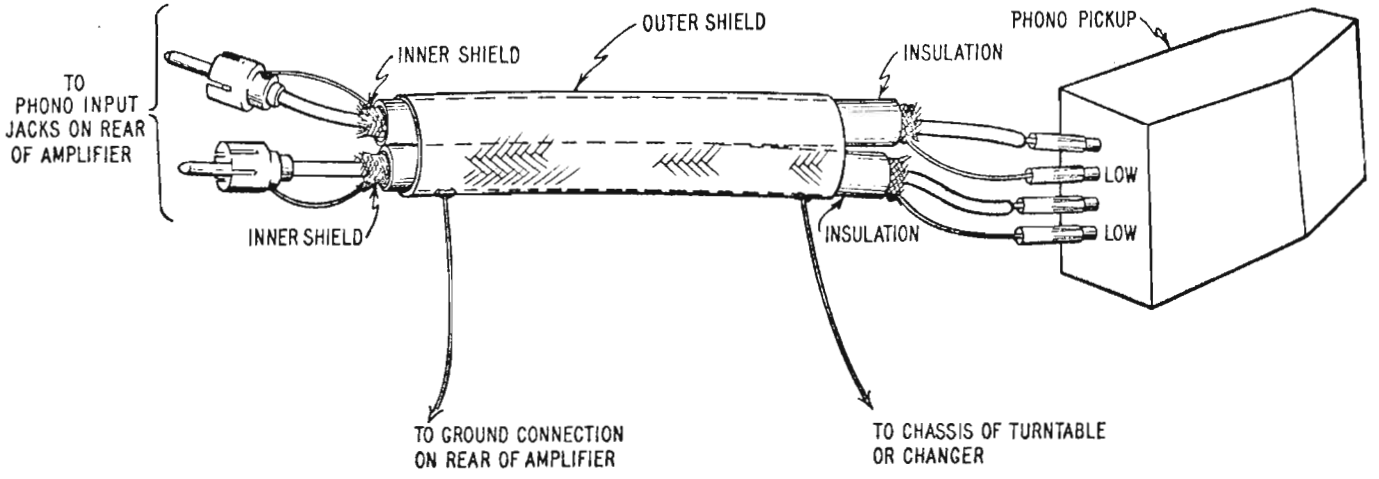
F. BASS Switch (FLAT, BOOST)

Located below the high frequency **FILTER** control is the two-position **BASS** switch. In the **BOOST** position, the switch raises the response at 6 dB/octave from 80 Hz down to 20 Hz. In the **BOOST** position, approximate compensation is provided for the usual low-end roll-off of good speakers. (Two poles at 40 — 50 Hz). If you are fortunate enough to have an overdamped pair of woofers with real poles at 80 Hz and 20 Hz (such as LE-15A's or ALTEC 411-A's in 9 cu. ft. or larger enclosures), the **BOOST** position will closely compensate the low-end roll-off down to the bottom of the audio range. For *very* high sound levels, the **FLAT** position is recommended.

SECTION III
INSTALLATION

A. PHONO CONNECTIONS

Special precautions must be observed for the **PHONO** input. Because a combination of shunt and series feedback is used to control the impedance faced by the cartridge and thereby produce the high end roll-off required by the **RIAA** recording characteristic, the "LOW" side of each input is not grounded inside the amplifier and THESE MUST *NOT* BE GROUNDED OR CONNECTED TOGETHER externally. (See Section V, A. for further information.) If coaxial or shielded wires are used for each channel, the two inner shields must be insulated from each other and from the outer shield around both as shown in Figure 1. In some cartridges, the LOW side of one or both channels is grounded to the case by a thin strap at one or both LOW terminals. IF PRESENT, THESE GROUNDING STRAPS MUST BE REMOVED BY PRYING THEM OUT AND OFF WITH A LARGE NEEDLE OR PICK. The overall shield should be connected to the turntable frame at one end and to the amplifier chassis at the other end using the binding post provided. After this is done, test that both channels are isolated from ground before connecting them to the amplifier.



NOTE:

Inner shields must *not* be grounded at either end. Also inner shields must not be connected together at any point (including at or inside pickup). Cables should have insulation over shields.

Outer shield must not make contact with any lead connecting pickup to amplifier (including inner shields).

In some locations the outer shield may not be necessary; in such cases, turntable or changer chassis should be connected to amplifier chassis (ground terminal on rear) with a separate wire, preferably insulated.

Figure 1. Phono Connections

The phono cartridge should be located as far as is convenient from any transformers, motors, or other source of AC magnetic field. With proper installation and a good cartridge, no AC hum should be audible even at the full setting of the volume control and with bass boost.

B. USE OF PHONOGRAPH PICKUPS OTHER THAN SHURE V15 TYPE II

The phonograph pre-amplifiers as shipped are optimized for the Shure V15 Type II pickup. Other good quality pickups can be used, but a resistor change on each of the phono pre-amp boards may be required. The resistors in question are designated R1 as shown near the left side of the pre-amp schematic in Section VI, A. To determine the optimum value for R1 for a given pickup, the inductance and resistance of the pick-up must be known. The value for resistor R1 may then be calculated by using the following equation:

$$R_1 = \frac{L_o}{.75} \times 10^6 - 100\ R_o - 20K$$

Where L_o is pickup inductance in Henries, R_o is pickup internal resistance in ohms, and R_1 is in ohms.

Once the value for R1 has been calculated, R1 resistors on each of the two phono pre-amp boards should be changed to the proper value. For additional information, see Section V, A.

C. SPEAKER CONNECTIONS

The amplifier may be located at any convenient distance from the loudspeakers. Twisted pairs of No. 18 wire or larger or ordinary zip-cord may be used to connect the amplifiers to the speakers if the distance is under 100 feet. For longer distances, heavier conductors are recommended. In general the d-c resistance of the cables or cords should not exceed 5% of the speaker impedance.

Connection to the amplifier outputs is via the two-terminal polarized Jones sockets at the rear of the amplifier. The cords or cables must be soldered to the mating plugs provided, taking care to avoid internal short circuits from wire strands or solder bridges. It is good practice to insulate the wire and lugs from each other with electrical tape or heat shrinkable tubing inside the plug sleeve after soldering.

D. SPEAKER PLACEMENT

The loudspeakers should be located at the ends of the base of an isosceles triangle with the listener at the apex. The apex angle of this triangle, i.e., the angle between the lines of sight to the two speakers should be about 15° to 45°, as shown in Figure 2. Good sound quality will then be heard up to 45° on either side of the perpendicular bisector of the line between the speakers.

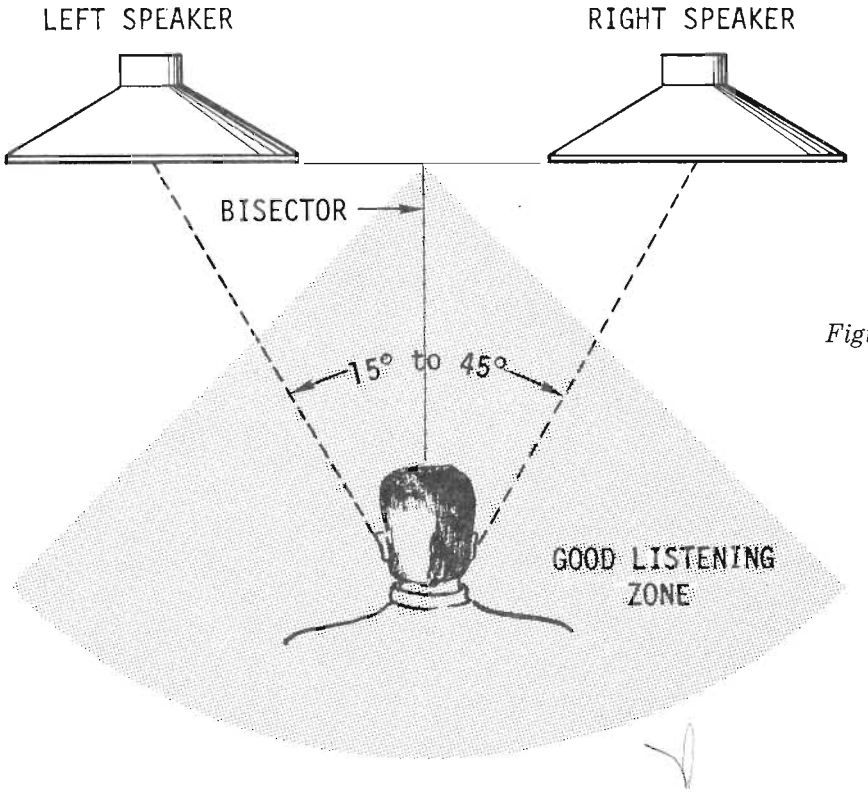


Figure 2.

E. LINE VOLTAGE, FREQUENCY AND LINE FUSING

Unless specifically tagged otherwise, amplifiers operate *only* on 115V ac line. 115V amplifiers have single power transformer primaries and cannot be connected for 230V operation. (An external 230-115V step-down transformer may be used.) The proper line fuse for 115V units is 1.6 amp, slow-blow.

Satisfactory operation will be obtained with line voltages within ±10% of the nominal (115V or 230V) value. The line frequency should be 50 Hz or greater. A grounding or three wire socket is recommended but not essential. If the chassis is not grounded through the power cord, a separate ground may be needed to get rid of hum on phono, mike or other low level inputs.

F. 115V/230V AMPLIFIERS (European Units)

Units shipped to Europe (and in a few cases within the United States) are equipped with 115/230V power transformers.

Units shipped to Europe will be connected for 230V operation and will be equipped with 0.8 amp slow-blow fuses. Because of the variety of ac plugs used, amplifiers shipped to Europe will not include line cords. The line connector on the rear of the amplifier is compatible with European line cords, and it is assumed that the user can obtain the proper cord. *Units connected for 230 operation will be prominently tagged.*

115/230 V amplifiers shipped within the United States will be connected for 115V operation, will use 1.6 amp slow-blow fuses, and will be equipped with standard line cords. These units will be tagged to indicate 115/230 capability.

Amplifiers with 115/230V power transformers may be reconnected by the user for either line voltage. 115V operation requires connecting the two halves of the transformer primary in parallel; for 230V, the two halves must be connected in series.

—NOTE—

When reconnecting transformer primaries, care must be taken to insure that windings are connected in an "aiding sense" (instantaneous flux produced by both windings must have the same polarity).

The line fuse must be changed when changing the line voltage (1.6 amp for 115V; .8 amp for 230V).

G. INSTALLING AMPLIFIER IN AN EXISTING CABINET

If the amplifier is to be installed in an existing cabinet, careful attention should be paid to the outline drawing shown in Section III, J. Because certain components, especially the power supply capacitors, are quite large, it will be seen that the overhang at the top of the front panel is not very great and at the bottom edge is virtually zero. This will require considerable care in cutting the necessary hole in the cabinet. It is strongly recommended that the amplifier be examined in detail before laying out this hole to prevent costly mistakes. Referring to the side view in the outline drawing in Section III, J., it will be seen that overall front panel height is 5", that the rear panel height is 4.85", and that the side gussets are 4.48" high. This will make possible the use of a hole somewhat less than 4.85" high, if the amplifier can be tipped slightly as it is inserted.

Front panel overhang at each side is approximately ¼", requiring less precision in the horizontal dimension.

H. ASSEMBLY OF WALNUT OR TEAK ENCLOSURE

If the walnut or teak enclosure option was included with your amplifier, it may be assembled as outlined below. (See Section III, J. for picture of assembled enclosure.)

The enclosure kit consists of the following:

Two wood side panels (one right and one left).

Black vinyl-clad aluminum top cover with retaining screw.

Four 10-32 flat-head Allen screws and nuts for attaching side panels to amplifier.

Wood side panels have been sanded *but not finished.* It is recommended that the wood pieces be finish sanded with fine sandpaper such as 400 or 600 grit. They can then be finished as you please. One quick, simple and beautiful finish which can be done by most anyone anywhere is an oil finish, with or without stain. Most paint stores and many hardware stores sell Danish oil finish materials (one brand is Watco).

If a high-gloss finish is desired, it will be necessary to apply filler to the wood before staining and applying finish. For this process the user is referred to his friendly paint store or cabinet shop.

ASSEMBLY INSTRUCTIONS

Attach the wood side panels to the amplifier with the Allen screws and nuts. It will be noted that the side panels are notched across one end to clear the front panel overhang and to allow the wood panel to extend slightly forward of the front panel. Near one edge of each wood panel is a slot extending the full length. The panel should be attached so that these slots are at the top of the amplifier and face inboard.

The aluminum top cover slides into the slots just mentioned, with the front edge fitting into a slot at the top rear of the front panel.

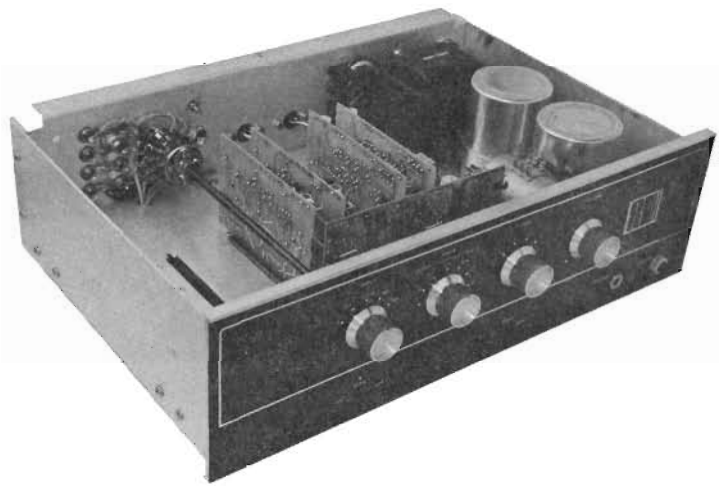
The rear edge of the top cover lies on the top of the back panel and is secured with a single screw through the top cover. It may be necessary to adjust the positions of the wood side panels to permit the top cover to slide into place without interference from side gussets or other amplifier parts.

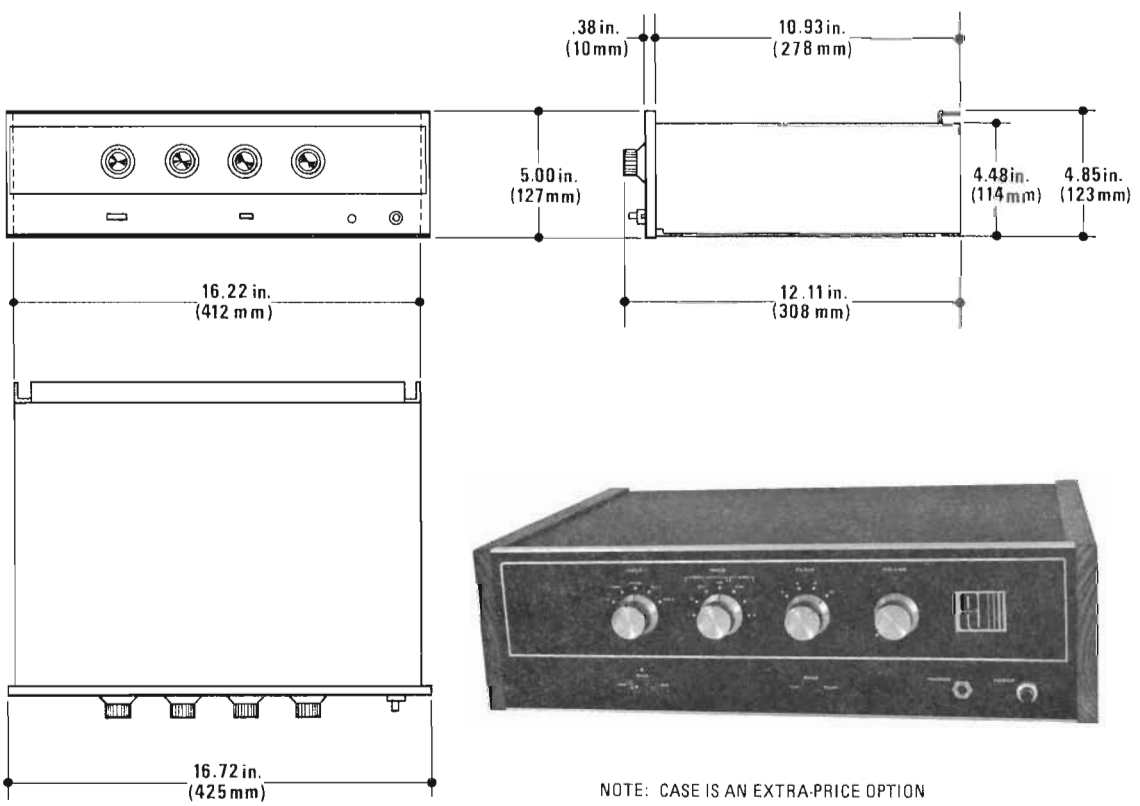
I. RACK MOUNTING CABINET

If your amplifier was furnished in an HP type cabinet, it can be rack mounted by use of the standard rack mount kit shipped with the instrument. Instructions are included with the kit.

J. PICTURES AND OUTLINE DRAWING

(See following page.)





NOTE: CASE IS AN EXTRA-PRICE OPTION

SECTION IV
LOUDSPEAKER PHASING

Proper stereo reproduction requires that the loudspeakers be properly phased. To check this, insert a reversing switch in the leads to one speaker as shown in Figure 3. Turn on the power and the signal sources and bring up the volume. Set the MODE switch to "DUAL". Station yourself *exactly* midway between the speakers and about three feet in front of the plane of their front baffles. Try reversing the switch. In the proper position the sound should appear to originate from dead ahead of you. In the improper position this illusion disappears and both sources are heard independently. Unless the speakers are matched, the above test is difficult, but with identical speakers the illusion is very striking and the test is easy to perform. Reconnect the speaker preserving the proper polarity. This test need only be done once. Return the MODE switch to the normal STEREO-DIRECT position.

If, on the average, one channel seems louder than the other, throw the MODE switch to the STEREO-REVERSE position. If the loud channel shifts to the opposite speaker the signal source or program material is defective. If the loud channel stays with the same speaker, the other speaker is less efficient. If the speakers are supposedly identical, the weak one may be defective. (Check the d-c resistance of the speakers. These should be the same within 5%.) The use of different speakers for the two channels is *not recommended.*

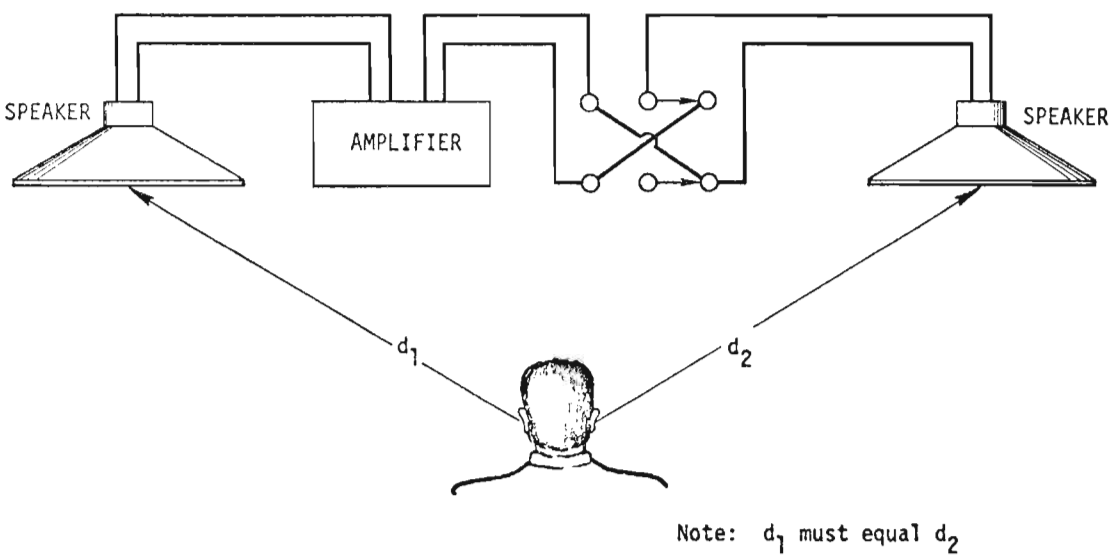


Figure 3.

SECTION V
CIRCUIT DESCRIPTIONS

A. PHONO-PRE-AMPLIFIER

The phono pre-amplifier uses a combination of series and shunt feedback to the input terminals to provide a resistive input impedance of the proper value to produce, together with the self inductance of the pickup, the required **RIAA** high frequency roll-off above 2120 Hz. If L_o is the pickup inductance and R_o the resistance, and if R is the input resistance to the pre-amp we require that

$$\frac{L_o}{R + R_o} = 75 \times 10^{-6} \text{ seconds}$$

This leads to the value of R1 given in the schematic. As supplied, R1 is appropriate for the Shure V-15 Type II cartridge. To provide the ±6 dB variation of high end response, the shunt feedback is halved or doubled.

The series feedback is applied to the low end of the pickup windings which places these ends (normally the outer shields of coaxial lines) 10 Ω above ground. To avoid hum and RF pickup it is recommended that an outer shield insulated from *both* inner shields be used. This shield should connect the record player frame to the amplifier chassis.

A balanced differential stage is used at the input to avoid drift and RF rectification. The remainder of the amplifier is similar to the power amplifier except for power level. The output Class B stage can supply a 600 Ω line or headphones at line level (0 dBm) without appreciable distortion.

The low end bass boost of the **RIAA** characteristic below 500 Hz is provided by C12 and R3 + R4 + R5 + R6 and R28. The low end cutoff is provided by C2 and C3 together with C4, C5 and R10. This combination provides unity d-c external gain and a fourth order maximally flat low-end cutoff at about 16 to 20 Hz.

Great care was used to make the projected area of the input circuit zero in all directions by properly routing the conductors and by providing the loops shown. This minimizes the magnetic coupling to the power transformer and reduces the hum below audibility. (If you notice any hum, it's from coupling directly to the cartridge.)

Because the input impedance is low (about 10 K Ω) cable capacitance has no effect on the high end response for lengths up to 10 or 20 feet depending on the cable used.

Many of the components that may puzzle you, such as Q3 or CR8 or such as CR1, CR2, CR5, etc., are there to avoid turn on transients or avoid emitter base breakdown. Everything has a function, but invincible fatigue prevents me from going into all the gory details.

B. FILTER BOARD

The filter board provides a sharp low-end cutoff below 16 Hz to protect the speakers against large useless cone exursions, and a controllable high-end cutoff to suppress the high frequencies with noisy or distorted program material.

The board contains four unity gain amplifiers consisting of two cascaded emitter followers (example: Q3 and Q5) with constant current supplies (example: Q1 and Q7). This combination provides very high input impedance, very low output impedance and low distortion.

The two input unity gain amplifiers are coupled to the input selector switch through active high pass filters that drop rapidly in transmission below 16 Hz (example: C1, R1, C3, R7, Q3, Q5). The output of these feed the mode selector switch.

The output unity gain amplifiers provide drive for the dual precision volume control and are coupled to the mode selector switch via active low-pass filters. These are three pole filters, two of the poles being provided by the input RC networks and the remaining poles (and zeros) by the shunt branch at the output.

Potentiometers are provided to supply the base currents of the input emitter followers and thereby enable the voltages at terminals 5, 4, 20 and 21 to be set equal to zero. This eliminates transients when the mode and filter switches are switched.

C. POWER AMPLIFIER

The output stage of the power amplifier is a cascaded complementary emitter follower comprising transistors Q12* and Q13*, with Q10 and Q11 as their drivers. Operating point stability is provided by resistors R5* and R6* and by currents from current source Q8 flowing through CR7, CR9, R22, CR8 and CR6. The power diodes CR1* and CR2* shunt R5* and R6* at high signal levels to avoid large voltage drops in these resistors. Inductance L1* protects the output stages from the effects of capacitive cable loads at very high frequencies while R8* eliminates any series resonance with this capacity. Diodes CR10, CR11, CR12 and CR13 provide output current limitation. Together with fuses F* these provide output short circuit protection. The output stages are driven by emitter follower Q9, which has current limitation in the collector.

The input stage consists of a differential pair, Q1 and Q2, whose emitter currents are supplied by Q4. The input signal is applied to the base of Q1 and the feedback to the base of Q2. The output collector swing of Q1 is limited by CR2 and CR3 to protect the emitter-base junctions of the second stage comprising Q5 and Q7.

The loop gain at d-c and low frequencies is extremely high (> 100 dB). The primary cutoff for the loop gain at high frequencies is the base-collector capacitance of Q7. Thus the loop gain falls at 6 dB/octave to reach a value of about 60 dB at 10 kHz. Inductors L1 and L2 introduce a second pole at 16 kHz above which the loop gain falls at 12 dB/octave to about 200 kHz, where C6 begins to shunt R16 producing a high end cutoff in the amplifier and reducing the loop gain cutoff rate to 6 dB/octave once more. Gain crossover is at about 1 MHz.

The bridged-T comprising C3, C4, R11, and R12 increases the loop gain below 16 Hz and reduces the external gain to unity at d-c. The poles in the external gain are slightly complex so the low end response rises slightly at the low end before dropping off. In the bass-boost position C7 and C8 together with R16 and R17 produce a pole at 16 Hz and a zero at 80 Hz in the external gain. Thus the gain rises at 6 dB/octave below 80 Hz, to compensate for the low end roll-off of most loudspeakers.

**Located on chassis. See righthand portion of Power Amplifier Schematic, Section VI, C.*

Transistor Q3 supplies current to two potentiometers R4 and R5, which are adjusted so that the currents through R2 and R3 supply the base currents of Q1 and Q2. By adjusting R5 with the input terminals shorted (volume control at minimum) and R4 with the input terminals open (or with the volume control at maximum) to give zero volts out of the amplifier, this condition will hold for any impedance the amplifier faces (any volume control setting).

D. POWER SUPPLY

All supply voltages (50V, 40V, 20V and 10V) are available in both polarities. The main supply (± 40V) is rectified by diodes CR1, CR2, CR3, and CR4 in a double full wave configuration. Filtering is by capacitors C3 and C4. This supply has a substantial amount of ripple, especially under load, but the power amplifier by-passing is such that this produces negligible hum in the amplifier output.

—WARNING—

The terminals and leads of C3 and C4 are not current protected. Do not short to ground or to each other. (You'll ruin your screwdriver.)

The ±50V supplies are really 10V supplies floated on the ±40V supplies respectively. They will show about the same ripple as the latter. Transistors Q1 and Q2 with their associated circuitry provide protective current limits on the ±50V supplies.

Zener diodes CR13 and CR14 establish the reference voltages for the ± 20V supplies obtained from the cascaded emitter followers Q3—Q5, and Q4—Q6. The rate of rise and fall of these supplies during turn on and turn off is determined by the two stage active filters comprising R9, C5, R13 and R15, C7 and transistor Q3 for the + 20V supply and R10, C6, R14 and R16, C8, and transistor Q4 for the -20 V supply. Diode CR17 compensates for junction drops in Q5 and Q7, while CR18 compensates for junction drops in Q6 and Q8. Resistors R11 and R12 compensate for the initial charging currents in C5 and C6 so that these currents do not flow through R17, R19, CR17 and R18, R20, CR18.

Resistors R17 and R19 as well as R18 and R20 are dividers to develop the ± 10V reference. The ± 10V outputs are taken from emitter followers Q7 and Q8.

CR15 and CR16 provide short circuit protection and transistors Q9 and Q10 protect the emitters of Q7 and Q8 against reverse voltage from shorts between the 10 and 20 volt supplies.

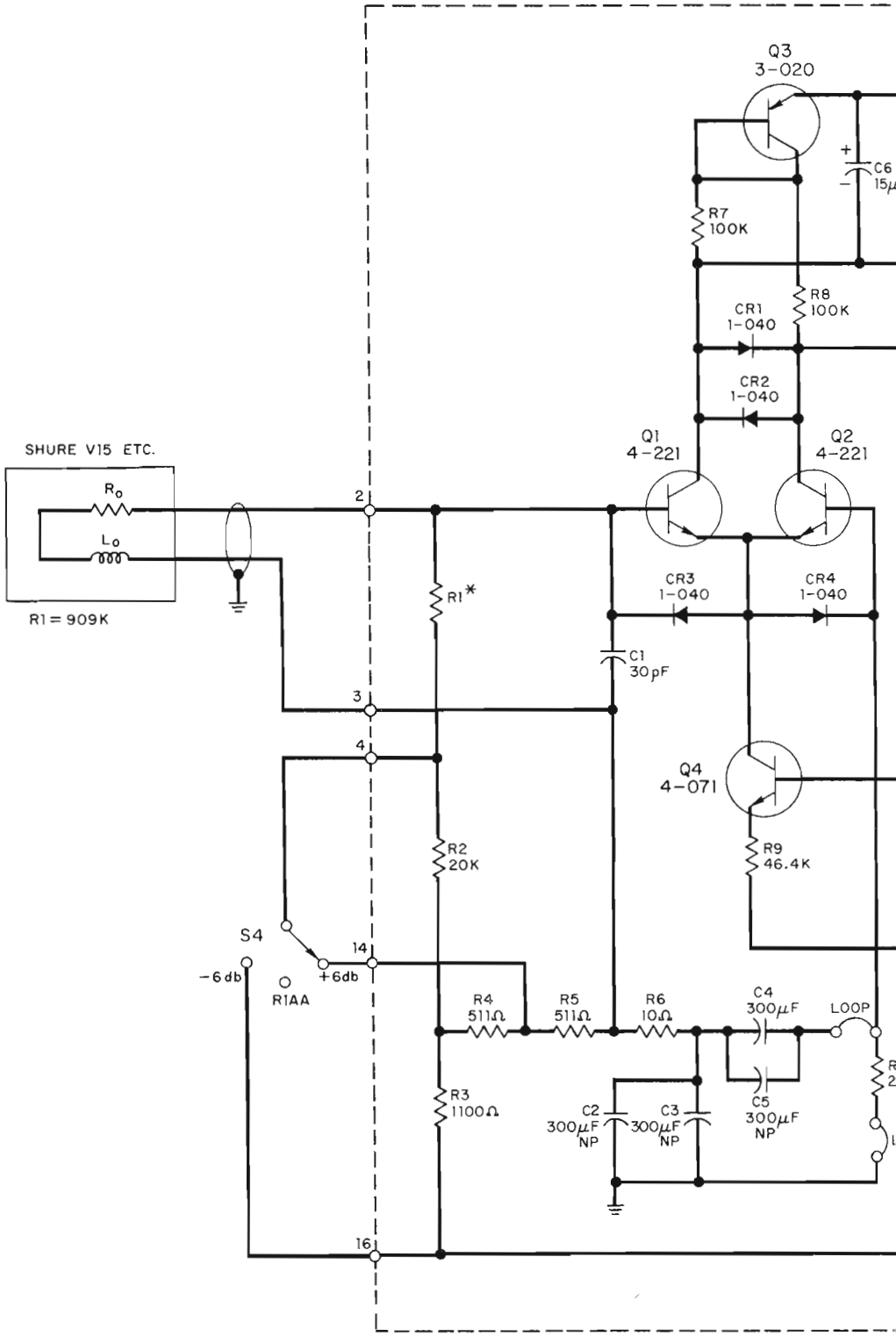
The 10 and 20 volt supplies are regulated and essentially ripple free.

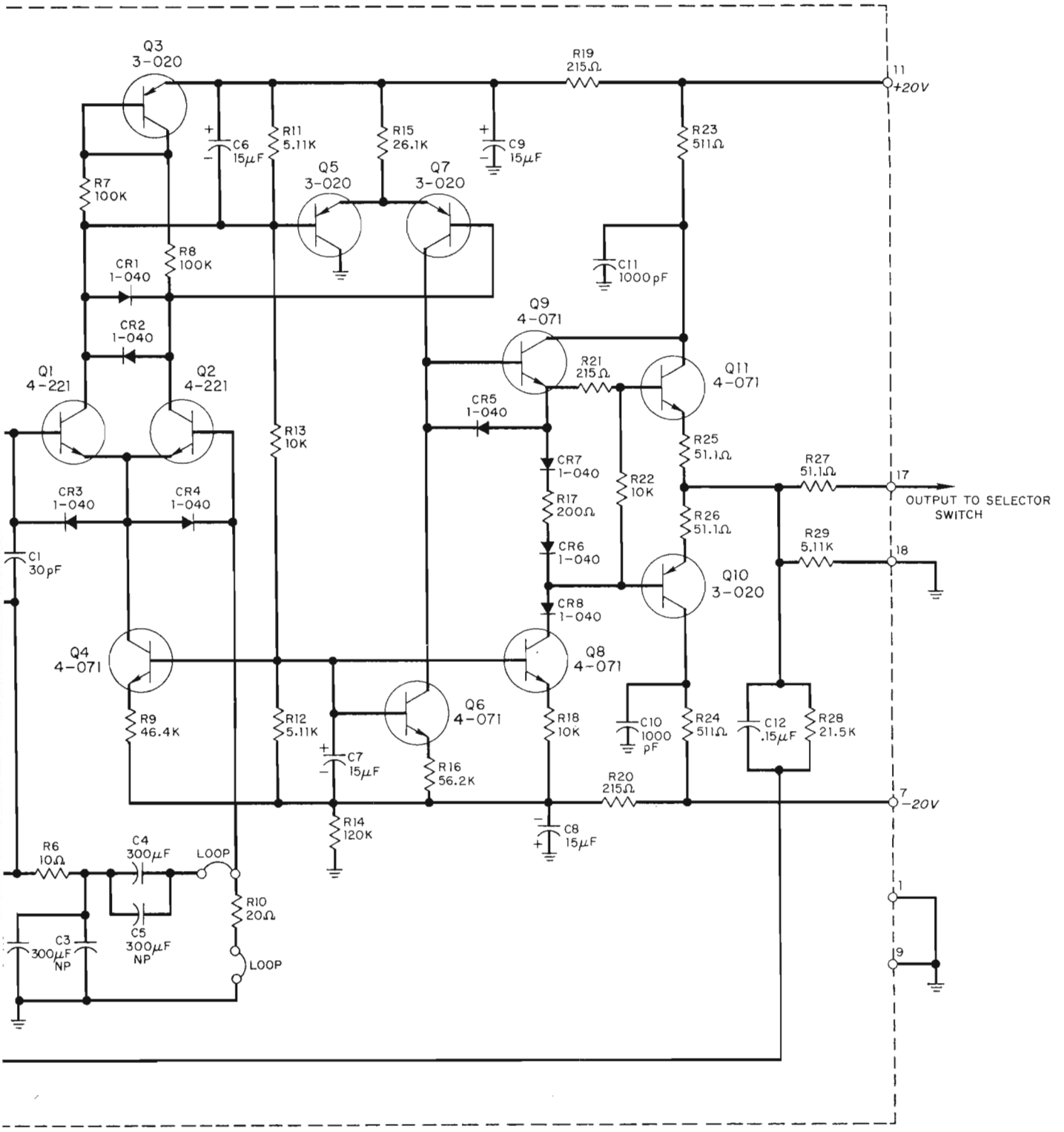
The maximum steady current ratings of the various supplies are:

Supply	Max Current
± 10V	18 ma
± 20V	70 ma
± 40V	3 amps
± 50V	0.5 amps

SECTION VI

CIRCUIT DIAGRAMS


Q3
3-020
C6
15μ
R7
100K
R8
100K
CR1
1-040
CR2
1-040
Q1
4-221
Q2
4-221
SHURE V15 ETC.
Ro
Lo
R1 = 909K
2
R1*
CR3
1-040
CR4
1-040
C1
30pF
3
4
Q4
4-071
R9
46.4K
R2
20K
S4
-6db
+6db
R1AA
14
16
R4
511Ω
R5
511Ω
R6
10Ω
C4
300μF
LOOP
R3
1100Ω
C2
300μF
NP
C3
300μF
NP
C5
300μF
NP



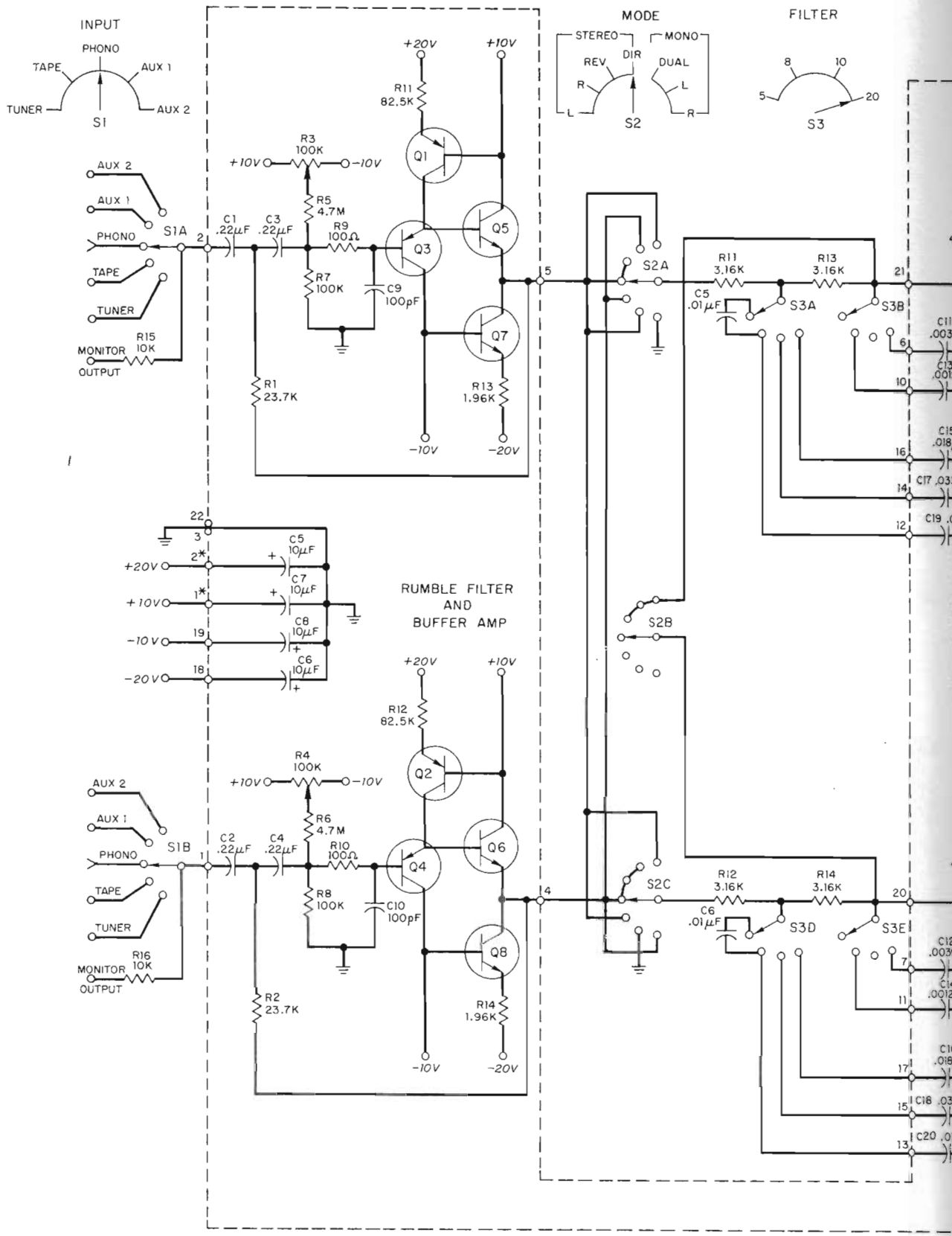
$$*R1 = \frac{L_o}{.75} \times 10^6 - 100R_o - 20K$$

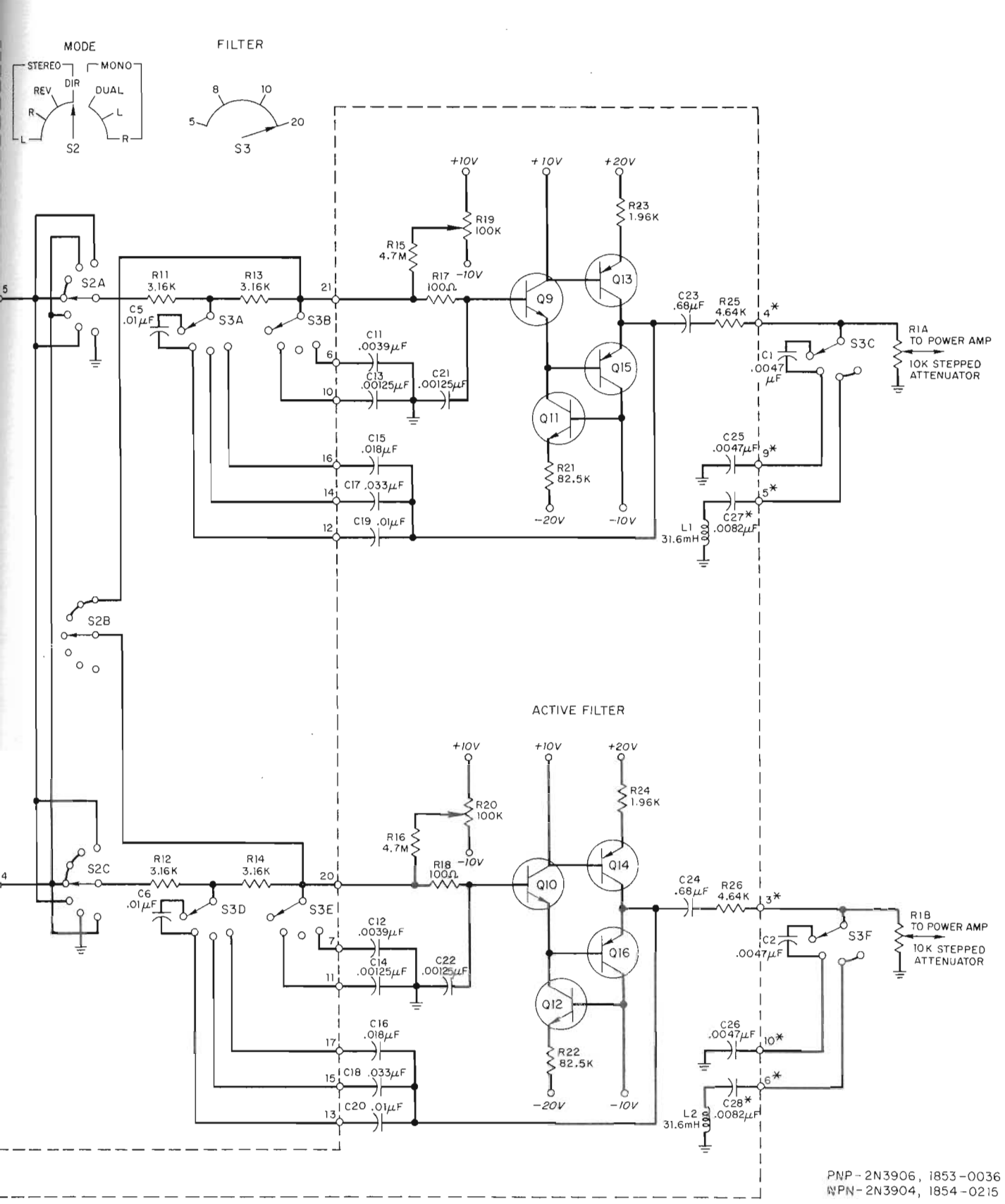
L_o IN H, R_o IN Ω

5mV PRODUCES 1 VOLT OUT AT 1KHz

ALL RESISTORS 1/8W METAL FILM UNLESS OTHERWISE NOTED.

VIA Phono Preamplifier


INPUT
PHONO
TAPE
AUX 1
TUNER
AUX 2
S1
MODE
STEREO
MONO
REV
DIR
DUAL
R
L
L
R
S2
FILTER
8
10
5
20
S3
AUX 2
AUX 1
PHONO
TAPE
TUNER
MONITOR OUTPUT
S1A
S1B
R15 10K
R16 10K
C1 .22μF
C2 .22μF
C3 .22μF
C4 .22μF
R3 100K
R4 100K
R5 4.7M
R6 4.7M
R7 100K
R8 100K
R9 100Ω
R10 100Ω
C9 100pF
C10 100pF
R1 23.7K
R2 23.7K
+20V
+10V
-10V
-20V
R11 82.5K
R12 82.5K
R13 1.96K
R14 1.96K
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
RUMBLE FILTER AND BUFFER AMP
C5 10μF
C7 10μF
C8 10μF
C6 10μF
S2A
S2B
S2C
R11 3.16K
R12 3.16K
R13 3.16K
R14 3.16K
C5 .01μF
C6 .01μF
S3A
S3B
S3D
S3E

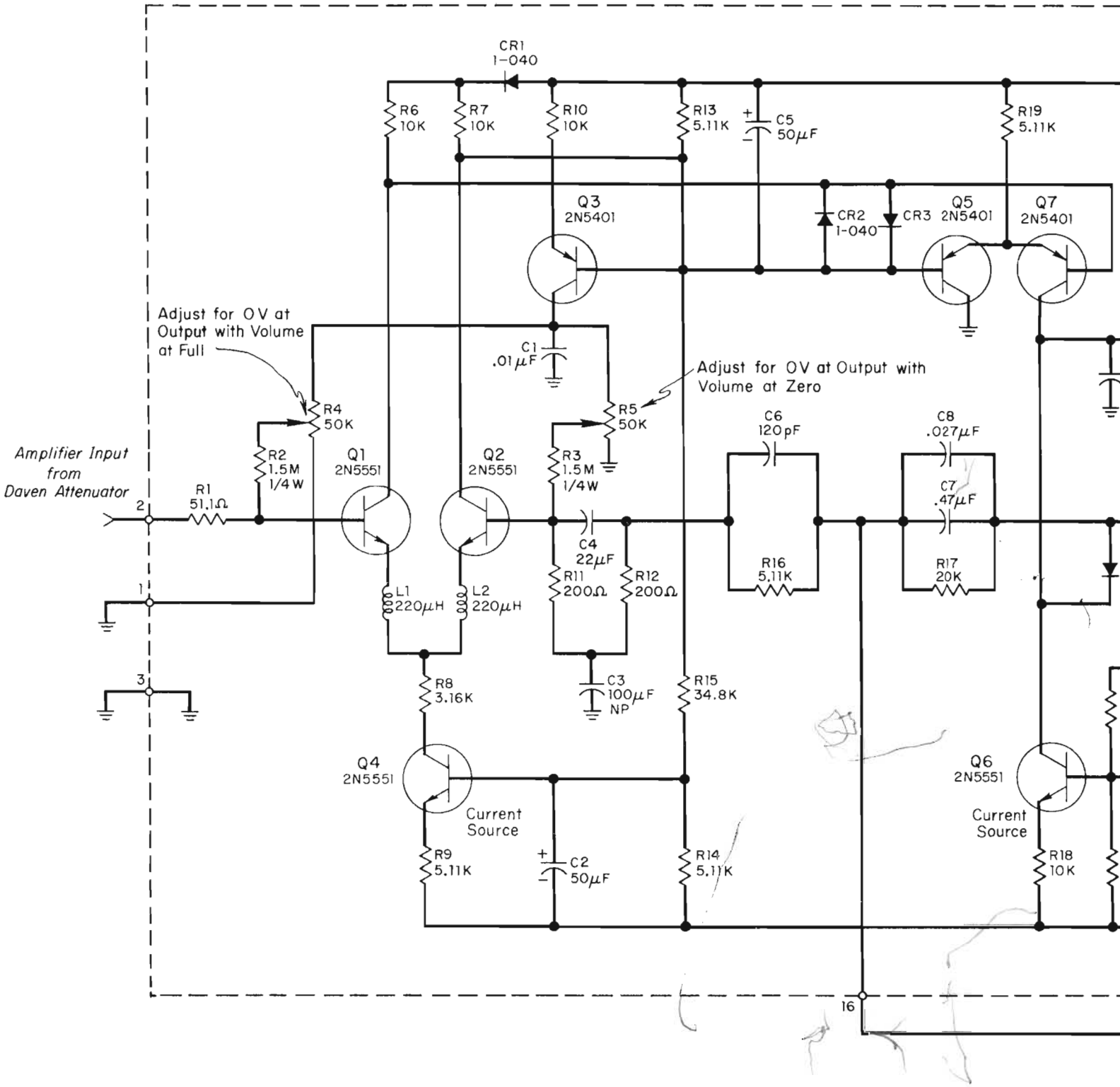


Notes:

This Board Utilizes Two Separate Connectors. Terminals on the Larger Connector are Labled 1 thru 22; Terminals on the Smaller Connector are Shown as 1* thru 10*.

All Resistors 1/8 W Metal Film Unless Otherwise Noted.

C27* and C28* Selected To Center 10KHz Notch at 10KHz ± 100Hz

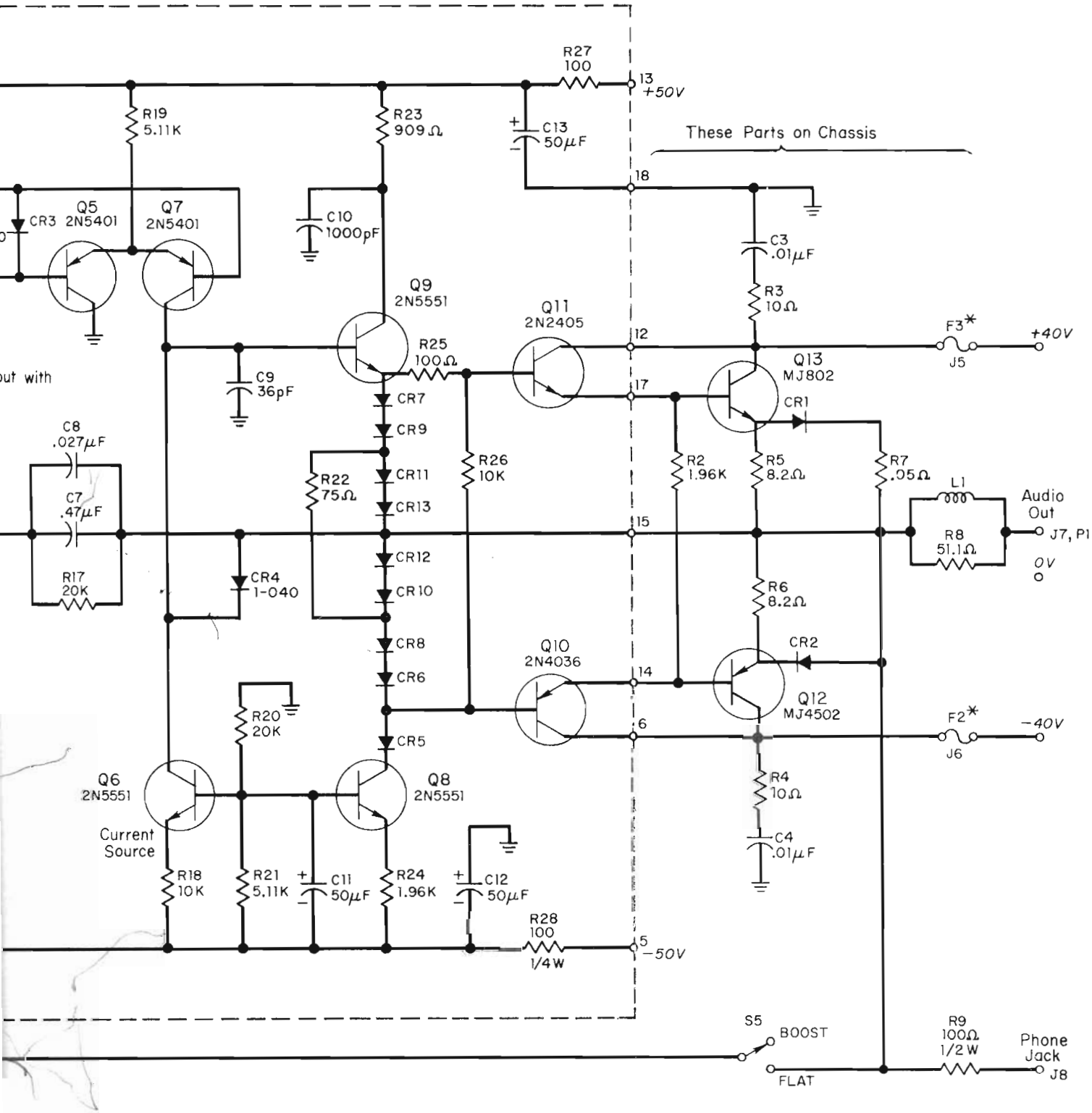


NOTES:

*Select for Speaker Protection 2.0A 3AG Maximum Located on Back Panel.

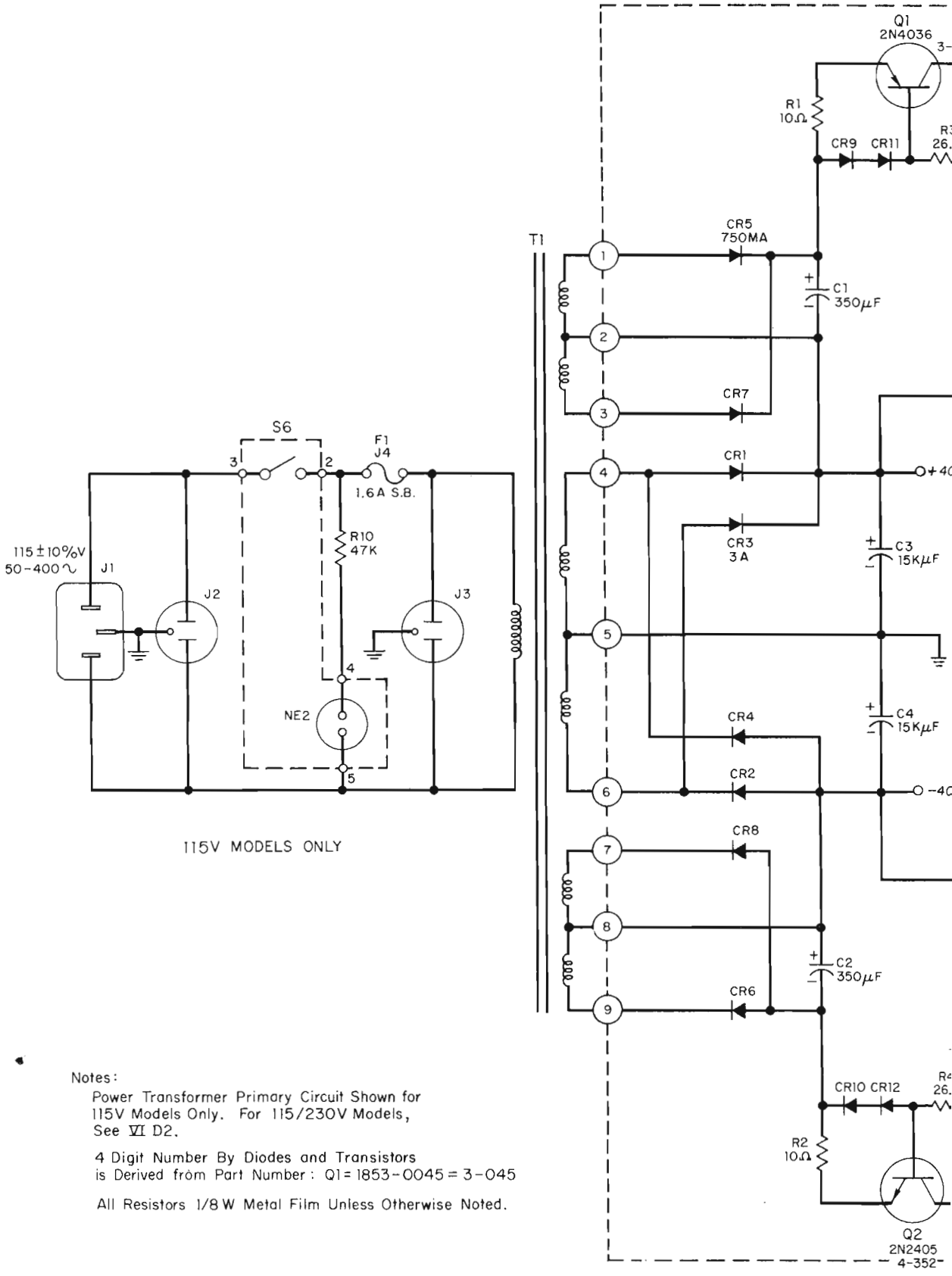
All Resistors 1/8W Metal Film Unless Otherwise Noted.

4 – Digit Number by Diodes is Derived from Part Number: CR1 = 1901–0040 = 1–040



VI C Power Amplifier

One Channel



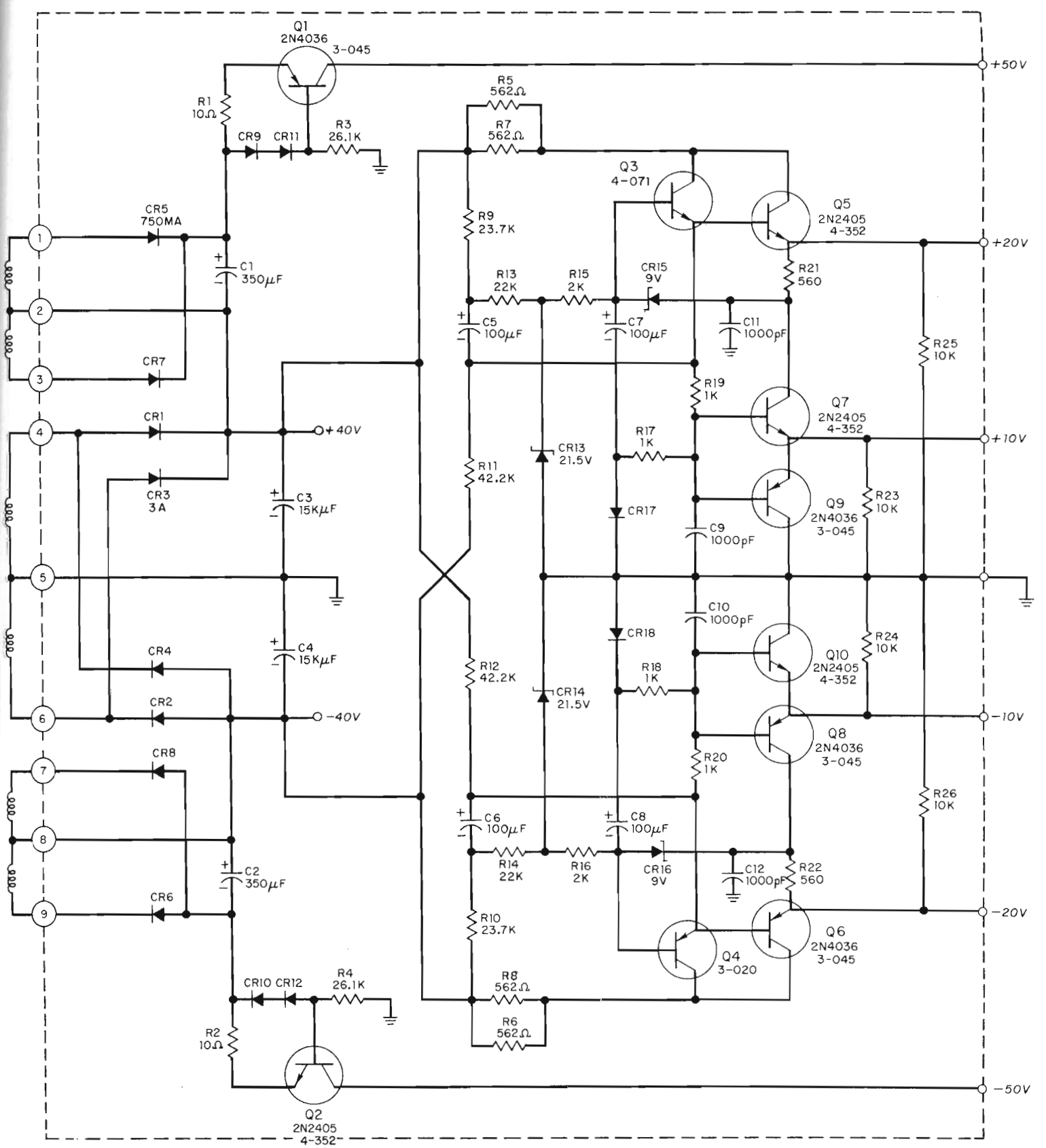
115V MODELS ONLY

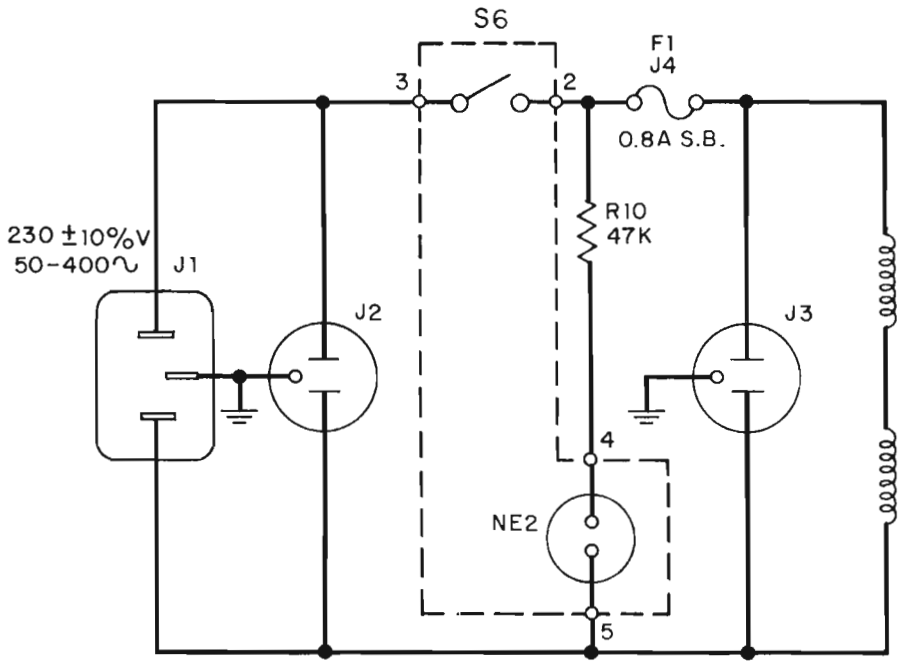
Notes:

Power Transformer Primary Circuit Shown for 115V Models Only. For 115/230V Models, See VI D2.

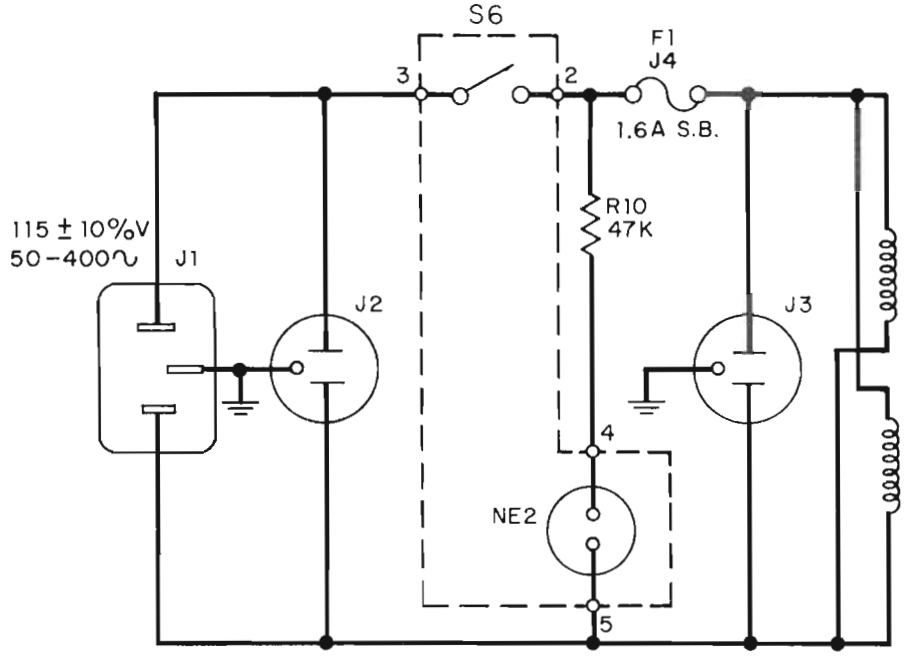
4 Digit Number By Diodes and Transistors is Derived from Part Number: Q1 = 1853-0045 = 3-045

All Resistors 1/8 W Metal Film Unless Otherwise Noted.


Q1
2N4036
3-045
R1
10Ω
CR9
CR11
R3
26.1K
R5
562Ω
R7
562Ω
Q3
4-071
Q5
2N2405
4-352
+50V
+20V
CR5
750MA
C1
350μF
R9
23.7K
R13
22K
R15
2K
CR15
9V
R21
560
C5
100μF
C7
100μF
C11
1000pF
R25
10K
CR7
R19
1K
Q7
2N2405
4-352
+10V
CR1
+40V
R17
1K
CR13
21.5V
R11
42.2K
CR3
3A
C3
15KμF
CR17
C9
1000pF
Q9
2N4036
3-045
R23
10K
C10
1000pF
CR18
R24
10K
CR4
C4
15KμF
R12
42.2K
R18
1K
Q10
2N2405
4-352
CR2
CR14
21.5V
-40V
-10V
Q8
2N4036
3-045
R20
1K
CR8
R26
10K
C6
100μF
C8
100μF
C2
350μF
R14
22K
R16
2K
CR16
9V
C12
1000pF
R22
560
CR6
R10
23.7K
Q6
2N4036
3-045
Q4
3-020
-20V
CR10
CR12
R4
26.1K
R8
562Ω
R6
562Ω
R2
10Ω
-50V
Q2
2N2405
4-352
1
2
3
4
5
6
7
8
9



115V/230V CONNECTED FOR 230V OPERATION



115V/230V CONNECTED FOR 115V OPERATION

VI D2 Primary Circuits

SECTION VII
PARTS LISTS

A. PHONO PREAMPLIFIER

Reference Designator	Description	Stock Number
C1	30pF mica	0160-2199
C2, C3, C4, C5	300 μF np 3V	30D1614
C6, C7, C8, C9	15 μF 20V tantalum	0180-1746
C10, C11	1,000pF ceramic	0150-0050
C12	.15 μ F 10% mylar	0160-0303
CR1, CR2, CR3, CR4, CR5, CR6, CR7, CR8	silicon diode	1901-0040
Q1, Q2	transistor npn X2N4044	1854-0221
Q3	transistor pnp (special)	1853-0020
Q4	transistor npn X2N3904	1854-0071
Q5	transistor pnp (special)	1853-0020
Q6	transistor npn X2N3904	1854-0071
Q7	transistor pnp (special)	1853-0020
Q8, Q9	transistor npn X2N3904	1854-0071
Q10	transistor pnp (special)	1853-0020
Q11	transistor npn X2N3904	1854-0071
R1*	Value is dependent upon characteristics of the phono pickup used. R1 = 909K for the Shure V-15 Type II. Otherwise calculate R1 per Section III, D.	0757-0195*
R2	20K	0757-0449
R3	1100Ω	0757-0424
R4, R5	511Ω 1/8 W m.f.	0757-0416
R6	10Ω	0757-0346
R7, R8	100K	0757-0465
R9	46.4K	0698-3162
R10	20Ω	0757-0458
R11, R12	5.11K	0757-0438
R13	10K	0757-0442
R14	120K	0757-0467
R15	26.1K	0698-3159
R16	56.2K	0757-0459
R17	200Ω	0757-0407
R18	10K	0757-0442
R19, R20, R21	215Ω	0698-3441
R22	10K	0757-0442
R23, R24	511Ω	0757-0814
R25, R26, R27	51.1Ω	0757-0394
R28	21.5K	0757-0199
R29, R30	5.11K	0757-0438

B. FILTER BOARD

Reference Designation	Description	Stock Number
C1, C2, C3, C4	.22 μ F mylar	0170-0086
C5, C6, C7, C8	10 μ F 20V electrolytic	0180-0374
C9, C10	100pF mica	0160-2204
C11, C12	.0039 μ F mylar	0160-0154
C13, C14	.00125 μ F mylar	0160-0297
C15, C16	.018 μ F mylar	0160-0302
C17, C18	.033 μ F mylar	0160-0163
C19, C20	.01 μ F mylar	0160-0161
C21, C22	.00125 μ F mylar	0160-0297
C23, C24	.68 μ F mylar	0170-0039
C25, C26	.0047 F mylar	0160-0157
C27, C28	.0082 μ F mylar (See Schematic VI,B.)	0160-0160
L1, L2	Inductor, 31.6 mH	special
Q1, Q2, Q3, Q4	transistor pnp 2N3906	1853-0036
Q5, Q6, Q7, Q8 Q9 Q10, Q11, Q12	transistor npn 2N3904	1854-0215
Q13, Q14, Q15, Q16	transistor pnp 2N3906	1853-0036
R1, R2	23.7K	0698-3158
R3, R4	100K pot	2100-2516
R5, R6	4.7 meg carbon	0684-4751
R7, R8	100K	0757-0465
R9, R10	100Ω carbon	0684-1011
R11, R12	82.5K	0757-0463
R13, R14	1.96K	0698-0083
R15, R16	4.7 meg carbon	0684-4751
R17, R18	100Ω carbon	0684-1011
R19, R20	100K pot	2100-2516
R21, R22	82.5K	0757-0463
R23, R24	1.96K	0698-0083
R25, R26	4.64K	0698-3155

C. POWER AMPLIFIER

Reference Designation	Description	Stock Number
C1	.01 μ F ceramic	0150-0093
C2	50 μ F 50V electrolytic	0180-0141
C3	100 μ F 6V np	30D603
C4	22 μ F tantalum	0180-0228
C5	50 μ F 50V electrolytic	0180-0141
C6	120pF mica	0160-2205
C7	.47 μ F	0170-0064
C8	.027 μ F	0170-0066
C9	36pF mica	0160-2308
C10	1,000pF ceramic	0150-0050
C11, C12, C13	50 μ F 50V electrolytic	0180-0141
CR1, CR2, CR3, CR4, CR5, CR6, CR7, CR8, CR9, CR10, CR11, CR12, CR13	silicon diode	1901-0040
L1, L2	220 μ H inductor	9140-0129
Q1, Q2	transistor npn 2N5551	1854-0474
Q3	transistor pnp 2N5401	1853-0264
Q4	transistor npn 2N5551	1854-0474
Q5	transitor pnp 2N5401	1853-0264
Q6	transistor npn 2N5551	1854-0474
Q7	transistor pnp 2N5401	1853-0264
Q8, Q9	transistor npn 2N5551	1854-0474
Q10	transistor pnp 2N4036	1853-0045
R1	51.1Ω 1/8 w	0757-0394
R2, R3	1.5 meg 1/4 w carbon	0684-1551
R4, R5	50K pot	2100-2517
R6, R7	10K 1/8 w m.f.	0757-0442
R8	3.16K 1/8 w	0757-0297
R9	5.11K 1/8 w m.f.	0757-0438
R10	10K 1/8 w m.f.	0757-0442
R11, R12	200Ω 1/8 w m.f.	0757-0407
R13, R14	5.11K 1/8 w m.f.	0757-0438
R15	34.8K 1/8 w m.f.	0757-0123

C. POWER AMPLIFIER (Continued)

Reference Designation	Description	Stock Number
R16	5.11K 1/8 w m.f.	0757-0438
R17	20K 1/8 w m.f.	0757-0449
R18	10K 1/8 w m.f.	0757-0442
R19	5.11K 1/8 w m.f.	0757-0438
R20	20K 1/8 w m.f.	0757-0449
R21	5.11K 1/8 w m.f.	0757-0438
R22	75 Ω 1/8 w m.f.	0757-0398
R23	909Ω 1/8 w m.f.	0757-0422
R24	1.96K 1/8 w m.f.	0698-0083
R25	100Ω 1/8 w m.f.	0757-0100
R26	10K 1/8 w m.f.	0757-0442
R27, R28	100Ω 1/4 carbon 10%	0684-1011

D. POWER SUPPLY

Reference Designation	Description	Stock Number
C1, C2	350μF 15V electrolytic	0180-2216
C3, C4	15000μF 50V Sprague electrolytic	6821 Type 36D 153G050CC2A
C5, C6, C7, C8	100μF 15V electrolytic	0180-0061
C9, C10, C11, C12	1000pF ceramic	0150-0050
CR1, CR2, CR3, CR4	diode, rectifier 3 amp 100V	1901-0200
CR5, CR6, CR7, CR8	diode, rectifier ¾ amp 100V	1901-0158
CR9, CR10, CR11, CR12	diode, silicon	1901-0040
CR13, CR14	diode, Zener 21.5V	1902-3245
CR15, CR16	diode, Zener 9V	1902-3149
CR17, CR18	diode, silicon	1901-0040
Q1	transistor pnp 2N4036	1853-0045
Q2	transistor npn 2N2405	1854-0352
Q3	transistor npn X2N3904	1854-0071
Q4	transistor pnp (special)	1853-0020
Q5	transistor npn 2N2405	1854-0352
Q6	transistor pnp 2N4036	1853-0045
Q7	transistor npn 2N2405	1854-0352
Q8, Q9	transistor pnp 2N4036	1853-0045
Q10	transistor npn 2N2405	1854-0352

D. POWER SUPPLY (Continued)

Reference Designation	Description	Stock Number
R1, R2	10 Ω	0757-0346
R3, R4	26.1K	0698-3159
R5, R6, R7, R8	562 Ω ½ watt	0757-0815
R9, R10	23.7K	0698-3158
R11, R12	42.2K	0698-3450
R13, R14	22K	0684-2231
R15, R16	1.96K	0698-0083
R17, R18, R19, R20	1K	0757-0280
R21, R22	562 Ω ½ watt	0757-0815
R23, R24, R25, R26	10K	0757-0442

E. DECK PARTS

Reference Designation	Description	Stock Number
C1, C2	.0047 μF	0160-0155
C3, C4	.01 μF ceramic disc cap	0150-0093
C5, C6	.01 μF mylar 200V	0160-0161
CR1, CR2	diodes Motorola MR 841	1901-1038
F1	line fuse 1.6A slo-blo for 115V .8A slo-blo for 230V	 2110-0005 2110-0020
F2, F3	speaker fuses 2 amp max	2110-0003
J1	AC power connector	1251-2357
J2, J3	power receptacles	1251-2073
J4	line fuse holder	1400-0084
	nut	2950-0038
	washer	2190-0068
J5, J6	fuse clips	1400-0008
J7	speaker output jack (mates with P1)	Cinch-Jones S-202-B
J8	phono jack, ring tip sleeve	Switchcraft 12B
J9	phono preamp p.c. connector 18 pin	1251-0141
J10	power amplifier p.c. connector 18 pin	1251-0141
J11	filter and control p.c. connector 27 pin	1251-0172
J12	filter and control p.c. connector 10 pin	1251-0166
J13, J14, J15, J16, J17, J18	input jacks	GC Electronics 33-804
	fibre washers	3050-0108

E. DECK PARTS (Continued)

Reference Designation	Description	Stock Number
J19, J20	sockets for Q12, Q13	1200-0041
	anodized insulators	1200-0043
L1	inductor ≈ 13μH	special
P1	speaker output plug (mates with J7)	Cinch-Jones P-202-CCT
Q12	power transistor pnp	Motorola MJ4502
Q13	power transistor npn	Motorola MJ802
R1 A & B	dual 10K stepped attenuator	Daven CPD-134-M-H-4C687P 2dB/step with detents
R2	1.96K	0698-0083
R3, R4	10Ω 2w	0698-3601
R5, R6	8.2Ω ½ w	0699-0003
R7	.05Ω	0811-1826
R8	51.1Ω ¼ w	0757-1000
R9	100Ω ½ w	0757-0198
R10	47K ¼ w	0684-4731
R11, R12, R13, R14	3.16K, 1/8 w	0757-0279
R15, R16	10K 1/8 w	0757-0442
S1	input switch	special
S2	mode switch	special
S3	filter switch	special
S4	phono equalization switch	3101-0106
S5	bass switch	3101-1235
S6	off/on switch w/pilot lamp	3101-0100
T1	power transformer	
	115V only	5081-0876
	115/230V	5081-5280

HEWLETT hp PACKARD

1501 Page Mill Road, Palo Alto, California 94304, Telephone 415 493-1501, TWX 910 373 1267

FROM: Dan Lansdon DATE: May 1973

TO: Barney Oliver Amplifier Owners SUBJECT: Corrections to Amplifier Manual

The following corrections should be made to the Barney Oliver Amplifier Manual.

Page 7-2 C11, C12

Part No. should read 0160-0156

Page 7-3 R2, R3

Part No. should read 0684-1551

Page 7-4 CR9, 10, 11, 12

Part No. should read 1901-0040

R27, R28

Part No. should read 0684-1011

Page 7-6 R10

Part No. should read 0684-4731

INSURANCE POLICY

BARNEY OLIVER STEREO AMPLIFIER

To insure the spectacular performance of which this fine instrument is capable, it is respectfully requested that you read the instruction manual very carefully, especially Sections II, III and IV. Certain connections are critical. Unless instructions are followed meticulously, the system PROBABLY WON'T WORK AND COULD BE DAMAGED. To help you avoid pitfalls already encountered by some users, here are a few tips.

A. Be certain that speaker leads are well insulated. (Beware of ancient "zip cord" which may be partially shorted.)

B. Make sure that leads are well soldered to speaker plugs and that there are no frayed wires or solder bridges between the terminals. (An ohmmeter check is advisable after soldering leads to plugs and before connecting leads to speakers.)

C. Be sure there is no connection between left and right speakers. (Some existing systems use a "common" lead.)

D. Be careful to avoid even momentary short-circuiting of the speaker outputs or leads. Short circuits will blow speaker fuses (located under the black cover on the rear of the amplifier). If in doubt, visually inspect these fuses (not with an ohmmeter).

E. If you have a signal source other than phono (i.e. tuner, tape unit, audio oscillator, etc.), try it first - in any (or all, in turn) of the following inputs on the rear of the amplifier: TUNER, TAPE, AUX 1, AUX 2. Be sure the input switch is in a position corresponding to the input which is connected. Also be sure the mode switch is in the STEREO NORMAL position.

F. If step D works out, then connect the phono pickup leads (from turntable or changer) to the phono inputs - but first:

1. Be sure the pickup (cartridge) has four independent terminals, with no metal or wire connection between any two terminals or between any terminal and the metallic case of the pickup. (See Section III A.)

2. Make certain there are separate shielded leads from each side (channel) of the pickup (cartridge). Be sure there is no connection between leads for left channel and right channel. (Some changers use a common shield; this will not work on this amplifier.) Also be sure the leads and shields are not grounded to the turntable or changer chassis - or to anything else. Some turntables or changers will have to be rewired.

3. Connect the amplifier chassis (thumbscrew on rear panel) to the turntable or changer chassis. In many cases this can be done with a piece of insulated wire. If you still notice hum when phono input is selected, install an outer shield around (but insulated from) the left and right channel leads and ground this outer shield (only) to the amplifier chassis thumbscrew and to the turntable or changer chassis. (See Section III A.)

G. If your phono pickup is other than a Shure V-15 Type II, please see Section III B.

H. If after you have carefully gone through steps A - G together with the admonitions and caveats in the instruction manual, your system still does not work, please try to get some help from an electronic friend in your area. Since this is a G-joboperating on a shoestring, we have no funds for trouble shooting or repair except for major problems (defective power transformer, defective attenuator, etc.) The likelihood of such problems is very small; on the other hand, if conscientious efforts at trouble shooting in your area fail to achieve results, please get in touch with Dan Lansdon, -hp - Labs, Palo Alto, Ext. 2706.