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MODEL D-90B POWER AMPLIFIER

OWNER'S MANUAL

(Includes Schematic)

2-15-82

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INTRODUCTION

Congratulations on your purchase. The D90B amplifier was conceived in response to the need for a totally "musical" amplifier at an affordable price for the 80's. This has been achieved, together with state-of-the-art electromechanical execution.

Accurately balanced circuitry throughout, together with other innovations and high energy, well regulated power supplies, provide a significantly wider musical bandwidth together with ARC's traditional High Definition® music reproduction.

The two-sided, plated through-hole circuit board mounts all of the components (except chassis parts). This makes all components readily accessible for replacement if every necessary without mechanical disassembly (except for top and bottom cover removal)!

Push-pull-parallel output tubes are used at approximately 70% of their dissipation ratings to prolong service life.

The D90B introduces a number of significant improvements over our previous design, including: new input and driver circuitry; automatic servo-balance control throughout tube life for the direct coupled stage; controlled warmup timer; electronic error correction in regulated power supplies; sonically better capacitors; automatic output bias correction for line voltage variations; and individual bias adjustments for each output tube.

With proper installation and reasonable maintenance, this amplifier should provide you with musical satisfaction for as many years as you care to own it.

WARRANTY STATEMENT

A Limited 90-Day Warranty (from date of purchase by the original purchaser; must be within 2 years of date of manufacture) is provided by Audio Research Corporation. This includes vacuum tubes. This warranty is subject to the conditions and limitations stated within the documents attached to the outer shipping carton and is repeated in full on Page 8 of this manual.

WARRANTY REGISTRATION CAUTION

It is your responsibility to register your unit. While it is true that Audio Research Corporation will provide warranty service for 90 days even if you do not (proof of purchase, such as a photo copy of your bill of sale, will be required), you will lose the extended Limited 3-Year Warranty unless you register the unit within 30 days of the date of your purchase. Be sure to read our warranty statement for complete information about this. (Note that this extended warranty does NOT include vacuum tubes.)

It is also important to register your unit so that Audio Research Corporation can contact you, if the need arises, for any possible modification news, etc.

USE CAUTIONS

1. Please be certain to read this manual over to familiarize yourself with your new amplifier before placing it in service.

2. Your D90B amplifier's power cord is equipped with a standard three-prong grounding plub which, if used normally, will ground the chassis to the power line. While this procedure undoubtedly provides the maximum possible safety in use it will, in many cases, cause your audio system to have a residual hum.

   The best way to prevent this hum, especially noticeable in bi- or multi-amplified systems, or in rack-mount installation with common mounting of multiple components, is to "float" this ground (as well as the ground of any and all other components). (ARC manufactures all its products so that there is no direct chassis connection to the power line except for the line cord's grounding wire. This is to say that all of our units have a power transformer which isolates the power line from all active circuitry. The only current that can flow between the chassis and some other line potential is the leakage of the transformer. Under any normal use applications this does not present any hazardous shock potential.) However, if there is any question as to the safety of such a procedure, be certain to seek competent help with the installation.

   And, of course:

   WARNING

   A. To prevent fire or shock hazard, do not expose this equipment to rain or moisture.

   B. This unit contains voltages which can be lethal. Do not operate this unit with its covers removed. Refer servicing to qualified personnel.

   CAUTION

   For continued protection against fire hazard, replace all fuses only with same type and rating of fuse as supplied and specified.

PACKAGING

Save all packaging. Your Audio Research® amplifier is a precision electronic instrument and should be properly cartoned any time shipment is made. You may not have occasion to return it to the factory for service, but if that should prove necessary, or other occasion to ship it occurs, the original packaging may save your investment from unnecessary damage or delay.

ACCESSORIES INCLUDED WITH YOUR D90B AMPLIFIER

Spare Fuses: 2 - 5A MDL Slo-Blo AC line fuses (3A MDX Slo-Blo 220-240V)
2 - 1/2A AGC normal blow screen fuses
1 - Phillips screwdriver

PREPARATION FOR USE

Your D90B is shipped with the output vacuum tubes removed for protection, individually boxed and labelled. Remove the protective top cover using the Phillips screwdriver supplied, and carefully install each tube in the corresponding socket as marked on the circuit board. Replace the cover.

INSTALLATION

To insure normal component life and safe operation, this unit must be operated only in a horizontal position.

The special non-marring elastomer feet provide adequate spacing only from a smooth, hard surface. Never operate the unit while it is sitting on a surface such as a rug or carpet because airflow will be restricted and will be inadequate for proper cooling.

If the unit is to be operated in an enclosure such as an equipment rack, make certain that adequate airflow above and below the unit is provided. The "ambient" operating temperature should never exceed 120°F or 50°C. Audio Research manufactures a "Rack Mount Ventilator" (RMV-3). The use of these in rack mount installations will assure proper ventilation.

It is normal for a vacuum tube power amplifier to run "warm" or "hot" to the touch. All components within are, however, operated at safe, conservative levels and will not be adversely affected thereby.

D90B CONNECTION INSTRUCTIONS

The front panel has only an on-off (LED) indicator.

The rear panel has:

2 Input Connectors
2 Input Level Control Knobs
2 Output Connection Terminal Barrier Blocks
1 Line Power Cord
1 Line Fuse

(The screen fuse is located just behind the front panel on the top, left side of the chassis.)

To place the unit in operation the following procedure is recommended:

1. Connect your speakers using the best available heavy gage speaker wires. Take care to observe "polarity" (ie: 4, 8 or 16 ohms to speaker "+"; "0" ohms to speaker "-"). (Note that the D90B is a "non-inverting" amplifier when connected in this manner.)

   Note: It is important to match impedances as closely as possible between amplifier and speaker so as to allow optimum transfer of power to the speaker while preserving minimum distortion operation of the amplifier.

2. Turn both input level controls fully counter-clockwise.

3. Connect the amplifier to the preamplifier or electronic crossover, using only the highest grade audio interconnect cables.

4. Connect the power line cord to the AC power, observing Paragraph 2 under USE CAUTIONS on Page 2 of this manual.

5. Proper adjustment of the input level controls can be accomplished very simply. Turn your preamplifier level control to 12 to 1 o'clock while playing a record. Then, advance (from the previously counter-clockwise settings) the amplifier level controls to your normal listening level. This provides optimum "bandspread" of adjustment at the preamplifier, as well as providing optimum signal-to-noise ratio. (The D90B will, however, normally perform best with its level controls at or near maximum.)

   CAUTION

   Make certain the amplifier is installed according to the instructions under INSTALLATION on Page 3 of this manual.

D90B ADJUSTMENT PROCEDURE AND DISCUSSION

The D90B utilizes very high quality commercial grade components and this, together with conservative operation of all components and tubes, should provide long adjustment-free service life.

After long service, or after vacuum tube failure and replacement, or in a location with consistently low line voltage, it may be desirable to readjust the amplifier for optimum performance.

CAUTION: The following procedures should not be attempted by the owner unless he is technically qualified. There are high voltages and currents within this unit which can be lethal under certain conditions. Refer all such adjustment to a qualified individual.

There are four parameters which may be adjusted (in the following sequence) in the D90B after removing the top cover:

1. B+ REGULATOR VOLTAGE
2. OUTPUT TUBE IDLE CURRENT ("BIAS")
3. DC BALANCE
4. AC BALANCE

1. B+ REGULATOR VOLTAGE

This adjustment sets the plate supply voltage for the input and phase inverter stages. Control RV17 is located next to the large capacitor shield on "channel one" side. Adjust for +300VDC on .47uF capacitor C47 lead located just behind the large filter capacitors.

2. OUTPUT TUBE IDLE CURRENT ("BIAS")

The output stages of the D90B are partially cathode coupled "push-pull parallel class AB_1," utilizing our tightly-coupled output transformers, which provide low distortion and sonic accuracy.

As shipped from the factory, the output bias adjustments are set for a nominal 60 mA. per tube with a stable power line of 120 Volts. Under these conditions the tubes are each dissipating approximately 25 watts of their 35 watt rating (30 watt plate, 5 watt screen). This point of operation provides "enriched" class AB_1, and will satisfy most critical listeners.

Make sure adequate ventilation is provided to prolong tube life.

2A. "BIAS" ADJUSTMENT PROCEDURE

A digital voltmeter capable of accurate measurement of .05 to .1 Volt DC is required to accomplish this adjustment.

There is a 1 ohm 5% wirewound resistor in the cathode circuit of each output tube, and test connections (test points referred to schematically and on the PWB as TPs) are provided on either end of these resistors so that a voltage measurement can be conveniently made across each resistor. These test points are identified and accessible from both the top and bottom sides of the PWB.

Because the resistor is 1 ohm, you can conveniently "direct" read the total cathode current in each tube. A .06 Volt reading indicates 60 mA.

TUBE	TP COMMON	TP
V7	13	5
V9		9
V11	15	7
V13		11
V8	14	6
V10		10
V12	16	8
V14		12

An individual adjustment is provided for each of the eight output tubes. The "front" controls affect the "front" tubes, etc. RV7 sets V7, RV9 sets R9, etc.

It is important that all 8 output tubes be reasonably matched (within 5%) for highest performance operation. (Matched sets are available from Audio Research.)

Observe the following:

1. These adjustments should be accomplished under no signal conditions and with line voltage at its "normal" for your location.

2. The D90B should be thoroughly "warmed up" (thermal equalibrium) prior to adjustment (typically 2 hours).

3. Move each adjustment slowly, allowing time for circuit equalibrium as you make your readings.

3. DC BALANCE

Because of the nature of the push-pull direct coupled input circuit, the bias of the driver stage following is determined by the DC balance of the input stage. Best sonic operation occurs when these DC voltages (found at TPs 1, 2, 3 and 4) are the same within 0.05 Volt DC or better. The actual voltage is not critical at about 100 to 102 VDC. It is the balance that is important.

3A. DC BALANCE ADJUSTMENT

A battery-operated digital voltmeter having a 10 megohm or higher input impedance and 3½ digit resolution or better is best for this adjustment.

RV3 and RV5 adjust the left channel (TP1 & TP3)
RV4 and RV6 adjust the right channel (TP2 & TP4)

Adjust RV3 and RV5 to achieve identical voltages at TP1 and TP3. Allow time for the servo to settle to its final voltage. There is some interaction between adjustments because of the nature of the circuit. Make final trim adjustment for as close to 0 DVC difference between TP1 and TP3 with the DVM connected between TP1 and TP3.

Repeat the above using RV4 and RV6 to achieve identical voltages at TP2 and TP4.

It is not required that the left channel voltages be exactly equal to the right channel voltages. It is important that each channel's two TP voltages match and that they be within the range of 100 to 102 Volts DC.

It should not be necessary to readjust DC balance once it is set. The servo balance circuits compensate for tube aging, tube changing and line voltage variations.

4. AC BALANCE

Normally the AC balance does not require readjustment unless the output or driver tubes are changed. This adjustment should not be attempted unless the previous adjustments are checked first.

Adjust RV15 and RV16 for minimum 2nd harmonic distortion at about 1 watt 1 kHz output into a 16 ohm load, typically less than .001%. As an approximation, the adjustments can be made for minimum 1 kHz total harmonic distortion and noise, typically less than .01%.

WARRANTY TERMS

This unit is offered with a limited warranty as follows:

1. Warranty. Audio Research warrants the product designated herein to be free of manufacturing defects in material and workmanship, subject to the conditions hereinafter set forth, for a period of three (3) years from the date of purchase by the original purchaser. To obtain this Warranty, THE ORIGINAL PURCHASER MUST MAIL TO AUDIO RESEARCH WITHIN THIRTY (30) DAYS OF THE DATE OF PURCHASE THE WARRANTY REGISTRATION FORM TOGETHER WITH A COPY OF THE BILL OF SALE OR OTHER PROOF OF PURCHASE OF THE PRODUCT. Audio Research will then validate the Warranty and return the validated Warranty to the purchaser.

2. Conditions. This Warranty is subject to the following conditions and limitations. The Warranty is void and inapplicable if the product has been used or handled other than in accordance with the instructions in the owner's manual, abused or misused, damaged by accident or neglect or in being transported, or the defect is due to the product being repaired or tampered with by anyone other than Audio Research or an authorized Audio Research repair center. The product must be packed and returned to Audio Research or an authorized Audio Research repair center by the customer at his or her sole expense. A RETURNED PRODUCT MUST BE ACCOMPANIED BY A WRITTEN DESCRIPTION OF THE DEFECT AND A PHOTOCOPY OF THE VALIDATED WARRANTY. Audio Research reserves the right to modify the design of any product without obligation to purchasers of previously manufactured products and to change the prices or specifications of any product without notice or obligation to any person.

3. Remedy. In the event the above product fails to meet the above Warranty and the above conditions have been met, the purchaser's sole remedy shall be to return the product to Audio Research or an authorized Audio Research repair center where the defect will be rectified without charge for parts or labor, except vacuum tubes (see 6 below).

4. Limited to Original Purchaser. This Warranty is for the sole benefit of the original purchaser of the covered product and shall not be transferred to a subsequent purchaser of the product.

5. Duration of Warranty. This Warranty expires on the third anniversary of the date of purchase. During the first ninety (90) day period following the date of purchase by the original purchaser, the Audio Research Limited 90-Day Warranty supersedes this Warranty.

6. Vacuum Tubes. Vacuum tubes and replacement thereof are warranted for the original 90-day period only.

7. Miscellaneous. ANY IMPLIED WARRANTIES RELATING TO THE ABOVE PRODUCT SHALL BE LIMITED TO THE DURATION OF THIS WARRANTY. THE WARRANTY DOES NOT EXTEND TO ANY INCIDENTAL OR CONSEQUENTIAL COSTS OR DAMAGES TO THE PURCHASER. Some states do not allow limitations on how long an implied warranty lasts or an exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

D90B SPECIFICATIONS (AC line set @120V 60Hz for these specifications)

Power Output:
80 watts per channel minimum continuous (both channels operating) at 16 ohms from 25Hz to 20kHz with less than 0.5% total harmonic distortion (typically below .005% at 1 watt)

Approximate actual power available per channel at "clipping" (both CH. OP, 1kHz): 90 Watts

Power Bandwidth:
(-3dB Points) 12Hz to 50kHz

Intermodulation Distortion:
Less than .3% at 1dB below rated output (100V p to p, 16 ohms) (SMPTE method)

Input Sensitivity:
1.2V RMS for rated output (adjustable)

Input Impedance:
75K ohms, nominal at maximum gain

Output Regulation:
Approximately .3dB, 16 ohm load to open circuit
(Damping factor approximately 25)

Negative Feedback:
21.5dB

Slew Rate:
15 volts/microsecond

Rise Time
5 microseconds

Hum & Noise:
Better than 90dB below rated output 20kHz bandwidth unweighted

Power Supply Energy Storage:
200 joules

Power Requirements:
105-125VAC 60Hz (210-250VAC 50Hz) 800 watts maximum
400 watts at "idle"
500 watts at rated power

Dimensions:
19" (48 cm) W (standard rack panel) x 7" (18 cm) H x 16.5" (42 cm) D (front panel back). Handles extend 1 5/8" (4.1 cm) forward of the front panel

Weight:
64 lbs. (29 kg) Net; 80 lbs. (36.3 kg) Shipping