audio research
HIGH DEFINITION®

3900 ANNAPOLIS LANE NORTH / PLYMOUTH, MINNESOTA 55447-5447 / PHONE: 763-577-9700 FAX 763-577-0323

# MODEL D-150 POWER AMPLIFIER

## OWNER'S MANUAL

## INTRODUCTION

Congratulations on your purchase. The D-150 dual channel audio frequency power amplifier was conceived and designed for audio perfectionists. Front panel controls and meters permit the utmost in operating convenience. Forced air cooling of the output stage insures long component life. A high energy power supply and balanced cross-coupled vacuum tube circuitry is employed for high definition music reproduction.

## PACKAGING

Save All The Packaging - Your Audio Research component is a precision electronic instrument and should be properly cartoned any time shipment is made. You may never have occasion to return it to the factory for service, but if such should be necessary, or other occasion to ship it occurs, the original packaging may save your investment from unnecessary damage or delay.

## ACCESSORIES

The following accessory items are included with your D-150:

(1) ¼" spin wrench (for cover removal)
(1) plastic adjustment tool (for front panel bias control adjustment)
(2) pair line fuses (spares)
(2) set plate and screen fuses (spares)

## SPECIFICATIONS

| | |
|---|---|
| Power Output: | 150 watts per channel minimum RMS (both channels operating) into a 4, 8, or 16 ohm load from 20 Hz to 15 KHz with less than 1% total harmonic distortion |
| Intermodulation Distortion: | Less than .5% at rated power |
| Output Impedance: | 4, 8, 16 ohms |
| Input Sensitivity: | 2.2 volts for rated output |
| Power Requirements: | 100,110, 120 220, 240 VAC 50-60 Hz, 1000 watts at rated power output |
| Input Impedance: | 80K ohms at 20 Hz 30K ohms at 15 KHz |
| Damping Factor: | 14 at 8 ohms (1 KHz) |
| Hum & Noise: | More than 80dB below rated output |
| Dimensions: | Rack Mount Front Panel 19" wide X 10½" high (16½" deep chassis) |
| Weight: | 115 lbs. net 155 lbs. shipping |

WARNING

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

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

CAUTION

For continued protection against fire hazard, replace only with same type and rating fuse.

INSTALLATION

Mechanical:

Install the Power Tubes - using the ⅛" spin wrench (contained in the accessory bag) remove the screws holding the top perforated cover in place. Carefully remove the box containing the 5 matched pairs of 6550 tubes. Observing the numbers by the tube sockets, install the corresponding tube (number is located on label at base of tube) by inserting the tube into the socket and rotating until the "key" on the stem of the tube base is aligned with the keyway in the tube socket and the tube drops into place. Push the tube firmly into the socket until the base of the tube is flush with the panel. Fasten the tube clamp around the base of the tube using the second or inner notch of the clasp. When all 10 tubes are in place, replace the top cover.

To insure normal component life, this equipment must be operated in a horizontal position to receive proper ventilation. Never confine this device or inhibit the forced air flow through the top and bottom of the ventilated enclosure. If this equipment is to be operated within a rack-type cabinet, proper cooling should be provided. Audio Research Model RMV-2 (rack mount ventilator) is available for such configurations. It is recommended that the ambient operating temperature never exceed 120 degrees F (49 degrees C).

Shelf Mount - The D-150 can rest directly upon a shelf or table. The special elastomer feet prevent slipping on or marring of the mounting surface. NEVER ATTEMPT TO SLIDE THE AMPLIFIER ON THE ELASTOMER FEET. This may result in damage to the feet due to the weight of the transformer assembly.

Panel Mount - The standard 19" width front panel enables "rack" mounting of the D-150 with other system components. A rack-type cabinet is a very convenient way for bi- and tri-amplified system equipment to be mounted. A suitable cabinet of this type is available as an Audio Research Model RC-1. This unit is of heavy gauge welded steel construction with a quality baked paint finish, pastel green, and standard rack mount spacing. It also has snap-on (and off) removable sides for ease of installation and wiring. The 52" rack opening will hold up to (3) D-150s, (3) RMV-2s plus any one of the Audio Research rack mount electronic crossovers.

Electrical:

Proceed with system wiring as outlined below:

1. Connect the left and right channel loudspeakers to the amplifier speaker output terminal strips on the rear panel. Use lamp cord or two conductor wiring according to the following table:

| Wire Gauge (AWG) | Maximum Distance -vs- Impedance (16 ohm) | (8 ohm) | (4 ohm) |
|---|---|---|---|
| 20 | 40 ft. | 20 ft. | 10 ft. |
| 18 | 60 ft. | 30 ft. | 15 ft. |
| 16 | 100 ft. | 50 ft. | 25 ft. |
| 14 | 160 ft. | 80 ft. | 40 ft. |

Select the appropriate amplifier output impedance as recommended by the speaker manufacturer. Connect one lead to the "0" ohm terminal and the second lead to the "4", "8", or "16" ohm terminal. Make sure that the left and right speakers are "phased" properly, i.e. identical wiring and connections for each channel between amplifier and speaker terminals.

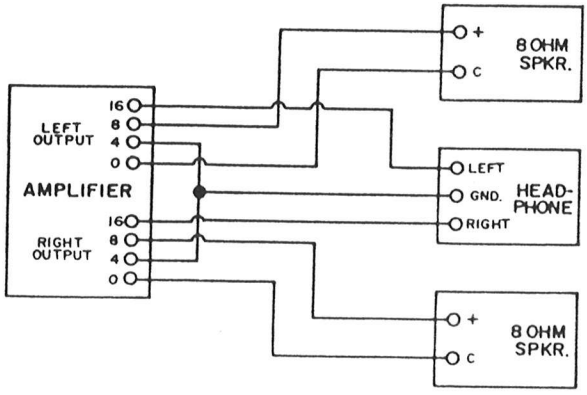
Note: The D-150 is an INVERTING amplifier - the output signal is 180 degrees out of phase with the input signal. This is of no consequence except in bi- and tri-amplified systems where the amplifiers and their respective speakers must be phased properly.

The D-150 also has a "balanced" output -- it is a requirement for the extremely high quality performance this equipment provides. This means that, unlike most amplifiers, the 4 ohm taps are the common or grounded taps, rather than the more conventional "0" or "C" taps. From a user standpoint, this is unimportant, except for the need to observe the following:

Avoid wiring and switching systems* (either for music distribution, such as background systems, or demonstration systems) that have common ground wiring or switching of the amplifier output.

It is recommended that your speakers not be switched with headphone switches.

*Some headphone switching systems have a common ground. They must not be used except as shown below.




TYPICAL SPEAKER/HEADPHONE CONNECTION
(Common Headphone Ground)

2. Connect the left and right channel audio inputs on the rear panel to the main left and right outputs respectively of the preamplifier or electronic crossover. Use only high quality shielded phono cables. Avoid inexpensive cables which use "weak" or soft metal grounding shells as they may introduce hum and/or noise into the system.

3. Turn the input gain controls on the rear panel fully counterclockwise to reduce the input sensitivity to zero. Proper setting of these controls will be discussed in the following section.

4. Finally, turn the power switch (center knob) on the front panel fully counterclockwise to the "off" position (straight up) and connect the line cord plug into an AC outlet or Audio Research RPR-1 Remote Power Receptacle.

5. Monaural Connection:

   The outputs of the D-150 can be bridged for monaural operation with increased power output capability. An 8 ohm load only must be used because of the special circuitry employed. Connections are as follows:

   a) Parallel the left and right inputs with a shielded cable "Y" adapter.

   b) Turn the left and right input level controls full clockwise.

   c) Connect the load (8 ohm only) between the "0" ohm tap of the left channel output and the "16" ohm tap of the right channel output.

   A slight loss of definition will result from the bridged operation; however, some individuals may feel that the extra power is worth the slight loss of definition.

## OPERATION

Before operating, make sure the D-150 has been properly connected into the system as instructed in the previous section. Proceed to operate as outlined below:

1. Power Line Voltage Meter - The center meter (A.C. Volts) on the front panel continuously indicates the power line voltage. Observe the meter reading before turning the power switch directly below the meter.

   Note: Before turning the D-150 on, advance or make sure the left and right meter selector switches located on each side of the power switch are turned fully clockwise to the "output power (operate)" position. These switches should always be left in this position except when adjusting the cathode current bias as discussed later.

2. Power Line Voltage (on-off) Switch - Having observed the line voltage in step 1, advance the 6 position rotary power switch in the center of the front panel from the "off" position to the labeled voltage nearest the meter reading. Do not switch to a setting lower than the voltmeter reading. The green pilot light on the front panel below the power switch should illuminate. Allow approximately 30 seconds for the amplifier to "warm up".

   Note: If an Audio Research RPR-1 Remote Power Receptacle is used, the D-150 power switch should be left in the voltage position corresponding to the line voltage "indicated" on the meter. The amplifier will thus turn on and off as commanded by the RPR-1.

3. Turn on or select desired "source" while the power amplifier is warming up.

4. Set the preamplifier level or volume control to a "normal" listening position (approximately a one to two o'clock setting). Advance the left and right input "gain" controls on the rear panel of the amplifier clockwise until a "full" listening volume is reached. The gain controls should be in a full clockwise position when an Audio Research SP-3A-1 preamplifier is used in the system.

   If necessary, the amplifier gain controls can be used to correct any channel imbalance caused by speaker placement etc. This enables the preamplifier balance control to remain "centered" even though the channels are deliberately unbalanced.

   Once the gain controls of the amplifier have been set, there is no need for re-adjustment each time the system is used.

5. There is generally no need to "fuse" larger speaker systems when using this equipment. The output transformers in the D-150 inherently isolate the speakers from any high current "DC failure" or subsonic condition which could otherwise damage a speaker.

If, however, protection for small speakers against sustained high power levels is desired, an "in-line" fuse should be included in the speaker wiring. A suitable fuse value can be calculated using the following equation:

$$I = \sqrt{\frac{P}{Z}}$$

where: I = fuse value in amps
P = RMS power rating of speaker
Z = nominal speaker impedance

example: What value fuse is required to protect an 8 ohm speaker rated at 35 Watts, RMS?

$$I = \sqrt{\frac{35}{8}} = \sqrt{4.375} = 2.09 \text{ Amps}$$

Use a 2 Amp instrument type fuse ("Littelfuse" 361000 series) or equivalent.

6. Output Meters - The front panel (Power Monitor) meters located to the left and right of the center meter are the left and right channel meters respectively. These meters indicate the power output or the cathode current bias of their respective channel as selected by the switch below each meter. When the switch is in the "power output (operate)" position, the meters indicate output power in watts. For 150 watts (sine wave) the meter indicator will be at the "adjust" mark or the line between the green and red operating zones. Meter calibration is based on a 4, 8, or 16 ohm resistive load connected to the proper output tap. At other power output levels, the meters will indicate as follows:

for 90 watts, 50% deflection
for 25 watts, 25% deflection
for 4 watts, 10% deflection
for 1 watt , 5% deflection

The meters operate "underdamped" to allow visual indication of transient (musical) program material. Continuous or prolonged operation in the red "caution" zone should be avoided. It is, however, considered normal for the meter to occasionally read in the red "caution" area for certain types of program material.

The meters also monitor the cathode bias current for each output tube. This feature permits optimum adjustment of the output stage idling current (for all line voltage and tube conditions) directly from the front panel. Each tube is adjusted for a 55 ma idling current which corresponds to the "adjust" mark on the meters when the meter switches are in any of the "cathode current (bias adj.)" positions. Proper procedure for making this adjustment will be given later. The meter switches must always remain in the "output power (operate)" position except when making a bias adjustment.

7. Output Meter Switches - The five position rotary switch below each Power Monitor meter controls the operating mode of the meter (as described above). THESE SWITCHES MUST ALWAYS BE RETURNED TO THE "OUTPUT POWER (OPERATE)" POSITION (FULL CLOCKWISE) - EXCEPT WHEN MAKING ANY CATHODE CURRENT BIAS ADJUSTMENTS. Make sure that the switches are returned to the "operate" position immediately after making any bias adjustments - as described below.

8. Cathode Current Bias Adjust Controls - The eight slotted rotor bias controls located in a single row near the bottom edge of the front panel can be adjusted by inserting the plastic accessory screwdriver through the appropriate access hole. Although these controls are factory set, periodic checking and adjustment of the bias current is desirable. It should be noted that the left channel output stage (V13, V15, V17, V19) is monitored with the "left" Power Monitor meter and switch while the "right" channel (V14, V16, V18, V20) is monitored with the "right" meter and switch. Optimum idling current for the push-pull parallel output stages is 55 ma (meter "adjust" mark) per tube. The range of the bias controls is approximately 25 to 85 ma. Make the bias adjustments as follows:

    a) Allow the amplifier to warm up for five minutes.

    b) Rotate the left meter switch from the "(operate)" position to the "V13" (bias adj.) position.

    c) Note the left meter indication.

    d) If necessary, turn the "V13" bias control SLOWLY until the meter indicator is at the "adjust" mark, which corresponds to 55 ma. The meter reading will "increase" with a "clockwise" rotation of the bias control as viewed from the front panel.

       NEVER TURN A BIAS CONTROL RAPIDLY OR FROM STOP TO STOP.

    e) Continue to monitor and adjust V15, V17, V19, V14, V16, V18, and V20 using the above procedure.

    f) If an output tube fails to "adjust" properly within the range of the bias control, it must be replaced as instructed below.

9. Power Output Tube Replacement - In the event an output tube should fail, it must be replaced with its counterpart as a factory matched pair. The following schedule must be followed when replacing power output tubes:

       V13 & V17, Matched Pair, Left Channel
       V15 & V19, Matched Pair, Left Channel

       V14 & V18, Matched Pair, Right Channel
       V16 & V20, Matched Pair, Right Channel

       V21 & V22, Matched Pair, Power Supply
       (not monitored with front panel meter)

To replace a matched pair of tubes, remove the screws holding the top perforated cover in place. Observing the numbers by the tube socket, unfasten the tube clamp clasp around the tubes to be replaced. Remove any other tubes that are in the way of those to be replaced, keeping track of their correct "position" for when they are re-installed. WHEN REMOVING POWER TUBES, DO NOT ALLOW THE TOP OF THE TUBE TO STRIKE THE METAL PANEL OPPOSITE THE SOCKET AS TUBE BREAKAGE MAY OCCUR. Tube removal is best accomplished by grasping the metal tube base with the thumb and forefinger while allowing the end of the tube to rest in the palm of the hand. Using a slight rotary motion, remove the tube with a steady pulling force. The edge of your hand should strike the metal panel and thus prevent breakage when the tube "suddenly" releases from the socket. Install the new matched pair according to the above schedule. Insert the tube into the socket and rotate until the "key" on the stem of the tube base is aligned with the keyway in the tube socket and the tube drops into place. Push the tube firmly into the socket until the base of the tube is flush with the panel. Fasten the tube clamp around the base of the tube using the second or inner notch of the clasp. Replace the top cover and adjust the bias (if an output tube was replaced) as instructed above.

10. Front Panel Fuses and Indicators - All fuses, both line and circuit are located on the front panel. Power line fuses (5 amp type FNM) are on the left side of the panel, while the plate fuse (2 amp type KLM) and screen fuse (1 amp type KLM) are on the right. These fuses may never need replacing, however, if a malfunction should occur, a red "fuse out" indicator(s) will illuminate to identify the open fuse. Occasionally a line transient or momentary arcing within a tube will cause a fuse to blow. It is therefore recommended that a new fuse be installed (spare fuses are supplied in the accessory bag) and the unit tried before considering any service work. ALWAYS TURN THE POWER SWITCH TO "OFF" IF A FUSE BLOWS OR BEFORE REPLACING ANY FUSES.

## SYSTEM DIAGNOSTICS

In case of difficulty after connecting the D-150 into your system, a list of common system problems and possible causes is provided below to aid in troubleshooting:

| Symptom | Possible Cause |
|---|---|
| Both channels dead | - Power not applied to amplifier<br>- Blown fuse(s)<br>- Input gain controls not turned up (CW)<br>- Improper or defective interconnect wiring<br>- Defective signal source |
| One channel dead | - Input gain control of dead channel not turned up<br>- Defective or improper interconnect wiring<br>- Balance control or mode switch on preamplifier not set properly<br>- Defective signal source |
| Hum or noise | - System ground loop<br>- Poor interconnect wiring<br>- Defective audio cable<br>- Excessive lead length<br>- Defective signal source |
| High distortion | - Low AC line voltage<br>- Incorrect speaker wiring<br>- Defective signal source<br>- Defective Power Tube(s) |

## FACTORY SERVICE

In the event that service becomes necessary, the D-150 must be returned to the factory with return authorization. Please write or call customer service at Audio Research for return authorization. The original equipment packaging should be used any time shipment is made.

All shipments to the factory must be prepaid and insured for full value. All factory serviced equipment will be returned freight collect. In the event that chargeable repairs are required, you will be contacted prior to the return of your equipment.