

Price: \$5.00

MODEL M-100 POWER AMPLIFIER  
OWNER'S MANUAL

10-1-86

**audio research corporation**

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## TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
INTRODUCTION	1
GENERAL DISCUSSION	2
USE CAUTIONS	1-2
PACKAGING	2
UNPACKING	2
ACCESSORIES	2
PREPARATION FOR USE	3
TUBE LOCATION CHART	3
INSTALLATION	4
CONNECTION INSTRUCTIONS	4-6
OPERATING INSTRUCTIONS	6
ADJUSTMENT PROCEDURE AND DISCUSSION	6-8
WARRANTY TERMS AND CONDITIONS	9-10
WARRANTY OUTSIDE THE USA	10
SPECIFICATIONS	11
ADDENDUM: SCHEMATIC	

## 1. INTRODUCTION

Please take the time to read this manual prior to installation or use of your M100 amplifier. Although the basic circuitry is similar to other Audio Research vacuum tube amplifiers, there are a number of differences from conventional amplifiers that make it important for you to familiarize yourself with this manual before installation or operation of this unit.

Interestingly enough, upon familiarization, you will find the M100 to be the most "user friendly" of all Audio Research amplifiers.

## 2. GENERAL DISCUSSION

The M100 is a vacuum tube amplifier constructed to high commercial standards. It is also capable of redefining the state-of-the-art of music reproduction. In order to achieve this, however, it is necessary that it be used synergistically with commensurate quality associated components. Just as a chain is not stronger than its weakest link, so it is in a music playback system. Attention to details such as the quality of interconnect cables, speakers wires, cartridge-arm interface and adjustments will reward you with satisfying results. It is also important that a preamplifier capable of unrestricted musical dynamics be used. Without these considerations you will no doubt hear a difference between this amplifier and others. However, the results may not be gratifying. The computer industry has a saying which is somewhat appropriate here: "Garbage in, Garbage out." Our analogy would be more like that of comparison of a very clean, clear window with one that is only translucent. If the scenery on the other side is pleasant, then the clean, clear window is preferred. So it is with the M100 amplifier. If you do not experience the definitive musical improvement available with this amplifier, a discussion of your system with your authorized Audio Research dealer or our Customer Service Department is suggested.

## 3. | | |--------------| | USE CAUTIONS | |--------------|

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

B. Your M100 amplifier's power cord is equipped with a standard three-prong grounding plug which, if used normally, will ground the chassis to the power line. While this procedure provides the maximum possible safety in use, it will, in some cases, cause your audio system to have a residual hum.

It is usually best to keep the preamplifier "earth grounded" and "float" the grounds of power amplifiers and other equipment to eliminate ground loop hum. The audio interconnect cables then keep the power amplifiers at safe earth ground potential. If there is any question as to the safety of grounding procedures, be certain to seek competent help with the installation.

## WARNINGS

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

B. This unit contains voltages which can cause fatal shock. 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 the same type and rating of fuse as specified.

## 4. PACKAGING

Save all the packaging. Your Audio Research amplifier is a precision electronic instrument and should be properly cartoned any time shipment is made. Because of its weight, it is highly probable that the unit will be damaged during shipment if repackaged in cartoning other than that designed for the unit. It is also important, again because of the units' weight, to pack each tube separately in its own carton.

You may not have occasion to return the unit 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, delay and expense.

REMEMBER: Remove all the vacuum tubes from their sockets and package them in the individual cartons to avoid damage in shipment. Mark each tube with its "V" number so that proper relocation can occur at re-installation.

## 5. UNPACKING

The M100 is packed within two cartons (inner and outer) which have polyfoam panels in between. Because of the weight of the unit and because it is a precision electronic instrument it is necessary to take reasonable care in its unpacking and preparation for use.

It is best to have a large, open work area with two people available to help. Set the carton upright in the center of the work area and with a knife or razor blade carefully slit the taped edges of the outer carton's top flaps. Fold the flaps to the sides and while holding the inner carton in place, roll the unit upside down. You can now lift the outer carton off and set it and the foam filler panels aside. Now slit the inner carton's bottom flaps taped edges. Again, fold the flaps over and while holding the unit in, roll it over as before. You can now lift the inner carton off to find your M100 sitting upright, undamaged and uncartoned. Carefully remove the plastic wrap. Now, while you remember how, reassemble the carton system for future use.

## 6. ACCESSORIES INCLUDED WITH YOUR M100 AMPLIFIER

- 1 - Phillips screwdriver (for cover removal)
- 1 - Plastic screwdriver (for adjustments)

### Spare Fuses:

- 1 - MDX-5 - 5 Amp line fuse for 120V Units (or)
- 1 - MDX-6 1/4 - 6 1/4 Amp line fuse for 100V Units (or)
- 1 - MDA-3 - 3 Amp line fuse for 220/240V Units
- 1 - 1A 3AB 322001 Screen Fuse (This is a "fast-blow," instrument type fuse. It is extremely important that only this type and rating be used as the screen fuse.)



## 7. PREPARATION FOR USE

Your M100 amplifier is shipped with all of the vacuum tubes removed, packaged and wrapped so that they will not be broken or internally damaged in shipment. It is necessary to install these before using your amplifier.

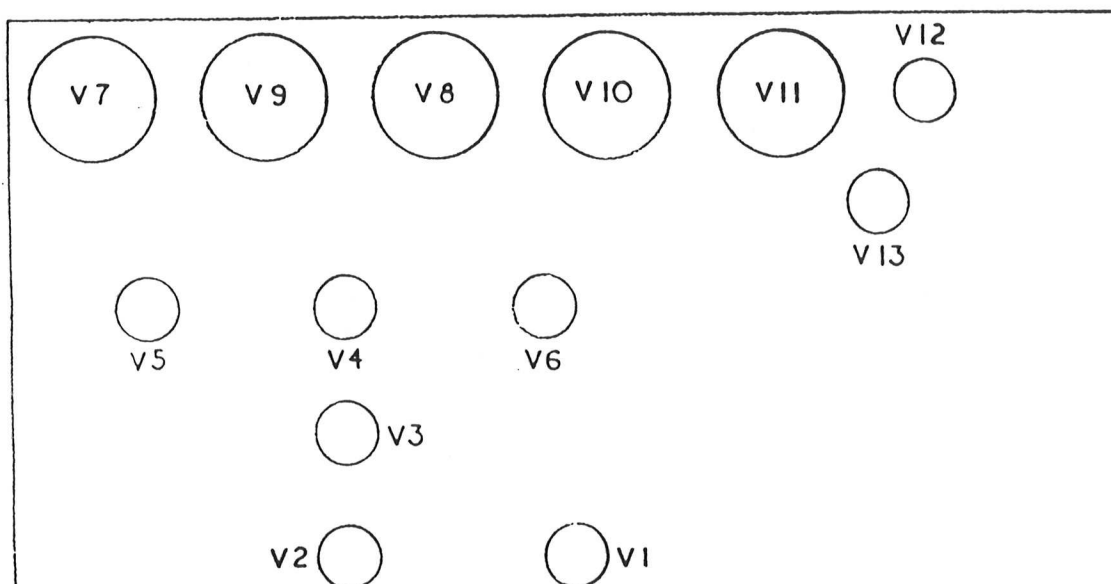
Your M100 utilizes a total of 13 vacuum tubes:

V1	6DJ8 - Phase Inverter
V2	6DJ8 - Input Amplifier
V3	7044 - Cross Coupler
V4	7044 - Driver Amplifier
V5,V6	(2)7044 - Direct Coupled Cathode Follower and Bias Controller
V7,V8	MP6550 - Power Output Tubes
V9,V10	MP6550 - Power Output Tubes
V11	6550 - Screen Regulator
V12	7044 - Driver Regulator
V13	12AT7 - Regulator Amplifier

These tubes are packed separately in individual cartons located under the protective cage. It is important to carefully install these vacuum tubes in their proper locations, observing the "V" markings of each tube and their corresponding sockets. A tube location chart is also included at the bottom of this page. Proceed as follows:

- Using the Phillips screwdriver provided, remove the top cage, momentarily setting it and the screws aside.
- Remove the 13 tubes individually from their cartons and insert them in their proper sockets.
- Re-install the protective cage.
- Save the Phillips screwdriver and the vacuum tube cartons for possible future use. Storing these items within the M100 packaging carton is a good way to assure finding them again.

## 8. TUBE LOCATION CHART



## 9. INSTALLATION

To insure normal component life and safe operation this unit must be operated only in a horizontal position. Adequate air flow and proper cooling thereby can occur only if there is no restriction below, behind and above the unit.

The five (5) 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.

If the unit is to be operated in an enclosure such as an equipment rack, make certain that adequate air flow above and below the unit is provided. The "ambient" operating temperature should never exceed 120°F or 49°C. Audio Research Corporation Rack Mount Ventilators (RMV-3) must be used above and below each unit. Improper installation will cause premature tube failure and will affect your warranty, as well as the service life of the unit.

It is normal for a vacuum tube power amplifier to run quite "warm," and if used for prolonged periods, "hot" to the touch. All components within are, however, operated at safe, conservative levels and will not be improperly affected thereby, providing the requirements outlined above are adhered to.

## 10. CONNECTION INSTRUCTIONS

The front panel has:

- |                 |  |
|-----------------|--|
| 2 Switches:     | 1 - Power Line On-Off  |
|                 | 1 - Bias Adjust-Operate  |
| 2 Fuse Holders: | 1 - Power Line   |
|                 | 1 - Screen   |
| 6 Indicators:   | 1 - Power "ON"   |
|                 | 1 - Screen Power "ON"  |
|                 | (Note that these two indicators also serve as fuse-out indicators) |
|                 | 4 - Output Tube "Bias" Indicators                                  |

The rear panel has:

- 1 - Input Level Control
- 1 - Input Connector
- 1 - Output Connection Terminal Barrier Block
- 1 - Power Line Cord

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

A. Connect your speakers using the best available speaker wires. We cannot emphasize this enough. It has been determined that the better the component system the more important it becomes to use the very best interconnect and speaker wires.

Note that the M100 is a "non-inverting" amplifier. It is important, sonically, that your entire speaker be connected so that the audio signal arriving at the speaker be "non-inverting."

B. Wire the speaker "0" or "-" connection to the "0" amplifier terminal. Wire the speaker "+" or otherwise identified (such as "4," "8," "16," "hot") positive terminal to the "4," "8" or "16" ohm amplifier terminal as required.

NOTE: It is important to use as close as possible an impedance match between amplifier and speaker so as to allow optimum transfer of power to the speaker while preserving minimum distortion operation of the amplifier. In the case of some complex speaker systems, including electrostatic types, the best impedance match should be determined empirically.

C. CAUTION: The output of your M100 amplifier, like all Audio Research tube amplifiers, is a "balanced" output. This is so because of the nature of our partially cathode-coupled output stage and overall balanced design. Since the output terminations are marked in "impedance" (ie: "4," "8" and "16" ohms), and since the center taps of the output windings must be grounded:

$$\frac{\sqrt{Z_1}}{\sqrt{Z_2}} = \frac{T_1}{T_2} \quad \text{OR} \quad \frac{\sqrt{4}}{\sqrt{16}} = \frac{2}{4}$$

the "4" ohm taps are grounded, being the center tap. This is unimportant in actual use except to be aware of the following situations (it is assumed that you are using two M100s for the following discussion):

a) Headphone speaker switching devices. Many of these units have a "common ground." This, of course, will connect the two amplifier "0" terminals together. Since the "4" ohm terminals are already connected together internally (remember, they are the common grounded center tap) you now have strapped the two amplifier sections together and created a modified monaural amplifier. Inevitably, these headphone speaker switching devices are also not satisfactory sonically in systems of a quality justifying the use of an M100 amplifier. Our recommendation is not to use them at all. If one "must" be used, contact Customer Service at Audio Research for instructions.

b) Some complex loudspeaker systems with integral power supply/crossover networks can have a common ground system, possibly also with grounding through the power line, just as the M100 amplifier does. If a "ground lifter" adaptor plug is not used, the result is that the amplifier is called upon to drive a virtual short circuit in addition to the problem listed in a) above. If your speaker system employs a power line connected power supply/crossover network and you experience either "monaural" sound and/or extremely weak and distorted sound, contact Customer Service or Engineering at Audio Research for instructions concerning your specific speaker.

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

E. Place the power on-off switch in the "off" position and connect the power line cord to the AC power, observing Paragraph B under USE CAUTIONS, Page 1 of this manual.



THE M100 AMPLIFIER SHOULD BE CONNECTED DIRECTLY TO A HIGH CURRENT POWER RECEPTACLE. IT SHOULD NOT BE CONNECTED TO CONVENIENCE RECEPTACLES ON PREAMPLIFIERS, ETC. THE POWER SOURCE USED MUST BE CAPABLE OF PROVIDING UP TO 10 AMPERES FOR 100/120 VOLT UNITS AND UP TO 5 AMPERES FOR 240 VOLT UNITS.

CAUTION: Make certain the amplifier is installed according to the instructions under INSTALLATION on Page 4 of this manual. Contact your dealer to help if you have any questions on the above procedure.

## 11. OPERATING INSTRUCTIONS

A. Make sure that you have complied with the INSTALLATION and CONNECTION INSTRUCTIONS prior to attempting operation.

B. The preamplifier should be on and initially muted and/or at minimum gain.

C. Turn the M100 power switch "on." You will note a short delay of approximately 1/2 second before the power relay clicks in and the "on" (and fuse out) indicator lamp reaches full brilliance. This "soft start" protection is provided to minimize the power surge of charging the M100 capacitors, to prolong component life and minimize the momentary "light dimming" encountered when switching on audio power amplifiers. The duration of this turn-on delay will vary with line voltage.

D. After the 10-30 seconds the "screen" lamp will also light, indicating that the high voltage regulators have reached operating temperature.

E. The M100 will now operate satisfactorily. However, a full stabilization time of at least 15 minutes is recommended for best sonic performance.

F. Bias-Operate Switch. Activates bias-adjust indicator circuit - See ADJUSTMENT PROCEDURE for full discussion of "Bias Adjustment." Observe the following:

- a) Never operate the unit in the bias-adjust position.
- b) Never adjust the bias with the unit playing OR in the operate position.

G. Input level control. The input level control may be used to "balance" the levels between amplifiers of different input sensitivity when using the M100 in a bi-amplified system.

If used alone in a single amplifier system, the input level control should be adjusted to provide a normal listening level when the gain control on the preamplifier control unit is in the range of 10 to 2 o'clock. This adjustment will provide optimum control by your preamplifier, as well as providing best signal-to-noise ratio therefrom.

## 12. ADJUSTMENT PROCEDURE AND DISCUSSION

The M100 utilizes very high quality, commercial and computer grade components and this, together with conservative operation of all components and tubes, will provide long service life, if installed and operated within the parameters outlined in this manual.



The output tubes, for example, are operated with a special electronically regulated and direct coupled "bias" circuit, as well as electronically regulated "screen" voltage. With these voltages regulated, the variation in output tube idle current for varying line voltage becomes normally of little consequence.

The output tubes are set at the factory for an "idle" cathode current of 65mA. (.065 amperes) each at a power line voltage of 120. Reducing the line voltage to 105 causes this current to drop to 62/63mA. Increasing the line voltage to 130 causes this current to increase to 67/68mA. This amount of change is not critical sonically nor will it materially affect tube life, although it may result in reduced brilliance of bias indicators.

A. Bias Adjustment Procedure. The M100 has a unique front panel indicating system that provides visual observation of correct bias adjustment.

With no audio signal present, proper bias setting may be observed or achieved by the following procedure (the M100 should be "warmed up" for at least 15 minutes prior to other than a preliminary adjustment):

Activate the "bias adjust" switch, making certain that no audio signal is present.

Note that each of the four power output tubes (V7, V8, V9, V10) has its own front panel bias adjustment as well as indicator.

Turning the adjustment counter-clockwise reduces the current (and dissipation) in each tube.

Turning the adjustment clockwise increases the current (and dissipation).

The indicator circuitry is designed to cause the lamps to light over a narrow range from approximately 63mA. to approximately 67mA., with maximum brilliance at approximately 65mA. Note that the lamps extinguish with either low or high bias settings.

Proper adjustment procedure is to initially rotate each adjustment counter-clockwise slowly. (This is in the direction of lowered dissipation.) If the indicator doesn't light, then slowly rotate clockwise, until indication occurs. When all four tubes are properly biased, all four indicators will be simultaneously at maximum brilliance. Some interaction is normal during adjustment.

Should an indicator not light throughout the adjustment range, a faulty tube or other circuit malfunction is indicated and appropriate service help should be obtained.

Be certain to return the "bias-adjust" switch to "operate" prior to use.

B. DC Balance. The direct and cross-coupled circuitry of the M100 maintains its DC balance by use of an automatic servo-circuit. This circuitry is normally effective throughout tube life as well as through changes of tubes.

There is an initial factory adjustment, RV3, which should not normally require adjustment throughout the life of the product.

In the unlikely event of accidental misadjustment of RV3, or in the event of a component change, RV3 can be readjusted using a Digital Voltmeter (with input impedance of 10 megohms or more) as follows (turn down the M100 input level control and allow a 15 minute warmup period):

a) Determine that the DC voltage at Test Point 1 is between +70 and +80 volts (reference to circuit common). (If not, replace V2, or other circuit component as necessary.)

b) With DVM connected between TP1 and TP2, adjust RV3 for minimum DC voltage. (Optimum value less than 1mV.)

C. AC Balance. Normally the AC balance does not require readjustment. If tubes are changed, however, you may want to recheck its setting. This adjustment should not be attempted unless low distortion measuring equipment is available.

First, make sure the output tubes are properly biased. (You should also verify DC balance prior to AC balance adjustment.)

Using the plastic alignment tool provided, set RV2 for minimum second harmonic distortion at 10 watts of 1kHz output into a 16 ohm load, typically less than .005%. As an approximation, the adjustments can be made for minimum 1kHz total harmonic distortion and noise, typically less than .02%.

If a "null" cannot be obtained, it may indicate a weak or unbalanced tube at V1 or V4, or possibly other tubes.



### 3-YEAR LIMITED WARRANTY TERMS AND CONDITIONS

1. **LIMITED 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 or no later than five (5) years from the date of shipment to the authorized Audio Research dealer, whichever comes first, excepting vacuum tubes which are warranted for 90 days only (See 6).
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. Audio Research will pay return freight of its choice. A RETURNED PRODUCT MUST BE ACCOMPANIED BY A WRITTEN DESCRIPTION OF THE DEFECT AND A PHOTOCOPY OF THE ORIGINAL PURCHASE RECEIPT. This receipt must clearly list model and serial number, the date of purchase, the name and address of the purchaser and authorized dealer and the price paid by the purchaser. 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 under this Limited Warranty 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).
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 or no later than the fifth anniversary of the date of shipment to the authorized Audio Research dealer, whichever comes first.
6. **VACUUM TUBES.** Vacuum tubes are warranted for the original 90-day period only.
7. **DEMONSTRATION EQUIPMENT.** Equipment used by an authorized dealer for demonstration purposes is warranted to be free of manufacturing defects in materials and workmanship for a period of three (3) years from the date of shipment to the dealer. Vacuum tubes are warranted for 90 days. Demo equipment needing warranty service must be packed and returned to Audio Research by the dealer at his sole expense. Audio Research will pay return freight of its choice. A returned product must be accompanied by a written description of the defect on an AUDIO RESEARCH RETURNED GOODS AUTHORIZATION form. Dealer-owned demonstration equipment sold at retail within three (3) years of date of shipment to the dealer is warranted to the first retail customer to be free of manufacturing defects in materials and workmanship for the duration of the 3-Year Limited Warranty remaining (as measured from the date of shipment of the equipment to the dealer). Vacuum tubes are not warranted for any period under these conditions of sale. In the event warranty service is needed under these conditions, the owner of



the equipment must provide a copy of his purchase receipt, fulfilling the requirements described under "2. Conditions" above. 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. Audio Research will pay return freight of its choice.

8. 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.

9. WARRANTOR. Inquiries regarding the above Limited Warranty may be sent to the following address:

Audio Research Corporation  
6801 Shingle Creek Parkway  
Minneapolis, MN 55430

#### WARRANTY OUTSIDE THE USA

Audio Research has formal distribution in many of the countries of the free world. In each country the Audio Research Importer has contractually accepted the responsibility for product warranty. Warranty should normally be obtained from the importing dealer or distributor from whom you obtain your product.

In the unlikely event of service need beyond the capability of the Importer, Audio Research does, of course, back up the warranty. Such product would need to be returned to Audio Research, together with a photostatic copy of the bill of sale.

M100 PRELIMINARY SPECIFICATIONS (AC line set @120V 60Hz for these specifications)

Power Output:

100 watts minimum continuous at 16 ohms from 20Hz to 20kHz with less than 1% total harmonic distortion (typically below .005% at 1 watt)

Approximate actual power available at "clipping": 115 watts (1kHz)  
(Note that actual RMS power output is dependent upon both line voltage and "condition" ie: if power line has high distortion, maximum power will be affected adversely, although from a listening standpoint this is not very critical.)

Power Bandwidth:

(-3dB Points) 12Hz to 60kHz

Intermodulation Distortion:

Less than .2% at 1dB below rated output (100V P to P, 16 ohms - SMPTE method)

Input Sensitivity:

0.7V RMS for rated output

Input Impedance:

65K ohms, nominal

Output Regulation:

Approximately .4dB, 16 ohm load to open circuit  
(Damping factor approximately 20)

Negative Feedback:

19dB

Slew Rate:

15 volts/microsecond

Rise Time:

5 microseconds

Hum & Noise:

Less than 2mV RMS 90dB below rated output (broad-bandwidth unweighted, inputs shorted)

Power Supply Energy Storage:

Approximately 280 joules

Power Requirements:

105-125VAC 60Hz (210-250VAC 50Hz) 800 watts maximum  
300 watts at "idle" - 400 watts at rated power output

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. Output connector extends 1" behind rear panel.

Weight:

53 lbs. (24 kg) Net; 69 lbs. (31 kg) Shipping

Tubes Required:

2 - Matched pair 6550 (low gas)	Power Output
1 - 6550 (low gas)	Regulator
1 - 12AT7 (ECC81)	Regulator Amplifier
2 - 6DJ8 (ECC88)	Phase Inverter, Input Amplifier
4 - 7044	Cross-Coupler, Driver, Output Couplers
1 - 7044	Regulator