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D400

STEREO POWER AMPLIFIER

OWNER'S MANUAL

1-1-92

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PREFACE

Please take time to carefully read and understand the following instructions before you install or attempt to operate your D400 stereo power amplifier. Familiarizing yourself with pertinent facts about your amplifier and its correct operating procedures will help assure you of maximum musical satisfaction and reliable operation. The effort you invest now will be well rewarded as time goes by.

INTRODUCTION

The D400 stereo power amplifier represents the latest and most sophisticated attempt by Audio Research engineers to embody the musicality and soundstaging of our world-acclaimed hybrid power amplifiers in a solid-state design which offers both maintenance-free convenience and tremendous reserves of power. For many music lovers, the D400 will probably be the last power amplifier they will ever need to purchase.

The D400 is a Class A-B design capable of some 400 watts per channel into a four-ohm load. Its power supply holds a mammoth 600 joules of energy storage, allowing the amp to deliver 60 amps of current at 60 volts per channel. Like its smaller sibling the D240 Mark II, the D400 uses numerous Multiple Emitter Transistors in a direct-coupled output stage. These devices are more musical than conventional bipolar transistors, yet more rugged than MOSFETS, giving the D400 both advantages with none of the drawbacks. The D400 retains its remarkable musical composure under the most demanding dynamic music conditions, making it an eminently suitable choice for any loudspeaker system currently available.

Input flexibility of the D400 is identical to the D240 Mark II: XLR connectors for balanced operation, as well as normal and inverted single-ended inputs, are provided. Output terminals are proprietary Audio Research design and manufacture, and were developed for sonic purity as well as for proper electromechanical function and durability. Internally, the D400 also has a silent electronic protection network that prevents damage to both the amplifier and loudspeakers under unexpected fault conditions at either input or output -- without the sonic compromises inherent in more conventional fused protection networks.

In short, the D400 reflects an approach to music reproduction painstakingly developed by Audio Research over the past 20 years: thoughtful, sophisticated design, critical selection and qualification of all components and exacting manufacture by skilled craftsmen in the United States. You can be assured that your D400 will enjoy lasting value as you continue to enjoy its lasting musicality for many years to come.

CONSTRUCTION AND TESTING

Like every Audio Research product, your D400 power amplifier has been designed and carefully handcrafted in the U.S.A., using precision mechanical parts, electronic

components and assembly procedures similar to those used in the manufacture of military electronics, aircraft electronics and scientific instruments. To assure performance standards each D400 is visually inspected at several assembly points, test run, electronically tested and sonically evaluated prior to shipment.

This time-consuming "perfectionist" approach to the design and manufacture of audio equipment is intended to provide you with the best in musical satisfaction and lasting value.

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.

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.

UNPACKING

Your D400 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 of its unpacking and preparation for use.

It is best to have a large, open work area with another person 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 lift off the polyfoam top support layer inside, exposing the inner carton top surface. Slit open the inner carton's taped edges and fold back the flaps. Remove top packing and enclosed materials, exposing the amplifier in plastic wrap. Remove one or both inner side supports and lift amplifier out of inner carton. Carefully remove plastic wrap, then reassemble the carton system for future use.

ACCESSORIES

Spare Fuses:

- 2 - 8 Amp MDQ slo-blo
- 2 - "RCA" shorting plugs

WARNINGS

1. To prevent fire or shock hazard, do not expose your D400 to rain or moisture.
2. This unit contains voltages which can cause serious injury or death. Do not operate with covers removed. Refer servicing to your authorized Audio Research dealer or other qualified personnel.

3. The 12-gauge, 3-conductor power cord on your D400 is equipped with a standard three-prong grounding plug. If used normally, it will provide a safe earth ground connection of the chassis. Refer to the Section on AC Power Connections for detailed information.

4. For continued protection against fire hazard, replace fuses only with the same type and rating of fuses as specified at individual fuse holders.

FRONT PANEL CONTROLS

The front panel has:

- | | |
|---------------|-----------------------------|
| 1 Switch | 1 - Power line On-Off |
| 2 Indicators: | 1 - Power "Operate" (green) |
| | 1 - "Protect" (amber) |

USE OF CONTROLS

POWER-ON SWITCH: Depress black pushbutton to initiate or terminate AC line power to the D400; you will hear a "click" as the switch engages or disengages. Initiation of power to the amplifier temporarily illuminates the amber "Protect" LED, which then extinguishes as the green "Operate" LED comes on. Termination of power to the amplifier extinguishes the green LED.

INSTALLATION

Highly efficient heat-sinking located along either side of the D400 help stabilize the D400 thermally and thereby preserve component life. The amplifier may be installed in a ventilated cabinet; observe the following guidelines to maximize the performance and service of your amplifier.

With proper installation, the D400 may be left on continuously for maximum performance on demand; it will draw approximately 220 watts of AC power at idle. However, the D400 has been designed and engineered to minimize any "warm up" necessary for best sonics; generally, a half-hour or 45 minutes of actual playing time will bring the amplifier around to more than acceptable performance levels, with some additional improvement noticeable over the next hour or two. "Warm-up" characteristics will depend upon ambient room temperature at start-up, the nature of the installation and the resolving power of the associated equipment.

It is best to operate the D400 only in a horizontal (upright) position. Adequate air flow and proper cooling thereby can occur only if there is no restriction below, behind and above the unit.

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.

If the unit is to be operated in an enclosure such as an equipment cabinet, be certain that adequate air flow above and below the unit is provided. The "ambient" operating temperature should never exceed 120°F or 49°C. Improper installation will cause premature component failure and will affect your warranty, as well as the service life of the unit.

It is normal for the D400 power amplifier to run "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, providing the requirements outlined above are adhered to.

CONNECTION INSTRUCTIONS

The rear panel has:

- 2 - RCA input connectors, normal phase, L&R
- 2 - RCA input connectors, inverted phase, L&R
- 2 - XLR input connectors, for differential ("balanced") connection

- 4 - output binding posts, (+) and (-), L&R

- 1 - AC power line fuseholder

- 1 - AC power line cord

IMPORTANT: Use the best available speaker wires and interconnects. As your system improves in resolution from the addition of quality components, it becomes increasingly important to avoid the limitations of inferior system interconnections. We recommend Audio Research LitzLink® interconnects and LitzLine® speaker cables.

It is important sonically that your entire system be connected so that the audio signal arriving at the speakers has correct absolute polarity or phase (i.e. is not inverted). Connect the black or (-) speaker terminal to the wire that connects to the appropriate-channel (-) gold binding post on the D240. Connect the red or (+) speaker terminal to the wire that connects to the appropriate-channel (+) binding post on the D400. Tighten the binding posts firmly to assure good contact and best sonic results.

For "bi-wired" loudspeaker systems (i.e. running separate wires to bass and treble speaker terminals), simply repeat the above instructions, taking care that all connections have the same (+) or (-) polarity.

AC POWER CONNECTIONS. It is essential that the D400 amplifier be connected to a wall AC power receptacle, or a similar heavy-duty source. If it is connected to convenience receptacles on preamplifiers, etc., the full sonic capabilities of both the D400 and the preamplifier will be compromised. Furthermore, the proper control of start-up and shut-down surges may not occur unless the power switch on the front of the D400 is actually used for on/off control of the amplifier. The AC power source for the D400 amplifier should be capable of supplying 15 amperes for 100 or 120 volt units, or 10 amperes for 220 or 240 volt units.

For the very best performance on domestic 100 or 120 volt circuits, the D400 should be connected to its own AC power circuit branch protected by a 20 amp breaker. The preamplifier and other audio equipment should be connected to a different power circuit and breaker. If the power receptacle of the D400 is more than 25 feet from the building power entrance and breaker box, it would be preferable to use installed wiring capable of 30 amperes to minimize voltage drop, using a 15 amp breaker. Avoid the use of extension cords. If they must be used on a temporary basis, use 14-gauge or heavier cords.

The D400 utilizes a compatible grounding system that generally does not require a "ground lifter" adapter plug on the AC power cord to minimize hum. The power cord on your D400 has a standard three-prong grounding plug to provide maximum safety when it is connected to a ground wall receptacle. If there is any question regarding the safety of grounding procedures, be certain to seek competent help with the installation.

If electronic crossovers or other AC powered equipment are used with the D400 it may be necessary to use "ground lifter" adapters on the power plugs of that equipment to minimize system hum. Generally, the lowest hum is achieved when the only direct connection between audio common "ground" and true earth ground occurs in the preamplifier, through its grounded power cord. Other equipment in the system should have some form of isolation to prevent ground loops and associated hum.

Always release the power on-off switch on the front of the D400 to the protruding "Off" position before connecting the power line cord to AC power.

UNBALANCED ("SINGLE-ENDED" OR "NORMAL") OPERATION

"Normal" inputs should be used with a preamplifier (or electronic crossover, etc) which does not invert overall phase or polarity. When using the "Normal" inputs, make sure that the RCA-type "shorting plugs" are inserted into the "Invert" inputs.

"Invert" inputs should be used with a preamp or crossover which inverts overall phase or polarity. In this case, make sure the shorting plugs are inserted into the "Normal" inputs.

BALANCED OPERATION

"XLR" inputs can be used with a preamplifier (or electronic crossover, etc.) having XLR ("balanced") outputs. Note: The RCA shorting plugs should not be inserted when using the XLR inputs.

For use with older Audio Research SP15 Preamplifiers: When using the "XLR" balanced outputs (only) from the SP15 to the D400, the absolute phase of the speaker cable leads should be reversed (i.e., the (+) leads should be connected to the (-) leads, at either the D400's or the speaker's binding posts). Check with your Audio Research Dealer.

"RCA" balanced mode of operation: The D400 can be driven in balanced mode by using both Normal and Invert pairs of RCA inputs if the preamp or crossover has both inverted and normal RCA outputs. If this mode of operation is desired, you must run two sets of interconnect cables from the preamplifier to the D400 -- one set of interconnects between the normal (non-inverting) outputs of the preamplifier and the "Normal" inputs of the D400; and another set of interconnects between the inverted output of the preamplifier and the "Invert" inputs of the D400.

It is important to use identical interconnect cables in this operational mode to maintain coherent sonic performance. Also take care to preserve correct phase or polarity at each connection.

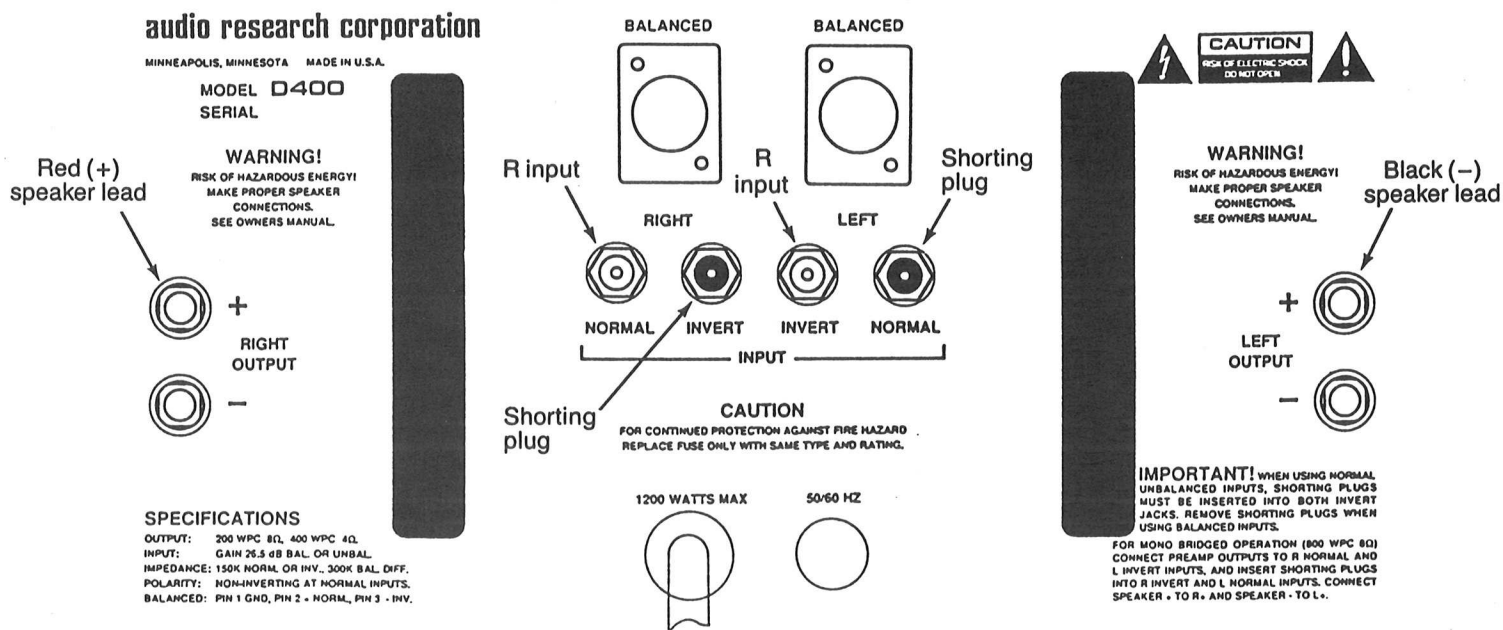
BRIDGED OPERATION

Bridging an amplifier simply means that both channels are combined to make a single "mono" channel, with a large increase in power output. When bridged, the D400 has a power output of 800 watts into 8 ohms. There are two basic methods of bridging the D400; both are described below.

Unbalanced or Normal Bridged Operation

- 1) Connect the preamplifier's right-channel output to the right-channel "Normal" input of the D400.
- 2) Connect the preamplifier's second right-channel output to the left-channel "Invert" input of the D400. (Note: if the preamp has only a single set of outputs, a "Y" connector may be used, although this will diminish performance).
- 3) Insert one RCA shorting plug into the right-channel "Invert" input; insert another shorting plug into the left-channel "Normal" input.
- 4) Connect the red (+) speaker cable lead to the right-channel positive (+) speaker terminal binding post of the D400.
- 5) Connect the black (-) speaker cable lead to the left-channel positive (+) speaker terminal binding post of the D400.
- 6) Repeat 1) through 5) as above, using the preamplifier's left-channel outputs for connection to the second D400 being used for the other channel.

NORMAL BRIDGED OPERATION



- 1) Connect one of the preamplifier's XLR outputs to the right-channel XLR input of the D400.
- 2) Connect a short interconnect from the right-channel "Normal" input to the left-channel "Invert" input of the D400.
- 3) Connect a short interconnect from the right-channel "Invert" input of the D400 to the left-channel "Normal" input of the D400.
- 4) Connect the red (+) speaker cable lead to the right channel positive (+) speaker terminal binding post of the D400.
- 5) Connect the black (-) speaker cable lead to the left-channel positive (+) speaker terminal binding post of the D400.
- 6) Repeat 1) through 5) as above, using the preamplifier's second XLR output for connection to the second (bridged) D400 being used for the other channel.

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OPERATING PROCEDURE

1. Make sure you have read and complied with the INSTALLATION AND CONNECTION instructions prior to attempting operation.
2. Make sure the D400 is properly connected to a high-current (15 amps) AC power receptacle via the attached power cord (see CONNECTIONS).
3. Your preamplifier should be "On" and muted and/or set at minimum gain.
4. Depress the spring-loaded Power switch to initiate operation; you will see the amber "Protect" LED immediately illuminate, then extinguish as the green "Operate" LED comes on. If both LEDs fail to illuminate, disengage the Power switch and check the power line fuseholder on the rear of the chassis for possible failure. An extra fuse is packed with your D400.
5. Your D400 should now operate satisfactorily. It may be played immediately, although best sonic performance will in most cases not be achieved for an hour or so (see INSTALLATION for further details).

POWER-OFF PROCEDURE

1. Mute your preamplifier or set gain at minimum.
2. Depress the D400 Power switch to disengage from "Operate." The D400 mutes itself at shut-off, so you should normally hear no "thumps" or "whistles" as you terminate AC power. The green "Operate" LED will extinguish.
3. Turn off your preamp and other "front-end" system components (turntables, FM tuner, CD player or digital processor).

START-UP FOLLOWING "PROTECT" SHUTDOWN

The D400 amplifier uses a sophisticated, non-fused sensing circuit to protect the amplifier from DC at the input, from thermal overload, and from shorting conditions at the output (e.g. defective speaker leads, etc.). This circuit also helps prevent damage to your loudspeakers.

When the amplifier senses a fault condition, it will automatically shut off any output from the amplifier, and indicate this condition by illumination of the amber "Protect" LED; the green "Operate" LED will simultaneously extinguish. If the fault condition is only momentary in nature, the amplifier will automatically resume normal operation (and output) after a few seconds. This sequence will also occur (with perhaps longer duration) in the event of severe power "brown-out" or "black-out" conditions, or after thermal overload.

If the fault condition persists and the amplifier does not resume normal operation, manually shut off the amplifier via the front-panel switch, wait 60 seconds, then power the amplifier on again. If the amplifier still fails to resume normal operation, shut the amplifier off once again and wait five (5) minutes or more before attempting to resume operation. (This allows a large resistor

to cool down sufficiently to allow the amplifier to come out of the "Protection" mode.)

If the amplifier fails to resume normal operation after an intervening "cooldown" period, contact your authorized dealer for further assistance.

SERVICING

Because of its careful design and exacting standards of manufacture, your D400 amplifier should normally require only minimal service to maintain its high level of performance.

CAUTION: The D400 amplifier contains sufficient levels of voltage and current to be lethal. Do not tamper with a component or part inside the unit. Even with the power turned off, a charge remains in the energy storage capacitors for some time. Refer any needed service to your authorized Audio Research dealer or other qualified technician.

Additional questions regarding the operation, maintenance or servicing of your D400 amplifier may be referred to the Customer Service Department of Audio Research Corporation: 612/566-7570.

CLEANING

To maintain the visual appearance of your D400 amplifier, occasionally wipe the front panel and top cover surfaces with a soft, damp (not wet) cloth to remove dust. A mild, non-alkaline soap solution may be used to remove fingerprints or similar smudges. Cleaners containing abrasives should not be used as they will damage the "brushed" grain of the front panel finish.

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.

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PRELIMINARY D400 SPECIFICATIONS (AC line set @120V 60Hz for these specifications)

Power Output:

200 Watts per channel into 8 ohms
400 Watts per channel into 4 ohms (Low level bandwidth (-3dB points) .01Hz to 160kHz)

Bandwidth:

Power: (-3dB points) 4 Hz to 100kHz Low Level: (-3dB points) .01Hz to 160kHz

Peak Output Current:

60 Amp Peak into 1 ohm

Input Sensitivity:

1.91V RMS for rated output (26.4 dB Gain) unbalanced or balanced

Input Impedance:

150K ohms normal or invert, 300K ohms balanced differential

Input Polarity:

Non-inverting at normal inputs. Balanced pin 2+

Output Regulation:

0.06dB 8 ohm load to open circuit
(Damping factor 150)

Negative Feedback:

9.3dB

Slew Rate:

50 volts/microsecond

Rise Time:

1.0 microseconds

Hum & Noise:

Less than 150 microvolts RMS (106dB below rated output IHF A-weighted)

Power Supply Capacitance:

270,000 uF

Power Requirements:

105-125VAC 60Hz (210-250VAC 50Hz) 760 watts at rated output (200WPC 8 ohms)
1200 watts maximum (400WPC 4 ohms), 220 watts idle

Dimensions:

19" (48 cm) W (standard rack panel) x 9" (22.8 cm) (8 3/4" (22.2 cm) panel + 1/4" feet (.6 cm) H x 17 3/4" (45.0 cm) D (front panel back). Handles extend 1 5/8" (4.1 cm) forward of the front panel. Handles extend 1 5/8" (4.1 cm) behind rear panel

Weight:

73 lbs. (33.2 kg) Net; 90 lbs. (41.0 kg) Shipping