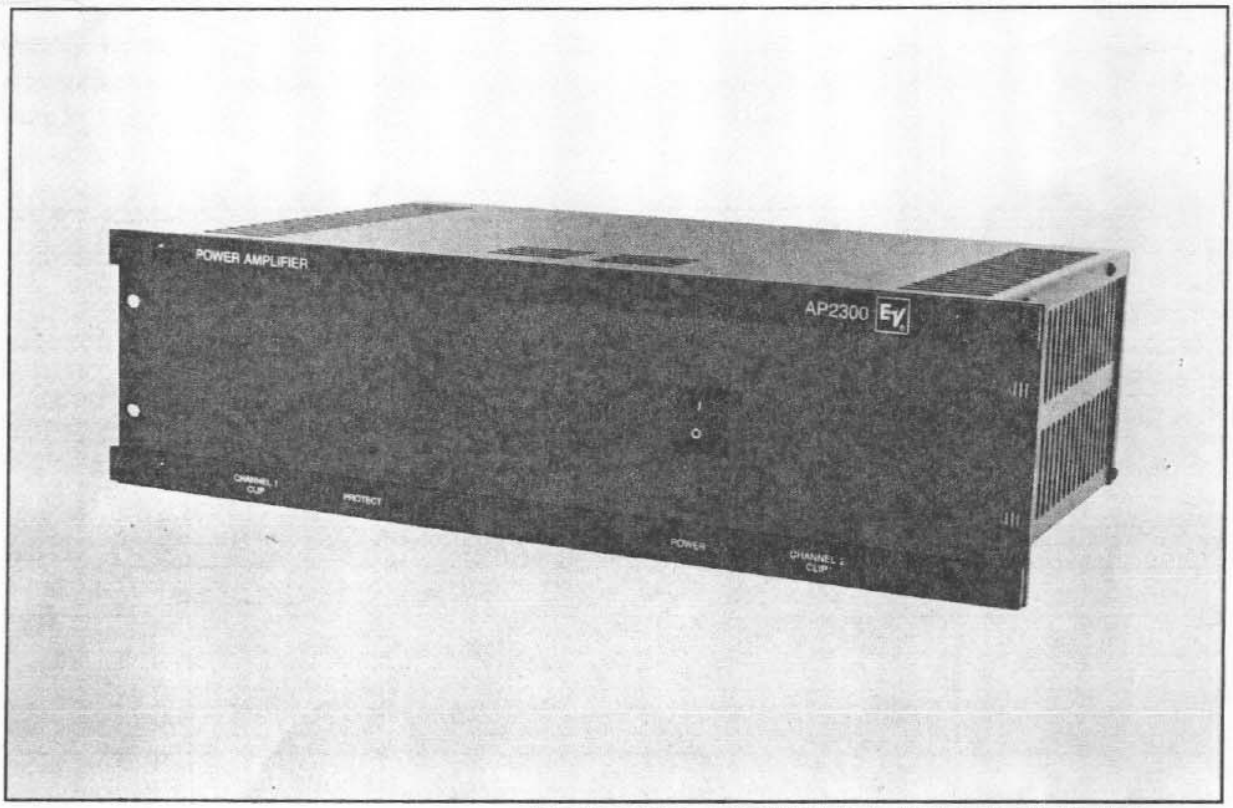
Electro-Voice®
POWER AMPLIFIERS

OWNER'S MANUAL



AP2300 POWER AMPLIFIER

MASTER COPY

AP2300SA POWER AMPLIFIER WITH STEPPED ATTENUATORS

TABLE OF CONTENTS

WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE.

FEATURES

- The amplifier's two channels can operate independently of each other, or may be bridged into an 8-ohm load.
- Differential inputs can be made to either an XLR-type connector or a terminal barrier strip.
- Octal sockets permit a variety of plug-in accessories to be used with the amplifier.
- Front panel LED's show when the power is on, the output signal is clipping, and the amplifier is in the protection mode.
- Input levels are controlled independently for each channel.
- Primary voltage may be configured to run on 100, 120, 200, 220 or 240 volts.
- Stepped input attenuators (AP2300SA) and continuously variable attenuators (AP2300) are available.
- Convection cooling is used for quiet operation.
- Inputs are electronically balanced (optional APM-1 plug-in transformer available).
- Level controls are located on the back panel to prevent "accidental" changes.

DESCRIPTION

The AP2300 is a dual-channel power amplifier for professional sound reinforcement.

The AP2300SA features stepped attenuators that are calibrated in 1-dB steps from 0 to 20 dB attenuation, 2-dB steps from 20 to 30 dB attenuation and 3-dB steps for attenuation beyond 30 dB. The AP2300 uses continuously variable attenuators. The two units are identical in all other respects.

Each channel can deliver 100 watts of power into an 8-ohm load or 150 watts into a 4-ohm load over the full audio frequency range. In bridge mode, the amplifier will deliver more than 300 watts into an 8-ohm load at less than 0.10% THD.

Input attenuators are located on the rear panel. Clip and protect LED indicators are located on the front panel. Efficient heat sinking and self-contained forced-air cooling enhance the reliability of the unit.

Each channel is independently protected against

- Overtemperature
- Excessive output voltage
- Excessive phase shift
- Radio-frequency interference
- Shorted loads

The load is protected from turn-on and turn-off transients, infrasonic signals, low ac line voltage and dc. When a problem is detected, an output relay automatically disconnects the load from the amplifier's output and activates the protect LED on the front panel.

SPECIFICATIONS

CONDITIONS

1. 0 dBu = 0.775 V rms.
2. Dual-mode ratings are for each channel.
3. Both channels operating at rated output power unless noted.
4. 120-volt ac line voltage maintained throughout testing.

CONTINUOUS RATED OUTPUT POWER (20 Hz-20 kHz at less than 0.1% THD, 30-kHz measurement bandwidth)

Dual Mode, 4 Ω: 150 watts/channel
Bridge Mode, 8 Ω : 300 watts
Dual Mode, 8 Ω: 100 watts/channel
Bridge Mode, 16 Ω: 200 watts

MAXIMUM MIDBAND OUTPUT POWER (1 kHz, 1% THD)

Dual Mode, 4 Ω: 200 watts/channel
Bridge Mode, 8 Ω: 400 watts
Dual Mode, 8 Ω: 125 watts
Bridge Mode, 16 Ω: 250 watts

DYNAMIC HEADROOM (1 kHz, 1% THD, any mode)

≥1 dB

POWER BANDWIDTH (1 kHz, +0/−3 dBr where 0 dBr = rated output power in any mode)

10 Hz - 50 kHz

VOLTAGE GAIN REFERENCE (1 kHz)

Dual Mode, 4 or 8 Ω: 30 dB
Bridge Mode, 8 or 16 Ω: 36 dB

INPUT SENSITIVITY FOR RATED OUTPUT POWER (1 kHz)

Dual Mode, 4 Ω: 0 dBu (0.775 V rms)
Bridge Mode, 8 Ω: 0 dBu (0.775 V rms)
Dual Mode, 8 Ω: +1.2 dBu (0.890 V rms)
Bridge Mode, 16 Ω: +1.2 dBu (0.890 V rms)

MAXIMUM INPUT LEVEL (1 kHz)

+20 dBu (7.75 V rms)

INPUT IMPEDANCE (1 kHz)

Balanced: 15 kΩ
Unbalanced: 15 kΩ (non-inverting input)

PHASE RESPONSE (at rated output power, any mode)

20 Hz: < +25°
20 kHz: > −25°

THD (any mode, 30 kHz measurement bandwidth)

<0.1%

IMD (SMPTE 4:1, any mode)

<0.1%

TIM (DIM 100, any mode)

<0.1%

RISE TIME (10% to 90%, any mode)

<5 μsec

SLEW RATE

Dual Mode, 4 or 8 Ω: >18 V/μsec
Bridge Mode, 8 or 16 Ω: >36 V/μsec

DAMPING FACTOR (dual Mode, 8 Ω)

20 Hz - 1 kHz: >200
20 kHz: >80

CROSSTALK (1 kHz, 0 dBr = rated output power into 8 Ω, single channel operating)

>75 dBr

NOISE (below rated output power, A-weighting filter, any mode, 50/60-Hz line frequency)

>100 dB

AMPLIFIER PROTECTION

Excessive output voltage
Shorted outputs
Excessive phase shift
Radio-frequency interference
Overtemperature

LOAD PROTECTION

Startup/shutdown transients
dc faults
Infrasonic signals
Low ac line voltage

COOLING

Convection

OUTPUT TOPOLOGY

True complementary symmetry

OUTPUT TYPE

Dual Mode: Unbalanced, each channel
Bridge Mode: Balanced

OUTPUT DEVICES

Total number: 8 devices (both channels)
P_{dmax} rating: 150 watts
V_{ceo}: 200 volts dc
I_c: 15 A dc
T_{jmax}: 150 °C (302 °F)

SPECIFICATIONS

CONTROLS AND SWITCHES

Two continuously variable input attenuators (AP2300) or two stepped attenuators (AP2300SA), rear
Bridge mode switch, rear
Power switch, front

STEPPED ATTENUATOR STEP SIZES

(AP2300SA only, from full clockwise position)

Click Position

1 - 20:	1-dB steps (20 dB attenuation at 20)
20 - 25:	2-dB steps (30 dB attenuation at 25)
25 - 26:	3-dB step (33 dB attenuation at 26)
26 - 27:	4-dB step (37 dB attenuation at 27)
27 - 28:	4-dB step (41 dB attenuation at 28)
28 - 29:	4-dB step (45 dB attenuation at 29)
29 - 30:	5-dB step (50 dB attenuation at 30)
30 - 31:	off (-∞ at 31)

FRONT-PANEL INDICATORS

Power LED
Clip LED's (two), one per channel
Protect LED

CONNECTIONS

Input: 6-terminal barrier strip, female XLR-type connectors (two), octal accessory sockets (two), with ±15 volts dc power
Output: 4-terminal barrier strip
Power: 3-terminal IEC ac line receptacle

POWER REQUIREMENTS

100, 120, 200, 220, 240 V ac, 50/60 Hz, 560 watts (at 120 V ac)

POWER CONSUMPTION/HEAT PRODUCED

(both channels operating in dual mode with 1 kHz input signal at stated output power into 4 Ω loads)

One-Third Midband Power: 560 watts/1.48 kBTU/hr
Rated Power: 750 watts/1.54 kBTU/hr
Maximum Midband Power: 850 watts/1.56 kBTU/hr

OPERATING TEMPERATURE RANGE

Up to 60 °C (140 °F) ambient

DIMENSIONS

Height: 13.3 cm (5-1/4 in.)
Width: 48.3 cm (19 in.)
Depth: 27.9 cm (11 in.)

COLOR

Black

ENCLOSURE

Rack-mount chassis, 16-GA steel bottom/sides, 18-gauge steel top/back, 3/16-inch 6061-T6 aluminum front panel

SHIPPING WEIGHT

21.8 kg (48 lb)

NET WEIGHT

17.7 kg (39 lb)

SUPPLIED ITEMS

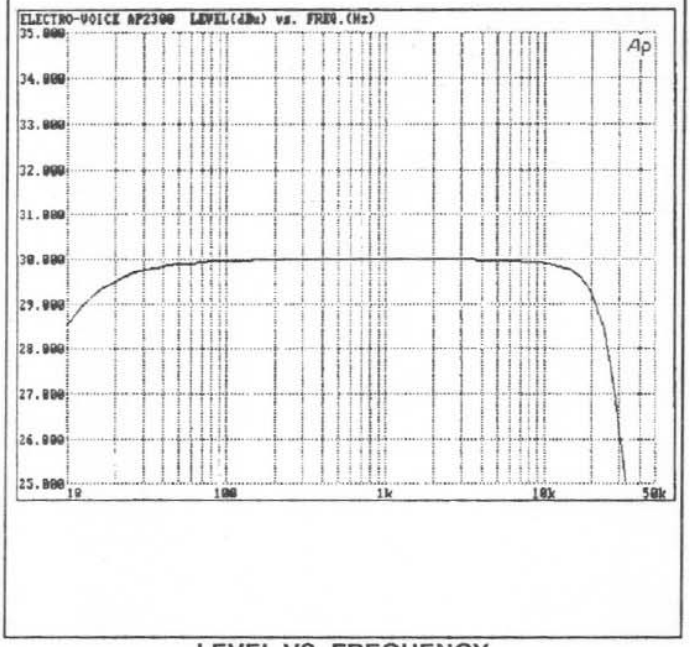
Four "U" jumper plugs for octal sockets (two per socket installed)
One owner's manual
One detachable power cord with three-prong male plug

OPTIONAL INPUT ACCESSORIES

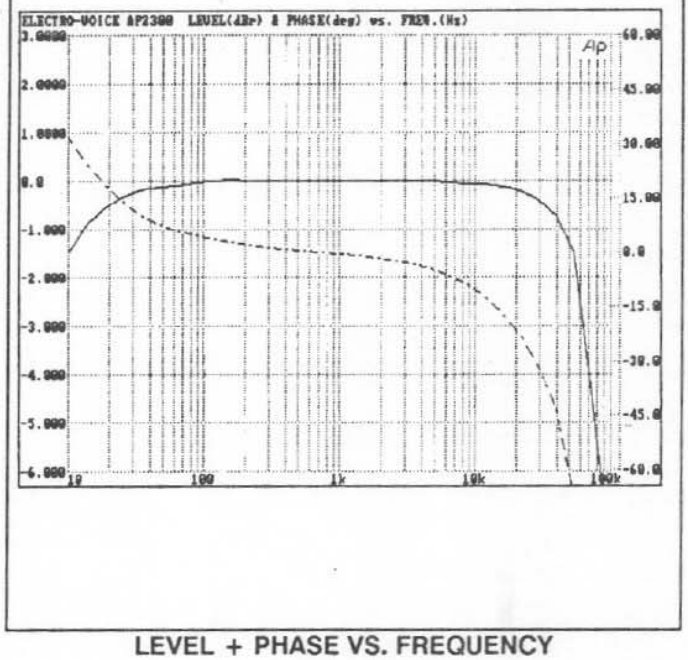
Model	Description
APM-1	15-kΩ bridging input transformer with fixed pad options
APL-125 APL-500 APL-800 APL-1250	3rd-order Butterworth (18 dB per octave) low-pass filters at indicated corner frequencies
APH-125 APH-315 APH-500 APH-800 APH-1250	3rd-order Butterworth (18 dB per octave) high-pass filters at indicated corner frequencies
APX	4th-order Linkwitz-Riley (24 dB per octave) crossover filter with 24 switch-selectable frequencies on ISO 1/3-octave centers from 50 Hz to 10kHz

OPTIONAL OUTPUT ACCESSORIES

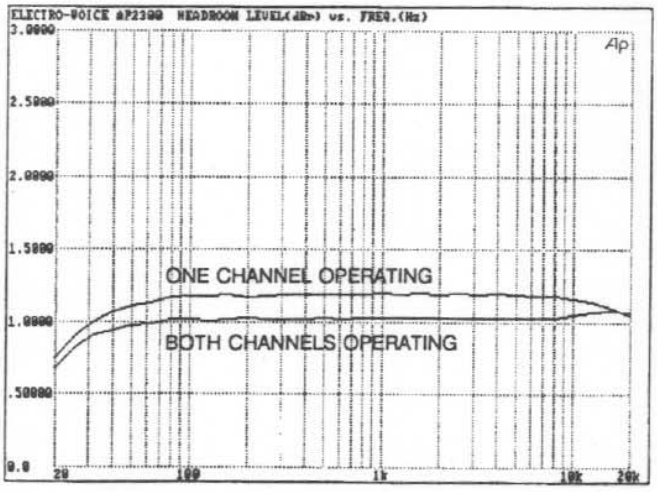
Model	Description
AT100	100-watt autoformer with 4-, 8-16-, 50-, 70.7- and 100- Ω taps
AT300	300-watt autoformer with 2.67-, 4-, 5.33-, 8- and 16- Ω taps
TR150	150-watt, 70.7-volt transformer
TR300	300-watt, 70.7-volt transformer



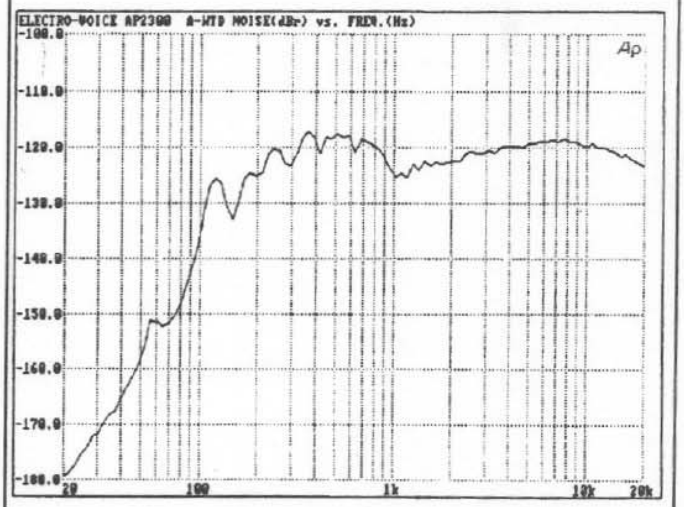
LEVEL VS. FREQUENCY



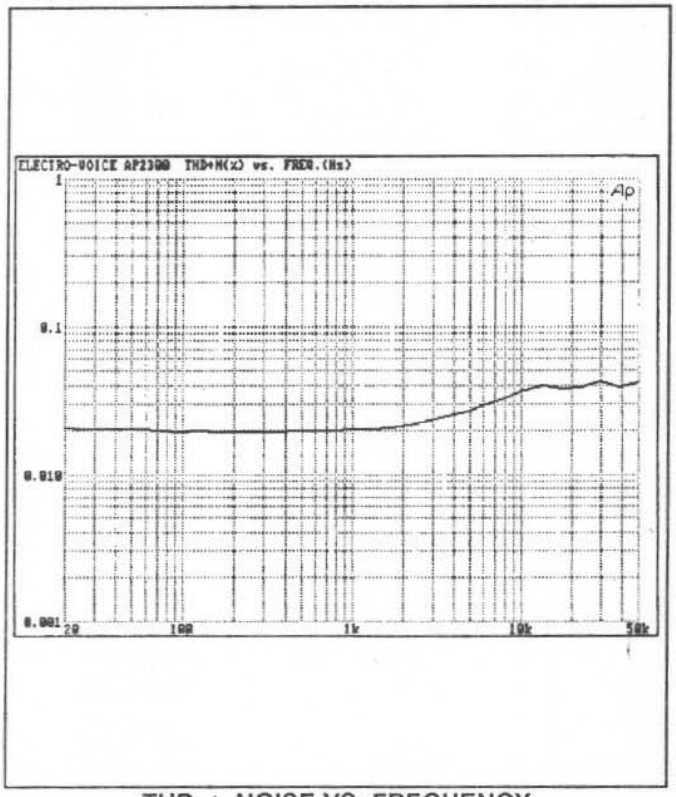
LEVEL + PHASE VS. FREQUENCY



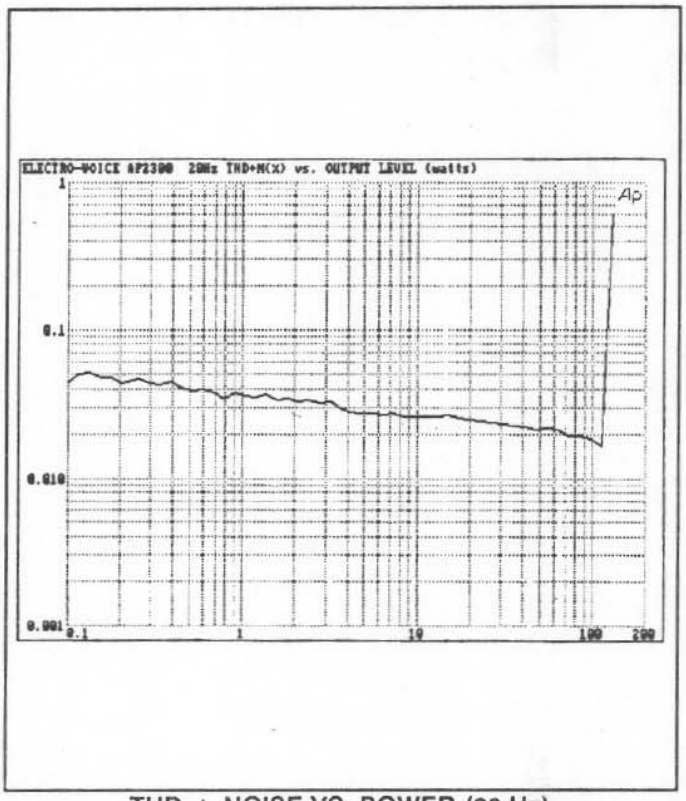
HEADROOM VS. FREQUENCY



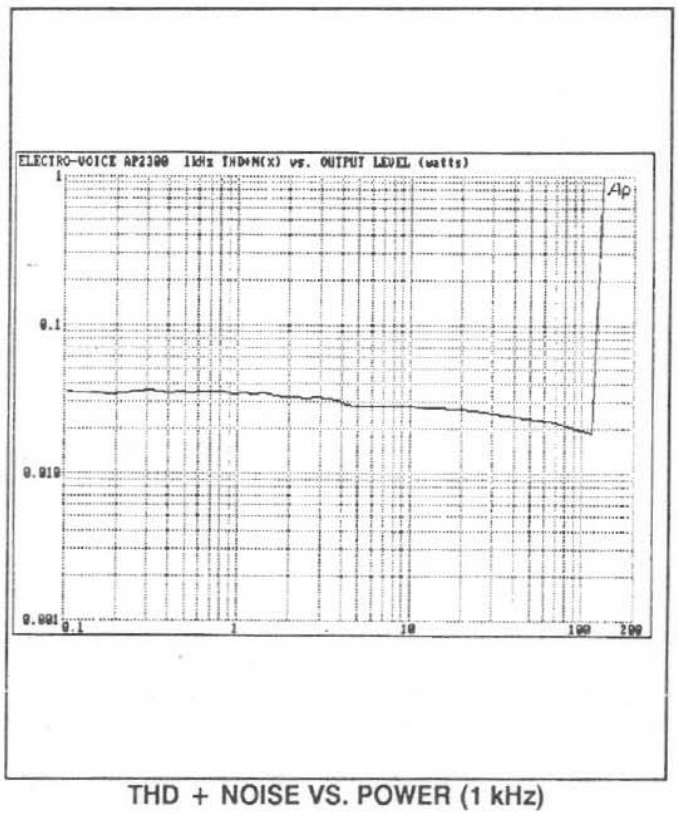
NOISE VS. FREQUENCY



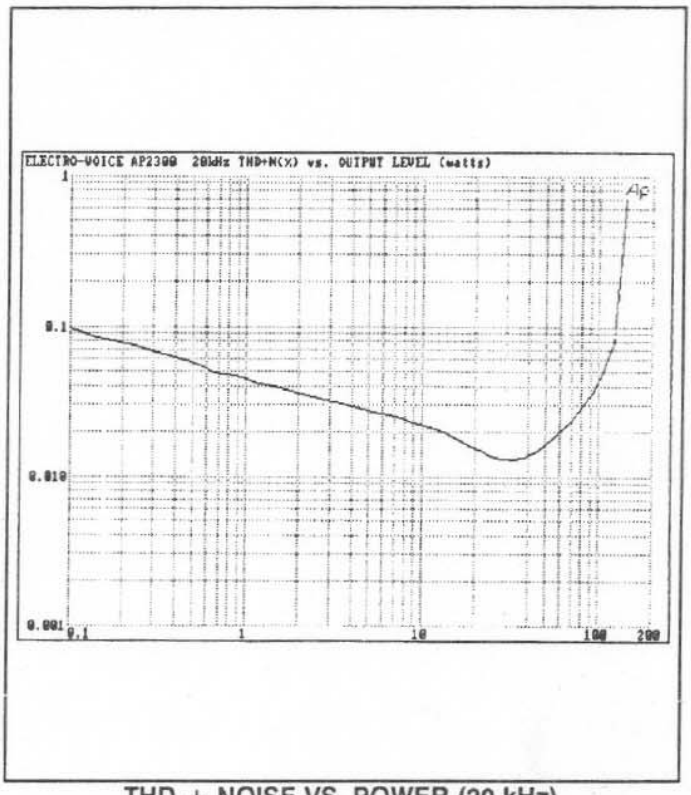
THD + NOISE VS. FREQUENCY



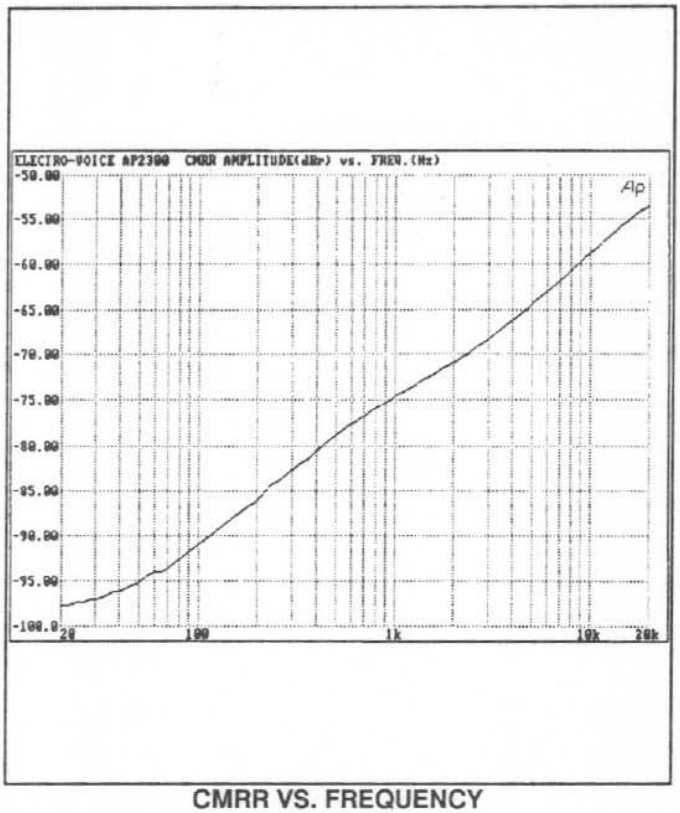
THD + NOISE VS. POWER (20 Hz)



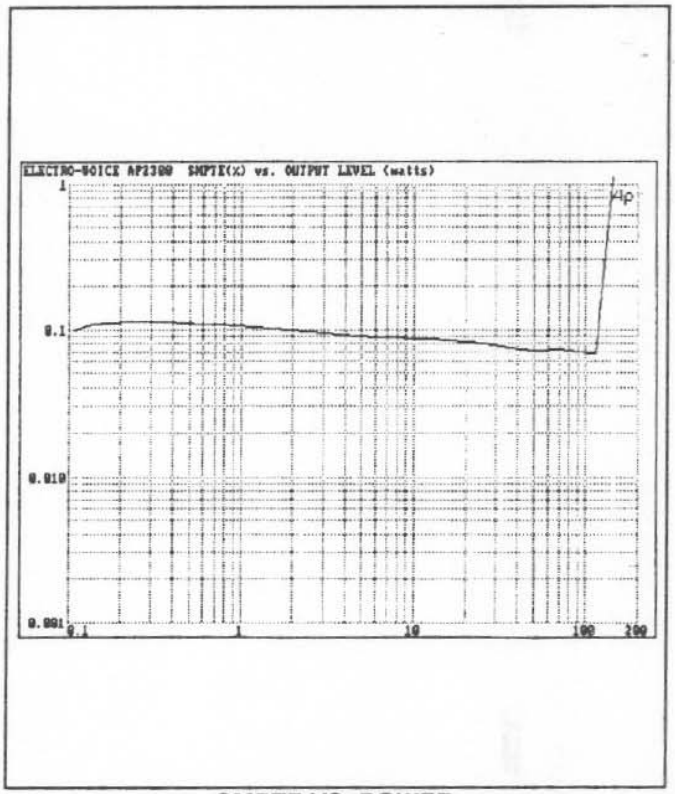
THD + NOISE VS. POWER (1 kHz)



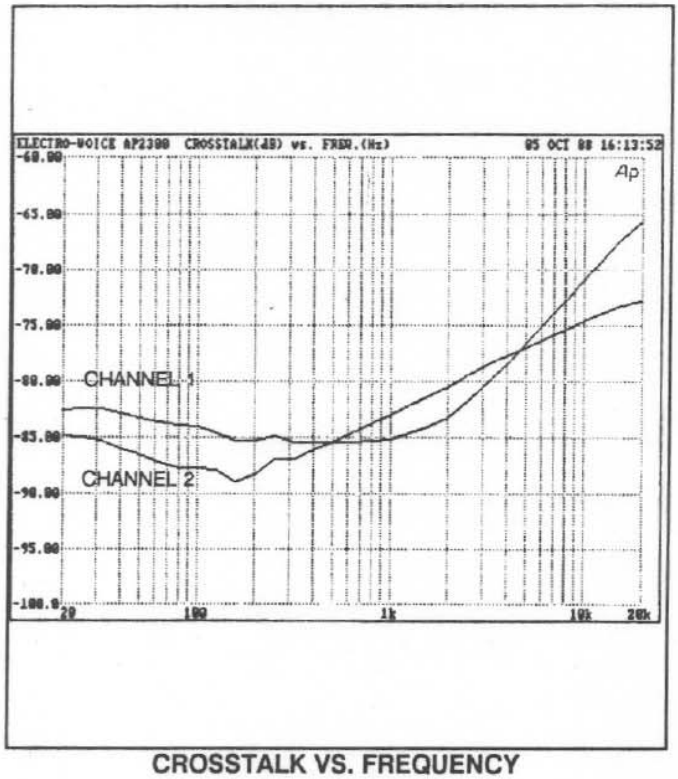
THD + NOISE VS. POWER (20 kHz)



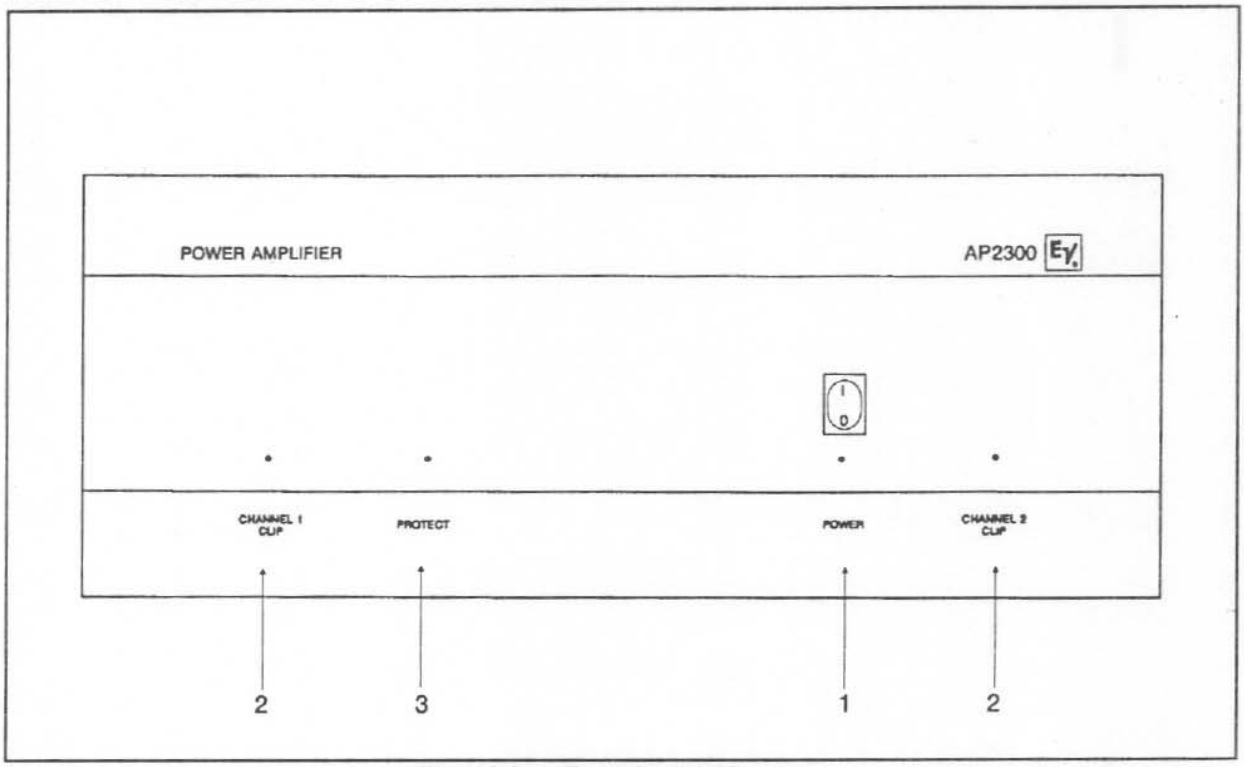
CMRR VS. FREQUENCY



SMPTE VS. POWER



CROSSTALK VS. FREQUENCY



Pictorial 1 - Front Panel Diagram

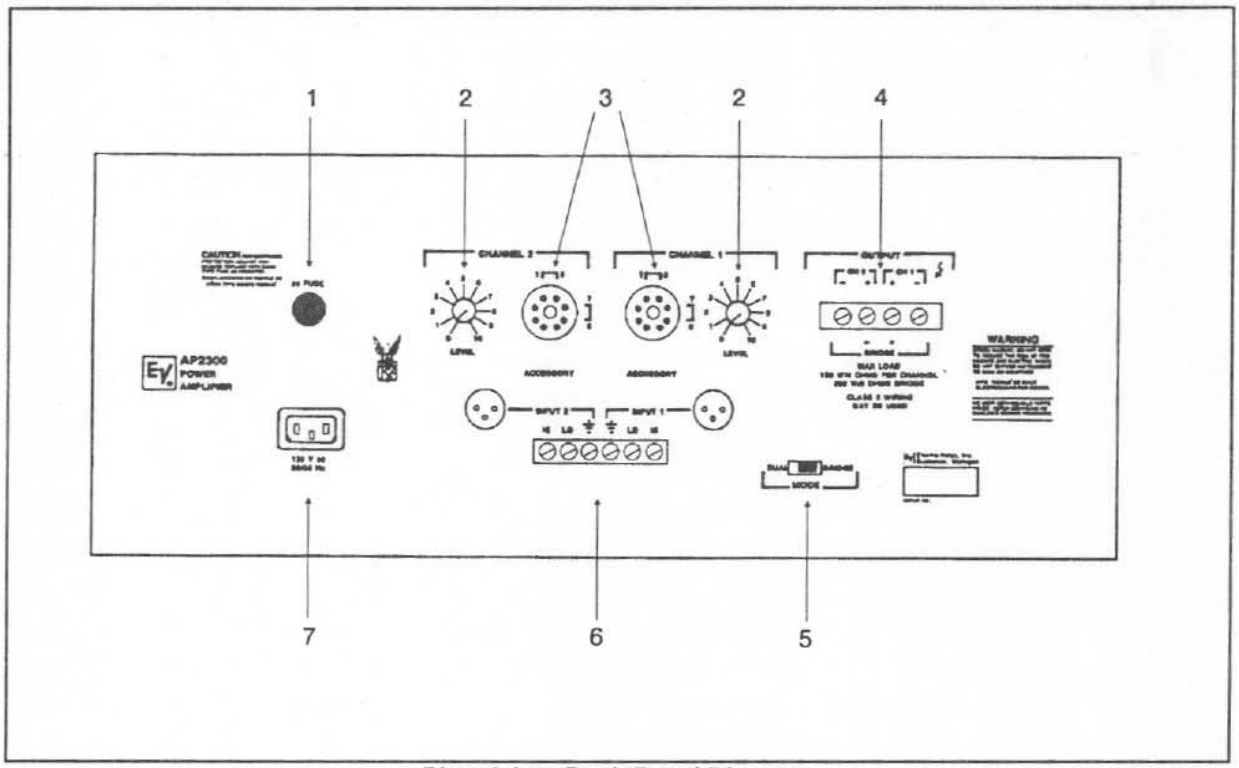
OPERATION

FRONT PANEL INDICATORS (refer to Pictorial 1).

1. POWER INDICATOR : This LED is located directly below the power switch and lights when the unit is on.

2.CLIP INDICATORS: These LED's will light when the peak value of the output signal approaches the dc operating rail.

3.PROTECT INDICATOR: This LED will light when the amplifier has detected a fault condition and is in the protect mode.



Pictorial 2 - Back Panel Diagram

OPERATION

BACK PANEL CONNECTIONS AND CONTROLS (refer to Pictorial 2).

1. AC FUSE RECEPTACLE: This holder requires either a 5-A, 250-V Normal-Blo fuse (for 100/120-V ac operation), or a 2.5-A, 250-V Normal-Blo fuse (for 200/220/240-V ac operation).

2. INPUT ATTENUATORS: These controls adjust the input levels for both channels.

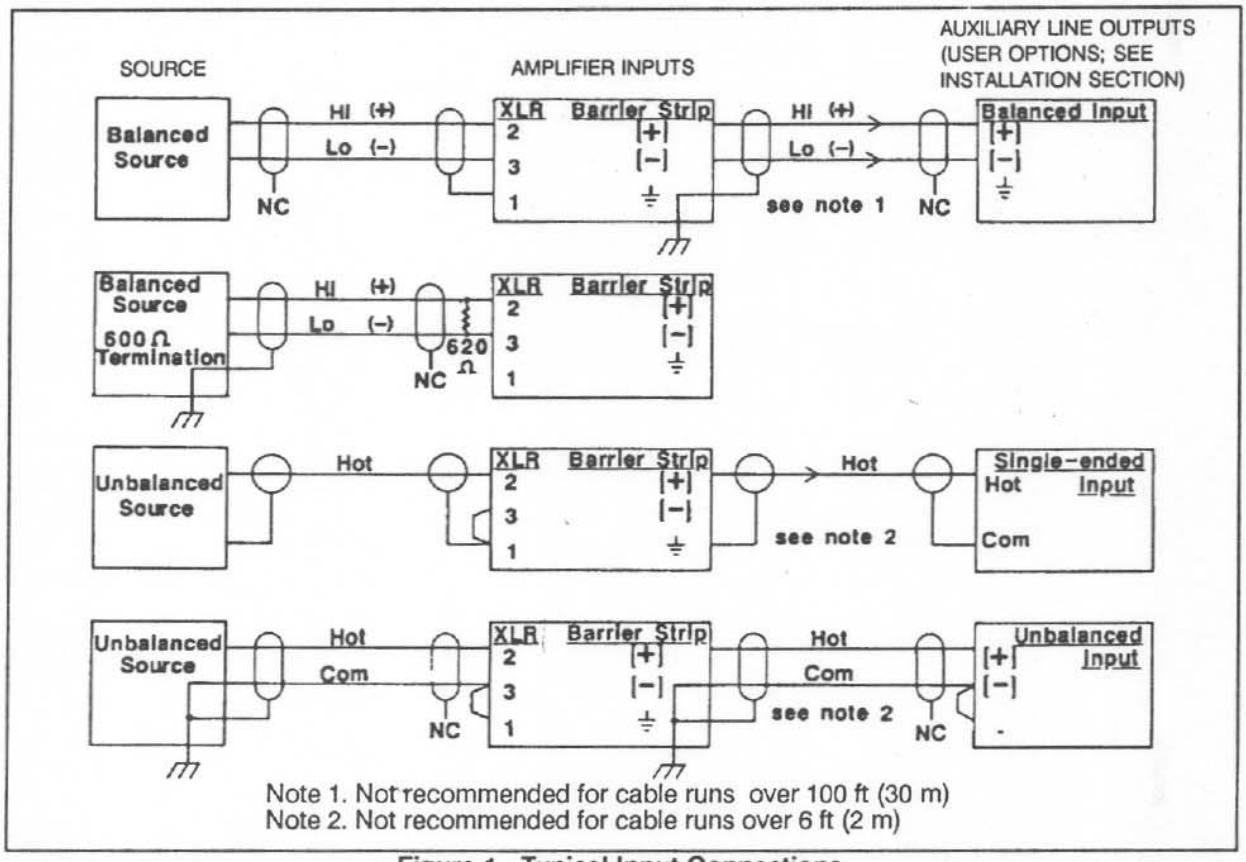
3. ACCESSORY SOCKETS: These octal sockets allow the use of several accessories. See the SPECIFICATIONS section, page 3, for a listing of all compatible accessories.

4. CHANNEL OUTPUT CONNECTIONS: This terminal strip is for speaker connections, either in the dual or bridge mode.

5. MODE SWITCH: This switch enables either the dual or bridge mode of operation.

6. CHANNEL INPUT CONNECTIONS: Differential input connections can be made to either the terminal strip or the XLR-type connectors.

7. POWER CORD RECEPTACLE: This receptacle is for the supplied three-prong male power cord.



Note 1. Not recommended for cable runs over 100 ft (30 m)
Note 2. Not recommended for cable runs over 6 ft (2 m)

Figure 1 - Typical Input Connections

INSTALLATION

Amplifier Input Connections

Differential input connections are made to either the terminal strip or the XLR-type connector. The channel input connectors are wired in parallel. Pin 2 of the XLR-type connector is (+), pin 3 is (−),and pin 1 is ground. The polarity of the terminal is marked on the barrier strip. Tie the low (−) side of the signal to ground when using an unbalanced line. See the left half of Figure 1 for typical input connections.

Auxiliary Line Output Connections

The XLR-type and terminal barrier strip connectors are wired in parallel. Since the input impedance of the amplifier is high, there is minimal loading on the signal source. Thus, when input connections are made to one connector, the other may be used as an auxiliary line output to feed other high-input-impedance equipment. See the right half of Figure 1 of possible applications.

Speaker Output Connections

Termination of the speaker line(s) is made to the 4-terminal barrier strip. The polarity for each channel is marked, as is proper speaker termination for bridged operation. See Figure 2, page 10, for typical output configurations. See the following sections for suggestions on choosing protection fuses and capacitors.

Before making output connections, the input attenuators should be turned off (full counterclockwise). This will eliminate any chance of damage to the loudspeaker.

Speaker cables of sufficient gauge for the length used are important. Cables that are too small result in a lower damping factor and power loss due to cable resistance. The nomograph in Figure 3, page 10, will aid in selection of the proper gauge cable. To use the graph see the following instructions.

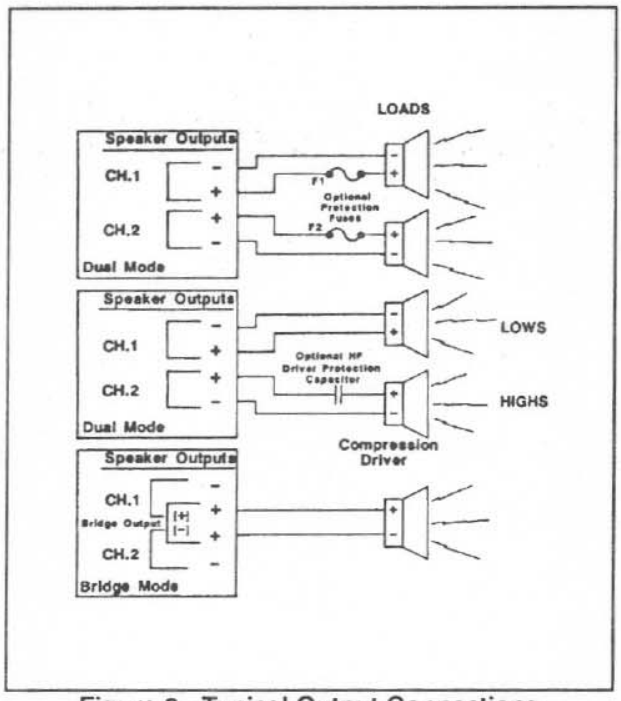


Figure 2 - Typical Output Connections

1. Note the load resistance of the speakers connected to each channel of the amplifier. Mark this value on the nomograph Load Resistance line.

2. Choose an acceptable system damping factor (50 is typical). Mark this value on the Damping Factor line.

3. Draw a pencil line through those two points, intersecting the Source Resistance line.

4. Mark the length of the cable run on the 2-Cond. Cable line.

5. Draw a pencil line from the intersection point on the Source Resistance line through the mark on the 2-Cond. Cable line.

6. Note where this pencil line intersects the Annealed Copper Wire line. This value is the required gauge of the speaker cable.

7. If the size of the cable is unacceptable, settle for a lower damping factor and try again.

Speaker Protection Fuse Selection

Sometimes it is desirable to use in-line fuses to protect loudspeaker systems. It is difficult to determine the proper fuse value with the correct time lag and overload characteristics to match the limitations of a given speaker system. The values shown in Table 1, page 11, should serve as a guide only. To use, determine the power rating and load value. Select a

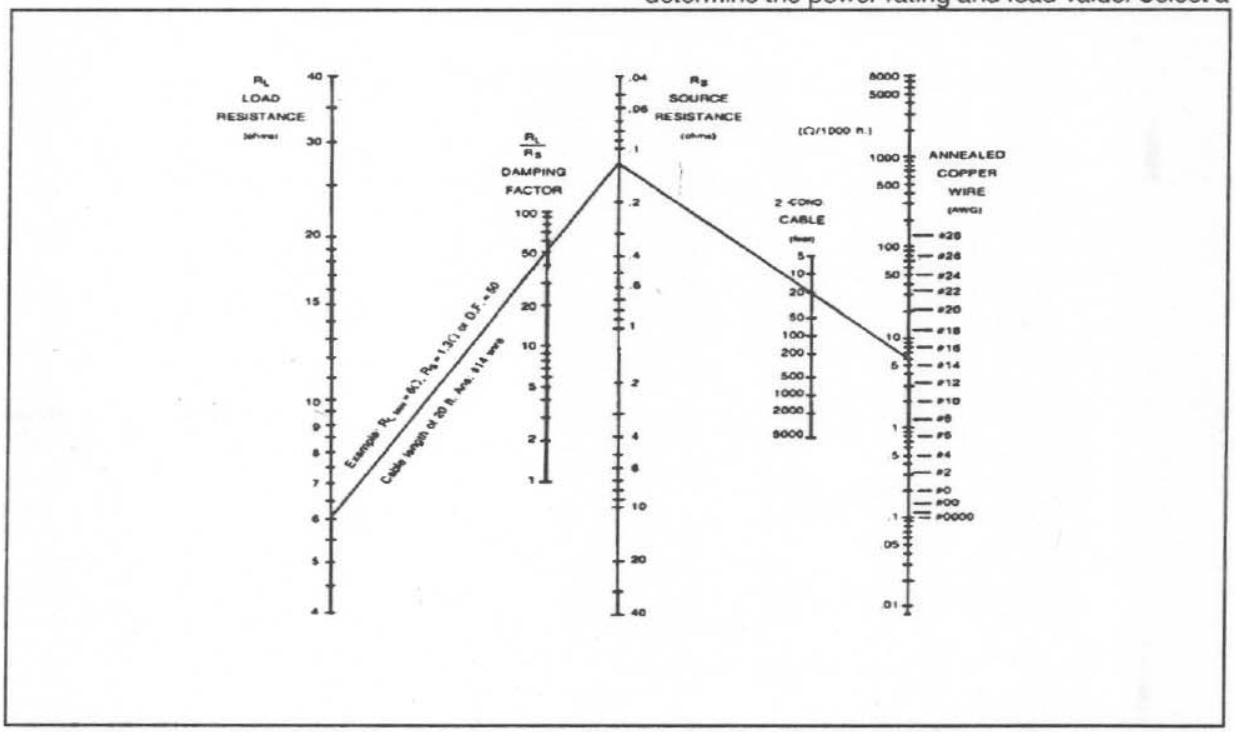


Figure 3 - Source Resistance and Damping Factor vs. Length and Size of Output Leads

standard value fuse of the next smaller value to the one in the table.

FUSE VALUES			
POWER	4-Ω LOAD	8-Ω LOAD	16-Ω LOAD
50 W	2.62 A	1.85 A	1.31 A
100 W	3.70 A	2.61 A	1.85 A
200 W	5.24 A	3.70 A	2.62 A
300 W	6.42 A	4.54 A	3.21 A
400 W	7.41 A	5.24 A	3.70 A

Table 1 - Calculated Speaker Protection Fuse Values

The values are calculated for fast-blow fuses which will carry 135% of their current rating for an hour but will blow within one second at 200%. Other fuse values may be calculated for different power levels from the following equation:

$$\text{Fuse value (amperes)} = \frac{P_{out} \times R_L}{R_L \times 1.35}$$

where R_L is the load impedance and P_{out} is the power rating.

Use 32-volt fuses if possible. They typically have the lowest internal resistance which will minimize deterioration of the amplifier's damping factor. Refer to Figure 2, page 10, for additional information.

Compression Driver Protection

Compression drivers, used for middle- and high-frequency sound reproduction, are much more susceptible to damage from low frequencies than large cone loudspeakers. Even though an electronic crossover may be employed, problems may arise in the cables between the crossover and the power amplifier, or from misadjustment of the crossover. Either of these could apply low-frequency signals or hum to the driver and cause damage. To prevent a potential mishap, it is recommended that a capacitor be used between the amplifier and the compression driver to suppress low frequencies and possible dc. Refer to Figure 2, page 10, for installation details.

In choosing a value, be careful not to interfere with the crossover frequency. As a general rule, select a capacitor whose break frequency, with respect to the load, is 3 dB down at approximately one-half of the high-pass corner frequency of the crossover. Mylar capacitors of at least 50 volts (preferably 100 volts) are recommended, but electrolytics are usable if they are nonpolar. Table 2 shows the recommended capacitor values for use with 8- and 16-ohm drivers at popular crossover frequencies.

CAPACITOR VALUES		
CROSSOVER FREQUENCY	8-Ω DRIVERS	16-Ω DRIVERS
500 Hz	80 μF	40 μF
800 Hz	50 μF	25 μF
1000 Hz	40 μF	20 μF
1200 Hz	33 μF	16 μF
2000 Hz	20 μF	10 μF
3500 Hz	12 μF	6 μF
7000 Hz	6 μF	3 μF

Table 2 - Compression-Driver Protection Capacitors

Modes of Operation

Dual Channel: In this mode, the amplifier's two channels operate independently of one another. Channel one's output is controlled by the channel one input attenuator. The same is true for channel two's output. The mode switch must be in the dual position.

Bridge: In this configuration, the amplifier can deliver 300 watts into an 8-ohm load. It is recommended that the load be greater than 4 ohms. Use the following directions to set the amplifier for bridge operation.

1. Set the rear panel switch to the bridge position.

2. Attach an input line to the channel one input only. Level adjustment is done with the channel one attenuator.

3. Do not use the channel two input; otherwise distortion may result. When in the bridged mode, disconnect the channel two input and turn the channel two input attenuator to the off position (full counterclockwise).

4. Connect the load across the two plus (+) terminals at the output barrier strip. Do not use either of the minus (−) terminals at the output strip. The channel one plus (+) output is in phase with pin 2 (+) of the channel one input connector.

Primary Voltage

The amplifier is provided from the factory with the primary of the power transformer wired for 120 volts. Make sure that the rear of the unit is marked for 120-volt operation before connecting the power cord.

CAUTION

Hazardous voltages and currents may exist within the chassis. The service information contained within this document is for use only by Electro-Voice authorized warranty stations and qualified service personnel.

Alternate Primary Voltage

The amplifier can be powered with line voltages other than 120 volts by altering the primary wiring of the power transformer. Table 3 lists the primary wire color, the terminal block (TB), and where the TB wire should be located for operation at the desired voltage.

To alter the transformer primary wiring configuration use the following procedure:

1. Disconnect the amplifier from the ac power source.

2. Remove the 14 screws securing the top cover.

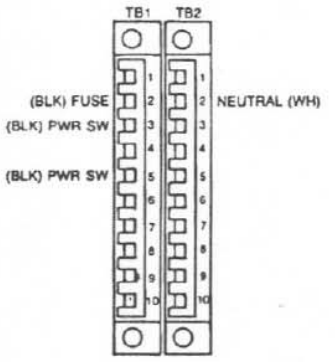
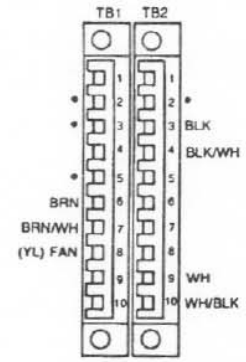
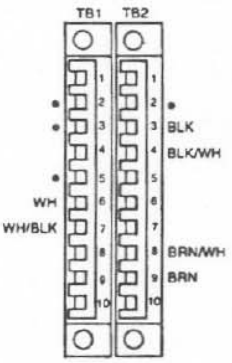
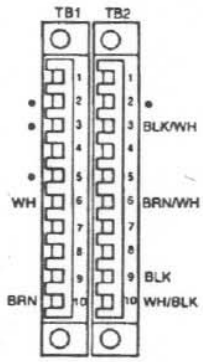
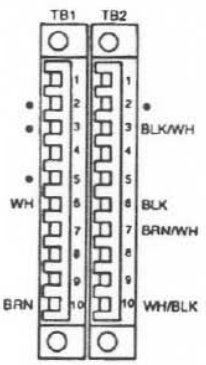
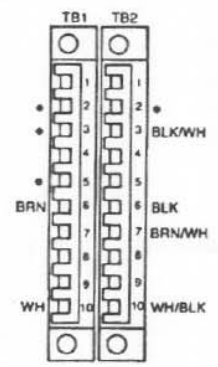
Permanent Connections●	Factory Wiring (120 V)	100 V
		
200 V	**220 V**	**240 V**
		
● DO NOT MOVE THESE WIRES, THEY ARE COMMON TO ALL PRIMARY VOLTAGES		

Table 3 - Primary Power Conversion Chart for 100-, 200-, 220-, and 240-V, 50/60-Hz Operation

SERVICE INFORMATION

Shipping Damage

Inspect the shipping carton for possible damage. If damage is found, notify the transportation company immediately. Save the carton as evidence for the carrier to inspect. If damage occurs during shipping, it is the responsibility of the consignee to file a claim with the carrier. If the carton is in good condition but the amplifier is damaged, call Electro-Voice.

Factory Service

If factory service is required, ship the unit prepaid in its original carton to:

Electro-Voice,Inc.
CustomerService/Repair
10500 W.Reno
Oklahoma City, OK 73128

Enclose a note describing the problem along with any other helpful information such as where and how the unit is used.

WARRANTY (Limited) -

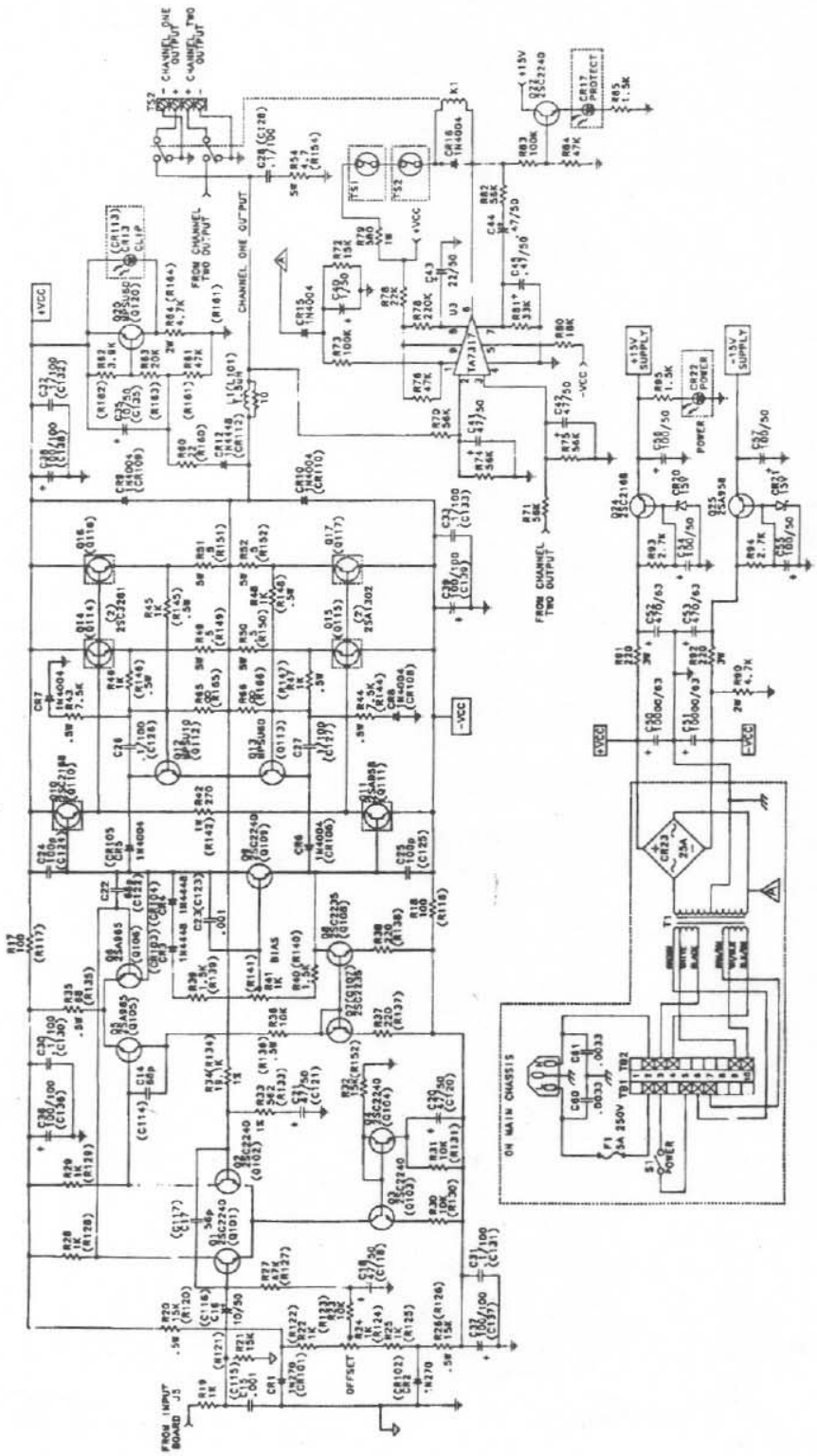
Electro-Voice Professional Sound Reinforcement Electronic Components are guaranteed for two years against malfunction due to defects in workmanship and materials. If such malfunction occurs, unit will be repaired or replaced (at our option) without charge for materials or labor if delivered prepaid to the proper Electro-Voice service facility. Unit will be returned prepaid. Warranty does not extend to finish, appearance items or malfunction due to abuse or operation under other than specified conditions, nor does it extend to incidental or consequential damages. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply to you. Repair by other than Electro-Voice or its authorized service agencies will void this guarantee. A list of authorized service centers is available from Electro-Voice, Inc., 600 Cecil Street, Buchanan, MI 49107 (AC/616-695-6831); Electro-Voice, Inc., 3810 148th Avenue N.E., Redmond, WA 98052 (AC/206-881-9555); and/or Electro-Voice West, 8234 Doe Avenue, Visalia, CA 93291 (AC/209-651-7777). This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Service and repair address for this product:

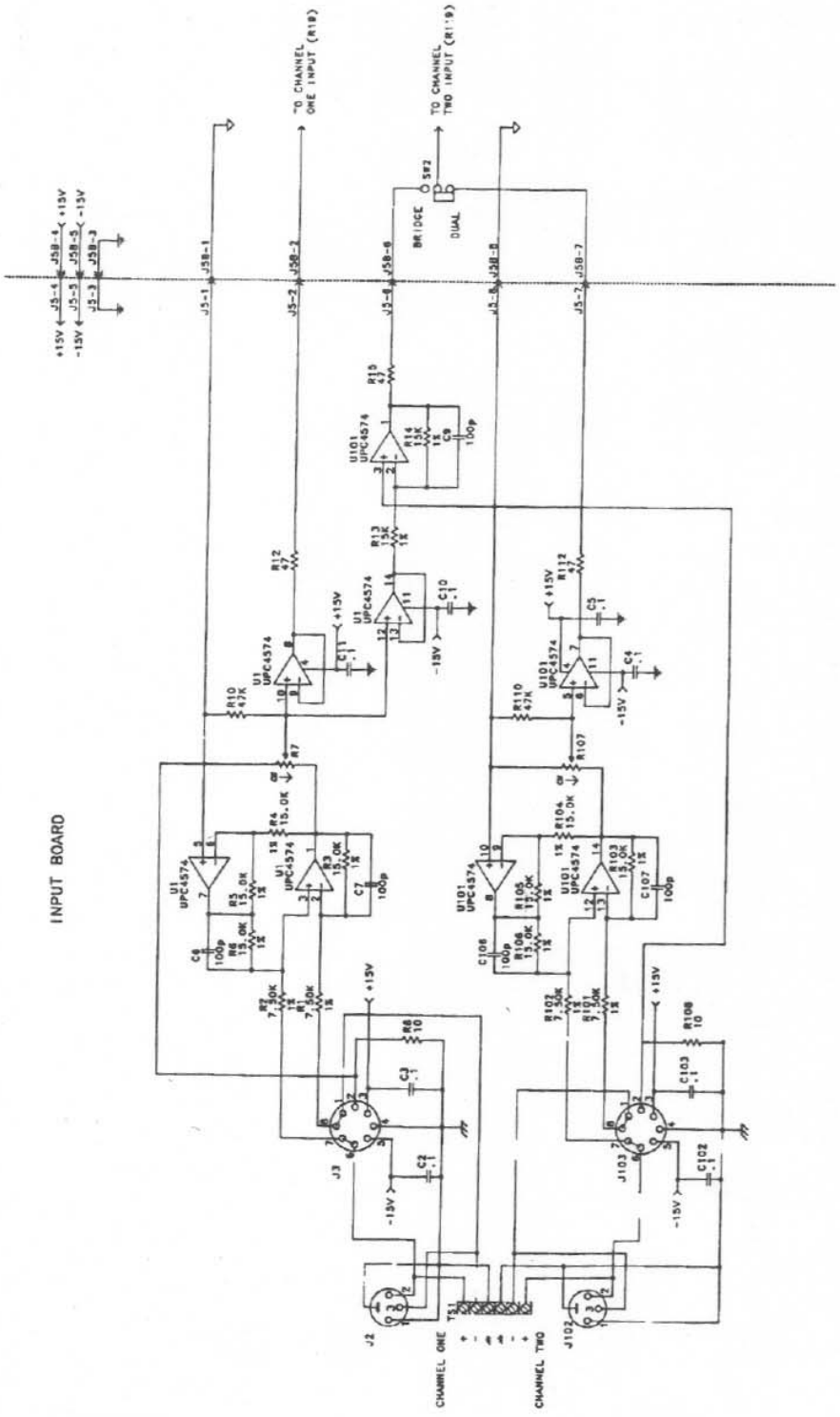
Electro-Voice, Inc., 10500 W. Reno, Oklahoma City, OK 73128

Specifications subject to change without notice.

AP2300 SCHEMATIC



AP2300 INPUT BOARD SCHEMATIC



3. Locate the two voltage-selection terminal blocks mounted on the crossbar between the heatsinks. The transformer has six primary leads. The colors are black, brown, white, black/white, brown/white and white/black. Disconnect the primary leads of the power transformer by pulling each wire firmly to disengage it from the terminal connector. Select the desired operating voltage on Table 4 and reconnect the wires accordingly. Push each wire firmly into the connector to snap it in place.

4. Install the correct line fuse (values in Table 4).

5. Plug the amplifier into a variac and sweep the mains voltage from zero to full operating voltage while monitoring the amplifier's dc rail voltages. The dc rail voltage should be approximately ±55 V dc, +5% at the selected primary voltage.

6. Reinstall the top cover with the 14 screws.

MAIN FUSE VALUES	
LINE VOLTAGE	LINE FUSE, 314 SERIES, NORMAL-BLO
100 V ac	5 A/250 V
120 V ac	5 A/250 V
200 V ac	2.5 A/250 V
220 V ac	2.5 A/250 V
240 V ac	2.5 A/250 V

Table 4 - Main Fuse Selection Guide

Mounting

The AP2300 may be installed in a standard 19-inch wide equipment rack and requires 3 rack spaces (5-1/4 inches). Mounting screws are supplied.

Cooling

The AP2300 must be adequately ventilated to avoid excessive temperature rise. Do not impede the air flow into or out of the amplifier. If the ambient temperature exceeds 60 °C (140 °F), units should be spaced at least 1-3/4 inches apart or a blower should be installed to increase the air flow in the rack cabinet. Further, if the load is less than 4 ohms, and the rms output is high (e.g., concert sound reinforcement) the additional cooling space is recommended.

Final Instructions

1. Do not operate the amplifier in a completely closed, unventilated housing.

2. Do not connect the outputs of the channels in parallel.

3. Do not connect the output terminals to a battery, power supply, or the power mains. Damage caused from such a hookup is not covered by the warranty.

4. Be careful when making connections, selecting signal sources and controlling the output level.

5. Do not tie the input signal ground to the ground lead of an output. Ground-loop-induced oscillations may occur.

6. Ensure that the main ac power is within 10% of selected voltage and frequency. Failure to operate the unit within these limits voids the warranty.

7. Use only the proper size mains fuse for the selected ac voltage, as indicated in Table 4.

8. Do not connect either side of the loudspeaker cable to ground when operating the unit in the bridged mode. The bridge mode is balanced to ground.

9. Make certain that the test equipment is not ground referenced when testing the unit in the bridged mode.

10. Tampering with the circuit or repair by unauthorized personnel will void the warranty of the unit.