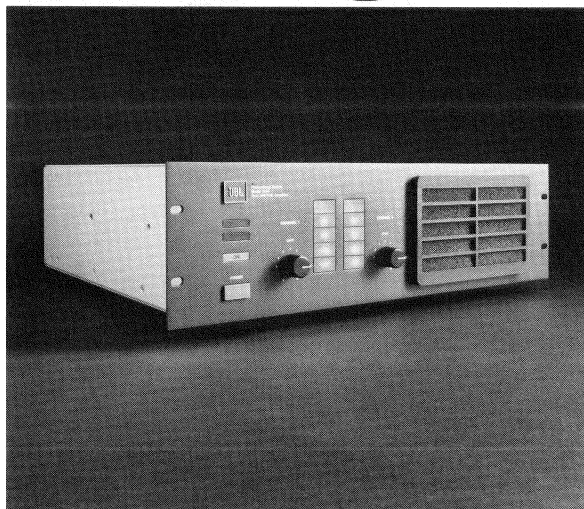


JBL 6233 INSTALLATION AND SERVICE MANUAL



Owner's Instructions

Architectural Specifications

The amplifier shall have two channels, each capable of producing an output of 300 W continuous sine wave into a 4 Ω load and 200 W continuous sine wave into an 8 Ω load from 20 Hz to 20 kHz at less than 0.05% THD. Full output shall be achieved by an input of not more than 0.8 V per channel. The power supply shall be the inverter type.

Rise time shall be no more than 5 μ s into a 4 Ω load or 3 μ s into an 8 Ω load and the slew rate shall be at least 20 V/ μ s.

Hum and noise shall be at least 100 dB below full rated output, measured with 20 kHz equivalent bandwidth, input shorted. No spurious oscillation shall be present with any combination of grounded or open input connections.

The program inputs shall each be provided with a socket to accommodate a matching/bridging transformer.

The amplifier shall be equipped with protection circuits that prevent damage due to overload, short circuit or excessive temperature rise. It shall meet all performance specifications in ambient temperatures up to 50°C (122°F). A thermal sensing device shall be provided for each channel. If one channel enters the protect mode, the other channel shall remain unaffected.

When thermally overloaded, the deactivated channel shall automatically resume operation when a safe operating temperature is reached.

Each amplifier channel shall be capable of being overdriven from 10 Hz to 20 kHz by at least 10 times its rated input voltage with the volume control in the maximum gain position. This overdrive condition shall not damage the amplifier. The amplifier shall be capable of sustained full rated output into a 4 Ω or 8 Ω load at 20 kHz for at least one hour without malfunctioning or entering the protect mode.

The amplifier shall have five indicator lights per channel for visually monitoring output. The lights shall become illuminated in sequence as higher output levels are reached. The display shall indicate true clipping level regardless of changes in AC line voltage.

Amplifier construction shall be modular, permitting complete replacement of each channel by the substitution of a replacement module.

The amplifier shall operate on a power source of 100 - 120 V AC or 200 - 240 V AC, 50/60 Hz. The performance specifications shall be listed under PRODUCT SPECIFICATIONS and be met or exceeded.

Product Specifications

Characteristic	Performance	Supplemental
Power Gain	70 dB	
Input Sensitivity	0.77 V	For full output
Power Output	300 W, 4 Ω	Continuous sine wave both channels driven
	200 W, 8 Ω	
	700 W, 8 Ω	Continuous sine wave both channels bridged
	400 W, 16 Ω	
THD	20 Hz to 20 kHz $\leq 0.05\%$	Both channels driven at rated output
IM	$\leq 0.05\%$	SMPTE Standard
Rise Time	5 μ s or less	Into 4 Ω
	3 μ s or less	Into 8 Ω
Slew Rate	>20 V/ μ s	
Load Impedance	4 Ω	Minimum
	8 Ω	Minimum in bridged configuration
Damping Factor	40	Minimum (4 Ω)
S/N	100 dB or better ¹	Reference rated output
Frequency Response	± 0.5 dB, 20 Hz - 20 kHz	
Power Supply		
Line Voltage	120 V normal and 240 V normal switch selectable	
Line Frequency	50 or 60 Hz	
Power Consumption	180 W	Quiescent
	920 W	33%, both channels driven
	1450 W	Full power, both channels driven
Environmental		
Operating Temperature	50°C (122°F)	Maximum
Physical		
CHARACTERISTIC	INFORMATION	
Overall Dimensions (including controls)	133 mm x 483 mm x 465 mm (5.25" x 19" x 18.3125")	
Mounting	3 EIA standard rack spaces	
Depth Behind Panel	445 mm (17.5")	
Panel Finish	Baked enamel, dark gray	
Net Weight	15.7 kg (34.5 lb)	
Accessories		
5195 Matching/bridging transformer for 15 k Ω bridging or 600 Ω matching, one per channel.		

Note 1. 20 kHz equivalent bandwidth.

Installation

The 6233 is suitable for either rack mounting in three EIA standard rack spaces without additional bracing, with chassis slides (not provided) or for counter-top placement. A full set of mounting hardware for all but chassis slide mounting is packed with each unit. All external connections are made on the rear chassis, Figure 2. Total depth necessary to mount the unit in a rack is 508 mm (20 inches). This allows room for air circulation, power cord and connections.

Indicators, Controls and Connections

Figure 2 shows the front and rear panel of the 6233.

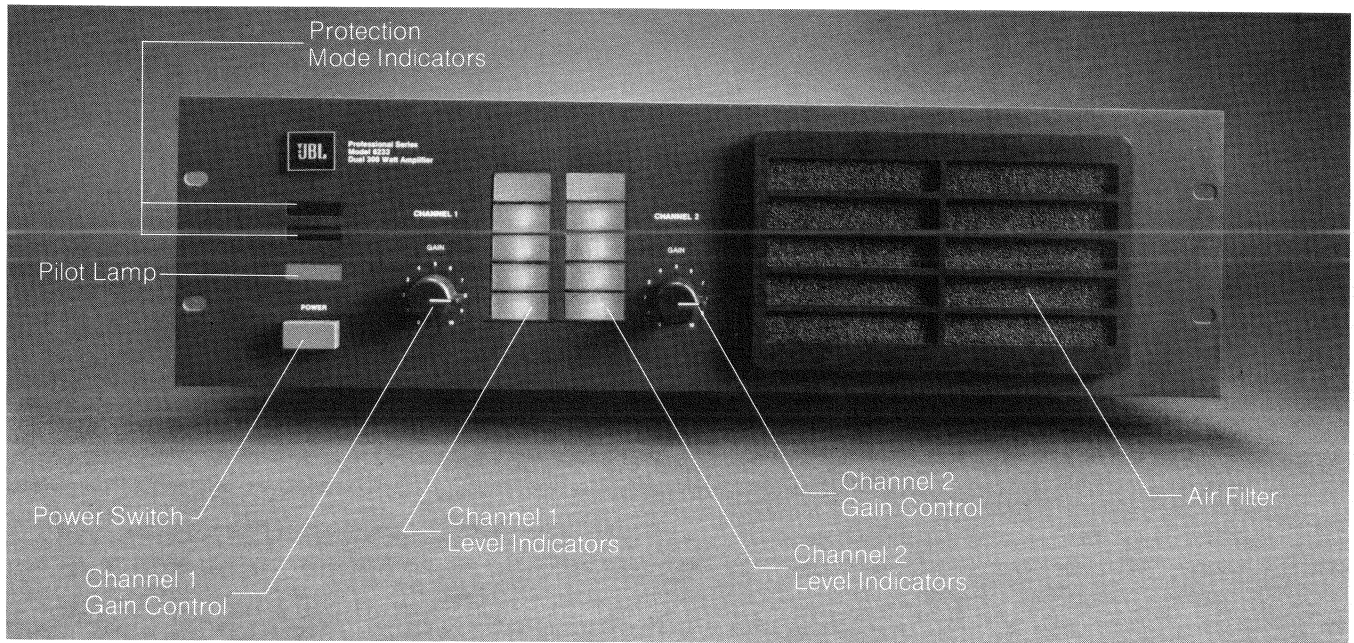
Front Panel

Pilot Lamp:	Indicates application of primary power.
Power Switch:	Applies primary power.
Protection Mode Indicators:	Indicates abnormal thermal condition and shutdown of output signal.
Channel Gain Control:	Controls input sensitivity.
Air Filter:	Prevents dust particles from entering unit.

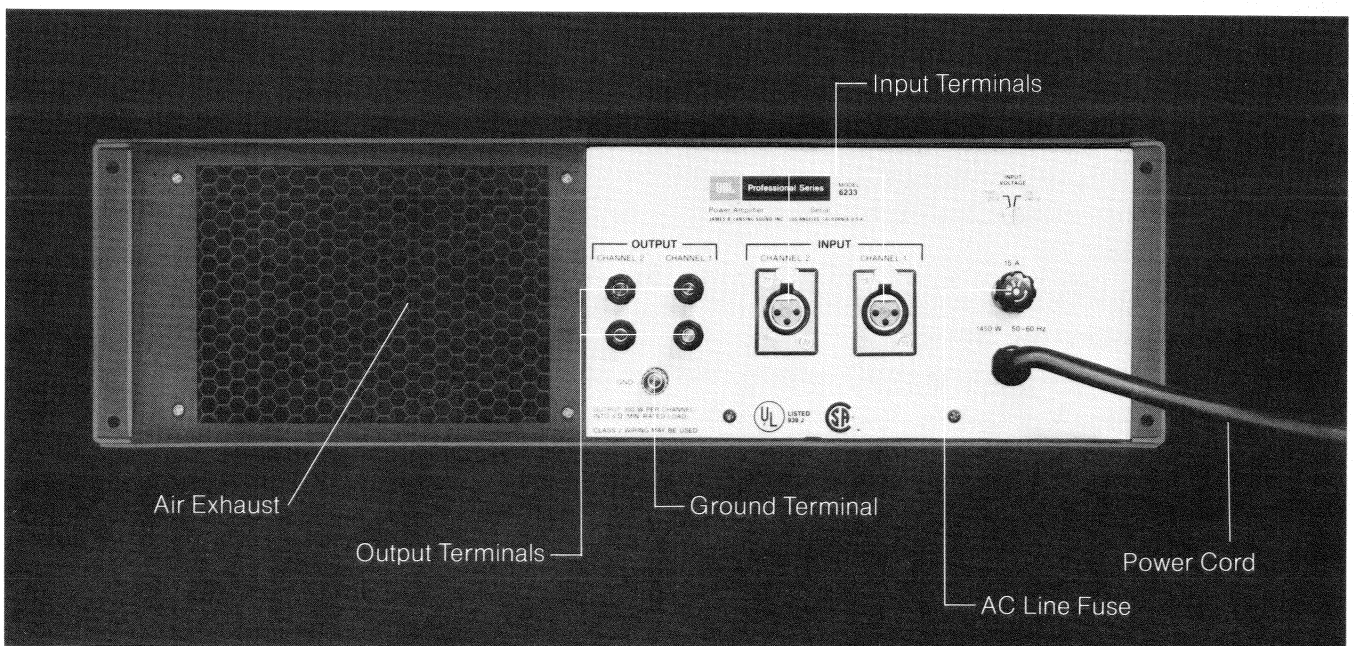
Rear Panel

Output Terminals:	Load impedance 4 Ω minimum per channel (dual-channel operation) or 8 Ω minimum (bridged operation).
Input Terminals:	XLR connector with input impedance of 20 k Ω (direct to volume control), of 15 k Ω or 600 Ω (balanced input with optional matching/bridging transformer).
Ground Terminal:	Required to prevent electric shock and for optimum performance of the unit's RF suppression system.
Air Exhaust:	Circulated air from unit.

FIGURE 2



FRONT VIEW



REAR VIEW

Counter-top placement—Turn the unit upside down and remove the four screws from the bottom cover as indicated in Figure 1. Install the four rubber feet using the four 6-32 x 3/8" screws.

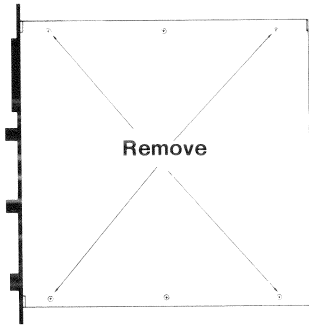


FIGURE 1

NOTE: Operation of the 6233 sitting on a flat surface without the above feet will result in excessive fan noise due to vibrations of the internal components against the bottom cover.

The remaining cover screws should be replaced with 6-32 x 1/4", 100° countersink screws only.

NOTE: Certain screw positions do not have clearance for longer screws.

Rack-mounting using chassis slides—Threaded mounting holes are incorporated into the 6233 chassis for use with CHASSIS TRACK C-300-B-120 chassis slides. These slides offer easy, convenient access to enclosed racks from the front of the cabinet.

CAUTION: If the 6233 is to be shipped in a rack mount cabinet, chassis slides are recommended in order to prevent damage to the front panel and chassis during transit.

Operating Temperature

The 6233 is cooled by air drawn in at the front and blown out through the back of the unit. Adequate clearance must be provided at the back to allow for adequate heat dissipation.

CAUTION: Do not block or restrict the air flow from the ventilation holes in the cabinet.

A number of thermal switches in the 6233 provide thermal protection and dual axial fan speed control if the internal temperature exceeds a safe operating level.

The air filter should be visually checked every few weeks and cleaned if dirty. More frequent inspections are required under severe operating conditions.

The following procedure is suggested for cleaning the air filter:

1. Remove the filter by pulling the filter frame and filter away from the front panel.
2. Flush the loose dirt from the filter with a stream of warm water.
3. Place the filter in a solution of mild detergent and warm water and let soak for several minutes.
4. Squeeze the filter to wash out the dirt remaining.
5. Rinse the filter in clean water and let dry.
6. Re-install the filter in the frame and install the filter/frame to the amplifier.

The maximum ambient operating temperature of the 6233 is 50° C (122° F).

NOTE: Operation at higher ambient temperatures will limit the maximum continuous power available.

Input Connections

The 6233 is shipped from JBL wired for an unbalanced input impedance of 20 kΩ.

Figure 3 shows the proper way to wire the XLR connector for an unbalanced input.

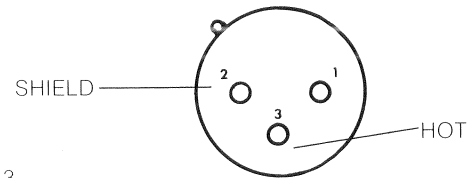


FIGURE 3

NOTE: To avoid ground loop problems, Pin 1 of the XLR connector should not be connected to the input signal source.

Output Connections

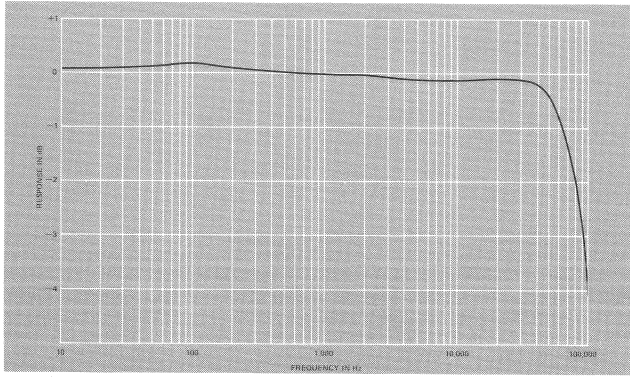
Output connections are via 5-way binding posts with 19 mm (0.75 inch) centers.

Cleaning

To clean the front panel of the 6233, use only a mild soap and warm water solution.

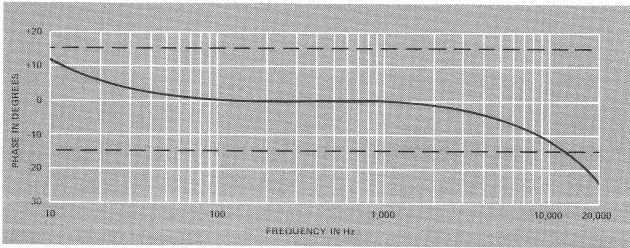
WARNING: The use of acetone, methyl-ethyl ketone (MEK) or any similar product will damage panel plastic components.

Proof Of Performance



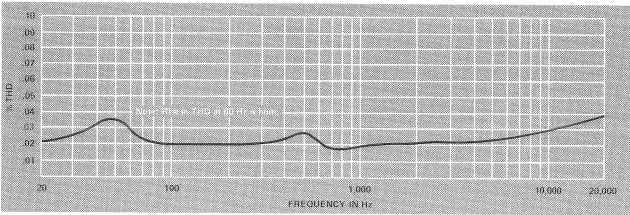
Frequency Response

Output of a typical unit at 1 W into a 4-Ω load.



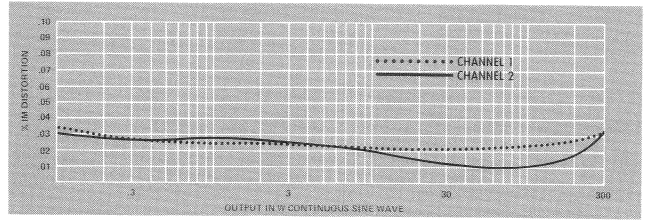
Phase Shift

Phase shift vs. frequency of a typical unit taken at 1W into a 4-Ω load. Note that phase shift of less than $\pm 15^\circ$ cannot be perceived, as shown by the dotted lines representing the threshold of perception.



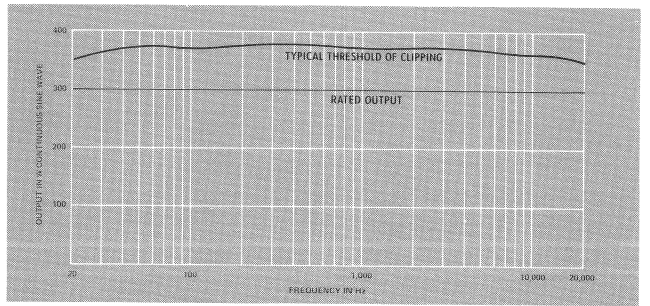
Total Harmonic Distortion

Total harmonic distortion of a typical unit, both channels driven at 300 W continuous sine wave into a 4-Ω load.



Intermodulation Distortion

Intermodulation vs. power output of a typical 6233, both channels driven simultaneously into 4-Ω loads. SMPTE standard test conditions were used: 60-Hz and 7-kHz test tones in a 4:1 ratio.



Threshold of Clipping

Output of a typical 6233 measured just below the level of clipping, both channels driven simultaneously into 4-Ω loads.

This manual section contains the information necessary for you to completely maintain the 6233 Dual Channel Power Amplifier. The information is contained under headings of: MAINTENANCE ACCESS, VOLTAGE CONVERSION AND LINE VOLTAGE SELECTION, INPUT IMPEDANCE CHANGE OPTIONS. We recommend that you thoroughly read and understand this section of the manual before attempting any maintenance procedures.

Maintenance Access

The following procedures are to be used to gain access to various portions of the 6233. Carefully follow the numerical sequence of Table 1 and the exploded view of Figure 4 to gain access to particular portions of the unit.

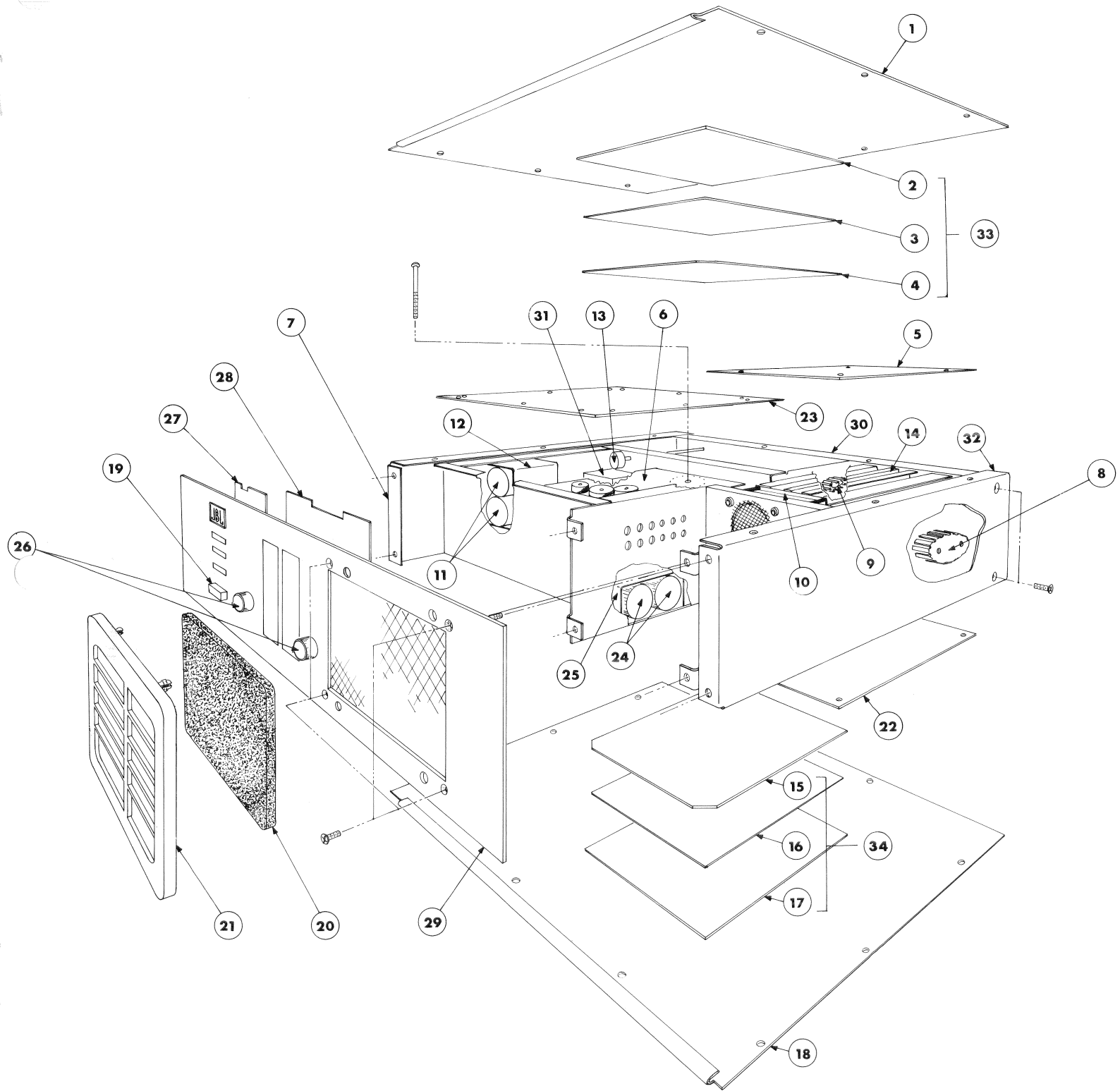
Table 1

MAJOR PARTS ACCESS	RECOMMENDED REMOVAL SEQUENCE									
AC LINE VOLTAGE RECTIFIER (CR401)	1	5 ¹⁰	18	22 ⁷						
LINE VOLTAGE FILTER CAPACITORS (C403 and C404)	1	18	23	12 ²						
AXIAL FAN	1	18	5 ¹⁰	22 ⁷						
BIPOLAR FILTER CAPACITORS (C410 and C411)	1	18	23	6 ¹	25 ³					
AIR FILTER	21									
FRONT PANEL	1	18	21	20	26 ⁴	27 ⁸	28 ⁸	19	-5	7 ⁶
HEAT SINK ASSEMBLY	1	5 ¹⁰	18	22 ⁷						
INVERTER RECTIFIER (CR 402)	1	5 ¹⁰	18	22 ⁷						
INVERTER P.C. BOARD	1	6	-1							
LEVEL LAMP ASSEMBLY	1	8								
ON/PROTECT ASSEMBLY	1	8								
POWER SWITCH	18									
POWER AMPLIFIER (CHANNEL #1)	1	2	3							
POWER AMPLIFIER (CHANNEL #2)	18	17	16							
VOLTAGE AMPLIFIER (CHANNEL #1)	1									
VOLTAGE AMPLIFIER (CHANNEL #2)	18									
RFI FILTER (Reference Internal dwg 50733)	1	18	23	6 ¹						
VOLTAGE SELECT SWITCH	1	23	30 ⁹							

Fig. & Index No.	JBL Part No.	Description
1	52115	Top Cover
33		Channel #1 Voltage/Amplifier Assembly
2		Voltage Amplifier
3		Shield
4		Power Amplifier
5	52694	Top Cover, Heat Sink
6		Inverter P.C. Board Assembly
7	52124	Side Panel-Left
8		Full Wave Bridge Rectifier (CR402)
9		Full Wave Bridge Rectifier (CR401)
10		Axial Fan
11		Capacitors (C403 & C404)
12		Capacitor Mounting Bracket
13		Voltage Select Switch
14		Heat Sink Assembly
34		Channel #2 Voltage/Amplifier Assembly
15		Power Amplifier
16		Shield
17		Voltage Amplifier
18	52115	Bottom Cover
19		Power Switch
20	52104	Filter
21	52103	Bezel
22	53788	Bottom Cover, Heat Sink
23	52695	Cover, RFI Filter
24		Capacitors (C410 & C411)
25		Capacitor Mounting Bracket
26		Knobs
27		On/Protect P.C. Board Assembly
28		Level Lamp P.C. Board Assembly
29	52132	Front Panel
30	52116	Rear Panel
31		RFI Filter
32	52127	Side Panel-Right

- Notes:
- Requires removal of 3.75 inch bolt holding inverter transformer/inverter PC board to chassis.
 - Requires removal of two Phillips-head screws on bottom of chassis and two screws holding bracket to chassis.
 - Requires removal of four Phillips-head screws on bottom of chassis to remove cover holding capacitors, (C410 and C411).
Note: DO NOT remove the two Phillips-head screws holding the cover to the capacitors until the cover is removed from the chassis.
 - Requires removal of knobs and potentiometer hardware.
 - Requires removal of four Phillips-flat head screws on front panel.
 - Requires removal of seven Phillips-head screws from outer side panels.
 - Requires removal of four Phillips-flat head screws on bottom of inverter shield cover.
 - Requires removal of Molex plug before removing assembly.
 - Requires removal of six Phillips-head screws on back panel and four Phillips-head screws on outer side panels.
 - Remove two quick disconnect terminals off the thermal breaker on top of the heat sink.

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Voltage Conversion and Line Voltage Selection

The 6233 can be operated from either a 100 - 120 V AC or 200 - 240 V AC, 50/60 Hz source. The INPUT VOLTAGE SELECTOR on the rear panel converts the amplifier from one operating range to the other. Use the following procedure to convert the amplifier voltage ranges:

1. Disconnect the amplifier from the power source.
2. To convert from 100 - 120 V AC to 200 - 240 V AC, rotate the INPUT VOLTAGE SELECTOR screwdriver slot to the desired voltage indication.
3. Change the line and/or attachment plug to match the supply source receptacle, or use a 120 V to 240 V AC adapter (not provided). The adapter as well as the power supply cord and/or attachment plug used for the 240 V AC mode in the U.S., Canada and Japan shall be both UL Listed and CSA Certified for use with said power source receptacle. For use in other countries, adapter, line cord and/or attachment plug selection shall be based on local regulations governing 240 V AC, 50/60 Hz supply sources.

U.L. and C.S.A. Line Voltage Wiring Code

Country	Line	Neutral	Safety Earth (Ground)
U.S., Canada, Japan	Black	White	Green
Europe (U.S., Canada & Japan Optional, but Acceptable)	Brown	Blue	Green/Yellow

4. Change the line fuse from a 15 A, type 3 AB to a 8 A, type 3 AB.

CAUTION: This unit may be damaged if operated with the INPUT VOLTAGE SELECTOR set to the incorrect position for line voltage applied.

CAUTION: The 6233 is designed to be used with a three-wire AC power system. If the three- to two-wire adapter is used to connect this unit to a two-wire AC power system, be sure to connect the ground lead of the adapter to safety earth (ground). Failure to complete the ground system may allow the chassis of the amplifier to be elevated above ground potential and pose a shock hazard.

Input Impedance Change Options

Input connections may be either direct-coupled or transformer-isolated at the XLR connectors, J301 or J302. Direct coupling is accomplished by the use of shorting plugs, JBL part no. 53820. These plugs are installed and shipped by the factory. Figure 5.

For transformer-isolated inputs, a 5195 matching/bridging transformer must be plugged into the 9-pin receptacles, XA401 or XA402, requiring removal of the top cover.

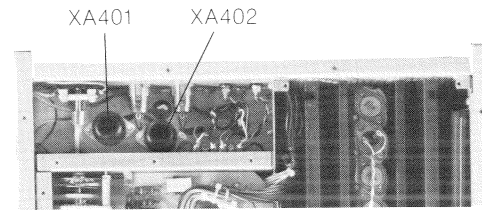


FIGURE 5

For 15 k Ω balanced input, connect the input per Figure 6 and replace the shorting plug with a JBL 5195 transformer.

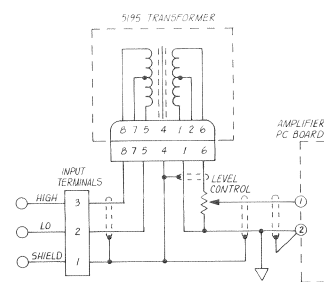


FIGURE 6

For a 600 Ω balanced input, wire the XLR connector per Figure 7 and replace the shorting plug with a JBL 5195 transformer.

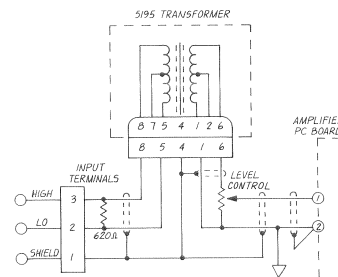


FIGURE 7

The input of the 6233 can be rewired to provide 14 dB of additional gain using the 5195 transformer. The RED wire soldered to pin #8 of WA401 or WA402 is removed and resoldered to pin #7. In this configuration, Figure 8, no input termination is required.

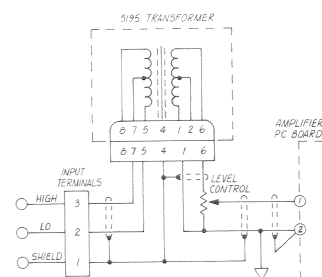


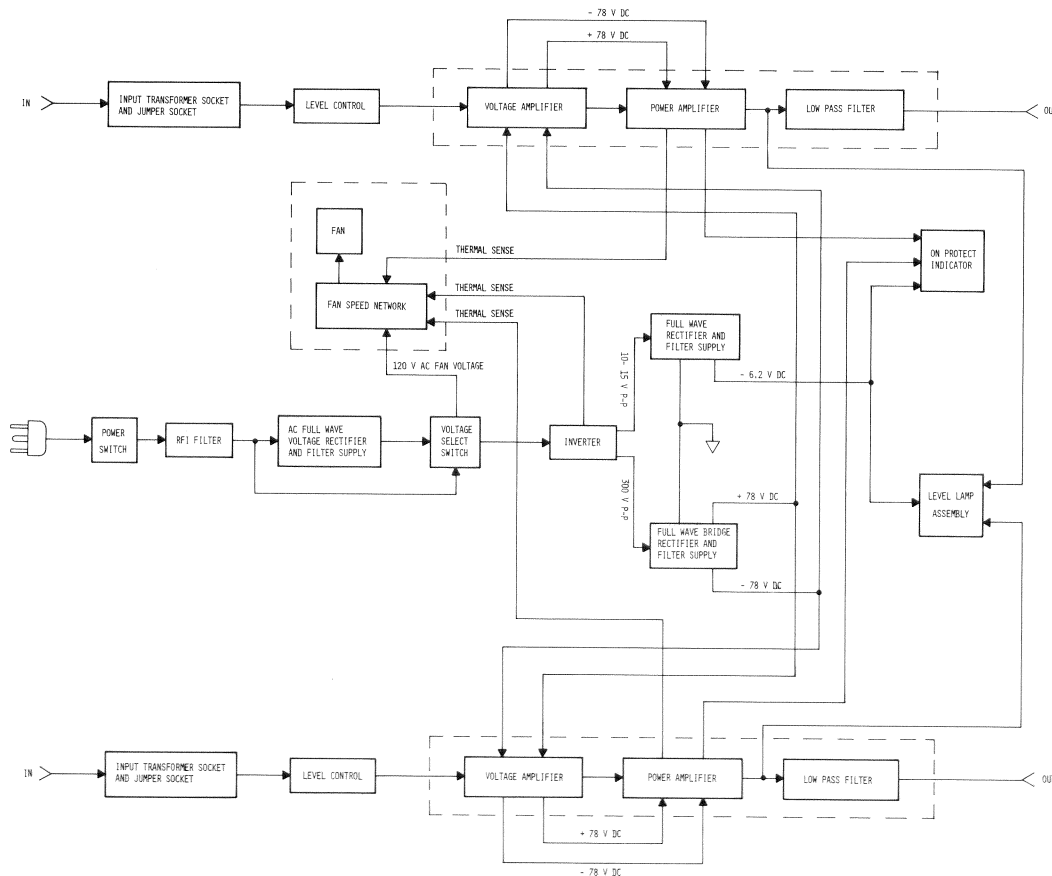
FIGURE 8

NOTE: In this configuration, the input signal must not exceed -4 dB, or saturation of the matching/bridging transformer will result.

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Recommended Test Equipment

Instrument Type	Required Characteristic	Recommended Instrument
Test Oscillator	Frequency Range: 20 Hz - 20 kHz Distortion: Less than 0.0018 Output: 1 V RMS Min.	Hewlett-Packard HP339
Distortion Analyzer	Measurable to 0.0018	
Oscilloscope	Bandwidth DC to 50 MHz	Tektronix Model 465
Multimeter	Accuracy: 0.1% reading +1 digit DC Range: ± 199.9 mV to ± 1199 V AC Range: 199.9 mV to 1199 V Input Impedance: 10 Ω	Fluke Model 8000A
Output Load Resistors	Total 500 W per each channel at 4 Ω (Non-inductive type)	Dale NH-250 250 W 8 Ω V, 1%, 4 required
Resistor Decade	1 Ω - 100 k Ω	
Variable Autotransformer	Must be capable of supplying 1.5 kVA over a range of 90 - 136 V	GenRad Model W20MT3A
Wattmeter	Range of 180 W min and 1500 W max.	
Current-measuring Probe	Termination: Passive Sensitivity: 2 mA/mV Accuracy: 3%	Tektronix Model P6021
1X Probe 10X Probe	Frequency: 50 MHz	Tektronix Model P6062A



Block Diagram

WARNING: Disconnect the AC power cord from the amplifier prior to removing covers. Exposed terminals within the amplifier (including several points on the printed circuit boards) can supply sufficient energy to cause injury or death.

Power Supply

If any component in the inverter supply is replaced, the following verification steps must be followed:

- 1. Diodes CR1, CR2, CR3 and CR4 must be checked for FORWARD and REVERSE resistance. Readings between 2.1 and 2.3 Ω are normal.

NOTE: The forward and reverse readings will be identical as most meters will not develop sufficient voltage across the 2 Ω resistors to turn on the diode junction.

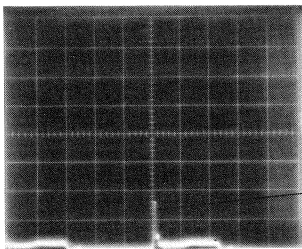
- 2. An infinite resistance measurement should exist between the case of transistors Q1, Q2, Q3 and Q4 of the inverter supply, heat sink and ground. Also, an infinite resistance should exist between the heat sink and the collectors of transistors Q1, Q2, Q3 and Q4.
- 3. The inverter supply should start to operate with approximately 30 V AC applied with the INPUT VOLTAGE select switch set at 100 - 120 V position.

NOTE: The start voltage will be double in the 200 - 240 V mode.

- 4. With a 120 V AC input and a current probe attached to each of the following color-coded wires:

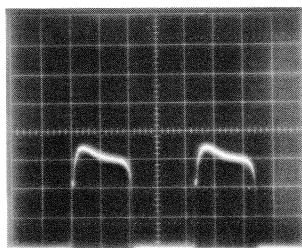
ORG/BLK	#11
YEL/BLK	#12
BRN/BLK	#13
RED/BLK	#14

The following waveforms MUST match the scope trace shown in Figure 9.



Collector current, IDLE POWER 2 A/div verticle, 10 μs/div horizontal.

Bump MUST disappear at FULL POWER. If not, replace all four inverter transistors.



Collector current, FULL POWER, 2 A/div verticle, 10 μs/div horizontal.

NOTES:

- A. If any of the traces do not match, turn the unit off and replace ALL FOUR INVERTER TRANSISTORS. These transistors must be ordered as a set of four.

Color coded identification of these transistors must match in sets of four. Replacement sets do not need to have the same color code indentification as the original.

- B. Wires attached to the inverter board are color coded as follows:

Base color	Indicates transistor
Stripe	Indicates function terminal
Black	Collector
White	Emitter
No stripe	Base resistor
Blue	Base

- 5. Normal idle power consumption is 160 - 180 W. Maximum idle power consumption is 200 W.
- 6. Before placing the shield over the inverter supply, make sure the wire harness does not pass over the resistor and capacitor bank.
- 7. With the amplifier running at full rated output at 1 kHz, confirm that the current waveforms of transistors Q1, Q2, Q3 and Q4 are balanced within ±10%, and have no leading or lagging short spikes.

Amplifier Assembly

WARNING: Disconnect the AC power cord from the amplifier prior to removing covers. Exposed terminals within the amplifier (including several points on the printed circuit boards) can supply sufficient energy to cause injury or death.

If any output device is replaced, the following verification steps must be followed:

- 1. Bias voltage across resistors R9, R11, R13, R18, R20 and R22 must measure 12 mV ± 5 mV.

NOTE: Unit must be warm before making bias measurements. A minimum of 5 minutes is required at idle current. Measure only that voltage amp/power amp assembly that is in the wind tunnel, making sure that the channel that is not being measured is not shorting against the unit.

- 2. Verify that all wire/screw connections are tight.
- 3. Before replacing the shield, check the clearance between the top of resistors R42, R45, R48 and R50 and the chassis. It should be 3.175 mm (0.125 inches).

FIGURE 9

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- 4. With both channels running at full rated output at 50 Hz, short one output channel. If the protect circuits are correctly operating, the channel under test will go into thermal protect mode within 1 to 2 minutes.
- 5. Confirm distortion specifications.
- 6. Offset voltage across the output of either channel must be ≤ 100 mV.

CAUTION: The 6233 does not have an offset adjustment. If the measured offset voltage is not within specifications, further investigation into the cause is necessary.

Minimum Specifications

Power Output, Continuous

Sine Wave

Both channels driven	
4 Ω load	300 W per channel
8 Ω load	200 W per channel
Both channels bridged	
8 Ω load	700 W
16 Ω load	400 W

Power Bandwidth,

Rated Output 20 Hz - 20 kHz, ± 0.5 dB

Frequency Response,

All Power Levels 20 Hz - 20 kHz, ± 0.5 dB

Total Harmonic Distortion,

Rated Output Less than 0.05%, 20 Hz - 20 kHz

Intermodulation Distortion,

SMPTE

Standard Less than 0.05%

Rise Time

4 Ω load 5 μ s or less
8 Ω load 3 μ s or less

Slew Rate

Greater than 20 V/ μ s

Damping Factor

Greater than 40

Signal-to-Noise Ratio

Greater than 100 dB ref. rated output,

20 Hz - 20 kHz equivalent bandwidth

70 dB

Power Gain

Input Sensitivity

0.77 V

Input Impedance

20 k Ω , direct to volume control

Output Impedance

Less than 0.1 Ω

Load Impedance

Dual-channel operation 4 Ω minimum per channel

Bridged operation 8 Ω minimum

Controls

Power switch

Level controls, one per channel

Voltage selector, 120/240 V AC

Pilot lamp

Protection mode, one lamp per channel

Level, 5 sequential lamps per channel

Indicators

Power Requirement

100 - 120 or 200 - 240 V AC, 50/60 Hz

Power Consumption

Quiescent

180 W

$\frac{1}{2}$ power, both

channels driven

920 W

Full rated power, both

channels driven

1450 W

Fuse

15 A at 120 V or 8 A at 240 V, 3AB

Maximum Ambient

Operating Temperature 50°C (122°F)

Connectors

Input XL-type 3-pin female latching

Output 5-way universal binding posts

Front Panel Finish

Semi-gloss baked enamel, dark gray

Mounting

3 EIA standard rack spaces

Dimensions

Front Panel 133 mm x 483 mm (5 $\frac{1}{4}$ in x 19 in)

Depth of controls 19 mm ($\frac{3}{4}$ in)

Depth behind panel 445 mm (17 $\frac{1}{2}$ in)

Net Weight

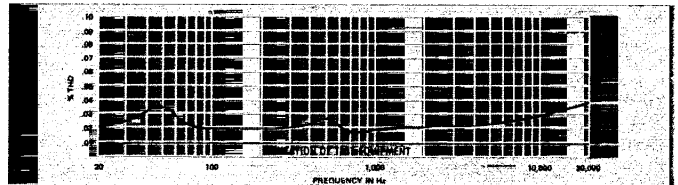
15.7 kg (34 $\frac{1}{2}$ lb)

Shipping Weight

19 kg (42 lb)

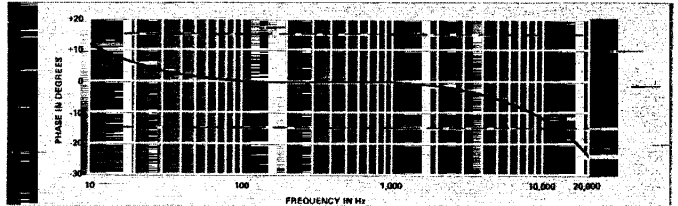
Accessory

JBL Model 5195 Matching/Bridging Transformer for 15 k Ω input bridging or 600 Ω input matching, one per channel required



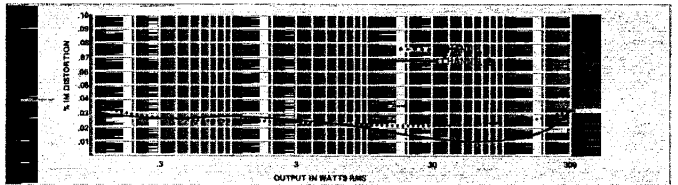
Total Harmonic Distortion

Total harmonic distortion of a typical unit, both channels driven at 300 W continuous sine wave into a 4- Ω load.



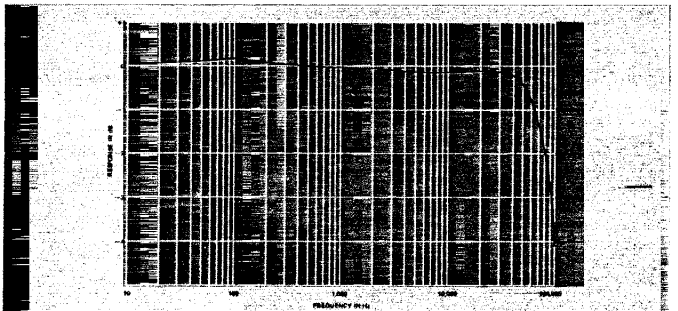
Phase Shift

Phase shift vs. frequency of a typical unit taken at 1W into a 4- Ω load. Note that phase shift of less than $\pm 15^\circ$ cannot be perceived, as shown by the dotted lines representing the threshold of perception.



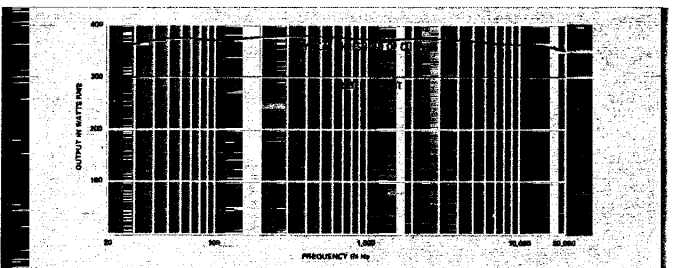
Intermodulation Distortion

Intermodulation vs. power output of a typical 6233, both channels driven simultaneously into 4- Ω loads. SMPTE standard test conditions were used: 60-Hz and 7-kHz test tones in a 4:1 ratio.



Frequency Response

Output of a typical unit at 1 W into a 4- Ω load.



Threshold of Clipping

Output of a typical 6233 measured just below the level of clipping, both channels driven simultaneously into 4- Ω loads.



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