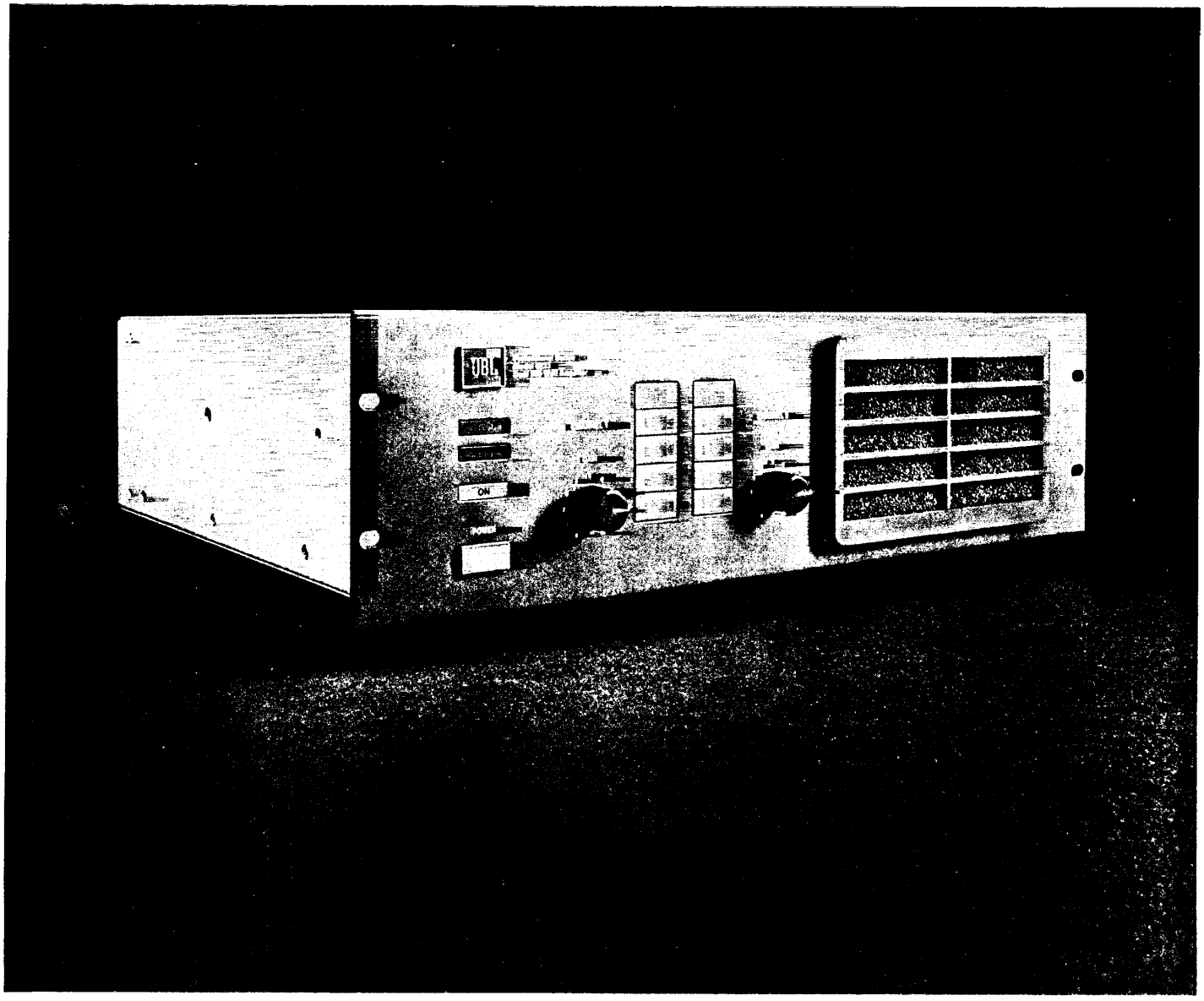
JBL Professional Series

Model 6233
Dual Channel Power Amplifier

300 watts continuous sine wave per channel into 4 Ω
200 watts continuous sine wave per channel into 8 Ω
700 watts continuous sine wave bridged into 8 Ω
400 watts continuous sine wave bridged into 16 Ω
100 dB s/n ratio, 20 Hz - 20 kHz
Less than 0.05% THD, 20 Hz - 20 kHz
Lightweight, portable. Forced air cooled



More Than Raw Power

Although high power amplifiers have been available for some time, they generally have been bulky units designed primarily for consumer use rather than for the more rigorous requirements of studio, reinforcement or PA applications. For the most part, they perform adequately, but lack reliability when used under road conditions, even with additional cooling.

The primary design goal was to build a rugged, high power amplifier of the highest quality, smallest size and lightest weight possible. This goal has been achieved in the Model 6233, a reliable, two-channel amplifier that mounts in three EIA standard rack spaces and weighs less than 16 kg (35 lb). Intended for use in recording studios, wide-range sound systems and similar applications, the 6233 delivers stable, virtually distortion-free amplification for sustained time periods at any power level, up to and including full output, without requiring additional cooling. The 6233 is clean as well as powerful: Each channel is capable of delivering 300 W continuous sine wave into a 4 Ω load, or 200 W into an 8 Ω load with total harmonic distortion of less than 0.05%, 20 Hz - 20 kHz. In addition, the two channels can be bridged for single-channel operation, in which case the 6233 will deliver 700 W continuous sine wave into 8 Ω (the minimum recommended impedance in the bridged configuration) or 400 W into 16 Ω, 20 Hz - 20 kHz at no more than 0.05% THD.

Input sensitivity of the 6233 is high: full rated output can be achieved with an input of only 0.77 V. Rise time is 4 μs into a 4 Ω load or 3 μs into an 8 Ω load, and the unit has a slew rate greater than 20 V/μs. The result is accurate, well-defined high frequency performance that is transparent and effortless, and which does not become veiled, muddy or harsh at even the highest power levels.

The 6233 is the first amplifier in its power class to use an inverter power supply. This saves weight and space: the 6233 is approximately one-third the size and weight of a comparable conventional amplifier, making it far more convenient to pack and transport. The inverter also provides transformer isolation from the power line, unlike other lightweight power supplies.

The inverter power supply uses high-speed switching technology, long proven in computers, to convert (or, more correctly, invert) the 50/60 Hz power line frequency to 20 kHz. This allows use of a 0.9 kg (2 lb) transformer instead of the 23 kg (50 lb) transformer normally required. The transformer output is then rectified to the DC voltages required by the amplifier modules. The inverter power supply has an output capacity greater than 2 kW, more than enough reserve to support both amplifier channels without strain under any conditions.

Advanced Circuit Design

Full complementary symmetry in each channel's output stage allows broad bandwidth without the imbalance inherent in a quasi-complementary approach. It also helps improve amplifier power response, reduce distortion and eliminate turn-on transients. Fourteen 150 W output transistors per channel greatly improve reliability, because each transistor typically operates at only a fraction of its capacity, regardless of amplifier power level.

The 6233 employs forced-air cooling: each transistor is mounted on an individual heat sink and optimally positioned in a cooling tunnel extending from the front to the rear of the amplifier. A two-speed fan forces air through the tunnel; thermal sensors in each channel and in the power supply increase fan speed as required. A thermal protection device in each channel suspends operation of only that channel if it overheats, and the device automatically resets when the module cools to a safe operating temperature. The 6233 will operate in ambient temperatures as high as 50°C (122°F) without degradation of performance.

Each channel of the 6233 operates independently and is fully protected against short circuits, mismatched loads, excessive temperatures and installation errors. Either channel can enter the protect mode without affecting the other. The 6233 will remain stable under all conditions, including operation into reactive loads presented by long cable lengths and high-quality loudspeakers. Most importantly, the protective circuitry cannot chatter when activated. (Chattering, a by-product typical of the protective circuitry in large amplifiers, occurs when the circuitry releases too soon, sending a large burst of current that can destroy high frequency drivers.)

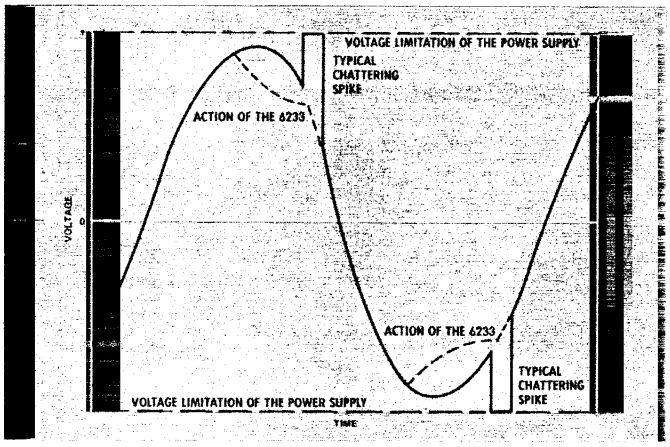
Versatility

Five sequential indicator lights for each channel allow the operator to monitor visually the power reserve available. A unique sensing circuit triggers the top, red light when the output level is 2 dB below clipping; each successive light indicates an output level of 6 dB (¼ power) less than the light above it. The lights are far more useful than VU meters, because they are an accurate performance indicator even when the power line voltage drops and can also be read quickly and accurately from a distance.

Any source device capable of driving a load of 20 kΩ or less can be used.* The amplifier inputs are unbalanced, the configuration typical of most applications. However, the high input sensitivity of the 6233 allows it to achieve full output when driven by almost any source, balanced or unbalanced.

To provide additional flexibility, at the expense of some loss in bandwidth, each channel of the 6233 is provided with a

*If the rated load impedance of the source device is greater than 20 kΩ, high frequency response will be compromised. In such cases, a line amplifier should be used to lower impedance.



Chattering in the Protect Mode
Chattering results from rapid operation of the protective circuitry which produces a clipped high frequency spike. Although the effect usually occurs below 100 Hz, it can be destructive to high frequency drivers. The protective circuitry of the 6233 reduces the amplitude of a sine wave in the manner shown, thus suppressing the chattering effect and the destructive spike it produces. The effect of the protection circuitry on the signal sounds similar to soft clipping.

socket for a JBL Model 5195 Matching/Bridging Transformer that will convert the input to 15 kΩ balanced bridging. With the 5195 installed, the input can also be utilized for 600 Ω balanced matching by placing a resistor across the input. If the 600 Ω line level is less than −20 dBm, the 5195 can be used in a step-up configuration, requiring moving a wire on the socket, to provide an additional 14 dB of gain. (The 5195 should not be driven with an input greater than 7.7 V, which is +20 dBm.)

Installation and Certification
The amplifier chassis and layout are designed for mechanical strength and ease of installation. The 6233 mounts in three EIA standard rack spaces. Input connectors are XL-type 3-pin female latching; universal 5-way binding posts are used for the outputs. Extensive shielding and filtering of the power supply allow stacking the amplifier with tuners or tape decks without interference—magnetic, electrostatic or thermal. Construction is modular; the amplifier boards can be replaced in 15 minutes once the unit has been removed from the rack.

Each 6233 is extensively pretested, then individually certified to meet or exceed its published specifications. To achieve certification, each amplifier is operated non-stop for 16 hours under conditions simulating extremely severe field use. Without being allowed to cool down, it must then produce its full rated output, and meet its rated distortion at that output or any fraction thereof.

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 4 μs into a 4 Ω load or 3 μs into an 8 Ω load, and the slew rate shall be at least 20 V/μs.

Hum and noise shall be at least 100 dB below full rated output, measured 20 Hz to 20 kHz with a 600 Ω input termination. 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 20 Hz to 20 kHz by at least ten times its rated input voltage with the volume control in the maximum gain position. This overdrive condition shall not cause the amplifier to enter the protect mode. 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. Indications shall remain accurate at substandard AC power line voltages.

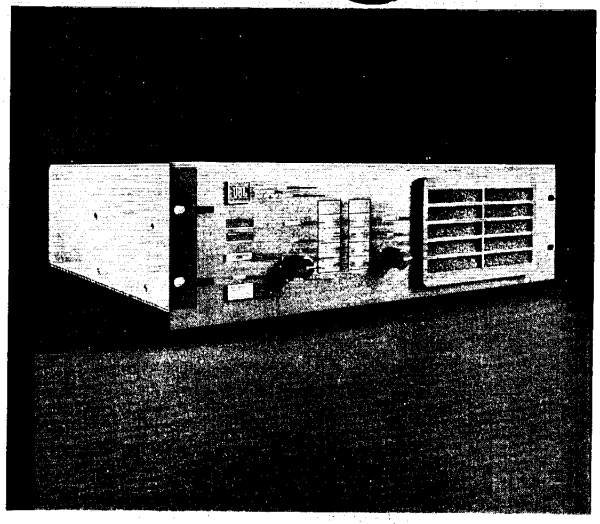
Amplifier construction shall be modular, permitting complete replacement of each channel by the substitution of a replacement module.

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

The amplifier shall be JBL Model 6233.

Input and output connections to the 6233.

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 μs into a 4 Ω load or 3 μs into an 8 Ω load and the slew rate shall be at least 20 V/μs.

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 ≤0.05%	Both channels driven at rated output
IM	≤0.05%	SMPTE Standard
Rise Time	5 μs or less	Into 4 Ω
	3 μs or less	Into 8 Ω
Slew Rate	>20 V/μs	
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 kΩ 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.

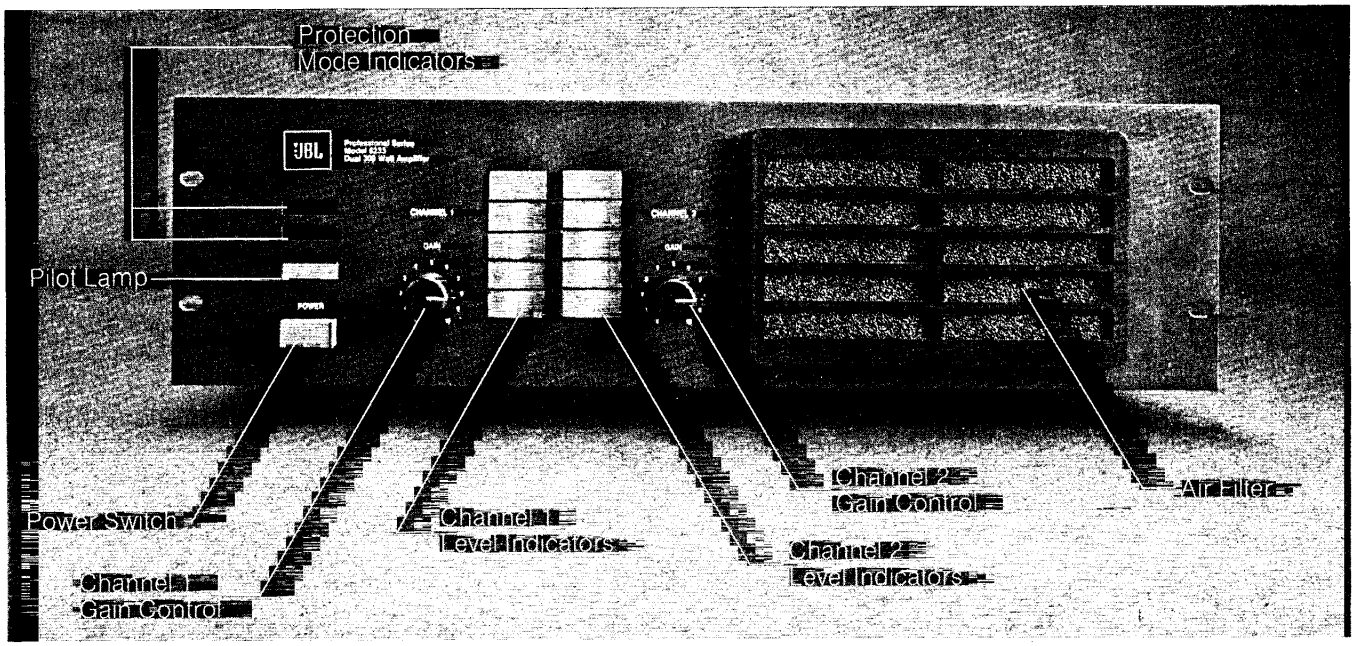
Front Panel

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.

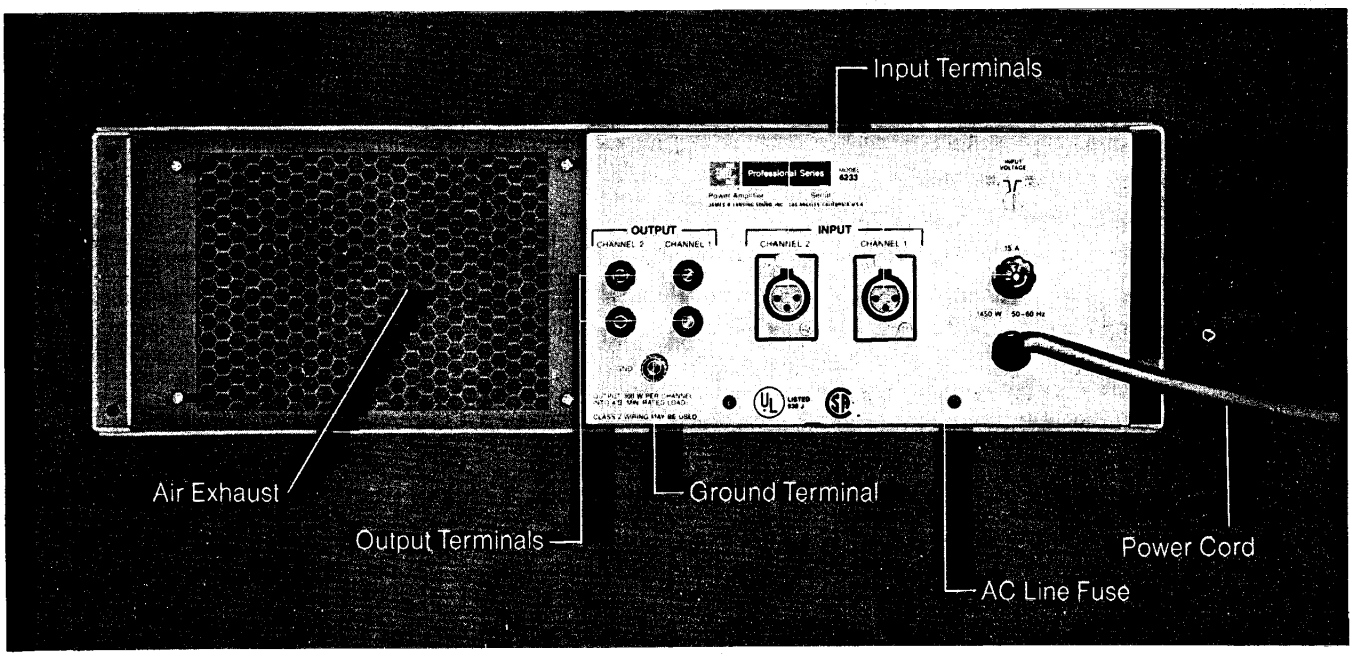
Rear Panel

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 kΩ (direct to volume control), of 15 kΩ 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 ⅜" screws.

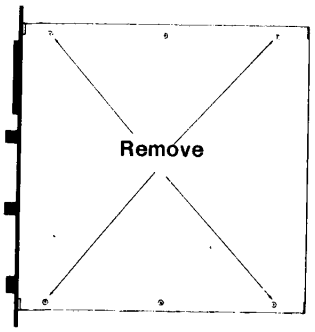


FIGURE 1

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 ¼", 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.

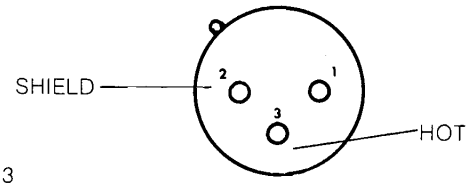


FIGURE 3

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

Output Connections

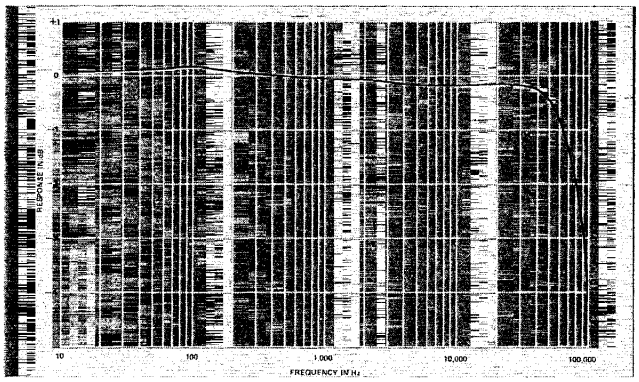
Output connections are via 5-way binding posts with 19 mm (0.75 inch) centers.

Cleaning

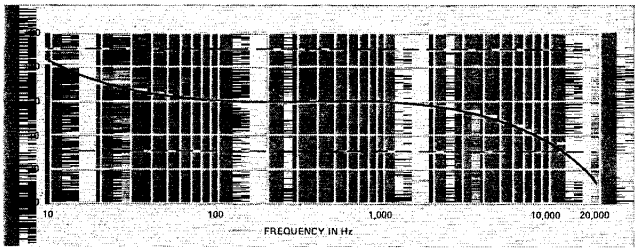
To clean the front panel of the 6233, use only a mild soap and warm water solution.

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

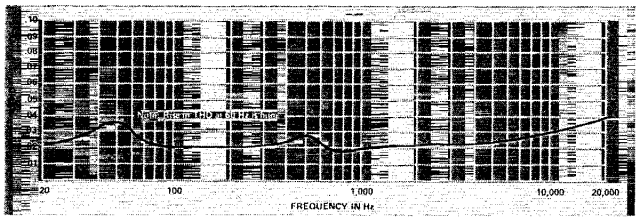
Proof Of Performance



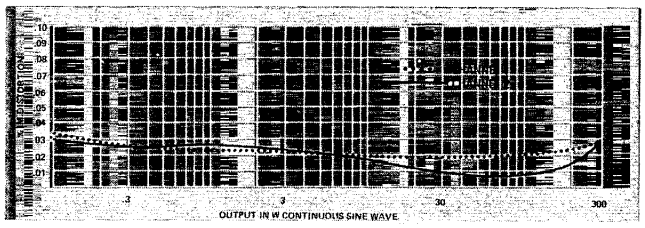
Frequency Response
Output of a typical unit at 1 W into a 4-Ω load.



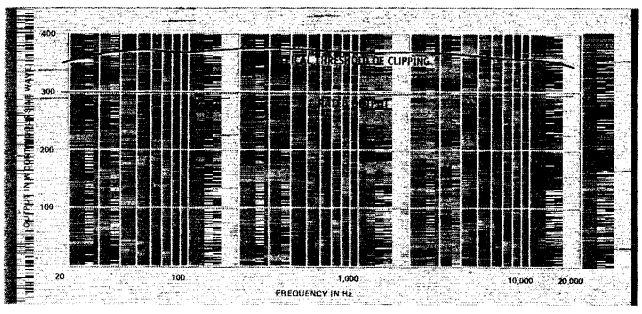
Phase Shift
Phase shift vs. frequency of a typical unit taken at 1W into a 4-Ω load. Note that phase shift of less than ±15° cannot be perceived, as shown by the dotted lines representing the threshold of perception.



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.

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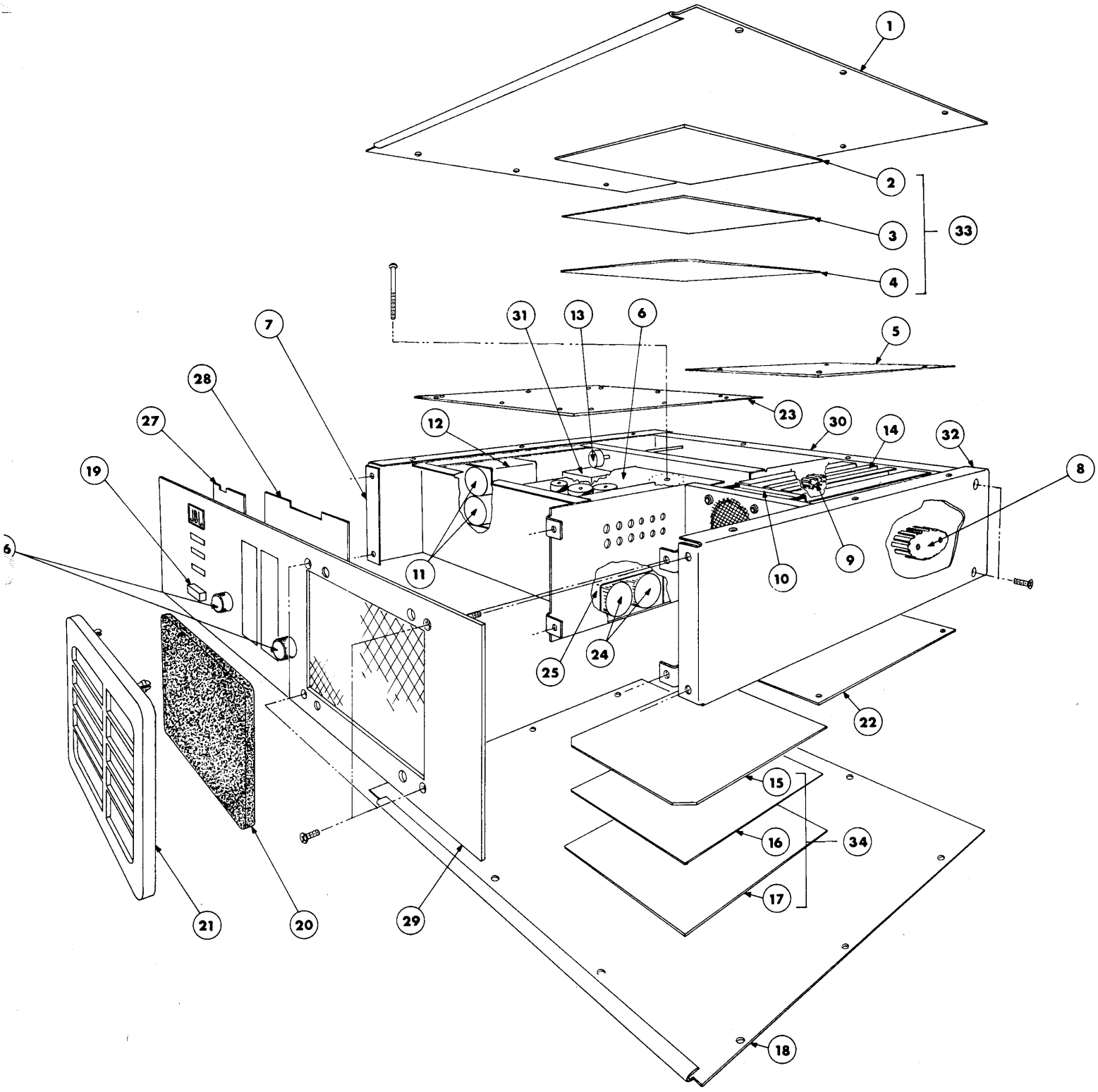

This manual section contains the information necessary for you to completely maintain the 6233 Dual Channel Power Amplifier. The information is contained under headings of: MAINTENANCE ACCESS, VOLTAGE CONVERSION AND LINE VOLTAGE SELECTION, INPUT IMPEDANCE CHANGE OPTIONS. We recommend that you thoroughly 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 PC 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]							

Notes:
1. Requires removal of 3.75 inch bolt holding inverter transformer/inverter PC board to chassis.
2. Requires removal of two Phillips-head screws on bottom of chassis and two screws holding bracket to chassis.
3. 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.
4. Requires removal of knobs and potentiometer hardware.
5. Requires removal of four Phillips-flat head screws on front panel.
6. Requires removal of seven Phillips-head screws from outer side panels.
7. Requires removal of four Phillips-flat head screws on bottom of inverter shield cover.
8. Requires removal of Molex plug before removing assembly.
9. Requires removal of six Phillips-head screws on back panel and four Phillips-head screws on outer side panels.
10. Remove two quick disconnect terminals off the thermal breaker on top of the heat sink.

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

FIGURE 4

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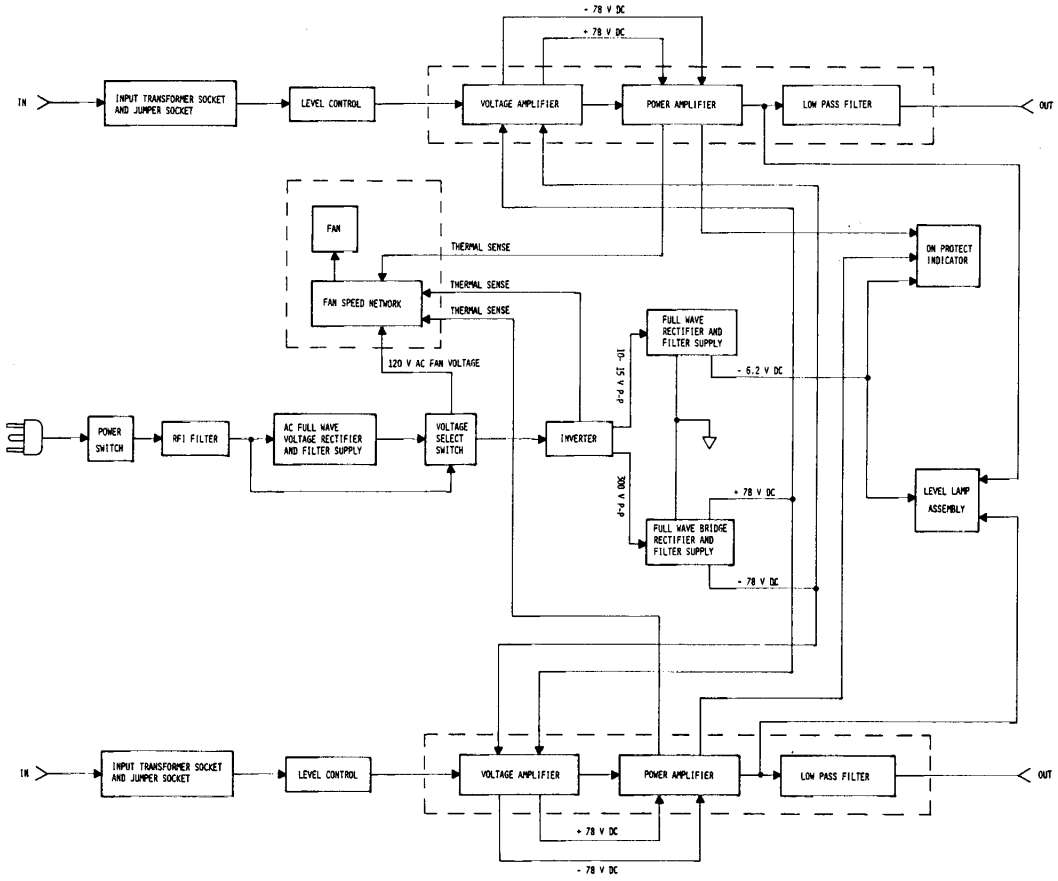
Recommended Test Equipment

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 mΩ	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 kΩ	
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

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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.

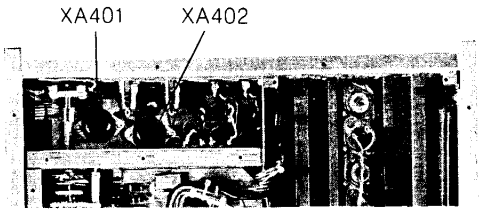

FIGURE 5

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

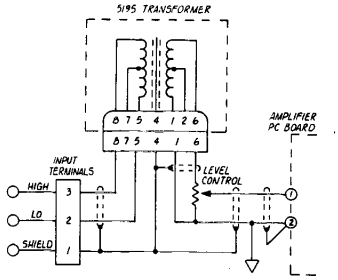

FIGURE 6

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

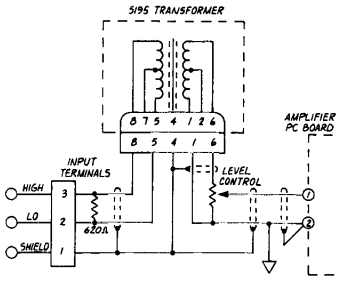

FIGURE 7

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.

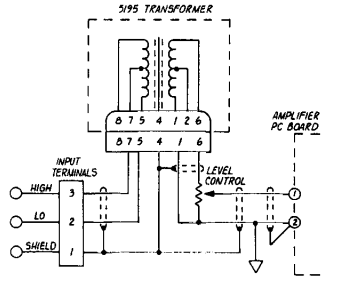

FIGURE 8

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

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.

WARNING
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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.

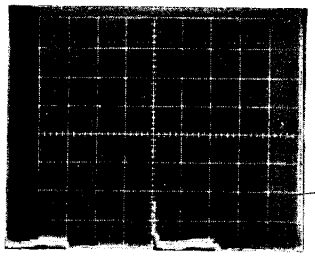
☐ 3. The inverter supply should start to operate with approximately 30 V AC applied with the INPUT VOLTAGE select switch set at 100 - 120 V position.

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:

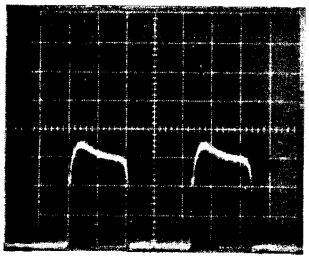
ORG/BLK	#11
YEL/BLK	#12
BRN/BLK	#13
RED/BLK	#14

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.

FIGURE 9

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).

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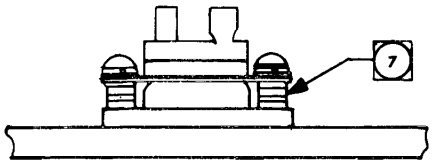
☐ 4. With both channels running at full rated output at 50 Hz, short one output channel. If the protect circuits are correctly operating, the channel under test will go into thermal protect mode within 1 to 2 minutes.

☐ 5. Confirm distortion specifications.

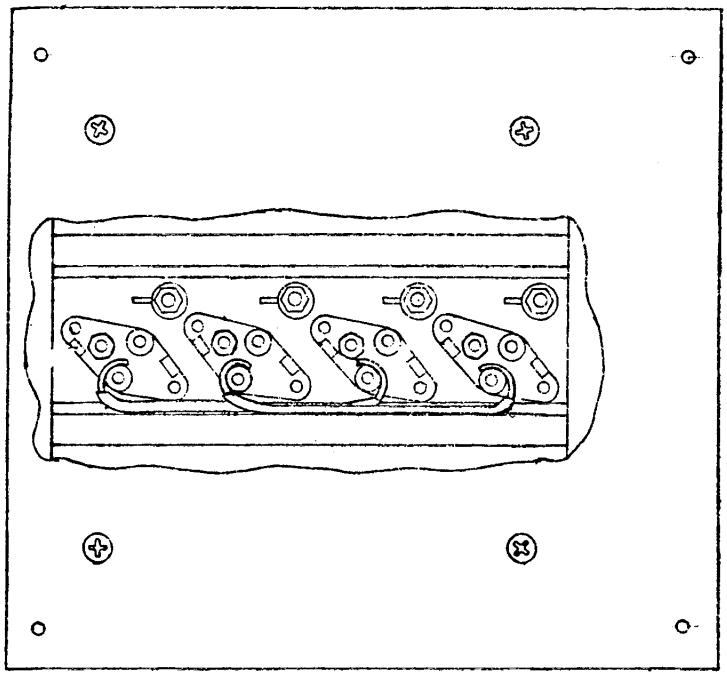
☐ 6. Offset voltage across the output of either channel must be ≤ 100 mV.

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.

Ref. Desig.	JBL Part No.	Description
RESISTORS		
All resistors in ohms, ½ W, 5%.		
R1	11464	100 k
R2	11464	100 k
SEMICONDUCTORS		
CR1	39869	1N4003
CR2	39869	1N4003
Q1	52699	2N4123
Q2	52699	2N4123
LAMPS		
DS1	53121	1302
DS2	53121	1302
DS3	53121	1302



VIEW A-A



[7] Stack washers and spacers until stack height is one washer less than height of transistor cap.
6. Apply thermal compound between the following:
   A. All four transistors and mica washers.
   B. Mica washers and heatsink.
   C. Transistor Q2 and thermal breaker, S1.
5. Route cable assembly under heatsink as shown.
4. Thermal breaker to be located as shown
3. Torque transistors to heat sink, 1.24- 1.46 N·m (11-13 in·lb)
2. Transistors Q1, Q2, Q3 and Q4 must be color coded the same.
1. JBL reserves the right to make minor changes without notice.

Notes: Unless otherwise specified.

Heat Sink Assembly

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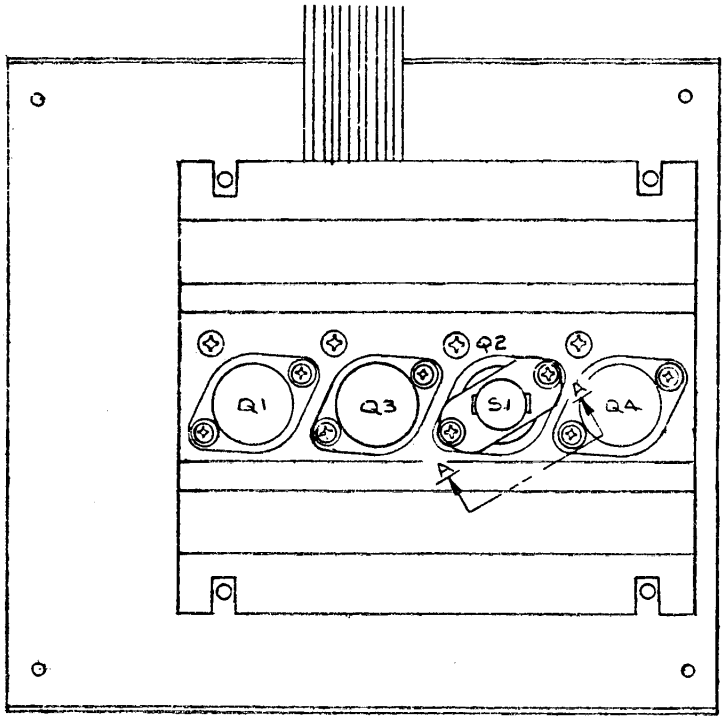
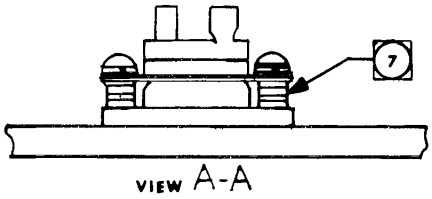
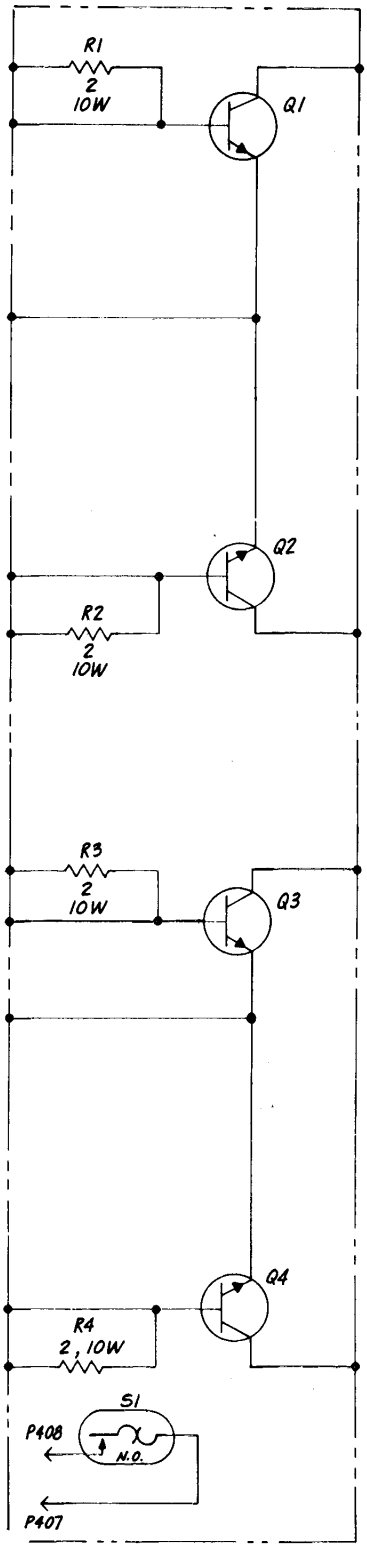
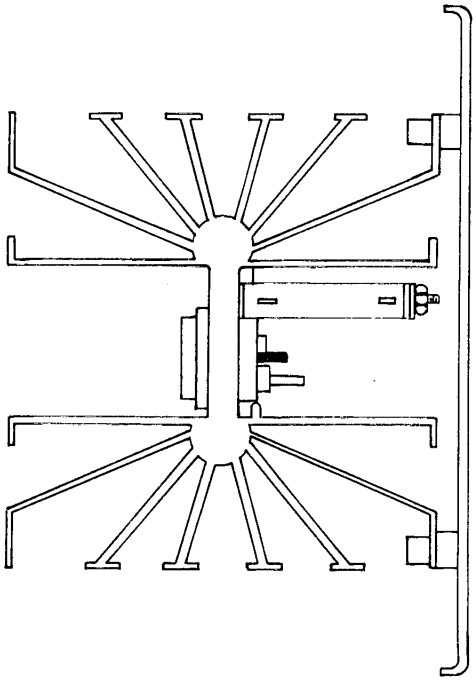




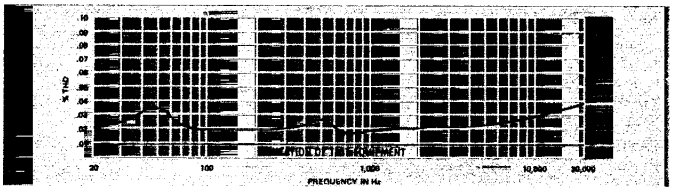
VIEW A-A



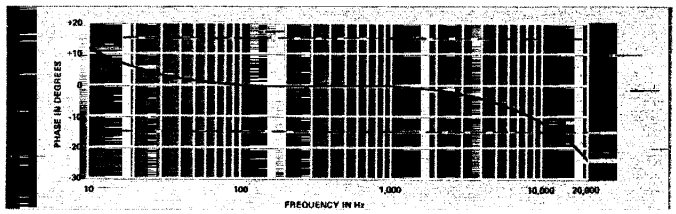


Minimum Specifications

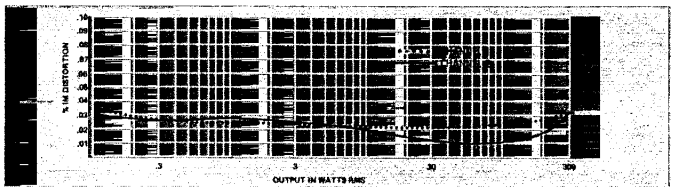
Power Output, Continuous	
Sine Wave	
Both channels driven	
4 Ω load	300 W per channel
8 Ω load	200 W per channel
Both channels bridged	
8 Ω load	700 W
16 Ω load	400 W
Power Bandwidth,	
Rated Output	20 Hz - 20 kHz, ±0.5 dB
Frequency Response,	
All Power Levels	20 Hz - 20 kHz, ±0.5 dB
Total Harmonic Distortion,	
Rated Output	Less than 0.05%, 20 Hz - 20 kHz
Intermodulation Distortion,	
SMPTE	
Standard	Less than 0.05%
Rise Time	
4 Ω load	5 μs or less
8 Ω load	3 μs or less
Slew Rate	Greater than 20 V/μs
Damping Factor	Greater than 40
Signal-to-Noise Ratio	Greater than 100 dB ref. rated output, 20 Hz - 20 kHz equivalent bandwidth
Power Gain	70 dB
Input Sensitivity	0.77 V
Input Impedance	20 kΩ, 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
Indicators	Pilot lamp
	Protection mode, one lamp per channel
	Level, 5 sequential lamps per channel
Power Requirement	100 - 120 or 200 - 240 V AC, 50/60 Hz
Power Consumption	
Quiescent	180 W
⅓ 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 (5¼ in x 19 in)
Depth of controls	19 mm (¾ in)
Depth behind panel	445 mm (17½ in)
Net Weight	15.7 kg (34½ lb)
Shipping Weight	19 kg (42 lb)
Accessory	JBL Model 5195 Matching/Bridging Transformer for 15 kΩ input bridging or 600 Ω input matching, one per channel required



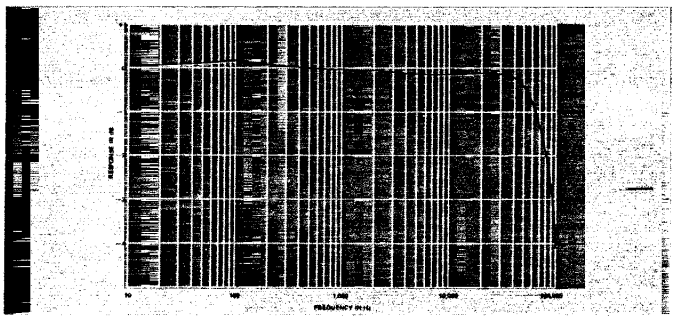
Total Harmonic Distortion
Total harmonic distortion of a typical unit, both channels driven at 300 W continuous sine wave into a 4-Ω load.



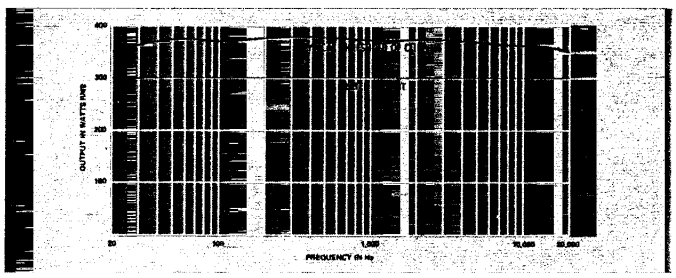
Phase Shift
Phase shift vs. frequency of a typical unit taken at 1W into a 4-Ω load. Note that phase shift of less than ±15° cannot be perceived, as shown by the dotted lines representing the threshold of perception.



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.

Professional Division
James B. Lansing Sound, Inc.,
8500 Balboa Boulevard,
Northridge, California 91329 U.S.A.

PPB 6233/7-79 Printed in U.S.A.

5. Simular Reference Desig. will appear wit in the schematic, refer to individual drawings for part No. and der ription.
4. Resistors are in ohms, 1/2 W, 5%.
3. Capacitors are in microfarads.
2. Inductors are in microhenries.
1. JBL reserver the right to make component changes without notice.
NOTES: Unless otherwise specified.

Notes: 1. Requires removal of 3.75 inch bolt holding inverter transformer/inverter PC board to chassis.

2. Requires removal of two Phillips-head screws on bottom of chassis and two screws holding bracket to chassis.

3. 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.

4. Requires removal of knobs and potentiometer hardware.

5. Requires removal of four Phillips-flat head screws on front panel.

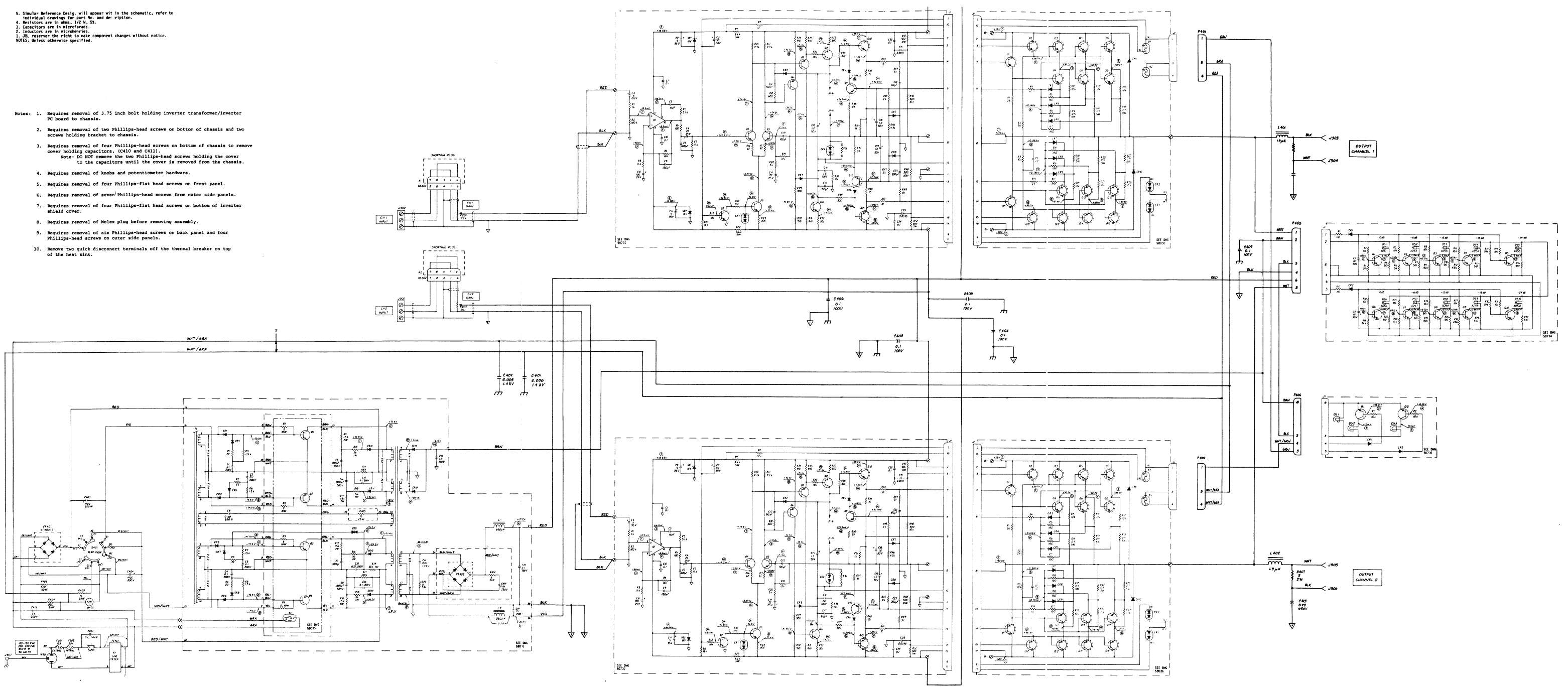
6. Requires removal of seven Phillips-head screws from outer side panels.

7. Requires removal of four Phillips-flat head screws on bottom of inverter shield cover.

8. Requires removal of Molex plug before removing assembly.

9. Requires removal of six Phillips-head screws on back panel and four Phillips-head screws on outer side panels.

10. Remove two quick disconnect terminals off the thermal breaker on top of the heat sink.



System Schematic and Chassis Internal View

Ref. Desig.	JBL Part No.	Description		
INDUCTORS				
L1	52909	250 μH		
L2	52909	250 μH		
RESISTORS				
All resistorsre in ohms, ±5%.				
R1	35684	22	½ W	
R2	35684	22	½ W	
R3	35684	22	½ W	
R4	35684	22	½ W	
R5	10078	1.5 k	½ W	
R6	10078	1.5 k	½ W	
R7	10078	1.5 k	½ W	
R8	36916	1.5 k	½ W	
R9	36916	1.5 k	2 W	
R10	36916	1.5 k	2 W	
R11	36916	1.5 k	2 W	
R12	36916	1.5 k	2 W	
R13	36731	56	1 W	
R14	10072	100 k	½ W	
R15	36731	56	1 W	
R16	36731	56	1 W	
R17	10071	100 k	½ W	
R18	36731	56	1 W	
R19	36793	22 k	1 W	
R20	53402	5	5 W	
CAPACITORS				
All capacitors in μF unless otherwise noted				
C1	10114	0.1	250 V	Mylar
C2	10114	0.1	250 V	Mylar
C3	10114	0.1	250 V	Mylar
C4	10114	0.1	250 V	Mylar
C5	48929	1800 pF	500 V	Mica
C6	48929	1800 pF	500 V	Mica
C7	48929	1800 pF	500 V	Mica
C8	48929	1800 pF	500 V	Mica
C9	53424	0.68	250 V	
C10	88753	0.22	250 V	
C11	13189	0.01	1400 V	Ceramic Disc
C12	53425	1.0	100 V	
C13	10114	0.1	250 V	Mylar
C14	10114	0.1	250 V	Mylar
C15	10114	0.1	250 V	Mylar
C16	10114	0.1	250 V	Mylar
SEMICONDUCTORS				
CR1	52220	1N4933		
CR2	52220	1N4933		
CR3	52220	1N4933		
CR4	52220	1N4933		
CR5	52220	1N4933		
CR6	52220	1N4933		
CR7	52220	1N4933		
CR8	52220	1N4933		
CR9	52224	1N5760	DIAC	
CR10	52221	1N4936		
CR11	52221	1N4936		
CR12	52221	1N4936		
CR13	52221	1N4936		
CR14	52221	1N4936		
CR15	52221	1N4936		
TRANSFORMERS				
T1	52906	Output		
T2	52907	Feedback		

All resistors in ohms.				
R1	55007	2	12 W	
R2	55007	2	12 W	
R3	55007	2	12 W	
R4	55007	2	12 W	
SEMICONDUCTORS				
Q1		Must be replaced in set of four matched transistors only. JBL Part No. 57475.		
Q2				
Q3				
Q4				
THERMAL BREAKER				
S1	54147			

4. Inductors are in microhenries.
3. Capacitors are in microfarads.
2. Resistors are in ohms, 1/2 W, 5%.
1. JBL reserves the right to make minor component changes without notice.

Notes: Unless otherwise specified.

Inverter P.C. Board Assembly

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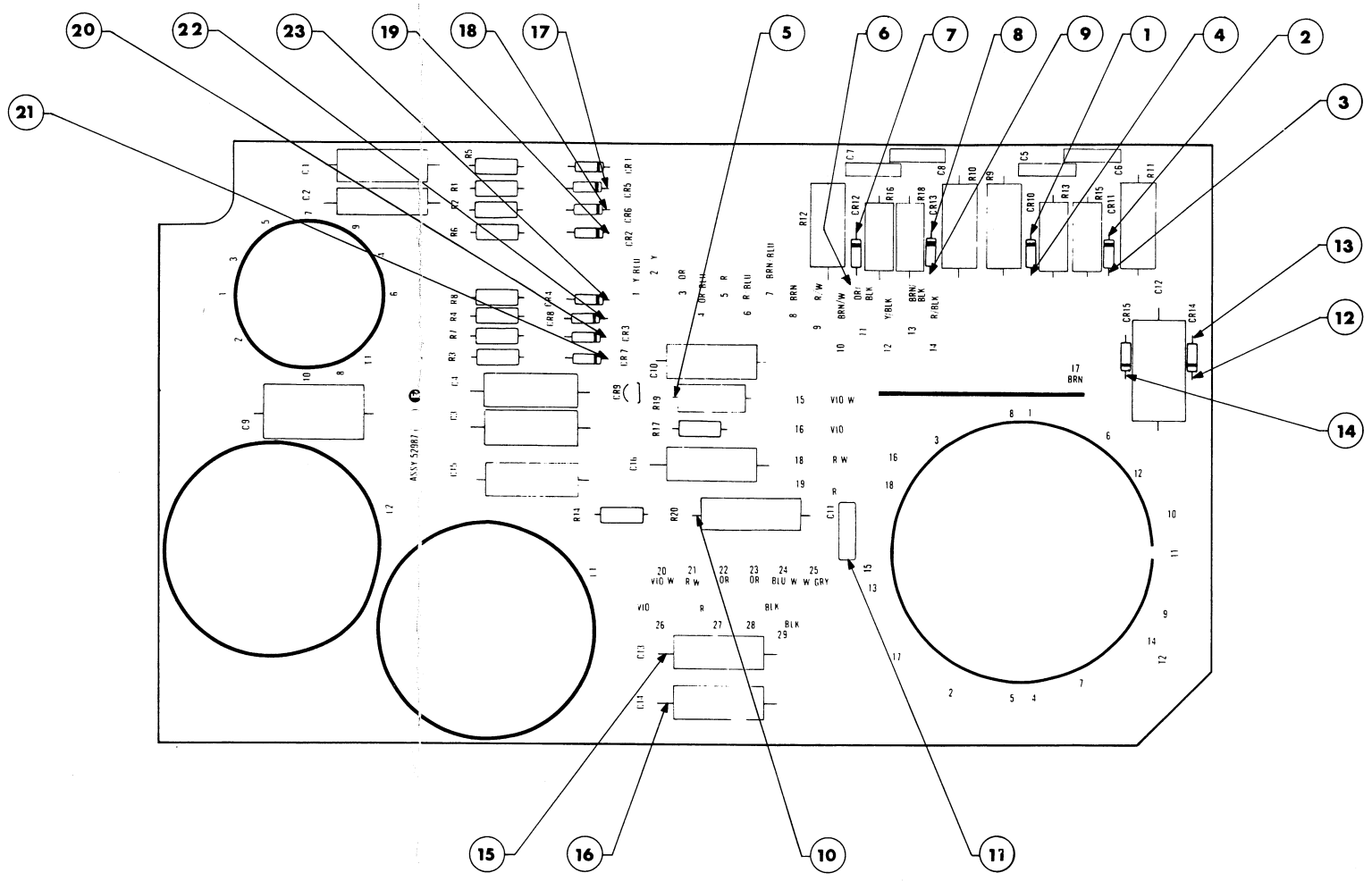

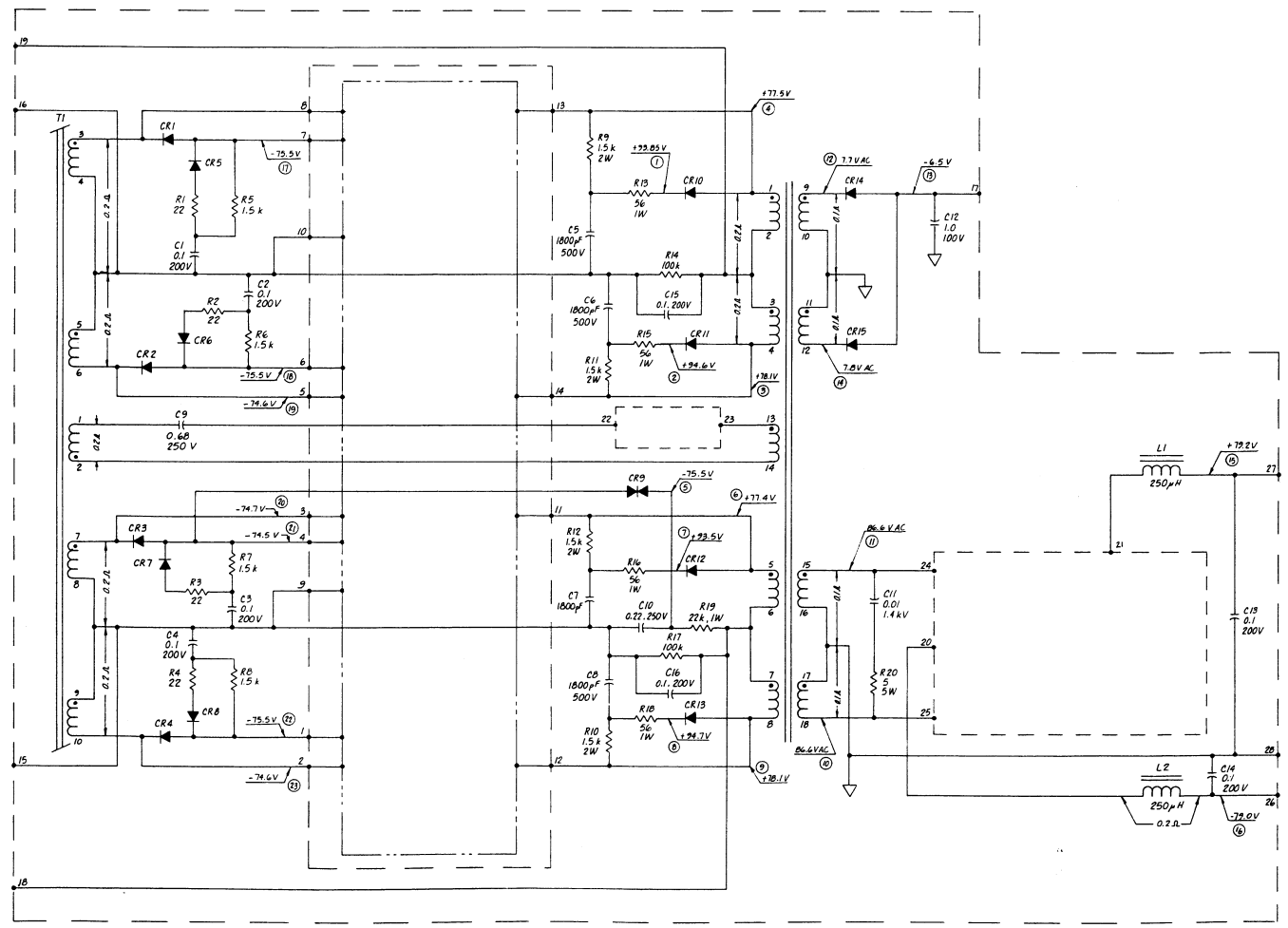

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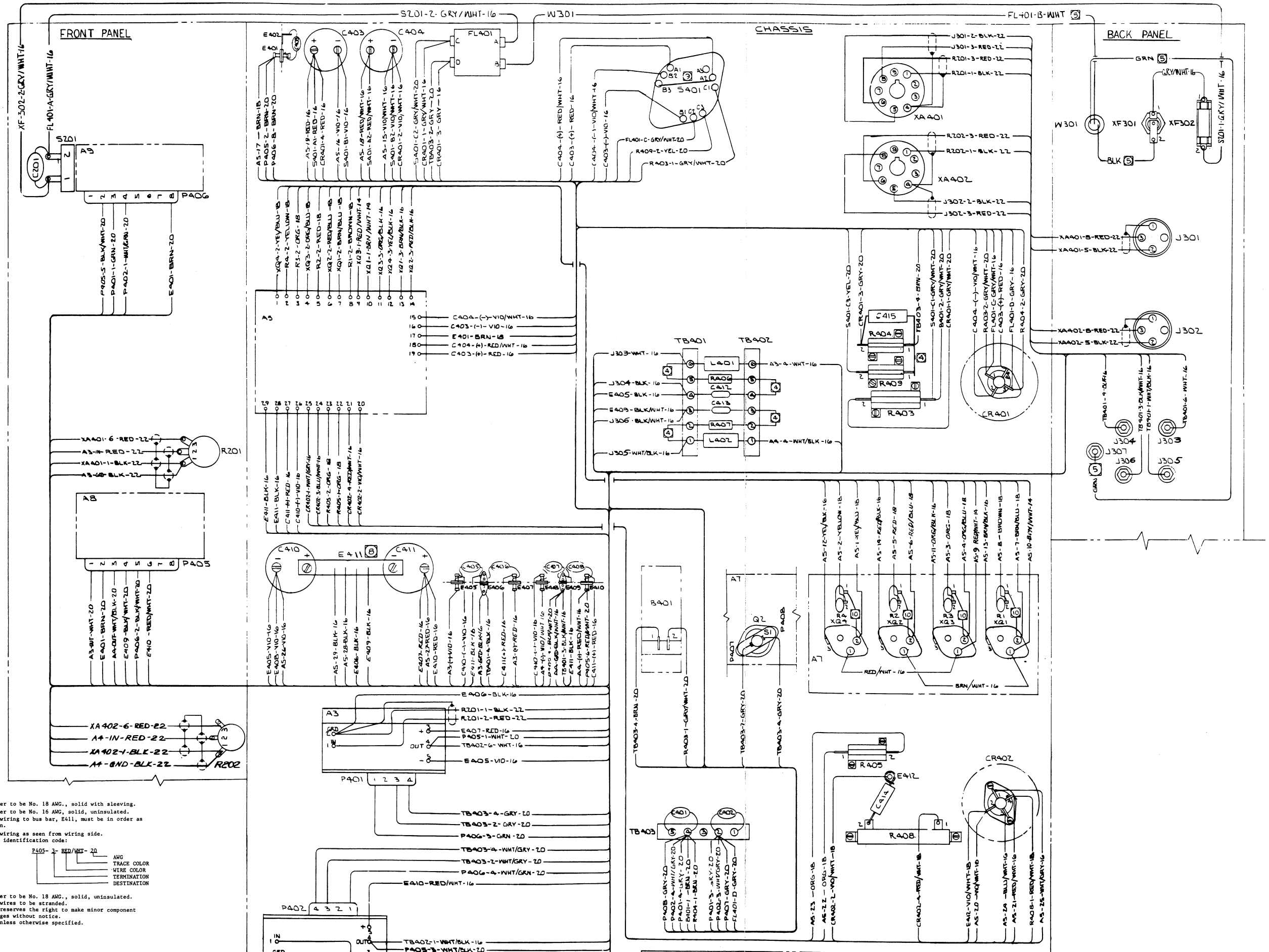

11 Jumper to be No. 18 AWG., solid with sleeving.
10 Jumper to be No. 16 AWG, solid, uninsulated.
9 All wiring to bus bar, E411, must be in order as shown.
8. All wiring as seen from wiring side.
7. Wire identification code:

5 Jumper to be No. 18 AWG., solid, uninsulated.
4. All wires to be stranded.
1. JBL reserves the right to make minor component changes without notice.
Notes: Unless otherwise specified.

Wiring Diagram

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Ref. Desig.	JBL Part No.	Description	
RESISTORS			
All resistors in ohms, 5%, ½ W.			
R1	35701	110	
R2	11464	10 k	
R3	35757	24 k	
R4	11459	510	
R5	11464	10 k	
R6	11047	51 k	
R7	11459	510	
R8	11464	10 k	
R9	35775	130 k	
R10	11459	510	
R11	11464	10 k	
R12	10945	470 k	
R13	11459	510	
R14	11613	39 k	
R15	11464	10 k	
R16	11459	510	
R17	35701	110	
R18	11464	10 k	
R19	35757	24 k	
R20	11459	510	
R21	11464	10 k	
R22	11047	51 k	
R23	11459	510	
R24	11464	10 k	
R25	35775	130 k	
R26	11459	510	
R27	11464	10 k	
R28	10945	470 k	
R29	11459	510	
R30	11613	470 k	
R31	11464	10 k	
R32	11459	510	
CAPACITORS			
All capacitors in μF.			
C1	36185	10	50 V
C2	36185	10	50 V
SEMICONDUCTORS			
CR1	39869	1N4003	
CR2	39869	1N4003	
Q1	52218	MPS-A65	
Q2	52218	MPS-A65	
Q3	52218	MPS-A65	
Q4	52218	MPS-A65	
Q5	52218	MPS-A65	
Q6	52218	MPS-A65	
Q7	52218	MPS-A65	
Q8	52218	MPS-A65	
Q9	52218	MPS-A65	
Q10	52232	MPS6519	
LAMPS			
DS1	53120	1847	
DS2	53121	1302	
DS3	53121	1302	
DS4	53121	1302	
DS5	53121	1302	
DS6	53120	1847	
DS7	53121	1302	
DS8	53121	1302	
DS9	53121	1302	
DS10	53121	1302	

3. Resistors are in ohms, 1/2 W, 5%.
2. Capacitors are in microfarads.
1. JBL reserves the right to make minor component changes without notice.

Notes: Unless otherwise specified.

Level Lamp P.C. Board Assembly

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WARNING
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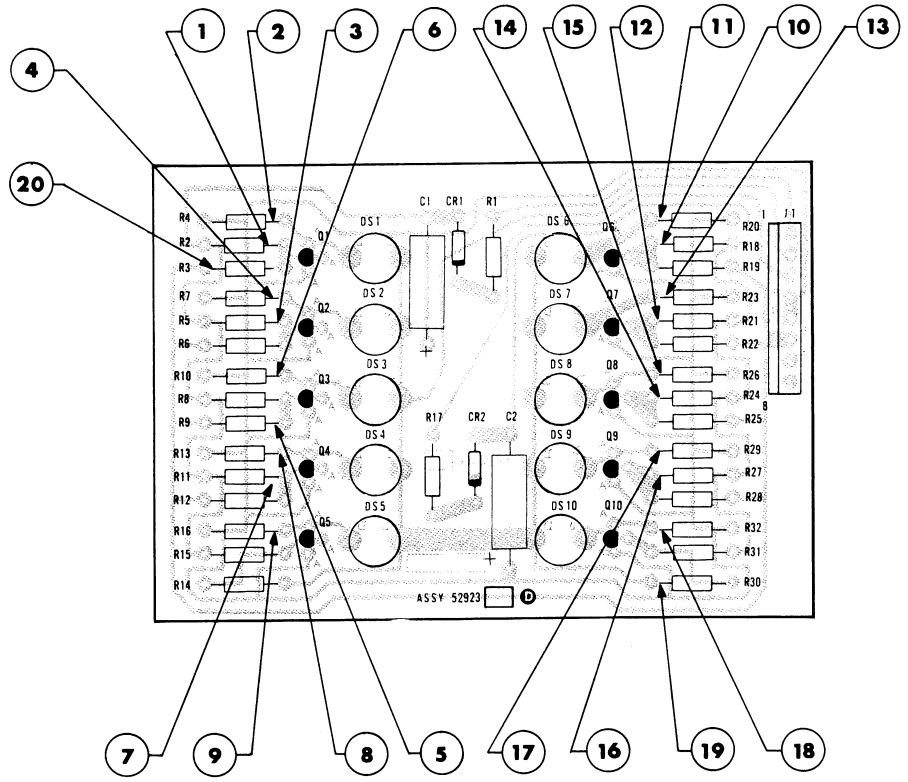
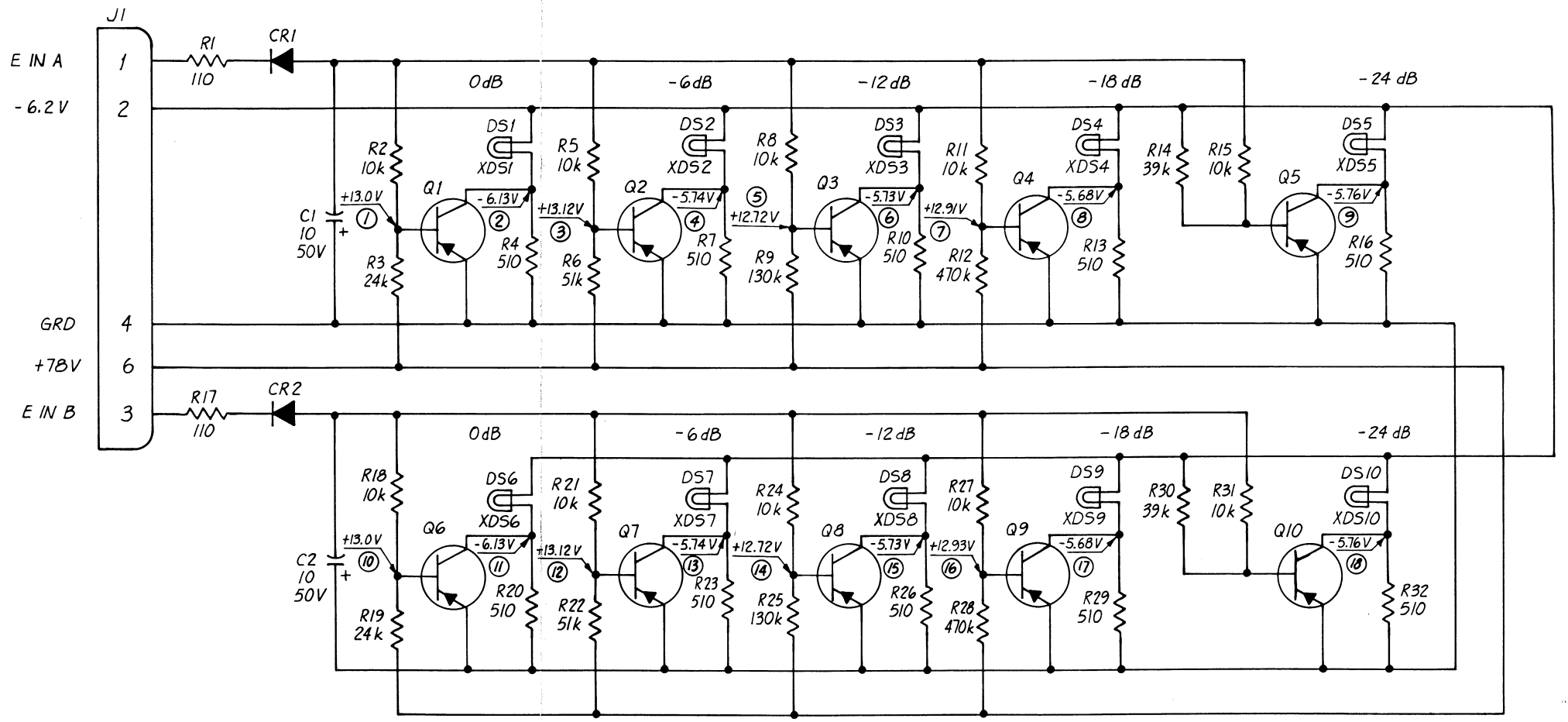
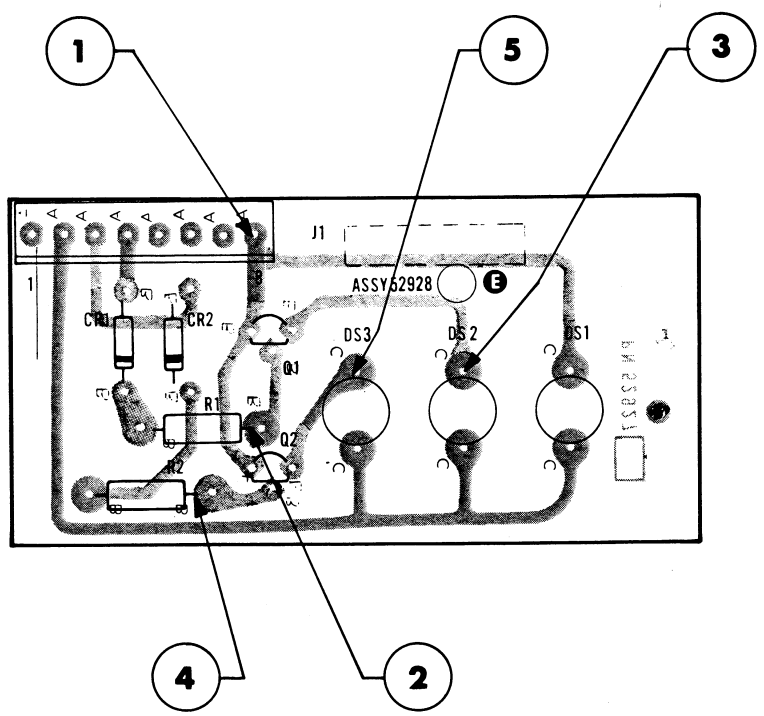
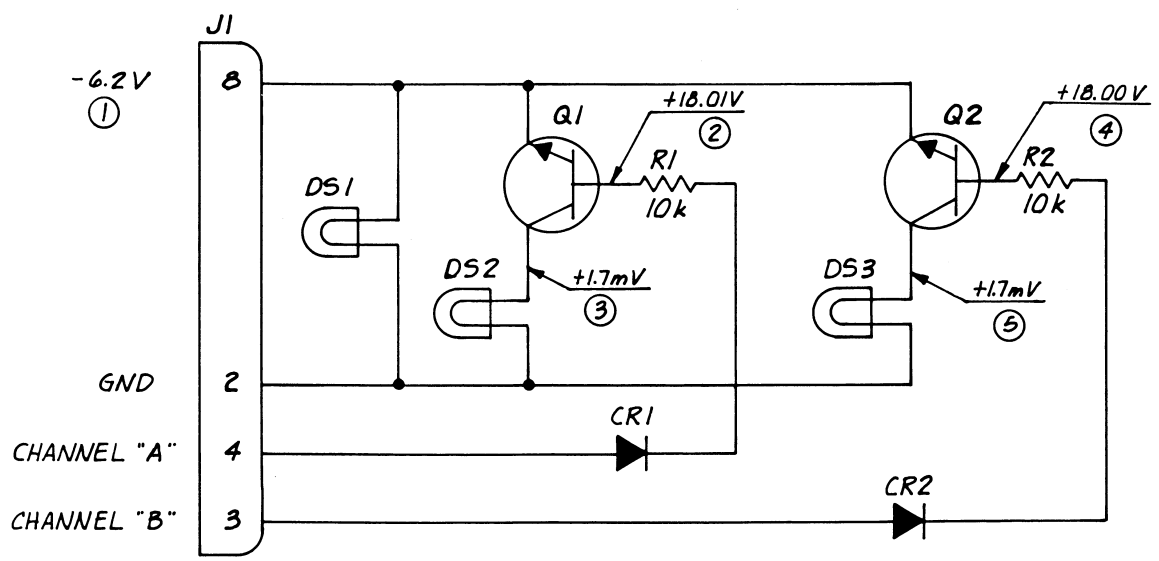




Ref. Desig.	JBL Part No.	Description
RESISTORS		
All resistors in ohms, ½ W, 5%		
R1	11464	100 k
R2	11464	100 k
SEMICONDUCTORS		
CR1	39869	1N4003
CR2	39869	1N4003
Q1	52699	2N4123
Q2	52699	2N4123
LAMPS		
DS1	53121	1302
DS2	53121	1302
DS3	53121	1302





2. Resistors are in ohms, 1/2 W, 5%.
1. JBL reserves the right to make minor component changes without notice.

Notes: Unless otherwise specified.

On/Protect P.C. Board Assembly

50735 O/P P.C. ASSEMBLY 6233 11/78 PRINTED IN THE U.S.A.

WARNING

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WARNING
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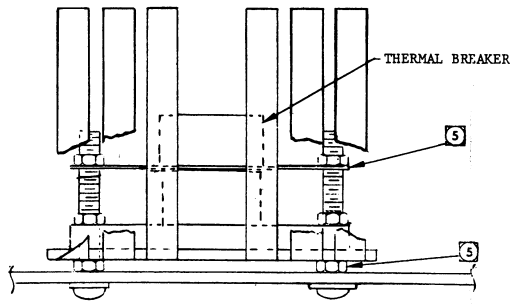
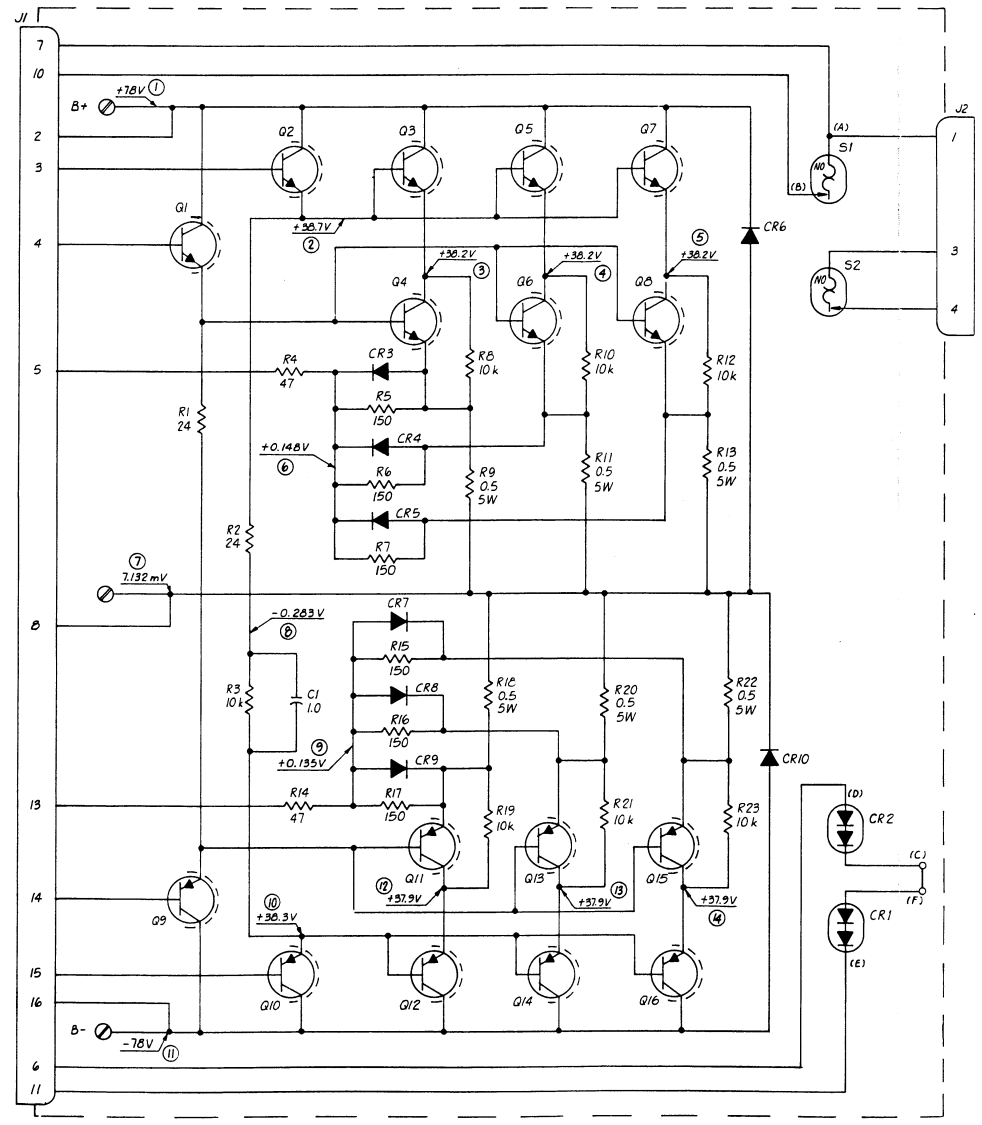
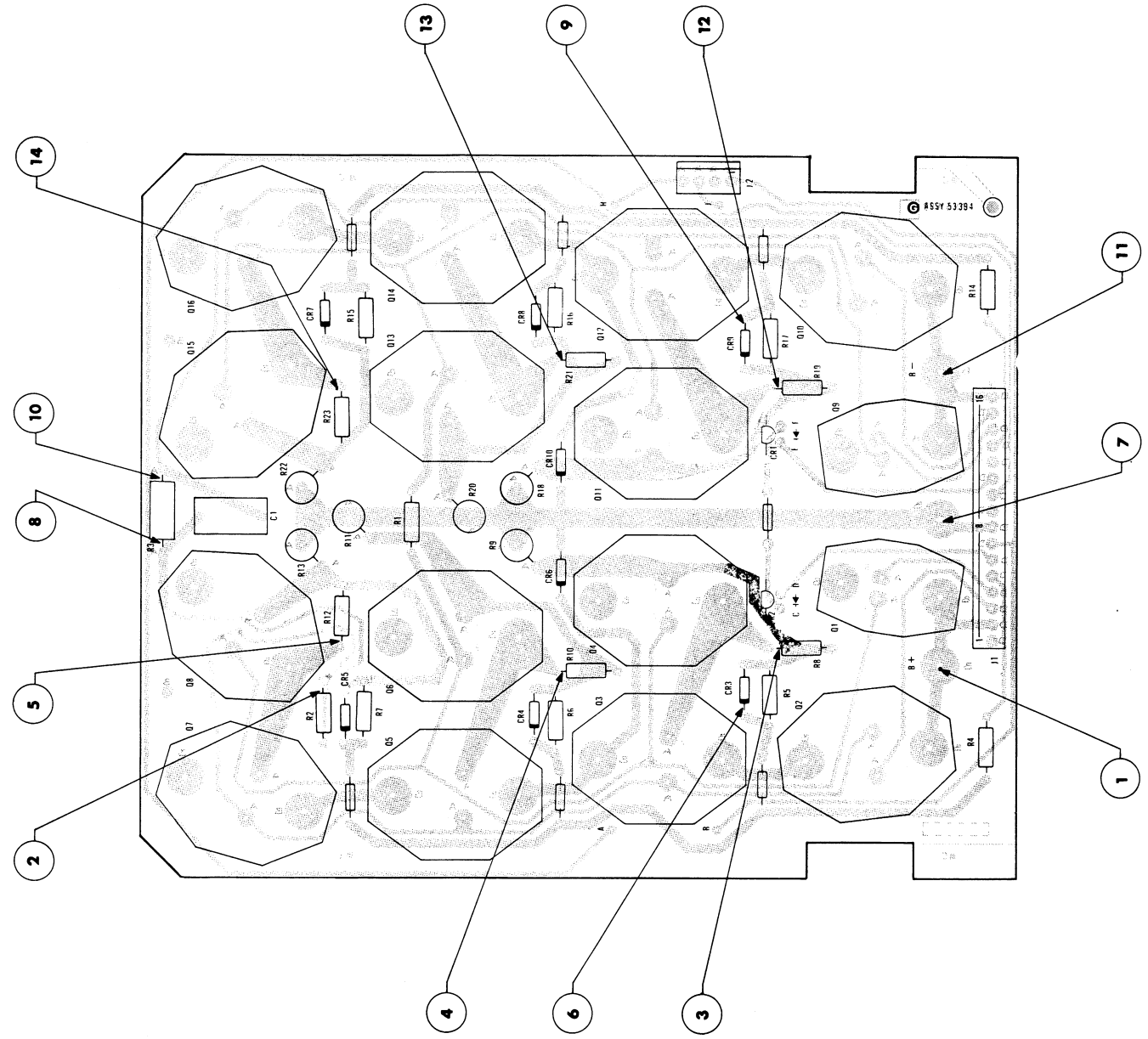
Ref. Desig.	JBL Part No.	Description	
RESISTORS			
All resistors in ohms, 5%, ½ W unless noted.			
R1	35685	24	
R2	35685	24	
R3	36785	10 k	1 W
R4	35692	47	
R5	35704	150	
R6	35704	150	
R7	35704	150	
R8	11464	10 k	
R9	53555	0.5	5 W
R10	11464	10 k	
R11	53555	0.5	
R12	11464	10 k	
R13	53555	0.5	5 W
R14	35692	47	
R15	35704	150	
R16	35704	150	
R17	35704	150	
R18	53555	0.5	5 W
R19	11464	10 k	
R20	53555	0.5	5 W
R21	11464	10 k	
R22	53555	0.5	5 W
CAPACITORS			
All capacitors in μF unless otherwise noted.			
C1	48503	1	100 V
SEMICONDUCTORS			
CR1	52219	MSD 7000	
CR2	52219	MSD 7000	
CR3	39869	1N4003	
CR4	39869	1N4003	
CR5	39869	1N4003	
CR6	52221	1N4936	
CR7	39869	1N4003	
CR8	39869	1N4003	
CR9	39869	1N4003	
CR10	52221	1N4936	
Q1	52207	RCA1E02	
Q2	52205	2N5634	
Q3	52205	2N5634	
Q4	52205	2N5634	
Q5	52205	2N5634	
Q6	52205	2N5634	
Q7	52205	2N5634	
Q8	52205	2N5634	
Q9	52208	RCA 1E03	
Q10	52206	2N6231	
S1	53398	100°C	
S2	53397	80°C	
HEAT SINKS			
	53540	T03	
	53541	T066	







[3] Torque to 1.69 N-m (15 in-lb).
4. Capacitors are in microfarads.
3. Resistors are in ohms, 1/2 W, 5%.
2. Thermal compound to be applied between all transistors, S1 and Q3, S2 and Q12 and heatsinks and diodes.
1. JBL reserves the right to make minor component changes without notice.

Notes: Unless otherwise specified.

Power Amplifier P.C. Board Assembly

58036 P.A.P.C. ASSEMBLY 6233 11/78 PRINTED IN THE U.S.A.

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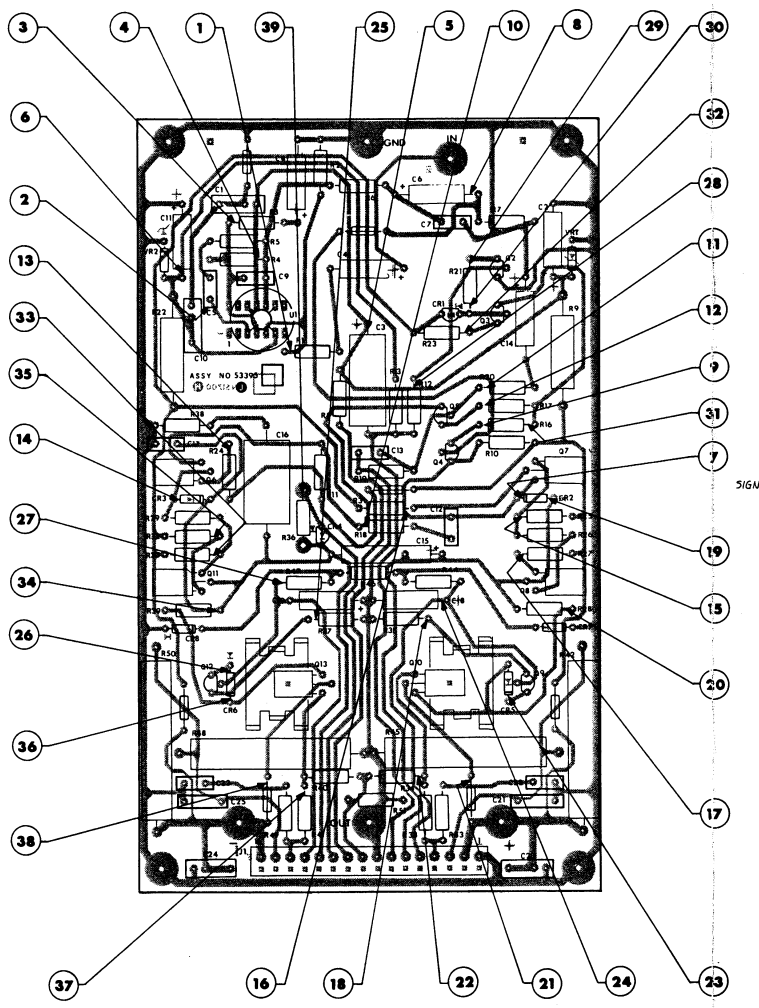
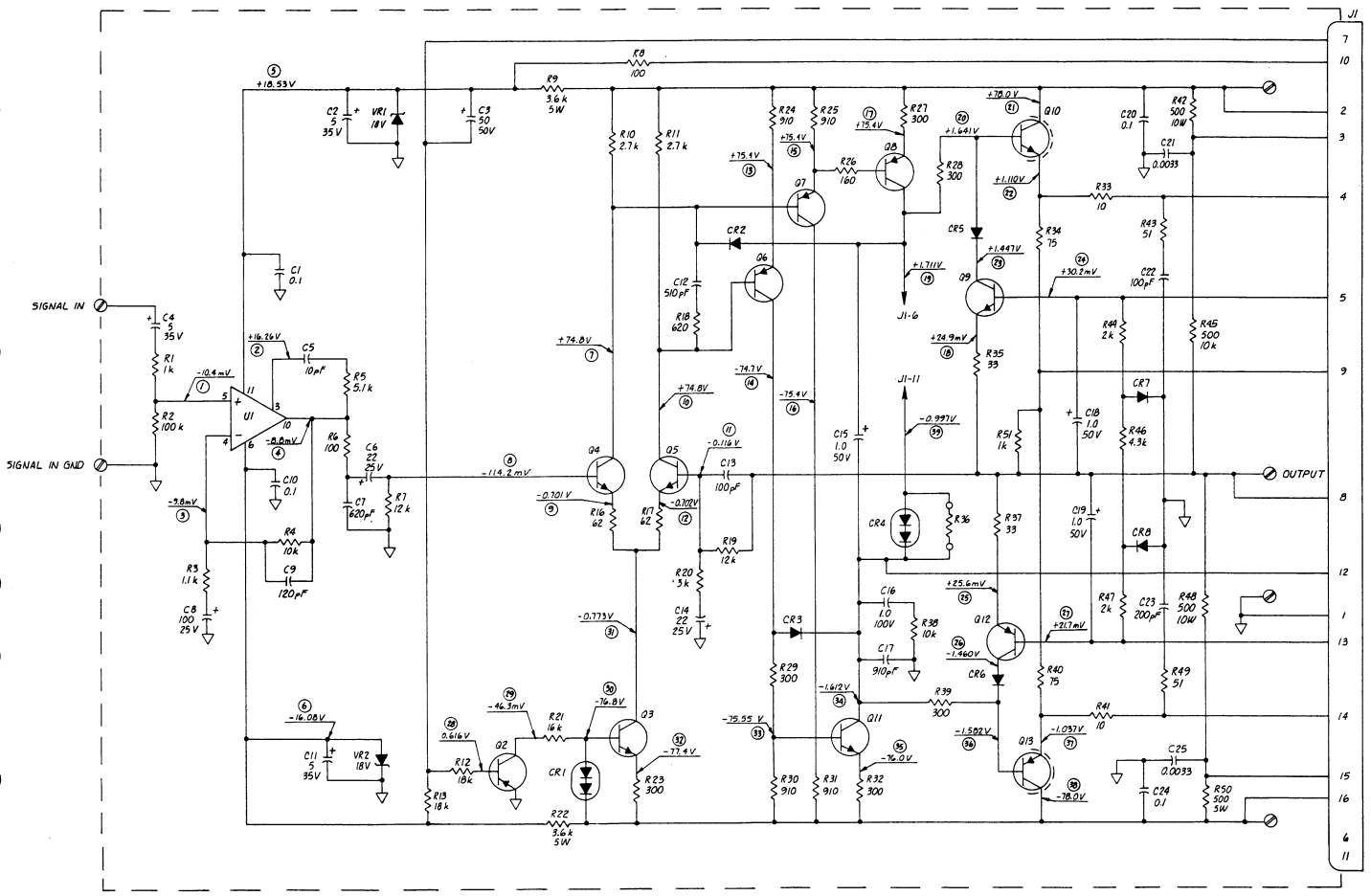
Ref. Desig.	JBL Part No.	Description		
RESISTORS				
All resistors in ohms, 5%, ½ W unless noted.				
R1	10940	1 k		
R2	10072	100 k		
R3	10949	1.1 k		
R4	11464	10 k		
R5	11461	5.1 k		
R6	11507	100		
R7	10077	12 k		
R8	11507	100		
R9	39866	3.6 k	5 W	10%
R10	12817	2.7 k		
R11	12817	2.7 k		
R12	11466	18 k		
R13	11466	18 k		
R16	35695	62		
R17	35695	62		
R18	10075	620		
R19	10077	12 k		
R20	11460	3 k		
R21	35753	16 k		
R22	39866	3.6 k	5 W	10%
R23	12013	300		
R24	12564	910		
R25	12564	910		
R26	35705	160		
R27	12013	300		
R28	12013	300		
R29	12013	300		
R30	12564	910		
R31	12564	910		
R32	12564	910		
R33	12600	10		
R34	35697	75		
R35	11454	33		
R36		Value selected at assembly		
R37	11454	33		
R38	11464	10 k		
R39	12013	300		
R40	35697	75		
R41	12600	10		
R42	53405	500	10 W	
R43	35693	51		
R44	12014	2 k		
R45	53405	500	10 W	
R46	12557	4.3 k		
R47	12014	2 k		
R48	53405	500	10 W	
R49	35693	51		
R50	53405	500	10 W	
CAPACITORS				
All capacitors in μF unless otherwise noted.				
C1	52486	0.1	100 v	
C2	47795	5	35 V	
C3	53423	50	50 V	
C4	47795	5	35 V	
C5	48429	10 pF	500 V	Mica
C6	36168	22	25 V	
C7	48472	620 pF	500 V	Mica
C8	48504	100	25 V	
C9	48453	120 pF	500 V	
C10	52486	0.1	100 V	
C11	47795	5	35 V	
C12	48470	510 pF	500 V	Mica
C13	48451	100 pF	500 V	Mica
C14	36168	22	25 V	
C15	53427	1	50 V	Poly
C16	53425	1	100 V	Poly
C17	48476	910 pF	500 V	Mica
C18	81321	1	50 V	
C19	81321	1	50 V	
C20	52486	0.1	100 v	
C21	48477	1000 pF	500 V	Mica
C22	48451	100 pF	500 V	Mica
C23	48458	200 pF	500 V	
C24	52486	0.1	100 V	
C25	48477	1000 pF	500 V	Mica

Ref. Desig.	JBL Part No.	Description
SEMICONDUCTOR		
CR1	52219	MSD 7000
CR2	39869	1N4003
CR3	39869	1N4003
CR4	52219	MSD 7000
CR5	39869	1N4003
CR6	39869	1N4003
CR7	39869	1N4003
CR8	39869	1N4003
Q2	55201	MPS 4356
Q3	52215	2N5551
Q4	52215	2N5551
Q5	52215	2N5551
Q6	52210	MJE350
Q7	52210	MJE350
Q8	52210	MJE350
Q9	48340	MPSA06
Q10	52209	MJE340
Q11	52209	MJE340
Q12	55201	MPS 4356
U1	52216	LM318H
VR1	52225	1N4746
VR2	52225	1N4746





3. Capacitors are in microfarads.
2. Resistors are in ohms, 1/2 W, 5%.
1. JBL reserves the right to make minor component changes without notice.

Notes: Unless otherwise specified.

Voltage Amplifier P.C. Board Assembly

50732 V.A.P.C. ASSEMBLY 6233 11/78 PRINTED IN THE U.S.A.

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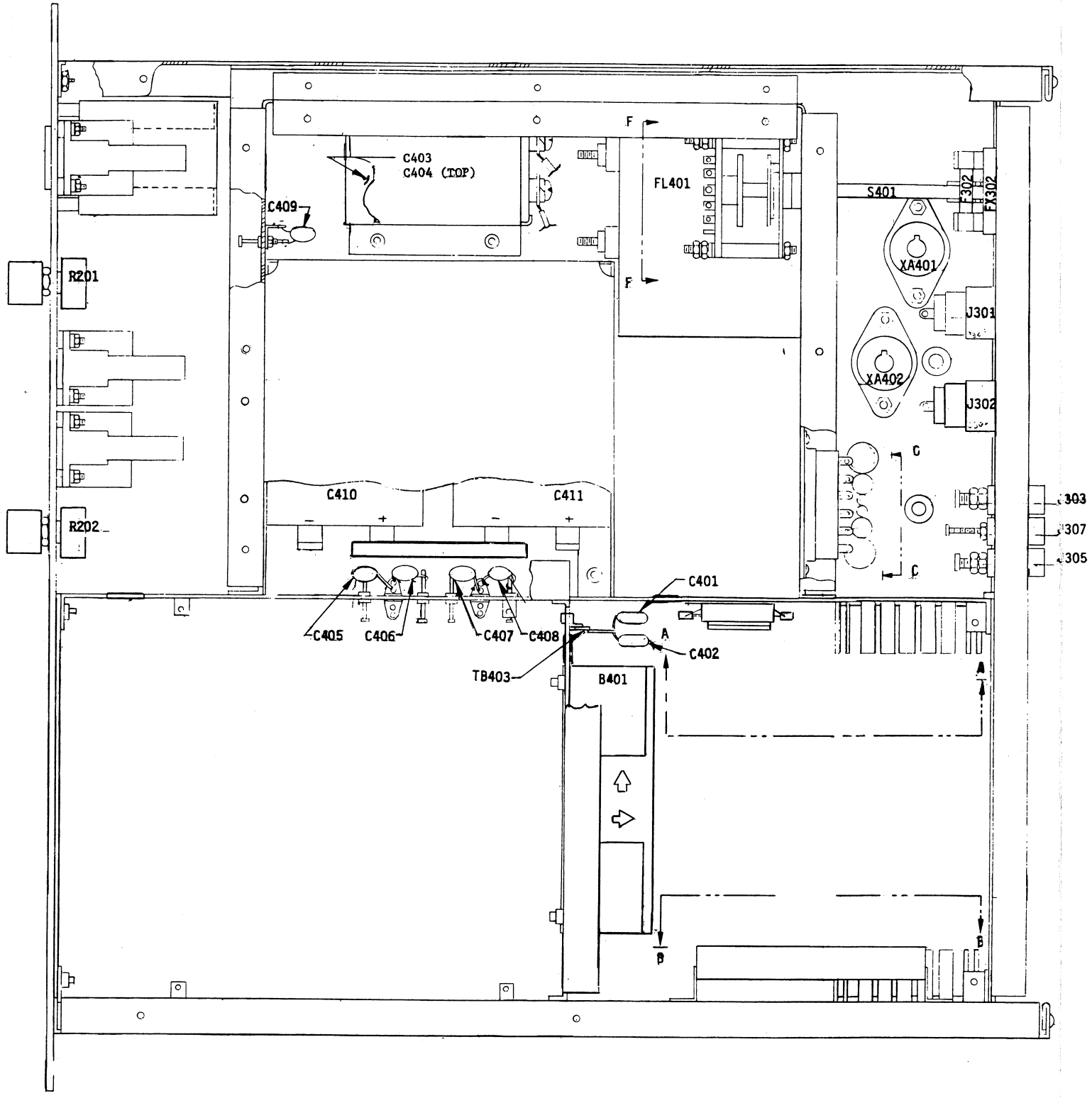

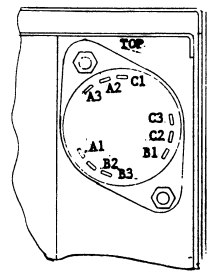

VIEW F-F