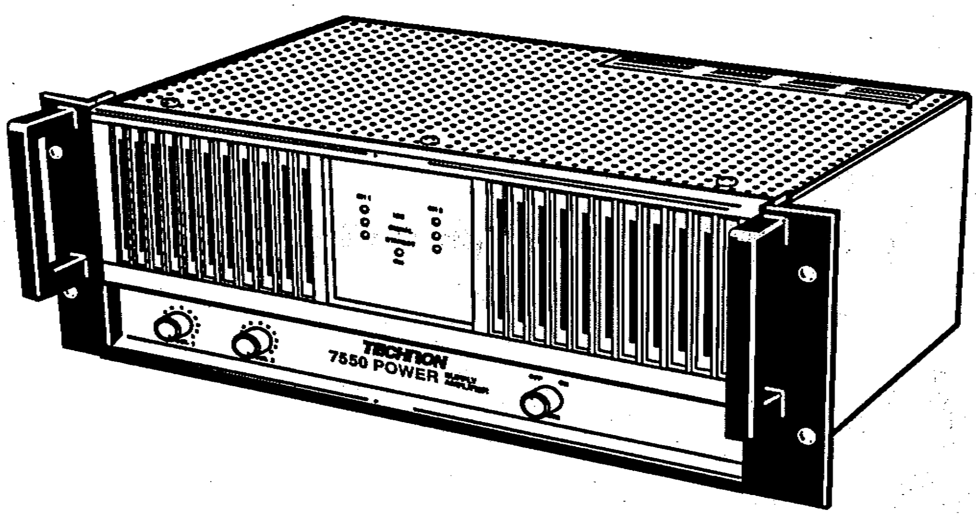
TECHRON®

TECHNICAL MANUAL



7550
POWER SUPPLY AMPLIFIER

Techron Division of Crown International, Inc., 1718 W. Mishawaka Road, Elkhart, IN 46517-4095

K80507-5
11/92

TECHRON
LIMITED ONE-YEAR WARRANTY

SUMMARY OF WARRANTY

CROWN INTERNATIONAL, INC., 1718 W. Mishawaka Road, Elkhart, Indiana 46517 (Warrantor) warrants to the ORIGINAL COMMERCIAL PURCHASER ONLY of each NEW TECHRON product, for a period of one (1) year from the date of purchase by the original purchaser (warranty period) that the product is free of defects in materials or workmanship and will meet or exceed all advertised specifications for such a product. This warranty does not extend to any subsequent purchaser or user, and automatically terminates upon your sale or other disposition of our product.

ITEMS EXCLUDED FROM WARRANTY

We are not responsible for product failure caused by misuse, accident or neglect. This warranty does not extend to any product on which the serial number has been defaced, altered or removed. It does not cover damage to loads or any other products or accessories resulting from Techron product failure. It does not cover defects or damage caused by your use of unauthorized modifications, accessories, parts, or service.

WHAT WE WILL DO

We will remedy any defect in materials or workmanship by repair, replacement, or refunds. If a refund is elected, then you must make the defective or malfunctioning component available to us free and clear of all liens or other encumbrances. The refund will be equal to the actual purchase price, not including interest, insurance, closing costs, and other finance charges less a reasonable depreciation on the product from the date of original purchase. Warranty work can only be performed at our authorized service centers or at our factory. Expenses in remedying the defect will be borne by Crown, including one way surface freight shipping costs within the United States. (Purchaser must bear the expense of shipping the product between any foreign country and the port of entry in the United States and all taxes, duties, and other custom's fee for such foreign shipments.)

HOW TO OBTAIN WARRANTY SERVICE

You must notify us of your need for warranty service not later than ninety (90) days after expiration of the warranty period. We will give you an authorization to return it to us for service. All components must be shipped in a factory pack or equivalent which, if needed, may be obtained from us for a nominal charge. Corrective actions will be taken within a reasonable time of the date of receipt of the defective product by us. If the repairs made by us are not satisfactory, notify us immediately.

DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES

YOU ARE NOT ENTITLED TO RECOVER FROM US ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN OUR PRODUCT. THIS INCLUDES ANY DAMAGE TO ANOTHER PRODUCT OR PRODUCTS RESULTING FROM SUCH A DEFECT.

WARRANTY ALTERATIONS

NO PERSON HAS THE AUTHORITY TO ENLARGE, AMEND, OR MODIFY THIS WARRANTY. THE WARRANTY IS NOT EXTENDED BY THE LENGTH OF TIME WHICH YOU ARE DEPRIVED OF THE USE OF THE PRODUCT. REPAIRS AND REPLACEMENT PARTS PROVIDED UNDER THE TERMS OF THIS WARRANTY SHALL CARRY ONLY THE UNEXPIRED PORTION OF THIS WARRANTY.

DESIGN CHANGES

We reserve the right to change the design of any product from time to time without notice and with no obligation to make corresponding changes in products previously manufactured.

LEGAL REMEDIES OF PURCHASER

There is no warranty which extends beyond the terms hereof. This written warranty is given in lieu of any oral or implied warranties not contained herein. WE DISCLAIM ALL IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No action to enforce this Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

TECHRON division of Crown International, Inc.
1718 W. Mishawaka Road, Elkhart, IN 46517-4095

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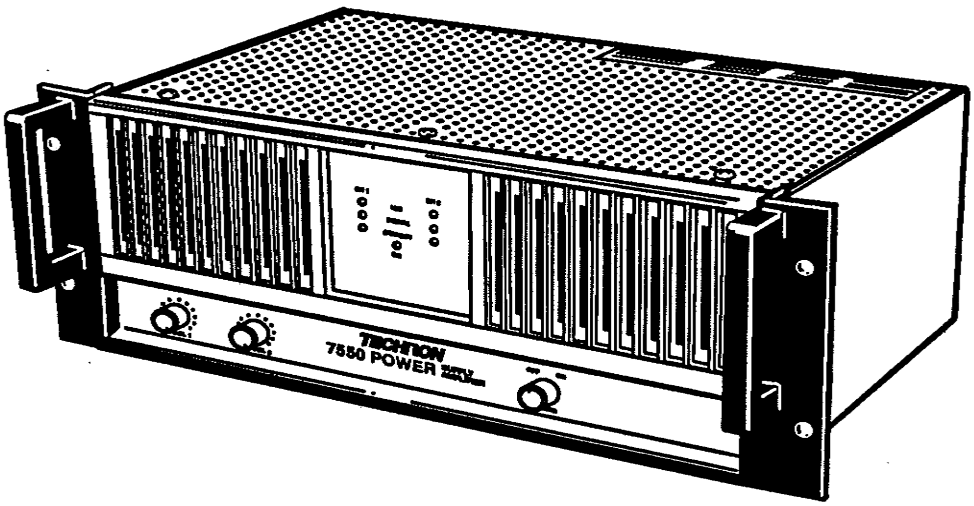


Illustration 1–1 Model 7550

Section 1. Introduction

1.1. General Description

The *TECHRON®** 7550 (shown above) is a high-powered, industrial power supply amplifier, single or dual channel. Read this manual completely to familiarize yourself with the details of this amplifier.

Model 7550 provides precision amplification of electrical signals with frequencies from zero (dc) to 20 kHz. It accomplishes this with extremely low harmonic and intermodulation distortion and low noise.

The continuous average power output is 90 watts minimum per channel into an 8 ohm load. Bridge the amplifier and operate it as a mono unit with 180 watts minimum power output into a 16 ohm load.

The rugged aluminum chassis measures five and a quarter inches high, nineteen inches wide, and almost twelve inches deep.

1.2. Mechanics

On the front panel, the push button power switch activates an amber ON indicator. Green SIGNAL PRESENCE indicators confirm signal path from input to output. Directly above these are red *IOC®* indicators which indicate clipping and STANDBY conditions.

Use the front panel output monitor jack with a high impedance load to monitor the output. Adjust the output level with the two controls on the front panel.

On the back panel are alternate means of input and output connection. Connect an unbalanced input to either BNC jacks or barrier strip screws, and a balanced input to an optional input module. Connect output to banana jack binding posts or barrier strip screws.

Other features on the back panel include a mono/dual switch, a grounding barrier strip, and a three-wire AC line cord with fuse.

* *TECHRON®* is a division of Crown International, Inc.

1.3. Circuitry

The output transistors operate in the Techron-designed *Multi-Mode*® AB + B configuration in which quiescent current is carried by the driver stages until the output transistors are summoned by a large current demand.

Techron tests each of the 16 rugged 150 watt output transistors to verify the safe operating area of each device which enhances the amplifier's overall reliability.

Massive black-anodized heat sinks thermally joined with the chassis enable the entire amplifier to function as a heat sink. In the event of overheating, the thermal sensing circuit will place the amplifier in the STANDBY mode. After cooling, the unit will return to normal operation. Frequent overheating may indicate the need for the optional forced air cooling system. See Section NO TAG

V-I current limiting provides protection against damage from shorted and low impedance loads, overloaded power supplies, input overload, and high frequency overloads. A four-second turn-on delay provides initial load protection.

1.4. Service Policies

Due to the sophisticated circuitry of Model 7550, have only qualified and fully trained technicians perform service work. Return to the factory in original packing for service. Replacement packing is available from Techron.

When returning Model 7550, enclose a brief letter explaining as completely as possible all problems. Include your address and telephone number. Ship "UPS™ ground" to:

TECHRON
Customer Service Department
57620 C.R. 105
Elkhart, Indiana 46517

Phone: (219) 294-8300
FAX: (219) 294-8329

1.5. About this Manual

Special instructions (Danger, Warning, Caution, and Note) appear throughout this manual. Examples of each follow:

⚠ DANGER

Danger is used before instructions that expose the reader to a hazard that *will* cause injury or death. The hazard will be explained and instructions to avoid the hazard will be included in the warning.

⚠ WARNING

A Warning is used before instructions that expose the reader to a hazard that *may* cause injury or death. The hazard will be explained and instructions to avoid the hazard will be included in the warning.

⚠ CAUTION

A Caution is used before instructions that if not performed properly, could cause equipment damage. The condition will be explained and instructions to avoid the condition will be included in the warning.

Note: A note is used when information needs special emphasis that does not call attention to a hazard.

The rest of this manual contains complete information on installation, operation, specifications, performance, theory, and applications.

Section 2. Installation

⚠ WARNING

To reduce the risk of *ELECTRIC SHOCK* or FIRE HAZARD, do NOT expose Model 7550 to rain or moisture.

⚠ CAUTION

Do not install Model 7550 into a small sealed chamber of any kind. Improper operation and overheating will result.

2.1. Unpacking

Every Techron Model 7550 is thoroughly inspected and tested prior to leaving the factory. Carefully unpack and inspect the unit for damage in shipment. If damage is found, notify the transportation company immediately. Save the shipping carton and packing materials as evidence of damage for the shipper's inspection. Techron will cooperate fully in the case of any shipping damage investigation. In any event, save the packing materials for later use in transporting or shipping the unit. Replacement packing materials are available from Techron. Always ship this amplifier in proper and appropriate packing material.

2.2. Mounting

The PSA–2X amplifier is designed for standard 19–inch (48.3 cm) rack mounting as well as stack mounting without a cabinet. When rack mounting, take care to support the heavy amplifier from behind. Use end supporting angles joined to the sides of the rack to support the amplifier from beneath.

If chassis slides are used, care should be taken to avoid toppling the rack when the slides are extended. The center of gravity of the amplifier is approximately 5.4 inches (13.7 cm) behind the front panel.

If a number of units are being racked on electrically common rails, remove the strap from the rear-panel ground-terminal strip to maintain a very high signal/noise ratio. This will reduce the possibility of ground loop hum.

Provide a source of cooling air for the fan intake. A vent tube to the outside of the rack may be necessary if the rack ventilation is poor and/or the amplifier heat output is high. NEVER block the air vents in the sides, front, and back of the amplifier. Allow a clearance of 1.75 inches (4.5 cm) above the unit for hot air discharge, if at all possible.

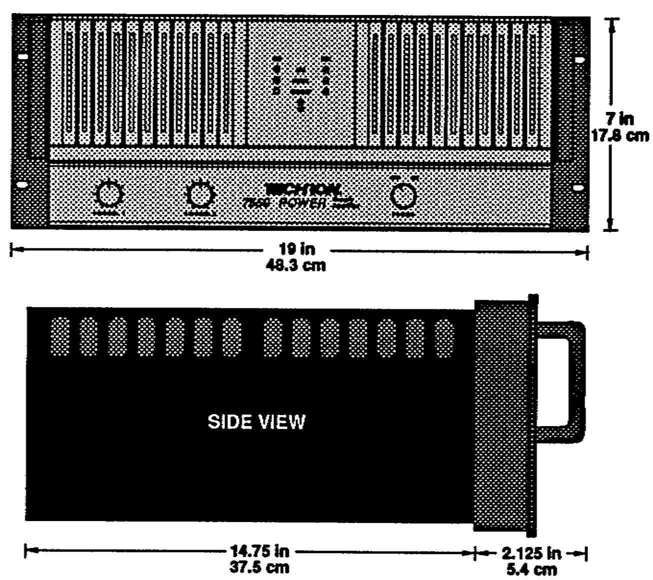


Illustration 2–1 Mounting Dimensions

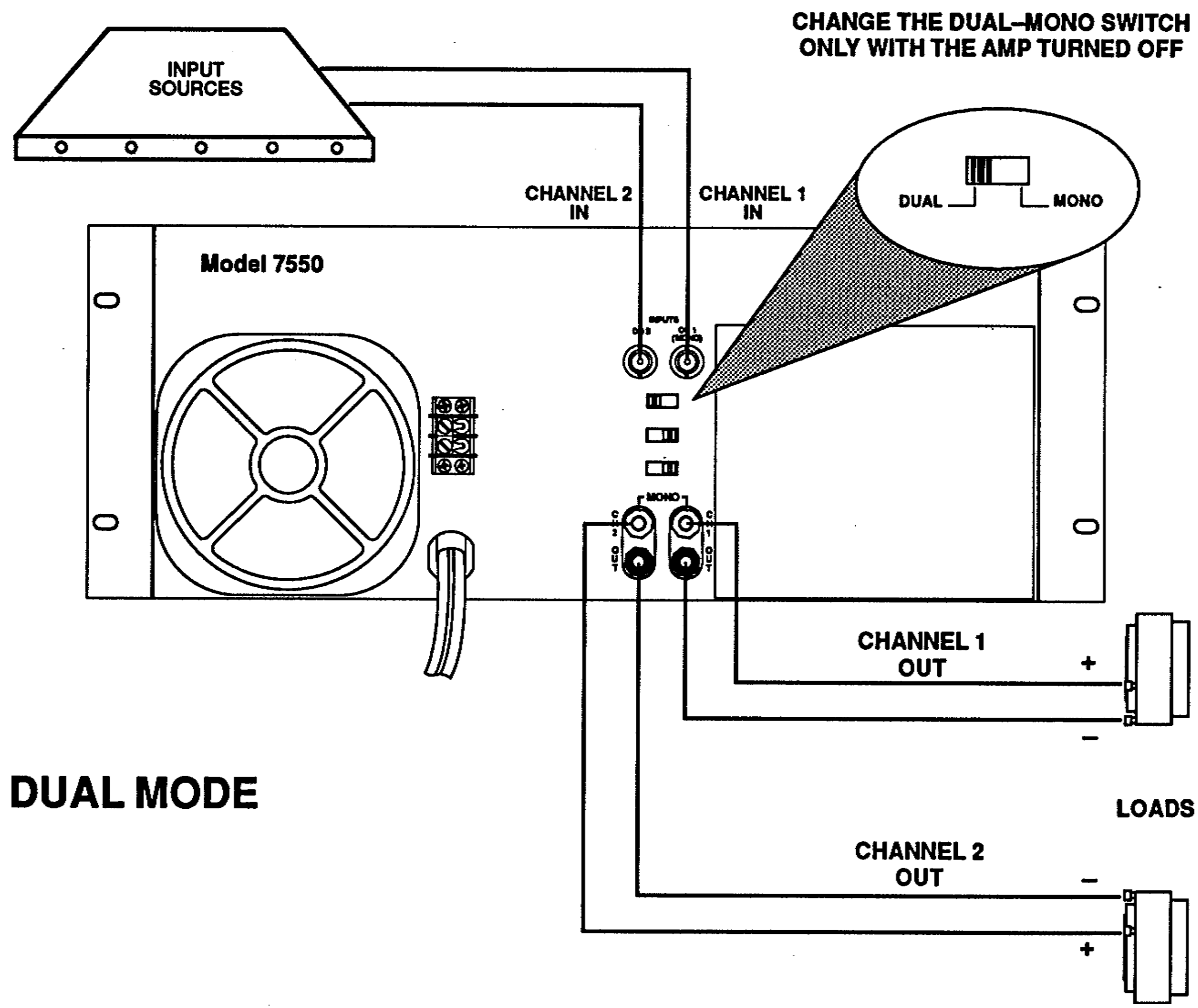


Illustration 2–2 Dual Channel Hookup

2.3. Hookup

Before beginning the installation of your amplifier, please note the following:

- Remove all power from the unit. Do not have the AC cord plugged in.
- Turn input level controls down (fully counter clockwise).

The input and output jacks are located on the rear panel. Use care in making connections, selecting signal sources, and matching loads. During hookup take the following precautions:

1. Use only shielded cable on inputs. The higher the density of the shield (the outer conductor), the better the cable. Spiral wrapped shield is not recommended.
2. The output wire and connectors should be heavy enough to carry the intended current to the load.
3. Use good quality connectors with proper strain relief.
   - Do not use connectors that have any tendency to short circuit.
   - Do not use connectors that can be plugged into AC power receptacles.
   - Do not use 1/4–inch phone plugs that short the high level outputs.
4. Keep unbalanced input cables as short as possible—avoid lengths greater than 10 feet.
5. Do not run signal (input) cables together with high level wiring such as load (output) wires or AC cords (this helps avoid most hum and noise).
6. Do not short the ground lead of an output cable to the input signal ground. Oscillations may result.

For important considerations about hooking up Inputs, Outputs, and AC power, see sections 2.3.3., 2.3.4., and 2.3.5.

The Model 7550 may be operated in either DUAL (two-channel) or MONO (single-channel) mode. Your hookup will depend on which mode you decide to use. There are very important wiring differences between these two modes.

2.3.1. Dual Channel Hookup

To put the amplifier in Dual mode, slide the Dual-Mono switch at the back of the amplifier (See Illustration 2–2) to the DUAL position. Be very careful not to short the two outputs together while in Dual mode and observe correct polarity.

The installation is very intuitive in DUAL mode. The input of Channel 1 feeds the output of the same channel as does the input of Channel 2.

⚠ CAUTION

Never parallel the two outputs together or parallel them with the output of any other amplifier without Techron approved modifications. See Section 6.2.2.

Paralleling the outputs does not safely increase power output and can cause the unit to prematurely go into Standby mode to prevent overheating.

Note: The two channels of Model 7550 may be operated in parallel under certain specific conditions. See Section 6.2.2. "Paralleling Channels for Increased Current".

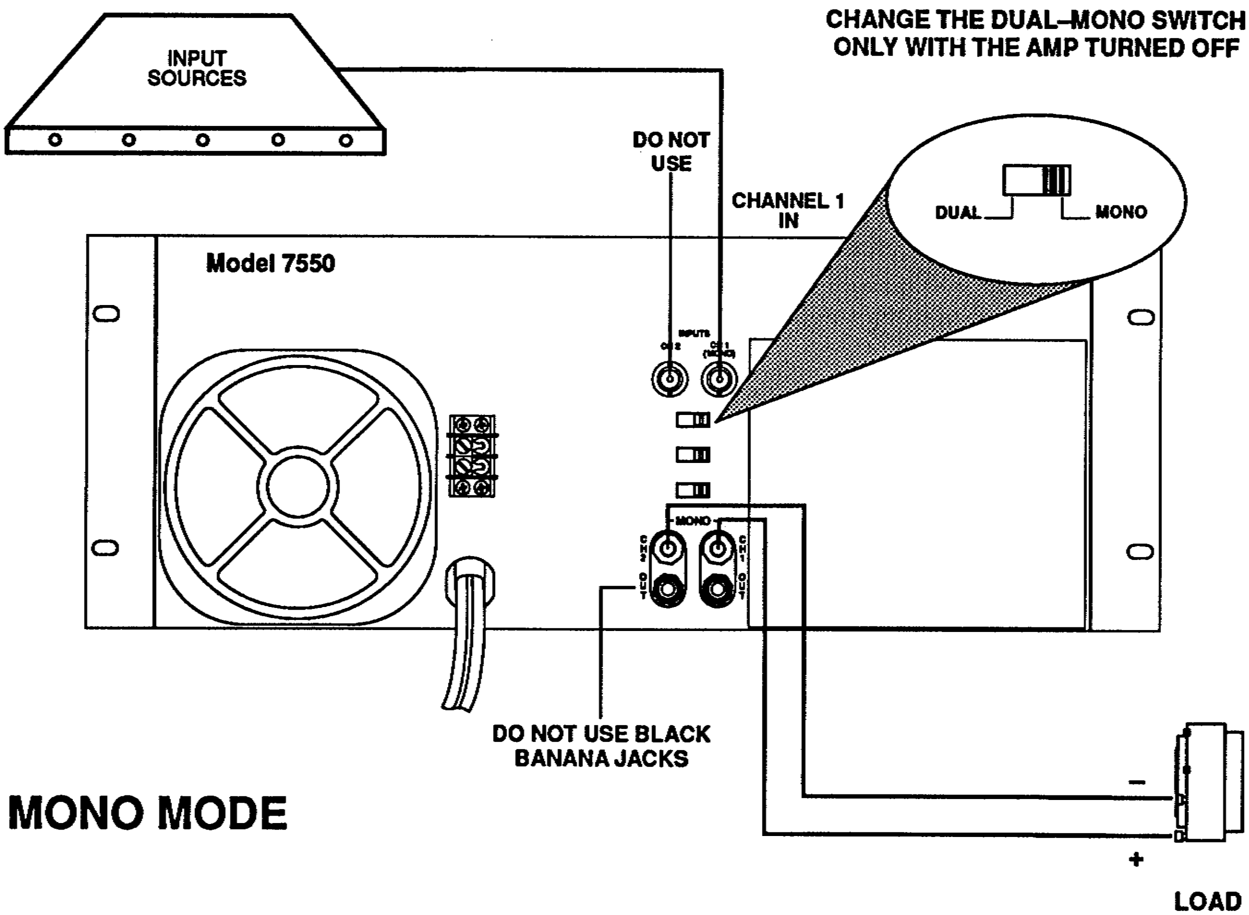


Illustration 2–3 Mono Hookup

2.3.2. Mono Hookup

To put the amplifier in Mono mode, slide the Dual-Mono switch at the back of the amplifier (see Illustration 2–3) to the MONO position.

Mono mode is quite different from Dual mode. Switching to the Mono position alters input circuitry of Model 7550 so that the two internal amplifiers work as a push-pull team for single channel output.

In this mode use *only* the Channel 1 input. DO NOT USE THE CHANNEL 2 INPUT. Signal level and quality may be greatly degraded. Keep the level control of Channel 2 turned completely down (counter clockwise).

> **Note:** The input jack and level control of Channel 2 are not defeated in MONO mode. Any signal fed into Channel 2 will combine with the signal in Channel 1 and result in distortion. Channel 2 input alone will result in low power output.

The output wiring is very different too. The polarity of the output of Channel 2 is inverted so it can be bridged with the output of Channel 1. The outputs of both channels receive the same signal from the input of Channel 1.

The most common hookup (see Illustration 2–3) connects the positive lead from the load to the red post or positive terminal of Channel 1 and the negative lead to the red post or positive terminal of Channel 2. The inner black posts are not used.

> **Note:** Mono output is balanced and is isolated from the chassis and from the input grounds. Thus, both output leads are connected to the red or "hot" connectors only.

⚠ CAUTION

Be certain that all equipment (meters, switches, etc.) connected to the MONO OUTPUT LINES is not grounded. Both sides of the line must be totally isolated from the input grounds to Model 7550. Failure to observe this precaution will result in severe oscillation.

> **Note:** Use of ungrounded test equipment may violate local codes.

2.3.3. Inputs

The inputs are unbalanced, have a nominal impedance of 25 k ohms and will accept most line-level outputs. There are three precautions to take when connecting to the inputs: 1) Keep undesirable signals off the inputs; 2) Avoid ground loops, and; 3) Avoid feedback between an output and an input.

Low frequencies are sometimes present in the input signal and can overload, overheat or otherwise damage loads. To remove such frequencies as well as any DC that may also be present, place a capacitor in series with the input signal line. The graph in Illustration 2–4 shows how the value of the capacitor affects the frequency response. Use only a low-leakage paper, mylar or tantalum capacitor.

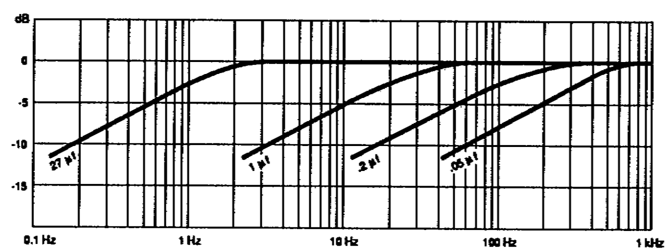


Illustration 2–4 Input Capacitor Chart

If large amounts of ultrasonic or RF (radio frequency) are found on the input, place a low-pass filter on the input. While high RF levels may not damage the amplifier, they can burn out sensitive loads, and activate the amplifier's protection system. The following filters are recommended for such situations:

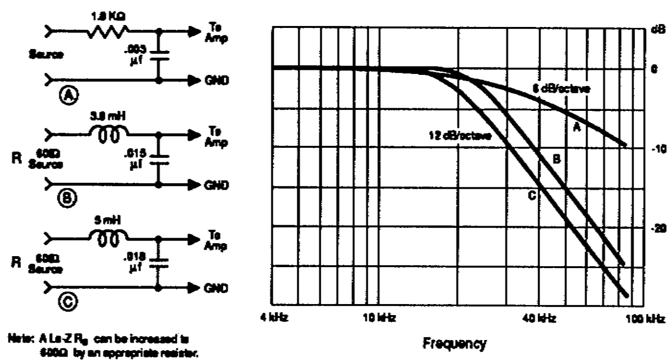


Illustration 2–5 RFI Input Filters

Improper grounding allows feedback oscillation to occur. DO NOT CONNECT INPUT & OUTPUT GROUNDS TOGETHER. In some cases, even the AC power line may provide this feedback path. Isolation of input grounds and common AC-line devices may be necessary.

2.3.4. Outputs

> **⚠ WARNING**
>
> **ELECTRIC SHOCK HAZARD. Output potentials can be lethal. Make connections only with AC power OFF and input signals removed.**

When connecting outputs, consider the following precautions:

- Use quality output connectors.
- If banana plugs are used, be sure to keep connectors snug fitting. Frequent misuse damages and loosens these connectors.
- Use proper output wire gauge and length. See nomograph, Illustration 2–6 for proper wire selection.
- To prevent spurious oscillations and undesired feedback, carefully lace output cables together. Never route output cables with input cables.
- Do not join amplifier input and output grounds externally to the unit.
- Never connect the output to a power supply output, battery, or AC power main.
- Consider the power handling capacity of your load before connecting it to the amplifier.

> **⚠ CAUTION**
>
> **Techron is not liable for damage to any Load due to overpowering.**

- The use of load protection fuses is highly recommended (see section 2.3.4.2.).

2.3.4.1. Load Wires

Use cables of sufficient gauge (thickness) for the length used. Otherwise, power is lost through cable heating and resistance. Refer to the nomograph (Illustration 2–6) below for recommended wire sizes.

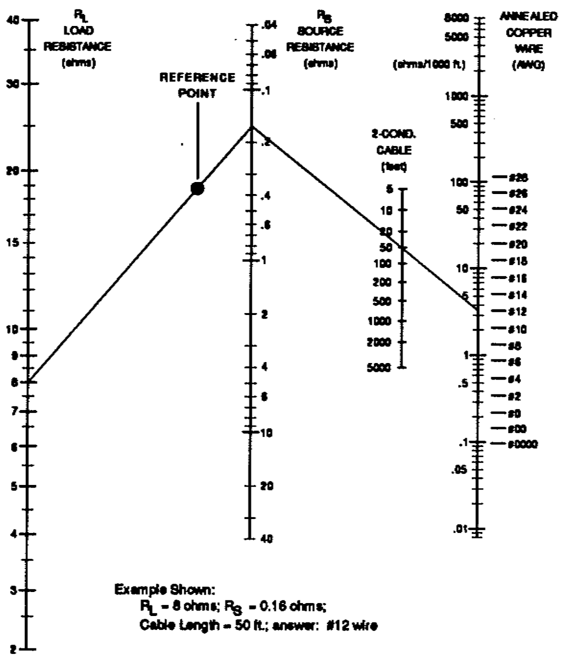


Illustration 2–6 Wire Size Nomograph

Use the nomograph as follows:

1. Note the load resistance connected to each channel of the amplifier. Mark this value on the nomograph "Load Resistance" line.
2. Note the "Reference Point" on the nomograph.
3. Draw a pencil line through these two points, intersecting the "Source Resistance" line.
4. On the "2–Cond. Cable" line, mark the length of cable run.
5. Draw a pencil line from the intersection point on the "Source Resistance" line through the mark on the "2–Cond. Cable" line.
6. Where the pencil line intersects the "Annealed Copper Wire" line indicates the wire gauge required.

2.3.4.2. Load Protection

Loads that are primarily inductive such as transformers require special attention. To prevent large low-frequency currents from damaging the transformer (and prevent the Model 7550 from unnecessarily activating its protection system) it may be necessary to install a capacitor in series with the load. If you are unsure whether this is necessary, measure the DC resistance across the terminals of each load with an ohmmeter. If the resistance you measure is less than 3 ohms either add the following parts as shown in Illustration 2–7 or add an appropriate high-pass filter or contact Techron Engineering for further information.

Place an external non-polarized capacitor of 590 to 708 mfd and a 4 ohm power resistor in series with the positive (+) lead as shown below:

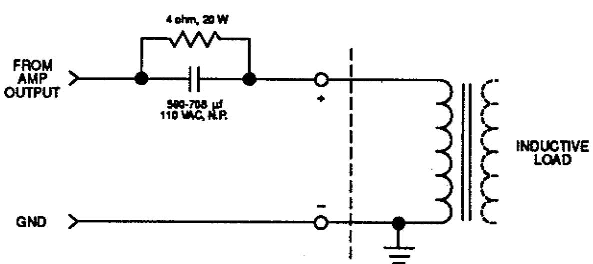


Illustration 2–7 Inductive Load Protection

We recommend that you protect your loads from damage resulting from excessive power. A common way to do this is to put a fuse in series with the load.

Fuses help prevent damage due to prolonged overload, but provide essentially no protection against damage from large transients. To minimize this problem, use high-speed instrument fuses such as the Littlefuse™ 361000 series.

If, on the other hand, the load is only susceptible to damage caused by overheating, use a fuse or circuit breaker having the same slow thermal response as the load itself such as a slow-blow fuse.

Illustration 2–8 is a nomograph showing what size fuse to use according to the impedance and peak power rating of the load.

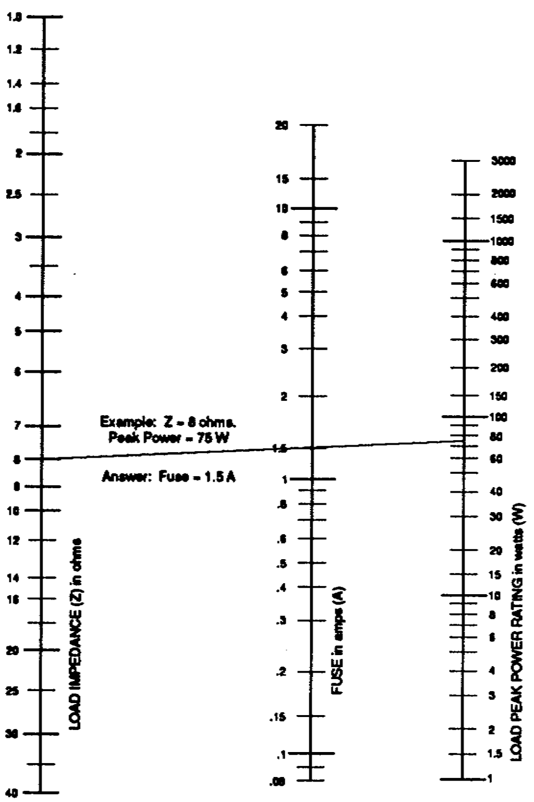


Illustration 2–8 Fuse Selector Nomograph

2.3.5. AC Power

Connect Model 7550 to proper AC current. Supply voltage must be 50 to 60Hz and no more than 10% above or below the selected line voltage. Failure to comply with these frequency limits may damage the unit and will result in unreliable operation.

Model 7550 may be operated at various line voltages. The serial plate indicates factory voltage wiring. The tag attached to the line cord also indicates the voltage for which the amplifier is connected.

Five standard line-voltage connections are offered: 100, 120, 200, 220 and 240 VAC. To convert from one voltage to another, see Section 6.5. Only a competent technician should attempt to convert from one voltage to another.

Replace the FUSES whenever AC voltage conversion is made or when they have blown. See Section 3.4. for fuse values and replacement procedure.

The amplifier is furnished with a standard three-wire (grounded) AC plug. Use third wire ground with caution, as this may introduce a ground loop into the system. If a ground loop is present, remove ground shorting strap on the back panel. See Illustration 3–2.

Three-to-two wire AC plug adapters are commercially available for adapting to a two-wire system if necessary.

⚠ CAUTION

Techron assumes no liability whatsoever for ungrounded operation which may violate UL or local electrical codes.

At this point, installation is complete. Read the next section to familiarize yourself with the operation and functions of Model 7550.

Section 3. Operation

⚠ WARNING

Never operate Model 7550 with cover panels removed because you could be *ELECTROCUTED*. Refer servicing to qualified personnel.

⚠ CAUTION

Do not operate Model 7550 in a small sealed chamber of any kind. Improper operation and overheating will result.

3.1. Operating Precautions

Although your amplifier is well protected from any external faults, we recommend the following precautions be taken for safe operation:

1. Operate the amplifier from AC mains of not more than 10% above or below the selected line voltage and within the specified line frequency (50–60 Hz). Failure to comply with these limits will invalidate the warranty.
2. When using input sources of uncertain level or any components which have not previously been used with your amplifier, always begin with the level controls at a minimum and gradually increase them while monitoring the output.
3. Operate the amplifier with the correct fuses (F1&F2 = 20 A, F3 = 1/2 A for 100 or 120 VAC; F1&F2 = 10 A, F3 = 1/4 A for 200, 220 or 240 VAC). Turn the amplifier off and unplug it from the AC line before replacing the fuses.
4. Do not expose the amplifier to corrosive chemicals such as soft drinks, lye, salt water, etc.
5. Do not tamper with the circuitry. Circuit changes made by unauthorized personnel, or unauthorized circuit modifications, will invalidate the warranty.

3.2. Functions

The operating functions of Model 7550 are shown and explained with captioned call-outs on the following two pages (Illustrations 3–1 and 3–2).

A two-position power switch and an amber LED power-on indicator are located on the front panel.

Independent level controls are located on the front panel. Both level controls are used in DUAL mode, but only the Channel 1 control should be used in MONO mode. They are used to adjust the desired output level.

There are red *IOC* (Input/Output Comparator) indicator LEDs located in the middle of the front panel. They will illuminate whenever the distortion specifications of the amplifier are being exceeded.

The green Signal Presence LEDs are located on the front panel just below the *IOC* LEDs. They illuminate any time there is more than 0.6 Vrms at the output of the amplifier.

There are yellow LEDs just below the green LEDs. They illuminate anytime either channel is in the standby state.

(Continued on page 3–4)

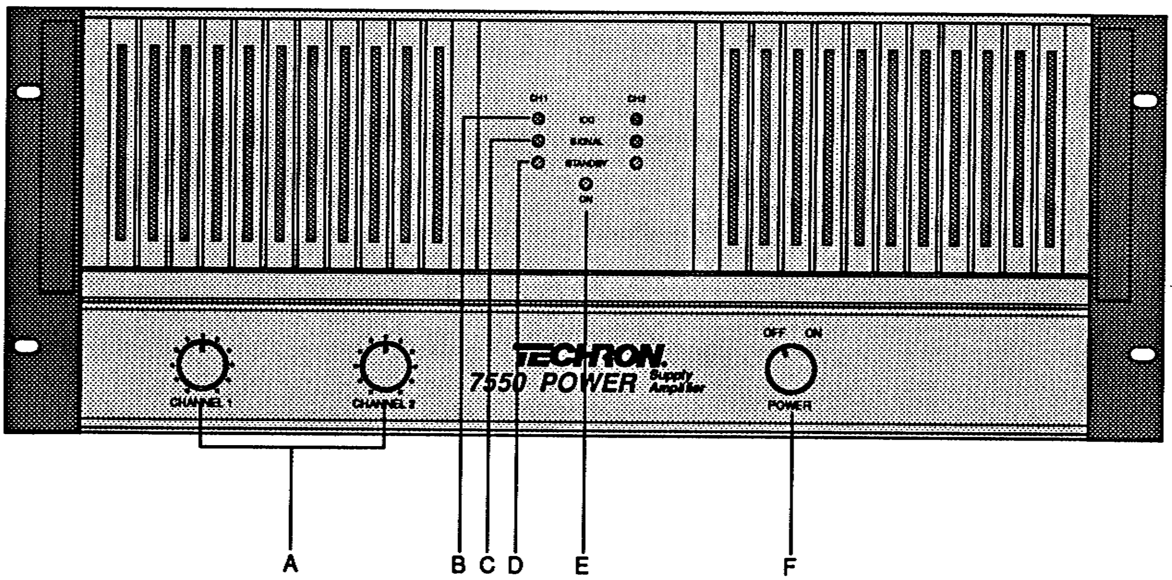


Illustration 3–1 Front Panel Functions

A. Level

The volume of each channel is independently controlled by these level controls. Each control has thirty-one detents for accurate incrementation. The control for Channel 2 should be turned down (fully counter clockwise) and not used when operating in MONO mode.

B. *IOC®*

A red Input/Output Comparator LED is provided for each channel. It illuminates when distortion of any kind exceeds 0.05%. It also acts as a standby indicator, illuminating when in STANDBY mode. It is normal for the *IOC* indicators to illuminate briefly when the amplifier is turned on or off.

C. Signal Presence

A green LED is provided for each channel to indicate when a signal is present. Normally they will either flash or stay illuminated (depending on the signal level). If the level is very low they may not illuminate at all.

D. Standby Indicators

Yellow LEDs illuminate when either channel is in the standby state. This will occur when using the DELAY feature.

E. Power Indicator

An amber LED will illuminate whenever the Model 7550 is switched on.

F. Power

This two-position switch turns the amplifier ON or OFF. At turn-on, the output is muted (placed in STANDBY mode) for about four seconds to protect your load from start-up transients. (This feature can be disabled with the Delay Switch on the back panel.)

G. Fan Intake

The 7550 has a dust filter on the air intake to the cooling system. The filter may be removed for cleaning.

The Model 7550 uses a basic output-protection mechanism that represents a dramatic departure from conventional designs. Computer analysis of transistor stress-test data, leading to design of appropriate dynamic transistor environment analog circuits, forms the heart of the system.

A continuous flow of operating data produces an analog output proportional to the changing Safe Operating Area (SOA) of the transistor. This output controls the limits imposed by a current gain stage ahead of the output section. The output limits this change along with actual operating conditions. The maximum advantage may then be taken of the transistor's SOA, without risk of destroying the device when conditions are less than ideal.

> ⚠ **CAUTION**
>
> **Whenever an OVERLOAD condition persists (*IOC* stays ON), take the following steps as applicable to protect amplifier and load:**
> 1. **Reduce or limit input level.**
> 2. **Disconnect load from amplifier.**

As described earlier, there is a Low Frequency Interrupt circuit. When activated, if it senses any DC at the output, it places the unit into the STANDBY mode. Every four seconds, the unit will sample the output signal for DC and return to normal operation when the problem signal has been removed.

The amplifier features a controlled slew rate which, coupled with the protection circuits, guards the amplifier from blowups when fed large RF input signals.

Each power transformer has a thermal switch embedded in the windings, to protect against overheating. If the transformers overheat, the thermal switch shuts off automatically, waits until the unit has cooled to a safe temperature and then resets itself.

In addition to all other protection, Model 7550 is protected with AC line fuses. The high-voltage power supply is fused with a 20 A fuse for 100 & 120 VAC, and a 10 A fuse for 200, 220, 240 VAC. The low-voltage power supply and cooling fan are fused with a 0.5 A fuse for 100 & 120 VAC, and a 0.25 A fuse for 200, 220, 240 VAC. The use of any other fuse sizes will invalidate the warranty.

3.4. Fuse Replacement

In the rare event that an internal fuse blows, refer the amplifier to a qualified technician.

> ⚠ **DANGER**
>
> **Always disconnect AC POWER (unplug line cord) before replacing fuses. The fuse holders still have power even when the power switch is turned off.**

The AC line fuses are located inside the amplifier on the relay board . To replace the fuses:

1. Turn the Power Switch OFF.
2. Unplug the AC power cord.
3. Remove the bottom cover.
4. Replace fuses F1, F2, & F3 according to the table below then reassemble unit.

Voltage \ Fuse	F1	F2	F3
100–120 VAC	20 A	20 A	1/2 A
200–240 VAC	10 A	10 A	1/4 A

Illustration 3–3 Fuse Selection Table

Section 4. Specifications and Performance

4.1. General Specifications

Hum and Noise (20 Hz–20 kHz): <0.130 mV. See Illustration 4–8.

Phase Response: +0, –15 degrees DC–20 kHz at 1 watt. See Illustration 4–3.

Input Impedance: 25 kohm ± 30%.

Amplifier Output Protection: Short, mismatch, and open circuit proof. Limiting is instantaneous with no flyback pulses, thumps, cutouts, or other spurious signals. No premature limiting transients.

Overall Protection: AC line fused. Thermal switch in control logic protects against overheating caused by insufficient ventilation. Transformer overheating results in shutdown (STANDBY) of that particular channel. Controlled slewing rate voltage amplifiers protect overall amplifier against RF burnouts. Input overload protection is furnished by internal resistance at inputs of amplifier.

Low Frequency Interrupt: *(This feature is switchable from the back panel.)* Interrupts output drive (goes into STANDBY) when DC greater than 10 volts or low frequency greater than 26 volts to 10 Hz is detected at the output. It samples the output every four seconds. See Illustration 4–6.

Turn-On Delay: *(This feature is switchable from the back panel.)* Zero or four seconds with minimum thumps and no dangerous transients.

DC Output Offset (shorted input): 10 mV or less, internally adjustable to zero.

Power Supply: High Voltage: Two 800 VA transformers with computer grade capacitors powered through 10 A relays.
Low Voltage: ± 15 VDC supplies are provided by current-limited short-proof regulated supplies for complete isolation and stability.

Power Requirements: Requires 50–400 Hz AC at 100, 120, 200, 220, or 240 V ± 10% operation. It is extremely important to have adequate AC power available to the amplifier. Power amplifiers can not create energy—they must have the required voltage and current to deliver the undistorted rated wattages you expect.

Cooling: Forced-air with high-efficiency coolers. A two-speed fan with an intake filter (washable) mounted on the back panel forces air through the coolers and out the top, front and side panels.

Chassis: All-aluminum construction for maximum heat conduction and minimum weight.

Controls: Round knob On/Off power switch. Independent Input Level control knobs. Rear panel Dual/Mono, Low Frequency Protect, and Delay slide switchs.

Displays: A pair of green LEDs indicate Signal Presence. A pair of red LEDs indicate the action of the *IOC®* circuitry. A pair of yellow LEDs indicate whether or not STANDBY mode is active. An amber LED is used as a Power indicator.

Connectors: Input is made to BNC connectors. Output is made to color-coded dual binding posts on 3/4 in. centers. Ground selectivity is made with a 2–lug terminal block with removable shorting strap. Accessories connect to an 11–pin radial socket. And the AC line uses a 3–wire grounded plug.

Dimensions: 19 in. wide (standard rack mount) x 7 in. high x 14.75 in. deep from front panel mounting surface. Handles extend 2.38 in. from front surface. (48.3 cm x 17.8 cm x 37.5 cm, handles 6 cm additional.)

Weight: Approximately 57 pounds (25.9 kg) net weight.

Finish: Polyester vinyl coated aluminum front panel and zinc die cast handles.

4.2. Dual Channel Specifications

Output Power: 265 watts per channel minimum continuous average power (both channels operating) into an 8 ohm load over a bandwidth of 20 Hz–20 kHz at a rated RMS sum total harmonic distortion of 0.1% of the fundamental output voltage. 380 watts per channel minimum continuous average power (both channels operating) into a 4 ohm load over a bandwidth of 20 Hz–20 kHz at a rated RMS sum total harmonic distortion of 0.1% of the fundamental output voltage. See Illustration 4–1.

Frequency Response: ± 0.1 dB 20Hz–20 kHz at 1 watt into 8 ohms; ± 1.5 dB DC–80 kHz. See Illustration 4–2.

1 KHz Power: 260 watts continuous average power into 8 ohms, per channel, both channels operating, 0.1% total harmonic distortion.

Harmonic Distortion: Less than .002% from 20 Hz–1 kHz, and increasing linearly to .05% at 20 kHz at 220 watts continuous average power per channel into 8 ohms.

I.M. Distortion: (S.M.P.T.E. 60 Hz to 7 kHz 4:1) Less than 0.01% from 0.25 watts to 220 watts per channel into 8 ohms.

Slewing Rate: 30 volts per microsecond.

Output Impedance: Less than 12 milliohms in series with less than 1.2 microhenries. See Illustration 4–7.

Load Impedance: Rated for 4, 8 and 16 ohm usage. Safely drives any load even totally reactive ones without harming the amplifier.

Crosstalk: See Illustration 4–5.

Voltage Gain: 20:1 ± 2% or 26 dB ± 0.2 dB at maximum gain.

Input Sensitivity: 2.1 volts ± 2% for 220 watts into 8 ohms per channel.

Output Signal: Unbalanced, dual channel.

4.3. Mono Specifications

Output Power: 520 watts minimum continuous average power into a 16 ohm load over a bandwidth of 20 Hz–20 kHz at a rated RMS sum total harmonic distortion of 0.1% of the fundamental output voltage. 760 watts minimum continuous average power into an 8 ohm load over a bandwidth of 20 Hz–20 kHz at a rated RMS sum total harmonic distortion of 0.1% of the fundamental output voltage. See Illustration 4–1.

Frequency Response: ± 0.2 dB, 20 Hz–20 kHz at 1 watt into 16 ohms, ± 1 dB, DC–60 kHz at 1 watt into 16 ohms.

1 KHz Power: 520 watts continuous average power into 16 ohms; 0.1% total harmonic distortion.

Harmonic Distortion: Less than .003% from 20 Hz–1kHz and increasing linearly to 0.08% at 20 kHz at 500 watts continuous average powe into 16 ohms. Less than .005% from 20 Hz–1kHz and increasing linearly to 0.12% at 20 kHz at 800 watts into 16 ohms.

I.M. Distortion: (S.M.P.T.E. 60 Hz to 7 kHz 4:1) Less than 0.015% from 0.25 watts to 500 watts into 16 ohms. Less than 0.015% from 0.25 watts to 700 watts into 8 ohms.

Slewing Rate: 60 volts per microsecond.

Output Impedance: Less than 24 milliohms in series with less than 2.4 microhenries.

Load Impedance: Rated for 8 and 16 ohm usage; drives any load including totally reactive loads without harm to amplifier.

Voltage Gain: 40:1 ± 2% or 32 dB ± 0.2 dB at maximum gain.

Input Sensitivity: 2.2 volts for 500 watts into 16 ohms.

Output Signal: Balanced, single channel.

4.4. Performance

The chart and graphs on the following pages show the performance of Model 7550.

Model 7550								
Configuration & Load (ohms)		FTC Continuous Average Power at 0.1% THD (See note 1)		Max Average Power at 0.1% THD (See note 2)	1 Cycle Tone Burst Watts at <0.05% THD (See note 3)	40 mS Tone Burst Watts at <0.05% THD (See note 4)	EIA Watts at 1% THD (See note 5)
		20Hz-20kHz	1 kHz	1 kHz	1 kHz	1 kHz	1 kHz
Dual (both channels powered)	2		580	700	840	740	650
	4	380	425	460	640	470	470
	8	265	260	275	335	280	285
	16	150	150	150	170	155	160
Bridged Mono (balanced output)	4		1,210				
	8	760	850	915	1,260	950	920
	16	520	520	545	670	565	565

Illustration 4–1 Power Matrix

Power Specifications:
Many manufacturers publish power specifications with a tolerance of ± 1 dB or worse. That means their amplifier can deviate more than 20% in output! A 100 watt amplifier would meet their spec if it only produced 79.4 watts. Other manufacturers qualify their specs by saying they are "typical" or "subject to manufacturing tolerances," thereby removing any performance guarantee. We take a different approach at Techron—because our "in-house" specs are more stringent than our published specs, <u>*every* Techron amplifier will *exceed* its published specs</u>, and they are *guaranteed* for one year.

Notes:
1. Continuous power in the context of Federal Trade Commission testing is understood to be a minimum of five minutes of operation. Harmonic distortion is measured at the RMS sum total as a percentage of the fundamental output voltage. This applies for all wattages greater than 0.25 watts.
2. A 1 kHz sine wave is presented to the amplifier and the output monitored for non-linear distortion. The level is increased until the THD reaches 0.1%. At this level the average power per channel is reported.
3. A single cycle of sine wave is presented to the amplifier and monitored for non-linear distortion. The average power during the burst is reported. Loads must be able to withstand this level if they are to be safely used with this amplifier.
4. A 40 millisecond burst or two cycles of sine wave (whichever is of greater duration) is used and the power computed as the average power during the burst. The duty cycle of this test is 10 percent.
5. EIA standard RS–490 (both channels driven).

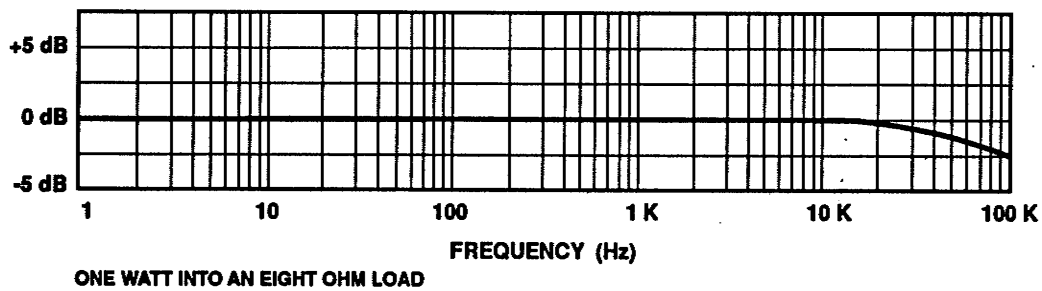


Illustration 4–2 Nominal Frequency Response

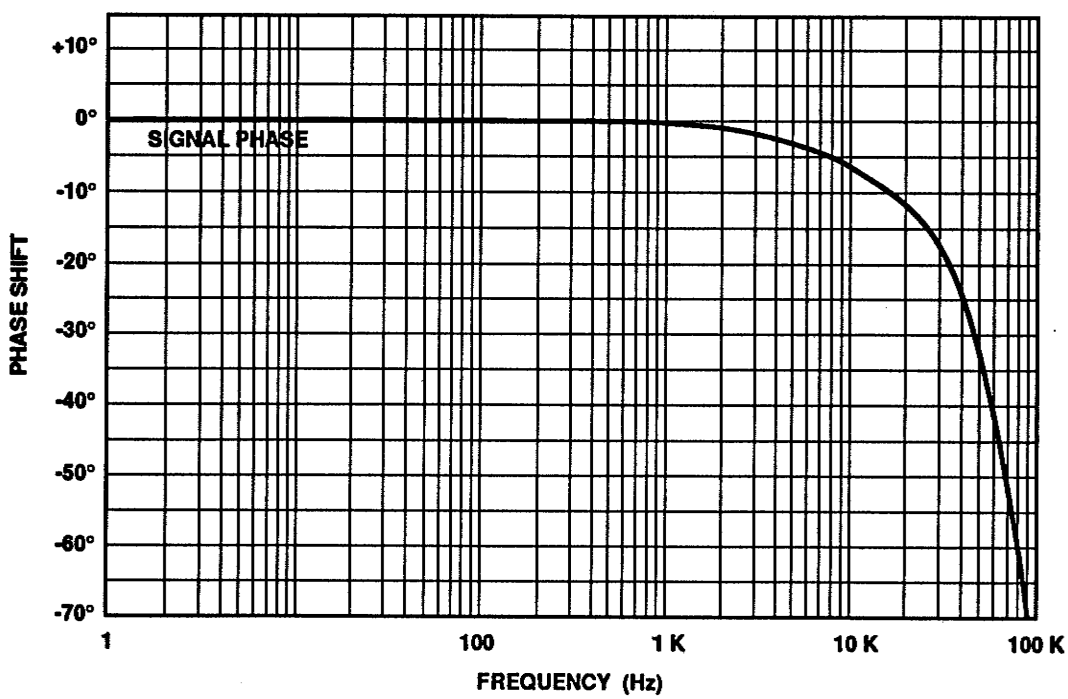


Illustration 4–3 Nominal Phase Response

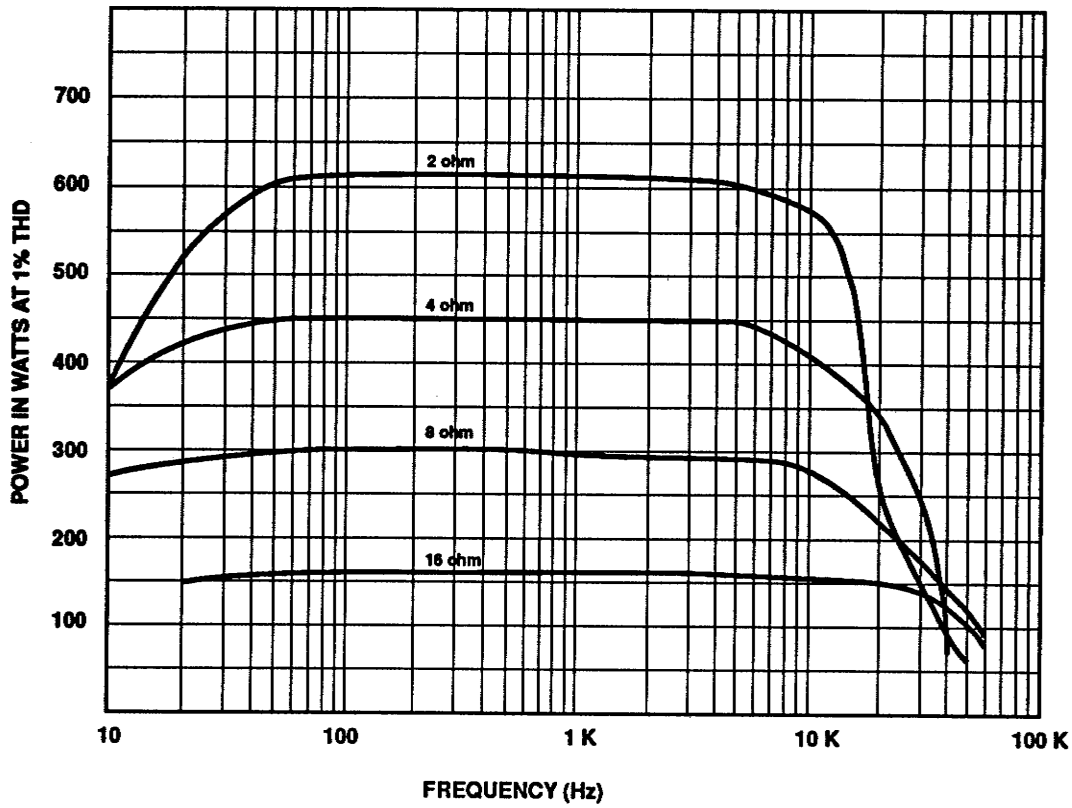


Illustration 4–4 Power Output Response

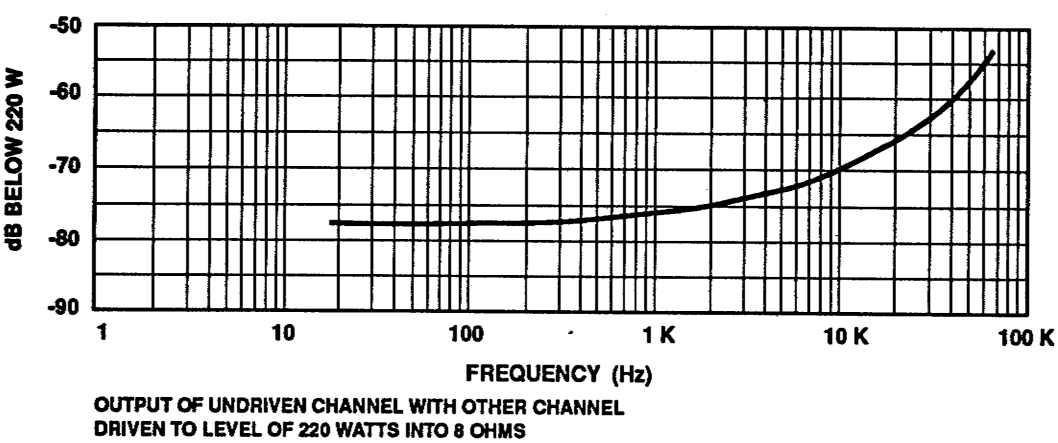


Illustration 4–5 Nominal Crosstalk

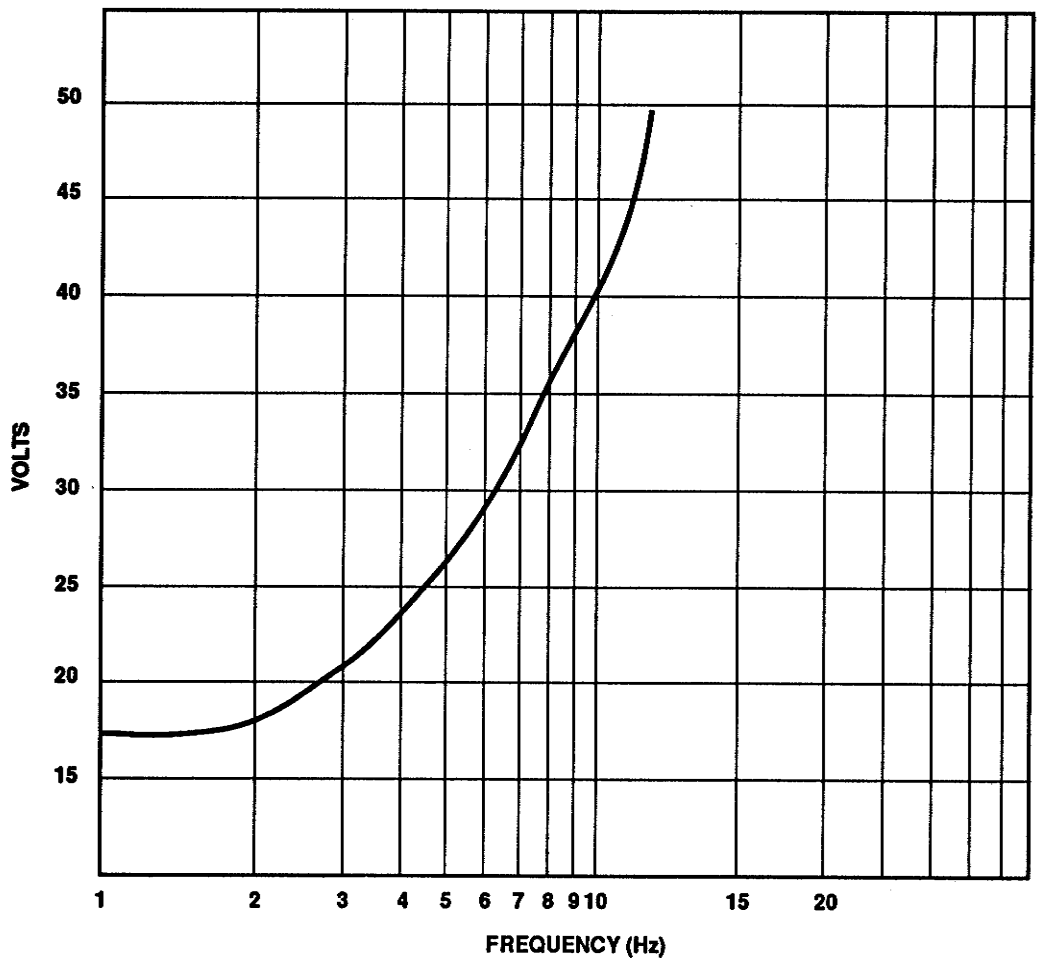


Illustration 4–6 Low-Frequency Interrupt Action

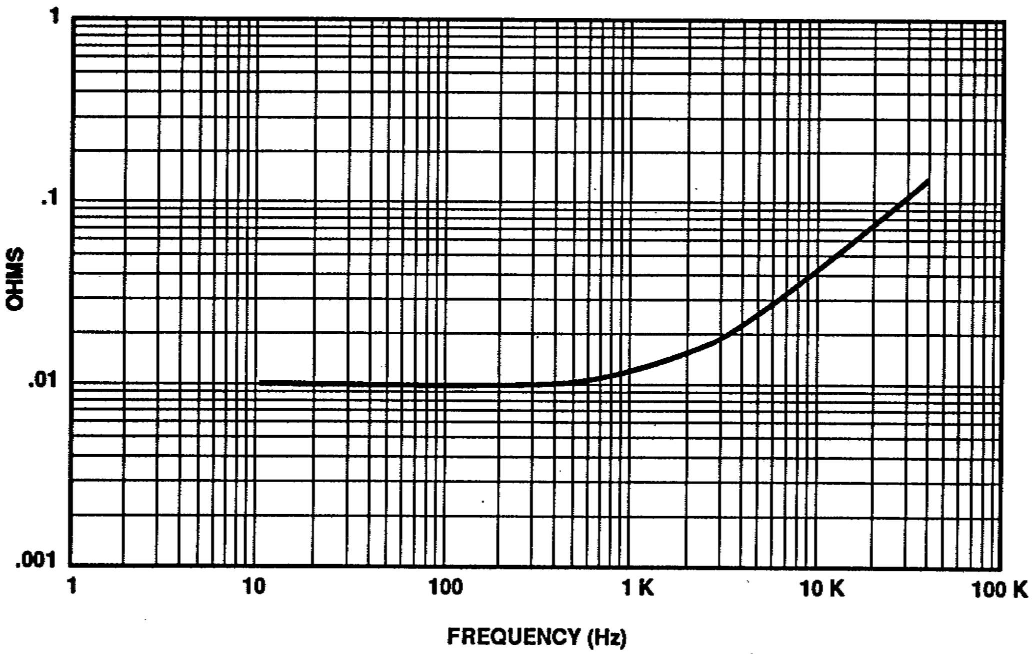


Illustration 4–7 Nominal Output Impedance
(Measurements taken at binding posts)

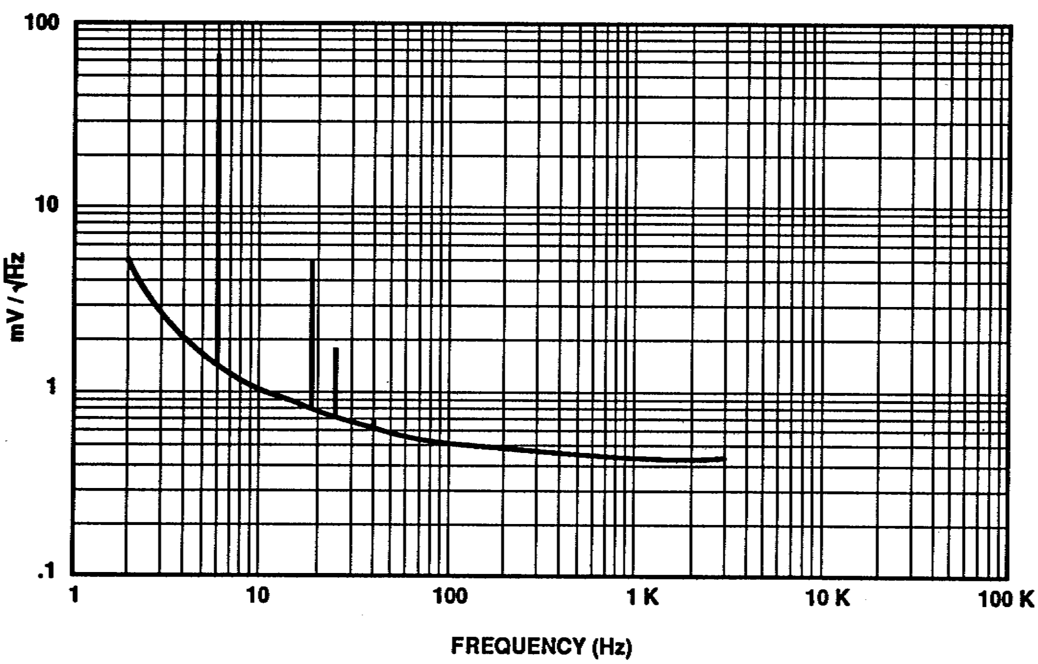


Illustration 4–8 Nominal Noise Spectrum
(Line frequency harmonics plotted to 10th order)

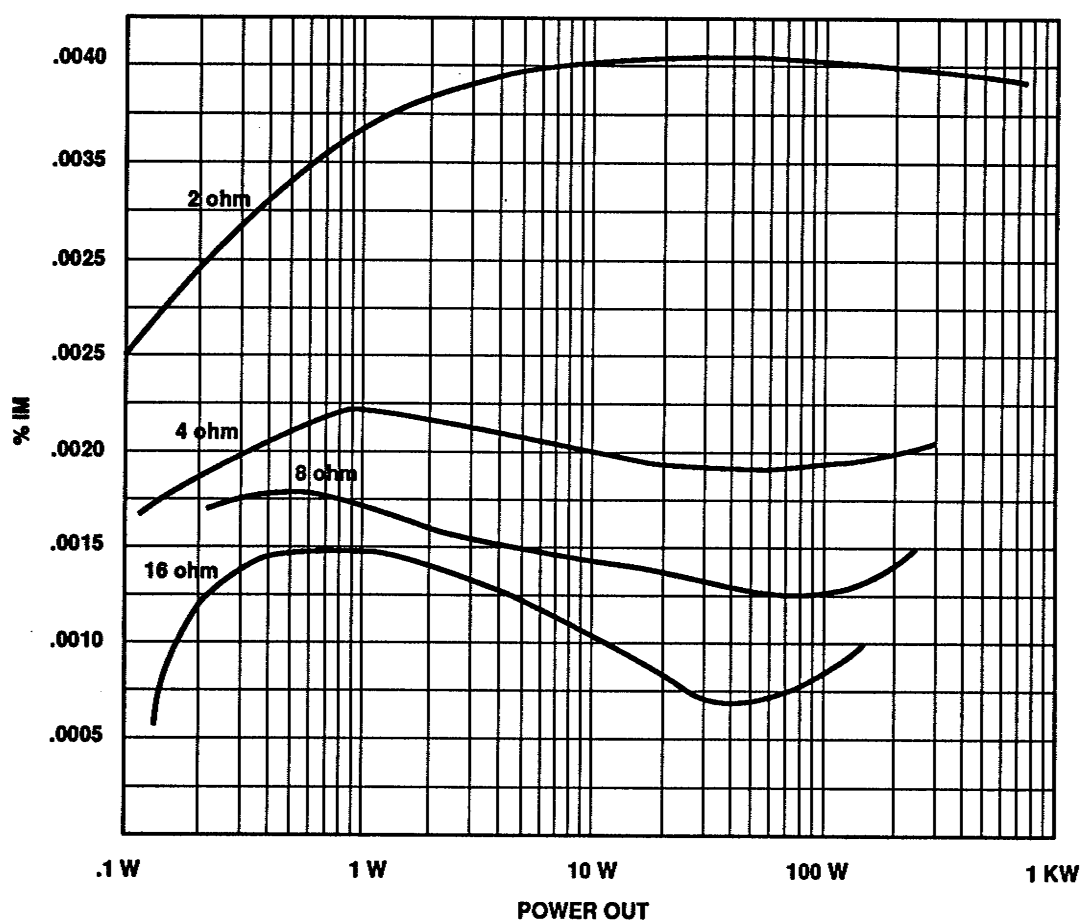


Illustration 4–9 Typical IM Distortion

Section 5. Theory of Operation

5.1. General Concepts

The Model 7550 is a high-power direct-coupled amplifier. It automatically and continuously analyzes its own dynamic environment and thus is able to control the output level relative to the output transistors' Safe Operating Area. The result: maximum output with maximum safety.

The output circuitry employs 16 rugged 150-watt transistors (2400 W dissipation), each tested on the Crown SOA III Transistor Analyzer. This testing verifies the safe operating area of each output device, which in turn helps improve the amplifier's overall circuit performance.

The output transistors operate in the AB mode of operation where quiescent current is carried by both the driver stages and the output stages. The output is a quasi-complementary design in which the common point between positive and negative output stages is returned to ground. Therefore, the power supplies are allowed to float with the signal output terminal common to the center tap of the high voltage power transformer.

The high-voltage power supply contains two transformers (one per channel) for driving the output stages. Because of this independence, a single channel output stage problem (very unlikely) will not affect the performance of the other. The single low-voltage power supply is responsible for pre-output signals and low power components (LEDs, fan, etc.).

All heat-sinking is internal, eliminating handling problems when the unit is hot as well as providing a shorter and more efficient path for air flow than standard convection cooling.

5.2. Circuit Analysis

Refer to the block diagram (Illustration 5–1). The diagram does not show all circuit connections or feedback loops due to circuit complexity, but there is sufficient data to grasp the function of each circuit. Note that only channel one is shown for simplicity.

An input signal is fed to the initial stages via the standard unbalanced input or the optional balanced input. Both cannot be used simultaneously due to the "interrupt" function of the unbalanced input jacks.

The input amplifier receives the signal next and sends any necessary error-correcting into the Compressor Control circuitry as well as sending the main signal on to the Balanced Stage. Essentially, this feedback path (from the output of the input amp through the Compressor Control circuitry) adjusts the amount of compression needed at that particular instant to provide distortion-free output.

In order to drive the Positive and Negative Output Stages, a Balanced Stage is necessary. Should a situation be encountered where protection of the Output Stages is needed, the Protection Circuitry will automatically reduce the drive available to the Balanced Stage and thus remove the stress on the output devices.

Both the Positive and Negative Output Stages consist of four SOA-analyzed and VBE-matched output transistors plus a predriver/driver combination that also aid in carrying the quiescent power load. Together they help form the quasicomplementary Class AB method of operation used in the Model 7550.

Feeding positive current to the POSITIVE OUTPUT STAGE, and negative current to the NEGATIVE OUTPUT STAGE, are the POS and NEG Vcc (High Voltage) Supplies. The common point between the two Output Stages is ground. A departure from previous smaller Techron amps, this method allows sophisticated information to be fed to the protection Circuitry from the Output Stages with reference to ground. Both channels' High Voltage supplies work independently of one another.

The point Common to the Neg and Pos Vcc supplies is the "hot" signal of the output terminal which also feed the front panel Display, the Mono switch (for selectable dual-mono output) and several of the main feedback paths.

The Control Logic is responsible for the action of the Lo Freq Protect, Delay, Standby and thermal protection of the unit. When signaled by the Lo Freq Protect, Standby and/or Delay feature, the Control Logic will remove the power from the Vcc supplies. In the case of Low Freq Protect, when the output has subsided it will place the high-voltage supplies back into operation from Standby or cycle through the same procedure again depending upon the existence of the problem.

Thermal protection may involve the same procedure as mentioned above but only in extreme cases. A thermal switch imbedded in the high-voltage transformer's windings will activate the Control Logic when potentially damaging current demands are being placed on it.

The Low Voltage supply drives all low-power signal path circuitry including the Control Logic, Display and Fan speed logic. At an internal temperature of 47° C (117° F), the unit will automatically shift to high fan-speed operation for additional cooling.

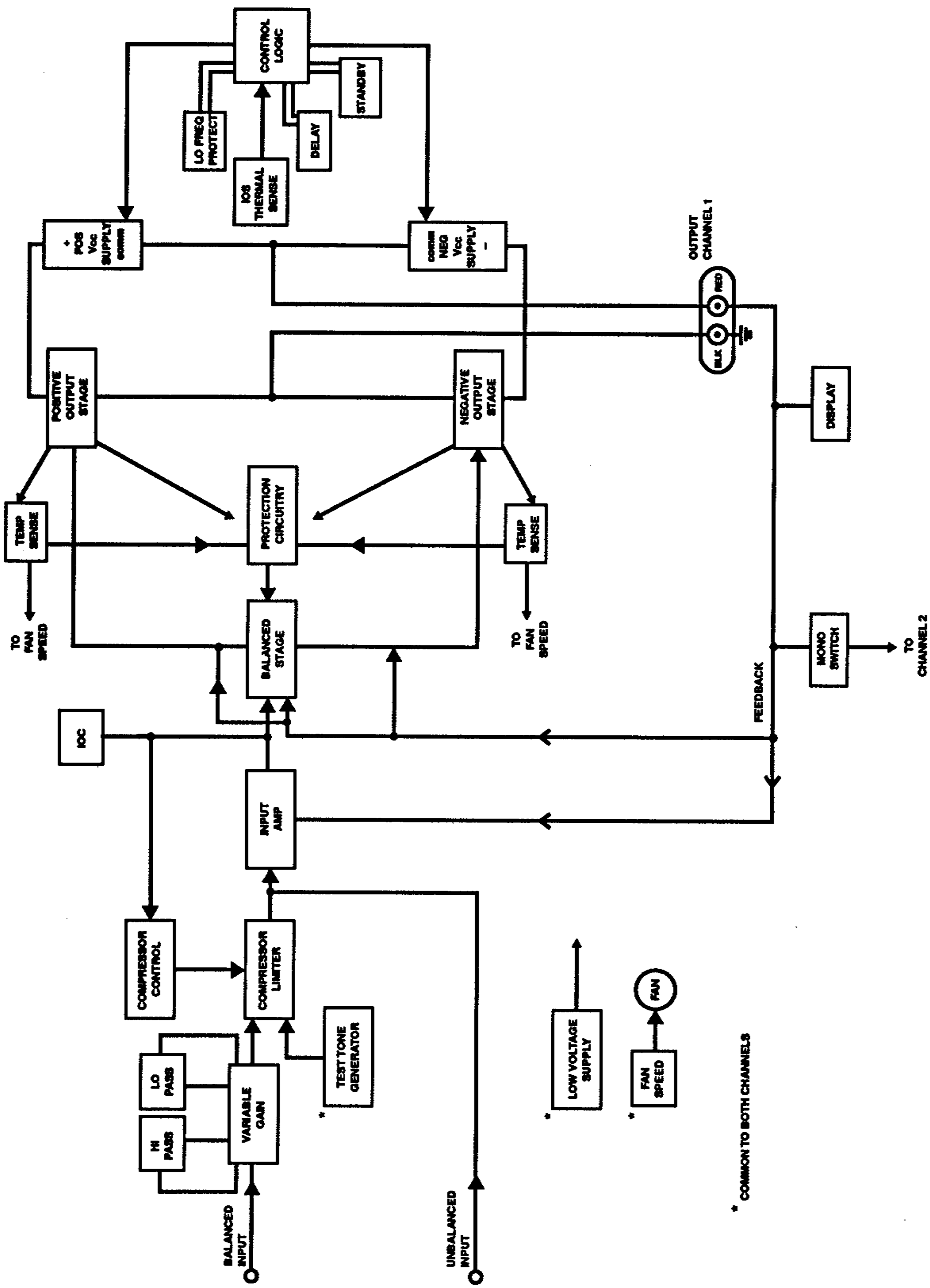


Illustration 5–1 Circuit Block Diagram

Section 6. Applications

6.1. Introduction to the Applications Section

Typically, Model 7550 Amplifiers are manufactured and shipped in specific configurations for a particular user requirement. This section provides guidance for customers who may subsequently need to change the settings or circuitry of the Model 7550 amplifier for a new application.

This section assumes significant competence on the part of the reader in terms of amplifier systems, electronic components, and generally sound electronic working practices. Readers are urged to contact Techron Engineering for assistance with any of this information.

⚠ WARNING

Except as recommended in this manual, attempts to change the settings and/or circuitry of Model 7550 could invalidate the Techron product warranty. In addition to possible damage to equipment, users face a safety hazard in the event such procedures are improperly performed. Only qualified personnel should make any component or circuitry changes from factory settings.

6.2. Special Operation Modes for Increased Output

Model 7550 may be operated in the usual, dual-channel mode, or in one of two special modes—Push-Pull or Parallel.

6.2.1. Push-Pull Operation for Increased Voltage

Switching the "Dual-Mono" switch to the "Mono" position automatically places Model 7550 in the Push-Pull configuration. The load will be balanced in reference to ground. Connect the Load across both red ("hot") terminals when using the Mono mode. See Section 2.3.2. for complete instructions on Mono operation.

6.2.2. Paralleling Channels for Increased Current

Ordinarily, the two channels of dual-channel amplifiers may not be operated in parallel. Parallel operation of Model 7550 is possible if the following steps are taken:

1. Connect a .1 to .25 ohm, 50 watt, 1% resistor to the (+) output of each channel.
2. Connect (+) outputs together beyond resistors, and then to (+) terminal of load.
3. Connect (–) outputs together, and then to (–) terminal of load.
4. Connect input in parallel to both inputs.
5. Adjust channel 1 input knob to the "9 o'clock" position.
6. Carefully adjust channel 2 input knob to achieve equal output from each channel, using channel 1 as the reference value.

Note: This adjustment will be very fine and may be quite difficult to achieve. It is possible, however, with care and patience.

7. Note changes in value:
   - V (voltage) remains the same as with one amplifier;
   - I (current) is multiplied by two;
   - Z (impedance) equals the number of amplifiers times the R value of the Load, plus the numerical value of the added resistor.

⚠ CAUTION

Never attempt to operate more than ONE dual-channel amplifier in parallel. The absence of an interlock exposes amplifiers to severe damage from this operation.

Note: Recommended resistor for outputs as described above: Dale brand, model NH50. Other resistors of equal value and precision are perfectly acceptable.

6.3. Input Modifications

6.3.1. Low Frequency Interrupt

Model 7550 includes a Low Frequency protection circuit which interrupts power (standby and turn-on delay modes) when low frequencies are present at the input. To activate this circuit, use the switch on the back panel.

6.3.2. Balanced Active Input (Module 75A06)

This option plugs into the 11–pin accessory socket on the back panel. Its active circuitry provides two channel balanced input with a frequency response of DC to 25 kHz.

6.3.3. Balanced Transformer Input (75A07)

This module provides a frequency response of 20 Hz to 20 kHz, along with complete isolation from power supply. Transformer balanced input provides complete electrical isolation of input signals. This option also plugs into the accessory socket on Model 7550 back panel.

Note: Use a balanced input when input lines are over 20 ft. long, or when the other advantages (isolation, etc.) are needed.

6.4. Constant Current Operation for Special Needs (75A08)

Constant Current Mode provides current correction via current sampling at the output for installations in which current must be maintained at specific levels. Constant Current is a factory-installed modification.

6.5. AC Power Conversion

Because there is a risk of electric shock, only a competent technician should attempt to convert from one voltage to another.

> **⚠ DANGER**
>
> **Disconnect AC mains at the source (unplug Model 7550) before converting AC voltage. Death or serious injury can result from contact with AC mains. Only a competent technician should attempt voltage conversion.**

Five standard line-voltage connections are offered: 100, 120, 200, 220, and 240 VAC.

The tag attached to the line cord and/or the serial tag on the back panel indicates the voltage for which the amplifier is connected. For operation from a different line voltage, the unit must be converted in the following manner:

1. Turn the Model 7550 off and disconnect it from any power source.
2. Remove the bottom cover from the unit (13 screws).
3. If the unit has been in recent use, discharge the large power capacitors by placing a 10 ohm, 5 watt resistor across each capacitor terminal to ground. USE EXTREME CAUTION while handling the resistor.
4. Determine the correct connections from Illustration 6–1 and move the necessary wires using the push-on connectors and terminal strips. Three sets of wires must be changed. One set on each of the two large power transformers and one set on the relay board.
5. Carefully check all connections and reinstall the bottom cover on the amplifier.
6. Make all necessary fuse changes.

Note: When selecting 100 or 120 volts, fuses (located on the relay board) F1 and F2 should be 20 ampere and F3 should be 1/2 ampere. For 200, 220 and 240 volts, fuses F1 and F2 should be 10 ampere and F3 should be 1/4 ampere.

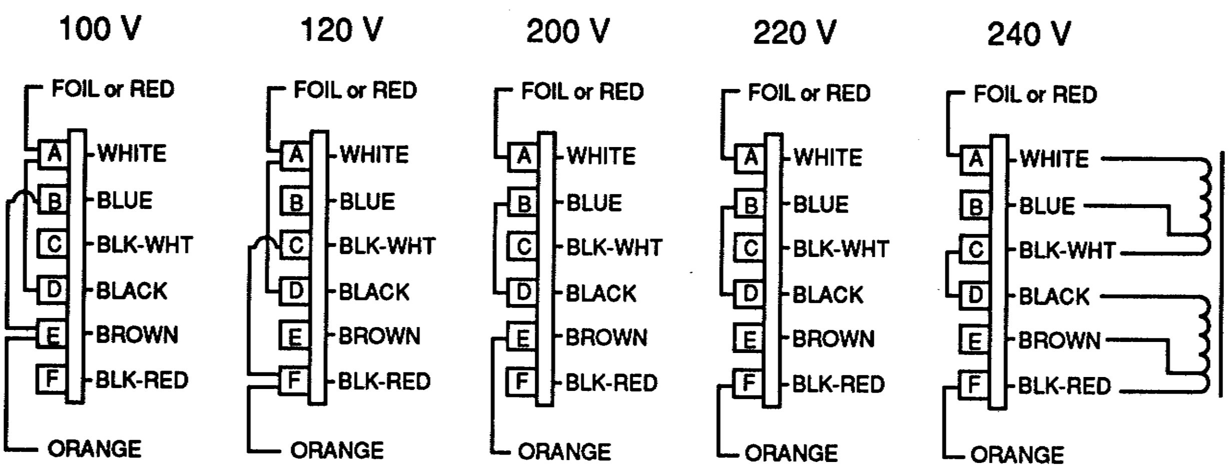


Illustration 6–1 Internal AC Connections

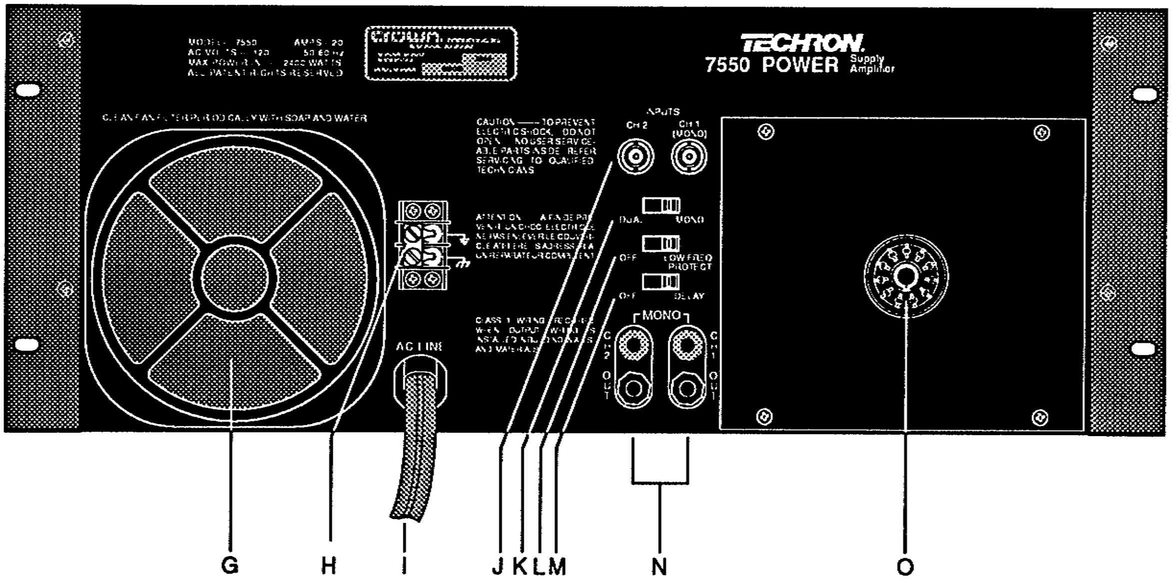


Illustration 3–2 Back Panel Functions

H. Ground Barrier Strip

Isolation of chassis ground from signal ground is easily accomplished by removing the shorting strap from this terminal strip. This may help remove any hum problems caused by "ground loops." (The grounds are always connected internally with a resistance of 2.7 ohms.)

I. Power Cord

A standard three-wire (grounded) AC cord is provided. Plug into the specified AC power (see Section 2.3.5.).

J. Input BNC Jacks

An unbalanced BNC jack is provided at the input of each channel. Do not use the input jack for Channel 2 when in MONO mode.

K. Dual-Mono Switch

Slide this switch left for DUAL mode and right for MONO mode. In MONO mode the input and level control for Channel 2 should not be used. Only balanced (ungrounded) loads should be connected to the output jacks. (See Section 2.3.)

L. Low Frequency Protect Switch

Engaging this switch causes the unit to cycle through the "STANDBY" mode if low frequency (DC–10 Hz) appears at the output.

M. Delay Switch

This switch activates a four-second delay in the transition state from "turn-on" to high-voltage power supplies on.

N. Output Connectors

Banana jacks are provided at the output of each channel. Only the two top jacks (red) are used in MONO mode since both channels are bridged.

O. Balanced Input Module Socket

This 11–pin radial socket is provided for one of two optional balanced input modules (75A06 or 75A07). The 75A07 uses a transformer to balance the inputs while the 75A06 uses active circuitry. If one of these modules is used, the unbalanced inputs should not be used.

On the back panel the Model 7550 has a dust filter on the air intake to the cooling system. The filter may be removed for cleaning.

To isolate chassis ground from signal ground, you can use the back panel Ground Barrier Strip by removing the shorting strap. Grounds are always connected internally with the resistance of 2.7 ohms.

The two BNC connectors on the back panel provide for easy connection and disconnection of input signals.

Switch between DUAL and MONO mode with the Dual/Mono switch located on the back panel.

Below this switch, is the Low Frequency Protect Switch. Engaging it causes the unit to cycle through the "STANDBY" mode when low frequency (DC–10 Hz) appears at the output.

The next switch is the Delay Switch. This switch activates a four-second delay in the transition state from "turn-on" to high-voltage power supplies on.

Model 7550 includes two standard MDP "dual banana" type output jacks on the back panel. In DUAL channel operation, use two dual banana plugs connected vertically. Use one dual banana plug connected horizontally to both "hot" (+) terminals in MONO operation.

The back panel also includes an 11–pin accessory socket. Some accessories are described in Section 6. Contact Techron engineering for any other accessories available. Each accessory comes with its own documentation for installation and use.

Also located on the back panel is a heavy duty three-wire (grounded) AC line cord.

3.3. Protection

Techron power amplifiers are widely known for their quality construction, high reliability and extensive internal protection circuitry. The Model 7550 is no exception. It is protected against all the common hazards which plague high-powered amplifiers such as:

- input overload damage;
- shorted, open and mismatched loads (load impedance too low);
- chain destruction phenomena;
- high frequency overload blowups;
- excessive temperature; and,
- overloaded power supplies.

The input stage is protected against excessive input signal level (overdrive) by a series-limiting resistor.

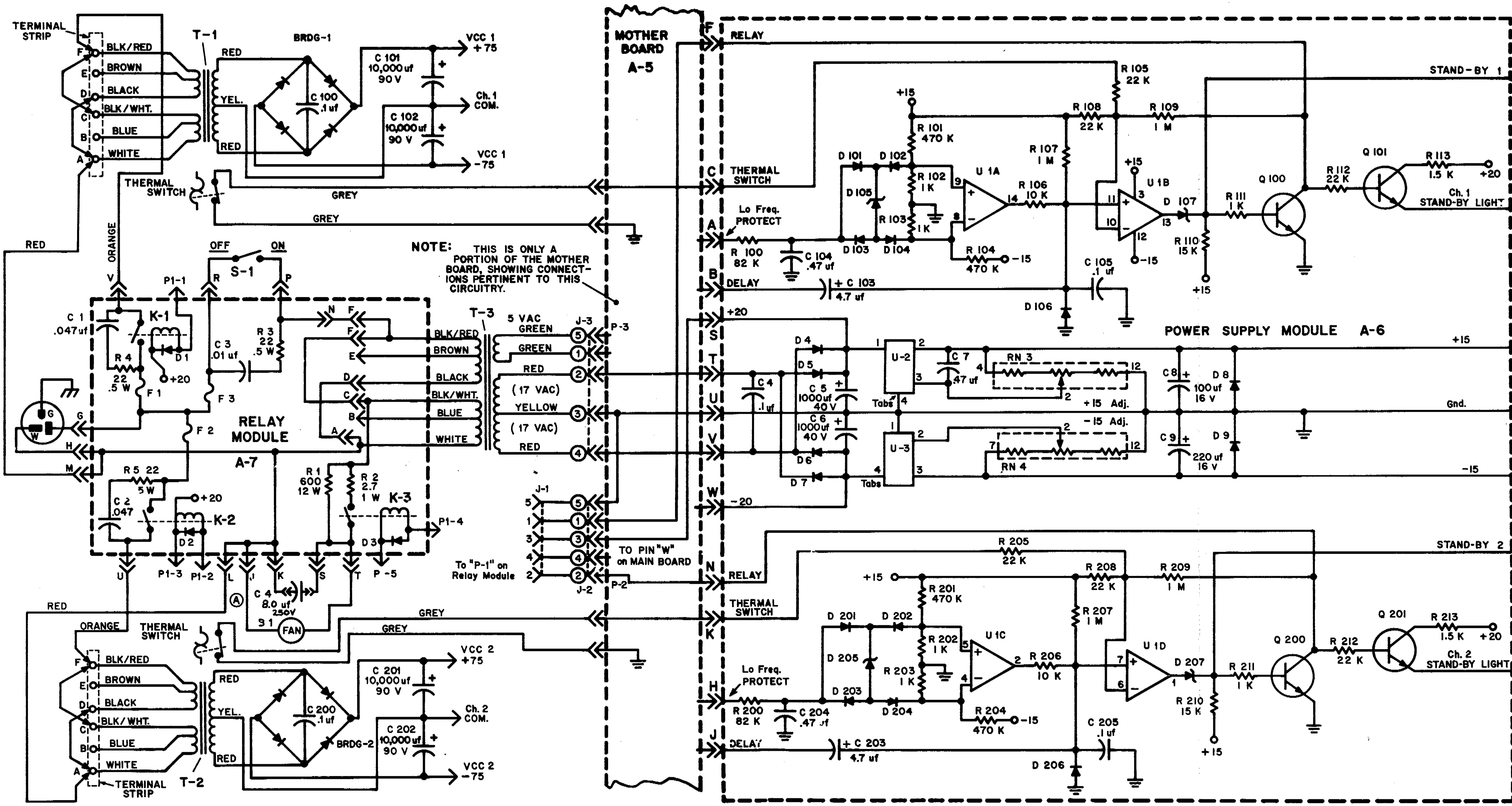
Protection against shorted and low impedance loads is provided by a fast-acting limiter circuit which instantaneously limits the output power to a maximum safe stress value.

It functions automatically as a current limiter at audio frequencies whose current limiting threshold is dependent on the history of the output signal.

Increased output current causes the threshold to increase, however, the no-signal threshold is high enough to allow tone bursting (even into 4 ohms) without premature limiting.

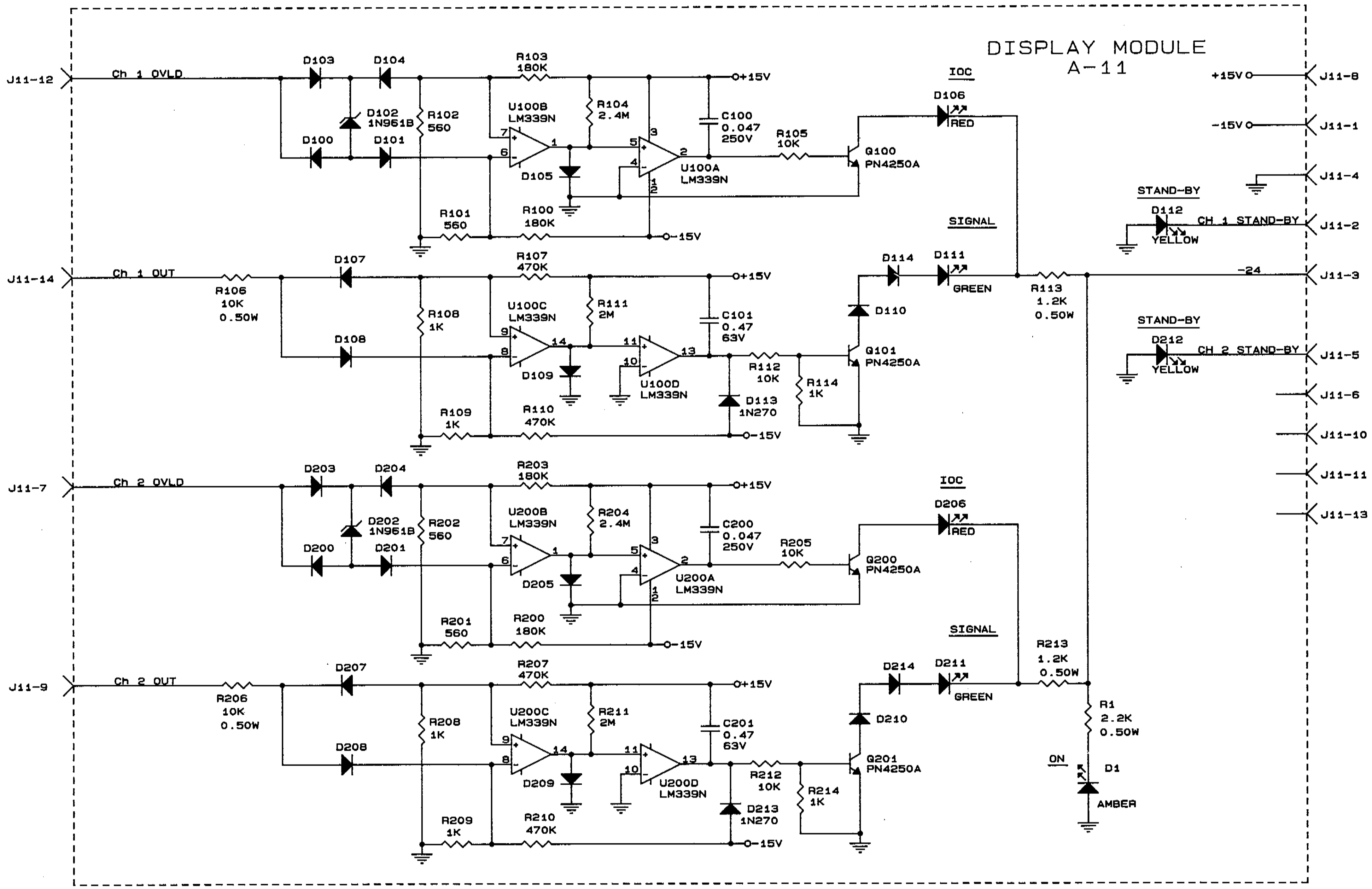
Since the limiter has no instantaneous response to output voltage, "flyback" transients do not appear in the output when limiting occurs on inductive loads. ("Flyback" transients are a normal by-product of VI limiting with an inductive load.)

Because the current limiter of the Model 7550 will not yield to the constant current demands of an inductive load, it is immune to "flyback" distortion.



Model 7550

Illustration 6-2 Schematic J0004-2 Power Supply



LAST USED	OBSOLETED
C101, C201, D114, D214	
J11, Q101, Q201	
R114, R214, U100, U200	

NOTES :

1. ALL RESISTORS ARE IN OHMS, 1/4W, 5% UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
3. DIODES ARE TYPE 1N4148
4. D110 AND D114 ARE MOUNTED IN THE POSITION MARKED D110 ON PCB ASSY
5. D210 AND D214 ARE MOUNTED IN THE POSITION MARKED D210 ON PCB ASSY
6. UNDERLINED TEXT REPRESENTS DISPLAY PANEL MARKINGS
7. D113 AND D213 ARE OMITTED ON EARLY UNITS AND MAY BE RETROFITTED TO PREVENT FALSE TRIGGERING OF "IOC".

Model 7550

Illustration 6-3 Schematic J0009A9 Display Module

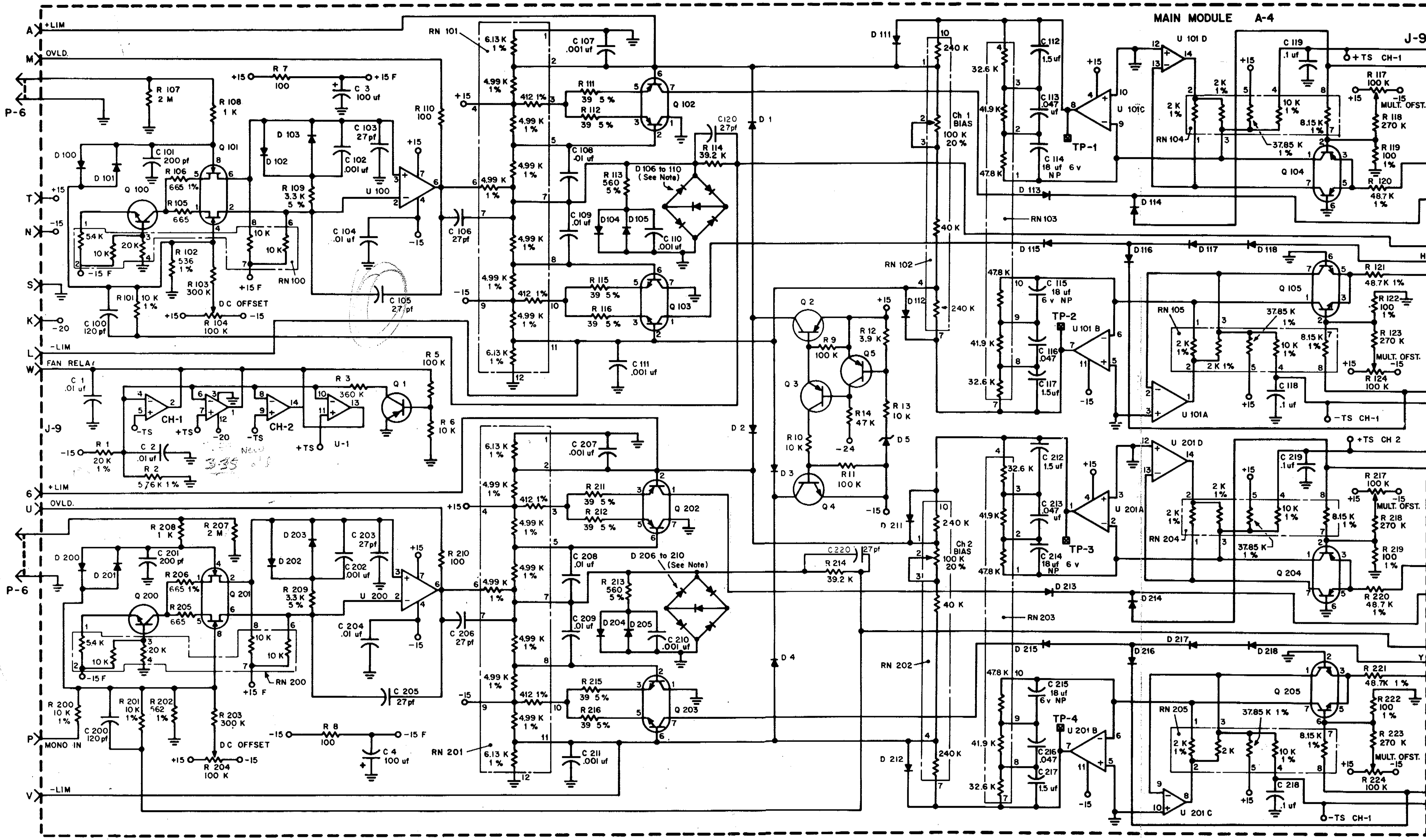


Illustration 6–4 Schematic J0003A2 Main Module

Model 7550

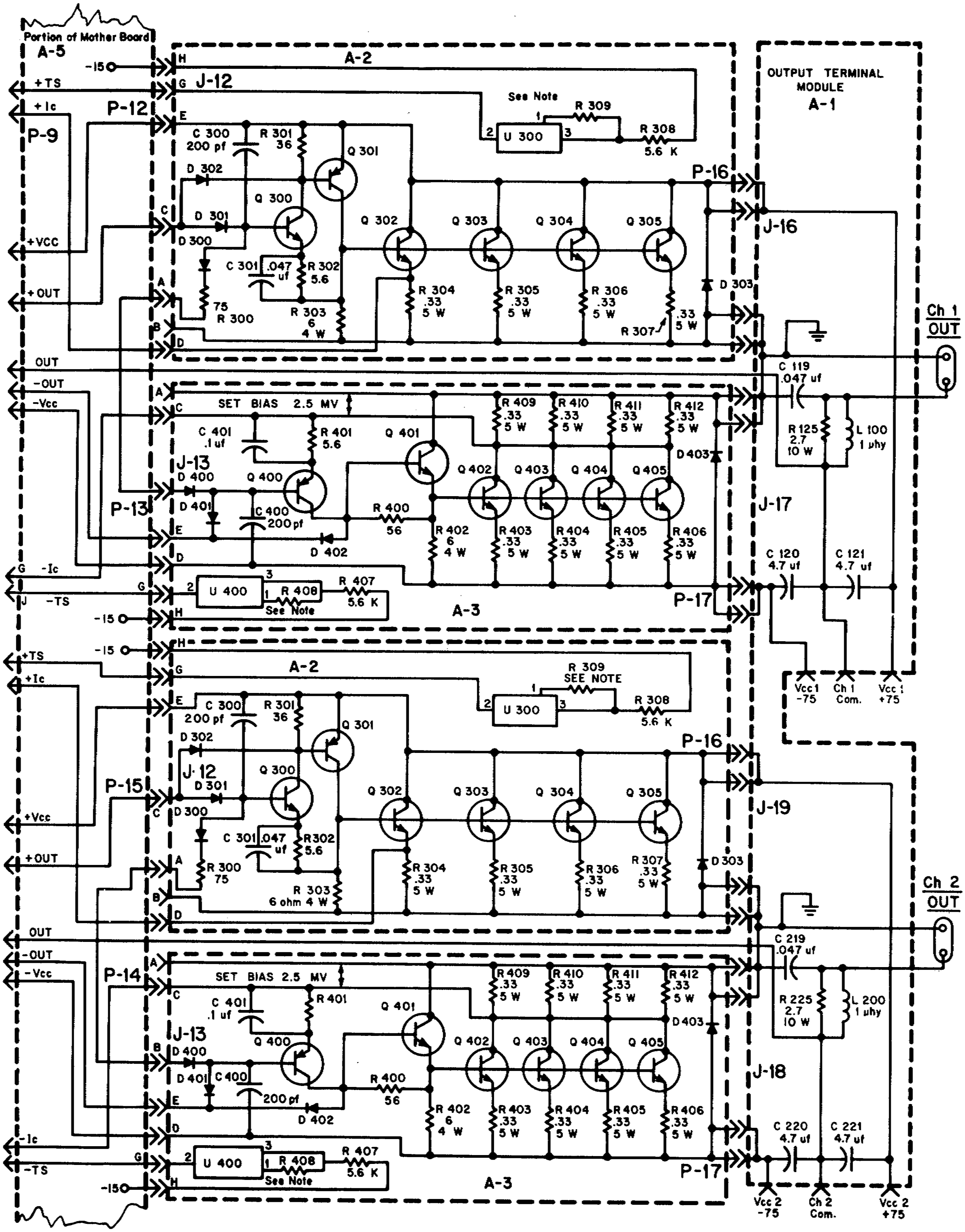


Illustration 6–5 Schematic J0003A2 Output **Model 7550**

crown®

PSA-2, PSA-2X
PSA-2D, PSA-2DX
POWER AMPLIFIER
SERVICE MANUAL

PSA-2, PSA-2X
PSA-2D, PSA-2DX
POWER AMPLIFIER
SERVICE MANUAL

CROWN INTERNATIONAL, INC. 1718 W. MISHAWAKA RD. ELKHART, IN 46517-4095

K80307-0
6/89

The information furnished in this manual does not include all of the details of design, production, or variations of the equipment. Nor does it cover every possible situation which may arise during installation, operation or maintenance. If you need special assistance, beyond the scope of this manual, please contact the Crown International Customer Services Department.

Crown International, Inc.
1718 West Mishawaka Road
Elkhart, Indiana 46517-4095
Phone: (219) 294-8000
Fax: (219) 294-8FAX
Twx: (810) 294-2160

WARNING

TO PREVENT SHOCK OR FIRE HAZARD, DO NOT EXPOSE TO RAIN OR MOISTURE!

CAUTION

TO PREVENT SHOCK DO NOT USE THE POLARIZED AC PLUG OF THIS UNIT WITH AN UNPOLARIZED EXTENSION CORD, RECEPTACLE OR OTHER OUTLET WHERE THE BLADES CANNOT BE FULLY INSERTED.

ATTENTION

POUR PREVENIR LES CHOCS ELECTRIQUES NE PAS UTILISER CETTE FICHE POLARISEE AVEC UN PROLONGATEUR. UNE PRISE DE COURANT OU UNE AUTRIE SORTIE DE COURANT, SAUF SI LES LAMES PEUVENT ETRE INSEREES A FOND SANS EN LAISSER AUCUNE PARTIE A DECOUVERT.

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List of Illustrations

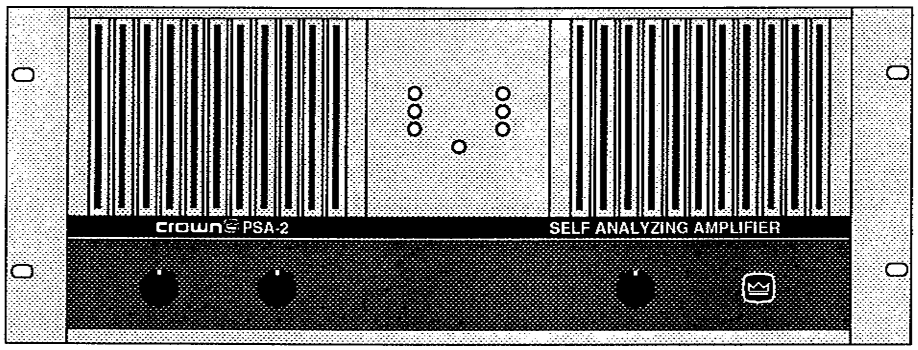


Fig. 1.1 PSA-2X Amplifier

1 Introduction

This manual contains complete service information on the Crown PSA-2 power amplifier. It is designed to be used in conjunction with the PSA-2 Instruction Manual. However, some important information is duplicated in this Service Manual in case the Instruction Manual is not readily available.
NOTE: THE INFORMATION IN THIS MANUAL IS INTENDED FOR USE BY AN EXPERIENCED TECHNICIAN ONLY!

1.1 The PSA-2

The PSA-2 amplifier is a compact, audio power amplifier designed for professional use. Providing high power amplification from 20Hz-20KHz with minimum distortion, the unit features balanced 1/4" phone inputs, monophonic capability and a means for isolating signal shield ground from circuit ground.

1.2 Warranty

As a Crown Warranty Service Station, you should be familiar with Crown warranty policies. Each Instruction Manual contains basic policies as related to the customer. However, under questionable circumstances, please contact the Technical Service Department or Director of Customer Service at:

Crown International, Inc.
1718 W. Mishawaka Road
Elkhart, Indiana 46517-4095
Phone: (219) 294-8000
FAX: (219) 294-8329
Twx: (810) 294-2160

Crown International, Inc.
1718 W. Mishawaka Road
Elkhart, Indiana 46517-4095
Phone: (219) 294-8000
FAX: (219) 294-8329
Twx: (810) 294-2160

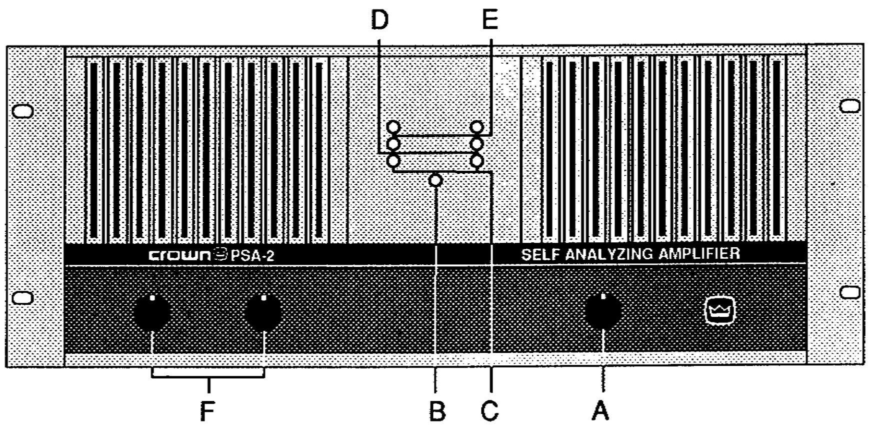


Fig. 2.1 PSA-2X Front Panel Facilities

2 Facilities

A. Power
The AC power switch, mounted at the right-hand corner of the PSA-2 is a simple 2 position "on/off" control. If the AC power switch is positioned at "on", the power indicator should be on (B).

B. Power Indicator
Amber LED illumination indicates that the low voltage and control circuitry are turned on.

C. Standby Indicator
Yellow LED illumination indicates that the unit is in a standby mode.

D. SPI
Green Signal Presents indicator will light when a signal of 1.2 volts peak appears at the output of the amplifier. This means that under normal operation, the SPI lights will be on. The SPI circuitry is of a switch by nature, therefore, the intensity of the SPI lights remains the same and does not vary with level.

E. IOC
Input/Output Comparator indicator that the output signal distortion is greater than .05%.

F. Level
The level of each channel is independently controlled by these controls. The control for channel 2 should be turned down and not used when operating in MONO mode. Both level controls are located on the front panel.

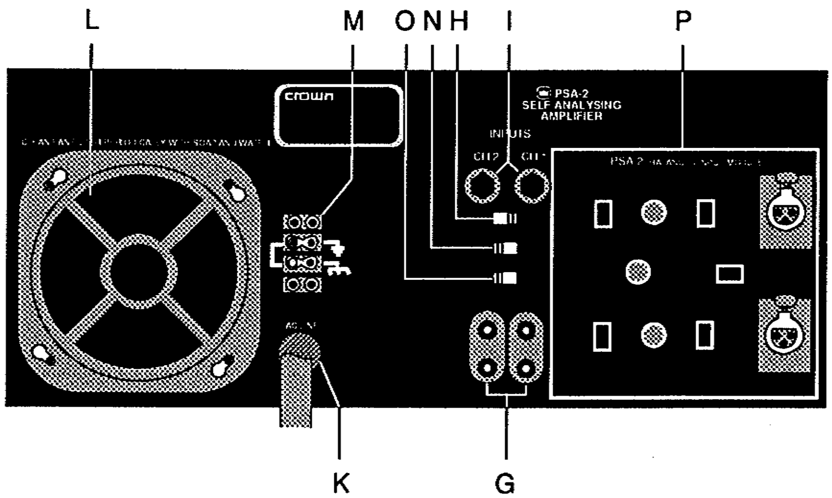


Fig. 2.2 PSA-2X Back Panel Facilities

G. Output Binding Posts
Dual binding post connectors are provided at the output of each channel. Use dual banana plugs on the speaker cables for connection to the jacks. In bridged-MONO, only the two top jacks (red) are used.

H. Bridged Mono-Stereo
Slide this switch to the left (ch. 1) for bridged MONO mode, and to the right (ch. 2) for Stereo mode operation. In bridged MONO mode the input and level control for channel two should not be used and only balanced (ungrounded) loads should be connected to the red output jacks (ch. 1) red binding post being the noninverting connection).

I. Input Phone Jack
An unbalanced 1/4 inch phone jack is provided at the input of each channel. Do not use the input jack for channel 2 when operating in bridge MONO mode.

J. Fuse
The AC line is safety fused with a fuse value of 20 amps per channel when operated at 120VAC (10 amps for 220VAC or 240VAC). The use of any other fuse value will invalidate the warranty. Fuses are internal to the unit.

K. Power Cord
A standard NEMA 20 ampere, three-wire (grounded) AC cord with a 20 amp plug is provided.

L. Fan Filter
The PSA-2X has a dust filter on the air intake to the cooling system. Should this filter become clogged the unit will demonstrate impared cooling and may produce "lower than normal" output levels due to high heat sink temperature.

M. Chassis /Circuit Ground Lift
Isolating chassis ground from circuit ground is done by simply removing the shorting strap from the ground terminal strip located next to the fan vent.

N. Low Frequency Protection
Engaging the Low Frequency Protection switch causes the unit to cycle through the "Standby" mode action if any signal from DC up to 10 Hz appears at the amplifier outputs (**Caution**: whenever the Low Frequency Protection switch is engaged, also engage the delay switch).

O. Five Second Delay
A Five second delay is inserted in the transition state from turn-on to high voltage power supply on.

P. Balanced Input Module
Located on the rear panel is the optional Balanced Input Module. The optional Balanced Input Module offers balanced XLR inputs, variable voltage gain of 20 dB, alterable and switchable High and Low Pass Filters, test tone generator and a variable compressor.

3 Required Test Equipment

Many of the service and repair problems with the PSA-2 can be performed with a limited amount of test equipment. However, in order to return the unit to its "factory new" specifications, the following list of required test equipment is recommended. The "Requirements" column provides information to allow intelligent selection of substitutes if the "Suggested Supplier and Model" is not available or is considered impractical to obtain.

EQUIPMENT	REQUIREMENTS	APPLICATION	SUGGESTED MODEL
Oscilloscope	Capable of displaying a 10MHz signal	Monitoring output during service and testing.	Telequipment D54A or equivalent.
Volt-Ohmmeter	Low-voltage resistance probe 100mv (range). High-voltage resistance probe (1.5V range).	Check resistance values (low voltage probe). Check semiconductor junctions for opens or shorts (high voltage probe) Check DC voltages.	Fluke 8024 or equivalent.
Freq. Counter		For accurate general monitoring.	Heath SM118A.
Signal Generator	Sine/Square wave available; flat frequency response. THD .1% maximum.	Provide test signals for service and checkout.	Wavetek 130 -Series or equivalent.
Circuit Breaker	20 ampere rating.	In AC line to unit; protects circuitry from overload if power supply has shorted.	
AC Line Voltage Monitor	Peak reading meter (displays rms equivalent to a sinusoidal peak for any waveform).	Monitor line voltage.	Circuit available from Crown.

Fig. 3.1 Required Test Equipment Chart

4. Maintenance

Effective repair involves three basic steps: 1) Determine the symptom(s) of the problem; 2) Identify the cause(s) of the symptom(s); 3) Repair the unit to eliminate the cause(s). Before proceding through these steps it is highly recommended that you first observe the safety precautions in the next section and conduct a visual inspection of the unit.

4.1 Safety First!

To avoid risking electric shock, turn off and unplug the PSA-2 from the AC power outlet before disassembly or reassembly is attempted.

If the unit has been in recent use, the large power supply capacitors will probably have enough power stored within them to present a shock hazard to you and the amplifier circuitry. To safely discharge them, place a 10 ohm, 5 watt resistor across the + and - terminals of each capacitor for several seconds. Use caution when handling the discharge resistor- particularly avoiding skin contact with the leads while discharging the capacitors.
Avoid risk of fire hazard from shorted power supplies by plugging the defective amplifier into an AC outlet which has a 20 amp circuit breaker.

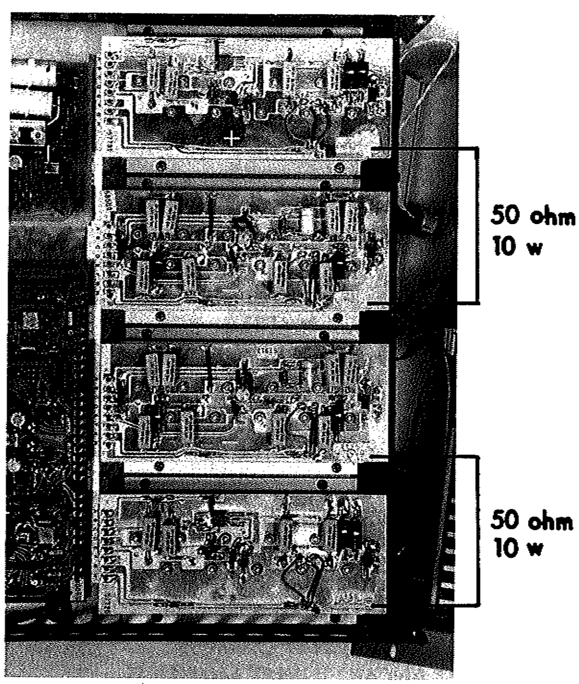


Fig.4.1 Discharge Points

4.2 Inspection

A careful visual inspection is valuable for most problems which you may encounter. To inspect the amplifier, remove the cover panels as described in section 4.3.1

Begin the inspection by looking for anything which appears abnormal, like broken wires and burnt or visibly damaged components. Check wire and component solder joints. Inspect the printed circuit board(s) for broken traces and loose connections. Be thorough- the time you spend visually inspecting the amp is time well spent.

4.3 Disassembly for Inspection, Service, Testing, Adjustment and Repair for the PSA-2.

The extent of disassembly required will depend upon the extent of inspection, service, testing, adjustment and repair to be performed. Illustrations referred to in parenthesis (index numbers) are located in the parts list (Section 9.6) of this manual.

4.3.1 Cover Removal

A fairly complete visual inspection can be performed by removing the top (102) and bottom (101) covers. To remove these parts, proceed as follows:
1. Remove the three top cover phillips head screws (107), located nearest to the front panel.
2. Next, remove the three back panel phillips head screws and respective star washers (106) located nearest the top of the unit.
3. Remove the two (one each side) phillips head screws and respective star washers (106, 109) centrally located between the side panel air vents.
4. Gently lift the rear of the top cover (102) with fingers placed on each side, through the air vent holes.
5. After complete removal of the top cover, the four output module boards, the main module circuit board and the power supply/logic module board should be exposed.

To remove the bottom cover:
1. Place the unit bottom side up.
2. Remove the nine phillips head mounting screws and respective lockwashers (106, 109) from the bottom cover.
3. Remove the four (two on each side) phillips head mounting screws and respective star washers (106) located nearest to the unit, gently lift and remove the cover. When the bottom cover is completely removed,

the following components are exposed: the power transformer, power capacitors, output terminal module, relay module, fan package, mother board, input connector module, anti-pop module (on earlier units) and on the PSA-2, the balanced input module.

WARNING

Immediately after removing the bottom cover as previously described, discharge the four large capacitors by connecting a 50 ohm resistor (not less than 10 watt rating) across the terminals of each Output Assembly trace (see Section 4.3.5). Failure to heed this warning could result in serious shock or damage to circuit components when handling modules.

The PSA-2 has been specially designed for ease of service. Most every component part is in fingers reach for fast and effective replacement. This means it should never be necessary to "replace" a board module itself, unless for testing or if damage was done beyond repair (severed, burnt, etc.). However, in order to apply standard repair procedures, it may be necessary to temporarily remove a board module. If so, observe the following procedures.

4.3.2 Main Board Module Removal (A)

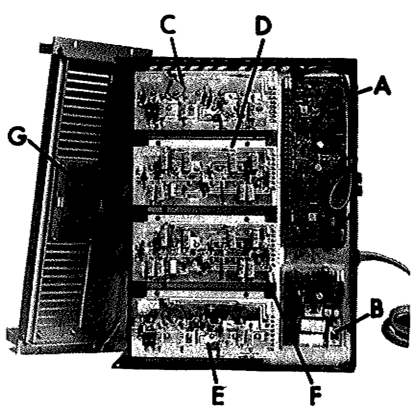
1. Remove the top cover (102) as described in Section 4.3.1. Locate main module (See Section 9).
2. Disconnect the four pin input cable by simply applying upward pressure on the plug casing. For future reconnection, note the location of pin No. 1.
3. Release the main support of the board by pushing the four retaining clips outward, while simultaneously lifting the board beyond the clips retention points.
4. At this point, apply equal upward pressure along the edge of the board which has inter-connect pins labeled 6 through A. The board will come free as soon as each of these pins are released.

4.3.3 Power Supply/Logic Module Removal (B)

1. Remove the top cover (102) as described in Section 4.3.1. Locate the power supply module (See Fig. 9)
2. Release the main support of the board by pushing the two retaining clips outward, while simultaneously lifting the board beyond the clips retention points.
3. Apply equal upward pressure along the edge of the board which has interconnect pins labeled A through W. The board will come free as soon as each of these pins are released.

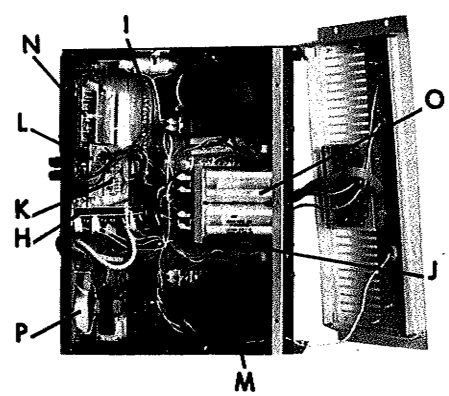
4.3.4 PNP/NPN Output Module Assembly Removal (Including output transistor replacement) (A, B, C, D)

1. Remove the top cover (102) as described in Section 4.3.1. Locate the output assembly(s) which must be removed (See Fig. 4.2).



A. MAIN MODULE
B. LOW VOLTAGE POWER SUPPLY MODULE
C. CH.1 NPN OUTPUT MODULE
D. CH.1 PNP OUTPUT MODULE
E. CH.2 PNP OUTPUT MODULE
F. CH.2 NPN OUTPUT MODULE
G. DISPLAY MODULE

Fig. 4.2 Top Component Location Diagram



H. RELAY MODULE
I. MOTHER BOARD MODULE
J. OUTPUT TERMINAL MODULE
K. ANTI-POP MODULE (EARLY UNITS ONLY)
L. INPUT CONNECTOR MODULE
M. CH.2 POWER TRANSFORMER
N. PSA-2 BALANCED INPUT MODULE
O. POWER SUPPLY CAPACITOR ASSEMBLY
P. FAN ASSEMBLY

Fig.4.3 Bottom Component Location Diagram

2. Remove the four phillips head mounting screws (69) being careful not to damage the delicate heat sink (68) fins.
3. Apply equal upward pressure on each short end of the assembly until it is released.
4. If it is necessary to replace an output device, desoldering of the transistor leads as well as screw-nut-washer removal must be performed.
5. To replace U300 (LM334H Thermal Sense IC), remove all four output and driver transistors from the assembly. At that point, the board can be removed from the heat sink fins exposing U300 (See page 9-52).

4.3.5 Relay Module Removal

1. Remove the bottom cover (101) as described in Section 4.3.1. Locate the Relay Board Module (See Fig. 4.3).
2. Remove the three pozidrive head screw(s) that mount the board support bracket. These screws are easily accessible from the outside of the rear panel (89).
3. After the entire assembly is loose, it is then possible to remove the board itself by pushing the four retaining clips outward and gently lifting the board out of its support bracket.
4. All connections to this board (except T3 primary) are made through removable clips/plugs. If their removal is necessary, note their location for future reconnection. (See Fig. 4.3).

4.3.6 Mother Board Removal

Because there are no active component parts on this board, replacement or need for removal is highly unlikely. In addition, special tools and procedures are needed in order to perform this operation successfully. Therefore, factory service replacement is highly recommended. Should questions or problems arise, contact the Crown Technical Service Department.

4.3.7 Output Terminal Board Removal

1. Remove the bottom cover (101) as described in Section 4.3.1.
2. Remove both power transformers (23, 24) as described in Section 4.3.11.
3. Remove power supply capacitor assembly (25) as described in Section 4.3.12.
4. Remove the four board mount screws and nuts (not shown on exploded view drawings).
5. Gently pull the board away from the unit to allow the pin-socket combination to disconnect.

4.3.8 Muting Module Removal (earlier units only)

1. Remove the bottom cover (101) as described in Section 4.3.1. Locate the Muting Board Module (See Fig. 4.3).
2. Push the two retaining clips outward and gently lift and remove the board.
3. Unsolder the seven colored wires and note their location for future reconnection.

4.3.9 Input Connector Module Removal

1. Remove the bottom cover (101) as described in Section 4.3.1. Locate the input connector module (See Fig. 4.3).
2. Disconnect each of the two five-pin cable connectors. Note their location and pin read-outs for future reconnection.
3. Remove the six pozidrive head switch mounting screws {89 as well as the phone jack nuts (74)}. For complete removal, it will be necessary to disconnect the multi-cable plug located at the Mother Board Module.

4.3.9 Balanced Input Module Removal

To remove the balanced input module, simply remove the four pozidrive head mounting screws (105) located two on the top row and two on the bottom row.

4.3.10 PSA-2D Display Module Removal (includes front panel removal)

1. Remove the four phillips head front panel mounting screws (108) along with their respective star washers (two screws per side.)
2. Remove the six (3 on top; 3 on bottom) pozidrive head cover/front panel mounting screws (107).
3. Loosen the four (two per side) pozidrive head top and bottom front panel extrusion screws (100).
4. Slide the front panel away from the unit as far as the cables will allow.
5. Disconnect the multi-cable connector located at the display board.
6. Remove the four mounting nuts and washers (3, 2, 1).

4.3.11 Power Transformer Removal

1. Remove the bottom cover (101) and front panel as described earlier (See Section 4.3.1 and 4.3.10).
2. Remove the six "push-on" terminal wires located on the voltage terminal strip, adjacent the transformer.
3. Disconnect all other wires that would inhibit transformer removal. Note their location for future reconnection.
4. Remove all six transformer phillips head mounting screws (31); four are located on the side of the unit and two are located behind the front panel. Note when remounting the transformer, be sure to include all mounting hardware and place it in the proper position .

4.3.12 Power Supply Capacitor Replacement (C101, C201, C102, C202)

WARNING

Before attempting any repair work in this area, be sure to discharge these four large capacitors by connecting a 50 ohm resistor (not less than 10 watt rating) across the terminals of each capacitor.

1. Remove the bottom cover (101) and front panel as described earlier (Section 4.3.1 and 4.3.10).
2. Remove four phillips head screws (39) from the front panel side, loosening capacitor assembly.
3. With an 11/32" nut driver, loosen and remove the center bracket shaft nut (56).
4. With a firm hold on all four power capacitors, pull back gently and position the assembly for best access to the capacitor terminal screw lugs.
5. Remove desired terminal screws from capacitor with a flat-head screwdriver (large head, small shaft works best).

4.3.13 Fan Removal

NOTE: There are actually two versions of fan filters incorporated in the PSA-2. Earlier versions used a hand removable, white filter frame. The latest models use a black framed filter that is removable only by loosening four screws (89).

1. Remove the bottom cover (101).
2. Remove the four-corner phillips head screw-bolt combination (88).
3. Disconnect the motor and frame by removing the correct connectors on the Relay Module.

4.3.14 Front Panel Controls Removal (Input Level and On/Off Controls)

1. Remove the front panel as described earlier (Section 4.3.10).
2. Remove knob (15) with proper size allen wrench.
3. Remove mounting nut and washer (18, 17) from the respective control.

4.4 Reassembly

Reassembly is essentially the reverse of disassembly. If in doubt about types and sizes of attaching parts, refer to the appropriate illustration in Section 9.

Repair of the unit includes replacement of component parts (both on and off the removable modules), damaged wiring and replacement of any structural parts such as panels and brackets. All replaceable parts are listed in the board layout/parts lists or in the exploded view drawings in Section 9.

Consumable materials (except wire) required in repairing the amplifier are listed in Fig. 4.5. The use of these materials are explained in the last column entitled "Use".

Name	Crown Part No.	Total Unit Qty.	Use
Heat Sink Compound (Type 340)	S 2162-4		Mounting output transistors and drivers on output modules
Silicon Sealer (Clear)	S 2422-4		Mounting U400 to the NPN/PNP output module: coupling D300 to Q300 and D400 to Q400
Insulating sleeving black (0.0221D) (0.042 ID) (0.0133ID)	B 1644-2 B 1363-9 B 1383-7	1.5" 4.75" 2"	Insulating jumper wiring on PNP/NPN output modules, etc.
Cable Ties	C 1811-6	28	Misc. wire "wrap-together" device
732 Silastic Rubber	S 3010-6		Sealing fan filter to back panel: small drop to seal ribbon cable connectors
Solder (63% tin 37% lead, rosin core)	S 3482-7		Soldering electrical connectors in wiring and on printed circuit boards

Fig. 4.4 Consumable Materials Chart

4.5 Troubleshooting

The three steps to effective troubleshooting and repair were mentioned earlier. They can be summarized in the three following questions: What is the problem (effect)? What is causing the problem (cause)? What can be done to eliminate the cause (repair)? The purpose of this section is to help you answer these questions in an orderly manner.

Finding and fixing the problem(s) is not the end of maintenance. The final step is to thoroughly test the amplifier to be certain that it meets the factory specifications after it has been repaired. The test procedures in section 4.5.2 will help you do this as well as aid you in locating the cause of problem(s).

4.5.1 Identifying Symptoms

Why was the amplifier brought in for repair? Can you get it to malfunction again? (Some problems can be intermittant and difficult to find.) If you don't observe anything wrong with the amplifier, tactfully inquire how the owner used it and try to determine if it was misused or some other component in their system could have been at fault. (Appendices A and B contain the installation and operation instructions for the PSA-2).

If you lack sufficient information about the problem and there isn't anything obvious wrong skip to the next section and procede directly to the test procedures.

4.5.2 PSA-2 Electrical Checkout and Adjustment Procedures

The following instructions outline an orderly checkout and troubleshooting procedure. The purpose and arrangement of this procedure is to determine the cause of the trouble as quickly as possible; leading to a detection of which component part(s) must be replaced or repaired.

WARNING!!

Most adjustments are made with protective covers removed. This means prior to any non-ac-powered testing, discharge all power capacitors; C101, C201, C102, C202, (See Discharge Instructions; Section 4.3.12). Also, use extreme caution while making any internal adjustments when the unit is powered.

Type of Test or Adjustment	Input Signal Characteristics	Comments
1. Turn-on (no AC applied)	None	1. Make sure that there is continuity from the rear panel ground terminal strip to: a) Test point P on LV Supply Board b) Test point T on LV Supply Board c) Barrels of unbalanced input jacks d) Black binding post of output banana jacks. With the power switch in the "off" position, connect the necessary input line power and check accuracy with a digital voltmeter. Set delay and low frequency protection slide switches to off.
2. Power Supply Voltage	None	2. AC power applied; check low and high voltage supplies with an accurate (+/-1%) voltmeter. The following voltages should be observed. a) On the Low Voltage Supply Board: Pin Q -15V Pin R +15V (+/- .05V) Pin S +24V Pin W -24V (greater than 19V) b) Between the PNP and NPN Output Board Modules, 150-160V should be measured from pin D of the ~~NPN~~ PNP to pin E of the NPN. Check both channels.

Type of Test or Adjustment	Input Signal Characteristics	Comments
3. Turn-on Delay	None	3. With the delay switch on, turn unit off and then on again while listening for the "click" of the relays becoming activated. This process should take approximately four seconds. Also note the illumination of "Standby" LED's at initial turn-on (they should remain on during the four second delay).
4. Fan Speed	None	4. Engage high speed by placing a 180K ohm resistor across pins G & H of each of the four output modules. (If the IOC lights are activated at anytime during this test, it may indicate that a problem exists).
5. Main Board Voltage	None	5. Check voltage on test points 1, 2, 3, and 4 (of Main board module) to ground. Voltages should be somewhere between 10.5V and 13.0V; pins 1 and 3 will exhibit a negative potential whereas 2 and 4 will be positive. If these voltages cannot be obtained, adjust to 12V via the multiplier balance circuitry (See step 11C).
6. Output Assembly Voltage	None	6. Check voltage on test pins G of each output board assembly. At room temperature (25 degrees C), the voltage should be 2.98V (+/- .12V).
7. Standby Relay	None	7. Check the operation of Relay K1 and K2 by grounding their channel standby pins: K1-pin "D" on power Supply Module K2-pin "L" on Power Supply Module
8. DC Offset	None	8. Adjust R104 and R204 so that with the input level controls fully clockwise, a dc voltage of less than +/- 10mV appears at the output of each channel.
9. Bias	None	9. Adjust RN102 and RN202 so that 2.5mV appears across pins A to C on both of the negative output modules. Be sure the unit has had sufficient warm-up time (at least 15 minutes).
10. Low Frequency Protect	9Hz sine wave (no load)	10. Insert a 9Hz signal into the unbalanced input of each channel. Slowly increase the input level; note that when the output reaches approximately ~~26V~~ [40V], the low frequency protect circuitry will deactivate that channel of the amplifier.
11. Protection Circuit	A. None (no load)	11 A. Place a 180K ohm resistor across pins "G" and "H" of each output module while checking the voltage at test pins 1, 2, 3, and 4. The voltage should vary from +/- 12V without the resistor to +/- 4V with the resistor.
	B. 1KHz sine wave; 1V	B. When applying a 1V, 1KHz signal into both an 8 and 4 ohm load, no oscillation should be visible (via oscilloscope) in the output waveform. Fig. 4.5 shows a correct waveform.

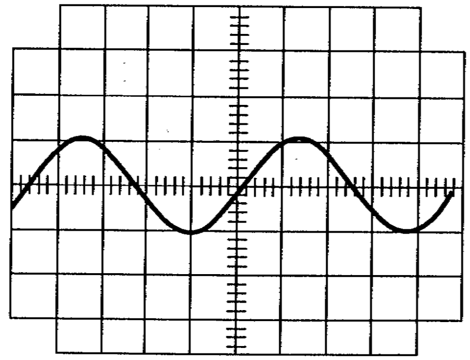


Fig. 4.5 Output Waveform

Type of Test or Adjustment	Input Signal Characteristics	Comments
Multiplier Balance	C. 100Hz sine wave; (no load)	C.This adjustment must be made if and only if the protection circuitry (steps 11A, B) is not functioning properly. Apply the input signal to full output 42.5Vrms) (without a load) without clipping the signal. Adjust R124 and R224 for minimum signal null at test pins 1, 2, 3 and 4 on main board module (scope should be set at 100mV for proper viewing). Repeat steps 11A, B; proceed to step 11D.
Temperature Computer	D. 10Hz sine wave; 30V, 4 ohm load	D. Measure the AC voltage across C112, C212, C113, C213, C114 and C214 with a true RMS meter. This may be done by measuring across the proper pins of RN103, RN203 (see schematic). C112/C212 measure .4VAC +/- 10% C113/C213 measure 1.7VAC +/- 10% C114/C214 measure .036 +/- 10% If these measurements cannot be obtained, a problem exists in the thermal computer circuitry.
12. Anti-pop Circuit	1KHz sine wave; 2V no load	12. Observe the output of pins M and U on the Main Module while turning the unit on and off several times. A spike should be noticeable upon each turn-on. Observe the signals at the output terminals. They should not exhibit any spike during turn-on.
13. Display Module (PSA-2)	A. 1KHz sine wave, no load	13.A Increase input level until the green "Signal" presence indicators illuminate. The voltage level should be approximately 1.2 volts peak at the output. Connect an oscilloscope to the amplifier output. Again raise the input level to the point just before clipping is observed. Note the IOC indicators; they should illuminate prior to the visible clipping point on the scope.
Display Module PSA-2D	B. 1KHz sine wave, no load	B. Vary input level, noting upward progression of ladder display proportional to the input signal variance. Connect an oscilloscope to the amplifier output. Raise the

		input level to the point just before clipping is observed. Note the IOC indicators, they should illuminate prior to the visible clipping point on the scope.
14. Power	A. 1KHz sine wave, 2Vrms; 8 ohm load	14 A. 44V minimum should be obtainable before clip.
	B. 1KHz , 2V; 8 ohm/inductive (159uh) load	B. 20V minimum should be obtainable before clip.
	C. 1KHz sine wave, 2V; 4 ohm load	C. 41V minimum should be obtainable before clip.
	D. 1KHz sine wave; 2V; 1 ohm load	D. ~~30V~~ 21V minimum should be obtainable before clip.
	E. 20KHz sine wave; 2V; 8 ohm load	E. 44V minimum should be obtainable before clip.
	F. 10KHz sq. ware; 2V; 8 ohm load	F. 50V minimum should be obtainable before clip; signal should be a good square wave with no aberrations (Fig. 4.7).

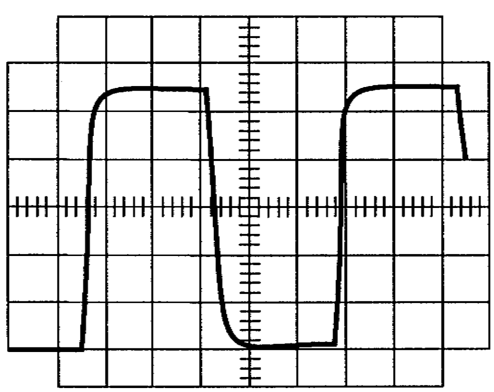


Fig. 4.6 10KHz Square Wave

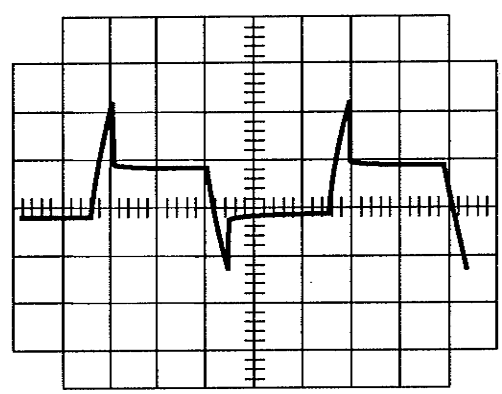


Fig. 4.7 Simulator Protection Limiting

Type of Test or Adjustment	Input Signal Characteristics	Comments
15. Thermal	100 HZ ~~20KHz~~ sine wave, variable input; 1 ohm load (output at 21V)	15. Observe the output voltage waveform. As protection circuit limiting takes place the waveform should look similar to Fig. 4.7.

16. Mono	1KHz sine wave; 2V; no load	16. Using only channel 1, apply input signal with mono/ stereo switch in MONO position. Observe the output signal simultaneously of both red or "hot" terminal of both channels. They should be 180 degrees out of phase (see Fig. 4.8).

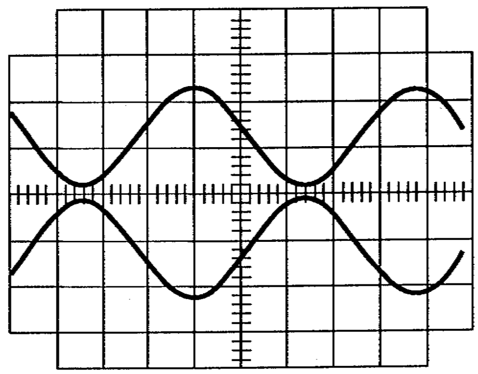


Fig. 4.8 Mono Output Waveform

Type of Test or Adjustment	Input Signal Characteristics	Comments
17. IM Distortion	60Hz/7KHz signal summed in a 4:1 ratio	17. Using an IM or THD analyzer, readings should be from 0 to -25dB, less than .004%, all other, less than .01%
18. Signal/Noise	None	18. With a sensitive ACVM, output signal should be at least 110dB below rated output power. Also, use a 20Hz-20KHz bandpass filter ahead of the voltmeter.
19. Quiescent Power	None	19. Should be less than 90W.
PSA-2 Balanced Input Module		In order to make proper repairs/adjustments with the PSA-2 balanced input module, it is necessary to remove the control panel plate and utilize an extender card (CPN M 20149-7). This allows easy access to all controls and adjustments. **NOTE:** Be sure to block air passage of the Balanced Input Module cut-away hole with a small piece of cardboard to ensure proper cooling during lengthy adjustments.
20. Test Tone Generator	None	20. Adjust all common mode rejection potentiometers (R101, R201, C102, C202) to mid rotation. Set all filter switches (SW100, SW200, SW101, SW201) to flat. Adjust Threshold control (R7) fully clockwise. While observing the output (of the amplifier), hold the Test tone switch (SW1) on. Observe 60 volt spikes, one positive then one negative at the rate of 50 spikes per second.

21. Compressor D.C. Balance	None Applied to balanced XLR inputs; 5Hz sq. wave applied to pin one of U6 (5-15V p-p)	21. Apply a 5Hz square wave (5-15V p-p with a DC, offset so that the most positive level is +15 volts) to pin 1 of U6. Adjust channel 1 compressor DC balance control (R116) for minimum signal at amplifier output. Perform the same adjustment with channel 2 however, apply the signal to pin 14 of U6 and adjust R216. Amplifier output for both should be less than 1 volt.
22. Compressor Action	1KHz sine wave; applied to pins 2 and 3 of balanced input; no load	22. Make sure that when GAIN ADJ (R106, R206) is slowly increased, that the voltage also increases smoothly until clip level is reached (about 44 VRMS). As the control is increased further, the output voltage should remain constant and then, increase once again. The exact range of compression can be measured by turning the gain adjust control fully clockwise and measuring the input voltage verses output voltage (see performance graph, Fig. 7.13).
23. Gain	1KHz sine wave, 2.1V applied to bal. inputs no load	23. Adjust Gain controls (R106, R206) for 42 VRMS at each output
24. Threshold	1KHz sine wave, 2.1V (output 42 volts) no load	24. Adjust the Threshold control (R7) fully counter-clockwise and note the output voltage (it should be approximately 11 volts). Move control back to fully clockwise.
25. Common Mode Rejection	20Hz/20KHz, 2.1V applied to specified XLR pins 200Hz and 2KHz, 2.1V sine wave; no load	25. Short pins 2 and 3 together of the XLR input jack while applying the signal to pins 1 and 2. With a 20Hz input signal, adjust R101, R201 form minimum output. With a 20KHz input signal, adjust C102, C202 for minimum output. Check the CMR Response output; output must be: 70dB below 42V from 5Hz-3KHz and 55dB below 42V at 20KHz.
26. Filter Response	50Hz, 15KHz; 2.1V sine wave; no load	26. Activate all LO and HI PASS filter switches (SW100, SW200, SW101, SW201). Apply a 50Hz signal to each channel. Vary the input signal frequency and make the following observations:Response should be +/-1 dB of the center frequency. At the 3dB down point from center frequency, the frequency should vary no more than +/-5%. Follow the same procedure for the 15KHz high pass filter. Return filter switches to "flat".
27. Noise	Variable 20Hz-20KHz sine wave; 600 ohm center tapped resistor	27. Insert a 600 ohm center tapped resistor into the balanced input. From 20Hz-20KHz, the amplifier output should be less than .775mV (-60dB on V/dB scale). With a voltage gain of 20 through the main amplifier (see specs), this corresponds to the -86dBm equivalent input noise.

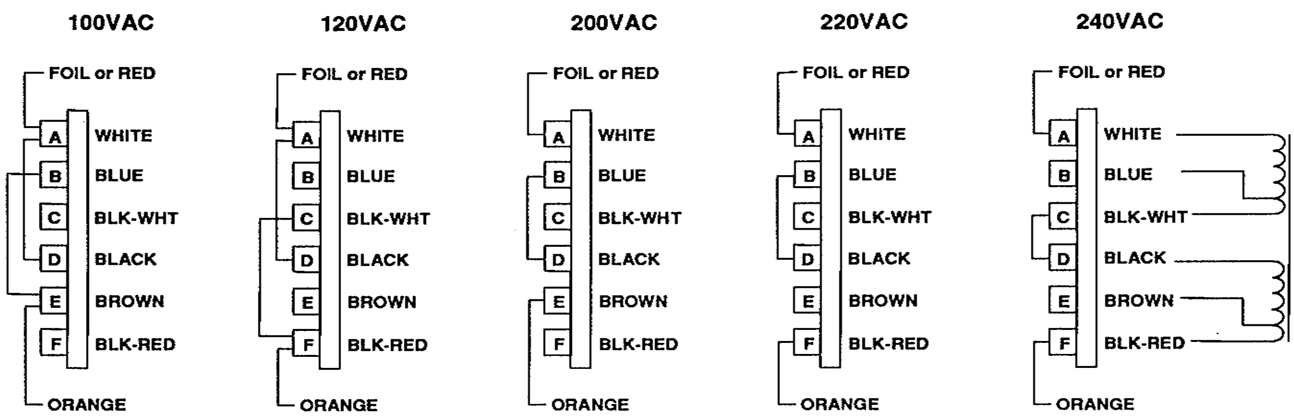
5 Voltage Conversion

Quite often it is necessary to transport a unit to another country. If so, it will be necessary to alter the operating voltage of the unit to match the standard voltage used there. For this reason the following interconnect diagram. (NOTE: On earlier units, this diagram is placed on the interior of the bottom cover should this manual not be readily available.)

In order to change the voltage, it is first necessary to disconnect power and remove the bottom cover from the unit.

WARNING
When removing PSA-2 covers, always discharge the unit as described in Section 4.3.1.

The voltage connections are made with push on terminals. After the correct operating voltage has been chosen and all leads properly identified, follow the connect drawing (Fig. 5.1). Be sure to also make all necessary fuse changes (if needed).



Note:
Three sets of jumpers must be changed. One set on each large power transformer and one set on the Relay Board. A 20 amp fuse should be used for 100 and 120volts. For 200, 220 or 240 volt usage use a 10 amp fuse.

Fig. 5.1 Line Voltage Conversion

6 Circuit Theory

6.1 Block Diagram Circuit Theory

Refer to the block diagram, Fig. 6.1. The diagram does not show all circuit connections or feedback loops due to circuit complexity, but there is sufficient data to grasp the function of each circuit. Note also that only channel one is shown for simplicity.

An input signal is fed to the initial stages via the standard unbalanced input or the balanced input. Both cannot be used simultaneously due to the "interrupt" function of the unbalanced input jacks.

The balanced input jacks are located on a separate, rear panel plug-in module board which also contains many of the professional features unique to the PSA-2.

A variable gain stage, next in line on the Balanced Input Module, adds an adjustable voltage gain (0-10) ahead of the main amplifier.

Connected to this stage, are Hi and Lo pass filters, factory set at 50Hz and 15KHz respectively.

The resultant of the above mentioned stage, along with a switch-controlled wide-bandwidth Test Tone Generator signal, is fed to the Compressor-Limiter circuitry. At its output point, an unbalanced signal may enter if so desired via 1/4" phone jacks.

The input amplifier receives the signal next and sends any necessary error-correcting information to the Compressor Control circuitry as well as sending the main signal on to the Balanced Stage. Essentially, this feedback path (from the output of the input amp through the Compressor Control circuitry) adjusts the amount of compression needed at that particular instant to provide distortion-free output.

In order to drive the NPN and PNP Output Stages, a Balanced Stage is necessary. Should a situation be encountered where protection of the Output Stages is needed, the Protection Circuitry will automatically reduce the drive available to the Balanced Stage and thus remove the stress on the output devices.

Both the NPN and PNP Output Stages consist of four SOA analyzed and Vbe matched output transistors plus a predriver/driver combination that also aid in carrying the quiescent power load. Together they help form the quasicomplementary, Class AB method of operation used in the PSA-2.

Feeding positive current to the NPN OUTPUT STAGE, and negative current to the PNP OUTPUT STAGE, are the POS and NEG Vcc (high Voltage) Supplies. The common point between the two Output Stages is ground. A departure from previous smaller Crown amps, this method allows sophisticated information to be fed to the protection Circuitry from the Output Stages with reference to ground. Both channel's High Voltage supplies work independently of one another.

The point Common to the Neg and Pos Vcc supplies is the "hot" signal of the output terminal which also feed the front panel Display, the Mono switch (for selectable stereo-mono output) and several of the main feedback paths.

The Control Logic is responsible for the action of the Lo Freq Protect, Delay, Standby and thermal protection of the unit. When signaled by the Lo Freq Protect, Standby and/or Delay feature, the Control Logic will remove the power from the Vcc supplies. In the case of Low Freq Protect, when the output has subsided it will place the high voltage supplies back into operation from STANDBY or cycle through the same procedure again depending upon the existence of the problem. Thermal protection may involve the same procedure as mentioned above but only in extreme cases. A thermal switch imbedded in the high voltage transformer's windings will activate the Control Logic when potentially damaging current demands are being placed on it.

The Low Voltage supply drives all low-power signal path circuitry including the Control Logic, Display and Fan speed logic. At an internal temperature of 62 degrees C, the unit will automatically shift to "high" fan speed operation for additional cooling.

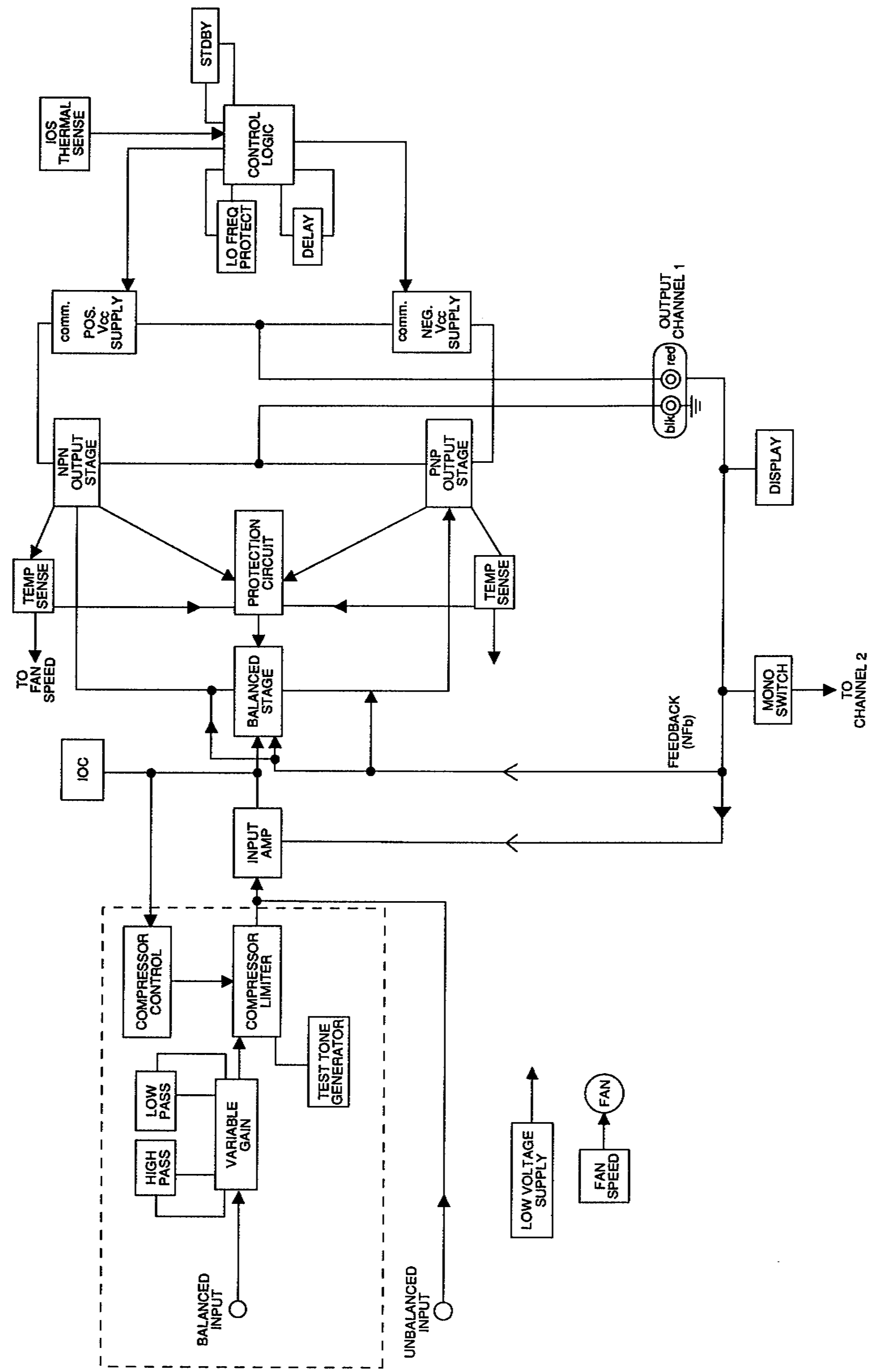


Fig. 6.1 PSA-2 Block Diagram

6.2 General

The Crown PSA-2 is a unique power amplifier which incorporates revolutionary design concepts as well as high performance technology. Much product research was done prior to the actual production of this unit. For example, self analyzing protection circuitry was needed in order to meet the demanding headroom requirements of very low impedance loads (usually the result of paralleling speakers). Modular internal construction was also needed in order to make servicing more time-efficient especially for those users involved in commercial sound. Delayed power-up and low frequency (including DC) protection is a feature long requested by loyal Crown users. For the cosmetically sensitive audiophile, an elaborate dual function LED display was developed as an accessory for the PSA2 (PSA-2D).

As well as the above mentioned features, many "pro-oriented" circuits such as balanced inputs, internal crossover capability, limiter-compressor and remote-control power capability were added to the PSA-2.

The PSA-2 amplifier from Crown's standpoint (as also from the customer's) is well worth the many months of design research and hard labor.

Principles of Operation for the PSA-2

Because the PSA-2 circuitry is different from any other

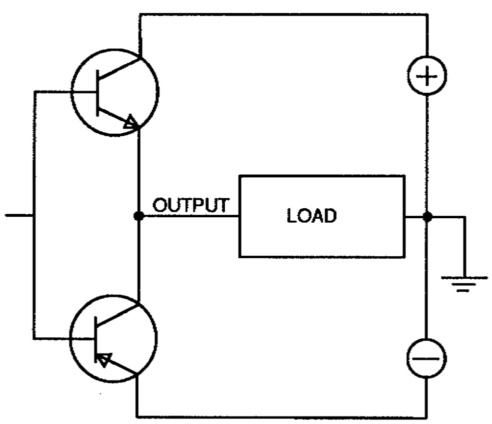


Fig. 6.2 Common Output Configuration

previously designed Crown amplifier, the following explanation is provided in hopes that the service-person will find it less confusing.

Shown in Fig. 6.2 is a diagram of the output configuration used most commonly in all other Crown stereo amplifiers. Note that the ground side of the load is connected between the positive and negative Vcc supply.

In Fig. 6.3 the output configuration used in the PSA-2 is shown. This topology is commonly referred to as "the low side of the bridge" circuit. With this configuration,

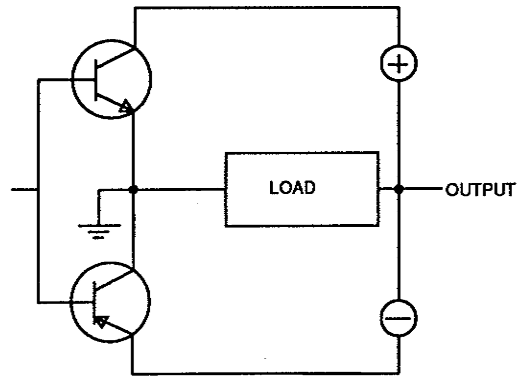


Fig. 6.3 PSA-2 Output Configuration

the load terminals are reversed with respect to ground (ground not connected between the positive and negative Vcc supply). This was done with the intent of making the output stage more readily controlled and observable to the voltage amplifier stages and protection stages of the unit. Also, the output stages can now be more easily driven from low-voltage stages (15V) while operating at +/- 75Vdc, rather than previously higher voltage requirements for similiar-type circuitry.

As mentioned earlier; because the protection circuitry is no longer common to the large AC voltage of the output signal but rather common to ground, a more sophisticated yet easily monitored circuit is possible. This complex circuitry is the "heart" of the self-analyzing amplifier, but is actually easier to trouble-shoot than any other Crown amplifier.

By using two power transformers rather than one, the transformer weight is kept close to the rack mounting surfaces and an additional 40% more power is available. Another advantage is the independent operation of each channel, particularly helpful should a supply problem arise.

A smaller third supply transformer is used for controlling such features as delay, LF protection, the PSA-2 balanced input module, displays and remote power control.

Detailed Circuit Theory

The following explanation refers to schematic diagrams located in the Instruction Manual as well as in Section 8 of this Manual. In most cases, only channel one is discussed for simplicity.

6.2.1 Input Stage

At the far left of the full schematic is the stage which receives the input signal and the overall feedback loop with the resulting highly amplified error signal being used to drive the amplifier composed of the balanced gain stage and the output stages.

A monolithic dual JFET, Q101 is used as a differential amplifier to drive the Bi-FET op-amp U100. The source leads of Q101 are current degenerated by resistors R105 and R106. The drain circuit loads of the differential amplifier are provided by RN100.
Compensation is provided by C102, R109, C105, and C103. The diodes D102 and D103 are used to limit the stored charge that could accumulate on C102 upon overload.
The main feedback loop is composed of R102, R101, and C100 which controls the closed loop frequency response as in all other Crown amplifiers. Note that the channel two equivalent of R102, R202 is a larger value. This is because in the stereo mode of operation the "mono-ing" resistor R200 is grounded, parallelling R202. R200 results is a gain of -1 at its input.
The DC offset voltage of Q101 can be compensated by the adjustment provided by R104 in conjunction with R103. Input overdrive protection is provided by R108. Diodes D100 and D101 are used to prevent overdriving of the common-mode input range of the input stage upon overload. R107 is used to provide a ground reference for the input signal should the signal line become open. Since the bias current of Q101 is negligible, no bias current adjustment is needed.
R110 is used to provide an output to the IOC or compressor circuits. This output will be at approximately 13 volts if any form of overload should occur in the amplifier. Should no overload be present the signal will be a 1/8 scale inverted replica of the output signal. This fact will allow the PSA-2 compressor to respond to levels below the overload threshold when the threshold is appropriately selected.
The supplies to the input differential amplifier stages are filtered by R7, C3, R8, and C4 to remove the noise induced by the 15 volt regulators.

6.2.2 Balanced Gain Stage

Continuing to follow the signal backwards through the amplifier we encounter the balanced gain stage. It is composed of two differential stages of complementary type. The differential amplifiers are constructed with monolithic dual bipolar NPN and PNP transistors. Resistor networks are used to balance the collector currents in the pairs such that the necessary current flows thru the bias network between the bases of the pre-drivers of the output stages. This bias network is composed of the previously mentioned components, D300, R300, and D400. The path of the current from Q102 (collector pin 7) to Q103 (collector pin 1) in channel 1 also flows through D113, D301, D401, D118, D117, and D115. Diodes D113 and D115 are used to isolate the driving stages in case of catastrophy from the output stages. If the output supplies were to propogate to the +/- 15VDC supplies, the overall damage would be great.
Diodes D117 and D118 are part of an instantaneous current limiter bias arrangement which limits the peak output current to approximately 7A per device. The remaining part of this current limiter is provided by diodes D114 and D116.
When sufficient current flows in the output devices, diodes D114 and D116 will become forward biased by the drive voltage to the output stages. When this occurs the current will be effectively limited. Note that the diodes are connected to the opposing output current sensing line rather than to ground. This is a simple means to limit common-mode current spiking in the output stage to values less than 7A per device. The spiking current can only reach a value which is 7A minus the per device load current. Since the worst spiking occurs when the load current is large, the reduction in spiking current is large.
The differential amplifiers are rather precisely balanced by the precision resistor packs RN101 and RN102. RN102 contains the bias control which is used to tweak the balanced to result in the desired bias. The standard bias at quiescent temperature is 2.5mV as measured across the current sensing resistors R409-412.
The input to the balanced gain stage can be conveniently probed at pin 7 of RN101. This point constitutes a virtual ground in the amplifier receiving input signals through the network from pin 6 of U100 and feedback from the output signal via R114. The signal propogates from this virtual ground to the bases of Q102 and Q103 (pin 2 and pin 6 respectively). These devices act as emitter-followers and drive the remaining half of each differential pair through resistors R112, 111 and R115, 116 respectively. Acting in the grounded-base mode of operation these remaining devices provide a high quality current generator to drive the output stages.
R113 and C110 are used to compensate the closed-loop amplifier formed by the balanced gain stage and the output stages. It has a closed loop voltage gain which is about -8, as measured from the output of U100 to the output terminal. When debugging the amplifier this is a useful relationship to observe if the output voltage is unusual. In normal operation the diodes D104 and D105 should not be in conduction. They are provided to limit the charge which can be stored on C110 upon overload. This charge if allowed to become large would produce an overload recovery delay. By limiting the voltage at pin 7 of RN101 in this manner, the voltages necessary to limit the drive of the balanced gain stage are confined. This is in regard to the voltages that would result in conduction of D111 and D112. These voltages are produced by the protection circuits analog computer junction temperature simulator U101C and U101B. Conduction of these

diodes limit the drive of the balanced gain stage to the respective overheating output stage.
The resistors in RN102 which parallel these diodes are used to provide the bias servo temperature feedback signal as is provided by the heatsink attachment of the bias servo transistor in other Crown amplifiers. The heating of the output devices is used to reduce the bias current control signal.
In the original design the diodes D106-110 were used to limit the voltage on pin 7 of RN101. R113 was chosen small enough that the effects of these diodes become negligible and as such these diodes are omitted from later units.
C107 and D111 are used to optimize the high-frequency behavior of the grounded-base side of the differential pairs.

6.2.3 Output Stage

There are two types of output modules within each amplifier. The module which produces the negative half of the output current waveform and is powered by the positive Vcc supply, (this is a result of the inverting output topology being used), and the module which produces the positive half of the output waveform and is powered from the negative Vcc supply. For the sake of discussion we will call them by the names of the type of transistor which they simulate (the former being referred to as the NPN stage and the latter the PNP stage). Note that this is identical to the type of pre-driver used in each. The PNP stage is constructed with NPN outputs and driver, much the same as a Crown DC-300A negative output stage. The differences are that the current sensing is the sum of all the collector junctions rather than just one device. This is necessary to eliminate the TO-3 IC housing to sink insulating hardware from all of the devices and maximize the available output power by keeping the heatsink thermal resistance as low as possible. All heatsinks in the amplifier are electrically hot! Q402-405 ar the output devices and are selected types whose Safe Operating Area is not voltage derated within the operating range of the amplifier. The driver (401) is a high Ft (Gain Bandwidth) type having power handling capability sufficient to eliminate it from the protection design. The collector of the driver is grounded to provide additional voltage when the output stage is driven to saturation. As such, the driver does not saturate. The pre-driver (Q400) is prevented from saturating by the diode clamp circuit of D401 and D402. D400 is part of the bias circuit of the output stages and is thermally joined to the predriver which at first characteristically cools as the drive to the output stage becomes large. This is due to the fundamentally class AB nature of the output stage accompanied by the high current gain of the driver and output devices.
It should be noted that the amplifier is usually biased for class AB operation rather than class AB+B as the other Crown products. It is possible to bias the unit for AB+B if the higher efficiency is desired. The heatsinking capability is large enough to minimize any such need.
C400 constitutes the local voltage feedback loop immediate to the output stage. (This is functionally identical to the capacitor (typically 200pf) which is placed from the collector of the last voltage amplifier to ground in other amplifiers.) Note that since in those units the Vcc supplies and ground are common that this is the same as making a connection to the Vcc supply as is done here.
Current degeneracy and phase compensation are achieved in the pre-driver circuit by R401 parallelled by C401.
D403 serves as a flyback diode as in all other Crown amps.
U400 along with R408 and R407 constitute an IC absolute temperature sensor to measure the heatsink temperature. This is needed to provide the protection system with knowledge of the absolute temperature of the transistor junctions of the output devices. The current flowing in U400 is proportional to absolute temperature: one microamp = one degree Kelvin. R408 is selected to obtain this constant as determined by grading of the ICs. R407 is selected to protect U400 from large signals and as such its value is not critical.
The NPN output stage is similar to the PNP as indicated:

PNP	NPN
Q402	Q302
Q401	Q301
Q400	Q300
D301,	D401
D302	D402
D400	D300
C400	C300
C401	C302
R401	R302
C301	C302
D403	D303
U400	U300
R408	R309
R407	R308

The topology of the NPN stage is different than any used in previous Crown products. Its principle advantage at this time is that the driver of this configuration must operate with minimum Vce which is less than that of the PNP stage, and this suggests the use of the PNP driver which retains it's F_t with lower voltages than the NPN part. If PNP outputs were available to complement the rugged NPN devices, it would be possible to use the topology of the PNP stage for the NPN stage as well and obtain a similar advantage for the PNP driver by grounding its collector. The tendacy of three-stage Darlington amplifier stages to oscillate at positive clip is often traceable to an F_t problem in the driver as its Vce becomes small.

6.2.4 Protection Circuitry

The protection circuitry of the PSA2X amplifiers is perhaps the most unusual of all its features. It is the result of an indepth study of the heating behavior of semiconductor junctions and the design and construction of a considerable amount of special hardware. It was necessary to implement the following equipment:
A. SOA III Transistor Analyzer
B. 12 bit A/D Convertor Data Aquisition Unit
C. Microcomputer (Altair 8800)
D. Instrument Amplifier
E. Dummy Heatsink with devices slaved to SOA
Once it was known what the nature of the sought after information would take, it was readily realized that this information would only be available by direct observation, since it was not available from the semiconductor manufacturers.
What was needed was a direct observation of the heating/cooling characteristics of a large sample of devices of the desired type. Data must be gathered over a large time interval (tens of seconds) with a maximum of data being gathered indicative of the shortest of time intervals. This constitutes a data gathering strategy which is not compatible with means such as storage oscilloscopes, strip-chart recorders, etc.
To meet this requirement it was necessary to program a computer to gather the data at the precise time intervals desired. The Altair was programmed to gather the data and then to transmit the data to the Crown Engineering Wang Computer for storage on disk and do the very elaborate number crunching which is needed to uncover the equivalent thermal circuit of the physical devices. Without the use of the computers the proper development of this circuitry would have been nearly impossible. The circuitry acts to simulate via an electrical signal the junction temperature inside the worst device that is likely to be mounted in the output stage. The circuitry does this without any direct probing of the output chip.
The knowledge we required was the time behavior of the junction temperature for an arbitrary power input signal. This was deduced by watching the cooldown phase of power transistors which had been heated in an environment identical to the heatsinking used in the amplifier.
In the amplifier we must also know what power has been applied to the output devices. This information is provided by the multiplier circuits; i.e. Q104 with U101D and Q105 with U101A. Assuming that we limit our attention to the protection circuit that protects the NPN output stage of channel one; Q104 is used to multiply the Vce of the output stage as sensed through R120 with the collector current as sensed by R304 via RN104 pins 8 to 7 and R119. Q104 is what is commonly referred to as a two-quadrant transconductance multiplier. Its operation is based on the logarithmic nature of the base-emitter voltage as a function of collector current.
Since the output of Q104 is balanced, the currents at its collector must be converted to provide an unbalanced signal. U101D forms an op-amp current mirror. The current of the collector of Q104 pin 7 is mirrored by the action of the output of U101D pin 7 RN104. The current in the feedback resistor pins 1 to 2 is equal and opposite to the current in the collector of Q104 pin 7. Since the resistor from pins 2 to 3 is of equal value to the first, the current will be identical. This current is joined with the current from the other collector output of Q104, pin 1. This node constitutes the output of the multiplier.
Summed with these currents is a current proportional to the heatsink temperature upon which the output devices are mounted.
The current from the IC sensor on the output stage is bypassed with a capacitor C117 to minimize audio signals capacitively coupled to the sensor wiring. Since the sensor is intimate to the heatsink which is electrically hot, such coupling is to be expected. To allow for monitoring of the temperature by the fan speed control circuits and troubleshooting, the current is input to a precision sense resistor (10K) in RN104. This converts the sensor signal to a voltage which is proportional to absolute temperature with a scale factor of -10mVDC/degree Kelvin. In other words, the voltage for room temperature (25 degrees centigrade) would be -2.93VDC at +Ts. This is a convenient point to probe should either the sink temperature or the sensor be suspect.
A fourth current is added to the output node from the multiplier. This current provides a bias for the temperature computer and references the device to the rating temperature of 25 degrees centigrade. The current is provided by RN104 pins 3 to 5. These combined currents are input to a virtual ground of the op-amp U101C which simulates the junction temperature. The feedback network of pins 1-4 of RN103 and C112-114 is an electrical analog of the thermal inpedance of the output semiconductors. Therefore when a current which represents the power being input to the transistors is input to this analog computer the output is a voltage which responds as the temperature of the transistors' junctions. When this temperature exceeds 200 degrees centigrade, the device is too hot. The output of the analog computer progressively remove operating bias from the associated balanced gain stage by forward biasing D111. Being

unable to provide more drive for the output devices, the output dissipation must decrease until the junction temperature is acceptable.

The dynamics of the output voltage of the analog computer ranges from approximately -12VDC at 25 degrees C. to +9VDC at 200 degrees C junction temperature. This voltage may be readily probed at TP-1.

The multiplier dual transistor has an offset adjustment for balancing composed of R117 and R118. This may be adjusted by removing all current from the output stage and producing a low-frequency output from the amplifier. If the multiplier is balanced no AC voltage will appear at TP-1.

The operation of the protection circuit for the PNP stage is similar except for the polarity reversal of the multiplier and simulator stages. By attaching the heatsink temperature sensor and offset current to the other output of the multiplier, i.e. the input to the current mirror, it is not necessary to reverse the polarity of the sensor. This allows all of the sensors to provide the same polarity of output voltage, simplifying the design of the fan speed controller.

The fan speed controller is shown on the full schematic between the input amplifier stages of the two channels. It perhaps is best discussed along with the protection system since its function is to increase the air flow by engaging the fan relay in high-speed whenever any one heat sink's temperature exceeds 50 degrees C. The quad-comparator U1 monitors the four heat sink temperature sensors. When one is sensed over-temp the output of U1 will turn on both Q1 and the fan relay. Q1 provides a temperature hysteresis for the controller to prevent erratic switching.

6.2.5 Muting Module applies to earlier units only; (*circuit incorporated into Main Module*).

The power-up and power-down phases of operation were found to produce noises in the output. While these signals were of such amplitude as to be harmless, it was recognized from experience that customers would not necessarily view such noises as insignificant. To prevent such noises, a simple circuit was added to the design to prevent the operation of the balanced gain stages until the ± 15VDC supplies were adequate to have the amplifier in control of its output.

Referring to the muting module schematic, the transistor Q4 driven by D1 acts to sense sufficient voltage on the supply rails. The conduction of D1 and Q4 act to turn off Q3 which saturates Q1 and Q2 in the low voltage state of operation. With Q1 and Q2 in saturation, the resulting conduction of diodes D100, D101, D200, and D201 inhibit all output drive from the balanced gain stage, which totally disables the output stages. This will happen both during power-up and power-down. Of course with the voltage very low none of these effects will occur including any drive to produce output noises.

6.3 Power Supplies

6.3.1 Low Voltage Power Supply and Control Circuitry

U2 and U3 constitute the IC regulators which are protected against overload and over-temperature by internal circuitry. Their output is adjusted to +/- 15VDC by RN3 and RN4 respectively. The unregulated input to these supplies is derived from T3 by diodes D4-7 and filter capacitors C5 and C6. C4 is used to prevent RFI from diodes D4-7. Capacitor C7 is used to reduce the high-frequency output noise of U2. C8 and C9 act also to suppress supply noise and impedance. Diodes D8 and D9 are the traditional diodes to prevent damage from application of reverse polarity voltages to the outputs of the supplies.

Transformer T3 is used as an autoformer to power the fan motor when the unit is wired for voltages other than 120VAC. T3 uses the typical universal primaries format used in other Crown products. In order to reduce the current drawn by the fan motor its power factor is corrected by the capacitor C4. T3 has a low voltage secondary which is used to power the LED's in the PSA-2D display module. This is more efficient than using the 15 volt supplies for all such power.

Quad-comparator U1 sections B and D are used to control the relay driver transistor Q100 and Q200 which power the channel 1 and channel 2 output stage supplies respectively. When Q100 or Q201 are off, the collector voltage will drive Q101 or Q200 respectively to light the corresponding standby lights for the down-powered channel. By grounding of the drive circuits at the junction of D107 and D207 and R111 or R211, the output stage supplies may be forced into the standby state.

Focusing our attention upon just the channel 1 relay control circuitry (channel 2 is identical) we find the following. Upon power-up the capacitor C105 is discharged and starts to charge with the current supplied by resistor R107. When the potential on U1B pin 11 exceeds the approximately 7.5 volts on pin 10 the output on pin 13 will proceed positive allowing Q100 to turn on. The result of Q100 turning on is the production of a small hysteresis voltage on pin 10 as a result of R109. This insures the decisive switching of U1B and Q100 for proper relay action. If C103 were switched in parallel with C105 (which is the function of the DELAY switch), the time needed to charge this circuit would result in a 4-5 second delay in the turn-on of the unit.

R105 is wired in series with a thermal switch wound in the windings of the output stage power supply transformer T1. Should T1 overheat the thermal switch will open causing U1B via D107 to turn off Q100. This method of protecting T1 allows for much larger outputs from the amplifier without fuse blowing. The use of conventional fuses or circuit breakers is not an optimum means of protecting a power transformer because the time constants of these devices are many times shorter than the thermal time constant of a large transformer whose time constant may be a matter of hours.

Low frequency protection of loads is made available by switching the output signal to drive R100 and C104 which act to low-pass the output signal. Should the output be too long in excess of 26VDC the diode network composed of D101-104 and zener D105 will conduct removing the bias-off voltage from the input of the comparator U1A as provided by resistors R101-104. The output of will act to discharge C105 and C103 via R106. This will remove power from the output stage and cycle the supply back on as soon as the DC input dissipates which caused the shut-down. This approach is more reliable than the use of a relay in the load circuit since such a relay may not be able to break a DC circuit due to prolific arcing caused by load inductance.

D106 is used to prevent back biasing of C105 and C103. Were this not necessary R106 would be unnecessary.

6.3.2 Output Stage Power Supplies

The output supplies are two thermally protected transformers T1 and T2 with bridge rectifiers driving filter capacitors C101, C102, C201 and C202. Capacitors C100 and C200 are used for RFI suppression.

T1 and T2 each have arc suppression across their relay contacts (C2, R5 and C1, R4) to improve relay life and to reduce radio frequency interference. These transformers have universal primaries. Fuses F1 and F2 are the aforementioned fault protection fuses. Only shorted supplies should be able to dislodge these fuses in normal circumstances.

Switch S1 is arc suppression protected by C3 and R3 and is the main front panel power switch. Should F3 be blown, indicating a failure in the control supplies, nothing will function in the amplifier. It would be as if the power were turned off.

The fan motor operates in low speed when the power is applied through resistor R1. To operate in high speed R1 is paralleled by R2. R2 is used to prevent destruction to the fan speed relay when engaging and charging C4.

All of the relays have damping diodes across their coils to protect their drivers.

6.4 Balanced Input Module

The balanced input module provides the following functions that are particularly useful to professional sound reinforcement users:

A. Balanced inputs with XLR connectors.
B. Gain adjustments for normalizing line levels.
C. Filters for use as crossovers, etc.
D. Variable threshold compressor limiter.
E. Impulse tone generator.

The channels are identical in design and the discussion will focus on channel 1. The balanced input amplifier is provided by U1A which receives its signal from J24. R101 is used as a low frequency common-mode rejection adjustment while C102 is provided for optimizing the high frequency common-mode rejection.

The output signal from U1A is high-pass filtered by U3D and is routed to SW100 where the user may select either the HP filtered or unfiltered signal for input to the gain stage. The filter constructed by U3D is a 3-pole Butterworth type of 50Hz, as supplied with the standard unit. It may be changed by swapping the filter module board or changing the component values on the filter board. This allows a sound installer to have an inventory of his preferred crossover frequencies available for use.

The gain stage is constructed with U1B whose output is routed to the low-pass filter using U3C. The low pass filter is standard as a 3-pole Butterworth type of 15KHz. It also may be readily reconfigured. The input and output of the LP filter are routed to SW101 for selection of the desired signal. The output of SW101 is then input to the limiter-compressor.

The limiter-compressor is constructed with deliberately restricted compression range. Compressors with large gain compression capability often exacerbate feedback in systems where the gain is increased only to be reduced by the compressor action. Should the input be reduced the gain will suddenly appear as the compressor recovers and feedback will result.

The compressor is not a part of the circuit function until a control signal biases on U4. U4 is what is known as an operational transconductance amplifier or OTA. Such a device converts a small input voltage into an output current which is proportional to the control current injected into pin 5. When Q100 is off, R117 acts to assure that no leakage current will enable any amount of compression. When Q100 is on, the current in R118 turns on U4 which becomes an additional feedback loop in parallel with R112 and decreases the net stage gain proportional to the current in R112. The input signal to U4 is provided by the divider R114 and R113. Since the OTA has an offset voltage like any other op-amp, this must be offset by a small DC voltage from R115 and R116, the offset adjustment. Failure to null this error

would result in thumping of the compressor as it changed gain. C111 is used to decouple any DC from the module. The output is then routed to the jack switch in J21. If an input is applied to J21, the balanced input module is not part of the signal path.
The control signal for the OTA is derived from a threshold detector (full-wave) composed of comparators U6A and U6B. Should the main input amplifier signal to the balanced gain stage exceed the thresholds established by the wiper of R7 or the output of U2D, the comparators will signal Q100 via R120 to turn on. C112 acts to filter the control signal such that the turn-on of Q100 is governed by C112 and R120 while the turn-off is governed by C112 and R119. This makes the attack time of the compressor much faster than the decay time, as is desired for minimum distortion operation of the system.
The output of U2D is the inverted replica of the DC threshold reference on the wiper of R7, the threshold control. When R7 is set to maximum the only signals which have sufficient amplitude to reach the threshold are feedback error signals caused by overload of the PSA. All overloads will then result in compression of signals processed by the balanced input module. If R7 is decreased the threshold will pass below the overload values and into the signal range (remember that the signal here detected is a -1/8th scale replica of the output). This will allow the compressor to restrain the output power of the unit to protect fragile drivers, etc.
Should stereo tracking of the compressors be desired the test points TP5 and TP6 may be shorted together. This will cause the compressors to compress equally despite which channel may have initiated the gain reduction.
If the action of the compressors is undesirable in an application, the OTA's U4 and U5 or comparators U6 may be removed from their sockets to prevent all compression.
When making a hurried hook-up of a sound system it is often handy to know if the amplifier is attached to the loudspeakers that it is to drive, i.e., no open or shorted speaker cables. To make this test easier, the PSA-2 has a built in tone generator which provides inpulses at a 50Hz rate. As such the spectrum will excite tweeters or woofers with a signal that have very little power yet is quite distinctive and audible.
The generator is constructed with U1D which excites both signal channels with a pulse shaped by C1 in conjuction with R111 and R211. U1D is wired as an astable pulse generator which has sufficient regeneration to oscillate only when SW1 is closed.

6.5 PSA-2 Display

The display of the PSA-2 is a combined set of indicators to show the state of the output stage supplies, power applied to the control supply, signal on the outputs and outputs overloaded (IOC).
Amber LED D1, powered by R1 and the -24VDC unregulated supply is used to indicate power applied. Yellow LED's D112 and D212 are used to indicate the standby condition of their respective channels.
The following discussion will center around the channel 1 circuitry which uses a quad-comparator, U100. Channel 2 is of course identical.
If a sufficient output signal is present to forward bias D107 and D108 with the current through R106 and overcome the bias of resistors R107-110 to U100C, then the monostable U100D will fire and turn on Q101. This will in turn light LED D111 (green) to indicate that a signal is present on the output of channel 1. Should the signal cease, the current in R111 will act to charge C101 and reset U100D. D109 is used to assure proper resetting of the charge on C101 when the monostable resets. The use of such a monostable driven signal indicator makes even short transients highly visable.
The operation of the IOC is very similar to the signal detector with the difference that U100B senses the output signal of the main input amplifier for excursions beyond approximately twelve peak volts. Diodes D100-104 in conjunction with zener D102 are used to sense such overload indications. U100B in turn sets monostable U100A which turns on Q100. Should Q100 be powered, LED D106 (red) will indicate overload and steal the operating current from D111 to extinguish the signal indicator. This is to make the IOC more noticeable in that two lights will flash upon its operation. D110 is placed in series with D111 to insure the extinction of the green LED when the IOC lights.

6.6 PSA-2D Display

The display of the PSA-2D is a combined set of indicators to show the state of the output signal amplitude, the dynamic range and to show if the amplifier may be experiencing any problems.
Amber Power Indicator LED D5, is powered by R6 and the -24Vdc unregulated supply. Yellow LED's D100 and D200 are used to indicate the standby condition of their respective channels.
As the signal enters the Display Module through pin 14, a resultant fully rectified signal, one-seventh the amplitude of the initial input signal, is present at the output of U3B (U3A, U3B and related circuitry form a full-wave rectifier.)
R111 and C101 create an absolute-peak detector, supplying a smoother dc signal to comparator U6A. The output of U6A is then determined by the comparison of the input signal (pin 7) and the log decay oscillator signal (pin 6) from 500Hz pulse oscillator (U5A, B). The lower

the input signal voltage, the shorter the time period comparator U6A will be turned on (producing +15Vdc logarithmic pulses). The window (U6B) however, compares the same log decay signal (pin 6) to a constant 10V on pin 5. When the oscillator signal is greater than 10V, U6B is turned on and produces a +15Vdc at its output (pin 2). Note here that this output is constant and is in no way related to the input signal. It is simply used to limit the upper and lower ends of the pulsating scale.
The output from these comparators then, is fed to exclusive OR gate U5C. The length of time the OR gate is turned on, is primarily attributed to the pulse transmitted by the log time base oscillator (U5A, B).
The resistors (R114, R115, R116) and capacitors (C102, C103) following U5C are filters that average the overall DC voltage output. The result is a DC voltage that rises and falls logarithmically with respect to the input signal.
U2D is a unity gain buffer stage, simply converting a high impedance signal to a low impedance output. This output is fed to U2A and associated circuitry, particularly C104. The level at which C104 charges, is the level of the peak hold of the display.
C105 is responsible for the actual "hold-time" of the peak by the amount of time it takes to discharge through R122 and U2B.
The DC voltages from the peak hold circuitry and the output of the log amp are then multiplexed into one signal that is fed into the LED display drivers. Here the signal is divided evenly among 15 LED's. The display will show one bright illumination shifting with the "always changing" output amplitude while another, less bright illumination will have a short hold time (about 4 seconds) respective to "peak amplitudes" only. Voltage divider R126, R127 and R128 assist the display driver in determining the high and low end of the display scale.

7 Specifications

General Protection: Protection circuitry limits the output level to protect the output transistor stage, even in the case of elevated temperature. Transformer overheating results in shutdown (STANDBY) of that particular channel. Controlled slewing rate voltage amplifiers protect the unit against RF burnouts. Input overload protection is furnished by a resistor at the input of the amplifier to limit current.

7.1 General

DC Output Offset: (Shorted input) +/- 10 millivolts.
Phase Response: +0, -15 degrees DC-20KHz at 1 watt.
Input Impedance: (XLR balanced) 20K ohms, (phone jack unbalanced) 25K ohms +/- 30%.
High Voltage Power Supply: Two 800VA transformers with computer grade capacitors powered through 10A relays.
Low Voltage Power Supply: +/- 15V DC supplies are provided by a current limited shortproof regulator.
Power Requirements: 50-60Hz AC with adjustable taps for 100, 120, 200, 220 and 240 +/- 10% operation. Draws 90 watts or less on idle. Maximum AC power required: 2400 watts.
Turn On: May be switch selected for instantaneous or four second delay after applying power. No dangerous transients.
Low Frequency Load Protect: May be switch selected to produce shutdown (STANDBY) of high voltage power supply for DC outputs greater than 26V or low frequency outputs greater than 26V at 5Hz (See Graph).
Controls: Two position ON/OFF rotary switch. Ch. 1 and Ch. 2 input level controls. The LOW FREQ PROTECT, DELAY and STEREO/MONO slide switches are located on the rear panel.
Displays: A yellow LED indicates STANDBY mode activated for that respective channel. A pair of green LED's indicate SIGNAL presence at the output of that respective channel. A pair of red LED's indicate amplifier OVERLOAD conditions for that respective channel. The amber LED POWER indicator is driven by the low power supply control circuit.
Connectors: Unbalanced Input - 1/4" phone jacks. Output-color coded dual binding posts on standard 3/4" centers; spaced 3/4" apart for mono (balanced) output connection.
AC Line: Three wire 20A, 120V male conector with 5 ft. cable.
Ground Selectivity:2 lug terminal block with removable shorting strap.
Module Plug-ins: Standard rear-panel balanced input module (module replacement information available upon request).
Dimensions: 19" standard rack mount (EIA Standard RS-310-B) 7" height, 14 3/4" behind mounting surface. Handles extend 2 1/8" in front of mounting surface. Center of gravity is 5.4" behind the front panel.
Weight: 57 pounds (25.8Kg) net weight.
Finish: Satinized aluminum front panel with gray suede Lexan insert and black adonized aluminum chassis and covers.
Construction: Aluminum chassis, specially designed "flow-through" ventalation top front and side panels. Heavy duty handles to ease transport. Plug in rear panel balanced input module.
Heat Sinking: Forced air with high efficiency coolers. A two speed fan with an intake filter (washable) mounted on the back (rear) of the amplifier forces air through coolers and out both the top and sides of the amplifier.

7.2 Stereo Specifications

Output Power: See power matrix on next page.
Hum and Noise: 115dB below rated output "A" weighted 110dB below rated output (20Hz-20KHz).
Frequency Response: +/-0.1dB 20Hz-20KHz at 1 watt into 8 ohms.
Harmonic Distortion: Less than 0.002% from 20Hz-1KHz and increasing linearly to 0.05% at 20KHz at 220 watts into 8 ohms, per channel.
IM Distortion: Less than 0.01% from 0.25 watts to 220 watts into 8 ohms per channel.
Slewing Rate: Greater than 30 volts per microsecond.
Damping Factor: Greater than 700, DC to 400Hz into 8 ohms.
Output Impedance: Less than 12 milliohms in series with less than 1.2 microhenries.
Load Impedance: Rated for 8, 4 and 2 ohm usage, safe with all loads.
Voltage Gain: 20 +/- 2% or 26dB at maximum gain.
Input Sensitivity: 2.1 volts for 220 watts into 8 ohms.
Output Signal: Unbalanced, dual channel.

7.3 Monaural Specifications

Output Power: See power matrix.
Frequency Response: +/- 0.2dB, DC-20KHz at 1 watt into 16 ohms.
Harmonic Distortion: Less than 0.003% from 20 Hz to 1 KHz and increasing linearly to 0.08% at 20 KHz, 500 watts into 16 ohms. Less than 0.005% from 20 Hz to 1 KHz and increasingly linearly to 0.12% at 20 KHz, 800 watts into 8 ohms.
IM Distortion: Less than 0.015% from 0.25 watts to 500 watts into 16 ohms. Less than 0.015% from 0.25 watts to 700 watts into 8 ohms.
Slewing Rate: Greater than 60 volts per microsecond.
Damping Factor: Greater than 700, DC-400 Hz into 16 ohms.
Output Impedance: Less than 24 milliohms in series with less than 2.4 microhenries.
Load Impedance: Rated for 16 and 8 ohm usage, safe with all loads.
Voltage Gain: 40 +/- 2% or 32dB +/- .2dB at maximum gain.
Input Sensitivity: 2.2 volts for 500 watts into 16 ohms.
Output Signal: Balanced, single channel. Channel 1 controls are active; Channel 2 inactive but not removed from operation.

7.4 Balanced Input Module Specifications

Controls: Channel 1 and Channel 2 input gain adjust with the AGC Threshold, is accessible from the rear on the Balanced Input Module.
Hum and Noise: -85dBm equivalent input noise 20Hz-20KHz, 600 ohm source, gain set at unity.
Frequency Response: Flat +/- 0.2dB 20Hz to 20KHz.
High and Low Pass Filters: 3 pole Butterworth 18dB/octave; 50Hz and 15KHz standard frequencies. (Other roll-off points available; see Appendix C for details.) Slide switch activated.
Compressor Action: Range of compression restricted to 13dB by design (wider range would aggravate feedback in live performance). Threshold adjustable from overload level of main amplifier to 12dB lower.
Balanced Input Voltage Gain: Variable 0-10 +/- 30%.
Test Tone: Switch activated wide spectrum 50Hz-20KHz tone.
Common Mode Rejection: 70dB 5Hz-3KHz 55dB 20KHz (see Graph).

Type of Test / Configuration & Load per Ohm		FTC Continuous Average Power at >1% THD (See note 1)		Single Cycle Tone Burst Watts at <0.05% THD (See note 2)	40mS Tone Burst Watts at <0.05% THD (See note 3)	EIA Watts 1% THD (See note 4)
		20Hz-20KHz	1KHz	1KHz	1KHz	1KHz
Stereo per CH. (both ch. powered)	2		600	840	740	650
	4	380	440	640	470	470
	8	265	270	335	280	285
Bridged Monaural (Balanced Output)			1250	1628	1349	
	8	760	880	1260	950	920
	16	520	540	670	565	565

Fig. 7.1 PSA-2X Power Matrix

Notes:
1. Continuous power in the context of Federal Trade Commission testing is understood to be a minimum of five minutes of operation. Harmonic distortion is measured at the RMS sum total as a percentage of the fundamental output voltage. This applies for all wattages greater than 0.25 watts.
2. A single cycle of sine wave is fed to the amplifier and monitored for non-linear distortion. The average power during the burst is reported. Speakers must be able to withstand this level to be safely used with this amplifier.
3. A 40 millisecond burst or two cycles of sine wave (whichever is of greater duration) is used and the power computed as the average power during the burst. The duty cycle of this test is 10 percent. This power level is a measure of how loud an amplifier is as perceived by the hearing process.
4. EIA standard RS-490 (both channels driven).

7.5 Performance Graphs

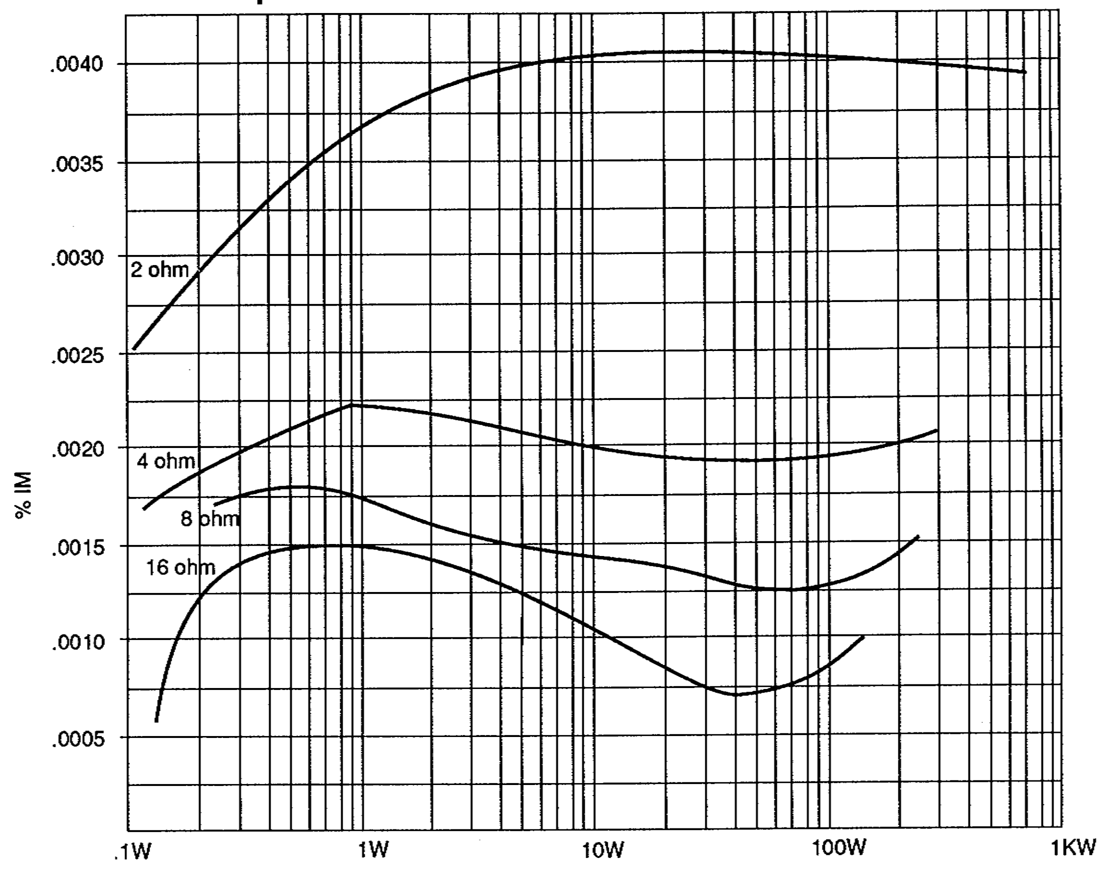


Fig. 7.2 Typical IM Distortion

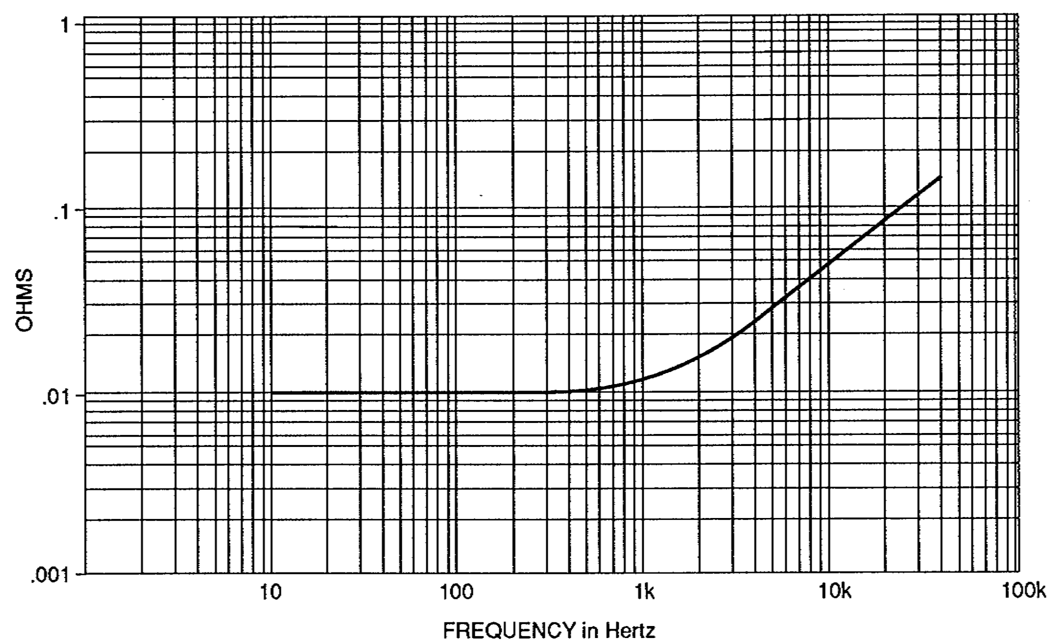


Fig. 7.3 Typical Output Impedance

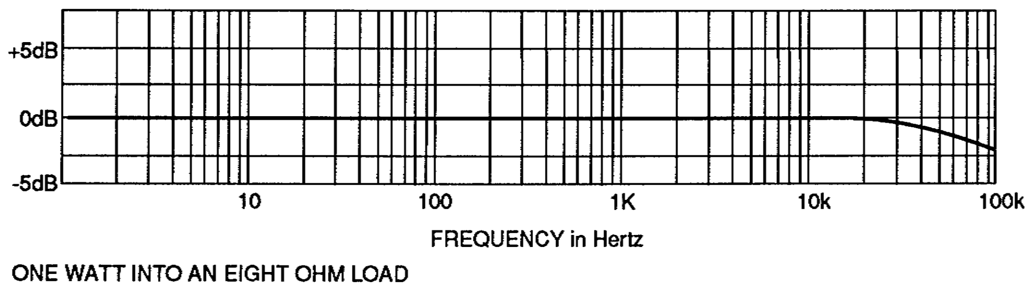


Fig. 7.4 Typical Frequency Response

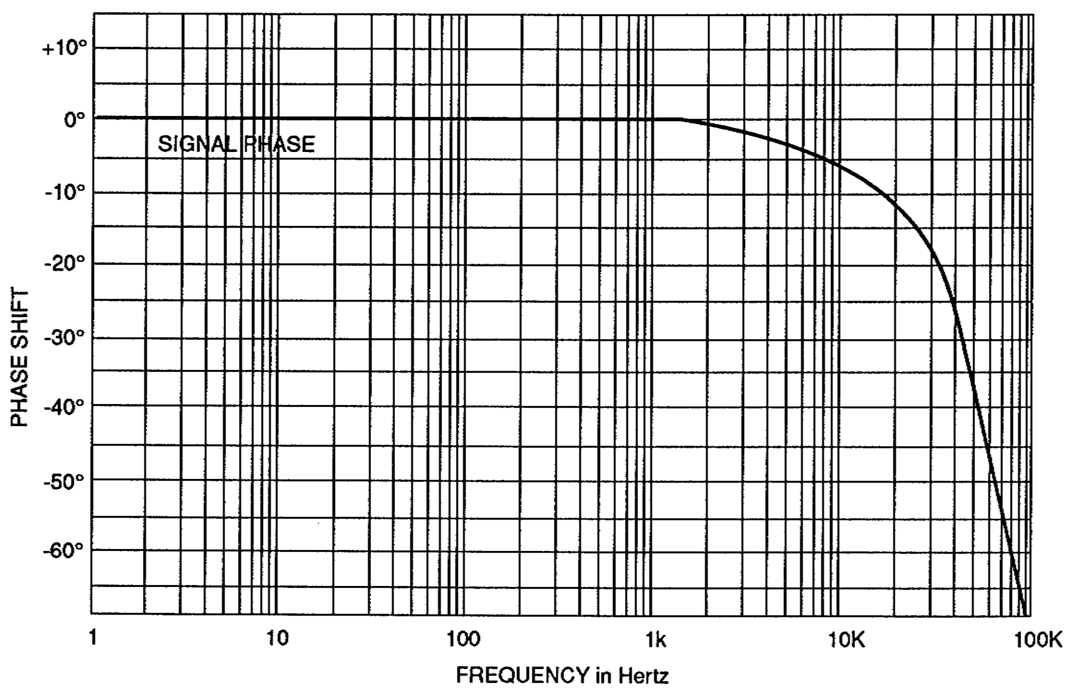


Fig. 7.5 Output Phase Response

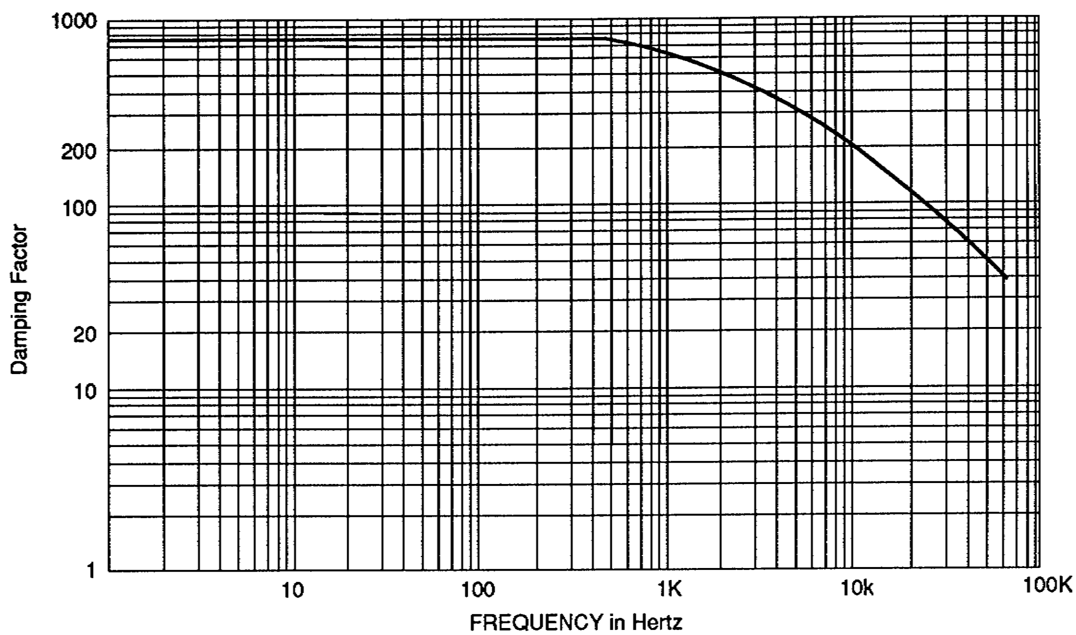
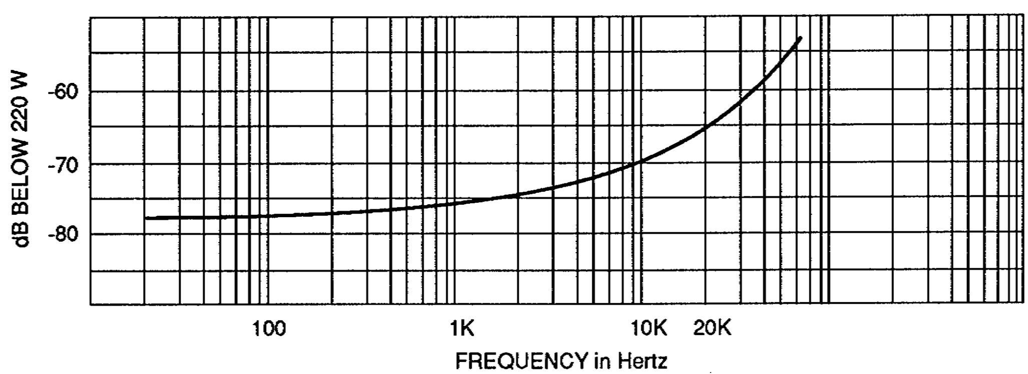


Fig. 7.6 Typical Damping Factor



OUTPUT OF UNDRIVEN CHANNEL WITH OTHER CHANNEL
DRIVEN TO LEVEL OF 220 WATTS INTO 8 OHMS

Fig. 7.7 Typical Crosstalk

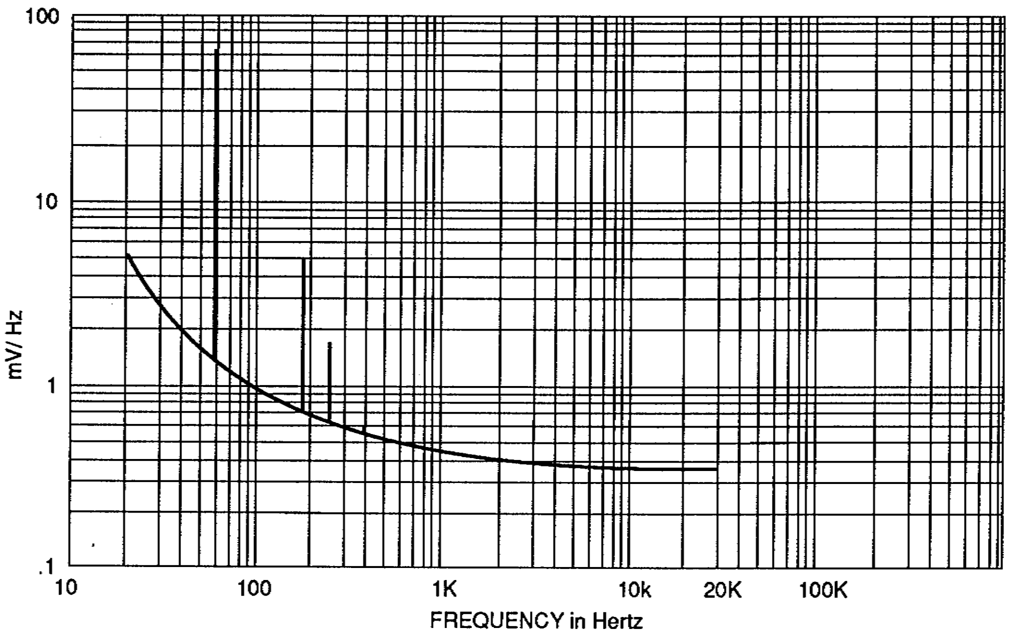


Fig. 7.8 Typical Noise

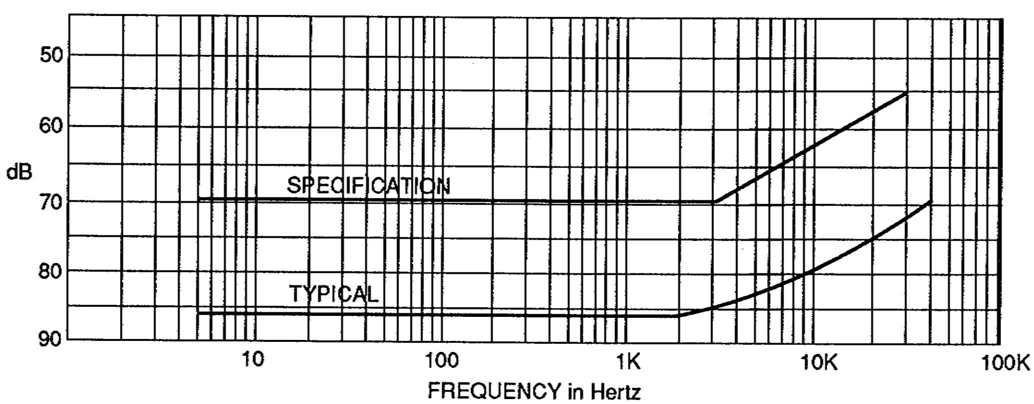


Fig. 7.9 Typical CMR
(Balanced Input Module)

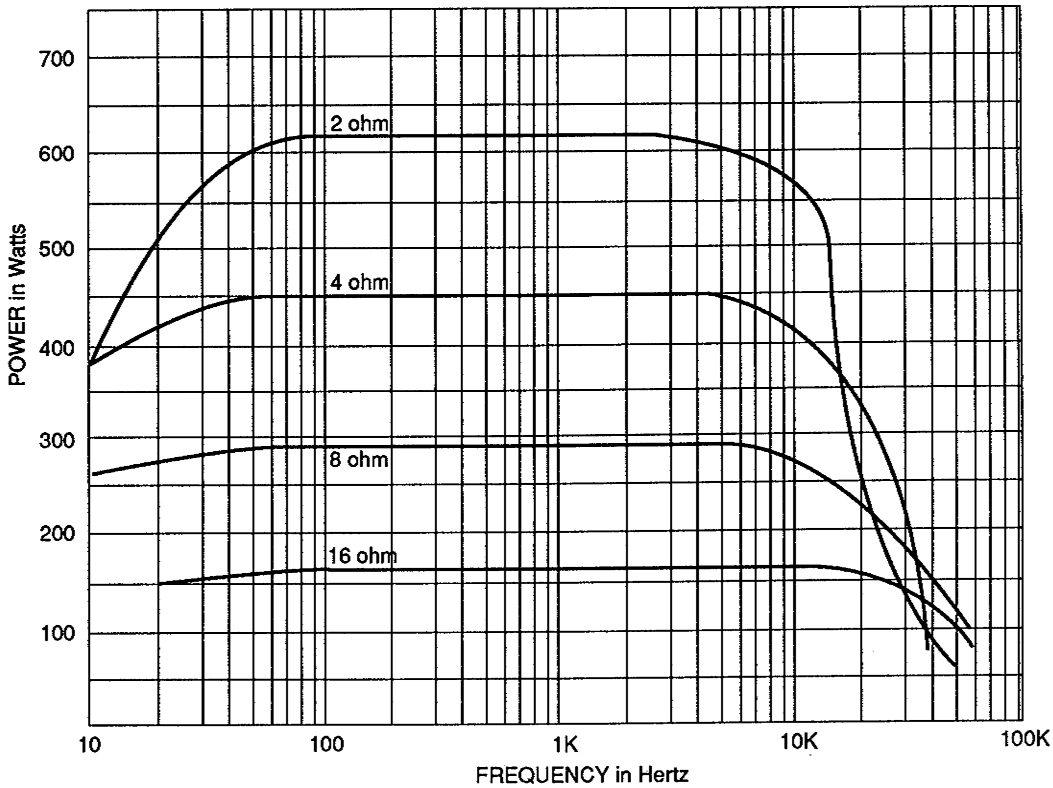


Fig. 7.10 Typical Output Power

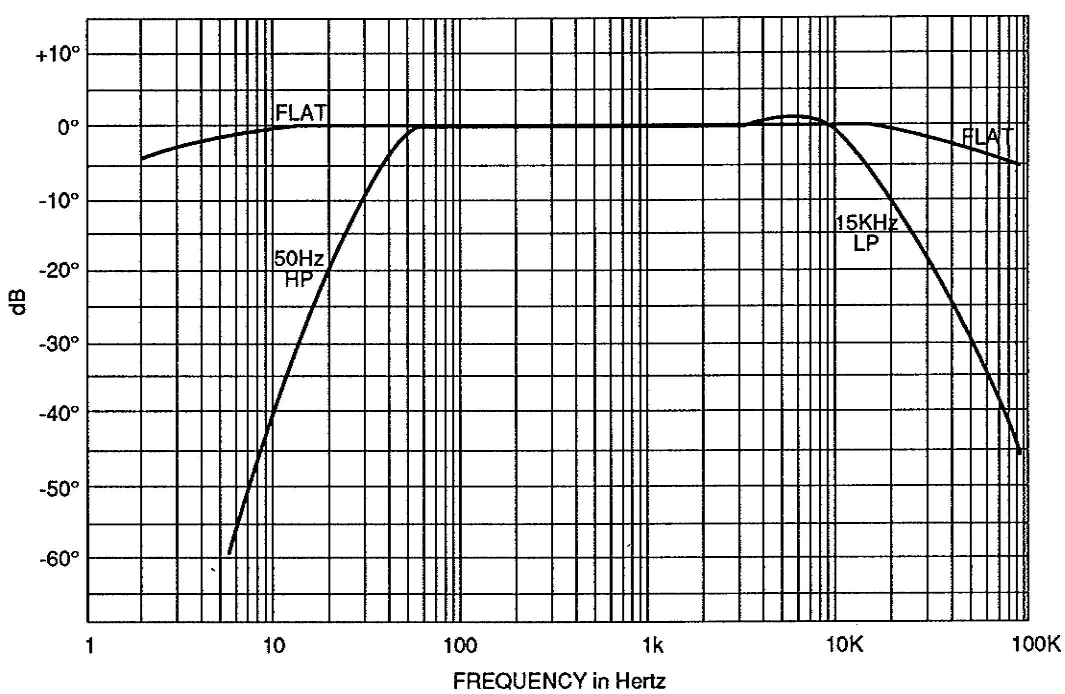


Fig. 7.11 Typical Frequency Response (Balanced Input Module)

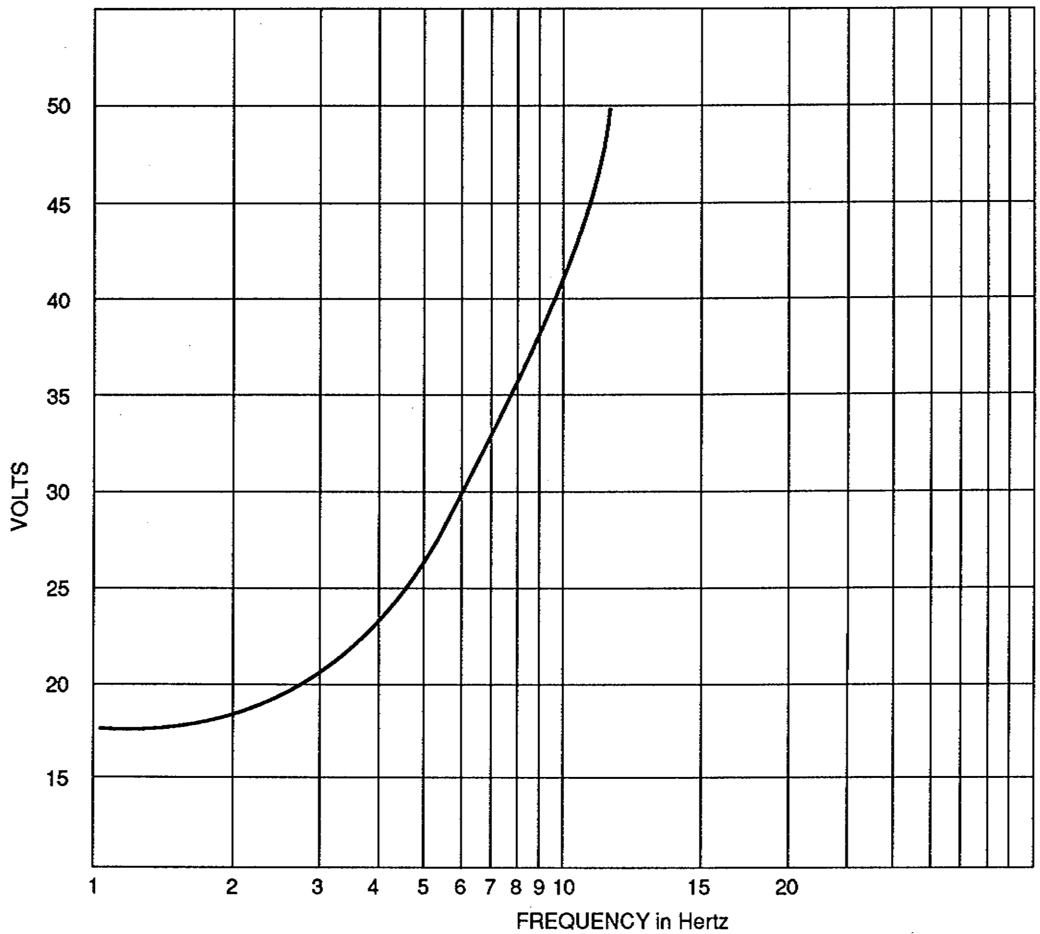


Fig. 7.12 Low Frequency Protection Action

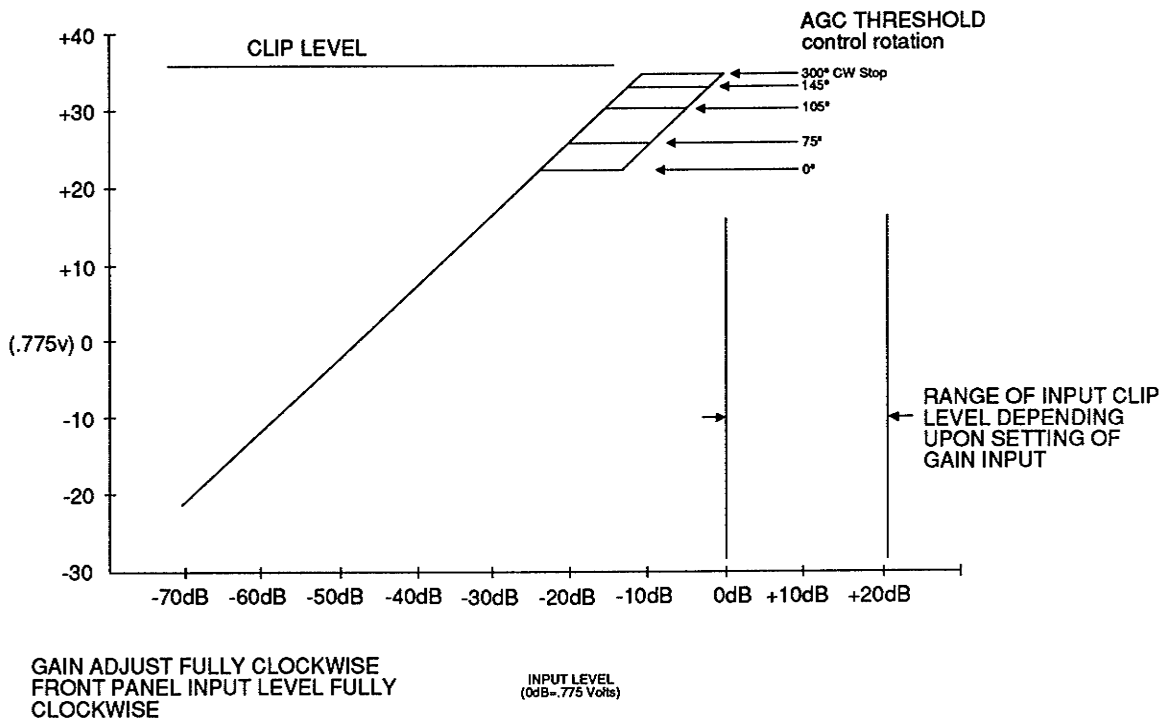


Fig. 7.13 Typical AGC Action

8 Schematic Diagrams

MI-289

PSA-2X S/N 11415 AND BELOW
PSA-2D S/N 305 AND BELOW

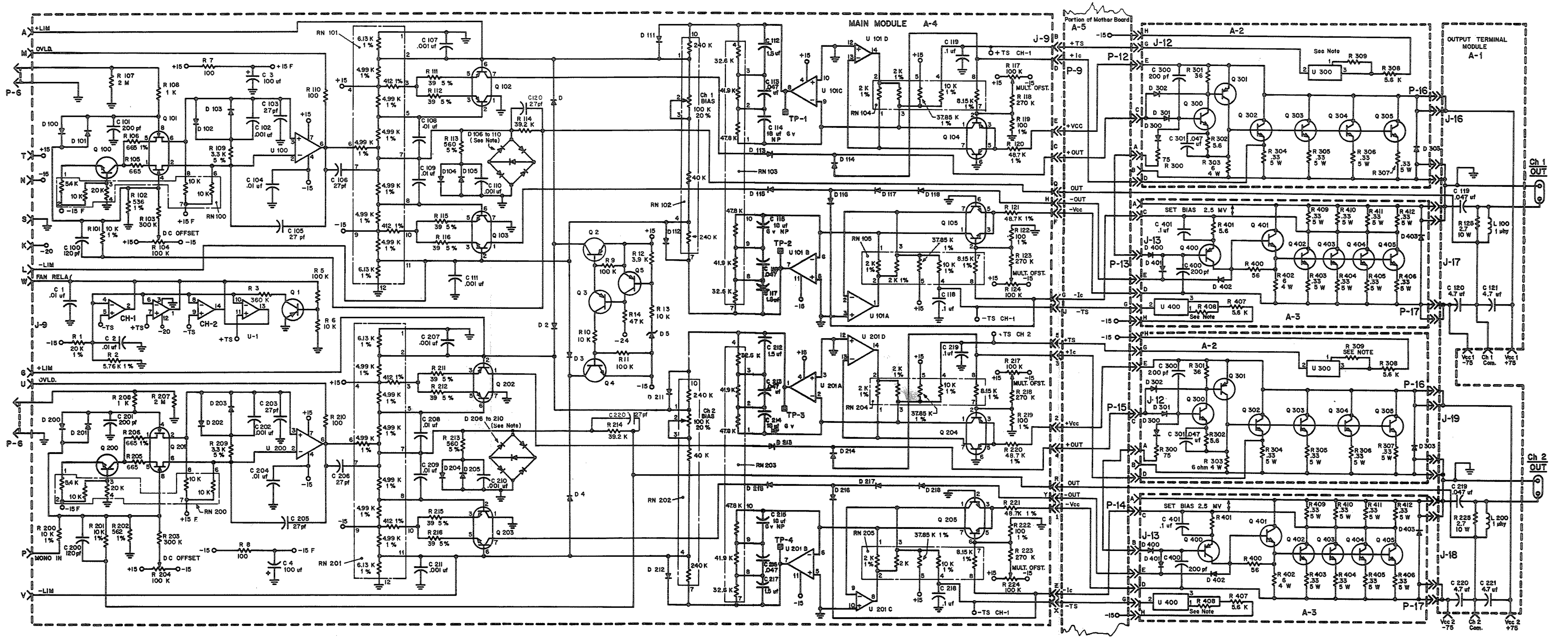
J0003A2

PSA-2X S/N 11416 AND ABOVE
PSA-2D S/N 306 AND ABOVE

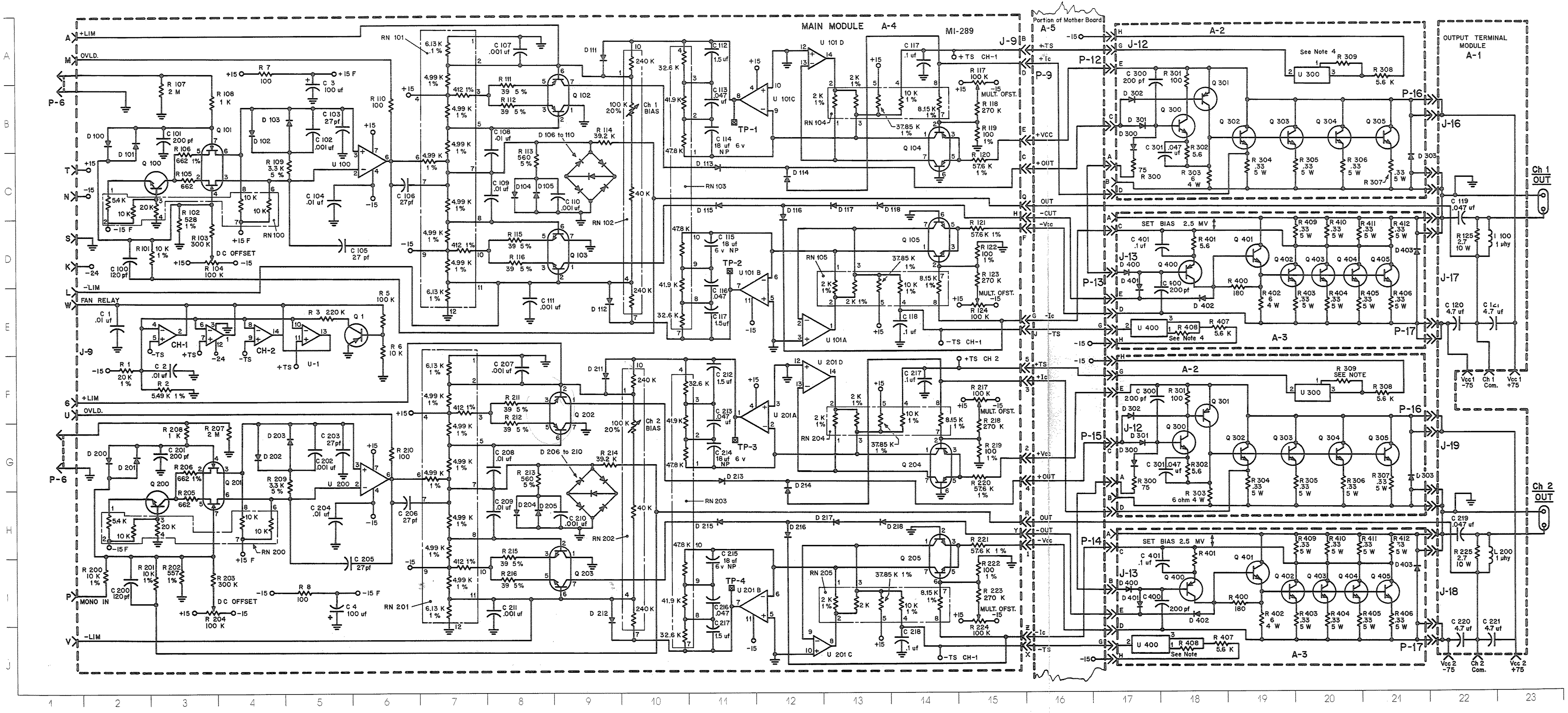
PSA-2 Schematic Notes

The following parts lists/board layouts apply to both the PSA-2X (and optional versions) and the PSA-2DX power amplifiers except where indicated.

Notes:
- All resistors are in ohms, all capacitors are in microfarads unless otherwise designated.
- All resistors are .25 watt, 5% tolerance unless otherwise designated.
- Components common to both channels are numbered 10 to 99 per board.
- Left channel components are numbered from 100 to 199 per board (except output module; 300-399).
- Right channel components are numbered from 200 - 299 (except output module; 400-499).
- Underlined captions denote front or rear panel markings.
- Circuits shown represent models with appropriate serial numbers as indicated.

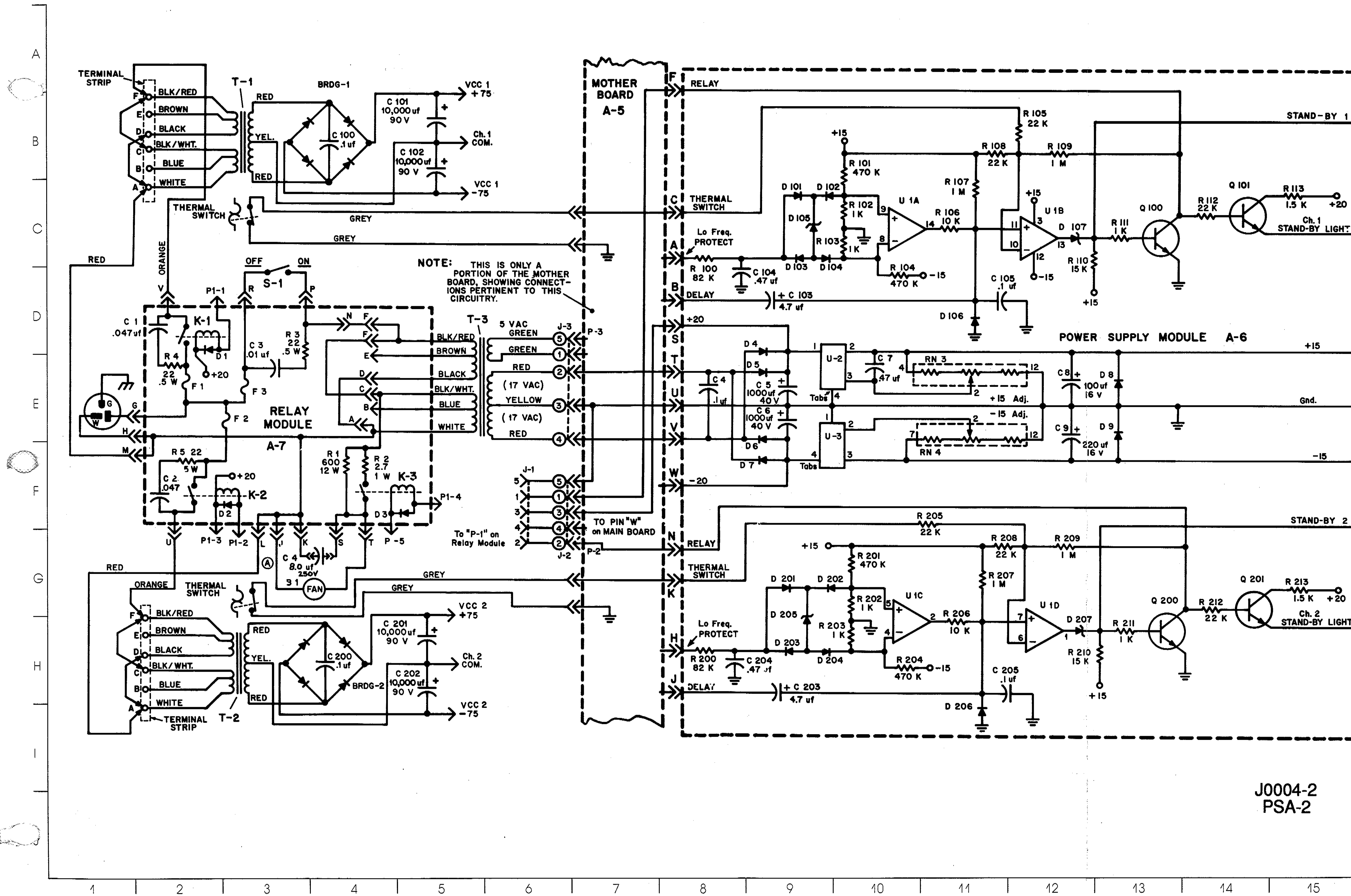


J0003A2
PSA-2

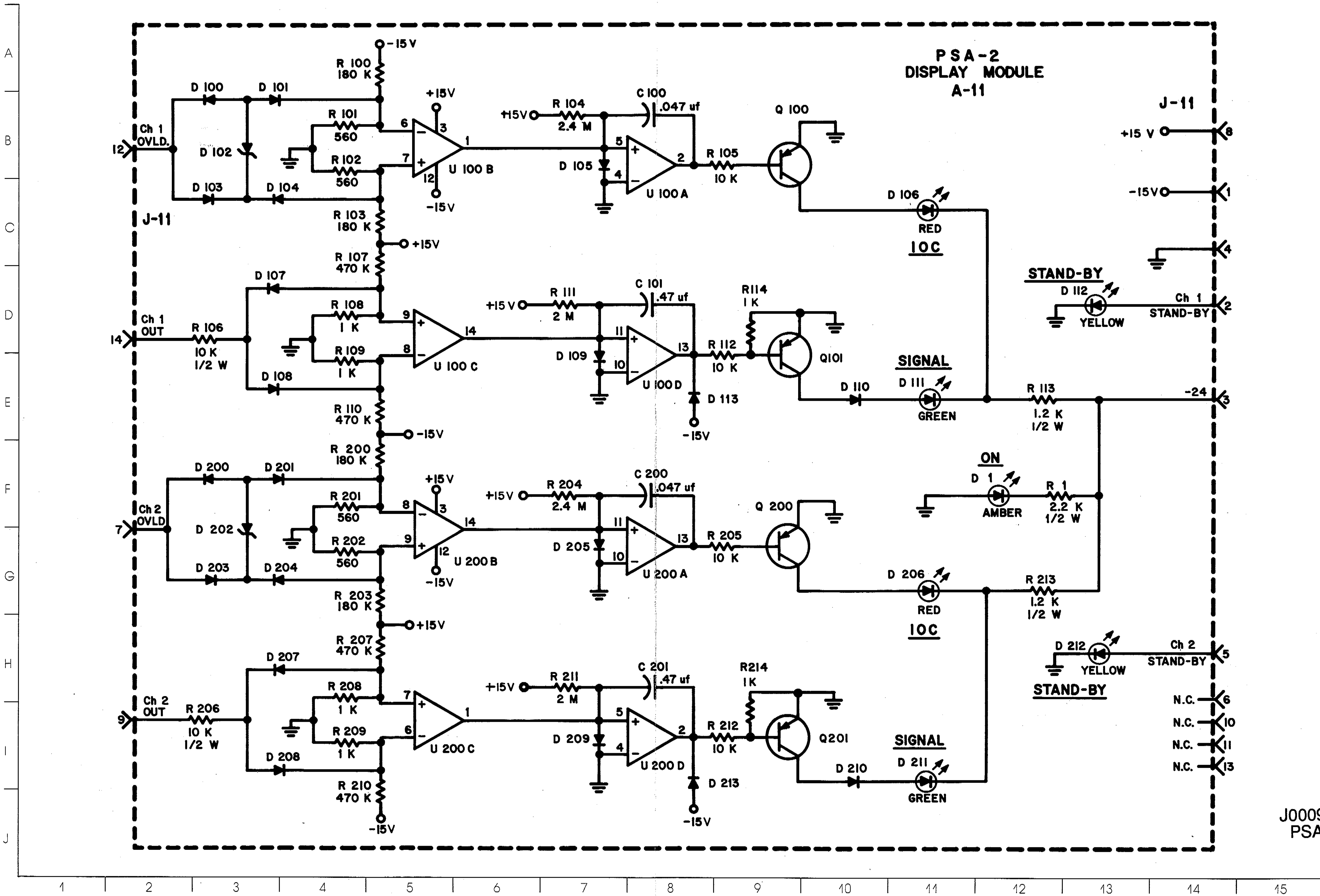


MAIN MODULE

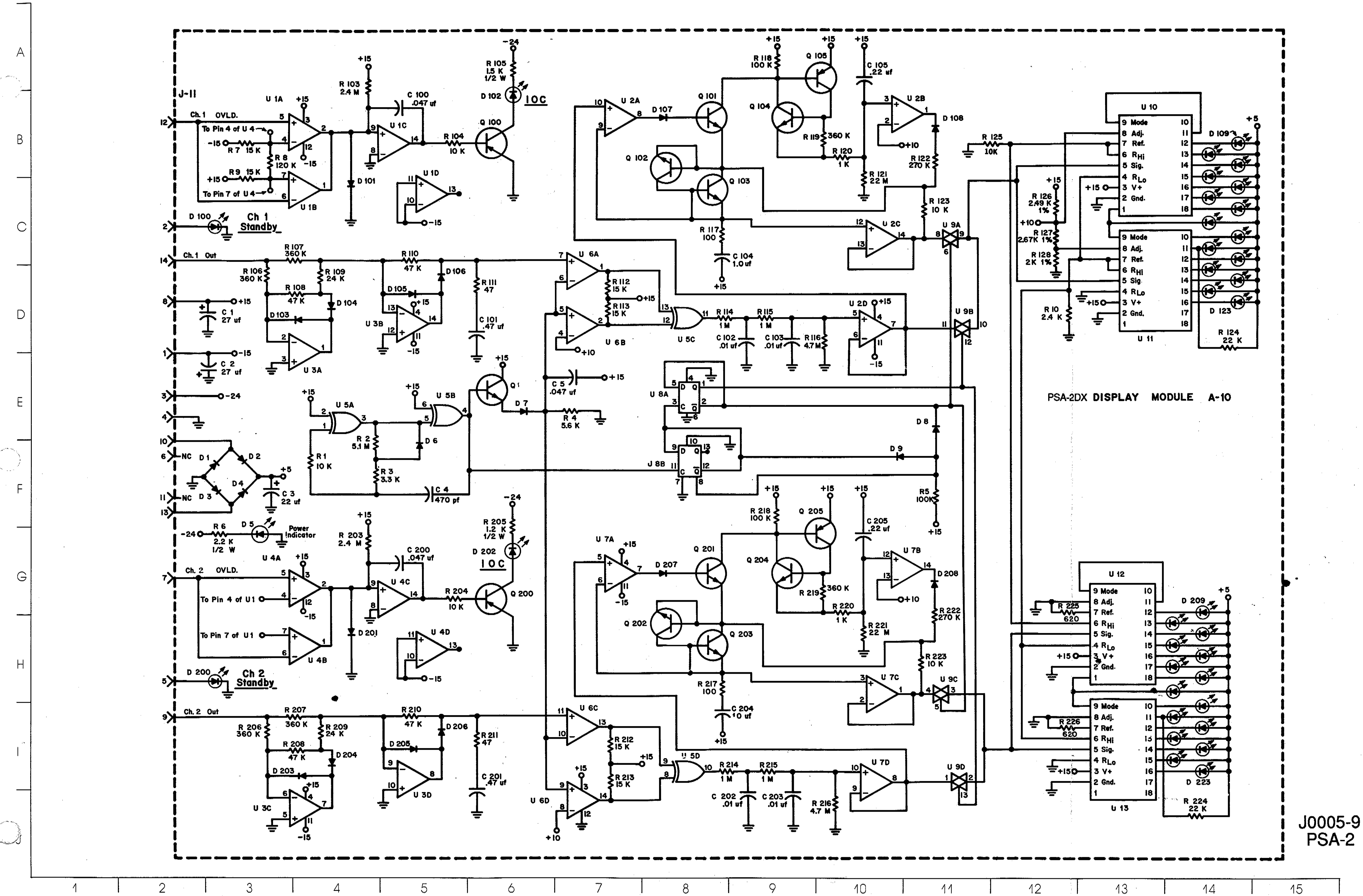
- D300 AND D400 ARE THERMALLY JOINED TO Q300 AND Q400.
- R309 AND R408 ARE SELECTED TO MATCH GRADE OF U300 AND U400.

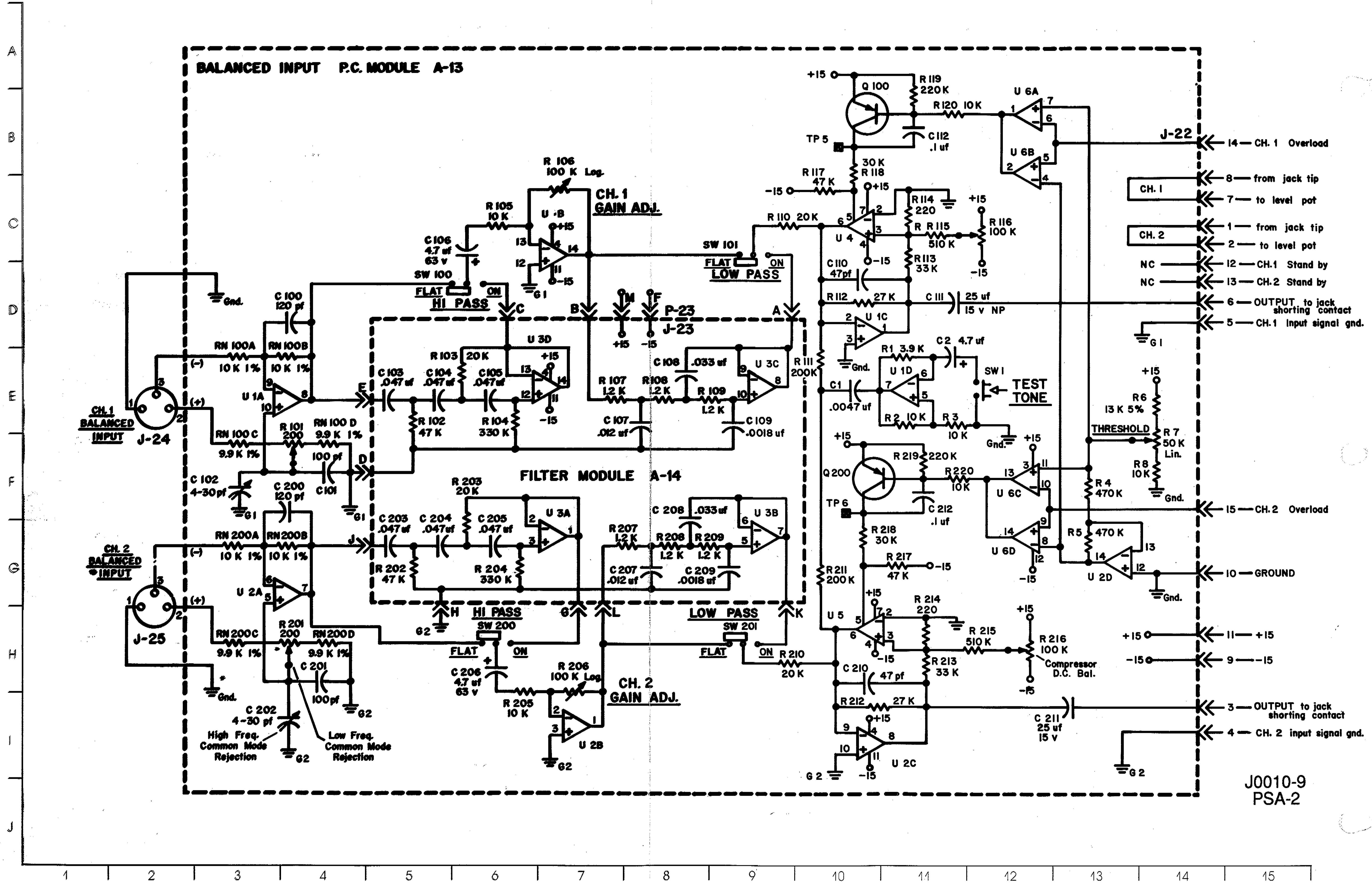


TERMINAL STRIP
T-1
BRDG-1
BLK/RED
BROWN
BLACK
BLK/WHT.
BLUE
WHITE
RED
YEL.
C 101 10,000 uf 90 V
C 100 .1 uf
C 102 10,000 uf 90 V
VCC 1 +75
Ch. 1 COM.
VCC 1 -75
THERMAL SWITCH
GREY
ORANGE
OFF
ON
S-1
P1-1
K-1
C 1 .047 uf
R 4 22 .5 W
D 1
+20
F 1
C 3 .01 uf
R 3 22 .5 W
F 3
F 2
RELAY MODULE
A-7
R 5 22 5 W
C 2 .047
K-2
D 2
R 1 600 12 W
R 2 2.7 1 W
K-3
D 3
P1-4
P1-3
P1-2
P -5
C 4 8.0 uf 250V
FAN
NOTE: THIS IS ONLY A PORTION OF THE MOTHER BOARD, SHOWING CONNECTIONS PERTINENT TO THIS CIRCUITRY.
T-3
5 VAC GREEN
GREEN
(17 VAC) YELLOW
(17 VAC) RED
J-3
P-3
J-1
J-2
P-2
To "P-1" on Relay Module
TO PIN "W" on MAIN BOARD
MOTHER BOARD A-5
T-2
BRDG-2
C 200 .1 uf
C 201 10,000 uf 90 V
C 202 10,000 uf 90 V
VCC 2 +75
Ch. 2 COM.
VCC 2 -75
RELAY
THERMAL SWITCH
Lo Freq. PROTECT
DELAY
R 100 82 K
C 104 .47 uf
C 103 4.7 uf
D 101
D 102
D 103
D 104
D 105
R 101 470 K
R 102 1 K
R 103 1 K
U 1A
R 104 470 K
R 105 22 K
R 106 10 K
R 107 1 M
R 108 22 K
R 109 1 M
U 1B
D 107
R 110 15 K
R 111 1 K
Q 100
R 112 22 K
Q 101
R 113 1.5 K
Ch. 1 STAND-BY LIGHT
STAND-BY 1
C 105 .1 uf
D 106
POWER SUPPLY MODULE A-6
D 4
D 5
D 6
D 7
C 4 .1 uf
C 5 1000 uf 40 V
C 6 1000 uf 40 V
U-2
U-3
Tabs
C 7 .47 uf
RN 3
RN 4
+15 Adj.
-15 Adj.
C 8 100 uf 16 V
C 9 220 uf 16 V
D 8
D 9
Gnd.
STAND-BY 2
R 200 82 K
C 204 .47 uf
C 203 4.7 uf
D 201
D 202
D 203
D 204
D 205
R 201 470 K
R 202 1 K
R 203 1 K
U 1C
R 204 470 K
R 205 22 K
R 206 10 K
R 207 1 M
R 208 22 K
R 209 1 M
U 1D
D 207
R 210 15 K
R 211 1 K
Q 200
R 212 22 K
Q 201
R 213 1.5 K
Ch. 2 STAND-BY LIGHT
C 205 .1 uf
D 206
J0004-2
PSA-2



J0009A9
PSA-2


PSA-2DX DISPLAY MODULE A-10
J0005-9
PSA-2
J-11
Ch. 1 OVLD.
Ch 1 Standby
Ch. 1 Out
Ch. 2 OVLD.
Ch 2 Standby
Ch. 2 Out
Power Indicator
To Pin 4 of U 4
To Pin 7 of U 4
To Pin 4 of U1
To Pin 7 of U1
IOC
9 Mode
8 Adj.
7 Ref.
6 RHi
5 Sig.
4 RLo
3 V+
2 Gnd.



BALANCED INPUT P.C. MODULE A-13
FILTER MODULE A-14
CH. 1 BALANCED INPUT J-24
CH. 2 BALANCED INPUT J-25
CH. 1 GAIN ADJ.
CH. 2 GAIN ADJ.
HI PASS
LOW PASS
SW 100
SW 101
SW 200
SW 201
FLAT
ON
P-23
J-23
J-22
TEST TONE
THRESHOLD
High Freq. Common Mode Rejection
Low Freq. Common Mode Rejection
Compressor D.C. Bal.
14 — CH. 1 Overload
8 — from jack tip
7 — to level pot
1 — from jack tip
2 — to level pot
12 — CH. 1 Stand by
13 — CH. 2 Stand by
6 — OUTPUT to jack shorting contact
5 — CH. 1 Input signal gnd.
15 — CH. 2 Overload
10 — GROUND
11 — +15
9 — -15
3 — OUTPUT to jack shorting contact
4 — CH. 2 input signal gnd.

J0010-9
PSA-2

9 Parts

9.1 General Information

Section 9 contains illustrations and parts lists for the PSA-2 power amplifier. This information should be used with the service, repair and adjustment procedure in Section 4. Most of the mechanical and structural type parts are illustrated and indexed on exploded view drawings.

Electrical and electronic parts on these illustrations are also identified by the circuit reference designation next to the illustration. Both the index number and the reference designation are included in the parts list in separate columns. The reference designations correspond to those shown in schematic diagrams.

Electrical and electronic parts located on printed circuit boards are illustrated by schematic symbols on the trace side and by component shape symbols on the component side. Reference designations also appear on these diagrams.

The quantity of each part used in each location is also shown in the parts listing.

9.2 Standard and Special Parts

Many electrical and electronic parts used in the PSA-2 are standard items stocked by and available from electronic supply houses. However, some electronic parts that appear to be standard, are actually special. A part ordered from Crown will assure an acceptable replacement. Structural items, covers and panels are available from Crown only.

9.3 Ordering Parts

When ordering parts, be sure to give the amplifier model and serial number and include the part description and Crown Part Number (CPN) from the parts list. Price quotes are available upon request.

9.4 Shipment

1. Shipment will be made by UPS or best method unless you specify a preferred method.
2. Shipments are made F.O.B. Elkhart, Indiana only.
3. Established Crown accounts will be freight prepaid and billed unless shipped by truck or air freight.
4. All others will be shipped freight collect.

9.5 Terms

1. Normal terms are C.O.D. unless the order is prepaid.
2. Net 30 days terms apply only to those firms who have an established line of credit with Crown.
3. If prepaying please add an amount for the freight charge. $2.00 is average for an order under one pound. NOTE: Part prices are subject to change without notice.
4. New parts returned for credit are subject to a 10% restocking charge.
5. You must receive authorization from the Parts Dept. before returning parts for credit.
6. We are not a general parts warehouse! Parts are available for servicing Crown products only.

9.6 Illustrated Parts Lists

Contained within this section are the illustrated parts lists for the PSA-2 amplifier. Most of the mechanical and structural parts are illustrated and indexed in the main chassis illustration. The electrical and electronic parts in the assembly drawings are also shown in the circuit schematics (Figures 8.1 and 8.2) and are labeled in the parts list with both the schematic component number and the Crown Part Number (CPN).

Electric and electronic parts which are located on printed circuit boards are illustrated by schematic symbols on the trace side of the boards and by their component shape symbol on the component side of the boards. Schematic component numbers also appear on these drawings.

The quantity of each part used in each location is also shown in the parts list.

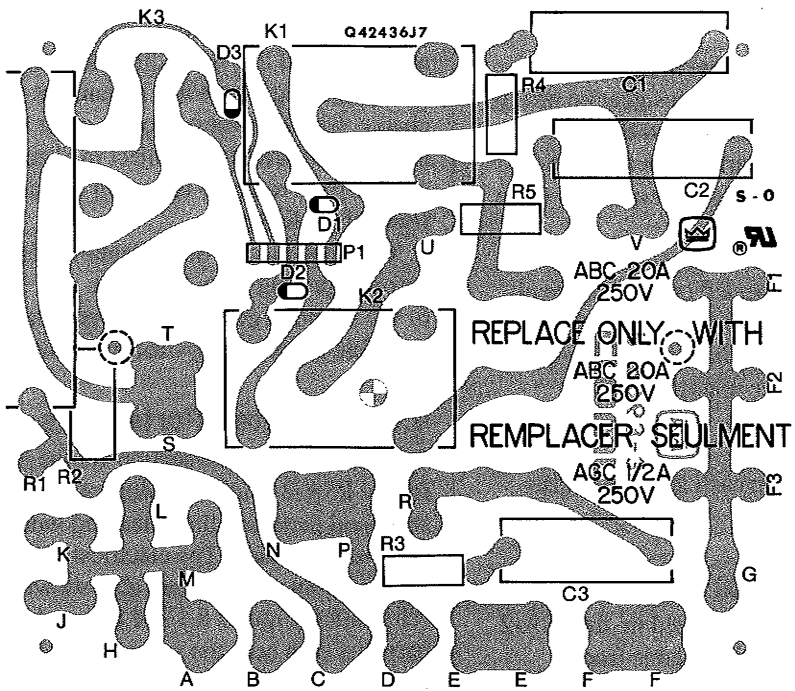


Fig. 9.1 Relay Module

PSA-2 Relay Board Module Q42436-8

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Resistors				
R1	600 ohm 12W 5% Wire	C 3902A9	1	
R2	2.7 ohm 1W 10% comp	C 1001-4	1	
R3, R4, R5	22 ohm .5W 5% CF	C 2004-7	3	
Capacitors				
C1, C2	.047mF 125 VAC	C 5234-7	2	
C3	.01mF 125 VAC	C 4443-5	1	
Diodes				
D1, D2, D3	1N4148	C 3181-2	3	
Relays				
K1, K2	10A SPDT 24V Relay	C 5245-3	2	
K3	5.6K ohm SPST 24V Relay	C 4941-8	1	
Fuses				
F1, F2	AGC 20 amp fuse	C 3840-3	2	
F3AGC	.5A 1.25x.25 IN	C 3841-1	1	
Miscellaneous				
	P1MOD 2 5 Pin 318 Header	C 5008-5	1	
	PCMount Fuse Clip	C 5060-6	6	MountsF1, F2, F3

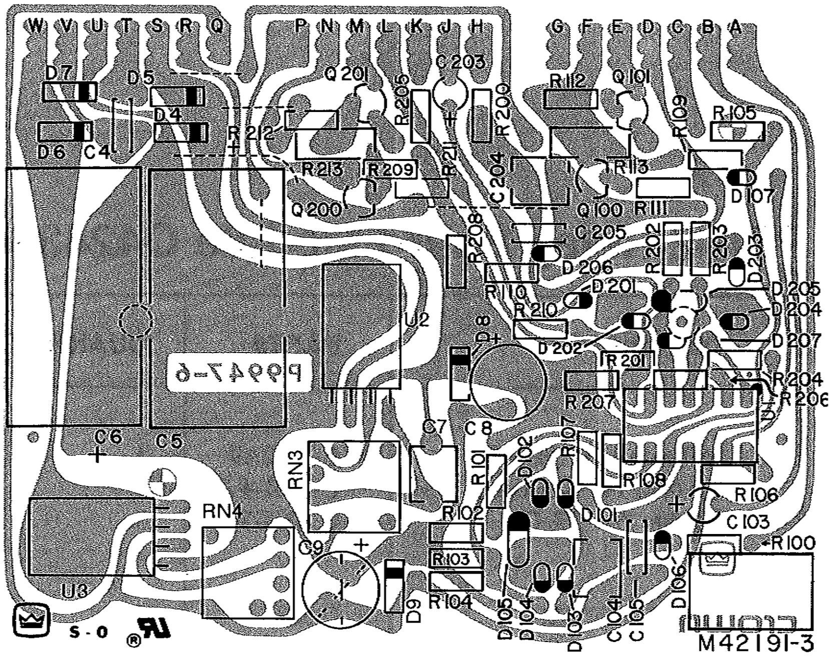


Fig. 9.2 Low Voltage/Control Circuit Module

Low Voltage/Control Circuit Module M43143-3

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Resistors				
R100, R200	82K ohm .25W 5% CF	C 4212-4	2	
R101, R201,				
R104, R204	470K ohm .25W 5% CF	C 4225-6	4	
R102, R202				
R103, R203				
R111, R211	1K ohm .25W 5% CF	C 2627-5	6	
R105, R205,				
R108, R208				
R112, R212	22K ohm .25W 5% CF	C 3302-4	6	
R106, R206	10K ohm .25W 5% CF	C 2631-7	2	
R107, R207,				
R109, R209	1M ohm .25W 5% CF	C 3198-6	4	
R110, R2101	5K ohm .25W 5% CF	C 2632-5	2	
R113, R213	1.5K ohm .5W 5% CF	C 1076-6	2	
Resistor Networks				
RN3, RN4	Resistor Trim Network	D 4445-9	2	

Low Voltage/Control Circuit Module M43143-3 (Continued)

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Capacitors				
C5, C6	1000mF 40V Axial	C 4303-1	2	
C7, C105, C205	0.1mF 100V Plycarb	C 5198-4	3	
C8	220mF 16V Vertical	C 3796-7	1	
C9	100mF 16V Vertical	C 3729-8	1	
C103, C203	4.7mF 25V Tant	C 6076-1	2	
C104, C204	.47mF 63V 5 Polycr	C 7603-1	3	
Diodes				
D4, D5, D6,				
D7, D8, D9	1N4004	C 2851-1	6	
D101, D201,				
D102, D202,				
D103, D203,				
D104, D204,				
D106, D206	1N4148	C 3181-2	10	
D107, D207	1N970B 24V Zener	C 3824-7	2	
D105, D205	1N961B 10V Zener	C 3549-0	2	
Transistors				
Q100, Q200				
Q101, Q201	Sel 2N3859A NPN	D 2961-7	4	
Integrated Circuits				
U1	LM339N Volt Comparator	C 4345-2	1	
U2	78M6T2C +V Reg	C 4296-7	1	Model PSA-2(X); used with SN11718 and below Model PSA-2D; used with SN305 and below.
U2	UA78 Adj Positive Reg	C 5487-1	1	Model PSA-2(X); used with SN11719 and above Model PSA-2D; used with SN306 and above.
U3	79M6T2C-V Reg	C 4297-5	1	Model PSA-2(X); used with SN11343 and below
U3	UA79 Negative Reg	C 5485-5	1	Model PSA-2(X); used with SN11344 to SN11718 Model PSA-2D; used with SN226 to SN305

Low Voltage/Control Circuit Module M43143-3 (Continued)

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
U3	UA79 Adj Negative Reg	C5486-3	1	Model PSA-2(X); used with SN11719 and above Model PSA-2D; used with SN306 and above
Miscellaneous				
	Z5 Silicon Compound	S 2422-4		For use with U2, U3
	14 pin Dil IC Socket	C 3450-1	1	Mounts U1
J10	Ampmod 1 PC Receptacle	C 3846-0	21	
	PSA V-Reg	F 9655-6	2	Heatsink for U2, U3
	0 ohm jumper	C 5868-2	3	

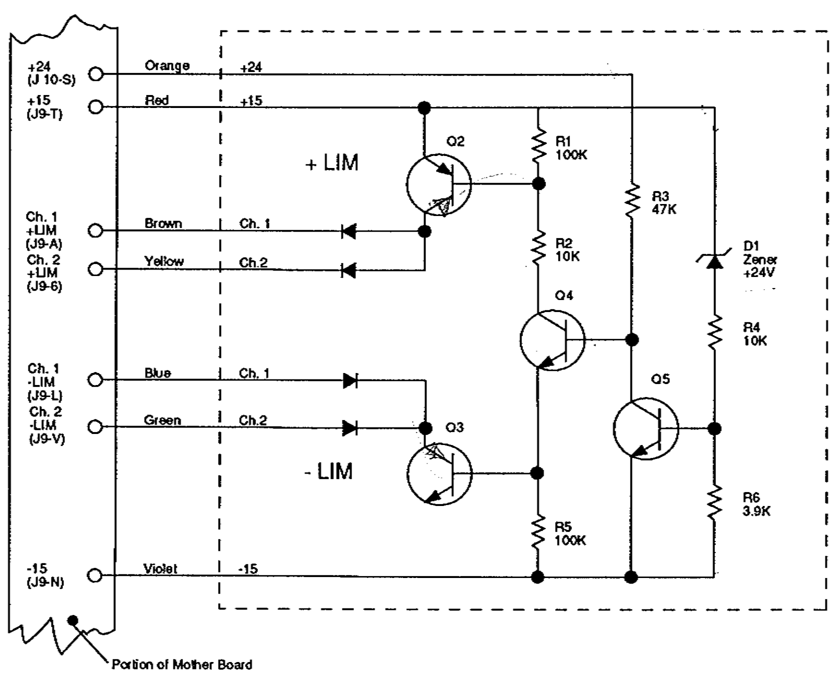


Fig. 9.3 Anti-Pop Schematic

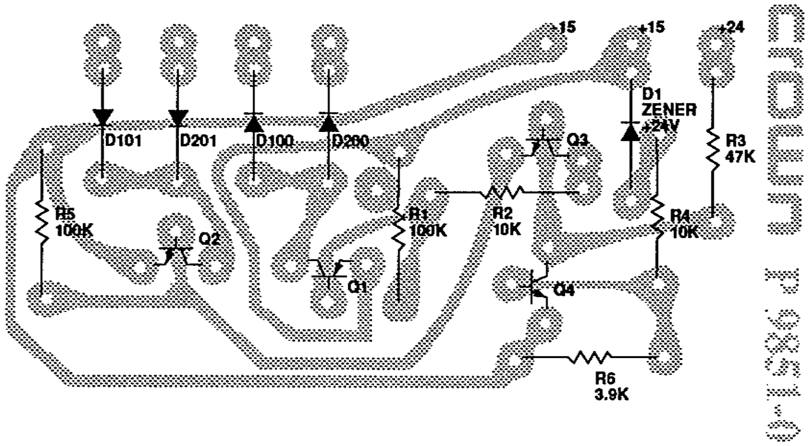


Fig. 9.4 Anti-Pop Module

Anti-pop Module Q42168-7

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
(Earlier units only; circuit included on Main bd. Module M42332-3)				
Resistors				
R1, R5	100K ohm .25W 5% CF	C 2883-4	2	
R2, R4	10K ohm .25W 5% CF	C 2631-7	2	
R3	47K ohm .25W CF	C 2880-0	1	
R6	3.9K ohm .25W 5% CF	C 2630-9	1	
Diodes				
D1	1N970B 24V Zener	C 3824-7	1	
D100, D200				
D101, D201	1N4148	C 3181-2	4	
Transistors				
Q1	2N4125 PNP	C 3625-8	1	
Q2, Q3, Q4	Sel 2N3859A NPN	D 2961-7	3	

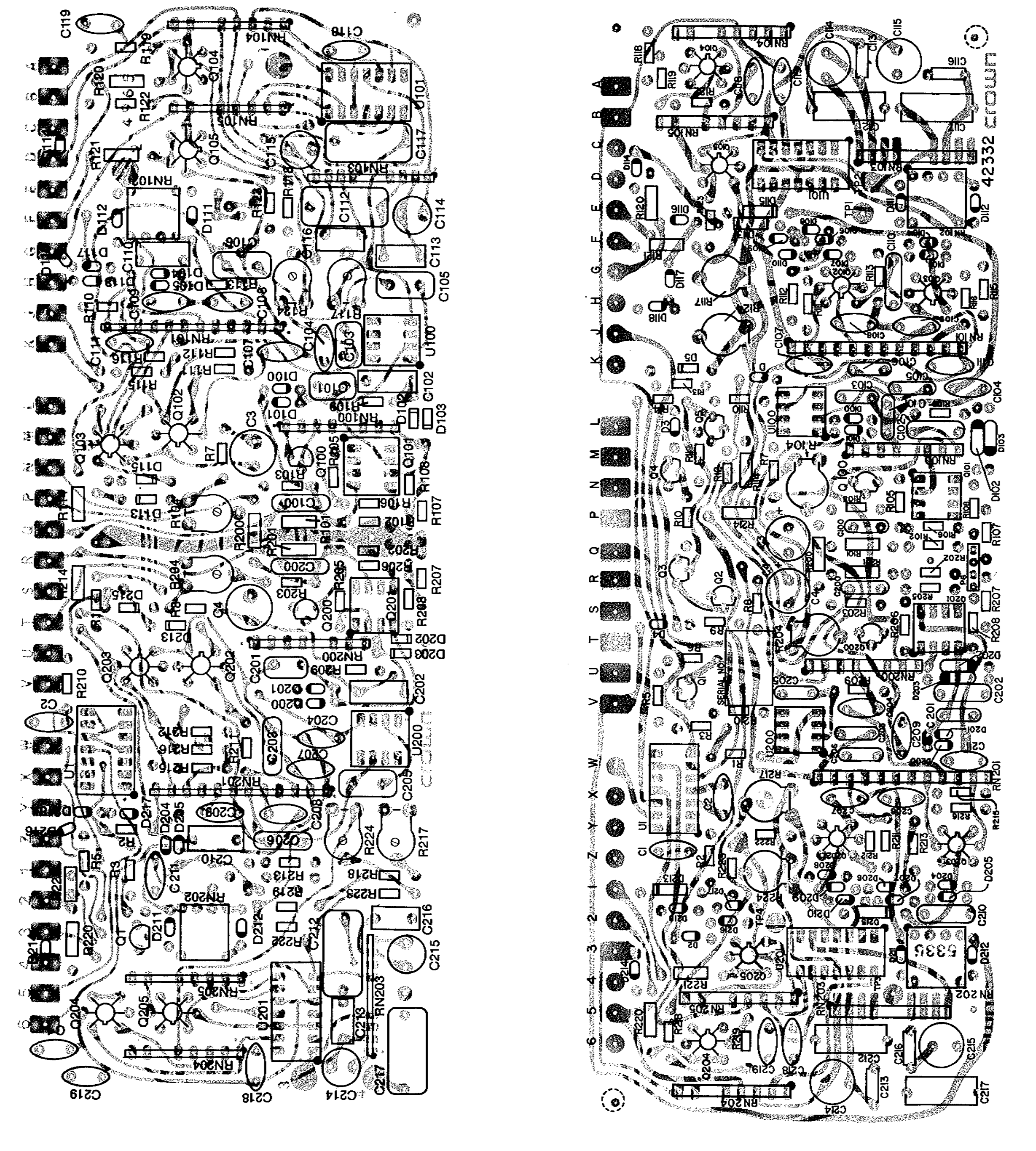


Fig. 9.5 Main Module (M42192-1)

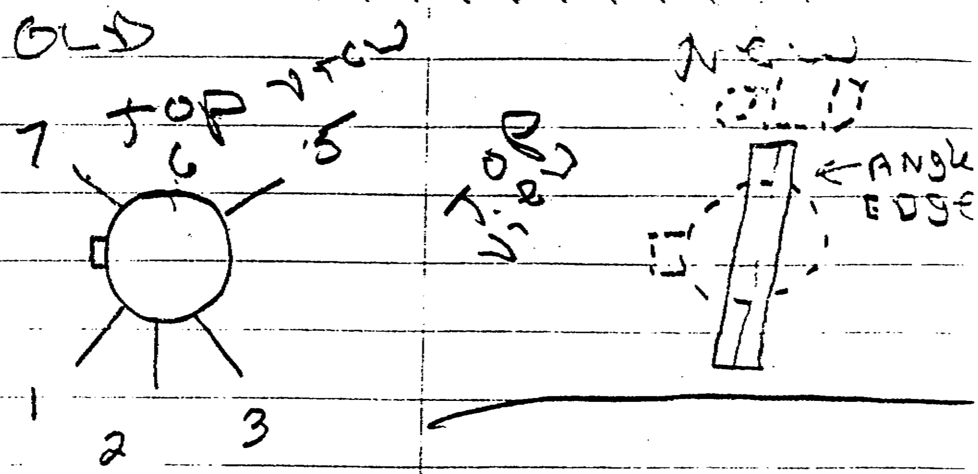
Main Board Module M42192-1

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
(Model PSA-2(X); used with SN11415 and below. Model PSA-2DX; used with SN305 and below.)				
Resistors				
R1	20K ohm .25W 1% MF	C 4861-8	1	
R2	5.49K ohm .25W 1% MF	C 5041-6	1	
R3	220K ohm .25W 5% CF	C 4219-9	1	
R4				
R5	100K ohm .25W 5% CF	C 2883-4	1	
R6	10K ohm .25W 5% CF	C 2631-7	1	
R101, R201,				
R200	10K ohm.5W 1% MF	C 2343-9	3	
R102	528 ohm .25W 1% MF	C 5044-0	1	
R202	557 ohm .25W 1% MF	C 5045-7	1	
R103, R203	300K ohm .25W 5% CF	C 4221-5	2	
R104, R204,				
R117, R217				
R124, R224	100K ohm lin. Trim pot	C 5062-2	6	
R105, R205,				
R106, R206	662 ohm .25W 1% MF	C 5040-8	4	
R107, R207	2M ohm .25W 5% CF	C 3199-4	2	
R108, R208	1K ohm .25W 5% CF	C 2627-5	2	
R109, R209	3.3K ohm .25W 5% CF	C 2629-1	2	
R110, R210				
R7, R8	100 ohm .25W 5% CF	C 2872-7	4	
R111, R211				
R112, R212,				
R115, R215,				
R116, R216	39 ohm .25W 5% CF	C 5038-2	8	
R113, R2135	60 ohm .25W 5% CF	C 2874-3	2	
R114, R2142	9.2K ohm .5W 1% MF	C 5042-4	2	
R118, R218,				
R123, R223	270K ohm .25W 5% CF	C2885-9	4	
R119, R219				
R112, R222	100 ohm .25W 1% MF	C 5039-0	4	
R120, R220,				
R121, R221	57.6K ohm .5W 1% MF	C 5256-0	4	
RN100, RN200	Resistor Network 13	D 4919-3	2	
RN101, RN201	Resistor Network 15	D 4921-9	2	
RN102, RN202	Resistor Trim Network 2	D 4703-1	2	
RN103, RN203	Resistor Network 14	D 4920-1	2	
RN104, RN204,				
RN105, RN205	Resistor Network 16	D 4922-7	4	

Main Board Module M42192-1 (Continued)

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Capacitors				
C1, C2 C104, C204, C108, C208, C109, C209	0.01mF Cer Disc	C 1751-4	8	
C3, C4	100mF 16V Vertical	C 3729-8	2	
C100, C200	120pF Mica	C 3290-1	2	
C101, C201	200pF Mica	C 3411-3	2	
C102, C202 C110, C210	.001mF 200V Filmatic	C 3480-8	4	
C103, C203, C105, C205, C106, C206	27pF Mica	C 2342-1	6	
C107, C207 C111, C211	.001mF Cer Disc	C 2288-6	4	
C112, C212, C117, C217	1.5mF 100V 5% Mylar	C 5084-6	4	
C113, C213, C116, C216	.047mF 250V Polycarb	C 4404-7	4	
C114, C214, C115, C215	18mF 6V NP Vert	C 5053-1	4	
C117, C217, C118, C2180	.1mF 12V Cer Disc	C 2600-2	4	
Transistors				
Q1	2N4125	C 3625-8	1	
Q100, Q200	Sel TZ-81	D 2962-5	2	
Q101, Q201	E411 Dual N-Ch JFET	4015	2	No longer available, replace with C 5440-0 see service bulletin
Q101, Q201	Dual N-Ch JFET	C 5440-0	2	Model PSA-2(X); used with SN11234 and above Model PSA-2DX; used with SN276 and above
Q102, Q202, Q104, Q204	Sel IT132 PNP	D 4837-7	4	
Q103, Q203, Q105, Q205	Sel IT129 NPN	D 4838-5	4	

Scott FYI (EARLY) ISA, RX7780 7550 - PSA DUAL Xsistor Replacement



OLD	NEW
1 = C1	1 = B1
2 = B1	2 = C1
3 = E1	3 = E1
4 = NONE	4 = NONE (cut off)
5 = E2	5 = E2
6 = B2	6 = C2
7 = C2	7 = B2

1349 D4837-7 PNP — OLD — MARKED IT132 OR ITS31120

101374-1 NEW REPLACES (C6911-9) (C6500-0) (D4837-7)

3381 D4838-5 NPN — OLD — MARKED IT129 OR ITS31085

101375-1 NEW REPLACES (C6910-1) (C6501-8) (D4838-5)

Tech Note

Technical Support Group

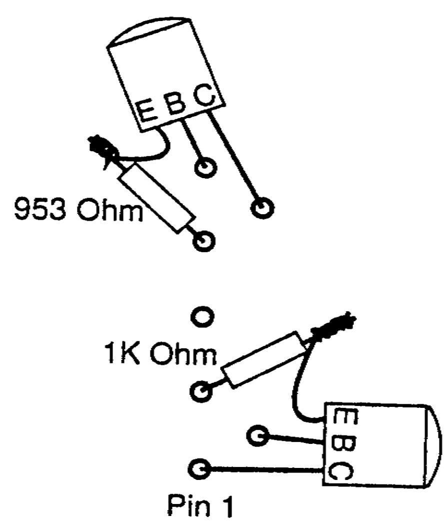
Audio Division of Crown International Inc.
PO Box 1000 Elkhart IN 46515-1000
Ph 800-342-6939/219-294-8200
Fax 219-294-8301

crown®

Issue Date: 10-95
Ref. No.: 0114
Subject: C 6500-0 (MPA77V PNP Dual Transistor IC) Replacement
Applicability: MT-1000

The MPA77V PNP Dual Transistor IC, Crown Part Number C 6500-0, is no longer available. In most amplifiers the MPA75, CPN C 6911-9, can be used as a direct replacement because there are pads on the module that will accept both devices. The MT-1000, however, only has pads for the MPA77V. If this device needs replacing in the MT-1000, two transistors will need to be used as a substitute along with two resistors. Below is a parts list and illustration for the replacement.

QTY	Part #	Description
2	C 3625-8	PNP 2N4125
1	~~C 4850-1~~	1K Ohm .25W 1% A10265-10011
1	A10265-95301	953 Ohm .25W 1%



Main Board Module M42192-1 (Continued)

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Integrated Circuits				
U1	LM339N Volt Comparator	C 4345-2	1	
U101, U201	TL074 Quad Op Amp	C 4696-8	2	
U100, U200	TL071 CP BI FET Op Amp	C 5096-7	2	
Diodes				
D100, D200, D101, D201, D104, D204, D105, D205, D111, D211, D114, D214, D116, D216, D117, D217, D118, D218	1N4148	C 3181-2	18	
*D106, D206, *D107, D207, *D108, D208, *D109, D209, *D110, D211	1N4148	C 3181-2	1	Model PSA-2(X); not used after SN10243
D113, D213, D115, D215	1N4004	C 2851-1	4	
D102, D202, D103, D203	1N270	C 3447-7	4	
Miscellaneous				
	8 pin DIL IC Skt	C 3451-9	4	Used with U100, U200, Q101, Q201
	14 pin DIL IC Skt	C 3450-1	3	For U1, U101, U201
J9	Ampmod 1 PC Recpt	C 3846-0	30	
P6	MOD 2 4 pin 318 Header	C 5007-7	1	
	.30 Term Circle	C 5291-7	3	Insulates C112, C117, C212

Note: Main Modules M42192-1 and M42332-3 directly replaced by M43147-4

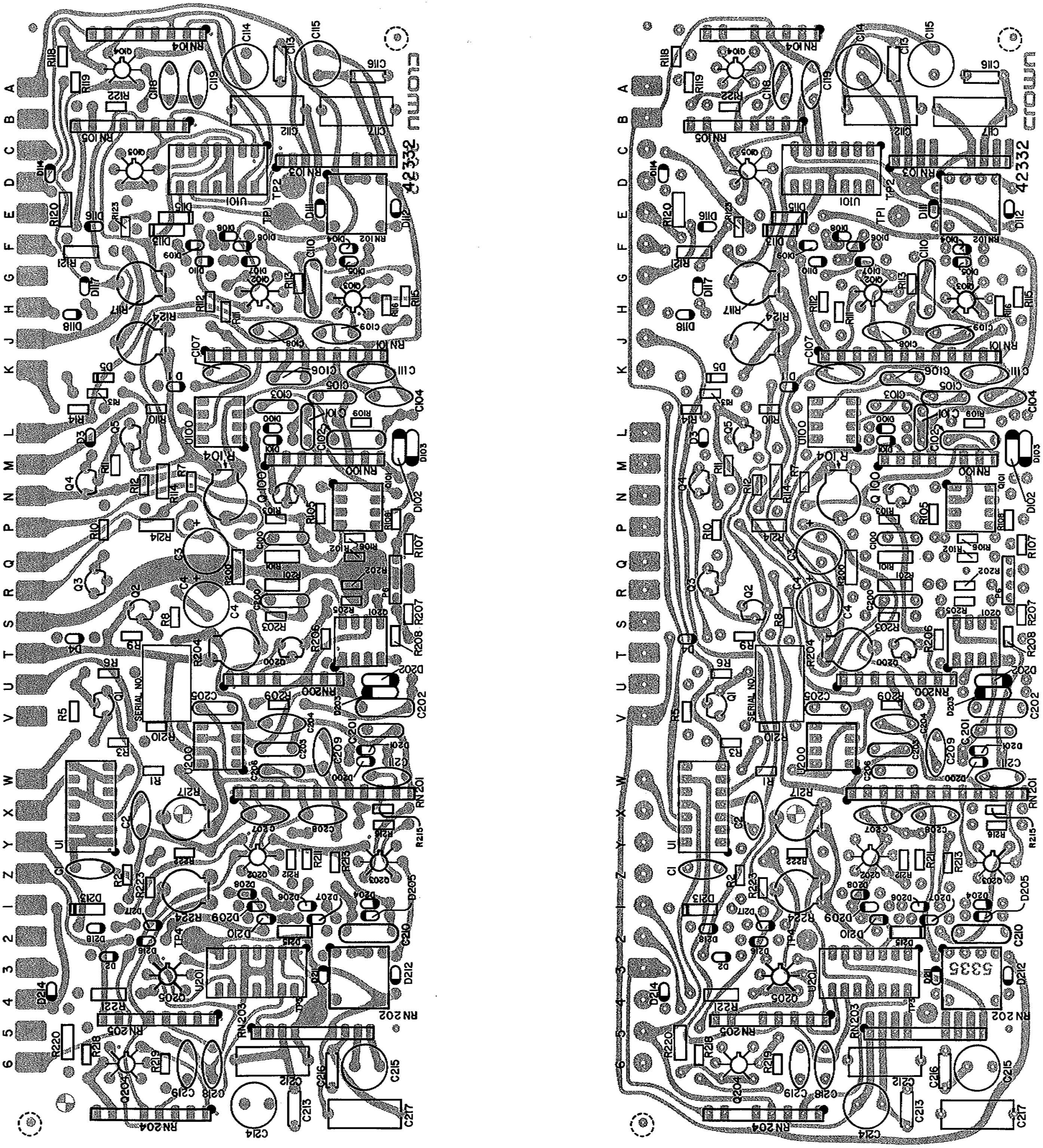


Fig. 9.6 Main Module (M42332-3)

Main Board Module #2 M42332-3

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
(Model PSA-2(X); used with SN11416 and above. Model PSA-2DX; used with SN306 and above)				
Resistors				
R1	20K ohm .25W 1% MF	C 4861-8	1	
R2	5.49K ohm .25W 1% MF	C 5041-6	1	
R3	220K ohm .25W 5% CF	C 4219-9	1	
R5, R9, R11	100K ohm .25W 5% CF	C 2883-4	3	
R6, R10, R13	10K ohm .25W 5% CF	C 2631-7	3	
R7, R8, R110, R210	100 ohm .25W 5% CF	C 2872-7	4	
R12	3.9K ohm .25W 5% CF	C 2630-9	1	
R14	47K ohm .25W 5% CF	C 2880-0	1	
R101, R201, R200	10K ohm .5W 1% MF	C 2343-9	3	
R102	528 ohm .25W 1% MF	C 5044-0	1	
R202	557 ohm .25W 1% MF	C 5045-7	1	
R103, R203	300K ohm .25W 5% CF	C 4221-5	2	
R104, R204, R117, R217, R124, R224	100K ohm LIN Trim Pot	C 5062-2	6	
R105, R205, R106, R206	662 ohm .25W 1% MF	C 5040-8	4	
R107, R207	2M ohm .25W 5% CF	C 3199-4	2	
R108, R208	1K ohm .25W 5% CF	C 2627-5	2	
R109, R209	3.3K ohm .25W 5% CF	C 2629-1	2	
R11, R211, R112, R212, R115, R215, R116, R216	39 ohm .25W 5% CF	C 5038-2	8	
R113, R213	560 ohm .25W 5% CF	C 2874-3	2	
R114, R214	39.2K ohm .5W 1% MF	C 5042-4	2	
R118, R218, R123, R223	270K ohm .25W 5% CF	C 2885-9	4	
R119, R219, R122, R222	100 ohm .25W 1% MF	C 5039-0	4	
R120, R220, R121, R221	57.6K ohm .5W 1% MF	C 5256-0	4	
RN100, RN200	Resistor Network 13	D 4919-3	2	
RN101, RN201	Resistor Network 15	D 4921-9	2	
RN102, RN202	Resist Trim Network	D 4703-1	2	
RN103, RN203	Resist Network 14	D 4920-1	2	
RN104, RN204, RN105, RN205	Resist Network 16	D 4922-7	4	

Main Board Module #2 M42332-3
(Continued)

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Capacitors				
C1, C2, C104, C204, C108, C208, C109, C209	0.01mF Cer Disc	C 1751-4	8	
C3, C4	100mF 16V Vertical	C 3729-8	2	
C100, C200	120pF Mica	C 3290-1	2	
C101, C210	200pF Mica	C 3411-3	2	
C102, C202, C110, C210	.001mF 200V Filmatic	C 3480-8	4	
C103, C203, C105, C205, C106, C206	27pF Mica	C 2342-1	6	
C107, C207, C111, C211	.001 Cer Disc	C 2288-6	4	
C112, C212, C117, C217	1.5mF 100V 5% Mylar	C 5084-6	4	
C113, C213, C116, C216	.047mF 250V Plycrb	C 4404-7	4	
C114, C214, C115, C215	18mF 6V NP Vert	C 5053-1	4	
C118, C218, C119, C219	0.1mF 12V Cer Disc	C 2600-2	4	
Transistors				
Q1, Q2, Q3, Q5	2N4125 PNP	C 3625-8	4	
Q4	Sel 2N3859A	D 2961-7	1	
Q100, Q200	Sel TZ-81 NPN	D 2962-5	2	
Q101, Q201	Dual N-Ch JFET	C 5440-0	2	
Q102, Q202, Q104, Q204	Sel 1T132 PNP	D 4837-7	4	
Q103, Q203, Q105, Q205	Sel 1T129 NPN	D 4838-5	4	
Diodes				
D1, D2, D3, D4, D104, D204, D105, D205, D111, D211, D112, D212, D114, D214, D116, D216, D117, D217, D118, D218	1N4148	D3181-2	20	
D102, D202, D103, D203	1N270	C 3447-7	4	

Main Board Module #2 M42332-3 (Continued)

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
D5	1N970 24V Zener	C 3824-7	1	
D113, D213, D115, D215	1N4004	C 2851-1	4	
Integrated Circuits				
U1	LM339N Volt Comparator	C 4345-2	1	
U101, U201	TL074 Quad Op Amp	C 4696-8	2	
U100, U200	TL071 CP Bi Fet Op Amp	C 5069-7	2	
Miscellaneous				
	8pinDIL IC Socket	C 3451-9	4	Used with U100,U200, Q101,Q201
	14 pin DIL IC Socket	C 3450-1	3	Used with U1, U101, U201
J9	Ampmod 1 PC Rcpt	C 3846-0	30	
P6	Mod 2 4 pin 318 Header	C 5007-7	1	

Note: Main Modules M42192-1 and M42332-3 directly replaced by M43147-4

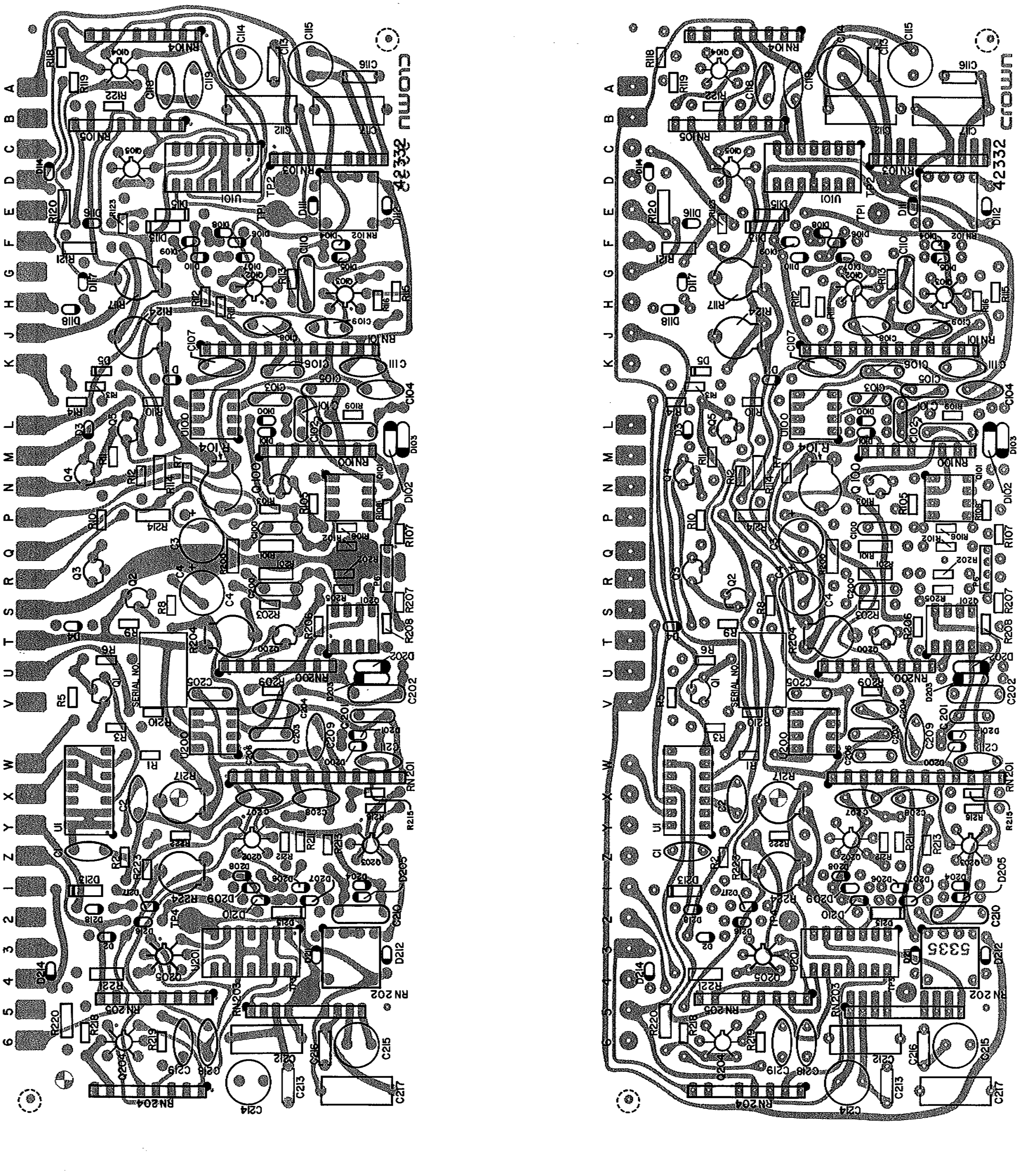


Fig. 9.7 Main Module (M43147-4)

Main Board Module #3 M43147-4

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
(Model PSA-2(X); used with SN17000 and above. Model PSA-2DX; used with SN640 and above)				
Resistors				
R1	20K ohm .25W 1% MF	C 4861-8	1	
R2	5.76K ohm .25W 1% MF	C 5744-5	1	
R3	360K ohm .25W 5% CF	C 4223-1	1	
R5, R9, R11	100K ohm .25W 5% CF	C 2883-4	3	
R6, R10, R13	10K ohm .25W 5% CF	C 2631-7	3	
R7, R8, R110, R210	100 ohm .25W 5% CF	C 2872-7	4	
R12	3.9K ohm .25W 5% CF	C 2630-9	1	
R14	47K ohm .25W 5% CF	C 2880-0	1	
R101, R201, R200	10K ohm .5W 1% MF	C 2343-9	3	
R102	528 ohm .25W 1% MF	C 5044A8	1	
R202	557 ohm .25W 1% MF	C 5045A5	1	
R103, R203	300K ohm .25W 5% CF	C 4221-5	2	
R104, R204, R117, R217, R124, R224	100K ohm LIN Trim Pot	C 5062-2	6	
R105, R205, R106, R206	662 ohm .25W 1% MF	C 5040A6	4	
R107, R207	2M ohm .25W 5% CF	C 3199-4	2	
R108, R208	1K ohm .25W 5% CF	C 2627-5	2	
R109, R209	3.3K ohm .25W 5% CF	C 2629-1	2	
R11, R211, R112, R212, R115, R215, R116, R216	39 ohm .25W 5% CF	C 5038-2	8	
R113, R213	560 ohm .25W 5% CF	C 2874-3	2	
R114, R214	39.2K ohm .5W 1% MF	C 5042-4	2	
R118, R218, R123, R223	270K ohm .25W 5% CF	C 2885-9	4	
R119, R219, R122, R222	100 ohm .25W 1% MF	C 5039-0	4	
R120, R220, R121, R221	48.7K ohm .5W 1% MF	C 5846-8	4	
Resistor Networks				
RN100, RN200	Resistor Network 13	D 4919-3	2	
RN101, RN201	Resistor Network 24	D 6842-5	2	
RN102, RN202	Resist Trim Network	D 4703-1	2	
RN103, RN203	Resist Network 14	D 4920-1	2	
RN104, RN204, RN105, RN205	Resist Network 16	D 4922-7	4	

Main Board Module #3 M43147-4 (Continued)

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Capacitors				
C1, C2,				
C104, C204,				
C108, C208,				
C109, C209	0.01mF Cer Disc	C 1751-4	8	
C3, C4	100mF 16V Vertical	C 3729-8	2	
C100, C200	120pF Mica	C 3290-1	2	
C101, C210	200pF Mica	C 3411-3	2	
C102, C202,				
C110, C210	.001mF 200V Filmatic	C 3480-8	4	
C103, C203,				
C105, C205,				
C106, C206	27pF Mica	C 2342-1	6	
C107, C207,				
C111, C211	.001 Cer Disc	C 2288-6	4	
C112, C212,				
C117, C217	1.5mF 100V 5% Mylar	C 5084-6	4	
C113, C213,				
C116, C216	.047mF 250V Plycrb	C 4404-7	4	
C114, C214,				
C115, C215	22mF 50V NP Vert	C 5311-3	4	
C118, C218,				
C119, C219	0.1mF 100V Poly	C 5198-4	4	
Transistors				
Q1, Q2, Q3, Q5	2N4125 PNP	C 3625-8	4	
Q4	Sel 2N3859A	D 2961-7	1	
Q100, Q200	Sel TZ-81 NPN	D 2962-5	2	
Q101, Q201	Dual FET NPD5566	C 5440-0	2	
Q102, Q202,				
Q104, Q204	Sel IT132 PNP	D 4837-7	4	
Q103, Q203,				
Q105, Q205	Sel IT129 NPN	D 4838-5	4	
Diodes				
D1, D2, D3, D4				
D104, D204,				
D105, D205,				
D111, D211,				
D112, D212,				
D114, D214,				
D116, D216,				
D117, D217,				
D118, D218	1N4148	D3181-2	20	
D102, D202,				
D103, D203	1N270	D6212-1	4	

Main Board Module #3 M43147-4
(Continued)

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
D5	1N970 24V Zener	C 3824-7	1	
D113, D213, D115, D215	1N4004	C 2851-1	4	
Integrated Circuits				
U1	LM339N Volt Comparator	C 4345-2	1	
U101, U201	TL074 Quad Op Amp	C 4696-8	2	
U100, U200	TL071 CP Bi Fet Op Amp	C 5069-7	2	
Miscellaneous				
	8pinDIL IC Socket	C 3451-9	4	Used with U100, U200, Q101, Q201
	14 pin DIL IC Socket	C 3450-1	3	Used with U1, U101, U201
J9	Ampmod 1 PC Rcpt	C 3846-0	30	
P6	Mod 24 pin 318 Header	C 5007-7	1	

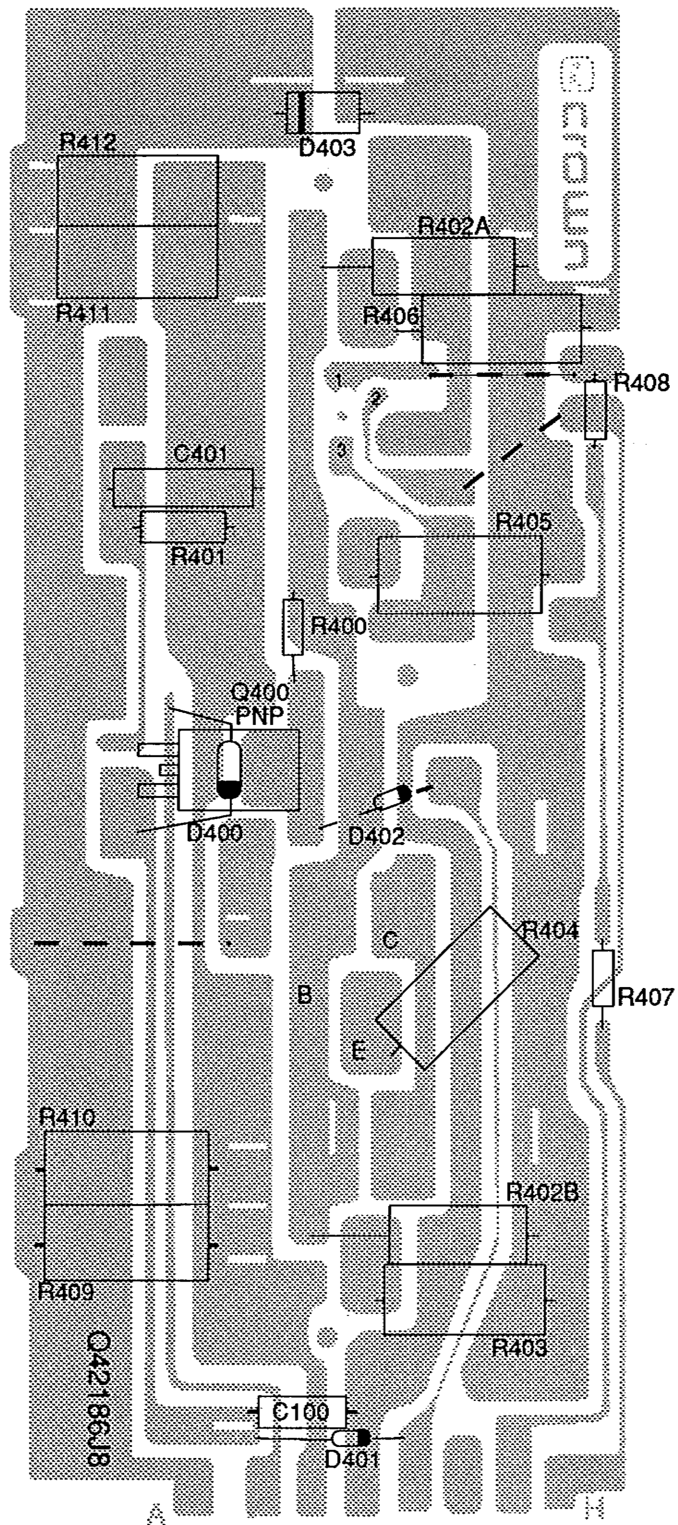


Fig. 9.8 PNP Output Module M43144-1

PNP Output Module M43144-1

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Resistors				
R400	56 .25W 5% CF	C 3511-0	1	
R401	5.6 ohm .5W 5% CF	C 3299-2	1	
R402	12 ohm 2W 10% Comp	C 3931-0	1	
R403, R404, R405, R406, R409, R410, R411, R412	.33 ohm 5W 5% Wire	C 3583-9	8	
R407	5.6K ohm .25W 5%	C 3220-8		
R408	218 ohm .25W 1% MF	C 5344-4	1	If U400 is yellow
R408	227 ohm .25W 1% MD	C 5343-6	1	If U400 is green
R408	236 ohm .25W 1% MF	C 5342-8	1	If U400 is blue
Capacitors				
C400	200pF Mica	C 3411-3	1	
C401	0.1mF 200V Filmatic	C 2938-6	1	
Transistors				
Q400	PNP Predriver	C 5453A1	1	
Q401	Driver Power NPN	D 5702-2	1	
	Driver Power NPN	C 5869-0	1	
Q402, Q403, Q404, Q405	Output Power NPN	C 7064-6	4	MJ15003 Sel.
Diodes				
D400	1N270	D 6212-1	1	
D401, D402	1N4938 or 1N3070	C 5061-4	2	
D403	1N5402	C 2941-0	1	
Integrated Circuits				
U400	LM334H Thermal Sense	C 5826-0	1	See Page 9-52
Miscellaneous				
J13	Ampmod 1 PC Mnt Rcpt	C 4731-3	8	
P17	Mate-N-Lock 4P Header	C 5000-2	1	
Z5	Silicon Comp Clear	S 2422-4		For D400
	Type 340 Heat-S Comp	S 2162-6		For Q401
	T03 Plastic Film Ins.	C 3180-4	1	Mounts Q401
	U400 Lead Insulator	H42257-8	3	See Page 9-52
	T03 Plastic Insulator	C 3180-3	1	
	6-32x.62 screw	C 7261-8	9	
	6-32x.75 screw	C 7267-5	1	
	Coolpak Well	M20142A0	1	
	6-32 nut	C 1889-2	10	
	PNP Board	P 9828-8	1	Blank Board

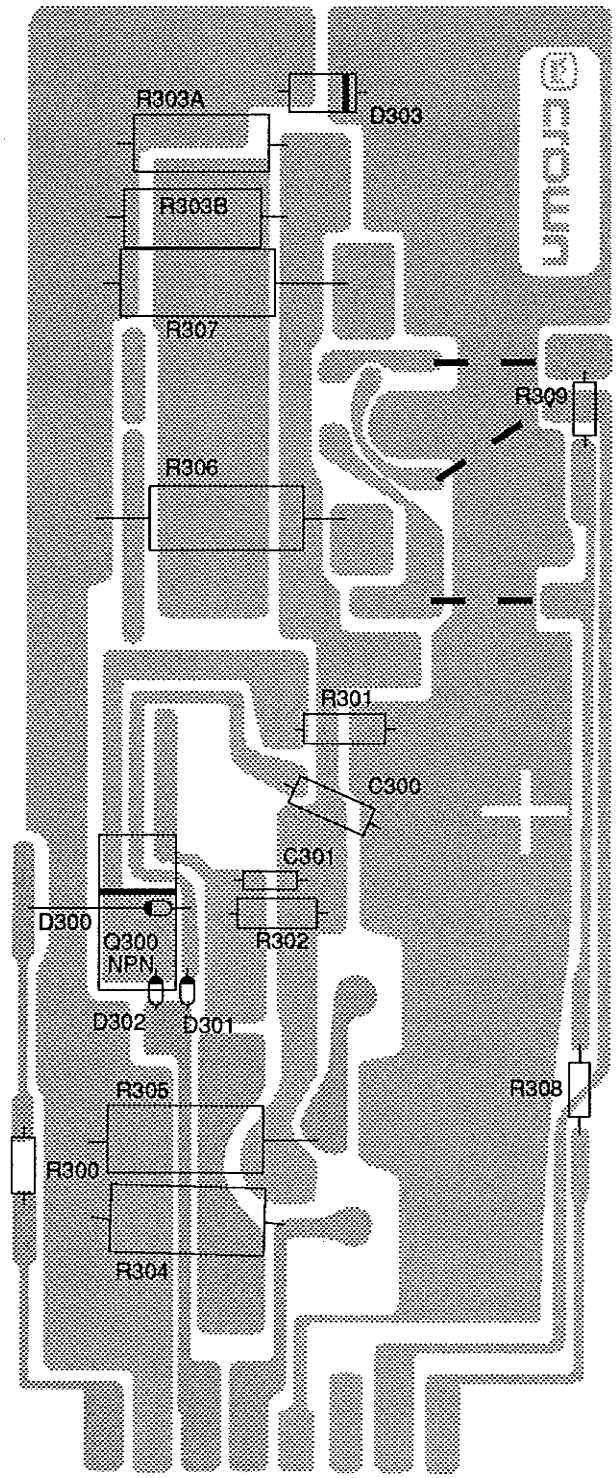


Fig. 9.9 NPN Output Module M42194-7

NPN Output Module M43145-8

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Resistors				
R300	75 ohm .25W 5% CF	C 3798-3	1	
R301	36 .5W 5% CF	C 2988-1	1	
R302	5.6 ohm .5W 5% CF	C 3299-2	1	
R303	12 ohm 2W 10% comp	C 3931-0	1	
R304, R305, R306, R307	0.33 ohm 5W 5% Wire	C 3583-9	4	
R308	5.6K ohm .25W 5% CF	C 3220-8	1	
R309	218 ohm .25W 1% MF	C 5344-4	1	If U300 is yellow
R309	227 ohm .25W 1% MF	C 5343-6	1	If U300 is green
R309	236 ohm .25W 1% MF	C 5342-8	1	If U300 is blue
Capacitors				
C300	200pF mica	C 3411-3	1	
C301	.047mF 250V Polycarb	C 4404-7	1	
Transistors				
Q300	Predriver	C 7339-2	1	
Q301	Driver PNP	C 6374-0	1	
Q302, Q303, Q304, Q205	Output Power NPN	C 7064-6	4	MJ15003 Sel.
Diodes				
D300	1N4148	C 3181-2	1	
D301, D302	1N4938 or IN3070	C 5061-4	2	
D303	1N5402	C 2941-0	1	
Integrated Circuits				
U300	LM334Z Thermal Sense	C 5826-0	1	See Page 9-52
Miscellaneous				
J12	Ampmod 1 PC Mnt Rcpt	C 4731-3	8	
P16	Mate-N-Lock Header	C 5000-2	1	
	Z5 Silicon Comp Clear	S 2422-4		Used for D300
	Type 340 Heat-S Comp	S 2162-6		Used for Q301
	U300 Lead Insulator	H42257-8	3	See Page 9-52

NPN Output Module M43145-8 (Continued)

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
	T03 Plastic Film INS	C 3180-4	1	Mounts Q301
	U300 Lead Insulator	H42257-8	3	See Page 9-52
	Coolpac Well	M20142A0	1	Heat Sink
	6-32x.625 screw	C 7261-8	10	
	6-32 nut	C 1889-2	10	
	NPN Output Board	P 9827-0	1	Blank Board

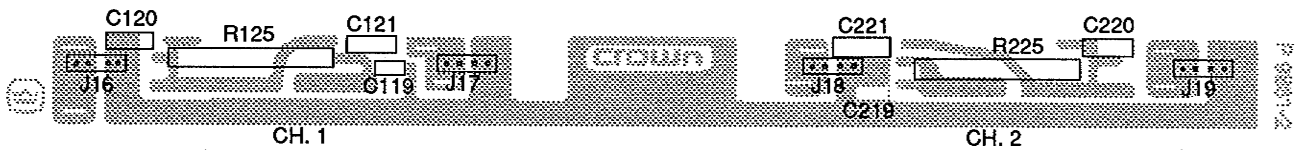


Fig. 9.10 Output Terminator Module

Output Terminator Module M43136-7

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Resistors				
R125, R225	2.7 ohm 10W 5% comp	C 7045-5	2	
Capacitors				
C119, C219	.047mF200V 5% Mylar	C 3978-1	2	
C120, C220, C121, C221	4.7mF 100V Axial	C 5050-7	4	
Miscellaneous				
J16, J17	Mate-N-Lock PC Socket	C 4998-8	16	
J18, J19	Mate-N-Lock Socket	C 4999-6	4	
L100, L200	Output coil	M43137-5	2	

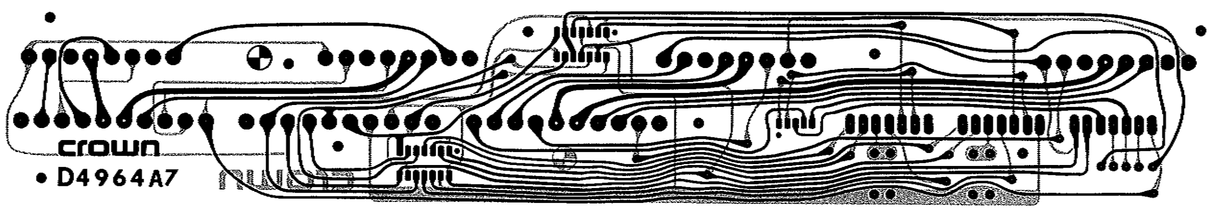


Fig. 9.11 Mother Board

Mother Board Module M43149-0

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Miscellaneous				
J4, J5	14 pin DIL IC Socket	C 3450-1	2	
P3	Amp Mod 1-5 pin Header	C 5002-8	1	
P2	MOD 2-5 pin 318 Header	C 5008-5	1	
	Mother Board	Q42463A0	1	
	Ribbon Cable	D 4939-1	1	
	250 Faston PC Tabterm	C 4997-0	4	

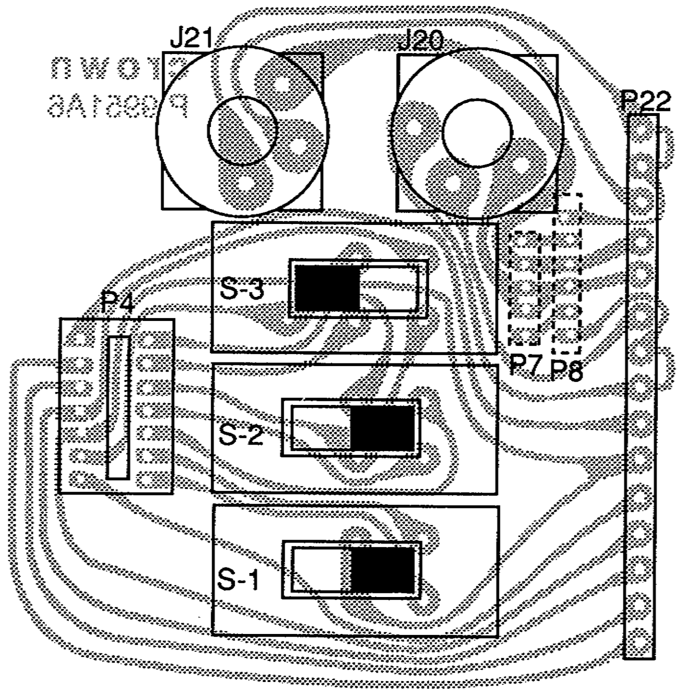


Fig. 9.12 Input Connector Module

Input Connector Module Q42173J6

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Switches				
S1, S2, S3	DPDT 11/16 PC Mount	D 5016-7	3	Delay, L.F. Prot., Mono
Miscellaneous				
J20, J21	2 conductor phone jacks	D 5015-9	2	
P4	8 in. 14 pin DIP Cable	D 4615-7	1	
P7	2-5 pin 608 Header	C 5009-3	1	
P8	2-6 pin 608 Header	C 5010-1	1	
P22	Ampmod 1-15 Pin Header	C 5874-0	1	
	Fiber washer	C 1646-6	2	Phone jack insulators
	Input Board	P 9951A6	1	Blank Board

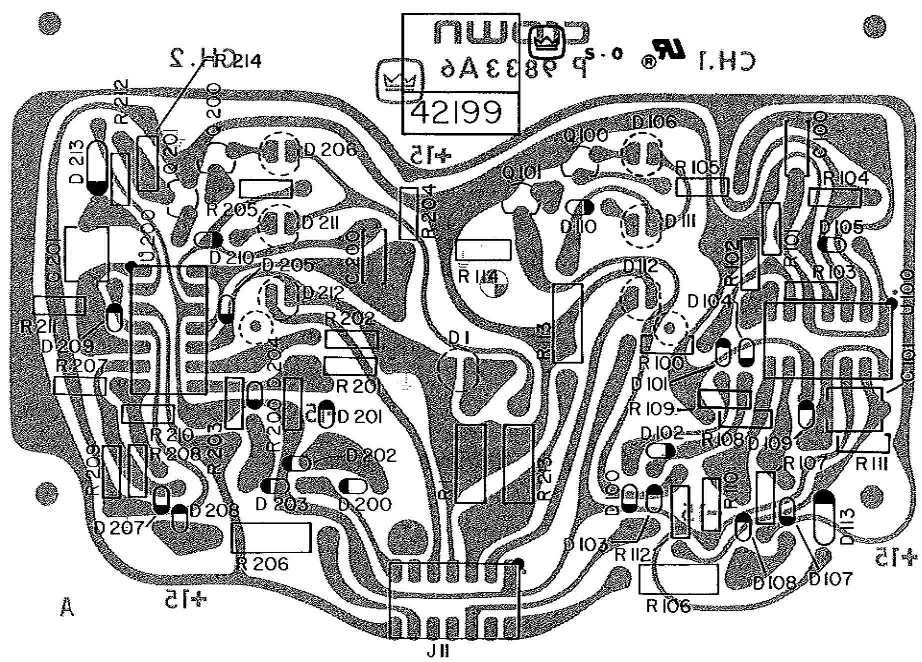


Fig. 9.13 PSA-2X Display Module

PSA-2X Display Module M43134-2

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Resistors				
R1	2.2K ohm .5W 5% CF	C 1036-0	1	
R100, R200, R103. R203	180K ohm .25W 5% CF	C 4218-1	4	
R101, R201, R102, R202	560 ohm .25W 5% CF	C 2874-3	4	
R104, R204	2.4M ohm .25W 5% CF	C 4600-0	2	
R105, R205, R112, R212	10K ohm .25W 5% CF	C 2631-7	4	
R106, R206	10K ohm .5W 5% CF	C 1035-2	2	
R107, R207, R110, R210	470K ohm .25W 5% CF	C 4225-6	4	
R108, R208, R109, R209	1K ohm .25W 5% CF	C 2627-5	4	
R111, R211	2M ohm .25W 5% CF	C 3199-4	2	
R113, R213	1.2K ohm .5W 5% CF	C1045-1	2	
Capacitors				
C100, C200	0.047 mF 250V 5% Poly	C 4404-7	2	
C101, C201	.47mF 63V Polycarb	C 7603-1	2	
Diodes				
D1	MV5153 Amber LED	C 4342-9	1	On/Off Indicator
D100, D200, D101, D201, D103, D203, D104, D204, D105, D205, D107, D207, D108, D208, D109, D209, D110, D210	1N4148	C 3181-2	18	
D102, D202	1N961B 10V Zener	C 3549-0	2	
D106, D206	MV5053 Red LED	C 4341-1	2	IOC
D111, D211	Green LED T 1.75	C 7813-6	2	SPI
D112, D212	MV5353 Yellow LED	C 4431-0	2	Standby indicator
D113, D213	1N270	D 6212-1	2	
Transistors				
Q100, Q200, Q101, Q201	PN4250A PNP	C 3786-8	4	
Integrated Circuits				
U100, U200	LM339N Volt Comparator	C 4345-2	2	
Miscellaneous				
	14 Pin DIL IC Socket	C 3450-1	3	
	Fishpaper	D 5083-7		

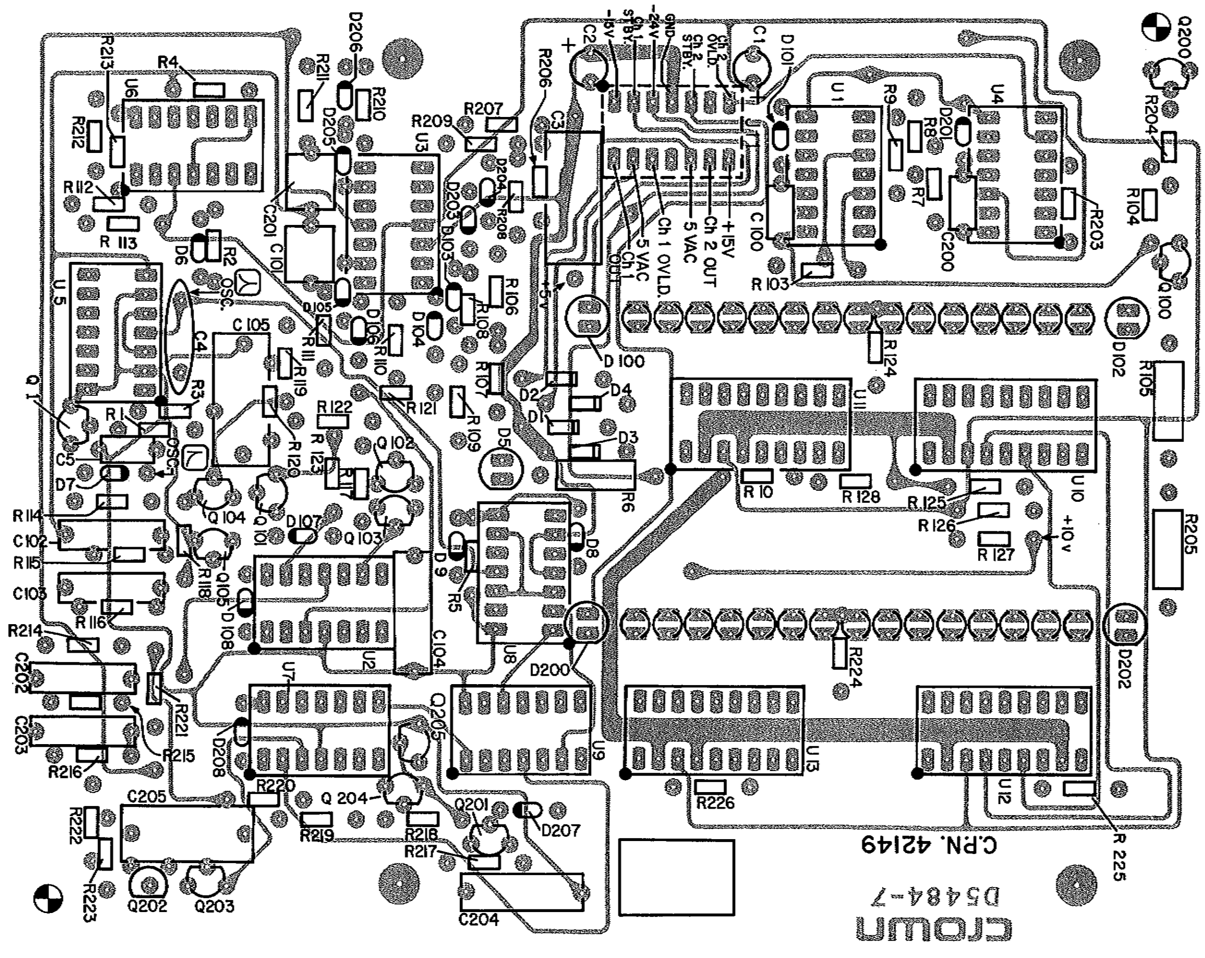


Fig. 9.14 PSA-2DX Display Module

PSA-2DX Display Board Module M42149-1

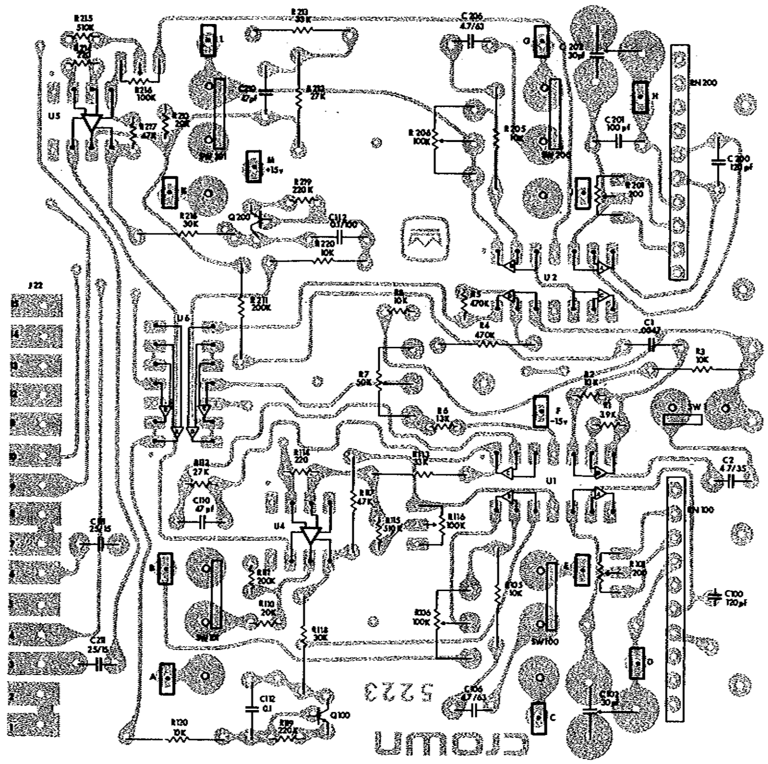
ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Resistors				
R1, R5, R104, R204, R123, R223	10K ohm .25W 5% CF	C 2631-7	6	
R2	5.1M ohm .25W 5% CF	C 4126-6	1	
R3	3.3K ohm .25W 5% CF	C 2629-1	1	
R4, R125	5.6K ohm .25W 5% CF	C 3220-8	2	
R6	2.2K ohm .5W 5% CF	C 1036-0	1	
R7, R9, R113, R213, R112, R212	15K ohm .25W 5% CF	C 2632-5	6	
R8	120K ohm .25W 5% CF	C 4214-0	1	
R103, R203	2.4M ohm .25W 5% CF	C 4600-0	2	
R105, R205	1.2K ohm .5W 5% CF	C 1045-1	2	
R106, R206, R107, R207, R119, R219	360K ohm .25W 5% CF	C 4223-1	6	
R108, R208, R110,R210	47K ohm .25W 5% CF	C 2880-0	4	
R109, R209	24K ohm .25W 5% CF	C 5217-2	2	
R111, R211	47 ohm .25W 5% CF	C 1011-3	2	
R114, R214, R115, R215	1M ohm .25W 5% CF	C 3198-6	4	
R116, R216	4.7M ohm .25W 5% CF	C 5216-4	2	
R117, R217	100 ohm .25W 5% CF	C 2872-7	2	
R118, R218	100K ohm .25W 5% CF	C 2883-4	2	
R120, R220	1K ohm .25W 5% CF	C 2627-5	2	
R121, R221	22M ohm .25W 5% Comp	C 5215-6	2	
R122, R222	270K ohm .25W 5% CF	C 2885-9	2	
R124, R224	22K ohm .25W 5% CF	C 3302-4	2	
R126	2.49K ohm .25W 1% MF	C 4852-7	1	
R225, R226	620 ohm .25W 5% CF	C 3872-6	2	
R127	2.67K ohm .25W 1% MF	C 5218-0	1	
R128	2.0K ohm .25W 1% MF	C 4505-1	1	
R10	2.7K ohm .25W5% CF	C 5168-7	1	
Capacitors				
C1, C2	33mF 16V Tant	C 6094-4	2	
C3	22mF 50V	C 4248-8	1	
C4	470pF Mica	C 2511-1	1	
C5, C100, C200	0.04mF 250V Polycarb	C 4404-7	3	
C101, C201	.47mF 63V 10% Polycarb	C 7603-1	2	
C102, C202, C103, C203	.01mF 200V Filmatic	C 3161-4	4	
C104, C204	1.0mF 100V 5% Polycarb	C 4472-4	2	
C105, C205.	.22mF 100V Filmatic	C 3218-2	2	

PSA2D Display Board Module M42149-1
(Continued)

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Transistors				
Q100, Q200	PN4250A PNP	C 3786-8	2	
Q101, Q201, Q102, Q202, Q103, Q203, Q104, Q204	Sel 2N3859A NPN	D 2961-7	8	
Q1	Sel TZ-81 NPN	D 2962-5	1	
Q105, Q205	2N4125 PNP	C 3625-8	2	
Diodes				
D1, D2, D3, D4	1N4004	C 2851-1	4	
D5	MV5153 Amber LED	C 4342-9	1	on/off indicator
D6, D7, D8, D9, D101, D201, D103, D203, D104, D204, D105, D205, D106, D206 D107, D207, D108, D208	1N4148	C 3181-2	18	
D100, D200	MV5353 Yellow LED	C 4431-0	2	Standby indicator
D102, D202	MV5053 Red LED	C 4341-1	2	IOC Indicator
D109, D209, D110, D210, D111, D211, D112, D212, D113, D213, D114, D214, D115, D215, D116, D216, D117, D217, D118, D218, D119, D219, D120, D220, D121, D221, D122, D222, D123, D223	TIL232-2 Green Mini LED	C 7733-6	30	Ladder Display
Integrated Circuits				
U1, U4, U6	LM339 Volt Comparator	C 4345-2	3	
U2, U7, U3, U4	TL074	C 4696-8	4	
U5	MC14070 Excl or Gate	C4 833-7	1	
U8	MC14013 Flip Flop	C 4831-1	1	
U9	MC14016 Quad Switch	C 4834-5	1	

PSA2D Display Board Module M42149-1 (Continued)

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
U10, U11, U12, U13	LM3914 Dot DDP Driver	C 4924-4	4	
Miscellaneous				
	14 Pin DIL IC Socket	C 3450-1	9	
	18 Pin DIL IC Socket	C 5118-2	4	
	Ribbon Cable	D 4939-1	1	
	PSA-2DX Display Brd	D 5484-7	1	



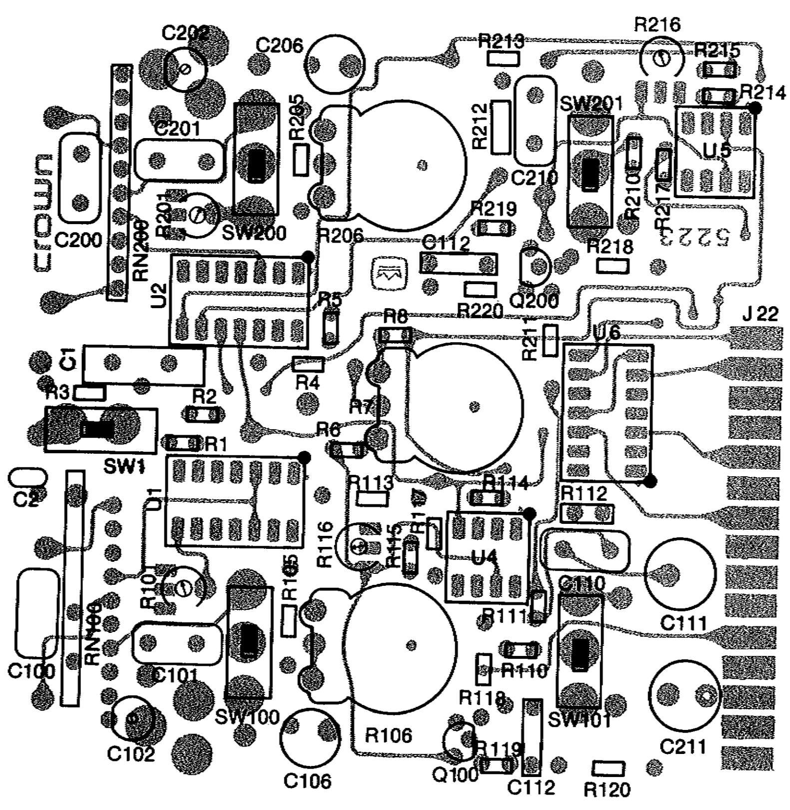


Fig. 9.15 Balanced Input Module

Balanced Input Module Q42189J2

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Resistors				
R13 .	3.9K ohm .25W 5% CF	C 2630-9	1	
R2. R3, R8, R105, R205, R120, R220	10K ohm .25W 5% CF	C 2631-7	7	
R4, R5	470K ohm .25W 5% CF	C 4225-6	2	
R6	13K ohm .25W 5% CF	C 4300-7	1	
R101, R201	200 ohm helipot trim	C 3683-7	2	Low frequency common mode rejection
R106, R206	100K ohm audio	D 5052-2	2	Gain adjust
R110, R210	20K ohm .25W 5% CF	C 5046-5	2	
R111, R211	200K ohm .25W 5% CF	C 3622-5	2	
R112, R212	27K ohm .5W 5% CF	C 1056-8	2	
R113, R213	33K ohm .25W 5% CF	C 4346-0	2	
R114, R214	220 ohm .25W 5% CF	C 5047-3	2	
R115, R215	510K ohm .25W 5% CF	C 4226-4	2	
R116, R216	100K ohm cermet trim pot	C 4843-6	2	Compressor DC Bal
R117, R217	47K ohm .25W 5% CF	C 2880-0	2	
R118, R218	30K ohm .25W 5% CF	C 5270-1	2	
R119, R219	220K ohm .25W 5% CF	C 4219-9	2	
R7	50K ohm linear Pot	D 5051-4	1	Threshold
Resistor Networks				
RN100, RN200	Resistor Network-K	D 4280-0	2	
Capacitors				
C1	.0047mF 200V 5 Polycarb	C 3996-3	1	
C2	4.7mF 25V Tant	C 6076-1	1	
C100, C200	120pF Mica	C 3290-1	2	
C101, C201	100pF Mica	C 3410-5	2	
C102, C202	30pF PC MNT Trimmer	C 5058-0	2	High freq. CMR
C106, C206	4.7mF 63V Vertical	C 4253-8	2	
C110, C210	47pF Mica	C 3409-7	2	
C111, C211	22mF 50V N-P Vertical	C 5311-3	2	
C112, C212	0.1mF 100V Polycarb	C 5198-4	2	
Transistors				
Q100, Q200	PN4250A PNP	C 3786-8	2	
Integrated Circuits				
U1, U2	TL074 Quad Op Amp	C 4696-8	2	
U4, U5	LM3080N Transcon Amp	C 5071-3	2	
U6	LM339N Volt Comparator	C 4345-2	1	

Balanced Input Module M42195-4 (Continued)

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Switches				
SW1	SPST Spring Return	D 5019-1	1	Test tone switch
SW100, SW200, SW101, SW201	SPDT31/64 PC Mount	D 5018-3	4	Hi/Lowpass switch
Miscellaneous				
J24, J25	XLR3-31 Panel F	C 4902-0	2	
	14 Pin DIL IC Socket	C 3450-1	3	Socket for U1, U2, U6
	8 Pin DIL IC Socket	C 3451-9	2	Socket for U4, U5
J22	Amp Mod 1 PC RCPT	C 3846-0	15	
	PSA-2 Shield Board	M43371-0	1	

PSA-2 Filter Board Module M43372-8

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Resistors				
R102, R202	47K ohm .5W 5% CF	C 1058-4	2	
R103, R203	20K ohm .5W 5% CF	C 5057-2	2	
R104, R204	330K ohm .25W 5% CF	C 4222-3	2	
R107, R207, R108, R208, R109, R209	1.2K ohm .5W 5% CF	C 1045-1	6	
Capacitors				
C103, C203, C104, C204, C105, C205	0.047mF 250V 5 Polycarb	C 4404-7	6	
C107, C207	0.012mF 200V Filmatic	C 3219-0	2	
C108, C208	0.033mF 100V Filmatic	C 5063-0	2	
C109, C209	1830pF 63V 2.5 STYR	C 7386-3	2	
Integrated Circuits				
U3	TL074 Quad Op Amp	C 4696-8	1	
Miscellaneous				
	14 Pin DIL IC Socket	C 3450-1	1	Socket for U3
J2	3Ampmod 1 PC RCPT	C 3846-0	12	

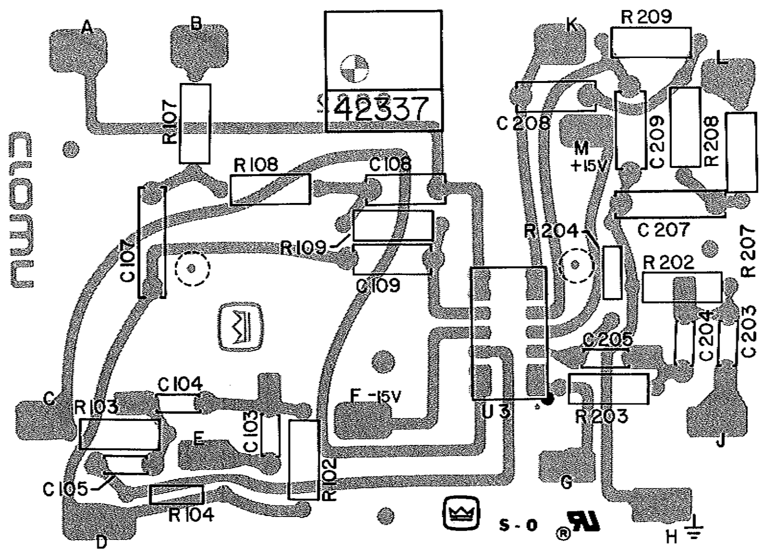


Fig. 9.16 Filter Module

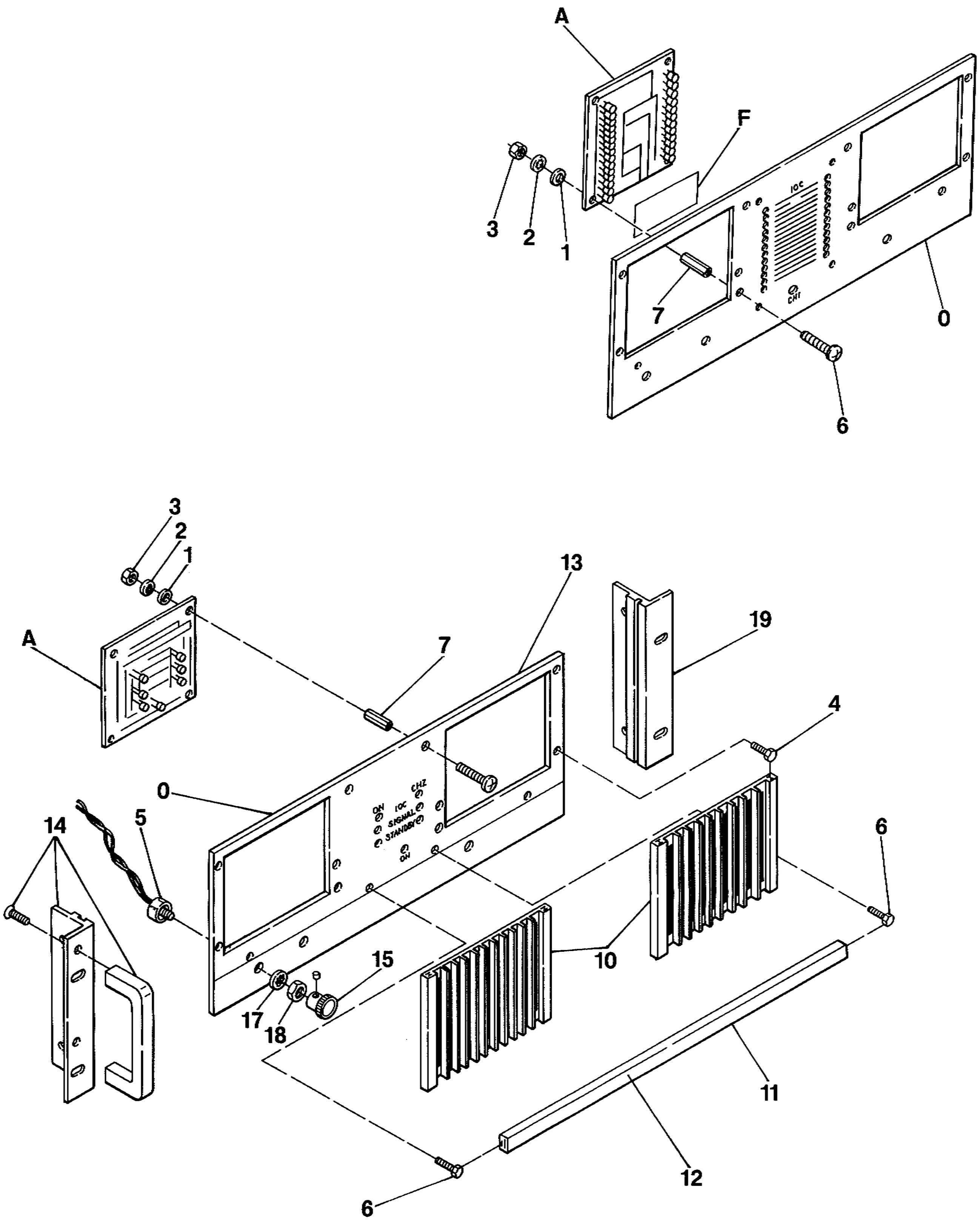


Fig. 9.17 Front Panel Assembly

Front Panel Assembly

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
0	Front Panel	F 9846J0	1	PSA-2X
0	Front Panel	F 9850J2	1	PSA-2DX
1	375x141x031 Fiber Washer	C 1296-0	4	Used with Display Board
2	#6 Internal Star Lockwasher	C-1823-1	12	
3	6-32 Hex Nut	C 1889-2	12	
4	6-32x.50 Machine Screw	C 3917-9	8	
5	Input Level Controls	D 2942A5	2	Input level pots
6	6-32 1.0 Machine Screws	C 4333-8	4	
7	PSA-2X 6-32 Hex Spacer	D 3251-2	4	Used with Display Board
7	PSA2D Brass Spacer	D 5231-2	4	Used with Display Board
10	Vertical Panel Extrusion	D 4265-1	2	
11	Logo Rail Extrusion	D5897-0	1	
12a	Crown Logo Insert,	F10216-4	1	Crown
12b	Amcron Logo Insert	F10640-5	1	Amcron
13	Front Panel Overlay	F10220-6	1	
14	Right Handle Assembly	M43132-6	1	
15	.880 Black Knob	D 4949-0	3	Volume, power knob
16	.375 Star Lockwasher	C 2188-8	4	Used with power, (not shown)
17	.507x.391 Star Lockwasher	C 4822-0	3	Used with power, volume controls
18	.375 Bright Nut	C 1288N7	3	Used with power, volume controls
19	Left Handle Assembly	M43133-4	1	
A	Display board PSA-2DX	M42148A7	1	Optional
	Display board PSA-2X	M42190-1	1	
E	Rotary Power Switch	D 3492-2	1	Power pot; cover C4028-4 (not shown)
F	Adhesive Fishpaper	D 3894-9		

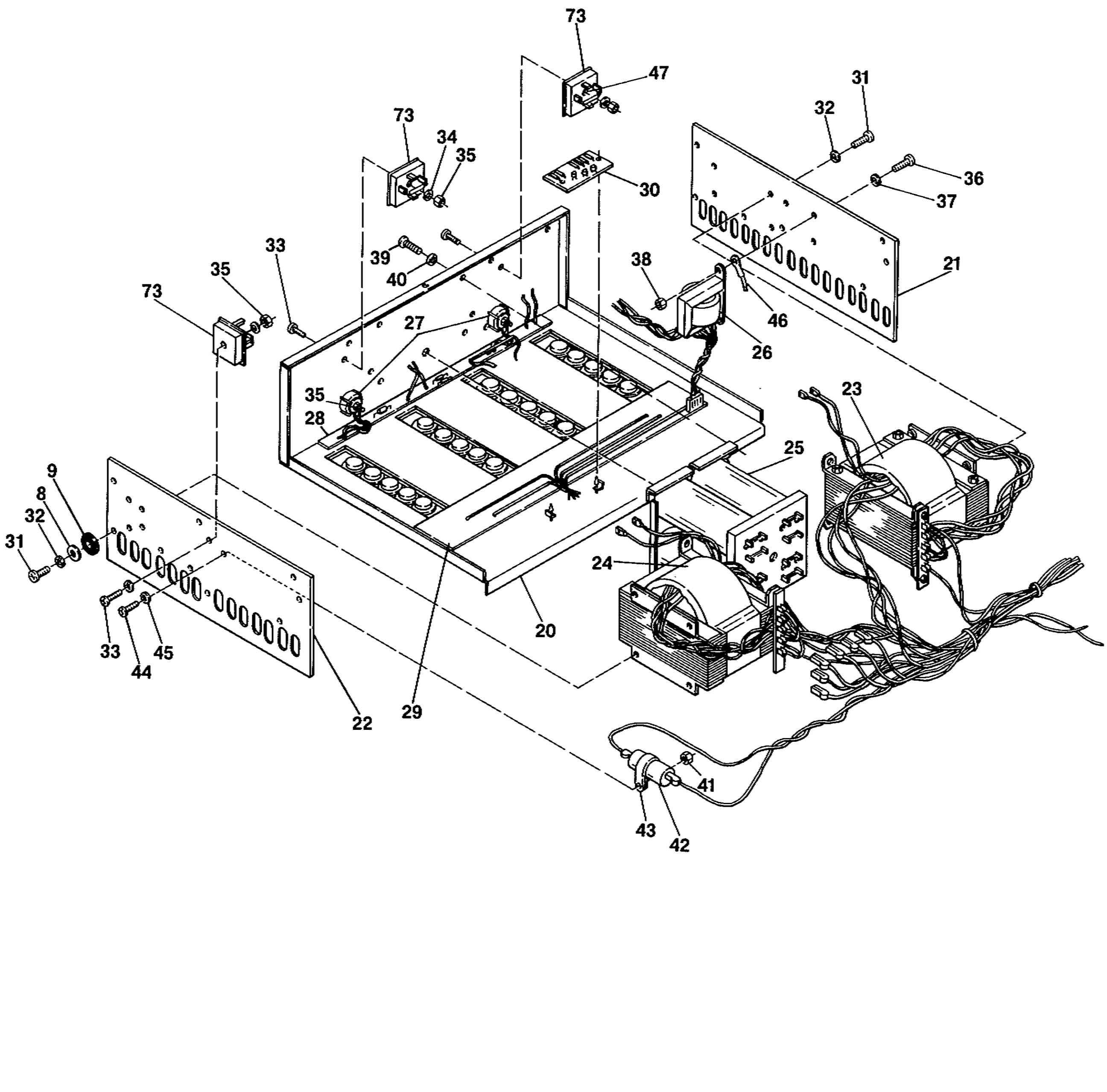


Fig. 9.18 Main Chassis Assembly

Main Chassis Assembly

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
20	Main Chassis PSA-2X	M20119K6	1	
21	PSA-2, Right Side Panel	M20122J3	1	
22	PSA-2, Left Side Panel	M20123J1	1	
23	Right Transformer Assembly		1	See Fig. 9.18
24	Left Transformer Assembly		1	See Fig. 9.18
25	Capacitor Assembly		1	See Fig. 9.19
26	Low Voltage Transformer	D 5037A1	1	
27	Output Coil	M43137-5	2	
28	Output Terminal Board	M43136-7	1	
29	Mother Board	M43149-0	1	
30	Anti-pop Board	Q42168J6	1	Earlier units only
31	R10 32 .62 Machine Screw	C5100-0	12	PSA-2 transformer mounting screws
32	#10 Star Lockwasher	C 2279-5	12	Transformer screw washers
33	T8 32 .75 Machine Screw	C 2270-4	2	Rectifier bridge mount screws
33	SW8 P .75 Screw	C 4330-4	2	Rectifier bridge mount screws
34	#8 Internal Star Lockwasher	C 1951-0	4	Bridge and coil mounting washers
35	8-32 Hex Nut	D 1986-5	4	Bridge and coil mounting nuts
36	R8 32 .37 Machine Screw	C 5099-4	2	LV transformer mounting screws
37	#8 Internal Star Lockwasher	C 1951-0	2	LV transformer mounting washers
38	8-32 Hex Nut	D 1986-5	2	LV transformer mounting nuts
39	R8 32 .37 Machine Screw	C 5099-4	4	Capacitor assembly mounting screws
40	#8 Internal Star Lockwasher	C 1951-0	4	Capacitor assembly mounting washers
41	8-32 Hex Nut	D 1986-5	1	Fan capacitor mounting nut
42	C4 7.5mF 220V rms 60Hz	C 4991-3	1	Fan capacitor
43	1.0 in. clamp	C 5056-4	1	Capacitor clamp
44	SW 8 P .75 Screw	C 4330-4	1	Fan capacitor mounting screw
45	#8 Internal Star Lockwasher	C 1951-0	1	Fan capacitor mounting washer
46	505 Solder Lug #8 Hole	D 2935-1	2	Ground lug
47	C100 0.1mF 200V Filmatic	C 2938-6	2	On bridge rectifier block
73	BRDG-1 Bridge Rectifier	C 4305-6	2	

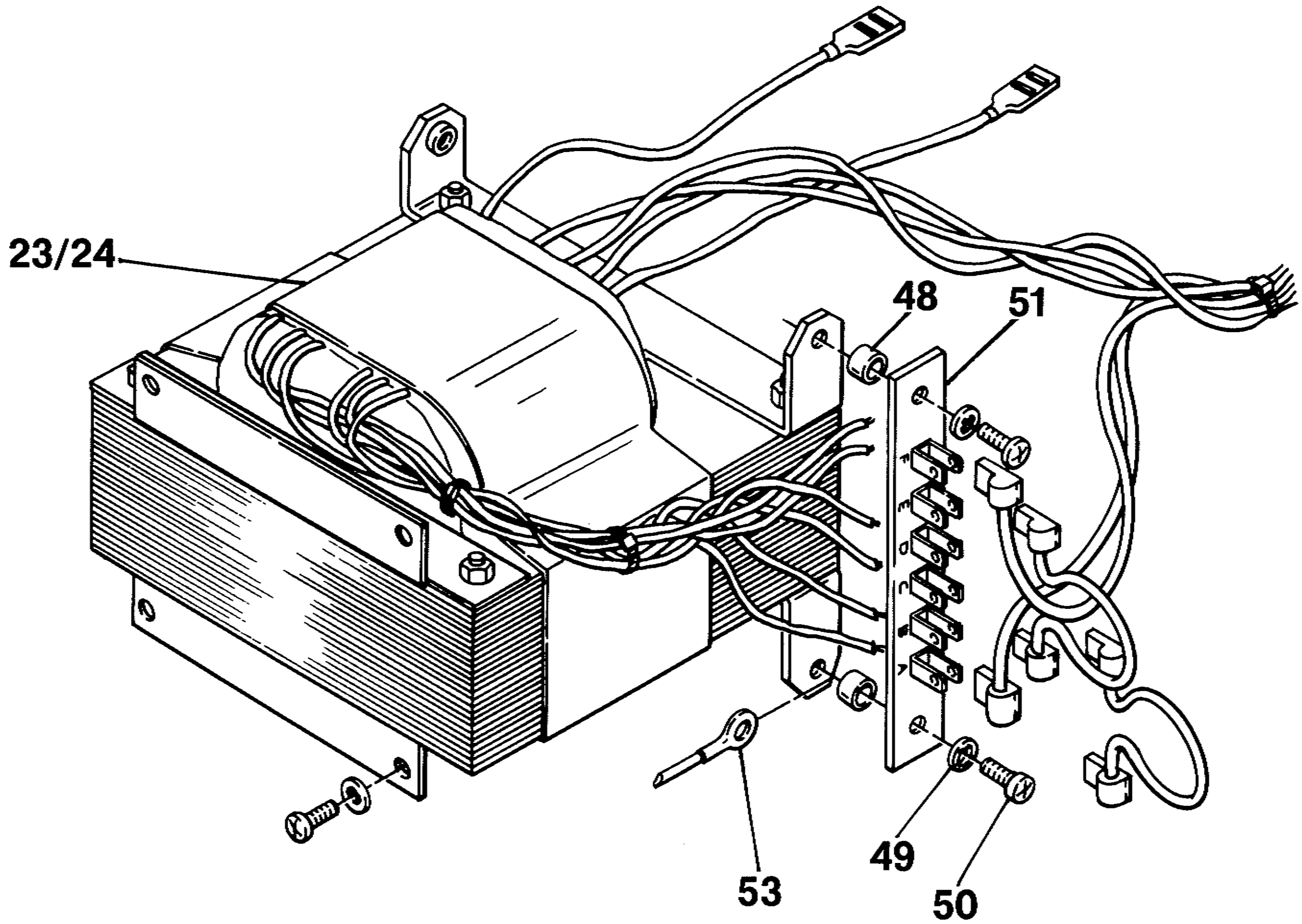


Fig. 9.19 Transformer Assembly

Transformer Assembly

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
(Left Transformer Shown)				
48	375x187x250 Nylon Spacer	C 2762A8	2	
49	#10 Star Lockwasher	C 2279-5	2	
50	R10 32 .62 Machine Screw	C 5100-0	2	
51	6 Post Terminal Board	D 4925-0	1	
23	RightTransformer Assembly	M43146-6	1	Transformer & hardware
24	Left Transformer Assembly	M43148-2	1	Transformer & hardware
	Power Transformer	D 4929-2	1	Left or Right

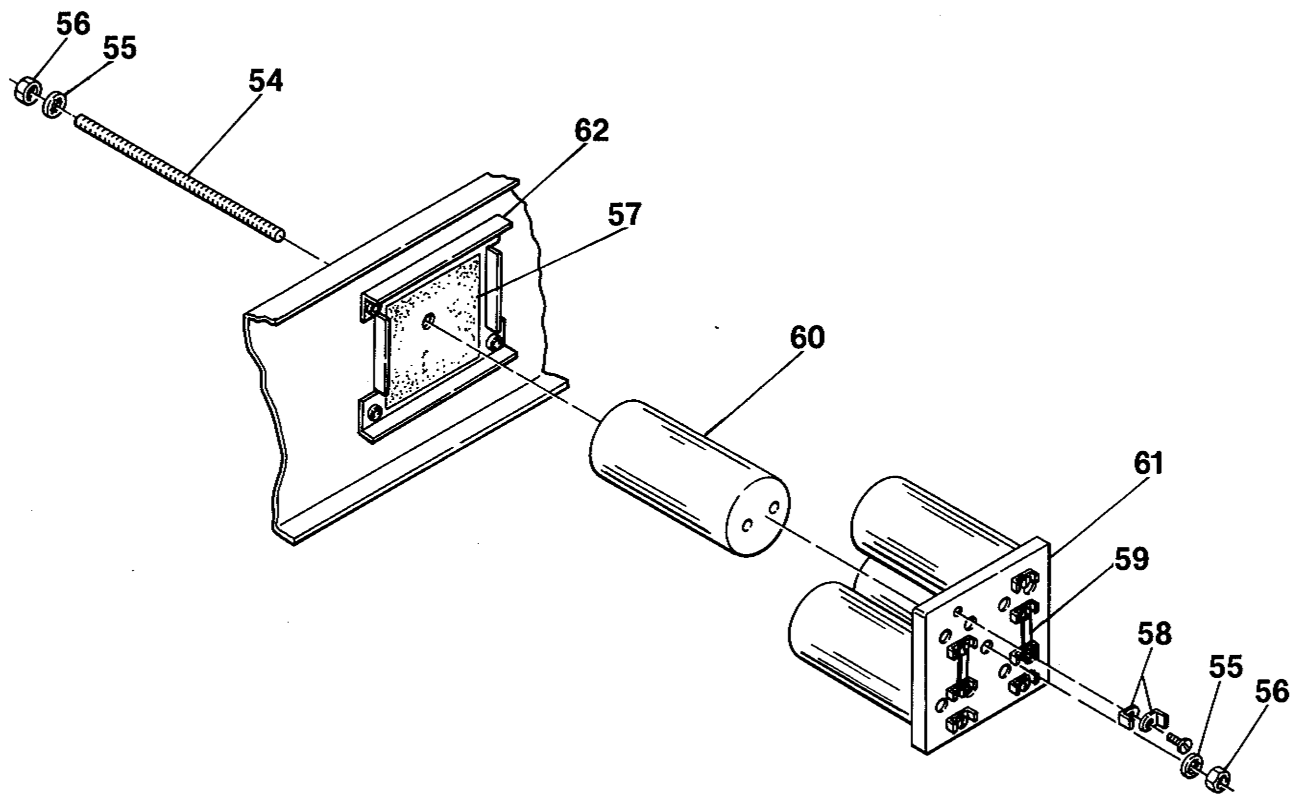


Fig. 9.20 Capacitor Assembly

Power Capacitor Assembly

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
25	Capacitor Assembly	M43771-1	1	
54	8-32x5.75 Rod	C 7337-6	1	
55	#8 Internal Star Lockwasher	C 1951-0	2	
56	8-32 Hex Nut	D 1986-5	2	
57	Polyfoam Capacitor Gasket	D 5133-0	2	
58	389 Solder Lug .218 Hole	D 2934-4	14	
59	1.187 Jumper Lug	D 5587-7	2	
60	C101, C201, C102, C202 10,000 ~~10mF~~ 90V Capacitor and Screws	C 6485-4	4	
61	Mounting Bracket - Lug Side	F11104-1	1	
62	Mounting Bracket - Front Side	M20110-9	1	

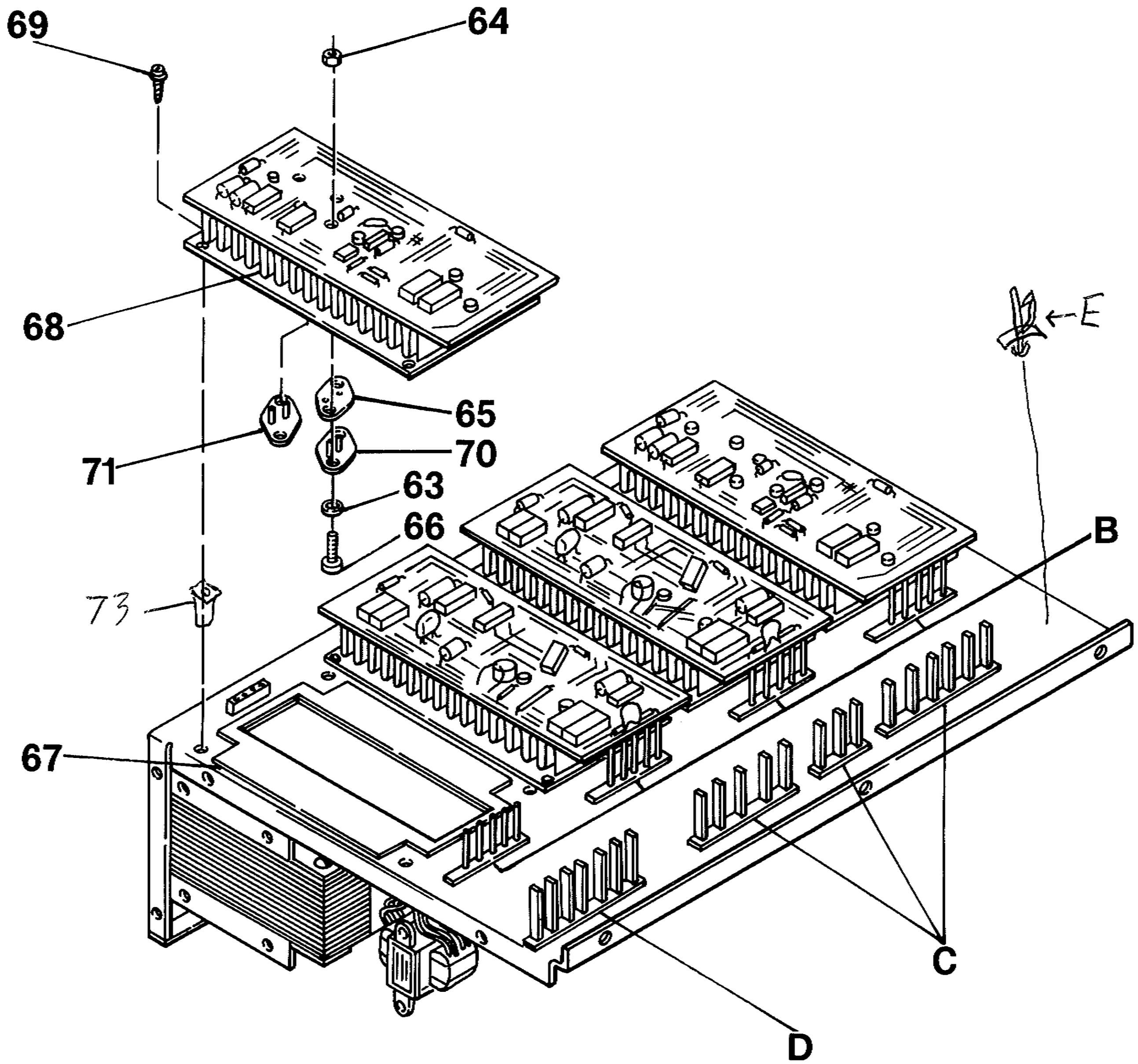


Fig. 9.21 NPN/PNP Output Assembly

NPN/PNP Output Assembly

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
Note: Quantity pertains to all four assemblies combined.				
63	#6 Internal Star Lockwasher	C 1823-1	80	Output device washers
64	6 32 Hex Nut	C 1889-2	40	Output device nuts
65	TO3 Plastic Film Insulator	C 3180-4	4	
66	R6 32x.62 Machine Screw	C 3879-1	40	Output device screws
67	Output Module Insulator	~~C 5064-8~~ D6176-8	1	
68	Cool Pack	M20142-2	4	
69	2u .25 Self-tapping Screw	~~C 5355-0~~ C3958-3	16	Assembly mounting screws
70	Driver Transistor		4	See board layout for CPN
71	Output Transistor		16	See board layout for CPN
72	S 6.32x.25 Machine Screw	C 5454-1	2	PNP assembly only; predriver mounting screw
73	Expansion Nut	C 2543-4	16	
B	Amp Mod 1 8 Pin Header	C 5003-6	4	Older PSA-2X's
C	Amp Mod Snap-in Header	C 5006-9	3	Older PSA-2X's
D	Amp Mod PC Chassis 7 Pin	C 3851-0	3	Older PSA-2X's
E	NYLON PC. EDGE CLIP	C 5054-9	6	

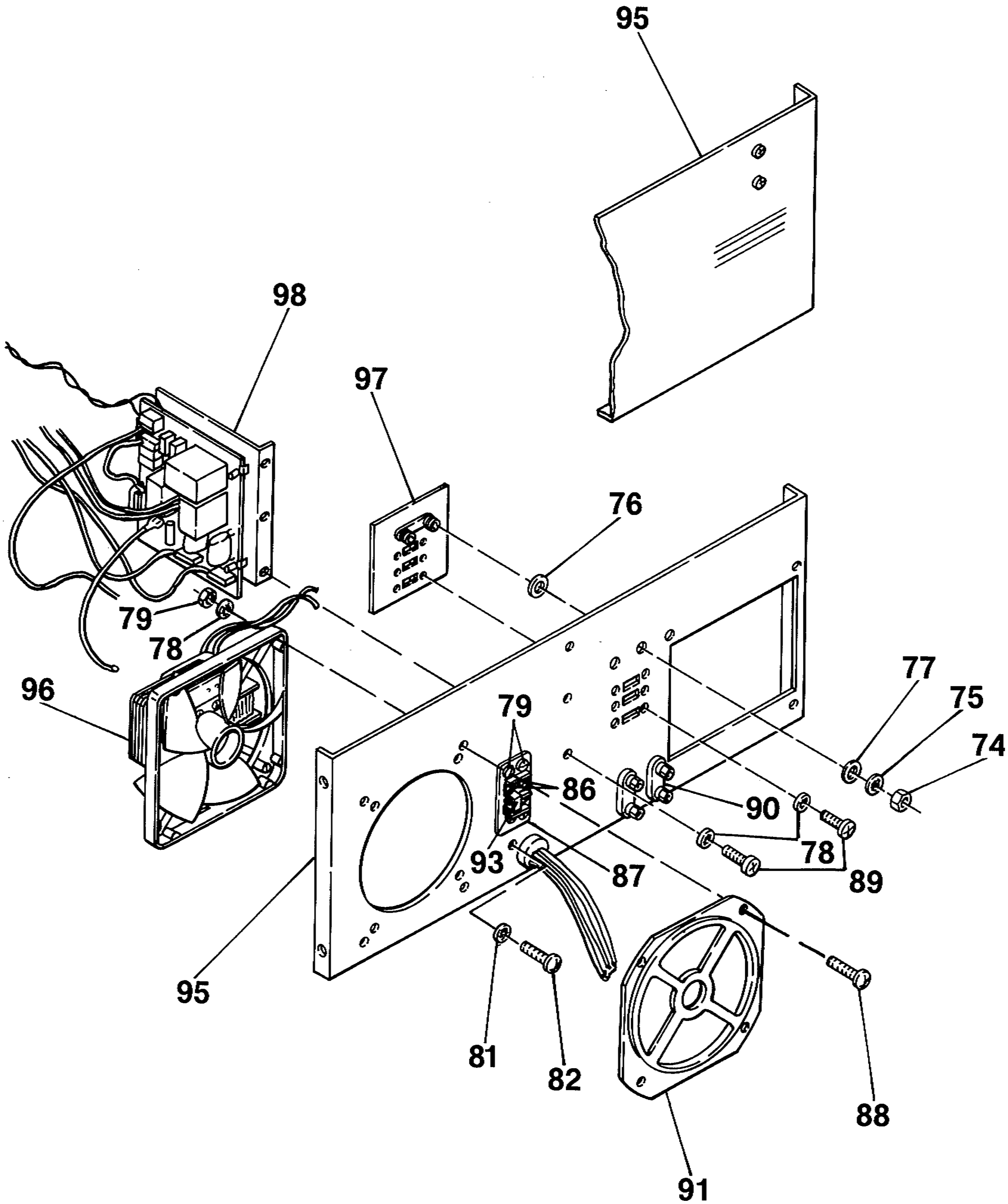


Fig. 9.22 Back Panel Assembly

Back Panel Assembly

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
74	.375 Bright Nut	C 1288-7	2	Used with ~~phone~~ BNC jacks
75	.375 Fiber Shoulder Washer	~~C 1306-7~~ A10099-10	2	Used with ~~phone~~ BNC jacks
76	.625x375x015 Fiber Washer	~~C 1646-6~~ A10101-23	2	Used with ~~phone~~ BNC jacks
77	.625x375x030 Washer	C 2189-6	2	Used with ~~phone~~ BNC jacks
78	#6 Internal Star Lockwasher	C 1823-1	18	Misc. mounting
79	6-32 Hex Nut	C 1889-2	8	Fan; barrier block mounting
	#8 Internal Star Lockwasher	C 1951-0	1	AC ground wire hardware (not shown)
81	#8 External Star Lockwasher	C 2706-7	1	AC ground wire hardware
82	8-32x.37 Machine Screw	C 5099-4	1	Hardware
	8-32 Hex Nut	D 1986-5	1	AC ground wire hardwire (not shown)
	389 Solder Lug .218 Hole	D 2934-4	1	AC ground wire hardware (not shown)
	505 Solder Lug #6 Hole	C 3163-9	1	Ground resistor hardware (not shown)
86	R6 32 .62 Machine Screw	C 3879-1	4	Barrier block hardware
87	2-140Y Barrier Block	C 3489-9	1	
88	6-32x1 Machine Screw	C 2138-3	4	Fan Mounting hardware
89	.37 Self-tapping Screw	C 4329-6	13	Relay board, Input connector board and fan mounting hardware
90	Dual Binding Post	C 2823-0	2	
91	Fan Filter Housing	D 5458-1	1	
92	Fan Filter Foam	D 5459A7	1	
93	Barrier Block Jumper			See # 87
R2	2.7 ohm 1.0W 10% comp	C 1001-4	1	(Not shown)
95	PSA-2 Back Panel	M20146J2	1	
96	Fan Motor and Housing	M20141-4	1	
97	Input Connector Module	Q42173J6	1	
98	Relay Module Assembly	Q42436-8	1	

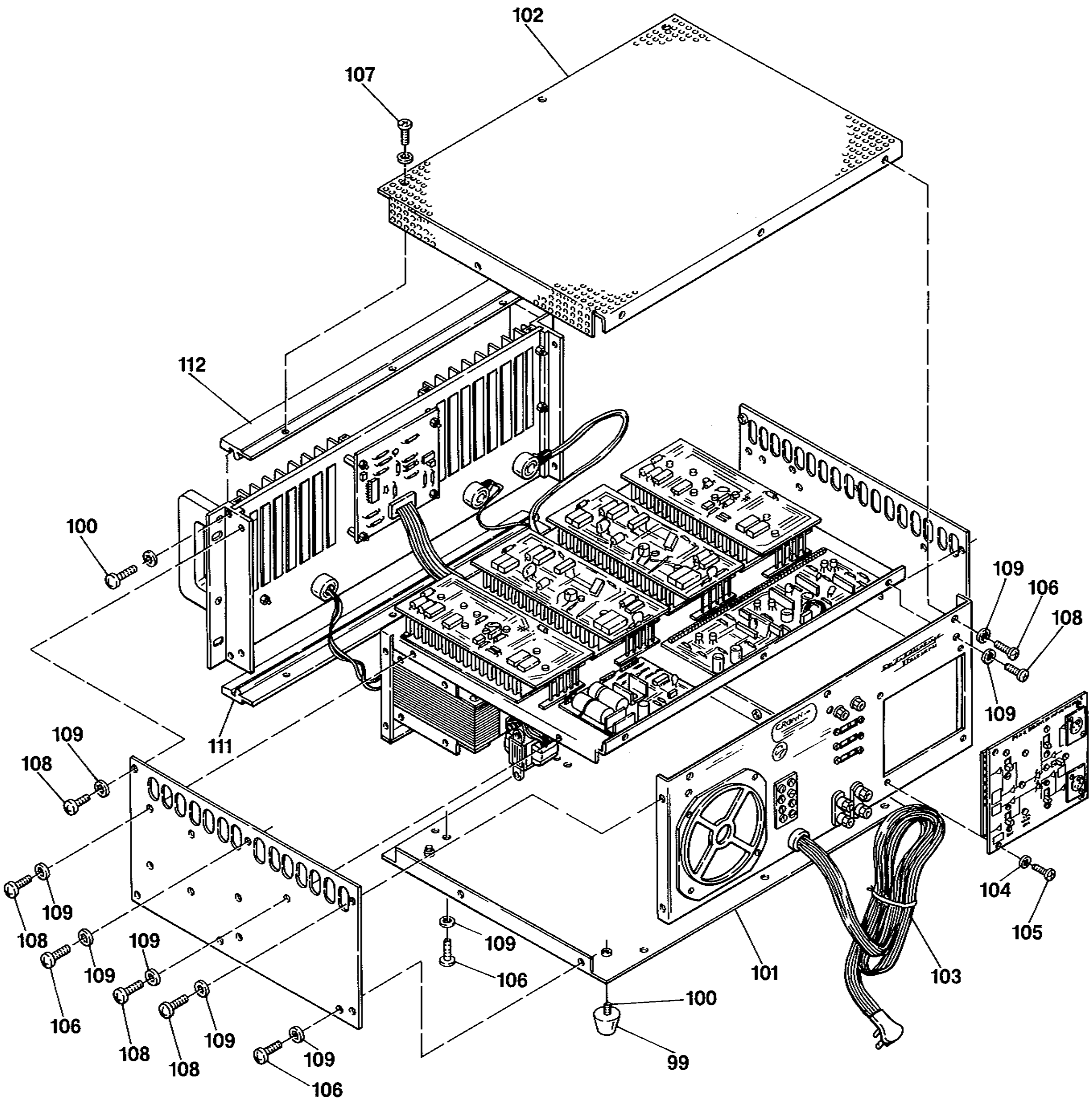


Fig. 9.23 Final Assembly

Final Assembly

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
99	Feet M195 .75 High	C 2945-1	4	
100	SW 8P .75 Screw	C 4330-4	8	Foot screws, rack angle mount screws
101	PSA-2 Bottom Cover	M20124J9	1	
102	PSA-2 Top Cover	M20125J6	1	
103	AC Power Cord	H42171-1	1	
104	#6 Star Lockwashers	C 1823-1	4	Balanced input hardware
105	SW 6 P .37 Screws	C 4329-6	4	Balanced input hardware
106	8 32x.37 #7 Truss Phillips	C 5297-4	15	Topcover;bottom cover screws
107	SW6 P .37 Screws	C 4329-6	6	Coverscrews
108	R8 32 .37 Machine Screw	C 5099-4	15	Side position mounting screws
109	#8 Internal Star Lockwasher	C 1951-0	30	Side mounting washers
111	Bottom Rail Extrusion	F10266J8	1	
112	Top Rail Extrusion	D 4264-4	1	

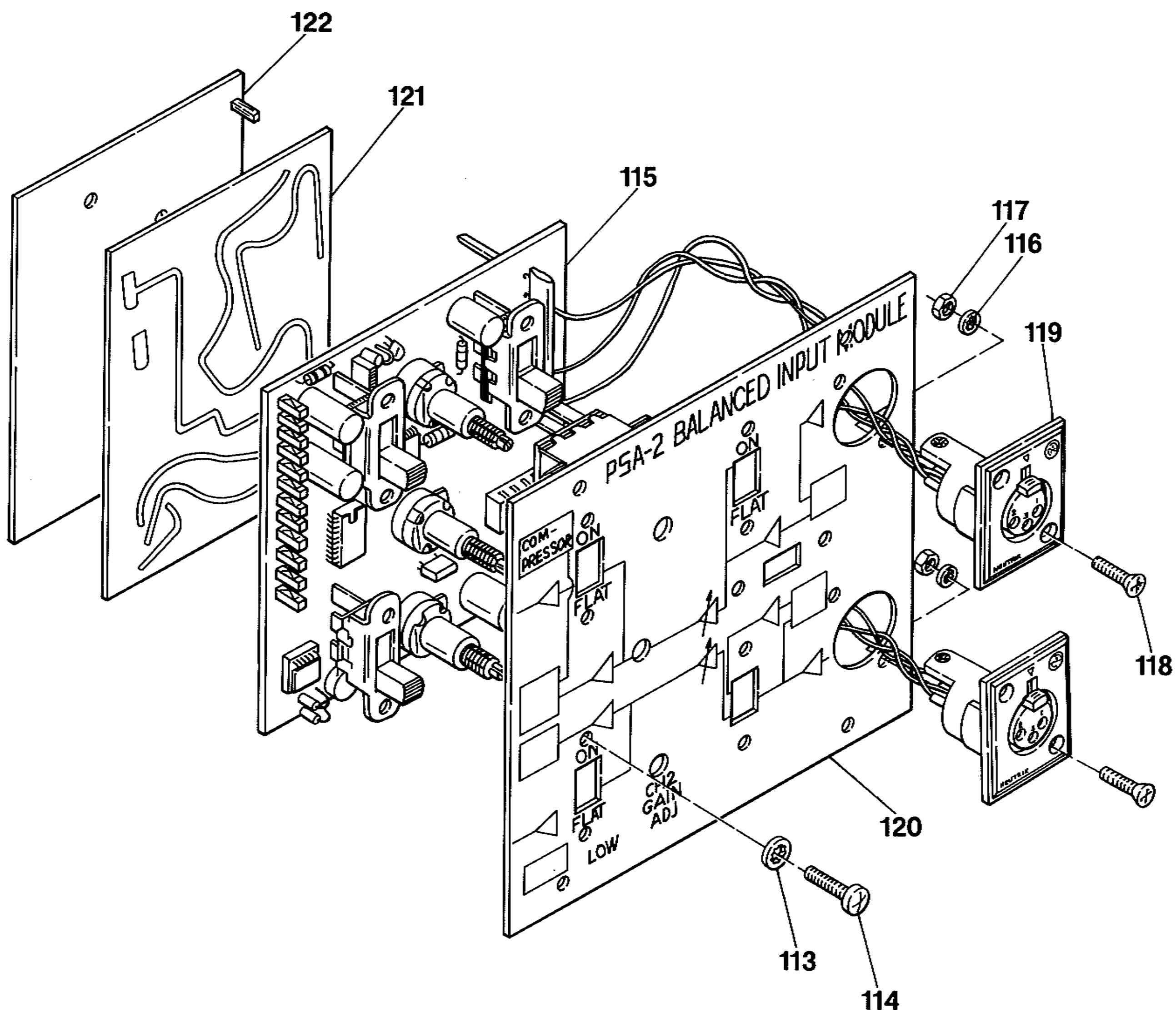


Fig. 9.24 Balanced Input Assembly

Balanced Input Module Assembly

ITEM#	DESCRIPTION	PART#	QUANTITY	NOTES
113	#6 Internal Star Lockwasher	C 1823-1	10	
114	SW 6P .37 B STSCR	C 4329-6	10	
115	Balanced Input Module	M42198-8	1	
116	#4 Internal Star Lockwasher	C 1824-9	4	
117	4-40 Hex Nut	C 1938-7	4	
118	F4 40 .37 AS Machine Screw	C 2247-2	4	
119	XLR-31 Panel Connector	C 4902-0	2	
120	Plate	F 9848K3	1	
121	PSA-2 Filter Assembly	M43372-8	1	
122	PSA-2 Shield Board	M43371-0	1	

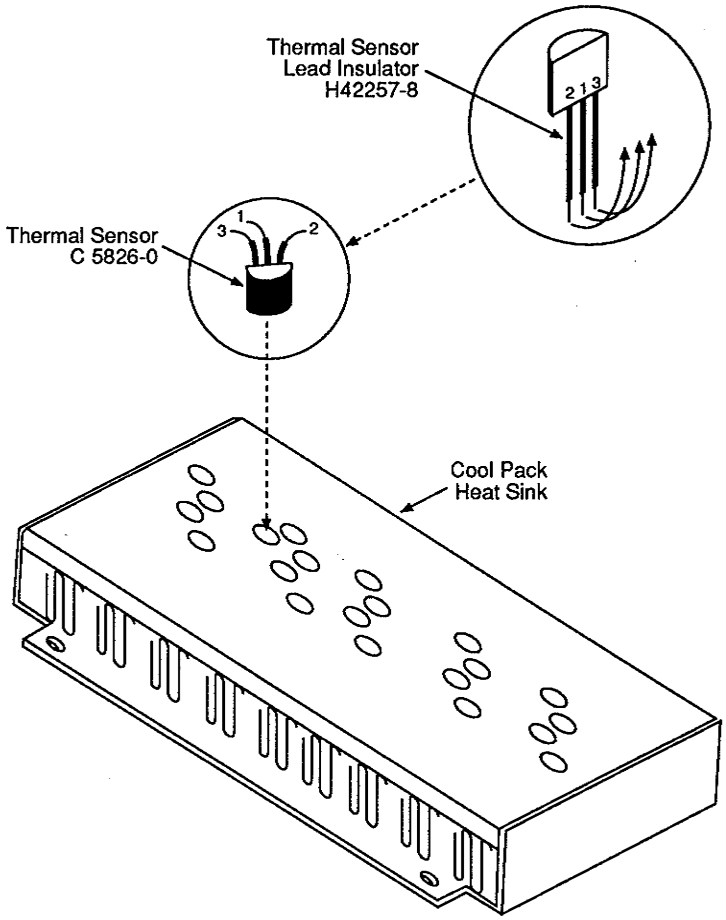
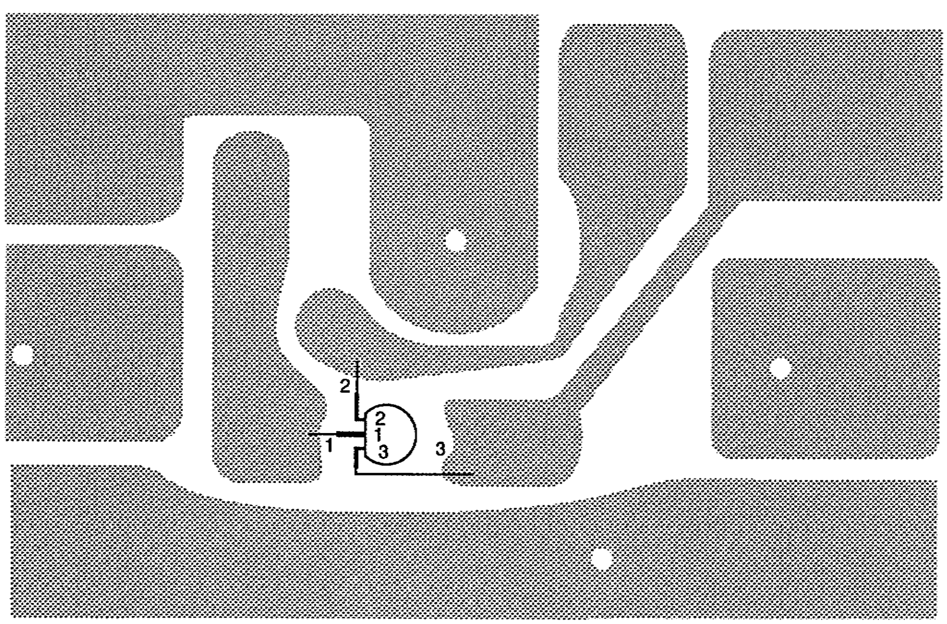


Fig. 9.24 Thermal Sensor Instalation



Appendix A: Installation

Before beginning the installation of your amplifier, please carefully note the following: It is always wise to remove power from the unit and turn the input level controls off while making connections - especially if the load is a loudspeaker system. This will eliminate any chance of loud blasts or damage to the loudspeakers.

A.1 Mounting

The PSA-2 can be mounted into a standard 19 inch wide equipment rack or a custom cabinet of your own design. It occupies 7 inches of vertical rack space.

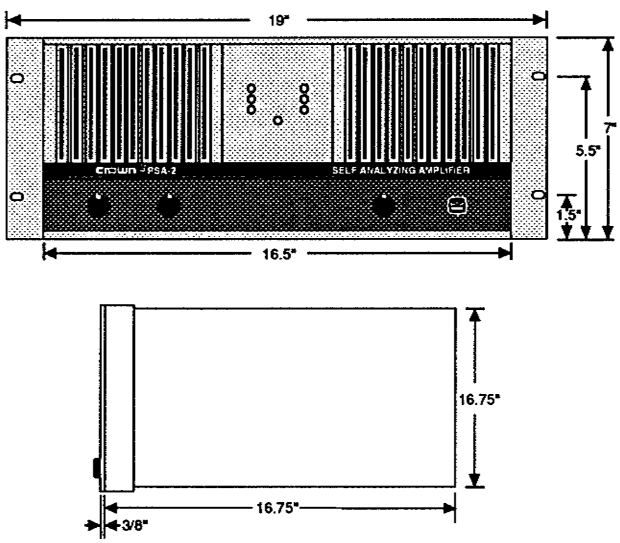


Fig. A.1 PSA-2 Dimensions

A.2 Wiring

The input and output jacks are located on the rear panel. Please use care in making connections, selecting signal sources and controlling the output level. The load you save may be your own! Crown is not liable for any damage done to loads due to careless amplifier usage and deliberate overpowering.

The PSA-2 may be operated in either STEREO (Dual or two-channel) or MONO mode by switching the stereo-mono switch on the rear panel of the amplifier. There are VERY IMPORTANT wiring differences between these two modes which are discussed next.

STEREO

The installation is very intuitive in STEREO mode. The input of Channel 1 feeds the output of the same channel as does the input of Channel 2. To put the amplifier in stereo mode, slide the Stereo-Mono switch at the back of the amplifier downward. Be very careful not to short the two outputs together while in STEREO mode and observe correct loudspeaker polarity. The load impedance should not be less than 4 ohms at either channel.

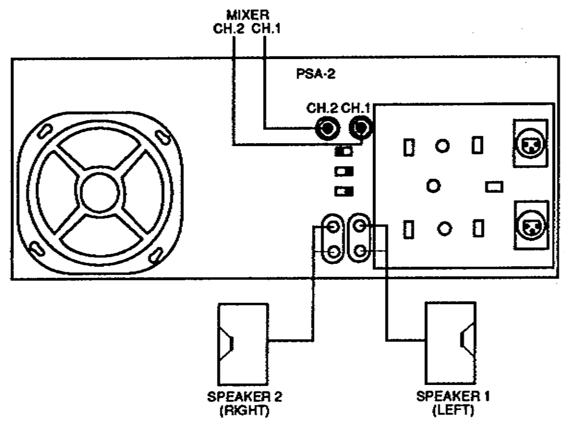


Fig. A.2 Stereo Interconnect

CAUTION: Never parallel the two outputs by directly tying them together or parallel them with the output of any other amplifier. Such connection does not result in increased power output and can possibly cause the unit to fail.

MONO

Installing the amplifier in MONO mode is very different. MONO mode is activated when the Stereo-Mono switch is pushed upward. In this mode only the Channel 1 input should be used. DO NOT USE THE CHANNEL 2

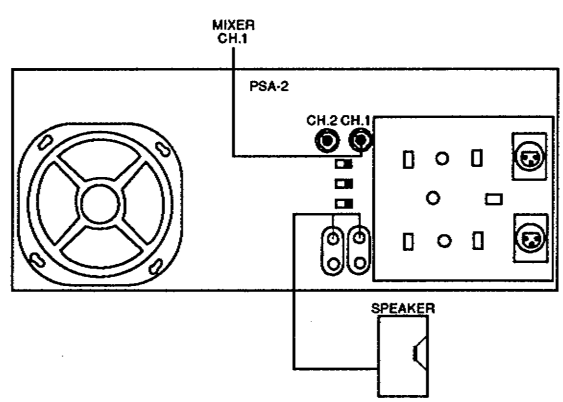


Fig. A.3 MONO Interconnect (#1)

INPUT or signal level. Keep the Level control of Channel 2 turned completely down.

Note: The input jack and Level control of Channel 2 are not defeated in MONO mode. Any signal fed into Channel 2 will beat against the signal in Channel 1.

The output wiring is very different, too. The polarity of the output of Channel 2 is inverted so it can be bridged with the output of Channel 1. The outputs of both channels receive the same signal from the input of Channel 1. This results in two possible mono output configurations (see Figure A.3).

The first and most common configuration connects the positive lead from the loudspeaker to the red post or positive terminal of Channel 1 and the negative lead to the red post or positive terminal of Channel 2 (the inner black posts are not used). This method, called "bridged-mono," produces the single highest-powered output and is the configuration referred to in section 7.2 of the Specifications. The load impedance should not be less than 8 ohms in this mode.

The second configuration connects a loudspeaker to the output of each channel separately. Remember that since the amplifier is in MONO mode, the output of Channel 2 is inverted. To compensate for this, reverse the connections to Channel 2 so that the positive lead from the loudspeaker goes to the black post and the negative lead to the red post. The output of Channel 1 is not

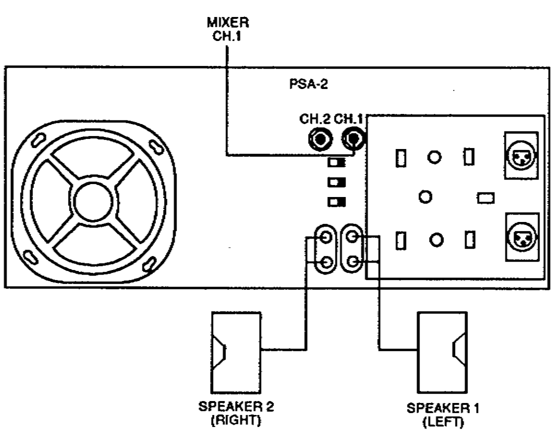


Fig. A.4 MONO Interconnect (#2)

inverted so the loudspeaker connected to it is wired in the normal fashion with its positive lead attaching to the red post (see Figure A.4).

CAUTION: Be certain that all equipment (meters, switches, etc.) connected to the MONO output lines is balanced. Both sides of the line must be totally isolated from the input grounds. If this is not strictly observed, severe oscillation may result.

A.3.2 Input

The unbalanced inputs have a nominal impedance of 25 K ohms and will accept most line-level outputs. The XLR inputs are 20 K ohms balanced and 10K ohms unbalanced (pin 2 is noninverting). There are three precautions to take when connecting to the inputs: 1) Keep undesirable signals off the inputs, 2) Avoid ground loops and 3) Avoid feedback between an output and an input.

Large subsonic (subaudible) frequencies are sometimes present in the input signal and can overload, overheat or otherwise damage loudspeakers. To remove such frequencies (and any unwanted DC that may also be present), place a capacitor in series in the input signal line. The graph in Figure A.5 shows how the value of the capacitor affects the frequency response. Use only a low-leakage paper, mylar or tantalum capacitor.

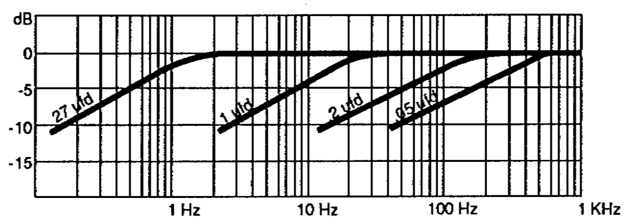


Fig. A.5 Subsonic Filter (6 dB per octave)

If large amounts of ultrasonic or RF (radio frequency) are found on the input, such as bias from tape recorders, etc., place a low-pass filter on the input. While the highest RF levels that can be reasonably expected may not damage the amplifier, they can burn out tweeters or other sensitive

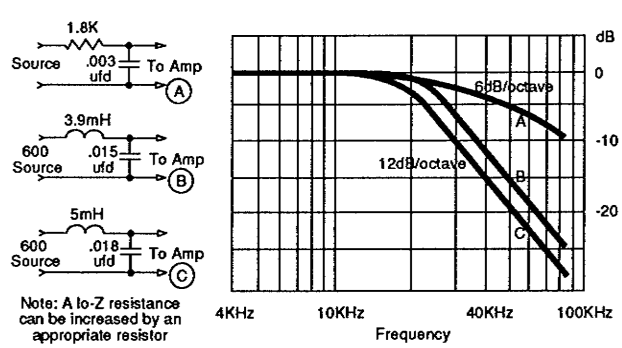


Fig. A.6 Ultrasonic Filter (6 dB per octave) loads, activate the amplifier's protective system or overload the controlled-slewing-rate stage of the amp. (This latter amp stage provides RF overload protection.) The following filters (Figure A.6) are recommended for such situations:

Another problem to prevent is ground loops - undesirable currents flowing in a grounded system, possibly causing hum in the output. A common form of loop is a pair of input cables whose area is subjected to a magnetic hum field. To prevent ground loops causing magnetic induction, lace both cables together along their length, and away from the power transformer. DO NOT CONNECT THE INPUT AND OUTPUT GROUNDS TOGETHER.

Yet another facet of this problem occurs when input and output grounds, tied together as in testing or metering, allow feedback oscillation from load current flowing in the loop. In some systems, even the AC power line may provide this feedback path. Proper grounding, isolation of inputs and common AC-line devices is good practice.

A.3.3 Output

Consider the power handling capacity of your load before connecting it to the amplifier. Crown is not liable for damage incurred at any transducer due to its being overpowered. The use of loudspeaker protection fuses is highly recommended (see Section A.3.4). Please also pay close attention to the Operating Precautions section (Section B.1).

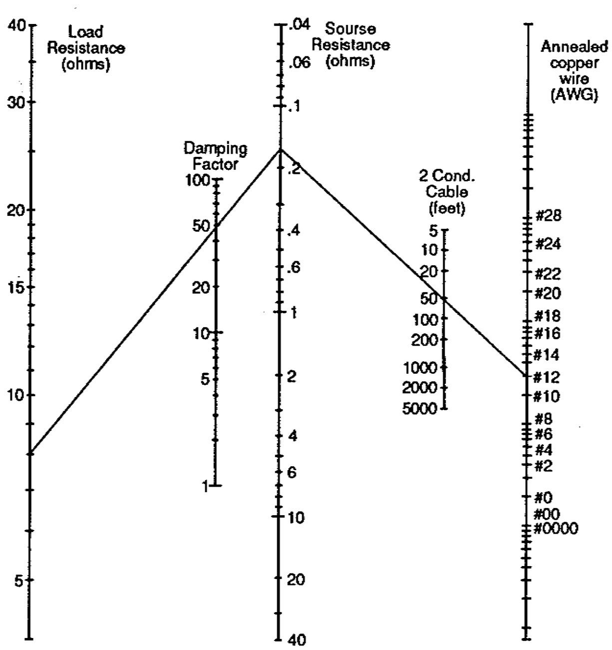


Fig. A.7 Speaker wire Nomograph

Under normal stereo conditions, a load impedance less than two ohms should not be used. Be careful when wiring multiple transducers to a channel. (Two 8-ohm speakers in parallel present an impedance of 4 ohms while the same two speakers in series have a 16 ohm impedance.)

Use speaker cables of sufficient gauge (thickness) for the length used. Otherwise, power is lost through cable heating and the damping factor decreased due to cable resistance. Refer to the nomograph for recommended wire sizes (Figure A.7). If dynamic moving-coil loudspeakers are used, find RL by measuring the resistance of the voice coil with an ohmmeter. If electrostatic loudspeakers are used, use the rated nominal impedance of the manufacturer for R_l.

Use the nomograph as follows:

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 these two points, intersecting the "Source Resistance" line.
4. On the "2-Cond. Cable" line, mark the length of cable run.
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 the pencil line intersects the "Annealed Copper Wire" line. The value is the required gauge of speaker cable.
7. If the size of cable exceeds what you want to use, settle for a lower damping factor and try again or use more than one cable for each line. A "rule of thumb" for the latter choice is: Every time you double the number of conductors (of equal gauge) the resulting apparent gauge is three less. For example, you determine that you need #10 AWG wire but this is too large, so you decide instead to use two #13 AWG wires in place of each #10 wire and achieve the same affect. In this same example you could also substitute four #16 AWG wires.

To prevent high-frequency oscillations:

1. Lace the loudspeaker cables together.
2. Keep the speaker cables well separated from the input cables.
3. Never connect the amplifier's input and output grounds together.
4. As a last resort, install a lowpass filter on the signal input line (see preceding Input section).

TRANSFORMER COUPLING

Loads that are primarily inductive such as 70 V step-up transformers and electrostatic loudspeakers require special attention. To prevent large low-frequency currents from damaging the transformer (and prevent the PSA-2 from unnecessarily activating its protective system) it may be necessary to install a capacitor in series with the load. If you are unsure whether this is necessary, measure the DC resistance across the terminals of each load with an ohmmeter. If the resistance you measure is less than 3 ohms either add the following parts as illustrated in Figure A.8. or add an appropriate high-pass filter (see Figure A.5).

Place an external non-polarized capacitor of 590 to 708 mfd and a 4 ohm power resistor in series with the positive (+) lead as shown below:

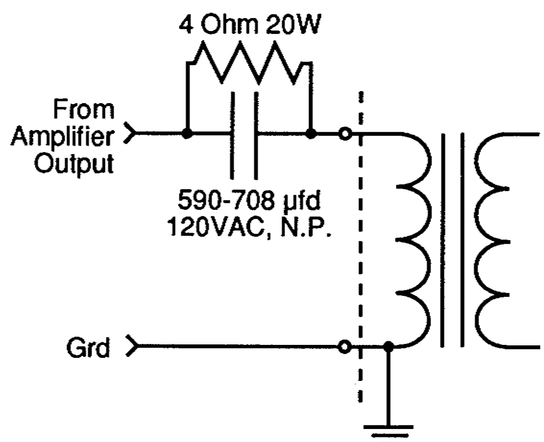


Fig. A.8 Transformer Coupling

A.3.4 Load Protection

We recommend that you protect your loudspeakers (or other sensitive loads) from damage resulting from excessive power. A common way to do this is to put a fuse in series with the load. The fuse may be single, fusing the overall speaker system or it may be multiple, with one fuse on each driver.

Fuses help prevent damage due to prolonged overload, but provide essentially no protection against damage from large transients. To minimize this problem, use high-speed instrument fuses such as the Littlefuse 361000 series. Figure 3.9 is a nomograph showing fuse size versus loudspeaker peak power ratings. If, on the other hand, the loudspeaker is only susceptible to damage caused by overheating, use a fuse or circuit breaker having the same slow thermal response as the loudspeaker itself (such as a slow-blow fuse).

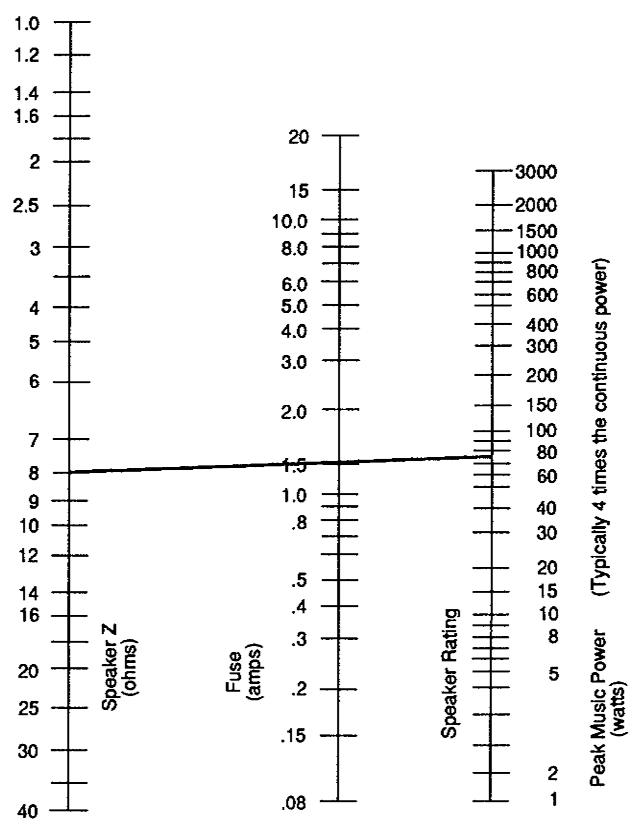


Fig. A.9 Fuse Nomograph

Appendix B: Operation

B.1 Precautions

Although your amplifier is well protected from any external faults, we recommend the following precautions be taken for safe operation:

1. When using input sources of uncertain level or any audio components which have not previously been used with your amplifier, always begin with the level controls at a minimum and gradually increase them while monitoring the audio output level to avoid suddenly blasting the loudspeakers.
2. Always turn the level controls down before inserting a headphone set into the output monitor jack on the front panel. This will eliminate the risk of damaging the headset or your ears with high sound levels.
3. Turn the amplifier off and unplug it from the AC line before replacing the fuse. (The unit must be totally disconnected from the AC power source because the fuse socket is still powered even when the unit is turned off.)
4. Operate the amp with the correct fuse (2 amp for 100 or 120 VAC; 1 amp for 200, 220 or 240 VAC).
5. Never drive a transformer-coupled device (such as an electrostatic loudspeaker) or any other device which appears as a low-frequency short (less than 3 ohms) without a series isolating capacitor. Such operation may damage the load and/or needlessly activate the amplifier's VI limiting.
6. Operate the amplifier from AC mains of not more than 10% above the selected line voltage and only the specified line frequency (50/60 Hz). Failure to comply with these limits will invalidate the warranty.
7. Never connect the output to a power supply output, battery, or power main. Damage incurred by such a hookup is not covered by the warranty.
8. Do not expose the amplifier to corrosive chemicals such as soft drinks, lye, salt water, etc.
9. Do not tamper with the circuitry. Circuit changes made by unauthorized personnel, or unauthorized circuit modifications, will invalidate the warranty.

B.2 Controls

Independent level controls and a power switch and power indicator are located on the front panel. Both level controls are used in STEREO mode, but only the Channel 1 control should be used in MONO mode. They are used to adjust the desired output level (both the monitor output and the main outputs) and have thirty one detents for precise adjustment.

The operation mode is switched between STEREO and MONO by the Stereo-Mono switch located on the back panel. Also located on the back panel is an AC line fuse.

In addition to the above essential controls, your high-performance amplifier has an IOC (Input/Output Comparitor) indicator and a Signal Presence indicator for each channel.

The red IOC LEDs are located on the front panel above the level controls. They will flash or glow whenever the distortion specifications of the amplifier are being exceeded.

Note: The IOC indicators also double as STAND-BY indicators and will glow every time this feature is active (turn-on delay, Low-Frequency Interrupt and temperature overload). It is also normal for them to glow momentarily when the AC power is turned off.

The green Signal Presence LEDs are located on the front panel . They blink or glow any time there is more than 0.6 V RMS at the output of the PSA-2. (If the signal level is very low they may not illuminate.) This provides a convenient method of observing whether or not a signal has been interrupted somewhere in between the input and the output.

B.3 Protection

Crown power amplifiers are widely known for their quality construction, high reliability and extensive internal protection circuitry. The PSA-2 is no exception. It is protected against all the common hazards which plague high-powered amplifiers, including: shorted, open and mismatched loads (load impedance too low); overloaded power supplies; excessive temperature; chain destruction phenomena; input overload damage; and, high frequency overload blowups.

Protection against shorted circuits is provided by a fast-acting limiter circuit which instantaneously limits the output power to a maximum safe stress value. It functions automatically as a current limiter at audio frequencies whose current limiting threshold is dependent on the history of the output signal. Output current causes the threshold to increase. The no-signal threshold is high enough to allow tone bursting without premature limiting, as is found in some recent products of other manufacturers.

A proprietary Crown Self-Analyzing circuit, employs an analog computer in each half of the output stages to respond to instantaneous output device junction thermal conditions. The computers output controls the continuously variable limiting circuitry to provide the appropriate operational limits for all conditions encountered. If the amplifier should heat excessively due to an extremely dirt filled fan filter, the thermal-sensing self-analysing computer will automatically decrease the output signal to a safe operating level.

The input stage is protected against excessive input signal level (overdrive) by a series-limiting resistor.

The amplifier features a controlled slew rate which, coupled with the protection circuits, guards the amplifier from blowups when fed large RF input signals.

B.4 Fuse Replacement

The AC line for 100 or 120 V is fused with a 20 Amp fuse. For 200, 220 or 240 VAC, a 10 Amp fuse is used. The use of any other type or size fuse will invalidate the warranty.

ALWAYS DISCONNECT AC POWER BEFORE REPLACING FUSES.

Appendix C: Options

When any of the following options are purchased, installation instructions are included as part of their packaging.

C.1 Balanced Input Module

Balanced input modules are available for the PSA-2 (Figure C.1 below). Model **PSA-MOD** uses active circuitry to unbalance the inputs. The PSA-MOD connects easily to the fifteen-pin socket on the back panel of the amplifier and provides standard three-pin female XLR connectors for easy wire hook-up.

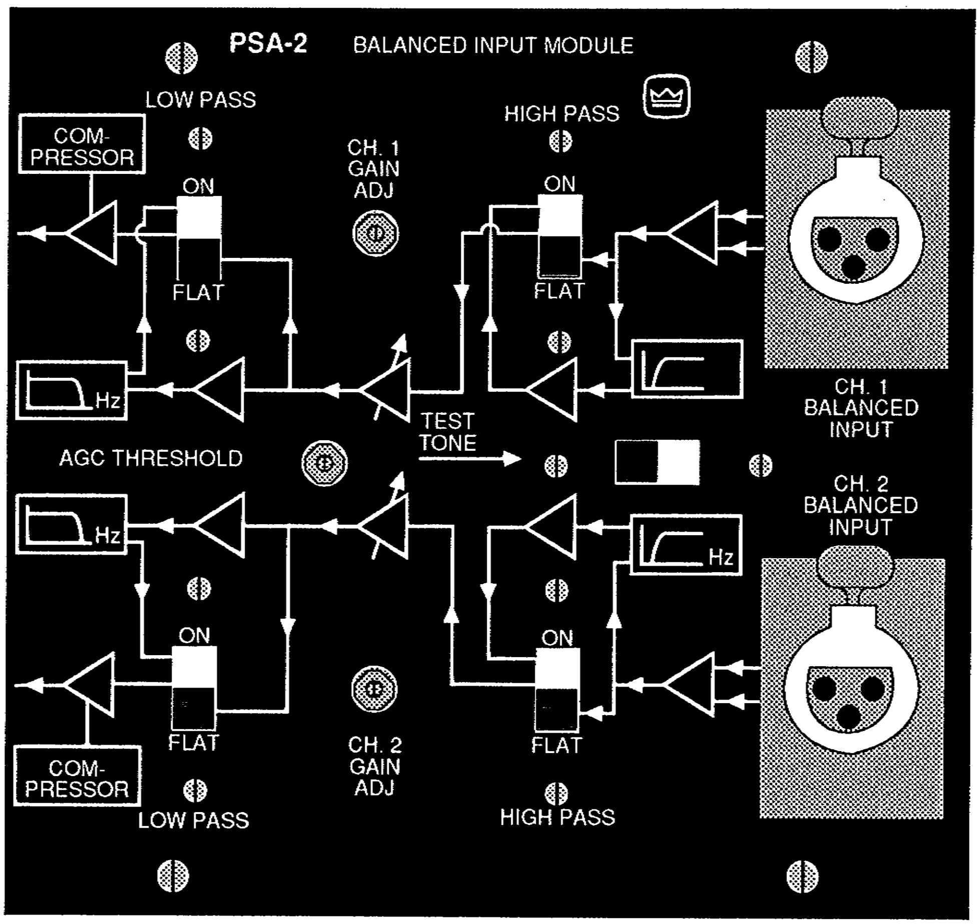


Fig. C.1 PSA-2 Balanced Input Module

C.1.1 HI/LO Pass Filter Frequency Alterations

In order to alter the roll-off frequency of the HI/LO pass filter, it is necessary to change several components located on the Filter Module (within the Balanced Input Module). A portion of the Balanced Input Module filter board layout diagram are duplicated below to aid in familiarity with the component parts referred to in conversion formulas.

Step 1: Remove the Balanced Input Module from the rear of the unit.

Step 2: Remove the shield board by gently crimping together each of the two retaining clips; lift board upward.

Step 3: Remove the filter board by gently crimping together the one retaining clip while simultaneously lifting board upward.

Step 4: Perform the following calculations which will determine the value of C107, C108. C109, C207, C208, C209, R102, R103, R104, R202, R203 and R204.

Component changes for various highpass and lowpass cutoff frequencies:

1. C103, C203, C104,, C204, C105, C205 all equal C*

2. R107, R207, R108, R208, R109, R209 all equal R*

3. R* and C* are chosen according to the following general limitations:

a.) 1K<R*<330K (increasing R* gives increased noise)

b.) R102, R202>2K

c.) R104, R204<1M

4. With valid values of R* and C*, the other resistor and capacitor values are chosen according to the following formulas:

R102, R202= $.7184/(2\pi f_h C^*)$

R103, R203= $.2820/(2\pi f_h C^*)$

R104, R204= $4.941/(2\pi f_h C^*)$

C107, C207= $1.392/(2\pi f_l R^*)$

C108, C208= $3.546/(2\pi f_l R^*)$

C109, C209= $.2024/(2\pi f_l R^*)$

when f_h=highpass cutoff

when f_l=lowpass cutoff

5. For values shown in schematic f_h=50Hz and f_l=15KHz

C.3 70V Transformer

The **UMX-300A** (Figure C.2) is a 70V transformer. By installing it, your PSA-2 can provide 70 or 25 volt output for "constant voltage" distributed system.

Note: One **UMX-300A** is required per channel and each channel may be configured independently of the other. Here are some sample configurations:

Driving two 70-V lines:

Install a **UMX-300A** on each channel and wire each for 70-V operation. The PSA-2X must be configured in STEREO mode and the volume of each channel is independently controlled.

Driving one 70-V and one 25-V line:

Install a **UMX-300A** on each channel as above except wire one **UMX-300A** for 25-V operation. Again, the PSA-2X must be in STEREO mode.

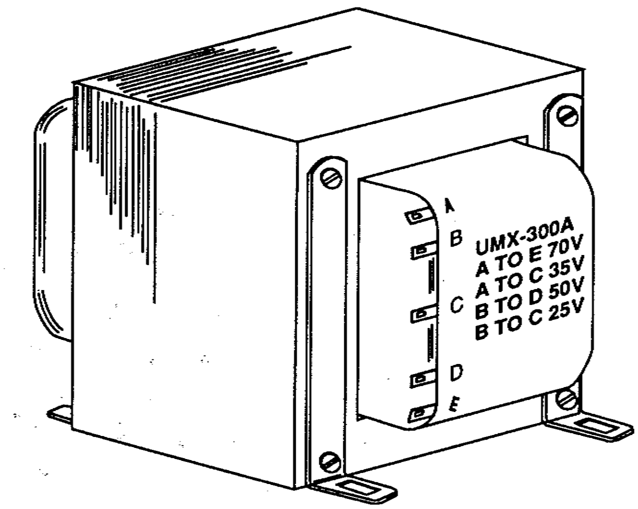


Fig. C.2 UMX-300A 70V Autoformer

Driving one 70-V and one 8-ohm line:

Install a **UMX-300A** on only one channel and wire it for 70-V operation. The PSA-2X must be configured in STEREO mode. The channel with the transformer drives the 70-V line and the channel without a transformer drives the 8-ohm line.

Note: The PSA-2X can be used to directly drive a single 70-V line with no transformer. Simply put it in MONO mode and feed the 70-V line from the bridged-mono output as described in the installation instructions (Section A.3).

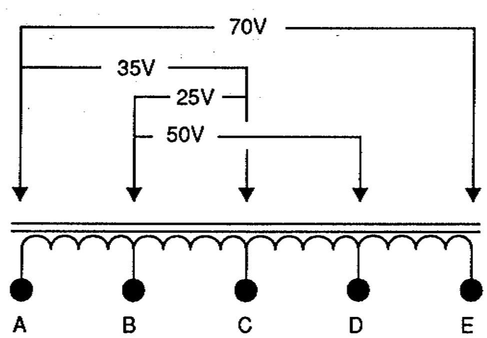


Fig. C.3 UMX-300A wiring diagram

Driving one 70-V and one 25-V line:
Install a **UMX-300A** on each channel as above except wire one **UMX-300A** for 25-V operation. Again, the PSA-2X must be in STEREO mode.

Driving one 70-V and one 8-ohm line:
Install a **UMX-300A** on only one channel and wire it for 70-V operation. The PSA-2X must be configured in STEREO mode. The channel with the transformer drives the 70-V line and the channel without a transformer drives the 8-ohm line.

Note: The PSA-2X can be used to directly drive a single 70-V line with no transformer. Simply put it in MONO mode and feed the 70-V line from the bridged-mono output as described in the installation instructions (Section A.3).

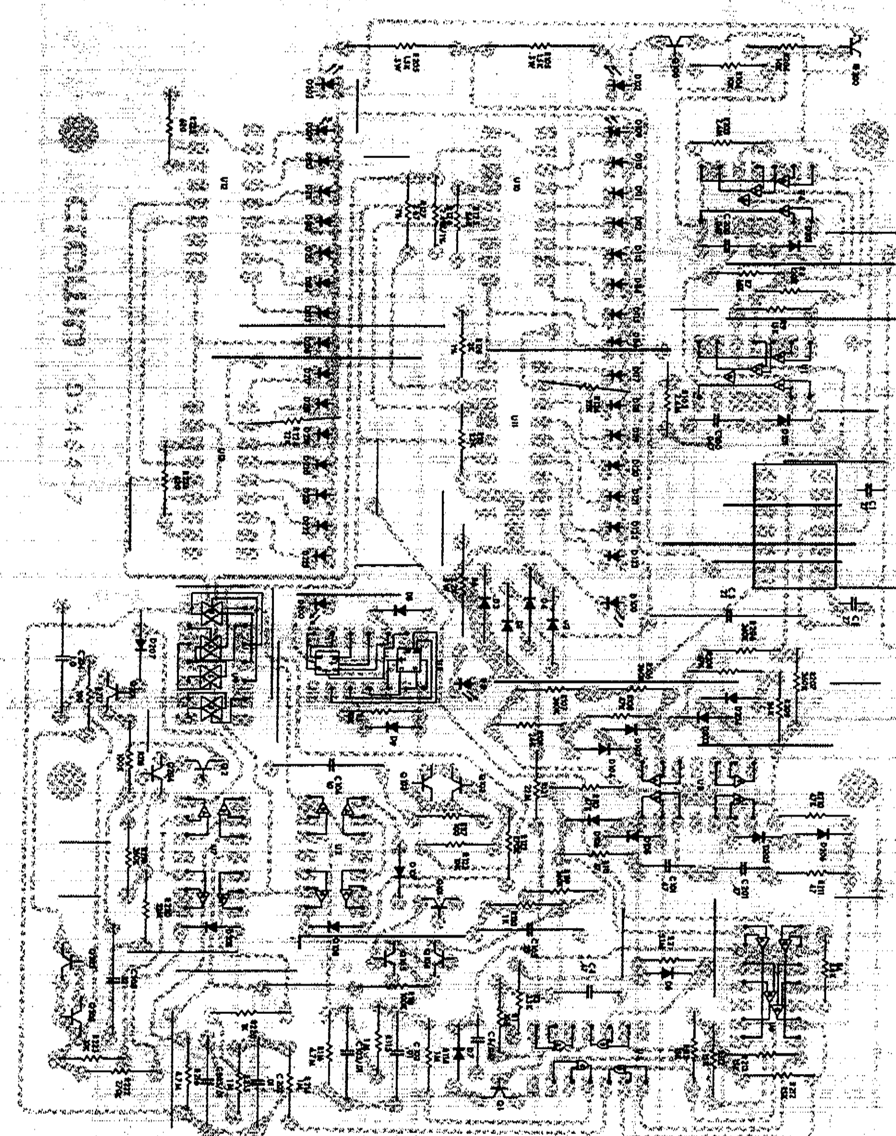


Fig. 6.23 SA2 Display Module Foil Board Layout

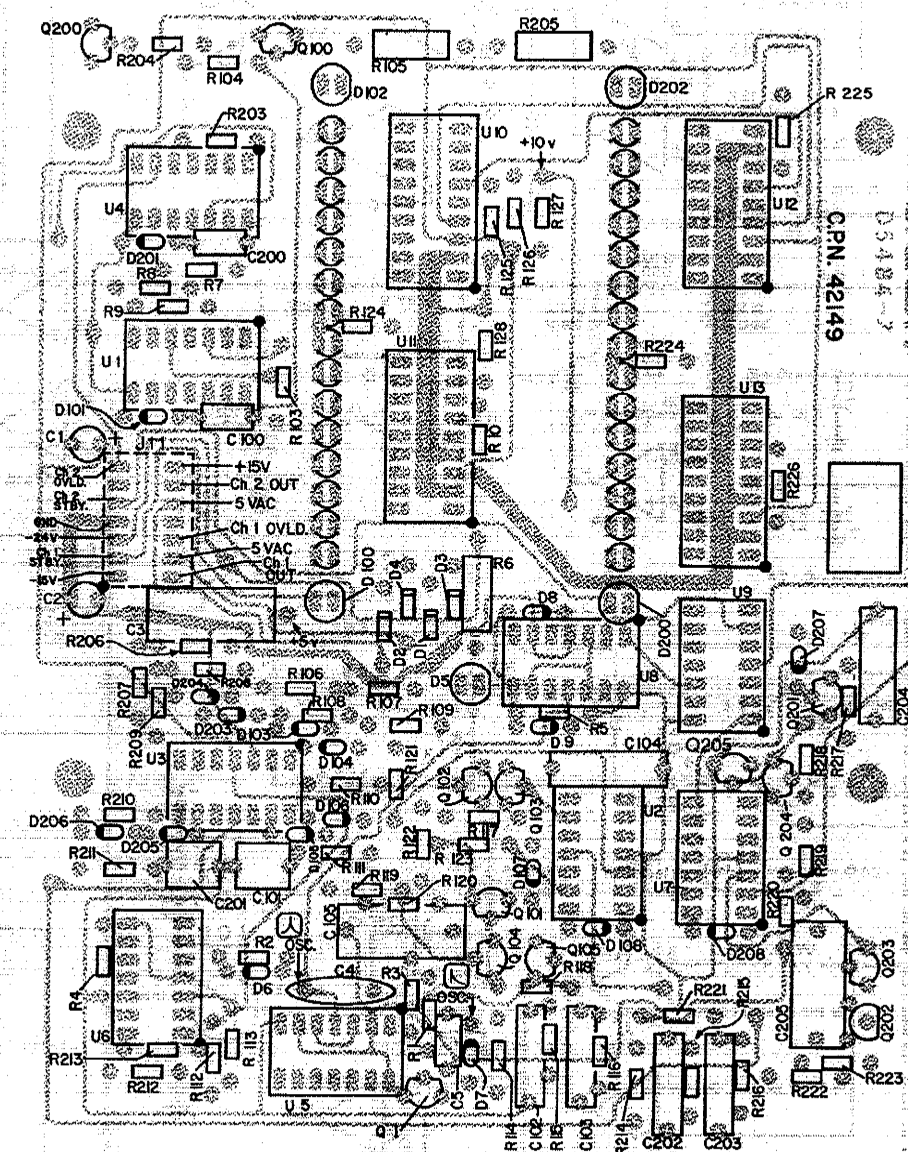


Fig. 6.24 SA2 Display Module Component Board Layout