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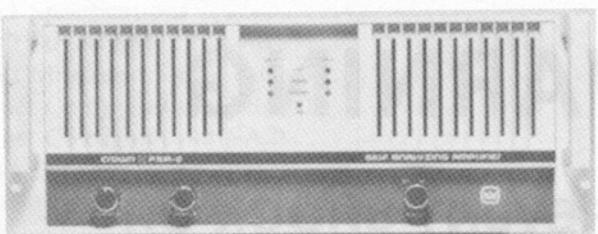
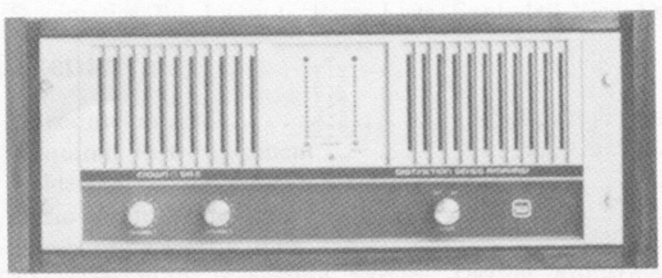
SERVICE MANUAL





PSA-2/SA2
PSA-2D/PSA-2DX/PSA-2X
SELF-ANALYZING AMPLIFIER

K80024-1

12/87

The information furnished in this manual does not include all of the details of design, production, or variations of the equipment. It does not cover all the possible contingencies which may arise during operation, installation, or maintenance. Should special problems arise, or further information be desired, please contact the Crown International Customer Services Department.

Crown International
1718 W. Mishawaka Rd.
Elkhart, Indiana 46514
Ph: (219) 294-5571

WARNING

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

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

REVIEW SECTION

I. Introduction

This manual contains complete service information on the Crown PSA-2/SA2/PSA-2D/PSA-2DX/PSA-2X amplifiers. It is designed to be used in conjunction with the PSA-2/SA2 Instruction Manual. However, some important information is duplicated in this Service Manual in case the Instruction Manuals are not readily available.

NOTE: THE INFORMATION IN THIS MANUAL IS INTENDED FOR USE BY AN EXPERIENCED TECHNICIAN ONLY!

II. 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, IN 46514.

III. PSA-2 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.

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 800W at 250W channel output into 8 ohms.

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 RVW.15).

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 (IOC) indicate amplifier OVERLOAD conditions for that respective channel.
An amber LED POWER indicator driven by low power control supply.

Connectors: Unbalanced Input - ¼" phone jacks.
Output-color coded dual binding posts on standard ¾" centers; spaced ¾" apart for mono (balanced) output connection.
AC Line - Three wire 20A, 120V male connector 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, 14¾″ behind mounting surface. Handles extend 2⅛″ 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.

IV. PSA-2 Stereo Specifications

(Exclusive of Balanced Input Module)

Output Power: 220 watts per channel minimum RMS (both channels operating) into an 8 ohm load, 20Hz-20KHz at a rated RMS sum total harmonic distortion of 0.05% of the fundamental output voltage (tested per FTC specifications). 250 watts ±1dB per channel, 20Hz- 20KHz into 8 ohms with no more than 1.0% THD (EIA Std. SE-101-A).

Output Power (4 ohms): 400 watts ±1dB per channel, 20Hz-20KHz into 4 ohms with no more than 1.0% THD (EIA Std. SE 101-A).

Output Power (2 ohms): 685 watts ± 1dB at 1KHz per channel into 2 ohms with no more than 1.0% THD.

Hum and Noise: 115dB below rated output "A" weighted 110dB below rated output (20Hz-20KHz).

Response: ± 0.1dB 20Hz-20KHz at 1 watt into 8 ohms +0 - 1.5dB DC-80KHz.

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 16, 8, and 4 ohm usage, safe with all loads.

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

Input Sensitivity: 2.1 volts for 220 watts into 8 ohms.

Output Signal: Unbalanced, dual channel.

V. PSA-2 Monaural Specifications

(Exclusive of Balanced Input Module)

Output Power (8 ohms): 800 watts ± 1dB; 20Hz-20KHz into 8 ohms with no more than 1.0% THD (EIA std. SE101-A).

Output Power (16 ohms): 500 watts ± 1dB; 20Hz-20KHz into 16 ohms with no more than 1.0% THD (EIA Std. SE-101-A).

Output Power (4 ohms): 1370 watts ± 1dB at 1KHz into 4 ohms with no more than 1.0% THD.

Frequency Response: ±0.2dB, DC-20KHz at 1 watt into 16 ohms.

Harmonic Distortion: Less than 0.003% from 20Hz to 1KHz and increasing linearly to 0.08% at 20KHz, 500 watts into 16 ohms.
Less than 0.005% from 20Hz to 1KHz and increasingly linearly to 0.12% at 20KHz, 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-400Hz 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.

VI. PSA-2 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 Sec. 7.10 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 RVW.13).

VII. SA2 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.

DC Output Offset: (Shorted input) ±10 millivolts.

Hum and Noise: 115dB below rated output "A" weighted 110dB below rated output (20Hz-20KHz).

Phase Response: +0, -15 degrees DC-20KHz at 1 watt.

Input Impedance: 25K ohms ±30%.

High Voltage Power Supply: Two 800VA tranformers 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; 800W at 220W channel into 8 ohms.

Turn On: May be switch selected for instantaneous or four second delay after applying power. No dangerous transients.

Low Freqency 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 peak at 5Hz into 8 ohms.

Controls: Two position ON/OFF rotary switch. Right and Left Input Level controls. The LOW FREQ PROTECT, DELAY and STEREO/MONO slide switches are located on the rear panel.

Displays: An amber LED indicates power on. A pair of yellow LED's indicate STANDBY mode activated for that respective channel. Two sets of fifteen green LED's form a display ladder that indicate by peak-hold and running peak simultaneously, the amplifier's output level over a 42dB range. A pair of red LED's, IOC (Input Output Comparator), indicate amplifier overload for that respective channel.

Connectors: Unbalanced Input - pin jacks. OutputColor coded dual binding posts on standard ¾" centers; spaced ¾" apart for MONO (Balanced) output connection. AC Line - Three wire 20A, 120V male connector with 5 ft. cable. Ground Selectivity - 2 lug terminal block with removable shorting strap.

Dimensions: 19" standard rack mount (EIA Standard RS-310B) 7" height, 14¾" behind mounting surface. Center of gravity is 5.4" behind front panel. Extends 2⅛" in front of mounting surface with optional handles.

Construction: Aluminum chassis, specially designed "flow-through" ventilation top and side panels.

Heat Sinking: Forced air with high efficiency coolers. A two speed fan with an intake filter (washable) mounted on the rear of the amplifier forces air thru coolers and out both the top and sides of the amplifier.

Weight: 57 pounds (25.8Kg) new weight.

Finish: Satinized aluminum front panel with gray suede Lexan insert and black anodized aluminum chassis and covers.

VIII. SA2 Stereo Specifications

Output Power: 220 watts per channel minimum RMS (both channels operating) into an 8 ohm load, 20Hz-20KHz at a rated RMS sum total harmonic distortion of 0.5% of the fundamental output voltage.
350 watts per channel minimum RMS (both channels

operating) into a 4 ohm load, 20Hz-20KHz at a rated RMS sum total harmonic distortion of 0.08% of the fundamental output voltage.
600 watts per channel minimum RMS (both channels operating) into a 2 ohm load, at 1KHz; rated RMS sum total harmonic distortion of 1.0% of the fundamental output voltage.

Frequency Response: ±0.1dB 20Hz-20KHz at 1 watt into 8 ohms +0 -1.5dB DC-80KHz.

Harmonic Distortion: Less than 0.002% from 20Hz-1KHz and increasing linearly to 0.05% at 20KHz, 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-400Hz into 8 ohms.

Output Impedance: Less than 12 milliohms in series with less than 1.2 microhenries.

Load Impedance: Rated for 16, 8, and 4 ohm usage, safe with all loads.

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

Input Sensitivity: 2.1 volts for 220 watts into 8 ohms.

Output Signal: Unbalanced, dual channel.

IX. SA2 Monaural Specifications

Output Power: 700 watts minimum RMS into an 8 ohm load, 20Hz-20KHz at a rated RMS sum total harmonic distortion of 0.12% of the fundamental output voltage.
440 watts minimum RMS into a 16 ohm load, 20Hz-20KHz at a rated RMS sum total harmonic distortion of 0.08% of the fundamental output voltage.
1200 watts at 1KHz into a 4 ohm load, at a rated sum total harmonic distortion of 1.0% of the fundamental output voltage.

Frequency Response: ±0.2dB, DC-20KHz at 1 watt into 16 ohms.

Harmonic Distortion: Less than 0.003% from 20Hz to 1KHz and increasing linearly to 0.08% at 20KHz, 440 watts into 16 ohms.
Less than 0.005% from 20Hz to 1KHz and increasingly linearly to 0.12% at 20KHz, 700 watts into 8 ohms.

IM Distortion: Less than 0.015% from 0.25 watts to 440 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-400Hz 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.

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

Input Sensitivity: 2.1 volts for 440 watts into 16 ohms.

Output Signal: Balanced, single channel. Channel 1 controls are active; Channel 2 inactive but not removed from operation.

X. Panel Configuration

A. IOC INDICATORS
B. SIGNAL PRESENCE INDICATORS
C. INPUT LEVEL CONTROLS
D. STANDBY INDICATORS
E. ON/OFF INDICATOR
F. POWER CONTROL

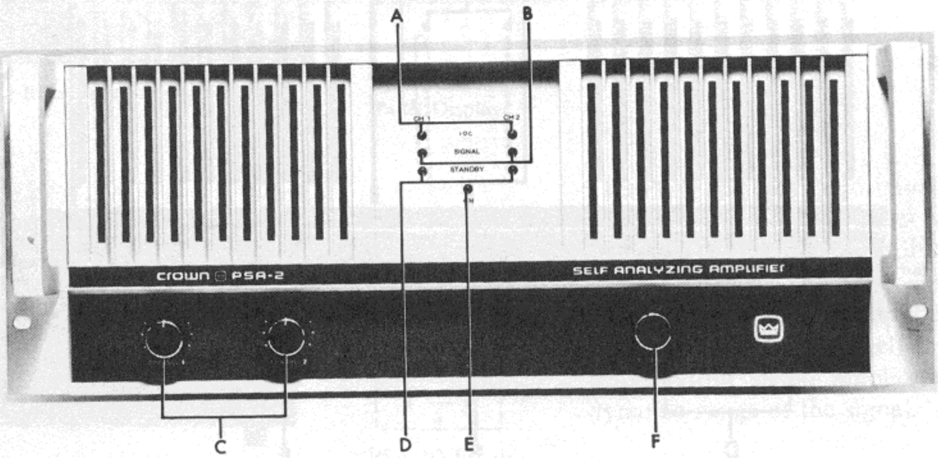
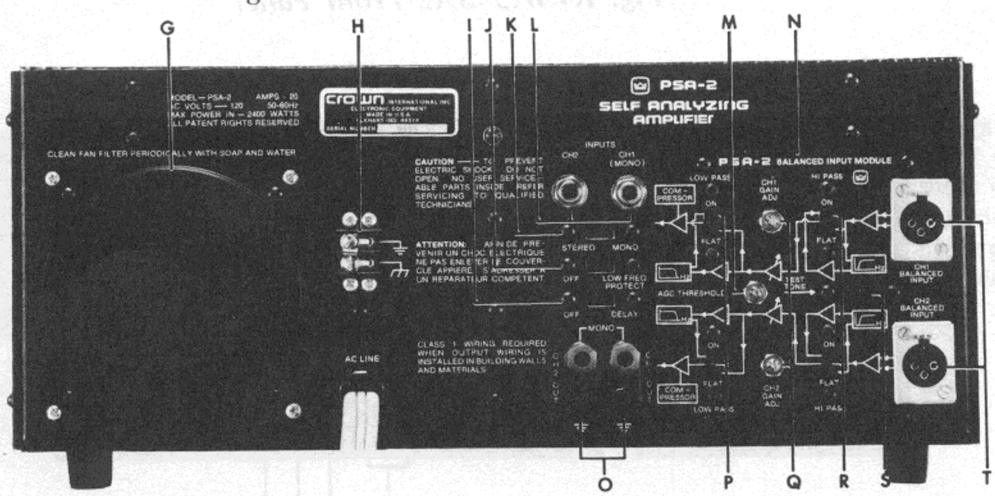


Fig. RVW.1 PSA-2 Front Panel



G. FAN FILTER COVER
H. GROUND TERMINAL STRIP
I. DELAY SWITCH
J. LOW FREQ. PROTECT SWITCH
K. STEREO/MONO SWITCH
L. UNBALANCED INPUT JACKS
M. AGC THRESHOLD CONTROL
N. BALANCED INPUT MODULE
O. OUTPUT BANANA JACKS
P. LOW PASS FILTER SWITCHES
Q. GAIN ADJUST CONTROLS
R. HIGH PASS FILTER SWITCHES
S. TEST TONE GENERATOR SWITCH
T. BALANCED XLR INPUT JACKS

Fig. RVW.2 PSA-2 Back Panel

A. STANDBY INDICATORS
B. IOC INDICATORS
C. LED LADDER DISPLAY
D. INPUT LEVEL CONTROLS
E. ON/OFF INDICATOR
F. POWER CONTROL

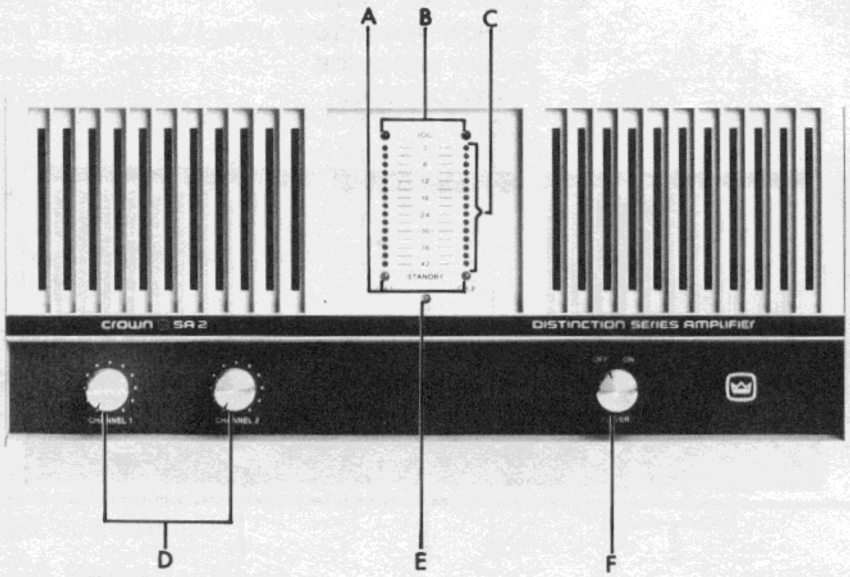
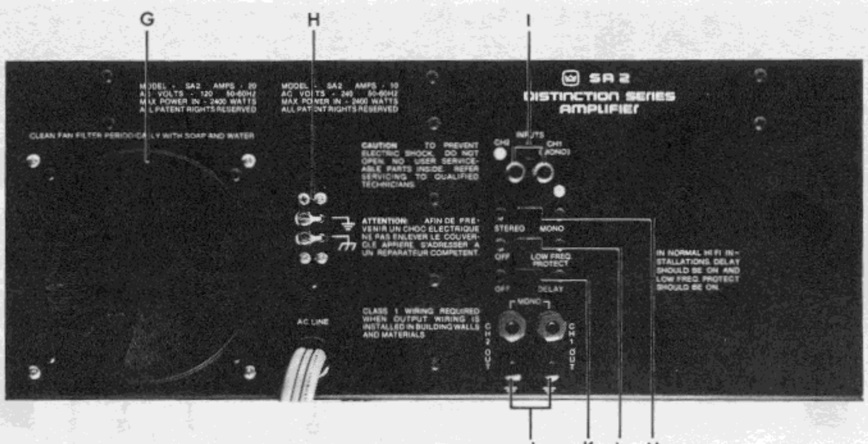


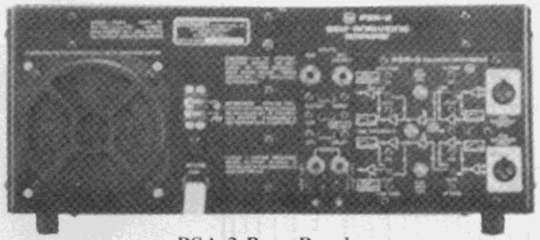
Fig. RVW.3 SA2 Front Panel



G. FAN FILTER
H. GROUND TERMINAL STRIP
I. UNBALANCED INPUT PIN JACKS
J. OUTPUT BANANA JACKS
K. DELAY SWITCH
L. LOW FREQUENCY PROTECT SWITCH
M. STEREO/MONO SWITCH

Fig. RVW.4 Back Panel

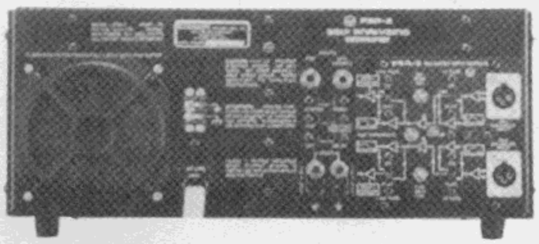
PSA-2 AVAILABLE FORMATS



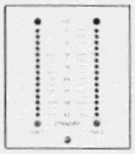
PSA-2 Rear Panel

PSA-2 Front Panel Display

The PSA-2 is the forerunner for each of the other PSA models. Its straight-forward front panel as well as its standard feature-laden input module, make it the most widely accepted version in the PSA family.

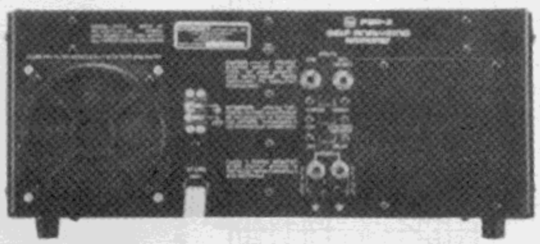


PSA-2D Rear Panel

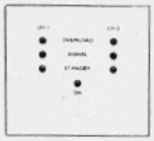


PSA-2D Front Panel Display

The PSA-2D, like the original PSA-2, incorporates the balanced input module which provides many professional features. In addition, the standard display is replaced with the "Dynamic Range Indicator" offered on the Crown SA2 power amplifier. This display consists of fifteen LED's (per channel) that indicate the amplifier's peak output signal amplitude as well as the overall dynamic range of the signal.

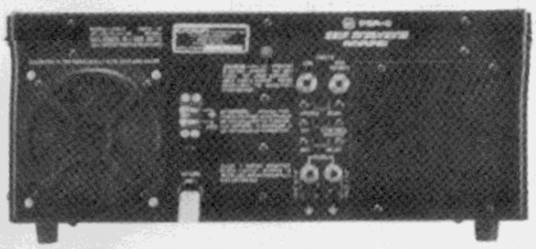


PSA-2X Rear Panel

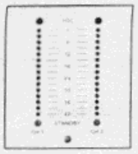


PSA-2X Front Panel Display

The PSA-2X provides the same high quality performance and display as the PSA-2, but does not include the balanced input module for those who do not require its features or for those who wish to design an input module of their own. This model will accept the standard PSA-2 balanced input module (PSA-2MOD) if so desired.



PSA-2DX Rear Panel



PSA-2DX Front Panel Display

The PSA-2DX features the sophisticated "Dynamic Range Indicator" display as used on the Crown SA2 amplifier, but excludes the balanced input module. As with the PSA-2X, the PSA-2MOD may be added later.

Fig. RVW.5 PSA-2 Available Formats

XI. Performance Graphs

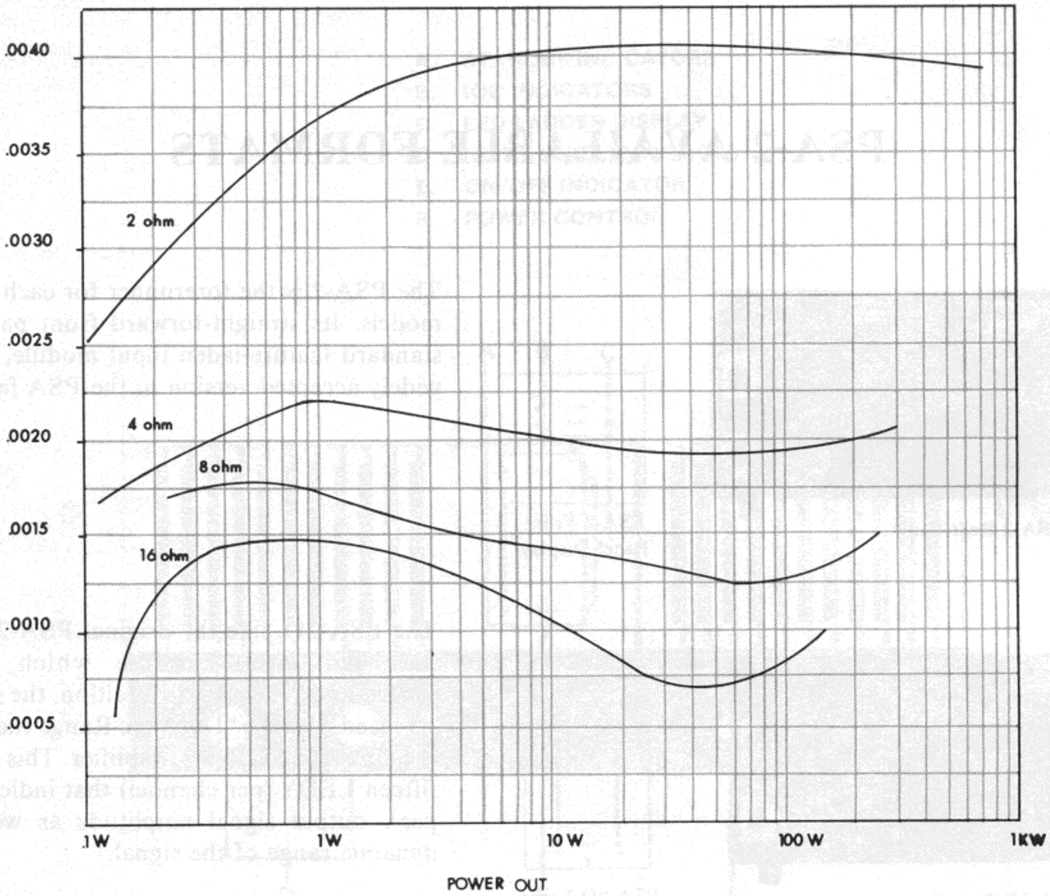


Fig. RVW.6 Typical IM Distortion

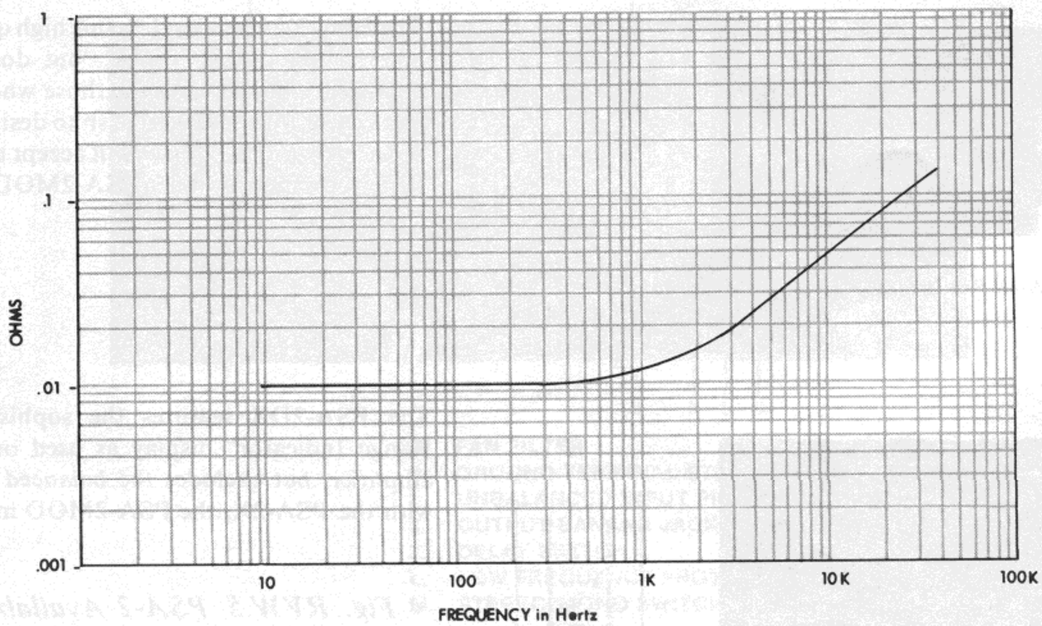
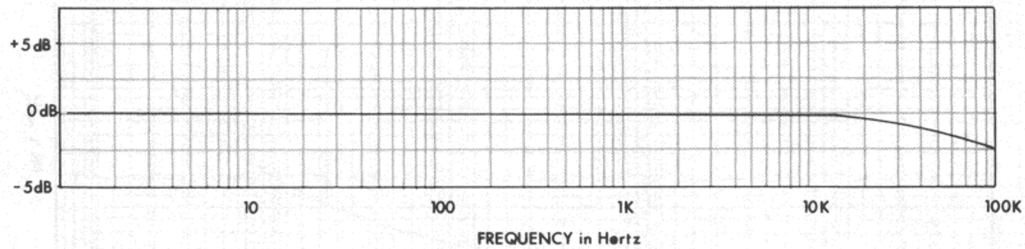


Fig. RVW.7 Typical Output Impedance



ONE WATT INTO AN EIGHT OHM LOAD

Fig. RVW.8 Typical Frequency Response

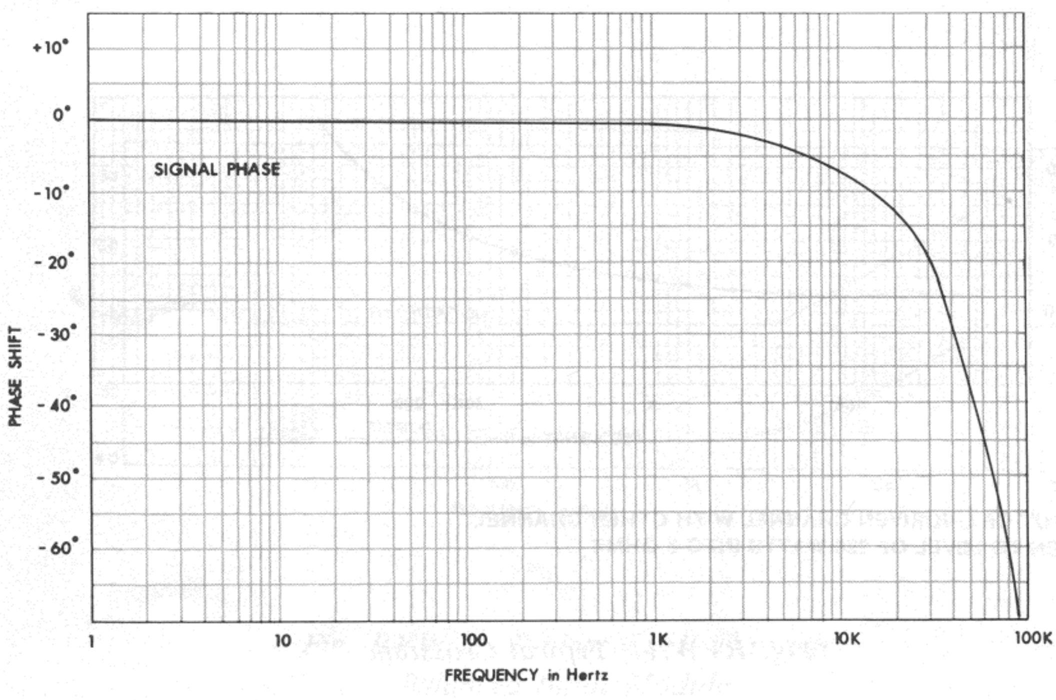


Fig. RVW.9 Output Phase Response

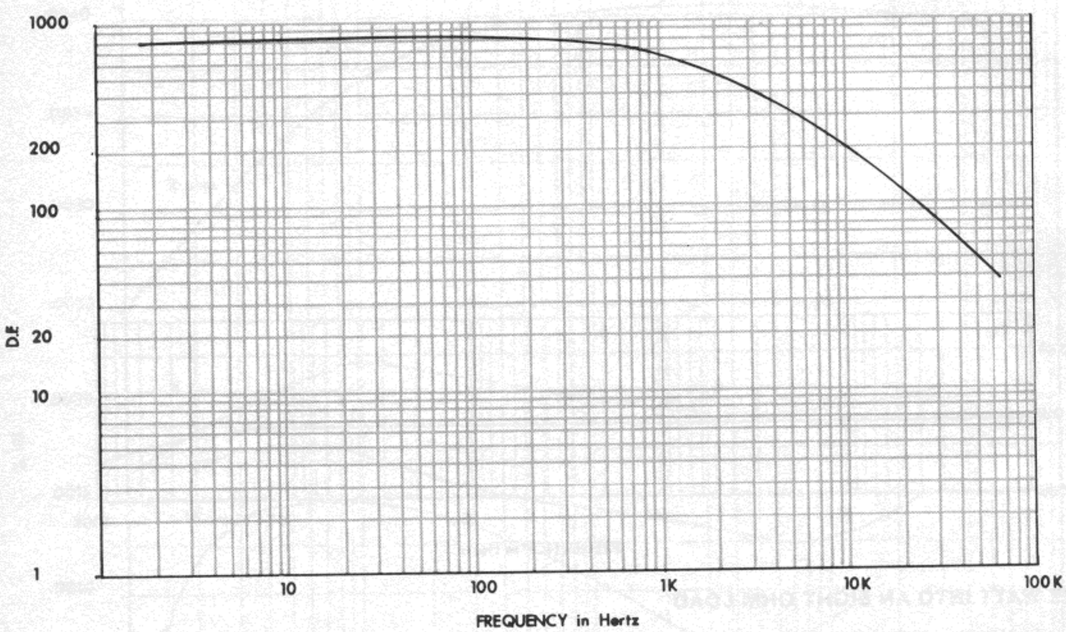
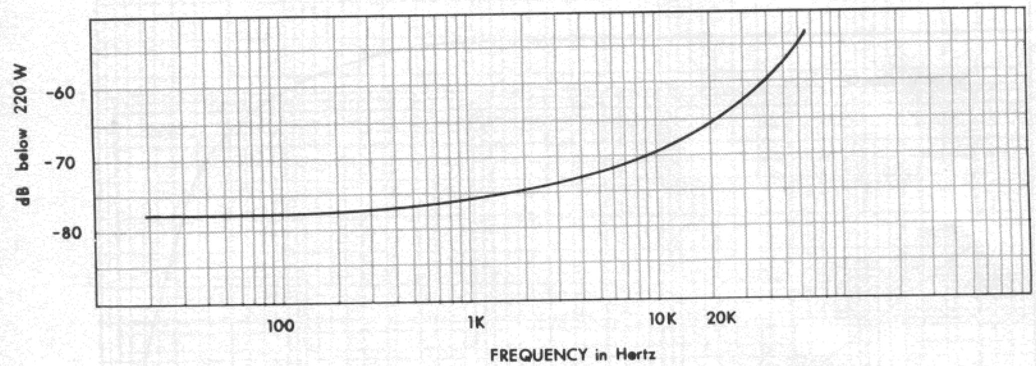


Fig. RVW.10 Typical Damping Factor



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

Fig. RVW.11 Typical Crosstalk

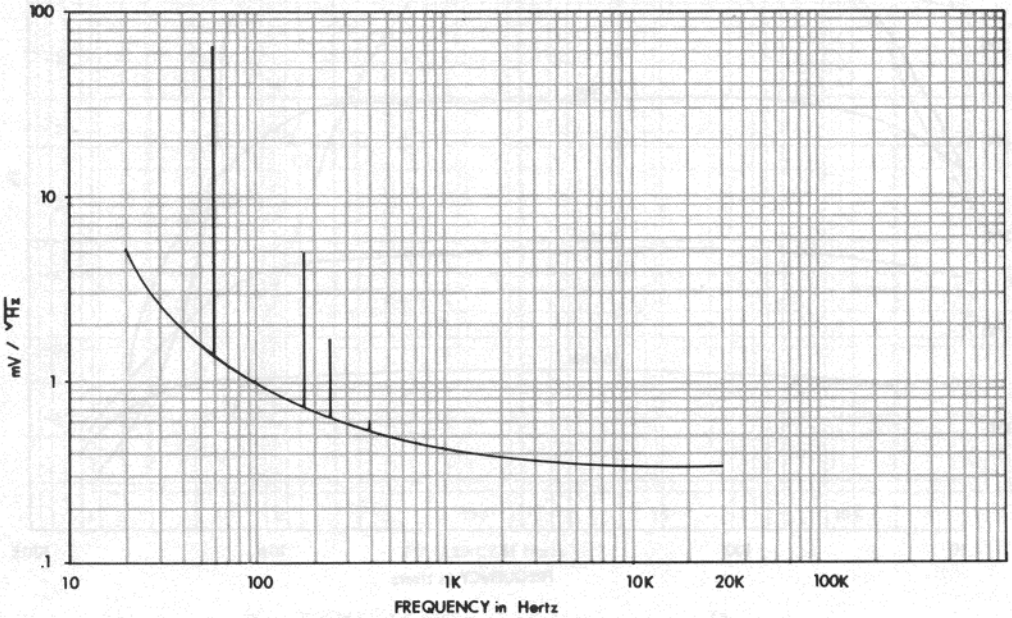


Fig. RVW.12 Typical Noise Spectrum

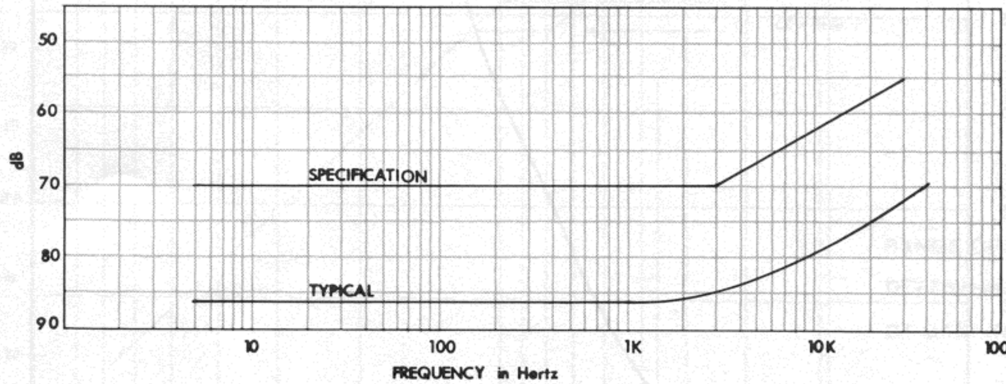


Fig. RVW.13 Typical CMR Through Balanced Input Module

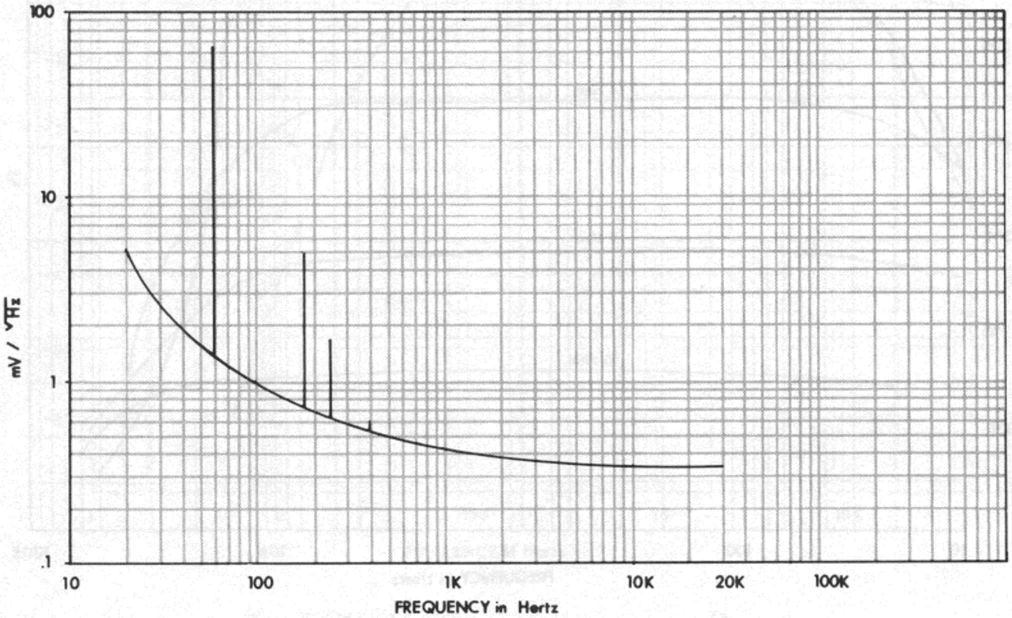


Fig. RVW.12 Typical Noise Spectrum

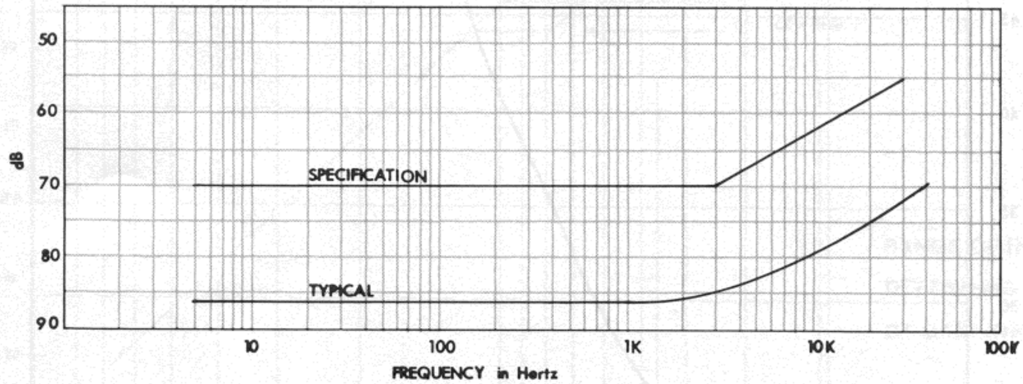


Fig. RVW.13 Typical CMR Through Balanced Input Module

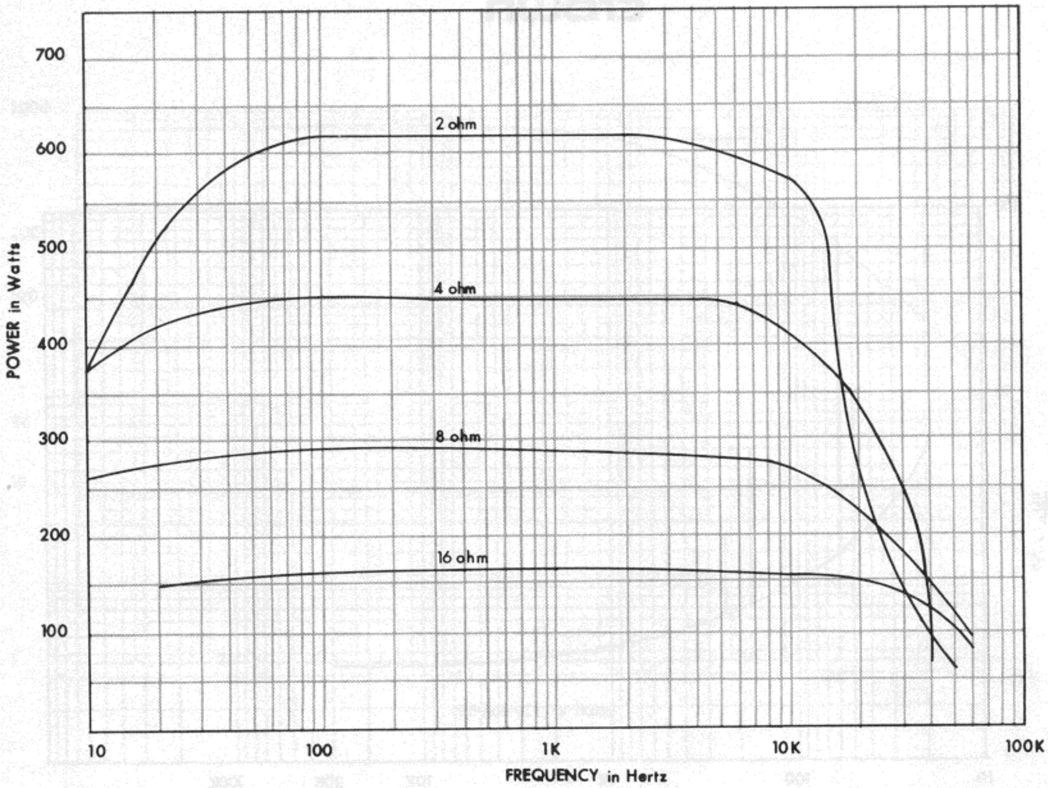


Fig. RVW.14 PSA-2 Typical Power Output

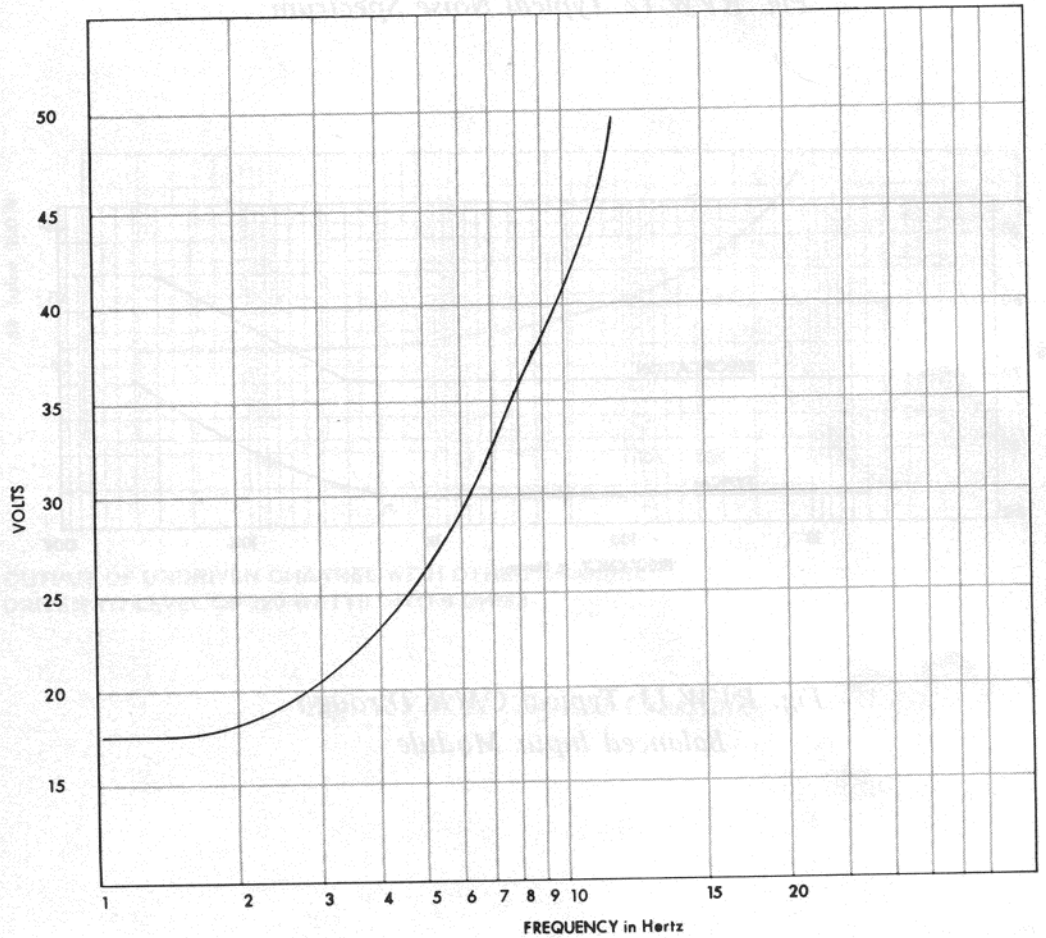


Fig. RVW.15 Low Frequency Protect Action

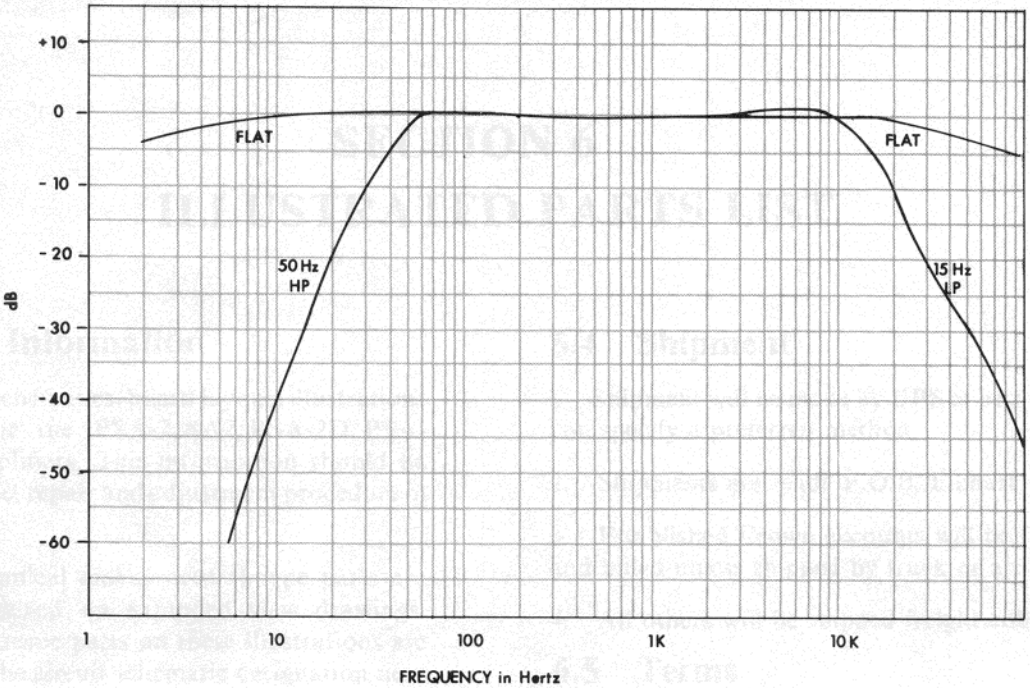


Fig. RVW.16 Typical Frequency Response - Balanced Input Module

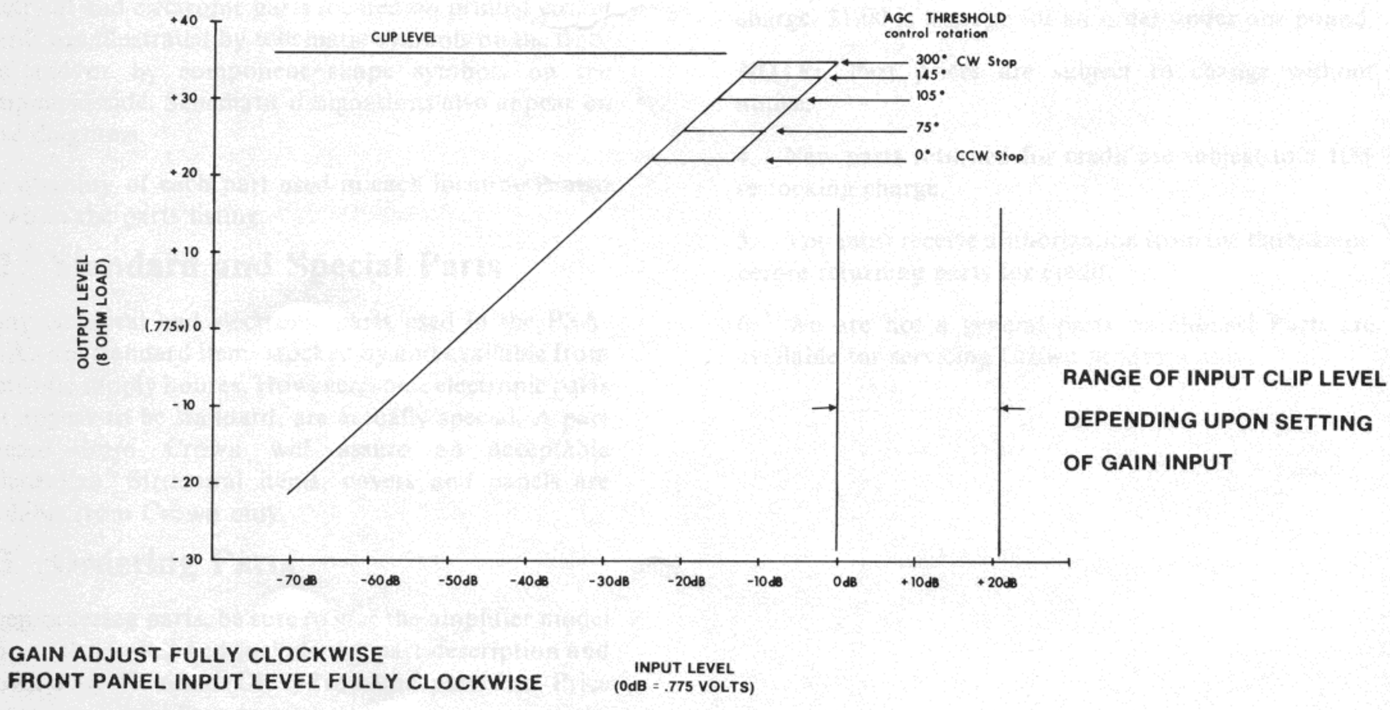


Fig. RVW.17 Typical AGC Action

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SECTION 6
ILLUSTRATED PARTS LIST

6.1 General Information

Section 6 contains schematics, board layouts illustrations and parts lists for the PSA-2/SA2/PSA-2D/PSA-2DX/PSA-2X amplifiers. This information should be used with the service, repair and adjustment procedure in Section 7.

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 schematic designation next to the illustration. Both the index number and the schematic designation are included in the parts list in separate columns. The schematic designations correspond to those shown in schematic diagrams in the Review Section.

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

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

6.2 Standard and Special Parts

Many electrical and electronic parts used in the PSA-2/SA2 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.

6.3 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.*

6.4 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.

6.5 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. $1.00 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.

PSA-2/SA2 SCHEMATIC NOTES

THE FOLLOWING SCHEMATIC DIAGRAMS/BOARD LAYOUTS APPLY TO BOTH THE PSA-2 (AND OPTIONAL VERSIONS) AND THE SA2 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 TO 299 (EXCEPT OUTPUT MODULE; 400 - 499).**
- **UNDERLINED CAPTIONS DENOTE FRONT OR REAR PANEL MARKINGS.**
- **CIRCUITS SHOWN REPRESENT MODELS WITH APPROPRIATE SERIAL NUMBERS AS INDICATED.**

POWER SUPPLY/RELAY MODULE
CIRCUITS SHOWN START WITH;
- MODEL SA2 SN111947
- MODEL PSA-2(X) SN9989
- MODEL PSA-2DX SN226
- ALL CONNECTIONS TO POWER SUPPLY MODULE ARE THROUGH J10 (PIN NUMBERS SHOWN).

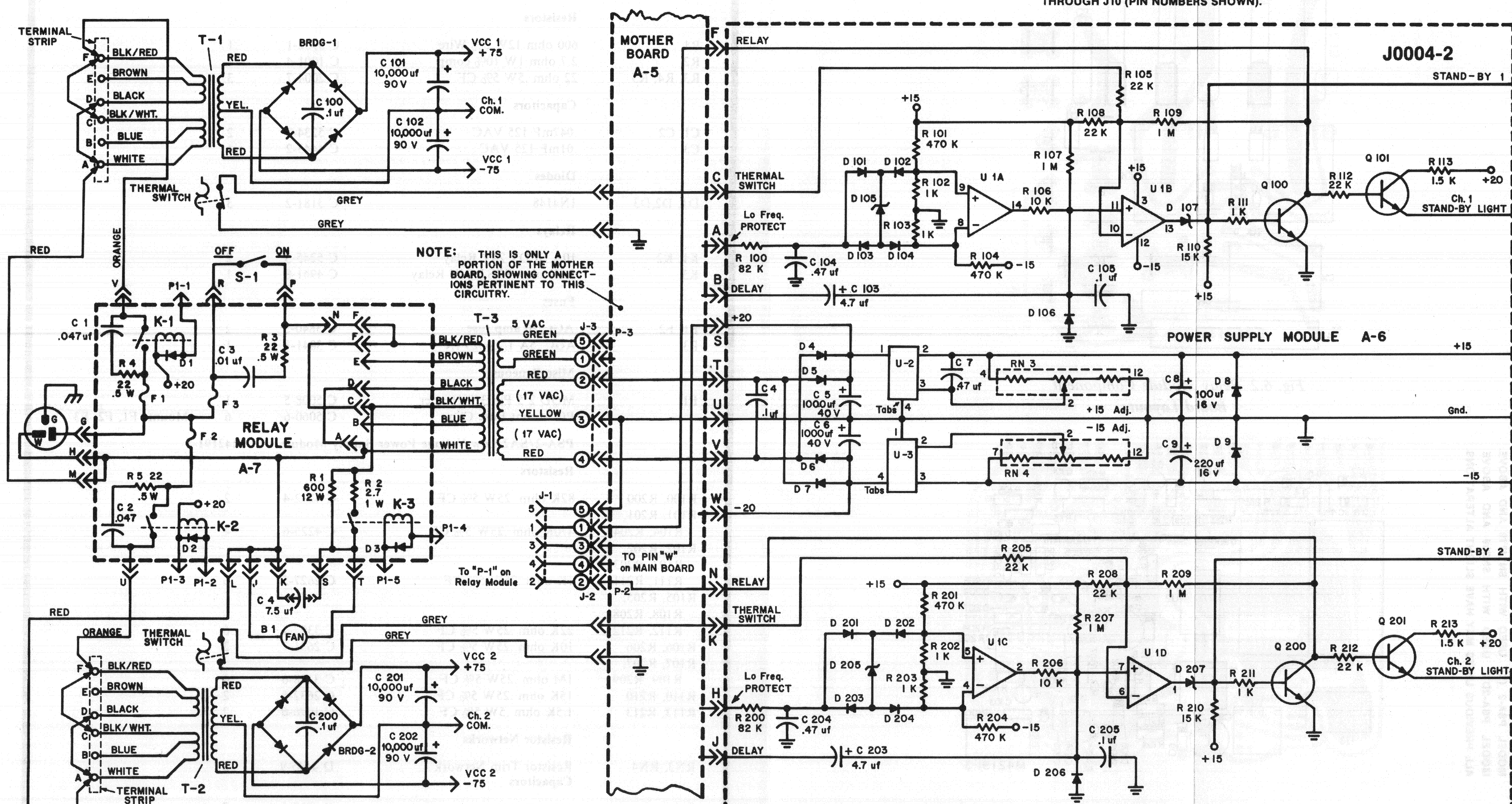


Fig. 6.1 Relay/Power Supply Schematic

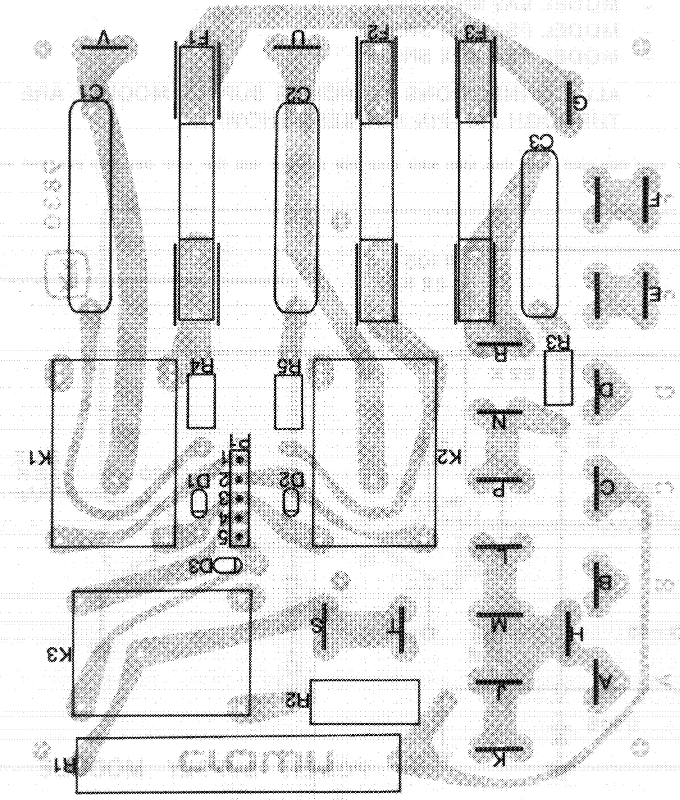


Fig. 6.2 Relay Module Component Board Layout

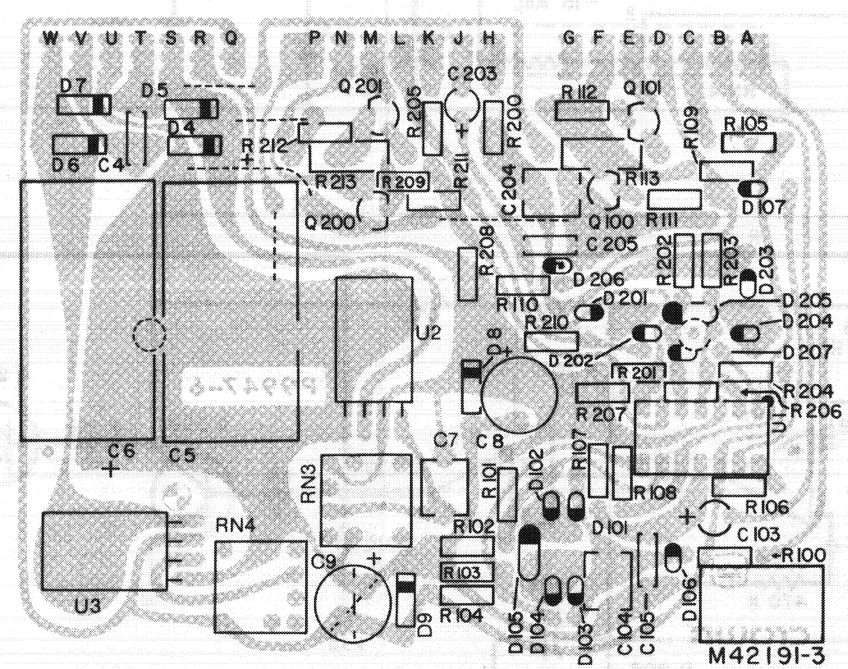


Fig. 6.3 Low Voltage Power Supply Component Board Layout

MODEL SA2; USED WITH SN112617 AND ABOVE.
MODEL PSA-2 (X); USED WITH SN11719 AND ABOVE.
MODEL PSA-2DX; USED WITH SN306 AND ABOVE.
ALL PREVIOUS UNITS MAY HAVE SLIGHT ALTERATIONS.

Parts List: Relay Module/Power Supply

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	PSA-2/SA2 Relay Board Module	**Q42174J4**		
	Resistors			
R1	600 ohm 12W 5% Wire	C 3902-1	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 4443-2	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	
F3	AGC .5A 1.25x.25 IN	C 3841-1	1	
	Miscellaneous			
P1	MOD 2 5 Pin 318 Header	C 5008-5	1	
	PC Mount Fuse Clip	C 5060-6	6	Mounts F1, F2, F3
	PSA-2/SA2 Low Voltage Power Supply Module	**M42191-3**		
	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, R210	15K 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	
	Capacitors			
C5, C6	1000mF 40V Axial	C 4303-1	2	
C7, C105, C205	0.1mF 100V Plycarb	C 4892-3	3	
C8	220mF 16V Vertical	C 3796-7	1	
C9	100mF 16V Vertiocal	C 3729-8	1	
C103, C203	4.7mF 35V Tant	C 4019-3	2	
C104, C204	.47mF 100V 5 Polycr	C 4119-1	3	

Parts List: Power Supply Module (Continued)

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	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	
	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 SA2; used with SN112616 and below Model PSA-2(X); used with SN11718 and below Model PSA-2DX; used with SN305 and below
U2	UA78 Adj Positive Reg	C 5487-1	1	Model SA2; used with SN112617 and above Model PSA-2(X); used with SN11719 and above Model PSA-2DX; used with SN306 and above
U3	79M6T2C -V Reg	C 4297-5	1	Model SA2; used with SN112491 and below Model PSA-2(X); used with SN11343 and below
U3	UA79 Negative Reg	C 5485-5	1	Model SA2; used with SN112492 to SN112616 Model PSD-2(X); used with SN11344 to SN11718 Model PSA-2DX; used with SN226 to SN305
U3	UA79 Adj Negative Reg	C 5486-3	1	Model SA2; used with SN112617 and above Model PSA-2(X); used with SN11719 and above Model PSA-2DX; 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	
	EQ-PSA-SA V-Reg	F 9655-6	2	Heatsink for U2, U3
	T0-5 Heat Sink	C 5214-9	1	

INCLUDED WITH THE FOLLOWING SERIAL NUMBERS ONLY:

SA2 - SN112616 and BELOW
PSA-2(X) - SN11453 AND BELOW
PSA—2DX - SN305 AND BELOW
CIRCUIT INCLUDED ON MAIN BOARD WITH LATER UNITS.

WIRES ARE SOLDERED TO MOTHER BOARD AT THE PIN NUMBERS GIVEN IN PARENTHESIS.

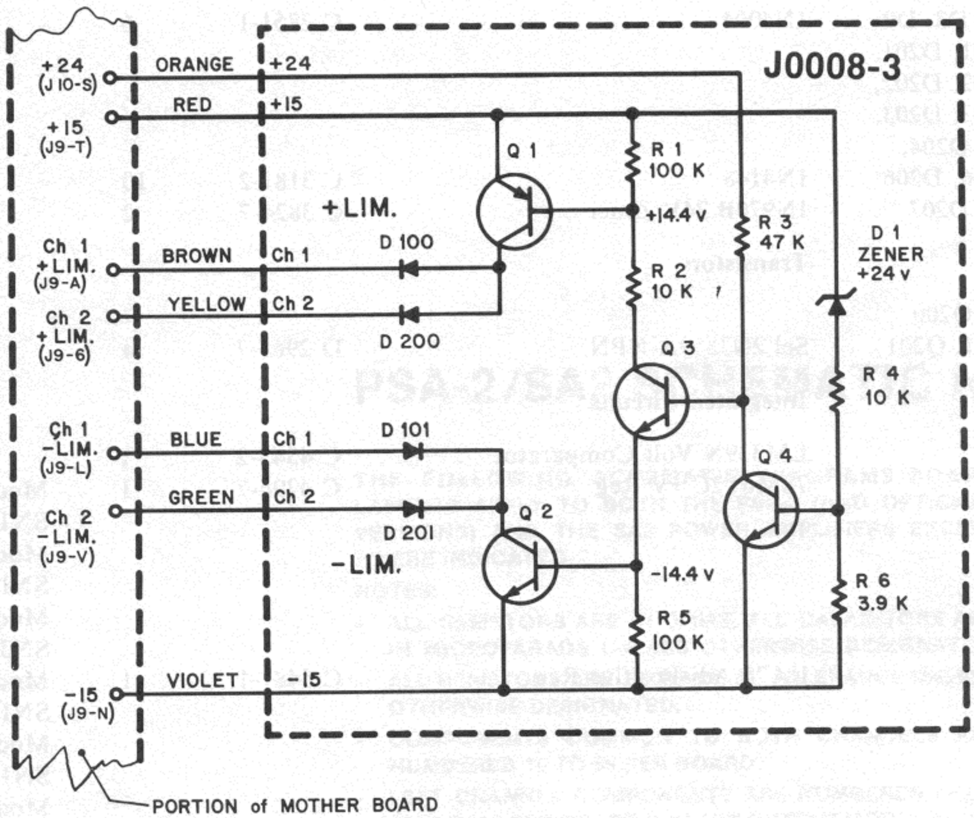


Fig. 6.4 Anti-Pop Module Schematic

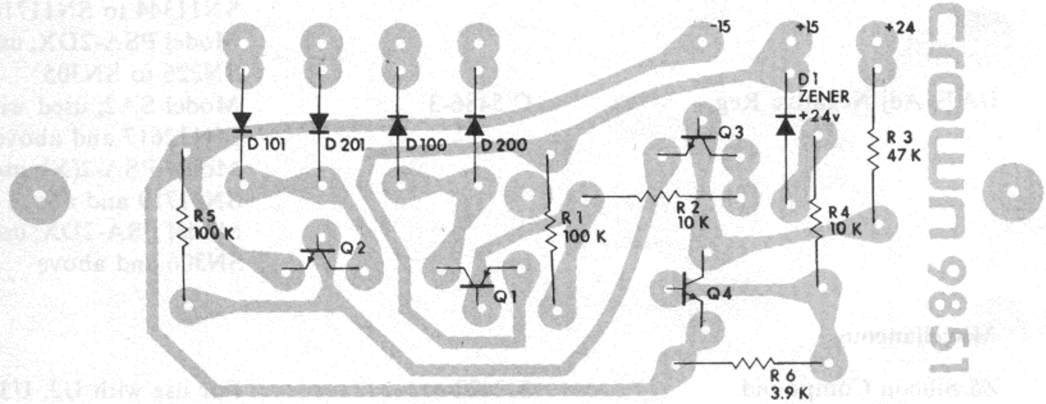


Fig. 6.5 Anti-Pop Module Foil Board Layout

crown

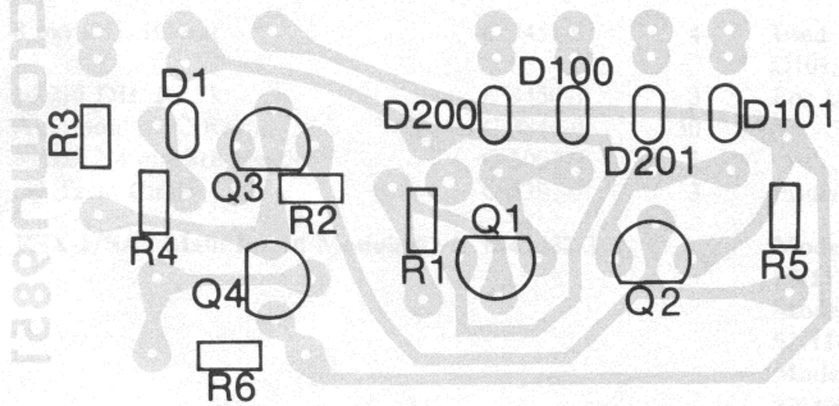


Fig. 6.6 Anti-Pop Module Component Board Layout

Parts List: Anti-Pop Module

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	PSA-2/SA2 Anti-pop Module	**Q42168-7**		**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. 6.8 Main Module #2 Schematic

CIRCUIT SHOWN USED WITH;
- SA2 SN112552 AND ABOVE
- PSA-2(X) SN11416 ABOVE
- PSA-2D SN306 AND ABOVE
- D300 AND D400 ARE THERMALLY JOINED TO Q300 AND Q400
- R309 AND R408 ARE SELECTED TO MATCH GRADE OF U300 AND U400

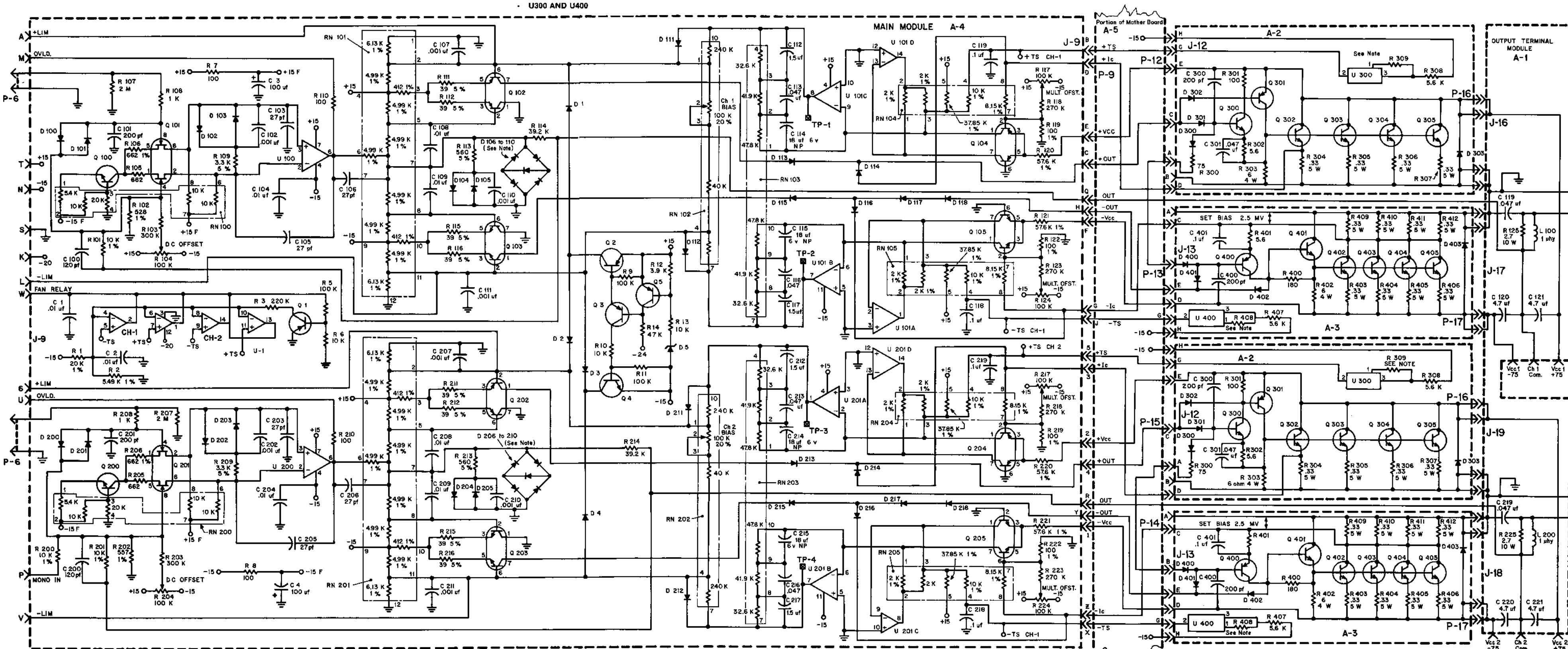
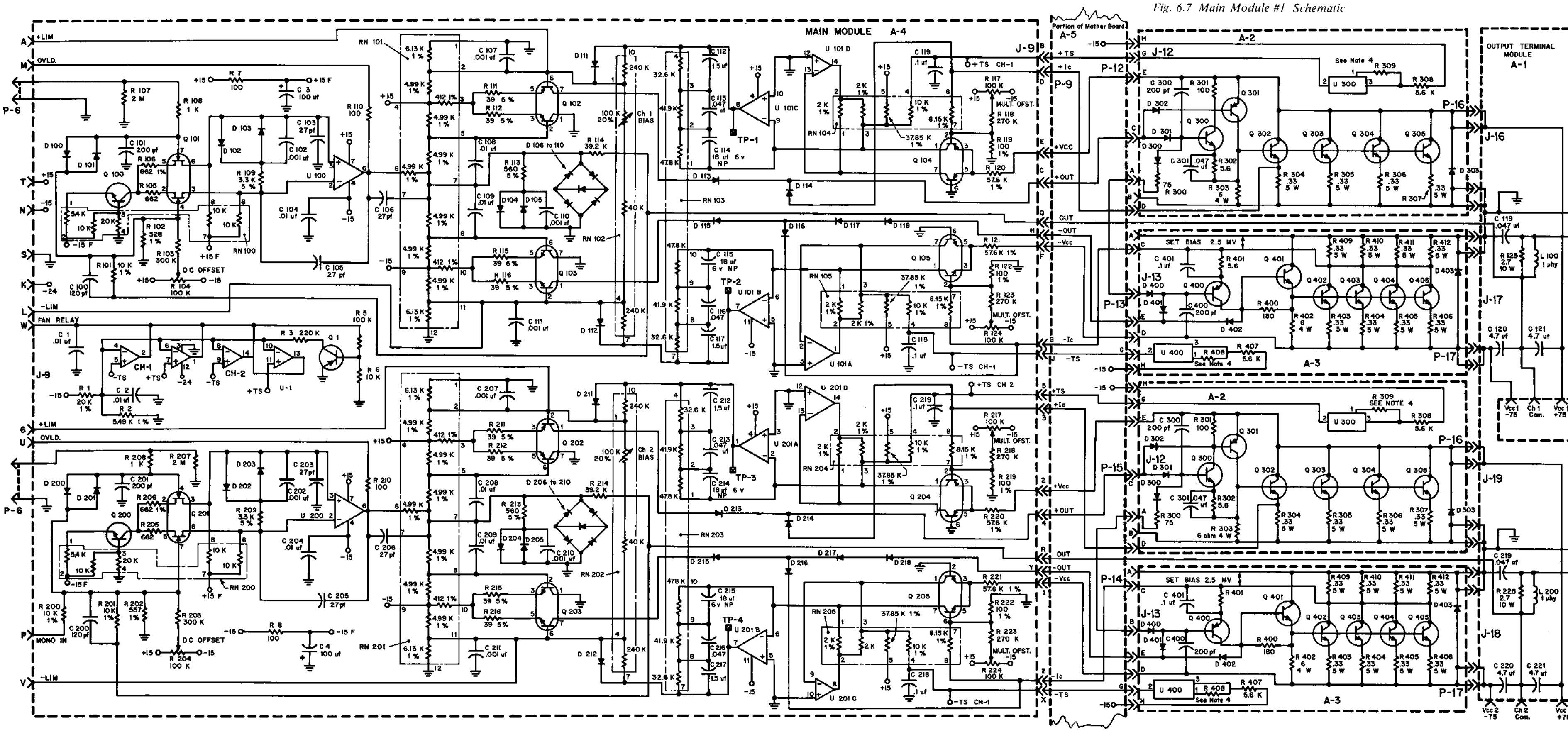


Fig. 6.7 Main Module #1 Schematic



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

CIRCUIT SHOWN USED WITH;
- MODEL SA2 SN112551 AND BELOW
- MODEL PSA-2(X) SN11415 AND BELOW
- MODEL PSA-2DX SN305 AND BELOW

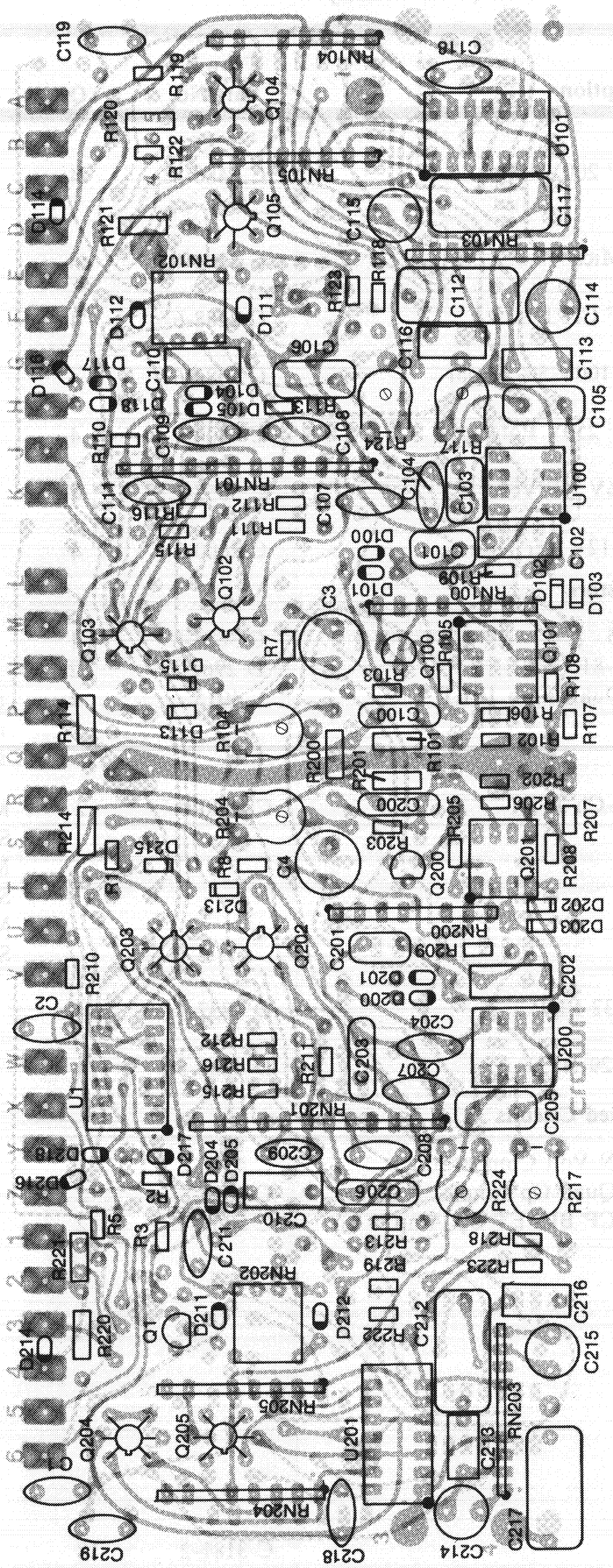


Fig. 6.9 Main Module #1 Component Board Layout

BOARD USED WITH;

- **MODEL SA2 SN112551 AND BELOW**
- **MODEL PSA-2(X) SN11415 AND BELOW**
- **PSA-2DX SN305 AND BELOW**

BOARD USED WITH;

- **MODEL SA2 SN112552 AND ABOVE**
- **MODEL PSA-2(X) SN11416 AND ABOVE**
- **MODEL PSA-2DX SN306 AND ABOVE**

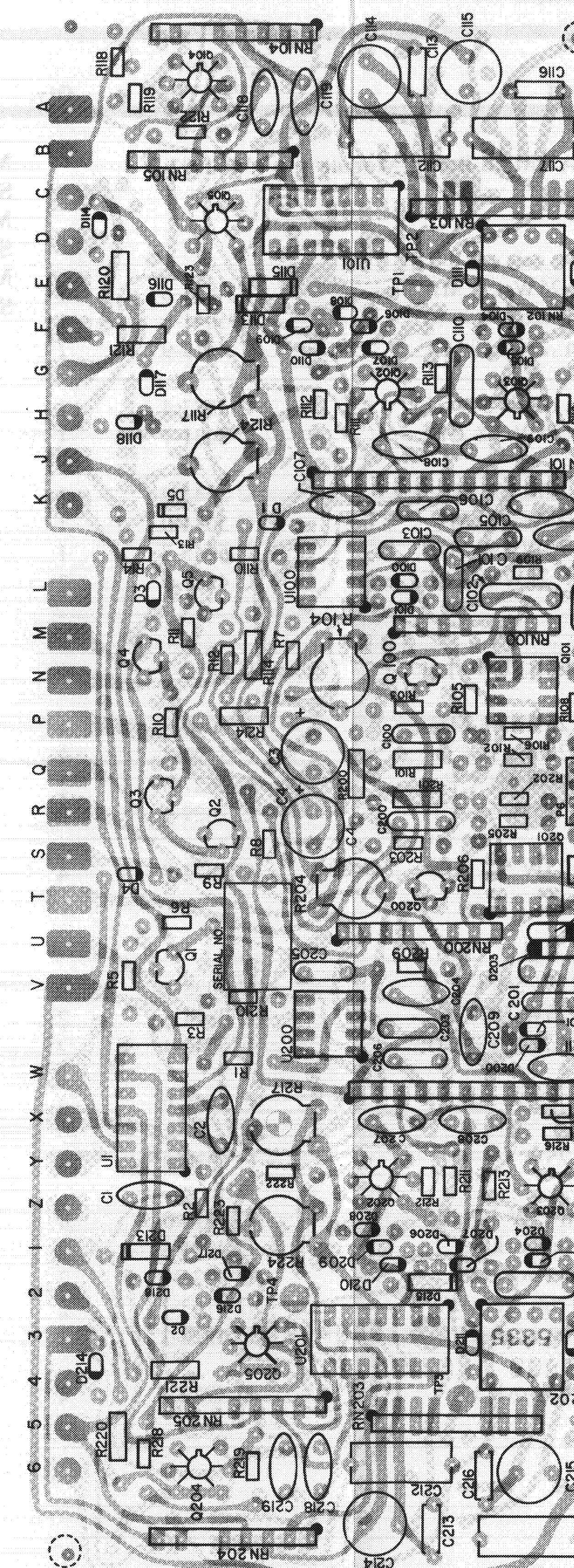


Fig. 6.10 Main Module #2 Component Board Layout

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	PSA-2/SA2 Main Board Module	**M42192-1**		**Model SA2; used with SN112551 and below 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, 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, 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	
	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	

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
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, C218	0.1mF 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 SA2; used with SN112667 and above 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	
	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	
	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,				

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
*D110, D211	1N4148	C 3181-2	10	Model SA2; not used after SN112166 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
	PSA-2/SA2 Main Board Module #2	**M42332-3**		**Model SA2; used with SN112552 and above 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	
R111, 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	

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
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	
	Resistor Networks			
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	
	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	.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	

Parts List: Main Board Module #2 (Continued)

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	Diodes			
D1, D2, D3, D4, D104, D204, D105, D205, D111, D211, D112, D212, D114, D214, D116, D216, D117, D217, D118, D218	1N4148	C 3181-2	20	
D102, D202, D103, D203	1N270	C 3447-7	4	
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			
	8 pin DIL 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	

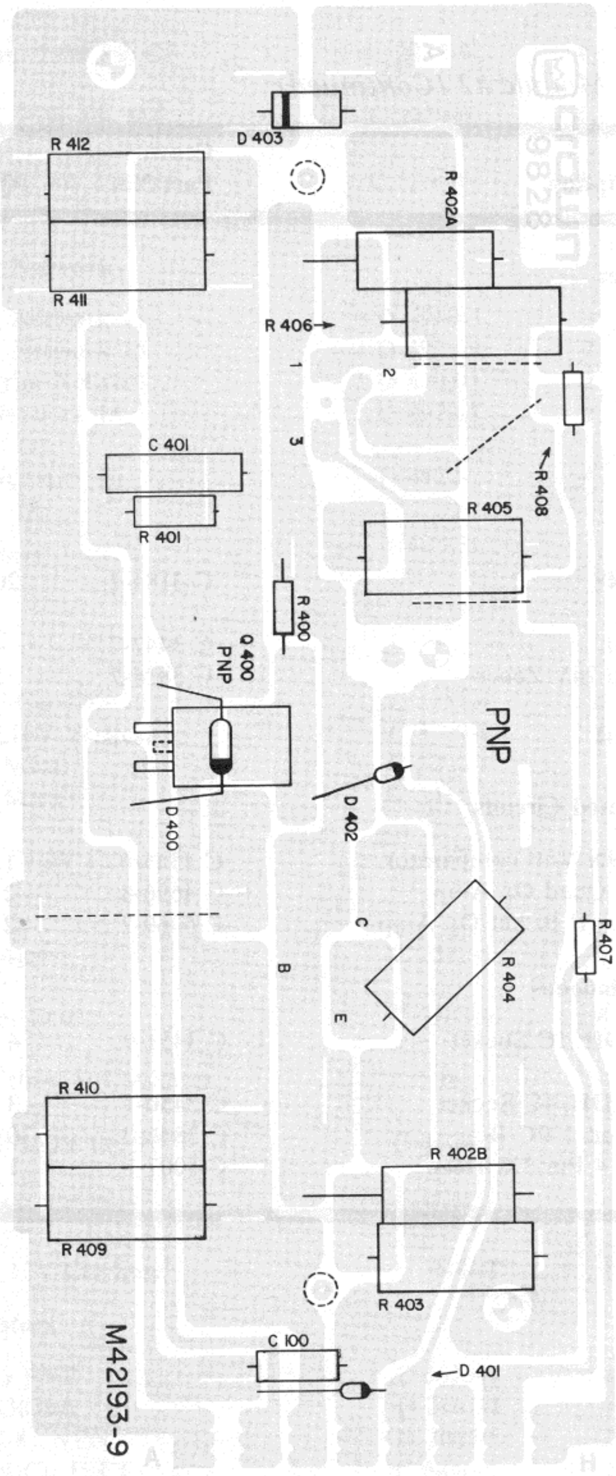


Fig. 6.11 PNP Output Module Component Board Layout

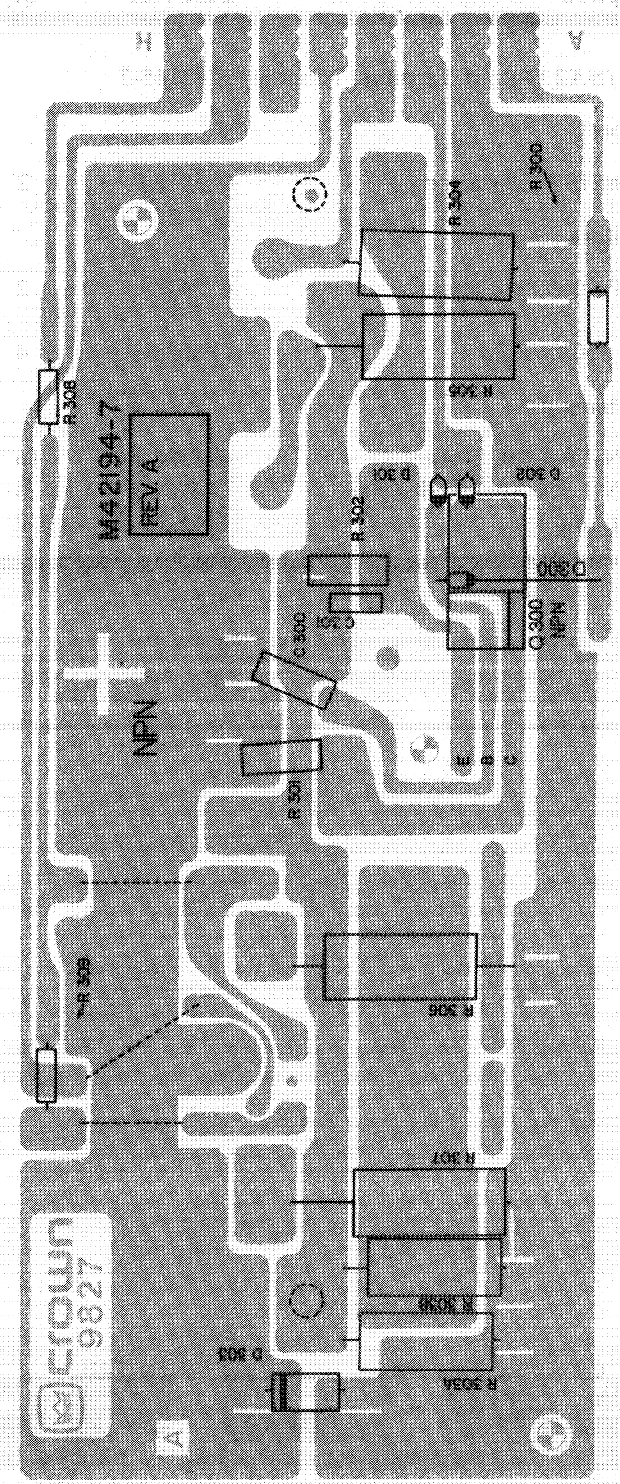


Fig. 6.12 NPN Output Module Component Board Layout

Parts List: PNP Output Module

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	PSA-2/SA2 PNP Output Module	**M42193-9**		.
	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% CF	C 3220-8	1	
R408	218 ohm .25W 1% MF 5344	C 5344-4	1	If U400 is yellow
R408	227 ohm .25W 1% MF	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 T05	2923 Sel	1	Model SA2; used with SN112491 and below Model PSA-2(X); used with SN11233 and below Model PSA-2DX; used with SN275 and below
Q400	PNP Predriver T0220	C 5453-3	1	Model SA2; used with SN112492 and above Model PSA-2(X); used with SN11234 and above Model PSA-2DX; used with SN276 and above
Q401	Driver Power NPN	C 5402-0	1	
Q402, Q403, Q404, Q405	Output Power NPN	C 4718-0	4	
	Diodes			
D400	1N270	C 3447-7	1	
D401, D402	1N4938 or 1N3070	C 5061-4	2	
D403	1N5402	C 2941-0	1	
	Integrated Circuits			
U400	LM334H Thermal Sense	C 5067-1	1	
	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
	.5x.5x.002 Insulator	D 5064-8	2	Mounts U400

Parts List: NPN Output Module

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	PSA-2/SA2 NPN Output Module	**M42194-7**		
	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 .25 W 1% MF	C 5344-4	1	used if U300 is yellow
R309	227 ohm .25W 1% MF	C 5343-6	1	Used if U300 us green
R309	236 ohm .25W 1% MF	C 5342-8	1	Used if U300 is blue
	Capacitors			
C300	200pF mica	C 3411-3	1	
C301	.047mF 250V Polycarb	C 4404-7	1	
	Transistors			
Q300	D40P3 Power NPN	C 5065-5	1	
Q301	Driver PNP	C 5463-2	1	
Q301	Driver PNP	C 4580-4	1	Model SA2; used with SN112616 and below Model PSA-2(X); used with SN11453 and below Model PSA-2DX; used with SN305 and below
Q302, Q303, Q304, Q305	Output Power NPN	C 4718-0	4	
	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	LM334H Thermal Sense	C 5067-1	1	
	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
	T03 Plastic Film INS	C 3180-4	1	Mounts Q301
	.5x.5x.022 Insulator	D 5064-8	2	Mounts U300

Parts List: Output Terminal Module

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	PSA-2/SA2 Output Terminal Module	**M42165-7**		
	Resistors			
R125, R225	2.7 ohm 10W 5% comp	C 3813-0	2	
	Capacitors			
C119, C219	.047mF 200V 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 Housing	C 4999-6	4	
L100, L200	Output coil	M42163-2	2	

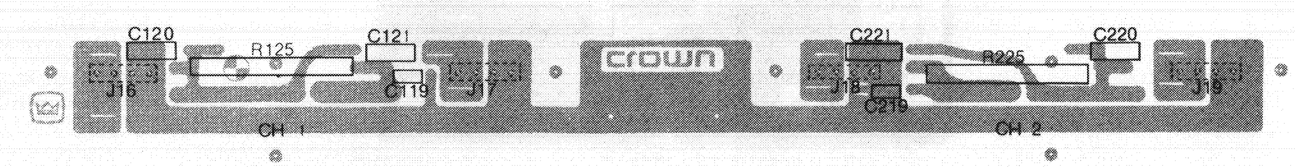


Fig. 6.13 Output Terminal Module Component Board Layout

Parts List: Mother Board Module

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	PSA-2/SA2 Mother Board Module	**M42166-5**		
	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	
P12, P13, P14, P15	8 pin Header	C 5003-6	4	
P9	10 pin Header	C 5006-9	3	
P10	7 pin Header	C 3851-0	3	
P12, P13, P14, P15	Amp Mod 1 8 Pin Header	C 5003-6	4	
P9	Amp Mod Snap-in Header	C 5006-9	3	
P10	Amp Mod PC Chassis 7 Pin	C 3851-0	3	

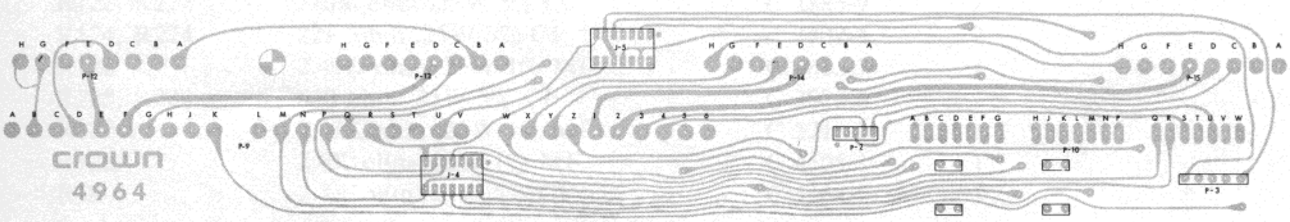
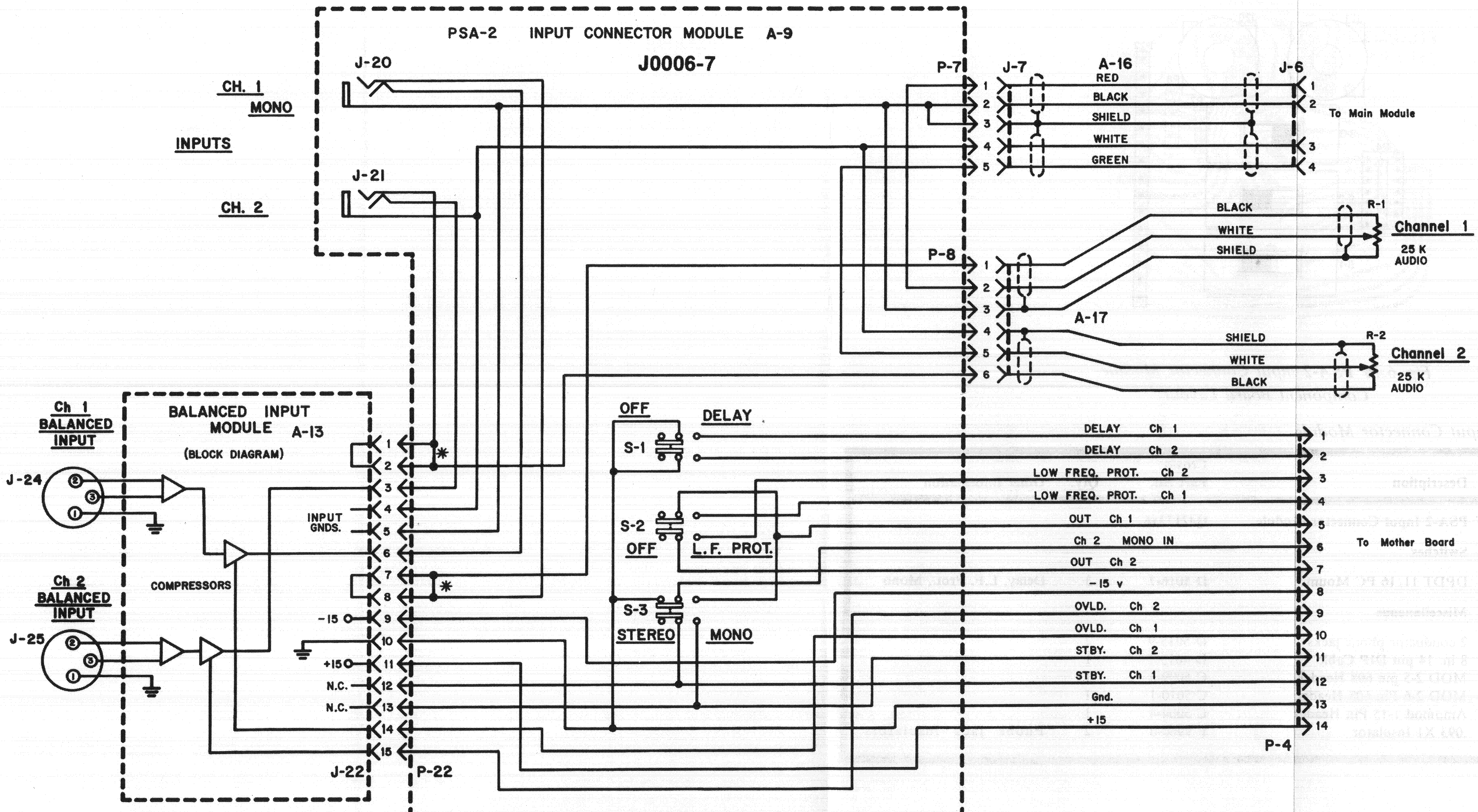


Fig. 6.14 Mother Board Module Component Board Layout



INPUT CONNECTOR MODULE

- DELAY, LOW FREQUENCY PROTECT AND STEREO-MONO SWITCH SHOWN INACTIVE.

USED WITH;

- MODEL PSA-2(X) SN9989 AND ABOVE
- MODEL PSA-2DX SN226 AND ABOVE

Fig. 6.15 PSA-2 Input Connector Module Schematic

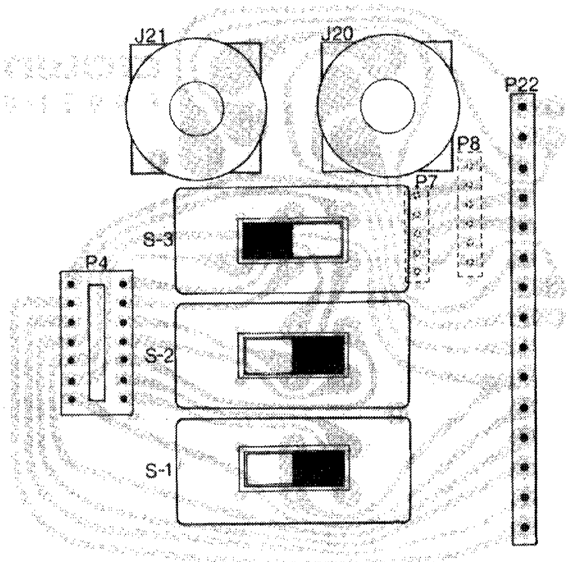


Fig. 6.16 PSA-2 Input Connector Module
Component Board Layout

Parts List: PSA-2 Input Connector Module

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	PSA-2 Input Connector Module	**Q42173J6**		
	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	MOD 2-5 pin 608 Header	C 5009-3	1	
P8	MOD 2-6 Pin 608 Header	C 5010-1	1	
P22	Ampmod 1-15 Pin Header	C 5004-4	1	
	.093 X1 Insulator	F 9960-0	2	Phone jack insulators

INPUT CONNECTOR MODULE
USED WITH;
- MODEL SA2 SN111947 AND ABOVE

- DELAY, LOW FREQUENCY PROTECT AND STEREO-MONO SWITCH SHOWN INACTIVE.

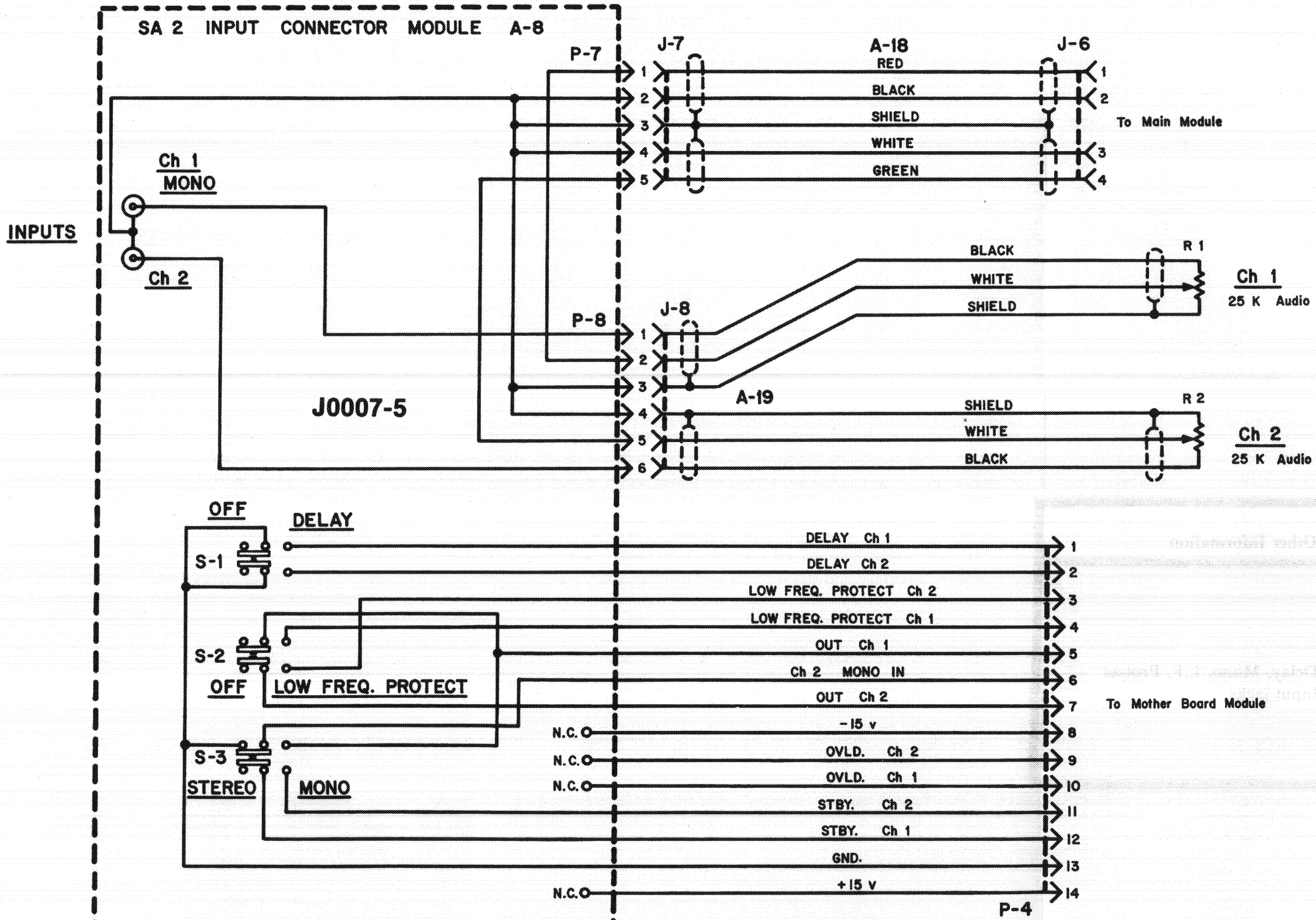


Fig. 6.17 SA2 Input Connector Module Schematic

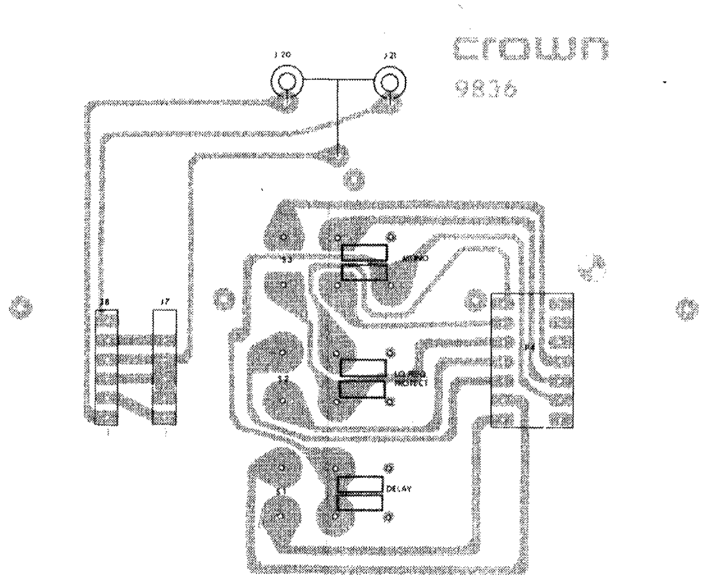


Fig. 6.18 SA2 Input Connector Module
Component Board Layout

Parts List: SA2 Input Connector Module

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	SA2 Input Connector Module	**Q42125J6**		
	Miscellaneous			
S1, S2, S3	DPDT 13/64 PC Mount	D 5017-5	3	Delay, Mono, L.F. Protect
	2 way Phono Jackplate	C 4933-5	1	Input jacks
P7	MOD 2-5 Pin 608 Header	C 5009-3	1	
P8	MOD 2-6 Pin 608 Header	C 5010-1	1	
	8 in 14 pin DIP Cable	D 4615-7	1	

DISPLAY

- CONNECTIONS THROUGH J11. PIN NUMBERS ARE SHOWN.
- D113 AND D213 OMITTED FROM EARLY UNITS -- MAY BE RETROFITTED TO PREVENT SIGNAL FROM FALSE TRIGGERING IOC.

USED WITH;
MODEL PSA-2(X) SN9989 AND ABOVE
MODEL PSA-2DX SN226 AND ABOVE

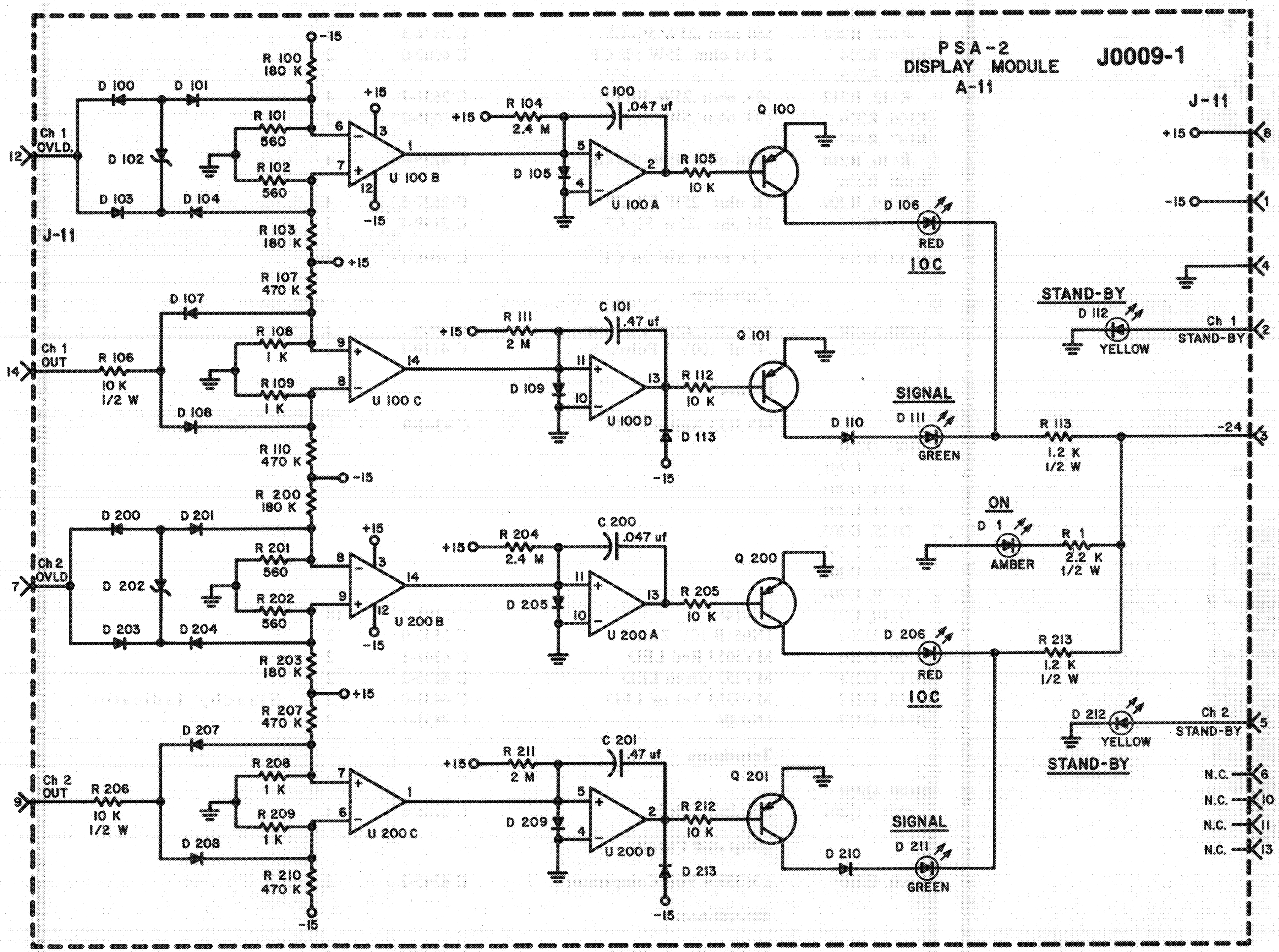


Fig. 6.19 PSA-2 Display Module Schematic

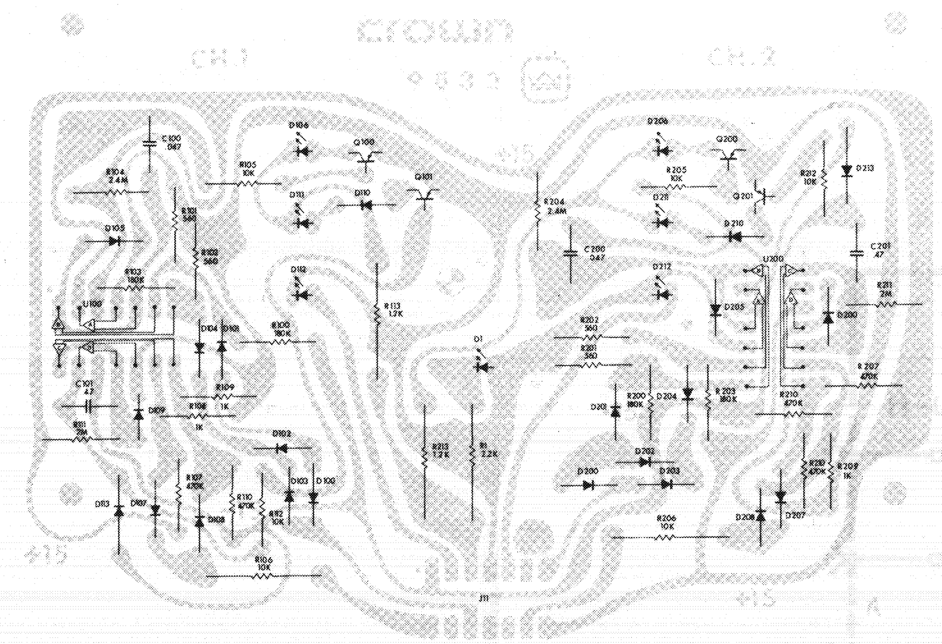


Fig. 6.20 PSA-2 Display Module Foil Board Layout

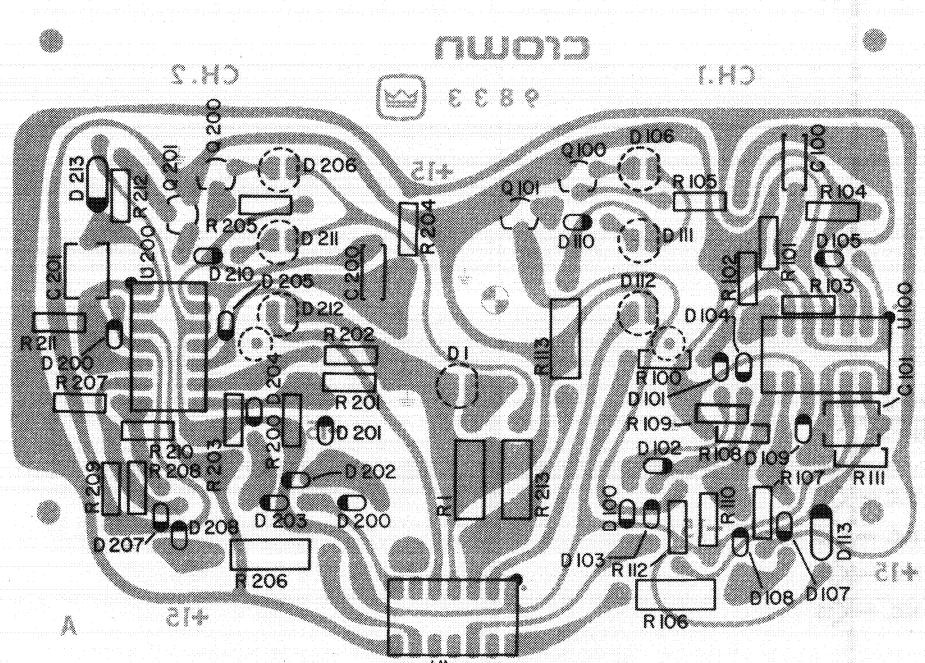
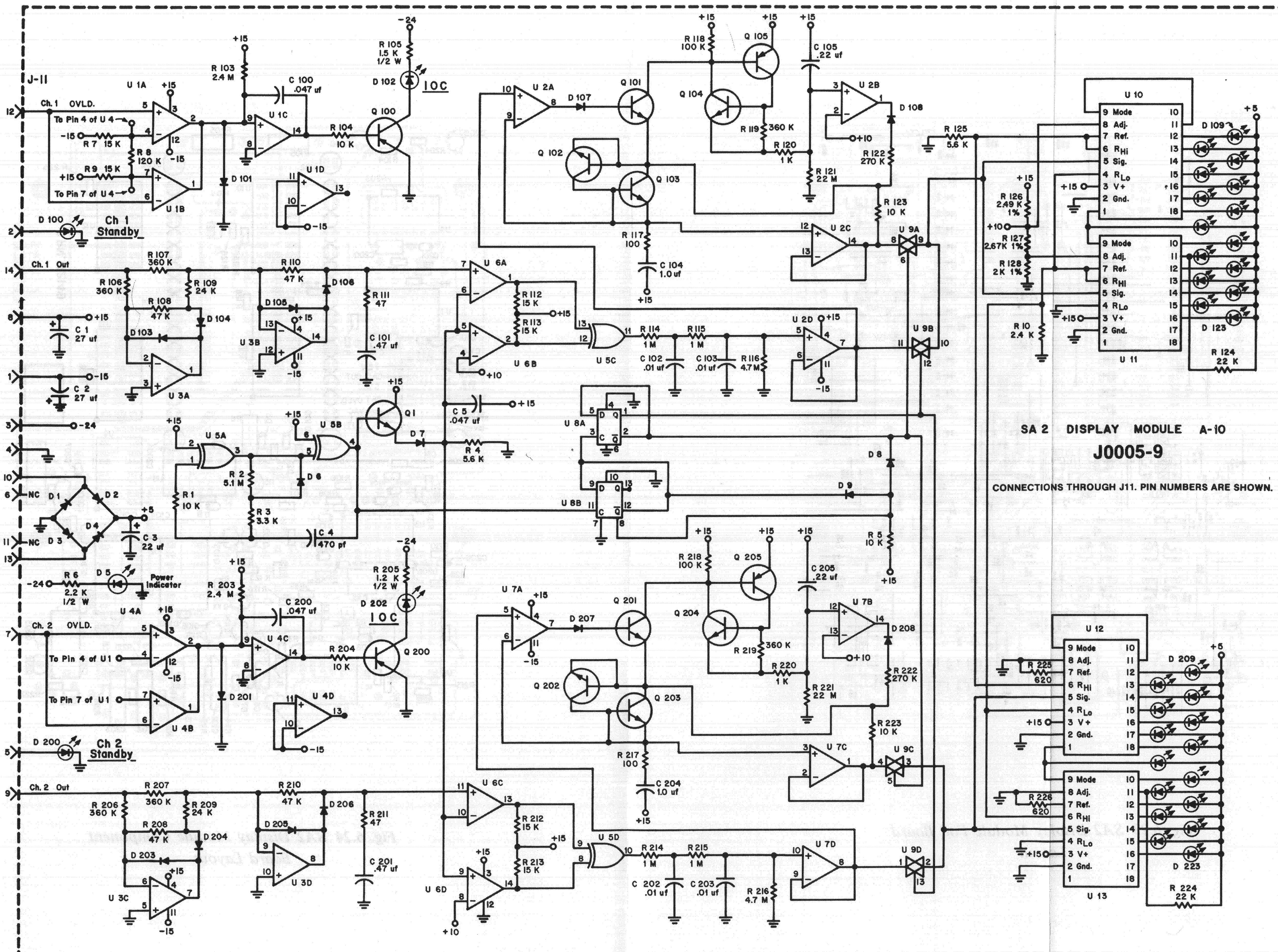


Fig. 6.21 PSA-2 Display Module Component Board Layout

Parts List: PSA-2 Display Board Module

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	PSA-2 Display Board Module	**M42199-6**		
	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	C 1045-1	2	
	Capacitors			
C100, C200	0.047 mF 250V 5% Poly	C 4404-7	2	
C101, C201	.47mF 100V 5 Polycarb	C 4119-1	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	
D111, D211	MV253 Green LED	C 4430-2	2	
D112, D212	MV5353 Yellow LED	C 4431-0	2	Standby indicator
D113, D213	1N4004	C 2851-1	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	-	



USED WITH MODEL SA2 SN111947 AND ABOVE

Fig. 6.22 SA2 Display Module Schematic

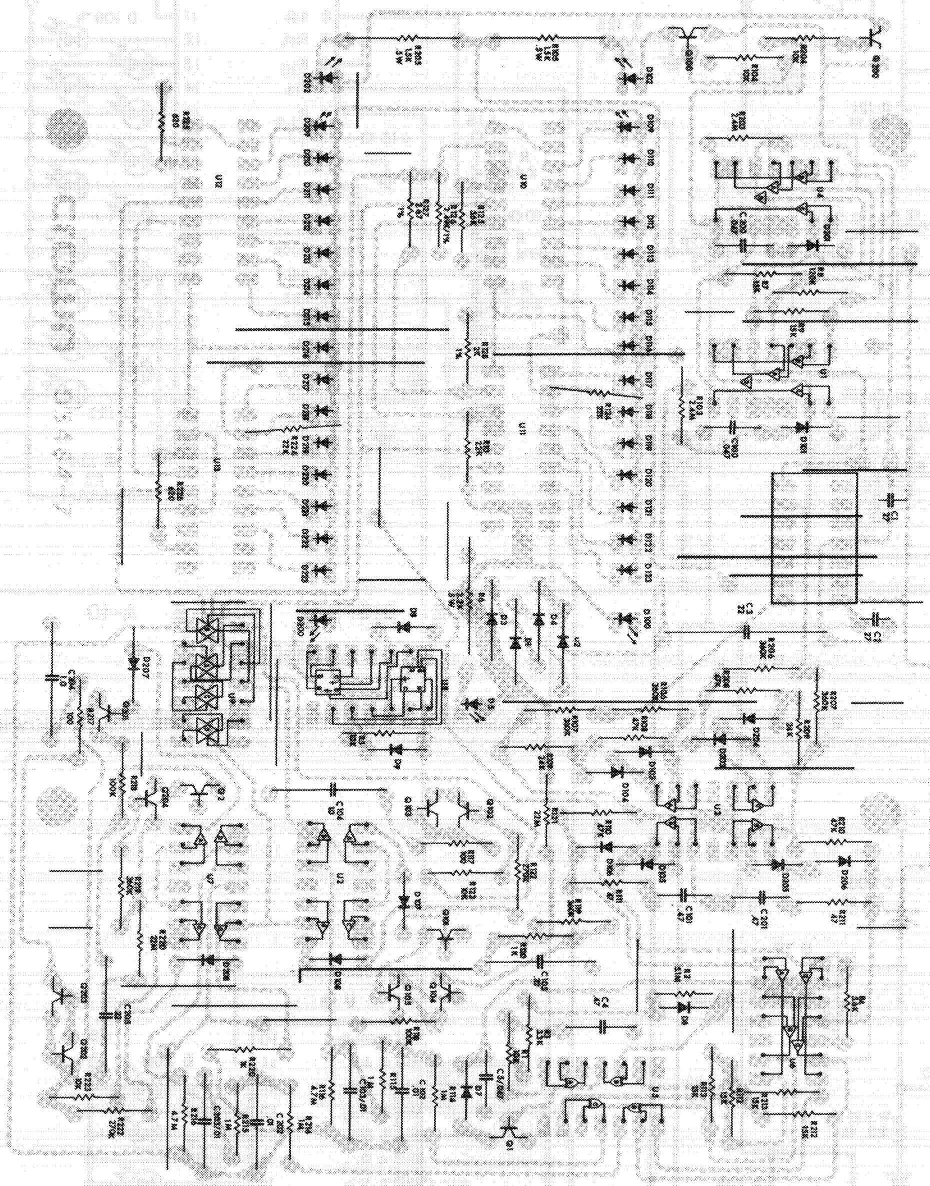


Fig. 6.23 SA2 Display Module Foil Board Layout

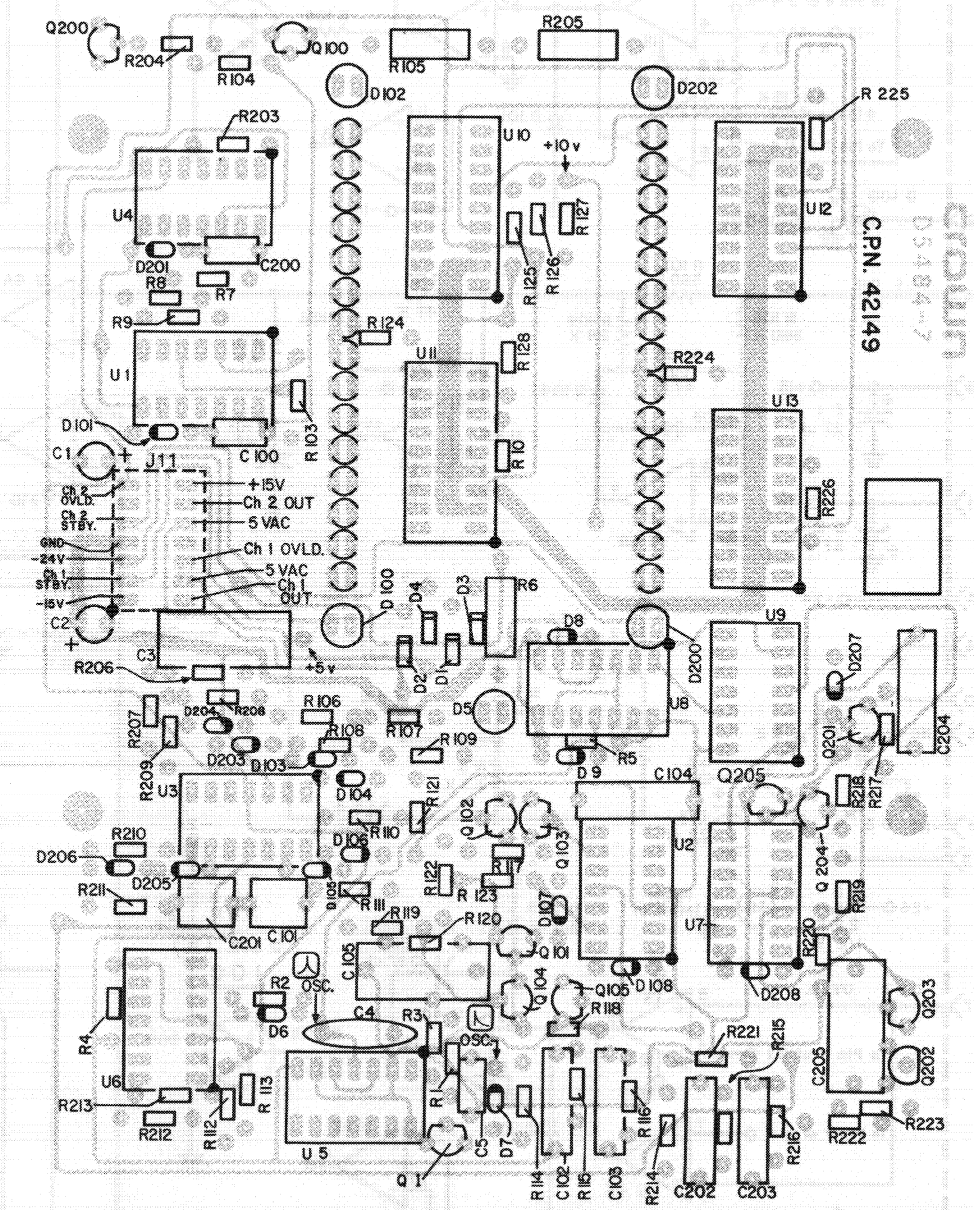
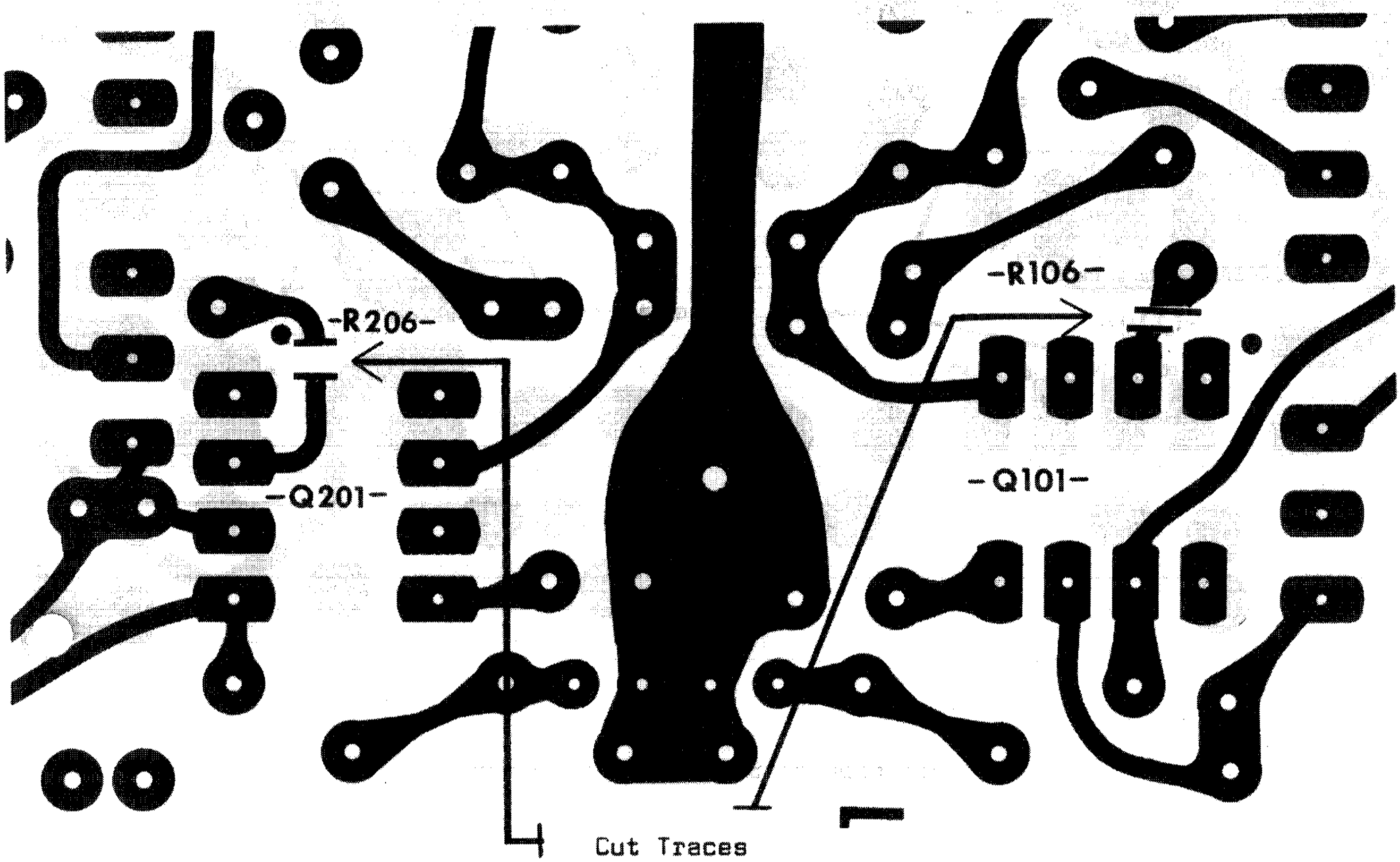
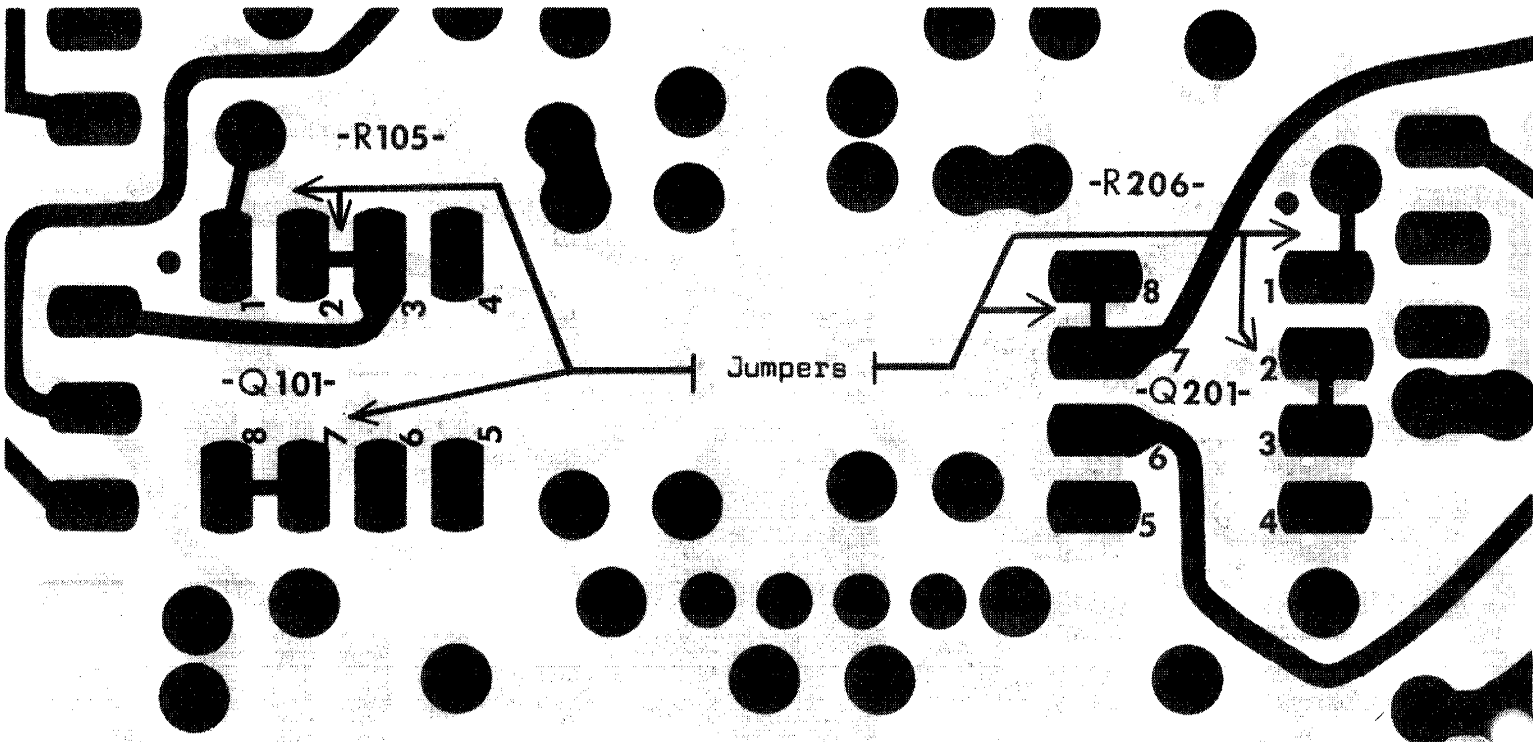


Fig. 6.24 SA2 Display Module Component Board Layout



Component side of SA-2/PSA-2 Main Module

Figure-1



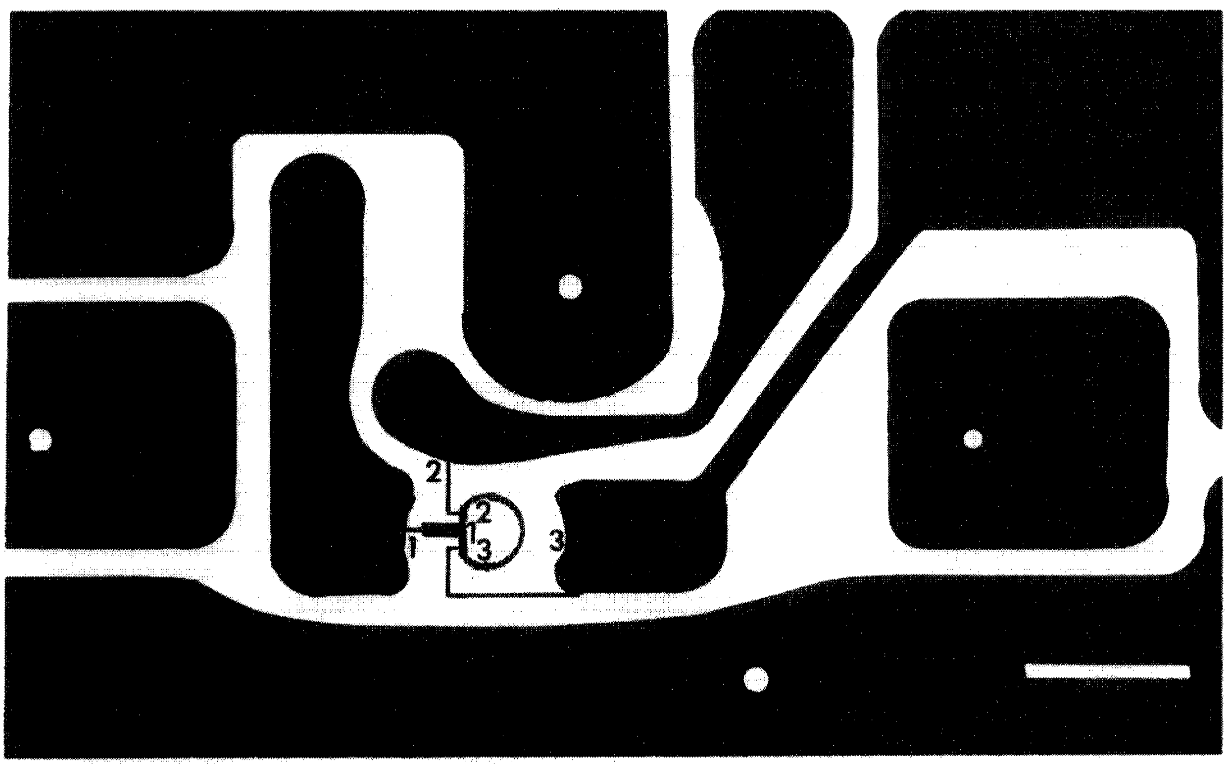
Foil side of SA-2/PSA-2 Main Module

Solder six jumper wires on the foil side at these locations:

Q101 pin 1 to R105
Q101 pin 2 to pin 3
Q101 pin 7 to pin 8
Q201 pin 1 to R206
Q201 pin 2 to pin 3
Q201 pin 7 to pin 8

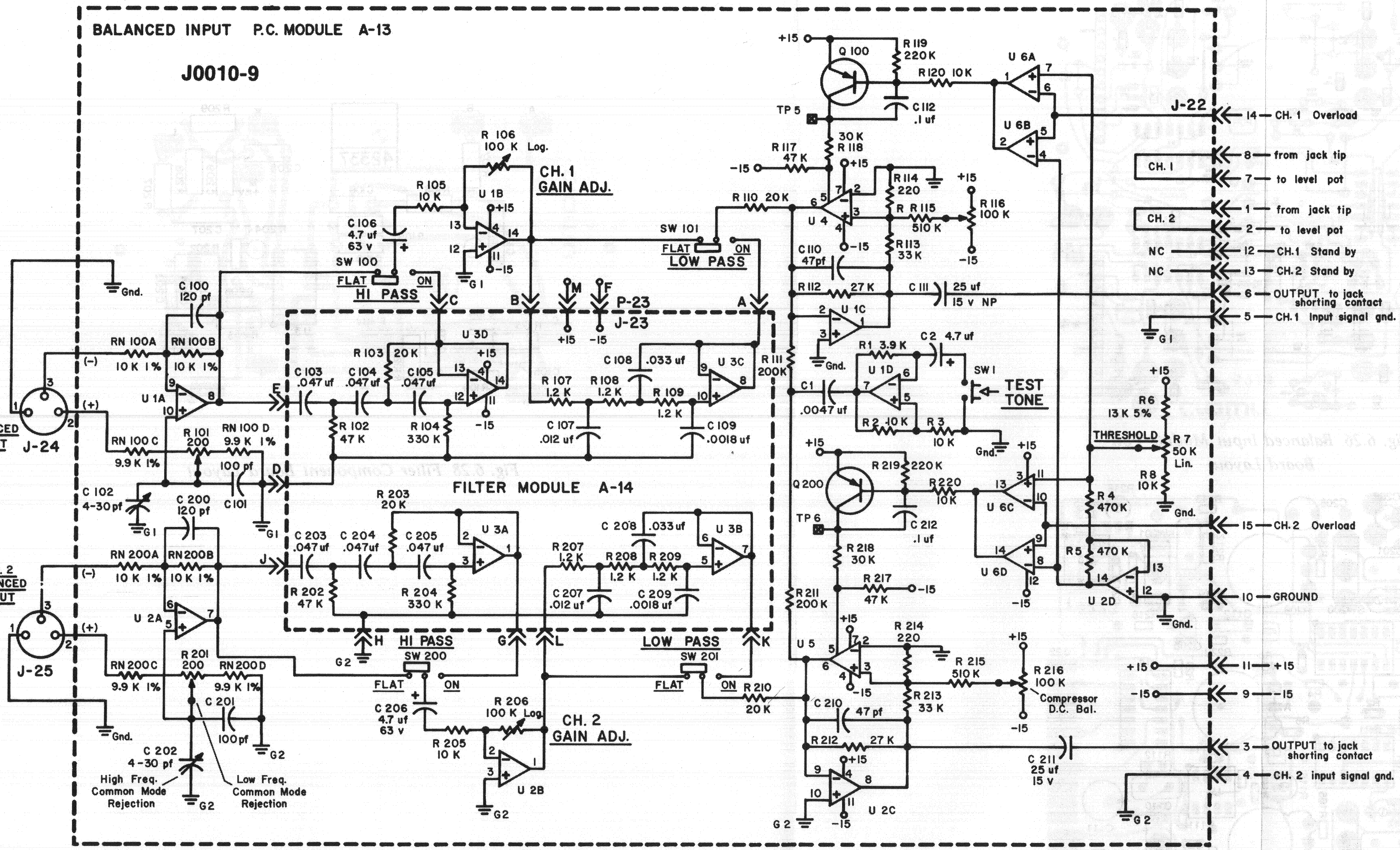
Figure-2

Figure 4



Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	SA2 Display Module	**M42149-1**		
	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 .25W 5% CF	C 5168-7	1	
	Capacitors			
C1, C2	27mF 15V Tant	C 3677-9	2	
C3	22mF 40V	C 4248-8	1	
C4	470pF Mica	C 2511-1	1	
C5, C100, C200	0.047mF 250V Polycarb	C 4404-7	3	
C101, C201	.47mF 100V 5% Polycarb	C 4119-1	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	

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	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 5098-6	30	Ladder Display
	Integrated Circuits			
U1, U4, U6	LM339N Volt Comparator	C 4345-2	3	
U2, U7, U3, U4	TL074	C4696-8	4	
U5	MC14070 Excl or Gate	C 4833-7	1	
U8	MC14013 Flip Flop	C 4831-1	1	
U9	MC14016 Quad Switch	C 4834-5	1	
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	
	14 pin Wirewrap IC Socket	C 5119-0	4	



BALANCED INPUT MODULE

- THREE SEPARATE GROUNDS JOIN AT BOARD.
- FOR STEREO TRACKING COMPRESSOR, ADD JUMPER TP5 TO TP6.
- UNDERLINED CAPTIONS DENOTE REAR PANEL MARKINGS.
- HIGH PASS FILTER SHOWN IN FLAT POSITION.
- LOW PASS FILTER SHOWN IN FLAT POSITION.
- TEST TONE GENERATOR SHOWN INACTIVE.

- USED WITH;
- MODEL PSA-2(X) SN9989 AND ABOVE
- MODEL PSA-2DX SN226 AND ABOVE

Fig. 6.25 PSA-2 Balanced Input Module/ Filter Board Schematic

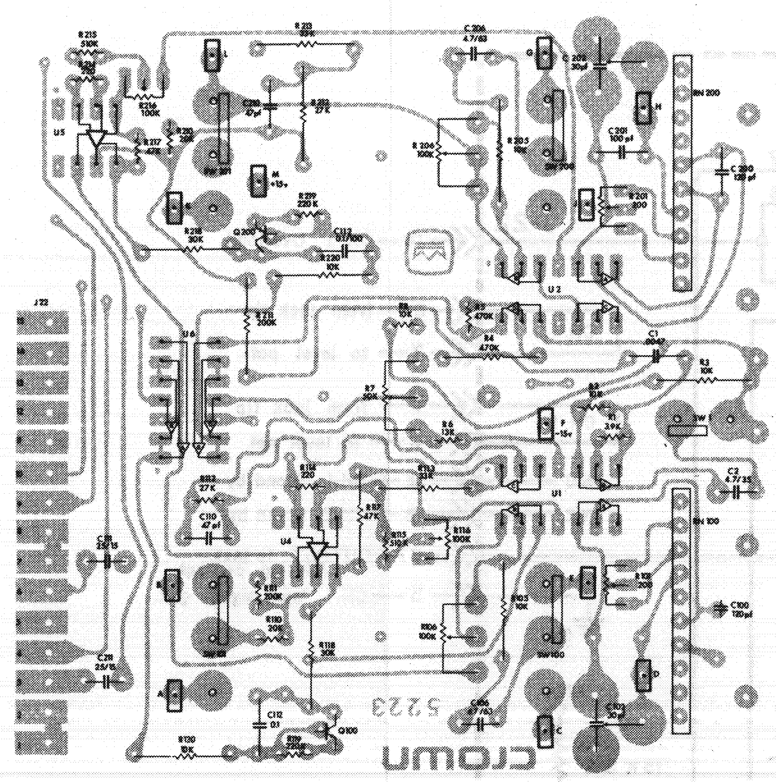


Fig. 6.26 Balanced Input Module Foil Board Layout

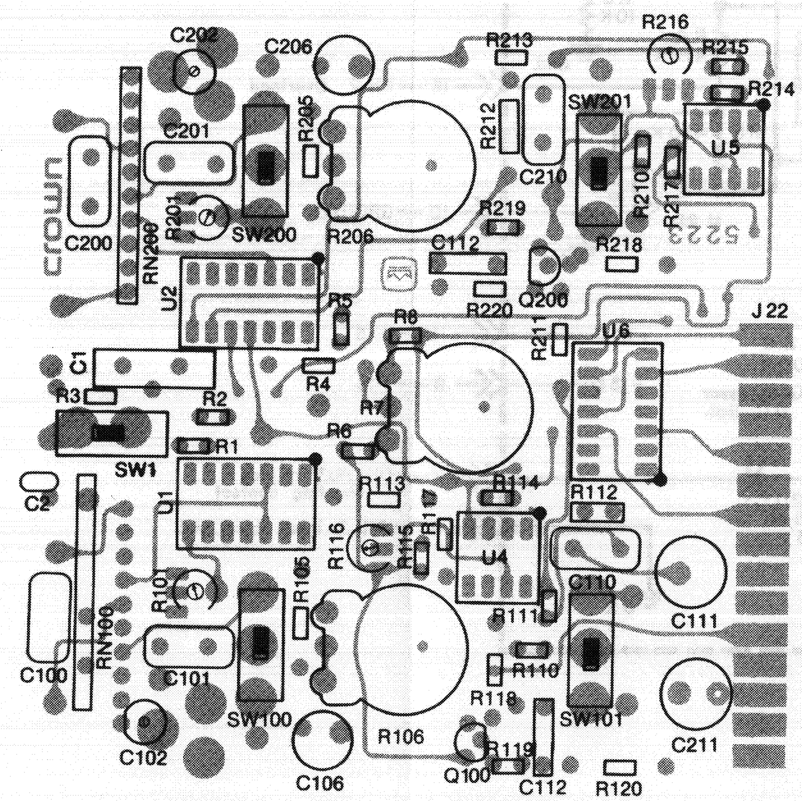


Fig. 6.27 Balanced Input Module Component Board Layout

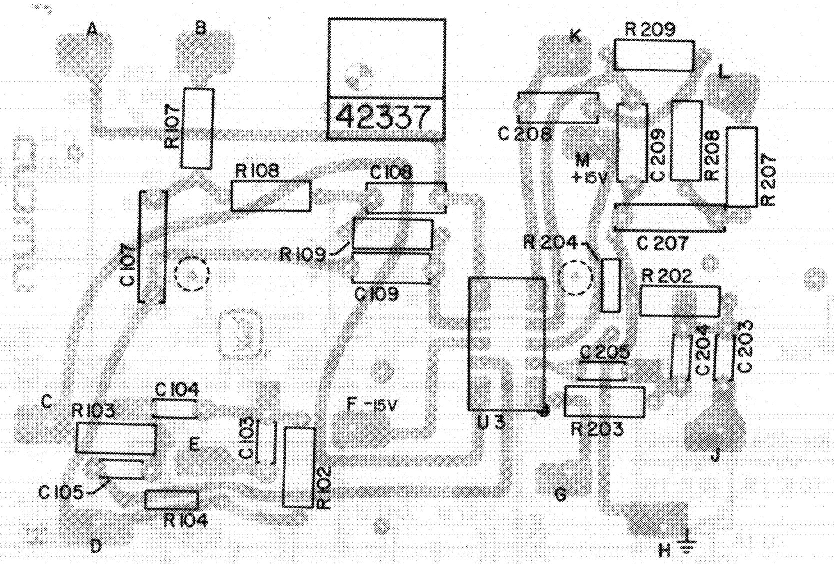


Fig. 6.28 Filter Component Board Layout

crown

Parts List: PSA-2 Balanced Input Module (PSA-2 MOD)

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	PSA-2 Balanced Input Module	**M42195-4**		
	Resistors			
R1	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	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 35V Tant	C 4019-3	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. common mode rejection
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 4892-3	2	
	Transistors			
Q100, Q200	PN4250A PNP	C 3786-8	2	
	Integrated Cricuits			
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	

Schematic Designation	Description	Crown Part No.	Qty.	Other Information
	Switches			
SW1	SPST Spring Return	D 5019-1	1	Test tone switch
SW100, SW200, SW101, SW201	SPDT 31/64 PC Mount	D 5018-3	4	Hi/Low pass 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	M42211-9		
	PSA-2 Filter Board Module	**M42337-2**		
	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	D 4286-7	2	
	Integrated Circuits			
U3	TLO74 Quad Op Amp	C 4696-8	1	
	Miscellaneous			
	14 Pin DIL IC Socket	C 3450-1	1	Socket for U3
J23	Ampmod 1 PC RCPT	C 3846-0	12	

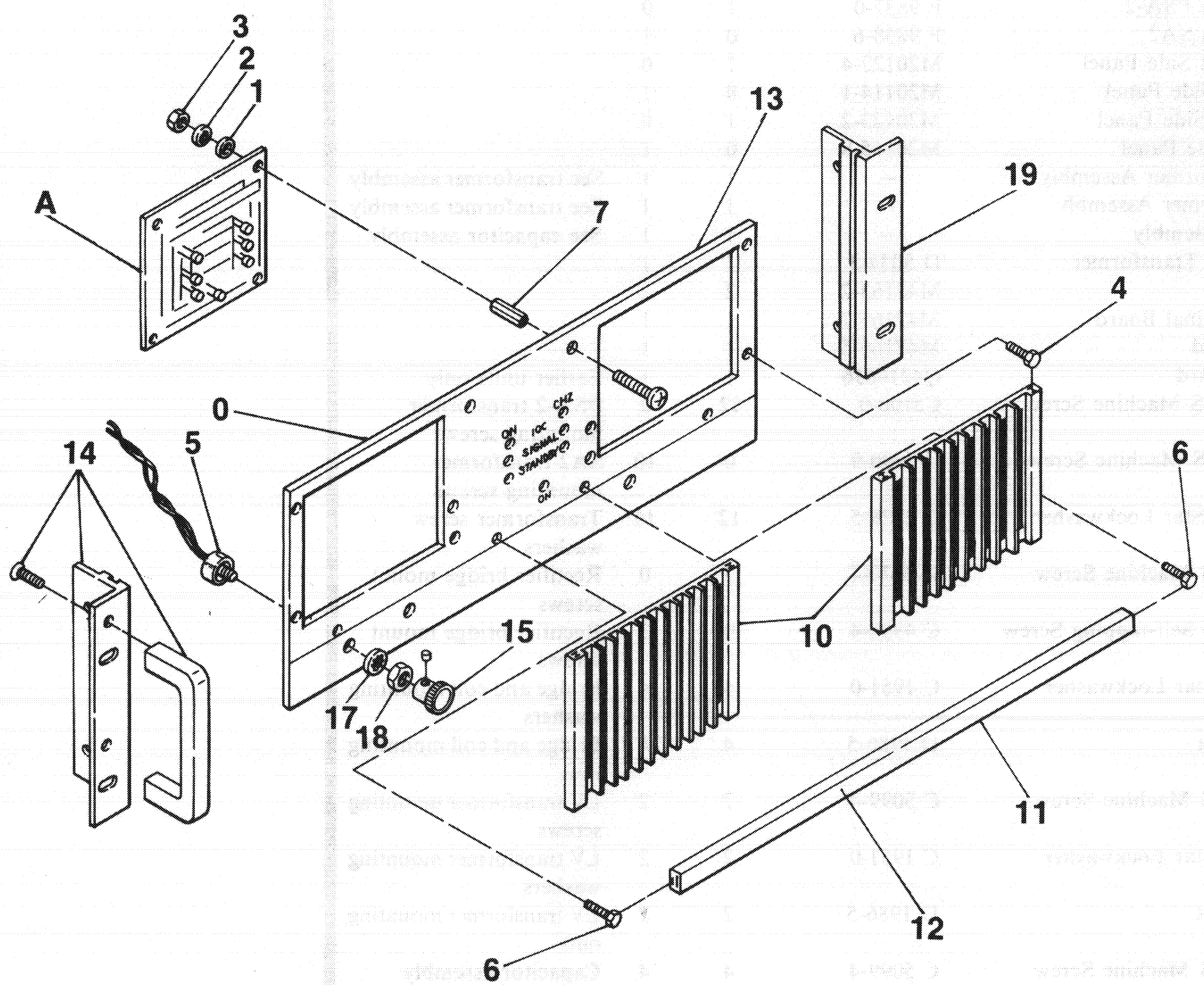


Fig. 6.29 Front Panel Assembly

Parts List: Front Panel Assembly

Index No.	Schematic Designation	Description	Crown Part No.	PSA-2 Qty.	SA2 Qty.	Other Information
		Front Panel Assembly				
0		Front Panel	PSA - F9846J0	1	0	
0		Front Panel	SA - F9850J2	0	1	
1		375x141x031 Fiber Washer	C 1296-0	4	4	Used with Display board
2		#6 Internal Star Lockwasher	C-1823-1	12	8	
3		6-32 Hex Nut	C 1889-2	12	12	
4		6-32x.50 Machine Screw	C 3917-9	8	8	
5		Pot Assembly	M42170-7	2	2	Input level pots
6		6-32 1.0 Machine Screw	C 4333-8	4	4	
7		PSA-2 6-32 Hex Spacer	D 3251-2	4	0	Used with Display board
7		SA2 Brass Spacer	D 5231-2	0	4	Used with Display board
10		Vertical Panel Extrusion	D 4265-1	2	2	
11		Logo Rail Extrusion	D-4266-9	1	1	
12		Crown Logo Insert, PSA-2	D 5073-8	1	0	
12		Crown Logo Insert, SA2	D 4640-5	0	1	
13		Front Panel Overlay	D 5132-2	1	1	
14		PSA-2 DSHMB-7R Handle Asmbly	M41888-5	1	0	
14		PSA-2 DSHMB-7L Handle Asmbly	M41939-6	1	0	
15		.880 Black Knob	D 4949-0	3	3	Volume, power knob
16		.375 Internal Star Lockwasher	C 2188-8	4	4	Used with power, (not shown)
17		.507x .391 Internal Star Lockwasher	C 4822-0	3	3	Used with power, volume controls
18		.375 Bright Nut	C 1288N7	3	3	Used with power, volume controls
19		SA2 Rack Mount Angle	D 4267-7	0	2	
A		Display board SA2	M42149-1	0	1	
		Display board PSA-2	M42199-6	1	0	
E		Rotary Power Switch	D 3492-2	1	1	Power pot; cover C4028-4 (not shown)
F		Adhesive Fishpaper	D 3894-9	0	1	

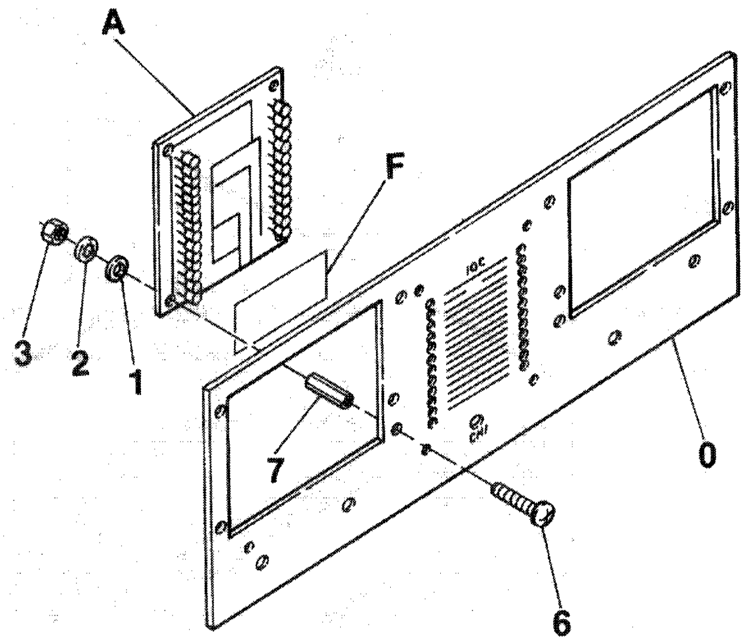
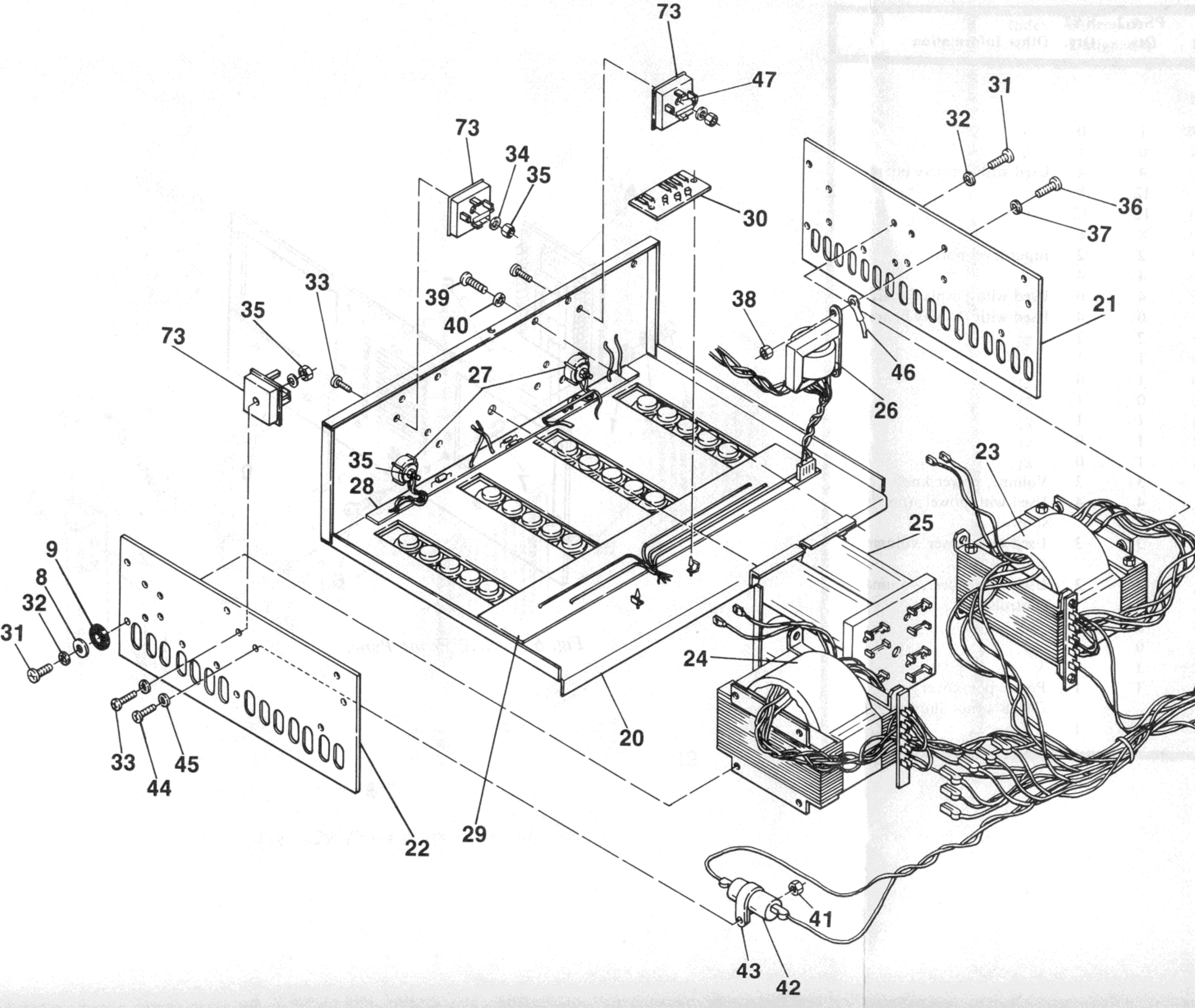


Fig. 6.30 SA2 Front Panel



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Index No.	Schematic Designation	Description	Crown Part No.	PSA-2 Qty.	SA2 Qty.	Other Information
		Main Chassis Assembly				
8		SA2 Transformer Isolation Washer	C 5249-5	0	10	Transformer mounting hardware
9		SA2 Isolation Spacers	D 5250-2	0	10	Transformer mounting hardware
20		Main Chassis PSA-2	F 9837-0	1	0	
20		Main Chassis SA2	F 9858-6	0	1	
21		PSA-2, Right Side Panel	M20122-4	1	0	
21		SA2, Right Side Panel	M20114-1	0	1	
22		PSA-2, Left Side Panel	M20123-2	1	0	
22		SA2, Left Side Panel	M20115-8	0	1	
23		Right Transformer Assembly	--	1	1	See transformer assembly
24		Left Transformer Assembly	--	1	1	See transformer assembly
25		Capacitor Assembly	--	1	1	See capacitor assembly
26		Low Voltage Transformer	D 5037-3	1	1	
27		Output Coil	M42163-2	2	2	
28		Output Terminal Board	M42165-7	1	1	
29		Mother Board	M42166-5	1	1	
30		Anti-pop Board	Q42168J6	1	1	Earlier units only
31		R10 32 .62 BS Machine Screw	C5100-0	12	0	PSA-2 transformer mounting screws
31		T10 32 .75 BS Machine Screw	C 5290-9	0	10	SA2 transformer mounting screws
32		#10 Internal Star Lockwasher	C 2279-5	12	10	Transformer screw washers
33		T8 32 .75 AS Machine Screw	C 2270-4	2	0	Rectifier bridge mount screws
33		SW8 P .75 B Self-tapping Screw	C 4330-4	0	2	Rectifier bridge mount screws
34		#8 Internal Star Lockwasher	C 1951-0	4	4	Bridge and coil mounting washers
35		8-32 Hex Nut	D 1986-5	4	4	Bridge and coil mounting nuts
36		R8 32 .37 BS Machine Screw	C 5099-4	2	2	LV transformer mounting screws
37		#8 Internal Star Lockwasher	C 1951-0	2	2	LV transformer mounting washers
38		8-32 Hex Nut	D 1986-5	2	2	LV transformer mounting nuts
39		R8 32 .37 BS Machine Screw	C 5099-4	4	4	Capacitor assembly mounting screws
40		#8 Internal Star Lockwasher	C 1951-0	4	4	Capacitor assembly mounting washers
41		8-32 Hex Nut	D 1986-5	1	1	Fan capacitor mounting nut
42	C4	7.5mF 220V rms 60Hz	C 4991-3	1	1	Fan capacitor
43		1.0in. clamp	C 5056-4	1	1	Capacitor clamp
44		SW 8 P .75 B Self-tapping Screw	C 4330-4	1	1	Fan capacitor mounting screw
45		#8 Internal Star Lockwasher	C 1951-0	1	1	Fan capacitor mounting washer
46		SA2 505 Solder Lug #8 Hole	D 2935-1	2	2	LV Transformer ground lug
47	C100	0.1mF 200V Filmatic	C 2938-6	2	2	On bridge rectifier block
73	BRDG-1	Bridge Rectifier Block	C 4305-6	2	2	

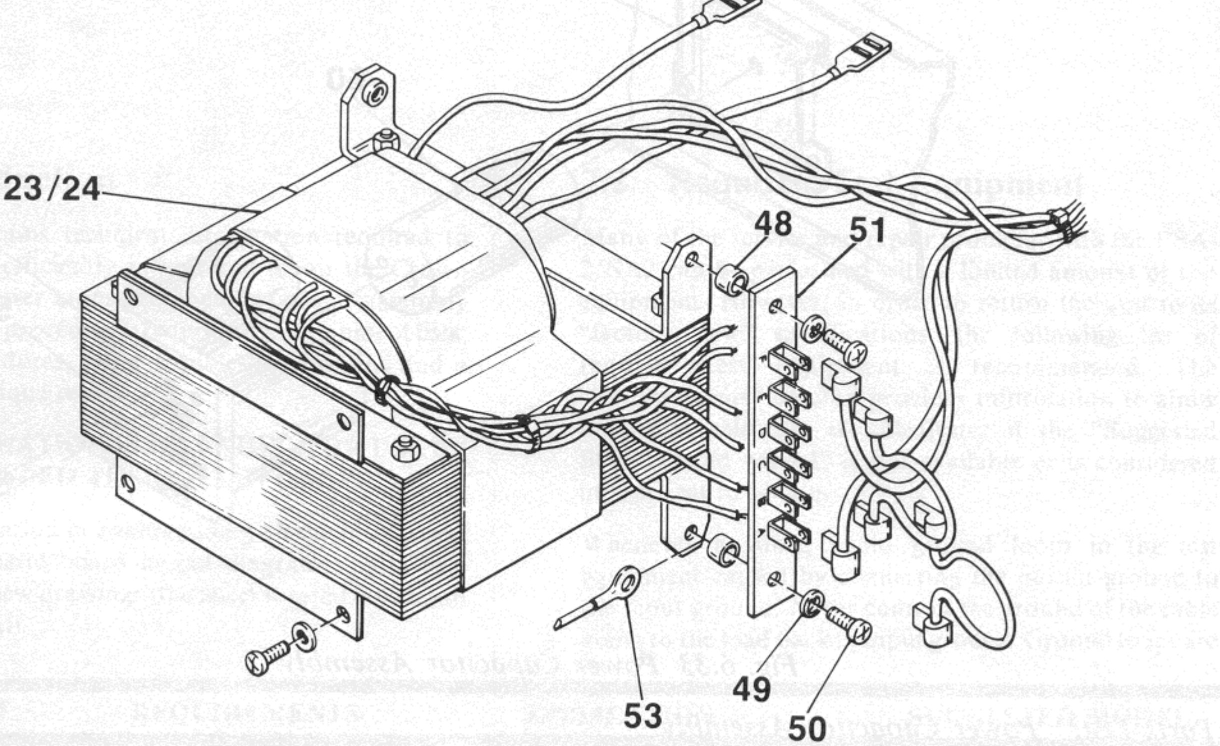


Fig. 6.32 Transformer Assembly

Parts List: Transformer Assembly

Index No.	Schematic Designation	Description	Crown Part No.	PSA-2 Qty.	SA2 Qty.	Other Information
		Transformer Assembly (Left Transformer Shown)				
48		375x187x250 Nylon Spacer	C 2762-0	2	2	
49		#10 Internal Star Lockwasher	C 2279-5	2	2	
50		R10 32 .62 BS Machine Screw	C 5100-0	2	2	
51		6 Post Terminal Board	D 4925-0	1	1	
23		Right Transformer Assembly	M42329-9	1	1	Transformer & hardware
24		Left Transformer Assembly	M42333-1	1	1	Transformer & hardware
53		SA2 806 Solder Lug	D 3312-2	0	1	Ground lug

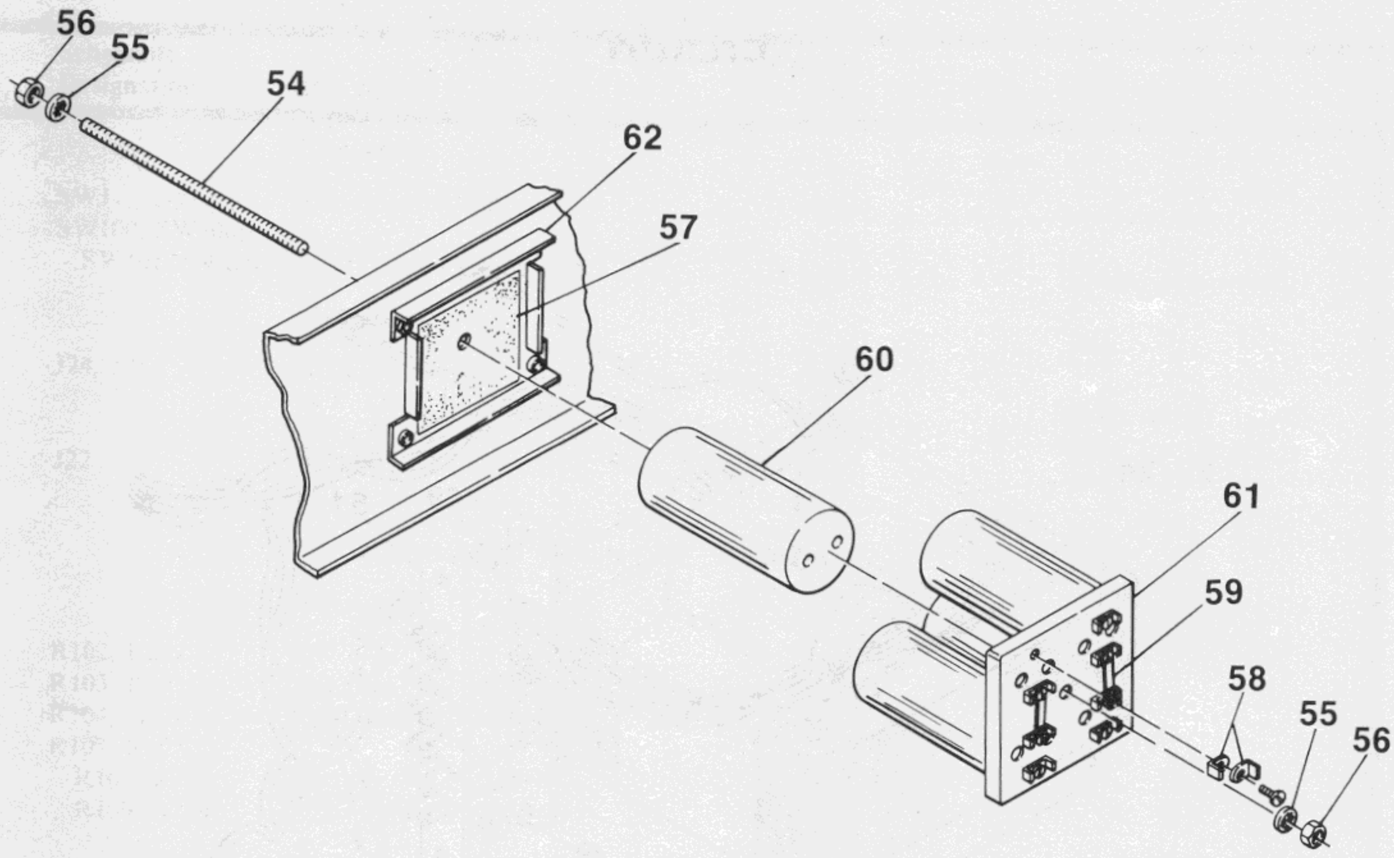


Fig. 6.33 Power Capacitor Assembly

Parts List: Power Capacitor Assembly

Index No.	Schematic Designation	Description	Crown Part No.	PSA-2 Qty.	SA2 Qty.	Other Information
25		**Capacitor Assembly**	**M42167-3**			
54		8-32x5.75 Rod	C 5492-1	1	1	
55		#8 Internal Star Lockwasher	C 1951-0	2	2	
56		8-32 Hex Nut	D 1986-5	2	2	
57		Polyfoam Capacitor Gasket	D 5133-0	2	2	
58		389 Solder Lug .218 Hole	D 2934-4	14	14	
59		1.187 Jumper Lug	D 5587-7	2	2	
60	C101, C201, C102, C202	10mF 90V Capacitor and Screws	C 4706-5	4	4	
61		Mounting Bracket - Lug Side	F 9842-0	1	1	
62		Mounting Bracket - Front Side	M20110-9	1	1	

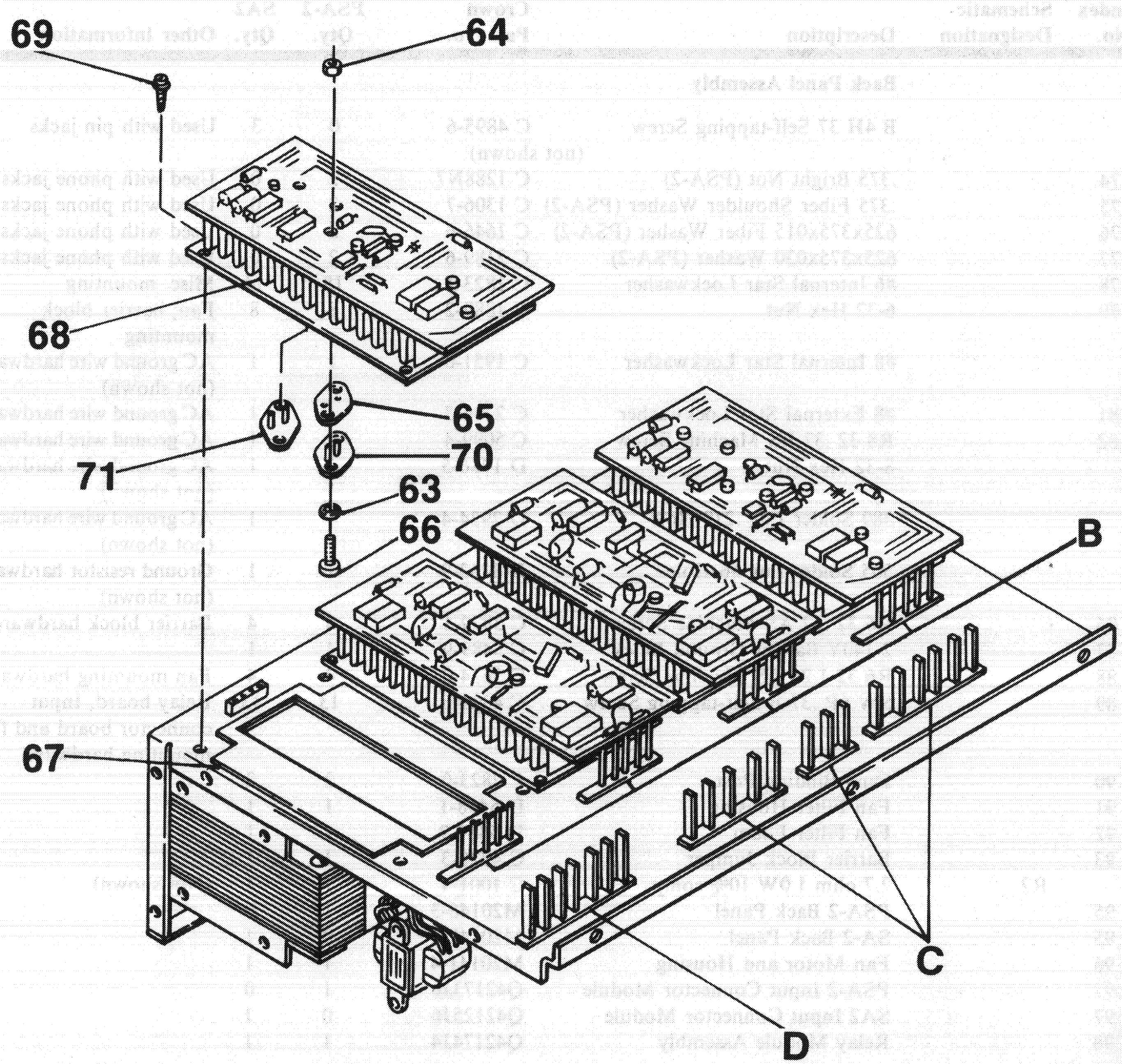


Fig. 6.34 NPN/PNP Output Assembly

Parts List: NPN/PNP Output Assembly

Index No.	Schematic Designation	Description	Crown Part No.	PSA-2 Qty.	SA2 Qty.	Other Information
		NPN/PNP Output Assembly **Note:** Quantity pertains to all four assemblies combined.				
63		#6 Internal Star Lockwasher	C 1823-1	80	80	Output device washers
64		6 32 Hex Nut	C 1889-2	40	40	Output device nuts
65		TO3 Plastic Film Insulator	C 3180-4	4	4	
66		R6 32x.62 Machine Screw	C 3879-1	40	40	Output device screws
67		.5x.5x.022 Insulator	C 5064-8	8	8	
68		Cool Pack	M20142-2	4	4	
69		2u .25 Self-tapping Screw	C 5355-0	16	16	Assembly mounting screws
70		Driver Transistor	--	4	4	See board layout for CPN
71		Output Transistor	--	16	16	See board layout for CPN
72		S 6.32x.25 Machine Screw	C 5454-1	2	2	PNP assembly only; predriver mounting screw
B		Amp Mod 1 8 Pin Header	C 5003-6	4	4	
C		Amp Mod Snap-in Header	C 5006-9	3	3	
D		Amp Mod PC Chassis 7 Pin	C 3851-0	3	3	

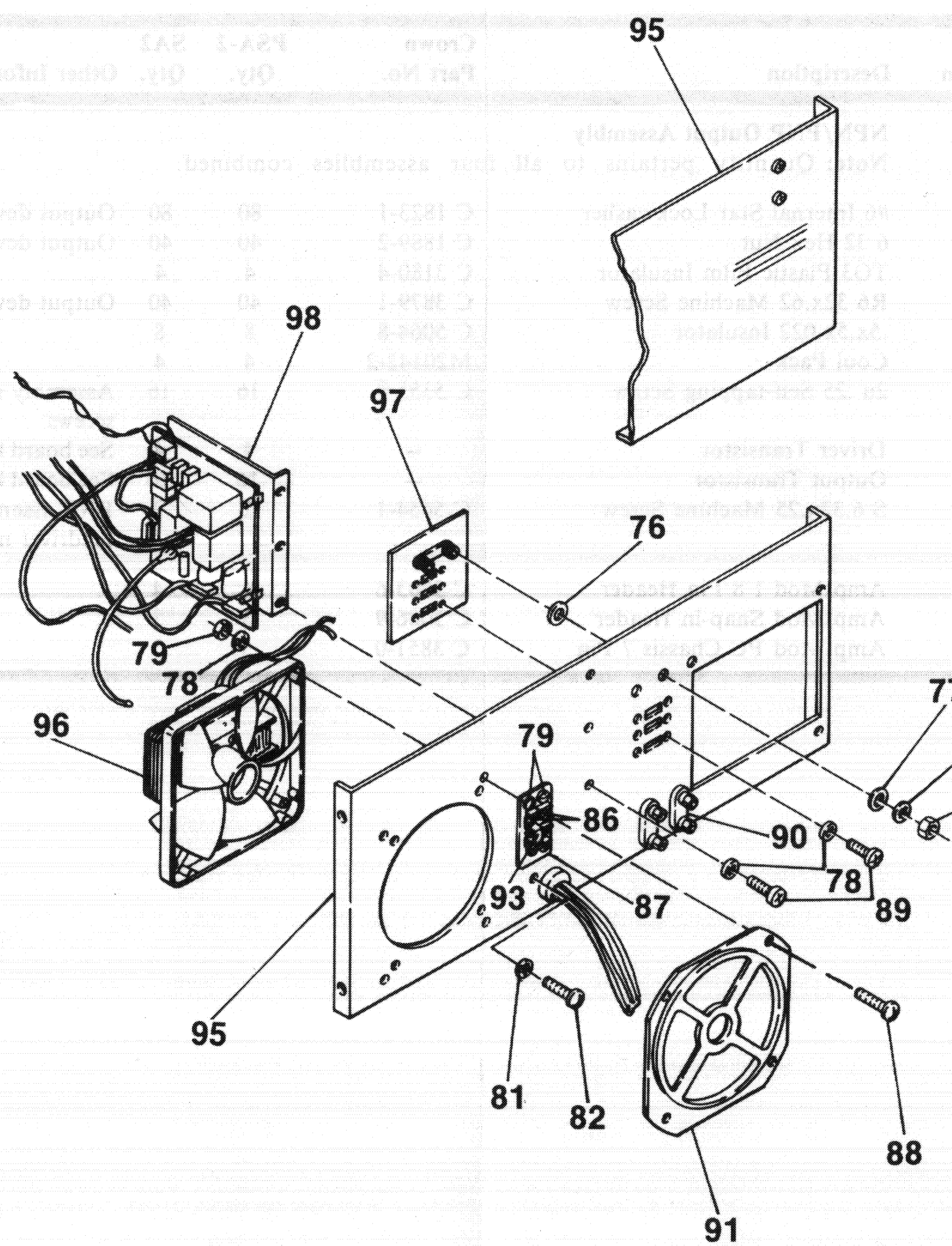


Fig. 6.35 Back Panel Assembly

Parts List: Back Panel Assembly

Index No.	Schematic Designation	Description	Crown Part No.	PSA-2 Qty.	SA2 Qty.	Other Information
		Back Panel Assembly				
		B 4H 37 Self-tapping Screw	C 4895-6 (not shown)	0	3	Used with pin jacks
74		.375 Bright Nut (PSA-2)	C 1288N7	2	0	Used with phone jacks
75		.375 Fiber Shoulder Washer (PSA-2)	C 1306-7	2	0	Used with phone jacks
76		625x375x015 Fiber Washer (PSA-2)	C 1646-6	2	0	Used with phone jacks
77		625x375x030 Washer (PSA-2)	C 2189-6	2	0	Used with phone jacks
78		#6 Internal Star Lockwasher	C 1823-1	18	14	Misc. mounting
79		6-32 Hex Nut	C 1889-2	8	8	Fan; barrier block mounting
		#8 Internal Star Lockwasher	C 1951-0	1	1	AC ground wire hardware (not shown)
81		#8 External Star Lockwasher	C 2706-7	1	1	AC ground wire hardware
82		R8 32 .37 BS Machine Screw	C 5099-4	1	1	AC ground wire hardware
		8-32 Hex Nut	D 1986-5	1	1	AC ground wire hardware (not shown)
		389 Solder Lug .218 Hole	D 2934-4	1	1	AC ground wire hardware (not shown)
		505 Solder Lug #6 Hole	D 3163-9	1	1	Ground resistor hardware (not shown)
86		R6 32 .62 AS Machine Screw	C 3879-1	4	4	Barrier block hardware
87		2-140Y Barrier Ground Block	C 3489-9	1	1	
88		R6 32 1.25 AS Machine Screw	C 3634-0	4	4	Fan mounting hardware
89		SW 6P .37 B Self-tapping Screw	C 4329-6	13	13	Relay board, Input connector board and fan mounting hardware
90		Dual Binding Post	C 2823-0	2	2	
91		Fan Filter Housing	D 5458-1	1	1	
92		Fan Filter Foam	D 5459-9	1	1	
93		Barrier Block Jumper	C 4726-3	1	1	
	R2	2.7 ohm 1.0W 10% comp	C 1001-4	1	1	(Not shown)
95		PSA-2 Back Panel	M20146-3	1	0	
95		SA-2 Back Panel	M20147-1	0	1	
96		Fan Motor and Housing	M20141-4	1	1	
97		PSA-2 Input Connector Module	Q42173J6	1	0	
97		SA2 Input Connector Module	Q42125J6	0	1	
98		Relay Module Assembly	Q42174J4	1	1	

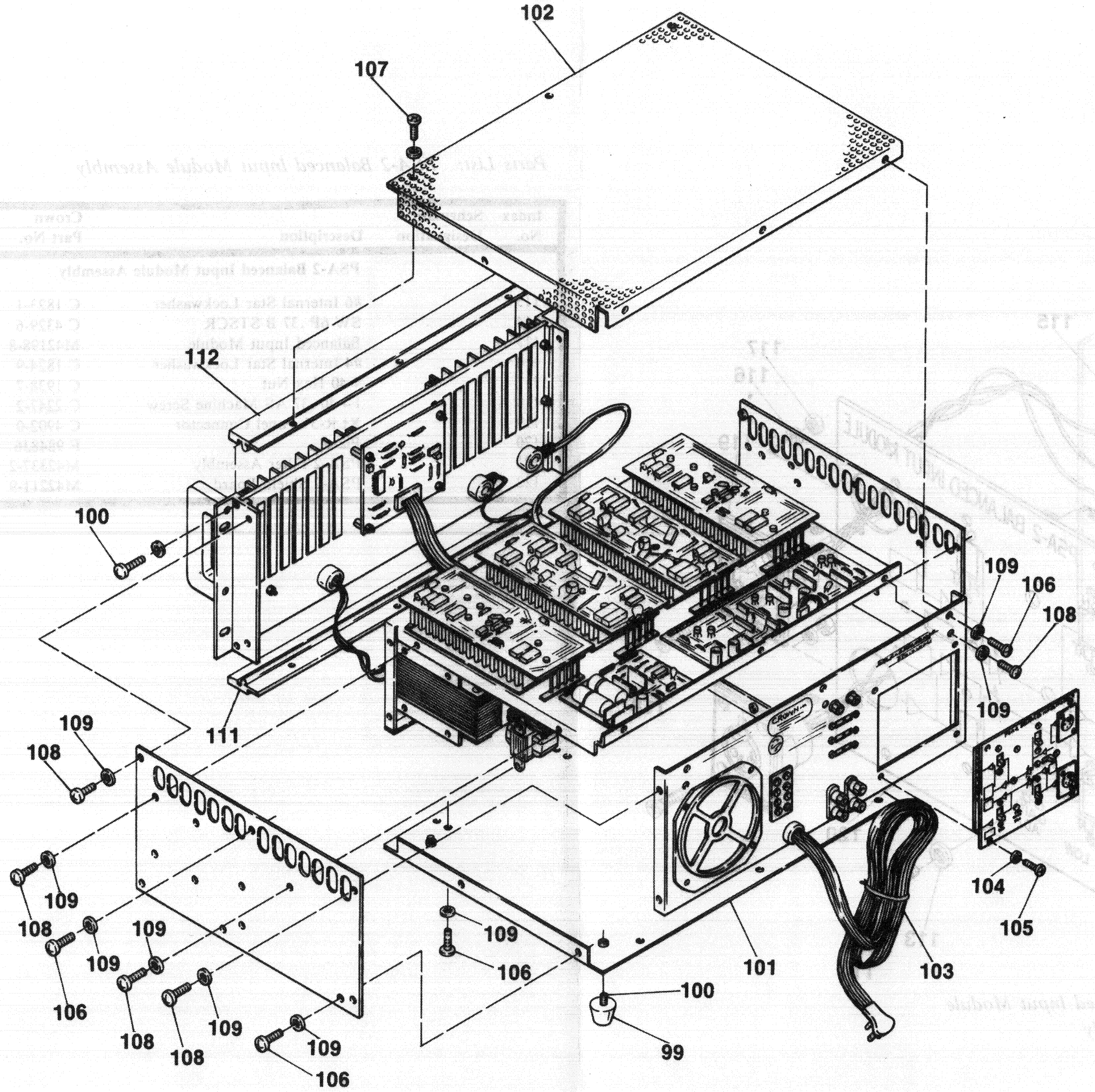


Fig. 6.36 Final Assembly

Parts List: Final Assembly

Index No.	Schematic Designation	Description	Crown Part No.	PSA-2 Qty.	SA2 Qty.	Other Information
		Final Assembly				
99		Feet M195 .75 High	C 2945-1	4	4	
100		SW 8P .75 B Self-tapping Screw	C 4330-4	8	8	Foot screws, rack angle mount screws
101		PSA-2 Bottom Cover	M20124-0	1	0	
101		SA2 Bottom Cover	M20116-6	0	1	
102		PSA-2 Top Cover	M20125-7	1	0	
102		SA2 Top Cover	M20117-4	0	1	
103		AC Power Cord	H42171-1	1	1	
104		#6 Internal Star Lockwashers	C 1823-1	4	0	Balanced input hardware
105		SW 6 P .37 B Self-tapping Screws	C 4329-6	4	0	Balanced input hardware
106		8 32x.37 #7 Truss Phillips	C 5297-4	15	15	Top cover; bottom cover screws
107		SW 6 P .37 B Self-tapping Screws	C 4329-6	6	6	Cover screws
108		R8 32 .37 BS Machine Screw	C 5099-4	15	15	Side position mounting screws
109		#8 Internal Star Lockwasher	C 1951-0	30	30	Side mounting washers
111		Bottom Rail Extrusion	D 4263-6	1	1	
112		Top Rail Extrusion	D 4264-4	1	1	

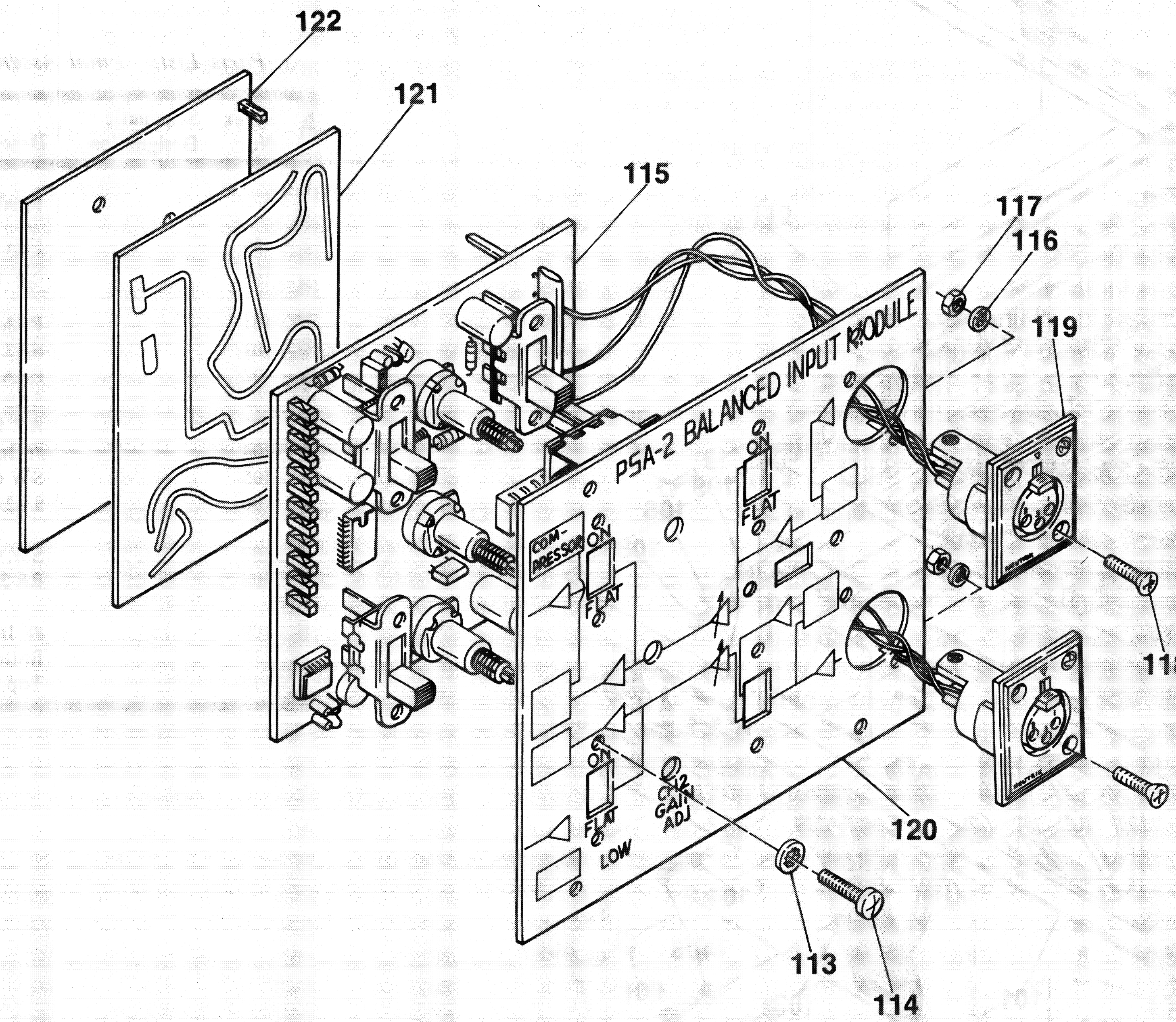


Fig. 6.37 PSA-2 Balanced Input Module Assembly

Parts List: PSA-2 Balanced Input Module Assembly

Index No.	Schematic Designation	Description	Crown Part No.	PSA-2 Qty.	SA2 Qty.	Other Information
		PSA-2 Balanced Input Module Assembly				
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 9848J6	1		
121		PSA-2 Filter Assembly	M42337-2	1		
122		PSA-2 Shield Board	M42211-9	1		

SECTION 7
MAINTENANCE

7.1 Introduction

Section 7 contains technical information required to effectively and efficiently service and repair the Crown PSA-2/SA2 power amplifier. Included are disassembly and reassembly procedures, required test equipment lists, checkout procedures, basic troubleshooting tips and a soldering technique review.

THIS INFORMATION IS INTENDED FOR USE BY AN EXPERIENCED TECHNICIAN ONLY!

Use this information in conjunction with the Instruction Manual, schematic/board layout diagrams, parts lists and exploded view drawings (the latter located in Section 6 of this manual).

7.2 Required Test Equipment

Many of the service and repair problems with the PSA-2/SA2 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.

Whenever possible, avoid ground loops in the test equipment caused by connecting the output ground to the input ground. Never connect the ground of the cable going to the load back to input ground. Ground loops are

EQUIPMENT	REQUIREMENTS	APPLICATION	SUGGESTED MODEL
Oscilloscope	Capable of displaying a 10MHz signal	Monitoring output during service and testing	Telequipment D54A or equivalent
Volt-ohmmeter (VOM)	Low-voltage resistance probe (100mv range). High-voltage resistance probe (1.5V range)	Check resistance values (low voltage probe). check semi-conductor junctions for opens or shorts (high volt-age probe) Check DC voltages	Triplett 601 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	15 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 sinu-soidal peak from any wave form)	Monitor Line voltage	Available from CROWN

EQUIPMENT	REQUIREMENTS	APPLICATION	SUGGESTED MODEL
Phase Meter			
AC Voltmeter	100mv low range, flat frequency response to 100KHz	Set output level for testing; check noise level	Hewlett-Packard 400F or equivalent
Filter	20-20KHz bandpass, low noise 20Hz-20KHz	Between preamplifier and voltmeter in noise test	Information available from CROWN
Intermodulation Distortion Analyzer	Residual (.002% or lower)	Check IM distortion	Information available from Crown

especially obnoxious when measuring distortion. An IM analyzer for example has its input and output terminals tied to a common ground. Such a test should use an ungrounded output return with the output lead wrapped around a well-shielded and grounded input cable (See Section 7.9 for additional information).

7.3 Soldering Techniques

Note: Proper continuity between internal components of any electronic device is the key to its successful operation. Therefore, a brief review of the following discussion on soldering techniques may be in order. Because most service work involves component part(s) replacement, hand-soldering with the use of a soldering iron will be the only method covered, even though many exist.

The difference between success and failure in service repair is often determined by the thermal characteristics of an iron and how well it matches the job at hand. One would not use a large flat-head screwdriver to work on a delicate Swiss watch. Likewise, the proper size iron and tip should be used when soldering delicate electronic parts in position.

Iron wattage classification is actually not a very good method of choosing an iron. The reason for this is because of the possible inefficiency of heat transfer to the tip internally. A large wattage iron (125W) may, in effect produce lower tip temperatures than another iron smaller in wattage. Likewise, tip size and shape does not necessarily work in proportion to temperature. Therefore, it is impractical to compare soldering irons by their wattage but more feasible to refer to them by their maximum tip temperature.

Usually, the skilled service technician can pick the right iron and tip for the job from experience or recommendation. In most cases, the miniature or small electrical soldering iron will work well with delicate semiconductor devices (Fig. 7.1). When the proper size iron is used (usually around 700° F. tip temperature), a joint is almost instantly heated (approx. 500-550°) and application of iron and solder melting is simultaneous.

Fig. 7.1 Miniature Soldering Iron

When clean metal is exposed to air a chemical reaction takes place known as oxidation. When heat is applied to metal, oxidation is speeded up and creates a non-metallic film that prevents solder from touching the base metal. By applying a small amount of solder to a hot iron tip, a desirable process known as tinning occurs. The main reason for tinning an iron is to help prevent it from oxidation as well as to aid in heat transfer. Tinning should be performed prior to each use as well as after long idling times.

To help prevent oxidation or remove existing oxidation while soldering, a natural rosin flux core solder should be used. Not only does flux aid in cleaning, but acts as a catalyst in that it helps speed up the joint formation without actually entering itself, into the bond. Never use an acid flux except to clean a highly oxidized tip that will not tin correctly. Crown recommends 63% tin/37% lead composition with a rosin flux core of 2.5% (melting temperature is approx. 361°F.).

Fig. 7.2 shows the correct and incorrect method of applying rosin flux core solder to a joint. Never apply solder to the iron tip directly and allow solder to run onto the joint (flux is burned away and does not clean the joints). Always apply heat to the connection and allow the joint to melt the solder, not the iron. This insures proper wetting and flow of the solder.

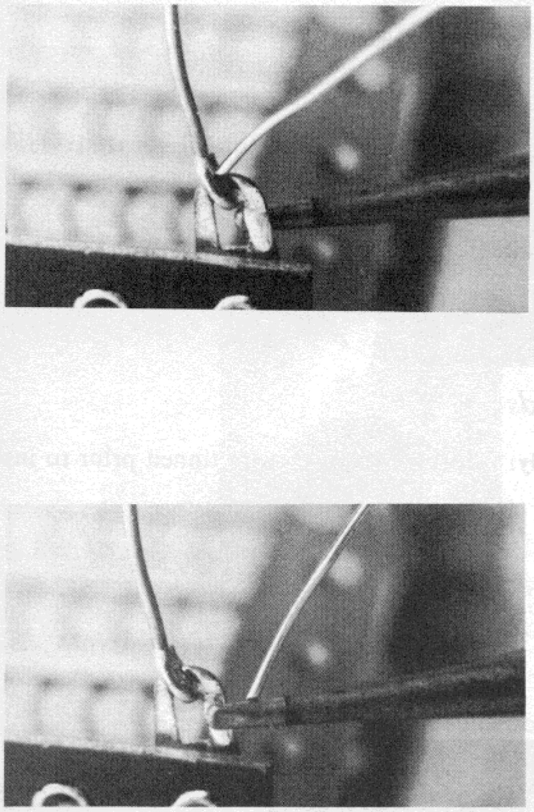


Fig. 7.2 *Correct and Incorrect Solder Application*

One of the main advantages of using solder to make connections is that it is one of the few joining methods responsive to visual examination. This permits 100% inspection, while other methods require sampling and lengthy electrical tests. With proper inspection of materials used, soldering is the most reliable, time-proved, and versatile form of electrical joining offering the benefits of economy, dependability and speed.

A good solder joint will have the following recognizable features:

a) Proper wetting - mixing of molecules to form a singular, shiny bond of metal
b) Proper flow - feathering out of solder
c) Proper contour - outline of wire under solder
d) Proper fillet - solder filling in holes and crevices.

Because visual inspection is an important part of recognizing a good solder joint, the following examples have been provided to help with familiarization.

Problem: Unsoldered wire.

Characteristics: Properly assembled junction of wire, but without any solder.

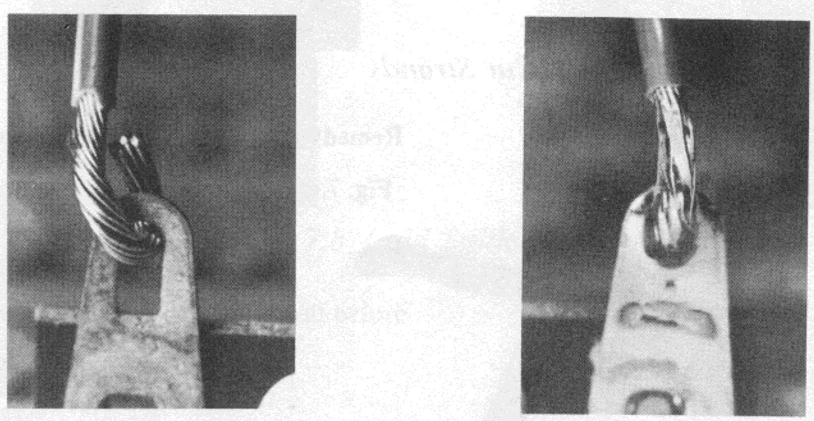


Fig. 7.3 Unsoldered Wire

Cause: Solder not applied.

Remedy: Correct amount of solder applied properly.

Problem: External strands.

Characteristics: One or more strands of wire outside terminal. This defect most common when cup-type terminals are utilized.

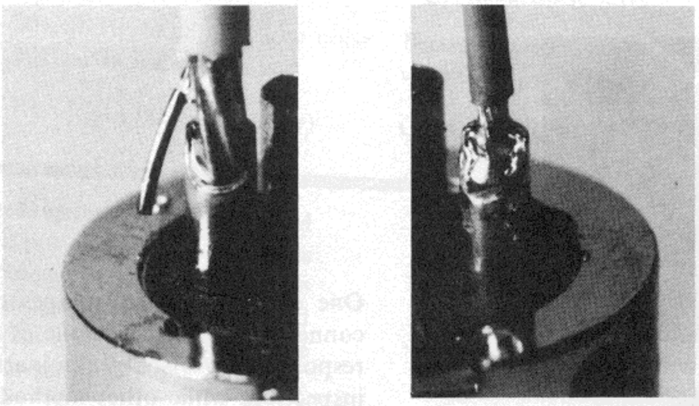


Fig. 7.4 External Strands

Cause: Poor assembly operation, too large diameter wire used.

Remedy: Correct diameter wire tinned prior to insertion.

Problem: Cut strands.

Characteristics: Several strands of wire cut or broken and usually not soldered to terminal.

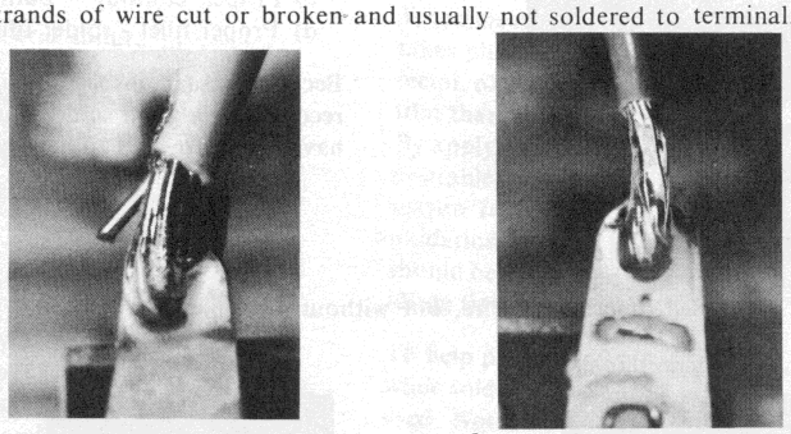


Fig. 7.5 Cut Strands

Cause: Improper wire stripping; wire flexed or bent excessively during or after assembly.

Remedy: Use wire strippers similar to the one shown in Fig. 7.6. Care must be taken to avoid nicking or cutting.

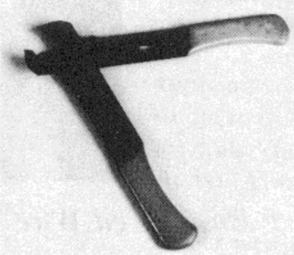


Fig. 7.6 Wire Strippers

Problem: Disturbed joint.

Characteristics: Rough appearance with questionable adhesion.

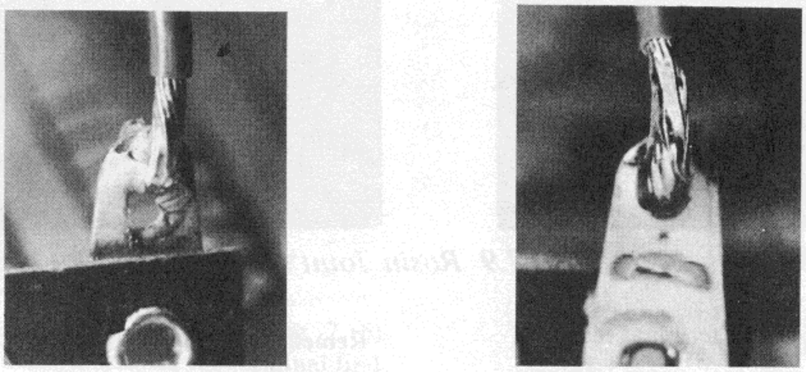


Fig. 7.7 Disturbed Joint

Cause: Movement of wire/joint during cool-off stage.

Remedy: Use of holding vice or similar tool to help prevent movement.

Problem: Cold solder joint.

Characteristics: Joint with dull, frosty appearance; often has poor adhesion as well as imperfect shaping.

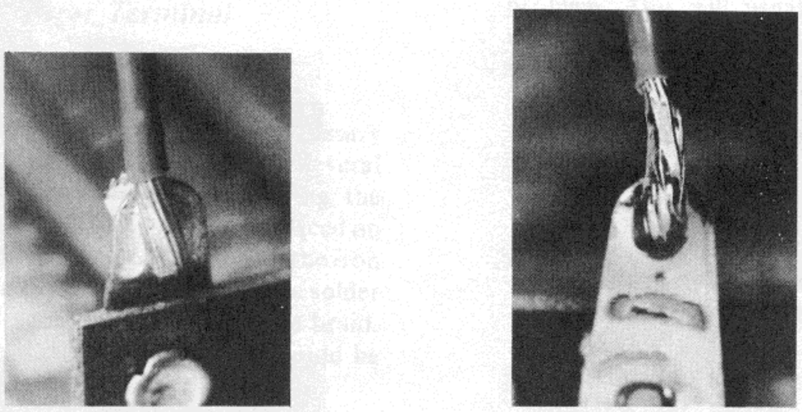


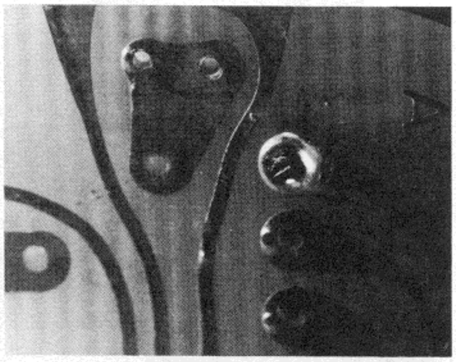
Fig. 7.8 Cold Solder Joint

Cause: Too much heat applied (flux is boiled off before oxide removal action takes place).

Remedy: Correct matching of iron/tip to specific job. Correct solder flux combination is also important.

Problem: Rosin joint.

Characteristics: Joint is separated by a thin coat of flux producing high resistance to current.



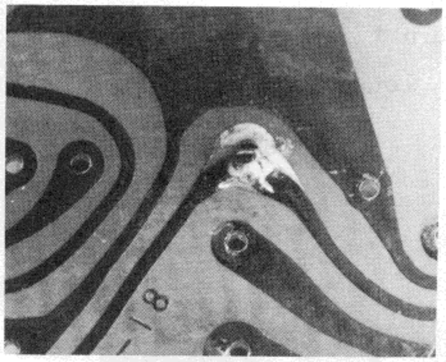


Fig. 7.9 Rosin Joint

Cause: Solder applied previous to terminal reaching minimum temperature (solder melting point).

Remedy: Apply correct amount of heat; remove only after good wetting and fillet is achieved.

When soldering individual component parts to printed circuit boards, several procedures may be followed. The following procedure complies to U.S. Government standards and may be altered to suit a specific situtation.

1. Components leads should be bent to exact spacing of mounting holes in PC board (Fig. 7.10). This allows leads to enter PC board at right angles and relieves stress.

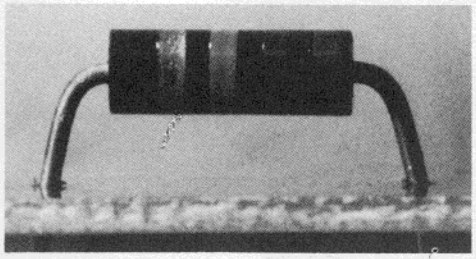


Fig. 7.10 Component Lead Spacing

2. Leads should be bent down tight to pad.

3. Leads should be bent in the direction of the run connected to the pad and clipped at a length approximately ⅛″ (Fig. 7.11).

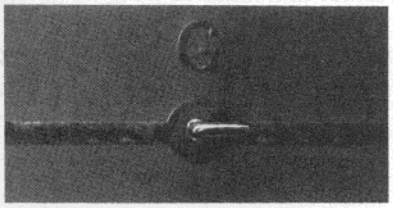


Fig. 7.11 Component Lead Bending

4. Components should be held tight to the PC board while clinching leads on other side (Fig. 7.12) and soldered accordingly. Fig. 7.13 shows acceptable solder joints.

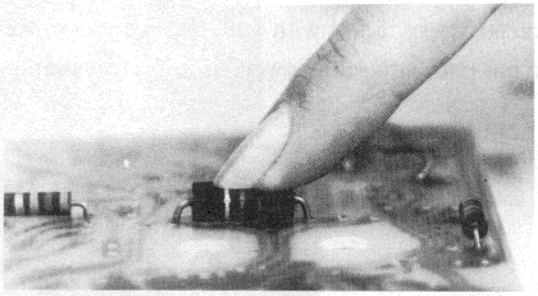


Fig. 7.12 Correct Pressure Applied

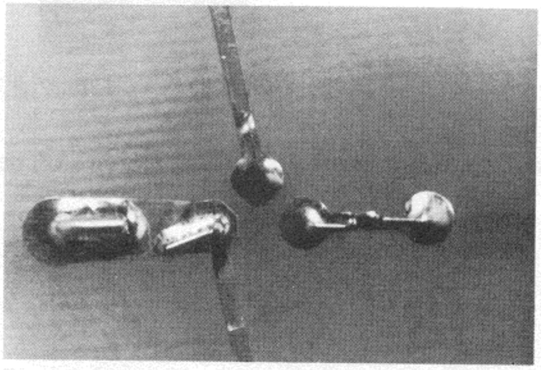


Fig. 7.13 Acceptable Solder Joints

When soldering to lugs (as on potentiometers), the mechanical wire wrap should be a J hook with correct insulation clearance as shown in Fig. 7.14.

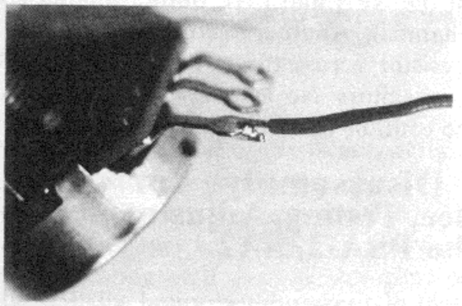


Fig. 7.14 Soldering to a Lug

Turret terminals also utilize the "J" hook (Fig. 7.15). Concentrate on good heat transfer to the terminal first, then the wire. If two wires are to be soldered, be sure of good solder flow to all three.

Fig. 7.15 Turret Terminal

Desoldering

In order to replace a component part, it is often necessary to remove the old part by means of desoldering. Several methods are available, the most common being the braided bare copper method. This wire braid is placed on the lead(s) of the component to be removed with the iron placed on top of the braided wire. This allows the solder to heat up while simultaneously adhering to the braid. When the braided wire is removed, the joint should be clean. (See Fig. 7.16)

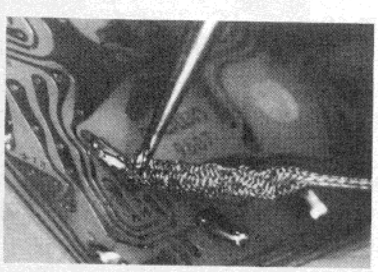


Fig. 7.16 Wire Braid Desoldering

Next, use points of small diagonals to lift ends of component lead wires and remove the part. This procedure is applicable to both PC board desoldering as well as terminal and lug desoldering.

Note: Be sure that lifting of the component lead does not also lift the copper foil pad from the board. Occasionally a small amount of iron will be helpful.

Soldering is one of the most reliable methods of joining electronic component parts and assemblies. When properly used, it can be one of the most helpful tools in service repair work.

7.4 Basic Troubleshooting

As is well known, time is an important factor in providing efficient service repair. Therefore, several time-saving troubleshooting steps are listed below. These hints may or may not already be implemented in your service work. If not, you may wish to experiment with them in order to help improve your efficiency. After all, time is money!

A. Establishing Problems

User complaints about defective operation may not always be clear or simple. Furthermore, the trouble the user has experienced may be due to the system and not the unit itself. If possible, talk to the user about this problem. This will usually be simpler than trying to understand written complaints. A first hand account of the problem can help in:

1) Getting the problem to re-occur on the service bench.

2) Getting an understanding of the probable cause. Some troubles will be obvious upon visual inspection. When the trouble (or its symptoms) is not so obvious ask:

a) Exactly what was the problem; how was it noticable?

b) How was the unit being used?

c) Has the system as a whole been carefully examined for possible external problems?

d) How long had the unit been operating when the problem occurred? Was it heat related?

If the user is unavailable or unable to explain the trouble the next step is a thorough visual inspection.

B. Visual Inspection

A good visual inspection may often save hours of tedious troubleshooting. Make a habit of proceeding in an orderly manner to insure that no vital part of the following procedure is omitted. The visual inspection can be performed in 10 to 15 minutes. It is recommended both as a preventive maintenance procedure and also for its value in determining cause of malfunction.

1) Check that all external screws are tight and that none are missing.
2) Check all fuses/circuit breakers.
3) Check for smooth and proper operation of switches, etc.
4) Inspect line cord for possible damage to cap, jacket and conductors.
5) Remove protective covers as outlined in disassembly instruction (Section 7.6).
6) Check that all attaching parts for internal circuits are tight and that none are missing.
7) Inspect all wiring for charred insulation, or discoloration as evidence of previous overheating.
8) Check that all electrical connections are secure. This includes wire terminals, screw and stud type terminals, and all soldered connections.
9) Check for obvious destruction of internal structural parts. Distortion in any of these parts could mean that the unit has been dropped or subjected to severe shock.

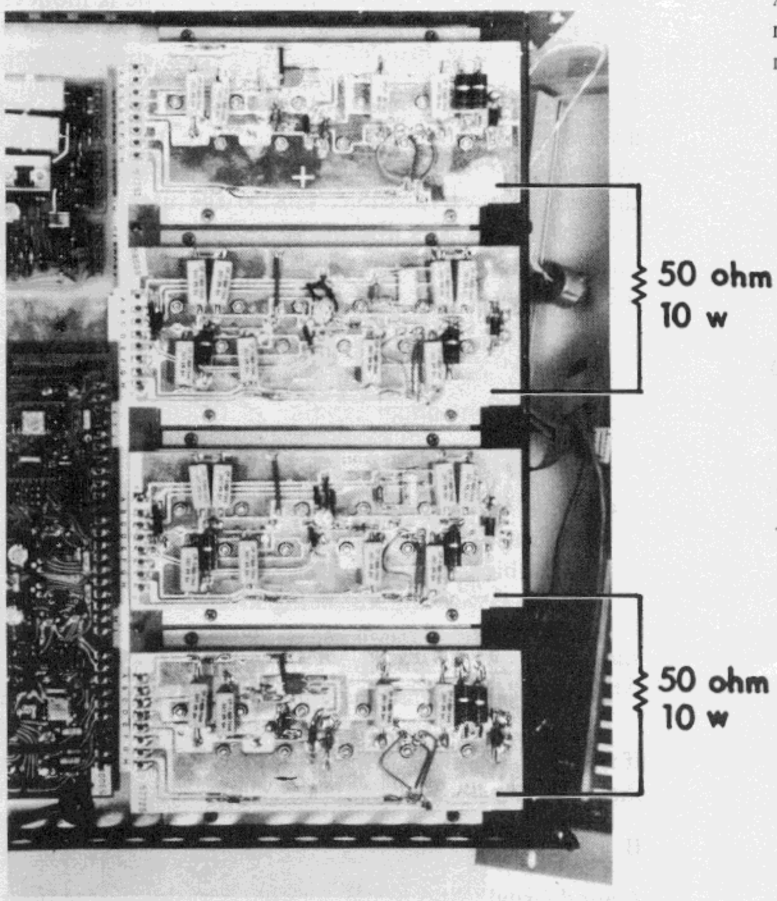


Fig. 7.17 Discharge Points

7.5 Discharging Instructions

Both the PSA-2 and SA2 amplifiers incorporate very large-storage capacitors in the power supply (C101, C201, C102, C202). For this reason, at any time the covers are removed it is necessary to discharge the power supply capacitors in order to avoid possible damage to the unit and also to prevent shock hazard. This is best performed by placing a 50 ohm/10 watt resistor across the main trace that surrounds the Crown logo (See Fig. 7.17) of the NPN and PNP output modules (do this on each channel). Another method is to place this same value resistor across the terminals of each of the four power capacitors. No matter which method is used, use extreme caution when handling the discharge device.

7.6 Disassembly for Inspection, Service, Testing, Adjustment and Repair for the PSA-2/SA2

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 6) of this manual.

A. 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 7.5). Failure to heed this warning could result in serious shock or damage to circuit components when handling modules.

Both the PSA-2 and SA2 have 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.

B. Main Board Module Removal

1. Remove the top cover (102) as described in Section A. Locate main module (See Fig. 7.18).
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.

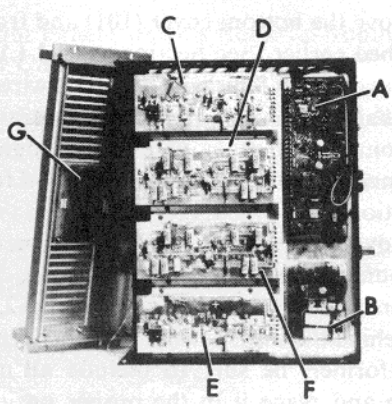
C. Power Supply/Logic Module Removal

1. Remove the top cover (102) as described in Section A. Locate the power supply module (See Fig.7.18).
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 labled A through W. The board will come free as soon as each of these pins are released.

D. PNP/NPN Output Module Assembly Removal (Including output transistor replacement)

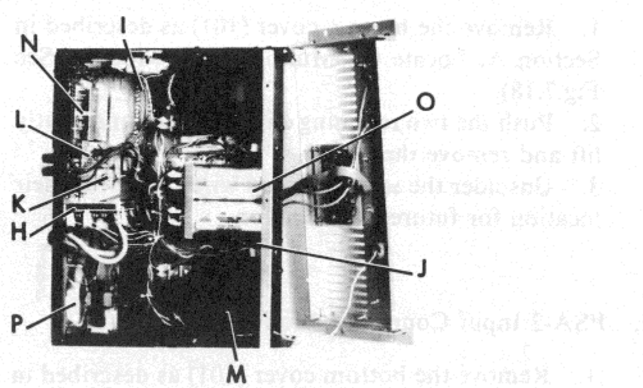
1. Remove the top cover (102) as described in Section A. Locate the output assembly(s) which must be removed (See Fig. 7.18).
2. Remove the four phillips head mounting screws (69) being careful not to damage the delicate heat sink (68) fins.
3. Apply equal upward pressure on each short end of the assembly 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.

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

H. RELAY MODULE
I. MOTHER BOARD MODULE
J. OUTPUT TERMINAL MODULE
K. ANTI-POP MODULE (EARLIER 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. 7.18 Component Location Diagram

A D D E N D U M

PSA-2 SERVICE MANUAL

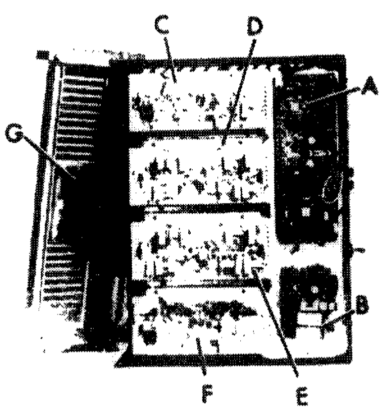
PAGE 7-9

FIG. 7.18

NOTE: E AND F ON PICTORIAL ARE REVERSED!

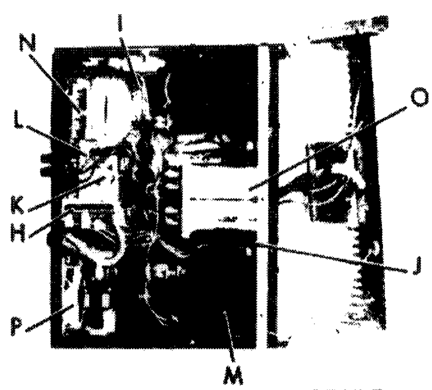
PLEASE CHANGE IN YOUR PSA-2/SA-2 SERVICE MANUAL

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

H. RELAY MODULE
I. MOTHER BOARD MODULE
J. OUTPUT TERMINAL MODULE
K. ANTI-POP MODULE (EARLIER 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. 7.18 Component Location Diagram

E. Relay Board Module Removal

1. Remove the bottom cover (101) as described in Section A. Locate the Relay Board Module (See Fig. 7.18).
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. 7.19).

F. 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.

G. Output Terminal Board Removal

1. Remove the bottom cover (101) as described in Section A.
2. Remove both power transformers (23,24) as described in Section M.
3. Remove power supply capacitor assembly (25) as described in Section N.
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.

H. Muting Module Removal (earlier units only)

1. Remove the bottom cover (101) as described in Section A. Locate the Muting Board Module (See Fig.7.18).
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.

I. PSA-2 Input Connector Module Removal

1. Remove the bottom cover (101) as described in Section A. Locate the input connector module (See Fig. 7.18).
2. Disconnect each of the two-five pin cable connectors. Note their location and pin read-outs for future reconnection (See Fig.7.19).
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.

J. SA2 Input Connector Module Removal

1. Remove the bottom cover (101) as described in Section A. Locate the Input Connector Module (See Fig.7.18).
2. Disconnect each of the two-five pin cable connectors. Note their location and pin read-outs for future reconnection (also see Fig.7.19).
3. Remove the six pozidrive head, switch mounting screws (89) as well as the two 3/16″ input jack screws. For complete removal, it will be necessary to disconnect the multi-cable plug located at the Mother Board Module.

K. PSA-2 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.

L. PSA-2/SA2 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).

M. Power Transformer Removal

1. Remove the bottom cover (101) and front panel as described earlier (See Section A and L).
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 (See Fig. 7.19).
4. Remove all six (SA2, five) transformer phillips head mounting screws (31); four (SA2, four) are located on the side of the unit and two (SA2, one) 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 (See Fig. 6.31).

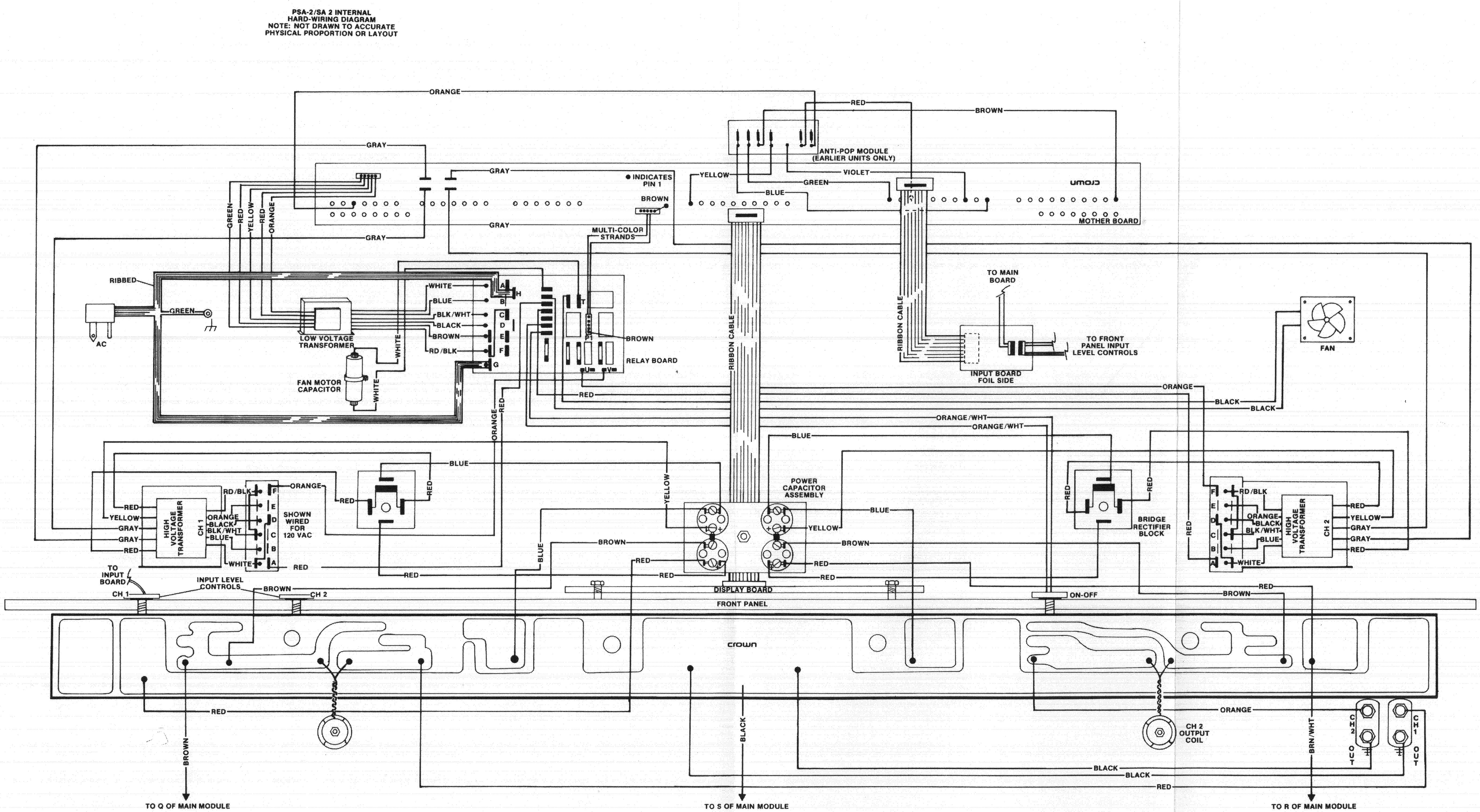


Fig. 7.19 Internal Hard Wiring Diagram

N. 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 A and L).
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).

O. Fan Removal

Note: There are actually two versions of fan filters incorporated in the PSA-2/SA2. 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).
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.

P. Front Panel Controls Removal (Input Level and On/Off Controls

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

7.7 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 6.

7.8 Repair Instructions

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 6.

Fig. 7.19 shows all amplifier wiring connections including color code, should it become necessary for wire replacement.

Consumable materials (except wire) required in repairing the amplifier are listed in Fig. 7.20. The use of these materials is explained in the last column entitled "Use".

Soldering techniques and common circuit board repair procedures are listed in Section 7.3.

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
Insulation sleeving			Insulating jumper wiring on PNP/NPN Output Modules, etc.
black (0.022ID)	B 1644-2	1.5″	
(0.042 ID)	B 1363-9	4.75″	
(0.0133ID)	B 1383-7	2″	
Shrink tubing (0.250 ID)	B 4782-7	2″	SA2 Power Transformer leads
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. 7.20 Consumable Materials Chart

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7.9 PSA-2/SA2 Electrical Checkout, Troubleshooting and Adjustment

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 7.5). Also, use extreme caution while making any internal adjustments when the unit is powered.

Checkout and Adjustment

Type of Test/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 S 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 (See Fig. 6.3 for test points). 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 to pin E of the NPN. Check both channels.
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" lights 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).

Type of Test/Adjustment	Input Signal Characteristics	Comments
5. Main Board Voltage	None	5. Check voltage on test points 1, 2, 3, and 4 (of Main board module; See Fig. 6.9) 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	Check voltage on test pins G of each output board assembly. At room temperature (25°C), the voltage should be 2.98V (±.12V).
7. Standby Relay	None	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	SA2 - None PSA-2-Shorting plug in unbalanced input jack	Adjust R104 and R204 so that with the input level controls fullyclockwise, a dc voltage of ±10mV appears at the output of each channel.
9. Bias	None	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, variable (no load)	Insert a 9Hz signal into the unbalanced input of each channel. Slowly increase the input level; note that when the output reaches approximately 42V, the low frequency protect circuitry will activate.
11. Protection Circuit	A. None (no load)	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 oscilliscope) in the output waveform. Fig. 7.21 shows a correct waveform.

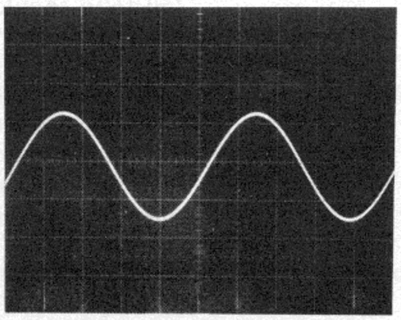

Fig. 7.21 Correct Output Waveform

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Type of Test/Adjustment	Input Signal Characteristics	Comments
Multiplier Balance	C. 100Hz sine wave; variable (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 (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 output level with 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). Across: C112/C212 measure .4VAC ±10% C113/213 measure 1.7VAC ±10% C114/214 measure .036 ±10% If these measurements cannot be obtained, a problem exists in the thermal computer circuitry.
12. Anti-pop Circuit (earlier PSA-2/SA units have this circuit on separate module. Later amps include this circuit on Main Module).	1KHz sine wave; 2V no load	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 noticable 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/PSA-2X)	A. 1KHz sine wave; variable no load	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 oscilliscope 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 SA2/PSA-2D PSA-2DX)	B. 1KHz sine wave; variable no load	B. Vary input level, noting upward progression of ladder display proportional to the input signal variance. Connect an oscilliscope 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	A. 44V minimum should be obtainable before clip.
	B. 1KHz sine wave, 2V; 8 ohm and inductive (159uh) load	B. 20V minimum should be obtainable before clip.
	C. 1KHz sine wave, 2V; 4 ohm load	C. 41V minumum should be obtainable before clip.

Type of Test/Adjustment	Input Signal Characteristics	Comments
	D. 1KHz sine wave; 2V; 1 ohm load	D. 30V 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. wave; 2V; 8 ohm load	F. 50V minimum should be obtainable before clip; signal should be a good square wave with no abberations (Fig. 7.22).

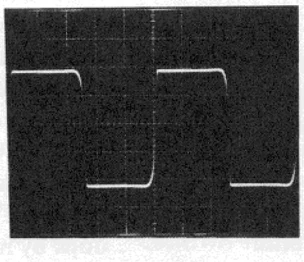

Fig. 7.22 Correct Square Wave Output Waveform

Type of Test/Adjustment	Input Signal Characteristics	Comments
15. Thermal	20KHz sine wave, variable input; 1 ohm load (output at 21V)	On each output module, observe the voltage (actually temperature) on test pin "Q". Voltage should drop to approximately 3.0V-3.2V as signal reduces in amplitude.
16. Mono	1KHz sine wave; 2V; no load	Using only channel 1, apply input signal with mono/stereo switch in MONO position. Observe the output signal simultaneously of both red or "hot" terminals of both channels. They should be 180° out of phase (see Fig. 7.23).

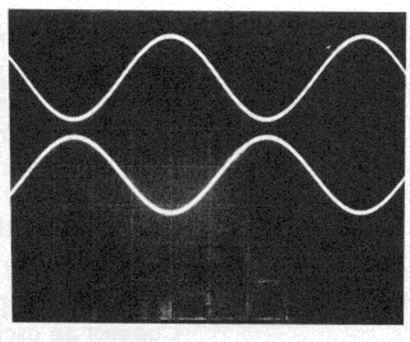

Fig. 7.23 Mono Output Waveform

Type of Test/Adjustment	Input Signal Characteristics	Comments
17. IM Distortion	60Hz/7KHz signal summed in a 4:1 ratio (See Fig. 7.24 for hook-up)	Using Crown IMA, readings should be from 0 to -25dB, less than .004%, all other, less than .01%.
18. Signal/Noise	None - (See Fig.7.25 for hook-up)	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	Should be less than 90W.

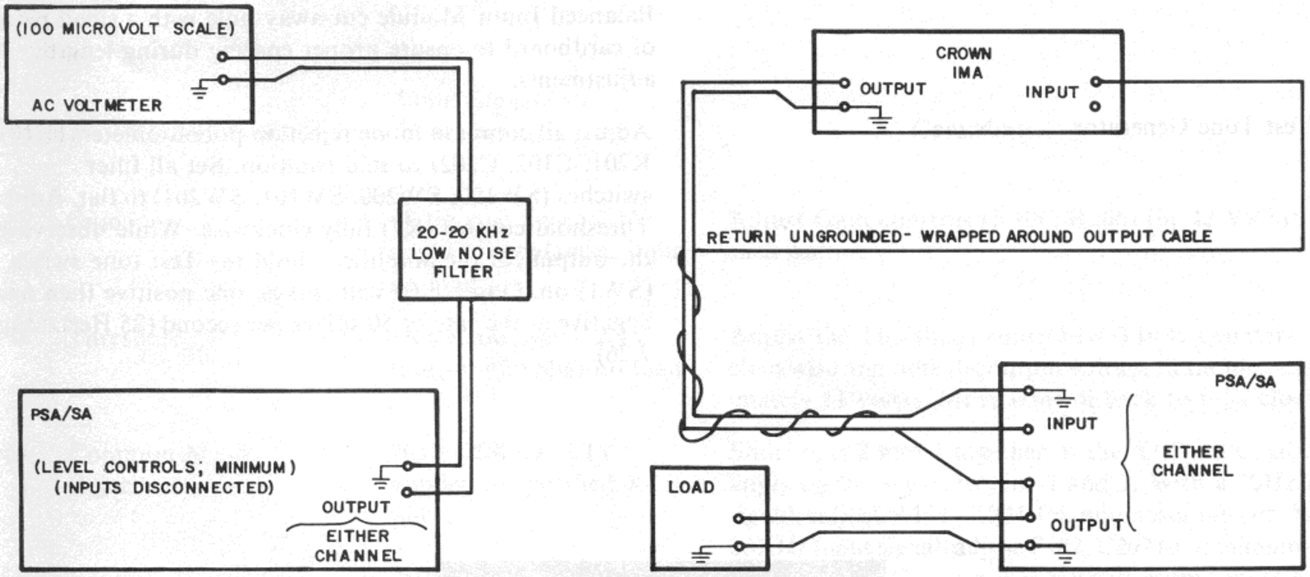

Fig. 7.24 IM Distortion Test Set-Up

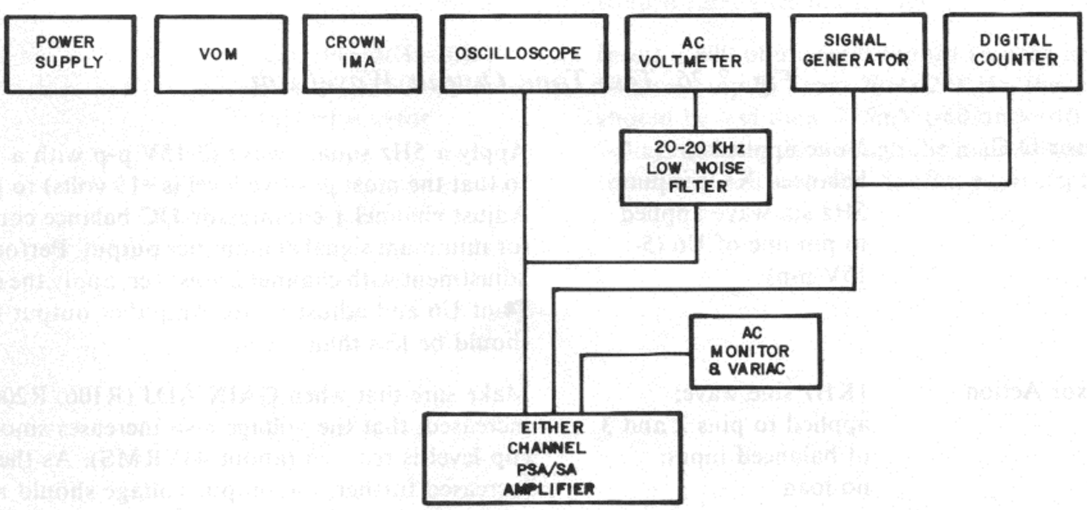

Fig. 7.25 Signal To Noise Test Set-Up

	Type of Test/Adjustment	Input Signal Characteristics	Comments
	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	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 (25 Hertz; Fig. 7.26).

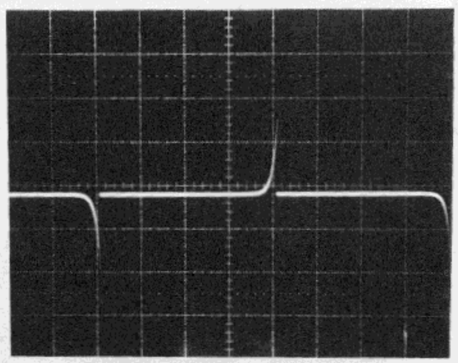

Fig. 7.26 Test-Tone Output Waveform

	Type of Test/Adjustment	Input Signal Characteristics	Comments
21.	Compressor D.C. Balance	None applied to balanced XLR inputs; 5Hz sq. wave applied to pin one of U6 (5-15V p-p)	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	Make sure that when GAIN ADJ (R106, R206) is slowly increased, that the voltage also increases smoothly until clip level is reached (about 44VRMS). 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. RVW.17).

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Type of Test/Adjustment	Input Signal Characteristics	Comments
23. Gain	1KHz sine wave, 2.1V applied to balanced inputs no load	Adjust Gain controls (R106, R206) for 42 VRMS at each output
24. Threshold	1KHz sine wave, 2.1V (output 42 volts) no load	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	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 for 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	Activate all LO and HI PASS filter switches (SW100, SW200, SW101, SW201). Apply 50Hz signal to each channel. Vary the input signal frequency and make the following observations: Response should be flat within ±1dB 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	Insert a 600 ohm center tapped resistor into the balanced input. From 20Hz-20KHz, the amplifier output should be less than .775mV (-60 on V/dB scale). With a voltage gain of 20 through the main amplifier (see specs), this corresponds to the -86dBm equivalent input noise.

7.10 PSA-2 HI/LO Pass Filter Frequency Alterations

In order to alter the roll-off frequency of the HI/LO pass filters, it is necessary to change several components located on the Filter Module (within the Balanced Input Module). A portion of the Balanced Input Module schematic and 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, 203, 104, 204, 105, and 205 all equal C*
2. R107, 207, 108, 208, 109, and 209 all equal R*
3. R* and C* are chosen according to the following general limitations:
   a) 1K< R*< 330K (increasing R* value gives increased noise)
   b) R102, 202 > 2K
   c) R104, 204 < 1M
4. With valid values of R* and C*, the other resistor and capacitor values are chosen according to the following formulas:

R102, 202 $= \frac{.7184}{2\pi f_h C^*}$

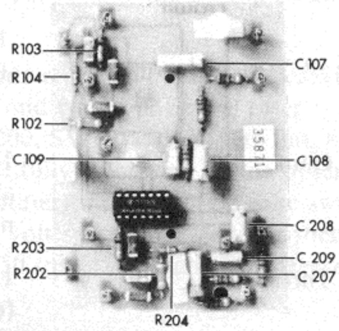
R103, 203 $= \frac{.2820}{2\pi f_h C^*}$

R104, 204 $= \frac{4.941}{2\pi f_h C^*}$

C107, 207 $= \frac{1.392}{2\pi f_l R^*}$

C108, 208 $= \frac{3.546}{2\pi f_l R^*}$

C109, 209 $= \frac{.2024}{2\pi f_l R^*}$



when f_h = highpass cutoff
when f_l = lowpass cutoff
5. For values shown in schematic f_h = 50Hz and f_l = 15KHz

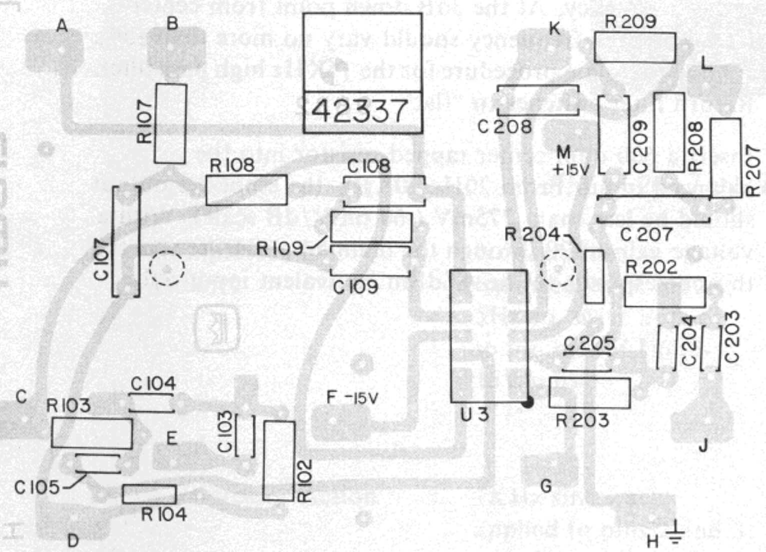


Fig. 7.27 Filter Board Schematic

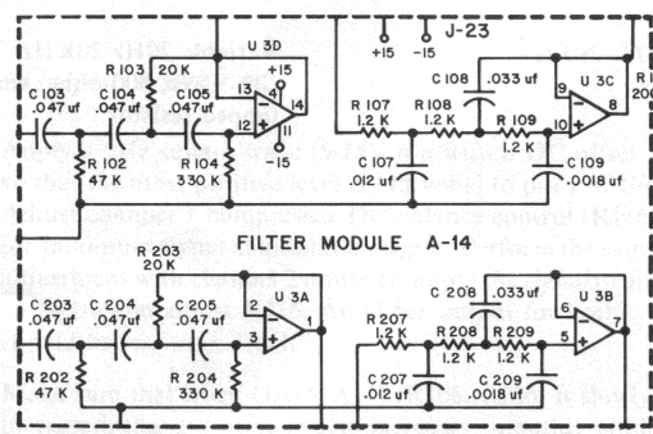


Fig. 7.28 Filter Board Component Layout

7.11 Voltage Conversion Instructions

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 a world-wide voltage map is supplied (Fig. 7.30) as well as 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.)

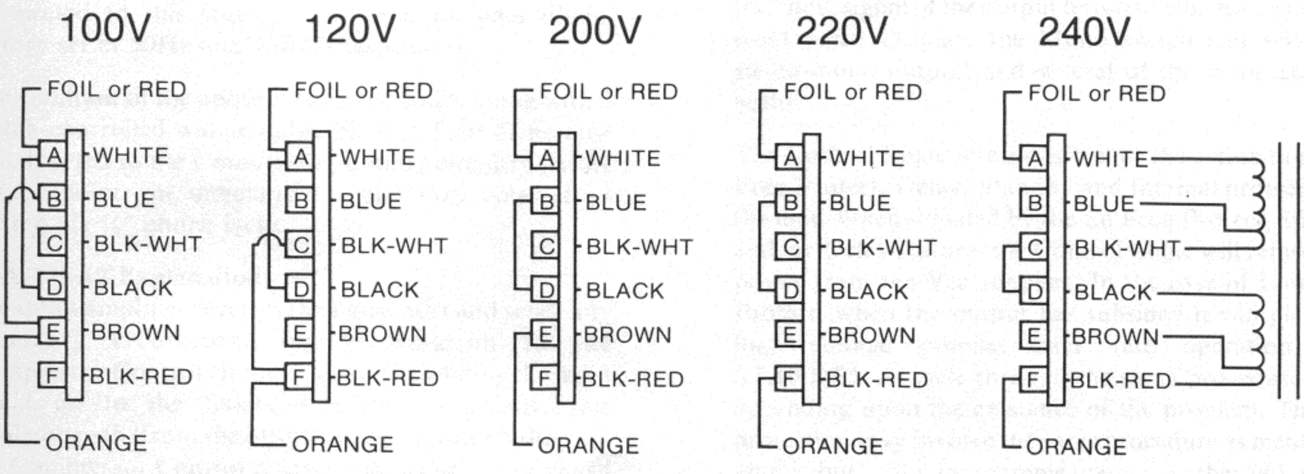
In order to change the voltage, it is first necessary to disconnect power and remove the bottom cover from the unit.

Warning

When removing PSA-2/SA2 covers, always discharge the unit as described in Section 7.5.

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. 7.29). Be sure to also make all necessary fuse changes (if needed).

VOLTAGE CHANGE JUMPERS



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 ON 100 AND 120 VOLTS. FOR 200, 220 AND 240 VOLTS USE A 10 AMP FUSE.

Fig. 7.29 Voltage Conversion

7.12 Block Diagram Circuit Theory

General
Refer to the block diagram, Fig. 7.31. 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.

PSA-2 Input Explanation Only
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 ¼″ phone jacks.

PSA-2/SA2 Explanation
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 V_{BE} 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/SA2.

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 47°C, the unit will automatically shift to "high" fan speed operation for additional cooling.

BLOCK DIAGRAM

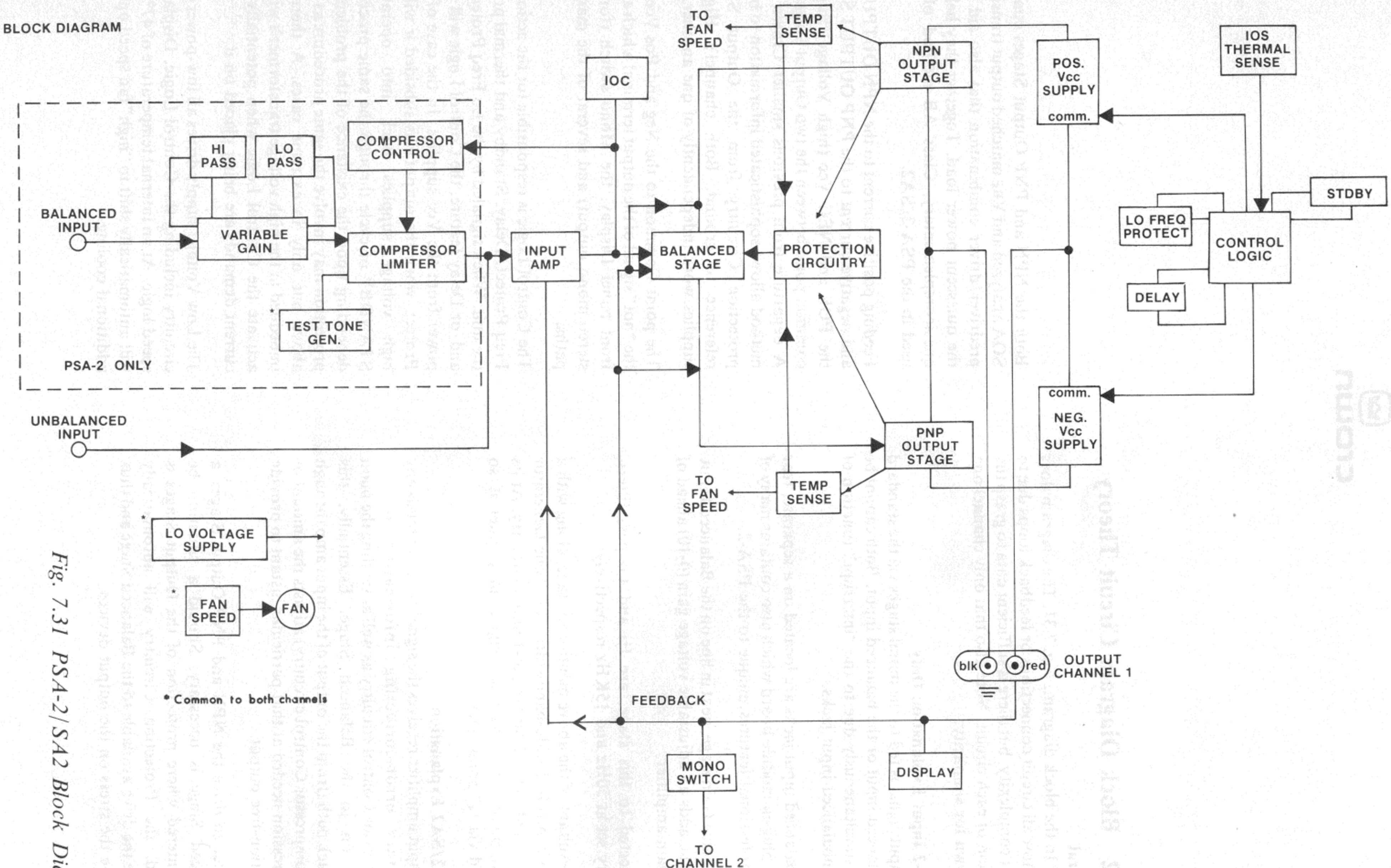


Fig. 7.31 PSA-2/SA2 Block Diagram

7.13 Theory of Operation

General

The Crown PSA-2 and SA2 are two unique power amplifiers which incorporate revolutionary design concepts as well as high performance technology. Much product research was done prior to the actual production of these units. 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 and made standard on the SA2, but also available for the PSA-2D and PSA-2DX.

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 SA2 and the PSA-2 amplifiers from Crown's standpoint (as also from the customer's) were well worth the many months of design research and hard labor.

Principles of Operation for the PSA2/SA2

Because the PSA-2/SA2 circuitry is different from any other previously designed Crown amplifier, the following explanation is provided in hopes that the service-person will find it less confusing.

Shown in Fig. 7.32 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. 7.33 the output configuration used in the PSA-2/SA2 is shown. This topology is commonly referred to as "the low side of the bridge" circuit. With this 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

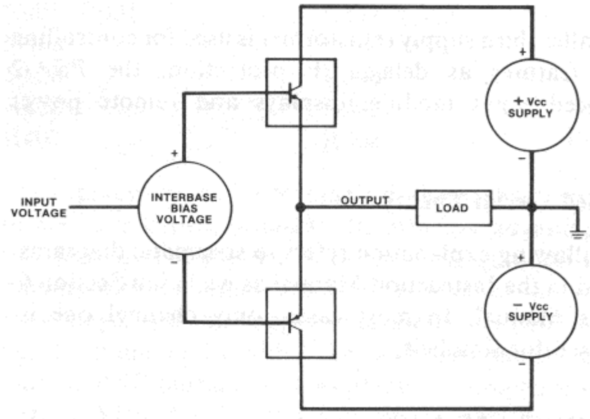


Fig. 7.32 Common Output Configuration

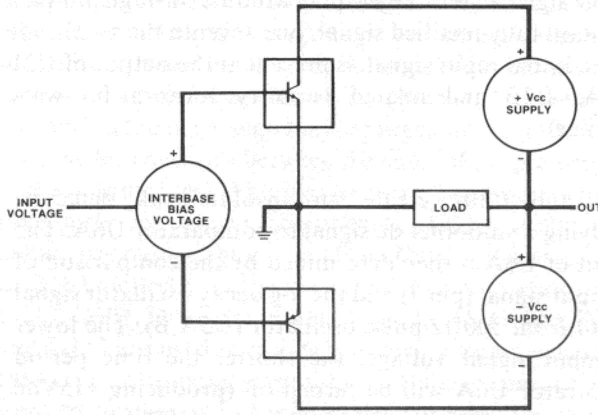


Fig. 7.33 SA2 Output Configuration

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 6 of this Manual. In most cases, only channel one is discussed for simplicity.

SA2 Display Module

The display of the SA2 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 "alwayschanging" 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.

A. Output Stage - PSA-2/SA2

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 are the output devices and are selected types whose Safe Operating Area is not voltage derated within the operating range of the amplifier. The driver (Q401) 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 capacity 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 the 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
Q402-405	Q302-305
Q401	Q301
Q400	Q300
D401, 402	D301, D302
D400	D300
C400	C300
C401, R401	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 its Ft 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 tendancy of three-stage Darlington amplifier stages to oscillate at positive clip is often tracable to an Ft problem in the driver as its Vce becomes small.

B. Balanced Gain Stage - PSA-2/SA2

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 C111 are used to optimize the high-frequency behavior of the grounded-base side of the differential pairs.

C. Input Amplifier - PSA-2/SA2

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 in 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 ⅛ 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.

D. Protection Circuitry

The protection circuitry of the SA2 amplifiers is perhaps the most unusual of all its new 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 impedance 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.

E. Muting Module applies to earlier units only; (circuit incorporated into Main Module above indicated SN).

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.

F. Power Supplies

U2 and U3 constitute adjustable 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 SA 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.

G. Output 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.

H. PSA-2 Balanced Input Module

The balanced input module is used only on the PSA-2(D). It 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 thresold will pass below the overload values and into the signal range (remember that the signal here detected is a -⅛th 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 has 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 conjunction with R111 and R211. U1D is wired as an astable which has sufficient regeneration to oscillate only when SW1 is closed.

I. PSA-2/PSA-2X 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.

SECTION 8
SERVICE BULLETINS

Periodically, a situation may arise where Crown will feel that it is necessary to change or update specific circuitry by the addition or subtraction of component parts. This information is automatically sent to all Crown Warranty Service Stations. It should be kept with this manual, preferably behind this page as indicated by the note at bottom. Should there be any question pertaining to these changes or updates, call or write the Crown Technical Service Department.

PLACE ALL SERVICE UPDATES HERE

SUBJECT: Thermal Sense Chip Change

SERIAL NUMBERS AFFECTED: SN 10000-11343 (PSA-2) 111947-112551 (SA-2)

On each SA2/PSA2 output module is a thermal sensing chip (U300/U400). Because of availability problems of the metal case chip, we are going to the same circuit in a plastic case. The old part number is C 5067-1. When changing the thermal sense chip (metal type) on the above serial number group, the following parts and installation procedures are essential:

QUANTITY	CPN	DESCRIPTION
1	C 5826-0	Thermal Sense Chip
1	W 9351-3	Teflon tubing 3/8" (.375) length
1	D 5064-7	Kapton Insulator

Step 1. Install the teflon tubing (CPN W9351-3) on the middle lead of the chip (fig.1)

Step 2. Bend all leads up the face or flat surface of the chip so leads are extending above the chip (fig. 2).

Step 3. Insert the chip into the Kapton Insulator (fig. 2 and 3) used to insulate the thermal sense leads from the heat sink

Step 4. Insert the chip, wrapped with the Kapton Insulator, into the heat sink with flat surface of chip facing D 303 (positive module) or D 403 (negative).

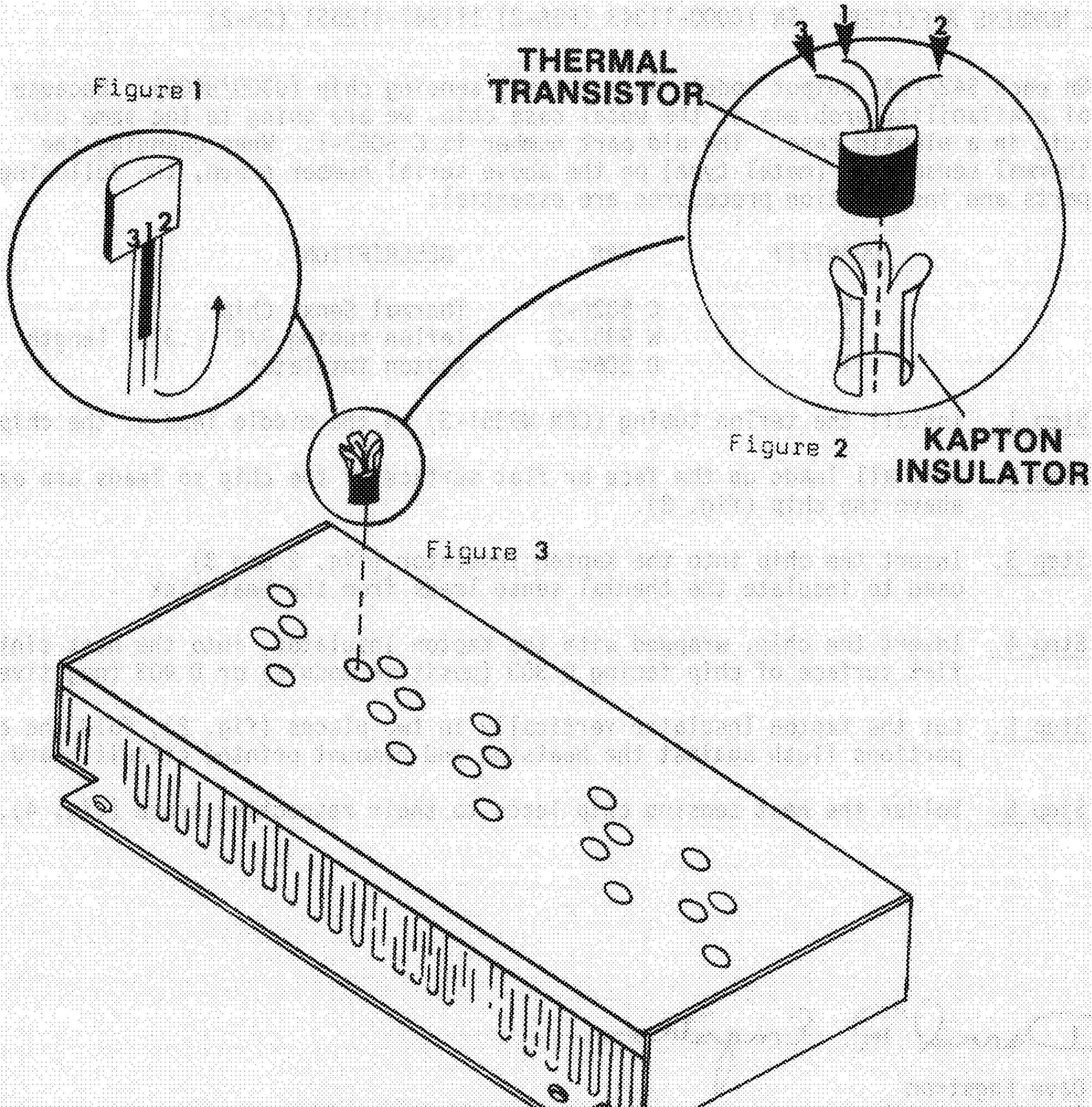
Step 5. Cut the Kapton Insulator vertically in two places (fig. 2), fold the cut portions flush against the heatsink and remount printed circuit board.

Step 6. Solder the heat sensing chip leads to their respective trace (fig. 4).

David R. Engstrom

Dave Engstrom
Product Specialist

DRE/jao



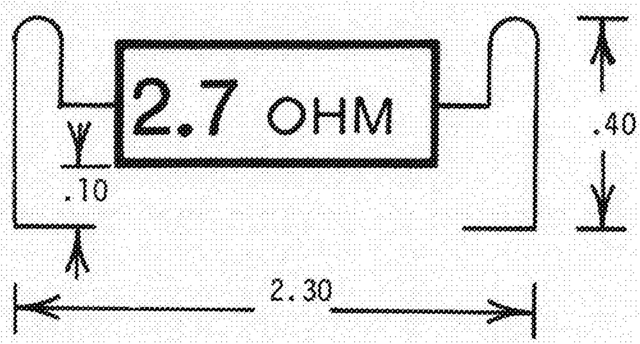
PSA-2/SA2
COOL PACK HEAT SINK

SA2/PSA2 Intermittant Instability (Addendum)

10000-11343 (PSA2) 11947-112551 (SA2)

With reference to the RLC output terminating network problem (refer to Service Bulletin SA2PSA2020780), two components in particular were mentioned the 2.7 ohm 10w resistor and the 1uh torriod coil.

If replacement of the resistor is in order be sure the leads are bent to provide optimum tension relief (see diagram below). Lead lengths should be within given measurements.



Scale in inches

All SA2/PSA2 amplifiers after the above serial number group have the above mentioned modification installed during production.

If you have any further questions concerning this modification, please feel free to call or write.

Dave R. Engstrom
Product Specialist

SA2/PSA2 Intermittant Instability

10000-11343 (PSA-2) 111947-112551 (SA-2)

On the output of every SA2/PSA2 Amplifier is a RLC output terminating network (L100/L200, R125/R225,C119/C219). It has come to our attention that because of the wrapping and soldering techniques used in production an instability problem can develop. The following are two possibilities to look for:

1.) The leads of the 2.7 ohm 10w resistor were cut too short so the resistor sits rather snug on the mother board (located inside chassis). If excessive pressure is used to install the output modules, the resistor could be damaged (the resistor lead breaking away from the resistor itself). Replacement of the resistor is in order.

	CPN	DESCRIPTION
Part	C3813-0	2.7 ohm 10w

2.) The torroid coils (L100,L200) were produced with the connector leads wrapped to tight. When soldered, the insulation heats and a break in the insulation takes place; causing a short and eliminating the coil/resistor network from the circuit. Unsolder the leads from the coil and unwrap one or more lead windings to seperate the wire ends where the insulation is broken through.

If you have a SA2 or PSA2 that exhibits instability, excessive heating and the high speed fan turns on between 5-10 seconds after the instability shows itself, the above may be the cause of the failure. If you have any further questions, please call or write.

David R. Engstrom

Dave R. Engstrom
Product Specialist

SUBJECT: Input FET Change Board Modification

SERIAL NUMBERS AFFECTED: 10000-11233 (PSA-2) 11947-112666 (SA-2)

On the input circuitry of every SA-2/PSA-2 amplifier is dual FET (Q101 and Q201). Because of availability problems of this part, we are changing part suppliers. The currently used E411 Dual N-CH JFET (CPN C 4015-1) will be replaced with a NPD 5566 Dual FET (CPN C 5440-0). These two parts are not interchangeable so in the event Q101 or Q201 is defective and the new part is used as a replacement, follow the procedures below:

Quantity	CPN	Description
1	C 5440-0	Q101/Q201 input Dual FET

1) Cut the trace on the component side between Q101 and R105 (see fig.-1)

2) Cut the trace on the component side between Q201 and R206 (see fig.-1)

3. Solder six jumper wires on the foil side at these locations (fig.-2)

Q101-pin 1 to R105
Q101-pin 2 to pin 3
Q101-pin 7 to pin 8
Q201-pin 1 to R206
Q201-pin 2 to pin 3
Q201-pin 7 to pin 8

If you have any questions, please call or write.

David R. Engstrom

David R. Engstrom
Product Specialist

High Speed Fan Modification

10000-11994 (PSA-2X) 226-360 (PSA-2DX) 11947-112787 (SA2)

Many customers have experienced a problem with the fan going into high speed operation at both low power levels and at turn on. The Crown Engineering Department has issued a modification raising the threshold where the fan comes on. This modification changes the high speed fan threshold point from -3.23Vdc (122 degrees F) to -3.36Vdc (144 degrees F). Because of the Self Analyzing protection circuit, this change will not cause undo stress on the output devices. The modification procedures and parts are as follows:

QUANTITY	CPN	DESCRIPTION
1	C 5744-5	5.76K Ω ¼w 1%
1	C 4223-1	360K Ω ¼w 5% (R3)

MODIFICATION PROCEDURES:

1. Change R2 (on the main drive printed circuit board) from 5.49K Ω ¼w resistor to 5.76K Ω ¼w 1%.

2. Change R3 (on the main drive printed circuit board) from the 220K Ω ¼w 5% resistor to the new 360K Ω ¼w 5% resistor.

All amplifiers with serial numbers in the above mentioned ranges that exhibit this problem should have this modification. All amplifiers above these serial numbers are being modified in production.

If you have any further questions, please feel free to call or write.

Dave R. Engstrom
Product Specialist

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SUBJECT:Power Supply Fuse Change

SERIAL NUMBERS AFFECTED: 10000-11719 (PSA-2X) 226-336 (PSA-2DX) 111947-112787 (SA-2)

All PSA-2/SA-2 amplifiers in the above serial number group are incorporated with two 12 amp fuses (F1 and F2) on the amplifiers relay module. However, the original design called for two 20 amp fuses, but because of a Bill of Material error, the 12 amp fuse was used instead. This may result in premature blowing of this fuse when operating at maximum output into a 2 ohm load in stereo or a 4 ohm load in mono operation.

Anytime a PSA-2X, PSA-2DX or SA-2 is in for repair, please change the fuses from the 12 amp to 20 amp as standard procedure. Replacement parts are as follows:

QUANTITY	CPN	DESCRIPTION
2	C 3840-3	20 amp fuse

If you should have any questions, please feel free to call or write.

David R. Engstrom

Dave R. Engstrom
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SA-2/PSA-2 OUTPUT TRANSISTOR SUBSTITUTION MODIFICATION

Because of availability problems in obtaining the C 4718-0 output transistor, part number D 5617-2 is being used as a substitutionary part with the following main module modification:

QUANTITY	CPN	DESCRIPTION
4	C 5846-8	48.7K ohm ½ w 1%

When substituting D 5617-2 output transistor in PSA-2 or SA-2 amplifiers for C 4718-0 output transistors, change R120, R121, R220, R221 from the existing value of 57.6K ohm ½ w 1% resistor (CPN C 5256-0) to the value of 48.7K ohm ½ w 1% (CPN C 5846-8) resistor.

If you have any further questions, please feel free to call or write.

David R. Engstrom

David R. Engstrom

jao

SUBJECT -	SA2/PSA2 Main Board Change		May 6, 1980
SERIAL NO'S.	PSA-2X	11415	
	PSA-20X	305	
	SA-2	112551	

Incorporated into either an SA2 or PSA2 amplifier is an input muting circuit to eliminate turn-on transients. The input mute module is located inside the amplifier's main frame near the input connector module.

All SA2/PSA2 amplifiers over the serial numbers given above will have the muting circuit incorporated on the main module. Both boards are interchangeable; however, if replacing an SA2/PSA2 main module with a serial number higher than the above given numbers (with an older module) the amplifier will not have the input muting circuit. The SA2/PSA2 Service Manual, pages 6-9 and 6-10 show the incorporation of the circuit on the main module, pages 6-11 show the main module layouts.

If you have any further questions, please call or write.

David R. Engstrom

David R. Engstrom
Product Specialist

SUBJECT: PSA-2 Output Device Change Mod

SERIAL NUMBERS AFFECTED: PSA-2 Amps in for service with C4718-0 or D5617-2 output devices

Due to reliability problems in the PSA-2 amplifier, caused by output transistor failure, output device part numbers C 4718-0 and D 5617-2 have been discontinued and are being replaced by part number C 5869-0.

When servicing a PSA-2 amplifier, all C 4718-0 or D 5617-2 output devices should be removed (even if failure is not output device related) and the new C 5869-0 output device installed. The only circuit modification required is the deletion of the two (2) capacitors, C 401 (.1 mfd) from the negative output modules in both channels.

This change is for the PSA-2 amplifier only. We are not experiencing this mode of failure in the SA-2 amplifier.

If you have any further questions, please feel free to call or write.

David R. Engstrom

David R. Engstrom
Product Specialist

jao

SA-2/PSA-2X/PSA-2DX OUTPUT TRANSISTOR CHANGE

Because of availability problems with the C 4718-0 output transistor used in the SA-2/PSA-2X/PSA-2DX amplifiers, we are changing to a new transistor. The new part number is C 5869-0.

The new output transistors were first used in the following serial numbers:

MODEL	SERIAL NUMBER
SA-2	112801
PSA-2X	11922
PSA-2DX	361

As of this date, we are using both types of output devices, however, when servicing, keep in mind they are not interchangeable.

We have an alternate part (CPN C 5617-2) that is a direct replacement for the C 4718-0 with a small modification on the main module (when ordering replacement output transistor C 4718-0, the C 5617-2 will be sent with service letter #SA2PSA2 010881, explaining the modification procedures).

David R. Engstrom

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jao

PSA-2 IOC Low level triggering modification

Any PSA-2 Display Module

In early production of the PSA-2 amplifier, a low level signal would cause the IOC LED's to illuminate. This was caused by crosstalk within the LM339 used for both the IOC as well as the signal presents indicator (U100 and U200 on the PSA-2 display module). For this reason, D113 and D213 were added to limit the size of this spike by (at .6v greater than the -15v supply) shunting the spike to the -15v supply.

In November of 1980, we used LM339 chips purchased from a different vendor to be used in this circuit and the problem reappeared. To cure is as follows:

QUANTITY	CPN	DESCRIPTION
2	C 3447-1	1N270 diode
2	C 2631-7	10 K ohm ¼ w

1) Remove the diodes presently being used in positions D113 and D213 (CPN C 2851-1) on PSA-2X display module

2) Replace with CPN C 3447-1 (1 N270 germanium diode)

3) Install from the base to emitter junction of each transistor (Q101 and Q201) a 10 K ohm ¼ w resistor (CPN C 2631-7)

We have found this problem exists only when using the National LM339 chip for U100 and U200 on the PSA-2X display board (problem does not exist on the SA-2 display board).

If you have any questions, please call or write.

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