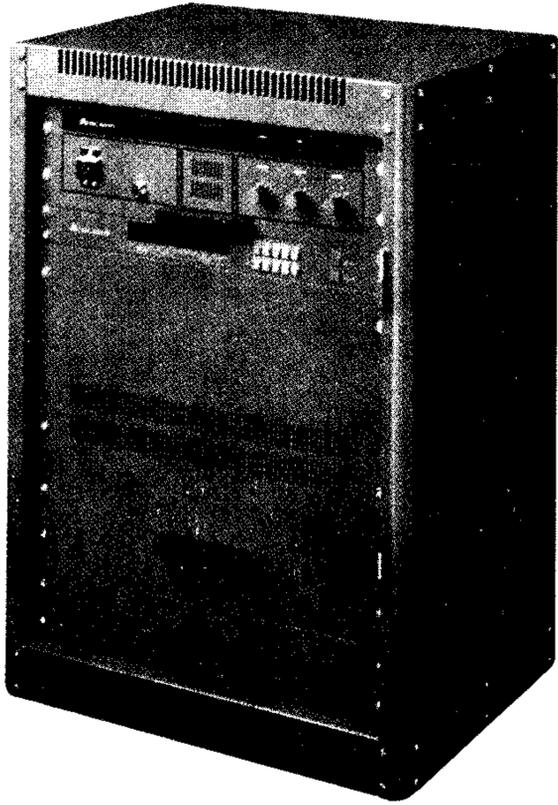


# **MIDLAND** LMR LAND MOBILE RADIO



## **BASE-TECH SERVICE MANUAL**

## **PART ONE: BASE/REPEATER STATIONS**

## BASE-TECH SERVICE MANUALS

BASE-TECH service information is published in two separately-bound parts....

**Part One** contains operating and installation information plus servicing information for non-frequency dependent equipment which is common to the entire BASE-TECH line.

**Part Two** contains technical data and drawings for the BASE-TECH Transmitter, Receiver, and RF Power Amplifier units. Construction of these units differs with frequency-band of operation; therefore, different versions of Part Two correlate to the various frequency bands.

This service-manual section is Part One, and it contains general servicing information and specific technical data and drawings for control circuitry, the Power Supply, and the cabinet.

As necessary, service manual supplements will be published and distributed on the following forms:

Manual Addition (MA): For supplemental information useful in product alignment, service, or improvement. Printed on BLUE paper.

Change Notice (CN): For circuitry change details made during production by model and serial number. Printed on YELLOW paper.

Manual Correction (MC): For correcting literature errors not related to production changes. Printed on GREEN paper.

Technical Bulletin (TB): For solutions to field problems and tips for performance improvement. Printed on PINK paper.

# TABLE OF CONTENTS

	PAGE
SECTION 1 - Base-Tech	
Description . . . . .	.S1-2
Configurations . . . . .	.S1-3
Operating Instructions . . . . .	.S1-4
SECTION 2 - Repair Hints	
Static Precautions . . . . .	.S2-2
Chip Resistor Identification . . . . .	.S2-2
Chip Capacitor Identification . . . . .	.S2-3
Replacing Leaded Components . . . . .	.S2-4
Replacing Chip Components . . . . .	.S2-5
SECTION 3 - Control Panel & Cabinet	
Control Panel Alignment . . . . .	.S3-2
Option Connector Pinout Descriptions . . . . .	.S3-5
Base-Tech Interconnect Schematic . . . . .	.S3-7
Switch Board (Z-468) Layout . . . . .	.S3-8
Microphone Jack (Z-469) . . . . .	.S3-8
Main Board (CX-54) Layout . . . . .	.S3-9
71-7900 Control Panel Schematic . . . . .	.S3-11
Control Panel Option Cables . . . . .	.S3-12
71-7910 Repeater Board (optional) . . . . .	.S3-13
71-8215 CTCSS Board (optional) . . . . .	.S3-14
71-8210 HP Filter Board (optional) . . . . .	.S3-15
71-7900 Mechanical View . . . . .	.S3-16
Control Panel Parts . . . . .	.S3-17
Cabinet Parts . . . . .	.S3-21
SECTION 4 - Power Supply	
71-7240 Circuit Description . . . . .	.S4-3
71-7200 Circuit Description . . . . .	.S4-4
Adjustments . . . . .	.S4-5
71-7200/7240 Block Diagram . . . . .	.S4-7
Driver Board Layout . . . . .	.S4-8
Voltage Measurements . . . . .	.S4-8
Main Board Layout . . . . .	.S4-9
71-7200 Schematic . . . . .	.S4-11
71-7240 Schematic . . . . .	.S4-13
71-7200/7240 Exploded View . . . . .	.S4-14
Mechanical Parts . . . . .	.S4-15
Electrical Parts . . . . .	.S4-16
Parts Ordering Instructions . . . . .	.S4-19



**SECTION 1**

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**BASE-TECH**

## BASE-TECH

The BASE-TECH Stations are Land-Mobile Radios designed for fixed base station use. They are rated for continuous duty, and can be fitted with options to operate as repeaters. BASE-TECH stations are housed in cabinets that are designed to stand on a floor. Because the station should be located close to the antenna, it often must be installed in an remote location such as a storage room, basement, roof-top access room, or bunker. Standard primary power requirement for the BASE-TECH is 120 or 240 Volt, 50/60 Hz AC-line.

The BASE-TECH has an internal control panel with a hand microphone, speaker, and applicable controls for local operation; but, as location often dictates, the station must be operated remotely. Options are available to equip the BASE-TECH with a tone-remote interface so that it can be remotely controlled over great distances via a dedicated telephone line. A DC-remote control can be installed instead for remote control across less than 1 mile via 2- or 4-wire direct lines.

Separate female N-type RF antenna connections from the transmitter and receiver are provided with the standard BASE-TECH configuration. This allows connection to independent antennas or to a duplexer for full duplex (simultaneous transmit and receive) operation. If the station is to be operated simplex, the 71-7750 Antenna Relay option can be installed to connect a single antenna to both transmitter and receiver.

## CONFIGURATIONS

### BASE STATION CONFIGURATION

#### STANDARD ITEMS (provides local control only):

1. 71-5050 TX/RX Drawer  
     includes: A) Transmitter Unit (example: 71-5051 Exciter)  
               B) Receiver Unit (example: 71-5052 UHF Receiver)  
               C) 71-7700 Drawer (empty)
2. RF Power Amplifier (example: 71-5300 UHF Power Amplifier)
3. 71-7900 Control Panel
4. 71-7200/7240 Power Supply
5. 71-8820 31.5" Indoor Cabinet

#### OPTIONAL ITEMS:

- For CTCSS: 71-8215 Duplex CTCSS Module, and  
             71-8210 High-Pass Filter
- For RF Switching: 71-7750 T/R Relay
- For Remote Control: 71-2050 Tone-Remote or 71-2060 DC-Remote  
                             Line Termination (not detailed in this  
                             publication)
- For more rack space: 71-8830 41.25" Indoor Cabinet

### REPEATER STATION CONFIGURATION

#### STANDARD ITEMS:

1. 71-5050 TX/RX Drawer  
     includes: A) Transmitter Unit (example: 71-5051 Exciter)  
               B) Receiver Unit (example: 71-5052 UHF Receiver)  
               C) 71-7700 Drawer (empty)
2. RF Power Amplifier (example: 71-5300 UHF Power Amplifier)
3. 71-7900 Control Panel
4. 71-7200/7240 Power Supply
5. 71-8820 31.5" Indoor Cabinet
6. 71-7910 Repeater Control Circuit

#### OPTIONAL ITEMS:

- For CTCSS: 71-8215 Duplex CTCSS Module  
             71-8210 High-Pass Filter
- For Remote Control:  
             71-2050 Tone-Remote or 71-2060 DC-Remote Line  
                             Termination (not detailed in this publication)
- For more rack space: 71-8830 41.25" Indoor Cabinet
- To improve immunity to duplex desensitization:  
             71-8453 3-MHz Duplexer (not detailed in this publication)  
             71-8455 5-MHz DUplexer (not detailed in this publication)

# OPERATION

## CONTROLS

### ON/OFF SWITCH

Lift up to switch primary DC power on. Push down to switch off.

### VOLUME CONTROL

Rotate to set listening volume of received signals that are audible in the Control Panel speaker. This control does not affect re-transmitted audio (repeater) or line audio (remote control).

### SQUELCH CONTROL

Adjust to mute annoying noise in the absence of message signals. When turned fully counterclockwise, the squelch function is disabled. At approximately one-quarter turn clockwise, muting occurs. At this threshold point, weak message signal will "break" squelch; but so will interference. The further clockwise the SQUELCH Control is set from the threshold point, the less sensitive the radio becomes and the stronger the message signal (and interference) must be to "break" squelch and be heard.

This adjustment affects both remote and repeater operations.

### CHANNEL SWITCH

Selects the radio channel that the station will operate on.

### MONITOR SWITCH

Located behind the Control Panel. Disables the coded squelch option (if equipped), thereby allowing any signal strong enough to overcome carrier squelch to be heard. This switch has no affect on repeater coded squelch operation; but does affect remote line operation. This switch functions only if the station is equipped with coded squelch (CTCSS or DCS).

### LOCAL/REMOTE SWITCH

Located behind the Control Panel. Selects either local control (radio responds to the Control Panel) or remote control (radio responds to remote control) modes. The latter is available only if the station is equipped with a remote control option. NOTE: If the station is not equipped with a remote control option, always leave this switch set to "LOCAL".

DIRECT/REPEAT SWITCH
----------------------

Located behind the Control Panel. If set to DIRECT, the station operates as a base station under control of the Control Panel or a remote control device. If set to REPEAT, the station re-transmits (on the transmit frequency of the selected channel) signals received on the receive frequency of the selected channel. NOTE: IF the station is not equipped with the repeater option, leave this switch set to "DIRECT".

## INDICATORS

POWER INDICATOR
-----------------

Green. Illuminates while primary DC power is on.

BUSY INDICATOR
----------------

Orange. Illuminates while noise squelch is opened by traffic on the receiver frequency.

TX INDICATOR
--------------

Red. Illuminates when the transmitter is on the air.

## BASE STATION OPERATION

MESSAGE RECEIPT

1. Assure all connections are secure.
2. Select DIRECT mode with the DIRECT/REPEAT Switch.
3. Select LOCAL mode with the LOCAL/REMOTE switch.
4. Turn on the Power Switch located on the Power Supply.

5. Rotate the Channel Selector to the desired channel.
6. Set the Squelch control to minimum (full counterclockwise). If the station is equipped with coded squelch, set the Monitor Switch to the MONITOR position.
7. Set the Volume control for a comfortable sound level.
8. Wait until no messages are present on the channel, then rotate the Squelch control until the rushing sound ceases. At this position, sensitivity of the radio receiver is maximum. If weak non-message interference is heard later, rotate the Squelch control a little further clockwise to "tighten" Squelch. Remember: the further clockwise the Squelch control is set, the less sensitive the radio receiver is and, consequently, the closer the mobile transmitter must be for the base station to receive its messages. After initial adjustment, readjustment is usually not necessary.
9. If your station is equipped with a coded squelch feature, set the Monitor switch to the OFF position. This activates coded squelch that masks extraneous traffic so that unwanted signals will not be heard.

Whenever traffic on the selected channel is strong enough to "break" squelch, the BUSY indicator illuminates. If the signal contains the correct squelch code, it will be audible. If the station is not equipped with a Coded Squelch feature, any signal that lights the BUSY indicator will be heard.

#### MESSAGE TRANSMISSION

1. Perform Message Receipt procedure above, first.
2. Set the Monitor switch to the MONITOR position to assure the channel is clear (no traffic). If emergency traffic is present, federal law requires that you yield to it. In addition; because your transmissions may interfere or block other transmissions on the same channel, it is courteous to wait until other conversations on the channel are complete (unless you are in an emergency situation).
3. Press and hold the Push-To-Talk button on the hand microphone while speaking into it in a normal voice. The red TX indicator will light during transmission. When finished with your message, release the Push-To-Talk button to hear a reply.

## REPEATER OPERATION

The BASE-TECH must be equipped with the repeat feature for this function to operate. The repeater function is an automatic operation; therefore, after set-up, no operator action is needed. Although channel integrity is the responsibility of the licensee; it is courteous for all mobile and portable radio operators using the repeater to promptly report repeater malfunctions to the licensee.

**Repeat Operation:** Radio systems that contain a repeater utilize channels with two frequencies: one for transmit, one for receive. The BASE-TECH repeater simply re-broadcasts traffic (that appears on the mobile-transmit frequency) onto the mobile-receive frequency. This at least doubles the maximum distance that mobile radios can communicate with each other.

The receiver of the BASE-TECH repeater is tuned to the transmit frequency of the channel so that it can detect traffic using its carrier-squelch or coded-squelch circuitry. Once traffic is detected, the BASE-TECH transmitter, which is tuned to the receive frequency of the channel, is energized and voice signals demodulated by its receiver are re-broadcasted.

Initial set-up of the BASE-TECH repeater station is as follows:

1. Perform the Message Receipt procedure above. While setting the Squelch control, keep in mind that noise-squelch triggers re-transmission.
2. Set the DIRECT/REPEAT switch to REPEAT to enable the repeat function.

- NOTES:
1. While a received signal is re-transmitted, both BUSY and TX indicators will illuminate simultaneously.
  2. The Push-To-Talk button on the hand microphone is disabled while the repeat function is on.
  3. Re-transmitted messages will also be heard in the Control Panel speaker and in the remote control unit (if so equipped).
  4. The Volume control will only affect the Control Panel speaker, not repeated audio levels or remote control line levels.
  5. If the Monitor switch is in the MONITOR position, local audio will not be screened for squelch code and all received signals will be audible at the local speaker and at the remote control, but only signals carrying the correct squelch code will be re-transmitted.

## REMOTE CONTROL OPERATION

1. Perform the Message Receipt procedure described in Base Station Operation. While setting the Squelch control, keep in mind that the operator will not be able to readjust it.
2. Set the LOCAL/REMOTE switch to REMOTE.
3. Refer to the Operator's Manual of the remote control device for further operating instructions.

## NOTES:

1. The Push-To-Talk button on the hand microphone is disabled while the station is under remote control.
2. The Channel Selector on the Control Panel is disabled.
3. Received messages will also be heard in the Control Panel speaker.
4. The Volume control only affects the Control Panel speaker, not remote control line levels.
5. If the Monitor switch is in the MONITOR position, coded squelch screening will not occur, and any receivable signal will be heard at the remote.

**SECTION 2**

---

**REPAIR HINTS**



## CHIP CAPACITOR IDENTIFICATION

Chip capacitors used in the BASE-TECH typically are brown, green or white and marked with one alphabetical character followed by a numerical multiplier. Some chip capacitors have bars above, below, or beside these characters define temperature characteristic.

NOTE: Because of critical factors such as Q and tolerance; do not substitute any chip capacitors used in the PA Module nor the receiver preselector. Use direct replacement parts that are available from MIDLAND.

FIRST DIGIT				SECOND DIGIT	
ALPHABET CHARACTER	NUMERICAL VALUE	ALPHABET CHARACTER	NUMERICAL VALUE	NUMERICAL CHARACTER	MULTIPLIER VALUE
A	1.0	T	5.1	0	1.0
B	1.1	U	5.6	1	10
C	1.2	V	6.2	2	100
D	1.3	W	6.8	3	1000
E	1.5	X	7.5	4	10,000
F	1.6	Y	8.2	5	100,000
G	1.8	Z	9.1	8	0.01
H	2.0	a	2.5	9	0.1
J	2.2	b	3.5		
K	2.4	d	4.0		
L	2.7	e	4.5		
M	3.0	f	5.0		
N	3.3	m	6.0		
P	3.6	n	7.0		
R	4.3	t	8.0		
S	4.7	y	9.0		

Example: **A 1** is a 10 pF capacitor.

1 = multiply by 10  
 A = 1.0

— REPLACING FEED-THROUGH LEADED COMPONENTS —

Copper plating on both sides of the printed circuit board and inside component lead holes easily separates and tears from the PC board when heated. This introduces particular dangers when replacing components with leads that feed through a PC board.

To extract a component with feed-through leads, a solder suction tool or braided desoldering-wick should be used to carefully and thoroughly remove solder from component leads and holes so that the device can be pulled without resistance. After removing as much solder as possible, use a dental pick or straight-pin to break the leads loose from the inside of the cleaned-out hole. If light pressure does not free the lead, too much solder is left in the hole. If you can cut the defective component away from its leads, first; lead and solder removal will be much easier.

Before installing a new component, remove all solder from lead holes and assure proper orientation of the device. Always check the leads of the old part for feed-through plating rings that may have been pulled out of holes. The plating may have completed a circuit. If so, make sure the corresponding lead of the new component is soldered to plating runners on both sides of PC board as shown below.

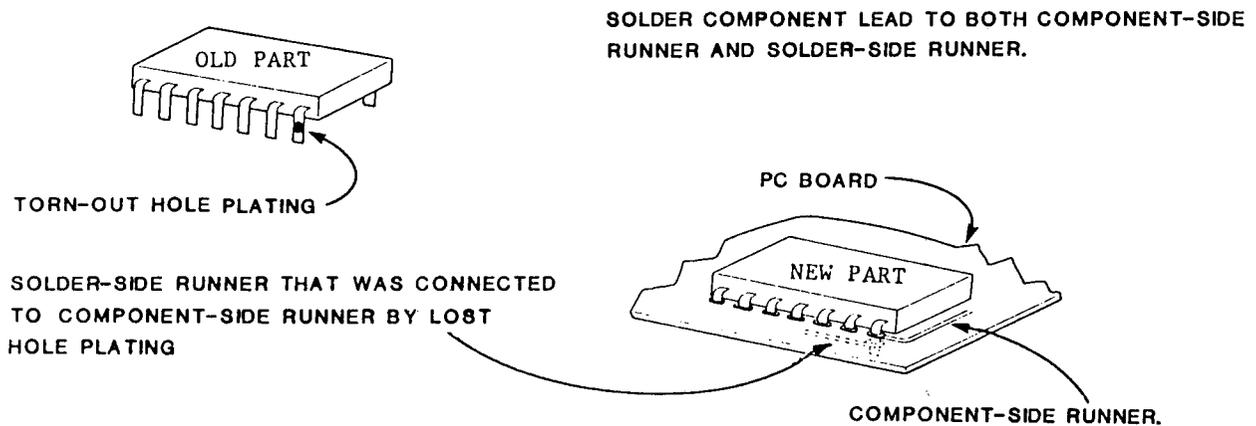


FIGURE 2.1

## REPLACING CHIP CAPACITORS AND RESISTORS

The following describes how to remove a chip component and affix a new one with maximum solder-bond success. Chip components do not have leads, just metallic film on end-surfaces to solder to. Often the surface is tinned with solder. Because the metallic film can be easily damaged by contamination and excessive heat, these components must be soldered very carefully. No chip component can be unsoldered, then resoldered without some damage. Always discard a used component.

### ITEMS REQUIRED:

- \* Grounded temperature-controlled soldering iron with a 1/32-inch flat-blade tip. The tip temperature must be maintained at approximately 600° Fahrenheit.
- \* 60/40 electronics-grade solder, 22 gauge or thinner, with rosin flux
- \* Tweezers or longnose pliers
- \* Thin desoldering-wick
- \* Freon-TF or isopropyl alcohol, for solvent

### PROCEDURE:

1. Place a solder iron tip directly on the defective component to melt solder and glue under the component as shown below. Remove component with tweezers or longnose pliers. Discard the component.

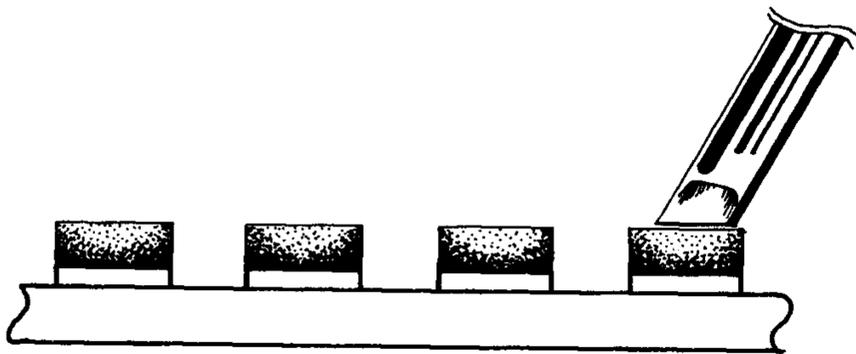


FIGURE 2.2

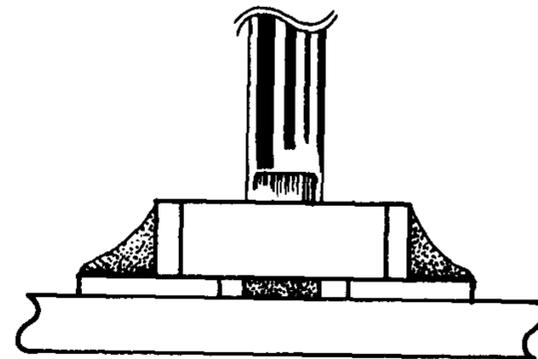


FIGURE 2.3

2. Completely remove old solder, old glue, and any other contaminants from the area with desoldering-wick and solvent.

3. Apply a thin coat of fresh solder to one clean PC pad as shown below.

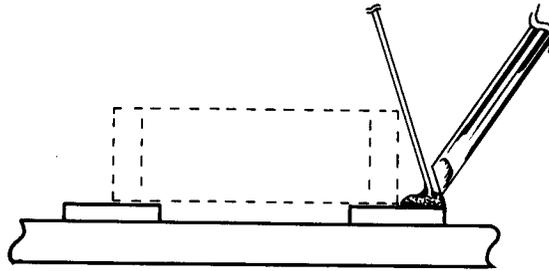


FIGURE 2.4

4. Place the component and briefly heat the new solder and pad while holding the component with tweezers — do not touch the new component with the iron. Only hot solder should touch the component to make a light 'tack' bond to it, as shown below.

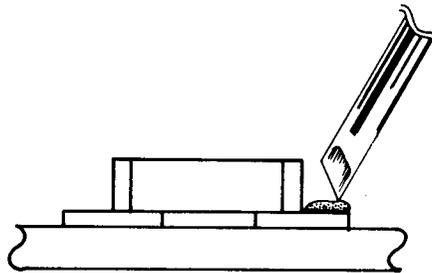


FIGURE 2.5

5. With one component end tacked to hold it, the other end can be soldered. Carefully apply heat to the PC pad while adding only enough fresh solder to produce a clean fillet as in Figure 2.6. Do not apply too much solder, otherwise it may flow underneath and short the pads together. Let the hot solder flow onto the component — avoid touching the component with the iron. Repeat to finish the first end of the component. Solder must adhere to all metallic end-surfaces on both ends and make a concave fillet.

CAUTIONS:

- \* Application of too much solder can create solder bridges between PC patterns under the soldered component and around the pad.
- \* Avoid direct contact to the chip component with the iron tip. For example: A capacitor is comprised of several wafer plates that

connect through the metallic end-surfaces. Too much heat and contamination will break down the metallic film on the capacitor ends resulting in loss of internal connection. If satisfactory solder adhesion does not occur, the metallic end surface has been damaged and the capacitor should be discarded. More soldering will only damage it further.

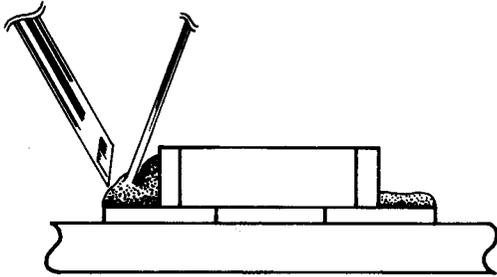


FIGURE 2.6

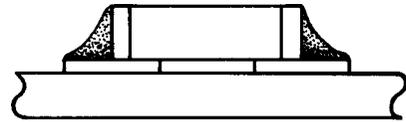


FIGURE 2.7

6. Clean the entire area with solvent to remove flux and residue.

# NOTES

**SECTION 3**

---

**CONTROL PANEL AND CABINET**

## CONTROL PANEL ALIGNMENT

### ALL UNITS:

#### -- TX Indicator --

1. Set RV303 on the main board of the Control Panel to minimum (fully counterclockwise).
2. Initiate transmit mode.
3. While the transmitter applies its rated power into a 50-ohm dummy load, rotate RV303 clockwise until the TX Indicator on the front panel illuminates. Turn RV303 20° further clockwise.

### UNITS WITH CTCSS:

#### -- Receive CTCSS Frequency --

1. Add or remove jumpers on the 71-8215 CTCSS Board as required for the desired CTCSS tone frequencies as shown below. The 71-8215 CTCSS Board is located on the chassis floor of the Control Panel, behind the Microphone Jack. Refer to page S3-14 for jumper locations.

FREQUENCY RANGE JUMPERING  
FOR DECODE TONE

TONE FREQUENCY	JUMPERS			
	JP1	JP3	JP6	JP7
67-75 Hz	IN	OUT	OUT	OUT
75-100 Hz	OUT	OUT	OUT	IN
100-141.3 Hz	IN	OUT	OUT	IN
141.3-250 Hz	IN	IN	IN	IN

2. Apply to the receiver antenna connector, on-channel RF signal that is modulated with the desired CTCSS tone frequency.
3. Adjust RV1 on the CTCSS Board (located to obtain peak AC amplitude on TP1).

#### -- Transmitter CTCSS Frequency --

1. Add or remove jumpers on the 71-8215 CTCSS Board as required for the desired CTCSS tone frequencies as shown below. The 71-8215 CTCSS Board is located on the chassis floor of the Control Panel, behind the Microphone Jack.

FREQUENCY RANGE JUMPERING  
FOR ENCODE TONE

TONE FREQUENCY	JUMPERS			
	JP2	JP4	JP8	JP9
67-75 Hz	IN	OUT	OUT	OUT
75-100 Hz	OUT	OUT	IN	OUT
100-141.3 Hz	IN	OUT	IN	OUT
141.3-250 Hz	IN	IN	IN	IN

2. Adjust VR2 on the CTCSS Board to obtain the desired transmit CTCSS frequency. Encode tone frequency can be measured in receive mode at J280 pin 4.

-- TX CTCSS Level --

1. Initiate transmit mode and adjust VR3 on the 71-8215 CTCSS Board (located on the chassis floor of the Control Panel, behind the Microphone Jack) to obtain  $\pm 750$  Hz carrier deviation by the CTCSS tone.
2. Readjust Total Deviation Limiting as prescribed in the 71-5051 Exciter Alignment Procedure.

REPEATERS:

-- TX Hang Time --

1. Place the station in repeat mode.
2. Apply an on-channel RF test signal that is appropriately coded to access the repeater station.
3. Remove the test signal, and note the duration that the station remains transmitting after received signal ceases.
4. Turn VR3 on the 71-7910 Duplex Control Board (located on the Control Panel floor behind the speaker) clockwise to shorten hang time or counterclockwise to lengthen. Repeat steps 3 and 4 to obtain desired hang time. JP2 can be removed if no hang time is needed.

**-- Time-Out Timer --**

1. Place the station in repeat mode.
2. Apply an on-channel test RF signal that is appropriately coded to access the repeater station, and note the duration of transmission that ends with automatic transmitter shut-down.
3. Turn VR2 on the 71-7910 Duplex Control Board (located on the Control Panel floor behind the speaker) clockwise to shorten transmitter time-out time or counterclockwise to lengthen. Repeat steps 2 and 3 to obtain desired time. JP1 can be removed to defeat transmitter time-out.

**-- Repeat Audio --**

1. Apply to the receiver input, 1mV of correctly coded on-channel RF signal that is modulated to  $\pm 3\text{KHz}$  by a 1KHz tone.
2. Adjust VR1 on the 71-7910 Duplex Control Board (located on the Control Panel floor behind the speaker) to obtain transmit modulation of  $\pm 3\text{KHz}$  deviation by only the 1KHz test tone. Total deviation with the CTCSS tone should be  $\pm 3.75\text{KHz}$ .

## CONTROL-PANEL OPTION CONNECTOR PINOUT DESCRIPTIONS

### J304

PIN NO.	SIGNAL	DETAILS
1	DC 12V	12-Volt DC output
2	AF (TX MOD)	Transmit Audio input. 310mV of 1KHz produces $\pm 3$ KHz modulation. Impedance = 4700 ohms @ 1KHz.
3	RX DISC	Receive discriminator output. 140mV @ $\pm 3$ KHz modulation. Impedance = 10Kohms
4	ALARM	Open collector output. Ground sink = TX LED off while PTT on.
5	PTT	Open collector output. Ground sink = transmit.
6	COS	Carrier Operated Squelch output. 9-Volts DC output when carrier breaks noise squelch.
7	GND	ground
8	GND	ground
9	TONE	Signaling tone input. 700mV produces $\pm 0.7$ KHz modulation. Impedance = 10Kohms.

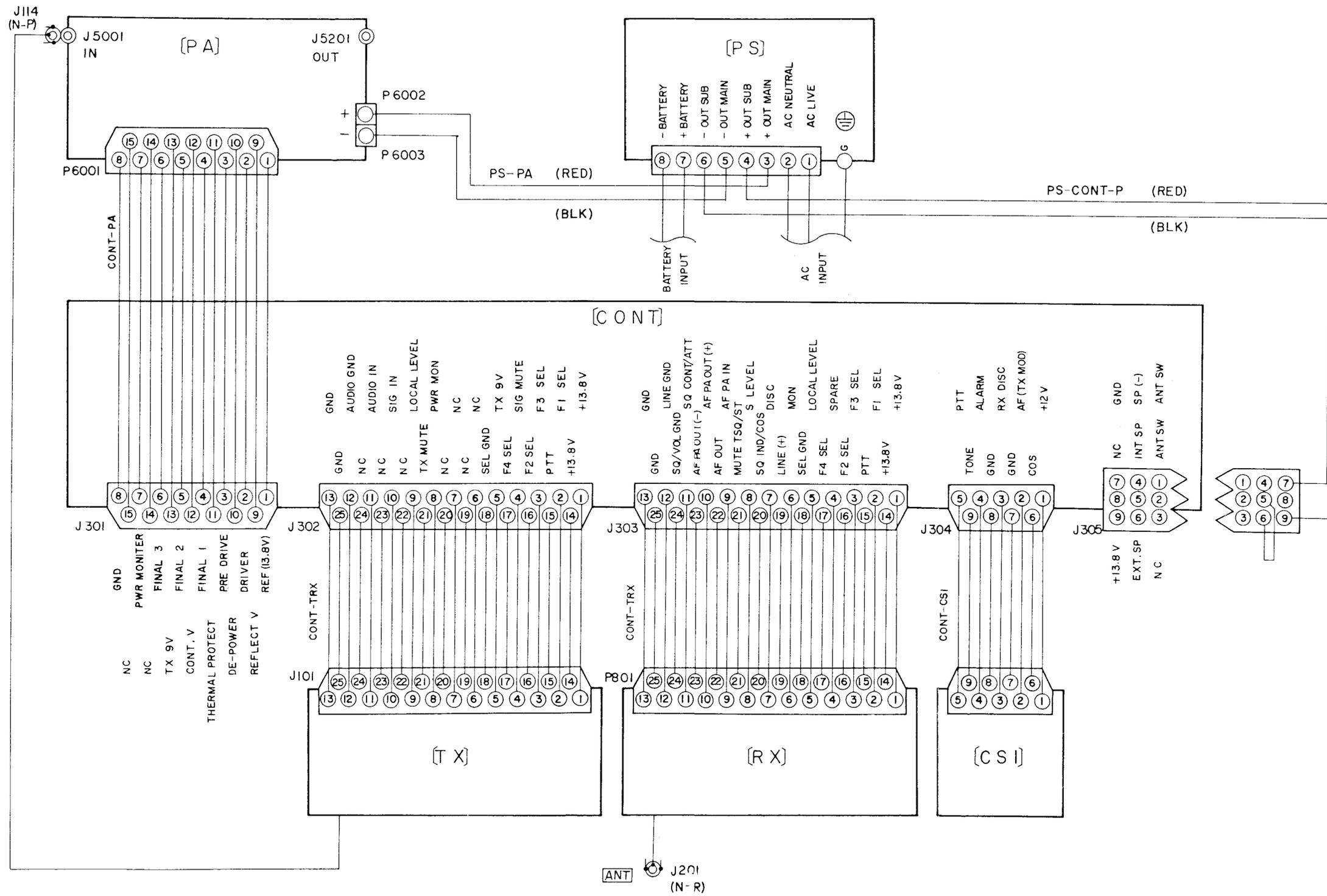
### P307

PIN NO.	SIGNAL	DETAILS
1	+13.8V	13.8-Volt DC output
2	F1 SEL	Channel 1 select. Connection to SEL GND = on
3	F3 SEL	Channel 3 select. Connection to SEL GND = on
4	LINE GND	Audio ground
5	SIG MUTE	Active low input. Ground sink = defeat CTCSS muting
6	SPARE	not used
7	SPARE	not used
8	COS	Carrier Operated Squelch output. 9-Volts DC when carrier breaks noise squelch.
9	MIC	Transmit Audio input. 310mV of 1KHz produces $\pm 3$ KHz modulation. Impedance = 4700 ohms @ 1KHz.
10	PTT REM	Open collector output. Ground sink = transmit.
11	SPARE	not used
12	SPARE	not used
13	GND	ground

## P308

PIN NO.	SIGNAL	DETAILS
1	SEL GND	Channel select return.
2	SPARE	not used
3	F2 SEL	Channel 2 select. Connection to SEL GND = on
4	F4 SEL	Channel 4 select. Connection to SEL GND = on
5	TONE	Signaling tone input. 700mV produces $\pm 0.7$ KHz modulation. Impedance = 10Kohms.
6	DISC OUT	Receive discriminator output. 140mV @ $\pm 3$ KHz modulation. Impedance = 10Kohms
7	SPARE	not used
8	AF VOL IN	Volume control audio output. Receive audio after de-emphasis and squelch muting. 300mV of 1KHz @ $\pm 3$ KHz modulation. Impedance = 200 ohms
9	TSQ ST	Audio mute input. Ground sink = defeat CTCSS muting.
10	SPARE	not used
11	SPARE	not used
12	SQ STT	Squelch defeat input. Ground sink = force carrier squelch open

# BASE-TECH INTERCONNECT SCHEMATIC

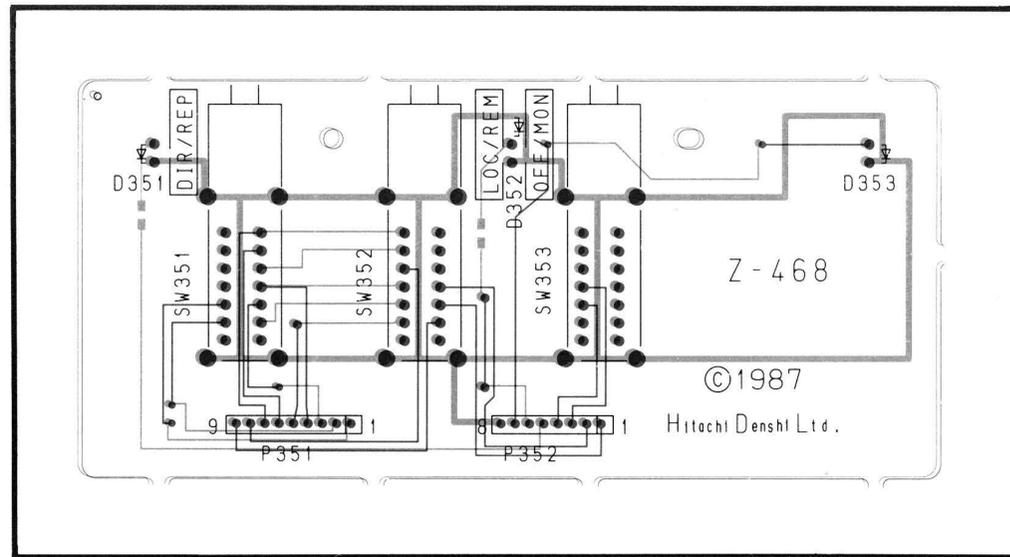


S3-7

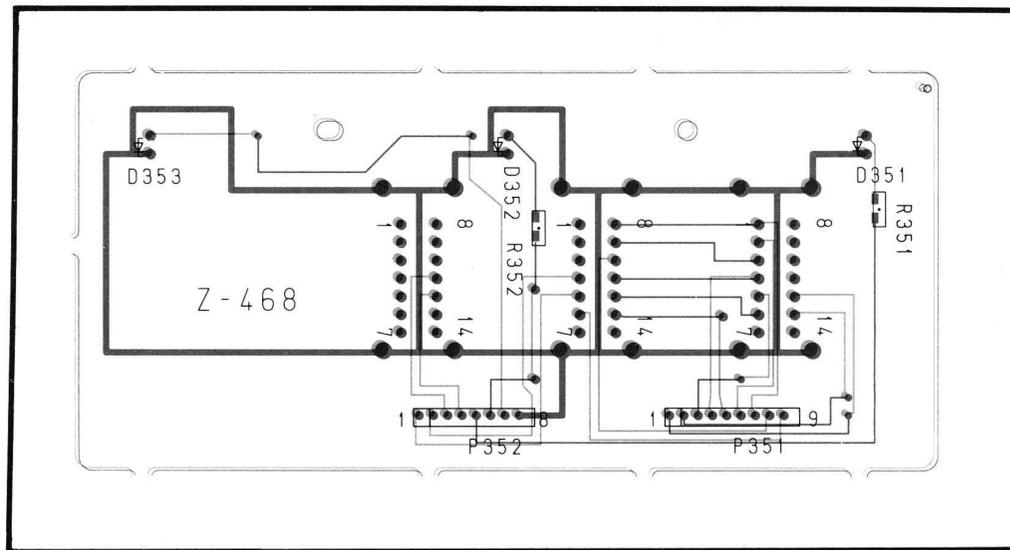
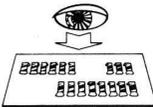
# SWITCH BOARD (Z-468) LAYOUT

# MICROPHONE JACK (Z-469)

**TOP VIEW**

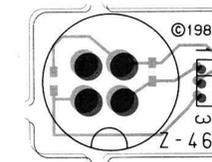
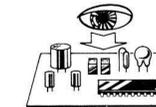


**BOTTOM VIEW**

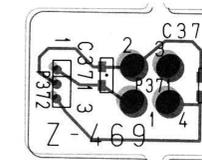
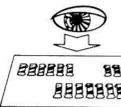


**BLUE: VISIBLE PLATING  
RED: UNDERSIDE PLATING**

**TOP VIEW**



**BOTTOM VIEW**



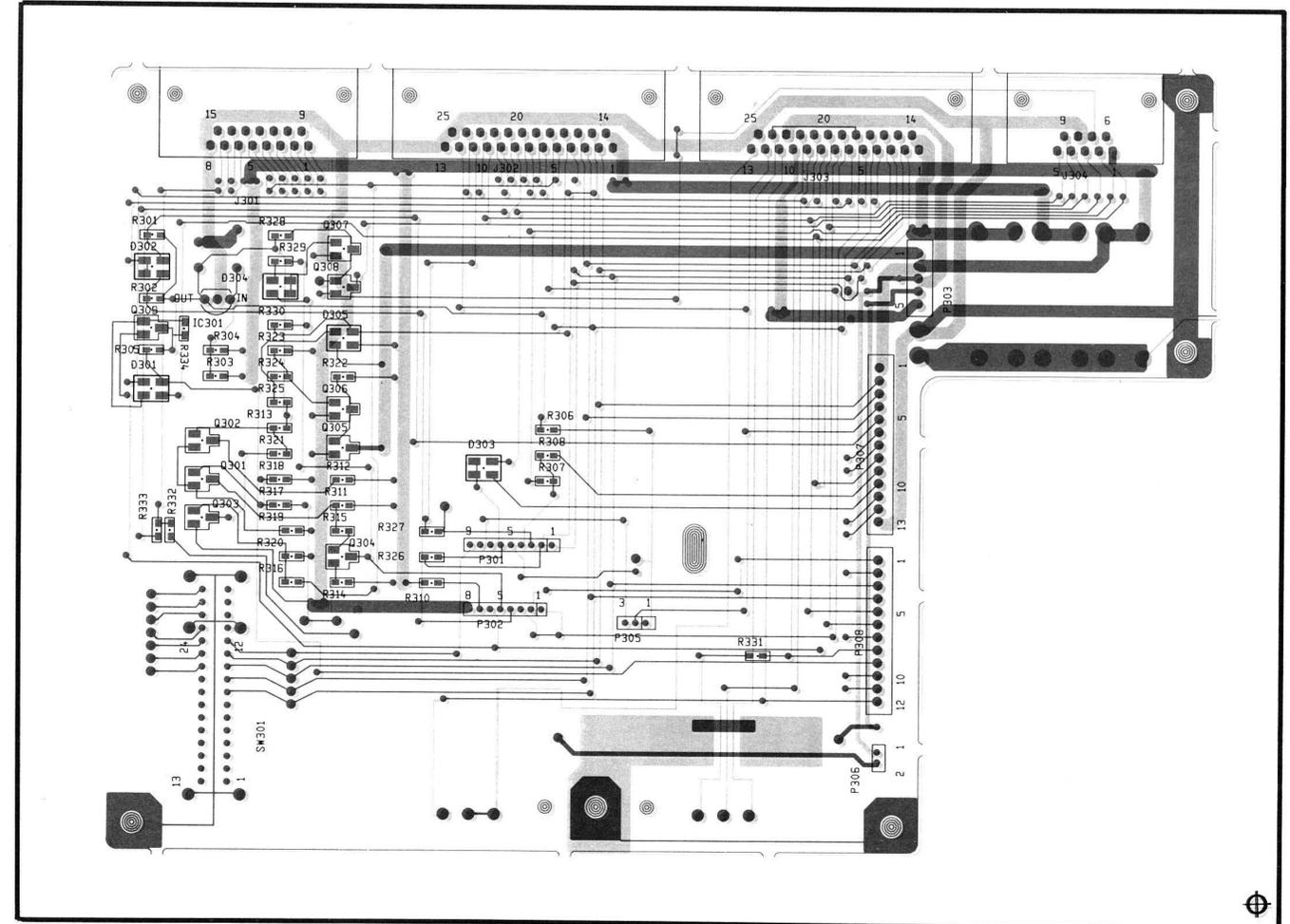
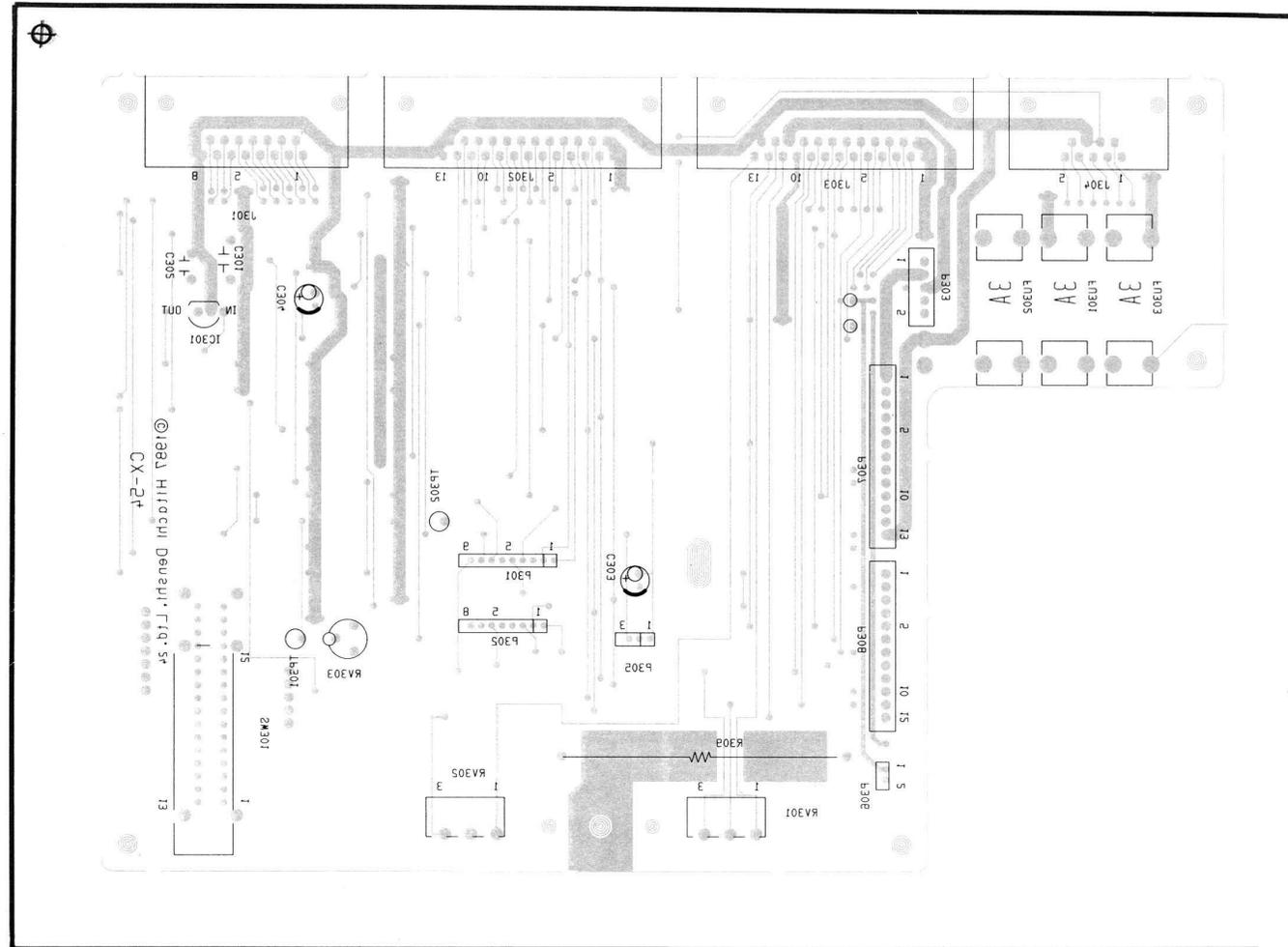
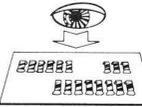
**BLUE: VISIBLE PLATING  
RED: UNDERSIDE PLATING**

S3-8



# MAIN BOARD (CX-54) LAYOUT

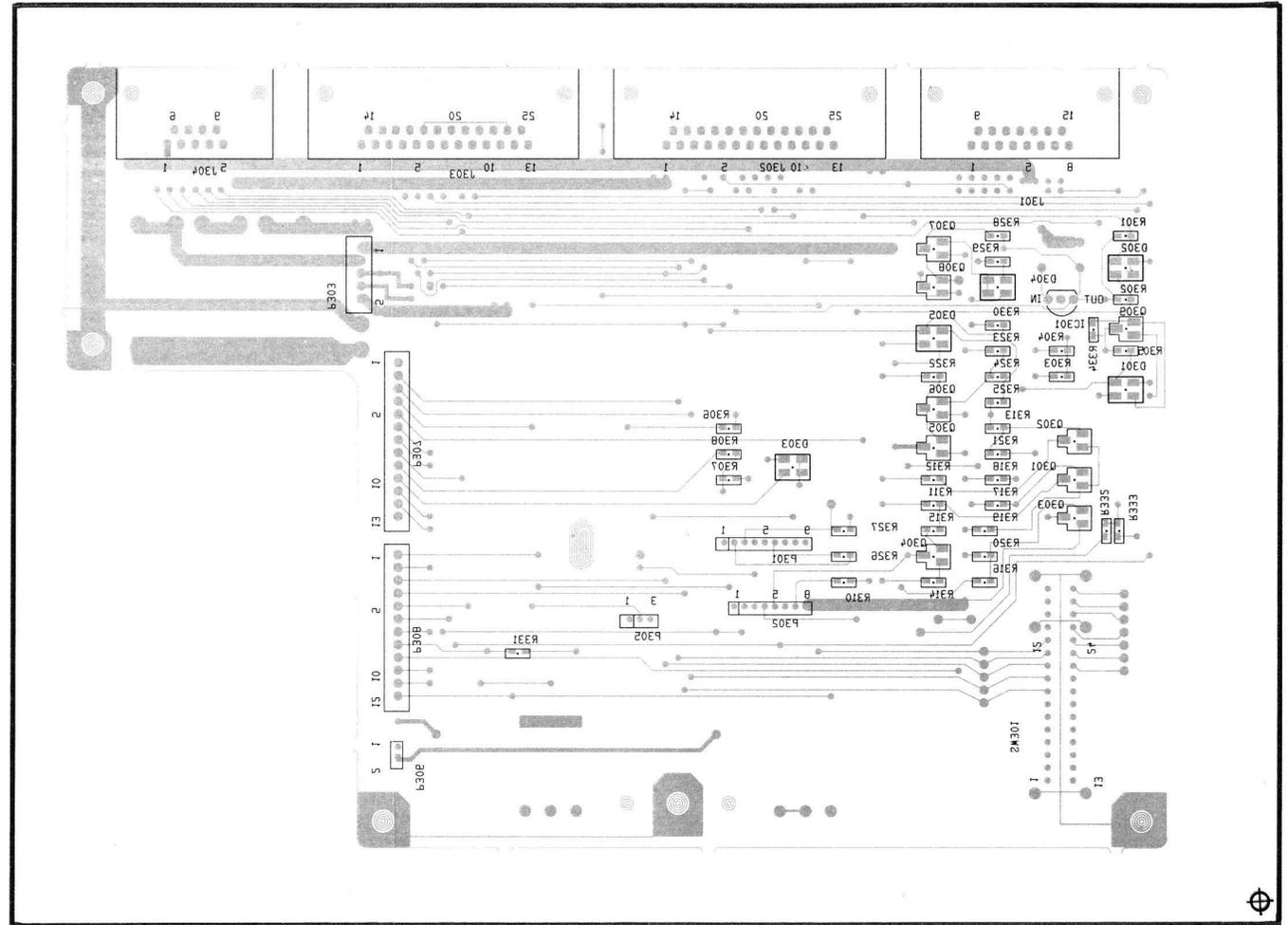
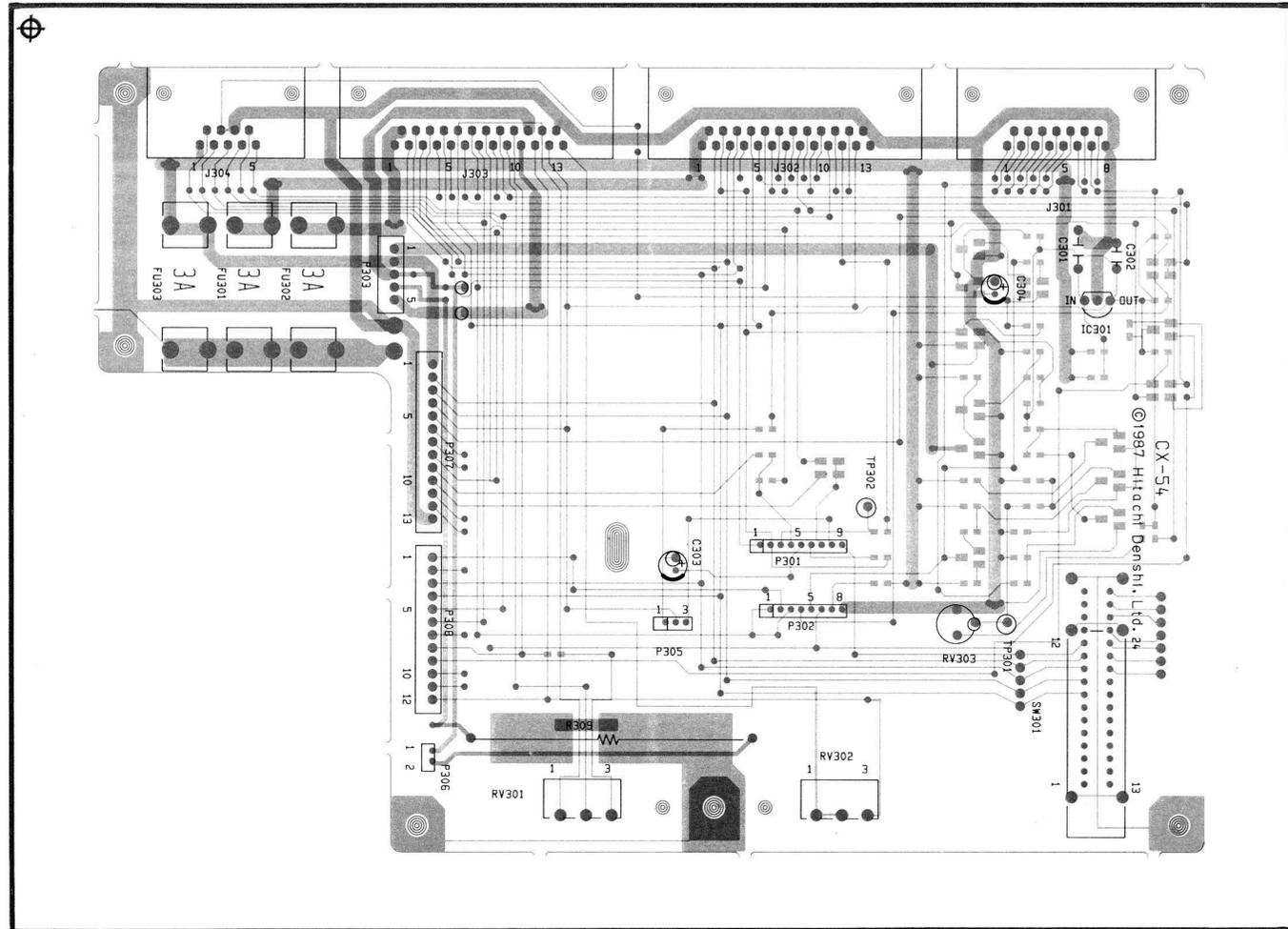
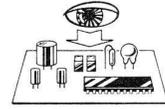
## BOTTOM VIEW



**BLUE: VISIBLE PLATING**  
**RED: UNDERSIDE PLATING**

# MAIN BOARD (CX-54) LAYOUT

## TOP VIEW



**BLUE: VISIBLE PLATING**  
**RED: UNDERSIDE PLATING**

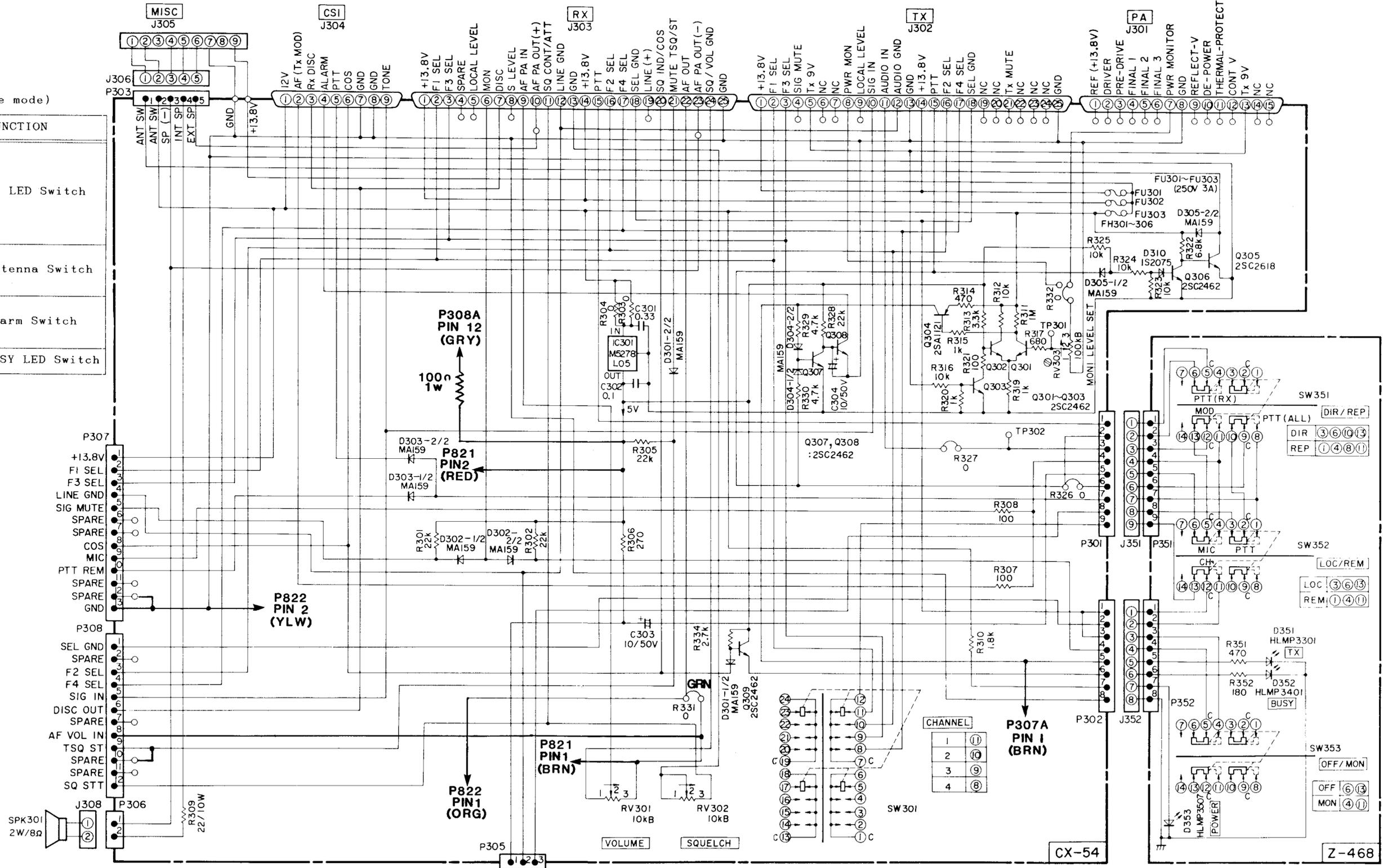


S3-10

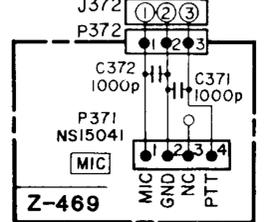
# 71-7900 CONTROL PANEL SCHEMATIC

DC VOLTAGES  
(measured in receive mode)

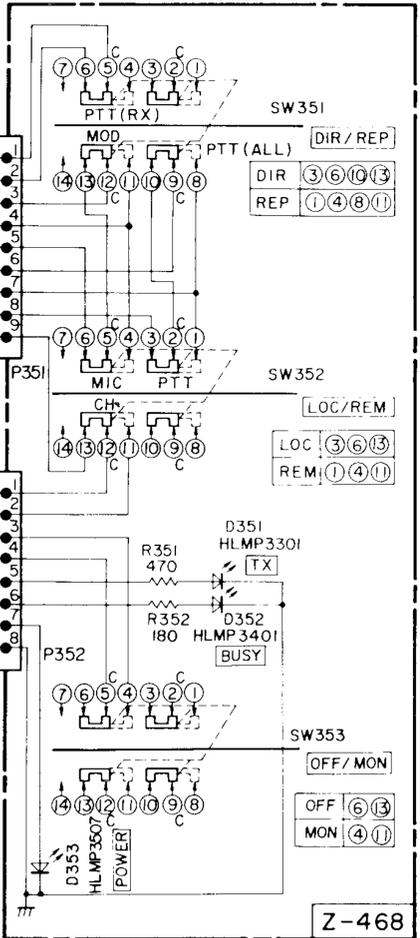
DEVICE	BASE	COLL	EMIT	FUNCTION
Q301	0	13.2	1.9	TX LED Switch
Q302	2.6	1.9	1.9	
Q303	0	2.6	0	
Q304	13.2	0	13.8	
Q305	0	0.6	0	Antenna Switch
Q306	0.7	1.7	0	
Q307	0.7	0	0	Alarm Switch
Q308	0	1.7	0	
Q309	4.8	5.0	4.1	BUSY LED Switch



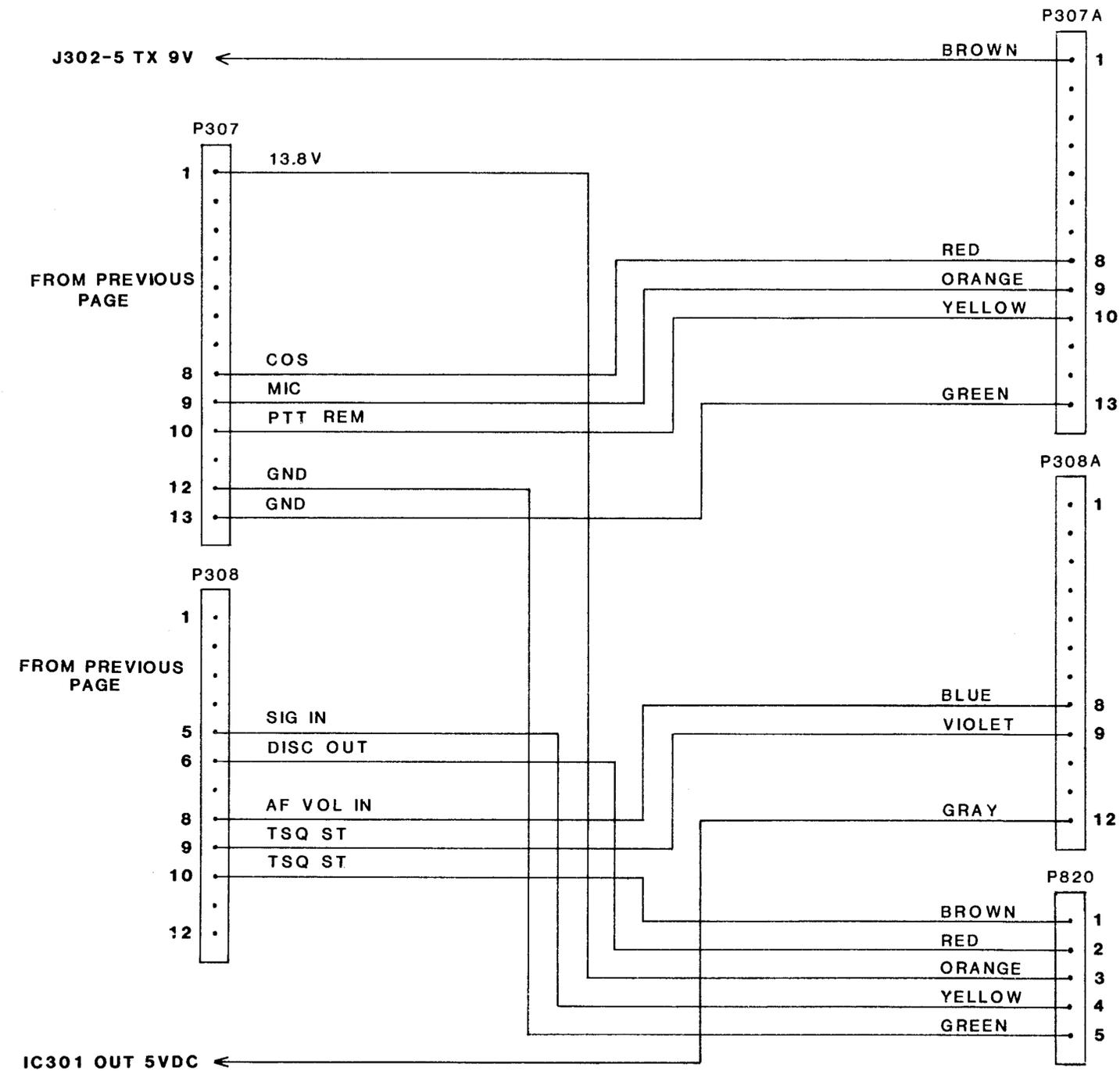
S3-11



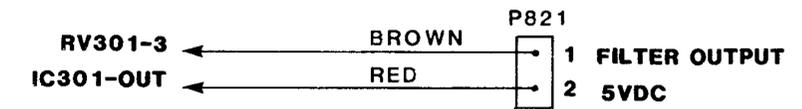
NOTE: P307A, P308A, P821, P822 ARE FLOATING CONNECTORS. SEE NEXT PAGE FOR DETAILS.



# CONTROL PANEL OPTION CABLES



TO 71-7910 REPEATER BOARD OPTION



TO 71-8210 HP FILTER BOARD OPTION

TO 71-7910 REPEATER BOARD OPTION



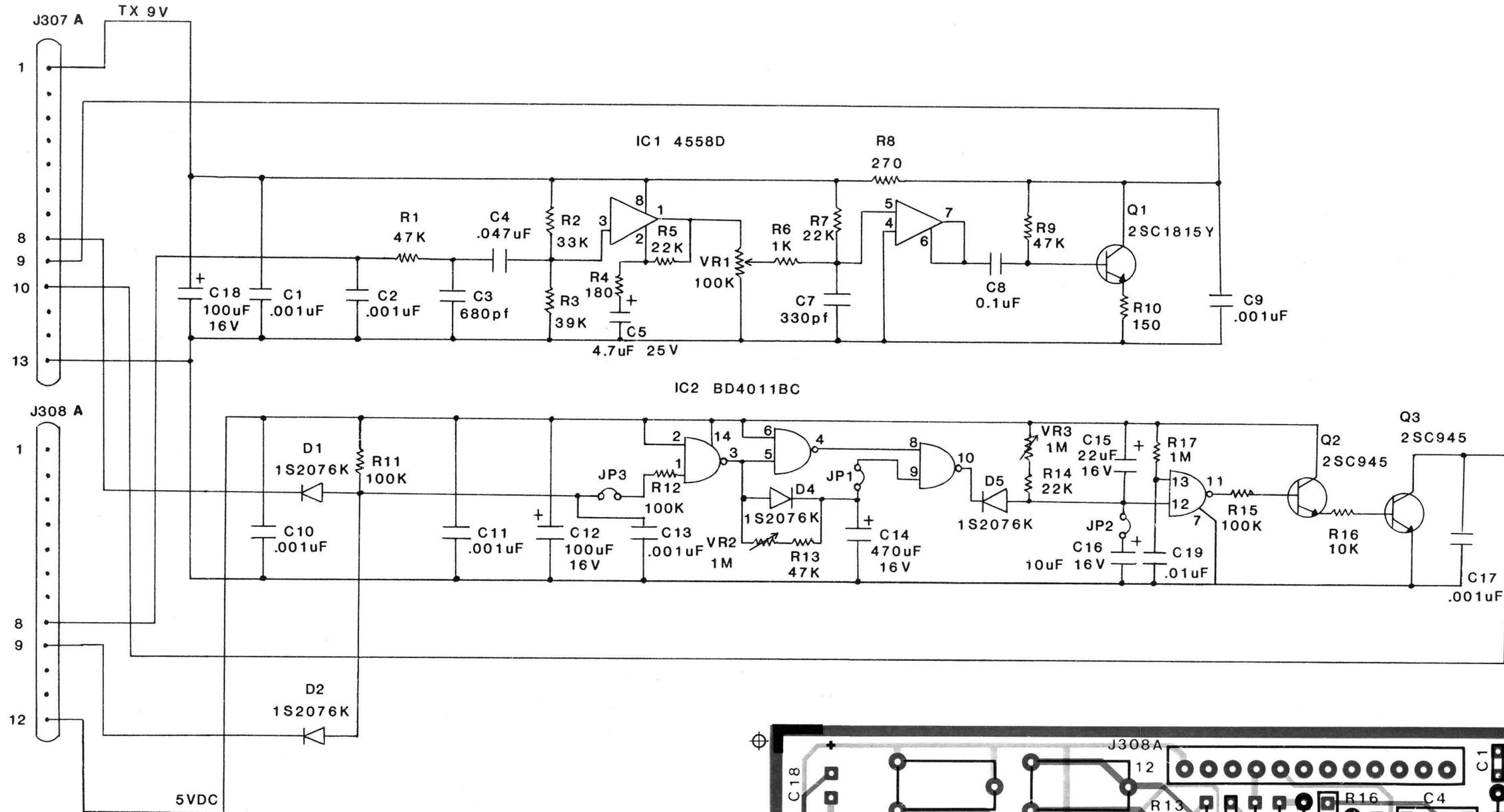
TO 71-8210 HP FILTER BOARD OPTION

TO 71-8215 DUPLEX CTCSS BOARD OPTION

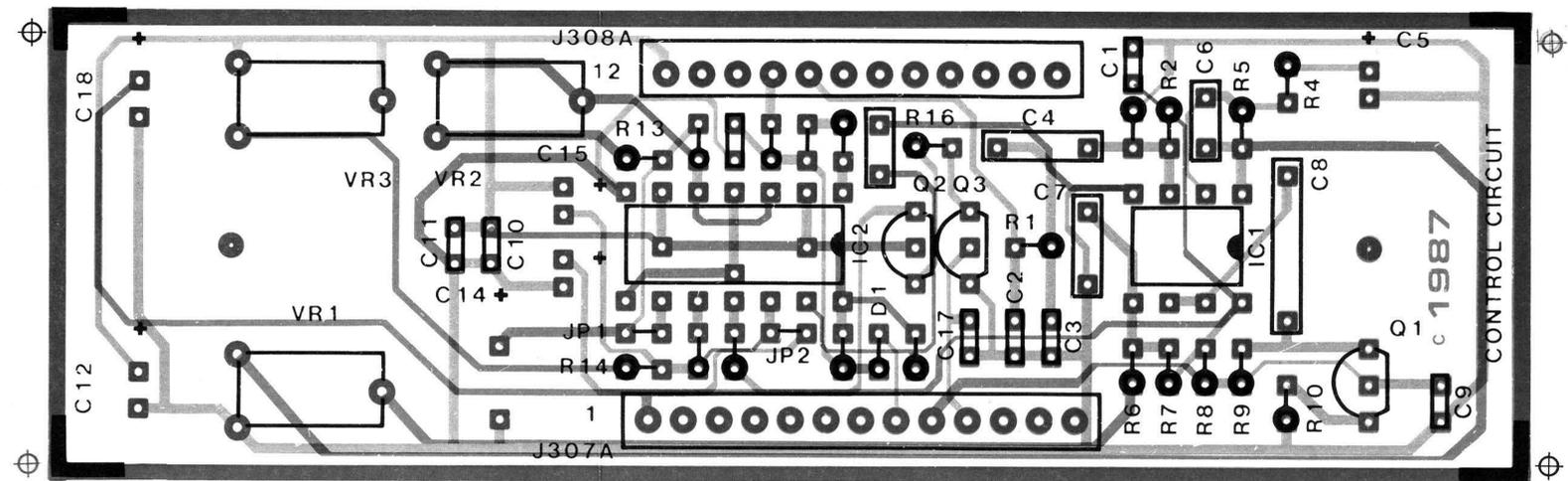
FOLD OUT

S3-12

# 71-7910 REPEATER BOARD (OPTIONAL)

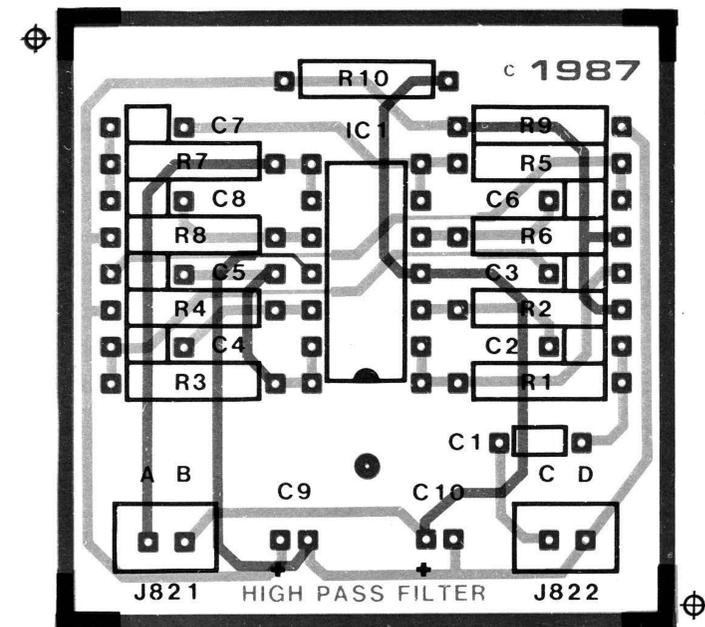
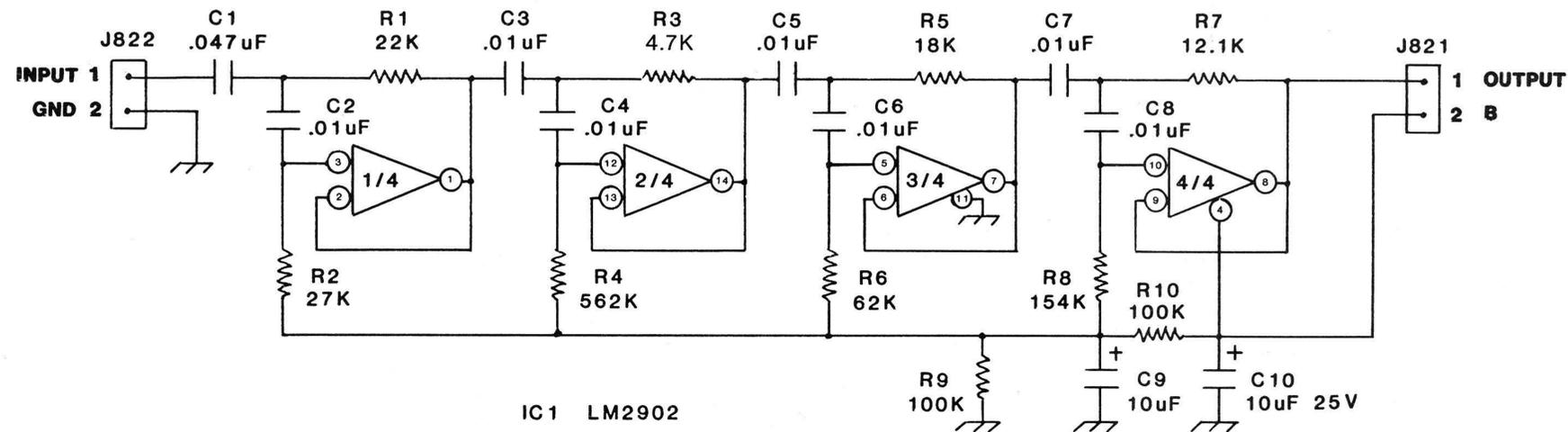


**BLUE: VISIBLE PLATING**  
**RED: UNDERSIDE PLATING**



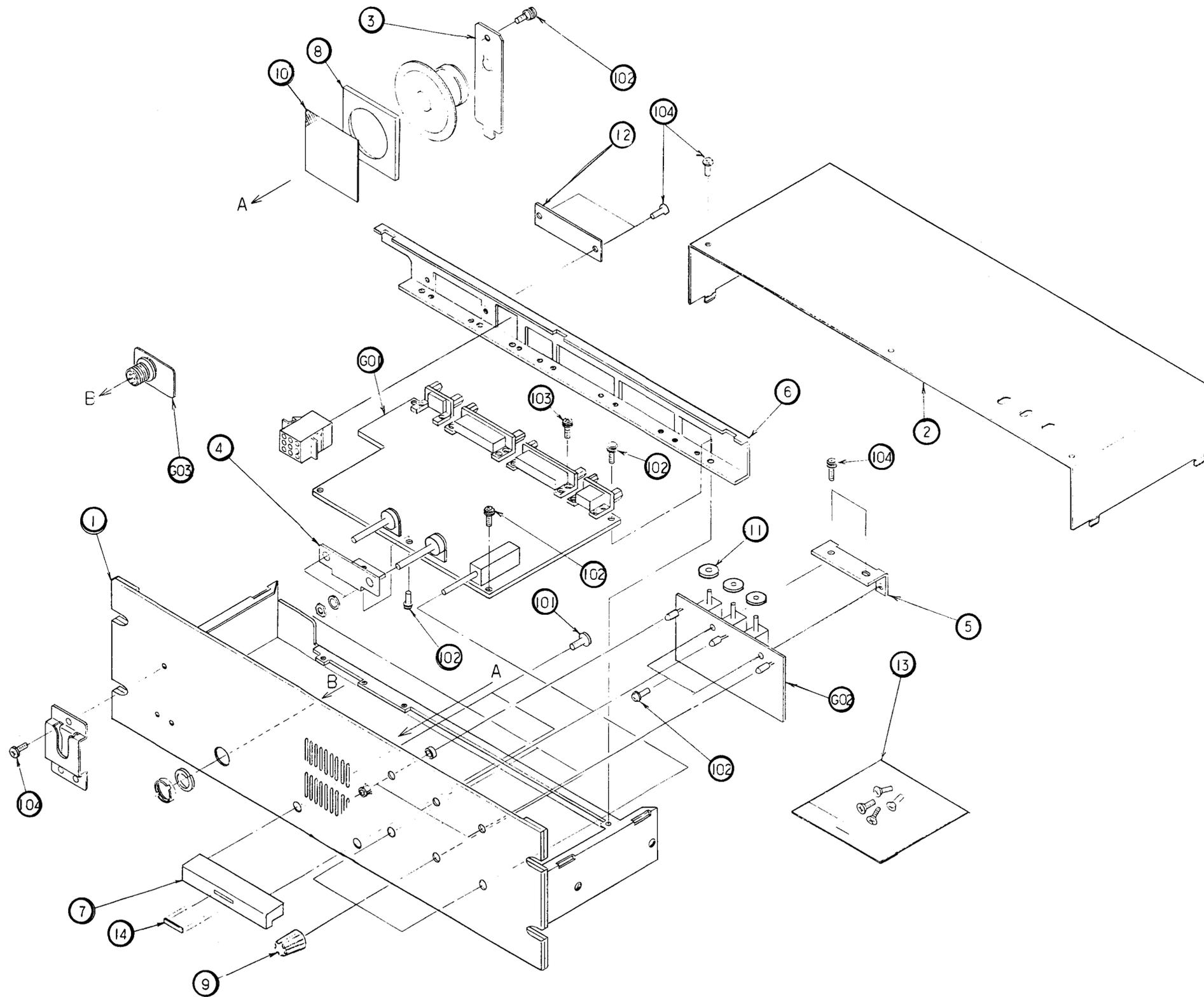


# 71-8210 HP FILTER BOARD (OPTIONAL)



BLUE: VISIBLE PLATING  
 RED: UNDERSIDE PLATING

# 71-7900 EXPLODED VIEW



FOLD OUT

S3-16

## CONTROL PANEL PARTS

71-7900 MECHANICAL PARTS  
(refer to 71-7900 Exploded View)

REF.NO.	DESCRIPTION	PART NO.
<u>EXPLODED MECHANICAL VIEW</u>		
1	Cntrl. Panel	70-010164
2	Cover	70-010165
3	Spkr. Brkt.	70-158239
4	Vol. Cntrl Brkt	70-158240
5	LED Brkt.	70-158241
6	Cnctr. Brkt.	70-158242
7	Handle	70-158243
8	Spkr. Gasket.	70-157261
9	Vol. Knob	70-110036
10	Spkr. Net	70-020183
11	Cov. Swtch.	70-020180
12	Cov. Cnctr.	70-020181
13	Screw	70-151808
14	Label	70-020182
101	Screw 6x12	70-151809
102	Screw 3x8	70-151810
103	Screw 3x10	70-151273
104	Screw 3x6	70-151616
G01	CX-54 Asy.	70-075282
G02	Z-468 Asy.	70-075283
G03	Z-469 Asy.	70-075284
<u>MISCELLANEOUS</u>		
FU301,302, 303	Fuse, 3 Amp	70-204060
FH301,302, 303,304, 305,306	Fuseholder	70-159395
SPK301	Speaker	70-060011
	Mic Clip	70-151807
	Blank J304 Plug	70-159400
<u>CABLE ASSEMBLIES</u>		
	J308-Spkr.	70-034300
	J302-J101	70-034293
	J303-P801	70-034293
	J301-P6001	70-034294
	P305-P.S.	70-034295
	J306-J306	70-034296
	P307/P308/P820	
	Option Cable	70-034283
	P821 Option Cbl	70-034284
	P822 Option Cbl	70-034285

## 71-7900 ELECTRICAL PARTS

## CX-54 MAIN BOARD

TOPSIDE COMPONENTS			BOTTOMSIDE COMPONENTS		
REF. NO.	DESCRIPTION	PART NO.	REF. NO.	DESCRIPTION	PART NO.
<u>INTEGRATED CIRCUITS</u>			<u>TRANSISTORS</u>		
IC301	M5278L05	70-076443	Q301,302, 303,306, 307,308, 309	2SC2462LC	70-080160
<u>CONTROLS</u>			Q304	2SA1121SC	70-080159
RV301	Vol. 10K	70-164085	Q305	2SC2618RC	70-080279
RV303	PWR,MON,SENS	70-164090			
RV302	SQ 10K	70-164085			
<u>JACKS, PLUGS &amp; CONNECTORS</u>			<u>DIODES</u>		
J301A	PA Intrf.Ctr	70-159417	D301,302, 303,304, 305	MA159	70-085222
J302,303	Rx/Tx IntCtr	70-159396			
J304	CSI Intr.Ctr	70-159418			
P301	Plug,PA Intr	70-159397			
P302	Plug,Tx Intr	70-159253			
P303	Plug,Rx Intr	70-159398			
P305	Plug, Misc.	70-159254	R301,302, 305,328	22K, 1/10W	70-144121
P306	Plug, Spkr.	70-159399	R303,304, 326,327, 331,332, 333	0 ohm	70-144106
P307	Plug, Option	70-159098	R306	270 Ohm,1/10W	70-144116
P308	Plug, Spkr.	70-159097	R307,308, 321	100 Ohm1/10W	70-145146
<u>SWITCHES</u>			R310	1.8K,1/10W	70-144154
SW301	Rotary Swth.	70-180038	R311	1M, 1/10W	70-144155
<u>WIRE RESISTORS</u>			R312,325	10K,1/10W	70-144120
R309	220 Ohm	70-145148	R313	3.3K,1/10W	70-144118
<u>PLASTIC CAPACITORS</u>			R314	470 Ohm 1/10W	70-144152
C301	.33uf, 50V	70-138227	R315,319, 320,342	1K,1.10W	70-144125
C302	.10uf, 50V	70-138189	R316	10K, 1/10W	70-144120
<u>ELECTROLYTIC CAPACITORS</u>			R317	680 Ohm 1/10W	70-144157
C303,304	10uf, 50V	70-135142	R322	6.8K, 1/10W	70-144158
			R323	3.9K, 1/10W	70-145132
			R329,330	4.7K, 1/10W	70-144123
			R334	2.7K, 1/10W	70-144159

## Z-468 SWITCH BOARD

## Z-469 MICROPHONE JACK

REF. NO.	DESCRIPTION	PART NO.	REF. NO.	DESCRIPTION	PART NO.
<u>CABLE ASSEMBLIES</u>			<u>CONNECTORS</u>		
P351	Cable Assy.	70-034297	P371	Multi Cnctr.	70-159100
P352	Cable Assy.	70-034298	<u>CABLES</u>		
<u>SWITCHES</u>			P372	Cable Assy.	70-034299
SW351,352, 353	Switch	70-180037	<u>CERAMIC CAPACITORS</u>		
<u>DIODES</u>			C371,372	1000 Pf, 50V	70-138170
D351	HLMP-3301	70-085223			
D352	HLMP-3401	70-085224			
D353	HLMP-3507	70-085225			
<u>METAL CHIP RESISTORS</u>					
R351	470 Ohm 1/10W	70-144152			
R352	180 Ohm 1/10W	70-144153			

## 71-7910 REPEATER BOARD OPTION

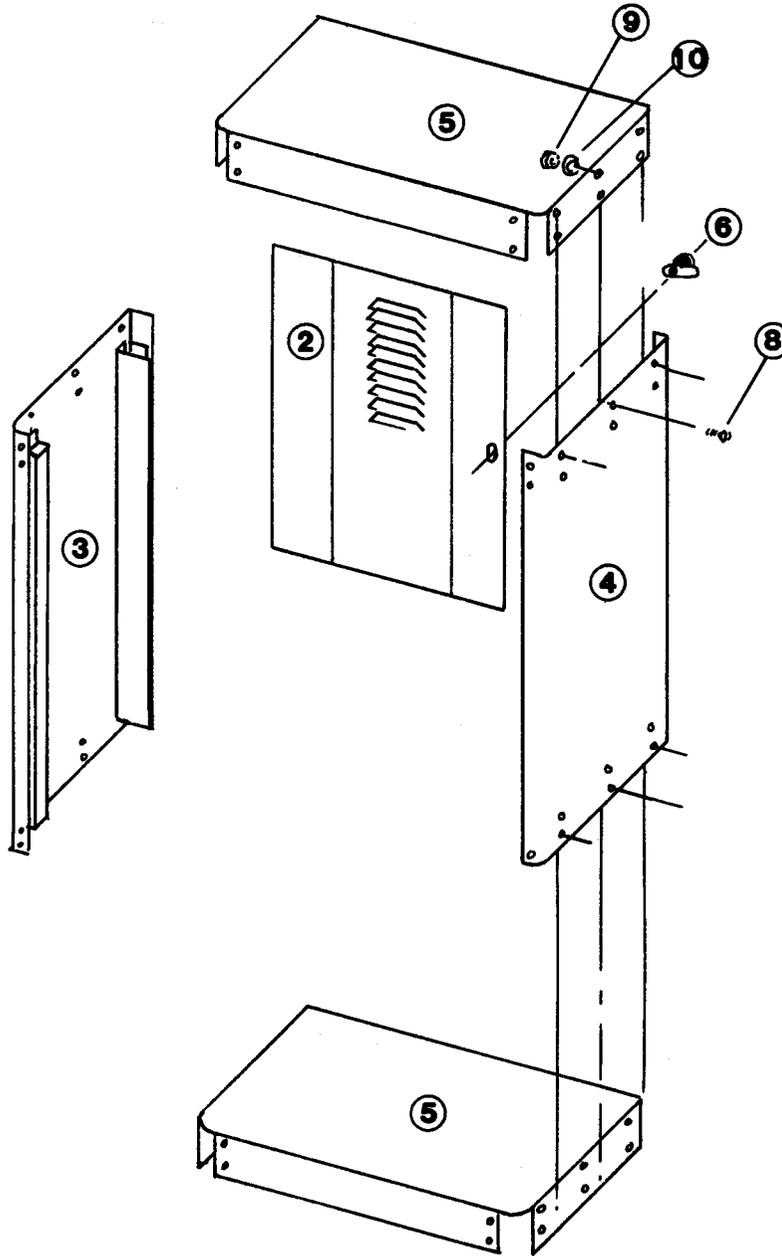
REF. NO.	DESCRIPTION	PART NO.	REF. NO.	DESCRIPTION	PART NO.
<u>CAPACITORS</u>			<u>RESISTORS</u>		
C1	.001uf, Cer	70-136006	R1	47K, 1/8 W, 5%	70-147085
C2	.001uf, Cer	70-136006	R2	33K, 1/8 W, 5%	70-147083
C3	680pf, Cer	70-135121	R3	39K, 1/8 W, 5%	70-147084
C4	.047uf, Mylar	70-137057	R4	180, 1/8 W, 5%	70-147071
C5	4.7uf, 25V Tant	70-138030	R5	22K, 1/8 W, 5%	70-147087
C7	330pf, Cer	70-136147	R6	1K, 1/8 W, 5%	70-147079
C8	0.1uf, Cer	70-135120	R7	22K, 1/8 W, 5%	70-147087
C9	.001uf, Cer	70-136006	R8	270, 1/8 W, 5%	70-147078
C10	.001uf, Cer	70-136006	R9	47K, 1/8 W, 5%	70-147085
C11	.001uf, Cer	70-136006	R10	150, 1/8 W, 5%	70-147077
C12	100uf, 16V Elec	70-135124	R11	100K, 1/8 W, 5%	70-147086
C13	.001uf, Cer	70-136006	R12	100K, 1/8 W, 5%	70-147086
C14	470uf, 16V Elec	70-135125	R13	47K, 1/8 W, 5%	70-147085
C15	22uf, 16V Elec	70-135126	R14	22K, 1/8 W, 5%	70-147087
C16	10uf, 16V Elec	70-135122	R15	100K, 1/8 W, 5%	70-147086
C17	.001uf, Cer	70-136006	R16	10K, 1/8 W, 5%	70-147082
C18	100uf, 16V Elec	70-135124	R17	1M, 1/4 W, 5%	70-140032
C19	.01uf, Cer	70-137056	<u>VARIABLE RESISTORS</u>		
<u>DIODES</u>			VR1	100K Trim Pot	70-164056
D1	1S2076K	70-085065	VR2	1M Trim Pot	70-164057
D2	1S2076K	70-085065	VR3	1M Trim Pot	70-164057
D4	1S2076K	70-085065	<u>MISCELLANEOUS</u>		
D5	1S2076K	70-085065	Stand-off, qty 2	70-156082	
<u>INTEGRATED CIRCUITS</u>			3mm Nut, qty 2	70-151018	
IC1	4558D	70-076006	3x6 Screw, qty 2	70-151355	
IC2	BD4011BC	70-076243	Star Wash, qty 4	70-156093	
<u>CONNECTORS</u>					
J307A	13 Pin Jack	70-159098			
J308A	12 Pin Jack	70-159097			
<u>TRANSISTORS</u>					
Q1	2SC1815Y	70-080036			
Q2	2SC945	70-080183			
Q3	2SC945	70-080183			

## 71-8215 CTCSS BOARD OPTION

## 71-8210 HP FILTER BOARD OPTION

REF. NO.	DESCRIPTION	PART NO.	REF. NO.	DESCRIPTION	PART NO.
<u>CAPACITORS</u>			<u>CAPACITORS</u>		
C1	.001uf Cer	70-136006	C1	.047uf, 50V, Mylar	70-137057
C2	0.1uf, 16V, Tant	70-138046	C2	.01uf, 50V, "	70-137048
C3	.001uf, Cer	70-136006	C3	.01uf, 50V, "	70-137048
C4	.001uf, Cer	70-136006	C4	.01uf, 50V, "	70-137048
C5	4.7uf, 16V Elect	70-136067	C5	.01uf, 50V, "	70-137048
<u>INTEGRATED CIRCUITS</u>			<u>INTEGRATED CIRCUIT</u>		
IC1	70-T02G ToneMod	70-T02G	IC1	LM2902	70-076150
IC2	70-T02G ToneMod	70-T02G			
<u>CONNECTOR</u>			<u>CONNECTORS</u>		
J820	5 Pin Jack	70-159093	J821	2-Pin Jack	70-159138
<u>RESISTORS</u>			<u>RESISTORS</u>		
R1	49.9K, 1%	70-144091	J822	2-Pin Jack	70-159138
R2	49.9K, 1%	70-144091			
R3	10K	70-147082			
R4	10K	70-147082			
R5	110K, 1%	70-144092			
R6	110K, 1%	70-144092	R1	22K, 1/4W	70-140124
R7	10K	70-147082	R2	27K, 1/4W	70-140140
R8	10K	70-147082	R3	4.7K, 1/4W	70-141070
<u>VARIABLE RESISTORS</u>			R4	562K, 1/4W 1%	70-140142
VR1	100K Trim Pot	70-123001	R5	18K, 1/4W	70-140143
VR2	100K Trim Pot	70-123001	R6	62K, 1/4W	70-140144
VR3	10K Trim Pot	70-144045	R7	12.1K 1/4W 1%	70-140145
<u>MISCELLANEOUS</u>			R8	154K, 1/4W 1%	70-140146
TP1	Test Point	70-159140	R9	100K, 1/4W	70-140132
	3mm nut	70-151018	R10	100K, 1/4W	70-140132
	Star wash, qty 2	70-156093	<u>MISCELLANEOUS</u>		
	Stand-off	70-156082		Fiber Washer	70-151449
	3 x 6 Screw	70-151355		Stand-off	70-156072
				3mm Nut	70-151018
				Star Wash qty 2	70-156093
				3x6 Screw	70-151355

CABINET PARTS

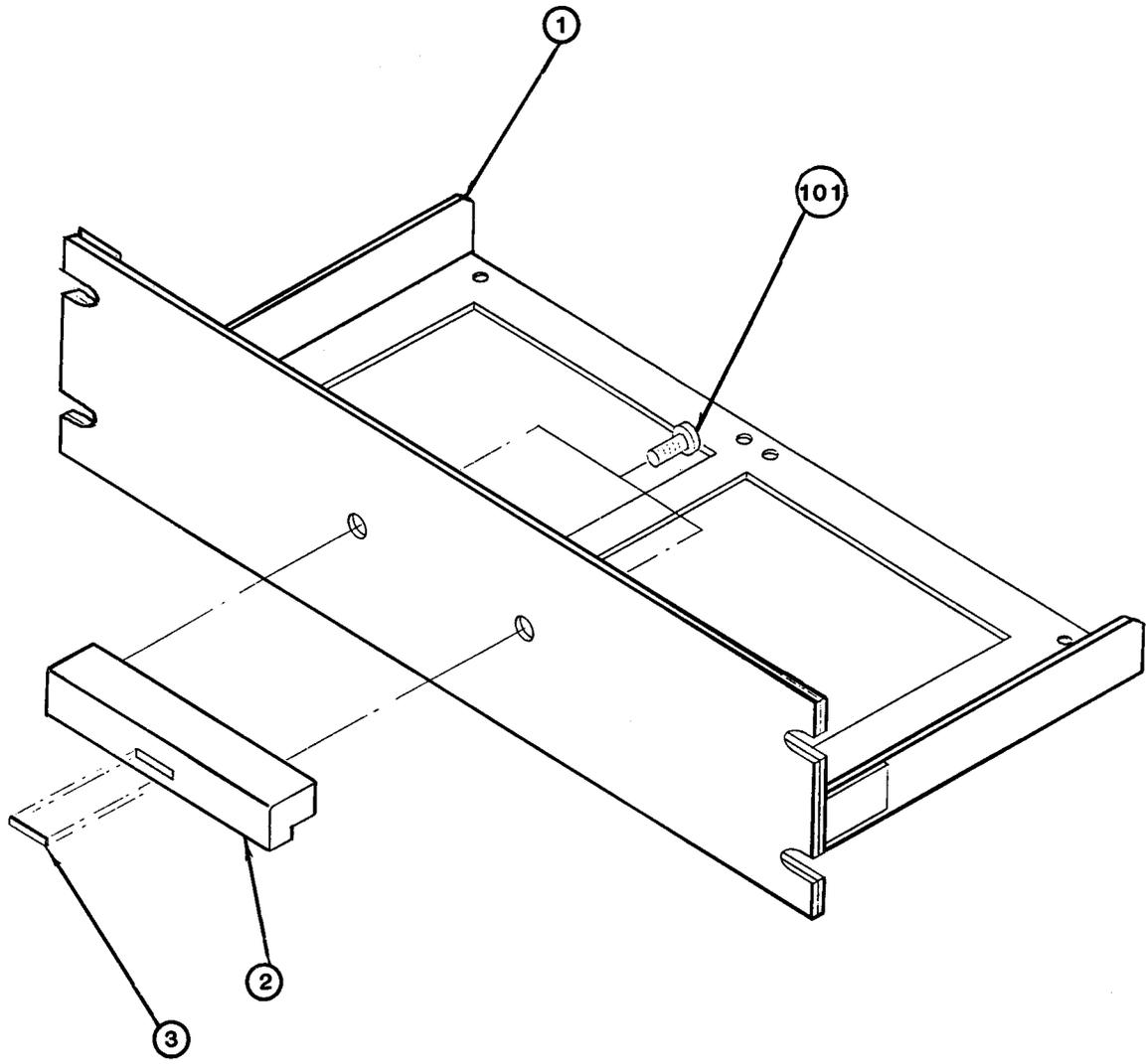


71-8820 31.5 in. CABINET

REF. NO.	DESCRIPTION	PART NO.
2	Rear Door	70-010210
3	Cab. Side Lft.	70-010208
4	Cab. Side Rt.	70-010209
5	Cabinet Top	70-010206
5	Cabinet Bottom	70-010207
6	Lock & Key	70-151864
8	Cabinet Screws	70-151861
9	Nut	70-151863
10	1/4" Split Wash.	70-151838
	10-32 Rack Scrw.	70-151837

71-8830 41.25 in. CABINET

REF. NO.	DESCRIPTION	PART NO.
2	Rear Door	70-010215
3	Cab. Side Lft.	70-010213
4	Cab. Side Rt.	70-010214
5	Cabinet Top	70-010211
5	Cabinet Bottom	70-010212
6	Lock & Key	70-151864
8	Cabinet Screws	70-151861
9	Nut	70-151863
10	1/4" Splt.Wash.	70-151862
	10-32 Rack Scrw.	70-151837



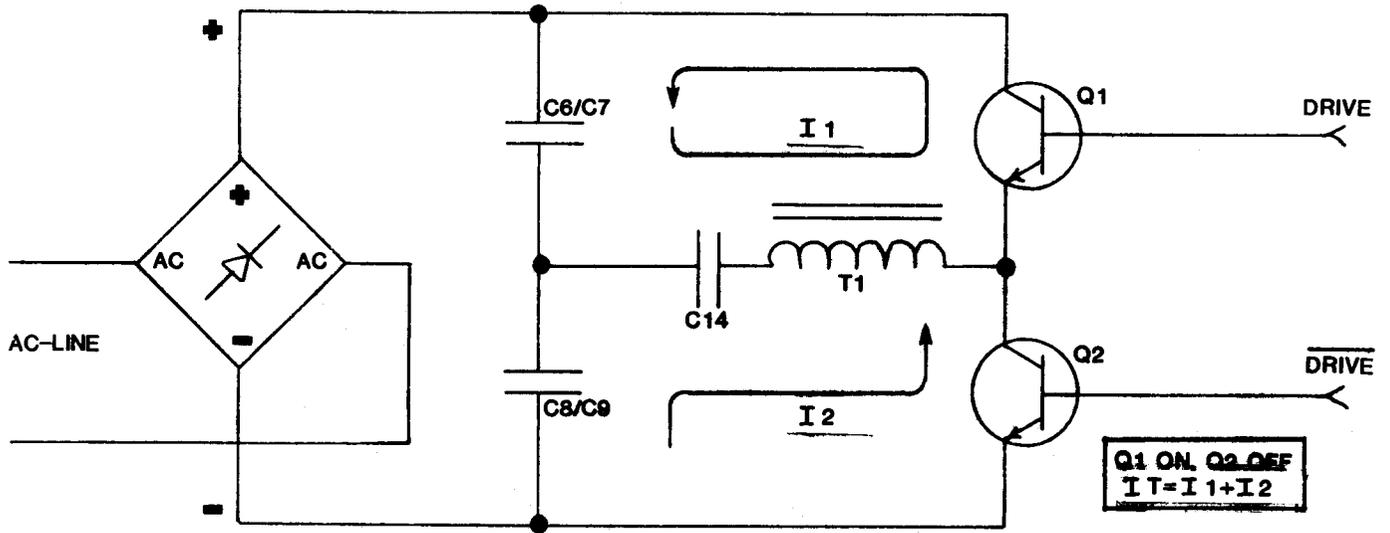
71-7700 TX/RX DRAWER

REF. NO.	DESCRIPTION	PART NO.
1	Drawer	70-010166
2	Handle	70-011062
3	Label	70-020184
101	Screw	70-151809

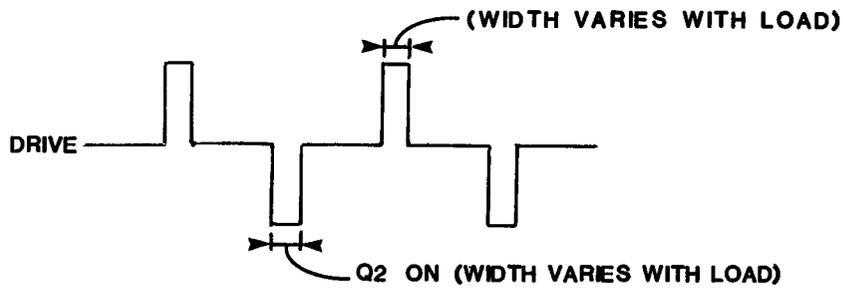
**SECTION 4**

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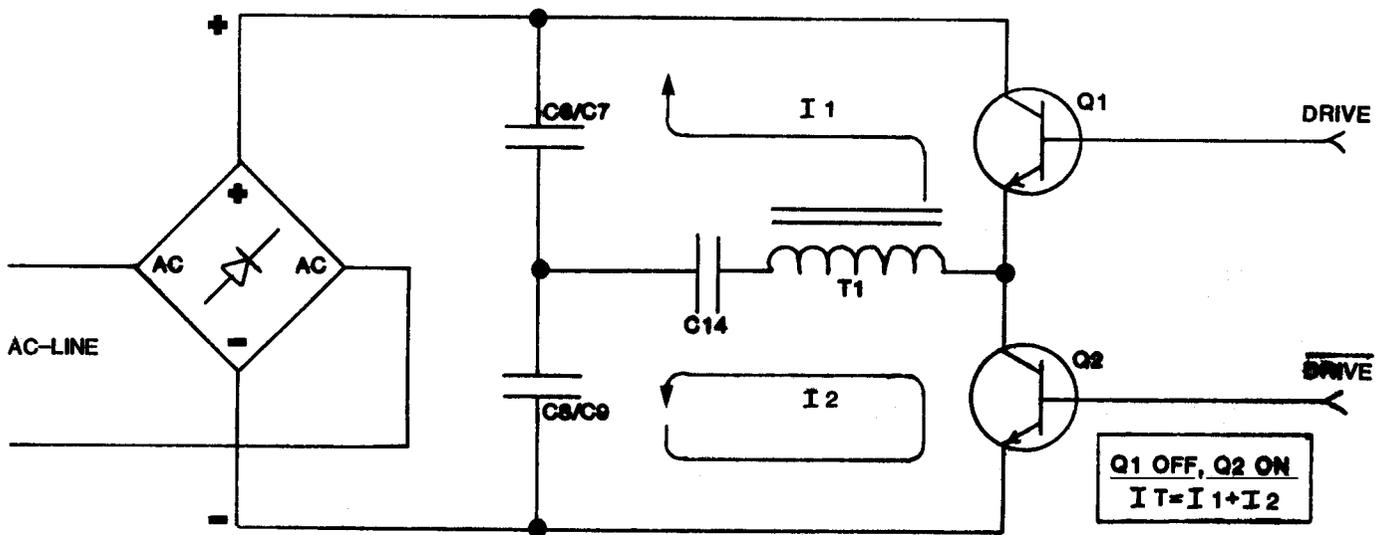
**POWER SUPPLY**



(A)



(B)



(C)

FIGURE 4.1 — Primary Circuit

## 71-7240 CIRCUIT DESCRIPTION

### PRIMARY CIRCUIT

AC-line voltage is surge protected by arrestor AAR3, capacitors C1-C5, and L1. AC-line is converted to DC by full-wave bridge diode D1. R3 serves as a fuse.

C6/C7 pair and C8/C9 pair each are charged to half of rectified line voltage. The junction of these capacitors is connected to the junction of Q1 and Q2 through main transformer T1. Q1 and Q2 connect across the rectified line voltage (see Figure 1). Q1 and Q2 are driven push-pull by pulses from IC101 that turns the transistors on alternately.

When IC101 drives Q1 on, current from source-negative charges C8/C9 as it passes through T1 primary (Figure 4.1-A). Also, C6/C7 discharge through T1 and Q1. During this half-cycle, both C8/C9 charge current and C6/C7 discharge current produce magnetic fields in T1.

When IC101 drives Q2 on, Q1 is off and current flows from source-negative through Q2, through T1, into C6/C7 (Figure 4.1-C). C8/C9 discharge through Q2 and T1. During this second half-cycle, C6/C7 discharge and C8/C9 charge currents drive T1 to the opposite polarity.

As the load demands more current, driver circuitry increases width of drive pulses so that more primary energy is passed into T1. See Figure 4.1-B.

### PUSH-PULL DRIVE GENERATOR AND DRIVERS

T2 is a standard 60-cycle E-I-lamination transformer that produces source voltage for Q1 and Q2 driver and control circuitry. Q3 and Q4 drive Q1 and Q2, respectively; and these drivers are electrically isolated from the high-voltage primary circuit by T3 and T4.

An oscillator within IC101 drives flip-flop and driver circuits that alternately apply pulses to switch-drivers Q3 and Q4. Pin 11 applies pulses to Q3. Q3 drives T3 that couples the pulses to switcher Q1. IC101 pin 8 applies pulses to Q4; but 180° out of phase with the pulses at pin 11. Q4 drives T4, which drives switcher Q2.

A pulse-width modulator is utilized within IC101 to vary the width of the Q1/Q2 switching pulses. The modulator is controlled by two analog inputs at IC101 pins 1 and 16. A sample of power supply output voltage (14 V) is calibrated by VOLTAGE ADJUST RV101 and applied to pin 1. As output voltage increases, the pulse width modulator narrows the switching pulses so that less energy is fed into T1. This feedback loop establishes voltaic equilibrium.

Another transformer (CT1) is connected in series with T1 primary feed. CT1 output is isolated from high voltages, and varies in proportion to

current drawn into T1. D14-D17 convert CT1 output to a DC voltage that is applied to IC101 pin 16, which is the other input of the pulse-width modulator. When pin 16 is pulled above voltage at D101 anode, power supply drive is reduced. CURRENT ADJUST RV1 absorbs variable amounts of CT1 output energy so that the current limit can be calibrated to 40 Amperes.

#### CROWBAR SHUT-DOWN

IC102 is a threshold comparator that applies a logic high at output (pin 8) when input at pin 2 exceeds its internal 2.6-Volt reference. Power supply output is divided by R124 and R125 to 2.4 Volts. If power-supply output swings above 14.9 Volts, IC102 output triggers SCR PUT101. PUT101 then passes bias to Q101, which clamps IC101 dead-time input (pin 4) high to freeze all output.

The crowbar circuit will not reset until the power supply is shut-off.

### 71-7200 POWER SUPPLY

The 71-7200 Power Supply is a 110-Volt version of the 71-7240 Power Supply and is identical; except that C6/C7 to C8/C9 junction is connected to AC-line neutral, which creates a voltage doubler circuit with D1. Thus, DC voltage input to the switcher circuit is the same as that of the 71-7240 Power Supply.

## ADJUSTMENTS

### VOLTAGE ADJUSTMENT:

1. Establish full load condition (34 Amperes) by initiating transmit at rated power.
2. Set VR101 (located on the Driver Board) to obtain 13.85 Volts DC output while operating under the full load condition.

### OVER-CURRENT PROTECTION ADJUSTMENT:

1. Connect 600-Watt load resistor that is adjustable from 0.3 to 1.0 ohms to the DC output terminals.
2. Set VR1 to minimum resistance (fully clockwise).
3. Vary the load until current flow is 34 Amperes.
4. Adjust VR101 to obtain 13.85 Volts output. Readjust the load as necessary to maintain 34-Ampere current flow while adjusting VR101.
5. Reduce the load resistance to obtain 40 Amperes of current flow.
6. Rotate VR1 to the point where output voltage and current drops.

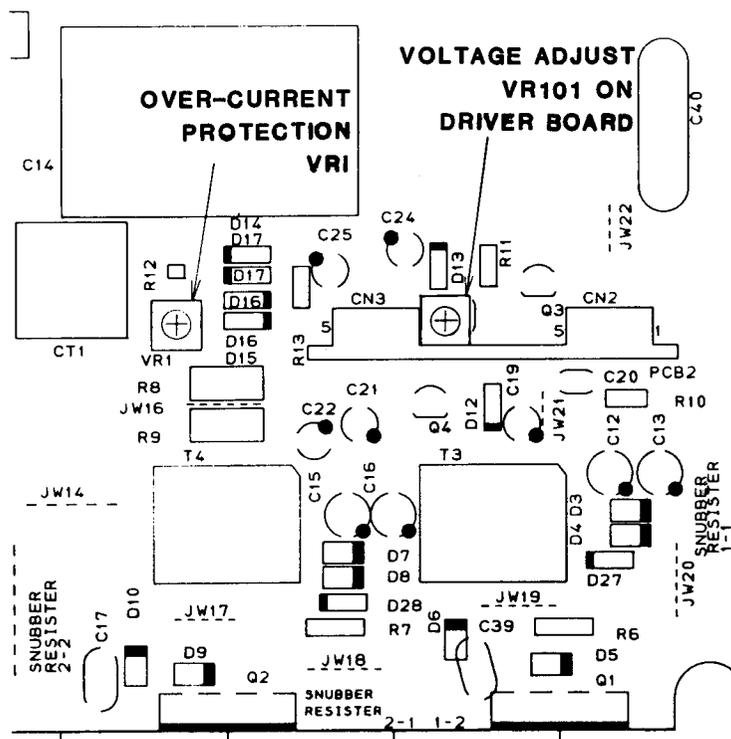
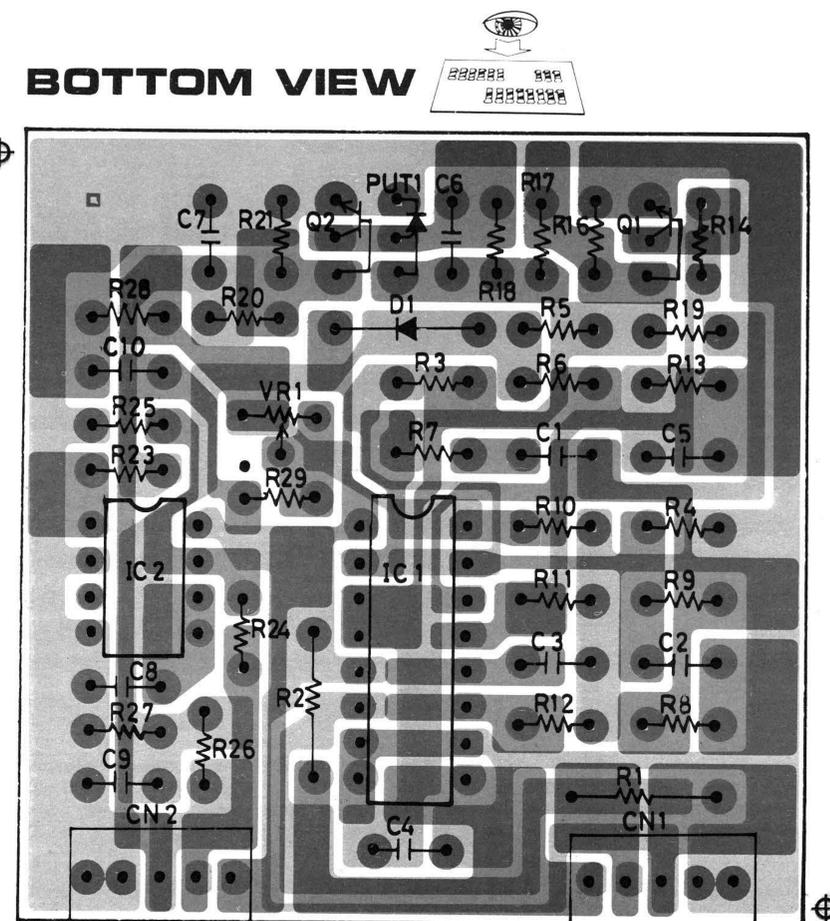
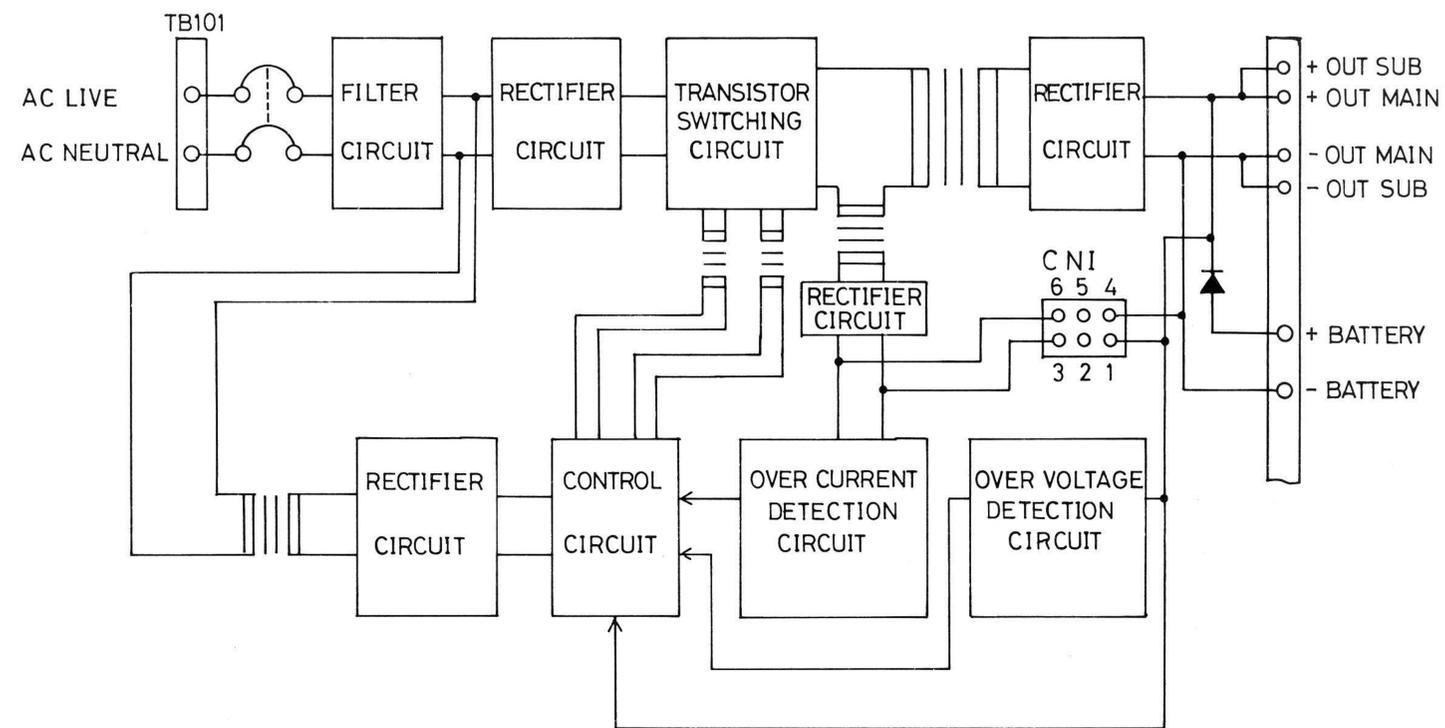
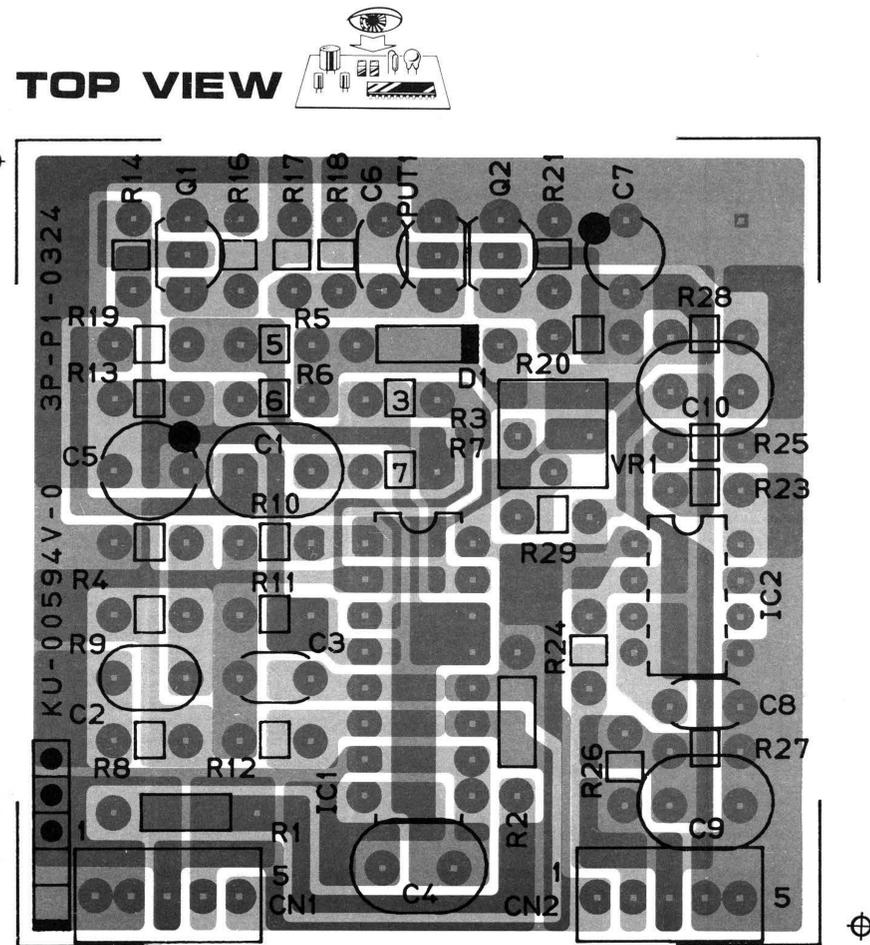


FIGURE 4.2 — ADJUSTMENTS

# NOTES



BLUE: VISIBLE PLATING  
 RED: UNDERSIDE PLATING



THE FOLLOWING VOLTAGE MEASUREMENTS HAVE BEEN MADE UNDER THE FOLLOWING CONDITIONS:

INPUT VOLTAGE = 117 Volts AC  
 OUTPUT VOLTAGE = 13.85 Volts DC  
 OUTPUT CURRENT = 34 Amperes

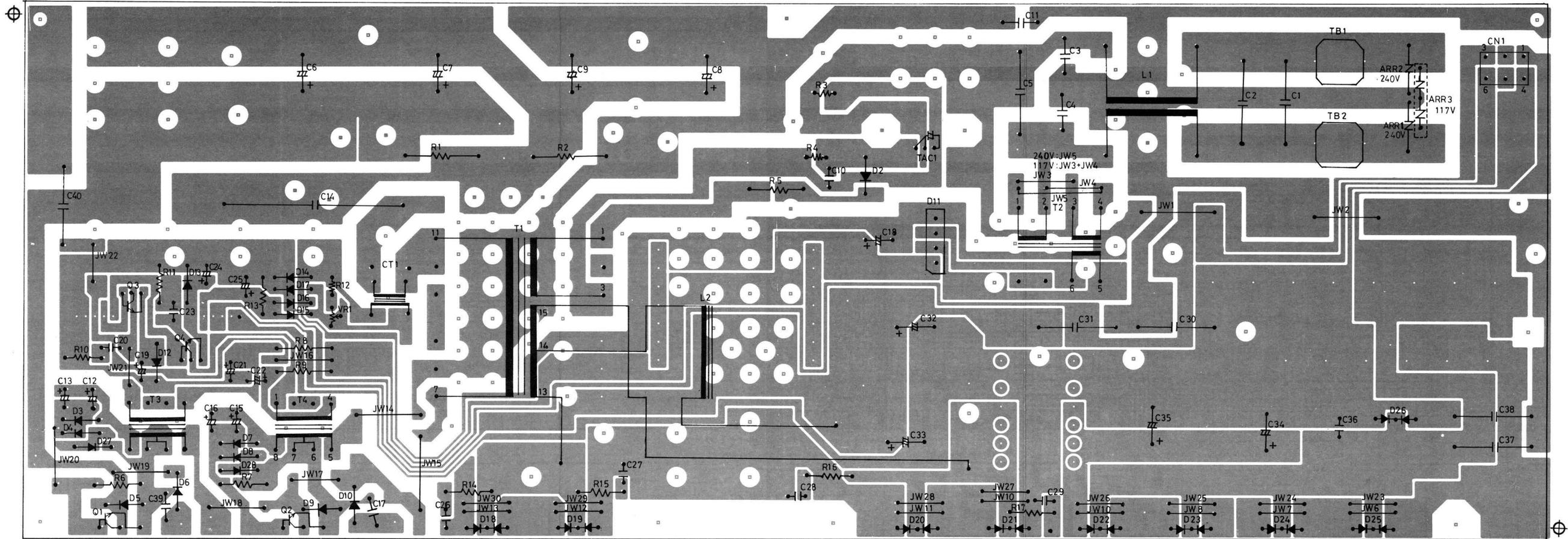
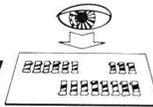
TEST POINTS		VOLTAGE
A	B	
Q1 COLLECTOR	Q1 EMITTER	330 V <sub>p-p</sub>
C18	(-) OUTPUT	19 V <sub>rms</sub>
CN1 PIN 3	CN2 PIN 6	3 V <sub>rms</sub>
C7 (+)	C7 (-)	150 V <sub>rms</sub>

S4-8



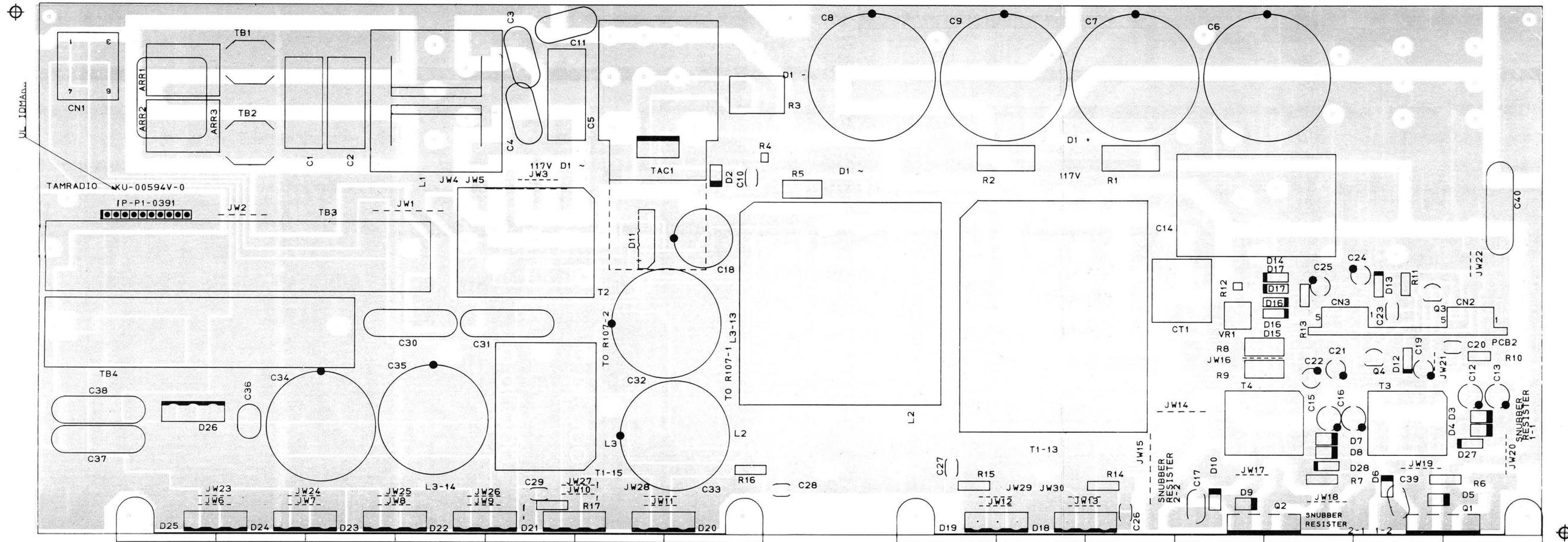
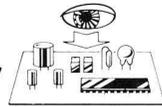
# MAIN BOARD LAYOUT

## BOTTOM VIEW



# MAIN BOARD LAYOUT

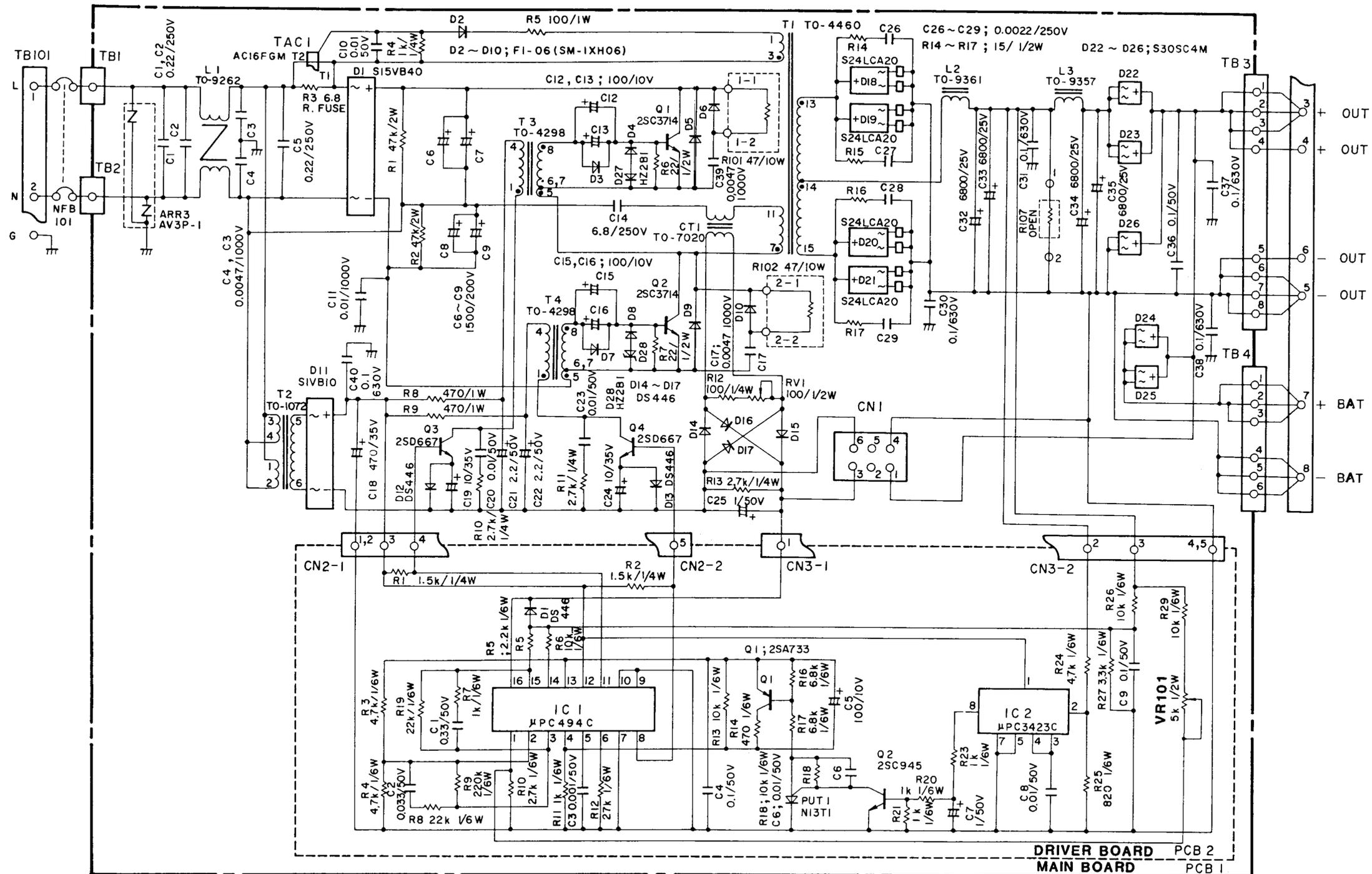
## TOP VIEW



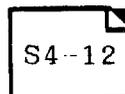
FOLD OUT

S4-10

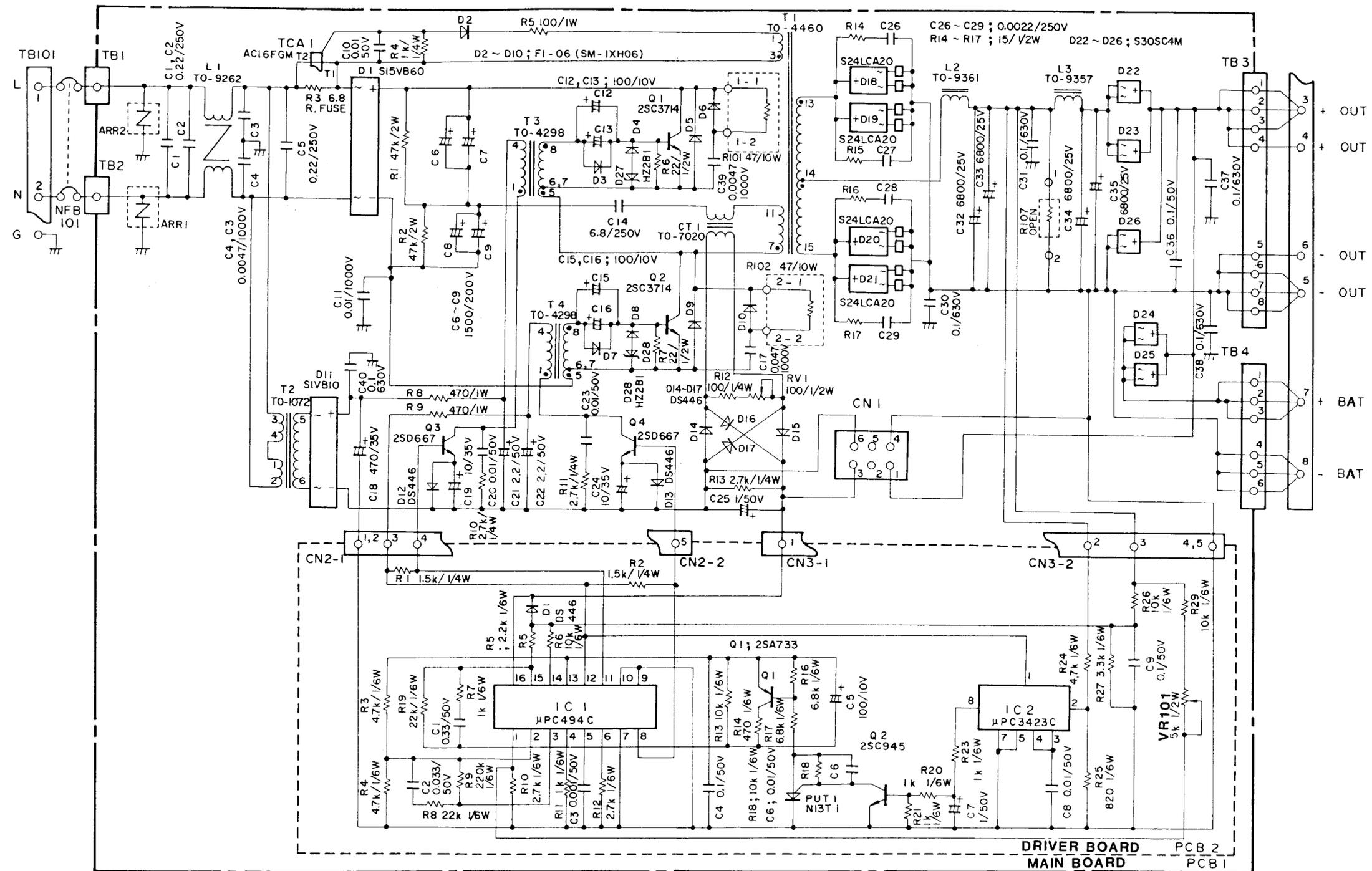
# 71-7200 POWER SUPPLY



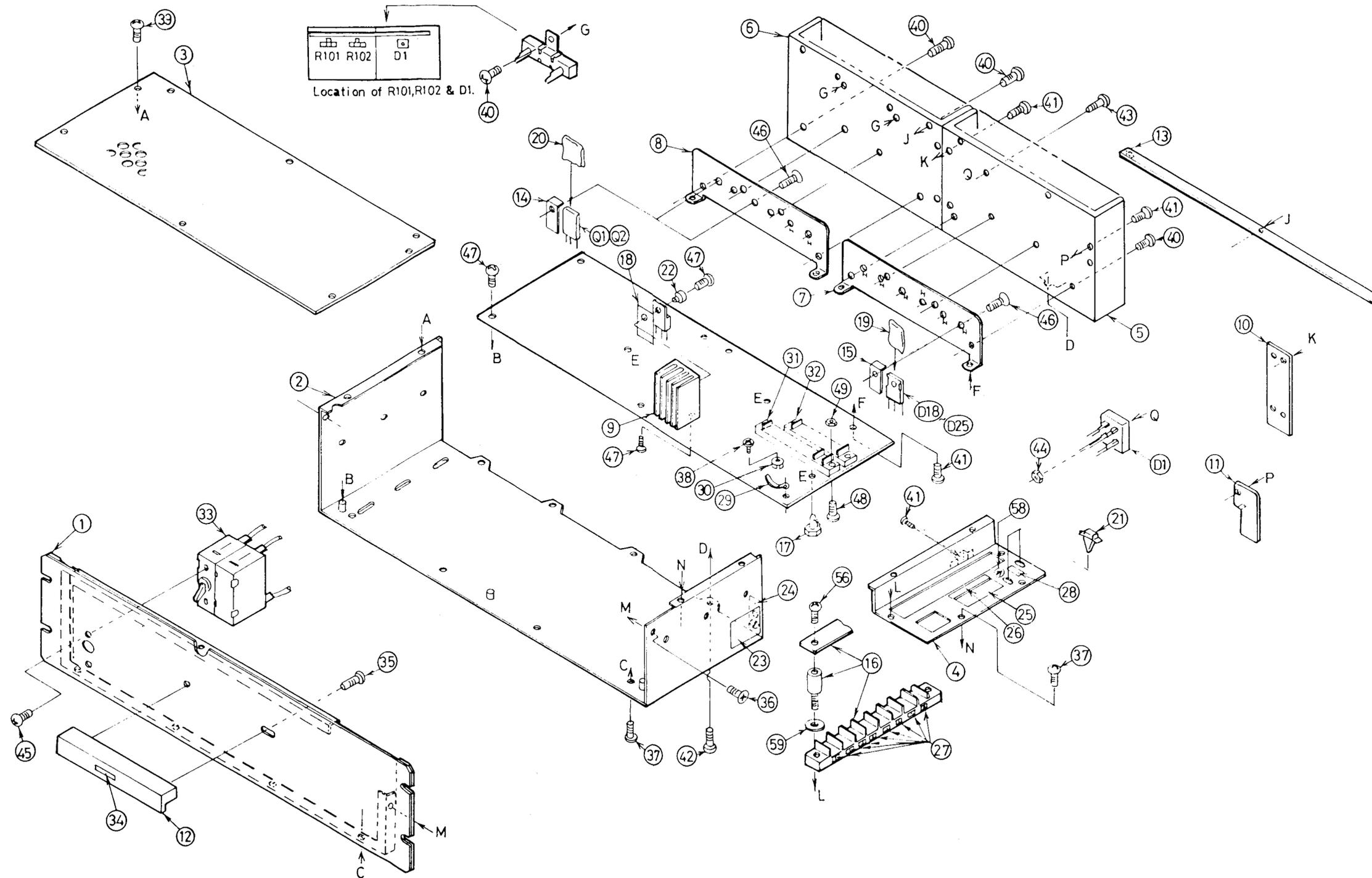
NOTES



# 71-7240 POWER SUPPLY



# 71-7200/7240 EXPLODED VIEW



## 71-7200/7240 MECHANICAL PARTS

REF. NO.	DESCRIPTION	PART NO.
1	Panel	70-010182
2	Chassis	70-010183
3	Cover	70-010184
4	Cover	70-010185
5	Heat Sink	70-089299
6	Heat Sink	70-089300
7	Heat Sink	70-089301
8	Heat Sink	70-089302
9	Heat Sink	70-089303
10	Heat Sink	70-089304
11	Cover	70-010186
12	Handle	70-011065
13	Bracket	70-158247
14	Clamp	70-158248
15	Clamp	70-158249
16	Terminal, TB101	70-157416
17	Spacer	70-157264
18	Insulator	70-157265
19	Insulator	70-157266
20	Insulator	70-157267
21	Clamp	70-158250
22	Bushing	70-157268
23	Label 71-7200	70-020186
23	Label 71-7240	70-020187
24	Label Gnd.	70-020188
25	Label Terminal	70-020188
26	Label Terminal	70-020189
27	Label Terminal	70-020190
28	Label Vltg. 7200	70-020191
28	Label Vltg. 7240	70-020192
29	Clamp	70-158251
30	Terminal, TB 1	70-159413
31	Terminal, TB 3	70-159414
32	Terminal, TB4	70-159415
33	Breaker, NFB101	70-204061
34	Label	70-020194
35	Screw	70-151819
36	Screw	70-151820
37	Screw	70-151821
38	Screw	70-151822
39	Screw	70-151823
40	Screw	70-151824
41	Screw	70-151825
42	Screw	70-151826
43	Screw	70-151827
44	Nut	70-151828
45	Screw	70-151829
46	Screw	70-151830
47	Screw	70-151831
48	Screw	70-151832
49	Nut	70-151833
50	Screw	70-151834
56	Screw	70-151835
59	Washer	70-151836

## 71-7200/7240 ELECTRICAL PARTS

## MAIN BOARD

The following parts list is a composite listing for the 71-7200 and 71-7240 (A=71-7200, B=71-7240). For application of each individual part, refer to the respective designator, shown after its reference number.

REF.NO.	DESCRIPTION	PART NO.	REF.NO.	DESCRIPTION	PART NO.
<u>TRANSISTORS</u>			<u>CONNECTORS</u>		
Q1,2	2SC3714	70-080290	CN1	Meter Socket	70-159411
Q3,4	2SD667	70-080291	<u>PLASTIC CAPACITORS</u>		
<u>DIODES</u>			C1,2,5	.022uf, 250V	70-137072
D1A	S15 VB60	70-085242	C10	.01uf, 50V	70-137053
D1B	S15 VB40	70-085233	C14	6.8uf, 250V	70-137073
D2,3,4,			C26,27,		
5,6,7,			28,29,	2200Pf, 250V	70-137076
8,9,			C30,31,		
10	F1-06LFE	70-085234	37,38,		
D11	S1VB10	70-085235	40,41,		
D12,13,			42	.1uf, 680V	70-137074
14,15,			C36	.1uf, 50V	70-137075
16,17	DS446-FA3	70-085236	C20,23	1000uf, 50V	70-137048
D18,19,			<u>CERAMIC CAPACITORS</u>		
20,21	S24LCA20	70-085237	C3,4,		
D22,23,			17,39	4700Pf, 1000V	70-138247
24,25,			C11	103PVA1-KC	70-138248
26	S30SC4M	70-085238	<u>ELECTROLYTIC CAPACITORS</u>		
D27,28	HZ2B1-FA3	70-085239	C6,7,	1500uf, 200V	70-135159
<u>COILS &amp; TRANSFORMERS</u>			8,9		
L1	Coil TO-9262	70-090312	C12,13,		
L2	Coil To-9361	70-090313	15,16	100uf, 10V	70-135112
L3	Coil TO-9357	70-090314	C18	470uf, 35V	70-138226
CT1	Tnsf TO-7020	70-096005	C19,24	10uf, 35V	70-135160
T1	Tnsf TO-4460	70-096006	C21,22	2.2uf, 50V	70-135087
T2	Tnsf TO-1072	70-096007	C25	1 uf, 50V	70-135161
T3,4	Tnsf To-4298	70-096008	C32,33,		
<u>CONTROLS</u>			34,35	6800uf, 25V	70-135158
VR1	Level Adj., 100 Ohm	70-164087	<u>METAL RESISTORS</u>		
<u>ARRESTORS</u>			R1,2	47K, 2W	70-144178
ARR3A	AV-3P	70-085263	R5	100 Ohm, 1W	70-144179
ARR1,2B	AV-14	70-085241	R6,7	22 Ohm, 1/2W	70-144189
<u>RECTIFIERS</u>			R8,9	470 Ohm, 1W	70-144190
TAC1	AC16FGM	70-085232	R101, 102	47 Ohm, 10W	70-144191
			<u>CARBON RESISTORS</u>		
			R4	1K, 1/4W	70-147228
			R10,11, 13	2.7, 1/4W	70-140134
			R12	150, 1/4W	70-141126
			<u>FUSE RESISTORS</u>		
			R3A	5.6 Ohm	70-146104
			R3B	10 Ohm	70-146106
			R14,15, 16,17	15 Ohm 1/2 W	70-146105

## DRIVER BOARD

REF. NO.	DESCRIPTION	PART NO.
<u>INTEGRATED CIRCUITS</u>		
IC 1	UPC 494C	70-076458
IC2	UPC 3423C	70-076459
<u>TRANSISTORS</u>		
Q1	2SA 733	70-080187
Q2	2SC 945	70-080005
<u>DIODES</u>		
D1	DS446-AT	70-085243
<u>CONTROLS</u>		
VR1	Level Adj.5K	70-164088
<u>CONNECTORS</u>		
CN1,2	PCB Int.Cnct.	70-159412
<u>SCR</u>		
PUT 1	N13T1	70-085244
<u>PLASTIC CAPACITORS</u>		
C1	.33uf, 50V	70-137077
C4,9	.1uf, 50V	70-137078
C2	.033uf, 50V	70-137079
C3	1000Pf, 50V	70-137080
C6,8	.01uf, 50V	70-137053
<u>ELECTROLYTIC CAPACITORS</u>		
C5	100uf, 10V	70-135053
C7	1uf, 50V	70-135161
<u>CARBON RESISTORS</u>		
R1,2	1.5K, 1/4 W	70-147215
R3,4,24	4.7K, 1/6W	70-147216
R5	2.2K, 1/4W	70-147217
R6,13,18, 26,29	10K, 1/6W	70-147218
R8,19	22K, 1/6W	70-147219
R9	220K, 1/6W	70-147220
R10	2.7K, 1/6W	70-147221
R14	4700hm, 1/6W	70-147222
R16,17	6.8K, 1/6W	70-147223
R7,20,21, 23,28,11	1K, 1/6W	70-147224
R25	2200hm, 1/6W	70-147225
R27	3.3K, 1/6W	70-147226
R12	27K, 1/6W	70-147227

NOTES

## REPLACEMENT PARTS ORDERING

To speed delivery and avoid errors, always include the following information when ordering replacement parts:

1. Best identification of the parts.
  - A. part number, or
  - B. Model and Serial numbers of equipment in which the part is used, with
  - C. Part description, and
  - D. Schematic reference designator, and,
  - E. If necessary, return the old part as sample.
2. Specify quantity desired of each part.
3. Ship-to address (and billing address if different).

Mail or phone your order to:

MIDLAND USA  
1690 North Topping Avenue  
Kansas City, Missouri 64120  
(816) 241-8400



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TELEPHONE: (816) 241-8400 • FAX: (816) 920-1145