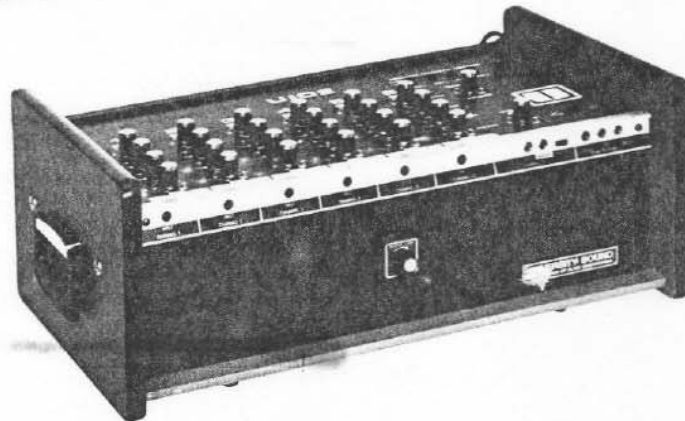
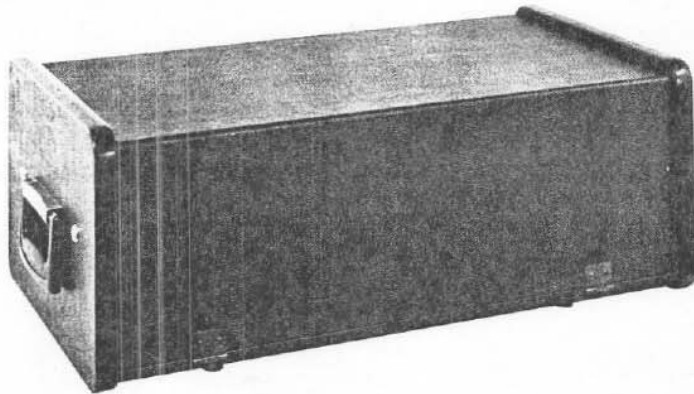


# UNIVERSITY<sup>®</sup> SOUND

## U102 PORTABLE CONTROL CONSOLE

### OPERATING INSTRUCTIONS



- **Seven Channels**      The University Sound U102 Portable Control Console mixes and controls up to seven independent input signals.
- **High Power**      Up to 100 watts of continuous power. Powered speakers may be connected singly or in arrays for sound systems that deliver several hundred watts of audio power from a single U102 source.
- **13 Microphone Inputs**      Seven high-impedance and six low-impedance balanced inputs may be used in any combination simultaneously. Inputs may also be used for phono, amplifier musical instruments, or other audio sources.
- **Reverberation System**      Either the internal reverberation system may be used or an external reverberation system may be switched in. Six channels have separate reverberation volume controls.
- **Acoustic Equalization**      Each channel may be monitored and separately adjusted before bringing up the total sound volume. Compensation for room acoustics in four frequency areas is provided by four acoustic feedback controls.
- **Portable and Easy to Set Up**      The U102, conveniently portable for the traveling professional entertainer, can be quickly and easily set up in minutes.

## DATA CONTENTS

Item	Page	Graphics	Page
<b>SPECIFICATIONS</b>	3	Figure 1. Top Panel Controls	4
<b>OPERATION</b>	7	Table I. Top Panel Control/Indicator Functions	4
CONTROLS AND INDICATORS	7	Figure 2. Front Panel Connections and Controls	5
<u>Setup Procedure</u>	7	Table II. Front Panel Connections and Control Functions	5
<u>Recommended Mixing Procedure</u>	9	Figure 3. Rear Panel Connections and Controls	6
<u>Setting Acoustic Feedback</u>	10	Table III. Rear Panel Connections and Control Functions	6
<u>Speaker Placement</u>	10	Figure 4. Cascading U102 Consoles	9
<b>SIGNAL FLOWS</b>	11	Figure 5. Signal Flow Diagram	12-13
INPUT CHANNELS	11	Table IV. Troubleshooting Guide	15
MAIN CHANNEL	11	Figure 6. Console Interior	16
AUXILIARY CHANNEL 7	11	Figure 7. Rear View, Rear Panel Removed	17
REVERB CIRCUIT	11	Figure 8. Underside of Console, Bottom Panel Removed	18
<b>SERVICE AND MAINTENANCE INSTRUCTIONS</b>	14	Figure 9. Typical Solid-State Component Configurations	19
ACCESS	16	Figure 10. Schematic (2D280-6), Main Chassis	20
<u>Console Interior</u>	16	Figure 11. Electronic Part Locations (3D038-2), Channel Preamp and Tone Control Amplifier PCB Assembly	21
<u>Rear Panel Removal</u>	16	Figure 12. Schematic (2D280-6), Channel Preamp and Tone Control Amplifier PCB Assembly	21
<u>Bottom Panel Removal</u>	16	Figure 13. Electronic Part Locations (3D041-2), Auxiliary Preamp and Master Summing Amplifier PCB Assembly	22
PILOT LAMP REPLACEMENT	16	Figure 14. Schematic (2D280-6), Auxiliary Preamp and Master Summing Amplifier PCB Assembly	22
PRINTED CIRCUIT BOARD (PCB) REPLACEMENT	16	Figure 15. Electronic Part Locations (3D040-1), Reverb Preamp and Driver Summing Amplifier PCB Assembly	23
<u>Channel Preamp and Tone Control Amplifier PCB Assembly</u>	16	Figure 16. Schematic (2D280-6), Reverb Preamp and Driver Summing Amplifier PCB Assembly	23
<u>Auxiliary Preamp and Driver Summing Amplifier PCB Assembly</u>	16	Figure 17. Electronic Part Locations (3D604-1), Driver Amplifier PCB Assembly	24
<u>Reverb Preamp and Driver Summing Amplifier PCB Assembly</u>	16	Figure 18. Schematic (2D280-6), Driver Amplifier PCB Assembly	24
<u>Driver Amplifier PCB Assembly</u>	16	Figure 19. Electronic Part Locations (3D025-2), Fanning Strip PCB Assembly	25
<u>Fanning Strip PCB Assembly</u>	16	Figure 20. Schematic (3D027-3), Fanning Strip PCB Assembly	25
POWER TRANSISTOR REPLACEMENT	18		
RECOMMENDED SERVICE TECHNIQUES	18		
<u>Transistor Orientation</u>	18		
<u>Testing Transistors</u>	18		
<u>Replacing PCB Components</u>	18		
<u>Repairing Fractured or Damaged PCB Conductor</u>	18		
<b>PARTS LIST</b>	26		
MAIN CHASSIS	26		
CHANNEL PREAMPLIFIER AND TONE CONTROL AMPLIFIER PCB ASSEMBLY	27		
AUXILIARY PREAMPLIFIER AND MASTER SUMMING AMPLIFIER PCB ASSEMBLY	28		
REVERB PREAMPLIFIER AND DRIVER SUMMING AMPLIFIER PCB ASSEMBLY	29		
DRIVER AMPLIFIER PCB ASSEMBLY	30		
FANNING STRIP PCB ASSEMBLY	31		

Auxiliary Channel 7:	103 dB power gain with MIC-TAPE switch in MIC position  90 dB power gain with MIC-TAPE switch in TAPE position
Input Sensitivity - Input Channels 1-6:	18 mV rms for 100 watts output with MIC-TAPE switch in MIC position  1.5 mV rms for 100 watts output with low-impedance connectors
Auxiliary Channel 7:	18 mV rms for 100 watts output with MIC TAPE switch in MIC position  70 mV rms for 100 watts output with MIC-TAPE switch in TAPE position
Frequency Response:	20 Hz to 20,000 Hz $\pm 2$ dB (high-impedance input)
Power Output:	100 watts with typically less than 1% THD
Source Impedance:	20,000 ohms nominal for high-impedance input  150/250 ohms for low-impedance input
Load Impedance:	4 ohms minimum
Output Impedance:	Less than 10% of nominal load impedance
Noise Level:	Equivalent input noise, -120 dBm  Output noise, 80 dB below full output with MASTER VOLUME control closed
Powered Speaker Output:	500 mV rms for full power output into 1000 ohms minimum for each output jack
Monitor Output:	0 dBm nominal into 600 ohms
Equalizer Input/Output Operating Levels:	0.5V rms nominal (10,000-ohm nominal impedance level)
External Reverb/Echo - Output:	200 mV rms nominal, source impedance less than 100 ohms
Input:	200 mV rms nominal, input impedance 10,000 ohms nominal

	TRUL 1 INTERNAL REVERB/EXTERNAL ECHO switch 4 ACOUSTIC FEEDBACK CONTROL switches 1 MIC-TAPE switch 1 LINE GND SWITCH 1 POWER-OFF switch 1 PUSH TO RESET pushbutton 1 REVERB LOCK control 1 POWER AMPLIFIER GAIN control (on power amplifier module - screwdriver adjust)
Indicators:	1 red power-on lamp 1 LINE GND INDICATOR lamp
Connections:	6 CHANNEL INPUT jacks for high impedance (on front panel) 6 CHANNEL INPUT XLR-3 type connectors for low-impedance (on rear panel), transformer-coupled to high-impedance jacks on front panel 1 CHANNEL 7 INPUT jack 1 AUX OUT jack 1 TO ECHO jack 1 FROM ECHO jack 1 FOOT SWITCH jack 2 SPEAKERS jacks 2 OUTPUT TO POWERED SPEAKERS jacks 2 250 WATTS, 120V external receptacles
Power Requirements:	120V ac, 50/60 Hz - 36 watts at zero signal 120 watts at 1/3 output 200 watts at full output
Dimensions:	24-1/4"W x 9-1/4"H x 15"D
Weight:	42.5 pounds
Enclosure:	Luggage style with blue Lavant vinyl covering and heavy vinyl edge bumpers

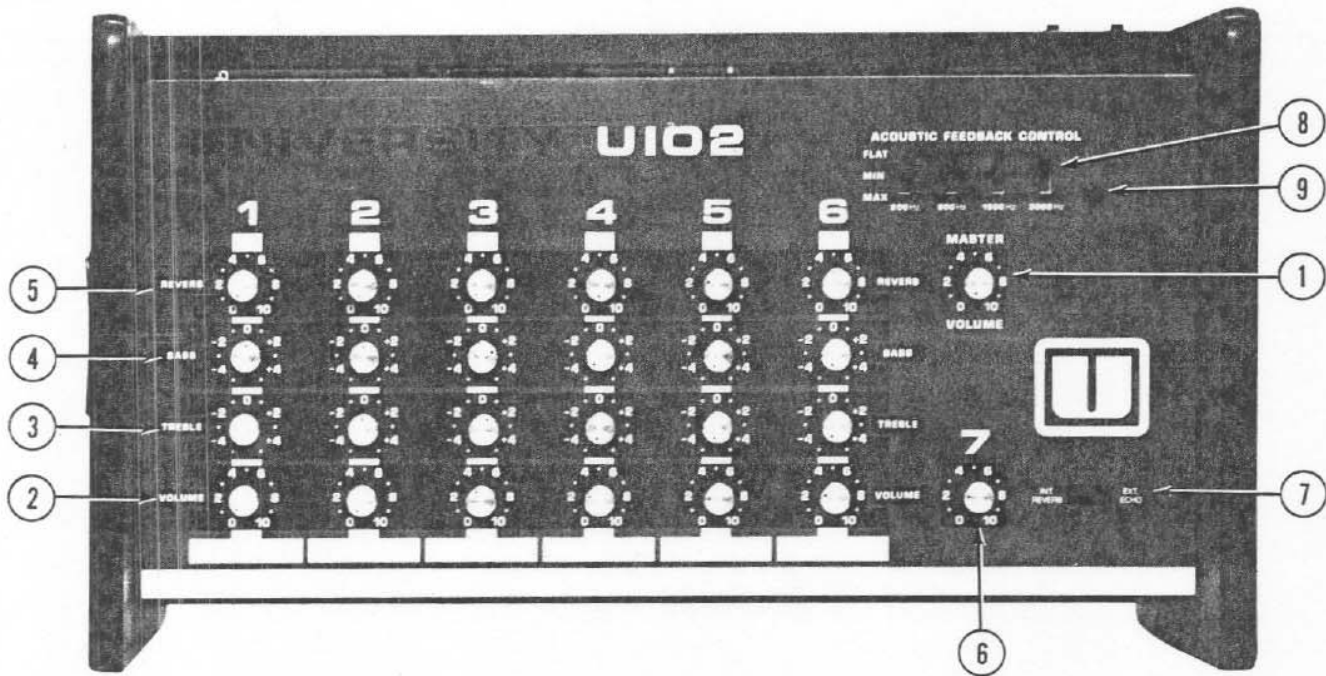


Figure 1. Top Panel Controls

Table I. Top Panel Control/Indicator Functions

Item	Name	Function
1	MASTER VOLUME control	Adjusts gain of all channels simultaneously. Rotate clockwise (cw) to increase gain.
2	CHANNEL 1 - 6 VOLUME CONTROLS	Adjust gain of corresponding input channel. Rotate cw to increase gain.
3	CHANNEL 1 - 6 TREBLE controls	Adjust high-frequency (HF) tones on corresponding input channel $\pm 10$ dB at 10 kHz. Rotate cw to increase HF response.
4	CHANNEL 1 - 6 BASS controls	Adjust low-frequency (LF) tones on corresponding input channel $\pm 10$ dB at 100 Hz. Rotate cw to increase LF response.
5	CHANNEL 1 - 6 REVERB VOLUME controls	Adjust gain of internal reverb or external echo on corresponding input channel. Rotate cw to increase gain.
6	CHANNEL 7 VOLUME control	Adjusts gain of auxiliary input channel. Rotate cw to increase gain.
7	INTERNAL REVERB/EXTERNAL ECHO switch	Selects internal reverb or external echo. External echo sources may be other reverb units or tape echo devices.
8	ACOUSTIC FEEDBACK CONTROLS	Provide compensation for room acoustics to improve tone quality and increase total gain before feedback. Three switch positions for each of four separate frequencies; 200 Hz, 600 Hz, 1500 Hz and 3000 Hz.
		FLAT switch position provides no acoustic compensation for the selected frequency.
		MIN switch position provides -3 dB acoustic compensation for the selected frequency.
		MAX switch position provides -6 dB acoustic compensation for the selected frequency.
9	Power Indicator	Red pilot lamp is illuminated when power is on.

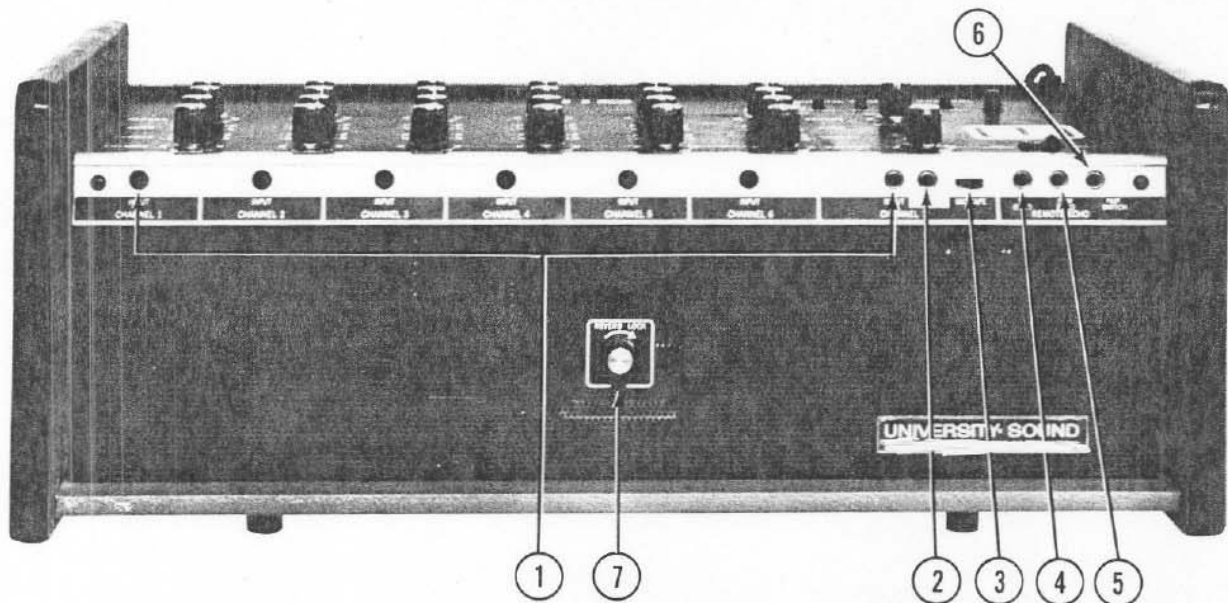


Figure 2. Front Panel Connections and Controls

Table II. Front Panel Connections and Control Functions

Item	Name	Connection/Function
1	CHANNEL 1 - 7 high-impedance INPUT jacks	Accept cable from high-impedance microphones or other devices.
2	AUX OUT jack	Permits monitoring each channel while setting desired CHANNEL VOLUME CONTROL. Not influenced by MASTER VOLUME control. May be used with headphones having not less than 500 ohms impedance, or for monaural recording. Also may be used to connect two U102 consoles in a multiple sound system.
3	MIC-TAPE switch	Selects proper gain for CHANNEL 7 INPUT when microphone (high gain), tape recorder or additional mixer (low gain) is used.
4	TO ECHO jack	Applies output of combined signals from all channels to external echo devices.
5	FROM ECHO jack	Applies output of external echo device to input of U102 console. Echo volume is adjusted by REVERB VOLUME controls (see Table I).
6	FOOT SWITCH jack	Accepts cable from a foot switch. Operating foot switch mutes all reverb sound.
7	REVERB LOCK	Locks internal reverb unit to prevent damage to internal reverb spring when traveling with console. Rotate cw to lock.

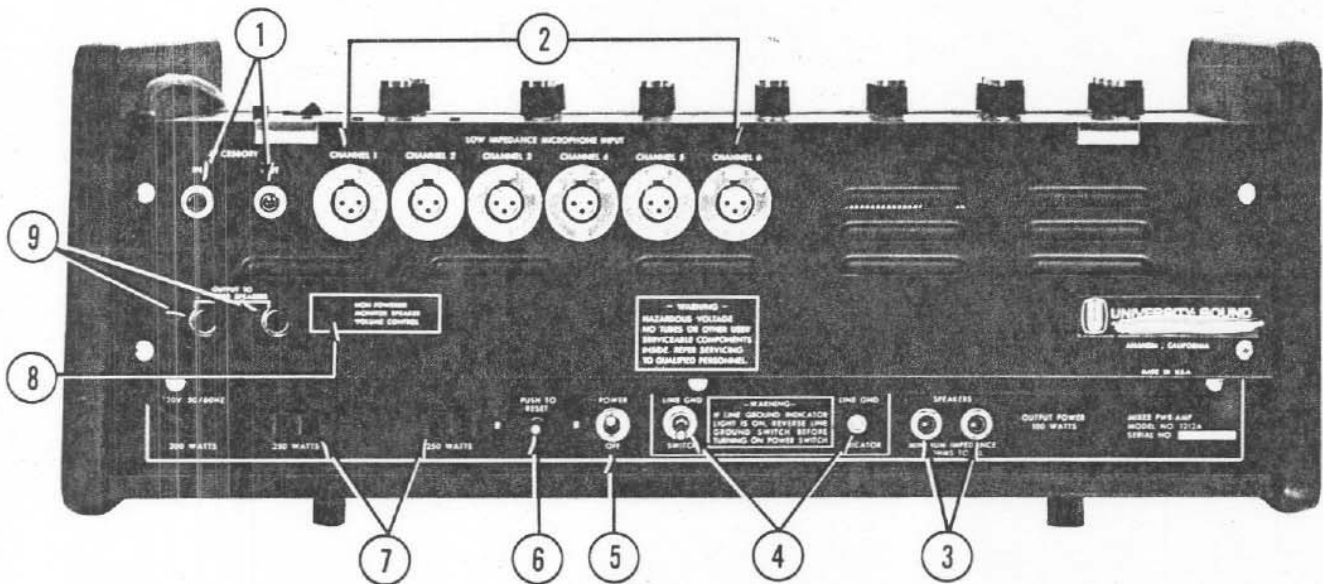


Figure 3. Rear Panel Connections and Controls

Table III. Rear Panel Connections and Control Functions

Item	Name	Connection/Function
1	ACCESSORY IN-OUT jacks	Accept input and output cables of accessories such as equalizers or filters to 'shape' effects of output sound. Provide input and output capability between preamplifier and power amplifier of U102.
2	LOW-IMPEDANCE MICROPHONE INPUT connectors (CHANNELS 1 - 6)	Accept cables from low-impedance (150/250 ohms) microphones or other devices. Six transformer-isolated, balanced-input channels with XLR-3-31 receptacles.
3	SPEAKERS jacks	Accommodate speakers having total impedance not less than 4 ohms. Provide maximum output of 100 watts continuous music power.
4	LINE GND SWITCH and LINE GND INDICATOR	Eliminate any possibility of electrical shock. Proper LINE GND SWITCH position extinguishes LINE GND INDICATOR after connecting power cord. POWER-OFF switch should be left in OFF position until LINE GND INDICATOR is extinguished.
5	POWER-OFF switch	Applies 120V ac, 50/60 Hz line power to U102 console when in POWER position. Disconnects line power when in OFF position.
6	PUSH TO RESET pushbutton	Resets overload-protection circuit breaker. If circuit breaker opens repeatedly, find and correct cause before resetting.
7	250 WATTS receptacles	Provide 120V ac, 50/60 Hz line power for auxiliary equipment such as turntables, tape recorders, etc. POWER-OFF switch need not be in POWER position to use these receptacles.
8	MONITOR SPEAKER VOLUME CONTROL	Adjusts gain applied to output at SPEAKERS jacks when nonpowered speakers are used. Screwdriver adjustment. Rotate cw to increase gain. This control operates only when OUTPUT TO POWERED SPEAKERS jacks are in use.
9	OUTPUT TO POWERED SPEAKERS jacks	Accommodate powered speakers or external power amplifiers having total impedance not less than 1000 ohms. Maximum output is 500 mV rms at each jack.

## OPERATION

### CONTROLS AND INDICATORS

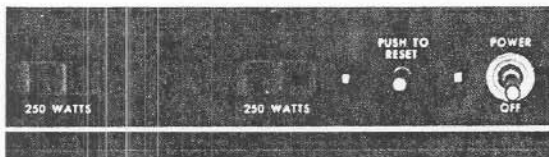
Operating controls most frequently used are located on the top panel as shown in Figure 1. Input jacks and the REVERB LOCK are located on the front panel as shown in Figure 2. Other controls and output jacks are located on the rear panel as shown in Figure 3. Details of control/indicator functions and connections are given in Tables I, II and III, respectively.

#### Setup Procedure

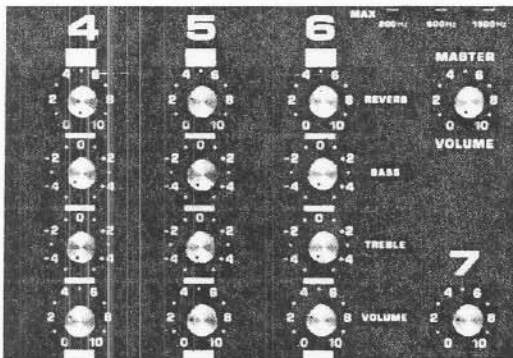
After microphone positions and speaker locations are determined, set the console on a convenient table or stand and use the following procedure to make connections and set controls.

Step 1. Set controls and switches to the following positions.

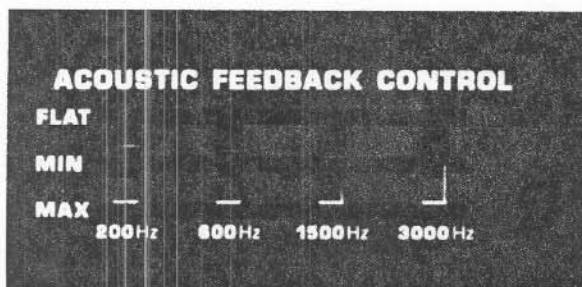
- a. POWER-OFF switch to OFF.



- b. MASTER VOLUME control to 5.
- c. All CHANNEL VOLUME CONTROLS to 0.

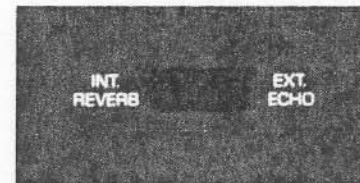


- d. All BASS and TREBLE controls to 0.
- e. All REVERB VOLUME controls to 0.
- f. All ACOUSTIC FEEDBACK CONTROLS to FLAT.

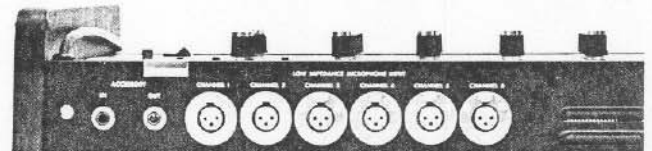


#### NOTE

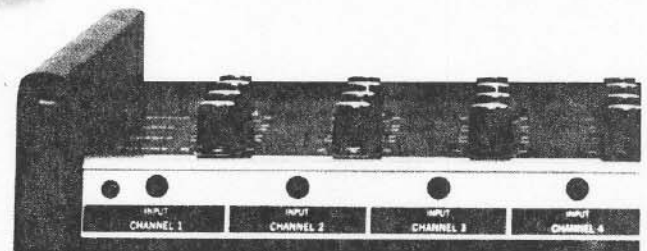
If the internal reverb is to be used, set INTERNAL REVERB/EXTERNAL ECHO switch to INTERNAL REVERB position and turn REVERB LOCK fully counter-clockwise (ccw) to release reverb device. If not using internal reverb or if external echo devices are to be used, set INTERNAL REVERB/EXTERNAL ECHO switch to EXTERNAL ECHO position. (When traveling with U102, be sure the REVERB LOCK is turned fully cw to prevent damage to internal reverb spring.)



Step 2. Plug low-impedance (150/250 ohms) devices into the low-impedance input receptacles on the rear panel.



Step 3. Plug high-impedance devices (microphone, musical instruments, etc.) into CHANNEL INPUT jacks on front panel.

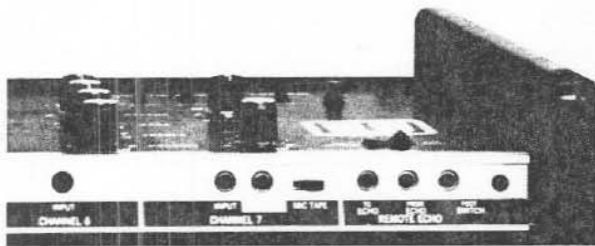


Both the front and rear (high-impedance and low-impedance) inputs may be used simultaneously when operation with two microphones in the same channel is desired. A microphone plugged into the rear panel channel input receptacle for CHANNEL 1, and a microphone plugged into the front panel jack for CHANNEL 1, use the same channel controls. The VOLUME CONTROL of CHANNEL 1 adjusts the gain of both microphones equally and simultaneously. This also applies for the BASS, TREBLE and REVERB VOLUME controls.

NOTE

When two microphones are used in the same channel, any high-impedance microphone with an on-off switch turns off both microphones in the channel when the microphone switch is in the 'off' position.

- Step 4. If it is desired to 'shape' the effects of the output sound with a filter device, plug the input cable of the device into the ACCESSORY OUT jack on the back of the U102. Plug the output cable of the device into the ACCESSORY IN jack of the U102.
- Step 5. If auxiliary CHANNEL 7 INPUT is used; set MIC-TAPE switch to MIC position for microphone or musical instrument use, or set MIC-TAPE switch to TAPE position for tape recorder use.



- Step 6. If an external echo device is used, plug its input cable into TO ECHO jack on U102 front panel and plug its output cable into FROM ECHO jack on U102 front panel.
- Step 7. If a foot switch is used, plug it into FOOT SWITCH jack on U102 front panel.
- Step 8. Plug unpowered or monitor speakers into SPEAKERS jack on U102 rear panel. Total speaker impedance must be not less than 4 ohms for maximum output of 100 watts.



NOTE

A speaker load of 2 ohms or less may cause distortion in reproduction of high-level program material because of clipping action of Active Dissipation Sensing Circuit.

When both SPEAKERS jacks are used with an 8-ohm load plugged into each, they are electrically paralleled for a total impedance of 4 ohms and the amplifier operates at full 100-watt efficiency.

If total speaker impedance is more than 4 ohms, the amplifier operates at less efficiency and less power output.

- Step 9. Plug powered speaker(s) into OUTPUT TO POWERED SPEAKERS jacks on rear panel. Output is nominally 500 mV rms into 1000 ohms for each output and delivers a maximum of 2 volts.



CAUTION

Be sure that POWER-OFF switch is in OFF position to prevent possible speaker damage. Also, turn powered speakers 'off'.

- Step 10. Separate power amplifiers may be connected to the U102 as an option. Any power amplifier requiring an input from 1/2 volt (500 mV) to 5 volts may be plugged into either OUTPUT TO POWERED SPEAKERS jack. If the powered speaker amplifier is equipped with a volume control, it may be connected to the AUX OUT jack on the front panel of the U102; this jack bypasses the MASTER VOLUME control and ACOUSTIC FEEDBACK CONTROL switches. The volume control on the powered speaker amplifier may then be used as the master volume control.



- Step 11. If more than seven input channels are needed, two or more U102 consoles may be cascaded (connected in series). Two cascaded consoles provide 13 input channels, three provide 19 input channels, etc.

Connect shielded cable from AUX OUT jack of first U102 to CHANNEL 7 INPUT jack on second U102. Set MIC-TAPE switch to TAPE position. CHANNEL 7 VOLUME CONTROL of second U102 is then sub-master control of first U102. Both U102 consoles operate normally, EXCEPT THE MASTER VOLUME CONTROL OF THE SECOND U102 COMPLETELY CONTROLS BOTH U102 CONSOLES. Any number of additional U102 consoles may be connected in this manner for an unlimited number of input channels with only one final MASTER VOLUME control for all U102 consoles (see Figure 4).



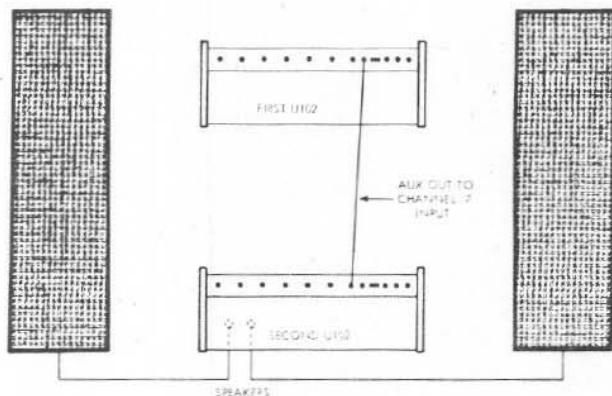
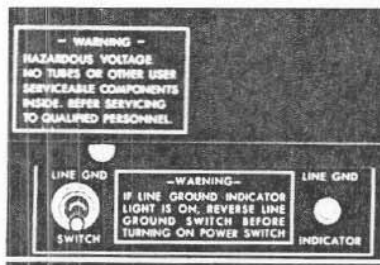


Figure 4. Cascading U102 Consoles

- Step 12. Plug power cord of U102 into 120V ac, 50/60 Hz outlet.
- Step 13. Check LINE GND INDICATOR on rear panel of U102. If orange lamp is lit, change position of LINE GND SWITCH to extinguish indicator.



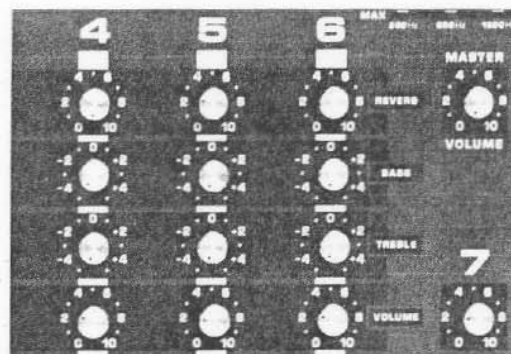
**WARNING**  
 LINE GND INDICATOR must be extinguished to eliminate the potential hazard of electrical shock. This feature is provided specifically to protect personnel from electrical shock caused by improper grounding of line power.

- Step 14. Set POWER-OFF switch to POWER position. Red power indicator lamp on top panel should illuminate.
- Step 15. If it is desired to monitor the mixing procedure with headphones, plug a headphone set into the AUX OUT jack on the U102 front panel. Minimum acceptable impedance of the headphones is 500 ohms.
- Step 16. Proceed with the recommended mixing procedure.

#### Recommended Mixing Procedure

The following recommended mixing procedure is typical for all channels except auxiliary CHANNEL 7 INPUT. For CHANNEL 7 INPUT, use Step 1 only.

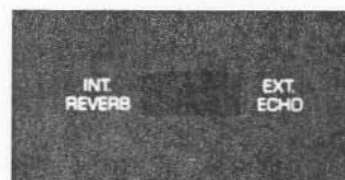
- Step 1. Set MASTER VOLUME control at minimum of 6 to obtain distortion-free blend of sound on all channels.



- Step 2. Adjust VOLUME CONTROL of selected channel while talking or singing into microphone until desired volume is obtained. If onstage speakers (connected to SPEAKERS jacks) are used for monitoring, MONITOR SPEAKER VOLUME CONTROL on rear panel usually requires adjustment. This adjustment is needed because feedback occurs readily when monitor speakers are very close to onstage microphones.



- Step 3. Increase bass or treble response as desired by turning BASS control or TREBLE control cw into the (+) area. From '0' or flat setting, this provides a maximum of +6 dB at 100 Hz for bass and a maximum of +6 dB at 10 kHz for treble. Turn the controls ccw into the (-) area to decrease bass or treble; this provides a maximum of -6 dB from the '0' or flat setting.
- Step 4. If internal reverb is used, adjust REVERB VOLUME control for desired effect. Be sure INTERNAL REVERB/EXTERNAL ECHO switch is at INTERNAL REVERB position.



If external echo devices are used, adjust REVERB VOLUME control for desired effect with INTERNAL REVERB/EXTERNAL ECHO switch at EXTERNAL ECHO position.

NOTE

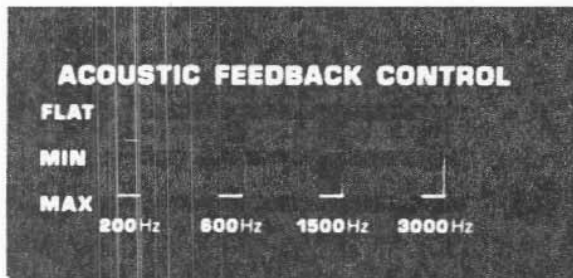
Internal reverb or external echo may be shut off by setting INTERNAL REVERB/EXTERNAL ECHO switch to opposite position; i.e., to EXTERNAL ECHO position when using internal reverb.

- Step 5. Repeat Steps 1 through 4 for each of the other input channels to be used. Previously adjusted channels may be unplugged from CHANNEL INPUT jacks while adjusting subsequent channels. As additional channels are used in the U102, feedback may increase. To overcome this problem, slightly decrease volume of other contributing channels. The number of open microphones (turned up to maximum) should be kept to a minimum because many open microphones add unwanted feedback.
- Step 6. Verify that all CHANNEL INPUT jacks are plugged in after setting volume levels for all channels used.
- Step 7. Adjust MASTER VOLUME control for desired sound level. If feedback occurs, refer to Setting Acoustic Feedback to complete adjustments.

Setting Acoustic Feedback

The ACOUSTIC FEEDBACK CONTROL switches change the amplifier frequency response to compensate for room acoustics. In large reverberant rooms, such as gymnasiums, the bass must be decreased to avoid a 'boomy' or 'muddy' sound. In very 'dead' rooms, such as nightclubs or lounges, acoustical effects of carpets, drapes and crowds of people require additional power from the amplifier and generally an increase in bass and treble.

After individual microphone levels are set, position ACOUSTIC FEEDBACK CONTROL switches. Begin by slowly turning up the MASTER VOLUME control until feedback is just noticeable. Listen closely to the pitch of the feedback. If the pitch is low, set the 200 Hz or 600 Hz switch from FLAT to MIN. If the pitch is higher, try the 1500 Hz or 3000 Hz switch.



EXAMPLE

Assume the 1500 Hz switch eliminates feedback when set to the MIN position. If no ringing is heard, do not set the switch to the MAX position. Once again, slowly turn up the MASTER VOLUME control until feedback is just noticeable. If the pitch is higher than the previous feedback, try the 3000 Hz switch in the MIN position. If the pitch of the feedback is lower than the previous feedback, try the 200 Hz or 600 Hz switch in the MIN position. If the pitch is exactly as before, set the 1500 Hz switch to the MAX position.

Be conservative in using the ACOUSTIC FEEDBACK CONTROL switches. In most cases, no more than two switches should be in the MAX position. When used properly, these switches can be extremely helpful in raising potential gain before feedback. In low-level systems, where feedback is no problem, these switches can be used in much the same way as program equalizers, giving various alterations to the frequency response.

NOTE

When using a sound system outdoors, remember that speakers may be driven very hard to distortion before producing feedback because no reflecting surfaces are close by. The best solution to this problem is adding speakers and power amplifiers. The outdoors 'soaks up' sound very quickly (especially bass) and the ACOUSTIC FEEDBACK CONTROL switches should be used only for tone variation.

Speaker Placement

Proper speaker placement is essential for uniform distribution of sound, to minimize echoes and reverberation and, most of all, to minimize feedback.

To provide uniformity of sound distribution over the entire listening area, place the speakers on the stage or close to the stage, as far forward of the microphones as possible. Never set the speakers too far apart as this may create 'dead spots' in the listening area. Whenever possible, place the speakers on sturdy tables, scaffolding or stands. This allows the sound to be projected over the heads of the people in the audience instead of being quickly absorbed. Proper placement and directional orientation of the speakers will achieve the goal of uniform sound distribution with minimum adverse effects and will provide the illusion that sound from the speakers emanates from the real source.

## SIGNAL FLOWS

Knowledge of signal flows through the U102 Console will enable the operator to use the console with greater effectiveness. These signal flows are described in the following paragraphs in conjunction with the signal flow diagram of Figure 5.

### INPUT CHANNELS

Channels 1 through 6 receive microphone inputs via high-impedance INPUT CHANNEL jacks on the front panel and/or low-impedance INPUT CHANNEL CONNECTORS (XLR-3-type) on the rear panel. These low- and high-impedance inputs are transformer coupled. Each of the six channels have controls to adjust volume, bass response, treble response, and reverb-send level. The six channels combine at the summing amplifier and enter onto the main channel.

### MAIN CHANNEL

The six input channels and the reverb signal are combined into the main channel at the summing amplifier. Following the summing amplifier is the auxiliary output (AUX OUT) of the combined signal. A MASTER VOLUME control is provided to adjust the level of the combined channels (channels 1 through 6). Following the MASTER VOLUME control is the point on the main channel where an accessory, such as an equalizer, may be connected in series with the signal flow.

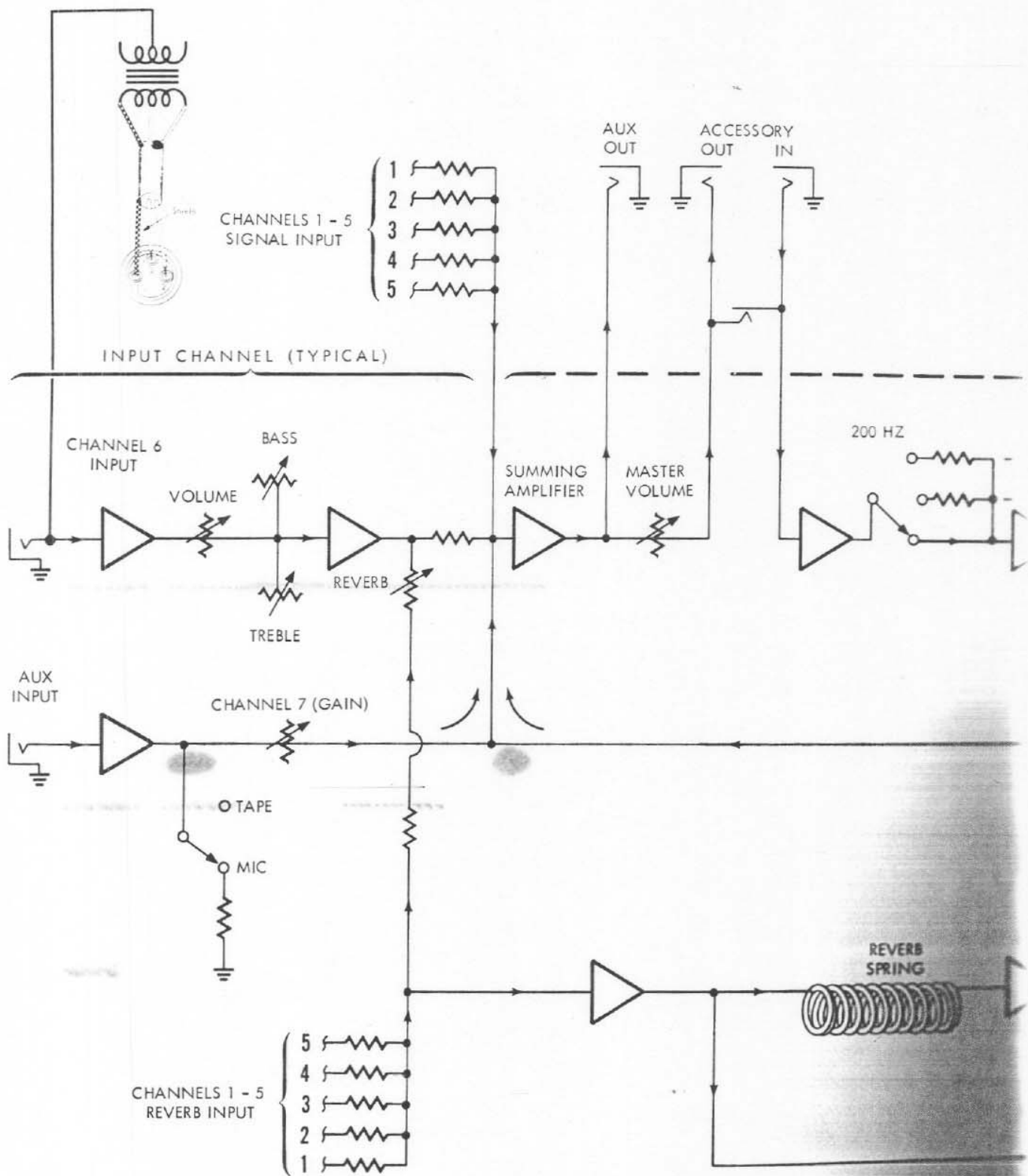
Control of acoustic feedback is provided by the series of switchable filters for frequencies of 200 Hz, 600 Hz, 1500 Hz and 3000 Hz. The switches should normally be positioned at FLAT for maximum signal. Following the feedback controls are two types of speaker outputs. An output to powered speakers is provided from the main channel in conjunction with a volume (gain) control. Output to nonpowered speakers is provided from a power amplifier rated at 100 watts.

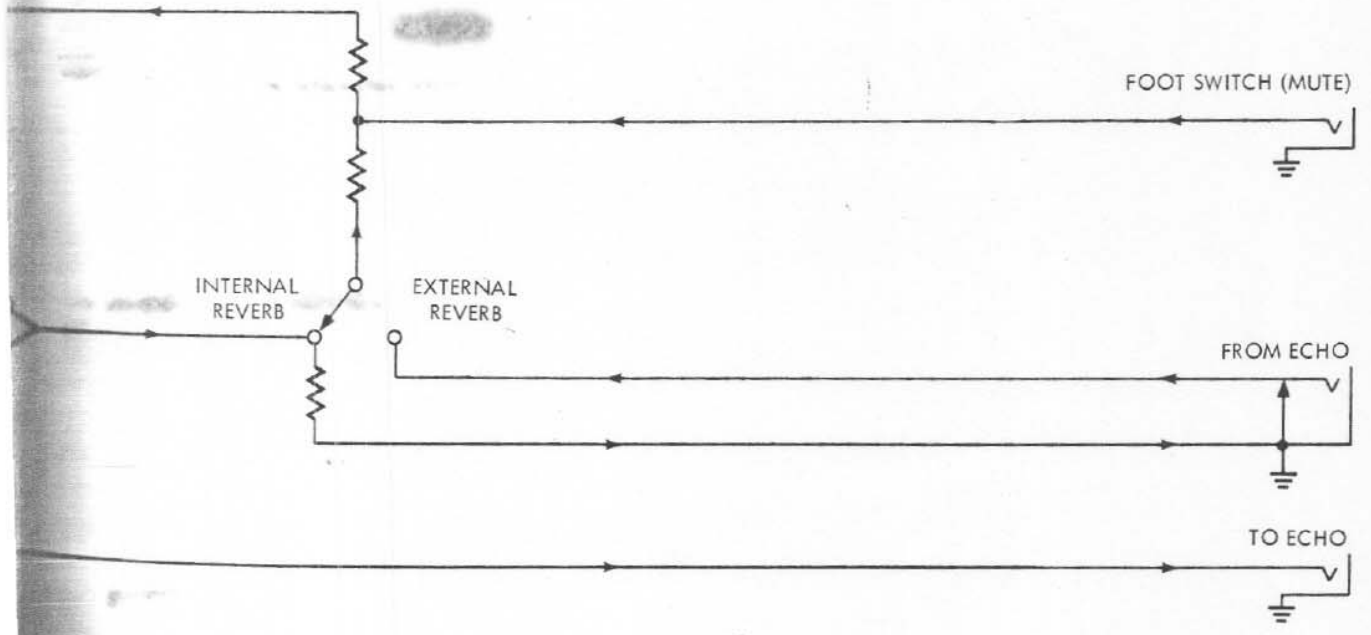
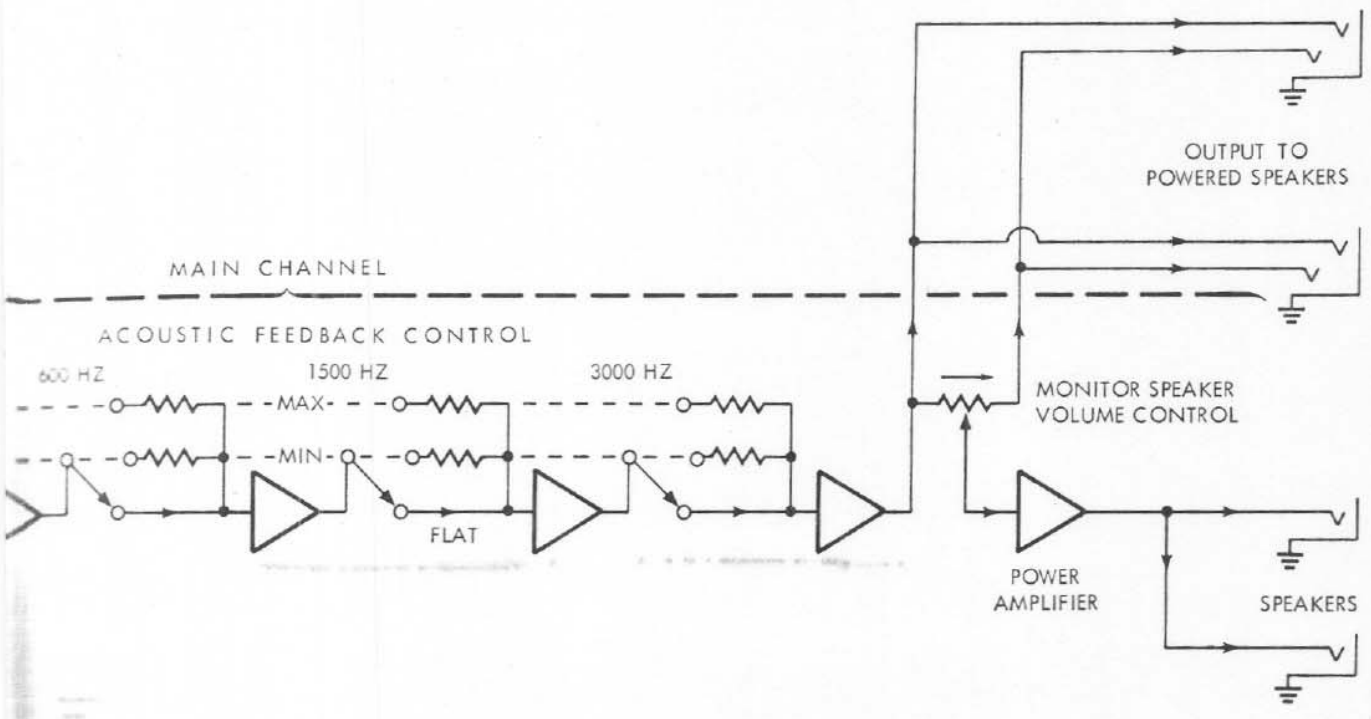
### AUXILIARY CHANNEL 7

An auxiliary input source with a nominal impedance of 600 ohms may be connected to the CHANNEL 7 INPUT jack. Signal level is adjusted with the CHANNEL 7 control. A switch selects high-impedance (microphone) or low-impedance (tape recorder or phonograph) sources. Channel 7 enters the main channel at the same point as input channels 1-6.

### REVERB CIRCUIT

A reverb unit is built into the U102 Console. An external reverb system may be used via the INTERNAL REVERB/EXTERNAL ECHO switch. This switch also may be used as a master on-off switch for the internal reverb unit. Each input channel (except channel 7) is applied to the reverb circuit at a level determined by the channel REVERB VOLUME control. A FOOT SWITCH jack is provided for muting the reverb signal. Closing this external switch short circuits the reverb-receive signal to ground.





Block Diagram

# **SERVICE AND MAINTENANCE INSTRUCTIONS**

This service information is for the use of authorized warranty stations (dealers) only. Service must be performed by UNIVERSITY SOUND Qualified Service Representatives.

## **NOTICE**

**REPAIR PERFORMED BY OTHER THAN AUTHORIZED WARRANTY STATIONS (DEALERS) OR OTHER QUALIFIED PERSONNEL SHALL VOID THE WARRANTY PERIOD OF THIS UNIT. TO AVOID LOSS OF WARRANTY, SEE YOUR NEAREST UNIVERSITY SOUND AUTHORIZED DEALER OR CALL UNIVERSITY SOUND CUSTOMER SERVICE DIRECTLY AT (714) 774-2900, OR WRITE:**

**Customer Service  
UNIVERSITY SOUND  
1515 South Manchester Avenue  
Anaheim, California 92803**

Table IV. Troubleshooting Guide

Symptom	Probable Cause	Corrective Action
Console inoperative, no pilot light.	1. No line power.	Check line power.
	2. Circuit breaker open.	Reset circuit breaker.
	3. Failed power transistor.	Check Q401, Q402, Q403, Q404. Replace failed transistor(s); reset circuit breaker.
One channel inoperative.	Defective Channel Preamplifier and Tone Control Amplifier PCB Assembly.	Replace or repair PCB.
Auxiliary channel inoperative.	Defective Auxiliary Preamplifier and Master Summing Amplifier PCB Assembly (preamplifier section).	Replace or repair PCB.
No output or very low output for all channels, pilot light lit.	Defective Auxiliary Preamplifier and Master Summing Amplifier PCB Assembly (master summing section) or defective Driver Amplifier PCB Assembly. Verify which PCB is defective.	Replace or repair Auxiliary Preamplifier and Master Summing Amplifier PCB if Test 1 indicates nonfunctioning.
	1. Apply reverb to one channel with REVERB VOLUME control fully cw. Alternately connect headphones (or speaker) to AUX OUT and TO ECHO jacks. Nearly equal output (TO ECHO output slightly lower) indicates Auxiliary Preamplifier and Master Summing Amplifier PCB Assembly is functional; weak or no output from AUX OUT jack indicates this PCB is defective.	
No output from SPEAKERS jacks, but output present at OUTPUT TO POWERED SPEAKERS jacks.	2. If Auxiliary Preamplifier and Master Summing Amplifier PCB Assembly is functional, Driver Amplifier PCB Assembly is defective.	Replace or repair defective Driver Amplifier PCB.
	1. MONITOR SPEAKER VOLUME CONTROL not properly adjusted.	Adjust control cw.
	2. Failed power transistor.	Check Q401, Q402, Q403, Q404. Replace failed transistor(s); reset circuit breaker.
Reverb inoperative.	3. Defective Driver Amplifier PCB Assembly.	Replace or repair PCB.
	1. REVERB LOCK turned cw, securing reverb unit.	Turn REVERB LOCK ccw.
	2. Defective Reverb Preamplifier and Driver Summing Amplifier PCB Assembly. Verify defective condition.	Replace or repair PCB.
	a. Monitor speaker output while alternately switching from INTERNAL REVERB to EXTERNAL ECHO with no external echo applied. An increase in noise level indicates PCB is operative; no increase in noise level indicates defective PCB.	
b. Connect headphones or power speaker to TO ECHO jack. Set INTERNAL REVERB/EXTERNAL ECHO switch to INTERNAL REVERB position and turn one channel REVERB VOLUME control fully cw. No output on headphones or power speaker indicates defective PCB.	Replace or repair PCB.	
3. Defective reverb unit. To verify, set INTERNAL REVERB/EXTERNAL ECHO switch to INTERNAL REVERB position and jar console. Speakers should produce loud, thunderous noise. No output indicates defective reverb unit.	Replace reverb unit and return defective reverb to factory.	

## ACCESS

### Console Interior

Remove two screws securing channel jack strip to front panel. Remove jack strip and raise top panel to gain access to chassis interior (see Figure 5).

### Rear Panel Removal

Remove four screws securing rear panel to console, then remove rear panel to expose power transistors at rear of console (see Figure 6).

### Bottom Panel Removal

Remove four polyethylene feet from console, noting orientation of washer and foot. Remove bottom panel to gain access to underside of console (see Figure 7).

## PILOT LAMP REPLACEMENT

Unscrew pilot lamp from top panel and replace with new lamp (see **PARTS LIST**).

## PRINTED CIRCUIT BOARD (PCB) REPLACEMENT

Open console to gain access to interior (see Figure 6), then remove appropriate PCB in accordance with the following applicable procedures. After PCB removal, install new or repaired PCB by reversing applicable removal procedure; then close top panel and install jack strip with two screws previously removed.

### Channel Preamp and Tone Control Amplifier PCB Assembly

Remove all control knobs from the selected PCB, then remove hardware securing these controls to the top panel. Remove nut securing selected PCB to Fanning Strip PCB Assembly. The selected PCB may then be removed.

### Auxiliary Preamp and Driver Summing Amplifier PCB Assembly

Use same procedure as for removal of Channel Preamp and Tone Control Amplifier PCB Assembly.

### Reverb Preamp and Driver Summing Amplifier PCB Assembly

Remove two plug connectors from PCB. Remove three nuts securing Reverb Preamp and Driver Summing Amplifier PCB Assembly to Fanning Strip PCB Assembly. The PCB may then be removed.

### Driver Amplifier PCB Assembly

Remove two screws securing PCB to console chassis, then remove PCB.

### Fanning Strip PCB Assembly

Remove all PCB's plugged into Fanning Strip PCB Assembly. Remove eight nuts and washers securing PCB to top panel. Fanning Strip PCB Assembly may then be removed.

**CAUTION**  
Do not warp, bend or twist the board or conductor may fracture.

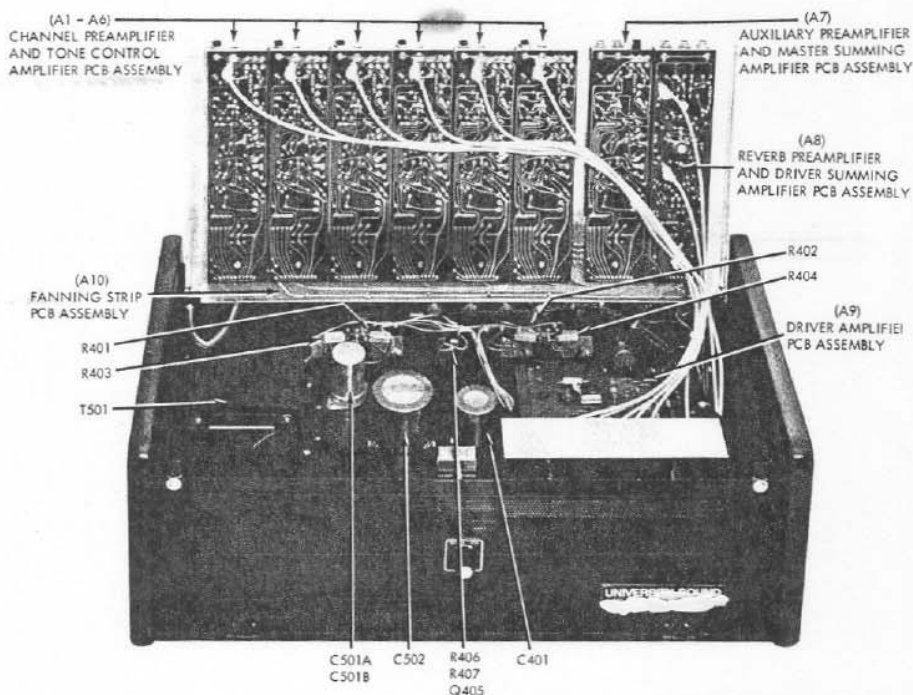


Figure 6. Console Interior



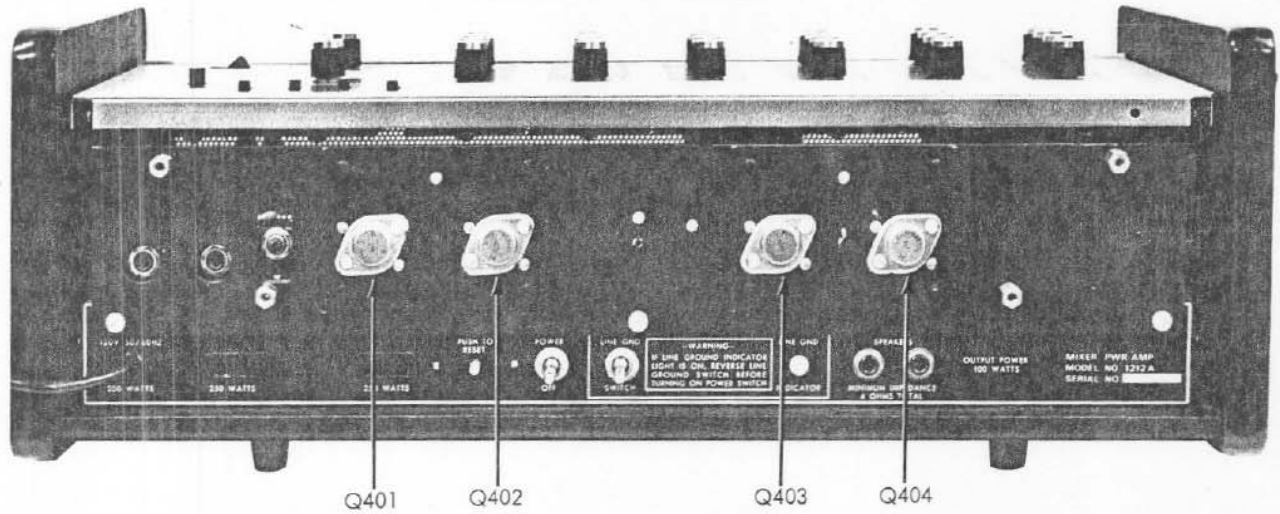


Figure 7. Rear View, Rear Panel Removed

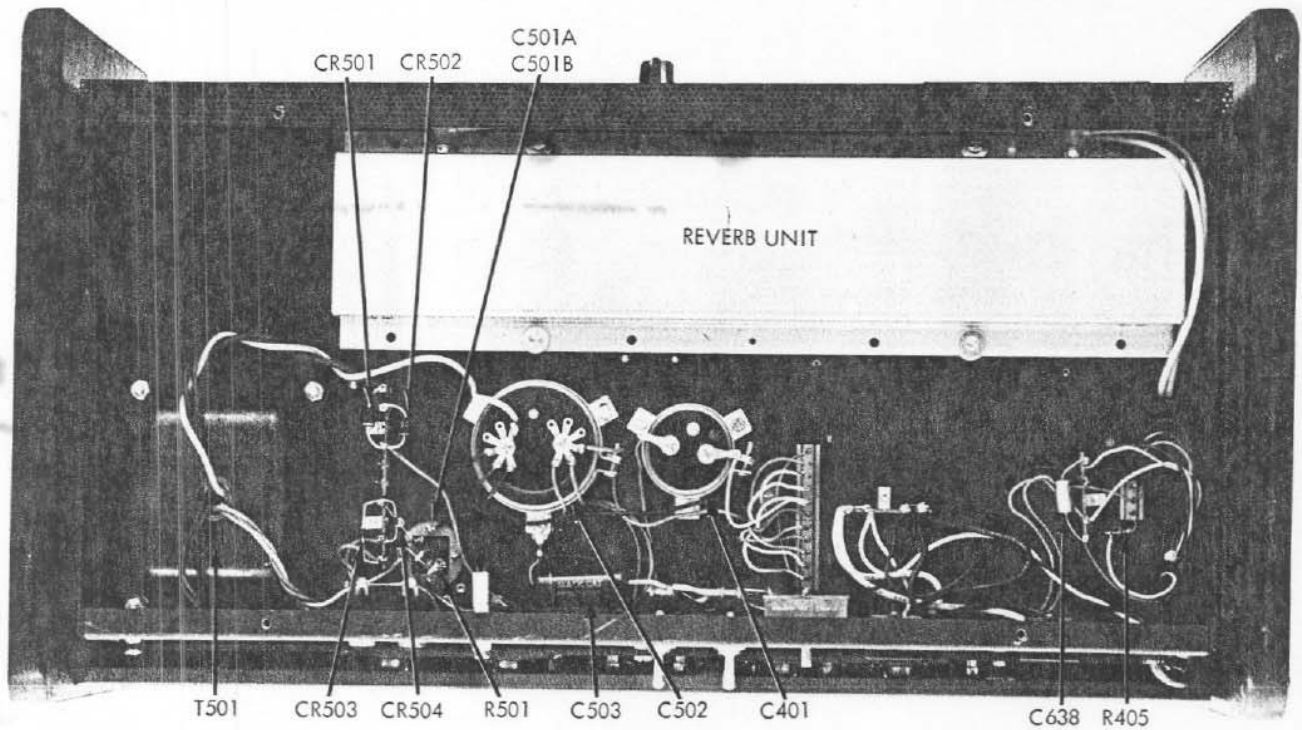


Figure 8. Underside of Console, Bottom Panel Removed

## POWER TRANSISTOR REPLACEMENT

- Step 1. Remove rear panel (see Figure 6).
- Step 2. Remove two screws securing transistor to be replaced.
- Step 3. Install new transistor (see **PARTS LIST**); be sure the following conditions exist:
  - a. Mica insulator is not damaged. If damaged, replace with new insulator.
  - b. No grit or metal particles are between replacement transistor and heat sink.
  - c. Both sides of mica insulator are covered with silicone grease or fluid.
  - d. Mounting screws are tight.
- Step 4. Install rear panel and secure with four screws previously removed.

## RECOMMENDED SERVICE TECHNIQUES

Use the troubleshooting guide of Table IV to help locate trouble sources. If systematic troubleshooting indicates replacement of a component is necessary, observe the following precautions.

### Transistor Orientation

Solid-state components are packaged in various case sizes and types with various lead configurations. Typical solid-state component orientations are shown in Figure 8. Before removing a solid-state component from tie points or from a PCB, sketch the lead orientation with respect to the tie points or PCB. Form the leads of the new component to conform with the leads of the part being replaced to aid in making proper connections.

Before removing small transistors, note position of index tab with respect to the PCB or socket. Cut the leads of the new transistor to the required length and insert them into the PCB or socket properly indexed.

### Testing Transistors

Transistors should be checked with a transistor tester. If a tester is not available, use the following procedure for testing transistors with an ohmmeter.

- Step 1. Remove suspected transistor from the circuit (see Replacing PCB Components).
- Step 2. Connect ohmmeter leads to base and emitter. Read on lowest ohms scale. Reverse leads and read again.

Normal readings should be at least 10 times greater in one direction than the other.

- Step 3. Connect ohmmeter leads to base and collector and repeat Step 2. Readings should be similar to those obtained in Step 2.
- Step 4. If Steps 2 and 3 are normal, connect ohmmeter leads to collector and emitter. Read on lowest ohms scale. Reverse leads and read again. If the reading is low and virtually unchanged when ohmmeter connections are reversed, the transistor has a short circuit between collector and emitter.

### Replacing PCB Components

Schematics are shown in Figures 9, 11, 13, 15, 17 and 19. Electronic part locations on PCB's are shown in Figures 10, 12, 14, 16 and 18. Before removing components for testing or replacement, read and observe the following instructions.

1. Solid-state components and PCB's may be damaged by excessive heat. Use a small soldering iron with a 1/8-inch diameter chisel tip. Use small-diameter, 60/40 rosin-cored solder.
2. Remove components by placing soldering tip on component lead on conductor side of PCB and pull out lead. Avoid overheating conductor.

### CAUTION

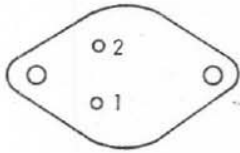
The PCB conductor is a metal surface plated with solder and laminated to the board. Excessive pressure or heat may lift the conductor from the board.

3. If component is faulty, clip leads close to component and unsolder leads from board. Withdraw leads from component side.
4. Clear solder from circuit board holes before inserting leads of new component. Heat solder in hole, remove iron and quickly insert a pointed nonmetallic object, such as a toothpick, from the conductor side.
5. Shape new component leads and clip them to proper length. Leads should be shaped to provide stress relief for component. Insert leads into holes, observing same polarity or orientation of component removed. Apply heat and solder on conductor side.

### Repairing Fractured or Damaged PCB Conductor

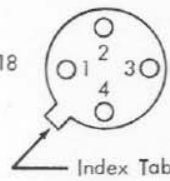
If a conductor is fractured, damaged or lifted from the PCB, a recommended method of repair is to solder a length of good conducting wire along the damaged area and then seal the repair with epoxy.

TO-3  
&  
TO-66



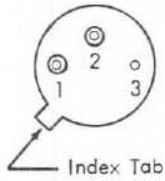
Pin 1 - Base  
Pin 2 - Emitter  
Mtg Flange - Collector

TO-18



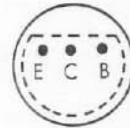
Lead 1 - Emitter  
Lead 2 - Base  
Lead 3 - Collector  
Lead 4 - Connected to Case

TO-5



Lead 1 - Emitter  
Lead 2 - Base  
Lead 3 - Collector & Case\*

G.E. Epoxy



Lead E - Emitter  
Lead C - Collector  
Lead B - Base

\*Not all types. Some have base-to-case internally; others have no connection to case.

TO-92



Lead E - Emitter  
Lead B - Base  
Lead C - Collector

Figure 9. Typical Solid-State Component Configurations

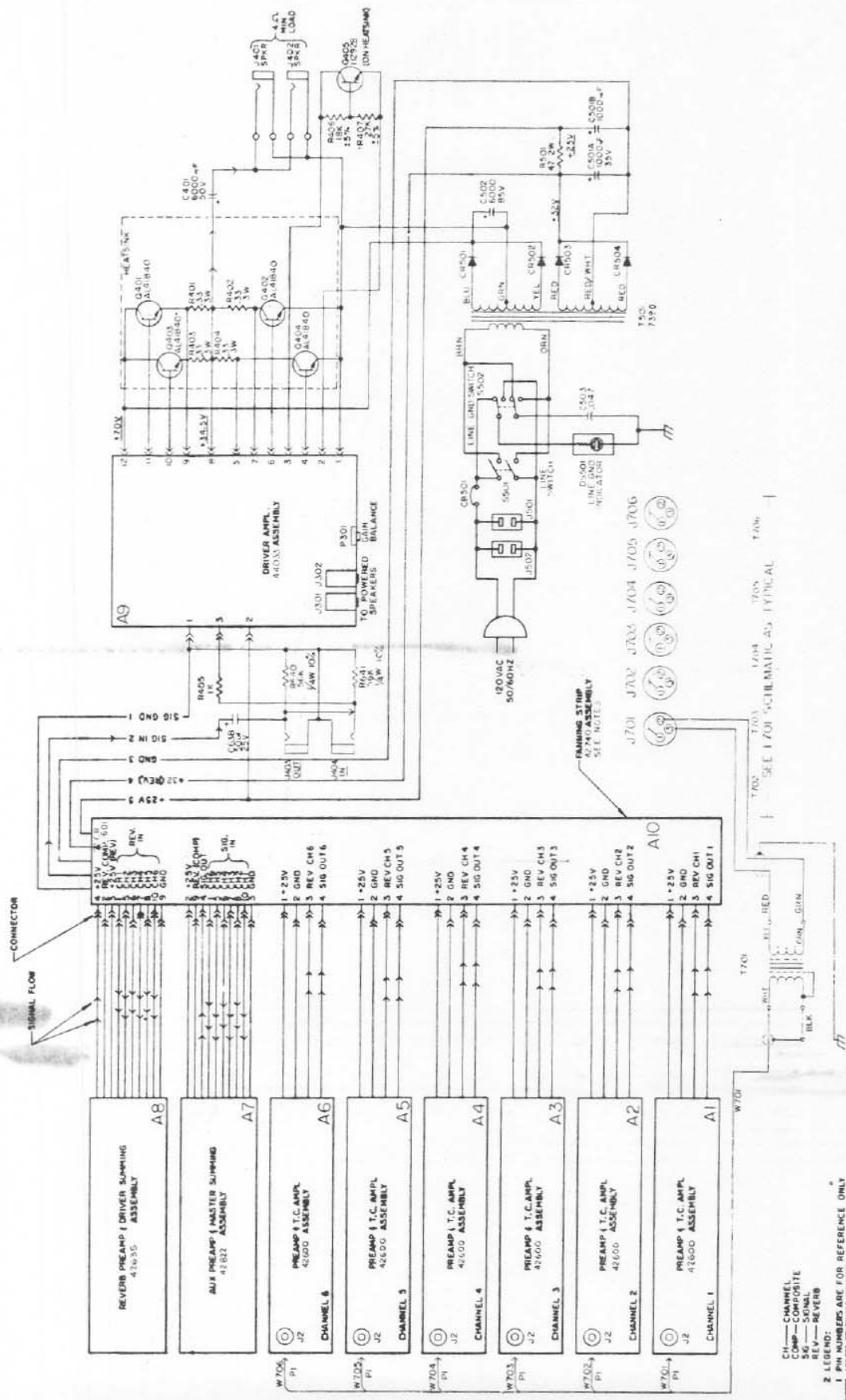


Figure 10. Schematic (2D280-6), Main Chassis

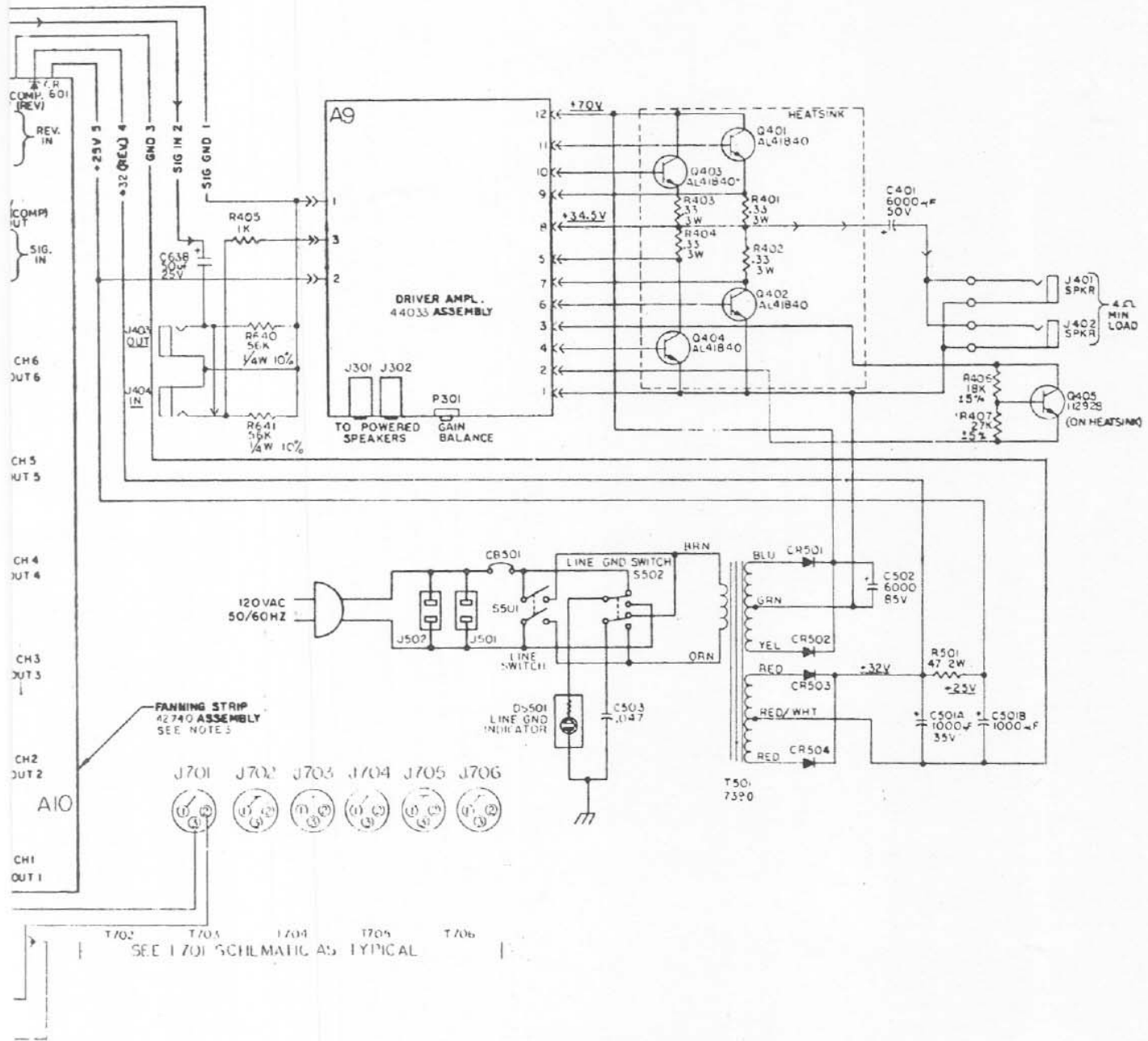


Figure 10. Schematic (2D280-6), Main Chassis

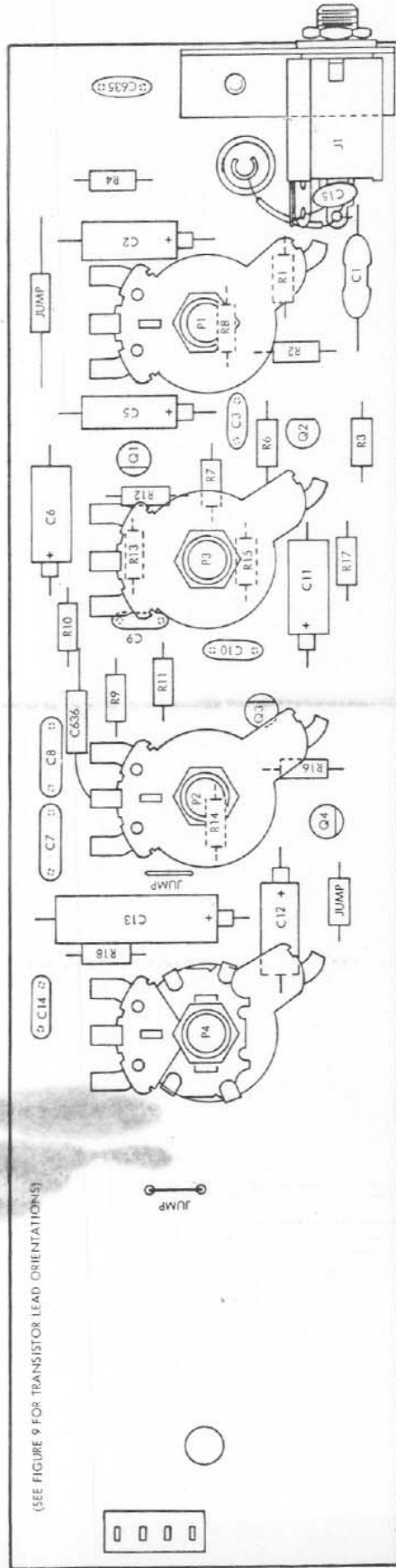


Figure 11. Electronic Part Locations (3D038-2), Channel Preamp and Tone Control Amplifier PCB Assembly

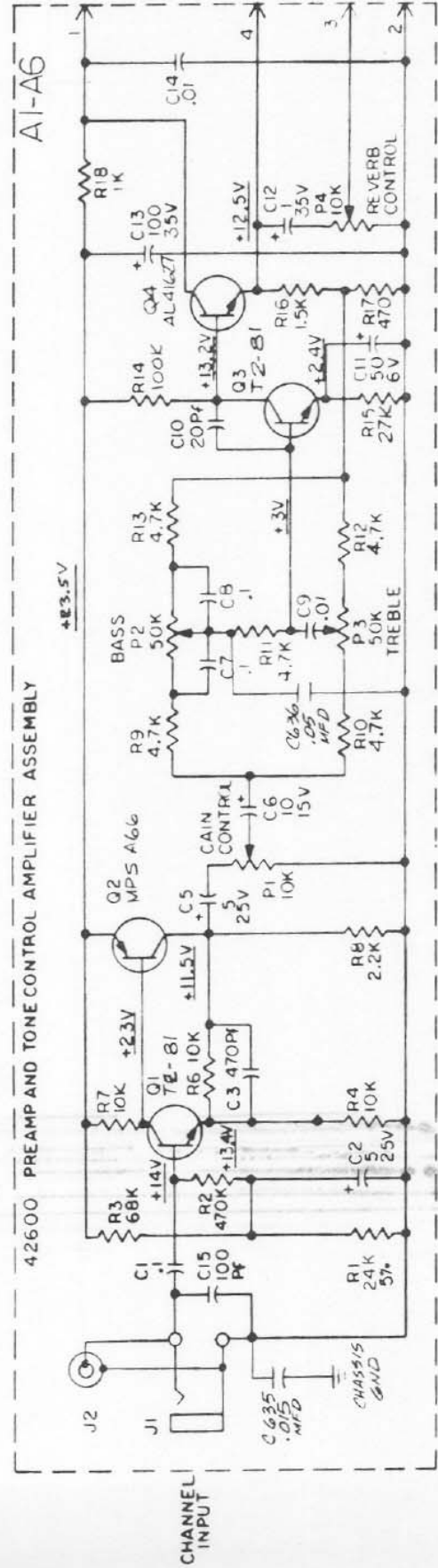


Figure 12. Schematic (2D280-6), Channel Preamp and Tone Control Amplifier PCB Assembly

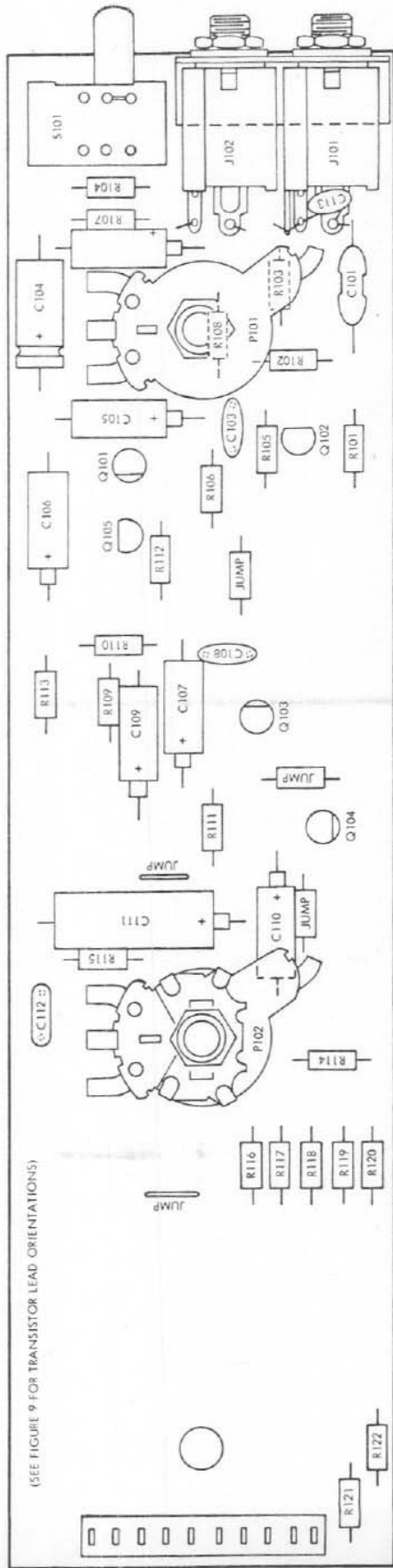


Figure 13. Electronic Part Locations (3D041-2), Auxiliary Preamplifier and Master Summing Amplifier PCB Assembly

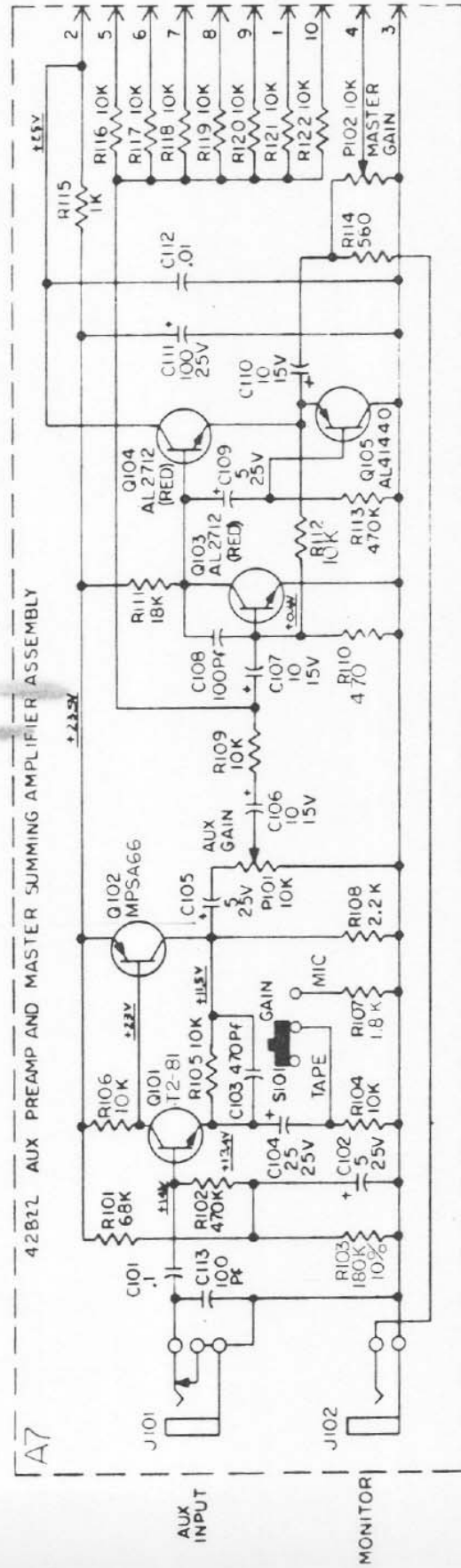


Figure 14. Schematic (2D280-6), Auxiliary Preamplifier and Master Summing Amplifier PCB Assembly

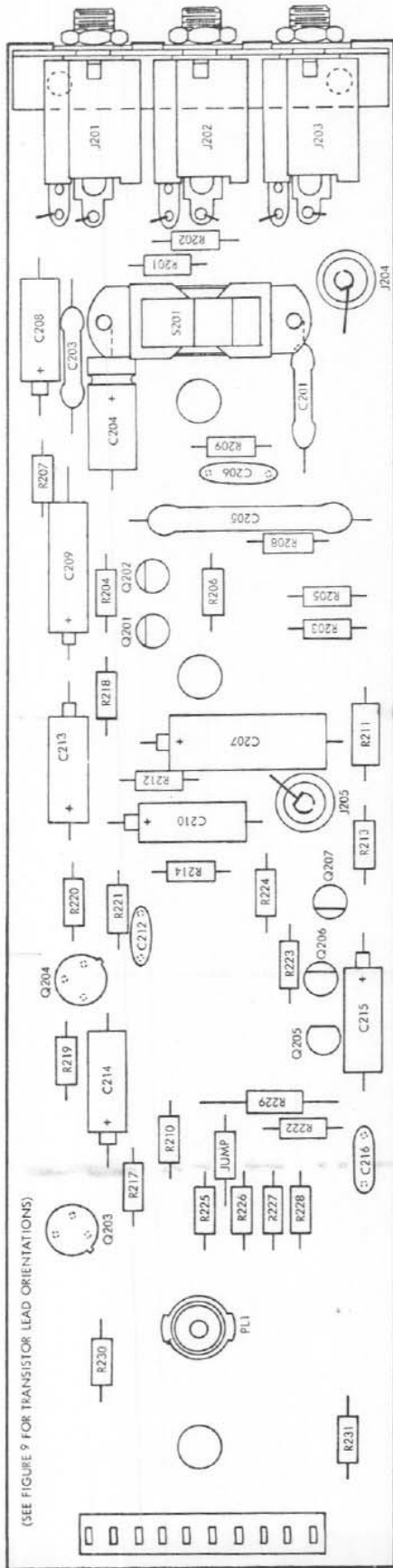
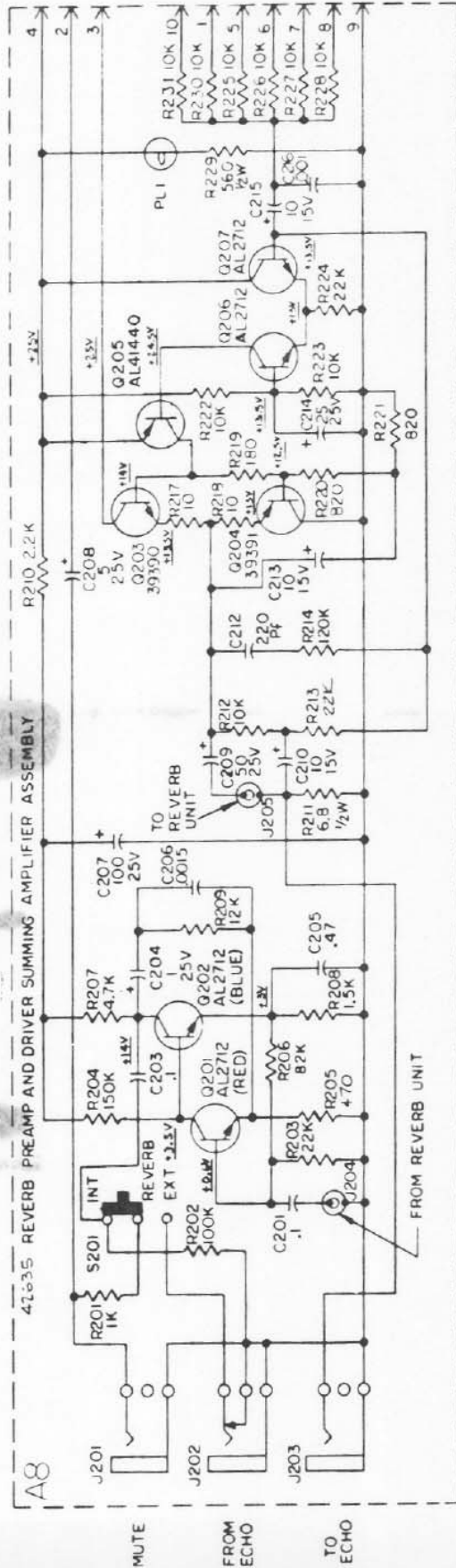


Figure 15. Electronic Part Locations (3D040-1), Reverb Preamp and Driver Summing Amplifier PCB Assembly





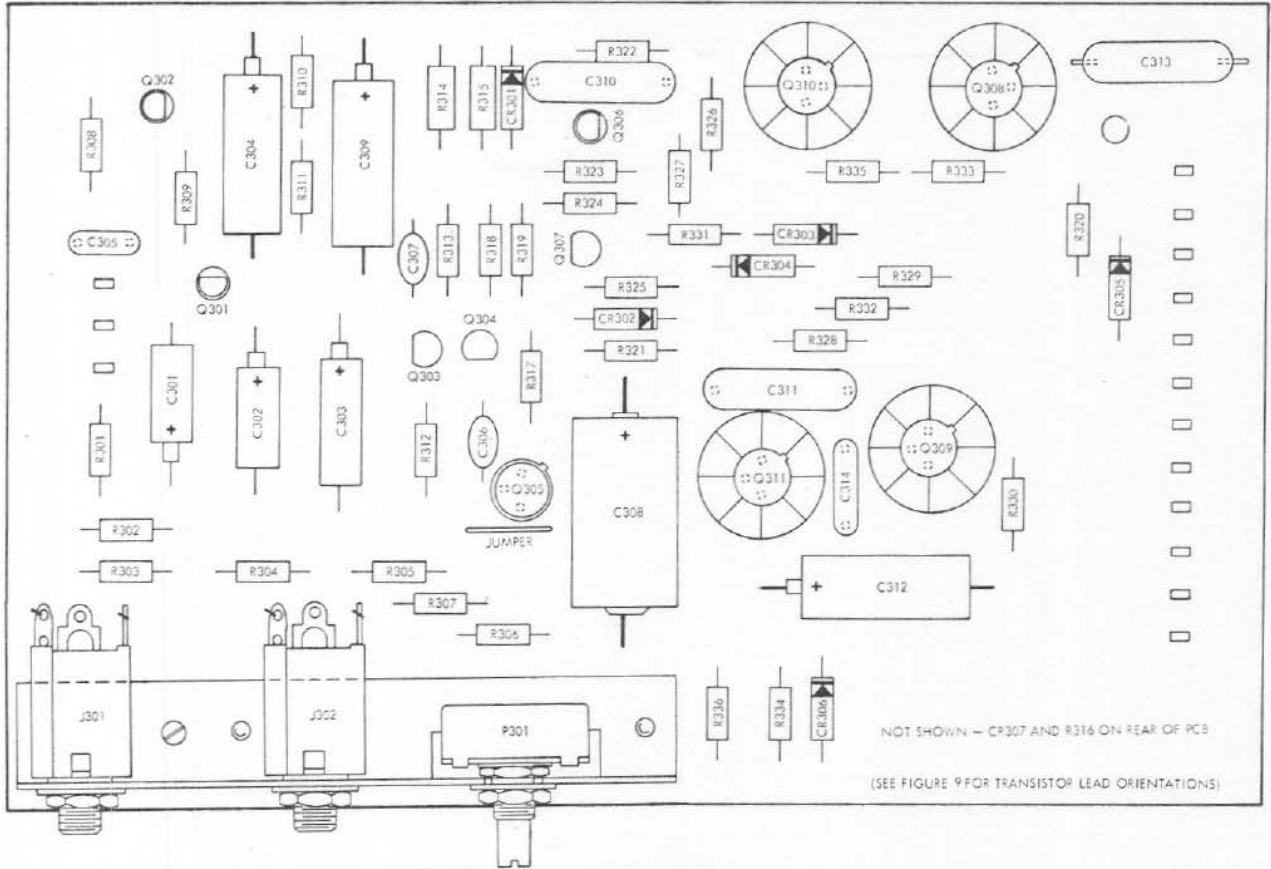


Figure 17. Electronic Part Locations (3D604-1), Driver Amplifier PCB Assembly

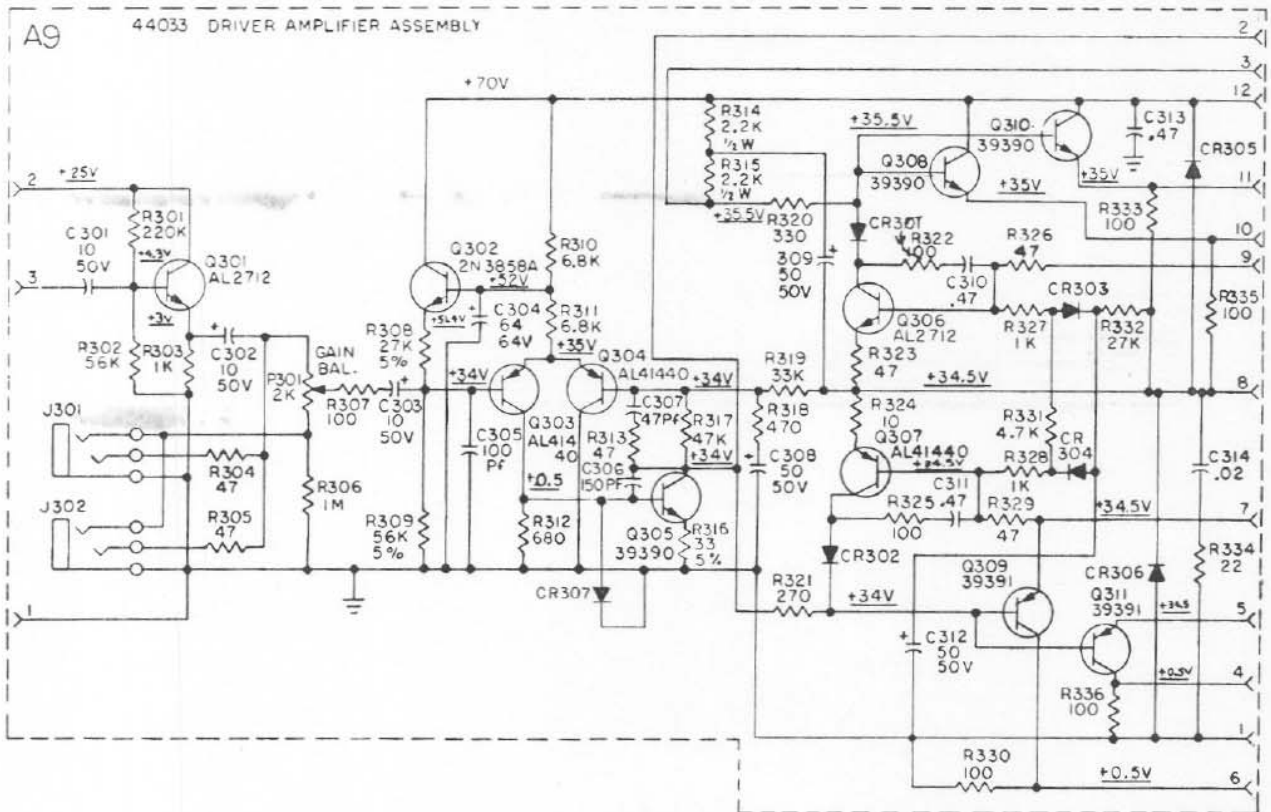


Figure 18. Schematic (2D280-6), Driver Amplifier PCB Assembly

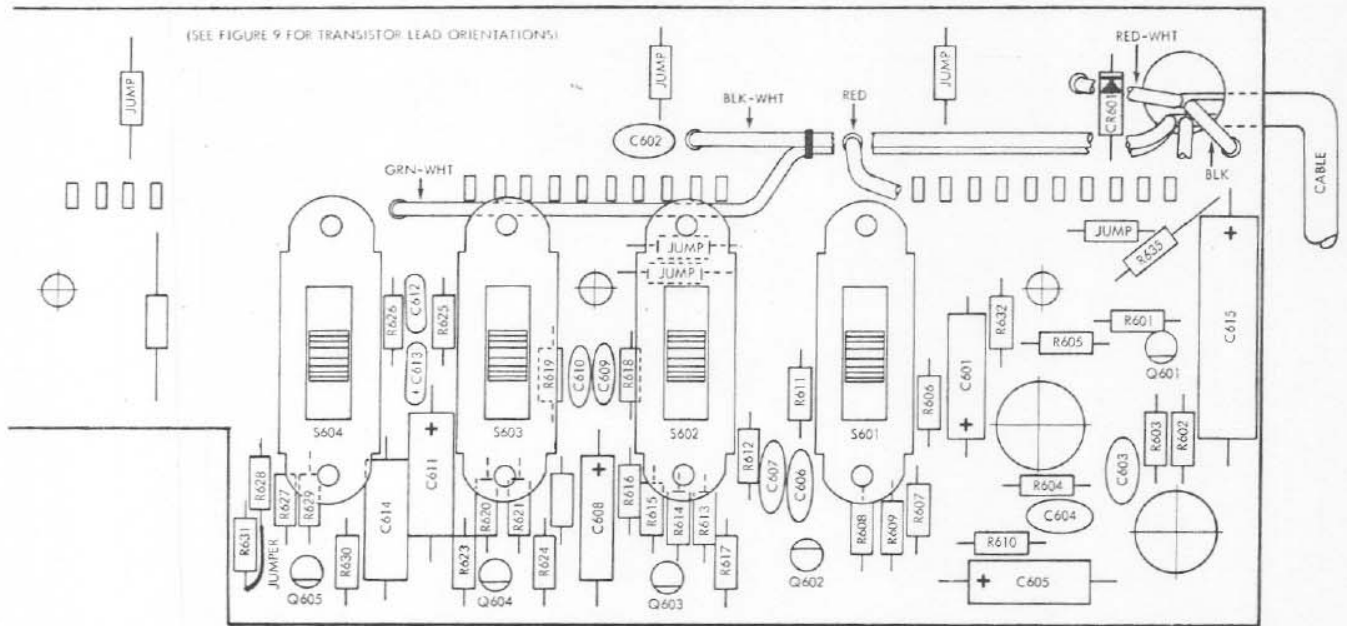


Figure 19. Electronic Part Locations (3D025-2), Fanning Strip PCB Assembly



Figure 20. Schematic (3D027-3), Fanning Strip PCB Assembly

## PARTS LIST

### MAIN CHASSIS

Reference Designator	Ordering Number	Name and Description
A1,2,3,4,5,6	27-01-042600-01	PCB assembly, channel pre-amplifier and tone control amplifier
A7	27-01-042822-01	PCB assembly, auxiliary pre-amplifier and master summing amplifier
A8	27-01-042635-01	PCB assembly, reverb pre-amplifier and driver summing amplifier
A9	27-01-044033-01	PCB assembly, driver amplifier
A10	27-01-042740-01	PCB assembly, fanning strip
C401	15-01-109098-01	Cap., 6000 $\mu$ F, 50V
C501A, 501B	15-01-107431-01	Cap., 1000-1000 $\mu$ F, 35V
C502	15-01-109097-01	Cap., 6000 $\mu$ F, 85V
C503	15-06-107433-01	Cap., 0.047 $\mu$ F $\pm$ 10%, 1600V
C638	15-01-100236-01	Cap., 50 $\mu$ F, 25V
CB501	51-03-109163-01	Circuit breaker
CR501, 502	48-02-107467-01	Diode, 1N5402, 200V, 3A
CR503, 504	48-02-042787-01	Rect., 1A, 400V, PIV
DS501	39-01-107475-01	Pilot lamp assembly, 28V, 0.04A
J401,402,403	21-01-100494-01	Jack, single phone, insulated sleeve

Reference Designator	Ordering Number	Name and Description
J404	21-01-113288-01	Jack, insulated
J501,502	21-01-100577-01	Outlet, ac, snap-in
J701,702,703,704,705,706	21-02-100722-01	Receptacle, 3-pin, XLR-3-13
Q401,402,403,404	48-03-041840-02	Transistor, NPN, 2N3055, 115W, 100V
Q405	48-03-112928-01	Transistor, NPN, 2N5305
R401,402,403,404	47-02-107434-01	Res., 0.33 $\Omega$ $\pm$ 10%, 3W
R405	47-01-102163-01	Res., 1K $\Omega$ $\pm$ 10%, 1/4W
R406	47-01-102108-01	Res., 18K $\Omega$ $\pm$ 5%, 1/4W
R407	47-01-102112-01	Res., 27K $\Omega$ $\pm$ 5%, 1/4W
R501	47-01-102923-01	Res., 47 $\Omega$ $\pm$ 10%, 2W
R640,641	47-01-102184-01	Res., 56K $\Omega$ $\pm$ 10%, 1/4W
S501	51-02-107437-01	Switch, DPST, toggle
S502	51-02-107438-01	Switch, DPDT, toggle
T501	56-08-007464-02	Transformer, power
T701,702,703,704,705,706	56-05-041887-01	Transformer, isolation
W701,702,703,704,705,706	60-04-041741-01	Cable, 18GA, 1-conductor, 32-inch, w/plug

PARTS LIST (continued)

CHANNEL PREAMPLIFIER AND TONE CONTROL AMPLIFIER PCB ASSEMBLY

Reference Designator	Ordering Number	Name and Description
C1	15-06-107463-01	Cap., 0.1 $\mu$ F $\pm$ 10%, 250V
C2,5	15-01-108543-01	Cap., 5 $\mu$ F, 25V
C3	15-02-100302-01	Cap., 470 pF $\pm$ 10%, 100V
C6	15-01-107461-01	Cap., 10 $\mu$ F, 15V
C7,8	15-06-100311-01	Cap., 0.1 $\mu$ F $\pm$ 20%, 250V
C9,14	15-02-100307-01	Cap., 0.01 $\mu$ F $\pm$ 20%, 100V
C10	15-02-100012-01	Cap., 20 pF $\pm$ 10%, 500V
C11	15-01-100230-01	Cap., 50 $\mu$ F, 6V
C12	15-01-107462-02	Cap., 1 $\mu$ F, 35V
C13	15-01-108236-01	Cap., 100 $\mu$ F, 35V
C15	15-02-107454-01	Cap., 100 pF $\pm$ 10%, 100V
C635	15-06-100084-01	Cap., 0.015 $\mu$ F $\pm$ 10%, 100V
C636	15-02-100082-01	Cap., 0.05 $\mu$ F $\pm$ 80% -30%, 75V
J1	21-01-100494-01	Jack, single phone, insulated sleeve
P1,4	47-06-042275-03	Pot., 10K $\Omega$ $\pm$ 30%

Reference Designator	Ordering Number	Name and Description
P2,3	47-06-042273-03	Pot., 50K $\Omega$ $\pm$ 30%, linear
Q1,3	48-03-109714-01	Transistor, NPN
Q2	48-03-118651-01	Transistor, PNP
Q4	48-03-041627-01	Transistor, NPN
R1	47-01-102111-01	Res., 24K $\Omega$ $\pm$ 5%, 1/4W
R2	47-01-100477-01	Res., 470K $\Omega$ $\pm$ 10%, 1/4W
R3	47-01-102185-01	Res., 68K $\Omega$ $\pm$ 10%, 1/4W
R4,6,7	47-01-102175-01	Res., 10K $\Omega$ $\pm$ 10%, 1/4W
R8	47-01-102167-01	Res., 2.2K $\Omega$ $\pm$ 10%, 1/4W
R9,10,11,12,13	47-01-102171-01	Res., 4.7K $\Omega$ $\pm$ 10%, 1/4W
R14	47-01-102187-01	Res., 100K $\Omega$ $\pm$ 10%, 1/4W
R15	47-01-102372-01	Res., 27K $\Omega$ $\pm$ 10%, 1/4W
R16	47-01-102165-01	Res., 1.5K $\Omega$ $\pm$ 10%, 1/4W
R17	47-01-102159-01	Res., 470 $\Omega$ $\pm$ 10%, 1/4W
R18	47-01-102163-01	Res., 1K $\Omega$ $\pm$ 10%, 1/4W

**PARTS LIST (continued)**

AUXILIARY PREAMPLIFIER AND MASTER SUMMING AMPLIFIER PCB ASSEMBLY

Reference Designator	Ordering Number	Name and Description
C101	15-06-107463-01	Cap., 0.1 $\mu$ F $\pm$ 10%, 250V
C102, 105, 109	15-01-108543-01	Cap., 5 $\mu$ F, 25V
C103	15-02-100302-01	Cap., 470 pF $\pm$ 10%, 100V
C104	15-01-107495-01	Cap., 25 $\mu$ F $\pm$ 10%, 25V
C106, 107, 110	15-01-107461-01	Cap., 10 $\mu$ F, 15V
C108, 113	15-02-107454-01	Cap., 100 pF $\pm$ 10%, 100V
C111	15-01-108236-01	Cap., 100 $\mu$ F, 35V
C112	15-02-100068-01	Cap., 0.01 $\mu$ F $\pm$ 20%, 100V
J101	21-01-107497-01	Jack, single circuit, shorting
J102	21-01-107459-01	Jack, phone, single circuit
P101	47-06-042274-02	Pot., 10K $\Omega$ $\pm$ 30%
P102	47-06-042618-01	Pot., 10K $\Omega$ , audio taper, fast rise
Q101	48-03-109714-01	Transistor, NPN
Q102	48-03-118651-01	Transistor, PNP

Reference Designator	Ordering Number	Name and Description
Q103, 104	48-03-101098-01	Transistor, NPN
Q105	48-03-041140-02	Transistor, PNP
R101	47-01-102185-01	Res., 68K $\Omega$ $\pm$ 10%, 1/4W
R102, 113	47-01-100477-01	Res., 470K $\Omega$ $\pm$ 10%, 1/4W
R103	47-01-102190-01	Res., 180K $\Omega$ $\pm$ 10%, 1/4W
R104, 105, 106, 109, 112, 116, 117, 118, 119, 120, 121, 122	47-01-102175-01	Res., 10K $\Omega$ $\pm$ 10%, 1/4W
R107	47-01-102166-01	Res., 1.8K $\Omega$ $\pm$ 10%, 1/4W
R108	47-01-102167-01	Res., 2.2K $\Omega$ $\pm$ 10%, 1/4W
R110	47-01-102159-01	Res., 470 $\Omega$ $\pm$ 10%, 1/4W
R111	47-01-102178-01	Res., 18K $\Omega$ $\pm$ 10%, 1/4W
R114	47-01-102160-01	Res., 560 $\Omega$ $\pm$ 10%, 1/4W
R115	47-01-102163-01	Res., 1K $\Omega$ $\pm$ 10%, 1/4W
S101	51-02-107499-01	Switch, DPDT, slide

PARTS LIST (continued)

REVERB PREAMPLIFIER AND DRIVER SUMMING AMPLIFIER PCB ASSEMBLY

Reference Designator	Ordering Number	Name and Description
C201,203	15-06-107463-01	Cap., 0.1 $\mu$ F $\pm$ 10%, 250V
C204	15-01-107462-01	Cap., 1 $\mu$ F, 25V
C205	15-06-100142-01	Cap., 0.47 $\mu$ F $\pm$ 10%, 250V
C206	15-02-100306-01	Cap., 0.0015 $\mu$ F $\pm$ 10%, 100V
C207	15-01-108236-01	Cap., 100 $\mu$ F, 35V
C208	15-01-108543-01	Cap., 5 $\mu$ F, 25V
C209	15-01-100236-01	Cap., 50 $\mu$ F, 25V
C210,213,215	15-01-107461-01	Cap., 10 $\mu$ F, 15V
C212	15-02-107470-01	Cap., 220 pF $\pm$ 10%, 100V
C214	15-01-107495-01	Cap., 25 $\mu$ F $\pm$ 10%, 100V
C216	15-02-100304-01	Cap., 0.001 $\mu$ F $\pm$ 10%, 100V
J201,203	21-01-107459-01	Jack, phone, single circuit
J202	21-01-107497-01	Jack, shorting, single circuit
J204,205	21-02-107473-01	Socket, phone pin, roll-in
PL1	39-02-107476-01	Pilot lamp assembly
Q201,202,206,207	48-03-101098-01	Transistor, NPN
Q203	48-03-107447-02	Transistor, NPN, 2N5320, 10W, 75V
Q204	48-03-107448-02	Transistor, PNP, 2N5322, 10W, 75V
Q205	48-03-041440-02	Transistor, PNP

Reference Designator	Ordering Number	Name and Description
R201	47-01-102163-01	Res., 1K $\Omega$ $\pm$ 10%, 1/4W
R202	47-01-102187-01	Res., 100K $\Omega$ $\pm$ 10%, 1/4W
R203,213,224	47-01-102179-01	Res., 22K $\Omega$ $\pm$ 10%, 1/4W
R204	47-01-102189-01	Res., 150K $\Omega$ $\pm$ 10%, 1/4W
R205	47-01-102159-01	Res., 470 $\Omega$ $\pm$ 10%, 1/4W
R206	47-01-102186-01	Res., 82K $\Omega$ $\pm$ 10%, 1/4W
R207	47-01-102171-01	Res., 4.7K $\Omega$ $\pm$ 10%, 1/4W
R208	47-01-102165-01	Res., 1.5K $\Omega$ $\pm$ 10%, 1/4W
R209	47-01-102176-01	Res., 12K $\Omega$ $\pm$ 10%, 1/4W
R210	47-01-102167-01	Res., 2.2K $\Omega$ $\pm$ 10%, 1/4W
R211	47-01-102328-01	Res., 6.8 $\Omega$ $\pm$ 10%, 1/2W
R212,222,223,225,226,227,228,230,231	47-01-102175-01	Res., 10K $\Omega$ $\pm$ 10%, 1/4W
R214	47-01-102188-01	Res., 120K $\Omega$ $\pm$ 10%, 1/4W
R217,218	47-01-102140-01	Res., 10 $\Omega$ $\pm$ 10%, 1/4W
R219	47-01-102154-01	Res., 180 $\Omega$ $\pm$ 10%, 1/4W
R220,221	47-01-102162-01	Res., 820 $\Omega$ $\pm$ 10%, 1/4W
R229	47-01-102352-01	Res., 560 $\Omega$ $\pm$ 10%, 1/2W
S201	51-02-107498-01	Switch, DPDT, rocker

PARTS LIST (continued)

DRIVER AMPLIFIER PCB ASSEMBLY

Reference Designator	Ordering Number	Name and Description
C301,302,303	15-01-107452-01	Cap., 10 $\mu$ F, 50V
C304	15-01-107591-01	Cap., 64 $\mu$ F, 64V
C305	15-02-107454-01	Cap., 100 pF $\pm$ 10%, 100V
C306	15-02-107453-01	Cap., 150 pF $\pm$ 10%, 100V
C307	15-02-107455-01	Cap., 47 pF $\pm$ 10%, 100V
C308,309,312	15-01-100240-01	Cap., 50 $\mu$ F, 50V
C310,311,313	15-06-108173-01	Cap., 0.47 $\mu$ F $\pm$ 20%, 100V
C314	15-02-100087-01	Cap., 0.02 $\mu$ F $\pm$ 20%, 100V
CR301,302,303,304	48-01-107017-01	Diode, 1N456A, 25V, 100 mA
CR305,306	48-01-102592-01	Diode
J301,302	21-01-107505-01	Jack, phone, insulated
P301	47-06-107503-01	Pot., 2K $\Omega$ $\pm$ 30%, audio taper
Q301,306	48-03-101098-01	Transistor, NPN
Q302	48-03-107317-01	Transistor, NPN, 2N3858A
Q303,304,307	48-03-041440-02	Transistor, PNP
Q305,308,310	48-03-107447-02	Transistor, NPN, 2N5320, 10W, 75V
Q309,311	48-03-107448-02	Transistor, PNP, 2N5322, 10W, 75V
R301	47-01-102191-01	Res., 220K $\Omega$ $\pm$ 10%, 1/4W
R302	47-01-102184-01	Res., 56K $\Omega$ $\pm$ 10%, 1/4W

Reference Designator	Ordering Number	Name and Description
R303,327,328	47-01-102163-01	Res., 1K $\Omega$ $\pm$ 10%, 1/4W
R304,305,313,323,326,329	47-01-102147-01	Res., 47 $\Omega$ $\pm$ 10%, 1/4W
R306	47-01-100482-01	Res., 1M $\Omega$ $\pm$ 10%, 1/4W
R307,322,325,330,333,335,336	47-01-102151-01	Res., 100 $\Omega$ $\pm$ 10%, 1/4W
R308	47-01-102112-01	Res., 27K $\Omega$ $\pm$ 5%, 1/4W
R309	47-01-102121-01	Res., 56K $\Omega$ $\pm$ 5%, 1/4W
R310,311	47-01-102173-01	Res., 6.8K $\Omega$ $\pm$ 10%, 1/4W
R312	47-01-102161-01	Res., 680 $\Omega$ $\pm$ 10%, 1/4W
R314,315	47-01-102359-01	Res., 2.2K $\Omega$ $\pm$ 10%, 1/2W
R317	47-01-102183-01	Res., 47K $\Omega$ $\pm$ 10%, 1/4W
R318	47-01-102159-01	Res., 470 $\Omega$ $\pm$ 10%, 1/4W
R319	47-01-102181-01	Res., 33K $\Omega$ $\pm$ 10%, 1/4W
R320	47-01-102157-01	Res., 330 $\Omega$ $\pm$ 10%, 1/4W
R321	47-01-102156-01	Res., 270 $\Omega$ $\pm$ 10%, 1/4W
R324	47-01-102140-01	Res., 10 $\Omega$ $\pm$ 10%, 1/4W
R331	47-01-102171-01	Res., 4.7K $\Omega$ $\pm$ 10%, 1/4W
R332	47-01-102180-01	Res., 27K $\Omega$ $\pm$ 10%, 1/4W
R334	47-01-105306-01	Res., 22 $\Omega$ $\pm$ 10%, 1/4W

PARTS LIST (continued)

FANNING STRIP PCB ASSEMBLY

Reference Designator	Ordering Number	Name and Description
C601,605,608,611	15-01-107462-01	Cap., 1 $\mu$ F, 25V
C602	15-02-100302-01	Cap., 470 pF $\pm$ 10%, 100V
C603,604,606,607	15-02-100304-01	Cap., 0.001 $\mu$ F $\pm$ 10%, 100V
C609,610	15-02-100307-01	Cap., 0.01 $\mu$ F $\pm$ 20%, 100V
C612	15-06-109089-01	Cap., 0.039 $\mu$ F $\pm$ 20%, 100V
C613	15-01-109413-01	Cap., 5 $\mu$ F, 15V
C614	15-06-108173-01	Cap., 0.47 $\mu$ F $\pm$ 20%, 100V
C615	15-01-108236-01	Cap., 100 $\mu$ F, 35V
CR601	48-01-100853-01	Diode, Zener, 9.1V $\pm$ 5%
Q601	48-03-109714-01	Transistor, NPN
Q602,603,604,605	48-03-041627-01	Transistor, NPN
R601	47-01-102190-01	Res., 180K $\Omega$ $\pm$ 10%, 1/4W
R602	47-01-102182-01	Res., 39K $\Omega$ $\pm$ 10%, 1/4W
R603,622,623,632	47-01-102163-01	Res., 1K $\Omega$ $\pm$ 10%, 1/4W
R604	47-01-102131-01	Res., 150K $\Omega$ $\pm$ 5%, 1/4W
R605	47-01-102108-01	Res., 18K $\Omega$ $\pm$ 5%, 1/4W

Reference Designator	Ordering Number	Name and Description
R606,613,620,627	47-01-100482-01	Res., 1M $\Omega$ $\pm$ 10%, 1/4W
R607,621	47-01-102157-01	Res., 330 $\Omega$ $\pm$ 10%, 1/4W
R608,629	47-01-102160-01	Res., 560 $\Omega$ $\pm$ 10%, 1/4W
R609,610,617,624,631	47-01-102167-01	Res., 2.2K $\Omega$ $\pm$ 10%, 1/4W
R611	47-01-109204-01	Res., 470K $\Omega$ $\pm$ 5%, 1/4W
R612	47-01-102114-01	Res., 33K $\Omega$ $\pm$ 5%, 1/4W
R614	47-01-102153-01	Res., 150 $\Omega$ $\pm$ 10%, 1/4W
R615	47-01-102156-01	Res., 270 $\Omega$ $\pm$ 10%, 1/4W
R616	47-01-102165-01	Res., 1.5K $\Omega$ $\pm$ 10%, 1/4W
R618	47-01-102125-01	Res., 82K $\Omega$ $\pm$ 5%, 1/4W
R619,628	47-01-102102-01	Res., 10K $\Omega$ $\pm$ 5%, 1/4W
R625	47-01-108931-01	Res., 3.9M $\Omega$ $\pm$ 10%, 1/4W
R626	47-01-102100-01	Res., 8.2K $\Omega$ $\pm$ 5%, 1/4W
R630	47-01-102077-01	Res., 910 $\Omega$ $\pm$ 5%, 1/4W
R635	47-01-102171-01	Res., 4.7K $\Omega$ $\pm$ 10%, 1/4W
S601,602,603,604	51-02-109115-01	Switch, DPTT, slide