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**ALTEC**

**1592B  
MIXER/AMPLIFIER**

**OPERATING  
INSTRUCTIONS**



**NOTICE**

Read this manual before operating  
the 1592B Mixer/Amplifier.

**FEATURES**

- Very Low Noise Level
- Controls and Mixes 5 Inputs
- +30 dBm (1 watt) output
- Typical Distortion Less Than 0.2%
- Microphone Preamplifier Gain is Selectable at 0, -10 and -20 dB
- Provisions to Connect Additional Input Channels
- Articulation Enhancement Switch
- Bass and Treble Tone Controls
- 1000 Hz Test Tone Generator
- AC or Battery Operation
- Automatic Transfer to Battery Operation if AC Power Fails
- Hinged Front Panel for Easy Maintenance
- Small Size
- Light Weight
- Safety — Underwriters' Laboratories Listed

**ALTEC**

SOUND PRODUCTS DIVISION

*Specifications and components subject to change without  
notice. Overall performance will be maintained or improved.*

**1515 S. Manchester Ave., Anaheim, Calif. 92803**

42-02-044127-03  
LITHO IN U.S.A. CP-774-2.5K

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## SPECIFICATIONS

Type:	5-channel solid-state mixer/amplifier with provisions for plug-in input accessory modules	Noise Level (20 kHz Bandwidth):	-124 dBm equivalent input noise
Gain:	87 dB with 1588B Microphone Preamplifier (gain may be reduced 10 or 20 dB with GAIN switch) 38 dB with 15095A Transformer bridging 600-ohm line 54 dB with 15356A Line Matching Transformer		Output noise at least 90 dB below full output with MASTER gain control closed or at least 85 dB below full output with MASTER gain control fully open and all MIX controls closed
Input Clipping Level — With 1588B Module:	-22 dBm with GAIN switch at 0 dB -10 dBm with GAIN switch at -10 dB 0 dBm with GAIN switch at -20 dB	Controls:	1 POWER ON-OFF switch 5 MIX gain, continuously variable 1 MASTER gain, continuously variable 1 MON VOL gain, continuously variable 1 LF tone, continuously variable 1 HF tone, continuously variable 5 GAIN switches (-20, -10, 0 dB) 1 NORMAL-BRIGHT switch (3 to 5 kHz response rise) 1 TONE ON-OFF switch (1000 Hz test tone) 1 TONE CONTROL OUT-IN switch (inside front panel) 1 VU RANGE switch; OFF, +8, +18 VU
With 15095A Module:	Greater than 20 volts		
Power Output:	+30 dBm at less than 1% THD from 20 Hz to 20 kHz (see Figure 1). +28 dBm at less than 0.5% THD from 35 Hz to 20 kHz (see Figure 1).	Indicators:	1 VU meter, -20 to +3 VU (optional accessory) 1 RED overload indicator (light-emitting diode)
Total Harmonic Distortion (THD):	Typically less than 0.2%	Connections — Inputs:	5 XLR3-31 receptacles (INPUT 1 — INPUT 5) 5 octal sockets (ACC 1 — ACC 5, input accessory modules) 2 MASTER MULTIPLE phono pin tip jacks 2 BATT 24/28V, -/+ terminals
Monitor Output:	18 dB below amplifier output with maximum monitor volume (+12 dBm maximum into 600-ohm load)	Outputs:	2 MON -/+ terminals 150Ω/600Ω, terminals GND, 1, 2, 3, 4
Frequency Response:	±1 dB from 20 Hz to 20 kHz	Power Requirements:	120/240V ac, 50/60 Hz, 16 watts — or — 24/28V dc at 0.3A. Battery minus (-) is ground.
Source Impedance — With 1579B Module:	Up to 50,000 ohms (unbalanced input)		
With 1588B Module:	150/250 ohms nominal (balanced input)		
With 15095A Module:	600 to 15,000 ohms (balanced bridging input)		
With 15356A Module:	150 or 600 ohms (balanced matched input)		
Load Impedance:	150 ohms and 600 ohms (transformer-isolated output)		
Output Impedance:	120 ohms nominal		



# SPECIFICATIONS (Continued)

Operating Temperature Range:	Up to 55°C (131°F)	Accessories: (Continued)	ALTEC 15095A Line Bridging Transformer ALTEC 15356A Line Matching Transformer ALTEC 42526 Shelf Mount Cover (7"H) ALTEC 42625 Shelf Mount Cover (8-1/4"H)
Dimensions:	5-1/4"H x 19"W x 6-1/2"D		
Color:	ALTEC green		
Weight:	10-1/2 pounds		
Accessories:	ALTEC 1579B Equalized Pre-amplifier ALTEC 1588B Microphone Preamplifier ALTEC 1599A Mixer Extender		

## NOTE

ACCESSORIES MUST BE ORDERED SEPARATELY. One 1579B, 1588B, 15095A or 15356A must be ordered for each input channel used.

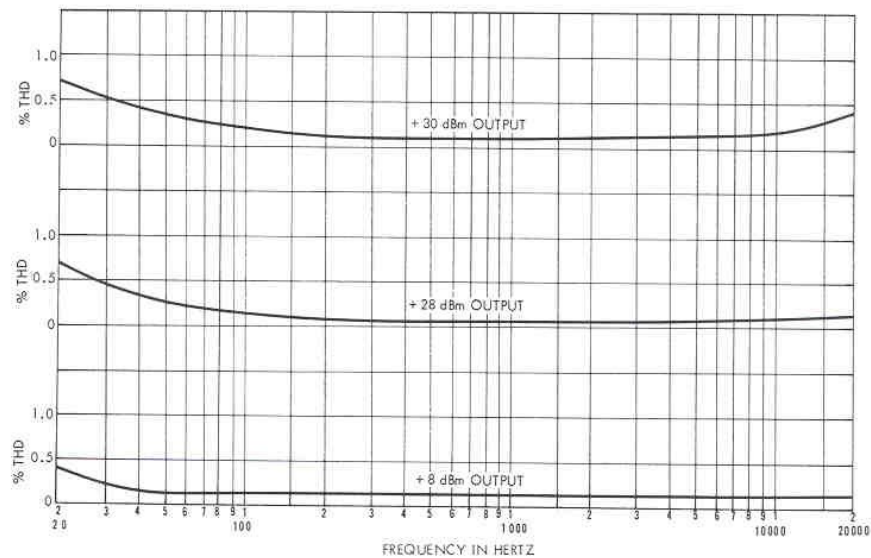


Figure 1. Frequency Versus THD for +8, +28 and +30 dBm Output

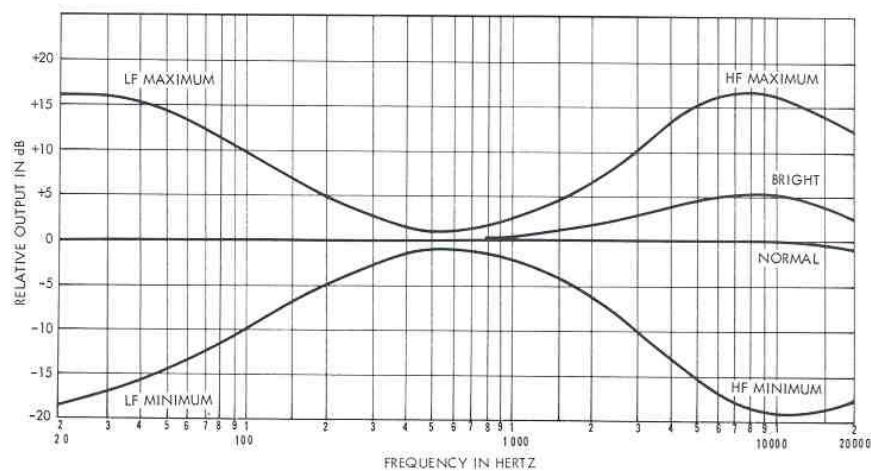


Figure 2. Frequency Response and Tone Control Characteristics

## DESCRIPTION

The ALTEC 1592B Mixer/Amplifier controls and mixes up to five independent input signals. The 1592B operates at an exceptionally low noise level and delivers up to +30 dBm output. Optional plug-in accessory input modules permit each input channel to be used for microphone, magnetic phono pickup, or high-level line sources. Gain is 87 dB with the 1588B Microphone Preamplifier accessory. Each channel is provided with a gain switch to reduce gain by either 10 or 20 dB, allowing use of high-output microphones without introducing distortion. Frequency response and tone control characteristics are shown in Figure 1. Power characteristics are shown in Figure 2.

Two master multiple jacks permit two or more 1592B Mixer/Amplifiers or 1599A Mixer Extenders to be connected in parallel. Two parallel mixer/amplifiers provide 10 mix inputs which may be controlled by a single master control on the selected 1592B. All inputs of such a system appear at the output of both mixer/amplifiers. The output of each mixer/amplifier is adjustable for a separate application. Where public address and radio must share the same microphones, one MASTER control and output line may be used to control and feed each system.

## ACCESSORIES

### Input Modules

One plug-in input accessory is required for each input channel used. These include the 1588B Microphone Preamplifier, the 1579B Equalized Preamplifier, the 15095A Line Bridging Transformer and 15356A Line Matching Transformer (see Figure 3). Applications and requirements are summarized in Table I (see INSTALLATION section).

### Mixer Extender

The ALTEC 1599A Mixer Extender accessory is available to provide additional input channels for the 1592B. Each of the six additional channels has a separate MIX gain control and a microphone GAIN switch. A MASTER gain control sets the level simultaneously for all six channels. Several 1599A Mixer Extenders may be connected to the 1592B. By paralleling a number of 1599A's with the 1592B, up to 30 input channels can be made available for use in the 1592B sound system.

### Shelf Mount Covers

The ALTEC 42526 Shelf Mount Cover accessory encloses the 1592B for shelf use. It tilts the 1592B for easy access to front panel controls. The

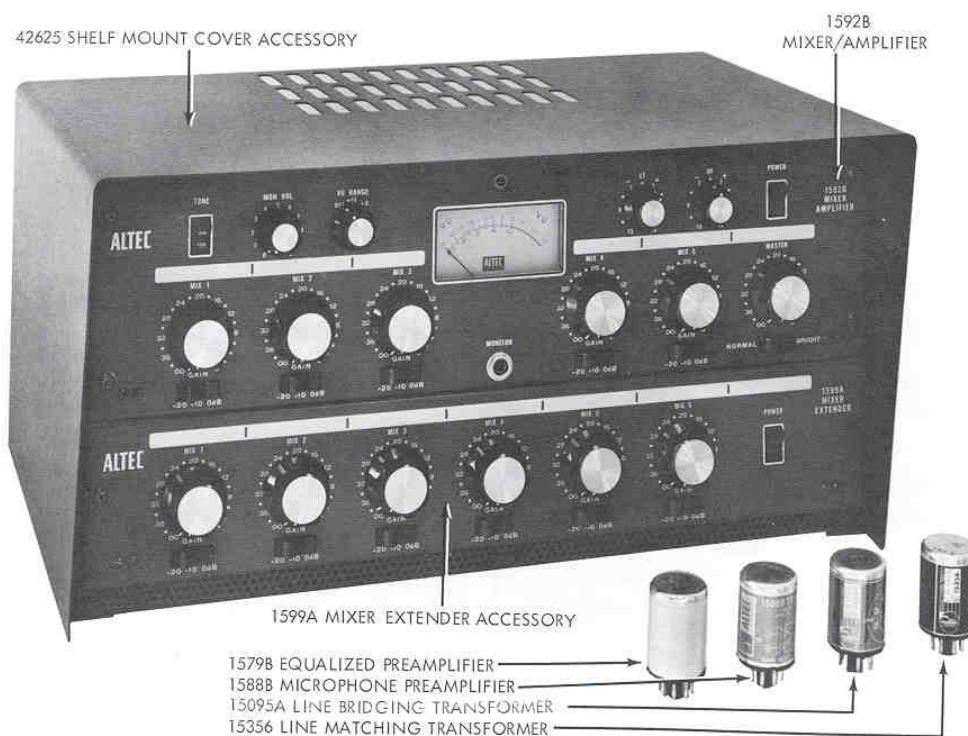


Figure 3. 1592B with Accessories

sides and top extend beyond the front panel to prevent accidental changes to control settings. The cover provides easier handling for portability and is sturdy enough to support lightweight equipment placed on top. Four polyethylene feet prevent marring of surfaces. The ALTEC green finish of the cover matches the front panel of the 1592B.

Slightly larger, the ALTEC 42625 Shelf Mount Cover accessory accommodates the 1592B and one 1599A Mixer Extender accessory (see Figure 3).

## INSTALLATION

### MECHANICAL

The 1592B may be mounted in a standard 19-inch equipment rack, or installed in the 42526 or 42625 Shelf Mount Cover accessory for shelf use. Vertical space required for mounting is 5-1/4 inches.

#### Rack Mounting

- Step 1. Remove four screws securing front panel, open and lower panel (see Figure 4).
- Step 2. Install 1592B in equipment rack with appropriate four screws supplied with unit.

- Step 3. Close front panel and secure with four screws previously removed.

#### Shelf Mounting

The 1592B may be shelf mounted after installing the 42526 or 42625 Shelf Mount Cover accessory.

### VENTILATION

The 1592B generates minimal heat during normal use. Although the amount of heat is relatively low, the amplifier must be ventilated to prevent excessive temperature rise. Because transistors are heat sensitive, the 1592B should not be placed adjacent to heat-generating equipment or in areas where ambient temperature exceeds 55°C (131°F).

If the 1592B is mounted in an equipment rack or cabinet with other heat-producing equipment mounted above and/or below (two or more or one with real time analyzer, oscilloscope, etc.), space must be provided between the units or the 1592B may become too warm. The 1-3/4" perforated panel (ALTEC Part No. 10399) is recommended for this purpose.

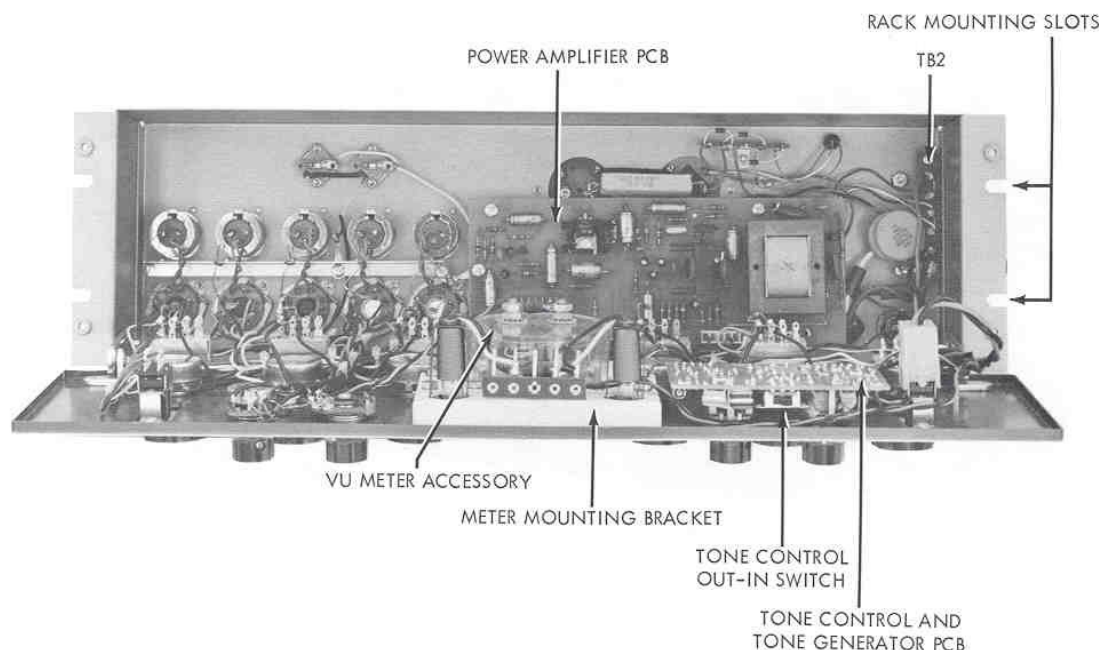


Figure 4. Front View with Hinged Panel Open



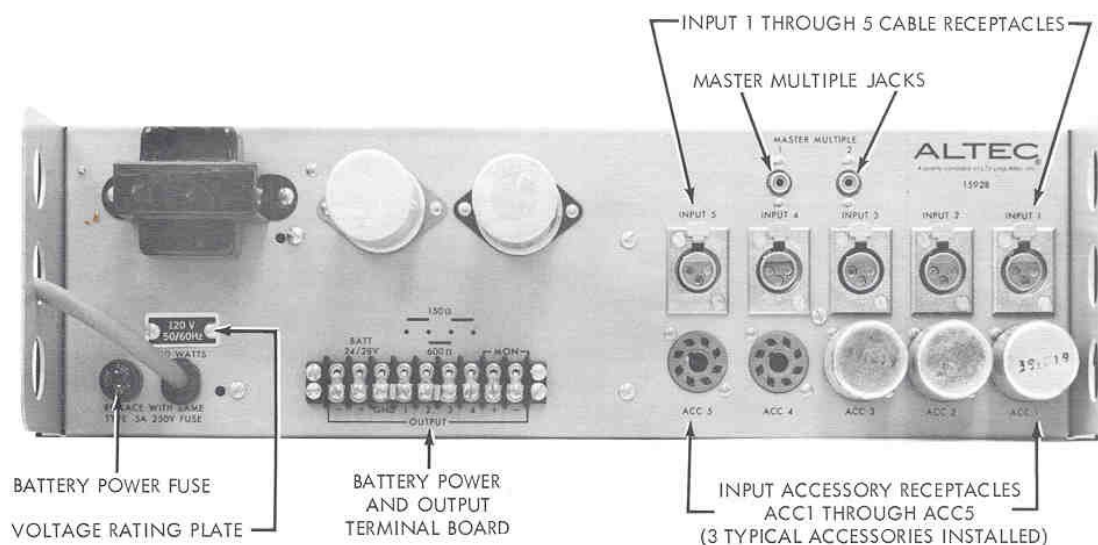


Figure 5. Rear View

To determine temperature conditions, operate the system until temperatures stabilize, then measure air temperature with a bulb-type thermometer held at the bottom of the uppermost amplifier. Do not let the thermometer bulb touch metal because the metal probably will be hotter than the ambient air. If air temperature exceeds 55° C, the equipment should be spaced farther apart or a blower should be installed to ventilate the cabinet.

#### CAUTION

Do not block the cover ventilation holes when placing other equipment on the 42526 or 42625 Shelf Mount Cover accessory. When shelf-mounting the 1592B, allow at least 1-3/4" between the unit and any wall behind it to assure air circulation past the output transistors.

## ELECTRICAL

### 120 Volt, 50/60 Hz Power Connections

Equipment supplied for domestic use is provided with the power transformer primary strapped for 120 volts (terminals 1 to 2 and 3 to 4 on TB2). The power input nameplate, adjacent to the power cord on the chassis, is mounted to show the appropriate side specifying the connections (see Figure 5). Verify that line voltage is in accordance with the voltage rating before connecting primary power.

### 240 Volt, 50/60 Hz Power Connections

Export equipment is provided with the power transformer primary strapped for 240 volts (terminals 2 to 3 on TB2). The power input nameplate, adjacent to the power cord on the chassis, is mounted to show the appropriate side specifying the connections.

For a 1592B previously wired for 120V ac primary power, use the following procedure to change wiring for 240V ac, 50/60 Hz operation:

- Step 1. Remove four screws securing front panel, open and lower panel.
- Step 2. Locate terminal board TB2 beneath power transformer T1 (see Figure 4).
- Step 3. Remove strap "A" connecting terminals 1 and 2, and remove strap "B" connecting terminals 3 and 4; then solder strap "C" to terminals 2 and 3 (see Figure 6).
- Step 4. Remove voltage-rating plate from chassis, reverse and reinstall to show 240V rating (see Figure 5).
- Step 5. Close front panel and secure with four screws previously removed.

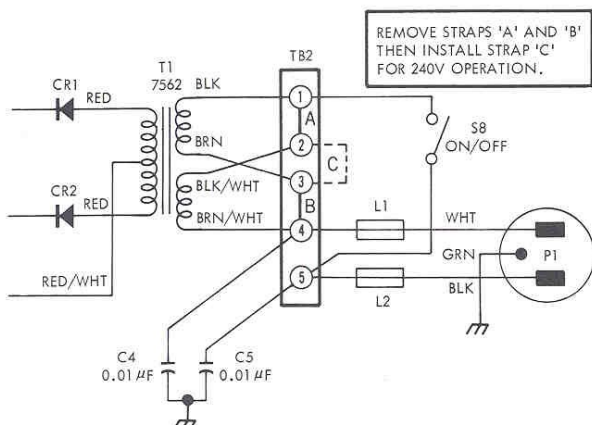


Figure 6. Converting to 240V, 50/60 Hz Power

### Battery Connections

If desired, the 1592B may be connected to an external 24/28V dc battery with minus (–) as ground. Terminals for the dc power connections are on the OUTPUT terminal board (see Figure 5). If ac power fails, transfer to dc power is instantaneous, automatic and silent.

The battery power supply is not operated by the primary POWER switch. If switching to battery power is desired, an external relay or switch should be provided by the user.

### Input Connections

Inputs to the mixer channels are connected on the chassis at connectors INPUT 1 through INPUT 5 (see Figure 5), with cables terminating in XLR3-12 type plugs. Appropriate internal wiring is shown in Figure 7 for these plugs. Input for any channel may be microphone, magnetic phono, or high-level line sources.

One plug-in input accessory is required for each channel used. Input accessories are selected to meet application requirements and plugged into the corresponding receptacle (ACC1 through ACC5). Applications of plug-in input accessories for various sources are shown in Table I.

An expanded sound system having up to 30 inputs is shown in Figure 8. All inputs of such a system appear at the output of the 1592B. Each input to the 1599A Mixer Extender accessories is separately adjustable. The MIX controls of the 1592B function as *system submasters*, or master gain controls

Table I. Plug-In Accessory Applications for Various Input Sources

Input Source	Acceptable Source Impedance	Plug-In Input Accessory
Magnetic Phono	Up to 50,000 ohms (unbalanced input)	Use 1579B Equalized Preamplifier
Microphone	150/250 ohms nominal (balanced input)	Use 1588B Microphone Preamplifier
High-Level Line (Bridging)	Up to 15,000 ohms	Use 15095A Line Bridging Transformer
High-Level Line (Matching)	150 or 600 ohms	Use 15356A Line Matching Transformer

for each 1599A. The 15095A Line Bridging Transformer accessories are used for the required input interface.

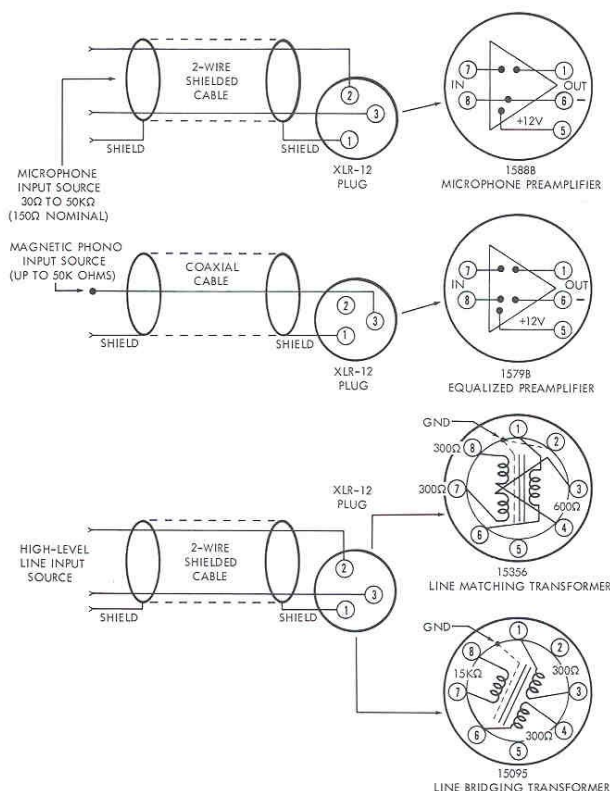


Figure 7. Input Wiring for Various Applications



EACH 1599A MIXER EXTENDER PROVIDES 6 INPUTS. UP TO 30 INPUT CHANNELS ARE AVAILABLE WITH 5 PARALLEL UNITS.

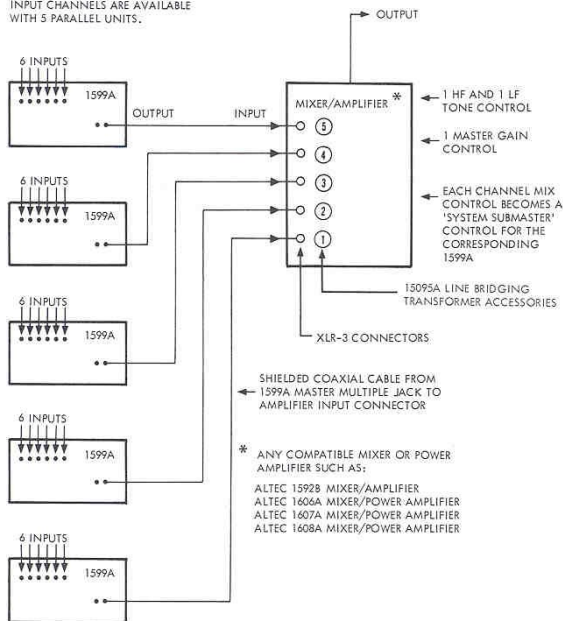


Figure 8. Individually Submastered 1599A Mixer Extender Accessories

### Output Connections

Transformer-isolated output connections are provided at the OUTPUT terminal board on the chassis (see Figure 5) for a load impedance of 150 or 600 ohms. Figure 9 shows wiring connections. Jumpers are connected between terminals 1 and 2, 3 and 4 for 150 ohms and between terminals 2 and 3 for 600 ohms.

#### IMPORTANT OPERATING NOTE

Before connecting the 1592B into a system read carefully 'NORMAL GAIN SETTINGS' on page 10: Intrasystem gain factors must accommodate nominal output level (+18 dB) of the 1592B.

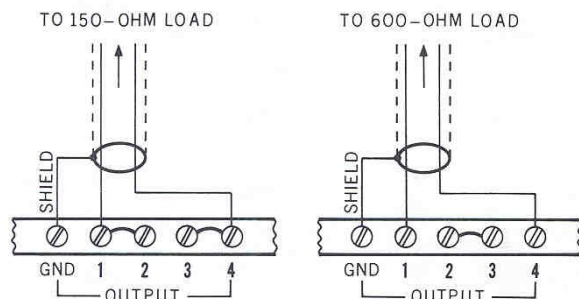


Figure 9. Output Wiring Connections

### Monitor Output Connections

The MONITOR jack on the front panel (see cover photo) accepts a standard phone plug. Headphones with an impedance of 600 ohms are recommended for monitoring program material, but any high-impedance headphones are satisfactory. Maximum monitor output level is +12 dBm into a 600-ohm load.

Monitor output is also available at the OUTPUT terminal board, at the MON + and - terminals. These terminals permit permanent installation of an appropriate monitoring system, such as the ALTEC 1598A Amplified Monitor Speaker Panel. Output impedance of the MON + and - terminals is 600 ohms.

### Master Multiple Connections

Two MASTER MULTIPLE jacks (see Figure 5), independent of all gain controls, enable combining additional amplifiers or mixers into one system. Two or more 1592B Mixer/Amplifiers may be combined as shown in Figure 10A. A single coaxial cable with pin tip phone plugs connects each amplifier. Either MASTER MULTIPLE jack may be used for interconnection.

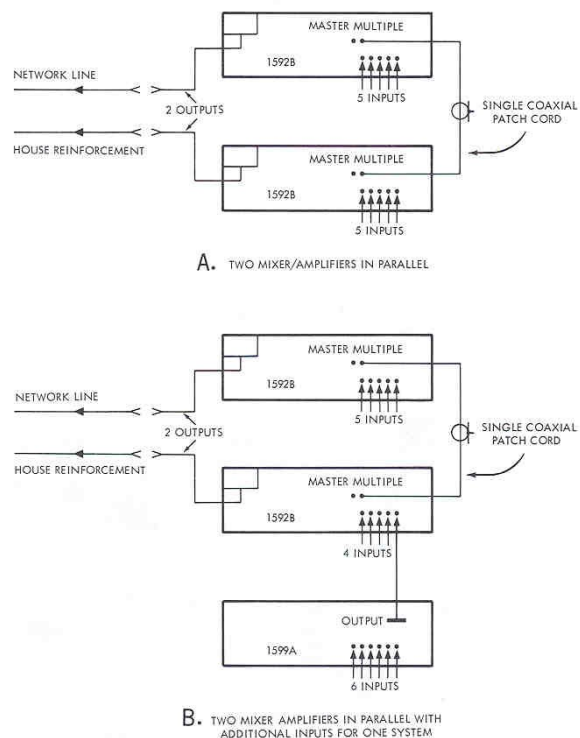


Figure 10. Typical Multiple Coupling of Mixer/Amplifiers

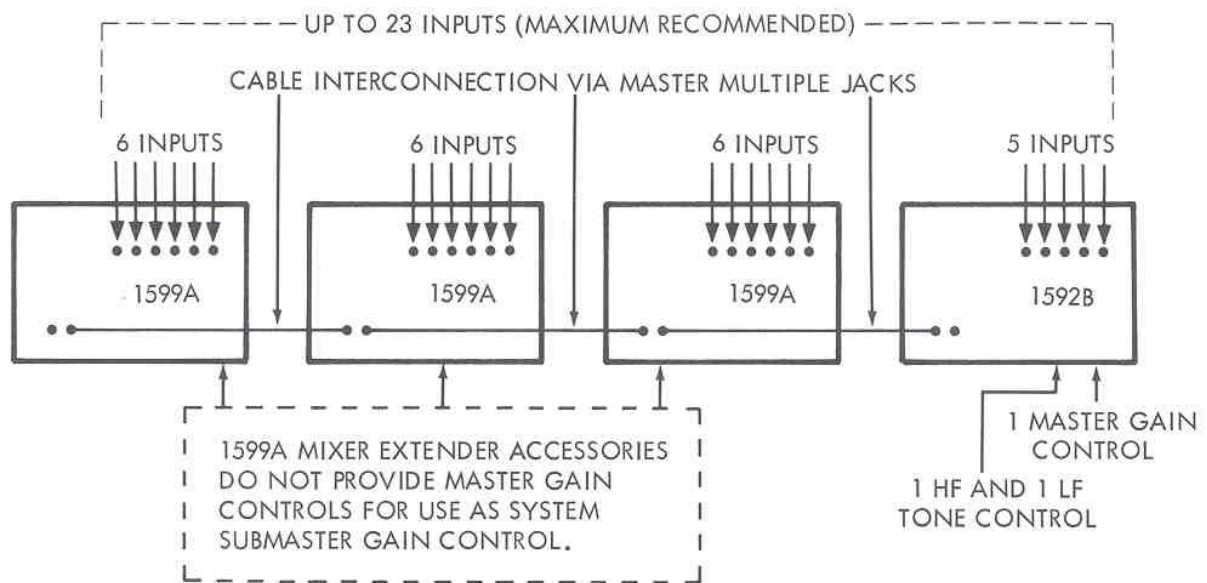


Figure 11. Parallel Multiple Connection of 1599A Mixer Extender Accessories

One or more 1599A Mixer Extender accessories also may be connected to add six additional input channels to the system, each additional channel having separate gain controls (see Figure 10B). All inputs of such a system appear at the output of each 1592B amplifier; the output of each amplifier is then adjustable for a separate application.

A single 1592B having as many as 23 inputs may be connected as shown in Figure 11. Three 1599A Mixer Extender accessories are connected via the MASTER MULTIPLE jacks.

Any combination of the two methods of interconnection (Figures 8 and 11) may be connected as a hybrid system, adding as many inputs as per-

mitted by overall system performance (gain requirements).

## OPERATION

### CONTROLS AND INDICATORS

All normal operating controls are located on the front panel (see Figure 12). Controls and functions are given in Table II.

### WRITE-IN BLOCKS

The write-in blocks above the six gain controls may be marked with a **soft** lead pencil to identify use. To remove writing, use a damp cloth — never a pencil eraser or other abrasive material.



Figure 12. Controls and Features



Table II. Control and Indicator Functions

Name	Function/Description (see Figure 12)
MASTER control	Provides simultaneous attenuation for all input channels. Continuously variable potentiometer, graduated from 0 dBm to $\infty$ . Turn clockwise (cw) to increase gain.
MIX 1 – 5 controls	Provide attenuation for corresponding input channels. Continuously variable potentiometers, graduated from 0 dBm to $\infty$ . Turn clockwise to increase gain. The MIX 1 control also adjusts test tone level.
GAIN switches	Reduce gain –10 dB or –20 dB on corresponding input channels to allow use of high-output microphones without introducing distortion (when using 1588B Microphone Preamplifier accessory). Place switches to 0 dB for other applications such as use of 15095A or 15356A transformers. Turn associated MIX control counterclockwise (ccw) to $\infty$ before switching to avoid system <i>pops</i> .
NORMAL-BRIGHT switch	Raises response in the 3 to 5 kHz range to improve articulation (BRIGHT position).
TONE ON-OFF switch	Provides 1000 Hz tone to aid in setting system levels, adjusting compression thresholds and checking multiple speaker arrangements. Test tone level is adjusted with the MIX 1 control.
MON VOL control and MONITOR jack	Adjusts monitor output level. Continuously variable potentiometer, graduated from 0 to 10. Turn clockwise to increase level. MONITOR jack accepts standard phone plug. Headphones with 600 ohms impedance are recommended, but any high-impedance headphones give satisfactory operation.
RED overload indicator	Shows overload of amplifier circuitry. Red light-emitting diode, located on front panel above meter area. If continuous overloading prevails, appropriate MIX gain controls should be adjusted until indicator remains extinguished.
VU RANGE switch	Selects full-scale range of VU meter. Selectable positions of OFF, +8 and +18 VU.
VU METER	Displays mixer/amplifier output in VU. Meter is illuminated when power is on.
HF tone control	Provides boost or attenuation in treble response. Continuously variable potentiometer. Normal or flat response at zero setting. Turn clockwise to boost treble response.
LF tone control	Provides boost or attenuation in bass response. Continuously variable potentiometer. Normal or flat response at zero setting. Turn clockwise to boost bass response.
POWER switch	Applies primary power to mixer/amplifier.
TONE CONTROL OUT-IN switch	Disconnects HF and LF tone controls when tone control is inappropriate for application, such as Acousta-Voicing <sup>®</sup> . * Located on back of front panel on tone control PCB (see Figure 4).

\*The exclusive ALTEC Acousta-Voicing process is patented under Pat. No. 3,624,298.



## NORMAL GAIN SETTINGS

For average input signals, the MASTER gain control should be set to approximately 14 dB. This allows maximum flexibility in setting individual mixer gain controls (MIX 1, MIX 2, MIX 3, MIX 4 and MIX 5) to the desired operating level for respective input channels. If one input is unusually low, it may be necessary to increase the MASTER gain control setting and operate the other inputs at a proportionately lower gain setting. A recommended procedure is to divide the losses equally between the MASTER and MIX gain controls.

When the output of the 1592B feeds high-gain power amplifiers such as the ALTEC 1590B or 1594B, the gain controls should be set to preserve an optimum signal-to-noise ratio. The average signal through the 1592B should be set with the VU METER at the +18 VU range (using program material), then the gain control(s) of the power amplifier(s) should be set for optimum audience listening level.

Compressor amplifiers connected between the 1592B and other amplifiers may provide excessive gain, which must be attenuated by the following recommended procedure:

- Step 1. Place MIX and MASTER gain controls of the 1592B at *normal* gain settings.
- Step 2. With a typical signal feeding into the 1592B, adjust compressor amplifier for desired compression. If compressor is not equipped with an input gain control, an attenuator or fixed pad must be connected at the compressor input.
- Step 3. Set gain control of power amplifier for desired loudspeaker level.

Excessive gain **MUST** be attenuated at the points described above and **NOT** at the 1592B MIX and MASTER gain controls, or undesirable noise may be introduced into the sound system.

## VU METER

The 1592B output is indicated in dBm by the VU meter when the VU RANGE switch is moved from OFF to one of the two range positions. The meter is calibrated from -20 VU to +3 VU; these calibrations are equal to dBm indications.

A value in VU (also dBm) for the 1592B output is obtained by adding the range setting to the meter indication as follows:

Range Setting	Meter Indication	1592B Output
+ 8	-2	+ 6 dBm
+ 8	0	+ 8 dBm
+18	0	+18 dBm
+18	+2	+20 dBm

VU meter indications are approximately 10 dB below peak output of voice and music program material because the meter cannot follow such rapidly changing signal peaks. For an indicated +16 dBm on the meter, the output may be assumed to have peaks of +26 dBm.

## SERVICE

If a malfunction occurs, service should be performed by an ALTEC Qualified Service Representative. For factory service, ship the 1592B prepaid to Customer Service, ALTEC, 1515 South Manchester Avenue, Anaheim, California 92803. For additional information or technical assistance, call (714) 774-2900, or TWX 910-591-1142.

## ACCESS

Remove the four screws securing the front panel, then open and lower the hinged front panel to gain access to the chassis interior.

## FUSE REPLACEMENT

The battery power fuse is located on the rear of the chassis. If replacement is required, determine and correct any cause of failure before replacing fuse. Install an identical fuse (see **PARTS LIST**) by unscrewing fuse holder, replacing fuse and resealing fuse holder.

The primary ac power line is not fused because of the low current drain of the power transformer.

## PILOT LAMP REPLACEMENT

If pilot lamps DS1 and DS2 fail, open and lower the hinged front panel. The lamps are mounted with spring clips. Squeeze the clip of the inoperative lamp and lift the lamp assembly from the mounting bracket. Verify type of lamp from the **PARTS LIST**. Replace with identical lamp, then replace the lamp assembly in the mounting bracket, close the hinged front panel and secure with the four screws previously removed.

## REPLACEMENT OF OVERLOAD INDICATOR

If the RED overload indicator fails, open and lower the hinged front panel. Remove the indicator from the clip ring mounting by pressing it through from the front side of the panel. Unsolder and replace with an identical diode (see **PARTS LIST**), observing polarity. Press the diode into the clip ring mounting, then close the front panel and secure with the four screws previously removed.

## REPLACEMENT OF POWER AMPLIFIER PRINTED CIRCUIT BOARD (PCB)

- Step 1. Remove four screws securing front panel, open and lower panel.
- Step 2. Remove two plug connectors from PCB.
- Step 3. Remove four screws securing PCB to chassis.
- Step 4. Install replacement (or repaired) PCB, securing with four screws removed in Step 3.
- Step 5. Carefully fit two plug-in connectors onto pin connectors of PCB.
- Step 6. Close front panel and secure with four screws previously removed.

## REPLACEMENT OF TONE CONTROL AND TONE GENERATOR PCB

- Step 1. Loosen set screws and remove knobs from LF and HF tone controls. Remove nuts and washers from sleeves of these controls.
- Step 2. Remove four screws securing front panel, open and lower panel.
- Step 3. Lift PCB from front panel and note soldered connections.
- Step 4. Unsolder connecting leads from PCB, tagging leads as removed.
- Step 5. Solder leads to replacement (or repaired) PCB in accordance with tagging of Step 4. If necessary, refer to schematic diagram of Figure 15.
- Step 6. Place PCB in proper position and secure LF and HF tone controls with washers and nuts removed in Step 1.

- Step 7. Close front panel and secure with screws previously removed. Install knobs on LF and HF tone controls and tighten set screws.

## RECOMMENDED SERVICE TECHNIQUES

If systematic troubleshooting indicates parts replacement is needed, observe the following precautions:

### Orientation of Solid-State Components

Solid-state components are packaged in various case sizes and types with various lead orientations (see Figure 13). 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.

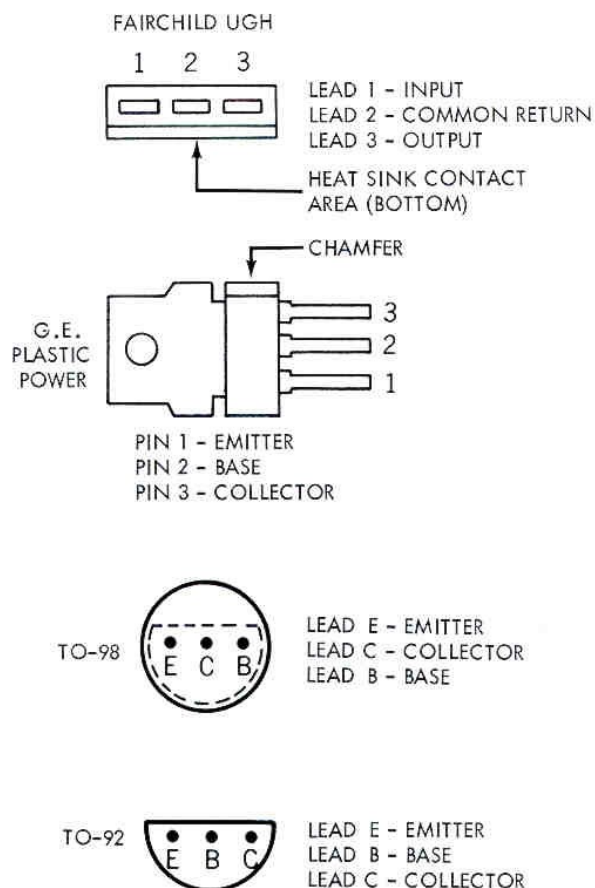


Figure 13. Typical Solid-State Component Configurations



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 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 oriented.

### Replacing Power Transistors

Be sure contact area on both sides of heat sink are coated with silicone grease or fluid and clip-on heat sink is properly installed.

### Replacing Voltage Regulator (IC)

Be sure no grit or metal particles are between replacement IC and heat sink. Verify heat sink contact area is coated with silicone grease or fluid and that mounting screw is tight.

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

### Replacing PCB Components

Component locations on the main chassis are shown in Figure 14. The main chassis schematic is shown in Figure 15. Component locations on the PCB's are shown in Figures 16 and 18. PCB schematics are shown in Figures 17 and 19. Before removing PCB 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 iron on component lead on **conductor side** of PCB and pull out lead. Avoid overheating the conductor.

#### CAUTION

The conductor on the PCB is a metal surface plated with solder and laminated to the board. Too much pressure or overheating may lift the conductor from the board.

3. If component is faulty or damaged, clip leads close to component and then unsolder leads from board. Withdraw leads from **component side**.
4. Clear solder from circuit board holes before inserting leads of new component. Heat solder remaining in hole, remove iron and quickly insert a pointed nonmetallic object, such as a toothpick, from **conductor side**.
5. Shape new component leads and clip to proper length. Lead shape should provide stress relief for component. Insert leads in holes, observing same polarity or orientation of removed component. 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 section of good conducting wire along the damaged area and seal with epoxy.



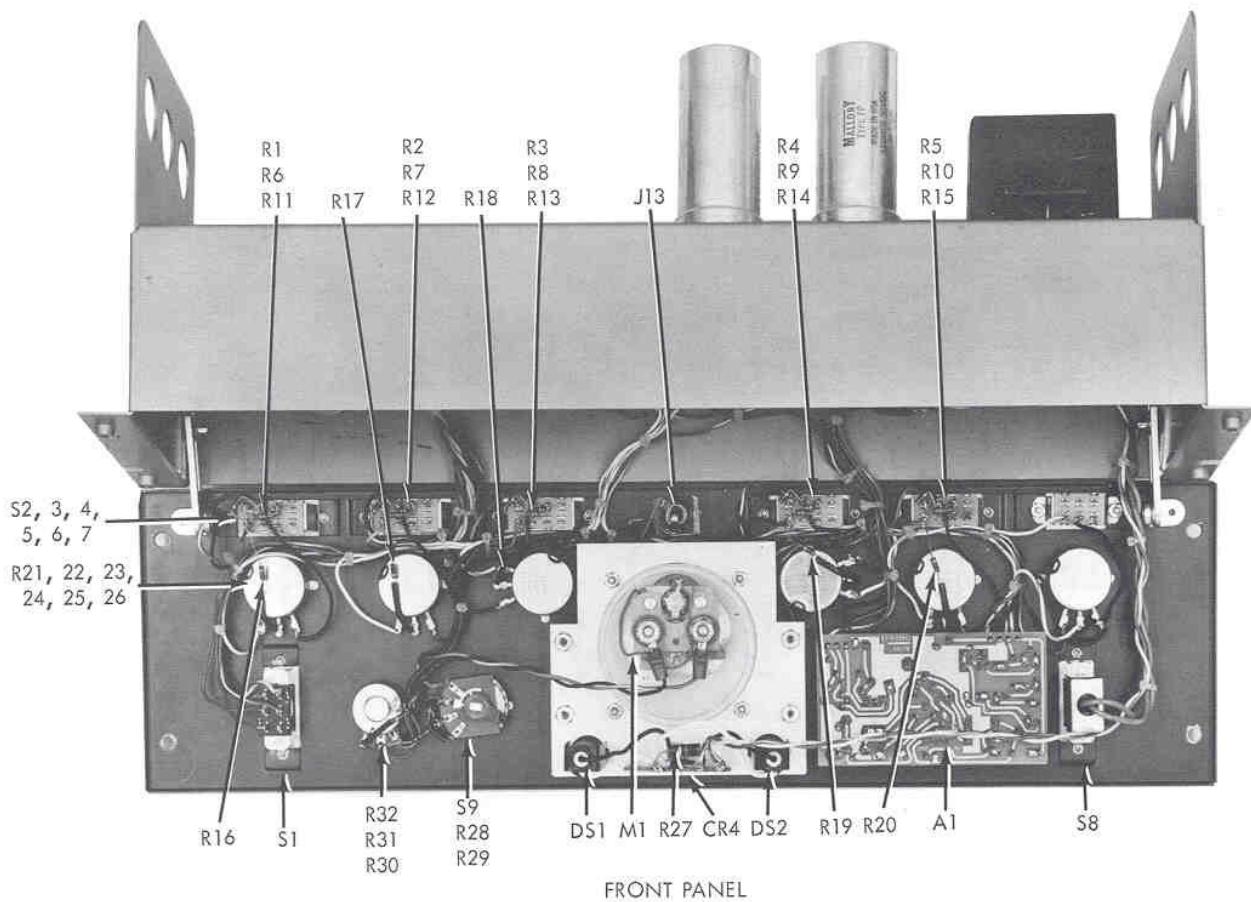
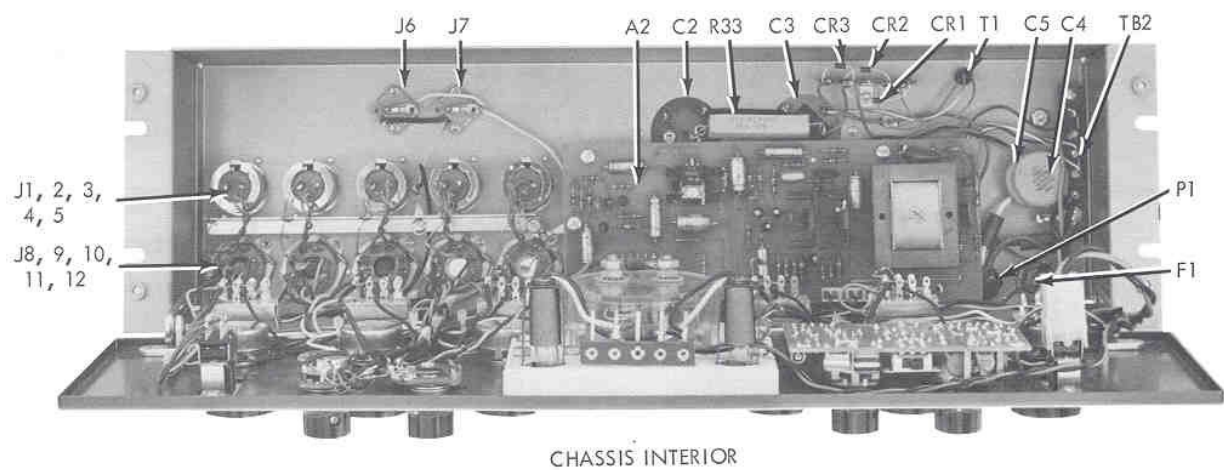


Figure 14. Chassis Components







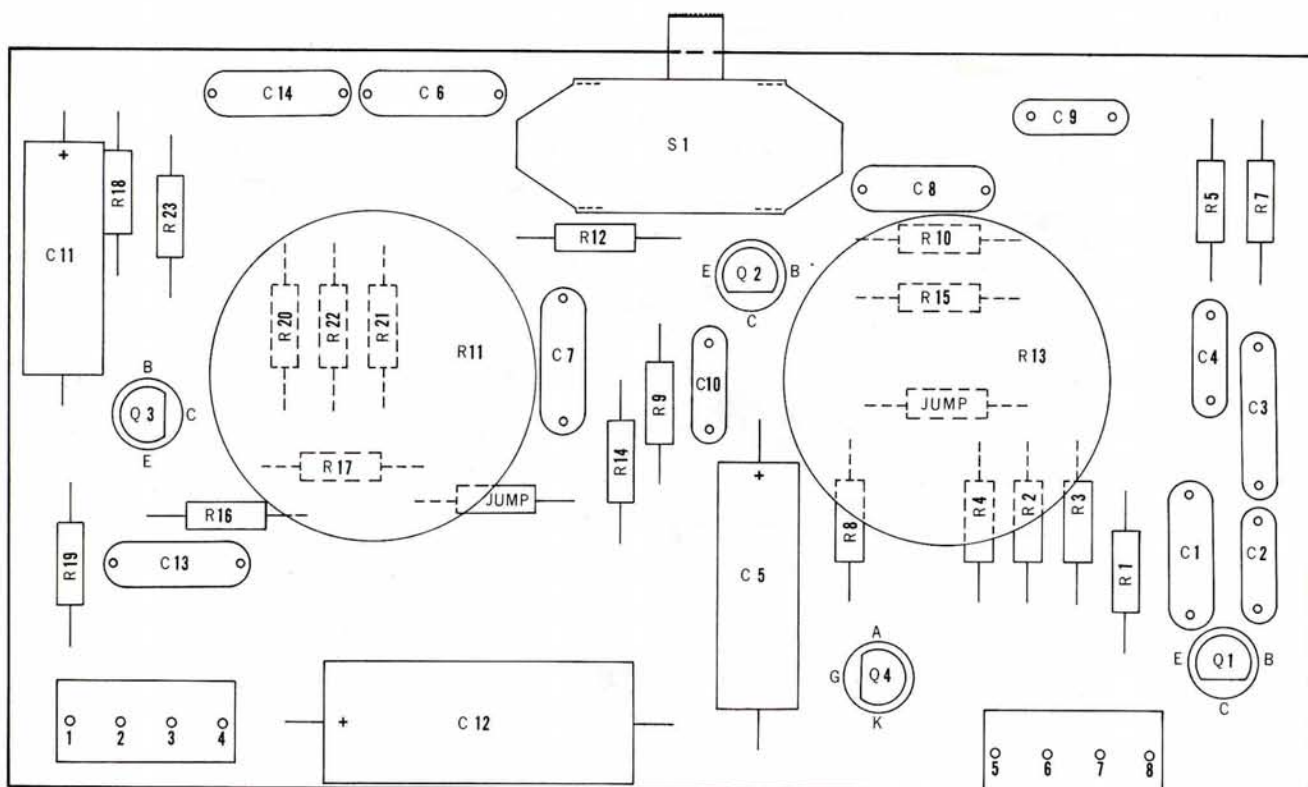


Figure 18. Electronic Part Locations (3D482-1), Tone Control and Tone Generator PCB Assembly

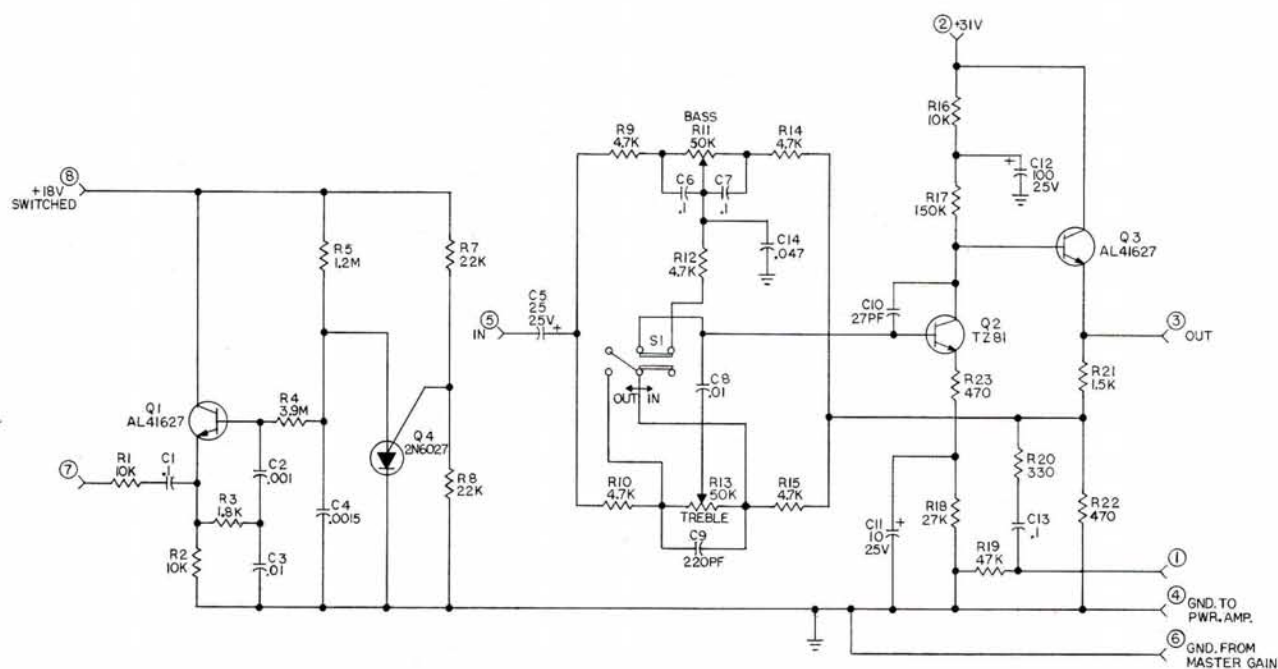


Figure 19. Schematic (3C477-2), Tone Control and Tone Generator PCB Assembly

## PARTS LIST

### MAIN CHASSIS

Reference Designator	Ordering Number	Name and Description	Reference Designator	Ordering Number	Name and Description
A1	27-01-042695-01	PCB assembly, tone control and tone generator	P1	60-06-012636-03	Cord, 18 gauge, 3-conductor, 6 ft., w/plug
A2	27-01-042690-03	PCB assembly, power amplifier	R1,2,3,4,5	47-01-102103-01	Res., 11K $\Omega$ $\pm$ 5%, 1/4W
C1	15-02-100110-01	Cap., 0.1 $\mu$ F, 100V	R6,7,8,9,10	47-01-102187-01	Res., 100K $\Omega$ $\pm$ 10%, 1/4W
C2	15-01-114352-01	Cap., 4000 $\mu$ F, 50V	R11 through R20,31	47-01-102163-01	Res., 1K $\Omega$ $\pm$ 10%, 1/4W
C3	15-01-109683-01	Cap., 2000 $\mu$ F, 50V	R21,22,23,24,25	47-06-042485-02	Pot., 1M $\Omega$
C4, 5	15-02-100089-01	Cap., 0.01 $\mu$ F $\pm$ 20%, 1400V	R26	47-06-013600-01	Pot., 750 $\Omega$ $\pm$ 20%
C6,7,8,9,10	15-02-107454-01	Cap., 100 pF $\pm$ 10%, 100V	R27	47-01-100671-01	Res., 100 $\Omega$ $\pm$ 10%, 2W
CR1,2,3	48-02-042787-01	Diode, TA10, 1A, 400V	R28	47-01-102086-01	Res., 2.2K $\Omega$ $\pm$ 5%, 1/4W
CR4	39-01-112201-01	Lamp, 20mA, 1.8V	R29	47-01-102102-01	Res., 10K $\Omega$ $\pm$ 5%, 1/4W
DS1,2	39-01-100784-01	Lamp, 40mA, 28V	R30	47-01-102098-01	Res., 6.8K $\Omega$ $\pm$ 5%, 1/4W
F1	51-04-109448-01	Fuse, 1/2A, 3AG, SLO-BLO	R32	47-06-014574-05	Pot., 750 $\Omega$ $\pm$ 30%
J1,2,3,4,5	21-02-113172-01	Receptacle, 3-pin, microphone type	R33	47-02-107365-01	Res., 10 $\Omega$ $\pm$ 10%, 10W
J6,7	21-01-100508-01	Jack, phone, insulated sleeve	S1,8	51-02-113178-01	Switch, DPDT
J8,9,10,11,12	21-02-100973-01	Socket, octal	S2,3,4,5,6	51-02-119053-01	Switch, 3P3T, rocker
J13	21-01-107505-01	Jack, single phone, insulated sleeve	S7	51-02-107498-01	Switch, DPDT
L1,2	56-01-044110-01	Choke, ferrite bead	S9	51-01-118710-03	Switch, rotary, 3-position
M1	29-01-042486-05	Meter assembly, VU	T1	56-08-007562-01	Transformer, power
			TB1	21-04-101058-01	Terminal board, 9-terminal
			TB2	21-04-101013-01	Terminal board, 5-terminal

## PARTS LIST (continued)

## POWER AMPLIFIER

Reference Designator	Ordering Number	Name and Description	Reference Designator	Ordering Number	Name and Description
C1,3	15-01-107452-01	Cap., 10 $\mu$ F, 50V	R4,19,21,22	47-01-102102-01	Res., 10K $\Omega$ $\pm$ 5%, 1/4W
C2	15-02-107455-01	Cap., 47 pF $\pm$ 10%, 100V	R5,23,26	47-01-102159-01	Res., 470 $\Omega$ $\pm$ 10%, 1/4W
C4,12,13	15-01-100236-01	Cap., 50 $\mu$ F, 25V	R6	47-01-102154-01	Res., 180 $\Omega$ $\pm$ 10%, 1/4W
C6	15-02-107047-01	Cap., 0.0033 $\mu$ F $\pm$ 20%, 100V	R7	47-01-102145-01	Res., 33 $\Omega$ $\pm$ 10%, 1/4W
C7,10	15-01-107495-01	Cap., 25 $\mu$ F $\pm$ 10%, 25V	R10	47-01-102157-01	Res., 330 $\Omega$ $\pm$ 10%, 1/4W
C9	15-02-107454-01	Cap., 100 pF $\pm$ 10%, 100V	R11	47-01-102175-01	Res., 10K $\Omega$ $\pm$ 10%, 1/4W
C11	15-06-109103-01	Cap., 0.047 $\mu$ F $\pm$ 10%, 250V	R12	47-01-102140-01	Res., 10 $\Omega$ $\pm$ 10%, 1/4W
C15	15-01-107462-02	Cap., 1 $\mu$ F, 25V	R13	47-01-102078-01	Res., 1K $\Omega$ $\pm$ 5%, 1/4W
C16	15-01-107485-01	Cap., 1000 $\mu$ F, 25V	R14	47-01-102071-01	Res., 510 $\Omega$ $\pm$ 5%, 1/4W
CR1,2	48-01-107017-01	Diode, 1N456A, 25V, 100 mA	R15,17	47-01-102188-01	Res., 150K $\Omega$ $\pm$ 10%, 1/4W
IC1	17-01-118679-01	Integrated circuit UGH7818393, 18V, regulated	R16	47-01-102155-01	Res., 220 $\Omega$ $\pm$ 10%, 1/4W
Q1,2	48-03-109714-01	Transistor, TZ81	R18	47-01-102179-01	Res., 22K $\Omega$ $\pm$ 10%, 1/4W
Q3	48-03-108557-02	Transistor, 2N5367, 0.36W, 40V, selected	R20	47-01-102176-01	Res., 12K $\Omega$ $\pm$ 10%, 1/4W
Q5,6,7,8,12	48-03-101098-03	Transistor, 2N2712, 100mA 25V (selected)	R24,25	47-01-102162-01	Res., 820 $\Omega$ $\pm$ 10%, 1/4W
Q9,10	48-03-119046-01	Transistor, D43C7	R27,29,36	47-01-102167-01	Res., 2.2K $\Omega$ $\pm$ 10%, 1/4W
Q11	48-03-119140-01	Transistor, 2N5308, low noise (selected)	R28,30	47-01-102330-01	Res., 10 $\Omega$ $\pm$ 10%, 1/2W
Q13	48-03-112934-01	Transistor, uni-junction, 2N6027	R31	47-01-102124-01	Res., 75K $\Omega$ $\pm$ 5%, 1/4W
R1	47-01-102190-01	Res., 180K $\Omega$ $\pm$ 10%, 1/4W	R33	47-01-102128-01	Res., 110K $\Omega$ $\pm$ 5%, 1/4W
R2	47-01-102127-01	Res., 100K $\Omega$ $\pm$ 5%, 1/4W	R34	47-01-102177-01	Res., 15K $\Omega$ $\pm$ 10%, 1/4W
R3	47-01-102075-01	Res., 750 $\Omega$ $\pm$ 5%, 1/4W	R35	47-01-102187-01	Res., 100K $\Omega$ $\pm$ 10%, 1/4W
			R37,38,39,40,41,42,43,44	47-01-102101-01	Res., 9.1K $\Omega$ $\pm$ 5%, 1/4W
			R45	47-01-102161-01	Res., 680 $\Omega$ $\pm$ 10%, 1/4W
			T1	56-07-016762-01	Transformer, output



PARTS LIST (continued)

TONE CONTROL AND TONE GENERATOR

Reference Designator	Ordering Number	Name and Description
C1,6,7,13	15-06-100311-11	Cap., 0.1 $\mu$ F $\pm$ 20%, 250V
C2	15-02-100304-01	Cap., 0.001 $\mu$ F $\pm$ 10%, 100V
C3,8	15-06-107005-01	Cap., 0.01 $\mu$ F $\pm$ 5%, 200V
C4	15-02-100306-01	Cap., 0.0015 $\mu$ F $\pm$ 10%, 100V
C5	15-01-107495-01	Cap., 25 $\mu$ F $\pm$ 10%, 25V
C9	15-02-107470-01	Cap., 220 pF $\pm$ 10%, 100V
C10	15-02-108584-01	Cap., 27 pF $\pm$ 10%, 500V
C11	15-01-107452-01	Cap., 10 $\mu$ F, 50V
C12	15-01-108236-01	Cap., 100 $\mu$ F, 35V
C14	15-06-109103-01	Cap., 0.047 $\mu$ F $\pm$ 10%, 250V
Q1,3	48-03-119140-02	Transistor, 2N5308 (selected)
Q2	48-03-109714-01	Transistor, TZ81
Q4	48-03-112934-01	Transistor, 2N6027, uni- junction
R1,2,16	47-01-102175-01	Res., 10K $\Omega$ $\pm$ 10%, 1/4W

Reference Designator	Ordering Number	Name and Description
R3	47-01-102166-01	Res., 1.8K $\Omega$ $\pm$ 10%, 1/4W
R4	47-01-108931-01	Res., 3.9M $\Omega$ $\pm$ 10%, 1/4W
R5	47-01-108933-01	Res., 1.2M $\Omega$ $\pm$ 10%, 1/4W
R7,8	47-01-102179-01	Res., 22K $\Omega$ $\pm$ 10%, 1/4W
R9,10,12, 14,15	47-01-102171-01	Res., 4.7K $\Omega$ $\pm$ 10%, 1/4W
R11,13	47-06-107492-02	Pot., 50K $\Omega$ $\pm$ 30%
R17	47-01-102189-01	Res., 150K $\Omega$ $\pm$ 10%, 1/4W
R18	47-01-102180-01	Res., 27K $\Omega$ $\pm$ 10%, 1/4W
R19	47-01-102183-01	Res., 47K $\Omega$ $\pm$ 10%, 1/4W
R20	47-01-102157-01	Res., 330 $\Omega$ $\pm$ 10%, 1/4W
R21	47-01-102165-01	Res., 1.5K $\Omega$ $\pm$ 10%, 1/4W
R22,23	47-01-102159-01	Res., 470 $\Omega$ $\pm$ 10%, 1/4W
S1	51-02-042697-01	Switch, DPDT, slide