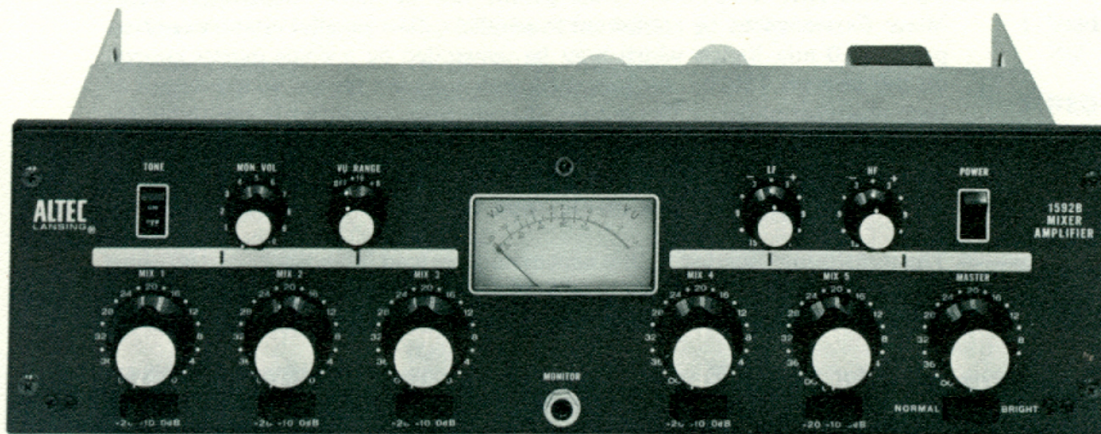


1592B Mixer/Amplifier

1592B



The ALTEC 1592B Mixer/Amplifier is a general-purpose mixer preamplifier that may be used with a wide selection of ALTEC power amplifiers. It controls and mixes up to five independent input signals and delivers up to +30 dBm of output power to associated power amplifiers.

Every Input Can Accommodate:
Microphones,
Turntables,
Tuners or
Tape Machines

— Each input has an associated octal socket for the selected accessory module: The 1579B Equalized Preamplifier for magnetic phono pickup, the 1588B Microphone Preamplifier for balanced microphone inputs, the 15095A Line Bridging Transformer for high-level balanced-line bridging inputs and the 15356 Line Matching Transformer for high-level balanced-line matched inputs.

Easy to Operate

— All controls are on the front panel. A MIX gain control is provided for each channel and a MASTER gain control adjusts the output level of all channels simultaneously. A NORMAL-BRIGHT switch, associated with the MASTER gain control, provides a rise in response in the 3 to 5 kHz region for improved articulation. Each input has a 3-position GAIN switch to reduce input gain 0 dB, -10 dB or -20 dB. These switches allow high-output microphones to be used with the 1588B module without introducing distortion. Independent LF and HF tone controls adjust bass and treble response at the output. The tone controls may be bypassed if fixed equalization is used at some other point in the system by using the TONE CONTROL OUT-IN switch, located behind the front panel. A test tone generator with test TONE ON-OFF switch provides a 1000 Hz signal to aid in setting system levels, adjusting compressor thresholds and checking multiple speaker arrangements. The MIX 1 control adjusts test tone level. The MON VOL control adjusts monitor volume. The VU meter assembly includes a range selector switch that allows 0 VU indication to equal +8 dBm or +18 dBm.

ALTEC

A DIVISION OF ALTEC CORPORATION

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

ALTEC 1592B

- Optional Mixer Extender Available** — Two MASTER MULTIPLE jacks permit two or more 1592B's 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.
- Transformer-Isolated Output** — The transformer-isolated output accommodates load impedances of 150 ohms and 600 ohms with levels up to +30 dBm. A MONITOR output terminates at a standard phono jack on the front panel and also at the rear of the chassis.
- AC or Battery Operation** — Power for the 1592B may be obtained from any 120/240V ac, 50/60 Hz line. Auxiliary 24/28V dc battery power may be connected to the battery terminals on the rear of the chassis. Battery minus (-) is ground. If ac power fails, transfer to dc power is instantaneous, automatic and silent.
- Solid-State Silicon Circuitry** — Solid-state silicon circuitry guarantees long life and low power consumption.
- Rugged Construction, Easy Installation** — The 1592B is assembled on a 19-inch chassis that occupies 5 $\frac{3}{4}$ " of vertical space in a standard 19-inch equipment rack. The front panel is hinged and can be opened for rapid access to the chassis interior. Write-in blocks for channel identification are provided on the front panel. Electrical connections and selected plug-in accessory modules are conveniently installed on the rear of the chassis. Five XLR-type receptacles are provided for input connections. The terminal board provides connections for battery input, amplifier outputs and monitor output.
- Optional Portable Covers** — The 42526 or 42625 Shelf Mount Cover is available for shelf-mounting the 1592B.

SPECIFICATIONS

Type:	5-channel solid-state mixer/amplifier with provisions for plug-in input accessory modules	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
Gain:	87 dB with 1588B Microphone Preamplifier (gain may be reduced 10 or 20 dB with GAIN switch)	With 15095A Module:	Greater than 20 volts
	38 dB with 15095A Transformer bridging 600-ohm line	Power Output:	+30 dBm at less than 1% THD from 20 Hz to 20 kHz +28 dBm at less than 0.5% THD from 35 Hz to 20 kHz
	54 dB with 15356 Line Matching Transformer		

Total Harmonic Distortion (THD):	Typically less than 0.2%	Indicators:	1 VU meter, -20 to +3 VU
Monitor Output:	18 dB below amplifier output with maximum monitor volume (+12 dBm maximum into 600-ohm load)		1 RED overload indicator (light-emitting diode)
Frequency Response:	±1 dB from 20 Hz to 20 kHz	Connections — Inputs:	5 XLR3-31 receptacles (INPUT1—INPUT5) 5 octal sockets (ACC1 — ACC5, input accessory modules) 2 MASTER MULTIPLE phono pin tip jacks 2 BATT 24/28V, -/+ terminals
Source Impedance —		Outputs:	2 MON -/+ terminals 150/600Ω, terminals GND, 1, 2, 3, 4
With 1579B Module:	Up to 50,000 ohms	Power Requirements:	120/240V ac, 50/60 Hz, 16 watts — or — 24/28V dc at 0.3A. Battery minus (-) is ground.
With 1588B Module:	150/250 ohms nominal (balanced input)	Operating Temperature Range:	Up to 55°C (131°F)
With 15095A Module:	600 to 15,000 ohms (balanced bridging input)	Dimensions:	5¼" H x 19" W x 6½" D
With 15356 Module:	150 or 600 ohms (balanced matched input)	Color:	ALTEC green
Load Impedance:	150 ohms and 600 ohms (transformer-isolated output)	Weight:	10½ pounds
Output Impedance:	120 ohms nominal	Accessories:	ALTEC 1579B Equalized Preamplifier ALTEC 1588B Microphone Preamplifier ALTEC 1599A Mixer Extender ALTEC 12866 Portable Carrying Case ALTEC 15095A Line Bridging Transformer ALTEC 15356 Line Matching Transformer ALTEC 42526 Shelf Mount Cover (7" H) ALTEC 42625 Shelf Mount Cover (8¾" H)
Noise Level (20 kHz Bandwidth):	-124 dBm equivalent input noise (20 Hz to 20 kHz) 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		
Controls:	1 POWER 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 dBm		

NOTE

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

ALTEC 1592B

ARCHITECT'S AND ENGINEER'S SPECIFICATIONS

The mixer amplifier shall be a solid-state device and shall contain a power supply capable of operating from a 120/240V ac, 50/60 Hz line or from a 24/28V dc battery. The power supply shall automatically transfer the power to dc operation if ac power fails. Operating controls shall be on the front panel. Connections shall be on the rear panel. Five octal sockets shall be provided on the rear panel for installation of accessory input modules.

The mixer amplifier shall have five mixer input channels and two phono jacks for master multiple inputs. Each mixer input channel shall be usable with microphone, phono pickup or high-level input devices. Five MIX gain potentiometers and five GAIN range switches shall be provided for these channels. The GAIN switches shall be usable with the microphone preamplifier accessory module and shall provide three selectable attenuation positions of 0 dB, -10 dB and -20 dB to prevent distortion when using high-output microphones. The mixer amplifier shall have terminal board connections for battery input, monitor output and for 150-ohm and 600-ohm output loads. A MONITOR phone jack shall be included on the front panel. A 1000 Hz tone generator and TONE ON-OFF switch shall be provided for testing. The test tone level shall be controlled by the MIX 1 gain control. The following additional controls shall be provided: 1 POWER switch, 1 MASTER gain, 1 MON VOL gain, 1 LF tone, 1 HF tone, 1 NORMAL-BRIGHT switch and 1 TONE CONTROL OUT-IN switch.

The mixer amplifier shall meet the following performance criteria. Gain; 87 dB with microphone preamplifier, 38 dB with line-bridging transformer, 54 dB with line-matching transformer. Input clipping level with microphone preamplifier; -22 dBm with GAIN switch at 0 dB, -10 dBm with GAIN switch at -10 dB, 0 dBm with GAIN switch at -20 dB. Input clipping level with line-bridging transformer, greater than 20 volts. Power output; +30 dBm at less than 1% THD 20 Hz to 20 kHz, +28 dBm at less than 0.5% THD 35 Hz to 20 kHz. Monitor output, 18 dB below amplifier output with maximum monitor volume. Total harmonic distortion, typically less than 0.2%. Frequency response, ± 1 dB 20 Hz to 20 kHz. Source impedance; up to 50,000 ohms with equalized preamplifier, 150/250 ohms nominal with microphone preamplifier, 600 to 15,000 ohms with line-bridging transformer and 150 or 600 ohms with line-matching transformer. Load impedance, 150 ohms and 600 ohms (transformer-isolated output). Nominal output impedance, 120 ohms. Noise level; -124 dBm equivalent input noise 20 Hz to 20 kHz; at least 90 dB below full output with MASTER gain control closed or at least 85 dB below full output with MASTER gain control open and all MIX controls closed.

The VU meter assembly shall meet the following performance criteria. It shall consist of a VU meter and a 3-position switch. Meter scale shall be from -20 VU to +3 VU. Switch positions shall be OFF, +8 dBm and +18 dBm. Switch shall set range of VU meter. Adding range setting to VU meter indication shall give amplifier output in dBm.

The mixer amplifier shall be the ALTEC Model 1592B Mixer Amplifier.

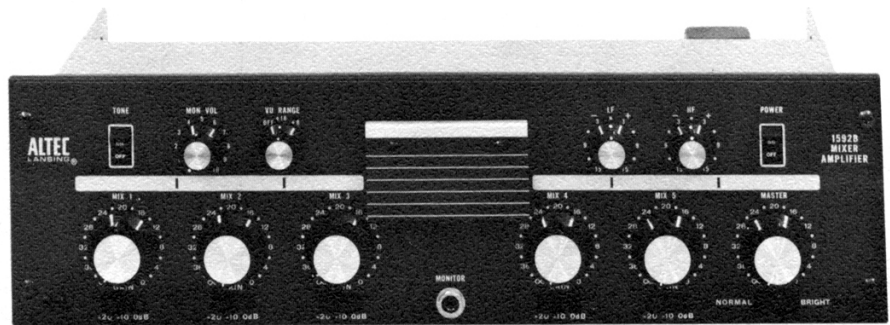
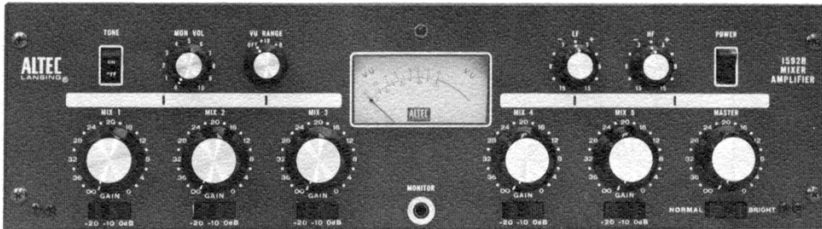
The 1592B shall be furnished with the following ALTEC accessories (select as required and insert quantity):

_____ 1579B Equalized Preamplifier	_____ 15095A Line Bridging Transformer
_____ 1588B Microphone Preamplifier	_____ 15356 Line Matching Transformer
_____ 1599A Mixer Extender	_____ 42526 Shelf Mount Cover
_____ 12866 Portable Carrying Case	_____ 42625 Shelf Mount Cover

ALTEC®

1592B MIXER/AMPLIFIER

OPERATING INSTRUCTIONS



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

NOTICE

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

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

ALTEC®

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

42-02-044127-01
Litho in USA CP-1172-2.5K

DATA CONTENTS

Item	Page
SPECIFICATIONS	3
DESCRIPTION	4
ACCESSORIES	4
<u>Input Modules</u>	4
<u>VU Meter</u>	4
<u>Mixer Extender</u>	4
<u>Shelf Mount Covers</u>	4
<u>Portable Carrying Case</u>	4
INSTALLATION	4
MECHANICAL	4
<u>Rack Mounting</u>	4
<u>Shelf Mounting</u>	4
VENTILATION	4
ELECTRICAL	7
<u>120 Volt, 50/60 Hz Power Connections</u>	7
<u>240 Volt, 50/60 Hz Power Connections</u>	7
<u>Battery Connections</u>	7
<u>Input Connections</u>	8
<u>Output Connections</u>	8
<u>Monitor Output Connections</u>	8
<u>Master Multiple Connections</u>	9
<u>Installing VU Meter Accessory</u>	10
<u>Installing 1592B in 12866 Portable Carrying Case Accessory</u>	10
OPERATION	10
CONTROLS AND INDICATORS	10
WRITE-IN BLOCKS	12
NORMAL GAIN SETTINGS	12
VU METER ACCESSORY	12
SERVICE	12
ACCESS	12
FUSE REPLACEMENT	12
PILOT LAMP REPLACEMENT	12
REPLACEMENT OF OVERLOAD INDICATOR	12
REPLACEMENT OF POWER AMPLIFIER PRINTED CIRCUIT BOARD (PCB)	12
REPLACEMENT OF TONE CONTROL AND TONE GENERATOR PCB	13
RECOMMENDED SERVICE TECHNIQUES	13
<u>Orientation of Solid-State Components</u>	13
<u>Replacing Power Transistors</u>	13
<u>Replacing Voltage Regulator (IC)</u>	13
<u>Testing Transistors</u>	13
<u>Replacing PCB Components</u>	14
<u>Repairing Fractured or Damaged PCB Conductor</u>	14
PARTS LIST	18
MAIN CHASSIS	18
POWER AMPLIFIER	19
TONE CONTROL AND TONE GENERATOR	20

Graphics	Title	Page
Figure 1.	Frequency Versus THD for +8, +28 and +30 dBm Output	5
Figure 2.	Frequency Response and Tone Control Characteristics	5
Figure 3.	1592B with Accessories	6
Figure 4.	Front View with Hinged Panel Open	6
Figure 5.	Rear View	7
Figure 6.	Converting to 240V, 50/60 Hz Power	7
Table I.	Plug-In Accessory Applications for Various Input Sources	8
Figure 7.	Input Wiring for Various Applications	8
Figure 8.	Individually Submastered 1599A Mixer Extender Accessories	8
Figure 9.	Output Wiring Connections	9
Figure 10.	Typical Multiple Coupling of Mixer/Amplifiers	9
Figure 11.	Parallel Multiple Connection of 1599A Mixer Extender Accessories	9
Figure 12.	Installation of VU Meter Accessory	10
Figure 13.	Controls and Features	11
Table II.	Control and Indicator Functions	11
Figure 14.	Typical Solid-State Component Configurations	13
Figure 15.	Chassis Components	14
Figure 16.	Schematic (3D276-1), 1592B Mixer/Amplifier	15
Figure 17.	Electronic Part Locations (3C484-2), Power Amplifier PCB Assembly	16
Figure 18.	Schematic (3D483-3), Power Amplifier PCB Assembly	16
Figure 19.	Electronic Part Locations (3D482-1), Tone Control and Tone Generator PCB Assembly	17
Figure 20.	Schematic (3C477-1), Tone Control and Tone Generator PCB Assembly	17

SPECIFICATIONS

Type:	5-channel solid-state mixer/amplifier with provisions for plug-in input accessory modules
Gain:	87 dB with 1588B Microphone Pre-amplifier (gain may be reduced 10 or 20 dB with GAIN switch) 38 dB with 15095 Transformer bridging 600-ohm line 54 dB with 15356 Line Matching Transformer
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
With 15095 Module:	Greater than 20 volts
Power Output:	+30 dBm at less than 1% THD from 20 Hz to 20 kHz +28 dBm at less than 0.5% THD from 35 Hz to 20 kHz
Total Harmonic Distortion (THD):	Typically less than 0.2%
Monitor Output:	18 dB below amplifier output with maximum monitor volume (+12 dBm maximum into 600-ohm load)
Frequency Response:	±1 dB from 20 Hz to 20 kHz
Source Impedance — With 1579B Module:	Up to 50,000 ohms (unbalanced input)
With 1588B Module:	150/250 ohms nominal (balanced input)
With 15095 Module:	600 to 15,000 ohms (balanced bridging input)
With 15356 Module:	150 or 600 ohms (balanced matched input)
Load Impedance:	150 ohms and 600 ohms (transformer-isolated output)
Output Impedance:	120 ohms nominal
Noise Level (20 kHz Bandwidth):	-124 dBm equivalent input noise 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
Controls:	1 POWER ON-OFF switch 5 MIX gain, continuously variable 1 MASTER gain, continuously variable 1 MON VOL gain, continuously variable

Controls (cont'd):	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
Indicators:	1 VU meter, -20 to +3 VU (optional accessory) 1 RED overload indicator (light-emitting diode)
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
Outputs:	2 MON -/+ terminals 150Ω/600Ω, terminals GND, 1, 2, 3, 4
Power Requirements:	120/240V ac, 50/60 Hz, 16 watts - or - 24/28V dc at 0.3A. Battery minus (-) is ground.
Operating Temperature Range:	Up to 55° C (131° F)
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 Preamplifier ALTEC 1588B Microphone Preamplifier ALTEC 1599A Mixer Extender ALTEC 12866 Portable Carrying Case ALTEC 15095 Line Bridging Transformer ALTEC 15356 Line Matching Transformer ALTEC 42486 VU Meter Assembly ALTEC 42526 Shelf Mount Cover (7"H) ALTEC 42625 Shelf Mount Cover (8-1/4"H)

NOTE

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

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 15095 Line Bridging Transformer and 15356 Line Matching Transformer (see Figure 3). Applications and requirements are summarized in Table I (see **INSTALLATION** section).

VU Meter

An ALTEC 29-01-042486 VU Meter is available for indicating the 1592B output in VU (read as dBm) with ranges of +8 and +18 VU (read as dBm) provided by the VU RANGE switch. The meter is easily installed in a few minutes, with no soldering required.

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 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).

Portable Carrying Case

The ALTEC 12866 Portable Carrying Case is fitted and leather-bound with a luggage type handle. It accommodates the 1592B for a maximum convenience of portability. The lid of the case is divided into compartments for cable and microphone storage.

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.

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.

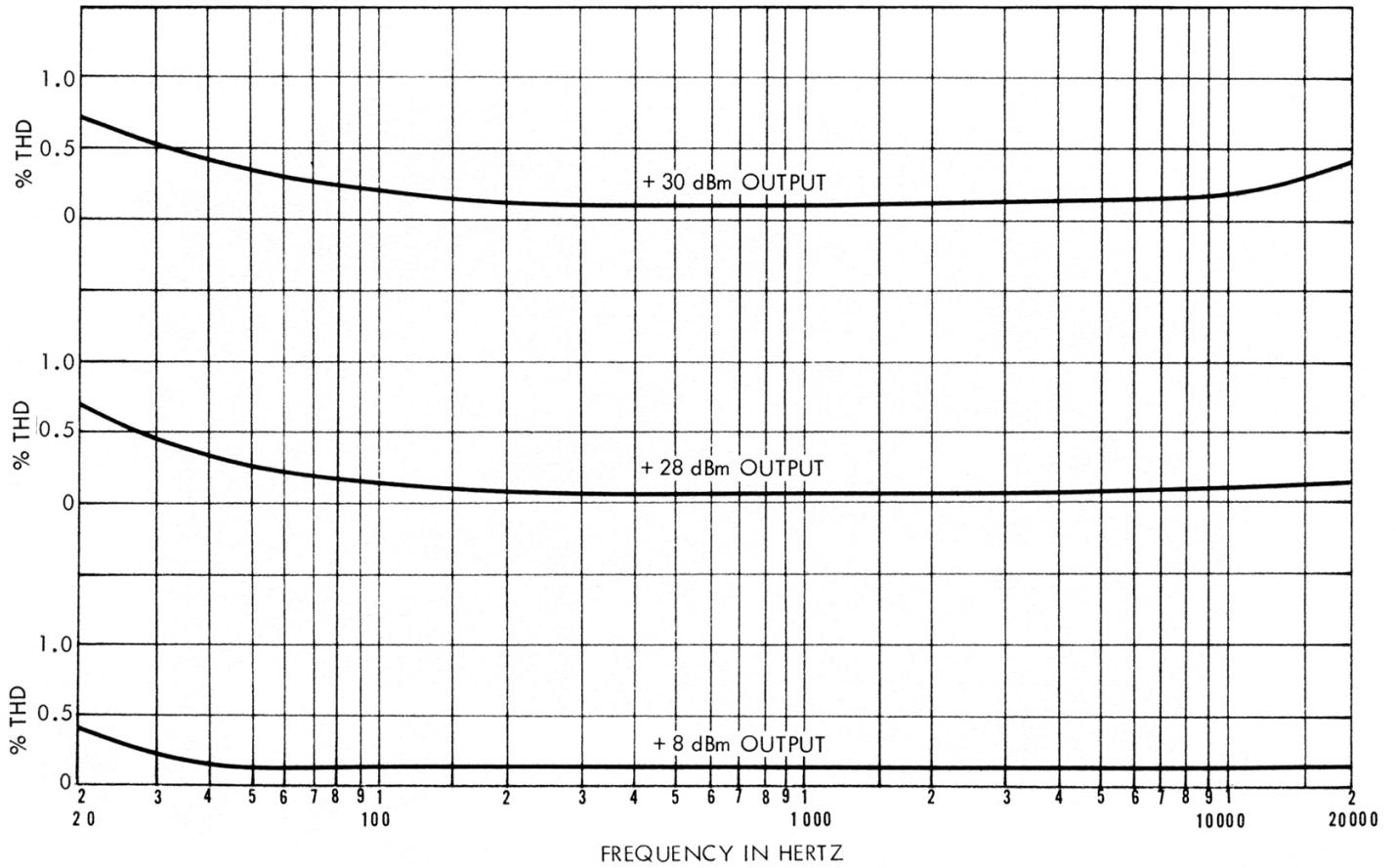


Figure 1. Frequency Versus THD for +8, +28 and +30 dBm Output

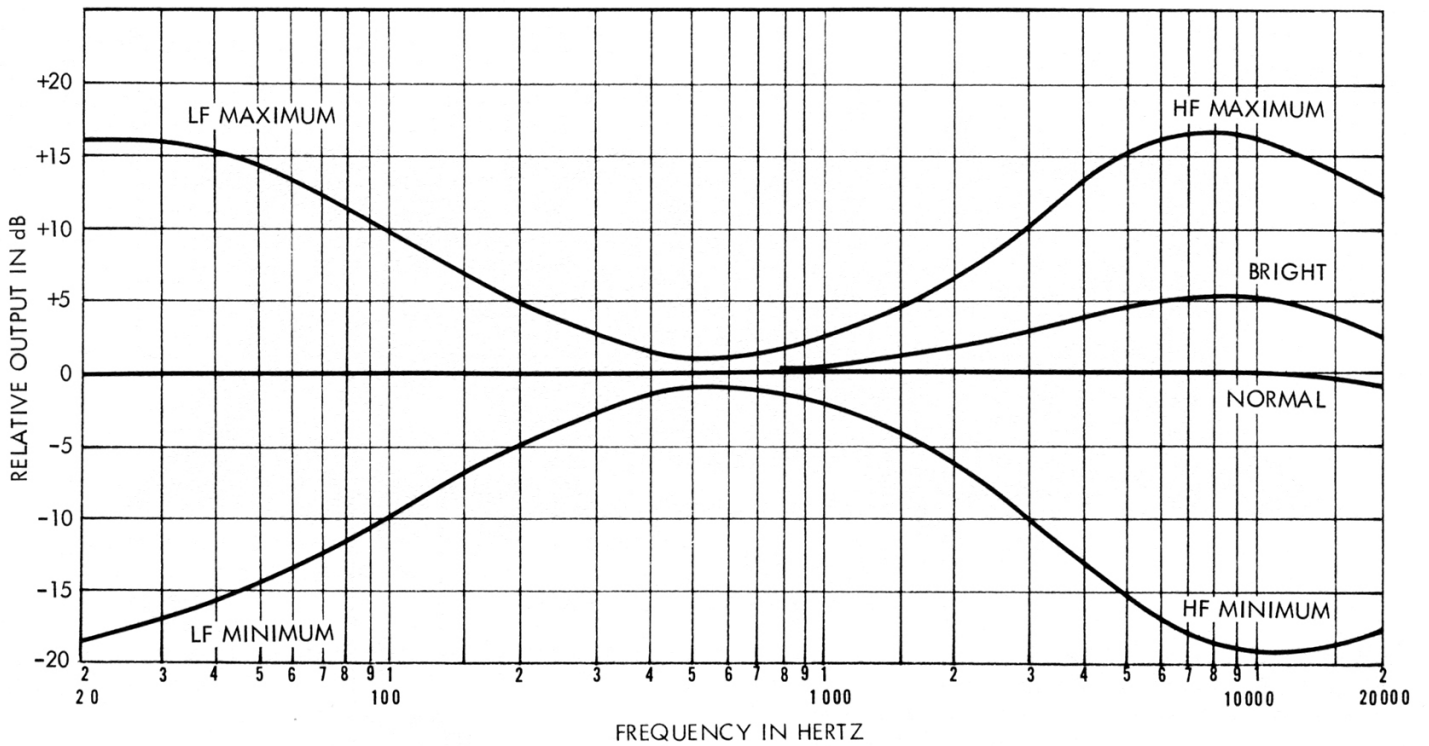


Figure 2. Frequency Response and Tone Control Characteristics

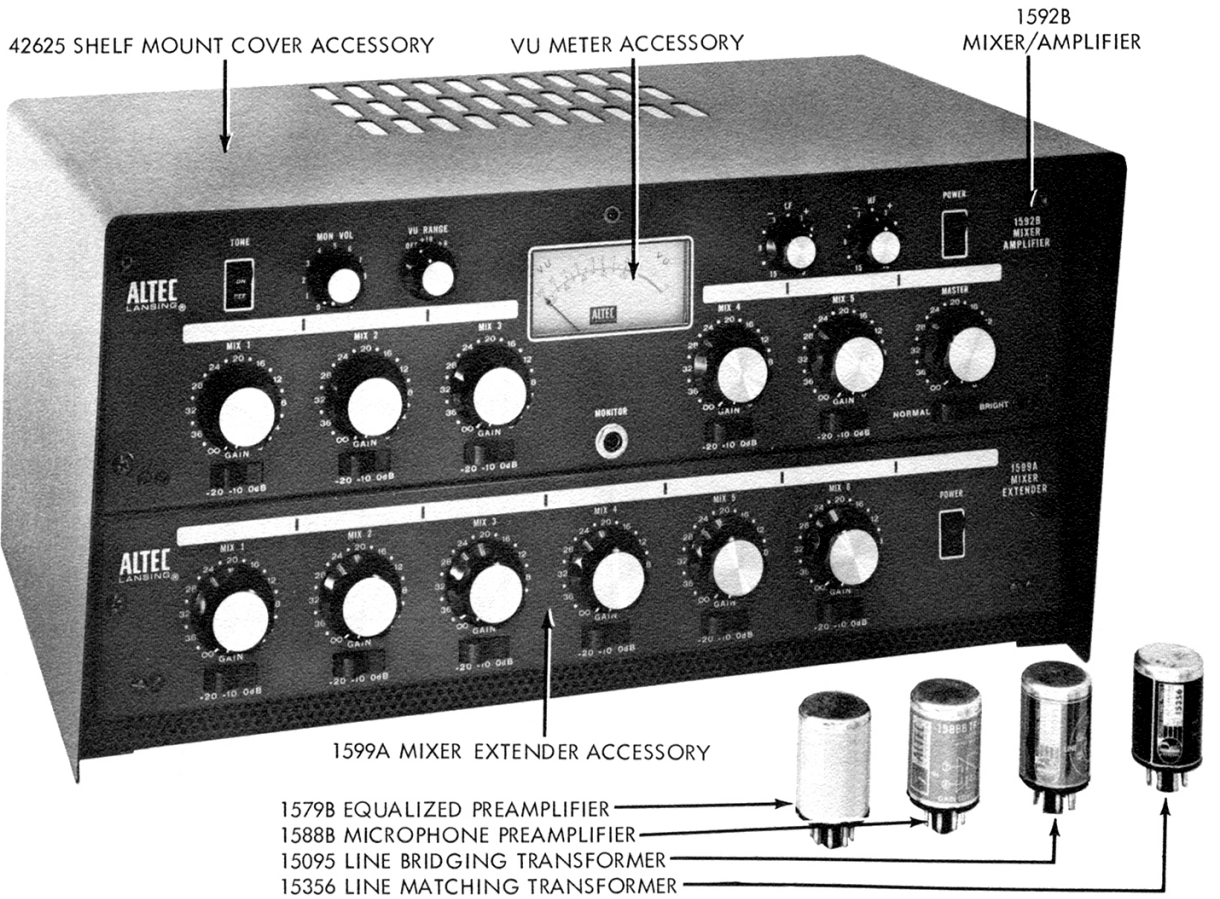


Figure 3. 1592B with Accessories

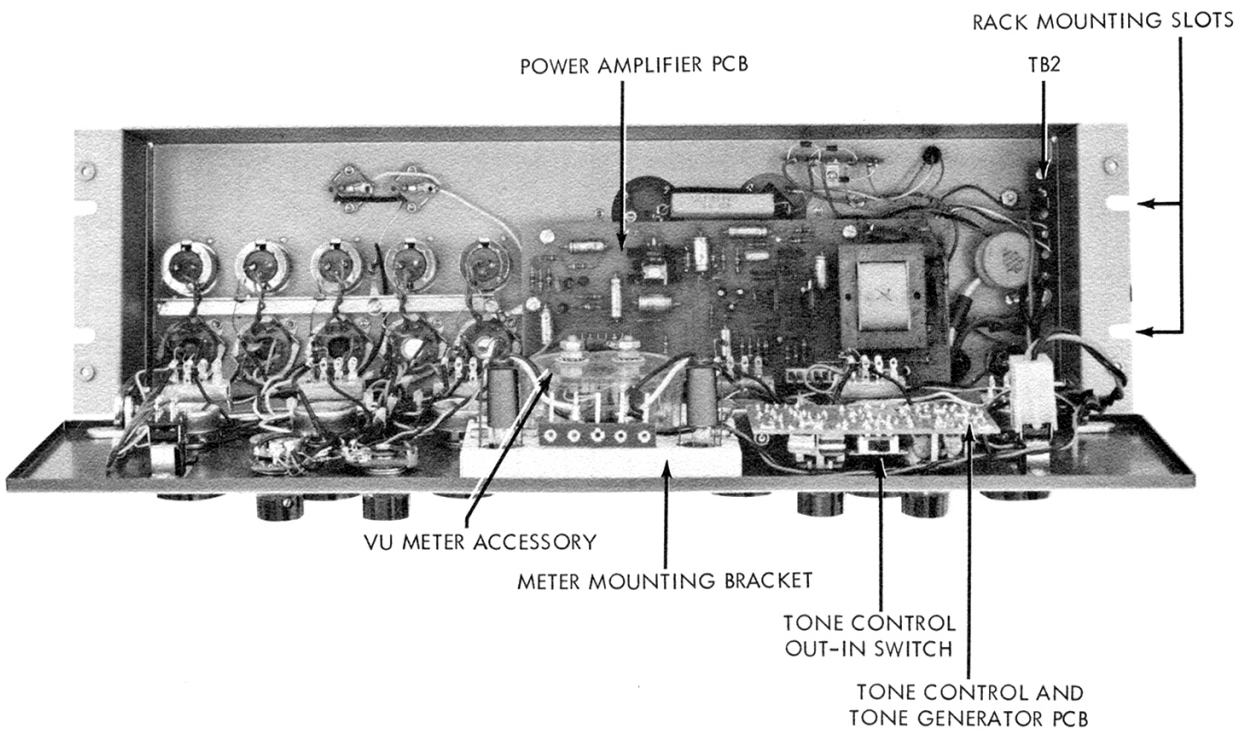


Figure 4. Front View with Hinged Panel Open

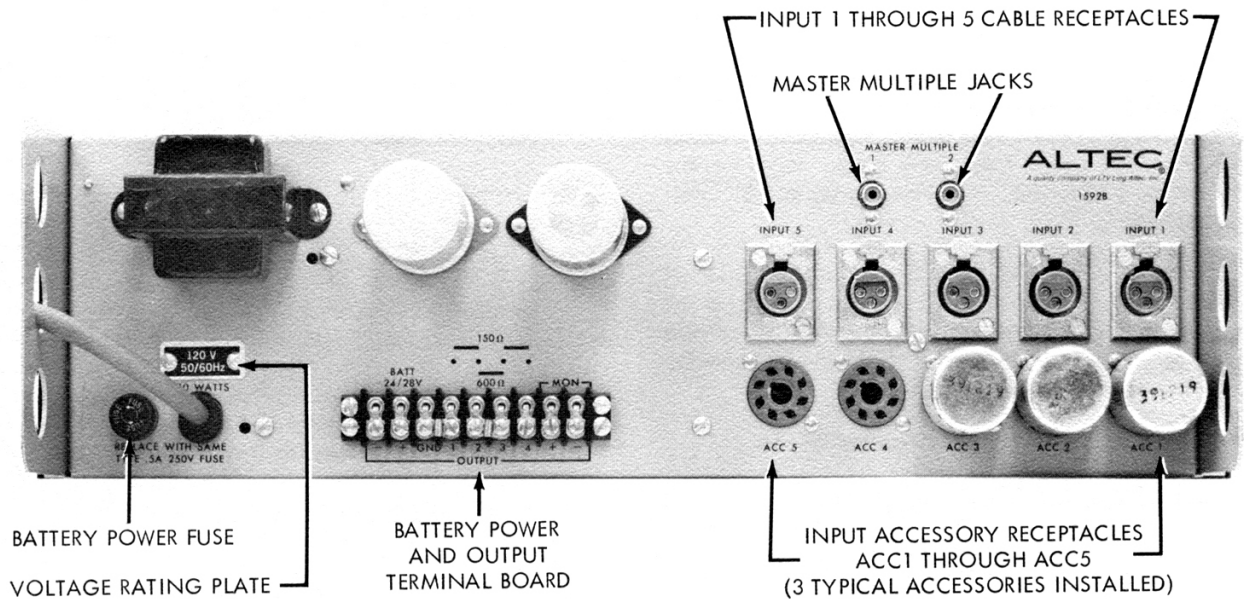


Figure 5. Rear View

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.

- 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.

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).

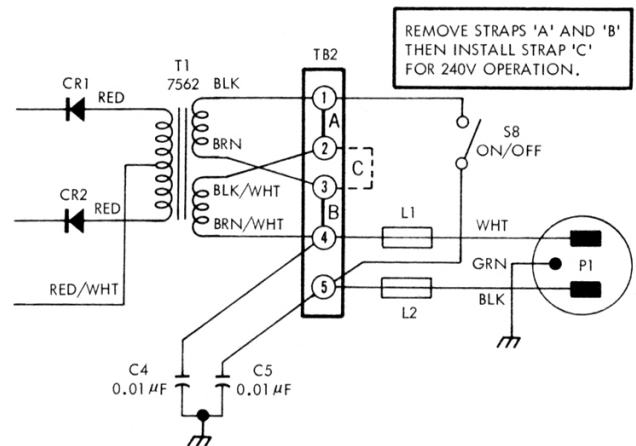


Figure 6. Converting to 240V, 50/60 Hz Power

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.

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 Preamp
Microphone	150/250 ohms nominal (balanced input)	Use 1588B Microphone Preamp
High-Level Line (Bridging)	Up to 15,000 ohms	Use 15095 Line Bridging Transformer
High-Level Line (Matching)	150 or 600 ohms	Use 15356 Line Matching Transformer

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

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.

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.

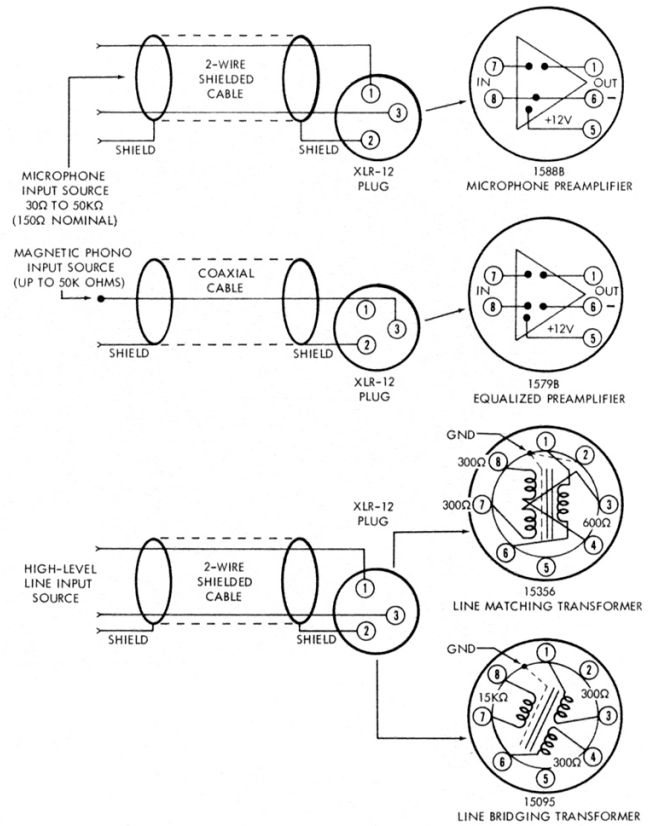


Figure 7. Input Wiring for Various Applications

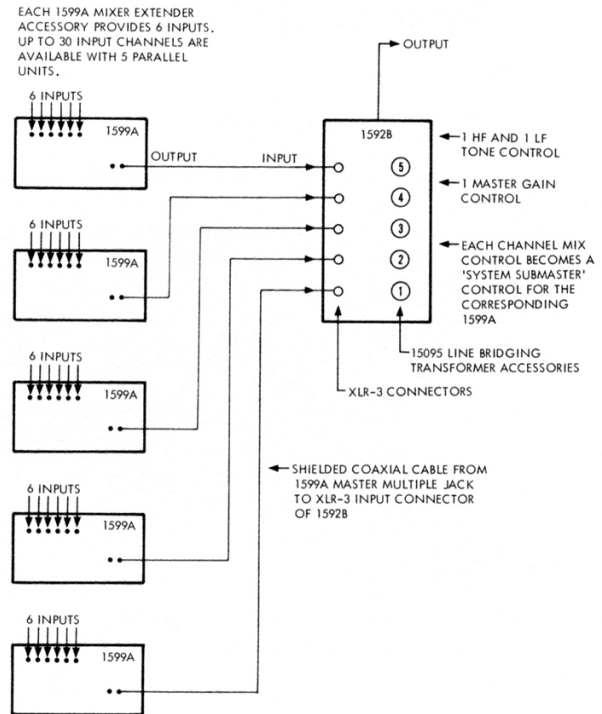


Figure 8. Individually Submastered 1599A Mixer Extender Accessories

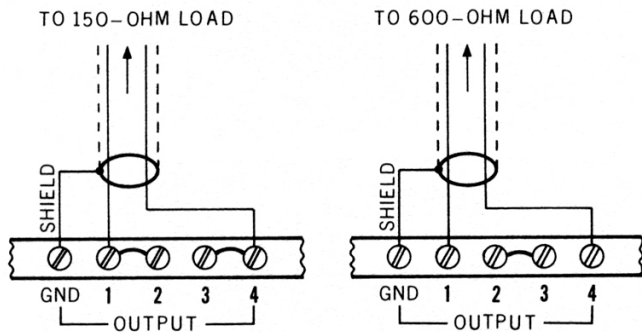


Figure 9. Output Wiring Connections

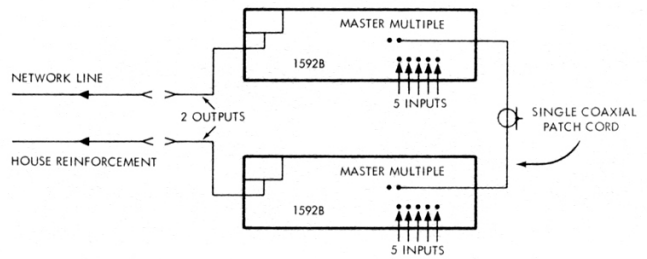
Monitor output is also available at the OUTPUT terminal board, at the MON + and - terminals. These terminals permit permanent installation of an appropriate monitoring system, such as the ALTEC 1598A Amplified Monitor Speaker Panel. Output impedance of the MON + and - terminals is 600 ohms.

Master Multiple Connections

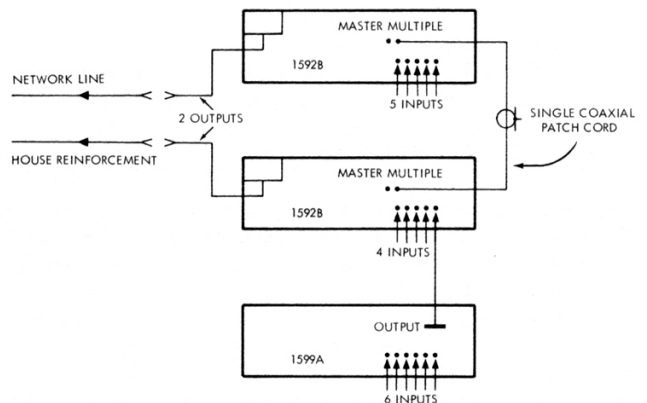
Two MASTER MULTIPLE jacks (see Figure 5), independent of all gain controls, enable combining additional amplifiers or mixers into one system. Two or more 1592B Mixer/Amplifiers may be combined as shown in Figure 10A. A single coaxial cable with pin tip phone plugs connects each amplifier. Either MASTER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

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.



A. TWO MIXER/AMPLIFIERS IN PARALLEL



B. TWO MIXER AMPLIFIERS IN PARALLEL WITH ADDITIONAL INPUTS FOR ONE SYSTEM

Figure 10. Typical Multiple Coupling of Mixer/Amplifiers

Any combination of the two methods of interconnection (Figures 8 and 11) may be connected as a hybrid system, adding as many inputs as permitted by overall system performance (gain requirements).

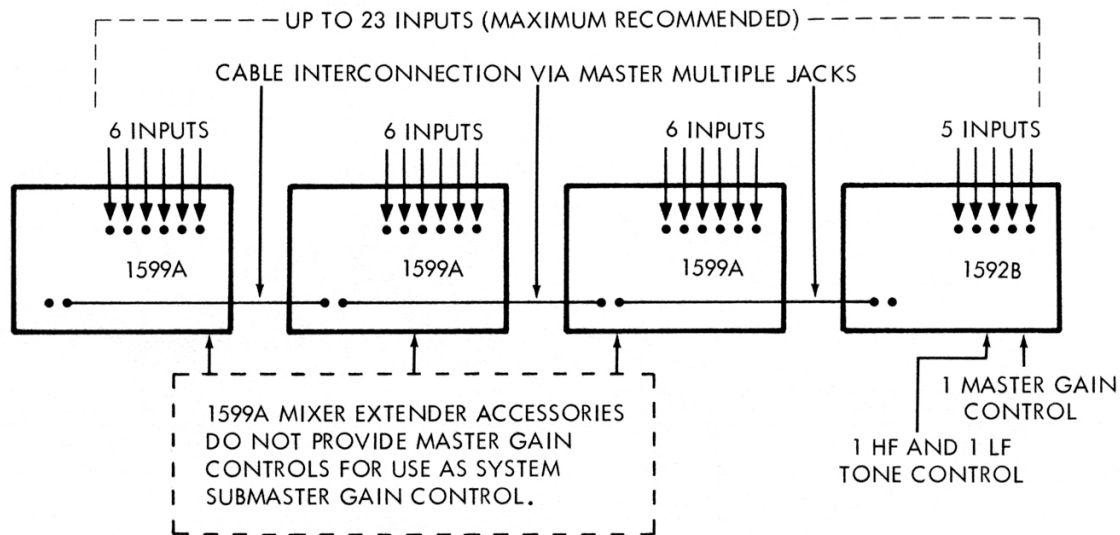


Figure 11. Parallel Multiple Connection of 1599A Mixer Extender Accessories

Installing VU Meter Accessory

- Step 1. Remove four screws securing front panel, open and lower panel.
- Step 2. Remove two No. 6 x 1/2" screws securing meter hole cover to meter bracket. Discard cover and screws.
- Step 3. Remove four No. 6 nuts and washers securing meter bracket to front panel (see Figure 12).
- Step 4. Lift meter bracket and install VU meter, using associated mounting hardware supplied.
- Step 5. Install meter bracket, now containing VU meter, on front panel, using hardware removed in Step 3.
- Step 6. Locate two VU meter wires on front panel and remove tape from lugs. Attach lugs to VU meter as shown in Figure 12.
- Step 7. Close front panel and secure with four screws previously removed.

Installing 1592B in 12866 Portable Carrying Case Accessory

The 12866 Portable Carrying Case consists of a fitted case having two covers. Two brackets and eight 8-32 x 3/8" screws are furnished as loose parts. Use the following installation procedure:

- Step 1. Remove top cover of case.
- Step 2. Attach brackets at each end of case with four 8-32 x 3/8" screws.

- Step 3. Slip 1592B into case and onto brackets.

- Step 4. Remove four screws securing front panel of 1592B and open hinged front panel.

- Step 5. Secure 1592B to brackets with four 8-32 x 3/8" screws.

NOTE

Do not mix 8-32 x 1/4" panel screws with 8-32 x 3/8" screws.

- Step 6. Close front panel of 1592B and secure with screws previously removed.

NOTE

The bottom case cover has a small slot along one edge for passage of connecting cables when the cover is attached. The cover may be attached with the slot on the bottom or on the top to allow cable passage in either direction.

OPERATION

CONTROLS AND INDICATORS

All normal operating controls are located on the front panel (see Figure 13). Controls and functions are given in Table II.

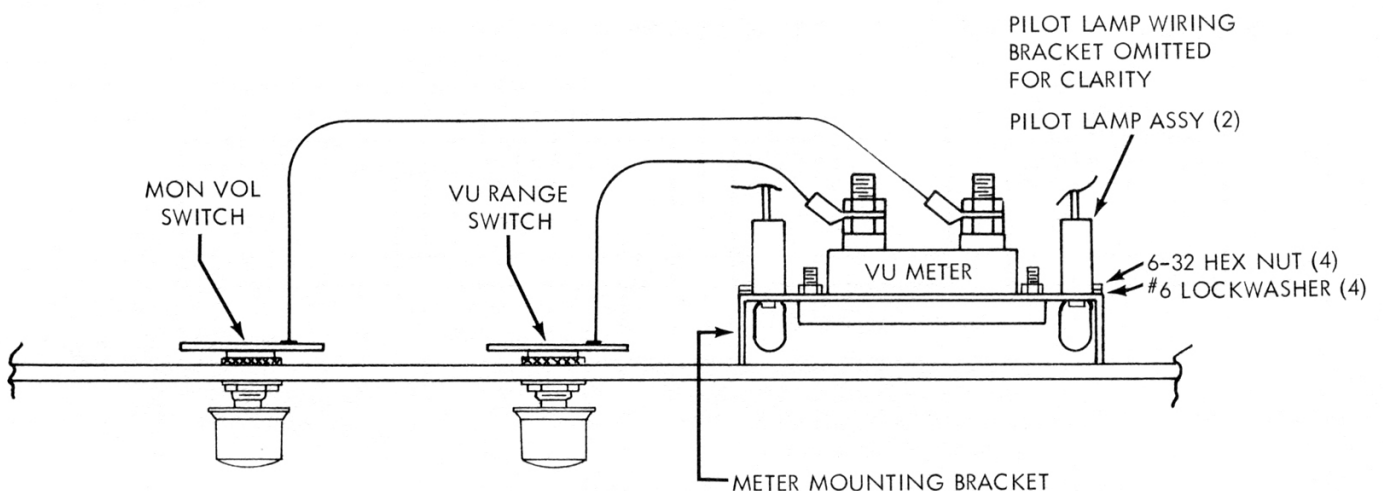


Figure 12. Installation of VU Meter Accessory

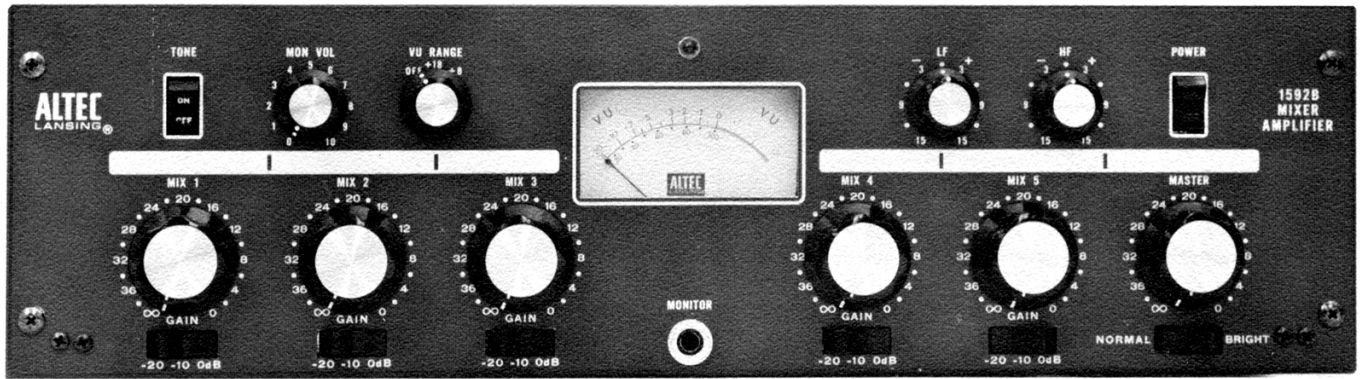


Figure 13. Controls and Features

Table II. Control and Indicator Functions

Name	Function/Description
MASTER control	Provides simultaneous attenuation for all input channels. Continuously variable potentiometer, graduated from 0 dBm to ∞ . Turn clockwise (cw) to increase gain.
MIX 1 - 5 controls	Provide attenuation for corresponding input channels. Continuously variable potentiometers, graduated from 0 dBm to ∞ . 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 15095 or 15356 Transformers. Turn associated MIX control counterclockwise (ccw) to ∞ before switching to avoid system 'pops'.
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 accessory. Selectable positions of OFF, +8 and +18 VU.
VU METER (optional accessory)	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®.* 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.

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.

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 +8 or +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 loud-speaker 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 ACCESSORY

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:

<u>Range Setting</u>	<u>Meter Indication</u>	<u>1592B Output</u>
+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 16.

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 14). 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 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.

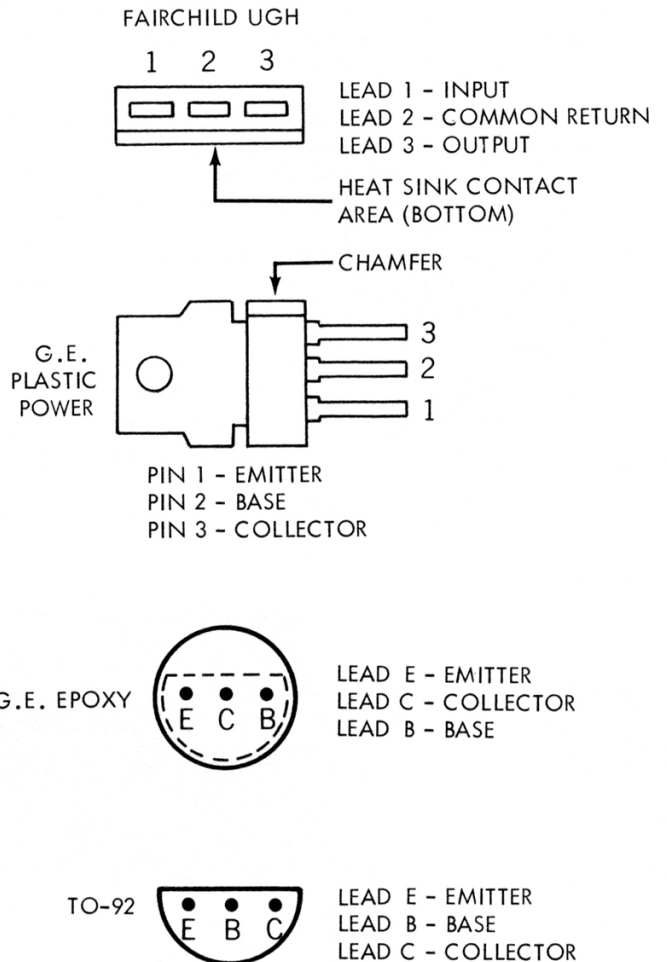


Figure 14. Typical Solid-State Component Configurations

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 15. The main chassis schematic is shown in Figure 16. Component locations on the PCB's are shown in Figures 17 and 19. PCB schematics are shown in Figures 18 and 20. 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.

3. If component is faulty or damaged, clip leads close to component and then unsolder leads from board. Withdraw leads from conductor 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.

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.

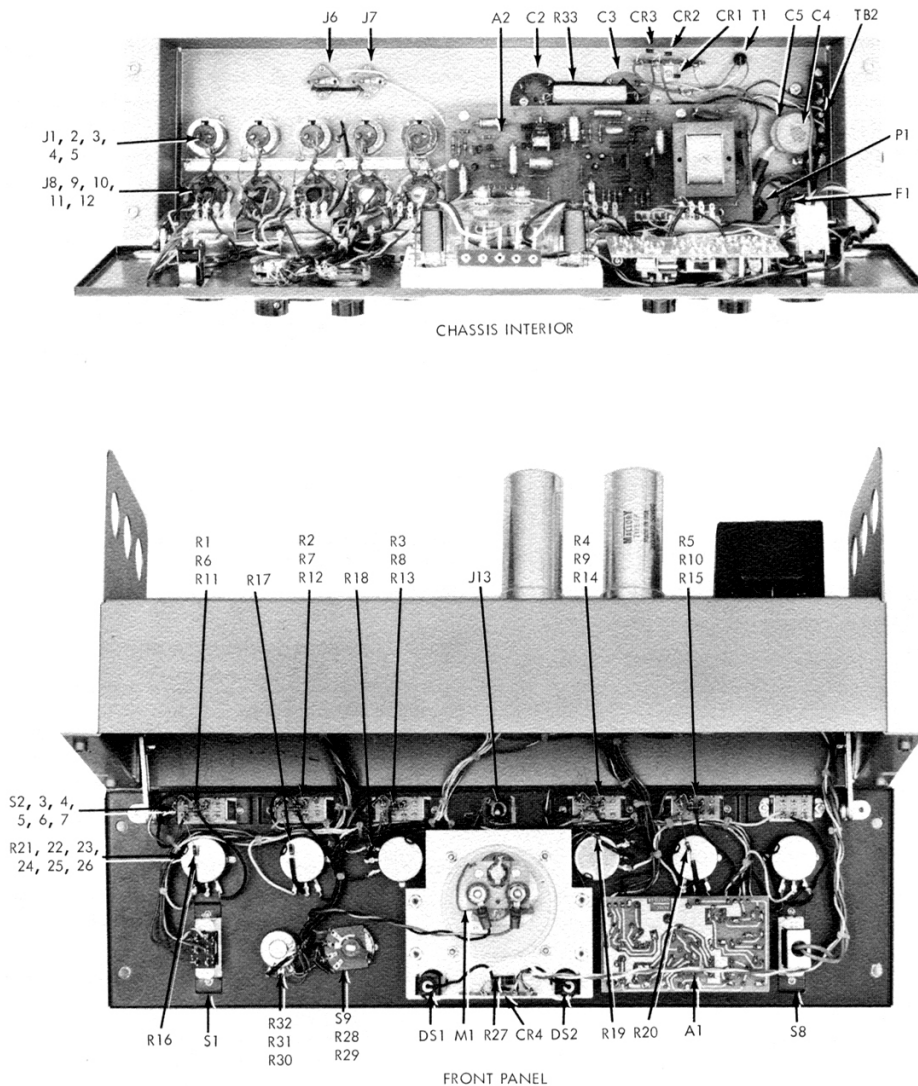


Figure 15. Chassis Components

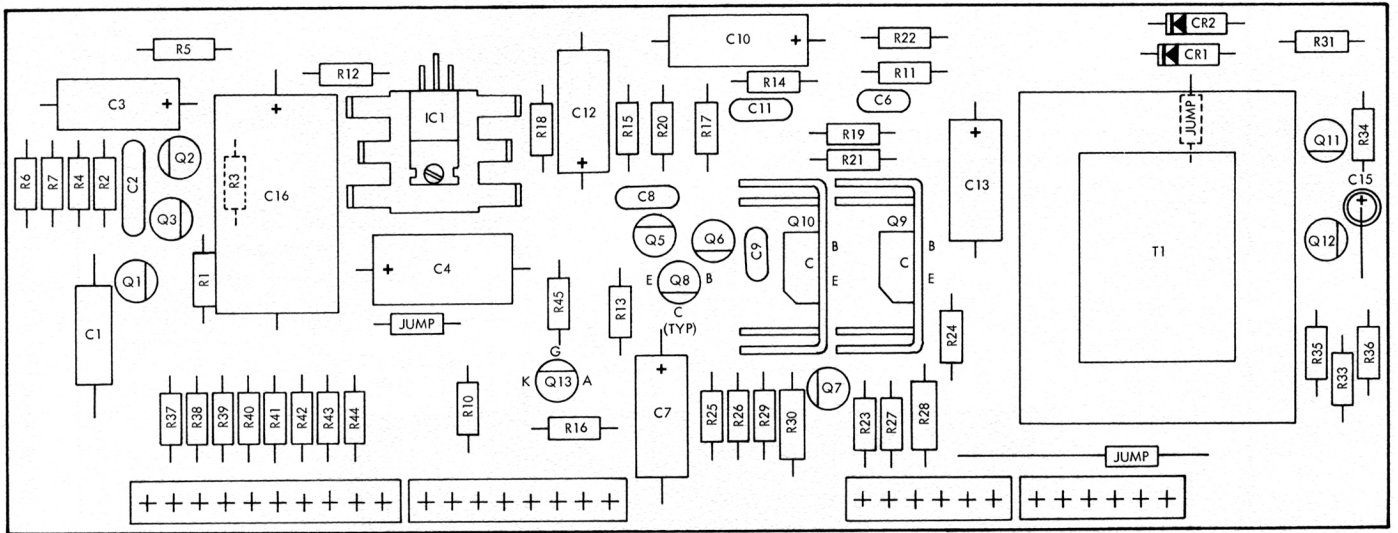


Figure 17. Electronic Part Locations (3C484-2), Power Amplifier PCB Assembly

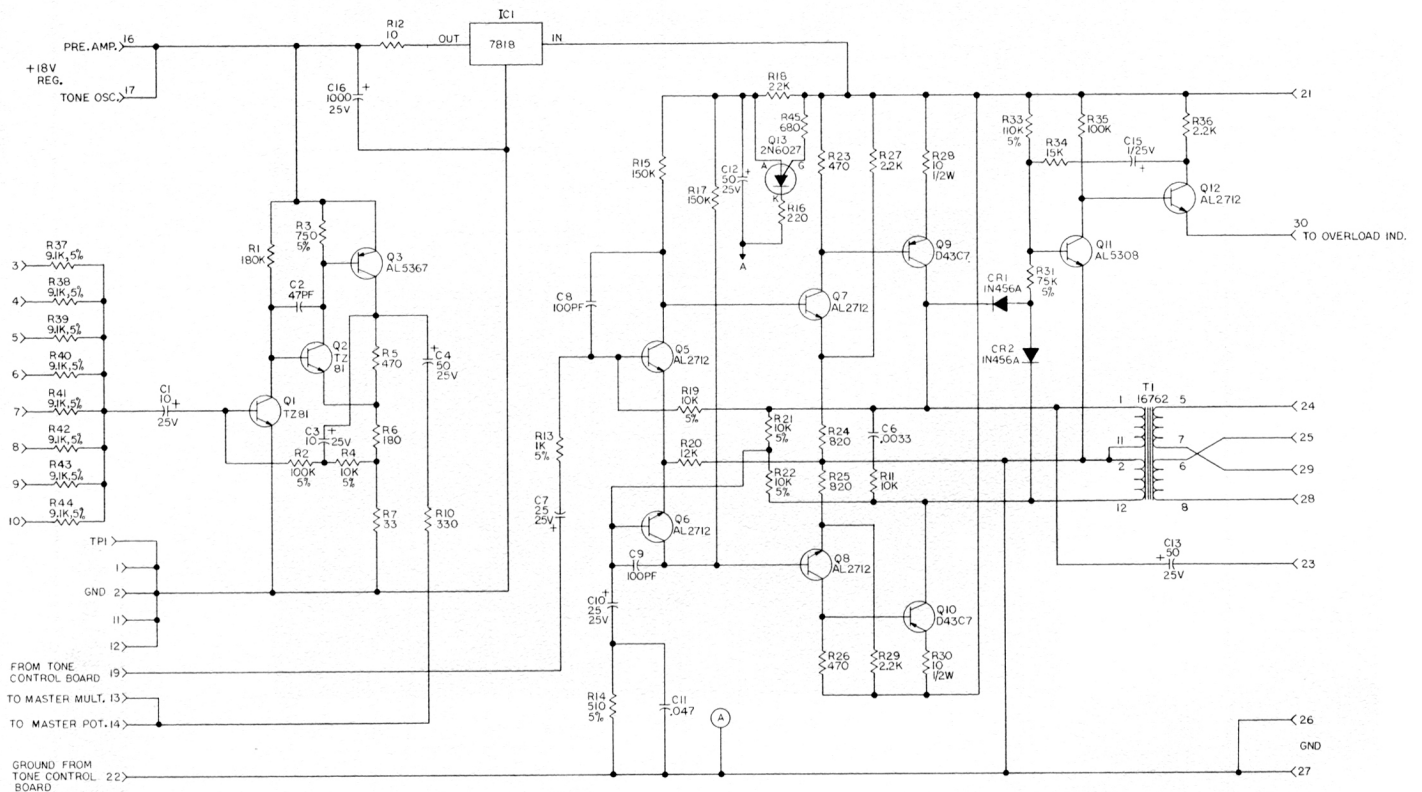


Figure 18. Schematic (3D483-3), Power Amplifier PCB Assembly

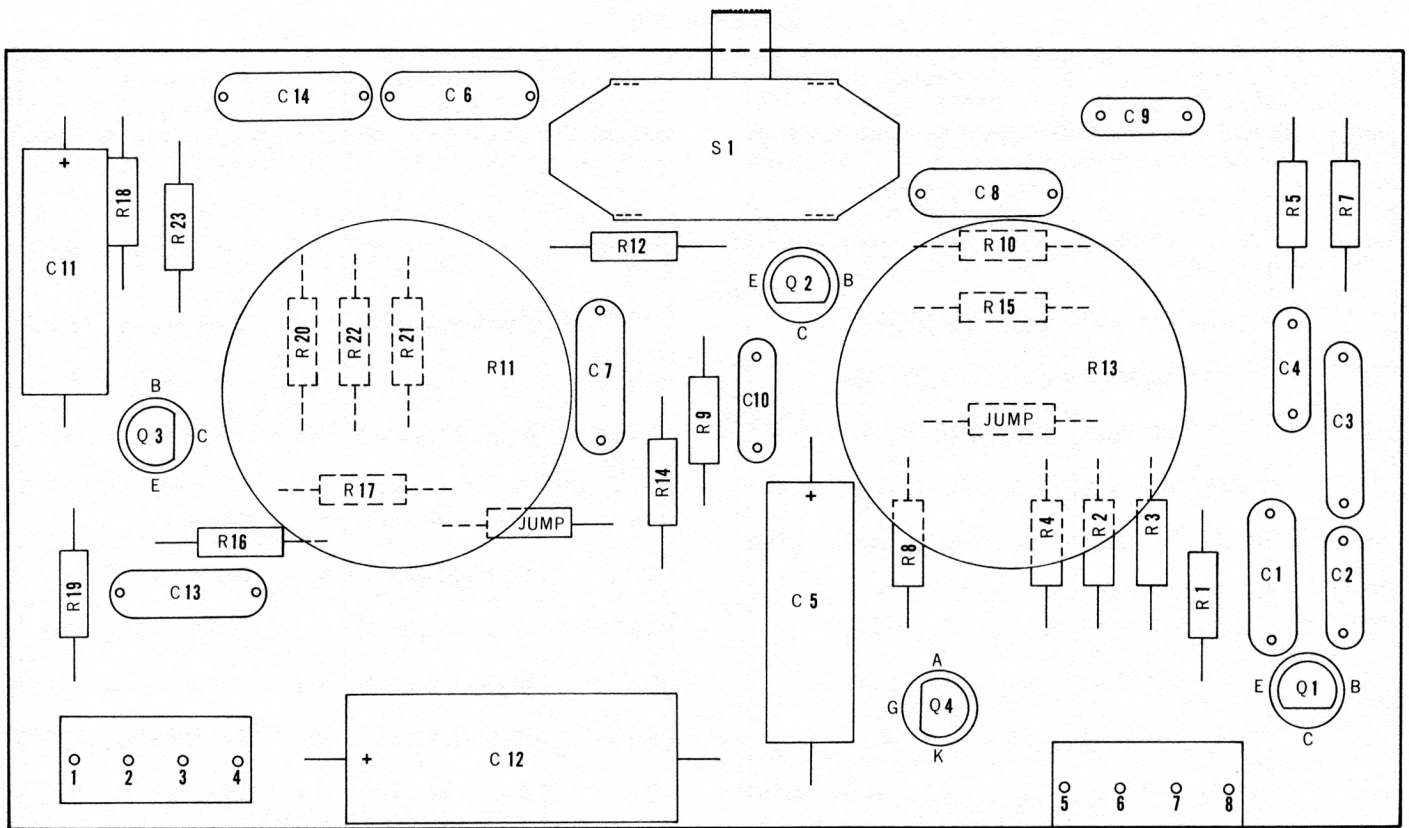


Figure 19. Electronic Part Locations (3D482-1), Tone Control and Tone Generator PCB Assembly

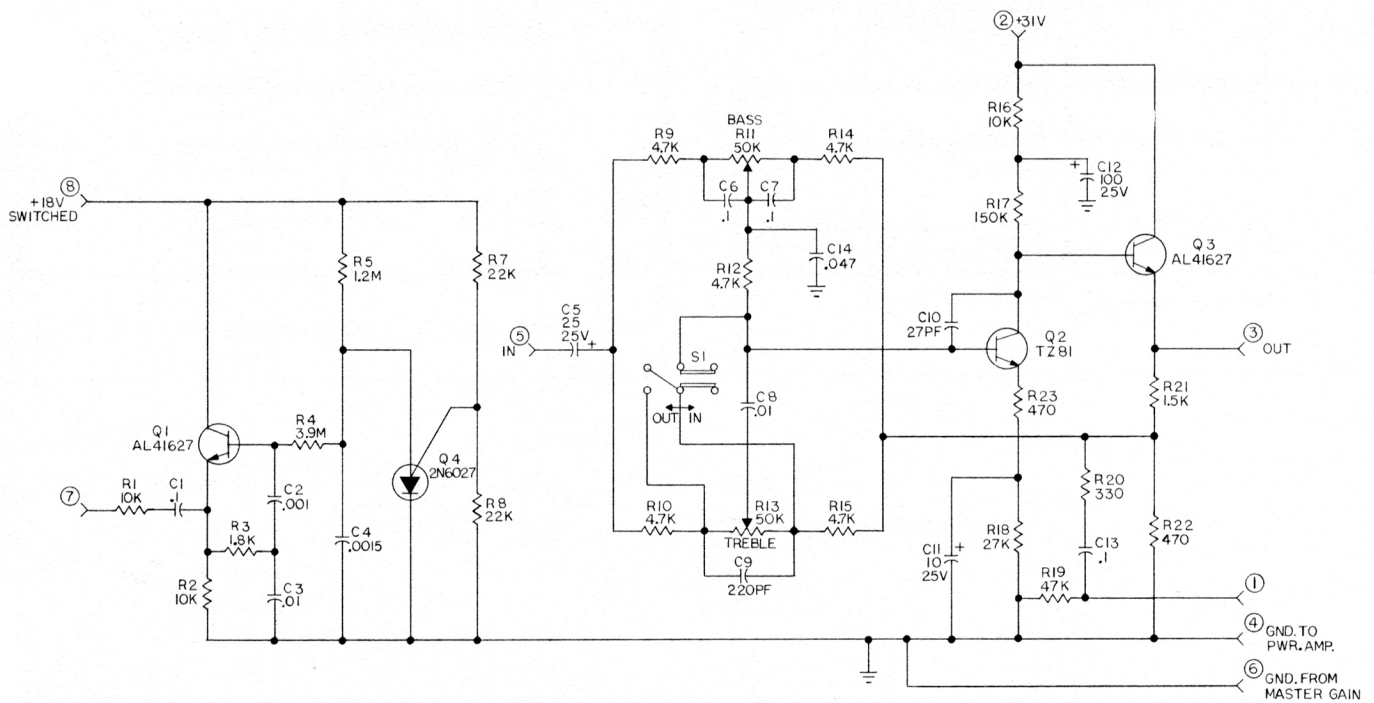


Figure 20. Schematic (3C477-1), Tone Control and Tone Generator PCB Assembly

PARTS LIST

MAIN CHASSIS

Reference Designator	Ordering Number	Name and Description
A1	27-01-042695-01	PCB assembly, tone control and tone generator
A2	27-01-042690-03	PCB assembly, power amplifier
C1	15-02-160110-01	Cap., 0.1 μ F, 100V
C2	15-01-114352-01	Cap., 4000 μ F, 50V
C3	15-01-109683-01	Cap., 2000 μ F, 50V
C4,5	15-02-100089-01	Cap., 0.01 μ F \pm 20%, 1400V
C6,7,8,9,10	15-02-107454-01	Cap., 100 pF \pm 10%, 100V
CR1,2,3	48-02-042787-01	Diode, 1A, 400V PIV
CR4	39-01-112201-01	Lamp, 20mA, 1.8V
DS1,2	39-01-100784-01	Lamp, 40mA, 28V
F1	51-04-100463-01	Fuse, 1/2A, 3AG, 250V
J1,2,3,4,5	21-02-118172-01	Receptacle, 3-pin, microphone type
J6,7	21-01-100508-01	Jack, phone, insulated sleeve
J8,9,10,11,12	21-02-100973-01	Socket, octal
J13	21-01-100494-01	Jack, single phone, insulated sleeve
L1,2	56-01-100458-01	Choke, ferrite bead
M1	29-01-042486-03	Meter assembly, VU (optional)
P1	60-06-012636-03	Cord, 18 gauge, 3-conductor, 6 ft., w/plug

Reference Designator	Ordering Number	Name and Description
R1,2,3,4,5	47-01-102103-01	Res., 11K Ω \pm 5%, 1/4W
R6,7,8,9,10	47-01-102187-01	Res., 100K Ω \pm 10%, 1/4W
R11 through R20,31	47-01-102163-01	Res., 1K Ω \pm 10%, 1/4W
R21,22,23,24,25	47-06-042485-02	Pot., 1M Ω
R26	47-06-107365-01	Pot., 750 Ω \pm 20%
R27	47-01-100671-01	Res., 100 Ω \pm 10%, 2W
R28	47-01-102086-01	Res., 2.2K Ω \pm 5%, 1/4W
R29	47-01-102102-01	Res., 10K Ω \pm 5%, 1/4W
R30	47-01-102048-01	Res., 6.8K Ω \pm 5%, 1/4W
R32	47-06-014574-05	Pot., 750 Ω \pm 30%
R33	47-02-107365-01	Res., 10 Ω \pm 10%, 10W
S1,8	51-02-113178-01	Switch, DPDT
S2,3,4,5,6	51-02-119053-01	Switch, 3P3T, rocker
S7	51-02-107498-01	Switch, DPDT
S9	51-01-118710-01	Switch, rotary, 3-position
T1	56-08-007562-01	Transformer, power
TB1	21-04-101858-01	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
C1,3	15-01-100202-01	Cap., 10 μ F, 25V
C2	15-02-107455-01	Cap., 47 pF \pm 10%, 100V
C4,12,13	15-01-100236-01	Cap., 50 μ F, 25V
C6	15-02-107047-01	Cap., 0.0033 μ F \pm 20%, 100V
C7,10	15-01-107495-01	Cap., 25 μ F \pm 10%, 25V
C8,9	15-02-107454-01	Cap., 100 pF \pm 10%, 100V
C11	15-06-109103-01	Cap., 0.047 μ F \pm 10%, 250V
C15	15-01-107462-02	Cap., 1 μ F, 25V
C16	15-01-107485-01	Cap., 1000 μ F, 25V
CR1,2	48-01-107017-01	Diode, 1N456A, 25V, 100 mA
IC1	17-01-118679-01	Integrated circuit, 18V, regulated
Q1,2	48-03-109714-01	Transistor, NPN
Q3	48-03-108557-02	Transistor, PNP, 2N5367, 0.36W, 40V
Q5,6,7,8,12	48-03-105857-01	Transistor, NPN, 2N2712
Q9,10	48-03-119046-01	Transistor, PNP
Q11	48-03-119140-01	Transistor, NPN, 2N5308
Q13	48-03-112934-01	Transistor, unijunction, 2N6027
R1	47-01-102190-01	Res., 180K Ω \pm 10%, 1/4W
R2	47-01-102127-01	Res., 100K Ω \pm 5%, 1/4W
R3	47-01-102075-01	Res., 750 Ω \pm 5%, 1/4W
R4,19,21,22	47-01-102102-01	Res., 10K Ω \pm 5%, 1/4W

Reference Designator	Ordering Number	Name and Description
R5,23,26	47-01-102159-01	Res., 470 Ω \pm 10%, 1/4W
R6	47-01-102154-01	Res., 180 Ω \pm 10%, 1/4W
R7	47-01-102145-01	Res., 33 Ω \pm 10%, 1/4W
R10	47-01-102157-01	Res., 330 Ω \pm 10%, 1/4W
R11	47-01-102175-01	Res., 10K Ω \pm 10%, 1/4W
R12	47-01-102140-01	Res., 10 Ω \pm 10%, 1/4W
R13	47-01-102078-01	Res., 1K Ω \pm 5%, 1/4W
R14	47-01-102071-01	Res., 510 Ω \pm 5%, 1/4W
R15,17	47-01-102189-01	Res., 150K Ω \pm 10%, 1/4W
R16	47-01-102155-01	Res., 220 Ω \pm 10%, 1/4W
R18	47-01-102179-01	Res., 22K Ω \pm 10%, 1/4W
R20	47-01-102176-01	Res., 12K Ω \pm 10%, 1/4W
R24,25	47-01-102162-01	Res., 820 Ω \pm 10%, 1/4W
R27,29,36	47-01-102167-01	Res., 2.2K Ω \pm 10%, 1/4W
R28,30	47-01-102330-01	Res., 10 Ω \pm 10%, 1/2W
R31	47-01-102124-01	Res., 75K Ω \pm 5%, 1/4W
R33	47-01-102128-01	Res., 110K Ω \pm 5%, 1/4W
R34	47-01-102177-01	Res., 15K Ω \pm 10%, 1/4W
R35	47-01-102187-01	Res., 100K Ω \pm 10%, 1/4W
R37,38,39,40,41,42,43,44	47-01-102101-01	Res., 9.1K Ω \pm 5%, 1/4W
R45	47-01-102161-01	Res., 680 Ω \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	15-06-100311-01	Cap., 0.1 μ F \pm 20%, 250V
C2	15-02-100304-01	Cap., 0.001 μ F \pm 10%, 100V
C3,8	15-06-107005-01	Cap., 0.01 μ F \pm 5%, 200V
C4	15-02-100306-01	Cap., 0.0015 μ F \pm 10%, 100V
C5	15-01-107495-01	Cap., 25 μ 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	15-01-100202-01	Cap., 10 μ F, 25V
C12	15-01-107460-01	Cap., 100 μ F, 25V
C14	15-06-109103-01	Cap., 0.047 μ F \pm 10%, 250V
Q1,3	48-03-041627-01	Transistor, NPN
Q2	48-03-109714-01	Transistor, NPN
Q4	48-03-112934-01	Transistor, 2N6027, unijunction
R1,2,16	47-01-102175-01	Res., 10K Ω \pm 10%, 1/4W

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