

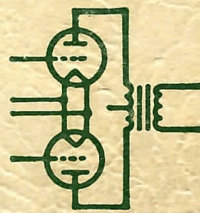
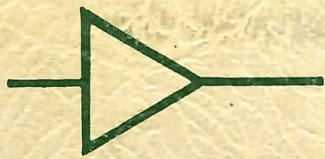
**ALTEC**

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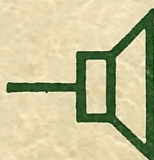
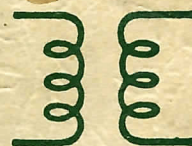
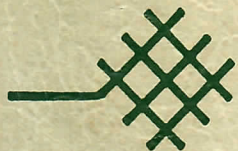
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Products



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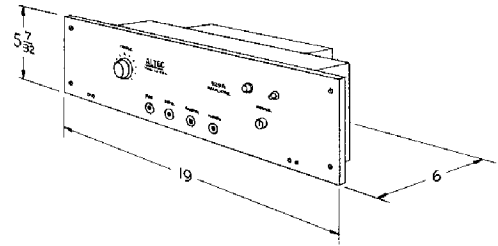


Figure 1. ALTEC 129A Distribution Amplifier

## SPECIFICATIONS

Type:	Power amplifier (with accessories for program bridge operation)
Gain:	40 dB
Input Sensitivity:	0.78 volt for full-rated output power (without input transformer)
Power Output:	6 watts at less than 5.0% THD from 100 Hz to 15 KHz With 13151 Distribution Board, +15 dBm at less than 2.0 THD from 100 Hz to 15 KHz from each of 20 outputs terminated by 600 ohms
Input Impedance:	47,000 ohms
Source Impedance:	500/600, 250/300, 125/150, 30/50 ohms with 4665 Plug-in Transformer
Load Impedance:	4, 8, or 16 ohm, or 20, 600 ohm lines with 13151 Distribution Board
Frequency Response:	±1 dB from 30 to 15,000 Hz
Controls:	Volume Control with audio taper, Power Switch, four test jacks to permit circuit alignment and measurements
Power Supply:	117 volts, 60 Hz, 85 watts
Dimensions:	5-7/32" H x 19" W x 6" D
Finish:	Panel - Dark Green Chassis - Dichromate dip
Weight:	13 lb.
Requisite Accessory:	ALTEC 4665 Transformer
Optional Accessories:	ALTEC 17224 Equalizer (8 KHz) or ALTEC 17249 Equalizer (15 KHz) ALTEC 13151 Distribution Board

## DESCRIPTION

The ALTEC 129A Amplifier is a rack-mounted, ac-operated, three-stage power amplifier. When equipped with the ALTEC 13151 Distribution Board, it will provide up to twenty outputs for distribution over telephone or intercommunication lines. The 129A provides mounting facilities for the 13151 Board as an accessory, as well as both of the equalizers and the ALTEC 4665 Plug-in Transformer. The 13151 Distribution Board, an accessory, contains resistors which build out the twenty outputs from the four-ohm secondary winding of the output transformer. The distribution may be sectionalized with each section connected to a different secondary tap, and the range of output

levels of +2, +5 and +8 dBm may be obtained. This feature may prove useful when lines are to be fed which present different transmission equivalents. Each output is balanced, and provides a source impedance of 300 ohms. The 13151 Board is an optional accessory since the amplifier may be used to feed a single load.

The unit occupies three units of rack space (5-7/32 inches) and has a hinged front panel on which are mounted the power switch, pilot light, gain control, and four circuit test jacks. All circuitry is accessible for installation and servicing when the front panel is open.

An optional accessory, the 17224 (8 KHz) or the 17249 (15 KHz) Equalizer, permits equalization to be effected at the high frequencies and thereby offsets telephone cable losses.


## APPLICATION

The ALTEC 129A Amplifier is designed to permit specially recorded messages to be relayed to telephone subscribers to advise of a change in an exchange code or a subscriber's number. Also, it may be used for time signals, weather and athletic events; and, in general, to feed any type of program material over telephone lines to places such as supermarket chains, wired music subscribers, etc.

## INSTALLATION AND OPERATION

The 129A Amplifier will always be installed at the central offices of a telephone system, and mounted on an equipment rack. The source of input signal is connected to the terminal block at the rear of the chassis, and the output signals are obtained at the resistor-network distribution board located within the unit, access to which may be obtained by lowering the front panel. The board, which mounts forty resistors (twenty balanced outputs), is wired so that all the outlets are connected to the four-ohm secondary winding of the output transformer. If required, the outlets may be sectionalized by cutting strapping connections. Each section may deliver a different output level and may be connected respectively to the four-, eight-, and sixteen-ohm secondary windings of the output transformer. These appear at a terminal strip inside and to the extreme lower right of the unit. The black lead is common and the orange, yellow, and green leads are the four-, eight-, and sixteen-ohm taps, respectively. It should be noted that the highest



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degree of loop loss between the outlets is achieved when the lowest source impedance is used at the transducer.

In some installations the amplifier may feed a low impedance source such as a loudspeaker, and the resistor board will not be required. Four test jacks are provided to facilitate alignment and level checks when used with transmission measuring equipment. The line loop may be checked at the LINE jacks; the equalizer may be checked at the EQUALIZER jack (or disconnected by a dummy plug); and an input signal may be applied directly to the amplifier at AMP IN. The MONITOR jack permits the output level to be determined when the unit is in operation, the level indicated being the level normally fed to a line. The VOLUME (gain) control and the POWER switch are located on the front panel. If an ALTEC 17224 (8 KHz) or 17249 (15 KHz) Equalizer is used to correct the frequency/amplitude characteristic of an incoming telephone line, lowering the front panel will provide access for alignment. Alignment is accomplished by sending signals from the remote end of the line over the frequency range concerned and adjusting the equalizer potentiometer and the gain control of the amplifier until the desired frequency characteristic and transmission equivalent is obtained. Refer to the operating instructions of the 17224 or 17249 Telephone Cable Equalizers in the Equalizer

section of the Telecommunication Products Catalogue.

These equalizers mount at the rear of the chassis, through the holes provided and are fastened by 6-32 nuts. Wired connections must be made between the two terminals of the equalizer and the two-way terminal strip which is located nearby.

## SERVICING

All circuitry is completely exposed for service when the hinged front cover is opened and lowered. All routine servicing may be done by means of voltage and resistance checks.

The ALTEC 13151 Board mounts inside the chassis on the lower panel and may be fixed in place by inserting three 6-32 screws through the side panel and into the threaded inserts on the board. Wire connections between the board and the secondary winding of the output transformer are made at the seven-way terminal strip located at the extreme right of the lower panel. The board may be wired to give a single level, or a range of levels, at the numbered output terminals. The MONITOR jack feed may be wired to any one of the three transformer impedances to suit the requirements of the installation.

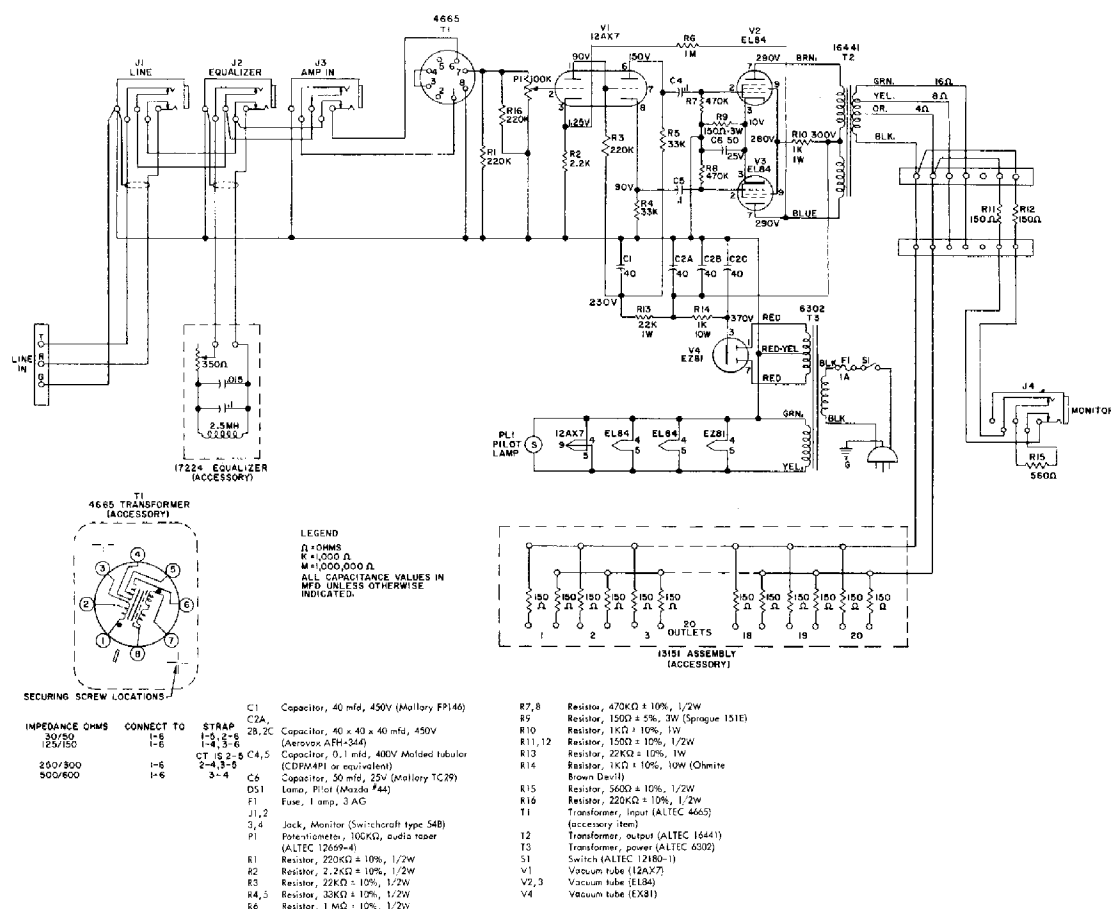


Figure 2. Schematic 129A Distribution Amplifier

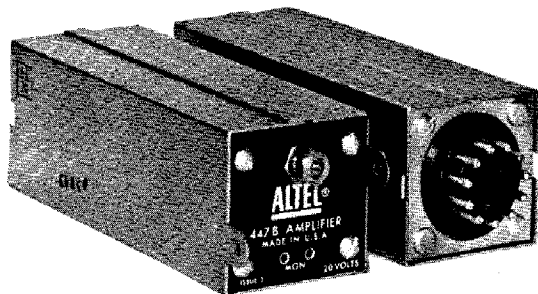


Figure 1. 447B Amplifier

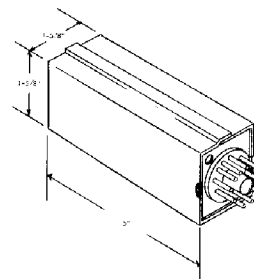


Figure 2. Dimensional Drawing

### SPECIFICATIONS

Frequency Response:	$\pm 1.0$ dB from 200 to 6000 Hz
Gain:	$39 \pm 1.0$ dB (matched load)
Distortion:	1.5% THD (at +10 dBm 200 to 6000 Hz)
Maximum Power Input:	-22 dBm (at maximum gain)
Maximum Power Output:	+17 dBm
Output Noise Level:	-70 dBm
Input Gain Control:	Varies gain from -2.0 dB to maximum of 39 dB
Operating Voltage:	20V dc
Operating Current:	50 milliamperes
Impedance, Output:	600 ohms
Impedance, Input:	600 ohms
Monitor Facilities:	$11 \pm 1.5$ dB below amplifier output available at test jacks on front panel and connector J1 when bridged by 600 ohms
Mounting Socket:	11-pin socket (Amphenol 78-511)
Dimensions:	1-5/8" H x 1-5/8" W x 5" D
Finish:	Cadmium plate with dichromate finish
Weight:	14 ounces
Accessories:	ALTEC 7305A Mounting Panel (mounts twelve 447B Amplifiers) ALTEC 12910 Mounting Panel (mounts ten 447B Amplifiers for standard 19" rack mounting) ALTEC 12962 or ALTEC 13227 Mounting Assembly (mounts single 447B Amplifier for 105 type Apparatus Box) ALTEC 14115A Assembly (mounts two 447B Amplifiers in a KTU-15A type frame)

### DESCRIPTION

The ALTEC 447B Transistor Amplifier is a two-stage, plug-in unit, designed for use in voice frequency circuits and used as a direct replacement for the 408A tube-type amplifier. The amplifier can be operated from a 20 volt central office or battery supply. Telephone repeater systems can be assembled using this amplifier and other additional plug-in items of equipment.

With a maximum gain control setting, the amplifier is capable of receiving 1.0 milliwatt input without harmful effects to the transistors. Negative feedback is utilized to reduce distortion and to stabilize gain within 0.3 dB for a 25 percent reduction of supply voltage. When the ambient temperature increases from 75 to 110 degrees Fahrenheit; the gain decreases 0.2 dB. Output capacity is adequate for a maximum +10 VU level of the transmitting toll switchboard and other equipment having a similar signal level. The input and output longitudinal balance is sufficiently high so that normal noise requirements are met without use of a mid-point ground.

### INSTALLATION AND OPERATION

The ALTEC 447B Amplifier is dependent upon the polarity of the power supply for its operation. Prior to installation, make certain that the positive side of the supply is at pin 9, and the negative at pin 8, of the 11-pin socket of the mounting. The amplifier should be inserted into its socket carefully to prevent possible damage to the pins of the connector plug.

In order to adjust the gain control, which has a range of approximately 40 dB, the locknut located on the front panel must be released. The level of the monitor pins on the front panel (bridged by 600 ohms) is approximately 11 dB below the output level of the unit. After adjustment is completed, carefully retighten the locknut and recheck the gain settings to make certain that the control shaft has not been disturbed in the tightening operation.


Please refer to the ALTEC Telephone Engineering Department if information is desired in reference to gain versus temperature, change in gain versus output power, phase shift characteristics and envelope delay and distortion characteristics.

### MAINTENANCE

In the event of a malfunction, use the ALTEC 13204 or 13903 Extractor Tool to remove the unit from its mounting. Use of a replacement amplifier will permit quick restoration of service. The amplifier may be serviced locally or returned to the manufacturer for repair. If it is necessary to remove the unit from its protective cover, remove the two screws and plate from the rear (plug end), then withdraw the unit from the front.

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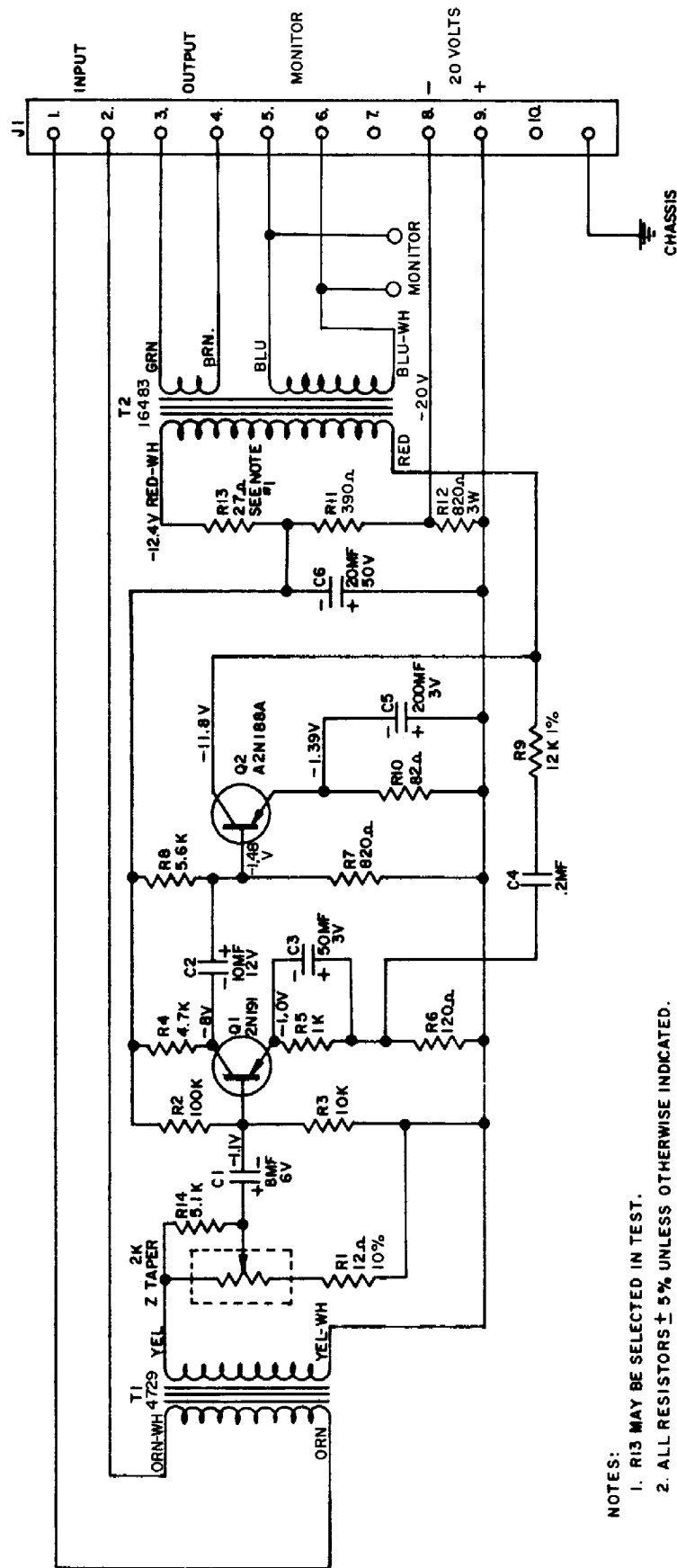


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TELECOMMUNICATIONS



# NOTES:

1. R13 MAY BE SELECTED IN TEST.

2. ALL RESISTORS  $\pm 5\%$  UNLESS OTHERWISE INDICATED.

C1	Capacitor, 8 mfd, 6V (Sprague 40D126A1)	R4	Resistor, 4.7K $\pm 5\%$ , 1/2W
C2	Capacitor, 10 mfd, 12V (Sprague 40D146A1)	R5	Resistor, 1K $\pm 5\%$ , 1/2W
C3	Capacitor, 50 mfd, 3V (Sprague 40D112A1)	R6	Resistor, 120 $\pm 5\%$ , 1/2W
C4	Capacitor, 0.2 mfd, 200V (Hopkins P22D)	R7	Resistor, 820 $\pm 5\%$ , 1/2W
C5	Capacitor, 200 mfd, 3V (Sprague 40D116A1)	R8	Resistor, 5.6K $\pm 5\%$ , 1/2W
C6	Capacitor, 20 mfd, 50V (Sprague 40D195A1)	R9	Resistor, 12K $\pm 1\%$ , 1/2W
J1	Plug, 11-pin (Amphenol 86-CP-11)	R10	(Dolohm DC1/2 or equivalent)
Q1	Transistor (G.E. 2N191)	R11	Resistor, 82 $\pm 5\%$ , 1/2W
Q2	Transistor (G.E. A2N188A)	R12	Resistor, 390 $\pm 5\%$ , 1/2W
R1	Resistor, 12 $\pm 10\%$ , 1/2W	R13	Resistor, 820 $\pm 5\%$ , 3W (Sprague 242E8215 or Tru-Ohm VAL 3-820)
R2	Resistor, 100K $\pm 5\%$ , 1/2W		
R3	Resistor, 10K $\pm 5\%$ , 1/4W		
		R14	Resistor, 5.1K $\pm 5\%$ , 1/2W
		R15	Potentiometer, 2K $\Omega$ , Z taper (Clarostat CM22782)
		T1	Transformer (ALTEC 4729)
		T2	Transformer (ALTEC 16483)

Figure 3. Schematic 447B Transistor Amplifier



Figure 1. 453B Transistor Amplifier

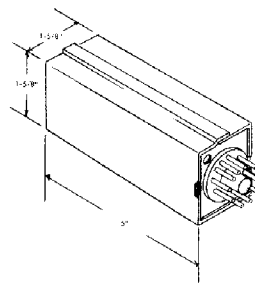


Figure 2. Dimensional Drawing

### SPECIFICATIONS

Frequency Response:	$\pm 1.0$ dB from 200 to 6000 Hz
Gain:	39 $\pm 1$ dB (matched to load)
Distortion:	1.5% THD (at 10 dBm, 200 to 6000 Hz)
Maximum Power Input:	-22 dBm (at maximum gain)
Maximum Power Output:	+17 dBm
Output Noise Level:	-70 dBm
Input Gain Control:	Varies gain from -2.0 dB to maximum of 39 dB
Operating Voltage:	24 to 26V dc
Operating Current:	20 milliamperes
Impedance, Input:	600 ohms
Impedance, Output:	600 ohms
Simplex:	100 milliamperes maximum with 5 milliamperes maximum out-of-balance
Monitor Facilities:	11 $\pm 1.5$ dB below amplifier output is available at test jacks on front panel when bridged by 600 ohms
Mounting Socket:	11-pin socket (Amphenol 78-S11)
Dimensions:	1-5/8" H x 1-5/8" W x 5" D
Finish:	Cadmium plate with dichromate finish
Weight:	14 ounces
Accessories:	ALTEC 7305A Mounting Panel (mounts twelve 453B Amplifiers) ALTEC 7316A Mounting Panel (mounts up to ten 453B Amplifiers) ALTEC 12910 Mounting Panel (mounts ten 453B Amplifiers for standard 19" rack mounting.) ALTEC 12962 or ALTEC 13227 Mounting Assembly (mounts single 453B Amplifier for 115 type apparatus box) ALTEC 14115A Assembly (mounts two 453B Amplifiers in KTU-15A type frame)

### DESCRIPTION

The ALTEC 453B Transistor Amplifier is a two-stage, plug-in unit designed for use in voice frequency circuits and can be operated from 24 to 26 volt central office or battery supply.

Telephone repeater systems may be assembled by using the 453B Amplifier and other ALTEC plug-in items.

With a maximum gain control setting, the 453B Amplifier is capable of receiving 1.0 milliwatt input without harmful effects to the transistors. Negative feedback is utilized to reduce distortion and to stabilize gain within 0.3 dB for a 25 percent reduction of supply voltage. When the ambient temperature increases from 75 to 110 degrees Fahrenheit, the amplifier gain decreases 0.2 dB. Output capacity is adequate for a maximum +10 VU level of the transmitting toll switchboard and other equipment having a similar signal level. The input and output longitudinal balance is sufficiently high so that normal noise requirements are met without use of a mid-point ground.

### INSTALLATION AND OPERATION

The ALTEC 453B Amplifier is dependent upon the polarity of the power supply for its operation. Prior to installation, make certain that the positive side of the supply is at pin 9, and the negative at pin 8, of the 11-pin socket of the mounting. The amplifier should be inserted into its socket carefully to prevent damage to the pins of the connector plug.

In order to adjust the gain control, which has a range of approximately 40 dB, the locknut located on the front panel must be released. The level of the monitor pins on the front panel (bridged by 600 ohms) is approximately 11 dB below the output level of the unit. After adjustment is completed, carefully retighten the locknut and recheck the gain settings to make certain that the control shaft has not been disturbed in the tightening operation.

Please refer to the ALTEC Telephone Engineering Department if information is desired in reference to gain versus temperature, change in gain versus output power, phase shift characteristics and envelope delay and distortion characteristics.

### MAINTENANCE

In the event of a malfunction, use the ALTEC 13204 or 13903 Extractor Tool to remove the unit from its mounting. Use of a replacement amplifier will permit quick restoration of service. The unit may be serviced locally or returned to the manufacturer for repair. If it is necessary to remove the unit from its protective cover, remove the two screws and plate from the rear (plug end), then withdraw the unit from the front.

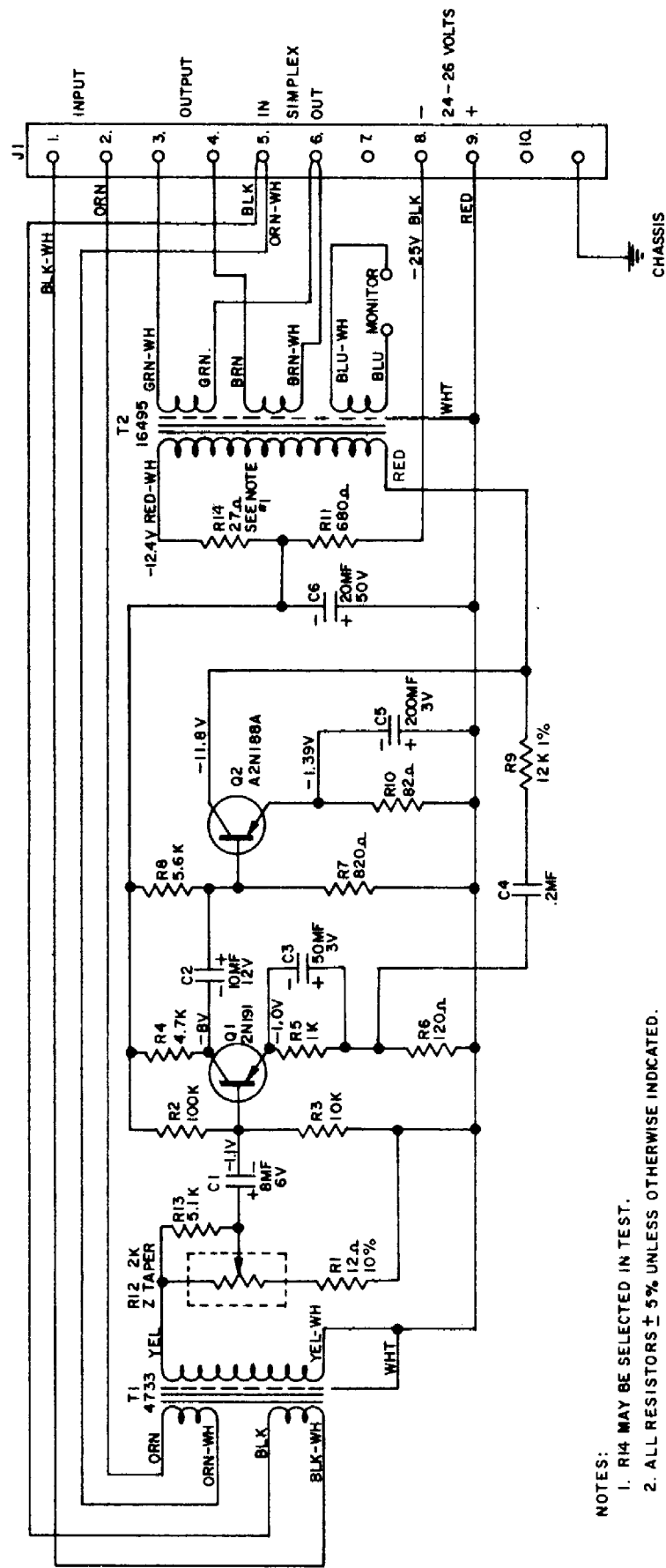


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NOTES:  
1. R14 MAY BE SELECTED IN TEST.

2. ALL RESISTORS  $\pm 5\%$  UNLESS OTHERWISE INDICATED.

C1	Capacitor, 8 mfd, 6V (Sprague 40D126A1)	R4	Resistor, 4.7K $\Omega \pm 5\%$ , 1/2W
C2	Capacitor, 10 mfd, 12V (Sprague 40D146A1)	R5	Resistor, 1K $\Omega \pm 5\%$ , 1/2W
C3	Capacitor, 50 mfd, 3V (Sprague 40D112A1)	R6	Resistor, 120 $\Omega \pm 5\%$ , 1/2W
C4	Capacitor, 0.2 mfd, 200V (Hopkins P22D)	R7	Resistor, 820 $\Omega \pm 5\%$ , 1/2W
C5	Capacitor, 200 mfd, 3V (Sprague 40D116A1)	R8	Resistor, 5.6K $\Omega \pm 5\%$ , 1/2W
C6	Capacitor, 20 mfd, 50V (Sprague 40D195A1)	R9	Resistor, 12K $\Omega \pm 1\%$ , 1/2W
J1	Plug, 11-pin (Amphenol 86-CP-11)		(Dialohm DC1/2 or equivalent)
Q1	Transistor (G.E. 2N191)	R10	Resistor, 820 $\Omega \pm 5\%$ , 1/2W
Q2	Transistor (G.E. A2N188A)	R11	Resistor, 680 $\Omega \pm 5\%$ , 1/2W
R1	Resistor, 12 $\Omega \pm 10\%$ , 1/2W	R12	Potentiometer, 2K $\Omega$ , Z taper (Clarostat CM22782)
R2	Resistor, 100K $\Omega \pm 5\%$ , 1/2W	R13	Resistor, 5.1K $\Omega \pm 5\%$ , 1/2W
R3	Resistor, 10K $\Omega \pm 5\%$ , 1/2W		
R14	Resistor, 27 $\Omega \pm 5\%$ , 1/4W		
T1	Transformer (ALTEC 4733)		
T2	Transformer (ALTEC 16495)		

Figure 3. Schematic 453B Transistor Amplifier

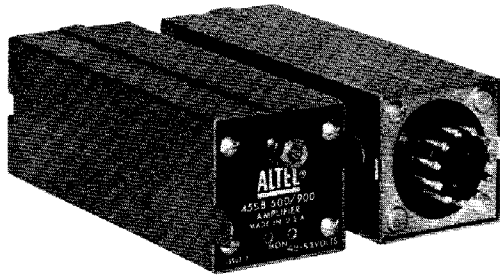


Figure 1. 453B 600/900 Transistor Amplifier

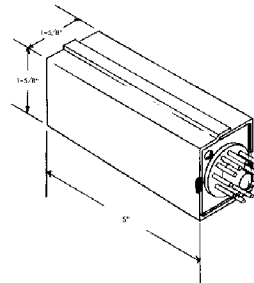


Figure 2. Dimensional Drawing

### SPECIFICATIONS

Frequency Response:	$\pm 1.0$ dB from 200 to 6000 Hz
Gain:	$39 \pm 1.0$ dB (matched to load)
Distortion:	1.5% THD (at +10 dBm, 200 to 6000 Hz)
Maximum Power Input:	-22 dBm (at maximum gain)
Maximum Power Output:	+17 dBm
Output Noise Level:	-70 dBm
Input Gain Control:	Varies gain from -2.0 dB to maximum of 39 dB
Operating Voltage:	24 to 26V dc
Operating Current:	20 milliamperes
Impedance, Input:	600 or 900 ohms
Impedance, Output:	600 or 900 ohms
Monitor Facilities:	11.0 $\pm$ 1.5 dB below amplifier output is available at test jacks on the front panel when bridged by 600 ohms
Simplex:	100 milliamperes maximum with 5.0 milliamperes maximum out-of-balance
Mounting Socket:	11-pin socket (Amphenol 78-S11)
Dimensions:	1-5/8" H x 1-5/8" W x 5" D
Finish:	Cadmium plate with dichromate finish
Weight:	14 ounces
Accessories:	ALTEC 7305A Mounting Panel (mounts up to twelve 453B 600/900 Amplifiers) ALTEC 7316A Mounting Panel (mounts up to ten 453B 600/900 Amplifiers) ALTEC 12962 or ALTEC 13227 Mounting Assembly (mounts single 453B 600/900 Amplifier for type 105 Apparatus Box) ALTEC 14115A Assembly (mounts two 453B 600/900 Amplifiers in KTU-15A type frame)

### DESCRIPTION

The ALTEC 453B 600/900 Transistor Amplifier is a two-stage, plug-in unit designed for use in voice frequency circuits. It can be operated from a 24 to 26V central office or battery supply. Telephone repeater systems can be assembled using these amplifiers and additional ALTEC plug-in items of equipment. The ALTEC 453B 600/900 Amplifier provides dual input and output impedances of 600 and 900 ohms, internally selected.

With a maximum gain control setting, the amplifier is capable of receiving 1 milliwatt input without harmful effects to the transistors. Negative feedback is utilized to reduce distortion and to stabilize gain within 0.3 dB for a 25 percent reduction of supply voltage. When the ambient temperature increases from 75 to 110 degrees Fahrenheit, the gain decreases 0.2 dB. Output capacity is adequate for a maximum +10 VU level of the transmitting toll switchboard and equipment having a similar signal level. Center taps are furnished on input and output transformers for a maximum simplex current of 100 milliamperes, with a permissible five milliamperes out-of-balance current. The input and output transformer longitudinal balance is sufficiently high that normal noise requirements can be met without the use of a mid-point ground.

Please refer to the ALTEC Telephone Engineering Department if information is desired in reference to gain versus temperature, change in gain versus output power, phase shift characteristics and envelope delay and distortion characteristics.

### INSTALLATION AND APPLICATION

The ALTEC 453B 600/900 Transistor Amplifier is dependent upon the polarity of the power supply for its operation. Prior to installation, make certain that the positive side of the supply is at pin 9, and the negative at pin 8, of the 11-pin socket of the mounting. The amplifier should be inserted carefully into its socket to prevent possible damage to the pins of the connector plug.

The ALTEC 453B 600/900 Amplifier (24 to 26V dc) is shipped wired for 600 ohm operation. If the amplifier is to be used in 900 ohm facilities, the input and output pair must be removed from terminals 1 and 2 of the terminal strips (TS1 and TS2, Figure 3) and transferred to terminals 3 and 4.

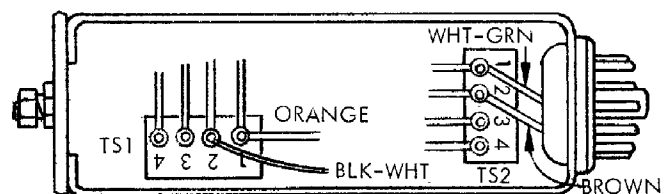



Figure 3



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To change the input impedance from 600 to 900 ohms, proceed as follows:

1. Unsolder the orange wire from terminal 1 (TS1, Figure 3) and resolder the wire to terminal 3.
2. Unsolder the black-white wire from terminal 2 and resolder the wire to terminal 4.

To change the output impedance from 600 to 900 ohms, proceed as follows:

1. Unsolder the green-white wire from terminal 1 (TS2, Figure 3), and resolder it to terminal 3.
2. Unsolder the brown wire from terminal 2 and resolder it to terminal 4.

#### NOTE

When changing input and output impedances, transfer only those wires connected to the 11-pin plug (J1) of the amplifier. Do not transfer the wiring from transformers T1 or T2.

In order to adjust the gain control, which has a range of approximately 40 dB, the lock nut, located on the front panel, must be released. The level at the monitor pins on the front panel (bridged by 600 ohms) is 11 dB below the output level of the unit. After adjustment is completed, carefully re-tighten the lock nut and recheck the gain settings to make certain that the control shaft has not been disturbed in the tightening process.

#### MAINTENANCE

In the event of a malfunction, use the ALTEC 13204 or 13903 Extractor Tool to remove the unit from its mounting. Use of a replacement amplifier will permit quick restoration of service. The unit may be serviced locally or returned to the manufacturer for repair. If it is necessary to remove the unit from its protective cover, remove the two screws and plate from the rear (plug end), then withdraw the unit from the front.

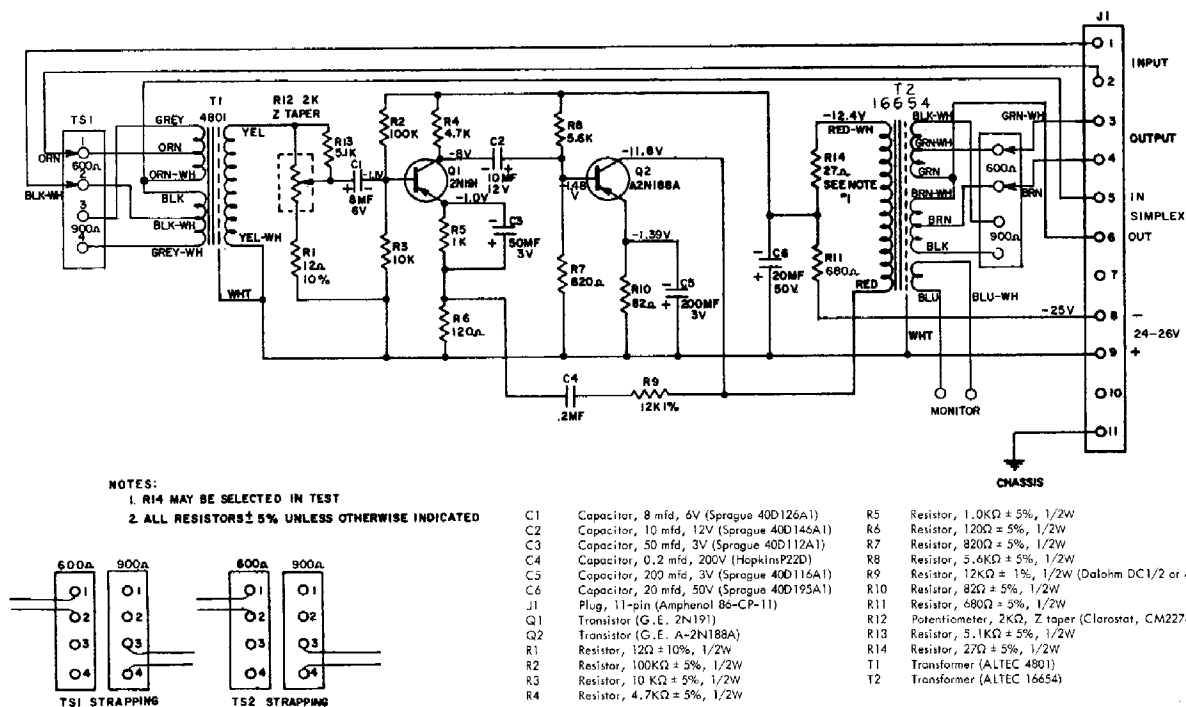


Figure 4. Schematic 453B 600/900 Transistor Amplifier

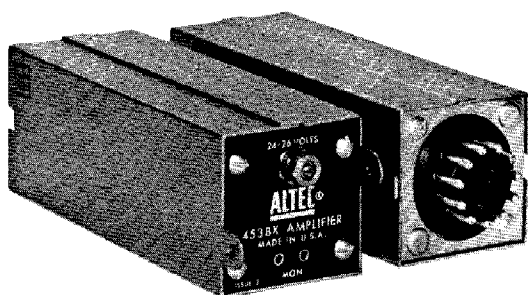


Figure 1. 453BX Transistor Amplifier

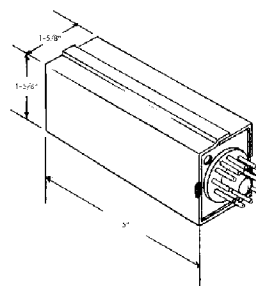


Figure 2. Dimensional Drawing

**SPECIFICATIONS**

Frequency Response:	$\pm 1.0$ dB from 200 to 6000 Hz
Gain:	$39 \pm 1.0$ dB (matched load)
Distortion:	1.5% THD (at +10 dBm, 200 to 6000 Hz)
Maximum Power Input:	-22 dBm (at maximum gain)
Maximum Power Output:	+17 dBm
Output Noise Level:	-70 dBm
Input Gain Control:	Varies gain from -2.0 dB to maximum of 39 dB
Operating Voltage:	24 - 26V dc
Operating Current:	20 milliamperes
Impedance, Input:	600 ohm
Impedance, Output:	600 ohm
Monitor Facilities:	11.0 $\pm$ .5 dB below amplifier output is available at test jacks on the front panel when bridged by 600 ohm
Simplex:	100 milliamperes maximum with 5.0 milliamperes maximum out-of-balance
Mounting Socket:	11-pin socket (Amphenol 78-S11)
Dimensions:	1-5/8" H x 1-5/8" W x 5" D
Finish:	Cadmium plate with dichromate finish
Weight:	14 ounces
Accessories:	ALTEC 7305A Mounting Panel (mounts up to twelve 453BX Amplifiers) ALTEC 7316A Mounting Panel (mounts up to ten 453BX Amplifiers) ALTEC 12910 Mounting Panel (mounts up to ten 453BX Amplifiers) ALTEC 12962 or ALTEC 13227 Mounting Assembly (mounts single 453BX Amplifier for type 105 Apparatus Box) ALTEC 14115A Assembly (mounts two 453BX Amplifiers in KTU-15A type frame)

**DESCRIPTION**

The ALTEC 453BX Transistor Amplifier is a two-stage, plug-in unit designed for use in voice frequency circuits. The amplifier can be operated from a 24 to 26V dc central office or battery supply. Telephone repeater systems can be assembled using the 453BX Amplifier with additional ALTEC plug-in units.

With a maximum gain control setting, the amplifier is capable of receiving 1 milliwatt input without harmful effects to the transistors. Negative feedback is utilized to reduce distortion and to stabilize gain within 0.3 dB for a 25 percent reduction of supply voltage. When the ambient temperature increases from 75 to 110 degrees Fahrenheit, the gain decreases 0.2 dB. Output capacity is adequate for a maximum +10 VU level of the transmitting toll switchboard and equipment having a similar signal level. Center taps are furnished on input and output transformers for a maximum simplex current of 100 milliamperes, with a permissible five milliamperes out-of-balance current. The input and output transformer longitudinal balance is sufficiently high that normal noise requirements can be met without the use of a mid-point ground.

Please refer to the ALTEC Telephone Engineering Department if information is desired in reference to gain versus temperature, change in gain versus output power, phase shift characteristics and envelope delay and distortion characteristics.

**INSTALLATION AND OPERATION**

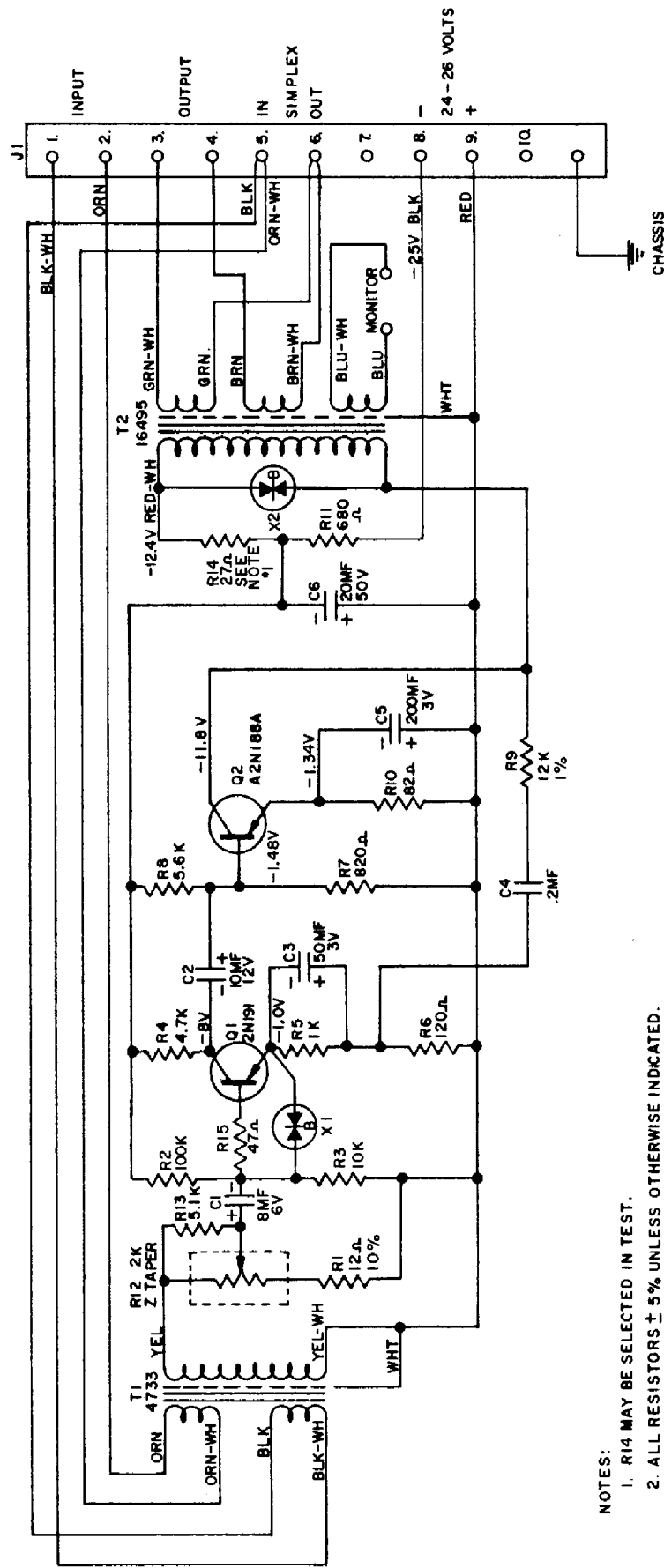
The ALTEC 453BX Transistor Amplifier is dependent upon the polarity of the power supply for its operation. Prior to installation, make certain that the positive side of the supply is at pin 9, and the negative at pin 8, of the 11-pin socket of the mounting. The amplifier should be inserted carefully into its socket to prevent possible damage to the pins of the connector plug.

In order to adjust the gain control, which has a range of approximately 40 dB, the lock nut located on the front panel must be released. The level at the monitor pins on the front panel (bridged by 600 ohms) is 11 dB below the output level of the unit. After adjustment is completed, carefully re-tighten the lock nut and recheck the gain settings to make certain that the control shaft has not been disturbed in the tightening operation.

**MAINTENANCE**

In the event of a malfunction, use the ALTEC 13204 or 13903 Extractor Tool to remove the unit from its mounting. Use of a replacement amplifier will permit quick restoration of service. The unit may be serviced locally or returned to the manufacturer for repair. If it is necessary to remove the unit from its protective cover, remove the two screws and plate from the rear (plug end), then withdraw the unit from the front.





NOTES:  
1. R14 MAY BE SELECTED IN TEST.

2. ALL RESISTORS  $\pm 5\%$  UNLESS OTHERWISE INDICATED.

C1	Capacitor, 8 mfd, 6V (Sprague 40D126A1)	R4	Resistor, 4.7K $\pm 5\%$ , 1/2W	R14	Resistor, 27 $\Omega \pm 5\%$ , 1/2W
C2	Capacitor, 10 mfd, 12V (Sprague 40D146A1)	R5	Resistor, 1K $\Omega \pm 5\%$ , 1/2W	R15	Resistor, 47 $\Omega \pm 5\%$ , 1/2W
C3	Capacitor, 50 mfd, 3V (Sprague 40D112A1)	R6	Resistor, 120 $\Omega \pm 5\%$ , 1/2W	T1	Transformer (ALTEC 4733)
C4	Capacitor, 0.2 mfd, 200V (Hopkins P22D)	R7	Resistor, 820 $\Omega \pm 5\%$ , 1/2W	T2	Transformer (ALTEC 16495)
C5	Capacitor, 200 mfd, 3V (Sprague 40D116A1)	R8	Resistor, 5.6K $\Omega \pm 5\%$ , 1/2W	X1, 2	Thyrector (G.E. 6RS5SP1B1)
C6	Capacitor, 20 mfd, 50V (Sprague 40D195A1)	R9	Resistor, 12K $\Omega \pm 1\%$ , 1/2W		
J1	Plug, 11-pin (Amphenol 86-CP-11)		(Dallm DC 1/2 or equivalent)		
Q1	Transistor (G.E. 2N191)	R10	Resistor, 82 $\Omega \pm 5\%$ , 1/2W		
Q2	Transistor (G.E. 2N188A)	R11	Resistor, 680 $\Omega \pm 5\%$ , 1/2W		
R1	Resistor, 12 $\Omega \pm 10\%$ , 1/2W	R12	Potentiometer, 2K $\Omega$ , Z taper (Clarostat CM 22782)		
R2	Resistor, 100K $\Omega \pm 5\%$ , 1/2W				
R3	Resistor, 10K $\Omega \pm 5\%$ , 1/2W				

Figure 3. Schematic 453BX Transistor Amplifier



Figure 1. 455B Transistor Amplifier

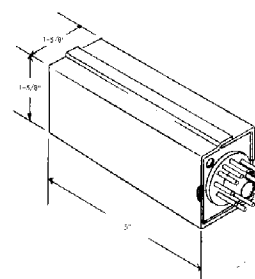


Figure 2. Dimensional Drawing

## SPECIFICATIONS

Frequency Response:	$\pm 1.0$ dB from 200 to 6000 Hz
Gain:	39 $\pm 1.0$ dB (matched to load)
Distortion:	1.5% THD (at +10 dBm, 200 to 6000 Hz)
Maximum Power Input:	-22 dBm (at maximum gain)
Maximum Power Output:	+17 dBm
Output Noise Level:	-70 dBm
Input Gain Control:	Varies gain from -2.0 dB to maximum of 39 dB
Operating Voltage:	48 to 52V dc
Operating Current:	20 milliamperes
Impedance, Input:	600 ohms
Impedance, Output:	600 ohms
Monitor Facilities:	11.0 $\pm 1.5$ dB below amplifier output is available at test jacks on the front panel when bridged by 600 ohms
Simplex:	100 milliamperes maximum with 5.0 milliamperes maximum out-of-balance
Mounting Socket:	11-pin socket (Amphenol 78-S11)
Dimensions:	1-5/8" H x 1-5/8" W x 5" D
Finish:	Cadmium plate with dichromate finish
Weight:	14 ounces
Accessories:	ALTEC 7305A Mounting Panel (mounts up to twelve 455B Amplifiers) ALTEC 7316A Mounting Panel (mounts up to ten 455B Amplifiers) ALTEC 12910 Mounting Panel (mounts up to ten 455B Amplifiers) ALTEC 12962 or ALTEC 13227 Mounting Assembly (mounts single 455B Amplifier for type 105 Apparatus Box) ALTEC 14115A Assembly (mounts two 455B Amplifiers in KTU-15A type frame)

## DESCRIPTION

The ALTEC 455B Transistor Amplifier is a two-stage, plug-in unit designed for use in voice frequency circuits. It can be operated from a 48 to 52V dc central office or battery supply. Telephone repeater systems can be assembled using these amplifiers and additional ALTEC plug-in items of equipment.

With a maximum gain control setting, the amplifier is capable of receiving 1.0 milliwatt input without harmful effects to the transistors. Negative feedback is utilized to reduce distortion and to stabilize gain within 0.3 dB for a 25 percent reduction of supply voltage. When the ambient temperature increases from 75 to 110 degrees Fahrenheit, the gain decreases 0.2 dB. Output capacity is adequate for a maximum +10 VU level of the transmitting toll switchboard and equipment having a similar signal level. Center taps are furnished on input and output transformers for a maximum simplex current of 100 milliamperes, with a permissible five milliamperes out-of-balance current. The input and output transformer longitudinal balance is sufficiently high that normal noise requirements can be met without the use of a mid-point ground.

Please refer to the ALTEC Telephone Engineering Department if information is desired in reference to gain versus temperature, change in gain versus output power, phase shift characteristics and envelope delay and distortion characteristics.

## INSTALLATION AND APPLICATION

The ALTEC 455B Transistor Amplifier is dependent upon the polarity of the power supply for its operation. Prior to installation, make certain that the positive side of the supply is at pin 9, and the negative at pin 8, of the 11-pin socket of the mounting. The amplifier should be inserted carefully into its socket to prevent possible damage to the pins of the connector plug.

In order to adjust the gain control, which has a range of approximately 40 dB, the lock nut, located on the front panel, must be released. The level at the monitor pins on the front panel (bridged by 600 ohms) is 11 dB below the output level of the unit. After adjustment is completed, carefully re-tighten the lock nut and recheck the gain settings to make certain that the control shaft has not been disturbed in the tightening process.

## MAINTENANCE

In the event of a malfunction, use the ALTEC 13204 or 13903 Extractor Tool to remove the unit from its mounting. Use of a replacement amplifier will permit quick restoration of service. The unit may be serviced locally or returned to the manufacturer for repair. If it is necessary to remove the unit from its protective cover, remove the two screws and plate from the rear (plug end) then withdraw the unit from the front.

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



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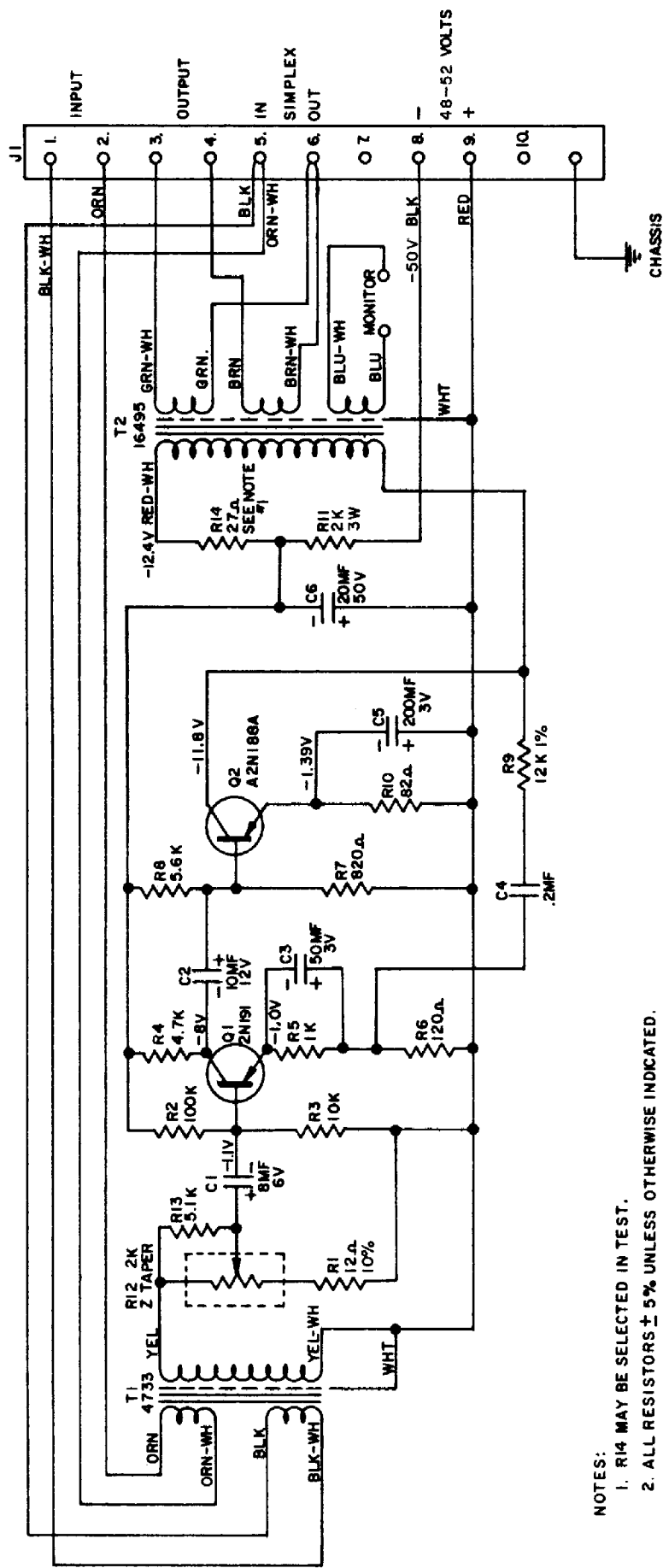
1515 S. Manchester Ave., Anaheim, Calif. 92803

New York

AL-1905

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TELECOMMUNICATIONS



# NOTES:

1. R14 MAY BE SELECTED IN TEST.

2. ALL RESISTORS  $\pm 5\%$  UNLESS OTHERWISE INDICATED.

- |     |  |     |  |
|-----|--|-----|--|
| C1  | Capacitor, 8 mfd, 6V (Sprague 40D126A1)    | R4  | Resistor, 4.7K $\pm 5\%$ , 1/2W                |
| C2  | Capacitor, 10 mfd, 12V (Sprague 40D146A1)  | R5  | Resistor, 1K $\pm 5\%$ , 1/2W                  |
| C3  | Capacitor, 50 mfd, 3.0V (Sprague 40D112A1) | R6  | Resistor, 120K $\pm 5\%$ , 1/2W                |
| C4  | Capacitor, 0.2 mfd, 200V (Hopkins P22D)    | R7  | Resistor, 820 $\pm 5\%$ , 1/2W                 |
| C5  | Capacitor, 200 mfd, 3V (Sprague 40D116A1)  | R8  | Resistor, 5.6K $\pm 5\%$ , 1/2W                |
| C6  | Capacitor, 20 mfd, 50V (Sprague 40D195A1)  | R9  | Resistor, 12K $\pm 1\%$ , 1/2W                 |
| J1  | Plug, 11-pin (Amphenol 86-CP-11)           | R10 | (Dallohm DC1/2 or equivalent)                  |
| Q1  | Transistor, (G.E. 2N191)                   | R11 | Resistor, 82 $\pm 5\%$ , 1/2W                  |
| Q2  | Transistor, (G.E. A2N188A)                 | R12 | Resistor, 2K $\pm 5\%$ , 3W (Sprague 242E2025, |
| R1  | Resistor, 12K $\pm 10\%$ , 1/2W            |     | Tru-ohm VAL 3-2000 or equivalent)              |
| R2  | Resistor, 100K $\pm 5\%$ , 1/2W            |     | Potentiometer, 2K $\Omega$ , Z taper           |
| R3  | Resistor, 10K $\pm 5\%$ , 1/2W             |     | (Clarostat CM27782)                            |
| R13 | Resistor, 5.1K $\pm 5\%$ , 1/2W            |     |  |
| R14 | Resistor, 27 $\Omega$ $\pm 5\%$ , 1/4W     |     |  |
| T1  | Transformer (ALTEC 4733)                   |     |  |
| T2  | Transformer (ALTEC 16495)                  |     |  |

Figure 3. Schematic 455B Transistor Amplifier



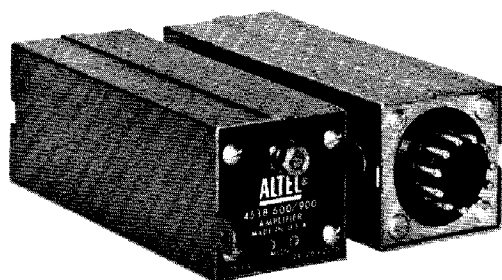


Figure 1. 455B 600/900 Transistor Amplifier

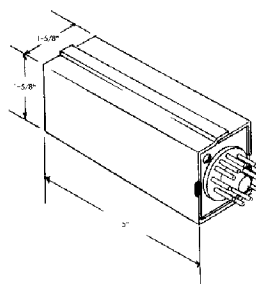


Figure 2. Dimensional Drawing

### SPECIFICATIONS

Frequency Response:	$\pm 1.0$ dB from 200 to 6000 Hz
Gain:	$39 \pm 1.0$ dB (matched to load)
Distortion:	1.5% THD (at +10 dBm, 200 to 6000 Hz)
Maximum Power Input:	-22 dBm (at maximum gain)
Maximum Power Output:	+17 dBm
Output Noise Level:	-70 dBm
Input Gain Control:	Varies gain from -2.0 dB to maximum of 39 dB
Operating Voltage:	48 to 52V dc
Operating Current:	20 milliamperes
Impedance, Input:	600 or 900 ohms
Impedance, Output:	600 or 900 ohms
Monitor Facilities:	11 $\pm 1.5$ dB below amplifier output is available at test jacks on the front panel when bridged by 600 ohms
Simplex:	100 milliamperes maximum with 5.0 milliamperes maximum out-of-balance
Mounting Socket:	11-pin socket (Amphenol 78-S11)
Dimensions:	1-5/8" H x 1-5/8" W x 5" D
Finish:	Cadmium plate with dichromate finish
Weight:	14 ounces
Accessories:	ALTEC 7305A Mounting Panel (mounts up to twelve 455B 600/900 Amplifiers) ALTEC 7316A Mounting Panel (mounts up to ten 455B 600/900 Amplifiers) ALTEC 12910 Mounting Panel (mounts up to ten 455B 600/900 Amplifiers) ALTEC 12962 or ALTEC 13227 Mounting Assembly (mounts single 455B 600/900 Amplifier for type 105 Apparatus Box) ALTEC 14115A Assembly (mounts two 455B 600/900 Amplifiers in KTU-15A type frame)

### DESCRIPTION

The ALTEC 455B 600/900 Transistor Amplifier is a two-stage, plug-in unit designed for use in voice frequency circuits. It can be operated from a 48 to 52V central office or battery supply. Telephone repeater systems can be assembled using

these amplifiers and additional ALTEC plug-in items of equipment. The ALTEC 455B 600/900 Amplifier provides dual input and output impedances of 600 and 900 ohms, internally selected.

With a maximum gain control setting, the amplifier is capable of receiving 1.0 milliwatt input without harmful effects to the transistors. Negative feedback is utilized to reduce distortion and to stabilize gain within 0.3 dB for a 25 percent reduction of supply voltage. When the ambient temperature increases from 75 to 110 degrees Fahrenheit, the gain decreases 0.2 dB. Output capacity is adequate for a maximum +10 VU level of the transmitting toll switchboard and equipment having a similar signal level. Center taps are furnished on input and output transformers for a maximum simplex current of 100 milliamperes, with a permissible five milliamperes out-of-balance current. The input and output transformer longitudinal balance is sufficiently high that normal noise requirements can be met without the use of a mid-point ground.

Please refer to the ALTEC Telephone Engineering Department if information is desired in reference to gain versus temperature, change in gain versus output power, phase shift characteristics and envelope delay and distortion characteristics.

### INSTALLATION AND APPLICATION

The ALTEC 455B 600/900 Transistor Amplifier is dependent upon the polarity of the power supply for its operation. Prior to installation, make certain that the positive side of the supply is at pin 9, and the negative at pin 8, of the 11-pin socket of the mounting. The amplifier should be inserted carefully into its socket to prevent possible damage to the pins of the connector plug.

The ALTEC 455B 600/900 Amplifier (48 to 52V dc) is shipped wired for 600 ohm operation. If the amplifier is to be used in 900 ohm facilities, the input and output pair must be removed from terminals 1 and 2 of the terminal strips (TS1 and TS2, Figure 3) and transferred to terminals 3 and 4.

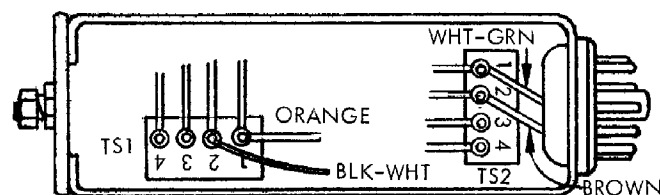


Figure 3

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



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To change the input impedance from 600 to 900 ohms, proceed as follows:

1. Unsolder the orange wire from terminal 1 (TS1, Figure 3) and resolder the wire to terminal 3.
2. Unsolder the black-white wire from terminal 2 and resolder the wire to terminal 4.

To change the output impedance from 600 to 900 ohms, proceed as follows:

1. Unsolder the green-white wire from terminal 1 (TS2, Figure 3) and resolder it to terminal 3.
2. Unsolder the brown wire from terminal 2 and resolder it to terminal 4.

#### NOTE

When changing input and output impedances, transfer only those wires connected to the 11-pin plug (J1) of the amplifier. Do not transfer the wiring from transformers T1 or T2.

In order to adjust the gain control, which has a range of approximately 40 dB, the lock nut, located on the front panel, must be released. The level at the monitor pins on the front panel (bridged by 600 ohms) is 11 dB below the output level of the unit. After adjustment is completed, carefully re-tighten the lock nut and recheck the gain settings to make certain that the control shaft has not been disturbed in the tightening process.

#### MAINTENANCE

In the event of a malfunction, use the ALTEC 13204 or 13903 Extractor Tool to remove the unit from its mounting. Use of a replacement amplifier will permit quick restoration of service. The unit may be serviced locally or returned to the manufacturer for repair. If it is necessary to remove the unit from its protective cover, remove the two screws and plate from the rear (plug end), then withdraw the unit from the front.

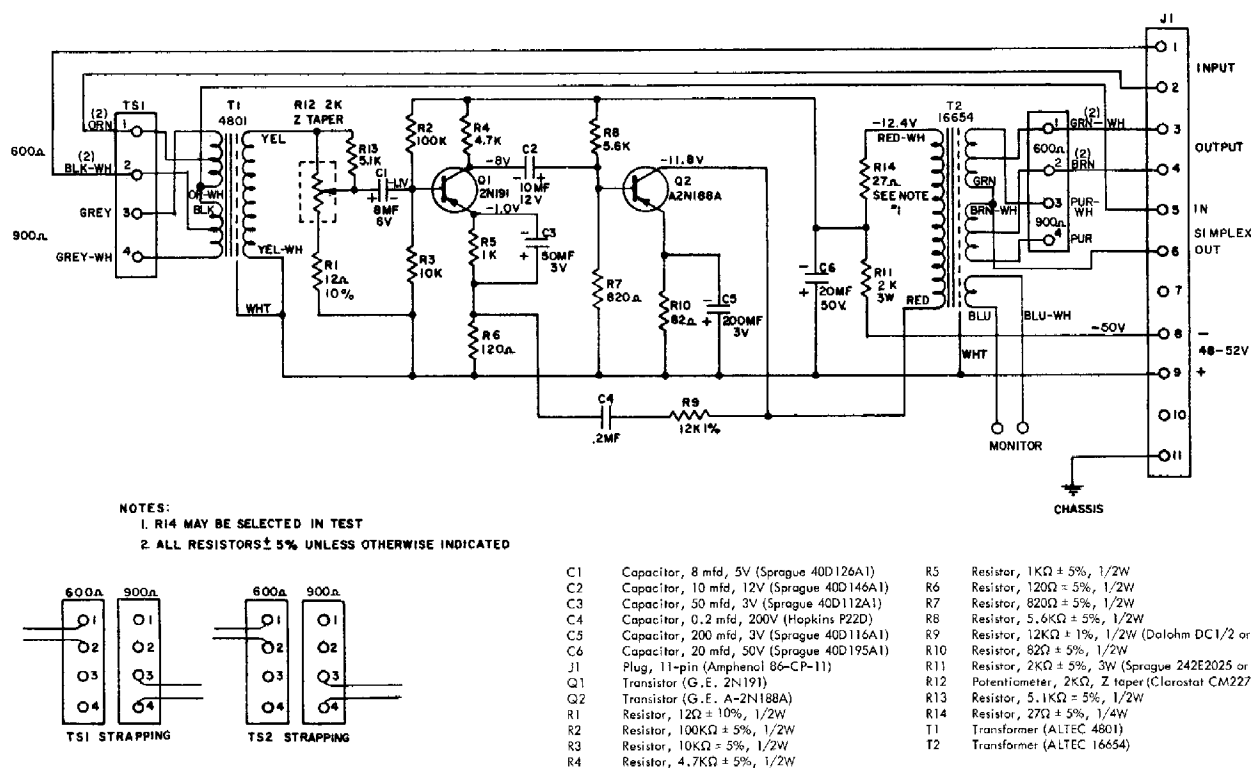


Figure 4. Schematic 455B 600/900 Transistor Amplifier

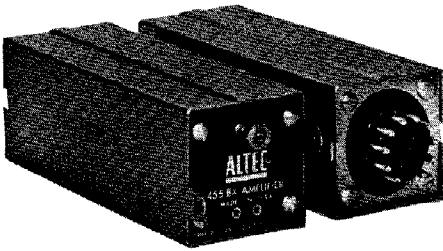


Figure 1. 455BX Transistor Amplifier

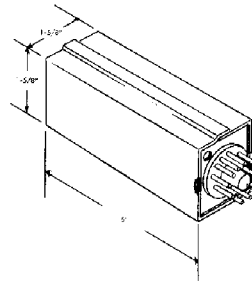


Figure 2. Dimensional Drawing

**SPECIFICATIONS**

Frequency Response:	$\pm 1.0$ dB from 200 to 6000 Hz
Gain:	39 $\pm 1.0$ dB (matched to load)
Distortion:	1.5% THD (at +10 dBm, 200 to 6000 Hz)
Maximum Power, Input:	-22 dBm (at maximum gain)
Maximum Power, Output:	+17 dBm
Output Noise Level:	-70 dBm
Input Gain Control:	Varies gain from -2.0 dB to maximum of 39 dB
Operating Voltage:	48 to 52V dc
Operating Current:	20 milliamperes
Impedance, Input:	600 ohms
Impedance, Output:	600 ohms
Monitor Facilities:	11 $\pm 1.5$ dB below amplifier output is available at test jacks on the front panel when bridged by 600 ohms
Simplex:	100 milliamperes maximum with 5.0 milliamperes maximum out-of-balance
Mounting Socket:	11-pin socket (Amphenol 78-S11)
Dimensions:	1-5/8" H x 1-5/8" W x 5" D
Finish:	Cadmium plate with dichromate finish
Weight:	14 ounces
Accessories:	ALTEC 7305A Mounting Panel (mounts up to twelve 455BX Amplifiers) ALTEC 7316A Mounting Panel (mounts up to ten 455BX Amplifiers) ALTEC 12910 Mounting Panel (mounts up to ten 455BX Amplifiers) ALTEC 12962 or ALTEC 13227 Mounting Assembly (mounts single 455BX Amplifier for type 105 Apparatus Box) ALTEC 14115A Assembly (mounts two 455BX Amplifiers in KTU-15A frame)

**DESCRIPTION**

The ALTEC 455BX Repeater Type Transistor Amplifier is a two-stage, plug-in unit designed for use in voice frequency circuits. The amplifier can be operated from a 48 to 52 volt central office or battery supply. Telephone repeater systems can be assembled using this amplifier and additional ALTEC plug-in items of equipment.

With maximum gain control settings, the amplifier is capable of receiving 1.0 milliwatt input without harmful effects to the transistors. Negative feedback is utilized to reduce distortion and to stabilize gain within 0.3 dB for a 25 percent reduction of supply voltage. When the ambient temperature increases from 75 to 110 degrees Fahrenheit, the gain decreases 0.2 dB. Output capacity is adequate for a maximum of +10 VU level of the transmitting toll switchboard and equipment having a similar signal level. Center taps are furnished on input and output transformers for a maximum simplex current of 100 milliamperes, with a permissible five milliamperes out-of-balance current. The input and output transformer longitudinal balance is sufficiently high that normal noise requirements can be met without the use of a midpoint ground.

The 455BX Amplifier is provided with protective devices (Thyrectors) which minimize the effect of extraneous static, lightning, or power line surges.

Please refer to the ALTEC Telephone Engineering Department if information is desired in reference to gain versus temperature, change in gain versus output power, phase shift characteristics and envelope delay and distortion characteristics.

**INSTALLATION AND APPLICATION**

The ALTEC 455BX Amplifier is dependent upon the polarity of the power supply for its operation. Prior to installation, check to ascertain that the positive side of the supply is at pin 9, and the negative at pin 8, of the 11-pin socket of the mounting. The amplifier should be inserted carefully into its socket to prevent possible damage to the pins of the connector plug.

In order to adjust the gain control, which has a range of approximately 40 dB, the lock nut, located on the front panel, must be released. The level at the monitor pins on the front panel (bridged by 600 ohms) is 11 dB below the output level of the unit. After adjustment is completed, carefully re-tighten the lock nut and recheck the gain settings to make certain that the control shaft has not been disturbed in the tightening process.

**MAINTENANCE**

In the event of a malfunction, use the ALTEC 13204 or 13903 Extractor Tool to remove the unit from its mounting. Use of a replacement amplifier will permit quick restoration of service. The unit may be serviced locally or returned to the manufacturer for repair. If it is necessary to remove the unit from its protective cover, remove the two screws and plate from the rear (plug end), then withdraw the unit from the front.

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



# PARTS LIST - 455BX (ISSUE 2) - ALTEC SCHEMATIC NUMBER 8334-1

C1	Capacitor, 8 mfd, 6 v (Sprague 40D126A1)	R5	Resistor, 1000 $\Omega$ $\pm$ 5%, 1/2 w
C2	Capacitor, 10 mfd, 12 v (Sprague 40D146A1)	R6	Resistor, 120 $\Omega$ $\pm$ 5%, 1/2 w
C3	Capacitor, 50 mfd, 3 v (Sprague 40D112A1)	R7	Resistor, 820 $\Omega$ $\pm$ 5%, 1/2 w
C4	Capacitor, 0.2 mfd, 200 v (Hopkins P22D)	R8	Resistor, 5600 $\Omega$ $\pm$ 5%, 1/2 w
C5	Capacitor, 200 mfd, 3 v (Sprague 40D116A1)	R9	Resistor, 12,000 $\Omega$ $\pm$ 1%, 1/2 w (Dalohm DC1/2)
C6	Capacitor, 20 mfd, 50 v (Sprague 40D195A1)	R10	Resistor, 82 $\Omega$ $\pm$ 5%, 1/2 w
J1	Plug, 11-pin (Amphenol 86-CP-11)	R11	Resistor, 2000 $\Omega$ $\pm$ 5%, 3 w (Sprague 242E2025)
Q1	Transistor (G. E. 2N191)	R12	Potentiometer, 2000 $\Omega$ , Z taper (Clarostat)
Q2	Transistor (Altec AL 2N188A)	R13	Resistor, 5100 $\Omega$ $\pm$ 5%, 1/2 w
R1	Resistor, 12 $\Omega$ $\pm$ 10%, 1/2 w	R14	Resistor, 47 $\Omega$ $\pm$ 5%, 1/2 w
R2	Resistor, 100,000 $\Omega$ $\pm$ 5%, 1/2 w	T1	Transformer (Altec 4733)
R3	Resistor, 10,000 $\Omega$ $\pm$ 5%, 1/2 w	T2	Transformer (Altec 16495)
R4	Resistor, 4700 $\Omega$ $\pm$ 5%, 1/2 w	X1, X2	Thyrector (G. E. 6RS55P1B1)

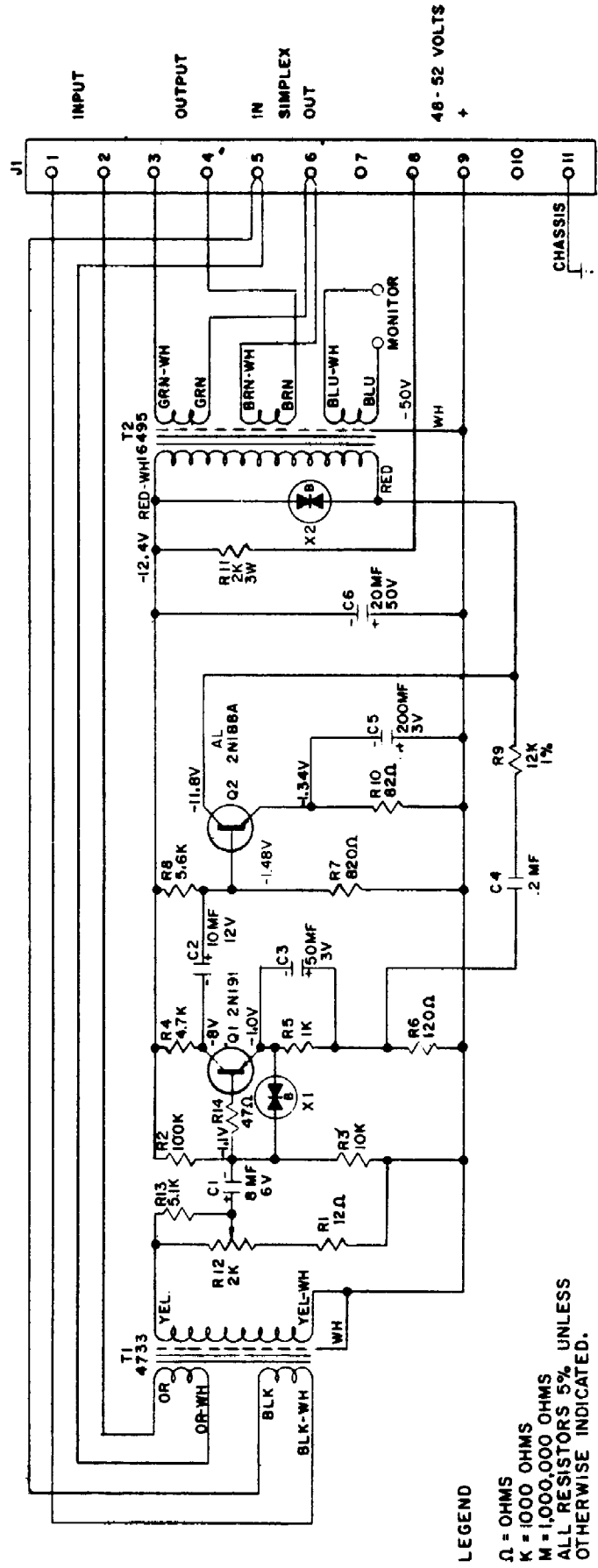


Figure 3. Schematic 455BX Transistor Amplifier

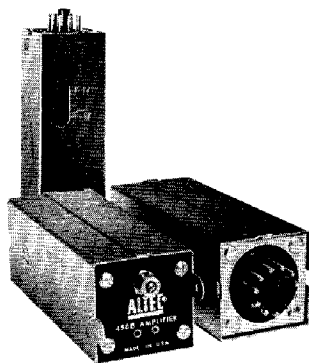


Figure 1. 456B Transistor Amplifier

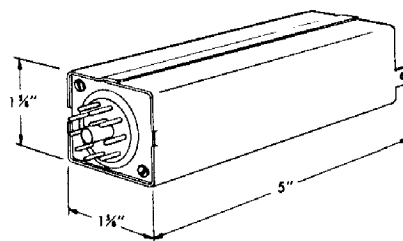


Figure 2. Dimensional Drawing

### SPECIFICATIONS

Frequency Response:	$\pm 1$ dB, 200 - 6,000 Hz
Distortion:	Below 1% THD (at +10 dBm, 200 - 6,000 Hz)
Maximum Power Input:	-22 dBm (at maximum gain)
Maximum Power Output:	+17 dBm
Output Noise Level:	-70 dBm
Input Gain Control:	Varies gain from -2 dB to maximum of 39 dB
Operating Voltage:	24 or 48V dc (Selected by moving screw, accessible on bottom of amplifier case)
Input Impedance:	600 ohms
Output Impedance:	600 ohms
Current Drain:	20 mA (at 25 and 50V dc, when selector screw is in proper position)
Max. Simplex Current:	100 mA
Max. Out-of-Balance Simplex Current:	5 mA
Monitor Facilities:	11 $\pm$ 1.5 dB below amplifier output is available at test jacks on front panel and pins 7 and 10 on J1 when bridged by 600 ohms
Dimensions:	1-5/8" H x 1-5/8" W x 5" D
Finish:	Cadmium plated/dichromate finish
Weight:	13 ounces

### DESCRIPTION

The 456B Amplifier is an all-transistor unit, utilizing three silicon transistors and a printed circuit for maximum uniformity of production and minimum variation in operational characteristics when subjected to ambient temperatures as great as 140°F. Operating voltage of the 456B is selectable (24 - 26 or 48 - 52V dc) by moving the small screw on the bottom of the amplifier case, to one of the two positions indicated as shown on the above illustration and on the schematic. This acts as a strap, connecting the B+, (pin 9), to either R10, 270 ohms, for 24 - 26 volt operation or to R11, 1500 ohms, for 48 - 52 volt operation.

The circuitry of the 456B Amplifier has been designed to minimize RF radiation from nearby relays, stepping switches, battery supply spikes, etc., in order that relatively high speed data

may be passed through the amplifier without excessive signal mutilation. The 456B will meet all published specifications for the ALTEC 453B and the 455B Repeater Amplifiers when operated within the proper voltage limits. With the gain control set at the maximum position, the ALTEC 456B is capable of receiving an input level of 1 milliwatt without damage to the transistors. Negative feedback is utilized to reduce distortion and to stabilize gain within 0.3 dB for a 25% reduction of supply voltage. When the ambient temperature increases from 100° to 140°F, the output impedance undergoes an insignificant variation of only -1.5%.

The output carrying capacity is adequate for a maximum +10 VU level of the transmitting toll switchboard and equipment having a similar level. The input and output longitudinal balance is sufficiently high, so that normal noise requirements are met without the use of a mid-point ground.

In-and-out center taps are provided for simplex operation; the maximum simplex current is 100 mA; maximum out-of-balance simplex current is 5 mA.

### APPLICATIONS

The 456B Amplifier is used in voice frequency communication circuits. A telephone repeater system can be assembled on the ALTEC 7300/7306A Telephone Repeater Terminating Unit, using these amplifiers and additional plug-in items of equipment.

### INSTALLATION AND OPERATION

The 456B depends upon the polarity of the repeater station supply voltage for proper operation. Prior to inserting the amplifier, it should be determined that the positive side of the supply is at pin 9; the negative side at pin 8 (of the 11-pin socket mounted on the repeater rack). The amplifier should be inserted carefully to prevent possible damage to the locating pin of the 11-pin plug connector; removal of the 456B is accomplished by means of the 13204 or 13903 extractor tool.

The gain control affords a range of approximately 40 dB. In order to adjust the gain, the lock nut on the control must be loosened. The level at the monitor pins on the front panel, bridged by 600 ohms, is 11 dB below the output level of the am-

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plifier. After adjustment is completed, carefully tighten the locking nut and recheck the gain setting to ascertain that the control shaft is not disturbed in the tightening operation.

## MAINTENANCE

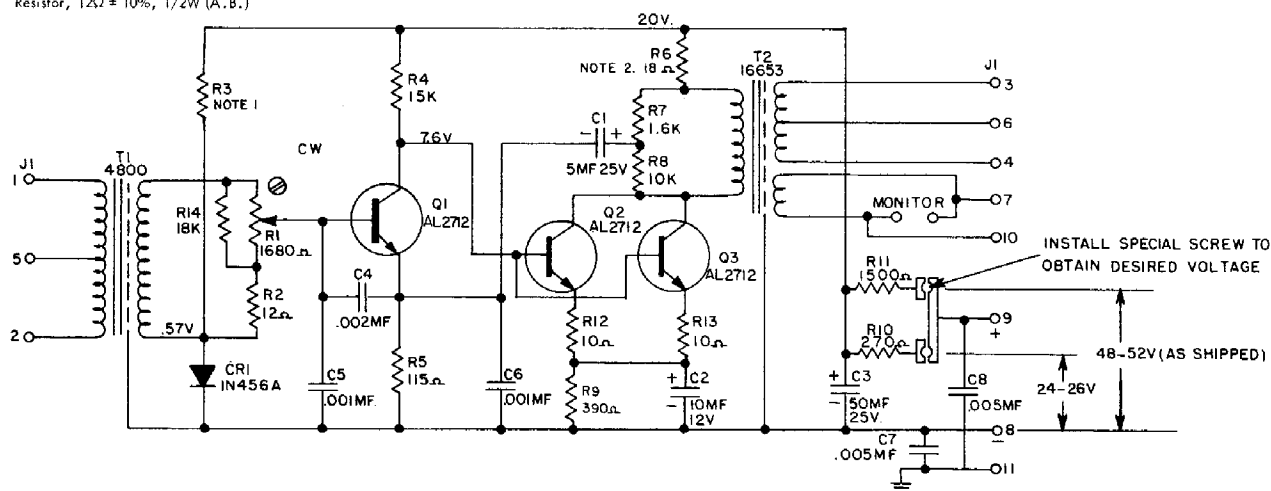
All 456B Amplifiers are of the plug-in type. In the event of a malfunction, the 13204 or 13903 extractor tool is used to remove the amplifier from the mounting panel. A replacement amplifier may then be installed, enabling rapid restoration to normal service. The defective amplifier may be serviced locally or returned to the manufacturer for repair. Should it become necessary to remove the amplifier from its protective cover,

remove the two screws and plate from the rear (plug end), then withdraw the unit from the front.

## SUPPORT EQUIPMENT

PANEL	CAPACITY	LOCATION
7305A	12 Amplifiers	19-inch relay rack
7316A	10 Amplifiers	19-inch relay rack
12910	10 Amplifiers	19-inch relay rack
12962	1 Amplifier	Type 105 apparatus box or equal
13227	1 Amplifier	Type 105 apparatus box or equal
14115A	2 Amplifiers	KTU-15A type frame or equal

- |        |   |        |   |
|--------|---|--------|---|
| C1     | Capacitor, 5 mfd, 25V (Sprague 40D176A1 or Callins ASDP 5-25, insulated)        | R3     | Resistor (selected) $\pm 10\%$ , 1/2W (A.B.)                                      |
| C2     | Capacitor, 10 mfd, 25V (Sprague 40D146A1 or Callins ASDP 10-12, insulated)      | R4     | Resistor, 15K $\pm 10\%$ , 1/2W (A.B.)  |
| C3     | Capacitor, 50 mfd, 25V (Sprague 40D506GO25DC3 or Callins ASDP 50-25, insulated) | R5     | Resistor, 115 $\Omega \pm 2\%$ , 1/2W, dep. carbon                                |
| C4     | Capacitor, .002 mfd $\pm 20\%$ , Z5U or Z5F ceramic disc                        | R6     | Resistor, 22 $\Omega \pm 5\%$ , 1/2W (A.B.)                                       |
| C5,6   | Capacitor, .001 mfd $\pm 20\%$ , Z5U or Z5F, ceramic disc                       | R7     | Resistor, 1.6K $\Omega \pm 5\%$ , 1/2W (A.B.)                                     |
| C7,8   | Capacitor, .005 mfd $\pm 20\%$ , Z5U or Z5F, ceramic disc                       | R8     | Resistor, 10K $\Omega \pm 5\%$ , 1/2W (A.B.)                                      |
| CR1    | Diode, 1N456A per dwg. 8668-1   | R9     | Resistor, 390 $\Omega \pm 10\%$ , 1/2W (A.B.)                                     |
| J1     | Plug, 11-pin (Amphenol 86-CP-11)  | R10    | Resistor, 27 $\Omega \pm 10\%$ , 1/2W (A.B.)                                      |
| Q1,2,3 | Transistor (ALTEC 2712)   | R11    | Resistor, 1.5K $\Omega \pm 5\%$ , 2W (Sprague 240E1525 or 3W Ohmite W.W. Axial L) |
| R1     | Potentiometer, 1.68K $\Omega$ (ALTEC 14395-1)                                   | R12,13 | Resistor, 10 $\Omega \pm 5\%$ , 1/2W (A.B.)                                       |
| R2     | Resistor, 12 $\Omega \pm 10\%$ , 1/2W (A.B.)                                    | T1     | Transformer (ALTEC 4800)  |
|        |   | T2     | Transformer (ALTEC 16653)   |



### NOTES:

1. SELECTED IN TEST VALUE BETWEEN 10K AND 50K AS REQUIRED TO ADJUST AMPLIFIER FOR MAX OUTPUT.
2. R6 NOMINAL VALUE IS 18 OHMS, THIS VALUE MAY BE SELECTED IF Q2 AND Q3 ARE HIGH GAIN TRANSISTORS. WHEN VALUE SHOULD BE BETWEEN 20 AND 27 OHMS.

Figure 3. Schematic 456B Transistor Amplifier

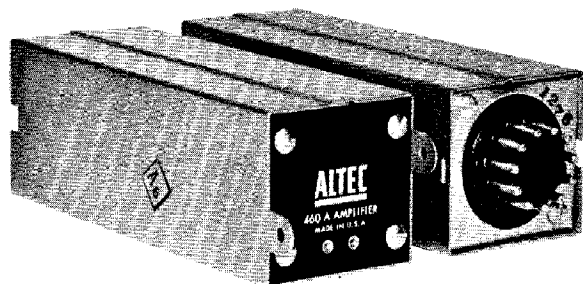


Figure 1. ALTEC 460A Amplifier

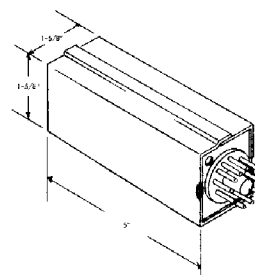


Figure 2. Dimensional Drawing

#### SPECIFICATIONS

Type:	Compressor Amplifier
Gain:	35 dB (no compression)
Compression:	25 dB (35 dB change in input results in 10 dB change in output)
Power Output:	+15 dBm with +5 dBm input +9 dBm with -10 dBm input +6 dBm with -20 dBm input +2 dBm with -30 dBm input
Distortion:	Less than 6% at +5 dBm output
Frequency Response:	$\pm 3$ dB from 200 to 6000 Hz
Input Impedance:	600 ohms
Load Impedance:	600 ohms
Output Noise Level:	-65 dBm
Power Required:	25 mA at 24V dc
Power Supply:	24 to 26V dc battery or rectified ac with total ripple contents below 2 mV
Dimensions:	1-5/8" H x 1-5/8" W x 5" D
Finish:	Cadmium plate with dichromate finish
Mounting Socket:	11-pin socket (Amphenol 78-511)
Monitor Taps:	11 $\pm 1.5$ dB below amplifier output available at test jacks on front panel when bridged by 600 ohms
Simplex Taps:	Primary of input transformer and secondary of output transformer center tapped for dc simplex operation
Simplex Current:	100 mA maximum; 5 mA maximum out-of-balance current
Weight:	16 ounces

#### DESCRIPTION

The 460A Amplifier is a two-stage, transistorized plug-in compressor-type amplifier designed for use with telephone repeater and communication equipment. The amplifier operates from a 24 to 26 volt central office supply, a local battery or ALTEC power supply units. The output power is dependent upon the input signal and approximates +2 dBm with an input of -30 dBm, increases to +9 dBm with -10 dBm input and +15 dBm with +5 dBm input. Negative feedback is used to reduce distortion and to stabilize gain. The unit is designed to operate at temperatures of up to 60° C and is rated most conservatively at room temperatures.

A dc simplex current may be used to bypass the amplifier. A maximum current of 100 mA is permitted, provided out-of-balance current does not exceed 5 mA.

#### APPLICATION

The 460A Amplifier may be used in voice frequency systems to enable a sensibly constant speech level output to be obtained when input signal levels vary widely. The amplifier may be used advantageously in many telephone system applications, some of which are:

- Toll Conference Grouping Systems
- Loudspeaking Telephone Systems
- Supervisory Monitoring

#### SUPPORT EQUIPMENT

A number of mounting panels are available for the 460A Compressor Amplifier:

PANEL	CAPACITY	LOCATION
7305A	12 Amplifiers	19-inch relay rack
7316A	10 Amplifiers	19-inch relay rack
12910	10 Amplifiers	19-inch relay rack
13227	1 Amplifier	Type 105 apparatus box or equal
14115A	2 Amplifiers	KTU-15A type frame or equal

#### INSTALLATION AND OPERATION

The 460A Compressor Amplifier should be inserted into its socket carefully to prevent possible damage to the pins of the connector plug. The 460A is a transistorized unit and is dependent upon the polarity of the power supply for its operation. Prior to connecting the amplifier, a careful check should be made to determine that the positive side is at pin 9, and the negative side is at pin 8 of the 11-pin socket of the mounting panel.

#### MAINTENANCE

The 460A Compressor Amplifier is of the plug-in type. In the event of a malfunction, the 13204 or 13903 extractor tool is used to remove the amplifier from the mounting panel. A replacement amplifier will enable speedy restoration of service. The defective amplifier may be serviced locally or returned to the manufacturer for repair.

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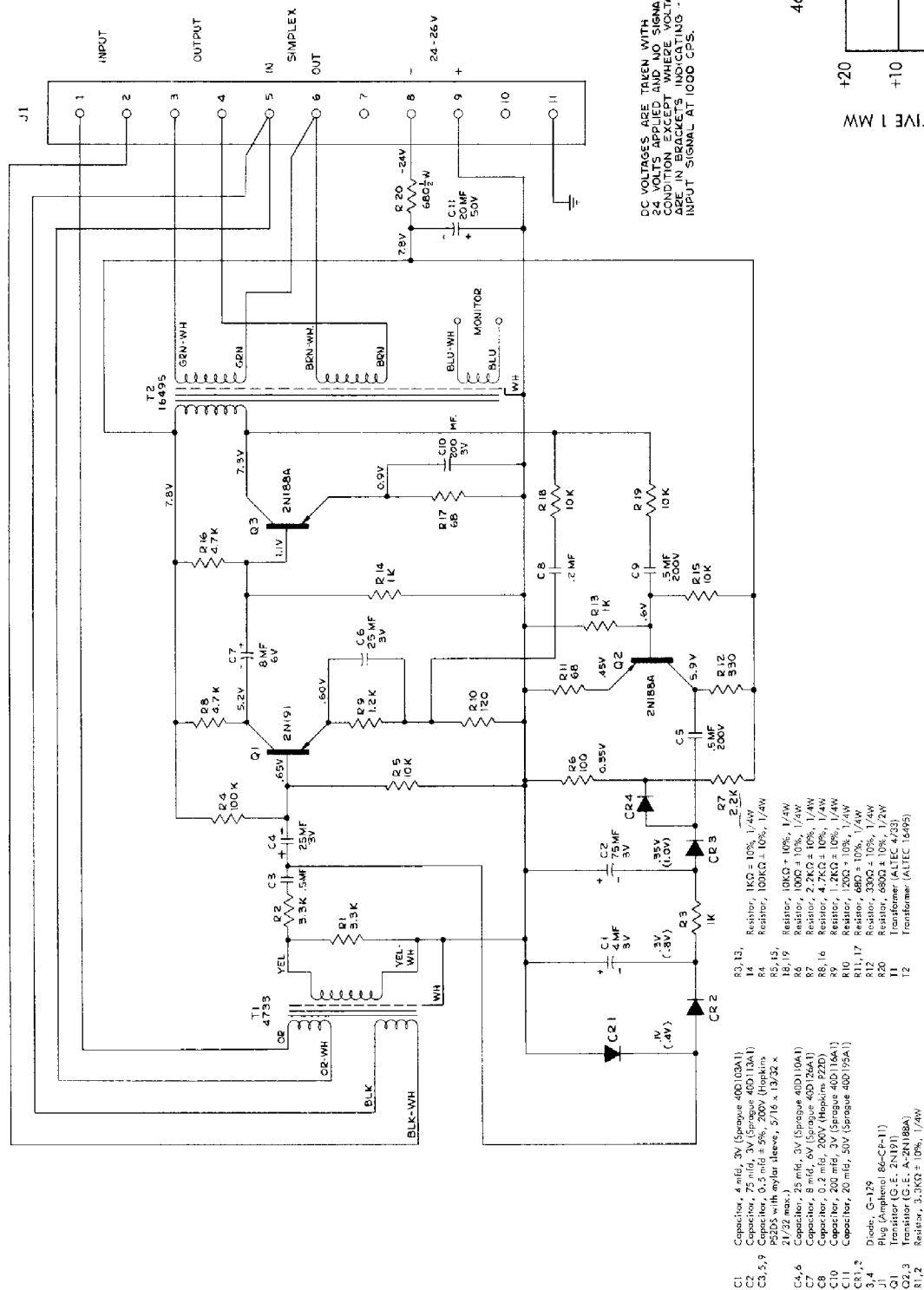
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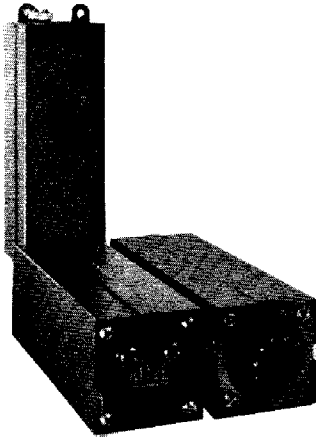


Figure 1. 460B Compressor Amplifier

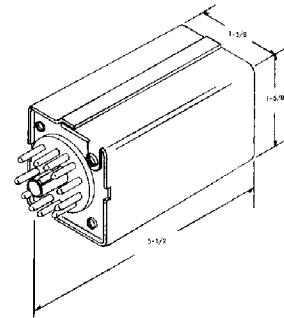


Figure 2. Dimensional Drawing

**SPECIFICATIONS**

Type:	Telephone Type Compressor Amplifier	Dimensions:	1-5/8" H x 1-5/8" W x 5-1/2" D
Gain:	35 $\pm$ 1.5 dB (without compression)	Finish:	Cadmium plate with dichromate finish
Compression Threshold (LEVEL):	Adjustable, -9 to +10 dBm	Mounting:	11-pin Amphenol 86-CP-11 plug to engage with 78-S11 equipment socket
Compression Ratio (SLOPE):	Adjustable, 3:1 to 40:1	Simplex Operation:	Center tapped input and output transformers
Maximum Power Output:	+13 dBm	Simplex Current:	100 milliamperes maximum with 5 milliamperes out-of-balance current
Distortion:	Below 5.0% THD, 300 to 6000 Hz adjusted for +5.0 dBm output	Weight:	11 ounces
Frequency Response:	$\pm$ 1.0 dB, 300 to 6000 Hz at +5.0 dBm output	Accessories:	ALTEC 12910 Mounting Panel, 19" x 1-3/4" for standard rack mounting, containing ten 11-pin sockets for mounting ten 460B Amplifiers ALTEC 13227 Assembly for mounting a single 460B Amplifier within a type 105B Apparatus Box or a custom built panel ALTEC 529A Power Supply (24V) capable of energizing up to 100 460B Amplifiers ALTEC 538A Power Supply Unit capable of energizing two 460B Amplifiers ALTEC 533A Power Supply Unit capable of energizing one 460B Amplifier
Input Impedance:	600 ohm		
Load Impedance:	600 ohm		
Noise Level:	-65 dBm		
Operating Voltage (By "U" link transfer):	48 to 52V (as shipped) or 24 to 26V dc		
Current Drain:	20 to 30 milliamperes		
Controls:	LEVEL and SLOPE, front mounted potentiometers		

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### ALTEC 460B COMPRESSOR AMPLIFIER

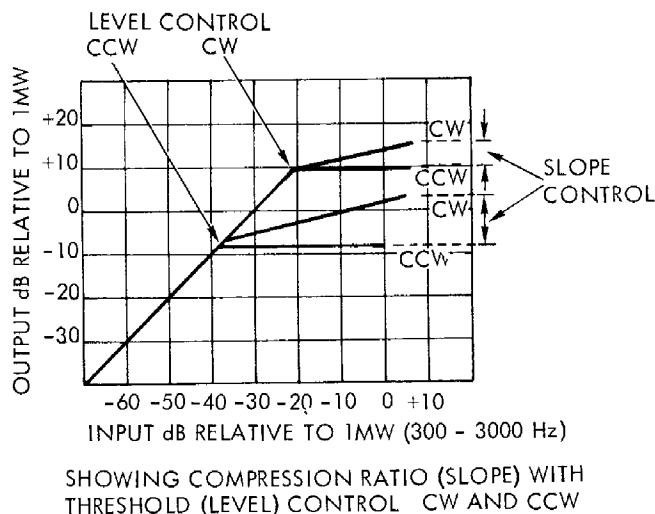


Figure 3

#### DESCRIPTION

The 460B Compressor Amplifier is a two-stage, transistorized plug-in compressor-type amplifier designed for use with telephone repeater and communication equipment. The amplifier operates from 24 to 26 or 48 to 52V dc power. The output power is dependent upon the input signal and approximates -3 dBm with an input of -40 dBm, increases to +7 dBm with -30 dBm input and +14 dBm with -23 dBm input. Negative feedback is used to reduce distortion and to stabilize gain. The unit is designed to operate at up to 150°F (65°C).

The circuitry of the 460B Amplifier has been designed to reduce to a minimum, pickup of radiated interference from nearby stepping switches, relays and spikes arising from power supplies and other equipment. A reverse polarity diode is also included in the circuitry in order to protect the transistors if the power supply voltage is inadvertently reversed.

A dc simplex current may be used to bypass the amplifier. A maximum current of 100 milliamperes is permitted, provided out-of-balance current does not exceed 5 milliamperes.

#### APPLICATION

The 460B Compressor Amplifier may be used in voice frequency systems to enable a relatively constant output speech level to be maintained with wide variations of input signal level. The amplifier may be used with advantage in many telephone system applications, some of which are:

- Toll Conference Systems
- Loudspeaking Telephone Systems
- Systems as Used at Military Complexes
- Supervisory Monitoring

#### INSTALLATION AND OPERATION

The ALTEC 460B Amplifier operation depends upon the polarity of the telephone repeater station supply voltage. Prior to inserting the amplifier into the mounting, it should be determined that the voltage "U" link position agrees with the operating voltage. Also, make certain that the positive of the supply is

### ALTEC 460B COMPRESSOR AMPLIFIER

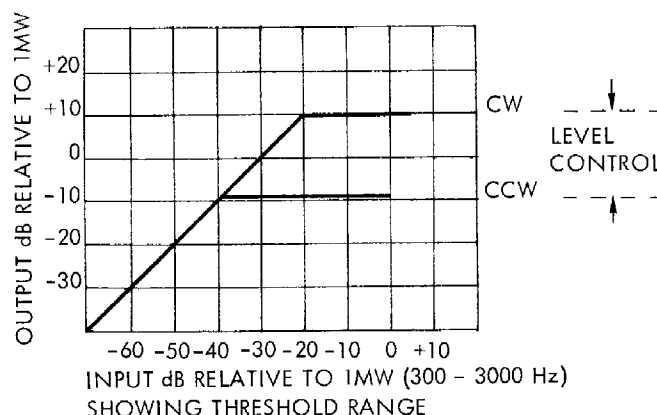


Figure 4

on pin 9 of the socket, with the negative on pin 8. The amplifier should be inserted carefully to prevent damage to the plug pins or the locating keyway.

A functional check may be carried out by applying a 1000 Hz, -20 dBm signal at the input of the amplifier and noting that the output signal does not increase more than 3.0 dBm when the input signal is increased to "0" dBm.

#### CAUTION

Damage to the equipment will result if 50 volts are applied to the equipment with the "U" link in the 24 volt position.

#### Compression Resetting Procedure

##### SLOPE Control (Initial Setting)

The SLOPE control, located on the front of the 460B Amplifier, should be turned fully clockwise (CW), then returned counterclockwise (CCW) by approximately 5.0 degrees. This is the minimum slope adjustment.

##### LEVEL Control

When a 1000 Hz, 0 dB signal into 600-ohms, is applied to the input of the 460B Amplifier, the output signal level will remain constant regardless of any further increase in input signal level. However, a clockwise rotation of the LEVEL control, located on the front panel, will raise the level of the output threshold and decrease compression. A counterclockwise rotation of the LEVEL control will increase compression and again change the threshold.

##### SLOPE Control (Resetting)

When a close value of compression relief is desired, a resetting of the SLOPE control will be necessary. A counterclockwise rotation of the SLOPE control will produce characteristics as shown by the graphs. (See Figures 3 and 4).



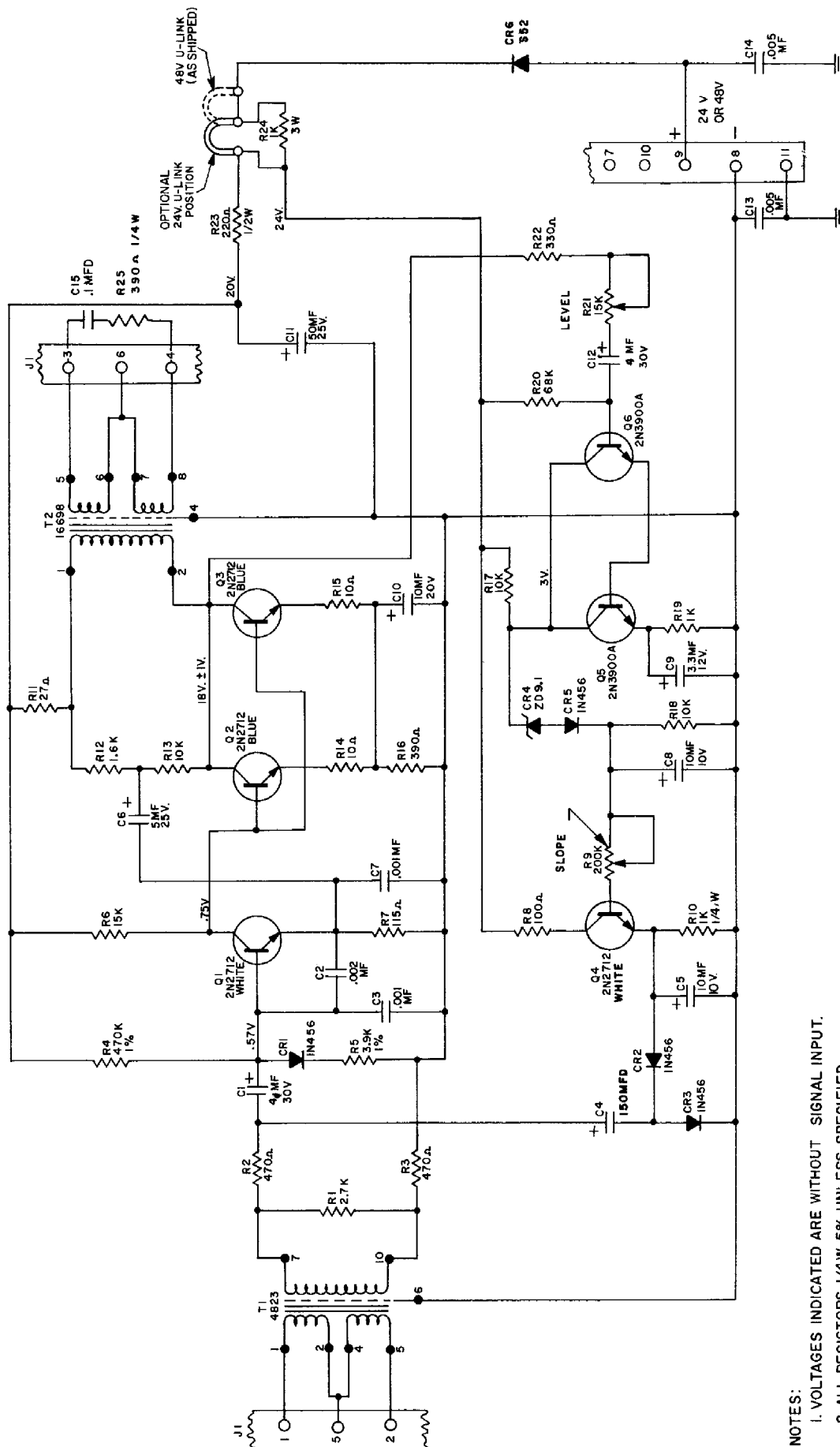
## MAINTENANCE

The 460B Amplifier is of the plug-in type. In the event of a malfunction, the unit should be withdrawn from the rack or panel with the aid of an ALTEC 13204 or 13903 Extractor Tool. The insertion of a serviceable unit will rapidly restore normal service. The defective amplifier may be serviced locally or

returned to the manufacturer for repair. To withdraw the amplifier assembly from its protective cover, remove the two screws from the rear (plug end) of the unit and withdraw the assembly from the front.

## PARTS LIST

Reference Designator	Name and Description	Reference Designator	Name and Description
C1,12	Capacitor, 4 $\mu$ F, 30V, PSD (Callins)	R6	Resistor, 15K $\Omega$ , 5%, 1/4W
C2	Capacitor, 0.002 $\mu$ F, Ceramic Disc (Erie)	R7	Resistor, 115 $\Omega$ , 5%, 1/4W
C3,7	Capacitor, 0.001 $\mu$ F, Ceramic Disc (Erie)	R8	Resistor, 100 $\Omega$ , 5%, 1/4W
C4	Capacitor, 150 $\mu$ F, 3V, 285 PSS (Callins)	R9	Potentiometer, 200K $\Omega$ , PC leads, 3/8" split locking bushing, 1/16" slotted shaft (Clarostat 63M series)
C6	Capacitor, 5 $\mu$ F, 25V, PSS (Callins)	R10,19	Resistor, 1K $\Omega$ , 5%, 1/4W
C5,8	Capacitor, 10 $\mu$ F, 10V, CM106 (Comps Inc.)	R11	Resistor, 27 $\Omega$ , 5%, 1/4W
C9	Capacitor, 3.3 $\mu$ F, 12V, CM335 (Comps Inc.)	R12	Resistor, 1.6K $\Omega$ , 5%, 1/4W
C10	Capacitor, 10 $\mu$ F, 20V, CL106 (Comps Inc.)	R13,17,18	Resistor, 10K $\Omega$ , 5%, 1/4W
C11	Capacitor, 50 $\mu$ F, 25V, 4-85 PSD 50-25 (Callins)	R14,15	Resistor, 10 $\Omega$ , 5%, 1/4W
C13,14	Capacitor, 0.005 $\mu$ F, Ceramic Disc (Erie)	R16,25	Resistor, 390 $\Omega$ , 5%, 1/4W
C15	Capacitor, 0.1 $\mu$ F, 200V, 10% (Electrocube 710)	R20	Resistor, 68K $\Omega$ , 5%, 1/4W
CR1,2,3,5	Diode, 1N456	R21	Potentiometer, 15K $\Omega$ , PC leads, 3/8" split locking bushing, 1/16" slotted shaft (Clarostat 63M series)
CR4	Diode, Zener, LPM 9.1A (Semcor)	R22	Resistor, 330 $\Omega$ , 5%, 1/4W
CR6	Diode (S52)	R23	Resistor, 220 $\Omega$ , 5%, 1/2W
J1	Plug (Amphenol 86-CP-11)	R24	Resistor, 1K $\Omega$ , 10%, 3W WW (Sprague)
Q1,2,3,4	Transistor, (G.E 2N2712)	T1	Transformer (ALTEC 4823)
Q5,6	Transistor, (G.E 2N3900A)	T2	Transformer (ALTEC 16698)
R1	Resistor, 2.7K $\Omega$ , 5%, 1/4W		
R2,3	Resistor, 470 $\Omega$ , 5%, 1/4W		
R4	Resistor, 470K $\Omega$ , 5%, 1/4W		
R5	Resistor, 3.9K $\Omega$ , 5%, 1/4W		



- NOTES:
1. VOLTAGES INDICATED ARE WITHOUT SIGNAL INPUT.
  2. ALL RESISTORS 1/4W 5% UNLESS SPECIFIED.

Figure 5. Schematic 460B Compressor Amplifier

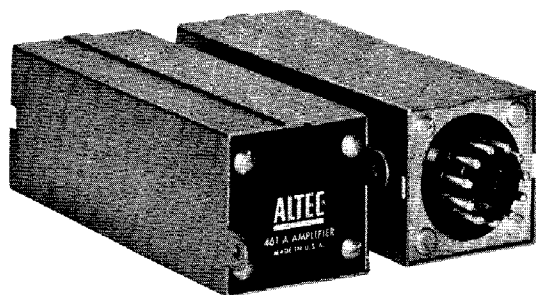


Figure 1. ALTEC 461A Amplifier

### SPECIFICATIONS

Type:	Power Amplifier, Transistor Type, Class B push-pull
Power Output:	2 watts maximum
Distortion:	Less than 6% THD at 2 watts, 1000 Hz
Gain:	22 dB (+11 dBm input for 2 watts output)
Input Impedance:	600 ohms
Load Impedance:	8 ohms
Frequency Response:	±1 dB, 100 to 6000 Hz relative to 1000 Hz
Power Supply:	24V dc battery or rectified ac with total ripple contents below 2 mV and regulation better than 5% for a current change of 250 mA
Power Required:	250 mA for 2 watts output
Dimensions:	1-5/8" H x 1-5/8" W x 5" D
Finish:	Cadmium plate with dichromate finish
Weight:	16 ounces
Mounting Socket:	11-pin socket (Amphenol 78-S11)

### DESCRIPTION

The ALTEC 461A Amplifier is a single stage, push-pull Class B operated transistor power amplifier designed for use with telephone and other communications equipment. The unit operates from a single supply source (24 volt) which may be obtained from a central office talking battery supply, a local battery, or from a power supply unit which has good regulation characteristics and low ripple content in its output. No other supply voltage is required.

The current drawn from the supply depends on the degree to which the unit is driven by the input signal. For example, with +11 dBm applied at the input, the output power approximates two watts and the current consumption is 250 mA. With no input signal, the current drawn is less than 20 mA.

The output power into the nominal output load of eight ohms is dependent on the input signal as indicated below:

Input (600 ohms)	Output watts (8 ohms)
+11 dBm	2
+ 8 dBm	1
+ 5 dBm	1/2

### APPLICATION

The output power of the 461A Amplifier is intended to drive a

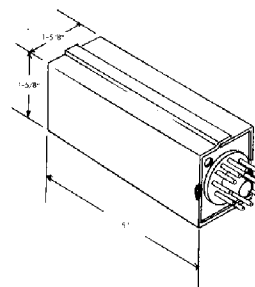


Figure 2. Dimensional Drawing

loudspeaker for monitoring purposes or a distribution network to route information to several locations.

The 461A Amplifier can be used advantageously in many telephone system applications, some of which are:

- Loudspeaking Telephone Systems
- Supervisory Monitoring Systems
- Audio Distribution Systems

### INSTALLATION AND OPERATION

The 461A Amplifier can be mounted in the ALTEC 12910 Mounting Panel in quantities up to a maximum of ten amplifiers, or in a 12962 Assembly if only one unit is to be mounted. The 12910 Mounting Panel occupies 1-3/4 inches of rack space on a 19-inch rack. Four 12962 Assemblies may be mounted within a type 105 Apparatus Box. A terminal strip on the 12962 Assembly indicates where the cable connections are to be made.

The 461A Amplifier should be inserted into its socket carefully to prevent possible damage to the pins of the connector plug. Withdrawal of the amplifier from the 12910 Mounting Panel should be made using the Altec 13204 Extractor Tool.

The 461A is a transistorized unit and is dependent upon the polarity of the power supply for its operation. It is strongly recommended that a functional check be made immediately after the supply is connected. This check could consist of applying +10 dBm, 1000 Hz, at the input of the unit and measuring the output. It should be approximately two watts in eight ohms.

### MAINTENANCE

The 461A Amplifier is of the plug-in type. In the event of a malfunction, use a 13204 or 13903 Extractor Tool to remove the amplifier from the mounting panel. Use of a replacement amplifier will enable speedy restoration of service. The defective amplifier may be serviced locally or returned to the manufacturer for repair.

### SUPPORT EQUIPMENT

PANEL	CAPACITY	LOCATION
7305A	12 Amplifiers	19-inch rack
7316A	10 Amplifiers	19-inch rack
12910	10 Amplifiers	19-inch rack
12962	1 Amplifier	Type 105 Apparatus Box
13227	1 Amplifier	Type 105 Apparatus Box
14115A	2 Amplifiers	Type 105 Apparatus Box



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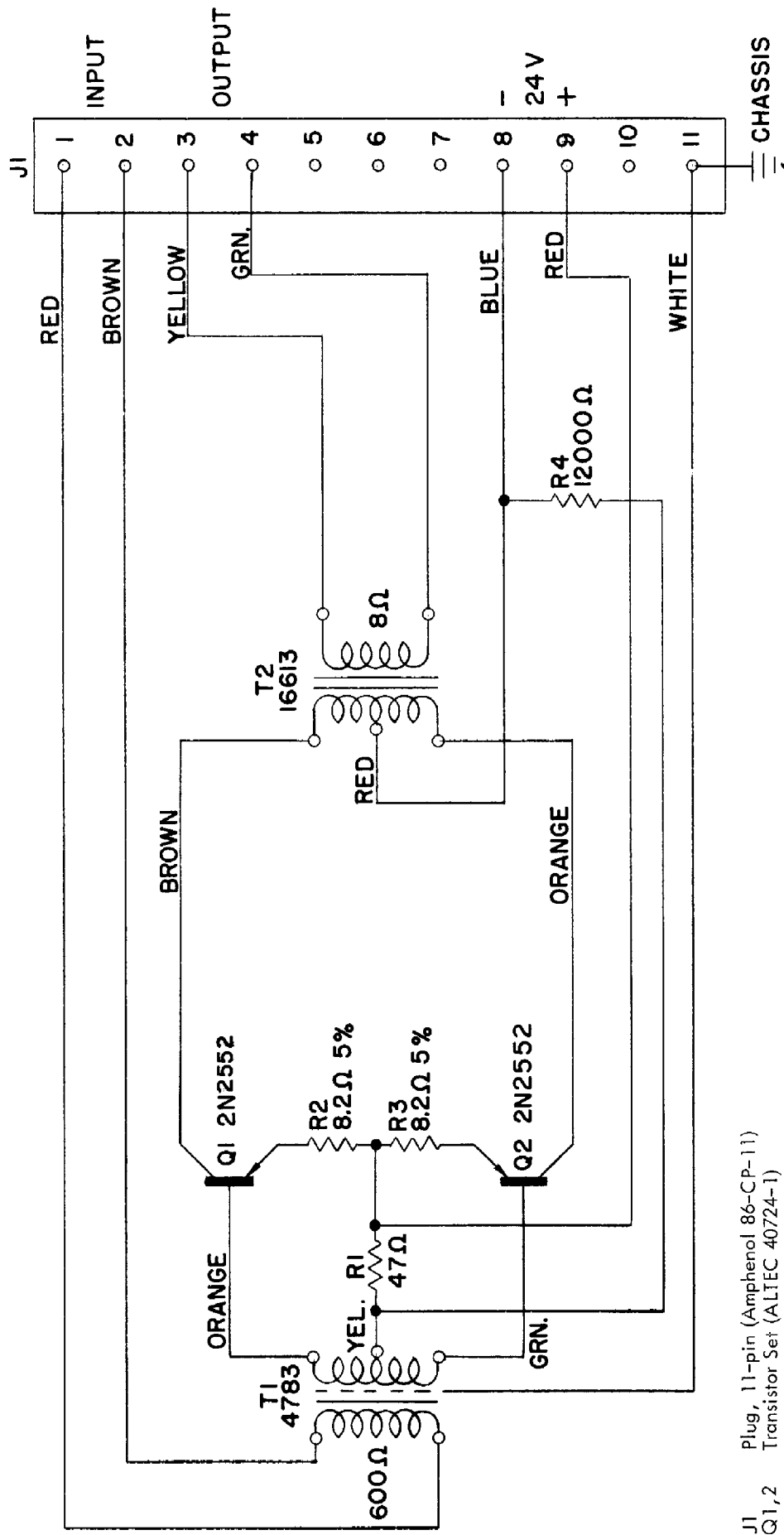
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- J1 Plug, 11-pin (Amphenol 86-CP-11)  
 Q1,2 Transistor Set (ALTEC 40724-1)  
 R1 Resistor,  $47\Omega \pm 10\%$ ,  $1/2W$   
 R2,3 Resistor,  $8.2\Omega \pm 5\%$ ,  $1/2W$   
 R4 Resistor,  $12K\Omega \pm 10\%$ ,  $1/2W$   
 T1 Transformer (ALTEC 4783)  
 T2 Transformer (ALTEC 16613)

Figure 3. Schematic 461A Amplifier

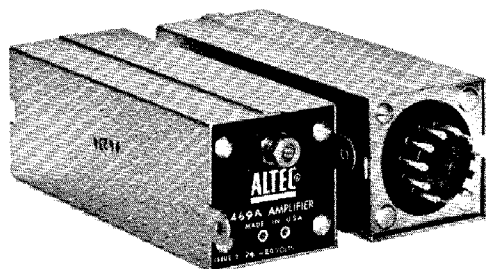


Figure 1. ALTEC 469A Transistor Amplifier

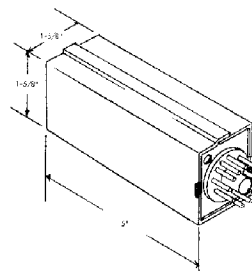


Figure 2. Dimensional Drawing

### SPECIFICATIONS

Frequency Response:	$\pm 1$ dB, 200 - 6,000 Hz
Distortion:	Below 1% THD (at +10 dBm, 200 - 6,000 Hz)
Maximum Level Input:	-5.5 dB bridging 600 ohm line (at maximum gain)
Maximum Power Output:	+17 dBm
Output Noise Level:	-70 dBm
Input Gain Control:	Varies from -2 dB to maximum gain
Maximum Gain:	22.5 dB bridging 600 ohm line
Operating Voltage:	24 - 26V dc
Input Impedance:	24,000 ohms
Output Impedance:	600 ohms
Current Drain:	20 mA at 25V dc
Monitor Facilities:	11 $\pm 1.5$ dB below amplifier output is available at test jacks on front panel when bridged by 600 ohms
Dimensions:	1-5/8" W x 1-5/8" H x 5" D
Finish:	Cadmium plated/dichromate finish
Weight:	13 ounces

### DESCRIPTION

The 469A ALTEC Transistor Amplifier, two-stage, plug-in unit, is designed as a high input impedance bridging amplifier for use in voice frequency circuits and can be operated from 24-26 volt central office or battery supply. The input circuit of the amplifier can be connected across a voice frequency telephone circuit and introduces negligible loss.

The circuitry of the 469A Amplifier has been designed to be relatively insensitive to RF radiation from nearby relays, stepping switches, battery supply spikes, etc., in order that relatively high speed data may be passed through the amplifier without excessive signal mutilation. With the gain control set at the maximum position, the ALTEC 469A is capable of receiving an input level of 1 milliwatt without damage to the transistors.

Negative feedback is utilized to reduce distortion and to stabilize gain within 0.3 dB for a 25% reduction of supply voltage.

The output carrying capacity is adequate for a maximum +10 VU level of the transmitting toll switchboard and equipment having similar signal level. The input and output longitudinal balance is sufficiently high so that normal noise requirements are met without the use of a mid-point ground. The input winding of the transformer may be dc isolated if required.

### APPLICATIONS

The 469A Amplifier is used in voice communication circuits where it is necessary to bridge a transmission path for circuit distribution, interception, etc.

### INSTALLATION AND OPERATION

The 469A depends upon the polarity of the repeater station supply voltage for proper operation. Prior to inserting the amplifier, it should be determined that the positive side of the supply is at pin 9, the negative side at pin 8 (of the 11-pin socket mounted on the repeater rack). The amplifier should be inserted carefully to prevent possible damage to the pins of the 11-pin plug connector.

The gain control affords a range of approximately 40 dB. In order to adjust the gain, the lock nut on the control must be loosened. After adjustment is completed, carefully tighten the locking nut and recheck the gain setting to ascertain that the control shaft is not disturbed in the tightening operation. DC isolation of the input transformer winding is provided by capacitor C7. If a center tap ground is required, J1 pins 5 and 7 should be strapped and grounded.

### MAINTENANCE

In the event of a malfunction, the ALTEC 13204 or 13903 Extractor Tool is used to remove the amplifier from the mounting panel. A replacement amplifier may then be installed to enable rapid restoration of normal service. The defective amplifier may be serviced locally or returned to the manufacturer for repair. Should it become necessary to remove the amplifier from its protective cover, remove the two screws and plate from the rear (plug end), then withdraw the unit from the front.

### SUPPORT EQUIPMENT

The following panels are available for the amplifier, as listed:

PANEL	CAPACITY	LOCATION
7305A	12 Amplifiers	19" relay rack
7316A	10 Amplifiers	19" relay rack
12910	10 Amplifiers	19" relay rack
12962	1 Amplifier	Type 105 apparatus box or equal
13227	1 Amplifier	Type 105 apparatus box or equal
14115A	2 Amplifier	KTU-15A type frame

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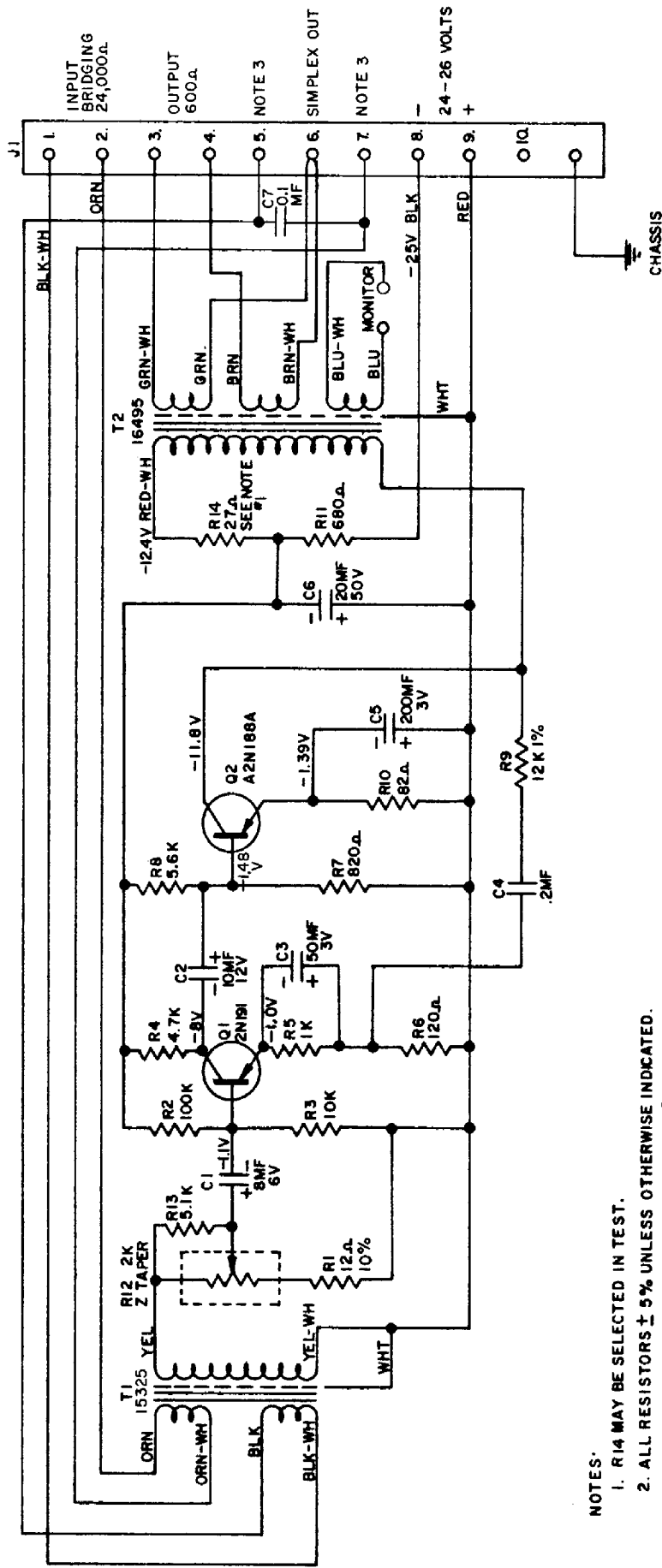
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#### NOTES:

1. R14 MAY BE SELECTED IN TEST.
2. ALL RESISTORS  $\pm 5\%$  UNLESS OTHERWISE INDICATED.
3. STRAP SOCKET PINS 5 & 6 IF SIMPLEX INPUT REQUIRED.

C1	Capacitor, 8 mfd, 6V (Sprague 40D126A1)	R1	Resistor, 12 $\Omega$ $\pm 10\%$ , 1/2W	R11	Resistor, 680 $\Omega$ $\pm 5\%$ , 1/2W
C2	Capacitor, 10 mfd, 12V (Sprague 40D146A1)	R2	Resistor, 100K $\Omega$ $\pm 5\%$ , 1/2W	R12	Potentiometer, 2K $\Omega$ , Z taper (Clarostat CM22782)
C3	Capacitor, 50 mfd, 3V (Sprague 40D112A1)	R3	Resistor, 10K $\Omega$ $\pm 5\%$ , 1/2W	R13	Resistor, 5.1K $\Omega$ $\pm 5\%$ , 1/2W
C4	Capacitor, 0.2 mfd, 200V (Hopkins P22D)	R4	Resistor, 4.7K $\Omega$ $\pm 5\%$ , 1/2W	R14	Resistor, 27 $\Omega$ $\pm 5\%$ , 1/4W
C5	Capacitor, 200 mfd, 3V (Sprague 40D116A1)	R5	Resistor, 1K $\Omega$ $\pm 5\%$ , 1/2W	T1	Transformer (ALTEC 15325)
C6	Capacitor, 20 mfd, 50V (Sprague 40D195A1)	R6	Resistor, 120 $\Omega$ $\pm 5\%$ , 1/2W	T2	Transformer (ALTEC 16495)
C7	Capacitor, 0.1 mfd $\pm 5\%$ , 300V (Hopkins P-13 MF Oreg.)	R7	Resistor, 820 $\Omega$ $\pm 5\%$ , 1/2W		
J1	Plug, 11-pin (Amphenol 86-CP-11)	R8	Resistor, 5.6K $\Omega$ $\pm 5\%$ , 1/2W		
Q1	Transistor (G.E. 2N191)	R9	Resistor, 12K $\Omega$ $\pm 1\%$ , 1/2W (Dalaohm DC 1/2 or equivalent)		
Q2	Transistor (G.E. A2N188A)	R10	Resistor, 82 $\Omega$ $\pm 5\%$ , 1/2W		

Figure 3. Schematic 469A Transistor Amplifier

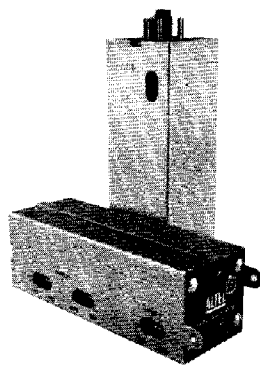


Figure 1. 479A Repeater Amplifier

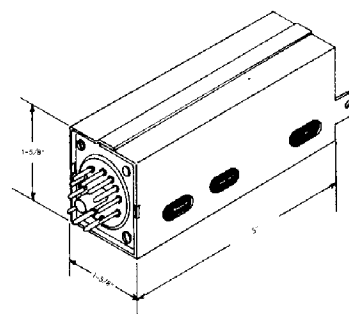


Figure 2. Dimensional Drawing

#### SPECIFICATIONS

Type:	Telephone Repeater Amplifier, 600/1200
Frequency Response:	$\pm 1.0$ dB, 200 to 6000 Hz
Distortion:	Below 1.0% THD at +10 dBm, 200 to 6000 Hz
Power Input (Maximum)	-22 dBm at maximum gain
Power Output:	+17 dBm
Noise Level:	-70 dBm
Gain:	Front panel potentiometer, -2.0 dB to $39.0 \pm 1.0$ dB
Impedance, Input:	600 or 1200 ohms $\pm 10\%$ by "U" link transfer
Impedance, Output	600 or 1200 ohms $\pm 10\%$ by "U" link transfer
Operating Voltage:	24 or 48V dc by "U" link transfer
Current Drain:	22.0 milliamperes
Monitor Facilities:	At 600 ohms - $11.0 \pm 1.5$ dB below amplifier output level at pin numbers 7 and 10 on Amphenol 11-pin connector (J1) and at front panel test jacks. At 1200 ohms - $13.0 \pm 1.5$ dB.
Max. Simplex Current:	100 mA
Max. out-of-balance Simplex Current:	5.0 mA
Dimensions:	1-5/8" H x 1-5/8" W x 5" D (less plug)
Finish:	Cadmium plated with dichromate finish
Weight:	13 ounces
Mounting:	11-pin plug connector, Amphenol 86-CP-11

#### DESCRIPTION

The ALTEC 479A Telephone Repeater Amplifier is an all-transistor unit, utilizing three silicon transistors and a printed circuit for maximum uniformity of production. A minimum variation in operational characteristics is noted when the amplifier is subjected to ambient temperatures as great as 140°F.

The design of the ALTEC 479A Amplifier provides the following features:

- (a) Dual voltage.
- (b) Selectable input and output impedances.
- (c) Effects of pulsing transients from adjacent circuits are minimized.
- (d) Minimum gain variations at elevated temperatures of up to 140°F.

Operating voltages of the 479A Amplifier are selectable (24 to 26V or 48 to 52V dc) and is obtained by "U" link transfer through the appropriate cover cutout. (See Figures 1 and 3). The "U" link acts as a strap, connecting the B-, (pin 8), to either R10, 270 ohms, for 48 to 52 volt operation or to R11, 1500 ohms for 24 to 26 volt operation.

Input and output impedances (600 or 1200 ohms) are similarly selected by transfer of the "U" links in the appropriate cover cutout, located on the left side of the amplifier cover.

The circuitry of the 479A Amplifier has been designed to minimize RF radiation pick up from nearby relays, stepping switches, battery supply spikes, etc., in order that relatively high speed data may be passed through the amplifier without excessive signal mutilation. With the gain control set at the maximum position, the ALTEC 479A Amplifier is capable of receiving an input level of 1.0 milliwatt without damage to the transistors. Negative feedback is utilized to reduce distortion and to stabilize gain within 0.3 dB for a 25% reduction of supply voltage. When the ambient temperature increases from 70°F to 140°F, the output impedance undergoes an insignificant variation of only -1.5%.

The output carrying capacity is adequate for a maximum +10 VU level to the transmitting toll switchboard and equipment requiring a similar level. The input and output longitudinal balance is sufficiently high, enabling normal noise requirements to be met without the use of a mid-point ground.

In-and-out center taps are provided for simplex operation. The maximum simplex current is 100 mA and the maximum out-of-balance simplex current is 5 mA.

#### APPLICATIONS

The ALTEC 479A Amplifier is used in voice frequency communications circuits. A telephone repeater system can be assembled

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on the ALTEC 7300 through 7305 Telephone Repeater Terminating equipment using these amplifiers and additional ALTEC plug-in items of equipment.

## INSTALLATION AND OPERATION

The operation of the 479A Amplifier depends upon the polarity of the supply voltage for proper operation. Prior to inserting the amplifier, it should be determined that the positive side of the supply is at pin 9; the negative at pin 8 (of the 11-pin socket mounted on the repeater rack). The amplifier should be inserted carefully to prevent possible damage to the locating pins of the 11-pin plug connector. Removal of the 479A Amplifier is accomplished by means of the ALTEC 13204 or 13903 Extractor Tool.

The gain control affords a range of approximately 40 dB. In order to adjust the gain, the lock nut on the control must be loosened. The level at the monitor pins on the front panel, bridged by 600 ohms, is approximately 11 dB below the output level of the amplifier. After adjustment is completed, carefully tighten the locking nut and recheck the gain setting to ascertain that the control shaft is not disturbed in the tightening operation.

## MAINTENANCE

All 479A Amplifiers are of the plug-in type. In the event of a malfunction, the ALTEC 13204 or 13903 Extractor Tool is used to remove the amplifier from the mounting panel. A replacement amplifier may then be installed, enabling rapid restoration of service. The defective amplifier may be serviced locally or returned to the manufacturer for repair. Should it become necessary to remove the amplifier from its protective cover, remove the two screws and plate from the rear (plug-end), then withdraw the unit from the front.

## MOUNTING PANELS

PANELS	CAPACITY	LOCATION
7305A	12 amplifiers	19-inch relay rack
12910	10 amplifiers	19-inch relay rack
12962	1 amplifier	Type 105 apparatus box or equivalent
13227	1 amplifier	Type 105 apparatus box or equivalent
14115A	2 amplifiers	KTU-15A type frame or equivalent

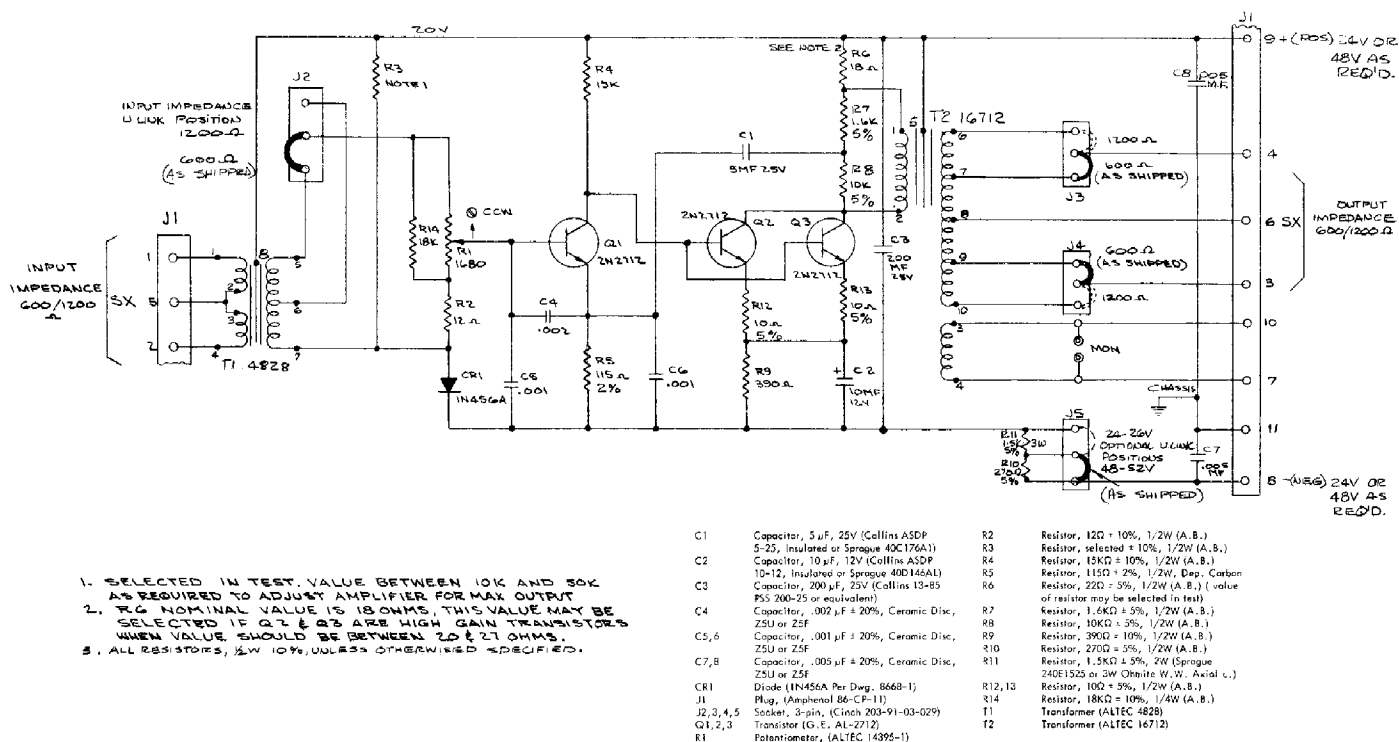


Figure 3. 479A Schematic Diagram

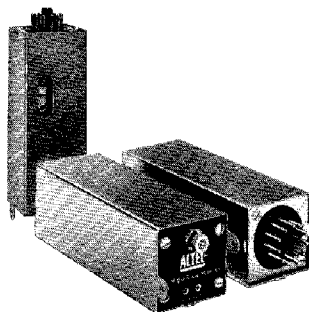


Figure 1. 480A Repeater Amplifier

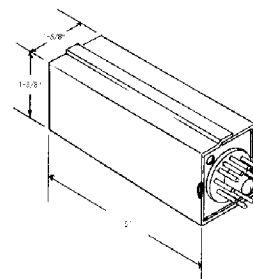


Figure 2. Dimensional Drawing

### SPECIFICATIONS

Type:	Bridging Amplifier
Frequency Response:	$\pm 1.0$ dB, 200 to 6000 Hz
Distortion:	Below 1% THD (At +10 dBm, 200 to 6000 Hz)
Maximum Power Input:	-5.5 dBm (at maximum gain) bridging 600 $\Omega$ line
Maximum Power Output:	+17 dBm
Output Noise Level:	-70 dBm
Input Gain Control:	From -2 dB to maximum gain
Maximum Gain:	22.5 dB bridging a 600 $\Omega$ line
Operating Voltage:	24 or 48 V dc (selected by moving screw, accessible on base of amplifier case)
Input Impedance:	24,000 ohms
Output Impedance:	600 ohms
Current Drain:	20 mA (at 25 and 50V dc, when selector screw is in proper position)
Monitor Facilities:	11 $\pm 1.5$ dB below amplifier output is available at test jacks on front panel when bridged by 600 $\Omega$
Dimensions:	1-5/8" H x 1-5/8" W x 5" D (less plug)
Finish:	Cadmium plated with dichromate finish
Weight:	13 ounces

### DESCRIPTION

The ALTEC 480A Repeater Amplifier is a solid-state bridging amplifier which utilizes three silicon transistors and a printed circuit board. Because of the amplifiers' design, ambient temperatures as great as 140°F (60°C) produce only a minimum variation in operational characteristics. Operating voltage of the 480A Amplifier is selectable (24-26 or 48-52V dc) by moving the screw, located on the base of the amplifier case, to one of the two positions indicated. The screw performs the same function as a strap by connecting the B+, (pin 9), to either the 270-ohm resistor, R10, for 24-26 volt operation or to the 1500-ohm resistor, R11, for 48-52 volt operation. Refer to the schematic drawing.

The circuitry of the 480A Amplifier has been designed to minimize RF radiation from nearby relays, stepping switches, battery supply spikes, etc. This enables relatively high speed

data to be passed through the amplifier without excessive mutilation. With the gain control set at the maximum position, the ALTEC 480A Amplifier is capable of receiving an input level of one milliwatt without damage to the transistors. Negative feedback is utilized to reduce distortion and to stabilize gain within 0.3 dB for a 25% reduction of supply voltage.

The output carrying capacity is adequate for a maximum +10 VU level of the transmitting toll switchboard or equipment having a similar signal level. The input and output longitudinal balance is sufficiently high so that normal noise requirements are met without the use of a mid-point ground.

The primary of the input transformer may be dc isolated, or alternatively, simplex signaling may be used by strapping terminals 5 and 7. Refer to the schematic drawing.

### APPLICATIONS

The 480A Amplifier is used in voice frequency communication circuits where it is necessary to bridge a transmission path for circuit distribution monitoring, interception, etc.

### INSTALLATION AND OPERATION

The ALTEC 480A Amplifier depends upon the polarity of the repeater station supply voltage for proper operation. Prior to inserting the amplifier into the panel, it should be determined that the positive side of the supply is at pin 9 and the negative side at pin 8 (of the 11-pin socket mounted on the repeater rack). The amplifier should be inserted into the panel carefully, to prevent possible damage to the locating pin of the 11-pin connector. Removal of the 480A Amplifier from the panel is accomplished by means of the ALTEC 13204 or 13903 extractor tool.

The gain control affords a range of approximately 22.5 dB. In order to adjust the gain, the lock nut on the control must be loosened. The level at the monitor pins on the front panel, bridged by 600-ohms, is 11 dB below the output level of the amplifier. After adjustment is completed, carefully tighten the locking nut and recheck the gain setting to ascertain that the control shaft is not disturbed in the tightening operation. DC isolation of the input transformer is provided by capacitor C9. If a center tap is required, J1 pins 5 and 7, can be strapped.

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## MAINTENANCE

The 480A Amplifier is of the plug-in type. In the event of a malfunction, the ALTEC 13204 or 13903 Extractor Tool is used to remove the amplifier from the mounting panel. A replacement amplifier may then be installed, enabling normal service to be restored. The defective amplifier may be serviced locally or returned to the manufacturer for repair. Should it become necessary to remove the amplifier from its protective cover, remove the two screws and the plate from the rear (plug end), then withdraw the unit from the front of the panel.

## SUPPORT EQUIPMENT

The following panels are available for the amplifier:

PANEL	CAPACITY	LOCATION
12910	10 Amplifiers	19" relay rack
12962	1 Amplifier	Type 105 apparatus box or equal
13227	1 Amplifier	Type 105 apparatus box or equal
14115A	2 Amplifiers	KTU-15A frame or equal

### NOTES:

1. STRAP SOCKET PINS 5&7 IF SIMPLEX INPUT REQUIRED
2. SELECTED IN TEST VALUE BETWEEN 10K AND 50K (R3) AS REQUIRED TO ADJUST AMPLIFIER FOR MAX OUTPUT.
3. R6 NOMINAL VALUE IS 18 OHMS, THIS VALUE MAY BE SELECTED IF Q2 AND Q3 ARE HIGH GAIN TRANSISTORS WHEN VALUE SHOULD BE BETWEEN 20 AND 27 OHMS.

C1	Capacitor, 5.0 mfd, 25V (Callins ASDP 5-25 insulated or Sprague 404D176A1)	J1	Plug, 11-pin (Amphenol 86-CP-11)
C2	Capacitor, 10 mfd, 12V (Callins ASDP 10-12 insulated or Sprague 40D146AL)	Q1,2,3	Transistor (2N2712)
C3	Capacitor, 200 mfd, 25V (Callins PSS200.25 or equivalent 13-85)	R1	Potentiometer, 1.68K $\Omega$ (ALTEC 14395-1)
C4	Capacitor, .002 mfd $\pm$ 20%, Ceramic Disc, Z5U or Z5F	R2	Resistor, 82 $\Omega$ $\pm$ 5%, 1/4W (A.B.)
C5,6	Capacitor, .001 mfd $\pm$ 20%, Ceramic Disc, Z5U or Z5F	R3	Resistor, Selected $\pm$ 10%, 1/4W (See schematic)
C7,8	Capacitor, .005 mfd $\pm$ 20%, Ceramic Disc, Z5U or Z5F	R4	Resistor, 15K $\Omega$ $\pm$ 10%, 1/4W (A.B.)
C9	Capacitor, 0.1 mfd $\pm$ 5%, 300V (SE110W3104J or Electro-Cube Rep P1 3 MFC-703 or equiv.)	R5	Resistor, 115 $\Omega$ $\pm$ 2%, Dep. Carbon
CR1	Diode (1N456A per ALTEC Dwg. 8668)	R6	Resistor, 18 $\Omega$ $\pm$ 1.0%, 1/4W (A.B.)
		R7	Resistor, 1.6K $\Omega$ $\pm$ 5%, 1/4W (A.B.)
		R8	Resistor, 10K $\Omega$ $\pm$ 5%, 1/4W (A.B.)
		R9	Resistor, 390 $\Omega$ $\pm$ 10%, 1/4W (A.B.)
		R10	Resistor, 270 $\Omega$ $\pm$ 10%, 1/4W (A.B.)
		R11	Resistor, 1.5K $\Omega$ $\pm$ 5%, 2W, W.W. Axial L (Sprague 240E1525 or 3W Ohmite)
		R12,13	Resistor, 10 $\Omega$ $\pm$ 5%, 1/4W (A.B.)

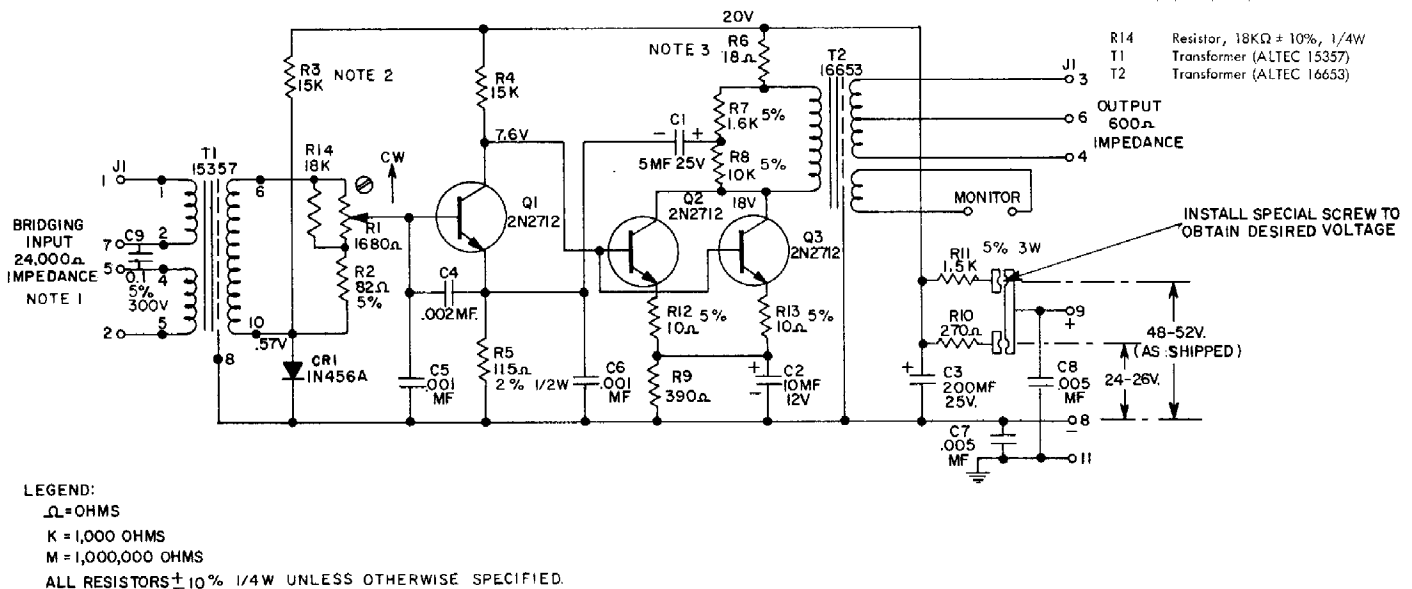


Figure 3. Schematic of 480A Amplifier

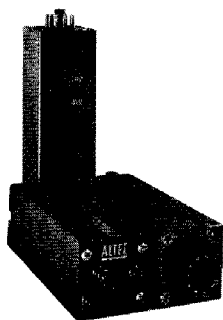


Figure 1. 481A Equalizing Amplifier

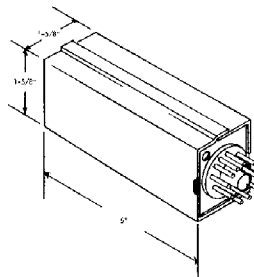


Figure 2. Dimensional Drawing

### SPECIFICATIONS

Type:	Telephone Repeater with Equalization.
Gain:	(No equalization) 24.5 dB $\pm 0.5$ dB (Equalized) 28.5 dB $\pm 0.5$ dB @ 3750 Hz.
Equalization:	200 Hz to 3750 Hz, 20 dB max.
Controls:	1 gain control variable 0-29 dB 1 equalization control variable 0-20 dB.
Frequency Response:	$\pm 1$ db 200 Hz - 3000 Hz without equalization.
Distortion:	Below 1% THD 200 Hz - 4000 Hz at +10 dBm
Maximum Power	
(Input):	-7.0 dBm at maximum gain
(Output):	+17.0 dBm $\pm 1$ dBm
Noise Level:	-70 dBm with input terminated into 600-ohm with maximum gain.

Operating Voltage:	24 or 48 volts by selection of screw position.
Impedances	
Input & Output:	600-ohm nominal $\pm 10\%$ , 200 Hz to 4000 Hz at maximum gain.
Current Drain:	22.5 milliamperes $\pm 2$ milliamperes
Max. Simplex Current:	100 mA
Max. Out-of-Balance Current:	5 mA
Monitor Facilities:	11 dB ( $\pm 1.5$ dB) below amplifier output at test jacks on front panel, into 600-ohms
Dimensions:	1-5/8" x 1-5/8" x 5" less plug
Finish:	Cadmium plated/dicromate finish
Weight:	13 ounces

### DESCRIPTION

The ALTEC 481A Amplifier is an all-transistor item utilizing three silicon transistors on a printed circuit board giving minimum variation in operational characteristics with ambient temperatures up to 140°F. Operating voltage is selectable (24-48 or 48-52V dc) by moving a small screw to the alternate position on the amplifier base as indicated on the case, as may be seen in the above illustration and on the schematic. The screw acts as a strap connecting B+ (pin 9) to either R10 (270 ohms) for 24-26 volt operation, or to R11 (1500 ohms) for 48-52 volt operation. Equalization is achieved by a fixed LC and adjustable R network across the amplifier input stage, having the EQUALIZATION control (R14) on the front panel adjacent to the GAIN control, R1.

The circuitry of the ALTEC 481A Amplifier has been designed to minimize pick up of RF radiation from nearby relays, stepping switches and battery supply transients spikes, etc., in order that relatively high speed data may be passed through the amplifier without excessive signal mutilation. With the gain control set at maximum, the ALTEC 481A Amplifier is capable of receiving an input level of 1 milliwatt without transistor damage. Negative feedback is utilized to reduce distortion and to give gain stability at elevated temperatures.

The output power capability is adequate for a maximum of +10 VU level to the toll switching and other transmission equipment. Input and output center taps are furnished on the transformers for simplex operation requiring up to 100 milliamperes of current and with an out-of-balance current not exceeding 5 milliamperes.

### APPLICATION

The ALTEC 481A Amplifier can be used on non-loaded facilities requiring equalization, such as data or voice circuits having deviation of  $\pm 1.0$  dB, 200 to 3000 Hz. The various charts, Figure 3, give some typical facilities of 19-22-24 and 26 GA and the equalization limits obtainable in Kilo feet and  $\pm 1$  dB of deviation. The non-loaded curves indicate the facility loss NRCL in all cases and the gain with equalization as shown, as RCL.

### INSTALLATION AND OPERATION

The ALTEC 481A Amplifier is shipped with the voltage selection screw set for 48 volt operation. Before installation it may be necessary to change the voltage selection screw. Also, prior to installation of the amplifier, it should be determined that the positive of the power supply is connected to pin 9 and the negative to pin 8 of the 11 pin receptacle of the associated



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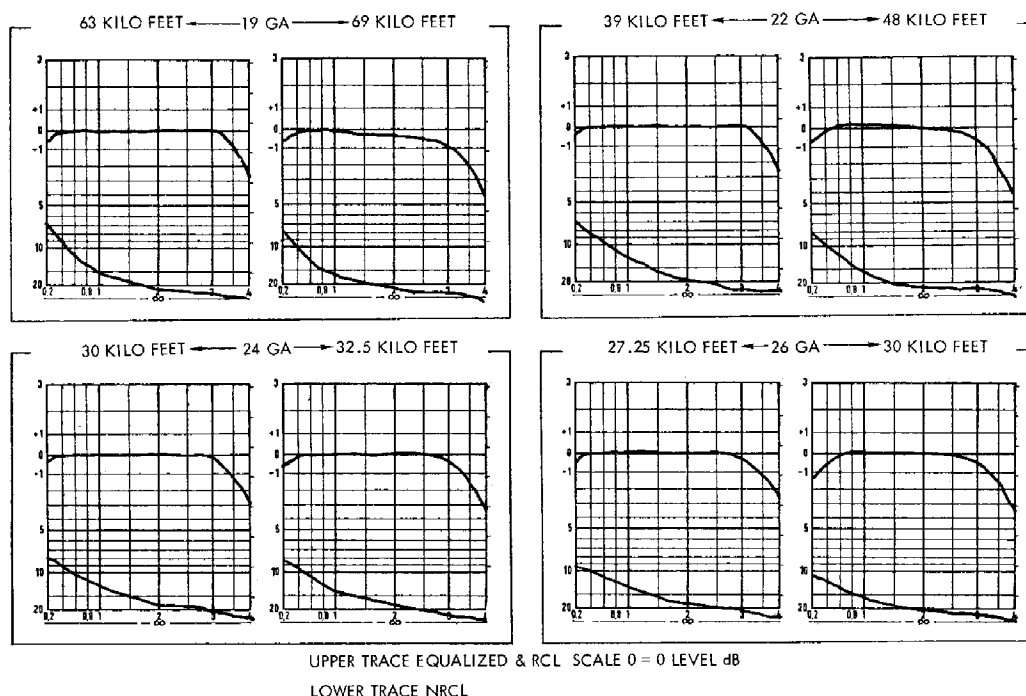


Figure 3. Typical Equalization Curves

mounting. The unit should be carefully inserted to prevent possible damage to the locating keyway on the 11 pin connector plug.

The GAIN control affords a range of approximately 25 dB and the EQL control gives equalization of approximately 20 dB. In order to make control adjustments, the lock-nuts on the potentiometers must first be loosened. Attention should be given to their re-locking when adjustments are optimized and a final check made that tightening has not disturbed the optimized settings.

#### Line-Up Procedure

The length of cable or line facility that can be equalized is determined first, by the capability of the amplifier and then by the degree of deviation required. The capability of the ALTEC 481A Equalizing Amplifier is approximately 20 dB. (See Figures 3 and 4 for non-loaded facilities).

The following equipment is needed at the sending end of a circuit facility requiring equalization:

1. Oscillator 19C, 21A TMS or equivalent sweep generator.
2. A coordinating telephone talk circuit between the sending and the receive locations.

The following equipment is needed at the receiving end of a circuit facility requiring equalization:

1. A TMS or VTVM or equivalent sweep receiver as measuring equipment.
2. The coordinating telephone talk circuit between the send and the receive locations.

The receive location should request over the talk coordinating telephone circuit, a level of 1 milliwatt at 3000 Hz ("0" dBm into 600-ohms), as a transmit signal into the line under test from the send location.

All tests at the receive location are to be made at the ALTEC 481A output with a VTVM terminated into 600-ohms or a sweep receiver.

#### NOTE

It is assumed that a "0" loss circuit is being established between the send and receive locations. It is recognized that a -1.0 dB or some other value may be required, dependent upon the equalization and the overall gain available and also the line facility. Set the equalization control fully CW and adjust the gain control until a "0" dB signal level is read on the VTVM across the 600-ohm termination. The receive location should then request a "0" dB signal level at 1000 Hz into the line from the send location.

Since the equalizing curve has a characteristic slope, adjustments to the following curve, Figure 6, must be made for optimum response.

Due to the slope of the equalizing characteristic, the reading at 1000 Hz will always be less than the reading obtained at 3000 Hz, hence the minus (-) values given. The readjustment at 1000 Hz is the slope differential changing the equalization to the required amount. (See Figure 6).

Having arrived at the amount of equalization, it is now necessary to set the gain to the reference level required and this is accomplished by the final adjustment to the "0" dB reference level.

If sweep receiving and transmitting equipment is available, the indicated curve can visually be adjusted for optimum deviation by experiment on either the gain or the equalization control at the receive location, having first requested a sweep send from the send location into the line under test.

Having optimized the settings, the control potentiometers should be locked.

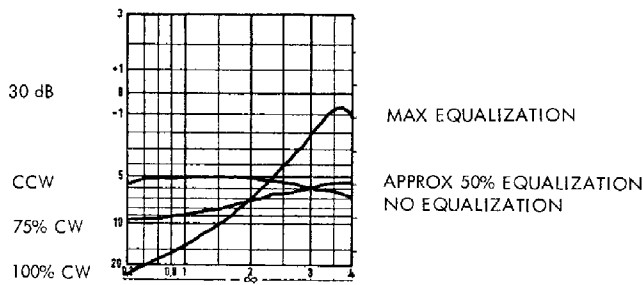


Figure 4. Equalizing Capability Control

#### EXPLANATION OF CURVES

Figure No. 3 indicates typical gage and lengths for  $\pm 0.25$  dB deviation and other curves showing the same gage and varying lengths to obtain  $\pm 1.0$  dB deviation.

The Non-Repeater Circuit Loss (NRCL) is shown in all cases and the Repeater Circuit Loss (RCL) is shown with equalization in all cases.

Figure No. 4 shows the degree of control by equalization at 0% - 50% and 100% rotation.

Figure No. 5 indicates the impedance change of the input, relative to gain and equalization minimum and maximum. Note the actual ohms reading for input is times two on the scale. The output impedance is also shown as within 10% of 600 ohms.

Figure 6 is a simplified method of obtaining the best equalizing response with a minimum of adjustment, giving the readjustment value for a certain 1000 Hz received reading. For example, a -4 dB reading at 1000 Hz would require only a 1.4 dB increase adjustment and that would give a good flat response at that

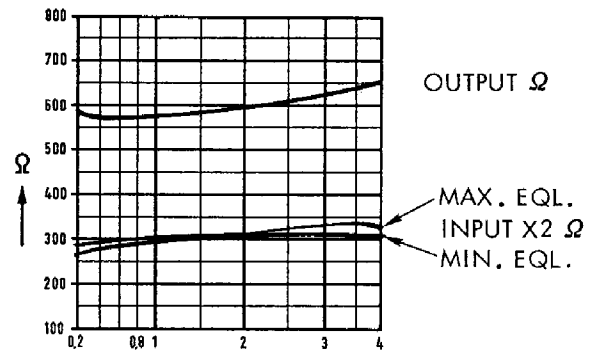


Figure 5. Impedance Curve with Maximum and Minimum Equalization

level, which now only requires gain increase to give a "0" dB level.

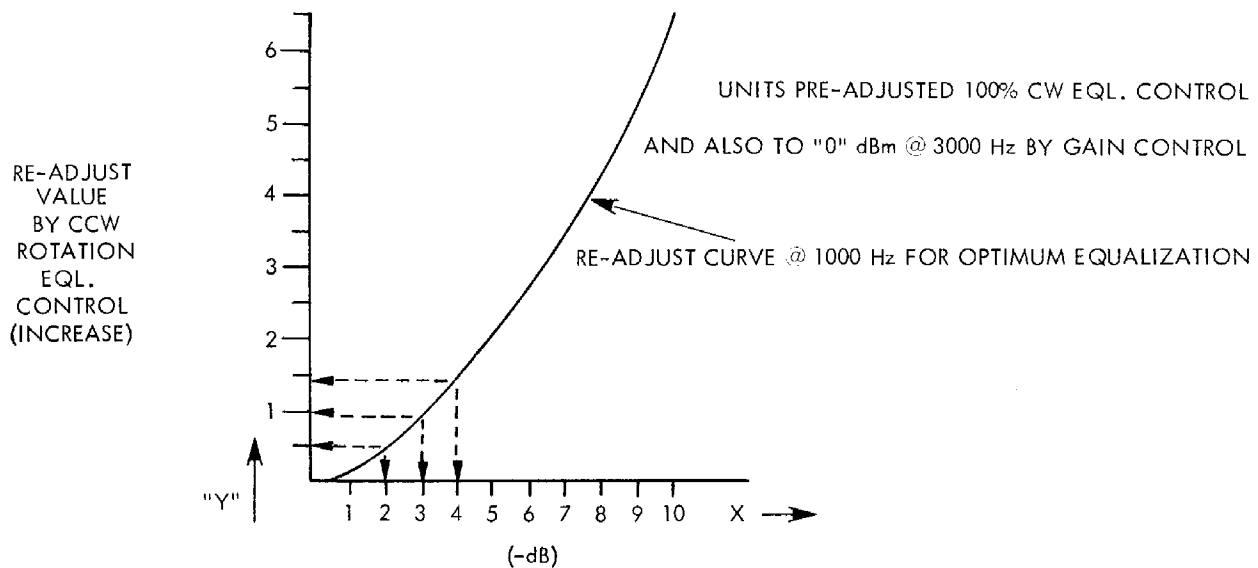
#### MAINTENANCE

The ALTEC 481A Equalizing Amplifier is of the plug-in type; in the event of a malfunction, the 13204 or 13903 extractor tool is used to remove the amplifier from its socket in the mounting panel. A replacement amplifier may then be installed, enabling rapid service restoration to be made.

#### SUPPORT EQUIPMENT

The following panels are available for the amplifier as listed:

PANEL	CAPACITY	LOCATION
12910	10 Amplifiers	19" relay rack
12962	1 Amplifier	Type 105 Apparatus box or equal
13227	1 Amplifier	Type 105 Apparatus box or equal
14115A	2 Amplifiers	Type KTU 15A type frame or equal

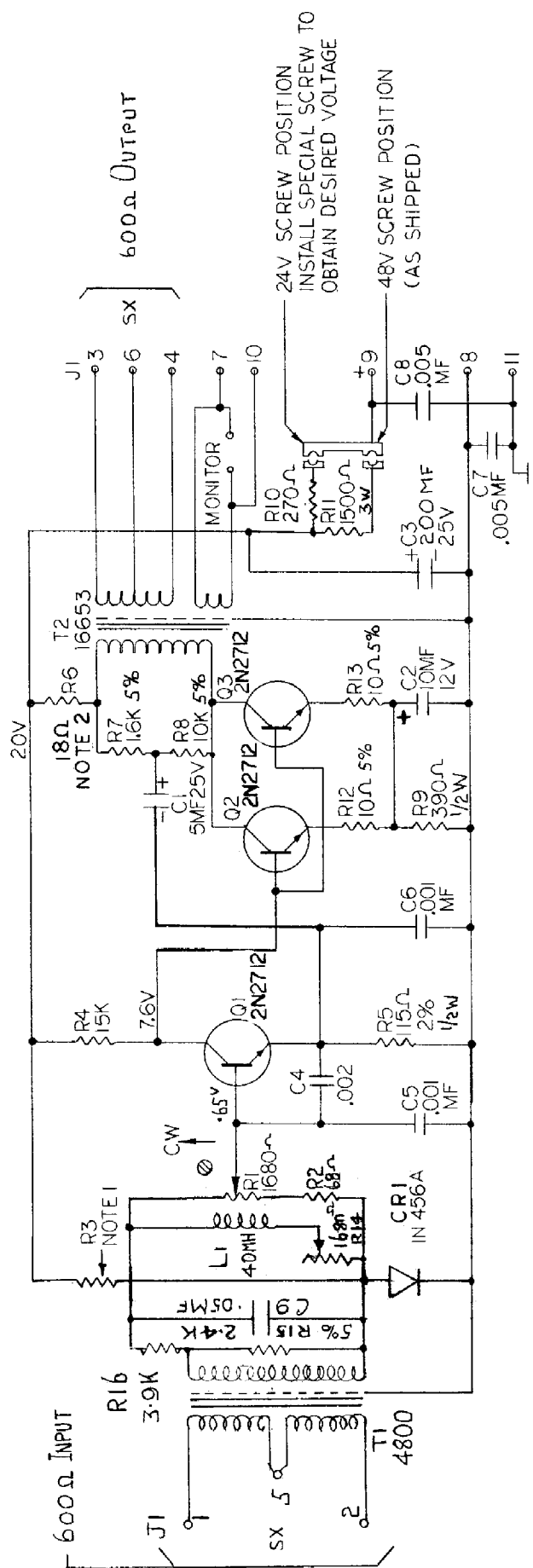


FOR "X" RECEIVED READING @ 1000 Hz ADJUST TO "Y" VALVE OF "0" REFERENCE LEVEL

FINALLY: ADJUST GAIN TO EQUIVALENT TRANSMISSION LEVEL

Figure 6. Adjustment Curve





NOTES . SELECTED IN TEST. VALUE BETWEEN 10 & 50K AS REQUIRED TO ADJUST AMPLIFIER FOR MAXIMUM OUTPUT

2. R6 NOMINAL VALUE IS 18 OHMS. THIS VALUE MAY BE SELECTED IF Q2 AND Q3 ARE HIGH GAIN TRANSISTORS WHEN VALUE SHOULD BE BETWEEN 20 AND 27 OHMS.

ALL RESISTORS 10% 1/4W UNLESS SPECIFIED

C1	Capacitor, 5 mfd, 25V (Callins ASDP 5-25, insulated or Sprague 40D176A1)	R1	Potentiometer (ALTEC 14395-1)
C2	Capacitor, 10 mfd, 12V (Callins ASDP 10-12, insulated or Sprague 40D146A1)	R2	Resistor, 68Ω ± 10%, 1/4W (A.B.)
C3	Capacitor, 200 mfd, 25V (Callins PSS200.25 or equivalent)	R3	Resistor, Selected ± 10%, 1/4W
C4	Capacitor, .002 mfd ± 20%, Ceramic Disc, Z5U or Z5F	R4	Resistor, 15KΩ ± 5%, 1/4W
C5,6	Capacitor, .001 mfd ± 20%, Ceramic Disc, Z5U or Z5F	R5	Resistor, 115Ω ± 2%, 1/2W, Dep. Carbon
C7,8	Capacitor, .005 mfd ± 20%, Ceramic Disc, Z5U or Z5F	R6	Resistor, 18Ω ± 5%, 1/4W (A.B.)
C9	Capacitor, .05 mfd ± 5%, 200V (SEI 17W 503J)	R7	Resistor, 1.5KΩ ± 5%, 1/4W (A.B.)
CR1	Diode (1N456A per ALTEC Dwg. 8668)	R8	Resistor, 10KΩ ± 5%, 1/4W (A.B.)
J1	Plug, 11-pin (Amphenol 86-CP-11)	R9	Resistor, 390Ω ± 10%, 1/2W (A.B.)
L1	Toroid (ALTEC 17919)	R10	Resistor, 270Ω ± 10%, 1/4W (A.B.)
Q1,2,3	Transistor (G.E. 2N2712)	R11	Resistor, 1.5KΩ ± 5%, 2W (Sprague 240E1525 or 3W Ohmite W.W. Axial L)
		R12,13	Resistor, 10Ω ± 5%, 1/4W (A.B.)
		R14	Potentiometer, (ALTEC 41417-1)
		R15	Resistor, 2.4KΩ ± 5%, 1/4W
		R16	Resistor, 3.9KΩ ± 10%, 1/4W (A.B.)
		T1	Transformer (ALTEC 4800)
		T2	Transformer (ALTEC 16653)

Figure 7. Schematic 481A Equalizing Amplifier

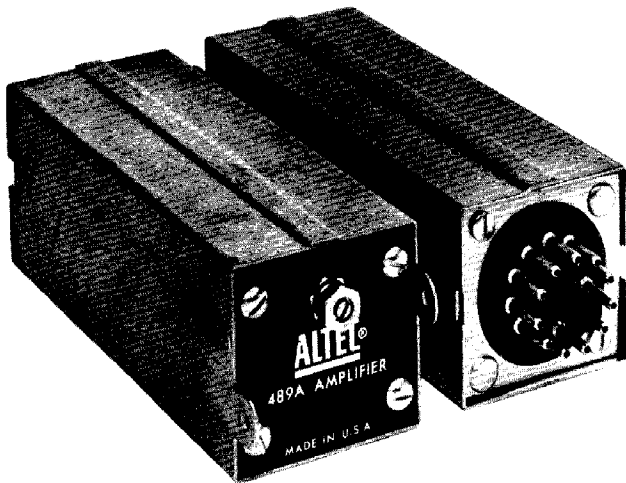


Figure 1. 489A Combination Preamplifier/Power Amplifier

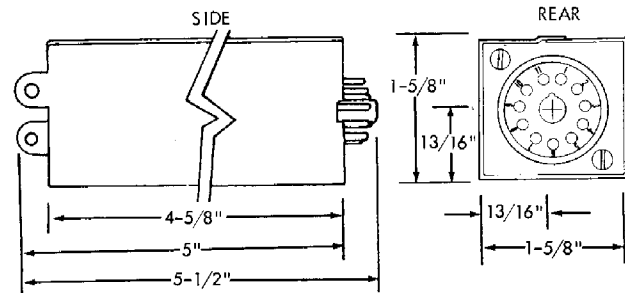


Figure 2. Dimensional Drawing

### FUNCTION

The function of the ALTEC 489A Combination Preamplifier/Power Amplifier is to provide gain on voice-frequency circuits for speech or program transmission.

### SPECIFICATIONS

Type:	Solid-state, plug-in, voice-frequency telephone preamplifier/power amplifier combination. Class A-B operation.
Input Impedance:	600 ohms $\pm 10\%$ or 24,000 ohms nominal
Load Impedance:	Not less than 4 ohms
Frequency Response:	$\pm 1$ dB from 200 to 6000 Hz (relative to 1000 Hz)
Gain:	63 dB $\pm 1$ dB (600-ohm input impedance from 600-ohm source) 47 dB $\pm 1$ dB (24,000 ohms bridging 600-ohm line)
Distortion:	Less than 2% THD at 2W
Power Output:	2W into 4-ohm load (speech or program)
Power Input (Maximum):	0 dBm
Noise Level:	More than 60 dB below full 2W output
Input Return Loss (at 600 ohms):	23 dB from 200 to 6000 Hz 27 dB from 300 to 3000 Hz 30 dB from 800 to 2500 Hz
Sensitivity:	To produce 2W into 4-ohm load — -30 dBm at 600-ohm input -14 dBm at 24,000-ohm input bridging 600-ohm line
Gain Control:	Potentiometer — continuously variable from 0 dB to 63 or 47 dB
Operating Voltage:	-24 to -26V dc or -48 to -52V dc
Operating Current — Maximum (2W):	180 mA at -24V dc or 190 mA at -48V dc
Condition:	Idle Condition:
Idle Condition:	5 mA at -24V dc or 16 mA at -48V dc

Temperature Range:	Up to 55° C (131° F)
Type of Termination:	Amphenol 86-CP-11 plug (mates with Amphenol 78-S11 socket)
Dimensions:	1-5/8" H x 1-5/8" W x 5-1/2" D (see Figure 2)
Finish:	Cadmium plate with dichromate finish
Weight:	16 ounces
Mounting Facilities:	ALTEC S-19 Loudspeaking Telephone System ALTEC 7305 Mounting Panel ALTEC 7316A Mounting Panel ALTEC 12910 Mounting Panel ALTEC 13227 Mounting Assembly ALTEC 14115A Mounting Assembly ALTEC 42399A KTU Mounting

### DESCRIPTION

The ALTEC 489A Combination Preamplifier/Power Amplifier is a solid-state plug-in unit. It is designed for use with voice-frequency circuits in telephone and other communications equipment where speech or program transmission is required. The amplifier can be operated from a -24 to -26V dc or -48 to -52V dc central office battery supply. It will provide two watts of output power to a four-ohm load. The current drain at full output (2W) is 180 mA with -24V dc input or 190 mA with -48V dc input. The current drain with no signal applied (idle condition) is 5 mA at -24V dc or 16 mA at -48V dc.

The circuitry of the 489A amplifier (see Figure 3) has been designed to minimize the effect of RF radiation from nearby relays, stepping switches, battery supply spikes, etc. Negative feedback is used to reduce distortion and stabilize gain. The amplifier provides a signal with low distortion — less than 2% THD — across the band from 200 to 6000 Hz and can thus be used for audio distribution via splitting networks or for loudspeaking telephone systems or for other circuits where audible output is required.

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



ALTEC DIVISION OF LANSING ALTEC, INC.

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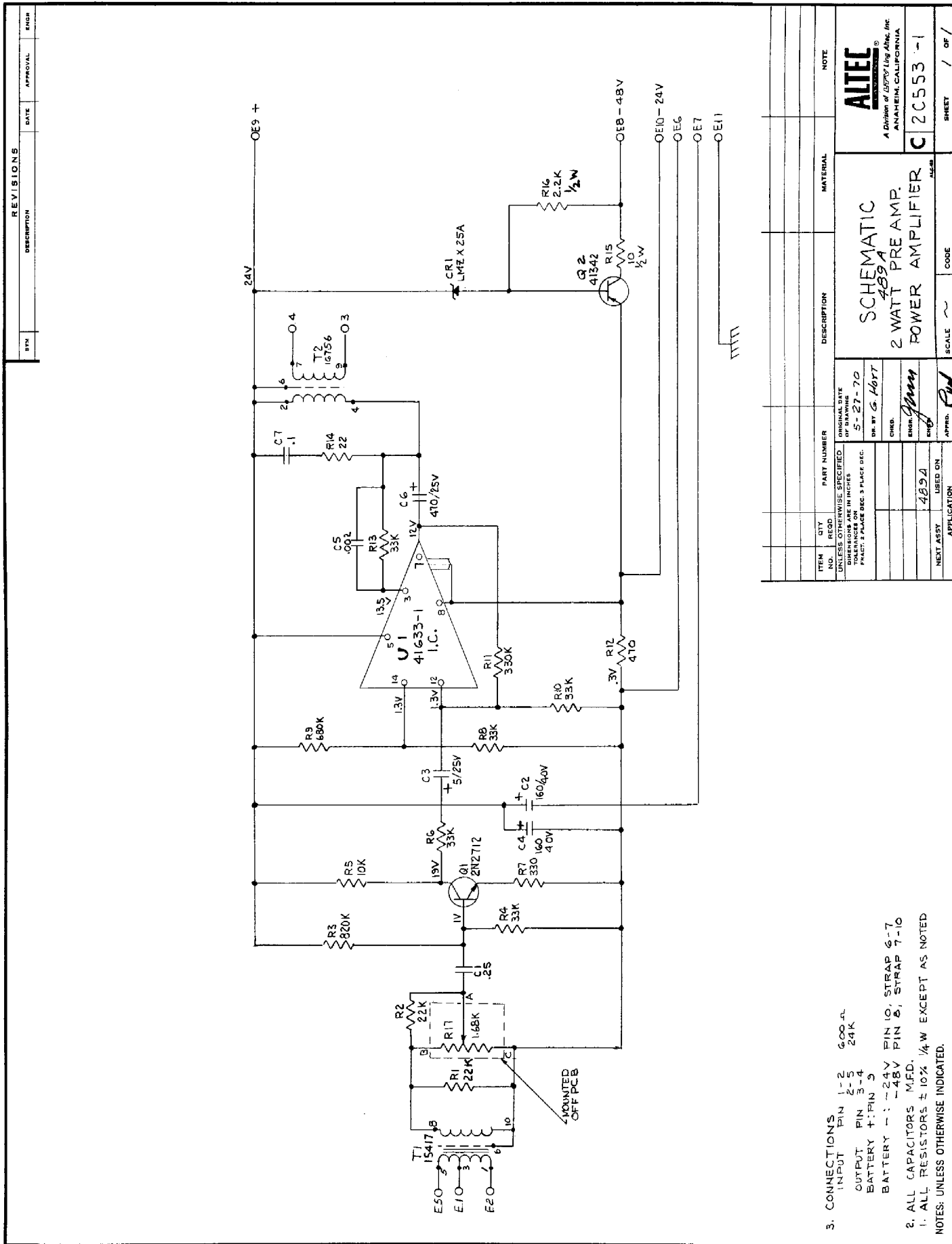


Figure 3. Schematic, 489A ( ) ination Preamplifier/Power Amplifier

## APPLICATION

The 489A amplifier is used in circuits requiring up to two watts of continuous speech or program transmission power. It is capable of delivering continuous-duty tone; but because of heat dissipation problems, the unit must be derated when it is operated in ambient temperatures greater than 25° C (77° F) or when it is operated in the 48V dc mode. Maximum allowable power for continuous-duty operation can be obtained from Figure 4 or by calculation from the following equations.

$$(1) \text{ 24V dc operation: } P = 2 - \frac{(T - 77)}{54}$$

$$(2) \text{ 48V dc operation: } P = 1.25 - \frac{(T - 77)}{72}$$

Where: P is in watts  
T is ambient temperature of intended installation area in °F.

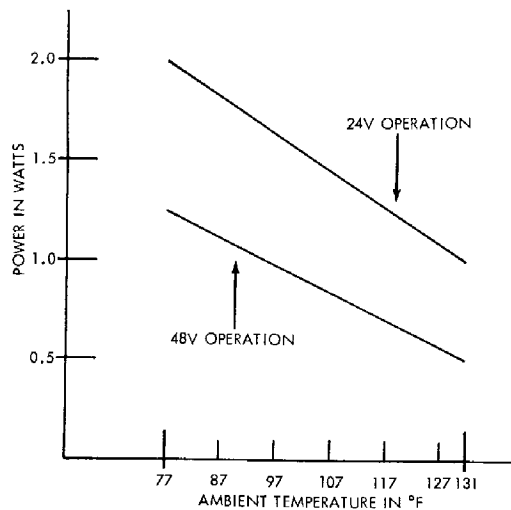


Figure 4. Power Derating for Continuous-Duty Operation

## OPERATION AND INSTALLATION

The 489A amplifier may be installed in any ALTEC mounting facility containing an Amphenol 78-S11 socket; typical mounting facilities are specified above. The 489A amplifier depends on the polarity of the supply voltage for proper operation. Prior to installing the amplifier in its intended mounting socket, the socket should be wired in accordance with Table 1. The amplifier should then be carefully inserted to prevent possible damage to the locating key or pins of the plug and/or socket.

Table 1. Socket Wiring Connections

Function	Pin Connections
600-ohm input	1 and 2
24,000-ohm input	2 and 5
Output	3 and 4
Battery Positive	9
Battery Negative (-24V)	10 (also strap 6 to 7)
Battery Negative (-48V)	8 (also strap 7 to 10)

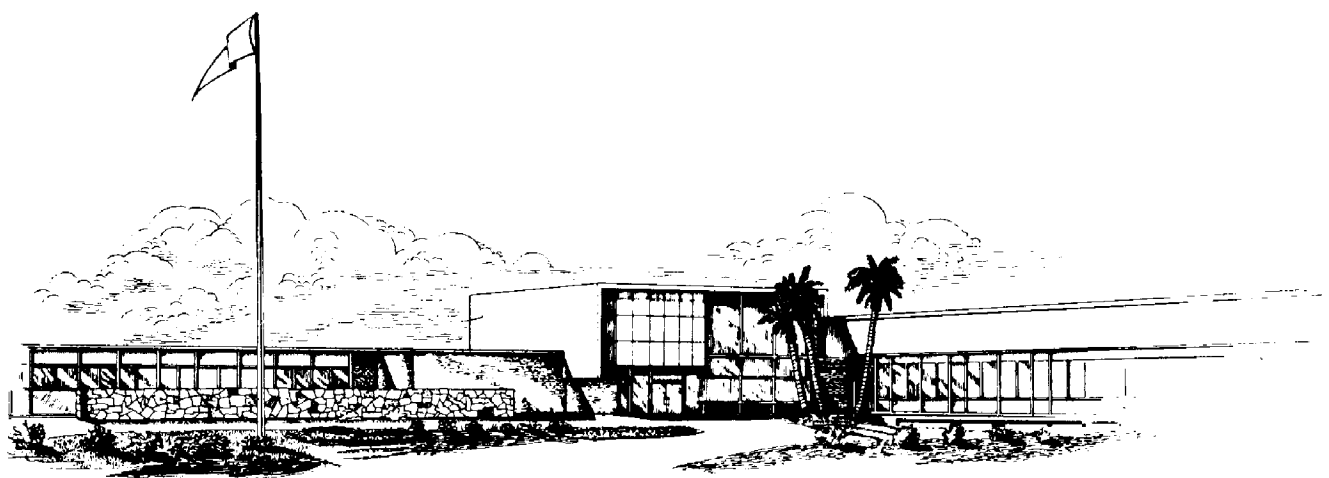
The gain control is on the front panel and provides a range of 63 dB or 47 dB, depending on the type of application. To adjust the gain, the locknut on the control must be loosened. The output level can be monitored with a suitable meter at connector pins 3 and 4. After adjustment is completed, carefully tighten the locknut and recheck the gain setting to make certain the control shaft has not been disturbed in the tightening process.

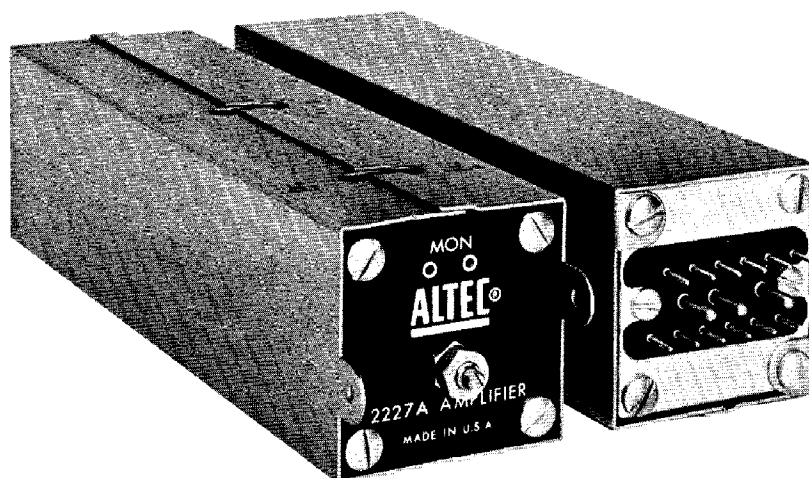
## MAINTENANCE

To achieve restoration of service if a malfunction occurs, remove the unit from the mounting panel with an ALTEC extractor tool and install a replacement unit. A defective unit may be serviced locally but it should be returned to ALTEC for repair. To remove the unit from its protective cover, remove the two screws and plate from the rear (plug end), then withdraw the unit from the front. For factory service, contact the Order Manager — Telecommunications Products, ALTEC, 1515 South Manchester Avenue, Anaheim, California 92803 to obtain necessary ALTEC authorization documents to expedite repair and return of the unit. The unit should then be returned with the documents to ALTEC. For additional information or technical assistance, call (714) 774-2900, or TWX 910-591-1142.

## PARTS LIST

Reference Designator	Ordering Number	Name and Description
C1	15-06-109828-01	Cap., 0.25 µF ±5%, 100V
C2,4	15-01-112803-01	Cap., 160 µF, 40V
C3	15-01-107221-01	Cap., 5 µF, 25V
C5	15-02-107046-01	Cap., 0.002 µF ±20%, 100V
C6	15-01-112804-01	Cap., 470 µF, 25V
C7	15-06-051234-02	Cap., 0.1 µF ±5%, 100V
CR1	48-01-109849-01	Diode, Zener, 25V ±5%, 400 mW
J1	21-01-100748-01	Plug, 11-pin
Q1	48-03-101098-01	Transistor
Q2	48-03-041342-01	Transistor
R1,2	47-01-102179-01	Res., 22K Ω ±10%, 1/4W
R3	47-01-100480-01	Res., 820K Ω ±10%, 1/4W
R4,6,8,10,13	47-01-102181-01	Res., 33K Ω ±10%, 1/4W
R5	47-01-102175-01	Res., 10K Ω ±10%, 1/4W
R7	47-01-102157-01	Res., 330 Ω ±10%, 1/4W
R9	47-01-100479-01	Res., 680K Ω ±10%, 1/4W
R11	47-01-100474-01	Res., 330K Ω ±10%, 1/4W
R12	47-01-102159-01	Res., 470 Ω ±10%, 1/4W
R14	47-01-105306-01	Res., 22 Ω ±10%, 1/4W
R15	47-01-102330-01	Res., 10 Ω ±10%, 1/2W
R16	47-01-102359-01	Res., 2.2K Ω ±10%, 1/2W
R17	47-06-014395-01	Pot., 1.68K Ω ±10%
T1	56-05-015417-01	Transformer, input
T2	56-07-016756-01	Transformer, output
U1	17-01-041633-01	Integrated circuit





2227A Transistor Amplifier

# SPECIFICATIONS

Normal Frequency Response:	+0.25 dB to -0.5 dB, 300 to 10,000 Hz +0.25 dB to -1.25 dB, 200 Hz relative to 1000 Hz -11.5 dB at 50 Hz relative to 1000 Hz	Operating Current:	18 milliamperes dc $\pm$ 2 millampere
Extended Frequency Response (By "U" Link Transfer):	$\pm$ 1.0 dB at 70 to 10,000 Hz -3.0 dB at 50 Hz relative to 1000 Hz	Impedance, Input:	600 or 1200 ohms
Distortion:	Less than 2.0% THD, 70 to 6000 Hz at +10 dBm and below Less than 1.0% THD, 200 to 6000 Hz at +15 dBm	Impedance, Output:	600 or 1200 ohms (Wiring options on mounting receptacle)
Power Maximum Output:	+19 dBm at 1000 Hz Input: -17 dBm at maximum gain at 1000 Hz	Noise Level:	-65 dB at maximum gain (600 ohm input termination)
Maximum Gain at 1000 Hz:	35 dB $\pm$ 1 dB (Normal Frequency Response) 36 dB $\pm$ 1 dB (Extended Frequency Response)	Monitor:	Output bridging test jacks on front panel
Minimum Gain:	0 dB to -2.0 dB	Simplex:	100 milliamperes maximum with 5 milliamperes maximum out-of-balance
Operating Voltage (By "U" Link Transfer):	24 or 48V dc	Mounting:	15-pin (male connector) To mate with customer furnished 15-pin receptacle (Amphenol 126-150 or Continental 14525L5)
		Dimensions:	1-21/32" x 1-23/32" x 6-15/16" overall
		Finish:	Cadmium plate with iridite overcoat
		Weight:	16 ounces

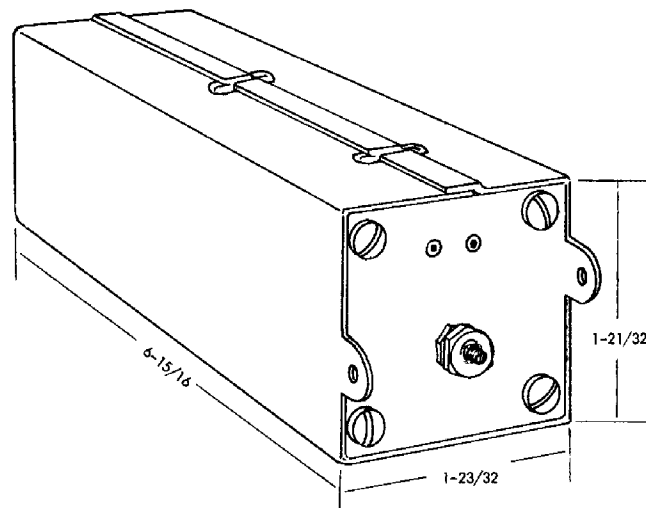


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1515 S. Manchester Ave., Anaheim, Calif.  
New York

AL-1601  
CP-117-1K  
Litho in USA



Dimensional Drawing

## DESCRIPTION

The ALTEC 2227A Amplifier, designed as a substitute or equivalent item having mechanical and electrical compatibility with the 227 type Amplifier, utilizes a similar 15-pin connector for the circuit functions.

The design of the ALTEC 2227A Amplifier provides the following features:

- (a) Dual voltage.
- (b) Normal or extended low frequency response.
- (c) Protective devices to guard against high voltages.
- (d) The effects of pulsing transients are minimized.
- (e) Minimizes gain variations at elevated temperatures of up to 150°F.
- (f) Has a single gain control.

The option for the Normal/Extended LF response is obtained by "U" link transfer through the appropriate cut-out in the cover. The option for operating voltage selection of either 24 or 48 Volt operation, is similarly obtained by "U" link transfer through the appropriate cover cut-out.

The amplifier circuit incorporates three silicon type transistors and employs negative feedback to reduce distortion and to stabilize gain within 0.15 dB of change for a 25% reduction in supply voltage. With the gain control set at maximum, the ALTEC 2227A Amplifier is capable of receiving an input level of one (1) milliwatt without transistor damage.

The power output is adequate for a maximum of a +10 VU level to the toll or other switching equipment for transmission purposes. An ambient temperature increase from normal up to 150°F changes the output impedance less than 1.5%.

Center taps are furnished on input and output transformers for a maximum simplex current of 100 milliamperes, with a permis-

sible five milliampere out-of-balance current. The input and output transformer longitudinal balance is sufficiently high that normal noise requirements can be met without the use of a mid-point ground.

The frequency response feature which permits normal or extended operation, gives optional use for ordinary VF transmission or, with a minimum of circuit changing, for digitized speech voice coding use requiring the improved VF response.

## AMPLIFIER CONSTRUCTION

The ALTEC 2227A Amplifier consists of eight printed circuit boards or wafers, four support rods, a front panel, interconnecting bus leads, rear connectors, and a cover. Seven of the eight wafers are positioned by the four cover support rods and the eighth is part of the rear connector plate assembly, which, with the front panel, locates the rods.

The separate printed circuit wafer assemblies are interconnected with bare tinned copper wire of #20 gage which is soldered at each wafer, to circuit requirements. The soldering of the bus leads imparts rigidity to the assembly, making a unit of rugged construction, not easily damaged.

The inner assembly of wafers, rods and bus leads slides into the cover and is secured by two screws at the connector end of the unit.

Slots are furnished in the cover to give access for the changing of the operating voltage, or the changing of the low frequency response. This is accomplished by moving a "U" link to an alternate position. The cover is suitably engraved to indicate which slot gives access for voltage and/or frequency response change.

The cover has front extension tabs which permit removal of the amplifier from its mounting socket with the aid of an extractor tool.

## APPLICATION

The ALTEC 2227A Amplifier can be used with any 227 type Amplifier mounting, having a 15-pin receptacle. It is completely compatible as regards equalization, gain, operating voltages, input and output impedances with existing 227 type Amplifiers and has only a single potentiometer for gain adjustment.

The amplifier may be used where a relatively flat frequency response is required, as in data transmission, or alternatively, in VF speech transmission where low frequency attenuation may be desirable.

Because of the good battery isolation and noise rejection factor, the amplifier may be applied with advantage in locations where dialing transients from adjacent circuits may give rise to cross-talk effects via the rack common power source.

## INSTALLATION

The ALTEC 2227A Amplifier is a transistorized unit and is dependent upon the polarity of the power supply for its operation. Prior to installation, a check should be made to determine that the positive polarity is present on pins 7 and 15 and that negative polarity is present on pin 14 of the mounting shelf.

The 2227A Amplifier should be inserted into its socket carefully to prevent damage to the pins of the plug connector.

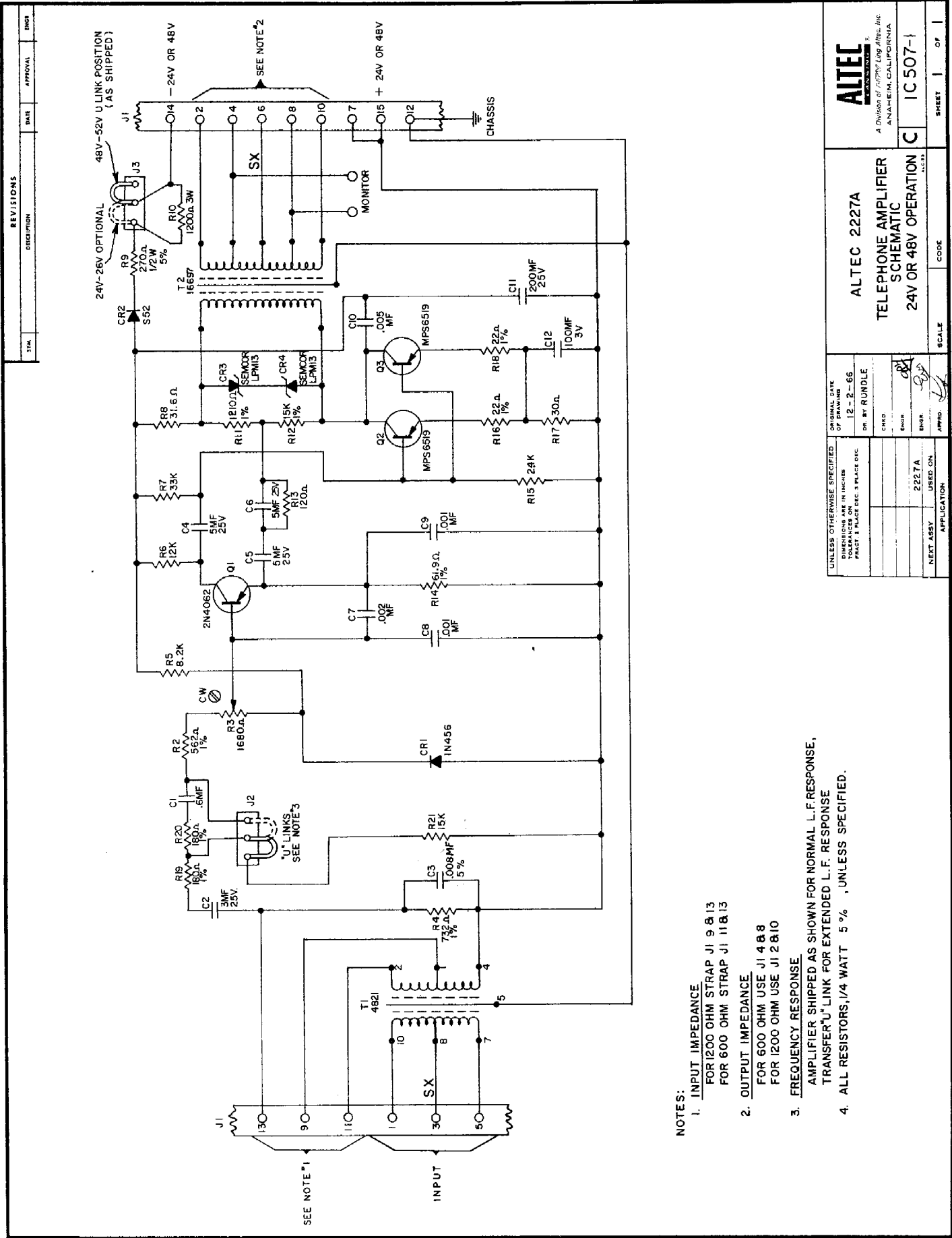
## MAINTENANCE

The 2227A Amplifier is of the plug-in type. In the event of a malfunction, an extractor tool should be used to remove the unit from the mounting and a replacement amplifier inserted. The defective amplifier may be serviced locally or returned to the manufacturer for repair.

## PARTS LIST

Reference Designator	Name and Description
C1	Capacitor, 0.6 $\mu$ F, 100V, 5% (SEI 1294)
C2	Capacitor, 3 $\mu$ F, 25V (Callins 1.85 ASD 325 with sleeving or equivalent)
C3	Capacitor, 0.008 $\mu$ F, 300V (Hopkins PO 0083 $\mu$ F or equivalent)
C4,5,6	Capacitor, 5 $\mu$ F 25V (Callins 1.85 ASD 5.25 with sleeving or equivalent)
C7	Capacitor, .002 Ceramic Disc $\pm$ 20%, Z5U or 25F
C8,9	Capacitor, .001 Ceramic Disc $\pm$ 20%, Z5U or 25F
C10	Capacitor, .005 Ceramic Disc $\pm$ 20%, Z5U or 25F
C11	Capacitor, 200 $\mu$ F, 25V (Callins 13.85 PSS 200.25 or equivalent)
C12	Capacitor, 100 $\mu$ F, 3V (Callins 4.85 ASD 100.3 with sleeving or equivalent)
CR1	Diode (1N456)
CR2	Diode (Diodes Inc., 52S)
CR3,4	Diode, Zener 13V, 10% (LPM13 or D12488)
J1	Plug, (Continental KS 14524-L9)
J2,3	Socket, 3-pin (Cinch 203/91/03/029)
Q1	Transistor (2N4062 TI)
Q2,3	Transistor (Motorola MPS 6519)
R2	Resistor, 562 $\Omega$ , 1%, 1/8W Ohmite .312 x .093)
R3	Potentiometer, 1.68K $\Omega$ , $\pm$ 2% "Z" Taper, PC leads, 3/8" Split Locking Bushing, 1/16" Slotted Shaft (Clarostat Series 63M)
R4	Resistor, 732 $\Omega$ , 1% 1/8W (RN60D)
R5	Resistor, 8.2K $\Omega$ , 5%, 1/4W
R6	Resistor, 12K $\Omega$ , 5%, 1/4W
R7	Resistor, 33K $\Omega$ , 5%, 1/4W
R8	Resistor, 31.6 $\Omega$ , 1%, 1/4W (RN60D)
R9	Resistor, 270 $\Omega$ , 5%, 1/2W
R10	Resistor, 1.2K $\Omega$ , 5%, 3W
R11	Resistor, 1210 $\Omega$ , 1%, 1/8W (RN60D)
R12	Resistor, 15K $\Omega$ , 1%, 1/8W (RN60D)
R13	Resistor, 120 $\Omega$ , 5%, 1/4W
R14	Resistor, 61.9 $\Omega$ , 1%, 1/4W (RN60D)
R15	Resistor, 2.4K $\Omega$ , 5%, 1/4W
R16,18	Resistor, 22.1 $\Omega$ , 1%, 1/4W (RN60D)
R17	Resistor, 30 $\Omega$ , 5%, 1/4W (Ohmite .25 x .090)
R19,20	Resistor, 180 $\Omega$ , 5%, 1/4W (Ohmite .25 x .90)
R21	Resistor, 15K $\Omega$ , 5%, 1/4W
T1	Transformer (ALTEC 4821)
T2	Transformer (ALTEC 16697)





NOTES:

1. INPUT IMPEDANCE  
FOR 1200 OHM STRAP J1 9 & 13  
FOR 600 OHM STRAP J1 11 & 13
2. OUTPUT IMPEDANCE  
FOR 600 OHM USE J1 4 & 8  
FOR 1200 OHM USE J1 2 & 10
3. FREQUENCY RESPONSE  
AMPLIFIER SHIPPED AS SHOWN FOR NORMAL L.F. RESPONSE,  
TRANSFER "U" LINK FOR EXTENDED L.F. RESPONSE
4. ALL RESISTORS, 1/4 WATT 5% , UNLESS SPECIFIED.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS PLACE DECIMALS		DATE OF CHANGE 12-2-66		BY RUNDLE	
DESIGN		CHKD		ENGR	
2227A		2227A		ENGR	
NEXT ASSY		USED ON		APPRO	
APPLICATION		SCALE		CODE	
				SHEET 1 OF 1	

**ALTEC**  
A Division of *AMP* Corp., Inc.  
ANAHEIM, CALIFORNIA

**ALTEC 2227A**  
**TELEPHONE AMPLIFIER**  
**SCHEMATIC**  
**24V OR 48V OPERATION**

**IC 507-1**