MOBILE RADIO

MAINTENANCE MANUAL
MASTR CONTROLLER

SERIES 539 & 549

Maintenance Manual LBI-4478F

SERIES 539 & 549

SPECIFICATIONS *

Audio Output	
Speaker	5 Watts at 3.5 ohms.
Line	+11 dBm (600 ohm load) (150 and 900 ohms optional).
Line Loop Impedance (DC Control only)	11,000 ohms (8000 line +3000 termination) maximum.
Compression Range	With audio increase of 30 dB beyond start of compression, output level increases less than 3 dB.
Frequency Response	+1, -3 dB (300 to 3000 Hz).
Power Requirement	20 W (TX), 35 W (RX), 15 W (Stby) 117 VAC ± 20%, 50/60 Hz
Dimensions (HxWxD)	5.12" x 12" x 12.58"

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

GENERAL ELECTRIC

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TABLES

WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

COMBINATION NOMENCLATURE

1st Digit	2nd Digit	3rd Digit	4th Digit	5th Digit	6th Digit	7th Digit
Product	Type of Control	Mechanical Package	Frequency Control	Channel Guard Option	Color	Repeat Disable Option
5 Remote Control	**3** DC Control	**9** Standard	**A** 1 Freq.Tx 1 Freq.Rx	**1** Standard	**S** Standard	**1** Standard
	4 Tone Control		**B** 2-Freq.Tx 1-Freq.Rx	**2** Channel Guard		**2** Repeat Disable
			C 2-Freq.Tx 2-Freq.Rx			
			D 1-Freq.Tx 2-Freq.Rx			
			R 1-Freq.Tx PSLM(1Rx) or Sim.Mon of two Rx			
			S 2-Freq.Tx PSLM(1Rx) or Sim.Mon of two Rx			

OPTIONS

DC & TONE CONTROL

8528 Alert Tone
8529 VU Meter
8531 Control Line Surge Kit
8532 Line Compensation Kit
8533 Partial Speaker Mute
8534 12 Hour Clock
8535 24 Hour Clock
8536 Intercom
8539 Alternate Line Selection
8553 Four Wire Audio Kit
8556 Power Line Surge Kit
8566 Switch Name Mod. Kit

DC CONTROL ONLY

8526 Battery Standby Kit
8527 Parallel Transmit Indicator
8530 E & M Signalling
8537 Supervisory Control

TONE CONTROL ONLY

8538 Take Over Control
8540 Auxiliary No. 1 Control
8541 Auxiliary No. 2 Control
8545 Light Flasher Kit
8547 Two Level Squelch Control
8554 Parallel Tx Control & Notch Filter
8555 Notch Filter
8548 CG ON-OFF
8557 CG and Repeater ON-OFF

ACCESSORIES

8542 Handset with Hookswitch Exchange for Channel Guard Desk Mike
8543 Handset with Hookswitch Exchange for Standard Desk Mike
8544 PWB Extension Cables
5227 Dual Footswitch
5014 Single Footswitch
5229 Headset, Head band
5228 Headset, Earmount
8546 Headset Adapter Box
8549 Boom Mike Exchange for CG Desk Mike
8550 Boom Mike Exchange for Standard Mike
5179 Stepdown Transformer 230/115 VAC
5273 6-Watt Headset, Earmount
5274 6-Watt Headset, Head band

INTERFACE KIT OR CABLE FOR ENCODER OR DECODER

8560 Interface for Type 90 or 99 Tone Decoder
8561 Interface for Type 90 Encoder
8562 Interface for Type 99 Encoder
8563 Interface for Secode Digital Encoder
8564 4' Extension Cable for Type 90 Tone Encoder
8565 4' Extension Cable for Type 90 or 99 Tone Decoder
8559 Interface for Connection to Voting Selector

DESCRIPTION

The General Electric MASTR Controller is a compact desk top control console designed for remote control and repeater base stations. The MASTR Controller is provided for DC control (Series 539) or for tone control (Series 549).

The MASTR Controller is housed in a compact cabinet with the selector switches mounted on a slight incline for ease of operation. The standard unit is equipped with a built-in speaker, ON-OFF power switch, volume control, PTT bar and selector switches for the functions provided. A transistorized dynamic microphone is used with the Controller. Blank panels are mounted in the unused switch positions. Light Emitting Diodes are included with each function switch and PTT bar as well as the ON-OFF switch for status indication.

A 12-hour or 24-hour clock and a VU meter are optional accessories that may be located in the vertical panel alongside the speaker grille.

DC Control (Series 539)

The Series 539 MASTR Controller utilizes DC current selectively applied to a telephone line to activate circuits at the remote base station. Three current levels are available: ±6 milliamps (adjustable to ±5 mA.), ±11 milliamps (adjustable to ±15 mA.), and -2.5 milliamps (adjustable to -6 mA.). The 2.5 mA level provides extra control capability, such as Channel Guard disable with two-frequency transmit and two-frequency receive functions.

An E&M signaling option, along with four-wire audio operation, allows separation of the transmit and receive audio paths and signaling on the M lead of the E&M control pair.

Tone Control (Series 549)

The Series 549 MASTR Controller uses audio tones to provide function selection. A total of 12 functions are available. Each function is preceded by a "Secur-it" tone which is a high-level burst of 2175 Hertz transmitted each time a function is selected. The Secur-it tone is decoded at the base station, killing the receiver line audio and enabling the function decoders for a period of 200 milliseconds. After a 125 ms delay, the selected function tone is transmitted for a period of 40 ms. The proper function decoder responds at the station.

The Secur-it tone is used at a level 30 dB below the initial level when the transmit function is selected. This holds the transmitter keyed as long as the PTT switch is depressed.

Circuit Boards

System Board A1101 is common to both the DC and tone control versions of the MASTR Controller. To expand the function capability, function boards are plugged into the proper sockets on the System Board and the appropriate function switches are snapped into place. Bead-chain connectors from the switches are connected to the proper pins on the System Board. Audio Board 19D416629G1 is also common to both series of Controllers.

TELEPHONE LINE CHARACTERISTICS

As a result of propagation conditions, ambient noise levels, space limitations or other conditions, the most advantageous location for the dispatcher may not be the best location to originate or receive transmissions. The MASTR Controller permits the dispatcher to transmit, receive, select transmitter and receiver frequencies, etc. over telephone lines. Control currents applied to the telephone lines from the controller are normally translated into the desired operation at the base station by the remote control panel.

The key link in a remote control installation is the telephone pair between the Controller and the base station. To obtain the most satisfactory service over this link, some general knowledge of the capabilities of such lines is required.

A telephone pair is simply a pair of wires, normally ranging from AWG #19 to AWG #26 in size. These wires, furnished by the local telephone company, pass through overhead cables, underground cables, through junction points, and switchboards. To the user, however, they may be considered a simple pair of wires. Equipment that is designed to operate with such a pair should have nominal impedance of 600 ohms. A telephone pair will normally have a maximum length of about 12 miles before amplification is added by the telephone company to make up for line losses. There is an inherent loss in any telephone line installation due to the series inductance and resistance and the shunt capacitance of the wires. This loss is a direct function of the length of the line, and varies with the wire size used. As an example, with AWG #19 wire, a distance of six miles may be covered before one-half the input voltage of a 1,000 Hz tone is lost. With AWG #26 wire, only two and one-quarter miles may be covered before one-half the input voltage is lost. Line losses as high as 30 dB can be tolerated in operating a transmitter from the Controller, but such high losses should be avoided whenever possible. Although the telephone pair is fairly well balanced, some noise will be induced into the line, especially if an unshielded run has to be made in a fluorescent-lighted building.

The amount of noise pickup is a function of the length of the line and the environment through which it passes. Assume, for instance, that 0.01 Volt of noise is picked up in a particular installation. If the audio output of the Controller is 1 Volt and the line loss is 10:1, the audio signal at the base station is 0.1 Volt, only 10 times (20 dB) higher than the noise.

This relatively high background noise would greatly reduce the intelligibility of the system and, consequently, the maximum working range. Now, consider a short line in which the noise pick-up is only 0.002 Volt and the line loss only 2:1. The signal at the receiving end would then be 250 times (48 dB) greater than the noise. For the best signal-to-noise ratio, the shortest, lowest loss line available is desired.

The DC resistance of any telephone pair will affect the control circuits between the Controller and the base station. Current regulators incorporated in the MASTR controller minimize these variations after initial adjustment. The Controller operates with a total control line loop resistance as great as 8000 ohms. There is a possibility, however, that stray currents, due to leakage, noise, faults, earth currents, etc., may cause faulty operation.

Three types of telephone line connections are commonly used. Before choosing one of these types, consider the cost and performance of each, as one type may be available at a much lower rate. Also, some telephone companies offer no choice. The following chart contains information to assist in selecting the control method and type of telephone line to be used in DC control applications.

Any transmission circuit capable of handling audio frequencies in the 300 to 3000 Hz range can be used for tone control. It is not necessary to observe polarity in wire line connections.

DC Control Telephone Line Connections (Refer to Figure 1)

Connect the telephone lines to Terminal Board TB1101, using one of the following methods:

Method 1 - Single telephone pair (control voltage simplexed line to line)

a. Connect telephone pair to TB1101-1 and TB1101-2.
b. Connect jumper between TB1101-3 and TB1101-5.
c. Connect jumper between TB1101-4 and TB1101-6.

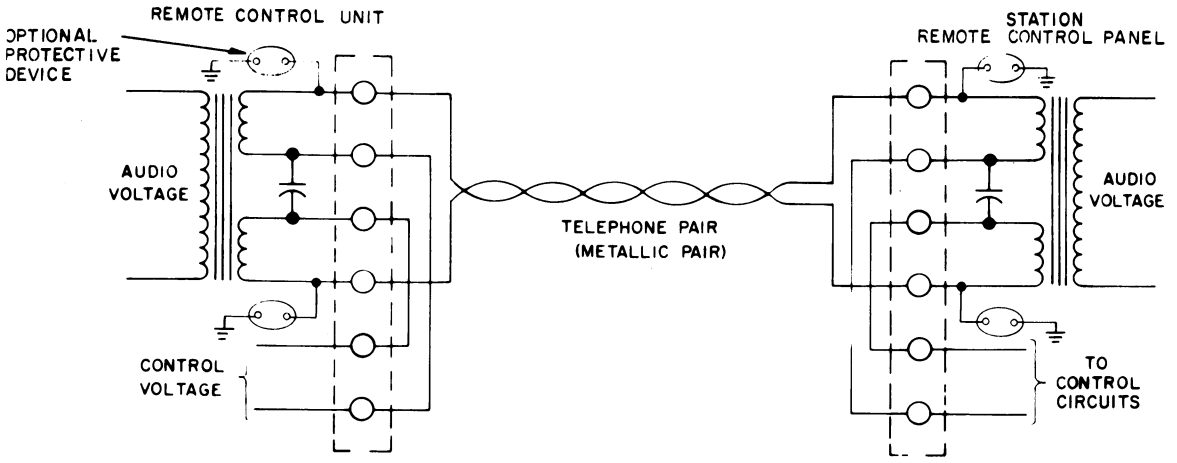
Method 2 - Single telephone pair (Control voltage simplexed line to ground)

a. Connect telephone pair to TB1101-1 and TB1101-2.
b. Connect jumper between TB1101-4 and TB1101-5.
c. Connect jumper between TB1101-6 and TB1101-17.
d. Connect jumper between TB1101-3 and TB1101-4.

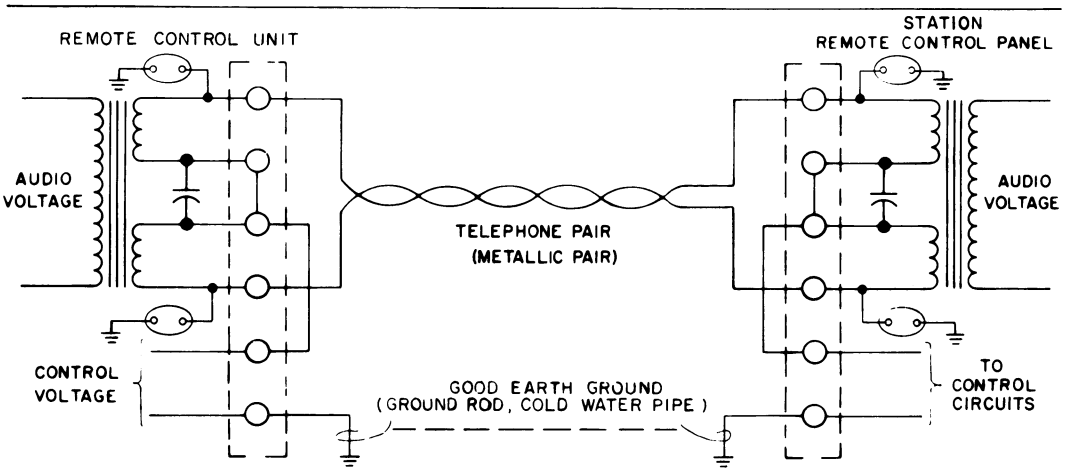
Method 3 - Separate Control and audio pair

a. Connect audio pair to TB1101-1 and TB1101-2.
b. Connect control pair to TB1101-5 and TB1101-6.
c. Connect jumper between TB1101-4 and TB1101-3.
d. Remove jumpers between holes 14 and 15 and between holes 16 and 17 on System Board A1101.

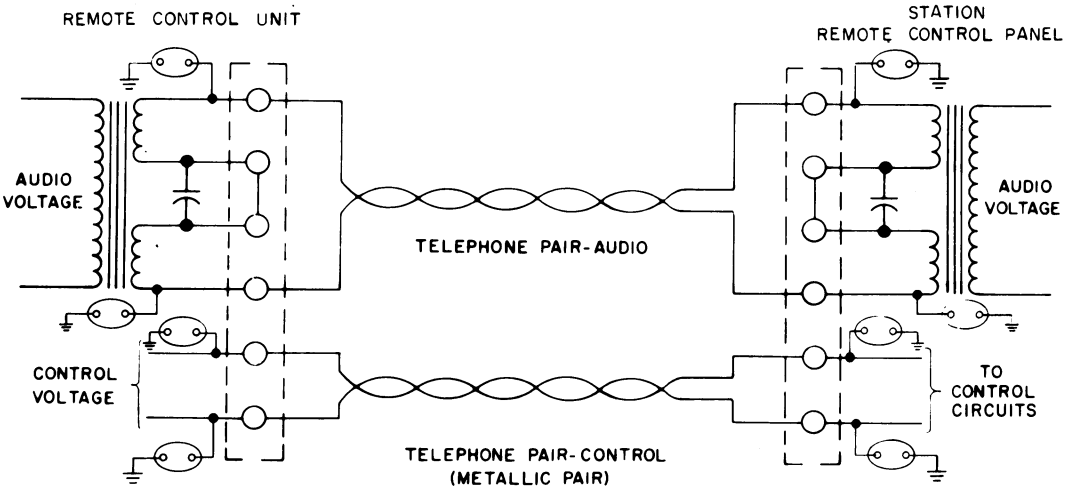
METHOD	DESCRIPTION	ADVANTAGES OR DISADVANTAGES
1	One metallic pair: for both audio and control voltages with control voltage simplexed from line to line.	Economical; dependable where earth currents may be large, or where a good earth ground cannot be obtained; keying clicks will be heard in paralleled Remote Control Units.
2	One metallic pair: for both audio and control voltages with control voltages simplexed from line to ground.	Economical; earth ground currents (encountered near power company substations) may result in interference with control functions; keying clicks minimized.
3.	Two telephone pairs; one for audio voltage and one for control voltage (metallic pair).	Provides best performance; keying clicks will not be heard; least susceptible earth ground currents which may interfere with control functions.



METHOD 1 - SINGLE TELEPHONE PAIR WITH CONTROL SIMPLEXED LINE TO LINE



METHOD 2 - SINGLE TELEPHONE PAIR WITH CONTROL SIMPLEXED BETWEEN CENTER TAP AND GROUND



METHOD 3 - SEPARATE CONTROL AND AUDIO PAIRS

RC-2556A

Figure 1 - Telephone Line Connections

Proper Grounding Practices (Method 2)

The telephone company specifies that their customer's equipment signal ground should be made using the proper connection to a ground electrode such as a metallic cold water pipe.

The ground connection should be made with a single No. 14 AWG or larger copper conductor. The conductor should be short, straight and a continuous piece of wire. Attention should be given to providing the lowest possible resistance at the connection at each end of the ground wire.

When optional line surge protection devices are provided in the customer equipment, it is imperative that the good earth ground be used. If the telephone company also provides protective devices, the customer provided device earth ground connections should be located close to the telephone company earth ground connection but should not use the same ground clamp that the telephone company uses.

If a good earth ground as described above cannot be obtained, Method 2 should not be used. Also, the addition of surge protective devices are of little value without the proper earth ground.

Four-Wire Audio

In remote control two-way radio systems where customer-owned multiplex/microwave systems are utilized, or where leased lines obtained from the local telephone company do not utilize hybrids in the transmission path, 4-wire audio operation may be required. The 4-wire audio system provides separate connections for the receive audio path and the transmit audio path. See Figure 2.

The 4-Wire Audio Kit (Option 8553) consists of a separate transformer mounted to the System Board. Refer to the Installation Instructions for Option 8553.

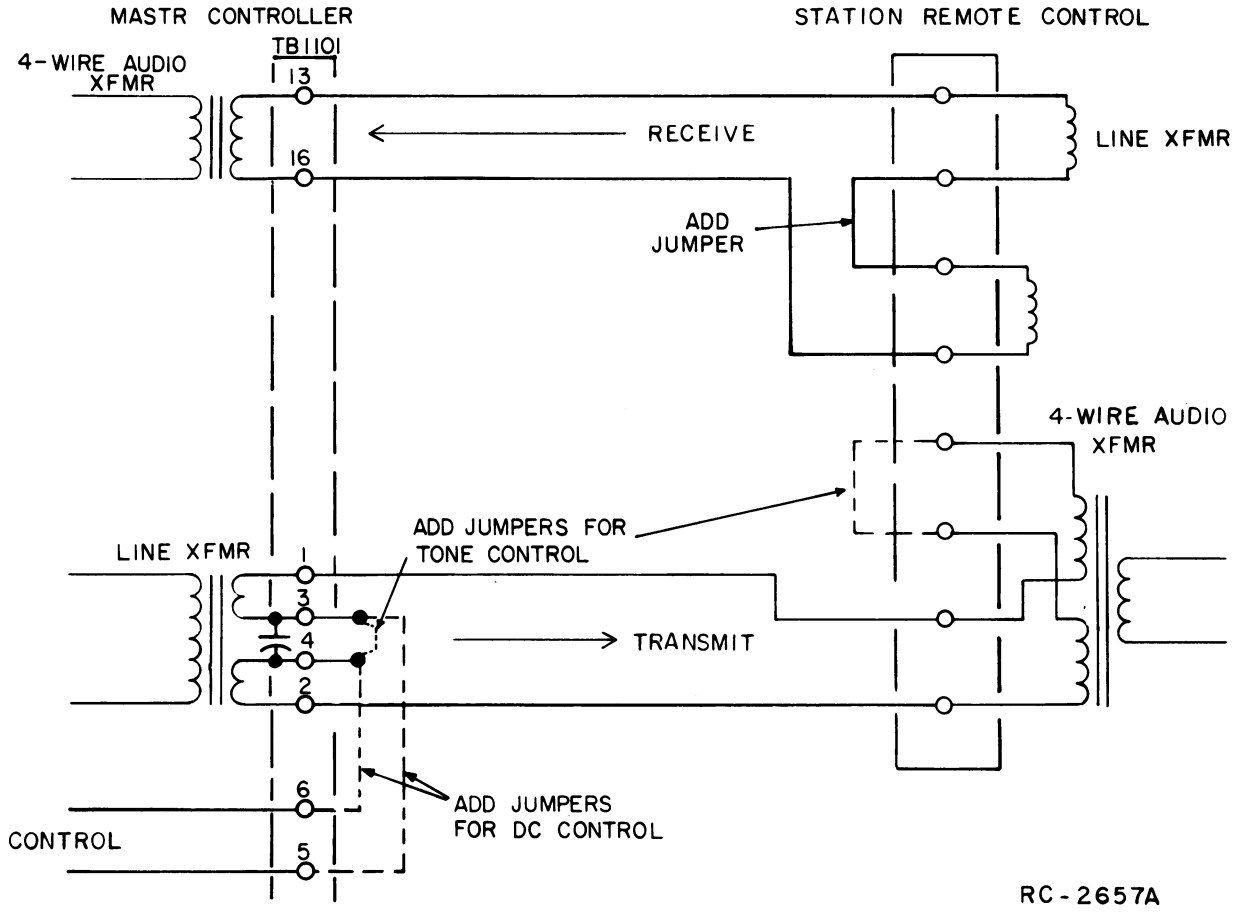


Figure 2 - Typical 4-Wire Audio Installation

E & M Signaling

E & M lead signaling systems derive their name from certain historical designations of the signaling leads on circuit drawings. An "M" lead is associated with the transMit function while the "E" lead is associated with the recEive function. In two-way radio systems with remote control, E & M Signaling may be the only type of supervision offered by the available carrier circuits.

Generally both 4-Wire Audio and E & M Signaling options are used to interface between the radio and carrier systems. However, 2-Wire Audio may be used in the two-way radio portion of the control system if hybrids are installed to provide transition between the 2-wire and 4-wire connections. Usually the E & M Signaling is separated from the audio (separate line) in both 2-wire and 4-wire installations.

Figure 3 illustrates a typical interface between a two-way radio system and a multiplex/microwave system. The Remote Control Console and Base Station are equipped with the E & M Signaling Option and 4-Wire Audio Option. The console provides a regulated -48 VDC output (or -24 VDC with minor modifications) to the "M" lead when the TRANSMIT switch is pressed. This -48 volts activates a tone encoder (usually 3825 Hertz) in the multiplex rack. The tone encoder modulates the carrier frequency which is transmitted over the microwave link.

At the station end of the microwave link, the signal is demodulated and the 3825 Hertz tone operates a tone decoder in the multiplex rack. The output of the decoder results in a contact closure to provide transmitter keying in the Remote Control Base Station.

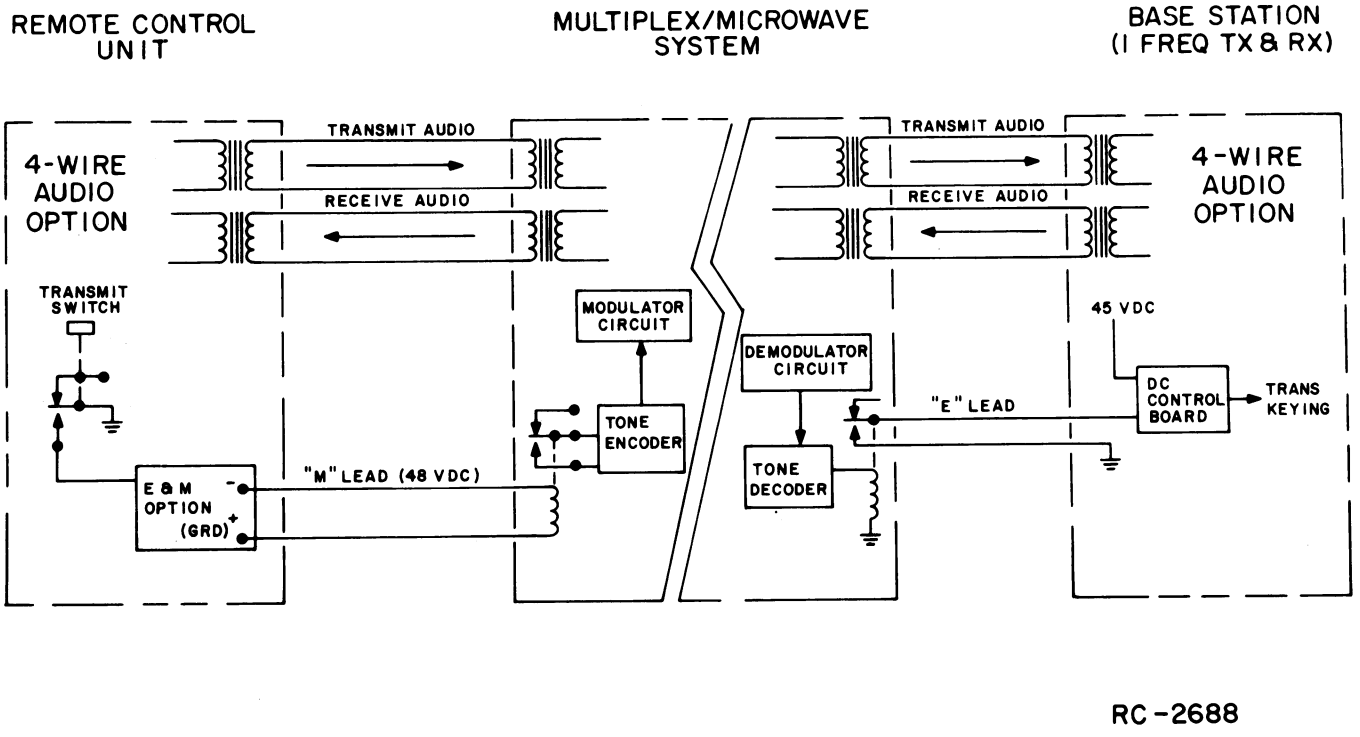


Figure 3 - Typical Application of E & M Signaling

DC CONTROL CIRCUIT ANALYSIS

(Refer to DC Control System Diagram)

Control Functions

By using accessory kits and options, the MASTR Controller can perform a maximum of six different DC control functions. This is accomplished by applying three different levels and changing the polarities of the control current to activate switches at the station remote control panel. The control current requirements for selecting each function in "T" series MASTR Professional Remote and Repeater Stations are listed in Table 1.

TABLE 1

DC CONTROL CURRENT AND FUNCTION

FUNCTION	CONTROL CURRENT IN MILLIAMPS					
	-11	-6	-2.5	0	+6	+11
1 Freq. TX (P) 1 Freq. RX				Receive	Transmit	
2 Freq. TX (P) 1 Freq. RX				Receive	TX-F1	TX-F2
1 Freq. TX 2 Freq. RX		RX-F2		RX-F1	Transmit	
2 Freq. TX 2Freq. RX		RX-F2		RX-F1	TX-F1	TX-F2
1 Freq. TX & PSLM or 2 separate Receivers	RX-F2	RX-F1		RX-F1&F2	Transmit	
2 Freq. TX & PSLM or 2 separate Receivers	RX-F2	RX-F1		RX-F1&F2	TX-F1	TX-F2
1 Freq. TX (P) 1 Freq. RX with Channel Guard Disable			CG Disable	Receive With CG	Transmit	
2 Freq. TX (P) 1 Freq. RX with Channel Guard Disable			CG Disable	Receive With CG	TX-F1	TX-F2
1 Freq. TX 2 Freq. RX with Channel Guard Disable	RX-F2 CG Disable	RX-F2 with CG	RX-F1 CG Disable	RX-F1 with CG	Transmit	
2 Freq. TX 2 Freq. RX with Channel Guard Disable	RX-F2 CG Disable	RX-F2 with CG	RX-F1 CG Disable	RX-F1 with CG	TX-F1	TX-F2
Repeater Disable		Repeater Disable		Receive	Transmit	
Repeater Disable & Channel Guard	Repeater Disable & CG Disable	Repeater Disable	CG Disable	Receiver With CG	Transmit	

NOTE

Functions marked with symbol (P) can be used in Parallel consoles. When units with Channel Guard are paralleled, CG Disable must be a momentary function.

DC Control of KC16 Remote Control Panel

The control current required to select each function in the KC16 Remote Control Panel is given in Table 2.

TABLE 2

DC CONTROL CURRENT AND FUNCTION FOR KC16 CONTROL PANEL

FUNCTION	CONTROL CURRENT IN MILLIAMPERS				
	-15**	-6**	0	+6*	+15**
1 Freq. TX 1 Freq. RX (P)			Receive	Transmit	
2 Freq. TX 1 Freq. RX			Receive	TX-F1	TX-F2
1 Freq. TX 2 Freq. RX		RX-F2	RX-F1	Transmit	
2 Freq. TX 2 Freq. RX		RX-F2	RX-F1	TX-F1	TX-F2
1 Freq. TX and PSLM or 2 Separate Receivers	RX-F2	RX-F1	RX-F1&F2	Transmit	
2 Freq. TX and PSLM or 2 Separate Receivers	RX-F2	RX-F1	RX-F1&F2	TX-F1	TX-F2
1 Freq. TX and Receive with Channel Guard (P)			Channel Guard Receive	Monitor (Noise Squelch)	Transmit
Repeater Disable		Repeater Disable	Receive	Transmit	
Repeater Disable Channel Guard	Repeater Disable and Monitor	Repeater Disable	Channel Guard Receive	Monitor (Noise Squelch)	Transmit

NOTES

*Jumper from H13 to H14 on H. V. Board 19D416592 must be moved to between H13 and H15. 5K resistor R35 must be adjusted for 6 mA.

** 1K resistor R37 must be adjusted for 15 mA.

Connections

All connections to the MASTR Controller except the power connections are made at the screw terminals on TB1101. For proper operation of the DC control circuits, the polarity of the telephone pair carrying the control currents must be the same at both the MASTR Controller and the station remote control panel. To identify the wires at each end of the telephone line, temporarily short one wire of the control pair (disconnected from the equipment) to a good earth ground at the station remote control panel and measure the resistance between each of the two wires and a good earth ground at the MASTR Controller. The ungrounded wire will appear as an open circuit. The grounded wire will show a resistance which will depend upon the size and length of the pair used.

Label each end of the wire and remove the ground. Remove the short. Be sure that both of the telephone wires which carry the control currents are connected to corresponding terminals on the MASTR Controller and the remote control panel.

Single Frequency Transmit and Single Frequency Receive

The single frequency transmit and single frequency receive DC control function requires the use of High Voltage Module 19C320169 connected to J1104 on the MASTR Controller system board. The high voltage from the controller power supply is applied to pins 7 and 8 and connected to current regulator Q1 and VR1. When zero current is applied to the control pair at pins 2 and 13, the control circuit is in the receive mode. When the TRANSMIT bar is pressed, PTT ground is applied to the 250 kHz oscillator Q3, initiating oscillator operation. The 250 kHz signal serves as a bias circuit for the current regulator, current selection, and provides isolation for the control pair.

The 250 kHz signal is coupled through transformer T1 and turns on regulator switch Q2. This switch allows Q1 to conduct and the current through Q1 is regulated by VR1. The +6 mA is adjusted by potentiometer R2. The regulated control current is applied to the control pair at pins 2 and 13 to key the transmitter at the remote station.

Multi-Frequency Switching

Switching more than one transmit or receive frequency requires the application of High Voltage Module 19D416592 connected to J1103 and J1104 on the systems board. Refer to the Schematic Diagram (See Table of Contents) for the function switch legends and jumper connections on the 19D416592 Board.

The selection function applies a ground to the appropriate terminal at P3. For example, selecting XMIT #2 transfers ground from terminal P3-9 to P3-8. CR23 is forward biased, preventing Q2 from conducting. Since ground is removed from P3-9, CR27 is back biased. Q1 and Q3 are normally conducting, holding Q2 and Q4 off. When the PTT lead is grounded, CR24 and CR25 are forward biased. This turns off Q1 and Q3. Since CR27 is back biased, Q4 is now allowed to conduct. Conduction of Q4 forward biases CR10 and CR11. This allows the 250 kHz oscillator (Q12) output to flow through the primary of T4 and T5. Transformer T4 serves as the bias coupler for the 11 mA selector transistor Q15. Q15 conducts and the 11 mA control current is applied to the line. The 11 mA current is adjusted by R37.

The oscillator output is also allowed to flow through the primary of T5. This current is applied to the SCR bridge (CR42 - CR48) to provide a positive 11 mA at the control pair connected to P4-2 and P4-13. Similarly, T6 provides a negative polarity for the selected control current; T2 and Q13 provide a control current of 2.5 mA adjusted by R35, and T3 and Q14 provide a control current of 6 mA adjusted by R36.

Channel Guard Control

In standard Channel Guard applications, Channel Guard microphone 19B209459P1 is provided. A CG MONITOR switch is located on the microphone. When the microphone is unkeyed and the MONITOR switch is not depressed, no control current is applied to the control pair. This selects Channel Guard operation at the base station for Receive - F1. In applications with 2-Frequency Receive, when the REC F2 function is selected the -6 mA control current is applied to the line. In either of these cases, Channel Guard operation is selected at the base station, and only those transmissions coded by the proper Channel Guard tone will be heard at the MASTR Controller.

Pressing the MONITOR switch on the microphone applies ground to the Channel Guard latch flip-flop (Q17 - Q18), turning on Q17 and turning off Q18. Turning off Q18 turns on Q19, applying a negative potential to operate the Channel Guard Monitor Lamp and turning off Q5. Q6 conducts, connecting -2.5 mA to the control pair. This disables the station Channel Guard so that all transmissions on the receiver frequency selected can be heard. Pressing the PTT switch applies either +6 mA (TX-F1) or +11 mA (TX-F2) to the control pair to key the desired transmitter. If negative currents other than -2.5 mA are used, parallel operation of the MASTR Controllers is not recommended.

For momentary operation of Channel Guard control refer to the Wiring Diagram of High Voltage Module 19D416592 (see Table of Contents).

Remote/Repeater Control

In remote/repeater applications, the station transmitter may be keyed by either an incoming RF signal (repeater operation) or by a control current from the MASTR Controller. Two methods may be employed to give the dispatcher priority over repeater operations.

1. Without Repeater Disable:

   When the Repeater Disable option is not employed, keying the microphone applied +6 or +11 mA to the control pair. This opens the ground return of the COS at the repeater station. The station will then operate as a remote only as long as the microphone remains keyed.

2. Repeater Disable:

   With the Repeater Disable option, pressing in the REPEAT DISABLE switch applies -6 mA to the control pair. This opens the ground return to the COS at the repeater station, and the station will operate as a remote as long as the REPEAT DISABLE switch remains depressed.

Repeater Disable and Channel Guard Monitor

With the microphone unkeyed and the CG MON switch not depressed, Channel Guard is energized and no control current is applied to the control pair. This permits normal Channel Guard and repeater operation. Pressing the MONITOR switch on the microphone or the Controller applies -2.5 mA to the control pair. This disables the station Channel Guard so that all transmissions on the receiver frequency can be heard. The station will still operate as a repeater whenever a properly tone-coded message is received.

With the MONITOR switch not depressed, pressing the REPEAT DISABLE switch applies -6 mA to the control pair. This removes the ground to the Carrier Operated Switch (COS) on the repeater control panel so that the station will operate as a remote as long as the REPEAT DISABLE switch is depressed.

Depressing both the MONITOR and REPEAT DISABLE switches applies -11 mA to the control pair. This provides Channel Guard monitoring and disables the COS so that the station operates as a remote.

Keying the microphone at the Controller applies +6 mA to the control pair and removes the -11 mA from the control pair, disabling the repeater function and keying the station transmitter.

Simultaneous Monitor of Two Receivers of 2-Frequency PSLM of One Receiver

Refer to the Schematic Diagram (See Table of Contents) for the extensive circuit changes required for this function. Two 19D416628G2 Switch Kits are provided to allow individual selection of the receiver frequencies or simultaneous selection of both receiver frequencies.

With no receive selector switch depressed, no current is applied to the control pair. This allows receiving either of the receiver frequencies selected by PSLM. Depressing the REC 1 switch applies -6 mA to the control pair, disabling the PSLM function and allowing the RX-F1 signal to be monitored. Depressing the REC 2 switch applies -11 mA to the control pair, disabling the PSLM function and allowing the RX-F2 signal to be monitored.

Supervisory Control (Option 8537)

According to FCC regulations, if more than one controller is connected in parallel in a system and their number and location are not specified on the station license, the dispatcher must be able to cut any conversation off the air that he judges unfit for transmission.

Pressing the SUPV CONT switch places a short across the control pair, terminating the transmission. The dispatcher can use the intercom (if present) to prevent a recurrence of the unauthorized transmission before releasing the short on the control pair.

Tone Alert (Option 8528)

The Tone Alert Oscillator accessory is used by the dispatcher to transmit an alerting tone to call attention to messages of more than usual importance. The accessory consists of a tone oscillator and indicator light mounted in the selector switch.

Depressing the ALERT TONE switch applies ground to the tone transmit output to key the transmitter and turns on the Tone Alert LED. The nominal 1000 Hz output of the tone oscillator is connected to the audio board where the external tone switch is turned off, feeding the tone signal to the audio pair at TB1101-7 and -10 and then transmitted by the station. The tone output is adjusted by R5 on the tone board for 2 Volts RMS at the audio pair.

Intercom Switch Kit (Option 8536)

The Intercom Switch Kit permits communication between paralleled MASTR Controllers without keying the transmitter. It also permits intercommunication between the controller and the base station when the remote control panel has been equipped with the intercom accessory.

Depressing the INTCM switch transfer PTT ground to the audio PTT path. This opens the transmit control current path and disables the transmit light.

VU Meter Kit (Option 8529)

The VU Meter enables the operator to check the line level of the MASTR Controller in the transmit, intercome or receive mode. The VU Meter provides a relative indication of the audio levels applied to and received from the audio pair. Audio from the compressor or the line is coupled through potentiometer R3 to the amplifier. The output of the amplifier drives the meter.

The meter is normally shipped from the factory adjusted to indicate frequent peaks in the -1 to +3 VU range when the operator is talking into the microphone at a normal voice level. For this type of operation, the LINE OUTPUT control is set for +11 dBm. If desired, the meter may be set for -1 to +3 VU peaks at lower operating levels.

Clocks (Options 8534, 8535, 8568, 8569)

Optional 12-hour clocks (Option 8534, 60 Hz and Option 8568, 50 Hz) or 24-hour clocks (Option 8535, 60 Hz and 8569, 50 Hz) are available for mounting on the MASTR Controller. The clocks are connected so that they operate with the power switch in the ON or OFF position. In the event of a power failure, the clocks can be reset by removing the clock window and turning the indicator wheels in either direction until the correct time shows in the window.

Partial Speaker Mute (Option 8533)

The speaker muting option permits the dispatcher to temporarily reduce the volume of incoming calls to a low level for business discussions, telephone calls, etc.

Pressing in the SPKR MUTE switch connects a 20,000 ohm resistor into the volume control high lead, reducing the speaker output approximately 20 dB.

Parallel Transmit Indicator (Option 8527)

The parallel transmit option is used in systems with parallel controllers to provide a visual indication when any console is in the transmit condition.

Keying the transmitter at any controller applies a positive voltage to the control pair. This voltage is dropped through voltage dividers R4 and R5 and applied to the base of Q2, turning Q2 on. Conduction of Q2 forward biases CR2, allowing the 250 kHz oscillator (Q3) output through to transformer T1. This turns Q1 on. When Q1 is conducting, its collector voltage drops to ground potential. This completes the ground path for the transmit indicator, turning it on.

In Channel Guard systems where a higher keying voltage is required, the jumper bypassing zener diode VR1 is removed. The diode now prevents Q2 from turning on when a lower voltage is applied to the control pair.

Line Compensation (Option 8532)

The line compensation option compensates for high frequency telephone-line losses in the 1000 to 3000 Hz range. The option consists of a parallel L-G circuit in series with a potentiometer, and should be used when the high-frequency attenuation in the 2500 to 3000 Hz range is more than 10 dB below the 400 to 600 Hz level. Complete instructions for setting the line compensation option after the MASTR Controller has been installed are contained in the Adjustment Procedure (see Table of Contents).

DC Control Battery Standby (Option 8526)

This option allows the 539 Series MASTR Controller to be operated on a 12-Volt battery (customer furnished) in the event the AC power source fails. The dispatcher depresses the BATT STBY switch to transfer the controller to the battery supply. The controller will remain on DC power until the switch is pushed again. An LED on the BATT STBY switch remains illuminated to remind the dispatcher that he is operating on standby power.

E&M Signaling Control (Option 8530)

This option provides a means of keying the M lead of an E&M signaling facility. With E&M signaling, the MASTR Controller becomes a push-to-talk control for single frequency transmit and receive and operates full duplex. Either -48 VDC (60 mA max.) or -24 (10 mA max.) will be available on the M lead.

Applying PTT ground at P4-11 turns off Q2 and turns on Q3. Conduction of Q3 allows Q1 to conduct and the 48 VDC applied to P4-7 and -8 is regulated by Q1 and VR1 and VR2 in series. For 24 VDC operation, VR1 is removed from the regulator circuit and Q4 is added. The resultant regulated 48 VDC (or 24 VDC) is applied to the M lead connected to P4-2 via TB1101-6.

The Four Wire Audio Kit (Option 8553) is required for separate transmit and receive audio lines.

Four Wire Audio Kit (Option 8553)

This kit consists of an additional 600 ohm line transformer for received audio. The purpose of the option is to allow separate audio connections for the received audio and for the transmit audio.

When this option is installed at the factory, the Controller will operate in the simplex mode with the received audio switched off during PTT periods and with the transmit audio switched off during receive periods. To operate the Controller simultaneous duplex: clip out diode CR3 on the 19D416629G1 Audio Board, remove the jumper between H1 and H2, and add the 620 ohm resistor between H3 and H4 on the Audio Board.

TONE CONTROL CIRCUIT ANALYSIS

(Refer to Tone Control System Diagram)

Control Functions

The MASTR Controller can perform a maximum of 12 different tone control functions. This is accomplished by applying two or three tones in sequence at the prescribed level to the transmission medium for detection at the remote base station. All of the tones are generated at the MASTR Controller by one oscillator whose frequency is selected by resistors activated by a combination of switch selection and logic circuitry. The control tone frequencies required to select each function in the "T" series MASTR Professional Remote and Repeater Stations are listed in Table 3.

TABLE 3

TONE CONTROL FREQUENCY AND FUNCTION

FUNCTION	TONE FREQUENCY	TONE DURATION
RX Channel Guard Disable (Reset by PTT)	2050 Hertz	40 milliseconds
TX-Freq. No. 1 *	1950 Hertz	40 milliseconds
TX-Freq. No. 2	1850 Hertz	40 milliseconds
RX-Freq. No. 1 or Receiver No. 1	1750 Hertz	40 milliseconds
RX-Freq. No. 2 or Receiver No. 2	1650 Hertz	40 milliseconds
Channel Guard Enable or Minimum Squelch or Repeater Enable	1550 Hertz	40 milliseconds
Channel Guard Disable or Maximum Squelch or Repeater Disable	1450 Hertz	40 milliseconds
Aux. Function 1 ON	1350 Hertz	40 milliseconds
Aux. Function 1 OFF	1250 Hertz	40 milliseconds
Aux. Function 2 ON	1150 Hertz	40 milliseconds
Aux. Function 2 OFF or PSLM or Sim. Monitor	1050 Hertz	40 milliseconds
TX Hold **	2175 Hertz	

NOTES

* All functions but Transmit F1 and Transmit Hold are optional.

** Transmit Hold is transmitted at 30 dB below the Secur-it tone level as long as PTT switch is depressed.

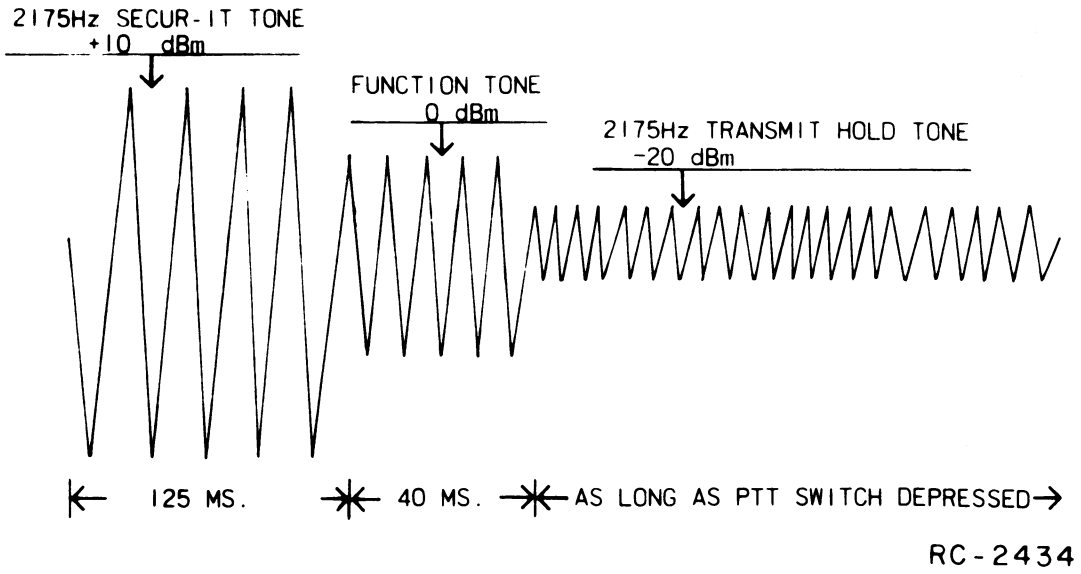


Figure 4 - Tone Control Sequence

When a non-transmit function is selected, the Secur-it tone frequency of 2175 Hz is transmitted for a period of 125 milliseconds at a level equal to normal voice peaks. In the case of a 0 VU line level, the Secur-it tone is transmitted at a level of +10 dBm. At the end of this 125 milliseconds, the oscillator output frequency is changed to that of the function selected. This tone is transmitted for a period of 40 milliseconds at a level 10 dB below the Secur-it tone burst. Upon completion of this sequence, all encoder circuits are returned to normal. See Figure 4.

When a transmit function is selected the Secur-it tone is transmitted as in the sequence described above, followed by a 40 ms burst of the F1 or F2 transmit function tone. At the end of this tone period, the Secur-it tone is turned on again and transmitted at a level 30 dB below its initial burst level, as shown in Figure 4. The Secur-it tone remains on at this level in the presence of voice as long as the PTT switch is depressed.

Connections

All Connections to the MASTR Controller except the power connections are made at the screw terminals on TB1101. Any transmission circuit capable of handling audio frequencies in the 300 to 3000 Hz range can be used for tone control. It is not necessary to observe polarity in wire line connections for tone control applications.

1. Connect Telephone pair or metallic pair to TB1101-1 and TB1101-2.

2. Connect jumper between TB1101-3 and TB1101-4.

Tone Control Board 19D416597

In early versions of the MASTR Controller, Tone Control Board 19D416597G1 was used. In later versions Tone Control Board 19D416597G2 is used. The G2 Board has an IC regulator (U8) for better control of the 5.0 VDC logic supply.

The 19D416597 Tone Control Board provides the necessary logic required for selecting the individual functions. The tone oscillator is located on this board. The Oscillator consists of integrated circuit U1 and the associated frequency-determining circuits. Variable resistor R54 provides a means of adjusting the oscillator to its center frequency. By the logical selection of frequency-determining resistors, the oscillator's nominal frequency can be changed as required.

Depressing the desired function selector switch applies in low to U2A pin 1, 2 or 3 on the Tone Control Board. This low is inverted by NOR gate U2A and inverted again by U4A. The resultant low at pin 2 of U4A discharges C12 and operates the Secur-it

Tone One Shot U3A-U4B. The low output at pin 4 of U4B turns off Q7. The high at the collector of Q7 is inverted by U4C and the low output at U4C-6 (TP8) is applied to NOR gate U2B (Tone Inhabit). The high output at U2B-8 (TP10) is inverted at U6E and the resultant low turns off Tone Gate Q3. Transistor Q9 is normally conducting, connecting R28 into the frequency-determining network of the tone oscillator. Turning off Tone Gate Q3 thus allows the 2175 Hertz Secur-it tone through to the tone amplifiers Q4-Q5. The Amplified tone is connected through TONE LEVEL ADJUST potentiometer R18 to the tone output terminal P4-14. The low output of U4C is also inverted by U3D and again by U6D. The resultant low turns off 30-dB attenuator Q2.

The Secur-it tone One Shot remains in the on condition for a period of 125 milliseconds, determined by the RC time constant of R22 and C13. When the one shot returns to its normal state, the high at pin 4 of U4B turns Q7 on. The low at the collector of Q7 is inverted by U4C and inverted again by U4D. Capacitor C14 is discharged, turning on the Function Tone One Shot U3B-U4E. The low output at U4E-10 turns off Q8 and the high at the collector of Q8 is inverted by U4F, turning off Q9. The low at U4F-12 (TP2) is applied to U2B-9, keeping the Tone Gate (Q3) open. This same low is applied to the base of Q19.

Enable switch Q19 is normally conducting, disabling the Tone Control Function Modules. When the Function Tone One Shot is turned on, Q19 is turned off. This enables the Tone Control Function Modules. The function tone selected is determined by the enable voltage at P3-13, the 200 millisecond one shot selected, and the function selector switch position. The high output of U3B is connected to the base of Q1 (10 dB attenuator), turning the transistor on. Thus the selected function tone is transmitted at a level 10 dB below the Secur-it tone level.

The high output of U3D (when either of the tone control one shots is active) is applied to the AUDIO INHIBIT lead P4-1, preventing the mike output on the Audio Board from operating during tone transmission. The output of U3D also continues to hold the 30 dB attenuator off and operates the VU Meter level switch Q12.

The high output of U2B is applied to the INHIBIT lead at P3-14, preventing the non-selected 200 ms one shots on the Tone Control Function Modules as well as the Channel Guard Monitor One Shot from operating. This same high turns on Q16, enabling the Audio Board to transmit the tones.

Channel Guard Monitor

Depressing the MONITOR bar on the Channel Guard microphone applies a ground to P3-6 on the Tone Control Board. The 200 ms Channel Guard Monitor One Shot U5A-U5C is operated. This same ground is applied to pin 2 of U2A, operating the 125 ms one shot and, in turn, the 40 ms one shot. The high output of U5A is NANDed with the high from U3B to provide a low to U6A. The resultant high at the output of U6A operates Q10, connecting R35 into the frequency-determining network of the tone oscillator. Thus the Channel Guard monitor of 2050 Hz is transmitted with the Function Tone One Shot is active. When this tone is transmitted, the Channel Guard function at the base station is disabled, allowing the dispatcher to monitor received audio.

Transmit F1 and F2

When the transmit function switch is in the F1 position (not depressed) ground is connected to the XMIT F1 terminal P3-9 on the Tone Control Board. Operating the PTT switch applies ground to P4-11. Q14 is turned off and Q15 is turned on. The low at the collector of Q15 (TP7) is inverted at U6C, turning on PTT latch transistor Q17. This transistor remains on during the period that the 125 ms and 40 ms one shots are active. Q14-Q15 senses the level of the PTT line above ground and maintains the level within 0.6 Volts to insure proper audio inhibit. The low at the collector of Q15 is also applied to U7A-2, U2B-12 and U6C-5. The resultant high output of U6C is applied to U7B-5. The high output of U3B is applied to U7B-3. The high on P3-8 (XMIT F2) is applied to U7B-4. The resultant low output of U7B-6 is inverted by U6F, turning on Q13 and connecting R29 into the frequency-determining network of the tone oscillator. Thus the TX F1 tone of 1950 Hz is transmitted.

The ground at XMIT F1 is applied to NAND gate U7C. The resultant high output of U7C is inverted by U3C, preventing Q18 from conducting. As long as the PTT switch is depressed, a ground is maintained at terminal 12 of Tone Inhibit gate U2B, keeping the Tone Gate open (Q3 turned off). At that end of the 40 ms function tone period, a high is applied to U3D at pin 12. The low output of U3D is inverted by U6D and the resultant high turns the 30-dB attenuator (Q2) back on. Q9 is also turned back on, transmitting the 2175 Hz tone at a level 30 dB below its Secur-it tone level as long as the PTT switch is depressed. This keeps the base station transmitter keyed while the message is being sent.

If the transmit function switch is depressed for F2, ground is applied via the XMIT F2 lead to U7B, preventing TXF1 transistor Q13 from conducting. Thus Q18 conducts during the function tone one shot period, connecting R50 into the frequency

TABLE 4

TONE CONTROL FUNCTION MODULE APPLICATION

FUNCTION	MODEL NUMBER	TONE FREQUENCY
RX-Freq. No. 1 or Receiver 1	19C320182G1	1750 Hz
RX-Freq. No. 2 or Receiver 2	19C320182G1	1650 Hz
Channel Guard Enable or Minimum Squelch or Repeater Enable	19C320182G2	1550 Hz
Channel Guard Disable or Maximum Squelch or Repeater Disable	19C320182G2	1450 Hz
Aux. Function No. 1 ON Aux. Function No. 1 OFF	19C320182G3	1350 Hz 1250 Hz
Aux. Function No. 2 ON Aux. Function No. 2 OFF or PSLM or Simultaneous Monitor	19C320182G4	1150 Hz 1050 Hz

determining network of the oscillator and transmitting the TXF2 tone of 1850 Hertz for 40 ms.

Tone Control Function Modules 19C320182G1-G4

Four Tone Control Function Modules are available for the various tone control functions provided for the MASTR Controller. Table 4 lists the function, the module required for the function, and the tone control frequency used.

As long as the function tone one shot on the Tone Control Board is inactive, a "high" is applied to the inhibit lead P7-12 on the Tone Control Function Module. This prevents the 200 ms one shot (U1A and U1B) from being activated. When the function tone one shot is activated, the inhibit lead is grounded and enable transistor Q19 on the Tone Control Board removes ground from the enable lead at P7-11, enabling the frequency-determining switches Q1-Q2 and Q3-Q4.

Grounding one of the switch contacts at P7-7 or P7-8 activates the 200 ms one shot. Q5 is turned off supplying a low to the initiate lead at P7-13. This low initiates the Secur-it tone and function control tone one shots on the Tone Control Board to begin the function tone sequence.

Receive F1 and F2

With the receive function switch in the REC F1 position, ground is applied to P7-7. This prevents Q3 on the 19C320182G1 Tone Control Function Module from conducting. When the 200 ms one shot is activated, Q1 is turned on because the RX-F2 lead (P7-8) is not grounded. Q1 turns on Q2, connecting the frequency-determining resistor R17 into the oscillator circuit. Thus REC F1 tone 1750 Hz is transmitted. Depressing the receive function switch to the REC F2 position grounds P7-8 and prevents Q1 from conducting. The RX F1 lead at P7-7 is no longer grounded, allowing Q3 and Q4 to conduct and insert R18 into the frequency-determining network of the oscillator. Thus the RX F2 tone frequency of 1650 Hertz is transmitted. The other Tone Control Function Modules operate in the same manner as described to select the functions outlined in Table 4.

Take Over Control (Option 8538)

When a number of MASTR Controllers are connected in parallel on the same control pair, this option allows all paralleled units to be completely disabled and the main dispatcher to assume full control of the system.

Depressing the 19D416628G9 TAKE OVER function switch grounds the +24 Volt line, disconnects the + line DC and audio line from the - Supervisory Control line, and disconnects the - line DC and audio line from the + supervisory control line. The telephone pair at the controlled remote unit is connected to TB1101-9 (+ SUPV CONTROL) and TB1101-12 (- SUPV CONTROL).

Alert Tone (Option 8528)

The Tone Alert Oscillator accessory is used by the dispatcher to transmit an alerting tone to call attention to messages of more than usual importance. The accessory consists of a tone oscillator and indicator light mounted in the selector switch.

Depressing the ALERT TONE switch applies 13.8 VDC to the tone oscillator (Q1), applies ground to the tone transmit output to key the transmitter and turns on the Tone Alert LED. The nominal 1000 Hz output of the tone oscillator is connected to the Audio Board where the external tone switch is turned off, feeding the tone signal to the audio pair at TB1101-7 and -10 and then transmitted by the station. The tone output is adjusted by R5 on the tone board for 1 Volt RMS at the audio pair.

Intercom Switch Kit (Option 8536)

The Intercom Switch Kit permits communication between paralleled MASTR Controllers without keying the transmitter. It also permits intercommunication between the dispatcher and the base station when the remote control panel has been equipped with the intercom accessory.

Depressing the INTCM switch transfers PTT ground to the audio PTT path. This opens the transmit control path and disables the transmit light.

VU Meter Kit (Option 8529)

The VU Meter enables the operator to check the line level of the MASTR Controller in the transmit, intercom or receive mode. The VU Meter provides a relative indication of the audio levels applied to and received from the audio pair. Audio from the compressor amplifier or the line is coupled through potentiometer R3 to the amplifier. The output of the amplifier drives the meter.

The meter is normally shipped from the factory adjusted to indicate frequent peaks in the -1 to +3 VU range when the operator is talking into the microphone at a normal voice level. For this type of operation, the LINE OUTPUT control is set for +11 dBm. If desired, the meter may be set for -1 to +3 VU at lower operating levels.

Clocks (Options 8534, 8535, 8568, 8569)

Optional 12-hour clocks (Option 8534, 60 Hz and Option 8568, 50 Hz) or 24-hour clocks (Option 8535, 60 Hz and 8569, 50 Hz) are available for mounting on the MASTR Controller. The clocks are connected so that they operate with the power switch in the ON or OFF position. In the event of a power failure, the clocks can be reset by removing the clock window and turning the indicator wheels in either direction until the correct time shows in the window.

Partial Speaker Mute (Option 8533)

The speaker muting option permits the dispatcher to temporarily reduce the volume of incoming calls to a low level for business discussions, telephone calls, etc.

Depressing the SPKR MUTE switch connects a 20,000 ohm resistor into the volume control high lead, reducing the speaker output approximately 20 dB.

Battery Standby

Battery standby is provided with the Series 549 MASTR Controller as a standard item. A diode is connected across terminals 18 and 19 of J1111. This diode is normally back-biased by the supply voltage. If the supply voltage fails, the diode becomes forward biased and connects an auxiliary battery (customer furnished) into the supply circuit. When the supply voltage is restored, the diode is again reverse-biased, automatically disconnecting the battery.

Battery Standby Light Flasher Kit (Option 8545)

The POWER ON indicator is connected to P6-14 on the Light Flasher Kit when this option is used. As long as the power supply voltage is present, CR1 is forward biased and Q2 is conducting. Q1 is turned off. If the supply voltage fails, and the standby battery is switched into the circuit, CR1 is back biased and Q2 is turned off. This turns the POWER ON indicator off but also turns Q1 on. Conduction of Q1 turns on the POWER ON indicator. This process continues to flash the POWER ON indicator until the supply voltage is restored.

Notch Filter (Option 8555)

In systems with several MASTR Controllers connected in parallel, where positive indication of the transmit condition is not required, the Notch Filter Option (8555) may be used to remove the 2175 Hz transmit hold tone when another controller is transmitting.

The notch filter consists of pi-network L1-C3, L2-C4, and L3-C1. The filter is tuned to the 2175 Hertz tone frequency, trapping the tone and passing it to ground. The speech audio is amplified by Q1 and Q2 and passed to the audio circuits.

Parallel Transmit Indicator and Notch Filter (Option 8554)

Option 8554 provides a notch filter for removing the 2175 Hertz transmit hold tone at the MASTR Controller whenever another controller connected in parallel is transmitting. Also provided is a tone detector circuit for operating the XMIT

LIGHT to indicate to the dispatcher that another controller is transmitting a message.

The notch filter consists of pi-network L1-C15, L2-C16, and L3-C17. The filter is tuned to the 2175 Hertz tone frequency, trapping the tone and passing it to ground. The speech audio is amplified by Q14 and Q15 and passed to the audio circuits.

The audio input at P5-6 is also connected to the active RC filter composed of C2-C6 and R1-R3. Variable resistor R3 allows adjustment of this filter to the 2175 Hertz tone frequency. The 2175 Hertz tone is amplified by high-gain amplifier Q1-Q4, with a feedback path from the emitter of Q5 to provide stability.

The 2175 Hertz output is buffered by Q6, amplified at Q7 and passed to the tone detector CR1 and CR2. Q8 is normally conducting, clamping the amplifier output to prevent noise pulses from operating the XMIT LIGHT. When the 2175 Hertz tone is present, it is rectified and turns off Q9. Q10 is also turned off. Q11 is turned on. Conduction of Q11 turns off the attenuator Q8 and also turns off Q12. Q13 is now turned on, operating the XMIT LIGHT.

AUDIO SYSTEM

The MASTR Controller Audio System consists of the audio board (19D424084) and the speaker PA circuit located on the System Board A1101.

Audio Board 19D424084G1 & G2

The Audio Board consists of the microphone compressor amplifier, the line compressor amplifier, the line preamplifier and the various switching and level control circuitry required for proper operation of the control system. The 19D424084G1 board is used in DC control systems. The 19D424084G2 board is used in tone control systems and includes a 2175 Hz notch filter in the audio path to prevent falsing of the transmit function.

Operating the PTT switch applies ground to the receive audio switch Q8, turning the switch on. When Q8 is conducting, the feedback loop through R23 and CR4 increases the conduction of gain control stage Q1, shorting the AC onput to ground. This cuts off the line input to the line compressor amplifier. With Q8 turned on, Q7 conducts. This grounds the VOLUME HI lead, preventing any received audio from reaching the speaker PA.

Audio from the microphone is coupled to the MIKE IN ADJUST control R28 where the proper level is set for the compressor amplifier. The adjusted audio is coupled by C38 to preamplifier Q21. The output of Q21 is applied to the Line Compressor Amplifier. The Line Compressor Amplifier circuit consists of gain control stage Q10, high-gain audio amplifiers Q11 through Q14, and DC amplifier Q15.

When audio is applied to the compressor amplifier, R29 and the AC impedance of Q10 act as a voltage divider for the AC input signal. The output of Q10 is amplified by a four-stage, direct-coupled amplifier (Q11 through Q14). Both AC and DC feedback in the amplifier circuit provides for extremely stable operation.

A portion of the amplified output is fed through LINE OUT ADJUST Control R54 to the output line amplifier (Q17-Q18) and to the line transformer T1. The remaining portion of the audio output is rectified by detector CR9, filtered by C24 and amplified by DC current amplifier Q15. This DC output is fed back to the base of gain control transistor Q10.

The amount of DC feedback to the gain control stage determines the AC impedance of Q10. An increase in feedback reduces the AC impedance of Q10 which decreases the audio voltage to the AC amplifier, keeping the amplifier output constant. When the audio input decreases, the output of the AC amplifier starts to decrease, reducing the feedback to Q10. This raises the AC impedance of Q10 and increases the audio voltage to the AC amplifier, keeping the amplified output constant.

In tone control systems, the 19D424084G2 Audio Board is used. This board has a 2175 Hz notch filter inserted in the audio path between H5 and H6. This filter consists of C36, C37, L1 and R70. The filter consists of C36, C37, L1 and R70. The filter prevents falsing of the transmit function by the 2175 Hz tone.

In the receive mode of operation, a positive voltage is applied to the base of transmit audio switch Q20, turning the transistor on. Conduction of Q20 grounds the output of the mike compressor AC amplifier, preventing any audio from the mike input from passing to the line amplifier. With no ground applied through the PTT lead, Q8 is turned off and the gain control stage Q1 is allowed to function. Q7 also is turned off, allowing the speaker PA to function. Audio from the line is coupled to the LINE IN ADJUST control R1 which, in turn, connects the received audio to the line compressor amplifier. This amplifier functions in the same manner as described for the mike compressor amplifier. Q2 through Q5 serve as the AC amplifiers; Q6 is the DC amplifier; Q1 is the gain control stage.

The output of the line compressor amplifier is coupled through VOLUME control R1 and passed to the speaker PA.

Speaker PA

The Speaker PA is located on the A1101 System Board. This amplifier consists of audio polarity switches Q7 and Q8, phase inverters Q5 and Q6, and the quasi-complementary output Q2 and Q3. The positive half-cycle of the audio is switched by Q7 to Q5 and Q2. The negative half-cycle of the audio is switched by Q8 to Q6 and Q3. The audio output of the PA is capacitively coupled by C5 to TB1101-24 and to the MASTR Controller Speaker LS1.

Four Wire Audio Operation

When Option 8553 (Four Wire Audio Kit) is installed in the controller, a separate line transformer is connected across TB1101-13 and -16. Diode CR3 on the Audio Board is removed, disabling the speaker mute function. The controller may then be operated full duplex by connecting a separate wire pair to terminals 13 and 16 of TB1101.

POWER SUPPLY

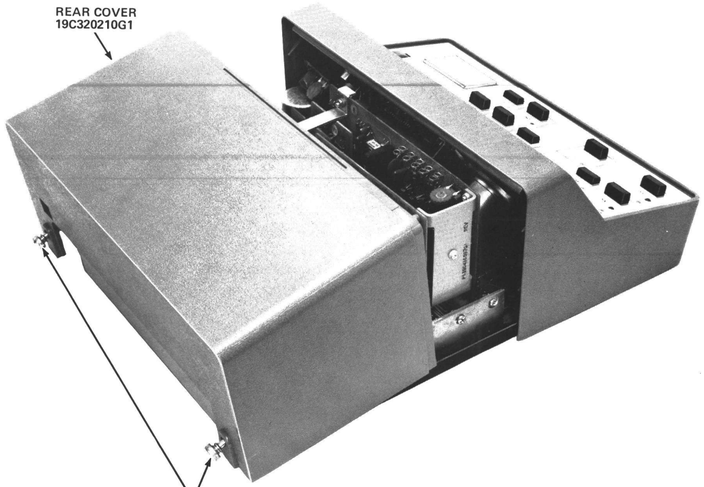
Turning OFF-ON switch S1101 to the ON position applies 117 Volts AC to the primary of power transformer T1101. The primary is fused by F1101. The power supply contains two rectifier circuits in the secondary of T1101 to provide the control and operating voltages for the MASTR Controller.

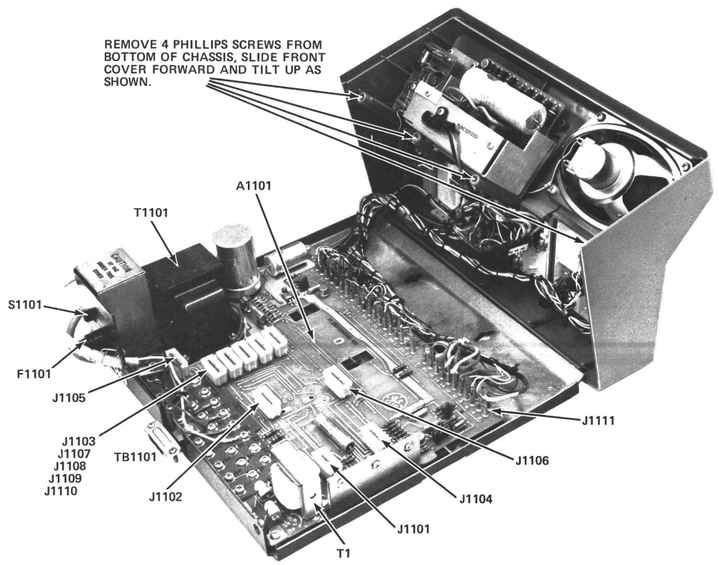
Full wave bridge rectifiers CR1 through CR4 supply the control high voltage. R16 is a bleeder resistor for filter capacitor C10.

Full wave rectifiers CR5 through CR8 supply 24 Volts for operating the speaker PA stage and for application to the pushbutton switch kits. The output of this rectifier circuit is also connected to the 13.8 VDC regulator circuit composed of Q1, Q4 and zener diode CR1. The regulated 13.8 VDC supplies the amplifier circuits in the DC and Tone Control Boards, the Parallel Transmit Indicator options, the Tone Alert option as well as the POWER ON and TRANSMIT LED.

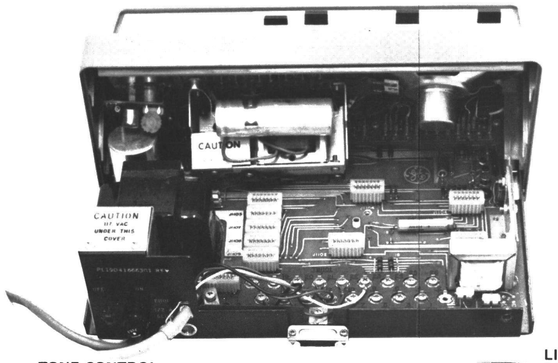
DISASSEMBLY INSTRUCTIONS

REMOVING FRONT AND REAR COVERS

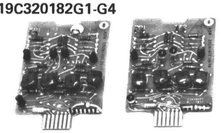


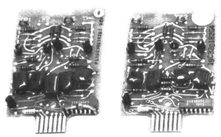


CONTROL BOARD LOCATIONS

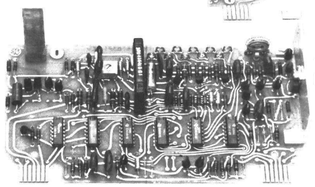


TONE CONTROL FUNCTION MODULES 19C320182G1-G4

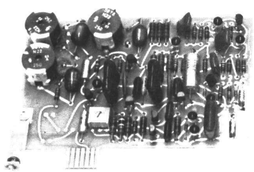




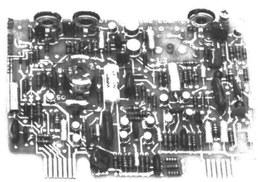
LIGHT FLASHER BOARD (OPTION 8545)



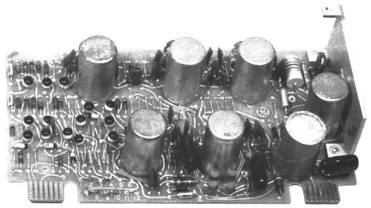
TONE CONTROL BOARD 19D416597



TONE CONTROL PARALLEL TRANSMIT INDICATOR (OPTION 8554)



AUDIO BOARD 19D424084G1



DC CONTROL BOARD 19D416592

SYSTEM TEST, ADJUSTMENT & CONNECTIONS

DESK MICROPHONE CONNECTIONS

A. Connect Standard Desk Microphone 19209458P1 leads as follows:

   a. White lead to TB1101-23 (MIKE HI)
   b. Blue lead to TB1101-22 (MIKE LO)
   c. Red lead to TB1101-21 (PTT)
   d. Black lead to TB1101-17 (GRD)

B. Connect Channel Guard Desk Microphone 19B209459P1 leads as follows:

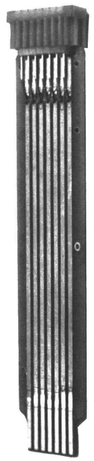
   a. White lead to TB1101-23 (MIKE HI)
   b. Blue lead to TB1101-22 (MIKE LO)
   c. Red lead to TB1101-21 (PTT)
   d. Black lead to TB1101-17 (GRD)
   e. Green lead to TB1101-20 (C.G. MON)

OPTION CONNECTIONS

Refer to the individual option Installation Instructions for special connections. See the Table of Contents.

TEST FIXTURE

Two Test Fixtures (19B219710G1) are recommended for servicing the boards out of the unit while maintaining circuit connections.



TEST FIXTURE
19B219710G1

AUDIO ADJUSTMENT PROCEDURE

Before adjusting the MASTR Controller, make sure that all AC power lines, phone lines, and ground connections have been completed at the Controller and the Base Station.

LINE OUTPUT

The MASTR Controller's line output is adjustable up to a maximum of +11 dBm. When the unit is connected to a commercial phone line, the line output should be set to the maximum permissible test tone level which the local phone company will allow. If a short run of wire (less than 1000 feet) is used to connect the Controller to the base station, the line output should be set to 0 dBm. Average voice will be sent 10 dB below the level at which you set the line output.

1. Connect an AC-VTVM across the audio pair (TB1101-1 and TB1101-2). Use a 0.5 mfd capacitor in series with the meter if a DC control voltage is simplexed line-to-line.

2. Turn MIKE GAIN control R28 on Audio Board to maximum (fully clockwise) disconnect the MIKE HI from TB1101-23.

3. Apply a 1000 Hertz signal to TB1101-22 (mic lo0 and TB1101-23 (MIC HI) at a level of 40 millivolts (Desk Mike or Boom Mike), or 120 millivolts (Handset). Use a 100 mfd capacitor in signal generator lead with (+) side of capacitor to TB1101-23.

4. Operate PTT switch S1 on Controller and adjust LINE OUTPUT control R54 on Audio Board for desired Line Output Level.

MIKE GAIN

The Mike Gain control sets threshold of compression on the Mike Compressor.

This setting will vary depending on the dispatcher's voice and operating habits. The following level given should be used in most cases. If you want more compression use a lower input to the mike jack, if you want less compression use a higher input to the mike jack. Before making the mike gain adjustment you must perform the Line Output adjustment above.

1. Reduce the 1000 Hz signal at the mike jack to 25 millivolts (desk mike) or 80 millivolts (Handset).

2. On TONE UNITS, connect a jumper from TP10 to ground on the Tone Control Board.

3. Operate the PTT switch S1 on the Controller and adjust MIKE GAIN Control R28 until the line output level is reduced 1 dB from the output level set in step 4 above.

SECUR-IT TONE OUTPUT (TONE UNITS ONLY)

The Line Output and Mike gain Adjustments should be made before setting the Secur-it Tone Output.

1. Disconnect Mike Hi lead from TB1101-23. Connect an AC-VTVM to TB1101-1 and TB1101-2. Set Tone Level Adjust R18 on the Tone Control Board to minimum.

2. To enable Secur-it Tone connect a jumper from TP8 to ground on the Tone Control Board.

3. Operate the PTT switch S1. Slowly increase the Tone Level Adjust R18 on the Tone Control Board until the AC-VTVM reaches the same level as you set the line output to in step 4 under LINE OUTPUT.

LINE INPUT

The Line Input control R1 sets Threshold of Compression on the Receive Compressor. Threshold of Compression is adjustable with line inputs as low as -20 dBm. Setting the control for excessive compression will accent background and line noise during pauses in transmission. The Line Output adjustment at the Base Station should be made before setting the Line Input on the Controller.

1. Connect a signal generator to the Base Station Receiver, adjust to the receiver frequency and modulated 3 kHz deviation by a 1000 Hz signal.

2. Adjust Line Input Control R1 on the audio board full clockwise (maximum).

3. Connect the + lead of an AC-VTVM to TB1101-24 and the - lead to TB1101-17. While receiving the 1000 Hz signal adjust the volume control on the Controller to a reference level on the AC-VTVM.

4. Reduce the Line Input Control R1 until the reading on the AC-VTVM is reduced 1 dB from the reference level set to in step 3.

Converting dBm to RMS Volts

dBm	Volts RMS
+10	2.45
0	.776
-10	.245
-20	.0776
-30	.0245
-40	.00776
-50	.00245

DC CONTROL CURRENT TESTS

One-Frequency Transmit and One-Frequency Receive

1. With High-Voltage Board 19C320169G1 plugged into J1104 on the System Board, connect a DC milliammeter in series with the control line (positive lead of meter to TB1101-5).

2. Push in the TX-F1 switch. Operate the TRANSMIT switch and set CONTROL CURRENT potentiometer R2 on the H.V. Board for a reading of +6.0 mA at the milliammeter.

One-Frequency Transmit and One-Frequency Receive with Channel Guard

1. With High-Voltage Board 19C320592G2 plugged into J1103-J1104 on the System Board, connect a DC milliammeter in series with the control line (negative lead of meter to TB1101-5).

2. Push in the C.G. MON switch. Adjust R35 on the H.V. Board for a reading of -2.5 mA at the milliammeter. Release the C.G. MON switch.

3. Reverse the milliammeter connections (positive lead to TB1101-5). Push in the TRANSMIT Switch and adjust R36 on the H.V. Board for a reading of +6 mA at the milliammeter.

Two-Frequency Transmit, Two-Frequency Receive with Channel Guard

1. With High Voltage Board 19D416592G1 plugged into J1103-J1104 on System Board, connect a DC milliammeter in series with the control line (negative lead of meter to TB1101-5).

2. Select REC F1 on the switch panel and push in the C.G. MON switch. Adjust R35 on the H.V. Board for a reading of -2.5 mA on the milliammeter.

3. Select REC F2 on the switch panel. Adjust R36 on the H.V. Board for a reading of -6.0 mA on the milliammeter.

4. Select REC F2 on the switch panel and push in the C.G. MON switch. Adjust R37 on the H.V. Board for a reading of -11.0 mA on the milliammeter.

5. Reverse the milliammeter connections (positive lead to TB1101-5) and select XMIT F1 and push in TRANSMIT switch. Reading should be +6.0 mA on the milliammeter.

6. Select XMIT F2 and push in the TRANSMIT switch. Reading should be +11.0 mA on the milliammeter.

TONE CONTROL TEST

FUNCTION SELECTED	MASTER CONTROLLER LIGHT INDICATION
PTT	Transmit ON
XMIT F1 PTT	XMIT F1 ON Transmit ON
XMIT F2 PTT	XMIT F2 ON Transmit ON
MONITOR PTT	Transmit ON
REC F1	REC F1 ON
REC F2	REC F2 ON
PSLM (Both REC F1 & REC F2 ON)	REC F1 & REC F2 ON
PSLM (Both REC F1 & REC F2 OFF)	REC F1 & REC F2 OFF
RPTR OFF	RPTR OFF
RPTR ON	RPTR ON
CG OFF	CG OFF
CG ON	CG ON
SQUELCH MAX	SQUELCH MAX ON
SQUELCH MIN	SQUELCH MIN ON
AUX. 1 ON	AUX. 1 ON
AUX. 1 OFF	AUX. 1 OFF
AUX. 2 ON	AUX. 2 ON
AUX. 2 OFF	AUX. 2 OFF

OPTION ADJUSTMENTS

Tone Alert Kit (Option 8528)

1. Connect an AC-VTVM across the audio pair TB1101-1 and TB1101-2.

2. Hold in the ALERT TONE switch and adjust R5 on the Tone Alert Board for a meter reading of 1.0 Volt RMS (or less when required by local regulations).

Line Compensation Kit (Option 8532)

The Line Compensation Kit is shipped from the factory disconnected to prevent interference with normal adjustment of the MASTR Controller. The White wire is connected to J1 of the Audio Board.

1. Complete all the normal adjustments as outlined in the AUDIO ADJUSTMENT PROCEDURE section.

2. Move the White wire from J1 to J2 of the Audio Board.

3. Feed a 3000 Hz signal to the audio pair from the Base Station at the highest permissible level.

4. Adjust R1 on the Audio Board for a reading of 0.4 VDC as measured at the emitter of Q6 on the Audio Board.

5. Change the 3000 Hz signal to 600 Hz at the same level.

6. Adjust R1701 to as near a reading as possible of 0.4 VDC as measured at Q6-E.

VU Meter (Option 8529)

The VU Meter was set at the factory to indicate 0 VU at a +11 dBm line output. If the line output is set for other than +11 dBm, it will be necessary to re-adjust R3 on the VU meter to obtain 0 VU readings at threshold of compression.

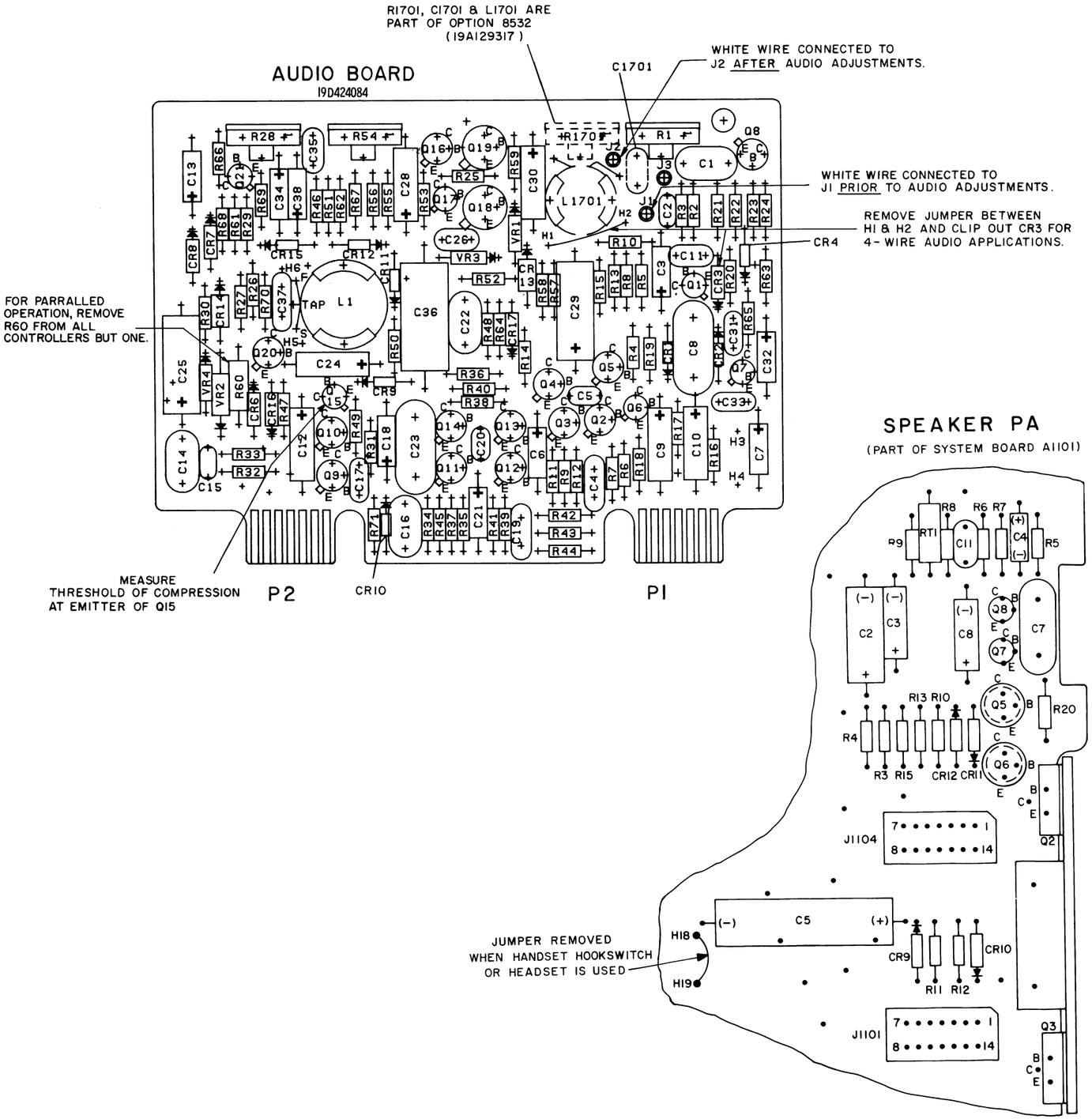
1. Connect an AC-VTVM across the audio pair (TB1101-1 and TB1101-2). Use a 0.5 mfd capacitor in series with the meter if a DC voltage is simplexed line-to-line.

2. Apply a 1000 Hz signal to TB1101-22 (MIC LO) and TB1101-23 (MIC HI) through a 0.22 µf capacitor with + side of capacitor connected to TB1101-23. Set the audio oscillator to the level used in the MIC GAIN setting.

3. Reduce the signal until the line output level has been reduced 10 dB.

4. Adjust R3 on the VU Meter until a reading of 0 VU is obtained on the VU Meter.

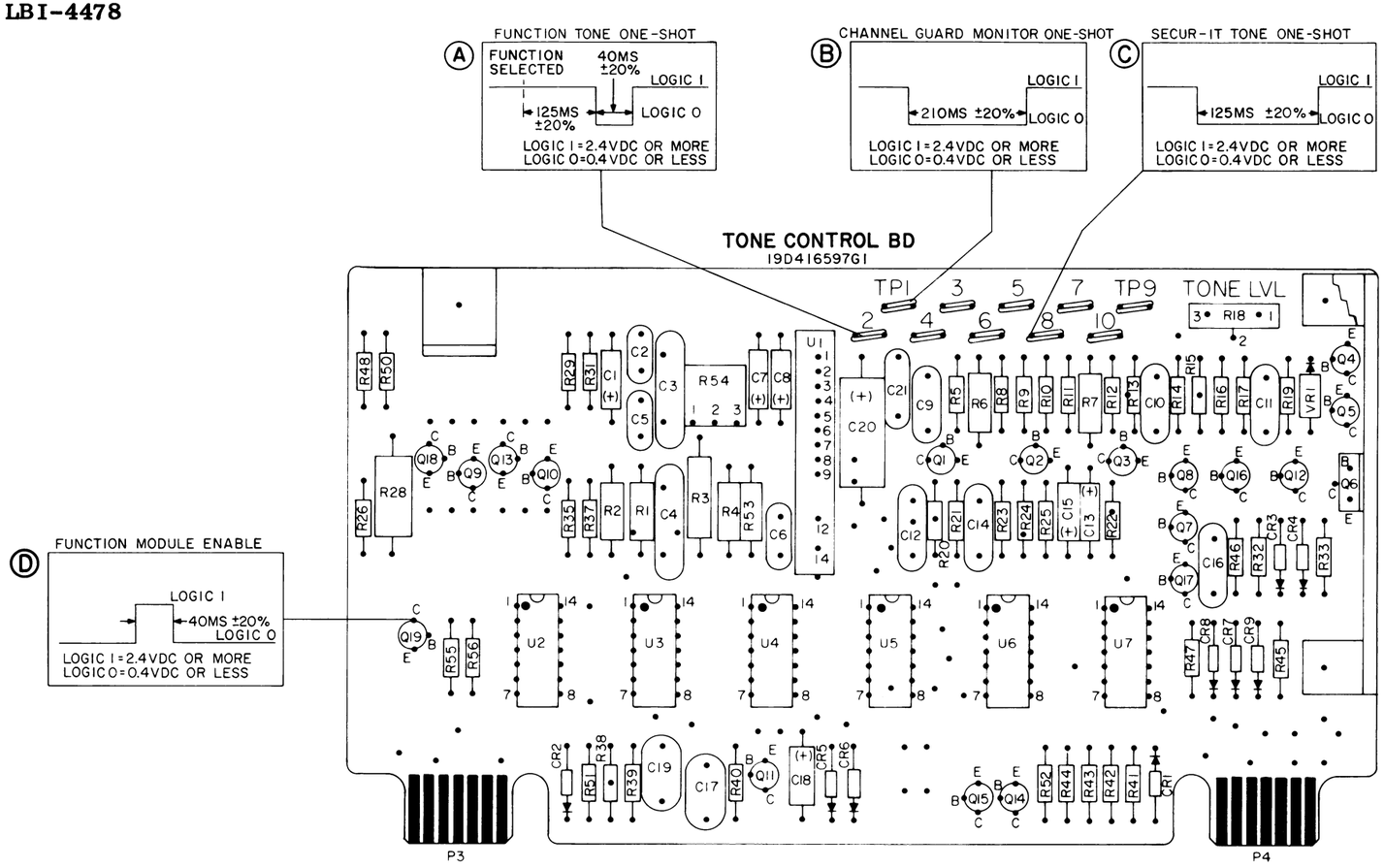
5. The VU Meter should now indicate frequent peaks in the -1 to +3 VU range when talking into the microphone in a normal tone of voice.

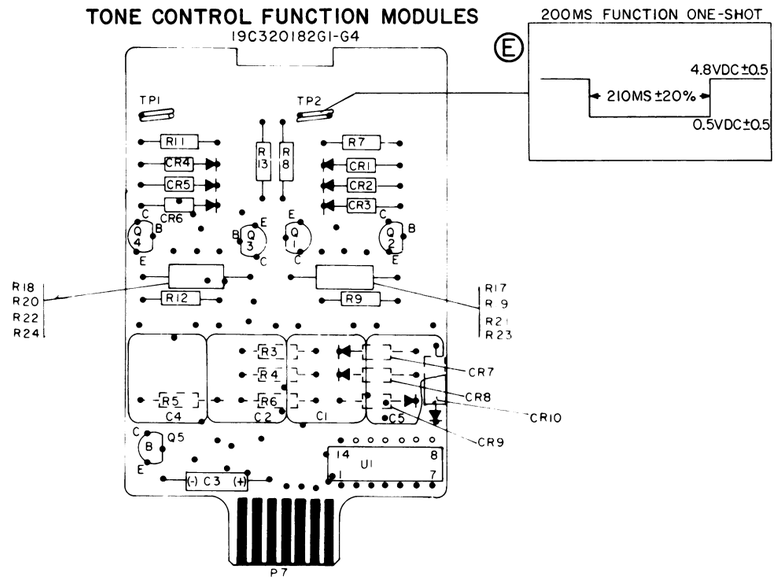


TROUBLESHOOTING PROCEDURE

SYMPTOM	PROCEDURE
NO AUDIO FROM THE SPEAKER.	1. CHECK THE AUDIO INPUT AT P1-1 AND 14 WITH AN AC-VTVM. 2. MAKE SURE THAT VOLUME CONTROL IS NOT SET AT MINIMUM (FULLY COUNTERCLOCKWISE). 3. CHECK TO SEE THAT THE CONTROLLER IS NOT IN THE TRANSMIT MODE (TRANSMIT LIGHT ON). IF THE LIGHT IS ON, CHECK FOR A SHORT IN THE PUSH-TO-TALK CIRCUIT. 4. CHECK THE SETTING OF LINE OUTPUT CONTROL R54 (REFER TO THE AUDIO ADJUSTMENT PROCEDURE). 5. CHECK SUPPLY VOLTAGE AT P2-5. SHOULD BE 13.8 VDC. 6. CHECK THE DC VOLTAGES ON Q1-Q8 (REFER TO SCHEMATIC DIAGRAM). CHECK DC VOLTAGES ON SYSTEM BOARD PA (REFER TO SYSTEM DIAGRAM).
NO AUDIO ON THE LINE.	1. CHECK MICROPHONE AUDIO LEADS AT P2-1 AND -14. 2. CHECK THE SETTING OF MIKE IN CONTROL R28 (REFER TO THE AUDIO ADJUSTMENT PROCEDURE). 3. KEY THE MICROPHONE AND CHECK THE DC VOLTAGES ON Q9-Q18 AND Q20-Q21 (REFER TO SCHEMATIC DIAGRAM)
LINE COMPENSATION (OPTION 8532).	1. THE HIGH-FREQUENCY COMPENSATION SHOULD BE ADJUSTED AFTER ALL AUDIO ADJUSTMENTS HAVE BEEN COMPLETED. REFER TO AUDIO ADJUSTMENT PROCEDURE. 2. THE MASTR CONTROLLER IS SHIPPED FROM THE FACTORY WITH THE WHITE WIRE CONNECTED TO J1 ON THE AUDIO BOARD. AFTER ALL AUDIO ADJUSTMENTS HAVE BEEN COMPLETED, MOVE THE WHITE WIRE TO J2.

RC-2452A





TROUBLESHOOTING PROCEDURE

TONE CONTROL BOARD 19D416597G1

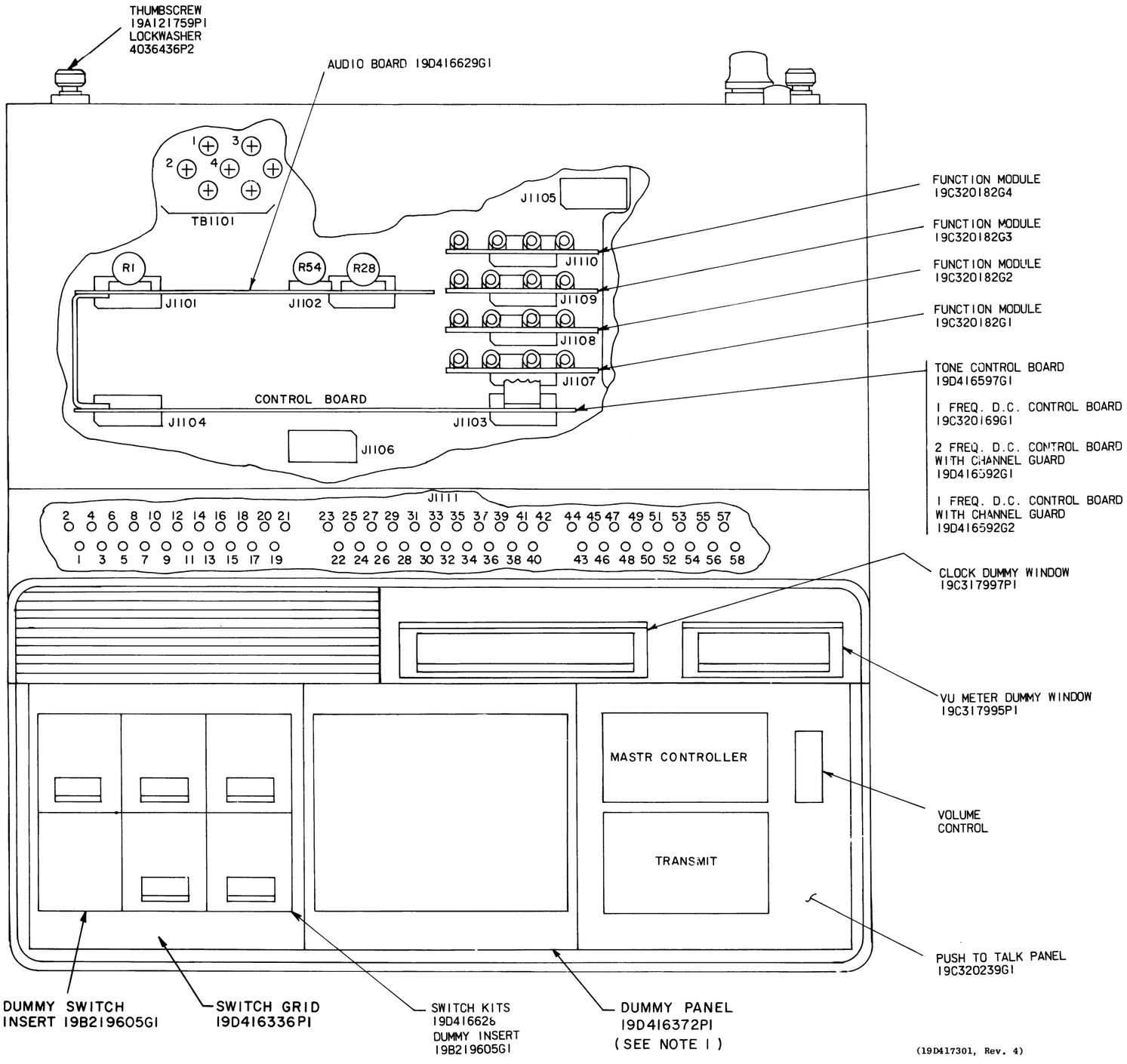
TEST EQUIPMENT REQUIRED
1. COUNTER, ELDORADO 1650C OR EQUIVALENT.
2. SCOPE, LECTROTECH TO -50 OR EQUIVALENT.
3. VTVM, HEWLETT-PACKARD 400D OR EQUIVALENT.
4. EXTENDER BOARDS(OPTION 8544)ARE RECOMMENDED FOR IN-CIRCUIT TESTING OF THESE BOARDS.

SYMPTOM	PROCEDURE
NO TONE OUTPUT FOR ANY FUNCTION SELECTED.	1. CONNECT COUNTER TO TP4. OSCILLATOR SHOULD BE IDLING AT 2175 Hz AT A LEVEL BETWEEN 150 TO 200 MV. IF NOT CHECK OSCILLATOR CIRCUIT. 2. CONNECT SCOPE TO TP5. SELECT PTT FUNCTION. WAVE FORM SHOULD BE AS SHOWN IN FIGURE 1 IN TONE CONTROL FUNCTION DESCRIPTION. IF NOT, CHECK TONE GATING CIRCUITS.
NO SECUR-IT TONE BURST.	1. CONNECT SCOPE TO TP8. WAVE FORM SHOULD BE AS SHOWN IN Ⓒ WHEN FUNCTION IS SELECTED. IF NOT, CHECK SECUR-IT TONE ONE-SHOT AND ASSOCIATED GATES.
NO FUNCTION TONE BURST.	1. CONNECT SCOPE TO TP2. WAVE FORM SHOULD BE AS SHOWN IN Ⓐ WHEN FUNCTION IS SELECTED. IF NOT, CHECK FUNCTION-TONE ONE-SHOT AND ASSOCIATED GATES. 2. SELECT FUNCTION TO BE CHECKED. GROUND TP2. CONNECT SCOPE OR COUNTER TO TP5 AND OBSERVE FUNCTION TONE. REFER TO TABLE 3 FOR CORRECT FUNCTION TONE FREQUENCY.
NO 2050 Hz TONE WHEN CHANNEL GUARD MONITOR SELECTED.	1. CONNECT SCOPE TO TP1. WAVE FORM SHOULD BE AS SHOWN IN Ⓑ. IF NOT, CHECK CHANNEL GUARD MONITOR ONE-SHOT AND ITS ASSOCIATED GATES.

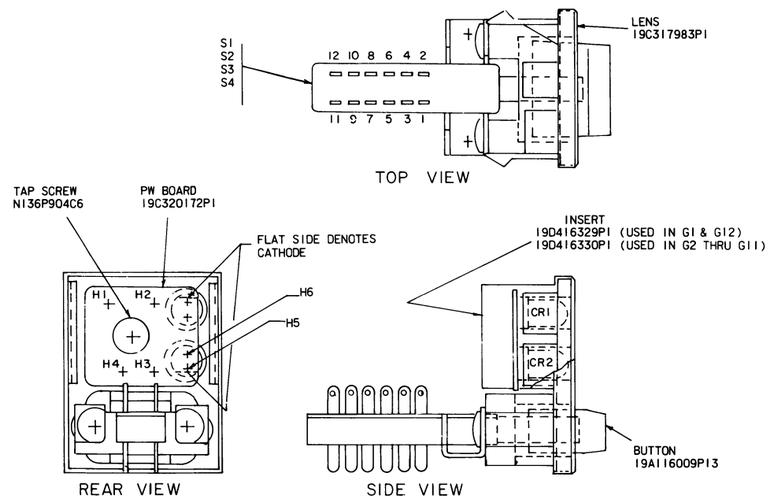
TONE CONTROL FUNCTION MODULES 19C320182G1-G4

SYMPTOM	PROCEDURE
NO TONES AVAILABLE WHEN FUNCTION MODULES SELECTED. G1-1750-1650 Hz G2-1550-1450 Hz G3-1350-1250 Hz G4-1150-1050 Hz	1. CONNECT SCOPE TO Q19-C ON TONE CONTROL BOARD. WAVE FORM SHOULD BE AS SHOWN IN Ⓓ. IF NOT, CHECK FUNCTION MODULE ENABLE CIRCUIT.
PARTICULAR GROUP OF TONES NOT AVAILABLE FROM FUNCTION MODULE.	1. SUBSTITUTE ANOTHER MODULE OF THE SAME GROUP. OR 2. CONNECT SCOPE TO TP2 ON FUNCTION MODULE. WAVE FORM SHOULD BE AS SHOWN IN Ⓔ. IF NOT, CHECK 200ms FUNCTION ONE-SHOT AND ITS ASSOCIATED GATES.

RC-2442A



(19D417301, Rev. 4)



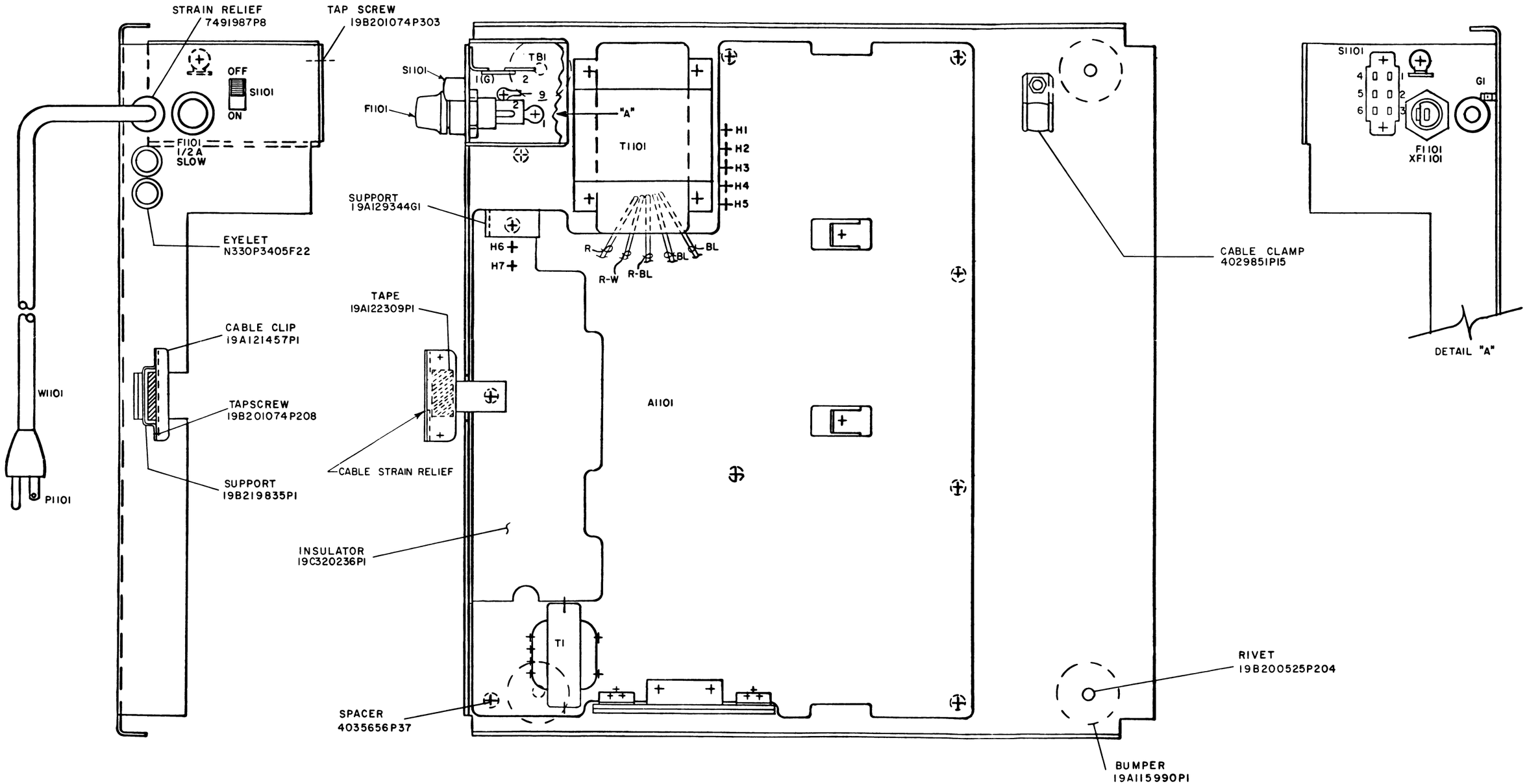
DETAILS OF SWITCH KIT 19D416628G1-G12

NOTE:

1. SWITCH GRID OPTION 8558 IS REQUIRED IF ANY ONE OR MORE OF THE FOLLOWING OPTIONS ARE USED: 8526, 8528, 8533, 8539, 8540, 8541. ONLY ONE SWITCH GRID OPTION IS REQUIRED FOR EACH MASTR CONTROLLER.

OUTLINE DIAGRAM

MASTR CONTROLLER
SERIES 539 & 549
19D416689G1

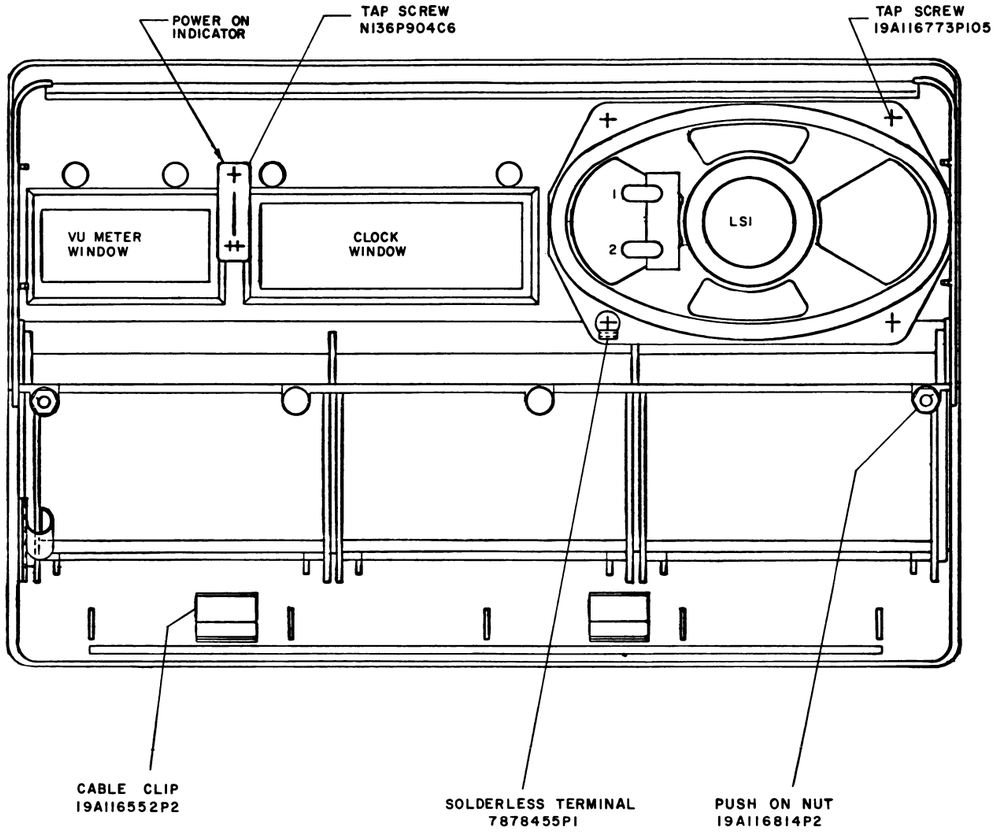


OUTLINE DIAGRAM

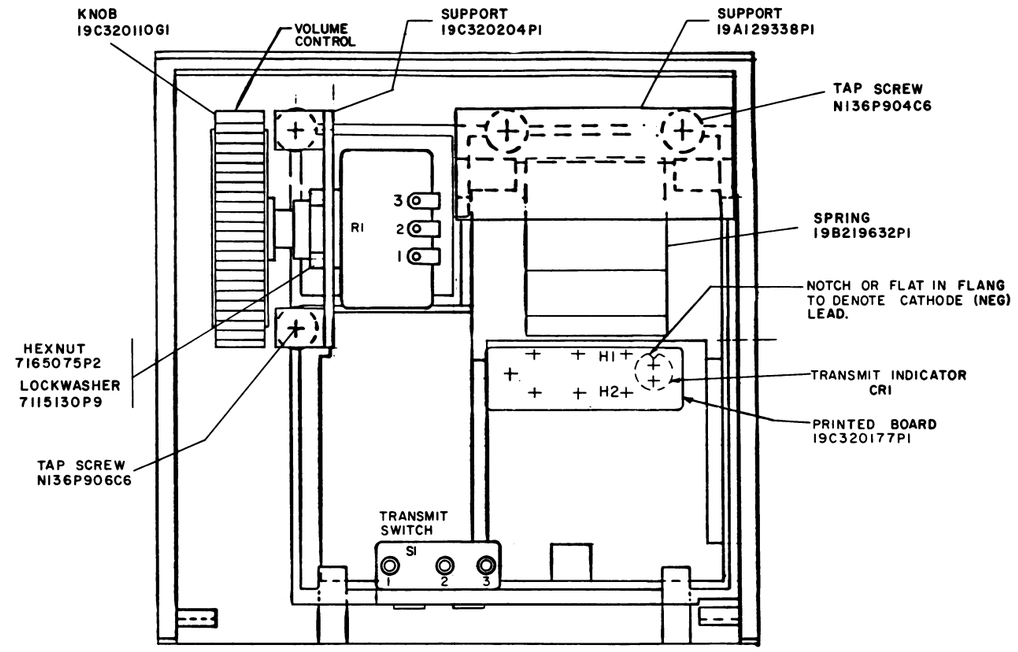
(19D417318, Rev. 1)

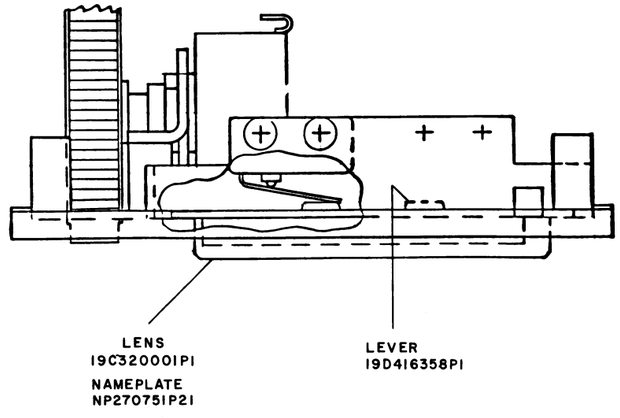
MASTR CONTROLLER BASE PLATE
19D416663G1

FRONT COVER ASSEMBLY (REAR VIEW)
19D416669G1



PTT PANEL (REAR VIEW)
19C320239G1



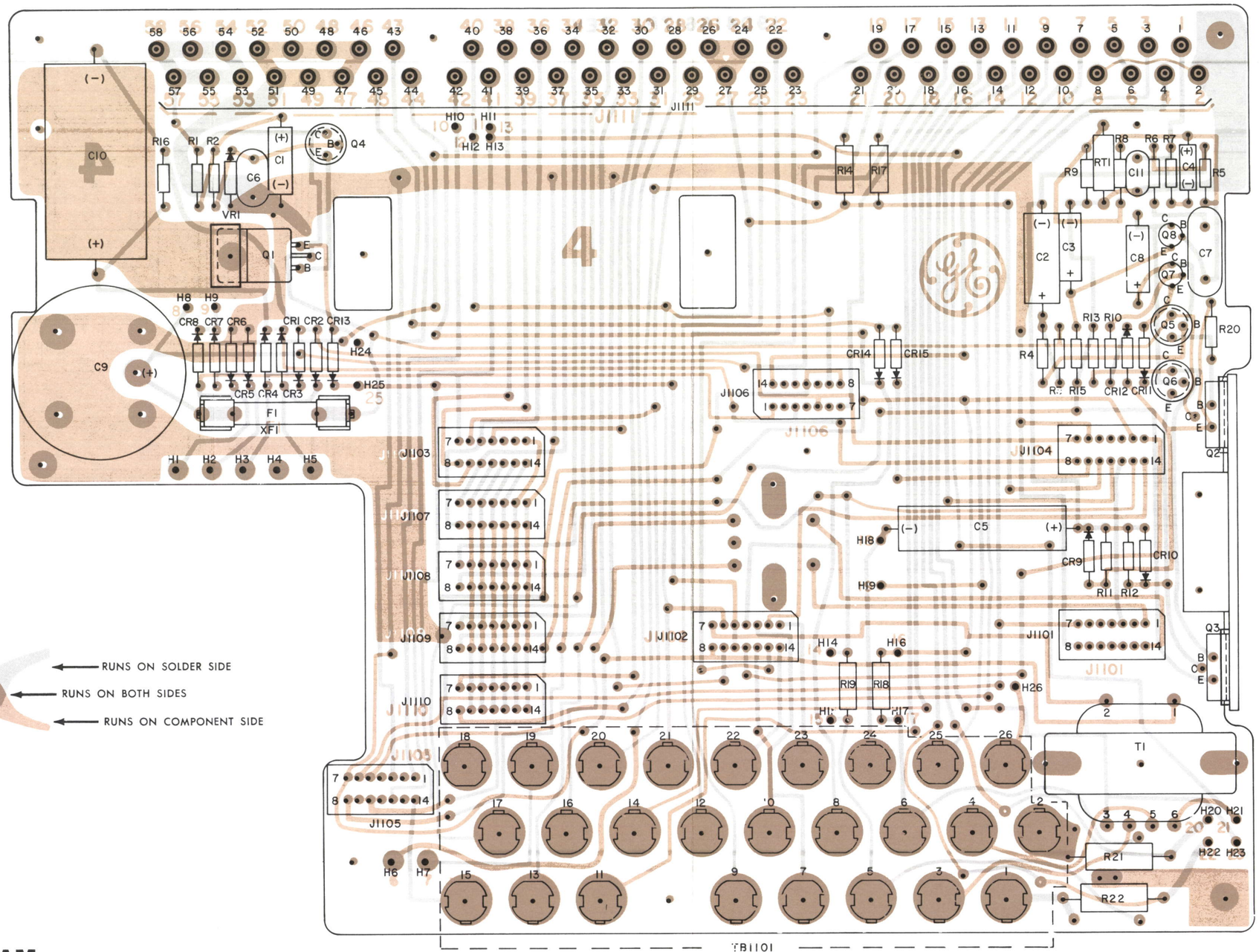


(19D417314, Rev. 2)

DF-4094

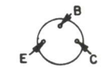
OUTLINE DIAGRAM

FRONT COVER AND PTT PANEL
19D416669G1 & 19C320239G1



RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

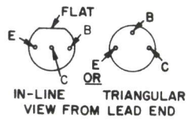
LEAD IDENTIFICATION FOR Q4,Q5 & Q6



TRIANGULAR
VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION FOR Q7 & Q8



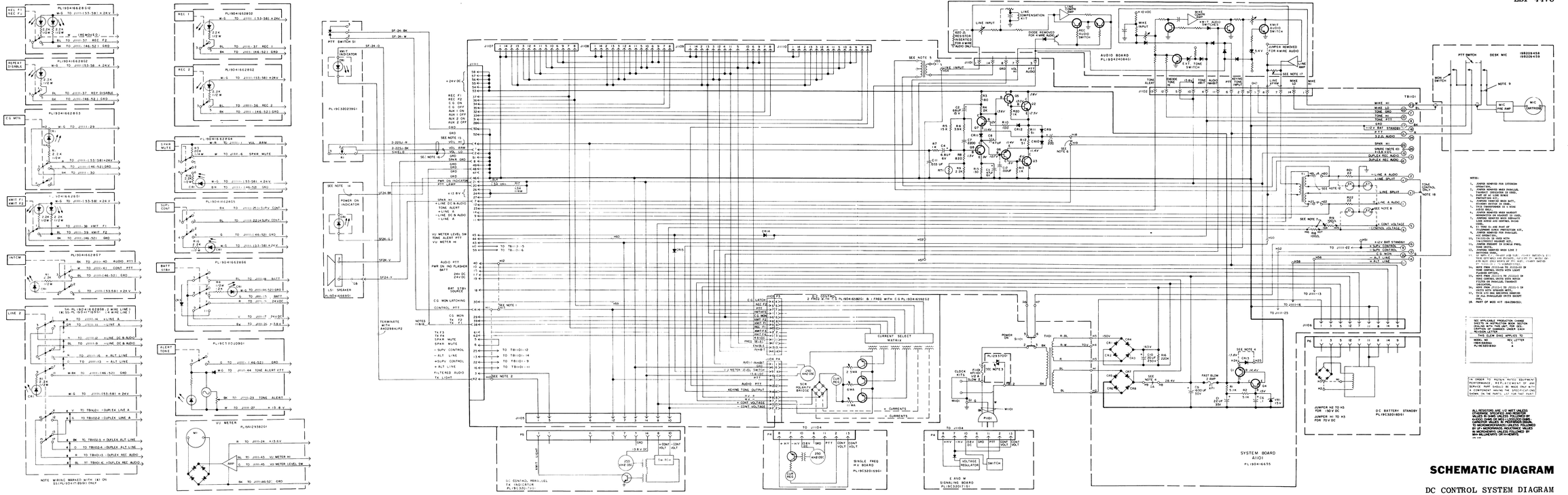
VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

(19D417319, Rev. 2)
(19D416617, Sh. 2, Rev. 4)
(19D416617, Sh. 3, Rev. 4)

OUTLINE DIAGRAM

SYSTEM BOARD A1101
19D416655G1



SCHEMATIC DIAGRAM

DC CONTROL SYSTEM DIAGRAM

Issue 6

PARTS LIST

LBI-4467D

MASTR CONTROLLER UNIT
19D416689G1

SYMBOL	GE PART NO.	DESCRIPTION
		FRONT COVER ASSEMBLY 19D416669G1
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	19A134146P4	Diode, optoelectronic: red; sim to Opcos LSH-6L.
		- - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS1	19C307094P1	Permanent magnet: 3.2 ohms ±10% voice coil imp, 3 x 5 inch speaker; sim to Oaktron S7473.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1	4036634P1	Contact, electrical; sim to AMP 42428-2.
		BASE PLATE ASSEMBLY 19D416663G1
A1101		SYSTEM BOARD 19D416655G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1*	5496267P19	Tantalum: 22 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
		Earlier than REV A:
	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C2	5496267P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C3	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C4	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C5	19A115680P10	Electrolytic: 200 µf +150% -10%, 18 VDCW; sim to Mallory Type TTX.
C6	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C7	7147203P16	Silver mica: 2200 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-20.
C8	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C9	19A116640P1	Electrolytic: 1600 µf +150% -10%, 50 VDCW; sim to GE 87F8188AB8.
C10	7774786P24	Electrolytic: 20 µf +100% -10%, 250 VDCW; sim to Mallory Type TC.
C11	19A116080P104	Polyester: 0.033 µf ±10%, 50 VDCW.
C12*	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV C.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1 thru CR8	4037822P2	Silicon.
CR9 thru CR11	4037822P1	Silicon.
CR12	19A115250P1	Silicon.
CR13	4037822P1	Silicon.
CR14 and CR15	19A115250P1	Silicon.
		- - - - - - - - - - FUSES - - - - - - - - - -
F1	1816P5	Quick blowing, cartridge: 2 amp 250 v; sim to Littelfuse 312002 or Bussmann AGC-2.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1101 thru J1110	19A116446P5	Connector, printed wiring, one-part.
J1111		(Part of printed wiring board).
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 thru Q3	19A116742P1	Silicon, NPN.
Q4 and Q5	19A115300P2	Silicon, NPN; sim to Type 2N3053.
Q6	19A115976P1	Silicon, PNP; sim to Type 2N4356.
Q7 and Q8	19A115889P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 and R2	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R3	3R152P181J	Composition: 180 ohms ±5%, 1/4 w.
R4	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R5	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R6	3R152P392J	Composition: 3900 ohms ±5%, 1/4 w.
R7	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R8	3R152P822J	Composition: 820 ohms ±5%, 1/4 w.
R9	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R10	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R11 and R12	3R152P510J	Composition: 51 ohms ±5%, 1/4 w.
R13	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R14	3R77P153J	Composition: 1500 ohms ±5%, 1/2 w.
R15	3R152P133J	Composition: 130 ohms ±5%, 1/4 w.
R16	3R152P224J	Composition: 0.22 megohm ±5%, 1/4 w.
R17	3R77P153J	Composition: 1500 ohms ±5%, 1/2 w.
R18 and R19	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R20	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R21* and R22*	19A116310P5	Composition: 22 ohms ±5%, 1.0 w; sim to Allen-Bradley Type GB. Added by REV B.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT1	19B209143P2	Rod: 4000 ohms ±10%. sim to Global Type 788F-12.
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
T1	19A116736P1	Audio freq: 300 to 6000 Hz, Pri: 30 ohms ±15%, Sec 1: 15 ohms ±15%, Sec 2: 15 ohms ±15%.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR1	4036887P12	Silicon, Zener.
		- - - - - - - - - - FUSES - - - - - - - - - -
F1101	7487942P3	Slow blowing: 1/2 amp at 250 v; sim to Bussmann MDL-1/2.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1101		(Part of W1101).
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1101	19B209261P8	Slide: DPDT, 2 poles, 2 positions, .5 amp VDC or 3 amps at VAC; sim to Switchcraft 46206L.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - TRANSFORMERS - - - - - - - - -
T1101	19A116743P1	Power, step-down: Pri: 120 VRMS, 50/60 Hz, Sec 1: 150 VDC ±5% at 0.015 amps, Sec 2: 24 VDC ±5% at 1.0 amps.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1101	19A116740P2	Power: 2 poles, 3 wire grounding, approx 8 feet long.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XF1101	19B209005P1	Fuseholder: 15 amps at 250 v; sim to Littelfuse 342012.
		PUSH TO TALK PANEL 19C320239G1
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	19A134146P4	Diode, optoelectronic: red; sim to Opcos LSH-6L.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	5496870P11	Variable, carbon film: 5000 ohms ±20%; sim to Mallory LC(5K).
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19A116676P1	Sensitive: SPDT, 5 amp at 24 VDC or 5 amp at 250 VRMS; sim to Microswitch 111SM1-T2.
		AUDIO BOARD 19D416629G1 (Parts List for Audio Board is located on back of Audio Board schematic).

PARTS LIST

LBI-4466B

SWITCH KIT (FUNCTION SELECTOR)
19D416628G1-G12

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1 and CR2	19A134146P4	Diode, optoelectronic: red; sim to Opcos LSH-6L.
CR3	4037822P1	Silicon.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 and R2	3R77P222J	Composition: 2200 ohms ±5%, 1/2 w.
R3	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R4	3R77P122J	Composition: 1200 ohms ±5%, 1/2 w.
R5 and R6	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19B209580P12	Push: DPDT, 1 station, momentary action operating currents, (A) 100 MADC at 28 v or (B) 15 MADC at 130 v; sim to Schadow Co. Series G.
S2	19B209580P13	Push: DPDT, 1 station, alternate action operating currents, (A) 100 MADC at 28 v or (B) 15 MADC at 130 v; sim to Schadow Co. Series G.
S4	19B209580P15	Push: 4PDT, 1 station, alternate action operating currents, (A) 100 MADC at 28 v or (B) 15 MADC at 130 v; sim to Schadow Co. Series G.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1	4036887P6	Silicon, Zener.
		- - - - - - - - MISCELLANEOUS - - - - - - - - -
	19C317983P1	Lens.
	19D423501P2	Knob, pushon.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

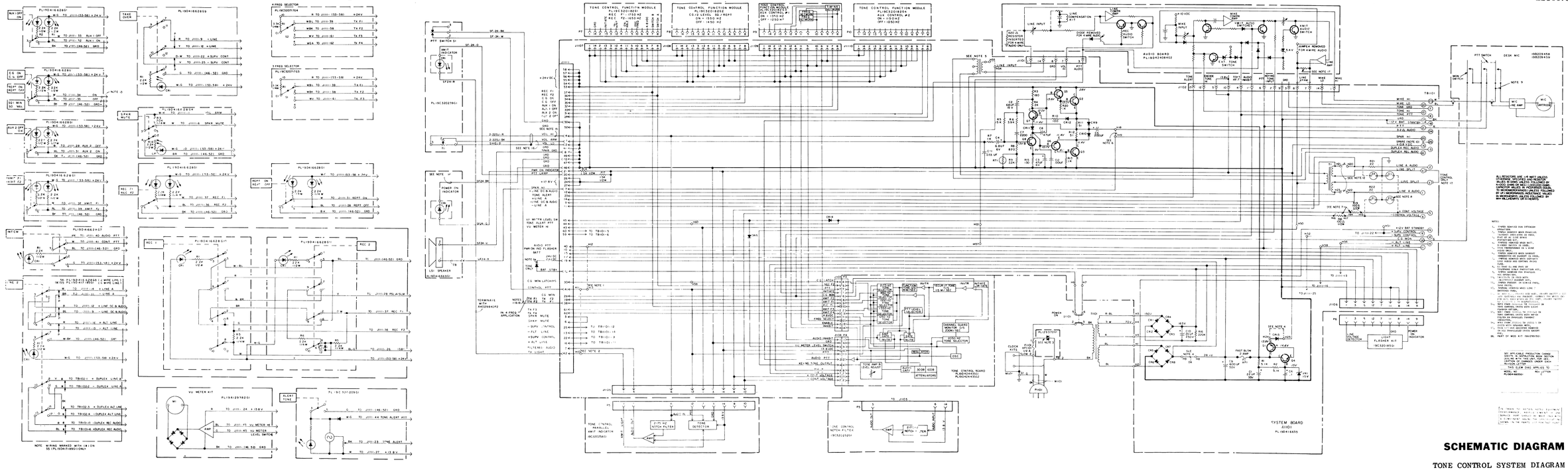
Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

SYSTEM BOARD 19D416655G1

REV. A - To increase voltage rating of capacitor. Changed C1.

REV. B - To provide phone line surge resistors for lightning protection. Added RZ1 and RZ2.

REV. C - To eliminate possibility of oscillation in Audio Amplifier. Added C12.



SCHEMATIC DIAGRAM

TONE CONTROL SYSTEM DIAGRAM

Issue 7

DF-4094

(19B640908, Rev. 19)

PARTS LIST

LBI-4467D

MASTR CONTROLLER UNIT
19D416698G1

SYMBOL	GE PART NO.	DESCRIPTION
		FRONT COVER ASSEMBLY 19D416669G1
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	19A134146P4	Diode, optoelectronic: red; sim to Opcoa LSM-6L.
		- - - - - - - - - - LOUDSPEAKERS - - - - - - - - - -
LS1	19C307094P1	Permanent magnet: 3.2 ohms ±10% voice coil imp, 3 x 3 inch speaker; sim to Oaktron 37473.
		- - - - - - - - - - - - PLUGS - - - - - - - - - - - -
P1	40366342P1	Contact, electrical; sim to AMP 42428-2.
		BASE PLATE ASSEMBLY 19D416653G1
A1101		SYSTEM BOARD 19D416655G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1*	5496267P19	Tantalum: 22 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
	5496267P10	Earlier than REV A: Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C2	5496267P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C3	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C4	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C5	19A115680P10	Electrolytic: 200 µf +150% -10%, 18 VDCW; sim to Mallory Type TTX.
C6	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C7	7147203P16	Silver mica: 2200 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-30.
C8	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C9	19A116640P1	Electrolytic: 1600 µf +150% -10%, 50 VDCW; sim to GE #37F118AB8.
C10	7774786P24	Electrolytic: 20 µf +100% -10%, 250 VDCW; sim to Mallory Type TC.
C11	19A116080P104	Polyester: 0.033 µf ±10%, 50 VDCW.
C12*	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Added by REV C.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 thru CR8	4037822P2	Silicon.
CR9 thru CR11	4037822P1	Silicon.
CR12	19A115250P1	Silicon.
CR13	4037822P1	Silicon.
CR14 and CR15	19A115250P1	Silicon.
		- - - - - - - - - - - FUSES - - - - - - - - - - -
F1	1R160P5	Quick blowing, cartridge: 2 amp 250 v; sim to Littelfuse 312002 or Bussmann MDC-2.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1101 thru J1110	19A116446P5	Connector, printed wiring, one-part.
J1111		(Part of printed wiring board).
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q3	19A116742P1	Silicon, NPN.
Q4 and Q5	19A115300P2	Silicon, NPN; sim to Type 2N3053.
Q6	19A115976P1	Silicon, PNP; sim to Type 2N4356.
Q7 and Q8	19A115889P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 and R2	3R152P513J	Composition: 5100 ohms ±5%, 1/4 w.
R3	3R152P181J	Composition: 180 ohms ±5%, 1/4 w.
R4	3R152P203J	Composition: 2000 ohms ±5%, 1/4 w.
R5	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R6	3R152P393J	Composition: 3900 ohms ±5%, 1/4 w.
R7	3R152P103J	Composition: 1000 ohms ±5%, 1/4 w.
R8	3R152P821J	Composition: 820 ohms ±5%, 1/4 w.
R9	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R10	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R11 and R12	3R152P510J	Composition: 51 ohms ±5%, 1/4 w.
R13	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R14	3R77P153J	Composition: 1500 ohms ±5%, 1/2 w.
R15	3R152P131J	Composition: 130 ohms ±5%, 1/4 w.
R16	3R152P224J	Composition: 0.22 megohm ±5%, 1/4 w.
R17	3R77P152J	Composition: 1500 ohms ±5%, 1/2 w.
R18 and R19	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R20	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R21* and R22*	19A116310P5	Composition: 22 ohms ±5%, 1.0 w; sim to Allen-Bradley Type GB. Added by REV B.
		- - - - - - - - - - THERMISTORS - - - - - - - - - -
RT1	19B209143P2	Rod: 4000 ohms ±10%; sim to Global Type 788F-12.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T1	19A116736P1	Audio freq: 300 to 6000 Hz. Pri: 30 ohms ±15%. Sec 1: 15 ohms ±15%. Sec 2: 15 ohms ±15%.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR1	4036887P12	Silicon, Zener.
		- - - - - - - - - - - FUSES - - - - - - - - - - -
F1101	7487942P3	Slow blowing: 1/2 amp at 250 v; sim to Bussmann MDL-1/2.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1101		(Part of W1101).
		- - - - - - - - - - - SWITCHES - - - - - - - - - - -
S1101	19B209261P8	Slide: DPDT, 2 poles, 2 positions, .5 amp VDC or 3 amps at VAC; sim to Switchcraft 46206L.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T1101	19A116743P1	Power, step-down: Pri: 120 VRMS, 50/60 Hz. Sec 1: 150 VDC ±4% at 0.015 amps. Sec 2: 24 VDC ±4% at 1.0 amps.
		- - - - - - - - - - - - CABLES - - - - - - - - - - - -
W1101	19A116740P2	Power: 2 poles, 3 wire grounding, approx 8 feet long.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XF1101	19B209005P1	Fuseholder: 15 amps at 250 v; sim to Littelfuse 342012.
		PUSH TO TALK PANEL 19C330239G1
		- - - - - - - - - - DIODES AND RECTIFIERS - - - - - - - - - -
CR1	19A134146P4	Diode, optoelectronic: red; sim to Opcoa LSM-6L.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	5496870P11	Variable, carbon film: 5000 ohms ±20%; sim to Mallory LC(5K).
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19A116676P1	Sensitive: SPDT, 5 amp at 24 VDC or 5 amp at 250 VRMS; sim to Microswitch 111SM1-T3.
		AUDIO BOARD 19D416629G1 (Parts List for Audio Board is located on back of Audio Board schematic).

PARTS LIST

LBI-4829

BATTERY STANDBY KIT
19A129915G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
	19A129387G1	Diode Assembly. Includes diode (4037822P2) and 2 contacts (4029840P1).
		- - - - - - - - - - - - CABLES - - - - - - - - - - - -
	19A129525G3	Cable Assembly: approx 3 inches.
	19A129914G1	Cable Assembly: approx 2-1/2 inches long.

PARTS LIST

LBI4466D

SWITCH KIT (FUNCTION SELECTOR)
19D416629G1-G17

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1 and CR2	19A134146P4	Diode, optoelectronic: red; sim to Opcoa LSM-6L.
CR3	403782229P1	Silicon, 1000 mA, 400 PIV.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 and R2	3R77P222J	Composition: 2.2K ohms ±5%, 1/2 w.
R3	3R152P203J	Composition: 20K ohms ±5%, 1/4 w.
R4	3R77P123J	Composition: 1.2K ohms ±5%, 1/2 w.
R5 and R6	3R152P222J	Composition: 2.2K ohms ±5%, 1/4 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19B209580P12	Push: DPDT, 1 station, momentary action; sim to Schadow Co. Series "G". (Used in G2, G3 & G12).
S2	19B209580P13	Push: DPDT, 1 station, alternate action; sim to Schadow Co. Series "G". (Used in G1, G2, G4, G5, G12, G14, G16 & G17).
S4	19B209580P15	Push: 4PDT, 1 station, alternate action; sim to Schadow Co. Series "G". (Used in G1, G6, G9, G10 & G13).
S5	19B209580P14	Push: 4PDT, 1 station, momentary action; sim to Schadow Co. Series "G". (Used in G13).
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR1	4036887P6	Silicon, Zener: 500 mw, 6.5 v, nominal.
		- - - - - - - - MISCELLANEOUS - - - - - - - - -
	19C317983P1	Lens.
	19D423501P2	Knob, pushon.
	19D416339P1	Insert. (Used in G2-G11, G13-G17).
	19D416330P1	Insert. (Used in G1, G12).
	19C320172P1	Printed board.
	4029840P2	Contact, electrical: sim to Amp 42827-2. (Hung in wiring).
	4033348P1	Contact, electrical: sim to Bead Chain M125-34. (Used in G4- Hung in wiring at S2-3).
	B136P904C6	Tap screw, phillips head: No. 4-24 x 1/4. (Secures switches and inserts).

PARTS LIST

LBI-30439

ROTARY SWITCH
3 AND 4 FREQUENCY SELECT
19C320713G3, G4

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P532K	Composition: 3300 ohms ±10%, 1/4 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19A116195P2	Rotary: 1 section, 2 poles, (adj 2-3 position), non-shorting; sim to Grayhill 50WY23156-2-3N.
S2	19A116195P3	Rotary: 1 section, 2 poles, (adj 2-5 position), non-shorting; sim to Grayhill 50WY23156-2-4N.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19A129867G1	Insert.
	19A129869G1	Lens.
	19A127319P2	Nut: thd, size No. 1/4-28. (Secures S1, S2).
	X414P25C6	Lockwasher, internal tooth: No. 1/4. (Secures S1, S2).
	19B209527P1	Knob. (Used with S1, S2).
	8P276388	Nameplate.
	4029840P2	Contact, electrical: sim to Amp 42827-2. (Used with S1-1, S1-2, S1-3, S2-1, S2-2, S2-3, S2-4).
	4033348P1	Contact, electrical: sim to Bead Chain M125-34. (Used with S1-10, S2-10).

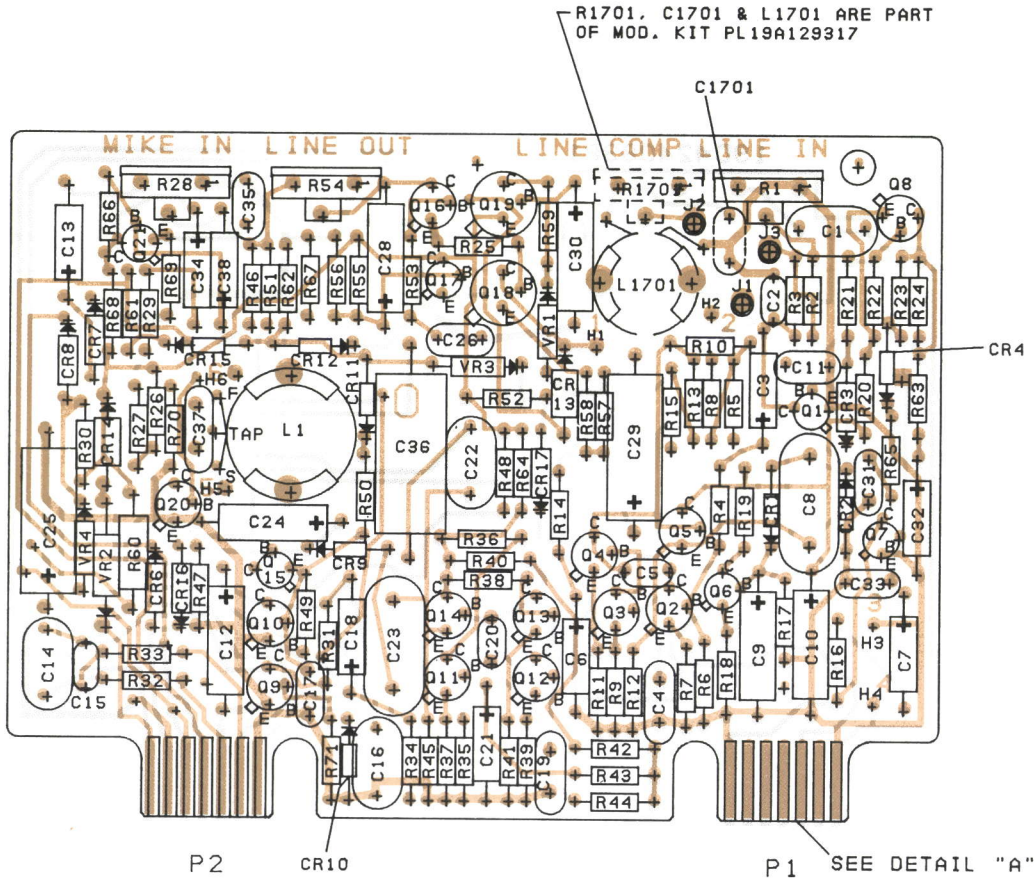
PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

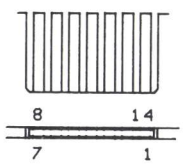
SYSTEM BOARD 19D416655G1
Rev. A - To increase voltage rating of capacitor. Changed C1.

REV. B - To provide phone line surge resistors for lightning protection. Added S21 and S22.

REV. C - To eliminate possibility of oscillation in Audio Amplifier. Added C12.



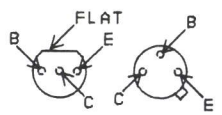
CONNECTIONS CHART			
FROM	TO	WIRE	REMARKS
H1	H2	DA	
H5	H6	DA	CR 1 ONLY



SOLDER SIDE
TYP. NUMBERING OF
CONTACT FINGERS.

DETAIL "A"

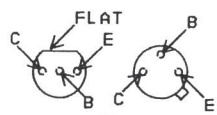
LEAD IDENTIFICATION
FOR Q1-Q5, Q7-Q14, Q16, Q20



TOP VIEW

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION
FOR Q6, Q15, Q17-Q19, Q21



TOP VIEW

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

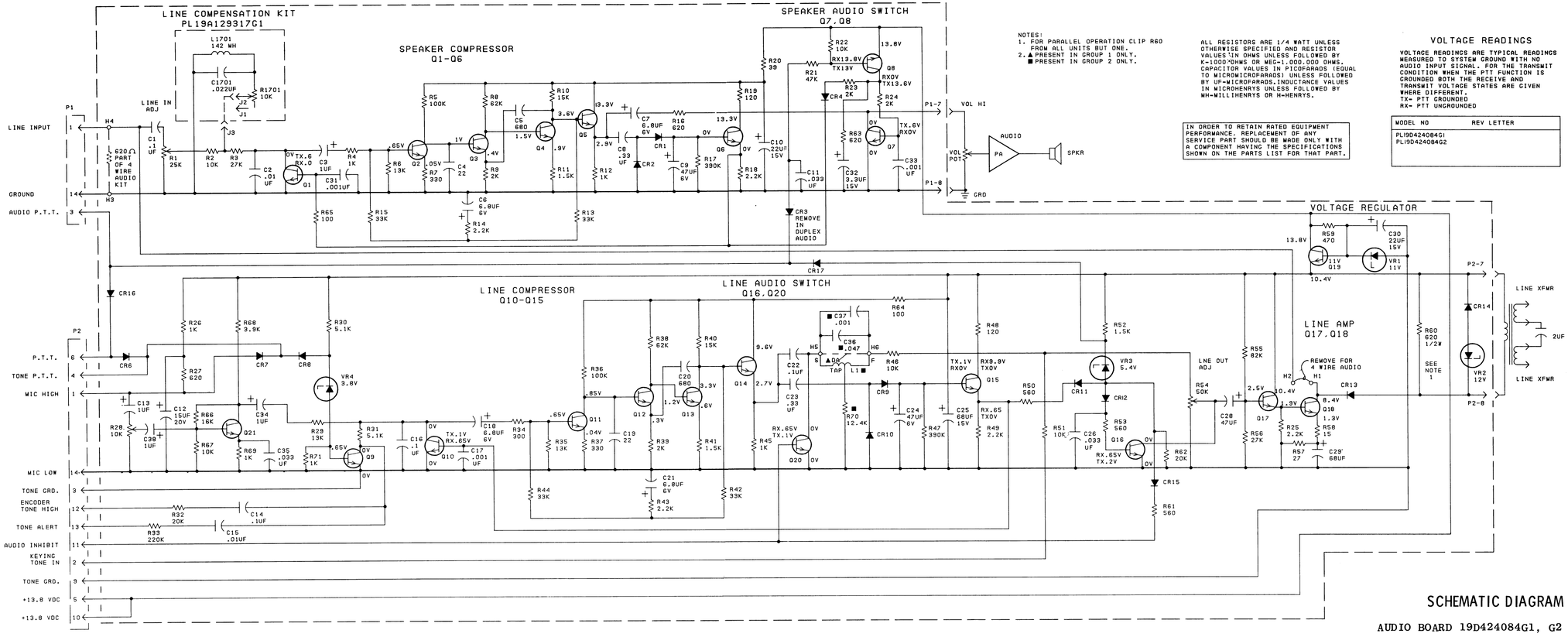
(19D424085, Rev. 1)
(19B227491, Sh. 1, Rev. 0)
(19B227491, Sh. 2, Rev. 0)

DF-4094

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

OUTLINE DIAGRAM

AUDIO BOARD
19D424084G1, G2



SCHEMATIC DIAGRAM

AUDIO BOARD 19D424084G1, G2

Issue 1

(19B622233, Rev. 2)

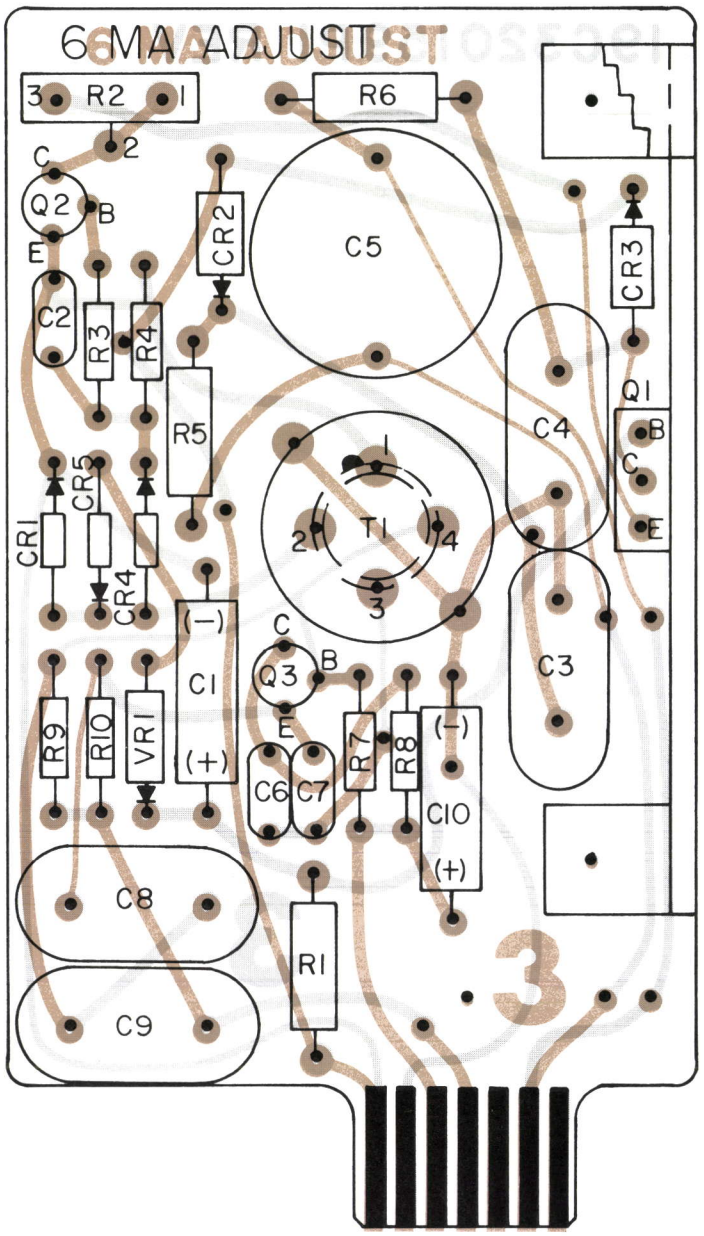
PARTS LIST

LBI-30272

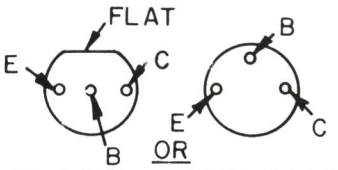
AUDIO BOARD
19D424084G1 DC CONTROL
19D424084G2 TONE CONTROL

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C2	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C3	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C4	7489162P11	Silver mica: 22 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C5	5494481P109	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C6 and C7	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C8	19A116080P10	Polyester: 0.33 µf ±20%, 50 VDCW.
C9	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C10	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C11	19A116080P4	Polyester: 0.033 µf ±20%, 50 VDCW.
C12	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C13	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C14	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C15	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C16	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C17	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C18	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C19	7489162P11	Silver mica: 22 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C20	5494481P109	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C21	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C22	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C23	19A116080P10	Polyester: 0.33 µf ±20%, 50 VDCW.
C24	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C25	5496267P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C26	19A116080P4	Polyester: 0.033 µf ±20%, 50 VDCW.
C28	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C29	5496267P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C30	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C31	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C32	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C33	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C34	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C35	19A116080P204	Polyester: 0.033 µf ±5%, 50 VDCW.
C36	19C307114P4702G	Polystyrene: 47,000 pf ±2%, 100 VDCW, temp coef -120±30 PPM/°C.
C37	5496203P481	Ceramic disc: 1000 pf ±5%, 500 VDCW, temp coef -5600 PPM.
C38	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1 and CR2	19A115250P1	Silicon.
CR3	19A115100P2	Silicon; sim to Type 1N459A.
CR4	19A115250P1	Silicon.
CR6 thru CR8	19A115100P2	Silicon; sim to Type 1N459A.
CR9 thru CR12	19A115250P1	Silicon.
CR13 and CR14	403782ZP7	Silicon.
CR15	19A115250P1	Silicon.
CR16 and CR17	19A115100P2	Silicon; sim to Type 1N459A.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 thru J3	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B205354G8	Coil.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1 and P2		(Part of printed board 19D424083P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A115552P1	Silicon, NPN; sim to Type 2N2714.
Q2 thru Q5	19A115889P1	Silicon, NPN.
Q6	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q7	19A115552P1	Silicon, NPN; sim to Type 2N2714.
Q8	19A115779P1	Silicon, PNP; sim to Type 2N3251.
Q9	19A115720P1	Silicon, NPN; sim to Type 2N2222.
Q10	19A129184P1	Silicon, NPN.
Q11 thru Q14	19A115889P1	Silicon, NPN.
Q15	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q16	19A115720P1	Silicon, NPN; sim to Type 2N2222.
Q17	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q18 and Q19	19A115300P4	Silicon, NPN.
Q20	19A129184P1	Silicon, NPN.
Q21	19A116774P1	Silicon, NPN; sim to Type 2N5210.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	19B209358P107	Variable, carbon film: approx 800 to 25,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R2	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R3	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R4	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R5	3R152P104J	Composition: 0.10 megohm ±5%, 1/4 w.
R6	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R7	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
R8	3R152P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R9	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R10	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R11	3R152P152J	Composition: 1500 ohms ±5%, 1/4 w.
R12	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R13	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R14	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R15	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R16	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R17	3R152P394J	Composition: 0.39 megohm ±5%, 1/4 w.
R18	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R19	3R152P121J	Composition: 120 ohms ±5%, 1/4 w.
R20	3R152P390J	Composition: 39 ohms ±5%, 1/4 w.
R21	3R152P473J	Composition: 47,000 ohms ±5%, 1/4 w.
R22	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R23 and R24	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R25	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R26	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R27	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R28	19B209358P106	Variable, carbon film: approx 300 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R29	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R30 and R31	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R32	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R33	3R152P224J	Composition: 0.22 megohm ±5%, 1/4 w.
R34	3R152P301J	Composition: 300 ohms ±5%, 1/4 w.
R35	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R36	3R152P104J	Composition: 0.10 megohm ±5%, 1/4 w.
R37	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
R38	3R152P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R39	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R40	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R41	3R152P152J	Composition: 1500 ohms ±5%, 1/4 w.
R42	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R43	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R44	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R45	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R46	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R47	3R152P394J	Composition: 0.39 megohm ±5%, 1/4 w.
R48	3R152P121J	Composition: 120 ohms ±5%, 1/4 w.
R49	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R50	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R51	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R52	3R152P152J	Composition: 1500 ohms ±5%, 1/4 w.
R53	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R54	19B209358P108	Variable, carbon film: approx 2000 to 50,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R55	3R152P823J	Composition: 82,000 ohms ±5%, 1/4 w.
R56	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R57	3R152P270J	Composition: 27 ohms ±5%, 1/4 w.
R58	3R152P150J	Composition: 15 ohms ±5%, 1/4 w.
R59	3R152P471J	Composition: 470 ohms ±5%, 1/4 w.
R60	3R77P621J	Composition: 620 ohms ±5%, 1/2 w.
R61	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R62	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R63	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R64 and R65	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R66	3R152P163J	Composition: 16,000 ohms ±5%, 1/4 w.
R67	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R68	3R152P392J	Composition: 3900 ohms ±5%, 1/4 w.
R69	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R70	19C314256P21242	Metal film: 12,400 ohms ±1%, 1/4 w.
R71	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1	4036887P8	Silicon, Zener.
VR2	19A116325P4	Silicon, Zener; sim to 1N5349.
VR3	4036887P5	Silicon, Zener.
VR4	4036887P3	Silicon, Zener.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4035656P70	Spacer, threaded.
	4036555P1	Insulator, washer: nylon. (Used with Q18 and Q19).
	4034048P4	Machine screw, pan head, 6-32 x 9/16 with .340 cutaway.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

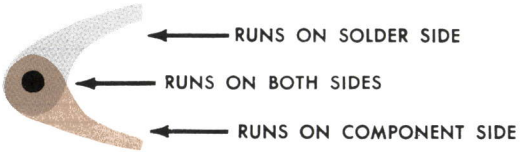


LEAD IDENTIFICATION FOR Q2 & Q3

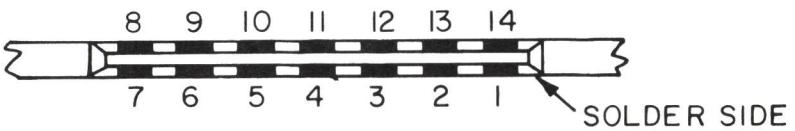


VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



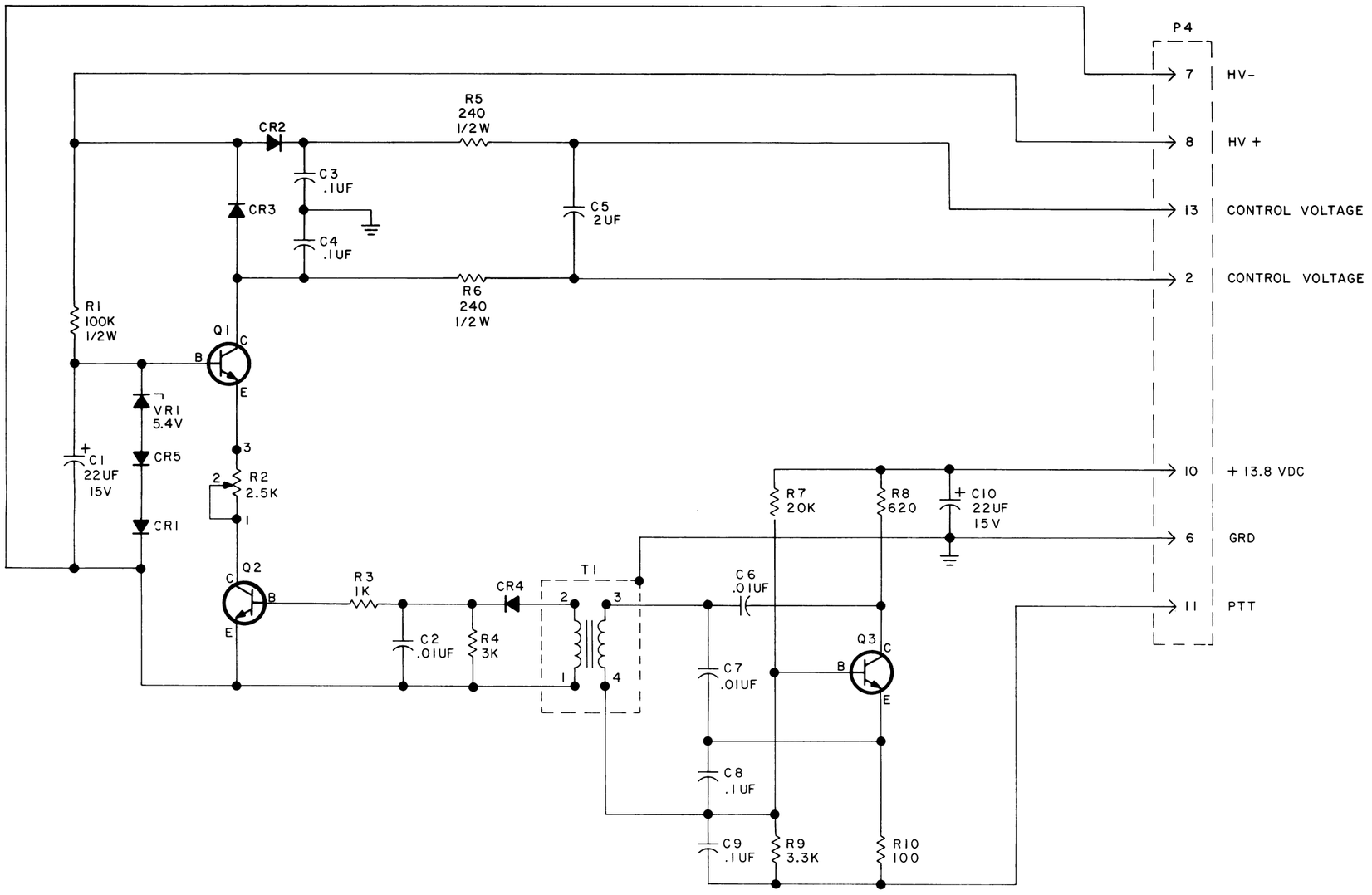
TYPICAL CONTACT FINGER NUMBERING



(19C320710, Rev. 0)
(19C320159, Sh. 2, Rev. 3)
(19C320159, Sh. 3, Rev. 3)

OUTLINE DIAGRAM

SINGLE FREQUENCY HIGH VOLTAGE BOARD
19C320169G1



(19D416671, Rev. 1)

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER

THIS ELEM DIAG APPLIES TO

MODEL NO	REV. LETTER
PL19C320169G1	

SCHEMATIC DIAGRAM

DC CONTROL HIGH VOLTAGE MODULE (SINGLE FREQUENCY) 19C320169G1

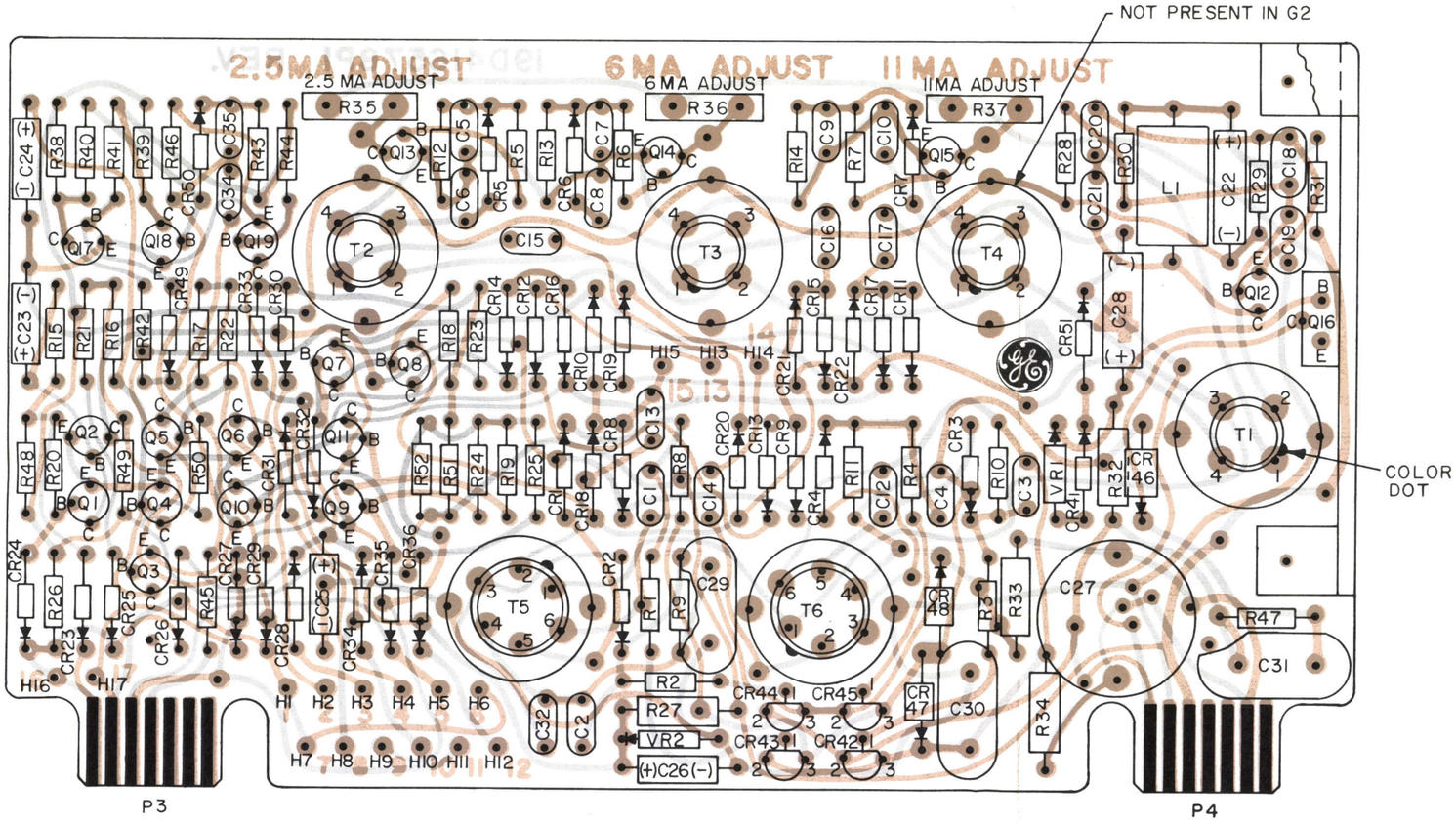
PARTS LIST

LBI-4456

SINGLE FREQ HIGH VOLTAGE BOARD
19C320169G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C2	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C3 and C4	19A115028P514	Polyester: 0.1 µf ±5%, 200 VDCW.
C5	7486445P6	Electrolytic, non polarized: 2 µf +100% -10%, 200 VDCW.
C6 and C7	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C8 and C9	19A115028P514	Polyester: 0.1 µf ±5%, 200 VDCW.
C10	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	19A115250P1	Silicon.
CR2 and CR3	4037822P2	Silicon.
CR4 and CR5	19A115250P1	Silicon.
		- - - - - - - - - - - - PLUGS - - - - - - - - -
P4		(Part of printed wiring board 19C320159P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A129183P1	Silicon, NPN.
Q2 and Q3	19A116774P1	Silicon, NPN; sim to Type 2N5210.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P104J	Composition: 0.1 megohm ±5%, 1/2 w.
R2	19B209358P104	Variable, carbon film: approx 50 to 2500 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R3	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R4	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w.
R5 and R6	3R77P241J	Composition: 240 ohms ±5%, 1/2 w.
R7	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R8	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R9	3R152P332J	Composition: 3300 ohms ±5%, 1/4 w.
R10	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - -
T1	19B219563G1	Coil.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR1	4036887P5	Silicon, Zener.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

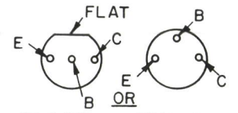


(19D417307, Rev. 0)
(19D416578, Sh. 2, Rev. 4)
(19D416578, Sh. 3, Rev. 4)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

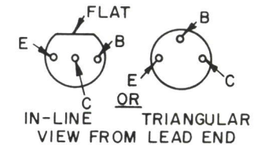
TYPICAL CONTACT FINGER NUMBERING

LEAD IDENTIFICATION
FOR Q12, Q13, Q14, Q15



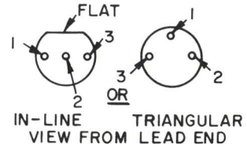
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION
FOR Q1—Q11, Q17, Q18, Q19



NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION
FOR CR42 THRU CR45



NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

OUTLINE DIAGRAM

DC CONTROL HIGH VOLTAGE
BOARD (MULTI-FREQUENCY)
19D416592G1 & G2

NOTES:
1. * THESE COMPONENTS ARE PRESENT IN GROUP 1 ONLY.
2. REFER TO JUMPER CHART TO DETERMINE CONNECTIONS.
3. FOR OPERATION WITH SYSTEMS USING +6MA FOR CG MONITOR MOVE JUMPER FROM H13-H14 TO H13-H15 AND ADJUST R35 FOR +6MA AND R36 FOR +15MA.
4. FOR MOMENTARY CHANNEL GUARD OPERATION REMOVE JUMPER H1-H2.

FOR DC CONTROL ONLY
H.V. BOARD JUMPER CHART

CONTROL FUNCTIONS	IDENTIFIED BY	SWITCH LEGANDS		JUMPERS REMOVE	JUMPERS ADD	DA
2 FREQ. TX 1 FREQ. RX	XMIT F1 XMIT F2			H16 TO H17 H1 TO H2		
1 FREQ. TX 2 FREQ. RX	REC F1 REC F2			H1 TO H2		
2 FREQ. TX 2 FREQ RX	XMIT F1 XMIT F2	REC F1 REC F2		H1 TO H2 H16 TO H17		
1 FREQ. TX 1 FREQ. RX WITH CG MON.	CG MON					
2 FREQ. TX 1 FREQ. RX WITH CG MON.	XMIT F1 XMIT F2	CG MON		H16 TO H17		
1 FREQ. TX 2 FREQ. RX WITH CG MON.	REC F1 REC F2	CG MON				
2 FREQ. TX 2 FREQ. RX WITH CG MON.	XMIT F1 XMIT F2 CG MON	REC F1 REC F2		H16 TO H17		
REPEAT DISABLE	REPEAT DISABLE			H1 TO H2		
REPEAT DISABLE CG MON	REPEAT DISABLE	CG MON				
1 FREQ. TX PSLM	REC 1	REC 2		H1 TO H2 H7 TO H8 H3 TO H4 H11 TO H12 H5 TO H6	H4 TO H9 H5 TO H8 H5 TO H12	
2 FREQ. TX PSLM	XMIT F1 XMIT F2 REC 2	REC 1		H1 TO H2 H7 TO H8 H3 TO H4 H16 TO H17 H11 TO H12 H5 TO H6	H4 TO H9 H5 TO H8 H5 TO H12	

CURRENT POLARITY BRIDGE

CURRENT LEVEL CONTROLS

FUNCTION SWITCHES

CG LATCH

BIAS OSCILLATOR

P4
13 CONTROL VOLTAGE
6 GRD
2 CONTROL VOLTAGE
10 +13.8 VDC

P3
XMIT-F2 8
PTT 7
XMIT-F1 9
CG MON LATCHING 4
MOMENTARY CG MON OR CG MON LIGHT 6
REC 1 10
REC 2 5

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
19D416592G1	A
19D416592G2	A

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS; CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

SCHEMATIC DIAGRAM

DC CONTROL HIGH VOLTAGE
BOARD (MULTI-FREQUENCY)
19D416592G1 & G2

Issue 2

(19E500991, Rev. 4)

PARTS LIST

LBI-4465A

MULTI-FREQ HIGH VOLTAGE BOARD
19D416592G1 2 FREQ WITH CG
19D416592G2 1 FREQ WITH CG

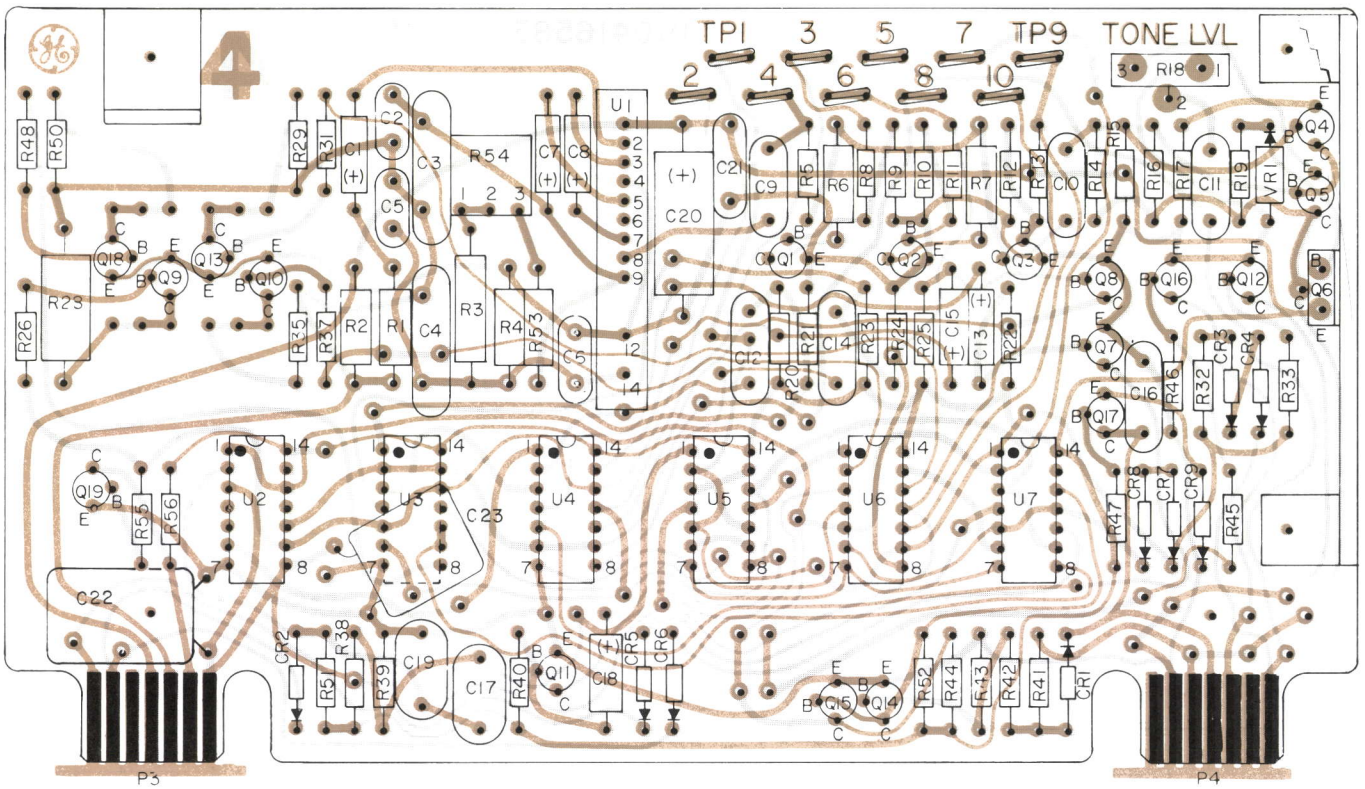
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C10	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C12 thru C17	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C18 and C19	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C20 and C21	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C22	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C23 and C24	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C25	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C26	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C27	7486445P6	Electrolytic, non polarized: 2 µf +100% -10%, 200 VDCW.
C28	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C29 thru C31	19A115028P414	Polyester: 0.1 µf ±5%, 200 VDCW.
C32	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C34 and C35	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 thru CR36	19A115250P1	Silicon.
CR41	19A115250P1	Silicon.
CR42 thru CR45	19A116642P1	Thyristor, silicon controlled: sim to Type 2N5064.
CR46 thru CR48	4037822P2	Silicon.
CR49 thru CR51	19A115250P1	Silicon.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	7491382P106	Coil, RF: 680 µh ±10%, 12 ohms DC res max; sim to Delevan 3500 Series.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P3 and P4		(Part of printed wiring board).
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1 thru Q11	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q12 thru Q15	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q16	19A129183P1	Silicon, NPN.
Q17 thru Q19	19A115889P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 thru R7	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R8 thru R14	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w.
R15 thru R19	3R152P272J	Composition: 2700 ohms ±5%, 1/4 w.
R20 thru R25	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R26	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R27	3R77P302J	Composition: 3000 ohms ±5%, 1/2 w.
R28	3R152P332J	Composition: 3300 ohms ±5%, 1/4 w.
R29	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R30*	3R152P203J	Composition: 23,000 ohms ±5%, 1/4 w.
		Earlier than REV A:
	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R31	3R152P470J	Composition: 47 ohms ±5%, 1/4 w.
R32	3R77P104J	Composition: 0.1 megohm ±5%, 1/2 w.
R33 and R34	3R77P241J	Composition: 240 ohms ±5%, 1/2 w.
R35	19B209358P105	Variable, carbon film: approx 75 to 5000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R36	19B209358P104	Variable, carbon film: approx 50 to 2500 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R37	19B209358P103	Variable, carbon film: approx 25 to 1000 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R38 and R39	3R152P332J	Composition: 3300 ohms ±5%, 1/4 w.
R40 and R41	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R42 and R43	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R44	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R45	3R152P562J	Composition: 5600 ohms ±5%, 1/4 w.
R46	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R47	3R152P105J	Composition: 1 megohm ±5%, 1/4 w.
R48 thru R52	3R152P272J	Composition: 2700 ohms ±5%, 1/4 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - -
T1	19B219562G1	Coil.
T2 thru T4	19B219563G1	Coil.
T5 and T6	19B219564G1	Coil.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1	4036887P5	Silicon, Zener.
VR2	4036887P3	Silicon, Zener.
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	19B219561P1	Heat sink. (Used with Q16).
	19A116022P1	Insulator bushing. (Used with Q16).
	19A116023P1	Insulator, plate. (Used with Q16).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

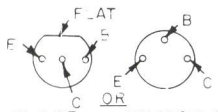
PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

Rev. A - To increase oscillator output.
Changed R30.

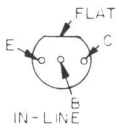


LEAD IDENTIFICATION
FOR Q7 THRU Q19, Q4 & Q5



NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

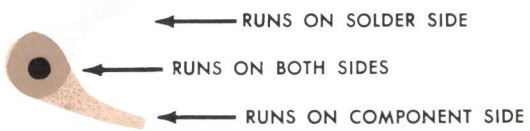
LEAD IDENTIFICATION
FOR Q1, Q2 & Q3



NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

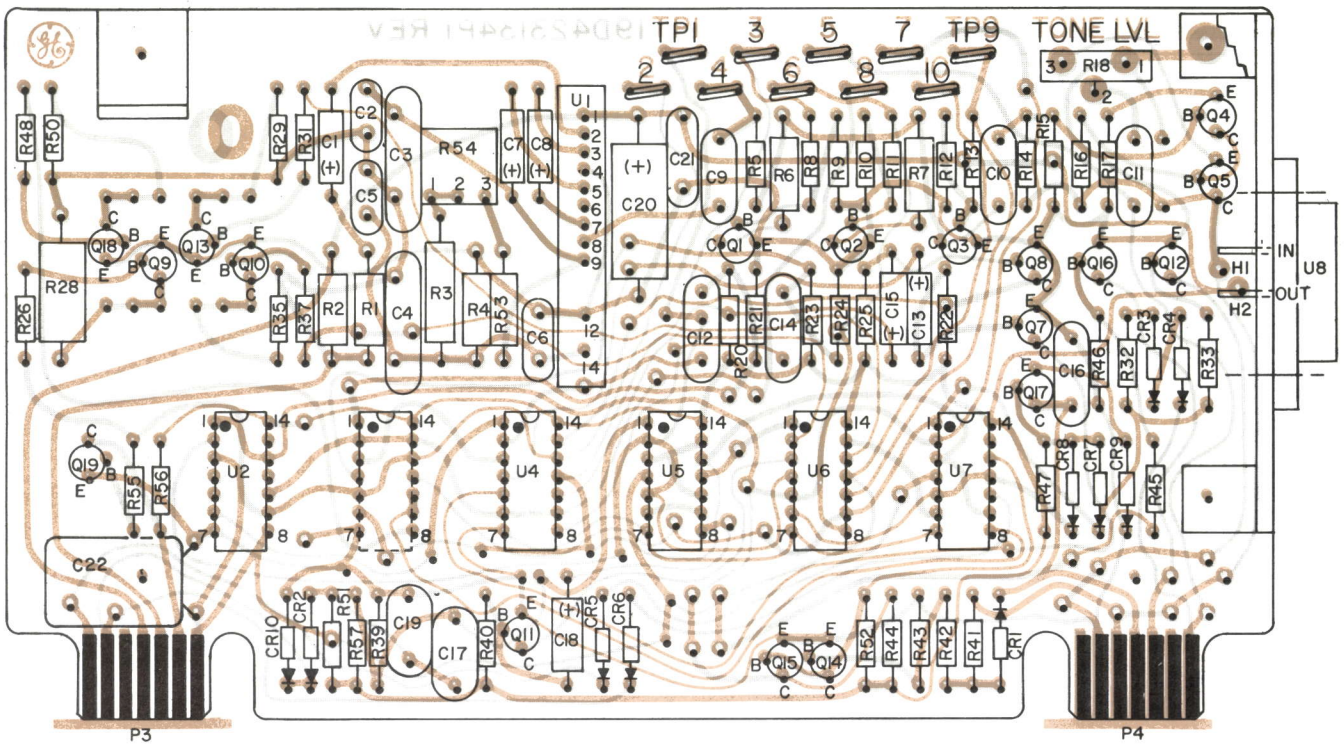
TYPICAL CONTACT FINGER NUMBERING

(19D417316, Rev. 2)
(19D416583, Sh. 2, Rev. 4)
(19D416583, Sh. 3, Rev. 4)

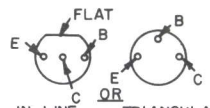


OUTLINE DIAGRAM

TONE CONTROL BOARD
19D416597G1



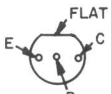
LEAD IDENTIFICATION
FOR Q7 THRU Q19, Q4 & Q5



VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

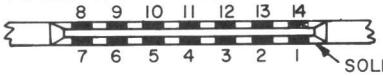
LEAD IDENTIFICATION
FOR Q1, Q2 & Q3



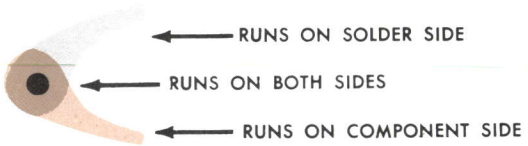
VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

TYPICAL CONTACT FINGER NUMBERING

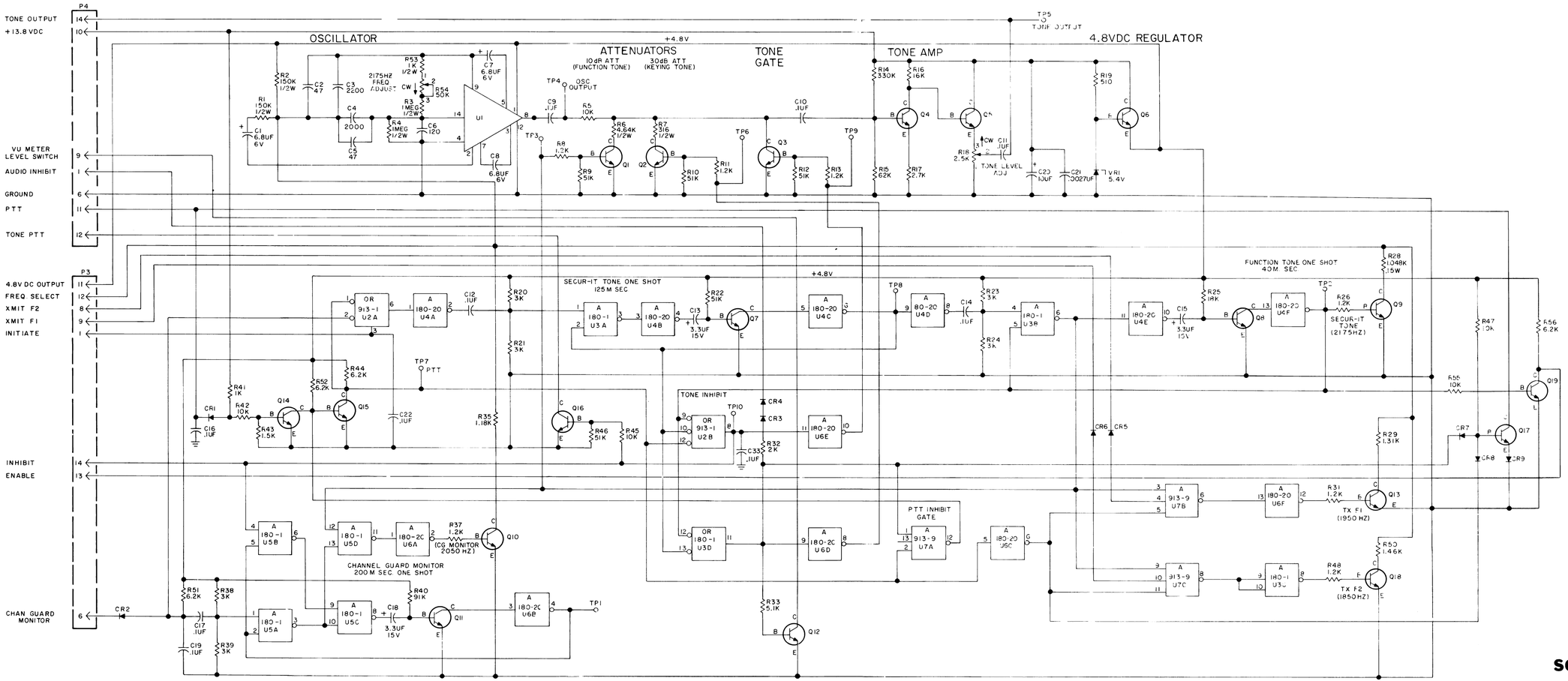


(19D423135, Rev. 0)
(19D423134, Sh. 2, Rev. 0)
(19D423134, Sh. 3, Rev. 0)



OUTLINE DIAGRAM

TONE CONTROL BOARD 19D416597G2



NOTES
1. 4.8VDC TO PIN 14 ON U2 THRU U7.
2. GROUND TO PIN 7 ON U2 THRU U7.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
FLN9046597G1	B

(19R621832, Rev. 4)

SCHEMATIC DIAGRAM

TONE CONTROL BOARD
19D416597G1

PARTS LIST

LBI-4464B

TONE CONTROL BOARD
19D416597G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C2	5496219P855	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef -1500 PPM.
C3 and C4	5491871P2200E	Mica: 2200 pf ±1/2%, 300 VDCW; sim to Electro Motive Type DM-20.
C5	5496219P855	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef -1500 PPM.
C6	7489162P29	Silver mica: 120 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C7 and C8	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C9 thru C12	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C13	5496267P409	Tantalum: 3.3 µf ±5%, 15 VDCW; sim to Sprague Type 150D.
C14	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C15	5496267P409	Tantalum: 3.3 µf ±5%, 15 VDCW; sim to Sprague Type 150D.
C16 and C17	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C18	5496267P409	Tantalum: 3.3 µf ±5%, 15 VDCW; sim to Sprague Type 150D.
C19	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C20	19A115680P8	Electrolytic: 10 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C21	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C22*	19A116080P107	Polyester: .1 µf ±10%, 50 VDCW. Added by REV A.
C23*	19A116080P107	Polyester: .1 µf ±10%, 50 VDCW. Added by REV B.
		- - - - - - - - DIODES AND RECTIFIERS - - - - -
CR1 thru CR9	19A115250P1	Silicon.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P3 and P4		(Part of printed wiring board).
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q3	19A115910P1	Silicon, NPN; sim to Type 2N3906.
Q4 and Q5	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q6	19A116118P1	Silicon, NPN.
Q7 and Q8	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q9 and Q10	19A129207P1	Silicon, NPN.
Q11 and Q12	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q13	19A129207P1	Silicon, NPN.
Q14 thru Q17	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q18	19A129207P1	Silicon, NPN.
Q19	19A115889P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 and R2	19A116278P418	Metal film: 0.15 megohm ±2%, 1/2 w.
R3	19A116624P1	Metal film: 1 megohm ±0.1%, 1/2 w.
R4	19A116278P501	Metal film: 1 megohm ±2%, 1/2 w.
R5	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R6	19A116278P265	Metal film: 4640 ohms ±2%, 1/2 w.
R7	19A116278P149	Metal film: 316 ohms ±2%, 1/2 w.
R8	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R9 and R10	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R11	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R12	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R13	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R14	3R152P334J	Composition: 0.33 megohm ±5%, 1/4 w.
R15	3R152P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R16	3R152P163J	Composition: 16,000 ohms ±5%, 1/4 w.
R17	3R152P272J	Composition: 2700 ohms ±5%, 1/4 w.
R18	19B209358P104	Variable, carbon film: approx 50 to 2500 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R19	3R152P511J	Composition: 510 ohms ±5%, 1/4 w.
R20 and R21	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w.
R22	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R23 and R24	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w.
R25	3R152P183J	Composition: 18,000 ohms ±5%, 1/4 w.
R26	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R28	19A116690P1048	Wirewound: 1048 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R29	19C314256P21311	Metal film: 1311 ohms ±1%, 1/4 w.
R31	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R32	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R33	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R35	19C314256P21181	Metal film: 1180 ohms ±1%, 1/4 w.
R37	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R38 and R39	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w.
R40	3R152P913J	Composition: 91,000 ohms ±5%, 1/4 w.
R41	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R42	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R43	3R152P152J	Composition: 1500 ohms ±5%, 1/4 w.
R44	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
R45	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R46	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R47	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R48	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R50	19C314256P21461	Metal film: 1460 ohms ±1%, 1/4 w.
R51 and R52	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
R53	19A116278P201	Metal film: 1000 ohms ±2%, 1/2 w.
R54	19A116559P108	Variable, cermet: 50,000 ohms ±20%, .5 w; sim to CTS Series 360.
R55	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R56	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
		- - - - - - - - - TEST POINTS - - - - - - - - -
TP1 thru TP10	19B211379P1	Spring (Test Point).
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U1	19D416410G1	Audio Oscillator.
U2	19A115913P1	Digital, Dual 4-Input Gate; sim to Fairchild DTL 930.
U3	19A116180P1	Digital, Quad 2-Input Nand Gate; sim to Texas Instrument Type SN7400N.
U4	19A116180P20	Digital, Hex Inverter; sim to Texas Instrument Type SN7404N.
U5	19A116180P1	Digital, Quad 2-Input Nand Gate; sim to Texas Instrument Type SN7400N.
U6	19A116180P20	Digital, Hex Inverter; sim to Texas Instrument Type SN7404N.
U7	19A115913P9	Digital, Triple 3-Input Gate; sim to Fairchild DTL 962.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR1	4036887P5	Silicon, Zener.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B219561P1	Heat sink. (Used with Q6).
	19A116022P1	Insulator bushing. (Used with Q6).
	19A116023P1	Insulator, plate. (Used with Q6).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

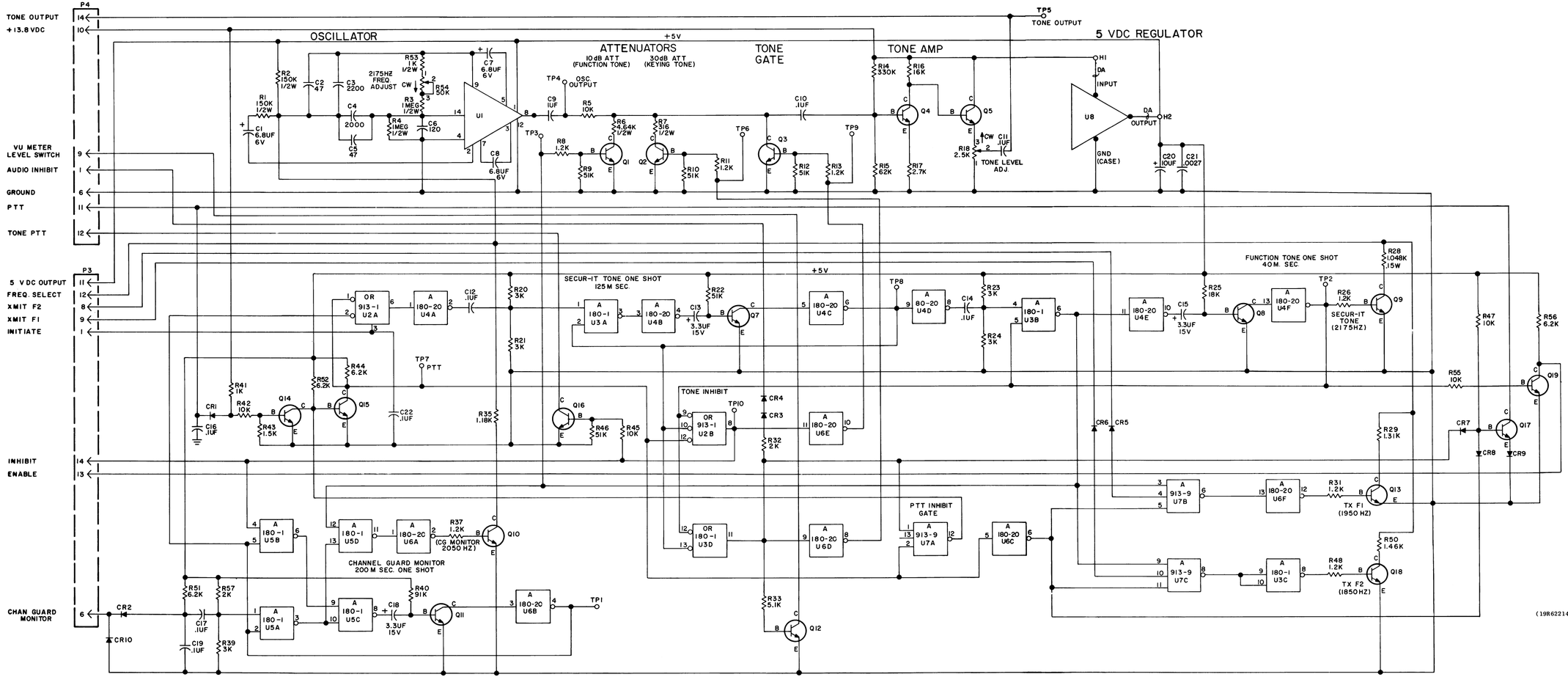
PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A (19D416597G1) - To improve oscillation performance in the Tone Control System when the Tone Control Modules are mounted on the Extender Board. Added a by-pass capacitor (C22) between pin 3 of U2-A and ground (pin 7).

REV. B (19D416597G1) - To prevent Falsing of Tone Control function module. Added C23.

TONE CONTROL BOARD



NOTES:
1. 5 VDC TO PIN 14 ON U2 THRU U7.
2. GROUND TO PIN 7 ON U2 THRU U7.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
PL19D416597G2	

(19R622146, Rev. 0)

SCHEMATIC DIAGRAM

TONE CONTROL BOARD 19D416597G2

PARTS LIST

LBI-4864

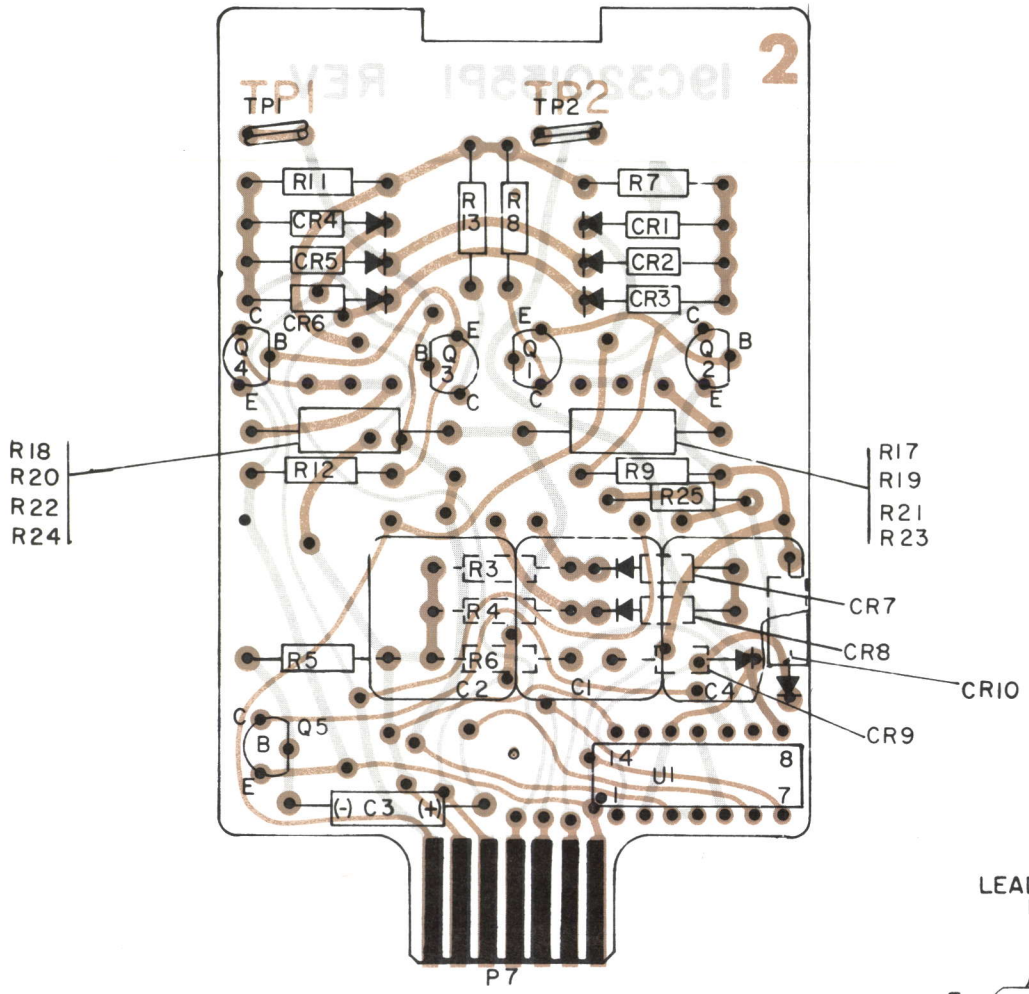
TONE CONTROL BOARD
19D416597G2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C2	5496219P855	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef -1500 PPM.
C3 and C4	5491871P2200E	Mica: 2200 pf ±1/2%, 300 VDCW; sim to Electro Motive Type DM-20.
C5	5496219P855	Ceramic disc: 47 pf ±5%, 500 VDCW, temp coef -1500 PPM.
C6	7489162P29	Silver mica: 120 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C7 and C8	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C9 thru C12	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C13	5496267P409	Tantalum: 3.3 µf ±5%, 15 VDCW; sim to Sprague Type 150D.
C14	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C15	5496267P409	Tantalum: 3.3 µf ±5%, 15 VDCW; sim to Sprague Type 150D.
C16 and C17	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C18	5496267P409	Tantalum: 3.3 µf ±5%, 15 VDCW; sim to Sprague Type 150D.
C19	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C20	19A115680P8	Electrolytic: 10 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C21	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C22	19A116080P107	Polyester: .1 µf ±10%, 50 VDCW.
		- - - - - - - - - DIODES AND RECTIFIERS - - - - -
CR1 thru CR10	19A115250P1	Silicon.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P4		(Part of printed wiring board 19D416583P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 thru Q3	19A115910P1	Silicon, NPN; sim to Type 2N3906.
Q4 and Q5	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q7 and Q8	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q9 and Q10	19A129207P1	Silicon, NPN.
Q11 and Q12	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q13	19A129207P1	Silicon, NPN.
Q14 thru Q17	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q18	19A129207P1	Silicon, NPN.
Q19	19A115889P1	Silicon, NPN; sim to Type 2N2712.

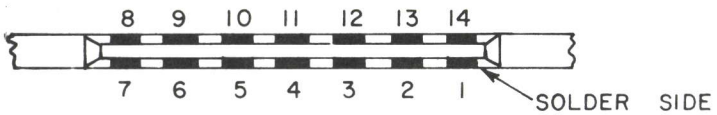
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1 and R2	19A116278P418	Metal film: 0.15 megohm ±2%, 1/2 w.
R3	19A116624P1	Metal film: 1 megohm ±0.1%, 1/2 w.
R4	19A116278P501	Metal film: 1 megohm ±2%, 1/2 w.
R5	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R6	19A116278P265	Metal film: 4640 ohms ±2%, 1/2 w.
R7	19A116278P149	Metal film: 316 ohms ±2%, 1/2 w.
R8	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R9 and R10	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R11	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R12	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R13	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R14	3R152P334J	Composition: 0.33 megohm ±5%, 1/4 w.
R15	3R152P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R16	3R152P163J	Composition: 16,000 ohms ±5%, 1/4 w.
R17	3R152P272J	Composition: 2700 ohms ±5%, 1/4 w.
R18	19B209358P104	Variable, carbon film: approx 50 to 2500 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R20 and R21	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w.
R22	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R23 and R24	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w.
R25	3R152P183J	Composition: 18,000 ohms ±5%, 1/4 w.
R26	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R28	19A116690P1048	Wirewound: 1048 ohms ±0.1%, 0.15 w; sim to Mille Type MR-100-2A.
R29	19C314256P21311	Metal film: 1311 ohms ±1%, 1/4 w.
R31	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R32	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R33	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R35	19C314256P21181	Metal film: 1180 ohms ±1%, 1/4 w.
R37	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R39	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w.
R40	3R152P913J	Composition: 91,000 ohms ±5%, 1/4 w.
R41	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R42	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R43	3R152P152J	Composition: 1500 ohms ±5%, 1/4 w.
R44	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
R45	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R46	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R47	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R48	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R50	19C314256P21461	Metal film: 1460 ohms ±1%, 1/4 w.
R51 and R52	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
R53	19A116278P201	Metal film: 1000 ohms ±2%, 1/2 w.
R54	19A116559P108	Variable, cermet: 50,000 ohms ±20%, .5 w; sim to CTS Series 360.
R55	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R56	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
R57	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - TEST POINTS - - - - - - - - -
TP1 thru TP10	19B211379P1	Spring (Test Point).
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
U1	19D416410G1	Audio Oscillator.
U2	19A115913P1	Digital, Dual 4-Input Gate; sim to Fairchild DTL 930.
U3	19A116180P1	Digital, Quad 2-Input Nand Gate; sim to Texas Instrument Type SN7400N.
U4	19A116180P20	Digital, Hex Inverter; sim to Texas Instrument Type SN7404N.
U5	19A116180P1	Digital, Quad 2-Input Nand Gate; sim to Texas Instrument Type SN7400N.
U6	19A116180P20	Digital, Hex Inverter; sim to Texas Instrument Type SN7404N.
U7	19A115913P9	Digital, Triple 3-Input Gate; sim to Fairchild DTL 962.
U8	19A116834P1	Linear: 5 Volt Regulator; sim to µA209K.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1	4036887P5	Silicon, Zener.

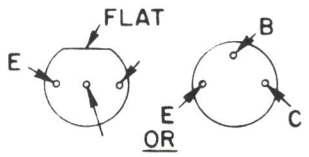
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



TYPICAL CONTACT FINGER NUMBERING

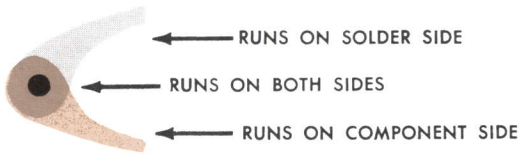


LEAD IDENTIFICATION FOR Q1 – Q5



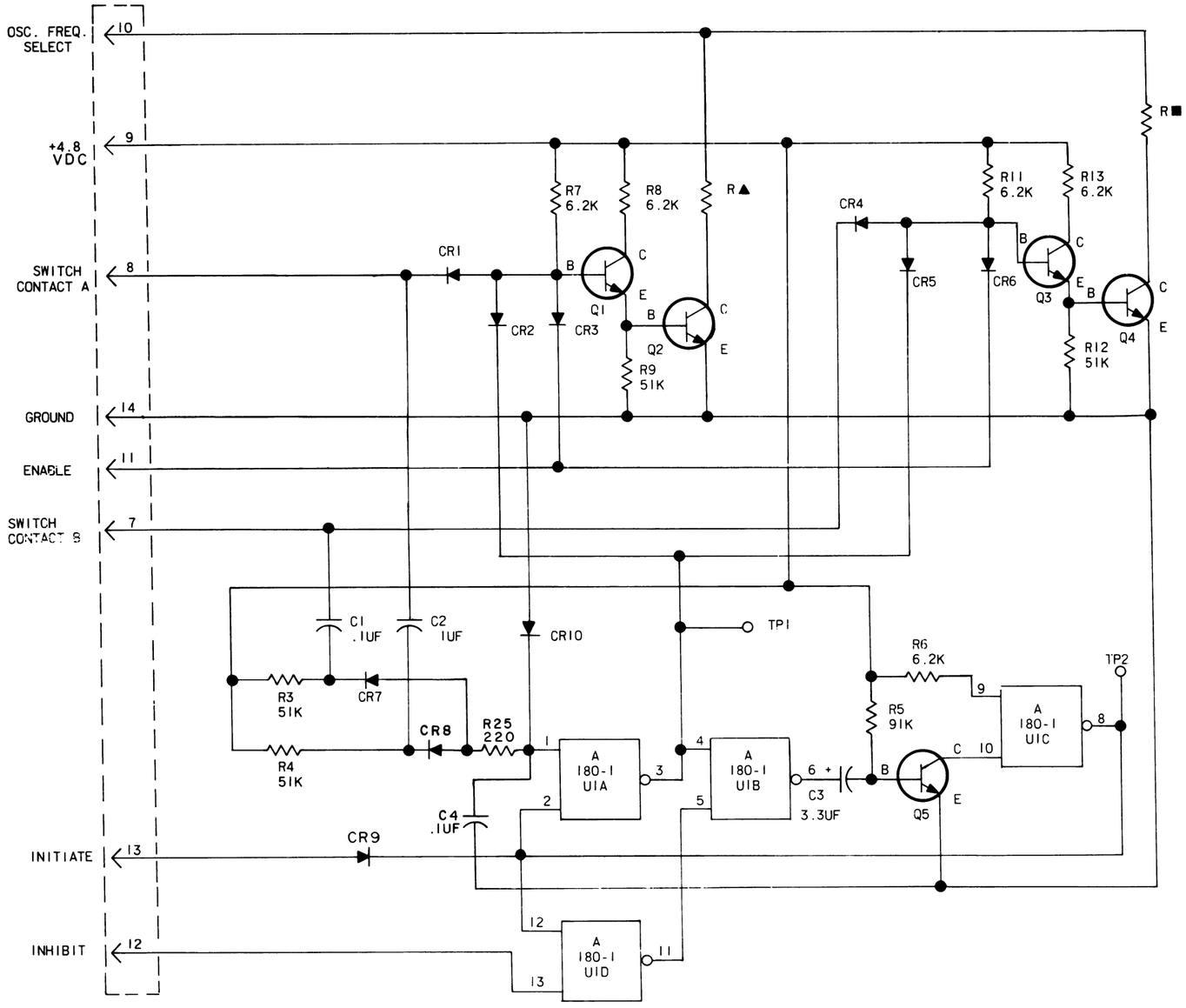
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

(19C320715, Rev. 1)
(19C320155, Sh. 2, Rev. 4)
(19C320155, Sh. 3, Rev. 2)



OUTLINE DIAGRAM

TONE CONTROL FUNCTION BOARD
19C320182G1-G4



(19C320238, Rev. 5)

GROUP	FREQ.-HR.	R▲	VALUE	R■	VALUE
1	1750/1650	R17	1630	R18	1840
2	1550/1450	R19	2100	R20	2410
3	1350/1250	R21	2790	R22	3290
4	1150/1050	R23	3910	R24	4740

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
PLI9C320182G1	A
PLI9C320182G2	A
PLI9C320182G3	A
PLI9C320182G4	A

NOTE: PIN 7 ON U TO GND.
PIN 14 ON U TO +4.8V

SCHEMATIC DIAGRAM

TONE CONTROL FUNCTION
MODULE 19C320182G1-G4

PARTS LIST

LBI-4459A

TONE FUNCTION MODULE
19C320182G1-G4

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 and C2	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C3	5496267P409	Tantalum: 3.3 µf ±5%, 15 VDCW; sim to Sprague Type 150D.
C4	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C5*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW. Deleted by REV A.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1 thru CR9	19A115250P1	Silicon.
CR10	4037822P1	Silicon.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P7		(Part of printed wiring board 19C320155P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q2	19A129207P1	Silicon, NPN.
Q3	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q4	19A129207P1	Silicon, NPN.
Q5	19A115889P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R3 and R4	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R5	3R152P913J	Composition: 91,000 ohms ±5%, 1/4 w.
R6 thru R8	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
R9	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R11	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
R12	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R13	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
R17	19C314256P21631	Metal film: 1630 ohms ±1%, 1/4 w.
R18	19C314256P21841	Metal film: 1840 ohms ±1%, 1/4 w.
R19	19C314256P22101	Metal film: 2110 ohms ±1%, 1/4 w.
R20	19C314256P22411	Metal film: 2410 ohms ±1%, 1/4 w.
R21	19C314256P22791	Metal film: 2790 ohms ±1%, 1/4 w.
R22	19C314256P23291	Metal film: 3290 ohms ±1%, 1/4 w.
R23	19C314256P23911	Metal film: 3910 ohms ±1%, 1/4 w.
R24	19C314256P24741	Metal film: 4740 ohms ±1%, 1/4 w.
R25*	3R152P221J	Composition: 220 ohms ±5%, 1/4 w. Added by REV A.
		- - - - - - - - - - TEST POINTS - - - - - - - - -
TP1 and TP2	19B211379P1	Spring (Test Point).
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U1	19A116180P1	Digital, Quad 2-Input Nand Gate; sim to Texas Instrument Type SN7400N.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

Rev. A - To reduce the probablity of sending false tones due to switch bounce and other noise sources. Deleted C5 and added R25. Relocated C4.

NOTE

Revision "A" of Tone Control Function Modules is compatible with Tone Control Board 19D416597G1 or G2. Boards with no revision (before Rev. A) are not compatible with Tone Control Board 19D416597G2.

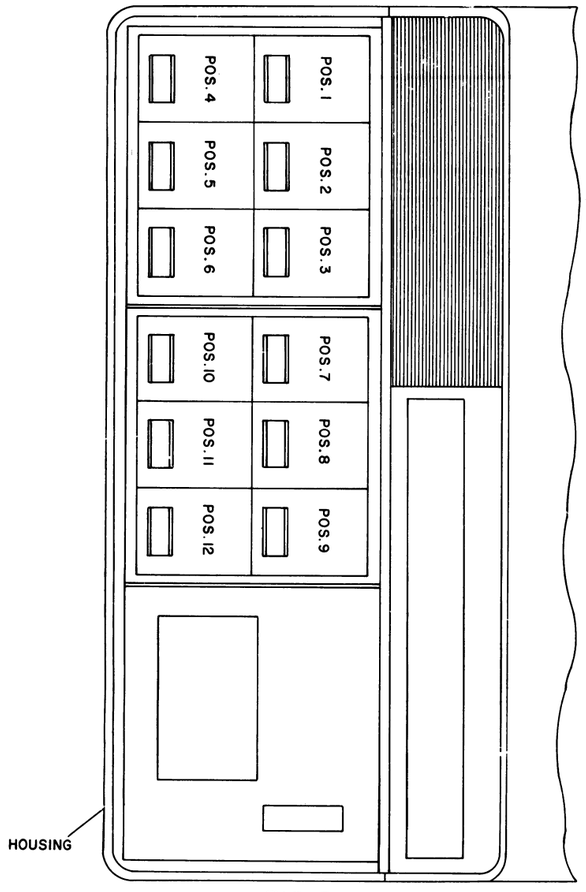
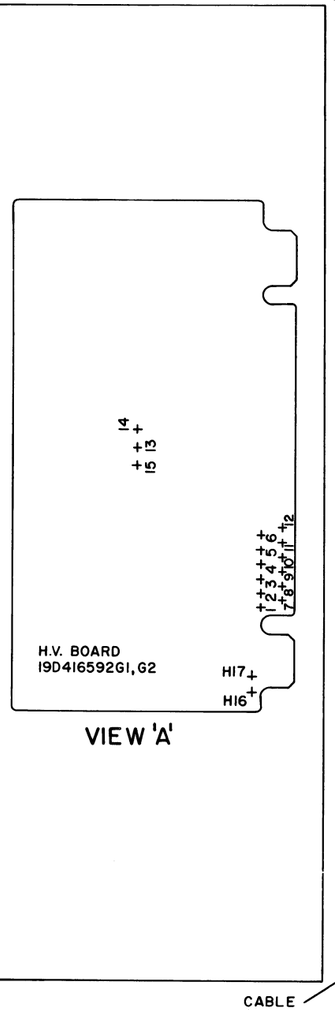


FIG. 2

FOR DC CONTROL ONLY

H.V. BOARD JUMPER CHART

CONTROL FUNCTIONS	IDENTIFIED BY (NOTE 8) SWITCH LEGANDS		JUMPERS REMOVE	JUMPERS ADD DA
2 FREQ. TX 1 FREQ. RX	XMIT F1 XMIT F2		H16 TO H17 H1 TO H2	
1 FREQ. TX 2 FREQ. RX	REC F1 REC F2		H1 TO H2	
2 FREQ. TX 2 FREQ. RX	XMIT F1 XMIT F2	REC F1 REC F2	H1 TO H2 H16 TO H17	
1 FREQ. TX 1 FREQ. RX WITH CG MON.	CG MON			
2 FREQ. TX 1 FREQ. RX WITH CG MON.	XMIT F1 XMIT F2	CG MON	H16 TO H17	
1 FREQ. TX 2 FREQ. RX WITH CG MON	REC F1 REC F2	CG MON		
2 FREQ. TX 2 FREQ. RX WITH CG MON	XMIT F1 XMIT F2 CG MON	REC F1 REC F2	H16 TO H17	
REPEAT DISABLE	REPEAT DISABLE		H1 TO H2	
REPEAT DISABLE CG MON	REPEAT DISABLE	CG MON		
1 FREQ.TX PSLM	REC 1	REC 2	H1 TO H2 H7 TO H8 H3 TO H4 H11 TO H12 H5 TO H6	H4 TO H9 H5 TO H8 H5 TO H12
2 FREQ. TX PSLM	XMIT F1 XMIT F2 REC 2	REC 1	H1 TO H2 H7 TO H8 H3 TO H4 H16 TO H17 H11 TO H12 H5 TO H6	H4 TO H9 H5 TO H8 H5 TO H12



VIEW 'A'

FIG. 4
SEE SH. 2

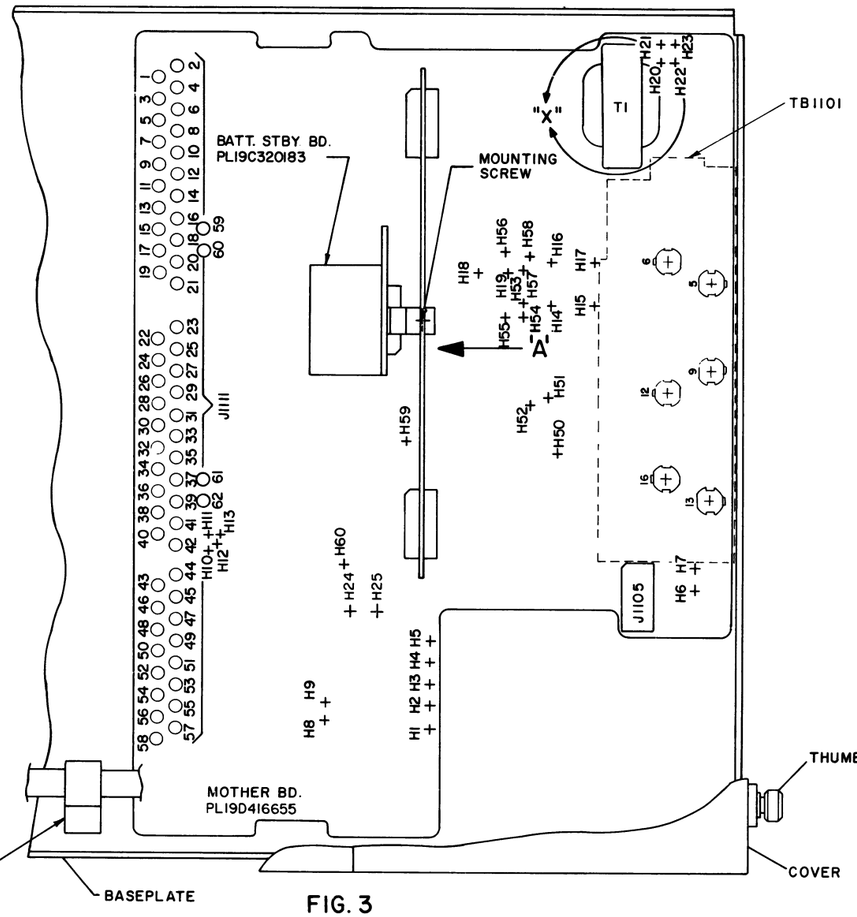


FIG. 3

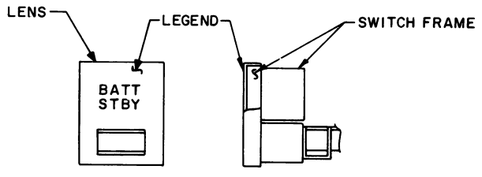


FIG. 1

INSTRUCTIONS(FOR FIG.1)
1. SNAP OFF (REMOVE) LENS FROM SWITCH FRAME.
2. PLACE LEGEND ON SWITCH FRAME ORIENTED AS SHOWN.
3. REPLACE LENS.

INSTALLATION INSTRUCTIONS

1. LOOSEN THUMBSCREWS ON REAR OF UNIT AND REMOVE COVER.
2. REMOVE 4-#8 SCREWS FROM BASEPLATE AND REMOVE HOUSING FROM BASEPLATE.
3. INSTALL SWITCH LEGEND AS SHOWN IN TABULATION AND IN FIG. 1 (NOTE-COMBINATION OF SWITCH LEGEND AND SWITCH GR. NO., SEE TABULATION ON SH. #2, DETERMINES WIRING CONNECTIONS FOR SWITCH MODULE).
4. INSTALL SWITCH MODULE IN HOUSING AS SHOWN IN TABULATION AND FIG. 2. (REMOVE SWITCH DUMMY, IF PRESENT, AND RETURN TO STOCK)
5. MAKE CONNECTIONS AS SHOWN IN TABULATION. ROUTE WIRES TO J1111 THRU CABLE CLAMPS SHOWN IN FIG. 3, AND IN HOUSING. SPOT TIE TO EXISTING WIRING.
6. MAKE OTHER MODIFICATIONS TO UNIT, IF REQUIRED, AS LISTED IN "P.W. BOARD MODIFICATIONS" COLUMN OF TABULATION.
7. REASSEMBLE UNIT.
8. SELECT THE BLOCK OF SWITCH COMBINATIONS THAT MATCHES THE CUSTOMER UNIT. (ONLY ONE BLOCK PER UNIT SHOULD BE USED)

(19D416690, Sh. 1, Rev. 6)

THESE INSTRUCTIONS COVER THE INSTALLATION OF SWITCH ASSEMBLY PL19D416628, 19D417189 AND PL19C320717, LEGEND NP270751, NP276388 & NP280350, COMPONENT BOARD PL19C320209, COMPONENT BOARD PL19C320183 FOR MODIFYING MASTR CONTROLLER TO PROVIDE CONTROL FUNCTIONS AND TO PROVIDE ALERT TONE FUNCTION AND TO PROVIDE BATTERY STANDBY IN D.C. CONTROL SYSTEMS.

DF-4094

INSTALLATION INSTRUCTIONS

SWITCH KITS 19D416628G1-G12

Issue 4

	LEGEND SEE FIG. 1	SWITCH	SWITCH LOCATION SEE FIG. 2	CONNECTIONS SEE FIG. 3	PW BOARD MOD INSTRUCTIONS
(1)	REPT. ON REPT. OFF NP270751P16	19D416628G1 (TONE)	POS. 3	W TO J1111-34 BL TO J1111-35 WG TO J1111-53-58 BK TO J1111-46-52	SEE NOTE 2
(2)	OFF AUX 2 ON NP270751P18	19D416628G1 (TONE)	POS. 12	W TO J1111-28 BL TO J1111-31 WG TO J1111-53-58 BK TO J1111-46-52	
(3)	CG ON CG OFF NP270751P14	19D416628G1 (TONE)	POS. 4	W TO J1111-34 BL TO J1111-35 WG TO J1111-53-58 BK TO J1111-46-52	
(4)	SQ MIN SQ MAX NP270751P15	19D416628G1 (TONE)	POS. 4	W TO J1111-34 BL TO J1111-35 WG TO J1111-53-58 BK TO J1111-46-52	
(5)	OFF AUX 1 ON NP270751P5	19D416628G1 (TONE)	POS. 11	W TO J1111-33 BL TO J1111-32 WG TO J1111-53-58 BK TO J1111-46-52	
(6)	REC F1 REC F2 NP270751P12	19D416628G12 (DC CONTROL)	POS. 2	BL TO J1111-37 WG TO J1111-53-58 BK TO J1111-46-52	SEE FIG. 4 FOR MODIFICATIONS TO H.V. BOARD PL19D416592G1 2
(7)	XMIT F1 XMIT F2 NP270751P13	19D416628G1 (DC & TONE)	POS. 1	W TO J1111-38 BL TO J1111-39 WG TO J1111-53-58 BK TO J1111-46-52	
(8)	REC 1 NP270751P2	19D416628G2 (DC)	POS. 2	BL TO J1111-37 WG TO J1111-53-58 BK TO J1111-46-52	
(9)	REC 2 NP270751P3	19D416628G2 (DC)	POS. 3	BL TO J1111-36 WG TO J1111-53-58 BK TO J1111-46-52	
(10)	REPEAT DISABLE NP270751P4	19D416628G2 (DC)	POS. 3	BL TO J1111-37 WG TO J1111-53-58 BK TO J1111-46-52	
(11)	CG MON NP270751P1	19D416628G3 (DC)	POS. 4	W TO J1111-53-58 BL TO J1111-46-52 WG TO J1111-29 BK TO J1111-30	
(12)	SPKR MUTE NP270751P8	19D416628G4 (DC & TONE)	POS. 9	W TO J1111-6 WG TO J1111-53-58 WR TO J1111-1 BR TO J1111-46-52	MOVE BLACK WIRE FROM J1111-1 TO J1111-5 SEE FIG. 3
(13)	SUPV CONT NP270751P6	19D416628G5 (DC)	POS. 5	BL TO J1111-22 WG TO J1111-53-58 BK TO J1111-25 G TO J1111-46-52	CONNECT JUMPER BETWEEN TB1101-5 & TB1101-9 AND CONNECT JUMPER BETWEEN TB1101-6 & TB1101-12 ON MOTHER BD. SEE FIG. 3
(14)	REC F1 REC F2 NP270751P12	19D416628G1 (TONE CONTROL)	POS. 2	W TO J1111-37 BL TO J1111-36 WG TO J1111-53-58 BK TO J1111-46-52	

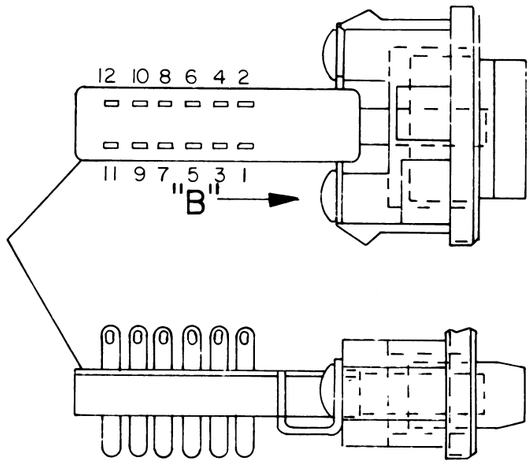
	LEGEND SEE FIG. 1	SWITCH	SWITCH LOCATION SEE FIG. 2	CONNECTIONS SEE FIG. 3	PW BOARD MOD INSTRUCTIONS
(15)	BATT STBY NP270751P10	19D416628G6 (DC)	POS. 10	BL TO J1111-18 WG TO J1111-46-52 BK TO J1111-26 G TO J1111-15 R TO J1111-19 V TO J1111-17	CLIP JUMPER BETWEEN H24&H25 REMOVE MTG. SCR. MOUNT BATT. STBY. BD. AS SHOWN. REPLACE SCR. THROUGH SPT. ON BATT. STBY. BD. (SEE FIG.3) CLIP JUMPER BETWEEN H8 & H9 ON MOTHER BD. SEE FIG. 3.
(16)	INTCM NP270751P7	19D416628G7 (DC & TONE)	POS. 6	W TO J1111-41 BL TO J1111-46-52 BK TO J1111-40 G TO J1111-53-58	CLIP JUMPER BETWEEN H12 & H13 ON MOTHER BD. SEE FIG. 3.
(17)	LINE 2 NP270751P11	19D416628G8 (DC & TONE)	POS. 7	WG TO J1111-53-58 WBK TO J1111-46-52 W TO J1111-14 BR TO J1111-11 R TO J1111-12 BL TO J1111-9 O TO J1111-13 R TO J1111-16	CLIP JUMPER BETWEEN H20 & H21 AND BETWEEN H22 & H23 ON MOTHER BD. SEE FIG. 3.
(18)	TAKE OVER NP270751P17	19D416628G9 **(DC & TONE)**	POS. 5	WG TO J1111-53-58 G TO J1111-46-52 OW TO J1111-22 R TO J1111-9 V TO J1111-25 Y TO J1111-12	
(19)	REC 1 NP270751P2	19D416628G10 (TONE)	POS. 2	O TO J1111-36 Y TO J1111-53-58	
(20)	REC 2 NP270751P3	19D416628G11 (TONE)	POS. 3	BL TO J1111-46-52 V TO J1111-28 OW TO J1111-37 WBL TO S4-5 R TO S4-7 WBK TO S4-11 BR TO S4-4 G TO S4-6 W TO S4-8 WG TO H4 **BL-G TO J1111-26**	ALL CONNECTIONS TO SWITCH ASM. LOCATED IN POS 2. SEE "DETAIL A" FOR TERMINAL LOCATIONS
(21)	ALERT TONE NP270751P9	19C320209G1 (DC & TONE)	POS. 8	G TO J1111-46-52 WG TO J1111-44 BK TO J1111-23 W TO J1111-27	
(22)	LINE 2 NP270751P11	19D417169G1 (DC & TONE)	POS. 7	WG TO J1111-53-58 WBK TO J1111-46-52 W TO J1111-14 BR TO J1111-11 R TO J1111-12 BL TO J1111-9 O TO J1111-13 R TO J1111-16 R TO TB1101-13 BL TO TB1101-16	CLIP JUMPER BETWEEN H20 & H21 AND BETWEEN H22 & H23 ON MOTHER BD. SEE FIG. 3. & DETAIL-X ROUTE WIRES AS SHOWN IN FIG. 5

NOTES:
1. IF THE NUMBER OF OPTIONS REQUIRING GROUND JACKS J1111-46-52 EXCEEDS SEVEN, REMOVE THE 4029840P2 CONTACT TERMINATION ON THE GROUND LEAD OF THE KIT AND INSTALL A 4033348P1 CONTACT PROVIDED IN THE KIT. INSTALL THIS "PIGGYBACK" CONNECTION ON J1111-46-52.
2. IF BOTH CG, ON-OFF AND REPT. ON-OFF SWITCHES ARE PRESENT CONNECT THE WHITE (W) AND BLUE (BL) WIRES OF THE REPT. ON-OFF SWITCH TO J1111-31 & 28 RESPECTIVELY.

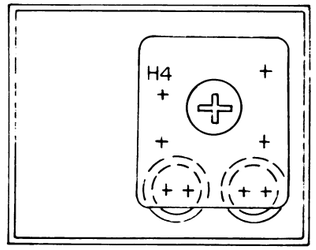
(19D416690, Sh. 2, Rev. 8)

INSTALLATION INSTRUCTIONS

SWITCH KITS 19D416628G1-G12



DE TAIL-"A"



VIEW AT"B"

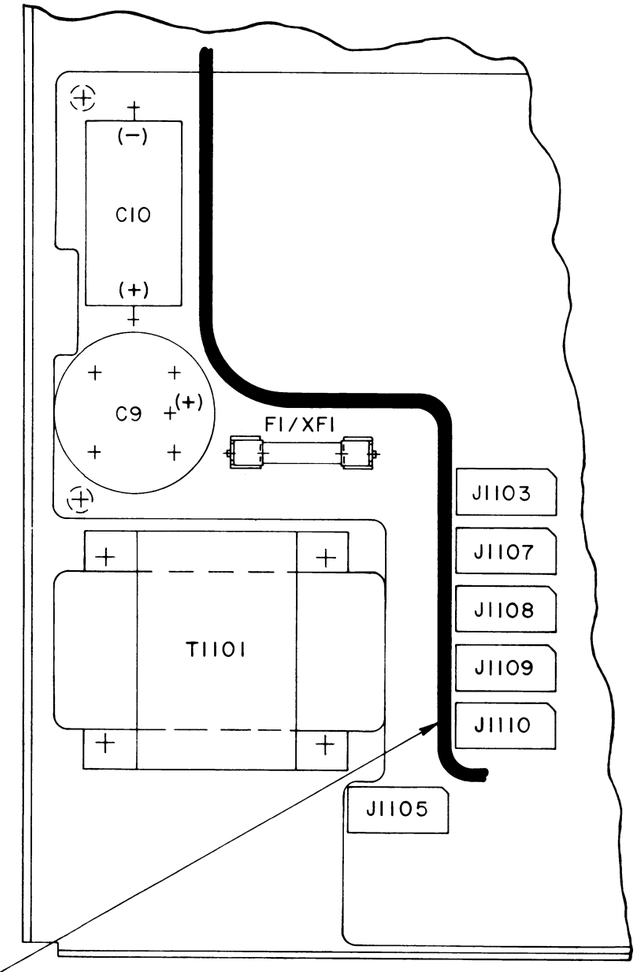
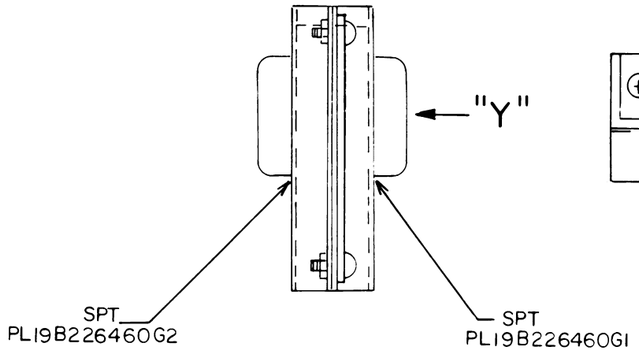
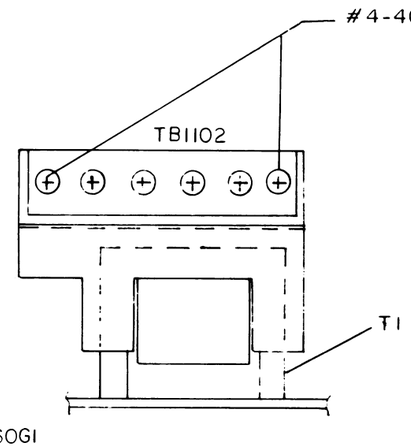


FIGURE 5



DETAIL "X"



VIEW @"Y"
(ROTATED 90°)

(19D416690, Sh. 3, Rev. 0)

PARTS LIST

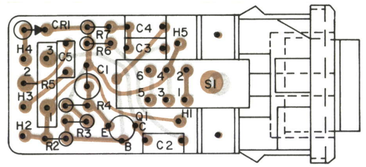
LBI-4468

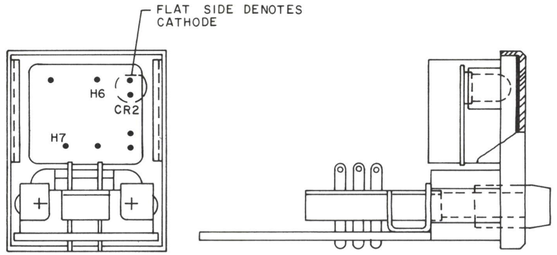
ALERT TONE KIT
19C320209G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C2 thru C4	19A116080P102	Polyester: 0.015 µf ±10%, 50 VDCW.
C5	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	4037822P1	Silicon.
CR2	19A129291P1	Diode, light emitting: red.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A116774P1	Silicon, NPN; sim to Type 2N5210.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R2	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R3	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R4	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R5	19B209358P105	Variable, carbon film: approx 75 to 5000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R6 and R7	3R152P182J	Composition: 1800 ohms ±5%, 1/4 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19A116009P14	Push: DPDT, 1 station, momentary action, operating currents, (A) 100 MADC at 28 v or (B) 15 MADC at 130 v.

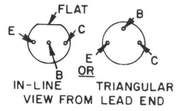
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

OUTLINE DIAGRAM

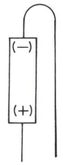




LEAD IDENTIFICATION FOR Q1



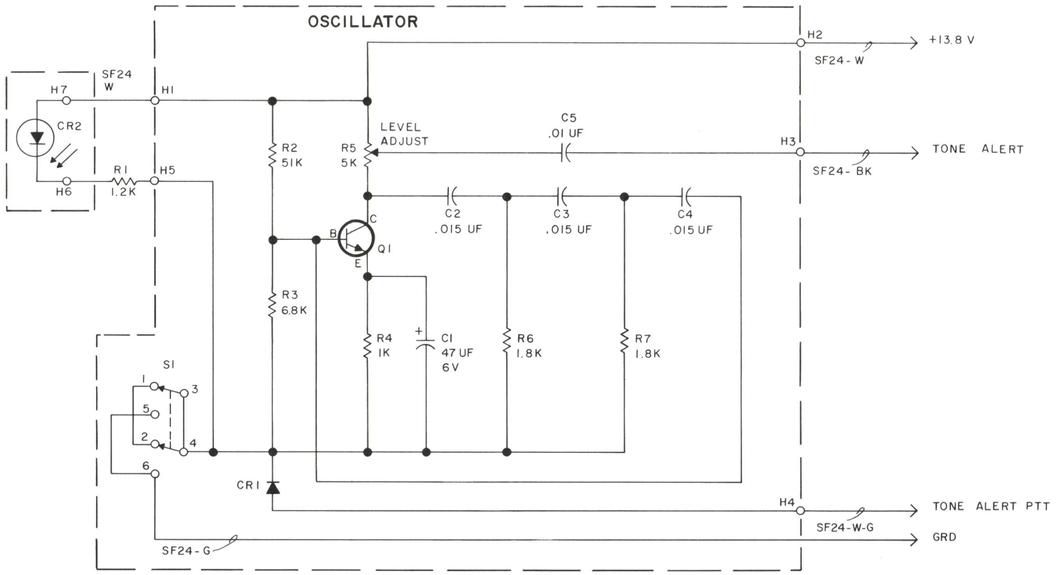
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



LEAD IDENTIFICATION FOR C1

(19C320701, Rev. 0)
(19B219569, Sh. 2, Rev. 0)
(19B219569, Sh. 3, Rev. 0)

SCHEMATIC DIAGRAM



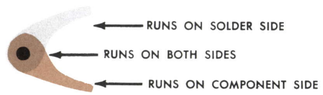
SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.	
THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PLI9C320209G1	

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

NOTES:
1. TERMINATE ALL LET HANG WIRES WITH TERMINAL A4029840P2.

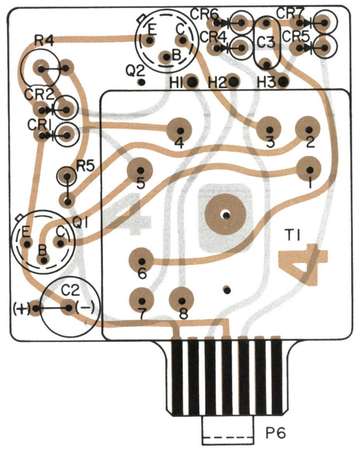
(19C320230, Rev. 1)



SERVICE SHEET

ALERT TONE KIT
(OPTION 8528)

OUTLINE DIAGRAM



TYPICAL CONTACT FINGER NUMBERING

LEAD IDENTIFICATION FOR Q1 & Q2

(19C320713, Rev. 2)
(19C320163, Sh. 2, Rev. 4)
(19C320163, Sh. 3, Rev. 4)

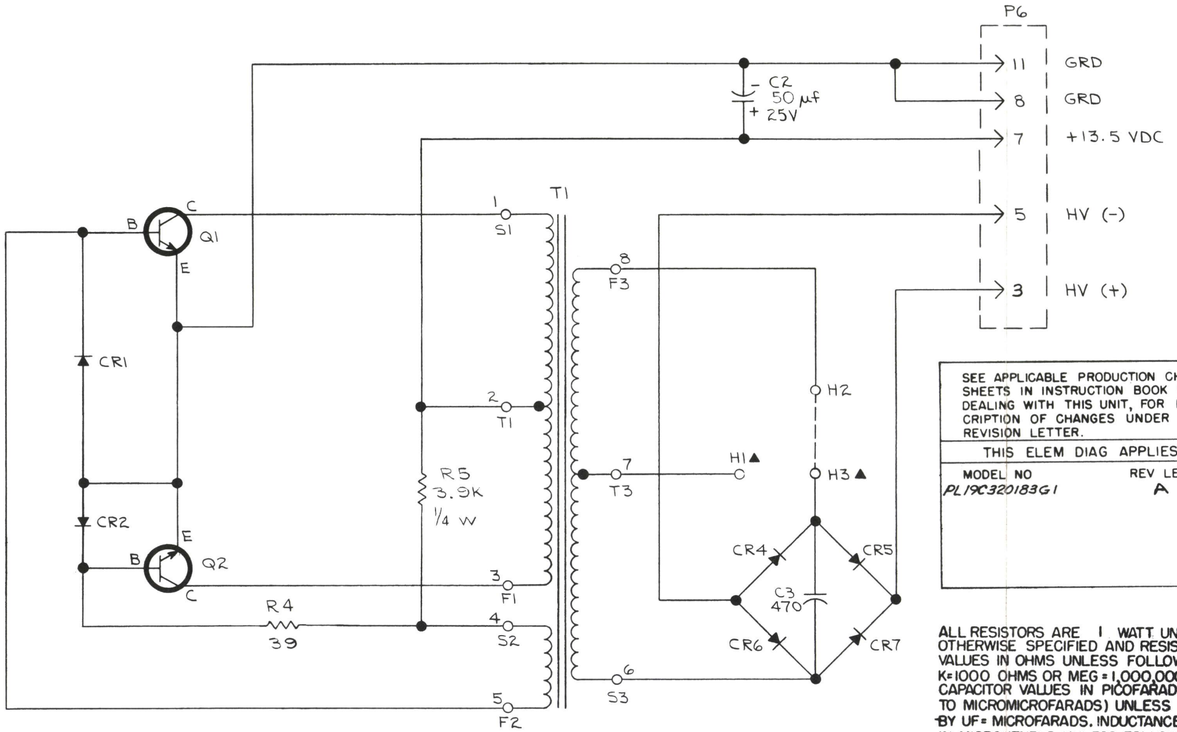
TRIANGULAR
VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

SERVICE SHEET

DC CONTROL BATTERY STANDBY BOARD
(OPTION 8526)

SCHEMATIC DIAGRAM

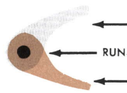


SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
PL19C320183G1	A

ALL RESISTORS ARE 1 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG = 1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.



RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

NOTE

▲1. IF E&M SIGNALLING IS USED, MOVE JUMPER FROM BETWEEN H2 & H3 TO H3 & H1.

(19C320240, Rev. 3)

LBI-4460B

DC BATTERY STANDBY KIT
19C320183G1

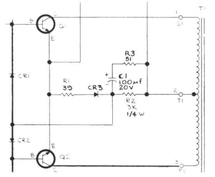
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1*	5496267P16	Tantalum: 100 µf ±20%, 20 VDCW; sim to Sprague Type 150D. Deleted by REV A.
C2	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C3	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	4037822P2	Silicon.
CR3*	4037822P2	Silicon. Deleted by REV A.
CR4 thru CR7	4037822P2	Silicon.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P6		(Part of printed wiring board 19C320163P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1* and Q2*	19A115300P4	Silicon, NPN.
		Earlier than REV A:
	19A115300P2	Silicon, NPN; sim to Type 2N3053.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1*	3R77P390K	Composition: 39 ohms ±10%, 1/2 w. Deleted by REV A.
R2*	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w. Deleted by REV A.
R3*	3R77P510J	Composition: 51 ohms ±5%, 1/2 w. Deleted by REV A.
R4*	3R78P390K	Composition: 39 ohms ±10%, 1 w. Added by REV A.
R5*	3R152P392J	Composition: 3900 ohms ±5%, 1/4 w. Added by REV A.
		- - - - - - - - - - TRANSFORMERS - - - - - - - -
T1	19C303894G3	Coil.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	4036555P1	Insulator, washer: nylon. (Used with Q1 and Q2).

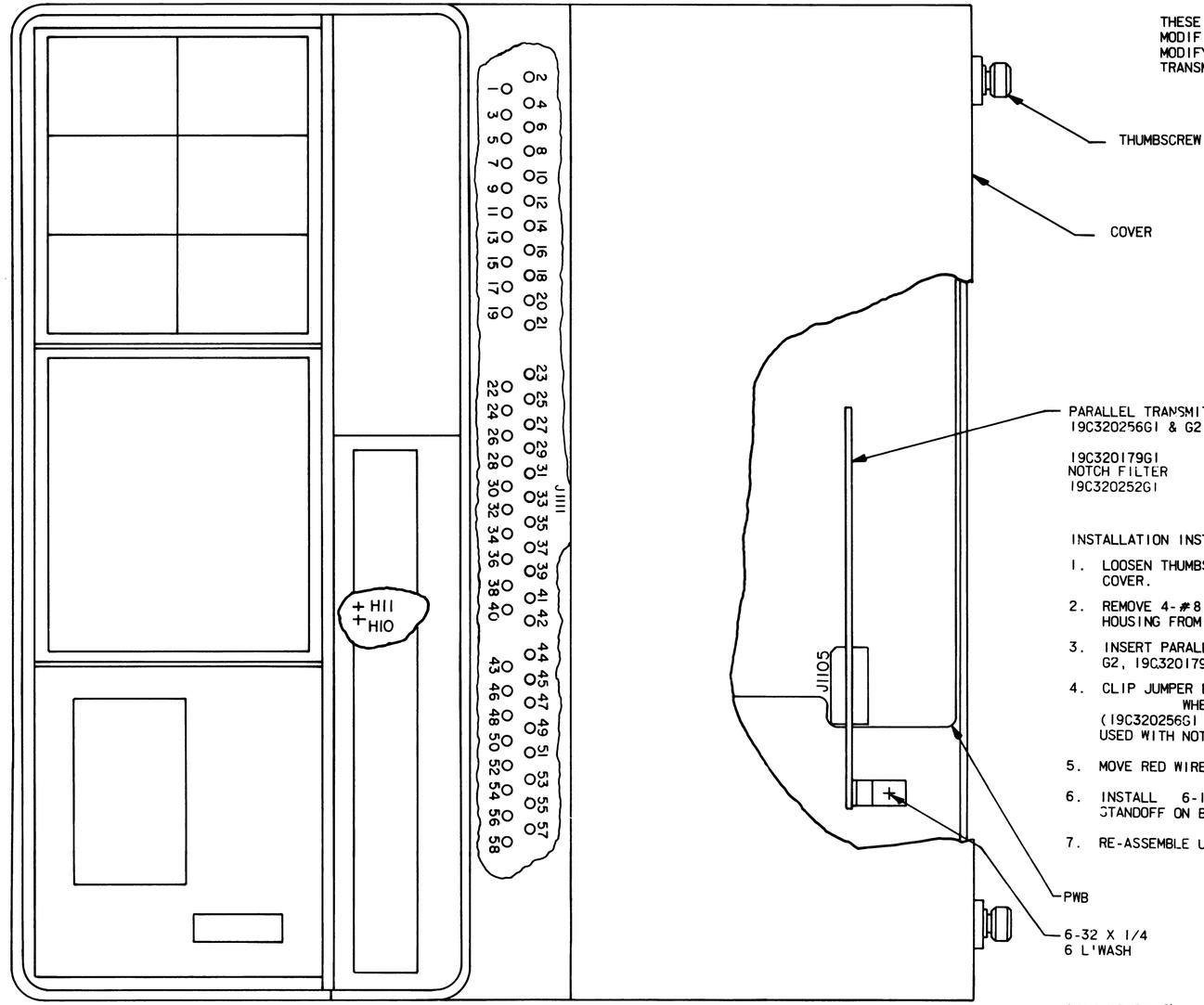
PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

Rev. A - To improve performance. Deleted C1, CR3, R1, R2, and R3. Added R4 & R5.

Schematic Diagram Was:





THESE INSTRUCTIONS COVER THE INSTALLATION OF MODIFICATION KIT PL19A129373G1, 2, 3 & 4 FOR MODIFYING MASTR CONTROLLER TO PROVIDE PARALLEL TRANSMIT INDICATOR FUNCTION OR NOTCH FILTER.

ASM OF PARALLEL TRANSMIT BOARD WITH INDICATOR (19C320256G2 AND 19C320179G1) SEE NOTES 3 & 4

ASM OF NOTCH FILTER (19C320252G1) SEE NOTE 5

PARALLEL TRANSMIT CONTROL AND NOTCH FILTER (19C320256G1) SEE NOTES 3, 4, & 5

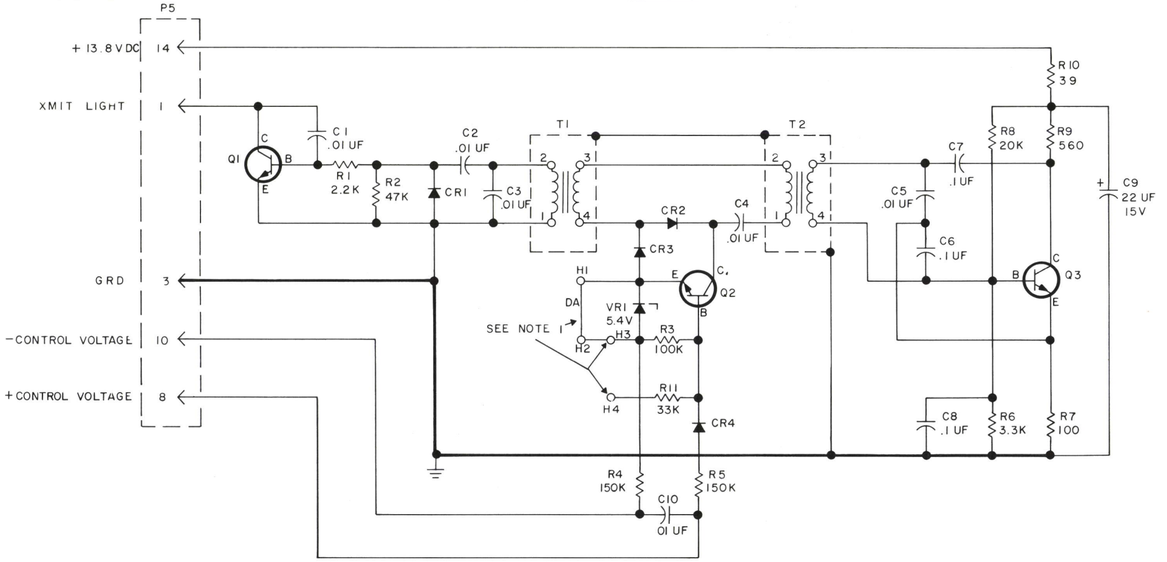
INSTALLATION INSTRUCTIONS:

1. LOOSEN THUMBSCREWS ON REAR OF UNIT AND REMOVE COVER.
2. REMOVE 4-#8 SCREWS FROM BASEPLATE AND REMOVE HOUSING FROM BASEPLATE.
3. INSERT PARALLEL TRANSMIT BOARD (19C320256G1 & G2, 19C320179G1) OR NOTCH FILTER (19C320252G1) INTO J1105.
4. CLIP JUMPER BETWEEN H10 & H11 OF MOTHER BOARD WHEN USED WITH PARALLEL TRANSMIT INDICATOR (19C320256G1 & G2, 19C320179G1). LEAVE IN JUMPER WHEN USED WITH NOTCH FILTER (19C320252G1).
5. MOVE RED WIRE FROM J1111-4 TO J1111-3 IN TONE UNITS ONLY.
6. INSTALL 6-1/4 SCREW AND L'WASH THROUGH SUPPORT INTO STANDOFF ON BASE PLATE.
7. RE-ASSEMBLE UNIT.

INSTALLATION INSTRUCTIONS

PARALLEL TRANSMIT INDICATOR
(OPTIONS 8527, 8554, 8555)

SCHEMATIC DIAGRAM



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

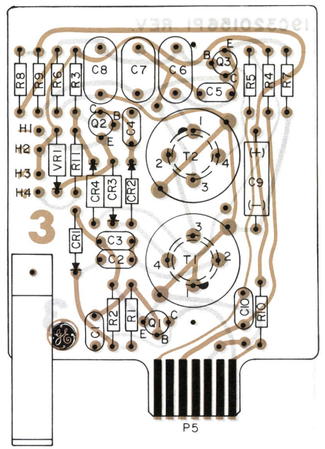
MODEL NO	REV LETTER
PL19C320179G1	

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN MICROFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

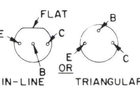
NOTE:
1. WHEN CG MON CURRENT IS +16 MA INSTEAD OF -2.5 MA, REMOVE JUMPER BETWEEN HI & H2 AND CONNECT A JUMPER BETWEEN H3 & H4.

(19C320232, Rev. 1)

OUTLINE DIAGRAM

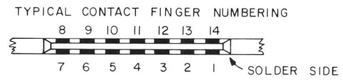


LEAD IDENTIFICATION FOR Q1, Q2, Q3

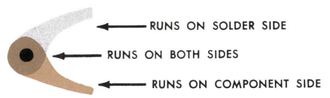


NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

TYPICAL CONTACT FINGER NUMBERING



(19C320714, Rev. 1)
(19C320156, Sh. 2, Rev. 3)
(19C320156, Sh. 3, Rev. 3)



PARTS LIST

LBI-4544

PARALLEL TRANSMIT INDICATOR
19A129373G4

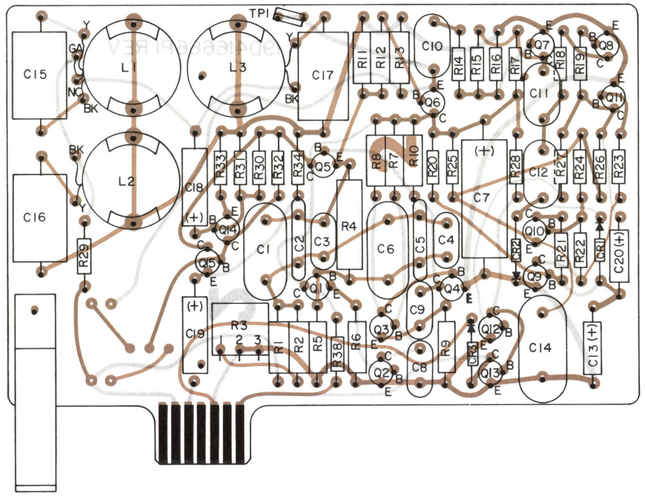
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1 thru C5	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C6 thru C8	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C9	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C10	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1 and CR2	19A115250P1	Silicon.
CR3 and CR4	4037822P2	Silicon.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P5		(Part of printed wiring board 19C320156P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q3	19A116774P1	Silicon, NPN; sim to Type 2N5210.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R2	3R152P473J	Composition: 47,000 ohms ±5%, 1/4 w.
R3	3R152P104J	Composition: 0.10 megohm ±5%, 1/4 w.
R4 and R5	3R152P154J	Composition: 0.15 megohm ±5%, 1/4 w.
R6	3R152P332J	Composition: 3300 ohms ±5%, 1/4 w.
R7	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R8	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R9	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R10	3R152P390J	Composition: 39 ohms ±5%, 1/4 w.
R11	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - -
T1 and T2	19B219563G1	Coil.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1	4036887P5	Silfcon, Zener.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

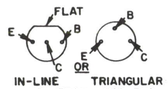
SERVICE SHEET

DC CONTROL PARALLEL
TRANSMIT INDICATOR
(OPTION 8527)

OUTLINE DIAGRAM

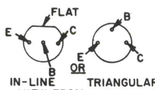


LEAD IDENTIFICATION FOR Q6, Q7, Q9-Q14



NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

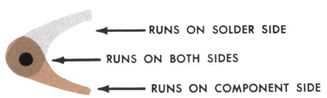
LEAD IDENTIFICATION FOR Q1-Q5, Q8, Q15



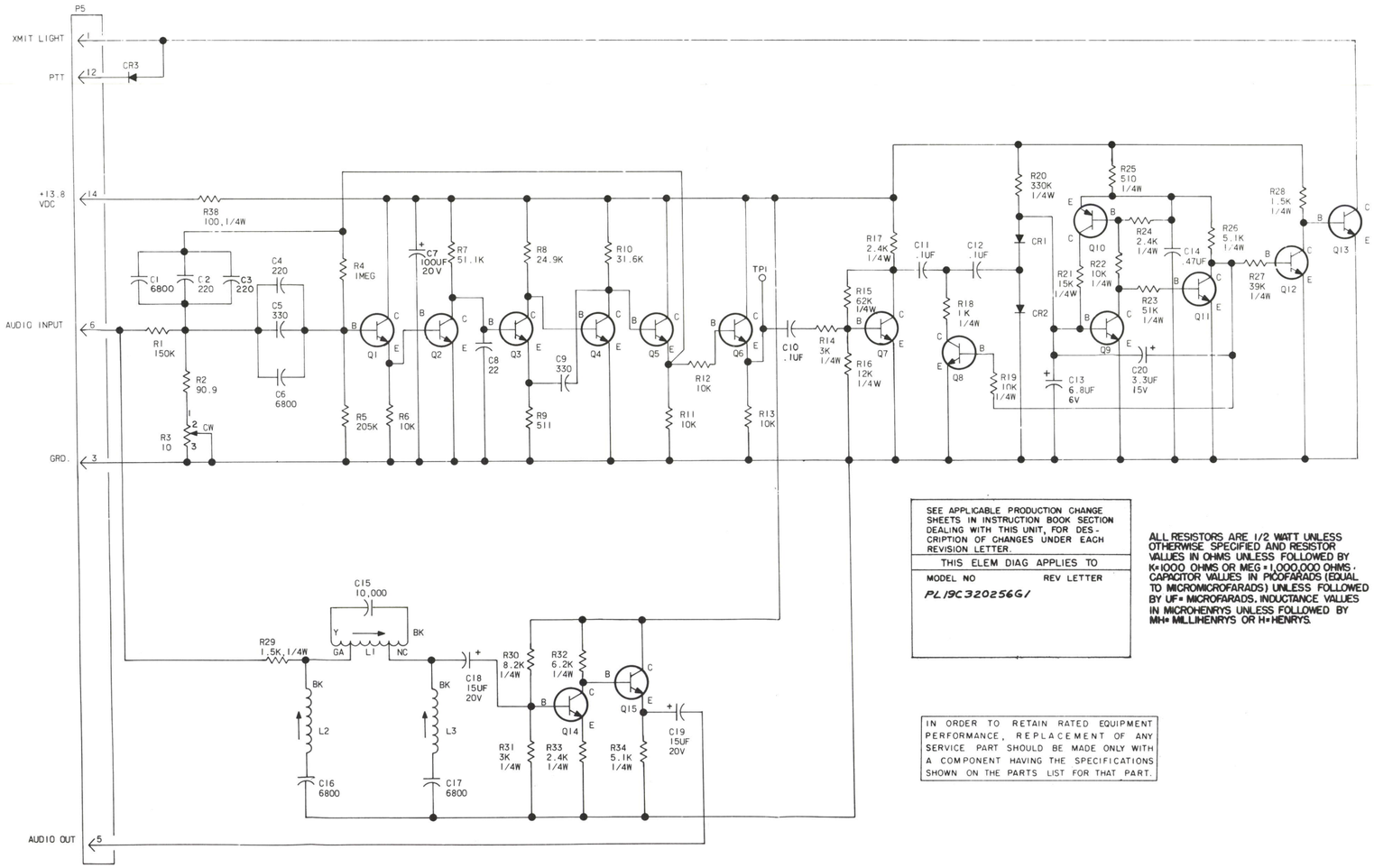
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

TYPICAL NUMBERING OF CONTACT FINGERS

(19C320707, Rev. 0)
(19D416666, Sh. 2, Rev. 2)
(19D416666, Sh. 3, Rev. 2)



SCHEMATIC DIAGRAM



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19C320256G1	

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19D416679, Rev. 2)

SERVICE SHEET

TONE CONTROL PARALLEL TRANSMIT INDICATOR (OPTION 8554)

PARTS LIST

LBI-4463

PARALLEL INDICATOR KIT
19A129373G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	5491871P6800G	Mica: 6800 pf ±2%, 300 VDCW; sim to Electro Motive Type DM-20.
C2	5496219P875	Ceramic disc: 330 pf ±5%, 500 VDCW, temp coef -750 PPM.
C3 and C4	7489162P235	Silver mica: 220 pf ±2%, 500 VDCW; sim to Electro Motive Type DM-15.
C5	5496219P875	Ceramic disc: 330 pf ±5%, 500 VDCW, temp coef -750 PPM.
C6	5491871P6800G	Mica: 6800 pf ±2%, 300 VDCW; sim to Electro Motive Type DM-20.
C7	5496267P16	Tantalum: 100 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C8	7489162P11	Silver mica: 22 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C9	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C10 thru C12	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C13	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C14	19A116080P111	Polyester: 0.47 µf ±10%, 50 VDCW.
C15	19A116738P3	Polystyrene: 10,000 pf ±2.5%, 33 VDCW; sim to Mial Series 617.
C16 and C17	19A116738P2	Polystyrene: 6800 pf ±2.5%, 33 VDCW; sim to Mial Series 617.
C18 and C19	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C20	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 thru CR3	19A115250P1	Silicon.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B205354G4	Coil.
L2 and L3	19B205354G5	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 thru Q5	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q6 and Q7	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q8	19A115910P1	Silicon, NPN; sim to Type 2N3906.
Q9	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q10	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q11 thru Q14	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q15	19A116774P1	Silicon, NPN; sim to Type 2N5210.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	19A116278P418	Metal film: 150,000 ohms ±2%, 1/2 w.
R2	19A116278P93	Metal film: 90.9 ohms ±2%, 1/2 w.
R3	19A116559P111	Variable, cermet: 10 ohms ±20%, .5 w; sim to CTS Series 360.
R4	19A116624P1	Metal film: 1 megohm ±0.1%, 1/2 w; sim to IRC Type CCA-T9.
R5	19A116278P431	Metal film: 205,000 ohms ±2%, 1/2 w.
R6	19A116278P301	Metal film: 10,000 ohms ±2%, 1/2 w.
R7	19A116278P369	Metal film: 51,100 ohms ±2%, 1/2 w.
R8	19A116278P339	Metal film: 24,900 ohms ±2%, 1/2 w.
R9	19A116278P169	Metal film: 511 ohms ±2%, 1/2 w.
R10	19A116278P349	Metal film: 31,600 ohms ±2%, 1/2 w.
R11 thru R13	19A116278P301	Metal film: 10,000 ohms ±2%, 1/2 w.
R14	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w.
R15	3R152P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R16	3R152P123J	Composition: 12,000 ohms ±5%, 1/4 w.
R17	3R152P242J	Composition: 2400 ohms ±5%, 1/4 w.
R18	3R152P620J	Composition: 62 ohms ±5%, 1/4 w.
R19	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R20	3R152P334J	Composition: 330,000 ohms ±5%, 1/4 w.
R21	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R22	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R23	3R152P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R24	3R152P242J	Composition: 2400 ohms ±5%, 1/4 w.
R25	3R152P511J	Composition: 510 ohms ±5%, 1/4 w.
R26	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R27	3R152P393J	Composition: 39,000 ohms ±5%, 1/4 w.
R28 and R29	3R152P152J	Composition: 1500 ohms ±5%, 1/4 w.
R30	3R152P822J	Composition: 8200 ohms ±5%, 1/4 w.
R31	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w.
R32	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
R33	3R152P242J	Composition: 2400 ohms ±5%, 1/4 w.
R34	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R38	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
		- - - - - - - - - TEST POINTS - - - - - - - - -
TP1	19B211379P1	Spring (Test Point).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

LBI4462A

NOTCH FILTER KIT
19A129373G3
(19C320252G1)

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116738P2	Polystyrene: 6800 pf ±2.5%, 33 v; sim to Mial Series 617.
C2	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C3	19A116738P3	Polystyrene: 0.01 µf ±2.5%, 33 v; sim to Mial Series 617.
C4	19A116738P2	Polystyrene: 6800 pf ±2.5%, 33 v; sim to Mial Series 617.
C5	5496267P16	Tantalum: 100 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C6	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B205354G4	Coil. Includes:
	5495789P3	Tuning slug.
L2 and L3	19B205354G5	Coil. Includes:
	5495789P3	Tuning slug.
		- - - - - - - - - - - PLUGS - - - - - - - - -
P5		(Part of printed wiring board 19C320214P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1 and Q2	19A115889P1	Silicon, NPN.
		- - - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R152P152J	Composition: 1.5K ohms ±5%, 1/4 w.
R2	3R152P822J	Composition: 8.2K ohms ±5%, 1/4 w.
R3	3R152P302J	Composition: 3K ohms ±5%, 1/4 w.
R4	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R5	3R152P242J	Composition: 2.4K ohms ±5%, 1/4 w.
R6*	3R152P222J	Composition: 2.2K ohms ±5%, 1/4 w.
		Earlier than REV A:
	3R152P512J	Composition: 5.1K ohms ±5%, 1/4 w.
R7	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A129488P1	Insulator. (Used with L1 & L3).
	19B219583P1	Support.
	N80P13004C6	Machine screw: No. 6-32 x 1/4. (Secures support to board).
	N404P13C6	Lockwasher, internal tooth: No. 6. (Secures Notch Filter support to mounting surface).
	N80P13005C6	Machine screw: No. 6-32 x 5/16. (Secures Notch Filter support to mounting surface).

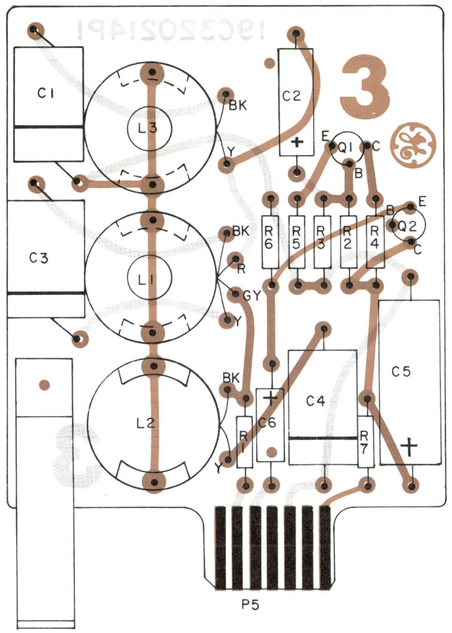
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

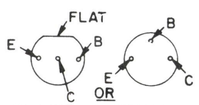
Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter," which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - To improve performance. Changed R6.

OUTLINE DIAGRAM



LEAD IDENTIFICATION FOR Q1 & Q2



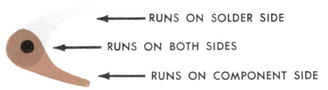
IN-LINE TRIANGULAR
VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

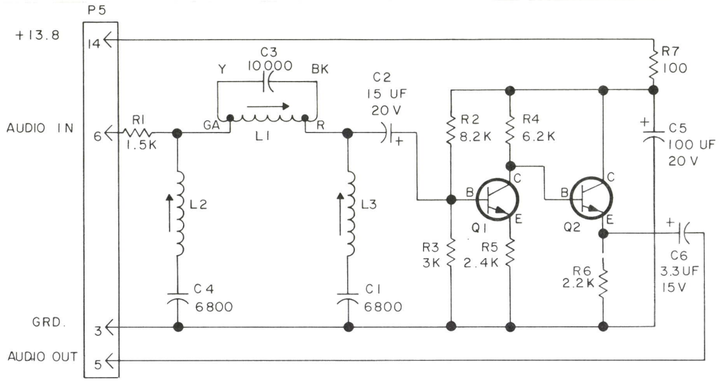
LEAD IDENTIFICATION FOR

TYPICAL CONTACT FINGER NUMBERING

(19C320709, Rev. 1)
(19C320214, Sh. 2, Rev. 3)
(19C320214, Sh. 3, Rev. 3)



SCHEMATIC DIAGRAM



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19C320252G1	A

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H= HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19B219646, Rev. 2)

SERVICE SHEET

TONE CONTROL PARALLEL TRANSMIT INDICATOR NOTCH FILTER (OPTION 8555)

INSTALLATION INSTRUCTIONS

12 HOUR OR 24 HOUR CLOCKS (OPTIONS 8534, 8535, 8568 & 8569)

THESE INSTRUCTIONS COVER THE INSTALLATION OF MODIFICATION KIT PL19A129372G1 - G4 FOR MODIFYING MASTR CONTROLLER TO PROVIDE 12 HOUR OR 24 HOUR CLOCK.

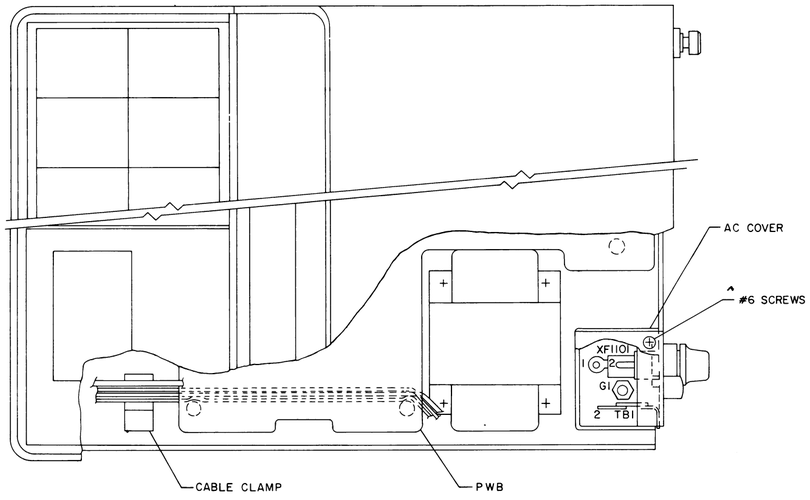
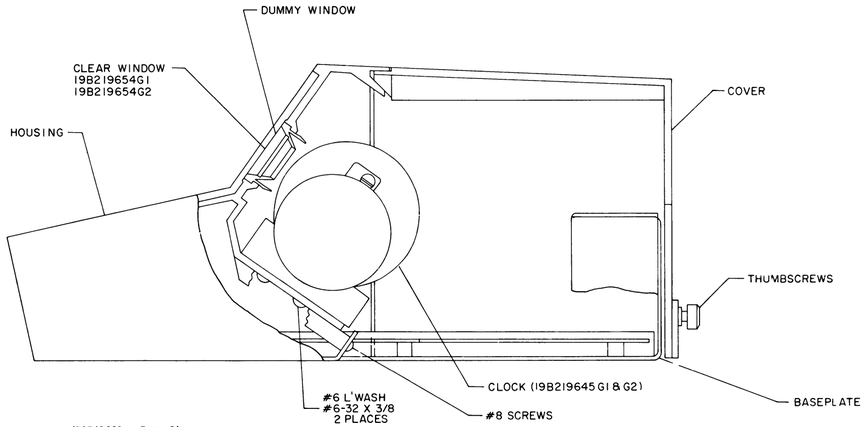


FIG. 2

(1) INSTALLATION INSTRUCTIONS:

1. LOOSEN THUMBSCREWS ON REAR OF UNIT AND REMOVE COVER.
2. REMOVE 4- #8 SCREWS FROM BASE PLATE AND REMOVE HOUSING FROM BASEPLATE.
3. REMOVE DUMMY WINDOW IN CLOCK OPENING AND REPLACE WITH CLEAR WINDOW FOR CLOCK. RETURN DUMMY TO STOCK.
4. MOUNT CLOCK AS SHOWN IN FIG. 1 WITH 2- #6-32X3/8 SCR. & L'WASH.
5. ROUTE WIRES FROM CLOCK UNDER PWB AS SHOWN IN FIG. 2 DO NOT ROUTE THRU CABLE CLAMP OR SPOT TIE TO OTHER WIRING.
6. REMOVE 2- #6 SCREWS AND AC COVER.
7. SOLDER ONE BLACK AND WHITE WIRE TO XF1101-2 AND THE OTHER BLACK AND WHITE WIRE TO TB1-2.
8. REMOVE NUT FROM G1. PLACE LUG FROM GREEN WIRE ON G1 FOLLOWED BY L'WASH. THEN RE-ASSEMBLE NUT.
9. RE-ASSEMBLE UNIT.



(19D416697, Rev. 3)

FIG. 1

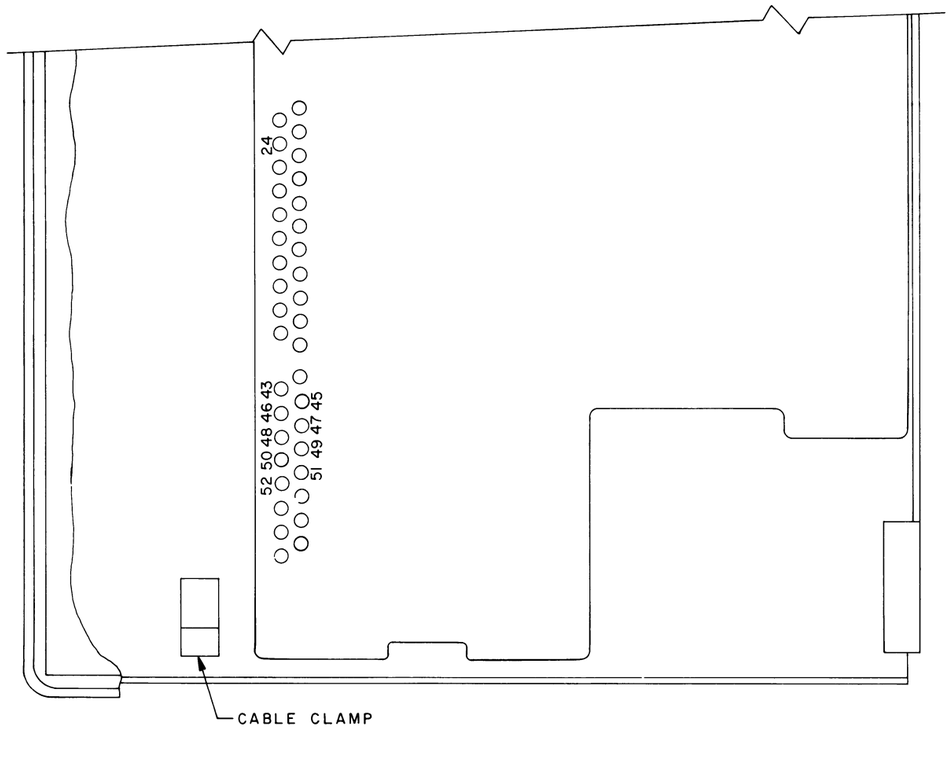
PARTS LIST

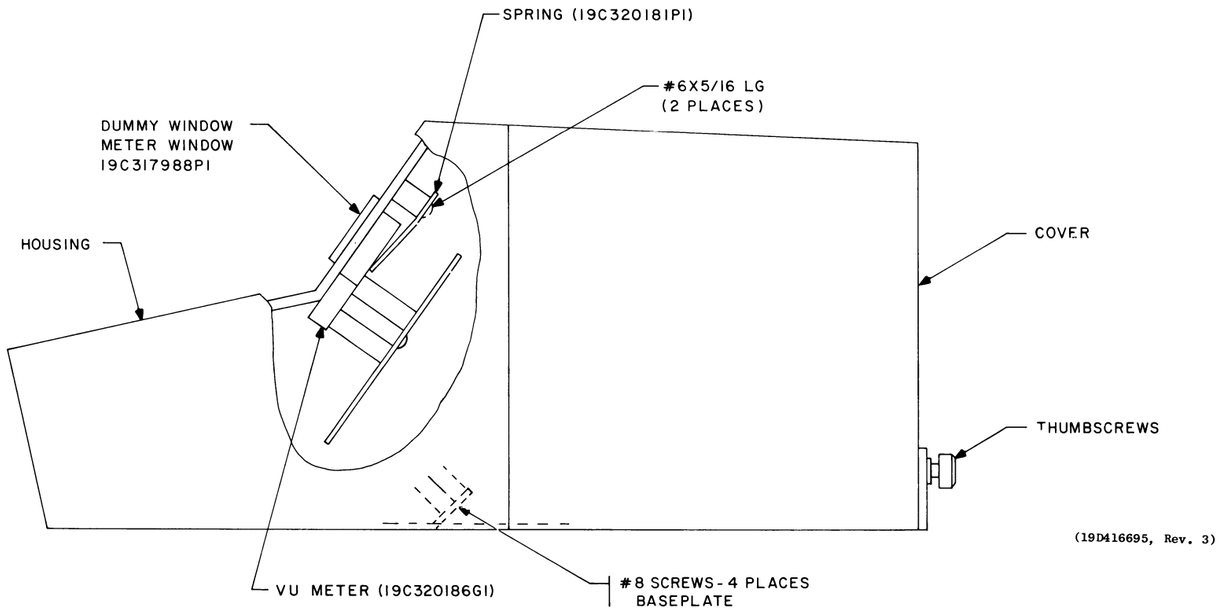
LBI-4677

MODIFICATION CLOCK KITS
19A129372G1 12 HOUR 60 CYCLE
19A129372G2 24 HOUR 60 CYCLE
19A129372G3 12 HOUR 50 CYCLE
19A129372G4 24 HOUR 50 CYCLE

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INDICATING DEVICES - - - - - - - -
M1	7491080P1	Clock, digital: 117 v, 60 Hz; sim to Pennwood Numechron 1P-12H.
M2	7491080P9	Clock, digital: 117 v, 60 Hz; sim to Pennwood Numechron STD-24H.
M3	7491080P5	Clock, digital: 117 v, 50 Hz; sim to Pennwood Numechron 1P-12H.
M4	7491080P10	Clock, digital: 117 v, 50 Hz; sim to Pennwood Numechron STD-24H.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B219654G1	Clock frame. (12 hour clock).
	19B219654G2	Clock frame. (24 hour clock).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES





(19D416695, Rev. 3)

THESE INSTRUCTIONS COVER THE INSTALLATION OF MODIFICATION KIT PL19A129382G1 FOR MODIFYING MASTR CONTROLLER TO PROVIDE VU METER.

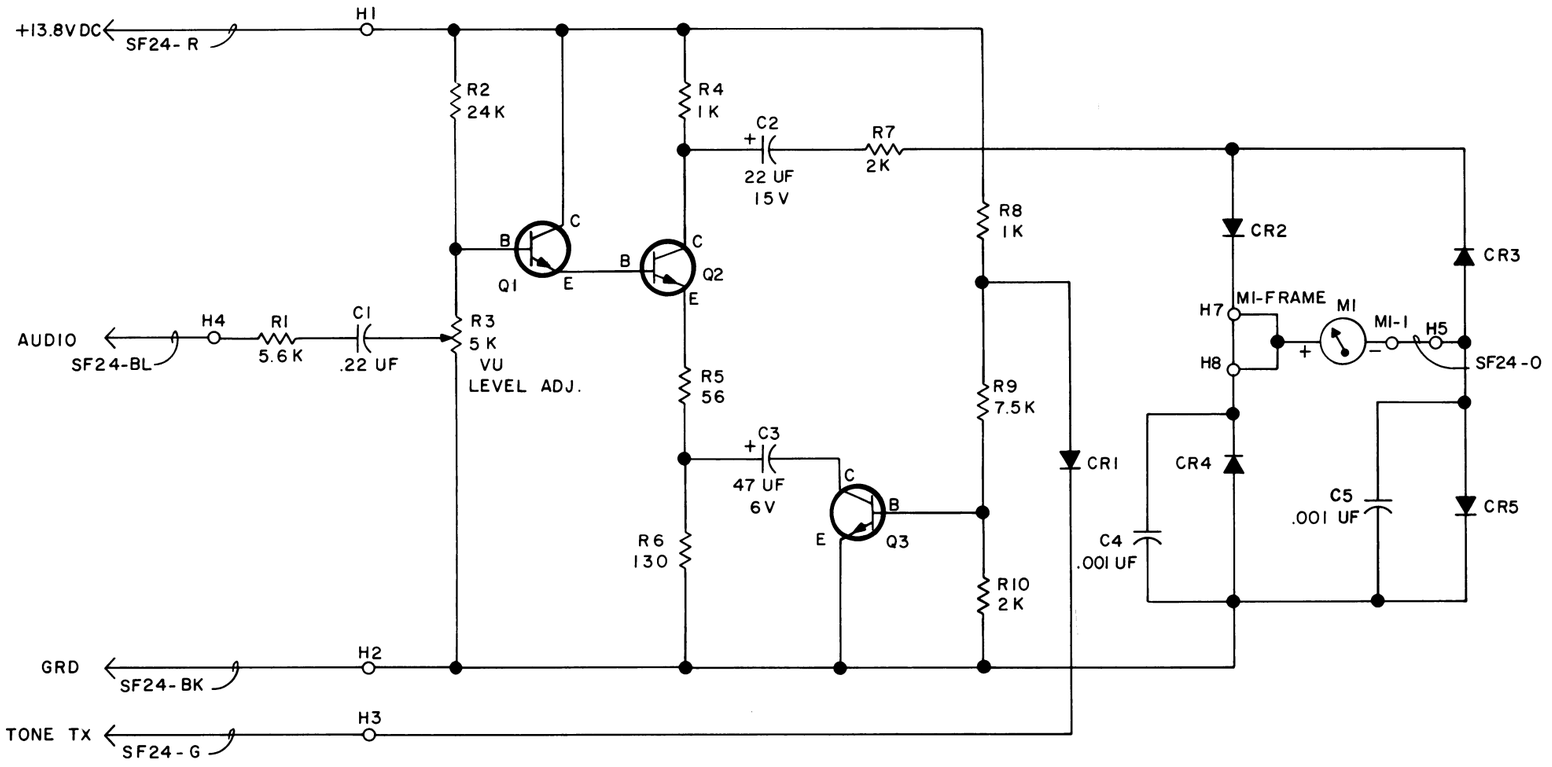
(1)

INSTALLATION INSTRUCTIONS:

1. LOOSEN THUMBSCREWS ON REAR OF UNIT AND REMOVE COVER.
2. REMOVE 4- #8 SCREWS FROM BASEPLATE AND REMOVE HOUSING FROM BASEPLATE.
3. REMOVE DUMMY WINDOW AND INSERT METER WINDOW. RETURN DUMMY WINDOW TO STOCK.
4. INSTALL SPRING (19C320181P1) LOOSELY WITH 2- #6 SCREWS AS SHOWN.
5. INSTALL VU METER (19C320186G1) UNDER SPRING AND TIGHTEN SPRING HDW.
6. ROUTE WIRES THROUGH CABLE CLAMP.
   CONNECT THE GREEN WIRE TO J1111 - 45
   CONNECT THE BLUE WIRE TO J1111 - 43
   CONNECT THE BLACK WIRE TO J1111 - 46 - 52
   CONNECT THE RED WIRE TO J1111 - 24
7. RE-ASSEMBLE UNIT.

INSTALLATION INSTRUCTIONS

VU METER KIT (OPTION 8529)



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PLI9C320186G1	A

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

19C320186G1

Rev. A - To improve performance.
Changed Q3.

PARTS LIST

LBI-4474A

VU METER KIT
19A129382G1

SYMBOL	GE PART NO.	DESCRIPTION
		COMPONENT BOARD 19C320186G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080P109	Polyester: 0.22 µf ±10%, 50 VDCW.
C2	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C3	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C4 and C5	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	19A115250P1	Silicon.
CR2 thru CR5	4038056P1	Germanium.
		- - - - - - - - - - METERS - - - - - - - - - -
M1	19A116729P1	Panel DC: 200 µa mechanism; sim to Jewell Instruments 20504003-032.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1 and Q2	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q3*	19A115720P1	Silicon, NPN; sim to Type 2N2222.
		Earlier than REV A:
	19A115552P1	Silicon, NPN; sim to Type 2N2714.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P562J	Composition: 5600 ohms ±5%, 1/4 w.
R2	3R152P243J	Composition: 24,000 ohms ±5%, 1/4 w.
R3	19B209358P105	Variable, carbon film: approx 75 to 5000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R4	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R5	3R152P560J	Composition: 56 ohms ±5%, 1/4 w.
R6	3R152P131J	Composition: 130 ohms ±5%, 1/4 w.
R7	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R8	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R9	3R152P752J	Composition: 7500 ohms ±5%, 1/4 w.
R10	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SCHEMATIC DIAGRAM

VU METER KIT (OPTION 8529)

(19C320231, Rev. 2)

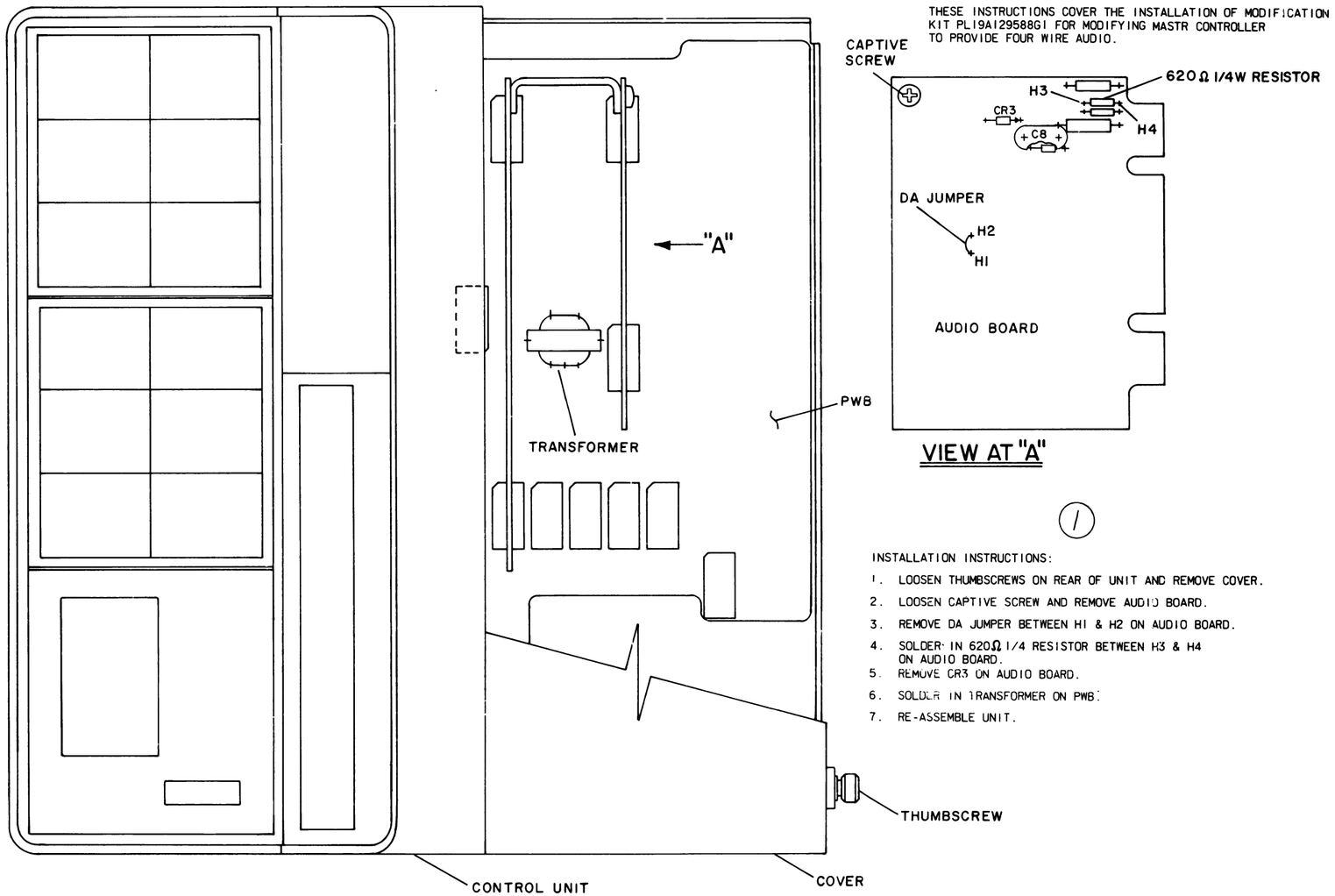
PARTS LIST

LBI-4476

WIRE AUDIO KIT
19A129588G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T1	5491609P1	Audio: 0.3-3 KHz freq range, 6 VDC operating, Pri: 500 ohms ±10% imp CT, 29 ohms ±10% DC res, Sec: 500 ohms ±10% imp, 22 ohms ±10% DC res.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



VIEW AT "A"

THESE INSTRUCTIONS COVER THE INSTALLATION OF MODIFICATION KIT PL19A129588G1 FOR MODIFYING MASTR CONTROLLER TO PROVIDE FOUR WIRE AUDIO.

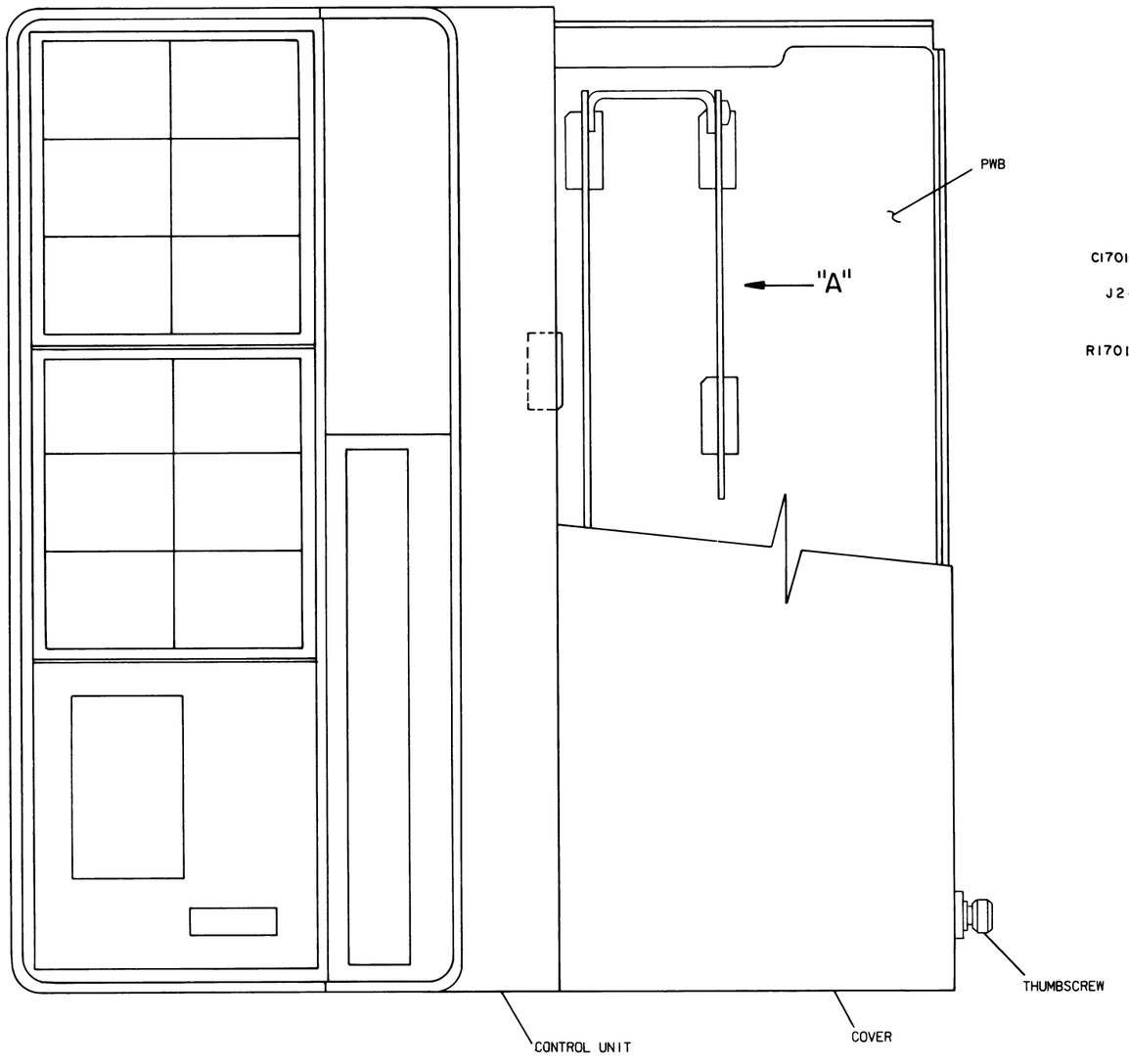
INSTALLATION INSTRUCTIONS:

1. LOOSEN THUMBSCREWS ON REAR OF UNIT AND REMOVE COVER.
2. LOOSEN CAPTIVE SCREW AND REMOVE AUDIO BOARD.
3. REMOVE DA JUMPER BETWEEN H1 & H2 ON AUDIO BOARD.
4. SOLDER IN 620Ω 1/4 RESISTOR BETWEEN H3 & H4 ON AUDIO BOARD.
5. REMOVE CR3 ON AUDIO BOARD.
6. SOLDER IN TRANSFORMER ON PWB.
7. RE-ASSEMBLE UNIT.

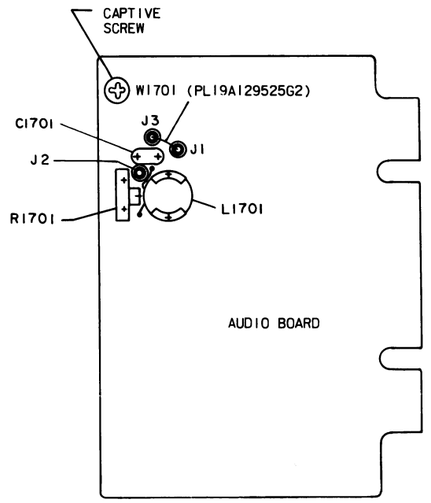
(19C320425, Rev. 4)

INSTALLATION INSTRUCTIONS

FOUR WIRE AUDIO KIT
(OPTION 8553)



THESE INSTRUCTIONS COVER THE INSTALLATION OF MODIFICATION KIT PL19A129317G1 FOR MODIFYING MASTR CONTROLLER TO ADD AUDIO LINE COMPENSATION.



VIEW AT "A"

(1) INSTALLATION INSTRUCTIONS:

1. LOOSEN THUMBSCREWS ON REAR OF UNIT AND REMOVE COVER.
2. LOOSEN CAPTIVE SCREW AND REMOVE AUDIO BOARD.
3. INSTALL C1701 (CAP), L1701 (COIL), R1701 (RES) AND W1701 AS SHOWN IN VIEW AT "A".
4. REASSEMBLE UNIT.

(19C320470, Sh. 1, Rev. 4)

PARTS LIST

LBI-4469

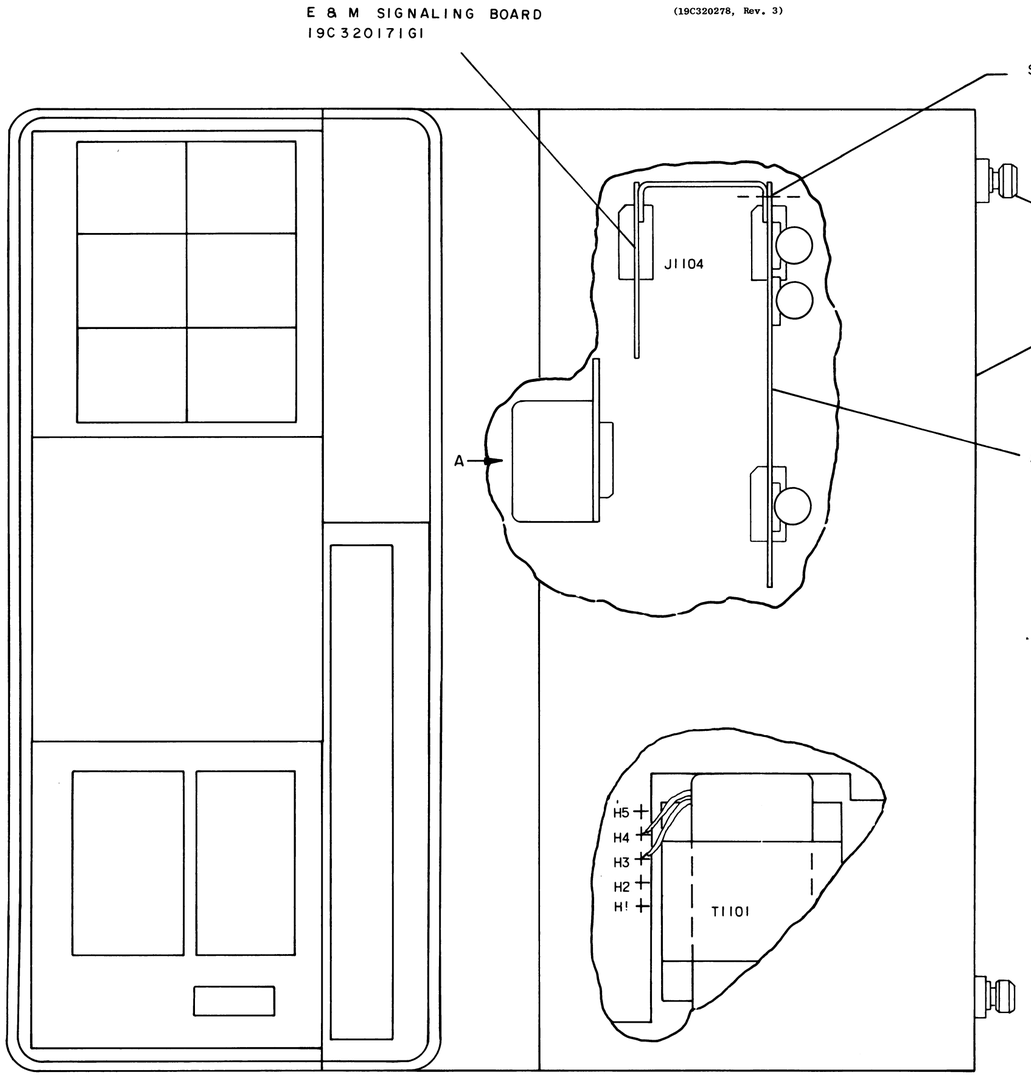
LINE COMPENSATION KIT
19A129317G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1701	19A116080P204	Polyester: 0.033 µf ±5%, 50 VDCW.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1701	19B206972G73	Coil: 106.2 mh.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1701	19B209358P106	Variable, carbon film: approx 75 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
		- - - - - - - - - - - - CABLES - - - - - - - - - -
W1701	19A129525G2	Cable: approx 3 inches long.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

INSTALLATION INSTRUCTIONS

AUDIO LINE COMPENSATION KIT
(OPTION 8532)



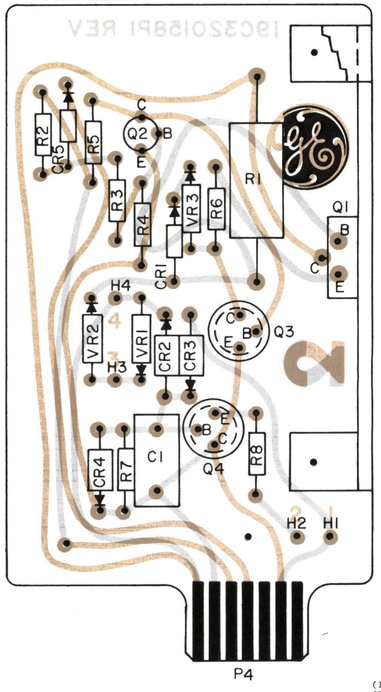
(1) INSTALLATION INSTRUCTIONS:

1. LOOSEN THUMBSCREWS ON REAR OF UNIT AND REMOVE COVER.
2. INSERT E & M SIGNALLING BOARD (PL19C320171G1) INTO J1104.
3. ON MOTHER BOARD MOVE R-W WIRE OF TRANSFORMER T1101 FROM H4 TO H3 AND R-BL WIRE FROM H3 TO H4.
4. IF BATTERY STDBY BOARD IS USED, MOVE JUMPER BETWEEN H2 & H3 TO H3 & H1 ON BATTERY STDBY BOARD.
5. SECURE E & M SIGNALLING BOARD TO AUDIO BOARD WITH CAPTIVE HARDWARE SUPPLIED.
6. RE-ASSEMBLE UNIT.

INSTALLATION INSTRUCTIONS

E & M SIGNALING (DC CONTROL)
(OPTION 8530)

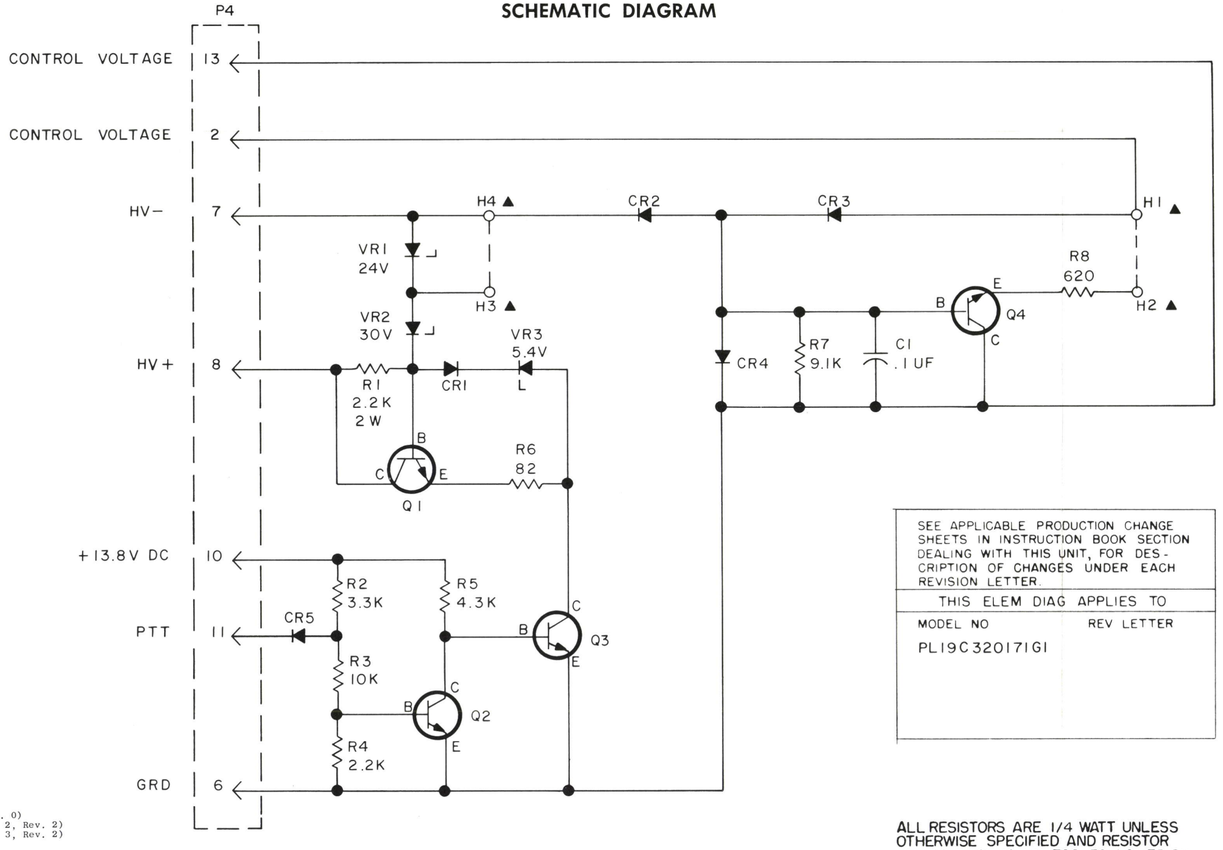
OUTLINE DIAGRAM



(19C320712, Rev. 0)
(19C320158, Sh. 2, Rev. 2)
(19C320158, Sh. 3, Rev. 2)

TYPICAL CONTACT FINGER NUMBERING

SCHEMATIC DIAGRAM

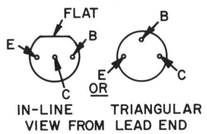


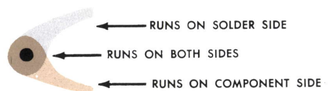
(19C320227, Rev. 1)

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19C320171G1	

LEAD IDENTIFICATION FOR Q2, Q3 & Q4





NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

▲ NOTE:
FOR 24 V DC OPERATION
CONNECT JUMPERS BETWEEN
H1 & H2 AND BETWEEN H3 & H4

PARTS LIST

LBI-4457

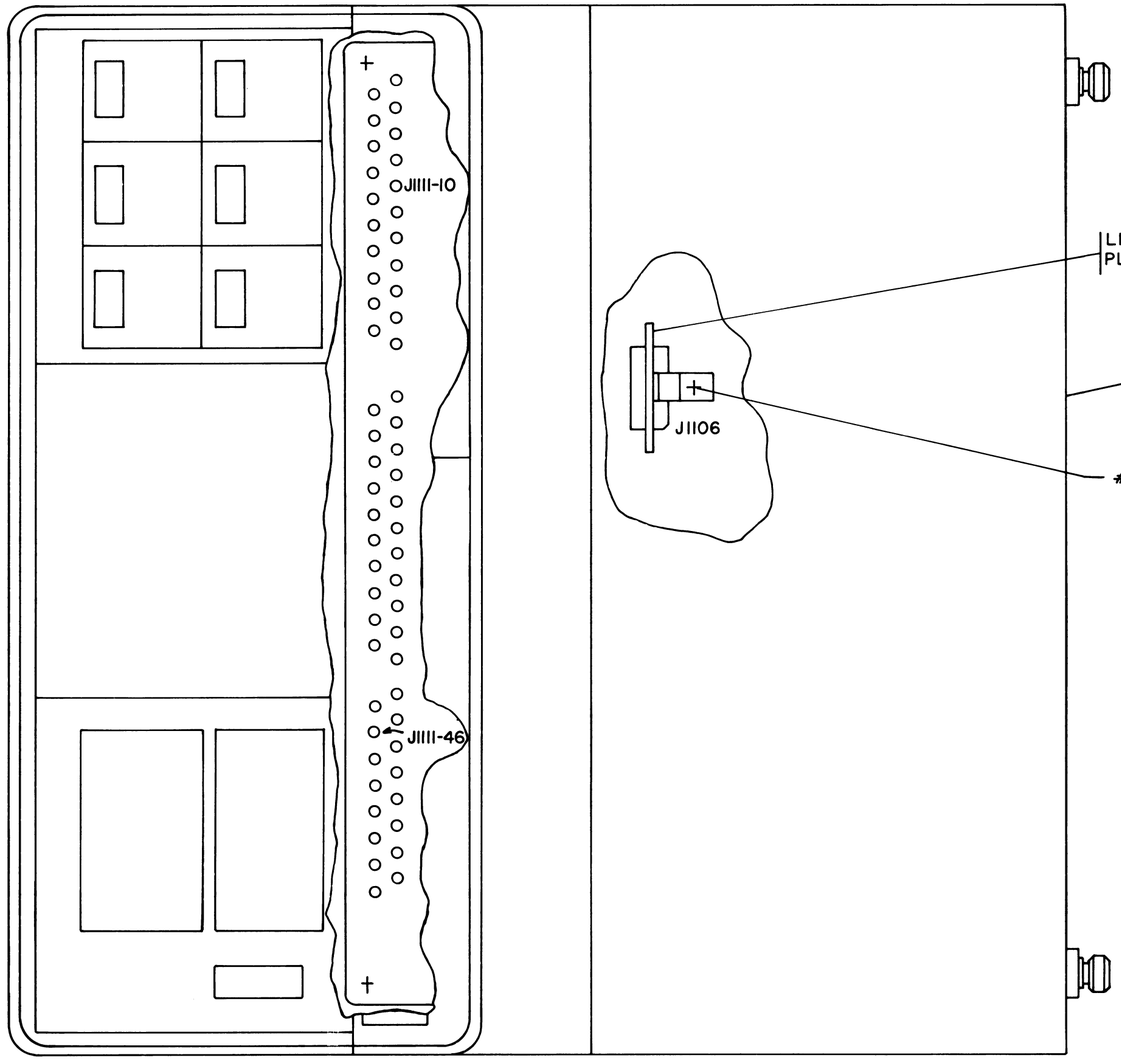
E/M SIGNALING BOARD
19C320171G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	19A115250P1	Silicon.
CR2 thru CR4	4037822P2	Silicon.
CR5	19A115250P1	Silicon.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P4		(Part of printed wiring board, 19C320158P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A129183P1	Silicon, NPN.
Q2	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q3 and Q4	19A115300P1	Silicon, NPN; sim to Type 2N3053.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R79P222J	Composition: 2200 ohms ±5%, 2 w.
R2	3R152P332J	Composition: 3300 ohms ±5%, 1/4 w.
R3	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R4	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R5	3R152P432J	Composition: 4300 ohms ±5%, 1/4 w.
R6	3R152P820J	Composition: 82 ohms ±5%, 1/4 w.
R7	3R152P912J	Composition: 9100 ohms ±5%, 1/4 w.
R8	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1	4036887P19	Silicon, Zener.
VR2	4036887P21	Silicon, Zener.
VR3	4036887P5	Silicon, Zener.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SERVICE SHEET

DC CONTROL E & M SIGNALING BOARD
(OPTION 8530)



THESE INSTRUCTIONS COVER THE INSTALLATION OF COMPONENT BOARD PL19C320185G1 FOR MODIFYING MASTR CONTROLLER TO PROVIDE FLASHING POWER ON INDICATOR WHEN TONE CONTROL SYSTEMS ARE OPERATING ON BATTERY POWER.

(19C320287, Rev. 3)

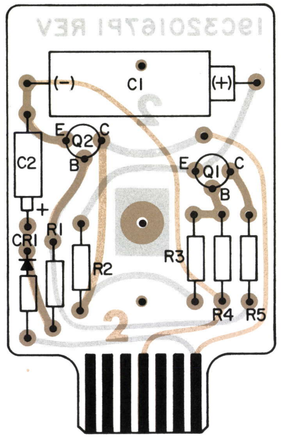
1. INSTALLATION INSTRUCTIONS

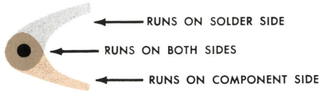
1. LOOSEN THUMBSCREWS ON REAR OF UNIT AND REMOVE COVER.
2. REMOVE SCREW, LOCATED NEXT TO J1106, FROM BOARD.
3. INSTALL BOARD PL19C320185G1 IN LOCATION SHOWN AND REPLACE SCREW THRU BRACKET AND INTO ORIGINAL LOCATION.
4. MOVE BROWN WIRE FROM J1111-46 TO J1111-10.
5. RE-ASSEMBLE UNIT.

INSTALLATION INSTRUCTIONS

LIGHT FLASHER KIT
(OPTION 8545)

OUTLINE DIAGRAM

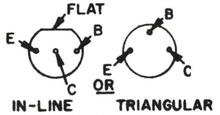




TYPICAL CONTACT FINGER NUMBERING

(19C320705, Rev. 0)
(19C320167, Sh. 2, Rev. 2)
(19C320167, Sh. 3, Rev. 2)

LEAD IDENTIFICATION FOR Q1 & Q2

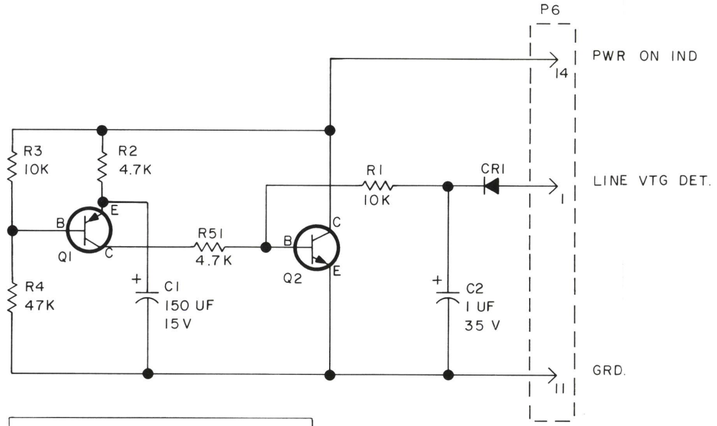


IN-LINE TRIANGULAR
VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

SCHEMATIC DIAGRAM

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG = 1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.



(19B219643, Rev. 1)

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19C320185G1	

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

PARTS LIST

LBI-4461

LIGHT FLASHER
19C320185G1

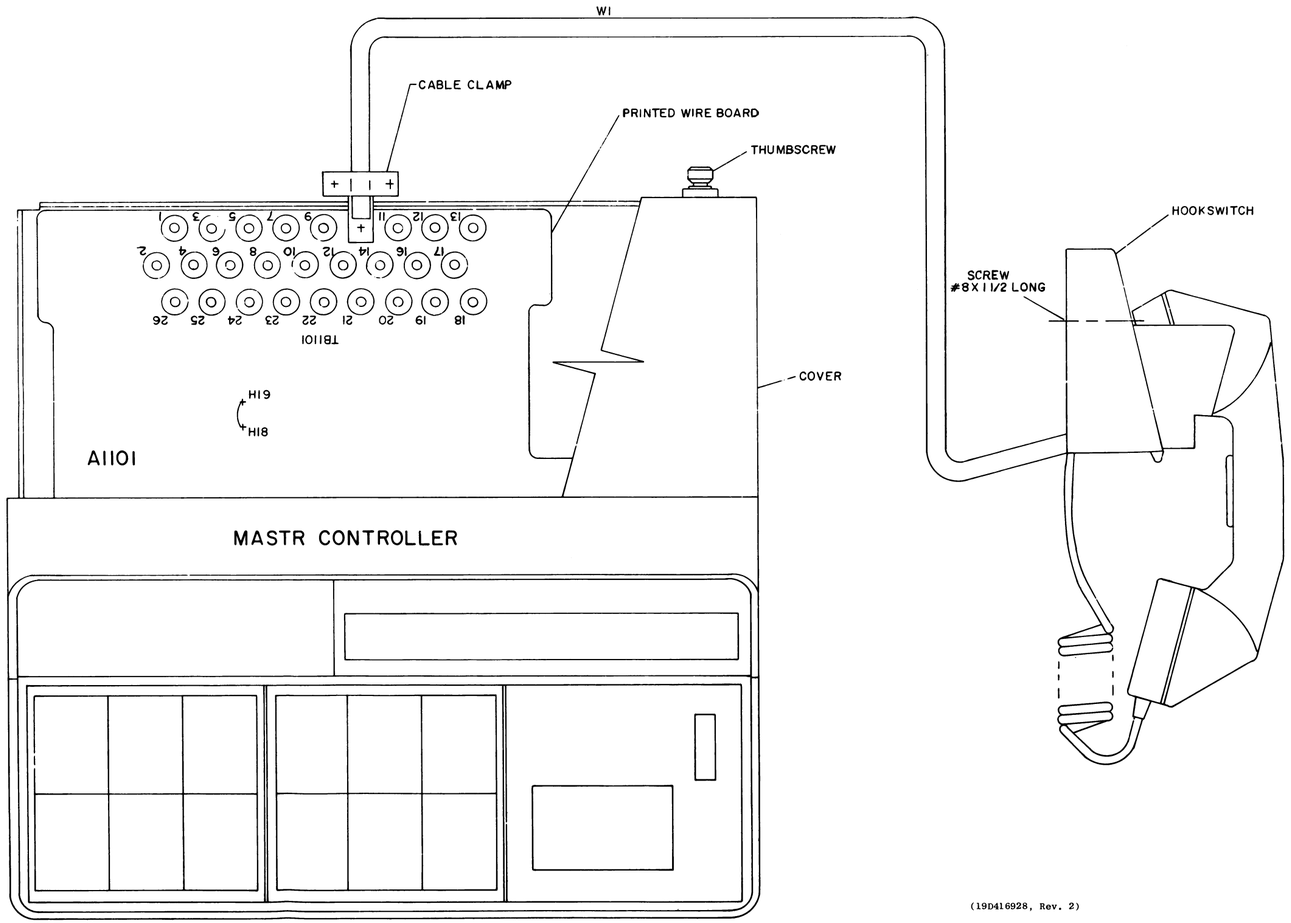
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	5496267P12	Tantalum: 150 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C2	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
		- - - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	19A115250P1	Silicon.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P6		(Part of printed wiring board, 19C320167P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q2	19A115889P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R2	3R152P472J	Composition: 4700 ohms ±5%, 1/4 w.
R3	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R4	3R152P473J	Composition: 47,000 ohms ±5%, 1/4 w.
R5	3R152P472J	Composition: 4700 ohms ±5%, 1/4 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SERVICE SHEET

LIGHT FLASHER BOARD
(OPTION 8545)

THESE INSTRUCTIONS COVER THE INTERCONNECTIONS HOOKSWITCH, HANDSET TO MASTR CONTROLLER.



(19D416928, Rev. 2)

INSTRUCTIONS

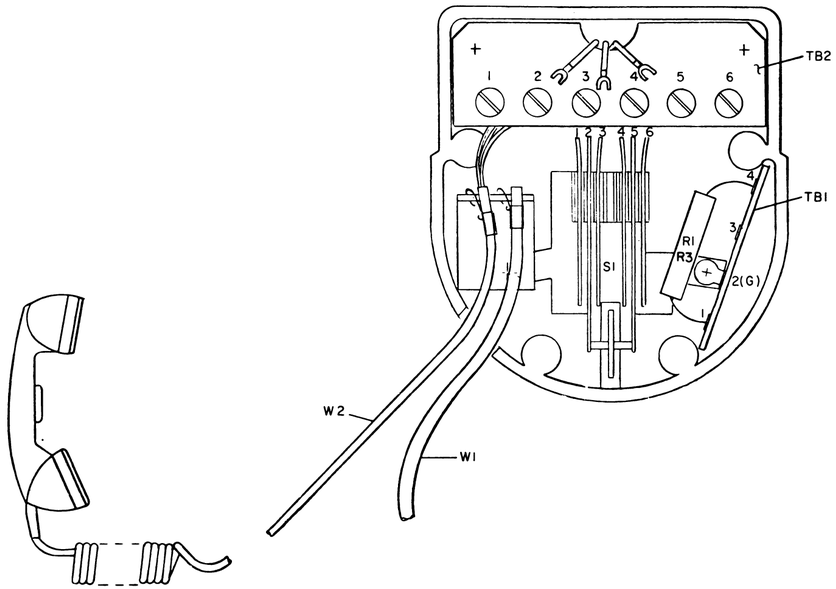
1. LOOSEN THUMB SCREW ON REAR OF CONTROL UNIT AND REMOVE COVER.
2. ROUTE W1 THRU CABLE CLAMP AS SHOWN.
3. CLIP JUMPER BETWEEN H18 & H19 OF A1101.
4. COMPLETE W1 CONNECTIONS TO MASTR CONTROLLER PER CONNECTIONS CHART.
5. RE-ASSEMBLE UNIT.
6. MOUNT HOOKSWITCH AS DESIRED WITH (2) #8 X 1 1/2 LG SCREWS SUPPLIED.

CONNECTIONS CHART	
WIRE	TO
W1-N22-W	TB1101-17
W1-N22-BL	TB1101-24
W1-N22-BR	TB1101-25
W1-N22-R	TB1101-23
W1-N22-G	TB1101-21
W1-N22-BK	TB1101-22

INSTALLATION INSTRUCTIONS

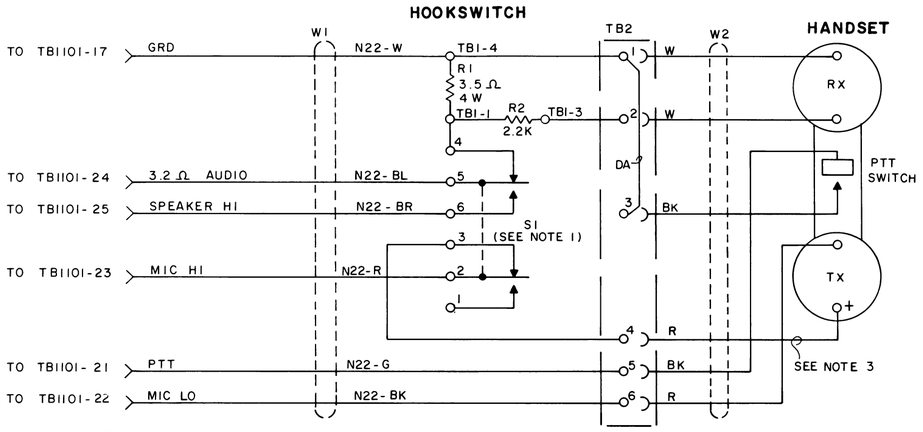
HANDSET HOOKSWITCH
(OPTIONS 8542 & 8543)

OUTLINE DIAGRAM



(19C320716, Rev. 1)

SCHEMATIC DIAGRAM



NOTES:
1. SHOWN WITH HANDSET OFF HOOK.
2. UNLESS OTHERWISE SPECIFIED, ALL WIRE IS N22.
3. RED WIRE WITH WHITE BANDS NEAR TERMINAL MUST CONNECT TO TB2-4.

(19B219863, Rev. 2)

PARTS LIST
LBI-4475B
MASTR CONTROLLER HOOKSWITCH HANDSET
19C320436G1

SYMBOL	GE PART NO.	DESCRIPTION
		---------- RESISTORS ----------
R1	5493035P10	Wirewound: 3.5 ohms ±5%, 5 w; sim to Hamilton Hall Type HR.
R2	3R77P222K	Composition: 2200 ohms ±10%, 1/2 w.
		---------- TERMINAL BOARDS ----------
TB1	7775500P10	Phen: 4 terminals.
TB2	19B219866G1	Terminal board: 6 terminals.
		---------- CABLES ----------
W1	19B219865G1	Cable: approx 5 feet long.
		HANDSET 19A116792P3 (BLACK)
		Transmitter cartridge. Shure Brothers RP117.
		Receiver cartridge. ITT P75547.
W2		Cable. Telephone Components TP-601 BLACK.
		Switch. Telephone Components 741-SA. (Includes 4 springs in housing with soldered on leads).
		Case. Telephone Components 74-H-01. (Less Receiver and Transmitter caps).
		Receiver Cap. Telephone Components 74-R-01.
		Transmitter Cap. Telephone Components 74-T-01.
		---------- MISCELLANEOUS ----------
	19A121612P1	Handset holder. (Includes S1).
	N113P1524P2	Tap screw: No. 8-15 x 1-1/2.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SERVICE SHEET

HANDSET HOOKSWITCH
(OPTIONS 8542 & 8543)

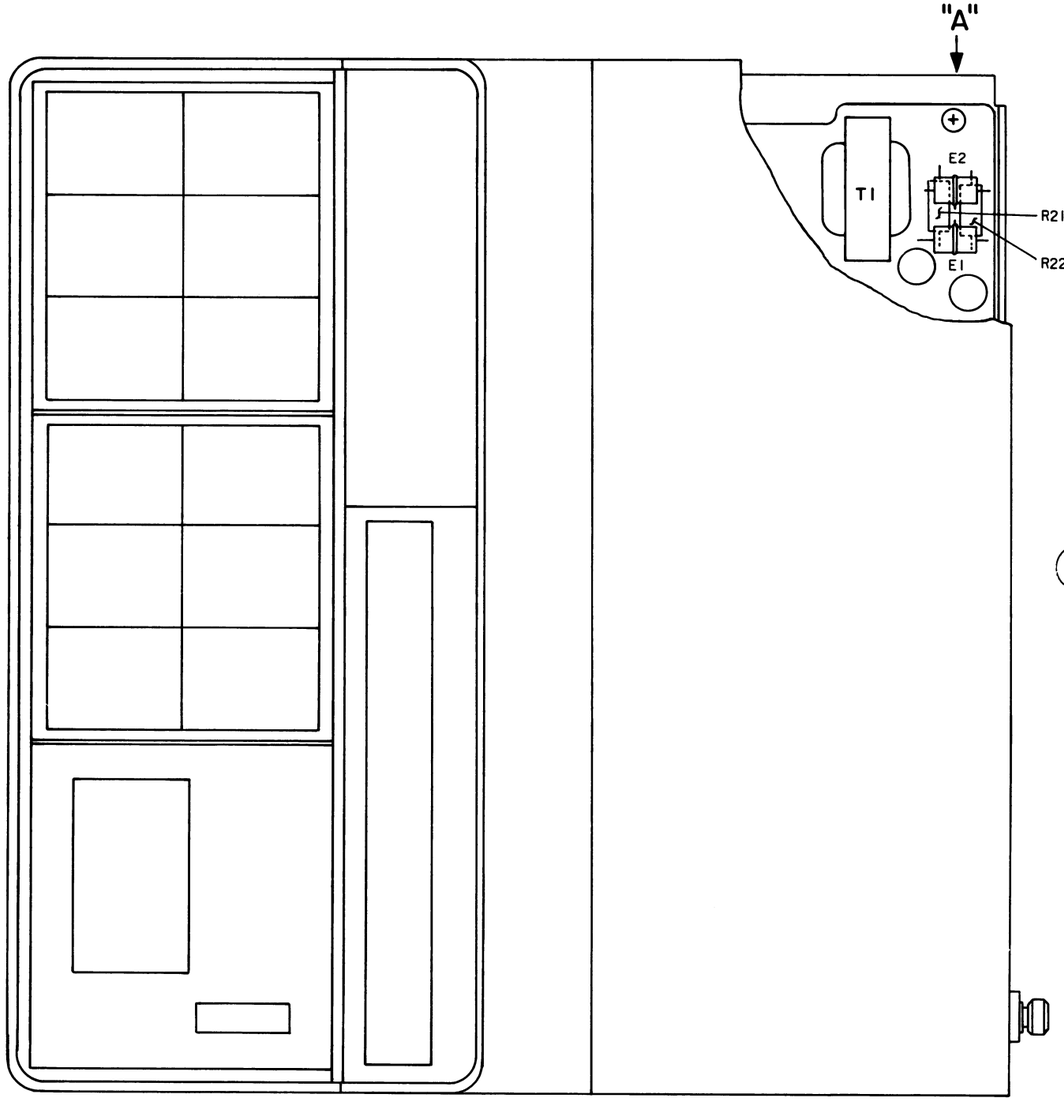
PARTS LIST

LBI-30494

TELEPHONE LINE SURGE PROTECTION KIT
19A136911G1

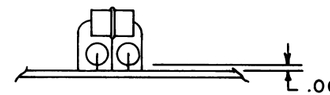
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - TELEPHONE PROTECTORS - - - - - - - -
E1 and E2	19A134356P1	Telephone protector: 250-350 VDC breakdown to ground, 700 VDC breakdown Line to Line; sim to JOSLYN 2022-24.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



(19C320272, Rev. 6)

THESE INSTRUCTIONS COVER THF INSTALLATION OF MODIFICATION KIT PL19A136911G1 FOR MODIFYING MASTR CONTROLLER TO PROVIDE TELEPHONE LINE. VOLTAGE SURGE PROTECTION.



VIEW "A" ROTATED 180°
ASM. AS SHOWN SO BODY OF COMPONENTS DO NOT TOUCH PW BOARD.

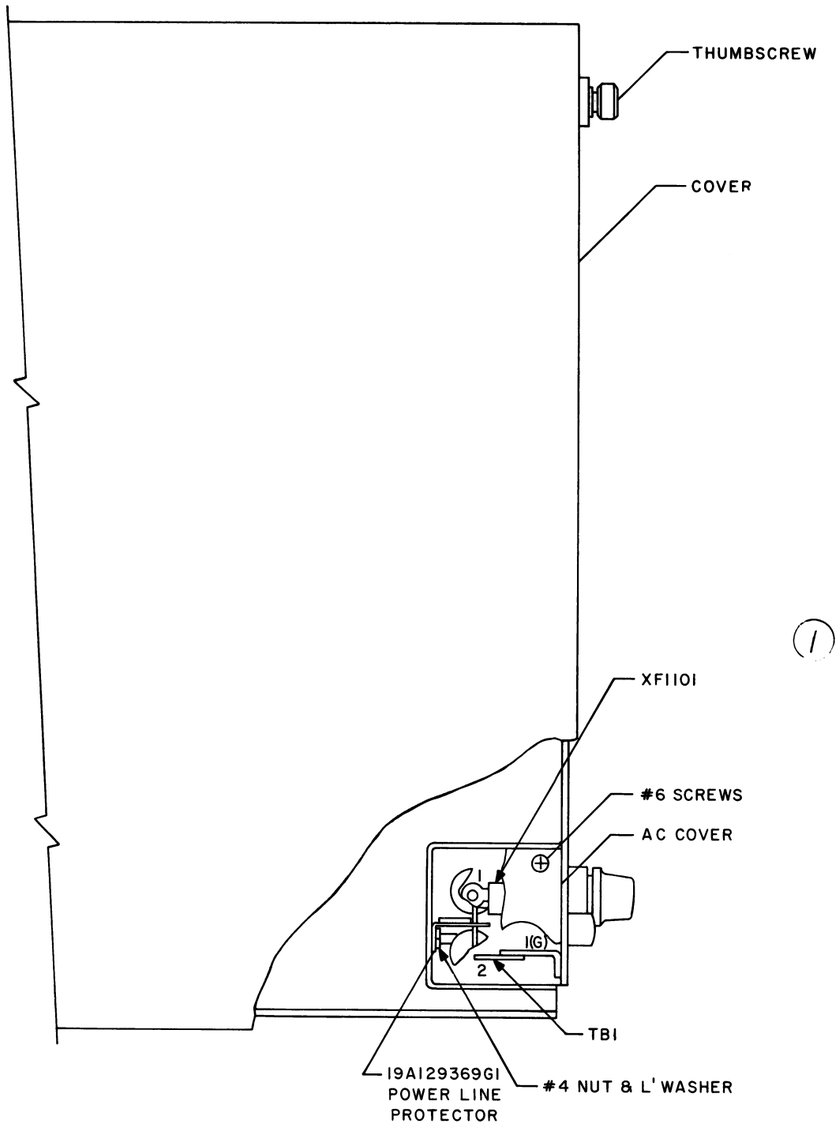
1. INSTALLATION INSTRUCTIONS
   1. LOOSEN THUMBSCREWS ON REAR OF UNIT AND REMOVE COVER.
   2. REMOVE 4-#8 SCREWS FROM BASE PLATE AND REMOVE HOUSING FROM BASE PLATE.
   3. REMOVE ALL SCREWS FROM COMPONENT SIDE OF PWB AND REMOVE PWB FROM BASE PLATE.
   4. SOLDER E1, AND E2 (19A134356P1) IN PWB AS SHOWN.
   5. TRIM LEADS ON E1 AND E2 TO .09 MAX. ON SOLDER SIDE OF PWB.
   6. REASSEMBLE UNIT.
   7. THE EFFECTIVENESS OF THE LINE PROTECTORS IS DEPENDENT UPON A GOOD EARTH GROUND. THE GROUND CONNECTION SHOULD BE MADE WITH A SINGLE #14 AWG OR LARGER COPPER CONDUCTOR AND SHOULD BE CONNECTED TO THE GROUND SIDE OF THE PROTECTORS AT THE BOARD MOUNTING SCREW. THE CONDUCTOR SHOULD BE SHORT, STRAIGHT AND A CONTINUOUS PIECE OF WIRE.

   PROVIDE THE LOWEST POSSIBLE RESISTANCE AT THE CONNECTORS AT EACH END OF THE GROUND WIRE.

DF-4094

INSTALLATION INSTRUCTIONS

TELEPHONE LINE SURGE PROTECTION
(OPTION 8531)



THESE INSTRUCTIONS COVER THE INSTALLATION OF MODIFICATION KIT PL19A129370G1 FOR MODIFYING MASTR CONTROLLER TO PROVIDE POWER LINE VOLTAGE SURGE PROTECTION.

(1) INSTALLATION INSTRUCTIONS:

1. LOOSEN THUMB SCREWS ON REAR OF UNIT AND REMOVE COVER.
2. REMOVE 2- #6 SCREWS FROM AC COVER AND REMOVE COVER.
3. INSTALL POWER LINE PROTECTOR (19A129369G1) WITH #4 HDW. AS SHOWN. DISCARD EXTRA HDW.
4. SOLDER ONE V18-RED WIRE TO XF1101-1 AND SOLDER THE OTHER V18-RED WIRE TO TB1-2.
5. RE-ASSEMBLE UNIT.

(19C320273, Sh. 1, Rev. 4)

INSTALLATION INSTRUCTIONS

POWER LINE SURGE PROTECTION
(OPTION 8556)

PARTS LIST

LBI-4471A

THYRACTOR KIT
19A129370G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - DIODES AND RECTIFIERS - - - - -
CR1	19A116062P1	Selenium.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1	7775500P14	Phen: 4 terminals.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	N80P9005C6	Screw, phillips: panhead, No. 4-40 x 5/16.
	7141225P2	Hexnut: No. 4-40.
	N40P11C6	Lockwasher, internal tooth: No. 4.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PARTS LIST

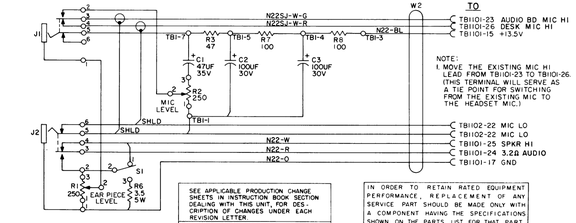
LBI-4479B

HEADSET ADAPTOR KIT
19A129002G2

SYMBOL	GE PART NO.	DESCRIPTION
		ADAPTOR BOX 19C317786G2
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496267P20	Tantalum: 47 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C2 and C3	19A115680P12	Electrolytic: 100 µf +150% -10%, 30 VDCW; sim to Mallory Type TTX.
		- - - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 and J2	5493473P11	Jack, panel: 3 conductors; sim to Switchcraft MT-335.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	5491537P14	Variable, carbon film: 250 ohms ±20%, 0.3 w; sim to CTS Series 70.
R2	5494774P101	Variable, carbon film: 250 ohms ±20%, 0.3 w; sim to CTS Series 70 Control.
R3	3R77P470J	Composition: 47 ohms ±5%, 1/2 w.
R6	5493035P10	Wirewound: 3.5 ohms ±5%, 5 w; sim to Hamilton Hall Type HH.
R7 and R8	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	5491899P1	Toggle: SPDT, 3 amps at 125 VAC/VDC; sim to Cutler-Hammer 8382K13.
		- - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1	7775500P23	Phen: 7 terminals.
		- - - - - - - - - - CABLES - - - - - - - - - -
W2	19C317809G2	Cable, RF: approx 9 feet long. Includes:
	4029840P2	Contact, electrical: sim to Amp 42827-2. Quantity (8).
	19B209260P103	Terminal, solderless: sim to AMP 60495-1. Quantity (8).
		EYELET BOARD 19A129003G1
		- - - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1 thru J4	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4035656P7	Spacer, threaded; thd size No. 4-40. (Used with eyelet board).
	19A128187G1	Cover. (Adaptor box).
	19C317785P1	Base plate. (Adaptor box).
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4. (Secures Cover to Base).
	5490407P6	Grommet, rubber. (Used with W2).
	4029851P6	Clip loop: nylon, sim to Weckesser 5/16-4-128. (Used with W2).
	19A115729P4	Flat washer. (Used with R1-R2).
	19A116296P1	Knob, push on: sim to Rohden Mfg Co. 26600-358. (Used with R1-R2).

SYMBOL	GE PART NO.	DESCRIPTION
	N529P20C13	Plug button. (Used with R1-R2).
	7115130P11	Lockwasher: sim to Shakeproof 1222-1. (Used with S1).
	4033394P1	Knurled nut: No. 15/32. (Used with S1).
	7127662P2	Flatwasher: 5/8 dia. (Used with S1).
	7115195P2	Hexnut: No. 15/32-32. (Used with S1).
	NP270466	Nameplate.
	19A128163P1	Insulator board. (Used with J1, and J2).
	N80P9009C6	Screw, phillips, recessed pan head: No. 4-40 x 5/16. (Used with W2 clip loop, J1, J2). mounting).
	N402P5C5	Flatwasher: No. 4. (Used with W2 clip loop).
	4029851P5	Clip loop, nylon: sim to Weckesser 1/4-4-128. (Used to secure W2 externally).
	7142162P56	Spacer. (Used when clearance between Adaptor box and mounting surface is desired).
	N196P812C13	Round head, slotted: No. 8 x 3/4. (Used when mounting Adaptor box to Wood.
	19B201074P404	Tap screw, Phillips POZIDRIV®: No. 8-32 x 1/4. (Used when mounting Adaptor box to Metal).
	19A116578P1	Earpiece (Option 5228).
	19A116579P1	Headband (Option 5229).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN MICROFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

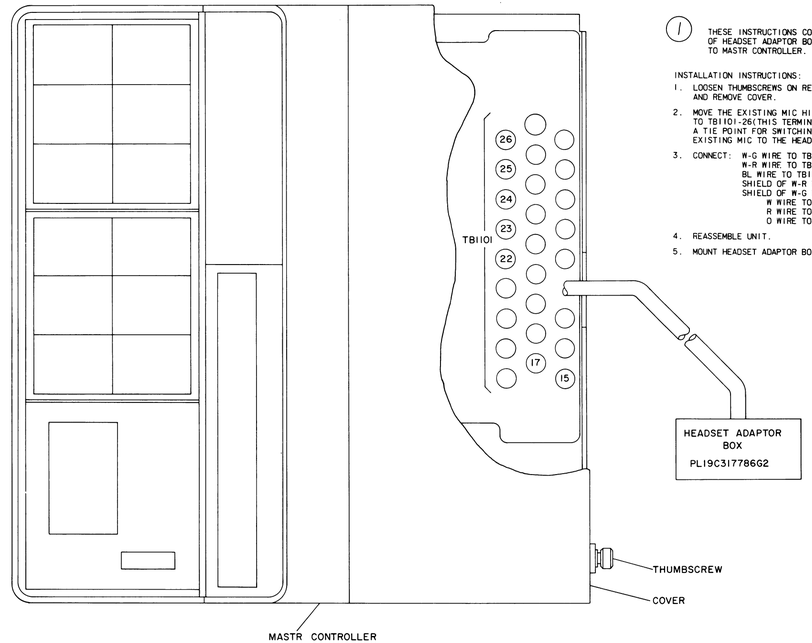
SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO. PL19C317786G2 REV LETTER

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

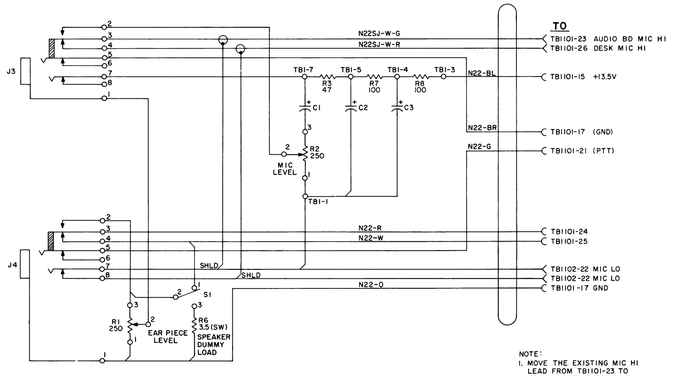
(19B219809, Rev. 3)



(19C320407, Rev. 2)

SERVICE SHEET

HEADSET ADAPTOR KIT
(OPTION 8546)



NOTE:
1. MOVE THE EXISTING MIC HI LEAD FROM TBI101-23 TO TBI101-26 (THIS TERMINAL WILL SERVE AS A TIE POINT FOR SWITCHING FROM THE EXISTING MIC TO THE HEADSET MIC.)

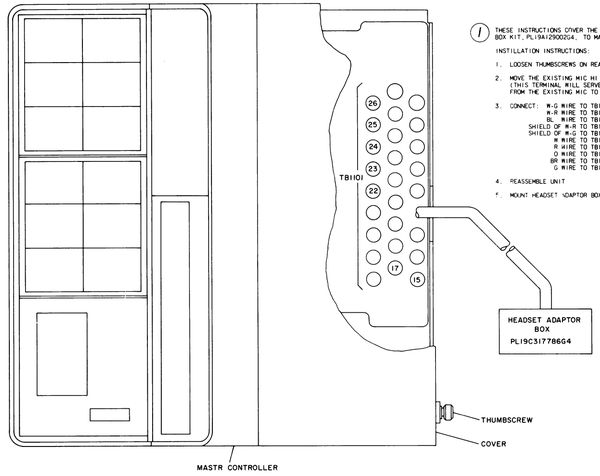
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PLI9C317786G4	

(19C320804, Rev. 2)



1. THESE INSTRUCTIONS COVER THE INSTILLATION OF HEADSET ADAPTOR BOX KIT, PLI9A129002G4, TO MASTR CONTROLLER.

INSTILLATION INSTRUCTIONS:

1. LOOSEN THUMBSCREWS ON REAR OF UNIT AND REMOVE COVER.
2. MOVE THE EXISTING MIC HI LEAD FROM TBI101-23 TO TBI101-26 (THIS TERMINAL WILL SERVE AS A TIE POINT FOR SWITCHING FROM THE EXISTING MIC TO THE HEADSET MIC).
3. CONNECT: W-G WIRE TO TBI101-23 (MIC HI)
W-R WIRE TO TBI101-26
BL WIRE TO TBI101-15 (+13.5V)
SHIELD OF W-R TO TBI101-22 (MIC LO)
SHIELD OF W-G TO TBI101-22 (MIC LO)
R WIRE TO TBI101-24
W WIRE TO TBI101-25
O WIRE TO TBI101-17 (GND)
BR WIRE TO TBI101-17 (GND)
G WIRE TO TBI101-21 (PTT)
4. REASSEMBLE UNIT
5. MOUNT HEADSET ADAPTOR BOX WITH HARDWARE SUPPLIED

(19C320805, Rev. 3)

PARTS LIST

LBI-4636A

HEADSET ADAPTER KIT
19A129002G4

SYMBOL	GE PART NO.	DESCRIPTION
		ADAPTOR BOX 19C317786G4
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	5496267P20	Tantalum: 47 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C2 and C3	19A115680P12	Electrolytic: 100 µf +150% -10%, 30 VDCW; sim to Mallory Type TTX.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J3 and J4	5493473P13	Jack, panel: 3 conductors; sim to Audio Devel Co, PJ-280.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	5491537P14	Variable, carbon film: 250 ohms ±20%, 0.3 w; sim to CTS Series 70.
R2	5494774P101	Variable, carbon film: 250 ohms ±20%, 0.3 w; sim to CTS Series 70 Control.
R3	3R77P470J	Composition: 47 ohms ±5%, 1/2 w.
R6	5493035P10	Wirewound: 3.5 ohms ±5%, 5 w; sim to Hamilton Hall Type HR.
R7 and R8	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
		- - - - - - - - - - SWITCHES - - - - - - - - -
S1	5491899P1	Toggle: SPDT, 3 amps at 125 VAC/VDC; sim to Cutler-Hammer H2RZK13.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7775500P23	Phen: 7 terminals.
		- - - - - - - - - - CABLES - - - - - - - - - -
W4	19C320803G2	Cable: approx 9 feet long.
		EYELET BOARD 19A129003G2
		- - - - - - - - JACKS AND RECEPTACLES - - - - -
J1 thru J4	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	4033656P7	Spacer, threaded: thd size No. 4-40. (Used with eyelet board).
	19A128187G1	Cover. (Adaptor box).
	19C317785P1	Base plate. (Adaptor box).
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4. (Secures Cover to Base).
	5490407P6	Grommet, rubber. (Used with W3).
	4029851P6	Clip loop: nylon, sim to Weckesser 5/16-4-128. (Used with W3).
	19A115729P4	Flat washer. (Used with R1-R2).
	19A116296P1	Knob, push on: sim to Rohden Mfg Co, 26600-355, (Used with R1-R2).
	N529P20C13	Plug button. (Used with R1-R2).
	7115130P11	Lockwasher: sim to Shakeproof 1222-1. (Used with S1).
	4033394P1	Knurled nut: No. 15/32. (Used with S1).
	7127662P2	Flatwasher: 5/8 dia. (Used with S1).
	7115195P2	Hexnut: No. 15/32-32. (Used with S1).
	NP270466	Nameplate.
	19A128163P1	Insulator board. (Used with J3 and J4).
	N80P9009C6	Screw, phillips, recessed pan head: No. 4-40 x 5/16. (Used with W3 clip loop, J3, J4 mounting).
	N402P5C5	Flatwasher: No. 4. (Used with W3 clip loop).
	4029851P5	Clip loop, nylon: sim to Weckesser 1/4-4-128. (Used to secure W3 externally).
	7142162P56	Spacer, (Used when clearance between Adaptor box and mounting surface is desired).
	N196P812C13	Round head, slotted: No. 8 x 3/4. (Used when mounting Adaptor box to Wood.
	19B201074P404	Tap screw, Phillips POZIDRIV : No. 8-32 x 1/4. (Used when mounting Adaptor box to Metal).
	19A116578P3	Earpiece (Option 5273).
	19A116579P3	Head Band (Option 5274).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SERVICE SHEET

HEADSET ADAPTOR KIT (OPTION 8575)

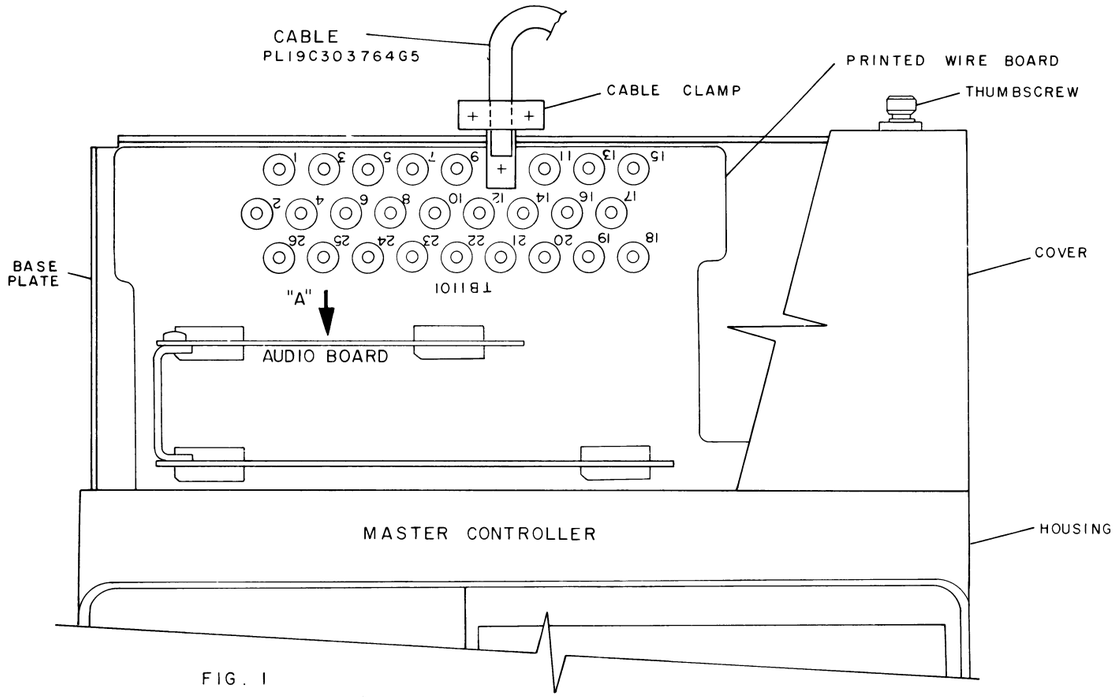


FIG. 1

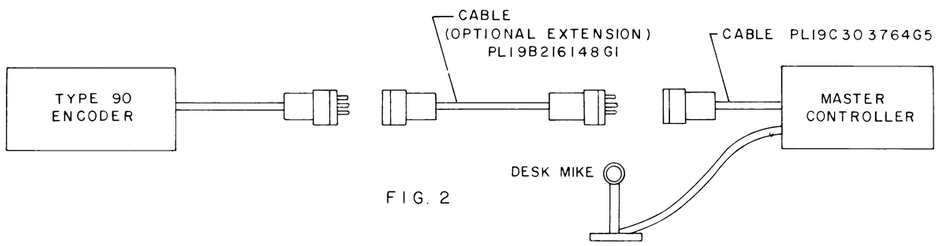
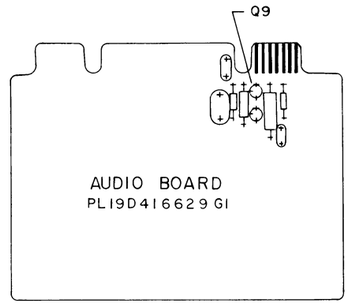
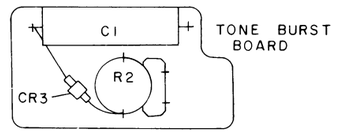


FIG. 2

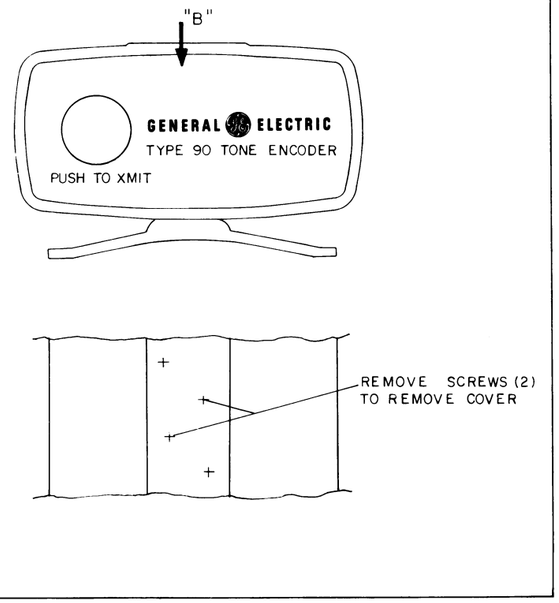


VIEW AT "A"

FIG. 3



VIEW AT "B"



THESE INSTRUCTIONS COVER THE INTERCONNECTION OF TYPE 90 ENCODER TO MASTR CONTROLLER.

(1) INSTRUCTIONS

1. LOOSEN THUMB SCREWS ON REAR OF MASTR CONTROLLER UNIT AND REMOVE COVER.
2. CONNECT I9C303764G5 CABLE TO MASTR CONTROLLER PER CONNECTION CHART.
3. IF THE TONE ENCODER IS EQUIPPED WITH THE TONE BURST OPTION MOVE BL WIRE FROM TBIIOI-8 TO TBIIOI-21. CLIP OUT Q9 ON AUDIO BOARD (SEE VIEW AT "A") AND CLIP OUT CR3 ON TONE BURST BOARD (AI302) FIG. 3.
4. REASSEMBLE UNITS.

CONNECTION CHART	
WIRE	TO
G	TBIIOI-IO
SHIELD	TBIIOI-7
BR	TBIIOI-I7
BL	TBIIOI-8

(19D416920, Rev. 2)

INSTALLATION INSTRUCTIONS

TYPE 90 ENCODER (OPTION 8564)

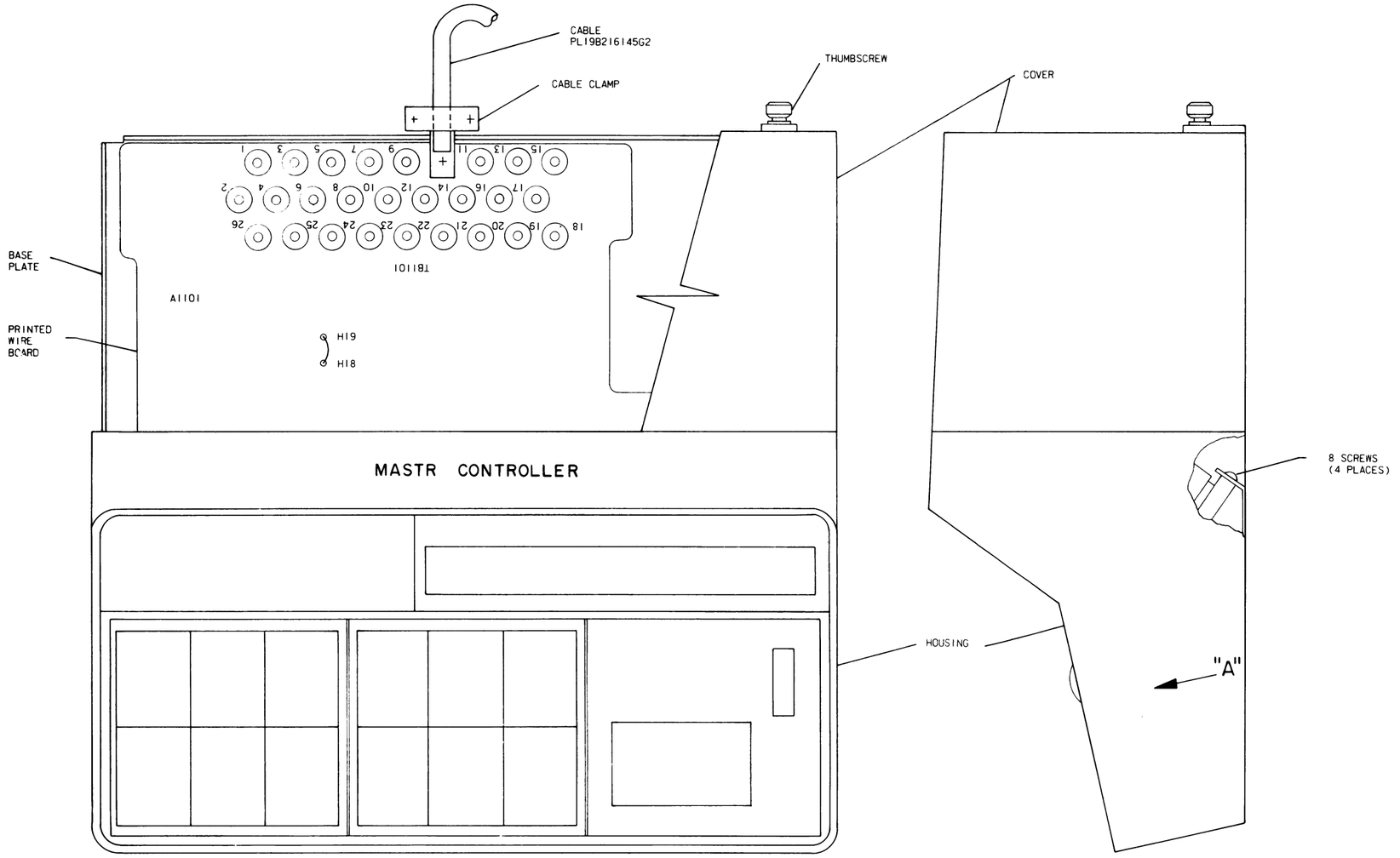


FIG. 1

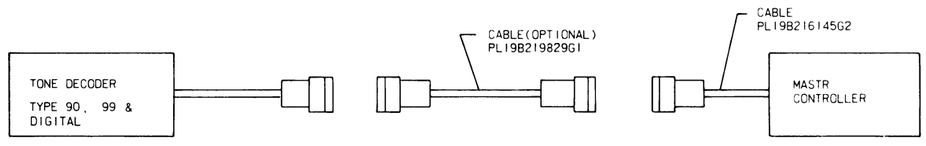
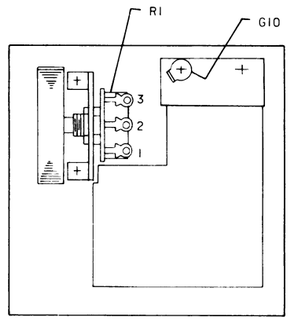


FIG. 2

THESE INSTRUCTIONS COVER THE INTERCONNECTION OF TYPE 90 DECODER, TYPE 99 DECODER OR DIGITAL DECODER TO MASTR CONTROLLER. (KIT PL19A12716G3)

INSTRUCTIONS:

1. LOOSEN THUMBSCREWS IN REAR OF MASTR CONTROLLER UNIT AND REMOVE COVER.
2. REMOVE FOUR (4) #8 SCREWS AND REMOVE HOUSING.
3. MOUNT G10 TERMINAL (A4036835P6) UNDER SCREW AS SHOWN IN VIEW AT "A".
4. MOVE SHIELD FROM VOLUME CONTROL (R1-1) TO G10.
5. CONNECT 27 OHM 1/2 W RESISTOR FROM G10 TO R1-1.
6. CONNECT CABLE (19B216145G2) TO MASTR CONTROLLER UNIT PER CONNECTION CHART. SEE FIGURE 1.
7. REMOVE JUMPER FROM A1101-H18 TO A1101-H19.
8. REASSEMBLE UNITS.



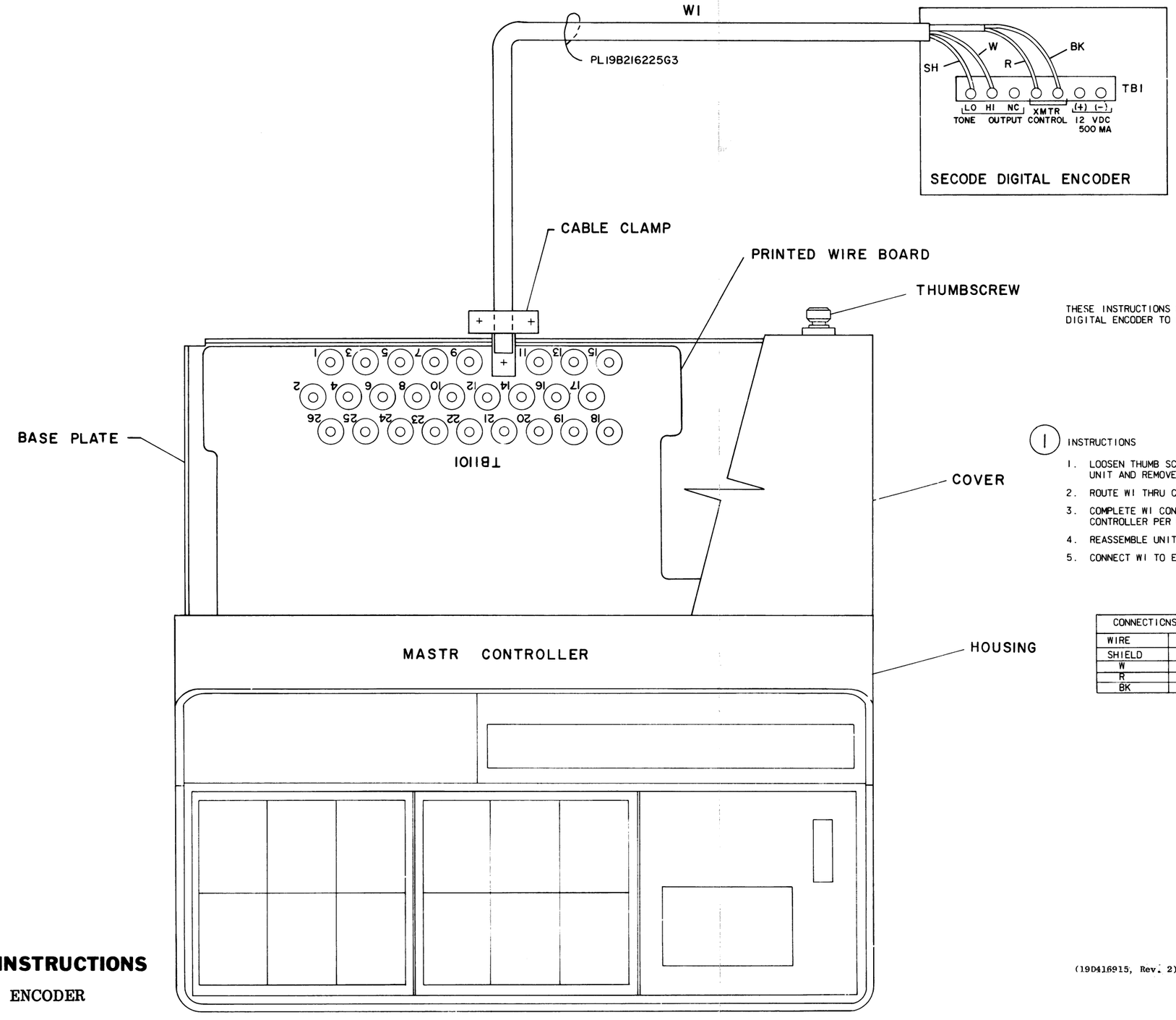
VIEW AT "A"

CONNECTION CHART		
CABLE PL19B216145G2	TO	REMARKS
R	TB1101-24	
BK	TB1101-25	SEE NOTE 1
SHIELD	TB1101-7	

NOTE:
1. WHEN OPTION 8560 OR 8565 IS USED WITH HANDSET OPTION 8582-8585, CONNECT BK WIRE TO TB1101-26.

INSTALLATION INSTRUCTIONS

TYPE 90, TYPE 99 OR DIGITAL DECODER (OPTIONS 8560 OR 8565)



THESE INSTRUCTIONS COVER THE INTERCONNECTIONS OF SECODE DIGITAL ENCODER TO MASTR CONTROLLER.

(1) INSTRUCTIONS

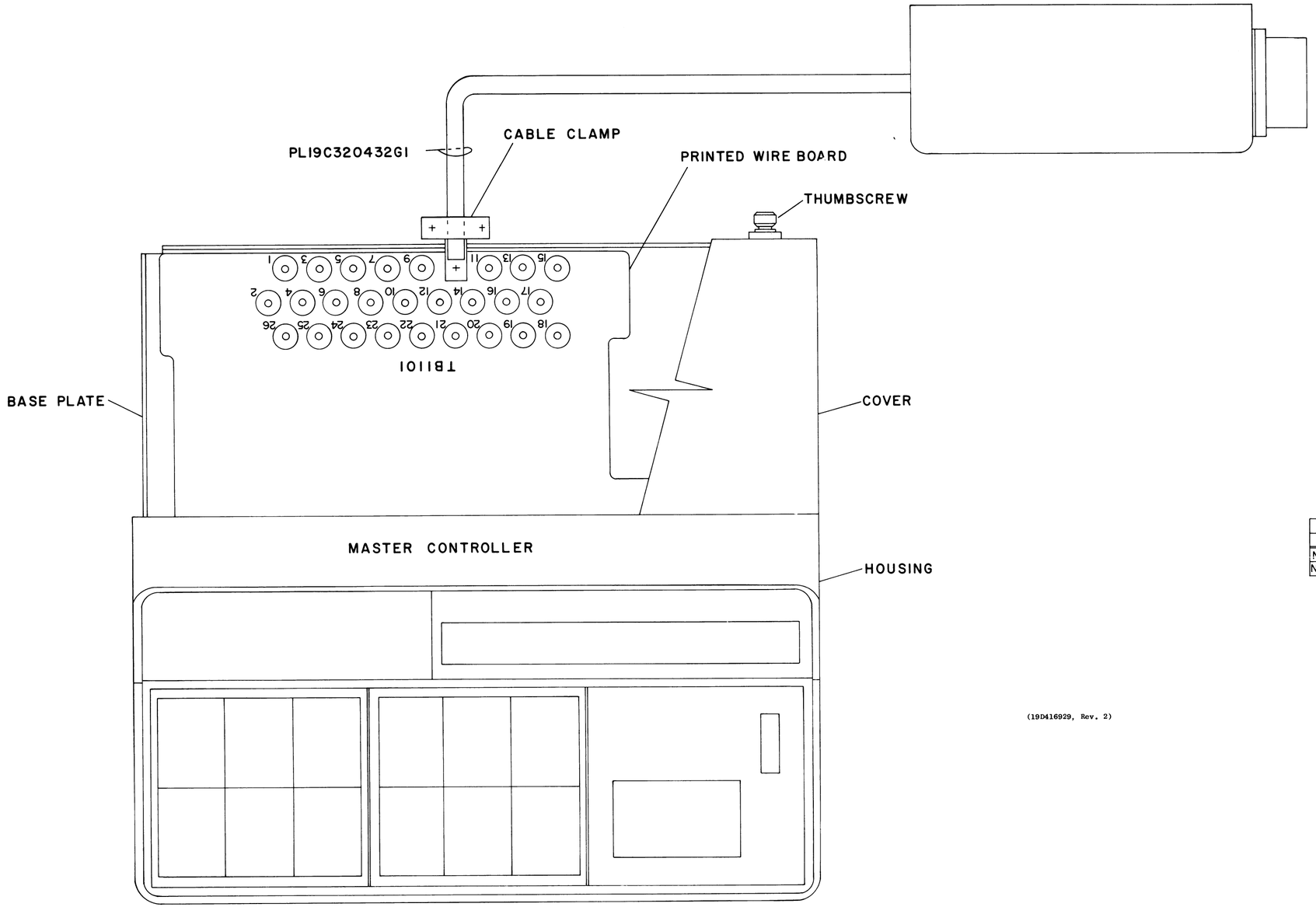
1. LOOSEN THUMB SCREWS ON REAR OF CONTROL UNIT AND REMOVE COVER.
2. ROUTE W1 THRU CABLE CLAMP AS SHOWN.
3. COMPLETE W1 CONNECTIONS TO MASTR CONTROLLER PER CONNECTIONS CHART.
4. REASSEMBLE UNIT.
5. CONNECT W1 TO ENCODER TB-1 AS SHOWN.

CONNECTIONS CHART	
WIRE	TO
SHIELD	TB1101-7
W	TB1101-10
R	TB1101-8
BK	TB1101-17

(19D416915, Rev. 2)

INSTALLATION INSTRUCTIONS

SECODE DIGITAL ENCODER
(OPTION 8563)



(19D416929, Rev. 2)

THESE INSTRUCTIONS COVER THE INTERCONNECTIONS MIC, BOOM TO MASTR CONTROLLER.

(1) INSTRUCTIONS

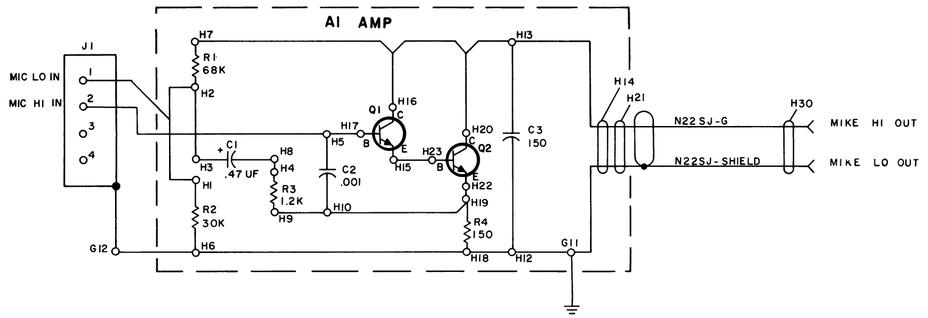
1. LOOSEN THUMB SCREW ON REAR OF CONTROL UNIT AND REMOVE COVER.
2. ROUTE W1 THRU CABLE CLAMP AS SHOWN.
3. COMPLETE W1 CONNECTIONS TO MASTR CONTROLLER PER CONNECTIONS CHART.
4. RE-ASSEMBLE UNIT.

CONNECTIONS CHART	
WIRE	TO
N22SJ-G	TB1101-23
N22SJ-SHIELD	TB1101-22

MIKE BOOM INTERCONNECTIONS

OPTIONS 8549 & 8550

WIRING DIAGRAM



ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN MICROFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

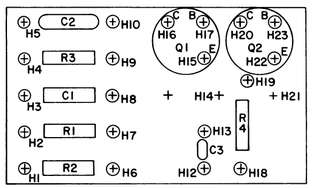
NOTE:
UNLESS OTHERWISE NOTED
ALL WIRE IS DA.

(19C320435, Rev. 3)

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.	
THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
19C320432G1	A

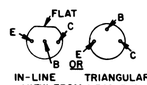
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

OUTLINE DIAGRAM



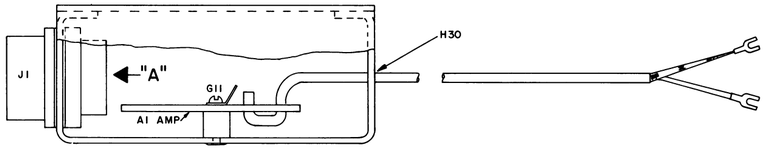
(19B226728, Rev. 0)

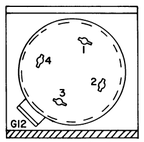
LEAD IDENTIFICATION FOR Q1 & Q2



NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION

ASSEMBLY DIAGRAM





VIEW AT "A"

(19B226183, Rev. 1)

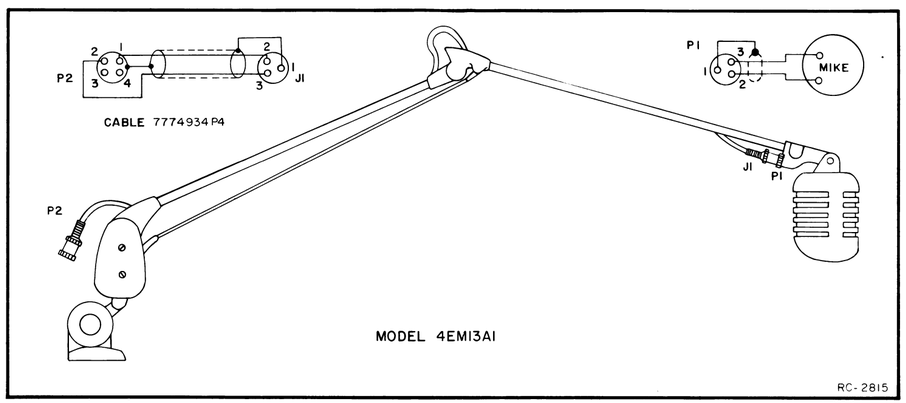
PARTS LIST

LBI-4678B

MIKE BOOM
4EM13A1
(SEE RC-2815)

SYMBOL	GE PART NO.	DESCRIPTION
		Cartridge. RP51.
		Cable and plug. (Includes J1, P2) RP52.
		Swivel hardware. RP53.
		Connector assembly. (Includes P1) RP54.
		Microphone housing. RP55.
		Transformer and switch assembly. RP56.
	7774934P4	Floating arm.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



PARTS LIST

LBI-4532B

MIKE BOOM PRE-AMP
19C320432G1

SYMBOL	GE PART NO.	DESCRIPTION
A1		COMPONENT BOARD 19B219940G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496267P228	Tantalum: 0.47 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C2	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C3	5494481P1	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 and Q2	19A116774P1	Silicon, NPN; sim to Type 2N5210.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P683J	Composition: 68,000 ohms ±5%, 1/4 w.
R2	3R152P303J	Composition: 30,000 ohms ±5%, 1/4 w.
R3	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R4	3R152P151J	Composition: 150 ohms ±5%, 1/4 w.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1		Connector. Includes:
	19A116061P2	Receptacle: 4 female contacts; sim to Amphenol Type 91-PN4F-1000.
	19A116061P4	Lockwasher.
	19A122600P1	Nut, knurled.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A116049P1	Ground lug.
	4035656P1	Spacer, threaded: No. 6-32 x 1/4.

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

19B219940G1

Rev. A - To make the mike connector compatable with MASTR Controller. Added a ground lug (19A116049P1) in place of the lock washer for J1.

SERVICE SHEET

MIKE BOOM PRE-AMP & MICROPHONE
(OPTIONS 8549 & 8550)

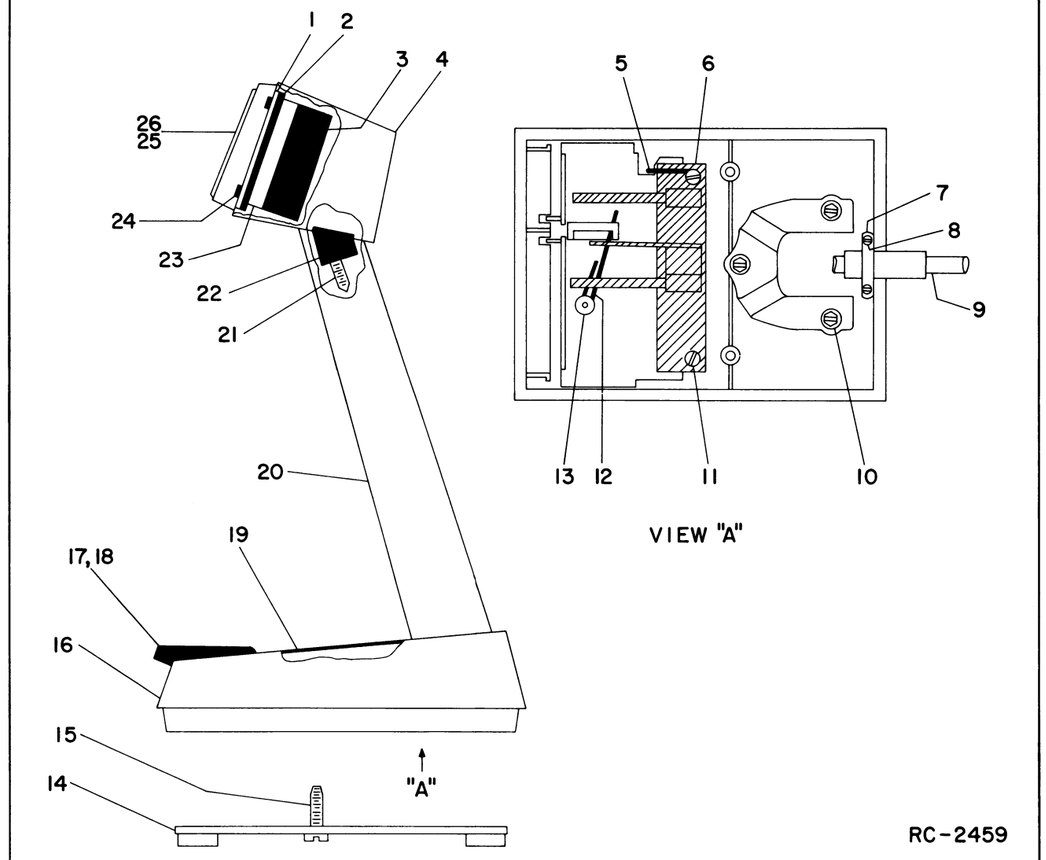
PARTS LIST

LBI-4473

DESK MICROPHONES
19B209458P1 (STANDARD)
19B209459P1 (CHANNEL GUARD)
(SEE RC-2459)

SYMBOL	GE PART NO.	DESCRIPTION
		STANDARD DESK MICROPHONE 19B209458P1
1		Locking plate. (Part of item 4).
2		Gasket. (Part of item 4).
3		"O" Ring. (Part of item 4).
4		Head Assembly. RP122. (Includes items 1-3, 24-26).
5		(Not Used).
6		Switch Kit. RP124. (Includes items 11, 17).
7		Retaining Bar. (Part of item 9).
8		Screw, thread forming, slotted: No. 4 x 1/2. (Part of item 9).
9		Cable Kit. RP123. (Includes items 7, 8).
10		Screw, thread forming, slotted: No. 8 x 3/4. (Part of item 20).
11		Screw, thread forming, slotted: No. 4 x 5/8. (Part of item 6).
12		(Not Used).
13		(Not Used).
14		Base plate. (Part of item 16).
15		Screw, thread forming, slotted: No. 8 x 3/4. (Secures Base Plate- Part of item 16).
16		Base Assembly. RP125. (Includes items 14, 15, 19).
17		Pushbutton, Transmit. (Part of item 6).
18		(Not Used).
19		Nameplate. (Part of item 16).
20		Stem Assembly. RP121.
21		Screw, thread forming, slotted: No. 8 x 1/2. (Part of item 20).
22		Clamp. (Secures Head Assembly to Stem Assembly- Part of item 20).
23		Transistorized Cartridge. RP117.
24		Screw, thread forming, slotted: No. 4 x 1/2. (Part of item 4).
25		Grille. (Part of item 4).
26		Dust cloth. (Part of item 4).
		CHANNEL GUARD DESK MICROPHONE 19B209459P1
1		Locking plate. (Part of item 4).
2		Gasket. (Part of item 4).
3		"O" Ring. (Part of item 4).
4		Head Assembly. RP122. (Includes items 1-3, 24-26).
5		Lock spring. (Part of item 6).
6		Switch Kit. RP119. (Includes items 5, 11, 12, 13, 17, 18).
7		Retaining Bar. (Part of item 9).
8		Screw, thread forming, slotted: No. 4 x 1/2. (Part of item 9).
9		Cable Kit. RP118. (Includes items 7, 8).
10		Screw, thread forming, slotted: No. 8 x 3/4. (Part of item 20).
11		Screw, thread forming, slotted: No. 4 x 5/8. (Part of item 6).
12		Spring. (Part of item 6).
13		Retainer. (Part of item 1).
14		Base plate. (Part of item 16).
15		Screw, thread forming slotted: No. 8 x 3/4. (Secures Base Plate- Part of item 16).
16		Base Assembly. RP120. (Includes items 14, 15, 19).
17		Pushbutton, Monitor. (Part of item 6).
18		Pushbutton, Transmit. (Part of item 6).
19		Nameplate. (Part of item 16).
20		Stem Assembly. RP121.
21		Screw, thread forming, slotted: No. 8 x 1/2. (Part of item 20).
22		Clamp. (Secures Head Assembly to Stem Assembly- Part of item 20).
23		Transistorized Cartridge. RP117.
24		Screw, thread forming, slotted: No. 4 x 1/2. (Part of item 4).
25		Grille. (Part of item 4).
26		Dust cloth. (Part of item 4).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



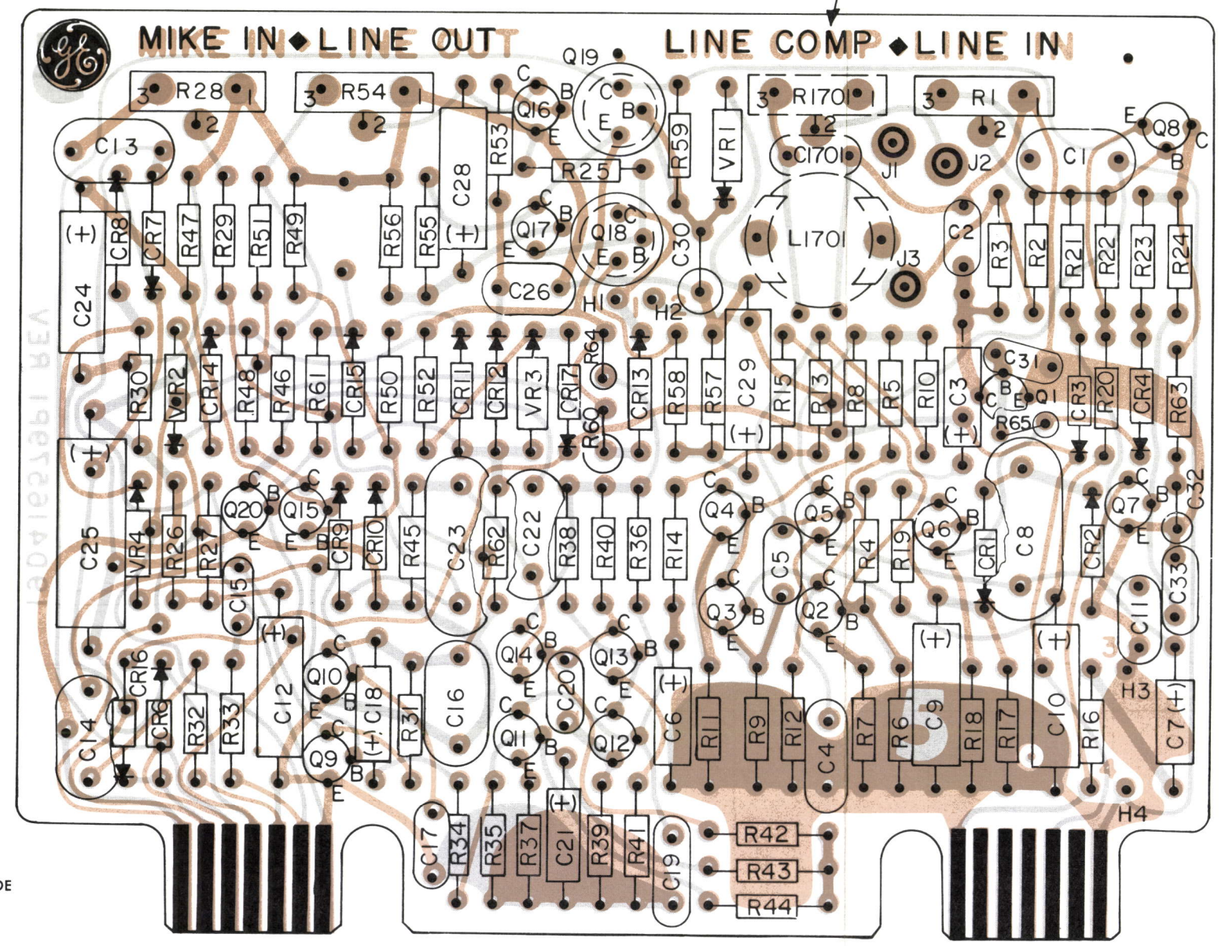
VIEW "A"

RC-2459

SERVICE SHEET

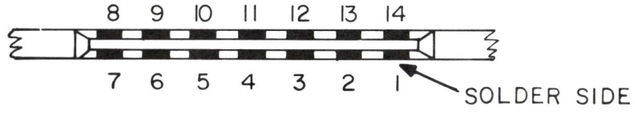
DESK MICROPHONES
19B209458P1 & 19B209459P1

R1701, C1701 & L1701 ARE PART OF MOD. KIT PL19A129317

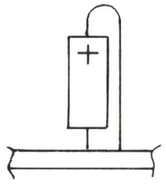


RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

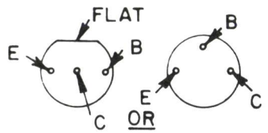
TYPICAL CONTACT FINGER NUMBERING



MOUNTING FOR C30 & C32

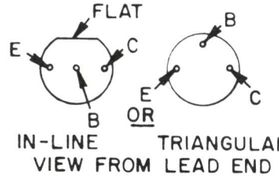


LEAD IDENTIFICATION FOR Q1-Q5, Q7-Q14, Q16, Q20



NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION FOR Q6, Q15, Q17, Q18, Q19

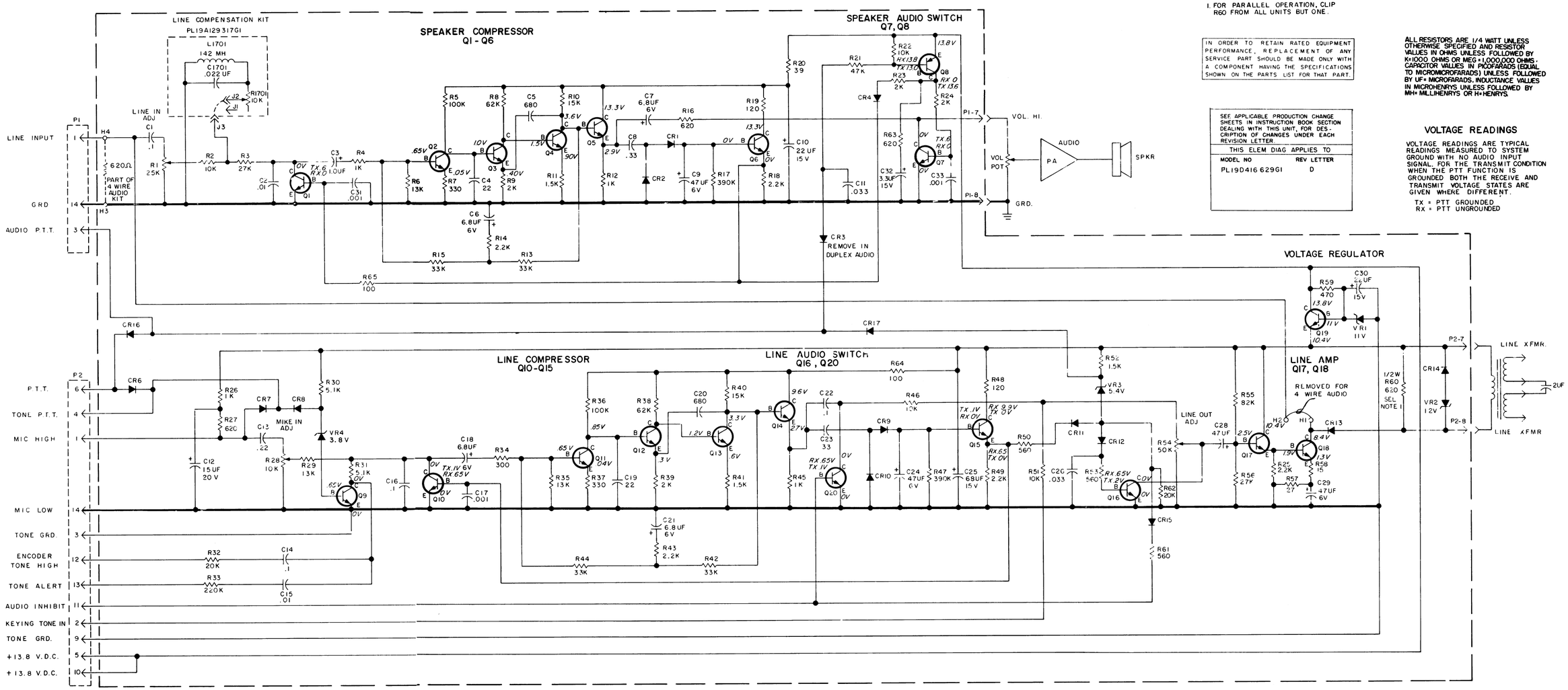


NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

OUTLINE DIAGRAM

AUDIO BOARD 19D416629G1

(19D417317, Rev. 3)
(19D416579, Sh. 2, Rev. 5)
(19D416579, Sh. 3, Rev. 5)



(19R621826, Rev. 8)

SCHEMATIC DIAGRAM

AUDIO BOARD 19D416629G1

PARTS LIST

LBI-4519B

AUDIO BOARD
19D416629G1
(Part of Mastr Controller 19D416689G1)

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C2	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C3	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C4	7489162P11	Silver mica: 22 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C5	5494481P109	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C6 and C7	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C8	19A116080P10	Polyester: 0.33 µf ±20%, 50 VDCW.
C9	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C10	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C11	19A116080P4	Polyester: 0.033 µf ±20%, 50 VDCW.
C12	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C13	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C14	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C15	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C16	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C17	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C18	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C19	7489162P11	Silver mica: 22 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C20	5494481P109	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C21	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C22	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C23	19A116080P10	Polyester: 0.33 µf ±20%, 50 VDCW.
C24	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C25	5496267P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C26	19A116080P4	Polyester: 0.033 µf ±20%, 50 VDCW.
C27*	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW. Deleted by REV A.
C28 and C29	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C30	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C31	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C32	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C33	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 and CR2	19A115250P1	Silicon.
CR3*	19A115100P2	Silicon; sim to Type 1N459A.
		In REV A and earlier:
	19A115250P1	Silicon.
CR4	19A115250P1	Silicon.
CR6* thru CR8*	19A115100P2	Silicon; sim to Type 1N459A.
		In REV A and earlier:
	19A115250P1	Silicon.
CR9 thru CR12	19A115250P1	Silicon.
CR13* and CR14*	4037822P7	Silicon.
		In REV A and earlier:
	4037822P2	Silicon.
CR15	19A115250P1	Silicon.
CR16* and CR17*	19A115100P2	Silicon; sim to Type 1N459A.
		In REV A and earlier:
	19A115250P1	Silicon.
		- - - - - - - - - JACKS AND RECEPTACLES - - - - -
J1 thru J3	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1 and P2		(Part of printed wiring board 19D416579P1).
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A115552P1	Silicon, NPN; sim to Type 2N2714.
Q2 thru Q5	19A115889P1	Silicon, NPN.
Q6	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q7	19A115552P1	Silicon, NPN; sim to Type 2N2714.
Q8	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q9*	19A115720P1	Silicon, NPN; sim to Type 2N2222.
		Earlier than REV A.
	19A115552P1	Silicon, NPN; sim to Type 2N2714.
Q10*	19A129184P1	Silicon, NPN.
		In REV B and earlier:
	19A115552P1	Silicon, NPN; sim to Type 2N2714.
Q11 thru Q14	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q15	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q16*	19A115720P1	Silicon, NPN; sim to Type 2N2222.
		Earlier than REV A:
	19A115552P1	Silicon, NPN; sim to Type 2N2714.
Q17	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q18 and Q19	19A115300P4	Silicon, NPN.
Q20*	19A129184P1	Silicon, NPN.
		In REV B and earlier:
	19A115552P1	Silicon, NPN; sim to Type 2N2714.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	19B209358P107	Variable, carbon film: approx 75 to 25,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R2	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R3	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R4	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R5	3R152P104J	Composition: 0.1 megohm ±5%, 1/4 w.
R6	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R7	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
R8	3R152P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R9	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R10	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R11	3R152P152J	Composition: 1500 ohms ±5%, 1/4 w.
R12	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R13	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R14	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R15	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R16	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R17	3R152P394J	Composition: 0.39 megohm ±5%, 1/4 w.
R18	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R19	3R152P121J	Composition: 120 ohms ±5%, 1/4 w.
R20	3R152P390J	Composition: 39 ohms ±5%, 1/4 w.
R21	3R152P473J	Composition: 47,000 ohms ±5%, 1/4 w.
R22	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R23 and R24	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R25	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R26	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R27	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R28	19B209358P106	Variable, carbon film: approx 75 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R29	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R30 and R31	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R32	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R33	3R152P224J	Composition: 0.22 megohm ±5%, 1/4 w.
R34	3R152P301J	Composition: 300 ohms ±5%, 1/4 w.
R35	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R36	3R152P104J	Composition: 0.1 megohm ±5%, 1/4 w.
R37	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
R38	3R152P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R39	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R40	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R41	3R152P152J	Composition: 1500 ohms ±5%, 1/4 w.
R42	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R43	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R44	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R45	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R46	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R47	3R152P394J	Composition: 0.39 megohm ±5%, 1/4 w.
R48	3R152P121J	Composition: 120 ohms ±5%, 1/4 w.
R49	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R50	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R51	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R52	3R152P152J	Composition: 1500 ohms ±5%, 1/4 w.
R53	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R54	19B209358P108	Variable, carbon film: approx 100 to 50,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R55	3R152P823J	Composition: 82,000 ohms ±5%, 1/4 w.
R56	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R57	3R152P270J	Composition: 27 ohms ±5%, 1/4 w.
R58	3R152P150J	Composition: 15 ohms ±5%, 1/4 w.
R59	3R152P471J	Composition: 470 ohms ±5%, 1/4 w.
R60*	3R77P621J	Composition: 620 ohms ±5%, 1/2 w.
		In REV A and earlier:
	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R61	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R62	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R63	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R64 and R65	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
		- - - - - - - - VOLTAGE REGULATORS - - - - - -
VR1	4036887P8	Silicon, Zener.
VR2	19A116325P4	Silicon, Zener; sim to Type 1N5349.
VR3	4036887P5	Silicon, Zener.
VR4*	4036887P3	Silicon, Zener.
		In REV C and earlier:
	4036887P1	Silicon, Zener.
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	4036555P1	Insulator, disc. (Used with Q18 and Q19).
	4035656P70	Spacer, threaded: No. 6-32 x 5/16.
	4034048P4	Screw, machine: No. 6-32 x 5/16.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

Rev. A - To reduce distortion at 300 Hz and to reduce tone feed through.
Deleted C27 and changed Q9 and Q16.

Rev. B - To add additional protection from lightning.
Changed CR3, CR6, CR7, CR8, CR13, CR14, CR16, CR17 and R60.

Rev. C - To improve reliability.
Changed Q10 and Q20.

REV. D - To prevent Q9 from loading the Tone Encode output.
Changed VR4.

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

MAINTENANCE MANUAL

LBI-4478

DF-4094

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

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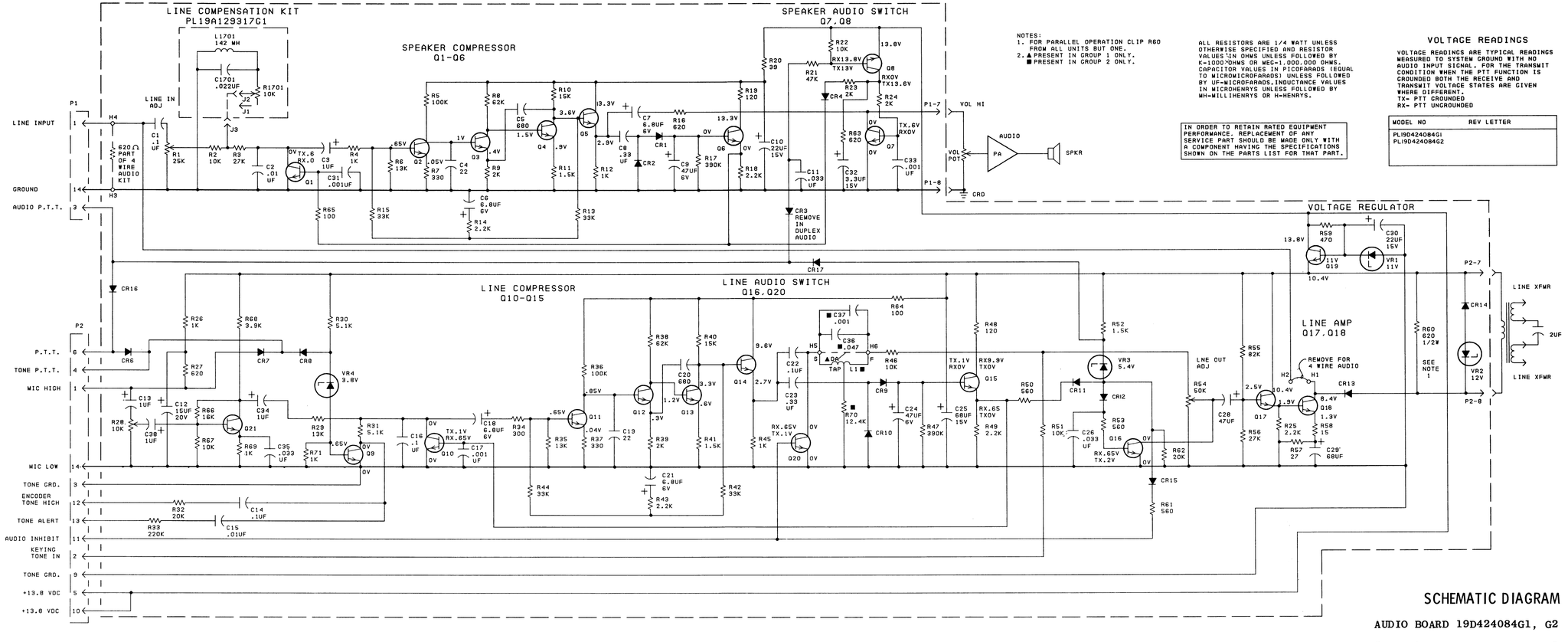

NOTES:
1. FOR PARALLEL OPERATION CLIP R60 FROM ALL UNITS BUT ONE.
2. ▲ PRESENT IN GROUP 1 ONLY.
   ■ PRESENT IN GROUP 2 ONLY.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K-1000 OHMS OR MEG-1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF-MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH-MILLIHENRYS OR H-HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM GROUND WITH NO AUDIO INPUT SIGNAL. FOR THE TRANSMIT CONDITION WHEN THE PTT FUNCTION IS GROUNDED BOTH THE RECEIVE AND TRANSMIT VOLTAGE STATES ARE GIVEN WHERE DIFFERENT.
TX- PTT GROUNDED
RX- PTT UNGROUNDED

MODEL NO	REV LETTER
PLI9D424084G1	
PLI9D424084G2	

SCHEMATIC DIAGRAM

AUDIO BOARD 19D424084G1, G2

Issue 1

(19R622233, Rev. 2)

PARTS LIST

LBI-30272

AUDIO BOARD
19D424084G1 DC CONTROL
19D424084G2 TONE CONTROL

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C2	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C3	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C4	7489162P11	Silver mica: 22 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C5	5494481P109	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C6 and C7	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C8	19A116080P10	Polyester: 0.33 µf ±20%, 50 VDCW.
C9	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C10	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C11	19A116080P4	Polyester: 0.033 µf ±20%, 50 VDCW.
C12	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C13	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C14	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C15	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C16	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C17	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C18	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C19	7489162P11	Silver mica: 22 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C20	5494481P109	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C21	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C22	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C23	19A116080P10	Polyester: 0.33 µf ±20%, 50 VDCW.
C24	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C25	5496267P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C26	19A116080P4	Polyester: 0.033 µf ±20%, 50 VDCW.
C28	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C29	5496267P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C30	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C31	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C32	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C33	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C34	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C35	19A116080P304	Polyester: 0.033 µf ±5%, 50 VDCW.
C36	19C307114P4702G	Polystyrene: 47,000 pf ±2%, 100 VDCW, temp coef -120±30 PPM/°C.
C37	5496203P481	Ceramic disc: 1000 pf ±5%, 500 VDCW, temp coef -5600 PPM.
C38	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1 and CR2	19A115250P1	Silicon.
CR3	19A115100P2	Silicon; sim to Type 1N459A.
CR4	19A115250P1	Silicon.
CR5 thru CR8	19A115100P2	Silicon; sim to Type 1N459A.
CR9 thru CR12	19A115250P1	Silicon.
CR13 and CR14	4037822P7	Silicon.
CR15	19A115250P1	Silicon.
CR16 and CR17	19A115100P2	Silicon; sim to Type 1N459A.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 thru J3	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19B205354G8	Coil.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1 and P2		(Part of printed board 19D424083P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A115552P1	Silicon, NPN; sim to Type 2N2714.
Q2 thru Q5	19A115889P1	Silicon, NPN.
Q6	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q7	19A115552P1	Silicon, NPN; sim to Type 2N2714.
Q8	19A115779P1	Silicon, PNP; sim to Type 2N3251.
Q9	19A115720P1	Silicon, NPN; sim to Type 2N2222.
Q10	19A129184P1	Silicon, NPN.
Q11 thru Q14	19A115889P1	Silicon, NPN.
Q15	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q16	19A115720P1	Silicon, NPN; sim to Type 2N2222.
Q17	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q18 and Q19	19A115300P4	Silicon, NPN.
Q20	19A129184P1	Silicon, NPN.
Q21	19A116774P1	Silicon, NPN; sim to Type 2N5210.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	19B209358P107	Variable, carbon film: approx 800 to 25,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R2	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R3	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R4	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R5	3R152P104J	Composition: 0.10 megohm ±5%, 1/4 w.
R6	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R7	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
R8	3R152P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R9	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R10	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R11	3R152P152J	Composition: 1500 ohms ±5%, 1/4 w.
R12	3R152P103J	Composition: 1000 ohms ±5%, 1/4 w.
R13	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R14	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R15	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R16	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R17	3R152P394J	Composition: 0.39 megohm ±5%, 1/4 w.
R18	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R19	3R152P121J	Composition: 120 ohms ±5%, 1/4 w.
R20	3R152P390J	Composition: 39 ohms ±5%, 1/4 w.
R21	3R152P473J	Composition: 47,000 ohms ±5%, 1/4 w.
R22	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R23 and R24	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R25	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R26	3R152P103J	Composition: 1000 ohms ±5%, 1/4 w.
R27	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R28	19B209358P106	Variable, carbon film: approx 300 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R29	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R30 and R31	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R32	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R33	3R152P224J	Composition: 0.22 megohm ±5%, 1/4 w.
R34	3R152P301J	Composition: 300 ohms ±5%, 1/4 w.
R35	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R36	3R152P104J	Composition: 0.10 megohm ±5%, 1/4 w.
R37	3R152P331J	Composition: 330 ohms ±5%, 1/4 w.
R38	3R152P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R39	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R40	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R41	3R152P153J	Composition: 1500 ohms ±5%, 1/4 w.
R42	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R43	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R44	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R45	3R152P103J	Composition: 1000 ohms ±5%, 1/4 w.
R46	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R47	3R152P394J	Composition: 0.39 megohm ±5%, 1/4 w.
R48	3R152P121J	Composition: 120 ohms ±5%, 1/4 w.
R49	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R50	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R51	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R52	3R152P152J	Composition: 1500 ohms ±5%, 1/4 w.
R53	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R54	19B209358P108	Variable, carbon film: approx 2000 to 50,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R55	3R152P823J	Composition: 82,000 ohms ±5%, 1/4 w.
R56	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R57	3R152P270J	Composition: 27 ohms ±5%, 1/4 w.
R58	3R152P150J	Composition: 15 ohms ±5%, 1/4 w.
R59	3R152P471J	Composition: 470 ohms ±5%, 1/4 w.
R60	3R77P621J	Composition: 620 ohms ±5%, 1/2 w.
R61	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R62	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R63	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R64 and R65	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R66	3R152P163J	Composition: 16,000 ohms ±5%, 1/4 w.
R67	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R68	3R152P392J	Composition: 3900 ohms ±5%, 1/4 w.
R69	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R70	19C314256P21242	Metal film: 12,400 ohms ±1%, 1/4 w.
R71	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR1	4036887P8	Silicon, Zener.
VR2	19A116325P4	Silicon, Zener; sim to 1N5349.
VR3	4036887P5	Silicon, Zener.
VR4	4036887P3	Silicon, Zener.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4035656P70	Spacer, threaded.
	4036555P1	Insulator, washer: nylon. (Used with Q18 and Q19).
	4034048P4	Machine screw, pan head, 6-32 x 9/16 with .340 cutaway.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES