(Includes Addendum 1)

MOBILE RADIO

LBI30705D
(DF4098)

INSTRUCTIONS
FOR
AUDIO BOARDS 19A129924G1-G3

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DESCRIPTION

The 19A129924G1 Audio Board is used in MASTR® II Repeater and Local/Repeater Base Stations. The 19A129924G2 Audio Board is used in MASTR II Remote/Repeater Base Stations. The 19A129924G3 Audio Board is used in MASTR II Remote Control Base Stations. The repeater circuits consist of a high-pass filter, audio amplifiers, a de-emphasis network, a repeater audio switch and receiver unsquelch sensor (RUS) switch. The remote circuits consist of a high-pass filter, audio amplifiers, a de-emphasis network, a line driver for feeding receive audio to the telephone line, a compressor amplifier for controlling the line audio level fed to the transmitter, and audio and RUS switches for controlling the transmit and receive audio paths.

CIRCUIT ANALYSIS

Audio Board 19A129924G1

Audio from the station receiver is coupled to emitter follower Q1 through the high-pass filter consisting of C2-C3 and R1-R2. This filter attenuates 60 and 120 Hz to reduce the hum and noise. The output of the emitter follower is passed through a de-emphasis network C5 and R6. This network provides a 6 dB/octave rolloff. The signal is then amplified by Q2 and fed to another emitter follower Q3. The TX MOD control R14 is connected in the emitter circuit of Q3 and allows feeding the transmitter modulator input at a maximum level of 200 millivolts.

The receiver Unsquelched Sensor Operating Switch (RUSOS) lead is at a positive potential when the receiver is squelched. CR4 is forward biased, allowing Q5 to conduct. This grounds the collector of Q2 at audio frequencies, preventing the audio signal from passing to Q3. Q12 is normally conducting, grounding the gate of FET Q13 and blocking the audio from the transmitter. When the receiver is unsquelched, the RUS lead D12 goes high, turning on Q11. This grounds the RUSOS lead and turns off Q5 and Q12. The audio signal is now allowed to pass through Q3 and Q13 to the transmitter modulator.

Audio Board 19A129924G2

The 19A129924G2 Audio Board is used in remote/repeat station combinations. The receiver audio amplifiers, de-emphasis network and repeater audio switch operate in the same manner as described for the 19A129924G1 Board. A separate emitter follower (Q4) is connected to the emitter of Q3 for repeater applications. The REPEATER TX LEVEL control (R15) is connected in the emitter circuit of Q4. R14 (in the emitter circuit of Q3) now serves as the LINE OUT level control.

The audio from the station receiver is connected to the Remote Control/Repeat Audio Board at VOL/SQ HI lead B11. The audio signal is amplified by Q1-Q4; the level is adjusted by means of REPEATER TX LEVEL Control R15 and passed to the TX AUDIO HI lead B14.

The emitter-follower Q3 output is coupled by means of C10 to the RCVR NOTCH FILTER OUTPUT lead D14 and connected to the Transmitter Control Board where the 2175 Hz Secur-it tone components are notched out of the received audio. Resistor R16 and the jumper between H7 and H8 are removed in tone control systems.

GENERAL ELECTRIC

When the audio is returned from the Transmitter Control Board, via RCVR NOTCH FILTER INPUT lead D13, the signal is connected to amplifiers Q6 and Q8. Q7 serves as an audio gate controlled by the RUS input circuit. As long as the RUS input is active Q7 passes the signal to the audio output transistor Q9 which, in turn, couples the signal to T1 and the audio path.

Line audio is coupled from the primary of T1 to LINE AUDIO lead A8. The signal is connected to the Secur-it Tone Board and the Transmitter Control Board. The TX NOTCH FILTER removes the 2175 Hz tone from the audio and the signal is returned to the COMP INPUT FROM TONE CONTROL lead A9. The compressor amplifier functions in the same manner as described for the Remote Audio Board.

Audio Board 19A129924G3

Audio from the station receiver discriminator is coupled to emitter follower Q1 through the high-pass filter consisting of C2-C3 and R1-R2. This filter attenuates 60 and 120 Hertz to reduce the hum and noise. The output of the emitter follower is passed through a de-emphasis network C5 and R6. This network provides a 6 dB/ octave rolloff. The signal is then amplified by Q2 and fed to another emitter follower Q3. The LINE OUT Control R14 is connected in the emitter circuit of Q3 and allows feeding the audio to the line driver at the proper level.

The audio is coupled through C10 to the RX NOTCH FILTER OUTPUT lead D14. This lead is connected to the Transmitter Control Board where the 2175 Hz tone components are notched out of the receiver audio. Resistor R16 and the jumper between H7 and H8 are removed in tone control systems.

When the audio is returned from the Transmitter Control Board via RCVR NOTCH FILTER INPUT lead D13, the signal is coupled to the line driver. Q6 and Q8 amplify the signal. Q7 serves as an audio switch controlled by the RUS circuit. As long as the RUS switch (Q11) is turned off (receiver squelched), CR5 is forward biased allowing Q7 to conduct. Conduction of Q7 grounds the audio path between Q6 and Q8, preventing the audio from being passed to the line. When the receiver unsquelches, the RUS lead goes high. This turns Q11 on, turning off CR5 and Q7. The audio is now allowed to pass to the output amplifier Q9 and to the line transformer T1. CR2, CR3 and VR1 are provided for line surge protection.

Audio from the telephone pair is coupled to the input of the transmitter compressor amplifier which consists of Q15-Q19. The proper audio level for the compressor amplifier is adjusted by LINE INPUT control R39. R41 and the AC impedance of transistor Q15 act as a voltage divider for the AC input signal. The output of Q15 is amplified by a four stage, direct-coupled amplifier (Q16-Q19). Both AC and DC feedback in the amplifier circuit provides for stable operation.

One portion of the amplified output is fed through R50 (REM TX LEVEL) to the XMTR AUDIO HI lead to modulate the transmitter. The remaining portion of the signal is rectified by detector CR6-CR7, filtered by C29, and amplified by DC current amplifier Q20. This DC output is fed back to the base of gain control transistor Q15.

The amount of DC feedback to Q15 determines the AC impedance of this transistor. When the input level rises, the AC amplifier output starts to increase. The output is detected, amplified and fed back to the base of Q15. The increase in feedback reduces the AC impedance of Q15 which decreases the audio voltage to the AC amplifiers, keeping the output constant.

When the input decreases, the output of the AC amplifier starts to decrease, reducing the feedback to Q15. This raises the AC impedance of Q15 and increases the audio voltage to the AC amplifier, keeping the output constant.

The compressor amplifier resets when switching from the receive to transmit mode. Resetting the compressor amplifier prevents losing the first portion of a weak line signal due to the compressor release time. When the RUS lead returns to ground, Q11 is turned off. This allows the Receiver Unsquelch Sensor Operating Switch (RUSOS) lead to go high. Transistor Q14 is turned on, grounding the base of Q20. This shorts capacitor C29 for approximately 10 milliseconds. This resets the compressor amplifier.

Transmit audio is coupled from the REM TX LEVEL control R50 to the source terminal of FET Q21. Q22 is normally conducting, grounding the gate terminal of Q21 and preventing the audio from passing through the FET. Applying ground to the REMOTE PTT terminal D3 forward biases CR10, turning Q22 off. Q21 is now allowed to conduct, passing the audio signal to the TRANSMITTER AUDIO HI lead D14 and to the station transmitter modulator.

When the Intercom Kit is used in the station, audio from the local microphone is connected from the Intercom Board via D9 to the base of Q8 and, after amplification, the local audio is fed to the line transformer.

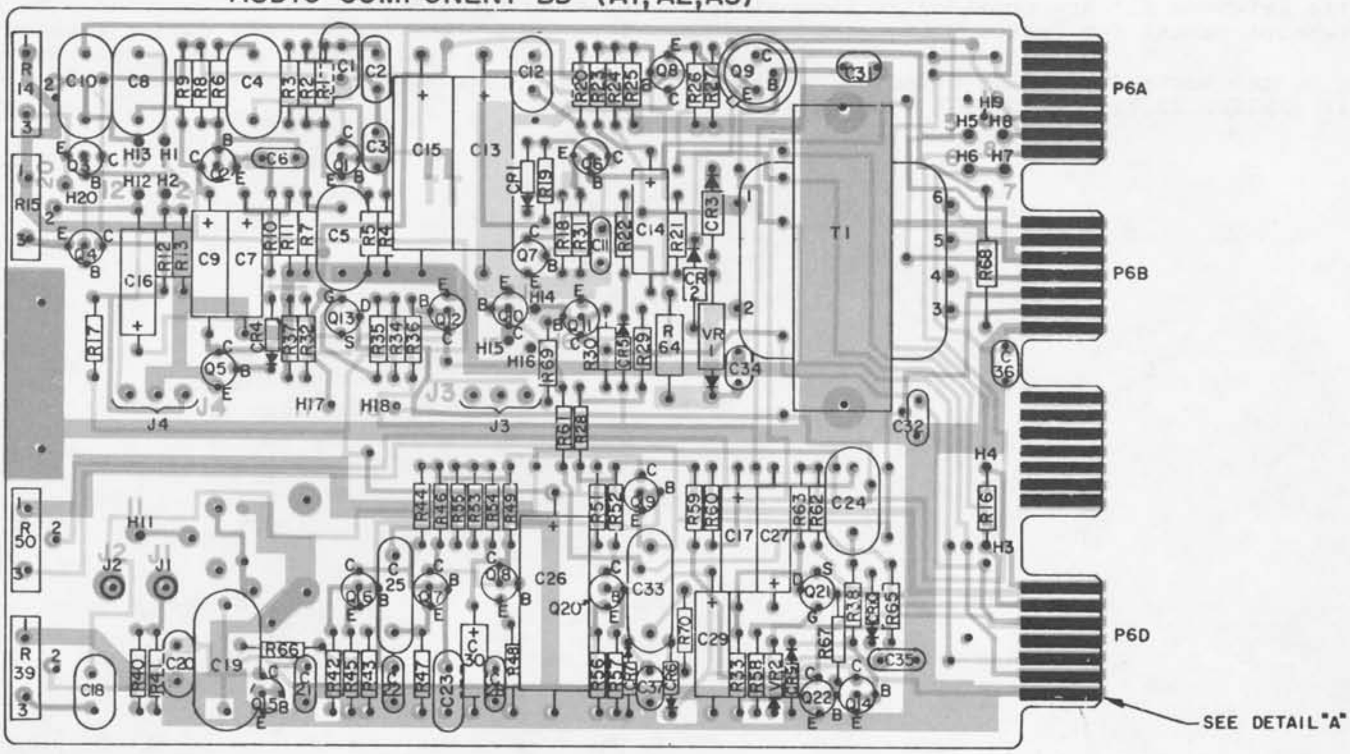
Line audio, after passing through the compressor amplifier is connected via B10 to the Intercom Board. Receiver audio overrides the intercom audio. Instructions for the Intercom Kit are provided in the maintenance manual for Option 9508.

When Secur-it Tone is detected, +10 VDC is applied to the AUDIO MUTE lead D2 from the Secur-it Tone Board. This turns Q10 on, grounding the base of Q11. Q7 is now allowed to conduct and prevent the receive audio from reaching the line and masking the function tone. The RX 1 MUTE lead turns the receiver off during transmit, causing the RUS lead to go low. This turns off the receiver audio to the line.

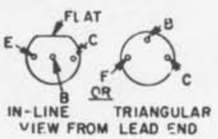
GENERAL ELECTRIC COMPANY • MOBILE COMMUNICATIONS DIVISION
WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.

GENERAL ELECTRIC*
U.S.A.

AUDIO COMPONENT BD (A1,A2,A3)



LEAD IDENTIFICATION FOR Q1-Q12, Q14-Q20, Q22



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

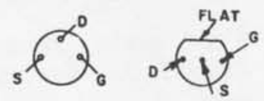
NOTE:
THIS DIAGRAM IS INTENDED TO SHOW COMPONENT LOCATIONS FOR ALL GROUPS OF THE BOARD. REFER TO APPROPRIATE SCHEMATIC DIAGRAM OR PARTS LIST FOR COMPONENTS USED IN A SPECIFIC GROUP.

REFER TO WIRING DIAGRAM FOR THE FOLLOWING CONNECTION

FROM	TO	WIRE	GROUP
H1	H2	DA	G1, G2, G3
H5	H6	DA	G2, G3
H7	H8	DA	G2, G3
H12	H13	DA	G1
H17	H18	DA	G2, G3
H19	H20	SF24-W	G1, G2, G3

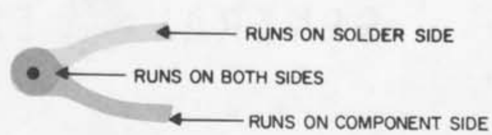
DETAIL "A"
TYP. NUMBERING OF CONT. FINGERS

LEAD IDENTIFICATION FOR Q13 & Q21



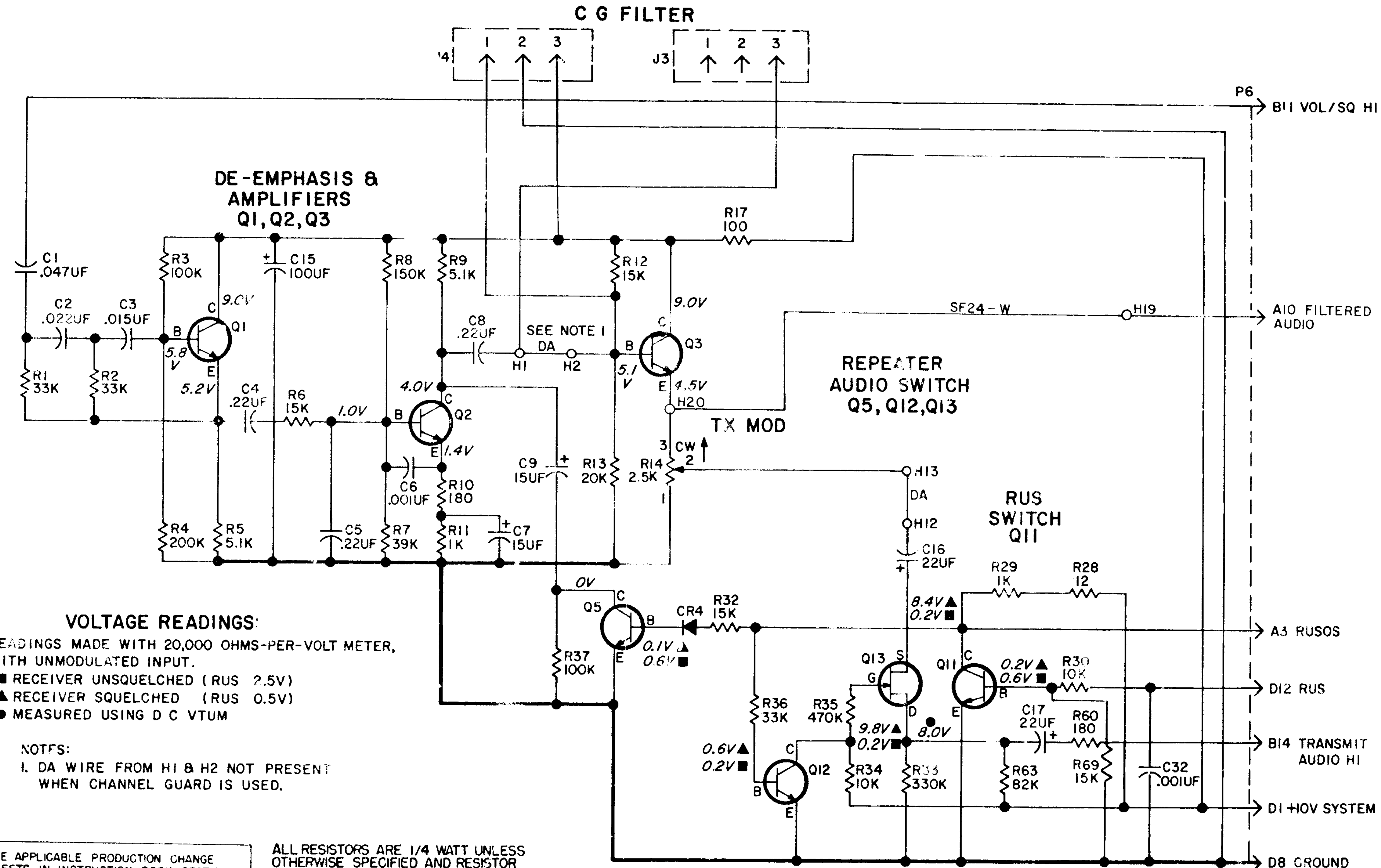
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

(19D423136, Rev. 9)
(19D417083, Sh. 2, Rev. 11)
(19D417083, Sh. 3, Rev. 11)



OUTLINE DIAGRAM

AUDIO BOARD 19A129924



VOLTAGE READINGS:

READINGS MADE WITH 20,000 OHMS-PER-VOLT METER, WITH UNMODULATED INPUT.

- ■ RECEIVER UNSQUELCHED (RUS 7.5V)
- ▲ RECEIVER SQUELCHED (RUS 0.5V)
- ● MEASURED USING D C VTUM

NOTES:

1. DA WIRE FROM H1 & H2 NOT PRESENT WHEN CHANNEL GUARD IS USED.

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
19A129924G1	A
19D417210G1	B

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.

(19C320650, Rev. 10)

SCHEMATIC DIAGRAM

REPEATER AUDIO BOARD
19A129924G1

Issue 5

PARTS LIST

LBI4803A

REPEATER AUDIO BOARD
19A129924G1

SYMBOL	GE PART NO.	DESCRIPTION
A1		COMPONENT BOARD 19D417210G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C2	19A116080P103	Polyester: 0.022 µf ±10%, 50 VDCW.
C3	19A116080P102	Polyester: 0.015 µf ±10%, 50 VDCW.
C4 and C5	19A116080P109	Polyester: 0.22 µf ±10%, 50 VDCW.
C6	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C7	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C8	19A116080P109	Polyester: 0.22 µf ±10%, 50 VDCW.
C9	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C15	19A115680P7	Electrolytic: 100 µf +150% -10%, 15 VDCW; sim to Mallory Type TT.
C16 and C17	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C32	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR4	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J3 and J4	19A116779P1	Contact, electrical: sim to Molex 08-54-0404. (Quantity 3 each connector).
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P6		Connector. (Part of printed board 19D417083P1).
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 and Q2	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q3	19A115889P1	Silicon, NPN.
Q5	19A129184P1	Silicon, NPN.
Q11	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q12	19A115889P1	Silicon, NPN.
Q13	19A134137P1	N Type, field effect; sim to Type 2N3458.
		- - - - - - - - - RESISTORS - - - - - - - - - -
R1 and R2	3R152P333J	Composition: 33K ohms ±5%, 1/4 w.
R3	3R152P104J	Composition: 0.10 megohm ±5%, 1/4 w.
R4	3R152P204J	Composition: 0.20 megohm ±5%, 1/4 w.
R5	3R152P512K	Composition: 5.1K ohms ±10%, 1/4 w.
R6	3R152P153K	Composition: 15K ohms ±10%, 1/4 w.
R7	3R152P393J	Composition: 39K ohms ±5%, 1/4 w.
R8	3R152P154J	Composition: 0.15 megohm ±5%, 1/4 w.
R9	3R152P512J	Composition: 5.1K ohms ±5%, 1/4 w.
R10	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R11	3R152P102K	Composition: 1K ohms ±10%, 1/4 w.
R12	3R152P153J	Composition: 15K ohms ±5%, 1/4 w.
R13	3R152P203J	Composition: 20K ohms ±5%, 1/4 w.
R14*	19B209358P116	Variable, carbon film: approx 25 to 2.5K ohms ±10%, 0.2 w; sim to Stackpole R11-44442.
		Earlier than REV A:
	19B209358P103	Variable, carbon film: approx 50 to 1K ohms ±10%, 0.2 w; sim to CTS Type X-201.
R17	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R28	3R152P120J	Composition: 12 ohms ±5%, 1/4 w.
R29	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
R30	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R32	3R152P153K	Composition: 15K ohms ±10%, 1/4 w.
R33	3R152P334J	Composition: 0.33 megohms ±5%, 1/4 w.
R34	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R35	3R152P474J	Composition: 0.47 megohms ±5%, 1/4 w.
R36	3R152P333J	Composition: 33K ohms ±5%, 1/4 w.
R37	3R152P104K	Composition: 0.10 megohms ±10%, 1/4 w.
R60	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R63	3R152P823J	Composition: 82K ohms ±5%, 1/4 w.
R69	3R152P153J	Composition: 15K ohms ±5%, 1/4 w.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B219690G1	Handle Assembly.

*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.

19D417210G1:

REV. A - To heop meet -20 dBm output level specification. Changed value of R14.

REV. B - Board change required for new design (GE-MARC V). Added H19 and H20.

19A129924G1:

REV. A - To avoid oscillation on board, changed Q3 from 19A115910P1 to 19A115889P1.

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
PL19A129924G2	C
PL19A129924G3	C
PL19D417210G2	C
PL19D417210G3	C

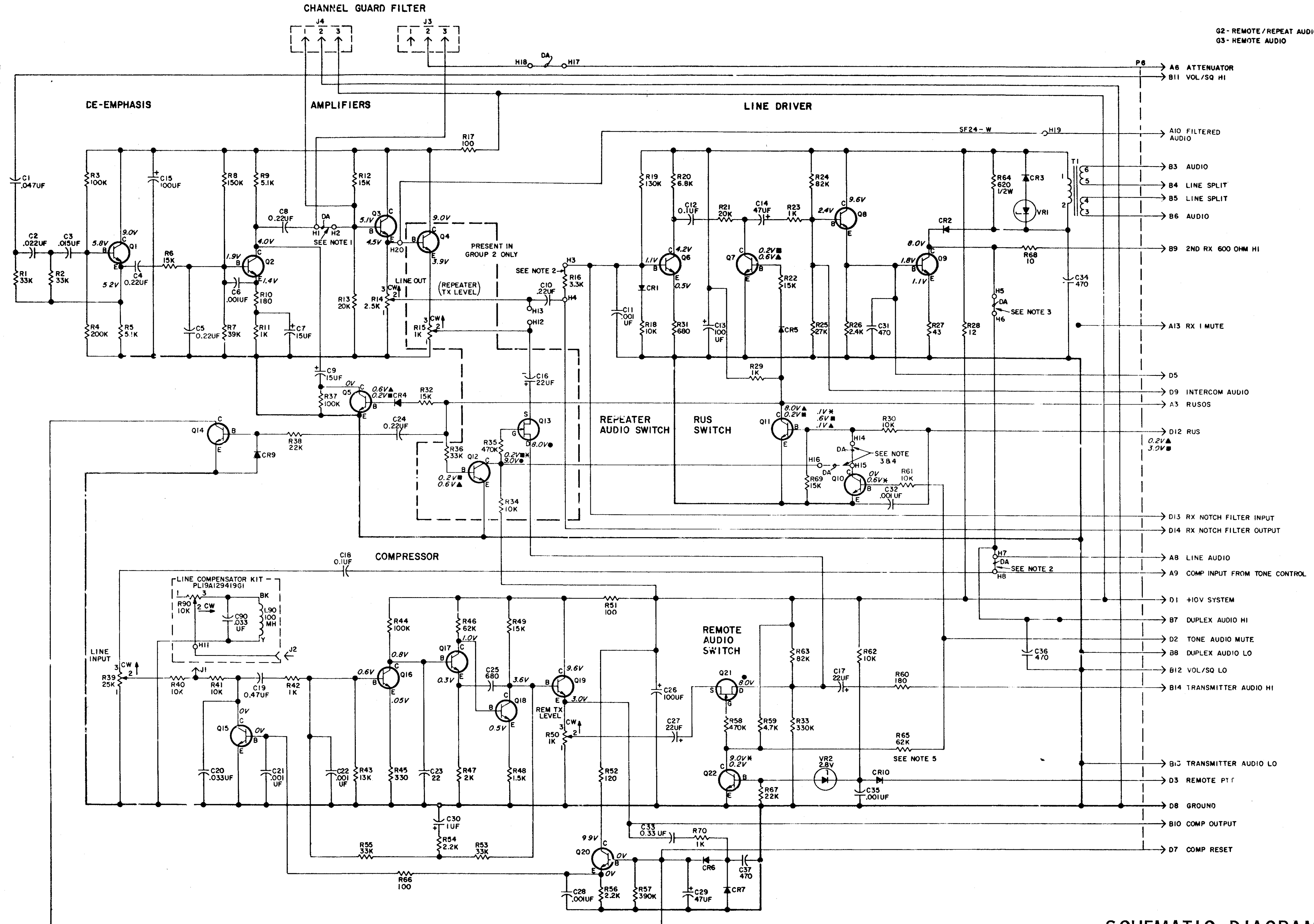
NOTES:

1. DA WIRE FROM H1 & H2 NOT PRESENT WHEN CHANNEL GUARD IS USED.
2. DA WIRE FROM H7 & H8 AND RESISTOR R16 NOT PRESENT IN TONE CONTROL.
3. DA WIRE FROM H5 & H6 AND H14 & H15 NOT PRESENT IN 4 WIRE AUDIO AND ALSO IN RCVR VOTING APPLICATION.
4. DA WIRE FROM H15 TO H16 IS PRESENT IN 4 WIRE AUDIO AND RCVR VOTING APPLICATION IN GR. 2 BD ONLY.
5. R65 NOT PRESENT IN TONE CONTROL.

VOLTAGE READINGS

MEASUREMENTS MADE WITH 20,000 OHMS-PER-VOLT METER. ALL READINGS TYPICAL.

- ■ RX UNSQUELCHED
- ▲ RX SQUELCHED
- ✱ REMOTE TRANSMIT KEYED
- ● MEASURED USING DC VTVM



(19E501150, Rev. 13)

SCHEMATIC DIAGRAM

AUDIO BOARD 19A129924G2 & G3

PARTS LIST

LBI4804E

REMOTE AUDIO BOARD
19A129924G2 REMOTE/REPEAT AUDIO - REV. C
19A129924G3 REMOTE AUDIO - REV. C

SYMBOL	GE PART NO.	DESCRIPTION
A2 and A3		COMPONENT BOARD A2 19D417210G2 REMOTE/REPEAT AUDIO - REV.C A3 19D417210G3 REMOTE AUDIO - REV. C
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A700234P11	Polyester: 0.047 uF ±10%, 50 VDCW.
C2	19A700234P9	Polyester: 0.022 uF ±10%, 50 VDCW.
C3	19A700234P8	Polyester: .015 uF ±10%, 50 VDCW; sim to NISSEI AMXV or AMZV.
C4 and C5	19A116080P109	Polyester: 0.22 uF ±10%, 50 VDCW.
C6	19A700233P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C7	5496267P14	Tantalum: 15 uF ±20%, 20 VDCW; sim to Sprague Type 150D.
C8	19A116080P109	Polyester: 0.22 uF ±10%, 50 VDCW.
C9	5496267P14	Tantalum: 15 uF ±20%, 20 VDCW; sim to Sprague Type 150D.
C10	19A116080P9	Polyester: 0.22 uF ±20%, 50 VDCW.
C11	19A700233P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C12	19A143477P26	Polyester: .1 uF ±20%, 50 VDCW.
C13	19A115680P7	Electrolytic: 100 uF +150-10%, 15 VDCW; sim to Mallory Type TTX.
C14	5496267P2	Tantalum: 47 uF ±20%, 6 VDCW; sim to Sprague Type 150D.
C15	19A115680P7	Electrolytic: 100 uF +150-10%, 15 VDCW; sim to Mallory Type TTX.
C16 and C17	5496267P10	Tantalum: 22 uF ±20%, 15 VDCW; sim to Sprague Type 150D.
C18	19A143477P26	Polyester: .1 uF ±20%, 50 VDCW.
C19	19A116080P111	Polyester: 0.47 uF ±10%, 50 VDCW.
C20*	19A700234P10	Polyester: 0.033 uF ±10%, 50 VDCW. Change incorporated in original shipment.
	19A116080P105	Polyester: 0.047 uF ±10%, 50 VDCW.
C21 and C22	19A700233P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C23	7489162P111	Silver mica: 22 pF ±10%, 500 VDCW; sim to Sprague Type 118.
C24	19A116080P109	Polyester: 0.22 uF ±10%, 50 VDCW.
C25	4029003P104	Silver mica: 680 pF ±10%, 500 VDCW, sim to Electro Motive Type DM-20.
C26	19A115680P7	Electrolytic: 100 uF +150-10%, 15 VDCW; sim to Mallory Type TTX.
C27	5496267P10	Tantalum: 22 uF ±20%, 15 VDCW; sim to Sprague Type 150D.
C28	19A700233P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C29	5496267P2	Tantalum: 47 uF ±20%, 6 VDCW; sim to Sprague Type 150D.
C30	5496267P17	Tantalum: 1.0 uF ±20%, 35 VDCW; sim to Sprague Type 150D.
C31	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
C32	19A700233P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C33	19A116080P10	Polyester: 0.33 uF ±20%, 50 VDCW.
C34	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
C35	19A700233P7	Ceramic: 1000 pF ±20%, 50 VDCW.
C36 and C37	19A700233P5	Ceramic: 470 pF ±20%, 50 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR2 and CR3	4037822P7	Silicon, 1000 mA, 800 PIV.
CR4 thru CR7	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR9 and CR10	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 and J2	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J3 and J4	19A701785P1	Contact, electrical; sim to Molex 08-50-0404.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P6		Connector. (Part of printed board 19D417083P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 and Q2	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q3	19A115889P1	Silicon, NPN.
Q4	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q5	19A129184P1	Silicon, NPN.
Q6	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q7	19A129184P1	Silicon, NPN.
Q8	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q9	19A115300P4	Silicon, NPN.
Q10 thru Q12	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q13	19A134137P1	N-type, field effect; sim to 2N4416.
Q14 thru Q19	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q20	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q21	19A134137P4	N Type, field effect; sim to Type 2N3458.
Q22	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 and R2	19A700019P55	Deposited carbon: 33K ohms ±5%, 1/4 w.
R3	19A700019P61	Deposited carbon: 0.1M ohms ±5%, 1/4 w.
R4	19A143400P64	Deposited carbon: 200K ohms ±5%, 1/4 w.
R5	19A143400P45	Deposited carbon: 5.1K ohms ±5%, 250 VDCW, 1/4 w
R6	19A700019P51	Deposited carbon: 15K ohms ±5%, 1/4 w.
R7	19A700019P56	Deposited carbon: 39K ohms ±5%, 1/4 w.
R8	19A700019P63	Deposited carbon: 0.15M ohms ±5%, 1/4 w.
R9	19A143400P45	Deposited carbon: 5.1K ohms ±5%, 250 VDCW, 1/4 w
R10	19A700019P28	Deposited carbon: 180 ohms ±5%, 1/4 w.
R11	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
R12	19A700019P51	Deposited carbon: 15K ohms ±5%, 1/4 w.
R13	19A143400P52	Deposited carbon: 20K ohms ±5%, 1/4 w.
R14*	19B209358P116	Variable, carbon film: approx 25 to 2.5K ohms ±10%, 0.2 w; sim to Stackpole R11-44442.
		Earlier than REV A:
	19B209358P103	Variable, carbon film: approx 50 to 1K ohms ±10%, 0.2 w; sim to CTS Type X-201.
R15	19B209358P103	Variable, carbon film: approx 50 to 1K ohms ±10%, 0.2 w; sim to CTS Type X-201.
R16	19A700019P43	Deposited carbon: 3.3K ohms ±5%, 1/4 w.
R17	19A700019P25	Deposited carbon: 100 ohms ±5%, 1/4 w.
R18	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R19	19A143400P62	Deposited carbon: 130K ohms ±5%, 1/4 w.
R20	19A700019P47	Deposited carbon: 6.8K ohms ±5%, 1/4 w.
R21	19A143400P52	Deposited carbon: 20K ohms ±5%, 1/4 w.
R22	19A700019P51	Deposited carbon: 15K ohms ±5%, 1/4 w.
R23	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
R24	19A700019P60	Deposited carbon: 82K ohms ±5%, 1/4 w.
R25	19A700019P54	Deposited carbon: 27K ohms ±5%, 1/4 w.
R26	19A143400P41	Deposited carbon: 2.4K ohms ±5%, 1/4 w.
R27	19A143400P20	Deposited carbon: 43 ohms ±5%, 1/4 w.
R28	19A700019P14	Deposited carbon: 12 ohms ±5%, 1/4 w.
R29	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
R30	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R31	19A700019P35	Deposited carbon: 680 ohms ±5%, 1/4 w.
R32	19A700019P51	Deposited carbon: 15K ohms ±5%, 1/4 w.
R33	19A700019P67	Deposited carbon: 0.33M ohms ±5%, 1/4 w.
R34	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R35	19A700019P69	Deposited carbon: 0.47M ohms ±5%, 1/4 w.
R36	19A700019P55	Deposited carbon: 33K ohms ±5%, 1/4 w.
R37	19A700019P61	Deposited carbon: 0.1M ohms ±5%, 1/4 w.
R38	19A700019P53	Deposited carbon: 22K ohms ±5%, 1/4 w.
R39	19B209358P107	Variable, carbon film: approx 800 to 25K ohms ±10%, 1/4 w; sim to CTS Type X-201.
R40 and R41	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R42	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
R43	19A143400P50	Deposited carbon: 13K ohms ±5%, 250 VDCW, 1/4 w.
R44	19A700019P61	Deposited carbon: 0.1M ohms ±5%, 1/4 w.
R45	19A700019P31	Deposited carbon: 330 ohms ±5%, 1/4 w.
R46	19A143400P58	Deposited carbon: 62K ohms ±5%, 1/4 w.
R47	19A143400P40	Deposited carbon: 2K ohms ±5%, 1/4 w.
R48	19A700019P39	Deposited carbon: 1.5K ohms ±5%, 1/4 w.
R49	19A700019P51	Deposited carbon: 15K ohms ±5%, 1/4 w.
R50	19B209358P103	Variable, carbon film: approx 50 to 1K ohms ±10%, 0.2 w; sim to CTS Type X-201.
R51	19A700019P25	Deposited carbon: 100 ohms ±5%, 1/4 w.
R52	19A700019P26	Deposited carbon: 120 ohms ±5%, 1/4 w.
R53	19A700019P55	Deposited carbon: 33K ohms ±5%, 1/4 w.
R54	19A700019P41	Deposited carbon: 2.2K ohms ±5%, 1/4 w.
R55	19A700019P55	Deposited carbon: 33K ohms ±5%, 1/4 w.
R56	19A700019P41	Deposited carbon: 2.2K ohms ±5%, 1/4 w.
R57	19A700019P68	Deposited carbon: 0.39M ohms ±5%, 1/4 w.
R58	19A700019P69	Deposited carbon: 0.47M ohms ±5%, 1/4 w.
R59	19A700019P45	Deposited carbon: 4.7K ohms ±5%, 1/4 w.
R60	19A700019P28	Deposited carbon: 180 ohms ±5%, 1/4 w.
R61 and R62	19A700019P49	Deposited carbon: 10K ohms ±5%, 1/4 w.
R63	19A700019P60	Deposited carbon: 82K ohms ±5%, 1/4 w.
R64	3R77P621J	Composition: 620 ohms ±5%, 1/2 w.
R65	19A143400P58	Deposited carbon: 62K ohms ±5%, 1/4 w.
R66	19A700019P25	Deposited carbon: 100 ohms ±5%, 1/4 w.
R67	19A700019P53	Deposited carbon: 22K ohms ±5%, 1/4 w.
R68	19A700019P13	Deposited carbon: 10 ohms ±5%, 1/4 w.
R69	19A700019P51	Deposited carbon: 15K ohms ±5%, 1/4 w.
R70	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
T1	19A116736P1	Audio freq: 300 to 6000 Hz Pri: 300 ohms +15% DC res, Sec 1: 15 ohms ±15% DC res, Sec 2: 15 ohms ±15% DC res.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1	19A116325P4	Zener: 5 w, 12 v; sim to Type 1N5349.
VR2	4036887P2	Silicon, zener: sim to 1N5223B.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A701332P4	Insulator, washer: nylon. (Used with Q9).
	19B219690G1	Handle assembly.

*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.

19A129924G2-G3:

REV. A - To help meet -20 dBm output level specification. Changed value of R14.

REV. B - To avoid oscillation on board, changed Q3 from 19A115910P1 to 119A115889P.

REV. C - To reduce audio distortion. Added R70.

19D417210G2-G3:

REV. B - Board change required for new design (GE-MARC V) Added R19 and R20.

REV. C - To reduce audio distortion. Added R70.

ADDENDUM NO. 1 TO LBI30705D

PC67

This addendum describes Revision Letter changes that are not yet included in the publication.

REV.D-Excessive gain caused distortion in repeat audio path. Changed R10 to 19A700019P31 (330 ohms +/-5%,1/4 w.).