



DESCRIPTION AND MAINTENANCE
MASTR® II TONE REMOTE/REPEATER STATION CONTROL SHELF

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DESCRIPTION

The General Electric MASTR® II Tone Remote/Repeater Station Control Shelf is a 3-rack unit card shelf. A Mother Board is utilized on the shelf to interconnect the plug-in function boards. This Mother Board provides the function board jacks, the station interconnect jacks and the printed wiring runs between these jacks. External connections are made to terminal board TB1201, located on the rear of the Mother Board.

Tone Control Sequence

When a non-transmit function is selected at the remote control console, 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 tone is changed to that of the function frequency selected. This tone is transmitted for a period of 40 milliseconds at a level of 10 dB below the Secur-it tone burst.

When a transmit function is selected at the remote control console, the Secur-it tone is transmitted as in the sequence described above, followed by a 50 ms burst of the F1 or F2 transmit function tone. This is followed by the 2175 Hz tone transmitted at a level 30 dB below its initial Secur-it burst level. The low level 2175 Hz tone remains on in the

presence of voice as long as the PTT switch is operated at the remote control console.

Control Frequency and Function

The control frequencies selected at the remote control console for performing the transmit, receive and repeat control functions are listed in Table 1.

TABLE 1 - CONTROL FREQUENCY AND FUNCTION

Function	Tone Frequency
TX F1	1950 Hz
Channel Guard Enable or Repeater Enable	1550 Hz
Channel Guard Disable or Repeater Disable	1450 Hz

The control frequencies selected at the remote control console for performing the three or four-frequency transmit, receive and repeat control functions are listed in Table 2.

In three and four-frequency remote/repeat systems, the transmit and receive oscillators are strapped together on the control shelf Mother Board. The receiver control board latches the selected TX and RX oscillators. This allows the TX oscillator to stay selected when the hold tone (2175 Hz) is removed by releasing PTT.

TABLE 2

3 OR 4-FREQUENCY CONTROL FREQUENCY AND FUNCTION

Function	Tone Frequency
TX-RX F1	1950 Hz
TX-RX F2	1850 Hz
TX-RX F3	1350 Hz
TX-RX F4	1250 Hz
Channel Guard Enable or Repeat Enable	1550 Hz
Channel Guard Disable or Repeat Disable	1450 Hz

Control Modules

The following chart indicates the plug-in boards required to provide the various tone remote/repeat functions.

Control Function	Required Plug-In Modules				
	Audio	TX Cont.	RX Cont.	Repeater	CG Filter
1 Freq. Transmit 1 Freq. Receive	19A129924G2	19D416660G1		19D417385G1	
1 Freq. Transmit 1 Freq. Receive CG Monitor	19A129924G2	19D416660G4		19D417385G2	19C320627G1
2 Freq. Transmit 2 Freq. Receive	19A129924G2	19D416660G2	19D429100G1	19D417385G1	
2 Freq. Transmit 2 Freq. Receive CG Monitor	19A129924G2	19D416660G3	19D429100G1	19D417385G2	19C320627G1
3 or 4 Freq. TX 3 or 4 Freq. RX	19A129924G2	19D416660G2 19D429082G1	19D429100G1	19D417385G1	
3 or 4 Freq. TX 3 or 4 Freq. RX CG Monitor	19A129924G2	19D416660G3 19D429082G1	19D429100G1	19D417385G2	19C320627G1

NOTE

Secur-it Tone Board 19D424051, 10 Volt Regulator 19D417401 are required in all applications. Repeater Disable with Channel Guard on/off requires Auxiliary Control Board 19D416702G5. Repeater Disable without Channel Guard on/off utilizes Auxiliary Control Board 19D416702G1.

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 1.

The 4-Wire Audio Kit (Option 9507) consists of a separate transformer mounted to the Mother Board with special connections to be made to TB1201. Refer to the Installation Instructions for Option 9507.

Four-Wire Audio

In remote control two-way radio systems where customer-owned multiplex/microwave

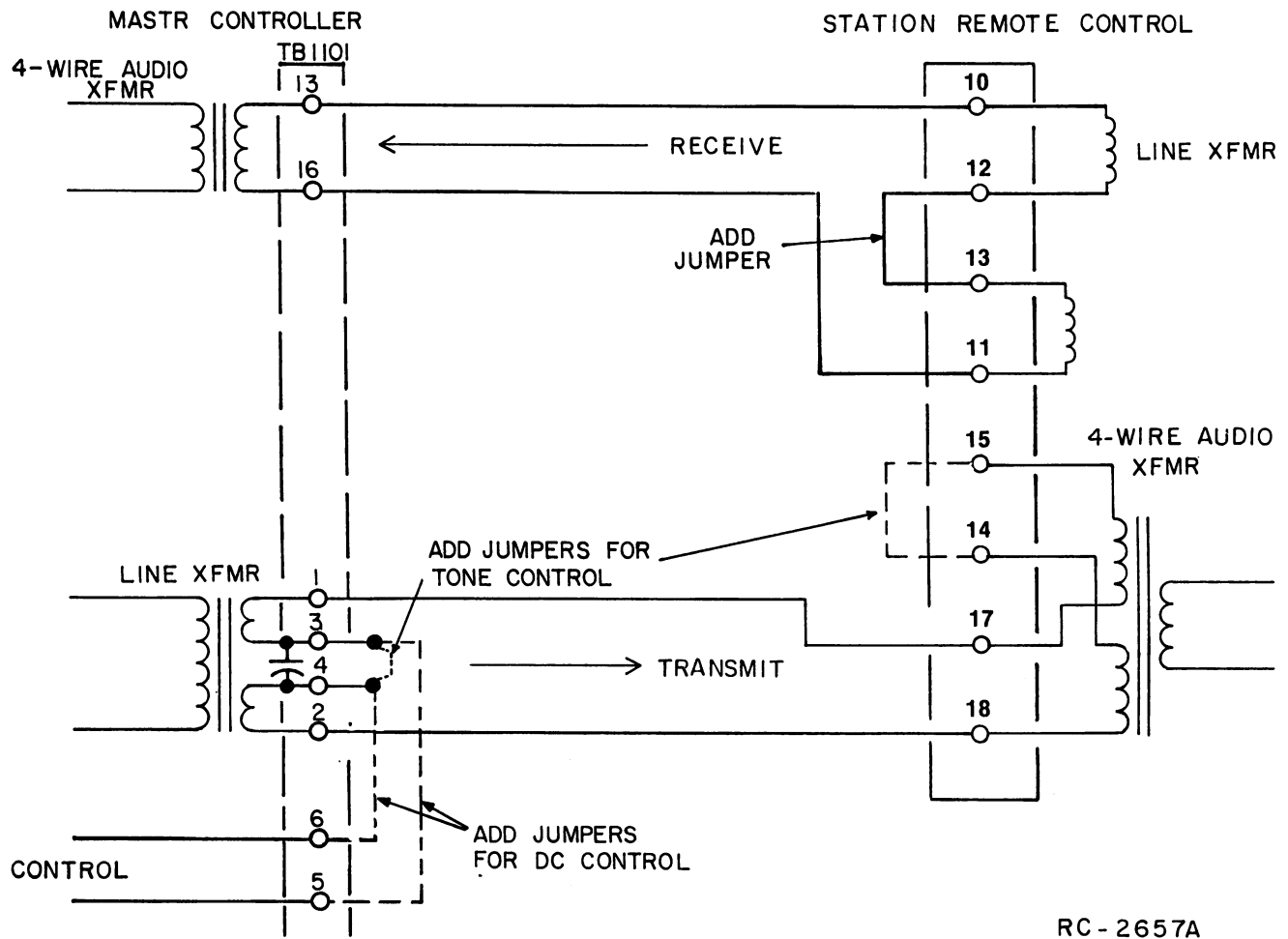


Figure 1 - Typical 4-Wire Audio Application

CONNECTIONS

All Connections to the Base Station Control Shelf are made at TB1201. 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 the telephone or metallic pair to TB1201-10 and TB1201-11.
2. Connect jumper between TB1201-12 and TB1201-13.

ADJUSTMENT PROCEDURE

Before making adjustments on the Base Station Control Shelf, make sure that all

power line, phone line and ground connections have been completed at the remote control console and at the Base Station. Also, the remote control console and Base Station should have been properly aligned.

A. TEST EQUIPMENT REQUIRED

1. Audio Oscillator, Hewlett Packard Model 401C or equivalent.
2. VOM. Simpson Model 260 or equivalent.
3. AC VTVM. Heathkit Model IM-38 or equivalent.

B. LINE INPUT

1. Feed a 1000 Hz tone at the required level into the microphone jack on the remote control console having the largest line loss. Adjust the remote control console line output

control for 2.7 Volts RMS as measured across the audio pair at the remote control console.

2. Key the Base Station Transmitter from the remote control console.* Adjust LINE INPUT control R39 on the Remote Audio Board for threshold of compression as indicated by a drop of 1 dB on an AC VTVM connected between the emitter of Q19 and ground.

*The station adjustments may also be made by connecting the audio generator across the audio pair at the station and keying the transmitter by holding the REMOTE PTT switch on the 10 Volt Regulator/Control Module in the REMOTE PTT position.

C. XMIT LEVEL

1. Key the Base Station Transmitter from the remote control console.* Adjust the XMIT LEVEL control R50 on the Remote Audio Board for 4.5 kHz system deviation as measured on a deviation meter.

D. LINE OUTPUT

1. Connect a signal generator to the Base Station Receiver, adjusted to the receiver frequency and modulated at 3 kHz deviation by a 1000 Hz signal. Disable Channel Guard if present.
2. Adjust the LINE OUT control R14 on the Remote Audio Board for a reading of 2.7 Volts RMS as measured at the Base Station Audio pair.

E. REPEATER TIMER ADJUSTMENTS

In stations equipped with Channel Guard, the CG Decoder Board should be removed

to make the following adjustments. In Remote/Repeat Combinations, operating the CG DISABLE switch does not disable the repeater function but only allows monitoring the receiver on noise squelch operation.

F. DROP OUT DELAY TIMER ADJUST

1. Using the station SQUELCH control, unsquelch and squelch the receiver. Note the time required for the transmitter to unkey.
2. If an adjustment is necessary, turn the DROP OUT DELAY TIMER control R14 clockwise to increase the delay time or counterclockwise to decrease the delay time.

G. 3-MINUTE LIMIT TIMER ADJUST

1. Unsquelch the receiver with the station SQUELCH control and note the time for the transmitter to unkey.
2. If an adjustment is necessary, turn the LIMIT TIMER control R8 clockwise to increase the timing cycle or counterclockwise to decrease the timing cycle.

MAINTENANCE

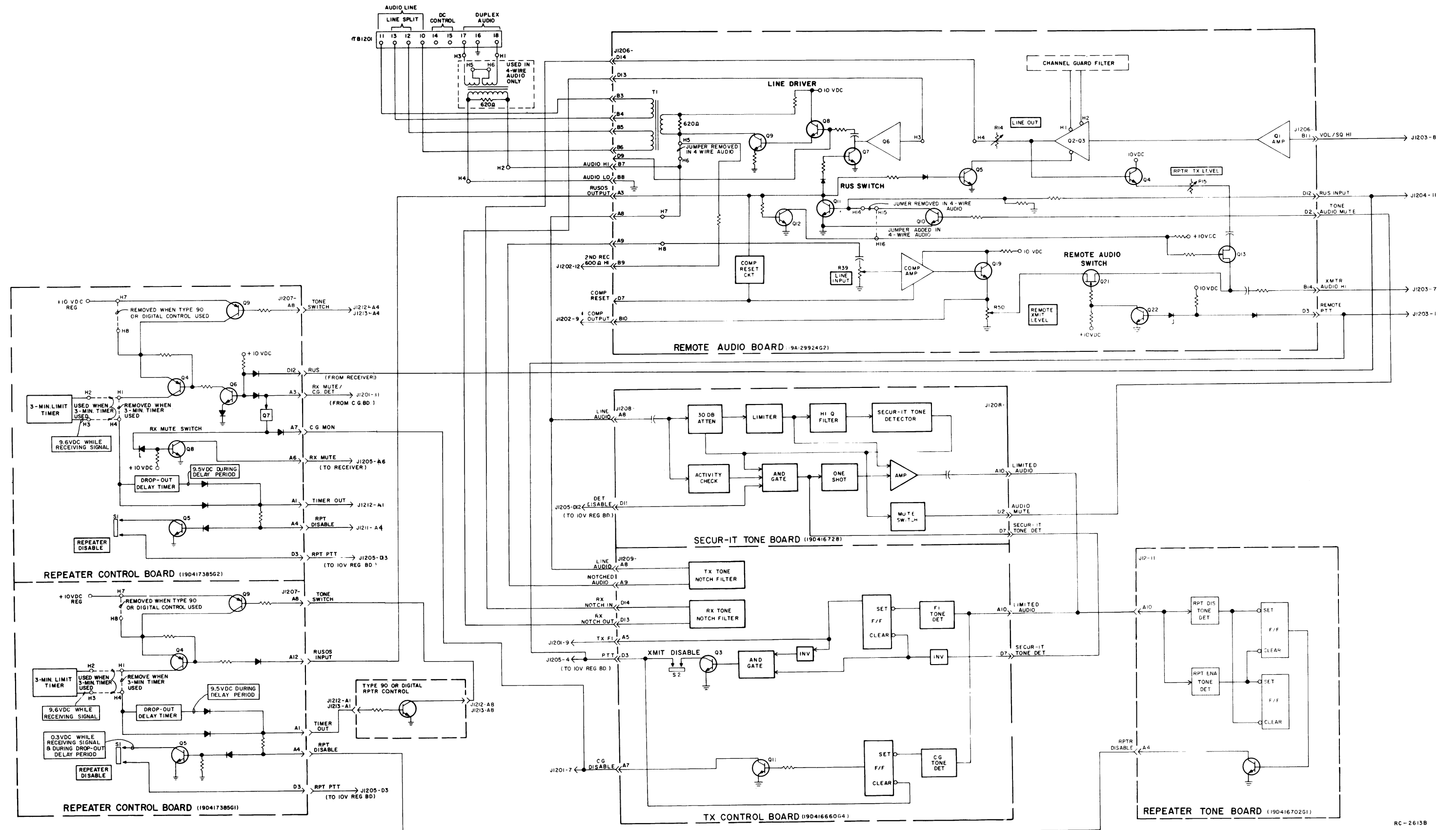
The Tone Remote/Repeater Control Shelf is designed for ease of servicing and minimum maintenance. All circuit modules can be easily removed for routine inspection. An Extender Board (19D417458G1, Option 9544) is recommended for servicing any of the modules out of the shelf while maintaining circuit connections. Refer to the Troubleshooting Procedure (see Table of Contents) when maintenance becomes necessary.



GE Mobile Communications

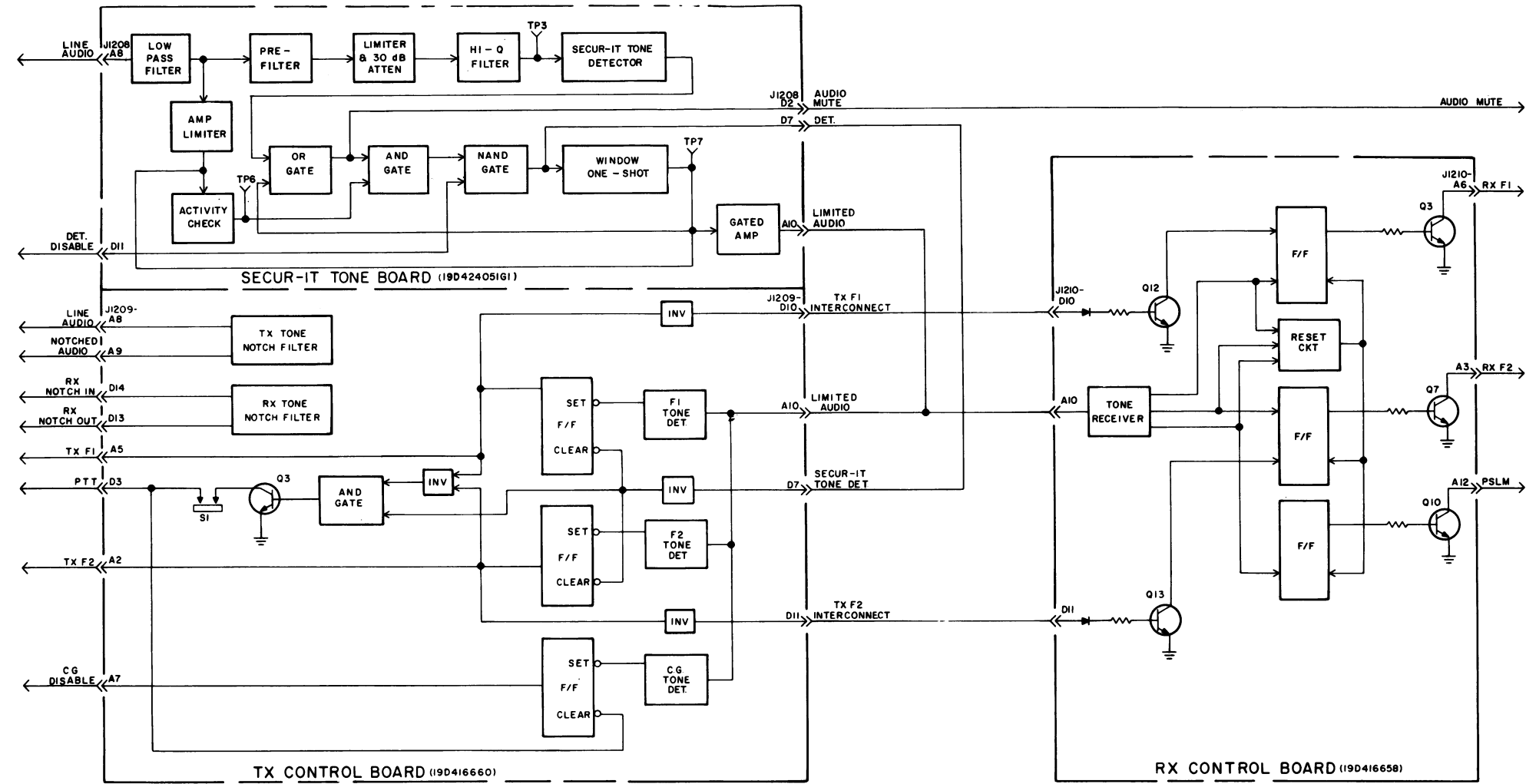
General Electric Company
Lynchburg, Virginia 24502

Printed in U.S.A.



RC-2613B

Figure 2 - Tone Remote/Repeat System and Troubleshooting



SECUR-IT TONE WAVEFORM CHART

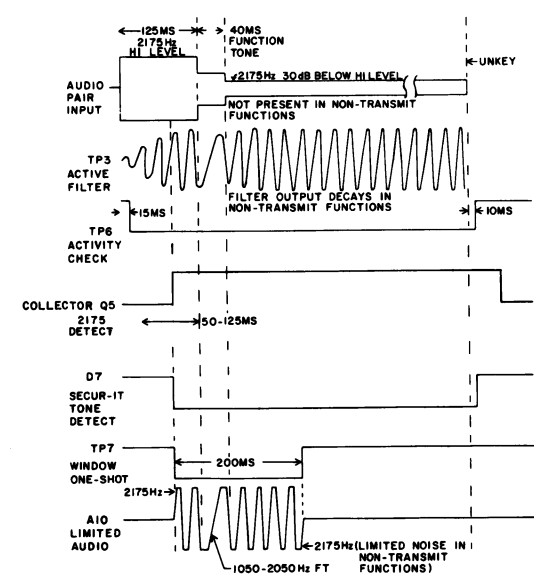


Figure 3 - Tone control System Troubleshooting

4 - FREQ. TONE CONTROL SYSTEM

SYMPTOM	PROCEDURE	SYMPTOM	PROCEDURE	SYMPTOM	PROCEDURE	SYMPTOM	PROCEDURE
NO SECUR-IT TONE DETECT	1. CHECK FOR 2175 HZ TONE AT LINE AUDIO TERMINAL J1208-A8 OR TP 3. 2. CHECK FOR TONE AT OUTPUT OF ACTIVE FILTER (TP3). REFER TO WAVEFORM CHART. 3. CHECK FOR PROPER WAVEFORM AT ACTIVITY CHECK CIRCUIT (TP6). REFER TO WAVEFORM CHART. IF PROPER WAVEFORM IS NOT OBTAINED, CHECK OPERATION OF A4A, Q9-Q12. 4. CHECK FOR PROPER WAVEFORM AT 2175 DETECT(Q5 COLLECTOR). REFER TO WAVEFORM CHART. IF PROPER WAVEFORM CANNOT BE OBTAINED, CHECK Q2-Q5.	NO PTT FUNCTION	1. CHECK FOR 2175 HZ TONE AT OUTPUT OF HI-Q FILTER(TP3). 2. CHECK FOR LOW AT PIN 3 OF U1A ON TRANSMITTER CONTROL BOARD. 3. CHECK OPERATION OF Q3 ON TRANSMITTER CONTROL BOARD. (REFER TO SCHEMATIC DIAGRAM FOR CORRECT VOLTAGE READINGS.)	NO RX F1 FUNCTION	1. CHECK AUDIO MUTE (J1208-Q2) FOR GROUND INDICATION. IF NOT PRESENT, CHECK OPERATION OF Q20 ON SECUR-IT TONE BOARD. Q20 SHOULD BE CONDUCTING. 2. CHECK FOR RX F1 TONE (1750 HZ) AT LIMITED AUDIO (A10) WHEN RX F1 FUNCTION IS SELECTED. 3. CHECK FOR LOW AT PIN 3 OF U1A ON RECEIVER CONTROL BOARD. 4. CHECK OPERATION OF Q3 ON RECEIVER CONTROL BOARD.	NO TX-RX F1 FUNCTION	1. CHECK FOR TX-RX F1 TONE (1950HZ) AT LIMITED AUDIO (A10) WHEN F1 FUNCTION IS SELECTED. 2. FOLLOW SAME PROCEDURE AS OUTLINED FOR TX F1 IN 2-FREQ SYSTEM. 3. CHECK OPERATION OF Q1, Q5 ON RECEIVER CONTROL BOARD. 4. CHECK FOR LOW AT PIN 3 OF U1A ON RECEIVER CONTROL BOARD.
NO LIMITED AUDIO OUTPUT	1. CHECK WAVEFORM OF WINDOW ONE-SHOT(TP7). 2. CHECK WAVEFORM AT Q1(A10).	NO TX F1 FUNCTION	1. CHECK FOR 1950 HZ TONE (TX F1) AT LIMITED AUDIO(A10)WHEN THE TX F1 FUNCTION IS SELECTED. 2. CHECK FOR LOW AT PIN 3 OF U1A ON TRANSMITTER CONTROL BOARD. 3. CHECK FOR OPERATION OF Q3 ON TRANSMITTER CONTROL BOARD.	NO RX F2 FUNCTION	1. CHECK FOR RX F2 TONE (1650 HZ) AT LIMITED AUDIO (A10) WHEN RX F2 FUNCTION IS SELECTED. 2. CHECK FOR LOW AT PIN 3 OF U1C ON RECEIVER CONTROL BOARD. 3. CHECK OPERATION OF Q7 ON RECEIVER CONTROL BOARD.	NO TX-RX F2 FUNCTION	1. CHECK FOR TX-RX F2 TONE (1850HZ) AT LIMITED AUDIO (A10) WHEN F2 FUNCTION IS SELECTED. 2. FOLLOW SAME PROCEDURE AS OUTLINED FOR TX F2 IN 2-FREQ SYSTEM. 3. CHECK OPERATION OF Q2, Q5 ON RECEIVER CONTROL BOARD. 4. CHECK FOR LOW AT PIN 8 OF U1C ON RECEIVER CONTROL BOARD.
NO AUDIO MUTE FUNCTION	1. CHECK OPERATION OF Q20. THIS TRANSISTOR SHOULD BE TURNED OFF DURING SECUR-IT TONE DETECT.	NO TX F2 FUNCTION	1. CHECK FOR 1850 HZ TONE (TX F2) AT LIMITED AUDIO(A10) WHEN THE TX F2 FUNCTION IS SELECTED. 2. CHECK FOR LOW AT PIN 3 OF U2A ON TRANSMITTER CONTROL BOARD. 3. CHECK OPERATION OF Q8 AND Q9 ON TRANSMITTER CONTROL BOARD.	NO PSLM (OR SIM MONITOR) CONTROL	1. CHECK FOR 1050 HZ TONE AT LIMITED AUDIO (A10) WHEN FUNCTION IS SELECTED. 2. CHECK FOR LOW AT PIN 3 OF U2A ON RECEIVER CONTROL BOARD. 3. CHECK OPERATION OF Q10 ON RECEIVER CONTROL BOARD.	NO TX-RX F3 FUNCTION	1. CHECK FOR TX-RX F3 TONE (1350HZ) AT LIMITED AUDIO (A10) WHEN F3 FUNCTION IS SELECTED. 2. CHECK FOR LOW AT PIN 3 OF U1A ON 19D429082 TX CONTROL BOARD. 3. CHECK OPERATION OF Q3, Q4, Q5 ON 19D429082 TX CONTROL BOARD. 4. CHECK OPERATION OF Q3, Q7 ON RECEIVER CONTROL BOARD. 5. CHECK FOR LOW AT PIN 3 OF U2A ON RECEIVER CONTROL BOARD.
						NO TX-RX F4 FUNCTION	1. CHECK FOR TX-RX F4 TONE (1250HZ) AT LIMITED AUDIO (A10) WHEN F4 FUNCTION IS SELECTED. 2. CHECK FOR LOW AT PIN 3 OF U2A ON 19D429082 TX CONTROL BOARD. 3. CHECK OPERATION OF Q3, Q8, Q9 ON 19D429082 TX CONTROL BOARD. 4. CHECK OPERATION OF Q4, Q8 ON RECEIVER CONTROL BOARD. 5. CHECK FOR LOW AT PIN 8 OF U2C ON RX CONTROL BOARD.

RC-3035A

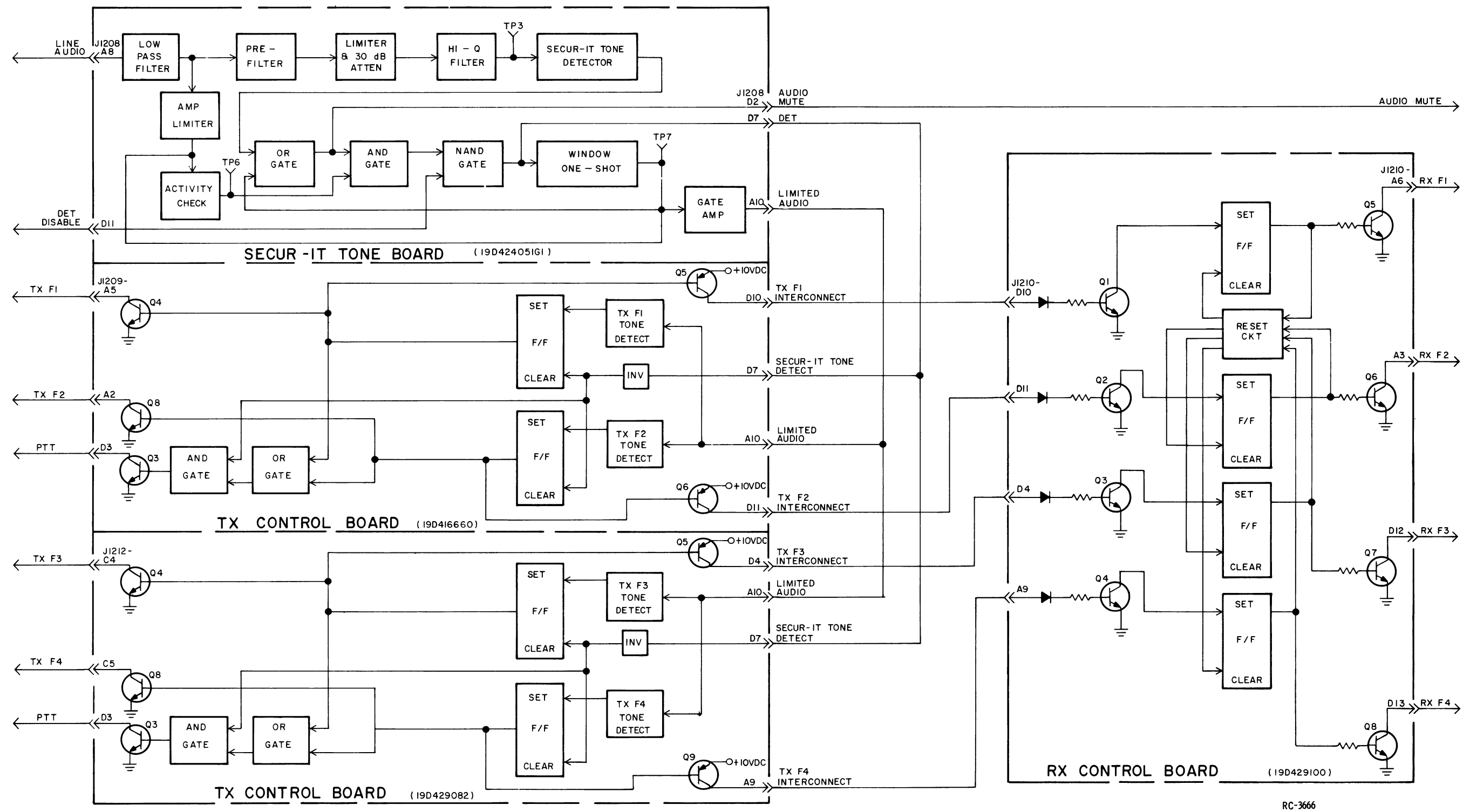
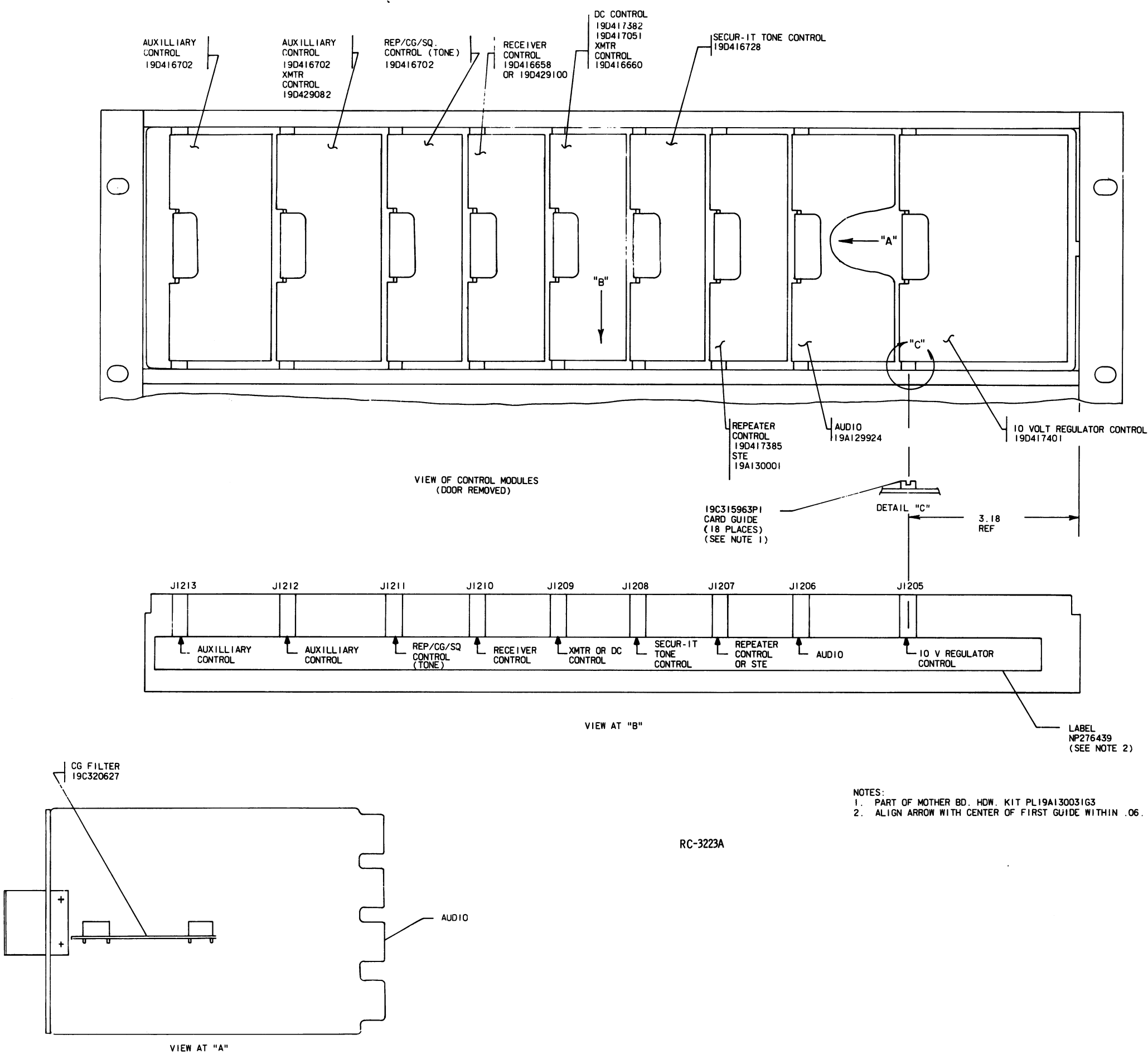


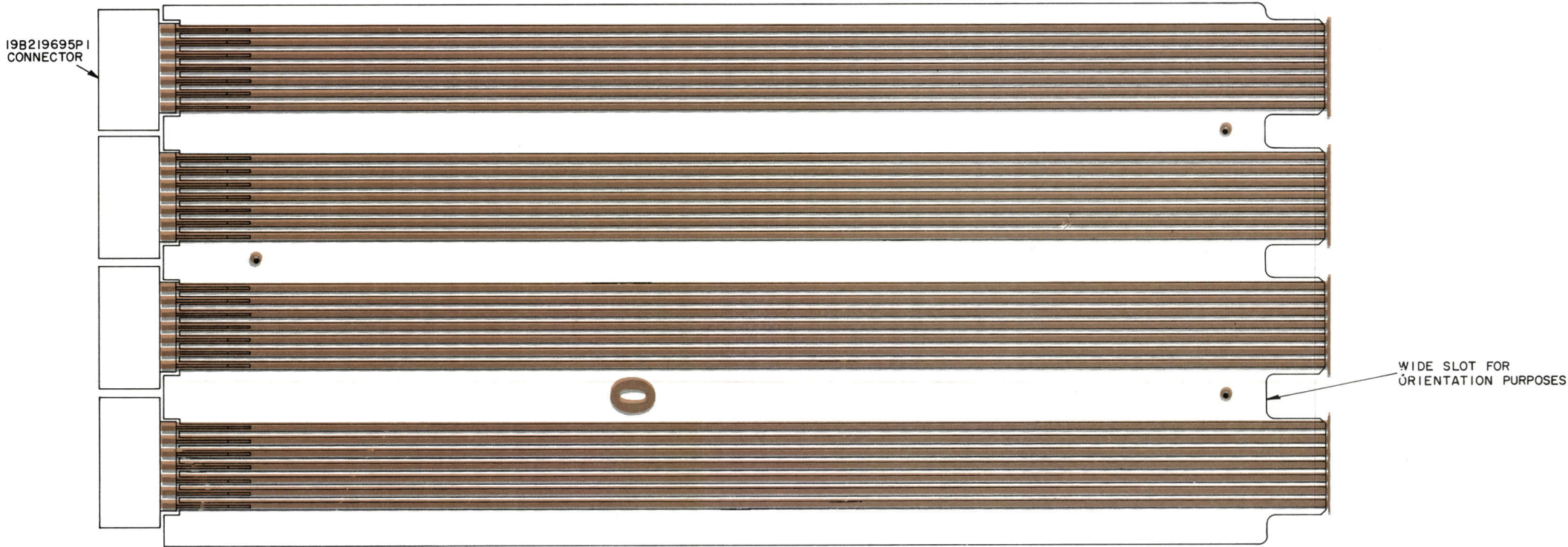
Figure 4 - Four Frequency
Tone Remote Control



OUTLINE DIAGRAM
CONTROL SHELF

EXTENDER BOARD

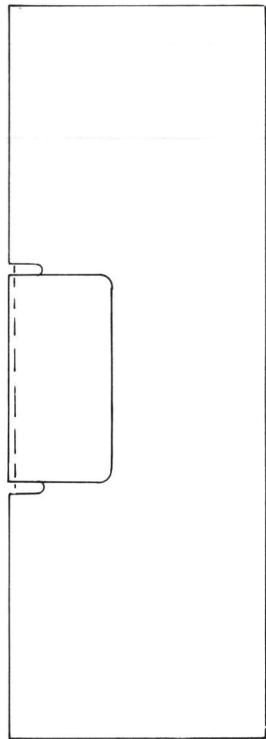
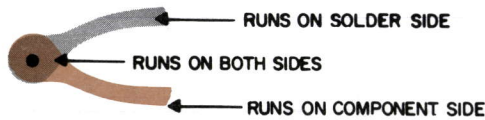
LBI30703



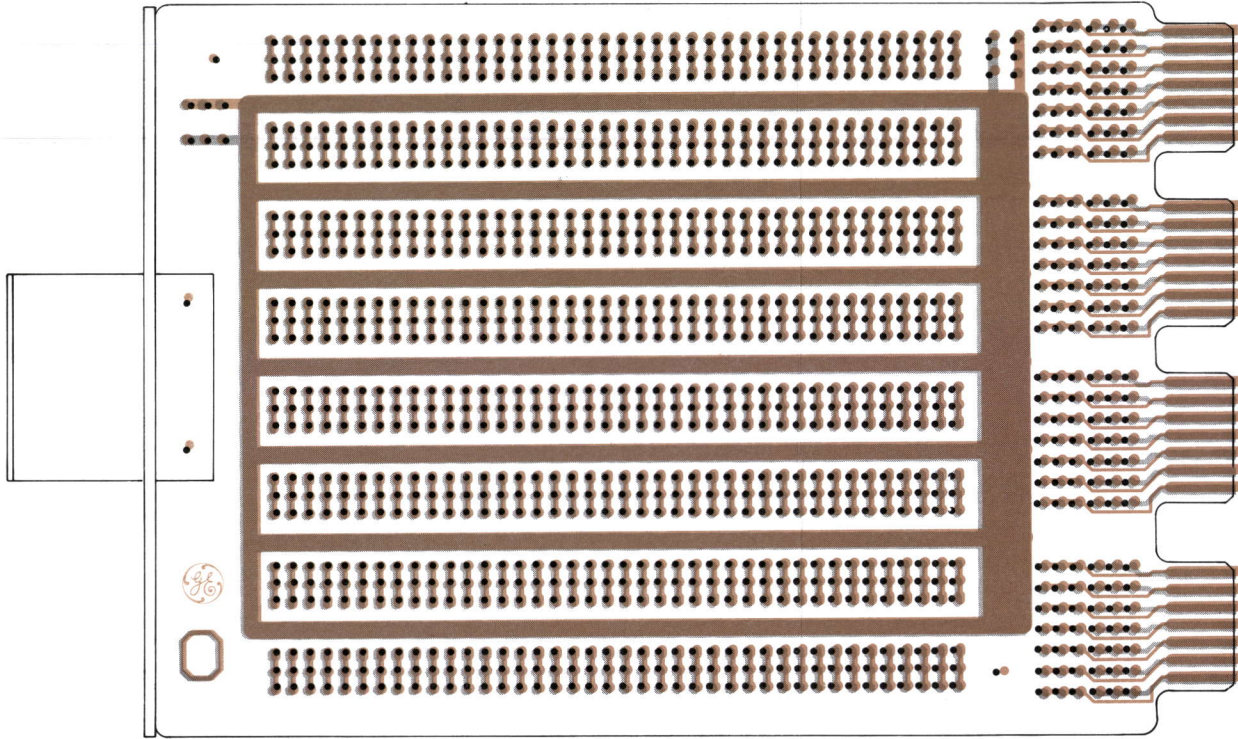
(19D423102, Rev. 0)
(19D417215, Sh. 2, Rev. 0)
(19D417215, Sh. 3, Rev. 0)

FIELD APPLICATION MODULE

COMPONENT BOARD 19C320912PI



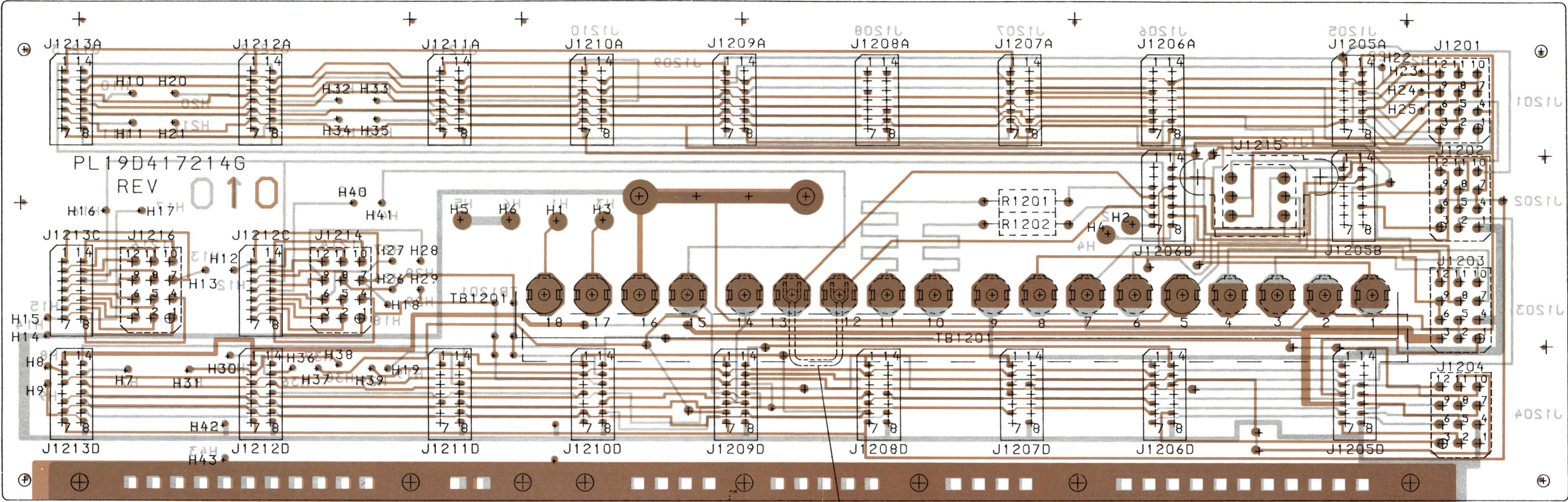
FRONT PANEL: 19D417384P5
HANDLE: 19B219690G1



(19C321422, Rev. 0)
(19B226246, Sh. 1, Rev. 0)
(19B226246, Sh. 2, Rev. 0)

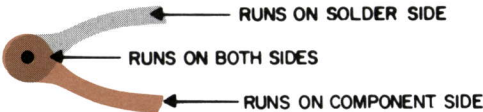
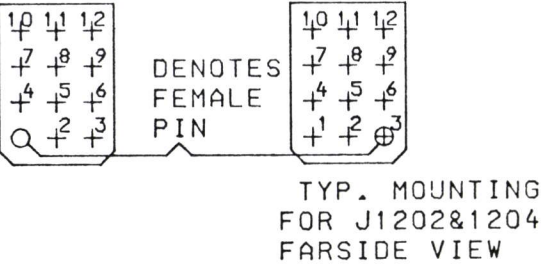
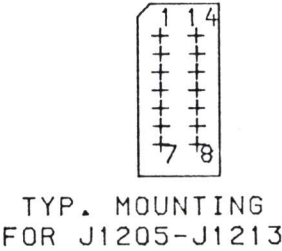
OUTLINE DIAGRAM

EXTENDER BOARD 19D417458G1 AND
FIELD APPLICATION MODULE 19D417941



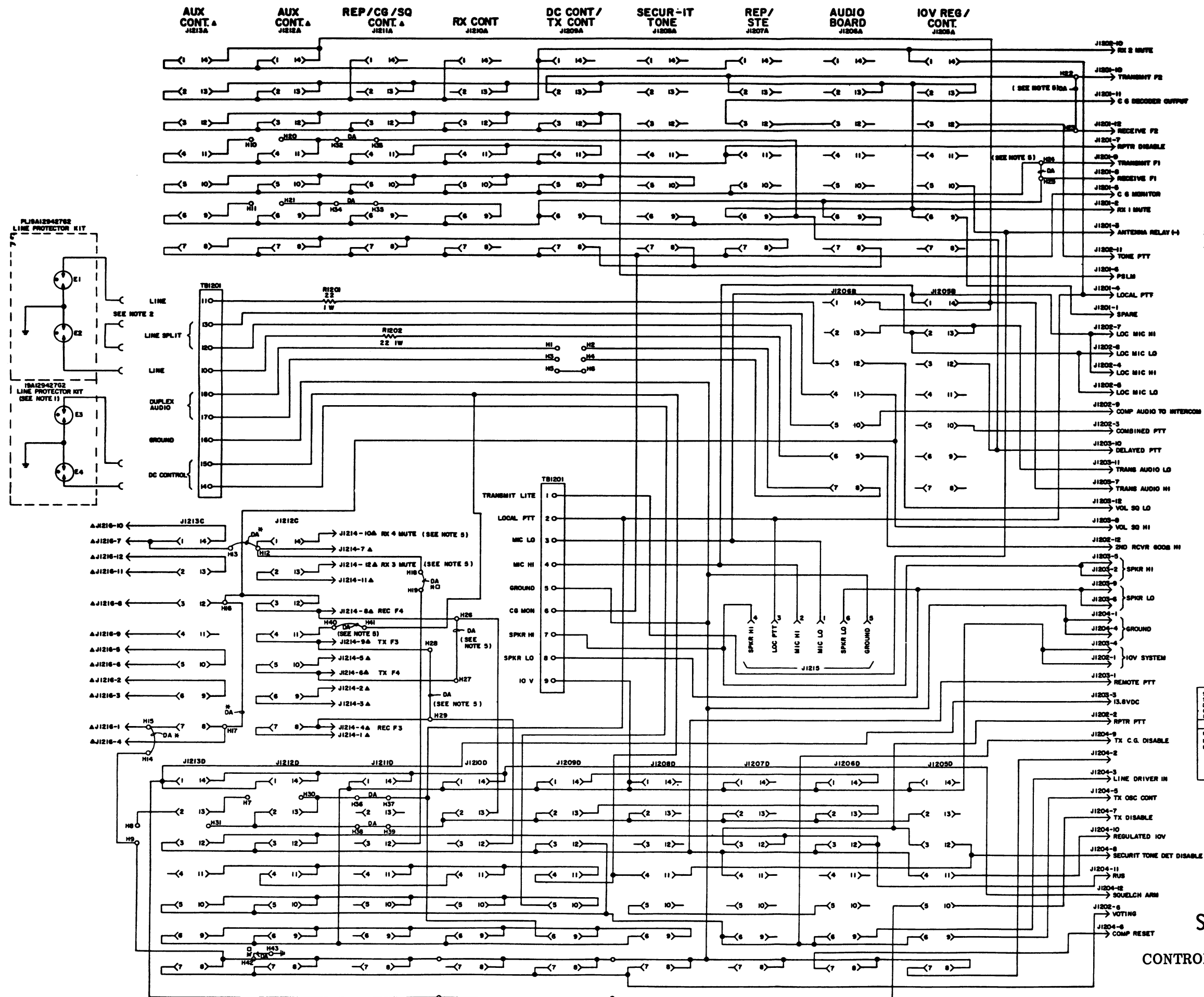
19A129525G3

(19D423897, Rev. 7)
(RC-2943)
(19D423597, Sh. 1, Rev. 10)
(19D423597, Sh. 2, Rev. 10)



OUTLINE DIAGRAM

CONTROL SHELF MOTHER BOARDS
19D417214G1 and G2



PARTS LIST

LBI4811B

CONTROL SHELF MOTHER BOARD
19D417214G1, G2

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 provide line surge protection and change polarity of DC Control leads. Added R1201 and R1202. Reversed connections to J1209-4 and J1209-5.
- REV. B - Changed printed board to provide outputs for EACOM Systems.
- REV. C - Changed board for use in 4-frequency remote systems.
- REV. D - To reduce falsing on noise. Changed printed pattern by interconnecting J1209D-4, TB1201-14 and J1208D-4.
- REV. E - To make both Auxiliary positions functional with station options. Added H32 thru H39 to the printed pattern.
- REV. F - To supply 10 Volts to J1210D-6. Changed printed pattern.
- REV. G - To solve falsing problem, added printed wiring run from 3 & 4 frequency Tx control to the Secur-it Tone Board.
- REV. H - To improve noise floor in EACOM station applications, added identification to H42 and H43 ground run holes.

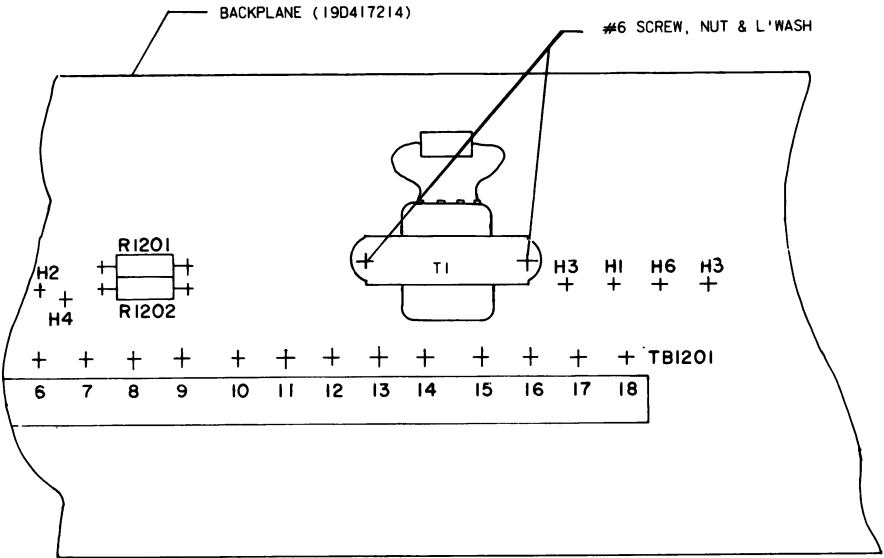
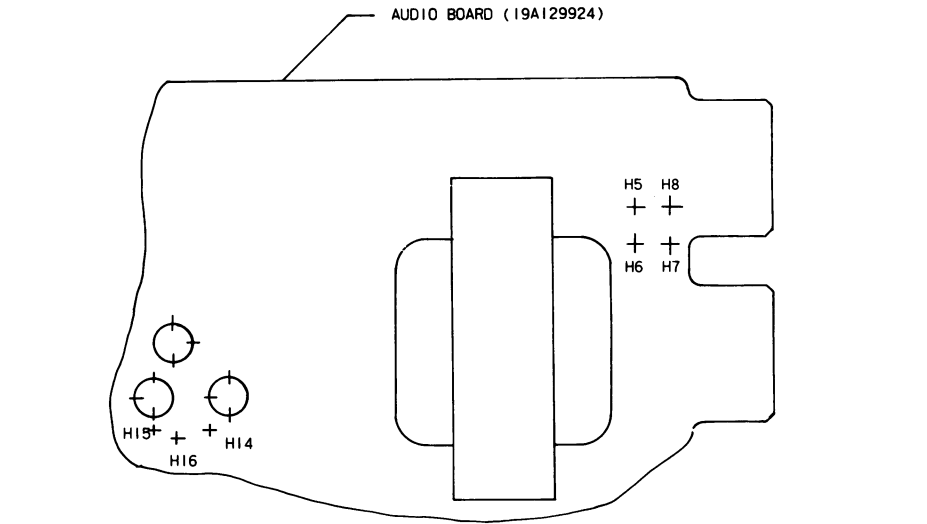
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - JACKS AND RECEPTACLES - - - - -
J1201	19A116647P4	Connector, printed wiring: 12 terminals; sim to Molex 09-18-5121.
J1202	19A116647P6	Connector, printed wiring: 12 terminals; sim to Molex 09-18-5927.
J1203	19A116647P4	Connector, printed wiring: 12 terminals; sim to Molex 09-18-5121.
J1204	19A116647P6	Connector, printed wiring: 12 terminals; sim to Molex 09-18-5927.
J1205A	19A116446P5	Connector, printed wiring: 14 contacts.
J1205B	19A116446P5	Connector, printed wiring: 14 contacts.
J1205D	19A116446P5	Connector, printed wiring: 14 contacts.
J1206A	19A116446P5	Connector, printed wiring: 14 contacts.
J1206B	19A116446P5	Connector, printed wiring: 14 contacts.
J1206D	19A116446P5	Connector, printed wiring: 14 contacts.
J1207A	19A116446P5	Connector, printed wiring: 14 contacts.
J1207D	19A116446P5	Connector, printed wiring: 14 contacts.
J1208A	19A116446P5	Connector, printed wiring: 14 contacts.
J1208D	19A116446P5	Connector, printed wiring: 14 contacts.
J1209A	19A116446P5	Connector, printed wiring: 14 contacts.
J1209D	19A116446P5	Connector, printed wiring: 14 contacts.
J1210A	19A116446P5	Connector, printed wiring: 14 contacts.
J1210D	19A116446P5	Connector, printed wiring: 14 contacts.
J1211A	19A116446P5	Connector, printed wiring: 14 contacts.
J1211D	19A116446P5	Connector, printed wiring: 14 contacts.
J1212A	19A116446P5	Connector, printed wiring: 14 contacts.
J1212C	19A116446P5	Connector, printed wiring: 14 contacts.
J1212D	19A116446P5	Connector, printed wiring: 14 contacts.
J1213A	19A116446P5	Connector, printed wiring: 14 contacts.
J1213C	19A116446P5	Connector, printed wiring: 14 contacts.
J1213D	19A116446P5	Connector, printed wiring: 14 contacts.
J1214	19A116647P4	Connector, printed wiring: 12 terminals; sim to Molex 09-18-5121.
J1215	19B219627G1	Connector: 6 contacts.
J1216	19A116647P4	Connector, printed wiring: 12 terminals; sim to Molex 09-18-5121.
		- - - - - RESISTORS - - - - -
R1201* and R1202*	19A700112P23	Composition: 22 ohms ±5%, 1 w. Added by REV A.
		- - - - - TERMINAL BOARDS - - - - -
TB1201	19A116667P3	Plate nut. (Quantity 18).
		- - - - - MISCELLANEOUS - - - - -
	19A129525G3	Cable: approx 3 inches long.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

LB14567B
4 WIRE AUDIO KIT
19A129508G1

SYMBOL	GE PART NO.	DESCRIPTION
		TRANSFORMER ASSEMBLY 19A129500G1
		----- RESISTORS -----
R1	3R77P621J	Composition: 620 ohms $\pm 5\%$, 1/2 w.
		----- TRANSFORMERS -----
T1	19A115731P1	Audio freq: 300 to 6000 Hz, Pri (1-4): 22 ohms $\pm 15\%$ DC res, Pri (2-3): 12.5 ohms $\pm 15\%$ DC res, Sec 1: 13 ohms $\pm 15\%$, Sec 2: 13 ohms $\pm 15\%$.
		----- MISCELLANEOUS -----
	19B209260P103	Terminal, solderless. (Used with T1).
	N80P13005B6	Screw: No. 6-32 x 5/16.
	7141225P3	Hex nut: No. 6-32.
	N404P13B6	Lockwasher, internal tooth: No. 6.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



THESE INSTRUCTIONS COVER THE INSTALLATION OF THE 4 WIRE AUDIO KIT PL19A129508.

INSTRUCTIONS FOR INSTALLATION ON 19D417214G1 BACK PLANE FOR D.C. REMOTE SYSTEM.

1. MOUNT T1 TO BACK PLANE AS SHOWN.
2. SOLDER BLACK LEAD IN HOLE 1.
3. SOLDER BROWN LEAD IN HOLE 3.
4. SOLDER ORANGE LEAD IN HOLE 2.
5. SOLDER RED LEAD IN HOLE 4.
6. CONNECT GREEN LEAD TO TB1201-15.
7. CONNECT YELLOW LEAD TO TB1201-14.
8. REMOVE JUMPER BETWEEN HOLES 5 & 6 ON AUDIO BOARD 19A129924.
9. MOVE JUMPER FROM HOLE 14 TO HOLE 16 ON AUDIO BD 19A129924.
10. REMOVE JUMPER FROM H16 TO H17 ON 10V REG/CONTROL BD (19D417401), IF THE VII LETTER OF STATION COMBINATION IS D OR L.
11. IF INTERCOM BD. (19C320671) IS PRESENT, ADD A JUMPER (D.A. WIRE) FROM H1 TO H2.
12. TEST PER 19A129945.

INSTRUCTIONS FOR INSTALLATION ON 19D417214G1 BACK PLANE FOR TONE CONTROL SYSTEM.

1. MOUNT T1 TO BACK PLANE AS SHOWN.
2. SOLDER BLACK LEAD IN HOLE 1.
3. SOLDER BROWN LEAD IN HOLE 3.
4. SOLDER ORANGE LEAD IN HOLE 2.
5. SOLDER RED LEAD IN HOLE 4.
6. CLIP TERMINAL OFF OF GREEN LEAD & SOLDER LEAD IN HOLE 5.
7. CLIP TERMINAL OFF OF YELLOW LEAD & SOLDER LEAD IN HOLE 6.
8. REMOVE JUMPER BETWEEN HOLES 5 & 6 ON AUDIO BOARD 19A129924.
9. MOVE JUMPER FROM HOLE 14 TO HOLE 16.
10. REMOVE JUMPER FROM H16 TO H17 ON 10V REG/CONTROL BD. (19D417401) IF THE VII LETTER OF STATION COMBINATION IS D OR L.
11. IF INTERCOM BD. (19C320671) IS PRESENT ADD A JUMPER (D.A. WIRE) FROM H1 TO H2.
12. REMOVE C33 ON SECUR-IT TONE BD. 19D424051G1.
13. TEST PER 19A129945.

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 PICO FARADS (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.

NOTE:
1. FOR TONE CONTROL CONNECT GREEN WIRE TO HOLE 5 & YELLOW WIRE TO HOLE 6 INSTEAD OF TB1201.

(19B226163, Rev. 1)

