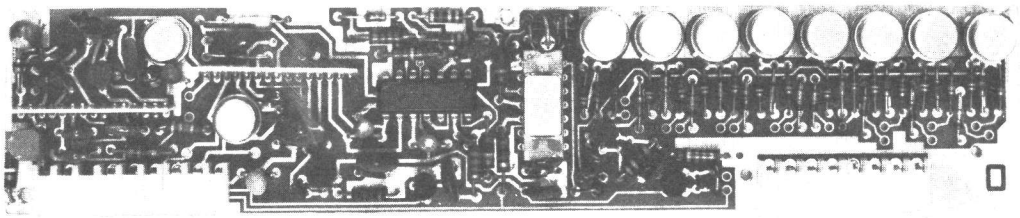
GE MOBILE RADIO

MASTR II
MAINTENANCE MANUAL

CHANNEL GUARD ENCODE/DECODE 19D423436G4, 10
CHANNEL GUARD ENCODE ONLY 19D423436G5

Maintenance Manual LBI-30264
PF-5046



MULTI-TONE CHANNEL GUARD
19D423436G4, 5 & 10

SPECIFICATIONS *

Tone Frequencies	71.9 to 203.5 Hertz - 19D423436G4 71.9 to 250.3 Hertz - 19D423436G5 71.9 to 250.3 Hertz - 19D423436G10**
Frequency Stability	±0.2%
Encode Tone Distortion	1%
Decode Sensitivity	6 dB SINAD
Decode Response Time	Less than $\frac{100}{\text{CG FREQ.}}$ x 250 ms
Temperature Range	-40°C to +85°C (-40°F to 185°F)
Power Requirements	10 VDC 30 Milliamperes Max.

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.
**Available on special order only. . . . . See Page ii

GENERAL ELECTRIC

TABLE OF CONTENTS

MULTI-TONE CHANNEL GUARD OPTIONS	
UNIT	OPTION
19D423436G4 19D423436G5 19D423436G10	9042 - 9048 9035 - 9041 9089 - 9095 *

* NOTE: These options are available on special order only due to special system applications. (See note in text)

WARNING

Although the highest DC voltage in the unit is supplied by the vehicle battery, high current may be drawn under short circuit conditions. These currents can possibly heat metal objects such as tools, rings, watchbands, etc. enough to cause burns. Be careful when working near energized circuits.

DESCRIPTION

MASTR II Multi-Tone Channel Guard equipment provides tone encoding and decoding transmission techniques to prevent the reception of unwanted calls.

The Multi-Tone Channel Guard assemblies use digital/analog techniques to generate EIA continuous tone controlled squelch system (CTCSS) frequencies. A monolithic integrated circuit and up to eight plug-in crystal packages are used for the generation and detection of the tone signals. The encoder provides tone modulation to the transmitter. The decoder operates in conjunction with the receiver to inhibit all calls that are not tone modulated with their proper Channel Guard tone frequency.

Three models of the Multi-Tone Channel Guard board are available. The 19D423436G4 & G10 boards provide multi-tone encode/decode capability. The 19D423436G5 board is for multi-tone encode applications only. The 19D423436G10 is available on special order only.

The Multi-Tone Channel Guard circuit consists of a voice reject filter, a limiter, an encode/decode integrated circuit, an encode passive resistor hybrid, a decode passive resistor hybrid, a resistive ladder digital to analog converter, a summing amplifier, a low pass filter, PTT delay, an antenna relay driver, and receiver mute delay. Also, an oscillator circuit with up to eight crystal packages is included to provide multi-tone capability.

Each MASTR II receiver is equipped with a tone reject filter to prevent the Channel Guard tone from being heard. In addition, all transmitters have a Channel Guard Modulation Adjust which is set in accordance with the "Transmitter Alignment Procedures".

OPERATION

A Channel Guard "disable" switch on the microphone or handset hookswitch controls the operation of the Channel Guard decode circuitry. When the disable switch on the microphone or handset hookswitch is in the "down" position (away from the small speaker symbol) and the microphone or handset is in the hanger, only those calls that are tone modulate with the corrected Channel Guard tone frequency are heard. Removing the microphone or handset from its hanger disables the Channel Guard and permits monitoring the channel before transmitting.

Placing the Channel Guard "disable" switch in the up position (towards the small speaker symbol) disables the Channel Guard decode function and allows all incoming calls to be heard whether the microphone or handset is in or out of the hanger.

In normal operation, the encode function is continuously enabled regardless of the condition of the PTT. Through modification, the encode function can be disabled when the PTT is not operated and enabled only during the time the PTT is operated.

NOTE

Per customer requirements, the Decode and/or Encode function can be disabled on any RF channel. Refer to the Table of Contents for the location of the Decode/Encode Disable Modification Instructions.

Selecting the operating RF channel on the channel selector switch of the Control Unit simultaneously selects the operating Channel Guard tone frequency. Since the Multi-Tone Channel Guard assemblies are limited to eight tone frequencies, Channel Guard tone frequencies F1 through F8 will correlate with operating RF channels 1 through 8; although, up to twelve RF channels may be provided on the Control Unit and/or radio.

NOTE

Tone frequencies may be repeated to eliminate the need for more than one crystal on the same frequency. To repeat a tone, refer to the Table of Contents for the location of the "Repeated Tone Frequency Modification Instructions".

CIRCUIT ANALYSIS

Channel Guard is a continuous-tone controlled squelch system that provides communications control in accordance with EIA standard RS-220. The basic Channel Guard system utilizes standard tone frequencies from 71.9 to 250.3 Hertz with both the encoder and decoder operating on the same frequency. The standard Channel Guard tone frequencies are listed below:

STANDARD TONE FREQUENCIES				
71.9	94.8	123.0	156.7	203.5
74.4	97.4	127.3	162.2	*210.7
77.0	100.0	131.8	167.9	*218.1
79.7	103.5	136.5	173.8	*225.7
82.5	107.2	141.3	179.9	*233.6
85.4	110.9	146.2	186.2	*241.8
88.5	114.8	151.4	192.8	*250.3
91.5	118.8			

* Extended Frequency Tones apply to Channel Guard Unit 19D423436G5 & G10.

NOTE

Due to the extended tone frequency range, an increased likelihood of voice blocking in the decoder of the 19D423436G10 unit may be experienced in some applications. Also, the extended tone frequencies are not compatible with all Channel Guard units.

CRYSTAL OSCILLATOR

The oscillator circuit consist of transistors Q1010 and Q1011, up to eight plug-in crystals, and a diode/resistor arrangement to control selection of the desired crystal. The crystal frequencies are 256 times the operating tone frequencies.

If RF channel 1 is selected, A- is applied from the control unit to pin 8 (F1) of J909 on the Channel Guard assembly (see Wiring Diagram). A- at pin 8 forward biases diodes CR1015 and CR1007. Forward biasing diode CR1007 completes the feedback path to crystal Y1001 and allows the oscillator to operate at the frequency of crystal Y1001. The oscillator output at the collector of transistor Q1010 is applied to pin 2 of Encode/Decode IC U1001. Selection of RF channel 2 through 8 controls crystals Y1002 through Y1008 and associated circuitry in a similar manner.

DECODE MODE

The Channel Guard circuitry continuously monitors all calls on the receiver frequency through the Volume/Squelch Hi circuit of the receiver. All signals are applied to the voice reject filter-limiter circuits. The Decode Resistor Hybrid (U1002) contains thirteen resistors used in the voice reject filter-limiter circuit.

Q1004 and the associated RC network form an active low-pass filter. Q1005, Q1006 and the associated RC network form an active notch filter. The two filters present a minimum attenuation of 25 dB to all frequencies above 300 Hertz while passing the Channel Guard tone frequencies.

The tone signals from the voice reject filter are coupled to Limiter AR1002. The clipping action of the limiter eliminates variations on the decoder performance due to changes in tone deviation.

The Encode/Decode IC (U1001) consists of a digital decoder, a divide-by-256 counter, a digital phase shifter and a digital tone wave generator (Walsh Function Generator).

The output of the limiter (pin 6 of AR1002) is applied to the decoder (pin 6) of U1001. The decoder compares the output of the limiter with the clock frequency derived from the crystal oscillator. The decoder determines when the proper Channel Guard tone is received.

The Receiver Mute Delay circuit consists of AR1001-B, AR1001-D, Q1003 and associated components. When the proper tone is received, the decoder output applied to AR1001-B causes Q1003 to turn off. This unmutes the receiver audio.

When the Channel Guard hookswitch is used, lifting the microphone from the hookswitch applies ground to the Receive CG Disable Input (J908-3) to disable (unmute) the mute circuit.

SERVICE NOTE

J908-5 on the Channel Guard assembly provides an indication of the Channel Guard operating status.

- When J908-5 is high -- receiver is unmuted.
- When J908-5 is low -- receiver is muted.

ENCODE MODE

The divide-by-256 counter in U1001 divides the reference clock frequency by 256 to produce a square wave at the desired Channel Guard frequency. The desired output is obtained by converting the digital pulses developed by the divider to a fair approximation of a sine wave. This is accomplished by a digital to analog converter consisting of the Walsh Function Generator, resistor ladder, and the summing amplifier.

The square wave produced by the divide-by-256 counter is applied to the Walsh Function Generator. The Walsh Function Generator produces four output waveforms. (see Figure 1).

The resistive (ladder) weighting network (R1028, R1029, R1030 and R1031) sets the level of the output current for each binary bit from the Walsh Function Generator. The Walsh Function coefficients of a sine wave determines the level of each output current which in turn determines the value of each resistor in the weighting network. (See Table 1).

TABLE 1

WALSH FUNCTION	SINE WAVE COEFFICIENTS
1	0.637
3	-0.264
5	-0.052
7	-0.127

From the weighting network, the combined current is coupled to the summing amplifier which serves as a current to voltage converter. The resultant waveshape is shown in Figure 2. The waveshape is the result of combining waveform No. 1

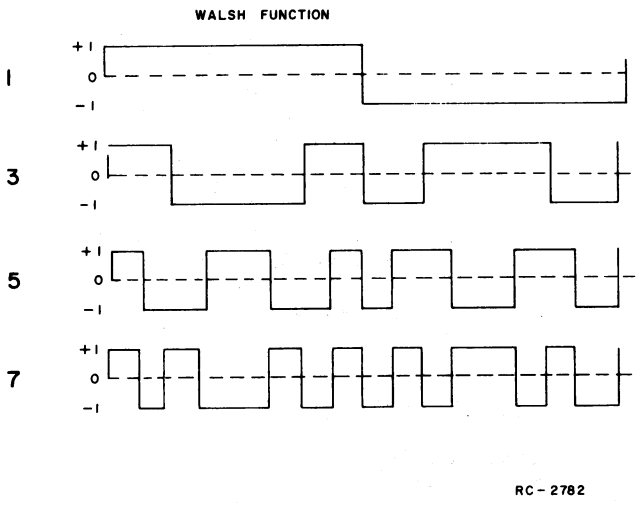


Figure 1 - Walsh Function Waveforms

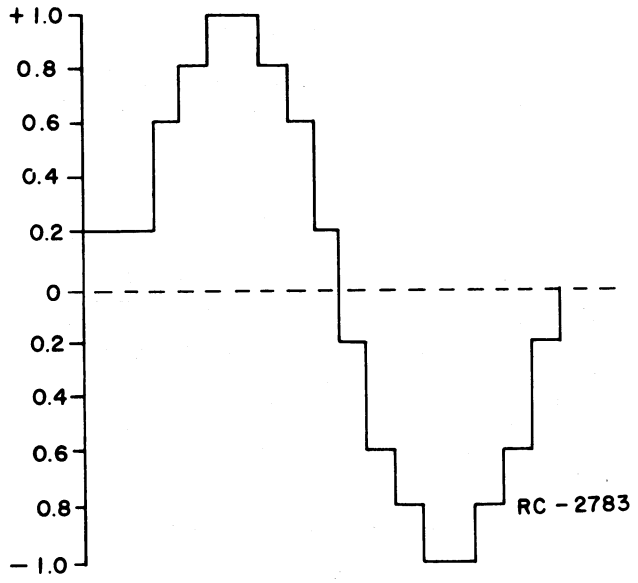


Figure 2 - Weighted Sum of Walsh Functions

times 0.637 to waveform No. 3 times -0.264 to waveform No. 5 times -0.052 to waveform No. 7 times -0.127.

De-emphasis capacitor C1003 in the feedback loop of the summing amplifier provides a 6 dB/octave rolloff. The signal is then passed through the active harmonic filter Q1007 and coupling capacitor C1014 to the transmitter exciter.

SQUELCH TAIL ELIMINATION

The purpose of Squelch Tail Elimination (STE) is to eliminate the undersirable noise burst after each transmission.

Squelch Tail Elimination (STE) is accomplished by changing the phase of the CG tone 135 degrees at the encoder when the PTT switch is released, and simultaneously delaying the transmitter carrier dropout for approximately 175 milliseconds. Delaying the carrier dropout allows the decoder to detect the shift in the CG tone and mute the receiver, eliminating the squelch tail.

In the encode mode when the PTT is closed, Q1001 turns on. Q1001 operates the digital phase shifter through pin 13 of U1001 causing the CG tone to shift. Q1001 also operates AR1001-A. The output of AR1001-A at pin 5 turns on Q1002, applying ground to J908-8 (delayed PTT) to key the transmitter.

When the PTT is released, Q1001 turns off. The digital phase shifter of U1001 again shifts the CG tone (135 degree shift). AR1001-A cannot turn off until C1006 discharges to a level where the current at pin 1 is less than the current at pin 6. After approximately 175 milliseconds (determined by the time constant of C1006 and R1008), AR1001-A turns off, turning off Q1002. Ground is thus removed from J908-8, unkeying the transmitter.

In the decode mode when the proper CG tone is detected, AR1001-B turns Q1003 off. This unmutes the receiver audio.

When the CG tone is shifted (PTT switch released), the decoder detects the shift as an improper CG tone. This causes Q1003 to turn on and mute the receiver audio. The Receiver Mute Delay circuit (AR1001-B and AR1001-D) keeps the receiver muted for approximately 300 milliseconds. This keeps the receiver muted during the 175 millisecond transmitter carrier dropout period, thus eliminating the squelch tail.

INSTALLATION

IN MOBILE RADIOS

To install Channel Guard in radios not previously equipped with this feature, proceed as follows:

1. Gain access to System Board and clip out the DA jumper wire between H71 and H72 on the System Board (Refer to the MASTR II Maintenance Manual for the Front Panel and System Board).

2. Plug the Channel Guard unit into J908 and J909 on the System Board.

3. Install the hookswitch to the control unit as directed in the Control Unit Maintenance Manual.

4. Adjust transmitter deviation in accordance with the Alignment Procedures in the Transmitter Maintenance Manual. No other adjustments are required.

IN STATIONS

Refer to the Station Combination Maintenance Manual for installation instructions.

MAINTENANCE

Troubleshooting the Channel Guard assembly is facilitated when using the Channel Guard extender board (19C320966G1). The extender board contains three slide switches which disable the decode and encode circuitry, and also bridges the PTT input to the delayed PTT output when the CG board is removed. In addition, "test points" are provided for all pins on J908.

PTT Bridge - Allows the transmitter to be keyed when the Channel Guard board is removed. Note: If transmitter is keyed with Channel Guard installed and PTT bridge closed, the Channel Guard PTT delay will lock up until PTT bridge is opened.

Encode Disable - Applies A- to J908-2, R1042, and Pin 14 of U1001 to prevent transmitting the Channel Guard tone.

Rx CG Disable - Applies A- to J908-3, R1039 and Pin 5 of U1001 to disable the decoder. Under this condition the receiver is not muted.

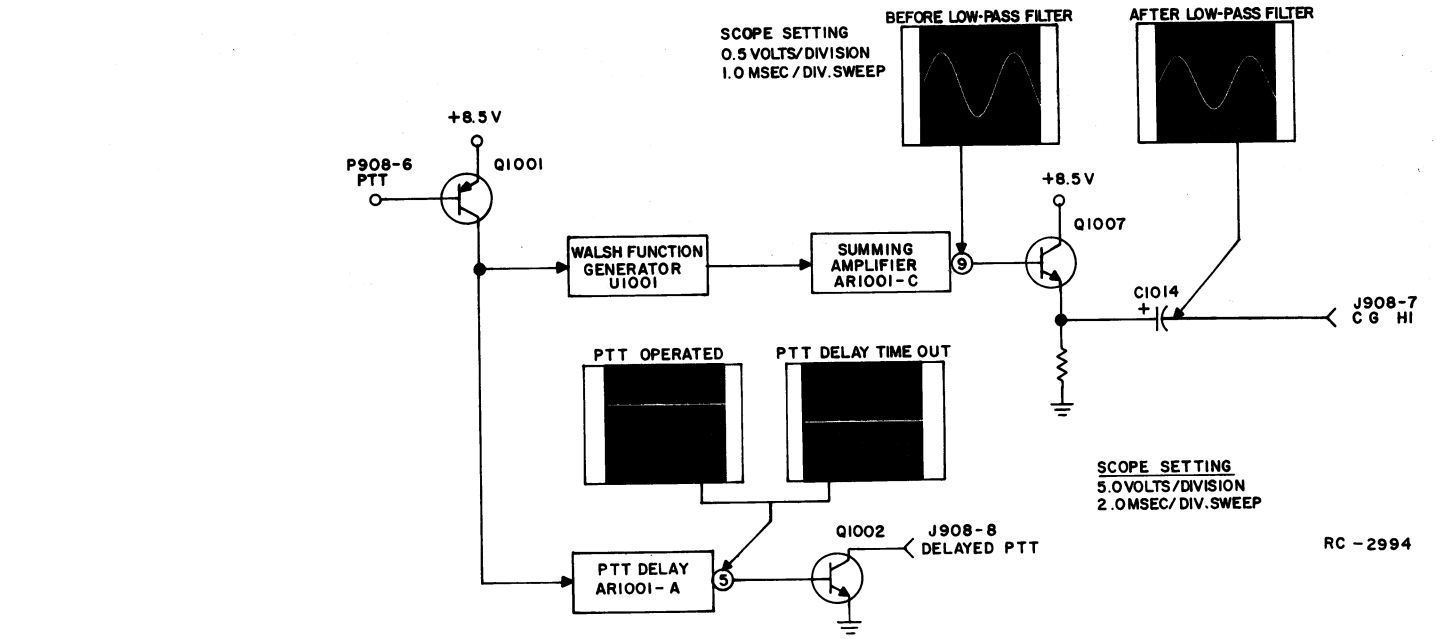
Typical voltage readings for servicing the Channel Guard board are provided on the schematic diagrams. A troubleshooting diagram containing waveform data at selected points in the circuit is provided. See Figure 3.

REMOVING INTEGRATED CIRCUITS

Removing IC's (and all other soldered-in components) can be easily accomplished by using a de-soldering tool such as a SOLDA-PULLT® or equivalent. To remove an IC, heat each lead separately on the solder side and remove the old solder with the de-soldering tool.

An alternate method is to use a special soldering tip that heats all of the pins simultaneously.

ENCODE



DECODE

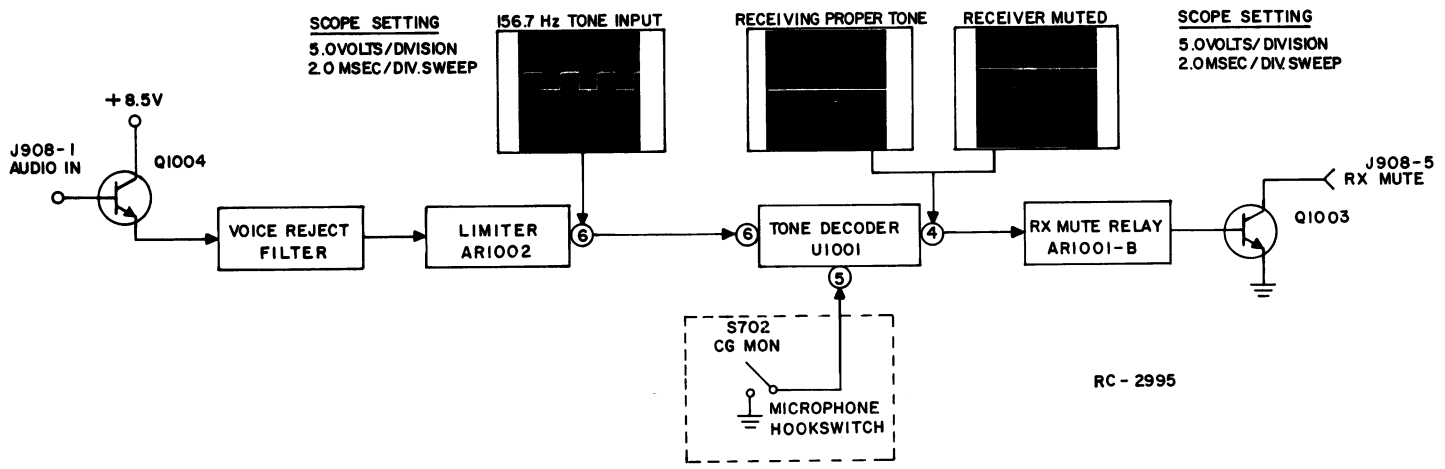
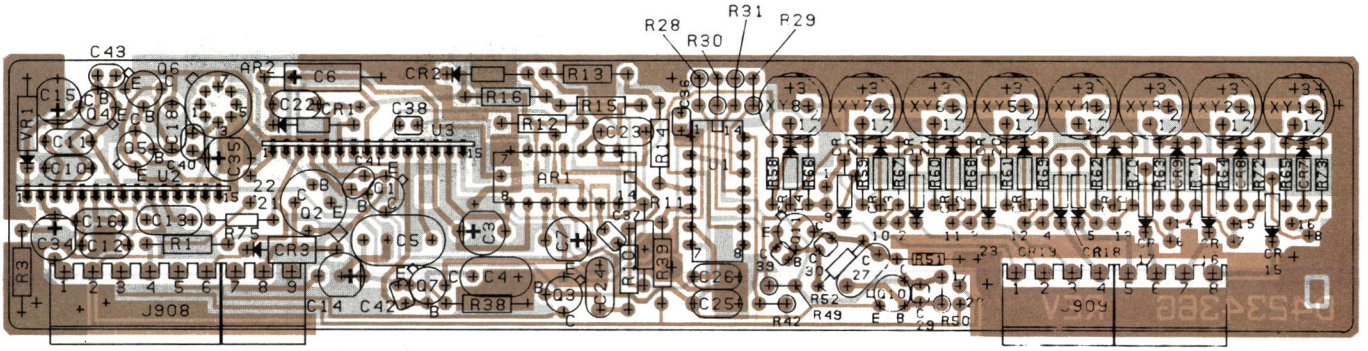


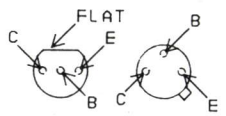
Figure 3 - Troubleshooting Diagram



(19D423940, Rev. 0)
(19B227364, Sh. 2, Rev. 0)
(19B227364, Sh. 3, Rev. 0)

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH 1000 SERIES.
EXAMPLE: C1- C1001, R1- R1001, ETC.

LEAD IDENTIFICATION
FOR Q1 THRU Q7
, Q10 AND Q11

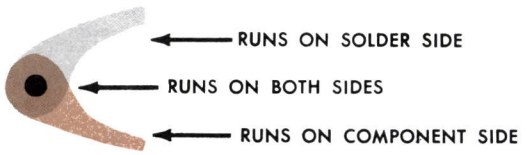


OR

IN-LINE TRIANGULAR

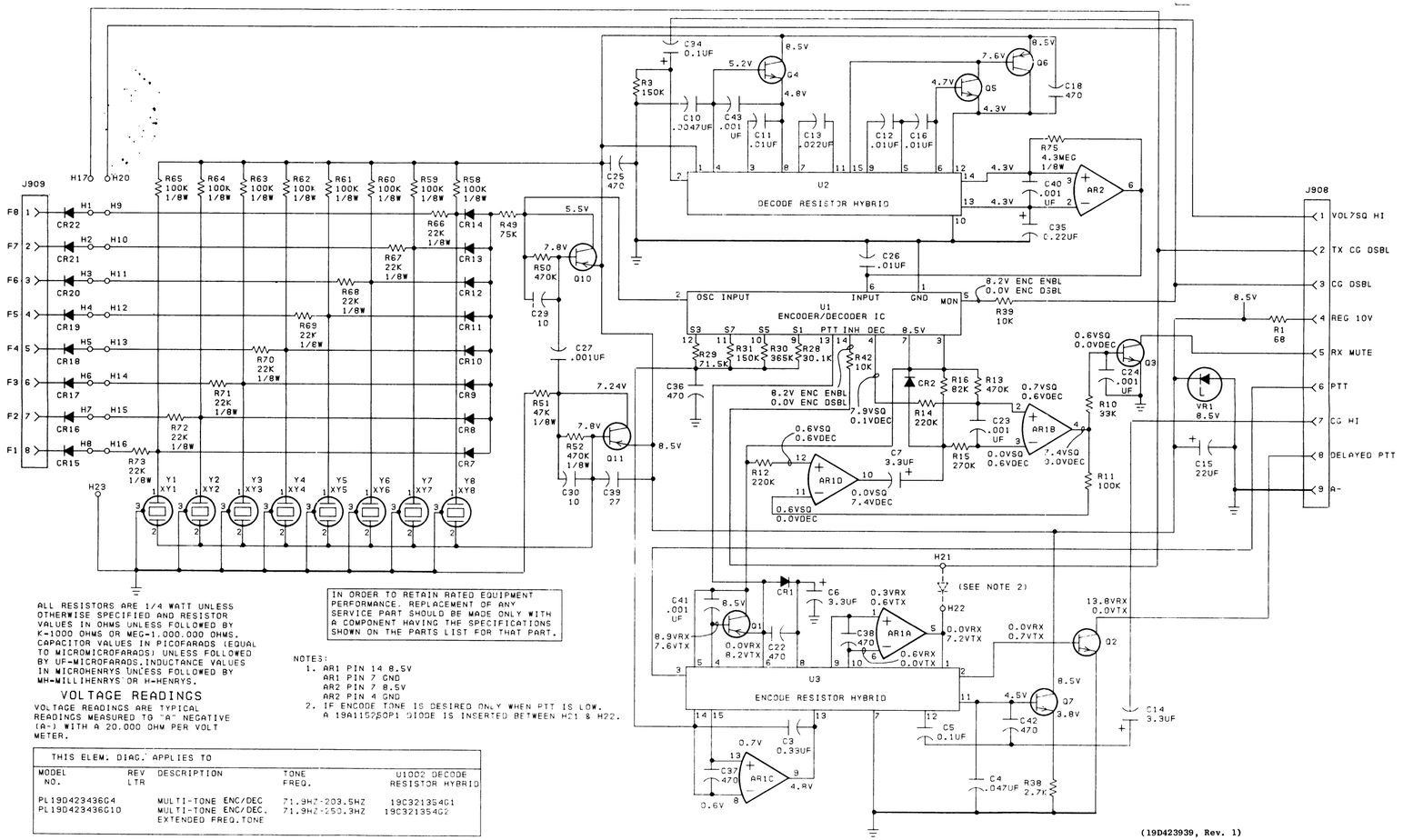
TOP VIEW

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



OUTLINE DIAGRAM

CHANNEL GUARD ENCODER/DECODER
19D423436G4, G5 AND G10



(19D423939, Rev. 1)

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.

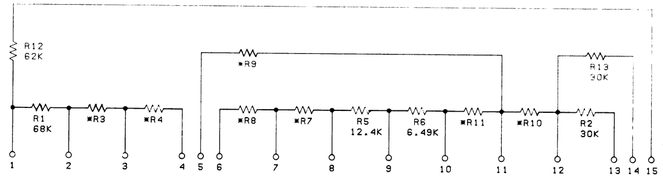
NOTES:
1. AR1 PIN 14 8.5V
   AR1 PIN 7 GND
   AR2 PIN 7 8.5V
   AR2 PIN 4 GND
2. IF ENCODE TONE IS DESIRED ONLY WHEN PTT IS LOW, A 19A115?6P1 DIODE IS INSERTED BETWEEN H21 & H22.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO "A" NEGATIVE (A-) WITH A 20,000 OHM PER VOLT METER.

THIS ELEM. DIAG. APPLIES TO				
MODEL NO.	REV LTR	DESCRIPTION	TONE FREQ.	U1002 DECODE RESISTOR HYBRID
PL19D423436G4		MULTI-TONE ENC/DEC	71.9HZ-203.5HZ	19C321354G1
PL19D423436G10		MULTI-TONE ENC/DEC. EXTENDED FREQ.TONE	71.9HZ-250.3HZ	19C321354G2

DECODE RESISTOR HYBRID

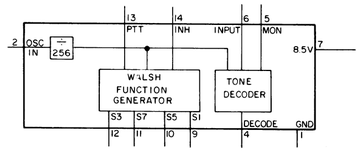


RESISTOR	VALUE	
	C1	C2
R3	162K	133K
R4	162K	133K
R7*	76.8K	63.4K
R8	76.8K	63.4K
R9	34.8K	31.6K
R10	1K	845 Ω
R11	10K	11.3K

*SEE CHART FOR VALUE

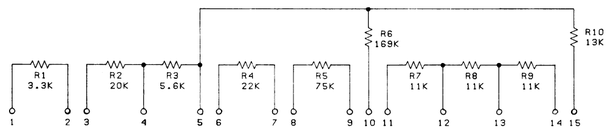
(19B227359, Rev. 1)

U1 - ENCODE/DECODE IC



(RC-3042)

ENCODE RESISTOR HYBRID



(19B227358, Rev. 1)

SCHEMATIC DIAGRAM

CHANNEL GUARD ENCODER/DECODER
19D423436G4 & G10

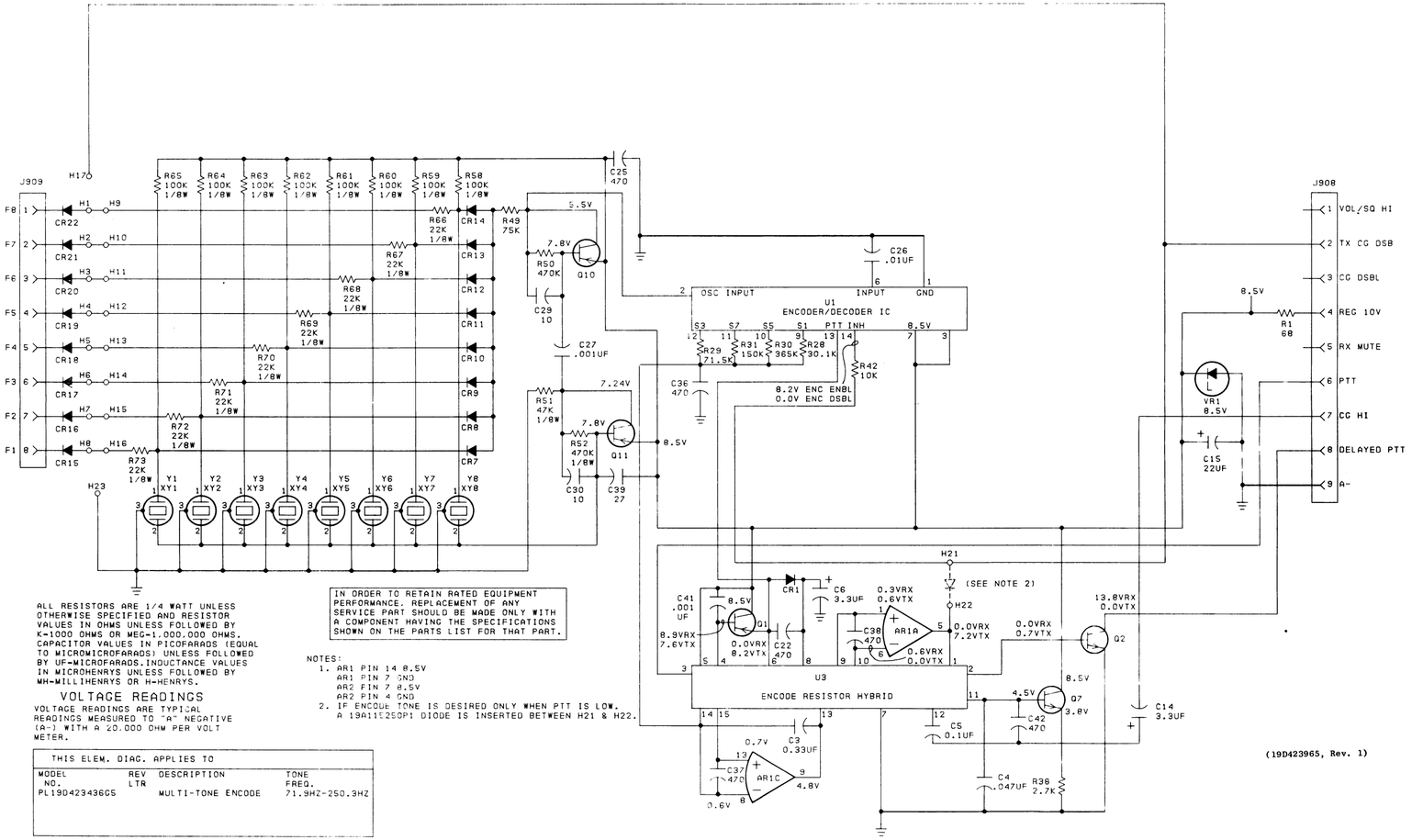
PARTS LIST

LBI-30265

MULTI-TONE CHANNEL GUARD
19D423436G4 ENCODE/DECODE
19D423436G5 ENCODE
19D423436G10 ENCODE/DECODE EXT. TONE FREQ.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
AR1001	19A134122P1	Linear: Quad Operational Amplifier; sim to RCA CA 3401.
AR1002	19A116297P2	Linear: Operational Amplifier; sim to µA 741C.
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1003	19A134202P111	Tantalum: 0.33 µf ±10%, 35 VDCW.
C1004	19A116080P205	Polyester: 0.047 µf ±5%, 50 VDCW.
C1005	19A116080P207	Polyester: 0.1 µf ±5%, 50 VDCW.
C1006	5496267P409	Tantalum: 3.3 µf ±20%, 5 VDCW; sim to Sprague Type 150D.
C1007	19A134202P105	Tantalum: 3.3 µf ±10%, 15 VDCW.
C1010	19A116080P215	Polyester: .0047 µf ±5%, 50 VDCW.
C1011 and C1012	19A116080P201	Polyester: 0.01 µf ±5%, 50 VDCW.
C1013	19A116080P203	Polyester: 0.022 µf ±5%, 50 VDCW.
C1014	19A134202P5	Tantalum: 3.3 µf ±20%, 15 VDCW.
C1015	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C1016	19A116080P201	Polyester: 0.01 µf ±5%, 50 VDCW.
C1018	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1022	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1023 and C1024	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1025	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1026	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C1027	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1029 and C1030	19A116114P31	Ceramic: 10 pf ±10%, 100 VDCW; temp coef 0 PPM.
C1034	19A134202P9	Tantalum: 0.1 µf ±20%, 35 VDCW.
C1035	19A134202P10	Tantalum: 0.22 µf ±20%, 35 VDCW.
C1036 thru C1038	19A116192P2	Ceramic: 470 pf ±20%, 50 VDCW; sim to Erie 8111-A050-W5R-471M.
C1039	19A116114P43	Ceramic: 27 pf ±10%, 100 VDCW; temp coef 0 PPM.
C1040 and C1041	19A116192P13	Ceramic: 1000 pf ±10%, 50 VDCW; sim to Erie 8121-A050-W5R-102K.
C1042	19A116192P2	Ceramic: 470 pf ±20%, 50 VDCW; sim to Erie 8111-A050-W5R-471M.
C1043	19A116192P13	Ceramic: 1000 pf ±10%, 50 VDCW; sim to Erie 8121-A050-W5R-102K.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1001 and CR1002	19A115250P1	Silicon.
CR1007 thru CR1022	19A115250P1	Silicon.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J908		Includes:
	19A116659P5	Connector, printed wiring: 3 contacts; sim to Molex 09-52-3031.
	19A116659P6	Connector, printed wiring: 6 contacts; sim to Molex 09-52-3061.
J909	19A116659P7	Connector, printed wiring: 4 contacts; sim to Molex 09-52-3041. (Quantity 2).
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1001	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q1002	19A115300P4	Silicon, NPN.
Q1003	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q1004	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q1005	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q1006	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q1007	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q1010 and Q1011	19A115852P1	Silicon, PNP; sim to Type 2N3906.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1001	3R152P680J	Composition: 68 ohms ±5%, 1/4 w.
R1002	3R152P683J	Composition: 68,000 ohms ±5%, 1/4 w.
R1003	3R152P154J	Composition: 150,000 ohms ±5%, 1/4 w.
R1010	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R1011	3R152P104J	Composition: 100,000 ohms ±5%, 1/4 w.
R1012	3R152P224J	Composition: 220,000 ohms ±5%, 1/4 w.
R1013	3R152P474J	Composition: 470,000 ohms ±5%, 1/4 w.
R1014	3R152P224J	Composition: 220,000 ohms ±5%, 1/4 w.
R1015	3R152P274J	Composition: 270,000 ohms ±5%, 1/4 w.
R1016	3R152P823J	Composition: 82,000 ohms ±5%, 1/4 w.
R1028	19C314256P23012	Metal film: 30,100 ohms ±1%, 1/4 w.
R1029	19C314256P27152	Metal film: 71,500 ohms ±1%, 1/4 w.
R1030	19C314256P23653	Metal film: 365,000 ohms ±1%, 1/4 w.
R1031	19C314256P21503	Metal film: 150,000 ohms ±1%, 1/4 w.
R1038	3R152P272J	Composition: 2700 ohms ±5%, 1/4 w.
R1039	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R1042	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R1049	3R152P753J	Composition: 75,000 ohms ±5%, 1/4 w.
R1050	3R152P474J	Composition: 0.47 megohm ±5%, 1/4 w.
R1051	3R151P473J	Composition: 47,000 ohms ±5%, 1/8 w.
R1052	3R151P474J	Composition: 0.47 megohm ±5%, 1/8 w.
R1058 thru R1065	3R151P104K	Composition: 0.10 megohm ±10%, 1/8 w.
R1066 thru R1073	3R151P223J	Composition: 22,000 ohms ±5%, 1/8 w.
R1075	3R151P435J	Composition: 4.3 megohms ±5%, 1/8 w.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - -
U1001	19D406009P1	Digital: sim to Collins 765-1693-001.
U1002L	19C321354G1	Integrated circuit.
U1003	19C327145G1	Integrated circuit.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1001	4036887P9	Silicon, Zener.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY1001 thru XY1008	5490277P1	Transistor, phen: 4 contacts; sim to Elco 3303.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
		NOTE: When reordering give GE Part Number and specify exact frequency needed.
Y1001 thru Y1008	19A134279	Crystal Unit, quartz.
	19A134279P1	71.9 Hz
	19A134279P3	74.4 Hz
	19A134279P5	77.0 Hz
	19A134279P7	79.7 Hz
	19A134279P9	82.5 Hz
	19A134279P11	85.4 Hz
	19A134279P13	88.5 Hz
	19A134279P15	91.5 Hz
	19A134279P17	94.8 Hz
	19A134279P19	97.4 Hz
	19A134279P21	100.0 Hz
	19A134279P23	103.5 Hz
	19A134279P25	107.2 Hz
	19A134279P27	110.9 Hz
	19A134279P29	114.8 Hz
	19A134279P31	118.8 Hz
	19A134279P33	123.0 Hz
	19A134279P35	127.3 Hz
	19A134279P37	131.8 Hz
	19A134279P39	136.5 Hz
	19A134279P41	141.3 Hz
	19A134279P43	146.2 Hz
	19A134279P45	151.4 Hz
	19A134279P47	156.7 Hz
	19A134279P49	162.2 Hz
	19A134279P51	167.9 Hz
	19A134279P53	173.8 Hz
	19A134279P55	179.9 Hz
	19A134279P57	186.2 Hz
	19A134279P59	192.8 Hz
	19A134279P61	203.5 Hz
	19A134279P63	210.7 Hz
	19A134279P65	218.1 Hz
	19A134279P67	225.7 Hz
	19A134279P69	233.6 Hz
	19A134279P71	241.8 Hz
	19A134279P73	250.3 Hz
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4036555P1	Insulator, washer: nylon. (Used with Q1002).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



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.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO "A" NEGATIVE (A-) WITH A 20,000 OHM PER VOLT METER.

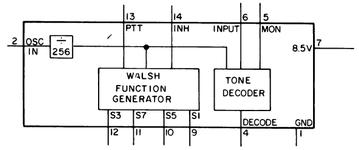
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

NOTES:
1. AR1 PIN 14 8.5V
   AR1 PIN 7 GND
   AR2 PIN 7 8.5V
   AR2 PIN 4 GND
2. IF ENCODE TONE IS DESIRED ONLY WHEN PTT IS LOW, A 19A116250P1 DIODE IS INSERTED BETWEEN H21 & H22.

THIS ELEM. DIAG. APPLIES TO			
MODEL NO.	REV LTR	DESCRIPTION	TONE FREQ.
PL19D423436G5		MULTI-TONE ENCODE	71.9HZ-250.3HZ

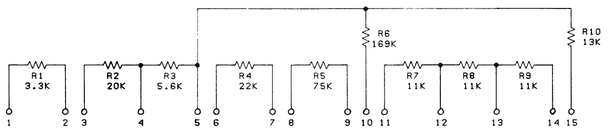
(19D423965, Rev. 1)

U1 - ENCODE/DECODE IC



(RC-3042)

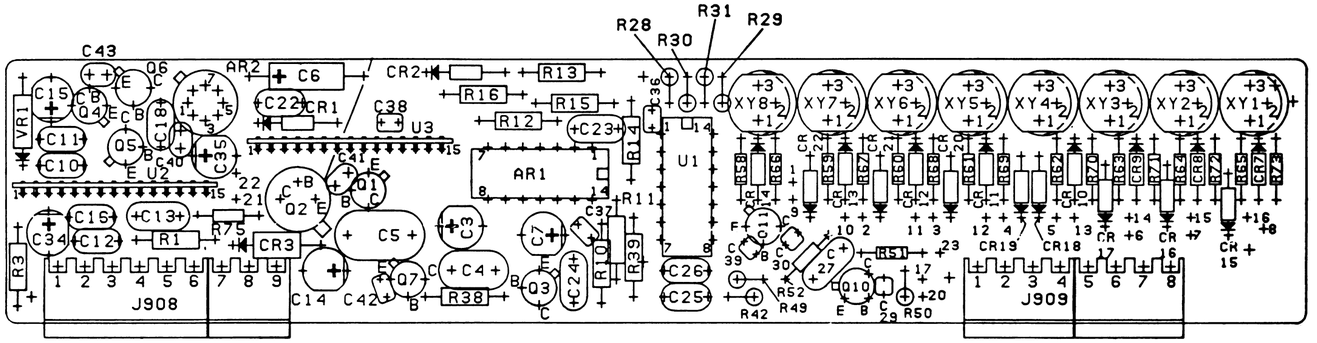
ENCODE RESISTOR HYBRID



(19B227358, Rev. 1)

SCHEMATIC DIAGRAM

CHANNEL GUARD ENCODER ONLY
19D423436G5



PURPOSE: THIS MODIFICATION IS APPLIED TO MASTR II MULTI-TONE ENCODE/DECODE CRYSTAL CHANNEL GUARD (19D423436G4), MULTI-TONE ENCODE ONLY CRYSTAL CHANNEL GUARD (19D423436G5) AND MULTI-TONE DECODE ONLY CRYSTAL CHANNEL GUARD (19D423436G6) OPTIONS WHICH REQUIRE RECEIVE AND/OR TRANSMIT CHANNEL GUARD DISABLE STRAPPING (PER CUSTOMER REQUEST).

REQUIRED PARTS: DM WIRE, SLEEVING, SF-24-W WIRE

INSTALLATION: TO THE 19D423436G4, G5 & G6 CHANNEL GUARD BOARD, PERFORM THE FOLLOWING FUNCTIONS:

FOR DISABLING BOTH RECEIVE AND TRANSMIT FUNCTION ON THE 19D423436G4 BOARD AND DISABLING DECODE FUNCTION ON 19D42343666 BOARD.

1. SELECT THE FREQUENCY POSITION FROM COLUMN "A" WHERE CHANNEL GUARD IS TO BE DISABLED. (CORRESPONDING TO "OPEN" TONE POSITIONS).
2. STARTING WITH THE LOWEST NUMBERED FREQUENCY POSITION TO BE DISABLED, CONNECT A SLEEVED DM WIRE FROM THE CORRESPONDING HOLE IN COLUMN "B" TO THE HOLE IN COLUMN "C" CORRESPONDING TO THE NEXT HIGHER NUMBERED FREQUENCY POSITION TO BE DISABLED. REPEAT UNTIL ALL FREQUENCY POSITIONS TO BE DISABLED ARE INTERCONNECTED.
3. CONNECT HOLE IN COLUMN "B" CORRESPONDING TO THE HIGHEST NUMBERED FREQUENCY POSITION TO BE DISABLED TO HOLE H20 WITH SF-24-W WIRE.
4. REMOVE CORRESPONDING RESISTORS FROM COLUMN "D".

"A" FREQUENCY	DM JUMPER CONNECTION		"D" REMOVE RESISTOR
	"B"	"C"	
F1	H8		R1073
F2	H7	H15	R1072
F3	H6	H14	R1071
F4	H5	H13	R1070
F5	H12	H4	R1069
F6	H11	H3	R1068
F7	H10	H2	R1067
F8	H9	H1	R1066

EXAMPLE: IF F2, F4 AND F7 HAVE "OPEN" CHANNEL GUARD TONES:

1. COLUMN "A" SEE F2, F4, F7
2. ADD DM JUMPERS BETWEEN H7 - H13, H5 - H2.
3. ADD SF-24-W WIRE BETWEEN H10 - H20.
4. REMOVE RESISTORS R1072, R1070 AND R1067.

FOR DISABLING TRANSMIT FUNCTION ON THE 19D423436G5 BOARD.

1. SELECT THE FREQUENCY POSITION FROM COLUMN "A" WHERE CHANNEL GUARD IS TO BE DISABLED, (CORRESPONDING TO "OPEN" TONE POSITIONS).
2. REMOVE CORRESPONDING RESISTORS FROM COLUMN "D".

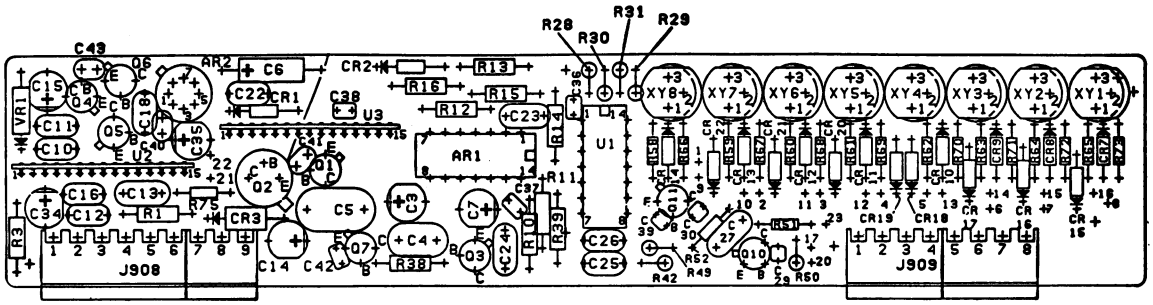
EXAMPLE: IF F2, F4 AND F7 HAVE "OPEN" CHANNEL GUARD TONES:

1. COLUMN "A" SEE F2, F4, F7
2. REMOVE RESISTORS R1072, R1070 AND R1067.

(19C321875, Sh. 4, Rev. 0)

MODIFICATION INSTRUCTION

DECODE/ENCODE DISABLE



PURPOSE: THIS MODIFICATION IS APPLIED TO MASTR II MULTI-TONE ENCODE/DECODE CRYSTAL CHANNEL GUARD (19D423436G4,10) MULTI-TONE ENCODE ONLY CRYSTAL CHANNEL GUARD (19D423436G5) AND MULTI-TONE DECODE ONLY CRYSTAL CHANNEL GUARD (19D423436G6,11) OPTIONS TO REPEAT CHANNEL GUARD TONES ON DIFFERENT FREQUENCY POSITIONS (PER CUSTOMER REQUEST).

REQUIRED PARTS: DM WIRE, SLEEVING

INSTALLATION: TO THE 19D423436G4, G5, G6, G10 & G11 CHANNEL GUARD BOARD, PERFORM THE FOLLOWING FUNCTIONS:

1. SELECT THE FREQUENCY POSITIONS FROM COLUMN "A" WHERE A CHANNEL GUARD TONE IS TO BE REPEATED.
2. STARTING WITH THE LOWEST NUMBERED FREQUENCY POSITION THAT HAS THE SAME CHANNEL GUARD TONE, CONNECT A SLEEVED DM WIRE FROM THE CORRESPONDING HOLE IN COLUMN "B" TO THE HOLE IN COLUMN "C" CORRESPONDING TO THE NEXT HIGHER NUMBERED FREQUENCY POSITION TO BE REPEATED. REPEAT UNTIL ALL FREQUENCY POSITIONS THAT HAVE THE SAME CHANNEL GUARD TONE ARE INTERCONNECTED.
3. REPEAT STEPS 1 & 2 FOR ALL OTHER CHANNEL GUARD TONES THAT EXIST IN MORE THAN ONE FREQUENCY POSITION.
4. PLACE CRYSTALS IN SOCKETS IN COLUMN "D" CORRESPONDING TO LOWEST NUMBERED FREQUENCY POSITION WHERE THE CHANNEL GUARD TONE FREQUENCY OF THE CRYSTALS EXISTS.

"A" FREQUENCY	DM JUMPER CONNECTION		"D" ADD CRYSTAL TO SOCKET
	"B"	"C"	
F1	H8		XY1
F2	H7	H15	XY2
F3	H6	H14	XY3
F4	H5	H13	XY4
F5	H12	H4	XY5
F6	H11	H3	XY6
F7	H10	H2	XY7
F8	H9	H1	XY8

EXAMPLE: IF F2, F4 AND F7 HAVE THE SAME CHANNEL GUARD TONE :

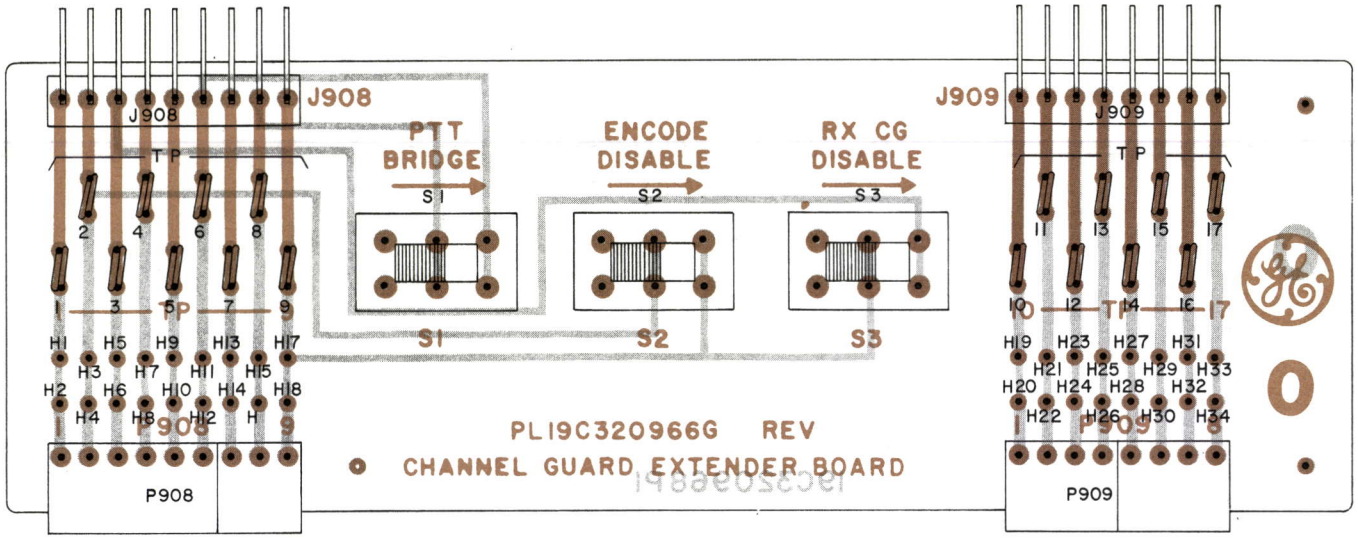
1. COLUMN "A" SEE F2, F4, F7
2. ADD DM JUMPERS BETWEEN H7 - H13, H5 - H2.
3. ADD CHANNEL GUARD CRYSTAL TO XY2.

(19C327499, Rev. 0)

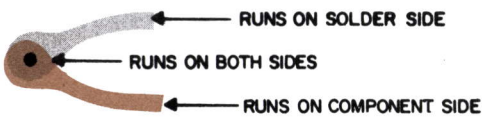
MODIFICATION INSTRUCTION

REPEATED TONE FREQUENCY

Issue 1

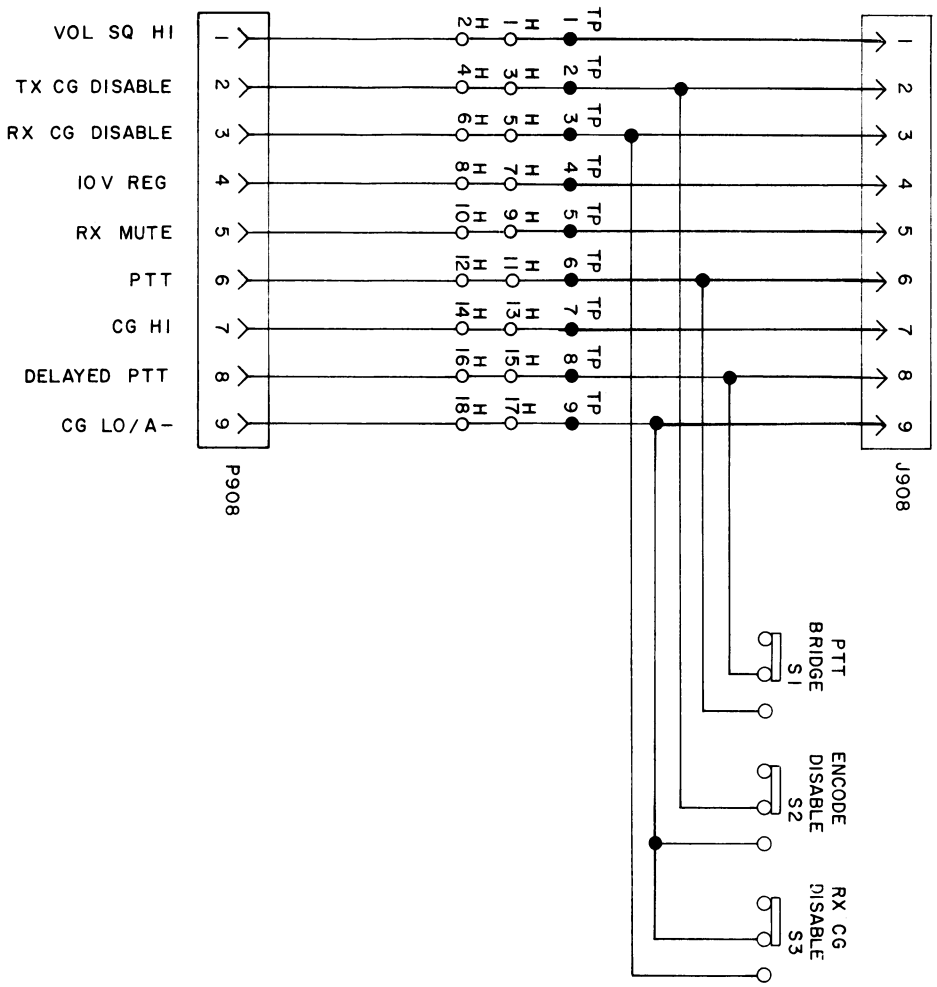


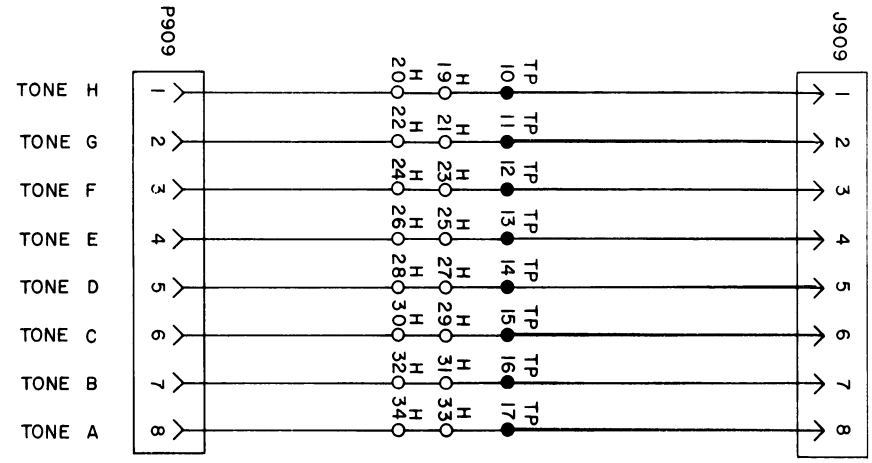
(19C321121, Rev. 0)
(19C320968, Sh. 2, Rev. 0)
(19C320968, Sh. 3, Rev. 0)



OUTLINE DIAGRAM

CHANNEL GUARD EXTENDER BOARD
19C320966G1





(19C321026, Rev. 1)

SCHEMATIC DIAGRAM

CHANNEL GUARD EXTENDER BOARD 19C320966G1

PARTS LIST

LBI-4626

CHANNEL GUARD EXTENDER BOARD
19C320966G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J908	19A116659P31	Connector, printed wiring: 9 contacts; sim to Molex 2373-9A.
J909	19A116659P30	Connector, printed wiring: 8 contacts; sim to Molex 2373-8A.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P908		Includes:
	19A116659P5	Connector, printed wiring: 3 contacts; sim to Molex 09-52-3031.
	19A116659P6	Connector, printed wiring: 6 contacts; sim to Molex 09-52-3061.
P909	19A116659P7	Connector, printed wiring: 4 contacts; sim to Molex 09-52-3041. (Quantity 2).
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1 thru S3	19B209261P14	Slide: DPDT, 2 poles, 2 positions, .5 amp VDC or 3 amps VAC at 125 v; sim to Switchcraft XW-1468.
		- - - - - - - - - TEST POINTS - - - - - - - - -
TP1 thru TP17	19B211379P1	Spring (Test Point).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

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 of component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

DF-5046

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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