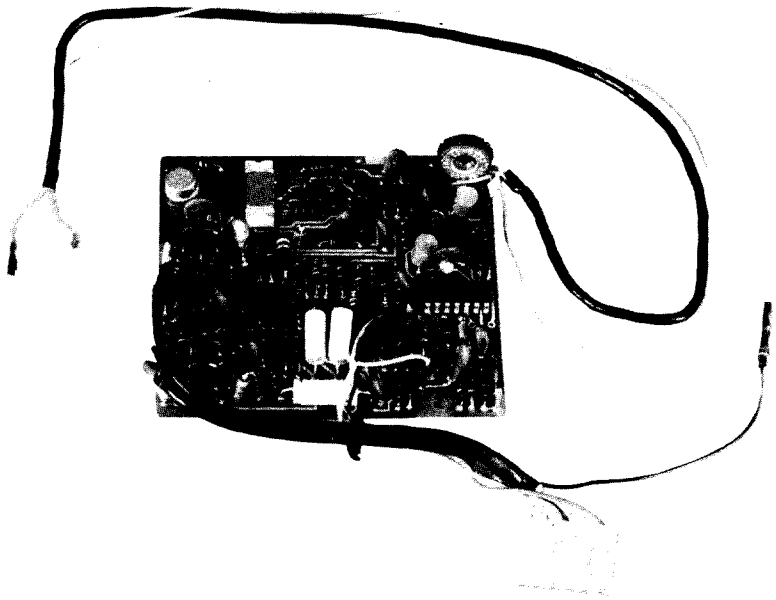
MOBILE RADIO

MAINTENANCE MANUAL

CHANNEL GUARD ENCODER/DECODER 19C321931G1
CHANNEL GUARD ENCODE ONLY 19C321931G2
CHANNEL GUARD DECODE ONLY 19C321931G3

Maintenance Manual LBI-30195A

CHANNEL GUARD 19C321931G1-G3



Appended
LBI 30370
New
Encoder-Decoder
19C327626G1

SPECIFICATIONS *

TONE FREQUENCIES	71.9 to 203.5 Hertz
ENCODER DISTORTION	1% Max.
DECODER RESPONSE	Less than $\frac{100}{\text{CG Freq.}}$ x 250 ms
POWER REQUIREMENTS	10 VDC @ 35 Milliamperes
TEMPERATURE RANGE	-30°C to +60°C (-22°F to 144°F)

*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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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

The 19C321931G1-G3 Channel Guard assemblies use digital techniques to generate the EIA continuous tone-controlled squelch system (CTCSS) frequencies. A monolithic integrated circuit is used for the generation and detection of the tone-coded signal. The encoder provides tone-coded modulation to the transmitter. The decoder operates in conjunction with the receiver to inhibit all calls that are not tone coded with the proper Channel Guard frequency.

Three models of the Channel Guard board are available. The 19C321931G1 board provides single-tone encode/decode capability. The 19C321931G2 board (Option 1918) is for single-tone encode only applications. The 19C321931G3 board (Option 1919) is for single-tone decode only applications.

The Channel Guard circuit consists of a voice reject filter, a limiter, the Channel Guard encode/decode integrated circuit, a resistive ladder digital-to-analog converter, a low pass filter, a tone reject filter, PTT delay and receiver mute delay. Frequency selection is achieved by the use of a plug-in crystal operation at 256 times the desired Channel Guard frequency.

OPERATION

A Channel Guard MONITOR switch (S702), located on the control panel of the radio, controls the operation of the Channel Guard decode circuitry. When the switch is moved to the MON position, the Channel Guard decode function is disabled, allowing all calls to be heard. The encode function is controlled by the PTT switch and is enabled only when the PTT switch is operated. All transmitted calls are tone coded with the Channel Guard frequency.

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 203.5 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	88.5	107.2	131.8	162.2
74.4	91.5	110.9	136.5	167.9
77.0	94.8	114.8	141.3	173.8
79.7	97.4	118.8	146.2	179.9
82.5	100.0	123.0	151.4	186.2
85.4	103.5	127.3	156.7	192.8
				203.5

DECODE MODE

The Channel Guard circuitry continuously monitors all calls on the receiver frequency via the Volume HI circuit in the receiver. All signals are fed to the filter-limiter circuits. Q1003 and the associated RC network form a low-pass active filter. Q1004 and Q1005, together with their associated RC network, form an active notch filter. The two filters present a minimum attenuation of at least 25 dB to all voice frequencies above 300 Hertz while passing the Channel Guard tone frequencies.

The tone signals are coupled to limiter AR1002-A. The clipping action of the limiter eliminates variations in the squelch performance due to changes in tone deviation.

The encoder/decoder integrated circuit (U1001) consists of a digital decoder, a divide-by-256 counter, a digital phase shifter and a digital sine wave generator (Walsh Function Generator).

The output of the limiter (pin 1 of AR1002-A) is applied to the tone decoder in U1001. The decoder compares the output of the limiter with the clock frequency (generated by the crystal oscillator). The decoder determines when the proper Channel Guard tone is received so that the receiver may be unmuted.

Audio from the SAS board is connected to the tone reject filter via P1006-3 The tone reject filter is an active filter composed of Q1006 and Q1007. All frequencies from 70 to 204 Hertz are rejected by the filter, while passing all other audio frequencies via P1006-2 back to the SAS audio circuits.

When the Channel Guard hookswitch (Option 1920) is used, lifting the handset from the hookswitch applies ground from J1-6 of the radio harness to the CG DISABLE terminal (J1-8) to disable the squelch circuit.

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. The Walsh Function Generator, summing amplifier and resistor ladder provide this conversion.

The Walsh Function coefficients of a sine wave are given in the following table. See Figure 1.

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

The resistive weighting network (R1023, R1024, R1027, R1029) sets the level of the output current for each binary bit from the Walsh Function Generator. Capacitor C1025 AC couples the combined current to the summing amplifier (AR1002-B) which serves as a current to voltage converter. The resultant waveshape is shown in Figure 2. This is the result of adding waveform No. 1 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 C1027 in the feedback loop of the summing amplifier provides a 6 dB/octave rolloff. The signal is then passed through the active harmonaic filter Q1008, through CG MOD ADJUST potentiometer R1060 to the transmitter exciter.

SQUELCH TAIL ELIMINATION

Squelch Tail Elimination (STE) is accomplished by changing the phase of the

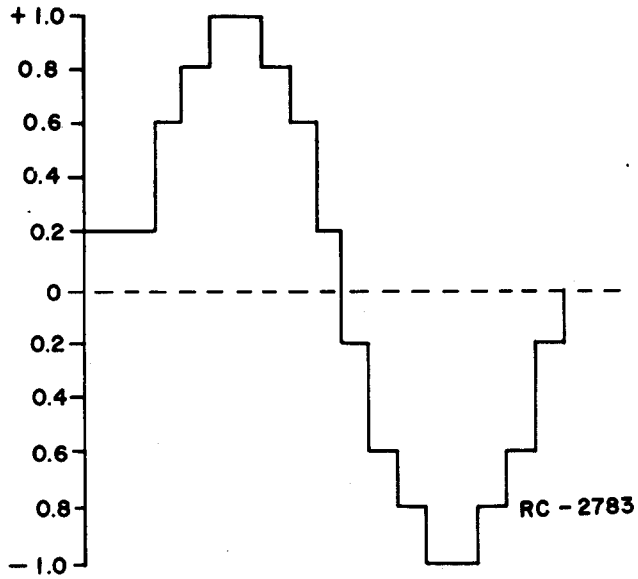


Figure 2 - Weighted Sum of Walsh Functions

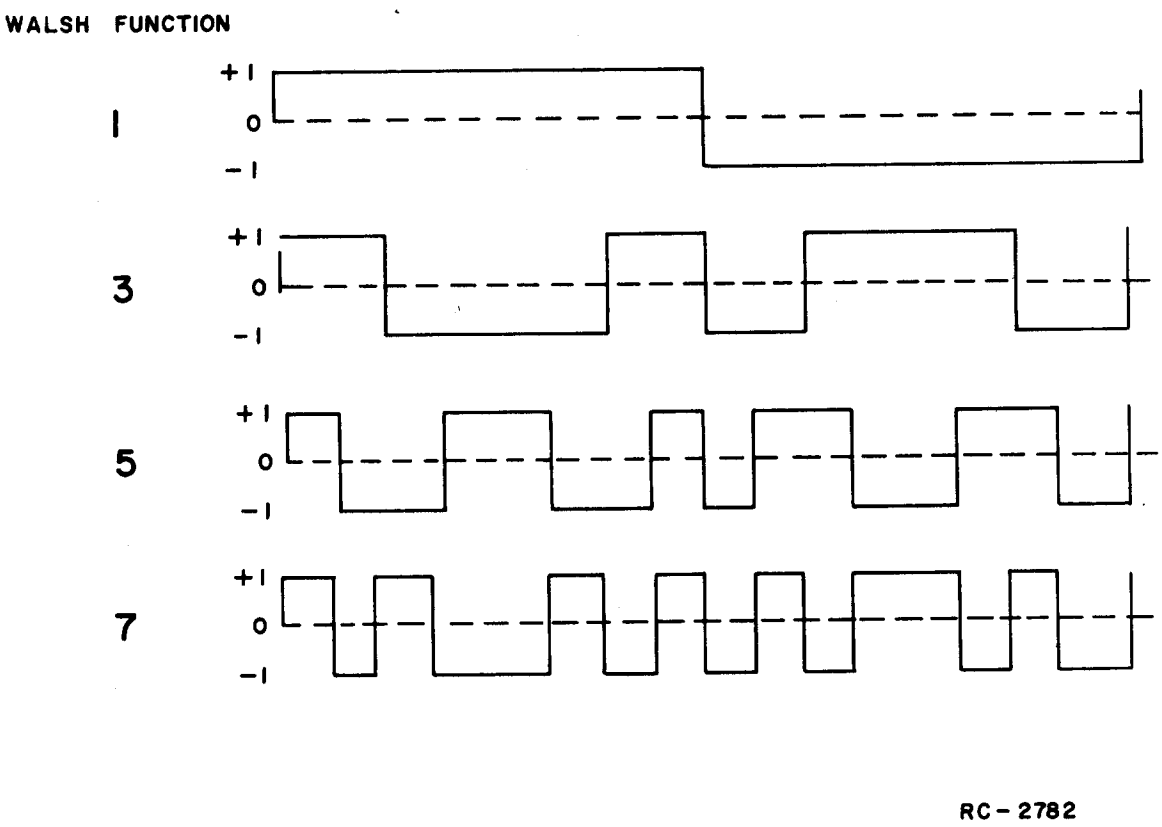


Figure 1 - Walsh Function Waveforms

modulating tone 135 degrees at the transmitter when the PTT switch is released and simultaneously delaying the transmitter carrier dropout for approximately 175 milliseconds. This allows sufficient time for the decoder to detect the phase reversal in the transmitted tone and mute the receiver, eliminating the squelch tail. The delay in transmit dropout is determined by the RC time constant of C1002 and R1005.

Initially, when the PTT switch is closed, Q1001 is turned on. Conduction of Q1001 operates AR1001-A. The 7.2 VDC at pin 5 of AR1001-A turns on Q1010, applying ground to P1011 to key the transmitter.

When PTT is released, Q1001 is turned off but AR1001-A cannot turn off until C1002 discharges to the level where the current at pin 1 is less than the current at pin 6. After approximately 175 milliseconds (determined by the RC time constant of C1002 and R1005), AR1001-A is turned off, turning off Q1010. Ground is thus removed from the DELAYED PTT lead P1011.

In the decode mode, when the tone decoder in U1001 detects the properly coded Channel Guard frequency, AR1001-B turns Q1009 off. This unmutes the receiver audio. In the squelch mode, Q1009 is operating, grounding the RX MUTE lead and muting the receiver audio.

The digital phase shifter in U1001 shifts the square wave at the Channel Guard frequency by 135 degrees. The receiver mute delay circuit (AR1001-B and AR1001-D) keeps the receiver muted for 300 milliseconds once the Channel Guard tone falls below the decode threshold. This prevents the receiver from opening during the 175 ms STE phase-shift tone burst.

MAINTENANCE

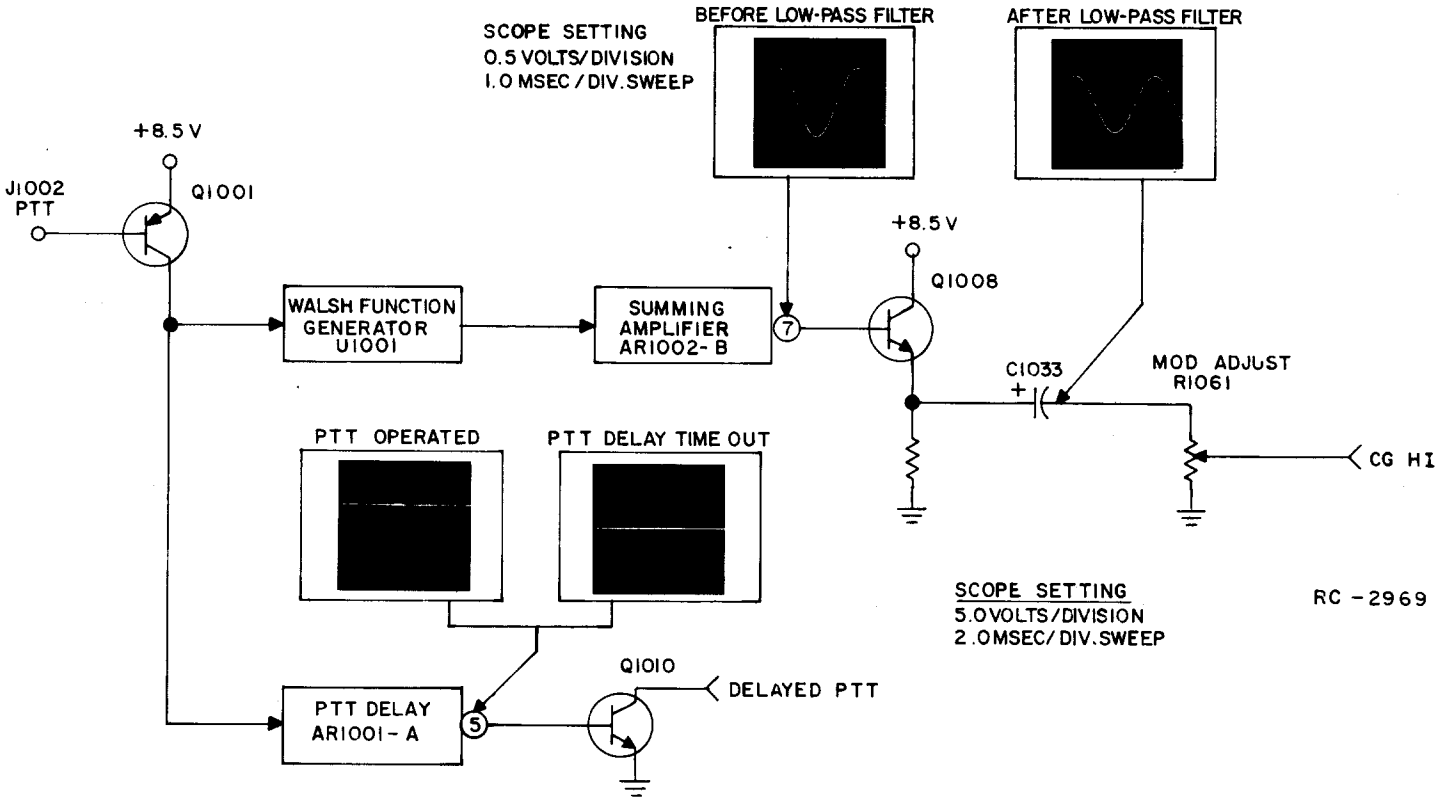
Typical voltage readings for servicing the Channel Guard board are provided on the schematic diagrams. A troubleshooting diagram containing waveform data at selected points in the circuit is provided. See Figure 3.

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

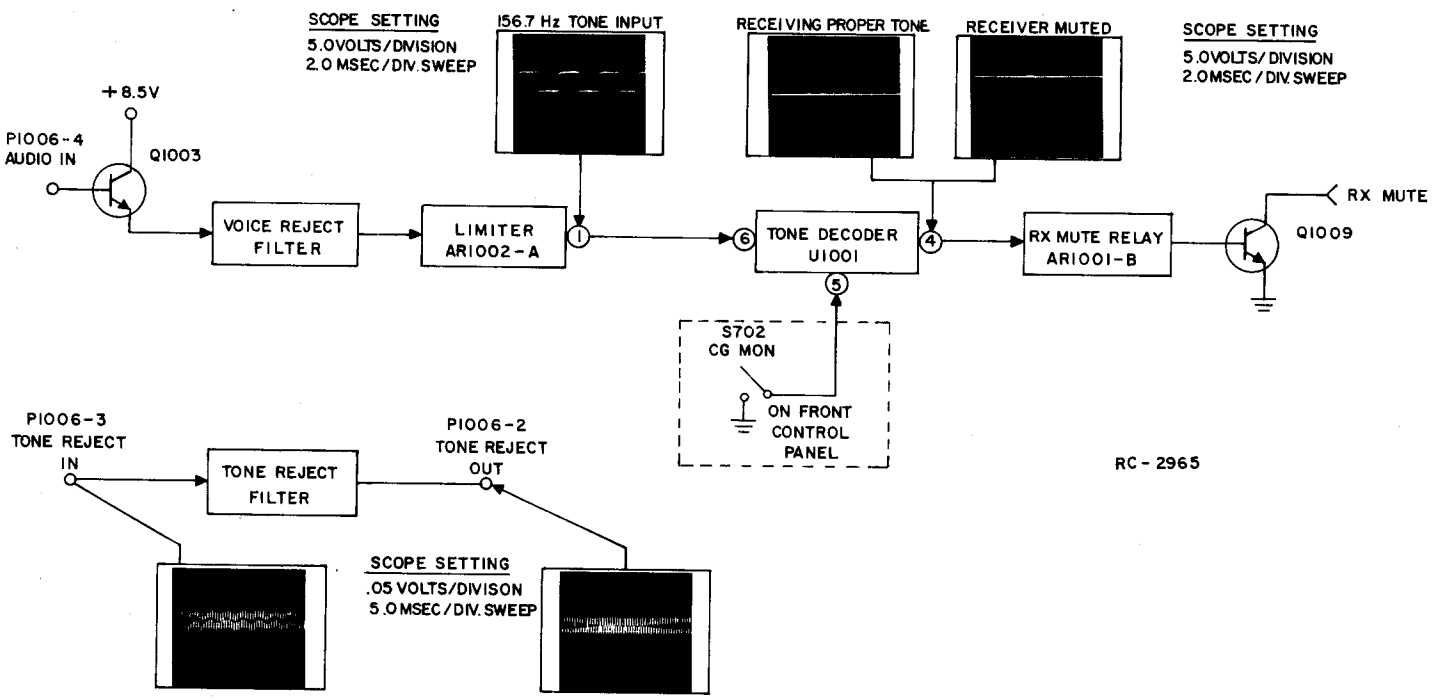
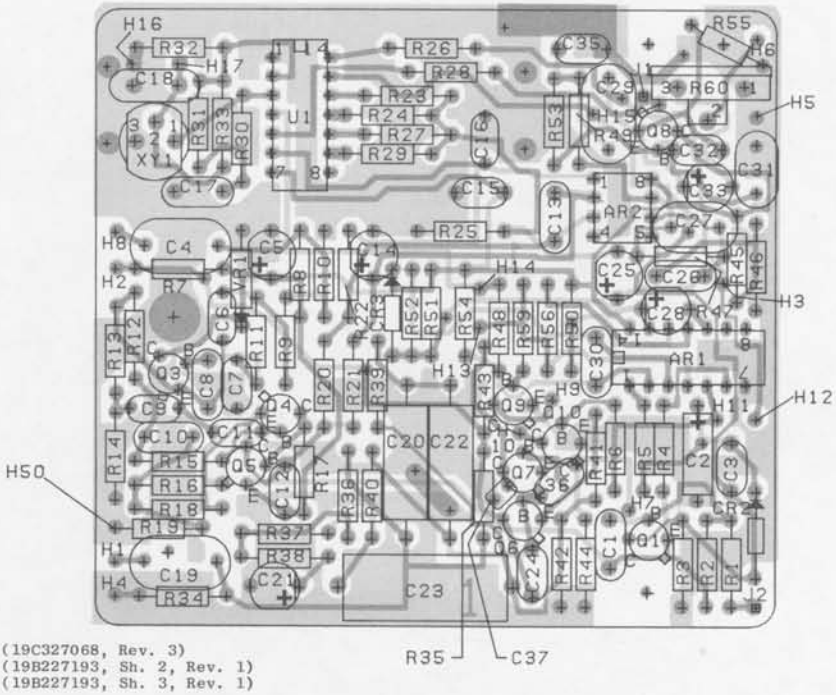


Figure 3 - Troubleshooting Diagram



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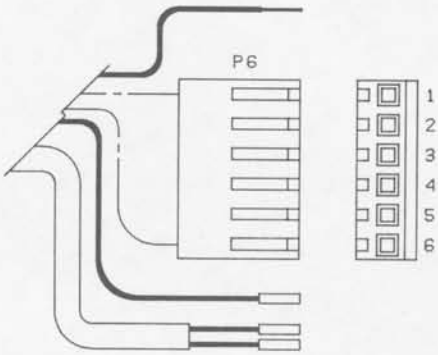
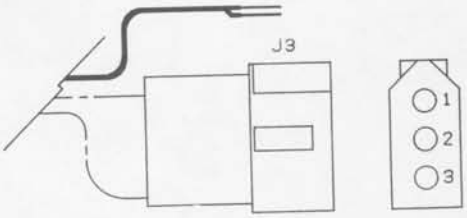
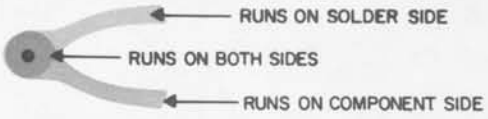
(19B227193, Sh. 2, Rev. 1)
(19B227193, Sh. 3, Rev. 1)

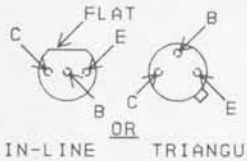




CONNECTION CHART							
FROM	TO	WIRE	TERMINATION	GR.1	GR.2	GR.3	GR.8
H2	P6-6	SF24-R		1	1	1	
H1	P6-3	N22SJ-WG		1		1	
H4	P6-1	SHIELD		1		1	
H8	P6-4	N22SJ-WBK		1		1	
	P6-1	SHIELD		1		1	
H7	P6-2	SF24-W		1		1	
H9	P6-5	SF24-Y		1		1	
H15	LET HANG	SF24-G		1			
H10	LET HANG	SF24-BR	P11	1	1		
H6	LET HANG	N22SJ-WR		1	1		
H5		SHIELD		1	1		
H2	J3-1	SF24-R					1
H50	J3-3	SF24-BK					1
H5		SHLD W-R					1
H6	LET HANG	N22SJ-WR					1
H10	J3-2	SF24-BR					1



LEAD IDENTIFICATION
FOR Q1-Q10



TOP VIEW

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

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

OUTLINE DIAGRAM

CHANNEL GUARD
19C321931G1-G3

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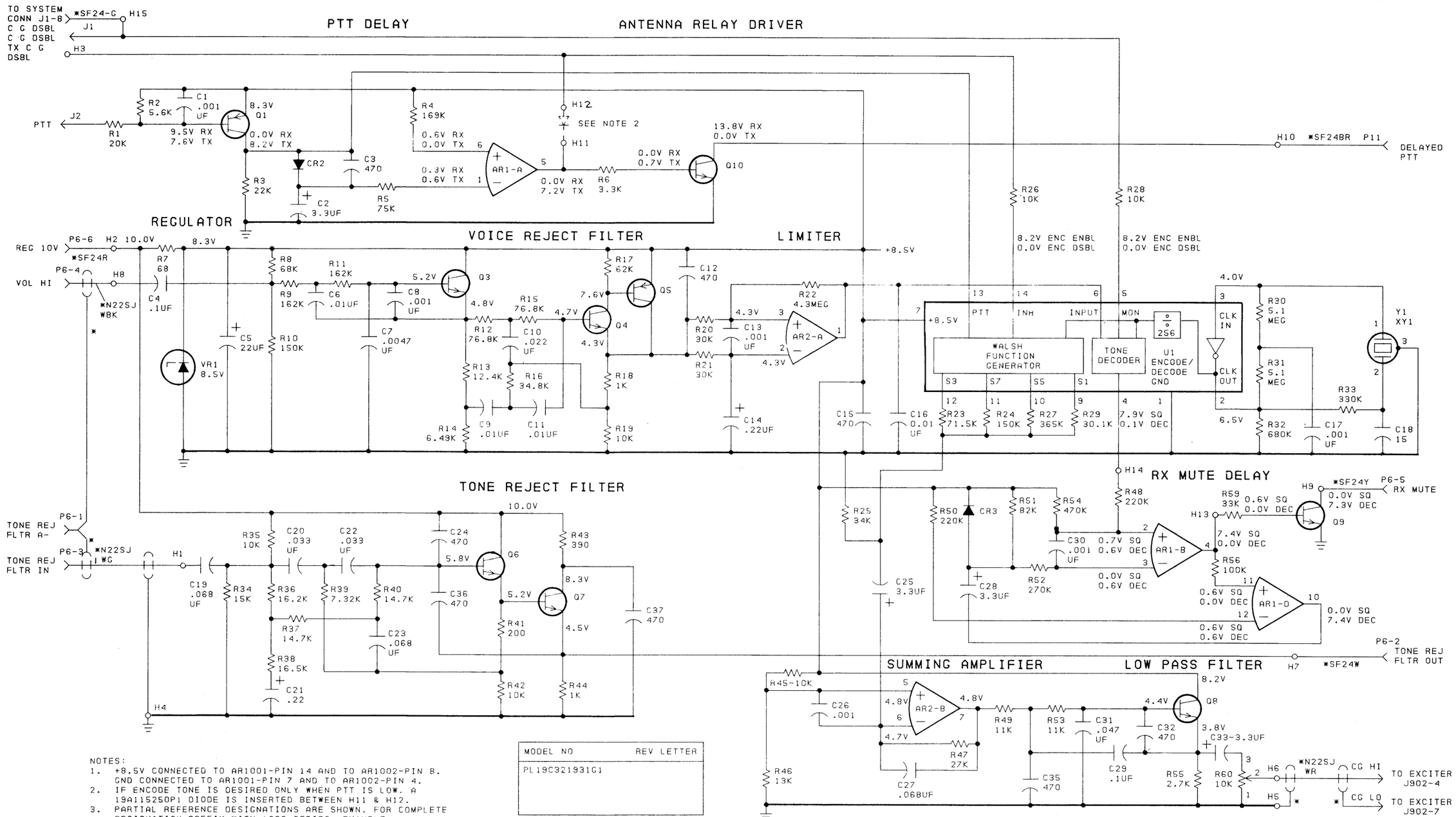


NOTES:
1. +8.5V CONNECTED TO AR1001-PIN 14 AND TO AR1002-PIN 8. GND CONNECTED TO AR1001-PIN 7 AND TO AR1002-PIN 4.
2. IF ENCODE TONE IS DESIRED ONLY WHEN PTT IS LOW, A 19A115250P1 DIODE IS INSERTED BETWEEN H11 & H12.
3. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH 1000 SERIES. EXAMPLE: C1-C1001; R1-R1001.

* PART OF W1001

VOLTAGE READING

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (H5) WITH A 20.000 OHM-PER-VOLT METER.

MODEL NO	REV LETTER
PL19C321931G1	

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.

SCHEMATIC DIAGRAM

CHANNEL GUARD ENCODER/DECODER 19C321931G1

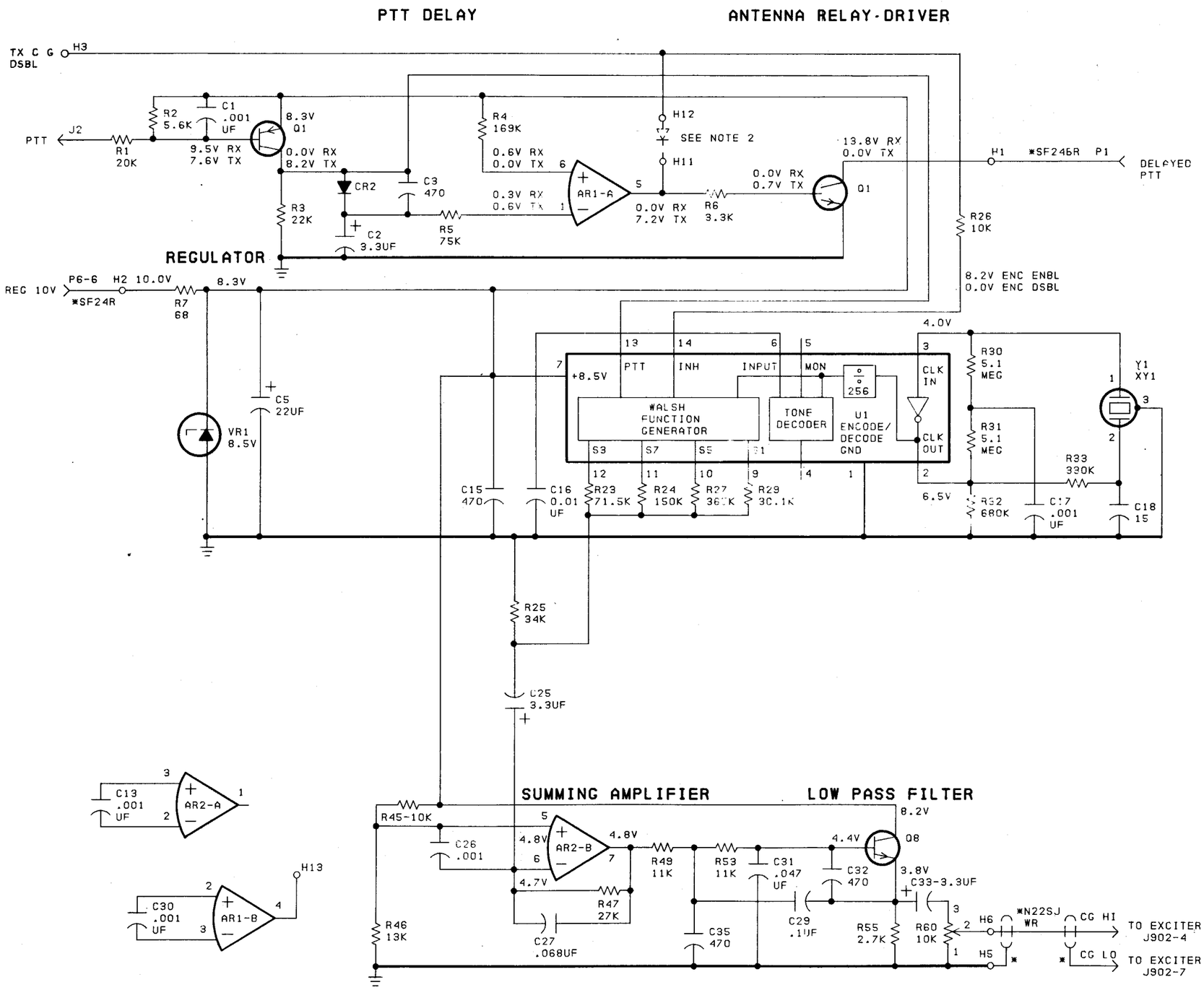
PARTS LIST

LBI-30178

CHANNEL GUARD
SINGLE TONE ENCODE/DECODE
19C321931G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
AR1001	19134122P1	Linear: Quad Operational Amplifier; sim to RCA CA 3401.
AR1002	19A116754P1	Linear: Dual In-Line 8- Pin Minidip package; sim to T1, SN72558 NSC.
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1001	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1002	5496267P409	Tantalum: 3.3 µf ±5%, 15 VDCW; sim to Sprague Type 150D.
C1003	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1004	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C1005	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C1006	19A116080P201	Polyester: 0.01 µf ±5%, 50 VDCW.
C1007	19A116080P215	Polyester: .0047 µf ±5%, 50 VDCW.
C1008	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1009	19A116080P201	Polyester: 0.01 µf ±5%, 50 VDCW.
C1010	19A116080P203	Polyester: 0.022 µf ±5%, 50 VDCW.
C1011	19A116080P201	Polyester: 0.01 µf ±5%, 50 VDCW.
C1012	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1013	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1014	19A134202P10	Tantalum: 0.22 µf ±20%, 35 VDCW.
C1015	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1016	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C1017	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1018	5490008P8	Silver mica: 15 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C1019	19A116080P6	Polyester: 0.068 µf ±20%, 50 VDCW.
C1020	19C300075P33001G	Polyester: 33,000 pf ±2%, 100 VDCW; sim to GE Type 61F.
C1021	19A134202P10	Tantalum: 0.22 µf ±20%, 35 VDCW.
C1022	19C300075P33001G	Polyester: 33,000 pf ±2%, 100 VDCW; sim to GE Type 61F.
C1023	19C300075P68001G	Polyester: 68,000 pf ±2%, 100 VDCW; sim to GE Type 61F.
C1024	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1025	19A134202P5	Tantalum: 3.3 µf ±20%, 15 VDCW.
C1026	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1027	19A116080P106	Polyester: 0.068 µf ±10%, 50 VDCW.
C1028	19A134202P105	Tantalum: 3.3 µf ±10%, 15 VDCW.
C1029	19A116080P207	Polyester: 0.1 µf ±5%, 50 VDCW.
C1030	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1031	19A116080P205	Polyester: 0.047 µf ±5%, 50 VDCW.
C1032	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1033	19A134202P5	Tantalum: 3.3 µf ±20%, 15 VDCW.
C1035 and C1036	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1037	19A116192P2	Ceramic: 470 pf ±20%, 50 VDCW; sim to Erie 8111-A050-W5R-471M.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1002 and CR1003	19A115250P1	Silicon.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1001 and J1002	19A116779P1	Contact, electrical: sim to Molex 08-50-0404.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P1006		Connector. Includes:
	19A116659P80	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108.
	19A116781P5	Contact, electrical: wire range No. 16-20 AWG; sim to Molex 08-50-0106.
P1011	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1001	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q1003	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q1004	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q1005	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q1006 thru Q1010	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1001	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R1002	3R152P562K	Composition: 5600 ohms ±10%, 1/4 w.
R1003	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R1004	19C314256P21693	Metal film: 169,000 ohms ±1%, 1/4 w.
R1005	19C314256P27502	Metal film: 75,000 ohms ±1%, 1/4 w.
R1006	3R152P332K	Composition: 3300 ohms ±10%, 1/4 w.
R1007	3R152P680J	Composition: 68 ohms ±5%, 1/4 w.
R1008	3R152P683J	Composition: 68,000 ohms ±5%, 1/4 w.
R1009	19C314256P21623	Metal film: 162,000 ohms ±1%, 1/4 w.
R1010	3R152P154J	Composition: 150,000 ohms ±5%, 1/4 w.
R1011	19C314256P21623	Metal film: 162,000 ohms ±1%, 1/4 w.
R1012	19C314256P27682	Metal film: 76,800 ohms ±1%, 1/4 w.
R1013	19C314256P21242	Metal film: 12,400 ohms ±1%, 1/4 w.
R1014	19C314256P26491	Metal film: 6490 ohms ±1%, 1/4 w.
R1015	19C314256P27682	Metal film: 76,800 ohms ±1%, 1/4 w.
R1016	19C314256P23482	Metal film: 34,800 ohms ±1%, 1/4 w.
R1017	3R152P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R1018	19C314256P21001	Metal film: 1000 ohms ±1%, 1/4 w.
R1019	19C314256P21002	Metal film: 10,000 ohms ±1%, 1/4 w.
R1020 and R1021	3R152P303J	Composition: 30,000 ohms ±5%, 1/4 w.
R1022	3R152P435J	Composition: 4.3 megohms ±5%, 1/4 w.
R1023	19C314256P27152	Metal film: 71,500 ohms ±1%, 1/4 w.
R1024	19C314256P21503	Metal film: 150,000 ohms ±1%, 1/4 w.
R1025	19C314256P23402	Metal film: 34,000 ohms ±1%, 1/4 w.
R1026	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R1027	19C314256P23653	Metal film: 36,500 ohms ±1%, 1/4 w.
R1028	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R1029	19C314256P23012	Metal film: 30,100 ohms ±1%, 1/4 w.
R1030 and R1031	3R152P515J	Composition: 5.1 megohms ±5%, 1/4 w.
R1032	3R152P684J	Composition: 0.68 megohm ±5%, 1/4 w.
R1033	3R152P334J	Composition: 0.33 megohm ±5%, 1/4 w.
R1034	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R1035	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R1036	19C314256P21622	Metal film: 16,200 ohms ±1%, 1/4 w.
R1037	19C314256P21472	Metal film: 34,700 ohms ±1%, 1/4 w.
R1038	19C314256P21652	Metal film: 16,500 ohms ±1%, 1/4 w.
R1039	19C314256P27321	Metal film: 7320 ohms ±1%, 1/4 w.
R1040	19C314256P21472	Metal film: 14,700 ohms ±1%, 1/4 w.
R1041	3R152P201J	Composition: 200 ohms ±5%, 1/4 w.
R1042	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R1043	3R152P391J	Composition: 390 ohms ±5%, 1/4 w.
R1044	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R1045	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R1046	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R1047	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R1048	3R152P224J	Composition: 220,000 ohms ±5%, 1/4 w.
R1049	19C314256P21102	Metal film: 11,000 ohms ±1%, 1/4 w.
R1050	3R152P224J	Composition: 0.22 megohm ±5%, 1/4 w.
R1051	3R152P823J	Composition: 82,000 ohms ±5%, 1/4 w.
R1052	3R152P274J	Composition: 270,000 ohms ±5%, 1/4 w.
R1053	19C314256P21102	Metal film: 11,000 ohms ±1%, 1/4 w.
R1054	3R152P474J	Composition: 0.47 megohm ±5%, 1/4 w.
R1055	3R152P272J	Composition: 2700 ohms ±5%, 1/4 w.
R1056	3R152P104J	Composition: 0.10 megohm ±5%, 1/4 w.
R1059	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R1060	19B209358P106	Variable, carbon film: approx 300 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
U1001	19D406009P1	Integrated circuit: digital.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1001	4036887P9	Silicon, Zener.
		- - - - - - - - - - - CABLES - - - - - - - - - -
W1001		HARNESS ASSEMBLY 19C321931G4 (Includes P1006, P1011)
		- - - - - - - - - - - SOCKETS - - - - - - - - - -
XY1001	5490277P1	Transistor, phen: 4 contacts; sim to Elco 3303.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
		NOTE: When reordering give GE Part Number and specify exact frequency needed.
Y1001	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

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



NOTES:
1. +8.5V CONNECTED TO AR1001-PIN 14 AND TO AR1002-PIN 8. GND CONNECTED TO AR1001-PIN 7 AND TO AP1002-PIN 4.
2. IF ENCODE TONE IS DESIRED ONLY WHEN PTT IS LOW, A 19A115250P1 DIODE IS INSERTED BETWEEN H11 & H12.
3. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH 1000 SERIES. EXAMPLE: C1-C1001; R1-R1001.

* PART OF W1002

VOLTAGE READING

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (H5) WITH A 20.000 OHM-PER-VOLT METER.

MODEL NO	REV LETTER
PL19C321931G2	

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.

(19D423952, Rev. 2)

SCHEMATIC DIAGRAM

CHANNEL GUARD ENCODE ONLY
19C321931G2

PARTS LIST

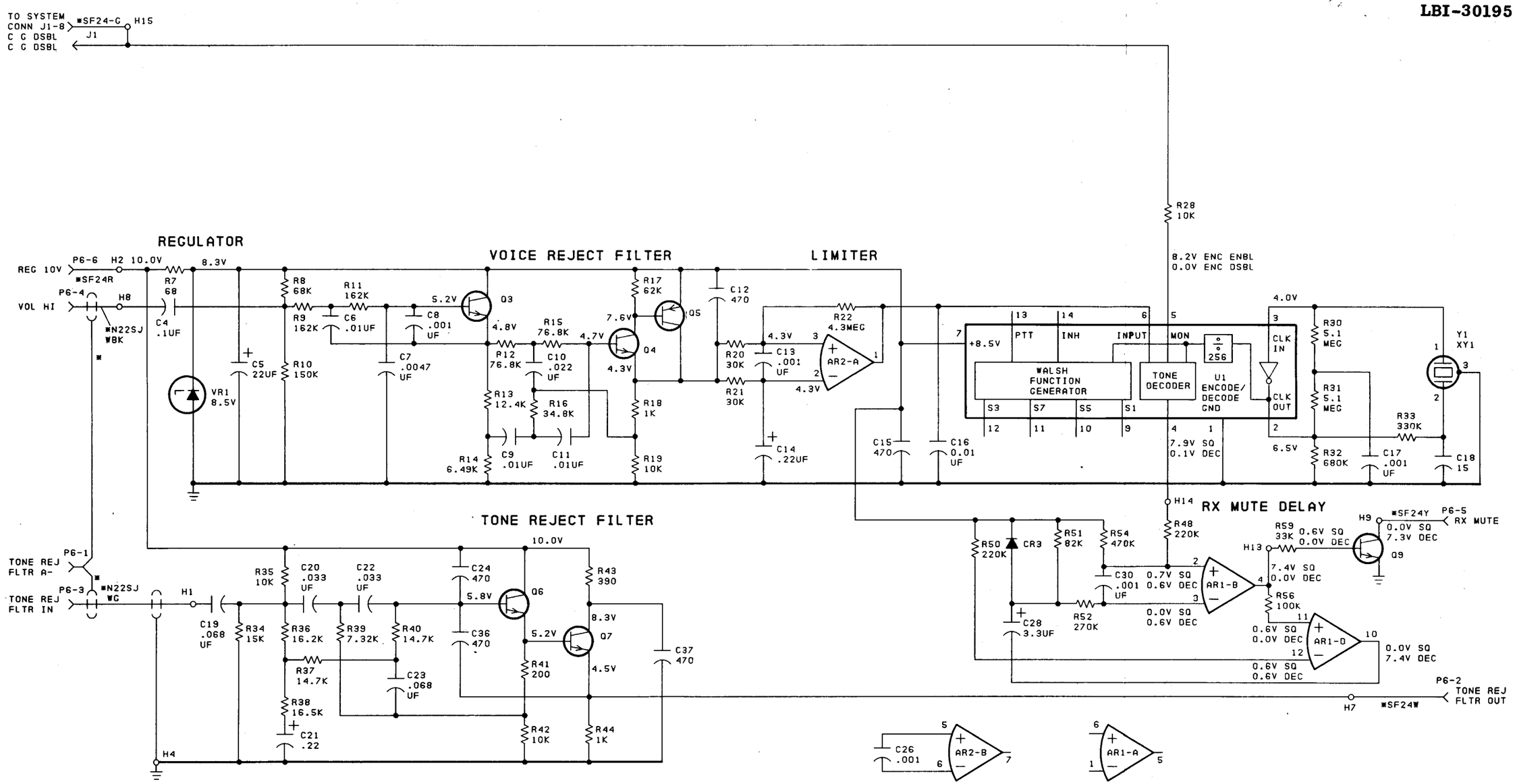
LBI-30177

CHANNEL GUARD
SINGLE TONE ENCODE
19C321931G2

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
AR1001	19134122P1	Linear: Quad Operational Amplifier; sim to RCA CA 3401.
AR1002	19A116754P1	Linear: Dual In-Line 8- Pin Minidip package; sim to TI, SN72558 NSC.
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1001	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1002	5496267P409	Tantalum: 3.3 µf ±5%, 15 VDCW; sim to Sprague Type 150D.
C1003	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1005	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C1013	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1015	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1016	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C1017	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1018	5490008P8	Silver mica: 15 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C1025	19A134202P5	Tantalum: 3.3 µf ±20%, 15 VDCW.
C1026	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1027	19A116080P106	Polyester: 0.068 µf ±10%, 50 VDCW.
C1029	19A116080P207	Polyester: 0.1 µf ±5%, 50 VDCW.
C1030	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1031	19A116080P205	Polyester: 0.047 µf ±5%, 50 VDCW.
C1032	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1033	19A134202P5	Tantalum: 3.3 µf ±20%, 15 VDCW.
C1035	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1002	19A115250P1	Silicon.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1002	19A116779P1	Contact, electrical: sim to Molex 08-50-0404.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P1006		Connector. Includes:
	19A116659P80	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108.
	19A116781P5	Contact, electrical: wire range No. 16-20 AWG; sim to Molex 08-50-0106.
P1011	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1001	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q1008	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q1010	19A115910P1	Silicon, NPN; sim to Type 2N3904.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - - RESISTORS - - - - - - - - - -
R1001	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R1002	3R152P562K	Composition: 5600 ohms ±10%, 1/4 w.
R1003	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R1004	19C314256P21693	Metal film: 169,000 ohms ±1%, 1/4 w.
R1005	19C314256P27502	Metal film: 75,000 ohms ±1%, 1/4 w.
R1006	3R152P332K	Composition: 3300 ohms ±10%, 1/4 w.
R1007	3R152P680J	Composition: 68 ohms ±5%, 1/4 w.
R1023	19C314256P27152	Metal film: 71,500 ohms ±1%, 1/4 w.
R1024	19C314256P21503	Metal film: 150,000 ohms ±1%, 1/4 w.
R1025	19C314256P23402	Metal film: 34,000 ohms ±1%, 1/4 w.
R1026	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R1027	19C314256P23653	Metal film: 36,500 ohms ±1%, 1/4 w.
R1029	19C314256P23012	Metal film: 30,100 ohms ±1%, 1/4 w.
R1030 and R1031	3R152P515J	Composition: 5.1 megohms ±5%, 1/4 w.
R1032	3R152P684J	Composition: 0.68 megohm ±5%, 1/4 w.
R1033	3R152P334J	Composition: 0.33 megohm ±5%, 1/4 w.
R1045	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R1046	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R1047	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R1049	19C314256P21102	Metal film: 11,000 ohms ±1%, 1/4 w.
R1053	19C314256P21102	Metal film: 11,000 ohms ±1%, 1/4 w.
R1055	3R152P272J	Composition: 2700 ohms ±5%, 1/4 w.
R1060	19B209358P106	Variable, carbon film: approx 300 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
U1001	19D406009P1	Integrated circuit: digital.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1001	4036887P9	Silicon, Zener.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1002		HARNESS ASSEMBLY 19C321931G5 (Includes P1006, P1011)
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY1001	5490277P1	Transistor, phen: 4 contacts; sim to Elco 3303.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
		NOTE: When reordering give GE Part Number and specify exact frequency needed.
Y1001	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

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



NOTES:
1. +8.5V CONNECTED TO AR1001-PIN 14 AND TO AR1002-PIN 8. GND CONNECTED TO AR1001-PIN 7 AND TO AR1002-PIN 4.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH 1000 SERIES. EXAMPLE: C1=C1001; R1=R1001.

* PART OF W1003

VOLTAGE READING

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

MODEL NO	REV LETTER
PL19C321931G3	

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.

(19D423953, Rev. 2)

SCHEMATIC DIAGRAM

CHANNEL GUARD DECODE ONLY 19C321931G3

PARTS LIST

LBI-30176

CHANNEL GUARD
SINGLE TONE ENCODE
19C321931G3

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
AR1001	19134122P1	Linear: Quad Operational Amplifier; sim to RCA CA 3401.
AR1002	19A116754P1	Linear: Dual In-Line 8- Pin Minidip package; sim to T1, SN72558 NSC.
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1004	19A116080P7	Polyester: 0.1 µf ±20%, 50 VDCW.
C1005	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C1006	19A116080P201	Polyester: 0.01 µf ±5%, 50 VDCW.
C1007	19A116080P215	Polyester: .0047 µf ±5%, 50 VDCW.
C1008	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1009	19A116080P201	Polyester: 0.01 µf ±5%, 50 VDCW.
C1010	19A116080P203	Polyester: 0.022 µf ±5%, 50 VDCW.
C1011	19A116080P201	Polyester: 0.01 µf ±5%, 50 VDCW.
C1012	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1013	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1014	19A134202P10	Tantalum: 0.22 µf ±20%, 35 VDCW.
C1015	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1016	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C1017	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1018	5490008P8	Silver mica: 15 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C1019	19A116080P6	Polyester: 0.068 µf ±20%, 50 VDCW.
C1020	19C300075P33001G	Polyester: 33,000 pf ±2%, 100 VDCW; sim to GE Type 61F.
C1021	19A134202P10	Tantalum: 0.22 µf ±20%, 35 VDCW.
C1022	19C300075P33001G	Polyester: 33,000 pf ±2%, 100 VDCW; sim to GE Type 61F.
C1023	19C300075P68001G	Polyester: 68,000 pf ±2%, 100 VDCW; sim to GE Type 61F.
C1024	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1026	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1028	19A134202P105	Tantalum: 3.3 µf ±10%, 15 VDCW.
C1030	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1036	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1037	19A116192P2	Ceramic: 470 pf ±20%, 50 VDCW; sim to Erie 8111-A050-W5R-471M.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1003	19A115250P1	Silicon.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1001	19A116779P1	Contact, electrical: sim to Molex 08-50-0404.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P1006		Connector. Includes:
	19A116659P80	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108.
	19A116781P5	Contact, electrical: wire range No. 16-20 AWG; sim to Molex 08-50-0106.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1003	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q1004	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q1005	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q1006 and Q1007	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q1009	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1007	3R152P680J	Composition: 68 ohms ±5%, 1/4 w.
R1008	3R152P683J	Composition: 68,000 ohms ±5%, 1/4 w.
R1009	19C314256P21623	Metal film: 162,000 ohms ±1%, 1/4 w.
R1010	3R152P154J	Composition: 150,000 ohms ±5%, 1/4 w.
R1011	19C314256P21623	Metal film: 162,000 ohms ±1%, 1/4 w.
R1012	19C314256P27682	Metal film: 76,800 ohms ±1%, 1/4 w.
R1013	19C314256P21242	Metal film: 12,400 ohms ±1%, 1/4 w.
R1014	19C314256P26491	Metal film: 6490 ohms ±1%, 1/4 w.
R1015	19C314256P27682	Metal film: 76,800 ohms ±1%, 1/4 w.
R1016	19C314256P23482	Metal film: 34,800 ohms ±1%, 1/4 w.
R1017	3R152P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R1018	19C314256P21001	Metal film: 1000 ohms ±1%, 1/4 w.
R1019	19C314256P21002	Metal film: 10,000 ohms ±1%, 1/4 w.
R1020 and R1021	3R152P303J	Composition: 30,000 ohms ±5%, 1/4 w.
R1022	3R152P435J	Composition: 4.3 megohms ±5%, 1/4 w.
R1028	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R1030 and R1031	3R152P515J	Composition: 5.1 megohms ±5%, 1/4 w.
R1032	3R152P684J	Composition: 0.68 megohm ±5%, 1/4 w.
R1033	3R152P334J	Composition: 0.33 megohm ±5%, 1/4 w.
R1034	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R1035	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R1036	19C314256P21622	Metal film: 16,200 ohms ±1%, 1/4 w.
R1037	19C314256P21472	Metal film: 34,700 ohms ±1%, 1/4 w.
R1038	19C314256P21652	Metal film: 16,500 ohms ±1%, 1/4 w.
R1039	19C314256P27321	Metal film: 7320 ohms ±1%, 1/4 w.
R1040	19C314256P21472	Metal film: 14,700 ohms ±1%, 1/4 w.
R1041	3R152P201J	Composition: 200 ohms ±5%, 1/4 w.
R1042	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R1043	3R152P391J	Composition: 390 ohms ±5%, 1/4 w.
R1044	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R1048	3R152P224J	Composition: 220,000 ohms ±5%, 1/4 w.
R1050	3R152P224J	Composition: 0.22 megohm ±5%, 1/4 w.
R1051	3R152P823J	Composition: 82,000 ohms ±5%, 1/4 w.
R1052	3R152P274J	Composition: 270,000 ohms ±5%, 1/4 w.
R1054	3R152P474J	Composition: 0.47 megohm ±5%, 1/4 w.
R1056	3R152P104J	Composition: 0.10 megohm ±5%, 1/4 w.
R1059	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
U1001	19D406009P1	Integrated circuit: digital.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - -
VR1001	4036887P9	Silicon, Zener.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CABLES - - - - - - - - - -
W1003		HARNESS ASSEMBLY 19C321931G6 (Includes P1006)
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY1001	5490277P1	Transistor, phen: 4 contacts; sim to Elco 3303.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
		NOTE: When reordering give GE Part Number and specify exact frequency needed.
Y1001	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

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

CHANNEL GUARD INSTALLATION

THE FOLLOWING CONNECTIONS AND MODIFICATIONS MUST BE MADE WHEN INSTALLING CHANNEL GUARD 19C321931G1-G3:

GROUP 1 ENCODE/DECODE

P1006 TO J906

GREEN WIRE TO C1

CUT DA WIRE JUMPER BETWEEN H1 & H2 ON SYSTEM BD.

WHITE-RED CENTER COND. TO J902-9 SHIELD TO J902-7

DISCONNECT BLUE WIRE (TERMINATED WITH P911) WHICH IS CONNECTED TO J911 ON SYSTEM BD. AND CONNECT TO J1002 ON CHANNEL GUARD BD.

CONNECT BROWN WIRE (TERMINATED WITH P1011) FROM CHANNEL GUARD BD. TO J911 ON SYSTEM BD.

DISCONNECT ORANGE WIRE (TERMINATED WITH P1001) WHICH IS CONNECTED TO J910 ON SYSTEM BD. AND CONNECT TO J1001 ON CHANNEL GUARD BD.

GROUP 2 ENCODE ONLY

P1006 TO J906

WHITE-RED CENTER COND. TO J902-9 SHIELD TO J902-7.

DISCONNECT BLUE WIRE (TERMINATED WITH P911) WHICH IS CONNECTED TO J911 ON SYSTEM BD. AND CONNECT TO J1002 ON CHANNEL GUARD BD.

CONNECT BROWN WIRE (TERMINATED WITH P1011) FROM CHANNEL GUARD BD. TO J911 ON SYSTEM BD.

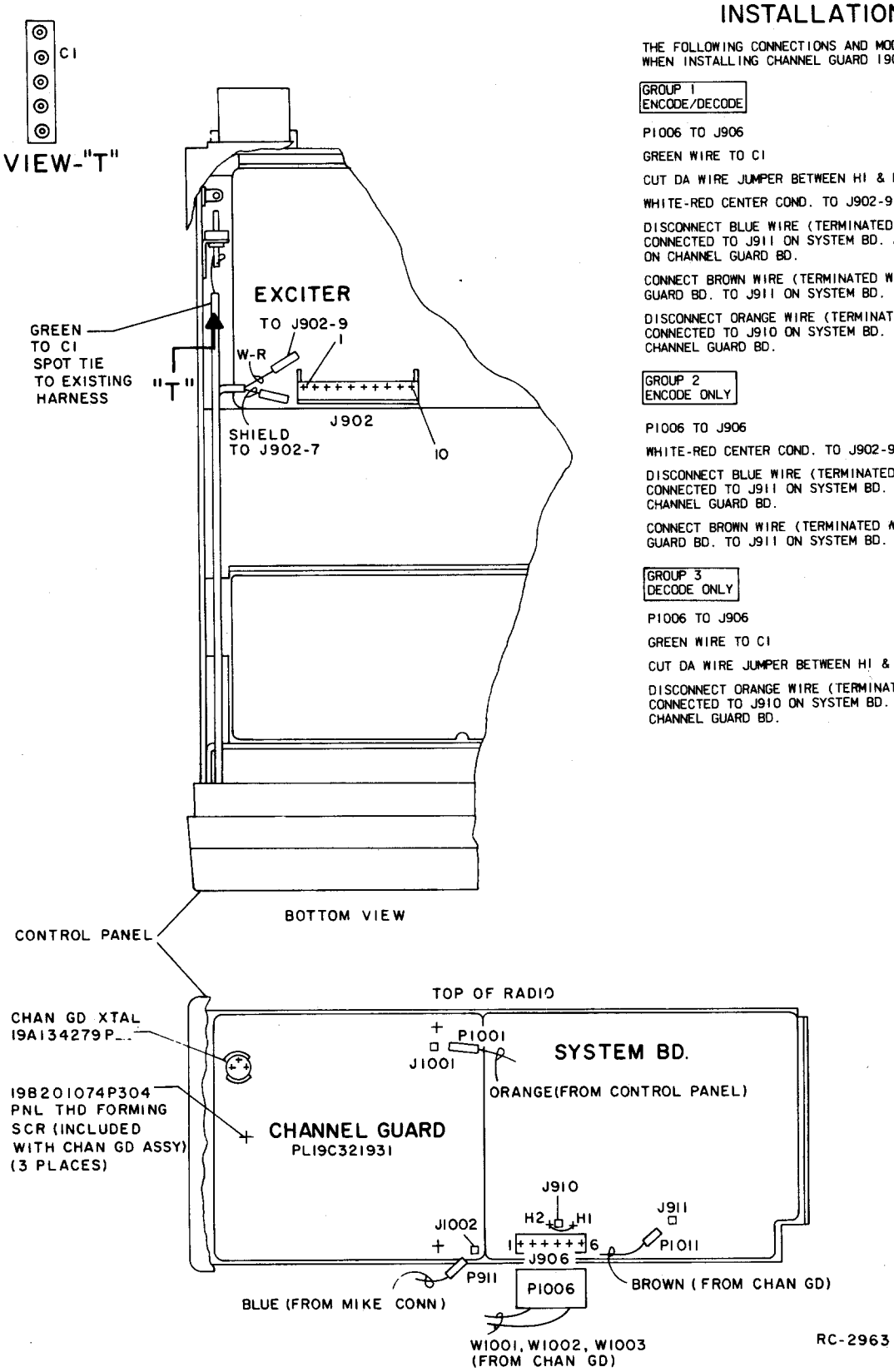
GROUP 3 DECODE ONLY

P1006 TO J906

GREEN WIRE TO C1

CUT DA WIRE JUMPER BETWEEN H1 & H2 ON SYSTEM BD.

DISCONNECT ORANGE WIRE (TERMINATED WITH P1001) WHICH IS CONNECTED TO J910 ON SYSTEM BD. AND CONNECT TO J1001 ON CHANNEL GUARD BD.



INSTALLATION INSTRUCTIONS

CHANNEL GUARD 19C321931G1-G3

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-30195

DF-5047

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

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