MOBILE RADIO

MAINTENANCE MANUAL

VEHICULAR REPEATER LOGIC BOARD 19C331423G1

TABLE OF CONTENTS

DESCRIPTION

The logic board controls the operation of the vehicular repeater and determines when it should function as a repeater or operate in a standby mode. A random self prioritizing system will cause a standby repeater to assume the repeating function when needed. It also controls the carrier control timer (function on base to portable transmissions only) and the courtesy beep. All the above mentioned control functions operate under software control.

Also residing in the software are the "Self Test Functions". The self test functions check the operation of the vehicular repeater as a system and also the microprocessor itself. An LED is used to provide a status indentification for all test functions.

The logic board is mounted on the underside of the chassis and plugs into the system board.

The logic board contains a 8748 microprocessor and the necessary buffering circuits for interfacing. It also contains a watchdog circuit to monitor microprocessor operation and a crystal controlled oscillator to provide the time base for the microprocessor. A 5-volt regulator provides power to the circuitry.

CIRCUIT ANALYSIS

INPUT BUFFERING

The logic levels present at P904 are 10 volt levels that interface with the radio. CMOS inverters U1 and U2 translate the 10 volt input levels to the 5 volt logic levels required by the microprocessor. R1 through R10 provide protection against static.

OUTPUT BUFFERING

Open collector TTL inverter U4 provides output buffering for the four outputs of the microprocessor. Voltage translation to 10 volts is provided by the 10 volt input at P904-4 and pull-up resistors R14-R17.

TIME BASE

The time base for the 8748 microprocessor is provided by Y1, a standard 3.5795 MHz crystal (TV color burst). The crystal is mounted directly to the board with DA wire to prevent excessive vibration.

WATCHDOG CIRCUIT

The watchdog circuit contsits of Q1, a 555 timer and associated circuitry connected as a one shot. The output is applied to Pin 4 (Reset) on the microprocessor. At power-up, the one shot will hold Pin 4 low long enough to let the system stabilize before starting the microcomputer. The computer must toggle the input to the one shot fast enough to prevent the input voltage from rising past the threshold voltage. If the threshold voltage is exceeded, the one shot will fire and reset the microprocessor. The interrupt frequency must be greater than 10 Hz. The output will hold Pin 4 high unless the one shot is triggered. If the program runs correctly, it will always toggle the input to the one shot and prevent it from firing.

5 VOLT REGULATOR

Five volt regulator U6 receives +10 V from the radio through P904-4 and provides regulated +5 VDC to the microprocessor, buffers, watchdog circuit and pull up resistors R29-R35. The heat sink for the regulator consists of the ground plane located near the regulator and on both sides of the board.

CARRIER CONTROL TIMER

The carrier control timer, CCT, resides in software and operates under microprocessor control. The CCT is active when repeating base-to-portable transmissions. Time duration is set at 2 minutes. The CCT may be disabled by connecting a DA jumper from H1-H2.

COURTESY BEEP

A courtesy beep is generated by the Type 90 encoder under microprocessor control at the end of each portable-to-base transmission. This tone lets the user know that his message has been repeated and that he has not disabled his Channel Guard or moved out of range.

In vehicular repeater systems using logic board 19C328461, the courtesy beep could cause all repeaters to count down to their top non-priority level. If this situation occured and the vehicle with the active repeater left the scene it would take 1.6 seconds for the remaining repeaters to count down the eight levels of priority. When this occurs it possible for several repeaters to turn on simultaneously. To avoid such a condition, a jumper arrangement has been incorporated to allow disabling the courtesy beep. To disable the courtesy beep connect DA jumper wire between H5-H6.

TYPE 90 PRIORITY TONE BURST

The Type 90 priority tone burst is a 700 millisecond burst that is used to establish the vehicular repeater as the priority repeater and regulate all other repeaters to the non-priority status. The Type 90 tone burst can be disabled on an enabled vehiclar repeater to prevent it from disrupting a portable-to-base transmission. If the priority tone burst is disabled and no portable-to-base carrier activity is detected, the Type 90 tone burst is transmitted as usual and the repeater will assume priority status. To disable the priority tone bust connect DA jumper H3-H4. If the jumper is not installed. The repeater will transmit the Type 90 tone burst over any portables that may be transmitting while the repeater is enabled.

SELF TEST FUNCTIONS

The logic board and microprocessor have seven vehicular repeater system test functions built in and a microprocessor self check. The microprocessor self check includes checking the RAM, ROM, counter/timer/crystal, and the watchdog circuit. The repeater tests can be selectively run while the microprocessor self check is run automatically, as part of the self test exit routine, when exiting from test mode. Pass/fail test status is indicated by the LED. The LED is turned on when any system tests have been run successfully and will flash five times in approximately five seconds upon successful completion of the microprocessor self check.

The following system functions may be checked:

TP2	Repeater CG
TP3	T-90 Decoder
TP4	Mobile CAS
TP5	Monitor CAS
TP6	Repeater CAS
TP7	Mobile CG
TP8	T-90 Encoder

TEST PROCEDURE

1. Gain access to the logic board and enter test mode by connecting TP1 to ground.

2. Individually connect TP2-TP8 to ground while observing the LED. It should be on while the indicated signal is received.

NOTE

When testing the T-90 encoder the repeater transmitter is keyed and the LED is on only during transmit.

3. After completing the system checks be sure TP2 through TP8 are not connected to ground. Then while observing the LED remove ground from TP1. The LED should flash five times in five seconds indicating successfull completion of the four microprocessor checks and return to normal operation. The LED is off during normal operation.

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NOTE

If the microprocessor is bad the LED will not light. If at the end of the microprocessor check the LED flashes at a rate other than 5 times in 5 seconds, the crystal may be defective.

If the watchdog circuit is bad the LED will flash five times and stay on. The microprocessor is not reset, and it will remain in the interrupt routine. There is no return to normal operation except by removing power to the unit.

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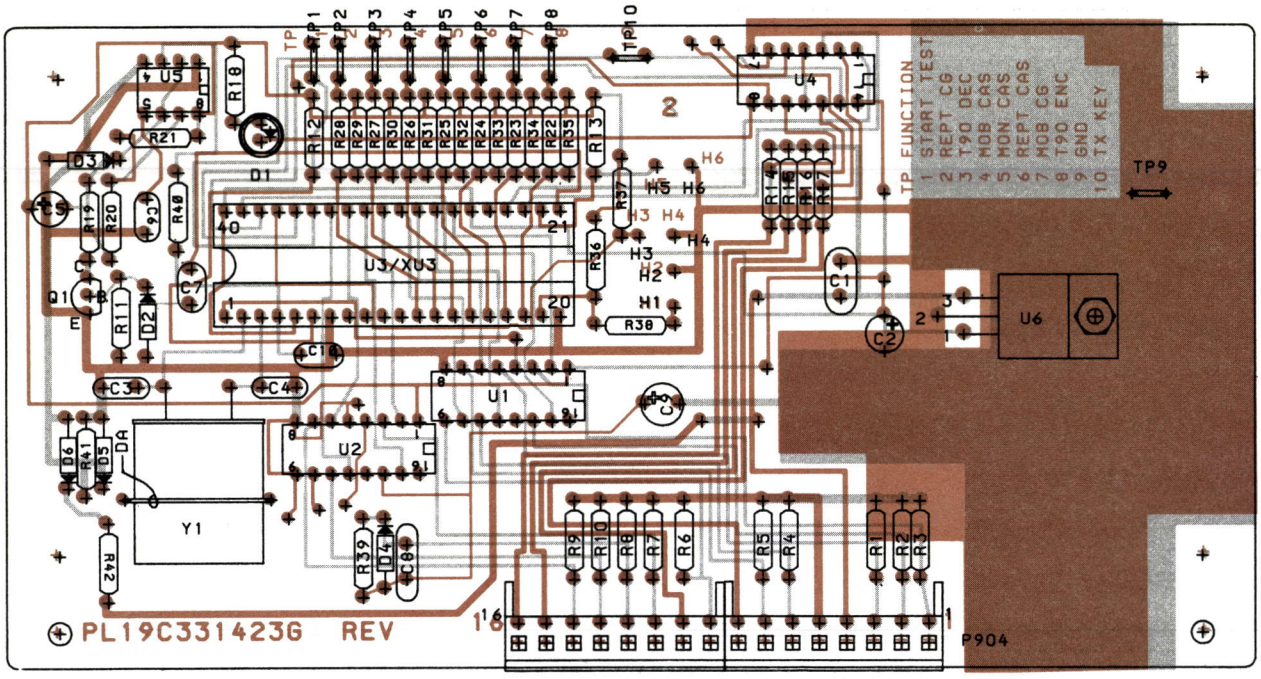
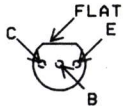


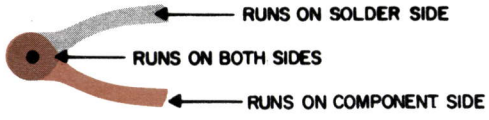
LEAD IDENTIFICATION
FOR Q1



IN-LINE
TOP VIEW

NOTE: CASE SHAPE IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

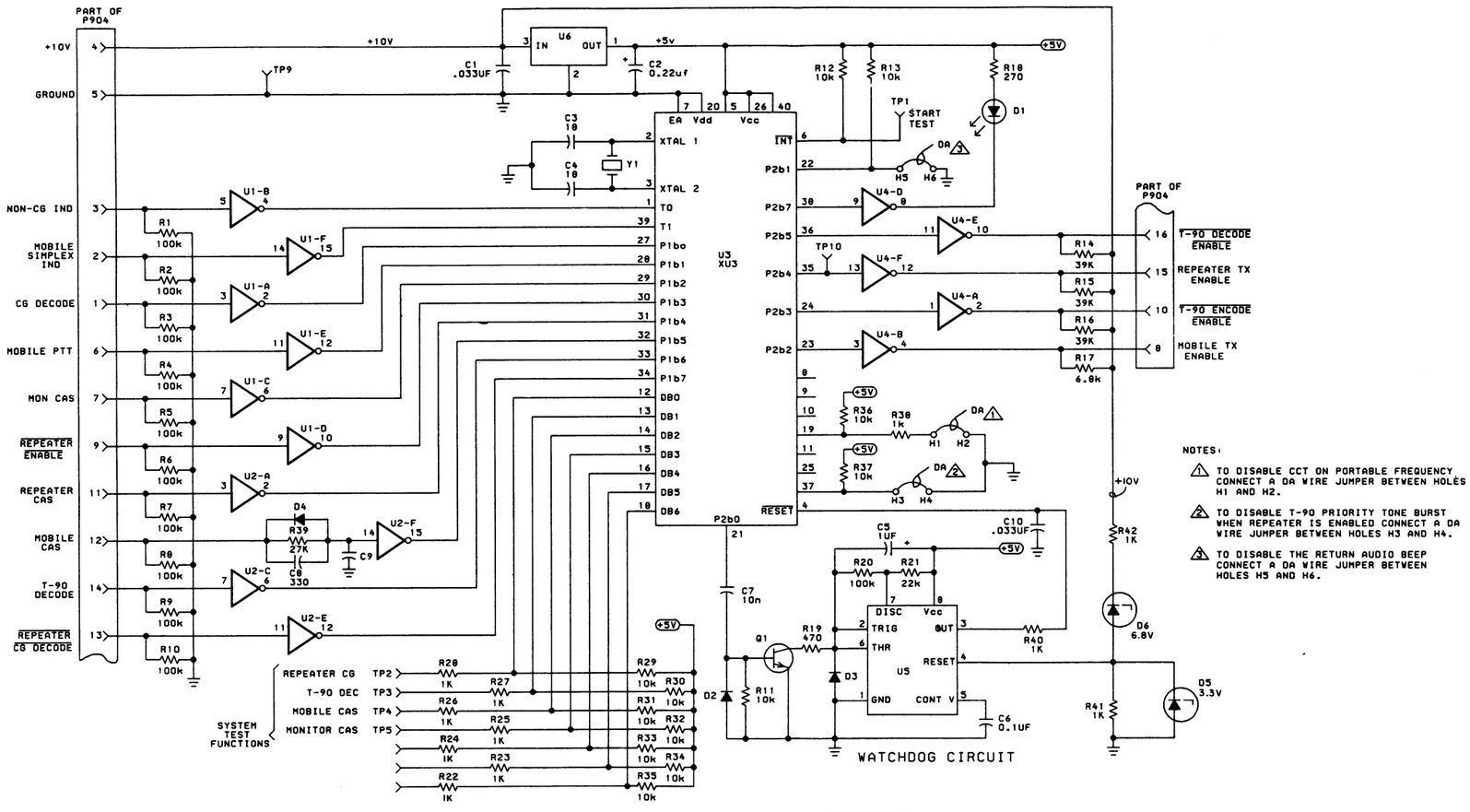
(19C331424, Rev. 2)
(19A144068, Sh. 1, Rev. 2)
(19A144068, Sh. 2, Rev. 2)



OUTLINE DIAGRAM

LOGIC BOARD 19C331423G1

5 VOLT REGULATOR



NOTES:

1. TO DISABLE CCT ON PORTABLE FREQUENCY CONNECT A DA WIRE JUMPER BETWEEN HOLES H1 AND H2.
2. TO DISABLE T-90 PRIORITY TONE BURST WHEN REPEATER IS ENABLED CONNECT A DA WIRE JUMPER BETWEEN HOLES H3 AND H4.
3. TO DISABLE THE RETURN AUDIO BEEP CONNECT A DA WIRE JUMPER BETWEEN HOLES H5 AND H6.

PWR & GND CONNECTION CHART

DEVICE	V (+5V) PIN NO	GROUND PIN NO
U1	1	8
U2	1	5,8,9
U4	14	7,5

SPARE GATES

DEVICE	INPUT PIN NO	OUTPUT PIN NO
U2-B	5	4
U2-D	9	10
U4-C	5	6

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.

MODEL NO.	REV. LETTER
PL19C331423G1	B

(19D433928, Rev. 4)

SCHEMATIC DIAGRAM

LOGIC BOARD 19C331423G1

PARTS LIST

VEHICULAR REPEATER LOGIC BOARD
19C331423G1
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	T644ACP333K	Polyester: .033 uF + or -10%, 50 VDCW.
C2	19A700003P2	Tantalum: 0.22 uF + or -20%, 35 VDCW.
C3 and C4	19A700235P16	Ceramic: 18 pF + or -5%, 50 VDCW.
C5	19A701534P4	Tantalum: 1 uF + or - 20%, 35 VDCW.
C6 and C7	T644ACP310K	Polyester: .010 uF + or -10%, 50 VDCW.
C8	19A700235P31	Ceramic, disc: 330 pF + or -5%, 50 VDCW.
C9	19A701534P5	Tantalum: 2.2 uF, + or -20%, 35 VDCW.
C10	T644ACP333K	Polyester: .033 uF + or -10%, 50 VDCW.
		- - - - - - - - - - DIODES - - - - - - - - - -
D1	19A134354P1	Diode, optoelectronic: red; sim to Hew. Packard 5082-4655.
D2 thru D4	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D5	19A700025P3	Silicon, zener: 400 mW max; sim to BZX55-C3V3.
D6	19A700025P8	Silicon, zener: 400 mW max; sim to BZX55-C6V8.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P904	19A116659P3	Connector, printed wiring: 8 contacts rated at 5 amps; sim to Molex 09-52-3082.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A700023P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 thru R10	H212CRP410C	Deposited carbon: 0.1M ohms + or -5%, 1/4 w.
R11 thru R13	H212CRP310C	Deposited carbon: 10K ohms + or -5%, 1/4 w.
R14 thru R16	H212CRP339C	Deposited carbon: 39K ohms + or -5%, 1/4 w.
R17	H212CRP268C	Deposited carbon: 6.8K ohms + or -5%, 1/4 w.
R18	H212CRP127C	Deposited carbon: 270 ohms + or -5%, 1/4 w.
R19	H212CRP147C	Deposited carbon: 470 ohms + or -5%, 1/4 w.
R20	H212CRP410C	Deposited carbon: 0.1M ohms + or -5%, 1/4 w.
R21	H212CRP322C	Deposited carbon: 22K ohms + or -5%, 1/4 w.
R22 thru R28	H212CRP210C	Deposited carbon: 1K ohms + or -5%, 1/4 w.
R29 thru R37	H212CRP310C	Deposited carbon: 10K ohms + or -5%, 1/4 w.
R38	H212CRP210C	Deposited carbon: 1K ohms + or -5%, 1/4 w.
R39	H212CRP327C	Deposited carbon: 27K ohms + or -5%, 1/4 w.
R40 thru R42	H212CRP212C	Deposited carbon: 1.2K ohms + or -5%, 1/4 w.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
U1 and U2	19A700176P1	Digital. HEX BUFFER/CONVERTER (INVERTING).
U3	19A144982G2	Micro Computer.
U4	19A116180P33	Digital: HEX INVERTER BUFFER/DRIVER (OPEN COLLECTOR).
U5	19A701865P1	Linear: 555 Timer, sim to Signetics NE555N.
U6	19A134717P1	4K PROGRAMMED MEMORY.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XU3	19A700156P5	Socket, integrated circuit: 40 contacts; sim to Augat 340-AG39D.
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y1	19A702599G2	Crystal, quartz: 3579.545 kHz.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19A701728P1	Washer, non-metallic; sim to 4035306P51.
	19A702028P1	Jumper.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PRODUCTION CHANGES

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

REV. A - Vehicular Reapter Logic Board 19C331423G1

To improve operation of 5 volt regulator. Changed C2 and added C8, C9, D4, and R39.
C2 was:
19A701534P9 Tantalum: 47 uf ±20%, 6.3 VDCW.

This addendum describes Revision Letter changes that are not yet included in LBI31159A.

REV. B - Vehicular Repeater Logic Board 19C331423G1

To add a low voltage reset circuit to prevent the radio from turning off when the vehicle is started with the radio turned on. Added C10, D5, D6, R1, R2 and R3.

Components are:

C10: T644ACP333K; Polyester, .033 uf ±10%, 50 VDCW.

D5: 19A700025P3; Zener, silicon, 3.3V, 400 mW max, sim to BZX55-C3V3

D6: 19A70002PP8; Zener, silicon, 6.8V, 400 mW max, sim to BZX55-C6V8.

R40 thru R42: H212CRP212C Deposited carbon, 1 K ohm ± 5%, ¼w.