

MAINTENANCE MANUAL
General Electric
MPI TYPE 99 & CHANNEL GUARD
LBI31316A

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SPECIFICATIONS

| | |
|----------------------|-------------------------------------|
| Tone Frequency Range | 288 Hz to 1433 Hz |
| Tone Input | 200 millivolts RMS \pm millivolts |
| Automatic Reset | 15 seconds \pm 2 seconds |
| Current Drain | |
| 5.4 Volts | 1.5 milliamps |
| 7.5 Volts | 12.0 milliamps |

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GENERAL  **ELECTRIC***
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DESCRIPTION

The MPI Decoder option consists of a option board and a top cover that includes MONITOR/RESET switch S1. Associated components consist of the Type 99 module and code plug module A/B. These components are not part of the Decoder kit and must be ordered separately.

OPERATION

In Type 99 Tone System calls will not be heard from the receive circuit until the proper tone is applied to the decoder.

The first tone causes the decoder to switch to accept the second tone after the first tone ends. An alert tone will sound when the second tone is recognized by the decoder, and will continue to sound as long as the second tone is transmitted.

When the correct tone is applied, the receiver circuit audio opens and remains open to receive calls until the decoder is reset. The decoder can be reset manually by tone option RESET/MONITOR switch S1, or by the automatic reset circuit that automatically resets the module after 15 seconds.

A block diagram of the Type 99 Decoder module and a simplified diagram of the Code Plug are provided in Figures 1 and 2.

References to symbol numbers used in the following test are found on the Schematic Diagram, Outline Diagram and Parts List.

CIRCUIT ANALYSIS

Type 99 module and associated Code Plug A/B operates as an Individual Call decoder for tone frequencies in the 288 to 1433 Hz range. The module consists of four chips: Tone Voice Controller U2, System Linear U3, T99 Controller U4, and Low Threshold Detector U5 (See Figure 1).

Turning the radio on resets the Type 99 module. This causes the RUS control lead on Pin 7 to go low. The RUS lead causes the receive circuit to squelch. Also, the data for processing the tone is loaded from code plug A/B into T99 Controller U4.

When a Type 99 tone is received, it is applied to Pin 17 of the Type 99 module and to the input of Digital Tone Detector U5. In Individual Call applications, the Group Call Disable lead at Pin 16 is tied to ground to disable the Group Call. So when a correct tone is received, the RUS lead goes to 0.7 volts and disables the Type 99 module. This allows the receiver to unsquelch.

NOTE

The tone must be present in the decoder for a minimum of 240 milliseconds before a valid detection occurs.

CODE PLUG PROGRAMMING

Code plug U2 is essentially a 26-bit parallel-to-serial converter (See Figure 2). However, only 20 bits are used in Type 99 options. The plug has programmable diodes that can be shorted to permanently store the tone codes. When ordering a code plug, always include the call tone frequency.

CHANNEL GUARD (CG)

The MPI Channel Guard is a continuous-tone encoder for operation on tone frequencies in the 71.9 to 210.7 Hz range. The option consists of a Channel Guard module and an option board. The option board provides the proper interface with the transmitter-receiver board.

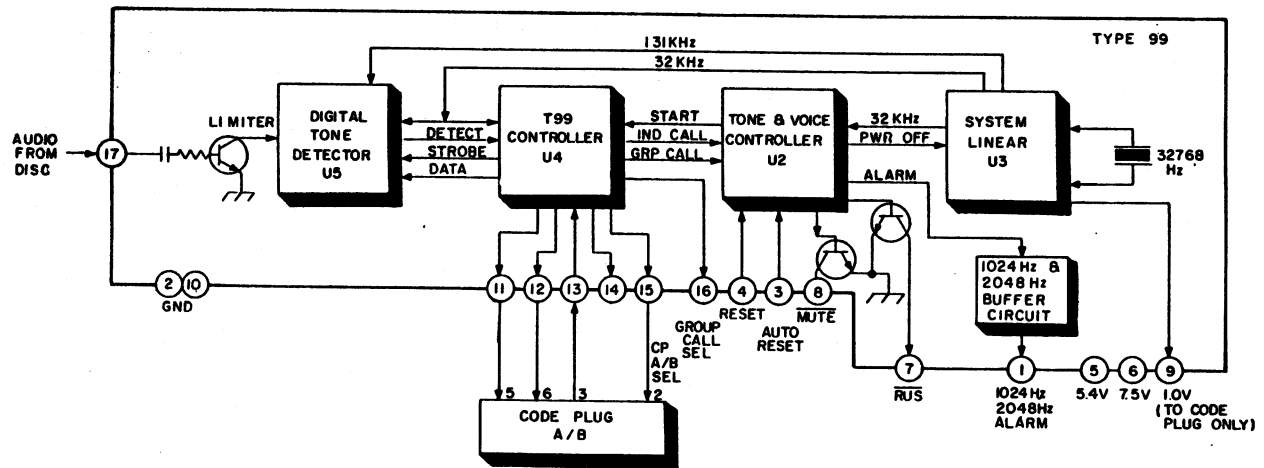
The Channel Guard module contains a tone frequency synthesizer and an encoder circuitry. The synthesizer is programmable to produce Channel Guard tones from 67 to 210.7 Hz in 0.25 Hz increments.

The synthesizer uses a crystal controlled 32,768 Hz reference to produce the desired clock inputs to the encoder module.

CIRCUIT ANALYSIS

ENCODE

When the transmit circuit is keyed the encoder circuit generates a sine wave encode tone which passes through a low pass filter to remove any clock and tone harmonics. This output tone is connected from the CG output lead to the transmitter audio circuit.



RC4444

Figure 1 - Type 99 Decoder Module

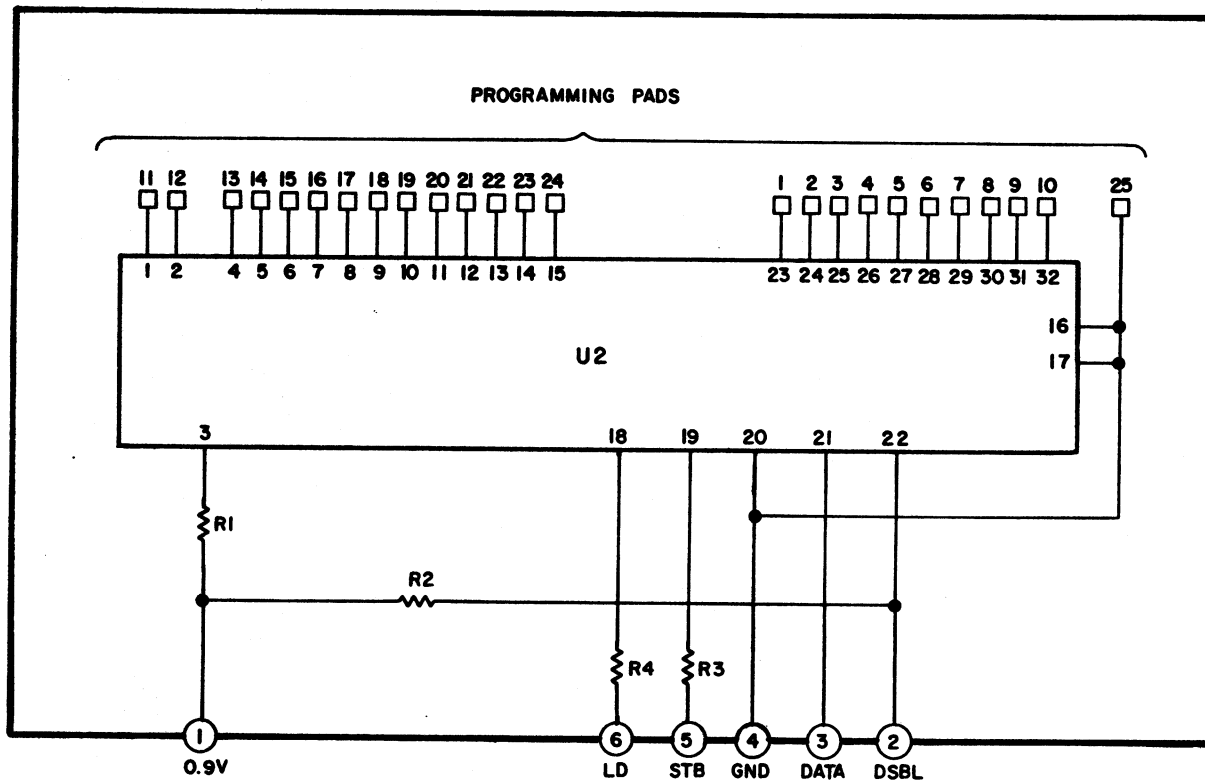
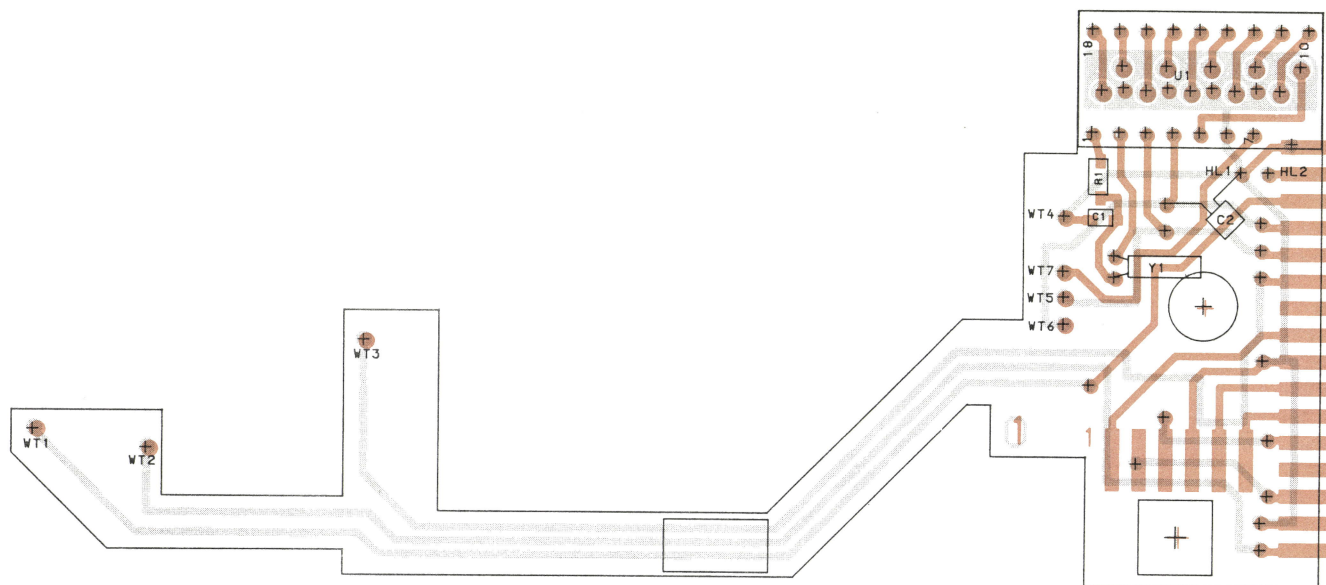
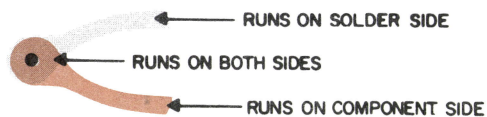


Figure 2 - Code Plug (RC4189)

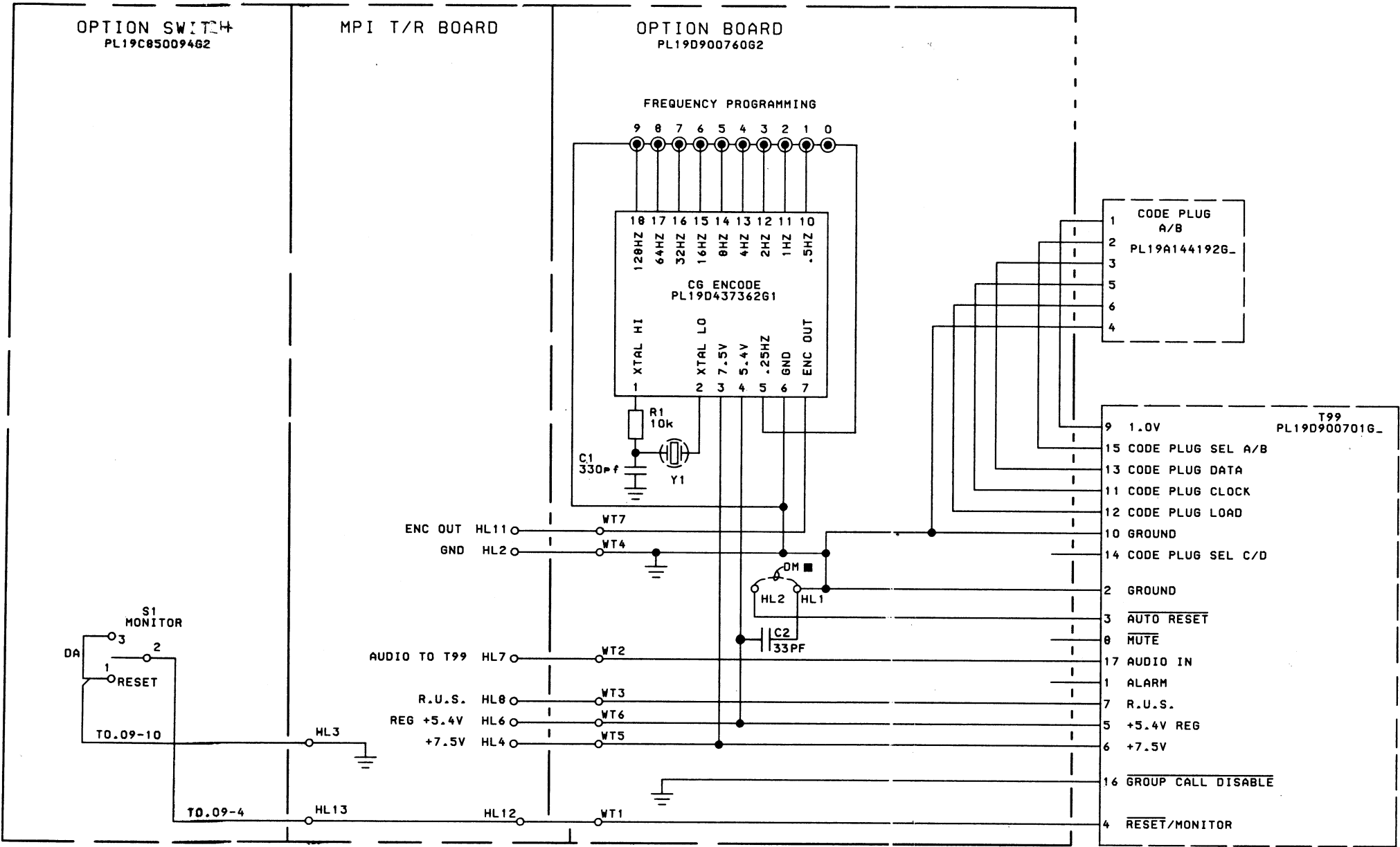


(19D901091, Rev. 3)
 (19A703366, Sh. 1, Rev. 1)
 (19A703366, Sh. 2, Rev. 1)



OUTLINE DIAGRAM

TYPE 99 DECODER AND
 CHANNEL GUARD



| MODEL NO. | REV. LETTER |
|-------------|-------------|
| 19D90076062 | A |

(19D901092, Rev. 2)

SCHEMATIC DIAGRAM

TYPE 99 DECODER AND
CHANNEL GUARD

TYPE 99 AND ENCODE ONLY KIT
19A702805G2 LOCAL
19A702805G4 LOCAL REMOTE
ISSUE 1

PRODUCTION CHANGES

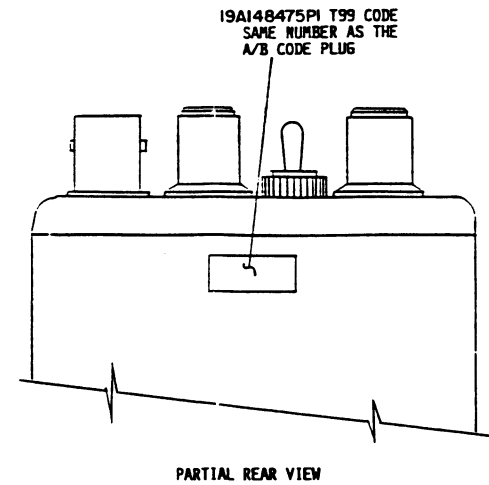
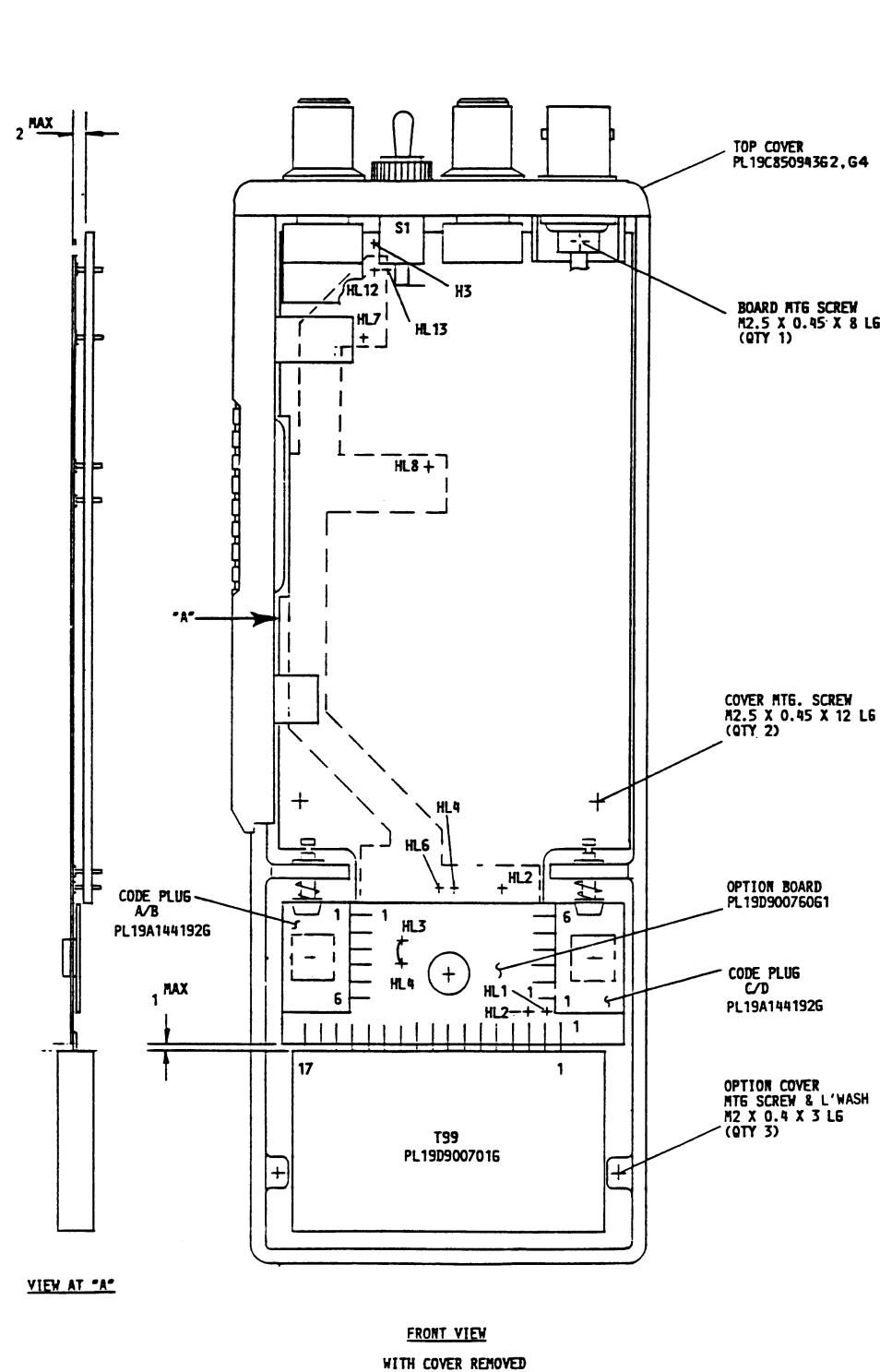
Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter," which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - T99 Board 19D900760G2

To prevent RF from causing the CG encode hybred to malfunction. Added C2.

| SYMBOL | GE PART NO. | DESCRIPTION |
|--------------------|---------------|---|
| | | T99 BOARD 19D900760G2 |
| | | - - - - - CAPACITORS - - - - - |
| C1 | 19A700058P2 | Ceramic: 330 pF $\pm 10\%$, 50 VDCW. |
| | | - - - - - RESISTORS - - - - - |
| R1 | 19B800607P103 | Metal film: 10K ohms $\pm 5\%$, 200 VDCW, 1/8 w. |
| | | - - - - - INTEGRATED CIRCUITS - - - - - |
| U1 | 19D437362G1 | Channel quard, encoder. |
| | | - - - - - CONTACTS - - - - - |
| WT1 thru WT7 | 19A702752P1 | Contact. |
| | | - - - - - CRYSTALS - - - - - |
| Y1 | 19A701383P1 | Quartz: 32.768 $\pm .1\%$; sim to Motorola MTF 32-30A. |
| | | TOP COVER 19C850943G2 LOCAL 19C850943G4 LOCAL REMOTE |
| | | - - - - - SWITCHES - - - - - |
| S1 | 19C850845P19 | Toggle: SPDT, contacts rated 1.5 amps @ 14 VDC; sim to C&K 7107MDG. |
| | | - - - - - MISCELLANEOUS - - - - - |
| | NP280976L | Nameplate. (T99 Code). |
| | 19A702392P1 | Nut, brass: No. 1/4-40. (Secures S1). |
| | 19A702460P1 | Contact, electrical. (Hung in wiring off S1). |
| | | ASSOCIATED PARTS (NOT PART OF KIT) |
| | 19D900701G2 | Type 99 Module. |
| | 19A144192G3 | Plug Kit. (Factory Programmed). |

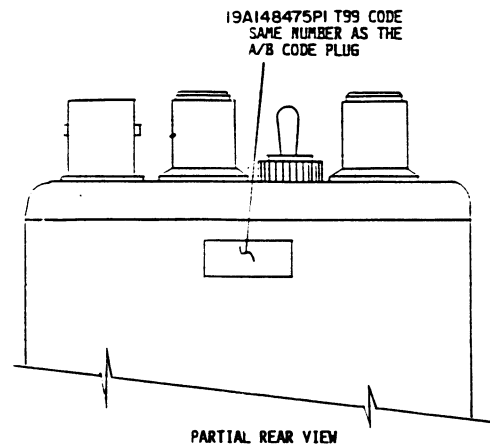
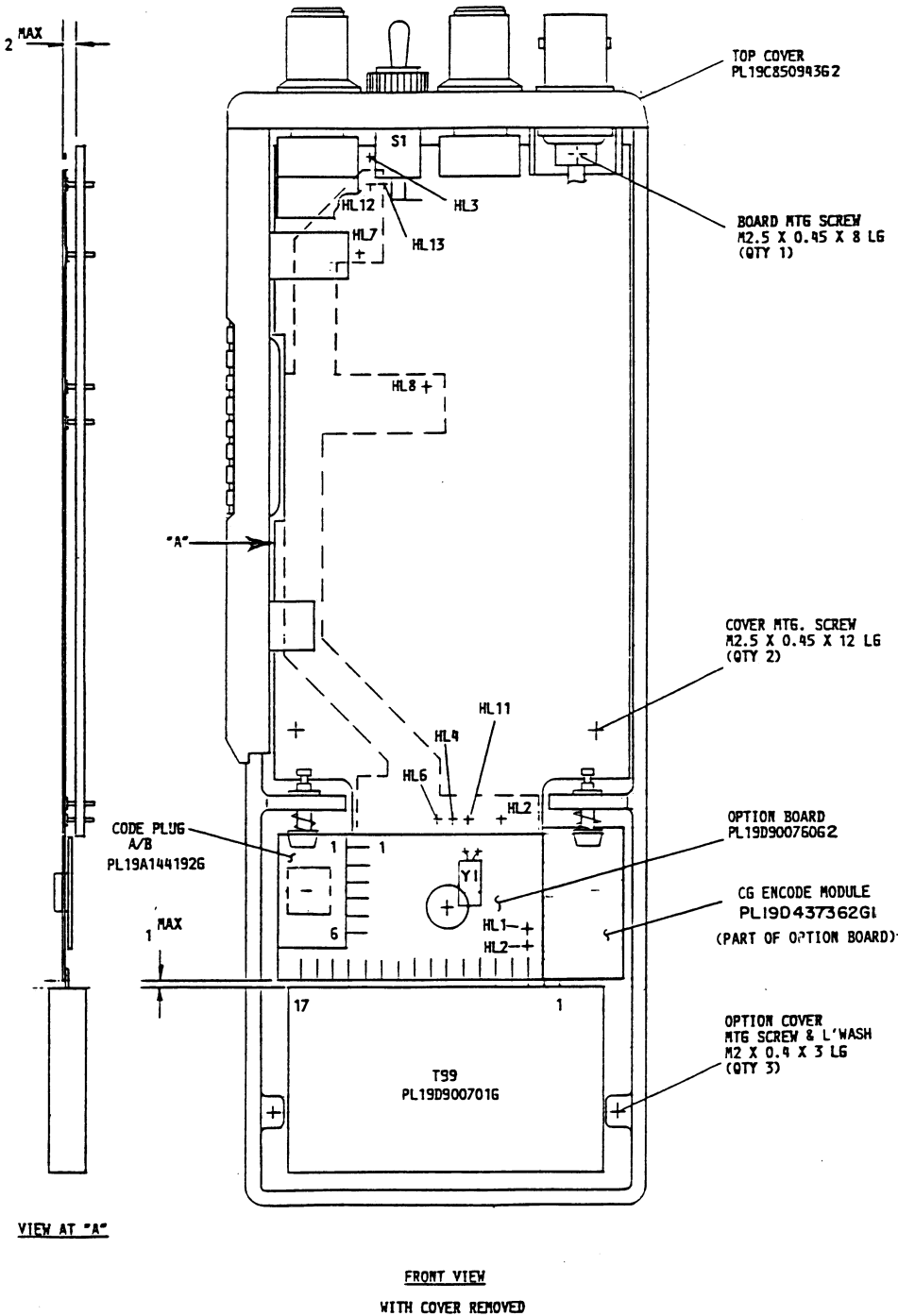
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



- ① THESE INSTRUCTIONS COVER THE INSTALLATION OF FACTORY KIT PL19A70280561, G3 OR FIELD KIT PL19A70377661 & G2 FOR APPLICATION OF TYPE 99 TO MP1 PERSONAL RADIO
- *1. REMOVE BATTERY PACK, FRONT COVER AND OPTION COVER. REMOVE SCREW FROM ANTENNA MOUNTING BRACKET AND REMOVE TOP COVER AND TRANSMIT/RECEIVE BOARD AS AN ASSEMBLY.
- *2. REMOVE KNOBS & NUTS SECURING TOP COVER TO TRANSMIT/RECEIVE BOARD POTS. REMOVE EXISTING TOP COVER, BEFORE ASSEMBLING NEW TOP COVER PL19C85094362, G4 MAKE THE FOLLOWING CONNECTIONS.
- | FROM | TO | WIRE |
|------|------|------|
| S1-1 | HL3 | BK |
| S1-2 | HL13 | Y |
3. SOLDER T99 MODULE TO OPTION BOARD AS SHOWN.
4. SOLDER CODE PLUG OR PLUGS IN DESIRED POSITION. IF ONLY ONE CODE PLUG IS USED THEN IT MUST BE SOLDERED IN THE A/B POSITION.
5. IF PRODUCTION TAG SHOWS THAT THE RADIO SHOULD RESPOND TO GROUP CALL, REMOVE DA JUMPER FROM HL3 TO HL4, AND ADD C/D CODE PLUG.
6. ALIGN PINS ON OPTION BOARD WITH CORRESPONDING HOLES ON TRANSMIT/RECEIVE BOARD. SEAT FULLY AND SOLDER. MAX ASSEMBLED HEIGHT TO BE 2 BELOW TRANSMIT/RECEIVE BOARD.
- *7. REASSEMBLE TRANSMIT/RECEIVE BOARD TOP COVER, REAR COVER, OPTION COVER, AND BATTERY PACK.
- * APPLIES ONLY IF OPTION IS INSTALLED IN AN ASSEMBLED RADIO.

(19D900800, Sh. 1, Rev. 6)

INSTALLATION INSTRUCTIONS

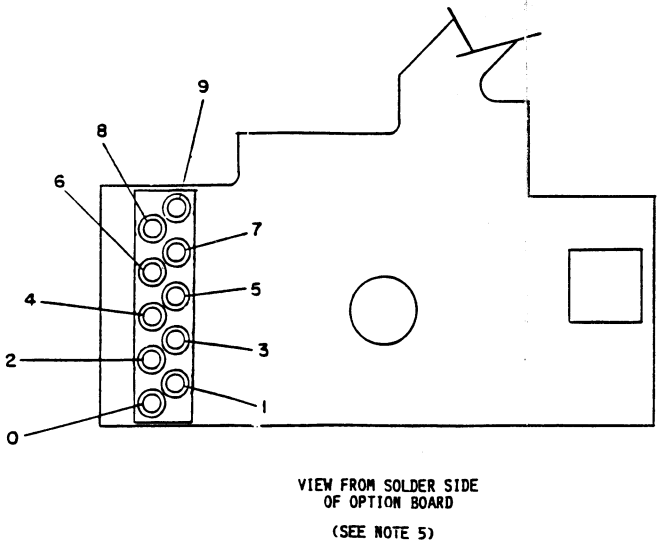


THESE INSTRUCTIONS COVER THE FREQ CODING FOR NON STANDARD CG ENCODER FREQ.

1. USE CHART 2 TO CALCULATE THE CG FREQ DESIRED.
 2. FIND THE FREQ DESIRED BY ADDING UP THE FREQ IN CHART 2. ABOVE EACH FREQ IS A SHORTING LOCATION NUMBER. IF THIS POSITION IS OPEN, THE CG WILL PRODUCE THAT FREQ. IF MORE THAN ONE IS LEFT OPEN, THE JUTPUT FREQ WILL BE THE SUM OF THE OPEN POSITIONS.
- EXAMPLE: CG FREQ 128 Hz THEREFORE SHORTING CIRCLE #9 WILL BE OPEN AND CIRCLES WILL BE SHORTED IN LOCATION 0, 1, 2, 3, 4, 5, 6, 7 AND 8.
- EXAMPLE: CG FREQ 132.75 Hz THEREFORE SHORTING CIRCLES #9 WHICH IS 128, #4 WHICH IS 4, #1 WHICH IS .5, AND #0 WHICH IS .25 WILL BE OPEN. ADD THE FREQ. 128 + 4 + .5 + .25 = 132.75. CIRCLES WILL BE SHORTED IN LOCATION #2, 3, 5, 6, 7 AND 8.

CHART 2

| 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | SHORTING LOCATIONS |
|-----|----|----|----|---|---|---|---|----|-----|--------------------|
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | .5 | .25 | FREQ IN Hz |



②

- THESE INSTRUCTIONS COVER THE INSTALLATION OF FACTORY KIT PL19A70280562, G4 OR FIELD KIT PL19A70377663 FOR APPLICATION OF TYPE 99 TO MP1 PERSONAL RADIO
- *1. REMOVE BATTERY PACK, FRONT COVER AND OPTION COVER. REMOVE SCREW FROM ANTENNA MOUNTING BRACKET AND REMOVE TOP COVER AND TRANSMIT/RECEIVE BOARD AS AN ASSEMBLY.
 - *2. REMOVE KNOBS & NUTS SECURING TOP COVER TO TRANSMIT/RECEIVE BOARD POTS. REMOVE EXISTING TOP COVER, BEFORE ASSEMBLING NEW TOP COVER PL19C850943G2 MAKE THE FOLLOWING CONNECTIONS.
- | FROM | TO | WIRE |
|------|------|------|
| S1-1 | HL3 | BK |
| S1-2 | HL13 | Y |
3. SOLDER T99 MODULE TO OPTION BOARD AS SHOWN. (CUT OFF PIN 1 BEFORE ASSEMBLY)
 4. SOLDER CODE PLUG IN DESIRED POSITION.
 5. PROGRAM CG ENCODER TO DESIRED FREQ. FROM CHART 1 OR 2 BY SHORTING CIRCLES WITH SOLDER BRIDGES.
 6. ALIGN PINS ON OPTION BOARD WITH CORRESPONDING HOLES ON TRANSMIT/RECEIVE BOARD. SEAT FULLY AND SOLDER. MAX ASSEMBLED HEIGHT TO BE 2 BELOW TRANSMIT/RECEIVE BOARD.
- * 7. REASSEMBLE TRANSMIT/RECEIVE BOARD TOP COVER, REAR COVER, OPTION COVER, AND BATTERY PACK.
- * APPLIES ONLY IF OPTION IS INSTALLED IN AN ASSEMBLED RADIO.

CHART 1

FREQ CHART

| C.G. FREQ. | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------------|---|---|---|---|---|---|---|---|---|---|
| 67 | X | | X | X | X | X | | | X | X |
| 71.9 | X | | X | X | X | X | | X | X | X |
| 77 | X | | X | X | | | X | | X | X |
| 82.5 | X | | X | | X | X | | X | X | X |
| 88.5 | X | | X | | | X | X | X | | X |
| 94.8 | X | | X | | | | X | X | | X |
| 100 | X | | | X | X | | X | X | X | X |
| 103.5 | X | | | X | X | | | | X | X |
| 107.2 | X | | | X | | X | | | | X |
| 110.9 | X | | | X | | | | | X | X |
| 114.8 | X | | | | X | X | | X | | |
| 118.8 | X | | | | X | | | X | | |
| 123 | X | | | | | X | | | X | X |
| 127.5 | X | | | | | | | | X | |
| 131.8 | | X | X | X | X | X | | | | X |
| 136.5 | | X | X | X | X | X | | X | X | |
| 141.3 | | X | X | X | | X | | X | X | |
| 146.2 | | X | X | X | X | X | | X | X | |
| 151.4 | | X | X | | X | | | | | X |
| 156.7 | | X | X | | | | X | X | | |
| 162.4 | | X | | X | X | X | | X | X | |
| 167.3 | | X | | X | X | X | | X | X | X |
| 173.8 | | X | | X | | X | | X | X | X |
| 179.9 | | X | | | X | | X | X | X | X |
| 186.2 | | X | | | X | | X | X | X | |
| 192.8 | | | X | X | X | X | X | X | | X |
| 205.5 | | | X | X | X | | | | | X |
| 210.7 | | | | X | X | X | | X | | |