MOBILE RADIO

LBI-31745A

PROGRAMMING INSTRUCTIONS FOR GENERAL ELECTRIC PLS TWO-WAY PERSONAL RADIO USING PROGRAMMER TQ2310 (WITH EPROM TQ2361)

GENERAL ELECTRIC

TABLE OF CONTENTS

GE UNIVERSAL RADIO PROGRAMMER
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INTRODUCTION

GENERAL

This manual presents the necessary programming instructions and procedures you must follow when programming the General Electric PLS Series personal radios using the Universal Radio Programmer TQ2310.

The Universal Radio Programmer (URP) may be used to program all GE field programmable radios and control units. The instructions in this manual however, are directed solely to programming the PLS Series personal radios.

PROGRAMMING EQUIPMENT

The URP consists of several hardware and software modules (EPROMs) to program the radio. The various modules are described below. In addition a unique software module and interconnect cable is required to program the radios as well as an EEPROM socket adapter.

- Software Module - TQ2361
- Adaptor Cable - TQ2330
- Interconnect cable - TQ2368

Hardware modules contained in the TQ2310 include:

- Panasonic Handheld Computer, RL-H1800
- Panasonic I/O Adapter, RL-P6001
- Panasonic AC Adapter, RD-9498
- Panasonic Mini Printer, RL-P1004 or Printer Cassette Adapter RL-P1004A
- Panasonic RS-232 Serial Interface, RL-3001 - TQ2325 and TQ2318
- General Electric Program Storage Module
- General Electric Data I/O Module

The handheld computer offers a full keyboard to input data and also provides a 26 character LCD display. It contains 8K bytes of memory for data files. To familiarize yourself with the operation and capabilities of the microcomputer, refer to the Panasonic Instruction manual provided with the programmer.

The printer is a 40 column dot matrix printer and utilizes a thermal printer mechanism and drive electronics. Special heat sensitive paper must be used in the printer and as such is subject to fading over extended periods of time when exposed to excessive heat or certain types of adhesives. It is suggested that a photocopy be made when a permanent file is to be maintained.

The Program Storage Module houses the programmable EPROMs that contain the computer application programs to program the radio equipment. Eight sockets are provided for the application programs. Refer to EPROM Installation Instructions for details.

PROGRAMMING CABLE CONNECTION

When connecting the programming cable (TQ2368) to the radio, it must be connected such that the wires protruding from the connector on the cable are parallel with the antenna on the top of the radio. Refer to Figure 1 below.

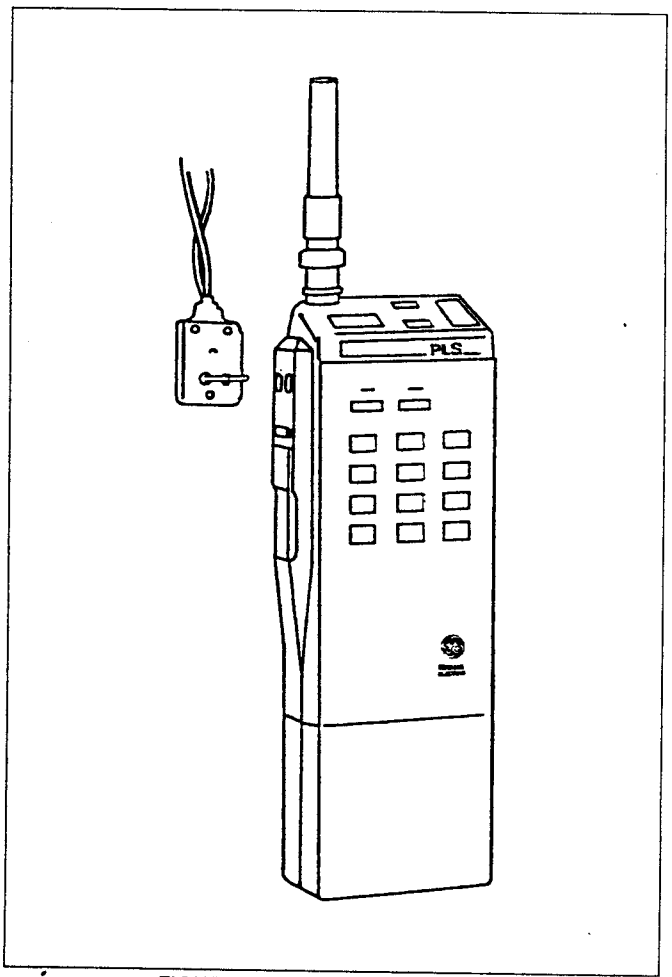


FIGURE 1 - CABLE CONNECTION

COMMUNICATING WITH THE TQ2310

The software for the PLS radio uses a series of multiple choice menus and prompts to guide you through the programming sequence. The user responds by answering multiple choice questions or entering data via the computer keyboard.

Menus are displayed one line at a time on the computer LCD display screen. The Primary Menu contained in the TQ2310 software is an index of programs and functions that are available in the Program Storage Module. These are identified by number. Enter the number of the program or function on the keyboard for the program you wish to run or modify. The name of the program will then be displayed followed by the menu of subprograms available to service the selected program.

Typically, the Primary Menu in the TQ2310 displays the following - a line at a time:

1 = CALCULATOR
2 = CLOCK/CONTROLLER
3 = FILE SYSTEM
X = The last entry on the menu

"X" is used to symbolize the last entry displayed from the menu. Adding EPROMs (software modules) to the Program Storage Module will force "X" to a higher number and display the name of the EPROM.

The EPROMs identify the programming capabilities of the programmer as configured. For example, when the PLS software module is installed, one entry on the Primary Menu will be "PLS".

Select the number associated with PLS to display the Program Menu.

To select an item from the Primary Menu, enter the number of the item on the keyboard. For example, pressing the "2" key will select CLOCK/CONTROLLER.

Forms/Key Definitions

The speed of the menu display can be controlled or stopped by pressing the STP/SPD key. The following key sequences will help you test this capability. Refer to sheet 1 of the Panasonic Instruction Manual for definitions of the keyboard display for the handheld computer.

STP/SPD	STP/SPD	- Stop/Restart the display.
STP/SPD	0	- Selects the fastest speed.
STP/SPD	1	- Selects the slowest speed.

Forms are also displayed one line at a time. However, you may control form modification or programming by using the arrow keys and the ENTER key. The up (▲) and down (▼) arrows select which line of the form is being displayed on the screen. The left (◄) and right (►) arrows position the cursor over the character position that can be changed. The cursor is limited to specific fields on the LCD display. The computer will beep if you attempt to move the cursor to an illegal position. The computer will also beep if you use the up arrow to go past the first line or the down arrow to go past the last line. Each time upon completion of a form, press the ENTER key. This stores the information into computer memory. You may abort the current operation any time by pressing the CLEAR key.

NOTE

DO NOT attempt to use the "HELP" key as described in the Panasonic literature during execution of the PLS program. The "HELP" key for use in defining the function keys f1, f2, f3 (if desired) should be done prior to selecting the PLS program.

The control keys c1, c2, c3, c4 are not defined for this application. The rotate key has no definition during execution of the PLS program.

Programming I/O Options

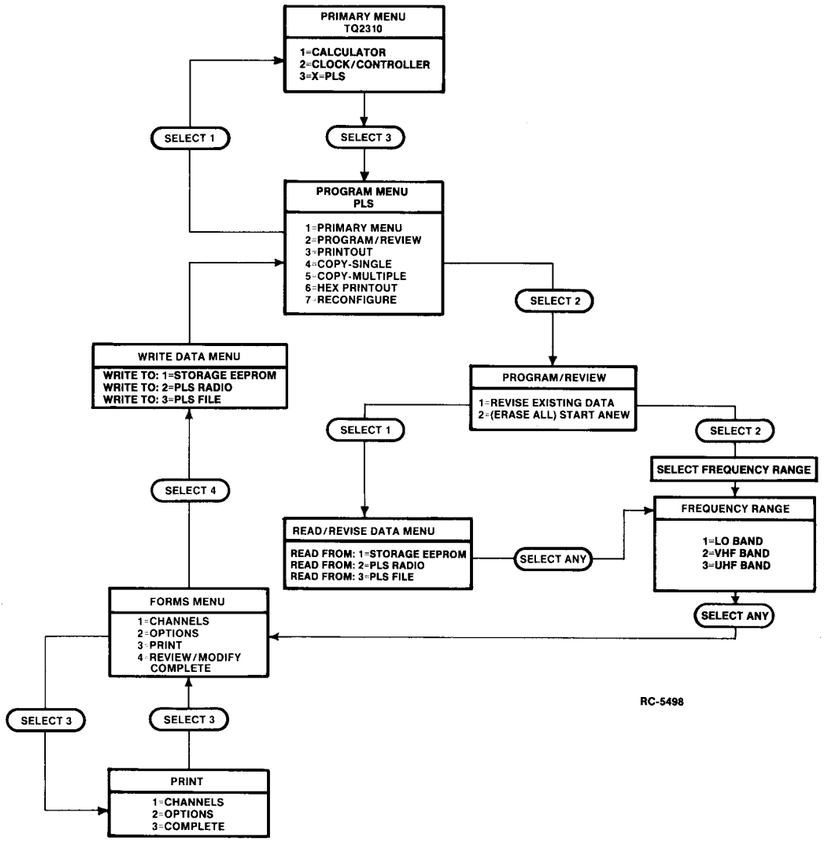
The Universal Radio Programmer provides the capability to store and access PLS radio data using three different media, the PLS radio, EEPROM and a file stored in the RAM area of the Panasonic HHC.

The internal file is always "read/write" and is maintained even when the HHC is off. This is because the HHC has a battery driven non-volatile RAM. **WARNING:** if the "ALL-OFF" switch on the back of the HHC is moved to the off position all files currently being stored in the HHC will be lost!!!!

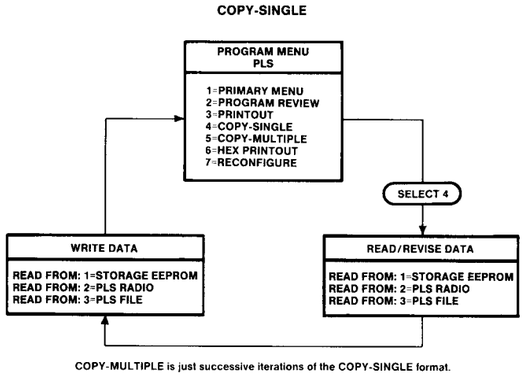
COPY utility operations enable data transfer between these media.

Access to these media are via:

1. an EEPROM
2. the PLS radio
3. PLS file in the system's computer memory.



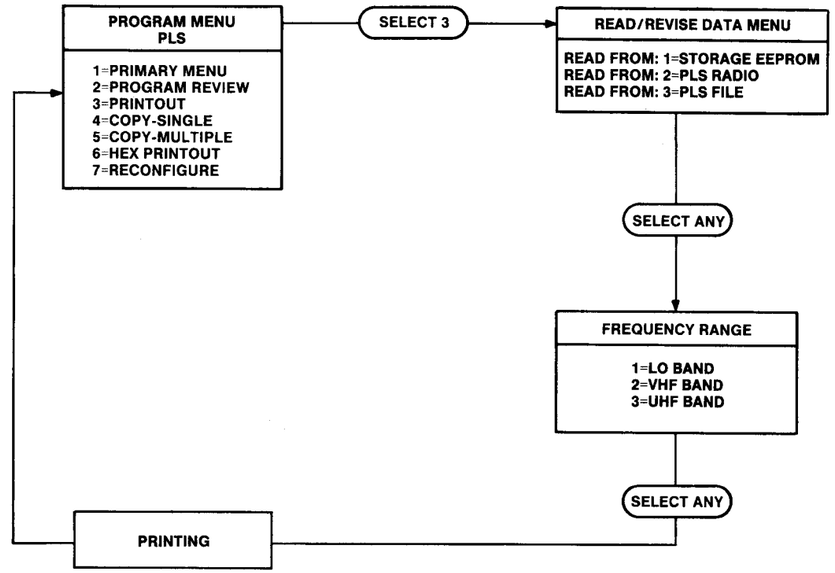
RC-5498



COPY-MULTIPLE is just successive iterations of the COPY-SINGLE format.

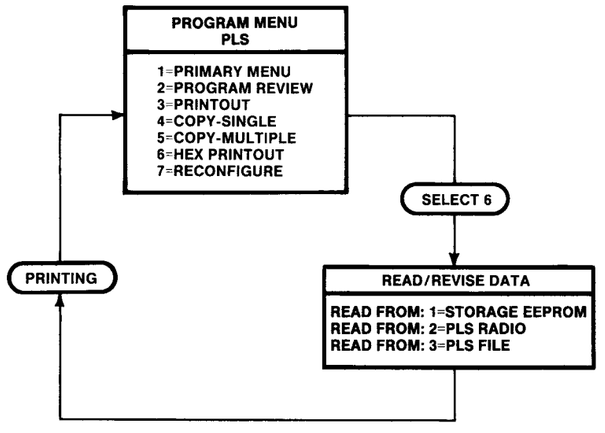
RC-5500

PRINTOUT



RC-5499

HEX PRINTOUT



RC-5501

FIGURE 2 - PROGRAM MENU FLOW

The programmer asks the operator for the INPUT device (i.e. "READ FROM") and OUTPUT device (i.e. "WRITE TO") at appropriate stages in the various programming functions.

PLS File

The Programmer file system can store a single copy of a PLS's Program in an internal file that remains intact as long as the Hand Held Computer batteries are not completely discharged, the unit is not powered off with the slightly hidden "all-off" switch in the back of the unit, or until the file data is modified or "overwritten" by the user via a "copy" operation. (Of course, the Programmer system can simultaneously store single copies of data for different radios: CELLULAR, PHOENIX, PLS, etc.)

Data may be read and previewed, printed, reprogrammed, etc. in the PLS file. Data may be copied from the file to the EEPROMS, and vice versa.

See Appendix A for additional discussions of the file system and file manipulation.

Program Menu Flow

The program menu provides you with some insight as to what you can do in programming or reprogramming the PLS Personal Series radios. Figure 2 is an overview of the Program Menu Flow. A review of this diagram will help you to organize the programmable data before you actually begin to program the radio.

Primary Menu - The Primary Menu displays the contents of the Program Storage Module. One of the lines displayed will read PLS along with a location or access number for the software module.

Entering the access number for PLS on the keyboard displays the program menu shown below a line at a time.

1 = PRIMARY MENU
2 = PROGRAM/REVIEW
3 = PRINTOUT
4 = COPY-SINGLE
5 = COPY-MULTIPLE
6 = HEX PRINTOUT

Each line identifies a function or series of functions that can be executed.

1 = PRIMARY MENU

Entering a 1 on the keyboard will return you to the Programmer's Primary Menu. i.e. 1 = CALCULATOR, 2 = CLOCK/CONTROLLER, etc. This is the only way you can return to the Primary Menu. Pressing the CLEAR key will return you to the PLS Program Menu. It will not return you to the Primary Menu.

NOTE

Exercise CAUTION when using the CLEAR key to return to the menu when programming or entering data. Use of the CLEAR key will erase all data that you have entered.

2 = PROGRAM/REVIEW

Program/Review allows you to select one of two routines: (1) revise existing data or (2) erase all old data and reprogram the radio with new data.

Entering a 2 on the keyboard selects Program/Review.

3 = PRINTOUT

Printout allows you to read the programmed data in the radio and print it out. Data to be printed may be read from:

1 = STORAGE EEPROM
2 = PLS RADIO
3 = PLS FILE

Entering a 3 on the keyboard selects the PRINTOUT mode.

4 = COPY-SINGLE

Copy-Single allows moving data from one device to another, including to the same device. Data may be read from:

1 = STORAGE EEPROM
2 = PLS RADIO
3 = PLS FILE

5 = COPY-MULTIPLE

Copy-Multiple allows moving data from one device to multiple copy of another device by reading data only one time and writing to the output device several times.

6 = HEX PRINTOUT

Hex Printout allows the hex-data information to be printed out for review or modification. Data to be printed may be read from:

1 = STORAGE EEPROM
2 = PLS RADIO
3 = PLS FILE

Program/Review Menu

Entering a 2 from the Program Menu will select PROGRAM/REVIEW and display the Program/Review Menu on the screen --- a line at a time.

1 = REVISE EXISTING DATA
2 = (ERASE ALL) START ANEW

Read/Revise Existing Data - Entering a 1 will select REVISE EXISTING DATA. Data to be read or revised may be selected from:

1 = STORAGE EEPROM
2 = PLS RADIO
3 = PLS FILE

After making your selection and entering the corresponding digit on the keyboard, the program will advance to the Forms Menu where the data may be reviewed or revised under control of the Forms format.

Forms Menu - Overview

The Forms Menu allows you to set the operating characteristics of each channel. Programmable characteristics include setting the transmit and receive frequencies, enabling/disabling the carrier control timer, setting the Channel Guard and/or Type 99 tones, enabling/disabling the STE (squelch tail eliminator). Programmable characteristics can be set on a per channel basis.

Programmable options include selecting the light timer, DTMF Parameters for * and #, and volume level upon power up.

PROGRAMMING PRELIMINARIES

- Be sure the PLS program module is installed in the PSM (Program Storage Module).

To determine if the PLS Module is present:

- Turn the URP on and clear it. (Press ON and then CLEAR on the keyboard).
- Enter a 1 to display the Primary Menu. The programmer will sequentially display all modules in the PSM.

NOTE

If the PLS modules are not listed, turn the power off and refer to the EPROM Installation Instruction to install the PLS EPROM.

NOTE

The software in the URP has been written to provide you with a default answer. If you are in doubt of an exact entry, take the default by pressing the ▼. Default values are listed in Appendix "B".

A sample program printout is included on page 10.

PROGRAMMING THE RADIO

- Connect the radio to the URP using interconnect cable, TQ2368.
- Enter the access number displayed on the keyboard for the PLS.
- The programmer will interrogate the file storage system of the URP. If there is not enough room to store a file, the programmer will display the following message:

NO ROOM FOR FILE - CONT Y/N?

If the data is to be written to the radio or EEPROM you may continue.

There are three ways to store a PLS file.

1. Replace an unused file in the URP with the new PLS file.
2. Store a file to the EPROM socket using an external EEPROM.
3. Write the file directly to the PLS radio.

Enter a 2 to display the Program Review Menu.

1 = REVISE EXISTING DATA

2 = (ERASE ALL) START ANEW

NOTE

Enter a 1 if you are revising existing data. This will advance the program to the READ/REVISE Data Menu where you will select the source of the data to be revised and then advance directly to the Frequency Range Menu.

Enter a 2 again to begin with all data cleared to program the radio. Program will advance to the Frequency Range Menu.

FREQUENCY RANGE MENU

The Frequency Range Menu allows you to select which frequency band is to be programmed.

The display will flash:

SELECT FREQUENCY RANGE

And the Frequency Range Menu will be displayed a line at a time:

1 = LO BAND

2 = VHF BAND

3 = UHF BAND

Enter the digit corresponding to the frequency range desired. After selecting the frequency range, the programmer displays the frequency band selected (VHF BAND, UHF BAND, etc.) and will advance to the Forms Menu.

FORMS MENU

The Forms Menu, displayed a line at a time appears as follows:

1 = CHANNELS
2 = OPTIONS
3 = PRINT
4 = REVIEW/MODIFY COMPLETE

Selecting 4 will terminate the data inputting function.

You may wish to review the discussion in the introduction on the use of the arrow keys. Using the arrow keys will enable you to review the entire form a line at a time. Each form is described using a sub menu. This sub menu organizes data on each line for your convenience. If you get stuck while using the form, consulting the sub menu described for each form may help you understand what to do next.

If an input error occurs the URP will beep. Working in a noisy area will make the beep hard to hear thus causing you to take special note of a probelm. Most of the errors that cause a beep will also have error messages associated with them. When an error message is displayed, it will remain on the screen until a key is pressed. The error messages are defined in Appendix C.

Channels

Enter a 1 from the keyboard. The display will flash:

1 = CHANNELS

then:

SELECT MODE 1 CHANNEL 1

The radio contains two frequency modes with up to eight channels in each mode. Enter mode 1 or 2 and the channel number (1-8) to be programmed and press the ▼ key. The display will show:

M1 CH1 TX FRQ 000.00000

NOTE: Two digits are indicated before the decimal point for Low Band radios.

Enter the channel frequency and press the ▼ . The display will show:

M1 CH1 TX-CG: 000.0

Here you enter the Channel Guard frequency assigned to channel 1 (or the channel being programmed). Enter a valid Channel Guard frequency within the range of 67.0 to 210.7 Hz and press the ▼. If no Channel Guard tone is assigned to that particular channel, simply press the ▼ to advance to the next display.

NOTE

Refer to Table 1 for standard EIA Channel Guard tone frequencies. Tone frequencies may be entered in 0.1 Hz increments.

TABLE 1 - Standard Channel Guard Tone Frequencies

CHANNEL GUARD TONE FREQUENCIES (HZ)					
67.0	88.5	103.5	123.0	146.2	173.8
74.4	91.5	107.2	127.3	151.4	179.9
77.0	94.8	110.9	131.8	156.7	186.2
79.7	97.4	114.8	136.5	162.2	192.8
82.5	100.0	118.8	141.3	167.9	203.5
85.4					210.7

NOTE

Should a tone frequency be entered in error, you must use the arrow keys to return to the display and re-enter the correct tone frequency and the ▼ key.

The display will show:

M1 CH1 RX FRQ. 000.00000

CH 01 RX 000.00000 MHZ

Enter the receive frequency assigned to channel 1 (or to the channel displayed) in megahertz. The frequency must be within the range of the band split selected.

After entering the assigned frequency press the ▼ . The display will show:

M1 CH1 RX-CG 000.0

Here you must enter the Channel Guard tone frequency assigned to the receive channel 1 (or to the channel displayed) and press the ▼ , or just press the ▼ if Channel Guard is not assigned to this channel.

The display will show:

Between the RX Ch. grd & CCT, the following screen will be shown:

MI CHI HIGH POWER Y

Here you may select the transmitter power level on a per channel basis. Enter a 'N' or press the ▼ and the programmer will display the following:

M1 CH1 CCT 2:00

The Carrier Control Timer (CCT) prevents the transmitter from staying keyed continuously past a preset time period. Valid entries are 0:00 to 3:00 minutes in 30 second increments.

By entering a 0, the Carrier Control Timer is disabled. Enter the desired time and press the ▼. The display will show:

M1 CH1 ENABLE STE N

Here you have the option of enabling or disabling the Squelch Tail Eliminating function. This produces a phase shift before the transmitter turns off and allows the receiver to mute. Enter a "Y" to enable the STE function or press the ▼ to disable (default) the STE function.

NOTE

You will not be prompted for the STE function if channel guard was not selected.

The display will show:

M1 CH1 ENABLE DTMF N

Here you are given the opportunity to enable the DTMF tones (telephone interconnect) on a per channel basis. enter a "Y" and press the ▼ key to enable or simply press the ▼ key to advance to the next display.

M1 CH1 TYPE 99 TONES N

Here you are asked if you want to enter any Type 99 Tones for the channel displayed. If the question is answered no, simply press the ▼ ; the program will advance to the next channel. If you answer "Y" and press the ▼ , the display will show:

M1 CH1 T99 GE TONES Y

Here you choose whether the Type 99 tone format is to be General Electric or Motorola. If a GE format is selected, answer this question "Y" and press the ▼ . The display will advance to the "Individual Call" screen. If a Motorola Tone format is used, enter a "N" and press the ▼ . If the Motorola tone format was selected the display will flash:

T99 MOTO. TONES SELECTED

and display the following:

M1 CH1 INDIVIDUAL CALL N

If this channel is to be programmed for individual call, enter "Y" and press the ▼ . If it is not an individual call channel, simply press the ▼. The display will show:

M1 CH1 GROUP CALL N

If this channel is to be preprogrammed for a Group call, enter "Y" and press the ▼ . If it is not a Group call simply press the ▼ . The display will show:

NOTE

The following display is shown only for GE tones. If the Motorola tone format is used, then the display will show "QUICK CALL" instead of "SUPER GROUP" call.

M1 CH1 SUPER GROUP CALL N

If this channel is to be programmed as a super group call, enter a "Y" and press the ▼. If it is not a super group call, simply press the ▼ to advance to the tone entry displays.

The General Electric Type 99 Tone System can selectively call up to 900 different decoders. Thirty tones in three groups of ten tones each (called tone groups A, B, and C) are combined to form 900 pairs. A thirty first tone, called the "Diagonal Tone" (Tone D) replaces the first tone in a tone pair that would otherwise consist of duplicate tones. Tone D is used only in GE Tone Systems and has a default frequency of 742.5 Hz.

Tone frequencies in the GE Tone System fall within the range of 517.5 Hz - 997.5 Hz. In Motorola Tone Systems the tone frequencies are within the range of 288.5 - 1433.4 Hz. Valid tone frequencies and their group association are identified in Table 2 below.

A detailed discussion of the Type 99 Tone formats is given in Appendix E.

NOTE

The following four displays ask for the Type 99 tones assigned to the channels referenced above. Enter these tone frequencies (for example: 682.5), as requested, and press the down ▼ each time to advance to the next display. The fourth tone, tone "D" (diagonal), is used only with the GE tone format.

M1 CH1 TONE A 0000.0

M1 CH1 TONE B 0000.0

M1 CH1 TONE C 0000.0

M1 CH1 TONE D 0000.0

TABLE 2 - GE Type 99 Tone Frequencies

TONE GROUP	TONE FREQUENCY
A	682.5 Hz 592.5 Hz 757.5 Hz 802.5 Hz 847.5 Hz 892.5 Hz 937.5 Hz 547.5 Hz 727.5 Hz 637.5 Hz
B	652.5 Hz 607.5 Hz 787.5 Hz 832.5 Hz 877.5 Hz 922.5 Hz 967.5 Hz 517.5 Hz 562.5 Hz 697.5 Hz
C	667.5 Hz 712.5 Hz 772.5 Hz 817.5 Hz 862.5 Hz 907.5 Hz 952.5 Hz 532.5 Hz 577.5 Hz 622.5 Hz
Diagonal Tone	742.5 Hz

NOTE

If a wrong tone frequency is entered, simply press the ▼ to display the tone. Reposition the cursor using the ← arrow keys and re-enter the correct tone frequency.

Tone D is the diagonal tone used in the GE Tone System when adjacent tone frequencies are the same. Since two tones of the same frequency would appear as one extended tone, Tone D must be used. The standard frequency for Tone D is 742.5 Hz. and is the default frequency. Legal frequencies for the Diagonal Tone are 0 or frequencies within the range of 517.5 to 997.5 Hz.

After entering all the DTMF tones the display will advance to the next channel to be programmed. When all channels have been programmed, the display will return to the Forms Menu.

Options

The Options Menu allows you to set the duration of the light timer, the length of the tone for DTMF digits * and #, and the power on volume. Enter a 2 from the Forms Menu to access the Options Menu. The display will flash:

OPTIONS

and display the following:

LIGHT TIMER 005 SEC.

Here you set the amount of time the backlight will remain on before automatically turning off. The time may be set to any value between 0 (OFF) and 255 seconds. The default value is 5 seconds. Enter the desired value and press the ▼. The display will show:

DTMF 0100 MS

Here you set the length of the DTMF digit and gaps for the DTMF tones. They may be set to any length between 0 and 1196 milliseconds. The length of the digit and gaps depends on the individual system parameters and must be determined specifically for each system. The default value is 100 milliseconds. After entering the correct value for your system, press the ▼ arrow. The display will show:

DTMF '*' '#' 0 100 MS

Here you enter the desired lengths for DTMF digits * and #. They may be set to any length between 0 and 1196 milliseconds. The length of the digit and gaps depends on the individual system parameters and must be determined specifically for each system. The default value is 100 milliseconds. Enter the desired value and press the ▼. Now the following is displayed:

ENABLE AUDIBLE BEEP Y

This allows the user to disable the beep that is heard when changing channels or modes. Enter a 'N' to disable the beep or press the ▼ to leave it enabled. The display will then return to the forms menu.

Review/Modify Complete

If Review/Modify Complete "4" is selected from the Forms Menu and no channels are programmed for Mode 1, the display will show:

NO CHANNELS IN MODE 1

Press any key to return to the Forms Menu to program Channels or Options. You must enter at least one channel for mode 1 or the same error message will appear. If programming is complete and a 4 is entered the display will show the following a line at a time:

WRITE TO: 1=STORAGE EEPROM

WRITE TO: 2=PLS RADIO

WRITE TO: 3=PLS FILE

If an error occurs in the "Write To" procedure, the entire "Write To" sequence is repeated.

If writing the data to the personality RAM or radio, the following will be displayed.

WRITING

then:

VERIFY

The display will return to the Program Review Menu.

PRINTOUT

If Printout is selected from the Program Menu, you may select the source from which the data is to be printed. Enter a 3 on the keyboard. The following menu will be displayed a line at a time:

READ FROM: 1=STORAGE EEPROM

READ FROM: 2=PLS RADIO

READ FROM: 3= PLS FILE

Enter the digit corresponding to the desired source. The programmer will flash the source. If 3 is selected, the following is displayed.

READ FROM: 3=PLS FILE

The display will then show:

PRINTING

When the data is printed the programmer will return to the PLS Program Menu.

HEX PRINTOUT

HEX PRINTOUT gives you a hexadecimal dump of the programmed data. After selecting HEX PRINTOUT from the Primary Menu, the following is displayed.

READ FROM: 1=STORAGE EEPROM
READ FROM: 2=PLS RADIO
READ FROM: 3=PLS FILE

Enter the source number of the data to be dumped, 1, 2, or 3. The display will show the source of the printout.

This allows you to print the data stored in the URP memory. Simply press 1 (CHANNELS) or 2 (OPTIONS). After obtaining your printout, press the #3 key to return to the Forms Menu. A sample printout is shown on Page 10.

COPY-SINGLE

Copy-Single is a utility function that allows you to copy data from the PLS RADIO, or the PLS FILE. Enter a 4 for Copy-Single. The following menu will be displayed one line at a time.

READ FROM: 1=STORAGE EEPROM
READ FROM: 2=PLS RADIO
READ FROM: 3=PLS FILE

Select the source by entering a 1, 2 or 3.

If an I/O error occurs in the "READ FROM" procedure, the entire "READ FROM" sequence is repeated.

Following a successful "READ FROM" operation the system prompts the user to select a "copy-to" device from the following menu.

WRITE TO: 1=STORAGE EEPROM
WRITE TO: 2=PLS RADIO
WRITE TO: 3=PLS FILE

If an I/O error occurs in the "WRITE TO" procedure, the entire "WRITE TO" sequence is repeated.

COPY-MULTIPLE

COPY-MULTIPLE is much like COPY-SINGLE except that the write operation is repeated as many times as the operator responds "Y" to the following prompt:

AGAIN Y/N ?

EPROM INSTALLATION

Programmed EPROMs for the various General Electric programmable mobile radios are required in the Program Storage Module before radio programming can be accomplished. These EPROMs are provided separately, as ordered, and are not initially installed in the Program Storage Module. The following installation procedure is suggested (refer to Figure 3).

CAUTION

The EPROM devices can be destroyed by static discharges. Before handling one of these, the installer should be discharged by touching the test bench ground bus. The PW board and EPROM should also be at ground potential. EPROMs should be stored in conductive material.

SAMPLE PRINTOUT

```
TUE 06:09:58 R APR 14 1987
PLS V0.4
      OPTIONS
     -----------
LIGHT TIMER   5 SEC.
LENGTH OF TOUCH TONE DIGIT    1000 MS
LENGTH OF TOUCH TONE '*' '#'   300 MS


MODE 1
C#  TX FREQ  TX-CG   RX FREQ  RX-CG  CCT
-- --------- -----  --------- -----  ---
 1 150.00000 000.0  150.00000 000.0 0:30
 2 151.00000 000.0  151.00000 000.0 2:00
 3 152.00000 000.0  152.00000 110.0 2:00
 4 153.57500 073.5  155.00000 000.0 2:00
 5 000.00000 000.0  000.00000 000.0 2:00
 6 000.00000 000.0  000.00000 000.0 2:00
 7 000.00000 000.0  000.00000 000.0 2:00
 8 000.00000 000.0  000.00000 000.0 2:00

STE ENABLED ON CHANNEL  1 2 3
DTMF ENABLED ON CHANNEL  1 2 3

                TYPE 99 TONES
MODE 1
CH        TONE A  TONE B  TONE C  TONE D
--        ------  ------  ------  ------
 1 GE      517.5   532.5   547.5   562.5
          INDIVIDUAL CALL  Y
          GROUP CALL       Y
          SUPER GROUP CALL Y

 2 GE      637.5   517.5   622.5   742.5
          INDIVIDUAL CALL  Y
          GROUP CALL       Y
          SUPER GROUP CALL N
```

HEX PRINTOUT

```
-----------------------------
 00:  00 00 00 00 00 00 00 00
      00 00 00 05 0F 00 80 80
 10:  40 DA 42 02 82 00 00 02
      00 00 00 00 00 00 00 10
 20:  00 00 00 E2 80 40 C0 20
      31 61 42 29 00 00 00 61
 30:  D4 41 29 00 00 00 00 00
      00 00 01 A4 0C 00 00 00
 40:  00 00 00 C2 90 80 10 08
      41 64 42 29 00 00 00 71
 50:  D7 41 29 00 00 00 00 00
      00 00 04 A4 0C 00 00 00
 60:  81 00 00 00 00 00 00 00
      51 67 42 29 FE 02 00 01
 70:  DB 41 29 00 00 00 00 00
      00 00 04 A4 0C 00 00 00
 80:  00 81 00 00 00 00 00 00
      01 71 42 29 00 00 00 77
 90:  DF 41 29 BE 23 00 00 00
      00 00 04 24 04 00 00 00
 A0:  00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00
 B0:  00 00 00 00 00 00 00 00
      00 00 04 24 04 00 00 00
 C0:  00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00
 D0:  00 00 00 00 00 00 00 00
      00 00 04 24 04 00 00 00
 E0:  00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00
 F0:  00 00 00 00 00 00 00 00
      00 00 04 24 04 00 00 00
-----------------------------
100:  00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00
110:  00 00 00 00 00 00 00 00
      00 00 04 24 04 00 00 00
120:  00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00
130:  00 00 00 00 00 00 00 00
      00 00 04 24 04 00 00 00
140:  00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00
150:  00 00 00 00 00 00 00 00
      00 00 04 24 04 00 00 00
160:  00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00
170:  00 00 00 00 00 00 00 00
      00 00 04 24 04 00 00 00
180:  00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00
190:  00 00 00 00 00 00 00 00
      00 00 04 24 04 00 00 00
1A0:  00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00
1B0:  00 00 00 00 00 00 00 00
      00 00 04 24 04 00 00 00
1C0:  00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00
1D0:  00 00 00 00 00 00 00 00
      00 00 04 24 04 00 00 00
1E0:  00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00
1F0:  00 00 00 00 00 00 00 00
      00 00 04 24 04 00 00 00
-----------------------------
200:  00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00
210:  00 00 00 00 00 00 00 00
      00 00 04 24 04 00 00 00
220:  00 00 00 00 00 00 00 00
      00 00 00 00 00 00 00 00
230 THRU 3FF SAME AS 1 ROWS ABOVE
```

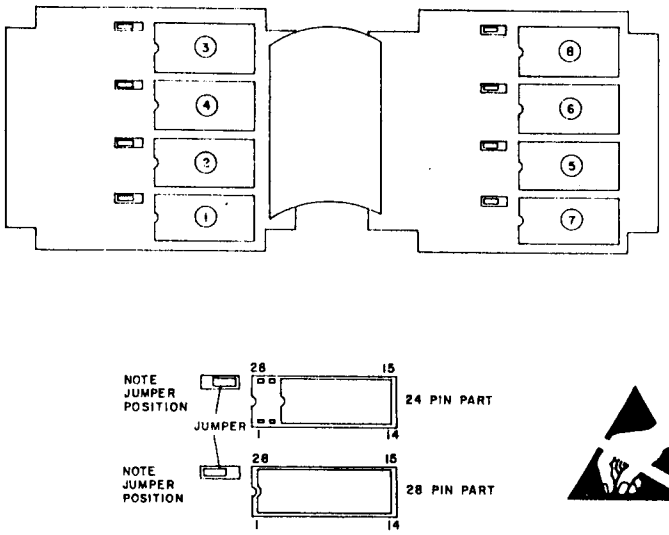


FIGURE 3 - INSTALLATION INSTRUCTIONS

1. Remove the Program Storage Module from the system I/O Module. Turn off the handheld computer before disconnecting.
2. Remove the four screws from bottom cover and open. Do not remove boards.
3. Install the first EPROM in socket 1, the second in socket 2, etc. (Note socket designations are in numerical sequence. Programs will be displayed according to socket number).
4. Close the cover and replace the four screws in bottom.
5. Reinstall the Program Storage Module in the programmer.

PRINTER PAPER REPLACEMENT

(Refer to vendor instruction manual)

1. Remove paper cover by sliding in direction of arrow (away from printer head).
2. Insert new roll of thermal paper with leading edge going into feed mechanism. Leading edge must come from bottom of roll.
3. Advance paper using paper feed knob. Note: Knob rotates in direction of arrow only.
4. Replace paper cover.

NOTE

Damage may result to thermal head if printer is activated without paper being set correctly.

IN CASE OF DIFFICULTY

It is possible that on occasion, unexplained problems will occur which may be caused by static electricity, jostling the unit, etc. The programmer may fail to operate as described or the word "RESET" may appear in the display. If this occurs, press CLEAR once to return to the start of the program being run. The data previously entered will be lost, but no data stored in files will be affected.

NOTE

Be sure all modules and the HHC are firmly in place.

If "RESTART" appears, press CLEAR twice. This should return you to the primary menu.

If you cannot reach the primary menu by pressing CLEAR twice, turn the computer off by means of the ALL-OFF switch in the back of the unit. You will have to remove the I/O Adaptor from the case and the computer from the I/O Adaptor to reach the switch. Wait about two minutes and turn the ALL-OFF switch on. Then using the AC Adaptor as a power source, press ON and then CLEAR. The work "RESTART" should appear in the display and pressing CLEAR again should display the primary menu. Otherwise the computer needs servicing. This procedure results in the loss of all internally stored files, including time and date.

HELPFUL SUGGESTIONS

The following suggestion may facilitate programming with the Universal Radio Programmer.

1. Select a display speed not greater than 6 or 7 for most convenient data entry.

2. If the PLS program does not show up the Primary menu, try removing the Hand Held Computer from the programmer turning it "ON" (with "ON KEY") type the CLEAR key a few times; turn the unit "OFF" with the normal "OFF KEY"; then re-insert into the suitcase and try again. If this fails to reveal the PLS remove the GE Program Storage Module, open it and extract the PLS EPROM. Examine the EPROM for any physical damage (e.g. broken or bent pins). If the EPROM appears to be undamaged return it to the Program Storage Module, but be sure to insert in a different socket than the one it was just extracted from. Replace the Program Storage Module and try again to gain access to the program.

3. DO NOT Plug/Unplug peripherals when the system is executing an application program. To be sure of the state of the unit depress CLEAR a few times until you see the PRIMARY menu being displayed. Then turn the unit off via the normal "OFF KEY" prior to inserting or removing modules or capsule programs.

4. The Panasonic BASIC Capsule program options (purchase from Panasonic) has special exiting procedures that one should carefully observe else one may have to play the "ALL OFF" game with the ALL OFF switch in the back of the Hand Held Computer.

5. You may purchase a variety of peripherals and software capsules for the Hand Held Computer from Panasonic. However, this PLS is designed for use only with basic computer, the GE Program Storage Module and GE I/O Module. As such, inclusion of other devices or other Capsules programs may cause problems. If a problem arises, simply unplug the problem Peripheral/Capsule when programming PLS.

APPENDIX A

FILE OPERATIONS

The programmer offers several facilities for managing radio data saved in files. for more detailed information, consult the sections of the Panasonic Hand Held Computer - Instructions for Use titled "File System" and "Beyond the Primary Unit with the I/O Key". PLS DATA is written to (and read from) a PLS file named PLS which is created automatically the first time radio data is written. The file can be deleted, renamed, or copied as required.

EXPANDING FILE STORAGE WITH PROGRAMMABLE MEMORY PERIPHERALS

Optional Panasonic Programmable Memory (RAM) Peripherals can be added to increase file storage capacity. Peripherals are availabe in several capacities, and one peripheral can be installed in each unused I/O adaptor slot.

Each Programmable Memory Peripheral, and internal RAM, are separate memory areas. Only one area can be active at at time, and only files stored in that area are available to the PLS program, or other programs. To find the current area, or change the current area designation, press the I/O key to enter the I/O menu. Each peripheral, and each memory area is displayed, with the space remaining, and the current area is in reverse image. For example:

```
1 = RADIO I/O IN, OFF, SLOT=2
2 = RADIO I/O OUT, OFF, SLOT=2
3 = PRINTER OUT, OFF, SLOT=3
4 = INT RAM, 6394 FREE
```

Change the current memory by pressing the number displayed with the desired memory area.

DELETING A FILE

It may be desirable to delete the PLS file if the memory space occupied by it is required for other files.

1. Return to the PRIMARY menu if not already there.
2. Select the file system by pressing "3" (3 = FILE SYSTEM). The computer will display a menu listing all (visible) files. Items 1 and 2 are special functions used to copy and create files.

```
1 = NEW FILE
2 = COPY FILE
```

for example:

```
3 = DELTA MOBILE
```

for example:

```
4 = PLS
5 = etc.
```

3. Choose the PLS file by pressing the number displayed with it (4 in this example). PLS will appear in reverse image.
4. Delete the file by depressing the "DELETE" and ▼. The programmer will begin displaying the menu of files (less the deleted file).
5. Return to the primary menu by pressing the "CLEAR" key twice.

RENAMING A FILE

Any file in the current memory area can be renamed.

1. First make certain that the desired radio data has been written to the PLS FILE.
2. Return to the PRIMARY menu if not already there.
3. Select the file system by pressing "3" (3 = FILE SYSTEM). The computer will display a menu listing all (visible) files, as described above.
4. Choose the PLS FILE, or any other desired file, by pressing the number displayed with it (4 in the example). The file name will appear in reverse image and the blinking cursor will follow the last character of the file name.

```
PLS N
```

5. Use the RIGHT ARROW and LEFT ARROW keys to reposition the cursor and type in the new name. The new name can be longer than the original name, up to 24 characters. Delete excess characters by pressing the DELETE key and then the RIGHT ARROW or LEFT ARROW keys, to delete the character at the cursor.

NOTE

It is better to add characters to the file name than to replace the file name. The added characters can simply be deleted if it is necessary to program another radio from the file, and the type of radio is not forgotten.

For example:

```
ace plumbing
```

or

```
PLS ace plumbing
```

6. Press the ENTER key when the name is correct. The programmer will beep, flash "CAN'T EDIT", and begin displaying the file menu again. The modified file name should appear in the menu.

RESTORING THE RENAMED FILE

The file must be renamed back to PLS (must be uppercase) for the PLS program to use it. Use the renaming procedure described above. Be careful to rename or delete any PLS file that already exists, to avoid confusing the computer with two identically-named files.

NOTE

PLS is not a text file and cannot be edited by the editing commands described in the Panasonic literature. In addition, the PLS program will reject text files, or files created by other programs, that have been renamed PLS. DO NOT name non-PLS files PLS.

PRINTING THE FILE LIST

A list of all (visible) files in the current memory can be printed using the following procedure.

1. First make certain the computer is in the Primary Menu.

2. Press the I/O key to display the I/O menu. The computer will display a menu of I/O devices and RAM. A typical I/O menu is displayed below:

```
1 = RADIO I/O IN,OFF,SLOT=2
2 = RADIO I/O OUT,OFF,SLOT=2
3 = PRINTER OUT,OFF,SLOT=3
4 = INT RAM  6394 FREE
```

3. If the printer is off (PRINTER OUT, OFF,SLOT=x), press the number displayed with the printer (3 in the example).

4. Press the I/O key to return to the PRIMARY menu.

5. Press the "3" key to enter the file system. The printer will print everything that appears on the display.

6. When a complete list of files has been printed, press the CLEAR key twice to return to the PRIMARY menu.

7. Press the I/O key to display the I/O menu. Then press the key corresponding to the printer to turn the printer off. Press the I/O key again to return to the Primary Menu.

COPYING A FILE

You may wish to copy a file from one memory area to another or to create a duplicate copy of a file. First make sure that the file to be copied is in the current memory area. If not, change the current memory designation as required, using the I/O menu.

1. If not in the Primary Menu, press CLEAR to return to the Primary Menu.

2. Press the "3" key to enter the file system.

3. Press the "2" key for COPY FILE; this prompt appears:

```
SELECT FILE
```

A menu of all the file names in the current memory will be displayed. Press the number of the file to be copied; and the following prompt appears followed by a menu of destination memory areas. The current memory is displayed in reverse image.

For example:

```
SELECT DESTINATION RAM

1 = INT RAM, 2625 FREE
```

Press the number corresponding to the desired destination memory area. When the copying is complete, the original file system menu will return.

APPENDIX B

DEFAULTS AND ACCEPTABLE VALUES

SUBJECT	ACCEPTABLE VALUES	DEFAULTS
Channel #	1 thru 8	1
Mode	1 or 2	1
TX Frequency	0 or range selected by the user	0
RX Frequency	0 or range selected by the user	0
Channel Guard	67.0 - 210.7	0.0
CCT	0:00, 0:30, 1:00, 1:30, 2:00, 2:30, 3:00	2:00
STE	Y or N	N
Type 99 Tones	Y or N	N
T99 GE Tones	Y or N	N
T99 Motorola Tones	Y or N	N
Individual Call	Y or N	N
Group Call	Y or N	N
Super Group Call	Y or N	N
Alt. Group Call	Y or N	N
Tone A	See Table 2	000.0
Tone B	See Table 2	000.0
Tone C	See Table 2	000.0
Tone D	See Table 2	000.0
Light Timer	0 - 255	5 sec
Length of DTMF Tone Digit	0 - 1196 ms	101 ms
Length of DTMF Tone * and #	0 - 1196 ms	101 ms

APPENDIX C

ERROR CODES/MESSAGES/CONDITIONS

The Programmer will display a number of error messages when certain error conditions are encountered.

1. NO SPACE - This message may occur if somehow there is not enough unused RAM memory to execute this program. This could result from other uses of the Hand Held Computer such as with the FILE system, or perhaps with basic. The PLS will not attempt to execute until you provide enough RAM. The ultimate "fix" to a RAM problem (i.e. the last resort) is to turn the "ALL OFF" switch OFF for a few minutes.

2. VERIFY ERROR - Indicates data written to or read from the EEPROM socket did not check during the verify read operation.

3. I/O ERROR - xxx - Where "xxx" is an I/O error resulting from invalid I/O of some sort and will cause the system to repeat the I/O sequences until the error condition is cleared.

4. NO FILE or WRONG TYPE - NO FILE is not actually an error. If no data has been written to the PLS File, this message results from an attempt to READ the file data.

5. NO ROOM FOR FILE - CONT Y/N? - This is also not actually an error. This message appears when there is insufficient file space to store a PLS file. If you do not need to make a file copy, but rather want to write to the EEPROM socket you can still get full access to the program by answering yes (Y). Answering no (N) returns the system to the HHC's main menu. If a file is desired it will be necessary to enter the HHC's file system and delete a file or files until enough space in RAM is created to hold the PLS module file.

6. LEGAL VALUES ARE - This message, followed by either a range or a list of numbers, is given when an attempt has been made to enter an unacceptable value. The message will remain on the screen until the ENTER key is hit. The program will then return to the screen containing the invalid data which you can then correct.

7. LAST ENTRY, ENTER TO LEAVE - This message is flashed when you try to go past the last screen available in the current menu item. After flashing, the program automatically returns to the last screen.

8. INVALID FREQUENCY - This message appears when the frequency is in range but is invalid. This message will remain on the screen until the ENTER key is hit.

9. NO CHANNELS IN MODE 1 - This message appears if an attempt is made to store data (to EEPROM, radio or file) and no channels have been entered in mode 1. You must return to the channels form and enter at least 1 channel in mode 1.

SERIAL I/O INTERFACE ERRORS

The Serial I/O error messages have an error number associated with them.

I/O ERROR ##

1 - Logical device number invalid
2 - Logical device number not assigned
3 - Invalid operation
4 - Device control ROM absent
5 - Operation already pending on this device
6 - No RAM workspace available for device
7 - Input buffer is within 5 characters of overflowing
B - Parity error
D - Framing error
E - Overrun error
F - Input buffer overflow
10 - Output buffer overflow

APPENDIX D

The Reconfigure Menu allows the programmer to reset specific operating parameters within the radio and is divided into two sections: Channels, and Fixed Data. Refer to Figure 1 in this appendix. The Channels section contains adjustable parameters that include squelch level, and audio modulation. Fixed Data is actually factory programmed test data used to set the radio to normal operating standards. Normally, there would be no reason to change or alter this data.

A small battery within the radio maintains RAM memory. Should this battery fail, memory will be lost. For this reason a hard copy of the radio's programmed data should be made and stored for future reference. Under normal operating conditions the projected life of the battery is three years.

WARNING

The RECONFIGURE option should not be programmed by any one other than a certified electronics technician familiar with two-way FM radio. Incorrect settings can result in a radio system that does not work.

WARNING

To prevent loss of memory in RAM A2 on the Controller Board, lithium battery BT1 should be replaced at three year intervals. A procedure for changing BT1 is provided in the Service Section of the PLS Maintenance Manual.

TEST EQUIPMENT REQUIRED

1. Communications Monitor
2. RF Generator
3. Modulation Meter
4. Interconnect Cable TQ2368

PROCEDURES

Before entering the Reconfiguration Mode you must first turn the radio off, connect the Interconnect Cable TQ2368, and then turn the radio back on.

To enter the RECONFIGURE MODE enter a 7 on the keyboard. the display will flash:

RECONFIGURE

then ask:

IS RADIO ATTACHED? N

If the question is answered no then the program will return to the Program Review Menu. If this question is answered yes the following screen will be displayed.

READING . . .

If an error occurs during the read sequence the program will return to the Program Review Menu. If the program is read successfully then the following menu will be displayed a line at at time.

RECONFIGURE: 1=CHANNELS

RECONFIGURE: 2=FIXED DATA

RECONFIGURE: 3=COMPLETE

Enter a 1 to select channels. The following will be displayed:

SELECT MODE 1 CHANNEL 1

Enter the mode and channel number of the channel that is to be reconfigured. Press ▼ and the display will show:

M1 CH1 SQLCH OPEN 0 0

In this example channel 1 was selected for reconfiguration. Here you may enter a new value for the radio to unsquelch. Legal values are 0 to FF (HEX). To set the new squelch level you must first determine the current SINAD level and then set the Test Generator to the desired squelch opening level. Select a new value, either higher or lower, than the current value so that the radio just unsquelches.

NOTE

It may be necessary to enter several values to achieve the desired squelch opening level.

After each new value is entered the program will write the new squelch opening level to the radio and then display the following:

M1 CH1 SQLCH OPEN 0 0 OK?

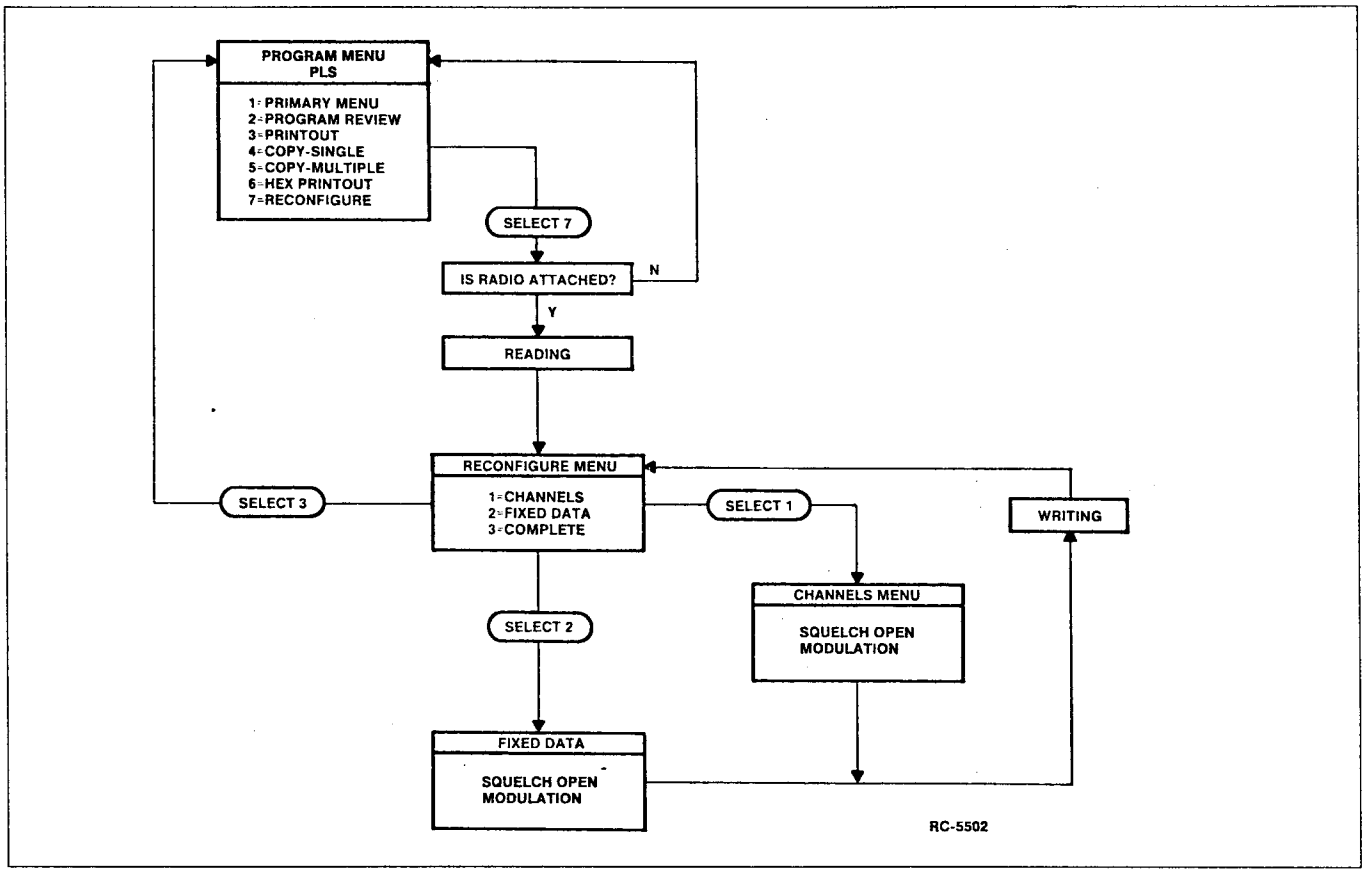


FIGURE 1

If the new value is not satisfactory you must enter an "N". The program will return you to the previous screen and display the SQLCH OPEN screen. This routine will be repeated until a satisfactory value is chosen. Typical (HEX) values fall within the range of C1-CF for a squelch opening level of 8 dB SINAD. When a satisfactory value is chosen enter a Y and press ▼ . The display will show:

M1 CH1 SQLCH CLOSE 0 0

Here you set the new squelch closing values for the selected channel. Legal values are 0 to FF (HEX). To set the new squelch closing level, you must enter the new value, either higher or lower, than the current value so that the radio just squelches. Typical values are the squelch opening level plus 5 (HEX).

NOTE

It may be necessary to enter several values to achieve the desired squelch closing level.

After each new value is entered the program will write the new squelch closing level to the radio and then display the following:

M1 CH1 SQLCH CLOSE 0 0 OK?

If the new value is not satisfactory you must enter an "N". The program will return you to the previous screen and display the SQLCH CLOSE screen. This routine will be repeated until a satisfactory value is chosen. When a satisfactory value is chosen enter a Y and press ▼ . The display will show:

M1 CH1 MODULATION 0 0

Here you may set the modulation level of individual channels. Modulation is set by successful approximations and varies considerably across the frequency band. Normal values for 4.5 kHz modulation are within the range of 9 to 1C (HEX). Legal values are 0 to 1F (HEX).

Use a modulation meter to monitor the modulation level. If it is not as desired, enter a new value and again measure the modulation. The new value is written immediately to the radio. The display will show:

M1 CH1 MODULATION 0 0 OK?

If the new value entered does not result in the desired modulation level enter an "N". The program will return to the MODULATION screen to allow you to

enter a new value. This routine will be repeated until the question is answered yes "Y".

If the new value resulted in the desired level of modulation, answer this question yes, "Y".

Enter a Y.

This completes the channel programming section of the Reconfiguration Menu. Press ENTER to return to the Reconfigure Menu.

RECONFIGURATION/FIXED DATA

The Fixed Data section of the RAM memory contains preprogrammed factory test data for all channels in the radio in the channels section of the Reconfiguration Option. Unlike the channels section, there are five bytes allocated to the squelch and RF power parameters and three bytes for modulation. This allows each frequency band to be split into five segments and the parameters set for each segment (three for modulation). The factory test data is located on a label mounted on the Logic Board (See Figure 2). Figure 3 is a sample copy of the preprogrammed factory

SR. NO. _____

TRACKING DATA

FREQ. (MHz)										
CHAN	L	LM	M	MH	H	L	LM	M	MH	H
PWR-H		—		—			—		—	
PWR-L		—		—			—		—	
MOO										
SO-OP		—		—			—		—	

RC-5518

FIGURE 2

FIXED DATA

LOC	0-- 3	C4	C2	C0	C0	←SQUELCH OPEN
LOC	4-- 7	C0	CE	CC	CA	←SQUELCH CLOSE
LOC	8--11	CA	CA	12	16	←MODULATOR
LOC	12--15	24	12	12	00	
LOC	16--19	00	00	00	00	
LOC	20--23	00	00	00	00	←NOT USED
LOC	24--27	00	00	00	00	
LOC	28--31	00	00	00	00	←CHECKSUM

RC-5522

FIGURE 3

The Fixed Data is generally not reprogrammed in the field and is provided here as reference data only in the unlikely event that the RAM memory is lost due to battery failure or major component changes in the control section.

WARNING

Incorrect data entered under the Fixed Data option can result in an inoperative radio or loss of communications. Fixed data should only be altered by a certified electronics technician familiar with the operation of two-way FM radios.

Enter a 3 to access the Fixed Data Menu. the display will show:

LOC 00–03 0 0 00 00 00

Locations 00 thru 03 contains the first four of the five bytes used for squelch opening data. After these four bytes are entered the display will show:

LOC 04–07 0 0 00 00 00

Locations 04 thru 07 contain the fifth byte of squelch data and the first three bytes of squelch closing. After the fifth byte of squelch opening data and the first three bytes of squelch closing data are entered the display will show:

LOC 08-11 0 0 00 00 00

Locations 08 thru 11 contain the last two bytes of squelch closing and the first two bytes of modulation data. After these four bytes are entered the display will show:

LOC 12-15 0 0 00 00

Locations 12 thru 14 contain the last three bytes of modulation data. Location 15 is blank. After the modulation data has been entered the display will return to the Program Menu.

After completing this section the fixed data will be written back to the radio and the following will be displayed:

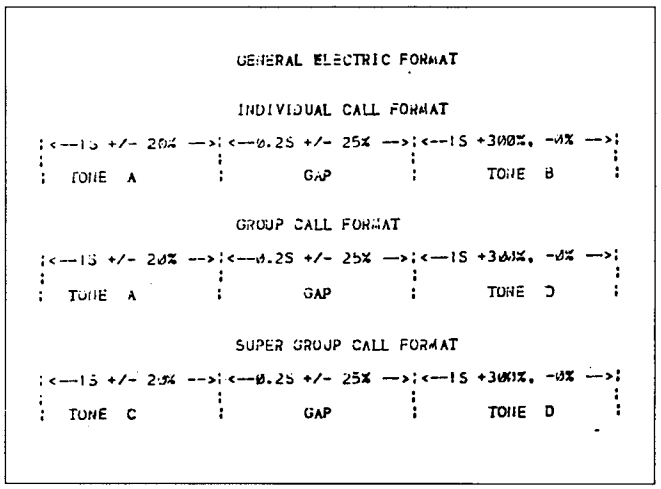
WRITING

Enter a 4 to return to the Program Review Menu.

APPENDIX E

TYPE 99 TONE PARTICULARS

In the GE tone format, it can be seen that both the first tone or second tone may each be one of two tones. The first may be A for Individual calls or C for Group calls. The second may be B for Individual calls or D for either Group or Super Group calls.



To detect one of two possible frequencies, the DTD is first programmed to the first frequency at LOW Q, and if no detect occurs in an allotted time (this time is established by the Maximum LO Q Decode time), is reprogrammed to the second frequency at LO Q, and again checked for decode in an allotted time. If no decode occurs at either frequency the process is repeated infinitely.

If a possible first tone is detected, then the DTD is reprogrammed for the same tone at HI Q, and a final more precise test is made where the allotted time (established by the Maximum HI Q Decode time) is considerably longer. Likewise if a C tone is found at LO Q, then it is also re-tested at HI Q.

When one of the two possible first tone decodes has been established, then the two possible second tones are checked, but in the case of second tones two differences are important. First in the event neither tone is found the search must be terminated, and the first tones again looked for. This must be done in time to find the earliest possible occurance of another valid first tone. Secondly, the search must not be abandoned too early, since there is an intentional gap between the two tones which is large enough to allow several LO Q tests. The retry count during the gap is a customer programmable value (established by the LO Q Retries In Gap variable, since not all paging systems use the same gap size. In other words, the user can select how many LO Q retries to repeat to get over the gap.

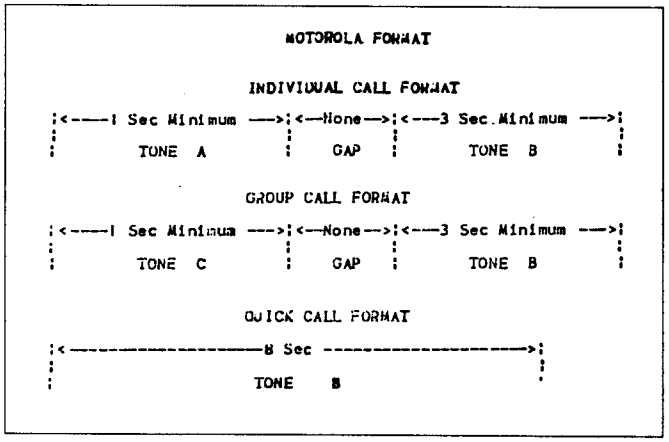
If one of the two second tones is found in the allotted number of retries, then a HI Q test for the same tone is made. On determining that a good second tone exists, the radio is enabled, and the alarm is sounded. For PLS radios, the alarm will be simply the second tone passing through the audio amplifier. MPR/MPX, the alarm may be generated by the processor and may be different for each of the three possible combinations of tones that finally resulted in a decode. In either case, the alarm will be ended when the second tone is no longer detected by the DTD.

Before continuing on with a similar Motorola sequence, a short description will be given of how the DTD and micro-computer (uC) of the circuit work together.

The DTD input acts as a filter with it's Q and acceptance threshold programmed by the uC. Once programmed, these variables determine the response time and bandwidth of the filter. If the combination of Q and threshold are too low then falsing can occur, too high and the response time may be so long that invalid tones will be missed while looking at invalid nearby tones.

When the DTD has detected a valid tone, the uC introduces a user adjustable "integration time" or waiting period before it actually accepts the decode as successful. For a LO Q decode the minimum time for this is set by the MIN LO Q DEC time. For HI Q decodes this is set by the MIN HI Q DEC time. The maximum time that the DTD looks for a valid tone is determined by the MAX LO Q DEC and MAX HI Q DEC tomes which are user selectable . For example, if Individual, Group and Super Group modes are selected there will be 2 first tones and 2 second tones that the DTD must be programmed to look for. The time that the unit hesitates in the presence of a strong tone and the time that it looks in the absence of a tone are determined by these variables. QCK-CALL MIN DEC and QCK-CALL MAX DEC are similar variables that pertain to Motorola's Quick-Call format.

Motorola's Quick-Call format relies on a relatively long burst of a single tone. Single tone systems are prone to falsing so it is necessary to decode for a long time. Instead of making the maximum time for a HI Q decode extremely long we allow the user to vary the number of HI Q decodes required to accept a Quick-Call tone in the HI Q DECODES, QCK-CALL variable.



In the Motorola tone format, it can be seen that the first tone may be one of three tones. It may be A for Individual Call, B for Quick-Call, or C for Group Call. The second or final tone is B in all cases.

It is not feasible to detect one of three tones, so a choice must be made between Group Call and Quick-Call. If Quick-Call is selected, the first tone will be tested for A or B. If Group Call is selected, then the first tone will be checked for A or C. If both Quick-Call and Group Call are selected, then Group Call will be ignored and the system will default to Quick-Call. The rest of the decode sequence is similar to GE.

Reconfiguration Displays. (For possible variable entries, see Appendix B)

(1) DTD HI Q setting for tones A-D

TONE n HI Q x xxx.x

n rotates from A thru D. The possible entries for Q, "xxxx.x", are contained in Appendix D. This sets the filter Q on the DTD input during a HI Q decode.

(2) DTD LO Q setting for tones A-D

TONE n LO Q x xxx.x

n rotates from A thru D. The possible entries for Q, "xxxx.x", are contained in Appendix D. This sets the filter Q on the DTD input during a LO Q decode.

(3) DTD HI Q THRESHOLD setting for tones A-D

TONE n HI Q THRESHOLD x. xx

n rotates from A thru D. The possible entries for Threshold, "xxxx", are contained in Appendix B. This sets the filter threshold on the DTD input during a HI Q decode.

(4) DTD LO Q THRESHOLD setting for tones A-D

TONE n LO Q THRESHOLD x x.x

n rotates from A thru D. The possible entries for Threshold, "xxxx", are contained in Appendix B. This sets the filter threshold on the DTD input during a LO Q decode.

Tone No.	Tone Group 1	Tone Group 2	Tone Group 3	Tone Group 4	Tone Group 5	Tone Group 6
1	349.0 Hz	600.9 Hz	288.5 Hz	339.6 Hz	584.8 Hz	1153.4 Hz
2	368.5 Hz	634.5 Hz	296.5 Hz	358.6 Hz	617.4 Hz	1185.2 Hz
3	389.0 Hz	669.9 Hz	304.7 Hz	378.6 Hz	651.9 Hz	1217.8 Hz
4	410.8 Hz	707.3 Hz	313.0 Hz	399.8 Hz	688.3 Hz	1251.4 Hz
5	433.7 Hz	746.8 Hz	953.7 Hz	422.1 Hz	726.8 Hz	1285.8 Hz
6	457.9 Hz	788.5 Hz	979.9 Hz	445.7 Hz	767.4 Hz	1321.2 Hz
7	483.5 Hz	832.5 Hz	1006.9 Hz	470.5 Hz	810.2 Hz	1357.6 Hz
8	510.5 Hz	879.0 Hz	1034.7 Hz	496.8 Hz	855.5 Hz	1395.0 Hz
9	539.0 Hz	928.1 Hz	1063.2 Hz	524.6 Hz	903.2 Hz	1433.4 Hz
0	330.5 Hz	569.1 Hz	1092.4 Hz	321.7 Hz	553.9 Hz	1122.5 Hz

TABLE 3 - MOTOROLA TONE FREQUENCIES AND GROUPS

GENERAL ELECTRIC COMPANY • MOBILE COMMUNICATIONS DIVISION
WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.

GENERAL ELECTRIC*
U.S.A.