Radius GR300/GR500

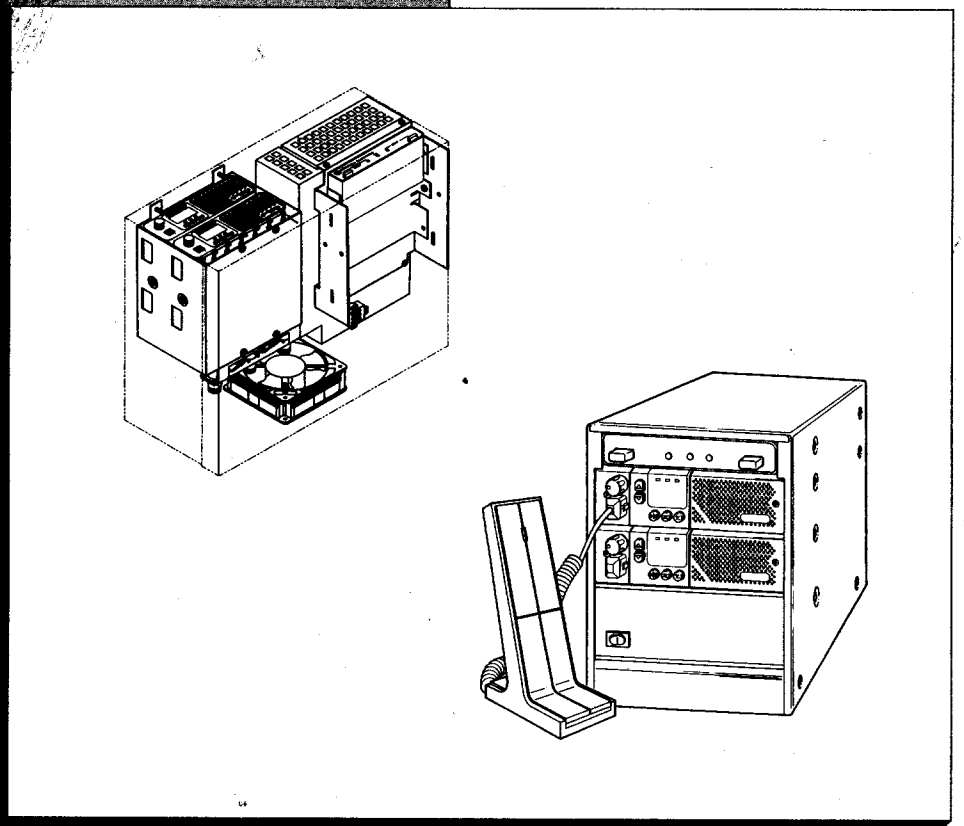
Repeater Stations and Controllers

Supplement to GM300 RSS Manual (6880902Z36)

Includes **all** programming information for:
- Motorola Basic Controller
- [illegible] Controllers
- Instrument Associates i50R and TRA100R Controllers

Includes all programming information for:

- Motorola Basic Controller (R*I*C*K)
- Zetron ZR320, ZR330, and ZR340
- Instrument Associates i50R and TRA100R



THIS MANUAL HAS BEEN
DISCONTINUED

Radius®

Radio Products Group

6880903Z43-A
October, 1997

Table of Contents

1 Introduction

1.1 Overview

The purpose of this manual is to serve as a guide for programming a GR Series repeater with the GM300, M10, or M120 mobile radios used with the available repeater controllers:

- Basic Repeater Controller (Basic)
- i50R Basic Interconnect Repeater Controller (i50R)
- ZR340 Advanced Interconnect Repeater Controller (ZR340)
- ZR330 Radio Telephone Interface (ZR330)
- ZR320 Selective Calling Interconnect Controller (ZR320)
- TRA100R Tone Remote Adapter Repeater Controller (TRA100R)

The GM300 mobile radios, and the ZR320 and ZR330 repeater controllers are customized using the GM300 RSS programming. Additionally, the ZR320 and ZR330 controllers use telephone and Over-The-Air programming. The ZR340 is customized using Over-The-Air programming. The Basic, i50R and TRA100R controllers are customized using DIP switch settings. Although this manual is designed primarily as a supplement to the GM300 Radio Service Software (RSS) Manual (6880902Z36), we also include the DIP switch settings for programming the i50R controller to provide you with comprehensive programming information regardless of the repeater controller that you have.

Because the programming of the radios depend upon your repeater controller, each of the following sections of this manual is titled with the name of a repeater controller. Each section contains programming information for the whole repeater unit (GR Series repeater, mobile radios, and repeater controllers).

1.2 Programming Via Radio Service Software (RSS)

We recommend that you program the GR Series repeater, mobile radios and repeater controller using a PC that runs the Motorola Radio Service Software (RSS), because it is the easiest programming method. Using this software allows you to access the programmable features of the repeater controller, where applicable, from user friendly screens on the PC. You can archive the final configuration for safekeeping or later examination.

The **Programming** ports on the ZR320 and ZR330 controllers are hardware compatible with the Motorola RIB. The RSS will prompt the system installer to plug into the controller so that the configuration can be read or written.

1.3 Programming Over-The Air

The ZR320 and ZR340 controllers can be programmed using a radio equipped with a DTMF keypad. While programming the unit, it is helpful, but not required, to have a secondary receiver (scanner, or monitor receiver) tuned to the repeater output frequency. This enables you to hear the prompt tones generated by the repeater controller.

1.4 Programming via DTMF Telephone

The ZR320 and ZR330 controllers can be programmed with a DTMF telephone. A telephone on a different extention or telephone number may "call" the ZR320 controller for programming. The DTMF telephone connected to the ZR330 controller Line Extender is used to program the ZR330 controller. There is no need to connect to the "Programming" jack of either the ZR320 or the ZR330 controllers.

1.5 Quick Reference to DTMF Codes

The tables in Appendix A contain all the DTMF programming and diagnostic commands which allow you to customize and test your repeater controller. If you are familiar with over-the-air programming, you can program the repeater controller by referring to the tables in Appendix A.

2 Programming for Radios and Repeater

2.1 Overview

This section provides basic information for programming the radios and repeater controller in your repeater station. In the Radio Service Software (RSS), the repeater controller is referred to as the "Repeater Option Board." Some of the repeater configurations may be easily programmed using the RSS "Repeater Mode." Included in these configurations are the Basic, i50R, ZR320, and ZR330 controllers. Other configurations require programming the radios in the RSS "Radio Mode." Included in these configurations are the ZR340, TRA100R, i20R, and i750R controllers. Separate, specialized RSS programming is required for the i20R and i750R controllers.

2.1.1 Getting Started

At the Main Menu:

1. Press **F3** (Get/Save).

You will see the Get/Save Screen, Radio Mode (Figure 2-1).

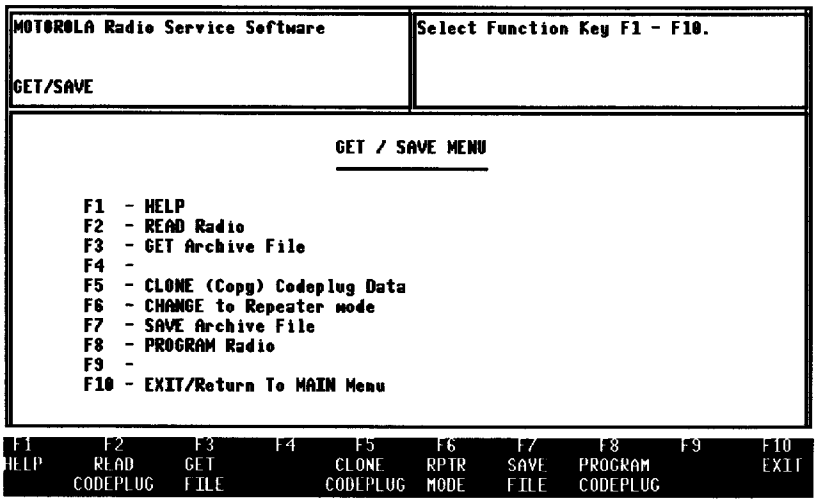


Figure 2-1. Get/Save Screen, Radio Mode

In most cases, the radios can be programmed in repeater mode. To begin programming in repeater mode:

2. Press **F6** to change to repeater mode.

You will see the Get/Save Screen, Repeater Mode (Figure 2-2).

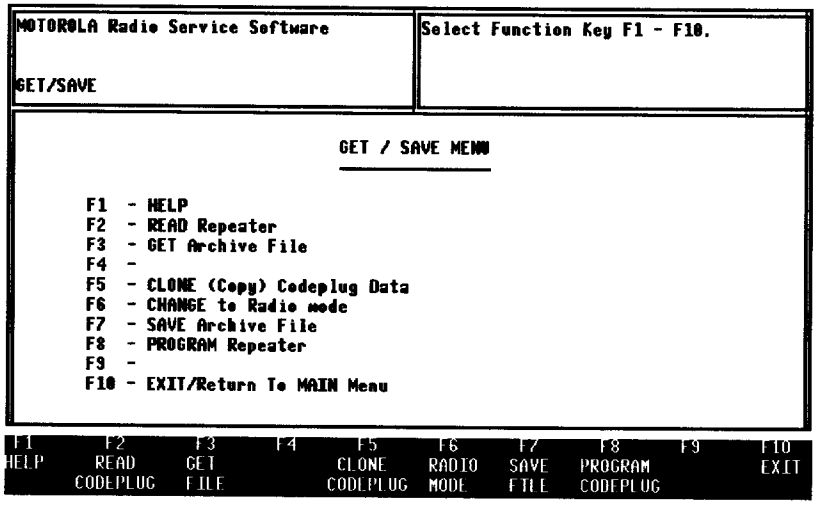


Figure 2-2. Get/Save Screen, Repeater Mode

2.1.2 Programming the Repeater

1. From the Get/Save Menu, Press **F2** to read the repeater.

You will see the screen in Figure 2-3.

You have two options: to read the repeater, or to designate it as generic. You may need to use the generic designation if the option board is not PC programmable (i.e. the Basic and i50R controllers).

To read the repeater controller:

1. Connect the programming cable to the repeater controller.
2. Press **F2** to continue reading the controller.

To skip the Basic or i50R controller:

3. Press **F10** to abort.

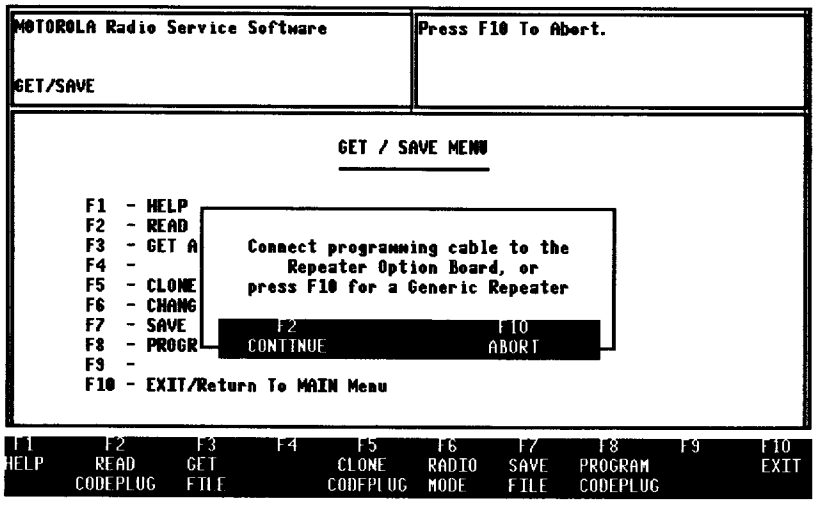


Figure 2-3. Read Repeater Screen

2.1.3 Reading the Transmit Radio

After reading or aborting the repeater controller, you will see the screen in Figure 2-4.

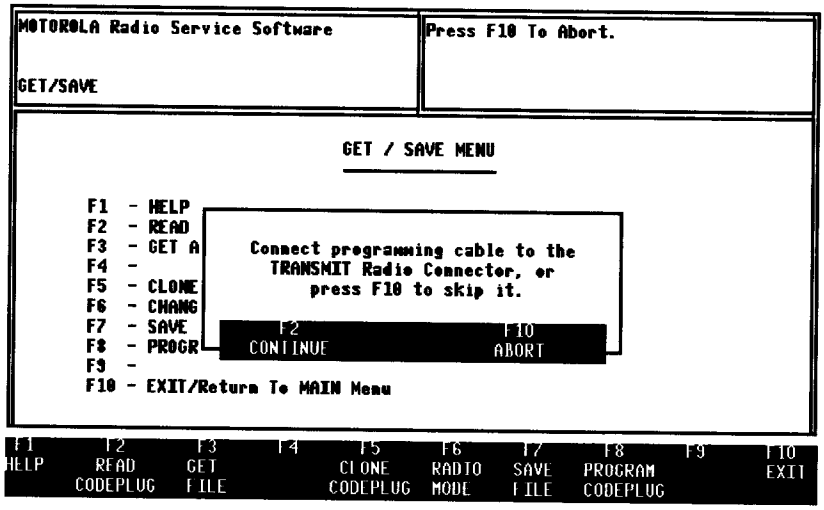


Figure 2-4. Read Transmitter Screen

You have two options: to read the transmitter, or to skip it.

To read the transmit radio:

1. Connect the programming cable to the transmitter.
2. Press **F2** to continue.

To skip the transmit radio:

1. Press **F10** to abort.

If you choose to read the radio, and it has previously been programmed in radio mode, you should see the screen in Figure 2-5.

Figure 2-5 is for your information only. It may indicate that the wrong radio was read.

2. Press **F2** to continue.

If custom settings have previously been programmed for the radio, you will see the screen in Figure 2-6..

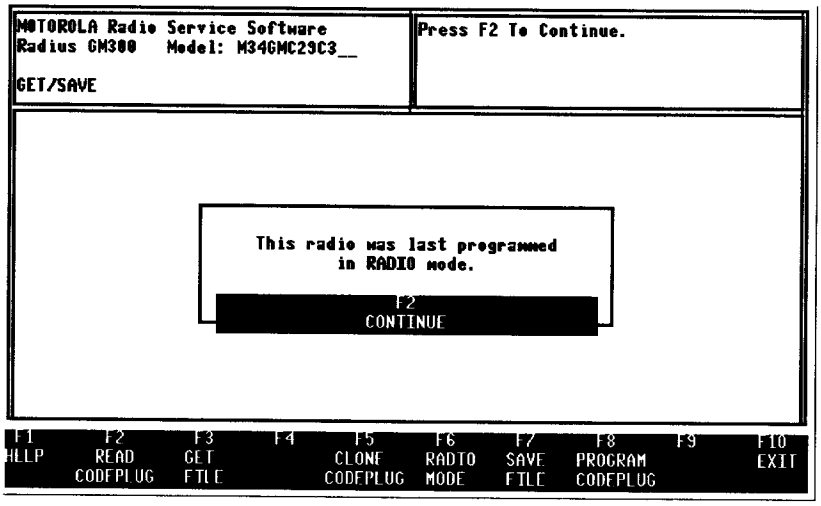


Figure 2-5. Radio Mode Warning

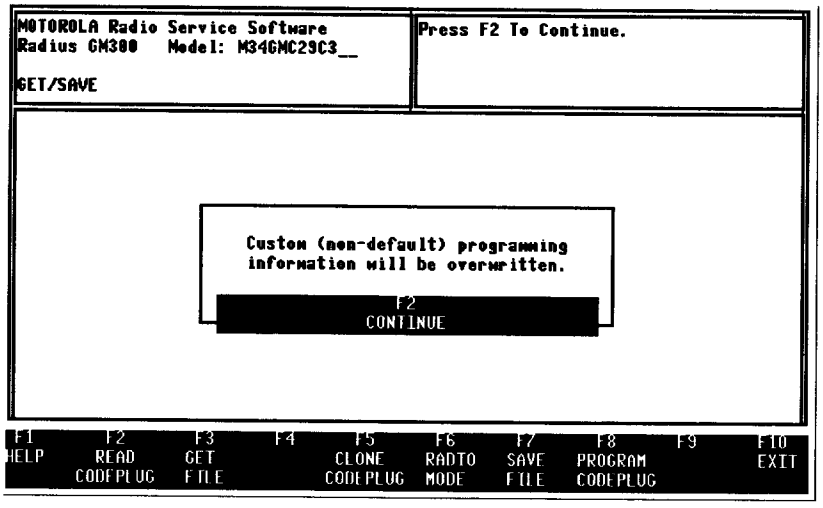


Figure 2-6. Non-Default Information Warning

To allow all programming information to be reset to default settings:

3. Press **F2** to continue.

To keep custom programming, you must use radio mode. Programming in repeater mode resets all custom accessory information to its default settings. Pressing F2 (Continue) will overwrite any custom programming.

2.1.4 Reading the Receive Radio

After reading the repeater controller option board and the transmitter, you will see the screen in Figure 2-7.

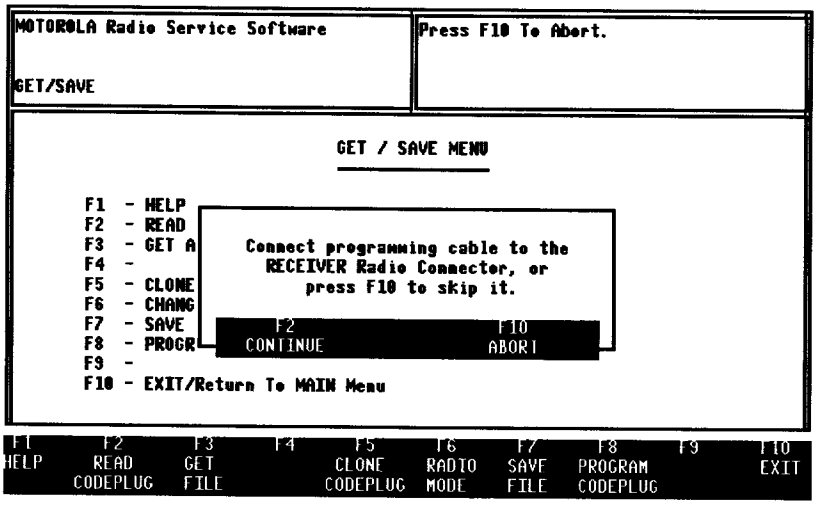


Figure 2-7. Read Receiver Screen

You have two choices: to read the receiver, or to skip it.

To read the receive radio:

1. Connect the programming cable to the receiver radio.
2. Press **F2** to continue.

To skip the receive radio:

3. Press **F10** to abort.

As with the transmitter, if the radio has previously been programmed in radio mode, the warning screens in Figure 2-5 and Figure 2-6 may appear.

2.1.5 Configuring the System

From the Main Menu:

1. Press **F4** (Change/View).
2. Press **F2** (Radio/Wide).

You will see a screen similar to Figure 2-8. (Exact format will depend upon which repeater controller was read.)

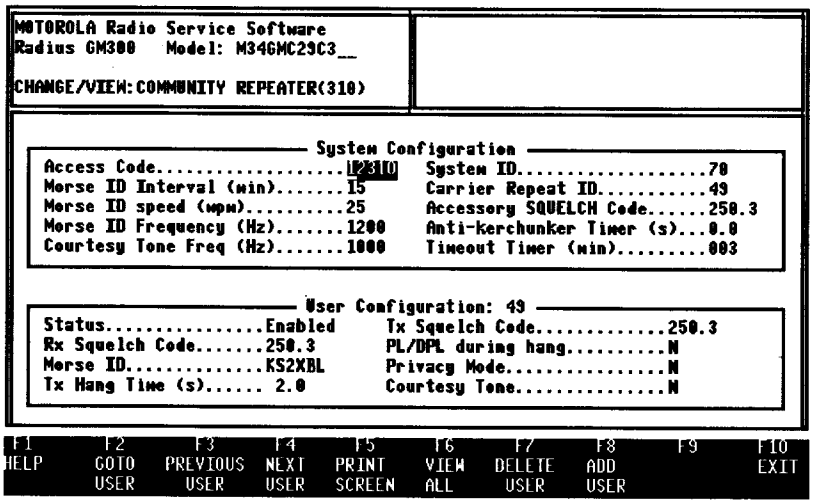


Figure 2-8. Sample Configuration Screen

Table 2-1 lists the functions you can perform from within the Configuration Screen. (Exact functions will depend upon which repeater controller was read.)

Table 2-1. Command Key Functions

Command	Function
F1=HELP	Get specific help for highlighted field
F2=GOTO USER	Choose a user number to display (TPL=1-50; DPL=51-70)
F3=PREVIOUS USER	Go to previous active user (both enabled and reserved users are active)
F4=NEXT USER	Go to next active user (both enabled and reserved users are active)
F5=PRINT SCREEN	Print contents of screen
F6=VIEW ALL	View user summary screens.
F7=DELETE USER	Delete currently displayed user from active list.
F8=ADD USER	Add new user to active list
F10=EXIT	Go to previous menu (Change/View)

Table 2-2 lists other keys and their general functions, regardless of which repeater controller is used.

Table 2-2. Other Key Functions

Key	Function
ESC	Exit to Main Menu
Tab/Enter/Return	Accept data currently in field and move prompt **forward** one field
Shift + Tab	Accept data currently in field and move prompt **backward** one field
Up/Down Arrow	Scroll through selections or increase/decrease current relative value
Left/Right Arrow	Move cursor left/right one space
Back Space	Erase current character in field and move cursor left one space
Page Up/Page Down	Display previous/next page of information on screen

2.1.5.1 Customizing Your Accessories

The repeater radios may be customized in **radio mode.** For detailed information on the programmable accessory packages, refer to the GM300 RSS manual, 6880902Z36. To set custom accessory information:

1. From the Main Menu, press **F4** to see the Change/View menu.
2. Press **F2** to access Radio Wide (Figure 2-9).
3. Press **F9** for the Accessory Connector Configuration.

You will see the screen in Figure 2-9.

4. Set the desired custom information.
5. Press **F10** to exit.

IMPORTANT: ***Repeater mode will not keep custom information. Therefore, if you customize your radios, you may limit yourself to always programming in radio mode. Refer to the GM300 RSS Manual (6880902Z36).***

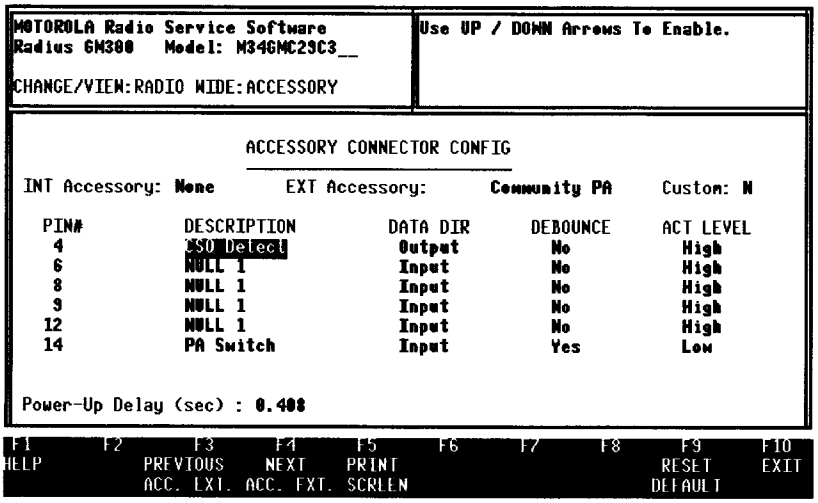


Figure 2-9. Radio Wide Accessory Screen

2.1.5.2 Low Battery Alert

To program the repeater to send out a warning signal when the voltage of the backup battery (if applicable) gets low, use **radio mode**:

1. From the Main Menu, press **F4** to see the Change/View Menu.
2. Press **F7** to access the Signalling Menu.
3. Press **F2** to see the screen in Figure 2-10.
4. Press the **Tab** key, to move the cursor to the space next to "Low Battery."
5. Use the up-down arrow keys to choose **Y** to set the low battery alarm on.
6. Press **F10** to exit.

You must have either MDC-1200 or Quik-Call II encode signalling active to use this low battery alert feature. Refer to the GM300 RSS manual, 6880902Z36.

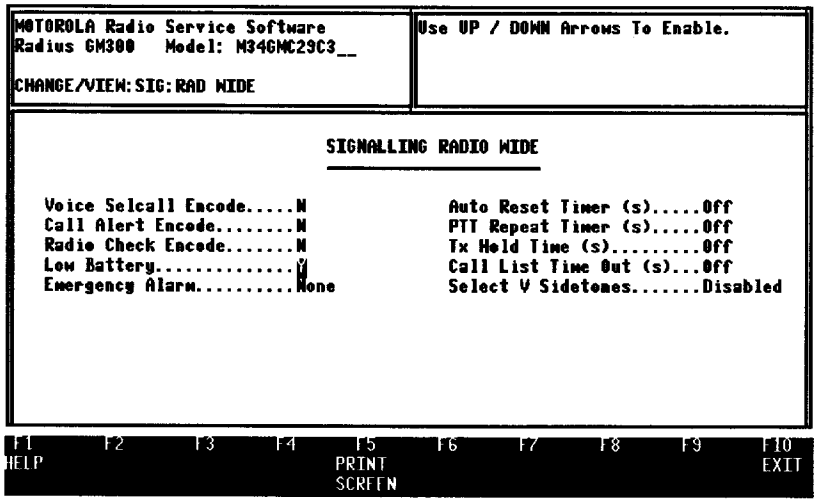


Figure 2-10. Signalling Radio Wide Screen

2.2 Enabling/Disabling the Repeater

The Basic, i50R, TRA100R, i20R, and i750R repeater controllers have pushbutton switches for enabling and disabling the repeater. Pressing the "Repeater Enable" pushbutton switch enables the appropriate audio and control paths to make the repeater functional. Pressing this button again disables repeater function. The status of this control is indicated by one of the LEDs on the front panel of the controller.

2.2.1 Setup/Knockdown of the Repeater

Some controllers use the external alarm of the receive radio to toggle the repeater state. The repeater may then be "set up" or "knocked down" from a radio. When it is set up, the repeater becomes active when it receives the proper signal(s) from a mobile. The status of this function is indicated by the "Set-Up" LED on the Basic and i50R controllers or the "RPTR" LED on the TRA100R, i20R, and i750R controllers. Additionally, the TRA100R controller will detect a 1450 Hz tone for repeater setup and a 1550 Hz tone for repeater knockdown from a tone remote (C100).

To remotely knockdown a repeater that is set up:

1. Initiate a Call Alert from the "console" radio to the receive radio of the repeater using the ID number that was assigned to the receive radio. If the receive radio has been programmed to transmit an Emergency Alarm, the Alarm will be transmitted by the receive radio when the repeater assumes the knockdown state. Clear the Emergency Alarm at the "console" radio, if applicable (refer to the Radius RapidCall Planning Guide).

An Emergency Alarm will be transmitted by the receive radio upon application of supply voltage if the repeater initializes in the knockdown condition.

To remotely set up a repeater that is knocked down:

2. Initiate a Call Alert to the receive radio from the "console" radio using the ID number that was assigned to the receive radio. The transmitter of the receive radio will briefly key to verify that the repeater is setup.

2.2.1.1 Remote Setup/Knockdown

Repeater Receive Radio

To establish remote control:

1. Add a signalling system to the receive radio such as MDC-1200 shown in Figure 2-12. The "Signalling Radio Wide" screen is shown in Figure 2-11.
2. Add a "Call List" to the receive radio and include the identification of a controlling field radio (defined as a "console" with the Radio Service Software). Refer to Figure 2-13.
3. Program the receive radio to receive and transmit on the receive frequency of the repeater. The latter is not necessary if verification of setup/knockdown is not required.

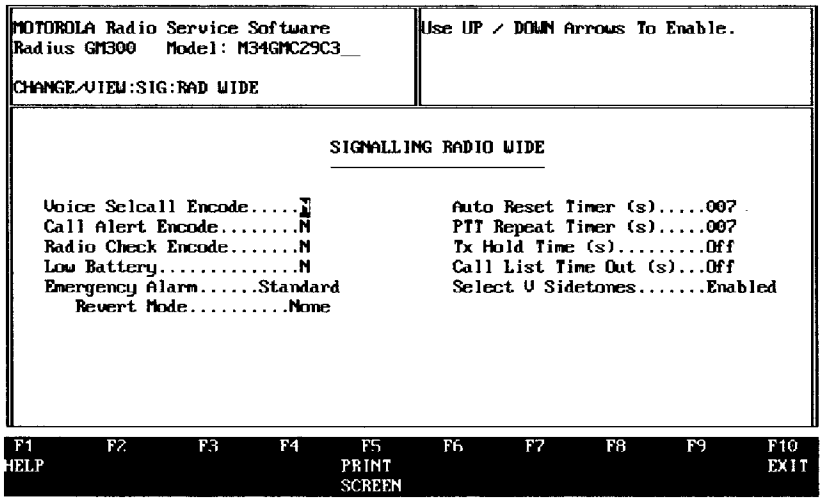


Figure 2-11. Change/View, Signalling Configuration, Radio Wide, Receive Radio

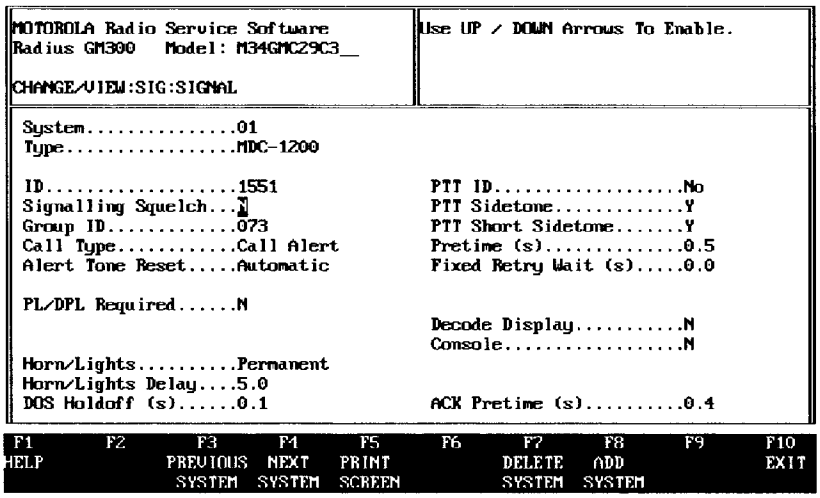


Figure 2-12. Change/View, Signalling Configuration, Signalling System, Receive Radio

4. Program the "Rx Signalling System" and "Tx Signalling System" for the system that was chosen in Step 1 (refer to Figure 2-14).
5. To enable Emergency Alarm on the receive radio (as a verification when the repeater has knocked down), program the receive radio to transmit an Emergency Alarm (refer to Figure 2-11).

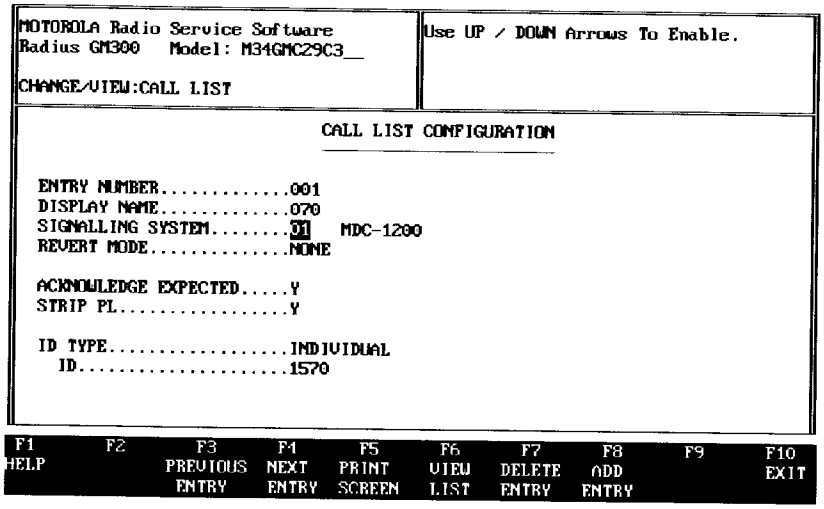


Figure 2-13. Change/View, Call List, Receive Radio

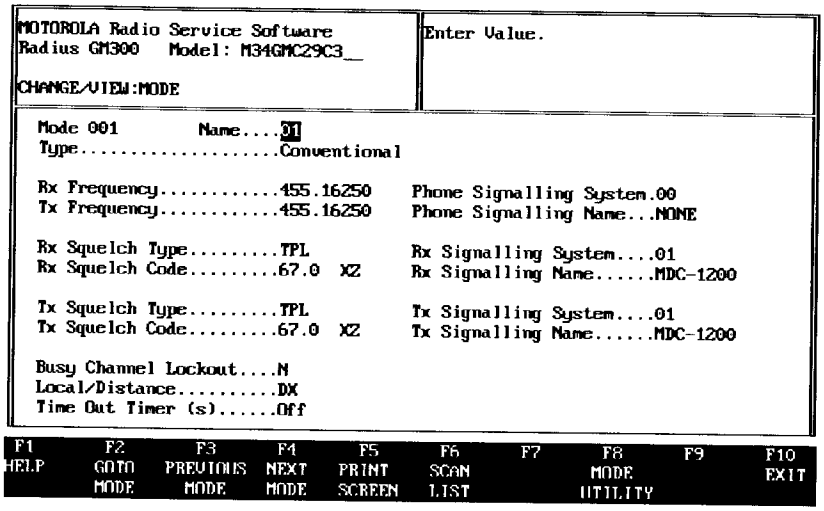


Figure 2-14. Change/View, Mode, Receive Radio

6. Add the same signalling system as the repeater receive radio to the console radio (refer to Figure 2-15). Make sure the "Console" is "Y" (Yes).
7. Enable the "Call Alert Encode" function for the console radio (refer to Figure 2-16).

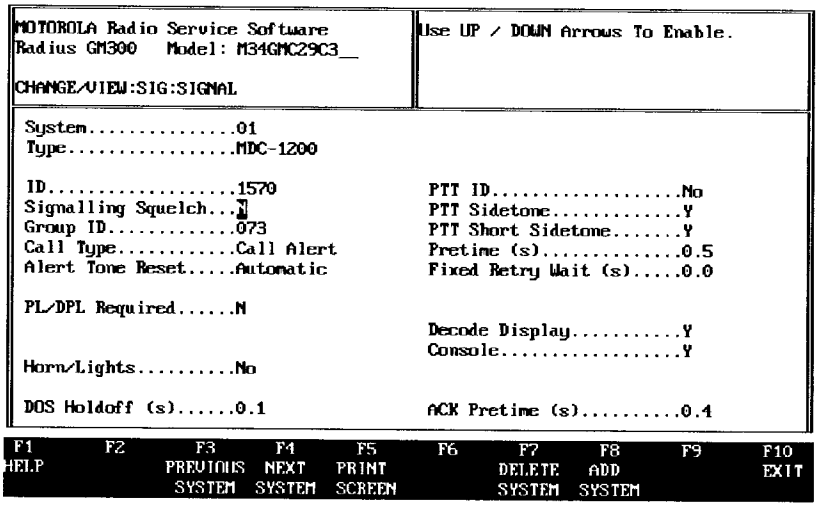


Figure 2-15. Change/View, Signalling, Signalling System, Console Radio

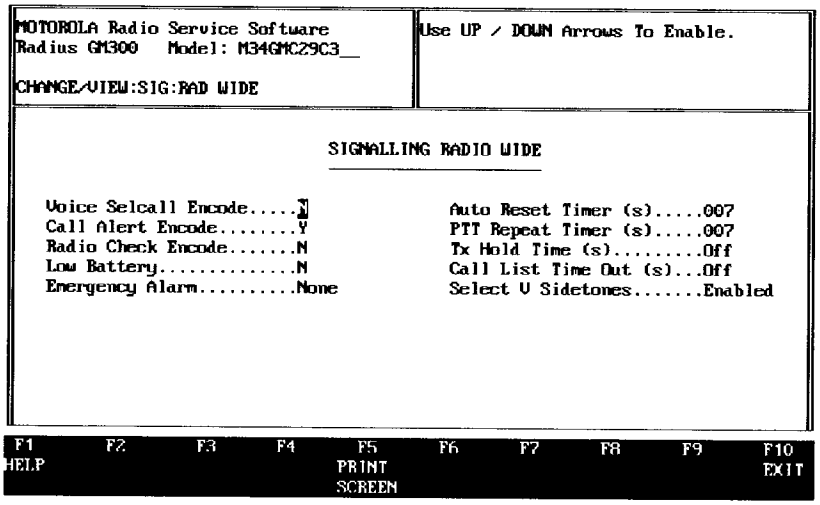


Figure 2-16. Change/View, Signalling, Radio Wide, Console Radio

8. Modify the Call List of the "Console" radio to contain the identification of the receive radio (refer to Figure 2-18).
9. Add a mode (or channel) allocated to receive and transmit on the frequency of the receive radio of the repeater (refer to Figure 2-17).
10. Program the "Rx Signalling System" and "Tx Signalling System" for the system that was chosen in Step 6 (refer to Figure 2-17).

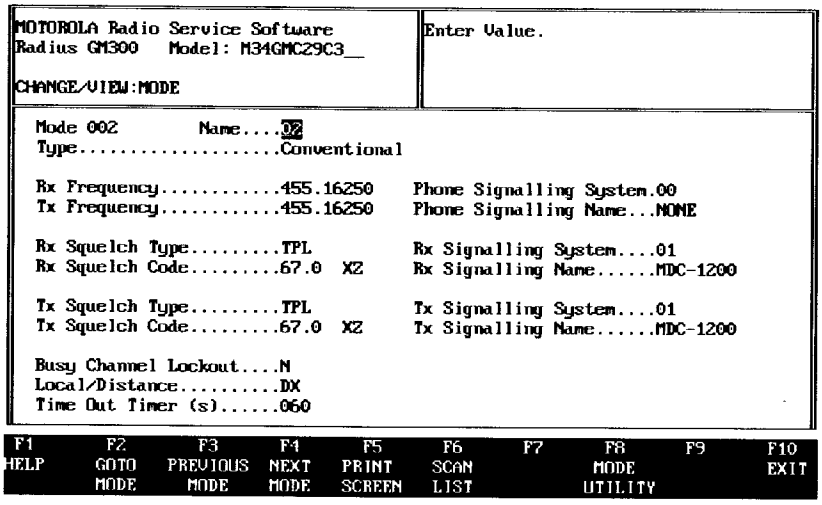


Figure 2-17. Change/View, Mode, Console Radio

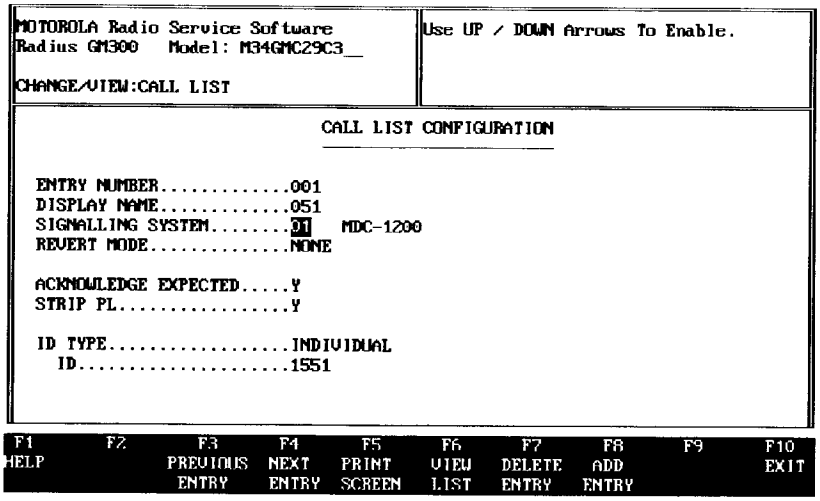


Figure 2-18. Change/View, Call List, Console Radio

3 Programming the Basic Controller

3.1 Overview

This section contains programming examples for a GR Series Repeater Station when used in conjunction with the Basic Repeater Controller (identical to the R*I*C*K). The two examples that follow will probably cover the majority of the applications for the Basic Repeater Controller. The step by step outlines and the screens from the Radio Service Software (RSS) should allow the service technician to easily get a Radius GR Series repeater "up and running."

To begin with the instructions provided, we assume that you have connected a Radio Interface Box (RIB) to an IBM PC or equivalent and that the RSS "MAIN MENU" is on the screen. If there are any questions concerning the RSS during the course of programming the radios, please refer to the "Radio Service Software Manual for Radius GM300 Mobile Radios" (Motorola P/N 6880902Z36).

Two configurations are outlined:

- ❑ a single band, unidirectional repeater
- ❑ a cross band, bi-directional repeater.

During the basic assembly of your GR Series Repeater Station, the following steps should have been performed:

1. All jumpers inside the radios should have been placed in the proper positions.
2. The ac voltage source switch on the power supply should have been placed in the proper position (either 115 Vac or 230 Vac).

*IMPORTANT: **Before placing a Radius GR300 or GR500 repeater in service, consult Part 90 of the FCC Rules and Regulations. You must determine the legal limits for frequency use, power output, coded squelch, and antenna height for a given service of operation.***

The "Enter" key on your keyboard may be marked only with an arrow or the word "Return."

Refer to the Glossary at the end of this manual, for the definitions of any unfamiliar terms.

3.2 Programming Examples

The following paragraphs contain the programming information for a GR300 in a single band, unidirectional repeater. Identical steps may be followed for a GR400 or GR500 for non-portable repeater usage. The first example uses Radius 16-channel GM300 radios for the receive radio and the transmit radio. You can use 8-channel GM300 or 1-channel M10 or 2-channel M120 radios instead of the 16-channel GM300 radios, but minor modifications are required. Please refer to "Using an M10, M120, or 8-Channel GM300 Transmit Radio" on page 3-5 for programming and setup details.

3.2.1 Using GM300 16-Channel Transmit and Receive Radios

A construction company requires the temporary use of a repeater to extend communications. The application for this Radius GR300 repeater is to "fill in" while work on a structure proceeds. The frequencies for the repeater are – receive on 469.550 MHz and transmit on 464.550 MHz. Digital coded squelch of DPL031 is used. The Time-Out Timer will be set for 45 seconds to keep the workers from "gabbing" too long. The repeater drop out delay (or hang time) is set at 1.5 seconds. No signalling systems are programmed into the radios. Normal receiver and transmitter audios are used for both radios.

3.2.1.1 Programming the Repeater

The receive radio is a UHF Radius 16-channel GM300 1-10 Watt model. The transmit radio is a UHF Radius 16-channel GM300 10-25 Watt model. The repeater mode in the GM300 RSS will be used to simplify the programming.

Setting Up the Equipment

1. Connect the repeater to an appropriate ac power source.
2. Turn on the power supply.

Reading the Repeater

1. From the "Main Menu", press **F3** for the "GET / SAVE MENU."
2. Press **F6** to change to "REPEATER MODE."
3. Press **F2** to "READ REPEATER."
   You will be prompted to first connect to an option card or choose **F10** for a "generic" repeater. In this case, the GR300 repeater with the Basic Repeater Controller is considered "generic." Later, the repeater type will be changed to "Radius RICK."
4. Press **F10** for the generic repeater types.
   You will be prompted to connect the RIB to the transmit radio and then to the receive radio. Follow the instructions that appear on the screen.

Entering the Radio Frequencies

1. When the computer has finished reading the two radios of the repeater, press **F10** (EXIT).
2. Press **F4** (CHANGE VIEW), for the "CHANGE/VIEW CODEPLUG MENU."
3. Press **F5** (MODE), to move to "MODE CONFIGURATION."
4. If necessary, press **Tab** to highlight "Rx Frequency" area, key in the receive frequency ("469.5500"), and press **Enter**.
5. Key in the transmit frequency ("464.5500") and press **Enter**.

Entering the DPL Codes

1. Press the up arrow key to scroll "Rx Squelch Type" to "DPL" and press **Enter**.
2. Key in the DPL code ("031") and press **Enter**.
3. Press the up-arrow key to scroll "Tx Squelch Type" to "DPL" and press **Enter**.
4. Key in the DPL code ("031") and press **Enter**.
5. If there are co-channel users that you cannot interfere with, you may wish to enable "Tx Inhibit on Busy." Use the up-arrow key to choose the desired operation ("Y" means yes; "N" means no) and press **Enter**.

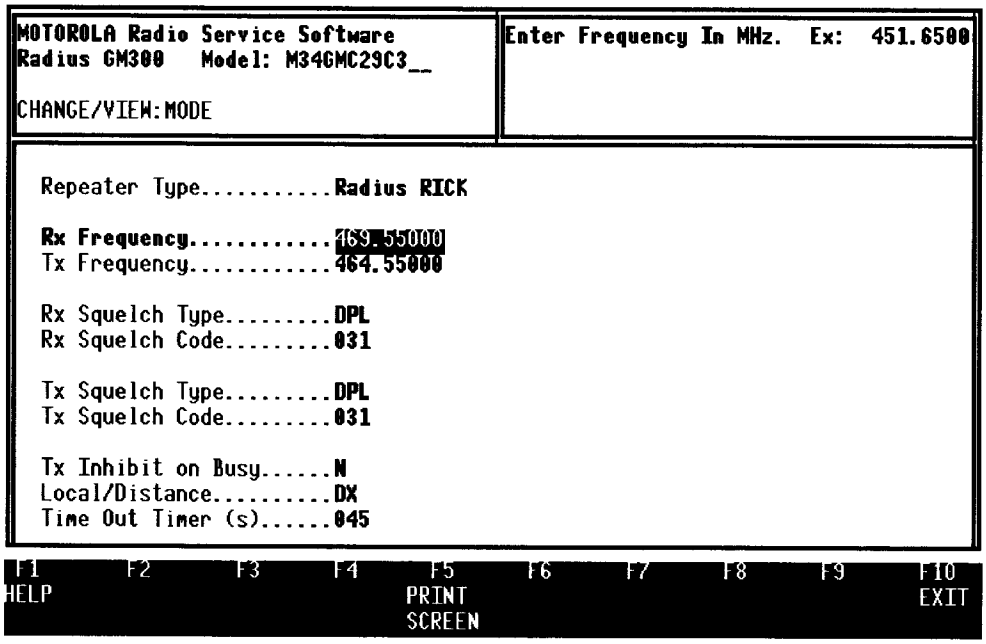


Figure 3-1. Change/View, Repeater Mode

6. If there are other nearby repeater systems that may cause interference ("IM hits"), you may wish to choose "Local" mode instead of "Distance" (DX) mode for the receive radio. Use the up-arrow key to choose the desired operation and press **Enter**.
7. Key in the desired "Time-Out Timer (s)" ("045") and press **Enter**.
8. Check the "Repeater Type" area to ensure that "Radius RICK" appears. If necessary, press **Tab** to move to the "Repeater Type" highlight. Use the up-arrow key to scroll to "Radius RICK."
9. Press **Esc** to return directly to the main menu. If you are prompted to confirm that this is a "Radius RICK" repeater, press **F2** (CONTINUE), then **F10** (EXIT).

Programming and Saving

1. Press **F3** for "GET/SAVE MENU."
2. Press **F8** (PROGRAM REPEATER) to program the GR300 repeater. You will be prompted to connect to the transmit radio and then to the receive radio. Follow the instructions on the screen.
3. Press **F7** (SAVE FILE) to archive the repeater information to a disk file. If the repeater has not previously been archived, you will be prompted to "CONTINUE" by pressing **F2**. You will be asked to supply a Customer ID such as "Miller_Const."
4. Press **F8** to save the data to the disk.

3.2.1.2 DIP Switch (S2) Settings for the Basic Repeater Controller

The 12 sections of DIP switch S2 in the Basic Repeater Controller should have been set during the initial assembly of your GR300 repeater. The correct settings are repeated here.

- ❑ The repeater is unidirectional: S2-1 OFF.
- ❑ The receive radio keys the transmit radio with the pin 8 "COR" signal: S2-2 OFF and S2-3 ON.
- ❑ No remote control is used: S2-4 OFF.

- ❑ The radio uses normal, muted audio from the receiver: S2-5 OFF and S2-6 ON.
- ❑ "COR" operation is used: S2-7 OFF.
- ❑ This is a unidirectional repeater: S2-8 OFF and S2-9 OFF.
- ❑ You desire a 1.5 second drop out delay: S2-10 ON and S2-11 OFF.
- ❑ Your configuration is standard: S2-12 OFF.

After setting all of the positions, DIP switch S2 should be set as shown in Figure 3-2.

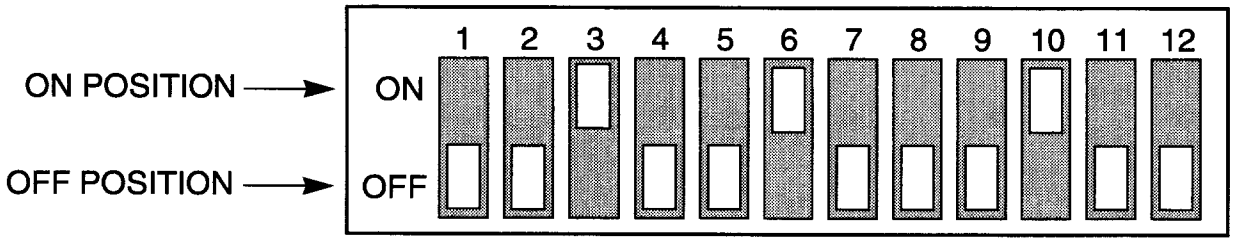


Figure 3-2. S2 Settings for Unidirectional Repeater

3

3.2.1.3 Adjustments to the Basic Repeater Controller

The proper audio level from the receive radio to the transmit radio should have been set during the assembly procedure. The procedure is repeated here.

The following steps should be performed with a dummy load connected to the antenna jack of the duplexer or the transmit radio and a deviation meter monitoring the output of the transmitter. An RF signal generator should be connected to the antenna jack of the duplexer, through an isolation device or directional coupler, or directly to the receiver radio. To simplify this process, you can use a communications service analyzer such as the Motorola R2000 series.

1. Remove the Basic Repeater Controller board from the housing by loosening the two screws at the back and pulling off the front panel. If there are any cables attached to the Basic Repeater Controller board, they must be disconnected before the board can be removed from the rear housing. Reattach the cables after the Basic Repeater Controller is out of its housing.

IMPORTANT: Remember which cable connects to which jack on the Basic Repeater Controller board.

2. ENABLE the Basic Repeater Controller by pressing the "REPEATER ENABLE" button.
3. Apply an on-channel signal from the RF signal generator to the receive radio; modulate the signal with a 1 kHz tone at 60% rated system peak deviation.
4. Adjust R23 on the Basic Repeater Controller board for 60% rated system peak deviation of the transmit radio. If it is not possible to attain the desired modulation, or at least 50% rated system peak deviation, of the transmit radio, move JU651 in the transmit radio from the "LOW" sensitivity position A to the "HIGH" sensitivity position B of P651. Readjust R23 on the Basic Repeater Controller.
5. Unplug the cables attached to the board of the Basic Repeater Controller.

IMPORTANT: Remember which cable connects to which jack on the board of the Basic Repeater Controller.

6. Place the Basic Repeater Controller board into the housing.
7. Attach the front panel with the two long screws and tighten the screws snugly.
8. Reattach the cables that were removed in step 5.

3.2.2 Using an M10, M120, or 8-Channel GM300 Transmit Radio

Any combination of the 8-channel GM300 radios and the 1-channel M10 and 2-channel M120 radios may be used to build a GR Series unidirectional repeater. Later versions of the GM300/GR300 repeater RSS support the programming of these limited capability radios. However, if one of these radios is used along with a 16-channel radio, then you will have to use the **Radio Mode** method to individually program the transmit and receive radios.

The first configuration uses one Radius 16-channel GM300 radio for the receive radio and one Radius 8-channel GM300, M10 or M120 radio for the transmit radio. An 8-channel Radius GM300, M10 or M120 radio may be used as the receive radio; refer to "Using an M10, M120, or 8-Channel GM300 Receive Radio" on page 3-10 for programming and setup details.

3.2.2.1 The Receive Radio

The receive radio is the same Radius 16-channel, low power (1-10 Watt) GM300 used in Section 3.2.1 on page 3-2. Mode 1 will be programmed to receive on 469.550 MHz with DPL031. The transmit frequency will be "BLANK."

Setting up the Equipment

1. Connect the RIB to the receive radio.
2. Turn on the power supply of the repeater.

Reading the Codeplug

1. From the RSS Main Menu, press **F3** to bring up the "GET / SAVE MENU." Make sure the RSS is in the "RADIO MODE." If "REPEATER MODE" is active, press **F6** to toggle to the "RADIO MODE."
2. Press **F2** to "READ CODEPLUG."
3. When the computer has finished reading the codeplug, press **F10** to "EXIT" to the "MAIN MENU."

Configuring the Accessory Connector

1. Press **F4** to bring up the "CHANGE/VIEW CODEPLUG MENU."
2. Press **F2** for "RADIO WIDE."

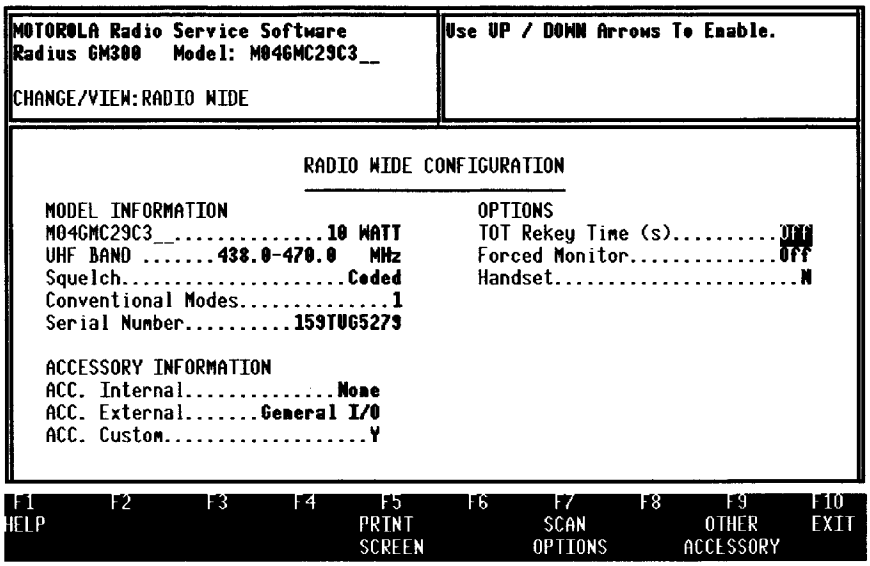


Figure 3-3. Change/View, Radio Wide

3. Press the **Tab** key to highlight the "ACC. External" area. Press the up-arrow key to scroll through the accessories until "General I/O" appears.
4. Press **F9**, "OTHER ACCESSORY," to view the "ACCESSORY CONNECTOR CONFIG" screen.
5. Press the **Tab** key until the "DESCRIPTION" column for "PIN#" 8 is highlighted. If the description is not "NULL 1", press the up-arrow key to set the "DESCRIPTION" to "NULL 1" and press **Enter**.
6. Press the **Tab** key until the "DESCRIPTION" for "PIN#" 14 is highlighted. If the description is not "PL/DPL & CSQ Det," press the up-down arrow key to set the "DESCRIPTION" to the "PL/DPL & CSQ Det" function with an "Output" data direction.
7. If the "Low" active level description is present, go to step 9. If the active level is "High," press the **Tab** key until the "High" is highlighted under the "ACT LEVEL" column.
8. Press the up-arrow to toggle to the "Low" condition and press **Enter**.
9. If you desire a "Power-Up Delay (sec)," press the **Tab** key until that area is highlighted. Select the desired delay with the up-down arrow key.
10. Press **F10** (EXIT), twice to return to the "CHANGE/VIEW CODEPLUG MENU."

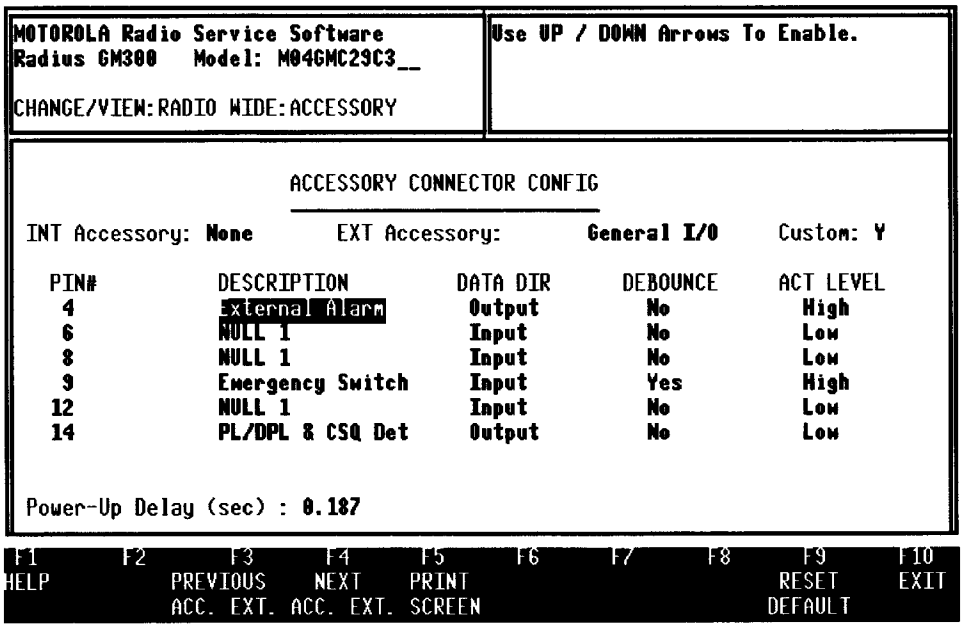


Figure 3-4. Change/View, Radio Wide, 16-Channel Receive Radio Accessory

Entering the Frequency

1. Press **F5** to move to the "CHANGE / VIEW: MODE" screen.
2. Press **Tab** to highlight the "Rx Frequency" area, key in the receive frequency ("469.5500"), and press **Enter**.
3. If a transmit frequency exists, key in "BLANK" (or "B") and press **Enter**.

Entering the DPL Code

1. Press the up-arrow key to scroll the "Rx Squelch, Type" to "DPL," and press **Enter**.
2. Key in the DPL code ("031") and press **Enter**.

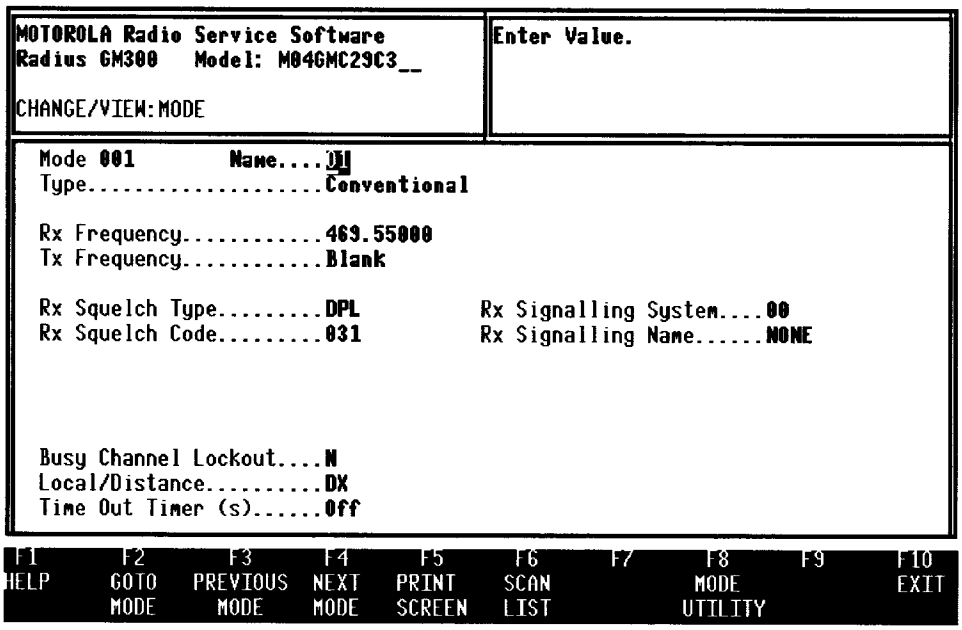


Figure 3-5. Change/View, 16-Channel Receive Radio Mode

Entering Local/Distance Operation of Receiver

1. Press **Tab** until "Local/Distance" is highlighted. If there are other repeater systems nearby that may cause interference ("IM hits"), you may wish to choose "Local" mode instead of "Distance" (DX) mode for the receive radio. Use the up-arrow key to choose the desired operation.
2. Press the **Esc** key to return to the "MAIN MENU."

Programming and Saving

1. Press the **F3** (GET SAVE) key to bring up the "GET/SAVE MENU."
2. Press the **F8** (PROGRAM CODEPLUG) key to program the radio and, when prompted to confirm that you want to program the radio, press **F2** (CONTINUE).
3. Press the **F7** (SAVE FILE) key to save the codeplug data to a disk file.
   If the radio has not been previously archived, you will be prompted to supply a "Customer ID:" such as "MillerConRX."
4. Press **F8** to save the data to the disk.

3.2.2.2 The Transmit Radio

The transmit radio is a Radius 25-40 Watt UHF M120. The operating frequency is 464.550 MHz with DPL031.

Setting Up the Equipment

1. Connect the RIB to the transmit radio.
2. Turn on the GR300 repeater's power supply (if not already on).

Reading the Codeplug

1. From the RSS Main Menu, press **F3** (GET SAVE) to bring up the "GET / SAVE MENU" screen (if you are not already at this screen).
2. Press **F2** to "READ CODEPLUG."
3. When the computer has finished reading the codeplug, press **F10** to "EXIT" to the "MAIN MENU."

Entering the Radio Frequencies

1. Press **F4** to bring up the "CHANGE/VIEW CODEPLUG MENU."
2. Press **F5** (MODE) to move to the "CHANGE / VIEW: MODE" screen.
3. Press **Tab** to highlight the "Rx Frequency" area.
4. Key in a receive frequency equal to the desired transmit frequency ("464.5500") and press **Enter.**
5. Key in the transmit frequency ("464.5500") and press **Enter.**

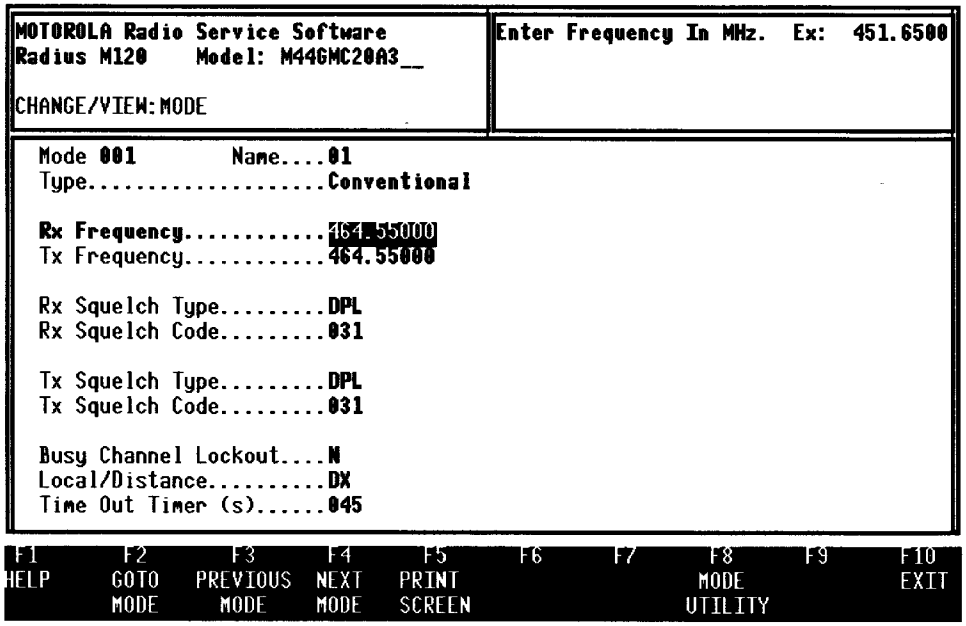


Figure 3-6. Change/View, M120 Transmit Radio Mode

Entering the DPL Codes

1. Press the up-arrow key to scroll the "Rx Squelch Type" to "DPL" and press **Enter.**
2. Key in the DPL code ("031") and press **Enter.**
3. Press the "up-arrow" key to scroll the "Tx Squelch Type" to "DPL" and press **Enter.**
4. Key in the DPL code ("031") and press **Enter.**

Entering Busy Channel Lockout

1. Press **Tab** until the "Busy Channel Lockout" is highlighted. If there are co-channel users that cannot be interfered with, you may wish to enable "Busy Channel Lockout." Use the up-arrow key to choose the desired operation. ("Y"means yes; "N" means no) and press **Enter.**

Setting the Time-Out-Timer

1. Key in "045" to set the "Time-Out Timer (s)" to 45 seconds.
2. Press **Esc** to return to the "MAIN MENU."

Programming and Saving

1. Press **F3** (GET/SAVE) to bring up the "GET / SAVE MENU."
2. Press **F8** to "PROGRAM CODEPLUG." You will be prompted to verify that you want to program the radio; press **F2** (CONTINUE) to confirm.
3. Press **F7** (SAVE FILE) to save the codeplug data to a disk file. If the radio has not been previously programmed, you will be prompted to supply a "Customer ID such as "MillerConTX."
4. Press **F8** to save the data to the disk.

3.2.2.3 DIP Switch (S2) Settings for the Basic Repeater Controller

The settings of the sections of Basic Repeater Controller DIP switch (S2) are as follows:

- ❑ The repeater is unidirectional: S2-1 OFF.
- ❑ The receive radio keys the transmit radio with the pin 14 COR signal; turn S2-2 ON and S2-3 OFF.
  (These settings are different from those used with two 16-channel radios.)
- ❑ No remote control is used: S2-4 OFF.
- ❑ The radio uses normal, muted audio from the receiver: S2-5 OFF and S2-6 ON.
- ❑ "COR" operation is used: S2-7 OFF.
- ❑ This is a unidirectional repeater: S2-8 OFF and S2-9 OFF.
- ❑ You desire a 1.5 second drop out delay: S2-10 ON and S2-11 OFF.
- ❑ The configuration is standard: S2-12 OFF.

After setting all of the positions, DIP switch S2 should be set as shown in Figure 3-7.

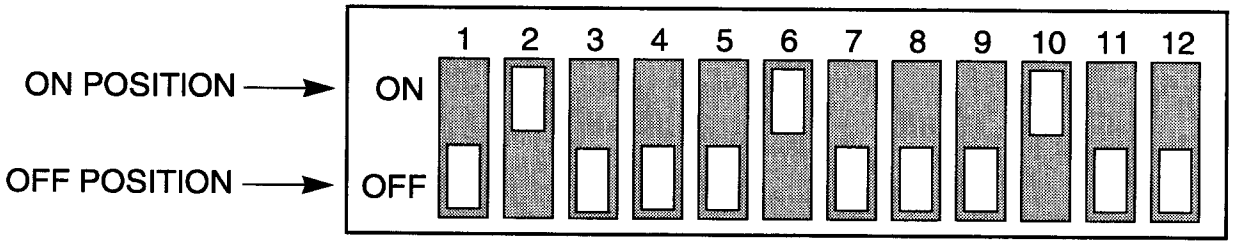


Figure 3-7. S2 Settings for Unidirectional Repeater Using an 8-Channel GM300, M10, or M120 Transmit Radio

3.2.3 Using an M10, M120, or 8-Channel GM300 Receive Radio

The following steps allow the use of one of these Radius radios as the receive radio for those cases in which no external accessory will be attached to the Basic Repeater Controller.

Setting Up the Equipment

1. Connect the RIB to the receive radio.
2. Turn on the GR300 repeater's power supply.

Reading the Codeplug

1. Press **F3** (GET SAVE), to bring up the "GET / SAVE MENU."
2. Press **F2** to "READ CODEPLUG."
3. When the computer has finished reading the codeplug, press **F10** (EXIT).

Entering the Radio Frequency

1. Press **F4** to bring up the "CHANGE/VIEW CODEPLUG MENU."
2. Press **F5** (MODE), to move to the "CHANGE / VIEW: MODE" screen.
3. Press **Tab** to highlight the "Rx Frequency" area.
4. Key in the receive frequency ("469.5500") and press **Enter**.
5. If a transmit frequency exists, key in "BLANK" (or "B") and press **Enter**.

Entering the DPL Code

1. Press the up-arrow key to scroll the "Rx Squelch Type" to "DPL" and press **Enter**.
2. Key in the DPL code ("031") and press **Enter**.
3. If there are other repeater systems nearby that may cause interference ("IM hits"), then you may wish to choose "Local" mode instead of "DX" mode for the receive radio. Use the up-arrow key to choose the desired operation.
4. Press **Esc** to return to the "MAIN MENU" screen.

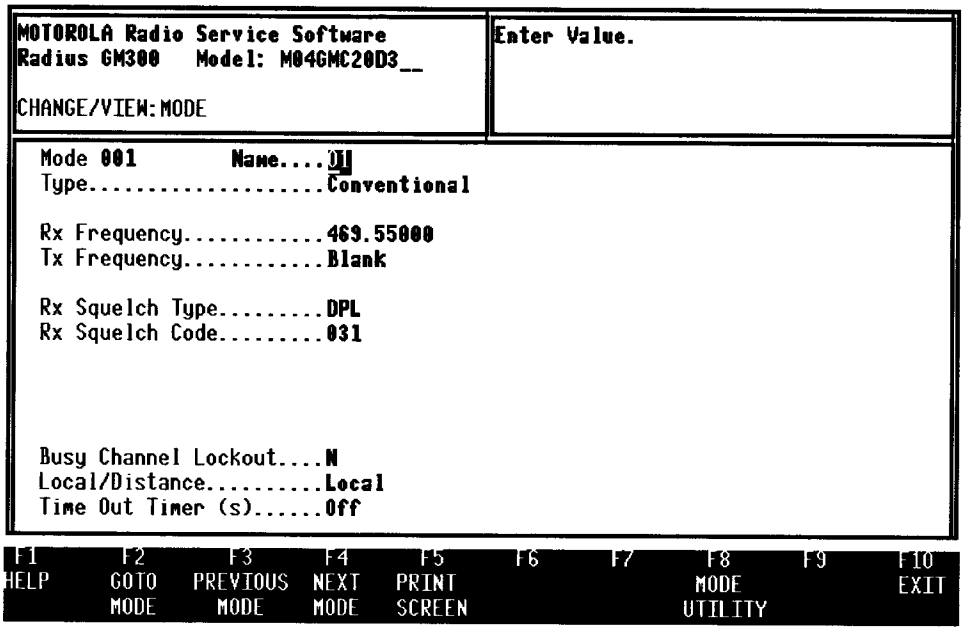


Figure 3-8. Change/View, 8-Channel Receive Radio Mode

Programming and Saving

1. Press **F3** (GET SAVE), to bring up the "GET / SAVE MENU."
2. Press **F8** (PROGRAM CODEPLUG), to program the radio. You will be prompted to verify that you want to program the radio; press **F2** (CONTINUE) to confirm.
3. Press the **F7** (SAVE FILE) key to save the codeplug data to a disk file.
   If the radio has not been previously archived, you will be prompted to supply a "Customer ID" such as "MillerConRX."
4. Press **F8** to save the data to the disk.

3.2.3.1 Modifying the 16-Conductor Cable on the Basic Repeater Controller

1. Locate the 16-conductor cable that will connect the Basic Repeater Controller to the transmit radio (not the one for the receive radio).
2. Remove the wire going to pin 8 at the transmit radio end of the cable using the tool supplied with the radio, or (carefully) cut the lead near the connector. (It may be necessary cut the tie wrap that binds the cable to the large strain relief tab of the connector to gain access to the lead. After removing (or cutting) the wire, secure the cable to the large tab with a new tie wrap.)

3.2.3.2 DIP Switch (S2) Settings for the Basic Repeater Controller

The settings of the sections of Basic Repeater Controller DIP switch (S2) are as follows:

- ❑ The repeater is unidirectional: S2-1 OFF.
- ❑ The receive radio keys the transmit radio with the pin 8 COR signal; turn S2-2 OFF and S2-3 ON.
- ❑ No remote control is used: S2-4 OFF.
- ❑ The radio uses normal, muted audio from the receiver: S2-5 OFF and S2-6 ON.
- ❑ "COR" operation is used: S2-7 OFF.
- ❑ This is a unidirectional repeater: S2-8 OFF and S2-9 OFF.
- ❑ You desire a 1.5 second drop out delay: S2-10 ON and S2-11 OFF.
- ❑ The configuration is standard: S2-12 OFF.

After setting all of the positions, DIP switch S2 should be set as shown in Figure 3-9

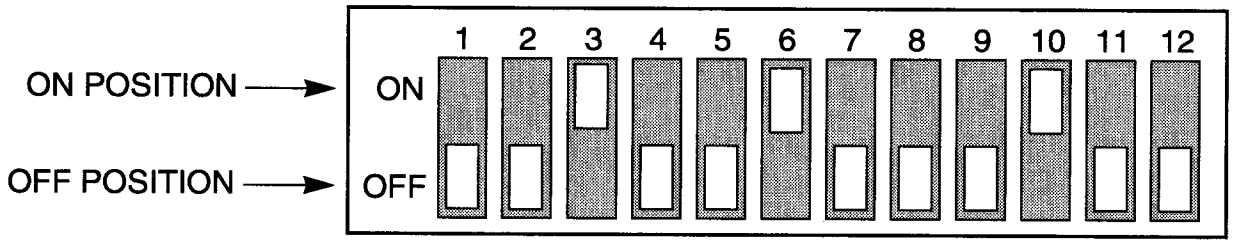


Figure 3-9. S2 Settings for Unidirectional Repeater Using an 8-Channel GM300, M10, or M120 Receive Radio

3.2.3.3 Additional Notes

Using 1, 2, or 8 Channel Mobiles

- ❑ The M10, M120, and 8-Channel GM300 can be used with the Basic Repeater Controller.
- ❑ RSS for the GM300/GR300 repeater must be version RO4.00.00 or later, use the "Generic" repeater definition. Both mobiles must be 16-channel or non-16-channel model radios for the RSS "Repeater" mode to function properly.
- ❑ The 8-position modular shorting jacks **must** be installed in the microphone jacks of both radios.
- ❑ Radios may not be operated in the "Monitor" mode.
- ❑ JU809 in the transmit radio must be in "Remote" position. (This is the default shipping position).
- ❑ The M10 microphone with LED (HMN3001) should not be used because it severely degrades repeater performance.

Using 16 Channel Mobiles

- ❑ The 16-channel GM300 radios will support ALL of the repeater controllers
- ❑ Both of the mobiles must be 16-channel GM300s for the RSS "Repeater" mode to function properly.
- ❑ In a bidirectional repeater, the receive radio must be a 16-channel GM300.

3.3 Cross Band, Bidirectional Repeater

The following section describes the programming information for the radios used to assemble a cross band, bi-directional repeater. Each radio will receive and transmit on a single frequency in its respective band of operation. The configuration uses one 16-channel Radius GM300 for the receive radio and one Radius M120 for the transmit radio.

NOTE: Due the limited capabilities of the accessory connector in the 8-channel GM300, M10 and M120 radios, the bi-directional repeater requires a 16-channel GM300 model for the receive radio.

Since we are using one 16-channel GM300 and one M120 the GM300/repeater RSS will not be usable in the "Repeater Mode." We are forced into using the normal **Radio Mode**.

Our example concerns a Police Department that desires to communicate with the local airport security during emergencies.

The two services are in different bands of operation as well as using radios for different channel spacings. The Police Department operates 25/30 kHz radios on 155.4300 MHz (highband VHF). The Airport Security operates low power, 12.5 kHz radios on 453.0625 MHz with inverted DPL code 431.

Since the bi-directional repeater requires a 16-channel radio for the receive radio, a low power (1-10 Watt), 16-channel UHF GM300 is chosen. A high power (45 Watt), VHF M120 is used as the transmit radio.

The Time-Out Timers of both of the radios will be set for 90 seconds. No signalling systems will be programmed into the radios. Normal receiver and transmitter audios will be used for both radios. "Busy Channel Lockout" mode will not be used in either radio. The VHF radio will use "DX" mode for the receiver; the UHF radio will operate in the "Local" mode to minimize interference ("IM hits").

3.3.1 The Receive Radio

Mode 1 of the receive radio will be programmed to receive and transmit on 453.0625 MHz. Inverted digital coded squelch "431" will be used. Turn ON the power supply of the GR Series repeater.

Setting Up the Equipment

1. Plug the RIB programming cable into the receive radio microphone jack.
2. Press **F3** (GET/SAVE), to bring up the "GET/SAVE MENU."

Reading the Codeplug

1. Press **F2** (READ CODEPLUG).
2. When the computer has finished reading the codeplug, press **F10** (EXIT) key.
3. Press **F4** (CHANGE VIEW), to bring up the "CHANGE/VIEW CODEPLUG MENU."
4. Press **F2** (RADIO WIDE).
5. Repeatedly press **Tab** until the "ACC. External" area is highlighted.
6. Press the up-arrow key to scroll through the accessories until "General I/O" appears. Your screen will appear similar to that of Figure 3-3.
7. Press **Enter**.

Configuring the Accessory Connector

1. Press **F9** (OTHER ACCESSORY), to view the "ACCESSORY CONNECTOR CONFIG" screen.
2. Repeatedly press the **Tab** key until the "DESCRIPTION" column for "PIN#" 8 is highlighted.

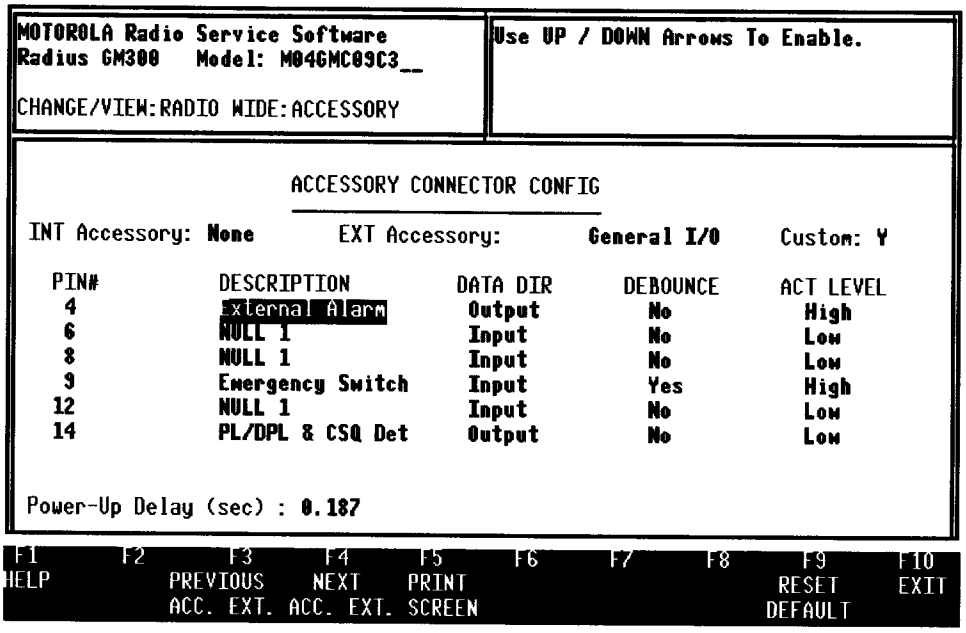


Figure 3-10. Change/View, Radio Wide, Crossband Receive Radio Accessory

3. Press the up-down arrow key to set a "NULL 1" (Input) function for Pin 8.
4. Press **Enter**.
5. Press **Tab** until the "DESCRIPTION" for "PIN#" 14 is highlighted.
6. Press the up-down arrow key to set the "DESCRIPTION" to the "PL/DPL & CSQ Det" function with an "Output" direction. If the "Low" active level description is present, proceed to Step 9. If the active level is "High," press **Tab** until the "High" is highlighted under the "ACT LEVEL" column.
7. Press the up-arrow to toggle to the "Low" condition.
8. Press **Enter**.
9. If a "Power-Up Delay (sec)" is desired, then press **Tab** until that area is highlighted. Select the desired delay with the "up-down" arrow key. We will use the default value of "0.187" seconds.
10. Press **F10** (EXIT), twice to return to the "CHANGE/VIEW CODEPLUG MENU."

Entering the Radio Frequencies

1. Press **F5** (MODE), to move to the "CHANGE/VIEW:MODE" screen.
2. Press **Tab** to highlight the "Rx Frequency" area. Key in the receive frequency ("453.0625").
3. Press **Enter**.
4. Key in the transmit frequency ("453.0625").
5. Press **Enter**.

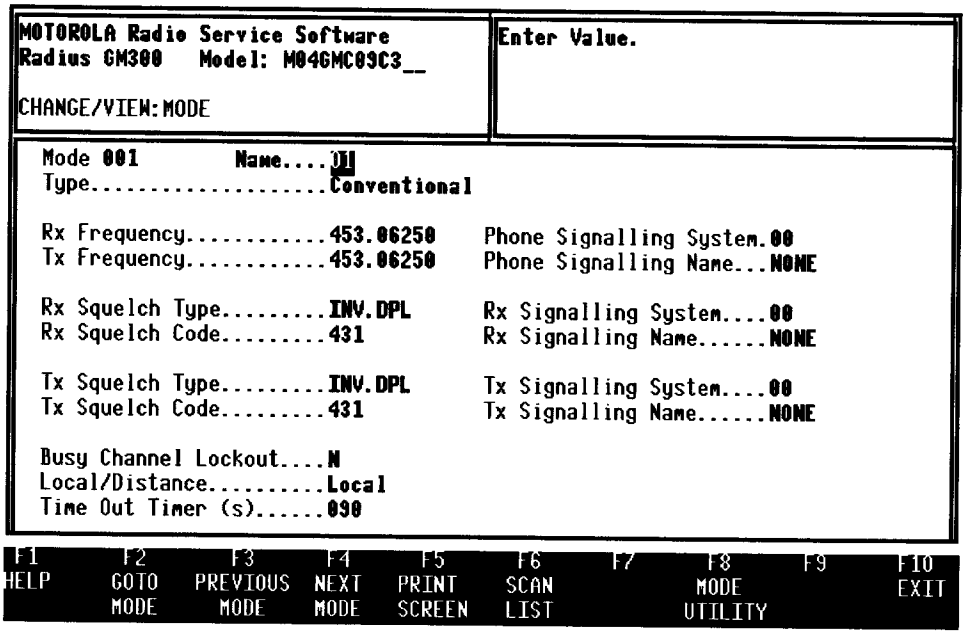


Figure 3-11. Change/View, Crossband Receive Radio Mode

Setting the Squelch Types

1. Press the up-down arrow key to set the "Rx Squelch Type" to "INV DPL."
2. Press **Enter**.
3. Key in the IDPL code number "431."
4. Press **Enter**.

5. Repeatedly press **Tab** until the "Tx Squelch Type" area is highlighted.
6. Press the up-down arrow key to set the "Tx Squelch Type" to "INV DPL."
7. Press **Enter**.
8. Key in the IDPL code number "431."
9. Press **Enter**.

Disabling Busy Channel Lockout

1. Repeatedly press **Tab** until the "Busy Channel Lockout" area is highlighted. If "N" (No) does not appear in the highlight, press the up arrow key to toggle to "N" (to disable the lockout function).
2. Press **Enter**.

Entering Local/Distance Operation

1. If "Local" does not appear in the "Local/Distance" highlight, use the up-arrow key to toggle to "Local."
2. Press **Enter**.

Setting the Time-Out Timer

1. Key in "090" to set the "Time-Out Timer (s)" to 90 seconds.

Programming and Saving

1. Press **F10** (EXIT), twice to return to the "MAIN MENU" screen. Verify that you have the "MAIN MENU" screen.
2. Press **F3** (GET SAVE), to bring up the "GET / SAVE MENU."
3. Press **F8** (PROGRAM CODEPLUG), to program the radio. You will be prompted to verify that you want to program the radio; press **F2** (CONTINUE), to confirm.
4. After the receive radio has been programmed, press **F7** (SAVE FILE), to save the codeplug data to a disk file. If the radio has not been previously programmed, you will be prompted to "CONTINUE" by pressing the **F2** key. You will be asked to supply a "Customer ID:" such as "AirportSec."
5. Press **F8** to save the data to the disk.

3.3.2 The Transmit Radio

The transmit radio is a 45 Watt, VHF M120 that operates on 155.4300 MHz in the Carrier Squelch mode.

Setting Up the Equipment

1. Connect the RIB to the transmit radio.

Reading the Codeplug

1. If you are in the "MAIN MENU", press **F3** (GET SAVE), to bring up the "GET / SAVE MENU."
2. Press **F2** (READ CODEPLUG).
3. When the computer has finished reading the codeplug, press **F10** (EXIT).

Entering the Radio Frequencies

1. Press **F4** (CHANGE VIEW), to bring up the "CHANGE/VIEW CODEPLUG MENU."
2. Press **F5** (MODE), to move to the "CHANGE/VIEW:MODE" screen.
3. Press **Tab** to highlight the "Rx Frequency" area. Key in the receive frequency ("155.4300").
4. Press **Enter**.
5. Key in the transmit frequency ("155.4300").
6. Press **Enter**.

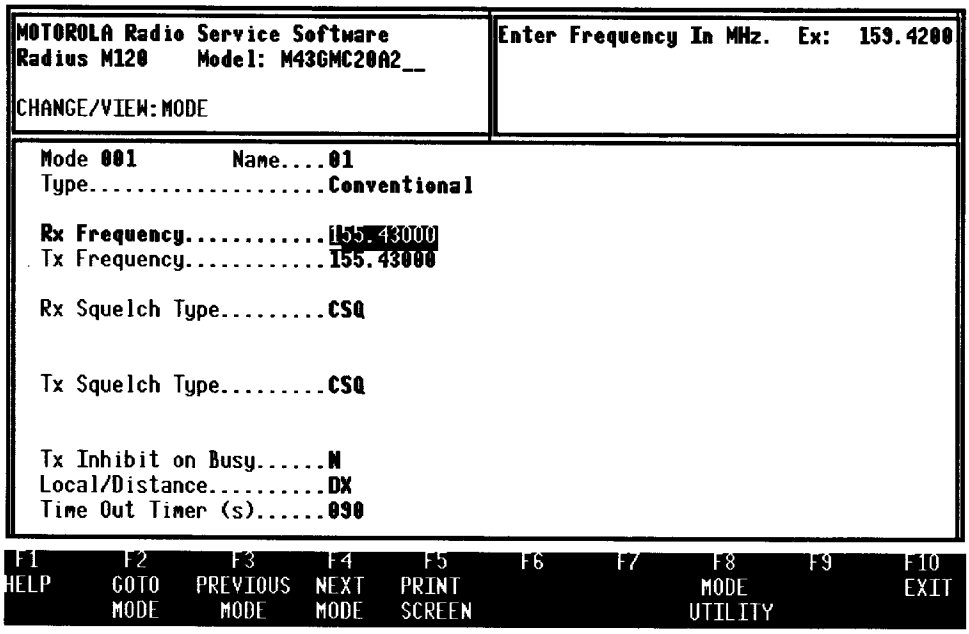


Figure 3-12. Change View, Crossband Transmit Radio Mode

Setting Squelch Types to CSQ

1. If a coded squelch mode was previously programmed into the radio, press the up arrow key to scroll the "Rx Squelch Type" to "CSQ."
2. Press **Enter**.
3. If a coded squelch mode was also previously programmed into the "Tx Squelch Type" for the radio, press the "up-arrow" key to scroll to "CSQ."
4. Press **Enter**.

Disabling Busy Channel Lockout

1. If "N" (No) does not appear in the "Busy Channel Lockout" highlight, press the up arrow key to toggle to "N" (to disable the lockout function).
2. Press **Enter**.

Entering Local/Distance Operation of Receiver

1. If "DX" does not appear in the "Local/Distance" highlight, use the up arrow key to toggle to "DX."
2. Press **Enter**.

Setting the Time-Out Timer

1. Key in "090" to set the "Time-Out Timer (s)" to 90 seconds.
2. Press **F10** (EXIT), twice to return to the "MAIN MENU" screen. Verify that you have the "MAIN MENU."

Programming and Saving

1. Press **F3** (GET SAVE), to bring up the "GET/SAVE MENU."
2. Press **F8** (PROGRAM CODEPLUG), to program the radio. At the prompt, press **F2** (CONTINUE), to confirm that you do want to program the radio.
3. After the transmit radio has been programmed, press **F7** (SAVE FILE), to save the codeplug data to a disk file. If the radio has not been previously programmed, you will be prompted to "CONTINUE" by pressing the **F2** key. You will be asked to supply a "Customer ID:" such as "NorthfieldPD."
4. Press **F8** to save the data to the disk.

3.3.3 DIP Switch (S2) Settings for the Basic Repeater Controller

- ❑ The repeater is bi-directional: S2-1 ON.
- ❑ The receive radio keys the transmit radio with the pin 14 "COR" signal: S2-2 ON and S2-3 OFF.
- ❑ No remote control is used: S2-4 OFF.
- ❑ The radios use normal, muted audios from the receivers: S2-5 OFF, S2-6 ON, S2-8 ON and S2-9 OFF.
- ❑ "COR" operation is used: S2-7 OFF.
- ❑ The bi-directional repeater requires the shortest dropout delay: S2-10 and S2-11 ON.
- ❑ Your configuration is standard: S2-12 OFF.

After setting all of the positions, DIP switch S2 should look like Figure 3-13.

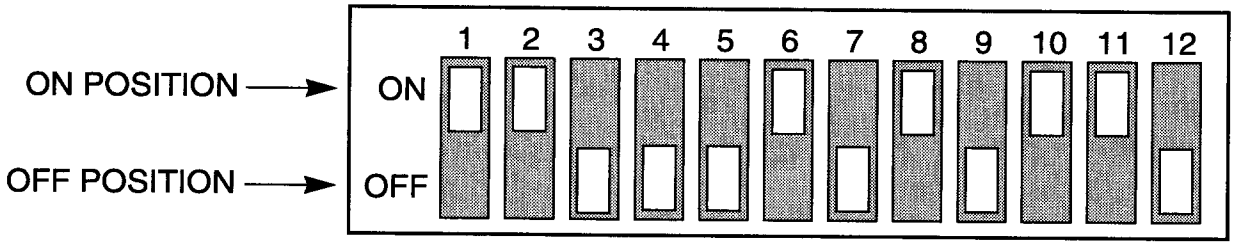


Figure 3-13. S2 Settings for Bidirectional Repeater

(Page 3-18 is blank)

4 i50R Controller Programming

4.1 Overview

This section contains DIP switch programming information and examples for the i50R Basic Interconnect Controller.

4.2 Programming the i50R Controller

4.2.1 DIP Switch Settings for SwA and SwB

Down is ON for all switches. SwA is the leftmost switch bank consisting of 8 switches that control the phone patch operations. SwB is the right switch bank consisting of 8 switches that control the repeater interface functions. Switches are numbered left to right.

Table 4-1 and Table 4-2 show the functions of the SwA and SwB switches for the i50R controller.

Table 4-1. SwA DIP Switch Settings for the i50R Controller

SwA Section	Function
1	**Ring Detect Defeat:** OFF = Land-line to mobile ring signalling allowed ON = Land-line to mobile ring signalling not allowed
2	**Phone Line Busy Detect (when mobile tries to access phone patch):** OFF = Mobile access allowed any time ON = Mobile access denied and busy signal returned when line in use (low voltage on line)
3	**Initiate Ring Signalling to Mobile:** OFF = After 1st ring ON = After 4th ring
4, 5	**Access Timer:** **SWA4** **SWA5** No Timer OFF OFF 3-Minute Timer ON or OFF ON 10-Minute Timer ON OFF
6	**Long Distance Inhibit (1 or 0 leading digit):** OFF = 1 or 0 leading digit allowed ON = 1 or 0 leading digit not allowed
7	**Telephone Line Signalling:** OFF = Rotary dial (pulse dialing) ON = DTMF (Touch Code dialing)
8	**2-Digit Connect and Release Command** OFF = "#*" to access, "##" to release ON = "*" to access, "#" to release

Table 4-2. SwB DIP Switch Settings for the i50R Controller

SwB Section	Function
1	**Dropout Delay Enable (transmitter only):** OFF = No repeater dropout delay ON = Enable repeater dropout delay
2	**Dropout Delay Length:** OFF = 3-second dropout time ON = 1.5-second dropout time
3	**Audio Output Select:** OFF = Audio to mic input of transmit radio (pin 2 of J3) ON = Audio to flat input of transmit radio (pin 5 of J3) Used when signalling features contained in the "RapidCall" package are going to be transmitted through the repeater to the field radios. All signalling will be generated by the field radios and the transmit radio of the repeater must be programmed to transmit "CSQ." JU551 in the receive radio must be in the "A" position.
4	**Transmit Audio from Receive Radio to Transmit Radio Mute:** OFF = Unmuted at all times Depends on the receive radio squelch functions for muting (JU551 in the GM300 mobile radio in the "B" position) ON = Muted when not receiving "COR"from receive radio Used when audio from the receive radio is flat (not deemphasized and unmuted [discriminator] JU551 in the GM300 mobile radio in the "A" position)
5	**Remote Setup/Knockdown Enable (from J5-4 [RX] or from J4-4 [ACC] external alarm outputs):** OFF = Disable remote setup/knockdown ON = Enable remote setup/knockdown
6	**Patched Mobile Mute:** OFF = Unmute repeat audio to the transmit radio while receiving a mobile, allowing other mobiles to hear both sides of the conversation ON = Mute repeater audio to the transmit radio while receiving a mobile and the patch is accessed. This prevents other mobiles from hearing the mobile side of the conversation, providing a measure of privacy.
7	**PTT Source:** OFF = I/O pin 14 of J5 (from receive radio to transmit radio) ON = I/O pin 8 of J5 (from receive radio to transmit radio)
8	**Power-up Setup/Knockdown Condition:** OFF = Repeater powers up in "knocked down" state ON = Repeater powers up in "setup" state.

4.2.2 Additional Jumpers

The following jumpers and controls are accessible by removing the i50R module cover. They are preset for normal installations and access is not normally required. Special installation requirements may necessitate adjustment.

JU1: Off hook voltage threshold (normally OUT)
The Threshold circuit output is used by the processor to determine that the telephone is busy (being used by a line sharing telephone). The shunt is normally out, allowing for the worst case.
IN (shunt in) = 48 V idle telephone line voltage
OUT (shunt parked) = 24 volt idle telephone line voltage

JU2: Telephone line load (normally OUT)
This jumper is in only for testing levels and **must** be out for normal operation.
IN (shunt in) = 620 ohm telephone line load in
OUT (shunt parked) = no load on telephone line

JU3: Watchdog timer defeat (normally OUT)
This jumper is in only during testing to defeat the watchdog timer when halting the processor during emulation. No shunt or header pins are provided.

JU4/JU5: Alert inhibit source (normally in JU4 position)
When the telephone line rings, the processor will not key the transmit radio and send ring signalling to the field radios if the alert inhibit source indicates that the channel is in use. This input normally comes from pin 8 of the ACC connector of the transmit radio that has been programmed to receive on the same frequency that it transmits. Certain cases may require that the "COR" signal from the receive radio be used instead. In this case, JU5 should be used. Note that the repeater must be enabled and set up in order for "COR" to be operational.
JU4 IN (shunt in JU4 position) = alert inhibit taken from J3 pin 8 of the transmit radio.
JU5 IN (shunt in JU5 position) = alert inhibit taken from receive radio COR as determined by SwB4.

JU6: Ring sensitivity (normally OUT)
The ring voltage on the telephone line is normally greater than 40 V RMS (90 V is generated by the central office). In certain cases of very long lines, or several devices with ringer loads on a telephone line, the ring voltage may be lower than normal. JU6 is normally out, but, if pulse dialing equipment causes ring falsing (possible on a highly inductive line that oscillates when pulsed), the ring voltage threshold can be reduced by installing JU6.
IN (shunt in) = low ring voltage
OUT (shunt parked) = normal ring voltage

JU21: ("1" or "2"): Repeater audio phase reversal
For use with digital signalling where "inverted code" is desired. Position 1 provides normal phase of flat transmit audio path. Position 2 provides phase reversal.

4.3 Programming Examples

4.3.1 i50R Repeater with 16-Channel GM300 Radios

The following section describes the programming information for the radios used to assemble a repeater with the i50R repeater controller. The configuration uses two 16-channel, UHF Radius GM300 radios to allow using the repeater mode of programming with the Radius RSS. A low power, 1 to 10 Watt, radio is used for the receive radio and a 25 Watt radio for the transmit radio.

A weekend sporting event requires the temporary use of a repeater with basic telephone interconnect capability. The frequencies for the repeater are receive on 469.550 MHz and transmit on 464.550 MHz. Tone coded squelch, TPL, of 114.8 (2A) will be used. The Time-Out-Timer of the transmit radio will be set for 240 seconds (4 minutes). The area to be covered is not great but the RF interference potential is significant; "local" mode will be needed. No signalling systems will be programmed into the radios. Normal receiver and transmitter audios will be used for both radios.

The repeater drop out delay (or hang time) will be set at 3.0 seconds. No remote setup/knockdown is needed but the repeater will have to power-up in the setup condition.

The interconnect system will be setup with a telephone deskset in parallel with the i50R controller to allow a local dispatcher to answer the telephone. If the dispatcher is not present, the mobiles and portables (field radios) will be signalled after the 4th ring on the telephone line. If the line is busy, the field radios will be denied access to the line. The event does not want the telephone line tied up excessively or long distance calls made by the field radios. The 3 minute (Call Limit) Timer will be used. DTMF dialing is required. To reduce the chance of voice falsing, the access code will be "#*" and the deaccess code will then be "##." Both sides of the field radio to telephone line conversation will be heard by all of the field radios.

4.3.1.1 The Repeater Radios

Setting Up the Equipment

1. Connect the power supply of the GR Series repeater to an appropriate ac outlet.
2. Turn on the power supply.

Reading the Repeater

1. From the "MAIN MENU," press **F3** (GET/SAVE Codeplug Data).
2. Press **F6** (CHANGE to Repeater mode). **F2** will be redefined as "READ Repeater."
3. Press **F2** (READ Repeater). A prompt will appear on the screen: "Connect the programming cable to the Repeater Option Board, or press **F10** for a Generic Repeater." The i50R controller is considered a "Generic" repeater.
4. Press **F10** (ABORT).

Reading the Transmit Radio

1. A prompt will appear to tell you to "Connect the programming cable to the TRANSMIT Radio Connector, or press **F10** to skip it." Plug the RIB programming cable into the microphone jack on the transmit radio.
2. Press **F2** (CONTINUE), to read the codeplug of the transmit radio.
3. After the radio is read, a highlight may appear to advise you that any custom programming will be overwritten. Press **F2** (CONTINUE).
4. Another highlighted area may appear to advise that the radio was previously programmed in Radio mode. Press **F2** (CONTINUE).

Reading the Receive Radio

1. After the transmit radio has been read, a prompt will appear to tell you to "Connect the programming cable to the RECEIVE Radio Connector, or press **F10** to skip it." Move the RIB programming cable to the microphone jack on the receive radio.
2. Press **F2** (CONTINUE), to read the codeplug of the receive radio.
3. After the radio is read, the highlighted areas detailed for the transmit radio may appear for the receive radio. For each highlighted area, press **F2** (CONTINUE).
4. A highlighted area will appear telling you "This repeater was not identified. For standard accessories, set repeater type on the MODE screen."
5. Press **F2** (CONTINUE).

Entering the Radio Frequencies

1. Press **Esc** to return to the "MAIN MENU."
2. Press **F4** (CHANGE VIEW).
3. Press **F5** (MODE).
4. Key in the receive frequency in MHz ("469.5500") and press **Enter**.
5. Key in the transmit frequency in MHz ("464.5500") and press **Enter**.
6. Press the up-arrow key to scroll the "Rx Squelch Type" to "TPL" and press **Enter**.

7. Key in the TPL code "2A" or the frequency, "114.8" and press **Enter**.
8. Press the up-arrow key to scroll the "Tx Squelch Type" to "TPL" and press **Enter**.
9. Key in the TPL code "2A" or the frequency, "114.8" and press **Enter**.

Setting Tx Inhibit on Busy

1. Use the up-arrow key to scroll "Tx Inhibit on Busy" to "N" (No).
2. Press **Enter**.

Setting Local/Distance

1. Use the up-arrow key to scroll "Local/Distance" to "Local."
2. Press **Enter**.

Setting the Time-Out Timer

1. Key in the desired "Time-Out Timer (s)" as "240" seconds.
2. Press **Enter**.

Programming and Saving

1. Use the up-arrow key to scroll the "Repeater Type" to "i50R Phone Patch."

You should see the screen in Figure 4-1.

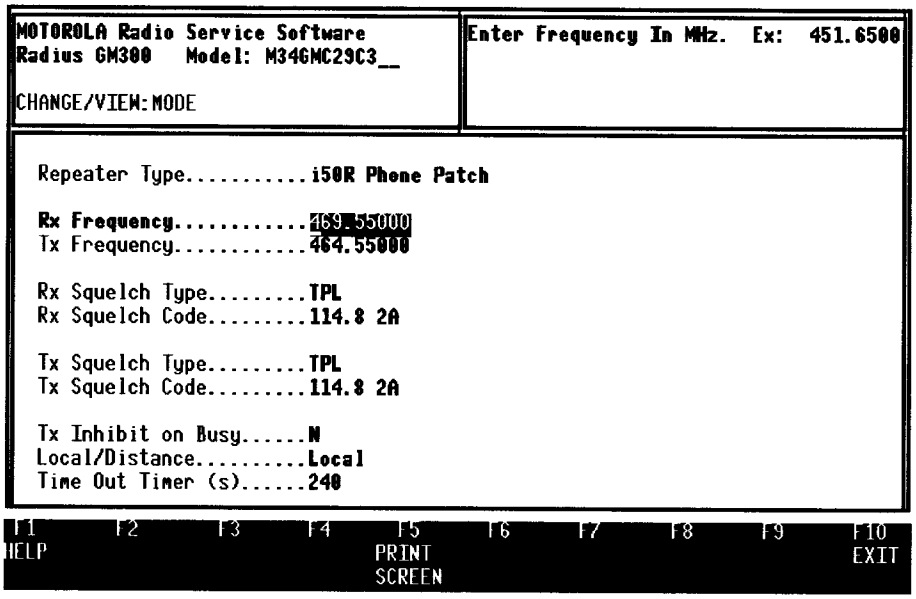


Figure 4-1. Change/View Screen, Repeater Mode

2. Press **F10** (EXIT). A highlight will appear stating "This appears to be an i50R repeater. Ready to correct accessory pins."
3. Press **F2** (CONTINUE).
4. Press **F10** (EXIT), to return to the 'MAIN MENU."
5. Press **F3** (GET/SAVE Codeplug Data).

6. Press **F8** (PROGRAM Repeater). A message will appear that states "Skipping Repeater Option Board."
7. Press **F2** (CONTINUE).
8. A message will direct you to plug the programming cable into the transmit radio.
9. Press **F2** (CONTINUE).
10. After the transmit radio is programmed, a message will direct to plug the programming cable into the receive radio.
11. Press **F2** (CONTINUE).
12. Press **F7**, "SAVE Archive File" to save all of the information to a disk file. If the repeater has not been previously programmed, you will be prompted to "CONTINUE" by pressing **F2** (CONTINUE). You will be asked for a "Customer ID:" such as "ProBeachVB_94."
13. Press **F8** (SAVE), to save the data to an archive file.

4.3.1.2 i50R Controller DIP Switches (SwA and SwB) Settings

The sections of DIP Switch SwA determine the phone patch operation.

- ❑ Telephone line to mobile calling is allowed: SwA-1 OFF.
- ❑ No field radio access to the telephone line if the line is busy: SwA-2 ON.
- ❑ Signal the field units after 4 rings to allow the dispatcher time to manually answer the telephone line: SwA-3 ON.
- ❑ The timer for a field radio to telephone line call is set to 3 minutes: SwA-4 OFF or ON, SwA-5 ON.
- ❑ No long distance calls are allowed: SwA-6 ON.
- ❑ DTMF dialing of the telephone line will be used: SwA-7 ON.
- ❑ The longer access and deaccess codes are desired to reduce falsing: SwA-8 OFF.

After setting all of the positions, DIP switch SwA should look like Figure 4-2.

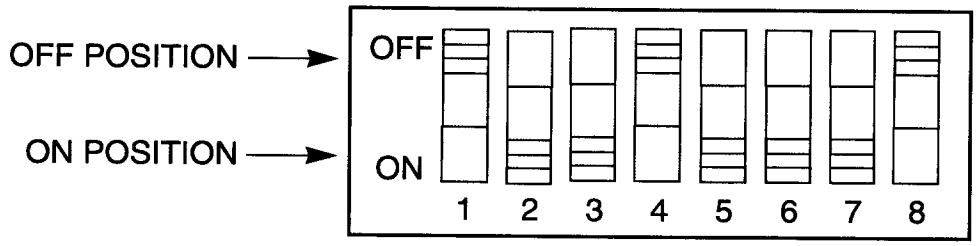


Figure 4-2. SwA Settings

The sections of DIP switch SwB determine the repeater functions.

- ❑ Enable drop out delay generator: SwB-1 ON.
- ❑ A 3.0 second transmitter drop out delay is desired: SwB-2 OFF.
- ❑ Normal, receiver audio: SwB-3 OFF.
- ❑ i50R will not gate the receive audio: SwB-4 OFF.
- ❑ No remote control: SwB-5 OFF.
- ❑ Mobile to phone audio will be repeated: SwB-6 OFF.
- ❑ Pin 8 COR signal: SwB-7 ON.
- ❑ The repeater is to be setup upon application of ac power: SwB-8 ON.

After setting all of the positions, DIP switch SwB should look like Figure 4-3:

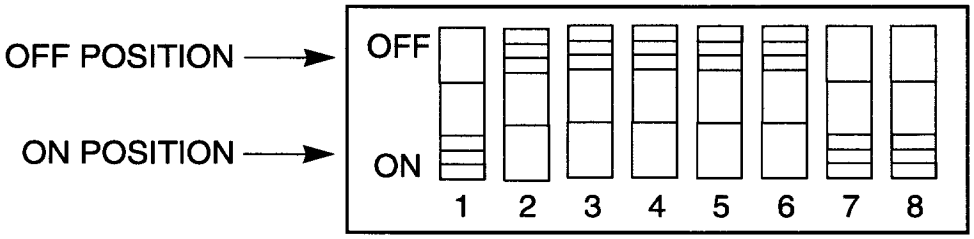


Figure 4-3. SwB Settings

4.3.2 i50R Repeater with Non-16-Channel Radios

The Repeater Mode of the RSS requires 16-channel GM300 radios. If non 16-channel model radios are used, you must program them separately using the Radio Mode. The following section describes the programming information for using other than 16-channel radios to assemble a repeater with the i50R repeater controller.

These models include the 8-channel GM300, the 2-channel M120 and the 1-channel M10 models of Radius radios.

This configuration uses one 8-channel, 1 to 10 Watt, UHF Radius GM300 as the receive radio and one 40 Watt, UHF Radius M120 as the transmit radio.

The scenario is the same weekend sporting event that requires the temporary use of a repeater with basic telephone interconnect capability. All of the repeater and the i50R parameters are the same as the 16-channel Radius GM300 example above.

4.3.2.1 The Transmit Radio

Setting Up the Equipment

1. Connect the power supply of the GR Series repeater to an appropriate ac outlet.
2. Turn on the power supply.

Reading the Transmit Radio

1. Plug the RIB programming cable into the microphone jack on the transmit radio.
2. From the "MAIN MENU," press **F3** (GET/SAVE Codeplug Data).

3. Press **F2** (READ Radio).
4. After the radio is read, press **Esc** to return to the "MAIN MENU."
5. Press **F4** (CHANGE VIEW).
6. Press **F5** (MODE).

Entering the Transmit Frequency

1. Press **Tab** to highlight "Rx Frequency." Key in the receive frequency (equal to the transmit frequency of the repeater) in MHz ("464.5500"). Press **Enter**.
2. Key in the transmit frequency in MHz ("464.5500") and press **Enter**.

Entering the Squelch Type

1. Press the up-arrow key to scroll the "Rx Squelch Type" to "TPL."
2. Press **Enter**.

Entering the TPL Code

1. Key in the TPL code "2A" or the frequency, "114.8."
2. Press **Enter**.

Setting Tx Inhibit on Busy

1. Press **Tab** until the "Tx Inhibit on Busy" area is highlighted.
2. Use the up-arrow key to scroll to "N" (No).
3. Press **Enter**.

Setting Local/Distance

1. Use the up-arrow key to scroll "Local/Distance" to "Local."
2. Press **Enter**.

Setting the Time Out Timer

1. Key in the desired "Time Out Timer (s)" as "240" seconds and press **Enter**.

You should see the screen in Figure 4-4.

Programming and Saving

1. Press **Esc** to return to the "MAIN MENU."
2. Press **F3** (GET/SAVE Codeplug Data).
3. Press **F8** (PROGRAM Codeplug). You will be prompted to verify that you want to program the radio; press **F2** (CONTINUE).
4. Press **F7** (SAVE Archive File) to save all of the information to a disk file. If the repeater has not been previously programmed, you will be prompted to "CONTINUE" by pressing **F2** (CONTINUE). You will be asked for a "Customer ID:" such as "ProBeachVB_Tx."
5. Press **F8** (SAVE) to save the data to an archive file.

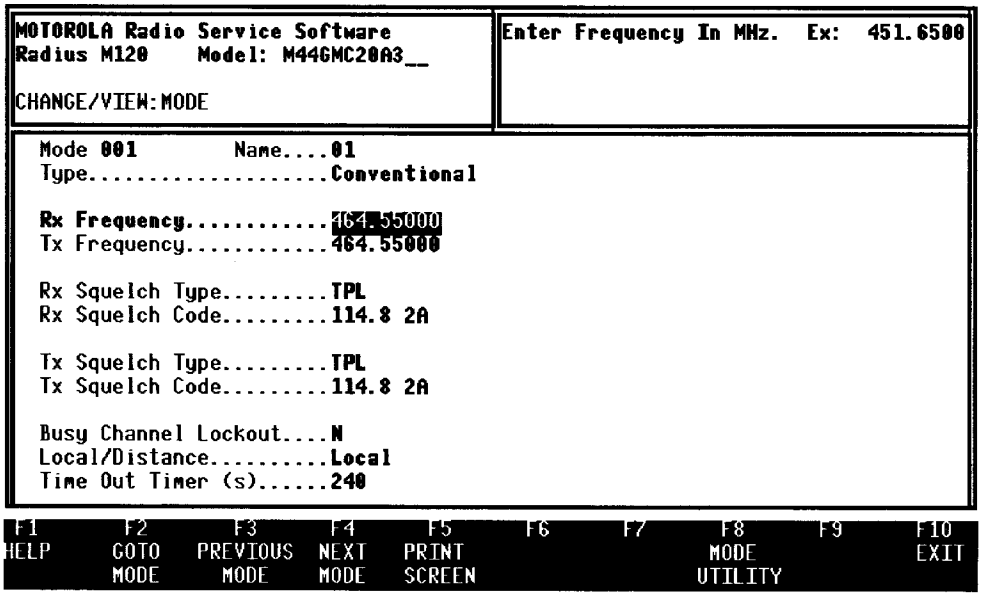


Figure 4-4. Change/View Screen, Transmit Radio Mode

4.3.2.2 The Receive Radio

Reading the Receive Radio

1. Move the RIB programming cable to the microphone jack on the receive radio.
2. Press **F2** (READ Radio).
3. After the radio is read, press **Esc** to return to the "MAIN MENU."

Entering the Receive Frequency

1. Press **F4** (CHANGE VIEW).
2. Press **F5** (MODE).
3. Press **Tab** to highlight "Rx Frequency."
4. Key in the receive frequency MHz ("469.5500").
5. Press **Enter**.
6. Key in a blank transmit frequency in MHz ("BLANK" or just "B").
7. Press **Enter**.

Entering the Squelch Type

1. Press the up-arrow key to scroll the "Rx Squelch Type" to "TPL."
2. Press **Enter**.

Entering the TPL Code."

1. Key in the TPL code "2A" or the frequency, "114.8."
2. Press **Enter**.

Setting Local/Distance

1. Press **Tab** to move to the "Local/Distance" highlight.
2. Use the up-arrow key to scroll to "Local."
3. Press **Enter**.

You should see the screen in Figure 4-5.

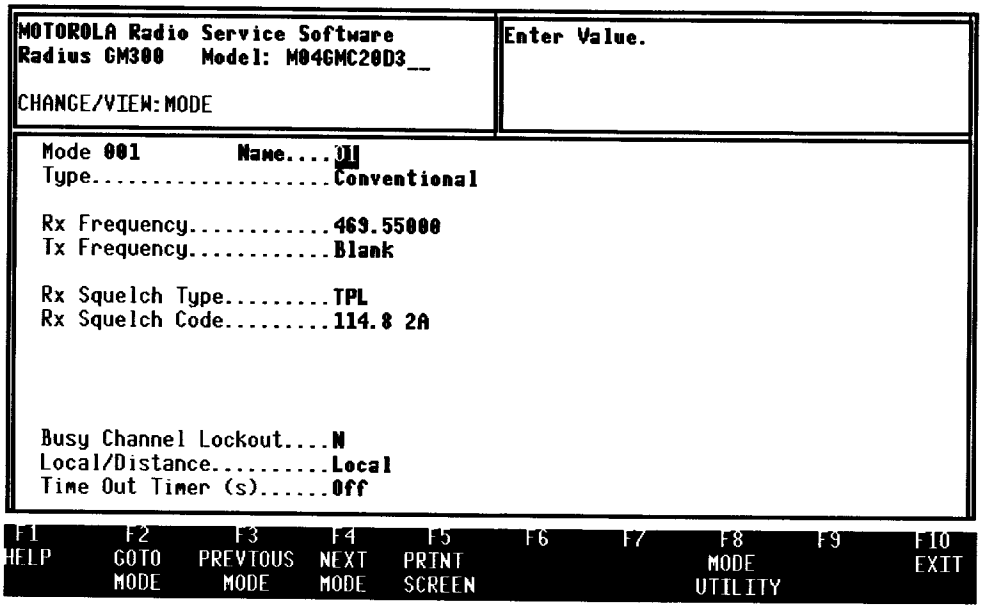


Figure 4-5. Change/View Screen, Receive Radio Mode

4

Programming and Saving

1. Press **Esc** to return to the "MAIN MENU."
2. Press **F3** (GET/SAVE Codeplug Data).
3. Press **F8** (PROGRAM Radio). You will be prompted to verify that you want to program the radio; press **F2** (CONTINUE).
4. Press **F7** (SAVE Archive File) to save all of the information to a disk file. If the repeater has not been previously programmed, you will be prompted to "CONTINUE" by pressing **F2** (CONTINUE). You will be asked for a "Customer ID:" such as "ProBeachVB_Rx."
5. Press **F8** (SAVE), to save the data to an archive file.

4.3.2.3 i50R Controller DIP Switches (SwA and SwB) Settings

The sections of both DIP switches SwA and SwB are set as shown in the previous example for the 16-channel Radius GM300 radios. Please refer to page 4-6 and page 4-7 for the discussions and diagrams of the proper settings of the DIP switch sections.

NOTE: Make sure to install the shorting plugs into the microphone connectors of both radios. Neither radio may be operated in the "Monitor" or "Volume Set" mode (the yellow "Mon" LED should NOT be lighted). If these instructions are not followed, the result will be in a carrier squelch operated repeater.

5 ZR340 Programming

5.1 Overview

This section contains information and procedures that allow the technician to program the ZR340.

You can program the ZR340 in two ways:

- ❑ DTMF over the radio channel ("over-the-air") from a radio, base station, or hand-held radio
- ❑ DTMF from a remote telephone, connected through the telephone company central office or a PBX to the **Phone** jack on the rear of the ZR340

5.2 Programming Over-The Air

The ZR340 may be programmed using a radio equipped with a DTMF keypad. While programming the unit, it is helpful, but not required, to have a secondary receiver (scanner, or monitor receiver) tuned to the repeater output frequency. This enables you to hear the prompt tones generated by the ZR340. The access code is user programmable (refer to "Program Access Code (90#) [See Also: "Access Code (01#)"]" on page 5-9).

The following paragraphs describe how to enter and exit the programming mode and how to enter a command.

5.2.1 Entering a Command

To execute a program command, a DTMF number is entered followed by the "#" key. Each time a command is completed, the ZR340 responds with five "go ahead" beeps indicating that it is waiting for another command. If an error is detected while programming, the ZR340 sends an error "bedo" signal over the transmit audio.

NOTE: While entering a command, the '' key functions as a "clear entry" key.*

All numbers can be entered with or without leading zeros except when programming the Morse code identification (CWID). For example, a 1 may be entered as 0001#, 001#, 01#, or 1#.

Some commands require additional numbers, as in the case of the program mode access code (refer to explanation below). These commands will send two "further information needed" beeps while programming. Although you do not have to wait for each prompt tone before entering the next command (because all commands are internally buffered), we recommend that you listen for the corresponding tones.

NOTE: At any time while programming the unit, if no DTMF tones are detected during a 60-second period, the ZR340 will exit program mode automatically.

5.2.2 Program Mode Access Code

The program mode access code must be entered before programming can take place. The default program mode access code is 12123.

5.2.3 Entering the Program Mode

To enter the program mode:

1. Key the radio and send the five digit DTMF program mode access code (the default is 12123).
2. Unkey the radio and listen for five beeps indicating that you have accessed the programming mode.

IMPORTANT: Each tone in the access code must be sent within one second of the preceding tone, or the access code will not be accepted.

5.2.4 Exiting the Program Mode

To exit the program mode:

1. Enter 99#.
2. Listen for a ringing prompt tone, which confirms that you have exited the programming mode.

NOTE: At any time while programming the unit, if no DTMF key is pressed during a period of 60 seconds, the ZR340 will exit program mode automatically.

5.2.5 DTMF Command Descriptions

A description of the command codes for the ZR340 are given in the following paragraphs. The codes that initiate these command codes follow the description. These codes are be entered into the ZR340 via the DTMF keypad on a radio or a DTMF telephone calling the ZR340.

5.2.5.1 System Commands

Access Code (01#)

This command sets a 1-9 digit (including "*") access code for radio users to access the ZR340.

Example:

01# *987# Set *987 as the access code.

Deaccess Code (02#)

This command sets a 1-9 digit (including "#") deaccess code for radio users to deaccess the ZR340. To enter the DTMF # in the sequence, enter it as a '*' because '#' is used to terminate the command. When the ZR340 writes the string to the EEPROM, it converts all of the '*' entries to '#' entries.

Example:

02# *77# Set #77 as the deaccess code.

Toll Restrict (03#)
[See also: "Toll Restrict Digits 1 and 2 (15#, 16#)"]

The toll restrict code operates in the same way as the access code, but allows the user to bypass all toll restrictions.

The toll restrict code can consist of the digits 0-9 and '*' and cannot exceed eight digits. The default is 99.

03# 88 * Set 88* as the access code required to bypass toll restrictions.

DTMF Dial (04#) / Pulse Dial (05#)

These commands set the dialing mode for the ZR340.

Examples:

04# Set to DTMF dial mode **(default).**

05# Set to pulse dial mode.

Ringing Interval (06#, 07#, 08#)

These commands designate how many times the ZR340 allows the phone to ring before answering and ring the mobile.

Examples:

06# Wait one ring **(default)**.

07# Wait five rings.

08# Wait ten rings.

DTMF Timeout Time (10#)

This command sets the number of seconds the ZR340 should wait between DTMF digits from the mobile, when dialing a phone number, before dropping out of digit regeneration. It can be from 0 to 60 seconds. The default is 3 seconds.

Example:

10# 11# Set DTMF timeout time to 11 seconds.

Hook Flash (11#, 12#)

The mobile may "hook flash" the telephone line by sending a DTMF "*0".

Examples:

11# Hook flash enabled.

12# Hook flash disabled **(default)**.

Call Alert (13#, 14#)

The ZR340 can alert mobiles with two quick beeps during normal repeater operation if a telephone call is coming in.

Examples:

13#	Call alert enabled.
14#	Call alert disabled **(default)**.

Toll Restrict Digits 1 and 2 (15#, 16#)

These commands designate up to four "prohibited" digits for the first (15#) and second (16#) digits dialed in a phone number.

Examples:

15# 9#	Disable all outside calls from inside plant area.
16# 019#	Disable long-distance calls by preventing a dial with 0 or 1, and "900-" or "976-" numbers with 9 as the second dialed digit.

Ringing Method (17#, 18#)

These commands designate the ringing method. The ringing and/or waiting ends after the mobile Radio Timeout has expired (refer to "Radio Timeout (36#, 37#, 38#)").

Examples:

17#	Ring once on channel, wait for mobile to answer. The ZR340 becomes inactive if mobile does not answer within one minute.
18#	Ring on channel until mobile answers or Radio Timeout is exceded **(default).**

Repeater Enable/Disable (19#, 20#)

These commands set the carrier repeat status.

Examples:

19#	Enable repeater **(default)**.
20#	Disable repeater.

Repeat Hang Time (21#-24#)

These commands set the delay before unkeying the transmit radio.

Examples:

21#	No repeat hang time.
22#	1-second repeat hang time **(default).**
23#	3-second repeat hang time.
24#	5-second repeat hang time.

Morse ID (25#)
(See also commands 63#-65#)

To program the Station ID with the DTMF keypad, you must first understand how to enter the number and letter codes so that the resulting Morse code corresponds to the required station's call sign. Each code will contain two digits. Refer to Figure 5-1 when following the steps to enter the codes.

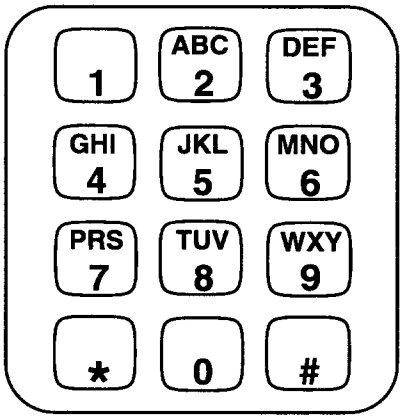


Figure 5-1. DTMF Keypad

To enter a letter code:

1. Determine the desired letter's position on the key (1 for the leftmost letter on a key, 2 for the center letter, or 3 for the rightmost letter).
2. Press the digit that corresponds to the letter's position (1, 2, or 3). This is the first digit of the letter code. For example, the first digit in the code for the letter N would be 2.
3. Press the key that the desired letter appears on. This is the second digit of the letter code. For example, the second digit in the code for the letter N would be 6.

The only characters not represented by this method are Q, Z, and the slant-bar ("/"). The code for Q is "10", the code for Z is "20", and the code for "/" is "30."

To enter a number code:

1. Press the "0" key.
2. Press the key that the desired number appears on.

Examples:

Set the call sign K9JU/R (enter the following on the DTMF keypad):

	25#	25	09	15	28	30	27	#
Meaning -	ID#	K	9	J	U	/	R	done

Courtesy Tone (26#, 27#)

These commands enable or disable the courtesy tone.

Examples:

26#	Enable courtesy tone.
27#	Disable courtesy tone **(default)**.

Privacy Mask (28#, 29#)

These commands set the privacy mask status. (Privacy Mask is functional only during Half-duplex operation.)

Examples:

28#	Set privacy mask on.
29#	Set privacy mask off **(default)**.

Call Limit Timer (30#-35#)

These commands set the duration of the call limit timer.

Examples:

30#	Enable call limit timer **(default).**
31#	Enable call limit timer and allow user to reset with '*.'
32#	Set no call limit/Disable call limit timer.
33#	Set call limit to 3 minutes **(default)**.
34#	Set call limit to 5 minutes.
35#	Set call minutes to 10 minutes.

Radio Timeout (36#, 37#, 38#)

These commands set the timer for loss of radio activity.

Examples:

	Stop call after loss of radio signal for:
36#	30 seconds **(default)**.
37#	45 seconds.
38#	1 minute.

Operating Mode (40#-46#)

These commands set the operating mode of the ZR340.

Examples:

40#	Set Half-duplex mode **(default)**.
42#	Set Simplex VOX.
43#	Set Simplex VOX with pre-key.
44#	Simplex sampling.
45#	Simplex sampling with VOX to extend the sample interval.
46#	VOX/sampling between words (intelligent mode).

VOX Sample Before Dial Tone (48#, 49#)

For the VOX sampling operating modes, these commands allow up to 15 seconds before issuing dial tone to the mobile.

Examples:

48#	Enable VOX sampling before issuing dial tone.
49#	Disable VOX sampling before issuing dial tone **(default).**

Auto Dial Numbers (50#-59#)

These ten commands may contain pre-programmed, speed dialing telephone numbers. Each command may contain a single number of up to 16 digits. The numbers are recalled by following the access code, within 1 second, with the auto dial number. 50# corresponds to auto dial number 0 and 59# corresponds to auto dial number 9.

Examples:

50#	17085763693	call Bob.
54#	18003561520	call Radius Product Services.

Mobile Answer Mode (60#-62#)

Examples:

60#	COR to answer (no DTMF required).
61#	Access code to answer **(default)**.
62#	Direct channel access (no mobile action required).

Repeat Morse Code ID (CWID) (63#-65#)

Examples:

63#	Disable CWID.
64#	Repeat CWID every 10 minutes only with channel activity **(default)**.
65#	Repeat CWID every 10 minutes.

Repeat Courtesy Tone (67#, 68#)

The "over" courtesy beep tone will be transmitted after a mobile unkeys.

Examples:

67#	Enable repeat courtesy tone.
68#	Disable repeat courtesy tone **(default)**.

Simplex Mode Parameters (70#-77#)

These commands select the operating parameters for Simplex operation.

Examples:

70#	Sample rate 0.5 seconds.
71#	Sample rate 1.0 second **(default)**.
72#	Sample rate 1.5 seconds.
73#	VOX hold time 0.5 seconds.
74#	VOX hold time 0.8 seconds.
75#	VOX hold time 1.0 second **(default)**.
76#	VOX hold time 1.3 seconds.
77#	VOX hold time 1.5 seconds.
78#	Automatic sample window*.
79#	Increment sample window by 10 msec.
80#	Decrement sample window by 10 msec.

NOTE: You can perform this command only from a DTMF equipped radio.

COR Hang Time (81#-84#)

These commands set the COR hang time or disable it.

Examples:

	Sets the COR hang time to:
81#	No COR hold time **(default)**.
82#	100 msec.
83#	300 msec.
84#	500 msec.

Detect Busy Telephone Line (85#-87#)

These commands set when busy signals will be detected to stop a call.

Examples:

85#	Disconnect on busy for first 20 seconds **(default)**.
86#	Disable busy detect.
87#	Disconnect on busy for duration of call.

Program Access Code (90#) [See Also: "Access Code (01#)"]

The program mode access code is used to gain access to the ZR340's program mode with either a DTMF equipped mobile or portable, or a DTMF telephone. The program access code must be exactly five digits in length (no shorter, no longer) and defaults to 12123.

This command sets a new program access code.

Example:

90# 63693#	Enter number '63693' as the new program access code.

Reset (91#)

This command will reset the ZR340 to all of the factory default settings. Refer to Appendix A, "Quick Reference of Programming Codes," for the defaults. When this command is used, all custom programming is returned to the factory defaults.

Setup and Testing (92#, 93#)

These commands are for initial setup and testing. Pressing any digit or the "Connect" button on the ZR340 will end the test.

Examples:

92#	Transmit audio level test.
93#	Repeat audio level test.

High Speed Telephone (Only) Programming (94#)

This command is used to rapidly program the ZR340 from automatic, high speed equipment via high speed DTMF. This is only possible from a telephone line ***not*** over-the-air.

Program Exit (99#)

This command causes the ZR340 to exit the programming mode.

Example:

99#	Exit programming.

NOTE: At any time while programming the unit, if no DTMF key is pressed during a period of 60 seconds, the ZR340 will exit program mode automatically.

5.3 Programming via Telephone

5.3.1 Entering Program Mode Through a Telephone

The ZR340 can be programmed using a DTMF telephone connected through the telephone company central office or a PBX to the **Phone** jack on the back panel.

1. Dial the number of the ZR340 repeater and wait 14 rings.
2. After the the ZR340 double beeps, enter the programming access code.

5.4 Programming Example

The following section describes the programming information for the radios used to assemble a GR Series repeater with the ZR340 repeater controller. The first configuration uses two 16-channel, UHF Radius GM300 radios. A low power, 1 to 10 Watt, radio is used for the receive radio and a 10-25 Watt radio for the transmit radio. The second configuration uses an 8-channel 25-40 Watt GM300 radio as the transmit radio.

The frequencies for the repeater are receive on 469.550 MHz and transmit on 464.550 MHz. Tone coded squelch, TPL, of 146.2 (4B)will be used. The Time Out Timer of the transmit radio will be turned OFF to allow "long" telephone calls to be made. "Local" mode will be used because of a high RF environment. No signalling systems will be programmed into the radios. Normal receiver and transmitter audios will be used for both radios.

5.4.1 The Receive Radio

The Receive Radio is a 16-channel, low power (1-10 Watt) Radius GM300. Mode 1 will be programmed to receive on 469.550 MHz with TPL146.2 (4B). The transmit frequency will be "BLANK".

1. Connect the RIB to the receive radio and the repeater power supply to an ac outlet. Turn on the power supply.
2. From the RSS "MAIN MENU", press **F3** (GET SAVE) to bring up the "GET / SAVE MENU".
3. Press **F2** (READ CODEPLUG).
4. When the computer has finished reading the codeplug, press **F10** (EXIT).
5. Press **F4** (CHANGE VIEW) to bring up the "CHANGE / VIEW CODEPLUG MENU".
6. Press **F2** (RADIO WIDE).
7. Repeatedly press **Tab** until the "ACC. External" area is highlighted.
8. Repeatedly press "up-arrow" key to scroll through the accessories until "General I/O" appears. (Refer to Figure 5-2.)
9. Press **F9** (OTHER ACCESSORY) to view the "ACCESSORY CONNECTOR CONFIG" screen.
10. If necessary, press **Tab** until the "DESCRIPTION" column for "PIN#" 4 is highlighted.
11. Press up arrow to set the "DESCRIPTION" to "CSQ Detect". If the "High" active level description is present then proceed to step 12. Otherwise, press **Tab** until the "Low" is highlighted under the "ACT LEVEL" column. Press "up-arrow" key to toggle to the "High" condition. Press **Enter**.
12. Repeatedly press **Tab** until the "DESCRIPTION" for "PIN#" 12 is highlighted.
13. Press the "up-down" arrow key to set the "DESCRIPTION" to "PL/DPL & CSQ Det". If the "Low" active level description is present then proceed to step 14. Otherwise, press **Tab** until the "High" is

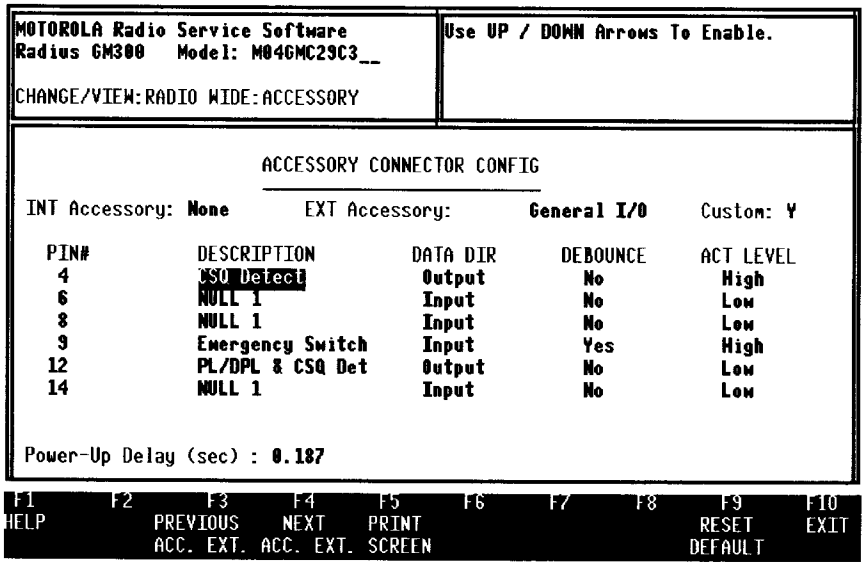


Figure 5-2. Change/View, Radio Wide, Receive Radio Mode

highlighted under the "ACT LEVEL" column. Press the "up-arrow" key to toggle to the "Low" condition. Press **Enter**.

14. If a "Power-Up Delay (sec)" is desired, then press **Tab** until that area is highlighted. Select the desired delay with the "up-down" arrow key. (Refer to Figure 5-3.)
15. Press **F10** (EXIT) twice to return to the "CHANGE / VIEW CODEPLUG MENU".
16. Press **F5** (MODE) to move to the "CHANGE/VIEW:MODE" screen.
17. Press **Tab** to highlight the "Rx Frequency" area. Key in the receive frequency ("469.5500"). Press **Enter**.
18. If a transmit frequency exists, key in "BLANK" or "B". Press **Enter**.
19. Press the "up-arrow" key to scroll the "Rx Squelch Type" to "TPL". Press **Enter**.
20. Key in the TPL tone ("146.2") or code designator ("4B"). Press **Enter**.
21. Press **Tab** until the "Local/Distance" area is highlighted. Use the "up-arow" key to toggle to "Local". Press **Enter**. (Refer to Figure 5-4.)
22. Press **F10** (EXIT) twice to return to the "MAIN MENU" screen. Verify that you have the "MAIN MENU".
23. Press **F3** (GET SAVE) to bring up the "GET / SAVE MENU".
24. Press **F8** (PROGRAM CODEPLUG) to program the radio. You will be prompted to verify that you want to program the radio; press **F2** (CONTINUE) to confirm.
25. Press the **F7** (SAVE FILE) key to save the codeplug data to a disk file. If the radio has not been previously archived, you will be prompted to supply a "Customer ID:" such as "ZR340_RX".
26. Press **F8** to save the data to the disk.

5.4.2 The Transmit Radio

1. Move the RIB programming cable to the transmit radio.
2. Press **F2** (READ CODEPLUG).
3. When the computer has finished reading the codeplug, press **F10** (EXIT).

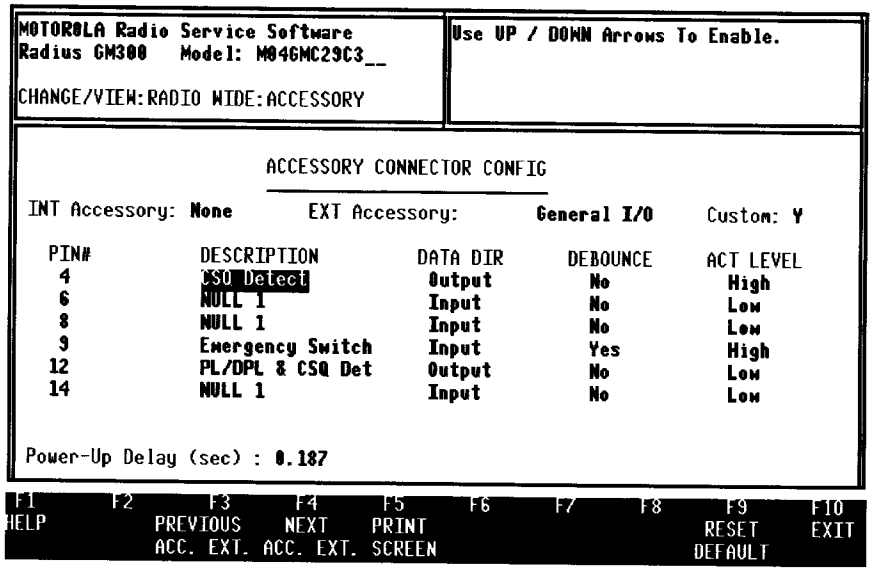


Figure 5-3. Change/View, Radio Wide, Receive Radio Mode

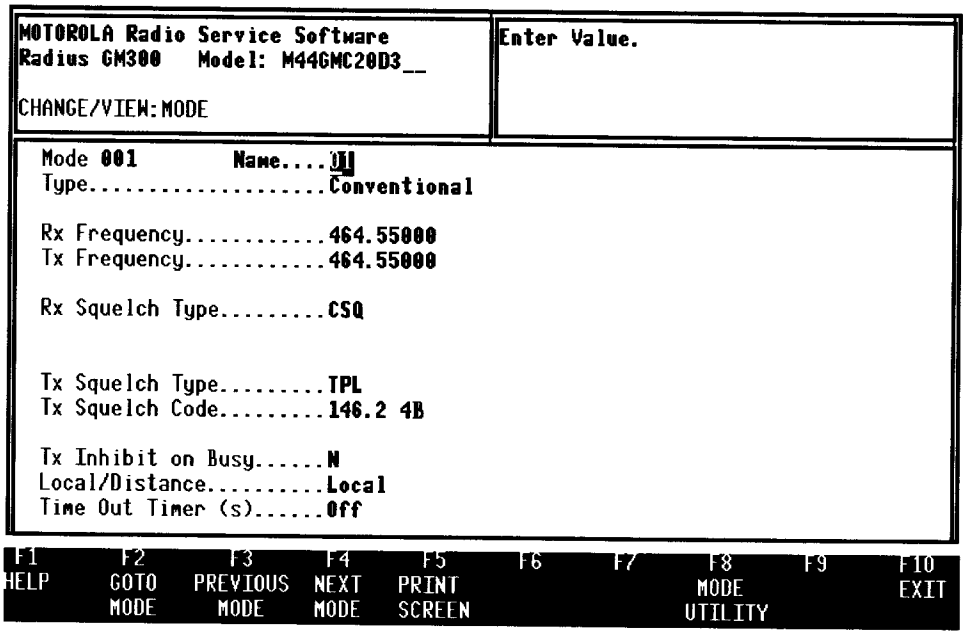


Figure 5-4. Change/View, 8-Channel Transmit Radio Mode

4. Press **F4** (CHANGE VIEW) to bring up the "CHANGE/VIEW CODEPLUG MENU".
5. Press **F2** (RADIO WIDE).
6. Repeatedly press the **Tab** key until the "ACC. External" area is highlighted.
7. Repeatedly press "up-arrow" key to scroll through the accessories until "General I/O" appears. Your screen will look similar to that of Figure 5-2.
8. Press **F9** (OTHER ACCESSORY) to view the "ACCESSORY CONNECTOR CONFIG" screen.
9. If necessary, press **Tab** until the "DESCRIPTION" column for "PIN#" 4 is highlighted.

10. Press "up-arrow" key to set the "DESCRIPTION" to "CSQ Detect". If the "High" active level description is present then proceed to step 11. If the active level is "Low", then press the **Tab** key until the "Low" is highlighted under the "ACT LEVEL" column. Press the"up-arrow" key to toggle to the "High" condition. Press **Enter**.
11. Repeatedly press **Tab** until the "DESCRIPTION" for "PIN#" 12 is highlighted.
12. Verify that that the "DESCRIPTION" is the "NULL1" function. If it isn't, press "up-arrow" key to scroll to "NULL1". Press **Enter**.
13. If a "Power-Up Delay (sec)" is desired, then press **Tab** until that area is highlighted. Select the desired delay with the "up-down" arrow key.) (Refer to Figure 5-5.)
14. Press **F10** (EXIT) twice to return to the "CHANGE / VIEW CODEPLUG MENU".
15. Press **F5** (MODE) to move to the "CHANGE/VIEW:MODE" screen.
16. Press **Tab** to highlight the "Rx Frequency" area. Key in the receive frequency ("464.5500" which equals the transmit frequency). Press **Enter**.
17. Key in the transmit frequency ("464.5500"). Press **Enter**.
18. Press "up-arrow" key to scroll the "Rx Squelch Type" to "TPL". Press **Enter**.
19. Key in the TPL tone ("146.2") or code designator "4B". Press **Enter**
20. Press "up-arrow" key to scroll the "Tx Squelch Type" to "TPL". Press "**Enter**.
21. Key in the TPL tone ("146.2") or code designator "4B". Press **Enter**.
22. If there are any co-channel users who may not be interferred with, you may wish to enable the "Tx Inhibit on Busy". ("Y" means yes, and "N" means no). Use "up-arrow" to choose your desired operation. Press **Enter**.
23. You are going to use local mode. Use "up-arrow: key to scroll to "Local" in the "Local/ Distance" highlight. Press **Enter**.
24. Key in "000" in the "Time-Out Timer (s)" highlight to turn OFF the time-out timer.

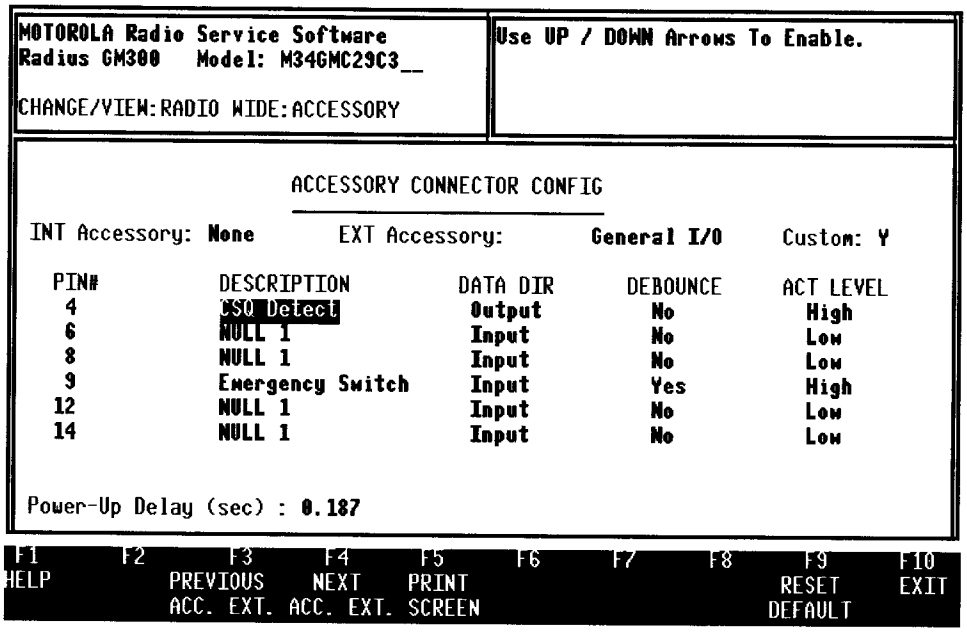


Figure 5-5. Change/View, Radio Wide, 16-Channel Transmit Radio Accessory

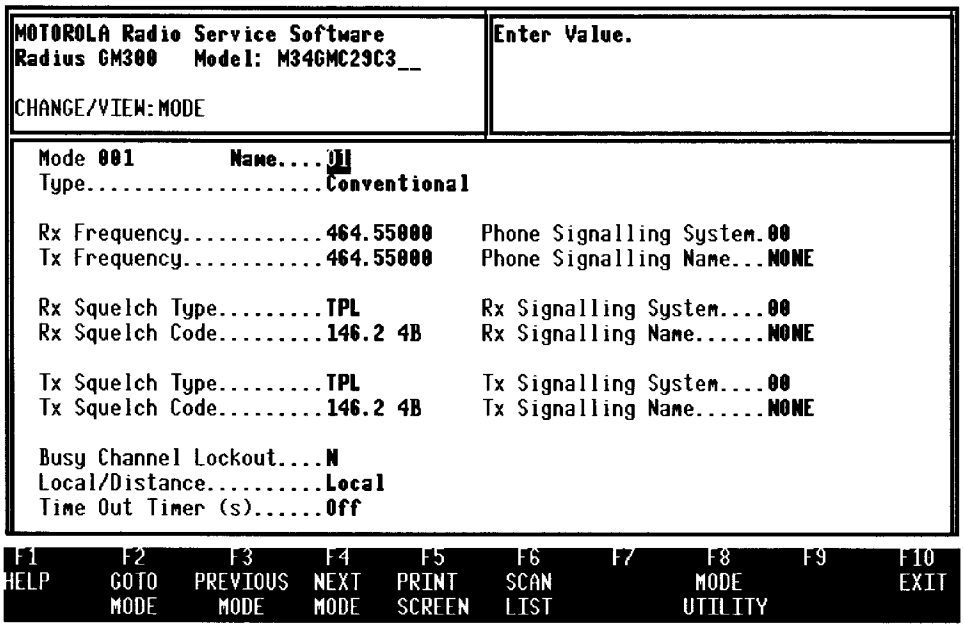


Figure 5-6. Change/View, 16-Channel Transmit Radio Mode

25. Press **F10** (EXIT) twice to return to the "MAIN MENU" screen. Verify that you have the "MAIN MENU".
26. Press **F3** (GET SAVE) to bring up the "GET / SAVE MENU".
27. Press **F8** (PROGRAM CODEPLUG) to program the transmit radio. You will be prompted to verify that you want to program the radio; press **F2** (CONTINUE) to confirm.
28. Press **F7** (SAVE FILE) key to save the codeplug data to a disk file. If the radio has not been previously archived, you will be prompted to supply a "Customer ID:" such as "ZR340_TX".
29. Press **F8** to save the data to the disk.

5.4.3 The Non 16-channel Transmit Radio

Instead of the 16-channel GM300 used above, the transmit radio may be a Radius 8-channel GM300, M10 or M120 radio. The programming is the same. Use an 8-channel 25-40 Watt UHF radio for the following.

1. Move the RIB programming cable to the transmit radio.
2. Press **F2** (READ CODEPLUG).
3. When the computer has finished reading the codeplug, press **F10** (EXIT).
4. Press **F4** (CHANGE VIEW) to bring up the "CHANGE/ VIEW CODEPLUG MENU".
5. Press **F5** (MODE) to move to the "CHANGE/VIEW:MODE" screen.
6. Press **Tab** to highlight the "Rx Frequency" area. Key in the receive frequency ("464.5500 which equals the desired transmit frequency). Press **Enter**.
7. Key in the transmit frequency ("464.5500"). Press **Enter**.
8. If necessary, use "up-arrow" key to scroll the "Rx Squelch Type" to "CSQ". Press **Enter**.
9. Press "up-arrow" key to scroll the "Tx Squelch Type" to "TPL". Press **Enter**.
10. Key in the TPL tone ("146.2") or code designator ("4B"). Press **Enter**.

11. If there are any co-channel users who may not be interferred with, you may wish to turn ON the "Tx Inhibit on Busy". ("Y" means yes, ON and "N" means no, OFF). Use "up-arrow" key to choose your desired operation. Then, press **Enter**.
12. You are going to use local mode. Use "up-arrow" key to scroll to "Local" in the "Local/ Distance" highlight. Press **Enter**.
13. Key in "000" to turn the time-out timer OFF.

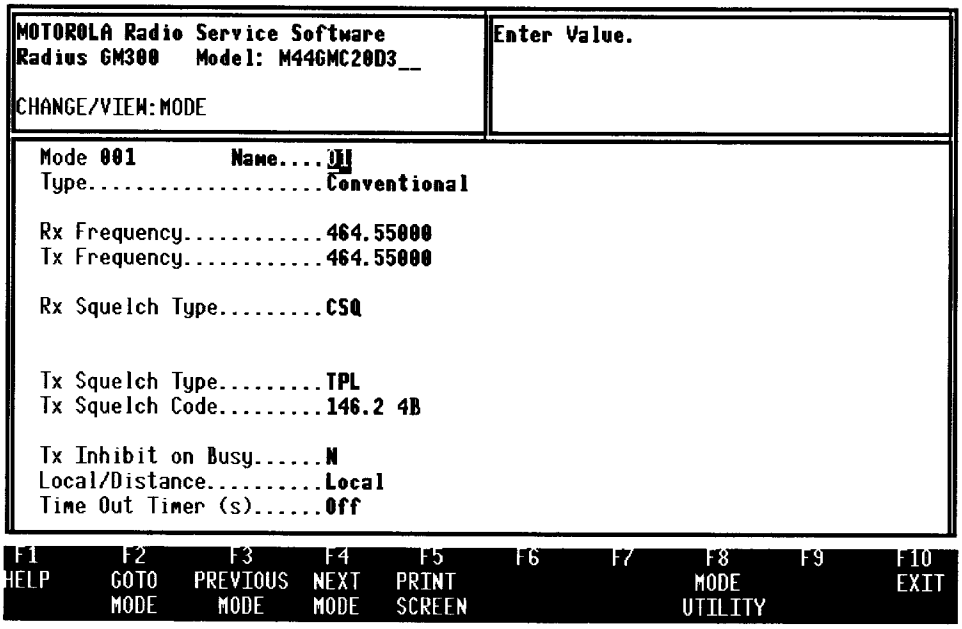


Figure 5-7. Change/View, 8-Channel Transmit Radio Mode

14. Press **F10** (EXIT) twice to return to the "MAIN MENU".
15. Press **F3** (GET SAVE) to bring up the "GET / SAVE MENU".
16. Press **F8** (PROGRAM CODEPLUG) to program the transmit radio. You will be prompted to verify that you want to program the radio; press **F2** (CONTINUE) to confirm.
17. Press **F7** (SAVE FILE) to save the codeplug data to a disk file. If the radio has not been previously programmed, you will be prompted to supply a "Customer ID:" such as "ZR340_8ch_TX".
18. Press **F8** to save the data to the disk.

NOTE: Note: Jumper plug, JP9, inside the ZR340 must be moved to the "8-A" position.

(Page 5-16 is blank)

6 ZR320 Controller Programming

6.1 Overview

This section contains information and procedures that allow the technician to program the ZR320 controller.

You can program the ZR320 controller in the following ways:

- with a Motorola RIB compatible interface, using a computer running Motorola GM300/GR300 Radio Service Software (RSS)
- DTMF over the radio channel ("over-the-air") from a radio, base station, or hand-held radio
- DTMF from a remote telephone, connected through the telephone company central office or a PBX to the **Phone** jack on the rear of the ZR320 controller
- remotely, through the ZR330 controller.

6.2 User Equipment Type

The ZR320 controller has the capacity for 100 users numbered from 00 to 99. Each user can be programmed to operate on a certain equipment type (i.e. TPL radio, QCII pager, etc.). When a user does not have an equipment type programmed, that user is considered inactive and is not allowed to place or receive calls. The equipment type determines how a user functions and what type of selective signalling is used to notify that user when a call is coming in. It only determines the **type** of selective signalling, i.e. TPL, DPL, QCII, or none, it does **not** determine the actual tones used to signal the radio. These tones are designated by the user number.

6.2.1 TPL User

When a user has an equipment type of TPL mobile or TPL talkback pager, the user number selects the tone. Refer to Table 3-1 on pages 3-2 and 3-3 for the tones assigned to each user number. For example, user number 01 encodes 67.0 Hz. This means that you must consider which user number will encode the correct tone, instead of which tone to assign to a user number. The user number with the desired tone becomes the one you will choose. User numbers 00 and 51-99 do not encode any TPL tone; they can be used for carrier squelch only TPL users.

6.2.2 DPL User

When a user has an equipment type of DPL mobile or DPL talkback pager, the user number selects the DPL code. Refer to Table 6-1 for the codes assigned to each user number. Note that user number 00 is not carrier squelch as in the case of TPL. In this case, the user number you choose will properly encode the correct DPL code.

6.2.3 Quik-Call II User

When a user has an equipment type of QCII mobile, QCII Group, QCII tone only page, QCII tone and voice pager or QCII talkback pager, the user number selects the two tones that make up the QCII sequence. Refer to Table 6-4 on page 6-9 for the tones that correspond to the digits of the user number. You must ensure that the user number for the ZR320 corresponds to the two-tone sequence in the user's equipment. For example, if tone one is 879.0 Hz, and tone two is 903.2 Hz, the user number is 89.

IMPORTANT: Only one equipment type may be assigned to each user number. TPL user 'carrier squelch,' DPL user '645,' and Quik-Call II user with tones 879.0 Hz and 903.2 Hz cannot exist at the same time for user number 89.

6.3 Programming via Radio Service Software (RSS)

We recommend that you program the ZR320 controller using a PC that runs the Motorola Radio Service Software (RSS), because it is the easiest programming method. Using this software allows you to access the programmable features of the ZR320 controller from user-friendly screens on the PC. You can archive the final configuration for safekeeping or later examination. The **programming** port is hardware compatible with the Motorola RIB. The RSS prompts the system installer to plug into the ZR320 controller, and when to read or write its configuration.

Table 6-1. TPL/DPL Code Conversion

User	DPL Code*	Freq. (Hz)/TPL Code	User	DPL Code*	Freq. (Hz)/TPL Code
00	023	– CSQ	†50	274	254.1 J9
01	025	67.0 XZ	51	306	–
02	026	69.3 WZ	52	311	–
03	031	71.9 XA	53	315	–
04	032	74.4 WA	†54	325	–
†05	036	77.0 XB	55	331	–
06	043	79.7 WB	†56	332	–
07	047	82.5 YZ	57	343	–
08	051	85.4 YA	58	346	–
†09	053	88.5 YB	59	351	–
10	054	91.5 ZZ	†60	356	–
11	065	94.8 ZA	61	364	–
12	071	97.4 ZB	62	365	–
13	072	100.0 1Z	63	371	–
14	073	103.5 1A	64	411	–
15	074	107.2 1B	65	412	–
16	114	110.9 2Z	66	413	–
17	115	114.8 2A	67	423	–
18	116	118.8 2B	68	431	–
†19	122	123.0 3Z	69	432	–
20	125	127.3 3A	70	445	–
21	131	131.8 3B	†71	446	–
22	132	136.5 4Z	†72	452	–
23	134	141.3 4A	†73	454	–
24	143	146.2 4B	74	464	–
†25	145	151.4 5Z	75	465	–
26	152	156.7 5A	76	466	–
27	155	159.8 J1	77	503	–

Table 6-1. TPL/DPL Code Conversion (Cont'd.)

User	DPL Code*	Freq. (Hz)/TPL Code	User	DPL Code*	Freq. (Hz)/TPL Code
28	156	162.2 5B	78	506	–
29	162	165.5 J2	79	516	–
30	165	167.9 6Z	80	532	–
31	172	171.3 J3	81	546	–
32	174	173.8 6A	82	565	–
33	205	177.3 J4	83	606	–
†34	212	179.9 6B	84	612	–
35	223	183.5 J5	85	624	–
†36	225	186.2 7Z	86	627	–
37	226	189.9 J6	87	631	–
38	243	192.8 7A	88	632	–
39	244	196.6 J7	89	645	–
40	245	199.5 J8	90	654	–
†41	246	203.5 M1	91	662	–
42	251	206.5 8Z	92	664	–
†43	252	210.7 M2	93	712	–
†44	255	218.1 M3	94	723	–
45	261	225.7 M4	95	731	–
46	263	229.1 9Z	96	732	–
47	265	233.6 M5	97	734	–
†48	266	241.8 M6	98	743	–
49	271	250.3 M7	99	754	–

* For Inverted DPL Codes, refer to Appendix B.
† DPL user numbers not valid for use with standard Motorola products.

6.3.1 Configuring the System

6.3.1.1 Set Repeater Type and Radio Parameters

After reading the ZR320 controller and/or the repeater radios, from the Main Menu:

1. Press **F4** (Change/View).
2. Press **F5** (Mode Configuration).

The screen that appears will vary, depending on the type of ZR320 repeater you have read (refer to Figure 6-1 and Figure 6-2).

You may choose between two types of ZR320 repeaters:

- ❑ Phone Base Rmt (with local, extended local, dc remote, or tone remote)
- ❑ Phone Base PA (with public address)

NOTE: If you have read only the ZR320 controller, the screens in Figure 6-1 and Figure 6-2 will not appear. If you have only read either the transmit or the receive radio, not all fields will be shown.

When the cursor is positioned on the line titled **Repeater Type**, the up/down arrow keys will toggle between the different repeater types. If you did not read the ZR320 option board, the screen may read "Generic" on this line.

For information about Rx and Tx frequencies, Rx squelch types and codes, Tx inhibit on busy, and local/distance, refer to the GM300 Radio Service Software Manual (6880902Z36).

6

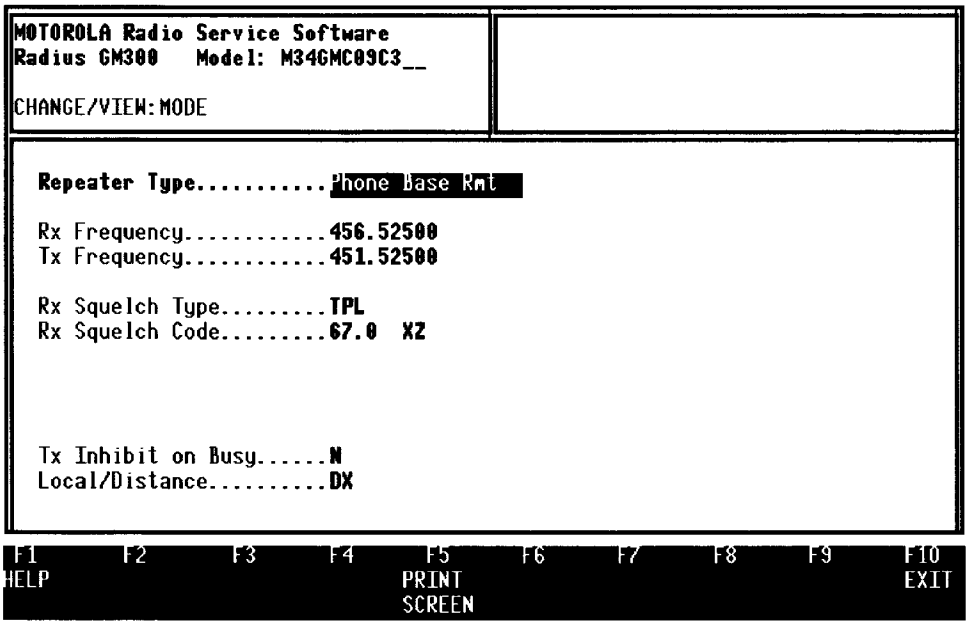


Figure 6-1. Change/View, Phone Base Rmt

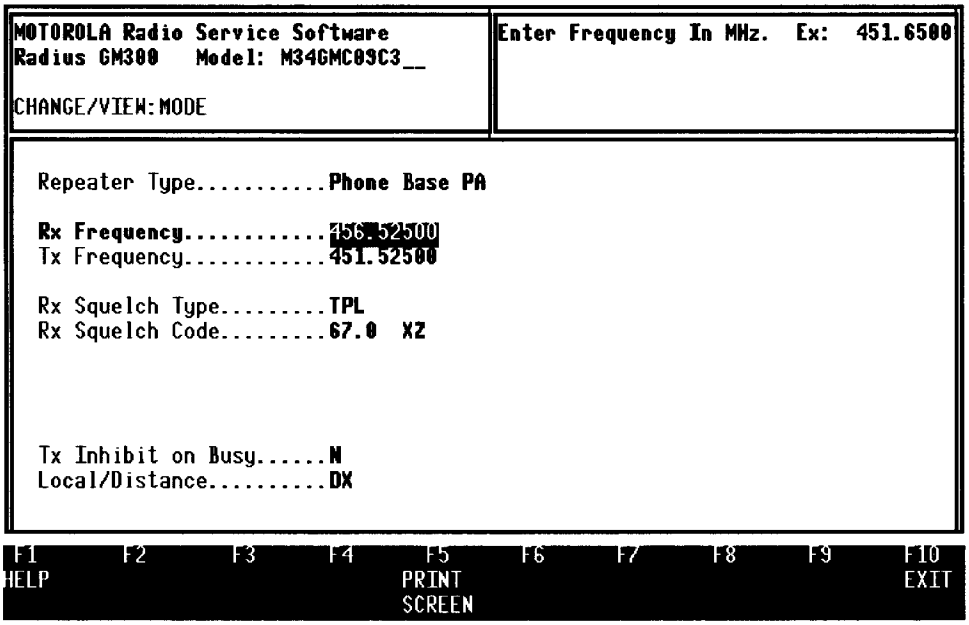


Figure 6-2. Change/View, Phone Base PA

6.3.2 ZR320 Controller Programmable Features

A variety of programmable features may be set for the ZR320 controller . They are divided into two categories:

- System-Programmable Fields
- User-Programmable Fields

6.3.2.1 System-Programmable Fields

The information in these fields affects all users on the repeater.

6

From the Main Menu:

1. Press **F4** (Change/View).
2. Press **F2** (Radio/Wide).

One of the ZR320 System Configuration Screens in Figure 6-3 or Figure 6-4 should appear. Figure 6-3 is the screen for simplex mode, and Figure 6-4 is the screen for full- and half-duplex modes for typical repeater operation. For an explanation on the operation of these modes, refer to the GR300/GR500 Repeater Service Manual (6880903Z42).

The information that was read for the repeater will determine which of the following screens appears.

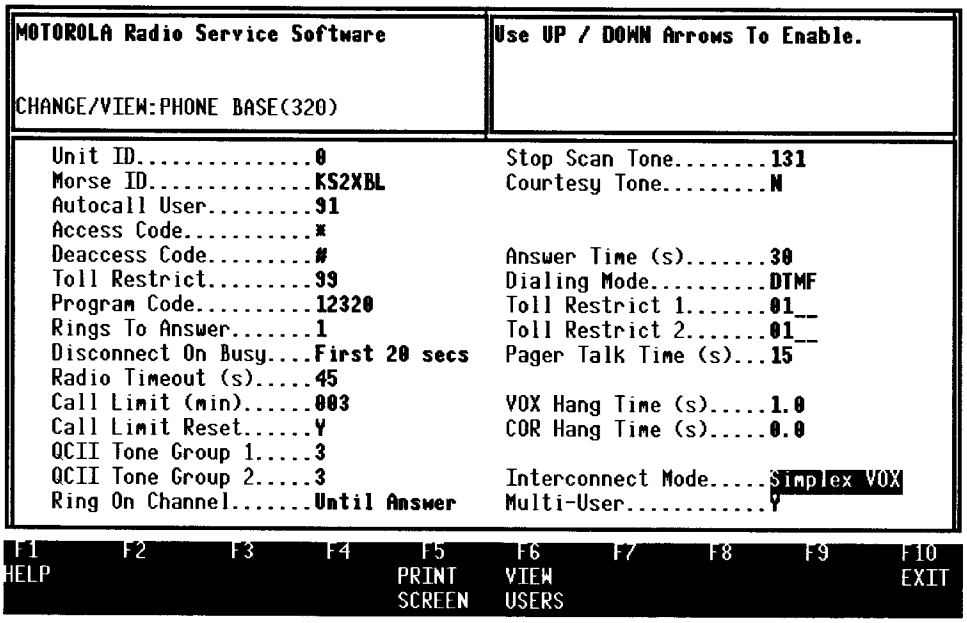


Figure 6-3. System Configuration, Simplex

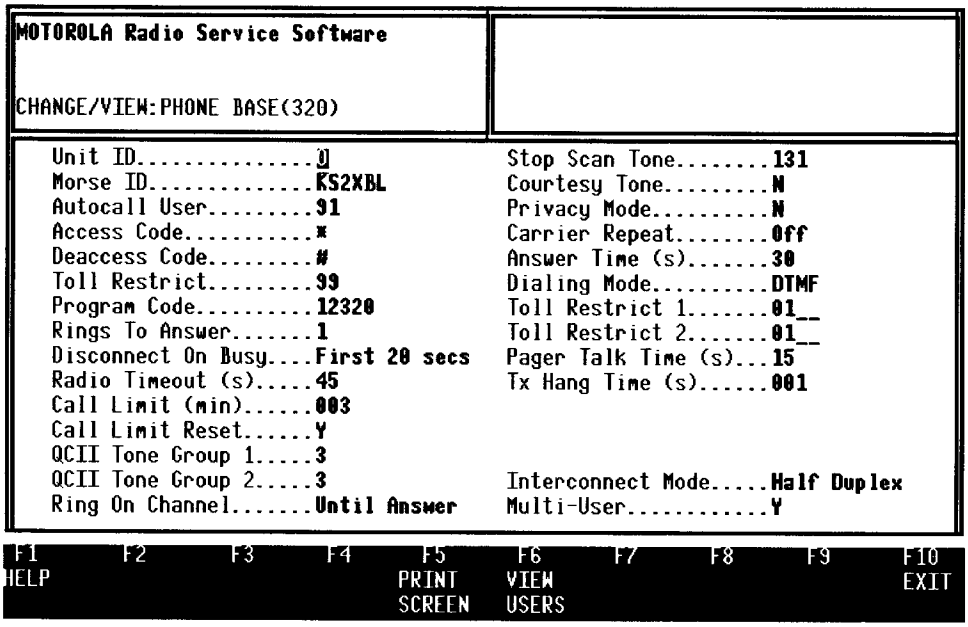


Figure 6-4. System Configuration, Duplex

6

Table 6-2 lists the command key functions available from within the ZR320 Configuration Screens. Table 6-3 lists other key functions available from within the ZR320 Configuration Screens.

Table 6-2. Command Key Functions

Command	Function
F1, Help	Get specific help for highlighted field
F5, Print Screen	Print contents of screen
F6, View Users	Go to User Configuration screen
F10, Exit	Go to previous menu

Table 6-3. Other Key Functions

Command	Function
ESC	Exit to Main Menu
Tab/Enter/Return	Accept data currently in field and move prompt **forward** one field.
Shift + Tab	Accept data currently in field and move prompt **backward** one field
Up/Down Arrow	Scroll through selections or increase/decrease current relative value
Left/Right Arrow	Move cursor left/right one space
Back Space	Erase current character in field and move cursor left one space

Unit ID

When multiple ZR320 controllers are used with a ZR330 controller, or multiple ZR330 controllers, the unit ID is used to distinguish between different ZR320 controllers in the system. A typical application would be a single ZR330 controller with foreign exchange (FX) lines for calling into more than one dialing area.

The range for the unit ID is 0-9. The default is 0.

Morse (Station) ID

If set, the ZR320 controller transmits the call sign of the repeater station at the end of each phone call and every 10 minutes, either continuously or only with channel activity. The station ID option sets the station's Morse code ID. The ID is sent at the end of each call at 30% deviation and 25 words per minute. The ID tone frequency is 1 kHz.

The Morse ID can be up to eight characters long. These characters can be digits from 0-9, he letters A-Z and the slat-bar '/'. The default is a blank field.

IMPORTANT: The ID will be sent even if the radio does not answer a call.

Autocall User

The autocall user number serves two purposes:

- ❑ Designates a default user, who is called if a caller does not specify a user number within five seconds after making a connection to the ZR320 controller (refer to "Multi-User" on page 6-12).
- ❑ Determines what action to take when the phone rings, and the ZR320 controller is operating in single-user mode.

The range for the autocall user number is 00-99. The default is 00.

Access Code

The access code must be entered before the user number and steering digit to sign-on to the ZR320 controller.

The access code can be up to eight digits long. It can consist of the digits 0-9 and the * symbol. The default is *.

Deaccess Code

The deaccess code must be entered before the user number to disconnect a call in progress.

The deaccess code can be up to eight digits long, and it can consist of the digits 0-9 and the # symbol. The default is #.

Toll Restrict

The toll restrict is a bypass code that can be entered from a radio to bypass the toll restrict digits 1 and 2 (refer to "Toll Restrict 1" and "Toll Restrict 2" on page 6-10). It eliminates any dialing restrictions.

Program Code

The program code is used to gain access to the ZR320's program mode from a DTMF equipped radio, portable, or a DTMF telephone. It is not required for RSS programming. The program code must be exactly five digits in length (no shorter, no longer), and it can be composed of the digits 0-9. The default is 12320.

*IMPORTANT: **Do not make the program code a subset of the access code. If you do, the ZR320 controller will not be programmable over the air.***

Rings to Answer

The rings to answer feature determines when the ZR320 controller answers the phone (multi-user) or when it begins ringing on the channel (single-user). This allows a dispatcher to answer the telephone and manually connect the ZR320 controller to the telephone line for greater control of telephone usage.

In single-user mode, the ZR320 controller doesn't need an overdial digit so it proceeds with the call when the number of rings from the PSTN has exceeded the number set. In multi-user mode, the ZR320 controller answers the phone after the number of rings from the PSTN has exceeded the count as set above.

The Rings to Answer can be set to:

- ❑ **1** ring before answering **(default)**
- ❑ **3** rings before answering
- ❑ **5** rings before answering

6

Disconnect on Busy

The ZR320 controller can use the VOX circuit for detecting a busy signal on the telephone line. After 10 cycles of busy tone are detected, the call is terminated.

The Disconnect on Busy can be set for:

- ❑ **no checking** for busy signal **(default)**
- ❑ **check** for busy signal during first 20 seconds of call
- ❑ **check** for busy signal continuously throughout the call

Radio Timeout

Because the radio party must be in control of the interconnect at all times, some means of automatically terminating a call is required. The Radio Timeout is the amount of time that the ZR320 controller allows the call to continue without the presence of carrier. The Radio Timeout is a safety net for times when a radio gets out of range and cannot terminate the call.

The Radio Timeout can be set to:

- ❑ **30** seconds **(default)**
- ❑ **45** seconds
- ❑ **60** seconds

Call Limit

The ZR320 controller has a call limit timer that is used to restrict the length of calls. Double warning beeps are sent every 3 seconds starting 15 seconds before the call is to be terminated.

The Call Limit can be set to:

- ❑ Off
- ❑ **3** minutes **(default)**
- ❑ **5** minutes
- ❑ **10** minutes

Call Limit Reset

The Call Limit Reset is used to allow or disallow the user to extend the call limit by using a DTMF '*.'

The Call Limit Reset can be set to:

- ❑ **Y**—reset allowed
- ❑ **N**—reset not allowed **(default)**

QCII Tone Groups 1 and 2

QCII Tone Groups 1 and 2 are used for selecting tones for signalling pagers. The user number is used to select the tones. Each digit in the user number can be set to correspond with a frequency in one of six tone groups. The first digit of the user number (in the 10's place) corresponds to the first tone from the QCII and the second digit of the user number (in the 1's place) corresponds to the second tone from the QCII (refer to Table 6-4 to determine the corresponding frequencies for the digits in the user number). If the first and second digits generate the same frequency, a group call (an eight-second tone of the same frequency) will be issued.

The QCII Group 1 and Group 2 digits can be set to correspond to frequencies in tone groups 1-6. The defaults are tone group 1 for QCII Tone Group 1 and tone group 2 for QCII Tone Group 2.

Table 6-4. QCII Tone Group Frequencies

User Digit	Tone Group 1 Frequencies	Tone Group 2 Frequencies	Tone Group 3 Frequencies	Tone Group 4 Frequencies	Tone Group 5 Frequencies	Tone Group 6 Frequencies
0	330.5	569.1	1092.4	321.7	553.9	1122.5
1	349.0	600.9	288.5	339.6	584.8	1153.4
2	368.5	634.5	296.5	358.6	617.4	1185.2
3	389.0	669.9	304.7	378.6	651.9	1217.8
4	410.8	707.3	313.0	399.8	688.3	1251.4
5	433.7	746.8	953.7	422.1	726.8	1285.8
6	457.9	788.5	979.9	445.7	767.4	1321.2
7	483.5	832.5	1006.9	470.5	810.2	1357.6
8	510.5	879.0	1034.7	496.8	855.5	1395.0
9	539.0	928.1	1063.2	524.6	903.2	1433.4

Ring on Channel

The Ring on Channel determines how the ZR320 controller will ring on the air when a user is called over the radio channel. For the ZR330 controller user, this option has no effect; the ZR320 controller rings until the ZR330 controller answers.

The Ring on Channel can be set to:

- **Once and wait**—The ZR320 controller sends a single ring over the channel and waits for the radio to answer within the mobile answer time.
- **Until answer**—The ZR320 controllerrings on the air until the radio answers, for up to the mobile answer time **(default)**.

NOTE: If you are using the call forwarding feature, the ZR320 controller should be set to Until answer.

Stop Scan Tone

You can specify a TPL tone or DPL code (refer to Table 6-1) as the stop scan tone. This option is system-wide, so each time a QCII page is transmitted, the set TPL/DPL will accompany it. When scanning with QCII as the squelch system on a GP300/GM300, the radio will detect the subaudible TPL/DPL, and will remain on the channel as long as that tone is transmitted. Without the TPL/DPL decode, the radio will remain on the QCII channel during scan whenever there is activity on the channel. Programming a TPL or DPL stop scan tone, however, speeds up the scanning process, because, as soon as the page is answered, the subaudible frequency is no longer sent, and the radio will continue scanning other channels.

The Stop Scan Tone can be set to:

- Off (default)
- Any TPL frequency
- Any DPL code (023-754)

Courtesy Tone

When using TPL with reverse-burst or DPL in a quiet area, sometimes the telephone party is unable to tell when the radio user has stopped talking. The courtesy or "over" tone (1 kHz) indicates to the telephone user when it is time to speak. It is always disabled on radio to radio calls.

The courtesy tone can be set to:

- Y—enabled
- N—disabled **(default)**

6

Privacy Mode

Privacy mode is an option for blocking out one side of the conversation when the repeater is operating in half-duplex mode. When privacy mode is on, a high-pitched tone is sent in place of the receive audio from the radio, thus discouraging casual eavesdropping by scanner listeners, etc.

The privacy mode can be set to:

- ❑ **Y**—On
- ❑ **N**—Off **(default)**

Carrier Repeat

The carrier repeat option is to enable the repeater function. If TPL/DPL has been programmed on the receive radio, only received signals with the correct TPL or DPL are repeated.

The carrier repeat can be set to:

- ❑ On (CSQ, any TPL tone, or any valid DPL code)
- ❑ Off (default)

Answer Time

The answer time is the amount of time allowed for a radio to answer the call before the call is forwarded to the call forward user, if such a user has been programmed (refer to "Forward Call To" on page 6-14 for information on how to program the call forward user). A call can be forwarded twice before it is terminated.

An example of multiple call forwarding would be a user who is called at home on a ZR330 controller. If the user does not answer, the call is forwarded to his radio. If the radio does not answer, the call gets forwarded to his pager. In this way, very complicated communication schemes can be supported.

The range for the answer time is 10-60 seconds. The default is 30 seconds.

Dialing Mode

The ZR320 controllerdials into the Public Switched Telephone Network (PSTN).

The dialing mode can be set to:

- ❑ **Pulse**—using 40/60 make-break ratio rotary pulses at 10 pps (pulses per second)
- ❑ **DTMF**—using nonregenerated DTMF digits **(default)**

When used with the ZR330 controller, the pulse setting instructs the ZR320 controller to pulse dial all DTMF digits. The DTMF setting instructs the ZR320 controller to pass the DTMF commands from the radio or ZR330 controller directly to the telephone.

Toll Restrict 1

Use the toll restrict feature for a repeater on an internal phone exchange. Its function is to limit calls from mobiles and portables. The values entered for toll restrict 1 designate certain digits to be "prohibited" as the first digit in a telephone number. If a mobile user dials any of these "prohibited" digits as the first digit, the call will be terminated.

Up to four separate values can be set for the toll restrict 1, each in the range of 0-9. The default setting is a blank field (no restrictions).

Toll Restrict 2

The values entered for toll restrict 2 designate certain digits to be "prohibited" as the second digit in a telephone number. If a mobile user dials any of these digits as the second digit, the call will be terminated.

Up to four separate values can be set for the toll restrict 2, each in the range of 0-9. The default setting is a blank field (no restricted digits).

Pager Talk Time

When calling a tone + voice pager, the talk time determines the maximum amount of time that the caller's voice may be transmitted on the channel. If the pager talk time is set to 10, the call is terminated after 10 seconds. Also, as soon as there is a loss of carrier from a mobile, or a gap of 2 seconds is detected in the caller's voice (using the VOX circuit), the call is terminated.

The range for the pager talk time is 1-30 seconds. The default is 10 seconds.

Tx Hang Time

The transmit or repeat hang time is the amount of time after loss of the received signal carrier before the transmitter is actually unkeyed. This keeps the transmitter from being keyed/unkeyed continuously between gaps in the conversation.

The Tx Hang Time can be set to:

- ❑ Off
- ❑ 1 second
- ❑ 3 seconds **(default)**
- ❑ 5 seconds

VOX Hang Time

When the ZR320 controller is operating in the simplex VOX or simplex VOX with pre-key, the VOX hang time keeps the transmitter keyed during small gaps or pauses in the telephone party's speech.

The VOX hang time can be set to:

- ❑ **0.5** seconds
- ❑ **0.8** seconds
- ❑ **1.0** seconds **(default)**
- ❑ **1.3** seconds
- ❑ **1.5** seconds

COR Hang Time

During simplex operation, the COR hold timer is used to desensitize the COR input for times when the mobile is fading or picket-fencing. The ZR320 controller remains in the mobile to telephone mode for a programmable period of time after carrier has dropped.

The COR hang time can be set to:

- ❑ **0.0** seconds **(default)**
- ❑ **0.1** seconds
- ❑ **0.3** seconds
- ❑ **0.5** seconds

Interconnect Mode

There are four modes of operation of the ZR320 controller during telephone interconnect.

Half Duplex—interconnect for a duplex repeater.
This mode provides normal conversation for the caller. The mobile user may only listen or speak. Half Duplex Mode allows the mobile user to interrupt the caller but the caller cannot interrupt the mobile user.

Full Duplex—interconnect for a duplex repeater.
This is normal "telephone" operation. The caller and the mobile user can talk and listen at the same time,

6

and either may interrupt the other at any time. The mobile radio used must be full-duplex capable. This is the mode of operation used when the ZR330 controller acts as a single user, telephone line extender.

Simplex VOX—interconnect for a simplex radio.
The mobile to phone connection uses the COR indication of the simplex radio. The phone to mobile connection uses the voice detection circuits of the ZR320 controller. Both paths are talk or listen but not at the same time. The phone to mobile path or the mobile to phone path is determined on a "first-come-first-served" basis.

Simplex Prekey—interconnect for a simplex radio.
This mode has the same basic operation as Simplex VOX, except that the loss of COR from the simplex radio will key the transmitter of the simplex radio, anticipating the phone caller's speech transmission.

Multi-User

The ZR320 controller can operate in Multi-User or Single-User mode.

In the Multi-User mode, a caller to the ZR320 controller must enter a user number. If the user number is not entered within five seconds of making the connection, the call will be put through to the autocall user (refer to "Autocall User" on page 6-7).

In the Single-User mode, the call is directed to the autocall user immediately.

The Multi-User can be set to:

- ❑ **Y**—multi-user operation
- ❑ **N**—single-user operation **(default)**

6.3.2.2 User-Programmable Fields

The information in these fields affects the active user.

You must go through one of the System Configuration Screens (Figure 6-3 or Figure 6-4) to reach the screen containing the User-Programmable Fields.

From the System Configuration Screen:

1. Press **F6** (View Users).

The screen in Figure 6-5 should appear.

In the User ID field on the left half of the screen, the information for that user is displayed. The right half of the screen is the information for the first call forward user (refer to "Forward Call To" on page 6-14). This user number can be entered at the bottom left of the screen, in the **Forward Call To** field.

NOTE: The right half of the screen is for display only; none of the settings can be changed. To change settings for any user, that user number must be active in the User ID field on the left half of the screen.

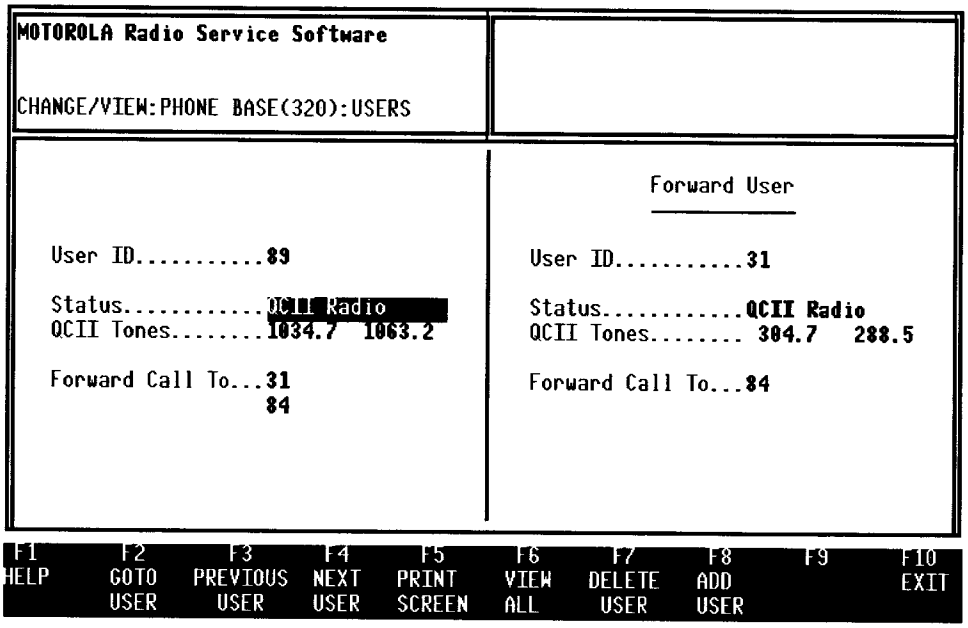


Figure 6-5. User Configuration

Table 6-5 lists the command key functions available from within the User Configuration screen.

Table 6-5. Command Key Functions

Command	Function
F1, Help	Accesses on-line help option
F2, GoTo User	Sets the cursor on the field next to User ID and allows you to go directly to a user number
F3, Previous User	Displays previous active user
F4, Next User	Displays next active user
F5, Print Screen	Prints contents of screen
F6, View All	Goes to screen in Figure 6-6.
F7, Delete User	Deactivates current user, next active user appears in User ID field
F8, Add User	Sets cursor on the field next to User ID, and allows you to activate a new user number
F10, Exit	Go to previous menu

User ID

There are 100 users numbered from 00 to 99. The user ID can be set to any of these.

Status

The Status field allows you to set a particular user number to a particular equipment type. The user number and equipment type determine the method of selectively signalling the user. For example, if user number 01 has been programmed with an equipment type of TPL radio, a call to user 01 will cause the ZR320 controller to selectively signal the radio with a TPL of 67.0 Hz (refer to Table 6-1 for TPL Tone and DPL Code information). Users above user number 51 with equipment types of TPL radio or TPL talkback are called with carrier only. As a second example, if user number 65 has been programmed with an equipment type of QCII talkback, when user 65 is called, the ZR320 controller will selectively signal that user with digit 6 and digit 5 from Table 6-4.

6

Each user's status can be set to:

- ❑ Off—disabled (default)
- ❑ PL (TPL) Radio
- ❑ DPL Radio
- ❑ QCII Tone Pager
- ❑ QCII Tone and Voice (T&V) Pager
- ❑ PL (TPL) Talkback
- ❑ DPL Talkback
- ❑ QCII Talkback
- ❑ Direct Air
- ❑ Direct Air DPL
- ❑ Direct Air TPL
- ❑ ZR330 Remote
- ❑ QCII Radio
- ❑ QCII Group Radio

Quik-Call II Tones

The frequencies corresponding to each digit of the Quik-Call II user number are displayed in these fields. Refer to "QCII Tone Groups 1 and 2" on page 6-8 for a more detailed explanation.

Forward Call To

The Forward Call To field contains the call forward user number (the user to whom a call is forwarded if the active user does not answer). Because calls to pagers are not expected to be answered, call forwarding is not used on tone only or tone + voice pagers.

Use Table 3-1 on pages 3-2 and 3-3 when cross-referencing TPL tones or DPL codes to user numbers. Remember that a user number cannot be used more than once on the same system. Therefore, it is not possible to have one radio user that decodes TPL tone 67.0 Hz and another radio user that decodes DPL 025 on the same system since user slot 01 cannot be programmed as both TPL radio and DPL radio. Multiple users (00 and 51-99) can be set for an equipment type of carrier squelch.

6.3.2.3 View All Users

From the User Configuration screen, you can call up a screen that allows you to view the settings for all available users on the system. To do this:

1. Press **F6** (View All).

The screen in Figure 6-6 should appear.

To place the cursor on a given user field, press **F2**, type in the desired user number, and press **Enter**. Although this screen is primarily for your reference, you can designate the current user by pressing **F10** (EXIT) while the cursor is on the desired user.

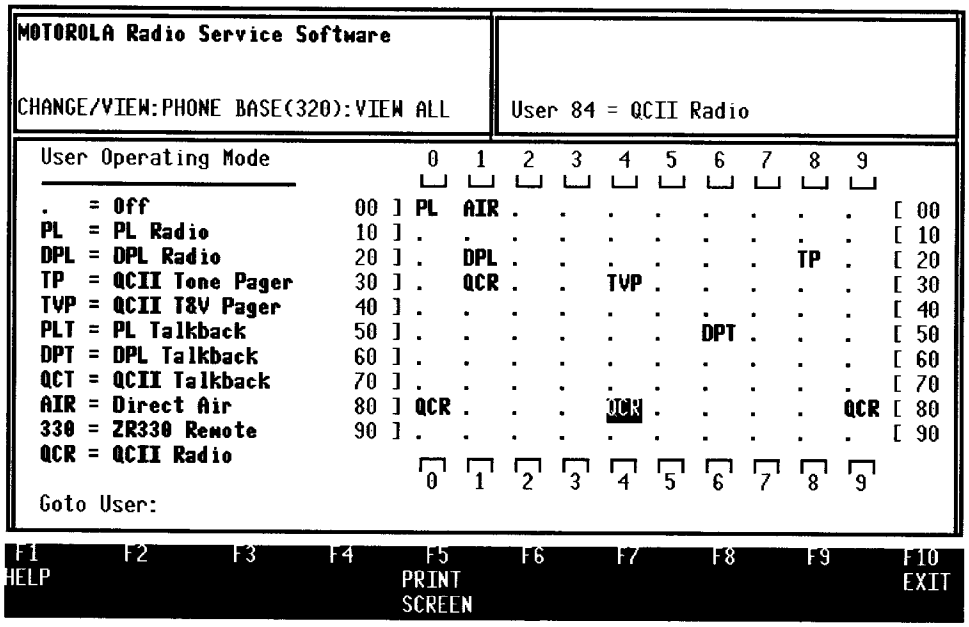


Figure 6-6. View All Users

6.3.3 Programming Example

A major renovation and expansion of the Hotel Donotell includes an improved radio communications system. The hotel desires selective paging capabilities as well as telephone interconnect for designated management and service personnel. Portable and mobile radios and pagers will be used by the various functions of the hotel.

A permanent installation of a GR500 repeater is requested by the customer. There are some older PL and DPL only pagers that will be supplemented by newer Quik-Call II pagers and field radios. The features of the ZR320 Selective Calling Interconnect Controller are needed.

The ZR320 repeater controller requires the 16-channel GM300 radios. A 1 to 10 Watt, UHF GM300 will be used as the receive radio. A 40 Watt UHF GM300 radio will be used as the transmit radio. The repeater will transmit on 463.5250 MHz and receive on 468.5250 MHz. All of the field radios have time-out-timers; the "TOT" of the transmit radio will be programmed to OFF for extended interconnect operation.

Carrier Repeat operation will be with DPL code 131 which the ZR320 controller generates. The repeater will have a Tx Hang Time of 3 seconds. The FCC station callsign of KJUU658 will be identified by Morse ID (CWID) every 10 minutes when the repeater is active.

The personnel of the hotel will be defined as "users" and separated by the TPL tones, DPL codes and Quik-Call II capcodes. Therefore, the ZR320 controller will be operating in the multi-user mode. The user groups to be programmed into the ZR320 controller based GR500 repeater will be assigned the User Numbers and Equipment types shown in Table 6-6; the user numbers for the TPL and DPL pagers are determined from Table 6-1 (TPL/DPL Code Conversions). Note that the TPL and DPL pagers will be entered as "Talkback Pagers" even though they can not transmit.

6

Table 6-6. User Groups

User	User Number	Equipment
Hotel supervisor	21	QCII Radio
Maintenance manager	29	QCII Radio
Maintenance employees	89	QCII T & V Pager
Front desk	23	QCII Radio
Grounds and landscaping	13	TPL-1Z Talkback Pager
Convention center manager	27	QCII Talkback Pager
Kitchen/food services	57	DPL343 Talkback Pager
Housekeeping	10	TPL-ZZ Talkback Pager
House "dick"	26	QCII Radio
"Group" call	22	(QCII format)

The new Quik-Call II pagers that were purchased have Capcodes requiring the A and B tones both come from tone group 2.

Telephone interconnect operation will be Half Duplex. The Access Code prefix will be "411207" and the Deaccess Code prefix will be "#73." The Answer Time will be set at 10 seconds to increase efficiency. To discourage extended interconnect operation, the Call Limit Timer of the ZR320 controller defaults to 3 minutes but it can be extended (reset) if necessary. The Privacy Mode is used to prevent the field radio half of the conversation from being heard by other field radios. The Courtesy Tone is activated to assist the telephone callers. If a busy signal is detected anytime during interconnect operation, the call is to be terminated.

The employees of the hotel are not allowed to place outside calls. Toll Restrict 1 digits will be "0", "1" and "9." Toll Restrict 2 digits will not be needed. Managers will be allowed to place toll calls; the Toll Restrict bypass code will be "880808."

In case a manager does not answer a page or a telephone caller does not know the User number, Call Forward and Autocall User will be the Front Desk (user 23).

To prevent unauthorized reprogramming of the ZR320 controller, you want to change the "Program Code" to "60107."

6.3.3.1 Programming the Controller and Radios

The programming of the repeater controller and radios will be addressed in this example.

For the following, **Esc** is the escape key, **Tab** is the tab key, and **Enter** is the enter key (which may be marked with only an arrow).

Reading the Codeplug

1. From the "MAIN MENU", press **F3** (GET/SAVE Codeplug Data).
2. Press **F6** (CHANGE to Repeater mode). **F2** will be redefined as "READ Repeater."
3. Press **F2** (READ Repeater). A prompt will appear on the screen: "Connect the programming cable to the Repeater Option Board, or press **F10** for a Generic Repeater." The ZR320 controller is a Repeater Option Board. Plug the RIB programming cable into the ZR320 controllerfront panel "Programming" jack.
4. Press **F2** (CONTINUE) to read the ZR320 controller.

5. When the ZR320 controller has been read, a prompt will appear to tell you to "Connect the programming cable to the TRANSMIT Radio Connector, or press **F10** to skip it." Move the RIB programming cable to the microphone jack on the transmit radio.

6. Press **F2** (CONTINUE) to read the codeplug of the transmit radio.

7. After the radio is read, a highlighted area may appear to advise that the radio was previously programmed in Radio mode. Press **F2** (CONTINUE).

8. Another highlight may appear to advise you that any custom programming will be overwritten. Press **F2** (CONTINUE). A prompt appears: "Connect the programming cable to the RECEIVE Radio Connector, or press **F10** to skip it."

9. Move the RIB programming cable to the microphone jack on the receive radio.

10. Press **F2** (CONTINUE) to read the codeplug of the receive radio.

11. After the radio is read, the highlighted areas detailed for the transmit radio may appear for the receive radio. For each highlighted area, press **F2** (CONTINUE).

12. Press **Esc** to return to the "MAIN MENU."

Entering the Radio Frequencies

1. Press **F4** (CHANGE/VIEW Codeplug Data).

First, we will program the radio parameters.

2. Press **F5** (MODE).

3. Use **Tab** to move to the "Rx Frequency" highlight. Key in the receive frequency, in MHz, ('468.5250'). Press **Enter**.

4. Key in the transmit frequency, in MHz, in the "Tx Frequency" highlight ('463.5250'). Press **Enter**.

5. In the "Rx Squelch Type" highlight, use the up/down arrow keys to scroll through the choices to "DPL." Press **Enter**.

6. In the highlight for "Rx Squelch Code", key in the desired DPL code for the repeater operation, ('131'). Press **Enter**.

7. If the "Tx Squelch Type" is not "CSQ", use the up/down arrow keys to select "CSQ." Press **Enter**.

8. The hotel is the sole user on this frequency. In the "Tx Inhibit on Busy" highlight, use the up arrow to choose "N" (for No). Press **Enter**.

Setting the Local/Distance Operation

1. The hotel is located near an urban environment. Maximum interference protection of the receive radio is needed. In the "Local/Distance" highlight, use the up arrow key to select "Local" operation. Press **Enter**.

2. The "Repeater Type" highlight at the top of the screen, should show either "Phone Base PA" or "Phone Base Rmt." No other external accessories will be used with the ZR320 controller; choose either type.

6

3. The RSS screen should look like Figure 6-7. Press **F10** (EXIT).

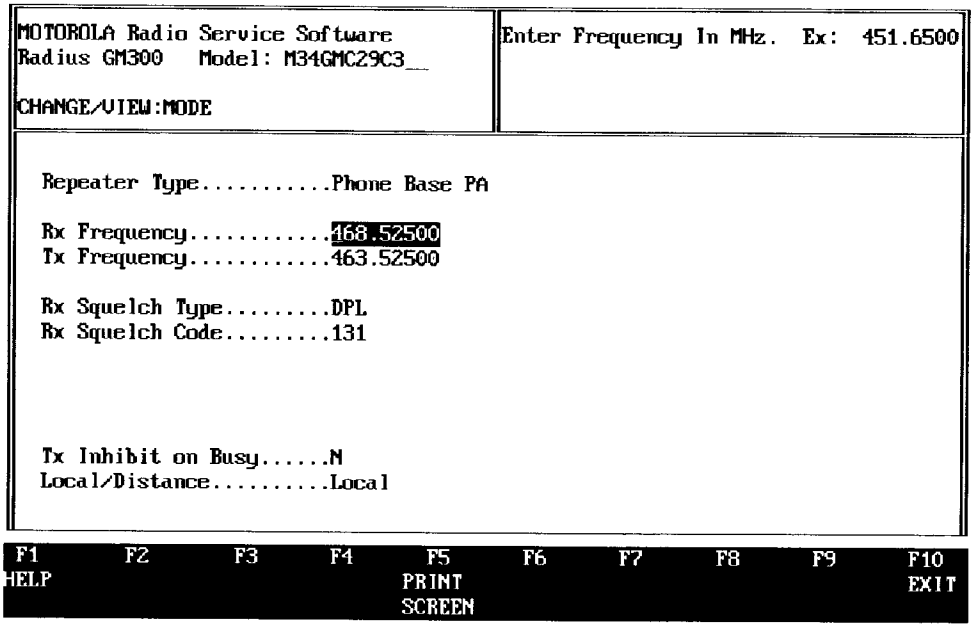


Figure 6-7. Change/View: Mode, Local/Distance

Next, the system wide parameters of the ZR320 controller will be set.

Setting the ZR320 System Wide Parameters

1. Press **F2** (RADIO WIDE Configuration: Repeater Option Board).
2. Press **Tab** to highlight "Morse ID." Key in "KJUU658" as the FCC assigned call sign of the repeater. Press **Enter**.
3. In the "Autocall User" highlight, key in "23" for the front desk. Press **Enter**.
4. In the "Access Code" highlight, key in "411207" for the access code prefix. Press **Enter**.
5. In the "Deaccess Code" highlight, key in "#73" for the deaccess code prefix. Press **Enter**.
6. In the "Toll Restrict" highlight, key in "880808" for the toll restrict bypass access code prefix. Press **Enter**.
7. In the "Program Code" highlight, key in "60107." Press **Enter**.
8. In the "Rings To Answer" highlight, use the up/down arrow keys to select "1" (RSS default value). Press **Enter**.
9. In the "Disconnect On Busy" highlight, use the up/down arrow keys to select "Always." Press **Enter**.
10. In the "Radio Timeout (s)" highlight, use the up/down arrow keys to select "30" (RSS default value). Press **Enter**.
11. In the "Call Limit (min)" highlight, use the up/down arrow keys to select "003" (RSS default value). Press **Enter**.
12. In the "Call Limit Reset" highlight, use the up/down arrow keys to select "Y." Press **Enter**.
13. In the "QCII Tone Group 1" highlight, key in "2." Press **Enter**.

14. In the "QCII Tone Group 2" highlight, key in "2." Press **Enter**.
15. In the "Ring On Channel" highlight, use the up/down arrow keys to select "Until Answer" (RSS default value). Press **Enter**.
16. In the "Stop Scan Tone" highlight, use the up/down arrow keys to select "Off" (RSS default value). Press **Enter**.
17. In the "Courtesy Tone" highlight, use the up/down arrow keys to select "Y." Press **Enter**.
18. In the "Privacy Mode" highlight, use the up/down arrow keys to select "Y." Press **Enter**.
19. In the "Carrier Repeat" highlight, key in "131" for the desired repeater DPL code to be transmitted. Press **Enter**.
20. In the "Answer Time (s)" highlight, key in "10." Press **Enter**.
21. In the "Dialing Mode" highlight, use the up/down arrow keys to select "DTMF" (RSS default value). Press **Enter**.
22. In the "Toll Restrict 1" highlight, key in "019." Press **Enter**.
23. In the "Toll Restrict 2" highlight, use the space bar to "erase" any previously entered digits. Press **Enter**.
24. In the "Pager Talk Time (s)" highlight, key in "20." Press **Enter**.
25. In the "Tx Hang Time (s)" highlight, use the up/down arrow keys to select "003" (RSS default value). Press **Enter**.
26. In the "Interconnect Mode" highlight, use the up/down arrow keys to select "Half Duplex" (RSS default value). Press **Enter**.
27. In the "Multi-User" highlight, use the up/down arrow keys to select "Y." Press **Enter**.
28. The RSS screen should look like Figure 6-8. This completes the entries for the system wide parameters.

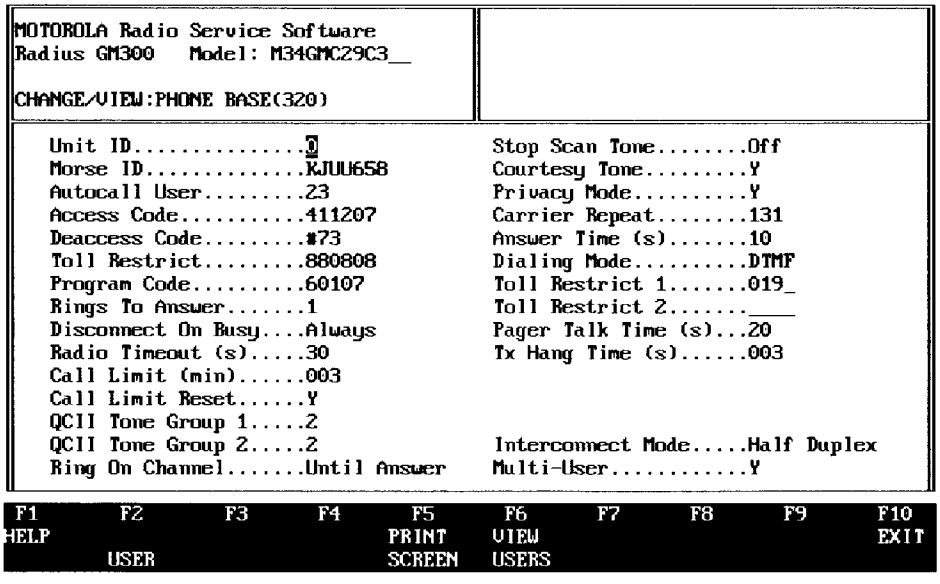


Figure 6-8. Setting System Wide Parameters

6

Enabling and Configuring Users–The Supervisor

We will now begin defining the users for the repeater. Let's start with the head Kahuna, the Hotel Supervisor.

1. Press **F6** (View Users).
2. Press **F8** (Add User or Add Format).
3. In the "User ID" highlight, key in "21" for the Hotel Supervisor. Press **Enter**.
4. In the "Status" highlight, use the up/down arrow keys to select "QCII Radio." The "QCII Tones" for user 21 will appear below the "Status" line (A tone = 634.5 Hz and B tone = 600.9 Hz). Press **Enter**.
5. In the "Forward To" highlight, key in "23" for the Hotel Supervisor call forward to the Front Desk. Press **Enter**. This completes the entries for the "Super." Let's continue with the Front Desk, user "23."

Enabling and Configuring Users–The Front Desk

1. Press **F8** (Add User or Add Format).
2. In the "User ID" highlight, key in "23" for the Front Desk. Press **Enter**.
3. In the "Status" highlight, use the up/down arrow keys to select "QCII Radio." The "QCII Tones" for user 21 will appear below the "Status" line (A tone = 634.5 Hz and B tone = 669.9 Hz). Press **Enter**.
4. If there is an entry in the "Forward To" highlight, use the space bar to "erase" it. Press **Enter**.

The other QCII radios will be entered in the same way the Hotel Supervisor except the "user" number and, therefore, the QCII tones will be different. Call Forward will also be to user "23." The RSS screens for the QCII radio should look like Figure 6-9.

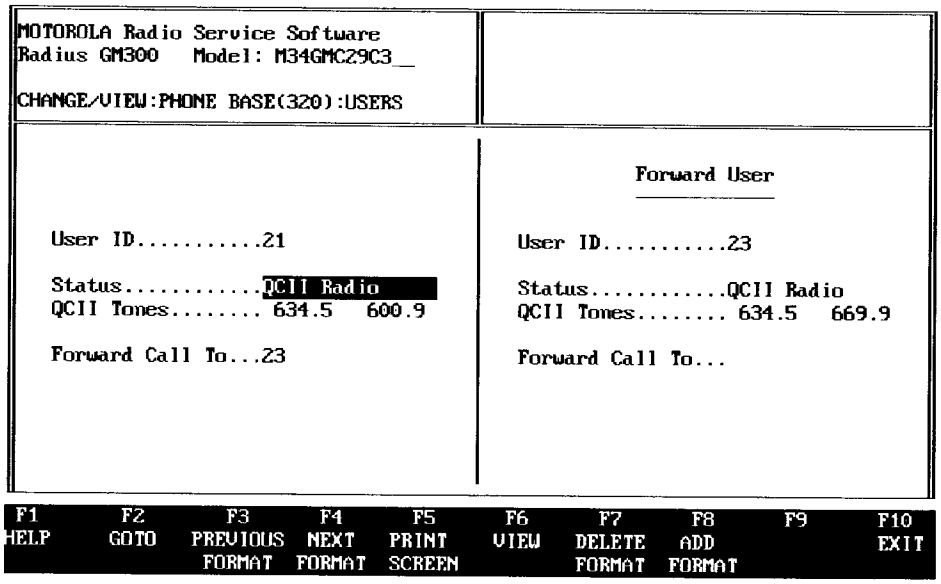


Figure 6-9. Enabling and Configuring Users–Supervisor

The TPL and DPL pagers will be entered as equipment type "TPL (or DPL) Talkback" pagers. The QCII Tone & Voice pagers are entered as equipment type "QCII T&V." The different TPL tones or DPL codes are cross referenced to the user numbers in Table 6-1. Those user numbers are then entered in the "User ID" highlight. The correct equipment type must be chosen in the "Status" highlight with the up/down arrow keys. There is no call forwarding for the pagers.

The "Group" call user number "22" will be entered as a "QCII T&V Pager" since group calls are normally broadcast announcements. Again, no call forwarding is required.

After all of the users data has been entered, press **F6** (View) to check the user numbers and equipment types on a single screen (see Figure 6-10). If every thing is correct, the repeater can be programmed. If there are any mistakes, press **F10** (EXIT) to return to the "Users" screen for correction.

Programming the ZR320 Controller and Repeater Radios

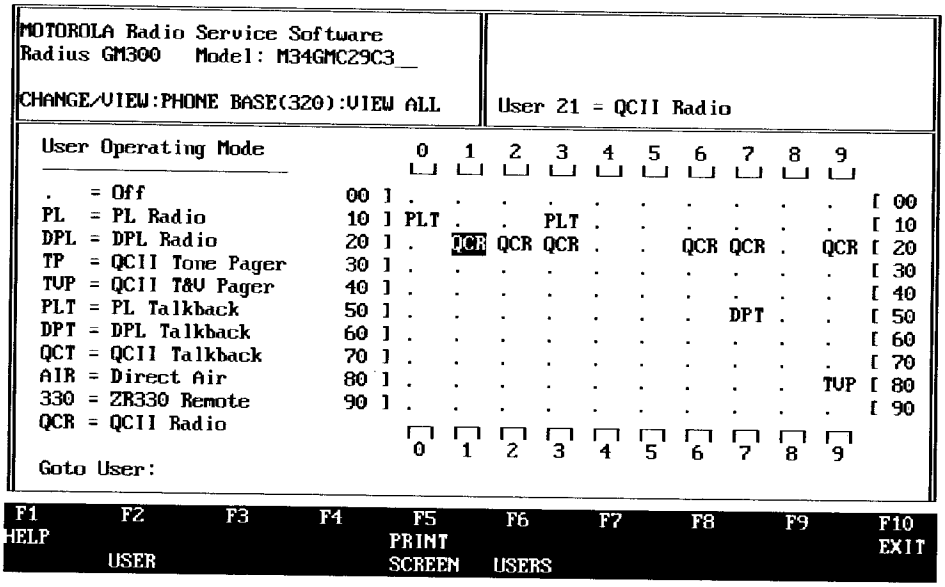


Figure 6-10. Enabling and Configuring Users–Front Desk

1. Press **Esc** to return to the "MAIN MENU."
2. Press **F3** (GET/SAVE Codeplug Data).
3. Press **F8** (PROGRAM Repeater). A message will appear that directs you to plug the RIB programming cable into the Repeater Option Board (the ZR320 controller in this case). Then press **F2** (CONTINUE).
4. When the ZR320 controller has been programmed, a message will direct you to plug the programming cable into the TRANSMIT radio. Then press **F2** (CONTINUE).
5. After the transmit radio is programmed, a message will direct you to plug the programming cable into the RECEIVE radio. Then press **F2** (CONTINUE).
6. Press **F7** (SAVE Archive File), to save all of the information to a disk file. If the repeater has not been previously programmed, you will be prompted to "CONTINUE" by pressing **F2** (CONTINUE). You will be asked for a "Customer ID:" such as "Hotel_Donotell."
7. Press **F8** (SAVE), to save the data to an archive file.

Enabling the CWID

To enable the CWID to transmit every 10 minutes on with activity, the DTMF section 3.4 – "Programming Over-The Air" will be used. Please refer to section 3.4 for details on using this method.

1. Access the operating ZR320 repeater with a DTMF radio.
2. Key in the programming mode access code "60107*" with the Touch-Code pad on the DTMF radio.

3. After the 5 "OK beep" tones, from the ZR320 controller, key in "61#" with the Touch-Code pad.
4. After the 5 "OK beep" tones, deaccess the programming mode by keying in "99#" with the Touch-Code pad.
5. The ZR320 controller exits the program mode with a "ringing" signal.

6.4 Programming Over-The Air

The ZR320 controller can be programmed using a radio equipped with a DTMF keypad. While programming the unit, it is helpful, but not required, to have a secondary receiver (scanner, or monitor receiver) tuned to the repeater output frequency. This enables you to hear the prompt tones generated by the ZR320 controller. The access code is user programmable (refer to "Program Access Code (90#) [See Also: "Access Code (01#)"]" on page 6-29).

The following paragraphs describe how to enter and exit the programming mode and how to enter a command.

6.4.1 Entering a Command

To execute a program command, a DTMF number is entered followed by the "#" key. Each time a command is completed, the ZR320 controller responds with five "go ahead" beeps indicating that it is waiting for another command. If an error is detected while programming, the ZR320 controller sends an error "bedo" signal over the transmit audio.

NOTE: While entering a command, the '' key functions as a "clear entry" key.*

All numbers can be entered with or without leading zeros except when programming the Morse code identification (CWID). For example, a 1 may be entered as 0001#, 001#, 01#, or 1#.

Some commands require additional numbers, as in the case of the program mode access code (refer to explanation below). These commands will send two "further information needed" beeps while programming. Although you do not have to wait for each prompt tone before entering the next command (because all commands are internally buffered), we recommend that you listen for the corresponding tones.

NOTE: At any time while programming the unit, if no DTMF key is pressed during a 60-second period, the ZR320 controller will exit program mode automatically.

6.4.2 Program Mode Access Code

The program mode access code followed by a '#' must be entered before programming can take place. The default program mode access code is 12320.

6.4.3 Entering the Program Mode

To enter the program mode:

1. Key the radio and send the five digit DTMF program mode access code (the default is 12320), followed by a '#'.
2. Unkey the radio and listen for five beeps indicating that you have accessed the programming mode.

IMPORTANT: Each tone in the access code must be sent within one second of the preceding tone, or the access code will not be accepted.

6.4.4 Exiting the Program Mode

To exit the program mode:

1. Enter 99#.
2. Listen for a ringing prompt tone, which confirms that you have exited the programming mode.

NOTE: At any time while programming the unit, if no DTMF key is pressed during a period of 60 seconds, the ZR320 controller will exit program mode automatically.

6.4.5 DTMF Command Descriptions

A description of the command codes for the ZR320 controller are given in the following paragraphs. The codes that initiate these command codes follow the description. These codes are be entered into the ZR320 controller via the DTMF keypad on a radio or a DTMF telephone calling a ZR320 or ZR330 controller in the remote programming mode.

6.4.5.1 System Commands

Access Code (01#)

This command sets a 1-9 digit (including "*") access code for radio users to access the ZR320 controller.

Example:

01# *987# Set *987 as the access code.

Once set, *987019 is the full **phone** access code for user 01, and *987017 is the full **paging** access code for user 01.

NOTE: The underlined steering digit (7 or 9) dictates the function of the ZR320 controller. For phone access, either a "9" or a "*" may be used as the steering digit.

Deaccess Code (02#)

This command sets a 1-9 digit (including "#") deaccess code for radio users to deaccess the ZR320 controller. To enter the DTMF # in the sequence, enter it as a '*' because '#' is used to terminate the command. When the ZR320 controller writes the string to the EEPROM, it converts all of the '*' entries to '#' entries.

Example:

02# *77# Set #77 as the deaccess code.

Once set, #7701 is the disconnect code for user 01.

Toll Restrict (03#)
[See also: "Toll Restrict" Digits 1 and 2 (14#, 15#)]

The toll restrict bypass prefix code operates in the same way as the connect prefix code, but allows the user to bypass all toll restrictions.

The toll restrict bypass prefix can consist of the digits 0-9 and '*' and cannot exceed eight digits. The default is 99.

Example:

03# 88# Set 88 as the code required to bypass toll restrictions.

Using the previous examples, the toll restrict/bypass code for user 01 would be 8801*.

6

DTMF Dial (04#) / Pulse Dial (05#)

These commands set the dialing mode for the ZR320.

04# Set to DTMF dial mode **(default).**

05# Set to pulse dial mode.

Ringing Interval (06#, 07#, 08#)

These commands designate how many times the ZR320 allows the phone to ring before answering.

06# Wait one ring **(default)**.

07# Wait three rings.

08# Wait five rings.

Accessory TPL/DPL (09#)

This command enables TPL or DPL generation with local or accessory microphone PTT. This allows an auxiliary microphone input to have TPL or DPL capability. The syntax is identical to the 20# command.

Examples:

09# 01# Encode TPL 67 Hz during local/accessory PTT.

09# 199# Encode DPL 754 during local/accessory PTT.

09# 00# Disable TPL/DPL during local/accessory PTT.

Answer Time (10#)

This command sets the number of seconds the ZR320 controller should wait before forwarding a call to the call forward user. The range is 10 to 60 seconds. The default is 30 seconds.

Example:

10# 11# Set answer time to 11 seconds.

Toll Restrict Digits 1 and 2 (14#, 15#)

These commands designate up to four "prohibited" digits (0-9) for the first (14#) and second (15#) digits dialed in a phone number.

Examples:

14# 9# Disable all outside calls from inside plant area.

15# 019# Disable long-distance calls by preventing a dial with 0 or 1, and "900-" or "976-" numbers with 9 as the second dialed digit.

Ringing Method (16#, 17#)

These commands designate the ringing method. The ringing and/or waiting ends after the mobile answer time has expired (refer to "Answer Time (10#)").

16# Ring once on channel, wait for mobile to answer.

17# Ring on channel until mobile answers **(default).**

Repeater Enable/Disable (18#, 19#, 20#)

These commands set the carrier repeat status and TPL/DPL encoding. The correct TPL tone or DPL code is from the list of users, Table 6-1. A DPL user number must be preceded by a "1".

NOTE: Setting encoding enables the repeat only in RSS programming. You must use the 18# command to enable the repeater as well as the 20# command to encode TPL/DPL when programming via DTMF tones.

Examples:

18#	Enable repeater.
19#	Disable repeater **(default)**.
20# 01#	Encode TPL 67.0 Hz during repeat.
20# 199#	Encode DPL 754 during repeat.
20# 0#	Repeat carrier squelch without TPL/DPL encode (disable encode).

Repeat Hang Time (21#-24#)

These commands set the delay before unkeying the transmit radio.

21#	No repeat hang time.
22#	1-second repeat hang time.
23#	3-second repeat hang time **(default)**.
24#	5-second repeat hang time.

Morse ID (25#)

To program the Station ID with the DTMF keypad, you must first understand how to enter the number and letter codes so that the resulting Morse code corresponds to the required station's call sign. Each code will contain two digits. Refer to Figure 6-11 when following the steps to enter the codes.

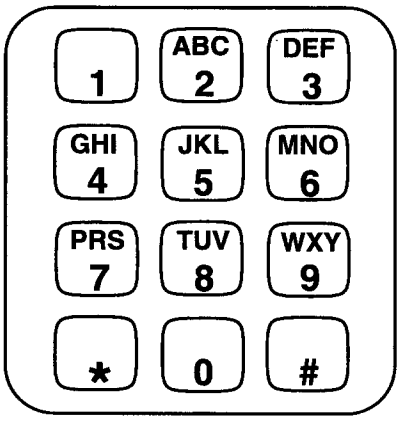


Figure 6-11. DTMF Keypad

To enter a letter code:

1. Determine the desired letter's position on the key (1 for the leftmost letter on a key, 2 for the center letter, or 3 for the rightmost letter).
2. Press the digit that corresponds to the letter's position (1, 2, or 3). This is the first digit of the letter code. For example, the first digit in the code for the letter N would be 2.
3. Press the key that the desired letter appears on. This is the second digit of the letter code. For example, the second digit in the code for the letter N would be 6.

6

The only characters not represented by this method are Q and Z. The code for Q is "10" and the code for Z is "20." Later issues of firmware include the slant-bar ("/"); the code for "/" is "30."

To enter a number code:

1. Press the "0" key.
2. Press the key that the desired number appears on.

Example:

Set the call sign WNQR 414 (enter the following on the DTMF keypad):

	25#	19	26	10	27	04	01	04	#
Meaning -	ID#	W	N	Q	R	4	1	4	done

Courtesy Tone (26#, 27#)

These commands enable or disable the courtesy tone.

26# Enable courtesy tone.

27# Disable courtesy tone **(default)**.

Privacy Mask (28#, 29#)

These commands set the privacy mask status.

28# Set privacy mask on.

29# Set privacy mask off **(default)**.

Call Limit Timer (30#-35#)

These commands set the duration of the call limit timer.

30# Enable call limit timer **(default).**

31# Enable call limit timer and allow user to reset with '*.'

32# Set no call limit/Disable call limit timer.

33# Set call limit to 3 minutes **(default)**.

34# Set call limit to 5 minutes.

35# Set call minutes to 10 minutes.

Radio Timeout (36#, 37#, 38#)

These commands set the timer for loss of radio activity. Stop call after loss of radio signal for:

36# 30 seconds **(default)**.

37# 45 seconds.

38# 1 minute.

Operating Mode (40#-43#)

These commands set the operating mode of the ZR320.

40# Set half-duplex mode **(default)**.

41# Set full-duplex mode.

42# Set simplex VOX.

43# Set simplex VOX with pre-key.

VOX Hang Time (44#-49#)

For the VOX operating modes, these commands change the VOX hang time. Change VOX hang time to:

44#	0.5 seconds.
45#	0.8 seconds.
46#	1 second **(default)**.
47#	1.3 seconds.
48#	1.5 seconds.

6.4.5.2 User Commands

Call Forward User Number (50#)

This command is used to set the call forward user number for any user. After the command has been executed, two beeps sound, prompting you to enter the user number. After you enter the user number, the ZR320 issues two more beeps prompting you to enter a call forward user number (for forwarding calls to, if the first user does not answer). If you wish to disable call forwarding on a particular user, press the '#' key when the ZR320 is asking for the second user number. Because calls to pagers are not expected to be answered, call forwarding is not used on tone only or tone + voice pagers.

NOTE: For calls to be forwarded as programmed, the first user must both be enabled. Refer to "Selecting User Equipment Type (69#-80#)".

Example:

50# 89# 31# If user number 89 does not answer, forward the call to user 31.

Morse ID (60#, 61#, 62#)

60#	Disable any Morse ID.
61#	Sends the Morse ID every 10 minutes only with activity.
62#	Sends the Morse ID every ten minutes regardless of activity.

Unit ID (63#)

Unit ID is used where multiple ZR320 controllers are used with one or more ZR330 controllers. The range is 0-9. The default is 0.

Example:

63# 3# Enter unit ID of 3.

QCII Stop Scan Mode (64#)

To enter a TPL, begin the sequence with a '0' and for DPL, begin with a '1'. The TPL/DPL digits (the last two entered) come from Table 6-1 that is used to assign TPL and DPL codes to system users. To eliminate TPL/DPL encode during QCII signaling, enter "00." During calls to tone only and tone and voice pagers, the stop scan tone will not be encoded. The default is "00" - no TPL or DPL encode with QCII pages.

Examples:

64# 013#	Set ZR320 to generate TPL tone 100.0 Hz.
64# 103#	Set ZR320 to generate DPL code 031.
64# 0#	Disable DPL/TPL encode with QCII pages.

6

QCII Tone Groups 1 and 2 (65#, 66#)

These commands set the QCII tone groups. The range is 1-6. Both tone groups may be the same.

Examples:

65# 4# Select QCII tone 1 from group 4 **(default =1)**.

66# 6# Select QCII tone 2 from group 6 **(default =2)**.

Talk Time (67#)

This command sets the amount of time for callers to talk to pagers. The range is 1-30 seconds. The default is 10 seconds.

Example:

67# 20# Set the talk time to 20 seconds.

Autocall User Number (68#)

This command sets the autocall user number, who is called if a telephone caller does not enter a user number within five seconds of connecting to the ZR320 controller.

Example:

68# 31# Select user 31 as the autocall user.

Selecting User Equipment Type (69#-80#)

These commands select the equipment type for the active user.

Examples:

69# 23# QCII Radio Group Call unit for user 23.

70# 02# Disable User 02.

71# 49# PL (TPL 250.3 Hz) Radio User 49.

72# 80# DPL 532 Radio User 80.

73# 89# QCII Radio User 89.

74# 21# QCII Tone Only Pager User 21.

75# 23# QCII Tone and Voice Pager User 23.

76# 28# TPL (TPL 162.2 Hz) Talkback Pager User 28.

77# 83# DPL 606 Talkback Pager User 83.

78# 61# QCII Talkback Pager User 61.

79# 73# Direct Air User 73.

80# 00# ZR330 Remote Phone User 00.

NOTE: You may also want to set call forwarding for the enabled user, unless that user's equipment type is a tone only or a tone and voice pager (74#, 75#). Refer to "Call Forward User Number (50#)" for the necessary commands.

Single-/Multi-User (81#, 82#)
[See Also: "Unit ID (63#)" and "Autocall User Number (68#)"]

These commands set the mode of operation for the ZR320 controller.

81# Set single user operation **(default)**.

82# Set multi-user operation.

COR Hang Time (83#-86#)

These commands set the COR hang time or disable it. Set the COR hang time to:

83# No COR hold time **(default)**.

84# 100 msec.

85# 300 msec.

86# 500 msec.

Detect Busy Telephone Line (87#, 88#, 89#)

These commands set when busy signals will be detected to stop a call.

87# Disconnect on busy for first 20 seconds **(default)**.

88# Disable busy detect.

89# Disconnect on busy for duration of call.

6.4.5.3 Diagnostic Commands

Program Access Code (90#)
[See Also: "Access Code (01#)"]

The program mode access code is used to gain access to the ZR320 controller's program mode with either a DTMF equipped mobile or portable, or a DTMF telephone. The program access code must be exactly five digits in length (no shorter, no longer) and defaults to 12320.

This command sets a new program access code.

Example:

90# 63693# Enter number '63693' as the new program access code.

Reset (91#)

This command will reset the ZR320 controller to all of the factory default settings. Refer to Appendix A, "Quick Reference of Programming Codes," for the defaults. When this command is used, the user and the call forwarding databases are erased.

Setup and Testing (92#,93#, 95#)

These commands are for initial setup and testing. Pressing any digit will end the test.

Examples:

92# Transmit level test.

93# TPL/DPL level test.

95# Hybrid test.

6

Remote Programming (97#)

This command is used to remotely program a ZR320 controller from a ZR330 controller. Refer to "Programming the ZR320 Controller through the ZR330 Controller" below.

Program Exit (99#)

This command causes the ZR320 controller to exit the programming mode.

Example:

99# Exit programming.

NOTE: At any time while programming the unit, if no DTMF key is pressed during a period of 60 seconds, the ZR320 controller will exit program mode automatically.

6.5 Programming via Telephone

6.5.1 Entering Program Mode Through a Telephone

The ZR320 controller can be programmed using a DTMF telephone connected through the telephone company central office or a PBX to the **Phone** jack on the back panel.

NOTE: While in the telephone programming mode, DTMF programming cannot be accessed over the radio channel.

6.5.1.1 Single/Multi User Mode

The differences in the way the ZR320 controller handles incoming phone calls from the landline require two methods for programming, one for single-user and another for multi-user mode.

To access programming mode for the ZR320 controller in **single-user mode**:

1. Turn off the transmit radio. (This frees the radio channel for other users.)
2. Dial the phone number of the ZR320 controller.
3. Let the phone ring until the mobile answer time has expired. At this time the ZR320 controller answers the telephone line and sends two beeps to the caller.

IMPORTANT: Phone mail or answering machines on the same line as the ZR320 controller may prevent the mobile answer time from expiring, inhibiting program mode.

4. Enter the five digit program mode access code, remembering to enter digits no more than one second apart.
5. Press #.
6. Listen for five beeps indicating that you have accessed the programming mode.

To access programming mode for the ZR320 controller in **multi-user mode**:

1. Turn off the transmit radio. (This frees the radio channel for other users.)
2. Dial the phone number of the ZR320 controller.
3. Let the ZR320 controller answer the telephone and send the query beep to the caller.
4. Enter the five digit program mode access code, remembering to enter digits no more than one second apart.
5. Press #.
6. Listen for five beeps, indicating that you have accessed the programming mode.

6.6 Programming the ZR320 Controller through the ZR330 Controller

The ZR320 controller can be remotely programmed through a ZR330 Radio/Telephone Interface. To accomplish this, perform the following steps.

1. Enter the ZR330 controller's DTMF programming mode.
2. Enter command code 97#. A beep will be heard indicating that the VOX to talk mode has been accessed.
3. Enter the program mode access code of the ZR320 controller being programmed, remembering to enter digits no more than one second apart.
4. Press #.
5. Program the ZR320 controller as you would with a DTMF-equipped mobile radio.

NOTE: At any time while programming the unit, if no DTMF key is pressed during a period of 60 seconds, the ZR320 controller will exit program mode automatically.

6. Hang up the ZR330 radio/telephone when finished programming.

NOTE: Hanging up the telephone will send the command 99# to the ZR320 controller to terminate remote programming. If the user has already sent the command, nothing will happen when the ZR330 radio/telephone sends it again.

(Page 6-32 is blank)

7 ZR330 Controller Programming

7.1 Overview

This section contains information and procedures that allow the technician to program the ZR330 controller.

You can program the ZR330 controller in the following ways:

- ❑ with a Motorola RIB compatible interface, using a computer running Motorola GM300/GR300 Radio Service Software (RSS)
- ❑ locally, using an attached telephone
- ❑ remotely, through the ZR320 controller.

7.2 Programming via Radio Service Software (RSS)

We recommend that you program the ZR330 controller using a PC that runs the Motorola Radio Service Software (RSS), because it is the easiest programming method. Using this software allows you to access the programmable features of the ZR330 controller from user-friendly screens on the PC. You can archive the final configuration for safekeeping or later examination. The **Programming** port is hardware compatible with the Motorola RIB. The RSS prompts the system installer to plug into the ZR330 controller, and when to read or write its configuration.

7.3 Configuring the System

The configuration of the ZR330 controller is similar to that of the ZR320 controller.

7.3.1 Set Repeater Type and Radio Parameters

From the Main Menu:

1. Press **F4** (Change/View).
2. Press **F5** (Mode Configuration).

The screen that appears will vary, depending on the type of ZR330 Remote Telephone System you have read (refer to Figure 7-1 and Figure 7-2).

You may choose between two types of ZR330 systems:

- ❑ Phone Remote RMT (with tone or dc remote)
- ❑ Phone Remote PA (with public address)

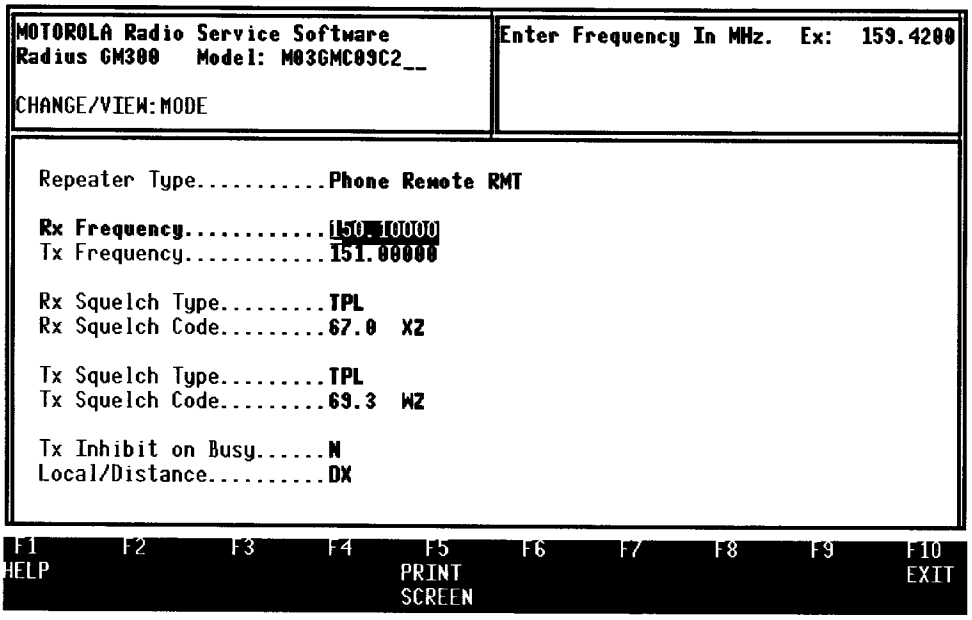


Figure 7-1. Change/View: Phone Remote RMT

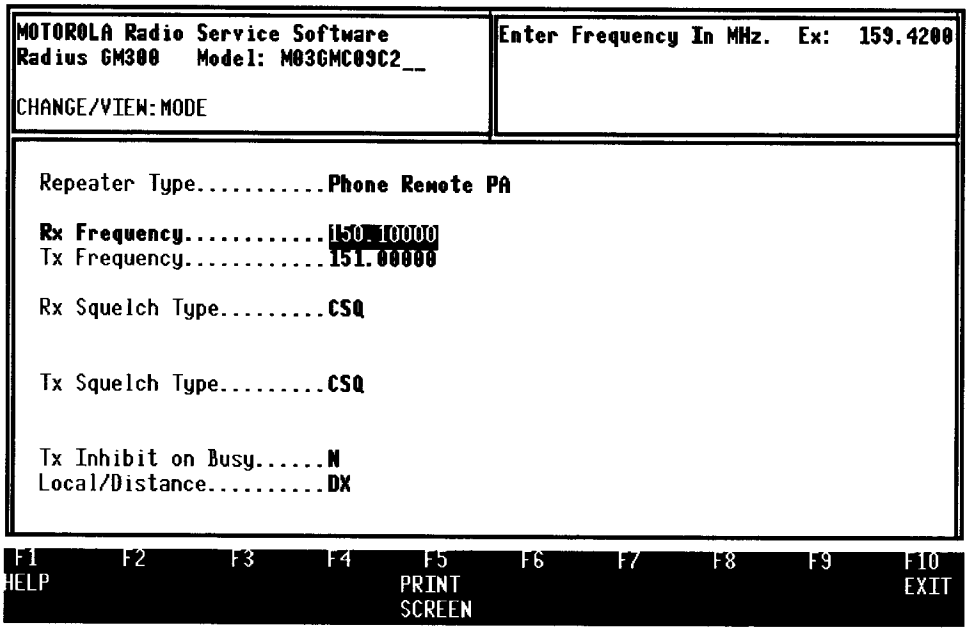


Figure 7-2. Change/View: Phone Remote PA

NOTE: If you have read only the option board, the screens in Figure 7-1 and Figure 7-2 will not appear. If you have read only the transmit or the receive radio, not all fields will be shown.

When the cursor is positioned on the line titled **Repeater Type**, although the ZR330 controller is not a repeater, use the up/down arrow keys to toggle between the different ZR330 controller types.

For information about Rx and Tx frequencies, Rx squelch types and codes, Tx inhibit on busy, and local/distance, refer to the GM300 Radio Service Software Manual (6880902Z36).

7.3.2 ZR330 Programmable Features

Four programmable features can be set for the ZR330 controller. They all fall into the category of System-Programmable Fields.

7.3.2.1 System-Programmable Fields

The information in these fields affects all users.

From the Main Menu:

1. Press **F4** (Change/View).
2. Press **F2** (Radio/Wide).

The ZR330 Controller System Configuration Screen in Figure 7-3 should appear.

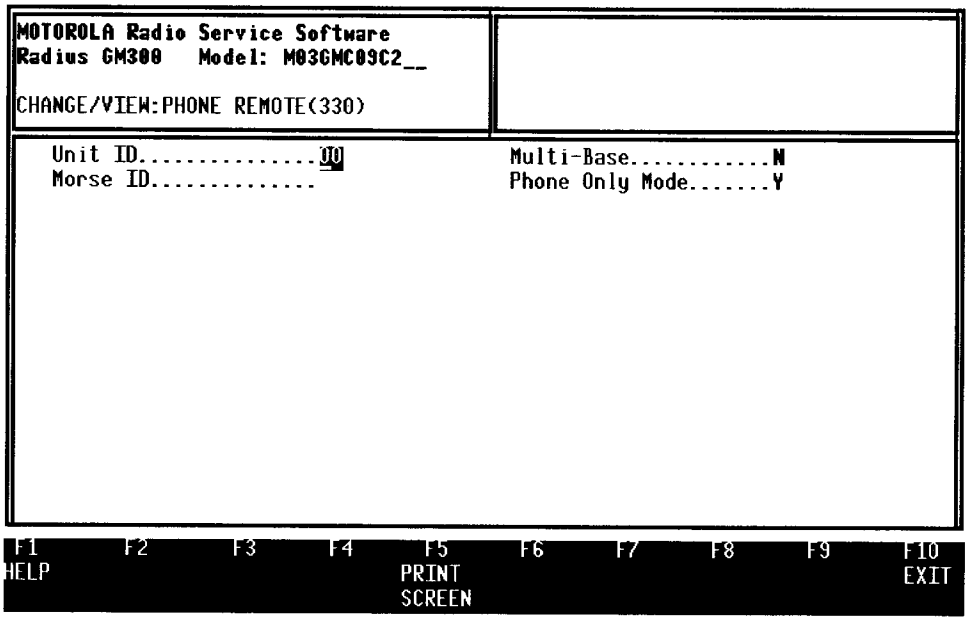


Figure 7-3. Change/View: Phone Remote (ZR330 Controller)

Unit ID

The ZR330 controller must be used in conjunction with a ZR320 controller (or multiple ZR320 controllers). The unit ID for the ZR330 controller corresponds with a user number on the ZR320 controller (or ZR320 controllers).

The range for the unit ID is 00-99. The default is 00.

Morse (Station) ID

If set, the ZR330 controller transmits the call sign of the station at the end of each phone call. The station ID option sets the station's Morse code ID. The ID is sent at the end of each call at 30% deviation and 25 words per minute. The ID tone frequency is 1 kHz.

The Morse ID can be up to eight characters long. These characters can be digits from 0-9, or the letters A-Z. The default is a blank field.

IMPORTANT: The ID will be sent even if the radio does not answer a call.

Multi-Base

The multi-base option allows the ZR330 controller to address multiple ZR320 controllers.

The multi-base can be set to:

- ❑ **Y**—address multiple ZR320 controllers
- ❑ **N**—address only a single ZR320 controller **(default)**

Phone Only Mode

The phone only mode restricts the ZR330 controller to telephone use only. If this mode is set to Y (Yes), mobile "like" operation is disabled. For telephone line extender (rural telephone) operation, use phone only mode (**Y**).

The phone only mode can be set to:

- ❑ **Y**—telephone use only **(default)**
- ❑ **N**—mobile or telephone use possible

7.4 Local Programming

7.4.1 Entering a Command

To execute a program command, a DTMF number is entered followed by the "#" key. Each time a command is completed, the ZR330 controller responds with five "go ahead" beeps indicating that it is waiting for another command. If an error is detected while programming, the ZR330 controller sends an error "bedo" signal over the transmit audio.

NOTE: While entering a command, the '*' key functions as a "clear entry" key.

All numbers can be entered with or without leading zeros except when programming the Morse code identification (CWID). For example, a 1 may be entered as 0001#, 001#, 01#, or 1#.

Some commands require additional numbers, as in the case of the program access mode (refer to explanation below). These commands will send two "further information needed" beeps while programming. Although you do not have to wait for each prompt tone before entering the next command (because all commands are internally buffered), we recommend that you listen for the corresponding tones.

NOTE: At any time while programming the unit, if no DTMF key is pressed during a 60-second period, the ZR330 controller will exit program mode automatically.

7.4.2 Entering the Program Mode

To enter the program mode:

1. Press the "*" key on the telephone set, then lift the handset from the cradle.
2. Listen for five beeps, indicating that you have accessed the programming mode.

7.4.3 Exiting the Program Mode

To exit the program mode:

1. Enter 99#.
2. Listen for a ringing prompt tone, which confirms that you have exited the programming mode.

NOTE: At any time while programming the unit, if no DTMF key is pressed during a period of 60 seconds, the ZR330 controller will exit program mode automatically.

7.4.4 DTMF Command Descriptions

The DTMF commands are entered from the DTMF telephone set connected to the ZR330 controller "Telephone" jack or remotely from a ZR320 controller.

7.4.4.1 System Commands

The following DTMF system commands can be used in the same way as for the ZR320 controller (refer to the explanations and examples for the ZR320 controller):

25# Morse ID (default = blank).

63# Unit ID (default = 00).

IMPORTANT: Any system commands not listed here or explained below are not valid programming commands for the ZR330 controller.

Single-/Multi-ZR320 Controller Operation (81#, 82#)

These commands tell the ZR330 controller whether or not to prompt the user to enter the unit ID of a ZR320 controller. For single-ZR320 controller operation, no prompt is given; for multi-ZR320 controller operation, there is a prompt tone.

81# Single-ZR320 controller operation **(default)**.

82# Multi-ZR320 controller operation.

Telco Link Enable/Disable (83#, 84#)

These commands enable or disable the ZR330 controller to make mobile to mobile calls.

83# Telco link enable Phone Only mode; (disable mobile calling).

84# Telco link disable (enable mobile calling) **(default).**

7.4.4.2 Diagnostic Commands

The following DTMF diagnostic commands can be used in the same way as for the ZR320 controller (refer to the explanations and examples for the ZR320 controller):

Reset (91#)

91# Reset to defaults.

Setup and Testing (92#,93#, 95#)

92# Transmit level test.

93# TPL/DPL level test.

95# Hybrid test.

Remote Programming (97#)

97# Remote programming.

IMPORTANT: Any diagnostic commands not listed here are not valid programming commands for the ZR330 controller.

7.5 Programming the ZR330 Controller Through the ZR320 Controller

1. Using a telephone, enter the programming mode on the ZR320 controller.
2. Enter command code 97# to enter remote programming for programming the ZR330 controller. A double beep will sound.
3. Enter the two-digit unit ID of the ZR330 controller.
4. Wait until a "bedo" tone sounds, confirming that the link is established. You are ready to program.

*NOTE: **If you hear three error tones, the link could not be established.***

5. Wait for the accessed ZR330 controller to respond with five programming beeps.
6. Program the ZR330 controller.

*NOTE: **At any time while programming the unit, if no DTMF key is pressed during a period of 60 seconds, the ZR320 controller will exit program mode automatically.***

7. To exit the remote programming mode, enter 99# (both units will exit programming mode).

8 TRA100R Controller Programming

8.1 Overview

The following section describes the programming information for the radios used to assemble a repeater with the TRA100R Tone Remote Repeater Controller.

8.2 Programming the TRA100R Controller

8.2.1 DIP Switch Settings for SwA and SwB

Down is ON for all switches. SwA is the leftmost switch bank consisting of 8 switches that control the tone remote operations. SwB is the right switch bank consisting of 8 switches that control the repeater interface functions. Switches are numbered left to right.

Table 8-1 and Table 8-2 show the functions of the SwA and SwB switches for the TRA100R controller.

Table 8-1. SwA DIP Switch Settings for the TRA100R Controller

SwA Section	Function
1	Revert Control (refer to Table 8-3)[1]
2	Revert Control (refer to Table 8-3)[1]
3	Revert Control (refer to Table 8-3)[1]
4	Latch Last Channel UP Revert to channel determined by SwA-1, 2 and 3 above (after line PTT is removed) DOWN Stay on last channel commanded from remote
5	Monitor Function UP Monitor function, from remote, constantly enabled until reception of a line PTT command. DOWN Monitor function active for 3 seconds after monitor command.
6	Line Monitor Select UP Monitors receive audio of transmit radio. Pin 8 of transmit radio must be programmed for CSQ Detect active low. The "Rx Squelch Type" of the transmit radio must be programmed to "CSQ." DOWN Monitors receive audio of receive radio. When down: • Pin 4 of receive radio must be programmed for CSQ Detect. (Active Level=Low) • Pin 14 of receive radio must be programmed for Mic Off Hook. (Active Level=Low) • JU14-3 and -4 must be jumpered together. • Remote setup/knockdown feature, via RapidCall, is lost.
7	Transpond Enable UP Normal operation (no acknowledge beeps) DOWN TRA100R sends short acknowledge beep to remote after a valid function tone is decoded.[2]
8	Line Termination UP Line termination OUT (bridging) DOWN Line termination IN (600 Ω)

1: Revert means that the channel steering outputs will latch to the selected channel (per Table 8-3) after the removal of line PTT. This requires that SwA-4 be set to the UP position.

2: The transpond beep cannot be heard during transmit unless the remote deskset is equipped for full duplex or 4-wire operation. For 4-wire operation, the 4-wire option board must be installed in the TRA100R controller.

Table 8-2. SwB Functions for the TRA100R Controller

SwB Section	Function
1	Drop Out Delay (refer to Table 8-4)
2	Drop Out Delay (refer to Table 8-4)
3	Repeater Audio Output Select UP EIA microphone transmit audio DOWN Flat transmit audio
4	Receiver to Transmitter Audio Mute Control UP Receive radio audio muted (normal) DOWN Receive radio audio continuous
6	RapidCall Remote Setup/Knockdown Enable UP RapidCall remote setup/knockdown disabled DOWN RapidCall remote setup/knockdown enabled
7	Line PTT Priority Enable UP Line PTT priority disabled DOWN Line PTT priority enabled
8	Power-Up State UP Unit powers up in knockdown state DOWN Unit powers up in setup state

Table 8-3. Revert Controls

SwA-1 Position	SwA-2 Position	SwA-3 Position	Revert to:
UP	UP	UP	"HOME" CH
DOWN	UP	UP	CH-1
UP	DOWN	UP	CH-2
DOWN	DOWN	UP	CH-3
UP	UP	DOWN	CH-4
DOWN	UP	DOWN	"HOME" CH
UP	DOWN	DOWN	"HOME" CH
DOWN	DOWN	DOWN	"HOME" CH

Table 8-4. Drop-Out Delays

SwB-1 Position	SwB-2 Position	Drop Out Delay
UP	UP	no delay
DOWN	UP	1.5 second delay
UP	DOWN	3 second delay
DOWN	DOWN	6 second delay

8.2.2 Programming Example

A waste disposal company, "Mona and Becky's Waste Systems," has just won the contract to haul trash for several surrounding communities. Their simplex operation does not allow communications between the trucks in these outlying areas. You decide that this is an excellent application for a Radius GR500 wall mount repeater. The frequencies for the repeater are: receive on 468.450 MHz and transmit on 463.450 MHz. Tone coded squelch and TPL of 103.5 (1A) will be used. The Time-Out Timer of the transmit radio will be set for 180 seconds (3 minutes). "DX" mode of the receive radio will be needed. No signalling systems will be programmed into the radios. Normal receiver and transmitter audios will be used for both radios.

The repeater drop out delay (or hang time) will be set at 3.0 seconds. No remote setup/knockdown is needed but the repeater must power-up in the setup condition.

The antenna site for the repeater is located on top of a tall building about a half mile from the dispatcher office. A dedicated leased line is available for remote control of the repeater. A TRA100R repeater controller will allow a local dispatcher to communicate with the trucks. Line PTT will have priority over repeater PTT. Since this is a single channel repeater, channel steering is not required. The receiver audio of the transmit radio will be monitored for 3 seconds after pushing the monitor button on the C100 Remote Deskset. The TRA100R controller is the only telephone type device on the leased line and will provide the proper 600 Ω termination.

8.2.2.1 Programming the Receive Radio

The receive radio is a 1-10 Watt UHF 16-Channel GM300 mobile radio. Mode 1 will be programmed to receive on 468.4500 MHz with PL 103.5 Hz (1A). The transmit frequency will be "BLANK".

Setting Up the Equipment

1. Connect the GR500 repeater's power supply to an appropriate ac outlet.

Reading the Radio

1. From the "MAIN MENU", press **F3** (GET/SAVE CODEPLUG DATA).
2. Check that **F2** is defined as "READ Radio". If not, press **F6** (CHANGE TO RADIO MODE).
3. Connect the RIB programming cable to the receive radio. Press **F2** (READ RADIO).
4. After the radio is read, a highlighted area may appear to advise that the radio was previously programmed in Repeater mode. Press **F2** (CONTINUE).
5. Press **F10** (EXIT) to return to the "MAIN MENU".

Adjusting the Accessory Connector Settings

1. Press **F4** (CHANGE VIEW).
2. Press **F2** (RADIO WIDE).
3. **Tab** down to the "ACC. External" highlight. Use the up or down arrow key to scroll to "Remote". Press **Enter** (refer to Figure 8-1).
4. Press **F9** (OTHER ACCESSORY).
5. **Tab** down to highlight "Pin 8" function. Use the up or down arrow key to scroll to "PL/DPL & CSQ Det" with an "Output" direction. If the "Low" active level description is present, proceed to Step 7. If the active level is "High", press **Tab** until the "High" is highlighted under the "ACT LEVEL" column.
6. Press the up-arrow key to toggle to the "Low" condition. Press **Enter**.
7. If a "Power-Up Delay (sec)" is desired, then press **Tab** until that area is highlighted. Select the desired delay with the up/down arrow key. We will use the default value of "0.187" seconds (refer to Figure 8-2).
8. Press **F10** (EXIT) twice to return to the "CHANGE/VIEW CODEPLUG MENU".

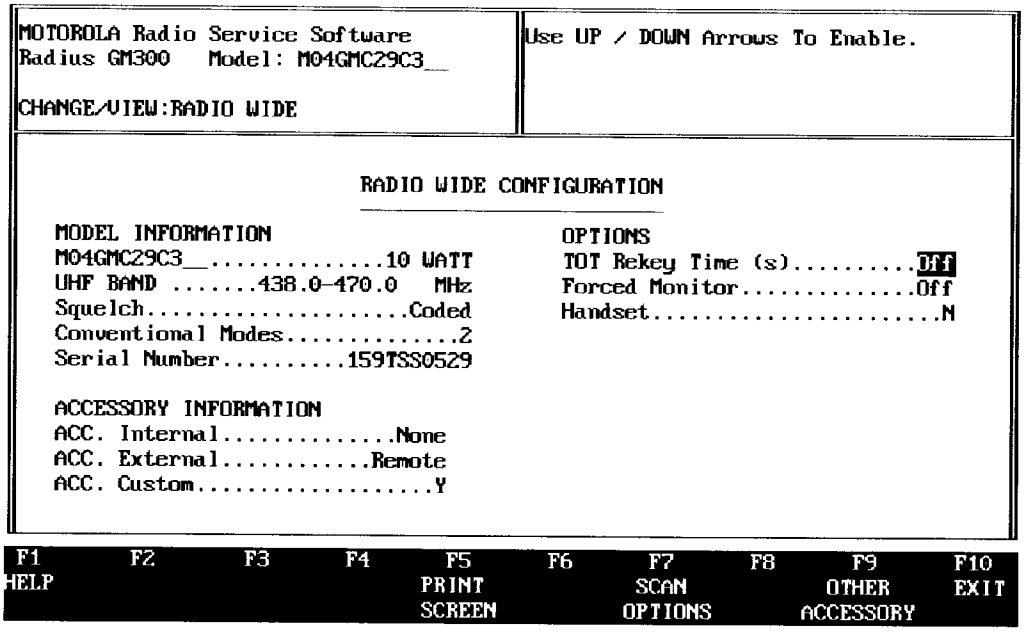


Figure 8-1. Change/View, Radio Wide, Receive Radio

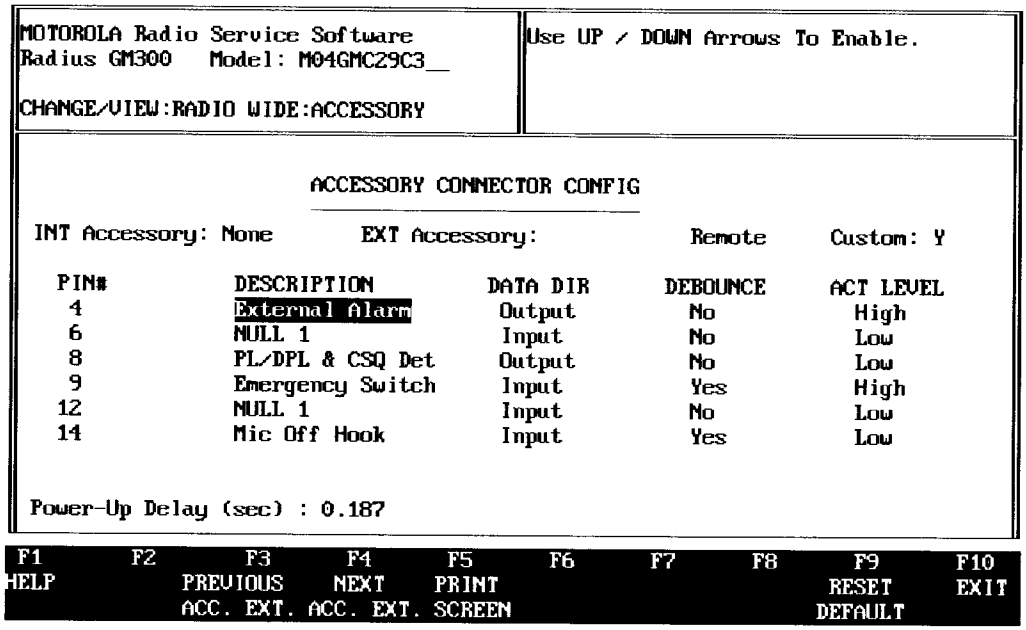


Figure 8-2. Change/View, Radio Wide, Accessory, Receive Radio

Setting the Radio Frequencies

1. Press **F5** (MODE).
2. Use **Tab** to highlight "Rx Frequency".
3. Key in the receive frequency of 468.4500 MHz. Press **Enter**.
4. Key in "BLANK" (or "B") for the transmit frequency. Press **Enter**.

Setting the Receive Squelch Type

1. Press the up-arrow key to scroll the "Rx Squelch Type" to "TPL". Press **Enter**.
2. Key in the TPL frequency, "103.5"or the code "1A." Press **Enter**.

Setting Local/Distance

1. Press **Tab** until "Local/Distance" is highlighted. Use the up-arrow key to scroll to "DX". Press **Enter** (refer to Figure 8-3).
2. Press **F10** (EXIT) twice to return to the "MAIN MENU". Verify that you have the "MAIN MENU" screen.

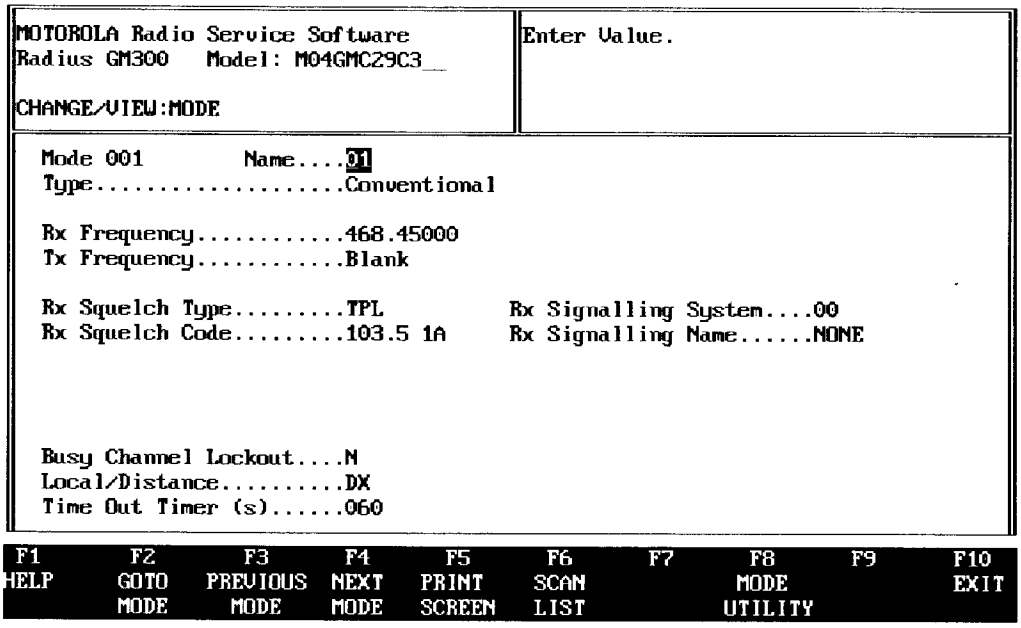


Figure 8-3. Change/View, Mode, Receive Radio

Programming and Saving

1. Press **F3** (GET SAVE).
2. Press **F8** (PROGRAM CODEPLUG) to program the radio. A message will appear to verify that you want to program the radio. Press **F2** (CONTINUE), to confirm.
3. Press **F7** (SAVE FILE) to save the codeplug data to a disk file. If the radio has not been previously programmed, you will be prompted to "CONTINUE" by pressing **F2**. You will be asked for a "Customer ID:" such as "Mo_and_Becks_Rx".
4. Press **F8** (SAVE), to save the data to the disk.

8.2.2.2 Programming the Transmit Radio

The transmit radio is a Radius 10-25 Watt UHF 16-channel GM300 radio. Mode 1 will be programmed with receive and transmit frequencies of 463.4500 MHz. The receiver will operate in CSQ mode for monitoring by the C100 deskset. The transmitter will encode PL 1A (103.5 Hz). The Time-Out Timer will be set to 3 minutes (180 seconds).

Reading the Radio

1. Move the RIB programming cable to the transmit radio. Press **F2** (READ RADIO).
2. After the radio is read, a highlighted area may appear to advise that the radio was previously programmed in Repeater mode. Press **F2** (CONTINUE).
3. Press **F10** (EXIT) to return to the "MAIN MENU".

Adjusting the Accessory Connector Settings

1. Press **F4** (CHANGE VIEW).
2. Press **F2** (RADIO WIDE).
3. Tab down to the "ACC. External" highlight. Use the up/down arrow key to scroll to "Remote". Press **Enter**. (Your screen will look similar to Figure 8-4.)

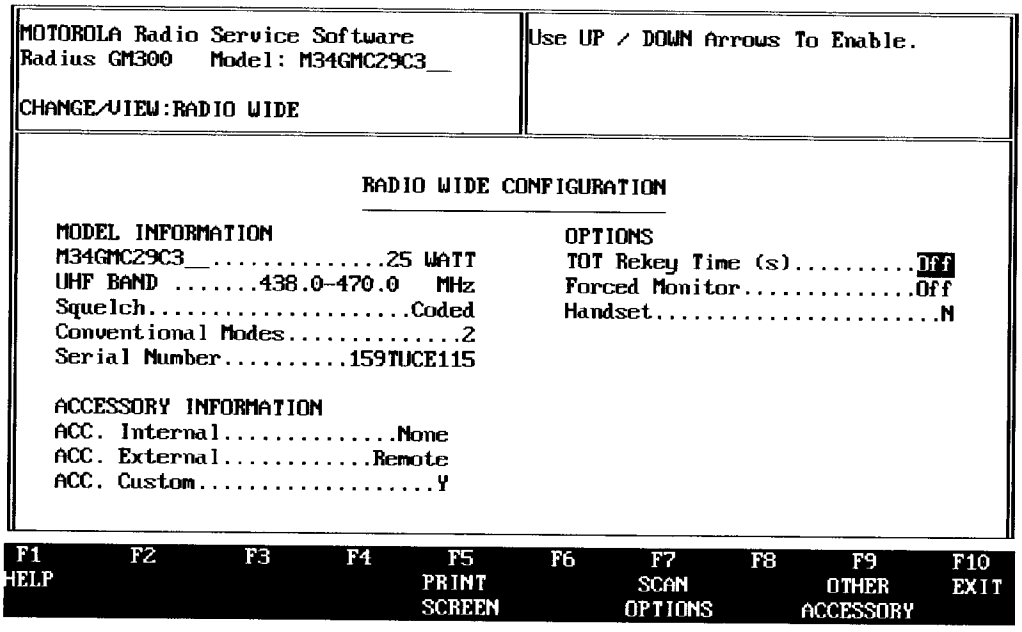


Figure 8-4. Change/View, Radio Wide, Transmit Radio

4. Press **F9** (OTHER ACCESSORY).
5. **Tab** down to highlight "Pin 8" function. Use the up/down arrow key to scroll to "PL/DPL & CSQ Det" with an "Output" direction. If the "Low" active level description is present, proceed to Step 7. If the active level is "High", press **Tab** until the "High" is highlighted under the "ACT LEVEL" column.
6. Press the up-arrow key to toggle to the "Low" condition. Press **Enter**.

7. If a "Power-Up Delay (sec)" is desired, press **Tab** until that area is highlighted. Select the desired delay with the up/down arrow key. We will use the default value of "0.187" seconds. (Your screen will look similar to Figure 8-5).

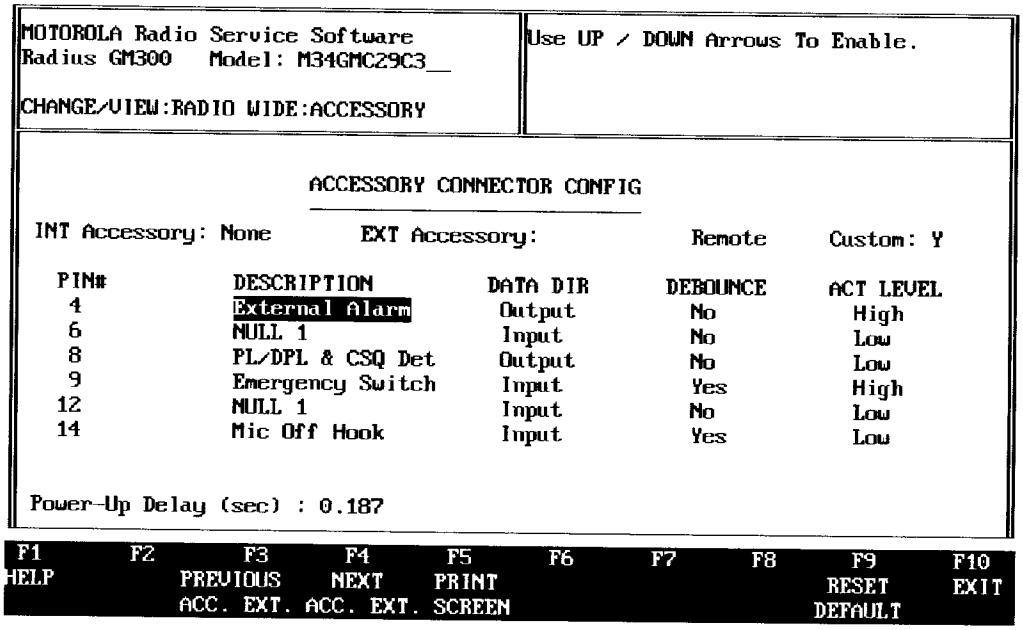


Figure 8-5. Change/View, Radio Wide, Accessory, Transmit Radio

8. Press **F10** (EXIT) twice to return to the "CHANGE/VIEW CODEPLUG MENU".

Setting the Radio Frequencies

1. Press **F5** (MODE).
2. Press **Tab** to highlight "Rx Frequency".
3. Key in the receive frequency of 463.4500 MHz. Press **Enter**.
4. Key in the transmit frequency of 463.4500 MHz. Press **Enter**.

Setting the Receive and Transmit Squelch Types

1. Press the up-arrow key to scroll the "Rx Squelch Type" to "CSQ". Press **Enter**.
2. Press **Tab** to highlight "Tx Squelch Type".
3. Press the up-arrow key to scroll the "Tx Squelch Type" to "TPL". Press **Enter**.
4. Key in the TPL frequency of "103.5" or the TPL code "1A". Press **Enter**.

Setting Busy Channel Lockout to "NO"

1. Press **Tab** until "Tx Inhibit on Busy" is highlighted.
2. Use the up-arrow key to scroll to "N" (NO). Press **Enter**.

Setting Local/Distance

1. Use the up-arrow key to scroll "Local/Distance" to "DX". Press **Enter**.

Setting the Time Out Timer

1. Key in the desired "Time-Out Timer (s)" of "180" seconds (refer to Figure 8-6). Press **Enter**.

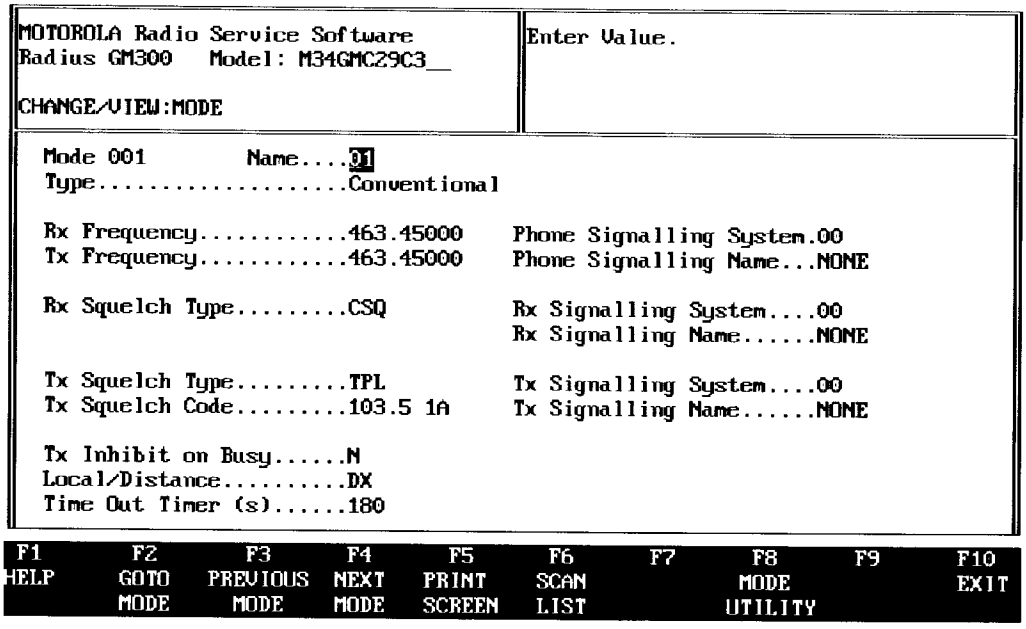


Figure 8-6. Change/View, Mode, Transmit Radio

2. Press **F10** (EXIT) twice to return to the "MAIN MENU". Verify that you have the "MAIN MENU" screen.

Programming and Saving

1. Press **F3** (GET SAVE).
2. Press **F8** (PROGRAM CODEPLUG) to program the radio. A message will appear to verify that you want to program the radio. Press **F2** (CONTINUE), to confirm.
3. Press **F7** (SAVE FILE) to save the codeplug data to a disk file. If the radio has not been previously programmed, you will be prompted to "CONTINUE" by pressing **F2**. You will be asked for a "Customer ID:" such as "Mo_and_Becks_Tx".
4. Press **F8** (SAVE), to save the data to the disk.

8.2.2.3 TRA100R DIP Switches (SwA and SwB) Settings

For DIP switches SwA and SwB, the OFF position is UP and the ON position is DOWN. The sections of dipswitch SwA determine the remote control operation:

- ❑ There is no channel steering, so the settings of the first four switches, SwA-1 through SwA-4 may be OFF or ON.
- ❑ The monitor function will be active for only 3 seconds each time the Monitor button on the C100 deskset is pressed: SwA-5 ON.
- ❑ Line monitoring of the receive audio from the transmit radio is used: SwA-6 OFF.
- ❑ Normal operation of the TRA100R is used: SwA-7 OFF.
- ❑ The TRA100R will terminate the line: SwA-8 ON.

After setting all of the positions, DIP switch SwA should look like Figure 8-7:

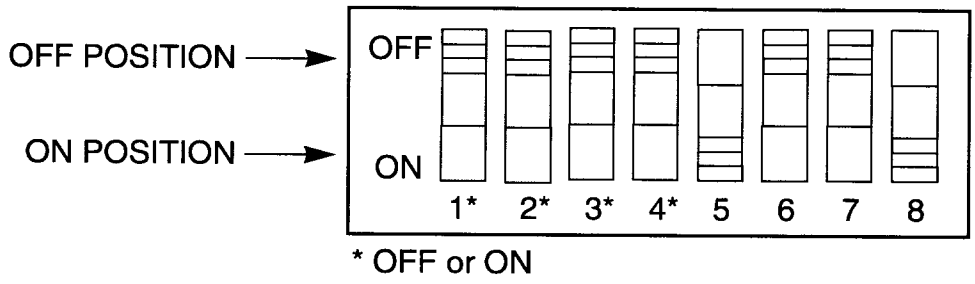


Figure 8-7. SwA Settings

The sections of DIP switch SwB determine the repeater functions:

- A 3.0 second transmitter drop out delay is desired: SwB-1 OFF and SwB-2 ON.
- Normal, EIA microphone transmit audio: SwB-3 OFF.
- TRA100R will gate the repeated audio: SwB-4 OFF.
- SwB-5 has no function: set it ON or OFF.
- No remote setup/knockdown: SwB-6 OFF.
- Line PTT has priority: SwB-7 ON.
- The repeater is to be setup upon application of ac power: SwB-8 ON.

After setting all of the positions, DIP switch SwB should look like Figure 8-7:

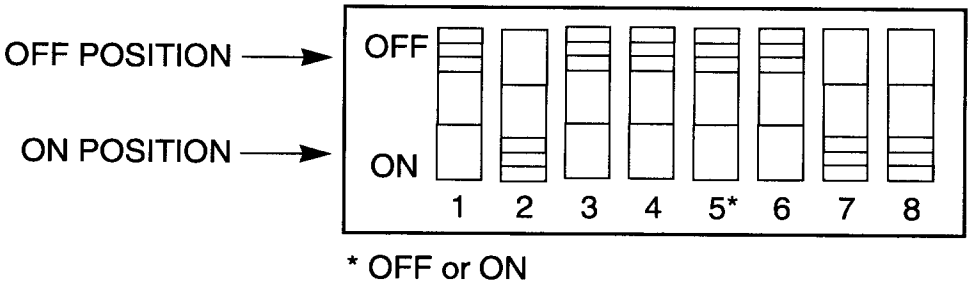


Figure 8-8. SwB Settings

8.2.3 Using Non 16-Channel Radios with the TRA100R Controller

The Radius non 16-channel radios, including the M10, M120, M130 and 8-channel GM300 radios, can be used with the TRA100R controller. There are two differences between those radios and the 16-channel GM300 radio.

- No programming of the accessory connector is required.
- It is not possible to monitor the audio from the receive radio by the remote. The audio from the receive radio does appear as normal line audio.

As in all cases of using the non 16-channel radios in the GR300 or GR500 repeaters, a carrier squelch activated repeater will occur if the shorting plugs are not installed in the microphone jacks of the radios. Ensure that the radios are not in monitor or volume set mode (the "mon" LED should be OFF).

Programming of the operating frequencies and squelch modes are the same as for the 16-channel radios. (Refer to Figure 8-3 and Figure 8-6).

(Page 8-10 is blank)

Appendix A
DTMF Commands

A.1 Overview

This appendix provides a quick-reference for DTMF programming of the ZR310, ZR320, ZR330, and ZR340 controllers. If you are familiar with over-the-air programming, you may refer to the tables in this section to find the required commands.

The following items are a review of DTMF programming information covered in several sections of this manual. For a more detailed description about entering the program access mode and executing program commands, refer to the section dedicated to the repeater controller you are programming.

- ❑ In most cases, numbers can be entered with or without leading zeros (1 can be entered as 001 or 1). However, for the Morse Code ID, a leading 0 must precede a number.
- ❑ All commands are ended with the # key.
- ❑ The "*" key can be used as a clear entry key.
- ❑ Where "uu" is indicated, User numbers from 00 to 99 can be entered.
- ❑ Program mode has a 60-second "no-digits heard" timeout.
- ❑ The default program mode access code is: 12310 for the ZR310, 12320 for the ZR320, and 12123 for the ZR340 controller.
- ❑ The command to exit the program mode is 99#.

A.2 ZR310 DTMF Programming Commands

Tables A-1 through A-3 contain the DTMF programming commands which allow you to customize and test your GR300 or GR500 Repeater Station when used with the ZR310 repeater controller.

Table A-1. DTMF System Commands for ZR310 Controller

Command	Function	Parameter
201# t# 202# tt#	Set stuck mic timeout timer to t minutes Set anti-kerchunker filter timer to t.t seconds	t=1-9 minutes tt=0.1-5.0 seconds (0=disable)
203# uu# 204# nn#	Set CSQ user number uu Accessory PTT TPL/DPL, 0=off	uu=0-70 nn=50 for TPL, 1000-1777 for DPL
205# tt# 206# ffff# 207# ss# 208# uu#	Set station ID interval to tt Set station ID tone frequency to ffff Hz Set station ID speed to ss WPM Set system ID user number to uu	tt=1-99 minutes ffff=400-2000 Hz ss=4-25 WPM uu=0-70 (0=off)
209# ffff#	Set courtesy beep tone frequency ffff	ffff=400-2500 Hz

Table A-1. DTMF System Commands for ZR310 Controller (Cont'd.)

Command	Function	Parameter
210# n# 213# nn#	DPL acquire maximum bit errors TPL turnoff code detect delay	
214# aaaaa#	Set program mode access code aaaaa	aaaaa=0-32000
215# 216# 217# 218#	Normal DPL encode Inverted DPL encode Normal DPL decode Inverted DPL encode	
281# t#	Set Mic DTMF hang time to t seconds	t=1-3 seconds
300#	Repeater knockdown	
2501# tt# 2502# ttt#	Set conversation idle reset time to tt seconds Set conversation limit penalty time to ttt x 10 seconds.	tt=1 to 99 seconds (default=5 seconds) ttt=1 to 999 x 10 seconds (default=003 x 10=30 seconds)
2511# ttt# 2512# ttt#	Set minimum dynamic limit time to ttt x 0.1 minutes. Set maximum dynamic limit time to ttt x 0.1 minutes	ttt=5 to 250 x 0.1 minutes (default=10 x 0.1=1 minute) ttt=8 to 250 x 0.1 minutes (default=100 x 0.1=10 minutes)
2531# 2532#	Accumulate airtime excluding the transmitter hold time. Accumulate airtime include the transmitter hold time.	
3501#	List all airtime counts greater than one minute (sends uu, delays one second, then hhmm, repeats for each user)	uu=user hh=hours mm=minutes
3502#	Clear all airtime counts.	25327# must be entered to confirm the command to clear all airtime counts.
4510# 4511#	System ID when transmitter has been used. System ID when ID timers expires and channel is inactive	

Table A-2. DTMF User Commands for ZR310 Controller

Command	Function	Parameter
110# uu# 111# uu#	Disable user number uu Enable user number uu	uu=1-70 uu=1-70
112# uu# ee#	Set user uu's DPL decode to code number ee	uu=51-70
115# uu# 116# uu#	Enable user uu's co-channel busy protect Disable user uu's co-channel busy protect	
120# uu# 121# uu#	Disable user uu's TPL/DPL encode during transmit hold time Enable user uu's TPL/DPL encode during transmit hold time	
122# uu# ee#	Tone translation , user uu encodes tone/code ee	ee=0 for CSQ, 1-50 for TPL, or 1000+uu for DPL
123# uu# ttt#	Set transmit hang time tt.t for user uu.	ttt=0.0-25.0 seconds default=2.0 seconds)
130# uu# 131# uu#	Disable user uu reserve mode disabled, normal repeat audio operation Enable user uu reserve mode, doesn't pass repeat audio	
140# uu# 141# uu#	Disable user uu privacy mode, normal operation Enable user uu privacy mode, no new users allowed until transmit radio drops out	

Table A-2. DTMF User Commands for ZR310 Controller (Cont'd.)

Command	Function	Parameter
151# uu# 150# uu#	Enable user uu courtesy tone Disable user uu courtesy tone	
160# uu# xx, xx,... 161# uu#	Set users uu's Morse ID to xx, xx, ... Play back user uu's ID	xx, xx, ... up to 8 characters
170# uu# 171# uu#	Disable DTMF commands for user uu Enable DTMF commands for user uu	uu=1 to 70
1500# uu# 1501# uu#	Disable pre-pay commands for user uu Enable pre-pay commands for user uu	uu=1 to 70
1510# uu# ttt#	Set conversation time limit for user uu to ttt x 0.1 minutes	uu=1 to 70 ttt=0 to 250 x 0.1 minutes 0=no limit 1=use dynamtic limits, 2 to 250 sets time limit (default=50 x 0.1 =5 minutes)
1521# uu# 1522# uu# 1523# uu#	List minutes:seconds via Morse code for user uu List hours:minutes via Morse code for user uu List hours via Morse code for user uu	uu=1 to 70
1530# uu# 1531# uu# hhh#	Clear airtime accumulator for user uu Add hhh hours of airtime to the counter for user uu	uu=1 to 70 hhh=0 to 249

Table A-3. DTMF Diagnostic Commands for ZR310 Controller

Command	Function	Parameter
301# 302#	PTT on PTT off (keys up when sending progress tones)	
303# 304#	Repeat audio disable, squelch/unsquelch test Repeat audio enable, squelch/unsquelch test	
305# tt# 306# 307# ffff#	Encode TPL tone tt TPL tone sweep, ends with DTMF # Encode TPL frequency fff.f	tt=1-50 or 0=none ffff=50.0-300.0
308# ffff#	Encode audible tone	ffff=400-3000 Hz or 0=none
309# 25327#	Clear all memory, setup default settings	25327# (must be entered to confirm command to clear memory)
360# 361# 362# 363# 364# 365# 366# 367#	List the number of enabled users List the enabled user numbers List the number of program mode accesses List the number of resets List the number of power fails List the number of users with memory errors List the user numbers with errors List the system error number	
32147#	Transmit ZR310 serial number	
99#	Exit the program mode	

A.3 ZR320 Controller DTMF Programming Commands

Table A-4 contains the DTMF programming commands which allow you to customize and test your ZR320 repeater controller. For those commands which set non-default information, the defaults are indicated in parentheses in the Function column. For the default commands themselves, a "(d)" appears after the command.

Table A-4. DTMF Programming Codes for ZR320 Controller

Code	Function	Parameters
01# *aaa#	Access code (*)	Digits 0-9 or *. Maximum length: 8 digits
02# *ddd#	Deaccess code (#)	Digits 0-9 or *. Maximum length: 8 digits
03# nn#	Toll restrict (99)	Digits 0-9 or *. Maximum length: 8 digits
04# 05#	DTMF dial (d) Pulse dial	
06# 07# 08#	Wait 1 ring before ringing mobile/answering (d) Wait 3 rings before ringing mobile/answering Wait 5 rings before ringing mobile/answering	
09# nuu#	Accessory TPL/DPL encode (none)	Any TPL tone (n=0) or DPL code (n=1) , 0=none
10# tt#	Answer time (30 seconds)	10-60 seconds
14# nnnn#	Toll restrict 1 digits (none)	Digits 0-9. Up to 4 restricted digits
15# nnnn#	Toll restrict 2 digits (none)	Digits 0-9. Up to 4 restricted digits
16# 17#	Ring once on channel, wait for mobile to answer Ring on channel until mobile answers (d)	
18# 19#	Enable repeater Disable repeater (d)	
20# nuu#	Repeat TPL tone, DPL code, or carrier squelch	Any TPL tone (n=0), DPL code (n=1), or 0=carrier squelch
21# 22# 23# 24#	No repeat hold time 1 second repeat hold time 3 second repeat hold time (d) 5 second repeat hold time	
25# nn...nn#	Morse code station ID (blank)	Letters A-Z, digits 0-9, and /. Up to 8 characters
26# 27#	Courtesy tone enabled Courtesy tone disabled (d)	
28# 29#	Privacy mask on Privacy mask off (d)	
30# 31# 32# 33# 34# 35#	Enable call limit timer (d) Enable call limit timer/allow mobile to reset with * No call limit Call limit=3 minutes(d) Call limit=5 minutes Call limit=10 minutes	
36# 37# 38#	Disconnect after 30 seconds (d) Disconnect after 45 seconds Disconnect after 1 minute	
40# 41# 42# 43#	Half duplex mode (d) Full duplex mode Simplex VOX mode Simplex VOX with pre-key mode	
44# 45# 46# 47# 48#	.5 seconds VOX hold time .8 seconds VOX hold time 1 second VOX hold time (d) 1.3 seconds VOX hold time 1.5 seconds VOX hold time	

Table A-4. DTMF Programming Codes for ZR320 Controller (Cont'd.)

Code	Function	Parameters
50# uu# cc#	Assign call forward user number (none)	uu=user number; cc=call forward user number
60# 61# 62#	Disable Morse ID Morse ID every 10 minutes if activity Morse ID every 10 minutes	
63# n#	Unit ID (0)	Digits 0-9
64# nuu#	QCII stop scan tone (0)	Any TPL tone (n=0), DPL code (n=1), or 0=off
65# n#	QCII group 1 ('1')	n=1-6
66# m#	QCII group 2 ('2')	m=1-6
67# tt#	Talk time (10 seconds)	1-30 seconds
68# uu#	Autocall user number (00)	
69# uu#	QCII Radio Group Call	
70# uu# 71# uu# 72# uu# 73# uu# 74# uu# 75# uu# 76# uu# 77# uu# 78# uu# 79# uu# 80# uu#	User disabled (d) TPL radio DPL radio QCII radio QCII tone only pager QCII tone + voice pager TPL talkback pager DPL talkback pager QCII talkback pager Direct air ZR330 controller remote phone	
81# 82#	Single-user operation (d) Multi-user operation	
83# 84# 85# 86#	No COR hang time (d) 100 msec COR hang time 300 msec COR hang time 500 msec COR hang time	
87# 88# 89#	Disconnect on busy for 1st 20 seconds (d) Disable busy detect Disconnect on busy for duration of call	
90#	Program access code ('12320')	Digits 0-9; code must be exactly 5 digits long
91#	Reset to defaults	
92#	TX level test	
93#	CTCSS level set	
95#	Hybrid test	Not valid from DTMF radio
96#	Dial click test	
97#	Remote programming for the ZR330 controller	
99#	Exit program mode	

A.4 ZR330 Controller DTMF Programming Commands

Table A-5 contains the DTMF programming commands for the ZR330 controller.

Table A-5. DTMF Programming Codes for ZR330 Controller

Code	Function	Parameters
25# nn... nn#	Morse code station ID (blank)	Letters A-Z, digits 0-9 and /. Up to 8 characters
63#	Unit ID (00)	00-99
81# 82#	Single-ZR320 controller operation (d) Multi-ZR320 controller operation	
83# 84#	Enable telco link Disable telco link(d)	
91# 92# 93# 95# 97#	Reset to defaults Transmit level test TPL/DPL level test Hybrid test Remote programming mode	
99#	Exit program mode	

A.5 ZR340 Controller DTMF Programming Commands

Table A-6 contains the DTMF programming commands which allow you to customize and test your ZR340 repeater controller. For those commands which set non-default information, the defaults are indicated in parentheses in the Function column. For the default commands themselves, a "(d)" appears after the command.

Table A-6. DTMF Programming Codes for ZR340 Controller

Code	Function	Parameters
01# *aaa#	Access code (*)	Digits 0-9 or *. Maximum length: 9 digits
02# *ddd#	Deaccess code (#)	Digits 0-9 or *. Maximum length: 9 digits
03# nn#	Toll restrict (99)	Digits 0-9 or *. Maximum length: 8 digits
04# 05#	DTMF dial (d) Pulse dial	
06# 07# 08#	Wait 1 ring before ringing mobile/answering (d) Wait 5 rings before ringing mobile/answering Wait 10 rings before ringing mobile/answering	
10# tt#	DTMF timeout time (3 seconds)	0-60 seconds
11# 12#	Hook flash enabled Hook flash disabled (d)	
13# 14#	Call alert enabled Call alert disabled (d)	
15# nnnn#	Toll restrict 1 digits (none)	Digits 0-9. Up to 4 restricted digits
16# nnnn#	Toll restrict 2 digits (none)	Digits 0-9. Up to 4 restricted digits
17# 18#	Ring once on channel, wait for mobile to answer Ring on channel until mobile answers (d)	
19# 20#	Enable repeater (d) Disable repeater	
21# 22# 23# 24#	No repeat hold time 1 second repeat hold time (d) 3 second repeat hold time 5 second repeat hold time	
25# nn...nn#	Morse code station ID (blank)	Letters A-Z, digits 0-9, and /. Up to 8 characters
26# 27#	Courtesy tone enabled Courtesy tone disabled (d)	
28# 29#	Privacy mask on Privacy mask off (d)	
30# 31# 32# 33# 34# 35#	Enable call limit timer (d) Enable call limit timer/allow mobile to reset with * No call limit Call limit=3 minutes(d) Call limit=5 minutes Call limit=10 minutes	
36# 37# 38#	Radio timeout disconnect after 30 seconds (d) Radio timeout disconnect after 45 seconds Radio timeout disconnect after 1 minute	
40# 42# 43# 44# 45# 46# 48# 49#	Half duplex mode (d) Simplex VOX mode Simplex VOX with pre-key mode Simplex sampling Simplex sampling w/VOX to extend the sample interval VOX /sampling between words (intelligent mode) Enable VOX sampling before issuing dial tone Disable VOX sampling before issuing dial tone (d)	

Table A-6. DTMF Programming Codes for ZR340 Controller (Cont'd.)

Code	Function	Parameters
50#-59#	Auto dial numbers	Maximum 16 digits per number.
60# 61# 62#	COR to answer (no DTMF required) Access code to answer (d) Direct channel access	
63# 64# 65#	Disable Morse ID Morse ID every 10 minutes if activity Morse ID every 10 minutes	
70# 71# 72#	Sample rate 0.5 seconds Sample rate 1.0 seconds (d) Sample rate 1.5 seconds	
73# 74# 75# 76# 77#	VOX holdtime 0.5 seconds VOX holdtime 0.8 seconds VOX holdtime 1.0 seconds (d) VOX holdtime 1.3 seconds VOX holdtime 1.5 seconds	
78# 79# 80#	Automatic sample window Increment sample window by 10msec. Decrement sample window by 10msec.	
81# 82# 83# 84#	No COR hang time (d) 100 msec COR hang time 300 msec COR hang time 500 msec COR hang time	
85# 86# 87#	Disconnect on busy for 1st 20 seconds (d) Disable busy detect Disconnect on busy for duration of call	
90#	Program access code ('12123')	Digits 0-9; code must be exactly 5 digits long
91#	Reset to defaults	
92#	TX level test	
93#	Repeater level set	
94#	High speed telephone programming	Not valid from DTMF radio
99#	Exit program mode	

Appendix B TPL Tones and DPL Codes

B.1 Overview

This appendix provides a quick-reference of the TPL Tones and DPL Codes used with the ZR310 and ZR320 repeater controller.

B.2 TPL Tones for ZR310

Table B-1 lists the TPL Tone conversions for the ZR310 controller.

Table B-1. TPL Tone Conversion for ZR310

User	Code	Freq. (Hz)	User	Code	Freq. (Hz)
1	XZ	67.0	36	7Z	186.2
2	WZ	69.3	37	J6	189.9
3	XA	71.9	38	7A	192.8
4	WA	74.4	39	J7	196.6
5	XB	77.0	40	J8	199.5
6	WB	79.7	41	M1	203.5
7	YZ	82.5	42	8Z	206.5
8	YA	85.4	43	M2	210.7
9	YB	88.5	44	M3	218.1
10	ZZ	91.5	45	M4	225.7
11	ZA	94.8	46	9Z	229.1
12	ZB	97.4	47	M5	233.6
13	1Z	100.0	48	M6	241.8
14	1A	103.5	49	M7	250.3
15	1B	107.2	50	J9	254.1
16	2Z	110.9	51	CSQ/DPL	-
17	2A	114.8	52	CSQ/DPL	-
18	2B	118.8	53	CSQ/DPL	-
19	3Z	123.0	54	CSQ/DPL	-
20	3A	127.3	55	CSQ/DPL	-
21	3B	131.8	56	CSQ/DPL	-
22	4Z	136.5	57	CSQ/DPL	-
23	4A	141.3	58	CSQ/DPL	-
24	4B	146.2	59	CSQ/DPL	-

Table B-1. TPL Tone Conversion for ZR310 (Cont'd.)

User	Code	Freq. (Hz)	User	Code	Freq. (Hz)
25	5Z	151.4	60	CSQ/DPL	-
26	5A	156.7	61	CSQ/DPL	-
27	J1	159.8	62	CSQ/DPL	-
28	5B	162.2	63	CSQ/DPL	-
29	J2	165.5	64	CSQ/DPL	-
30	6Z	167.9	65	CSQ/DPL	-
31	J3	171.3	66	CSQ/DPL	-
32	6A	173.8	67	CSQ/DPL	-
33	J4	177.3	68	CSQ/DPL	-
34	6B	179.9	69	CSQ/DPL	-
35	J5	183.5	70	CSQ/DPL	-

Note: User numbers 51 through 70 can be set to Carrier Squelch or to any Motorola DPL code.

B.3 TPL Tones and DPL Codes for the ZR320 Controller

Table B-2 lists the TPL Tone and DPL Code Conversions for the ZR320 controller.

Table B-2. TPL Tone/DPL Code Conversion for the ZR320 Controller

User	DPL Code*	Freq. (Hz)/TPL Code	User	DPL Code*	Freq. (Hz)/TPL Code
00	023	– CSQ	†50	274	254.1 J9
01	025	67.0 XZ	51	306	–
02	026	69.3 WZ	52	311	–
03	031	71.9 XA	53	315	–
04	032	74.4 WA	†54	325	–
†05	036	77.0 XB	55	331	–
06	043	79.7 WB	†56	332	–
07	047	82.5 YZ	57	343	–
08	051	85.4 YA	58	346	–
†09	053	88.5 YB	59	351	–
10	054	91.5 ZZ	†60	356	–
11	065	94.8 ZA	61	364	–
12	071	97.4 ZB	62	365	–
13	072	100.0 1Z	63	371	–
14	073	103.5 1A	64	411	–
15	074	107.2 1B	65	412	–
16	114	110.9 2Z	66	413	–
17	115	114.8 2A	67	423	–
18	116	118.8 2B	68	431	–
†19	122	123.0 3Z	69	432	–
20	125	127.3 3A	70	445	–
21	131	131.8 3B	†71	446	–
22	132	136.5 4Z	†72	452	–
23	134	141.3 4A	†73	454	–
24	143	146.2 4B	74	464	–
†25	145	151.4 5Z	75	465	–

Table B-2. TPL Tone/DPL Code Conversion for the ZR320 Controller (Cont'd.)

User	DPL Code*	Freq. (Hz)/TPL Code	User	DPL Code*	Freq. (Hz)/TPL Code
26	152	156.7 5A	76	466	–
27	155	159.8 J1	77	503	–
28	156	162.2 5B	78	506	–
29	162	165.5 J2	79	516	–
30	165	167.9 6Z	80	532	–
31	172	171.3 J3	81	546	–
32	174	173.8 6A	82	565	–
33	205	177.3 J4	83	606	–
†34	212	179.9 6B	84	612	–
35	223	183.5 J5	85	624	–
†36	225	186.2 7Z	86	627	–
37	226	189.9 J6	87	631	–
38	243	192.8 7A	88	632	–
39	244	196.6 J7	89	645	–
40	245	199.5 J8	90	654	–
†41	246	203.5 M1	91	662	–
42	251	206.5 8Z	92	664	–
†43	252	210.7 M2	93	712	–
†44	255	218.1 M3	94	723	–
45	261	225.7 M4	95	731	–
46	263	229.1 9Z	96	732	–
47	265	233.6 M5	97	734	–
†48	266	241.8 M6	98	743	–
49	271	250.3 M7	99	754	–

* For Inverted DPL Codes, refer to Table B-3.

† DPL user numbers not valid for use with standard Motorola products.
TPL user numbers 51-99 are CSQ (Carrier Squelch_

B.4 Inverted DPL Codes

The "Inversion" (or inverted DPL Code) may be needed for older radio equipment or a previous radio system, where inversion of codes can occur. Table B-3 lists the inverted codes.

Table B-3. Inversion of DPL Codes

DPL Code	Inversion	DPL Code	Inversion	DPL Code	Inversion	DPL Code	Inversion
023	047	145	274	274	145	465	331
025	244	152	115	306	071	466	662
026	464	155	731	311	664	503	162
031	627	156	265	315	423	506	073
032	051	162	503	325	645	516	432
036	172	165	251	331	465	532	343
043	445	172	036	332	456	546	132
047	023	174	074	343	532	565	703
051	032	205	263	346	612	606	631
053	452	212	356	351	243	612	346
054	413	223	134	356	212	624	632
065	271	225	122	364	131	627	031
071	306	226	411	365	125	631	606
072	245	243	351	371	734	632	624
073	506	244	025	411	226	645	325
074	174	245	072	412	143	654	743
114	712	246	523	413	054	662	466
115	152	251	165	423	315	664	311
116	754	252	462	431	723	712	114
122	225	255	446	432	516	723	431
125	365	261	732	445	043	731	155
131	364	263	205	446	255	732	261
132	546	265	156	452	053	734	371
134	223	266	454	454	266	743	654
143	412	271	065	464	026	754	116

Glossary

Basic Repeater Controller:
a repeater interface component that connects between two Radius mobile radios to construct an intermittent duty radio repeater (identical to the R*I*C*K).

Bi-directional repeater:
a repeater configuration in which the receive and transmit radios perform both receive and transmit functions. The audio and COR signals from the receiver of the receive radio are routed to the transmitter of the transmit radio. Unlike the unidirectional case, though, the audio and COR signals of the receiver of the transmit radio are also routed to the transmitter of the receive radio. Example: the receive radio receives a signal on 456.550 MHz which is re-transmitted by the transmit radio on 451.550 MHz. The transmit radio then receives a signal on 451.550 MHz which is re-transmitted by the receive radio on 456.550 MHz.

Console radio:
a fixed (base station) or a mobile radio installation that has been designated as the controlling radio for the repeater or as the "hub" for communications. The console radio is not part of the repeater hardware.

CSQ:
Carrier SQuelch.

COR ("Carrier Operated Relay"):
a carry-over term from the early days of repeater operation. COR is used in its generic sense and does not necessarily mean only Carrier Squelch operation. For the GR300 and GR500 repeater stations, the COR signal is found on pin 4, pin 8, pin 12, or pin 14 of the 16-pin accessory jack (J3) of the radio. Whenever a "properly" identified signal is received, a dc level change occurs on pin 4, pin 8, pin 12, or pin 14.

Cross band repeater:
a repeater in which the receive radio operates in a different frequency band than the transmit radio. Example: the receive radio operates on 159.420 MHz in the highband VHF and the transmit radio operates on 451.650 MHz in the 450-470 MHz UHF band. Crossband repeaters may be either unidirectional or bi-directional.

CWID:
Morse code station identification.

Drop out delay:
the time, in seconds, that the transmit radio remains keyed, or on the air, after the input signal to the receive radio ceases. Also known as "transmit (tx) hang time."

EIA de-emphasized audio:
the audio frequency response of the receiver that is measured at the speaker and at pin 11 of the radio accessory connector with JU551 in the "B" position.

EIA pre-emphasized audio:
the audio frequency response of the transmitter for an audio input to the microphone or pin 2 of the radio accessory connector.

Field radio:
a mobile or portable radio that is neither a part of the repeater hardware nor a console radio. Field radios may intercommunicate via the repeater or directly.

Flat audio:
receiver or transmitter audio that does not change appreciably in amplitude as the frequency of that audio is varied from 1 Hz to 3 kHz. The receiver audio response from pin 11 of the radio accessory conector with JU551 in the "A" position and the transmitter audio response for input to pin 5 of the radio accessory connector are "flat."

i20R:
a repeater controller that provides service for up to 10 different user groups (TPL/DPL).

i50R:
a basic telephone interconnect with single user repeater operation.

i750R:
a repeater controller that provides telephone interconnect and revertive, selective calling. TPL, DPL, Quik-Call II and MDC-1200 signalling formats are supported.

Normal receiver audio:
see EIA de-emphasized audio.

Normal transmitter audio:
see EIA pre-emphasized audio.

PAC*RT:
Portable Area Communications RepeaTer; a specialized cross band, bi-directional repeater configuration. Example: paramedics at an accident scene may use 450-470 MHz UHF portable radios to communicate with a highband VHF dispatcher.

Power-up:
the initial application of operating potential (voltage) to the radios and the repeater controller.

"Properly" identified signal:
all signals being received on a CSQ receiver or those signals with the correct TPL tone or DPL code being received on a coded squelch receiver.

Receive radio:
the radio that performs the receiving functions in the GR300, GR400, or GR500 repeater station.

Repeater controller:
a module or option card that fits into the GR300, GR400, and GR500 repeater stations and provides the control of the repeater radios.

Repeater knockdown:
to deactivate a repeater or to remove it from service.

Repeater setup:
to activate a repeater or to place it into service.

Revertive Signalling (paging):
accessing the repeater with one signalling format (e.g., DTMF) and selective signalling with a different format (e.g., MDC-1200).

R*I*C*K:
a repeater interface component that connects between two Radius mobile radios to construct an intermittent duty radio repeater (identical to the Basic Repeater Controller).

Selective Signalling (calling):
a method of signalling with TPL, DPL, multiple tones or digital words to alert an individual radio user in a group.

Single band repeater:
a repeater in which both the receive radio and the transmit radio operate in the same frequency band. *Example:* receive at 456.650 MHz and transmit at 451.650 MHz in the 450-470 MHz UHF band.

TRA100R Controller:
a repeater controller that provides tone remote control capability to the repeater.

Transmit radio:
the radio that performs the transmitting functions in the GR300, GR400, or GR500 repeater station.

Unidirectional repeater:
a repeater configuration in which the receive radio only receives signals from the field radios and the transmit radio only transmits signals to the field radios.

VOX:
VOice controlled transmission; the transmit radio is keyed by a circuit that detects the presence of voice output from the receive radio or from a telephone line.

ZR310 Controller:
a repeater controller that provides individualized repeater service for up to 70 different customer groups (TPL/DPL).

ZR320 Controller:
a repeater controller that acts as an interface to the telephone line, providing selective calling telephone interconnect features and repeater operation. TPL, DPL, and Quik-Call II signalling formats are supported.

ZR330 Controller:
an interface between a standard DTMF telephone and the GR300, GR400, or GR500 repeater station, providing full duplex telephone extension to another GR300, GR400, or GR500 that has a ZR320 controller.

ZR340 Controller:
a repeater controller that provides telephone interconnect with expanded sign-on/sign-off code features and CWID for the single user repeater.

END OF DOCUMENT